SKIP-LINE®

HDVO-318/DL-18 Glass Cockpit Installation and Operation Manual

MANUAL

Skip-Line®

Road Marking & Monitoring Equipment

Leading the industry since 1972.

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PRELIMINARY

Last modified: 03/16/22

i. Warnings, Warranty, and Disclaimer

WARRANTY

Each unit of the HDVO / DL-18 is covered by a 30-day money-back guarantee. Buyer is responsible for determining the suitability of this product for intended application prior to engaging in any contract that would rely on product functionality.

This product is also covered by a limited one year warranty. Products with defects in workmanship will be repaired or replaced at the sole discretion of Skip-Line, LLC. without charge for up to one year from the date of invoice.

DISCLAIMER

All electronic equipment is subject to failure due to: Unanticipated use, non-compatibility of accessories, stress by mechanical vibration, electrical spikes, exposure to intermittent, poorly regulated, highly inductive, or noisy power sources, overload, temperature extremes, induced load-dump and welding currents, insulation chafing, improper wiring, poor cable routing, or stressed mounting. Indiscriminate high-pressure washing can cause moisture intrusion and corrosion.

All computerized systems can fail. Skip-Line, LLC. will not be held responsible or liable for any loss as a result of the use of this device, including but not limited to loss of time, money, opportunity, or personal injury. In no case shall Skip-Line, LLC. be responsible beyond the purchase price of this product.

IMPORTANT NOTE

Not all HDVO / DL-18 units have exactly the same functionality capabilities. Some graphics contained in this manual may show functions or features that are not installed on every unit and should not be relied upon for operational decisions. This system depends on the proper operation, calibration, and functionality of other devices in the Skip-Line product line. Full functionality may require purchase of further devices.

Contents of this manual are subject to change without notice.

If your system lacks a feature found in this manual that you would like to have added, contact Skip-Line to see if it is possible.

CAUTION
READ BEFORE INSTALLING!

**THIS EQUIPMENT IS FOR +12/24 VOLT NEGATIVE
GROUND SYSTEMS ONLY!**

Do not connect to positive ground systems or damage will result.

Avoid locations which are exposed to excessive vibration, direct sunlight, moisture, and extremes of temperature.

When installing, be sure to allow room for cables to plug in at the front of the HDVO / DL-18.

The HDVO / DL-18 is not waterproof. Outboard installations must be protected by a waterproof box or cover. Such enclosures need a small vent to prevent moisture accumulation.

Be sure to use a fuse in the +12/24 volt supply wire. If the +12/24 volt branch that feeds the HDVO / DL-18 is already fused, ensure that there are at least 5 amps reserved in the installed fuse rating for the HDVO / DL-18.

Table of Contents

1. Overview

1.1 Glass Cockpit

The 'Glass Cockpit' label has been used to describe the Skip-Line® video overlay product line consisting of the following products:

CVO-312 Video Overlay / DL-12 Data Logging System

HDVO High Definition Video Overlay / DL-18 Data Logging System

The Glass Cockpit series of products are an all-in-one add-on accessory for Skip-Line® skip-timer control systems. They are capable of video overlay and crosshair generation, operation monitoring, data logging & reporting, and controlling many peripheral truck functions (pumps, pressures, temperatures, flow rates, lights, and more!).

While many features are shared throughout the Glass Cockpit series the HDVO / DL-18 platform consists of the latest technology and will offer new features that are unavailable to the CVO-312 / DL-12 models.

Glass Cockpit Interface

Promote safer operations with a Skip-Line® Glass Cockpit near the vehicle driver. Upgrade to an Integrated Data Logging System for full-spec monitoring and reporting of material usage, temperatures, pressures, and more.
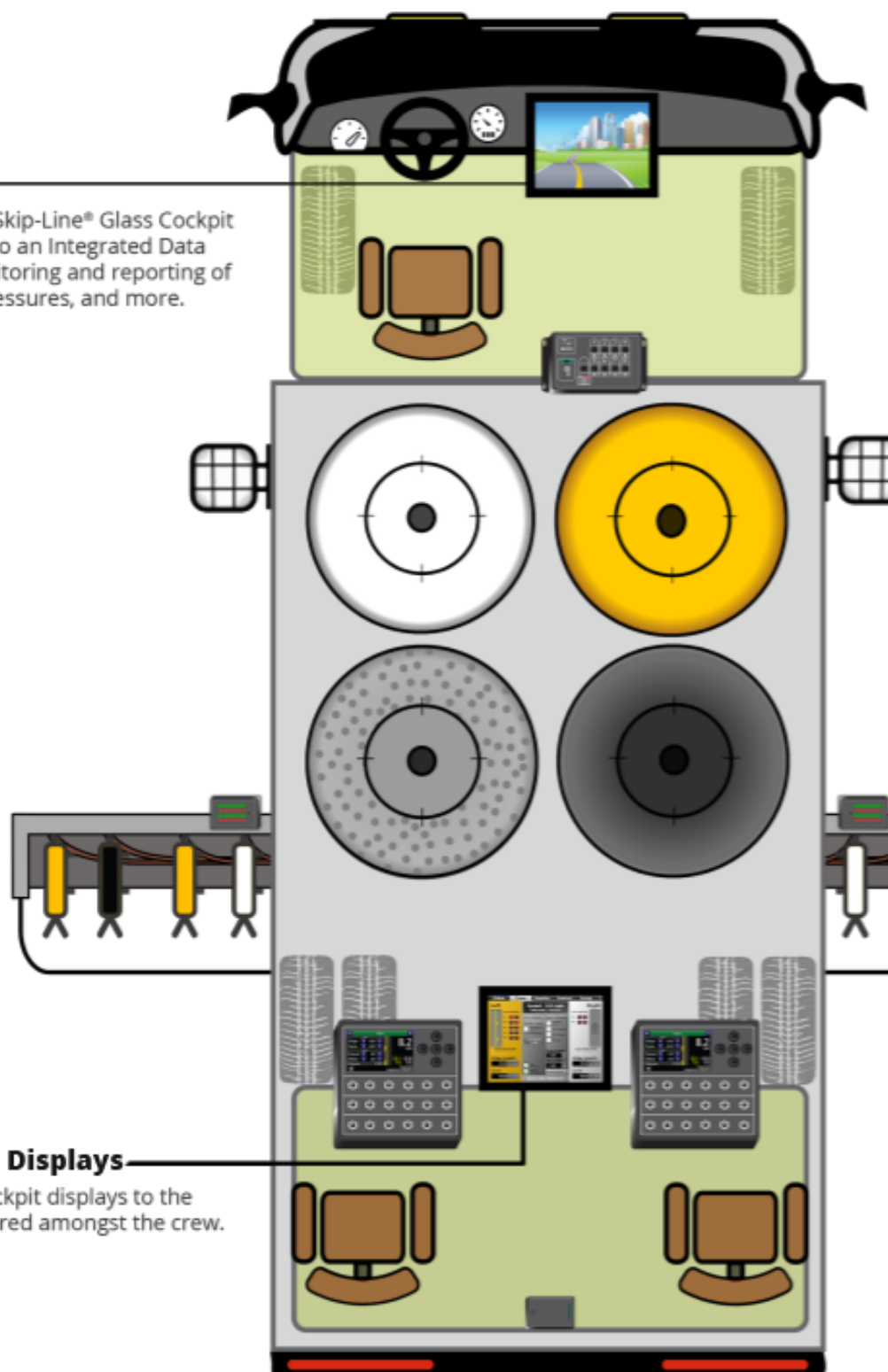
Additional Glass Cockpit Displays

Add multiple HDVO-318 Glass Cockpit displays to the vehicle so information can be shared amongst the crew.

1.2 HDVO High Definition Video Overlay

The HDVO High Definition Video Overlay and Crosshair Generator is an advanced device that provides both monitoring and video guidance capabilities in a single unit. It improves crew safety by allowing the driver to keep eyes on the road with minimal need to look away from the video guidance monitor.

This device can receive basic overlay data from several sources. While much of the information is the same, each data source has different information display capabilities.

- An SM-5 Skip Timer System (RS485).
- An SC-12 Control System (CAN).
- An MST-14 Mini Skip Timer (CAN).

Examples of basic overlay data include:

- Vehicle Speed
- Paint Usage
- Paint Distance

1.3 DL-18 Data Logging System

The DL-18 Data Logging System is an HDVO with monitoring and logging functionality enabled. In addition to the HDVO features listed above, the DL-18 system tracks material usage and performance metrics to reduce material waste and increase line quality. This Integrated Data Logging feature was designed to be unobtrusive by working in harmony with the striping operation.

This device can create painting data logs using the following primary sources:

SC-12 Control System (CAN): The SC-12 has full DL-18 integration.

MRL GC-12 Grind Control System (CAN): The MRL GC-12 Grind Control System has full DL-18 integration.

MST-14 Mini Skip Timer (CAN): The MST-14 has full DL-18 integration, although the MST-14 is a standalone timing system designed for single-carriage vehicles. The DL-18 cannot communicate with two MST-14 units simultaneously. Painting operations with multiple carriages should consider an SC-12 Control System.

SM-5 Skip Timer System (RS485): The DL-18 is backward compatible with SM-5 skip timers, although some functionality may be limited. The SM-5 is not capable of sharing some data such as pump and distance calibration values, gun widths, and gun colors.

In addition to acquiring data from a primary source, the DL-18 will record information from many optional peripheral devices and sensors such as those listed in the next section.

1.4 Utilizing Multiple Glass Cockpit Units

It is possible, and even recommended, for trucks to have multiple Glass Cockpit units installed.

Benefits Include:

- Control/Monitoring Redundancy in event of failure
- Data Logging Redundancy
- Shared Settings
- Information at Multiple Operator Stations

Using multiple Glass Cockpit units allows for system redundancy and monitoring/control at multiple operator stations. The HDVO / DL-18 share settings and responsibilities. Job Name, for example, can be added to an HDVO. Calibration values are shared between units, so changes made on one HDVO / DL-18 will be immediately reflected on all HDVO / DL-18's on the same vehicle.

An HDVO can take over logging responsibilities from a DL-18. The DL-18 and HDVO are physically identical, but the DL-18 designation is typically reserved for units that have the logging package enabled.

Example case 1:

The DL-18 does the logging and recording, as well as video guidance for the driver. The driver enters job names and prints reports. There is also an HDVO in back for controlling advanced features and monitoring pressures.

Example case 2:

The DL-18 does the logging and recording and is located in the rear cab at the centerline operator station where the crew lead guns and enters job names. There is a HDVO in front for video guidance. There is a second HDVO at the edgeline operator station for controlling edgeline pressures.

1.5 Optional Units

The Glass Cockpit system can be easily expanded using a BUS-012 Hub. Your system may or may not have devices from the following list—if it does, further information is provided in separate reference documents.

CHS/CJS Bead Scales: These scale heads have 4 load cell inputs to track material usage. They send weight, calibration, and usage data to the Glass Cockpit system.

CTH Temp/Hum Sensors: Adding a temperature and humidity sensor gives the Glass Cockpit ambient & road surface temperatures, relative humidity, and dew point.

CDRV-HI and CDRV-LO: These driver boxes drive loads on the system. A CDRV-HI sources +12V, while a CDRV-LO provides grounded outputs to loads. An LED shows the activated state of the output at all times. The Glass Cockpit can control outputs for lights, thermostats, and more.

CANLG-OUT: Sources a proportional (analog) 4-20mA or 0-5V output signal to proportional loads, such as valves or regulators.

COPTO: Provides digital signal, counter, or RPM inputs to the SC-12 system, which can be displayed on a Glass Cockpit.

CANLG-IN: Provides inputs from any proportional (analog) 4-20mA or 0-5V sensor, such as temperature, pressure, or level, to the SC-12 system. This information can be displayed on a Glass Cockpit and used as part of a control system.

CANLG-TC: Directly senses Type-J, ungrounded thermocouple sensors into the SC-12 system. This temperature information can be displayed on a Glass Cockpit and used as part of a thermostat control.

1.6 Line Pilot XP

The Skip-Line Line Pilot XP makes it easy to adjust and fine-tune cross hair lines on the HDVO while driving. Operators can use toggles to adjust on-screen line positioning. Adjust location, tilt, and thickness of existing crosshair lines on the HDVO display.

Functionality

① Move Left/Right

② Move Up/Down

③ Increase/Decrease Line Width

④ Rotate Clockwise/ Counterclockwise

⑤ Line Select (Scroll through the available lines)

2. Specifications

The HDVO / DL-18 is not waterproof. Outboard installations must be protected by a waterproof box or cover. Such enclosures need a small vent to prevent moisture accumulation. Operation or storage outside of these specifications may reduce the life of the device and, in some cases, void the warranty.

	Minimum	Maximum
Operating Temperature	-20°C -4°F	60°C 140°F
Storage Temperature	-30°C -22°F	70°C 158°F
Humidity (non-condensing)	10 %RH	90 %RH
Voltage	10V	30V
Current	--	5A
Monitor Resolution	720p (DisplayPort)	

2.1 Video Inputs

Video inputs use BNC Female connectors.

The recommended camera signal type is 1080p30 HD-TVI. Supported input signals:

	TVI	CVI	AHD	NTSC	PAL
1080p25	X	X	X		
1080p30	X	X	X		
720p25	X	X	X		
720p30	X	X	X		
720p50	X	X			
720p60	X	X	X		
960H				X	X
SD				X	X

2.2 Video Output (to Monitor)

The video output connector is a DisplayPort.

Skip-Line supplies compatible monitors that use a passive DisplayPort to HDMI cable adapter.

2.3 USB Ports

Left-side USB ports are high-current BC1.2 rated to 2.1 amps each

Right-side USB ports are rated to 500mA

Use these only for monitor(s), printer, and/or USB Flash Drive.

Do not plug any other USB devices into the HDVO / DL-18 USB ports!

Recommended cable length: 6'.

2.4 CAN Port

This is an RJ45 connector for connection to a BUS-012 Hub device only (unless otherwise directed in documentation from Skip-Line). It is compatible with standard network patch cables.

Important!

Never connect the CAN Port to anything other than a Skip-Line device. Damage to the HDVO / DL-18 and/or other equipment may result.

2.5 RS485 Port

There is an RJ12 connector for connection to an SM-5 skip timer system. RJ12 jack requires six conductor RJ12 plug and cable. Follow the standard Skip-Line wiring pattern only.

Important!

Never connect to telephone or networking equipment—damage to the HDVO / DL -18 and/or other equipment may result.

2.6 WiFi

An RP-SMA (Reverse-Polarity SMA) connector, compatible with any 2.4 GHz antenna.

In the event the installation location does not have sufficient wireless signal

strength, use a 50-ohm extension cable or a 2.4GHz WiFi external antenna with an attached cable. Contact your OEM or Skip-Line, or visit your local electronics store.

2.7 Cellular

The unit comes equipped with a cellular modem that supports 2G, 3G, and 4G(LTE) technologies.

Cellular does not require any setup.

To ensure cellular is properly working select the cellular icon in the upper right corner of the screen. If the "Connection Status" shows "Connected", then cellular is working properly.

2.8 Monitor

Monitor models supplied by Skip-Line are subject to change based upon availability and capabilities.

GeChic On-Lap 1503I Touch

- Panel: 15.6" TFT IPS LCD (16:9 Wide) LED Backlight
- Resolution: 1920 x1080 (262K colors)
- Brightness: 250 (cd/m2)(Typical)
- Touch Screen: Projective capacitive touch screen
- Rating Voltage: 5V-DC
- Rating Current: 2A
- Connectivity: Micro-HDMI x1, USB(C)*1
- Environment:
  - Operating :0~50℃;Humidity:20~90%RH,
  - Storage:-20~60℃;Humidity:10~90%RH
- Recommended Accessory: Multi-Mount Kit 1503 (For VESA 100)

GeChic On-Lap 1102I Touch

- Panel: 11.6" (16:9 Wide) FFS (Fringe Field Switching) panel
- Resolution: 1920 x1080
- Brightness: 250 (cd/m2)(Typical)
- Touch Screen: Projective capacitive touch screen
- Rating Voltage: 5V-DC
- Rating Current: 1.7A
- Connectivity: Micro-HDMI x1, 5V DC*1 (Micro USB)
- Environment:
  - Operating :0~50℃;Humidity:20~90%RH,
  - Storage:-20~60℃;Humidity:10~90%RH
- Recommended Accessory: Multi-Mount Kit 1102 (For VESA 75)

3. Installation

Installation of the HDVO / DL-18 system requires the physical installation of the boxes and communications cabling.

3.1 Preparing the installation

Select a mounting location for the HDVO / DL-18. A common mounting location for units in the front (driver) cab is mounted on/in the doghouse center console or on the back wall of the cab. For rear cab mounting, consider on/in the rear console or on the front wall of the cab.

- Find a location protected from moisture, excessive heat & vibration
- Ensure the location does not expose cable connectors to impacts or the environment.

Select a mounting location for touch monitor. This will be dependant on the desired mount type. Consider either movable VESA arm or ball mounting solutions.

- Select a mounting location for Touch Monitor.
    - Find a location protected from moisture, excessive heat & vibration
    - Ensure the location does not expose cable connectors to impacts or the environment.
    - Ensure the monitor mounting method is safe, does not impair driver view, and meets legal requirements when stowed for travel.

Plan cable routes before mounting to ensure mounting locations will suffice.

- Plan routes for communications cables from the HDVO / DL-18 to the closest hub box (if applicable).
- Plan routes for the +12V power to each of the hubs and driver output boxes.
- Plan routes for the monitor video and USB cabling.

Follow these precautions during installation:

- Do not connect power to the any of the hubs or other system devices until all other connections have been made.
- If a partial installation is made, some devices may be inoperable or may not operate as expected.

CAN Cable lengths are important in order to maintain the specifications of the CAN communications bus. Intermittent communications problems may arise if the following specifications are exceeded:

- Maximum length between a Hub and any device: 5 meters.

- Maximum length between Front Hub and Rear Hub: 20 meters.

Select mounting locations and cable routes so that the above cabling specifications can be met.

3.2 HDVO / DL-18 Physical Installation

The HDVO / DL-18 uses a simple flange mount mechanism that has several options for mounting. The unit will come with two flange mounts already attached to the unit. These flange mounts can be removed and reinstalled for either vertical or horizontal mounting as needed. The unit can easily be installed on the truck using this three step process:

1. Select a mounting location on the truck. Make sure the location is on a flat surface and keep accessibility in mind when selecting a location.

⚠ **Important!**	*Mounting on uneven surfaces can create flex or unintended tension on the internal electronics.*

2. Configure the two flange mounts on the unit for either horizontal or vertical mounting.
3. Test fit the unit in the mounting location and make adjustments as needed. Once the unit is ready to be mounted, use the four #8-32 bolts, washers, and nuts provided with the unit to secure the unit to the truck.

3.3 HDVO Power Cable

Using the supplied power cable with barrel jack connector, connect the HDVO / DL-18 to a +12V or +24V power source. Recommended fusing for +12V is at least 5amps. Fusing is to protect wiring and not the device, as the device has internal protections.

