
Model: LI90

# Commander Controller

Quick Start

QS**301036** Rev. A


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## Welcome to the LI90 Quick Start

The LI90 Quick Start is meant to show some of the more common setup solutions to getting the LI90 up and running quickly. If you run into an issue that is not addressed here or wish to install or set up with a non-standard configuration, please address the LI90 Manual or refer to the Flowline website at www.flowline.com.

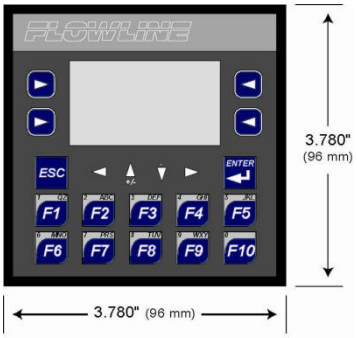
## We Do Your Level Best

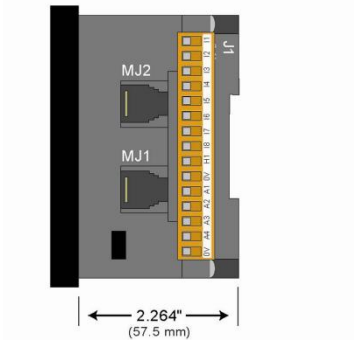
Thank you for purchasing the Commander Controller (LI90). The LI90 Series is a general purpose level controller displaying engineering units for up to four 4-20 mA continuous level sensor receivers and 6 programmable relays.

## Unpacking the Commander Controller

When unpacking the Loop-Powered Meter, thoroughly inspect the unit for any damage that may have occurred during shipping. Be sure to report any damage, as well as any missing parts or malfunctions to your supplier or Flowline.

**Front View**




**Side View**

## About the Commander Controller

Before using the Commander Controller, here is some general information to help keep the unit at peak performance.

### Temperature / Ventilation

The Commander Controller's layout design allows for adequate ventilation when used properly and maintained within an ambient temperature range of between 0°C and +50°C. Consider ventilation and temperature limitations when operating at the extreme ends of the ambient temperature range. Should a cooling device be required, for example, allow adequate clearance for ventilation.

### Orientation

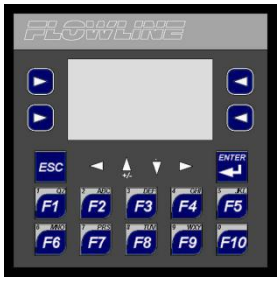
When panel-mounted, there are no orientation restrictions on the Commander Controller.

### Noise

Consider the impact on ventilation, temperatures and performance if noise suppression devices are needed. Be sure to maintain an adequate distance between the controller and noisy devices such as relays, motor starters, etc.

### Shock and Vibration

The Commander Controller has been designed to operate in typical industrial environments that may inflict some shock and vibration on the unit. For applications that may inflict excessive shock and vibration, please use proper dampening techniques or relocate the Commander to a location that minimizes shock and/or vibration.




**Front Cover**

### Configuration

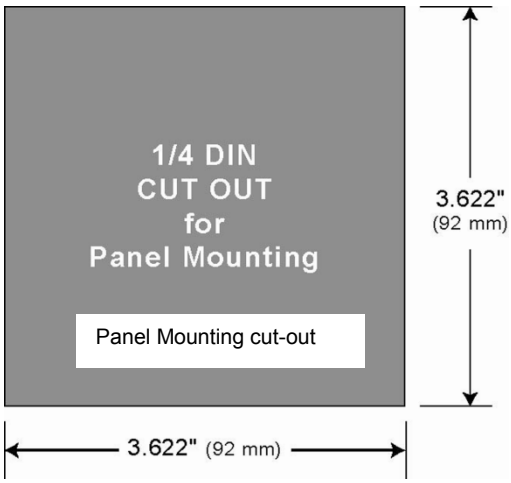
The Commander Controller is configured through the Human Machine Interface (HMI) located on the front cover.

## Mounting the Commander Controller

The Commander Controller can be mounted through a panel or on a DIN rail.

### Panel Mounting

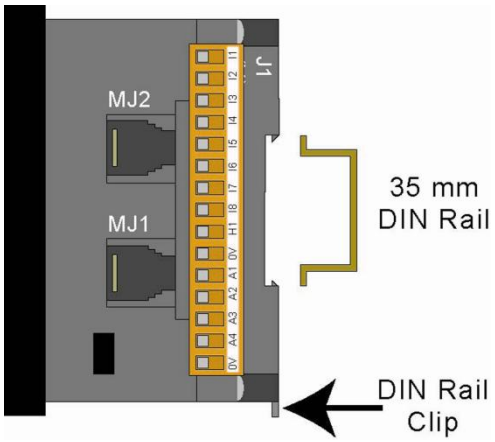
Panel design should be completed with the Commander Controller's requirements in mind. Use the standard cutout for a ¼ DIN: 3.622" (92 mm) x 3.622" (92 mm). Use the four mounting clips to secure the display to the panel. A mounting clip will attach to all four sides of the display. With this in mind, panel mount accordingly:




1) Remove all connectors from the Commander Controller;
2) Press the DIN rail clip up for passing the Commander Controller through the cutout;
3) Verify that the Commander Controller's gasket is installed, is free from dust and debris, and has all corners secure;
4) Pass the Commander Controller through the cutout;
5) Insert each of the four mounting clips into the Commander Controller's case. One clip should be installed at each corner. Tighten each screw so that the clip is held in place;
6) Tighten the screws on the clips so that the gasket is pressed against the panel; and
7) Mounting is now complete.

### DIN rail mounting

The Commander Controller is designed to clip onto a standard 35 millimeter DIN rail. If your installation requires liquid or dust protection, make sure the controller is placed in an appropriate sealed panel when mounting on the DIN rail. Use the following steps to mount on the DIN rail.




1) Move the DIN rail clip to the lower position;
2) Clip the "Top Clips" on the top of the DIN rail;
3) Press the Commander Controller into place; and
4) Press the DIN rail clip up. A small flat-head screwdriver can be used in the slot of the DIN rail clip if clearance is an issue.

The DIN rail connection does NOT provide an earth ground.

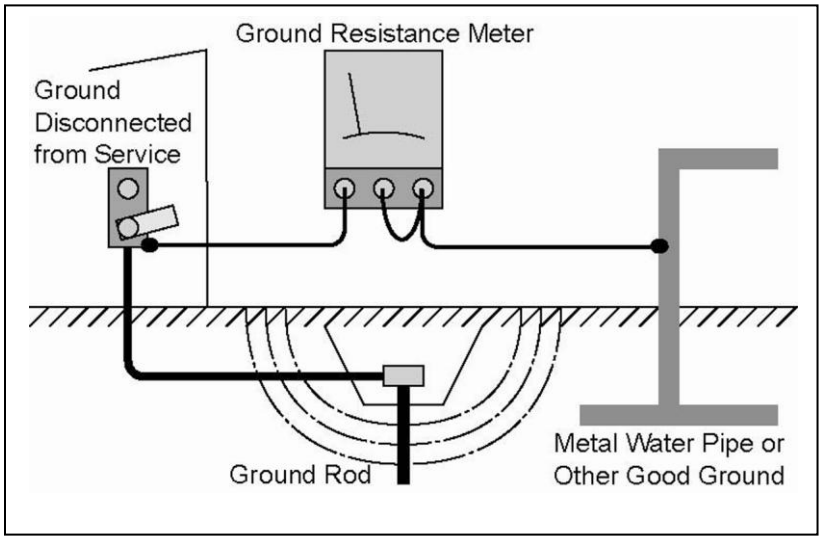
Only qualified personnel familiar with the construction and operation of this equipment and the hazards involved should install, adjust, operate, or service this equipment. Read and understand all applicable manuals in their entirety before proceeding. Failure to observe this precaution could result in severe bodily injury or loss of life. All applicable codes and standards need to be followed in the installation of this product.

## Grounding the Commander Controller

Ideally, a ground resistance measurement from equipment to earth is 0 ohms. This may actually turn out to be a bit higher. While the U.S. National Electrical Code (NEC) states the resistance to ground shall not exceed 25 ohms, resistance to ground when using the Commander Controller should not exceed 15 ohms from Commander Controller to ground. Resistance greater than 25 ohms can impede performance and possibly damage the Commander Controller.

### Testing for a Good Ground

In order to test ground resistance, a Ground Resistance Tester must be used. A typical Ground Resistance Meter Kit contains a meter, two or three wire leads, and two ground rods. Instructions are supplied for either a two-point or three-point ground test. The diagram below shows a two-point ground connection test.



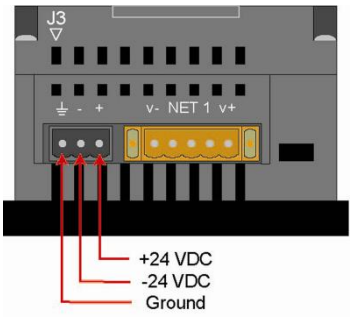

**Ground Connection Test Diagram**

To avoid the risk of electric shock or burns, always connect the safety (or earth) ground before making any other connections.

## Connections to the Commander Controller

### Power Connections

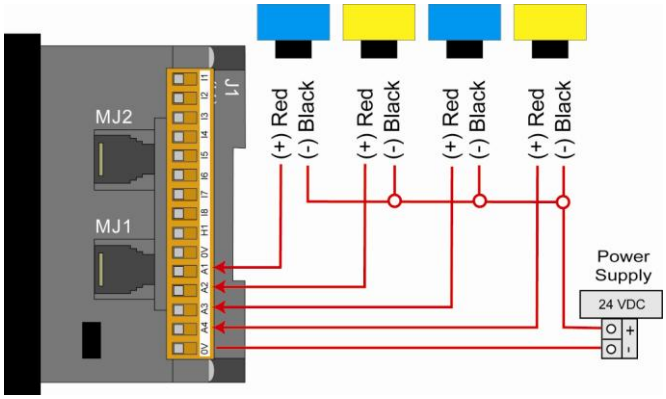
The Commander Controller has one grounding connection and power connections for 10-30 VDC. The configuration of the LI90 series is retained if there is a power loss or power is turned off.




**Power Connections**

### Receiving Connections (Transmitter/Sensor Inputs)

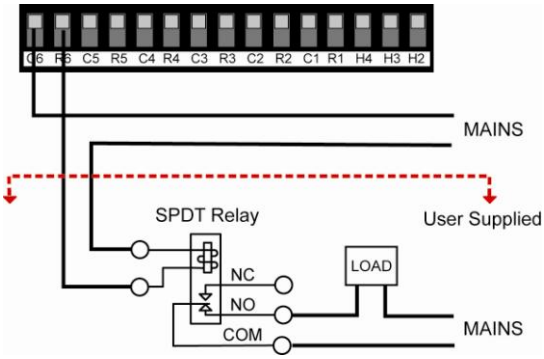
The Commander Controller can receive signals from up to four 4-20 mA sensors. The 24VDC power supply may be shared with the Power terminal as well as the other transmitters.



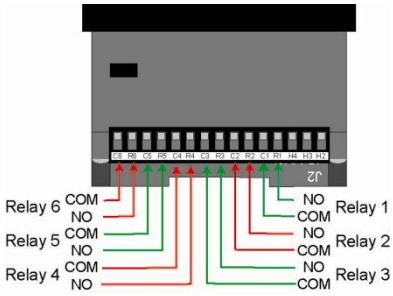

**Sensor Input Connections**

### Transmitting Connections (Relay Outputs)

The Commander Controller can control up to six relays, depending on the application selection. These relays can switch voltages up to 275 VAC, 30 VDC with a maximum output current of 3 A at 250 VAC, resistive. All relays are Normally Open (NO) relays and may share the same power source.




**Relay wiring example**




**Relay Output Connections**

Observe all safety regulations. Electrical wiring should be performed in accordance with all agency requirements and applicable national, state, and local codes to prevent damage to the meter and ensure personnel safety.

Be sure to fuse the voltage measurement wires, locating them as close to the source as possible, to reduce the risk of fire, electrical shock, or physical injury.

Fuses should be replaced with the same type and rating to protect against fire and shock hazards. Repeated fuse failure, indicates a defective condition that will not clear by replacing the fuse.

### Some additional notes on safety:

- When connecting electric circuits or pulse-initiating equipment, open their related breakers. Do not make connections to live power lines.
- Make connections to the module first; then connect the circuit to be monitored.
- Route power wires in a safe manner in accordance with good practice and local codes.
- Wear proper personal protective equipment including safety glasses and insulated gloves when making connections to power circuits.
- Ensure hands, shoes, and floors are dry before making any connection to a power line.
- Make sure the unit is turned OFF before making connection to terminals. Make sure all circuits are de-energized before making connections.
- Before each use, inspect all cables for breaks or cracks in the insulation. Replace immediately if defective.

## Starting the Commander Controller

### Basic Startup

When the Commander Controller is powered for the first time, the user can select the application to be used. Follow the instructions on the screen to choose the application. See below for a description of the three applications within the LI90 series. Press either F2 for Multi-Tank Application, F3 for Differential Level or F4 for Pump Controller.


