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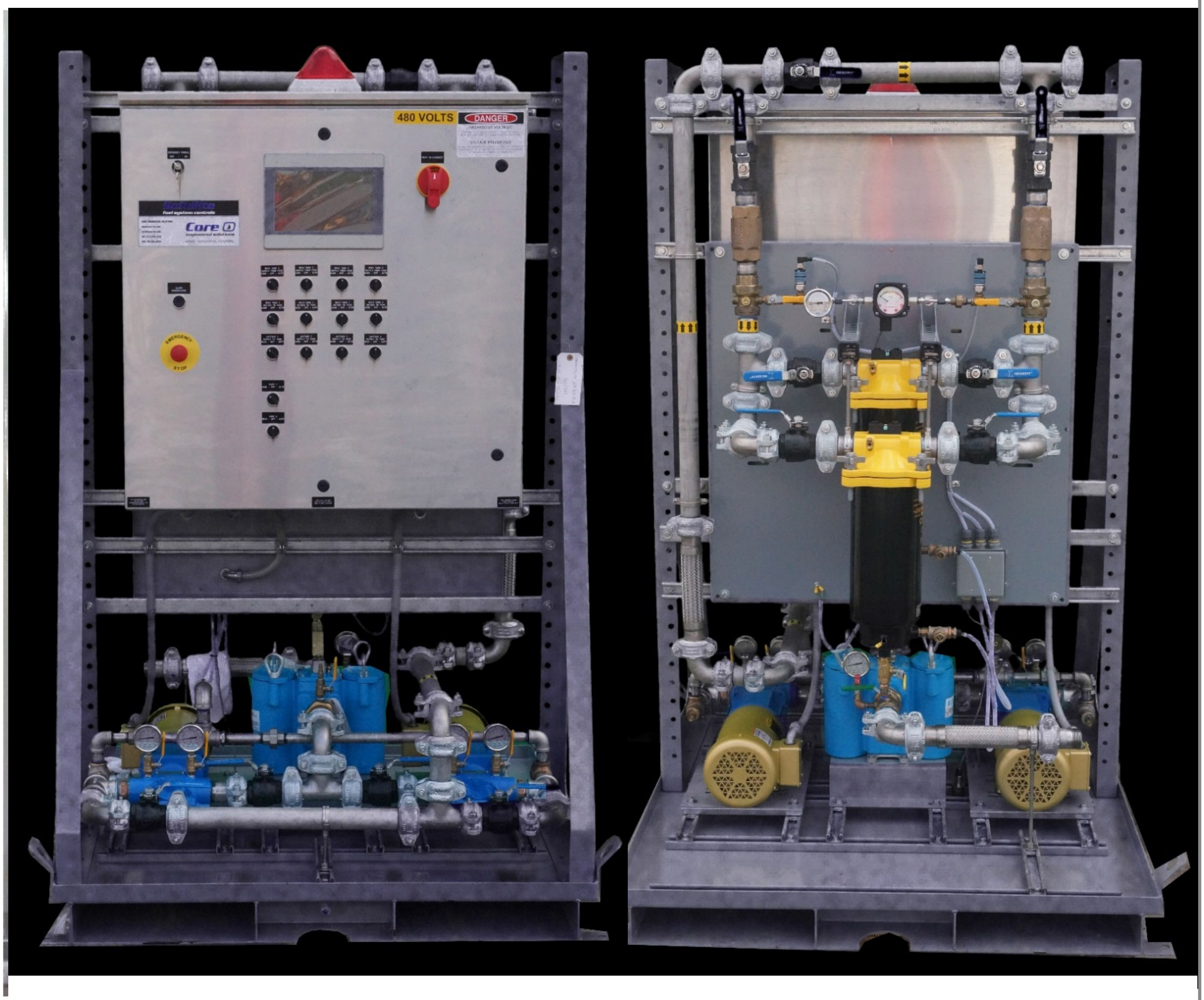
Critical Mission Fuel Transfer System

SmartControls™ Series Operations Manual



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System Overview

The SmartControls™ Series – Critical Mission Fuel Transfer System (CMFTS) is designed for use in critical applications requiring a high degree of reliability such as backup power facilities, data centers, institutional boiler supply, and hospitals. The CMFTS intelligently integrates fuel system monitoring and control functions in one simple automated package. Superior quality components insure years of trouble-free service. Integration with our upstream and downstream fuel storage tank and pump systems provides one call service and support from the industry Leader in mission critical fuel systems.

System Monitoring and Control

Main Storage Tanks

The system will display the following information for each main storage tank.

- In “Full Automatic Mode” status.
- Product level in US gallons.
- Product level in inches.
- Product level in Percent of full tank capacity.
- High level alarm status.
- High level warning status.
- Low level warning status.
- Low level alarm status.
- Interstitial (double wall) leak sensor status.
- Supply or return flow indicator Status.
- Control valves status.
- Present and historical alarm conditions.

Day Tanks

The system will display the following information for each day tank.

- In “Full Automatic Mode” status.
- High level alarm status.
- Pump start level status.
- Normal product level status.
- Pump stop level status.
- Low level alarm status.
- Interstitial (double wall) leak sensor status.
- Control valves status.
- Present and historical alarm conditions.

Duplex Lead/Lag Pumps

The system will display the following information for each pump.

- In “Full Automatic Mode” status.
- Emergency stop (remote and local) status.
- Pump “Lock out” Status.
- Pump ready status.
- Pump on/off status.
- Lead/Lag pumps selection.
- Pump run elapsed time meter.
- Pump motor starter status.
- Pump motor overload status.
- Pump enclosure leak sensor status.
- Flow indication status.
- Present and historical alarm conditions.

Fuel Polishing/Filtration

The system will display the following information for the fuel polishing/filtration system.

- Filters differential pressure status.
- Filters water sensor status.
- Present and historical alarm conditions.

