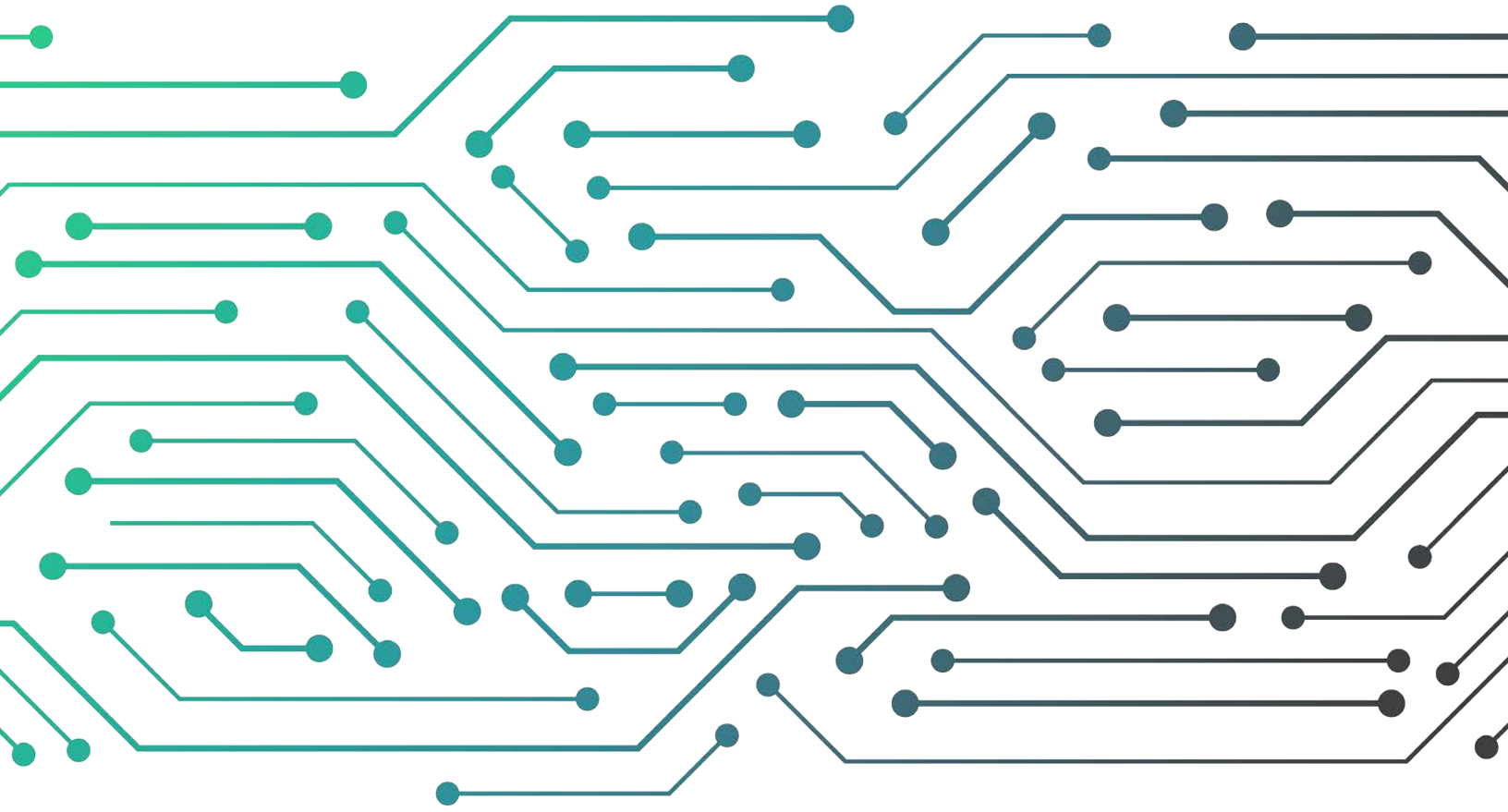
Nabsys

OhmX™ Analyzer Service Guide



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Chapter 1: Safety

The OhmX Analyzer is a comprehensive genomics platform that provides fully integrated instrumentation, consumables, protocols, reagents, and analytical software. This chapter provides important safety information for the system with compliance and regulatory statements. Read this chapter before operating the OhmX Analyzer.

1.1 Safety Alerts

This guide includes three safety words: **IMPORTANT**, **WARNING**, and **DANGER**. The words imply different levels of observation or indicate the actions for safe analyzer operation.

IMPORTANT!	Indicates information necessary for proper system operation, accurate chemistry kit use, or safe use of a chemical.
WARNING!	Indicates a potentially hazardous event that, if not avoided, could lead to minor or moderate injury. It could also be used to alert against unsafe practices.
DANGER!	Indicates an imminently hazardous event that, if not avoided, will lead to death or serious injury. This alert word is limited to the most extreme situations.

1.2 Analyzer Markings

The OhmX Analyzer is labeled with the following compliance and regulatory markings:

UL 61010-1, Electrical equipment for measurement, control, and laboratory use.

UL 61010-2-081, Requirements for automatic and semi-automatic laboratory equipment for analysis and other purposes.

The following safety symbols or labels might appear on the analyzer. Each symbol appears alone or with text explaining the hazard.

Consult the guide for further information and proceed with caution.

The following environmental symbol or label might appear on the analyzer:

Do not dispose of the product as unsorted municipal waste. Follow the local municipal waste ordinances and regulations for proper disposal to reduce the environmental impact of waste electrical and electronic equipment (WEEE).

1.3 Analyzer Safety

General Analyzer Safety

WARNING! PHYSICAL INJURY HAZARD
Use the product only as specified in this document. Using the OhmX Analyzer in a manner not specified by Nabsys can result in personal injury or damage to the analyzer.

WARNING! PHYSICAL INJURY HAZARD
Do not attempt to lift or move the analyzer without assistance, appropriate moving equipment, and proper lifting techniques. Improper lifting can cause painful and permanent back injury. Moving or lifting the analyzer might require two people.

Consider the following safety protocols before lifting the analyzer:

- Make sure you have a secure, comfortable grip on the analyzer.
- Make sure the path from where the analyzer is to where it is being moved is clear of obstructions.
- Do not lift the analyzer and twist your torso simultaneously.
- Keep your spine in a neutral position and lift with your legs.
- Coordinate lifting and moving intentions with other participants.

IMPORTANT!
Anyone who operates the analyzer must meet the following qualifications:

- Received instructions in both general safety practices for laboratories and specific safety practices for the analyzer and chemistry.
- Read and understand all applicable safety data sheets (SDSs).

Chemical Safety

WARNING! CHEMICAL HAZARD
Before handling chemicals, reference the manufacturer-supplied SDSs and observe all relevant precautions.

WARNING! CHEMICAL HAZARD
Chemicals in the analyzer, including waste tubes, are potentially hazardous. Always determine what chemicals have been used in the analyzer before changing reagents or analyzer components. Wear appropriate eyewear, protective clothing, and gloves when working on the analyzer.

Safety Data Sheets

Chemical manufacturers supply current SDSs with shipments of hazardous chemicals to new customers. They also provide SDSs with the first shipment of a hazardous chemical to a customer after an SDS has been updated. SDSs provide the safety information you need to safely store, handle, transport, and dispose of the chemicals. Each time you receive a new SDS packaged with a hazardous chemical, make sure to replace the appropriate SDS in your files.

Chemical Safety Guidelines

To minimize the hazards of chemicals:

- Read and understand the SDSs provided by the chemical manufacturer before storing, handling, or working with any chemicals or hazardous materials.
- Minimize contact with chemicals. Wear appropriate personal protective equipment (PPE) when handling chemicals (e.g. safety glasses, gloves, or protective clothing). For additional safety guidelines, consult the SDSs.
- Minimize the inhalation of chemicals. Do not leave chemical containers open. Use only with adequate ventilation. For additional safety guidelines, consult the SDSs.
- Check regularly for chemical leaks or spills. If a leak or spill occurs, follow the manufacturer's cleanup procedures as recommended in the SDSs.
- Comply with all local, state, provincial, and national laws and regulations related to chemical storage, handling, and disposal.

Chemical Waste Safety

IMPORTANT! HAZARDOUS WASTE
Reference the SDSs and local regulations for waste handling and disposal.

DANGER: CORROSIVE REAGENTS
The analyzer produces waste that is corrosive, potentially hazardous, and able to cause injury, illness, or death.

WARNING! CHEMICAL WASTE STORAGE HAZARD
Never collect or store waste in a glass container due to the risk of breaking or shattering. Reagent and waste bottles can crack and leak. Secure each waste bottle in a low-density polyethylene safety container with the cover fastened. Wear appropriate eyewear, clothing, and gloves when handling reagent and waste bottles.

Chemical Waste Safety Guidelines

To minimize the hazards of chemical waste:

- Read and understand the SDSs provided by the manufacturer of the chemicals before you store, handle, or dispose of any chemical waste.
- Provide primary and secondary waste containers. A primary waste container holds the immediate waste. A secondary container contains spills or leaks from the primary container. Both containers must be compatible with the waste material and meet federal, state, provincial, and local requirements for container storage.
- Minimize contact with chemicals. Wear appropriate PPE when handling chemicals (e.g., safety glasses, gloves, and protective clothing). For additional safety guidelines, consult the SDSs.
- Minimize the inhalation of chemicals. Do not leave chemical containers open. Use only with adequate ventilation. For additional safety guidelines, consult the SDSs.
- Dispose of the waste tube contents and OhmX Reagent Cartridges in accordance with good laboratory practices and state, provincial, and national environmental and health regulations.

IMPORTANT!
Biohazardous materials can require special handling and disposal limitations might apply.

Electrical Safety

DANGER! ELECTRICAL HAZARD
Grounding circuit continuity is vital for the safer operation of the analyzer. Never operate the analyzer with the grounding conductor disconnected.

DANGER! ELECTRICAL HAZARD
Use properly configured and approved line cords for the voltage supply in your facility.

DANGER! ELECTRICAL HAZARD
Plug the analyzer into a properly grounded receptacle with adequate current capacity.

Biological Hazard Safety

WARNING! BIOHAZARD
Biological samples such as tissues, body fluids, infectious agents, and the blood of humans and animals, have the potential to transmit infectious diseases. Follow all applicable local, state, provincial, and national regulations. Wear appropriate PPE, which includes but is not limited to protective eyewear, face shield, lab coat, and gloves. Conduct all work in properly equipped facilities using the appropriate safety equipment (for example, physical containment devices). Train individuals according to applicable regulatory, company, and institution requirements before working with potentially infectious materials.

Read and follow the applicable guidelines and regulatory requirements in the following publications:

- U.S. Department of Health and Human Services guidelines published in *Biosafety in Microbiological and Biomedical Laboratories* (stock no. 017-040-00547-4; bmbl.od.nih.gov).
- Occupational Safety and Health Standards, Bloodborne Pathogens (29 CFR §1910.1030; www.access.gpo.gov/nara/cfr/waisidx_01/29cfr1910a_01.html).
- Your company or institution's biosafety program protocols for working with and handling potentially infectious materials.
- Additional information about biohazard guidelines is available at www.cdc.gov.

Physical Hazard Safety

WARNING! PHYSICAL INJURY HAZARD

- Moving parts can crush and cut.
- Keep hands clear of moving parts while operating the analyzer. Disconnect the power before servicing the analyzer.
- Configure your workstation to promote neutral or relaxed working positions. Correct ergonomic configuration can reduce or prevent effects such as fatigue, pain, and strain.

WARNING! MUSCULOSKELETAL AND REPETITIVE MOTION HAZARD
Musculoskeletal and repetitive motion hazards are caused by potential risk factors that include but are not limited to repetitive motion, awkward posture, forceful exertion, holding static unhealthy positions, contact pressure, and other workstation environmental factors.

To minimize musculoskeletal and repetitive motion risks:

- Use equipment that comfortably supports you in neutral working positions and allows adequate accessibility to the keyboard, monitor, and trackpad.
- Position the keyboard and monitor to promote relaxed body and head postures.

Detector-Specific Safety and Disposal

Electrostatic Discharge (ESD) Precautions

1. Nabsys detectors are silicon-based devices attached to conventional printed circuit boards (PCBs). A silicon device contains 256 individual detectors, each of which contains a pair of nano-electrodes. Each electrode is individually wired (wire-bonded) to the PCB. A cover protects the detector and wire bonds and provides an integrated fluidic gasket.
2. Each PCB-mounted detector is packaged in a static shielding bag compatible with Restriction of Hazardous Substances in Electrical and Electronic Equipment (RoHS) EU Directive 2015/863 or later and protects the device under normal handling conditions.
3. When removing the detector from the ESD shielding bag, only grip the attached tab. When handling the detector, only touch the PCB edges. Do not touch the front surface of the PCB or the bare gold contacts on the back side of the PCB.

This symbol confirms that this product is lead-free.

This symbol indicates that the product cannot be disposed of with household waste. Disposing of waste equipment separately from the municipal waste stream is your responsibility. The correct disposal of end-of-life equipment will help prevent potential negative consequences for the environment and human health.

Chapter 2: OhmX Platform Overview

The OhmX Analyzer utilizes state of the art electronic nanodetectors to detect nicked, labeled, and tagged high molecular weight (HMW) DNA molecules with unprecedented precision and speed offering a superior and reliable tool for structural variant analysis. The purpose of the OhmX Analyzer Service Guide is to provide guidance for Nabsys Certified Field Service Engineers to undertake specific troubleshooting and perform repair procedures that can be accomplished remotely or at the customer site. This manual does not cover all service procedures that are performed at a Nabsys authorized service depot.

2.1. OhmX Detector

The OhmX Detector consists of a high-performance silicon chip mounted onto a printed circuit board (PCB), designed for seamless integration with the OhmX Analyzer. The OhmX Detector features an array of 256 sensing nanochannels for high-sensitivity electronic detection of nicked, labeled, tagged, and coated HMW DNA molecules. The detector is paired with a black gasket that 1) forms a fluidic seal between the chip and the fluidic manifold nosepiece on the OhmX Analyzer and 2) covers and protects the sensitive wire bond connections between the chip and the PCB.

2.2. OhmX Controller

The OhmX Controller consists of a computer, monitor, keyboard, and mouse. The controller should be set up as described below:

A. Facility network Ethernet connected to the primary controller Ethernet port.

B. Analyzer connected to the secondary Ethernet port.

C. Monitor power cord connected to an AC power outlet.

D. HDMI port on the monitor connected to the HDMI port on the controller.

E. USB port on the monitor connected to a USB port on the controller.

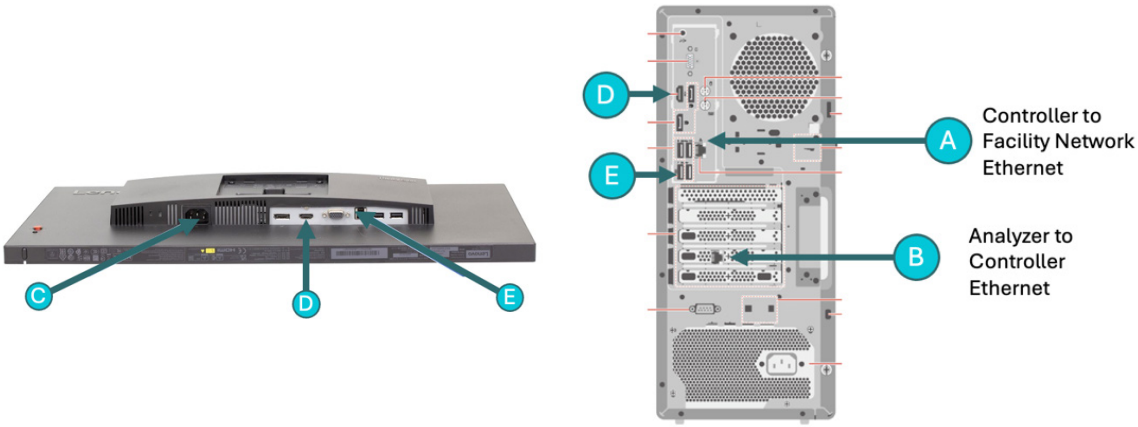

Figure 1. OhmX Controller connections. Connections for the monitor (left) and computer (right) are shown.

2.3. Electronics

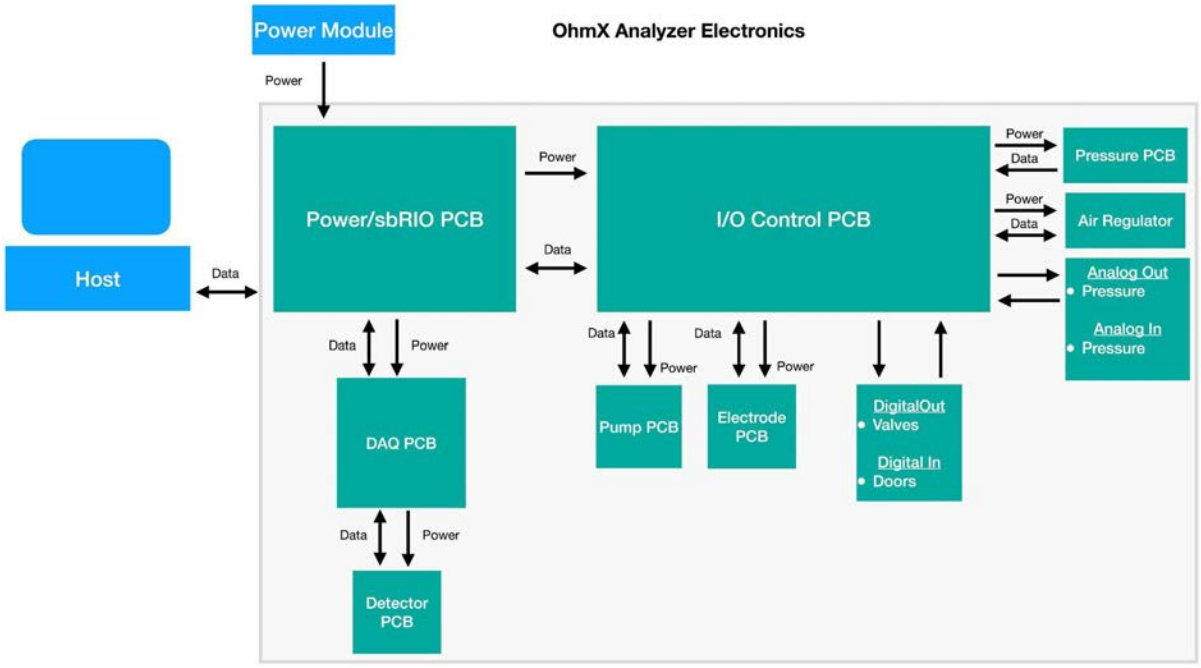

Figure 2: OhmX Analyzer Electronics Schematic. The gray shaded box represents the electronics inside the OhmX Analyzer. Blue boxes represent the components of the OhmX Controller, which includes the desktop computer, monitor, and Analyzer Power Module Assembly.

DAQ/LVDS Assembly

The Data Acquisition/Low Voltage Differential Signaling (DAQ/LVDS) Assembly holds the detector, makes the electrical connections to the 256 sensing nanochannels, and makes the fluidic connections to the detector manifold. It performs signal conditioning, preprocessing, digital conversion, and communicates with the single board Reconfigurable Input/Output (sbRIO).

I/O Control PCB

The Input/Output (I/O) Control PCB is controlled by the sbRIO. Specifically, the I/O Control PCB performs the following functions:

- Analog control for the detector drive electrodes and pressure regulator
- Signal conditioning and data conversion for the electrodes, pressure transducers, compressor readback, and regulator readback
- Digital control of the air valves for the detector carriage and the waste pressurization system

Power/sbRIO PCB

The Power/sbRIO PCB is used to condition the power coming into the system from the 24 VDC external universal power module (Analyzer Power Module Assembly). It distributes the power to the sbRIO, DAQ/LVDS Assembly, and I/O Control PCB.

Pump Control PCB

The Pump Control PCB simplifies wiring and powers the 12 solenoid pumps.

Electrode PCB

The Electrode PCB is attached to the detector manifold and makes the connections from the embedded platinum electrodes in the fluid path to the I/O Control PCB.