The supplied power cable (pictured below) is 20ft long.

Red Wire - Connect to +12V or +24V source
Black Wire - Connect to negative ground
Shield - Leave disconnected or connect to ground

> ⚠️ **Important Note!**
>
> *Do not connect power to the device or monitor until all other connections have been made.*

> ⚠️ **Important Note!**
>
> *Never plug the barrel jack connector into the HDVO / DL-18 when "hot" (with active power). It may result in blown fuses and/or equipment damage.*

3.4 Camera Connections

Compatible cameras will require their own power source. You may need to run coaxial cables. RG6 or RG59 coaxial cable and connectors are recommended.

Connect cameras using the supplied IN1 - IN4 BNC Female jacks.

Desired camera configuration will vary by operation and painting style. The most common configuration has forward-facing cameras mounted on either side of the vehicle to create a perspective representative of the carriage(s). This allows the driver to align off the camera for convenience and accuracy.

Common Camera Configuration:
- IN1 - Forward-facing Centerline (left) Camera
- IN2 - Forward-facing Edgeline (right) Camera
- IN3 - Unused / Aux
- IN4 - Rear-Facing / Backup Camera

Note that the IN4 connection has the ability to operate as a backup camera and automatically change to IN4 when the vehicle is in reverse. This capability is only available when attached to an SC-12 Control System with a +12V reverse signal connected to Pin L on the SC-12 Core Skipper or SC-12 Core Hub.

3.5 Monitor Physical Installation

It is recommended that you purchase a VESA mounting plate with your GeChic monitor. Using this mount plate, nearly any VESA 100mm x 100mm (GeChic 1503I Monitor) or VESA 75mm x 75mm (GeChic 1102I Monitor) option will work. Here are some commonly used examples:

Window Suction - RAM Mount RAM-101U-B-SPX1

Dash Mount - RAM Mount RAM-102U-246

*Slide Bar Mount - RAM Mount RAM-404U w/ RAM-201U-B & RAM-246U*

Generic VESA TV or Monitor Mount

3.6 Monitor USB & Video Cables

There will likely be only two cables for your GeChic monitor. One is a 15ft HDMI-A to micro-HDMI with a DisplayPort to HDMI adapter dongle. This supplies the monitor with video. The other cable is a 15ft USB cable that will adapt from USB-A to either USB-C or micro-USB, depending on your monitor model. The GeChic monitors will be powered through the USB cable, which also sends touch feedback to the HDVO / DL-18. A dedicated power cable is not necessary.

If the monitor is mounted on or above the vehicle dash, it may be prudent to run the cables through the dash or console to help manage cables better and reduce the chance of pulling on them in normal operations.

Connect the supplied cables to their respective ports (HDMI to HDMI, USB to USB).
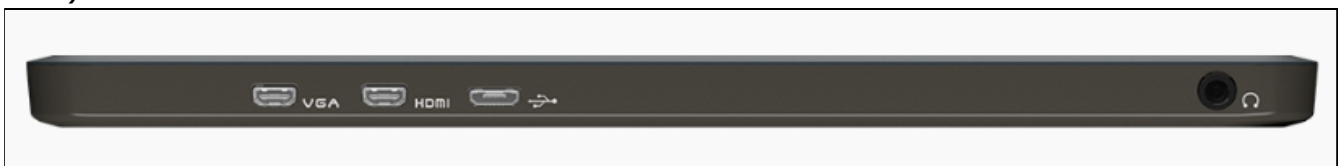
Connect the USB cable to either of left-side 2.1A USB-A ports on the HDVO / DL-18. The left-side ports are capable of high current, and some monitor sizes may consume too much power for the lower-rated 500mA USB ports. Connect the

HDMI cable to the DisplayPort to HDMI adapter dongle and plug the dongle into the OUT port pictured on the right side of the unit.

Try to keep the USB and video cables unstrained at the connector with cable management and cable routing. Zip ties or other cable management supplies are recommended.

3.7 Antennas
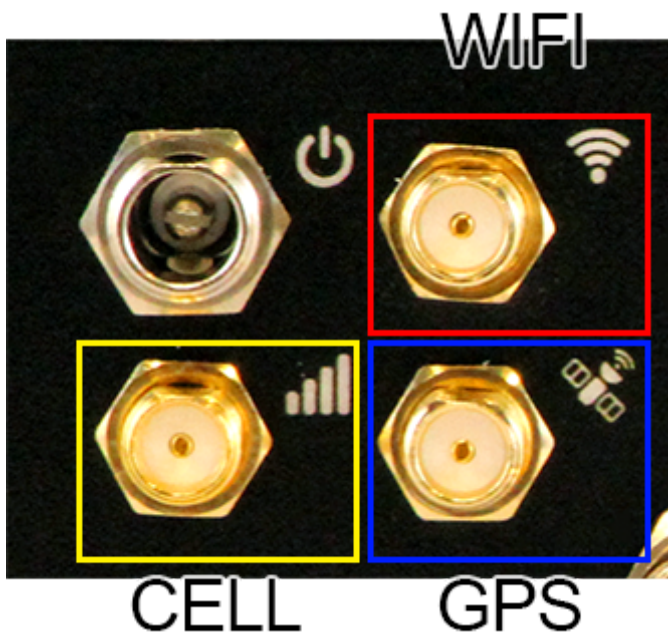
DL-18 units will be supplied with a magnetic GPS antenna and a 6" 2.4GHz WiFi antenna, a cellular antenna, and a wifi antenna.

GPS Antenna:

The GPS antenna is magnetic. It should be mounted on a cab roof with a clear view of the sky.

WiFi Antenna:

The WiFi antenna simply screws onto the unit. Additional 2.4GHz antenna options are available if the default option does not suffice (if it has trouble connecting to a shop WiFi due to signal strength).

Cellular Antenna:

The cellular antenna simply screws into the unit's cellular port, designated by the

cellular icon .

The cellular antenna is IP67 rated; it's recommended the antenna is installed on a window inside the cab or on the dash, using the adhesive backing.
- The antenna should not be mounted on any metal surfaces.
- Mount the antenna in an open area without any surrounding objects that may obstruct the signals.
- Mount at least 12 inches away from other antennas.

3.8 CAN Cabling

Cabling should use 26AWG (or larger) Cat5 cable and RJ-45 connectors. The Hubs accept only standard RJ-45 plugs. Some of the devices have sealed RJ-45 jacks, available from Skip-Line, which will accept either standard or strain-relieved IP-67 rated plugs. See Appendix B for instructions on RJ-45 connector wiring.

Cable protection devices should be used to prevent vibration-induced chaffing from occurring against sharp edges. Avoid pinch points where the cable may be damaged from moving parts.

- ➢ Run cable between each of the devices and the Hub each device will connect to.
- ➢ Run a cable between the Rear Hub and Front Hub.
- ➢ Plug all the boxes into the nearest Hub. Any available port (except for UPLINK ports) can be used.
- ➢ Plug the Front Hub into the Rear Hub using a connection cable from the

UPLINK on one Hub to the UPLINK port on the second Hub.
➢ Double check each connection, and then supply the Hub(s) with +12V power. Make sure that each Hub lights up and does not show power faults or short circuits. If any fault lights occur, remove power from the system immediately and correct the faulty device.

Refer to the BUS-012 insert for more information on HUB wiring and diagnostic LED information.

The HDVO / DL-18 is now ready to be configured.

4. Touch Calibration and Initial Setup

You are ready to begin configuring the unit. Turn on the power source to boot up the HDVO / DL-18 and monitor.

4.1 Touch Calibration

Monitor touch screen calibration is typically not needed if your monitor was supplied with your HDVO / DL-18 unit.

This section is relevant if:

- You purchased a monitor separately from your HDVO / DL-18
- You are replacing your monitor.
- You are noticing issues using the touch screen where the software does not react in alignment with the location of finger presses.

To enter the calibration, simply press and release the button next to the LED indicators.

This will initiate the Touchscreen Calibration process. Follow the onscreen instructions.
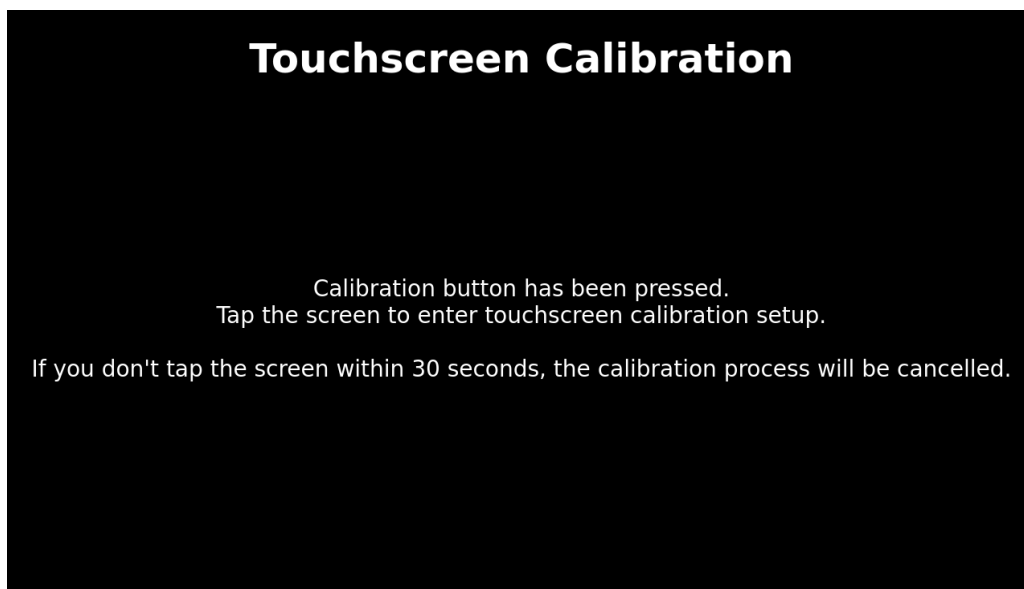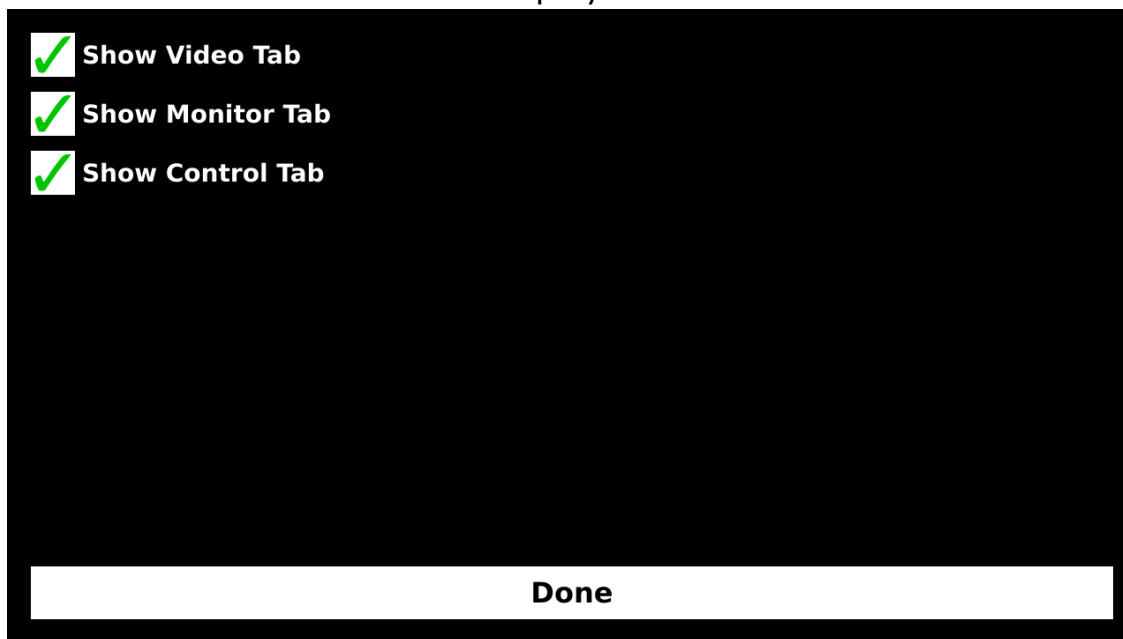

4.2 Date & Time Setup

If prompted, enter data and time.

It is important to set the correct Time Zone for accurate data logging.

See *Date & Time Setup*

4.3 Enabling/Disabling Tabs

The tabs at the top may be enabled/disabled. Hold your finger on the top bar for 4 seconds to choose which tabs are displayed.

5. Items & Lines

"Lines", also referred to as crosshairs, may be placed on any video channel and will overlay on top of a video feed. Lines are highly customizable.

All non-line objects are called "items". Items include metrics, counters, tank levels, buttons, and functional widgets. They can be placed on any screen (Video, Monitor, or Control), and are highly customizable.

5.1 Select an Item or Line

Before dragging, resizing, or editing an item or line, you must first select it. The selection process is different on the Video Tab than it is on Monitor & Control Tabs.

A selected item will have a red box around it with squares in each corner box. A selected line will turn green and have green squares on either end. These squares are referred to as 'handles'.
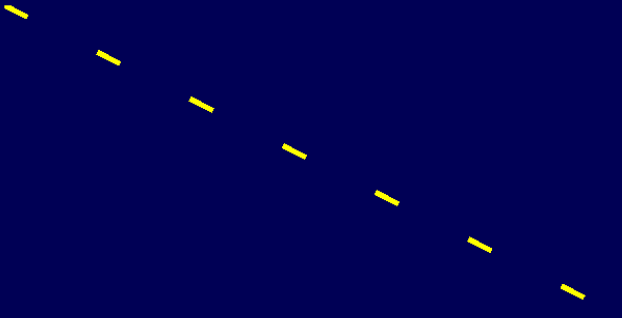
5.2 Drag & Resize

To drag/move an item or line, you must first touch to select it. Once the item or line is selected, press your finger anywhere on the item/line and then slide your finger to the desired location.

To resize an item or line, you must first touch to select it. Once the item or line is selected, press and hold your finger on one of the square handles on the edges. Slide your finger to resize item/line.

5.3 Edit Lines

To edit a line, you must first touch to select it. Once the line is selected, press the 'Edit' button to edit line characteristics including color, pattern, thickness, and transparency.
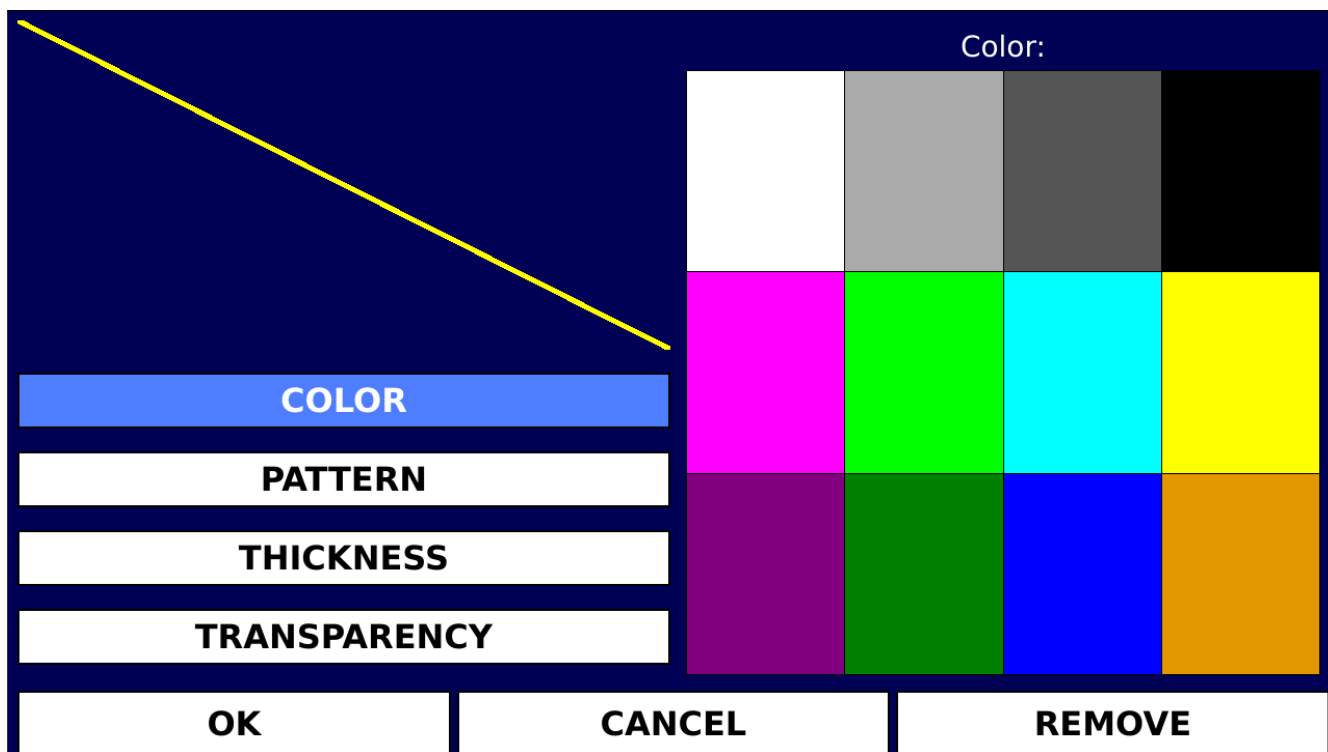
Color:

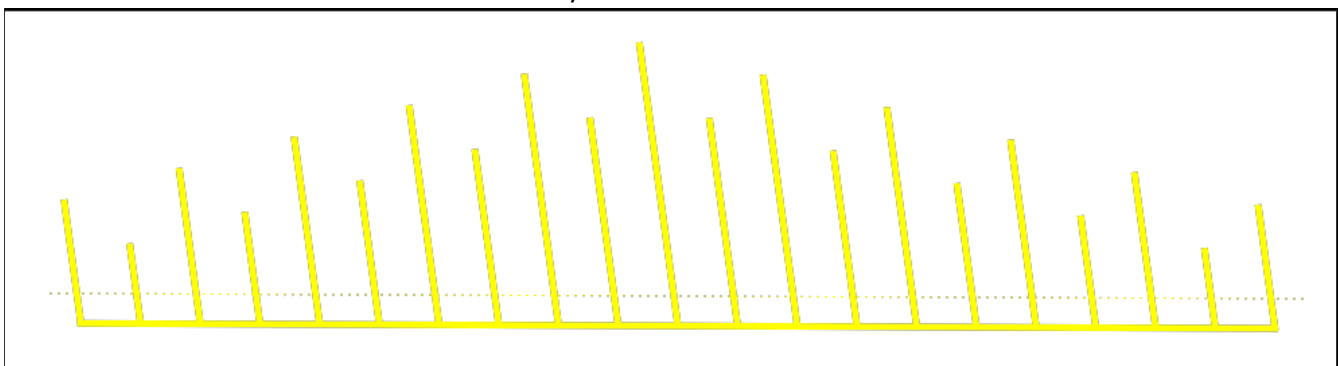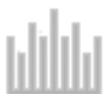| COLOR |
| PATTERN |
| THICKNESS |
| TRANSPARENCY |

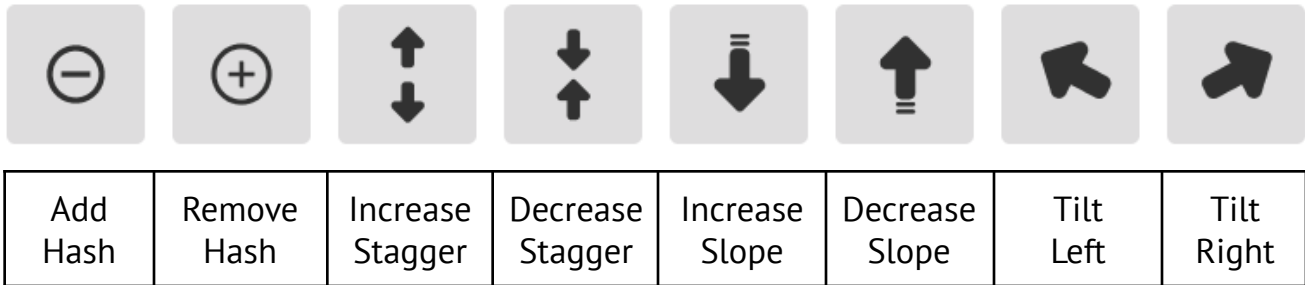| OK | CANCEL | REMOVE |

5.3.1 Hashed Lines

Hashed lines are frequently used to assist the driver while executing turns of varying sharpness. For example, if the radius is severe, align using a hash far from center. If the radius is shallow, use a hash close to center.