System Alarms (all alarms)

The stem is designed to monitor and display the current and historical conditions of the complete system and components. When an alarm occurs the horn will enunciate and the strobe will flash.

- All alarm conditions will be display on the system monitor.
- All alarm conditions will be sent to the remote building management system (BMS).
- All alarm conditions will remain displayed active until acknowledged.
- No active alarm conditions will be cleared until resolved.

End of Section

System Operations (Modes)

Systems Operations Overview

The system is designed to fully monitor and control the fuel levels of all the main storage tanks, day tanks and the fuel polishing system. All of the conditions will be displayed on the Operator Interface Terminal (OIT) system monitor.

The system monitors and controls the “fuel transfers” by monitoring the following conditions:

- Each main tank, day tank, pumps and filtration system Hand – Off- Auto (H-O-A) Selector switch.
- Day tanks fuel level sensors at the pump start, pump stop, low level and high level set points.
- Main storage tanks fuel level at the low level alarm, low level warning, high level warning and high level alarm set points.
- Duplex pump performance by monitoring the motor starters, motor overloads, flow switch indicators and pump run timers.
- Main tank, day tank and filter piping/enclosure leak sensors.
- Fuel polishing system filters pressure differential, water sensors, and water storage tank.

The system will monitor and alarm all leak and level conditions regardless of any “Mode” of operations the system might be in.

Full Automatic Mode (Day Tank Automatic Transfer Mode)

When the system is in the “Full Automatic Mode” it is designed to fully monitor and control the fuel levels of the system. When any day tank is in need of fuel, the system will automatically start and replenish the fuel in the day tank. Note: all alarms are available via (optional) Modbus or dry contact.

To place the system in the Full Automatic Mode:

- **Turn each main tank, day tank, pump and filtration system H-O-A selector switch to the “Auto” position. (Excludes Auto Fuel polishing H-O-A switch)**
- **Note: If the system is using an “Automatic Return Pump” option, the return pump H-O-A selector switch to the “Auto” position.**

When the system is in the “Full Automatic Mode:”

- When any day tank level reaches the pump start set point (Call for Fuel):
  - The system will automatically start a fuel transaction.
  - The selected lead tank supply and return control valves will open and the stand by (other tanks) tanks control valve will all be closed.
  - The lead pump will start and the corresponding day tank fuel supply control valve will open.
  - The lag (standby) pump will start if three or more day tanks call for fuel at the same time.
  - The lag (standby) pump will start if a flow is not indicated after 45 seconds.
  - The transfer will stop when day tank reaches the pump stop level set point.
  - The pumps will stop and the corresponding day tank fuel supply control valve will close.

- When any day tank reaches a high level alarm (HLA) set point:
  - An alarm will sound and the day tank will be taken out of service.
  - All fuel transactions will be stopped to the day tank and fuel polishing.
  - The day tank HLA solenoid valve will be energized locking out the tank and remain until the HLA condition is resolved.
  - The tank will remain out of service until the condition is resolved and all alarms are cleared.

- When any day tank reaches a low level alarm set point:
  - An alarm will sound and the system will automatically start a fuel transfer.
  - The lead (standby) pump will start and the corresponding day tank fuel supply control valve will open.
  - The lag (standby) pump will start if a flow is not indicated after 45 seconds.
  - The transfer will stop when day tank reaches the pump stop level set point.
  - The lead pump will stop and the corresponding day tank fuel supply control valve will close.
  - The alarm condition will remain until the operator acknowledges the condition.

- When any day tank leak sensor senses fuel or water:
  - An alarm will sound and all fuel transactions to that day tank will stop.
  - The day tank will be taken out of Automatic Mode.
  - The day tank will remain out of Automatic Mode until the condition is resolved and the alarm is cleared.
  - Alarm will sound and the system will remain in full auto mode.

- When any pump or sump leak sensor senses fuel or water (excludes all main and day tank leak sensors):
  - An alarm will sound and all fuel transactions will stop.
  - The system will be taken out of Full Automatic Mode.
  - The system will remain out of Full Automatic Mode until the condition is resolved and all alarms are cleared.

- When any main tank leak sensor senses fuel or water:
  - An alarm will sound.
  - The system will remain in Full Automatic Mode.
  - The alarm condition will remain until the operator acknowledges the condition.

- When any main tank reaches a high level alarm set point:
  - An alarm will sound.
  - (optional) Remote main tank high level alarm enunciator will activate.
  - The alarm condition will remain until the operator acknowledges the condition.

- When any main tank reaches a high level warning set point:
  - An indicator will illuminate on the monitor only.
  - (optional) Remote main tank high level alarm enunciator will activate.

- When any main tank reaches a low level warning set point:
  - An indicator will illuminate on the monitor only.

  - The system will switch to the next available main tank (optional).

- When any main tank reaches a low level alarm set point:
  - An alarm will sound and the system will switch to the next available main tank.
  - If no main tanks are available, then the system will be taken out of Full Automatic Mode.
  - The system will remain out of Full Automatic Mode until the condition is resolved and all alarms are cleared.

- When any flow sensor fails to sense flow when a fuel transaction takes place (excludes fuel polishing and main tank return flow sensors):
  - An alarm will sound and the system will automatically start the lag (standby) pump.
  - The lead pump will continue to run
  - The alarm condition will remain until the operator acknowledges the condition.

- When lead pump fails to perform:
  - An alarm will sound and the system will automatically start the lag (standby) pump.
  - The alarm condition will remain until the operator acknowledges the condition.

- When lag standby pump fails to perform:
  - An alarm will sound.
  - The system will remain in the Full Automatic Mode.
  - The alarm condition will remain until the operator acknowledges the condition.

Automatic Return Pump Mode

The system is designed to automatically return fuel from a day tank back to a main tank in the event that a day tank is in jeopardy of overfilling. Each day tank is equipped with a return pump, a pump on level sensor and a pump off level sensor.