2.4. Fluidics and Pneumatics

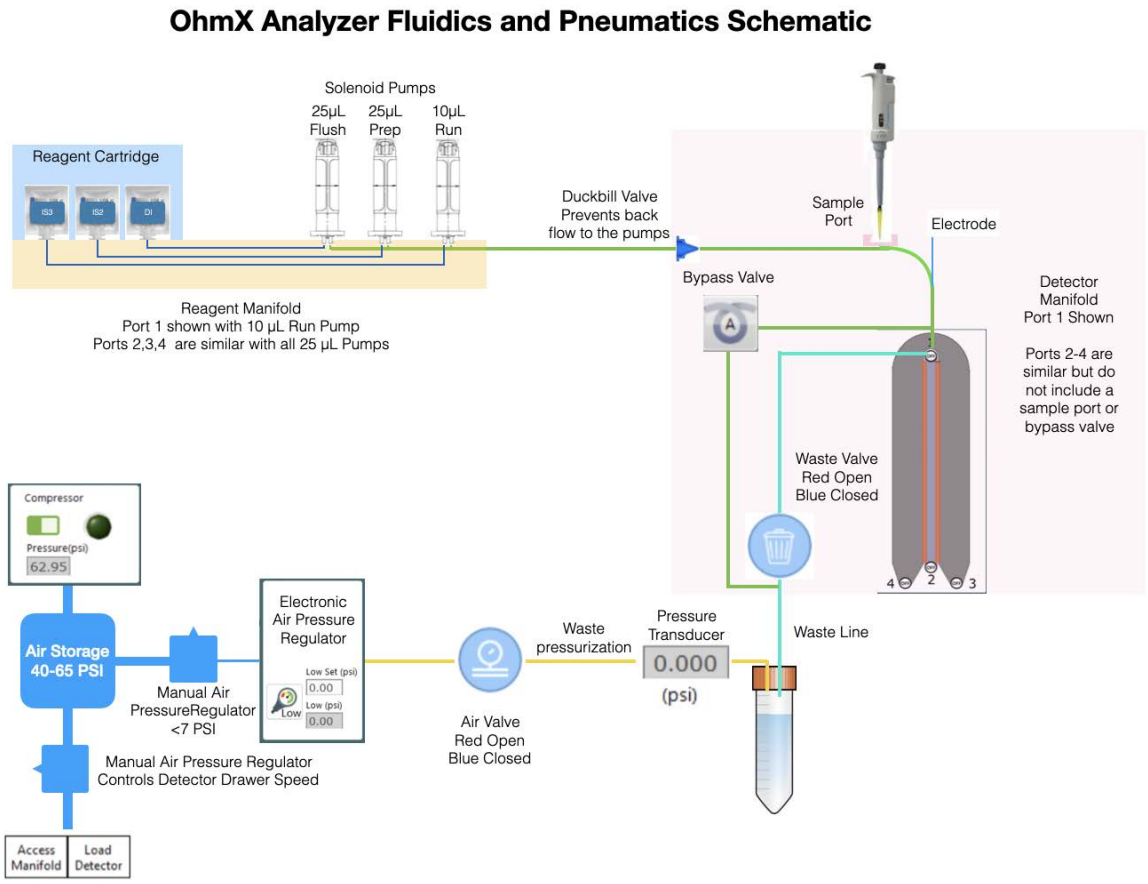

Figure 3: OhmX Analyzer Fluidics and Pneumatics Schematic. The blue, yellow, and pink boxes represent the OhmX System Reagent Cartridge, Reagent Manifold, and Detector Manifold, respectively.

Fluidics

The fluidics system is used to flow reagents and samples through the detector for data collection. There are a total of 12 solenoid pumps mounted to the reagent manifold—eleven 25 µL pumps and one 10 µL pump. For each of the four ports on the detector, there are three pumps consisting of a **Flush Pump**, **Prep Pump**, and **Run Pump**. The 10 µL pump is used for Port 1 Running Buffer to allow finer control of the sample. Each pump is rated at 24 volts direct current (VDC), but the circuitry opens the pump with a short 42 VDC pulse to reduce the chance of sticking. The duty cycle of the pumping system is 500 ms allowing for two pump cycles every second. The solenoid pumps fill when opened and dispense when closed.

Each row of pumps is connected to the detector manifold through a duckbill valve that is used to prevent backflow to the reagent manifold. The detector manifold is sealed against the detector with a molded gasket. At each detector port, there is an inlet that comes from the reagent manifold and an outlet that goes through a waste valve and into a waste tube. Reagents flow by the detector ports and are stored in the detector manifold and waste line. Air pressure in the waste tube is used to push the reagent into the detector port.

Pneumatics

The pneumatics system is used to open and close the detector carriage and provide precise pressure control to the fluidics system. A compressor and pressure controller switch are used to fill and maintain an air storage tank between 45 and 65 pounds per square inch (psi). The software monitors the duty cycle of the compressor and turns it off if there is a leak to prevent overheating.

The air storage tank feeds two manual air pressure regulators. One air pressure regulator is used to control the pressure and ultimate force used for the carriage opening mechanism through two air solenoid valves (below the air storage tank in Figure 2). The second regulator reduces the inlet pressure to the software controlled electronic 0-1 psi air pressure regulator (to the right of the air storage tank in Figure 2). The outlet of the electronic regulator goes to a four-valve air manifold that is used to selectively pressurize the waste tubes.

2.5. OhmX Software

The OhmX Platform uses two major software applications:

- OhmX Embedded Software, which runs on the sbRIO
- OhmX Controller Software, which runs on the OhmX Controller Workstation

Software Upgrade Procedure: W004_OhmX Instrument Controller Software Update

OhmX Embedded Software

Within the Analyzer is a central processing unit (CPU) with a real-time operating system. The embedded software runs on this CPU. It provides basic functionality of the system at the hardware control level. Adjacent to the CPU is a Field Programmable Gate Array (FPGA) (containing Nabsys Intellectual Property) that provides early signal processing by selecting molecules from the raw stream of data to pass to the OhmX Controller Software.

OhmX Controller Software

The OhmX Controller Software is tasked with operating the OhmX Analyzer, collecting the data produced, and providing feedback to the customer on the status of the run. System operation is controlled by protocols, which are scripts that provide the order of operations for cleaning detectors and running samples. Data collection is done to TDB (Time Domain Block) files. Each block represents one molecule. Those files are passed to a separate process (`wfmproc.exe`) to find tags and further refine molecules for future data analysis. Approximate genome coverage, channel activity (% of channels active), and molecule rate (how many molecules are being collected per second) are reported as real-time metrics. At the user level of service or above, the software also provides a few extra screens. The Detector screen provides data collected during electrode response and channel response tests. The Manual screen provides full control of all functions within the Analyzer.

User-Level Privilege Descriptions:

Role	Privileges
User	Access Home and Maintenance screens
Manager	Create new users
Administrator	• Access Settings screen • Create managers and users

For more information on the OhmX Controller Software, see **Chapter 2: OhmX Platform Overview** of the **OhmX Analyzer Guide** (Document #755-00003-001).

Manual Screen

The Manual Screen is only available using Developer, Factory or Service logins. This screen allows manual control of all analyzer functions.

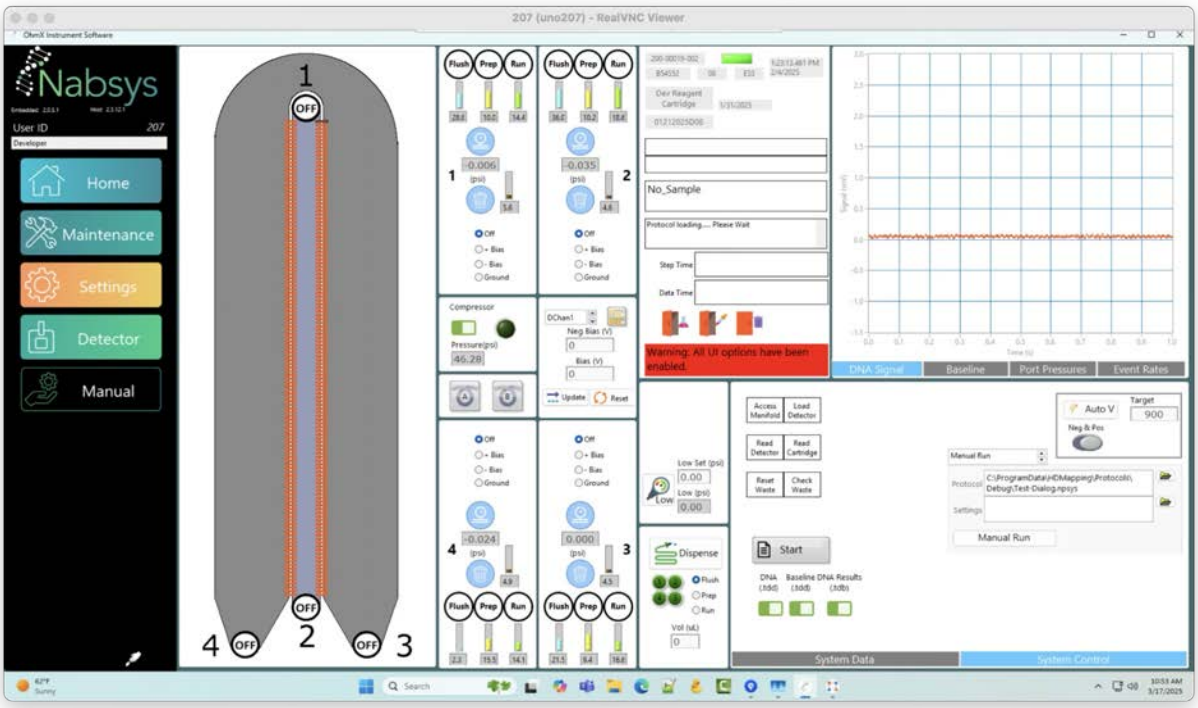

Figure 4: Manual screen of the OhmX Analyzer.

> **WARNING!**
> Personal injury and analyzer damage may occur if the Manual screen is used without proper knowledge of instrument operations.

OhmX Detector Schematic Panel

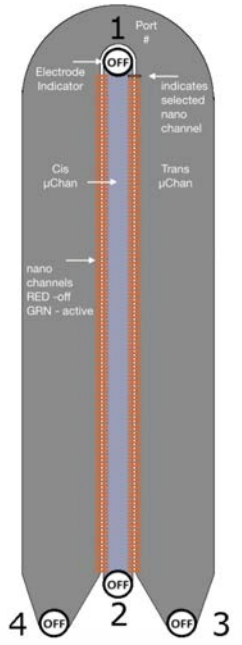

Figure 5: OhmX Detector Schematic panel on the Manual screen of the OhmX Analyzer.

Port #—The numbers **1-4** indicate the location of Ports 1-4.

Electrode Indicator—Displays the status of the electrode configuration (**Off**, **Ground**, **+ Bias**, or **- Bias**).

Cis µChan—Cis microchannel containing the sample diluted with Running Buffer.

Trans µChan—Trans microchannel containing Running Buffer.

Nanochannels—Each red or green line represents one of the 256 nanochannels. Red lines indicate inactive nanochannels while green lines indicate active nanochannels.

System Control Panel

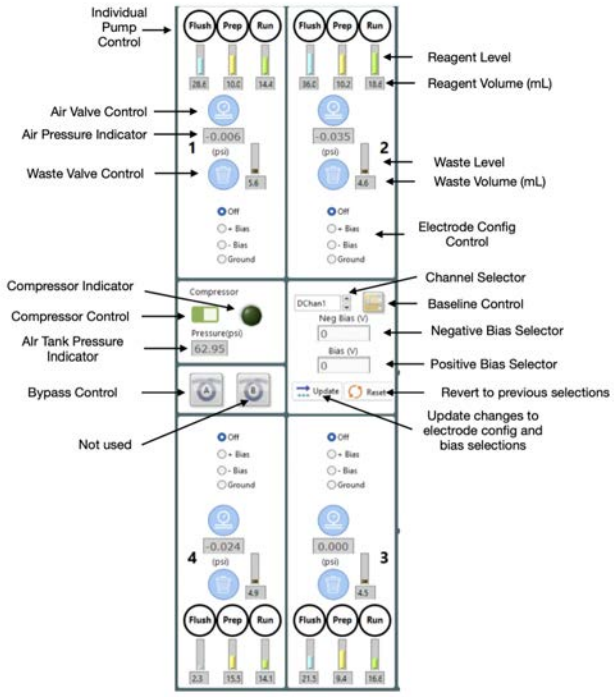

Figure 6: System Control panel on the Manual screen of the OhmX Analyzer.

Individual Pump Control—Allows opening (filling) and closing (dispensing) each pump. The indicator turns RED when the pump is open and BLUE when the pump is closed.

> **WARNING!**
> Only one pump can be actuated at a time due to the hardware design. Do not open an additional pump when another is open. If a second pump is opened when one is already open, the first pump will close but the indicator will remain RED and the second pump will open.

Air Valve Control—Allows air from the regulator to pressurize the waste tubes. The indicator turns RED when the valve is open and BLUE when the valve is closed. Any combination of valves can be open at a time.

> **WARNING!**
> If there is no detector or gasket in place, the air can push any liquid in the waste line and detector manifold out of the detector manifold, creating a hazardous risk of exposure to corrosive reagents.

Air Pressure Indicator—Displays the pressure in the waste tube and waste circuit. If the Waste Valve is closed, it displays the pressure up to the valve. If the Waste Valve is open, it displays the pressure up to the detector port.

> **IMPORTANT!**
> Currently, the pressure sensors may have a small amount of offset and gain differences. This may change in the future if calibration is added in manufacturing.

Waste Valve Control—Allows reagents to move out of the detector manifold, through the waste line, and into the waste tubes. The indicator turns RED when the valve is open and BLUE when the valve is closed. Any combination of valves can be open at a time.

Compressor Indicator—Turns GREEN when the compressor is running and **BLACK** when it is off. This is helpful when using the manual screen remotely. An electronic pressure switch is used to operate the compressor and keep the air tank filled. It turns the compressor on at 45 psi and turns it off at 65 psi.

Compressor Control—Manually turns the electronic pressure switch on and off. If you manually turn off the pressure switch during service, be sure to turn it back on when you are done. It will automatically be turned back on when the Host is re-started.

Air Tank Pressure Indicator—Indicates the pressure in the air tank. The indicator will display values between 45 and 65 psi. It is useful to determine if there are air leaks in the system.

Bypass Control—Turns the bypass valve on and off. It turns ORANGE when on and WHITE when off. It allows refreshing Running Buffer at the electrode while preserving sample and reducing ion depletion allowing for longer sample runs.

Reagent Level—Graphical indication of the reagent volume in the cartridge bags. The level is proportional to the bag volume. For example, if there is 3 mL remaining in a bag that is manufactured with 6 mL, it will indicate that the bag is 50% full.

Reagent Volume—Displays the reagent volume in mL in the cartridge bags. This is calculated using pump cycles for each bag based on the manufactured bag volume. Recall that only the Port 1 Run pump is 10 µL per cycle and the other pumps are 25 µL per cycle.

Waste Level—Graphical indication of the waste volume in the waste tubes. The level is proportional to the 45 mL waste tube volume.

Waste Volume—Displays the waste volume in mL in the waste tube. This is calculated using pump cycles. Recall that the Port 1 Run pump is 10 µL per cycle and the other pumps are 25 µL per cycle.

Electrode Configuration Control—Sets the configuration of the four port electrodes. There are four platinum electrodes in the detector manifold. Each electrode has four settings selectable by one of the four radio buttons: **Off, Ground, + Bias and - Bias**.

For example, during a sample run, Ports 1 and 2 are set to **Ground** and Ports 3 and 4 are set to **+ Bias**. The negatively charged molecules in the cis microchannel are attracted to the positively charged buffer in the trans microchannel causing translocation through the nanochannel.

After selecting the electrode configuration, the **UPDATE** button must be pressed in order to set the configuration.

Channel Selector—Sets the channel (1-256) that is displayed in the **Detector Schematic** and in the **System Data** tab.

Baseline Control—Turns baseline multiplexing on (ORANGE) or off (WHITE). When baseline multiplexing is off, only 32 baselines are collected. When baseline multiplexing is on, all 256 baselines are collected through multiplexing. This was implemented to support the V2 DAQ PCBs which had noisy baseline multiplexing. The V3 DAQ PCBs have clean baseline multiplexing.

Bias Selector—Negative and positive bias selectors are used to set the bias voltages on the negative and positive electrode selections. Each has a range of 0-5 Volts (V). After entering the bias value(s), the **UPDATE** button must be pressed in order to set the bias.

Revert—Used to clear any changes to the electrode configuration or bias voltages prior to the **UPDATE** button being pressed.

Update—Used to enter changes to the electrode configuration or bias voltages.

Pressure and Dispense Control Panels

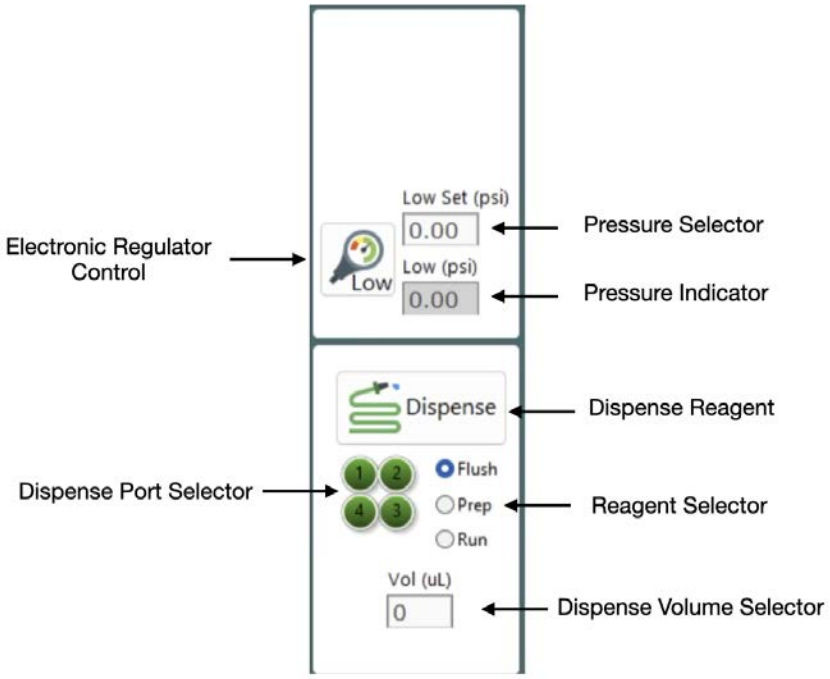

Figure 7: Pressure and Dispense Control panels on the Manual screen of the OhmX Analyzer.

Electronic Regulator Control—Turns the 1psi air regulator on and off.

Dispense Port Selector—Allows selection of which ports will dispense the selected reagent and volume. Any number of ports can be selected for dispensing.

Pressure Selector—Used to enter the air pressure setting. The acceptable pressure range is 0.00 to 1.00 psi.

Pressure Indicator—Readback from the pressure regulator output.

Dispense Reagent—Starts dispensing the selected reagent and volume to the selected port(s).

Reagent Selector—Radio buttons used to select which reagent will be dispensed.

Dispense Volume Selector—Used to enter the desired dispense volume in µL. Port 1-4 Prep and Flush reagents and Port 2-4 Run reagents are dispensed in 25 µL increments, while Port 1 Run reagent is dispensed in 10 µL increments.

System Data Tab

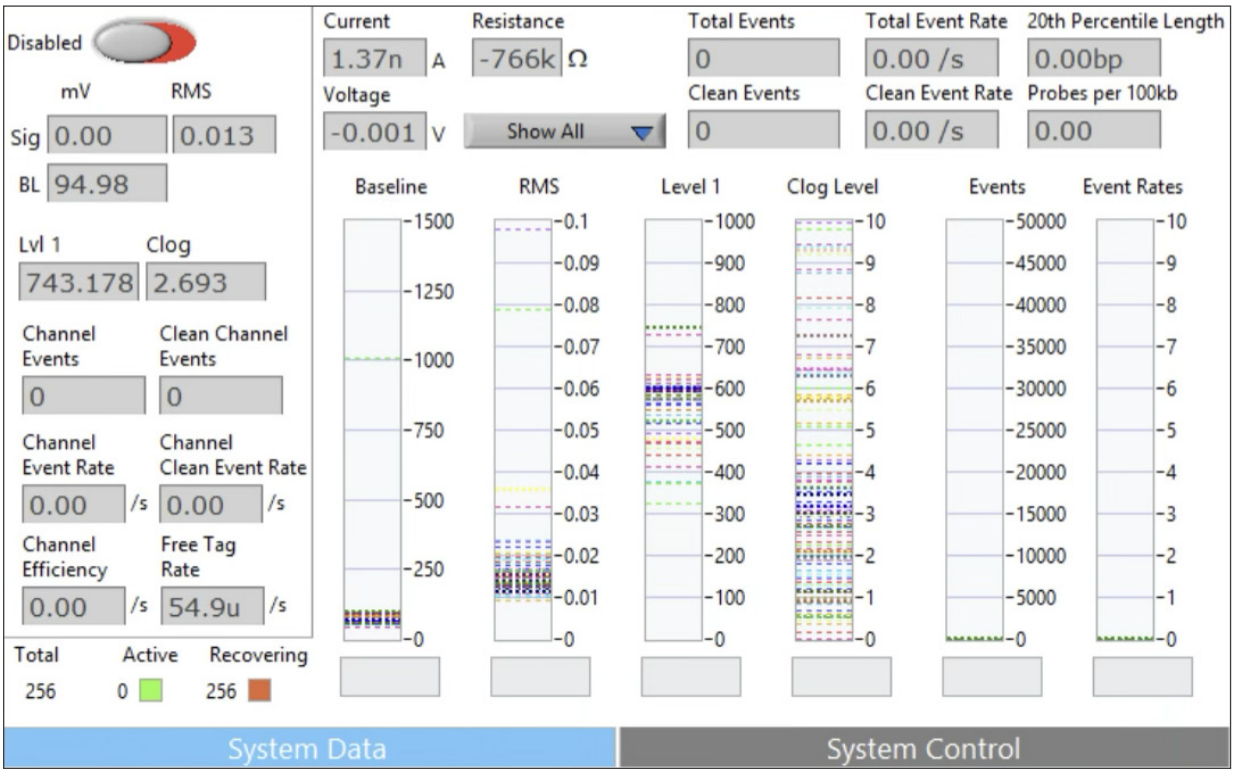

Figure 8: System Data tab on the Manual Screen of the OhmX Analyzer.

Disabled Switch—Disables data collection on the selected channel.

Sig—Signal level on the selected channel in mV.

BL—Baseline level of the selected channel in mV.

Lvl 1—Level 1 signal of the selected channel at the selected bias voltage in mV. This is only valid when the channel is enabled and molecules are translocating.

Clog—Data for future development.