To create or edit a hashed line, select a line. There will be a hash icon next to the edit button. Press the hash icon.

Adjust the hash marks as desired. Start by adding hashes using the "Add Hash" button.

| Add Hash	Remove Hash	Increase Stagger	Decrease Stagger	Increase Slope	Decrease Slope	Tilt Left	Tilt Right

5.4 Edit Items

All non-line objects are called "items". Items include metrics, counters, tank levels, buttons, and functional widgets. They can be placed on any screen (Video, Monitor, or Control), and are highly customizable.

5.4.1   ITEM Tab

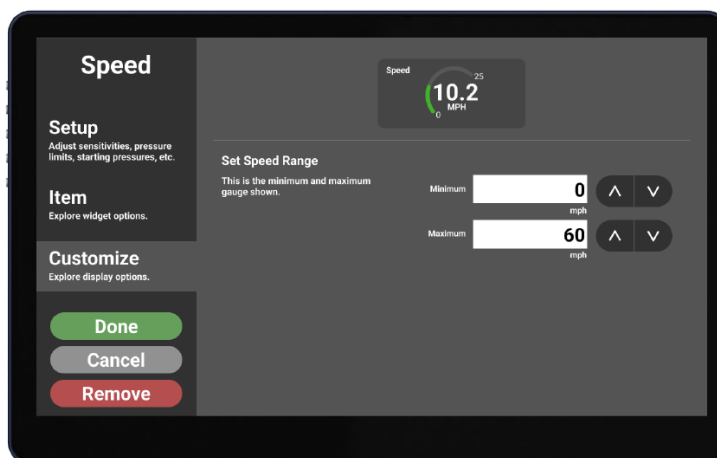The "ITEM" tab is the default tab. If needed, tap the "ITEM" tab at the top to begin.
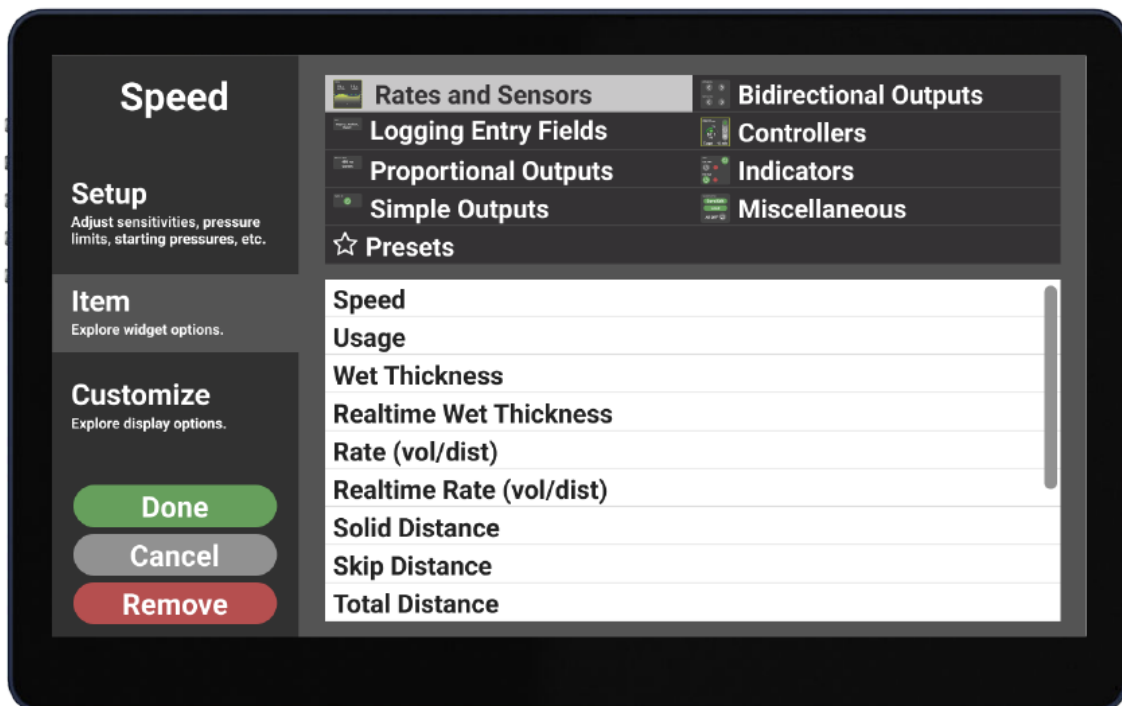
This tab is where you select the item to be shown. See <u>Item Categories</u> for a list of items.

5.4.2   STYLE Tab

Tap the "STYLE" tab to begin. Different items may have alternate display appearances.
Apply the desired appearance for this item by tapping on an appearance in the list.

APPEARANCE: Apply the desired appearance for this item by tapping on an appearance in the list. Some items are available as a Numeric Value or Bar Graph.

A Numeric item shows a reading in large digits, with the label above and units below.

Items showing tank weights or volume may be better presented as a Bar Graph to better portray relevant information (such as remaining amounts). A Bar Graph item shows a reading below a graph, with the label vertically oriented on the left and units vertically oriented on the right. The top and bottom points on the graph come from the Critical Limits (or the tank Capacity for Tank Gauge items). If the reading is outside of the set Warning or Critical Limits, the bar graph color will change to indicate.

COLOR: Select a color by tapping a color square on the right side of the screen. **TIP:** Yellow paint and white paint parameters are often colored respectively to make it easier to differentiate measurements on the screen.

LINE COLOR: Select a line color by tapping a color square on the right side of the screen. The line color outlines the text, and can be adjusted to make the text easily visible given varying colors of background video.

LINE THICKNESS: The text outline can be made as thin as a single pixel, or thick enough to see given any background.
Tap the "THINNER" button to incrementally make the outline thinner.
Tap the "THICKER" button to incrementally make the outline thicker.

ALIGNMENT: Text within the frame of the item can be left, center, or right aligned.

OPACITY: Scroll the opacity bar to make the selected item darker (more opaque) or lighter (more transparent) as it overlays the video.

When you are done modifying the item, tap "OK" to save and return to the main screen, or "Cancel" to not make changes.

Tap "Remove" to remove this item from the screen.

5.4.3   LIMITS Tab

Tap the "LIMITS" tab to change limits. Use the "+" and "-" buttons to change target value.
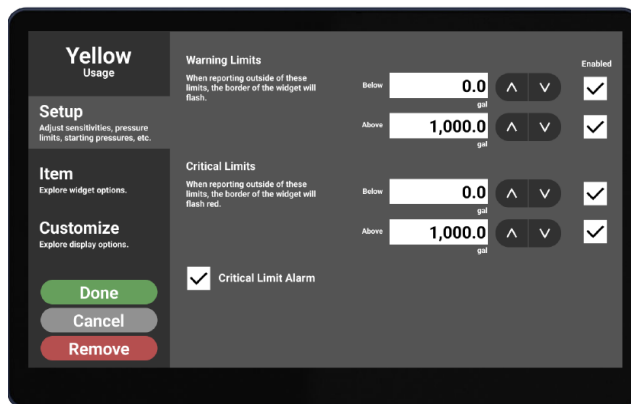
WARNING LIMITS: If an item exceeds the warning limits that are set for it, it will cause the item to flash yellow (Monitor & Control Tabs) or blink (Video Tab). This helps the operator know when a specification is approaching an allowable operating range. Set WARNING LIMITS to 0 to

disable flashing.

CRITICAL LIMITS: If an item goes out of the bounds set by the CRITICAL LIMITS, it will cause the item to flash red on the main video screen. This helps the operator know that a specification is outside of operating range, and that immediate corrective action must be taken. Set CRITICAL LIMITS to 0 to disable flashing.

CRITICAL LIMIT ALARM: A "Critical Limit Alarm" creates an alarm pop-up whenever a critical limit is exceeded. This is used in cases where equipment may be damaged if operation continues, and is not recommended for most items. **WARNING:** This alarm pop-up requires operator approval, and will block all other screens (including video).

CONFIGURE TANKS: *See Configure Tanks*

USE AS TANK GAUGE: When displaying paint usage as a bar graph, the operator has the option to "USE AS TANK GAUGE". This inverts the usage to estimate the amount in a tank. Set tank/tote capacity in *Configure Tanks*. Pump counter usage is then subtracted from the tank/tote capacity to give an estimate of remaining material.

When you are done modifying the item, tap "OK" to save and return to the main screen, or "Cancel" to not make changes.

Tap "Remove" to remove this item from the screen.

5.5 Fine Tune

To make smaller adjustments to lines or items, tap on the Fine Tune Controls button once an item has been selected.
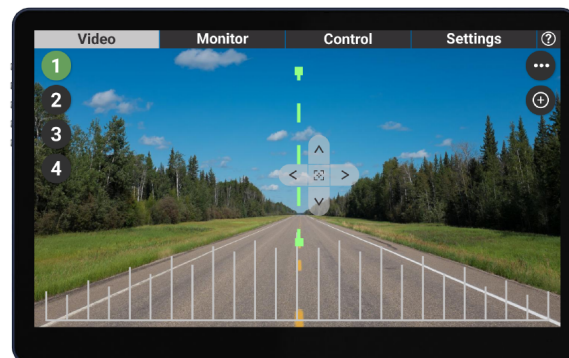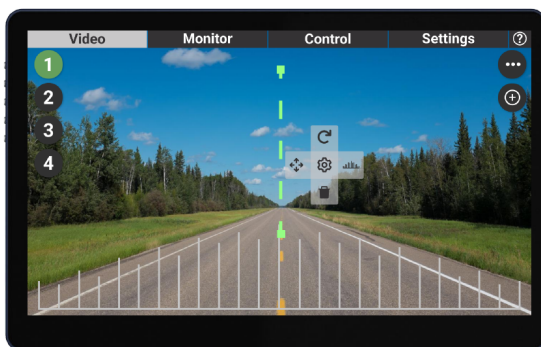
Up, Down, Left, and Right arrows move the line in small increments.

The Left Circle Arrow and Right Circle Arrow rotate the line in small increments.

The Inward Arrows shrink the line length, and the Outward Arrows expand the line.

Disable these buttons by tapping on the Fine Tune Controls button again.

5.6 Item Categories
5.6.1 Rates and Sensors

This category provides monitoring items from sensors, vehicle productivity, and application rate calculations to provide situational awareness to the operators. This assists the crew in producing high quality road markings that meet all application specifications.

In addition to simple application rate calculations, the HDVO / DL-18 also provides RealTime application rates. These RealTime application rates immediately respond to operational changes (speed, number of guns on, etc.), allowing the crew to quickly make corrective decisions to operational situation changes.

 Available Rates and Sensor items are described below.

Speed
- **Truck Speed:** The current speed of the truck.

Paint Usage/Rate/Footage
- **Yellow/White/Black Usage:** The material volume that has been dispensed.
- **Yellow/White/Black Wet Thickness:** The wet mil thickness calculated on the road, based on line width, volume used, and distance painted.
- **Yellow/White/Black RealTime Wet Thickness:** The RealTime wet mil thickness, based on line width, volume used, distance painted. Weighted for recent usage and speed.
- **Yellow/White/Black Rate (vol/dist):** The amount of gallons used per distance (e.g., gallons per mile).
- **Yellow/White/Black RealTime Rate (vol/dist):** The amount of gallons used per distance (e.g., gallons per mile). Weighted for recent usage and speed.
- **Yellow/White/Black Solid Distance:** The distance of solid pattern for a given material color.
- **Yellow/White/Black Skip Distance:** The distance of skip pattern for a given material color.
- **Yellow/White/Black Total Distance:** The total distance (skip and solid

combined) for a given material color.

Bead Usage/Rates
Bead usages and rates will appear for each bead tank on the vehicle.
- **Beads Weight:** Current weight of material in the tank.
- **Beads Usage:** Material used since the last time distance/pump counter channels were cleared.
- **Beads Rate (wt/vol):** Bead application rate in weight per unit material volume (e.g., pounds per gallon).
- **RealTime Beads Rate (wt/vol):** Bead application rate in weight per unit material volume (e.g., pounds per gallon) adjusted for recent usage and speed.
- **Beads Rate (wt/dist):** Bead application rate in weight per unit distance (e.g., pounds per mile).
- **RealTime Beads Rate (wt/dist):** Bead application rate in weight per unit distance (e.g., pounds per mile), adjusted for recent usage and speed.
- **Beads Rate (wt/area):** Bead application rate in weight per area (e.g., pounds per 100 square feet).
- **RealTime Beads Rate (wt/area):** Bead application rate in weight per area (e.g., pounds per 100 square feet), adjusted for recent usage and speed.

Temperatures
- **Air Temp:** Ambient air temperature.
- **Road Temp:** Surface temperature of the road.
- **Humidity (%):** Relative humidity, in percent.
- **Dew Point:** Dew point, calculated using temperature and relative humidity.

Analog Sensors
- **Pressures:** Provides information about operating pressures, such as hydraulic, pneumatic, tank, line, or other pressures on the truck.
- **Other Sensors:** Any other sensors can be added that provide industry standard 4-20mA or 0-5V signals.

Analog sensors provide information as an electronic readout that would otherwise require significant plumbing, panel fabrication, and gauges. Since this information is digitized, it can also be logged.

In order for these sensors to work properly, sensor calibration range settings are required. Under the "Edit Item" menu, tap the "CAL Tab".

Digital Sensors
- **RPM:** Detects RPM of auxiliary equipment on the vehicle.

- **Other Sensors:** Frequency, pulse counting, counters, and other methods of processing pulses and level signals can be sensed and reported to the operator.

Thermocouple Sensors
- **Yellow/White/Black Tank Temp:** Temperatures of material at the tank.
- **Yellow/White/Black Line Temp:** Temperatures at some point in the line. This sensor is often placed at the material heat exchanger.
- **Glycol Temp:** For systems that use glycol as a material heat source, this temperature can also be monitored.

5.6.2   Logging Entry Fields
See Logging & Reporting for more information.

5.6.3   Proportional Outputs
Proportional Outputs are control items that manage pressures or proportional valves. These require entering the calibration range of the control device.

A Proportional Output item will show the current target setpoint. Tap on the item to bring up the change setpoint controls.

Use the UP and DOWN arrows to set the proportional setpoint. The setpoint cannot go higher or lower than the calibration range for this item. Tap again anywhere outside of this item to remove the setpoint controls and item highlighting.
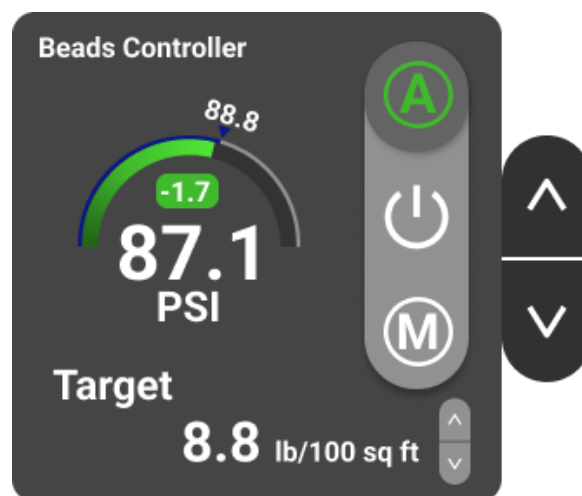
5.6.4   Simple Outputs

Simple outputs control, as the name implies, simple on/off load outputs. These are often used for:

- **Lights:** Work lights, safety lights, strobes, etc.
- **Valves:** Material valves, pneumatic actuators, carriage controls, pointer bar controls.
- **Camera Power:** Camera +12V power.
- **Other:** Any other load that simply needs to be turned on or off.

To turn on a simple output control, tap the button icon.
The output is engaged when the icon is green, and disengaged when it is gray.
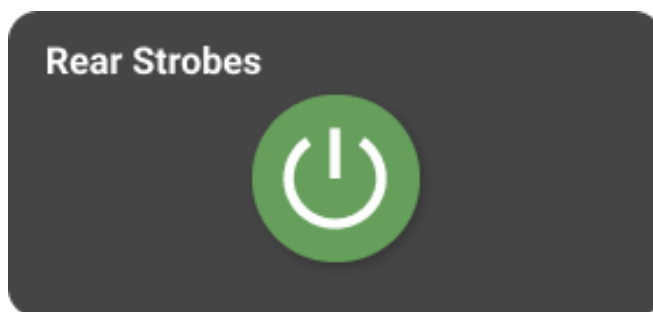

5.6.5   Bidirectional Outputs

Bidirectional outputs control linear motors, hydraulics, or other actuators that have a directional component to them. This often includes:

- **Camera In/Out:** Moves the camera linear actuator in and out.
- **Gun Raisers:** Raise and lower guns.
- **Sign Board:** Raises and lowers message board.
- **Other:** Any other bidirectional load.

Move a load in a particular direction by tapping on the arrow in the direction you want it to move.

Left Camera
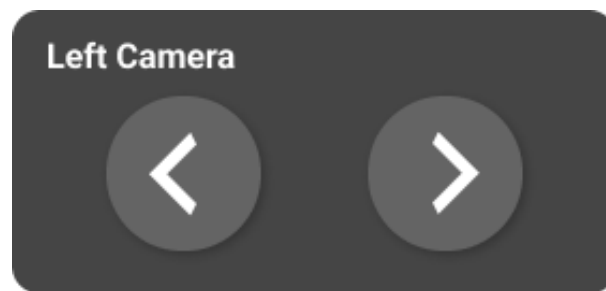
5.6.6   Controllers

These controllers provide the interface for advanced control features, such as hysteresis tank pressure controllers, thermostat controls, bead application rate controls, paint application rate controls, and more. These features typically utilize one or more calculations, sensor inputs, and control outputs to manage a process.

