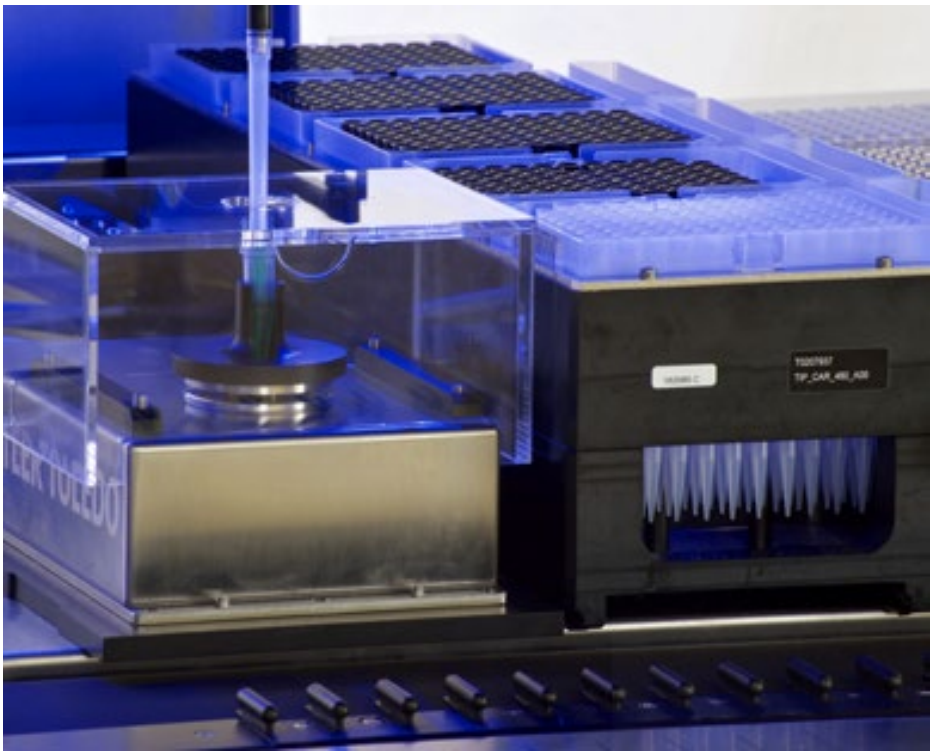
HAMILTON®

Liquid Verification Kit

User's Manual

P/N: 6605205-01, Rev. A



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1 About

1.1 About this Manual

This manual describes the components and functionality of the Hamilton Liquid Verification Kit (LVK) and will guide users in the correct and safe installation and operation of the LVK.

Revision History:

Version	Revision	Release Date	Description
01	A	12/2020	Document created

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The Microlab® STAR™, STAR^{PLUS}, STAR^{LET}, NIMBUS®, and NIMBUS HD will be referred to as STAR and NIMBUS for the remainder of this manual.

For the latest revisions of Hamilton manuals, drivers, and software, contact Hamilton support.

1.2 Intended Use of the LVK

The Hamilton Liquid Verification Kit (LVK) is a tool to help users to develop or optimize liquid classes and verify liquid transfers on Hamilton liquid handling platforms. The LVK software provides an interface to design and run custom liquid handling tests and analyze the volumes pipetted in real time for precision and accuracy. These volumes are calculated gravimetrically using information entered by the user and a Mettler Toledo High-Precision Weigh Module.

1.3 Product Identification

CE	EC Declaration of Conformity The CE marking is the manufacturer's declaration that allows sale of product in the EU that the produce meets the requirements of the applicable EC directives. It is a mandatory conformity marking for certain products sold within the European Economic Area (EEA). In the United States, electronic device manufacturers need to meet similar requirements to obtain FCC approval.
C US	Product Certification The CSA C/US mark signifies that the product is certified for both the U.S. and Canadian markets, to the applicable U.S. and Canadian standards.
25	CHINA-RoHS All Electronic Information Products (EIP). Extensive list published which includes many products not covered by EU RoHS such as radar attached to aircraft or ships, medical equipment, measurement instruments, some production equipment, batteries and most types of components. The number is the Environmentally Friendly (safe use) Period or EFUP, denoting the number of years before any substance is likely to leak out into the environment. Orange is preferred but any prominent color may be used.
	WEEE (Waste of Electrical and Electronic Equipment) This directive represents recycling, sorting and handling of product. The symbol for separated collecting of electrical and electronic equipment shows a crossed out bin on wheels.

1.4 Disposal

1.4.1 Americas/Pacific Rim

After the life cycle of the LVK has ended, disposal must be considered. The customer is responsible for proper disposal of electronic devices per local regulations.

1.4.2 European

WEEE Declaration

Recycling of LVK devices is in accordance with EC directive WEEE.

The European Community requires from manufacturers to organize the disposal and Waste of Electrical and Electronic Equipment (WEEE). For this reason, Hamilton Bonaduz AG took part in an initiative to organize the disposal of LVK products through a European disposal network called RENE. RENE is the largest recycling network for the disposal of electronic equipment in Europe.

The mission of RENE is a European-wide, WEEE-compliant, high quality recycling for electrical and electronic equipment through a dense network with both innovative and SMB-sized partner companies. As a consequence, Hamilton Bonaduz AG gets a turn-key-solution that includes all processes from treatment of incoming orders over collection, logistics and recycling down to reporting and the according management of material flows.

Hamilton offers a WEEE process in collaboration with Toolpoint and RENE AG:

- Request for the collection of the Hamilton instrument via Toolpoint Home Page (www.toolpoint.ch).
- Completion of the decontamination confirmation form
- Preparation for transport: packing
- Activation of the recycling order
- Archiving of the decontamination confirmation
- Disposal of instrument

Responsibilities	
Ordering Party	Decontamination Preparation for transport Note: The cost for decontamination and preparation for shipment is paid by the ordering party. On request, Hamilton offers to take care of that part of the recycling process.

Responsibilities	
RENE	Transport Disposal
Toolpoint	Registration Invoice the disposal to Hamilton
Hamilton Company	Organize the disposal in accordance with the WEEE directive

Recycling process

1. **Request the disposal of the instrument.** Access to the order registration is given by the Toolpoint homepage www.toolpoint.ch.

   ☒ Recycling ☒ Order registration form

2. **Complete the decontamination form.** Once the form has been completed, the request for disposal is automatically activated and transferred to Toolpoint. The confirmation of the order will be sent to the registered contact person.

3. **Decontaminate the instrument.** The ordering party is responsible for decontamination. It is mandatory to sign the decontamination form and send an electronic copy to Toolpoint. Toolpoint forwards the documentation to RENE, which is in charge with the disposal of the instrument.

4. **Pack and prepare the instrument for shipping.** Instruments with a weight of over 30 kg need to be fixed on a euro pallet. Instruments below 30 kg can be packed in a cardboard or plastic box. A signed copy of the decontamination form needs to be added to the outer part of the shipping box or instrument.

2 Safety

2.1 Safety Symbols

The general Warning symbol indicates the possibility of damaging the instrument or compromising the results of a method.

The Electrical Hazard symbol indicates the presence of electrical components that can be harmful to the operator if handled incorrectly.

The Biohazard symbol indicates the presence of biological samples that can be harmful to the operator if handled incorrectly.

2.2 Installation

WARNING: The weigh module is extremely sensitive and fragile. Use caution when handling and transporting it.

2.3 Operation

WARNING: Observe and perform the appropriate cleaning and decontamination procedures for any biohazardous samples. Wear appropriate PPE when handling the samples and the LVK's components. Any surfaces on which liquid is spilled must be wiped down and decontaminated per laboratory protocols.

WARNING: If the LVK crashes and is not recoverable, refer to section 8.3 to view the warranty. Refer to the warranty if at any time the LVK has lost accuracy.

WARNING: The user is obligated to validate all methods.

WARNING: Observe good laboratory practices (GLP) when using the LVK. Suitable protective clothing, safety glasses, and protective gloves must be worn, particularly when dealing with a malfunction of the instrument where the risk of contamination from spilled liquid exists.

2.4 Maintenance

WARNING: Do not use cleaning or disinfecting solutions which contain hypochlorite, such as bleach, on the LVK.

2.5 Programming

WARNING: Perform test runs first with tap water and then with the final liquids prior to routine use. The programmer should supervise the run.

WARNING: Before using any newly-created or modified methods for routine test purposes, they must be validated according to laboratory protocols.

2.6 Electrical

WARNING: For reasons of data security or integrity, use of an uninterrupted power supply (UPS) is recommended, since a loss of power may cause data to be lost or corrupted.

WARNING: Only Hamilton Trained Field Service Engineers may remove a mechanical or electrical component in the LVK.

3 Device Overview

The LVK comes with the following components:

- Mettler Toledo WXS Weigh Module
- Control box
- Draft shield
- Plate and tube adapters
- Carrier base
- Pedestal base
- Hygrometer
- Mettler Toledo display (optional)
- Cables
- Protective case

The LVK also comes with the LVKUI software and a method for either the STAR or NIMBUS. The methods and software are discussed in greater detail in chapter 5.

3.1 Mettler Toledo WXS Weigh Module

The LVK uses the Mettler Toledo WXS205SDU/15 Weigh Module for precise gravimetric measurement of pipetted volumes. More information for this model is available on the Mettler Toledo website.

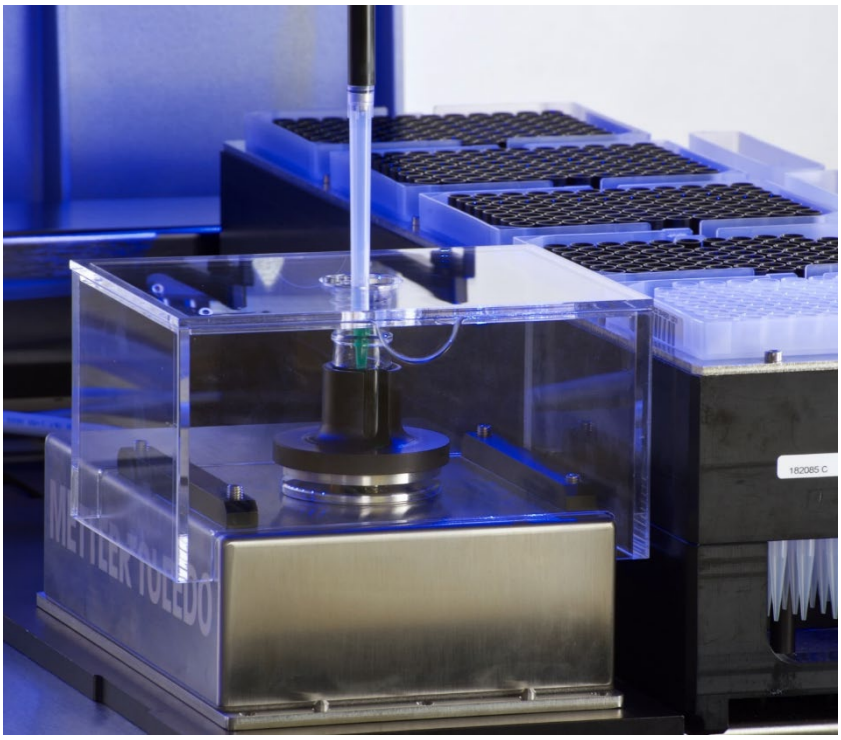

Figure 3–1: Mettler Toledo weigh module

The pedestal for the weigh module is stored separately. It must be placed on the load cell prior to use. For more information on installing the balance, refer to section 4.1.

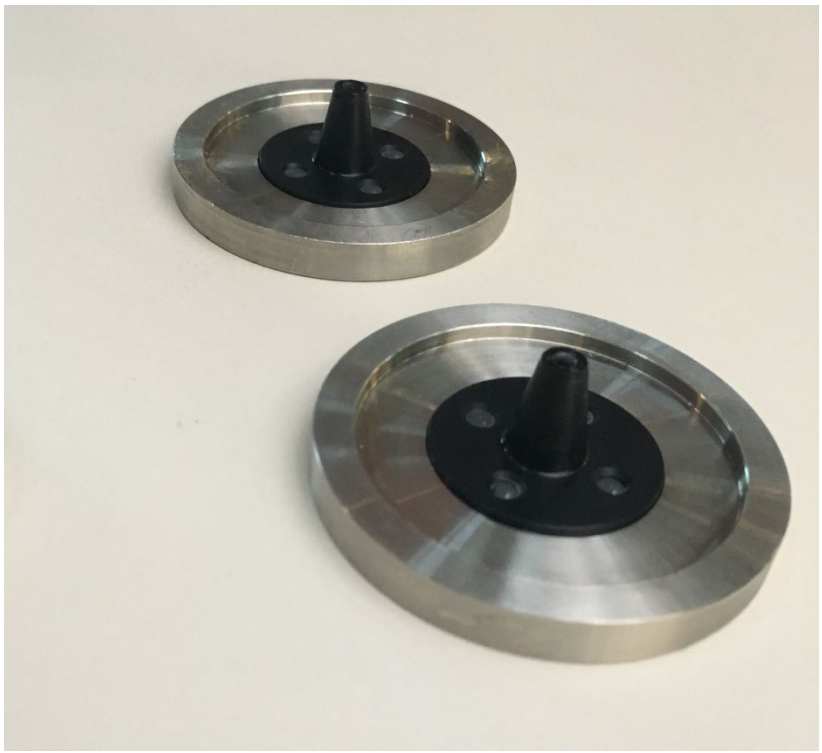

Figure 3–2: Weigh module pedestals

3.2 Control Box

The control box connects the weigh module to a power source and the controlling computer. It should be located near the LVK and out of the way of the pipetting arm.

Figure 3–3: Mettler Toledo control box

3.3 Draft Shield

The weigh module is sensitive to environmental changes and movement in its vicinity. A draft shield is placed over the balance to shield it and ensure the accuracy of its measurements. The draft shield lid is used with the tube adapters, but left off for the plate adapter.

Both parts of the draft shield are extremely fragile. Handle them with care.

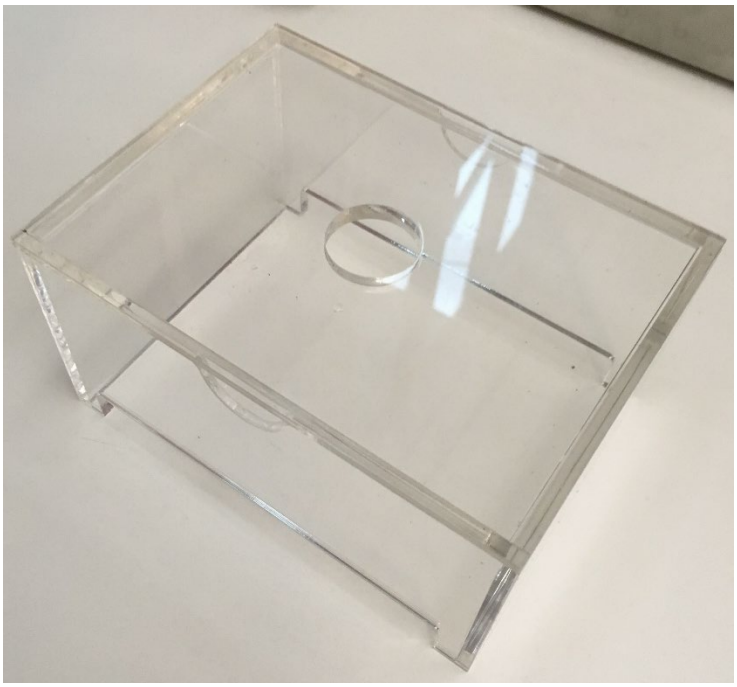

Figure 3–4: Draft shield

3.4 Plate and Tube Adapters

Adapters for the dispense labware are placed on the weigh module inside the draft shield. The following adapters are provided:

- Cryovial tube adapter (.5/2 mL)
- Eppendorf tube adapter (1.5 mL)
- Glass vial adapter (9 mL)
- Microplate adapter

Figure 3–5: Tube adapters

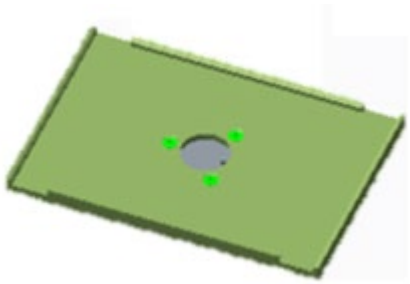

Figure 3–6: Microplate adapter

3.5 Carrier Base

For integration with STAR platforms, the LVK comes with an adapted seven-track Multiflex base. Steps for installing the LVK on the base are included in section 4.1.

