System Requirements Specification (SRS)

Lightning

Controls Group

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Revision History

Revision D

Change #	Description of Change	Source of Change	Date	Author
A	• Initial starting document		08/19/2015	KM
B	• Added missing modes		08/24/2015	KM
C	• Several reqs updated from PRS	Lightning PRS	9/1/2015	KM
D	• Addition of Touchscreen Checklist and various other requirements		10/22/2015	KM,JY

Table of Contents

1. Intro

1.1 Purpose

The Lightning Sweeper/Scrubber is a new machine form. This machine is targeted to combine the scrubbing functionality of the T17 with the sweeping functionality of the 8300. The machine will offer several variants, intended for use in commercial and industrial applications.

Standard electrical features include:

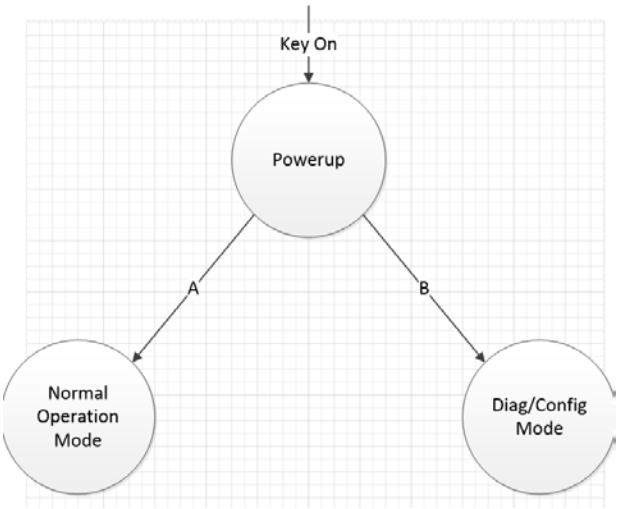
- Main sweep control
- Side sweep control
- Dust vac
- Main scrub control
- Side scrub control
- Water pickup control
- User interface POD
    - Standard POD with hardware buttons for machine functions
    - Optional Touchscreen POD incorporating rear camera
    - Panel switches for further machine functions (panel layouts differ between Standard and Touchscreen POD variants)
- Headlights, overhead light, audible backup alert
- Hopper control
- Vac wand control
- Key Switch
- Emergency Stop Switch
- Low battery cutoff

2. Machine Specifications

3. System Requirements

This section contains requirements that are traceable to the individual requirements contained in the PRS. Each requirement in this document will be modified so that they follow the conventions below:

Operational Modes and State Diagrams:



For machines with the Standard Pod, upon turning the key switch to the "1" position, “Tennant M17” shall be displayed on the top row of the LCD display and the master controller software revision date shall be displayed on the bottom row for between 2 to 4 seconds.

When the machine is started in normal mode the touchpad buttons shall be operational starting between 5 to 7 seconds after the key switch was turned to the "1" position.

Starting within two seconds of starting the Lightning machine in normal mode all of the LEDs shall be lit for 3 seconds.

During the flashing of the LEDs upon starting up in normal mode the LEDs associated with EcH2O and ES features should only be flashed if their respective features are configured.

If EcH2O is configured but severe environment is not configured, then EcH2O shall be selected if it was selected when the machine was last keyed off.

If EcH2O is configured with severe environment then instead EcH2O will always be selected when the machine enters normal mode.

If ES is configured it shall be selected if it was selected when the machine was last keyed off.

For five seconds after normal mode is entered the left arrow scroll button shall adjust the LCD contrast.

Pressing and holding the right arrow scroll button on power up shall cause the machine to enter Diagnostics/Configuration mode.

Once in Diagnostics/Configuration mode the machine shall stay in Diagnostics/Configuration mode until the key switch is cycled off.

In Normal Mode sweep and scrub operations shall be selectable in the combinations described in Table 1 below.

Lightning Machine Control Modes Chart

	Sweep/Scrub Parameters						
	Sweep Parameters			Scrub Parameters			
Mode name:	Side Sweep	Sweep Vac	Main Sweep	Side Scrub	Squeegee/Scrub Vac	Main Scrub	Description
"NONE/OFF"	0	0	0	0	0	0	No sweep or scrub functions enabled
	0	0	0	0	0	1	DOUBLE SCRUB without side scrub
"WATER PICKUP"	0	0	0	0	1	0	Squeegee/Scrub vac only
	0	0	0	0	1	1	SCRUB without side-scrub
	0	0	0	1	0	0	DOUBLE SCRUB without main scrub
"DOUBLE SCRUB"	0	0	0	1	0	1	SCRUB without squeegee/scrub vac
	0	0	0	1	1	0	SCRUB without main scrub
"SCRUB"	0	0	0	1	1	1	All scrub features enabled
	0	0	1	0	0	0	Main sweep without sweep vac
	0	0	1	0	0	1	Main sweep and main scrub without either vac.
	0	0	1	0	1	0	Main sweep and water pickup.
	0	0	1	0	1	1	SCRUB without side-scrub plus main sweep.
	0	0	1	1	0	0	Side scrub and main sweep only.
	0	0	1	1	0	1	DOUBLE SCRUB plus main sweep
	0	0	1	1	1	0	SCRUB without main scrub plus main sweep.
	0	0	1	1	1	1	SCRUB plus main sweep
	0	1	0	0	0	0	Sweep vac only
	0	1	0	0	0	1	Main scrub plus sweep vac.
	0	1	0	0	1	0	Both vacs only
	0	1	0	0	1	1	Both vacs plus main scrub.
	0	1	0	1	0	0	Both vacs plus side scrub.
	0	1	0	1	0	1	Double scrub plus sweep vac.
	0	1	0	1	1	0	SCRUB without main scrub plus sweep vac
	0	1	0	1	1	1	SCRUB plus sweep vac.
	0	1	1	0	0	0	SWEEP without side sweep.
	0	1	1	0	0	1	SWEEP without side sweep plus main scrub
	0	1	1	0	1	0	SWEEP without side sweep plus squeegee/scrub vac
	0	1	1	0	1	1	SWEEP-SCRUB without side sweep and side scrub
	0	1	1	1	0	0	SWEEP without side sweep plus side scrub
	0	1	1	1	0	1	SWEEP-SCRUB without side sweep and squeegee/scrub vac
	0	1	1	1	1	0	SWEEP-SCRUB without side sweep and main scrub
	0	1	1	1	1	1	SWEEP-SCRUB without side sweep
	1	0	0	0	0	0	Side sweep only
	1	0	0	0	0	1	Side sweep and main scrub only
	1	0	0	0	1	0	Side sweep and squeegee/scrub vac only
	1	0	0	0	1	1	SCRUB without side scrub plus side sweep
	1	0	0	1	0	0	Side sweep and side scrub only
	1	0	0	1	0	1	DOUBLE SCRUB plus side sweep
	1	0	0	1	1	0	SCRUB without main scrub plus side sweep
	1	0	0	1	1	1	SCRUB plus side sweep
	1	0	1	0	0	0	SWEEP without sweep vac
	1	0	1	0	0	1	SWEEP without sweep vac plus main scrub
	1	0	1	0	1	0	SWEEP without sweep vac plus squeegee/scrub vac
	1	0	1	0	1	1	SWEEP-SCRUB without sweep vac and side scrub
	1	0	1	1	0	0	SWEEP without sweep vac plus side scrub
	1	0	1	1	0	1	SWEEP-SCRUB without sweep vac and squeegee/scrub vac
	1	0	1	1	1	0	SWEEP-SCRUB without sweep vac and main scrub
	1	0	1	1	1	1	SWEEP-SCRUB without sweep vac
	1	1	0	0	0	0	SWEEP without main sweep
	1	1	0	0	0	1	SWEEP without main sweep plus main scrub
	1	1	0	0	1	0	SWEEP without main sweep plus squeegee/scrub vac
	1	1	0	0	1	1	SWEEP-SCRUB without main sweep and side scrub
	1	1	0	1	0	0	SWEEP without main sweep plus side scrub
	1	1	0	1	0	1	SWEEP-SCRUB without main sweep and squeegee/scrub vac
	1	1	0	1	1	0	SWEEP-SCRUB without main sweep and main scrub
	1	1	0	1	1	1	SWEEP-SCRUB without main sweep
"SWEEP"	1	1	1	0	0	0	All sweep features enabled
	1	1	1	0	0	1	SWEEP plus main scrub
	1	1	1	0	1	0	SWEEP plus squeegee/scrub vac
	1	1	1	0	1	1	SWEEP-SCRUB without side scrub
	1	1	1	1	0	0	SWEEP plus side scrub
	1	1	1	1	0	1	SWEEP-SCRUB without squeegee/scrub vac
	1	1	1	1	1	0	SWEEP-SCRUB without main scrub
"SWEEP-SCRUB"	1	1	1	1	1	1	All sweep and all scrub features enabled

Key:
Mode should be included
Mode should be precluded

Table 1: Allowed and disallowed sweep/scrub function combinations

Button presses which would otherwise result in a disallowed combination of sweep and scrub functions shall instead cause the machine to transition into an allowed state by automatically engaging or disengaging other functions than the one corresponding to the activated button.

Battery status information (Charge Level) shall be displayed in the left portion of the top row of the LCD display and in the upper-left portion of the Touchscreen display.

Battery level shall be depicted in terms of five bars which shall decrement from right to left as the battery is depleted.

Propel Hour meter information shall be displayed in the right portion of the top row of the LCD display and in the upper-right portion of the Touchscreen display, with a resolution of tenths of hours.

Solution tank status information shall be displayed in the left portion of the bottom row of the LCD, and in the upper-left portion of the Touchscreen display.

Note: 5 Incremental bars total

The solution tank level shall be depicted in terms of five bars which shall decrement from right to left as the battery is depleted.

Recovery tank status information shall be displayed on the bottom right portion of the LCD, and in the upper left portion of the Touchscreen display.

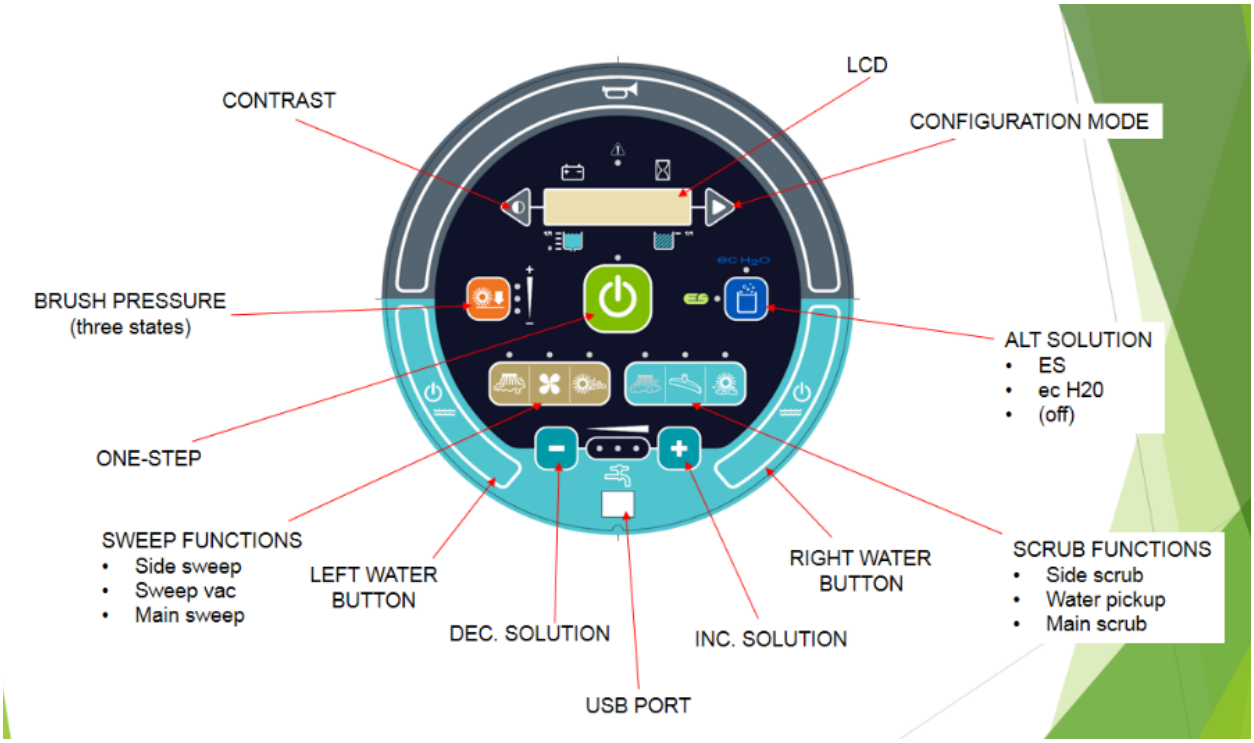
The recovery tank level resolution shall consist of an empty state, a half-full state, and a completely full state when the Extended Scrub (ES) option is in place.

The recovery tank level resolution shall consist of an empty state and a completely full state when the Extended Scrub (ES) option is not in place.

3.1 List of Inputs

3.1.1 Standard POD Option

3.1.1.1 Standard POD Inputs



Configuration Mode and Contrast buttons shall be disabled in Normal Mode.

The ON/OFF state of each of the following functions/modes shall be indicated by its adjacent LED:

- One-Step
- eC H2O
- ES (Extended Scrub)
- Side Sweep
- Dust Vac/Sweep Vac
- Main Sweep
- Side Scrub
- Water Pickup
- Main Scrub

The three LEDs between the 'Decrease Solution Flow' and 'Increase Solution Flow' buttons shall correspond to three degrees of solution flow via the following scheme:

- When only the leftmost LED is lit solution flow is at its lowest setting
- When the two leftmost LEDs are lit solution flow is at its intermediate setting
- When all three LEDs are lit solution flow is at its highest setting

The three LEDs to the right of the Brush Pressure button shall correspond to three degrees of brush pressure via the following scheme:

- When only the lowest LED is lit brush pressure is at its lowest setting
- When the two lowest LEDs are lit brush pressure is at its intermediate setting
- When all three LEDs are lit brush pressure is at its highest setting
- When none of the LEDs are lit no solution is being delivered.