Controllers are available on a per SC-12 system basis, and are documented separately. For further information, refer to other documentation received with your SC-12 system.

The most common controllers are:
- **Bead Rate:** Automatically adjusts bead tank pressure to meet target application rate.
- **Paint Rate:** Automatically adjusts paint tank or pump pressure to meet target application rate.
- **Temperature:** Thermostats for material and glycol temperatures.
- **Hysteresis:** Used to keep tank pressures within a specified range.

5.6.7   Indicators

Indicator items are digital equivalents of panel indicator lights. Common error signals, such as temperature and pressure limits, can be detected by an SC-12 system and reported on the HDVO / DL-18.

Indicators are lit bright red when active, and dim when inactive.
The image below is an inactive indicator.

5.6.8 Miscellaneous

Other items can be found in the Miscellaneous category, including report printing and operating values buttons.

Operating Values Button (See Below)

Weather App
All co

Video Display (Picture-in-Picture)
All co

5.7 CAL Tab

Analog sensors provide information as an electronic readout that would otherwise require significant plumbing, panel fabrication, and gauges. Since this information is digitized, it can also be logged.

Enter the Low range of calibration range, and the High end of calibration range. These numbers should come from the sensor specifications, and is often written on the sensor itself.
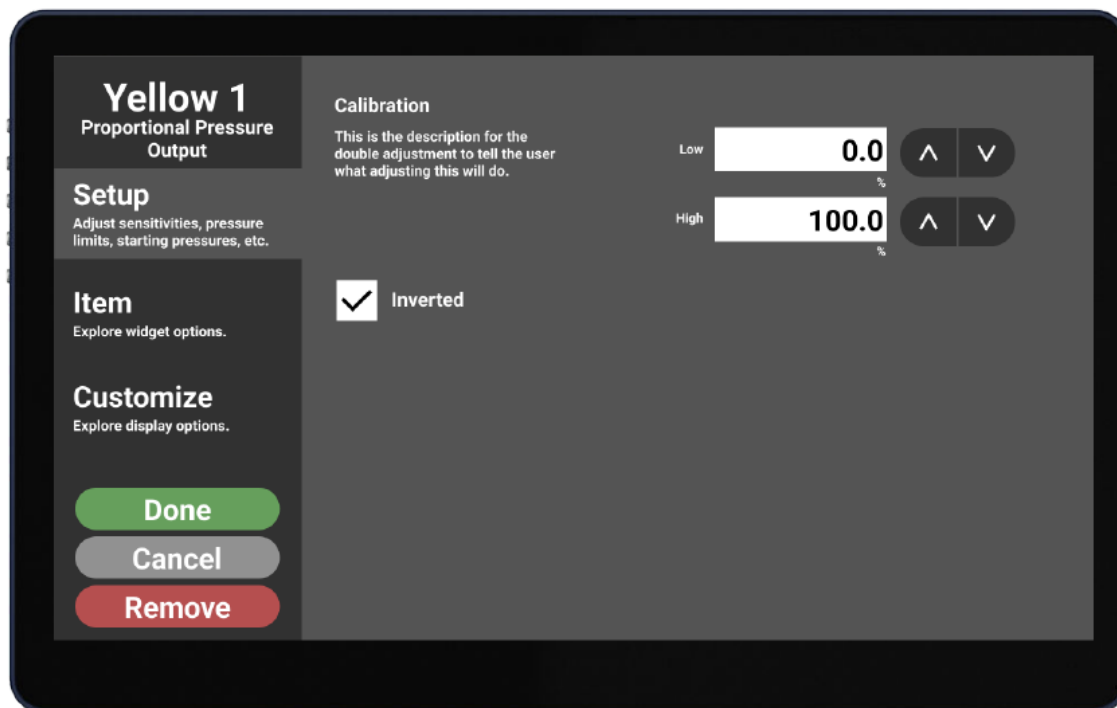
Note: These are NOT operating values. If you are using a 0-3000PSI pressure transducer, for example, but your system pressure maxes out 2000PSI, you will still use 0 as the minimum and 3000 as the maximum.

6. Video Tab

The Video Tab was designed for lines and items to be overlaid on top of video feeds. It operates differently than Monitor and Control Tabs.

6.1 Selecting Video Channel

Touching the screen will bring up the lower options bar. Click on one of the buttons labeled "1" to "4" to select that respective video input channel.

6.2 Selecting Items & Lines

Touching the screen will bring up the lower options bar. Select 'ITEMS' or 'LINES" to be able manipulate overlaid items or lines. Click and item to highlight it. You may now drag, resize or edit items & lines.

Note that when 'ITEMS' is selected on the bottom options bar, items such as buttons or Job Name that have a function will no longer interact. Select 'OFF' for

the lower options bar to regain normal item functionality.

6.3 Options
Touching the screen will bring up the lower options bar. Select 'Options' to pull up Video Tab options.

Add/remove overlay line
Select '+' to add a new line to the screen. The line edit options will pop up, allowing you to customize the line.

Add/remove overlay item
Select '+' to add a new item to the screen. The item edit options will pop up, allowing you to select item type and customize the item.

Distinct overlay on each video channel
Check this to have a unique line & item overlay for each video channel. For example, you may like yellow metrics displayed on the centerline camera on input 1, but you like white metrics displayed on the edgeline camera on input 2.

**Change to video channel 4 in reverse**
Check this to automatically flip to input 4 whenever a reverse signal is present. Requires SC-12 Control System with a +12V input on Pin L.

Black and white video
Changes color video to grayscale for low-light or poor line quality conditions. It may, at times, be easier to see residual lines in grayscale when retracing.

Mirror video channel
Horizontally flips the video input, which may be helpful to some when looking at a backup camera feed.
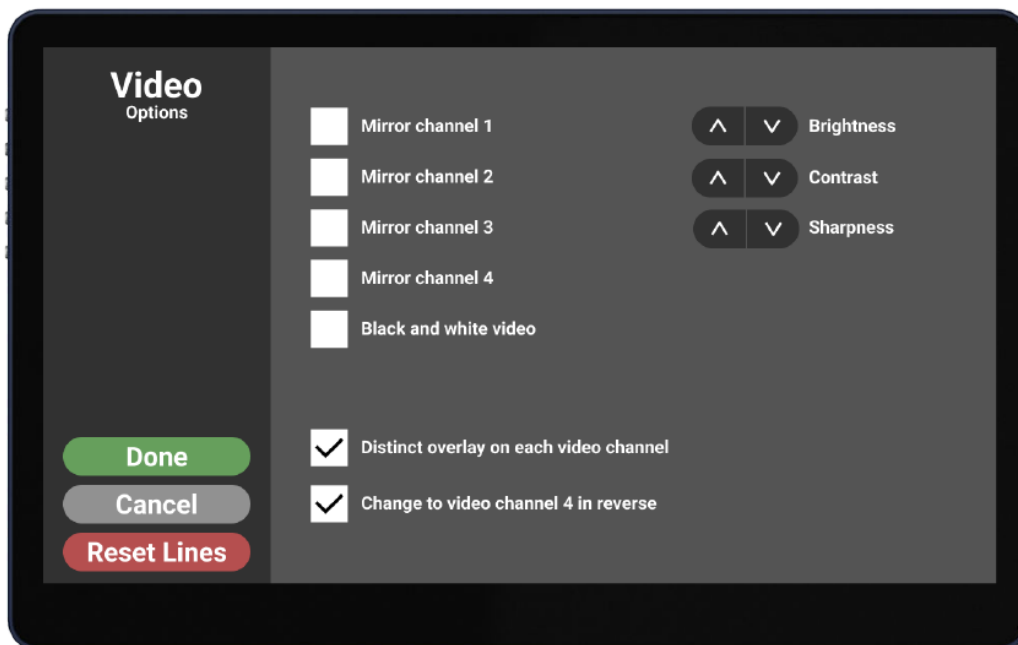
6.3.1   VIDEO OPTIONS

Several video options can be configured to ensure an optimal viewing experience. Notice that the live video feed in the background automatically changes to reflect these settings as they are adjusted.

Brightness
Brightness manually adjusts the total brightness of the picture. Use as needed to improve picture quality.

Contrast
Contrast manually adjusts the contrast level in the picture. Use as needed to improve picture quality.

Sharpness
Sharpness can improve the ability to distinguish small, distant features in the video picture, at the expense of a worse overall video quality.

6.3.2   RESET LINES & ITEMS

Selecting this will reset all lines and items to their originally provided settings.
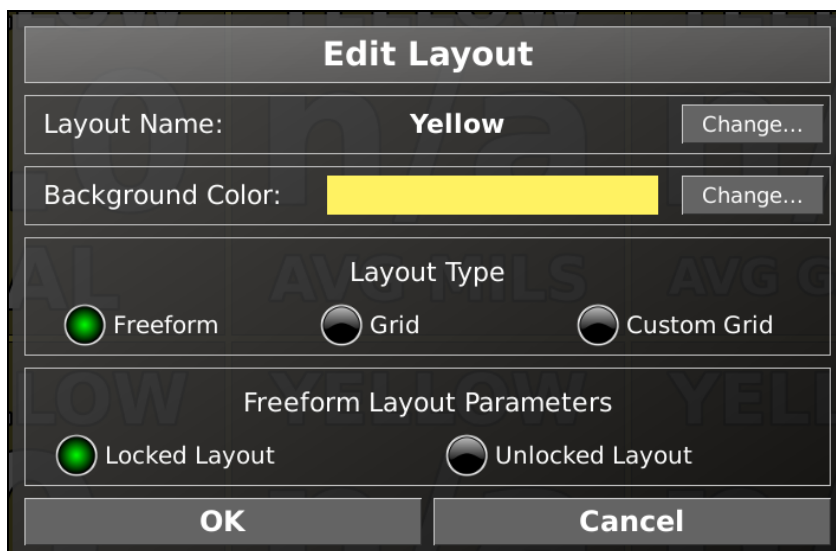
7. Monitor & Control Tabs

7.1 Layout Types

Choosing between the different layout types in the "Edit Layout" window will convert the existing screen layout from its old type to the selected type once the "OK" button is tapped. The conversion processes will generally try to preserve the old screen layout, but may rearrange some displayed items. Layout types include freeform, grid, and custom grid.

Freeform Layouts

Freeform layouts allows a "free" arrangement of items and controls, and without a limit on the number of displayed items allowed. Freeform layouts can be "locked" or "unlocked." When locked, the items in the layout react operationally – buttons can be tapped, values can be scrolled up and down, etc. When unlocked, the items in the layout can be manually shifted and resized. A "freeform" layout allows moving displayed items and individually resizing them to any desired rectangular shape. Tap an area not covered by a widget to bring up the "Freeform Layout Options" menu, which allows locking or unlocking the layout, and adding displayed items.

To add a display widget item to a Freeform layout, tap anywhere on the screen that doesn't have a display widget covering it, then select the "Add Item" option.

Grid Layouts

Grid layouts have a fixed number of rows and columns with uniform size. You can change the number of columns and rows of a grid layout in the "Edit Layout" window, but if you remove rows or columns, the items in the last row or column

will be removed.

A Grid Layout has equally-sized rows and columns. Change the number of rows and columns in the Grid Layout Parameters section of the Edit Layout screen.

To add a display widget item to a Grid or Custom Grid, tap in the upper left quadrant of the widget area. When the progress circle completes its animation, the item selection screen will appear.

Custom Grid Layouts

Custom grid layouts are similar to normal grid layouts, but allow each column and row to have custom widths and heights.

Custom grid layouts have a fixed number of rows, but the rows do not have to be the same size. The number of columns for each row is variable, and the columns can likewise be dissimilar. To change the number of rows, you select one of the numbered buttons to the left of the table of values that appears at the bottom of the "Edit Layout" window. To change the maximum number of columns for any row, you select one of the numbered buttons above the table of values.

To change the size proportions of the different rows, tap once on one of the values below the "Row % Size" header. This will bring up a set of up and down arrows that can be used to scroll the value up or down. Making a value smaller will increase the size of the smallest of any other rows. Making a value larger will decrease the size of the highest-numbered row that is not at its minimum. It is therefore usually best to start at the row numbered "1" and proceed in numerical order to set the size of each row. The minimum size for a row is 15%.

You can manually scroll a column size percentage to zero, which removes a column from the row. Otherwise, column changes work the same way as row changes. Once a column is set to zero, however, no automatic changes will be made to it by scrolling the sizes of other columns.

7.2 Selecting Items

Before dragging, resizing, or editing an item you must first select it. You may only select an item if the layout is unlocked in Freeform Layout. You cannot select an item for dragging and resizing in a Grid Layout.

To Unlock Layout & Select Item in a Freeform Layout (Default):

Option 1:
    1. Tap in a blank space on the screen. A dialogue box will pop up:

Freeform Layout Options

Add Item

Unlock Layout

Cancel
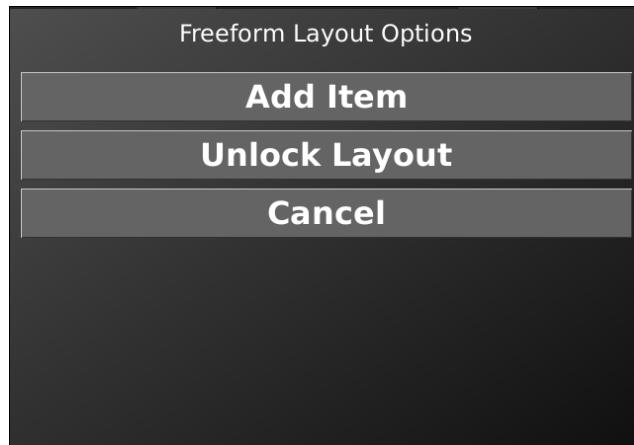
2. Select Unlock Layout. The layout is now unlocked
3. Tap the item you wish to edit, resize, or drag. The item will become selected.

A selected item will have a red box around it with squares in each corner box. These squares are referred to as 'handles'.

Option 2:

Navigate to the Edit Layout dialogue box and choose the Unlocked Layout in Freeform Layout Parameters. This will temporarily unlock the layout, and may be useful if there's too many items on the screen to find a black space to tap as in Option 1. To find the Edit Layout box, you must first enter the Configure Tab Bar by holding your finder on the Item Tab.

7.2.1 Enter Edit Screen

From a selected state in Freeform Layout hold your finger on an item for 4 seconds while the spinner loads to enter the Edit screen:
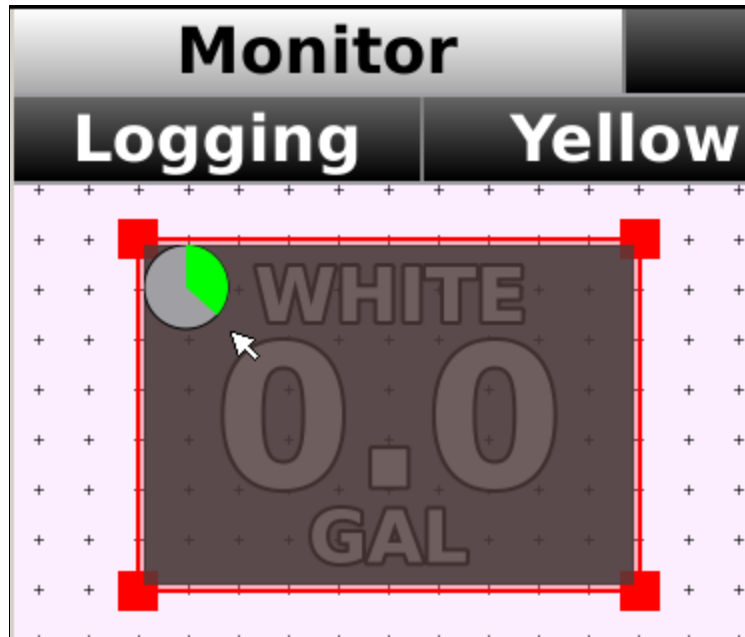
From a Grid Layout, simply hold your finger for 4 seconds on an item while the spinner loads to enter the Edit screen. The item need not be unlocked:

7.3 Configure Tab Bar

Pressing and holding on a tab that isn't in the main tab bar of the system will bring up a "Configure Tab Bar" dialog window with several options for moving tabs and editing their associated screen layouts. Simply press and hold a sub-menu tab and after a brief pause, a green circle animation will appear in the corner. Once the green circle animation completes, the "Configure Tab Bar" dialog window will appear.

Note: The selected tab (still showing in the background) has blue text to indicate that it is the selected tab

The "Configure Tab Bar" dialog window is broken into three sections. The top section contains movement arrows for changing the position of a tab on the screen. The middle section contains buttons that add a new tab on either side of the selected tab. The bottom section has two buttons: one for deleting a tab, and another for editing the selected tab and its item layout.

7.3.1 Moving Tabs

At the top of the Configure Tab Bar dialog window, you'll find arrows for moving tab positions both horizontally, and vertically among different tab levels. Tap the left or right arrow to shift a tab to the left or right on the same level of a tab bar. Tap the up arrow to move the selected tab into the tab level above it. If the selected tab is the only tab in its level, it will replace the highlighted tab above it when it is moved up.

Note: A tab cannot be moved into the topmost (main) tab bar of the system.

7.3.2 Inserting New Tabs

The middle section of the "Configure Tab Bar" dialog window has two buttons: one inserts a new tab before the tab that was tapped, the other inserts a new tab after it. Tap a tab insert button to create a new tab and item layout. Inserting a new tab creates a blank layout for the new tab, ready for adding display widgets (items).

7.3.3 Deleting a Tab

Unneeded tabs can be removed. If the currently selected tab has sub-levels beneath it, the current tab and all sub-levels will be removed as well. Tab removal can not be undone, so make sure you are certain the tab is not wanted. The last remaining tab in a level cannot be removed, but can be moved up. Tap the "Delete Tab" button to remove the currently selected tab (and all sub-tabs). A confirmation screen will appear.

7.3.4   Tab Editing

The "Edit Layout" menu allows you to change the name, background color, layout type, and layout parameters for a tab layout. Tap the "Edit Layout" button to open the Edit Layout menu.

Layout Name: This changes the tab label. Tap the "Change..." button next to "Layout Name" to change the current layout name. Use the on-screen keyboard to enter a new name, then tap "OK" to save it.

Note: Tapping the "Edit Layout" button when configuring a tab that has sub-level tabs beneath it allows you to change only the name of the tab.

Background Color: Tap the "Change..." button next to "Background Color" to change the background color. A color selection window will appear. Tap anywhere in the color map or the brightness slider to change the currently selected color.

Layout Type: The "Layout Type" section allows you to change the layout type. Parameters and layout type descriptions can be found in the section below.

7.3.5   Logging Tab

DL-18's are pre-populated with a Logging Tab. See Logging & Reporting for more information.