Up to two Multiflex modules can also be placed on the carrier. Make sure the modules will not affect the stability of the weigh module.

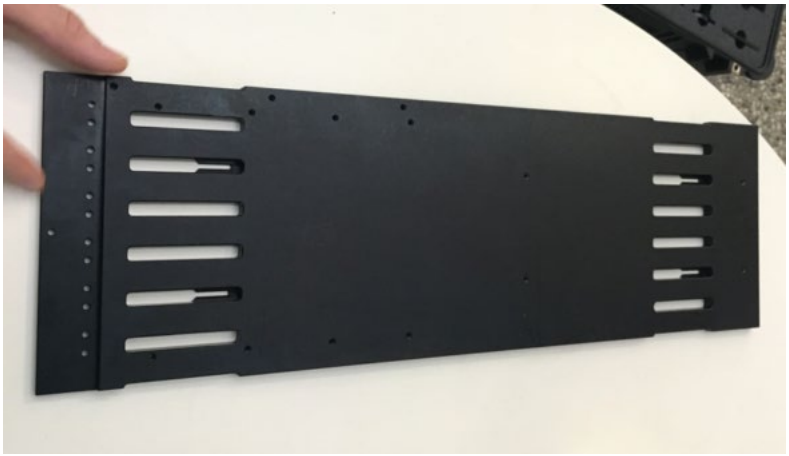

Figure 3–7: Carrier base

3.6 Pedestal Base

For integration with NIMBUS platforms, the LVK comes with a pedestal base. The base installs on the deck pins of all NIMBUS decks, including the HD deck. Steps for installing the LVK on the base are included in section 4.1.

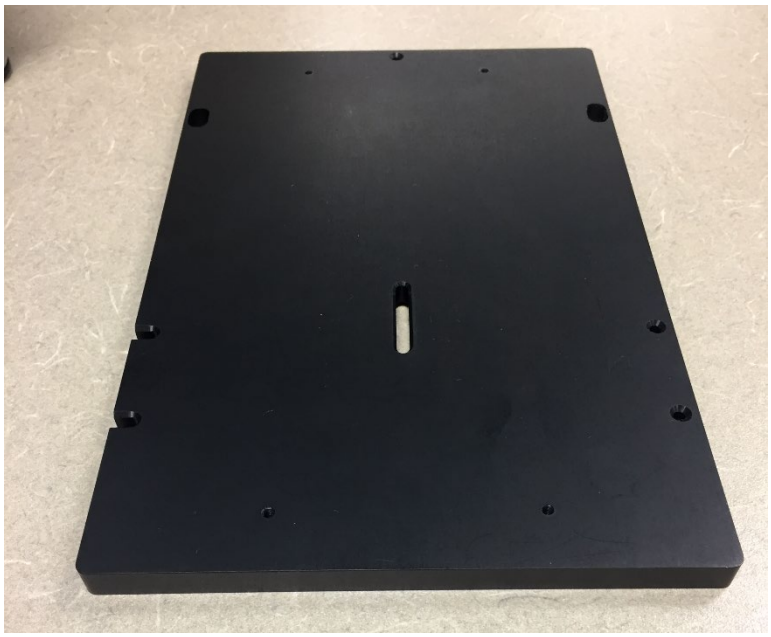

Figure 3–8: NIMBUS pedestal base

3.7 Hygrometer

The LVK uses a Testo Hygrometer to obtain ambient temperature and humidity measurements. These measurements are entered manually while creating a Test Profile in the LVK software.

Figure 3–9: Hygrometer

3.8 Mettler Toledo Display (optional)

The LVK can come with a display that connects directly to the weigh module. The display shows the weight read by the balance for additional help with calibration.

Figure 3–10: Mettler Toledo display

3.9 Cables

The LVK comes with the following cables. Refer to section 4.1 for details on connecting these cables between the LVK's components.

- AC adapter for the control box
- RS232 serial cable
- LTP cable

3.10 Protective Case

The LVK and all of its components are stored in the case shown in Figure 3–11. When the LVK is not in use, it must be stored in this case to ensure the scale warranty. Detailed instructions on storage of the LVK are given in section 6.2.

Figure 3–11: LVK Protective case

4 Installation

This chapter includes steps for installing the LVK and its software. Initial installation by a trained Hamilton service engineer is recommended, but these steps are also helpful for reintegrating the LVK after it has been stored.

4.1 Hardware Installation

The weigh module requires the following environmental conditions for safe operation:

- Temperature: 10–30°C
- Humidity: 20–80% rH

Do not remove the plastic cover from the load cell until installation is complete. Place the control box nearby, out of the way of the instrument.

1. **Place the weigh module on the appropriate adapter** for the instrument.

    - For the carrier base, place the weigh module on the pins or use the provided screws to attach the balance to the adapter. If using the screws, place them in the interior holes indicated in Figure 4–1. Make sure the cord points to the back of the instrument—otherwise, the load cell will not be in the correct position for the LVK method.

      Place the base on the desired tracks and slide it into place. Make sure to place the LVK in a position accessible by the desired pipetting device.

Figure 4–1: Placing the balance on a carrier base

- For the pedestal base, either place the weigh module on the pins or use the provided screws to connect the balance to the adapter.

  Place the pedestal on the desired deck position. Some integration positions for a 9+2 deck are shown in Figure 4–2. Make sure the position of the LVK is updated in the deck layout file per the steps in section 4.4.1.

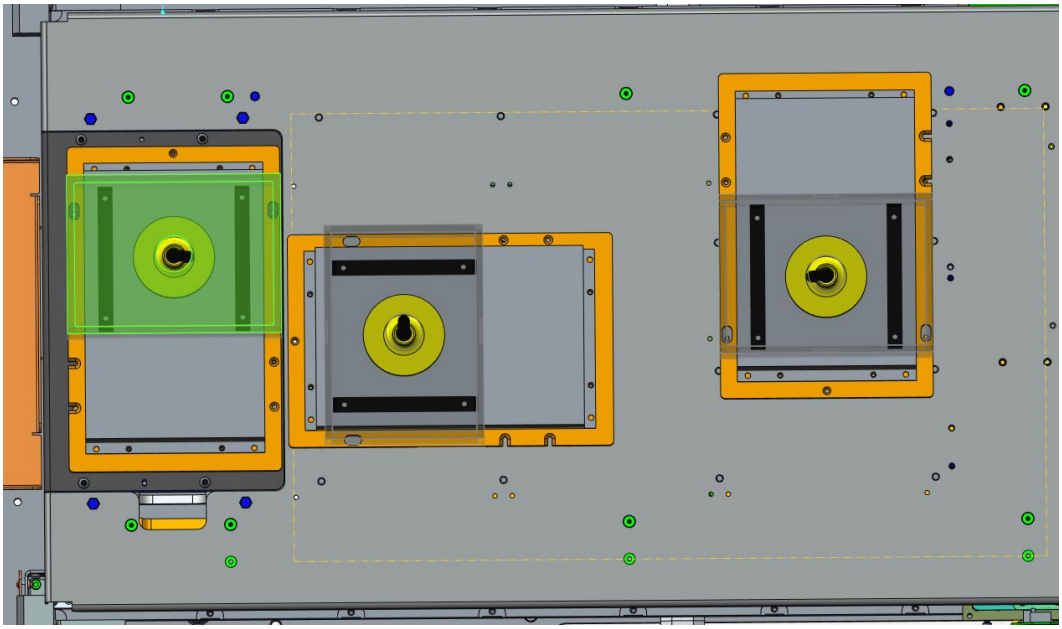

Figure 4–2: NIMBUS 9+2 deck integration positions

2. **Connect the following cables** between the balance, control box, and the controlling computer. Make sure the cables are routed to avoid obstructing any moving parts, namely the pipetting arm.

WARNING: Do not connect the LVK or control box directly to the instrument.

   a. **Connect the LTP cable** from the "for connection to balance only" port on the control box to the balance.

   b. **Connect the RS232 cable** from the RS232C port on the control box to a COM port on the controlling computer. Using a serial-USB converter is not recommended.

      Take note of which COM port the control box is connected to, as this information is required for editing the LVK method. For PCs with a single serial port on the main board, this is usually COM1.

Figure 4–3: Viewing the ports on the control box

3. **Connect the AC adapter** from the Power Supply port on the control box to an AC outlet. Compare the control box to the one shown in Figure 4–4 before continuing.

WARNING: The balance does not have a power switch—connecting the balance to the power supply activates the balance.

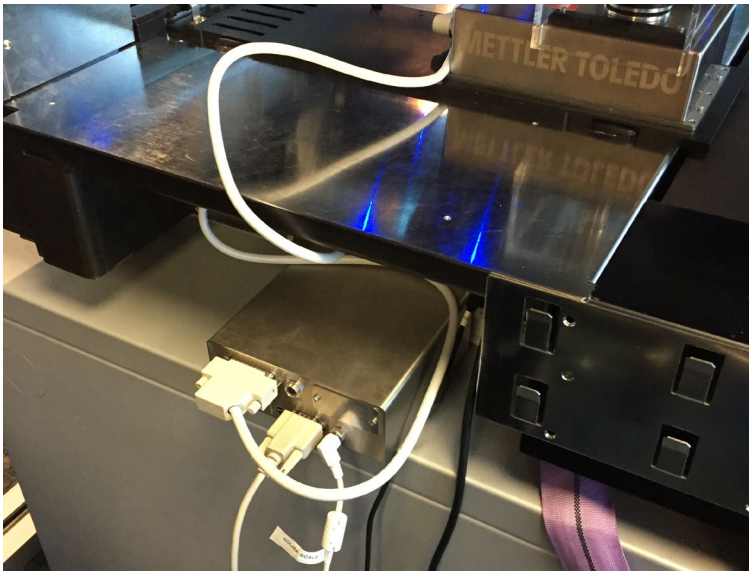

Figure 4–4: Connecting to the control box

4. **Let the instrument sit for 60 minutes.** The weigh module requires an hour to acclimate to the lab environment after it is connected to a power source.

4.2 Software Installation

4.2.1 Computer Requirements

VENUS 2 (Vector version 4.3.5) or later must be installed before installing the LVK software and methods. Refer to section 8.2.3 for details on finding the software version. If

VENUS 2 is installed and there is adequate storage available on the computer, then the LVK software and methods should also install successfully.

A PDF viewer and an Excel viewer are recommended for reviewing the results files.

4.2.2 Running the Installer

1. **Insert the installation media.**
2. **Open the installation media folder and run LVK Setup.exe.** The InstallShield Wizard appears.

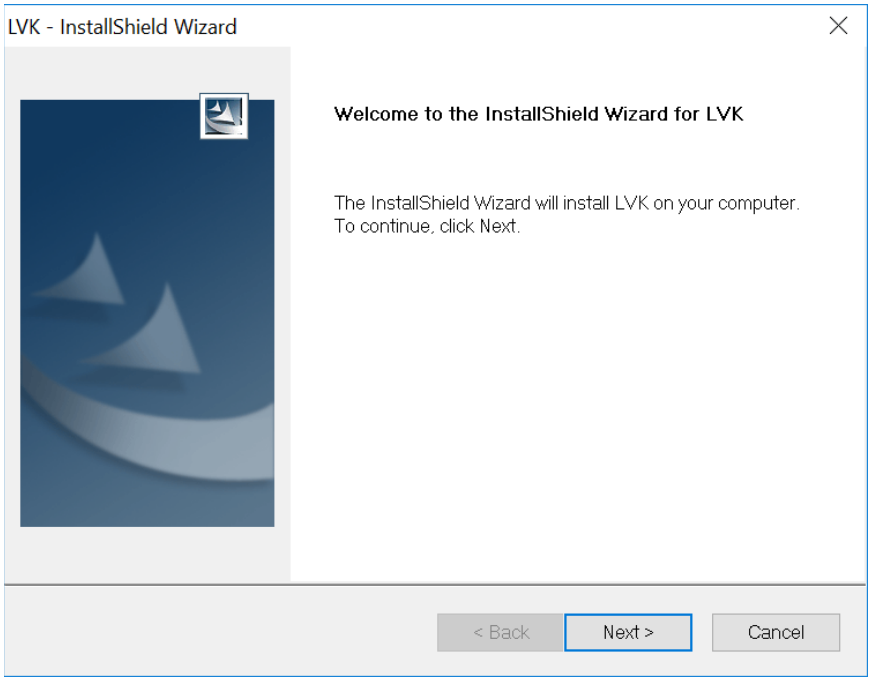

Figure 4–5: Viewing the LVK welcome dialog

3. **Click the Next button.** The Ready to Install the Program dialog appears.

