Covaris®

M220 Focused-ultrasonicator Setup & Instruction Manual

M220 Focused-ultrasonicator for Sample Processing using Adaptive Focused Acoustic® (AFA®)

For Research Only

Model Number: M220

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 HIV and Other Bloodborne Infections, published 1987, updated 1996
- Clinical and Laboratory Standards Institute (CLSI), GP17-A2 Clinical Laboratory Safety; Approved Guideline - Second Edition, published 2004, ISBN 1-56238-530-5
- Clinical and Laboratory Standards Institute (CLSI), M29-A3 Protection of Laboratory Workers from Occupationally Acquired Infections; Approved Guideline, Third Edition, published 2005, ISBN 1-56238-5674
- Occupational Safety and Health Administration (OSHA), 29 CFR 1910.1030 Bloodborne Pathogens
- International Standards Organization (ISO) 15190:2003, Medical Laboratories – Requirements for Safety

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Teflon is a registered trademark of The DuPont Company.

Covaris, Inc.

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Warnings

For the Safety of Operating Personnel:

- Make sure that the equipment is properly grounded. *DO NOT* operate if it's 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* run an acoustic treatment with the sample cover in the OPEN position or without a water bath - the acoustic system will not work.

- 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., 19 °C to 25 °C (66 °F to 77 °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 cause damage to 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.

- AFA-grade water should be used to fill the supply water bottle.

- Empty the water bath daily. *DO NOT* leave water in the water bath for an extended time since there is no water filtration or water cleaning system with the apparatus.

- *DO NOT* employ isopropyl alcohol, ammonia-based or abrasive cleaners on the acoustic assembly, as these will damage the acrylic or transducer surfaces.

- The Tube Holder should be stored in a dry place or in the M220 Accessories Storage Station when not in use.

- Establish a standard of operation and periodically test equipment, as described in Appendix A of this manual.

- *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

M220 Instrument Repair – Repair of all parts (including the laptop) from normal operation of equipment are provided in our Service Depot. All labor charges are included. Instrument packaging and ground shipping will be provided. 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.

Table of Contents

1. Introduction

1.1 Overview of the User Manual

This manual contains installation, operation and service instructions for the Covaris M220 Focused-ultrasonicator. It contains information 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 immediately.

The following definitions apply in this manual:

NOTE: Inconvenience if disregarded..	**WARNING:** Personal injury may occur.	**CAUTION:** Equipment damage may occur.

There is a PDF version of this manual available on the computer desktop. Open the manual by double clicking the user manual icon. A hypertext version of this manual can also be found in the Help tab of the SonoLab Software.

1.2 The M220 and the Covaris Process

The M220 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 the 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 Assembly

The following items should be found in the package of the Covaris M220 instrument:

- Quick Start User Guide
- User Manual
- Notebook Computer with AC Adapter (PN 500311)
- Cables
  - USB cable
  - 1 M220 power cord
  - 1 Computer AC Adaptor power cord (Non US customer only)
- Accessories
  - Fill-Drain Kit (PN 500299)
    - 1 100ml wash bottle
    - 1 20 ml Syringe
    - 2 Re-sealable plastic syringe tips
  - Cleaning Swab Kit (PN 500298)
    - 10 disposable swabs
  - AFA-grade water (125 ml)
- M220 Safety Cover
- M220 Main Unit

> **CAUTION:** Lift the M220 out of the box by its baseplate. Do not lift by the Acoustic Assembly. Lifting the unit by its acoustic assembly may damage the instrument.
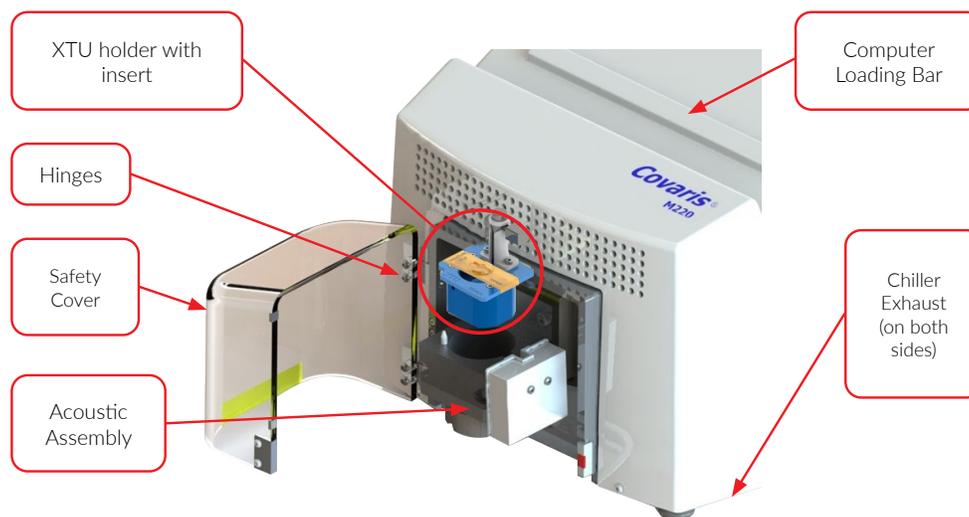
Figure 2.1 A front view of the M220 instrument.

After the instrument is unpacked, please locate the M220 on a flat surface near two power outlets. Use both sides of the base (***Figure 2.1***) to lift the instrument. Do not use the acoustic assembly to lift the instrument.

If necessary, adjust the four adjustable feet to ensure the instrument is stable and level. Do not remove the adjustable feet. They are needed to ensure proper air flow from the system chiller.

1. Peel off the backing from the Velcro strips on the Computer Loading bars. Place the computer on top of the glue side of the strips as shown in **Figure 2.2**. Gently press the computer to secure it in place.

Figure 2.2 Secure the computer on top of the M220 as shown.

USB port to computer

Ventilation Fan

Power Switch

Power Inlet

Figure 2.3 The back panel of the M220 instrument

2. As shown in **Figure 2.3**, plug the AC power cord into the power inlet located at the back panel of the instrument; Plug the AC power cord into the power outlet;
3. Plug the AC adaptor into the computer and into the power outlet;
4. Connect the USB cable into the USB port located at the back panel of the instrument (**Figure 2.3**) and USB port on the notebook computer;
5. Place the Safety Cover on the hinges (please refer to **Figure 2.1**);
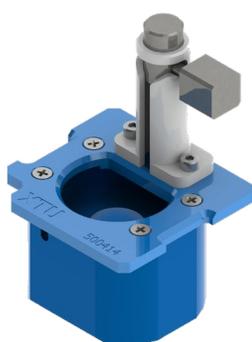6. Place the Tube Holder in the Acoustic Assembly housing (refer to **Section 2.2** below).

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

2.2 Installing the Tube Holder

Open the Safety Cover and place the Tube Holder into the Acoustic Assembly. Note that the undercut at the forward-left corner of the tube holder should be aligned with the pin on the assembly.

Water Bath Housing

Water Level Sensor

Sample Holder

Sensor Module

Transducer 500 khz
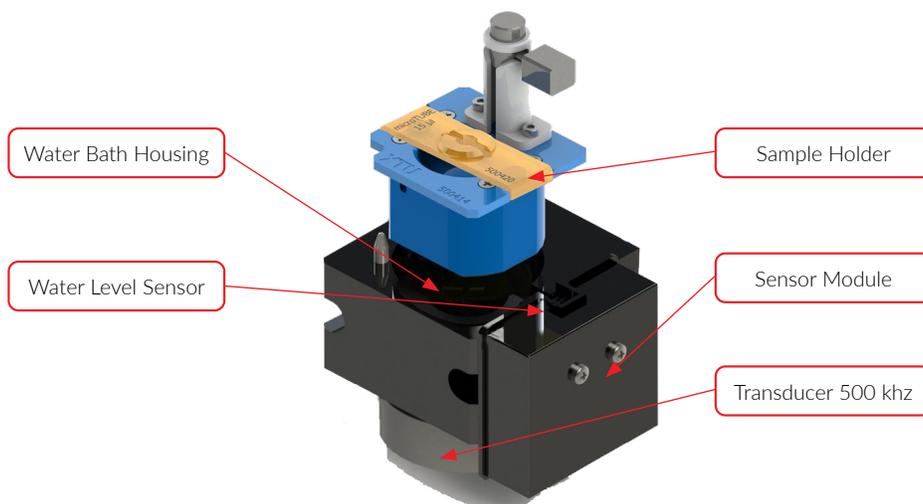
Figure 2.4 Depiction of XTU holder and insert placed in the acoustic assembly.
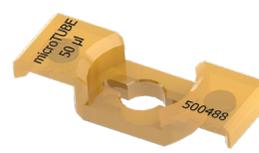
M220 Holder XTU
PN 500414
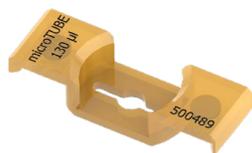
M220 Holder XTU Insert microTUBE 130 µl
PN 500489

M220 Holder XTU Insert microTUBE 15 µl
PN 500420

M220 Holder XTU Insert microTUBE 500 µl
PN 500471

M220 Holder XTU Insert microTUBE 50 µl
PN 500488

2.3 SonoLab Installation

SonoLab 7 is an application used to control a Covaris AFA 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. It also contains editors for customizing system settings and performing maintenance functions.

SonoLab 7 has been pre-installed in the computer purchased with the M220 instrument. No further installation or configuration is required if the computer is purchased with M220 instrument. Users can directly go to **Section 2.4** to start the SonoLab program.

If it is necessary to install or re-install SonoLab 7 or instrument drivers on a computer, please contact Covaris for the latest versions, downloading and installation instructions.

2.4 Starting SonoLab

Turn on the computer. Turn on the power switch located at the back of the M220 instrument. Wait at least 10 seconds to allow the instrument to initialize. Double click the SonoLab 7 icon on the desktop to start SonoLab. An animated splash screen will be displayed, followed by the SonoLab 7 Run screen, as illustrated in **Figure 2.5** (by default, user authentication is disabled). The user has a default setting in which they can run and edit methods. See User Authentication **Section 6.3.2** to create user types and to take advantage of the software's full capacity.
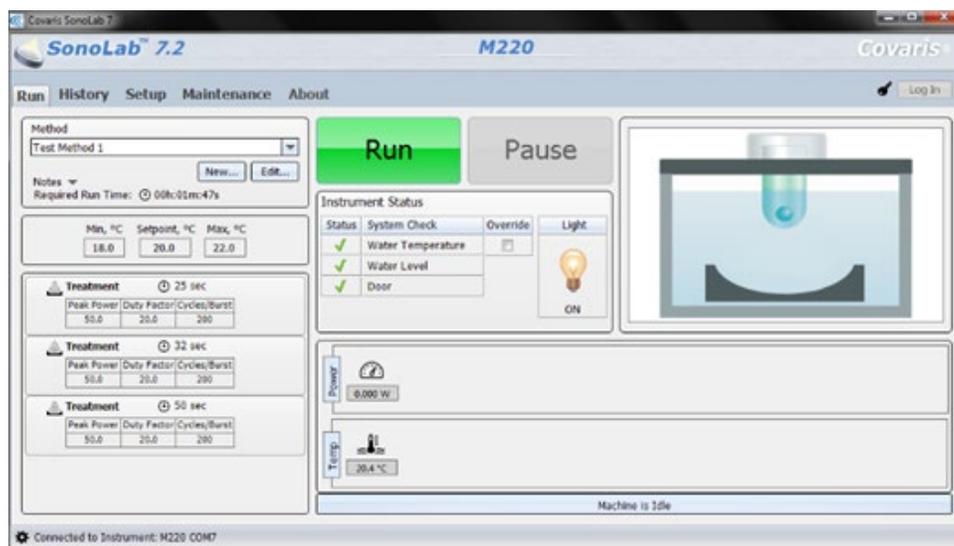

Figure 2.5 The SonoLab 7 Run Screen

2.5 Connect SonoLab to the Covaris System

SonoLab will automatically connect to the instrument, indicated by the "M220" at the lower left of the Run Screen. Go to the "Setup" tab, click on Communications and observe the Connection State. If the indicator is red and the state is "Disconnected", click "Connect" button. Once the connection status changes to "Connected", the system is ready for use. Click on the Run tab to return to the Run Screen.