**Commander Controller Startup Screen**

### Multi-Tank Operation (Application #1)

#### Overview

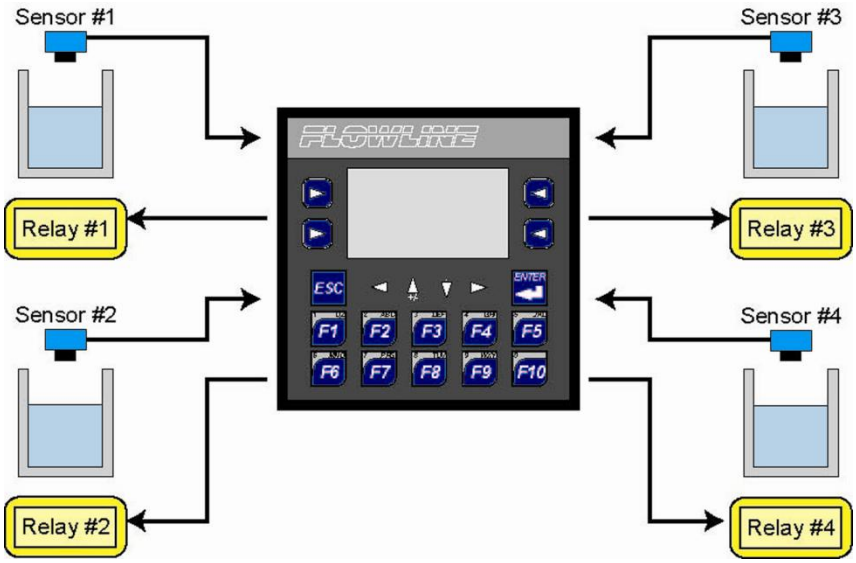
This application is typically used to eliminate the need of using one display for each transmitter. This application can accept up to four 4-20 mA input transmitters and will provide a 3A SPST relay for each transmitter.

#### Overview Specs

**Power:** This application operates with12 to 24 VDC power.

**Incoming Data:** The Commander Controller accepts up to four 4-20 mA channels, powered by 12 to 24 VDC power source.

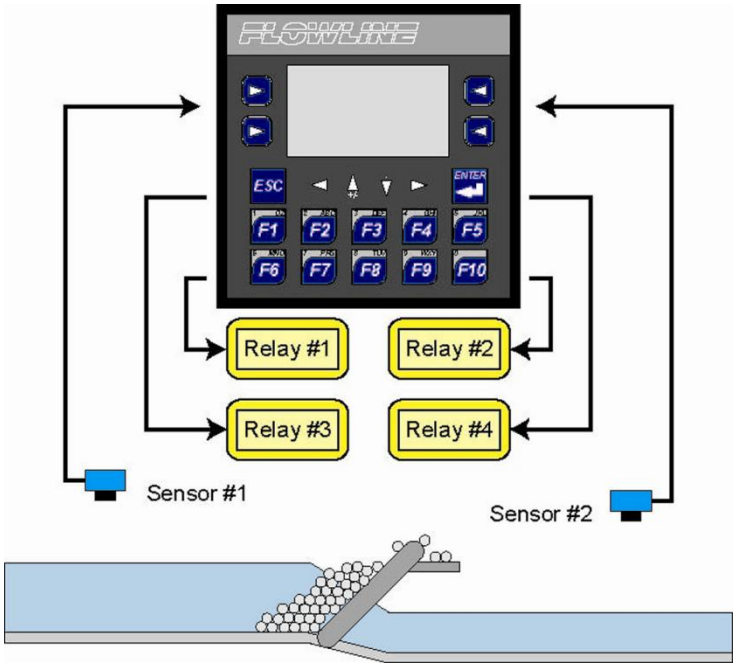
**Outgoing Data:** Each channel is assigned a transmitting relay (4 relays total).



## Differential Level Controller (Application #2)

### Overview

This application is used to monitor the levels above and below a rake and control a relay based upon the defined differential between the two levels. In addition, a differential alarm can be programmed as well as individual alarms for each input.




### Overview Specs

**Power:** This application operates with12 to 24 VDC power.

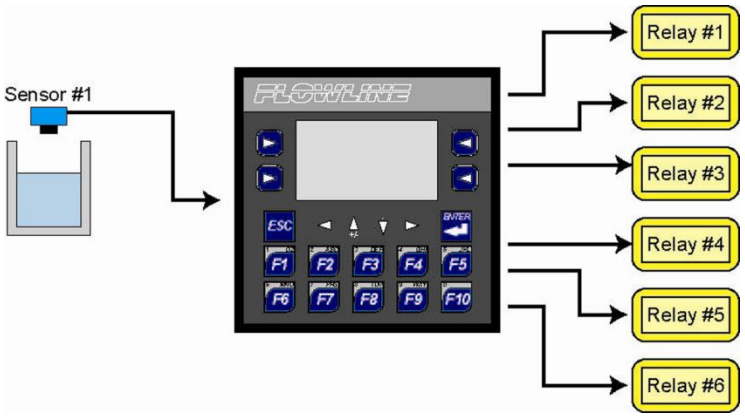
**Incoming Data:** The Commander Controller accepts up to two 4-20 mA channels, powered by 12 to 24 VDC power source.

**Outgoing Data:** Two alarm relays (one for each channel) and two relays that activate based on differing values from each channel.

## Pump Controller (Application #3)

### Overview

This application is used to provide multiple relay contacts for a single 4-20 mA input. Relays 5 and 6 can be combined to be programmed as duplexing / alternating relays




### Overview Specs

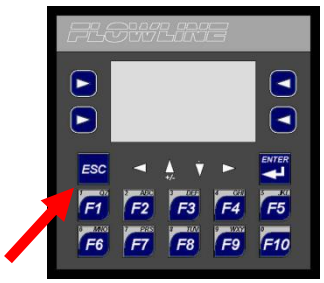
**Power:** This application operates with12 to 24 VDC power.

**Incoming Data:** The Commander Controller accepts a single 4-20 mA channel, powered by 12 to 24 VDC power source.

**Outgoing Data**: Six relays are available to program as alarms, pumps, or valves.

### Changing Applications:

If you need to change the application selection, press and hold the ESC button for 5 seconds. This will return you to the Selection Screen and allow for a new application to be selected. The selection can be accessed at any time.



### Basic Configuration Data

There are several configuration aspects similar for all the Commander Controller's applications.

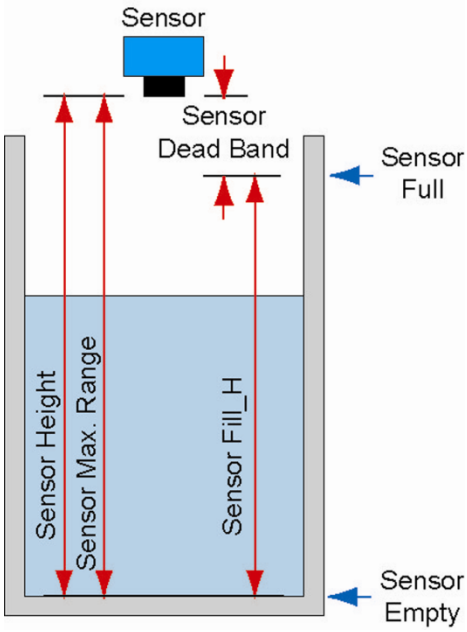
**Analog Input**

The Commander accepts any 4-20 mA signal. This signal may be scaled to the size of the tank or vessel or with a non-configured transmitter (in its original factory setup). If the transmitter has been scaled or configured to the size of the tank, use the Scaled Input for configuration. If the transmitter is a fixed output or in its original factory settings, then use the Non-Scaled Input for configuration. Analog data can be configured for scaled and non-scaled output, as follows:

**Scaled Inputs**

When using a transmitter that has been configured with 4 mA set to an empty tank/vessel and 20 mA set to a full tank/vessel, the data is displayed as follows:

- **Sensor Max. Range** – Displays the distance from the bottom of the tank to the bottom of the installed sensor.
- **Sensor Dead Band** – Displays the distance from the full level of liquid to the bottom of the sensor.
- **Sensor Height** – Displays the distance from the bottom of the tank to the bottom of the installed sensor. This will be the same setting as the Sensor Max. Range.
- **Sensor Fill-H** – Displays the distance from the bottom of the tank to the highest level of liquid. Adding the Fill-H value to the Dead Band value will equal the Max. Range or Height values.
- **Empty Setting** – Displays the display value when the tank is empty.
- **Full Setting** – Displays the display value when the tank is full.

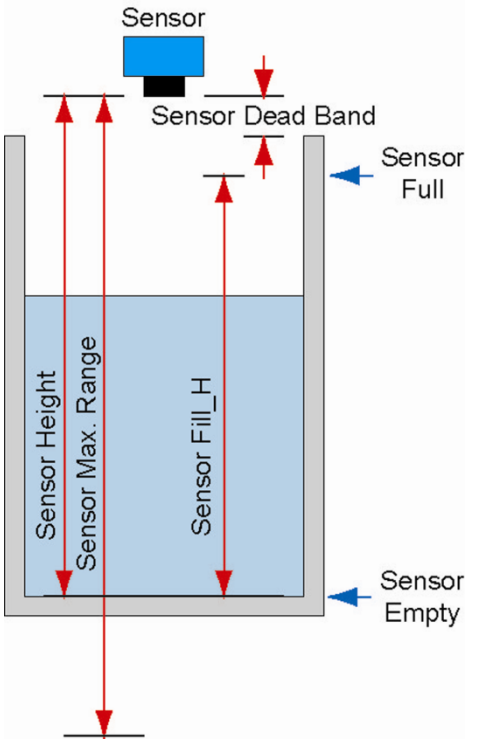



**Scaled Output Data**

**Non-Scaled Inputs**

When using a transmitter that is either set with its original Factory Settings or with a transmitter that has a fixed (non-configurable) 4-20 mA output, the data is displayed as follows:

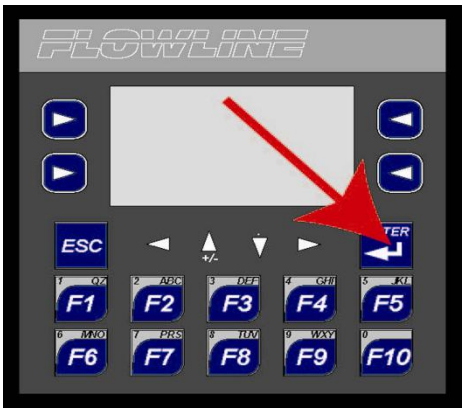
- **Sensor Max. Range** – Displays the maximum range of the sensor. This is typically the 4 mA set point for the sensor. Use the sensor's manual to obtain the sensors maximum range (4 mA output).
- **Sensor Dead Band** – Displays the dead band for the level sensor. Use the sensor's manual to obtain the sensors dead band (20 mA output).
- **Sensor Height** – Displays the distance from the bottom of the tank to the bottom of the installed sensor
- **Sensor Fill-H** – Displays the distance from the bottom of the tank to the highest level of liquid
- **Empty Setting** – Displays the empty tank value.
- **Full Setting** – Displays the full tank value.



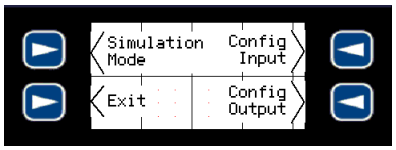

**Non-Scaled Data**

# Common Operations

## General (Secured Functions)



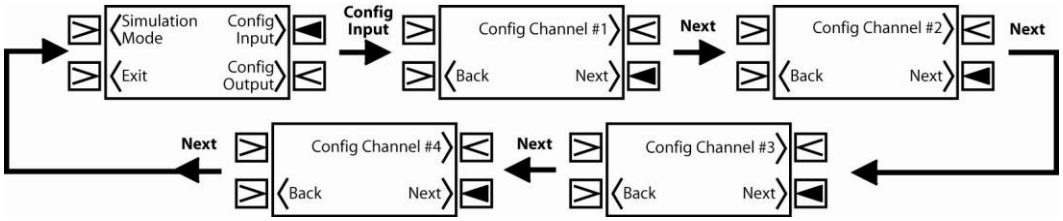

Sensor Inputs and Relay Output configurations are all set through the Commander Controller's secured section. To access this section, press and hold the ENTER key for 5 seconds. This section can then be exited pressing the Exit Soft Key (Lower Left Corner).




Inside this section you will be able to:

- Configure the analog inputs (Configure Transmitter Inputs)
- Configure the relays (Configure Outgoing Relays)
- Simulate the operation of the transmitters (Simulation Mode)

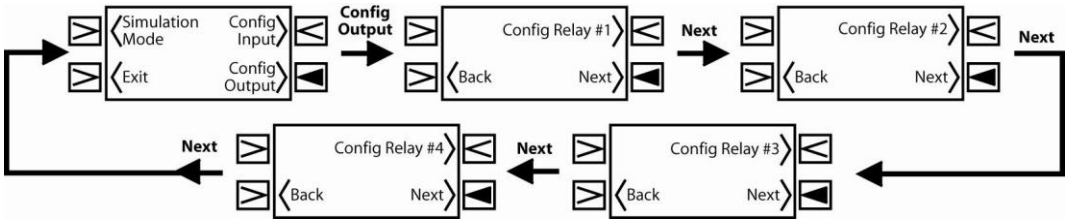
## Configure Transmitter Inputs




To configure sensor inputs, simply press the Config Inputs Soft Key from within the Secured Functions section. Press the Next or Back soft keys to scroll to the area you would like to configure. The above illustration is for a 4 input configuration. Configurations with a different number of inputs will differ slightly.

- After selecting an incoming channel, you can configure the following settings
  - Sensor Max. Range, Sensor Dead Band, Sensor Height, Sensor Fill-H, Empty Setting & Full Setting.
- The first four settings must use the same units of measure (i.e. inches, cm, feet, m, etc.).
- The last two settings can be in any engineering units as long as they are both the same (i.e. inches, cm, gallons, liters, etc.)

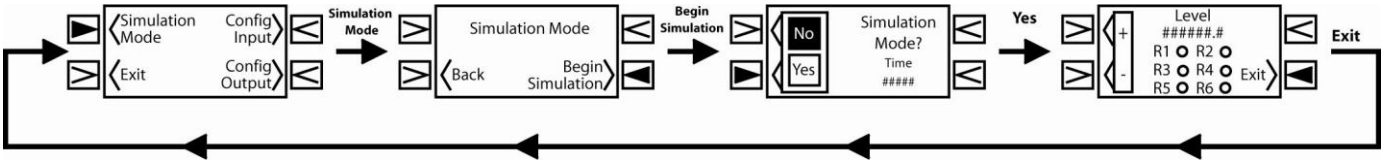
## Configure Outgoing Relays




To configure outgoing data, simply press the Config Outputs Soft Key from within the Secured Functions section. Press the Next or Back soft keys to scroll to the area you would like to configure. The above illustration is for a 4 output configuration. Configurations with a different number of relay outputs will differ slightly.