Channel Events—Total events on the selected channel since the beginning of the run.

Clean Channel Events—Total clean events on the selected channel since the beginning of the run.

Channel Event Rate—Total event rate on the selected channel in molecules per second.

Channel Clean Event Rate—The current clean event rate on the selected channel using a five-second running average.

Channel Efficiency—Clean event rate/total event rate in percent on the selected channel.

Free Tag Rate—Rate of tags detected unassociated with a molecule translocation.

Total—The number of channels in the supported detector design.

Active—The number of channels that are currently enabled to collect data.

Recovering—The number of channels that have been disabled.

Current—Displays the measured current in amps (A) based on the electrode configuration and the bias voltage setting.

Resistance—The calculated resistance in ohms (Ω) based on the measured current and bias voltage.

Total Events—Total number of events from all channels since the beginning of the Sample Run protocol.

Clean Events—Total number of clean events from all channels since the beginning of the Sample Run protocol.

Total Event Rate—Total event rate from all channels using a five-second rolling average.

Clean Event Rate—Total clean event rate from all channels using a five-second rolling average.

20th Percentile Length—Data for future development.

Probes per 100kb—Data for future development.

System Control Tab

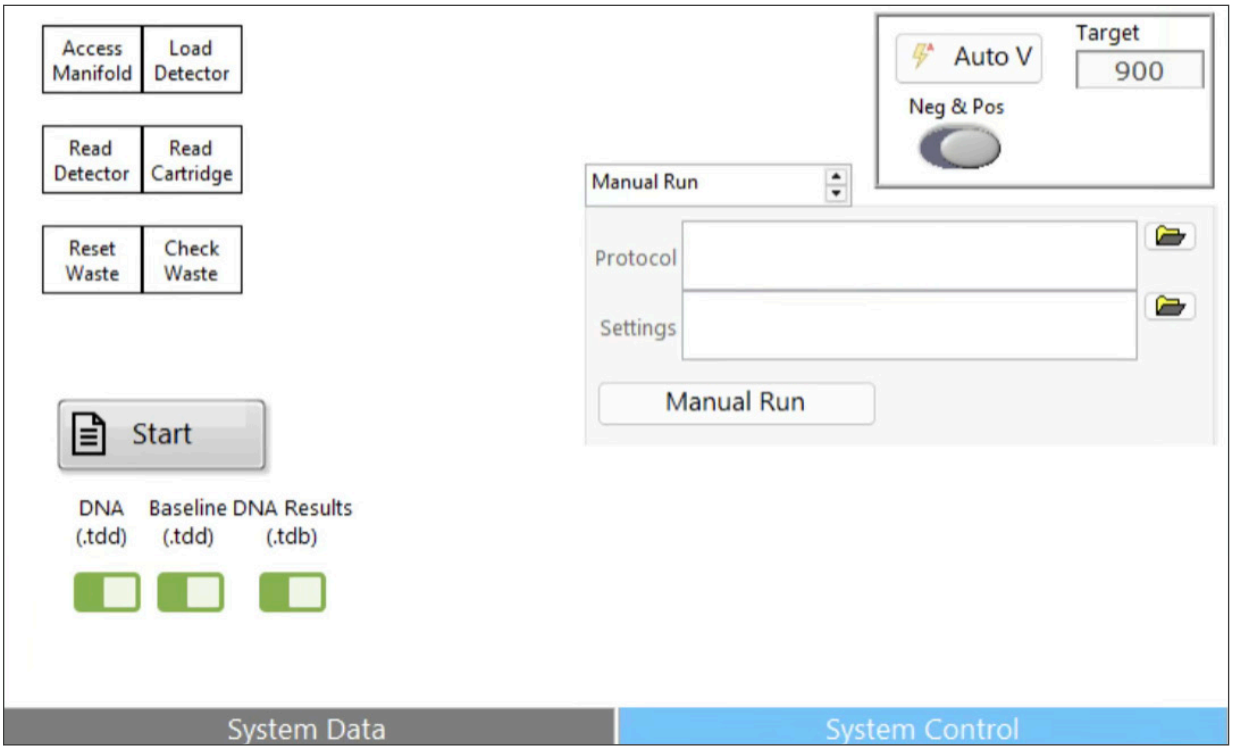

Figure 9: System Control tab on the Manual screen of the OhmX Analyzer.

Access Manifold—Moves the detector drawer forward and off of the alignment pins. This is required to allow detectors to be installed in the detector holder when it is opened. It also allows the DAQ assembly to be lifted and rotated down to provide access to the detector manifold and absorbent pad.

> ⚠ **WARNING!**
> Do not activate the Load Detector button if the DAQ assembly is rotated down.

Load Detector—Opens the detector holder allowing a detector to be removed or installed.

Read Detector—Reads the memory on the detector.

> **IMPORTANT!**
> You still must use **Load Detector** on the **Home** screen in order for the analyzer to load the correct detector parameters.

Read Cartridge—Reads the memory on the reagent cartridge.

> **IMPORTANT!**
> If you change the reagent cartridge while in the Manual screen during maintenance, be sure to select **Read Cartridge** in order to keep the remaining volumes accurate.

Reset Waste—Resets the waste to zero. **Do not use this button.** Instead, use **Empty Waste** on the **Home** screen.

Check Waste—Currently not supported (future development).

2.6. OhmX Analyzer Components

Components within the OhmX Analyzer (**Figure 10**) include:

Detector and Sample Compartments

(Figure 11)

1. **Sample door**—Manually lifts to provide access to the sample injection port.
2. **Sample injection port**—Contains a self-sealing septum that allows sample introduction using a standard-bore pipette tip. The sample passes through the port and into the fluidic manifold and detector.
3. **Detector drawer**—Automatically controlled with the OhmX software for detector loading and allows access to the fluidic manifold. Do not attempt to open the drawer manually.

Figure 10: Front of the OhmX Analyzer.

Reagent and Waste Compartments

(Figure 11)

4. **Reagent door**—Manually lifts to access the reagent compartment and controls movement of reagent cartridge in and out of the analyzer.
5. **Reagent compartment**—Holds the reagent cartridge during system operation.
6. **Waste drawer**—Manually slides open to access the waste collection tubes.
7. **Waste collection tubes**—Collects reagent waste from the OhmX analyzer.

Figure 11: Detector, Sample, Reagent, and Waste Compartments.

Back Panel

(Figure 12)

8. Power switch
9. Exhaust fan
10. Host connection
11. DC power connection
12. Drain

Figure 12: Back of the OhmX Analyzer.

2.7. OhmX Analyzer Specifications

Type	Specification
Dimensions	Height: 17 in (43 cm) Width: 5.1 in (76 cm) Depth: 17 in (43 cm)
Weight	35 lb (16 kg)
Electrical Input	100–240 VAC at 50-60 Hertz (grounded receptacle)
Power	Consumption ≤ 160 Watts Cord: 2 m, IEC 60320-C13 power cord compatible with local outlet requirements

Type	Nabsys Part Number	Original Manufacturer Part Number
OhmX Analyzer	900-00002-256	900-00002-256
OhmX Controller	900-00010-002	Lenovo ThinkStation P3 30GS Tower
OhmX Monitor	900-00038-001	Lenovo ThinkStation T24i-30 Monitor

Lenovo Warranty Statement: Upon purchase of a Nabsys OhmX Analyzer, warranty coverage is offered directly by Lenovo for the OhmX Controller and OhmX Monitor (**Figure 13**). Support is provided directly through Lenovo Premium Support. Please refer to these warranty terms and contact Lenovo directly by scanning the QR code which can be found on the side of each OhmX Controller. Below is an example of the QR code (**Figure 14**). Each Lenovo Unit has a Unique QR code. Lenovo customer support can be quickly contacted by scanning the QR code on the back of Lenovo OhmX Controller with your smart phone camera.

Figure 13: OhmX Analyzer and Controller. Only the OhmX Controller and Monitor (highlighted) are covered under the Lenovo warranty.

Figure 14: Example image of Lenovo QR code identified on OhmX Controller.

Chapter 3: Remote Diagnostics

Remote diagnostics protocols are used to confirm proper operation of an OhmX Analyzer or identify customer issues. Use of the **Manual** screen is required.

> ⚠ **WARNING!**
> The Manual screen allows independent control of all system functions. As a result, severe damage to the instrument can occur if used without knowledge of how the system operates.

On the Controller, log in using the Service to access the service functions:

User Name: Service

Password: M@ps+3r

3.1. DAQ Performance Evaluation Without Using the Detector Simulator

DAQ performance can be evaluated on a system that has run successfully in the past and there is a question if there has been a change in how the DAQ is functioning. It uses the **Detector** screen and the **Channel Response Summary** and **Electrode Response Summary** tabs. You can use these screens to look at previous detector runs and look for patterns of the same channels always being inactive.

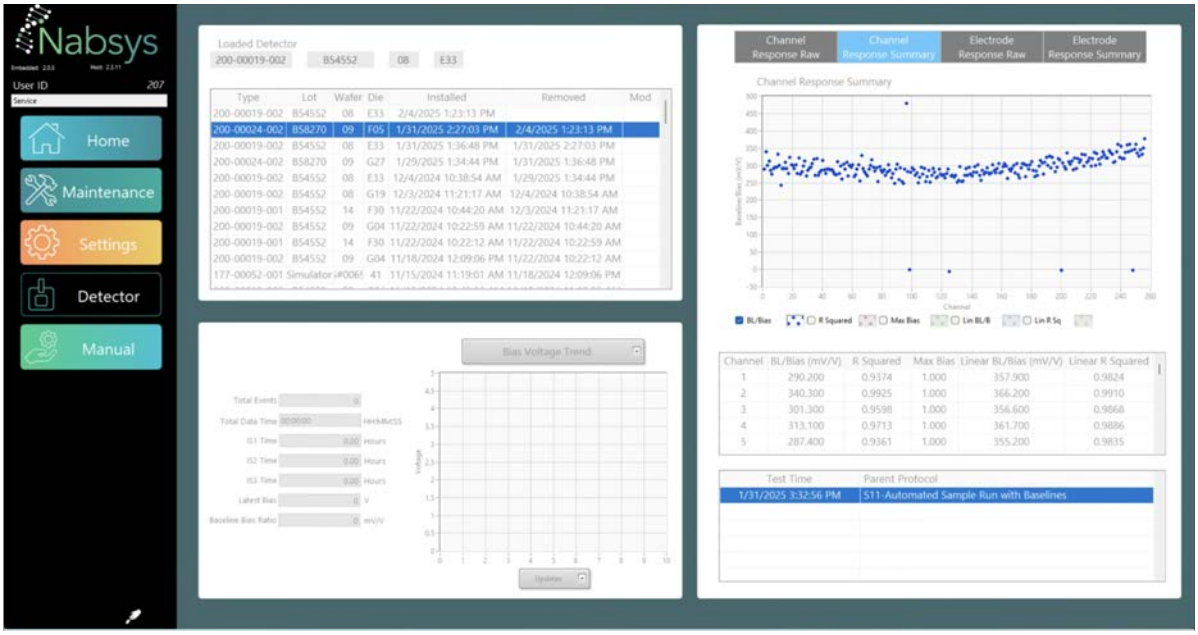

Figure 15: Detector screen and Channel Response Summary tab showing a good DAQ and detector.

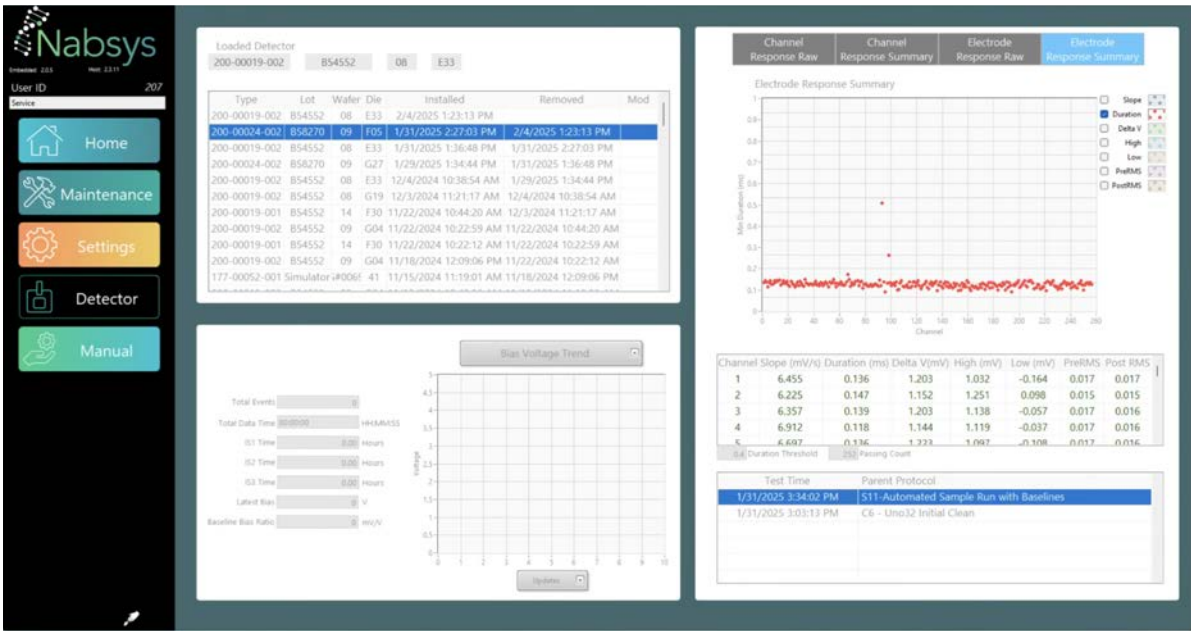

Figure 16: Detector screen and Electrode Response Summary tab showing a good DAQ and detector.

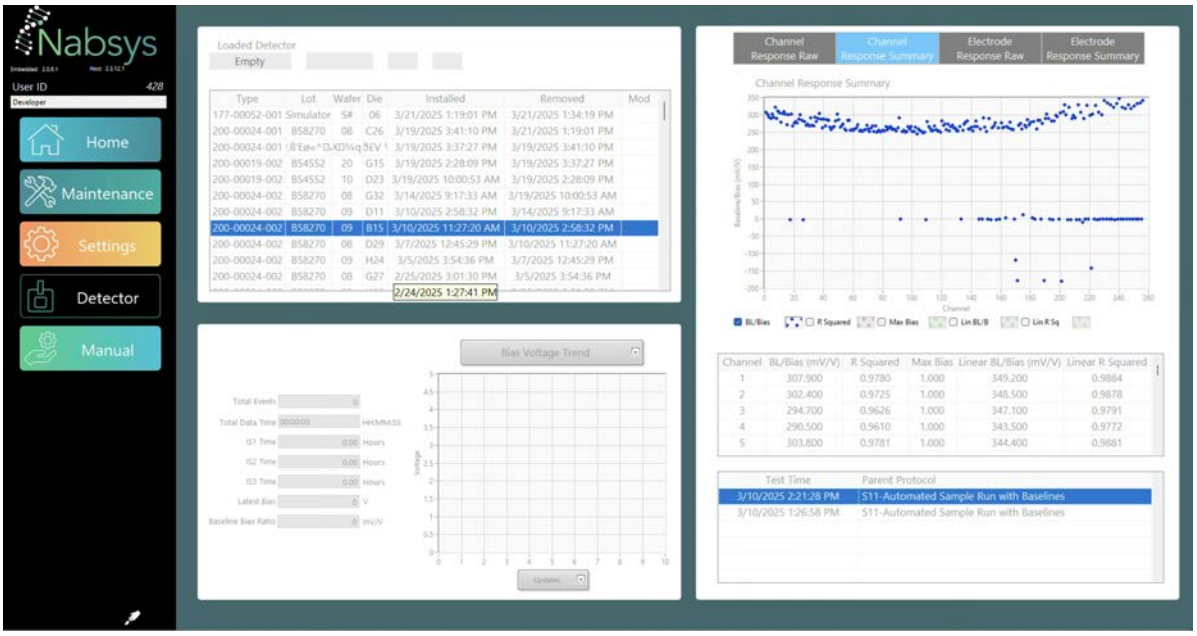

Figure 17: Detector screen and Channel Response Summary tab showing a bad DAQ and/or detector.

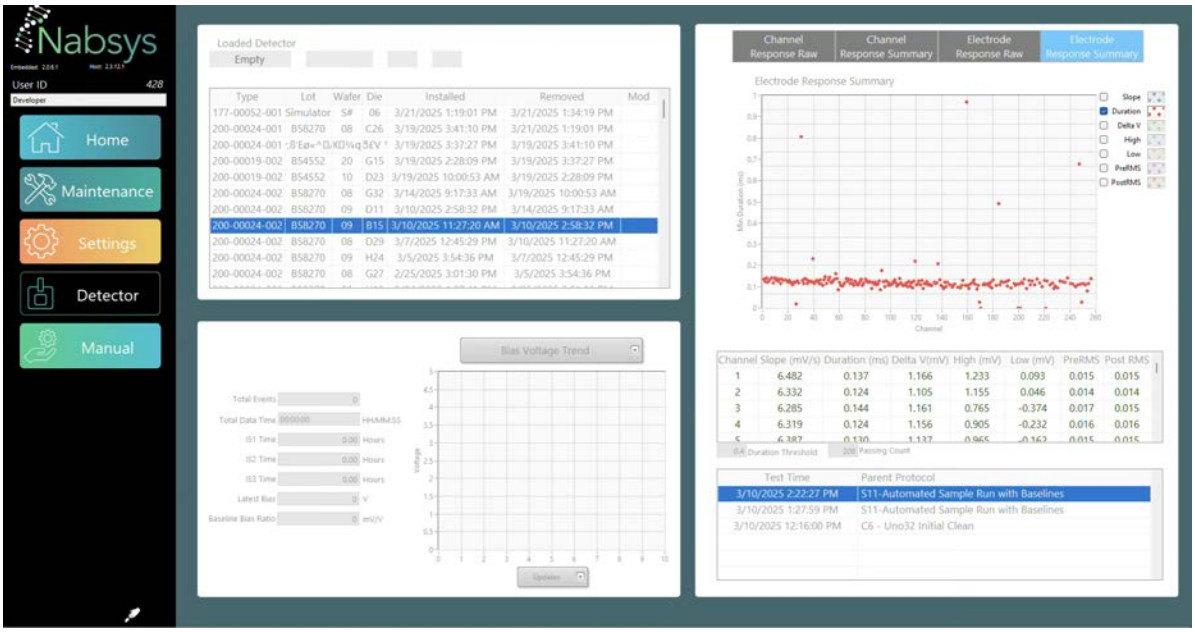

Figure 18: Detector screen and Electrode Response Summary tab showing a bad DAQ and/or detector.

3.2. Confirming Reagent Flow to Waste Tubes

This diagnostic can be used to demonstrate that all pumps are operational and there are no clogs in the system. It takes advantage of the sensitivity of the pressure transducers associated with each port.

> ⚠ **WARNING!**
> A used detector or storage detector with an integrated gasket must be installed to prevent damage. Either a Reagent Cartridge or Flush Cartridge may be used for this test.

Figure 19: OhmX Detector with integrated gasket.

Prior to performing this remote diagnostic testing, the following should be confirmed with the customer:

- A detector with an integrated gasket installed
- Waste tubes installed and are tightened
- A reagent cartridge installed

After confirming these with the customer, you can begin the remote diagnostic testing.

1. On the **Manual** screen, select the **Port Pressures** tab.

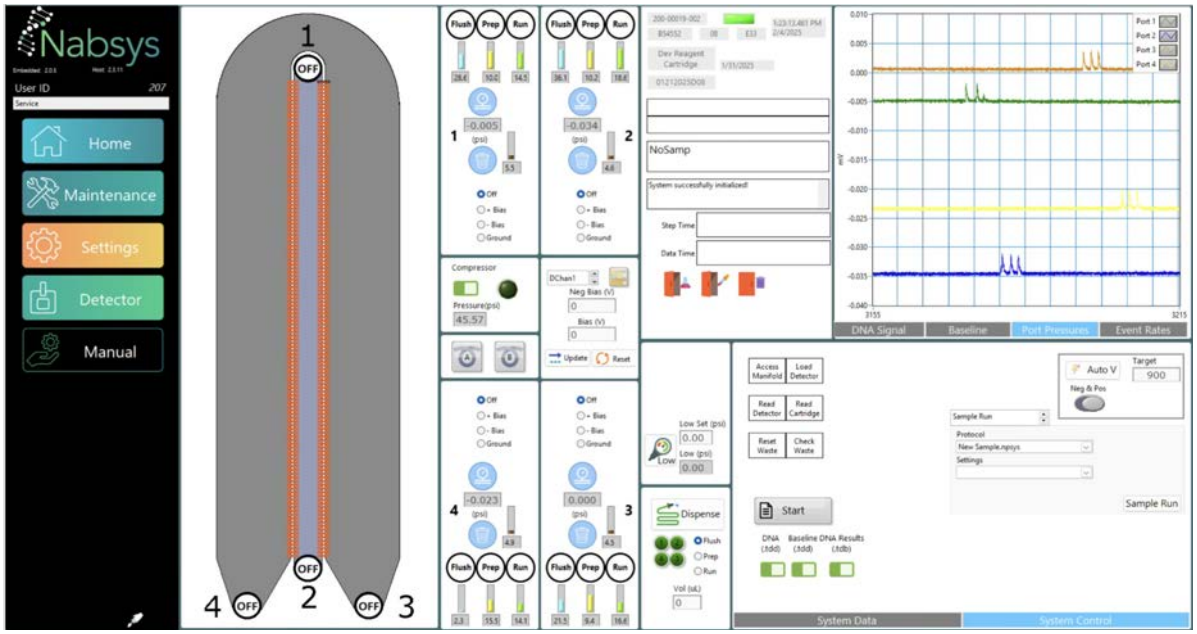

Figure 20: Manual screen with Port Pressures tab selected.