> **NOTE:** The Run tab is NOT visible if the instrument is disconnected.

> **NOTE:** Covaris recommends that the Laptop computer be employed exclusively for instrument control and that operation of additional application software be minimized.

3. Operation

3.1 General Overview

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

The Acoustic Assembly 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 a Sensor Module with water level and temperature sensors to ensure that these are appropriate during acoustic treatments.

The Tube Holder is designed to hold the sample tube at the appropriate position in the acoustic field during processing. It is normally inserted into the top of the Acoustic Assembly.

The Computer provides an interface and software to the operator for controlling the M220 instrument through SonoLab 7.

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

The Front Light is normally lit when the instrument is turned on. The user can disable the light from the main control panel of SonoLab.

The Chiller is used to control the water bath temperature. It is able to chill or heat the acoustic assembly to maintain the water bath at or near the set point programmed in acoustic Methods. No external chiller is required.

> **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 Preparing the M220 for Use

To start an acoustic treatment, four conditions must be met:

- There must be an acoustic method selected in the Method box
- Water Temperature must be within acceptable Min and Max limits
- Water Level must be at or above that required for correct operation
- The Safety Cover must be closed

The Run button will remain gray and inactive until all four of the conditions are met.

To select and load an acoustic method, click the pull-down menu of the "Method" combo box, as shown in **Figure 3.2**, and a list of existing method names along with their detailed information will be shown. Navigate through the list with the vertical scroll bar and select a method. Please note that several acoustic methods will come pre-loaded into your system. These pre-loaded methods cannot be edited.
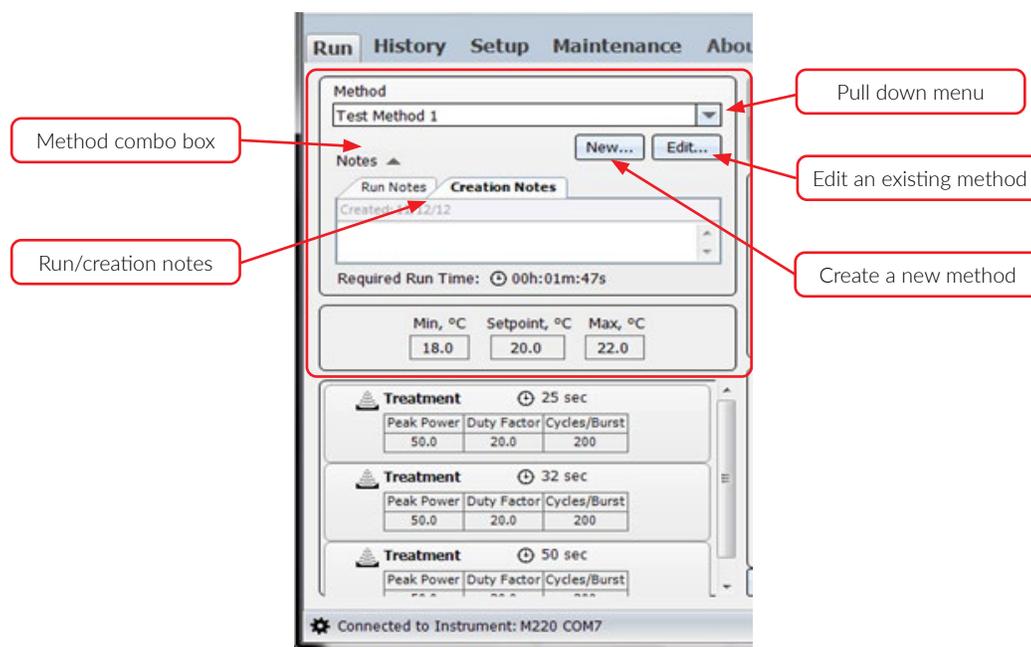
Method combo box

Run/creation notes

Pull down menu

Edit an existing method

Create a new method

Figure 3.2 Selecting and loading an acoustic method

The next three conditions are displayed in the Instrument Status panel (see **Figure 3.3**) of the Run Screen. An acceptable condition is indicated by a green check mark (✓) in the Status box. If a condition is not acceptable, the status will show (✗).
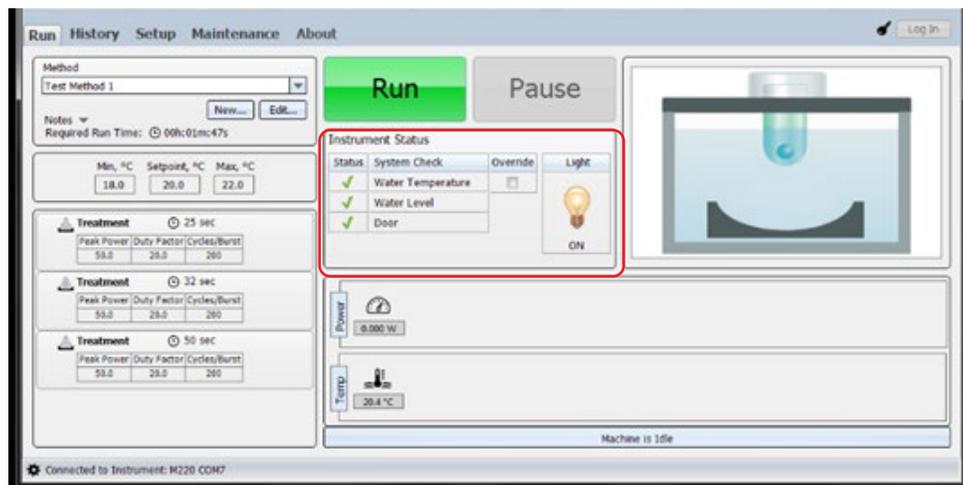

Figure 3.3 Instrument Status Panel and Instrument Light Control

To achieve an acceptable status on these conditions:

- The M220 system automatically adjusts the water temperature to match the set point, and Water Temperature status will turn green when temperature is within the Min and Max limits (typically 2 degrees above and below the set point). The default set point (in the absence of a selected method) is 20 °C.
- Filling the acoustic assembly (with the Tube Holder in place) to the top of the tube holder will allow the Water Level indicator to turn green. (See **Section 3.3**)
- The Door Closed status will turn green as soon as the Safety Cover is completely closed.

The temperature condition may be ignored by left-clicking the Override box. If Override is checked, then Water Temperature is considered acceptable regardless of actual value. The Status icon will continue to show a green ✓ or red ✗, but with a small horizontal line through it to indicate the Override condition.

Once all conditions are acceptable, and a method has been loaded, the Run button will illuminate and the selected acoustic Method can be started.

If user wants to modify an existing method, one click the "Edit" button in the Method window after the method is highlighted. The method editor window will show up. The "Edit" function allows user to modify an existing method.

3.3 Filling the Water Bath

To transmit acoustic energy to the sample vessel, the Acoustic Assembly must be filled with AFA-grade water. Covaris recommends AFA-grade Water (PN 520101). You can also use highly purified water (at least ASTM Type III or ISO grade 3). To fill the water bath, follow the steps listed below:
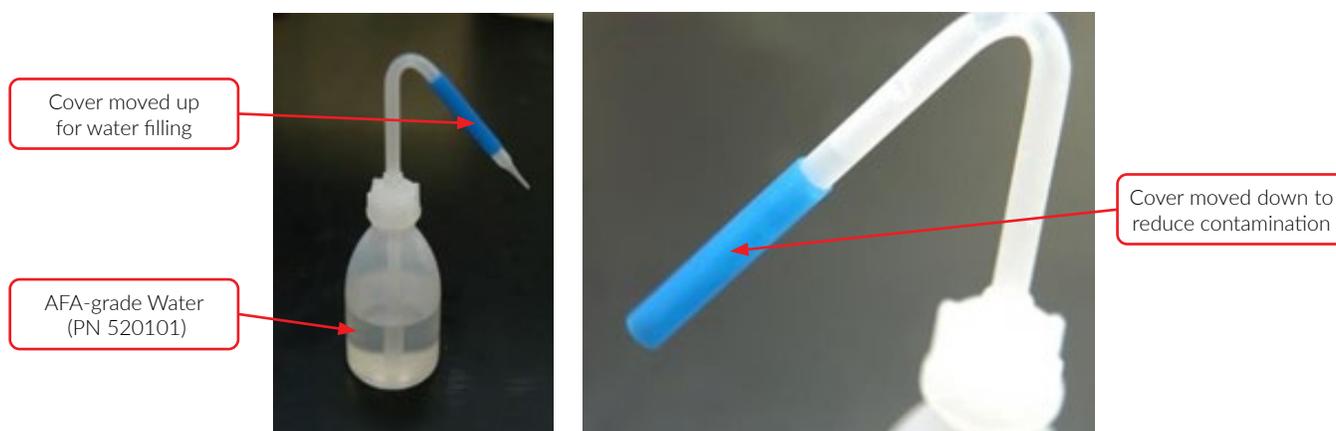

Cover moved up for water filling

AFA-grade Water (PN 520101)

Cover moved down to reduce contamination

Figure 3.4 Water bottle and tip cover.

As shown in **Figure 3.4**, fill the wash bottle with AFA-grade water. Slide the blue cover up to fill the water bath; slide the cover down after filling to keep the nozzle clean.

Figure 3.5 Easy filling with AFA-grade water

As shown in **Figure 3.5**, place the tip of the wash bottle in the water sense aperture and fill the water bath by squeezing the wash bottle until the water reaches and fills the central aperture of the tube holder. Approximately 15 ml of water will be required.

> **CAUTION:** For best results, ensure that water is visible in the aperture where tubes are loaded. Refill as needed, even if SonoLab indicates adequate Water Level.

3.4 Loading the Sample

Lift the sliding weight (step 1) and place it at the loading position by turning the sliding weight 90˚ (step 2) either clockwise or counter-clockwise to secure the sliding weight. Place the tube into the aperture at the center of the Tube Holder and make sure the tube sits all the way down in the holder. Place the Sliding Weight on the top of the sample tube by rotating the (step 1) and lowering (step 2) Sliding Weight. The Sliding Weight will be maintained at running position. Close the Safety Cover to ensure that the Door status in SonoLab turns to a green check.

3.5 Running a Method

Open the Safety Cover, load the sample tube to be treated into the center of the Tube Holder, and close the cover. When the "Run" button is green, the selected method may be started. Click Run to start. The power and temperature charts (lower right corner of the Run Screen) will display average power and temperature data during the running process. The progress bar will display the percentage of the run that has been completed.

The user can, at any time while running a method, click "Pause" to pause a running process. When the method is paused, the user may continue the process by clicking on "Resume" button or terminate the process by clicking on the "Abort" button.

