



SmartCAFS

Compressed Air Foam Systems

Models:

Manifold – Qmax, Qmax-XS, Qtwo

Volute – DSD

CAFS QUICKSTART GUIDE

FSG-MNL-00176

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WARNING



BEFORE USING THE SYSTEM THE FULL MANUAL SHOULD BE READ AND PERSONNEL TRAINED. THIS IS FOR REFERENCE PURPOSES ONLY.

SYSTEM OVERVIEW

Foam unit - Foam Proportioning System

The Foam unit system consists of three main components:

- 1) Foam Pump / Motor Assembly.
- 2) Control Panel (integral with main pump control panel).
- 3) Flow measurement and injection manifold.

All three elements combine to provide accurate foam proportioning. From the control panel the operator can initiate the system, adjust the foam ratio, monitor 'real time' water flow rate and record total water and foam concentrate usage.

Foam concentrate is only injected when the foam button has the **RED** selector around the control button.

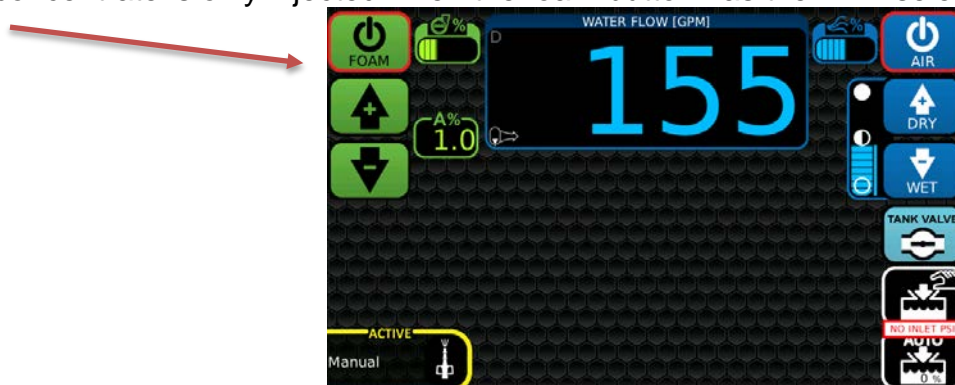


Figure 1 SmartCAFS Foam/CAFS Screen


The Foam unit 3.3, 5.0, 6.5 system for Class A or B foams, will inject foam in the range of 0.1% to 10.0%.

Further information is available in the **Foam unit Model 3.3/5.0/6.5** Description, [Installation and Operation manual](#).

COMMISSIONING / START-UP PROCEDURE

1. Check that all the necessary connections have been correctly made.
2. Ensure that the Compressed Air / Oil Separator Tank and pump gearbox are filled with the correct oil type and quantity.
3. Prime and Run the water pump at 125 PSI [0.86 MPa] with compressor engaged.
4. Run the compressor for 30 seconds to allow oil to circulate.
5. Stop unit and check compressor oil level – top up if necessary.
6. Turn the bypass valve on the Foam unit pump to “bypass” and provide a suitable receptacle to collect the foam agent.
7. Ensure that there is sufficient foam agent in the tank(s). For **Foam unit 3.3/5.0/6.5** select tank **A**
8. Select simulated flow on the UV display by pressing the Menu button then pressing the “Simulated Water” button on the screen or button. Then return to the operating screen by selecting the “Return to Operation” button.



9. Press the  button on the control head, and the Foam unit pump will prime itself. The pump will run for 30 seconds or until prime is achieved. If no prime is made, the display will show a plain test warning. Repeat this step once more to attempt to prime the pump. If priming is not achieved after several attempts, Insure the foam supply is connected and available to the pump.
10. **For 3.3/5.0/6.5 Foam unit**, flush then select tank **B**, and repeat the priming procedure for that tank.
11. When prime is achieved, deselect simulated flow by return to the menu and turning off simulated flow.
12. Return the bypass valve to the inject position.

The unit is now ready to run.

GENERAL OPERATION

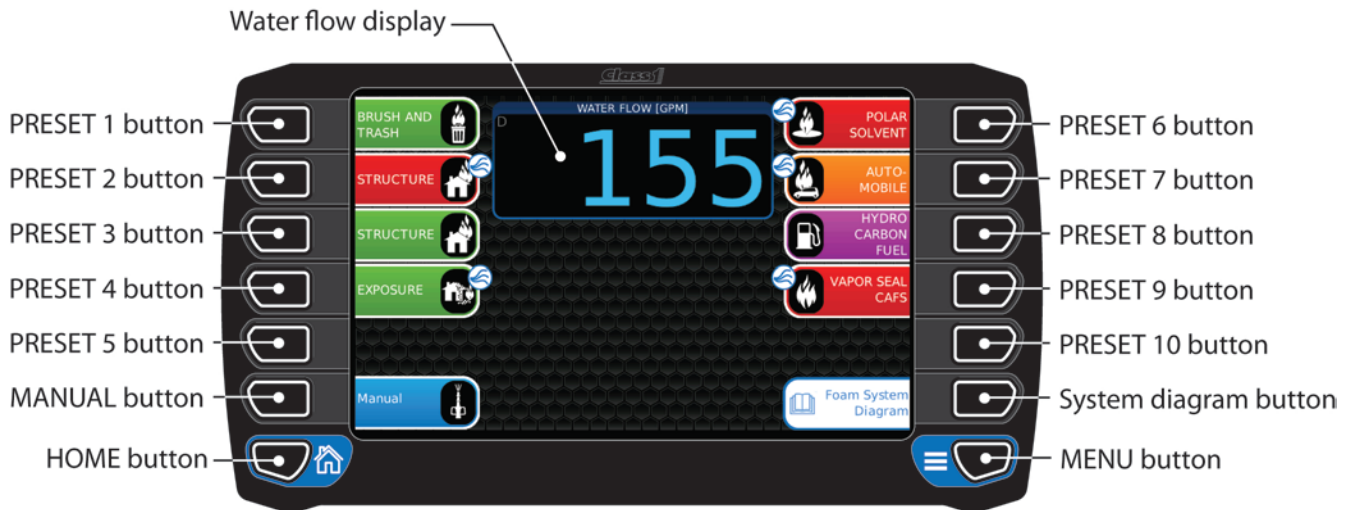


WARNING

NEVER USE CAFS WITH A PRESSURE FEED INTO THE EYE OF THE PUMP. SMARTCAFS PUMPS SHOULD ONLY BE USED WHEN WORKING FROM OPEN WATER OR A TANK FEED. PROBLEMS WILL OCCUR WITH THE WATER / AIR PRESSURE RATIO, SHOULD PRESSURISED (HYDRANT) WATER SUPPLY BE APPLIED DIRECTLY TO THE SUCTION TUBE. HYDRANT SUPPLY MAY ONLY BE USED TO MAINTAIN THE WATER LEVEL IN THE VEHICLE TANK.

Preset screen (start screen)

The SmartCAFS Controller shows the start screen after a power cycle. This screen allows the operator to select one of 10 preset operating modes (configurable) or manual operating mode.



Preset buttons



There are 10 configurable preset buttons. The text, icon, bar color, and CAFS indicator are configurable by the user through a password protected configuration screen. The preset configuration screen allows the user to select the operating foam tank (A/B), foam percentage, CAFS mode, and ARC valve position.

The operating screen is entered when a preset button is pressed and held for 0.5 seconds. The operating mode of the foam and CAFS will be set to the configured preset settings.

Water flow display

The water flow display is always visible and shows the current water flow rate through the Foam/CAFS discharge manifold.