2. Right-click on the **y-axis** and select **Autoscale**.
3. **Open the waste valve** for the port to be tested.
4. Select the **Flush** pump for the port to be tested. It will turn RED. Select the sample **Flush** pump again to close the pump.
5. Repeat **Step 4** for the **Prep** and **Run** pumps.
6. **Close the waste valve**.

Observe the pressure pulses on the trace for the port being tested. Compare the pulses to the example of good performance below. If pulses are not observed additional testing is required.

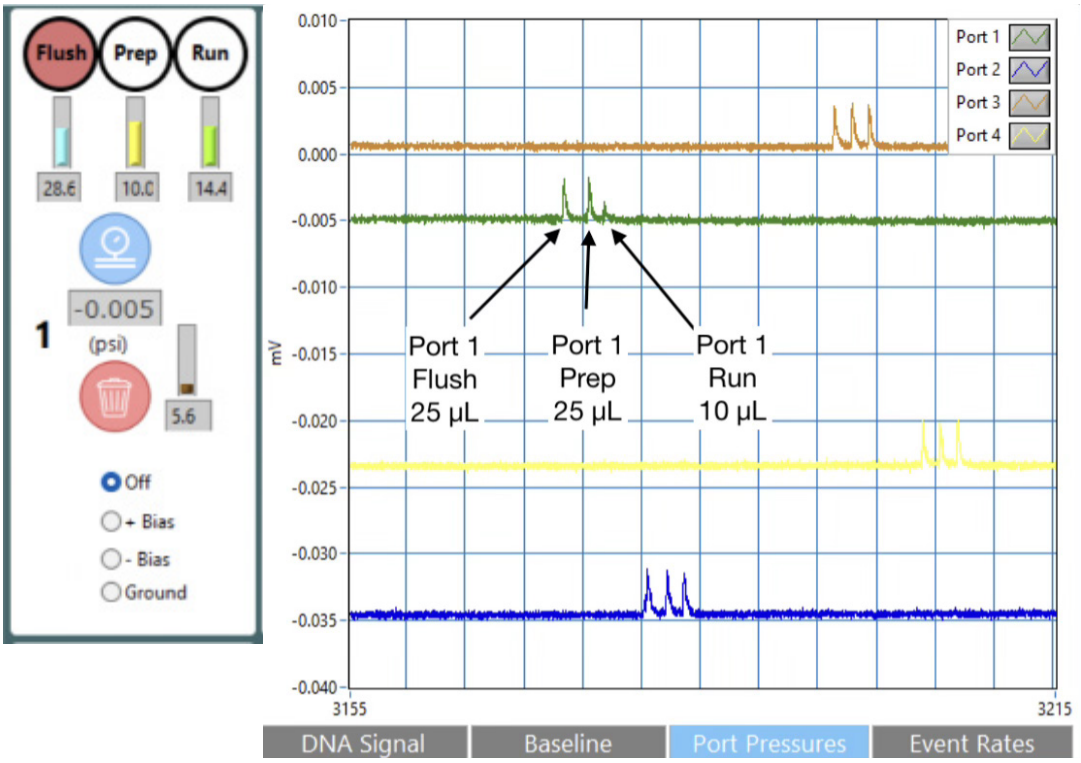

Figure 21: System Control panel and Port Pressures tab showing good Flush, Prep, and Run pulses for Ports 1-4. The pulses for Port 1 are labeled.

IMPORTANT!
The Run pulse on Port 1 will be smaller due to the pump volume of 10 µL versus the 25 µL volume of the other pumps.

If no pulses are observed on any pumps/ports, one of the following may be the possible root cause. These all require on-site service or system depot repair:

- Disconnected cable to Pump PCB
- Defective Pump PCB
- Defective I/O Control PCB

If no pulses are observed on any pump on one port, one of the following may be the possible root cause:

- Clogged waste line (see how to manually clear waste line)
- Clogged reagent or detector manifold (see how to manually flush the manifolds)
- Defective waste valve (onsite service or return for depot repair)

If at least one pump pulses on a port but the others do not, one of the following may be the possible root cause:

- Clogged Pierce Tube or clogged Reagent Manifold (see how to manually flush the manifolds)
- Defective pump or Pump PCB (onsite service or return for depot repair)

3.3. Determining Presence of a Pneumatic Leak

This diagnostic can be used to determine if there is a pneumatic leak and describes potential causes.

> **WARNING!**
> A detector and gasket must be installed to prevent damage.

Prior to performing this remote diagnostic testing, the following should be confirmed with the customer:

- A detector and gasket are installed
- Waste tubes installed and are tightened

After confirming these with the customer, you can begin the remote diagnostic testing.

Checking for a High-Pressure Leak

1. On the **Manual** screen, make sure all valves and the low pressure regulator are **off**.

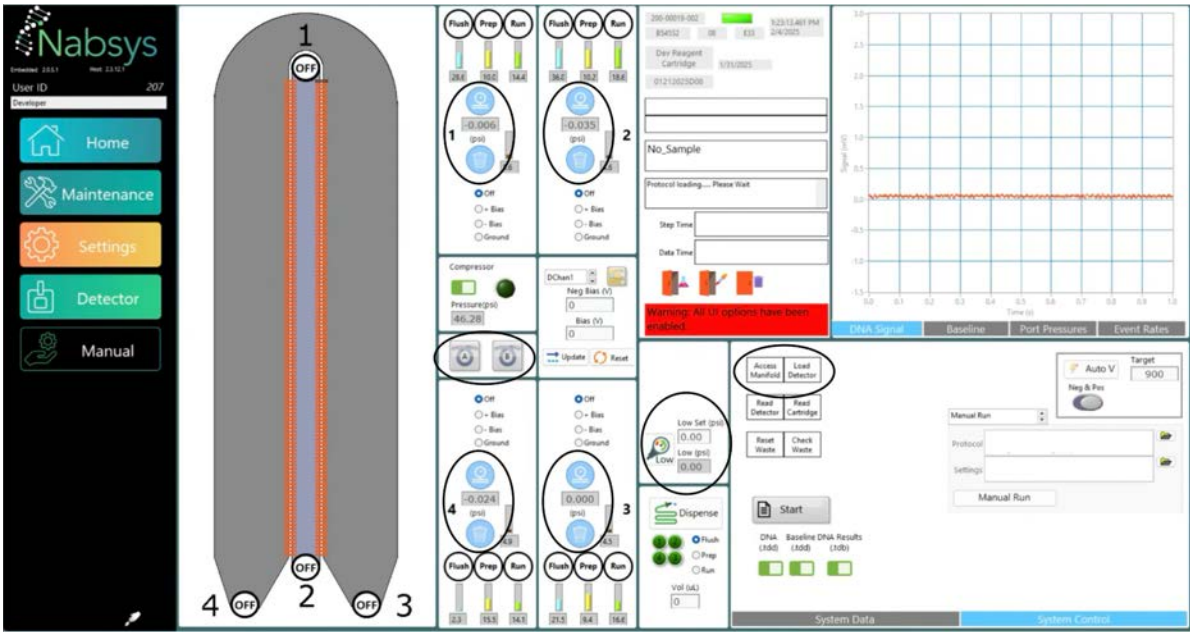

Figure 22: Manual screen showing proper settings for high-pressure leak identification.

2. Using the **Compressor Control** panel, confirm that the compressor is on (GREEN) and there is a value between 45 and 65 psi in the display.

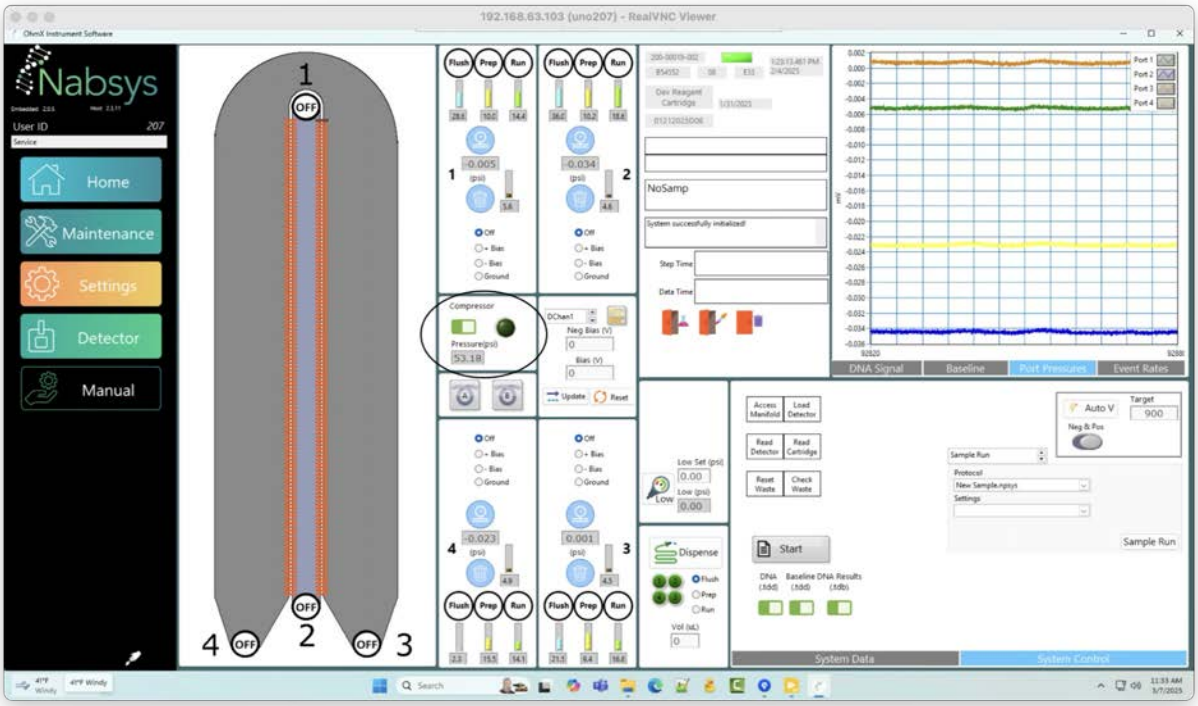

Figure 23: Manual screen showing the Compressor Control panel.

a. If the compressor is off it may have been disabled due to excessive operation.

b. If the compressor is on and the value is zero, you will need to restart the instrument and host.

c. When the compressor is not operating, confirm that the value is stable (not losing value over a period of 15 seconds. It may change values (up and down) by ~0.05 psi. If the value decreases over this time period there is a high-pressure leak in the system that will require access inside the system.

Checking for a Low-Pressure Leak

1. On the **Manual** screen, set the low-pressure regulator to 1.00 psi and turn **on** the regulator.
2. Observe the value in the **Compressor Control** panel as above.
   a. If the value is steady, proceed to the next step.
   b. If it is falling, the leak most likely is:
      i. In the tubing between the 1 psi regulator and the 4-valve manifold
      ii. In the 4-valve manifold including valve seal leaks
      iii. A 1 psi regulator malfunction

3. For each of the four ports:
    a. Set the 1 psi regulator to 1.00 psi and turn on the regulator.
    b. On Port 1, open the air valve and allow the pressure to stabilize.
    c. Turn off the regulator and monitor the Port 1 pressure transducer for leaks.
        i. If there is leaking, remove the waste tube, and check the waste tube and waste manifold seal cleanliness. Re-install the tube. Repeat **Steps 3a-c**.
4. If there is no leaking, continue to the next step.
5. Turn the regulator back on and open the waste valve. Allow the pressure to stabilize.
6. Open the corresponding waste valve and allow the pressure to stabilize.
7. Turn off the regulator and monitor the pressure transducer for a leak.

Chapter 4: Preventative Maintenance

4.1. Software Updates

Use the following guide to update the Analysis, Host, and Instrument software to the latest external release:

W004_Adraft OhmX Instrument Controller Software Update

4.2. Overall Instrument Cleaning and Volumetric Testing

1. On the OhmX Controller, select the **Login Icon** on the bottom left of the screen and log in with a **Service account**.
2. Make sure a used or storage detector is installed with the gasket. If there is not a detector in the Analyzer, install a storage detector. See **Chapter 5: Operate the OhmX Analyzer** in the **OhmX Analyzer Guide** (Document #755-00003-001) for more information.
3. Empty all four waste tubes using **Empty Waste** on the **Home** screen.
4. Select **Load Reagent Cartridge** on the **Home** screen to install a Flush Cartridge.
5. On the **Maintenance** screen, select **Init Flush**.

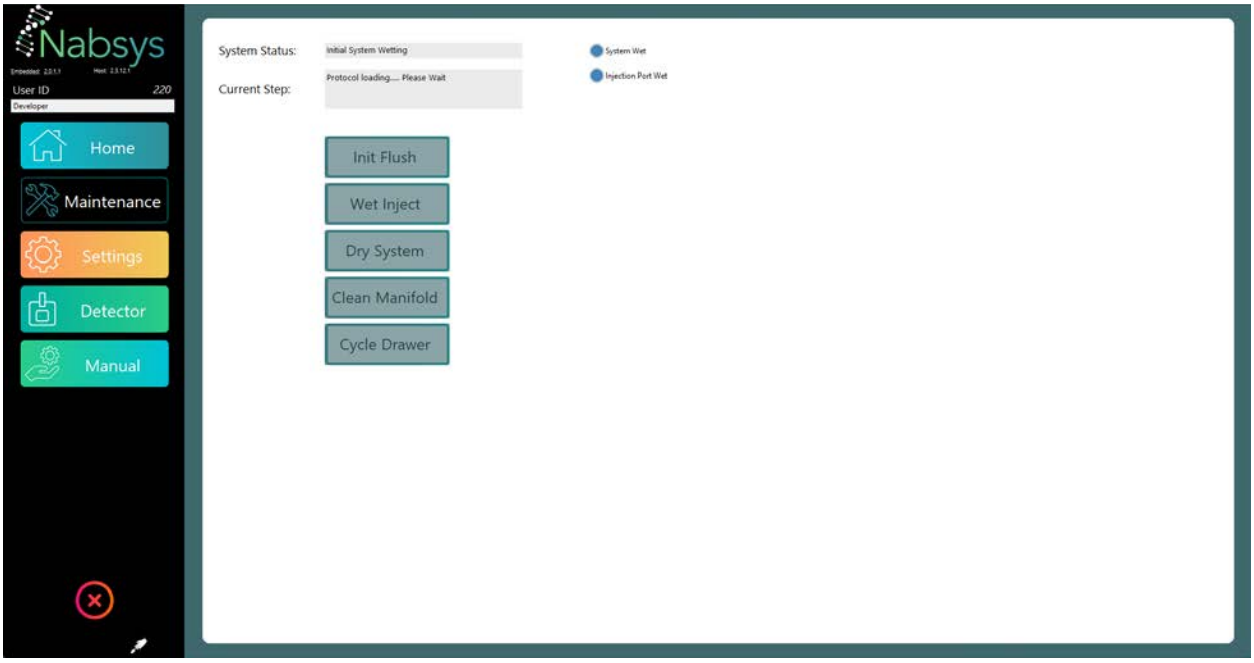

Figure 24: OhmX Maintenance screen.

6. Follow the software prompts to complete the flush.
   a. Confirm that a used or storage detector is loaded in the Analyzer and **Continue**.

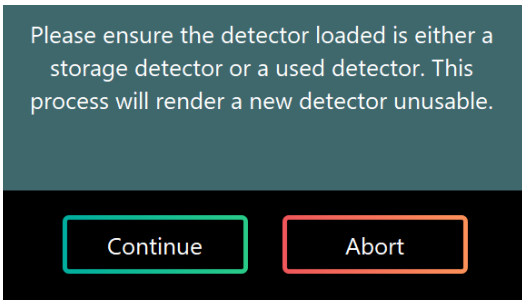

Figure 25: First software prompt requiring user input for the Init Flush protocol.

   b. Load an OhmX System Flush Cartridge and select **OK**.

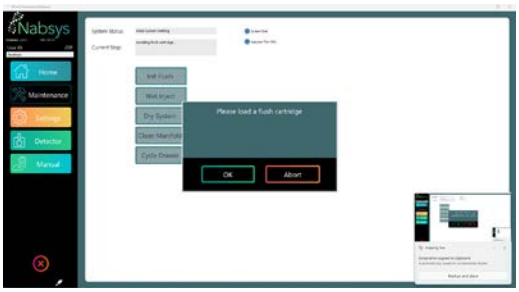

Figure 26: Second software prompt requiring user input for the Init Flush protocol.

7. On the **Manual** screen, select the **Port Pressures** tab on the upper right panel.

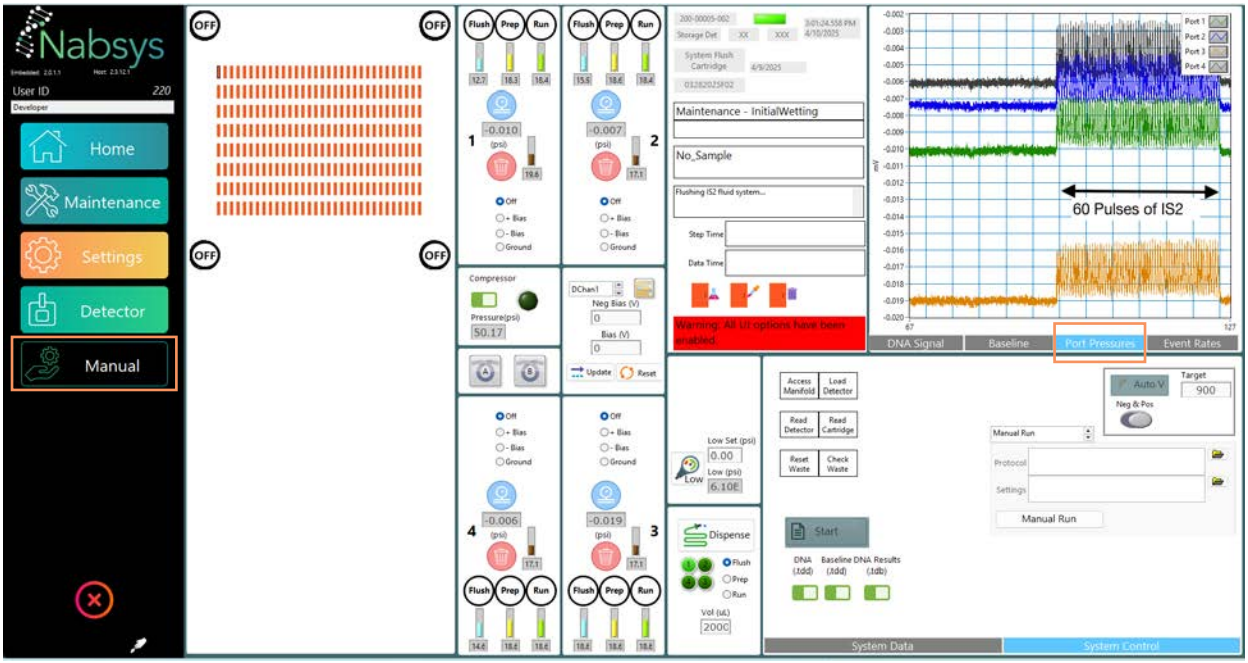

Figure 27: Manual screen with Port Pressures tab selected.

8. Right-click the y-axis of the **Port Pressures** tab and select **Autoscale**.

9. Observe the traces and confirm that all pumps are pumping 60 pulses of **Prep Buffer** (IS2).

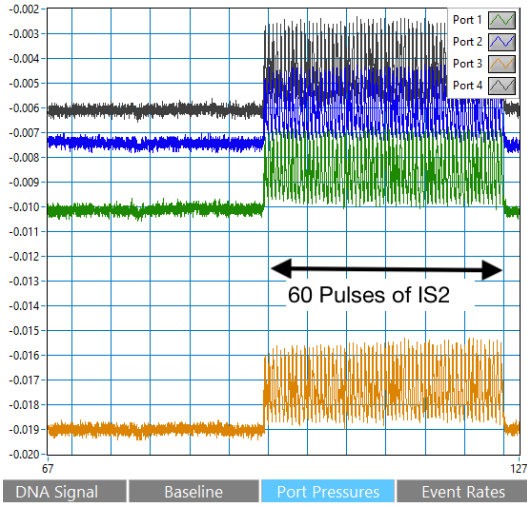

Figure 28: Manual screen traces showing 60 pulses of Prep Buffer (IS2).

10. Observe the traces and confirm that all pumps are pumping **Run Buffer** (IS3). Note that Port 1 will have a lower amplitude as a result of using a 10 µL pump in this location, instead of the other 25 µL pumps. It will also have 150 pulses compared to 60 pulses for Pumps 2, 3, and 4.