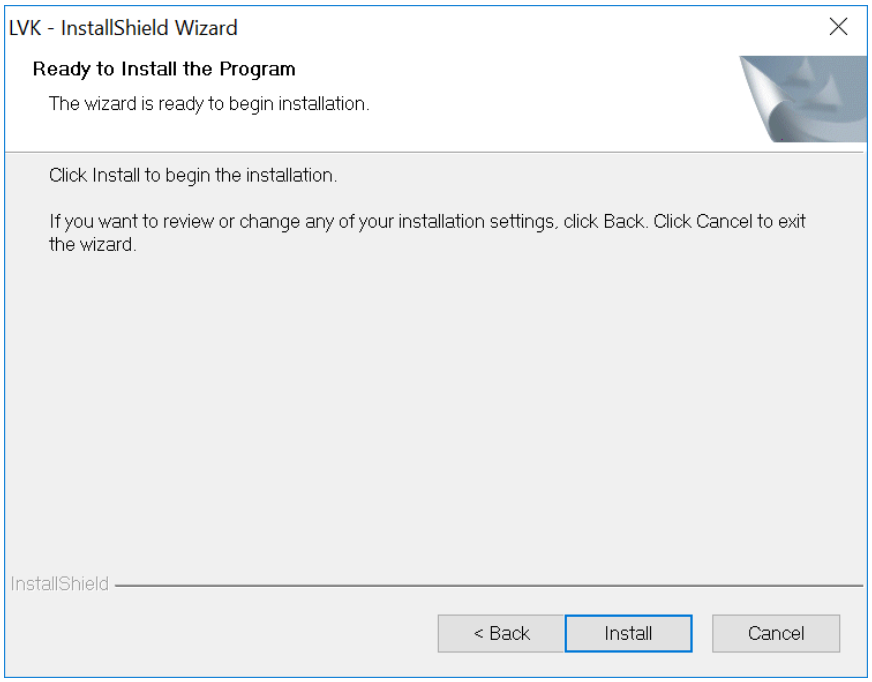

Figure 4–6: Confirming installation

4. **Click the Install button** to begin the installation process.
5. **A progress bar shows the status of the installation.**

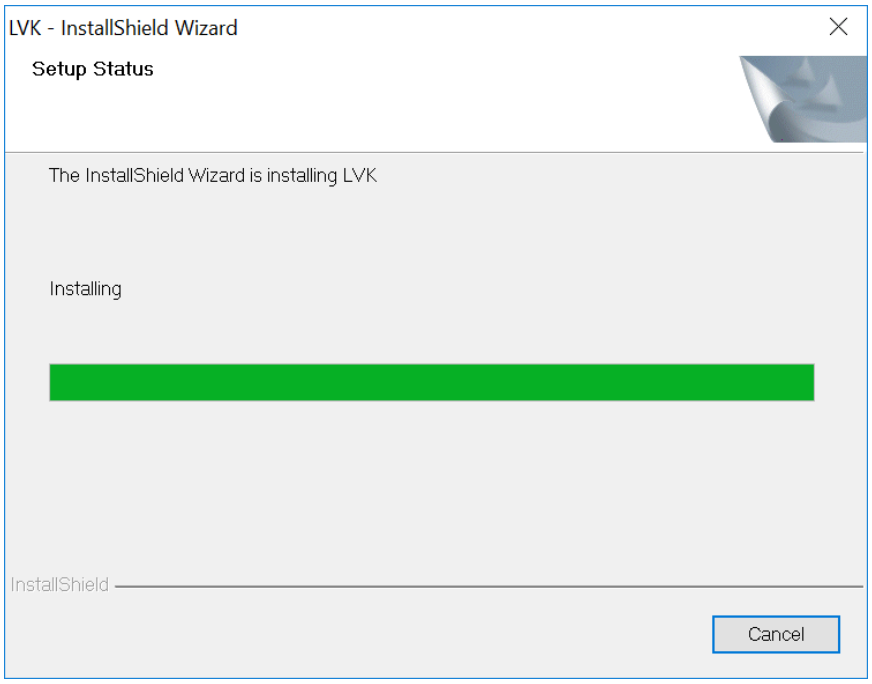

Figure 4–7: Viewing the installation progress bar

6. **When the InstallShield Wizard is complete, click the Finish button.**

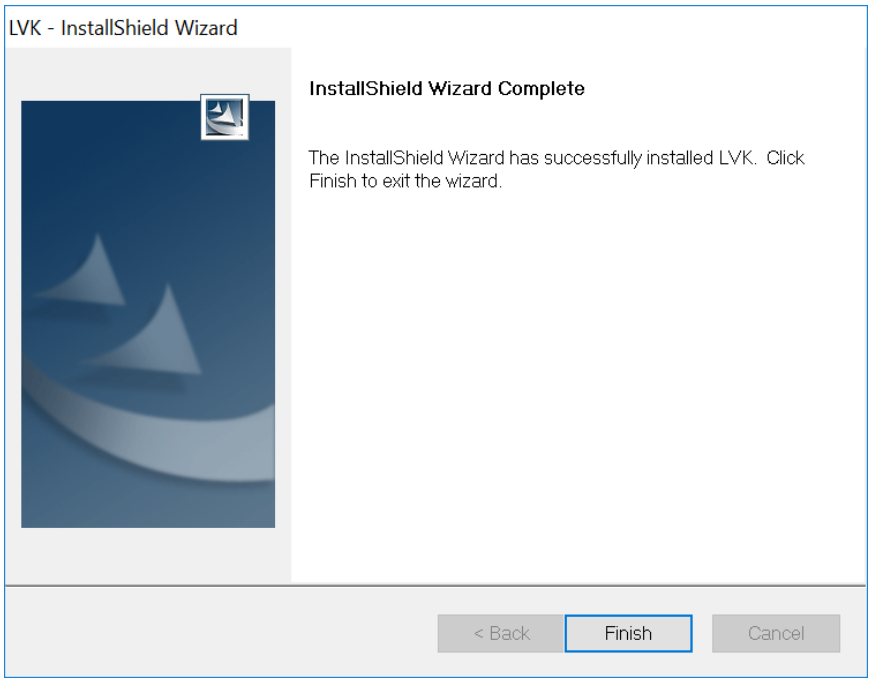

Figure 4–8: Completing the LVKUI installation

4.2.3 APW-Link Installation

Mettler's APW-Link software is useful for troubleshooting and configuring the weigh module. The software can be downloaded from the Mettler Toledo website. Make sure the weigh module is connected to the controlling computer via the control box before running the software.

1. **Open the installation media folder and run the installer.** The APW-Link Setup Wizard appears.

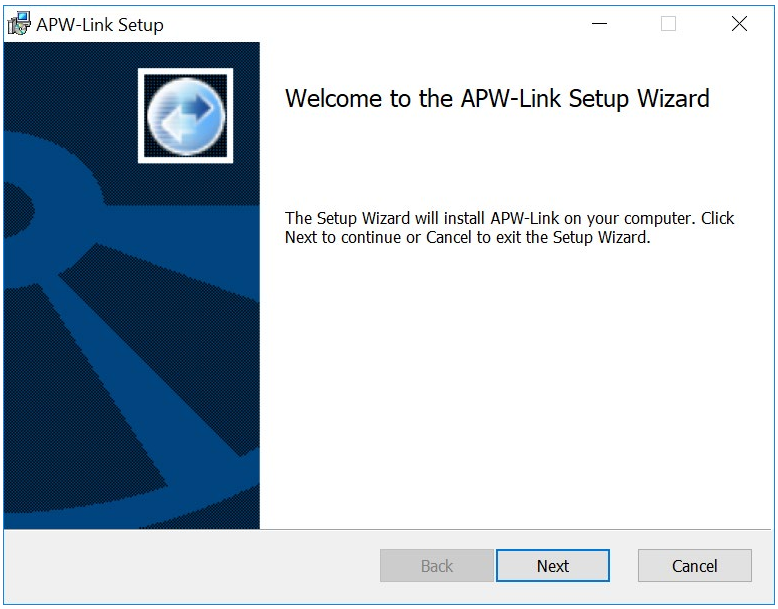

Figure 4–9: Viewing the APW-Link welcome dialog

2. **Click the Next button.** The License Agreement dialog appears.

Figure 4–10: Accepting the APW-Link License Agreement

3. **Check the box and click the Next button.** The Destination Folder dialog appears.

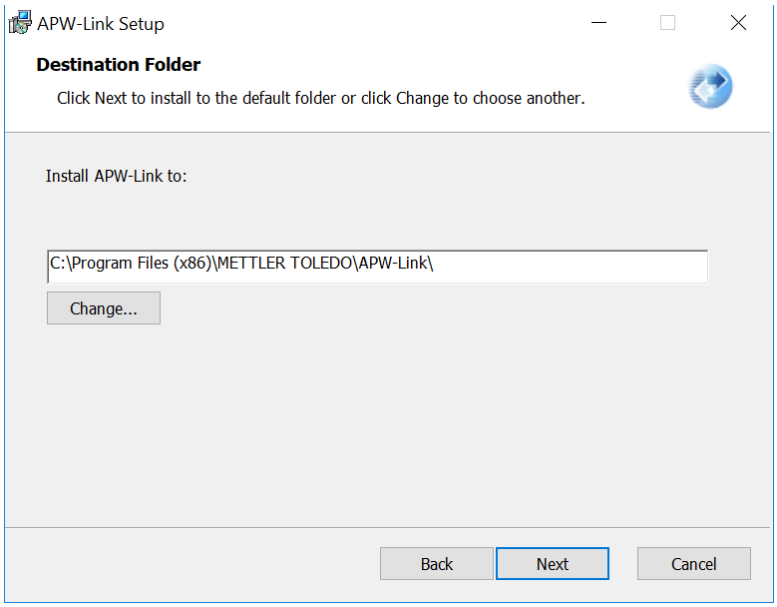

Figure 4–11: Choosing where to install APW-Link files

4. **Choose where the program files will be stored.** The default is C:\Program Files (x86)\METTLER TOLEDO\APW-Link\. To change the folder location, click the Change… button and select a new folder.
5. **Click the Next button.** The "Ready to install APW-Link" dialog appears.

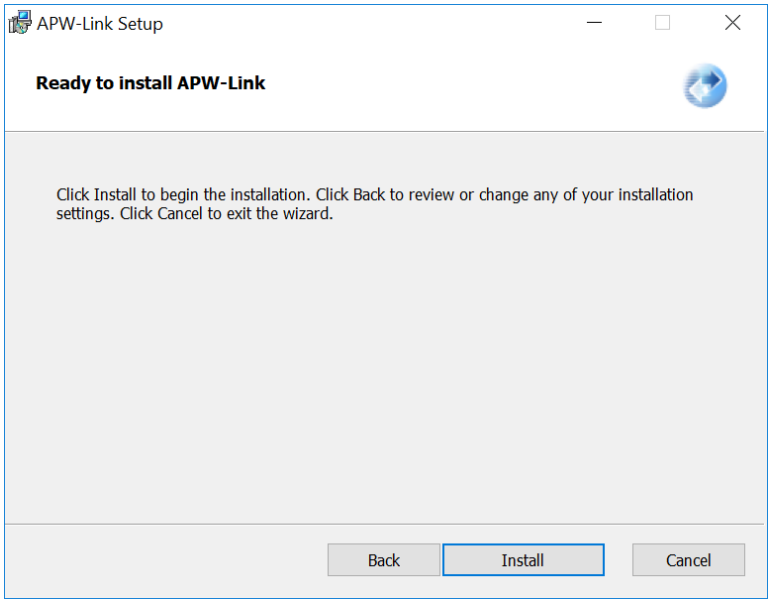

Figure 4–12: Confirming installation

6. **Click the Install button** to begin the installation process.
7. **When the APW-Link Setup Wizard is complete, click the Finish button.**

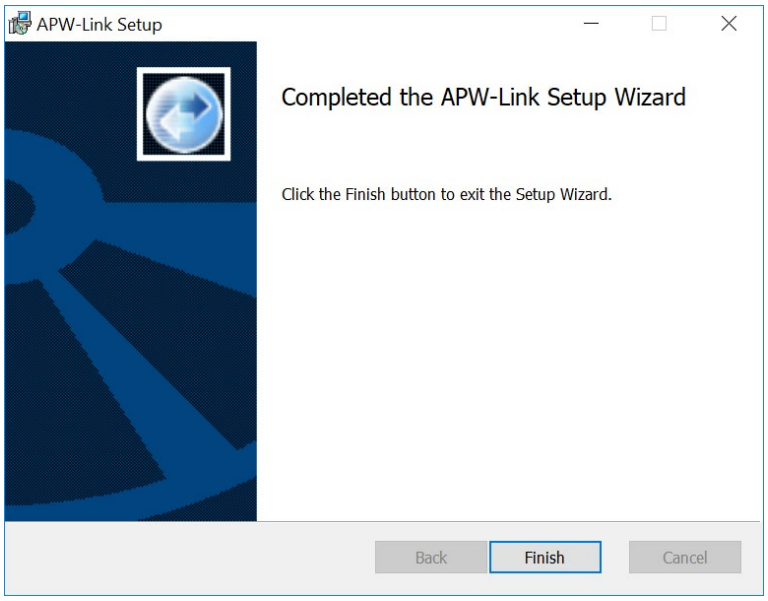

Figure 4–13: Finishing the APW-Link installation

4.3 Weigh Module Configuration

Before the LVK can be used, the weigh module must be configured using the APW-Link software. This process begins immediately upon installing APW-Link. The optional Mettler Toledo display may also be used to configure the weigh module.

1. **When the Port Configuration dialog opens, select Receive Configuration File.** Make sure the "Launch Wizard at startup" box is checked and click Next.

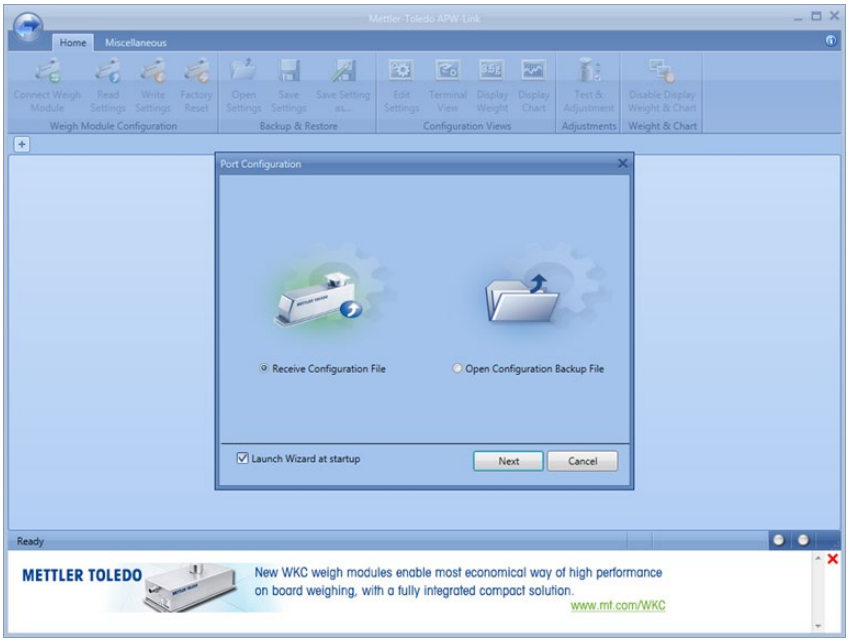

Figure 4–14: Configuring the weigh module

2. **Select COM for the connection type and Auto for the Detection Type.** Click Next and confirm the COM port that the balance is connected to.

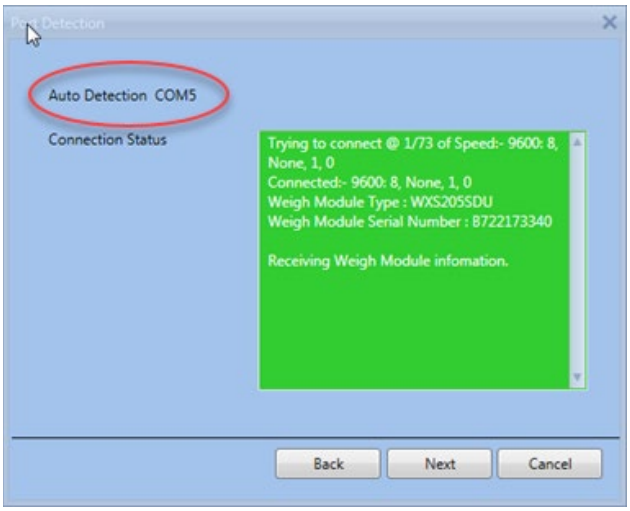

Figure 4–15: Confirming the COM port connection

3. **For the best results, perform an internal calibration by opening the Tests and Calibrations tab of the wizard.** Click Test and Adjustments in the Home tab, then select the Test and Internal radio buttons in the window that opens. Make sure the pedestal is on the weigh module before starting the calibration.

