SmartLabel Pro

User's Manual

lifecanvas technologies

Contents

Components & Accessories

SmartLabel Pro consists of the SmartLabel Pro module (left), SmartBox (SmartLabel Pro control module; right top), and SmartBox+ (SmartLabel Pro cooling module; right bottom):

SmartLabel Pro comes with the following accessories (from left to right):

- (Top row) Main power cable, with extra fuses in top right; 2 sample cups; mesh bag insert and extra mesh strips (x 2)
- (Bottom row) Inserts that control the solution level in the sample chamber; Magnetic lids to the sample chambers





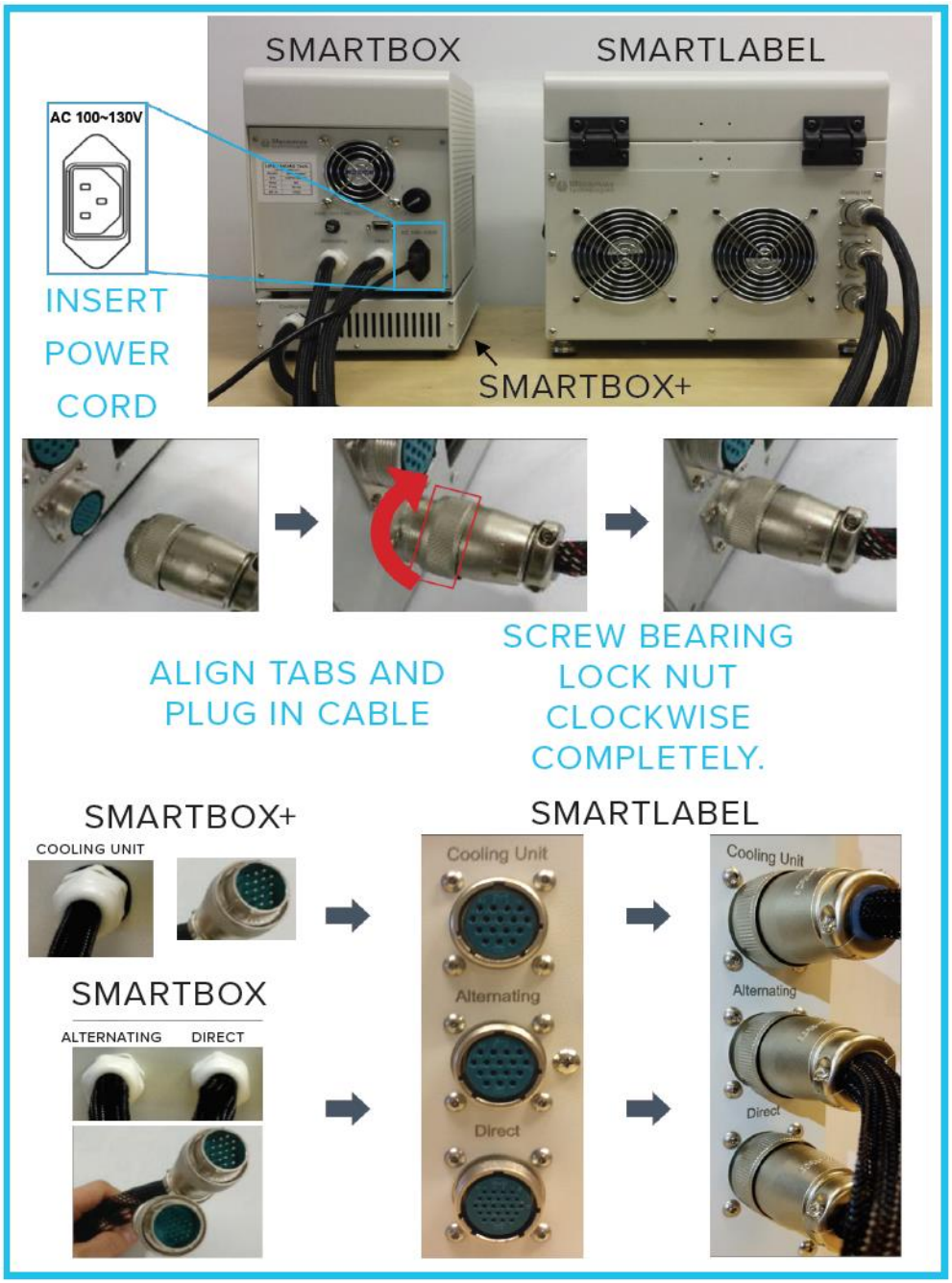
Installation

Please take note of the following before installation:

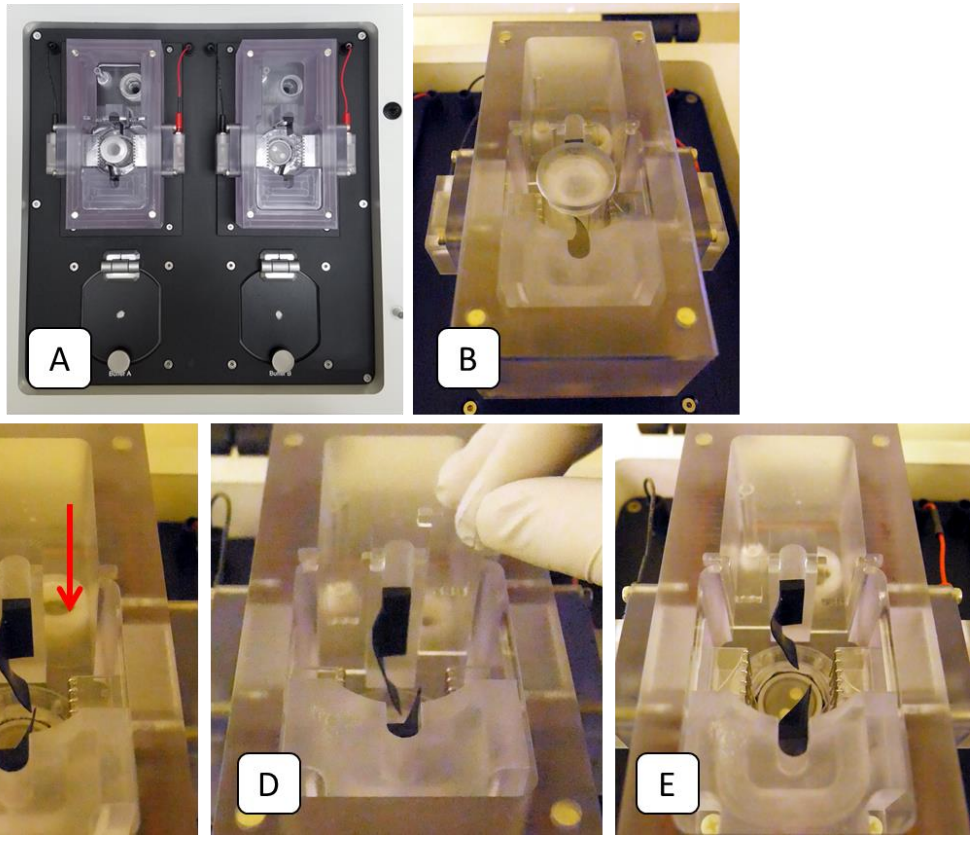
- Do not use the instrument for purposes other than those indicated by the manufacturer.
- At least two people are required to move the instrument.
- The instrument must be placed in a stable and level location.
- Follow instructions contained in the manual when setting up and operating the instrument, and when changing consumables.
- If deemed necessary, ask the manufacturer or your sales agent for help when setting up the system.
- Connect the instrument to an electrical outlet according to local or country standard.
- Do not switch on the instrument without having waited at least 20 seconds after switching it off.
- Only use buffers, membranes / sample cups, and parameter ranges provided by LifeCanvas Technologies. See product warranty for further information.
- Use the volumes recommended for both Buffer A and B.
- Do not leave the instrument in humid or wet conditions, as doing so could cause an electrical short.
- Do not use the instrument outdoors.