- After selecting an outgoing channel, or Relay, each relay will ask for a Relay ON and Relay OFF level.
- These settings must be in the same units used for the Empty and Full incoming data settings (above).

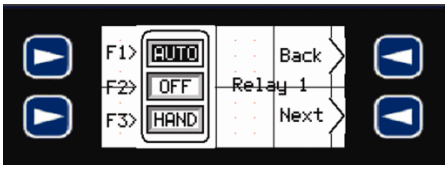
### Simulation Mode




Simulation Mode allows users to simulate changes in tank levels. Relays will turn ON and OFF depending on how they were configured. This will test your configuration and setup. The above illustration is for a 1 input configuration. Configurations with a different number of inputs will differ slightly.

### Relay Hand/OFF/AUTO (HOA) – non-secured function

From the Relay Info screen, pressing the H.O.A. Soft Key will show the HAND / OFF / AUTO (H.O.A.) functions for each relay. These selections function as follows:




- The screen for each relay will indicate each relay's current status, along with the soft keys to jump back or to the next relay
- The screen for each relay will indicate each relay's current status, along with the soft keys to jump back or to the next relay.
- AUTO (H.O.A.) Automatic mode. The relay will energize based on the ON setting and will De-energize based on the OFF setting.
- OFF – Off mode. This turns the relay OFF (de-energized), and all ON requests are ignored. This mode is helpful in taking a relay off-line for maintenance.
- HAND – On mode. This mode is helpful in overriding a relay function. Relay will remain ON until it is switched to the OFF mode or AUTO mode.

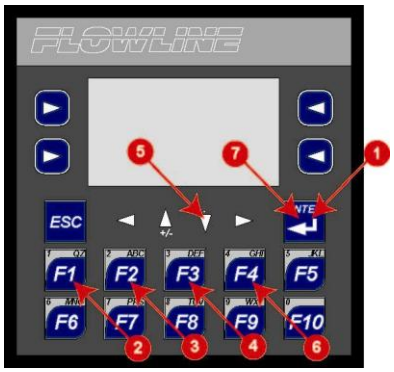
The first time the Commander Controller is powered up, all of the relays will be in the OFF mode. To activate the relay, you will need to change the relay mode to AUTO.

### Entering values into Commander

Use the 10-digit keypad along the bottom of the LI90 series to enter values into the controller.

1. To change a value, first press the Enter key (the value will be highlighted).
2. Use the 10-digit keypad to enter the desired value (i.e. for 123.4, press the following keys:
    a. Press F1 for number 1.
    b. Press F2 for number 2.
    c. Press F3 for number 3.
    d. Press F1 for number 1.
    e. Press F4 for number 4.
    f. Press ▼ for ".".
3. Press Enter when completed to store this value to memory

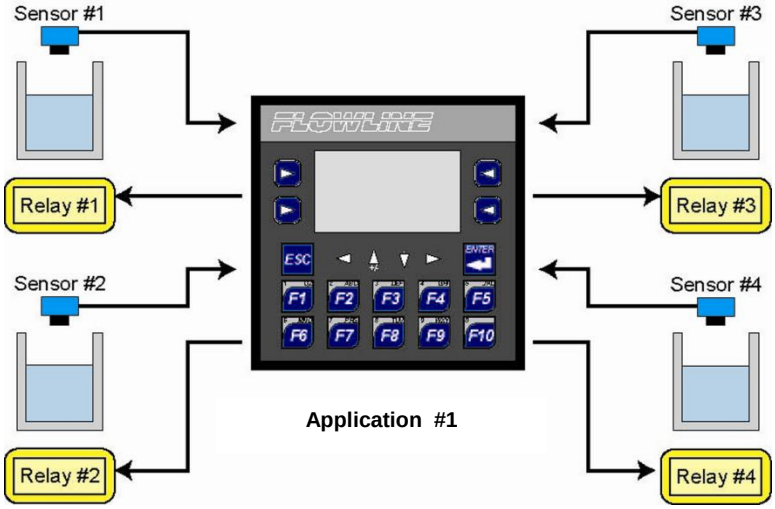
The screen cannot change until a value is stored in memory.



## Multi-Tank Operation - Application #1

### Overview

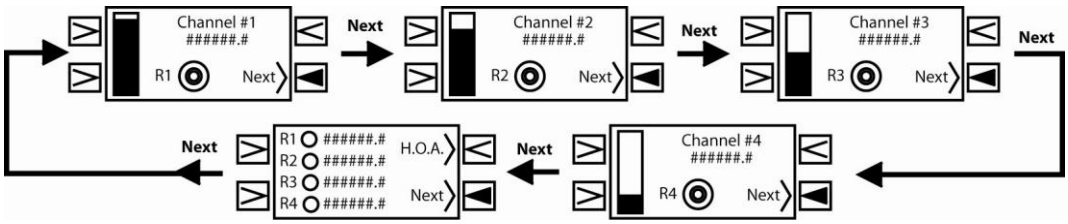
This application is typically used to eliminate the need of using one display for each transmitter. This application can accept up to four 4-20 mA input transmitters and will provide a 3A SPST relay for each transmitter. Sensor Input #1 will be interfaced with Relay #1. Sensor Input #2 will be interfaced with Relay #2. The same logic applies to sensor inputs and relays 3 and 4.



Application #1

- Step #1 – Determine the units of measurement to be display (ex. Inches, meters, gallons, liters).
- Step #2 – Determine the values for an empty and full tank in the units above.
- Step #3 – Configure the sensor inputs under Configure Inputs
- Step #4 – Configure the relay outputs under Configure Outputs
- Step #5 – Activate relays under H.O.A. settings

### Getting Around (Open Functions)




The Opening Screen indicates the Level of Liquid in the tank/vessel, along with the true analog (4-20 mA) for channel #1 and the status of Relay #1. Regardless on how the channel's level is configured the bar graph will show the true 4-20 mA level provided by the sensor.

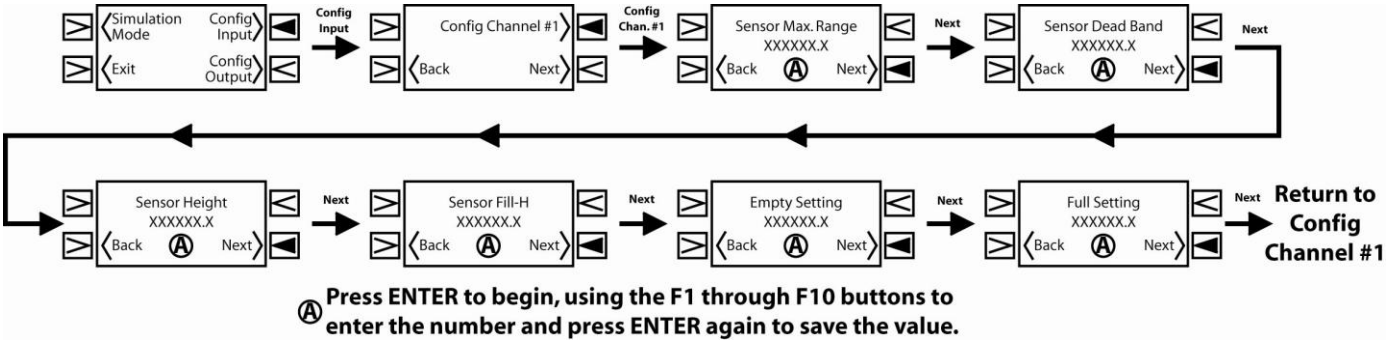
- Pressing the Lower Right Soft key will show the same information for Channel #2.
- Pressing it further will show Channels #3 and #4, followed by the Relay Status Page.
- The sequence for the Lower Right Soft key is as follows:
  - Channel 1, Channel 2, Channel 3, Channel 4, Relay Info, Channel 1, and so on.
- H.O.A. = Hand, Off, Auto – Refer to the Relay Hand/OFF/AUTO (HOA) – non-secured function section on Page ##.

## Accessing Config Inputs and Config Outputs (Secured Functions)

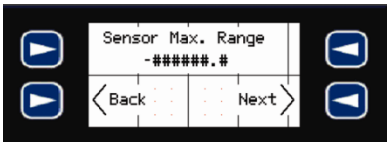
Incoming and outgoing settings are all configured through the Commander Controller's secured section. To access this section, press and hold the ENTER key for 5 seconds. This section can then be exited pressing the Exit Soft Key (Lower Left Corner).

## Configure Transmitter Inputs

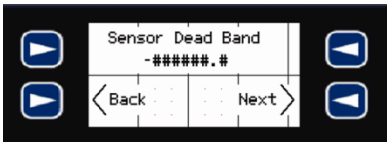
1. Press ENTER key for 5 seconds to access the **Config Inputs** and **Config Outputs** screen.



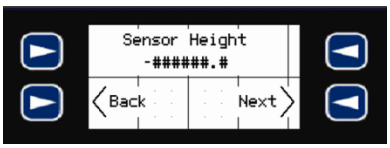

2. Press the ***Config Inputs Soft Key*** to begin. The first screen to appear is for Channel #1.
   a. Use the ***Next Soft Key*** to advance to the next channel.
   b. Use the ***Back Soft Key*** to return to the previous screen.



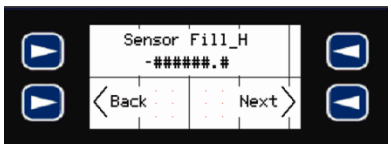

3. If the correct Channel is displayed, press the ***Config Channel #_ Soft Key*** to advance to **Sensor Max. Range**.
4. **Sensor Max. Range** is the distance from the bottom of the tank to the bottom of the installed sensor with a scaled 4-20 mA output. For a fixed output, this is the maximum range of the sensor (see next page). Use the sensor's manual to obtain the sensors maximum range (4 mA output).
5. To change the **Sensor Max. Range** value, first press the ***ENTER*** key. The value will now be highlighted and you can enter the number using the ***F-Keys*** as you would a 10-digit key pad, with the down arrow to enter the decimal point. Then, press ***ENTER*** again to complete the entry and store the value into memory.



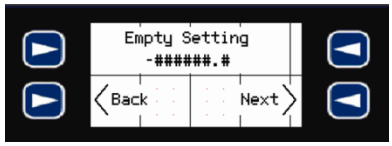

6. Press the ***Next Soft Key*** to proceed to **Sensor Dead Band**.
7. **Sensor Dead Band** is the distance from the full level of liquid to the bottom of the sensor with a scaled 4-20 mA output. For a fixed output, this is the dead band for the level sensor (see next page). Use the sensor's manual to obtain the sensors dead band (20 mA output).
8. To change the **Sensor Dead Band** value, first press the ***ENTER*** key. The value will now be highlighted and you can enter the number using the ***F-Keys*** as you would a 10-digit key pad, with the down arrow to enter the decimal point. Then, press ***ENTER*** again to complete the entry and store the value into memory.




9. Press the ***Next Soft Key*** to proceed to **Sensor Height**.
10. **Sensor Height** is the distance from the bottom of the tank to the bottom of the installed sensor (see next page).
11. To change the **Sensor Height** value, first press the ***ENTER*** key. The value will now be highlighted and you can enter the number using the ***F-Keys*** as you would a 10-digit key pad, with the down arrow to enter the decimal point. Then, press ***ENTER*** again to complete the entry and store the value into memory.

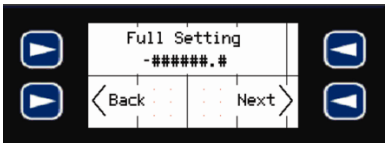



12. Press the ***Next Soft Key*** to proceed to **Sensor Fill-H**.
13. **Sensor Fill-H** is the distance from the bottom of the tank to the highest level of liquid (see next page).
14. To change the **Sensor Fill-H** value, first press the ***ENTER*** key. The value will now be highlighted and you can enter the number using the ***F-Keys*** as you would a 10-digit key pad, with the down arrow to enter the decimal point. Then, press ***ENTER*** again to complete the entry and store the value into memory.



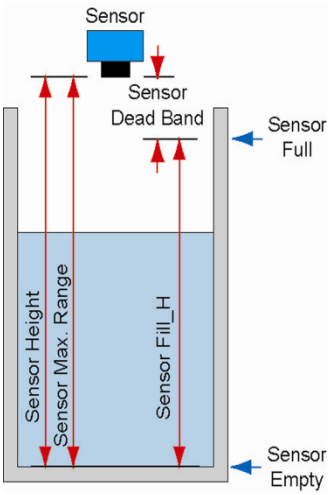

15. Press the ***Next Soft Key*** to proceed to Empty Setting.
16. **Empty Setting** is the display value when the tank is empty.
17. To change the **Empty Setting** value, first press the ***ENTER*** key. The value will now be highlighted and you can enter the number using the ***F-Keys*** as you would a 10-digit key pad, with the down arrow to enter the decimal point. Then, press ***ENTER*** again to complete the entry and store the value into memory.

18. Press the ***Next Soft Key*** to proceed to **Full Setting**.
19. **Full Setting** is the display value when the tank is full.
20. To change the **Full Setting** value, first press the ***ENTER*** key. The value will now be highlighted and you can enter the number using the ***F-Keys*** as you would a 10-digit key pad, with the down arrow to enter the decimal point. Then, press ***ENTER*** again to complete the entry and store the value into memory.