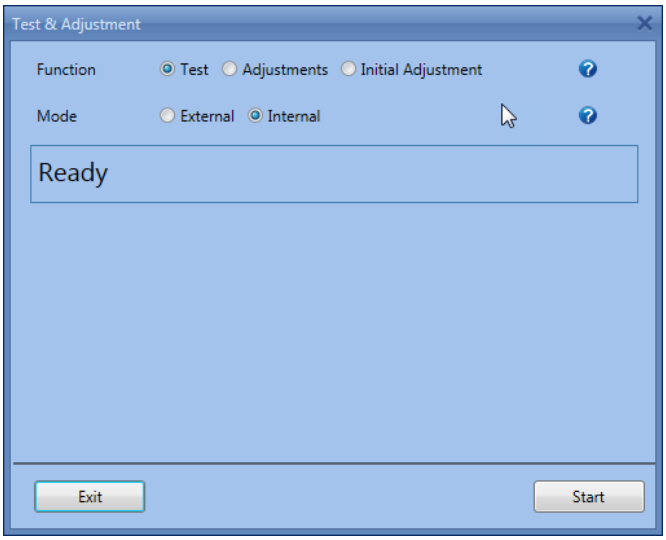

Figure 4–16: Performing an internal calibration

4. **If volatile liquids will be used with the LVK, change the stability settings for the weigh module.** In the Weighing tab of the Edit Settings panel, change the Environment

to Unstable. Click Write Settings under the Home tab to save changes to the weigh module.

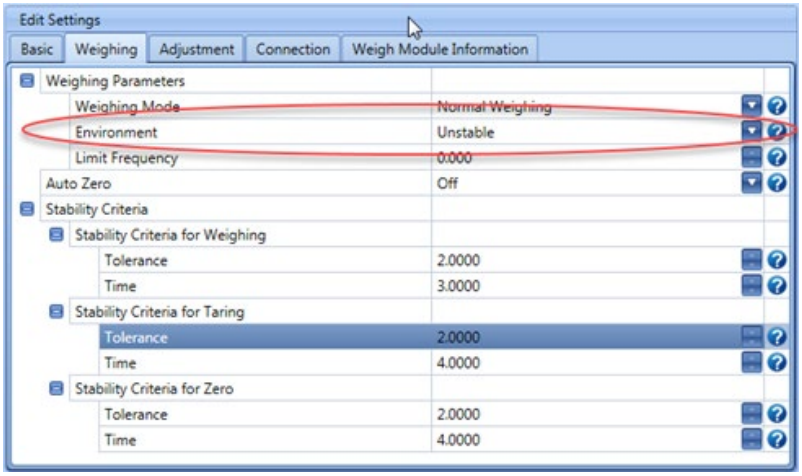

Figure 4–17: Configuring the weigh module for volatile liquids

5. **If small volumes (1-10 µL) will be tested, change the significant digits used for the weigh module.** In the Basic tab of the Edit Settings panel, change the Readability setting to weigh more significant digits – "1d" means more significant figures, while "1/10d" means fewer. Click Write Settings under the Home tab to save changes to the weigh module.

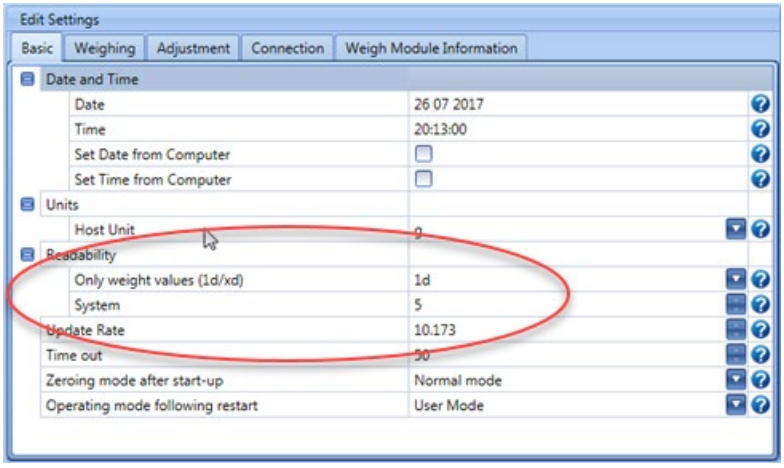

Figure 4–18: Changing the readability of the weigh module

4.4 Editing the LVK Method

The LVK method and deck layout will need to be edited depending on factors like the deck layout. Additional adjustments for taring and using timers are also detailed in this section.

4.4.1 Required Changes

The default LVK deck layout and tip sequences must be edited to reflect the instrument that is being used with the LVK. Each instrument type (STAR, STARlet, NIMBUS, and so on) has its own deck layout. The default labware on deck can be changed and relocated as necessary.

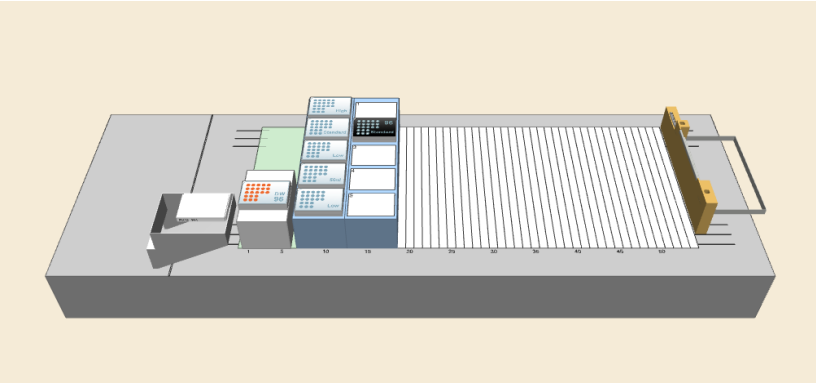

Figure 4–19: Viewing the default STAR deck layout

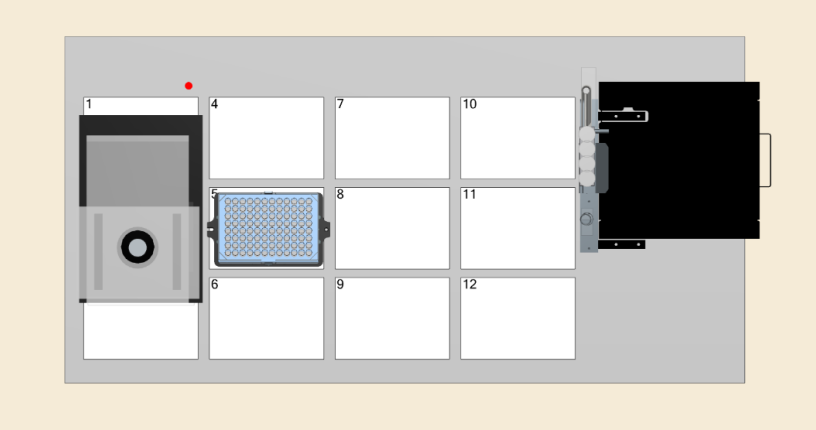

Figure 4–20: Viewing the default NIMBUS 3x4 deck layout

1. **Open the Hamilton Method Editor**.
2. **Navigate to File > Open and open the deck layout** for the instrument the LVK is installed on. The deck layouts are located in C:\Program Files\Hamilton\Methods\LVK.
3. **Change the position of the LVK and tip carriers/pedestals as necessary.** There should be at least one tip carrier/pedestal on the deck with adequate tips for the run. Make sure the tip type matches the tips on the deck. For new tip types, add labware to the appropriate carrier. A tip installer may need to be run to install tip definitions and new Liquid Classes.

   Keep in mind that if a 96 MPH will be used, a tip adapter must be used with the tip racks to pick up a single tip with channel H12. Do not place tips on the rearmost site of a tip carrier or the NIMBUS deck when using the 96 MPH with the LVK.

4. **Save the deck layout when finished**.
5. **Open the LVK method corresponding to the deck layout.** The methods are located in the same folder as the deck layouts.
6. **Go to the "A_Setup_TipSequences" submethod and update the source sequences in the SeqCopySequence steps** with the tips that were added or changed in the deck layout. Any steps for tip types that will not be used can be disabled.

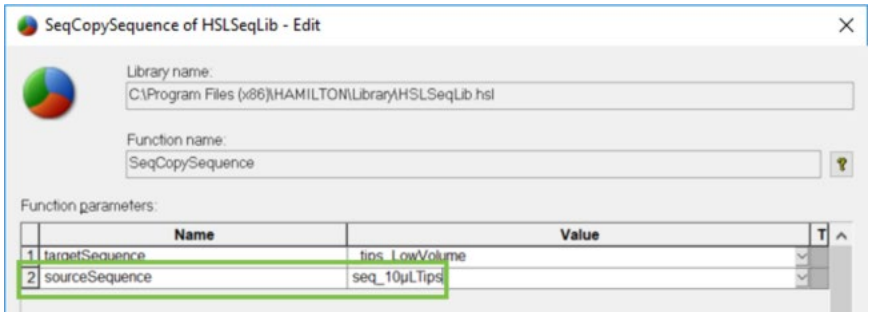

Figure 4–21: Updating the tip sequences

4.4.2 Optional Changes

4.4.2.1 Taring Between Measurements

By default, the LVK method is set to zero the weigh module, dispense the liquid, and report the weight for each measurement. The method can be changed to zero only at the beginning of the method and tare between measurements instead. This change can prevent the method from aborting inadvertently.

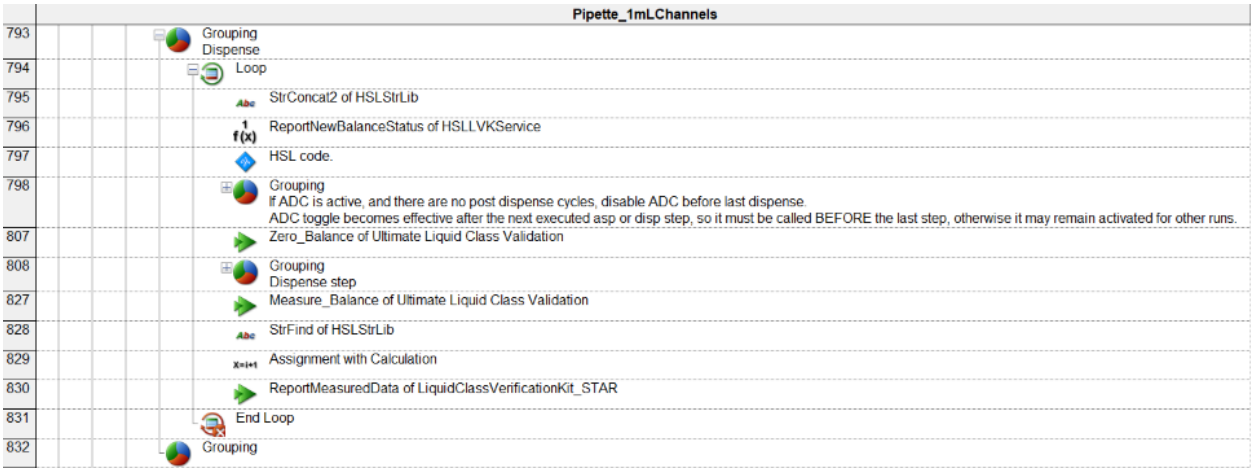

Figure 4–22: Viewing default commands in the LVK method

According to the Mettler Toledo good weighing practice brochure, it is best to zero and then tare the weigh module between measurements. The tare must never go below the set zero when weighing or taring. Anything tared with a weight below the zero will produce an error and abort the run. The solution is to zero the scale before placing the labware adapters on the weigh module.

1. **Open the main LVK method.**

2. **From the Hamilton Mettler Toledo WXS category of the Toolbox, add a METTLER_WXS::SetZero command.** Place the command between the Comment in line 9 and the If, Else statement beginning in line 10, as in Figure 4–23.

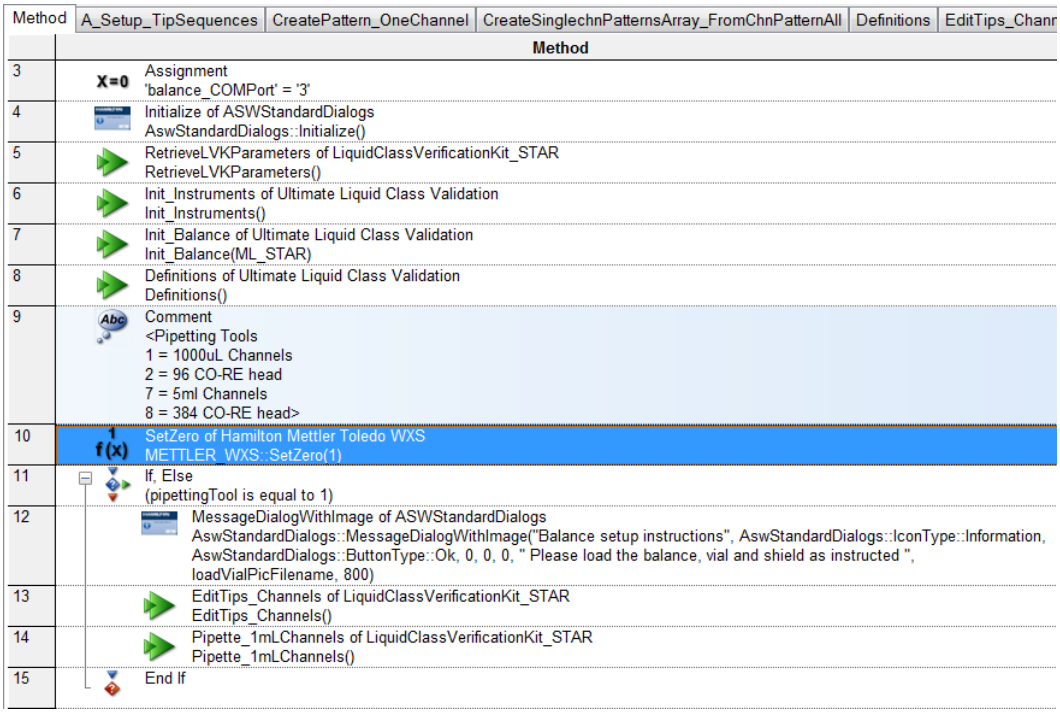

Figure 4–23: Adding the SetZero command

3. **In the SetZero dialog, select "bInSuccess" from the "Bind return value to:" drop-down menu and set the Value for the "i_bInZeroImmidiatly" parameter to 1.**

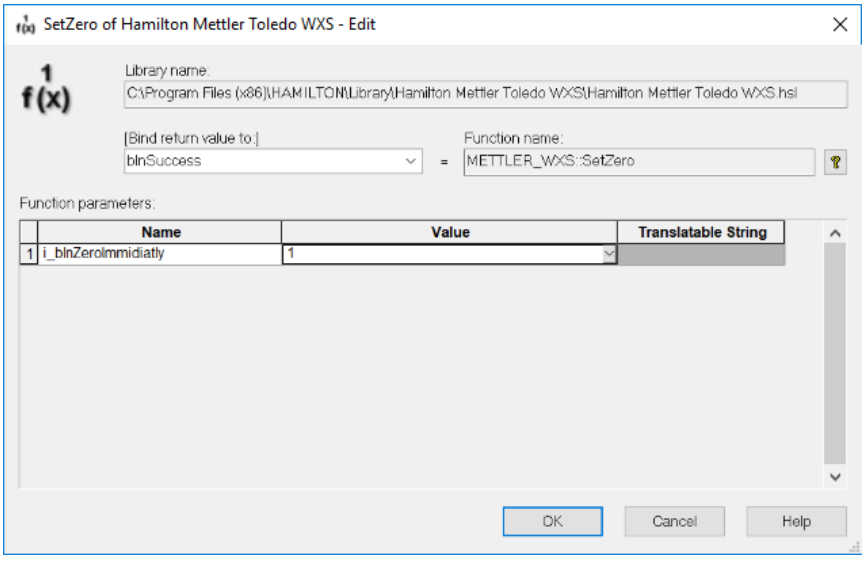

Figure 4–24: Configuring the SetZero command

4. **Open the Zero_Balance submethod.**

5. **Delete the METTLER_WXS::SetZero commands before the Tare commands in the submethod.** The SetZero commands can also be disabled instead of deleted, as in Figure 4–25.