8. Setup Tab

Some HDVO / DL-18 units can be configured with advanced features, depending on features purchased with the unit. These features are commonly required to configure Glass Cockpit features.

Please note that configurations may vary widely, so your setup screen options may differ significantly from the one you view. Contact your OEM or Skip-Line for more information if you desire features that are not presently available on your system.

8.1 Reset to Factory Setup

Resetting to Factory Setup will remove all tab customizations, monitoring limits, advanced control calibrations, and video overlay item and line setups.

Tap on the "Reset to Factory Setup" button in the setup menu to reset to factory

setup.

Tap "Reset" to approve resetting all limits, or "Cancel" to return without the setting reset.

<table>
<tr><td>⚠️
Important!</td><td>**WARNING**: This can not be reversed. All customizations will be lost and need to be reconfigured. Make sure you want to do this before proceeding.</td></tr>
</table>

8.2 Factory Settings

Factory settings refer to settings that should only change due to hardware or physical changes made to the vehicle.

The "Gun Widths and Colors" and "Calibration Numbers" screens are available on HDVO / DL-18 units with both CAN and RS485 data sources, however "Gun Delays" and "Gun Offset" menus are only available when used with an SC-12 system.

8.2.1 Gun Widths and Colors (SM-5 Only)

The SM-5 Control system does not share Gun Widths and Colors. Gun Widths and Colors are important elements to correct data logging application rate calculations. For example, the Wet Film Thickness calculation is determined using volume of paint and painted surface area for a given paint color. If the Gun Width or Gun Color is incorrect, the surface area of those guns will not be calculated correctly, causing erroneous results.

Note: You MUST update Gun Widths and Colors when changing a gun color or gun width on an SM-5 Control System.

Tap on "Gun Widths and Colors" to enter the Gun Widths and Colors menu.

Each gun line on your system has its own row in the table. Guns are separated between Left and Right sides of the truck.

Use the double arrow buttons to scroll in 2.0" increments. Use the single arrow buttons to scroll in 0.05" increments.

Color options are limited to pump inputs available on your skip timer system. Gun switches that are used for auxiliary purposes, and do not actually apply material, should be set to "None".

Note that gun lines with changes are highlighted red.

Tap OK to save, or Cancel to quit without saving.

A confirmation screen will appear to confirm your choice if you are saving or discarding changes.

8.2.2   Date and Time

Set the current date, time, and time zone. This will affect data logging records.

It is important that you set the correct time zone on DL-18 Data Logging Systems.

Please enter the correct date and time.
When you're finished, press OK to continue.

Date:

Year	Month	Day
2019 ▼	July ▼	22 ▼

Time:

Hour	Minute	Second	AM/PM	
3 ▼ :	42 ▼ :	13 ▼	PM ▼	PDT

Time Zone

US/Pacific ▼

OK

8.2.3   Logging Parameters

Please set proper logging configuration parameters.
When you're finished, press OK to continue.

Truck ID	Extra GPS Point Interval
CVO_SKLTEST	Disabled ▼
Truck Name	Logging Interval
SKLTEST	200 feet ▼
Scale Units	✅ Live Stream
Pounds ▼	
Logger Address	
Glass Cockpit #1 ▼	

WARNING: Please contact Skip-Line and check antennas before changing the Logger Address.

OK

Truck Name: Displays the Skip-Line profile name for support purposes.

Scale Units: It is important to set the scale units. This tells the logging system whether the scalehead was calibrated in imperial units or metric units. If the scale head is in pounds, leave this value as pounds. If the scale was in kilograms, specify it here.

Note: Even with scale that's calibrated in pounds and has the correct logging interval, metric usage can be displayed.

Logger Address: Establishes the logger when multiple units are available.

When both a DL-18 and HDVO have been purchased, we allow the logger responsibilities to be moved to HDVO's for both redundancy and convenience.

In the example above, Glass Cockpit #1 is the primary logger.

For more information about establishing the primary logger, see Change DL-18

Address

Extra GPS Point: Increases the frequency of GPS points attached to painting data.

Logging Interval: Logging interval defaults to 200 feet, but can be changed. The following intervals are available: 25 ft, 50 ft, 100 ft, 200 ft, 10 meters, 25 meters, and 50 meters. Skip-Line doesn't recommend that users do really fine intervals unless they have a specific need. Bead calculations won't work very well with small intervals, and larger segmenting intervals don't need the smaller intervals in the first place.

Live Stream: Logger HDVOs will now periodically transmit real-time data if "Live Stream" is enabled in the logging config screen. Additional functionality coming soon.

8.3 System Diagnostics

System Diagnostics vary widely from one system to the next. This screen will usually be used in conjunction with product support assistance from your OEM or Skip-Line. Refer to additional documentation included with your HDVO / DL-18, or call your OEM or Skip-Line for further assistance.

8.3.1 Start Logging (CAN Log)

See CAN Logging

8.3.2 Detected Devices

View all devices on the network. Some devices, when selected, will display information that may be helpful for diagnosing an issue. If no additional devices are detected, there is likely an issue with the HDVO / DL-18 CAN communication (CAT5 cable).

Analog Input: These device banks will display raw sensor readings as an uncalibrated percentage. This is very helpful for testing/troubleshooting pressure transducers.

Analog Output: These device banks will display raw outputs as a percentage. This is very helpful for testing/troubleshooting pressure transducers.

Thermocouple Input: These device banks will display current temperature readings for each thermocouple. This is useful for troubleshooting potential thermocouple connection or sensor issues.

Opto-isolated Input: These device banks will display current opto readings for each input. Depending on mode, this will either display On/Off or a reading value.

High-side/Low-side Driver: These device banks will display current on/off state for each output, and will display a special icon if the output is currently shorted.

Front/Rear Hub: These device pages show bus voltage, shunt voltage, current, and power for each port of the hub. It will also show a count of undervolt events, overvolt events, bus resets, and transmit and receive errors. Values on this page are color-coded, with grey values indicating no connection is detected on a port, and values in yellow indicating a damaged hub port. These values are invaluable for troubleshooting connection and electrical problems on the bus.

Switch Handler: These device pages show a switch test screen, which displays the currently-detected position of every switch on this switch board. This is useful to help troubleshoot any switch problems.

Other Devices: All devices will also display serial number, program ID, and version information. This information may be needed by technical support when troubleshooting an issue with a device.

8.4 Configure Tanks

Set tank/tote capacities on this screen for display purposes when viewing tanks/totes on a bar graph. This setting is for accurately displaying the levels for materials. Enter the maximum amount the tank or tote will hold (may be in volume or weight). Bead tanks will show current weight compared to capacity. Paint tanks show an estimate calculated by subtracting usage from capacity.

Refill on Counter Clears
Checking this box will reset the tank level to full capacity upon a counter channel clear. Only check this if you clear channels after refilling subject tanks (not recommended, as yellow and white are rarely depleted at the same time).

See Paint Tank Gauge for more information.

8.5 Manage Help Documents

Select this menu to import or remove help documents. Tap on the "Manage Help Documents" button in the setup menu to begin. The available documents are shown in the main list. To permanently remove a document from the HDVO / DL-18 help document list, tap on the "Delete..." button. A confirmation screen will appear. Tap "OK" to confirm the deletion. To import a new file from a USB drive, start by inserting a USB drive containing a PDF to import. The PDF should be on the root level folder. Tap on the "Import..." button after the USB drive has been inserted. The HDVO / DL-18 will let you know it is scanning the USB drive for importable PDF documents. The HDVO / DL-18 will show PDF documents that have been found. Tap on each document you would like to import. WARNING: Do not remove power while importing documents. Tap cancel prior to removing power if the process is taking too long.

The import progress screen will return to the manage documents page when done.

NOTE: To speed up viewing performance, the HDVO / DL-18 must convert the PDF document to an internally usable format. Importing can take a long time.

8.6 Operating Value Sets

All control settings, including pressures, lights, actuators, temperatures, and other settings can be saved and restored. This allows the vehicle to be set up for various operating conditions, and can be restored to any of those operating conditions without resorting to human memory and significant operator entry.

This menu can be entered by using the "Setup" menu, or by using the "Operating Value Button" from user customizable tabs.

If the intent is to save an operating value set, make sure the values of all controls are already set prior to entering the menu, since the current status of the controls are what will be saved to file.

Operating Values Button
All control settings, including pressures, lights, actuators, temperatures, and other settings can be saved and restored. This allows the vehicle to be set up for various operating conditions, and can be restored to any of those operating conditions without resorting to human memory and significant operator entry.

This menu can be entered by using the "Setup" menu, or by using the "Operating Value Button" item in the Item Category "Miscellaneous".

The Operating Values button can save and load operating value sets.
To shut off all loads controlled by the HDVO / DL-18, tap "ALL OFF".

If the intent is to save an operating value set, make sure the values of all controls are already set prior to entering the menu, since the current status of the controls are what will be saved.

9. Logging & Reporting

The DL-18 is continuously logging all painting data (from a control system) and peripheral inputs (from sensors). The DL-18 does not need to be started / engaged, and will work seamlessly in the background.

The logging feature requires less interaction than expected, leading some to believe they don't understand it or are missing something.

Here are the most critical elements to accurate data logging:

- Proper calibration
  - Pump calibration (pump strokes or flow meters)

- ○ Distance calibration
- ○ Bead scale calibration
- ○ Peripheral sensor calibration (pressure transducers)
- ○ Date/Time and Time Zone
- Job Name
- Choosing a Reporting Method

## 9.1 Date and Time

It is important that the DL-18 unit has the correct time, date, and time zone entered for accurate logging. See Date & Time Setup for more information.

9.2 Logging Entry Fields

Logging Entry Fields are fields that the operator must select manually. They can be imported using a USB drive (see USB Capabilities).

- **Job Name:** This is the most critical field, as 'Job Name' is the primary entry field for sorting. It is HIGHLY recommended that crews utilize this field daily.
  - ○ Note that Job Names can be grouped into folders.
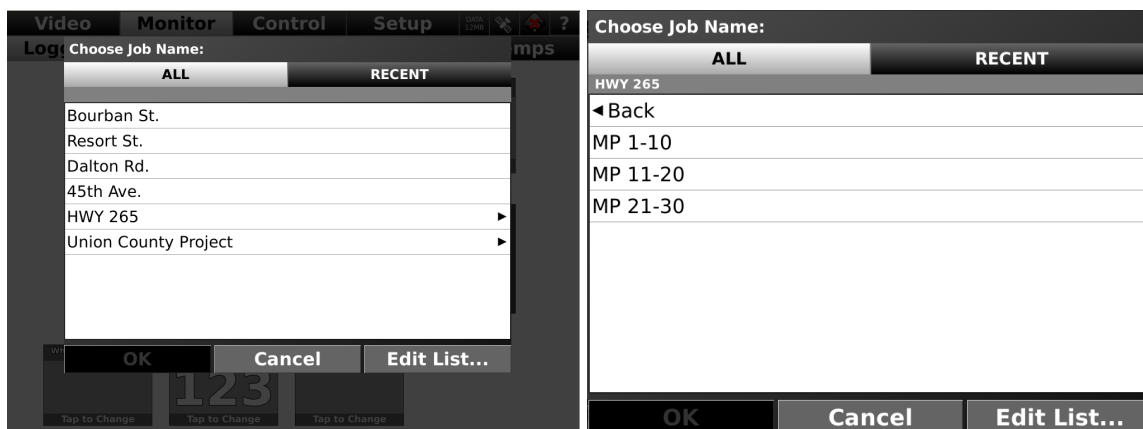
- **Project Name:** Spec-Rite Online has 'Project Name' sorting options. It will filter out 'Job Name' by a Project Name value. This field may be useful for large projects with numerous job sections.
- **Bead/Paint Batch Fields:** Commonly used for tracking when and where a batch has been applied. Useful for comparing products or in recall scenarios.
- **Bead/Paint Type Fields:** Usefully for tracking multiple types of products when both may be used on a project, such as Type I and Type III beads.
- **Comment:** Creates a time-stamped, GPS-stamped log. Can be used for making notes such as "gun tip clogged" or "blue Tundra violated mobile

work zone". These comments may be useful in tort/overspray claims.
- **Other Fields:** You may find a variety of other entry fields, which may be used in any fashion deemed appropriate, or just ignored.

9.3 WiFi Data Transmission

The DL-18 has an integrated WiFi module for automatic data transmission to Skip-Line servers. The DL-18 supports WPS Personal and WPA2 Personal encryption, with WPA-Enterprise to be added soon.

A WiFi hotspot must be available to establish a connection. You may consider a router in a shop or hotspotting a phone, but the ideal solution is a portable cellular MiFi device.

To connect to a WiFi hotspot, click the WiFi icon on the top right of the screen:
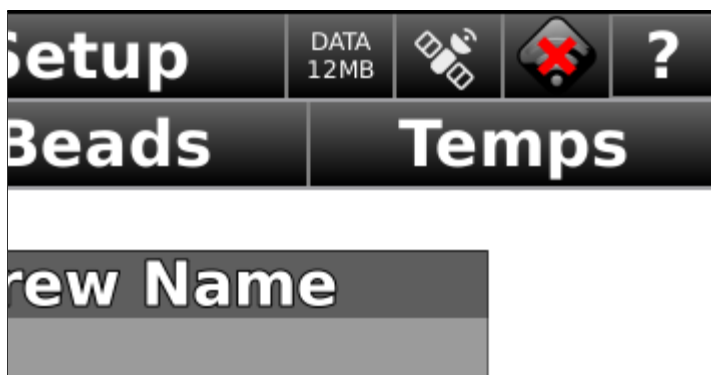
The Wireless Setup dialogue box will pop up:
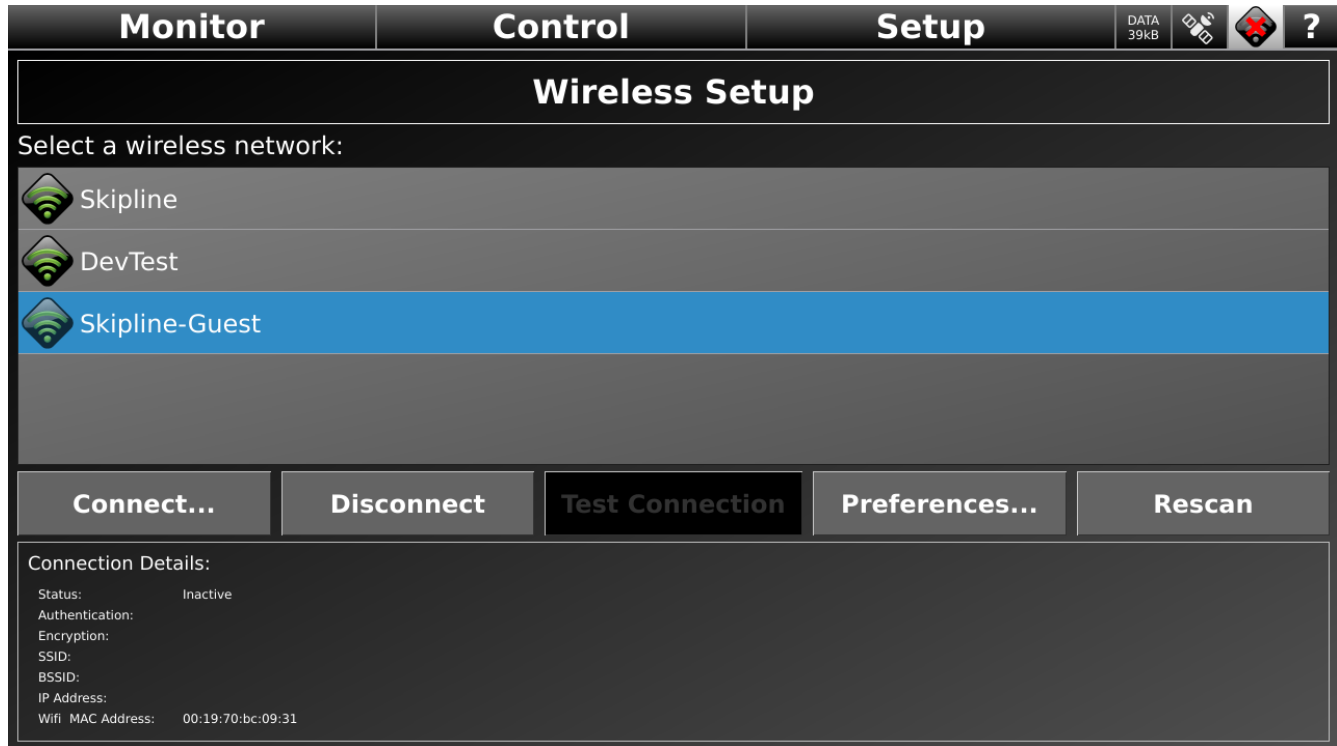
Select a network from the list and click 'Connect'.

> *Note: Make sure you enter a password, as it's easy to overlook this step.*

Important!

9.4 Reporting Options

One of the most critical decisions to make for useful data logging is deciding HOW you're going to use the information.

The DL-18 will collect large amounts of raw data. This raw data is nearly useless until it's been filtered into a consumable format. For raw data to become usable, there are four determinations to be made:

Time Period: You need to dictate how big of a time window to look at. Do you want the report to cover the current day, the 3rd week of June, or maybe the entire 2019 striping season?

Metrics: What metrics do you want a report to show? Total paint volume? Yellow paint distance? Average painting speed? The metrics are the columns of a spreadsheet.

Segmenting: Segmenting determines how we break down the report into sections. It's what the rows on a spreadsheet—the difference between one line and the next. It can be by distance, time, job name, or pattern change.

Delivery/Export: It must be determined how the report will be used. Do you want it on a printout? Saved to a pdf? Uploaded to an FTP server for GIS overlay?

9.4.1   Activity Report

The Activity Report button generates a "current activity report", which can be printed or saved to USB, and includes distance counters (separated by skip, solid, and total, per gun and per color), material usage, and wet film thickness. It

includes data since the last counter channel clear on the timer/control system. It is recommended that counter channels be cleared at least daily, as the AVG application rate items average since the last counter channel clear.

Time: Since the last counter channel clear
Metrics: Pre-determined (Logging Entry Fields, Distance Counters, Material Usage, Calibration Values)
Segmenting: Single-line

Job Name: I-84 MP 261 to 263

Start Switch On Distance: 6514 ft

Gun	Solid Ft	Skip Ft
Gun 1 (Yellow 4.0")	4036	161
Gun 2 (Yellow 4.0")	2548	220
Subtotal	6584	381

Yellow Usage: 16.9 gals
Yellow App Rate: 11.7 mils*
Yellow Cal Number: 0.2250

Gun	Solid Ft	Skip Ft
Gun 3 (White 4.0")	593	0
Gun 4 (White 4.0")	2127	1
Subtotal	2720	1

White Usage: 7.7 gals
White App Rate: 13.5 mils*
White Cal Number: 0.2250

Footage Totals:
Solid Ft: 9304
Skip Ft: 382

Tank	Usage	Rates		
	lb	lb/gal	lb/mi	lb/100ft²
Beads 1	189	7.7	103.0	5.9

* Thickness calculation based on line widths shown.
All report items based on calibration numbers.
Verify calibration frequently to ensure correct reports.