To place the system in the Full Automatic Mode:

- **Turn each main tank, day tank, pump and filtration system H-O-A selector switch to the “Auto” position. (Excludes Auto Fuel polishing H-O-A switch)**
- **Note: If the system is using an “Automatic Return Pump” option, the return pump H-O-A selector switch must be turned to the “Auto” position.**

When the system is in the “Full Automatic Mode”:

- When any day tank level reaches the return pump start level set point:
  - An alarm will sound.
  - The return pump will start.
  - The return pump will turn off when the product reaches the return pump stop level.
  - The alarm condition will remain until the operator acknowledges the condition.

Note: The lack of the return to tank’s flow sense will not cause an alarm or shut down the pump.

Automatic Fuel Polishing Mode

The system in the automatic mode is designed to fully monitor and control the fuel polishing of the system. The fuel polishing works on a programmable schedule. When the fuel piloting H-O-A button is in the “Auto” position and when the fuel polishing schedule is active, the fuel polishing transaction will automatically start. The fuel polishing will continue until the H-O-A button is taken out of “Auto” position.

NOTE: When any day tank “Call for Fuel” condition occurs, the automated fuel polishing transaction will stop and will not restart after the day tank “Call for Fuel” condition ends even if the fuel polishing schedule is active.

To place the system in the Automatic Fuel polishing Mode:

- **The system must be in “Full Automatic Mode” (Day tank automatic transfer mode).**
- **Place the Automatic Fuel polishing H-O-A button to the Auto Mode.**

When the system starts an automatic fuel polishing transaction:

- The start and stop a fuel polishing transaction based on the programmable schedule.
- If the fuel polishing system flow sensor fails to sense flow:
    - An alarm will sound and the system will automatically start the lag (standby) pump.
    - After 45 seconds if flow is not sensed and an alarm will sound.
    - The alarm condition will remain until the operator acknowledges the condition.
    - (optional) If the filtration water storage tank level high level warning is activated and the alarm will sound.
    - The alarm condition will remain until the operator acknowledges the condition.
    - If the filtration water storage tank level high level alarm is activated and the alarm will sound, the system will be taken out of Full Auto and the pumps will be locked out. The alarm condition will remain until the operator acknowledges the condition and resets the pumps.

Manual Mode (Supervised)

The system in the “Supervised Manual Mode” is designed to manually control the operations of the fuel transactions. All fuel transactions to any day tank (and main tanks if return pump option) will be supervised to not allow any overfills.

To place the system in the “Supervised Manual Mode:”

1. Turn each main tank, day tank, pump and filtration system H-O-A selector switch to the “Off” position.

2. Turn one each of the following to the “Hand” Position.
    - Source of fuel (example main tank #2)
    - Destination of the fuel (example day tank #8)
    - Pump to be used. (example pump #2)

Note: Only systems with two or more main storage tanks will have a main tank return control valve.

When the system is in the "Supervised Manual Mode:"

- When any day tank level reaches the pump start set point (Call for Fuel):
    - An alarm will sound.
    - The alarm condition will remain until the operator acknowledges the condition.

- When any day tank reaches a high level alarm set point:
    - An alarm will sound.
    - All fuel transactions to the corresponding day tank will be stopped.
    - The alarm condition will remain until the operator acknowledges the condition.

- When any day tank reaches a low level alarm set point:
    - An alarm will sound.
    - The alarm condition will remain until the operator acknowledges the condition.

- When any leak sensor senses fuel or water:
    - An alarm will sound.
    - The alarm condition will remain until the operator acknowledges the condition.

- When any main tank reaches a high level alarm set point:
    - An alarm will sound.
    - Remote main tank high level alarm enunciator will activate (optional).
    - All (optional) return pump transactions will stop.
    - The alarm condition will remain until the operator acknowledges the condition.

- When any main tank reaches a high level warning set point:
    - An indicator will illuminate on the monitor only.
    - Remote main tank high level warning indicator will activate (optional).
    - The alarm condition will remain until the operator acknowledges the condition.

- When any main tank reaches a low level warning set point:
    - An indicator will illuminate on the monitor only.

- When any main tank reaches a low level alarm set point:
    - An alarm will sound.
    - The alarm condition will remain until the operator acknowledges the condition.

Note: only one return to tank solenoid valve will be allowed to open at a time in Full auto and Manual supervised modes.

Emergency Manual Mode

The system in the "Emergency Manual Mode" is designed to manually control the operations of the fuel transactions in the event of a system component failure. This mode should never be used unless every attempt has been make to transfer and has failed in both the "Full Automatic Mode" and in the "Supervised Manual Mode." The "Emergency Manual Mode" should only be used to transfer fuel if the "critical" application is in jeopardy.

WARNING: The "Emergency Manual Mode" the operator will take 100% responsibility in the fuel transfer and "all" product levels.

To place the system in the "Emergency Manual Mode:"

1. Turn all main tank, day tank, pump and filtration system H-O-A selector switches to the "Off" position.

2. Turn the "Emergency Manual Key" to the "On" position.

When the system is in the "Emergency Manual Mode:"

- An alarm will sound
- The system strobe will remain flashing until the system "Emergency Manual Key" is turned to the "Off" position.
- When an H-O-A switch is turned to the "Hand" position the device may start, turn on, or open.