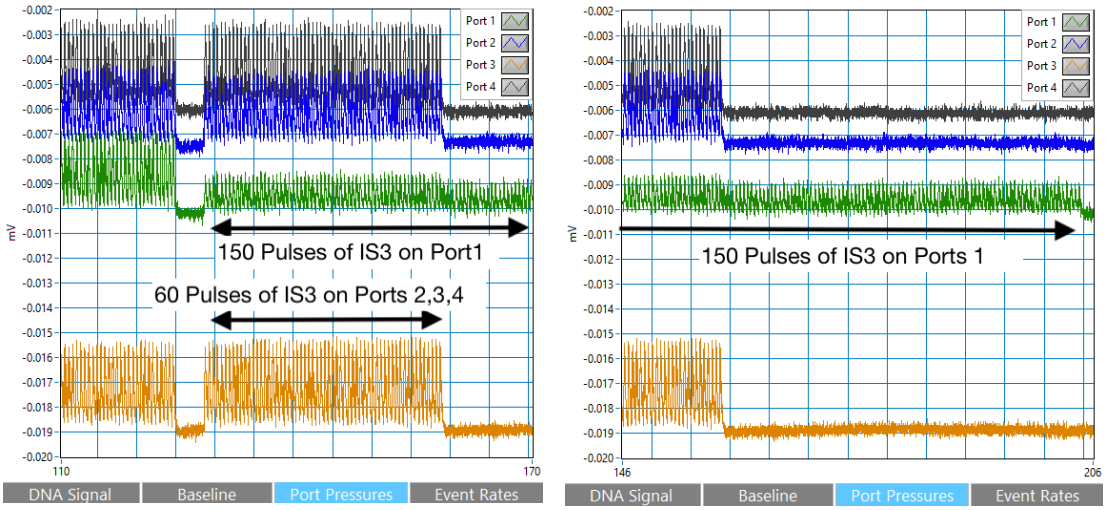

Figure 29: Manual screen traces showing 150 pulses of Running Buffer (IS3) in Port 1 and 60 pulses of Running Buffer (IS3) in Ports 2, 3, and 4.

11. Observe the traces and confirm that all pumps are pumping 60 pulses of **Flush Buffer** (IS1). After the pulses of Flush Buffer (IS3), confirm that the traces show the **bypass in Port 1**.

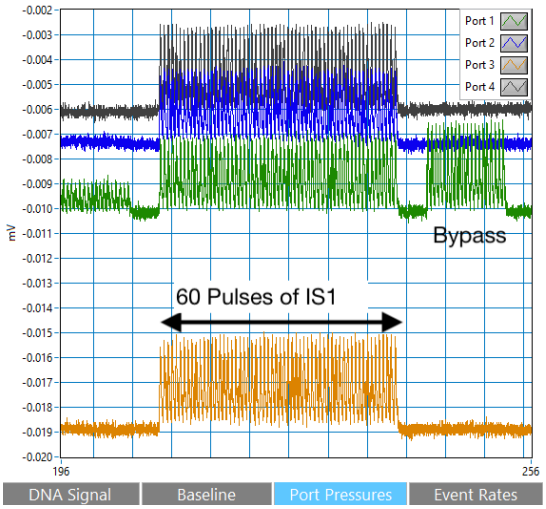

Figure 30: Manual screen showing 60 pulses of Flush Buffer (IS1) and bypass in Port 1.

12. Perform volumetric testing procedure by following the instructions in **Chapter 4.4: Volumetric Testing Procedure**.
13. Remove the Flush Cartridge and inspect the cartridge holder for any dried reagent.
14. Clean up residue on the Pierce Tubes using water and long cleaning swabs.
15. If there is a major reagent leak, follow the instructions in **Chapter 5.1: Cleaning a Major Reagent Leak in the Reagent Manifold**.
16. Use a soft cloth and water to clean the exterior of the instrument.
17. Remove the waste tubes and properly dispose of the contents. Dispose of the waste tubes.
18. Replace the waste tube gaskets by following the instructions in **Chapter 5.12: Replacing Waste Tube Gaskets**.
19. Install new waste tubes (Part #900-00013-001).
20. On the Home screen, follow the Empty Waste protocol and confirm proper operation.
21. On the Manual screen, select Access Manifold.
22. Inspect the Detector Manifold and clean as needed.

23. Remove the Absorbent Pad (Part #900-00023-002) by sliding it out of the holder.

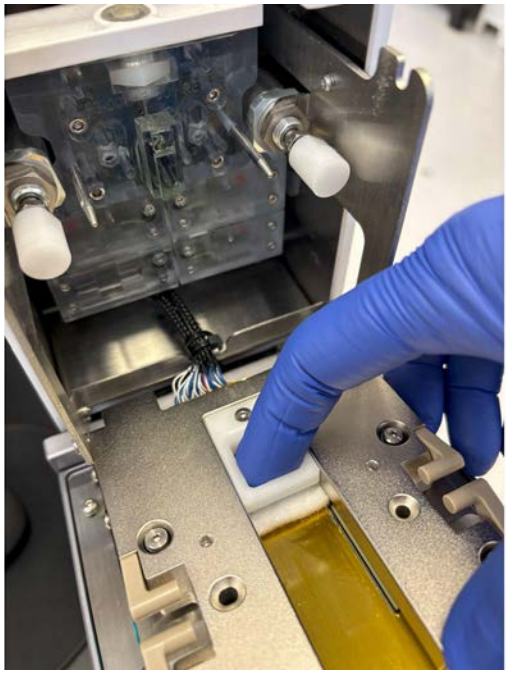

Figure 31: Removal of Absorbent Pad from the Detector Manifold.

24. Slide a new Absorbent Pad in place.

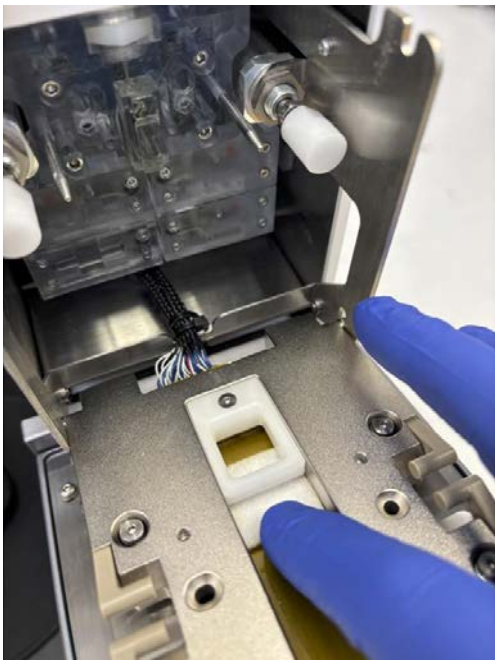

Figure 32: Installation of a new Absorbent Pad into the Detector Manifold by sliding into the holder.

4.3. Checking Detector Alignment

To check the detector alignment, follow the instructions in **Chapter** 5.11: Checking Manifold and Detector Alignment.

4.4. Volumetric Testing Procedure

This test should be performed after flushing the system with the **Init Flush** protocol described in **Chapter 3.2. Overall Instrument Cleaning and Volumetric Testing**.

In this section, you will use a 5 mL graduated cylinder to measure the buffer in each of the OhmX Analyzer's three pumps and four ports.

1. Remove the Port 1 waste tube and hold it above the 5 mL graduated cylinder.
2. On the **Manual Screen Dispense** panel, set the following parameters:
   a. Select **Port 1**
   b. Select **Flush**
   c. Enter **2000 µL** for the volume to be dispensed

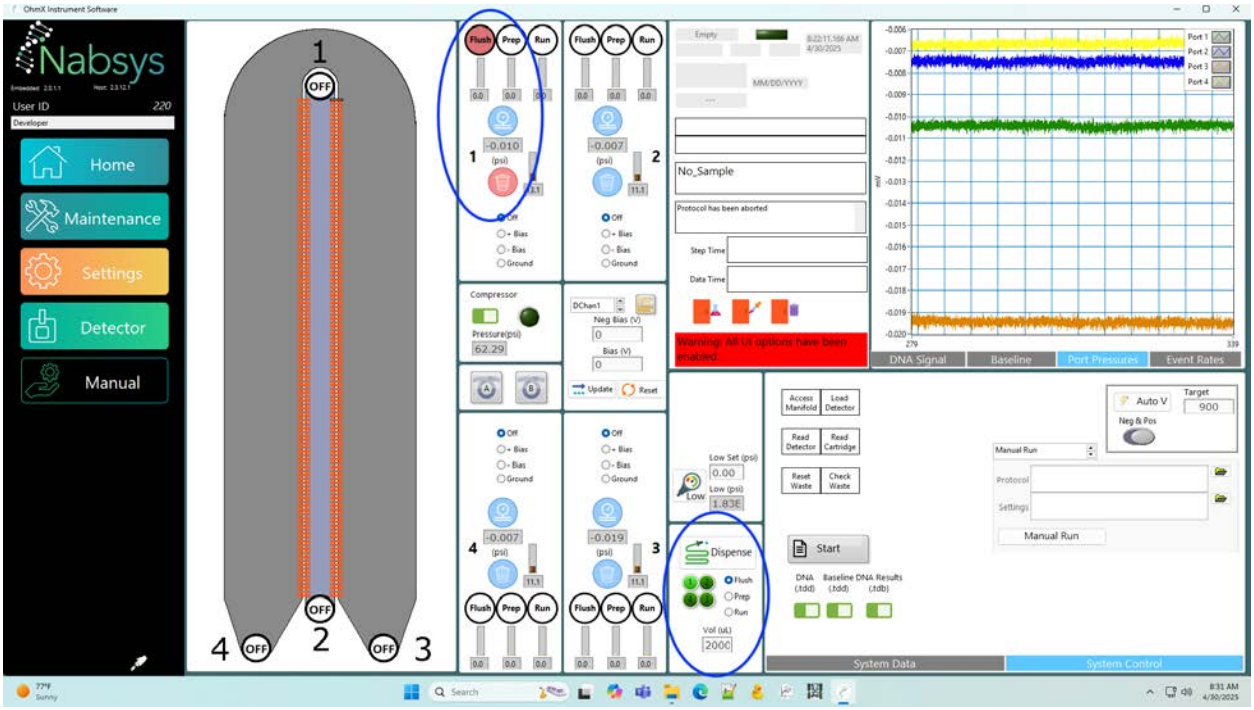

Figure 33: Manual screen showing settings for Port 1 Flush Pump volumetric testing.

3. Select **Dispense**.
4. Wait for the pumping to complete. This will take 40 seconds.
   2000 µL/25 = 80 pump cycles and there are 2 pump cycles per second
   Note that Port 1 Run Pump will take 100 seconds to dispense the required volume due to its smaller capacity.

5. Measure the volume of buffer in the 5 mL graduated cylinder. The meniscus should be at 1.8 mL or higher.

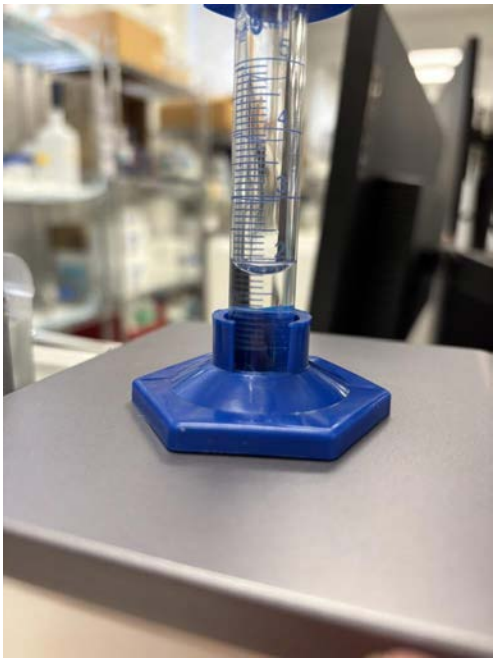

Figure 34: Graduated cylinder with a volume of 1.8 mL.

6. Enter the measurement into the Port 1 Flush section of the table below.
7. Empty and dry the graduated cylinder.
8. Repeat **Steps 1-7** for the remaining 11 ports and pumps.

Volumetric Testing Results			
Port	Flush	Prep	Run
1			
2			
3			
4			

4.5. Air Leak Testing

Follow the instructions in **Chapter 3.3: Determining Presence of a Pneumatic Leak**.

Chapter 5: Reactive Maintenance

5.1. Cleaning a Major Reagent Leak in the Reagent Manifold

1. Turn off the power and remove the communications and power cables.
2. Remove the cartridge if there is one in place.

Figure 35: Reagent Manifold with a reagent spill.

3. Install the spill tray behind the instrument below the drain tube. Gently pull out additional tubing if required.

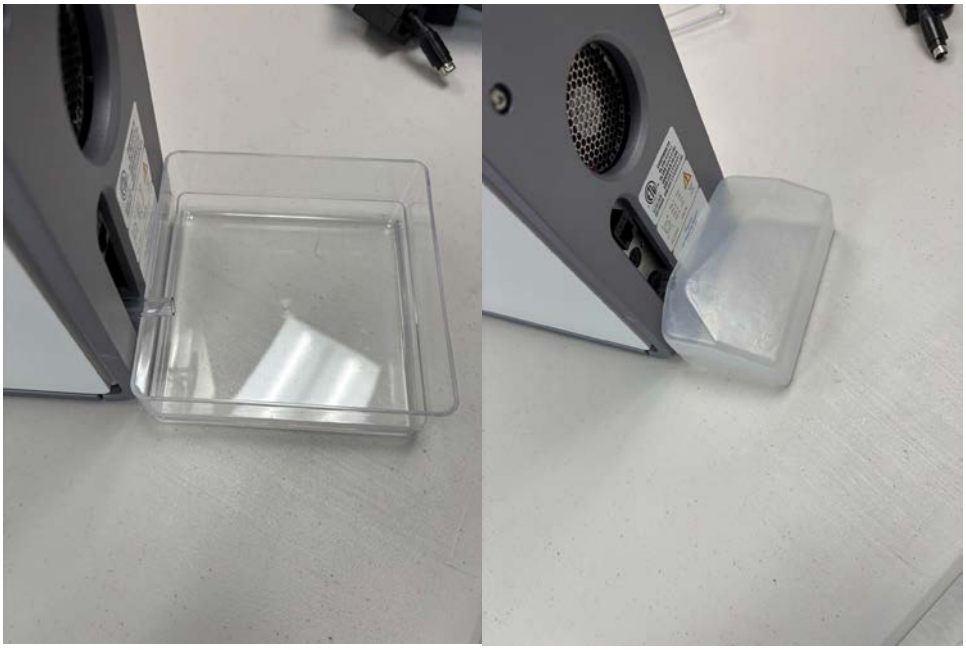

Figure 36: Large spill tray (left) and new spill tray (right) installed behind the analyzer.

4. Fill the 150 mL beaker with deionized (DI) water.
5. Fill the syringe with DI water and gently dispense water over the area of the leak. Be careful to keep the water level below the manifold edge.

Figure 37: Flushing the Reagent Manifold with a syringe and DI water.

6. Confirm that the liquid is flowing out of the drain tube and into the spill tray.

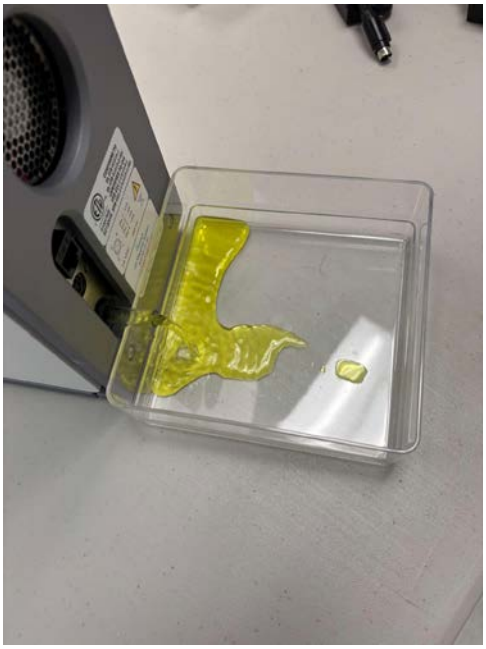

Figure 38: Liquid flowing from Reagent Manifold to spill tray.

7. Continue flushing the area, dissolving and diluting the leak. Use a long swab to scrub the area, if needed.
8. Using the Luer tip on the syringe, insert the tip into the flush ports and flush with water.

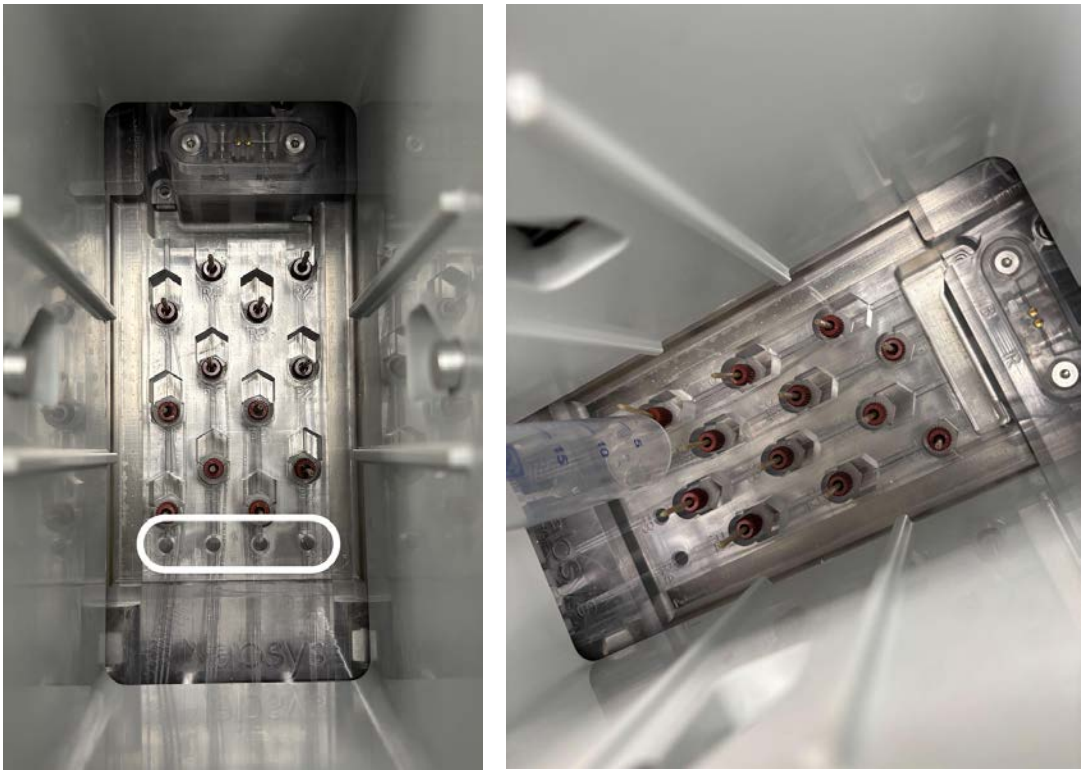

Figure 39: Flushing Reagent Manifold flush ports with syringe and water.

9. Carefully tip the instrument back to allow the water to flow out of the drain tube.
10. Insert a swab into the drain tube to remove any residual water.

Figure 40: Reagent Manifold drain location.

11. Use paper towels to dry the manifold by folding the towels to fit into the well at the rear of the manifold.

Figure 41: Drying the Reagent Manifold with a folded paper towel.

12. Properly dispose of the water in the spill tray.

5.2. Manually Clearing the Waste Line

1. Open the waste drawer and remove the affected waste tube.
2. On the **Maintenance** screen, select **Clean Manifold**.
3. Tilt the detector drawer faceplate down. It will rest on the waste drawer.
4. Place paper towels in front of the Detector Manifold to protect the faceplate.

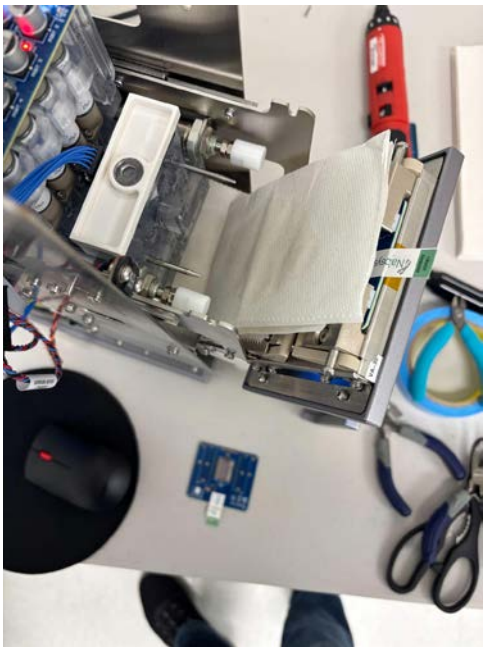

Figure 42: Paper towels over DAQ assembly to protect the faceplate.

5. On the **Manual** screen, open the waste valve for the clogged port.
6. Remove the affected waste tube.adapter
7. Fill a syringe with water.
8. Attach the flushing adapter to the piece of tubing in the waste tube cap and tighten the adapter.
9. Insert the syringe Luer tip into the flushing adapter.
10. Try to dispense water from the syringe and observe if water is coming out of the Detector Manifold.
    a. If water comes out of the Detector Manifold, perform the procedure in **Chapter 3.2: Confirming Reagent Flow to the Waste Tubes**.
    b. If water does not come out of the Detector Manifold, wait a few minutes and try again. If water still does not come out of the Detector Manifold, it needs to be replaced.

5.3. Manually Flushing the Manifolds

1. On the **Maintenance screen, select Clean Manifold.**
2. Tilt the detector drawer faceplate down.
3. Place paper towels in front of the Detector Manifold to protect the faceplate.
4. Identify the correct Pierce Tube.
5. On the **Manual** screen, open the affected pump.
6. Fill a syringe with DI water.

7. Attach the flushing adapter to the Pierce Tube.
8. Try to dispense water from the syringe and observe if water is coming out of the Detector Manifold.
    a. If water comes out of the Detector Manifold, perform the procedure in **Chapter 3.2: Confirming Reagent Flow to the Waste Tubes**.
    b. If water does not come out of the Detector Manifold, wait a few minutes and try again. If water still does not come out of the Detector Manifold, it needs to be replaced.