Date/Time	Comment
6/12/2019 10:48 AM	Blue Tundra violated work zone

Print   Cancel   Tap to Change   Tap to Cha...   Save to USB

Activity Report

View

The Activity Report item is preloaded onto every DL-18 under the Monitor - Logging tab.

Tap the item to pull up the current Activity Report. You have the option to Save to USB or Print.

<table>
<tr><td>⚠️
Important!</td><td>*Clearing counter channels on the timer system will clear the Activity Report. Continuing to paint without clearing will cause the Activity Report values to change.*</td></tr>
</table>

9.4.2   Desktop/Vehicle Report Generator

The Report Generator Button launches the Desktop/Vehicle Report Generator. This Report Generator is available on all DL-18's, but can be requested for office use as well. It is not a full-supported option, as Spec-Rite Online is the far superior reporting tool.

- Time: Completely Customizable
- Metrics: Completely Customizable
- Segmenting: Completely Customizable
- Delivery/Export: Printout, Save to USB (PDF, xls, csv)

To add the Desktop/Vehicle Report Generator to an HDVO / DL-18 tab, you'll need to add the Report Generator Button found under Item Category - Miscellaneous - Reports.
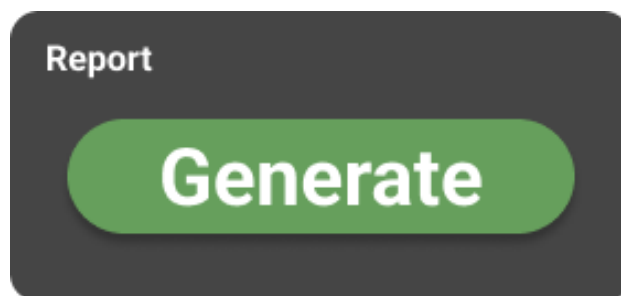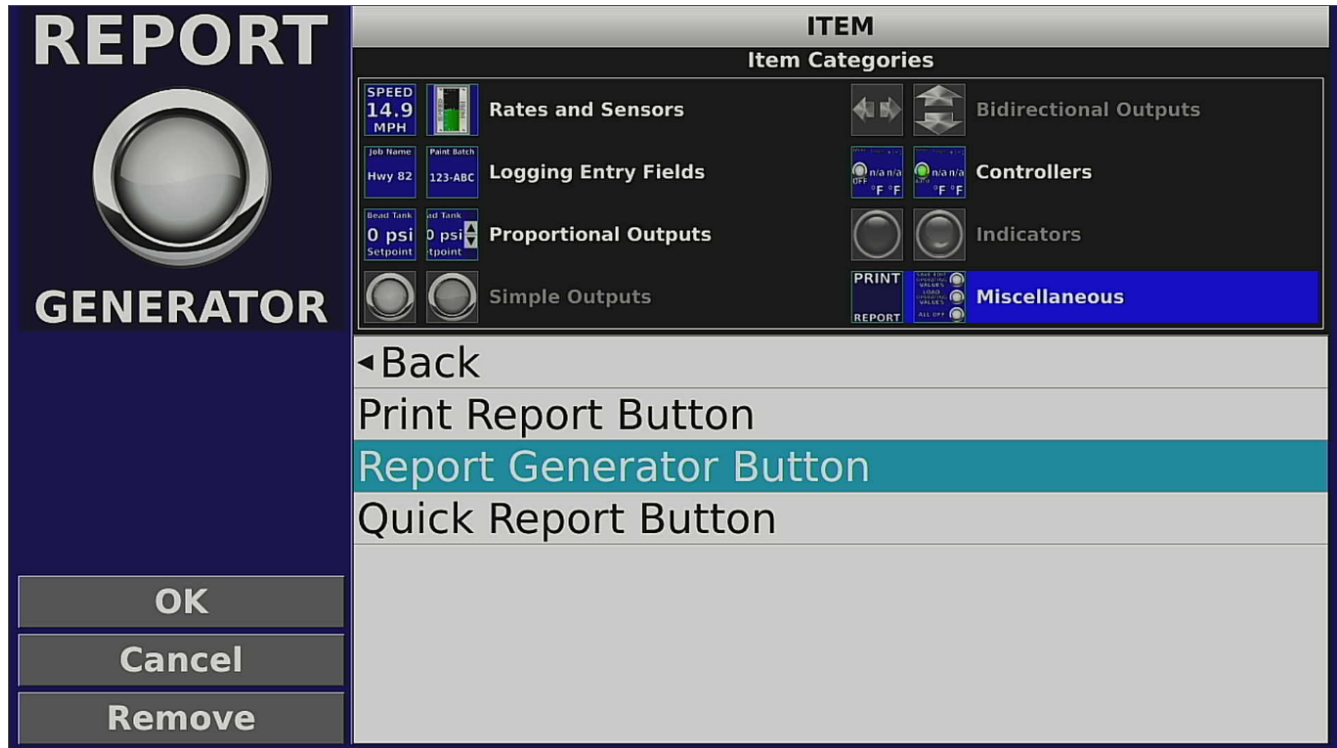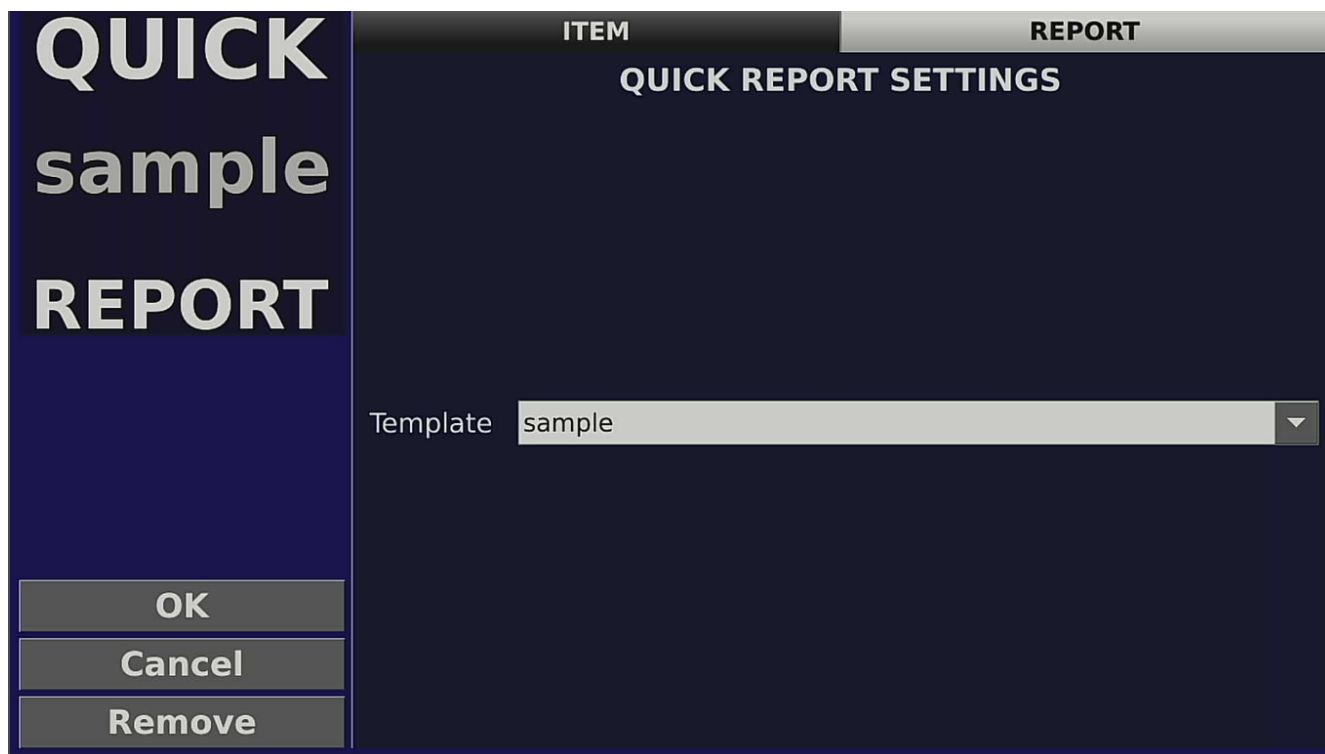
Quick Report- Users can run a custom "Quick Report" as a shortcut to the Desktop/Vehicle Report Generator. This shortcut applies a pre-selected template (found in the item settings) and prints the report for the current day only.

For the Quick Report to work:

- Printer must be connected
- Template must be set in Item Settings

9.4.3   Spec-Rite Online Markings Management Platform

Spec-Rite Online provides real-time information and data to help you manage

pavement markings. The system combines software and smart equipment to reduce waste and ensure quality and compliance.
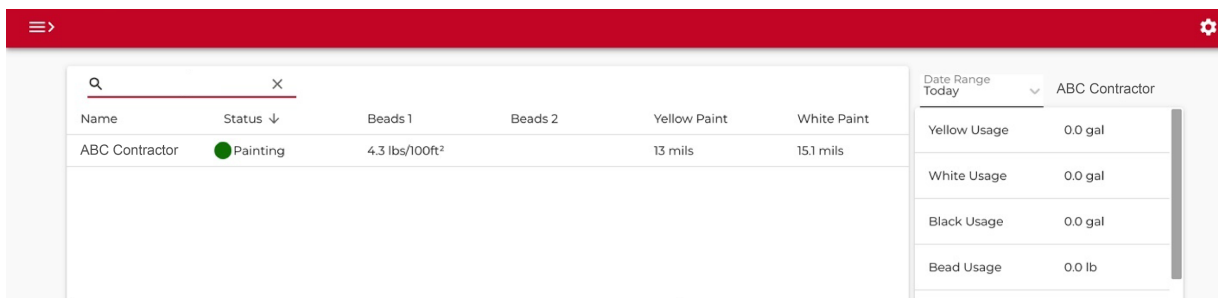
Spec-Rite Online seamlessly integrates your smart equipment on a single dashboard, combining data from Skip-Timers, retroreflectivity assessments, and third-party equipment to visualize your striping operation.

Spec-Rite Online is available in two subscription levels; Essentials Suite and Precision Suite. Each DL-18 purchase comes with Precision Suite. The Spec-Rite Precision Suite provides a comprehensive platform for complete marking management, taking your organization to the next level with increased performance and decreased waste.

Spec-Rite Online has four primary tools:
- Dashboard
  - View real-time application rates
  - Track fleet in real-time
- Sky-View
  - Visualize jobs on an interactive map
  - Query & Interact with data
- Reports
  - Export data in XLS, KML, Shapefile, Geojson
- Equipment
  - Access equipment telematics
  - Manage equipment fleet from a single location
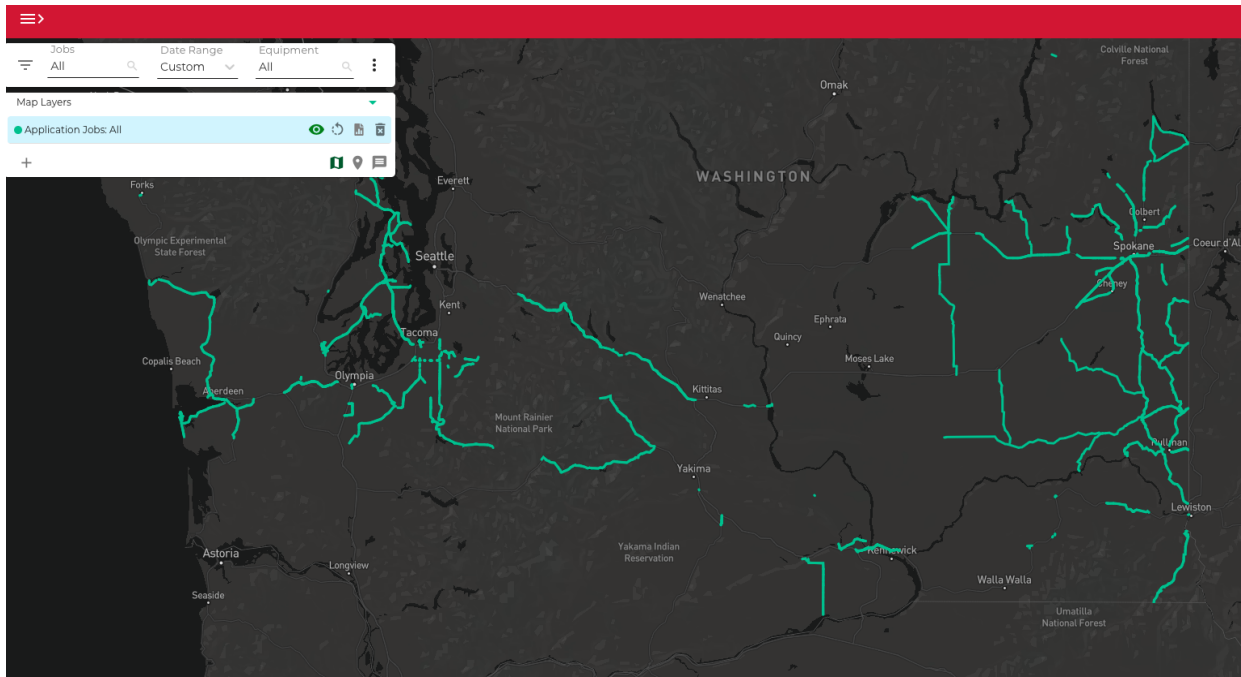
Please refer to the **Spec-Rite Online Manual** for additional information.

9.5 Printing Options

Skip-Line provides a Full-Sized Printer and a Paper Tape Printer option.

9.5.1 Full-Sized Printer

A full-sized printer (8.5" x 11" paper size) is available for multiple print options, such as:

- DL-18 Activity Report Printing
- DL-18 Desktop/Vehicle Report Generator or Quick Report

*Will not work with SC-12 or MST-14 counter channel printing

The paper uses standard office 8.5" x 11" paper.

Specifications:

- Model: HP® OfficeJet 200 Mobile Printer
- Recommended Paper size: 8.5 x 11 in
- Ink Cartridges: HP 62 Black Original Ink Cartridge
- Power: Requires 100 to 240 VAC via power inverter
- Power Consumption: 15 watts (Active)
- Dimensions (W X D X H) 14.3 x 7.32 x 2.70 in; 14.3 x 10.2 x 8.4 in (with input tray opened)
- Environment: 41°F to 104°F, 15 to 90% RH
- Communication: USB A to B cable connected to HDVO or DL-18

9.5.2   Paper-Tape Printer

A paper tape printer is available for multiple print options, such as:

- SC-12 Counter Channel Printing
- MST-14 Counter Channel Printing
- DL-18 Activity Report Printing
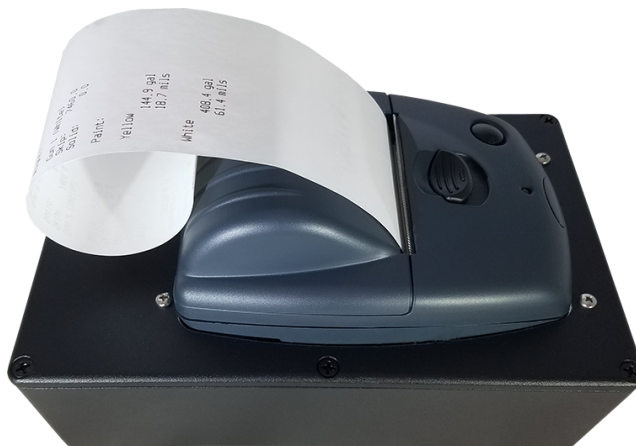
*Will not work with Desktop/Vehicle Report Generator or Quick Report

The paper uses thermal paper similar to a retail or restaurant receipt printer. Replacement paper can be found at many office supply stores.

Specifications:
- Model: CPR-212
- Recommended Paper size: 2 1/4 X 50' length
- Power: Requires +12V over Skip-Line supplied barrel jack connector. If on its own fuse, 3A recommended.
- Communication: Must be on Skip-Line CAN network via CAT5 cable and RJ45 connector. Note that CAN power is unused, so the paper tape printer may not light up BUS-012 Hub power LED.

10. USB Capabilities

A USB flash drive may be used in many helpful ways - included system updates, importing job lists, and more. It is important to use a FAT32-formatted drive. Most USB drives should work.

10.1 Remote USB System Updates

Using a USB Drive, an HDVO / DL-18 can be updated at any time. Find the most recent generic update with feature improvements and bug fixes at: https://skipline.com/hdvo-update/

There may be times that Skip-Line will send you a system-specific update to add capabilities or perform custom functions. For more information on the update process, see: *Appendix A: Glass Cockpit In-Field Software Updates*

10.2 USB Memory Drive Options

Inserting a USB drive into any one of the 4 USB ports will engage a pop-up dialog box.

Note: If an update is found in the form of an update.bin file, the update will automatically install. To utilize one of the capabilities listed below, you must not have an update on the USB drive.

This process is far inferior to using the automatic WiFi transmission capabilities.

10.2.1 Import Entry Field File

It is possible to import values for any Logging Entry Field on the DL-18. The system will recognize text (*.txt) files present on the USB drive in the root directory. This feature is very helpful for importing long job lists, or just pre-loading job assignments for a crew.

Each entry should be on its own line of a *.txt file. This name of the file is not relevant. On a Windows PC, using Notepad is the easiest way to create a *.txt file.