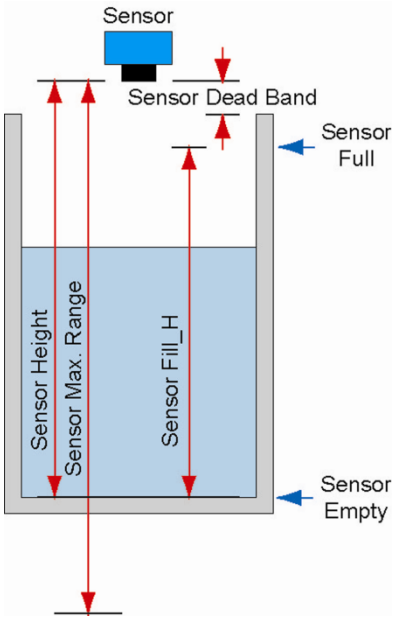



21. Press the ***Next Soft Key*** to return to **Config Channel #_** screen.
22. If you need to configure another **Input Channel**, go back to step 2. If not, continue on to step 23.
23. Press the ***NEXT Soft Key*** to return to the **Config Inputs** and **Config Outputs** screen.
24. Press ***Exit Soft Key*** to end configuration.

**Sensor with Scaled Output**

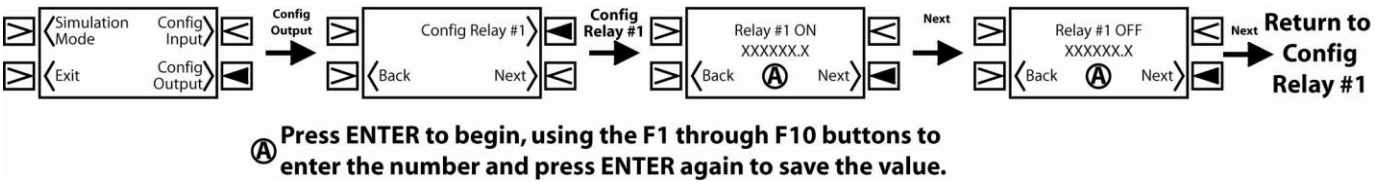



**Sensor with Non-Scaled Output (fixed output)**

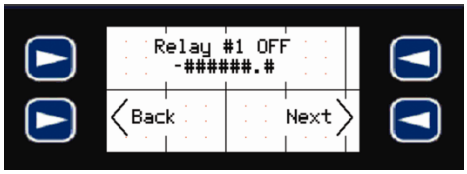



## Configure Outgoing Relays

1. Press ***ENTER*** key for 5 seconds to access the **Config Inputs** and **Config Outputs** screen.

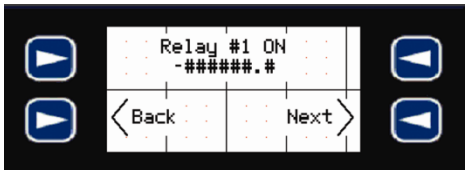



2. Press the ***Config Outputs Soft Key*** to begin. The first screen to appear is for **Relay #1.**
   a. Use the ***Next Soft Key*** to advance to the next relay.
   b. Use the ***Back Soft Key*** to return to the previous screen.
3. If the correct Relay is displayed, press the ***Config Relay #_ Soft Key*** to advance to **Relay #_ ON.**
4. **Relay #_ ON** is the set point where the relay will energize. For Alarm functions, this is the liquid level where the alarm will activate. For Automatic Fill or Empty functions, this is the level where the process begins.
   a. If a tank's sensor is reading between 0 to 500 gallons, then the relay set points must be measured in gallons.



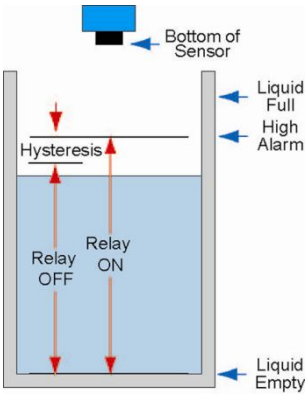

5. To change the **Relay #_ ON** value, first press the ***ENTER*** key. The value will now be highlighted and you can enter the number using the ***F-Keys*** as you would a 10-digit key pad, with the down arrow to enter the decimal point. Then, press ***ENTER*** again to complete the entry and store the value into memory.

6. Press the ***Next Soft Key*** to proceed to **Relay #_ OFF**.
7. **Relay #_ OFF** is the set point where the relay will de-energize. For Alarm functions, this is the liquid level where the alarm will de-activate. Use the OFF value to add a hysteresis to the relay to prevent relay chatter. For Automatic Fill or Empty functions, this is the level where the process ends.
8. To change the **Relay #_ OFF** value, first press the ***ENTER*** key. The value will now be highlighted and you can enter the number using the ***F-Keys*** as you would a 10-digit key pad, with the down arrow to enter the decimal point. Then, press ***ENTER*** again to complete the entry and store the value into memory.

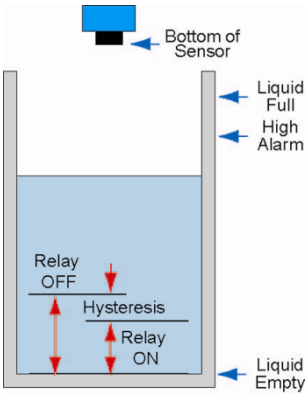



9. Press the ***Next Soft Key*** to return to **Config Relay #_.**
10. If you need to configure another **Relay**, go back to step 2. If not, continue on to step 11.
11. Press the ***NEXT Soft Key*** to return to the **Config Inputs** and **Config Outputs** screen.
12. Press ***Exit Soft Key*** to end configuration.

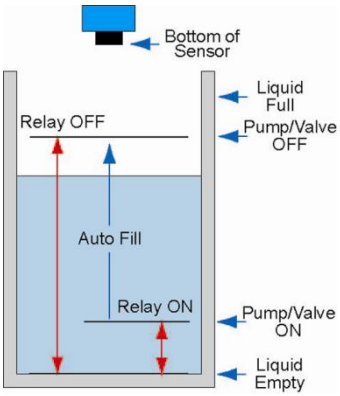
**High Alarm**



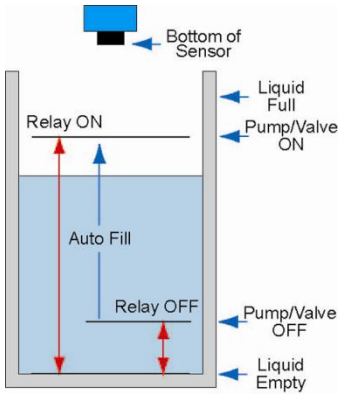

**Low Alarm**




**Automatic Fill**




**Automatic Empty**

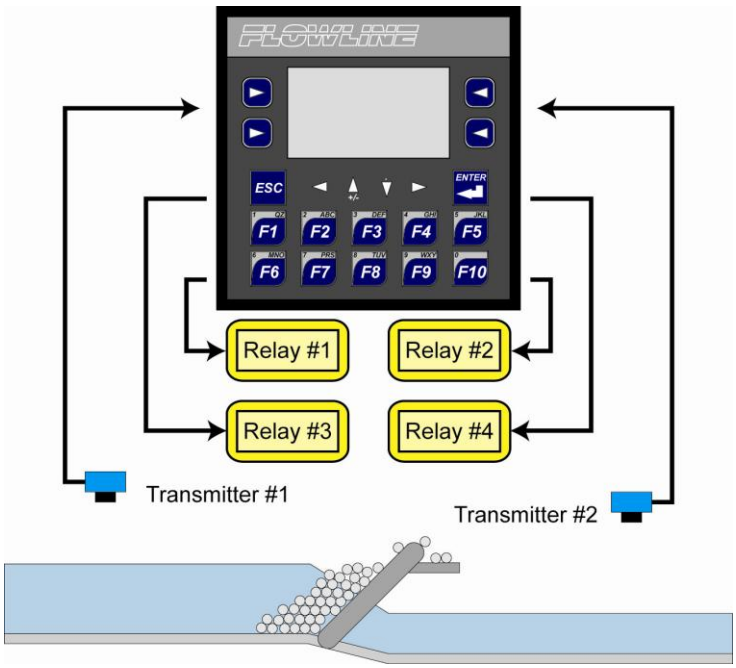


## Differential Level - Application #2

### Overview

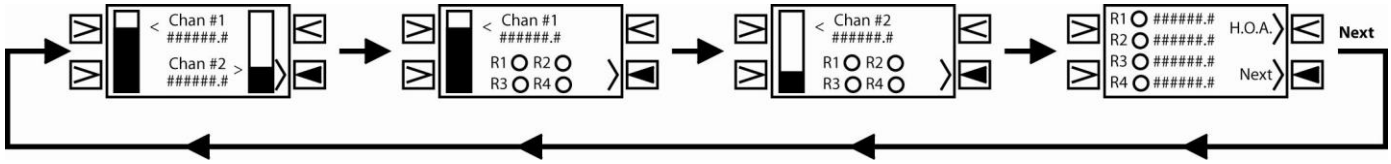
This application is used to monitor the levels above and below a rake and control a relay based upon the defined differential between the two levels. In addition, a differential alarm can be programmed as well as individual alarms for each input. For rake or screen control, wire the upstream transmitter to Input Channel #1 and the downstream transmitter to Input Channel #2.

- Step #1 – Determine the units of measurement to be display (ex. Inches, meters, gallons, liters).
- Step #2 – Determine the values for an empty and full tank in the units above.
- Step #3 – Configure the sensor inputs under Configure Inputs.
- Step #4 – Configure the relay outputs under Configure Outputs.
- Step #5 – Activate relays under H.O.A. settings.




Application #2

### Getting Around (Open Functions)




The Opening Screen indicates the Level of Liquid in the tank/vessel, along with the true analog data (4-20 mA) for channels #1 and #2. Regardless on how the channel's level is configured the bar graph will show the true 4-20 mA level provided by the sensor.

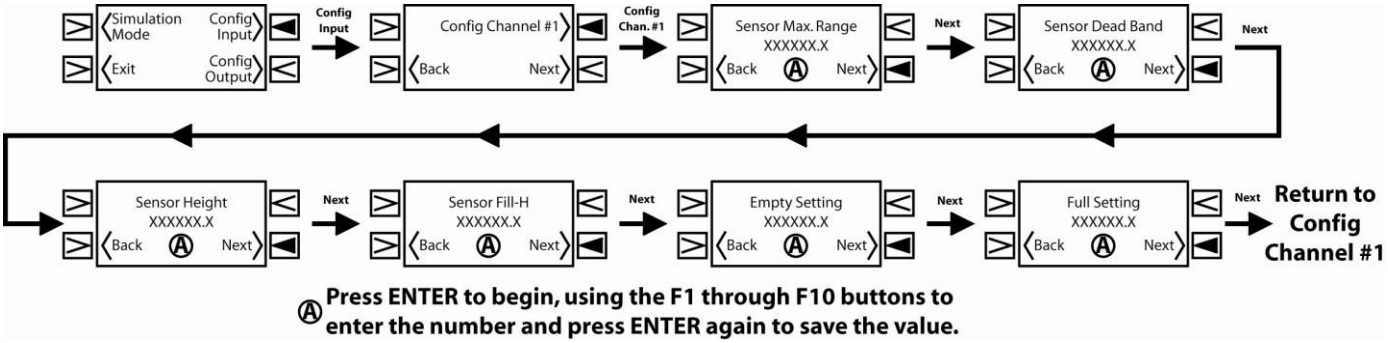
- Pressing the Lower Right Soft key will provide the following options:
  - Channel 1 and 2, Channel 1 only, Channel 2 only, Relay Info
- H.O.A. = Hand, Off, Auto – Refer to the Relay Hand/OFF/AUTO (HOA) – non-secured function section on Page ##

### Accessing Config Inputs and Config Outputs (Secured Functions)

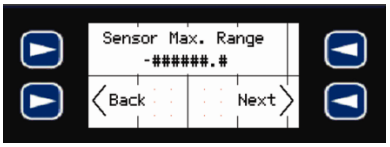
All Sensor Inputs and Relay Outputs are configured through the Commander Controller's secured section. To access this section, press and hold the ENTER key for 5 seconds. This section can then be exited by pressing the Exit Soft Key in the lower left corner.

### Configure Transmitter Inputs

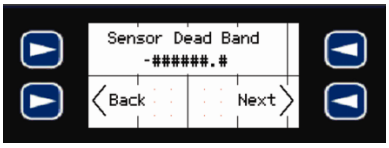
1. Press ENTER key for 5 seconds to access the **Config Inputs** and **Config Outputs** screen.



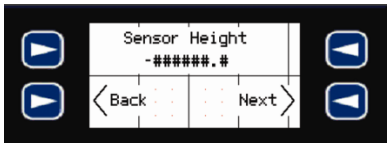

2. Press the ***Config Inputs Soft Key*** to begin. The first screen to appear is for Channel #1.
   a. Use the ***Next Soft Key*** to advance to the next channel.
   b. Use the ***Back Soft Key*** to return to the previous screen.
3. If the correct Channel is displayed, press the ***Config Channel #_ Soft Key*** to advance to **Sensor Max. Range**.
4. **Sensor Max. Range** is the distance from the bottom of the tank to the bottom of the installed sensor with a scaled 4-20 mA output. For a fixed output, this is the maximum range of the sensor (see next page). Use the sensor's manual to obtain the sensors maximum range (4 mA output).



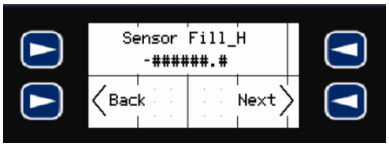

5. To change the **Sensor Max. Range** value, first press the ***ENTER*** key. The value will now be highlighted and you can enter the number using the ***F-Keys*** as you would a 10-digit key pad, with the down arrow to enter the decimal point. Then, press ***ENTER*** again to complete the entry and store the value into memory.
6. Press the ***Next Soft Key*** to proceed to **Sensor Dead Band**.
7. **Sensor Dead Band** is the distance from the full level of liquid to the bottom of the sensor with a scaled 4-20 mA output. For a fixed output, this is the dead band for the level sensor (see next page). Use the sensor's manual to obtain the sensors dead band (20 mA output).