Note: In the event of unexpected problems, please contact your service representative or LifeCanvas Technologies immediately:
support@lifecanvastech.com / info@lifecanvastech.com

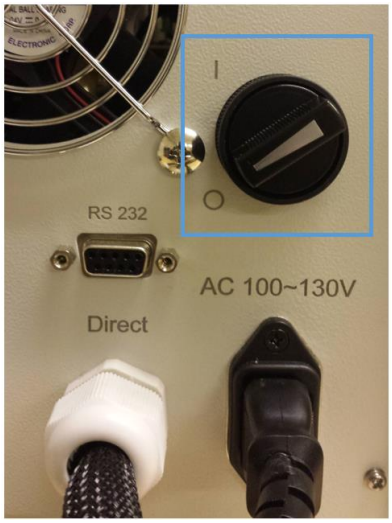
1. Carefully remove SmartLabel Pro and SmartBox/+ from the packaging and place at the installation location. Place SmartBox on top of SmartBox+.
2. Attach the power cord to the rear side of SmartBox and plug it into an outlet with the correct voltage requirements. Connect the cable originating from the ‘Cooling Unit’ port on SmartBox+ to the corresponding port on SmartLabel. Similarly, connect the cable from the ‘Alternating’ port on SmartBox to SmartLabel. Do the same for the cable originating from the ‘Direct’ port.



3. Open the lid to SmartLabel:
    - Observe the two translucent sample chambers located on top of the unit, visible in the top half of the image in panel A below. Observe the black screw-top lids to the two solution reservoirs, visible in the bottom half of the image in panel A. The left-side solution reservoir and sample chamber comprise side ‘A’ of SmartLabel, and the right-side reservoir and chamber comprise side ‘B’. Each side is a closed system and can be used to perform distinct labeling experiments.
    - Panel B shows the magnetic cover in place on the sample chamber. With the lid removed (panel C) identify the front section of the sample chamber, which contains the platinum electrodes (located laterally) and the hexagonal base plate on the floor of the chamber into which the sample cup is inserted. Identify the two ~1cm-wide gaps in the plastic located in the middle of the overall length of the chamber, to which the green arrows in panel C point.
    - Plastic spacers, which control the solution level in the front half of the chamber where the sample cup is placed, need to be lowered into place as shown in panel D on each side of the chamber. Panel E shows both spacers in place.

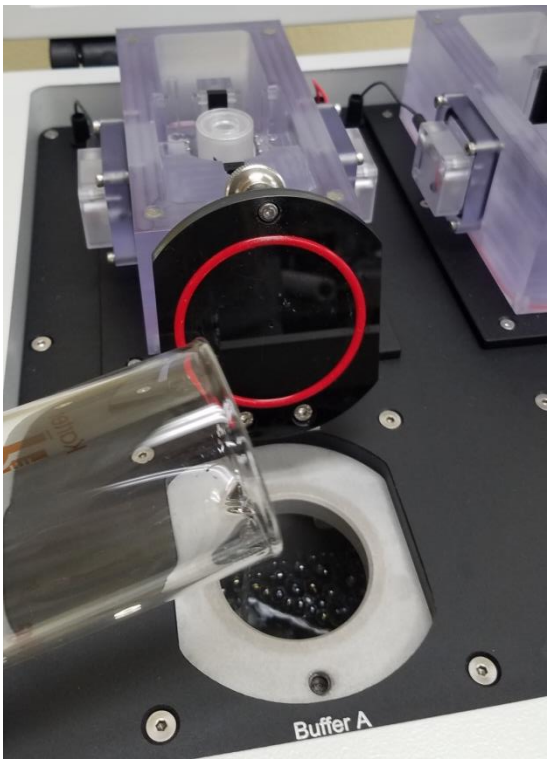


4. Turn the physical **power switch** on the rear side of SmartBox from O to I to power up the system.



5. There are drainage tubes located under the panel at the bottom front of SmartLabel, with the one on the left for reservoir A and the one on the right for reservoir B. In the left image below, the stopcock is in the closed position, preventing drainage of its connected reservoir. In the right image, the stopcock open, enabling drainage.

6. Making sure the stopcocks on the drainage tubes are in the closed position (i.e., not in-line with the axis of the tube, but turned perpendicular to it), open reservoirs A/left & B/right and pour 500 mL of deionized water into each reservoir opening, re-securing the reservoir lids when finished. A small piece of cotton is pre-installed in the ventilation hole of each reservoir lid to minimize bubbles rising out of the chamber and should be replaced when needed.



7. Wash the system for 15 minutes by turning on the pumps for both reservoirs A & B (see description of SmartBox User Interface (UI) below in the Operation section of the manual).
   Note: never run the pumps when no liquid is present as this will strain the pumps.
8. After washing, turn off the reservoir A & B pumps, and open the stopcocks on the drainage tubes to drain the waste water into a collection vessel. **Make sure to close the stopcocks when you are done.**

Drain Reservoir A

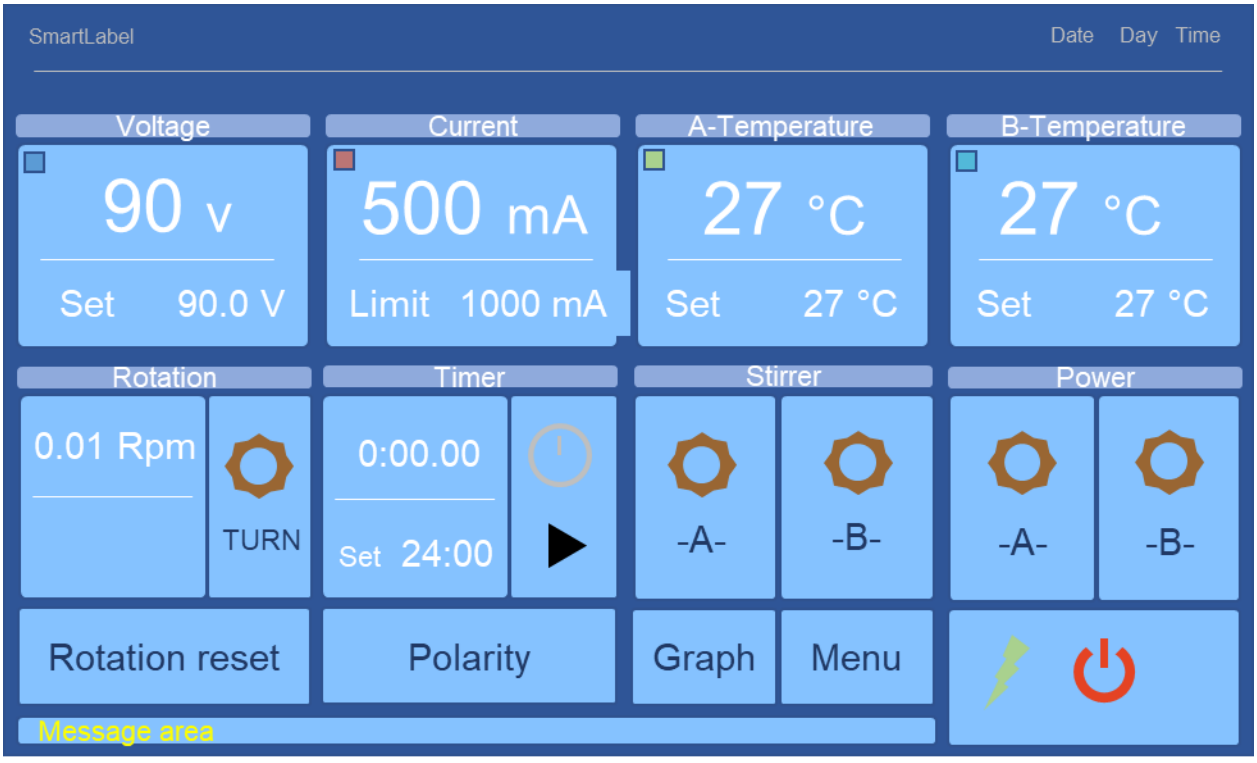
Drain Reservoir B

Operation

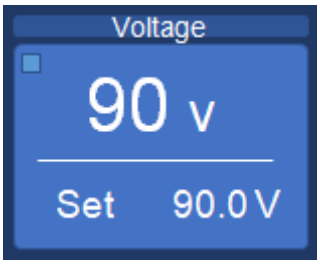
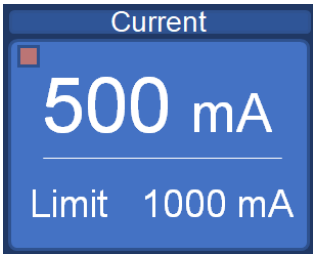
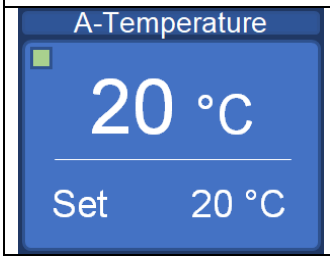
After installation, the device is ready to use for labeling samples.

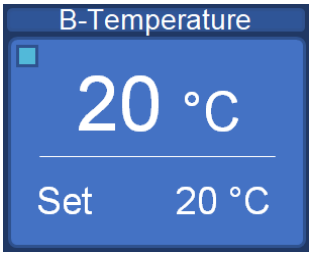
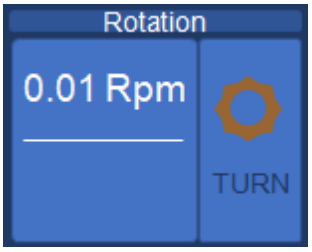
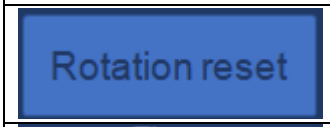
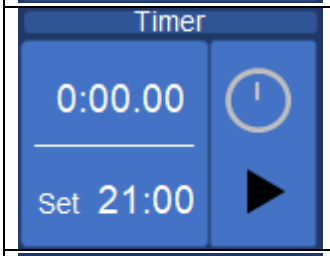
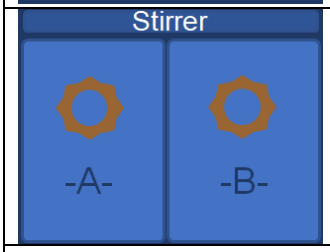
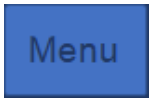
The home screen displays set values and present readings for various parameters of device functionality. From this screen, the user can view and has control of: **Voltage**, **Current**, temperature of buffer A (in the left/A solution reservoir), temperature of buffer B (in the right/B solution reservoir), sample cup **Rotation** speed, labeling experiment **Timer**, sample cup **Stirrer** toggle for sample chambers A & B, **Power** to turn on/off solution pumps serving each sample chamber (A & B) and, below, to turn on/off stochastic electrotransport-mediated labeling functionality for sample chambers A & B. There are also buttons to access further functions controlling: reset of the rotation speed, electrode polarity, graphing & history data, and an advanced settings menu.

The main user interface of the SmartBox module while it is controlling SmartLabel:



Complete description of SmartBox UI used to control SmartLabel operation:

	These are the **Power buttons** for the pumps (n=2; top) and electrodes (n=1; bottom). To power pumps A and B, press buttons -A- and -B-, respectively. When the pumps are on, the gear will light up as shown and rotate. To turn on electrode power to both sample chambers, press the bottom power button. The button will light up as shown to indicate that electrode power is on.
	This is the **Voltage** indicator and control button. The top number indicates the voltage that is presently being applied across the electrodes. **Note: it is normal for the system to read a voltage even if the electrode power is off.** The bottom number is the Set Voltage. The device normally operates in *Voltage Control mode*, the Set Voltage. However, if the current at that set voltage surpasses the limit current, the device will decrease the voltage to operate at the limit current. To change the Set Voltage, press this button, and enter the desired value using the number pad.
	This is the **Current** indicator and control button. The top number indicates the current presently being passed between the electrodes. **Note: it is normal for the system to read a small current (~10 mA) even if the electrode power is off.** The device normally operates in *Voltage Control mode*. The bottom Limit Current number is the maximum current the device will pass between electrodes. **To reach the Set Voltage, the actual current applied will depend on a number of factors such as the conductivity of the solution, and will differ at various points throughout the labeling protocol.** To change the Limit Current, press this button and enter the desired current. The default Limit Current is 1000 mA, and the user can lower this setting if desired. **Note: we do not recommend increasing the Set Current above 1000 mA. It is normal for this value to fluctuate around the Set value (± 20 mA).**
	This is the reservoir A/left **Temperature** indicator and control button. The top number indicates the present temperature of the solution in reservoir A. The bottom number shows the Set Temperature for reservoir A. To change the reservoir A temperature, press this button and enter the desired temperature. **Please follow recommended settings listed in Protocol.**

	This is the reservoir B/right **Temperature** indicator and control button. The top number indicates the current temperature of the solution in reservoir B. The bottom number shows the Set Temperature for reservoir B. To change the reservoir B temperature, press this button and enter the desired temperature. **Please follow recommended settings listed in Protocol.**
	This is the sample cup **Rotation** button. The upper number shows the rotation speed in rotations per minute (Rpm). Lower numbers show the time since the current rotation speed was started (middle) and the total elapsed time when the rotation speed reaches the next stage (bottom). Pressing this button will take the user to the Rotation settings screen. For more information, see the Rotation settings section of this manual. The button on the right toggles the sample cup rotation in chambers A & B on and off. When on, the gear will light up as shown and rotate.
	This is the **Rotation reset** button. Pressing this button will reset the timer to 0 and begin the cycle again. We recommend resetting the rotation when first starting to label a new sample.
	This is the **Timer** button and indicator. The top number is the current timer value (hours : minutes . seconds), and the Set value is the total length of time (hours : minutes) the electrodes will remain turned on. Press this button and enter the desired time to change the Set value. Press the button on the right to start the timer.
	This is the **Polarity** settings button, which opens the corresponding screen. For more information, see the Polarity settings section of this manual.
	These are the sample cup **Stirrer** bar toggle buttons and corresponding indicators. To power stir bars found in the bases of the sample cups in each chamber, A and B, press buttons -A- and -B-, respectively. When the stirrers are on, the gear icons will light up as shown and rotate.
	This is the **Graph** button. It takes the user to another menu to access a graph of the device operating history. For more information, see the Graphing & History section of the manual.
	This is the **Menu** button. It takes the user to another menu screen with advanced settings. For more information, see the Advanced Menu section of this manual.

Rotation settings

The Rotation settings screen controls the sample rotation in the labeling chamber. This screen can be accessed by pressing the Rotation button where the Rpm speed is displayed: 

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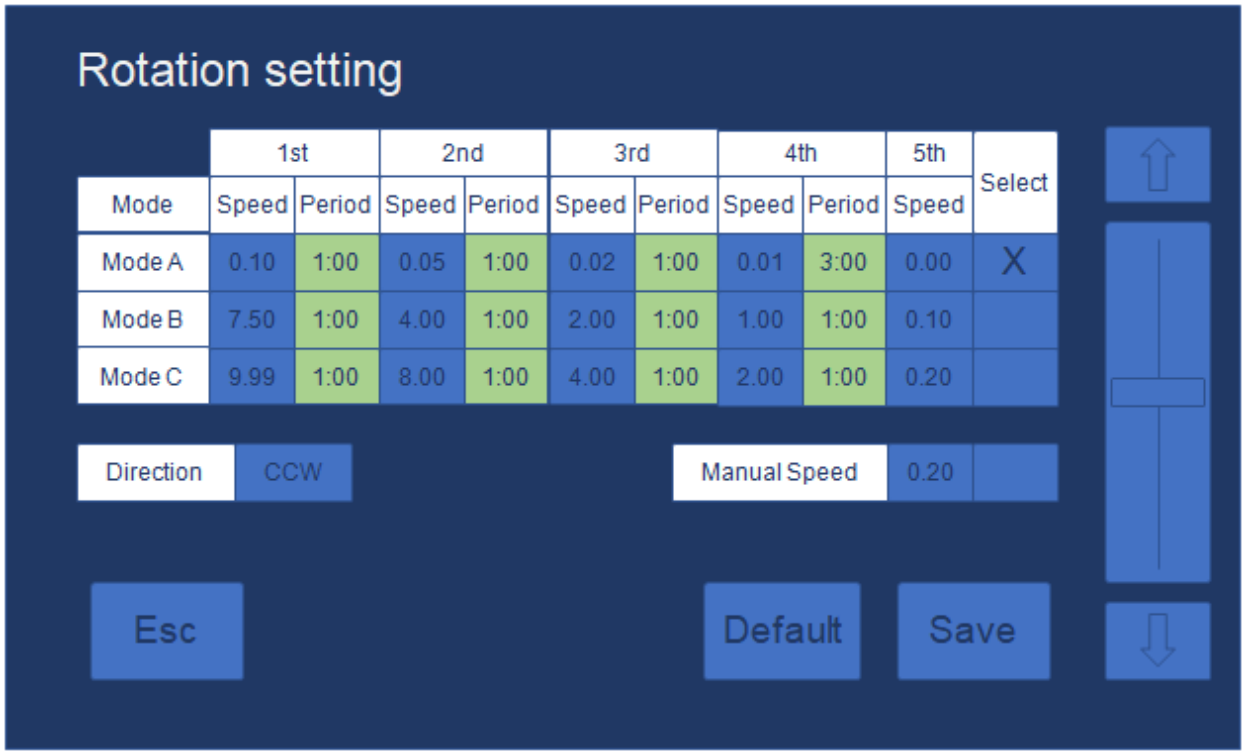

As displayed on the home screen, the device will keep track of the time and progress through periods accordingly. The device can remember 3 unique rotation modes (A, B, C). To change between modes, press the box under the Mode column in the appropriate row. The currently selected mode is identified by an 'X' in the Select column on the far-right. Each mode is split into 5 time segments as shown in the table. The user can modify the period of each time segment by pressing the box in the appropriate location and changing the time with the arrows and/or slider on the right side of the screen. The speed can be modified in a similar manner. The 5th time segment has no time limit and will continue indefinitely. The user can change between clockwise and counter-clockwise rotation by pressing the field next to Direction: 

. **To rotate the sample at a constant speed, select the field next to Manual Speed and set the desired speed:** 

. To reset the timer, press the '**Rotation Reset**' button on the main operating screen: 

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Note: Always press 'Save' after changing any settings you wish to keep: 

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To revert to Default settings, press 'Default': 

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To return to the home screen, press 'Esc': 

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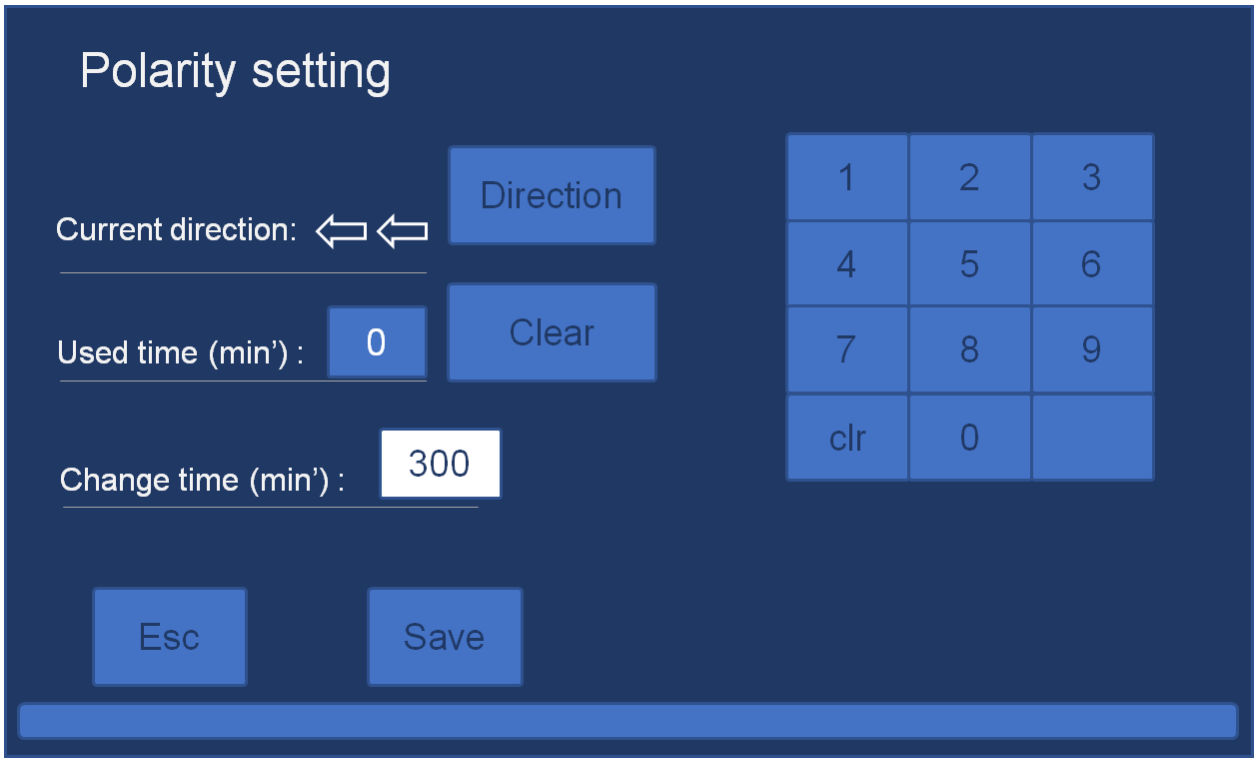
Polarity settings

The polarity settings screen controls the direction of current flow in the labeling chamber. This screen can be accessed by pressing the polarity button: Polarity. By default, the device will always pass current in one direction. **However, the device can switch polarity at a user defined time interval (recommended = 300 min').** By switching polarity, black particle accumulation will be even on both electrodes and may improve device longevity, but may slightly slow labeling.



The arrows indicate the present Current direction: Current direction: ⇦ ⇦.

To switch the Current direction, press 'Direction': Direction.

The device keeps track of the time since the polarity was last switched. This is shown in the Used time indicator: Used time (min') :. Press 'Clear' to reset the timer: Clear.

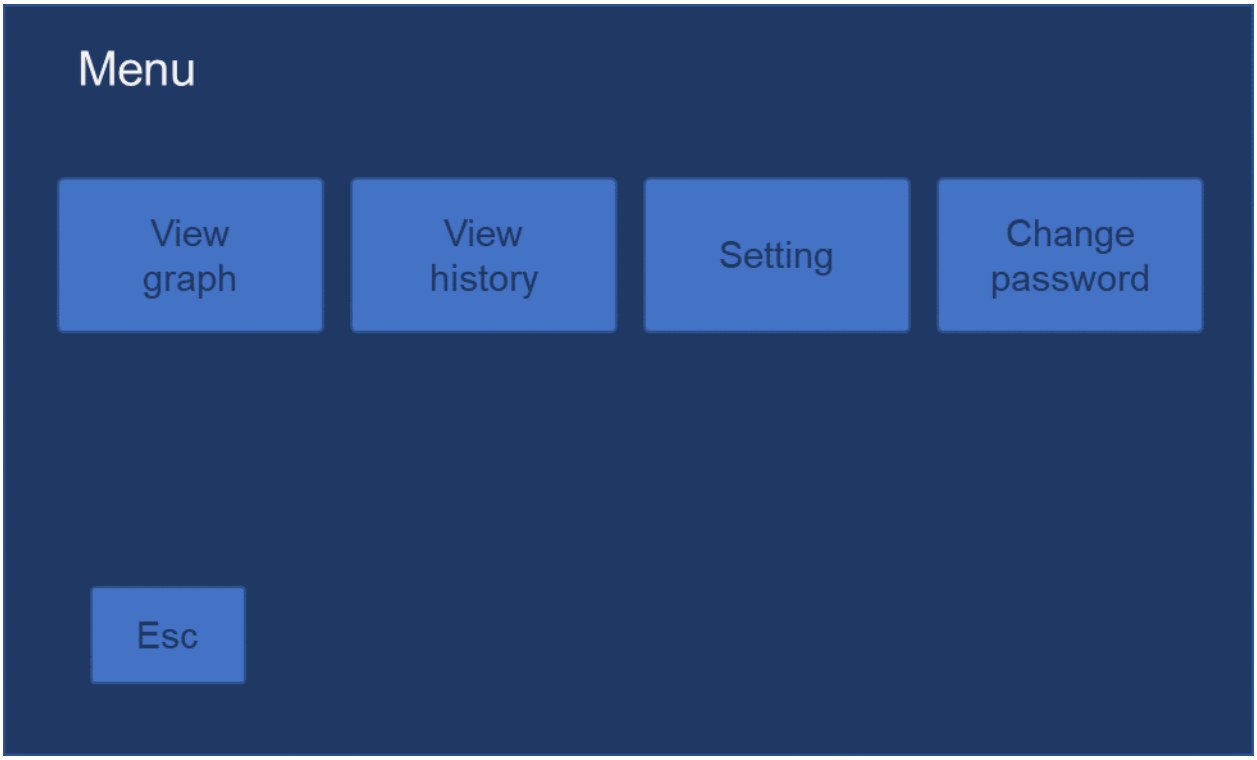
To change the time interval between polarity switching, press the number next to 'Change time': Change time (min') : and enter the desired time in the number pad to the right.

Note: if the change time is 0, the device will never switch polarities and will always pass current in one direction.

Note: Always press 'Save' after changing any settings you wish to keep: Save.

Advanced Menu

To access the Advanced Menu screen, press ‘Menu’ Menu on the home screen. This will open the menu screen shown below:



The ‘View Graph’ button takes the user to a graph of the device’s operating history. The ‘View History’ button takes the user to the history log screen, which tracks all changes in device settings and pump/electrode power. For more information, see the Graphing & History section of this manual.

To enter the Advanced Settings menu, press ‘Setting’: Setting and enter the password ‘**1234**’ and press ‘Enter’.

The password can be changed by pressing ‘Change Password’ in this menu.

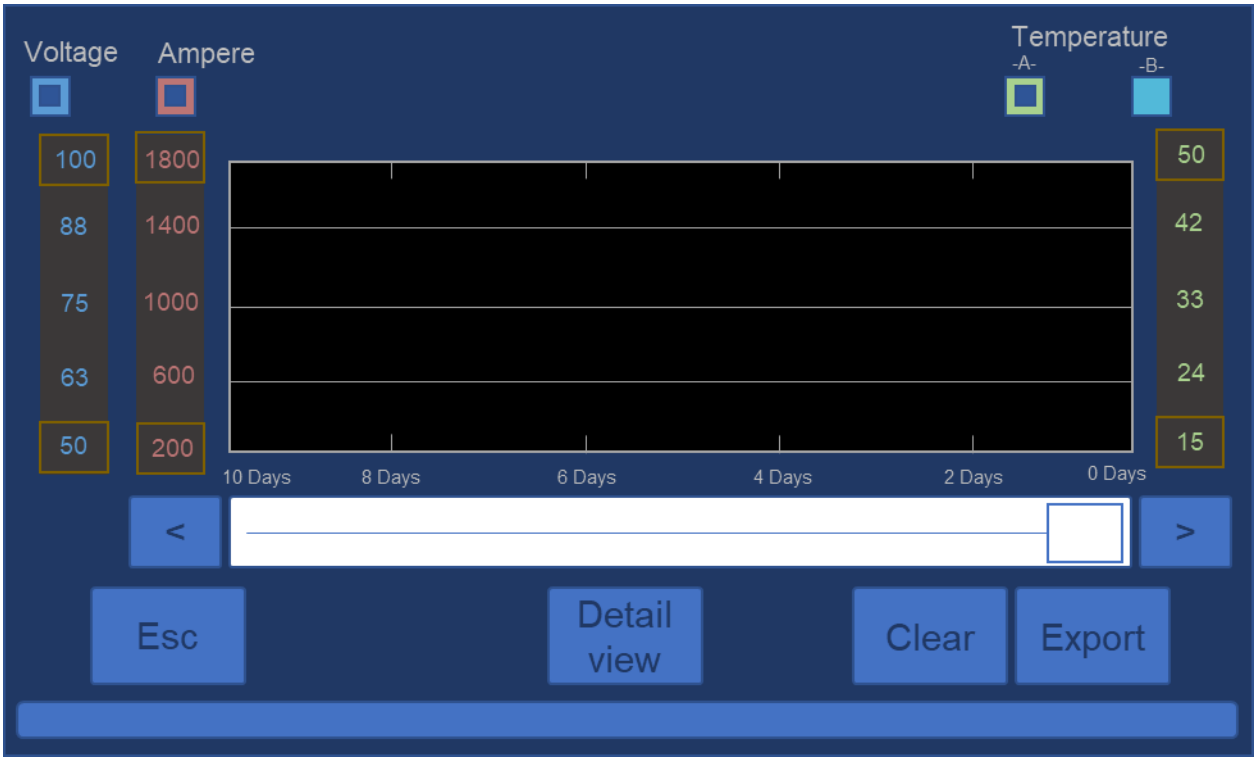
To return to the home screen, press ‘Esc’: Esc.

Graphing & History

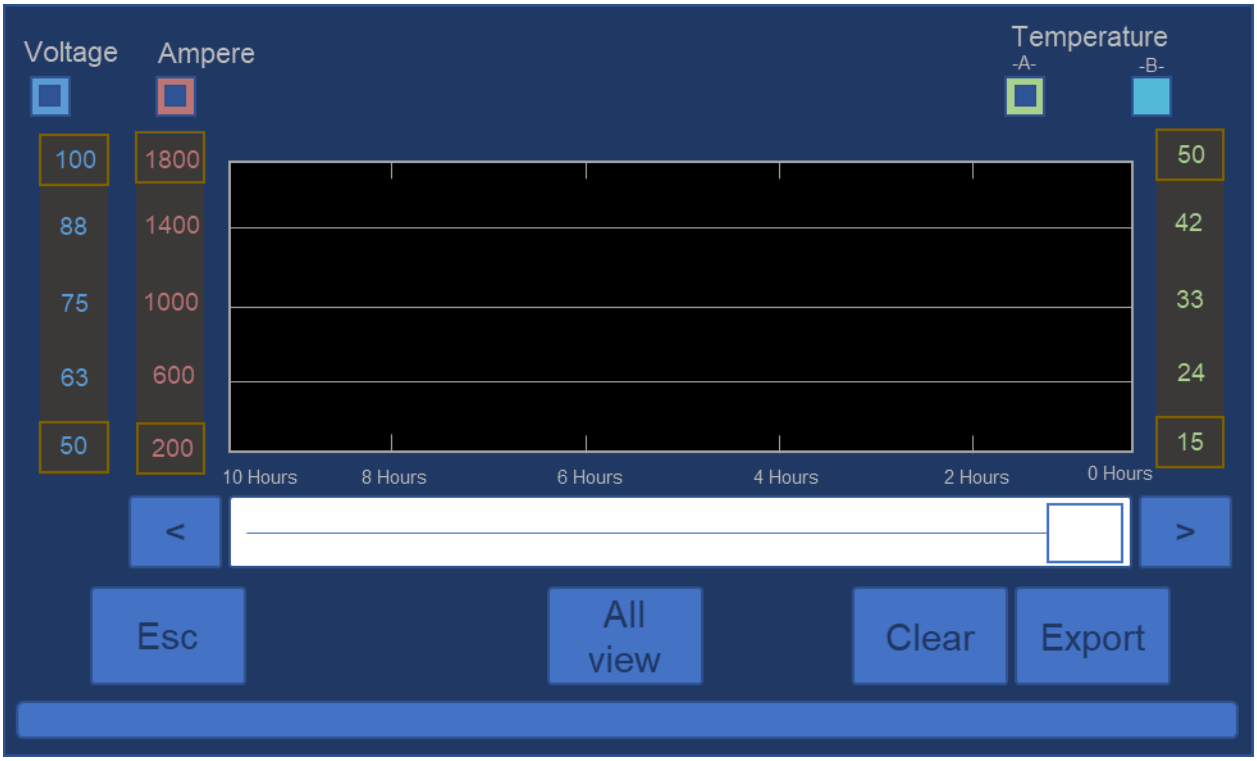
SmartLabel Pro saves the status information displayed on the front panel once per minute, and stores up to 10 days' worth of data. The device also records a log of any changes made to the settings or pump/electrode power.

Viewing the Graph

To access the graph, press the Graph button on the home screen or navigate through the Advanced Menu.



The data are color-coded, showing the Voltage and Current, as well as the Temperature of reservoir A and B solutions. To toggle which data are being plotted, press the square buttons under the appropriate label: . Each dataset uses its own, color-coded, y-axis scale. To adjust the upper limit, press the top number on the y-axis of the appropriate color, and enter the desired value. To adjust the lower limit, press the bottom number of the y-axis of the appropriate color, and enter the desired value. The scroll-bar and arrows can be used to scroll through time, where 0 hours is the present and 2 days is 48 hours ago. To zoom in on the x-axis, press 'Detail view': Detail view



To zoom back out in the x-axis, press ‘All view’: 

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To clear the stored graph data, press ‘Clear’: 

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To return to the previous screen, press ‘Esc’: 

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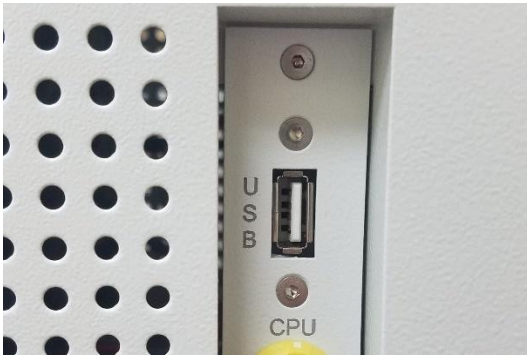
Exporting the Graph

The graph data can be exported via USB device to a .txt file. This text file will include each stored data point per minute for the past 10 days of stored data. **Note: the device will only export the datasets that are toggled on.**

1) Enter the graph screen by pressing the Graph button.
2) Insert a USB flash memory stick into the USB port on the side of the SmartBox:



3) Use the toggle buttons to choose which datasets to export:

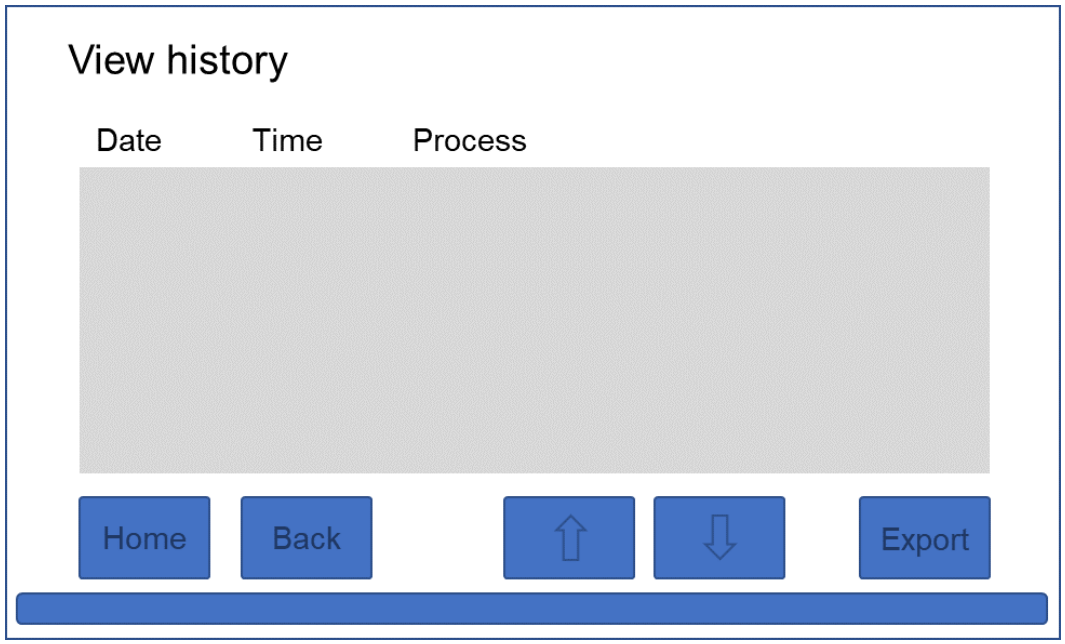
Only datasets with the blue square indicator will be exported.

4) Press 'Export': Export.
5) When the export is complete, a message will be displayed in the bottom left of the screen: Completed the export.
6) You may now remove the USB device.
7) To return to the previous screen, press 'Esc': Esc .

Viewing the History

SmartLabel Pro stores all changes in device settings & pump/electrode power in the history log.

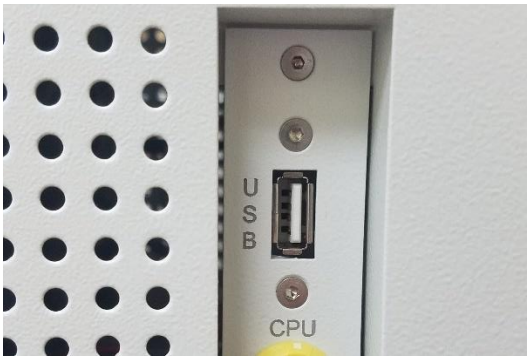
1. From the home screen, press ‘Menu’: Menu.
2. Press ‘View history’: View history. This is the history log screen:



3. Use the arrows to scroll through the history.
4. To return to the previous menu, press ‘Back’: Back.
5. To return to the home screen, press ‘Home’: Home.

Exporting the History

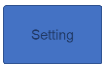
1. From the home screen, press ‘Menu’: Menu.
2. Press ‘View history’: View history .
3. Insert a USB flash memory stick into the USB port on the side of the SmartBox:



4. Press ‘Export’: Export.
5. When the export is complete, a message will be displayed in the bottom left of the screen: Completed the export.
6. You may now remove the USB device.
7. To return to the previous menu, press ‘Back’: Back.
8. To return to home screen, press ‘Home’: Home.

Advanced Settings

To enter the Advanced Settings screen from the Advanced Menu screen, press ‘Setting’:



and enter the password ‘**1234**’ and press ‘Enter’.

This is the Advanced Settings screen:

The top table contains information about the voltage and current settings. The column titled ‘Mode’ indicates whether the device will operate as a current source (Ampere) or voltage source (Voltage). By default the device runs as a current source, with a high current limit of 1000 mA and a high voltage limit of 90 V. The High limit values are the maximum values the user will be able to enter from the main operating screen. To change these values, press the appropriate box and use the arrows or scroll bar to reach the desired value.

Note: Please contact your equipment dealer or LifeCanvas Technologies before adjusting these settings from their factory presets.

The middle table is used to determine the minimum (Low limit) and maximum (High limit) temperature the user can enter for each buffer on the main operating screen. To change these values, press the appropriate box and use the arrows or scroll bar to reach the desired value. The ‘Offset’ column is used for Temperature calibration. For more information, see the Temperature Calibration section of this manual.

The bottom table has settings for whether SmartBox beeps when the screen is pressed, as well as for screen brightness. Press their respective boxes to toggle these settings or change the number with the arrows and scroll bar.

The ‘Admin Settings’ are set by the manufacturer and are password protected.

Note: Always press ‘Save’ after changing any settings: 

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To return to the home screen, press ‘Home’: 

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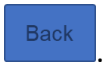
To return to the previous menu, press ‘Back’: 

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To return to Default settings, press ‘Default’: 

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Maintenance

Buffer Change

Due to changes in pH and other properties that occur as a result of electrolysis, the buffers are designed to only be used once (i.e., for a given step or experiment) and then discarded. Use of non- LifeCanvas Technologies buffers will void your warranty, and may result in sub-optimal labeling and even damage the device.

Remember to keep SmartLabel sample holders submerged in a sealed container filled with 0.02% sodium azide in deionized water when not in use.

The buffer change process is the same as the initial process described in the Installation section of this manual.

1. Turn off electrode power.
2. Turn off the pump(s) for the reservoir(s) that you plan to drain. Both can be changed at the same time, but if you plan to change only one, the other chamber will have its voltage off.
3. Drain used buffer using drainage tube(s), re-close stopcock(s), and pour 500 mL of deionized water into the reservoir(s). With a squirt bottle of deionized water, rinse the inside walls of the reservoir(s).
4. Turn on the pump(s) and run deionized water for at least 5 minutes to wash the device.
5. Open the stopcock(s) to drain the deionized water, re-closing them when done.
6. Repeat steps 3-5 two to three times, until bubbles are no longer visible as water is being pumped through the system.
7. Dispense solutions as needed for your next labeling experiment with SmartLabel.

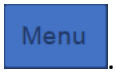
System Flushing

To keep the system clear of debris, we recommend flushing the system approximately once a month, or following every 5th change of the buffer set.

1. Turn off electrode power and pumps.
2. Remove sample cups from the sample chambers, and store them in a container with deionized water to keep them hydrated.
3. Drain used buffer using drainage tubes, re-close stopcocks, and pour 500 mL of deionized water into each reservoir. With a squirt bottle of deionized water, rinse the inside walls of the reservoirs above the waterline.
4. Open the sample chambers and pour ~100 mL of deionized water directly into the chamber, making sure the chamber does not overflow.
5. Run the pumps for a couple of minutes, then turn them off, drain the reservoirs, and repeat steps 3-5 again.
6. Pour 500 mL of deionized water into each reservoir.
7. Turn on the pumps and run them for 10 minutes.
8. Turn off the pumps and drain the reservoirs. Repeat steps 7-9 two to three times, until there are few bubbles (from the presence of residual SDS) in the sample chambers.
9. You are now ready to setup your next labeling experiment.

Temperature Calibration

We recommend re-calibrating the temperature sensors every 3 months to maintain proper system function and to ensure the best labeling results.

1. With buffers and a sample cup installed, run the system and wait to allow the buffer temperature to reach equilibrium.
2. Note the temperature of each reservoir as shown on the SmartBox display.
3. Turn off the electrode power, and then quickly perform steps 4 & 5 below before significant cooling occurs.
4. Open a sample chamber and its corresponding reservoir.
5. Using a digital thermometer, first measure the temperature directly inside the sample chamber, and then in its corresponding reservoir.
6. If the measured temperature and displayed temperature are the same, then SmartLabel is properly calibrated. If not, follow these steps to correct the temperature difference:
    a. Press 'Menu': 

.
    b. Press 'Setting': 

, enter **1234** as the password, and then press 'Enter'.
    c. Subtract the displayed temperature reading from the measured temperature for reservoir A.
    d. Add the value you calculated in (c) to the 'Offset' in the center table under the Temperature A row. To do this, press the box highlighted below and use the arrows and scroll-bar to add this number to the existing offset.*

	I.D	Offset	Low limit	High limit
A-Temperature	30	3	0	90
B-Temperature	40	4	0	90

    e. Repeat (c, d) for reservoir B to change its 'Offset'.
    f. Press 'Save': 

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* As an example, the SmartBox is reading TA = 42° C, and the thermometer measures 44° C in the chamber. We must increase the offset by 2° in this case. So, if the offset was previously 6°, it must be increased to 8° for proper calibration.

Specifications

SmartLabel Pro Module			
Physical Characteristics	Product Type		SmartLabel Pro: Active Antibody Immunolabeling System
	Product Dimensions		14.3” (W) x 14.6” (D) x 13.2” (H) 363 mm (W) x 370 mm (D) x 335 mm (H)
	Weight		48.5 lbs (22 kg)
	Operating Power/Frequency		AC 100~120 V / 50~60 Hz AC 200~240 V / 50~60 Hz
	Electrical Input		100~120 V (5 A) or 200~240 V (3 A)
Labeling Part	Chamber	Dimensions	1.1” (W) x 1.1” (D) x 2.0” (H) 29 mm (W) x 29 mm (D) x 49 mm (H)
		Sample Rotation Speed	0 rpm ~ 10 rpm
		Sample Protection Method	Specialized nanoporous membrane
		Control Values	Current value Current upper limit Voltage value Voltage upper limit Electricity cycle Sample cup rotation speed/period Scheduling for sample cup rotation speed Polarity direction change (timer function) Electricity On/Off/Timer Buffer pump On/Off Temperature control
	Buffer Reservoir	Reservoir A	Buffer A
		Reservoir B	Buffer B
		Reservoir Capacity	500 mL each
	Cooling		Water circulation with hydraulic pump and cooling fan, and thermoelectric Peltier unit

SmartBox: SmartLabel Pro Control Module		
Physical Characteristics	Product Dimensions	8.3” (W) x 14.8” (D) x 10.4” (H)
	Weight	27 lbs (12 kg)
	Electrical Input	100~120 V (15 A) or 200~240 V (8 A)
Interface	LCD Monitor/Touch	RGB 256 Color, 800 x 480 Pixel Resistive Touch
	Software	Fluorescent/Non-fluorescent preset

Smart Box+: SmartLabel Pro Cooling Module		
Physical Characteristics	Product Dimensions	8.3” (W) x 14.8” (D) x 3.0” (H)
	Weight	8 lbs (3.5 kg)

Warranty

We warrant the product you have purchased for one calendar year after the date of delivery. In the case of any manufacturer-originated malfunctions that arise during this period of time, LifeCanvas Technologies will be responsible for repair or replacement of failed parts. However, this warranty is guaranteed when only LifeCanvas consumables (buffers, sample holders, and any other consumables) are used with the SmartLabel Pro system and excludes the following conditions:

- When the system is used outside of recommended setting ranges (temperature higher than 30° C, voltage higher than 90V, current higher than 1000mA).
- Any damages due to fire, earthquake, rainstorm, or other catastrophic events, as well as damages arising from pollution or abnormal electrical supply.
- Any damages due to unofficial repair, adjustment, calibration, and modification.
- Any damages due to improper usage or mishandling.
- Any damages caused by moving, dropping, or transporting of the instrument.
- Repair of expendables and consumables.

For service, please contact the agent that you have purchased the instrument from or LifeCanvas Technologies. LifeCanvas Technologies offers direct support.

Warranty is valid only if the installation is done by trained people and in accordance with instructions provided in this manual.