When the method is complete, a dialog box will be posted over the Run Screen, notifying the user. If necessary, click the mouse in the text entry area to set the focus, then notes may be added either via the keyboard or an alternative input device. For instance, a barcode reader may be used to capture data directly from pre-labeled samples. When finished, simply open the Safety Cover and remove the sample tube.

3.6 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 clicking the Light control on the Run Screen.

3.7 Draining water and cleaning

Special care needs to be taken when draining the water from water bath. Remove the tube holder and place it on a clean, dry surface. Draw the water from the acoustic assembly using the provided syringe. It is important to use the plastic tip on the syringe to prevent the scratch of the transducer surface. Water needs to be drawn as completely as possible.

Use the disposable cleaning swab to sweep the water channels in the Acoustic Assembly. Wipe the surfaces of the transducer and the metal housing with lint-free cloth and air dry for next use. Store the Tube Holder in a dry place or in the M220 Accessories Storage Station (PN 500352); close the Safety Cover.

3.8 Shutdown 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, store the Tube Holder in a dry place.

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

Exit SonoLab software by clicking on the red X in the upper right corner. If there are unsaved changes in "Setup Screen", a message box will be popped up asking if user wants to save the changes. Select "Yes" to save the changes and leave SonoLab, or select "No" to leave SonoLab without saving the changes. The user can also select "Cancel" to continue working on the SonoLab.

To shut down the laptop, the user should select "Shut down" from the Start menu on the Windows screen to power down the computer.

The instrument should be powered off after the SonoLab software has closed. To turn off the instrument, the user needs to move the power switch to OFF position. The power switch of the M220 is located at the back of the instrument next to the power cord of the instrument.

4. Using a Pre-existing Method

SonoLab has protocols pre-installed on the computer running SonoLab 7. These methods have been developed by Covaris scientists and are ready to use for most common applications. To select a pre-loaded protocol, click on the pull down button to make the list appear.
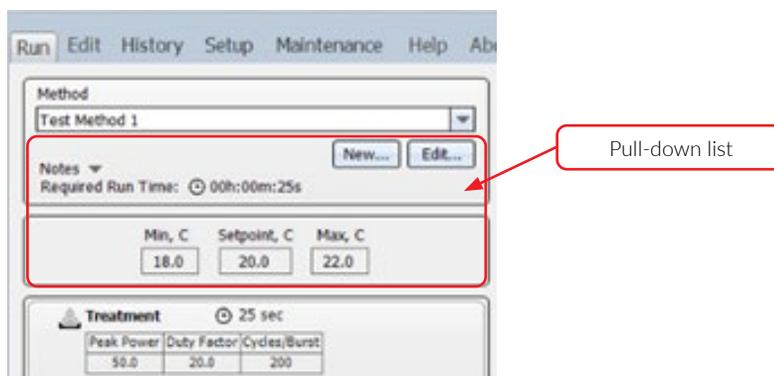
Covaris regularly updates these methods, and add new ones. The latest version of the SonoLab Protocol Updater can be found in the resource section of Covaris website.

4.1 DNA Shearing Protocol

DNA Shearing protocols are specific to the mean DNA fragments size that you're looking for, as well as sample volume and microTUBE vessel used. These protocols are stored in a folder called "DNA Shearing for M220". Naming convention is as follow:

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

4.2 Chromatin Shearing Protocols

Chromatin shearing protocols allow you to run a time course at a level of power optimized for efficient chromatin fragmentation when used in conjunction with Covaris TruChIP kits. Naming convention is as follow:
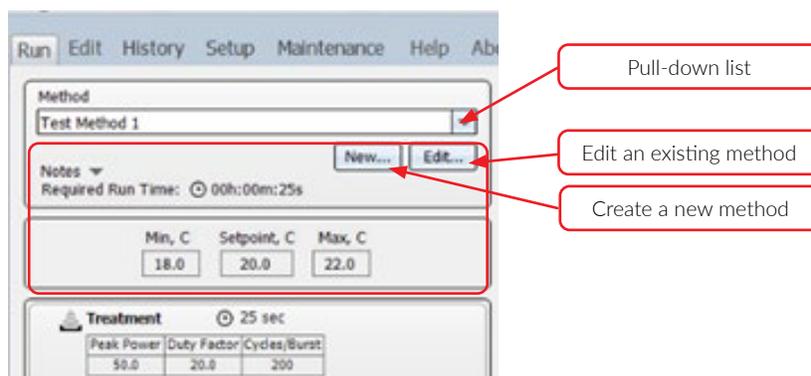
- ChIP _[duty factor] _[time]

5. Create and Edit Methods

SonoLab supports the creation of new methods and editing of existing methods from the Run Tab. A method consists of one or more treatments, delays and message prompts.
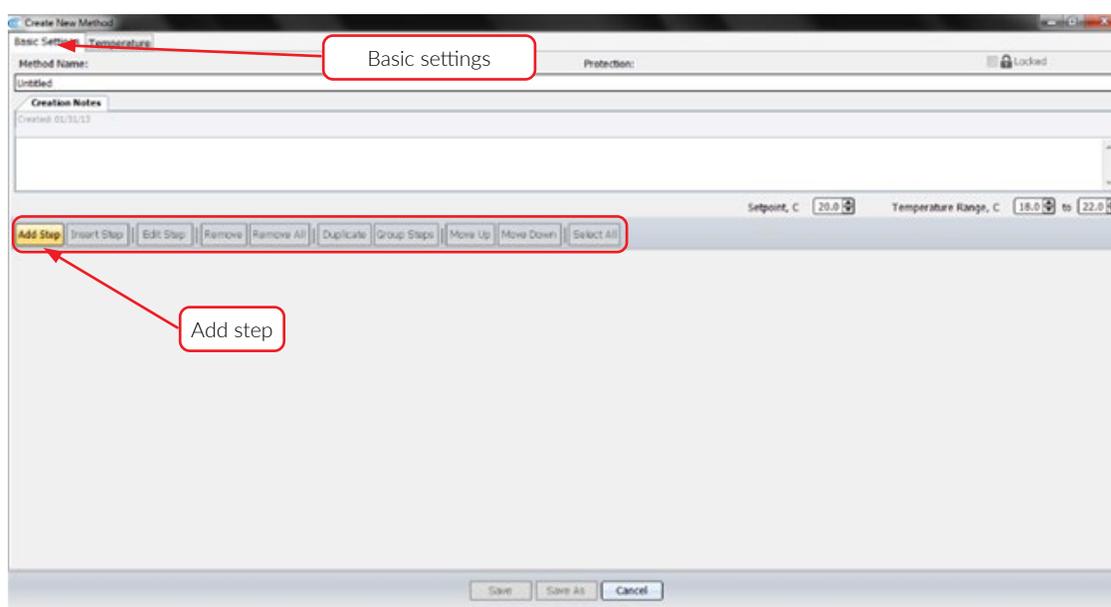
5.1 Create a New Method

To create a new method, click the "New..." button in the "Method" window (see **Figure 5.1**).

Figure 5.1 Controls for creating and editing a method

The Method Editor window will appear (See **Figure 5.2**). From the Basic Settings tab: Select the "Add Step" to create a method.

Figure 5.2 Method Editor Window

The Add Method Step window appears as shown in **Figure 5.3**. The Step Types available in this screen are Treatment, Delay, Prompt, and Repeat

5.1.1 Choosing Treatment allows editing of the four acoustic parameters:
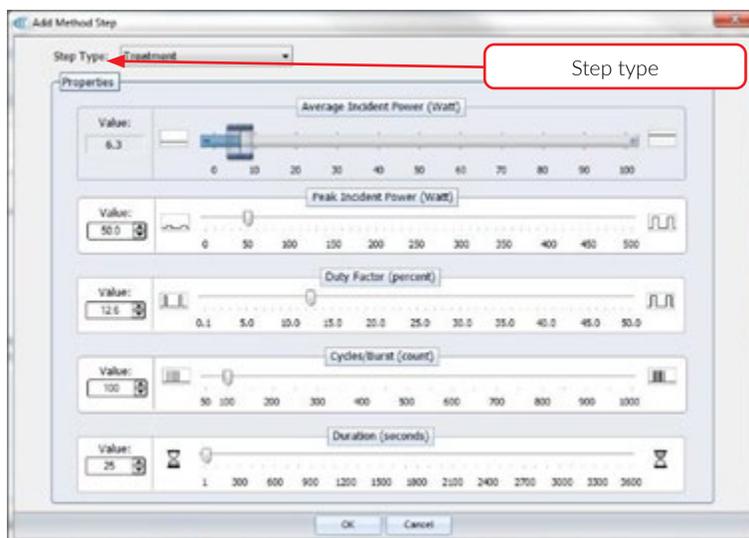

Figure 5.3 Add a treatment

Treatment parameters can be chosen either by sliding a control left or right, by clicking on up/down arrows in the value box or by directly editing the Value box. The treatment parameters are:

Peak Incident Power (PIP): This parameter measures the peak electrical power used to drive the ultrasound transducer. In the M220 instrument, the adjustable range of PIP is 2.5 to 75 Watts.

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 will result in more acoustic energy generated from the transducer. Users can define the Duty Factor from 0.1 to 50% in the M220 instrument.

The product of the PIP and Duty Factor gives the approximate Average Incident Power 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.

Cycles per Burst: This parameter indicates the number of electrical signals used in each acoustic "burst of" the transducer. One may define Cycles per Burst from 50 to 1000 in the M220 for different applications. Advanced users may use this parameter to fine tune their experiments.

Duration: This parameter defines the amount of time that the sample is under a treatment. The measurement of the Duration is in seconds. The maximum time for any treatment is 3600 seconds. Should a longer treatment be necessary, the "Duplicate" or "Group Steps" can be used to extend the treatment. At the top of the screen, the software displays the Average Incident Power, calculated simply from the PIP and Duty Factor. In the M220 instrument, the maximum Average Incident Power is 20 Watts, (for example, if the 50 PIP (50 Watts) and 40% Duty Factor are selected).

5.1.2 Choosing a Delay Step

Choosing a Delay step introduces a fixed time delay into a method. User can set the sample to settle between two different treatment steps. The delay is specified in seconds. See **Figure 5.4**.

Figure 5.4 Add a Delay Step

5.1.3 Choosing a Prompt Step

Choosing a Prompt step displays a specified message on the screen and pauses execution of the method until the operator clicks OK or Cancel. See **Figure 5.5**.

Figure 5.5 Add a Prompt Step

5.1.4 Choosing a Repeat Step

By choosing a Repeat step, the user can choose how many iterations they would like to apply to a method. See **Figure 5.6**.