The red LED above the two-line LCD screen shall be lit or flashing when a fault is active on the system.

For machines with the Extended Scrub option equipped the Alternative Solution button shall either toggle ES Mode on and off (when the EcH2O option is not also equipped) or rotate between ES Mode, EcH2O Mode, and conventional mode (no alternative solution) with each button press.

Pressing the Left Water Button or Right Water Button while scrubbing shall suspend solution delivery.

Pressing the Left Water Button or Right Water Button while solution delivery is suspended shall reenable solution delivery.

Once solution delivery has been suspended for ten seconds solution delivery shall be reenabled.

3.1.1.2 Panel Inputs: Standard POD Configuration

Machines configured with the Standard POD shall have control panels to the left and right of the steering column.

The panel to the left shall feature rocker switches to control the following functions:

- Propel forward/reverse

- Headlights/Overhead Light
- Spray wand

The panel to the left shall also house the ignition keyswitch and the e-stop switch.

The panel to the right shall feature rocker switches to control the following functions:

- Hopper lift/lower
- Hopper roll-in/roll-out
- Severe Environment (short cycle, long cycle)
- Filter Shaker

3.1.2 Touchscreen POD Option

3.1.2.1 Touchscreen POD Inputs

The Touchscreen POD shall feature the following user inputs:

- A 'touchscreen' touch-sensing liquid-crystal display
- A horn button (located above the Touchscreen LCD)
- Left and Right Water buttons (located below the Touchscreen LCD)

On startup, the Touchscreen shall display the Main Menu.

The Main Menu shall contain the following touchscreen buttons:

- One-Step
- Main Sweep
- Side Sweep
- Dust Vac
- Main Scrub
- Side Scrub
- Water Pickup
- Flow Control
- Downpressure
- Setup Menu (link)
- Hopper Control Menu (link)
- Rear Camera
- Severe Environment
- eC-H2O

The Main Menu shall display the following outputs:

- Hourmeter
- Solution Tank Level/Battery Level/Recovery Tank (in rotation)

The Setup Menu shall provide links to the following functions:

- Supervisor Menu
- Software versions list
- Instructional / troubleshooting videos
- Manual Mode

The Supervisor Menu shall provide the following capabilities:

- User creation/deletion
- User login/password management
- Checklist management

The Hopper Control Menu shall provide the following touchscreen buttons:

- Hopper Lift
- Hopper Lower
- Hopper Roll-In
- Hopper Roll-Out

All menus shall feature a 'return home' mechanism.

In Rear Camera Display and Video Playback modes touching the screen during playback shall cause the Main Menu to be displayed.

After initial machine startup, when the screen is not displaying the Rear Camera feed or video playback, a touchscreen 'home' button shall be displayed at the right edge of the screen.

3.1.2.2 Panel Inputs: Touchscreen POD Configuration

Machines configured with theTouchscreen POD shall have a control panels to the left of the steering column.

The panel shall feature rocker switches to control the following functions:

- Propel forward/reverse
- Headlights/Overhead Light
- Spray wand

3.2 USB Port

The UI POD shall feature a service USB port.
The USB port shall provide the ability to connect to the machine with a standard, off-the-shelf, cable
Machine parameters shall be configurable with <tool TBD> via the service USB port. The machine shall support system diagnostic reporting over USB using the Dashboard protocol.
The machine shall have all hardware necessary to be capable of supporting automatic end-of-line system testing over USB.
The machine shall support updating the firmware on each hardware module connected to the CAN bus over USB.

3.2.2.1 User USB Port

The Touchscreen POD shall feature a User USB port for export of completed checklists.

3.3 Normal Mode

Normal Mode shall encompass modes available to the user during normal, operational use of the machine.

Transport Mode and One-Step Mode shall be the modes available while Normal Mode is engaged.

Transport Mode is defined as the mode within Normal Mode in which the One-Step function is not active.

Propel functions (forward propel, reverse propel, brake, parking brake) shall be available to the user while the machine is in Transport Mode.

Sweeping and scrubbing functions shall not be available to the user while the machine is in Transport Mode.

In Transport Mode, sweep and scrub function button presses shall toggle the functions' corresponding LEDs without engaging the functions themselves.

Upon entering One-Step mode, functions with lit LEDs shall be activated.

3.3.1 Transport Mode

Upon initially entering Normal Mode following machine key-on, the machine shall enter Transport Mode.

Activation of the One-Step button shall effect a transition from Transport Mode to One-Step Mode.

Propel speed shall be reduced to 2.0 mph upon the hopper leaving the home position.

Propel speed shall be restored to 4.0 mph if in One-Step mode with the Main Scrub function active or 5.0 mph otherwise.

While in Transport Mode all squeegees, sweep and scrub brushes shall be in the 'parked' position.

While in Transport Mode vac fans shall not run, except for a brief period following the transition from One-Step Mode to Transport Mode with the Water Pickup function selected.

3.3.2 One-Step Mode

One-Step Mode shall become active immediately after pressing the One-Step button while in Transport Mode.

Pressing the One-Step button while in One-Step mode shall cause the machine to exit this mode.

The machine shall exit one-step mode and enter transport mode upon detecting a fault.

When in One-Step mode enabling sweep or scrub functions (Main Sweep, Side Sweep, Main Scrub, Side Scrub) shall cause the corresponding brush(es) to be actuated to contact with the floor.

When sweep or scrub functions (Main Sweep, Side Sweep, Main Scrub, Side Scrub) are selected entering One-Step mode shall cause the corresponding brush(es) to be actuated to contact with the floor.

When in One-Step mode enabling Water Pickup mode shall cause the Rear Squeegee to be actuated to contact with the floor.

When the Water Pickup function is selected entering One-Step mode shall cause the Rear Squeegee to be actuated to contact with the floor.

Upon exiting One-Step Mode all brushes shall return to 'parked' position and the rear squeegee shall return to the 'parked' position following a ten second delay.

When in One-Step Mode disabling sweep or scrub functions shall cause the corresponding brushes to return to a 'parked' position.

When in One-Step Mode disabling Water Pickup mode shall cause the Rear Squeegee to return to the 'parked' position following a ten second delay.

3.3.2.1 Sweep Functions

3.3.2.1.1 Main Sweep

While in One-Step mode with the Main Sweep function enabled the Main Sweep brush motors shall be engaged while the machine is propelling forward.

The main sweep brush motor shall be disengaged when the machine is stopped (PRS 3.4.4.5).

3.3.2.1.2 Side Sweep

While in One-Step mode with the Side Sweep function enabled the Main Sweep function shall also be enabled.

Following engaging One-Step Mode with the Side Sweep function enabled or enabling the Side Sweep function while in One-Step Mode and propelling forward, the Side Sweep brush(es) shall first start turning and the Side Sweep actuator(s) shall lower the Side Sweep brush(es) until it makes contact with the floor (PRS 3.5.6.5.1).

Following exiting One-Step mode with the Side Sweep function enabled or disabling the Side Sweep function while in One-Step mode, the Side Sweep actuator(s) shall first return the brush(es) to a 'parked' position and then the Side Sweep Motor shall be disengaged (PRS 3.5.6.5.4)

While in One-Step Mode with the Side Sweep function enabled:

- The side sweep brush motor shall be engaged when the machine is propelling in forward or reverse (PRS 3.5.6.5.3).
- The side sweep brush motor shall be disengaged when the machine is stopped (PRS 3.5.6.5.2).

3.3.1.2.1 Side Sweep Adjustment Mode (SSA)

Side Sweep actuation distance shall be configurable by the user via the Side Sweep Adjustment (SSA) Menu in Normal Mode.

Holding the Side Sweep button for more than three seconds shall bring up the SSA Menu.

Upon entry to the SSA Menu the user shall be prompted to select either the right or left Side Sweep for adjustment.

Upon selection of Right or Left Side Sweep, the selected brush's motor shall be engaged and a linear graphical representation of the configured Side Sweep actuation distance shall be displayed.

On the Touchscreen POD graphical representation shall be accompanied by touchscreen SSA buttons.

On the Standard POD, while the graphical representation is displayed the Configuration and Contrast arrow buttons to the left and right of the LCD shall function as SSA buttons.

Pressing an SSA button shall cause the brush to move one unit in the corresponding direction.

3.3.2.1.3 Dust Vac

The M17 machine's Dust Vac system shall be available in single- and dual-fan configurations.

While in One-Step mode with the Dust Vac function enabled:

- The Dust Vac fan shall be engaged.
- If the Main Scrub function is enabled the Water Pickup function shall also be enabled

3.3.2.2 Scrub Functions

3.3.2.2.1 Main Scrub

Following engaging One-Step Mode with the Main Scrub function enabled or enabling the Main Scrub function while in One-Step Mode the Main Scrub actuator shall lower the Main Scrub brushes until they make contact with the floor.

While in One-Step Mode with the Main Scrub function enabled:

- The Main Scrub brush motors shall be engaged when the machine is propelling forward or propelling in reverse.
- The Main Scrub brushes shall be positioned not more than one inch from the floor when the machine is not propelling forward.

- The Main Scrub actuator shall be in the lowered position when the machine is propelling forward.
- The down pressure shall be maintained when the machine is propelling forward.
- The main water valve shall be open when the machine is propelling forward.
- Upon initiating sustained propel in the forward or reverse direction the Main Scrub brushes shall make contact with the floor within six seconds.
- Key-cycling the machine shall not cause a change in the downpressure setting.
- Downpressure setting feedback shall be obtained from the current draw of the Main Sweep brushes.
- Main Sweep actuator adjustments to maintain selected downpressure shall be made every 500ms plus the calculated time of the last adjustment.
- The duration of individual Main Sweep actuator adjustments to maintain selected downpressure shall not exceed one second.
- If, while 'medium' or 'high' downpressure is selected, over a period of thirty seconds of actuator adjustments the selected downpressure cannot be achieved then the downpressure setting shall transition from 'high' to 'medium' (if initially set to 'high') or from 'medium' to 'low' (if initially set to 'medium').
- If, while 'low' downpressure is selected, over a period of thirty seconds of actuator adjustments the selected downpressure cannot be achieved then a 'Check Brushes' fault shall be issued.

3.3.2.2.2 Side Scrub

If the Main Scrub function is not enabled, the Side Scrub function shall be disabled.

Following engaging One-Step Mode with the Side Scrub function enabled or enabling the Side Scrub function while in One-Step Mode the Side Scrub actuator shall lower the Side Scrub brush until it makes contact with the floor (PRS 3.5.3.7.1).

Following exiting One-Step mode with the Side Scrub function enabled or disabling the Side Scrub function while in One-Step mode the Side Scrub actuator shall return the brush to a 'parked' position within 2.5 seconds (PRS 3.5.3.7.3).

While in One-Step Mode with the Side Scrub function enabled:

- The side scrub brush motor shall be engaged when the machine is propelling (PRS 3.5.3.7.1).
- The side valve shall be open when the machine is propelling forward (PRS 3.5.3.7.3)..
- The side valve shall be closed when the machine is not propelling forward.
- The side pump shall run when the machine is propelling forward.
- The side pump shall be off when the machine is not propelling forward.

3.3.2.2.3 Water Pickup

If the Main Scrub function is enabled and the Water Pickup function is disabled the Dust Vac function shall also be disabled.

When the Main Scrub function is enabled and the Side Scrub function is disabled the Water Pickup vacuum fans shall remain engaged for no less than fourteen but no more than fifteen seconds following disabling the Water Pickup function while in One-Step Mode or exiting One-Step Mode while the Water Pickup function is enabled.

When the Main Scrub function is enabled and the Side Scrub function is enabled the Water Pickup vacuum fans shall remain engaged for no less than twenty-one but no more than twenty-two seconds following disabling the Water Pickup function while in One-Step Mode or exiting One-Step Mode while the Water Pickup function is enabled

When the Water Pickup vacuum fans are engaged the Rear Squeegee shall remain in contact with the floor unless the machine is in reverse propel mode.

While in One-Step Mode with the Water Pickup function enabled:

- The Water Pickup vacuum fans shall be engaged.
- If the machine is in Forward Propel Mode the Rear Squeegee shall be in the lowered position (Thunderbolt PRS 3.6.1.4).
- Upon transitioning from Forward Propel Mode to Reverse Propel Mode the rear squeegee shall be actuated to the parked position within two seconds (Thunderbolt PRS 3.6.1.4.3).
- While the Full Recovery Tank sensor is activate the Main Scrub and the Side Scrub functions shall be disabled.
- If the Full Recovery Tank flag is not set, when the Full Recovery Tank sensor becomes activated the Full Recovery Tank flag shall be set in software and the Water Pickup function shall be disabled after a delay of sixty seconds.
- If the Full Recovery Tank flag is set and the Full Recover Tank sensor is not active the Full Recovery Tank flag shall be cleared.

3.3.2.2.4 Economy Mode

When the Main Scrub and Water Pickup Modes are engaged and downpressure and solution are at their lowest settings, the machine shall be in Economy Mode.

While in Economy Mode, the Water Pickup vacuums shall run at a reduced voltage of 28.75 V.

3.3.2.2.5 Severe Environment (SE)

On the Standard POD the short-duration timed Severe Environment cycle shall be activated when the SE rocker switch is pressed in the upward direction (toward the front of the machine).

On the Standard POD the long-duration timed Severe Environment cycle shall be activated when the SE rocker switch is pressed in the downward direction (toward the user).

On the Standard POD an active Severe Environment cycle shall be immediately cancelled when the SE rocker switch is pressed in the direction corresponding to the selected cycle (upwards for the short cycle, downwards for the long cycle)

On the Touchscreen POD the short-duration timed Severe Environment cycle shall be activated when the SE touchscreen button is pressed and held for less than two seconds.