1. Home button

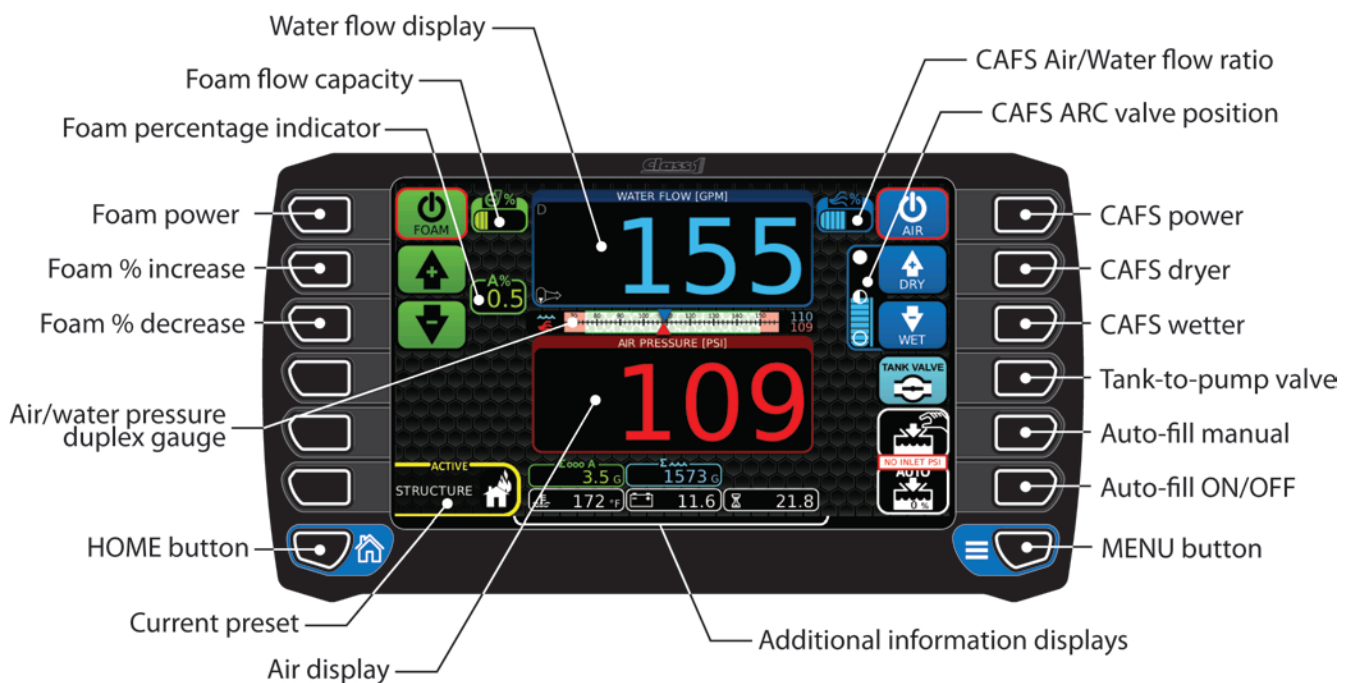
This button toggles the display between the Preset Screen and the Operating Screen.

2. Menu button

This button shows/hides the additional information displays. When this button is pressed and held for 3 seconds the menu will be displayed.

Operating screen

The operating screen allows control over the foam, CAFS, and tank valve. The water flow display is always active, but the air flow display is only shown when the CAFS power is ON.



Water flow display

The water flow display is always visible and shows the current water flow rate through the Foam/CAFS discharge manifold.

Foam flow capacity

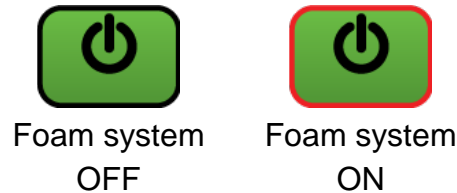
The foam flow capacity is a bar graph that shows how hard the foam pump is working (0% to 100%).

Foam percentage indicator

The foam percentage indicator shows the foam proportioning rate for the currently selected tank.

Foam power button

The foam power button turns the foam system OFF or ON. The foam power button's color indicates the currently selected foam tank (A green, B red, FLUSH orange). The border of the power button is black when OFF and red when ON.



Foam increase and decrease buttons

The increase and decrease foam buttons change the foam percentage for the currently selected foam tank. The color of these buttons indicates the tank selected and foam system power state:

- green = foam system ON, tank A selected
- red = foam system ON, tank B selected
- gray = foam system OFF

These buttons will modify the foam percentage value even when the foam power button is OFF.

Air/water pressure duplex gauge

The duplex gauge shows the air and water pressures. The background shows the proper CAFS operating range in green (75 PSI to 150 PSI). This gauge is only shown when the additional information is being shown (see section (y)).

Home button

Return to the preset screen.

Current preset

This display shows the currently selected preset name and icon (or “manual” if manual was selected).

Air display

This display shows the current air pressure, CAFS ratio, or current air flow rate based on the “CAFS air display” selection configured in the “user menu” (see section 0). The air flow rate and CAFS ratio displays are only shown when CAFS is turned ON.

CAFS air/water flow ratio

The CAFS air/water flow ratio is a bar graph that shows the relationship between the air flow and water flow rates (0% to 100%). This display is only available when equipped with the Hale air flow sensing valve.

CAFS ARC valve position

The ARC valve position indicator is a bar graph that shows the gating of the valve (0% [full wet] to 100% [full dry]). The border color indicates the state of air injection – red = not injecting air, blue = injecting air.

CAFS power button

The CAFS power button activates the CAF System (it will start the foam system if it is not already active). CAFS will be turned OFF when the foam power button is turned OFF. The CAF System will also evaluate the air pressure, compressor temperature, water flow, and foam flow before activating the air injection. The border of the power button is black when OFF and red when ON. The power button's color is gray when the clutch has been disengaged.



CAFS Wet and Dry buttons

The wet and dry buttons open/close the ARC valve. These buttons are only active when CAFS power is active. These buttons are active when they are blue and inactive when they are gray.

Tank-to-pump valve button

The tank valve button opens or closes the tank valve. The icon on the button indicates the current position of the valve (open or closed). The tank-to-pump valve can be configured (in the user menu) to open automatically when the pump engaged signal is detected. Even when set to automatic mode this button can be utilized to manually open/close the tank-to-pump valve.

Auto-fill manual button

(When an auto-fill system is installed) The auto-fill manual button opens the KZCO valve connected to the inlet in order to fill the water tank. This button is a momentary button and the valve will only be open as long as the button is held. The on-screen icon changes to green to indicate that the valve is being forced open.

Auto-fill ON/OFF button

(When an auto-fill system is installed) The auto-fill ON/OFF button turns ON or OFF the automatic water refill system. The on-screen icon shows the status of auto-fill: white = auto-fill ON, white with RED / = auto-fill is OFF.

The auto-fill system will only operate if there is sufficient inlet pressure (7+ PSI). If there is not enough inlet pressure the “NO INLET PSI” warning will be shown between the buttons.

Menu button

Toggle button shows/hides the additional information displays. When this button is pressed and held for 3 seconds it shows the password enter screen.

Additional information display

The additional information displays show the total water flowed, total foam flowed, battery voltage, pump engaged operating hours, and compressor oil temperature. This display is toggle ON/OFF with the menu button.

