

ML230 Focused-ultrasonicator Setup & Instruction Manual

Instrument Developed for High-performance
Sample Preparation using Adaptive Focused Acoustics®
(AFA®)

For Research Only

Model Number: ML230 | Software: SonoLab 10.1



UNIVERSAL PRECAUTIONS

Universal Precautions should be followed on all specimen samples, regardless of whether a sample is known to contain an infectious agent. Laboratories handling specimen samples are advised to comply with applicable parts of the following government and clinical standards, or their equivalent in the country of use:

- **Centers for Disease Control (CDC), Universal Precautions for Prevention of Transmission of Human Immunodeficiency Virus, Hepatitis B Virus, and Other Bloodborne Pathogens in Healthcare Settings, published 1988, updated 2016**
- **Clinical and Laboratory Standards Institute (CLSI), GP17-A3 Clinical Laboratory Safety; Approved Guideline - Third Edition, published 2012, ISBN 1-56238-798-7 (Electronic)**
- **Clinical and Laboratory Standards Institute (CLSI), M29-A4 Protection of Laboratory Workers from Occupationally Acquired Infections; Approved Guideline, Fourth Edition, published 2014, ISBN 1-56238-962-9**
- **Occupational Safety and Health Administration (OSHA), 29 CFR 1910.1030 Bloodborne Pathogens**
- **International Standards Organization (ISO) 15190:2020, Medical Laboratories – Requirements for Safety**

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Not for use in Diagnostic Procedures

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Covaris, LLC.

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01801-1721 USA

Printed in USA

Warnings

For the Safety of Operating Personnel:

- Make sure that the equipment is properly grounded. **DO NOT** operate if it is not properly grounded.
- The unit is equipped with a power plug appropriate for the destination country. **DO NOT**, under any circumstances, remove the grounding prong from the power cord.
- **DO NOT** attempt to operate the equipment with the safety cover in the open position or without water in the acoustic assembly; the acoustic system will not work.
- If there is any indication that the Safety System is not functioning properly, **DO NOT** operate the equipment and contact Covaris immediately.
- If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

To Prevent Damage to the Equipment:

- The instruments are designed to operate in ambient laboratory conditions e.g., 15 °C to 30 °C (59 °F to 86 °F). **DO NOT** operate the instrument in a cold room environment. The system is designed to operate with a water bath and includes a solid state heater/chiller apparatus to control sample temperature.
- **NEVER** run a method without water in the acoustic assembly; this could damage the transducer. The instrument is equipped with a water level sensor to protect the transducer. The system will not allow the acoustic wave treatment to start unless an adequate volume of water is detected.
- **DO NOT** leave water in the water bath with instrument power turned off for an extended time as this disables the water cleaning system within the apparatus.
- AFA-grade water should be used to fill the supply water bottle.
- **DO NOT** employ isopropyl alcohol, ammonia-based or abrasive cleaners on the acoustic assembly.
- Sample plates should be stored in a dry place when not in use.
- **DO NOT** load third party hardware, software, or parts onto the system without consulting with Covaris.
-

Warranty

When used in accordance with written instruction and under normal operating conditions, the Covaris instruments are guaranteed to be free of defects in MATERIAL and WORKMANSHIP for one (1) year from the date of original delivery by an authorized representative. Any component proven defective during the stated period will be repaired free of charge or replaced at the sole discretion of Covaris, F.O.B., Woburn, Massachusetts, U.S.A. provided that the defective component is returned properly packaged with all transportation charges prepaid. The customer is expected to perform basic diagnostics and component replacement via telephone support from Covaris personnel. If Covaris personnel are required to perform on-site repair, all travel related costs are paid by the customer. A limited warranty as specified may apply to certain components of the equipment.

Warranty Exceptions

This warranty is void if failure of the software or hardware has resulted from accidents, abuse, improper maintenance or repair, or by misapplication from the customer. It is also void if damage is caused by any unauthorized attachments or if modifications are made to the equipment. Removing or tampering with the Safety Enclosure will void the warranty, and the customer will assume all liabilities.

This warranty is limited to the original purchaser and is not transferable.

The software will perform according to the accompanying written materials and the medium on which the software is delivered is

free of defects in materials under normal use and service. The warranty is void if damage has resulted from third party software not intended for use with the system.

The high-power focused transducer is designed to give maximal mechanical energy output in water. Permanent damage to the transducer and electronic circuits could result if the transducer is operated without water. Operation of the system without water in the water bath voids the warranty.

CONTACT COVARIS, INC. SHOULD YOU HAVE QUESTIONS OR CONCERNS PERTAINING TO THE USE OF OUR EQUIPMENT.

Warranty Services

The purchased equipment is covered by a twelve (12) month warranty which includes all the necessary services and support necessary so that the customer can successfully operate their equipment. Extended warranties are available at the end of the original 12 month warranty period.

Services included with the original purchase of the system are:

Technical Support – Ongoing assistance with the operation or application of the equipment and/or troubleshooting is provided via:

- Telephone
 - United States: Tel: +1 781.932.3959 during the hours of 9:00 a.m. to 5:00 p.m., Monday through Friday, Eastern Standard Time (EST), Greenwich Mean Time (GMT-05:00)
 - Europe: Tel: 44 (0) 845 872 0100, during the hours of 9:00 a.m. to 5:00 p.m., Monday through Friday, Greenwich Mean Time
- E-mail queries to techsupport@covaris.com or applicationsupport@covaris.com

ML230 Instrument Repair – Warranty repair of the ML230 is provided on site. All labor and expense charges are included. Failure due to accident, abuse, or improper operation is not covered. An Operator's Manual is provided with the equipment. This manual includes sections on the operating instructions, maintenance guidelines, and troubleshooting tips.

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1. Introduction

1.1 Overview of the User Manual

This manual contains the installation, operation, and service instructions for the ML230 Focused-ultrasonicator which are essential to the proper use and care of this equipment. Should any unforeseen problems occur with the normal operation of the equipment, contact Covaris Technical Support (techsupport@covaris.com) immediately.

The following definitions apply in this manual:

NOTE: Inconvenience if disregarded	WARNING: Personal injury may occur.	CAUTION: Equipment damage may occur.
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1.2 The ML230 and the Covaris Process

The ML230 Focused-ultrasonicator is based on Covaris Adaptive Focused Acoustics (AFA) technology. This instrument is designed to provide researchers an integrated stand-alone tool to be used in laboratory environment. The instrument is ideal for those who work with DNA shearing and sample preparation.

The system is comprised of the **Treatment System** which delivers the acoustic energy to the sample, the **Safety System** which protects users from inadvertently contacting the high intensity acoustic energy, and an embedded *Computer and Application Software* which provides users an interface to control the device.

The Covaris Process uses Adaptive Focused Acoustic energy to precisely control cavitation and acoustic streaming within the sample treatment vessel in a non-contact, isothermal fashion. Focused acoustic energy is generated and delivered to individual samples. The mechanical energy imparted on the sample results in a controlled series of compression and rarefaction events.

2. Installation and Setup

2.1 Unpacking the System

Follow the included instructions for removing the ML230 instrument and accessories from their shipping materials.

2.2 Assembly

The following items should be found in the package of the Covaris ML230 instrument:

- ML230 main unit
- Accessory Box
 - Bubble Level Tool
 - Sample Tray Assembly



Figure 2.1 Leveling Tool



Figure 2.2 Sample Tray Assembly

- 2 Plastic water bottles
- 1 ML230 power cord
- Sample Racks and Consumables, depending on order configuration

CAUTION: The ML230 weighs about 80 pounds (36 kg). With the front of the instrument closest to your body, lift the ML230 by gripping from its base plate. Lifting the unit by its plastic case or doors will damage the instrument.

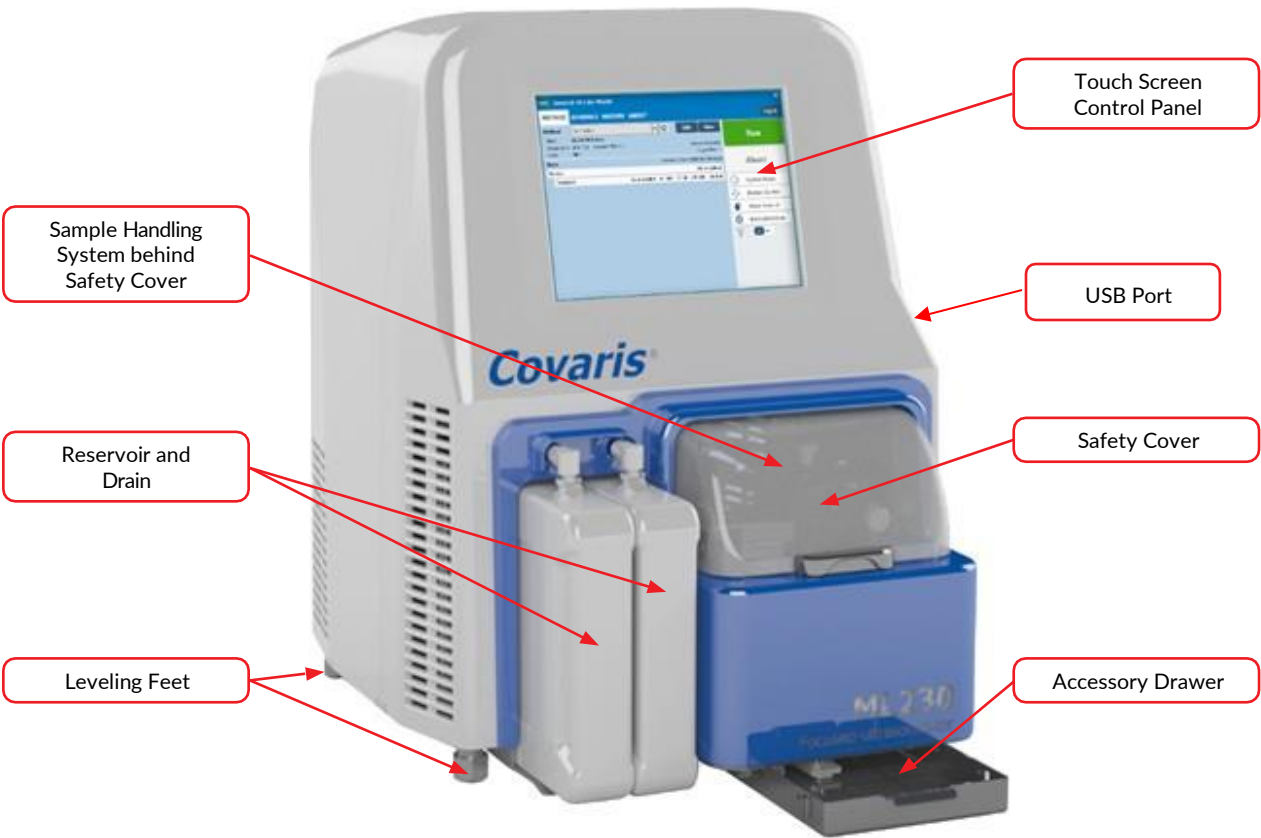


Figure 2.3 Front view of the ML230 instrument

After the instrument is unpacked, position the ML230 on a flat surface near a power outlet. Use both sides of the base to lift the instrument. **DO NOT** lift by the plastic parts at the front of the instrument.

1. Assemble the Water Control supply and waste bottles.
 - Locate the two plastic bottles in the accessory box.

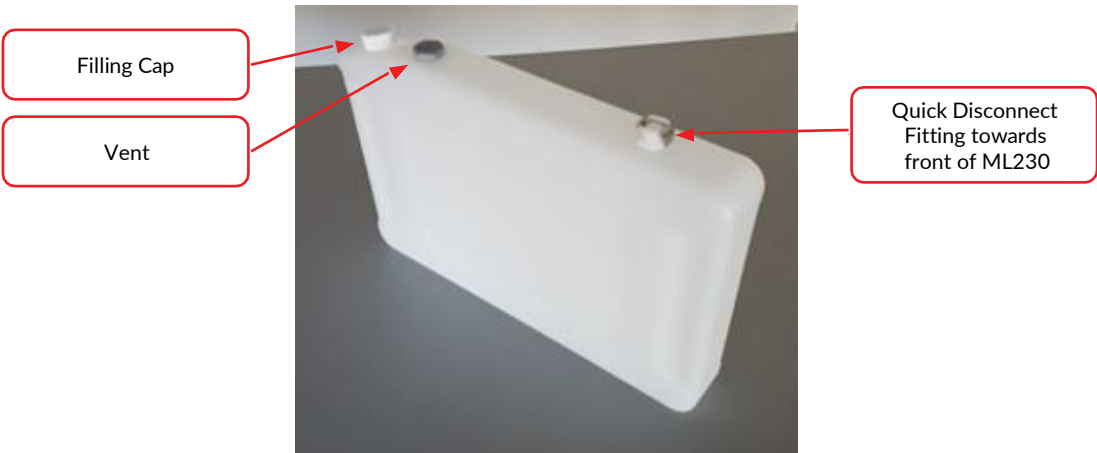


Figure 2.4 Water Control System Bottle

- Remove the cap on the 'Supply' bottle, fill the bottle with AFA-grade water, and replace the cap.



Figure 2.5 Remove cap to fill.

NOTE: The 'Waste' and 'Supply' reservoirs are not interchangeable. The 'Waste' bottle vent is marked 'Waste'.

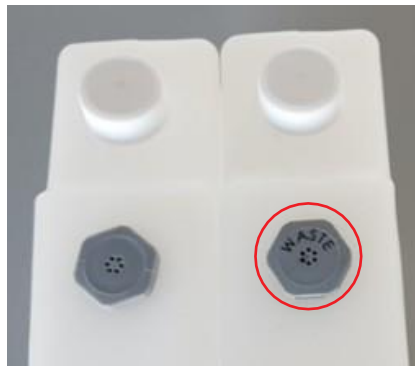


Figure 2.6 Supply and Waste Bottles with Waste Bottle Labeled.

- Holding the two quick-connect tubes up and out of the way, slide the empty Waste bottle into the left-most opening at the front of the ML230. The vent and cap are toward the rear; the Quick Disconnect port toward the front of the instrument.
- Slide the Supply bottle filled with water into the remaining opening, between the Waste Bottle and the sample handling area.



Figure 2.7 Bottles into Water Control Bay

- Press the two Quick Disconnect fittings into the Waste and Supply bottles until they click into place. See **Figure 2.4**.



Figure 2.8 Connecting Water Control Bottle to System

2. Assemble the Sample Tray Assembly to the ML230.

- Locate the Sample Tray Assembly in the accessory box

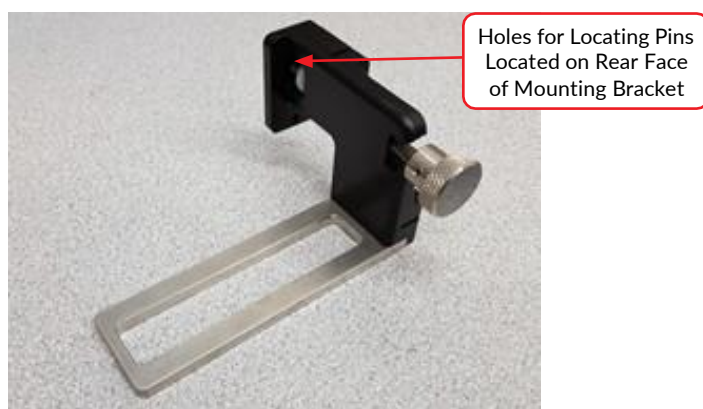


Figure 2.9 Mounting Bracket

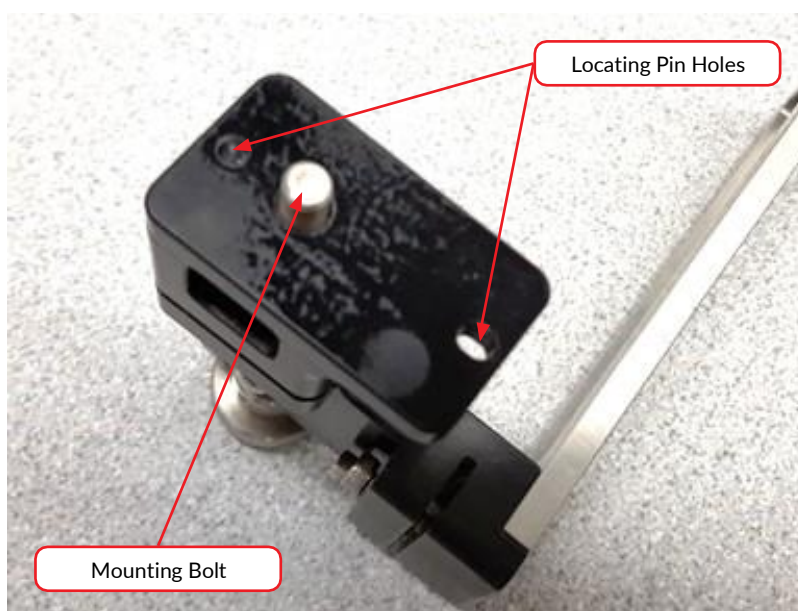


Figure 2.10 Mounting Bracket

- Lift the Safety Cover open.
- Slide the Sample Tray Assembly locating pin holes onto the pins on the motion system, behind the safety cover.
The sample tray faces to the left. Refer to the image below.

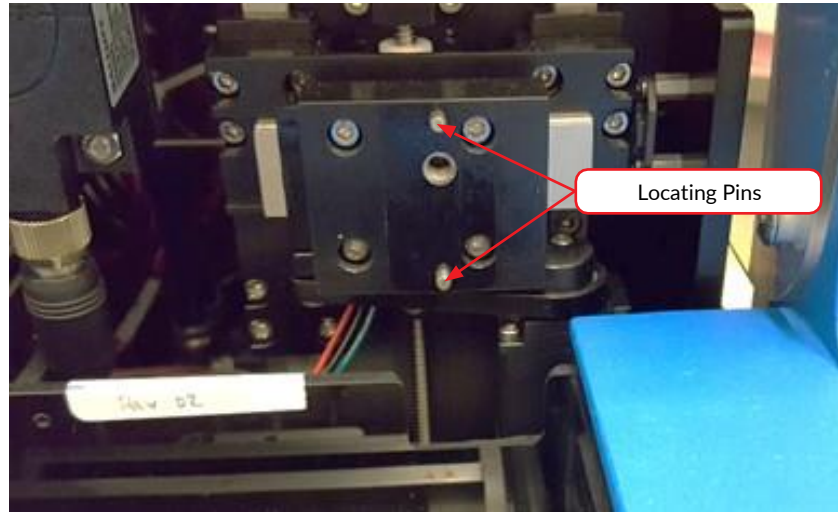


Figure 2.11 Mounting Bracket installed in ML230

- Thread the Sample Tray Assembly's thumbscrew into the motion system and snug it finger-tight.

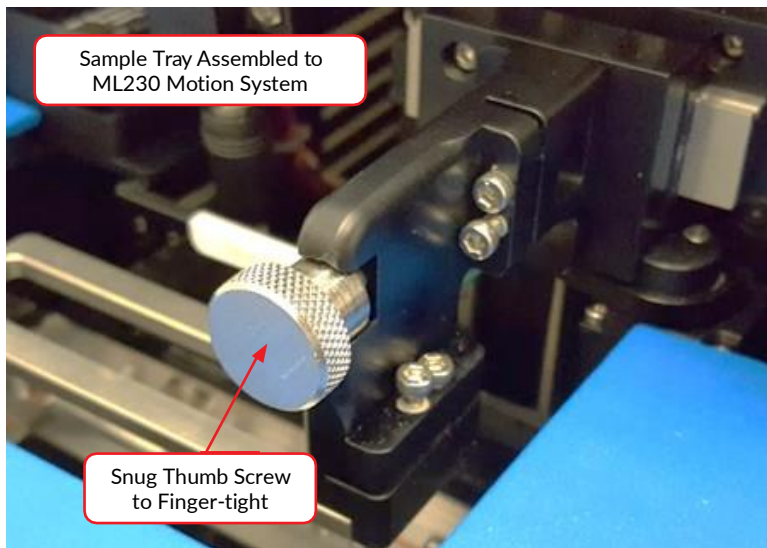


Figure 2.12 Sample Tray Assembled to ML230



Figure 2.13 The power panel of the ML230 instrument

3. As shown in **Figure 2.13**, plug the AC power cord into the power inlet located about half-way up the left side of the ML230 rear panel. Plug the AC power cord into the power outlet.