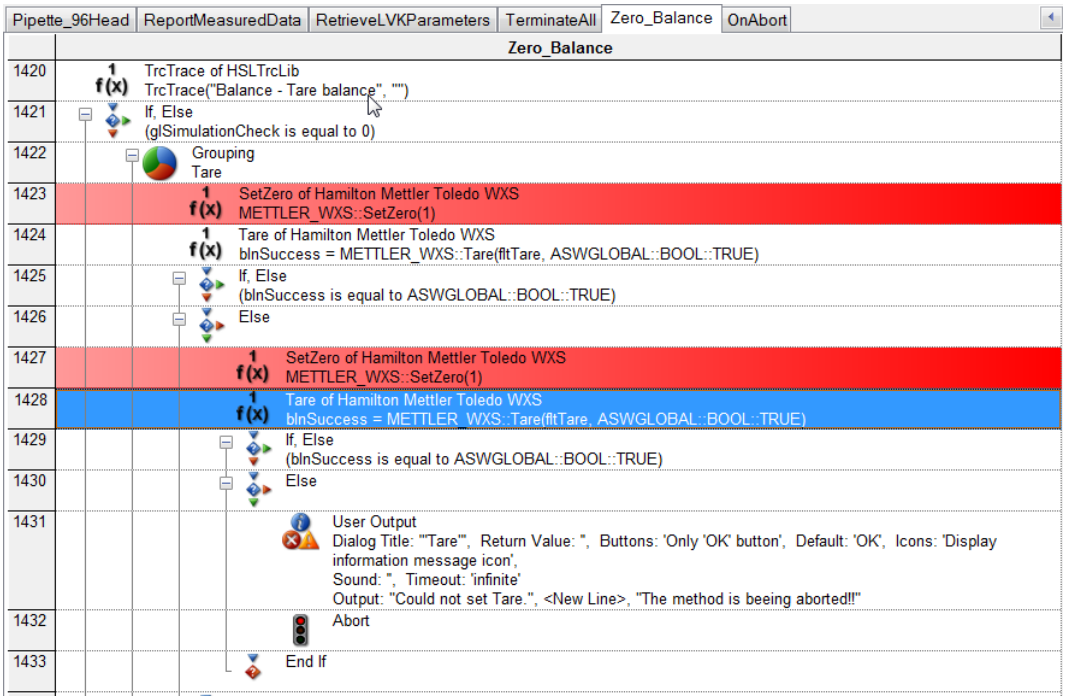

Figure 4–25: Replacing Zero with Tare

6. **If the Tare commands need to be configured, input the following values:**

    a. Bind return value to: blnSuccess

    b. o_fltTare: fltTare

    c. i_blnTareImmidiately: ASWGLOBAL::BOOL::TRUE

    Setting the Tare command to TRUE will wait until the scale reports a stable weight. If the environment is unstable, this setting can lead to long wait times or the method to abort if the timeout is reached.

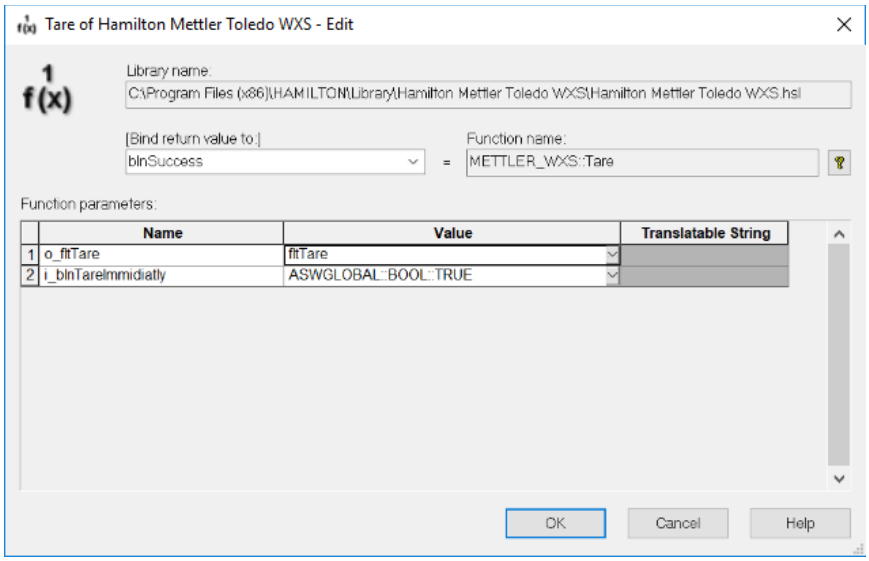

Figure 4–26: Configuring the Tare command

7. **Save the method.**

If the method is restarted or the aborted, the tube adapter must be taken off of the scale, since the scale will need to be set to zero every time a method is aborted. Alternatively, after running the LVK method once, open the method and disable the zero command before starting the method again.

4.4.2.2 Waiting before Dispensing

Movement around the weigh module can affect its measurements due to its sensitivity. To ensure the highest degree of accuracy, a timer step can be added before zeroing, measuring, and dispensing to wait for the balance to settle after the pipetting arm stops moving.

1. **Open the submethod for the desired pipetting device in the LVK method.** Figure 4–29 shows the submethod for the 1000 µL channels as an example.
2. **From the General Steps category of the Toolbox, add a Timer: Start command before the Zero_Balance, Measure_Balance, and ReportMeasureData submethods are called.** In the Timer dialog, select the Relative time radio button and enter 3 seconds for the time. The default timer handle does not need to be changed.

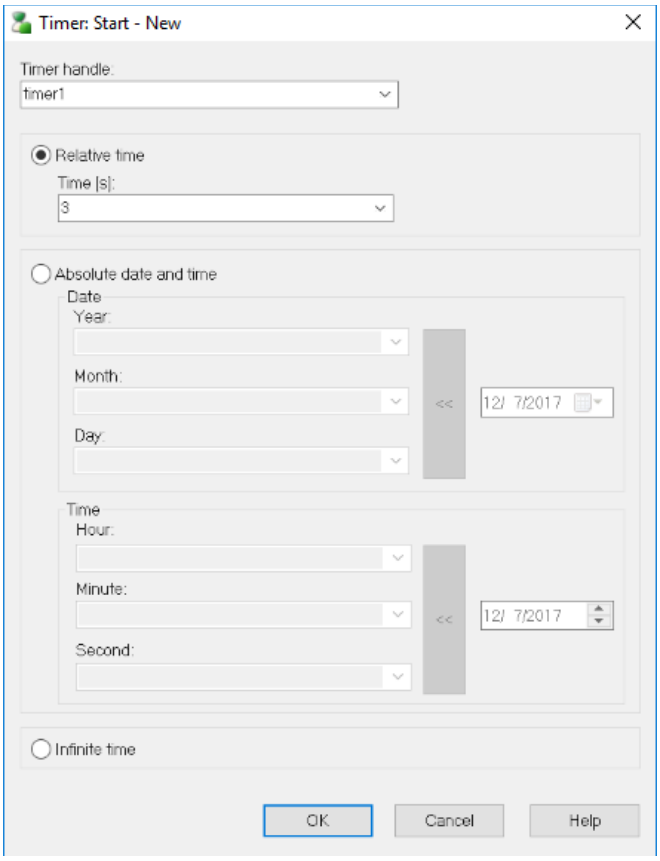

Figure 4–27: Adding Timer: Start command

3. **From the General Steps category, add a Timer: Wait for command after each Timer: Start command.** In the Timer dialog, select the respective timer handle from the previous step and uncheck the "Show timer display" checkbox.

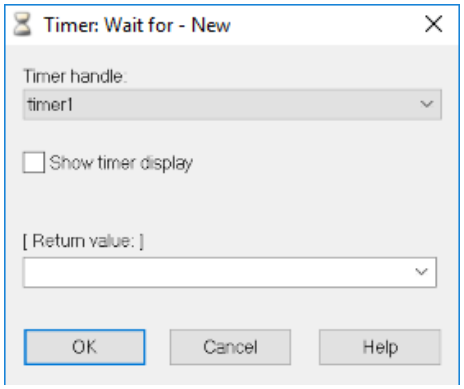

Figure 4–28: Adding a Timer: Wait for command

4. **Save the method.**

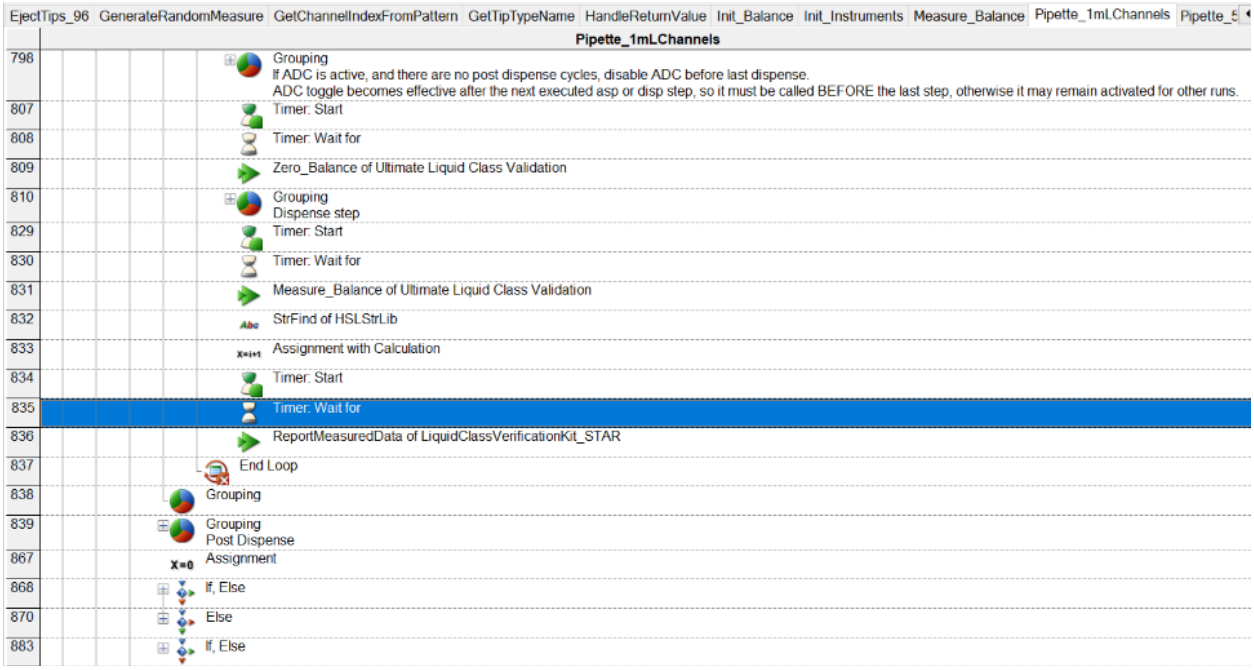

Figure 4–29: Adding timers before zeroing, measuring, and reporting

4.4.2.3 Using Vials with the 96 MPH

Because the 96 MPH only uses channel H12 with the LVK, it is possible to dispense to a tube adapter. This requires moving the LVK_BALANCE_VIAL_0001 sequence so it is under channel H12.

WARNING: Do not use the draft shield when using vials with the 96 MPH. The 96 MPH will collide with the draft shield if using 300 µL, 50 µL, or 10 µL tips.

1. **Open the LVK deck layout.** Click the Top View button to better see the sequences.
2. **Click the Clipping button and drag the slider until only one position is visible on the LVK.** Select LVK_BALANCE_VIAL_0001 in the Sequences tab to verify.

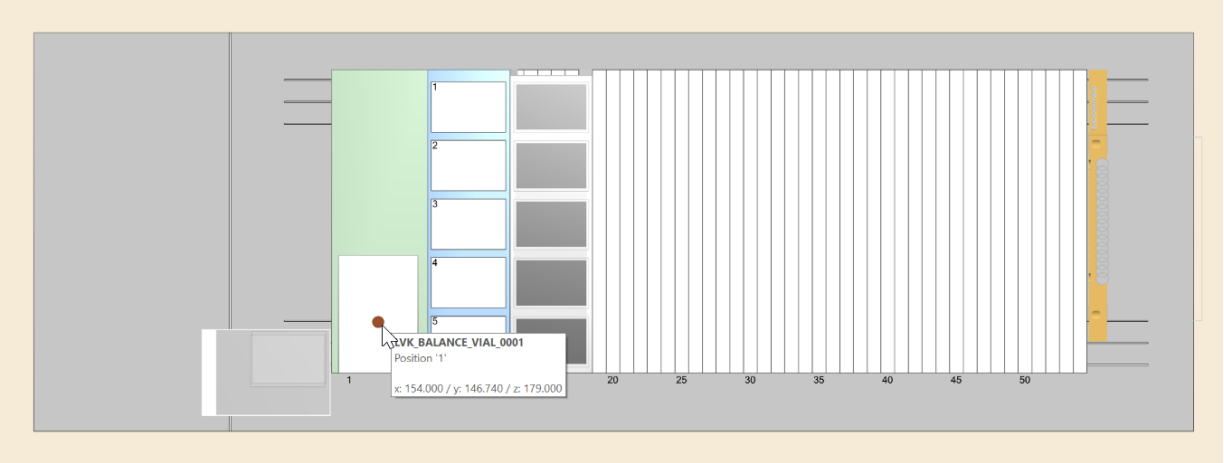

Figure 4–30: Isolating the vial position

3. **Place a single tip in position H12 in the tip rack at position 1 of the tip carrier**.
4. **Right-click the vial position and select "Adjust location…"**
5. **Adjust the location of the vial position so it lines up with the H12 channel on the 96 MPH.** Select the Fixed Deck radio button in the Adjust Labware Position dialog.

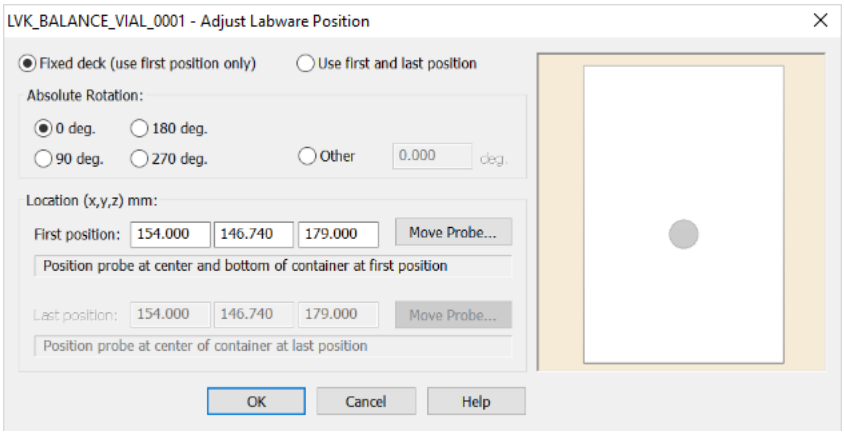

Figure 4–31: Adjusting the vial position

5 Operation

5.1 Software Overview

The LVK software runs the LVK method for a selected instrument to validate or develop Liquid Classes. The software creates and manages Test Profiles that contain settings like environmental values and pipetting settings, which are used to run the LVK method without opening Run Control or the Method Editor.

The software uses the same user authentication set in VENUS. If users are required to log into VENUS, they will also be required to log in when starting the LVK software. Lab operators can run existing Test Profiles, but they cannot create or edit them.

After running a Test Profile, the results are written to reports that can be reviewed later. These reports are saved to Documents\LVK\Results by default; the results folder can be changed by clicking the settings button at the top right corner.