Figure 5.6 Add a Repeat Step

5.1.5   When all method parameters and steps have been defined, click on ok to save changes.

5.1.6   From the Basic Settings Tab, once a method has been created general operation buttons are available for the following functions:
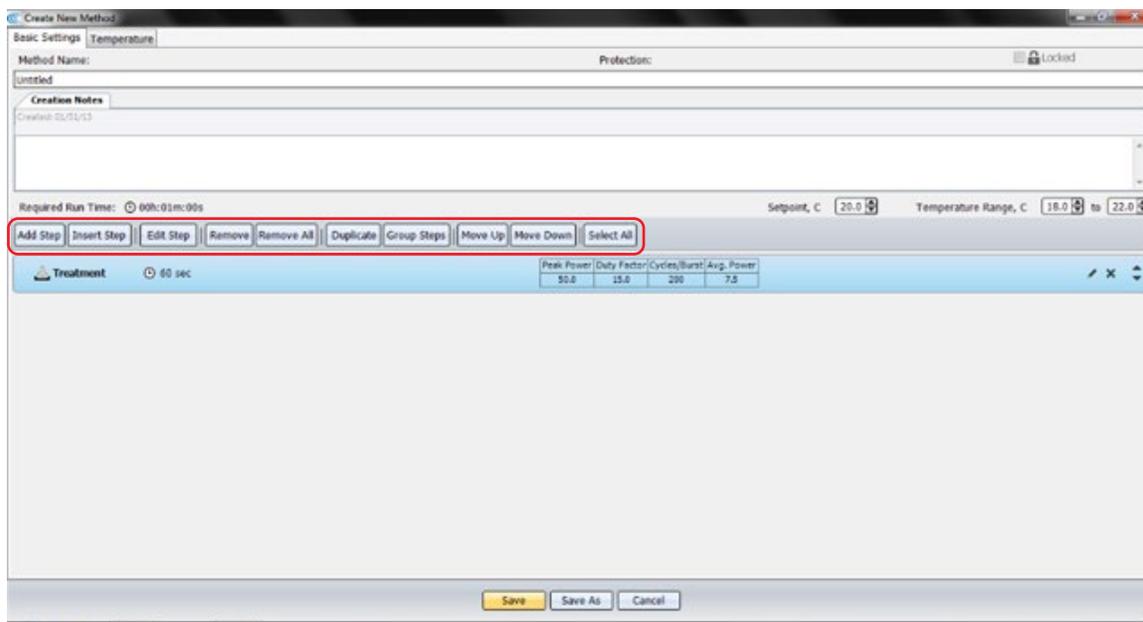

Figure 5.7 Available functions

- **Add Step**: Allows the user to add a step to the end of the method.
- **Insert Step**: Allows the user to select a step and insert a new step either before or after the selected step.
- **Edit Step**: Allows the user to edit the selected step.
- **Remove**: Allows the user to remove the selected step.
- **Remove All**: Allows the user to remove all the steps. Before removal, a confirmation window will appear asking the user if the user wants to remove all the steps.
- **Duplicate**: Allows the user to duplicate a selected step.
- **Group Steps**: Allows the user to create a group step with the multiple selected step(s). A "Create Step Group" window will appear allowing you to specify how many iterations the user wants to repeat the steps.
- **Move Up**: Allows the user to move the selected step up one level. If the selected step is already on the top of the list, it has no effect on the method. If the selected step is in a group, a confirmation window will appear asking if the user wants to move the step out of the group.
- **Move Down**: Allows the user to move the selected step down one level. If the selected step is already on the bottom of the list, it has no effect on the method. If the selected step is in a group, a confirmation window will appear asking if the user wants to move the step out of the group.
- **Select All**: Allows the user to select all steps created.

5.1.7 When a method has been created the user can group a step to extend the treatment. User can also repeat on treatment or a group of treatments. A Group step is used to repeat 1 or more method steps a pre-specified number of times.
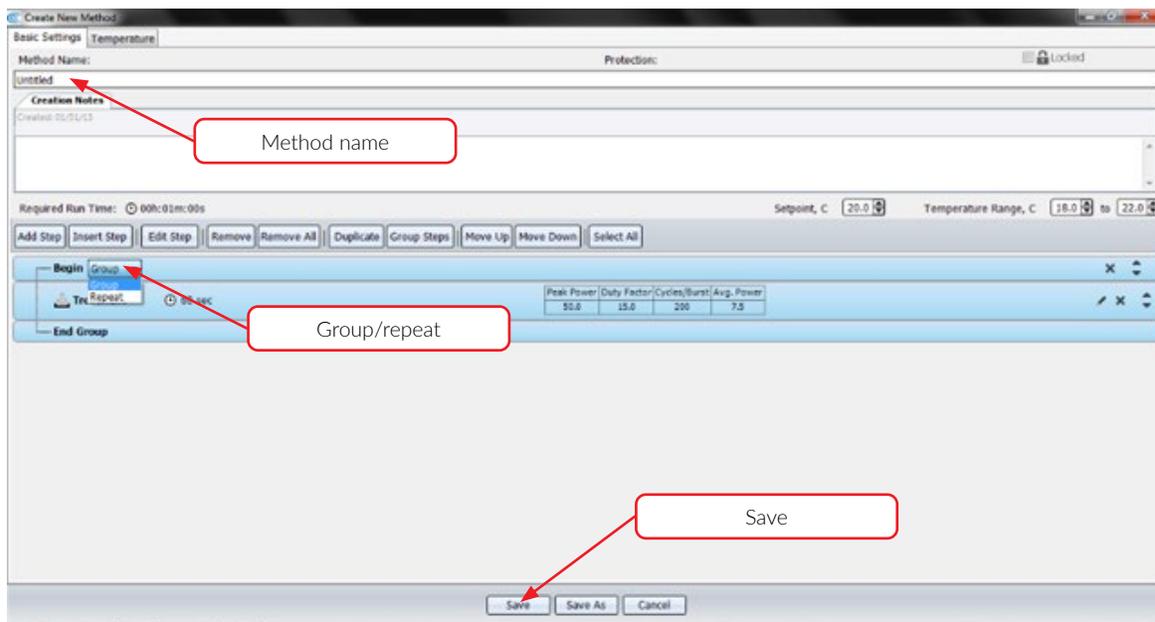

Figure 5.8 Group or Repeat Method

5.1.8 Type a Method Name and click Save to save this method for future use.
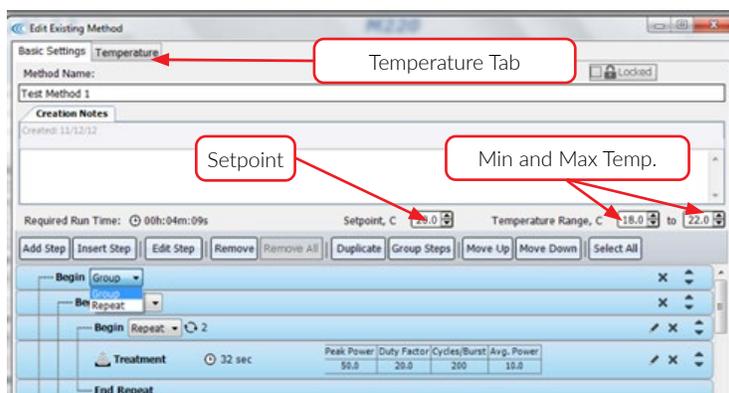
5.2 Edit an Existing Method

To edit an existing method, pull down the name of an existing method (see **Figure 5.1**) and click "Edit..."

5.2.1 Methods may be edited in a similar manner as creating a method if the user has the required Authorization (see User Authentication.)

5.3 Basic Settings Tab

5.3.1 Setpoint: The target value that the instrument will automatically aim to reach. User can choose a Temperature Setpoint from +6.0 to +40.0 °C.

5.3.2 Temperature Range: This function will set the upper and lower temperature limit to +/- 2 degrees of the setpoint.

5.4 Temperature Tab

To edit an existing method, pull down the name of an existing method (see **Figure 5.1**) and click "Edit..."

5.4.1 User to set an auto resume for the minimum and maximum temperature set point. Example: If customer sets a minimum temperature value of 18 degrees, and the instrument temperature drops to 17 degrees, the unit will pause. If auto resume value is set to 18.5, once temperature rises to this value the unit will automatically run.

5.4.2 User has the option to choose whether pause or abort method when maximum or minimum Temperature error occurs.
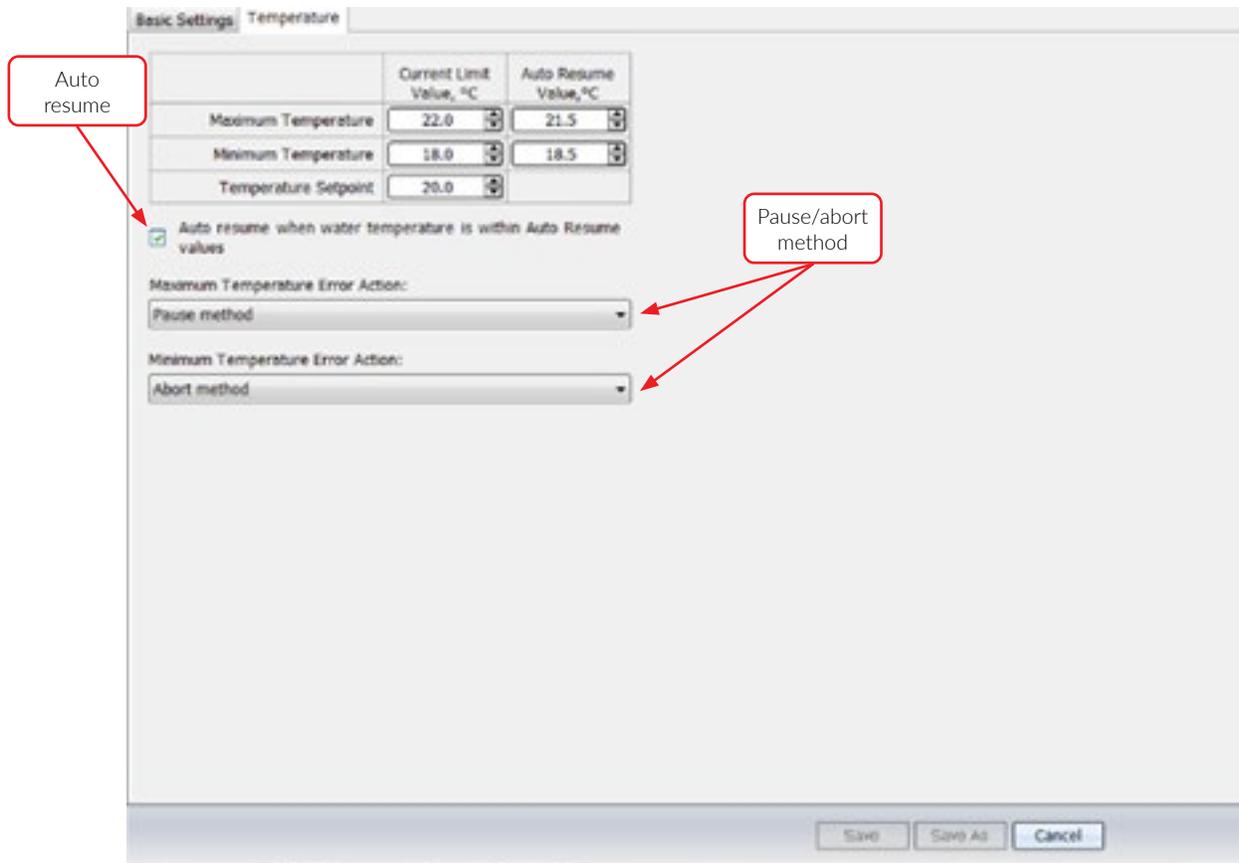
6. SonoLab Application Software

The main components of SonoLab software include:

- Run – compose or select methods to run
- History – view system usage history
- Setup – system setup by user
- Maintenance – instrument parameters set by factory or service personnel
- About – information on system configuration