On the Touchscreen POD the long-duration timed Severe Environment cycle shall be activated when the SE touchscreen button is pressed and held for longer than two seconds and released.

On the Touchscreen POD an active Severe Environment cycle shall be immediately cancelled when the SE touchscreen button is pressed.

The duration of the short Severe Environment timer shall be configurable within the range of 5 to 10800 seconds.

The duration of the long Severe Environment timer shall be configurable within the range of 5 to 10800 seconds.

The short Severe Environment timer duration shall default to 30 seconds.

The long Severe Environment timer duration shall default to 3600 seconds.

Upon entering Severe Environment Mode eC-H2O shall be shut off, down pressure be set to the maximum value, and flow rate shall be set to the maximum value.

If eC-H2O Mode was engaged prior to the initialization a Severe Environment cycle, eC-H2O mode shall be reengaged following completion of the cycle.

When a Severe Environment cycle is engaged the downpressure and flow rate values shall be retained. These values shall be restored once the Severe Environment cycle completes.

While in One-Step mode with the Main Scrub function enabled and the Severe Environment cycle active the detergent pump shall run while the machine is propelling.

3.3.2.2.6 Alternative Solution

3.3.2.2.6.1 Extended Scrub (ES)

While in One-Step mode with the Main Scrub function enabled and the Extended Scrub alternative solution selected:

- The ES Pump shall run for 45 seconds on and 10 seconds off when the solution tank is not full and the recovery is at least half full.
- The detergent pump shall run while the machine is propelling.
- The detergent pump shall be off when the machine is not propelling.

3.3.2.2.6.2 eC-H2O

Upon detecting that a flush cycle is needed a warning shall be issued and the eC-H2O alternative solution mode shall be disabled.

Upon completion of the flush cycle the eC-H2O solution mode shall be reenabled.

While in One-Step mode with the Main Scrub function enabled and the eC-H2O alternative solution selected:

- The EcH2O system shall be active while the machine is propelling.
- The detergent pump shall be engaged while the machine is propelling.
- When the Side Scrub function is selected the EcH2O side valve shall be open while the machine is propelling forward.

3.3.3 Hopper

The M17 shall feature control software such that normal operation of the hopper lift arms and roll actuator shall not cause damage to the machine itself.

The hopper control algorithm shall automatically prevent damage by over-extension to the hopper roll actuator.

The Hopper Lift and Roll Control Software shall prevent the Hopper Lift Arms from lowering the hopper beyond a minimum horizontal value, called the Minimum Dump Height, unless the hopper is oriented at the correct angle relative to the machine, called the Breakaway Angle, as read from the potentiometer of the Hopper Roll Actuator.

The hopper's angle, when set by the algorithm to the Breakaway Angle, as when lowering the hopper past the Minimum Dump Height, shall be such that, as the hopper arms lower completely the hopper does not make direct contact with the front of the machine.

If the user presses and holds the Lower Hopper button while the Hopper Roll Angle is greater than or equal to the Breakaway angle and the Hopper is at a height less than or equal to the Minimum Dump Height, the Hopper Lift and Roll Control Software shall run the Hopper Roll Actuator toward the Breakaway Angle until the Breakaway Angle is obtained.

If the user continues to hold the Lower Hopper button following the completion of the automatic hopper roll position adjustment the hopper shall resume lowering while the button is held until it reaches the mechanical stops with the arms at the fully lowered position.

When, following lowering of the hopper lift arms, the arms reach the fully lowered position the hopper shall automatically roll toward the machine and conform to the rubber seals against the front of the machine.

If the Lower Hopper button is released during the automatic hopper adjustment, pressing and holding the Lower Hopper button again shall cause the automatic hopper adjustment process to resume.

Hopper Lift and Roll functions shall be disabled if the seat switch is not engaged.

All Hopper Lift and Roll functions shall be active only so long as an individual is continuously pressing the hopper control button in question.

Hopper roll buttons shall be disabled while the hopper is below the minimum dump height.

The hopper lift actuator shall be disabled after running continuously at the end of its stroke for no less than six but greater than five seconds.

The hopper roll actuator shall be current limited to prevent over-loading the hopper's mechanical linkage, as follows:

- Current to the hopper roll actuator shall be software-reduced (via pulsewidth modulation) to no greater than 6.5 A at all times
- Current to the hopper roll actuator shall be software-reduced (via pulsewidth modulation) to no greater than 5 A while the hopper is being rolled out (as when dumping).
- Current to the hopper roll actuator shall be software-reduced (via pulsewidth modulation) to no greater than 3.5 A during the automatic roll-in to the sealed position.

3.3.4 Auto-Fill

The Auto-Fill option shall consist of an electronically controlled Auto-Fill valve to the Solution Tank.

Auto-Fill control shall only be available on machines configured for Auto-Fill via the configuration menu.

The Auto-Fill valve shall only open while the machine is not propelling, is in Normal Mode and when the Recovery Tank Half-Full sensor does not register a half-full Recovery Tank (systems with ES only).

The Auto-Fill valve shall close immediately after:

- Propel becomes engaged
- The solution tank sensor registers that solution has reached the Auto-Fill Level
- The Auto-Fill valve has been open continuously for sixty minutes.
- The Recovery Tank Half-Full sensor does not register a half-full Recovery Tank (systems switch ES only).

3.3.5 E-Stop

Upon pressing the E-Stop the throttle is disabled and engages the brake function.

The E-stop fault shall be cleared by disabling the E-Stop switch and then by either cycling the key switch from the "0" to the "1" position or cycling the keyswitch from the "1" to the "0" and back to the "1" position .

The E-Stop function is used to bring the vehicle to a stop when the E-Stop switch is depressed.

The key switch must be cycled after the E-Stop switch is released to enable normal functioning.

When the E-Stop switch, Switch 4 (Pin 10), is depressed the following settings are changed in the controller:

1. The throttle is shut off.

2. The normal Max Speed limits of the controller for Forward (3600 RPM) and Reverse (2010 RPM) are reduced to the value defined by the parameter “Fault Max Speed” (311 RPM or 0.50 mph). These speed limits are changed at a rate controlled by the parameter “E-Stop Speed Limit Decel Time”, 2.0 Sec. the machine shall get to 311 RPM in 2.0 seconds

3. The deceleration rate of the vehicle, when the vehicle’s speed drops below the Fault Max Speed is set by the parameter “E-Stop Decel Rate”, 3.0 Sec. The machine shall come to a stop in 3.0 seconds.

Fault Max Speed: Below this speed, the decel rate of the controller is set to the E-Stop Decel Rate.

Range: 100 - 5000 RPM Default: 311 RPM

E-Stop Speed Limit Decel Time: This is the time required to change the controller’s speed limit from the normal speed limit to the Fault Max Speed Limit.

Range: 0.1 to 30.0 sec Default: 2.0 Sec

E-Stop Decel Rate: The controller’s decel rate below the “Fault Max Speed”.

Range: 0.1 to 30.0 sec Default: 3.0 Sec

Emergency Stop Fault: – Shuts off Throttle

If the Park Brake is set while an e-stop fault is active, the vehicle will not move even after the Park Brake is released.

The keyswitch will need to be cycled to clear the e-stop fault.

An e-stop fault shall occur when the e-stop is active.

Setting the park brake with the e-stop active will result in no movement when the park brake is released.

The vehicle should not operate if the seat switch is not active.

3.3.6 Seat Switch / Battery Switch

The seat switch voltage while not sitting shall be ~0.0 V and while sitting shall be ~36.0 V.

The seat switch will have a Curtis Controller programmed delay time parameter that will control the propel motor after the seat has been vacated and the switch has toggled states.

The delay time will allow the operator to move around in the machine without shutting down the controls.

The Curtis Controller software will set and retain this parameter.

The Curtis Controller time will be set at 2 seconds and it is not configurable through the user interface display.

The machine shall come to a complete stop from standard maximum propel speed on level ground within 2 to 3 seconds after seat switch has toggled.

The Battery Rollout switch shall be a 36V switch with ~36 Volts DC equal to a closed battery rollout guard and ~0.0 Volt DC equal to an open battery rollout guard.

3.3.7 Lights

The light control switch shall work as:

1) Off

2) Warning light. (If they have an OHG, both warning lights turn on.)

3) Warning light, and headlights, and tail lights.

3.3.8 Display Requirements

3.3.8.1 Standard POD

3.3.8.1.1Two-Line LCD

3.3.8.1.1.1 Hour meters

All hour meters shall be resettable through the display.

All hour meters shall be accumulated by 1/10 of an hour and has a maximum of 9999.9 reading.

All shall be logged to non- volatile memory once 30 seconds.

All hour meters shall automatically reset the first time a new board is powered on.

3.3.8.1.1.1.1 Propel Hour Meter

This hour meter shall count anytime that the machine is in normal mode and not in neutral.

The propel hour meter shall be password protected.

This hour meter shall be settable from a configuration menu, so that in the event of a board being replaced the displayed hours won't be lost.

3.3.8.1.1.1.2 Sweep/Scrub Hour Meter

The scrub hour meter shall count anytime the machine is in normal mode and the right or left brush motors are enabled.

This hour meter shall be settable from a configuration menu, so that in the event of a board being replaced the displayed hours won't be lost.

The scrub hour meter shall be password protected.

3.3.8.1.1.2 Battery Level

The Battery Display Indication (BDI) will consist of five battery indication bars shown on the LCD.

The battery Display Indication shall receive its voltage data from the Curtis Controller based on the voltage at the Key Switch Input (KSI), which is 1.2V less than battery voltage (Approx. 2 diode voltage drops).

The bars of the battery display indication, warning codes, and faults shall correlate to the following voltage values:

5 bars (full) 69% <= BDI

4 bars 62% <= BDI <69%

3 bars 47% <= BDI <62%

2 bars 32% <= BDI <47%

1 bar (low) 16% <= BDI <32%

1 bar (Flashing) & Warning Code W1 Low Batt warning 3% <= BDI <16%

0 bars & Fault Code F4 Very Low Batt fault BDI <3%

The bars shall turn off when the voltage drops below the associated value range.

The number of bars shall only decrease except during a reset. The BDI charge reset value is 37.65 VDC @ the Battery = @ the KSI 36.70VDC and reset will occur if the voltage is above these levels when the key switch is cycled on. (NOMINAL VOLTAGE, MEASURED TOLERANCE +/-0.25VDC)

3.3.8.1.1.3 Solution Tank Level

The display will show a gradient style bar graph to indicate the solution tank level (Thunderbolt PRS 3.7.1.3).

Solution tank level with

No Bars = Tank 0% Full ("Voltage < 0.73 ±0.75V)

Solution tank level with

1st bar = Tank 20 % Full (0.73<= Voltage < 0.88 ±0.75V)

Solution tank level with

2nd bar = Tank 40% Full (0.88<= Voltage < 0.99 ±0.75V)

Solution tank level with

3rd bar = Tank 60% Full (0.99<= Voltage < 1.12 ±0.75V)

Solution tank level with

4th bar = Tank 80% Full (1.12<= Voltage < 1.34 ±0.75V)

Solution tank level with

5th bar = Tank 100% Full (1.34 <= Voltage ±0.75V)

Solution Tank Fluid Level Sensor

Solution Level Monitoring System

Level Voltage (voltmeter tolerance =+/- 0.75dc)

Supply voltage 12Vdc.

Open Tube

(Tank Empty) < 0.73V

1st Bar >= 0.73V and < 0.88V

2nd Bar >= 0.88V and < 0.99V

3rd Bar >= 0.99V and < 1.12V

4th Bar >= 1.12V and < 1.34V

5th Bar >= 1.34V

3.3.8.1.1.4 Recovery Tank Level

The tank full sensor shall be a type that is mounted through tank wall and it is a float style (toggle switch) (Thunderbolt PRS 3.7.2.4)..

There shall be two float switch sensors for the recovery tank. One sensor will represent the ½ full level and the other the full level (Thunderbolt PRS 3.7.2.4).

3.3.8.2 Touchscreen POD

3.3.8.2.1 Rear Camera Display Requirements

The touchscreen shall display video from the rear camera in Reverse Propel mode.

The touchscreen shall display video from the rear camera for the configured duration following a Rear Camera touchscreen button (PRS 3.8.2.4).

The display time shall be configurable via <TBD> for durations between 2 seconds to 15 seconds (PRS 3.8.2.5)

3.3.9 Horn

The Horn shall be enabled in normal mode.

3.3.10 Audible Alerts

3.3.10.1 Front alarm

While the machine is in Reverse Propel Mode a 50% duty-cycle 1 Hz tone shall sound from the alarm at the front of the machine.

When a fault occurs a 1 second tone shall sound from the front alarm unless the same fault has occurred previously since the machine was keyed on.

3.3.10.2 Backup alert

While the machine is being propelled in reverse a continuous backup alert tone shall sound from the alarm at the rear of the machine.

3.3.11 Telemetry

Telemetry shall be an option on M17 machines

The Telemetry feature shall enable wireless communications, and provide key performance data from the machine.

The hardware to support the telemetry requirements shall be integrated into the main scrub controller hardware module.

More information on the information captured by the telemetry option can be found in the project “Knight Rider” PRS and SRS documents.

A summary of the telemetry data currently captured on M17 machines is as follows:

The telemetry system shall be able to report daily machine usage statistics, including: Overall machine runtime, time sweeping and scrubbing combined.

The telemetry system shall be able to report daily eC-H2O metrics, including: minutes per day of usage vs. overall scrubbing time.

The telemetry system shall be able to generate an alert based on machine inactivity and non-ecH20 usage.

3.3.12 Touchscreen Subsystems

3.3.12.1 Checklists

(PRS 3.8.1.4.4.2)

The touchscreen subsystem shall have the capability of displaying a checklist the operator must complete before machine operation.

The checklist shall be enabled and configurable, via a supervisor mode checklist administration menu (name TBD), to be required daily per machine or daily per user (via operator log-ins).