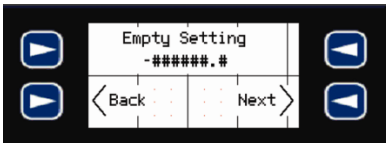

8. To change the **Sensor Dead Band** value, first press the ***ENTER*** key. The value will now be highlighted and you can enter the number using the ***F-Keys*** as you would a 10-digit key pad, with the down arrow to enter the decimal point. Then, press ***ENTER*** again to complete the entry and store the value into memory.
9. Press the ***Next Soft Key*** to proceed to **Sensor Height**.
10. **Sensor Height** is the distance from the bottom of the tank to the bottom of the installed sensor (see next page).



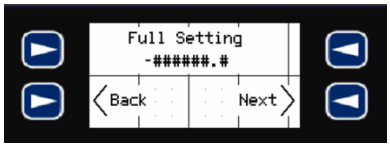

11. To change the **Sensor Height** value, first press the ***ENTER*** key. The value will now be highlighted and you can enter the number using the ***F-Keys*** as you would a 10-digit key pad, with the down arrow to enter the decimal point. Then, press ***ENTER*** again to complete the entry and store the value into memory.
12. Press the ***Next Soft Key*** to proceed to **Sensor Fill-H**.
13. **Sensor Fill-H** is the distance from the bottom of the tank to the highest level of liquid (see next page).




14. To change the **Sensor Fill-H** value, first press the ***ENTER*** key. The value will now be highlighted and you can enter the number using the ***F-Keys*** as you would a 10-digit key pad, with the down arrow to enter the decimal point. Then, press ***ENTER*** again to complete the entry and store the value into memory.
15. Press the ***Next Soft Key*** to proceed to Empty Setting.
16. **Empty Setting** is the display value when the tank is empty.
17. To change the **Empty Setting** value, first press the ***ENTER*** key. The value will now be highlighted and you can enter the number using the ***F-Keys*** as you would a 10-digit key pad, with the down arrow to enter the decimal point. Then, press ***ENTER*** again to complete the entry and store the value into memory.



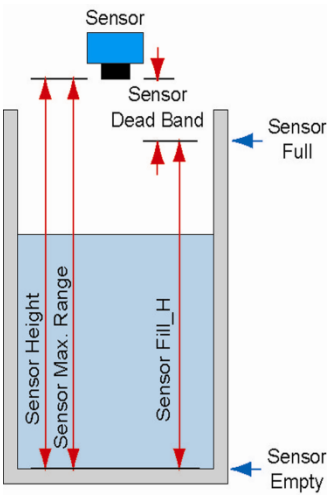

18. Press the ***Next Soft Key*** to proceed to **Full Setting**.
19. **Full Setting** is the display value when the tank is full.
20. To change the **Full Setting** value, first press the ***ENTER*** key. The value will now be highlighted and you can enter the number using the ***F-Keys*** as you would a 10-digit key pad, with the down arrow to enter the decimal point. Then, press ***ENTER*** again to complete the entry and store the value into memory.



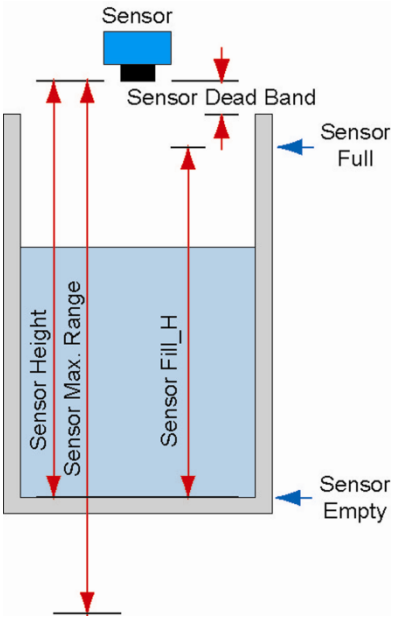

21. Press the ***Next Soft Key*** to return to **Config Channel #_** screen.

22. If you need to configure another **Input Channel**, go back to step 2. If not, continue on to step 23.
23. Press the ***NEXT Soft Key*** to return to the **Config Inputs** and **Config Outputs** screen.
24. Press ***Exit Soft Key*** to end configuration.

**Sensor with Scaled Output**



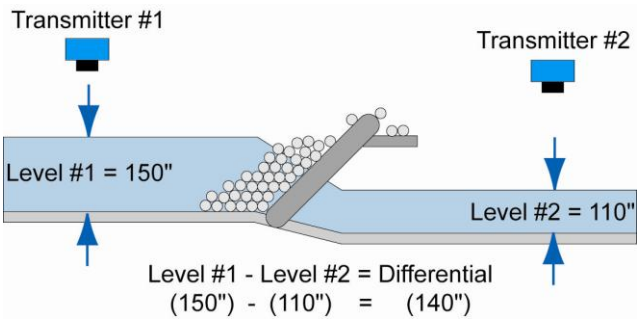

**Sensor with Non-Scaled Output (fixed output)**



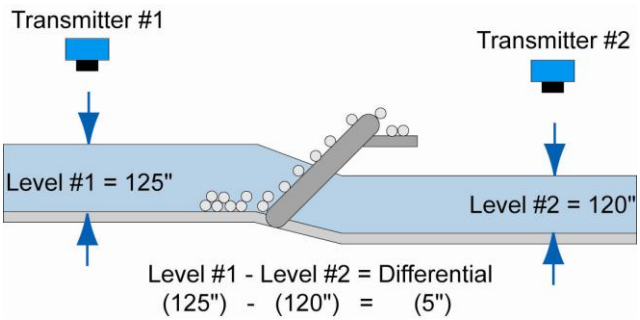

## Configure Outgoing Relays

Relays #1 and #2 are controlled directly by Transmitter Inputs #1 and #2 respectively. Relays #3 and #4 are interconnected to both Transmitter Inputs #1 and #2 and will activate (energize) when the difference between the two levels reaches a specific differential. The relays will de-activate (de-energize) when the differential becomes less than the OFF value. As a result, Relays #3 and #4 will have a Differential ON and Differential OFF setting instead of the Relay ON and Relay OFF settings.

Differential greater that 35", Relay #3 will energize



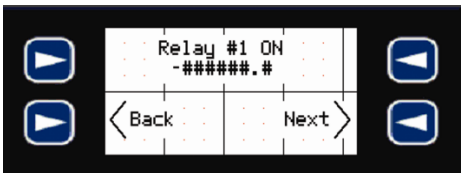

Differential less that 10", Relay #3 will de-energize



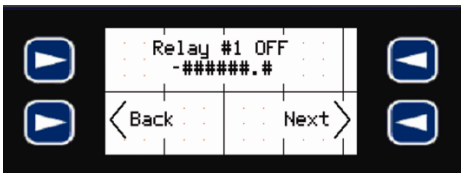

**EXAMPLE:** Relay #3 will energize when the difference between Level #1 and Level #2 is greater than 35". Relay #3 will de-energize when the difference between Level #1 and Level #2 is less than 10". Level #1 is the upstream level used for main differential control while Level #2 is the downstream level.

1. Press ***ENTER*** key for 5 seconds to access the **Config Inputs** and **Config Outputs** screen.

2. Press the ***Config Outputs Soft Key*** to begin. The first screen to appear is for **Relay #1.**
   a. Use the ***Next Soft Key*** to advance to the next relay.
   b. Use the ***Back Soft Key*** to return to the previous screen.
3. If the correct Relay is displayed, press the ***Config Relay*** #_ ***Soft Key*** to advance to **Relay** #_ **ON / Differential** #_ **ON.**
4. **Relay** #_ **ON / Differential** #_ **ON** is the set point where the relay will energize. For Alarm functions, this is the liquid level where the alarm will activate. For Automatic Fill or Empty functions, this is the level where the process begins.
   a. If a tank's sensor is reading between 0 to 500 gallons, then the relay set points must be measured in gallons.

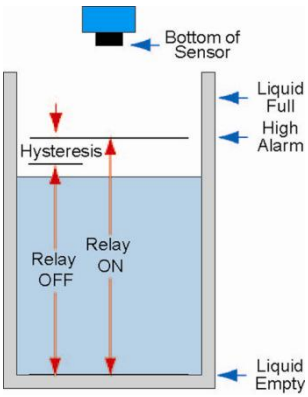



5. To change the **Relay** #_ **ON / Differential** #_ **ON** value, first press the ***ENTER*** key. The value will now be highlighted and you can enter the number using the ***F-Keys*** as you would a 10-digit key pad, with the down arrow to enter the decimal point. Then, press ***ENTER*** again to complete the entry and store the value into memory.
6. Press the ***Next Soft Key*** to proceed to **Relay** #_ **OFF / Differential** #_ **OFF**.

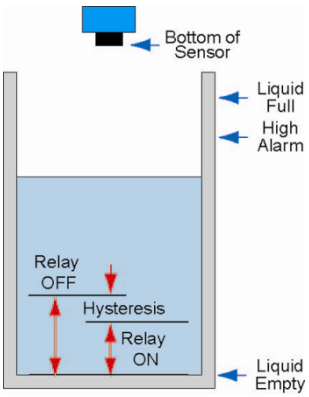



7. **Relay** #_ **OFF / Differential** #_ **OFF** is the set point where the relay will de-energize. For Alarm functions, this is the liquid level where the alarm will de-activate. Use the OFF value to add a hysteresis to the relay to prevent relay chatter. For Automatic Fill or Empty functions, this is the level where the process ends.
8. To change the **Relay** #_ **OFF / Differential** #_ **OFF** value, first press the ***ENTER*** key. The value will now be highlighted and you can enter the number using the ***F-Keys*** as you would a 10-digit key pad, with the down arrow to enter the decimal point. Then, press ***ENTER*** again to complete the entry and store the value into memory.
9. Press the ***Next Soft Key*** to return to **Config Relay** #_**.**
10. If you need to configure another **Relay**, go back to step 2. If not, continue on to step 11.
11. Press the ***NEXT Soft Key*** to return to the **Config Inputs** and **Config Outputs** screen.
12. Press ***Exit Soft Key*** to end configuration.

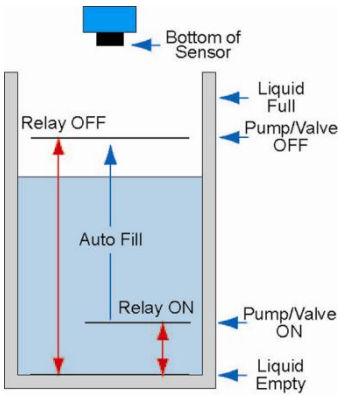
**High Alarm**



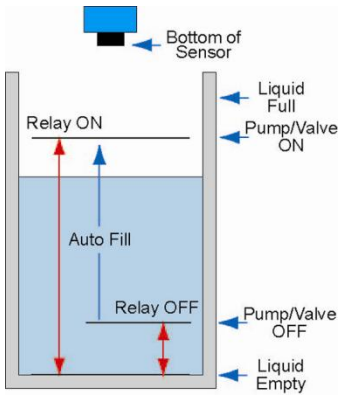

**Low Alarm**




**Automatic Fill**




**Automatic Empty**

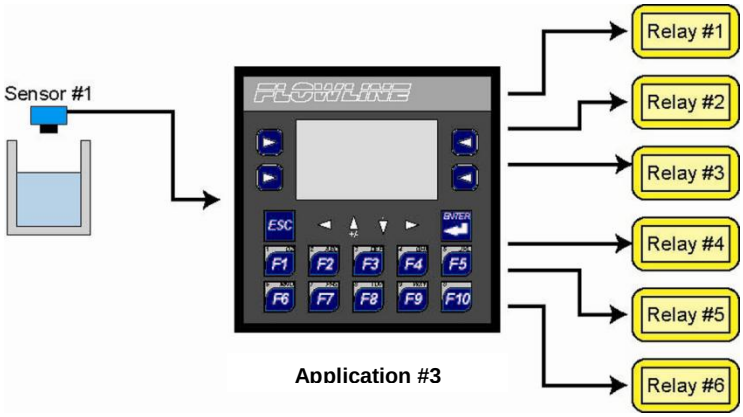


## Pump Controller - Application #3

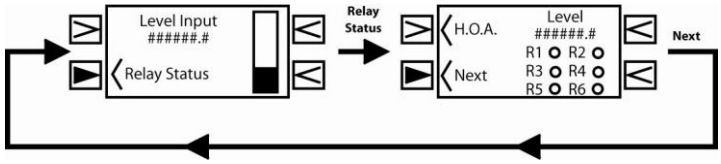
### Overview

This application is used to provide multiple relay contacts for a single 4-20 mA input. Relays 5 and 6 can be combined to be programmed as duplexing / alternating relays.

- Step #1 – Determine the units of measurement to be display (ex. Inches, meters, gallons, liters).
- Step #2 – Determine the values for an empty and full tank in the units above.
- Step #3 – Configure the sensor inputs under Configure Inputs.
- Step #4 – Configure the relay outputs under Configure Outputs.
- Step #5 – Activate relays under H.O.A. settings.




### Getting Around (Open Functions)




The Opening Screen indicates the Level of Liquid in the tank/vessel, along with the true analog data (4-20 mA) for channels #1. Regardless how the channel's level is configured the bar graph will show the true 4-20 mA level provided by the sensor.