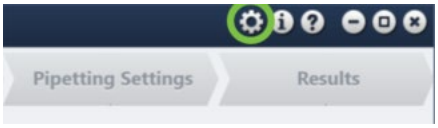

Figure 5–1: Opening LVK software settings

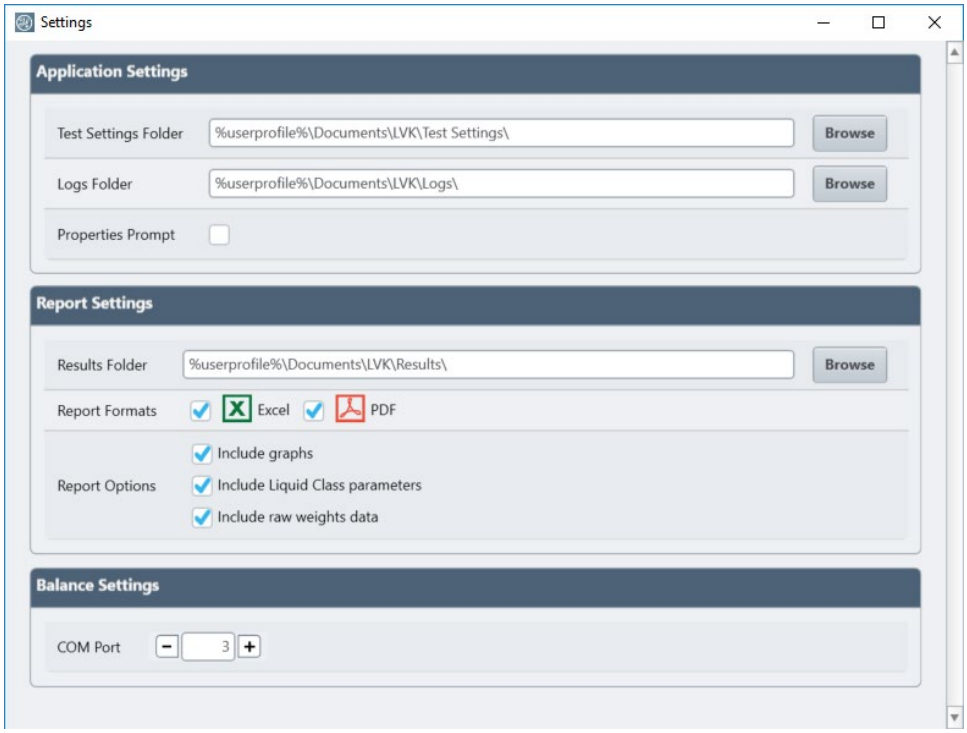

Figure 5–2: Changing LVK software settings

The file directories for the Test Profile settings and log files can also be configured. Check the Properties Prompt box to prompt for environmental settings like temperature and humidity every time a Test Profile is run.

In addition to the results folder, the contents of the results can be changed. Check the boxes in the Report Settings section to configure what kind of files are generated, as well as what data is included in these files.

- **Include graphs**: Check the box to include the graphs generated in the Results tab in the report.
- **Include Liquid Class parameters**: Check the box to include the parameters of the Liquid Class that was developed or verified during the run in the report.
- **Include raw weights data**: Check the box to include the weights measured by the LVK during the run in the report.

The COM port that the LVK is connected to must be specified in these settings before running a Test Profile.

5.2 Creating and Running a Test Profile

The LVK software uses Test Profiles in conjunction with the LVK method to validate or develop a Liquid Class. Test Profiles specify an instrument, pipetting settings, and whether the LVK method is being used for Validation or Development. Test Profiles can be saved for later use or editing at any point in its creation.

If the LVK is being used for Development, make sure to create a new Liquid Class in the CO-RE Liquid Editor first. Choose the Liquid Class closest to the new class and save it under a new name.

To get started, click Create New Test or select a preexisting Test Profile and click Load Selected. Existing Test Profiles can also be renamed or deleted from this screen.

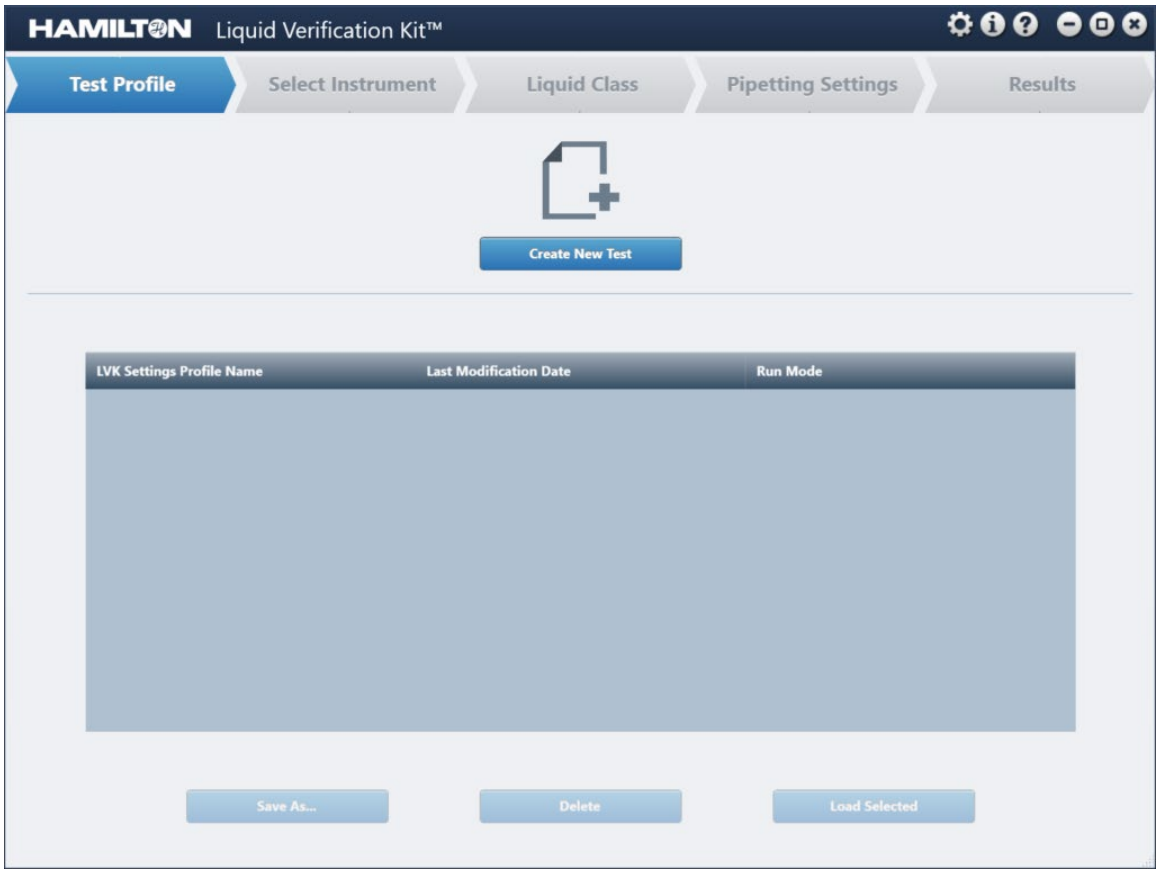

Figure 5–3: Creating a new Test Profile

5.2.1 Select Instrument

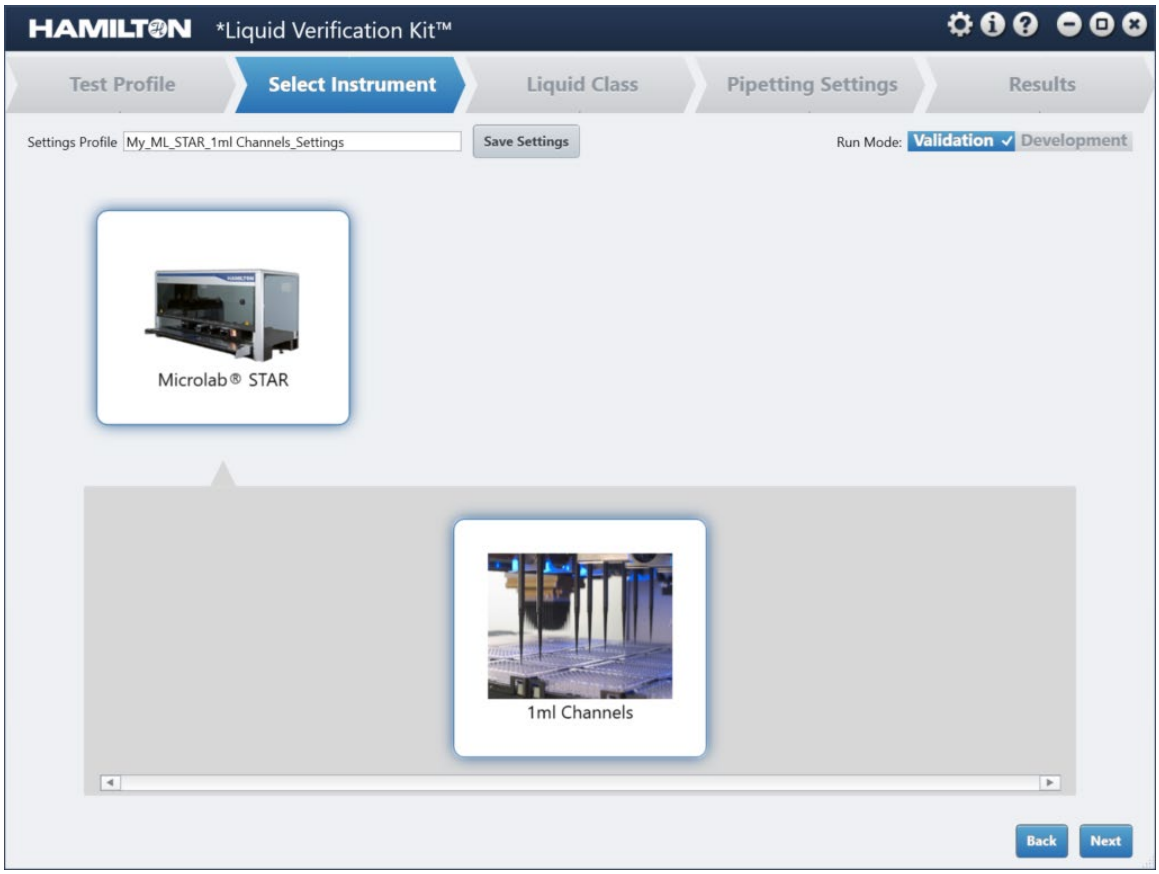

Figure 5–4: Selecting the instrument

Select the instrument and pipetting device that will be used with the LVK. Make sure the deck, labware adapters, and deck layout file are configured to use the specified pipetting devices. Refer to section 4.4 for the steps required to configure the LVK method and deck layout to the instrument.

Keep in mind that using the 96 MPH requires extra configuration. Only channel H12 can be used with the LVK, as pipetting with all 96 channels could hide inconsistencies in an overall average. Using the 96 MPH with the LVK will limit the number of dispenses to a total of five if clean tips are used each time, since the tip sequences are only defined across one tip carrier.

Note that the Test Profile can be saved at any time using the Save Settings button in the top left corner. The Run Mode can be switched between Validation and Development at any time before running the test. If any changes have not been saved to the Test Profile, an asterisk will appear next to "Liquid Verification Kit" at the top of the window.

Figure 5–5: Verifying unsaved changes

Click Liquid Class or the Next button to continue.

5.2.2 Liquid Class

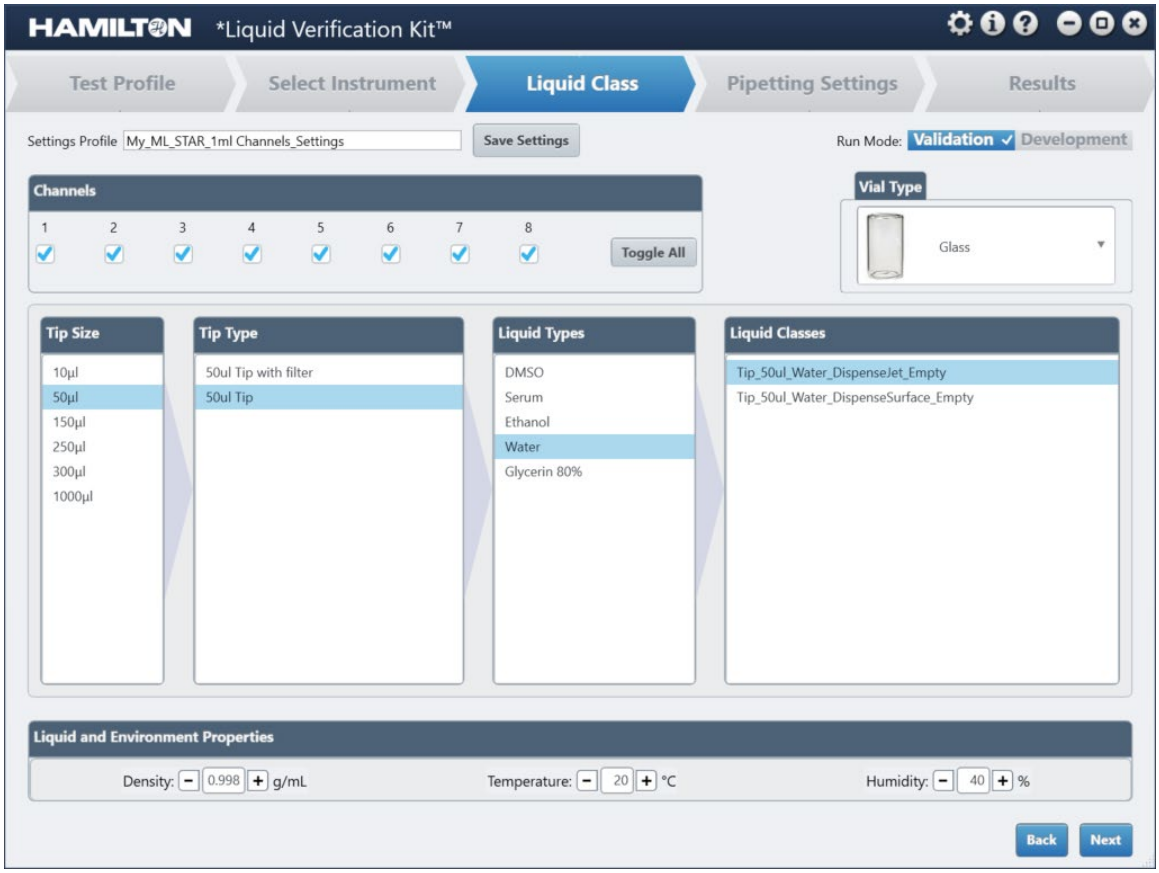

Figure 5–6: Selecting the Liquid Class

1. **Select the channels used to pipette in the method.** In Validation mode, all channels of interest should be selected. Fewer channels can be used for Development mode. If the 96 MPH was selected, the Channels selection will be disabled.
2. **Select the type of vial being used with the LVK**.
3. **Select the tip size and type**. These selections will affect the available liquid classes for both Validation and Development modes. Make sure the selected tips match those used for the method.
4. **Select the liquid type and class.** For both Development and Validation mode, select the liquid type closest to that used in the method if an exact match is not available. The Liquid Class will depend on the dispense mode.
5. **Enter liquid and environmental properties at the bottom of the screen.** An exact density is necessary to calculate accurate volumes based on the weigh module's measurements. The density will not automatically update based on the selected liquid,

so make sure to update it before proceeding. When possible, verify the density using a positive displacement pipette or syringe.