6.1 Run Screen

The Run tab (**Figure 6.1**) is the principal user screen for the system. See **Section 3.5** for details on operating the instrument through the Run Screen.
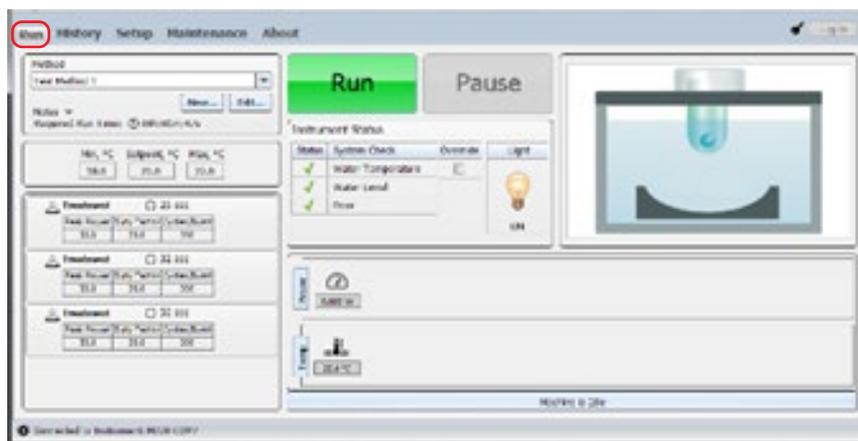

Figure 6.1 The Run screen

6.2 History Screen

The History tab (**Figure 6.2**) shows the history of every method performed on the instrument. It displays the selected method's runtime information and run details. A graph of the actual average power and temperature during each treatment step is stored.
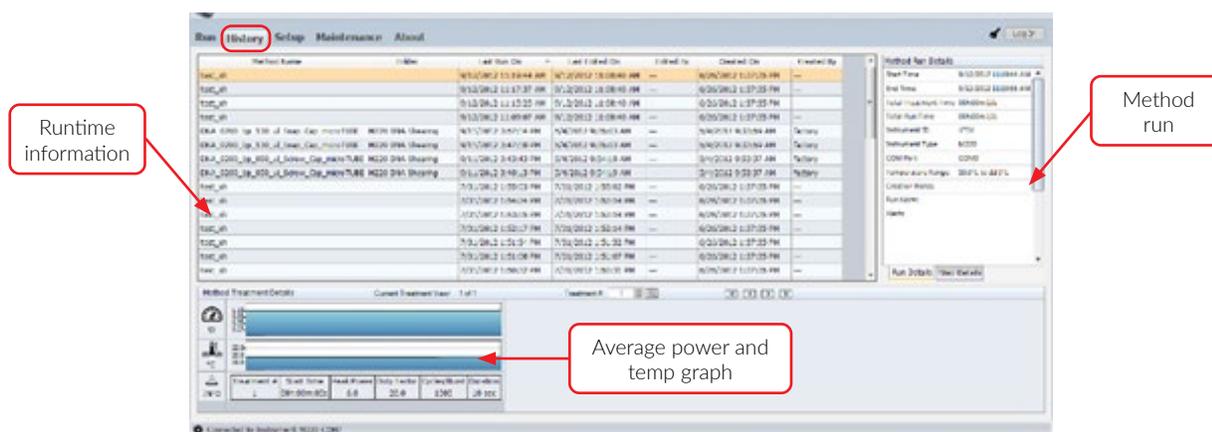

Figure 6.2 Example of History Tab

CAUTION: The history list can become long and slow the system. By default, log files older than 120 days are automatically deleted. (See **Section 6.3.8** for details).

6.3 Setup Screen

The Setup tab (Figure 5.3) allows an operator to:

- Configure the communication port used to control the instrument
- Enable/disable user authentication to configure user log in accounts
- Specify folders used to save methods, history files, and log files

6.3.1 Communication

By selecting the Communication tab or category, user can select "COM Port" or "USB Port" to communicate with the instrument. By clicking on the connect/disconnect button, user can manually connect or disconnect from the instrument (See **Figure 6.3**).
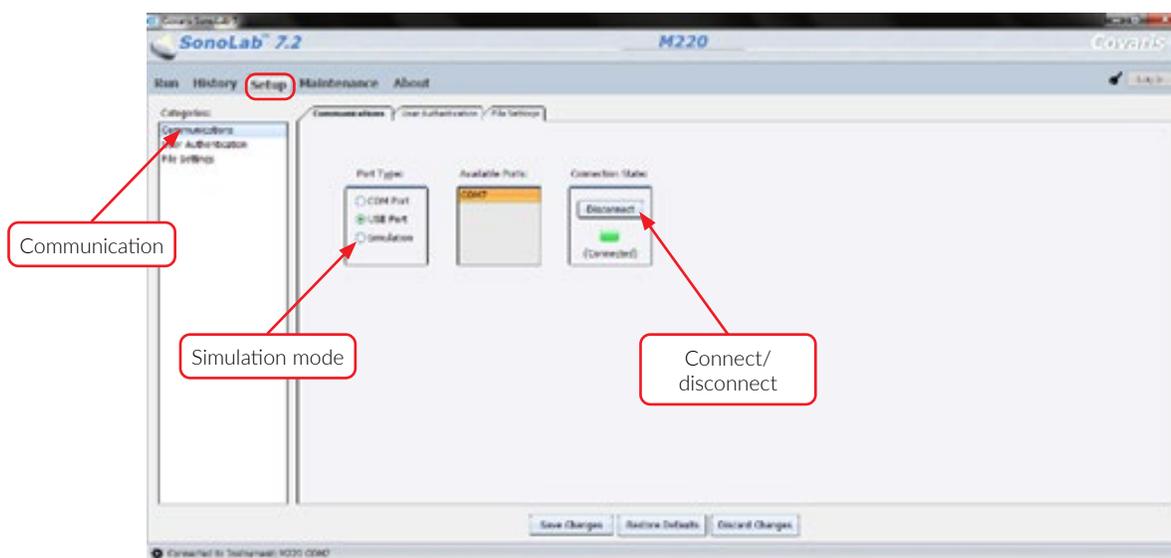
Figure 6.3 The setup tab

A user can select "Simulation" mode (See **Figure 6.3**) to run SonoLab 7 without connecting to an instrument. In the Run tab, user can create and edit methods. Click on the "Simulate" button to run a simulation of the method.
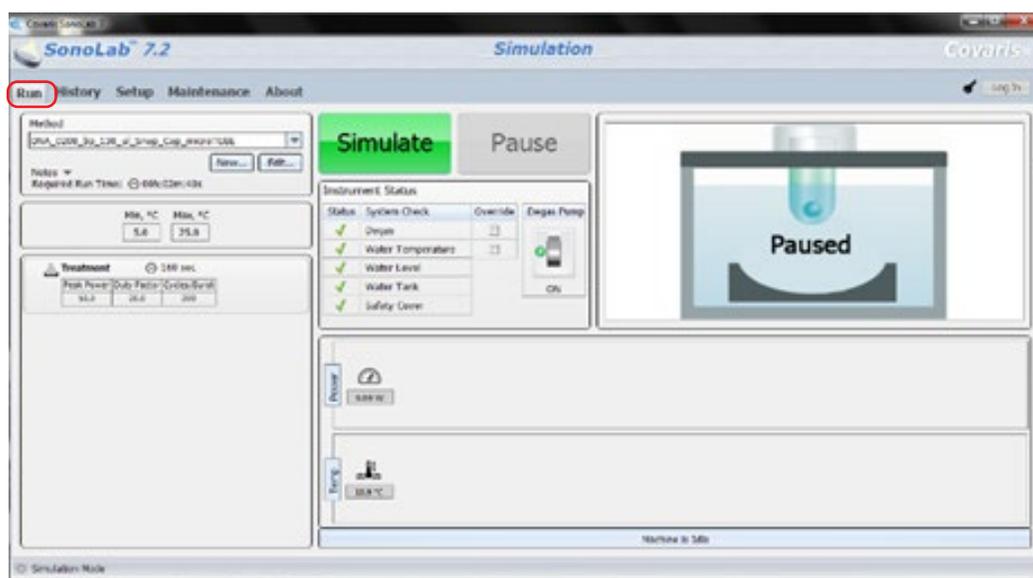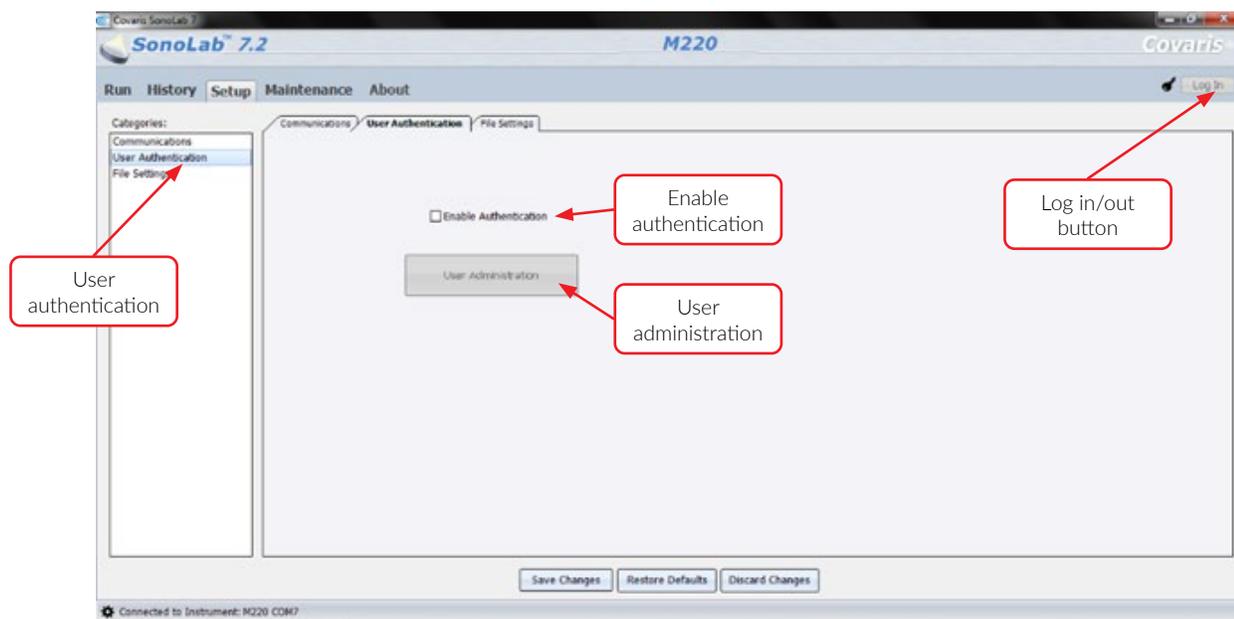

Figure 6.4 Simulation mode

6.3.2 User Authentication

By selecting the User Authentication tab or category (See **Figure 6.5**), user can establish 3 levels of users and identify the user by means of a log in/out format.

Figure 6.5 The User Authentication Tab

By default, authentication is disabled. In order to enable user authentication, a log in ID and password is required. Please contact Covaris Customer Service to obtain Administrator user name and password.

The SonoLab authentication model supports 3 types of users:
- Operator
- Specialist
- Administrator

The Operator is allowed to run a method from existing methods. Operator can review the history screens and system configuration information. Operator cannot edit an existing method or modify the systems operating mode.

A Specialist performs all of the duties of an operator. In addition, a Specialist is allowed to edit existing methods, unless methods have been locked by their creator.

The Administrator performs all operations of a Specialist. In addition has the responsibility of being able to configure the system's operating mode.

An Administrator can:
- Create and Remove User accounts.
- Secure methods.
- Set up File Settings and automate the deletion of old log and history files.
- Update Firmware.

6.3.3 Log In and Out of SonoLab

To log in as Administrator:

- Click on the Enable Authentication (See **Figure 6.5**) check box. Enter user name admin and password SonoLab. Click OK to log in. Once logged in, an Administrator may change this password or create an alternate administrator-level user.