The checklist shall be composed of questions that can be answered with 'Yes' or 'No'. A successful completion of the checklist shall allow machine operation. The questions in the checklist shall consist of those defined by Tennant Company. Excluding or including certain Tennant defined questions to the pre-operation checklist shall be configurable via supervisor mode. The questions in the checklist shall be translated to all applicable languages for the machine.

The set of questions of the checklist shall consist of the following:

TBD, examples:

Question	Correct Answer
Any visible damage to wheels?	NO
Any visible damage to squeegee?	NO
Any visible damage to hoses?	NO
Is the recovery tank empty?	YES

3.3.12.1.1 Checklist Completion Reporting

The completed checklists (either by day or by operator) shall be exportable via the USB port. The export functionality shall only be available via supervisor mode and a checklist administration menu option (name TBD).

The checklists shall be exported as .xml files. The exported checklist language setting shall be configurable by the supervisor.

Each exported checklist shall indicate the following information, depending on configuration:

1. Day it was performed and the machine serial number
2. Day it was performed, operator it was performed by, and the machine serial number

The checklist files exported shall be flagged as 'transmitted' after successful completion of the export. The checklists shall be exported and erased according to the following options, via supervisor mode:

1. Export: This button shall export all non-transmitted checklist files
2. Export All: This button exports all checklist files in memory (transmitted or non-transmitted)
3. Erase All: This button erases all checklist files in memory

3.3.12.2 Rear Camera

The rear camera shall provide a color video feed to the Touchscreen POD in standard definition (PRS 3.8.2.1).

3.3.12.3 Videos

The Touchscreen POD shall feature a library of instructional videos on machine use and maintenance topics [Topic list TBD] (PRS 3.8.1.4.4.3).

Daily Operator function videos:

Routine Maintenance videos:

3.3.12.4 User Profiles

The ProPanel POD shall store user profiles of two types, Supervisor and Operator.

Only Supervisor profiles shall have access to the Supervisor Menu.

Supervisor-level users shall be granted the ability to remove existing profiles unless the profile in question is a Supervisor profile and no other Supervisor profiles exist.

Supervisor-level users shall be granted the ability to change the login ID for any Supervisor profile or Operator profile.

3.3.12.5 Factory Reset

Entering the factory reset login ID shall grant access to the Factory Reset function.

The Factory Reset function, when activated, shall clear all stored data from the machine.

During the Factory Reset Process a Supervisor profile with a login ID of ‘1234’ and an Operator profile with a login ID of ‘123’ shall be automatically created.

3.3.13 Faults and Warnings

3.3.13.1 Fault Requirements

A fault message shall be displayed continuously on the LCD for each active fault.

The red fault LED shall flash at a 50% duty cycle with a period of six seconds while a fault or faults is active.

Whenever a machine fault is detected the machine shall enter transport mode.

If a scrub motor fault occurs while scrub mode is active, scrub mode shall exit to transport mode and shall inhibit entry into scrub mode.

3.3.13.2 Fault Definitions

Fault Table

Fault Code	Message	Fault
F1	F1:Rcv Tank FullRecovery	Tank Full
F2	F2:SolTank Empty	Solution Tank Empty
F3	F3:Batt Very Low	Very Low Battery Voltage
F4	F4:F/L Br Flt##	Front/Left Brush Fault
F5	F5:R/R Br Flt##	Rear Right Brush Fault
F6	F6:Vac 1 Short	Over Current Vacuum Fan 1
F7	F7:Vac 2 Short	Over Current Vacuum Fan 2
F8	F8:Check Brushes	Not Achieve Down Pressure Fault
F9	F9:Propel Error	A Propel Controller Error
F10	F10:Pickup Error	Pickup Module CAN Fault
F11	F11:Scrub Error	Scrub Module CAN Fault

Fault Descriptions

Fault	Description
F1	Upon detecting a full recovery tank the "F1:Rcv Tank Full" fault shall be displayed for 5 seconds and the machine will change from Scrub mode to Transport mode (One-Step and Vacuum Fan /Squeegee LEDs will not be illuminated).
F2	Upon detecting an empty solution tank and waiting 1 minute the "F2:SolTank Empty" fault will display on the lower part of the LCD (3 seconds on and 3 seconds off) and the machine will change from scrub mode to transport mode (One-Step and Vacuum Fan /Squeegee LEDs will not be illuminated).
F3	If the dead battery fault is active the Batt Very Low fault message shall be displayed.
F4	Upon detecting any front/left fault condition a F/L Br Flt VF, F/L Br Flt OT, F/L Br Flt HW, F/L Br FT COM, or F/L Br Flt MF fault shall be displayed.

F5	Upon detecting any rear/right fault condition a R/R Br Flt VF, R/R Br Flt OT, R/R Br Flt HW, R/R Br FT COM, or R/R Br Flt MF fault shall be displayed.
F6	Upon detecting a vacuum 1 short condition the fault "F6: Vac 1 Short" will be displayed on the lower part of the LCD (3 seconds on & 3 seconds off) and vacuum 2 will shut off.
F7	Upon detecting a vacuum 2 power short condition the fault "F7: Vac 2 Short" will be displayed on the lower part of the LCD (3 seconds on & 3 seconds off) and vacuum 1 will shut off.
F8	Upon detecting a down pressure regulation fault condition a "Check Brushes" fault shall be displayed.
F9	If the propel module CAN goes offline the fault "F9: Propel Error" will display on the lower part of the LCD (3 seconds on and 3 seconds off) and the machine will propel at an extremely slow rate.
F10	If the Water Pickup CAN module goes offline the fault "F10: Pickup Error" will display on the lower part of the LCD (3 seconds on and 3 seconds off) and the machine will not enter scrub mode.
F11	If the Main Scrub CAN module goes offline the fault "F11: Scrub Error" will display on the lower part of the LCD (3 seconds on and 3 seconds off) and the machine will not enter scrub mode.

If a recovery tank full fault is active when scrub mode is activated, an extra vac period 1 minute will be allowed if the allowable number of extra vac periods has not been exceeded. Each Vac period is 1 min and we allow one extra vac period.

An active recovery tank full fault and all extra vac periods used up shall inhibit entry into scrub mode and go to transport mode.

If a recovery tank full fault occurs, the current operating mode shall exit to transport mode and a recovery tank full message shall be displayed for 5 seconds.

An active solution tank empty fault and all extra scrub periods used up shall inhibit entry into scrub mode and go to transport mode.

If a solution tank empty fault is active when scrub mode is activated, an extra scrub period will be allowed if the allowable number of extra scrub periods has not been exceeded. Each scrub period is 1 min and we allow one extra scrub period.

If a solution tank empty fault occurs when the scrub head is operation, the current operating mode shall exit to transport mode and a solution tank empty message shall be displayed for 5 seconds.

When the recovery tank sensor indicates that the tank has been full for more than 5 seconds the recovery tank full fault shall be activated.

The recovery tank full fault shall be deactivated when the recovery tank sensor indicates that the tank is no longer full for a period of 5 or more seconds.

When the solution tank sensor indicates that the tank has been empty for more than 60 seconds the solution tank empty fault shall be activated.

The solution tank empty fault shall be deactivated when the solution tank sensor indicates that the tank is no longer empty for a period of 5 or more seconds.

When the battery discharge indicator is at or below 3% the fault shall be activated.

When the battery discharge indicator is above 3% the fault shall be deactivated.

When the motor controller reports a pulse by pulse fault for more than 5 seconds a F/L Br Flt HW shall be active and displayed.

When the motor controller reports an over temperature fault for more than 5 seconds a F/L Br Flt OT shall be active and displayed.

When the motor controller reports a voltage fault for more than 5 seconds a F/L Br Flt VF shall be active and displayed.

When the motor controller reports a loss of I2C communication a F/L Br Ft Com shall be active and displayed.

When the scrub controller detects the motor current is above 42A and the motor speed is 500 or more RPM under target for more than 5 seconds a F/L Br Flt MF shall be active and displayed.

When the motor controller reports a pulse by pulse fault for more than 5 seconds a R/R Br Flt HW shall be active and displayed.

When the motor controller reports an over temperature fault for more than 5 seconds a R/R Br Flt OT shall be active and displayed.

When the motor controller reports a voltage fault for more than 5 seconds a R/R Br Flt VF shall be active and displayed.

When the motor controller reports a loss of I2C communication a R/R Br Ft Com shall be active and displayed.

When the scrub controller detects the motor current is above 42A and the motor speed is 500 or more RPM under target for more than 5 seconds a R/R Br Flt MF shall be active and displayed.

Motor controller faults shall only be cleared by performing a key cycle.

When a vacuum fan has been in pulse by pulse for more than 5 seconds the respective Vacuum Fan 1 or Vacuum Fan 2 fault shall be active.

Vacuum fan faults shall only be cleared by performing a key cycle.

Whenever the main head down pressure control tries to down shift and there is no lower settings to down shift to, then a down shift check brushes system fault shall be activated.

Check brushes faults shall only be cleared by performing a key cycle.

When communication with the propel module has been lost for more than 3 seconds the Propel Fault shall be active.

Propel faults shall only be cleared by performing a key cycle.

When communication with the Water Pickup module has been lost for more than 1 second the Water Pickup CAN Fault shall be active.

When communication with the Main Scrub module has been lost for more than 1 second the Main Scrub CAN Fault shall be active.

When communication with the Side Scrub module has been lost for more than 1 second the Side Scrub CAN Fault shall be active.

When communication with the Main Sweep module has been lost for more than 1 second the Main Sweep CAN Fault shall be active.

When communication with the Side Sweep module has been lost for more than 1 second the Side Sweep CAN Fault shall be active.

When communication with the eC-H2O module has been lost for more than 1 second the eC-H2O CAN fault shall be active.

CAN faults shall only be cleared by performing a key cycle.

When the eC-H2O E-cell indicates that it has been scaled up, the red flashing eC-H2O Solution LED fault shall be activated.

The eC-H2O E-cell fault shall be deactivated after it has been flushed and the eC-H2O module is cleared of the fault.

The eC-H2O solution LED will flash RED once a second until the fault has been cleared.

When the eC-H2O E-cell fault is active an error message shall be displayed on the lower line of the LCD display.

When the eC-H2O E-cell has a system fault situation for either the pump or Sparger, the red solid eC-H2O Solution LED system fault shall be activated.

eC-H2O faults shall only be cleared by performing a key cycle.

3.3.13.3 Warning Requirements

A warning message shall be displayed continuously on the LCD for each active fault.

A message shall be displayed on the lower line of the LCD display.

Warnings do not shut the machine down or exit modes.

When multiple warnings are active they shall appear on the display one at a time in a scrolling pattern.

3.3.13.4 Warning Definitions

Warnings Table

Warning Code	Message	Warning
W1	W1:Batt. Low	Low Battery
W2	W2:Unavailable	No Optional Solution Enabled
W3	W3:No [Side/Sweep] Config	No Side option enabled
W4	W4: Not Active	Inactive Feature
W5	W5:Solution Off	Solution Water is Off
W6	W6:Brake On	Parking Brake On
W7	W7:SideBr Wrn ##	Side Scrub Motor Fault
W8	W8:LSideBr Short	Left Side Sweep Motor Shorted
W9	W9:RSideBr Short	Right Side Sweep Motor Shorted
W13	W13:Open [Frnt/Left] Br	Open Front/Left Motor
W14	W14:Open [Rear/Rght] Br	Open Right/Rear Motor
W15	W15:OpenSideBrush	Open Side Scrub Brush Motor
W16	W16:Open LSideBr	Open Left Side Sweep Brush Motor
W17	W17:Open RSideBr	Open Right Side Sweep Brush Motor
W22	W22:Open Vac 1	Vacuum Fan Motor 1 No Current
W23	W23:Open Vac 2	Vacuum Fan Motor 2 No Current
W25	W25:SqueegeeStall	Rear Squeegee Actuator Stalled
W26	W26:SideActStall	Side Scrub Brush Actuator Stalled
W27	W27:L Side Stall	Left Side Sweep Actuator Stalled
W28	W28:R Side Stall	Right Side Sweep Actuator Stalled
W30	W30:DetPumpShort	Shorted Detergent Pump
W31	W31:ES PumpShort	Shorted ES Pump
W32	W32:SidePumpShrt	Shorted Side Scrub Pump
W33	W33:Ec Pump Shrt	Shorted EcH20 Pump
W34	W34:DetPumpOpen	Open Detergent Pump
W35	W35:ES PumpOpen	Open ES Pump
W36	W36:SidePumpOpen	Open Side Scrub Pump
W37	W37:Ec Pump OPen	Open EcH20 Pump
W38	W38: [Side/Sweep] Offline	Side Module Offline
W39	W39: EcH2OOffline	Ec-H20 Offline

If the Low Battery Warning is active the Low Battery Warning message"W1: Low Battery" will flash on the lower part of the LCD for 3 seconds and then off for 3 seconds.

Pressing the Alternate Solution button when Ec-H20/ES is not configured shall display the Unavailable warning message for 5 seconds

If the no side options are configured turning on the side option shall display “No ST Config”, “No SS Config”, and “No PS Config”.

When the parking brake is engaged a brake on warning"W6 Brake On" will be displayed on the lower part of the LCD (3 seconds on & 3 seconds off) and the machine shall come to a propelling stop.

Upon detecting a side scrub shorted motor condition a ST Br Fault warning shall be displated.