Use the hygrometer to obtain values for the temperature and humidity; these values do not affect any measurements, but are necessary for documentation.

Click Pipetting Settings or the Next button to continue.

5.2.3 Pipetting Settings

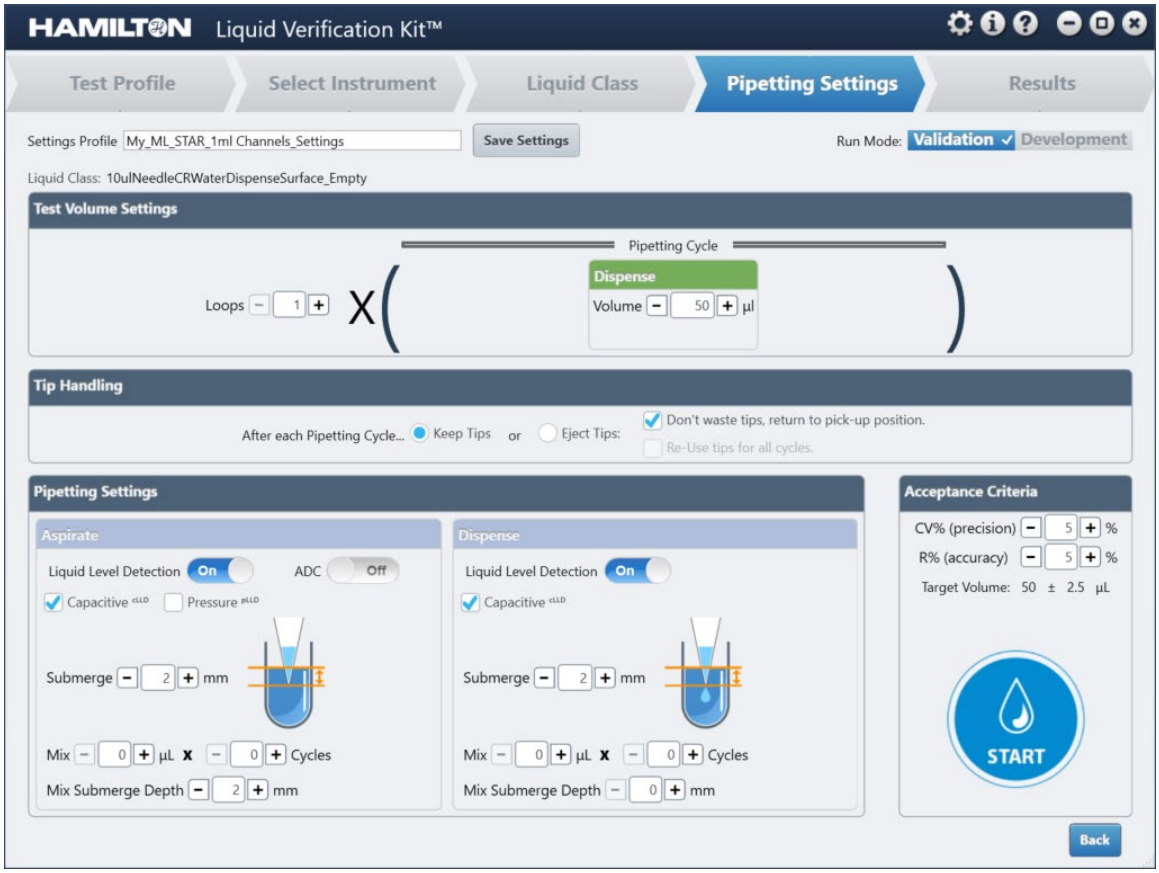

Figure 5–7: Entering pipetting settings

1. **Define the Pipetting Cycle properties and the number of loops.** This tab is the only one that is different depending on which Run Mode is selected. Validation mode requires a set number of loops, while Development mode will repeat until the user ends the run.

   If an empty dispense mode was selected in the Liquid Class section, only a dispense volume is required. If a part dispense mode was selected, the repetitions for the

dispense must then be specified, in addition to volumes and repetitions for the Pre- and Post-Dispense.

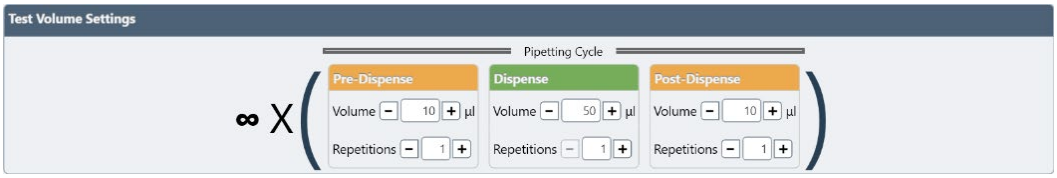

Figure 5–8: Entering a test volume in Development Mode

2. **Define the Tip Handling for the Test Profile**:
   - Keep tips: Reuse tips for each pipetting cycle and eject them to waste after the run.
   - Keep tips, return to pick-up position: Reuse tips for each pipetting cycle and return them to the tip rack after the run.
   - Eject tips: Eject tips to waste after each pipetting cycle and pick up new tips for the next cycle.
   - Eject tips, return to pick-up position: Return tips to the tip rack after each cycle and pick up new tips for the next cycle.
   - Eject tips, re-use tips for all cycles: Return tips to the tip rack after each cycle, then pick up the same tips for the next cycle.
3. **Define the Pipetting Settings for the Test Profile.** These settings are the same as those available in the Method Editor, so they are summarized briefly here. If a jet dispense mode was selected in the Liquid Class section, all dispense settings but Fixed Height will be disabled.
   - Liquid Level Detection: Use either capacitive or pressure sensors to detect the liquid level and pipette a specified distance below it. Only cLLD is available for surface dispense.
   - ADC: Use Anti-Droplet Control when pipetting volatile liquids.
   - Submerge: Specify a depth below the liquid level to pipette. This option is only available if LLD is enabled.
   - Fixed Height: Specify a height above the container bottom to pipette. This option is only available if LLD is disabled.
   - Mix: Set the volume and number of cycles for mixing. Mixing using half of the total pipetted volume is the recommended practice. The mixing submerge depth is measured from the dispense Submerge depth or Fixed Height.
4. **Set the Acceptance Criteria.** CV% refers to the consistency of the pipetted volumes, whereas R% refers to the accuracy of the pipetted volumes. The following equations are used to calculate CV% and R%:

   SD : standard deviation

V_M : mean volume
V_T : nominal volume

$$CV\% = 100 \times \frac{SD}{mean}$$

$$R\% = 100 \times \left(\frac{V_M - V_T}{V_T}\right)$$

5. **Click START to begin the test.**

5.2.4 Results

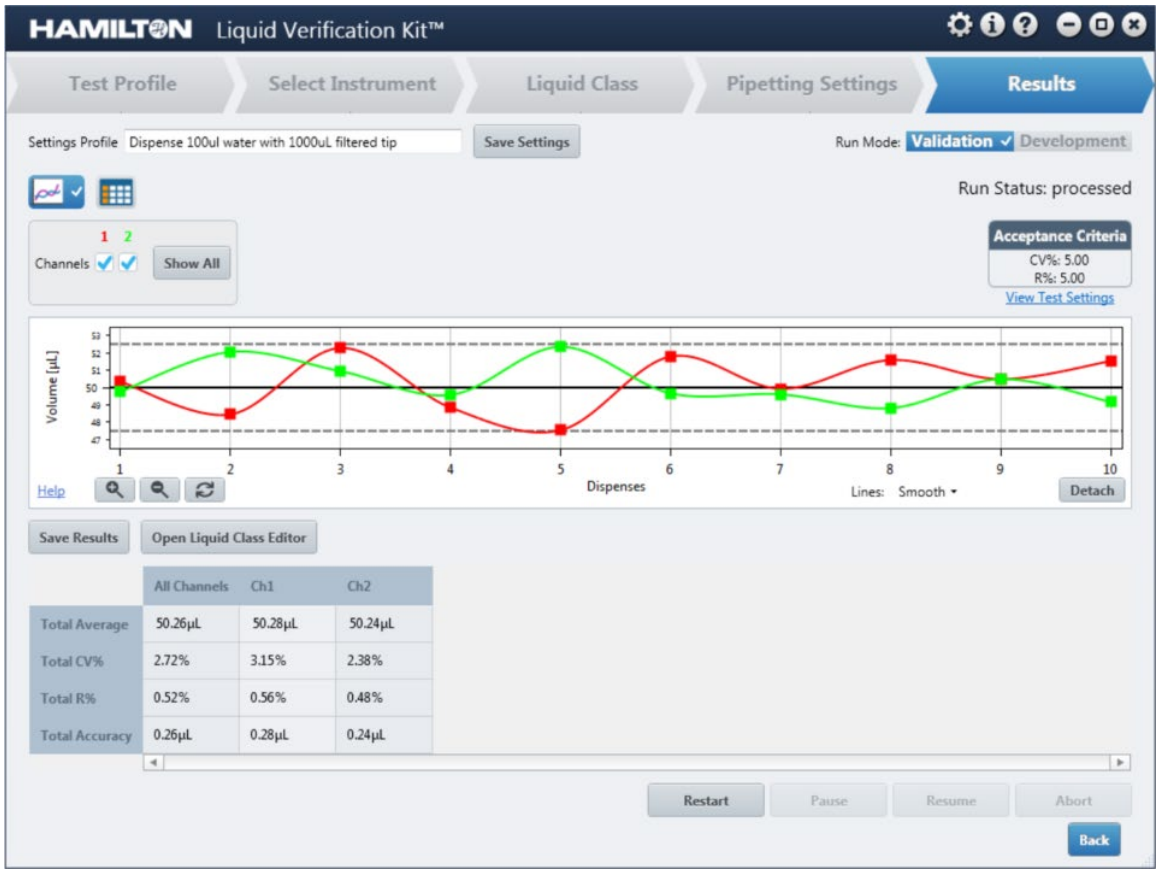

Figure 5–9: Viewing pipetting results

The Results section has several viewing options. Under the Settings Profile field are two buttons to switch between a graph and table that show the progress of the test in real time. The data for different channels can be enabled or disabled using the checkboxes underneath the view buttons.

Click the Detach button at the bottom right corner of the graph to open it in a separate window. Close the window to return the graph to the LVK software. The graph line style can be changed using the drop-down menu at the bottom of the graph. Use the zoom in/out buttons at the bottom left to adjust the scale of the axes; return to the default view by clicking the reset button.

Click the Help link to view additional controls for the graph view.

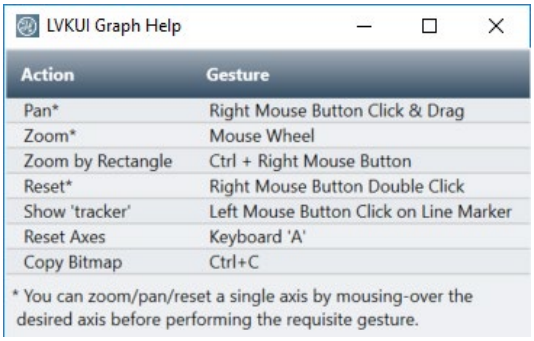

Figure 5–10: Graph controls

The table calculates values like CV% and R% and shows the status of each channel in real time. The Acceptance Criteria and Run Status can be viewed at the top right corner. The View Test Settings link opens a window with a summary of the settings associated with the Test Profile.

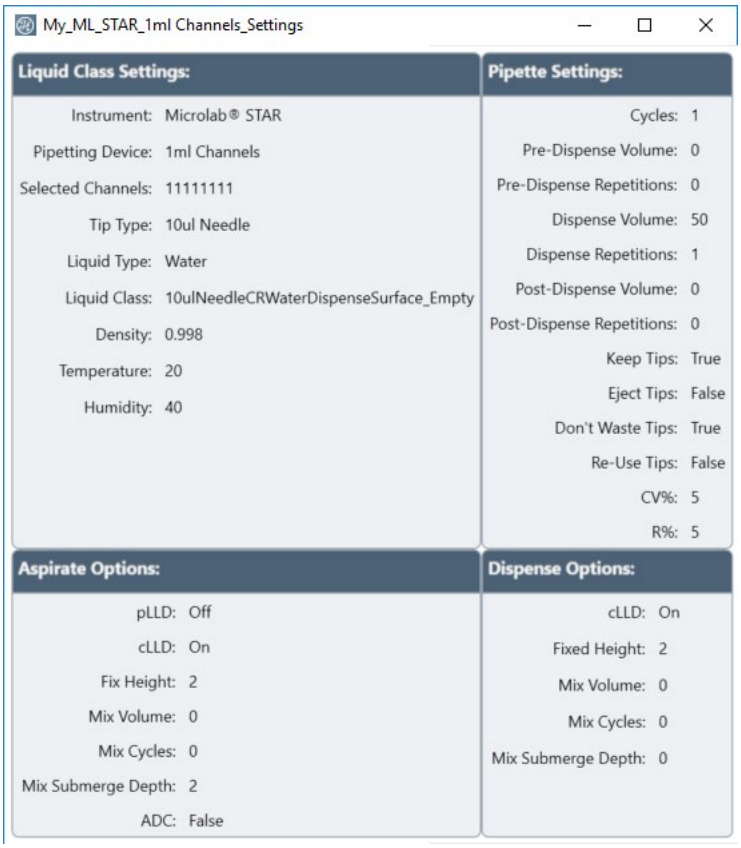

Figure 5–11: Test Profile settings

Once a Validation test is finished, the results of the test are shown in a table below the graph. A report will be saved to the folder specified in the Report Settings; refer to section 5.2 for details. The Liquid Class Editor can be opened from this section to make changes to a liquid class; this option is only available after a run when in Validation mode.

6 Maintenance

When the LVK is not actively being used, it should be stored in its case with its components. Because it is not permanently located on the instrument deck, the LVK does not require daily or weekly maintenance beyond routine cleaning or decontamination if spillage occurs.

Half-yearly calibration of the weigh module must be performed by certified Mettler Toledo service engineers. If there is no certified engineer on site, the balance must be sent either to Mettler Toledo or to Hamilton Company. Contact a local Hamilton representative for details.

6.1 Daily Maintenance

Clean the weigh module daily after system shutdown. Remove the weigh pedestal and clean it and the load cell with a damp cloth. The weigh module itself can be cleaned either with a damp cloth or a mild household cleaner. Make sure to place the plastic cover on the load cell before cleaning the weigh module.

Clean all used labware in accordance with standard procedures.

6.2 Storing the LVK

When not in use, the LVK must be stored in the protective case it shipped in. After disassembling the LVK, place all components in their designated places as they were shipped. Some components require extra care when packing them for storage:

1. **Power off and disconnect the LVK**.
2. **Place the white plastic cap on the weigh module's load cell and place the weigh module upside down in the protective case.** The weigh module and load cell are fragile, so take extra care when storing them.

WARNING: Do not store the LVK without placing the plastic cap on the load cell.

3. **Place the top of the draft shield in the case first, then store the rest upside down**.
4. **Do not jostle the protective case during transport.** The more sensitive components of the weigh module could be damaged if the protective case is mishandled. Store the LVK near the instrument to minimize transport.

Store the LVK in a location with an ambient temperature of 10–30°C. The weigh module cannot be stored in temperatures outside of this range.

6.3 Unpacking the LVK from Storage

1. **Remove the LVK components from the protective case**.
2. **Place the weigh module on the appropriate base.** Refer to section 4.1 for details.
3. **Connect the weigh module and control box.** Let the weigh module acclimate to ambient temperature and humidity for an hour before use.
4. **Make sure the deck layout and COM port used in the LVK method are accurate.** Refer to section 4.4.1 for help with editing the LVK method.