To log in as Operator/Specialist:

- Click the Log In button (See **Figure 6.5**). Enter the username and password provided by Administrator.

To log out User:

- Click the Log Out Button. User will be logged out.

This is especially important for users who logged in as Administrator or Specialist. Otherwise, anyone who walks up to the system will be able to operate the system with elevated privileges. To disable authentication: only the Administrator can disable authentication. Un-check the Enable Authentication tic and log out.

6.3.4 Add a New User

To add a new user to SonoLab 7, you must first Log In as an administrator.

- Click the "User Administration" button (See **Figure 6.5**)

The User Administration window will appear. (See **Figure 6.6**)

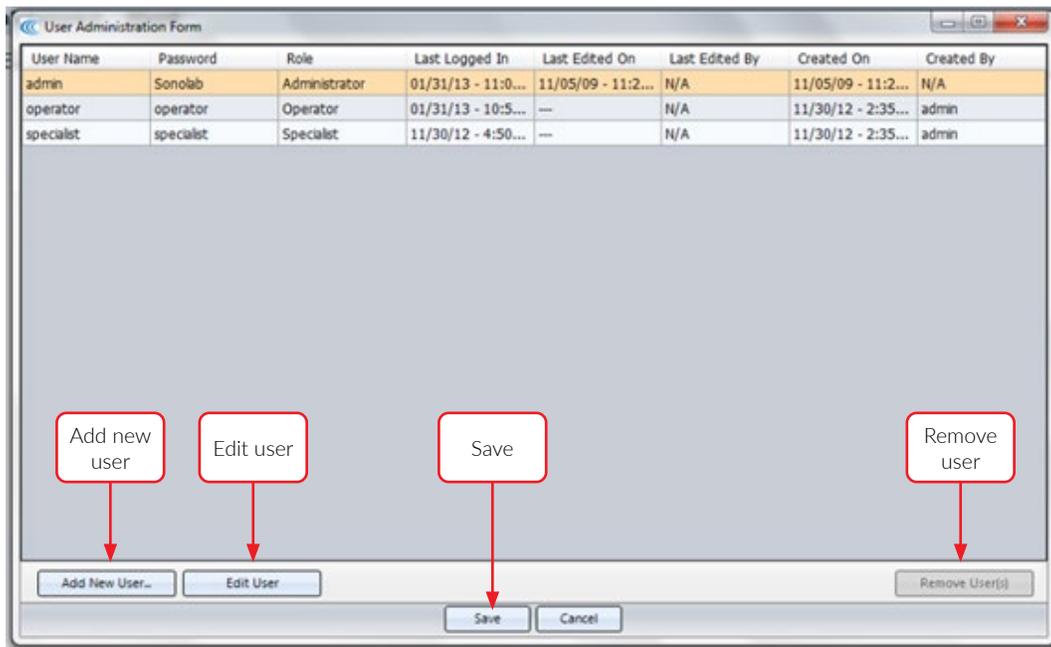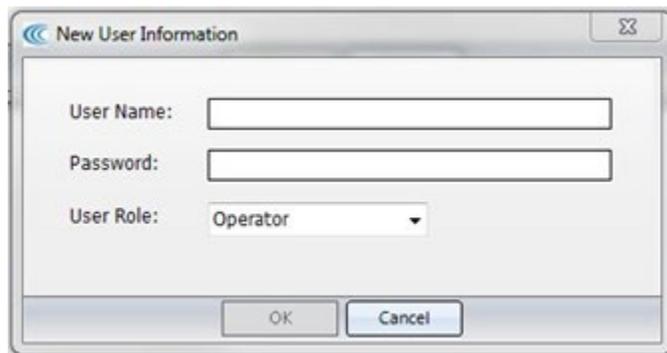- Click the "Add New User..." button.

Figure 6.6 User Administration Screen

The New User Information window will appear. (See **Figure 6.7**)

- Enter a User Name, Password, and User Role type. Click Ok.
- Click Save in the User Administration dialog.

Figure 6.7 New User Dialog

6.3.5 Remove a User

- Select the user that needs to be removed.
- Click "Remove User(s)" button from the User Administration Form. (See **Figure 6.6**)
- Click Save in the User Administration dialog**.**

6.3.6 Edit a User

- Select the user that needs to be edited.
- Click "Edit User(s)" button.
- Administrator can edit user password and role.
- Click OK.
- Click Save in the User Administration dialog.
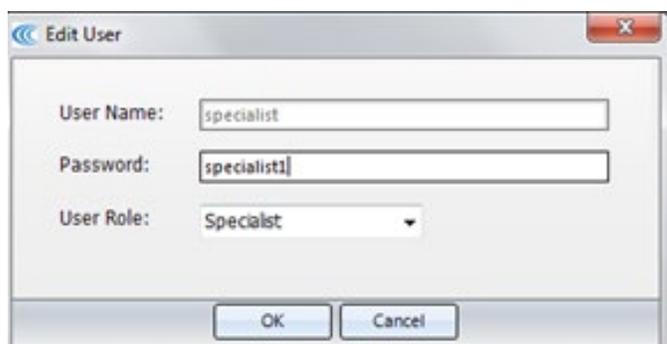
Figure 6.8 Edit User Dialog

6.3.7 Secure Method

Administrator user can create methods and lock these methods. Subordinate users will not have the ability to modify method.

- Create or edit a method.
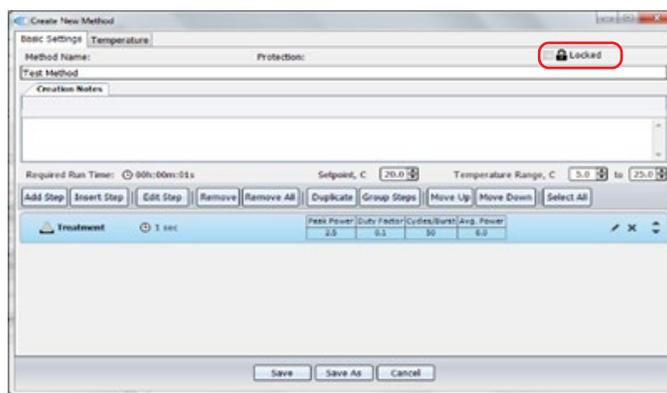- Select the Locked check box. (See **Figure 6.8**)
- Click Save.

Figure 6.9 Locked method

6.3.8 File Settings

By selecting the File Settings tab or category (See **Figure 6.9**), user can change file locations and set up a scheduled task to automatically delete the old log files. By default, log files older than 120 days are automatically deleted. For change to take effect user must close out of SonoLab and reopen.

To change File Setting:
- Click the "Browse…" button.
- Select or create a new folder for new location and click OK.
- Click Save Changes.

To change Auto Deletion of Files:
- Click on "Automatically delete…"check box to turn on auto delete.
- Enter or move the up/down arrow to specify how old the log files must be to be deleted.
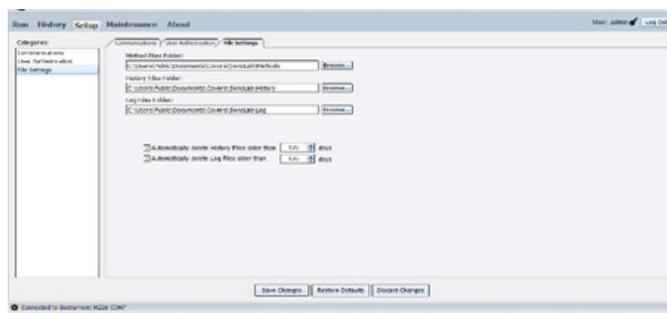- Click Save Changes.

Figure 6.10 File settings

6.3.9 Creating Folders

User can create folders for their methods within SonoLab 7 for a better organization of files. Methods can be saved as new or existing folders.
- Create or edit a method. See **Section 5.0**.
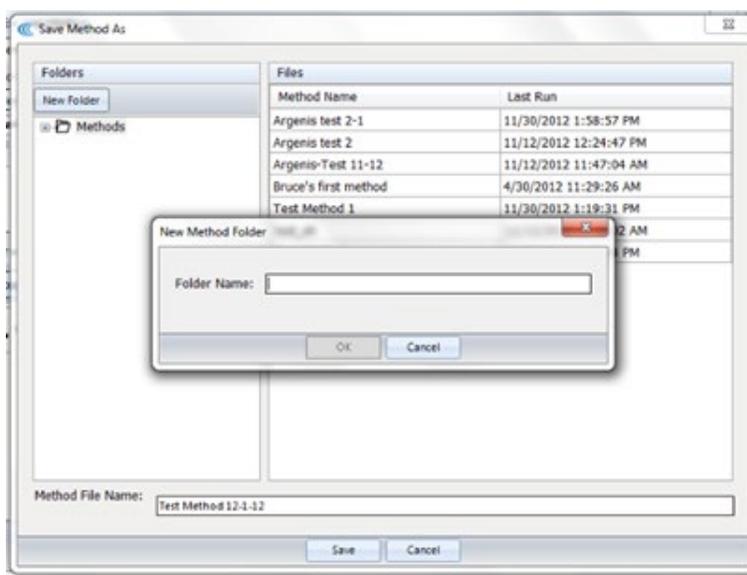- Click Save As.
- Click New Folder and enter Folder Name.

Figure 6.11 Creating folders

- Click on newly created folder or an existing folder to save method.
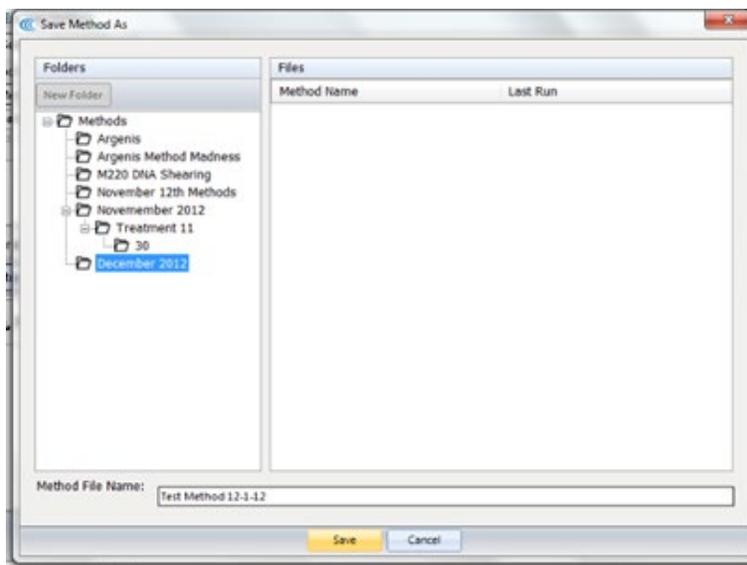- Click Save.