While propelling forward and upon detecting a left side sweep motor short a warning "W8: LSideBr Short" flashes on for 3 seconds and then off for 3 seconds

While only propelling forward and detecting a right side sweep motor short a warning "W9:RSideBr Short" will be displayed in the lower part of the LCD(3 seconds on and 3 seconds off)"

While propelling forward or propelling in reverse and upon detecting a main brush motor front/left open condition (6-Pin or Power disconnected) a warning "W13: Open [Front/Left] Br" shall be displayed on the lower part of the LCD (3 seconds on and 3 seconds off)

While propelling forward or propelling in reverse and upon detecting a main brush motor rear/right open condition(6-Pin or Power disconnected) a warning "W14: Open [Rear/Right] Br" shall be displayed on the lower part of the LCD (3 seconds on and 3 seconds off)

Upon detecting a side scrub motor open condition a warning "W15: OpenSideBrsh" shall be displayed on the lower part of the LCD (3 seconds on and 3 seconds off)

Upon detecting a left side sweep motor open condition a warning "W16: Open LSideBr" flashes on for 3 seconds and then off for 3 seconds

Upon detecting a right side sweep motor open condition a warning "W17: Open RSideBr" flashes on for 3 seconds and then off for 3 seconds

Upon detecting a vacuum 1 open condition the warning "W22: Open Vac 1"" will be flashed on the lower part of the LCD(On 3 seconds/Off 3 seconds)

Upon detecting a vacuum 2 open condition a Open Vac 2 warning "W23: Open Vac 2"" will be flashed on the lower part of the LCD(On 3 seconds/Off 3 seconds)

Upon detecting a rear squeegee actuator stall (short) a SqueegeeStall warning shall be displayed.

Upon detecting a side scrub actuator short a warning "W26: SideActStall" will flash on for 3 seconds then off for 3 seconds on the lower part of the LCD.

Upon detecting a left side sweep actuator stall a warning "W27: Lside Stall" flashes on for 3 seconds and then off for 3 seconds

Upon detecting a right side sweep actuator stall a warning "W28: R Side Stall" flashes on for 3 seconds and then off for 3 seconds

While propelling forward or propelling in reverse and upon detecting a detergent pump short the warning "W30: DetPumpShort" shall be displayed (3 seconds on/3 seconds off) on the lower part of the LCD.

While the recovery tank is greater than or equal to 50% full and upon detecting a ES pump short the warning "W31:ES PumpShort" shall display on the lower part of the LCD (3 seconds on and 3 seconds off)

While propelling forward or propelling in reverse and upon detecting a side scrub pump short the warning "W32:SidePumpShrt" will display on the lower part of the LCD (3 seconds on and 3 seconds off).

While propelling forward/reverse and upon detecting a EcH20 pump short the warning "W33:Ec Pump Shrt" will display on the lower part of the LCD (3 seconds on and 3 seconds off) and EcH2O logo and LED will flash on/off rapidly.

While propelling forward or propelling in reverse and upon detecting a detergent pump open the warning "W34: DetPumpOpen" shall be displayed (3 seconds on/3 seconds off) on the lower part of the LCD.

While the recovery tank is greater than or equal to 50% full and upon detecting a ES pump open the warning "W35:ES PumpOpen" shall display on the lower part of the LCD (3 seconds on and 3 seconds off)

While propelling forward or propelling in reverse and upon detecting a side scrub pump open the warning "W36:SidePumpOpen" will display on the lower part of the LCD (3 seconds on and 3 seconds off).

While propelling forward/reverse and upon detecting a EcH2O pump open the warning "W37:Ec Pump Open" will display on the lower part of the LCD (3 seconds on and 3 seconds off).

If the Side Scrub module CAN goes offline the warning "W38:Side Offline" will display on the lower part of the LCD (3 seconds on and 3 seconds off).

If the EcH2O module CAN goes offline the warning "W39:EcH2OOffline" is displayed on the lower part of the LCD (3 seconds on and 3 seconds off) and the EcH2O logo and LED flashes on/off multiple times a second.

When the controls indicate that the solution button has been pressed but the optional ES/eC-H2O has not been configured the ‘no solution enabled’ warning shall be activated.

When the side option rocker switch has been activated, but the side option has not been configured the ‘No Side Option Configuration’ warning shall be activated.

When the pre sweep option rocker switch has been activated, but the side option has not been configured the ‘No Side Option Configuration’ warning shall be activated.

The ‘not active’ message is displayed whenever the operator pressed a button for which the functionality is not currently active, then a warning will be displayed.

The ‘solution off’ message is displayed whenever the water is configured to off.

The ‘brake on’ message is displayed whenever the parking brake is engaged.

When the motor controller reports a pulse by pulse fault for more than 5 seconds a ST Br Wrn HW shall be active and displayed.

When the motor controller reports an over temperature fault for more than 5 seconds a ST Br Wrn OT shall be active and displayed.

When the motor controller reports a voltage fault for more than 5 seconds a ST Br Wrn VF shall be active and displayed.

When the motor controller reports a loss of I2C communication a ST Br Wrn Com shall be active and displayed.

When the scrub controller detects the motor current is above 42A and the motor speed is 500 or more RPM under target for more than 5 seconds a ST Br Wrn MF shall be active and displayed.

While side scrub motor controller or scrub controller warnings are active the Side Scrub function shall not be enabled.

Controller warnings shall only be cleared by performing a key cycle.

3.3.14 Filter Shaker Requirements

A Filter Shake Cycle shall be initiated when, following propelling for at least 10 seconds at at least 2 miles per hour, the Dust Vac function is disengaged, either by disengaging One-Step mode with the Dust Vac selected, or deselecting Dust Vac while One-Step is engaged.

When the filter shaker on-screen menu button (on the Touchscreen POD) or panel switch (Standard POD) is pressed the filter shaker shall initiate a filter shake cycle.

Following the start of the Filter Shake Cycle shall the filter shaker shall be engaged once the following conditions have been met:

- The main sweep head has been parked
- The dust vacs have been turned off

The Filter Shake Cycle shall run for thirty seconds or until interrupted by a press of the on-screen filter shaker menu button (on the Touchscreen POD) or the panel switch (Standard POD).

The value of the filter shaker’s hardware current limit threshold shall be 10 A.

The value of the filter shaker’s software current limit threshold shall be 5.5 A.

3.4 Utilities Modes

A user shall enter Utilities Mode by pressing the right-arrow button of the membrane while keying-on the machine.

The utilities mode shall consist of a scrollable menu which allows access to the machine configuration, manual activation, input display, propel diagnostic, engineering mode, CAN diagnostics mode, Motors mode.

The right and left arrow buttons shall be used to scroll between the available utility modes.

Pressing the Brush Down Pressure button will activate the currently selected utility mode.

The utilities modes that shall be selectable when entering the utilities mode upon key-on shall be:

CONFIG MODE

MANUAL MODE

INPUT DISPLAY

PROPEL DIAG MODE

ENGINEERING MODE

CAN DIAGNOSTICS MODE ?

MOTORS MODE ?

3.4.1 Configuration Mode

Configuration mode consists of a listing of parameters that are configurable for the various machine options. The left and right arrow scroll buttons are used to move through the parameter list.

Navigation of the list shall be implemented as follows:

The left-arrow button shall scroll to the previous item of the list. If the display is currently on the first item, pressing the left-arrow button shall scroll to the last item of the list.

The right-arrow button shall scroll to the next item of the list. If the display is currently on the last item of the list, pressing the right-arrow button shall scroll to the first item of the list.

Pressing the Brush Down Pressure button will select the displayed parameter for editing.

C9 – 13-14-10-11-12-15-16-16 (Propel H.M. + Chg Propel Hr) – 17-17(Scrub H.M. + Chg Scrub Hr) – 18 – 20

The following table describes the list of parameters and their display name.

Parameter Display Name	Description

C1:Disk/Cyl	Configuration of Head Type
C2:Ec/ES/None	Configuration of ES/ec-H2O
C3:Set Det Level	Configuration of Detergent Level
C4:Auto Fill/None	Configuration of Auto Fill option
C5:SE/None	Configuration of Severe Environment
C6:SE Short Time	Configuration of Severe Environment Short Time
C7:SE Long Time	Configuration of Severe Environment Long Time
C8:Option?	Configuration Side Scrub/Side Sweep/Pre Sweep
C9: Reset Press.?	Restore down pressure settings to factory default values.
C10:Main Press #1	Adjust down pressure setting 1
C11:Main Press #2	Adjust down pressure setting 2
C12:Main Press #3	Adjust down pressure setting 3
C13:Transport Spd	Adjust Transport Propel Forward Maximum Speed in MPH
C14:Scrubbing Spd	Adjust Scrub Mode Forward Maximum Speed in MPH
C15:Main Water	Adjust water flow range: (Low, Medium, High)
C16:Propel H.M.	Display/Edit Propel hour meter. Password protected.
C17:Scrub H.M.	Display/Edit Scrub hour meter. Password protected.
C18:Reset	Restore factory default values.
C19:Diag Mode	Turn on/off diagnostic screens in normal mode.
C20:Battery selection mode	Configuration of the type of battery Installed on machine
C21:Dust Vac	
C22:Side Sweep	Configuration of the Side Sweep
Exit Config Mode	Parameter allows to exit configuration mode

3.4.1.1 Configuration of Head Type

This Parameter shall set the scrub head type

The top row of the LCD display shall display the Parameter from the Configuration Mode (C1:Disk/Cyl).

The bottom row of the LCD display shall show the currently selected value for the parameter.

The display scroll right and left arrow buttons shall be used to change the currently selected parameter.

The Brush Down Pressure button shall be used to save the currently selected parameter value.

Setting the head type to disk will set the down pressure settings to the disk default values.

Setting the head type to cylindrical will set the down pressure settings to the cylindrical default values.

Configure Head Type Parameter Value Table

Parameter Options	Description
Disk	Configure Scrub Head As Disk Type
Cylindrical	Configure Scrub Head As Cylindrical Type
Exit	Exit Edit Mode

3.4.1.2 Configure ES/Ec-H20

This Parameter shall set the machine solution type

The top row of the LCD display shall display the Parameter from the Configuration Mode (C2:Ec/ES/None).

The bottom row of the LCD display shall show the currently selected value for the parameter.

The display scroll right and left arrow buttons shall be used to change the currently selected parameter value.

The Brush Down Pressure button shall be used to save the currently selected parameter value.

Configure Head Type Parameter Value Table

Parameter Options	Description
EcH20	Configure machine solution system as EcH20
ES	Configure machine solution system as Extended Scrub
None	Configure machine solution system with no options
Exit	Exit Edit Mode

3.4.1.3 Configure Detergent Flow Level

This Parameter shall set the detergent flow ranges for ES. The detergent flow shall only be activated when ES is activated.

The top row of the LCD display shall display the Parameter from the Configuration Mode (C3:Set Det Level).

The bottom row of the LCD display shall show the currently selected value for the parameter.

The display scroll right and left arrow buttons shall be used to change the currently selected parameter value.

The Brush Down Pressure button shall be used to save the currently selected parameter value.

Configure Head Type Parameter Value Table

Parameter Options	Description
3% Mix Ratio	Configure detergent flow to be mixed at 3% ratio
2% Mix Ratio	Configure detergent flow to be mixed at 2% ratio
1% Mix Ratio	Configure detergent flow to be mixed at 1% ratio
None	Configure no detergent flow to be mixed
Exit	Exit Edit Mode

3.4.1.4 Configure Auto Fill

This Parameter shall set the Auto Fill option for the machine.

The top row of the LCD display shall display the Parameter from the Configuration Mode (C3:AutoFill/None).

The bottom row of the LCD display shall show the currently selected value for the parameter.

The display scroll right and left arrow buttons shall be used to change the currently selected parameter value.

The Brush Down Pressure button shall be used to save the currently selected parameter value.

Configure Auto Fill Parameter Value Table

Parameter Options	Description
Auto Fill	Configure machine system as Auto Fill
None	Configure machine system with no Auto Fill option
Exit	Exit Edit Mode

3.4.1.5 Configure Severe Environment

This Parameter shall set the detergent flow rate for SE mode. The detergent flow shall only be activated when SE is activated.

The top row of the LCD display shall display the Parameter from the Configuration Mode (C5:SE/None).

The bottom row of the LCD display shall show the currently selected value for the parameter.

The display scroll right and left arrow buttons shall be used to change the currently selected parameter value.

The Brush Down Pressure button shall be used to save the currently selected parameter value.

Configure Auto Fill Parameter Value Table

Parameter Options	Description
Flow Rate 0	Configure no detergent flow rate during SE mode.
Flow Rate 1	Configure detergent flow rate 1(low) during SE mode.
Flow Rate 2	Configure detergent flow rate 2(medium) for SE mode.
Flow Rate 3	Configure detergent flow rate 3(high) for SE mode.
Exit	Exit Edit Mode
Off	Disable SE Mode

3.4.1.6 Configure Severe Environment Short Time

This Parameter option is used to configure the short run time (top switch) for severe environment mode.

The top row of the LCD display shall display the Parameter from the Configuration Mode (C6:SE Short Time).

The bottom row of the LCD display shall show the currently time value, in seconds, for the parameter.

The display scroll right and left arrow buttons shall be used to select the decimal place of the time value.

The + and – buttons shall increase and decrease, respectively the value of the currently selected decimal place. The valid range shall be 0 through 9.

The minimum parameter value for Severe Environment Short Time shall be 5 seconds. The maximum parameter value for Severe Environment Short Time shall be 10800 seconds (5 hours).

The Brush Down Pressure button shall be used to save the currently configured parameter time value for severe environment short time.

3.4.1.7 Configure Severe Environment Long Time

This Parameter option is used to configure the long run time (bottom switch) for severe environment mode.

The top row of the LCD display shall display the Parameter from the Configuration Mode (C7:SE Long Time).

The bottom row of the LCD display shall show the currently time value, in seconds, for the parameter.

The display scroll right and left arrow buttons shall be used to select the decimal place of the time value.

The + and – buttons shall increase and decrease, respectively the value of the currently selected decimal place. The valid range shall be 0 through 9.

The minimum parameter value for Severe Environment Long Time shall be 5 seconds. The maximum parameter value for Severe Environment Long Time shall be 10800 seconds (5 hours).

The Brush Down Pressure button shall be used to save the currently configured parameter time value for severe environment long time.

3.4.1.8 Configure Side Option

This Parameter shall set the side-scrub option installed on the machine.