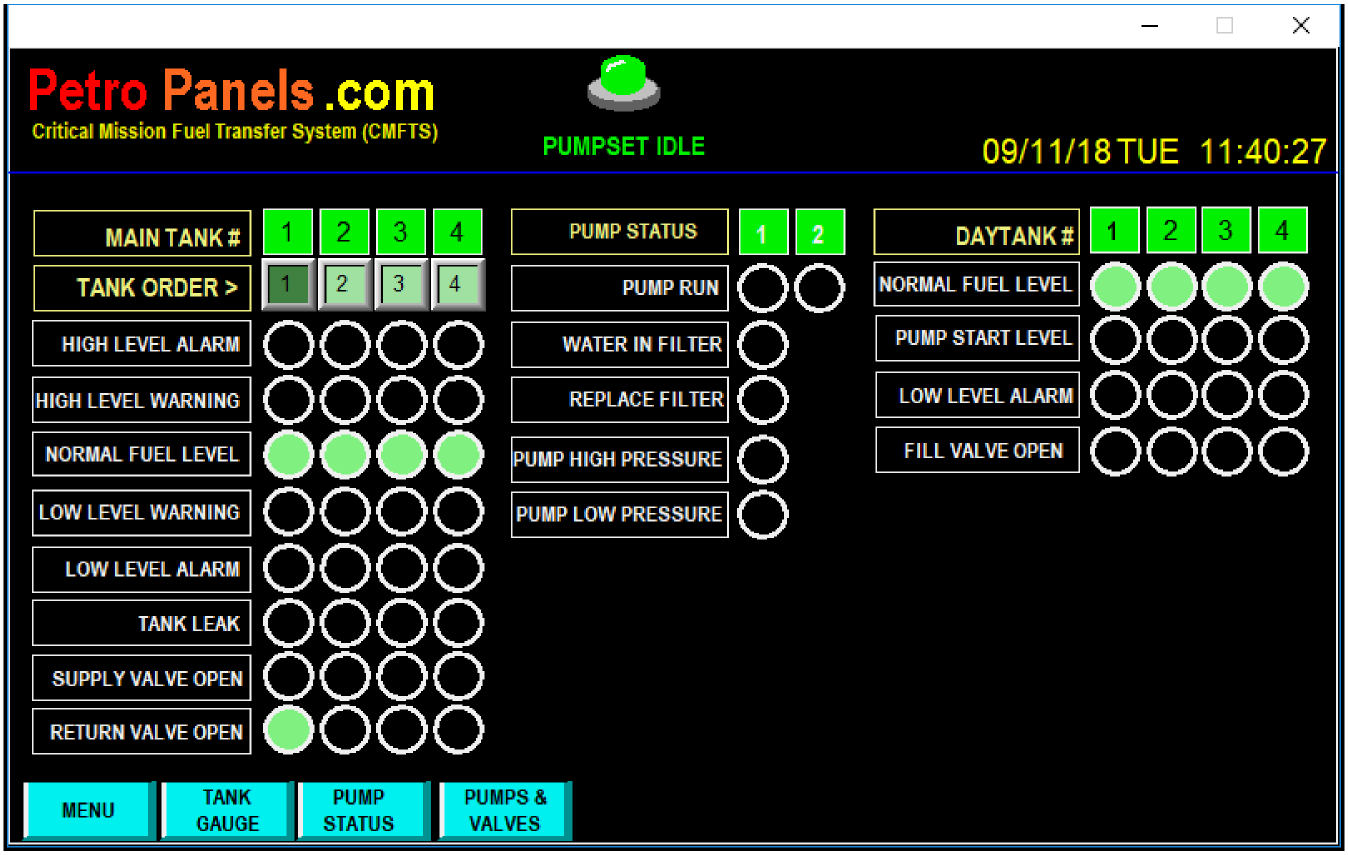
It is recommended before turning any pump to the "Hand" position, to open a source and a destination control valve prior. Examples are: (main tank #2 suction and day tank #8 supply valve).

End of Section

Operator Interface Terminal Screens

Note: your actual screen may be different based on your system than what the screen displayed here.
Your actual screens may be different based on your options.

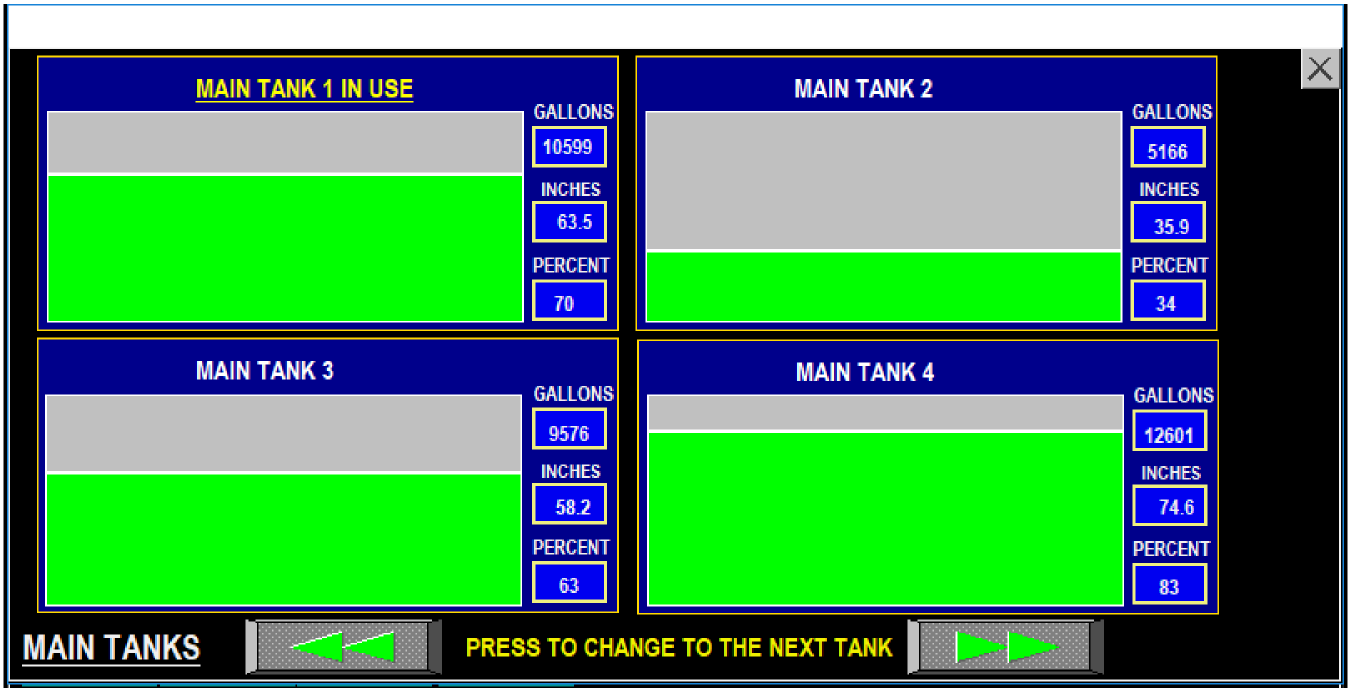
Main Menu



Main Menu is where you see the majority of the information that is required to see the system status. In this screen if you see anything in red it's a problem.