The entire instrument may be relocated in this assembled configuration by disconnecting power, lifting from the bottom, relocating, and repeating the appropriate assembly steps.

NOTE: Any time the ML230 is moved to a new location, follow the instrument leveling procedure described in Section 2.3.

2.3 Leveling the ML230 Instrument

This step is very important to ensure proper filling and draining of the water bath and proper instrument operation. Once the ML230 is installed in the location in which it will be used:

- Open the Front plastic safety cover
- Place the leveling fixture in the sample tray



Figure 2.14 Leveling Tool

- If the bubble is to the right side of the center markings of the sight glass, the right side is high, and the right side feet need to be shortened. If the bubble is to the left side, the right side is low, and the right side feet must be lengthened. Adjust both front and rear feet an equal number of turns.
- Repeat the process above to level front-to-rear, adjusting only the feet in the front. If the bubble is in the center of the fixture sight glass, no adjustment is required. If the bubble is to the front side of the center markings of the sight glass, the front side is high, and the feet need to be shortened. Alternatively, if the bubble is to the rear, the front side is low, and the legs must be lengthened. Adjust both front feet an equal number of turns. The feet can be adjusted by hand; no tools are necessary.

NOTE: The feet can be adjusted by hand; no tools are necessary.

- Lengthen or shorten both legs on the right side of the instrument an equal amount, as in **Figure 2.15**, until the bubble is centered in the leveling fixture sight glass.

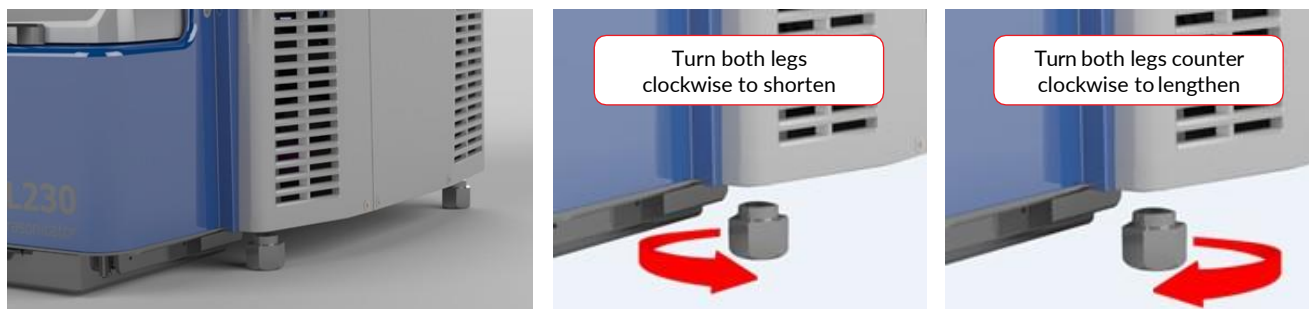


Figure 2.15 ML230 Leg Height Adjustment

2.4 ML230 Software

SonoLab 10 has been pre-installed on the ML230 instrument. No further installation or configuration is required.

SonoLab is the software used to control a Covaris Adaptive Focused Acoustics instrument for processing a sample. It is designed to create, edit, and run a sample processing program called a method. It has provisions to run, pause or stop a method and view execution histories which contain a record of key instrument parameter values during a run.

If it is necessary to install or re-install SonoLab, please contact Covaris for the latest versions, downloading, and installation instructions.

3. Operation

3.1 General Overview

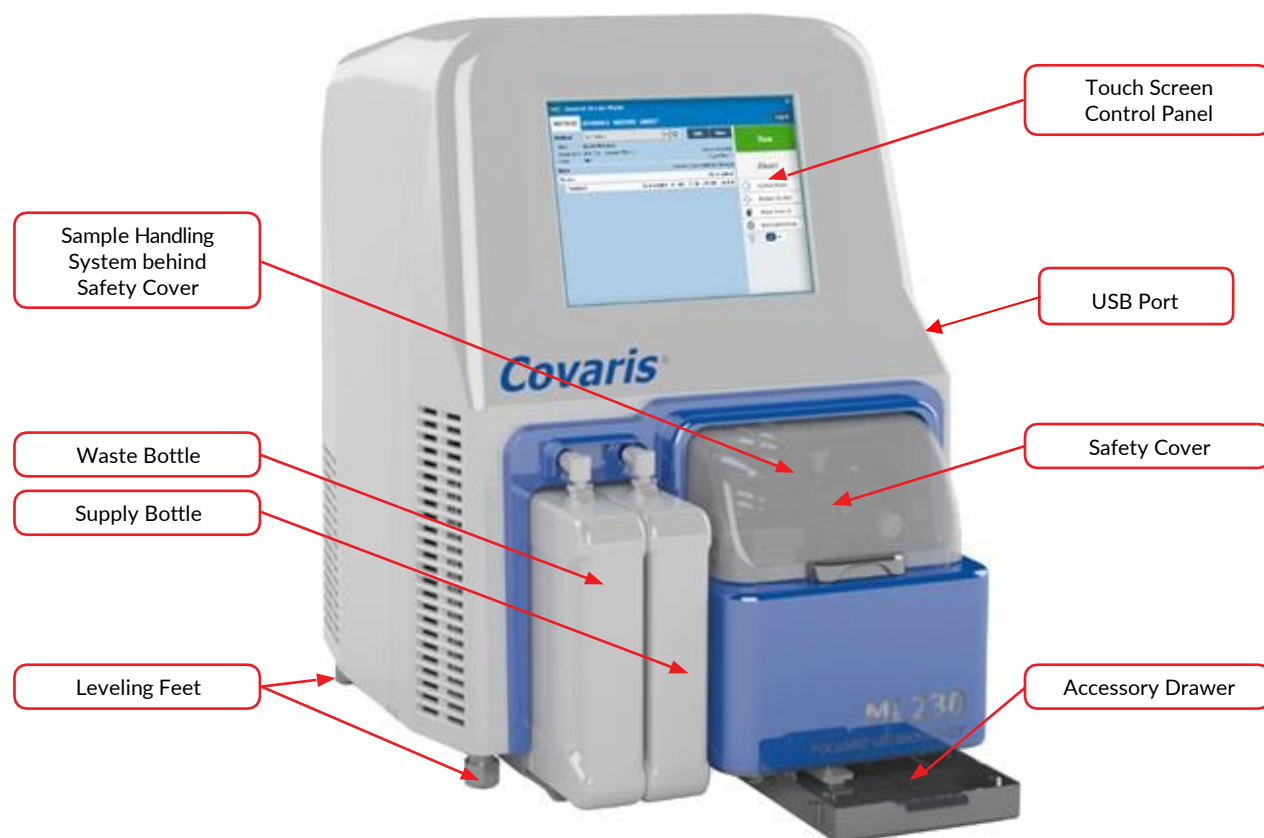


Figure 3.1 Principal components of the ML230 instrument

The Safety Cover is used to protect users from potential acoustic hazards during the treatment. The acoustic treatment will not be started if the Safety Cover is open.

The Acoustic Assembly, located in the water bath below the sample tray, is used to transmit the acoustic energy from transducer to the sample through the coupling media (AFA-grade water). The assembly incorporates an Acoustic Transducer which converts electrical signals into ultrasonic acoustic signals. The assembly also incorporates Sensors for water level and temperature to ensure that these are appropriate during acoustic treatments.

The 2-axis Motion System is designed to automatically align the sample tube at the appropriate position and height in the acoustic field for processing. Tubes are loaded into appropriate Racks, which are then placed on the ML230 sample tray.

An Embedded Processor provides an interface for controlling the ML230 instrument via the touch screen at the front of the ML230.

The Electronics Cabinet provides the hardware for controlling the acoustic transducer, the temperature, and sample position during processing.

The Enclosure Light is normally lit when the instrument is turned on. The user can disable the light from the SonoLab Home screen.

The Water Control consists of a pump, valves, supply and waste bottles, and interconnecting plumbing. These components are controlled automatically by SonoLab software to fill, drain, and maintain the correct water level in the water bath.

When the bath is filled, the water is circulated through a UV sterilizer and particulate filter to prevent biological growth in the water control hardware.

The Thermal Module controls the water bath temperature. It cools or heats the acoustic assembly, maintaining the water bath at or near the setpoint programmed in the method. No external chiller is required.

You may need to attach multiple USB devices to the ML 230. For example, the handheld RFID device discussed in Appendix F has two USB cables. Other USB devices may include an external keyboard or mouse. Connecting these requires an external USB hub. We recommend using a USB hub that has an independent power source to ensure that all attached devices receive adequate power. Refer to Image 3.1 above for the ML230 USB Port location.

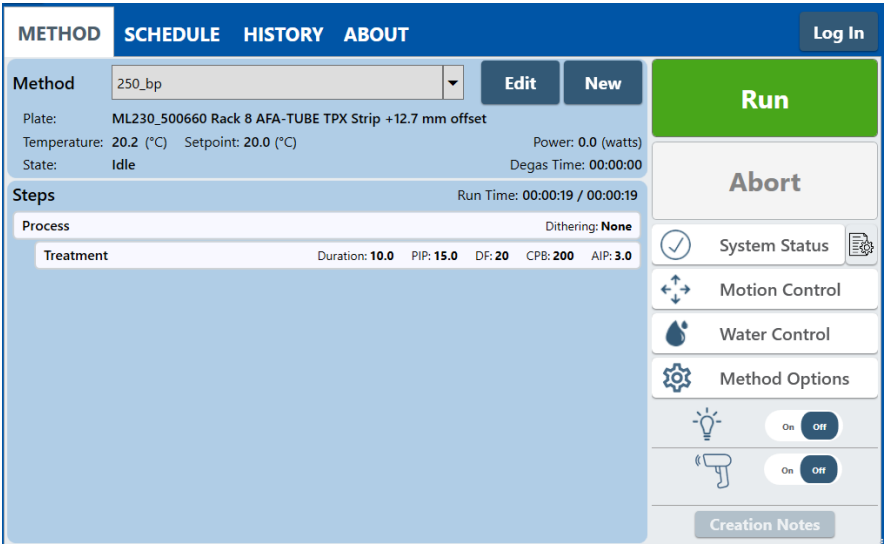
WARNING: During treatments, objects immersed in the focal zone above the transducer will be exposed to high acoustic intensity when the system is activated. Always close the Safety Cover prior to starting a method. Do not tamper with the door-closed sensor system.

3.2 Starting the ML230

NOTE: The ML230 is shipped with the sample tray removed. If the sample tray has not already been installed, follow the instructions from Section 2: Installation and Setup.

Turn on the ML230 power switch located about half-way up the left side of the rear panel.

SonoLab will automatically connect to the instrument, and a window will appear asking whether the instrument is to be homed. Tap “Yes”. The motion system will perform its initialization sequence, the homing window will close, and the SonoLab Home screen will be displayed.



3.3 Preparing the ML230 for Use

To run an acoustic treatment, the following conditions must be met:

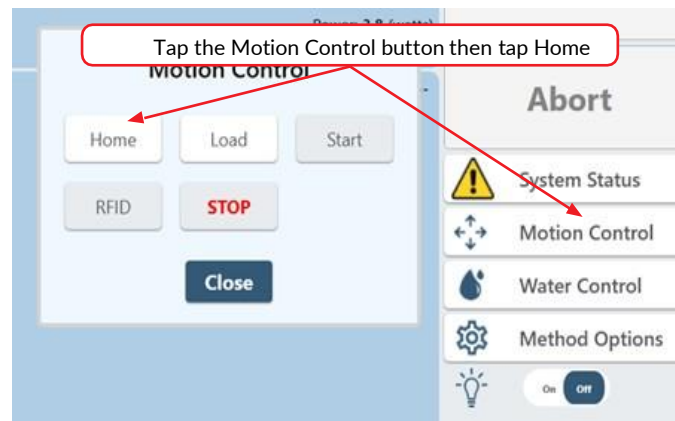
- a. The ML230 motion system must be initialized

- b. There must be an acoustic method selected in the Method box
- c. The proper rack and consumables must be in place on the ML230 sample tray. See [Section 3.5](#), Loading the Samples
- d. Water Temperature must be within acceptable Min and Max limits
- e. Water must be at the level required by the consumables specified in the selected method
- f. The safety cover must be closed

The Run button will remain gray and inactive until all necessary conditions except water level and temperature are met. The ML230 automatically corrects these when “Run” is selected.

To achieve an acceptable status on the other conditions:

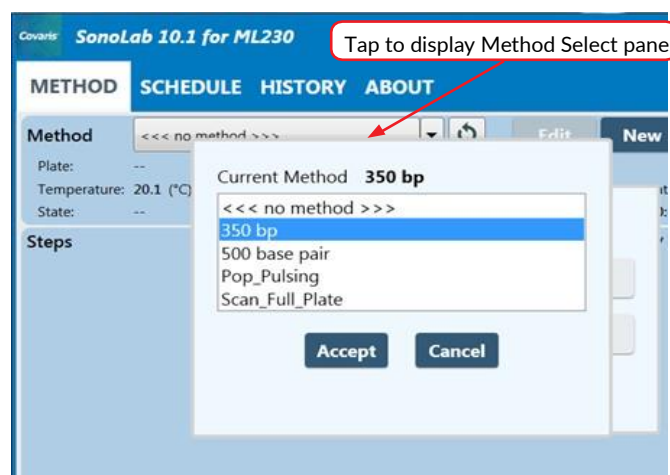
- a. The ML230 motion system normally initializes when SonoLab starts, unless the user purposely skipped this step, in which case the motion system can be homed from the Motion Control pane.
 - Tap the Motion Control button to display the Motion Control pane
 - Tap “Home” to initialize the motion system



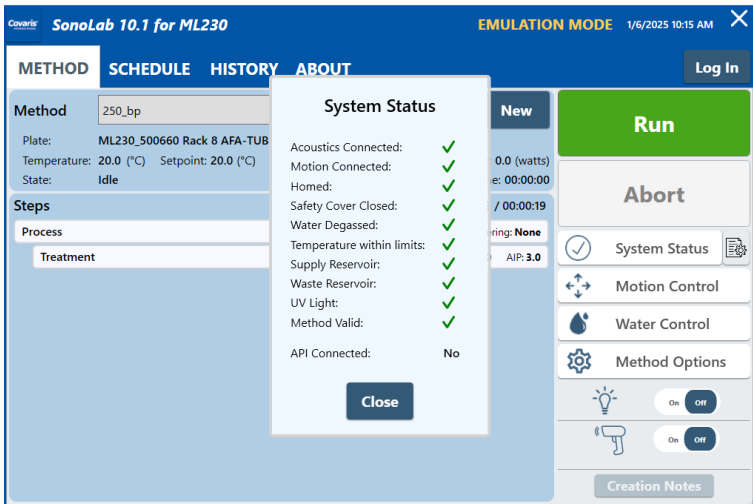
To select and load an acoustic method, tap the “Method” bar to display the Method Select pane. Navigate through the list with the vertical scroll bar, if necessary, and select a method.

If Consumable-based Method Selection is enabled, the “Method” bar is disabled. See Consumable-based Method Selection in Section 8.1 under Section 8, Advanced Topics for a detailed discussion of this option.

NOTE: Several acoustic methods will come pre-installed onto your system.

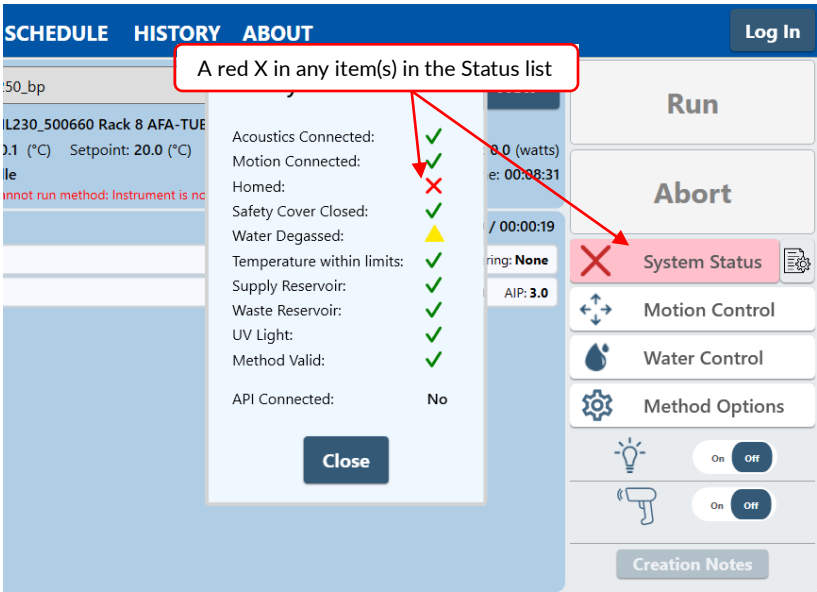


- b. Open the safety cover and insert the samples onto the sample tray.
- c. The Safety Cover Closed status will turn green as soon as the Safety Cover is completely closed.



The remaining conditions, along with their related states, are displayed in the Instrument Status panel. Tap the “System Status” button to display the Instrument Status panel. An acceptable condition is indicated by a green check mark in the Status box.

If any of the items in the Status list display, a red X will also be displayed in the System Status button, as shown below.

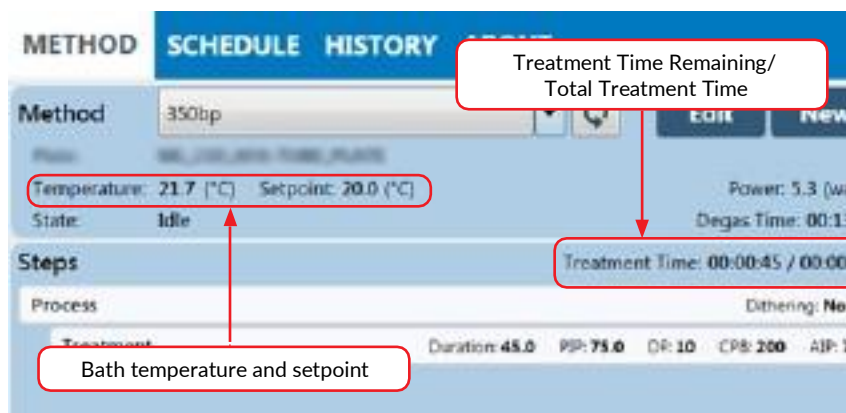


A yellow triangle indicates that degassing time or temperature targets have not yet been met.

Once a method has been loaded and all conditions except temperature, degas state, and water level are acceptable, the Run button will turn green and the selected acoustic method can be started.

To modify an existing method, see Create and Edit Methods in *Section 7*.

The method's total and remaining run time (hours, minutes, and seconds), temperature setpoint, and actual bath temperature will be displayed on the main screen as shown.