- Pressing the Lower Left Soft key will provide the following options:
  - Relay Info including H.O.A.
- H.O.A. = Hand, Off, Auto – Refer to the Relay Hand/OFF/AUTO (HOA) – non-secured function section on Page ##

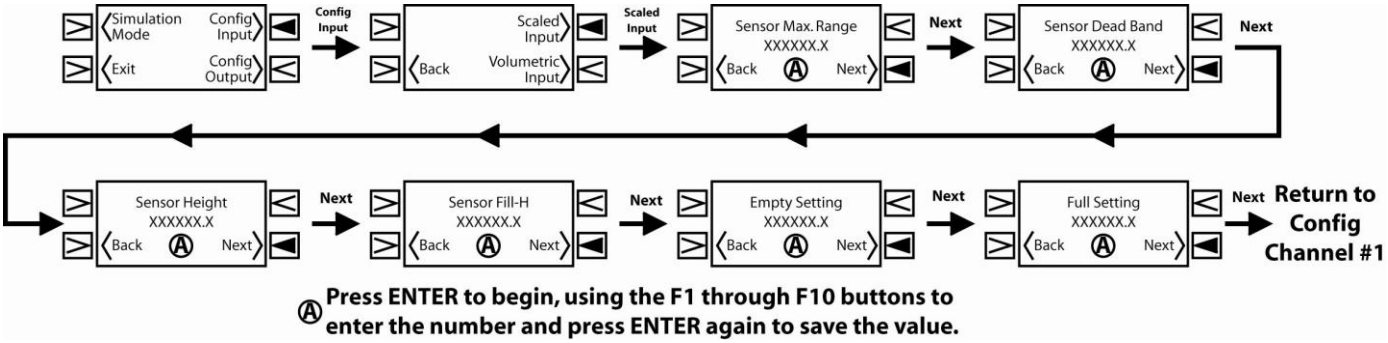
### Accessing Config Inputs and Config Outputs (Secured Functions)

All Sensor Inputs and Relay Outputs are configured through the Commander Controller's secured section. To access this section, press and hold the ENTER key for 5 seconds. This section can then be exited by pressing the Exit Soft Key in the lower left corner.

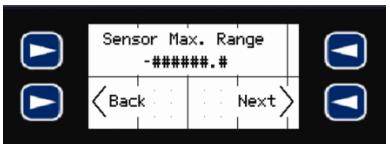
### Configure Transmitter Inputs (Scaled or Non-Scaled Inputs)

Incoming data is divided between Scaled / Non-Scaled Inputs and Volumetric Inputs. Scaled / Non-Scaled Inputs displays data in engineering units on a linear scale. Follow the steps below for Scaled / Non-Scaled Inputs. Volumetric Inputs displays tank volumes as calculated (in gallons or liters) for either vertical or horizontal tanks. Go to the next section for Volumetric Inputs.

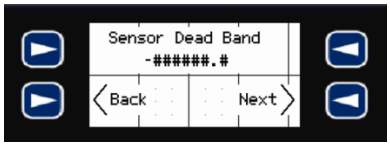
1. Press ENTER key for 5 seconds to access the **Config Inputs** and **Config Outputs** screen.



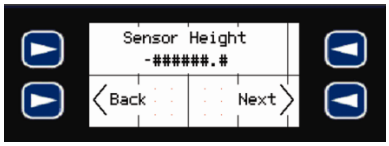

2. Press the ***Config Inputs Soft Key*** to begin. The first screen to appear is for Scaled Inputs or Volumetric Inputs.
   a. Use the ***Scaled Input Soft Key*** to advance to the begin configuration and to advance to **Sensor Max. Range**.
   b. Use the ***Volumetric Input Soft Key*** to advance to Volumetric Configuration (see next section).
3. **Sensor Max. Range** is the distance from the bottom of the tank to the bottom of the installed sensor with a scaled 4-20 mA output. For a fixed output, this is the maximum range of the sensor (see next page). Use the sensor's manual to obtain the sensors maximum range (4 mA output).



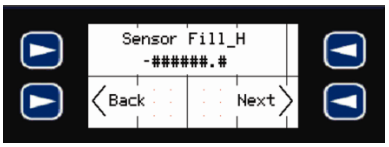

4. To change the **Sensor Max. Range** value, first press the ***ENTER*** key. The value will now be highlighted and you can enter the number using the ***F-Keys*** as you would a 10-digit key pad, with the down arrow to enter the decimal point. Then, press ***ENTER*** again to complete the entry and store the value into memory.
5. Press the ***Next Soft Key*** to proceed to **Sensor Dead Band**.
6. **Sensor Dead Band** is the distance from the full level of liquid to the bottom of the sensor with a scaled 4-20 mA output. For a fixed output, this is the dead band for the level sensor (see next page). Use the sensor's manual to obtain the sensors dead band (20 mA output).



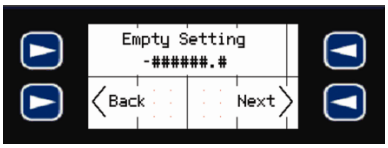

7. To change the **Sensor Dead Band** value, first press the ***ENTER*** key. The value will now be highlighted and you can enter the number using the ***F-Keys*** as you would a 10-digit key pad, with the down arrow to enter the decimal point. Then, press ***ENTER*** again to complete the entry and store the value into memory.
8. Press the ***Next Soft Key*** to proceed to **Sensor Height**.
9. **Sensor Height** is the distance from the bottom of the tank to the bottom of the installed sensor (see next page).



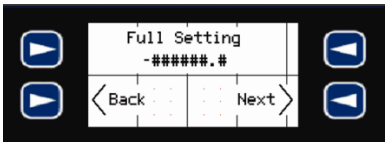

10. To change the **Sensor Height** value, first press the ***ENTER*** key. The value will now be highlighted and you can enter the number using the ***F-Keys*** as you would a 10-digit key pad, with the down arrow to enter the decimal point. Then, press ***ENTER*** again to complete the entry and store the value into memory.
11. Press the ***Next Soft Key*** to proceed to **Sensor Fill-H**.
12. **Sensor Fill-H** is the distance from the bottom of the tank to the highest level of liquid (see next page).




13. To change the **Sensor Fill-H** value, first press the ***ENTER*** key. The value will now be highlighted and you can enter the number using the ***F-Keys*** as you would a 10-digit key pad, with the down arrow to enter the decimal point. Then, press ***ENTER*** again to complete the entry and store the value into memory.
14. Press the ***Next Soft Key*** to proceed to Empty Setting.
15. **Empty Setting** is the display value when the tank is empty.




16. To change the **Empty Setting** value, first press the ***ENTER*** key. The value will now be highlighted and you can enter the number using the ***F-Keys*** as you would a 10-digit key pad, with the down arrow to enter the decimal point. Then, press ***ENTER*** again to complete the entry and store the value into memory.
17. Press the ***Next Soft Key*** to proceed to **Full Setting**.
18. **Full Setting** is the display value when the tank is full.

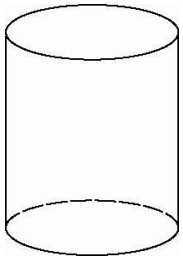



19. To change the **Full Setting** value, first press the ***ENTER*** key. The value will now be highlighted and you can enter the number using the ***F-Keys*** as you would a 10-digit key pad, with the down arrow to enter the decimal point. Then, press ***ENTER*** again to complete the entry and store the value into memory.
20. Press the ***Next Soft Key*** to return to the **Config Inputs** and **Config Outputs** screen.
21. Press ***Exit Soft Key*** to end configuration.

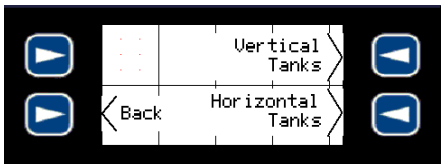
### Configure Transmitter Inputs (Volumetric Inputs – Vertical)

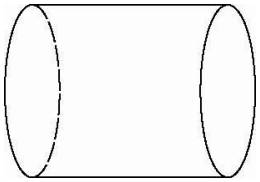
Volumetric Inputs displays tank volumes as calculated (in gallons or liters) for either vertical or horizontal tanks.

- The controller will ask basic shape and dimensional information in order to display either the gallons or liters within the tank or vessel.
  - Dimensional information must be entered as either inches or cm.
  - Dimensional inches must show gallons and cm must show liters.
  - Transmitter must be configured such that tank empty is 4 mA and tank full is 20 mA.
- Select between either Vertical Tanks or Horizontal Tanks.



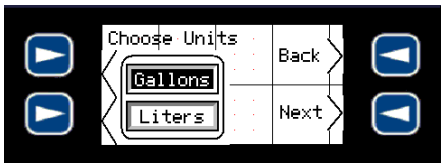
**Vertical Tanks**



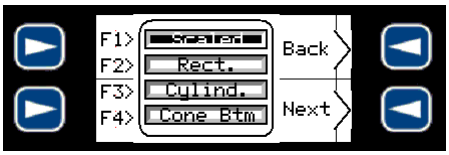



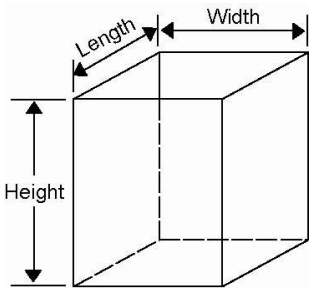
**Horizontal Tanks**

- Choose between Gallons or Liters for the display output.
  - When choosing Gallons, make sure all dimensional information entered is in inches.
  - When choosing Liters, make sure all dimensional information entered is in cm.

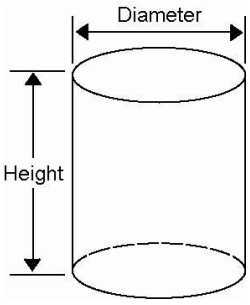



- Vertical Tanks – Select among Rectangular, Flat Bottom or Cone Bottom.

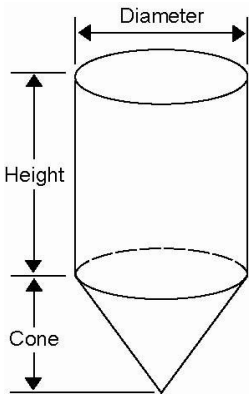



**Rectangular**

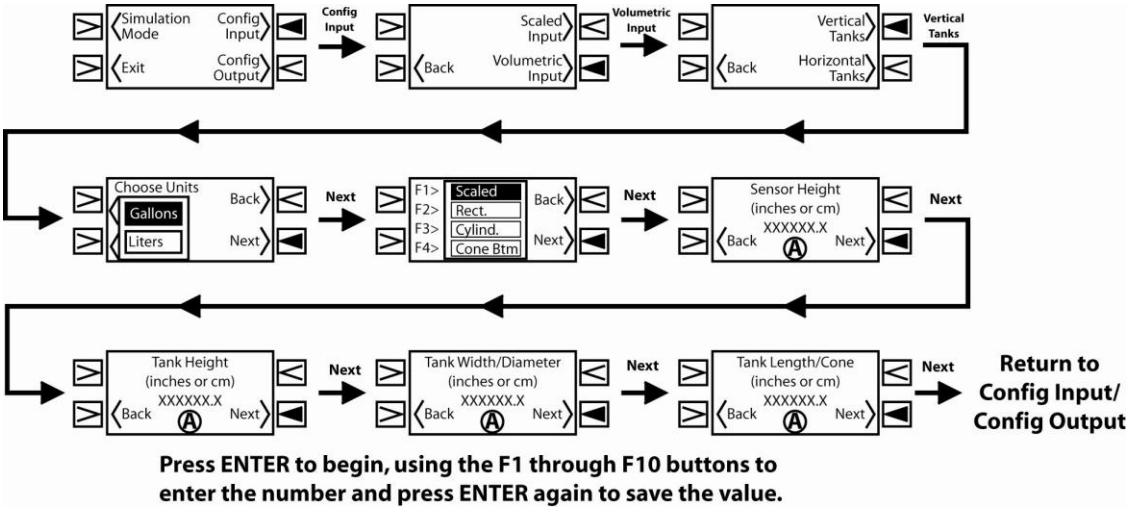



**Flat Bottom (Cylind.)**

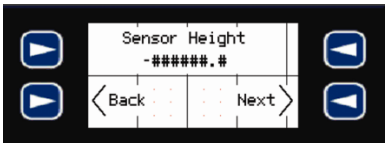



**Cone Bottom**

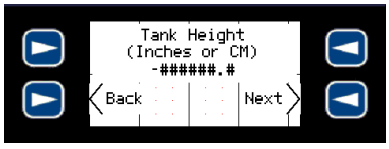
1. Press ENTER key for 5 seconds to access the **Config Inputs** and **Config Outputs** screen.



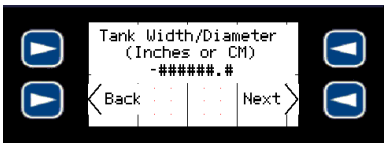

2. Press the ***Config Inputs Soft Key*** to begin. The first screen to appear is for Scaled Inputs or Volumetric Inputs.
    a. Use the ***Scaled Input Soft Key*** to advance to the Scaled/Non-Scaled Configuration (see previous section).
    b. Use the ***Volumetric Input Soft Key*** to advance to Vertical or Horizontal Tanks.
3. Press the Soft Key for either Vertical or Horizontal Tanks.
    a. Use the ***Vertical Tanks Soft Key*** to advance to Choose Units.
    b. Use the ***Horizontal Tanks Soft Key*** to advance to Horizontal Tanks (see next section).
4. **Choose Units** allows the selection of either Gallons or Liters to appear in the display. Use the ***Gallons Soft Key*** to select Gallons and the ***Liters Soft Key*** to select Liters.
5. Press the ***Next Soft Key*** to continue on to **Tank Shape**.
6. **Tank Shape** allows the selection of a tank shape for calculating the volume of the tank. Use the ***Rect. Soft Key*** to select a **Rectangular Tank,** the ***Cylind. Soft Key*** to select a **Cylindrical Tank** and the ***Cone Btm. Soft Key*** to select a **Cone Bottom Tank**. See above to review the tanks shapes.
7. Press the ***Next Soft Key*** to proceed to **Sensor Height**.
8. **Sensor Height** is the distance from the bottom of the tank to the bottom of the sensor. Measure this distance in inches or cm.
9. To change the **Sensor Height** value, first press the ***ENTER*** key. The value will now be highlighted and you can enter the number using the ***F-Keys*** as you would a 10-digit key pad, with the down arrow to enter the decimal point. Then, press ***ENTER*** again to complete the entry and store the value into memory.