- Main Tank information shows the level, leak and control value (CV) status of the main storage tanks. The dark green tank shows the active lead tanks.
- Pump information shows the pump running, water in the filter and the differential pressure, and the pressure of the product piping status.
- Day Tank information shows the level and CV status of the day storage tanks.
- Press one of the blue buttons on the button or the alarm status (not shown) in the upper right-hand corning to advance to the next screen.

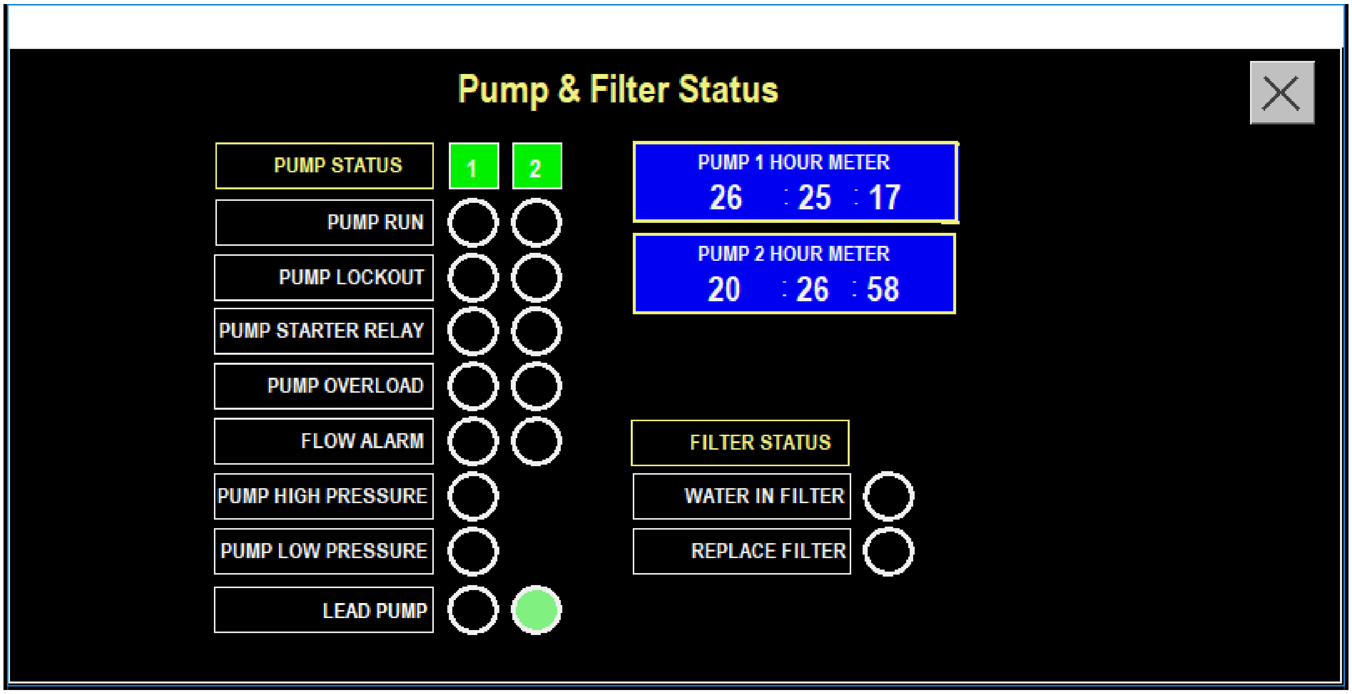
Main Tanks



Tank Gauge – Main Tanks is where you see the status for each tank. The yellow tank shows the active lead tank in use as the lead tank. By pressing the left or right arrow you can switch to the next available tank manually.

- Each tank is displayed with a graph that will change color to red if the tank is in a tank critical level alarm status.
- To the right of each tank is displayed the tank inches, percent and gallons information.
- By pressing the left or right arrow you can switch to the next available tank manually.
- Press the X in the top right hand corner to exit.