5.4. Analyzer Fails to Connect to the Host

1. On the host, run **AppVer** to make sure all software is compatible. (See **W004_OhmX Instrument Controller Software Update**).
2. Confirm that the network cable between the host and analyzer are properly connected. For more information, see the **OhmX Analyzer Guide** (Document #755-00003-001).
3. Restart the controller and log in.
4. Turn off the analyzer for 10 seconds and turn it back on.
5. Confirm the analyzer front panel LEDs turn BLUE and after 40 seconds turn RED.
6. Open **View Network Connections** and confirm it has connected to the Host.

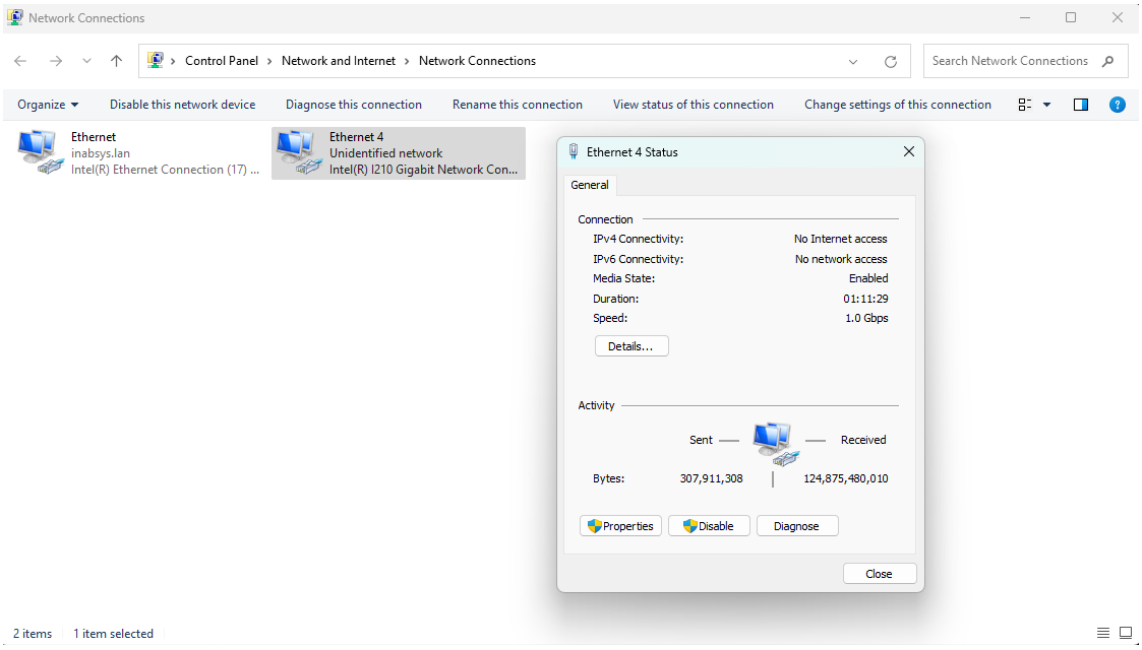

Figure 43: Network Connections and Ethernet Status.

7. Launch the Host software and confirm the front panel LEDs turn BLUE and GREEN, confirming connection followed by host screen confirmation.

5.5. Removing the Analyzer Covers

1. Turn off the power and disconnect the power and communications cable.
2. Remove the DAQ Assembly as described in **Chapter 5.17: Removing and Installing the DAQ Assembly** in this guide.
3. Remove the six (6) screws [M4 X 16 mm Button Head Screw [472-00028-016] using a 2.5 mm hex driver along with the lock washers [Part #, Description] and flat washers [Part #, Description]. Put the parts in a plastic beaker to avoid loss.

Figure 44: Removing screws from the back panel of the analyzer.

4. Carefully remove the back panel and set aside in a safe area.

Figure 45: Back of the analyzer with the back panel removed.

5. Lift the reagent door and the sample door to allow the two sides to be removed.
6. Carefully remove the left and right side panels by sliding them up and off the system, and set aside in a safe area.

7. Use a 2.5 mm hex driver to remove five (5) [Part #, Description] screws and lock washers [Part #, Description] on both sides of the instrument. Place the parts in the beaker to avoid loss.

Figure 46: Locations of screws on reagent cover.

8. Carefully lift the reagent top straight up and off of the system and set aside in a safe area.

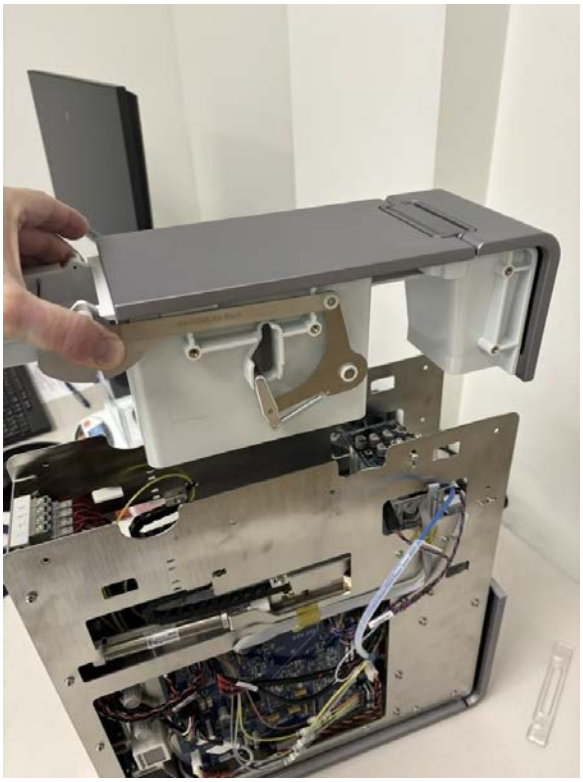

Figure 47: Removing the reagent cover.

5.6. Removing the Detector Manifold

1. Follow the instructions in **Chapter 5.5: Removing the Analyzer Covers.**
2. Remove the two springs on each side of the detector drawer.

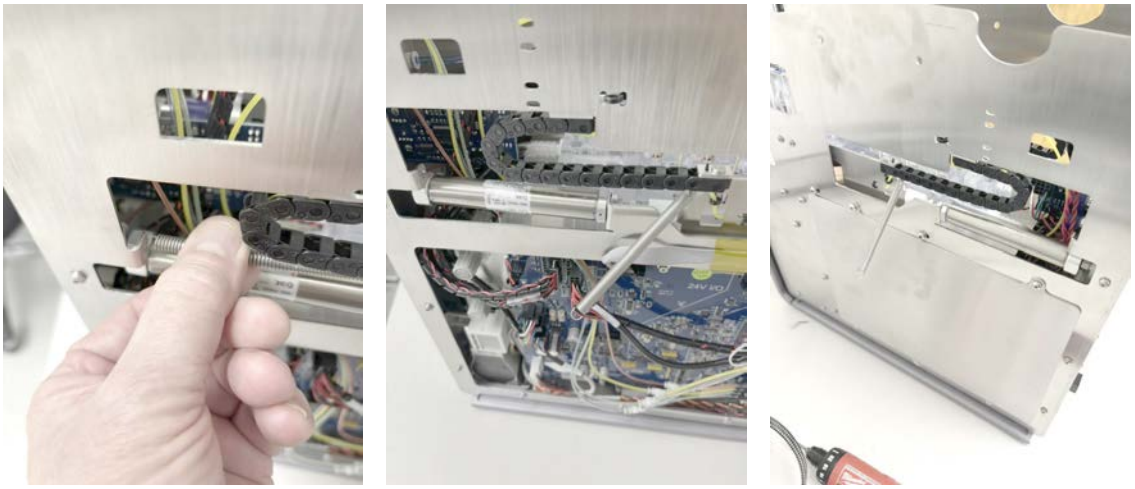

Figure 48: Unhooking the springs on the sides of the detector drawer (left), lefthand spring unhooked (middle), and righthand spring unhooked (right).

3. Slide the DAQ Assembly out.
4. Unlatch the DAQ cable and disconnect the cable.

Figure 49: Disconnecting the DAQ Connector.

5. Remove the two side screws on the side of the detector drawer holding the DA

Figure 50: Installing the DAQ pivot screws.

6. Lift the DAQ assembly off of the drawer and slide the drawer mechanism back.
7. Release and remove the blue cable on the electrode PCB.

Figure 51: Blue cable on the electrode PCB.

8. Remove the four screws [Part #, Description] and washers [Part #, Description].

Figure 52: Detector Manifold screw locations.

9. Gently slide the detector manifold [#850-00005-001] forward off of the alignment pins.

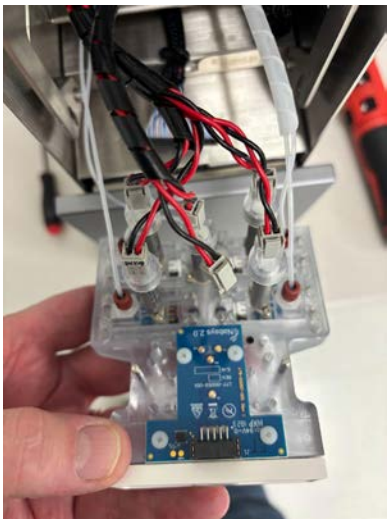

Figure 53: Removed Detector Manifold.

10. There are four duckbill valves [Part #, Description] that may be on either the reagent manifold or in the detector manifold. Using forceps remove the valves and set aside for later re-installation.

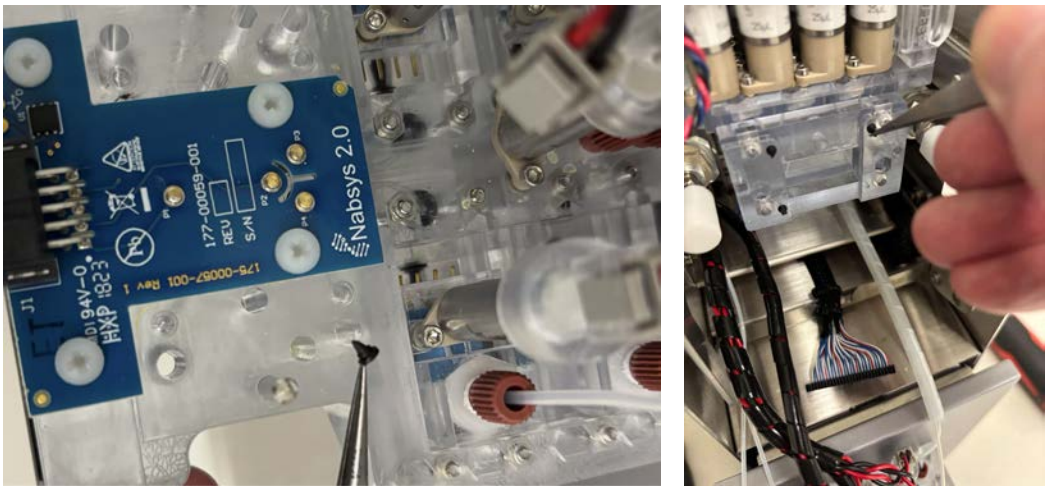

Figure 54: Duckbill valve removal.

11. Gently unlatch and remove the five valve connectors.
12. Using the blue tape [Part #, Description] in the service toolkit, label the four waste tubes with the port locations.
13. Using the fitting tool [Part # 485-00002-001, Headless Nut Extender Tool] if necessary, unscrew each fitting. The tubing will resist the rotation.

> If you are planning to remove the Reagent Manifold, continue to **Chapter 5.7: Removing the Reagent Manifold**.
>
> If you are only replacing the Detector Manifold, continue to **Chapter 5.9: Installing the Detector Manifold**.

5.7. Removing the Reagent Manifold

1. Before removing the Reagent Manifold, follow the instructions in **Chapter 5.6: Removing the Detector Manifold.**
2. Remove the three screws [Part #, Description] and lock washers [Part #, Description] on the side cover and remove the cover.

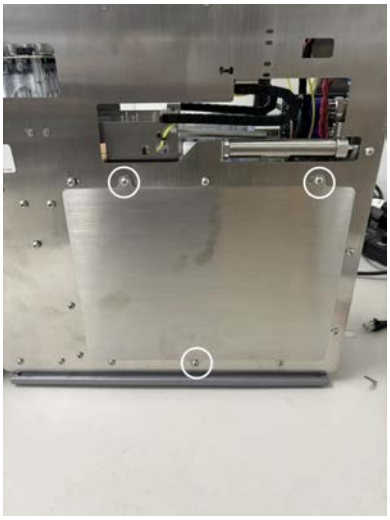

Figure 55: Right side cover screw locations.

3. Gently pull the drain tube out of the grommet at the back.

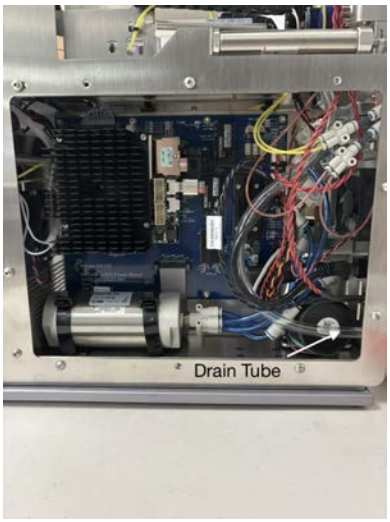

Figure 56: Right side drain tube location.

4. Unlock and remove the memory cable on the I/O Control PCB.

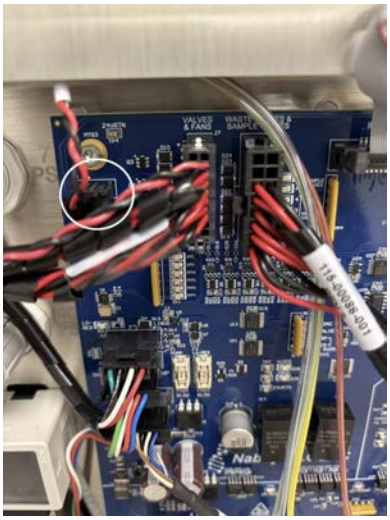

Figure 57: Removing the memory cable on the I/O Control PCB.

5. Gently pull the cable up into the Reagent Manifold area.
6. Unlatch the ribbon cable on the Pump PCB and move it to the other side of the sheet metal.

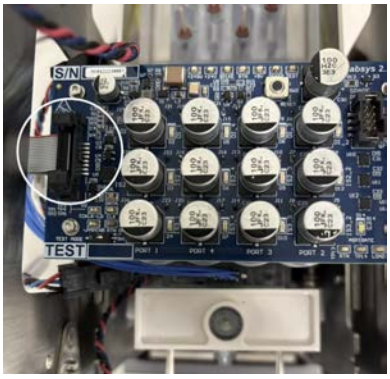

Figure 58: Pump PCB ribbon cable.

7.

8. Unscrew the four screws [Part #, Description], lock washers [Part #, Description], and flat washers [Part #, Description] on the top of the Reagent Manifold.

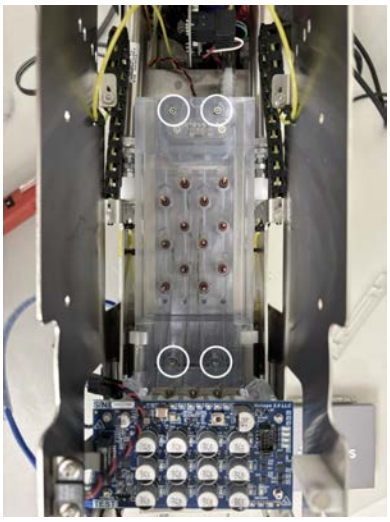

Figure 59: Reagent Manifold screw locations.

9. Gently lift and slide the manifold forward guiding the memory cable and drain tube, taking care to avoid the door switch above the Pump PCB.

Figure 60: Reagent Manifold removed from the analyzer.

5.8. Installing the Reagent Manifold

Before beginning, ensure that the covers, Detector Manifold, and Reagent Manifold have been removed. If they have not been removed, follow the instructions in:

- Chapter 5.5: Removing the Analyzer Covers
- Chapter 5.6: Removing the Detector Manifold
- Chapter 5.7: Removing the Reagent Manifold

1. Gently place the reagent manifold into the chassis taking care not to pinch any tubing or wires. It needs to be positioned in front of the door sensor to allow it to slide below it.

Figure 61: Placing the reagent manifold into the chassis.

2. Position the drain tube and memory cable in the tray and guide them while sliding the manifold into position.

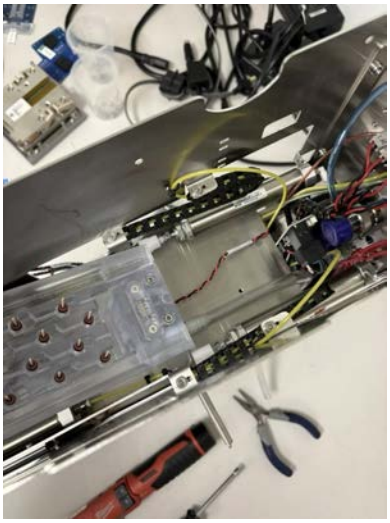

Figure 62: Drain tube and memory cable in the tray (left) and sliding the manifold into position (right).

3. Install and tighten the four screws [Part #, Description], lock washers [Part #, Description], and flat washers [Part #, Description].

4. Push the drain tube into the grommet at the rear of the instrument.

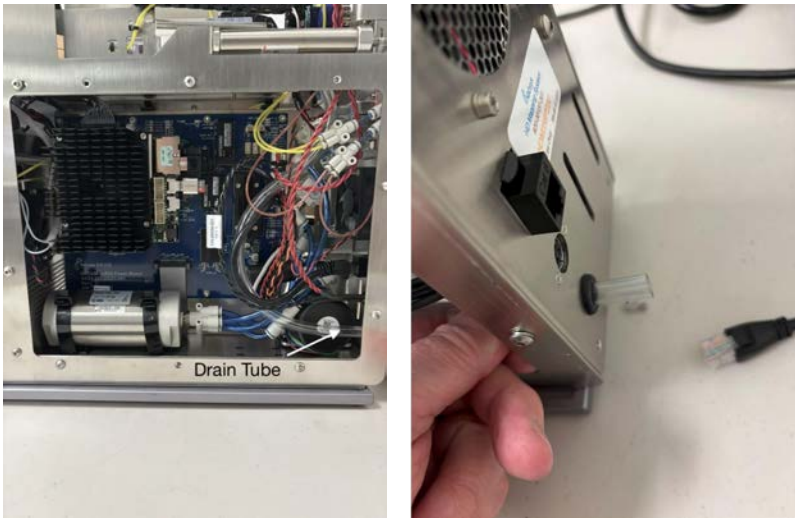

Figure 63: Pushing the drain tube into the grommet.

5. Reconnect the memory cable.

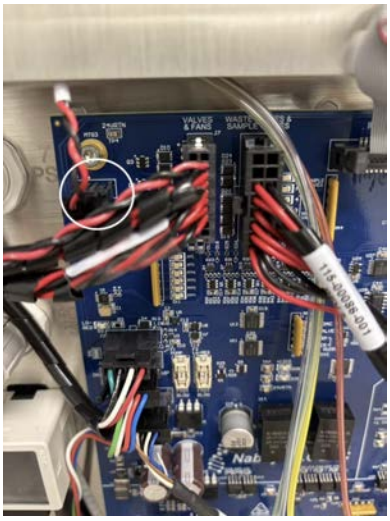

Figure 64: Reconnecting the memory cable.

5.9. Installing the Detector Manifold

Before beginning, ensure that the covers and Detector Manifold have been removed. If they have not been removed, follow the instructions in:

- Chapter 5.5: Removing the Analyzer Covers
- Chapter 5.6: Removing the Detector Manifold

You should also ensure that the Reagent Manifold is in place. If the Reagent Manifold is not in place, follow the instructions in **Chapter 5.8: Installing the Reagent Manifold**.

1. Loosen the ferrule of the VacuTight fitting [Part# 850-00018-001] from the nut by gently using the needle nose pliers to twist the ferrule.

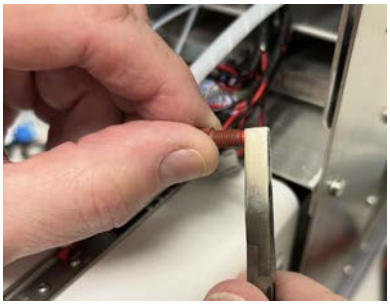

Figure 65: Loosening the VacuTight ferrule.

2. Push the tubing slightly through the ferrule.
3. Install the tubing into the manifold according to **Figures 77-78**. Make sure there is an o-ring [Part# 850-00020-001] in the Port 1 location.

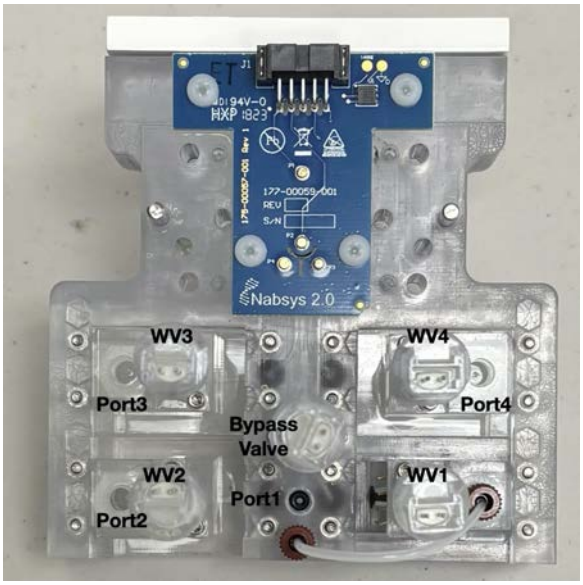

Figure 66: Detector Manifold diagram.