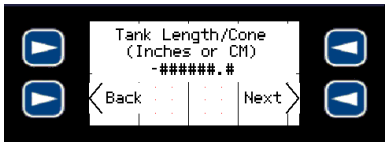

10. Press the ***Next Soft Key*** to proceed to **Tank Height**.
11. **Tank Height** is the height of the tank. Please refer to the illustrations above to identify the dimension to measure.
12. To change the **Tank Height** value, first press the ***ENTER*** key. The value will now be highlighted and you can enter the number using the ***F-Keys*** as you would a 10-digit key pad, with the down arrow to enter the decimal point. Then, press ***ENTER*** again to complete the entry and store the value into memory.




13. Press the ***Next Soft Key*** to proceed to **Tank Width/Diameter**.
14. **Tank Width/Diameter** is the width or diameter of the tank. Please refer to the illustrations above to identify the dimension to measure.
15. To change the **Tank Width/Diameter** value, first press the ***ENTER*** key. The value will now be highlighted and you can enter the number using the ***F-Keys*** as you would a 10-digit key pad, with the down arrow to enter the decimal point. Then, press ***ENTER*** again to complete the entry and store the value into memory.




16. Press the ***Next Soft Key*** to proceed to **Tank Length/Cone**.
17. **Tank Length/Cone** is the length or cone of the tank. Please refer to the illustrations above to identify the dimension to measure
18. To change the **Tank Length/Cone** value, first press the ***ENTER*** key. The value will now be highlighted and you can enter the number using the ***F-Keys*** as you would a 10-digit key pad, with the down arrow to enter the decimal point. Then, press ***ENTER*** again to complete the entry and store the value into memory.



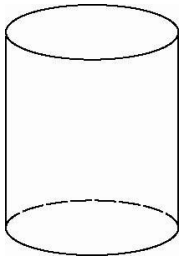

19. Press the ***Next Soft Key*** to return to the **Config Inputs** and **Config Outputs** screen.

20. Press ***Exit Soft Key*** to end configuration.

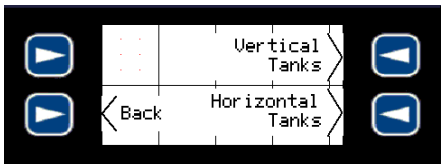
### Configure Transmitter Inputs (Volumetric Inputs – Horizontal)

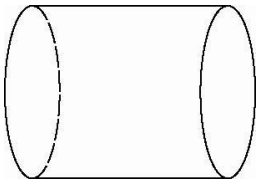
Volumetric Inputs displays tank volumes as calculated (in gallons or liters) for either vertical or horizontal tanks.

- The controller will ask basic shape and dimensional information in order to display either the gallons or liters within the tank or vessel.
  - Dimensional information must be entered as either inches or cm.
  - Dimensional inches must show gallons and cm must show liters.
  - Transmitter must be configured such that tank empty is 4 mA and tank full is 20 mA.
- Select between either Vertical Tanks or Horizontal Tanks.



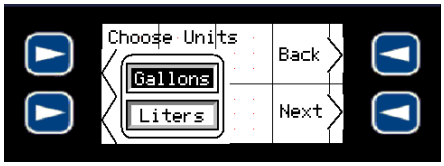
**Vertical Tanks**



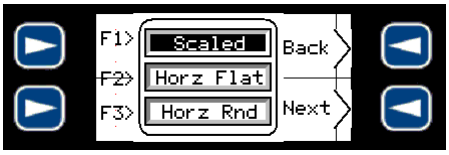



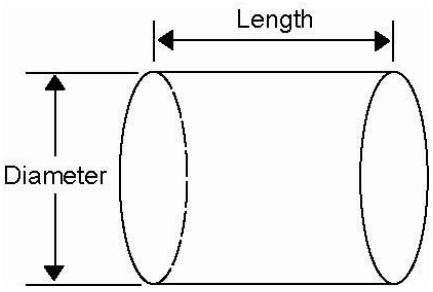
**Horizontal Tanks**

- Choose between Gallons or Liters for the display output.
  - When choosing Gallons, make sure all dimensional information entered is in inches.
  - When choosing Liters, make sure all dimensional information entered is in cm.

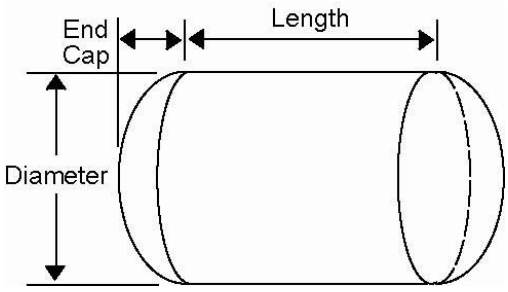



- Horizontal – Select among Flat Ends (Horz. Flat) or Round Ends (Horz. Rnd).



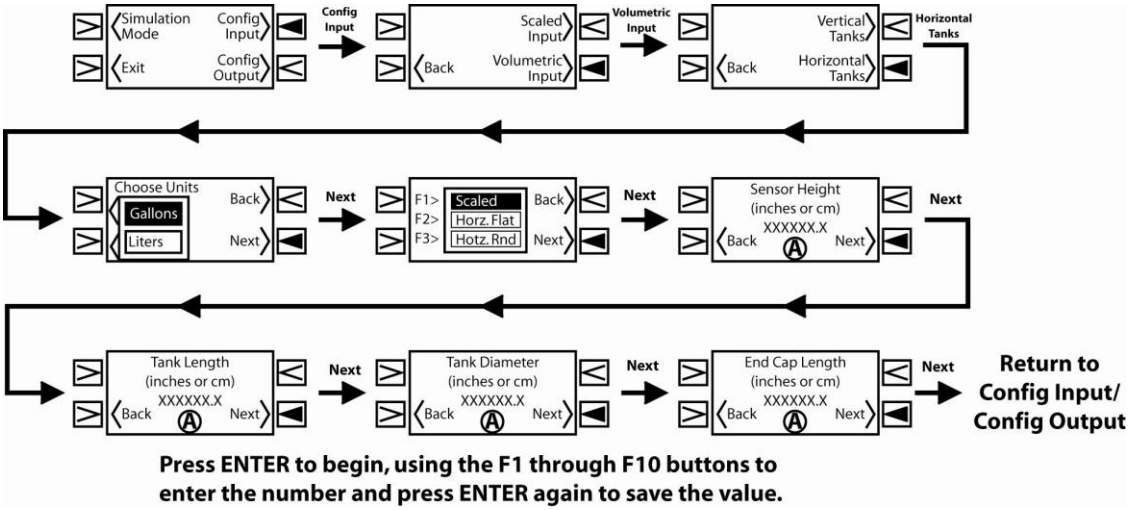




**Flat Ends (Horizontal Flat)**

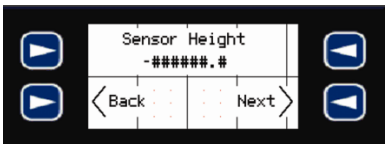



**Round Ends (Horizontal Round)**

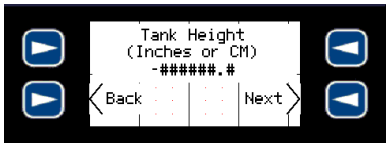
1. Press ENTER key for 5 seconds to access the **Config Inputs** and **Config Outputs** screen.



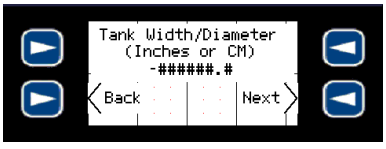

2. Press the ***Config Inputs Soft Key*** to begin. The first screen to appear is for Scaled Inputs or Volumetric Inputs.
   a. Use the ***Scaled Input Soft Key*** to advance to the Scaled/Non-Scaled Configuration (see previous section).
   b. Use the ***Volumetric Input Soft Key*** to advance to Vertical or Horizontal Tanks.
3. Press the Soft Key for either Vertical or Horizontal Tanks.
   a. Use the ***Vertical Tanks Soft Key*** to advance to Vertical Tanks (see next section).
   b. Use the ***Horizontal Tanks Soft Key*** to advance to Choose Units.
4. **Choose Units** allows the selection of either Gallons or Liters to appear in the display. Use the ***Gallons Soft Key*** to select Gallons and the ***Liters Soft Key*** to select Liters.
5. Press the ***Next Soft Key*** to continue on to **Tank Shape**.
6. **Tank Shape** allows the selection of a tank shape for calculating the volume of the tank. Use the ***Horz. Flat Soft Key*** to select a **Horizontal Tank with Flat Ends** and the ***Horz. Rnd Soft Key*** to select a **Horizontal Tank with Round Ends**. See above to review the tanks shapes.
7. Press the ***Next Soft Key*** to proceed to **Sensor Height**.
8. **Sensor Height** is the distance from the bottom of the tank to the bottom of the sensor. Measure this distance in inches or cm.
9. To change the **Sensor Height** value, first press the ***ENTER*** key. The value will now be highlighted and you can enter the number using the ***F-Keys*** as you would a 10-digit key pad, with the down arrow to enter the decimal point. Then, press ***ENTER*** again to complete the entry and store the value into memory.



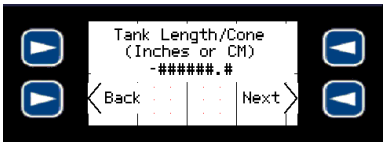

10. Press the ***Next Soft Key*** to proceed to **Tank Length**.
11. **Tank Length** is the height of the tank. Please refer to the illustrations above to identify the dimension to measure.
12. To change the **Tank Length** value, first press the ***ENTER*** key. The value will now be highlighted and you can enter the number using the ***F-Keys*** as you would a 10-digit key pad, with the down arrow to enter the decimal point. Then, press ***ENTER*** again to complete the entry and store the value into memory.




13. Press the ***Next Soft Key*** to proceed to **Tank Diameter**.
14. **Tank Diameter** is the width or diameter of the tank. Please refer to the illustrations above to identify the dimension to measure.
15. To change the **Tank Diameter** value, first press the ***ENTER*** key. The value will now be highlighted and you can enter the number using the ***F-Keys*** as you would a 10-digit key pad, with the down arrow to enter the decimal point. Then, press ***ENTER*** again to complete the entry and store the value into memory.



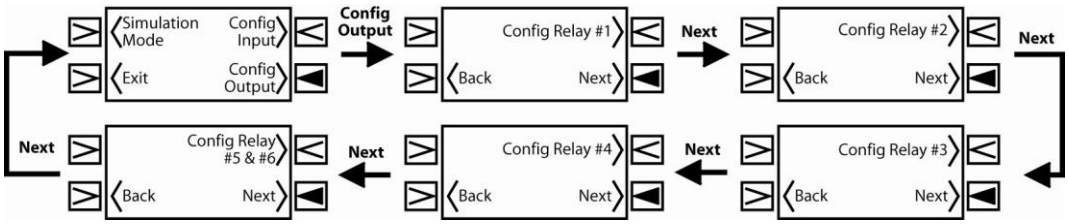

16. Press the ***Next Soft Key*** to proceed to **End Cap Length**.
17. **End Cap Length** is the length or cone of the tank. Please refer to the illustrations above to identify the dimension to measure. This setting is not required for a flat end tank.
18. To change the **End Cap Length** value, first press the ***ENTER*** key. The value will now be highlighted and you can enter the number using the ***F-Keys*** as you would a 10-digit key pad, with the down arrow to enter the decimal point. Then, press ***ENTER*** again to complete the entry and store the value into memory.




19. Press the ***Next Soft Key*** to return to the **Config Inputs** and **Config Outputs** screen.

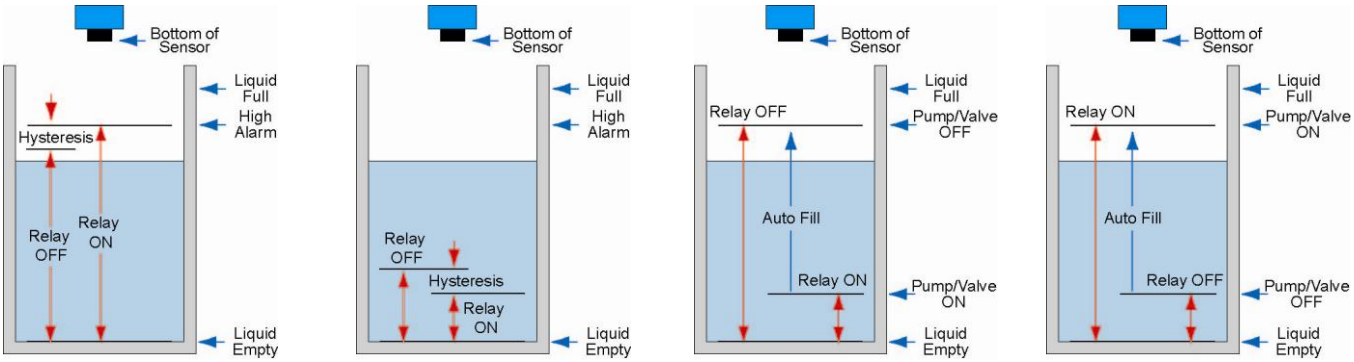
20. Press ***Exit Soft Key*** to end configuration.

### Configure Outgoing Relays




To configure outgoing data, simply press the Config Outputs Soft Key from within the Secured Functions section. Press the Next or Back soft keys to scroll to the relay you would like to configure. As an option, Relays 5 and 6 can be used as a Duplex / Alternation function. Select the Config. Relay #5 and #6 upper right soft key to configure relays #5 and #6. This setting will always configure both relays #5 and #6.