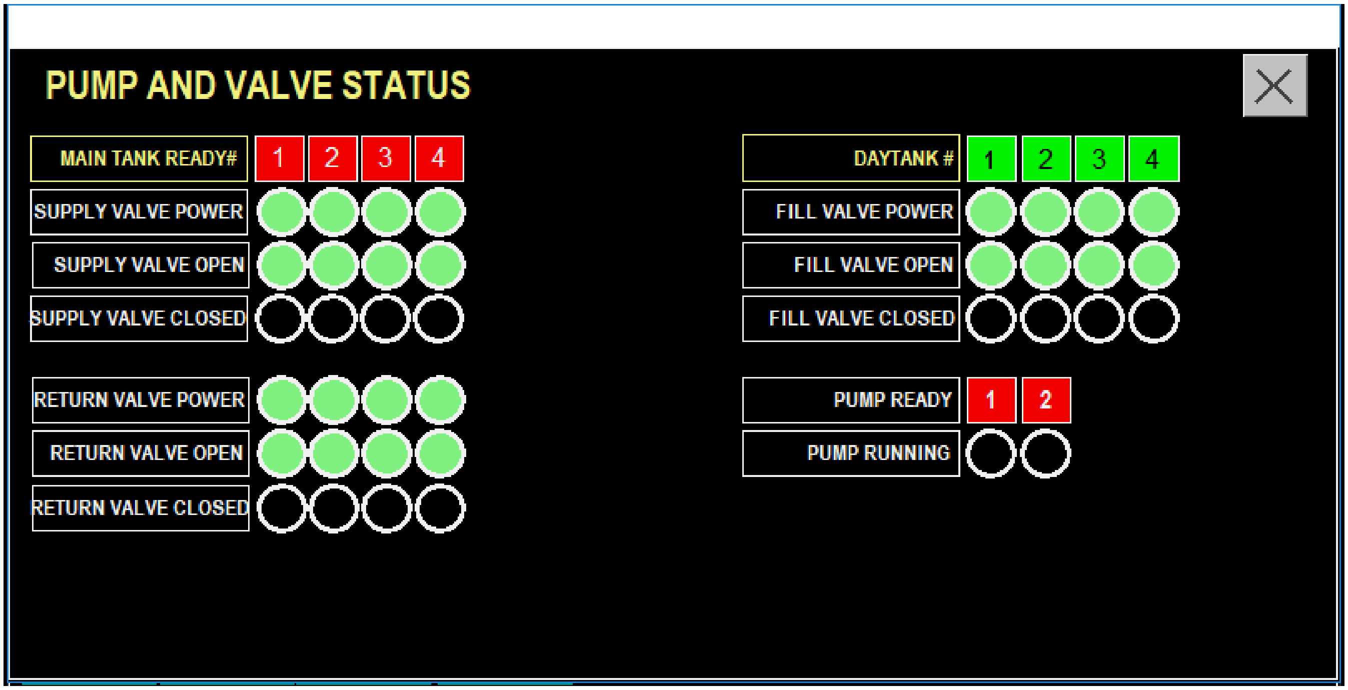
Pump and Filter Status



The pump and filter status is where you will see the information on the pumps and the filter. In this screen if you see anything in red it's a problem. This is where you will see the pump availability and why it might not be available.

- Pump Run shows the status of the pump running or not running.
- Pump Lockout is where it shows the status of the pump availability to be used. If locked out the pump H-O-A switch must be turned to the off position to reset the lockout condition after the problem has been fixed or an emergency stop button was depressed.
- Pump Motor Starter will show if the PLC is requesting the pump to be used.
- Pump Overload is where it shows the status of the pump's motor circuit protector/circuit disconnect.
- Flow Alarm will show if when the pump is running and there is no high or low pressure conditions.
- Pump High Pressure will show if when the piping pressure is too high.
- Pump Low Pressure will show if when the piping pressure is too low.
- Lead Pump will show what pump is the lead pump.
- Pump Hour Meters shows the time that each pump has been used.
- Filtration Status shows the status of the filter water and the differential pressure.
- Press the X in the top right hand corner to exit.

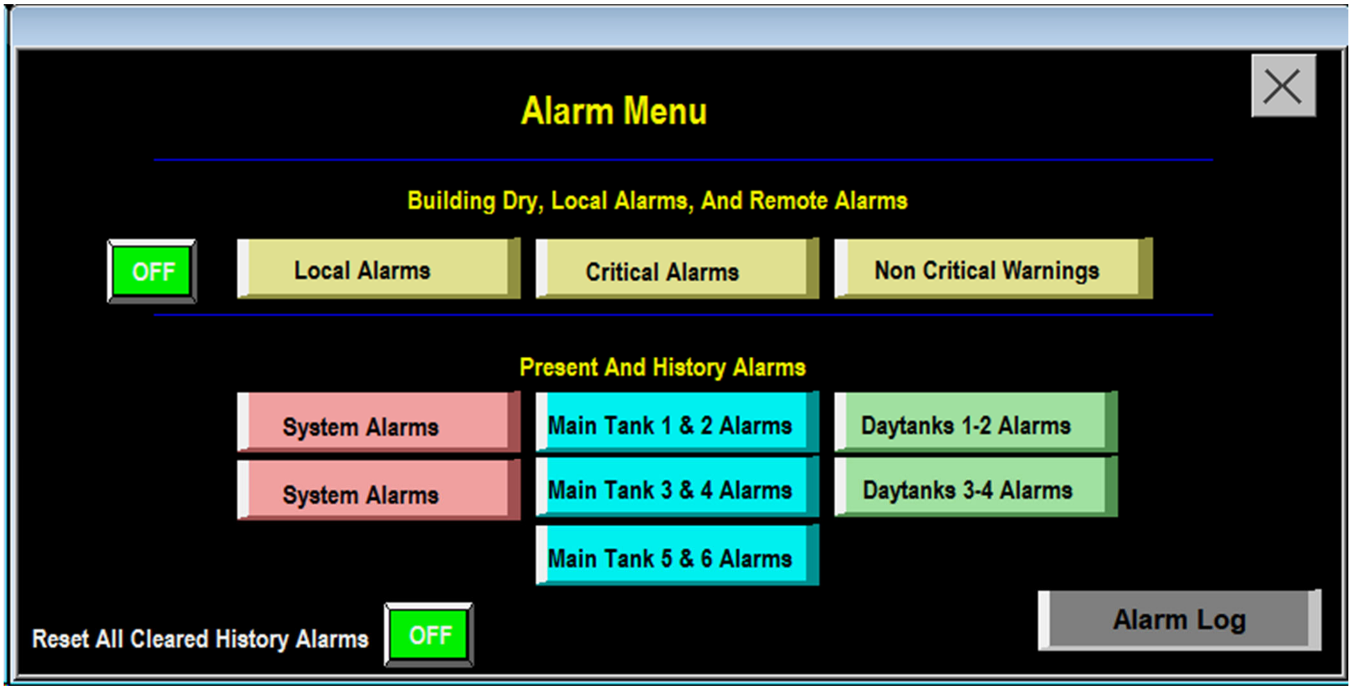
Pump and Valve Status



Pump and Valve Status is where you can see the open or closed position of every solenoid valve is the system. In this screen if you see any red squares it's a problem.