Figure 67: VacuTight Ferrules How-To Guide.

4. Using the diagram and labels on the waste valve connectors, install the connectors and make sure they are locked.

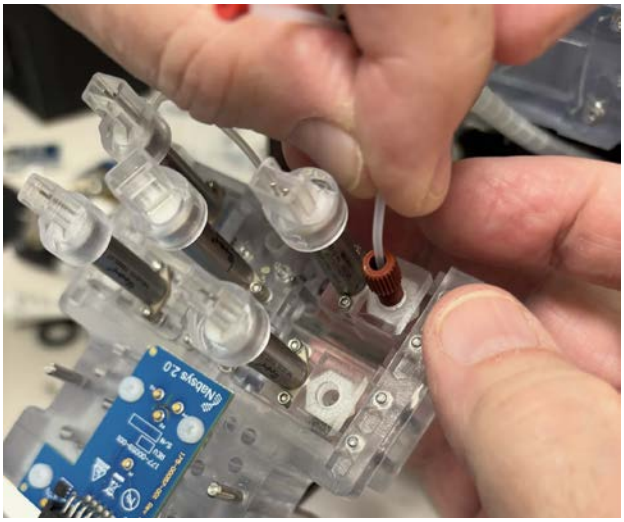

Figure 68: Installing and tightening the waste valve connectors.

5. Install the A connector to the Bypass Valve.

Figure 69: Installing the A connector to the Bypass Valve.

6. Install the four duckbill valves [Part# 850-00019-001].

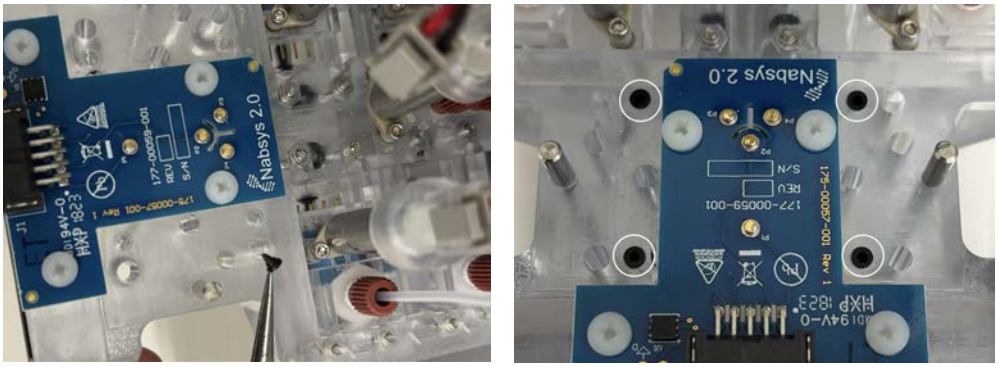

Figure 70: Installing the four duckbill valves.

7. Gently align the Detector Manifold with the alignment pins on the Reagent Manifold and slide forward until it is against the Reagent Manifold.

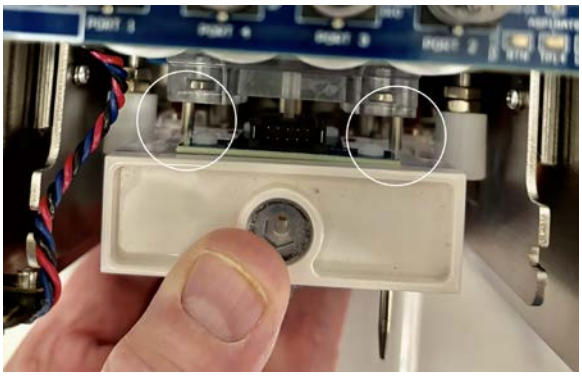

Figure 71: Detector Manifold guide pins.

8. Confirm the duckbill valves are in place by looking through the manifold.

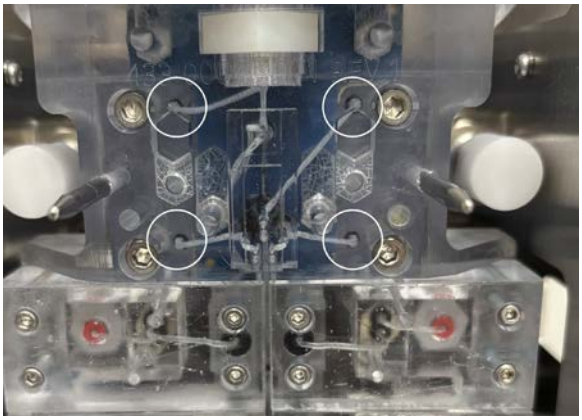

Figure 72: Confirming duckbill valves are in place.

9. While holding the detector manifold in place, install the four screws [Part #, Description], washers [Part #, Description], and lockwasher [Part #, Description] and gently tighten.
10. Confirm the duckbill valves are still in place, then firmly tighten the screws.

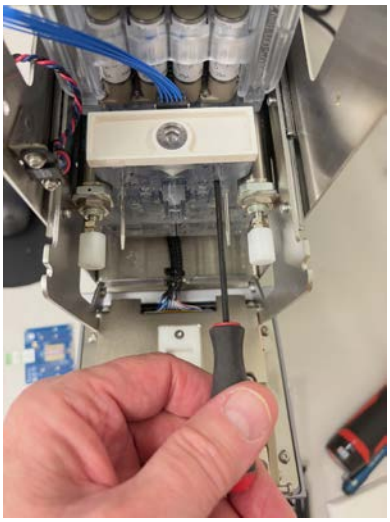

Figure 73: Manually tightening the screws.

5.10. Installing the DAQ Assembly

1. Use a hex driver to close the locks on the DAQ connector.

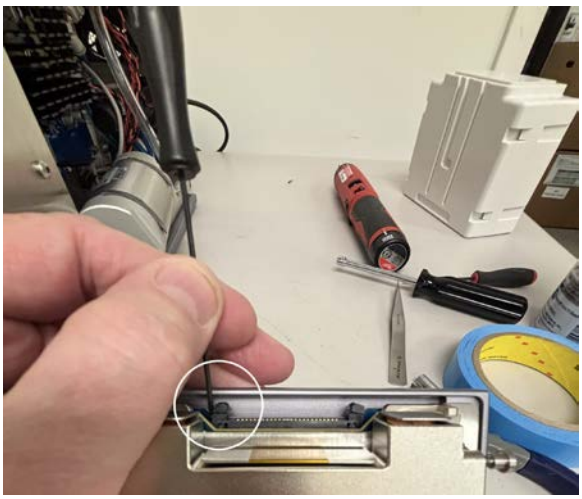

Figure 74: Closing the locks on the DAQ connector.

2. Align the slot on the DAQ connector with the slot on the back of the DAQ cable connector and press in place. Press the locking tabs in.

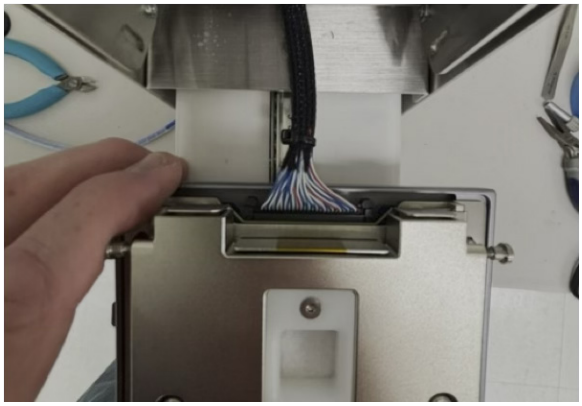

Figure 75: Aligning the slot on the DAQ connector with the slot on the back of the DAQ cable connector.

3. Hang the DAQ assembly on the top guides and lower the bottom to align with the pivot screws.

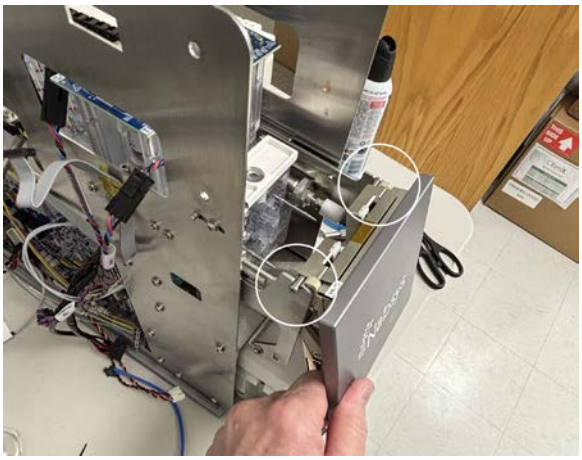

Figure 76: Hanging the DAQ assembly.

4. Install the two pivot screws [Part #, Description].

Figure 77: Installing the pivot screws.

5. Slide the Drawer into the Analyzer.
6. Attach the spring on each side of the system.
7. Install the Electrode PCB cable at the top of the Detector Manifold.

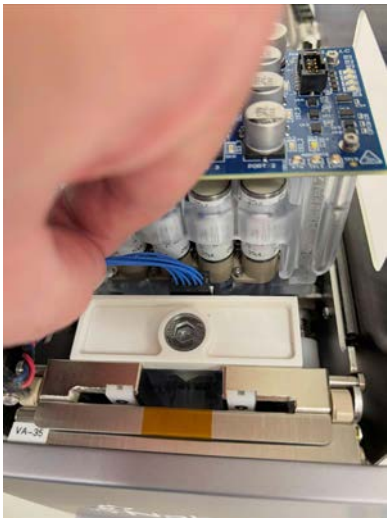

Figure 78: Installing the Electrode PCB cable.

8. Follow the instructions in **Chapter 5.11: Checking Manifold and Detector Alignment**.

5.11. Checking Manifold and Detector Alignment

1. Install a storage or used detector that does not have an attached gasket or wire shield.
2. Place a pen LED flashlight on top of the sample port to illuminate the manifold.

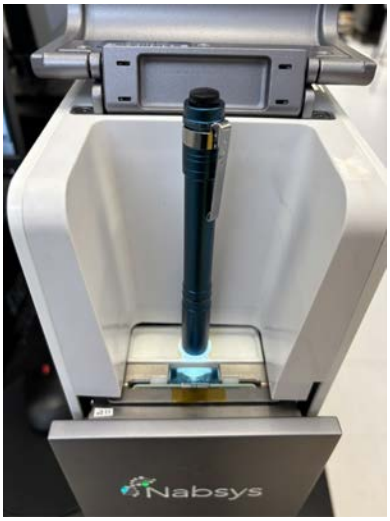

Figure 79: Pen LED flashlight illuminating the manifold.

3. Look straight down at the interface between the detector chip and the manifold and confirm that the manifold fluidic port is aligned with the detector fluid port as shown in the pictures.

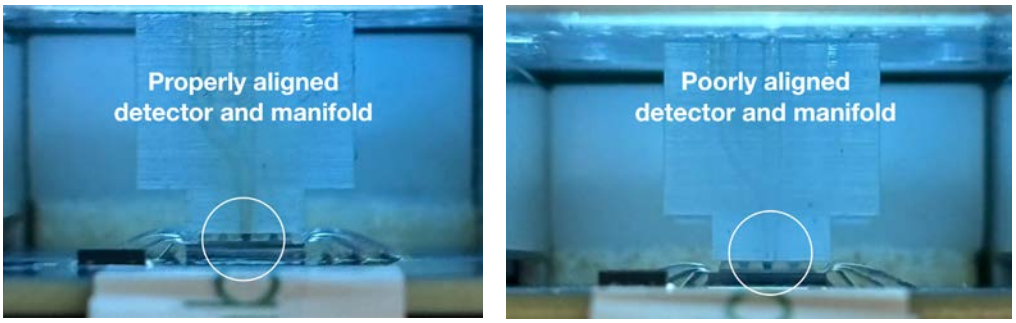

Figure 80: Examples of properly (left) and poorly (right) aligned detectors and manifolds.

   a. If the detector and manifold are properly aligned, remove the detector and install one with a gasket to prevent the manifold from drying out.
   b. If the detector and manifold are not properly aligned, proceed to **Step 4**.

4. Follow the instructions in **Chapter 5.5: Removing the Analyzer Covers**.
5. Loosen the four screws in the reagent manifold as shown.

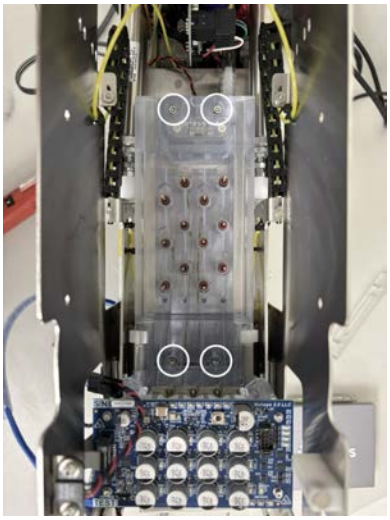

Figure 81: Reagent manifold screw locations.

6. Move the manifold (it will not move a lot) until the alignment improves.
7. Tighten the four screws and check alignment again.
8. Replace the reagent top and covers.

5.12. Replacing Waste Tube Gaskets

1. Remove, empty, rinse, and dry the waste tubes.
2. Use a small hex driver to lift the gaskets and remove.

Figure 82: Removing the waste tube gaskets.

3. Clean the tube holders with water and a paper towel.
4. Apply a thin layer of grease [Part #, Description] on both sides of each gasket [Part #, Description].

Figure 83: Greasing the waste tube gaskets.

5. Install the gaskets, taking care that the waste tubing is inside the center of the gaskets. Make sure the gaskets are flat against the tube holder.

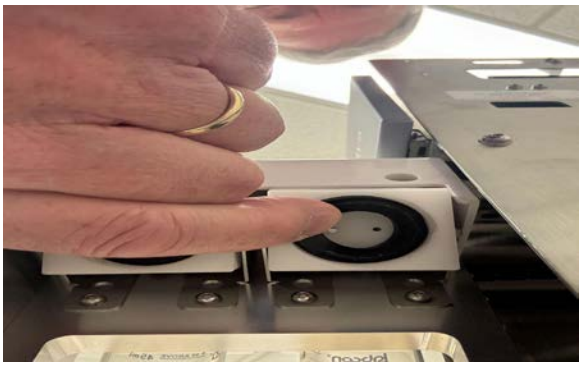

Figure 84: Installing the waste tube gaskets.

6. Install the Waste Tubes.
7. Select **Empty Waste** on the **Home** screen and confirm there are no leaks.

5.13. Remove and Install the I/O Control PCB

1. Follow **Step 1** and **Steps 3–5** in **Chapter 5.5: Removing the Analyzer Covers**.
2. Remove the left side cover.
3. Put on the anti-static strap and plug into a grounded outlet.
4. Disconnect all the connectors on the I/O Control PCB. Several have locks that need to be released.
5. Cut the tie wrap at the pressure transducer PCB and gently remove the PCB.
6. Remove the ten screws with lock washers [Part #, Description] on the PCB.
7. Gently maneuver the PCB out of the instrument.
8. Gently maneuver the replacement PCB into the instrument taking care that all of the cables and tubing are not caught behind the PCB.
9. Position the PCB so that the mounting holes line up with the threaded stand-offs and insert and tighten the ten screws [Part #, Description] and lock washers [Part #, Description].
10. Install the connectors using the figures below as a guide.

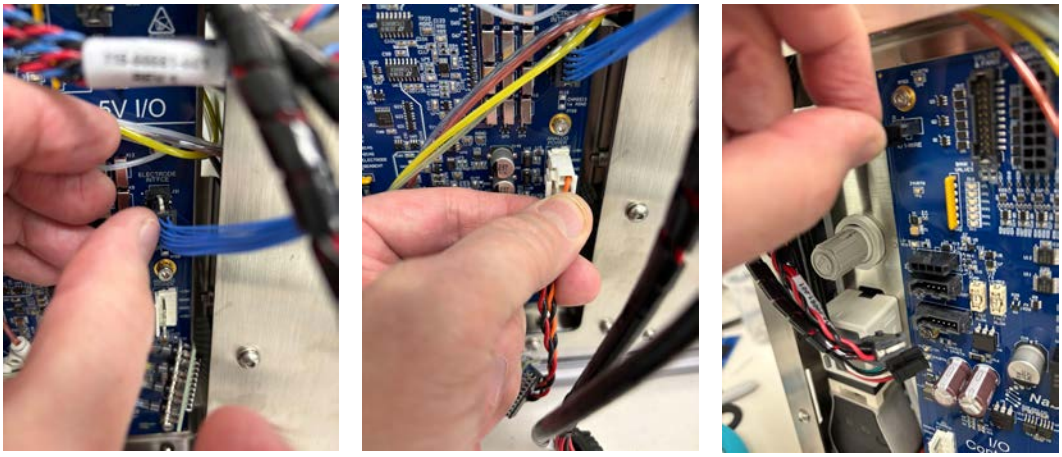

Figure 85: Installing the I/O PCB electrode connector (left), analog power connector (middle), and 1-wire connector (right).

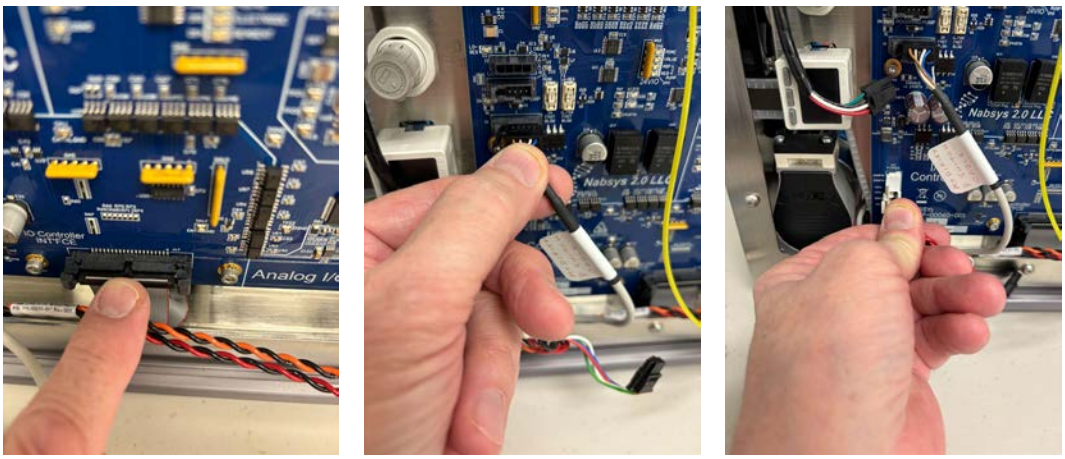

Figure 86: Installing the I/O PCB interface connector (left), PSWITCH connector (middle), and I/O power connector (right).

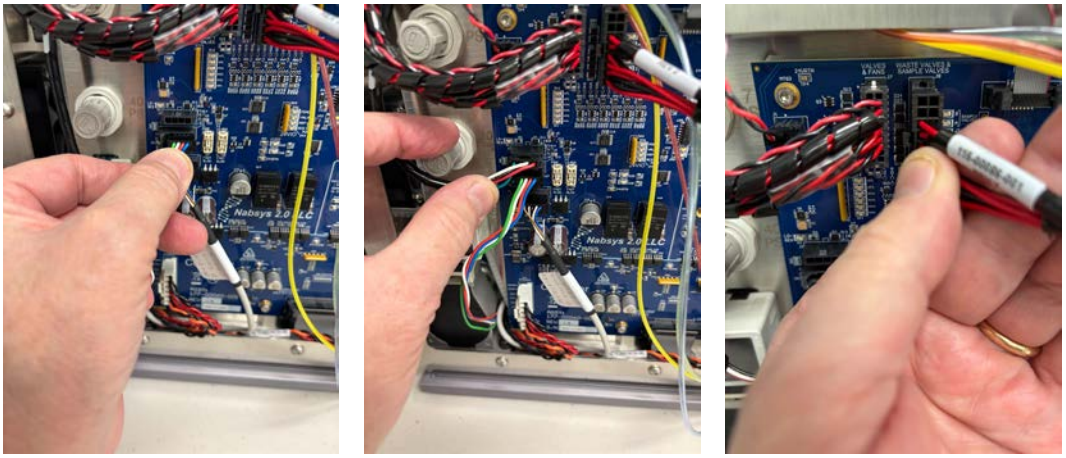

Figure 87: Installing the I/O PCB compressor connector (left), low pressure regulator connector (middle), and waste valves connector (right).

11. Carefully position the Pressure Transducer PCB making sure the two rows are aligned, and the top of the connector is aligned with the top row of pins.
12. Gently press the PCB onto the pins.
13. Bend the end of the cable tie [Part #, Description] as shown.

Figure 88: Cable tie with bent end.

14. Place the bent cable tie in between the transducers and the PCB and through the slot in the I/O Control PCB.

Figure 89: Inserting the bent cable tie in between the transducers and the PCB.

15. Push until the cable tie is visible on the right on the sheet metal.
16. Using needle nose pliers, grab the tip of the cable tie and pull it (while pushing the end of the cable tie down until it is even with the PCB).

Figure 90: Pulling the cable tie with needle nose pliers.

17. Put the tip of the cable tie into the cable tie end and tighten, making sure it is in the slot in the PCB.

Figure 91: Inserting the tip of the cable tie into the end to tighten.