NOTE: *Total water flowed and total foam flowed are erased when the system is repowered. These values may also be zeroed during operation when desired in the system menu.*

FOAM/CAFS OPERATION

Engage the pump



DO NOT APPLY HYDRANT PRESSURE TO PUMP SUCTION WHEN OPERATING CAFS. MAY BE OPERATED FROM OPEN WATER OR TANK FEED ONLY

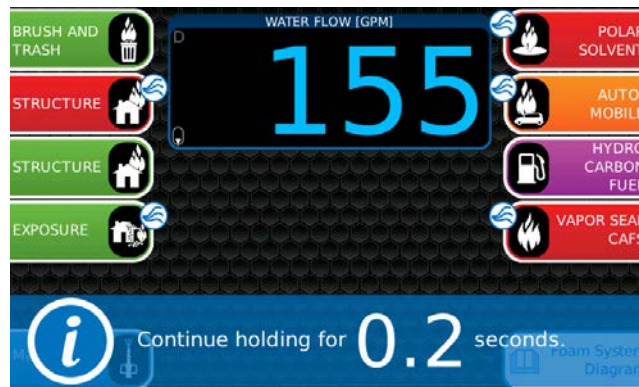
NOTE: *The automatic tank-to-pump open function is a menu selectable item and must be set for “automatic: for this operation to occur (this is the default). The SmartCAFS Controller will automatically open the tank-to-pump valve (see note) when the pump engaged signal is recognized.*

NOTE: *The SmartCAFS Controller will automatically engage the compressor clutch when the pump engaged signal is recognized OR when a CAFS preset button is first pressed. This operation is a menu selectable item. If pump input speed is >900rpm the compressor will not engage and a plain text error message will appear. Reduce speed below 900 RPM then the CAFS compressor can be engaged.*

NOTE: *When discharging dry foam at low pump pressure, the possibility of hose kinking is increased and should be considered when deploying hoses.*

Start foam/CAFS operation by selecting a preset (or manual)

Press and hold the desired preset button for 0.5 seconds. The display will show an information bar to indicate to keep holding the button for the required time.



The display will then show the operation screen. The SmartCAFS Controller is now ready to manage the foam/CAF System as the preset dictates when water flow is detected. Water flow is the driving factor for system operation in both “foam only” or “foam and air” (CAFS).



The bottom left corner of the screen shows the currently active preset.

Increase engine speed for desired water pressure

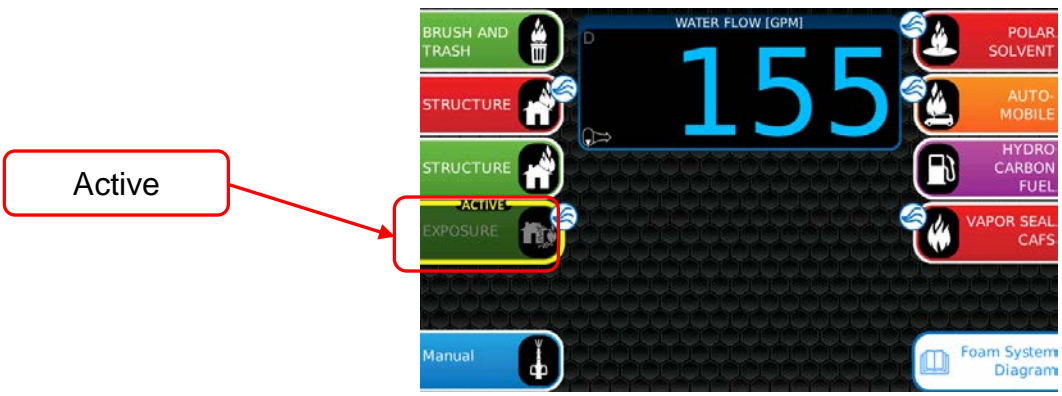
(With Sentry pressure governor) – The SmartCAFS Controller automatically communicates with the Sentry governor to set the governing system to RPM mode and ramp to its preset 1 engine speed.

(Without Sentry pressure governor) – Manually adjust the engine speed to set the water/air pressure to the desired value (CAFS operating range = 75 psi to 150 psi). When using a governor other than the Sentry make sure the governing mode is set to RPM.

Selecting a new preset

If a new preset is desired, press the HOME button to move back to the preset screen.

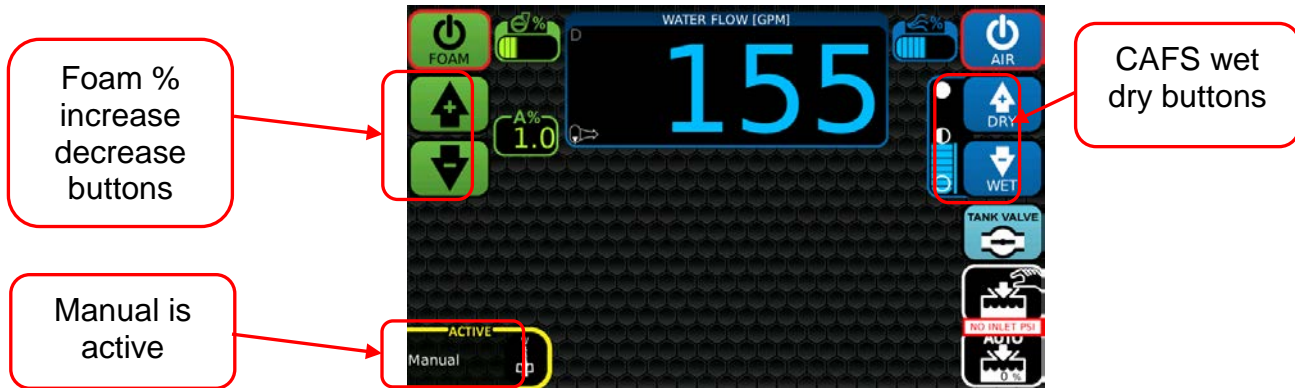
NOTE: The system continues to operate using the current foam/CAFS setting when going back to the preset screen.



The currently active preset will be indicated by the flashing “ACTIVE” border. Press a new preset button (or manual). Simply press the HOME button again if a new preset is not desired. The operation screen will again be shown.

Modify the current operating parameters

At any time the operating parameters can be modified by pressing the foam percentage (increase/decrease) buttons or by pressing the CAFS wet/dry buttons.



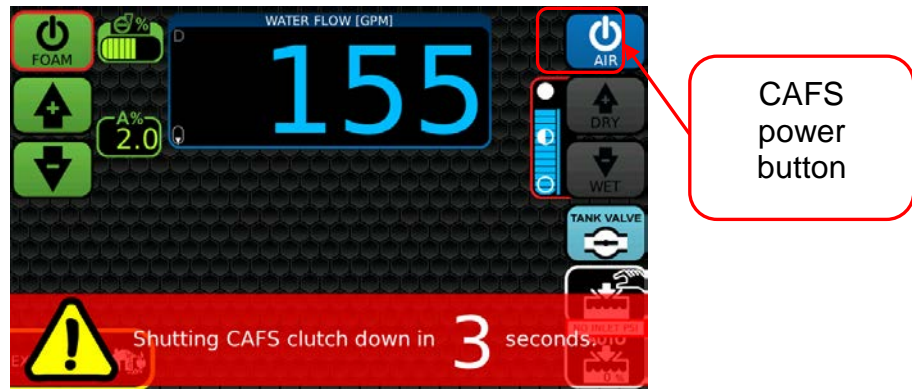
The bottom left corner of the screen will now show “manual” because the settings have been changed from the original preset values.

The foam and/or CAFS power buttons can be pressed to enable/disable the foam/CAF Systems.