- Supply Valve Power shows the valve ready status to open or closed.
- Supply Valve Open shows the valve status to open when green.
- Return Valve Power shows the valve ready status to open or closed
- Return Valve Open shows the valve status to open when green.
- Fill Valve Power shows the valve ready status to open or closed.
- Fill Valve Open shows the valve status to open when green.
- Pump Running shows the running status.
- Press the X in the top right hand corner to exit.

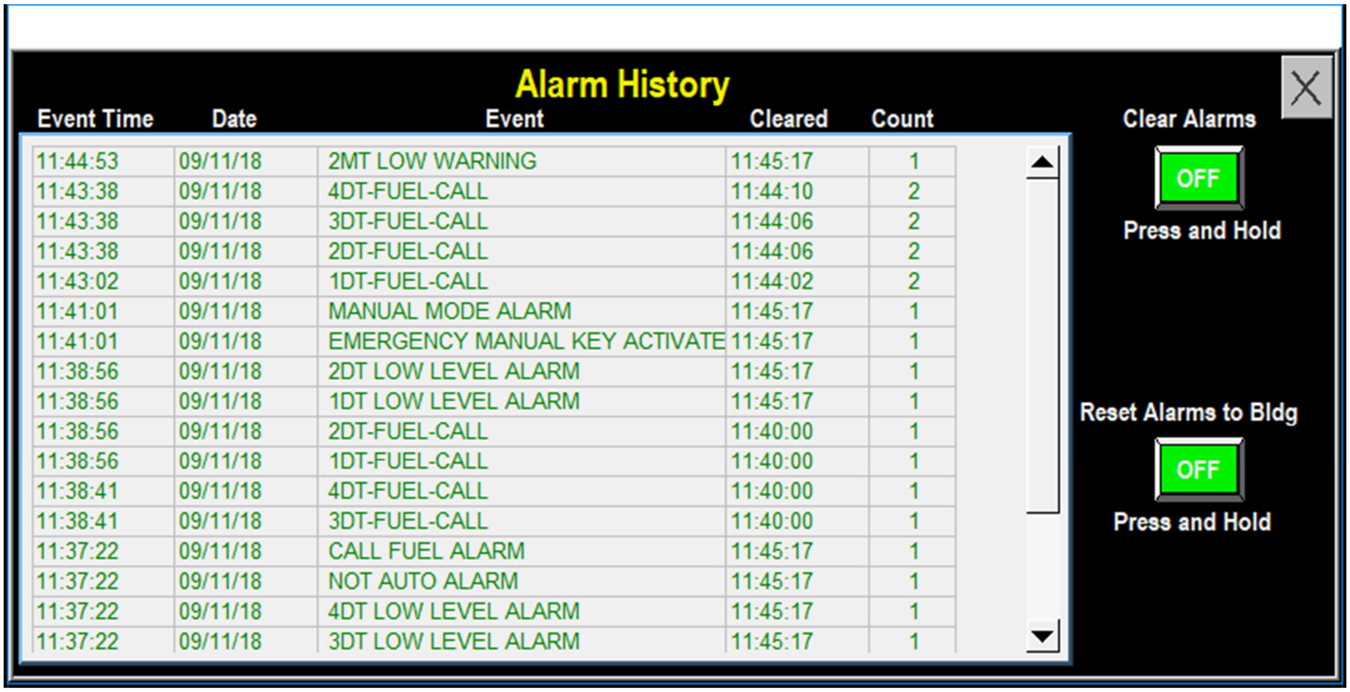
Alarm History



The Alarm History screen is where you can see all the active and historical alarms.

- Alarm Statues that are red have not been cleared.
- Press any button to view the alarms
- Reset alarms, Press and Hold Button the reset button, some alarm conditions will require the operator to press and hold the button for about 2 seconds to clear the alarms.
- Reset alarms to building, some alarm conditions will trigger a relay to be monitored remotely and will require the operator to Press and Hold Button the reset button for about 2 seconds, to clear the alarms.
- Press the Alarm Log button (optional) to view the Alarm Log. This is a new screen and is easier than the Alarm History screen to see all the past and present alarms.
- Press the X in the top right hand corner to exit.

Alarm History



Event Time	Date	Event	Cleared	Count
11:44:53	09/11/18	2MT LOW WARNING	11:45:17	1
11:43:38	09/11/18	4DT-FUEL-CALL	11:44:10	2
11:43:38	09/11/18	3DT-FUEL-CALL	11:44:06	2
11:43:38	09/11/18	2DT-FUEL-CALL	11:44:06	2
11:43:02	09/11/18	1DT-FUEL-CALL	11:44:02	2
11:41:01	09/11/18	MANUAL MODE ALARM	11:45:17	1
11:41:01	09/11/18	EMERGENCY MANUAL KEY ACTIVATE	11:45:17	1
11:38:56	09/11/18	2DT LOW LEVEL ALARM	11:45:17	1
11:38:56	09/11/18	1DT LOW LEVEL ALARM	11:45:17	1
11:38:56	09/11/18	2DT-FUEL-CALL	11:40:00	1
11:38:56	09/11/18	1DT-FUEL-CALL	11:40:00	1
11:38:41	09/11/18	4DT-FUEL-CALL	11:40:00	1
11:38:41	09/11/18	3DT-FUEL-CALL	11:40:00	1
11:37:22	09/11/18	CALL FUEL ALARM	11:45:17	1
11:37:22	09/11/18	NOT AUTO ALARM	11:45:17	1
11:37:22	09/11/18	4DT LOW LEVEL ALARM	11:45:17	1
11:37:22	09/11/18	3DT LOW LEVEL ALARM	11:45:17	1

The Alarm History screen is where you can see all the active and historical alarms.