The top row of the LCD display shall display the Parameter from the Configuration Mode (C8:Option?).

The bottom row of the LCD display shall show the currently selected value for the parameter.

The display scroll right and left arrow buttons shall be used to change the currently selected parameter.

The Brush Down Pressure button shall be used to save the currently selected parameter value.

Configure Side Option Parameter Value Table

Parameter Options	Description
Side Scrub	Configure Side Option to Side-scrub installed
None	Configure Side Option to none
Exit	Exit Edit Mode

3.4.1.9 Restore Down Pressure Settings

This Parameter shall all the down pressure ranges to be reset to default values.

The top row of the LCD display shall display the Parameter from the Configuration Mode (C9: Reset Press.?).

The bottom row of the LCD display shall show the currently selected value for the parameter.

The display scroll right and left arrow buttons shall be used to change the currently selected parameter.

The Brush Down Pressure button shall be used to save the currently selected parameter value.

Configure Head Type Parameter Value Table

Parameter Options	Description

Yes	Reset Down Pressure Ranges to default values
No	Exit Edit Mode (Do not reset Down Pressure Ranges)

3.4.1.10 Adjust Down Pressure Setting 1

This Parameter option is used to configure low value down pressure setting.

The top row of the LCD display shall display the Parameter from the Configuration Mode (C10:Main Press #1).

The bottom row of the LCD display shall show the current low value down pressure setting in Amps.

The display scroll right and left arrow buttons shall be used to increase and decrease the low value down pressure in increments of 0.1 Amps.

The minimum parameter value for low value down pressure shall be TBD Amps. The maximum parameter value for low value down pressure shall be TBD Amps

The Brush Down Pressure button shall be used to save the currently configured parameter value for low value down pressure.

3.4.1.11 Adjust Down Pressure Setting 2

This Parameter option is used to configure medium value down pressure setting.

The top row of the LCD display shall display the Parameter from the Configuration Mode (C11:Main Press #2).

The bottom row of the LCD display shall show the current medium value down pressure setting in Amps.

The display scroll right and left arrow buttons shall be used to increase and decrease the medium value down pressure in increments of 0.1 Amps.

The minimum parameter value for medium value down pressure shall be TBD Amps. The maximum parameter value for medium value down pressure shall be TBD Amps

The Brush Down Pressure button shall be used to save the currently configured parameter value for medium value down pressure.

3.4.1.12 Adjust Down Pressure Setting 3

This Parameter option is used to configure high value down pressure setting.

The top row of the LCD display shall display the Parameter from the Configuration Mode (C11:Main Press #3).

The bottom row of the LCD display shall show the current high value down pressure setting in Amps.

The display scroll right and left arrow buttons shall be used to increase and decrease the high value down pressure in increments of 0.1 Amps.

The minimum parameter value for medium value down pressure shall be TBD Amps. The maximum parameter value for medium value down pressure shall be TBD Amps

The Brush Down Pressure button shall be used to save the currently configured parameter value for high value down pressure.

3.4.1.13 Adjust Transport Propel Forward Maximum Speed

This Parameter option is used to configure the maximum transport propel forward speed, in units of MPH (miles per hour).

This parameter option shall be available for an operator to set via the supervisor mode (PRS 3.2.10.2)

The top row of the LCD display shall display the Parameter from the Configuration Mode (C13:Transport Spd).

The bottom row of the LCD display shall show the current maximum transport propel speed in the format X.X MPH.

The display scroll right and left arrow buttons shall be used to increase and decrease the maximum transport propel forward speed in increments of 0.1 MPH.

The minimum parameter value for the maximum transport propel forward speed shall be 4.1MPH, and the maximum parameter value for the transport propel forward speed shall be 5.5 MPH.

The default maximum transport propel forward speed shall be set to 5.5 MPH.

The Brush Down Pressure button shall be used to save the currently configured parameter value for maximum transport propel forward speed.

3.4.1.14 Adjust Scrub Mode Propel Forward Maximum Speed

This Parameter option is used to configure the maximum scrub propel forward speed, in units of MPH (miles per hour).

This parameter option shall be available for an operator to set via the supervisor mode (PRS 3.2.10.5)

The top row of the LCD display shall display the Parameter from the Configuration Mode (C14:Scrubbing Spd).

The bottom row of the LCD display shall show the current maximum scrub propel speed in the format X.X MPH.

The display scroll right and left arrow buttons shall be used to increase and decrease the maximum scrub propel forward speed in increments of 0.1 MPH.

The minimum parameter value for the maximum scrub propel forward speed shall be 2.0 MPH, and the maximum parameter value for the scrub propel forward speed shall be 4.0 MPH.

The default maximum scrub propel forward speed shall be set to 4.0 MPH.

The Brush Down Pressure button shall be used to save the currently configured parameter value for maximum transport propel forward speed.

3.4.1.15 Select Water Flow Range

This Parameter shall set water flow range for the main scrub head.

The top row of the LCD display shall display the Parameter from the Configuration Mode (C15: Main Water).

The bottom row of the LCD display shall show the currently selected value for the parameter.

The display scroll right and left arrow buttons shall be used to change the currently selected parameter value.

The Brush Down Pressure button shall be used to save the currently selected parameter value.

Configure Water Flow Range Parameter Value Table

Parameter Options	**Description**
Low	Configure water flow range to low.
Medium	Configure water flow range to medium
High	Configure water flow range to high
Exit	Exit Edit Mode

3.4.1.16 Display/Password/Edit the Propel on Hour Meter

This configuration parameter shall allow a password protected method of editing the propel hour meter or scrub hour meter.

Password Requirements for Propel and Scrub on Hour Meter:

The top row of the LCD display shall display the information from the Configuration Mode Menu Table.

The bottom row of the LCD display shall display initial message “ <****>” and blink the first digit once a second.

Pressing plus/minus water buttons shall increment/decrement the blinking digit.

Pressing scroll right/left buttons shall select the next/previous digit.

The selected digit shall blink once a second.

Pressing the down pressure shall validate the password

Edit Requirements for Propel on Hour Meter:

The top row of the LCD shall display the information from the Configuration Mode Menu Table.

The bottom row of the LCD shall display the currently saved value of the propel hour meter ex. <0123.4 >hrs. and blink the first digit

Pressing plus/minus water buttons shall increment/decrement the blinking digit.

Pressing scroll right/left buttons shall select the next/previous digit.

The selected digit shall blink once a second.

Pressing the down pressure shall save the currently displayed value and display the information

3.4.1.17 Set Scrub Hour Meter

The top row of the LCD display shall display the information from the Configuration Mode Menu Table.

The bottom row of the LCD display shall show the currently selected parameter.

The set scrub hour meter Table shows available parameter values.

The display scroll right and left arrow buttons shall be used to change the currently selected parameter.

The Brush Down Pressure button shall be used to save the currently selected parameter.

Set Scrub Hour Meter Table.

Parameter	**Description**
Scrub Hour Meter #####.#	Set the scrub hour meter.
Exit	Exit Edit Mode

3.4.1.18 Restore Default Settings

This Parameter shall allow all configuration parameters to be restored to default values.

The top row of the LCD display shall display the Parameter from the Configuration Mode (C18: Reset).

The bottom row of the LCD display shall show the currently selected value for the parameter.

The display scroll right and left arrow buttons shall be used to change the currently selected parameter.

The Brush Down Pressure button shall be used to save the currently selected parameter value.

Configure Restore Default Settings Value Table

Parameter Options	Description
Yes	Restore Configuration Parameters to default values
No	Exit Edit Mode (Do not restore default values)

3.4.1.19 Diagnostic Mode

This Parameter shall allow the diagnostic mode to be enabled in normal mode.

The top row of the LCD display shall display the Parameter from the Configuration Mode (C19: Diag Mode).

The bottom row of the LCD display shall show the currently selected value for the parameter.

The display scroll right and left arrow buttons shall be used to change the currently selected parameter.

The Brush Down Pressure button shall be used to save the currently selected parameter value.

Configure Restore Default Settings Value Table

Parameter Options	Description
Enabled	Enables Diagnostic Mode
Disabled	Exit Edit Mode and Disable Diagnostic Mode

3.4.1.20 Battery Selection

This Parameter shall set type of battery installed in the machine.

The top row of the LCD display shall display the Parameter from the Configuration Mode (C20: Battery Selection Mode).

The bottom row of the LCD display shall show the currently selected value for the parameter.

The display scroll right and left arrow buttons shall be used to change the currently selected parameter value.

The Brush Down Pressure button shall be used to save the currently selected parameter value.

Configure Battery Type Parameter Value Table

Parameter Options	Description
Lead Acid	Configure battery to Lead Acid type
Gel	Configure battery to Gel type
Gel 60%	Configure battery to Gel 60% type

3.4.1.22 Side Sweep

This Parameter shall set side sweep option installed on the machine.

The top row of the LCD display shall display the Parameter from the Configuration Mode (C22:Side Sweep).

The bottom row of the LCD display shall show the currently selected value for the parameter.

The display scroll right and left arrow buttons shall be used to change the currently selected parameter.

The Brush Down Pressure button shall be used to save the currently selected parameter value.

Configure Side Sweep Parameter Value Table

Parameter Options	Description
Right Only	Enable Right Side Sweep
Right and Left	Enable Left and Right Side Sweep
Disabled	Side sweep option disabled
Exit	Exit Edit Mode

3.4.2 Self Test Requirements

8/12 JGY: No implementation of self-test

The current test being run shall be displayed on the LCD display.

When the self test is first enabled, all the actuators shall be positioned in their parked positions before any tests commence.

Check Left/Front scrub brush motor for open condition.

Check Left/Front scrub brush motor for shorted condition.

Check Right/Rear scrub brush motor for open condition.

Check Right/Rear scrub brush motor for shorted condition.

If installed, check side scrub motor for open condition.

If installed, check side scrub motor for shorted condition.

If installed, check right side sweep motor for open condition.

If installed, check right side sweep motor for shorted condition.

If installed, check left side sweep motor for open condition.

If installed, check left side sweep motor for shorted condition.

Check vacuum motor 1 for open condition.

Check vacuum motor 1 for shorted condition.

Check vacuum motor 2 for open condition.

Check vacuum motor 2 for shorted condition.

Check Main Head Actuator Output for open condition.

Check Main Head Actuator Output for shorted condition.

Check Squeegee Actuator Output for open condition.

Check Squeegee Actuator Output for shorted condition.

If installed, check Side scrub Actuator Output for open condition.

If installed, check Side scrub Actuator Output for shorted condition.

If installed, check right side sweep Actuator Output for open condition.

If installed, check right side sweep Actuator Output for shorted condition.

If installed, check left side sweep Actuator Output for open condition.

If installed, check left side sweep Actuator Output for shorted condition.

Check Main Water Solution Valve output for open condition.

Check Main Water Solution Valve output for shorted condition.

Check detergent pump for open condition.

Check detergent pump for shorted condition.

If installed, Check side pump for open condition.

If installed, Check side pump for shorted condition.

If installed, Check side valve for open condition.

If installed, Check side valve for shorted condition.

If installed, check ecH20 system for open condition.

If installed, check ecH20 system for shorted condition.

If installed, check ecH20 valve for open condition.

If installed, check ecH20 valve for shorted condition.

If installed, Check ES pump for open condition.

If installed, Check ES pump for shorted condition.

If installed, check solution AF valve for open condition.

If installed, check solution AF valve for shorted condition.

If installed, check recovery AF valve for open condition.

If installed, check recovery AF valve for shorted condition.

Check Horn output for open condition.

Check Horn output for shorted condition.

Check Alarm output for shorted condition.

Check that the Curtis CAN Communication is Operational.

When self test is done running and if no opens or shorts are detected, then display a text message on the display.

If any opens/shorts are detected, then display a text code on display continuously.

In the event of multiple error conditions, the self test messages will be sequenced continuously on the display in order of detection.

3.4.2.1 Self Test Results

Any problems detected during the self test shall be displayed in the results screens.

The screens shall automatically change between each problem detected. The user can also use the left and right buttons to change the screens.

Each screen will display the peripheral with a problem, the connector and pins the peripheral uses on its circuit board, and the problem that was detected.

List of detectable problems:

OpenLoad - The peripheral was detected as being electrically open.

ShrtLoad - The peripheral was drawing too much current and hardware protection shut it down.

OverTemp - The peripheral was detected as being over temperature and was shut down.

Voltage - The peripheral's voltage driver was detected outside of safe operating ranges.

Comm Flt - Communication with peripheral was not working.

MotorFlt - The motor peripheral was detected as having a locked rotor condition.

Offline - The module was detected as being offline or having a communications failure.

NeedFlsh - The EcH20 module needs to be flushed.

3.4.2.2 Self Test Left/Front Cylindrical/Disk Brush Motor Control Requirements

With the main head actuator in the parked position, turn on the left/front brush motor to allow it to spin freely.

While being commanded to spin, monitor the current after (5 to 10) seconds from being commanded to spin. If no open or short is detected then this test passes the short and open tests.

When commanded to spin and short is detected (pulse by pulse active) then this will be considered a short circuit.

When commanded to spin and no current (0 Amps) is detected, then this will be considered an open circuit.

3.4.2.3 Self Test Right/Rear Cylindrical/Disk Brush Motor Control Requirements

With the main head actuator in the parked position, turn on the right/rear brush motor to allow it to spin freely.

While being commanded to spin, monitor the current after (5 to 10) seconds from being commanded to spin. If no open or short is detected then this test passes the short and open tests.

When commanded to spin and short is detected (pulse by pulse active) then this will be considered a short circuit.

When commanded to spin and no current (0 Amps) is detected, then this will be considered an open circuit.

3.4.2.4 Self Test Side Scrub Brush Motor Control Requirements

If machine is configured as side scrub, then with the Side brush actuator in the parked position; turn on the side brush motor to allow it to spin freely.