5.14. Removing the sbRIO/Power PCB

1. Follow **Step 1** and **Steps 3–5** in **Chapter 5.5: Removing the Analyzer Covers**.
2. Remove the three screws in the side cover and remove the cover.
3. Put on the anti-static strap and plug into a grounded outlet.
4. Release the air storage tank using a pair of pliers to lift the locking tab.

Figure 92: Lifting the locking tab on the air storage tank straps.

5. Carefully lift the tank off the straps. There is two-sided tape that needs to be released.

Figure 93: Removing the air storage tank from the straps.

6. Disconnect all cables from the PCB including the network cable.

7. Using a 2.5 mm Allen driver, remove the four (4) screws [Part #, Description] and washers [Part #, Description] on the sbRIO heat sink and remove the heat sink.

Figure 94: sbRIO heat sink screw locations.

8. Using the 2.5 mm nut driver, remove the four heat sink standoffs.

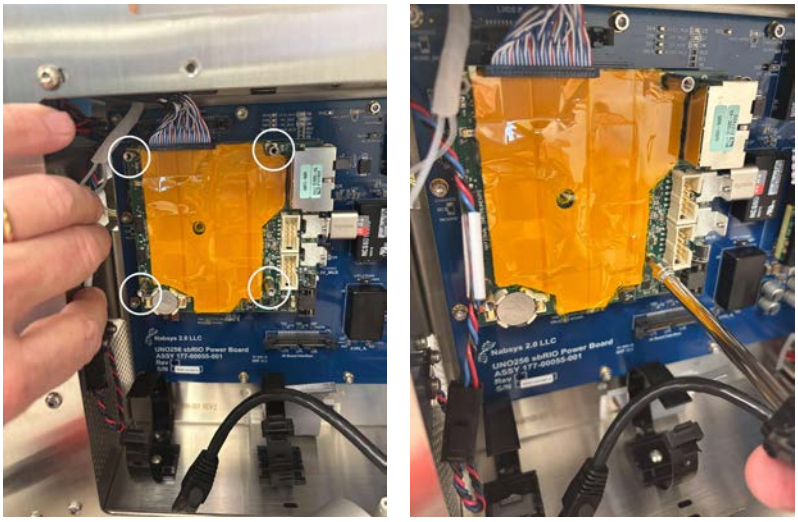

Figure 95: sbRIO heat sink standoff locations (left) and removal (right).

9. Gently pull the sbRIO PCB straight out and off of its connector.

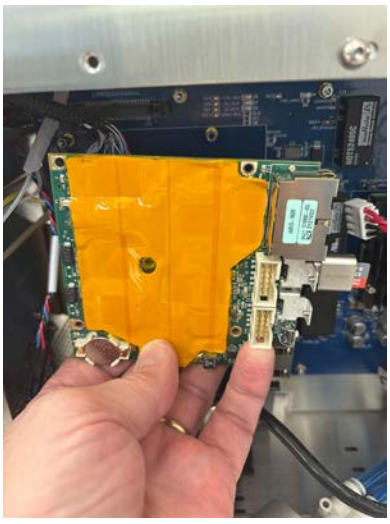

Figure 96: Removing the sbRIO.

10. Using the 2.5 mm nut driver, remove the four PCB standoffs that the sbRIO was mounted on. **Note that these are different from the heat sink standoffs.**

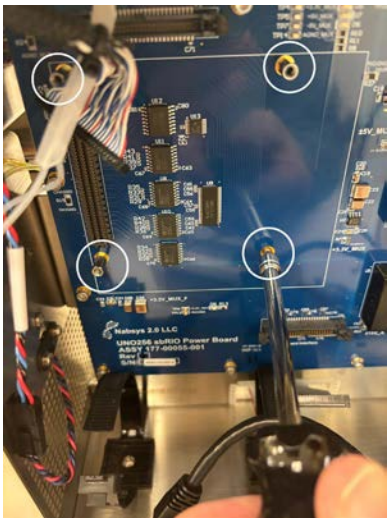

Figure 97: Removing the PCB standoffs.

11. Using a 2.5 mm Allen driver, remove the 11 screws and washers.
12. Gently remove the PCB avoiding the cables and tubing.

5.15. Installing the sbRIO/Power PCB

1. Put on the anti-static strap and plug into a grounded outlet.
2. Carefully put the PCB in place, taking care to avoid tubing and cables. Make sure no tubing or cables are behind the PCB.
3. Align the mounting holes with the standoffs in the mounting plate.
4. Using the 2.5 mm Allen driver, install the 11 screws and lockwashers.
5. Install the sbRIO standoffs (these are shorter than the heat sink standoffs) using the 2.5 mm nut driver.

Figure 98: sbRIO (top) and sbRIO heat sink (bottom) standoffs.

6. Carefully install the sbRIO PCB aligning the connector and the mounting holes. Gently press it into place against the connector.

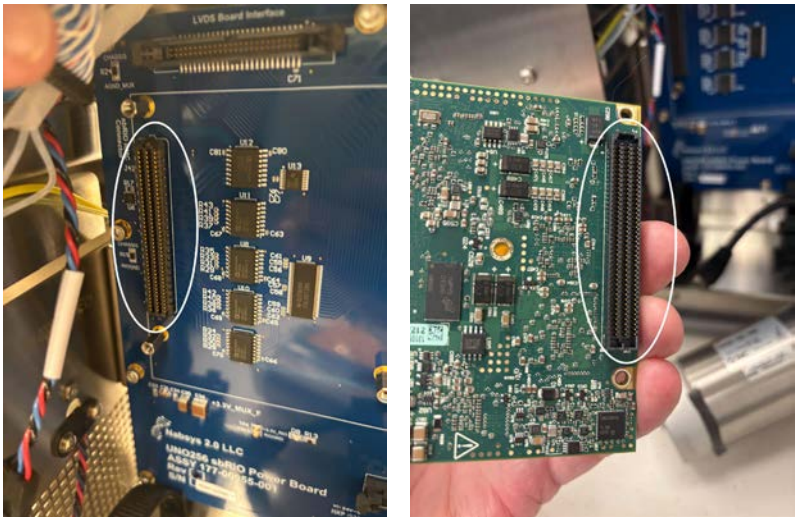

Figure 99: sbRIO connector.

7. Install the four heat sink standoffs using the 2.5 mm nut driver.

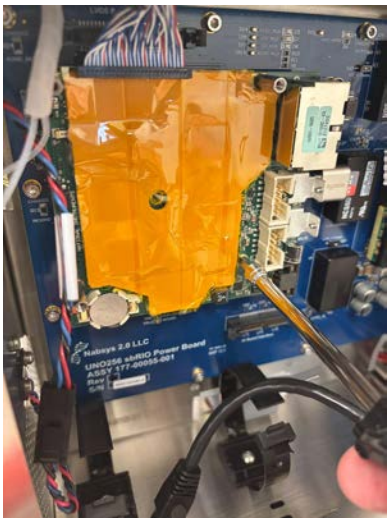

Figure 100: Installing the heat sink standoffs.

8. Install the cable at the top of the sbRIO and lock into place.

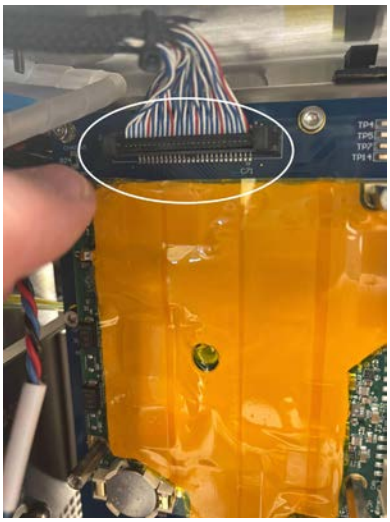

Figure 101: Connecting the LVDS connector.

9. Install the heat sink using four screws and lock washers.

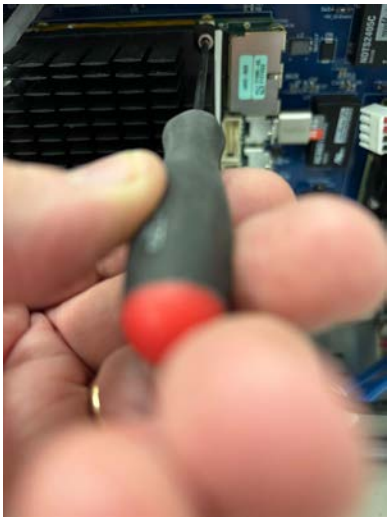

Figure 102: Installing the heat sink screws and lock washers.

10. Install the network cable in the lower connector.

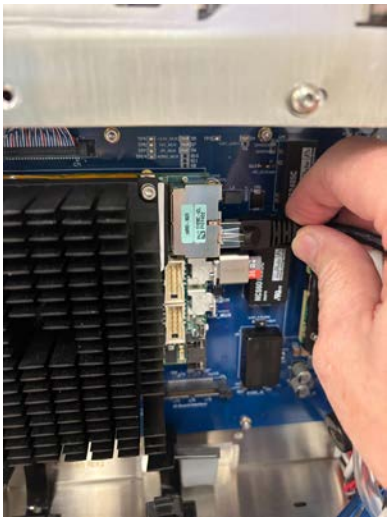

Figure 103: Installing the network cable.

11. Install the other cables.

Figure 104: Installing the I/O cable.

12. Install the air storage tank and secure it with the straps.

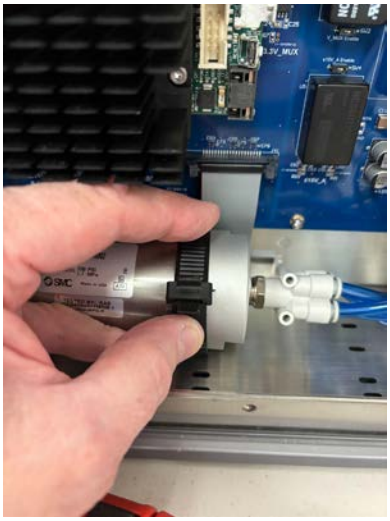

Figure 105: Installing the air storage tank.

13. Install the metal side cover.

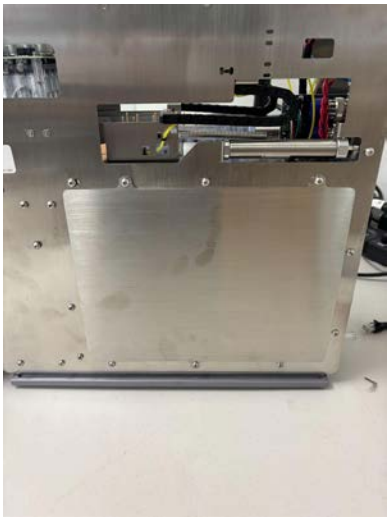

Figure 106: Installing the metal side cover.

5.16. Removing and Installing the Pump Control PCB

1. Follow the instructions in **Chapter 5.5: Removing the Analyzer Covers.**
2. Put on the anti-static strap and plug into a grounded outlet.
3. Disconnect the ribbon cable and put it on the other side of the sheet metal.

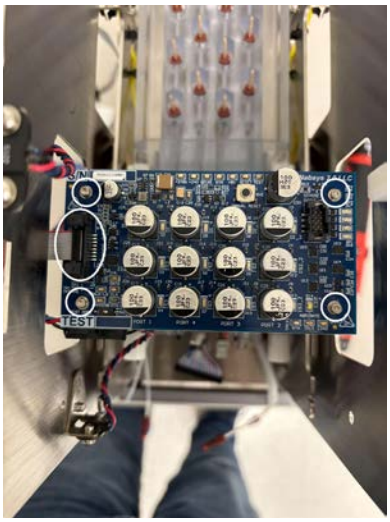

Figure 107: Pump Control PCB with locations of ribbon cable and screws highlighted.

4. Remove the four screws using a 1.5 mm Allen wrench.
5. Using two hands, gently pull up on the PCB using a slight rocking motion.

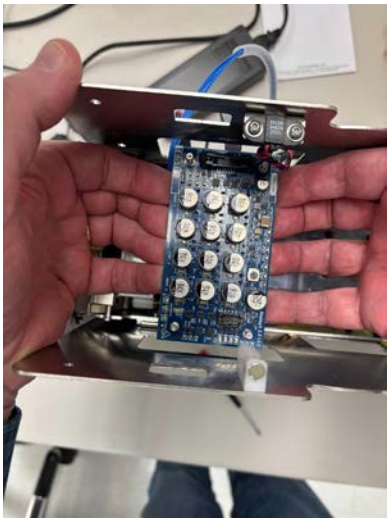

Figure 108: Lifting the Pump Control PCB.

6. Note the connections on the back of the PCB and the mounting fixture over the pumps. Align the connectors over the fixture with the ribbon connector on the left.

7. Using your hand, press evenly to seat the PCB on the mounting fixture.

Figure 109: Installing the Pump Control PCB.

8. Install the four screws [Part #, Description], lock washers [Part #, Description], and flat washers [Part #, Description].
9. Install the ribbon cable and lock.

5.17. Removing and Installing the DAQ Assembly

1. Access Manual Screen
2. Select "Access Manifold", then "Load Detector"

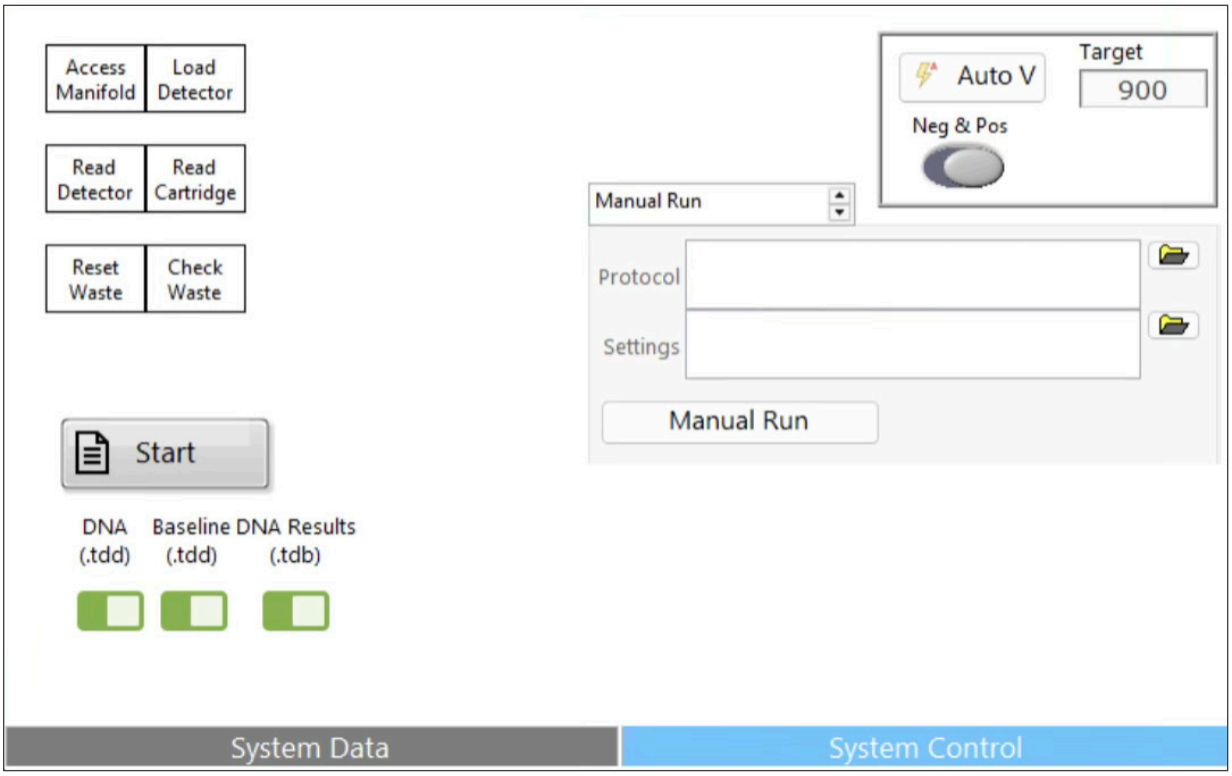

Figure 110: Manual screen showing the System Control panel.

3. Remove Detector
4. Install plastic carriage stop (delivered in DAQ assembly box)
5. Turn off "Access Manifold", then "Load Detector"
6. Shutdown OhmX software and power off OhmX Analyzer
7. Disconnect the DAQ cable

Figure 111: Disconnecting the DAQ cable.

8. Remove 2 bottom screws on DAQ assembly on OhmX Analyzer
9. Remove the DAQ assembly from the OhmX Analyzer
10. Install the DAQ cable from the new DAQ assembly
11. Position the DAQ guide pins correctly
12. Install the bottom two screens on the DAQ

Figure 112: Installing the DAQ screws.

13. Power on the OhmX Analyzer
14. Open OhmX software
15. Access the Manual screen to select “Access Manifold” & “Load Detector
16. Remove the plastic carriage stop
17. Install a storage or used detector
18. Turn off the OhmX Analyzer and Close OhmX Software
19. Turn on OhmX Analyzer and Open OhmX Software

5.18. Preparing the Analyzer for Shipment

1. Do **NOT** select **Load Cartridge** on the **Home** screen. Install a Flush Cartridge (Part #900-00057-001) and make sure a used detector or storage detector and gasket are in place.
2. Make sure waste tubes are installed.
3. On the **Maintenance** screen, select **Dry System**. Follow the system prompts and be sure to complete each step before continuing.

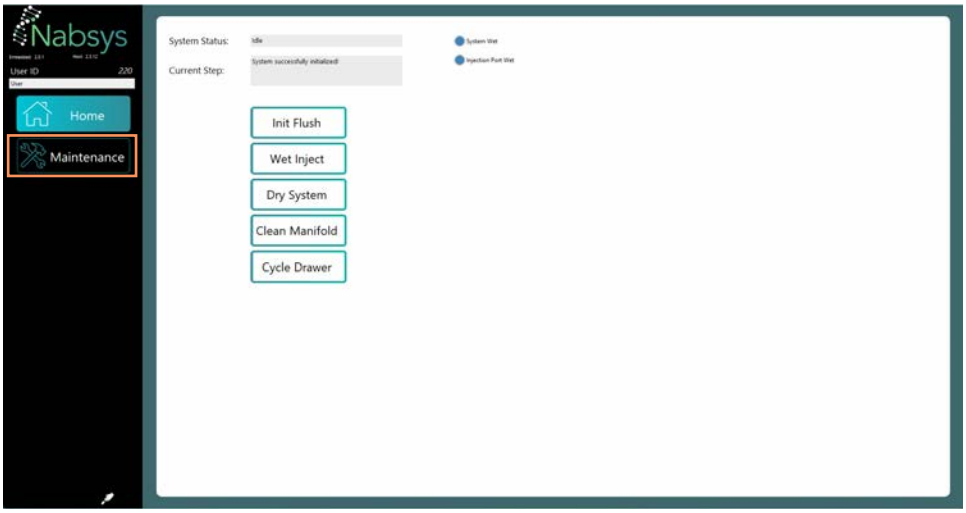

Figure 113: Maintenance screen with Dry System highlighted.

4. The system will ask about the detector and cartridge that was installed and will begin flushing the analyzer. It takes a few minutes.
5. Remove the Flush Cartridge when prompted by the protocol.
6. When the protocol is finished, empty, rinse, dry, and replace the waste tubes.
7. On the **Home** screen, select **Empty Waste**. Follow the system prompts and be sure to complete each step before continuing.
8. Select **Load Detector** and remove the detector. Do not install a detector when prompted.
9. Close the Host SW and turn the analyzer off.
10. Disconnect the network cable and power module cable.
11. Apply tape as shown in the Figure below.

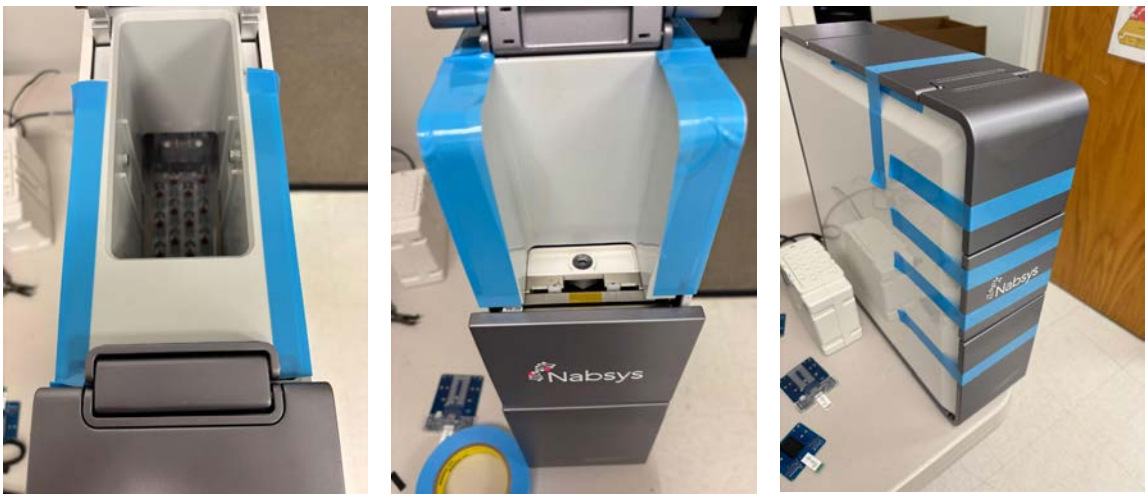

Figure 114: Applying tape to the analyzer for shipping.