Figure 6.12 Save method

6.4 Maintenance Screen

Selecting the Maintenance tab or category (See **Figure 6.13**) allows an operator to view:

- Instrument Information
- RF Power Board Calibration
- Frequency Sweeping Parameters
- Transducer Parameters
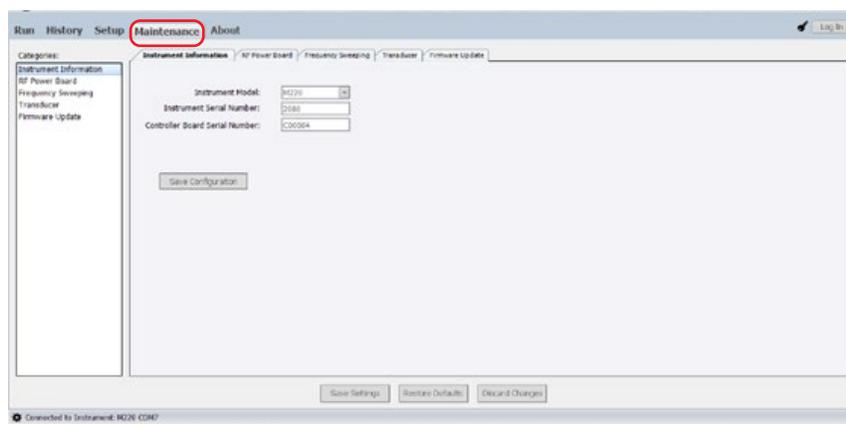- Update instrument firmware

Figure 6.13 Maintenance method

Only service or factory personnel are able to modify the system configuration. An administrator is allowed to perform a Firmware Update, but must log in to do that (See **Section 6.3.2**)

6.4.1 Firmware Updates

Covaris Instruments contain computer controllers which are responsible for operating the instrument and communicating with SonoLab. On occasion, it is necessary for Covaris to make changes to the firmware that operates the instrument. When SonoLab connects to an instrument, it checks the version of firmware that is running on that instrument. If the instrument's firmware is out of date, SonoLab will alert the operator and suggest that a firmware update should be performed. (See Appendix C Update Sonolab Software)

Figure 6.14 Firmware out of date alert
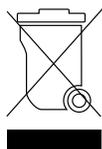
6.5 About Tab

The About Tab provides user basic information about the instrument such as serial number, software version, board serial numbers etc. See **Figure 6.15**.

Figure 6.15 About tab

7. System Specifications

Treatment System	Bench-top; high intensity acoustic transducer, temperature monitoring and controlling device, water bath with sample holder and safety enclosure
Treatment Power	75 Watts Peak Incident Power; 20 Watts Average Incident Power
Dimensions	12" W x 17" D x 10" H (30 cm x 43 cm x 25 cm)
Weight	Approximately 22 lbs. (10 Kg) (without computer)
Power Requirements	100 to 240; VAC 500 VA, 50 to 60 Hz
Ambient Temperature Range	19 °C to 25 °C (66 °F to 77 °F)
Ambient Humidity Range	30 to 70%
Regulatory Labeling	CE, ETL Mark (for Product Safety), WEEE
Safety	Complies with Low Voltage Directive 2006/95/EC. Certified to IEC/EN/ANSI/UL 61010-1:2004 and CAN/CSA C22.2 No. 61010-1:2004, 2nd Edition "Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use, Part 1: General Requirements"
EMC	Complies with Class A Industrial/Scientific/Medical (ISM) equipment under EN 61326-1:2005, EN 61000-3-2:2004 and EN 61000-3-3:1995 for EU EMC Directive 2004/108/EC. Also FCC Part 15 Class A radio emissions requirements for the USA and ICES-003 Class A for Industry Canada.
Water Bath	AFA-grade Water (Covaris PN 520101 or Highly Purified Water at least ASTM Type III or ISO grade 3)
Temperature; Temp. Limits	Programmable +6.0 °C to +40.0 °C; Soft limits +4.0 °C and +52.0 °C, Hard limits +2.0 °C and +42.0 °C
Computer	Notebook computer supplied by Covaris
Operating System	Microsoft Windows 7
Application Software	Covaris SonoLab 7
Data Input	Keyboard, mouse
Chiller	Solid state chiller for heating and cooling (built-in)
Power	0 to 160 Watts, 24 volts

8. Troubleshooting

System Trouble Analysis Chart		
Sympton	Possible Causes	Solution
Door status or water level status is not green.	1. Cover is not closed completely. 2. Water level is too low. 3. Tube holder is misaligned, causing low water level.	1. Re-close the front cover. 2. Fill water bath to the fill line. 3. Verify that the holder is fully seated into the acoustic housing.
Instrument unable to communicate with hardware – "Disconnected" mode	1. Cable is loose or damaged. 2. SonoLab is having difficulty identifying the instrument via USB.	1. Check the USB cable. 2. Restart the instrument and SonoLab. Go to Setup and reconnect manually.
Software Application is unresponsive	Windows resources are being employed by another application.	1. Terminate other Windows applications. 2. Reboot the computer. 3. Restart the system.
Low water level is detected when water bath is correctly filled.	Objects may be blocking the water level sensor.	Clean the water level measure channel.

9. Appendix

Appendix A: M Series Site or Transport Preparation

Placement of Equipment

The area required for the instrument (see attached drawings) is approximately 12" wide by 17" deep by 10" high (30 cm x 43 cm x 25 cm). Allow sufficient space in front of the bench to access each component of the installation. *DO NOT* cover the air intake at the front panel.

Power Requirements

Provide at least two standard outlets, one for the laptop computer, and one for the M220. The M220 draws a maximum of 500 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 M220 system water bath requires about 15 milliliters of AFA-grade Water, which should be changed daily. Water is added to the system by manually filling the bath with the water bottle supplied with the system. Covaris recommends AFA-grade Water, PN 520101. It is also possible to use highly purified water (Highly Purified Water at least ASTM Type III or ISO grade 3).

Moving or Packing the Instrument for Transport

When moving the instrument within a laboratory, or between nearby laboratories, please employ the following guidelines:

- Turn the instrument off. Disconnect line cords and USB cable.
- Remove the laptop from the top of the instrument (it is held in place by Velcro strips)
- Remove the sample holder, and lift and remove the safety cover.
- Remove remaining water from the acoustic assembly
- Lift the unit by its base-plate (not by the acoustic assembly). Hand carry or 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 our Customer Support Department (customerservice@covaris.com) for guidance and assistance.

Appendix B: Updating SonoLab Software

The latest version of SonoLab can be found in the resource section of Covaris website.

Un-Install Existing SonoLab

1. Turn off M220 series device and close SonoLab software application.

2. Navigate to the Control Panel>Programs>Uninstall a program.

3. Select the program named SonoLab and click uninstall.

4. "Are you sure you want to uninstall SonoLab?" Click Yes.

5. The desktop shortcut titled "SonoLab v7" will remove itself.

Install updated SonoLab Application

1. Download the latest SonoLab version and save it on your desktop.

2. Open the SonoLab 7.x.zip file.

3. Right click on the setup.exe application. Run as administrator.

4. You must Agree to the Program License Agreement, click next to put SonoLab 7.x in C:\Program Files, and then click Next to begin the installation.

5. Click Yes to enable the installer to install SonoLab 7.x if Windows User Access Controls have not been disabled.

6. Turn on the instrument and plug the USB cable into a USB port on the computer.

7. Navigate to C:\Program Files\Covaris\SonoLab on the computer.

8. Right Click on Sonolab.exe and select "Run As Administrator". SonoLab will open its' splash screen.

Depending on your previous SonoLab version, you may have to update your instrument Firmware

1. A dialog box will pop up to alert you that the firmware of the instrument is out of date. Click OK.

2. Click on the "Setup" tab and select the "User Authentication" sub tab.

3. Check the check box labeled "Enable Authentication".

4. Click on the login window.

5. Use the username admin and the password Sonolab to log in.

6. Click on Maintenance Tab and click on the Firmware Update Tab.

7. Click on the Start Updating Firmware button.

8. When the firmware update is completed, go back to the "Setup" tab and choose the "User Authentication" subtab.

9. Uncheck the "Enable Authentication" check box.

10. SonoLab 7.x and the instrument are now ready to use.

Depending of your previous SonoLab version, you may have to update your instrument Firmware. Contact Covaris Technical Service (techsupport@covaris.com) for additional information.

Appendix C: Installing SonoLab on a New Computer and Installing Windows Instrument Drivers

The latest version of SonoLab can be found in the resource section of Covaris website.

Install SonoLab Application

1. Download the latest SonoLab version and save it on your desktop.

2. Open the SonoLab 7.x.zip file.

3. Right click on the setup.exe application. Run as administrator.

4. You must Agree to the Program License Agreement, click next to put SonoLab 7.x in C:\Program Files, and then click Next to begin the installation.

5. Click Yes to enable the installer to install SonoLab 7.x if Windows User Access Controls have not been disabled.

6. Turn on the instrument and plug the USB cable into a USB port on the computer.

7. Navigate to C:\Program Files\Covaris\SonoLab on the computer.

8. Right Click on Sonolab.exe and select "Run As Administrator". SonoLab will open its' splash screen.

Depending of your previous SonoLab version, you may have to update your instrument Firmware. Contact Covaris Technical Service (techsupport@covaris.com) for additional information.

1. A dialog box will pop up to alert you that the firmware of the instrument is out of date. Click OK.
2. Click on the "Setup" tab and select the "User Authentication" sub tab.
3. Check the check box labeled "Enable Authentication".
4. Click on the login window.
5. Use the username admin and the password Sonolab to log in.
6. Click on Maintenance Tab and click on the Firmware Update Tab.
7. Click on the Start Updating Firmware button.
8. When the firmware update is completed, go back to the "Setup" tab and choose the "User Authentication" subtab.
9. Uncheck the "Enable Authentication" check box.
10. SonoLab 7.x and the instrument are now ready to use.

Install Windows Instrument Driver

Windows Drivers are software files required to support communications between a computer and any USB device. Specific drivers are needed to support communications with the M220.

A. If a laptop is configured for internet access (either via wireless link or Ethernet cable) and automatic driver updates, then the first time the M220 is connected to a laptop, Windows will automatically install the necessary driver and provide updates as these drivers are installed. Please note that drivers for several devices within the M220 will be installed sequentially. These include a Generic USB Hub, Covaris RF Controller Board, Covaris RS-485 Port, Covaris Serial Port 2 and Covaris Serial Port 3. Please allow all of these drivers to install and for Windows to confirm successful installation of all drivers before starting SonoLab 7.

B. If the laptop has internet access, but is not configured for automatic updates, then either change this setting to automatic, or instruct Windows to search for each driver automatically as this query appears.