- d. The ML230 system automatically adjusts the water temperature to match the method temperature setpoint after Run is selected. Water Temperature status will turn green when temperature is within the Min and Max limits (typically 3 degrees above or below the setpoint). The default setpoint (in the absence of a selected method) is 20 °C.
- e. The ML230 Water Control automatically fills the bath to the appropriate level for the tubes specified in the method when the Run button is tapped to start a method. The ML230 also degasses the water, as necessary.

3.4 ML230 Water Control

To transmit acoustic energy to the sample vessel, the bath surrounding the transducer must be filled with deionized water. Covaris recommends AFA-grade Water. You can also use highly purified water (at least ASTM Type III or ISO grade 3).

The ML230 Water Control automatically maintains the correct water level in the bath for the sample vessels specified by a method. This system either adds water from the Water Control supply bottle to raise the level of the bath or removes water from the bath to the Water Control waste bottle.

Sensors detect if the supply bottle is empty or the waste bottle is full, and these conditions are reported in the Instrument Status panel. To service the bottles, press the metal thumb latch on the Quick Disconnect Cap, as shown in **Figure 3.9** to release the Quick Disconnect Insert of the bottle being serviced, and slide the bottle out. Remove the cap at the rear of the bottle, then empty the waste bottle or fill the supply bottle, as appropriate, and reverse steps to reinstall the bottle. The Supply bottle is to the right, next to ML230 sample handling system, and the Waste bottle is to the left of the Supply bottle.



Figure 3.7 Releasing the Quick Disconnect Fittings

3.5 Loading the Samples

A variety of tubes and their associated racks are available for use with the ML230. In some cases, individual tubes are simply placed into the rack as shown.

The 8 microTUBE strip is fitted to its rack as a unit. Open the hinged rack and insert the 8 microTUBE strip. The strip is keyed to fit the rack in the correct orientation.



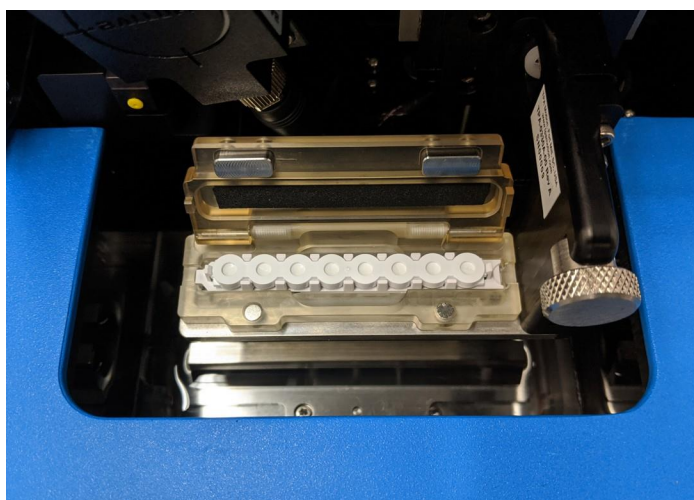
Assembling microTube 8-strip into Rack

Close the hinged rack cover to secure the strip. Magnets in the cover hold the cover in the closed position.



ML230 8 microTUBE Strip 50 Rack

Open the ML230 safety cover. Place tubes and rack assembly into the ML230 sample tray shown below. The racks are keyed to load into the sample tray in the correct orientation only.

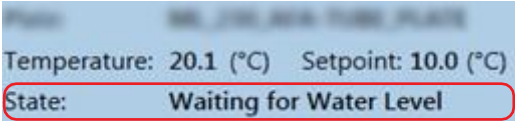


Sample Rack Loaded onto ML230 Sample Tray

Close the Safety Cover to ensure that the Door status in SonoLab turns to a green check.

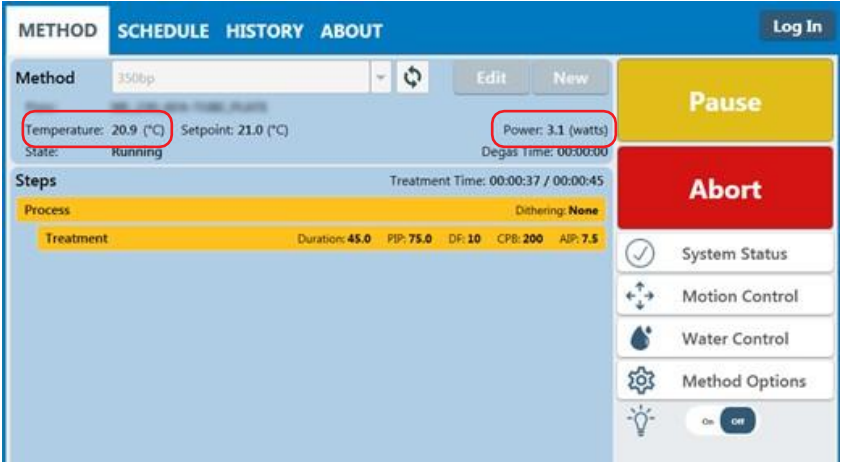
3.6 Running a Method

When the “Run” button is green, the selected method may be started. Tap the “Run” button to start. The green “Run” button becomes a yellow “Pause” button, and the “Abort” button turns red. The instrument will automatically adjust the water level and/or temperature to the appropriate settings, as shown below.



When the correct water level and bath temperature are reached, acoustic treatment begins.

As the method runs, the Process and Treatment bars turn yellow, and the actual average incident power and temperature data are displayed.



Running Method

The user can, at any time while running a method, tap “Pause” to pause a running method. The “Pause” button becomes a green “Resume” button



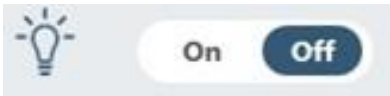
When the method is paused, the user may continue the process by tapping the “Resume” button or terminate the process by tapping the “Abort” button.



When the method has finished, the message “Method Complete” is displayed. Tap “OK”, then tap the “Motion Control” button, then the “Load” button from the motion menu to raise the sample tray out of the water bath. When the sample tray stops moving, raise the safety cover and remove the treated sample rack.

3.7 Instrument Light

The instrument light is located above the acoustic assembly and inside of the Safety Cover. By default, the light will be lit once the instrument is turned on. This light may be turned off by tapping the Light control on the Home screen.



3.8 User Maintenance

The water bath should be drained when the ML230 is not in use by tapping the Water Control button at the right of the main screen. The Water Control options will be displayed.



Water Control

Level (mm):

Current: 15.5

Load: 14.5

Run: 15.5

Temperature (°C):

Current: 20.0

Setpoint: 20.0

Range: 17.0 to 23.0

Degas Time:

00:00:00

Flow State:

Circulating

Fill to Load

Fill

Drain

Circulate

Off

Close

Tap “Drain”. Remove the rack from the sample holder and place it on a clean, dry surface. Blot up water remaining in the bath using a soft, lint-free cloth, wipe, or swabs included with instrument. Close the Safety Cover.

Cleaning Protocol

A cleaning protocol using an NaDCC solution should be performed once a month as follows, to prevent biological growth in the water bath or plumbing of the Water Control system. Refer to the cleaning instructions in **Appendix E** of this manual.

NOTE: Use only 70% isopropyl alcohol wipes to clean the exterior of the ML230.

Water Control Particulate Filter

The Water Control particulate filter element should be replaced every 12 months. Replacement filters can be obtained from Covaris Customer Service. See **Appendix C** for filter replacement instructions.

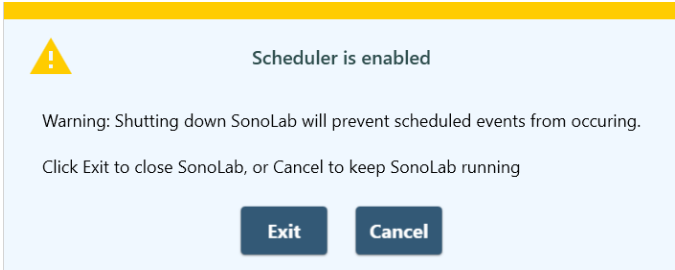
3.9 Shut-down Procedure

If the instrument will be idle for an extended time (e.g. overnight or a weekend), shut down the instrument using the following procedure: Empty the water bath and store the sample rack in a clean, dry place.

CAUTION: Leaving water in the water bath for an extended time may allow algae growth which will interfere with sample processing.

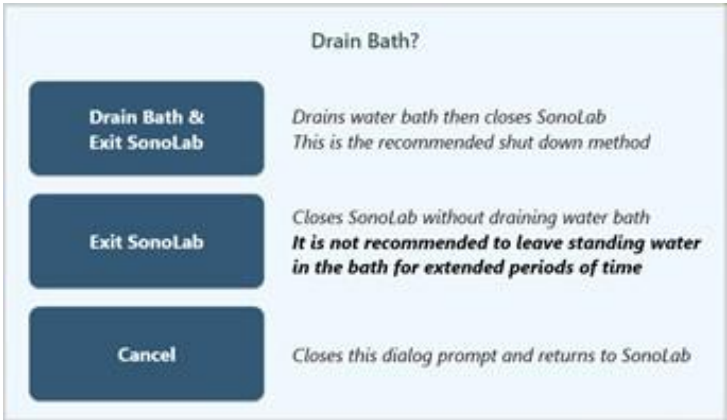
To shut-down the ML230:

- Close SonoLab by tapping the white X at the upper right corner of the screen.
If the scheduler is enabled, a warning message will be displayed.

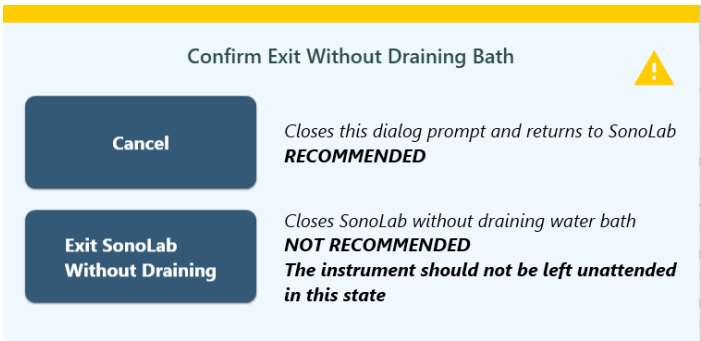


If 'Exit' is selected, the 'Drain Bath?' pane is displayed.

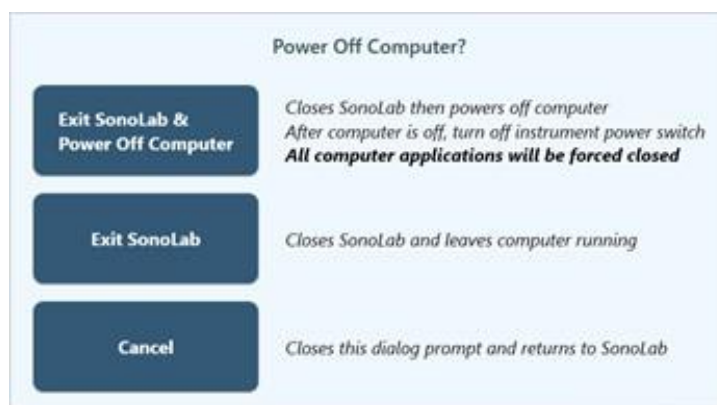
- When the 'Drain Bath?' pane appears, tap 'Drain Bath & Exit SonoLab' or 'Exit SonoLab'. As stated in the pane, 'Drain Bath & Exit SonoLab' is the preferred option, as leaving standing water in the bath when SonoLab is not running can result in bio-growth. The 'Exit SonoLab' option, which exits without draining the bath, may be used in the event SonoLab is to be shut down and shortly restarted.



- If 'Exit SonoLab' is chosen, the 'Confirm Exit Without Draining Bath' pane is displayed.



- When the bath has drained, or immediately if 'Exit SonoLab Without Draining' is chosen, the 'Power Off Computer?' pane is displayed.



- Once the computer is shut down, move the ML230 power switch to the OFF position. The power switch is located on the rear panel of the ML230, about half-way up the left side, above the power cord.

4. AFA Operation

AFA uses four parameters to fine tune specific acoustic treatments. These parameters are programmed into **Methods**, provided by Covaris. **Methods** can be executed manually or by automation software, including specifying the treatment to be performed and whether a full or only part of a plate is to be treated. A brief explanation of the treatment parameters is provided below.

Peak Incident Power (PIP)

This parameter measures the peak electrical power used to drive the ultrasound transducer. In the ML230, the range of Peak Incident Power is 1.5 to 450 Watts. Maximum power may be automatically limited by the consumables used in a treatment method.

Duty Factor

This parameter defines the ratio between transducer on-time and total operation time. Duty Factor is expressed as a percentage. For a given Peak Incident Power, a larger Duty Factor results in more acoustic energy generated from the transducer. Users can define the Duty Factor from 2 to 50% in the ML230.

The product of the Peak Power and Duty Factor gives the approximate Average Incident Power (AIP) generated from the transducer. For example, if Peak Incident Power is set to 10 Watts and Duty Factor is set to 15%, the Average Incident Power will be approximately 1.5 Watts. However, the real average incident power from the transducer may vary due to factors such as sample tube type, water level, and water temperature. Maximum Average Incident Power for the ML230 is 100 watts.

Cycles per Burst

This parameter indicates the number of electrical signals used in each acoustic “burst” of the transducer. Cycles per Burst (cycles/burst) range from 50 to 1000 in the ML230 for different applications.

Duration

This parameter defines the amount of time during which the sample is under treatment. The range of Duration is from 1.0 to 3600.0 seconds.

Treatment Records

SonoLab History contains a record of parameter information for each treatment method run. An RFID scan is performed on each treated sample tray to ensure that the correct consumables are being used for the treatment and to provide information for LIMS.

Each *sample* plate can be scanned twice, either with the built-in or a handheld RFID scanner.

Within a single method run, the usage count for a sample plate is only incremented by one, regardless of how many times the plate is treated in the method.

The count is only incremented if the sample is actually treated during the method run. The count is not incremented if the method is aborted before the first time the sample is treated.

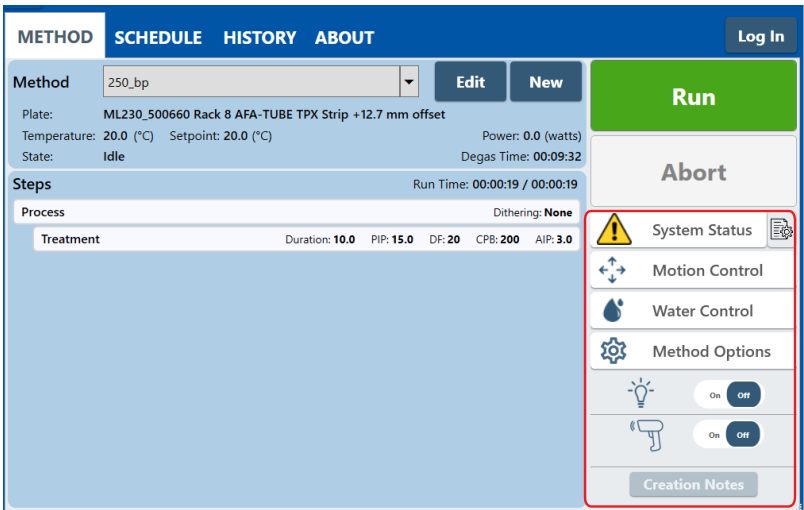
5. SonoLab Application Software

The main components of SonoLab software include:

- **Method** – compose or select methods to run
- **Schedule** - program times for the ML230 to automatically prepare for operation
- **History** – view system usage history
- **About** – information on system configuration

5.1 Method Screen

The Method Screen is the principal user screen for the system. *Section 3* contains details on operating the instrument through the Method Screen. The right side of the Method Screen displays buttons which display additional information and controls.



Tap the 'System Status' button to display the 'System Status' pane.



The 'System Status' pane, as explained in *Section 3*, displays the states of various ML230 subsystems, indicating whether the ML230 is ready to operate.

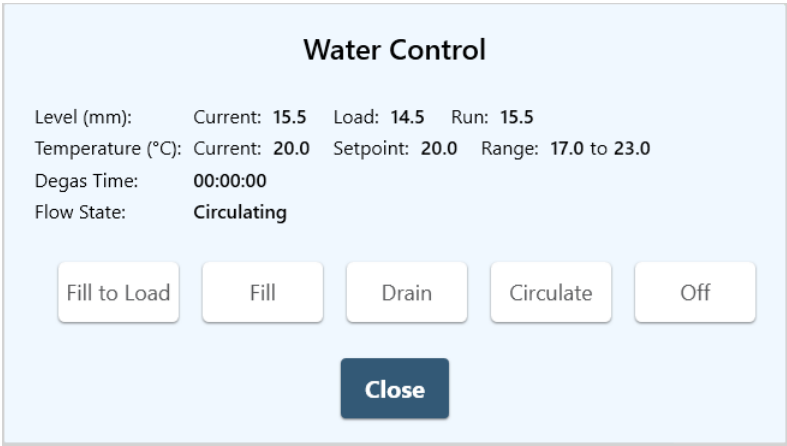
Tap the 'Motion Control' button to display the 'Motion Control' pane.



The 'Motion Control' pane contains buttons used to move the ML230 predefined position.

- **Home:** moves the sample tray to Home position and initializes the ML230 motion system.
- **Load:** moves the sample tray to a convenient location for loading and unloading samples.
- **Start:** moves the sample tray to the initial treatment position for the currently selected treatment method.
- **RFID:** moves the sample tray to the correct location for the currently selected method's rack to be scanned by the RFID reader.
- **Stop:** stops any current motion.

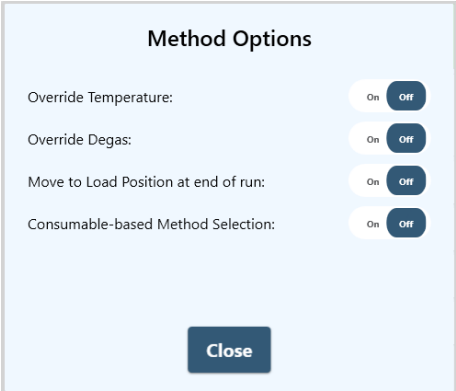
Tap the 'Water Control' button to display the 'Water Control' pane.



The 'Water Control' pane displays the current temperature, level, and degassing states of the ML230 water bath. The pane also contains the following buttons:

- **Fill to Load:** adjusts the bath water level to the level specified by the currently selected method.
- **Fill:** fills the water bath to its maximum fill height.
- **Drain:** drains the contents of the water bath to the waste bottle.
- **Circulate:** circulates the bath water through the UV sterilizer and particulate filter.
- **Off:** turns off both circulation and degassing pumps.

Tap the 'Method Options' button to display the 'Method Options' pane.



The 'Method Options' pane contains switches for enabling alternate behavior of treatment methods.

- **Override Temperature:** allows a treatment method to run when the water bath temperature is outside the limits specified within the method.
- **Override Degas:** allows a treatment method to run without waiting for the degassing timer to complete its countdown. This can be useful if the bath water is degassed but SonoLab has been restarted. This will cause the degas timer to start over.
- **Move to Load Position at end of run:** the sample tray moves to the Load position to facilitate loading and reloading samples.
- **Consumable-based Method Selection:** limits the list of available treatment methods to those using a specific consumable. Refer to *Section 8.1* for instructions on using this feature.