7 Troubleshooting

This section describes possible solutions for errors that can occur during routine use of the LVK. If the solutions presented in this section do not resolve the errors, contact a local Hamilton representative for assistance.

7.1 96 MPH Tip Pickup Error

The LVK method sometimes encounters errors when using the 96 MPH, since only one channel can be used. The sequence copy command for the tips can cause the method to abort when the tip pickup command for the 96 MPH is executed.

Solution

1. **Open the main method in the Method Editor**.
2. **Expand the If, Else conditionals and disable the EditTips_Head submethod call**.

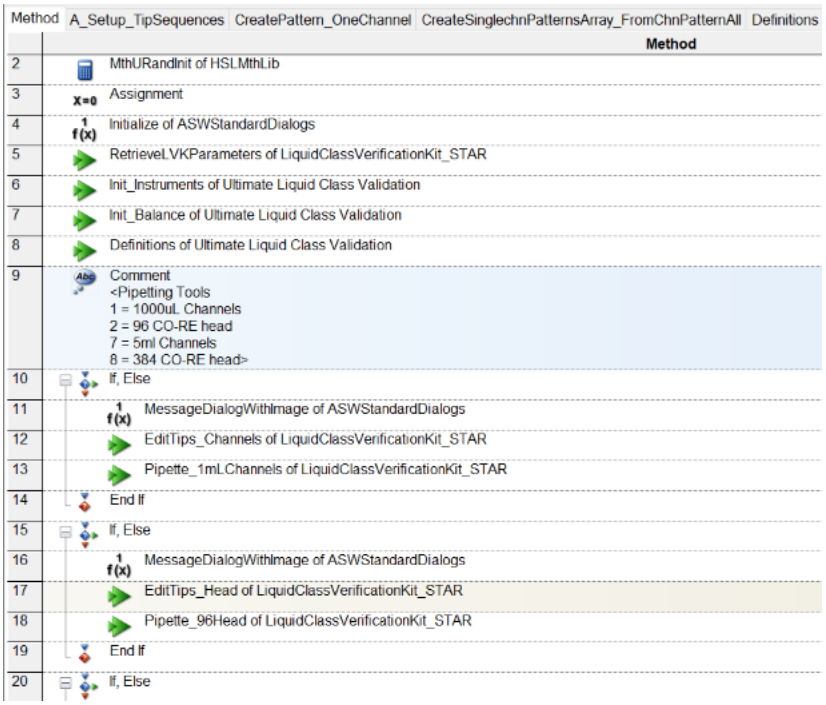

Figure 7–1: Disabling the EditTips_Head submethod call

3. **Open the Pipette_96Head submethod**.
4. **Disable the If, Else statement containing the EditTips_Head submethod call**.

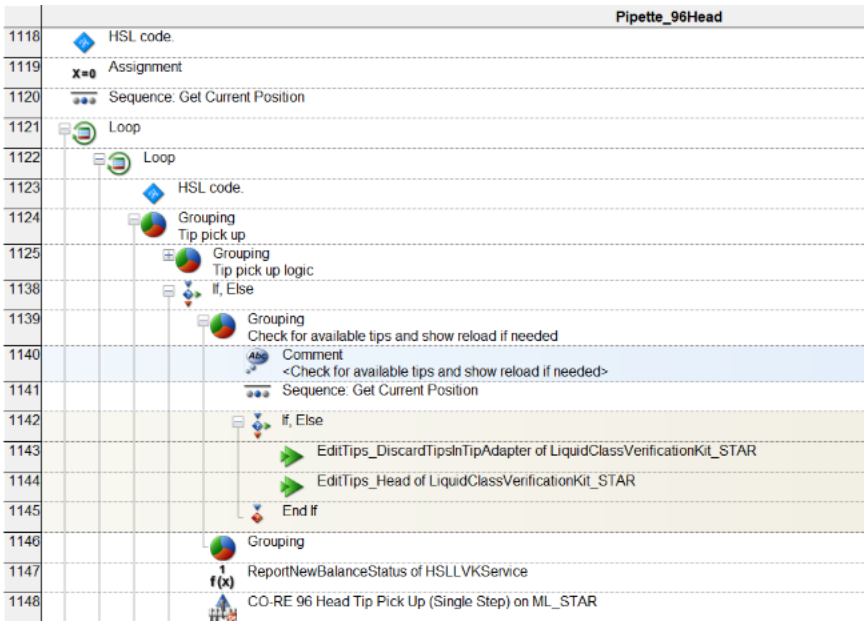

Figure 7–2: Disabling EditTips submethod calls

5. **Edit the tip pick-up sequence in the CO-RE 96 Head Tip Pick Up step** to reference the tip type being used. Change the sequence counting to manually.

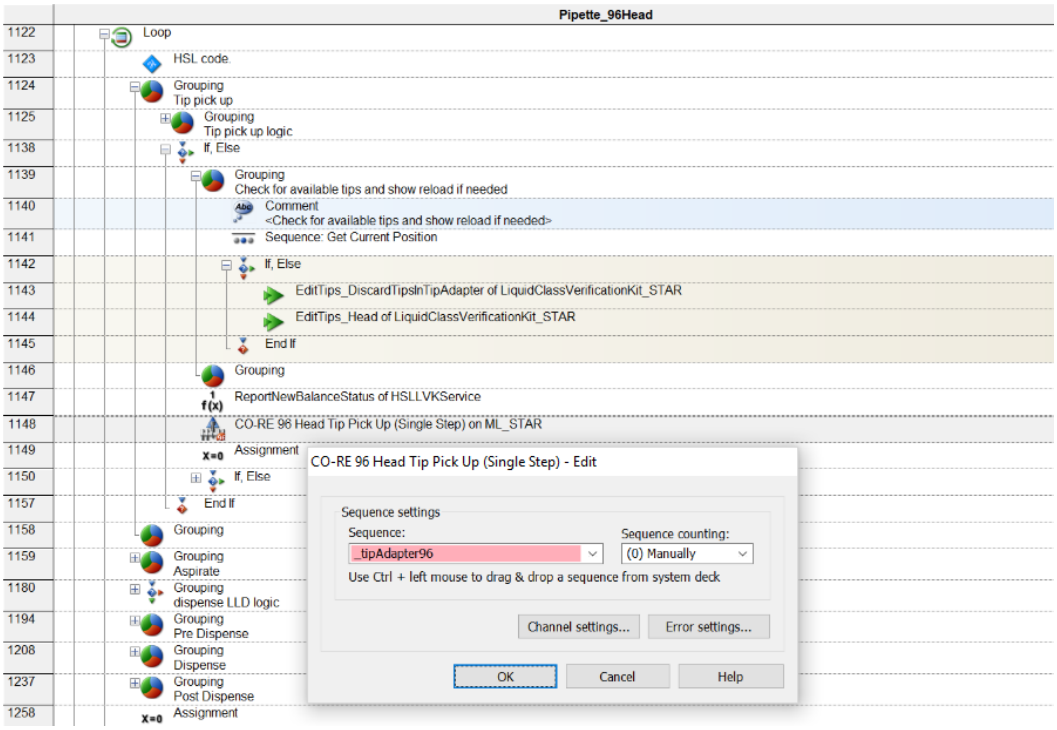

Figure 7–3: Editing the tip pick-up sequence

6. **Expand the If, Else statements and disable the EjectTips_96 submethod call**.

7. **From the ML_STAR category of the Toolbox, add a CO-RE 96 Head Tip Eject step**.

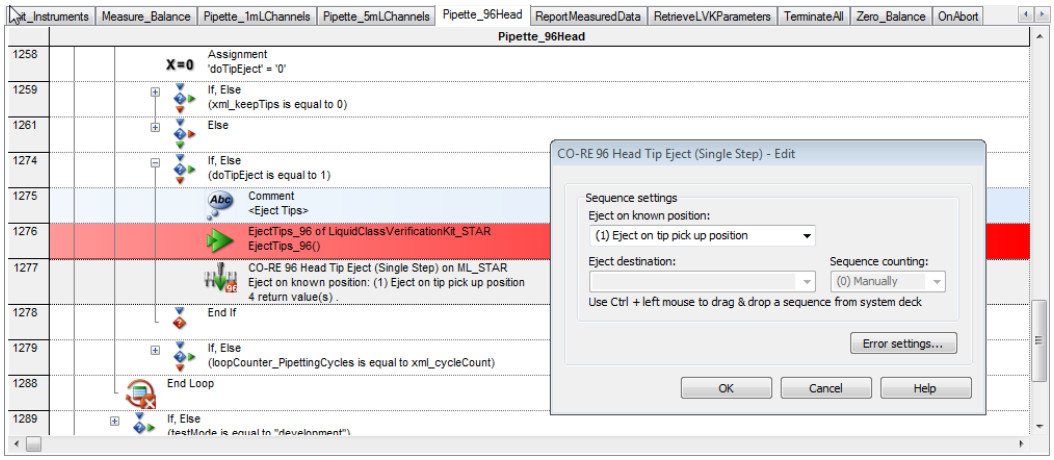

Figure 7–4: Adding a tip eject singe step

7.2 Init Balance Error

This error can indicate damage to the scale, but it can be caused by less serious issues as well. Try the following solutions before contacting Hamilton for support.

Solution 1	Let the scale acclimatize to room temperature and humidity and try again.
Solution 2	Remove labware and adapters, then power cycle.

Solution 1

This error can occur if the weigh module is not fully acclimated to the ambient temperature and humidity. The weigh module must sit for an hour after it is connected to power before the LVK can be used. Make sure the operating conditions match those in section 4.1, and wait for an hour before initializing the LVK again.

Solution 2

Turning on the LVK with any labware, adapters, or other materials on the load cell can cause this error to appear. Remove any materials from the load cell, then power cycle the scale.

8 Appendices

8.1 Technical Specifications

Refer to the Mettler Toledo website for the technical specifications of the weigh module.

8.2 Getting Technical Assistance

If additional assistance with the LVK is required, contact an authorized Hamilton Company distributor or Hamilton Company directly. Regional contact information is provided in sections 8.2.1 and 8.2.2. Have the following information available when requesting technical assistance:

- Instrument model number
- Instrument serial number
- Description of the problem
- Laboratory contact information

If possible, supply the following additional information:

- What was happening at the time of the error
- What has been tried so far to solve the problem
- Version of software (see section 8.2.3)
- Screenshots of any errors (see section 8.2.6)
- Photos that could more readily illustrate the problem
- Traces and log files (see section 8.2.5)

8.2.1 Technical Support in the Americas and Pacific Rim

Hamilton Company

4970 Energy Way, Reno, Nevada 89502, USA

Toll Free (USA and Canada), General: 800-648-5950

Toll Free (USA and Canada), Service Hotline: 800-527-5269

Telephone: +1-775-858-3000

Fax: +1-775-856-7259

E-Mail: tech@hamiltoncompany.com

8.2.2 Technical Support in Europe, Asia, and Africa

Hamilton Bonaduz AG

CH-7402, P.O. Box 26, Bonaduz, Switzerland

Telephone: +41 81 660 60 60

Fax: +41 81 660 60 70

E-Mail: itechsupport@hamiltoncompany.com

8.2.3 Mettler Technical Support

Some issues with the Mettler balance will require direct support from Mettler Toledo:

Mettler-Toledo, LLC

1900 Polaris Parkway

Columbus, OH 43240

800-638-8537

8.2.4 Finding the Software Version

To find the software version, navigate to Windows START > Hamilton > Version info.

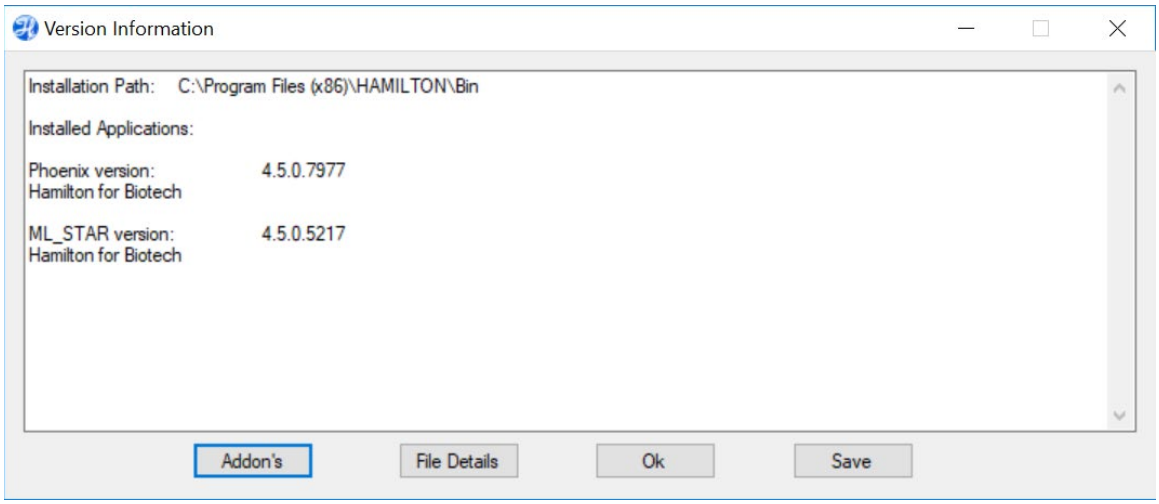

Figure 8–1: Locating the software version

8.2.5 Sending Trace Files

1. **Navigate to C:\Program Files\Hamilton\LogFiles for the method traces.** The Hamilton folder may also be located under C:\Program Files (x86).
2. Navigate to Documents\LVK\Logs for the LVK software traces.
3. Attach or copy/paste the relevant comm trace files to an email and send it to Hamilton.

8.2.6 Taking a Screenshot

If an error appears on the screen, follow these instructions to take a screenshot:

1. **Click the desired window or error dialog**.
2. **On the keyboard, press Alt+PrtScrn.** This will copy a picture of the window. To take a screenshot of the visible desktop, use Ctrl+PrtScrn.
3. **Paste the screenshot into a Word document or WordPad.** Save the document.

8.3 Warranty

Hamilton Company warrants this product to be free of defects in material and workmanship for a period of 12 months from the date of delivery. This warranty is extended to the buyer of record on the original purchase order to Hamilton Company.

Hamilton Company or an authorized Hamilton representative will repair or replace, at its option and free of charge to the buyer at a normal place of business or at a Hamilton repair facility, any part or parts that, under proper and normal use, prove to be defective during the warranty period.* Abuse, unauthorized replacement of parts, modifications, or adjustments made by anyone other than Hamilton Company or an assigned representative voids this warranty.

This warranty gives the owner specific rights. No other warranties, expressed or otherwise, including implications of warranties of merchantability and fitness for a particular product, are made.

This warranty does not apply if:

- The product has not been operated in accordance with the user manual
- The product is not regularly and correctly maintained
- The product is not maintained, repaired, or modified by a Hamilton authorized representative
- Parts other than original Hamilton parts are used
- The product and parts thereof have been altered without written authorization from Hamilton
- The product is not returned properly packaged and secured Hamilton Company's liability on the sale of all products shall be limited to repair, replacement, or refund of price of any defective product.

Hamilton Company endeavors to provide prompt and satisfactory service.

*Hamilton Company reserves the right to refuse to accept the return of any instrument or valve that has been used with radioactive, microbiological, or any other material or substance that may be deemed hazardous to employees of Hamilton Company.

8.4 Regulatory

The declaration of compliance of the CE and CSA is part of the delivery of the LVK. It verifies that the device meets all required Directive standards.