The following is an example of some Yellow Material Batch numbers that will be recorded and associated with their placement geographically. This information would be helpful in a material recall scenario, or when comparing products.
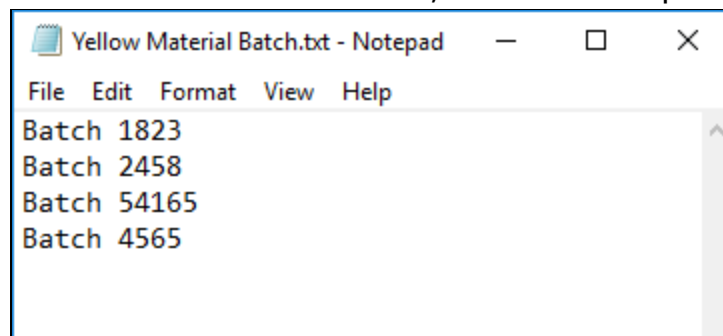
When importing Job Names, indenting (TAB button) will create a folder for grouping jobs. In the example below, importing the following will create a folder for 'HWY 265' and 'Union County Project' with job items inside them. On reports, the job name will include the folder name. For example, 'MP 1-10' in the 'HWY 265' folder will report as 'HWY 265 MP 1-10'.
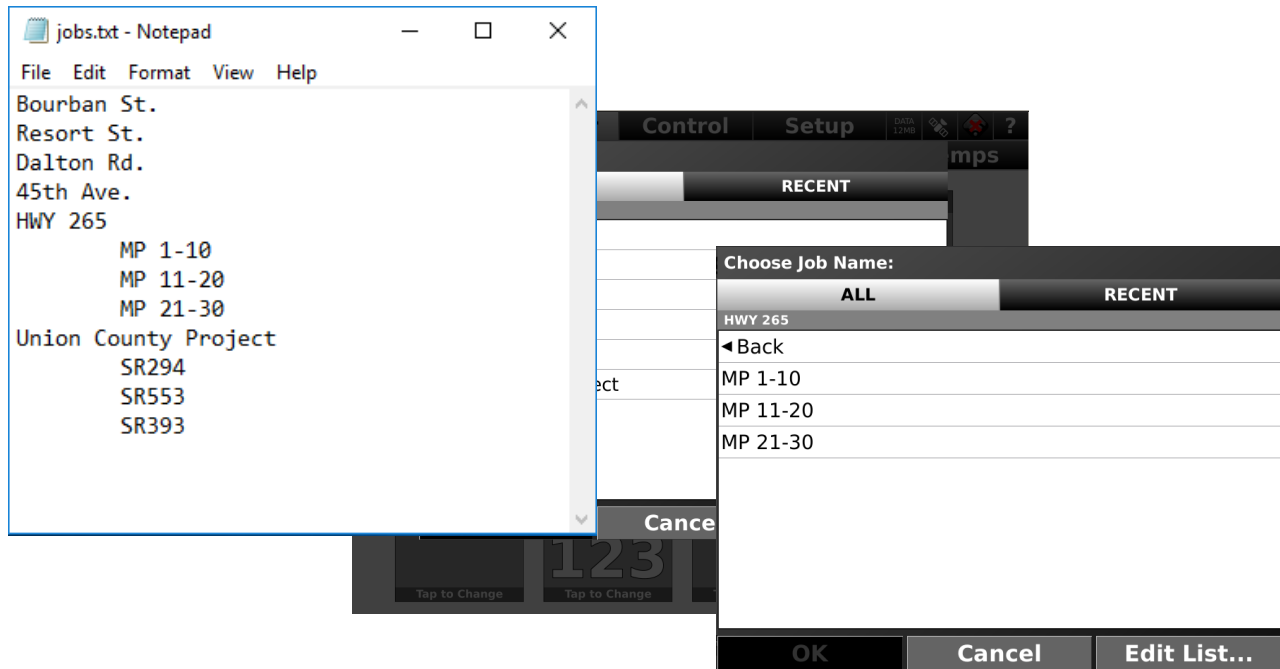
Select a *txt file to import from the left pane. You'll need to correctly choose the entry field value to assign it to on the bottom right pane under "Select where to import this file:".
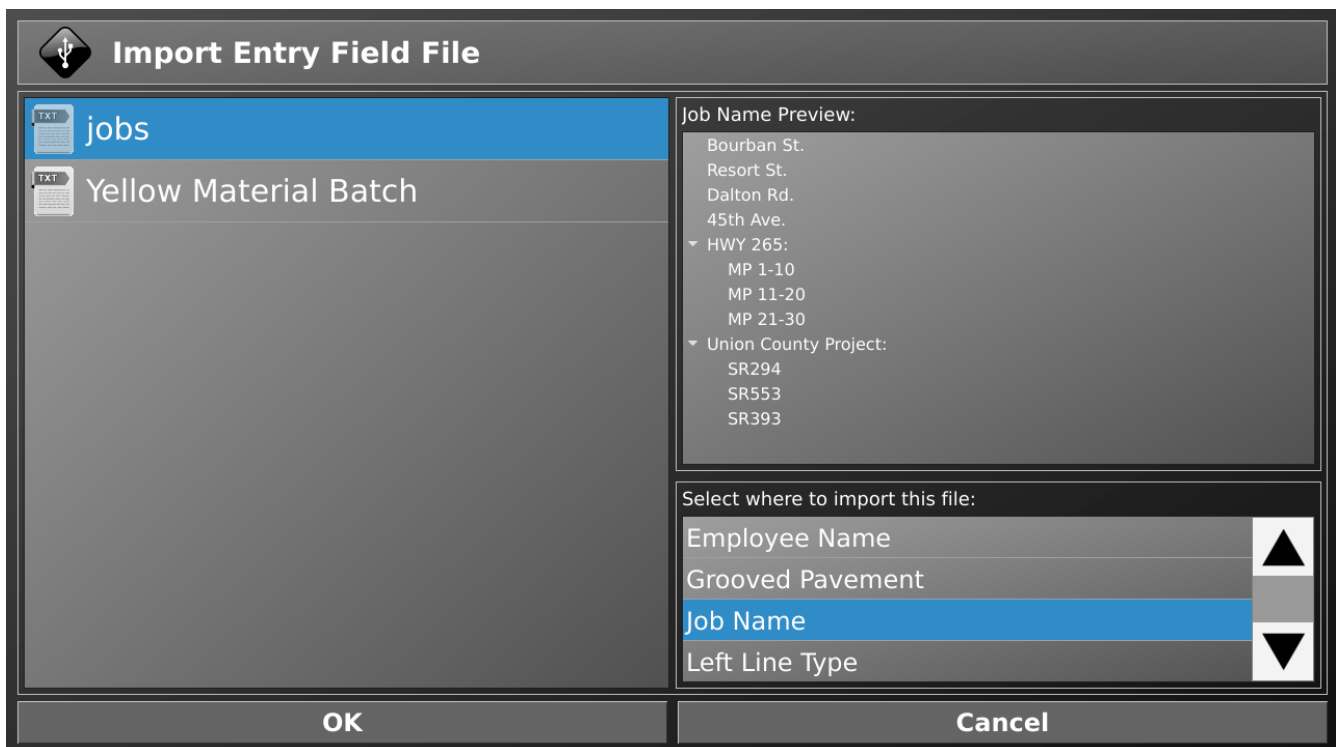
10.2.2 Export UI File

Exporting UI File saves the screen configurations. This includes lines, items, colors, tab names, and more. It does not save settings. Selecting this option saves the UI to the USB flash drive.

This is useful when working with multiple crews (day crew/night crew), or if the fleet has similar vehicles. An operator can save his or her preferred user interface.
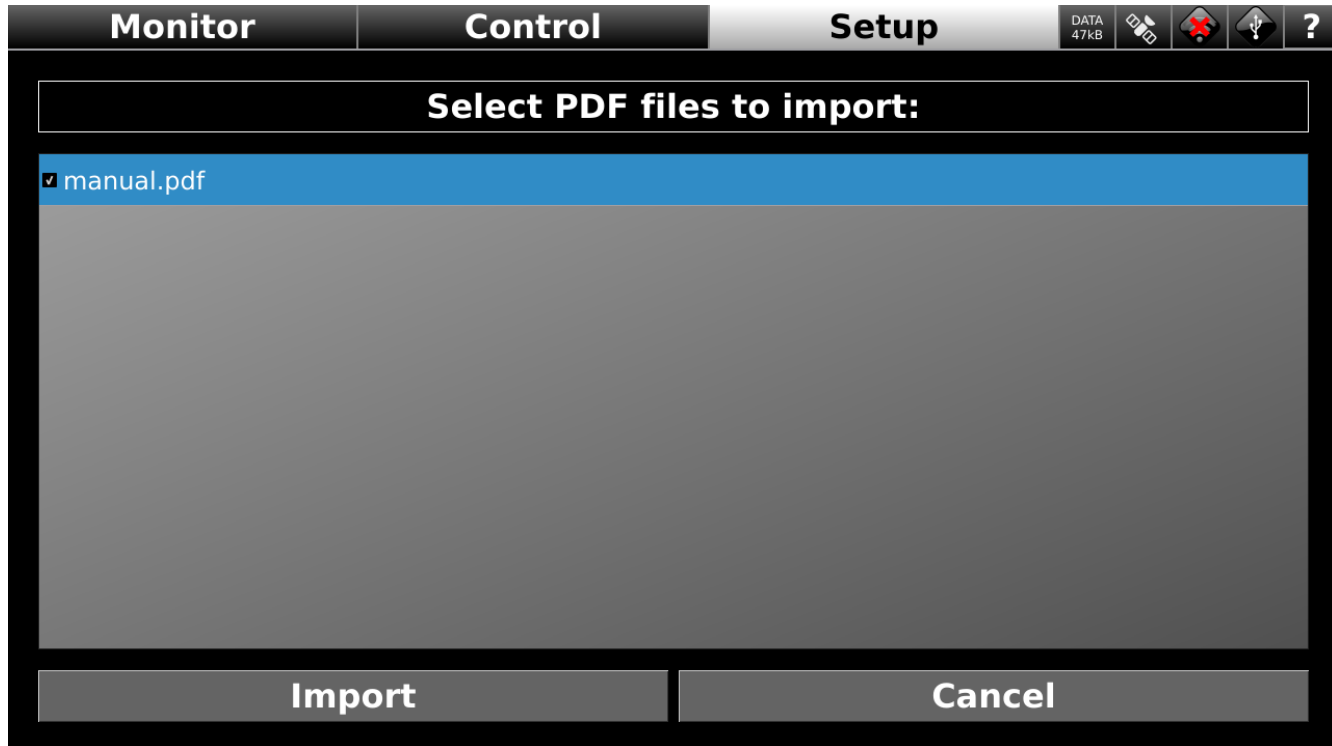
Additionally, an OEM may like to set an interface up in a certain manner.

10.2.3 Import UI File

Choosing this option will prompt the user to select a user interface file to load. The dialogue box will display all UI files on the USB drive (files ending in *sklUi). Simply select the UI you wish to load and choose 'OK'.
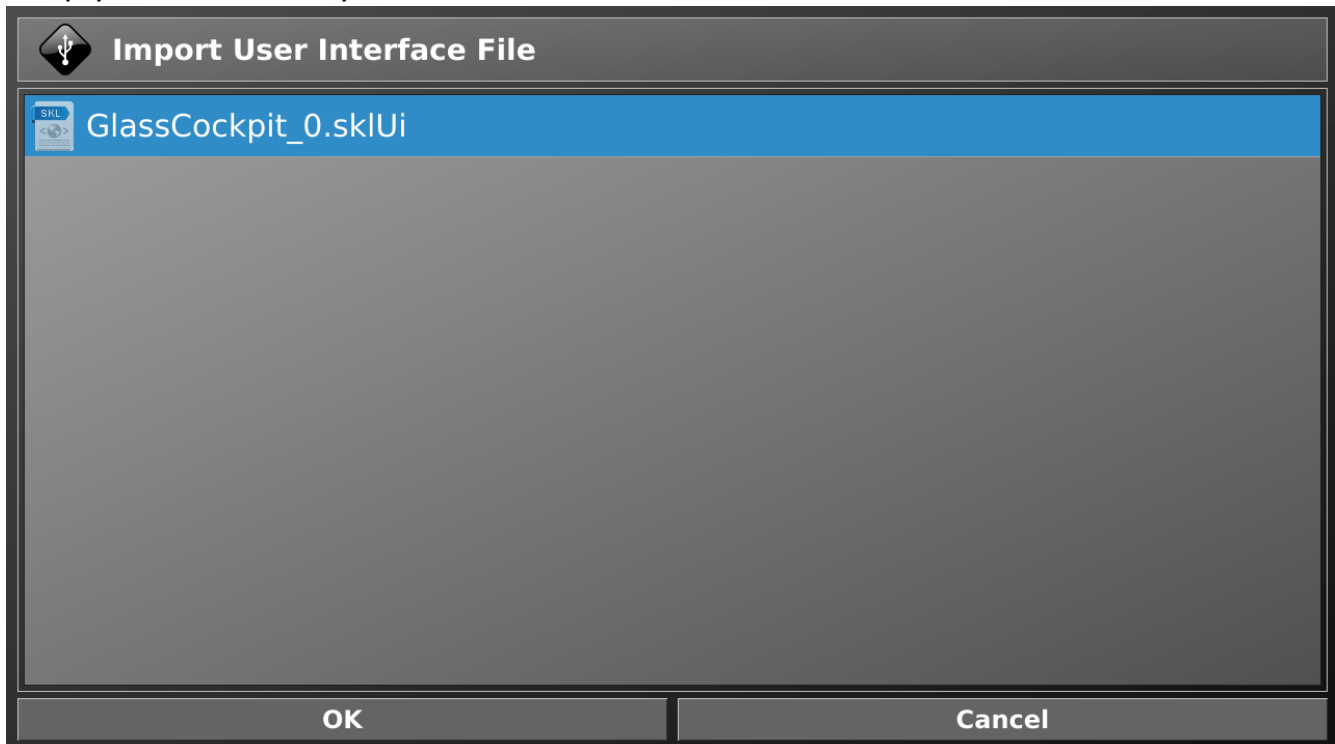
10.2.4 Import Help Files

10.3 USB Devices

Additional USB device support will be added over time.

Officially Supported Devices:
- Skip-Line Supplied Touch Monitors
- Skip-Line Supplied USB Camera
- Skip-Line Supplied HP Printer
- FAT32- Formatted USB Drives

Unofficially Supported Devices:
- Keyboards
- Multi-Monitors (touch input from multiple sources)
- Generic USB Cameras

11.   Troubleshooting & Help

11.1 On-Screen Help Documentation

The HDVO / DL-18 has on-screen help documentation available for all versions. In addition to skip timer and electronic manuals, common documents loaded into the

HDVO / DL-18 include manuals for other equipment on the vehicle, such as compressors, pumps, or applicators.

11.1.1   Opening Help Document Viewer

There is a "?" button on the top bar of every screen and can be tapped at any time to open the help document viewer to launch the general Help Document Viewer. When a line or item is being edited, the "?" will only be visible if there is context-specific help available for a special feature.

11.1.2   Viewing Help Documents

The Help Document Viewer provides access to the help documents that have been imported to the HDVO / DL-18. Most standard document viewing options are available, such as scrolling, zooming, and navigation.

Start by selecting a document to view from the list of loaded documents on the left hand side of the viewer.

Scroll the document by tapping and dragging on the document page.
Or, use the scroll bars to scroll.

Scroll bars may appear or disappear depending on zoom level.

To jump directly to a page number, use the page number entry box at the bottom left of the screen.

To scroll to different sections of the document quickly, tap and drag the page scroller bar on the bottom of the screen.

Tap the Fit Width "-" button to force the zoom level to fit the width of the document page.

Tap the Fit All "+" button to force the zoom level to fit the entire page (both height and width).

To manually control the zoom level, tap the Zoom In and Zoom Out buttons, which resemble a magnifying glass with a "-" (Zoom Out) or a "+" (Zoom In).

To scroll pages one at a time, tap the Page Up and Page Down buttons. These resemble a piece of paper with a folded edge and either an up arrow (Page Up) or a down arrow (Page Down).

11.2   Video and Overlay Troubleshooting

Issue	Resolutions
Video does not appear	• Check monitor power • Check monitor video cable • Check camera video cables • Check camera power • Make sure correct video input is selected
Touchscreen does not respond to screen presses	• Check USB cable is plugged in between monitor and HDVO / DL-18 • Check USB cable and connectors for damage
Touchscreen responds, but does not behave as expected	• Ensure USB cable has solid connection on both ends, and is not damaged. • Re-calibrate the touchscreen.

11.3   Power Troubleshooting

Issue	Resolutions
Power light solid, other 3 links blink together	• Failure to initialize processor, must be returned to Skip-Line
Power on barrel jack connector, no lights come on	• Confirm +12V and GND at barrel jack. Power supply failure, must be returned to Skip-Line
All 4 LED's on solid	• Check reset button - may be stuck

11.4   Change Logger Address

In the event that the primary logging unit needs to change (usually from a DL-18 to an HDVO), logging responsibility can be shifted in Logging Parameters on the Setup Tab.

Situational Examples:

- DL-18 unit damaged, needs to be sent in for repair
- HDVO location more conducive for mounting antennas

<table>
<tr>
<td>⚠
Important!</td>
<td>Note that antennas must be moved to the new logging unit..</td>
</tr>
</table>

Glass Cockpit #1 will be the primary logger address. Setting a unit to this address will cause it to take over logging responsibilities. If another unit already owns this address, you'll need to assign a different address to the previous logger before setting the new logger at Glass Cockpit #1.
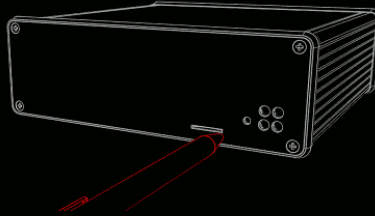
11.5   Recovery Mode

A failed/corrupt HDVO / DL-18 can nearly always be recovered as long as there's not failed hardware.

In the event of a catastrophic software failure, a Skip-Line representative may supply you with a recovery file. The generic HDVO update found at https://skipline.com/hdvo-update/ should also suffice for recovery. The recovery file must be placed on a USB drive in the root directory. Do not insert the USB drive into the HDVO / DL-18 until prompted.

To enter recovery mode, hold the recovery/calibration button while powering the unit on. Wait for this screen and follow the on-screen instructions:

Now entering recovery mode...

Please insert a USB drive containing a recovery file.

Note: This mode is entered by holding the recovery button on the front of the HDVO unit while powering on. If you did not intend to enter recovery mode, please release the button and restart the unit.

Appendix A: Glass Cockpit In-Field Software Updates

The **Glass Cockpi**t line can be updated in the field via USB flash drive, using program update files delivered via email or web download. This provides a quick and easy way to provide new features, functionality, or bug fixes remotely without vehicle downtime. There will only be one file, named **update.bin**. Follow this procedure to accomplish the update to the Glass Cockpit system.