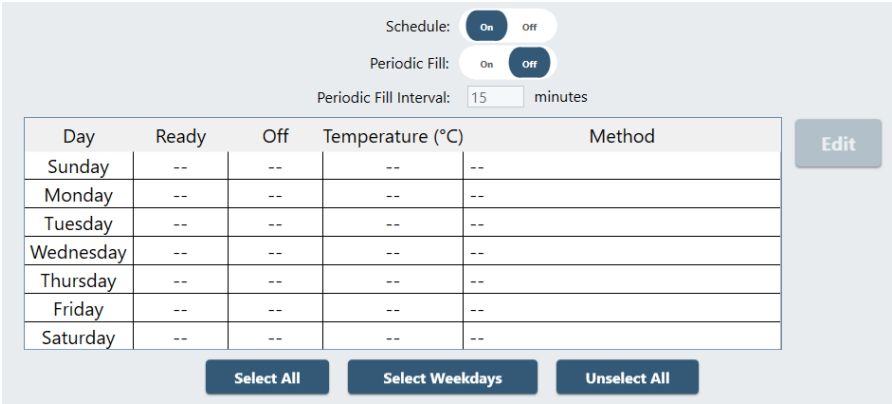
If either temperature or the degas timer is overridden, the word “Overridden” will appear next to it in the 'Status' pane as shown to the right.

5.2 The Schedule Screen

The Schedule screen is used to configure bath Periodic Fill and scheduling Ready and Off states daily. In the Ready state, the water bath is degassed, and the water bath temperature is at the temperature specified in the selected method.

In the Off state, Periodic Fill and the WCS temperature control are turned off, but the circulation pump is on to circulate the water through the filter and UV fixture, preserving water cleanliness. The selected method is set to none.

The operator must be logged in as Administrator, or higher permission level, to adjust the parameters on this screen.



- **Periodic Fill:** SonoLab checks and adjusts the ML230 water bath level at the start of each treatment method. However, if the ML230 will be idle for long periods of time during the day, the Periodic Fill function can be configured to periodically check the bath level while the system is idle. If necessary, the water level will be corrected, degassed, and the temperature adjusted so that the system will be ready when needed.

Tap the Periodic Fill on/off switch so that On is highlighted dark blue. Enter frequency desired for checking the water level. The default value is every 15 minutes.

- **Schedule**

- To configure the scheduler, first tap the Schedule On/Off switch so that On is highlighted dark blue.
- To configure a specific day, for instance Sunday, tap the Sunday line of the chart, then tap the Edit button, or just double-tap in the Sunday line of the chart, to display the Schedule Settings screen.

There are two sections of the Schedule Settings screen, READY and OFF. READY is for configuring a time for the system to be ready to run, typically ahead of a daily plant startup in the morning; OFF is for placing the system in an idle state, typically at the end of the day.

NOTE: If the bath is not drained, please do not turn off SonoLab, as shutting down SonoLab means that the water will not circulate through the filter and UV light.

- **Ready**

- Tap the on/off switch until On is highlighted in dark blue.
- Tap the Ready Time drop down list and select the time the ML230 will be ready to run treatment methods.
- Tap the Method drop-down list and select the method to be run.
- Water level will be set at the beginning of each method run. But, if the ML230 may be idle for long periods of time, tap the Periodic Fill on/off switch so that On is highlighted in dark blue. SonoLab will automatically maintain the correct water level, degassing state, and temperature.

- **Off**

- Tap the OFF section on/off switch so that "On" is highlighted dark blue.
- Select the time for the system to switch to standby (6:00 PM in this example) from the drop-down list.

Tap the Save button at the bottom of the screen when both Ready and OFF are configured. The updated Schedule screen is displayed.

Schedule:

On

Off

Periodic Fill:

On

Off

Periodic Fill Interval:

15

 minutes

Day	Ready	Off	Temperature (°C)	Method
Sunday	7:30 AM	6:00 PM	20.0	175 bp ML230 AFA-TUBE TPX Strip
Monday	--	--	--	--
Tuesday	--	--	--	--
Wednesday	--	--	--	--
Thursday	--	--	--	--
Friday	--	--	--	--
Saturday	--	--	--	--

Edit

Select All

Select Weekdays

Unselect All

Tap 'Select All', and then Edit if all seven days are to use the same scheduling parameters. Tap Select Weekdays then Edit if only the five weekdays are to use the same scheduling parameters.

NOTE: If a method is running at the time the scheduler is set to switch the ML230 to the OFF state, SonoLab ignores the scheduler and the ML230 will not be switched to standby on that day.

5.3 The History Screen

The History screen provides graphic and textual display of information for every treatment method run on the instrument. This list can be sorted by method name, date the method was run, the operator who ran the method, or the run status (complete, aborted, failed).

METHODSCHEDULEHISTORYABOUT

Go To: May 2024Previous 100Next 100

Method	Run Date	Run By	Status
EndLymphoma Shearing	5/20/2024 10:36:56 AM		Completed
EndLymphoma Shearing	5/20/2024 10:34:49 AM		Aborted
EndLymphoma Shearing	5/20/2024 10:18:55 AM		Aborted
EndLymphoma Shearing	5/20/2024 8:41:11 AM		Completed
CTO NCLN TWIST EXOME	12/13/2023 10:07:43 AM		Completed
MDA MAPP v1 Shearing	12/12/2023 12:45:10 PM		Completed
MDA MAPP v1 Shearing	12/12/2023 7:32:41 AM		Completed
MDA MAPP v1 Shearing	12/9/2023 8:23:56 AM		Completed
MDA MAPP v1 Shearing	12/8/2023 8:47:43 AM		Completed

When SonoLab is started, the most recent 100 results are loaded and displayed in the scrolling list, showing the name of the method with the date and time the method ran.

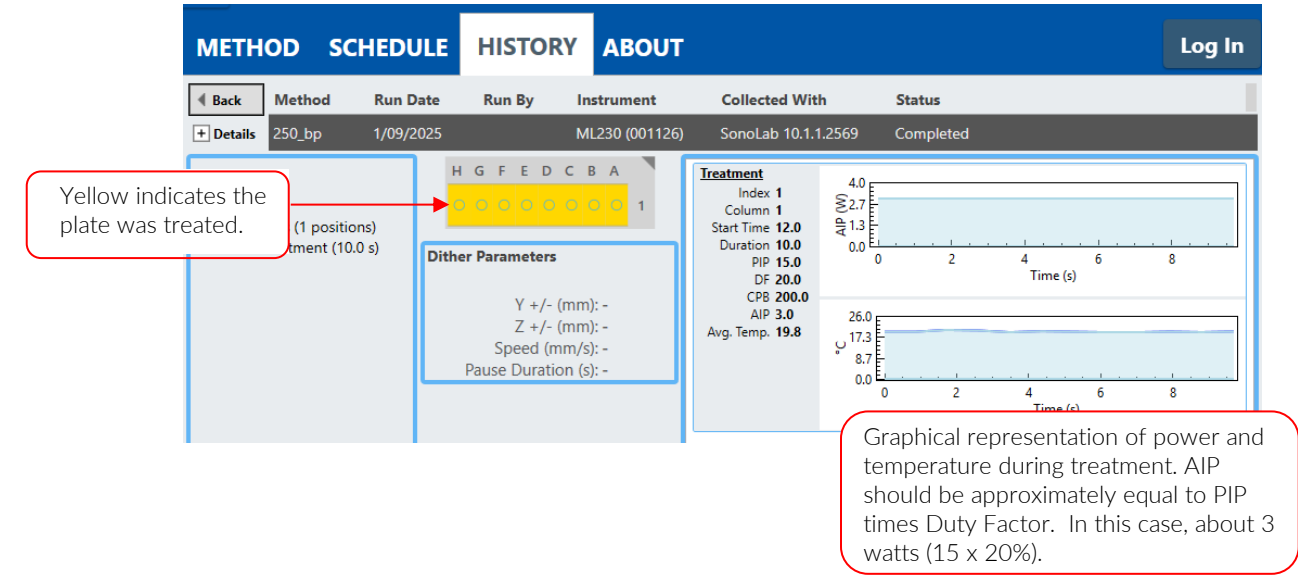
The status bar's Next 100 button loads the next 100 less recent files. The Previous 100 button loads the next 100 more recent files.

The Go To control allows the operator to select files run on a specific date. The files on the specified date will be displayed at the top of the list.

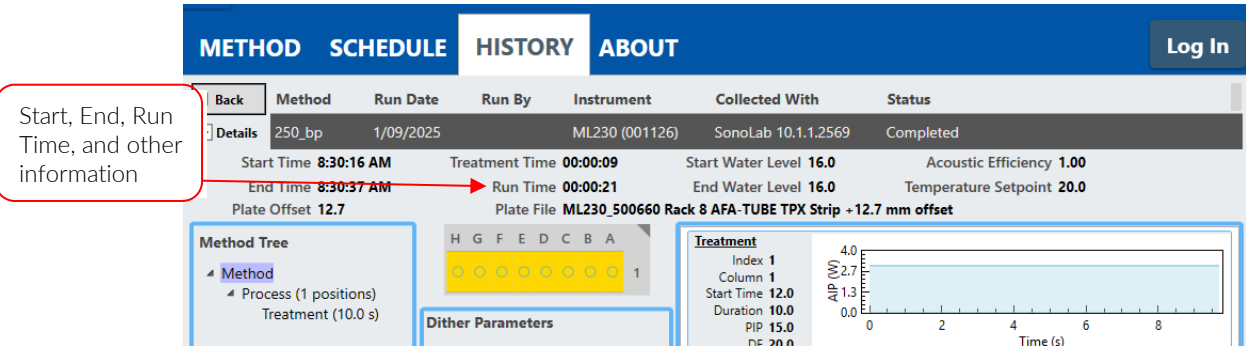
METHODSCHEDULEHISTORY

Go To: 20 May 2024

Double-tap on a line to display its details. The left side of the screen will display textual information concerning the method. A pane on the right side contains graphs of the temperature and power levels generated for each sample treated by the method. This pane scrolls as necessary to display the graphs of all samples treated by the method.



Tap the **+ Details** button at the top left. Additional information regarding the method run is displayed above the graphics.



History files are found at C:\Users\Public\Public Documents\Covaris\SonoLab 10\History. Each treatment method's history data are contained in a folder whose name is the same as the method with the date and time of the run appended. For example, the folder for a method named "300_bp" that was run on June 1, 2019 at exactly 10:30AM is named "300_bp_06_01_2019-10-30-00".

The history of a treatment consists of three or four files found in its folder, the Measurements, Summary, Treatments, and, if used, RFID files.

Measurements is a .csv file which can be opened as a spreadsheet, containing information about the methods run, including times, columns treated, acoustic power, bath water temperature and bath water level.

Treatments is also a .csv file containing treatment parameters and start and end times for the method, along with water level and temperature data. The Treatments file contains the same data as that sent to the LIMS.

Summary is a .xml file containing textual information which is shown along with the graphics in the History display.

The **RFID** file, with a time-date stamp appended to its name, and present if RFID is enabled, is a .csv file containing the RFID information

from the consumables used.

5.4 The About Screen

The About screen provides user basic information about the instrument such as serial number, software version, board serial numbers etc. The information on this screen can be provided to Covaris support personnel assisting with problem resolution.



5.5 The Admin Screen

The ADMIN tab is only available if an administrative user is logged in. The ADMIN tab is used for managing users, their permission levels, and access to treatment methods. It is also used to set system wide parameters.

5.5.1 User Authentication

SonoLab’s default configuration requires no login to create, run, and edit methods. User Authentication may be enabled to limit access to SonoLab functionality. To enable User Authentication

Start SonoLab.

6.5.1 Tap the Log In button at the upper right corner of the SonoLab screen.



- The Log In pane is displayed.

Covaris®

a PerkinElmer Company

Welcome to SonoLab 10

Username

Password

Login

Cancel

Set Password

- Enter the username “Administrator” and password “admin”. The password is case sensitive.
- Tap **LOGIN** and the ADMIN tab is added to the SonoLab window.

SonoLab 10.1 for ML230

Logged in as: Administrator

METHOD

SCHEDULE

HISTORY

ADMIN

ABOUT

Method

Plate:

Temperature: 22.0 (°C)

Setpoint: 20.0 (°C)

State: Idle

Steps

Process

Treatment

- Tap the ADMIN tab. The list of default SonoLab users, their roles, and assigned methods is displayed, along with the “USERS” and “GENERAL” tabs at the upper left.

METHOD

SCHEDULE

HISTORY

ADMIN

ABOUT

Log Out

USERS

GENERAL

Username	First Name	Last Name	Role	Methods
Administrator	Admin	Admin	Administrator	All
Default	Default	User	Editor	All
Editor	Editor	Editor	Editor	All
Operator	Operator	Operator	Operator	All

New

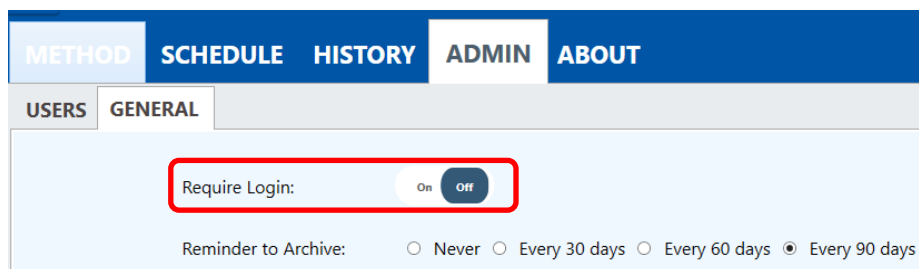
Edit

Delete

Set Password

Clear Password

- Tap the “GENERAL” tab.



- Tap the On/Off switch to turn on “Require Login”. If “Require Login” is not on, the Default user is active when SonoLab starts and no other user has logged in. An administrator can adjust the role of the Default user to allow this user the permissions desired. By default, the Default user has Editor permissions, access to all methods, and Optional Consumable- based Method Selection control. See *Section 5.5.2* below for details on users and their roles.

5.5.2. User and Roles

There are three permission levels within the user authentication, Administrator, Editor, and Operator.

An Operator:

- Can run methods assigned to them by an administrator.
- Can view History screens for all method runs.
- Can view Schedule screen.
- Can view the About screen

An Editor:

Can do everything an operator can do plus:

- Can run and edit methods assigned to them by an administrator.
- Can create methods and run the methods they create.

An Administrator:

Can do everything an Editor can do plus:

- Can create and edit methods.
- Can change settings on the Schedule screen.
- Can create and edit users, including other Administrator level users.
- Can assign access to specific methods to Editors and Operators.
- Can change settings on the Admin / General screen

5.5.3. Managing Users

To create a new user:

- Log into SonoLab as Administrator and tap the ADMIN tab.
- Tap the **NEW** button at the upper right side of the screen. The New User pane is displayed.

- Enter a new Username, the user’s first and last names.

By default, SonoLab assigns all available methods to a new user. If the Administrator only wants some methods assigned:

- Tap the Assigned button as shown in the image above.
- Tap the method(s) to be assigned in the list at left. Multiple methods may be selected by tapping “Shift” or “Control” simultaneously.
- Tap the **right arrow** button. The methods to be assigned are moved to the box at the right. See the image below.

New User

Properties

Username

Fuzzy1

First Name

Generic

Role

Operator

Last Name

Operator

Methods

☐ All

☒ Assigned

Available

175 bp Time course R230 96 AFA-TUBE TPX Plate

Assigned

175 bp R230 96 AFA-TUBE TPX Plate - 1 column
350 bp Time course R230 96 AFA-TUBE TPX Plate

Consumable-based Method Selection:

☐ Always On

☐ Always Off

☒ Optional

Save

Cancel

- Tap **Save** to save changes and exit the New User screen. The new user now appears in the list of system users.

METHOD SCHEDULE HISTORY ADMIN ABOUT				
USERS GENERAL				
Username	First Name	Last Name	Role	Methods
admin	Bruce	P	Administrator	All
Administrator	Admin	Admin	Administrator	All
Editor	Editor	Editor	Editor	All
Fuzzy1	Generic	Operator	Operator	3
Operator	Operator	Operator	Operator	All

The first time a new user logs in, the user must tap “Set Password” to display the Set Password pane.

Covaris®

Welcome to SonoLab 10

Username

Password

Login

Cancel

Set Password

Set Password

Username

New Password

Confirm Password

Set Password

Cancel

The user enters their Username, new password, and then must enter it again to verify correct spelling. Tapping “OK” returns the user to the login screen where the user may now enter their new password and log in.

5.5.4. The General Tab

METHOD SCHEDULE HISTORY ADMIN ABOUT				
USERS GENERAL				
Username	First Name	Last Name	Role	Methods
admin	Bruce	P	Administrator	All
Administrator	Admin	Admin	Administrator	All
Editor	Editor	Editor	Editor	All
Operator	Operator	Operator	Operator	All

- Tap the “GENERAL” tab.

METHOD SCHEDULE HISTORY ADMIN ABOUT

USERS GENERAL

Require Login:

On Off

Reminder to Archive:

Never

Every 30 days

Every 60 days

Every 90 days

Startup Water Behavior:

Control Temperature

Ask user

Fill upon startup

Handheld RFID:

On Off

Barcoding Supported:

On Off

API IP Address:

192.168.22.106, Port: 8100

Edit

Load position:

0.0, -5.0

Edit

Restore Default

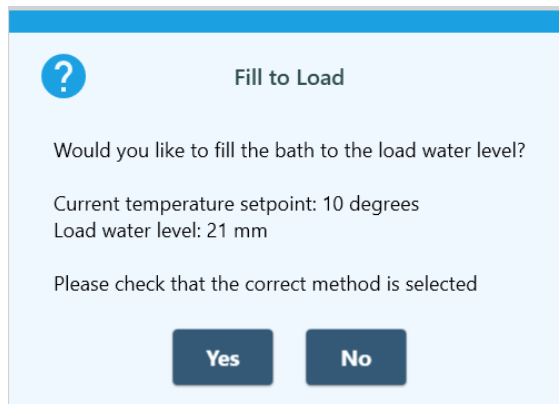
Log Out

- Require Login: toggle the On/Off switch to turn “Require Login” On or Off. If “Require Login” is not on, the Default user is active when SonoLab starts and no other user has logged in. An administrator can adjust the role of the Default user to allow this user the permissions desired. By default, the Default user has Editor permissions, access to all methods, and Optional Consumable-based Method Selection control. See **Section 5.5.2** for details on users and their roles.

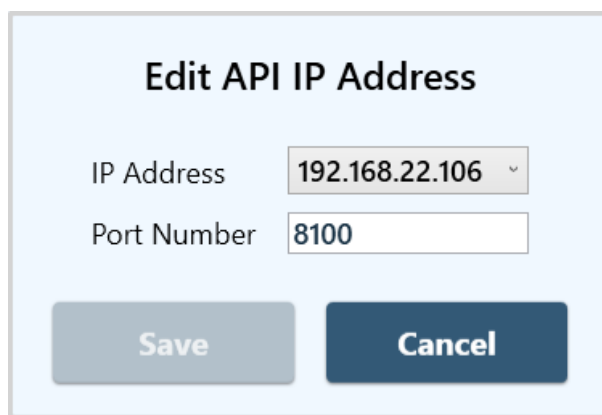
If “Require Login” is turned on when SonoLab starts, a login screen is displayed immediately following the homing sequence. If the user logs in, they have the SonoLab privileges defined by their predefined role. See **Section 5.5.2** for details on users and their roles. If the user cancels the login, they have access to minimal SonoLab functionality, for instance, viewing History files or the About tab.

- Reminder to Archive specifies how often a message is displayed, when SonoLab is started, suggesting that History files be archived to preserve disk space.

- Startup Water Behavior controls SonoLab behavior immediately following homing when SonoLab is started. There are three options:
 - Control Temperature adjusts the water bath temperature to that specified by the current method.
 - Fill upon startup fills the water bath to the Load water level of the current method and temperature control is turned on.
 - Ask user presents a message box asking if the bath should be filled. The level and temperature to which the bath will be set is displayed, as shown:



- Handheld RFID enables the use of a handheld RFID scanner as described in **Section 8.3**, Handheld Barcode and RFID Scanners.
- Barcoding Supported enables the use of a handheld barcode scanner as described in **Section 8.3**, Handheld Barcode and RFID Scanners.
- API IP Address displays the current IP address and port number of the API server (the SonoLab computer), and an Edit button to modify the IP address. Tap the 'Edit' button to open the API IP Address dialog. If the API server is currently connected, the user is instructed to first disconnect the server. The dialog opens initially showing the current IP address and port number. Beginning with SonoLab 10.0.2, the defaults will be 127.0.0.1 and 8100.