- Alarm Statues that are green have been cleared.
- Alarm Statues that are not green have not been cleared.
- Some alarm conditions will be automatically clear and some will require the operator to press and hold the alarm acknowledgement button on the CMFTS enclosure door. Some conditions alarm conditions will
- Reset alarms, Press and Hold Button the reset button, some alarm conditions will require the operator to press and hold the button for about 2 seconds to clear the alarms.
- Reset alarms to building, some alarm conditions will trigger a relay to be monitored remotely and will require the operator to Press and Hold Button the reset button for about 2 seconds, to clear the alarms.
- Press the X in the top right hand corner to exit.

System Menu

The System Menu screen is another way to navigate to other screens where you can see all the active and historical alarms.

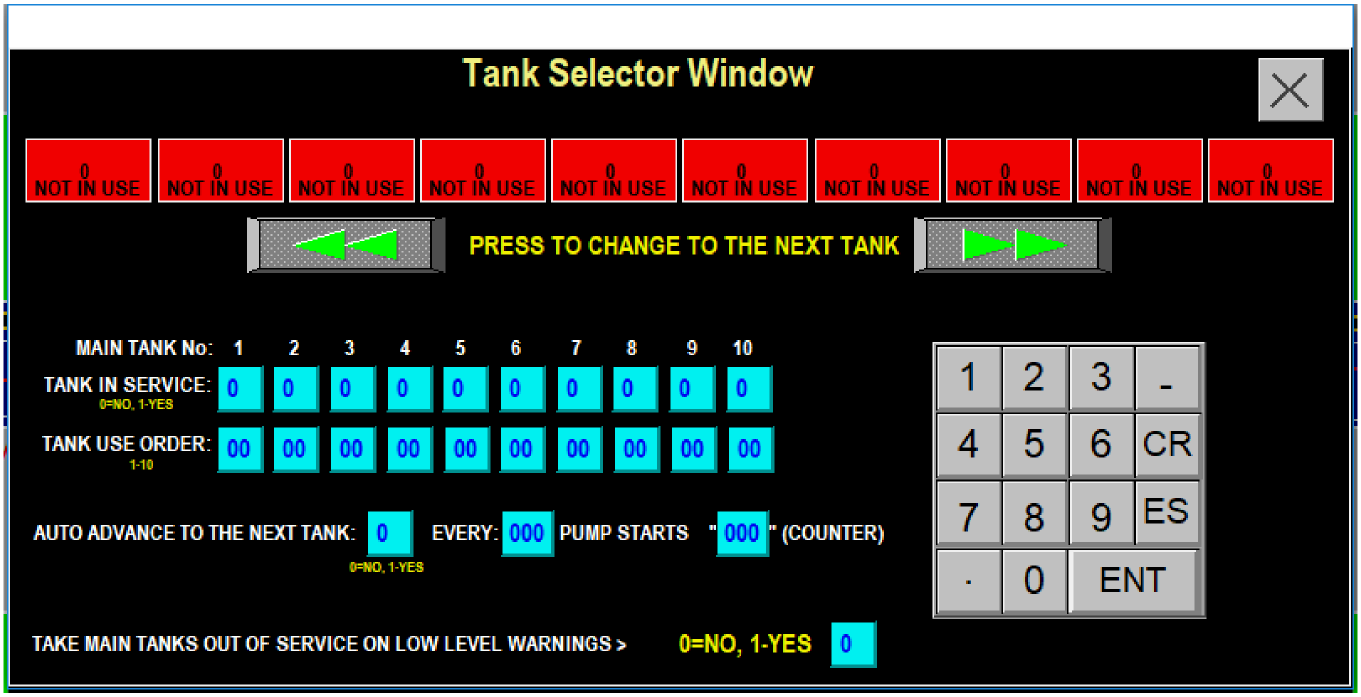
- System Status is where you can go back to the Main Menu screen.
- Tank Gauge is where you can go to the Tank Gauge menu.
- Pump and Filter Status is where you can go to the Pump and Filter Status menu.
- Ball Valve Status is where you can go to the motorized Ball Valve Status menu.
- Service & Setup is where you can go to the Service & Setup menu for advanced changes to the CMFTS program. This window is for technicians.
- View Input / Output Status is a helpful window for verifying a signal is active in the PLC for troubleshooting and variations.
- Alarms menus is where you can go to the Alarms menus screen.
- Press the X in the top right hand corner to exit.

Security Login

Security Login screen is where technicians would go to make modifications to the programmed options in the CMFTS.

- Enter User, in this field technicians enter the level of security that is required to make changes to the system
  - 1 = minor changes to the order of the tanks to be the next tank to be used. Change the systems PLC time, the filtration schedule and the IP address. Do not change the IP address without consulting a certified technician. The Password is 123.
  - 2 = changes to the tank information and alarm set points.
  - 3 = testing functions for trouble shooting certified technicians ONLY.
  - Press the X in the top right-hand corner to exit.
- Note to change the time on the alarm log screen you will have to change the screens time. On any pane press the small arrow on the bottom right of the screen. Enter the Password “111111” the go to the time and date tab.

Tank Select Window



The Tank Select Window is where the operator can change the order of what tank will be used next.

- Tank in Service, if you want to tank a tank out of service you would enter a 0.
- Tank Use Order, this is where you enter the order of what tank will be next when the lead tank switches over to the next tank available.
- Take Main Tank Out of Service on Low Level Warning, this is where you can select if the main tank is 100% out of service when a low level warning is active. This is not recommended. This should be a 0.
- By pressing the left or right arrow you can switch to the next available tank manually.
- Press the X in the top right hand corner to exit.

End of Section

TRAINING VERIFICATION:

We certify that we have reviewed the entirety of the owner's manual and the customer has been instructed in the use of the CMFTS System.

Technician Name:______________________ Customer Name:__________________________

Technician Signature:____________________ Customer Signature:____________________________

Date:_________________________________ Date: ___________________________