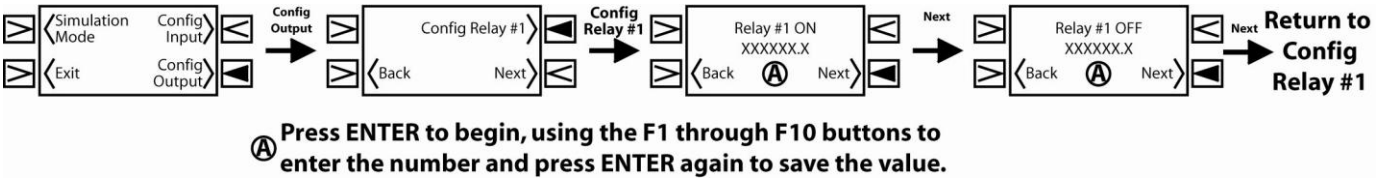
Relays #1, #2, #3 and #4 are controlled directly by the Transmitter Input. Each relay will ask for a Relay ON and Relay OFF level. These settings must be in the same units used for the Empty and Full incoming data settings.



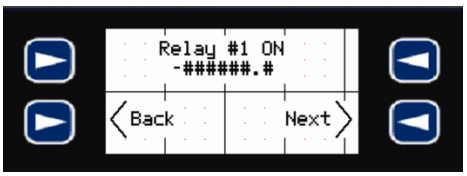

**High Alarm** **Low Alarm** **Automatic Fill** **Automatic Empty**

**EXAMPLE:** If a tank's sensor is reading between 0 to 500 gallons, then the relay set points must be measured in gallons. For Alarms (High or Low), use the ON point where the relay will start and the OFF as a hysteresis to prevent chattering of the relay. For Pumps and Valves (Auto Fill or Auto Empty), use both settings as the ON/OPEN and OFF/CLOSE points for the device.

1. Press ***ENTER*** key for 5 seconds to access the **Config Inputs** and **Config Outputs** screen.

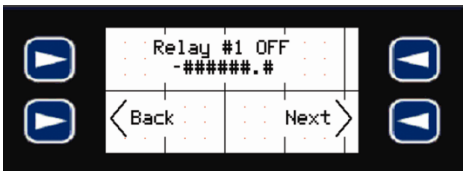



2. Press the ***Config Outputs Soft Key*** to begin. The first screen to appear is for **Relay #1.**
   a. Use the ***Next Soft Key*** to advance to the next relay.
   b. Use the ***Back Soft Key*** to return to the previous screen.
3. If the correct Relay is displayed, press the ***Config Relay #_ Soft Key*** to advance to **Relay #_ ON.**
4. **Relay #_ ON** is the set point where the relay will energize. For Alarm functions, this is the liquid level where the alarm will activate. For Automatic Fill or Empty functions, this is the level where the process begins.
   a. If a tank's sensor is reading between 0 to 500 gallons, then the relay set points must be measured in gallons.
5. To change the **Relay #_ ON** value, first press the ***ENTER*** key. The value will



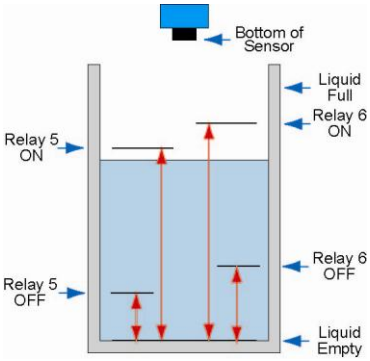
now be highlighted and you can enter the number using the ***F-Keys*** as you would a 10-digit key pad, with the down arrow to enter the decimal point. Then, press ***ENTER*** again to complete the entry and store the value into memory.

6. Press the ***Next Soft Key*** to proceed to **Relay** #_ **OFF**.
7. **Relay** #_ **OFF** is the set point where the relay will de-energize. For Alarm functions, this is the liquid level where the alarm will de-activate. Use the OFF value to add a hysteresis to the relay to prevent relay chatter. For Automatic Fill or Empty functions, this is the level where the process ends.



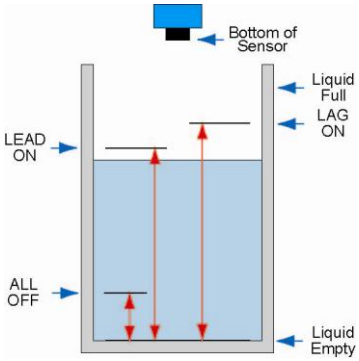

8. To change the **Relay** #_ **OFF** value, first press the ***ENTER*** key. The value will now be highlighted and you can enter the number using the ***F-Keys*** as you would a 10-digit key pad, with the down arrow to enter the decimal point. Then, press ***ENTER*** again to complete the entry and store the value into memory.
9. Press the ***Next Soft Key*** to return to **Config Relay** #_**.**
10. If you need to configure another **Relay**, go back to step 2. If not, continue on to step 11.
11. Press the ***NEXT Soft Key*** to return to the **Config Inputs** and **Config Outputs** screen.
12. Press ***Exit Soft Key*** to end configuration.

**Relays 5 & 6 – Independent, Duplex or Alternating**



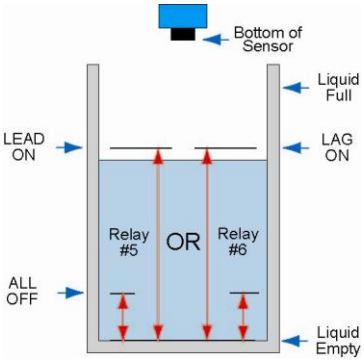

**Independent Relays**

This allows relays #5 and #6 to perform the same as relays #1 through #4. The two relays are not linked together.



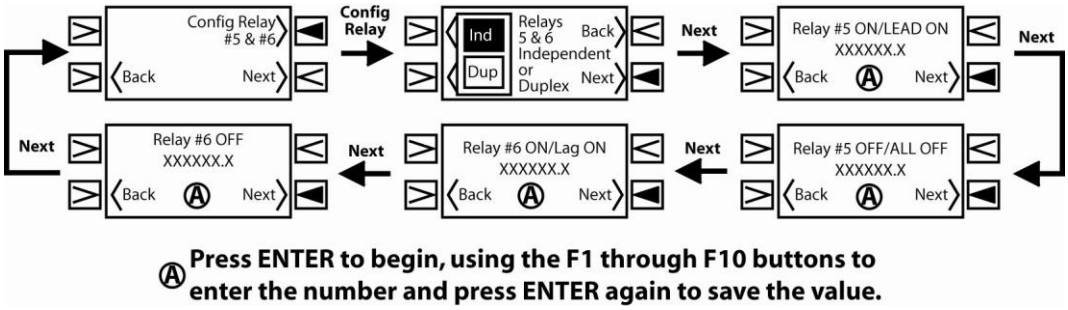

**Duplex Relays**

This links relays #5 and #6 together with two unique start levels and a common off position. The relays will also alternate between each LEAD start. If the level ever reaches the LAG start, the remaining relay will activate.




**Alternating Relays**

This switches relays #5 and #6 back and forth each time the ON level is reached. This is used to maintain a common use/life cycle for equipment.




Relay settings must be in the same units used for the Empty and Full settings

To use as Independent Relay mode, press the IND soft key and then press Next.

- Enter the Relay #5 ON set point (where Relay #5will energize) and press Next

To change to a Duplex mode, press the DUP soft key and then press Next.

- Enter the LEAD ON relay set point (where the lead relay will energize) and press Next

To change to an Alternating mode, press the DUP soft key and then press Next.

- Enter the LEAD ON relay set point (where relay #5 will energize) and press Next

- Enter the Relay #5 OFF set point (where Relay #5 will de-energize) and press Next
- Enter the Relay #6 ON set point (where Relay #6 will energize) and press Next.
- Enter the Relay #6 OFF set point (where Relay #6 will de-energize) and press Next.

- Enter the ALL OFF relay set point (where both relays will de-energize) and press Next
- Enter the LAG ON relay set point (where the lag relay will energize) and press Next.
- You do not need to provide a value for Relay #6 OFF.
- Duplex can be used as a Filling or Emptying configuration.
- *Always make sure that the LAG ON is above the LEAD ON for an Empty configuration or below the LEAD ON for a Fill configuration.*

- Enter the ALL OFF relay set point (where both relays will de-energize) and press Next
- Enter the LAG ON relay set point (where relay #6 will energize) and press Next.
- You do not need to provide a value for Relay #6 OFF.
- Alternate can be used as a Filling or Emptying configuration.
- *Always make sure that the LAG ON is the same as the LEAD ON. This will enable Relays 5 and #6 to alternate each time a relay is to become energized.*

To return Relays 5 and 6 back to an independent mode, press the IND soft key. Press Exit to leave the Secured Function Section.

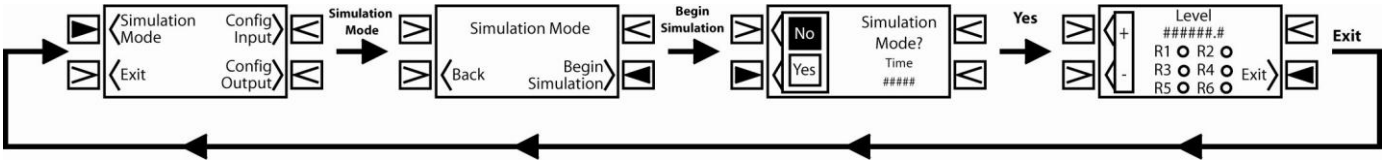
# Appendix

## Simulation Mode

Simulation Mode allows users to simulate changes in tank levels. Relays will turn ON and OFF depending on how they were configured. This will test your configuration and setup.

Simulation Mode turns relays ON and OFF as if in normal function. Any devices wired to the relays will become active in Simulation Mode. To turn off individual relays, select OFF in the H.O.A. section before entering Simulation mode.

1. Press ***ENTER*** key for 5 seconds to access the **Config Inputs** and **Config Outputs** screen.

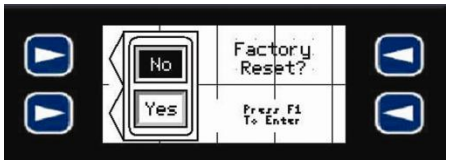



2. Press the ***Simulation Mode Soft Key*** to begin. The first screen to appear is for **Simulation Mode.**
3. Press the ***Begin Simulation Soft Key*** to enter the Simulation Mode. The **Simulation Mode** confirmation screen will appear. To return back to the previous screen, press the ***Back Soft Key***.
4. Press the ***YES Soft Key*** to begin the simulation. The simulation will begin after a short count down.
5. Once in Simulation mode, use the two soft keys on the left [***(+) Soft Key*** and ***(-) Soft Key***] to increase and decrease the level and check all active relays to verify operation. Verify the level with the display and the relay with the indicators on the screen.
6. To exit from Simulation mode, press the ***Exit soft key*** in the lower right corner of the screen.

## Factory Reset

Factory Reset will return the Commander back to its original factory settings. Follow the instructions below to reset the LI90 series.

1. To reset the Commander Controller to its default status, first hold down the F10 button for about 10 seconds.
2. A screen that reads “Factory Reset?” should appear. Press the ***Yes soft key***, followed by the ***F-1 button***, to reset the Commander Controller to its default settings.
    a. Be sure to press the F1 button to confirm the engage the Factory Reset.



**For full documentation of products, training video and technical support, please visit www.flowline.com. For telephone support, call 562-598-3015 from 8 am to 5 pm PST, Monday - Friday. (Please check that you have the piece and the number of available series.)**

## Warranty

Flowline warrants to the original purchaser of its products that such products will be free from defects in material and workmanship under normal use and service in accordance with instructions furnished by Flowline for a period, which is equal to the shorter of one year from the date of purchase of such products or two years from the date of manufacture of such products. Flowline's obligation under this warranty is solely and exclusively limited to the repair or replacement, at Flowline's option, of the products or components, which Flowline's examination determines to its satisfaction to be defective in material or workmanship within the warranty period. Flowline must be notified pursuant to the instructions below of any claim under this warranty within thirty (30) days of any claimed lack of conformity of the product. Any product repaired or replaced under this warranty will be warranted only for the remainder of the original warranty period.

## Returns

Products cannot be returned to Flowline without Flowline's prior authorization. To return a product that is thought to be defective, go to www.flowline.com, and submit a customer return (MRA) request form and follow the instructions therein. All warranty and non-warranty product returns to Flowline must be shipped prepaid and insured. Flowline will not be responsible for any products lost or damaged in shipment.

## Limitations

This warranty does not apply to products which: 1) are beyond the warranty period or are products for which the original purchaser does not follow the warranty procedures outlined above; 2) have been subjected to electrical, mechanical or chemical damage due to improper, accidental or negligent use; 3) have been modified or altered; 4) anyone other than service personnel authorized by Flowline have attempted to repair; 5) have been involved in accidents or natural disasters; or 6) are damaged during return shipment to Flowline. Flowline reserves the right to unilaterally waive this warranty and dispose of any product returned to Flowline where: 1) there is evidence of a potentially hazardous material present with the product; or 2) the product has remained unclaimed at Flowline for more than 30 days after Flowline has dutifully requested disposition. This warranty contains the sole express warranty made by Flowline in connection with its products. ALL IMPLIED WARRANTIES, INCLUDING WITHOUT LIMITATION, THE WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, ARE EXPRESSLY DISCLAIMED. The remedies of repair or replacement as stated above are the exclusive remedies for the breach of this warranty. IN NO EVENT SHALL FLOWLINE BE LIABLE FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES OF ANY KIND INCLUDING PERSONAL OR REAL PROPERTY OR FOR INJURY TO ANY PERSON. THIS WARRANTY CONSTITUTES THE FINAL, COMPLETE AND EXCLUSIVE STATEMENT OF WARRANTY TERMS AND NO PERSON IS AUTHORIZED TO MAKE ANY OTHER WARRANTIES OR REPRESENTATIONS ON BEHALF OF FLOWLINE. This warranty will be interpreted pursuant to the laws of the State of California. If any portion of this warranty is held to be invalid or unenforceable for any reason, such finding will not invalidate any other provision of this warranty.