Tap the IP Address drop-down to see a list of available IP addresses. In this example, only the original and loopback addresses are available. If the API client is also running on the SonoLab computer, the loopback address should be selected.

Edit API IP Address

IP Address

192.168.22.106

Port Number

192.168.22.106

127.0.0.1

Save

Cancel

The Port number must be an integer between 1 and 65535. The Save button will become active if changes are made and the port number is valid.

- Load Position displays the current Y and Z coordinates for the Load position, 'Edit ' and 'Restore Default' buttons.

To adjust the Load position:

- Open the Motion Control panel on the SonoLab Method screen and send the sample tray to the current Load position.
- Return to the Admin General tab and tap the Load position 'Edit' button. The Edit Load Position dialog displays the current Load position in millimeters from the Home position, in this example, 0.0 for the Y axis, and -5.0 for the Z axis.

Edit Load Position

Y

Z

Load Position

0.0

-5.0

OK

Cancel

- Estimate an approximate location from the current Load position the sample tray needs to be. The range of travel for the 2 axes are:
Y axis: -4.5 to 4.5 mm. 0 is centered over the transducer.
Z axis: -42.0 to 0.00 mm. 0 is as high as the tray will move. All movement is down from 0.

As an example, assume that the Load position must be 4mm toward the right of center and 5mm below the Z axis load position.

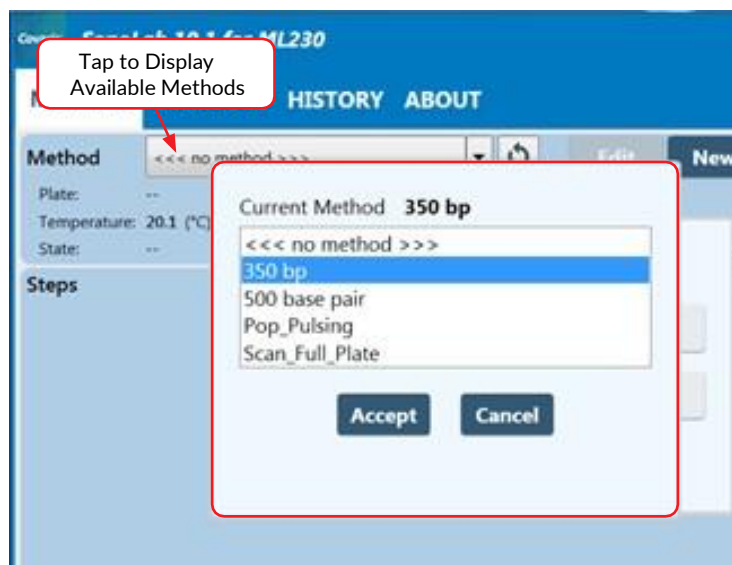
The new Y position is 4. The new Z position is -10.

- Enter these new positions in Y and Z fields, then tap 'OK'.
- Return to the SonoLab 'Method' screen and use the 'Motion Control' panel to Home the motion system, then move to the 'Load Position'. Verify that this new location is acceptable. If not repeat the above steps to adjust it closer to the required position.

- The 'Restore Default' button returns the 'Load Position' parameters to the factory default settings

6. Using a Pre-installed Method

SonoLab has protocols pre-installed on the ML230. These methods have been developed by Covaris scientists and are ready-to-use for some common applications. To select a pre-installed protocol, tap the Method field to display the list of available methods. If the "Method" bar is disabled, see Consumable-based Method Selection in *Section 8.1* of this document.



6.1 DNA Shearing Protocols

DNA Shearing protocols are optimized for the mean DNA fragments size, sample volume, and sample vessel used.

Naming convention is as follow:

- DNA_[size]_bp_[volume]_μl_[type of vessel]

Please contact the Covaris Applications team, applicationsupport@covaris.com, for assistance selecting parameters when creating new methods.

7. Create and Edit Methods

The SonoLab Method Editor supports the creation of new methods and editing of existing ones.

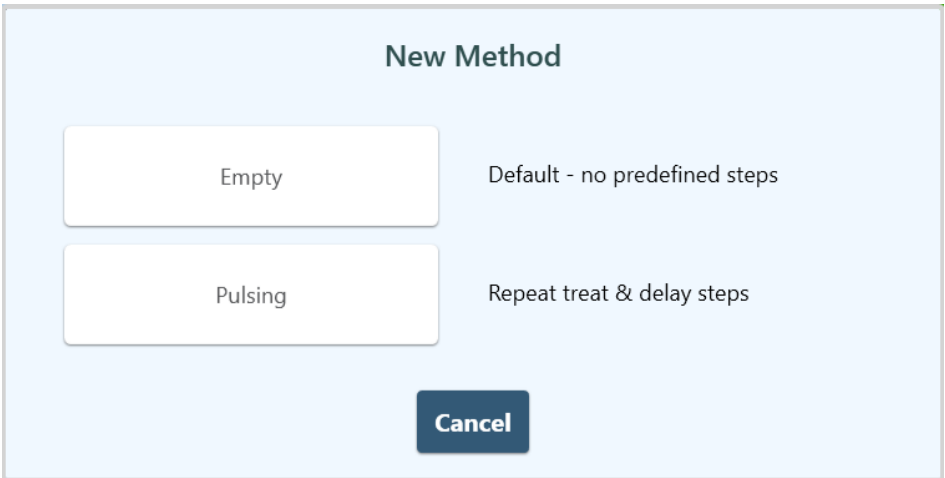
A method consists of one or more **Process or Scan Steps**. A Process contains at least one Treatment. Most methods will contain a single process, containing a single treatment step.

If more complex methods are required, they can be easily constructed.

7.1. Create a New Method Using Templates

SonoLab 10.1.1 introduces predefined templates to assist in creating more complex treatment methods. Available templates are displayed when creating a new method.

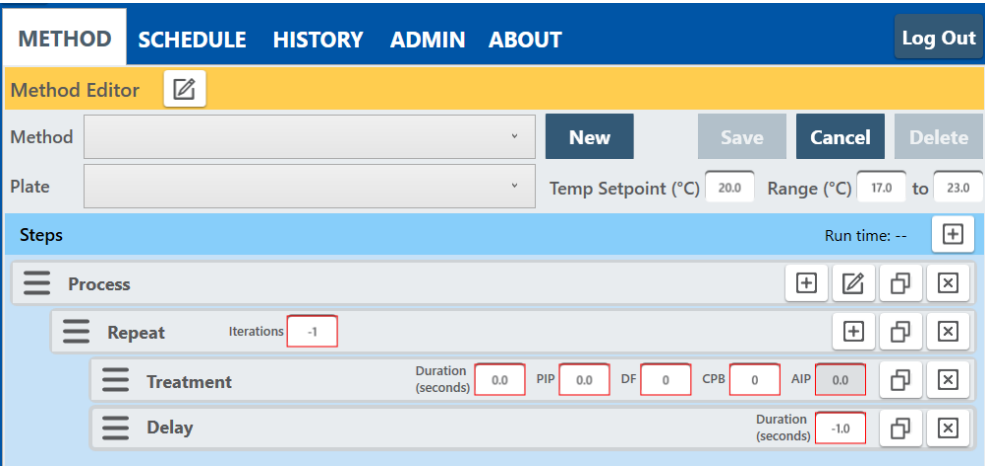
- 1. Tap the “New” button on the METHOD screen to display the New Method Template panel.



Empty: no predefined operations. Build either a normal or pulsing treatment method, as described below.

Pulsing: provides a template to treat and delay from 1 to 10,000 times. This is described in more detail below in [Section 7.2, Creating Methods Manually](#) and [Section 7.4 Using the Repeat Functions](#).

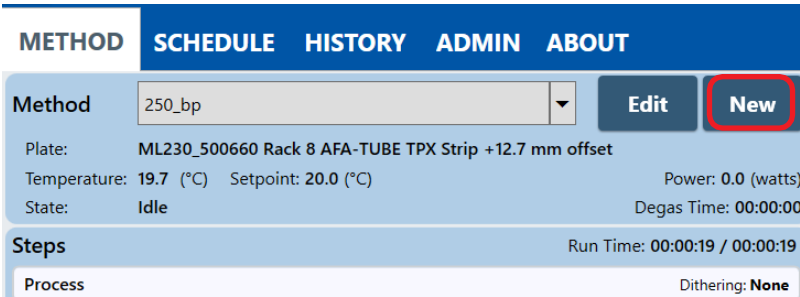
- Tap ‘Pulsing’ to use a template to create a pulsing method.



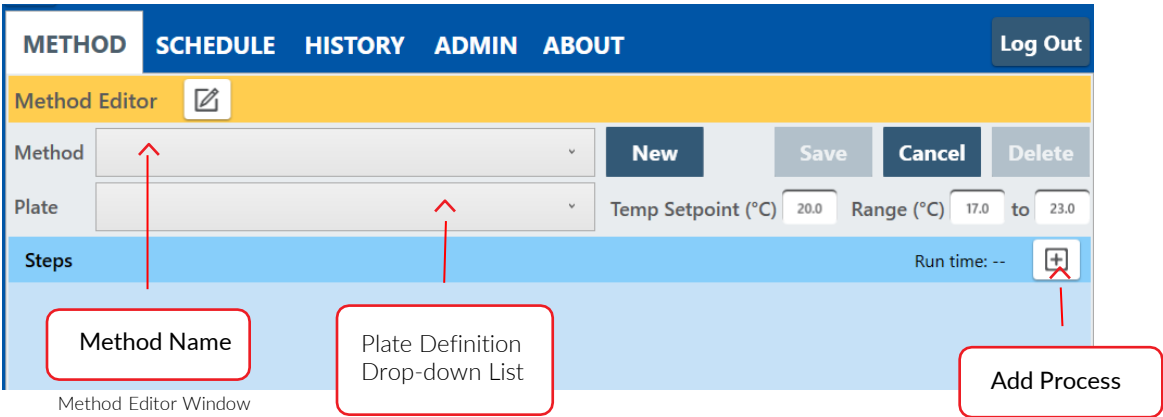
Enter the desired treatment parameters into the fields outlined in red, and save the method. Details regarding the specific treatment parameters are described in [Section 7.4 Using the Repeat Function](#) and [Section 7.5 Scanning Treatments](#).

7.2. Create a New Method Manually

1) Tap the “New” button on the METHOD screen.

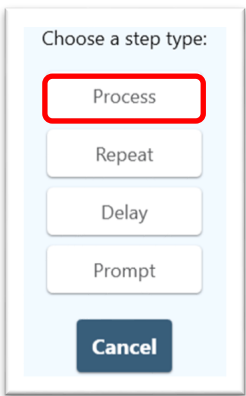


2) Then tap the “Empty” template option to display the Method Editor Window.

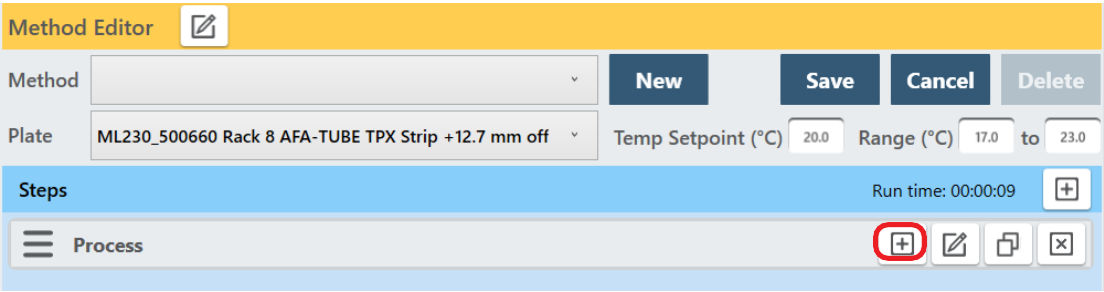


3) Select the appropriate plate for the consumables used in this method from the “Plate Definition” drop-down list.

4) Tap the + button. The “Choose a Step Type” pop-up is displayed.

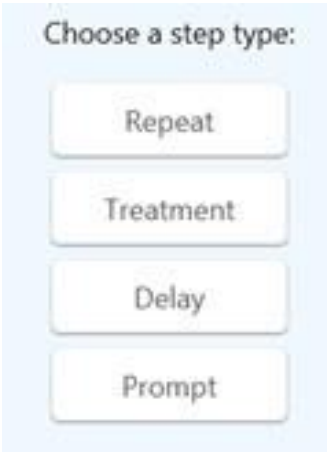


5) Tap “Process”. The process bar is displayed.

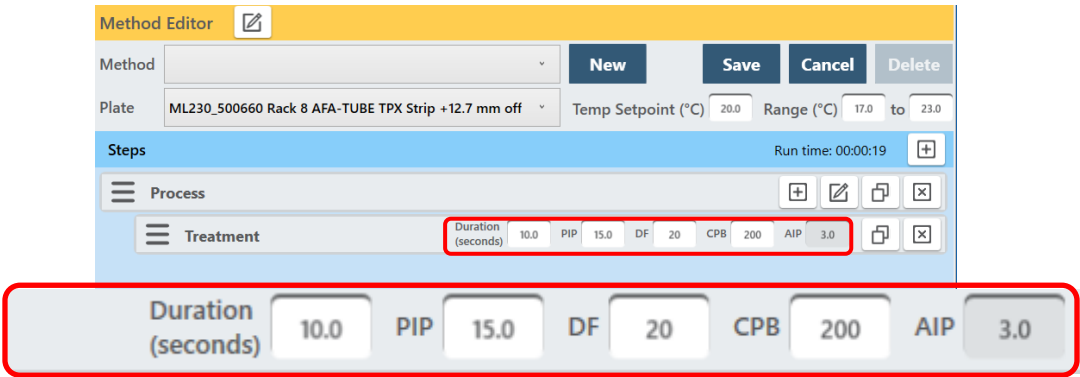


For descriptions of *Delay and Prompt steps*, see step 11 of this section below. *Repeat* steps are discussed in **Section 6.4** of this document.

6) Tap the + button inside the process bar to display the step type menu.



7) Choose Treatment to specify the four acoustic parameters: Duration, Peak Incident Power, Duty Factor, and Cycles per Burst.



Treatment parameters are chosen by directly editing the value boxes. When a parameter’s value box is selected, the valid parameter range is displayed in the blue bar above and at the top of the entry keypad. If an invalid parameter is entered, the valid parameter range is displayed in red.

PIP is a number between 1.5 and 450.0

PIP

15.0

1

2

3

-

PIP is a number between 1.5 and 450.0

PIP

500

1

2

3

-

Peak Incident Power (PIP)

This parameter measures the peak electrical power used to drive the ultrasound transducer. The adjustable range of Peak Incident Power is 1.5 to 450 Watts. Maximum power may be automatically limited by the consumables used in a treatment method.

Duty Factor

This parameter defines the ratio between the on-time of the transducer and total operation time and is expressed as a percentage. For a given Peak Incident Power, a larger Duty Factor results in more acoustic energy generated from the transducer. Users can specify a Duty Factor from 2% to 50%.

The product of the Peak Power and Duty Factor gives the approximate Average Incident Power (AIP) generated from transducer. For example, if Peak Incident Power is set to 10 Watts and Duty Factor is set to 15%, the Average Incident Power will be approximately 1.5 Watts. However, the real average incident power from the transducer may vary due to factors such as sample tube type, water level and water temperature. The ML230 Average Incident Power range is 0.5 to 100 watts. The range may be further limited by the consumables used in the treatment method.

Cycles per Burst

This parameter indicates the number of electrical signals used in each acoustic “burst” of the transducer.

The range of Cycles per Burst (cycles/burst) is from 50 to 1000 for different applications. Advanced users may use this parameter to fine tune their experiments.

Duration

This parameter defines the amount of time during which the sample is being treated. The measurement of the Duration is in seconds. The maximum time for any treatment is 3600 seconds. Should a longer treatment be necessary, “Duplicate Steps” can be used to extend the treatment.

SonoLab displays the Average Incident Power, calculated from the Peak Incident Power and Duty Factor, adjacent to the treatment parameters in the treatment step bar. The maximum allowed Average Incident Power is 100 Watts on the ML230.

Dithering

The motion system provides dithering motion capability in the Y axis (left-to-right). If a treatment specifies dithering, tap the “Pen-&-Paper” icon on the right end of the Process bar to display the Process Step Parameters pane.

Process Step Parameters

Dithering

Y +/- (mm):

0.0

Speed (mm/s):

0.0

Pause Duration (s):

0.0

Apply to all process steps:

On Off

OK

Cancel

The Y axis +/- distance range is +/- 4.5 millimeters. The Speed range is from 0 to 25 mm/second. The Pause Duration range is from 0 to 60 seconds.

- 8) Enter the desired dithering parameters, if any, and tap “OK”. If dithering is to be applied to all treatment steps of the method, tap the ‘Apply to all process steps’ switch to toggle it on. Tap OK.
- 9) Enter the temperature set point for the protocol and the allowable range into the text entry fields. SonoLab allows a minimum range of plus/minus 2 degrees; the default range is plus/minus 3 degrees.

Enter Temperature Set Point and Range

New

Save

Cancel

Delete

Temp Setpoint (°C)

20.0

Range (°C)

17.0

to

23.0

Adding a Delay Step

- 10) As an example and if desired, choose a Delay step to introduce a fixed time delay into a method to allow the sample to settle between the two different treatment steps. The delay is specified in seconds.