*Note: In the case of multiple units on board, the update must be applied to **all** units separately.*

These instructions are for system specific updates that enable or change functionality. Generic system updates (bug fixes, feature improvements, etc.), can be found here:
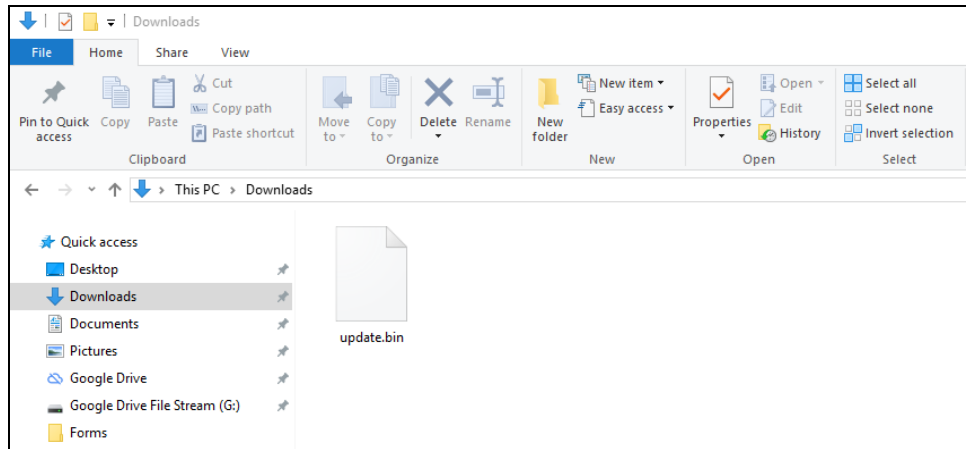
CVO-312 / DL-12: https://skipline.com/cvo-312-update-instructions/

HDVO / DL-18: https://skipline.com/hdvo-update/

Update Procedure:

1. From a PC, download *update.bin* files from the link supplied by Skip-Line.
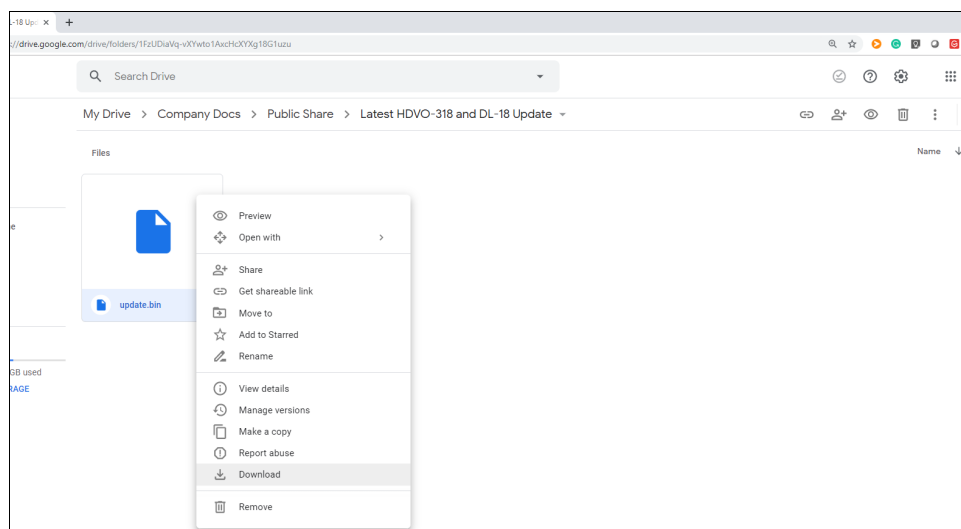
Note: Download will likely default to your Downloads folder

2. Copy or drag the update.bin file onto a USB drive. Make sure to not put the file into a sub-folder. Your system should have been supplied with a compatible (FAT32 formatted) USB drive. Most USB drives 32GB or less should work.
   a. Make sure the name is exactly **update.bin** and hasn't been renamed to something like update (1).bin
   b. File goes in the root directory. It does not go in a subfolder.
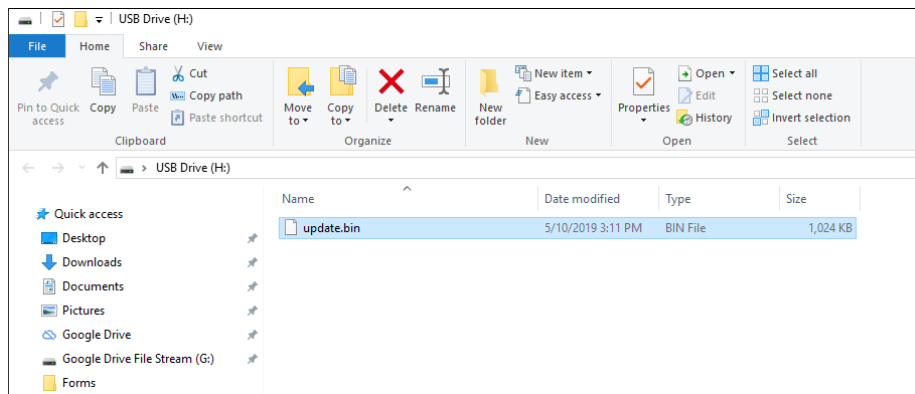
3. Close all file explorer windows. Properly eject the USB drive.
4. With the Glass Cockpit powered ON, insert the USB drive into one of the USB ports. You may need to unplug other USB devices to free up a port.

5. The unit should detect the USB drive, find the files, and commence with the update.
6. Once the Glass Cockpit update is complete, follow the onscreen instructions for removing the USB drive and rebooting. It will ask you to remove the USB drive, remove power for 60 seconds, and power the system back on.

The new software should now be installed on the Glass Cockpit system.

Update Troubleshooting

NOTHING HAPPENS: If the Glass Cockpit fails to recognize a USB drive at all, the drive is improperly formatted or does not have a partition table. Either reformat or try a different USB drive. Formatting should be FAT32, and the USB drive needs to have a partition table.

USB RECOGNIZED, DOESN'T UPDATE: If a dialogue box pops up, but the update does not commence, please check file name and directory. The file MUST be named update.bin and must be in the main folder (no subfolders).

Example of dialogue box:

	Update files are vehicle-specific, and cannot be used on other systems.
Update Note	*Make sure your OEM and/or Skip-Line has the correct serial numbers prior to requesting an update.*

Appendix B: Making a Communications Cable

Communications cables for the SC-12 system follow the EIA/TIA 568-B cable wiring standard. These are commonly referred to as Cat5, RJ45, or simply as a network patch cable.

A communications cable should be constructed using the following pin assignments on both ends of the cable.

- ➢ Pin 1 - white / orange stripe
- ➢ Pin 2 - orange
- ➢ Pin 3 - white / green stripe
- ➢ Pin 4 - blue
- ➢ Pin 5 - white / blue stripe
- ➢ Pin 6 - green
- ➢ Pin 7 - white / brown stripe
- ➢ Pin 8 - brown
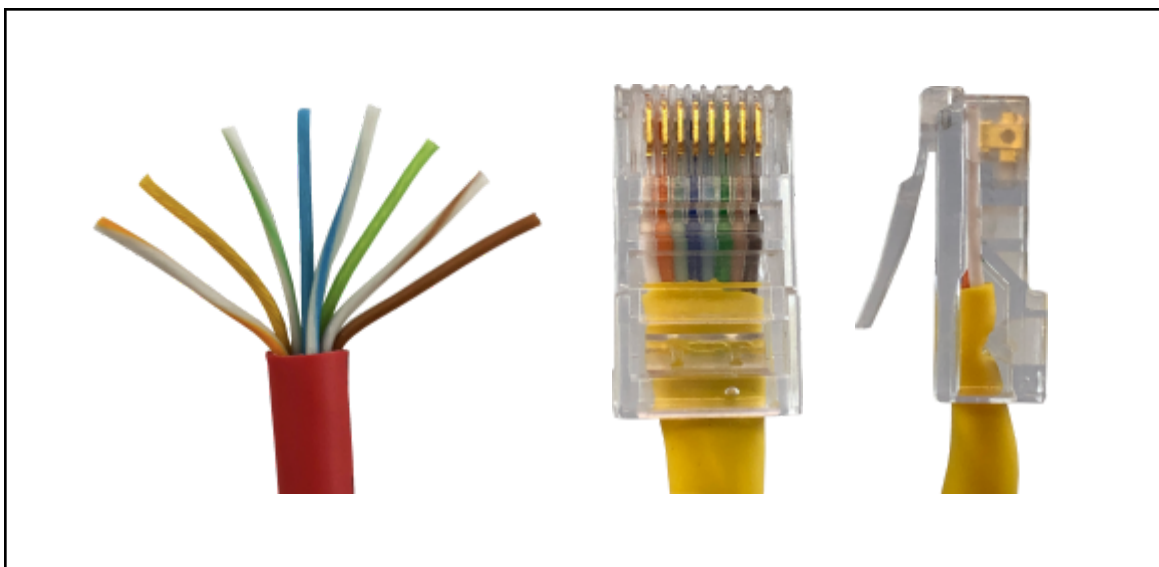
TIA/EIA 568-B

These cables can also be purchased pre-assembled from your local computer store or big box retailer in varying lengths.

A sealed waterproof RJ-45 connector with strain relief is available from your OEM or Skip-Line.
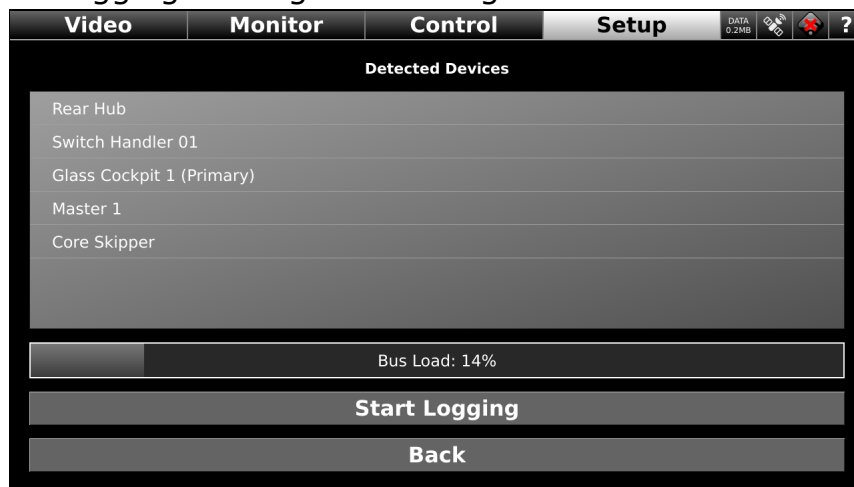
Appendix C: CAN Logging

The HDVO / DL-18 has the ability to manually record all system communications (CAN messages). With this information, Skip-Line can recreate an exact situation to help diagnose issues with the electronics or the vehicle.

A Skip-Line representative may request a CAN log to help track down an intermittent issue. It is recommended that you perform a CAN log only at the direction of Skip-Line.

To begin CAN Logging:

1. Insert a USB flash drive into a USB port. Close the dialogue box if it pops up.
2. Navigate to Setup ---> System Diagnostics screen.
3. Choose "Start Logging" to begin recording all CAN traffic.

4. Choose "Stop Logging" to stop the recording.
5. The USB drive now has the logging files on it in the root (main) directory. Email the log files to support@skipline.com to have the issue reviewed.

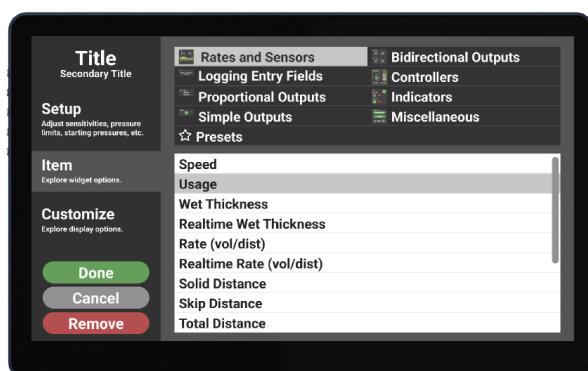*Example of CAN Log files to send to Skip-Line*
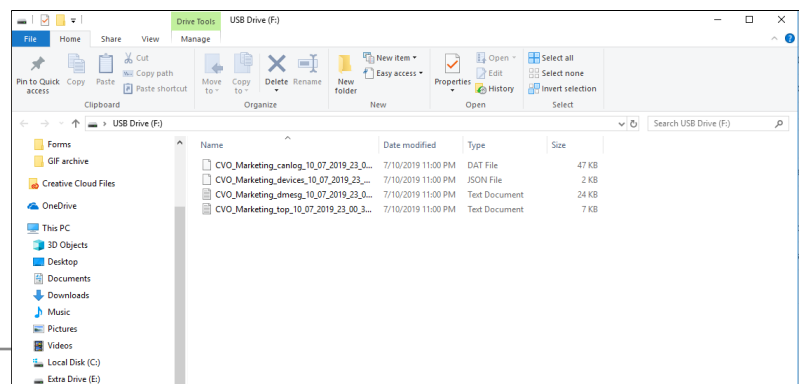
Appendix D: Paint Tank Gauge

The HDVO / DL-18 has the ability to notionaly display paint tank/tote volume on a bar graph. This is estimated by subtracting paint usage (from pump stroke or volume sensor) by tank/tote capacity.
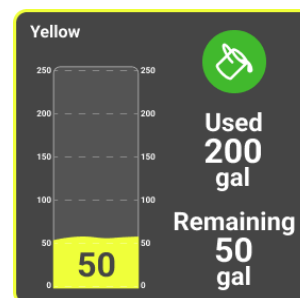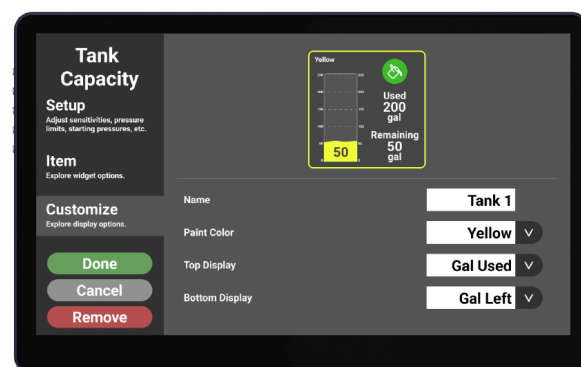
Step 1.
Edit Yellow/White/Black Usage Item.

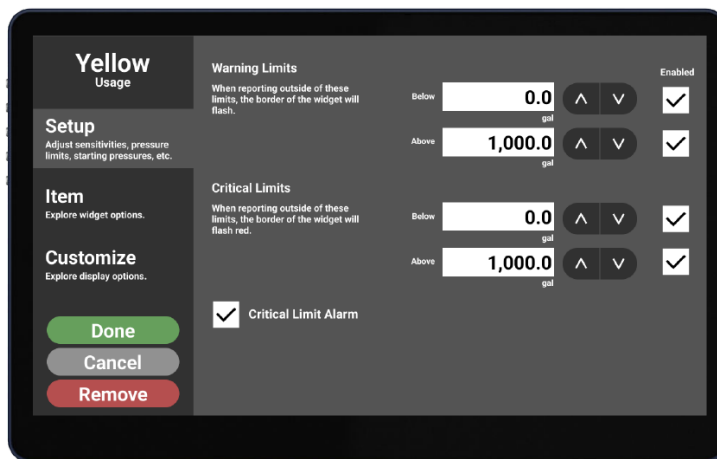**Step 2.**
Choose Bar Graph in STYLE

Step 3.
Choose USE AS TANK GAUGE,
Then CONFIGURE TANKS

Step 4.
Set Tank/Tote Capacity

Refilling:
Since the Paint Tank Gauge is an estimate and not a measurement, it requires a manual event to know when to refill. You may choose to automatically refill the graph upon a counter clear in the CONFIGURE TANKS screen, although this isn't recommended as White and Yellow tank/totes are rarely empty at the same time.

Alternatively, you may use the Refill button on the item. Tapping the button brings up a dialogue box.

- Full Refill: Brings graph up to full tank capacity
- Custom Refill Amount: Enter in a custom amount. Can be negative for fine-tuning.
- Custom Refill: Refills by custom amount
- Cancel: Leave screen, no changes.
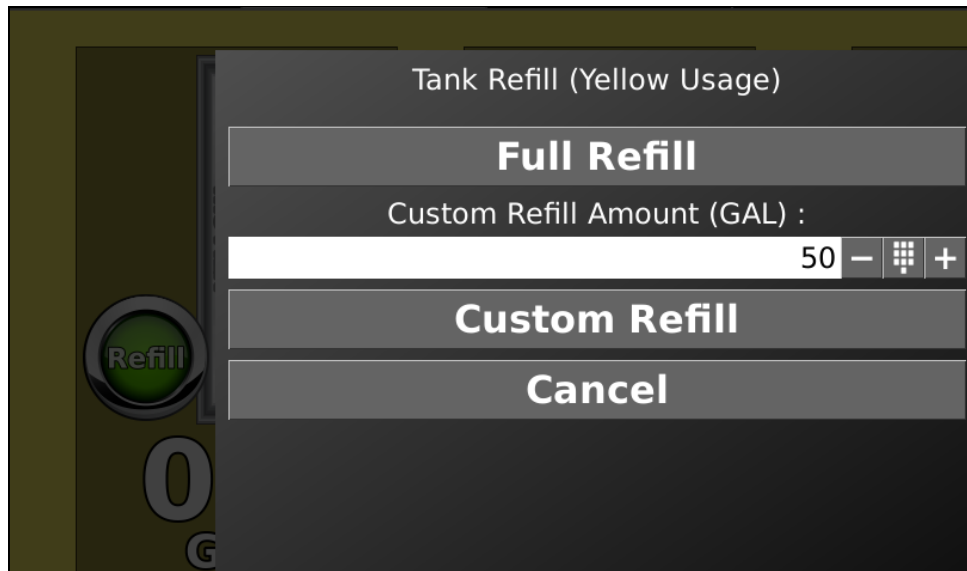
Appendix E: Repairs Form

The SC-12 Control System is field-updateable and many issues may be fixed using the **USB Remote Update** process (*See section 5.4 **In-Field Software Updates** for more information on the USB Remote Update process*). If an issue has been isolated to a hardware malfunction and needs to be sent in for repairs, there is a form that can be filled out to help streamline the process. The most up to date version of the form can be found on www.skipline.com and is also included in every Skip-Time newsletter. A copy of the repairs form is included on the following page in this manual. You may reproduce this form via photocopy, scanning, etc.

If for any reason you are unable to reproduce or print the form, please include a note with the following information in the box with your Skip-Line device(s):

Contact name
Phone number where contact can be reached during business hours
Return shipping address (no PO Boxes)
Return shipping method (Next day, 2nd day, 3rd day, or ground)
Billing address (if different from return address)
A description of the problem
PO number (if required by your organization's accounts payable department)

Boxes containing a note with the above information can be sent to us at:

Skip Line, LLC.
10514 N. McAlister Rd
La Grande, OR 97850

Should any of the information above be missing, we cannot guarantee the repaired unit will be returned in the manner expected.

UPS is the preferred shipping provider as our local UPS delivers earlier in the morning and picks up later in the evening than any other local courier.
The unit(s) being sent in should be relatively clean. Units should be wrapped in large bubble wrap (3/4" to 1" bubbles) and surrounded by newspaper or packing filler. Particular care should be taken for units with LCD displays by ensuring there are no other objects with sharp corners packed in such a way that they could damage the screen while the shipment is in transit. There should be two inches of filler between the unit and the edge of the shipping box.

If you have any questions about the process, please call (541) 963-0111.

Inspection or Repair Information Form

SKIP-LINE BY **SPEC-RITE**

Company:_____

Contact Name:_____

Phone Number:_____

Email: _____

P/O Number:_____

Date Sent: _____

Model(s): _____

Serial Number(s):_____

Return Method:
☐ Ground ☐ Next Day Air ☐ 2 Day ☐ 3 Day
☐ Saturday Delivery

Return Address (No PO Box):

_____

_____

_____

This is an: ☐ Inspection ☐ Repair ☐ Update ☐ Other: _____

Please provide a detailed description of the problems/issues you are experiencing below.

_____

_____

_____

_____

_____

Affix your business card here (optional)

Billing Address (Required if different from above):

_____

_____

_____

Thank You!

Ship this form with your equipment to:

Skip-Line Repairs
10514 N. McAlister Road
La Grande OR 97850

Contact Us:

Hours: 8am-4:30pm Pacific Time
Monday-Friday
repairs@skipline.com
541-963-0111