While being commanded to spin, monitor the current after (5 to 10) seconds from being commanded to spin. If no open or short is detected, then this test passes the short and open tests.

When commanded to spin and short is detected (pulse by pulse active), then this will be considered a short circuit.

When commanded to spin and no current (0 Amps) is detected, then this will be considered an open circuit.

3.4.2.5 Self Test Left Side Sweep Brush Motor Control Requirements

If machine is configured as side sweep, then with the Side brush actuator in the parked position; turn on the side brush motor to allow it to spin freely.

While being commanded to spin, monitor the current after (2 to 7) seconds from being commanded to spin. If no open or short is detected, then this test passes the short and open tests.

When commanded to spin and short is detected (pulse by pulse active), then this will be considered a short circuit.

When commanded to spin and no current (0 Amps) is detected, then this will be considered an open circuit.

3.4.2.6 Self Test Right Side Sweep Brush Motor Control Requirements

If machine is configured as side sweep, then with the Side brush actuator in the parked position; turn on the side brush motor to allow it to spin freely.

While being commanded to spin, monitor the current after (2 to 7) seconds from being commanded to spin. If no open or short is detected, then this test passes the short and open tests.

When commanded to spin and short is detected (pulse by pulse active), then this will be considered a short circuit.

When commanded to spin and no current (0 Amps) is detected, then this will be considered an open circuit.

3.4.2.7 Self Test Vacuum #1 Motor Control Requirements

Turn on the vacuum #1 fan motor.

While being commanded on, monitor the current after (2 to 8) seconds from being commanded on. If no open or short is detected, then this test passes the short and open tests.

When commanded on and short is detected (pulse by pulse active), then this will be considered a short circuit.

When commanded on and no current (0 Amps) is detected, then this will be considered an open circuit.

3.4.2.8 Self Test Vacuum #2 Motor Control Requirements

Turn on the vacuum #2 fan motor.

While being commanded on, monitor the current after (2 to 8) seconds from being commanded on. If no open or short is detected, then this test passes the short and open tests.

When commanded on and short is detected (pulse by pulse active), then this will be considered a short circuit.

When commanded on and no current (0 Amps) is detected, then this will be considered an open circuit.

3.4.2.9 Self Test Main Head Actuator Control Requirements

With the main head actuator in the parked position, retract it to the scrub down position. While being commanded to move, monitor the current for 1.5 seconds after being commanded to move.

Short test: lower actuator to ready position and monitor current and pulse by pulse current limit.

If the current < 0.8 A and in pulse by pulse current limit then set Shorted Fault

If not shorted then continue testing

Open test: If the current < 0.8A and not in pulse by pulse current limit set Open Fault.

If actuator passes short and open test then test is done

Actuator shall be parked after test is done.

3.4.2.10 Self Test Squeegee Actuator Control Requirements

With the squeegee actuator in the parked retracted up position, extend it to the down position. While being commanded to move, monitor the current for 1.25 seconds from being commanded to move.

Short test: If the squeegee marks itself as stalled set the shorted fault.

If not shorted then continue with the test.

Open test: if the current is less then 0.5A and the stalled flag is not set, set the open fault.

If actuator passes short and open test then test is done.

Actuator shall be parked after test is done.

3.4.2.11 Self Test Side Scrub Actuator Control Requirements

If the machine is configured for side scrub, then with the side brush actuator in the parked retracted in position, extend it to the out and down position. While being commanded to move, monitor the current after 1.2 seconds from being commanded to move.

Short test: If the squeegee marks itself as stalled set the shorted fault.

If not shorted then continue with the test.

Open test: if the current is less then 0.5A and the stalled flag is not set, set the open fault.

If actuator passes short and open test then test is done.

Actuator shall be parked after test is done.

3.4.2.12 Self Test Left Side Sweep Actuator Control Requirements

If the machine is configured for left side sweep, then with the side brush actuator in the parked retracted in position, extend it to the out and down position. While being commanded to move, monitor the current after 1.2 seconds from being commanded to move.

Short test: If the squeegee marks itself as stalled set the shorted fault.

If not shorted then continue with the test.

Open test: if the current is less then 0.5A and the stalled flag is not set, set the open fault.

If actuator passes short and open test then test is done.

Actuator shall be parked after test is done.

3.4.2.13 Self Test Right Side Sweep Actuator Control Requirements

If the machine is configured for side sweep, then with the side brush actuator in the parked retracted in position, extend it to the out and down position. While being commanded to move, monitor the current after 1.2 seconds from being commanded to move.

Short test: If the squeegee marks itself as stalled set the shorted fault.

If not shorted then continue with the test.

Open test: if the current is less then 0.5A and the stalled flag is not set, set the open fault.

If actuator passes short and open test then test is done.

Actuator shall be parked after test is done.

3.4.2.14 Self Test Side Brush Solution Pump Control Requirements

While being commanded on, monitor the status of the output circuitry. If the output status does not show a short, then this test passes the short test. Likewise, if the output status does not show an open, then this test passes the open test.

When commanded on and the output circuitry status shows an indication of a shorted output, then this will be considered a short circuit.

When commanded on and the output circuitry status shows an indication of an open output, then this will be considered an open circuit.

3.4.2.15 Self Test Detergent Pump Control Requirements

While being commanded on, monitor the status of the output circuitry. If the output status does not show a short, then this test passes the short test. Likewise, If the output status does not show an open, then this test passes the open test.

When commanded on and the output circuitry status shows an indication of a shorted output, then this will be considered a short circuit.

When commanded on and the output circuitry status shows an indication of an open output, then this will be considered an open circuit.

3.4.2.16 Self Test ES Pump Control Requirements

While being commanded on, monitor the status of the output circuitry. If the output status does not show a short, then this test passes the short test. Likewise, If the output status does not show an open, then this test passes the open test.

When commanded on and the output circuitry status shows an indication of a shorted output, then this will be considered a short circuit.

When commanded on and the output circuitry status shows an indication of an open output, then this will be considered an open circuit.

3.4.2.17 Self Test EcH20 Module Pump Control Requirements

Only if machine is configured as Ec, then turn on the ec-H2O Module output.

While being commanded on, monitor the status of the output circuitry. If the output status does not show a short, then this test passes the short test. Likewise, If the output status does not show an open, then this test passes the open test.

When commanded on and the output circuitry status shows an indication of a shorted output, then this will be considered a short circuit.

When commanded on and the output circuitry status shows an indication of an open output, then this will be considered an open circuit.

3.4.2.18 Self Test Side Water Solution Valve Control Requirements

If machine is configured for side scrub only, then turn on the side water solution valve output.

While being commanded on, monitor the status of the output circuitry. If the output status does not show a short, then this test passes the short test. Likewise, If the output status does not show an open, then this test passes the open test.

When commanded on and the output circuitry status shows an indication of a shorted output, then this will be considered a short circuit.

When commanded on and the output circuitry status shows an indication of an open output, then this will be considered an open circuit.

3.4.2.19 Self Test Main Water Solution Valve Control Requirements

Turn on the main water solution valve output.

While being commanded on, monitor the status of the output circuitry. If the output status does not show a short, then this test passes the short test. Likewise, If the output status does not show an open, then this test passes the open test.

When commanded on and the output circuitry status shows an indication of a shorted output, then this will be considered a short circuit.

When commanded on and the output circuitry status shows an indication of an open output, then this will be considered an open circuit.

3.4.2.20 Self Test EcH20 Side Valve Control Requirements

If machine is configured for side scrub and EcH20, then turn on the EcH20 side water solution valve output.

While being commanded on, monitor the status of the output circuitry. If the output status does not show a short, then this test passes the short test. Likewise, if the output status does not show an open, then this test passes the open test.

When commanded on and the output circuitry status shows an indication of a shorted output, then this will be considered a short circuit.

When commanded on and the output circuitry status shows an indication of an open output, then this will be considered an open circuit.

3.4.2.21 Self Test Solution Autofill Valve Control Requirements

If machine is configured for Autofill, then turn on the solution autofill valve output.

While being commanded on, monitor the status of the output circuitry. If the output status does not show a short, then this test passes the short test. Likewise, If the output status does not show an open, then this test passes the open test.

When commanded on and the output circuitry status shows an indication of a shorted output, then this will be considered a short circuit.

When commanded on and the output circuitry status shows an indication of an open output, then this will be considered an open circuit.

3.4.2.21.1 Self Test Recovery Autofill Valve Control Requirements

If machine is configured for Autofill and ES, then turn on the Recovery autofill valve output.

While being commanded on, monitor the status of the output circuitry. If the output status does not show a short, then this test passes the short test. Likewise, if the output status does not show an open, then this test passes the open test.

When commanded on and the output circuitry status shows an indication of a shorted output, then this will be considered a short circuit.

When commanded on and the output circuitry status shows an indication of an open output, then this will be considered an open circuit.

3.4.2.22 Self Test Horn Output Control Requirements

Turn on the horn output.

While being commanded on, monitor the status of the output circuitry. If the output status does not show a short, then this test passes the short test. Likewise, if the output status does not show an open, then this test passes the open test.

When commanded on and the output circuitry status shows an indication of a shorted output, then this will be considered a short circuit.

When commanded on and the output circuitry status shows an indication of an open output, then this will be considered an open circuit.

3.4.2.23 Self Test Alarm Output Control Requirements

Turn on the alarm output.

While being commanded on, monitor the status of the output circuitry. If the output status does not show a short, then this test passes the short test. Likewise, if the output status does not show an open, then this test passes the open test.

When commanded on and the output circuitry status shows an indication of a shorted output, then this will be considered a short circuit.

When commanded on and the output circuitry status shows an indication of an open output, then this will be considered an open circuit.

3.4.2.24 Self Test CAN Communications to Curtis Controller Requirements

Send and monitor CAN message status bits from and to the Curtis Controller.

Monitor the CAN status bits; if there is no communication then this is an error.

3.4.2.25 Self Test Running Test Messages:

Self test shall display “Self Test Starting” message while it is starting. The LCD screen shall then display the various messages during their respective tests:

"Testing Main Scrub Brushes..."

"Testing Side Scrub Brush..."

"Testing Side Sweep Brushes..."

"Testing Pre Sweep Brushes..."

"Testing Vacuum Fan Motors..."

"Testing Pre Sweep Vacuum..."

"Testing Main Scrub Actuator..."

"Testing Squeegee Actuator..."

"Testing Side Scrub Actuator..."

"Testing Side Sweep Actuators..."

"Testing Pre Sweep Actuator..."

"Testing Det Pump..."

"Testing Side Pump..."

"Testing Side Valve..."

"Testing Main Valve..."

"Testing Ec Side Valve..."

"Testing Ec Water Pump..."

"Testing ES Pump..."

"Testing Solution Autofill Valve..."

"Testing Recovery Autofill Valve..."

"Testing Horn Output..."

"Testing Alarm Output..."

“Test Curtis CAN Communication...”

3.4.3 Manual Mode Requirements

This mode allows the various machine subsystems to be manually activated.

When manual mode is active the top line of the LCD display shall display the current selected subsystem.

The lower line of the LCD display shall be used to show each subsystems current status.

The display scroll button shall be used to select which subsystems information is currently being displayed

Scrub Motor Functionality in Manual Mode:

Pressing the On/Off one-step button shall turn on the scrub motors.

When the scrub motors are running the one-step LED shall be lit.

Pressing the On/Off one-step button while the brushes are running shall turn off the scrub brushes.

Vacuum Functionality in Manual Mode:

Pressing the vacuum fan/squeegee button shall turn on the vacuum fans.

When the vacuum fan is running the vacuum fan LED shall be lit.

Pressing the vacuum fan/squeegee button while the vacuum fan is running shall turn off the vacuum fan.

ES Functionality in Manual Mode:

When ES is configured pressing the ES button shall turn on the ES pump.

When the ES pump is running the ES LED shall be lit.

Pressing the ES button while the ES pump is running shall turn off the ES pump.

Ec-H20 Functionality in Manual Mode:

When ec-H2O is configured pressing the ec-H2O button shall turn on the ec-H2O module.

When the ec-H2O module is running the ec-H2O LED shall be lit.

Pressing the ec-H2O button while the ec-H2O module is active shall turn off the ec-H2O module.

Actuator Functionality in Manual Mode:

Pressing and holding the left water button shall manually extend the scrub actuator.

Pressing and holding the right water button shall manually retract the scrub actuator.

When an actuator subsystem is selected, pressing the plus button shall retract the actuator.

When an actuator subsystem is selected, pressing the minus button shall extend the actuator.

Solution Functionality in Manual Mode:

When a pump subsystem is selected, pressing the plus/minus buttons shall increase/decrease the flow rate of the selected pump subsystem.

When any other subsystem is selected, pressing the plus/minus buttons shall increase/decrease the flow rate of the conventional solution system.

When a pump subsystem or the conventional solution system is active, the flow rate LEDs shall indicate the current flow rate of the system.

3.4.3.1 Manual Mode Menu Table

Parameter		**Displayed Info**
M01 :Left Brush		Displays Left Brush Current and RPM

M02 :Right Brush		Displays Right/Rear Current and RPM
M03 :SideScrubBr		Displays Side Brush Current and RPM
M27 : MainSwp Act		Displays Extended/Retracted, Duty Cycle and Current
M04:LeftSweepBr		Displays Left Side Sweep Brush Duty Cycle and Current
M05:RightSweepBr		Displays Right Side Sweep Brush Duty Cycle and Current
M09:Vac 1		Displays Vac 1 Duty Cycle and Current
M10:Vac 2		Displays Vac 2 Duty Cycle and Current
M12:Side Pump		Displays Side Pump Voltage, Duty Cycle, and Current
M13:Ec Pump		Displays Ec Pump Voltage, Duty Cycle, and Current
M14:ES Pump		Displays ES Pump Voltage, Duty Cycle, and Current
M15:Det Pump		Displays Detergent Pump Voltage, Duty Cycle, and Current
M16:Water Valve		Displays the state and status of the valve and the current
M17:Side Valve		Displays the state and status of the valve and the current
M18:Ec Valve		Displays the state and status of the valve and the current
M19:Soltn Valve		Displays the state and status of the valve and the current
M20:Recvr Valve		Displays the state and status of the valve and the current
M21:Ec Sparger		Displays the PWM and current
M22:Ec Cell		Displays the PWM and current
M23:Scrub Act		Displays Extended/Retracted, Duty Cycle and Current
M24:SideScrubAct		Displays Extended/Retracted, Duty Cycle and Current
M25:L Sweep Act		Displays Extended/Retracted, Duty Cycle and Current
M26:R Sweep Act		Displays Extended/Retracted, Duty Cycle and Current
M28:Squeegee Act		Displays Extended/Retracted, Duty Cycle and Current
Exit Manual Mode		

3.4.4 Input Display Mode Requirements

The purpose of this mode is to provide a means of verifying that all the inputs on the machine are operating correctly. The different fields displayed on the LCD display shall be viewed using the right and left arrow display scroll buttons.

Show solution tank level status.

Show recovery tank level status.

Show status of ES float on LCD display.

Show status of seat switch on LCD display.

Show status of horn switch on LCD display.

Toggle one-step LED and a display message every time that the one-step button is pressed.

Toggle vacuum fan LED and a display message every time the vacuum fan button is pressed.

Toggle a down pressure LED and a display message every time that down pressure button is pressed.

Toggle high water LED and a display message every time that the increase water button is pressed.

Toggle low water LED and a display message every time that the decrease water button is pressed.

Display message every time that the side brush switch is toggled on.

Display message every time that the presweep enabled switch is toggled on.

When configured, toggle ec-H2O LED and a display message every time that the alternate solution button is pressed.

When configured, Toggle ES LED and a display message every time that the alternate solution button is pressed.

Toggle a display message every time that the left water on/off button is pressed.

Toggle a display message every time that the right water on/off button is pressed.

The following table describes the input display parameters and their display information:

Parameter	**Displayed Information**
I1:Sltn Sensor	Display Solution tank Level and sensor voltage
I2:Recovery Tank	Display Recovery Tank Full/not full

I3:Hlf Rcvr Tank	Display Recovery Tank half full/not half full
I4:Seat Switch	Display Seat Switch, (empty/not empty).
I5:Side Scrub	Display Side Scrub switch state (off/on)
I6:Side Sweep	Display Side Sweep switch state, (off/on)
I8:Pressure Sw	Display EcH2O Pressure Switch, (closed/open)
I9:Flush Button	Display EcH2O Flush Button, (not flushig/flushing)
I10:SE Switch	Display SE switch state (long/short/none)
I??:Thermal Sw	Display hopper Thermal switch state (Active/Not Active)
I??:Roll Pos	Display the hopper roll position
I??:Hopper	Displays the elevation status of hopper (Down/Not Down)
I??:Filter Input	Displays the status of the filter clog sensor (Clogged/Not Clogged)
Exit	Exits the Input Display mode.

3.4.5 CAN Diagnostics Requirements

This mode shall display diagnostic information about the CAN nodes

Left/Right Screen Arrows shall allow scrolling the LCD display between different nodes on CAN. The Down Pressure button on the membrane shall allow selecting/deselecting a node to view more information about it.

The following table describes the CAN nodes that shall be displayed

3.4.5.1 CAN Diagnostics Message Table

Parameters	**Description**	**Displayed Information**
CD2: Scrub	Node #2: Main Scrub	online status, software name, build configuration, and revision

CD3: Pickup	Node #3: Water pickup	online status, software name, build configuration, and revision
CD5: Side Scrub	Node #5: Side scrub	software name, build configuration, and revision
CD6: EC	Node #6: ecH20	online status, software name, build configuration, and revision
CD7: Side Sweep	Node #7: Side Sweep	software name, build configuration, and revision
CD8: Main Sweep	Node #8: Main Sweep	software name, build configuration, and revision
CD38: Propel	Node #38: Propel	software name, build configuration, and revision
Exit CAN Diagnostics Mode	Selecting Parameter exits mode	

3.4.6 Propel Diagnostics Requirements

The purpose of this mode is to provide a means of verifying that the Curtis controller and propel motors are operating correctly. The different fields shown on the LCD display shall be viewed using the right and left arrow display scroll buttons.

The fields viewable on the LCD screen are described in the following table:

Parameter	**Description**
P1: Curtis Online/Error	Curtis Controller Status (Online/Error)
EP2:Throttle	Throttle Voltage
P3:Brake Pedal	Brake Pedal status (On/Off)
P4:Direction	Machine direction (forward/reverse)
P5:Speed	Machine speed (MPH)
P6: CurtisTemp	Curtis temperature (Degrees C&F)
P7: MotorTemp	Motor temperature (Degrees C&F)

P8: Propel Current	Propel Current in Amps

3.4.6 Motors Mode

The purpose of this mode is to provide a means of running the machines functional modules without propelling the machine, while providing some diagnostic information on the screen. Different functional modules can be chosen by using the left and right arrow buttons.

Pressing the down pressure button or the one-step button while a screen is selected will activate that module.

Holding down the left or right water button shall dispense water from the solution tank through the main water valve for as long as the button is held.

The following table describes the parameters in Motors Mode:

Is there a reason a mode the main sweep brush is not described?

Parameter	**Description**
MM1: Run Main Scrub Brushes	Allows running the main scurb head with down pressure.
MM2: Run Side Scrub Brush	Allows running side scrub brush on the floor.
MM4: Run Side Sweep Brushes	Allows running the side sweep brushes.
MM5: Run EcH20	Allows running the EcH20 with flush detection.
Exit Motors Mode	Allows leaving motors mode.

3.4.6.1 Run Main Scrub Brushes

The main scrub brushes shall run controlled to a selected down pressure level.

Pressing the down pressure button shall change the down pressure level.

Pressing the one-step button shall stop the main scrub brushes and return to motors mode screen selections.

The screen shall display information about the the front/left brush on the top line, starting with duty cycle, then current, then RPM.

The screen shall display information about the the rear/right brush on the bottom line, starting with duty cycle, then current, then RPM.

The down pressure LEDs shall indicate the currently selected down pressure level.

The one-step LED shall be on.

3.4.6.2 Run Side Scrub Brush

The side scrub brush shall run with its actuator extended.

Pressing the down pressure button or the one-step button shall stop the side scrub brush and return to motors mode screen selections.

The screen shall display information about the side scrub brush, starting with current, and then RPM.

3.4.6.3 Run Side Sweep Brushes

The side sweep brushes shall run with their actuators extended.

Pressing the down pressure button or the one-step button shall stop the side sweep brushes and return to motors mode screen selections.

The screen shall display current for the left and right brush.

3.4.6.4 Run EcH20

The EcH20 module will run.

Pressing the down pressure button or the one-step button shall stop the EcH20 module and return to motors mode screen selections.

The screen shall display if the module needs to flush, if the pressure switch is active, or if the module is currently flushing.

The EcH20 logo LED shall be on.

The EcH20 LED will function as it would during normal mode.

3.4.7 Engineering Mode

The mode allows the user to manually operate machine components at variable drive strengths or PWM duty cycles.

The following table describes parameters in Engineering mode:

Parameter	Description
E1: Conventional	Voltage, Duty Cycle, Amps
E2: Side Pump	Voltage, Duty Cycle, Amps
E3: Ec Pump	Voltage, Duty Cycle, Amps
E4: Ec With Side	Voltage, Duty Cycle, Amps
E5: ES Pump	Voltage, Duty Cycle, Amps
E6: Det Pump	Voltage, Duty Cycle, Amps
E7: Vac 1	Voltage, Duty Cycle, Amps
E8: Vac 2	Voltage, Duty Cycle, Amps
E9: Dust Vac 1	Voltage, RPM
E10: Dust Vac 2	Voltage, RPM
Exit Eng Mode	

3.4.8 Hopper Roll Actuator Configuration

The hopper roll actuator's stored minimum potentiometer value shall be settable in item 'M34' of Manual Mode.

Item 'M34' of Manual mode shall display the current hopper roll potentiometer reading followed by the configured minimum potentiometer value in parentheses.

While in item 'M34' of Manual Mode, holding down the downpressure button shall set the stored minimum potentiometer value to the current potentiometer value.

3.5 Motors, Actuators, and Valves

3.6 Battery

The battery indication level will be shown in bar graph form on the Standard POD or Touchscreen (PRS 3.3.1.5.1).

The standard battery shall be a flooded lead-acid type battery with removable caps on each cell for adding water (PRS: 3.3.1.2.1).

For North American machines, a 510AH (5HR discharge rate) battery shall be provided as an option (PRS: 3.3.1.3.1).

For North American machines, a 750AH (5HR discharge rate) battery shall be provided as an option (PRS: 3.3.1.3.2).

For North American machines, a 930AH (5HR discharge rate) battery shall be provided as an option (PRS: 3.3.1.3.3).

For European machines, a 625AH (5HR discharge rate) battery shall be provided as an option (PRS: 3.3.1.4.1).

For European machines, a 775AH (5HR discharge rate) battery shall be provided as an option (PRS: 3.3.1.4.2).

The machine shall turn off scrubbing and sweeping operations when the battery depth of discharge has reached 80% (PRS: 3.3.1.6.1).

Globally compatible (voltage/frequency) off-board opportunity battery chargers shall be provided as options – these chargers shall have a charge output of approximately 25% of the largest battery options in each region – 775 AH or 930 AH, depending on region – which is approximately 200A (PRS: 3.3.1.7.2)

The battery indication level shall be shown in bar graph form.

Battery Display Indication (BDI) Table:

The Battery Display Indication (BDI) will consist of five battery indication bars shown on the LCD.

The battery Display Indication shall receive its voltage data from the Curtis Controller based on the voltage at the Key Switch Input (KSI), which is 1.2V less than battery voltage (Approx. 2 diode voltage drops).

The bars of the battery display indication, warning codes, and faults shall correlate to the following voltage values:

5 bars (full) 69% <= BDI

4 bars 62% <= BDI <69%

3 bars 47% <= BDI <62%

2 bars 32% <= BDI <47%

1 bar (low) 16% <= BDI <32%

1 bar (Flashing) & Warning Code W1 Low Batt warning 3% <= BDI <16%

0 bars & Fault Code F4 Very Low Batt fault BDI <3%

The bars shall turn off when the voltage drops below the associated value range.

The number of bars shall only decrease except during a reset. The BDI charge reset value is 37.65 VDC @ the Battery = @ the KSI 36.70VDC and reset will occur if the voltage is above these levels when the key switch is cycled on. (NOMINAL VOLTAGE, MEASURED TOLERANCE +/-0.25VDC)

Notes:

1) B+ is +1.2 volts greater than the KSI voltage. (1.68Vdc/cell =empty = 0%)

2) Curtis algorithm uses the KSI value, so Tennant BDI software should be written to the KSI values.

3.7 Propel Requirements

The maximum backward speed shall be configurable by the operator via supervisor mode (PRS: 3.2.10.4).

3.7.1 Propel Interlocks

Interlocks are conditions that prevent machine operation.

If the throttle is depressed while key cycling from "0" to "1" the machine shall not propel forward until the throttle enters the neutral state.

Propel shall be disabled when the emergency stop is active.

Propel shall be disabled when the charger is plugged in.

Propel communications errors shall disable cleaning operations.

Propel controller faults that inhibit propel shall be displayed on the machine console.

When the machine is propelling in reverse and the Directional switch is changed to the “Forward” position then the machine transitions to neutral then to forward direction up to the selected throttle level.

When the machine is propelling in forward or reverse directions directional switch is removed (switch disconnected, or open wires), the machine will transition to a stop.

When the machine is propelling in the forward direction, and the operator activates the propel directional switch to the “reverse” position: The machine transitions to neutral, and then transitions in the reverse direction up to the selected throttle level. If the throttle signal is removed during this process, the machine will transition to a stop.

If the throttle sensor signal is opened or shorted the machine will go into neutral.

A audible alarm shall occur when the directional switch is in reverse while in transport, scrub, double scrub or water pickup mode.

If an optional back-up alarm is installed it will also sound in reverse while propelling.

If the throttle sensor signal is shorted the machine will go into neutral.

A forward / reverse switch shall determine propel direction.

Propel control shall be disabled after a specified programmed period of time whenever the operator seat is empty, and the machine shall stop moving from the default maximum forward speed within 2 to 3 seconds on a level floor. The Curtis Controller will be programmed with a specific time parameter of 2 seconds. This time will **not** be user settable through the user interface display.

3.7.2 Curtis Controller Parameters

Default Transport Mode speed 5.5 Mph

Default Scrub Mode speed 4.0 Mph

Max Reverse Speed 2.0 Mph

In the configuration parameters the minimum settable transport mode speed range shall be 4.1Mph

In the configuration parameters the maximum settable transport mode speed range shall be 5.5Mph (PRS 3.2.10.2)

In the configuration parameters the minimum settable scrub mode speed range shall be 2.0Mph

In the configuration parameters the maximum settable scrub mode speed range shall be 4.0Mph (PRS 3.2.10.5)

The braking distance shall be less than 5.65 Feet when in transport mode and propelling forward at 5.5 MPH (Max Speed).

Coast Distance at (~5.5 MPH) Max Speed 10 to 14 Ft. Coasting from full speed transporting

The machine acceleration from a neutral state to 5.5 MPH (Max Full Speed) shall be ~ 6 seconds .

Deceleration to max default speed 3.0 seconds

3.7.3 Propel Control From Tennant System

Description	**Details**
Set maximum propel speed config. mode)	Maximum speed set from Tennant Controller (only in
Propel Status	Propel fault status to Tennant Controller
Enable Propel	Enable Propel from Tennant Controller
Disable Propel	Disable Propel from Tennant Controller
Get Max Propel Speed	Max Propel speed to Tennant Controller
Get Distance Traveled	Get from Propel Controller total distance traveled