Method Editor

Method

New

Save

Cancel

Delete

Plate

ML230_500660 Rack 8 AFA-TUBE TPX Strip +12.7 mm off

Temp Setpoint (°C)

20.0

Range (°C)

17.0

to

23.0

Steps

Run time: 00:00:20

+

Process

+

✎

📄

✕

Treatment

Duration (seconds)

10.0

PIP

400.0

DF

20

CPB

200

AIP

80.0

📄

✕

Delay

Duration (seconds)

1.0

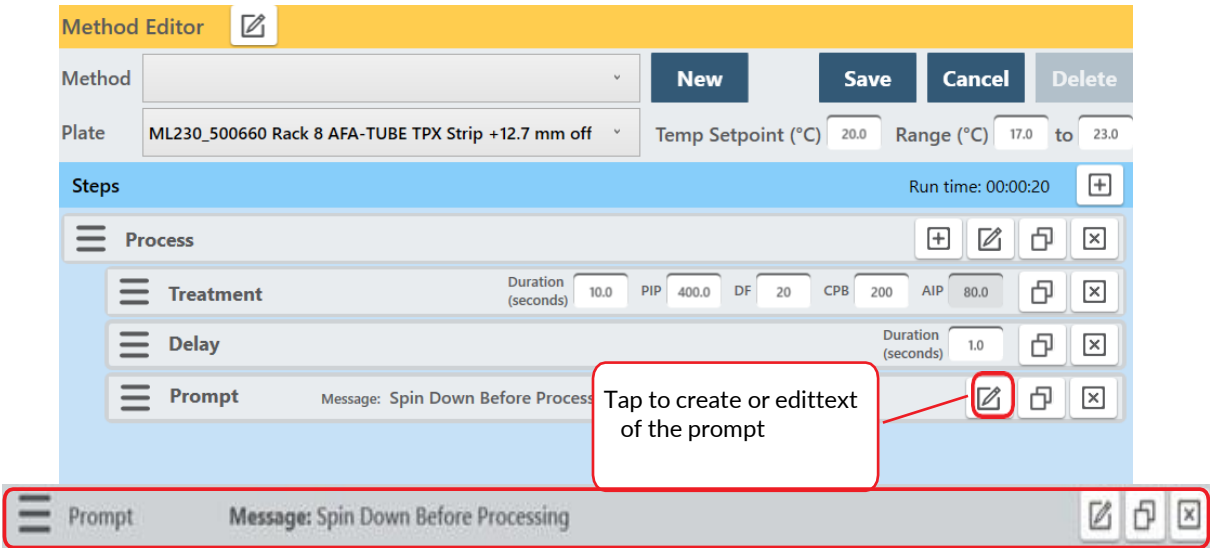
📄

✕

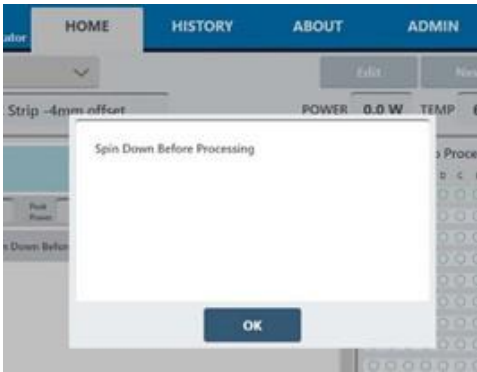
Enter Delay in Seconds

Adding a Prompt Step

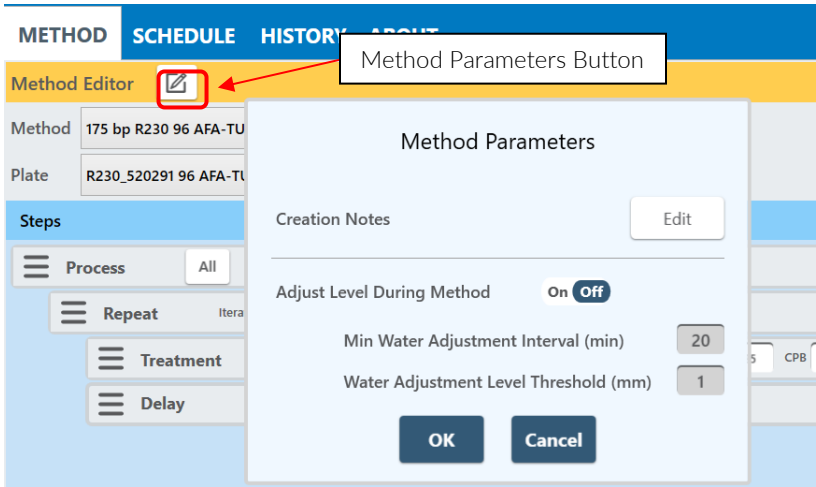
- 11) If desired, choose a Prompt step to display a message on the screen and pause execution of the method until the operator taps OK.
 - Tap the “pen & paper” button of the prompt bar to display the text entry field for the prompt.
 - Enter the text of the prompt and tap OK.



When the prompt step is reached during the treatment, the method pauses, and the prompt message will be displayed as shown.



12) Tapping the Method Parameters button, , in the orange Method Editor bar accesses optional Method Parameters.



Creation Notes: tapping the Edit button displays a text entry window. Enter descriptive text regarding the method into the text entry field. This may be left blank.

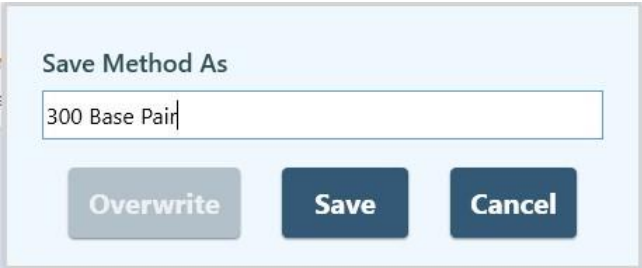
Adjust Level During Method: By default, Adjust Level During Method is off. This means that SonoLab checks and, if necessary, adjusts the water level prior to running a treatment method. Once the method starts, there are no more

adjustments. Beginning with SonoLab version 10.1.1, there is an option to check and adjust the water level while a treatment method is running. Each time acoustics are turned off, during the method, the water level is checked and, if necessary, adjusted before acoustics are again turned on. This feature is used to prevent a change in water level over the course of a lengthy treatment method.

To use this feature:

- Tap the 'Adjust Level During Method' button to 'On'.
- Enter the minimum adjustment level, in minutes. The default interval is 20 minutes. The actual interval may be longer as the adjustment will not take place if acoustics are on at the end of the specified time interval.
- Enter the 'Adjustment Level Threshold' in millimeters. This is the minimum change in water level to trigger an adjustment. The default value is 1 mm.

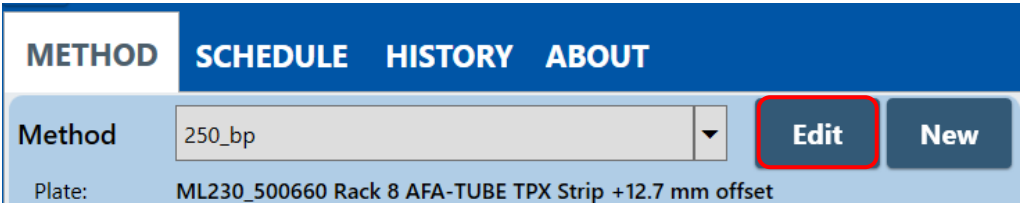
- 13) When all method parameters and steps have been defined, tap the **Save** button to save changes. The user is prompted to name the method.



- 14) Enter a name for the treatment method and tap Save. If the method name is the same as an existing method, the 'Save' button is disabled and the 'Overwrite' button is enabled. Tapping the 'Overwrite' button will result in the previous version being replaced.

7.3.Deleting and Archiving Methods

- 1) Select the method to be deleted or archived, then tap 'Edit'.

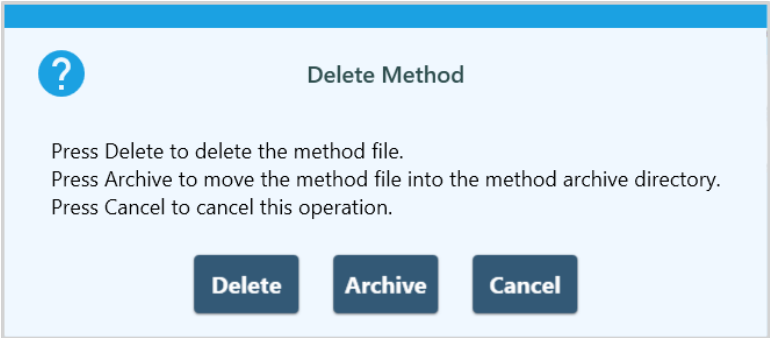


The Method Editor screen is displayed.

- 2) Tap the 'Delete' button at the upper right.



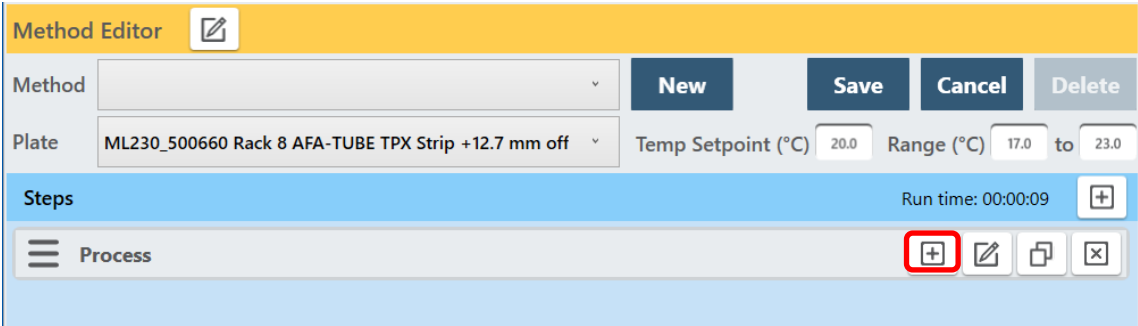
The 'Delete Method' panel is displayed.



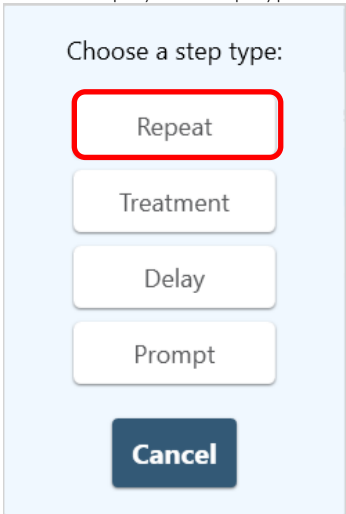
- 3) As instructed on the panel, tap 'Delete' to remove the method from the system, tap 'Archive' to move the method to the Archive folder, or tap 'Cancel' exit the operation without making any changes.

7.4. Using the Repeat Function

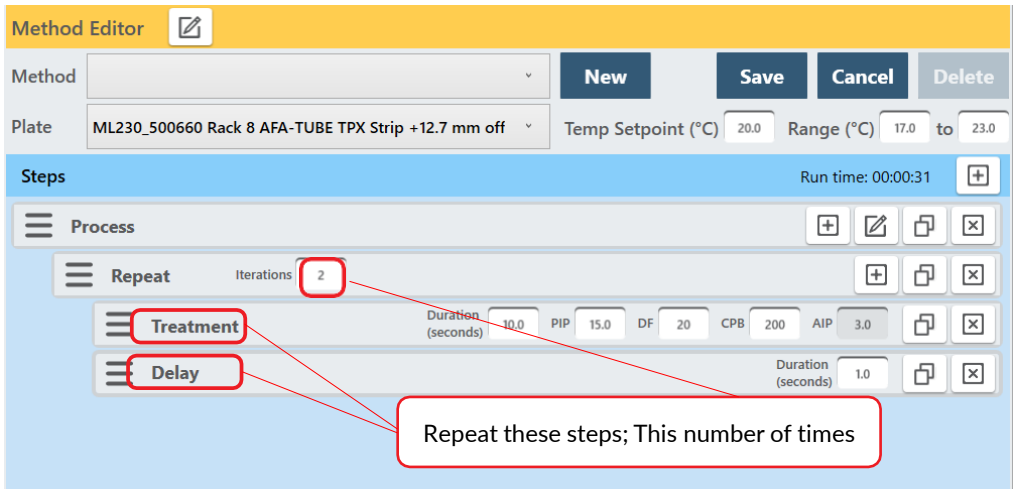
The Repeat function is used when one or more treatment, delay, or prompt steps are to be applied to the plate multiple times. This called Pulsing; perform the following steps to create the treatment manually. It can also be created by selecting the *Pulsing* template, as described in Section 7.1 above. Create a method with a Process step, as explained previously.



- Tap the + button inside the process bar to display the step type menu.



- Tap **Repeat**.
- Tap the + button inside the repeat bar to display the step type menu and create two or more treatment or delay steps. See image below.

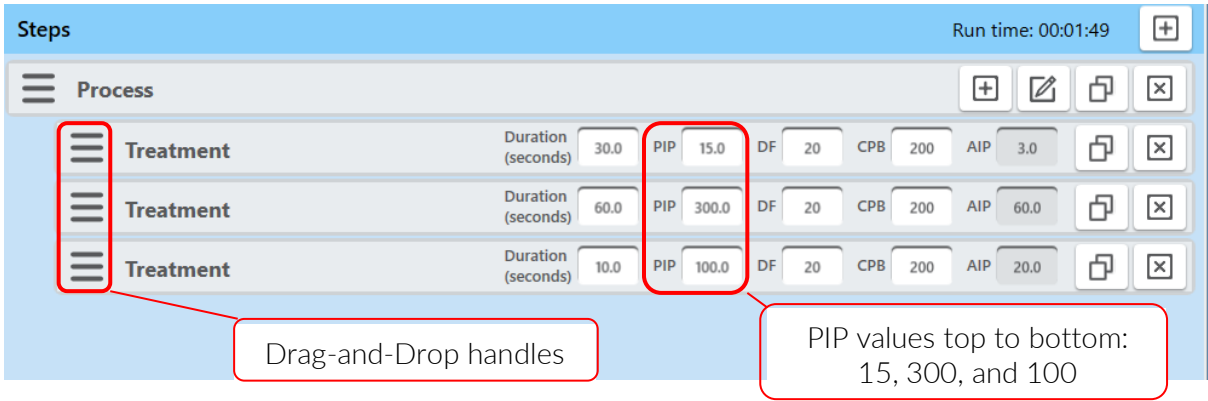


All listed treatment (or delay, etc.) steps will be applied to the plate the number of times specified in the Repeat bar.

- When all method parameters and steps have been defined, Tap **Save** to save changes.

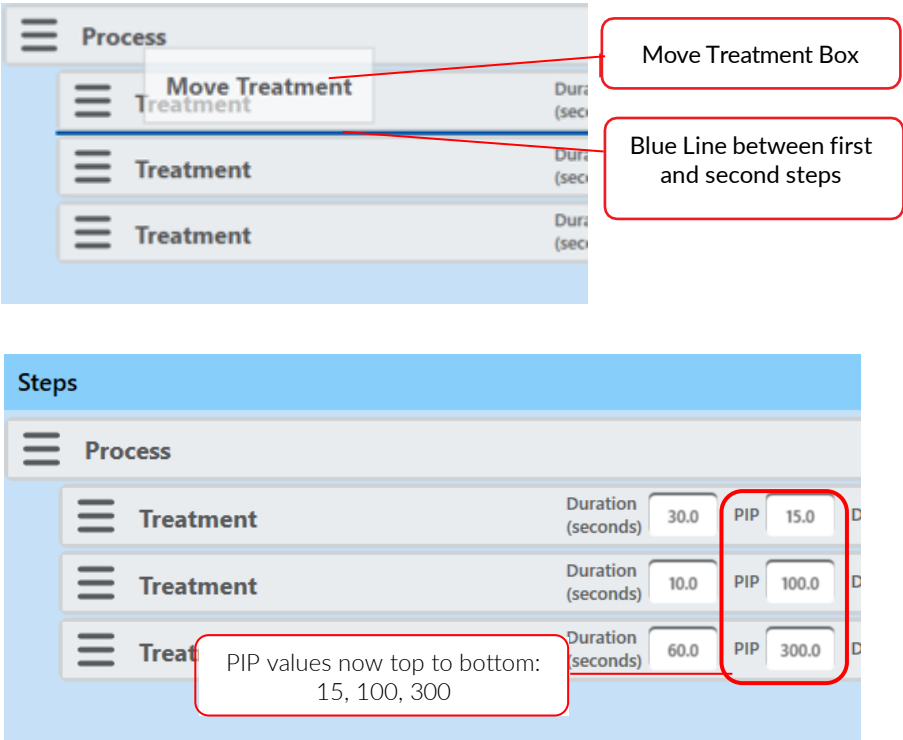
7.5.Using Drag and Drop with Treatment Steps

The order of treatment steps may be rearranged and Treatment steps may be moved in and out of Process steps and Repeat steps to optimize treatment or expedite experimenting with different orders of operations. In the example below, there are initially a single process and three treatment steps as shown.



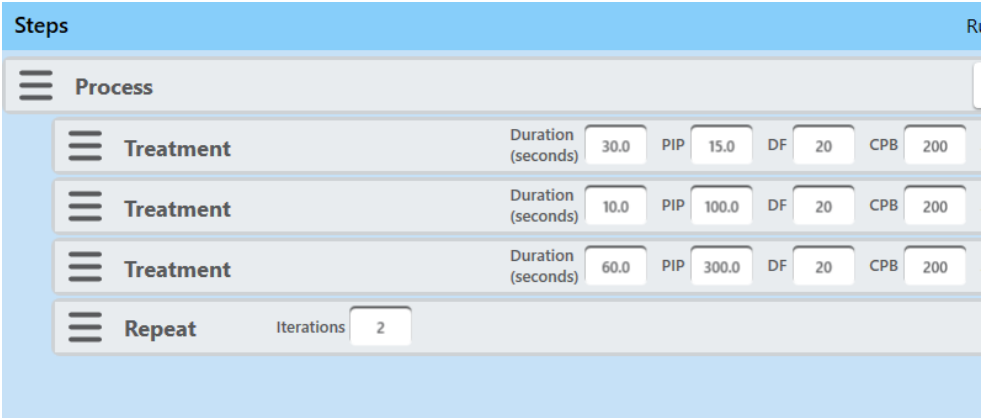
To swap the positions of the second and third steps:

- Tap on and hold the three bars at the left of the third step. A 'Move Treatment' box will hover over the mouse.
- Drag the 'Move Treatment' box over the first treatment step until a blue line shows between the first and second steps.
- Release the three bars when the blue line appears. The former third step will be inserted below the first step ahead of the former second step.



To move treatment steps into a repeat step:

- Tap the '+' button in the process bar to display the step types list as explained previously.
- Select 'Repeat'. The new Repeat step displays below the three treatment steps.



- Tap and hold the three bars at the left of the first Treatment step. A 'Move Treatment' will hover over the mouse.
- Drag it over the Repeat step until the blue line shows below the Repeat step.
- Release the three bars.
- Do the same for the two remaining Treatment steps. The screen is now configured as shown below.

Steps

≡

Process

≡

Repeat

Iterations

2

≡

Treatment

Duration (seconds)

60.0

PIP

300.0

DF

20

CP

≡

Treatment

Duration (seconds)

10.0

PIP

100.0

DF

20

CP

≡

Treatment

Duration (seconds)

30.0

PIP

15.0

DF

20

CP

Behavior of Repeat steps is described in detail in *Section 7.4* above.

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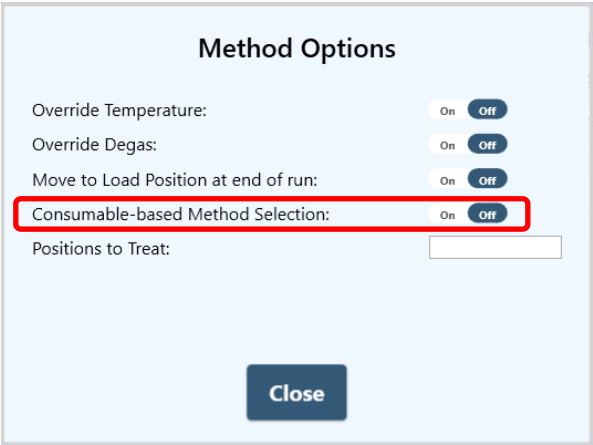
51

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8. Advanced Topics

8.1. Using SonoLab Consumable-based Method Selection

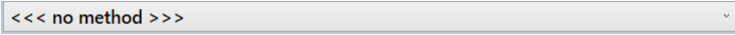
SonoLab can be configured with Consumable-based Method Selection to limit the displayed list of methods to only those using a specified consumable. For individual SonoLab users, Consumable-based Method Selection is set to either Always On, Always Off, or Optional, as described in **Section 5.5.3**, Managing Users. If Consumable-based Method Selection is set to Optional for a user, the user controls whether to enable it via the switch in the Method Options pane, described in **Section 5.1**.



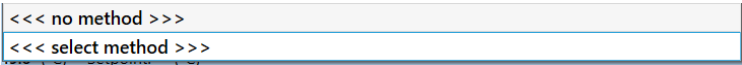
If a user’s Consumable-based Method Selection option is configured Always On or Always Off, these setting take precedence and the switch in the Method Options pane is disabled. See ‘Managing Users’ in **Section 5.5.3** for details on configuring users for Consumable-based Method Selection.