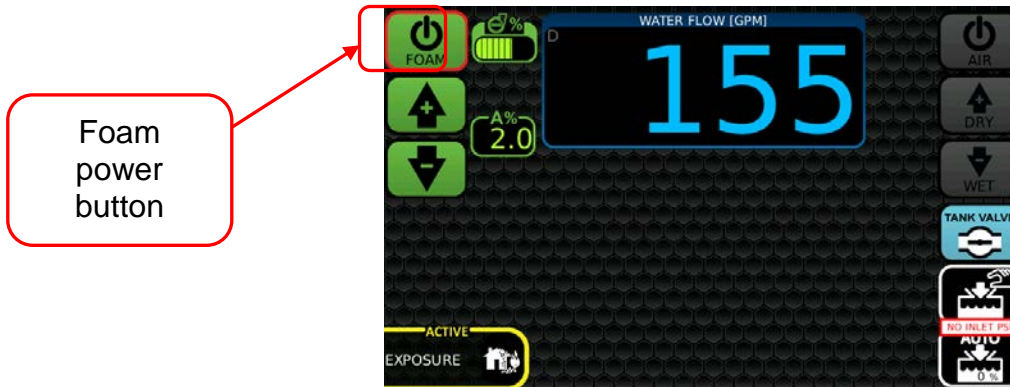
- When foam and CAFS are ON, pressing the foam power button will turn OFF foam and CAFS.
- When foam and CAFS are ON, pressing the CAFS power button turns OFF only CAFS.
- When foam and CAFS are OFF, pressing the foam power button will turn ON only foam.
- When foam and CAFS are OFF, pressing the CAFS power button turns ON foam and CAFS.

Disengaging the compressor clutch

1. The compressor clutch will be automatically disengaged when the pump engaged signal is turned OFF. At this time the SmartCAFS Controller will turn OFF foam and CAFS and return to the preset screen.
2. The compressor clutch can be manually disengaged by pressing and holding the CAFS power button for three seconds (the warning banner will pop-up to indicate how long the CAFS power button must be held).



The on-screen CAFS buttons will be gray to indicate that the compressor clutch is disengaged.



NOTE: It will be necessary to turn OFF the foam system if foam operation is no longer desired.

3. Run water through the CAFS discharge system to flush out the foam agent.
4. Close the CAFS discharge valves.
5. Shift the truck transmission from DRIVE to NEUTRAL and shift the water pump VPS from PUMP to ROAD mode.
6. If freezing conditions are expected, drain the manifold, pump, water strainer and CAFS heat exchanger.

Overheat Shut down

1. Should the compressor oil temperature reach 220°F [105°C], a control panel warning indicator will appear on the screen. The compressor can sustain 220°F [105° C] for short periods without damage.
2. If the compressor oil temperature reaches 230°F [110° C], the drive clutch will automatically disengage. This will stop the compressed air supply and only foam/water solution will be discharged. The compressor cannot be re-engaged until the unit has been cooled and the pump input speed is returned to below 900 RPM.
3. The most probable cause of compressor overheating is insufficient cooling water flow.

Flushing

When returning the apparatus to ready condition after using class B foam, the Hale Foam unit foam pump **must** be flushed. This is because some Class B foam concentrates deteriorate rapidly. It is recommended to flush for the preset time in the SmartCAFS.

NOTE: *Approved class A foam concentrates do not deteriorate at the rate of class B foam concentrates. Provided that an approved class A foam concentrate is used and the system is used within 30 days, flushing is not required. After class B foam concentrate has been used, flush the system then select class A.*

For detailed flushing instructions, please refer to the **Foam unit Model 3.3/5.0/6.5 Manual** [029-0021-68-0](#).

WATER AUTO-FILL OPERATION

The water auto-fill system attempts to maintain the desired water tank level by gating the KZCO valve on the inlet side of the pump. The current position (0% to 100%) of the valve is shown on the on-screen auto-fill ON/OFF button. The auto-fill system gets the tank level information from the Class1 ITL water gauge.

The system is only active when the inlet pressure is 7 PSI or greater. If there is not enough inlet pressure the “NO INLET PSI” warning will be shown between the auto-fill control buttons.

Start/stop auto-fill

Press the auto-fill ON/OFF button to change the system state.



Auto-fill system
OFF



Auto-fill system
ON

Manually open the auto-fill valve

Press the auto-fill manual button to force the valve open. Release the button to close the valve (if the auto-fill system is ON it will revert to the automatic control).



Manual fill OFF



Manual fill ON

Setting the desired tank level for auto-fill

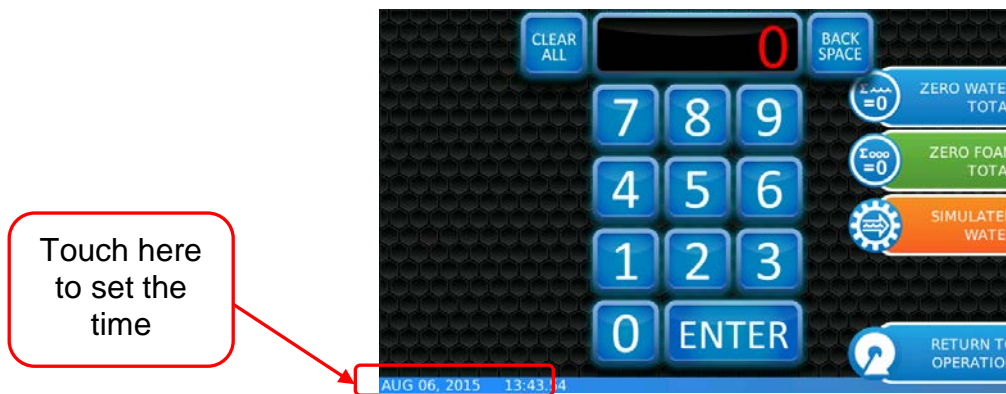
The USER menu contains the setting “Desired autofill water level” which can be set anywhere from “empty” to “full” in 1/8 tank increments (the default is 7/8).

MENUS

System menu

Press and hold the MENU button for 3 seconds until the system menu is shown. The system menu allows the clearing (zero) of the total water and total foam display, setting the simulated water flow (for diagnostics), and entering passwords for other menus (user and OEM), for calibrations (water and foam), and for configuration (presets).

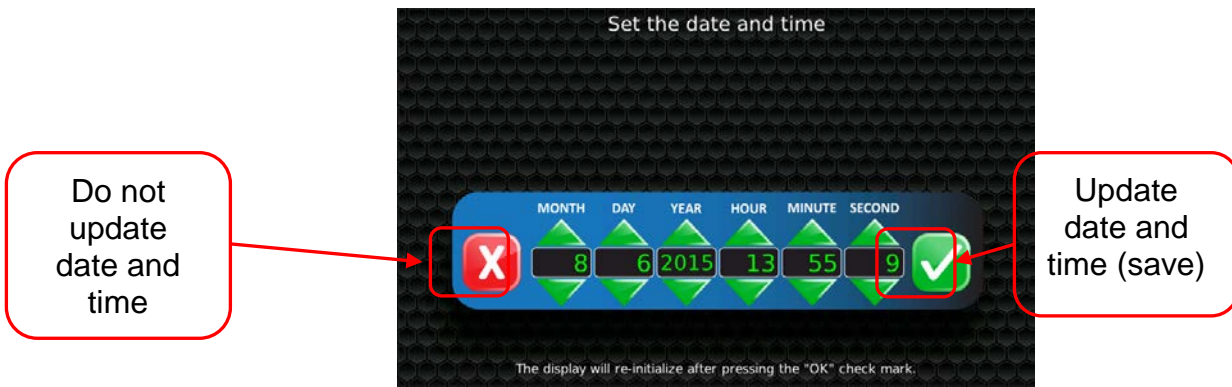
NOTE: The password keyboard greyed out if the foam and/or CAFS power buttons are ON.



Setting the system time

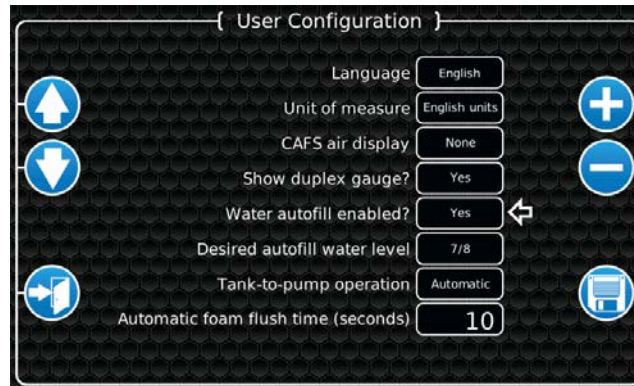
Press the blue bar in the bottom left corner of the system menu screen (over the month and day) and the “set the date and time” screen will appear. Enter the new date/time and press the “green check mark” to save.

NOTE: The display will re-boot after pressing the “green check mark”.



User menu

Enter the password **1849** in the system menu's keyboard to open the user menu. The user menu allows setting of user configurable items.



- Language - select the desired language to show within the SmartCAFS Controller.
Default: English
- Unit of measure - select the desired unit of measure for the system (English or metric).
Default: English units
- CAFS air display - select the desired display to be shown for the air. This display is shown beneath the water flow display (none, SCFM, ratio, or air pressure). Note: SCFM will only be shown if a Hale air flow sensing valve is installed.
Default: None
- Show duplex gauge? - select whether to show the duplex gauge when additional information is toggled.
Default: No
- Water autofill enabled? - select whether to use auto-fill.
Default: No
- Desired autofill water level - select the level to maintain in auto-fill (fill, 7/8, 3/4, 5/8, 1/2, 3/8, 1/4, 1/8, empty).
Default: 7/8
- Tank-to-pump operation - select whether the tank-to-pump valve is operated manually or automatically (or none if an air actuated tank-to-pump valve is not installed).
Default: Automatic
- Automatic foam flush time - number of seconds that the foam system must be flushed (2 to 60 seconds).
Default: 10 seconds

UP/DOWN arrow buttons



Select the menu item. The white arrow points to the currently selected menu item.

“+” and “-“ buttons



Change the value of the currently selected menu item.

Exit button



Exit the menu.

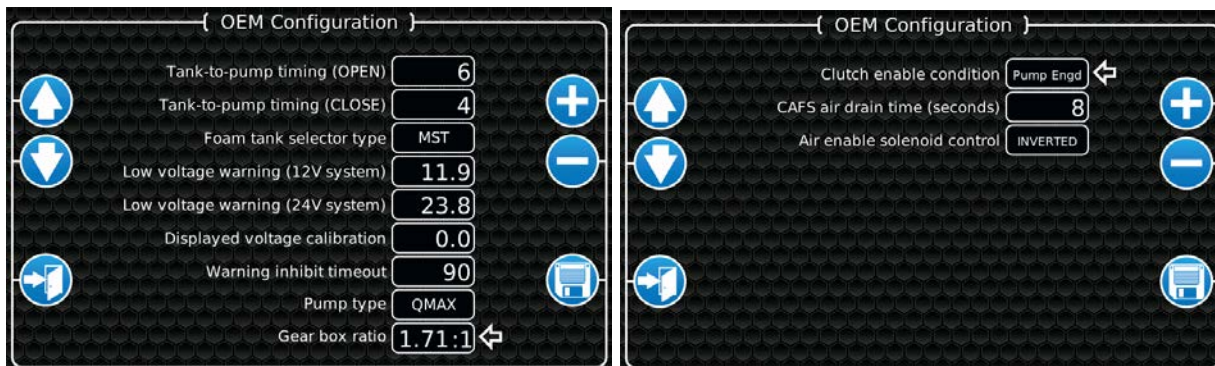
Save button



Save all items in the menu.

OEM menu

Enter the password **2314** in the system menu's keyboard to open the user menu. The user menu allows setting of user configurable items.



Page one

Page two

Tank-to-pump timing (open) - select the amount of time the “open” air solenoid is activated. The tank-to-pump valve is controlled via an linear air cylinder so this setting allows for fine tuning of the amount of time it actually takes to fully stroke the cylinder.

Default: 6 seconds

Tank-to-pump timing (close) - select the amount of time the “close” air solenoid is activated. The tank-to-pump valve is controlled via an linear air cylinder so this setting allows for fine tuning of the amount of time it actually takes to fully stroke the cylinder.

Default: 4 seconds

Foam tank selector type - select the foam tank selector type. Single tank systems (none or MST), dual tank systems (MDT or ADT).

Default: MST

Low voltage warning (12V) - select the low voltage warning level for 12V systems.

Default: 11.9 volts

Low voltage warning (24V) - select the low voltage warning level for 24V systems.

Default: 23.8 volts

Displayed voltage calibration - if the displayed voltage in the additional information displays does not match the actual system voltage this value can be adjusted to calibrate (offset) the voltage (-1.5 to +1.5 volts).

Default: 0.0 volts

Warning inhibit timeout - sets the amount of time (30 to 300 seconds) that a warning, which was inhibited (cleared) by the operator, will stay hidden until it shown again (if the warning is still active).

Default: 90 seconds

Pump type - select the Hale pump type (QMAX-XS, QMAX, QTWO, or DSD).

Default: QMAX-XS

Gear box ratio - select the gear box ratio. This is used along with the pump type to set the compressor over-speed warning.

Default: 1.71:1

Clutch enable condition - select when the compressor clutch will be enabled (Pump Engd = clutch engaged when the pump engaged signal is activated, Preset = clutch engaged when a CAFS preset is first pressed).

Default: Pump Engd

CAFS air drain time - select how long the air drain solenoid is open when the pump engage signal is deactivated (0 to 10 seconds). This allows the residual air to be bled off after system usage.

Default: 8 seconds

Air enable solenoid control - sets how the air enable solenoid is controlled. Inverted = air IS NOT blown into the air valve assembly to activate air injection. Normal = air IS blown into the air valve assembly to activate air injection. **Note: when**

using the Hale air sensing valve this value should be set to "inverted".

Default: INVERTED

UP/DOWN arrow buttons



Select the menu item. The white arrow points to the currently selected menu item.

“+” and “-“ buttons



Change the value of the currently selected menu item.

Exit button



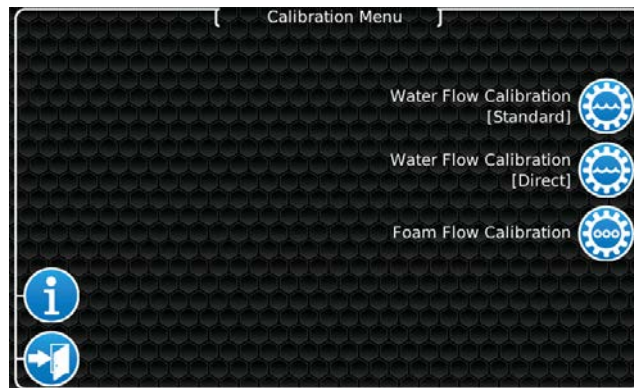
Exit the menu.



Save button

Save all items in the menu.

CALIBRATIONS

Enter the password **6679** in the system menu's keyboard to open the calibration menu. The calibration menu allows the foam and water calibrations to be performed.



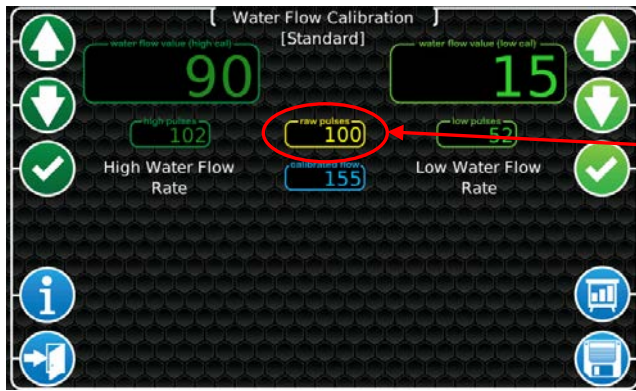
NOTE: Anytime the  button is shown it can be pressed to pop-up a tutorial about the current screen. The tutorial can be canceled at any time by pressing the  button again.

Water flow calibration (standard)

The standard water flow calibration requires plain water to be flowed through a foam/CAFS capable discharge. The water flow calibration requires flows at a high rate and a low rate. The high and low rate is determined by the person calibrating the system. This two-point calibration yields a very precise water flow calibration across the entire range.

NOTE: An accurate flow measuring device must be used to measure the water flow when calibrating the flow sensor. Use a suitable size, smooth bore nozzle and an accurate Pitot Gauge instrument.

1. Establish flow through a foam/CAFS capable discharge at either the high or low rate. Use the yellow "raw pulses" display window to verify that the paddlewheel sensor is detecting the water flow.



Raw pulses display

2. Press the “chart icon” button to open the flow rate calculator.

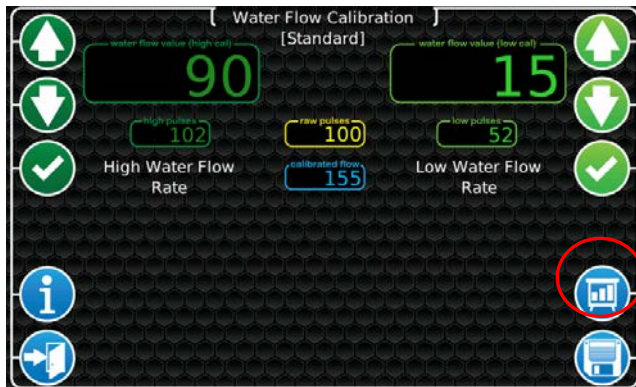
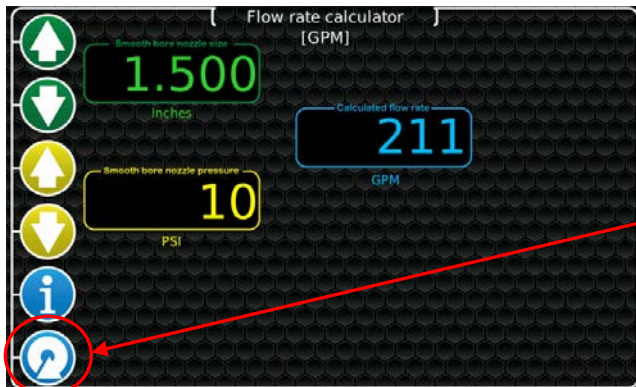


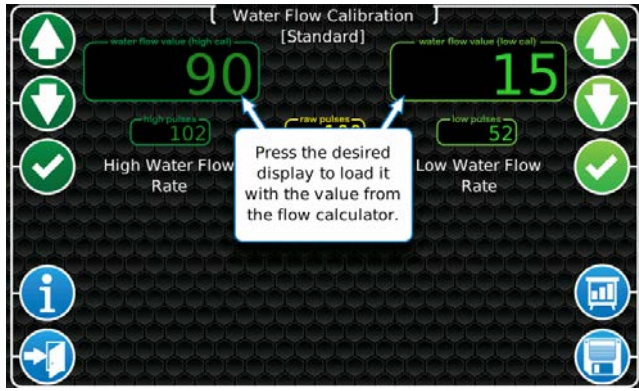
Chart icon

3. This calculator will allow the entry of the smooth bore nozzle size and the current pitot gauge reading in order to calculate the flow rate. Press the “return arrow icon” button to return to the water flow calibration screen.

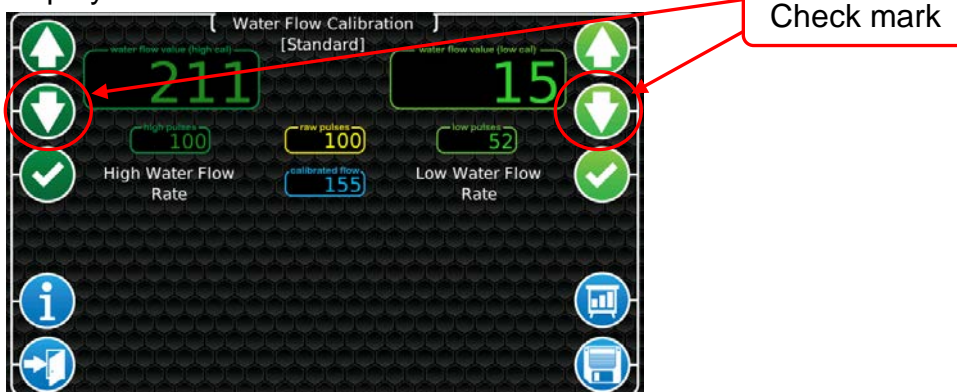


Return arrow icon

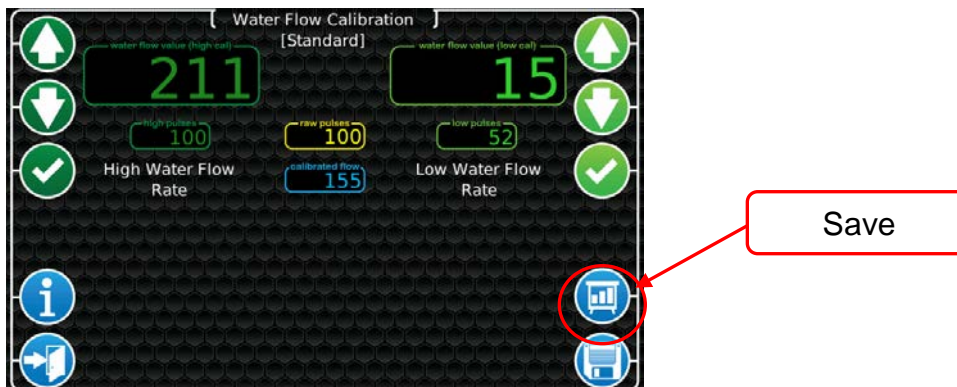
- 4. The display will ask where you want to place the calculated value. Press the display where you want the value to be placed.



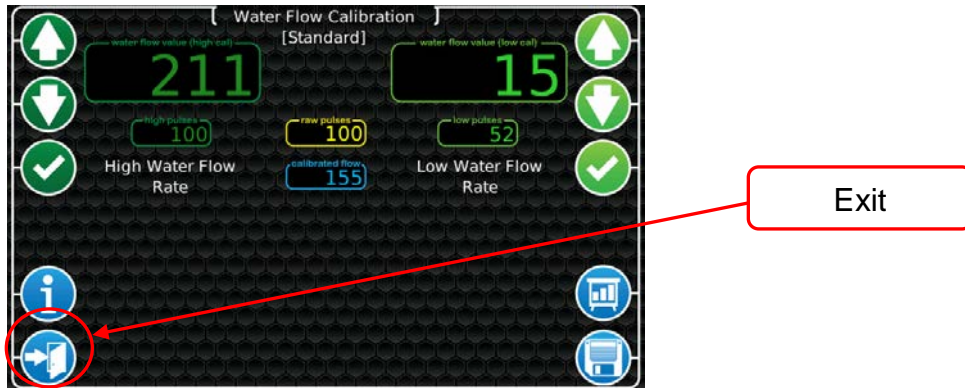
- 5. Press the "check mark" button on the desired side (high or low). Make sure that the value in the yellow "raw pulses" display window is now in the green "high pulses" (or "low pulses") display window.



- 6. Perform these same steps for the other flow rate.
- 7. Press the "save" button to complete the calibration. Decrease the throttle and stop water flow.

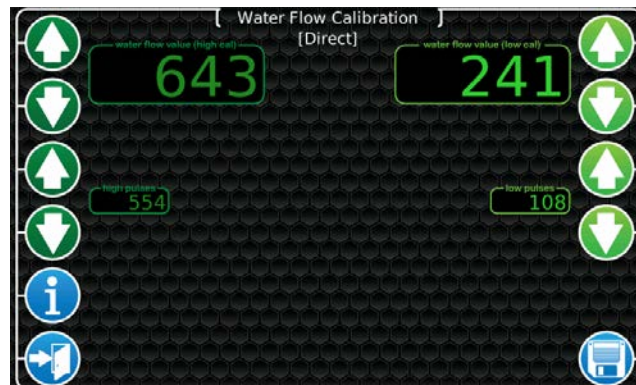


8. Press the “exit” button to return to the calibration menu.



Water flow calibration (direct)

The direct water flow calibration is simply a means of entering the values from a previous water flow calibration without the need to actually flow water. The direct water flow calibration requires the known values for the water flow value and its related water flow pulses (high and low) from a previously completed calibration. This is typically used when having to replace the SmartCAFS Controller or when another vehicle is determined to be exactly the same as a previous vehicle.



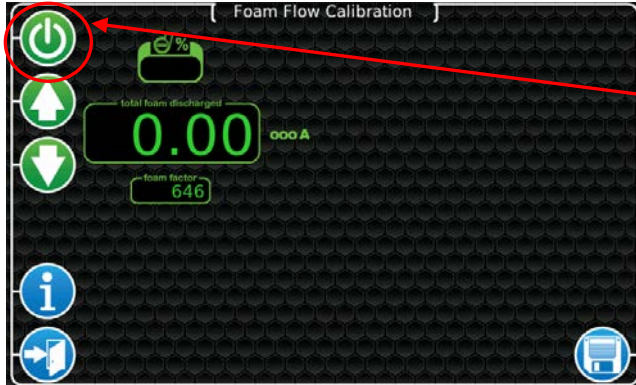
Foam flow calibration

The foam flow calibration requires the discharge of a known quantity of foam concentrate into a calibrated container.

NOTE: *Be sure to set the foam bypass handle into the “bypass” position so that the discharged foam concentrate may be collected.*

1. Place the foam bypass handle into the “bypass” position.
2. Place the calibrated container so that it will be filled with foam concentrate as it is discharged through the bypass hose.

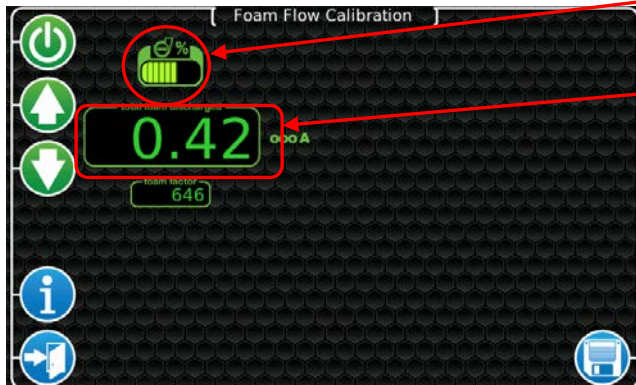
3. Press the power button.



Power

4.

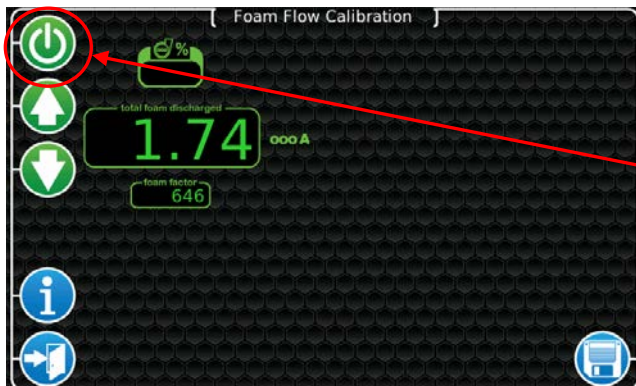
5. The bar graph will increase to indicate that the foam pump is running and the system will begin discharging foam concentrate. The “total foam discharged” display will begin incrementing.



Bar graph

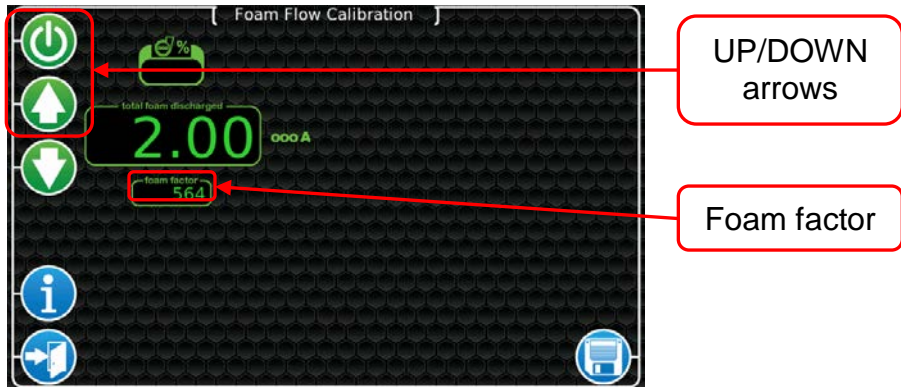
Total foam discharged

6. When the foam concentrate has filled the container to a known level press the power button again to stop the foam system.

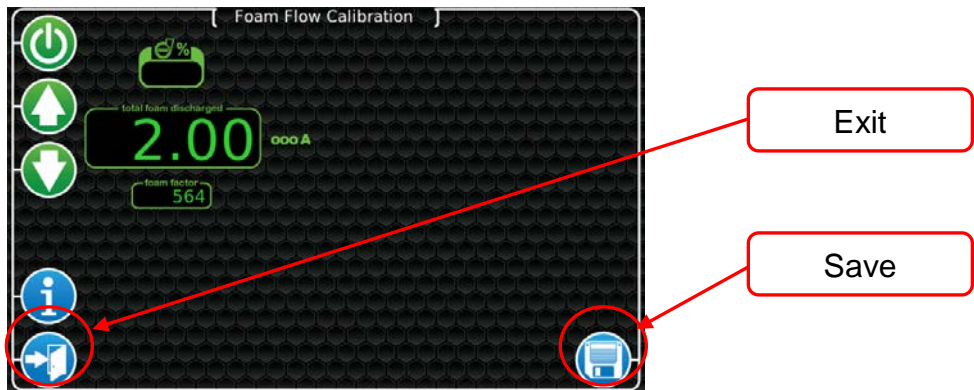


Power

- Use the UP/DOWN arrow buttons to change the value shown in the “total foam discharged” window to reflect the value actually collected in the container (the “foam factor” value will be changing, but in the inverse direction).



- Press the “save” button. Press the “exit” button to return to the calibration menu.



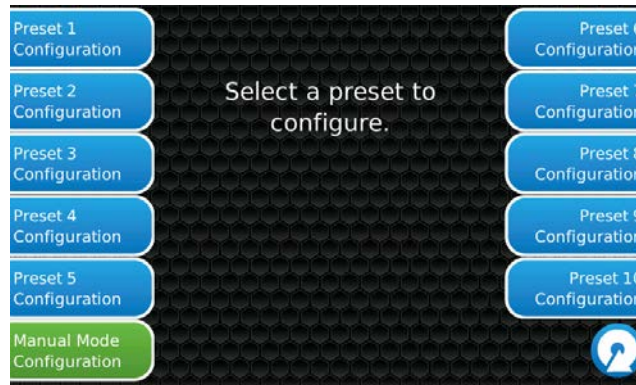
- Place the bypass handle back to the “inject” position.

CONFIGURATION

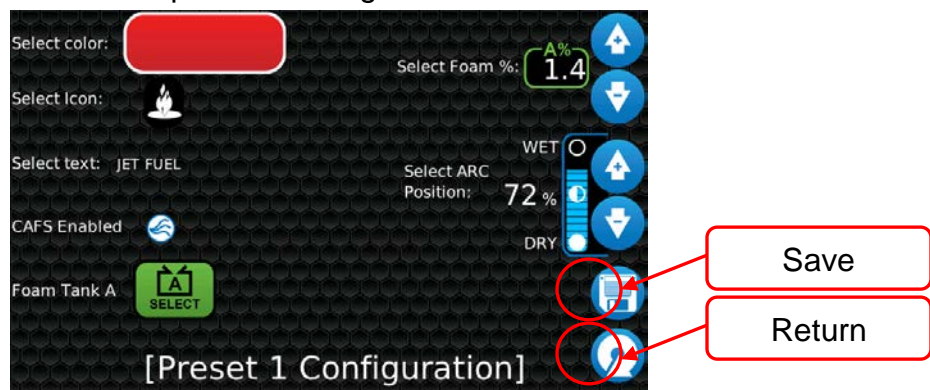
Preset configuration (standard)

The SmartCAFS Controller allows up to 10 presets to be configured. These presets can be set for foam only or foam and air (CAFS).

Enter the password **1023** in the system menu's keyboard to open the preset configuration menu.



Select the preset to configure and that preset's configuration screen will be shown.



- Select color: - select the color for the preset's bar (green, red, orange, purple, blue, disabled). If "disabled" is selected then the preset is turned OFF.
- Select icon: - select the icon to use for this preset.
- Select text: - pops-up a keyboard so that text can be set for this preset (9 characters per line, up to 3 lines).
- CAFS enabled/disabled - select whether this preset will be using CAFS or foam only.
- Foam Tank: - select which foam tank is used with this preset. If the foam selector is not set for the correct tank the SmartCAFS Controller will pop-up a warning to inform the operator to switch to the correct tank.
- Select foam %: - set the foam concentrate percentage required for this preset (this option is only visible if CAFS is enabled for this preset).
- Select ARC position: - set the consistency of the CAFS by setting the ARC valve between WET and DRY (this option is only visible if CAFS is enabled for this preset).
- "Save" button - save this preset to memory.
- "Return" button - return to the "select a preset" configuration menu.

Preset configuration (live)

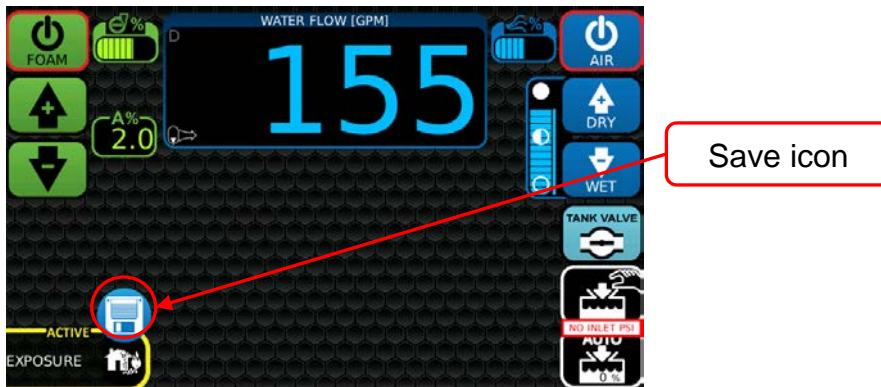
Once a preset has been configured via the standard configuration it may not have produced the CAFS consistency desired. The “live” preset configuration allows the operator to flow CAFS while adjusting the consistency and then re-save that new value to the desired preset.

Enter the password **40692** in the system menu’s keyboard to open the user menu. This enables the “live” preset ability. Information banners will pop-up to indicate that the “live” preset ability has been activated. Touch the banner to dismiss the message.



NOTE: You must recycle the SmartCAFS Controller’s power to disable the live preset configuration.

1. Select the desired preset from the preset page. You will notice a “save” icon above the currently selected preset (bottom left corner of the screen).



2. Run the CAFS and adjust the CAFS consistency as desired (WET/DRY buttons).
3. Press the button next to the currently selected preset indicator. The “saving” indicator will appear momentarily indicating that the new consistency has been saved.



ON-SCREEN WARNINGS AND INFORMATION

The SmartCAFS Controller uses on-screen pop-up warnings and information to indicate system status to the operator.

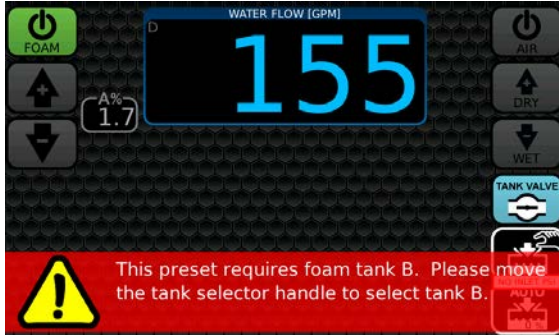


Figure 2 Warnings use a red background

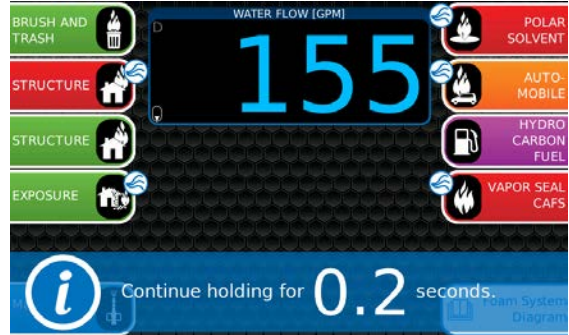


Figure 3 Information uses a blue background

Touch the warning/information to dismiss it (inhibited). The warning will be hidden for the number of seconds set in the OEM menu’s “warning inhibit timeout”. If the condition that caused the warning still exists the warning will pop-up again.

EXPRESS WARRANTY

EXPRESS WARRANTY: Hale Products, Inc (“Hale”) hereby warrants to the original buyer that products manufactured by it are free of defects in material and workmanship for one (1) year. The “Warranty Period” commences on the date the original buyer takes delivery of the product from the manufacturer.

LIMITATIONS: HALE’S obligation is expressly conditioned on the Product being:

- Subjected to normal use and service.
- Properly maintained in accordance with HALE’S Instruction Manual as to recommended services and procedures.
- Not damaged due to abuse, misuse, negligence or accidental causes.
- Not altered, modified, serviced (non-routine) or repaired other than by a Hale approved service facility.
- Manufactured per design and specifications submitted by the original Buyer.

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EXCLUSIVE REMEDIES: If the Buyer promptly notifies HALE upon discovery of any such defect (within the Warranty Period), the following terms shall apply:

- Any notice to HALE must be in writing, identifying the Product (or component) claimed defective and circumstances surrounding its failure.
- HALE reserves the right to physically inspect the Product and require Buyer to return same to HALE’s plant or other authorized service provider.
- In such event, Buyer must notify HALE for a Returned Goods Authorization (“RGA”) number and Buyer must return the Product F.O.B. to HALE.
- If determined defective, HALE shall, at its option, repair or replace the Product, or refund the purchase price (less allowance for depreciation).
- Absent proper notice within the warranty Period, HALE shall have no further liability or obligation to Buyer therefore.

THE REMEDIES PROVIDED ARE THE SOLE AND EXCLUSIVE REMEDIES AVAILABLE. IN NO EVENT SHALL HALE BE LIABLE FOR INCIDENTAL OR COSEQUENTIAL DAMAGE(S) INCLUDING, WITHOUT LIMITATIONS, LOSS OF LIFE; PERSONAL INJURY; DAMAGE TO REAL OR PERSONAL PROPERTY DUE TO WATER OR FIRE; TRADE OR OTHER COMMERCIAL LOSSES ARISING, DIRECTLY OR INDIRECTLY, OUT OF PRODUCT FAILURE.