C. If the laptop does not have internet access, please follow these steps:

1. Connect a 220 Series instrument to the instrument control computer using a USB Cable.

2. Plug the instrument in and power it up.

3. Click on the Start menu\ Control Panel\Hardware and Sound.

4. Under Devices and Printer, click on Device Manager. The Device manager window will appear.
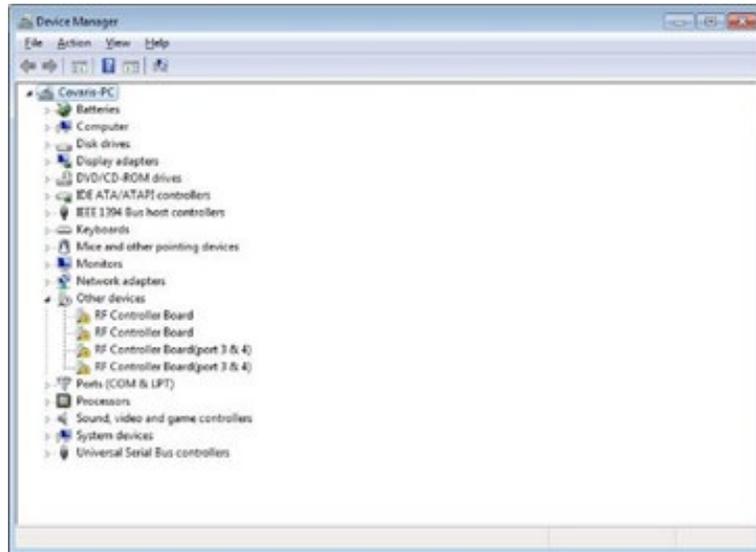
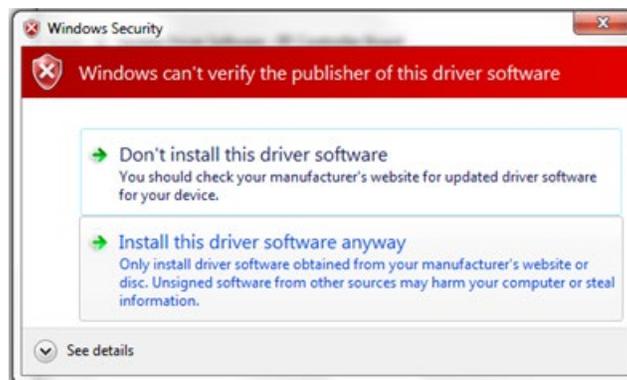5. Under Other devices, right click first device RF Controller Board and select Update Driver Software:
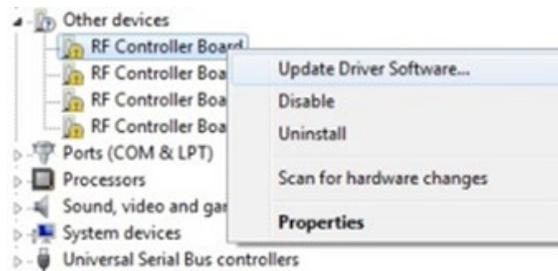
6. When the driver software update dialog opens, select the option to Browse my computer for driver software:
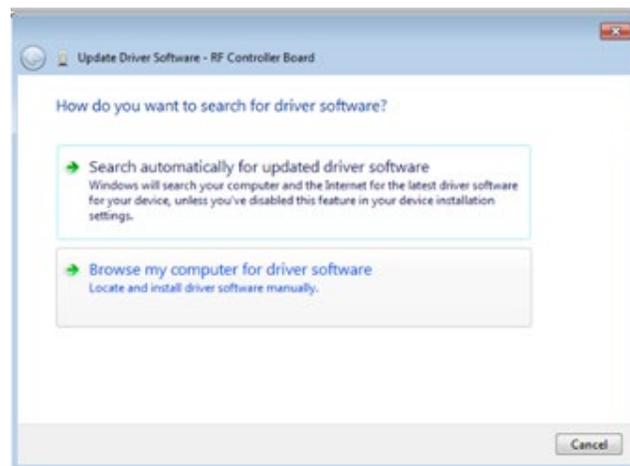
7. Point the file open dialog to "c:\Program Files\Covaris\Driver" to find the necessary instrument drivers.
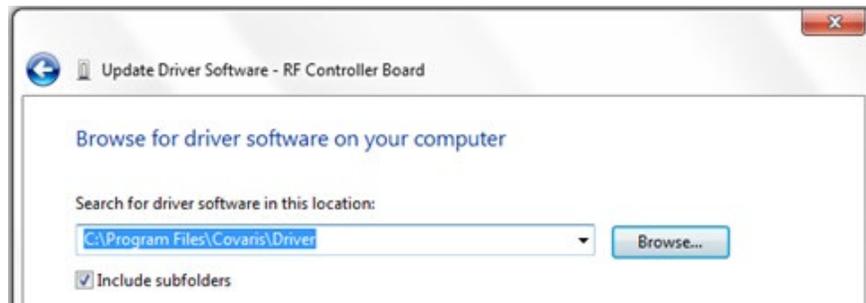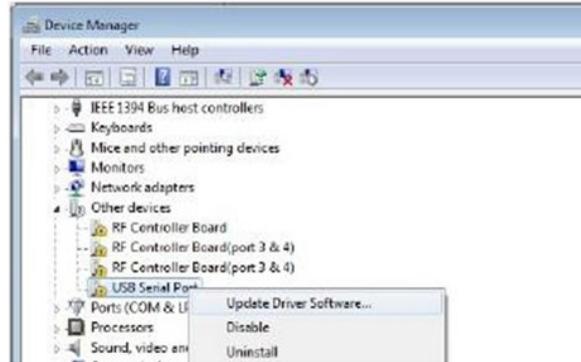

8. Click next. You will be notified that Windows can't verify the publisher of this driver software. Click on "Install the driver software anyway".

9. Windows will install the driver and post the following dialog box.
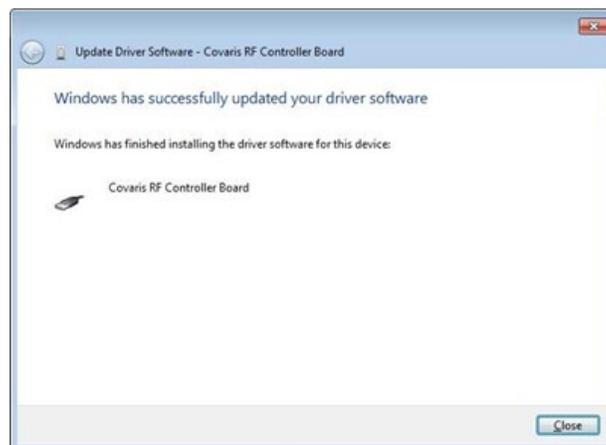
10. Under Other devices, right click device USB Serial Port and select Update Driver Software.

11. Repeat steps C - 5 to 9 (three more times for all devices under Other devices until they are all gone. (A total of 5 times).

NOTE: When you click on Browse My Computer from the Update Driver Software window, the path for the FTDI drivers will remain. No need to re-enter.

---

11. Go to C:\Program Files\Covaris\Sonolab

12. Right Click the Sonolab application.

13. Click on Run as Administrator.

14. Verify connection Status is green and connected.

15. Verify instrument information on the about SonoLab tab.

16. Close out of SonoLab 7.

17. Double click on the SonoLab Series vX.XX on the desktop to verify application works. Close out.

This completes the device driver installation. At the end of the installation, the following devices should be added to Device Manager under Ports (COM & LPT):

- Covaris RF Controller(COM3)
- Covaris RF Controller(COM4)
- Covaris RF Controller(Port 3&4)(COM5)
- Covaris RF Controller(Port 3&4)(COM6)

In addition, 4 devices should be added to Device Manager under Universal Serial Bus Controllers:

- Covaris RF Controller Board
- Covaris RS-485 Port
- Covaris Serial Port 2
- Covaris Serial Port 3
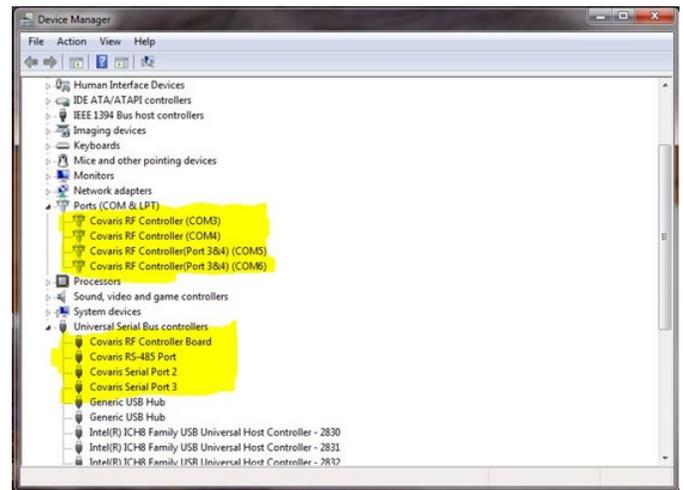
Appendix D: Running the SonoLab Protocol Updater

The SonoLab Protocol Updater is used to update the M220 DNA Shearing Protocols preinstalled on the computer running SonoLab 7. Latest version of the SonoLab Protocol Updater can be found in the resource section of Covaris website.

NOTE: The Updater may overwrite existing protocols. Please examine Release Notes prior to installation to verify what additions and changes will be made.
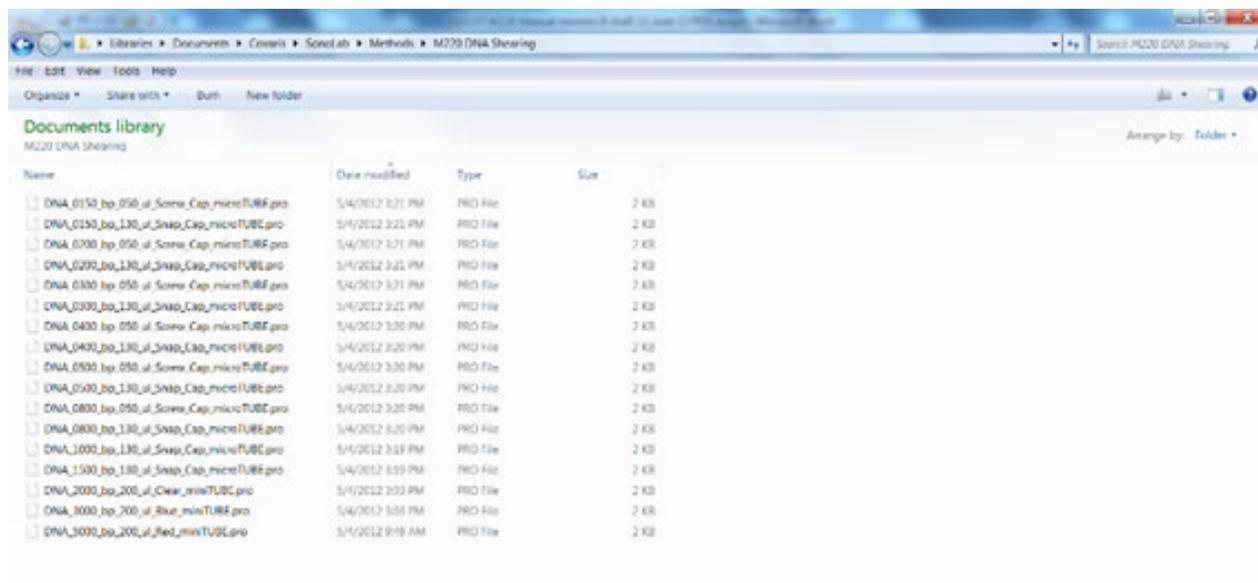
---

1. Close SonoLab before installing the Updater.

2. Download the latest version of the SonoLab Protocol Updater on Covaris website.

3. Open the M220 DNA Shearing Protocol Installer (zip) file.

4. Double click on the Setup application menu, to remove the filter cap.
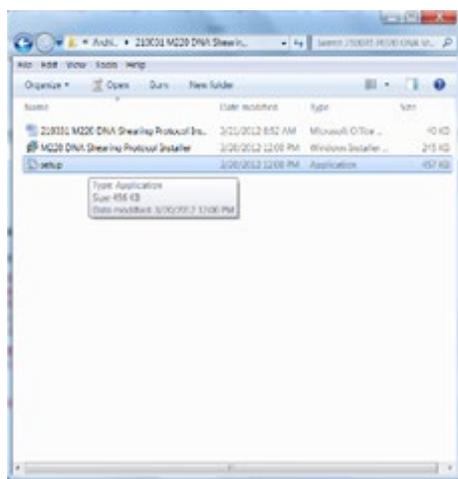
5. The Setup Wizard will start. Follow the installation wizard step by step until the installation is finished.

The installer places the protocols in the directory C:\Users\Public\Public Documents\Covaris\SonoLab\Methods\.

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