Using Consumable-based Method Selection

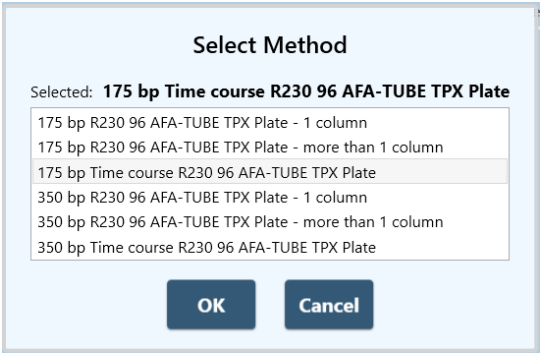
- Enable Consumable-based Method Selection; the currently selected method will be cleared, and the Method dropdown box will look like this:



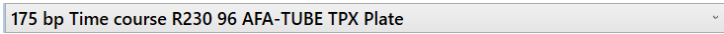
- Tap the Method dropdown box; there will be only one option:



Tap “<<< select method >>>”. The system performs an RFID scan of the consumable currently in the sample holder, and then displays a list of methods compatible with that consumable, as shown:

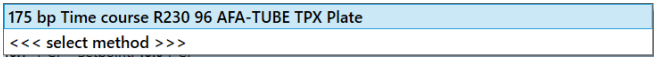


- Select the desired method and then tap “OK”. The method dropdown now looks like this:



- Tap the “Run” button and the method executes normally. This includes performing RFID validation of the consumable currently in the sample holder. If the consumable is replaced with a different consumable which is not compatible with the selected method, the method will fail and the user will be notified of the incompatibility.
A strip consumable may only be RFID scanned two times, a plate consumable six times.

- To select a different method, tap the Method dropdown box, which will now look like this:



- Tap on “<<< select method >>>”, and repeat the process described above.

8.2.Handheld Barcode and RFID Readers

Handheld Barcode Reader

SonoLab for the ML230 supports the following Barcode Scan levels:

1. None: barcoding is not supported.
2. Single: One barcode for the entire consumable.

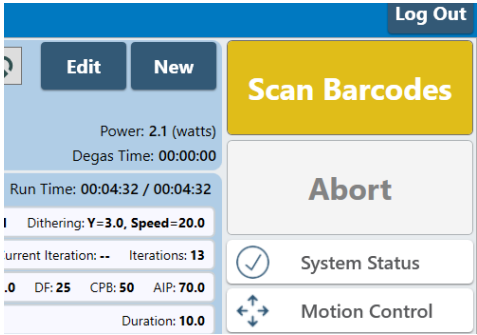
The plate definition will specify the barcode level to use when running a method.

To use barcoding:

- Select a treatment method from the drop-down list on the Method screen.
- Turn on the Barcode On/Off switch located on the Method screen, below the light switch.



The green Run button becomes a yellow Scan Barcodes button.



- Tap the Scan Barcodes button. The Scan/Enter Barcode pane is displayed.

Scan/Enter Barcode

Use the handheld barcode scanner to scan the barcode on the consumable

Barcode

Done

Cancel

- Scan (or type) the barcode(s) on the consumables to be treated.
- Tap “Done” when all labels’ barcodes have been scanned. The Scan/Enter Barcode pane closes and the Scan Barcodes button reverts to the green Run button.
- Tap the Run button to begin the treatment.

Handheld RFID Scanning

The RFID tag on the consumable is read via a handheld RFID scanner. The tag scanned is validated, and the serial and lot numbers of the tag are accessible via history files and the API.

An RFID scan is performed on each treated sample tray to ensure that the correct consumables are being used for the treatment and to provide information for LIMS. Prior to SonoLab version 10.1.1, a strip consumable may only be RFID scanned two times, a plate consumable six times.

Beginning with SonoLab release 10.1.1, by default, each *consumable* can be RFID scanned twice, either built-in or handheld RFID scanning, or a combination of both.

SonoLab 10 scans a single RFID tag for the entire consumable.

Using Handheld RFID Scanning

Turn on Handheld RFID in the “General” tab of the Admin screen.

METHODSCHEDULEHISTORYADMINABOUT

Log Out

USERSGENERAL

Require Login:

OnOff

Reminder to Archive:

Never

Every 30 days

Every 60 days

Every 90 days

Startup Water Behavior:

Control Temperature

Ask user

Fill upon startup

Handheld RFID:

OnOff

Barcoding Supported:

OnOff

API IP Address:

192.168.22.106, Port: 8100

Edit

Load position:

0.0, -5.0

Edit

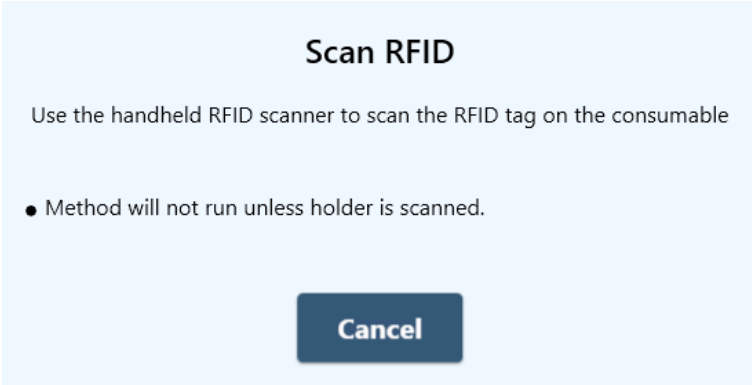
Restore Default

The lower right corner of the Method screen, below the light and barcode switches, now contains a switch to turn on Handheld RFID scanning.



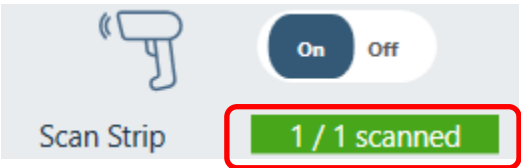
When the switch is turned on, the green Run button becomes a yellow Scan RFIDs button.

Tap the Scan RFIDs button to display the Scan RFID pane.



Scan the plate to be treated.

Scan the remaining columns to be scanned as above. The graphic in the RFID button at the lower right of the Method screen indicates that the sample has been scanned



The yellow Scan RFIDs button reverts to the green Run button and the method runs.

9. System Specifications

Treatment System	Bench-top; high intensity acoustic transducer, 1 to 8 sample batch process, temperature monitoring and controlling device, water bath with sample holder and safety enclosure
Treatment Power	1.5 to 450 Watts peak incident power, 0.5 to 100 Watts average incident power
Dimensions	18.25" W x 20.25" D x 23.00" H (46.5 cm x 51.5 cm x 58.5 cm)
Weight	Approximately 80 lbs. (36 kg)
Power Requirements	100-240 ±10% VAC 750 VA, 50/60Hz, 8 Amp Slo-Blo Fuse
Ambient Environment	15°C to 30°C (59°F to 86°F), Up to 80%, non-condensing, up to 3000M, pollution degree II, Overvoltage Category 2
Regulatory Labeling	CE, ETL Mark (for Product Safety), WEEE
Safety	Certified to IEC/EN/ANSI/UL61010-1 and CAN/CSA C22.2 No. 61010-1 "Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use, Part 1: General Requirements"
EMC	Certified to EN 61326-1 "Electrical equipment for measurement, control and laboratory use – EMC requirements – Part 1: General requirements". Also certified to FCC 47CFR Part 15 – Radio Frequency Devices and Part 18 – Industrial, Scientific and Medical Equipment, and ICES-003 Class A for Industry Canada
Water Bath	AFA-grade Water or Highly Purified Water, at least ASTM Type III or ISO grade 3
Method Temperature Setpoint	Programmable +10.0 °C to +40.0 °C
Computer	Integrated Panel Computer
Operating System	Microsoft Windows 10 or Windows 11
Application Software	Covaris SonoLab
Data Input	Touch Screen
Chiller	Solid state chiller for heating and cooling (built-in)
Power	0 to 160 Watts, 24 volts

10. Troubleshooting

Problem	Corrective Actions
Unable to HOME	- Ensure the door is closed - You can HOME the system by going to the Motion Control button and tapping HOME
Motion Errors	- The motion system should be homed by going to the Motion Control button and tapping HOME if any motion related errors are encountered. - It should be standard practice to home the motion system at least once daily.
RUN button disabled	- A Method must be chosen to enable RUN. Ensure a Method has been chosen. - System status conditions have not been met. Tap the System Status button. Identify the conditions that are marked with a red X and address the indicated conditions.
Drain Taking Too Long or Water Pressure Too High message	- Ensure the Waste bottle is properly connected to the Quick Disconnect Cap (see Section 2). - There could be a blockage in the drain lines. Ensure the bath is clean and free of debris. This may be resolved with a bath cleaning operation (see Section 3). The filter may need to be changed (see Appendix C).
Water Level Failure Error / Method Failure Due to Water Level Adjustment Timing Out	- Rerun / Restart the method
Water in bath will not completely drain	- If the water level is below 1, as seen under the Water Control status panel, the bath will not drain further. Use the Fill button to fill the bath above level 1 then use the Empty button to start the drain operation.
Shearing not as expected or inconsistent across a rack	- Verify the ML230 is level (see Section 2) - Ensure the rack is properly seated into the sample arm and the weight is in place

11. Appendix

Appendix A: M-Series Site or Transport Preparation

Placement of Equipment

The area required for the instrument is approximately 18.25" W x 20.25" D x 23.00" H (46.5 cm x 51.5 cm x 58.5 cm). Allow sufficient space in front of the bench to access each component of the installation.

Power Requirements

Provide at least one standard outlet for the ML230. The ML230 draws a maximum of 750 VA. The Covaris M-series instruments are configured with a universal power supply.

WARNING: To prevent the possibility of electrical shock, always plug the system into a grounded power source.

Water Requirements

The water bath should be drained when the ML230 is not in use for more than a few days. In normal operation, water is automatically added to the bath as necessary by the Water Control system. Sensors notify the user if the Water Control supply bottle is empty or if the waste bottle is full. Covaris recommends AFA-grade Water. It is also possible to use highly purified water (Highly Purified Water at least ASTM Type III or ISO grade 3).

NOTE: The ML230 Focused-ultrasonicator must not be left powered OFF with water in it. Keep the instrument power ON until the water bath is drained.

Moving or Packing the Instrument for Transport

When moving the instrument between nearby laboratories, please employ the following guidelines:

- Drain the water bath by tapping the Water Control button and selecting "Empty".
- Remove the sample tray by unscrewing the captive thumb-screw securing it to the motion system and gently pulling it forward, off the locating pins. Pack the sample tray with the water bottles and other accessories.
- Turn the instrument off.
- Remove the Supply and Waste bottles, empty them, and pack separately from the ML230.
- Remove remaining water from the acoustic assembly
- Lift the unit by its base-plate (not by the plastic case or doors). Transport by cart.

When packing the unit for shipment, please follow the guidelines above. Additionally, if feasible, obtain a packing box from Covaris and employ the foam end-cap inserts to support the instrument. If this is not feasible, wrap the main instrument in ample bubble wrap or similar packing. Wrap and package accessories (laptop, safety cover, sample holder, cords) separately to avoid damage.

Please contact the Covaris Customer Support Department (customerservice@covaris.com) for guidance and assistance.

Appendix B: Updating SonoLab Software

Contact Covaris Technical Support (techsupport@covaris.com) for assistance upgrading SonoLab.

Appendix C: Replacing the ML230 Particle Filter Element (with the ML230 Filter Assembly Repair Kit, PN 500679)

The Particle Filter removes particulate that could otherwise damage the pump or negatively affect the acoustic performance of the instrument. The Particle Filter Element should be replaced annually.

1. Drain the water ML230 water bath.
2. Disconnect the Supply and Waste bottles by pressing the thumb latch on the Quick Disconnect Fittings and lifting them out of the bottles. See **Figure C1**.

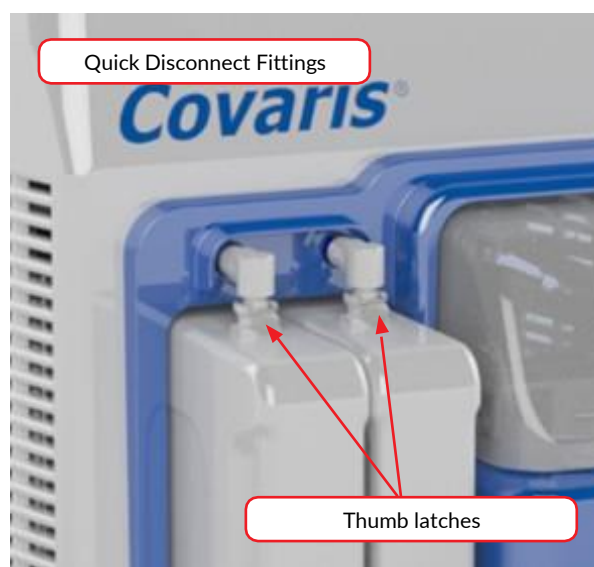


Figure C1 Quick Disconnect Components

3. Remove the Supply and Waste bottles by sliding them forward and clear of the ML230.
4. Locate the filter in a recess at the far-left side of the cabinet, inside the bottle bay.

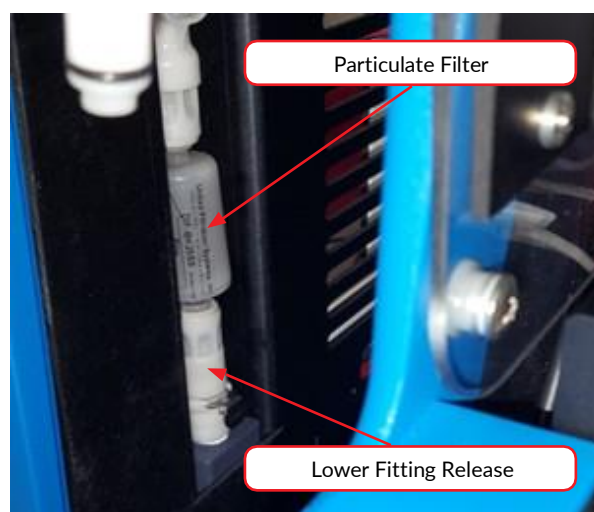
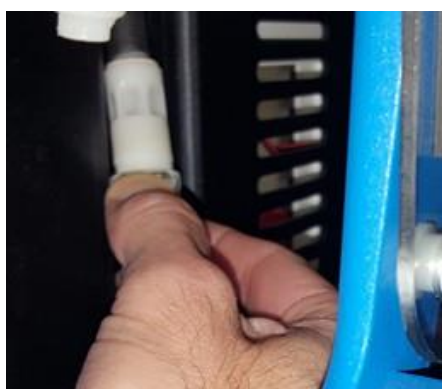


Figure C2 Particulate Filter

5. Press the release tab of the lower fitting and separate bottom of filter from the water line.



6. Press the release tab at the upper end of the filter, and remove the filter from the ML230.



7. Press the release tab at the upper end of the filter, and remove the filter from the ML230.



Figure C3 Particulate Filter Assembly

8. Orient the replacement Particle Filter Element so that the direction of flow arrow and female fitting face up. Gently, but firmly, press the upper water connector into the female fitting of the Particle Filter Element until it “clicks” into place.
9. Gently press the lower fitting of the Particulate Filter Element into the lower water fitting and stow the filter into the cabinet recess.
10. Reinstall the Supply and Waste bottles. The Waste bottle is on the left; the Supply bottle is on the right, next to the sample handling area.
11. Orient the bottle in the Water Control Bay with the label on the Quick Disconnect Cap facing out, as shown in **Figure 6**.
12. Reconnect the bottles by pressing the Quick Disconnect Inserts into the couplings on the Supply and Waste bottles until they click into place.

Appendix D: Networking Information

Networking a ML230

The ML230 control electronics and SonoLab software communicate via an internal TCP/IP network, which uses static IP addresses assignments.

The ethernet port at the rear of the system is provided only for Debug purposes by trained Covaris Service team members. Attempting to network the ML230 using the debug ethernet port can cause IP address conflicts and other communications errors, especially within some DHCP networks, which may result in failures when running a method. DO NOT use this Ethernet port.

If it is desired to network an ML230, a USB to Ethernet network adapter MUST be used. TCP/IP settings for that network adapter can be set using standard Windows utilities.

Firewall Rules

When the ML230 computer is networked, it is important that nothing other than SonoLab tries to communicate with the Covaris instrument. It is common that various network protocols (e.g., LDAP, NetBIOS, DNS) try to contact devices connected to a computer by Ethernet. Some anti-virus software can also do this.

Some of the devices inside the Covaris instrument can get confused if they receive network packets other than those sent by SonoLab. This can cause methods to fail. If this occurs, then it will be necessary to power cycle the instrument.

SonoLab comes with firewall rules that ensure that only SonoLab can communicate with the internal devices. ML230s come from the factory with these rules installed and enabled.

If you have an older ML230 then it may not have the firewall rules installed. In this case, you'll have to install the firewall rules that come with the latest version of SonoLab. There are two PowerShell scripts that install and enable firewall rules, located here:

C:\Users\Public\Documents\Covaris\SonoLab 10\Scripts

The two files are:

- CreateAllowSonoLab10FirewallRule.ps1
- CreateFirewallBlockingRules.ps1

These rules affect outbound connections from the internal computer to the devices inside the ML230. Both sets of rules can be installed but only one set will apply, depending upon the Windows Defender Firewall default setting for Outbound connections.

If the firewall is set to Allow outbound connections by default, then the rules specified in the CreateFirewallBlockingRules.ps1 script will apply.

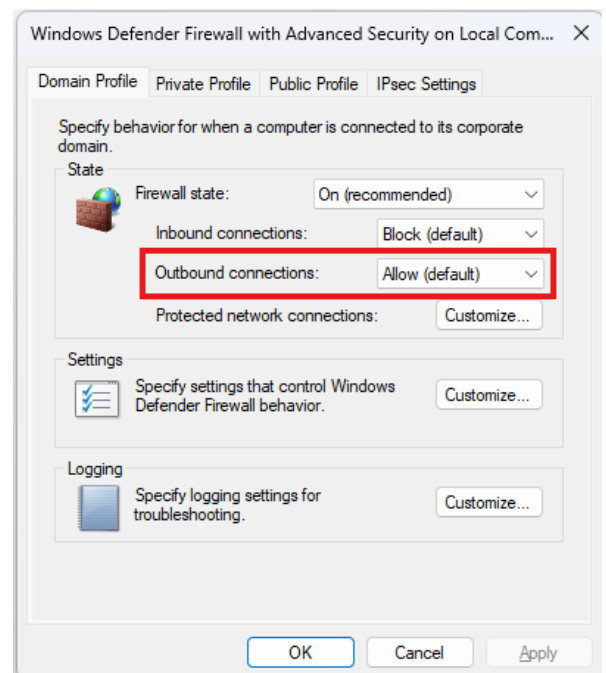
If the firewall is set to Block outbound connections by default, then the rules specified in the CreateAllowSonoLab10FirewallRule.ps1 will apply.

The firewall rules and other settings can be found in the Windows Defender Firewall with Advanced Security utility. Open the utility and click "Windows Defender Firewall Properties", to bring up the following window:

In this image, Outbound connections are currently set to Allow connections by default.

To change the setting, select the desired value (Allow (default) or Block (default)) from the Outbound connections dropdown list, then click OK.

It is recommended that your IT department make these changes. They may have preferences as to which default value to use.



Appendix E: NaDCC Instrument Cleaning Protocol

Purpose

An instrument cleaning procedure should be performed monthly to prevent biological growth in the water bath, chiller, degas, and water condition system (WCS).

Caution: Wear protective gloves when handling NaDCC tablets.

Use the 'Fill', 'Off', 'Drain', and 'Circulate' buttons in the 'Water Control' menu, as instructed below:
Instructions

1. Disconnect and empty the Supply and Waste reservoirs.
2. Dissolve (1) NaDCC 3.3 G tablet in 1 Liter DI water (in a separate lab container).
3. Pour NaDCC solution into the Supply Reservoir. Reconnect the Supply reservoir.
4. Reconnect the empty Waste reservoir.
5. Click 'Fill.' The water bath will fill with the solution and begin circulating.
6. Allow the solution to circulate for approximately 5 minutes.
7. Click 'Drain.' The water bath will drain.
8. Disconnect, empty, and rinse the Supply reservoir, thoroughly, with DI water.
9. Fill the Supply reservoir with DI water. Reconnect the Supply reservoir.
10. Click 'Fill.' The water bath will fill with water and begin circulating.
11. Allow the water to circulate for approximately 5 minutes.
12. Click 'Drain.' The water bath will drain.
13. Repeat rinse steps, 10-12, two more times for a total of three rinses.
14. Disconnect, empty, and rinse the Waste reservoir, thoroughly, with DI water.
15. Reconnect the Waste reservoir.

Appendix F: Implementing Handheld RFID for the ML230

Procedure

1. Ordering the ProMag Handheld RFID Reader and Supported Devices

The ProMag Handheld RFID Reader is sold by GAO and can be ordered through the following link: <https://gaorfid.com/product/reader-smart-label-passive-handheld-hf-13-56-mhz-rfid>.

The RFID Reader should include two USB cables. Please ensure that these cables are included when ordering this device:

- **WAS-T0153 USB Cable** to connect to a power source
- **WAS-T0804 USB Cable** to connect to the Covaris laptop

To establish a seamless connection, the purchase of a standard USB-to-Serial Adapter is required.

Additionally, a 3.0 USB hub is recommended to ensure availability of one of the two USB ports on the Covaris laptop for other uses. A powered USB hub (one with an external, plug-in power supply) is recommended to ensure that all devices plugged into the hub receive adequate power.

Both the standard USB-to-Serial Adapter and the 3.0 USB hub are available for purchase from several online vendors.

2. Connecting the RFID reader to a Covaris laptop

- Connect one side of the WAS-T0153 power cable to the open serial jack on the WAS-T0804 cable from the device itself, and the other end of the WAS-T0153 power cable to the USB hub.

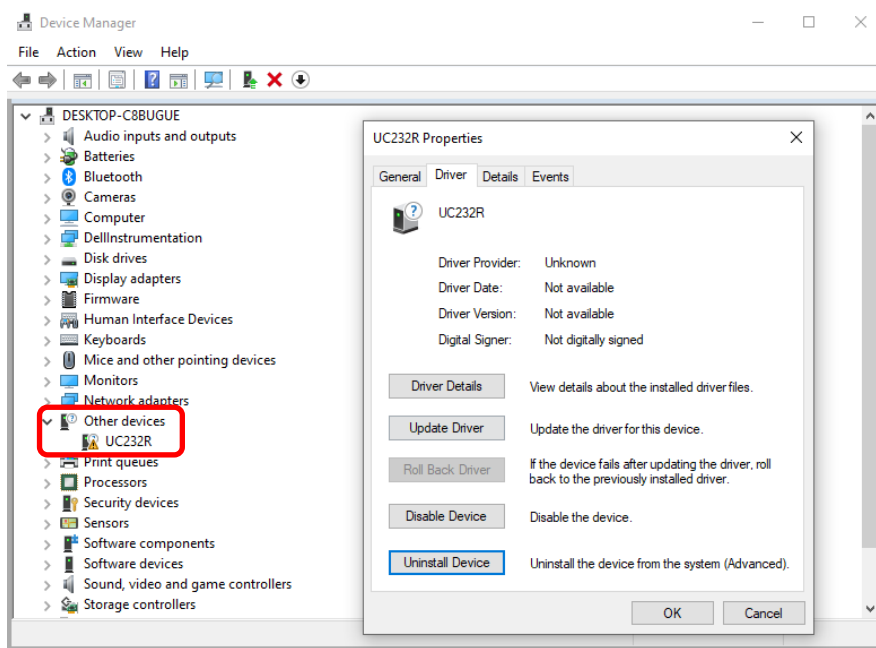


Open serial jack for power connection.

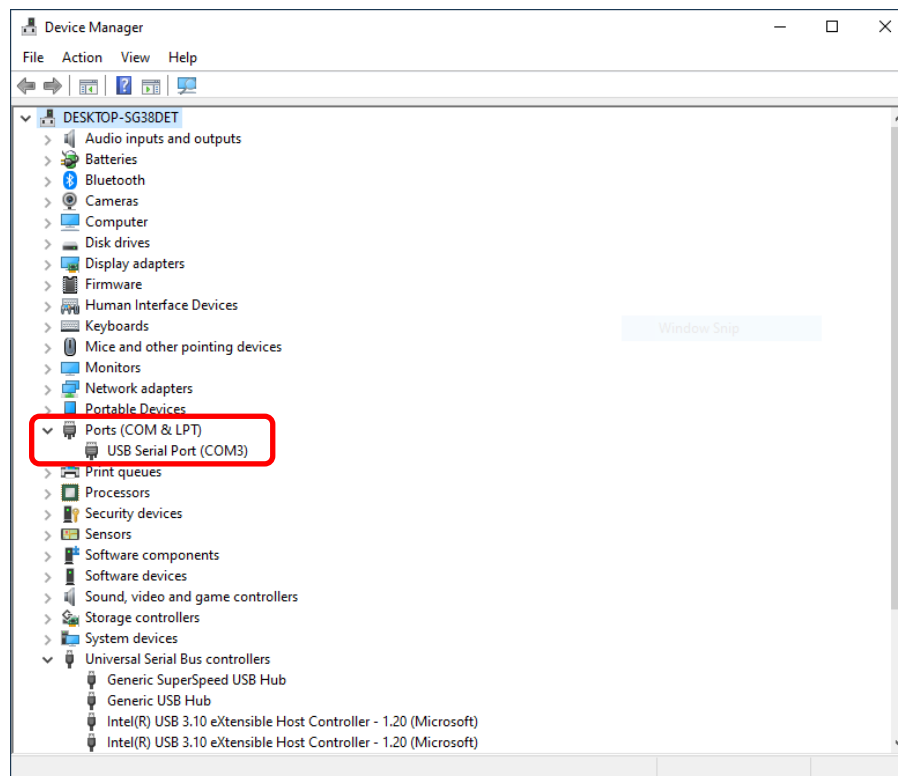


Power connected

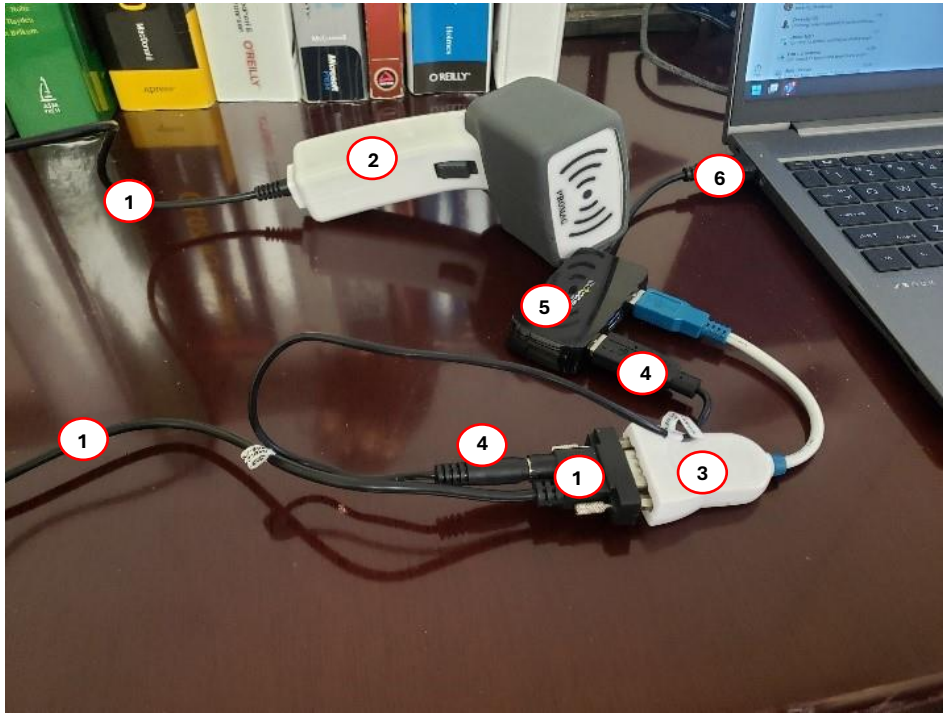
- Connect WAS-T0804 to a standard USB-to-serial adapter
- Connect the USB-to-serial adapter to the USB hub
- Open the **Device Manager** and plug the USB hub into any open USB port on the laptop.
 - The power connection has been established when the tones are finished playing.
 - A few seconds after the handheld has been plugged in, the list of devices will contain a UC232R device under **Other Devices**. Refer to the image below.



- It will remain in this state for a few more seconds, while it is downloading the driver for the handheld device. After the handheld driver has been installed, the Other Devices\UC232R node will be replaced by a Ports\USB Serial Port node.



- The laptop must have access to an internet connection in order for drivers to install correctly. If it does not have an internet connection, it will remain in the first state, showing the UC232R node, and SonoLab will not be able to talk to the device.



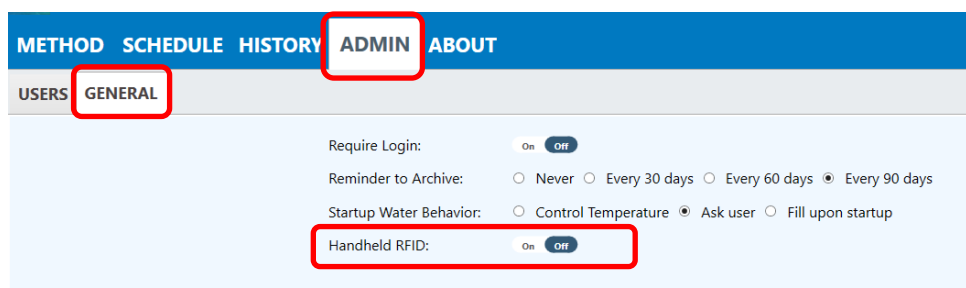
Final Setup

Referring to the image above, the following items must be assembled in order to use the scanner:

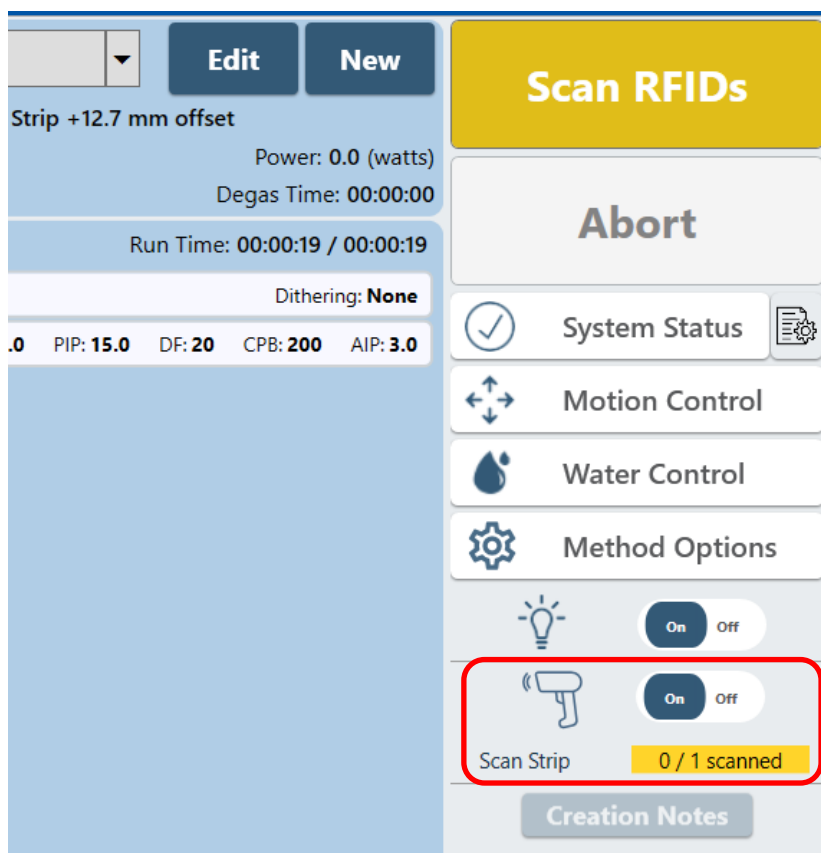
- The WAS-T0804 Data Cable cord (1) is connected to both the ProMag Handheld RFID Reader (2) and the serial jack end of the USB-to-Serial Adapter (3).
- The WAS-T0153 Power Cable (4) is plugged into the WAS-T0804 Data Cable serial jack (1) and the USB hub (5)
- A standard USB-to-Serial Adapter (3) is connected to the WAS-T0804 Data Cable serial jack (1) and the USB hub (5)
- The USBhub (5) is plugged into the Covaris laptop (6)

3. Verifying RFID Scanner Operation

1. Start SonoLab.
2. Click on the “**Log In**” button at the upper right of the SonoLab screen.
3. When prompted, enter the user name, “**Administrator**” and password, “**admin**”. Both are case sensitive.
4. Click on the “**ADMIN**” tab, then on the “**General**” tab within ADMIN.
5. Enable “**Handheld RFID**” by toggling on the switch to “**On**” position.



6. Make sure that the handheld RFID reader is connected to SonoLab. See the *“Connecting SonoLab to RFID Scanner”* section below.
7. Identify and select the appropriate Plate Definition File for 8 AFA-TUBE TPX Strips
8. Create a placeholder method to test connectivity of the RFID Handheld Reader.
9. The *“Scan Strip”* switch under the *“Method Options”* tab should be in the *“On”* position. This will cause the green *“Run”* button to change to a yellow *“Scan RFIDs”* button, as shown below.



10. Clicking the **Scan RFIDs** button will cause the handheld to begin searching for RFIDs. If a valid strip or label is brought within a few inches of the scanner, the tag data will be displayed and the tag counter will increment.

The following photo illustrates the scanning “sweet spot”: a few mm above the center dot on the face of the handheld. The handheld makes an audible beep when it detects and scans an RFID tag. The trigger on the handheld is not used in any way: bringing the strip to the sweet spot while it is scanning is sufficient.

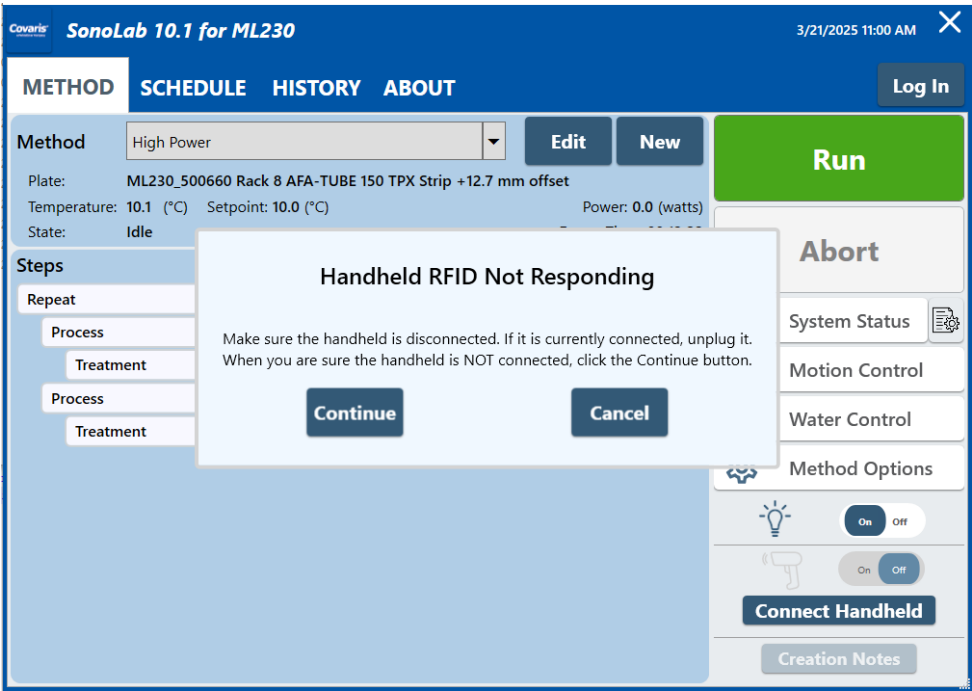


11. This indicates that the test was successful. **Cancel** out of the scanning dialog and delete the test method.

4. Connecting SonoLab to RFID Scanner

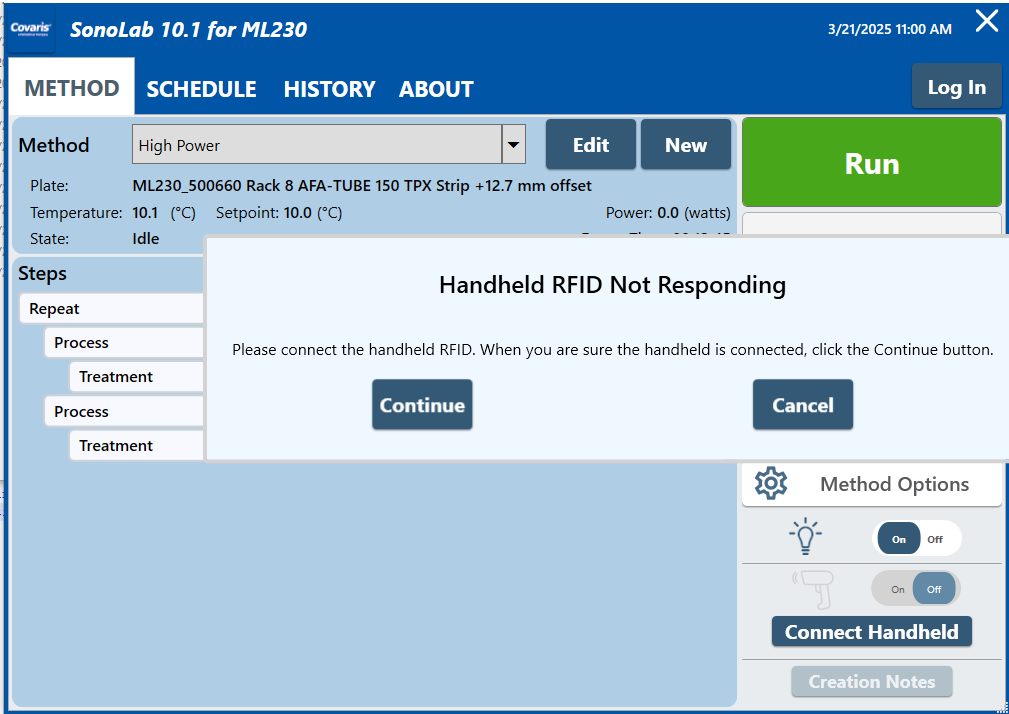
When SonoLab starts, if the Handheld RFID option is On, and if the handheld RFID reader is already connected to the ML230 via USB, SonoLab will detect the reader, and it will be ready for use.

If the reader is not connected, click the Connect Handheld button; the following dialog is displayed:



This dialog is just asking you to make sure that the handheld RFID reader is NOT currently connected to the ML230. If it's already plugged in, unplug the handheld RFID reader. Once you're sure that it is NOT connected, then click the Continue button.

The following dialog is displayed:



This dialog is telling you to connect the handheld RFID reader to the ML230. Once you have done so, click the Continue button.

The ML230 then detects the RFID reader, which is now ready to use. The screen will look like this:

