Innovate™ pHALCON™

MCH-4007 User Manual



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1. Introduction

The Innovate™ pHALCON™ from Hygiena® is a compact benchtop instrument for fast, accurate, and automated pH measurement of samples in microplates. The Innovate pHALCON contains a Mettler Toledo InLab® Micro Probe that provides highly accurate pH measurements for each sample. The probe is washed with distilled water and air-dried between each measurement to ensure uncontaminated and reproducible results. The Innovate pHALCON can be calibrated at any time with known pH buffers to ensure maximum accuracy.

The Innovate pHALCON brings these advantages to lab applications:

- Conserves bench space with its small footprint (15 x 13 in / 380.05 x 329 mm)
- Automatic export of pH data in XML, CSV, SAM, Excel®, or JSON formats
- Handles any ANSI/SLAS microplate format up to 96-well density, or vial racks

The Innovate pHALCON instrument is controlled using the Innovate pHALCON Software, which enables setup, calibration, data acquisition, and analysis within a single integrated platform.

This user manual will focus on Innovate pHALCON Hardware and Software and provides instructions for system configuration, calibration, operation, and data management.

2. Innovate pHALCON Hardware

2.1 Prerequisites and Compatibility

2.1.1 Physical Space

- The unit requires an operating space of 15 × 15 × 13 in / 38 × 38.05 × 32.9 cm (H x W x D)
- Weight: 13.15 kg / 29 lb.
- Do not position the equipment so that it is hard to access the disconnect device (the on/off switch)

2.1.2 Power Requirements

- AC Power Adapter Rating: 100-240 VAC, 2.3A, 50-60 Hz
- Instrument Power Rating: 24 VDC, 4.0 Amps
- This equipment is designed for use in Overvoltage Category I (OVC I) installations only
- Direct Current (DC): This symbol indicates that the equipment operates using direct current (DC). Ensure that only a DC power source with the specified voltage and current ratings is used.



2.1.3 Environmental

- Operating Temperature: 15 to 40 °C
- Operating Humidity: 0-85 %, no condensation
- Storage Temperature: –20 to 65 °C
- Altitude: Up to 2000 m
- This equipment is designed for use in Pollution Degree 2 (PD2) environments

Note: The Innovate pHALCON is intended for indoor use only.

2.1.4 Compressed Air

- Connection: ¼ in Push-to-connect
- Pressure: Regulated to 30-50 psi | 206-344 kPa
- Gas Types: Compressed Air, Argon, Nitrogen
- Purity Recommendation: ISO 8573-1 Class 2-3 or better.

2.1.5 Wash Water

- Use Distilled or Deionized Water. Reagent-grade is recommended.

2.1.6 Labware

- ANSI/SLAS Standard 96-well plates, 48-well plates, 24-well plates
- Deep well variants up to 50 mm tall

2.1.7 Probe

Mettler Toledo InLab® Micro, Product No. 51343160

2.1.8 Repair

For instrument repair and support, please contact Hygiena Technical Support at www.hygiena.com/support.

2.1.9 Disposal

This product is subject to the European Waste Electrical and Electronic Equipment (WEEE) Directive 2012/19/EU.



This equipment is intended for professional use. At the end of its service life, it should be returned to an authorized collection or recycling facility in accordance with applicable national regulations implementing the WEEE Directive. Do not dispose of this equipment as unsorted municipal waste.

The symbol of the crossed-out wheeled bin on the product, its packaging, or accompanying documentation indicates that this product must not be disposed of with unsorted waste.

Instead, dispose of the product through an appropriate collection facility for the recycling of waste electrical and electronic equipment. Proper disposal helps conserve natural resources, protect human health, and prevent potential negative environmental impacts from improper waste handling.

For information about available collection and recycling systems, contact your local municipal authority, waste disposal service, or the distributor from whom the product was purchased.

Before disposal, remove any batteries (if applicable) and dispose of them separately in accordance with local regulations. One small coin-cell battery may exist on the instrument controller board.

3. Instrument Setup

3.1 Wash Station

The Innovate pHALCON is shipped with two tube assemblies and two 1000 mL bottles (**Figure 1**). The tube assembly with the larger PMS connectors (containing the thumb disconnect) is for the export of wash fluid (waste). The second, smaller assembly is for import of wash fluid for the wash station (source).

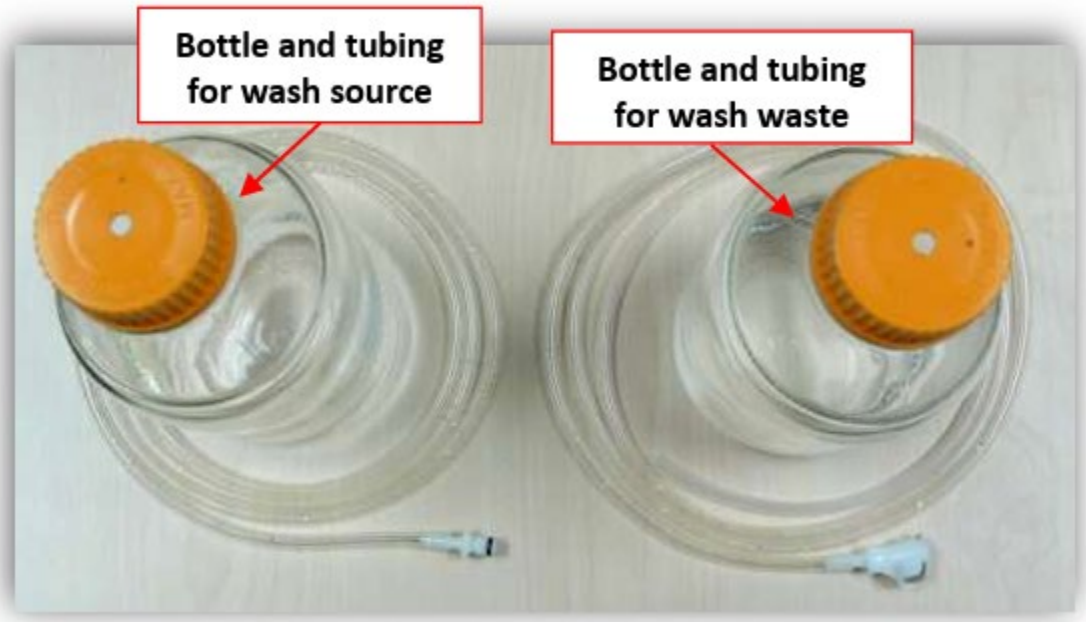


Figure 1. Wash Bottles and Tubing

Push the source tube into the source bottle and fill with fresh distilled water. Push the tubing far enough so it can access as much of the water as possible. Place the second tube into the waste bottle. Connect the two tubes (**Figure 2**).



Figure 2. Connections for Wash Tubing

3.2 Air Drying Station

The Innovate pHALCON requires an external air or nitrogen source to blow dry the probe between wash cycles and sample testing. A compressed air source with pressure regulated to a maximum of 50 psi is required (30 psi is recommended). The tubing required for connection to the instrument is ¼ in. If the air source requires a different tubing size, an appropriate adapter will be required (**Figure 3**). Clean, dry air or nitrogen is necessary to ensure accurate results (see Prerequisites and Compatibility).

Turn on the air source when you are ready to begin using the Innovate pHALCON.

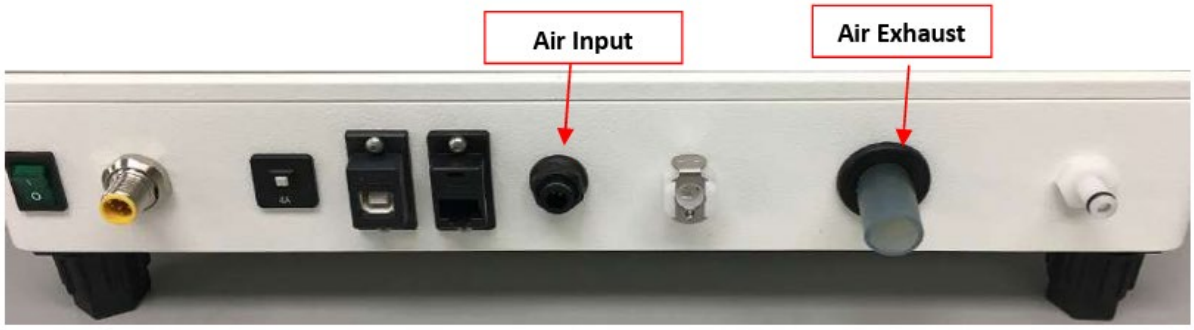


Figure 3. Air Supply Connections

3.3 Communication and Power Cables

The Innovate pHALCON is connected to a controlling computer by Ethernet. There is a port for this connection in the back, next to the air input connector (**Figure 4**). There is also a USB port that is used by Hygiena for maintenance and firmware updates.

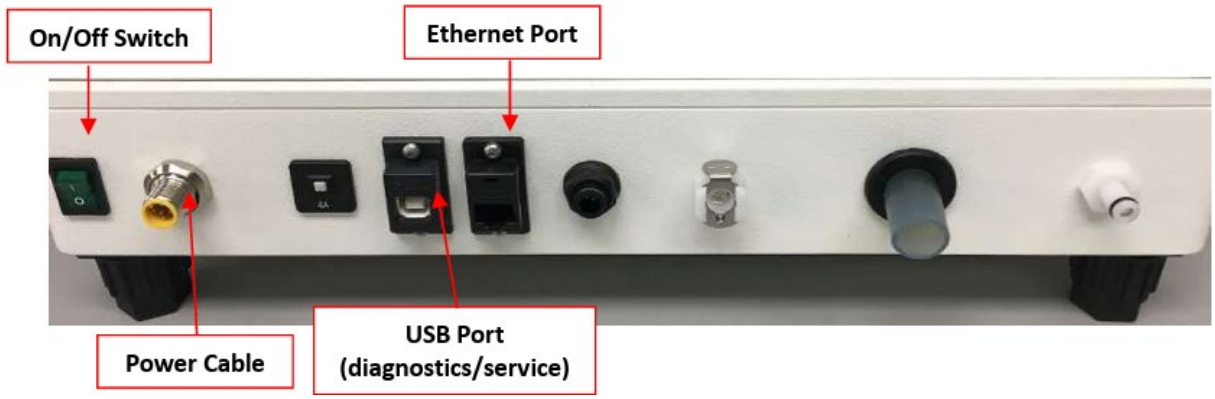


Figure 4. Cable Connections

The power cable screws into the port next to the on/off switch. Once the Innovate pHALCON is connected and turned on, it is automatically recognized and initialized when the Innovate pHALCON Software is started. If the unit is turned off when the software is started, this will be reflected as a “Not Connected” condition when the main screen is displayed. In this case, exit the software, power on the Innovate pHALCON, and re-run the software.

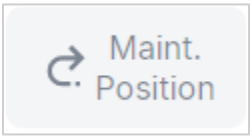
3.4 Probe and Probe Mount Installation

The probe mount is connected to the probe arm by two vertical stabilizing dowel pins and connects via a board-edge style connector. The probe arm locks in place with a ball detent (plunger with release pin). To connect the probe mount to the Innovate pHALCON instrument, slide the probe mount down into place on the probe arm (**Figure 5**).



Figure 5. Probe Configuration

To install the probe, it is recommended that the probe arm be raised to its maximum height and placed on the left side of the instrument. This can be done by pressing the "Maint. Position" button (see the image to the right) on the main screen of the Innovate pHALCON Software. (See *Points* section).



Note: Alternatively, the probe can be attached to the probe mount before the probe mount is attached to the probe arm.

Position the probe in the slot in the mount, then push the probe into the mount by holding the top of the probe mount with your fingers and using your thumb and forefinger to push the probe into the probe mount (**Figure 6**) as far as possible (**Figure 7**). The probe should audibly "click" into the mount and the top white part of the probe should contact the bottom of the opening in the probe mount.

Note: New probes from Mettler Toledo include a black rubber gasket or O-ring on the S7 connector. This should be removed.



Figure 6. Probe Installation

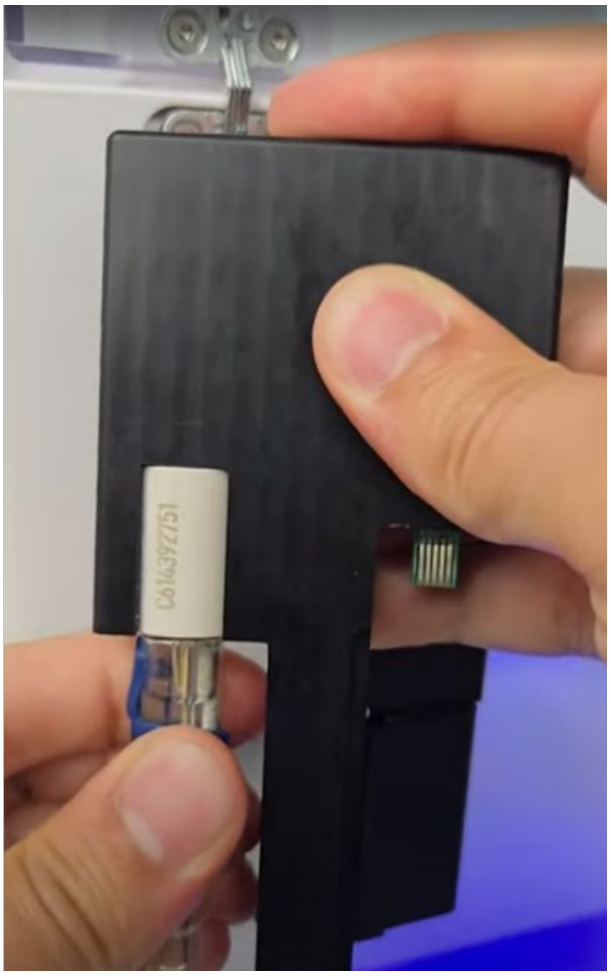


Figure 7. Probe Installed

After the probe is inserted in the probe mount, and the probe mount is installed on the arm,

press the “Home”(Home) button on the main screen of the software to move the probe to the storage buffer.

The probe tip may not be centered in the middle of the storage tube. If this is the case, gently twist the probe (gripping it by the white plastic piece on top) to position the probe as close to the center of the tube as possible. Try to physically center the probe in the front-to-back direction (closer to you or farther away from you). If it is not perfectly aligned in the side-to-side direction, the software can always be used to make small adjustments (See *Points* section).

See the pictures below for a probe that is too far forward (**Figure 8**) and a probe in the center of the storage buffer tube (**Figure 9**). Confirm the position of the probe for the Wash and Dry positions.

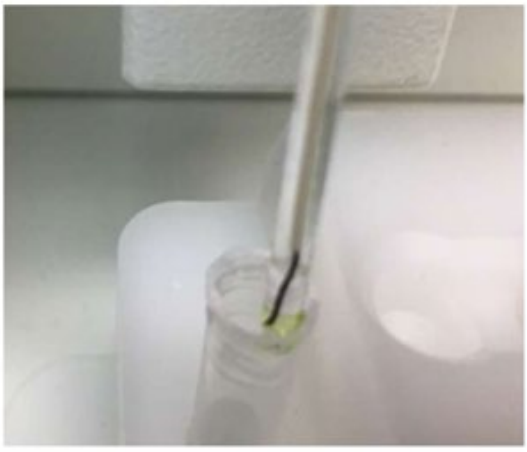


Figure 8. Improperly Placed Probe



Figure 9. Centered Probe Positioning

Add KCl or a pH 4 solution to the storage tube. It is suggested that the storage tube be removed and washed once a week to remove any crystallization at the bottom (**Figure 10**).



Figure 10. Removal of Probe Storage Tube

When using the Innovate pHALCON instrument, remove the blue stopper from the probe to open the small hole in the probe's glass barrel. Replace the blue stopper when the Innovate pHALCON is not in use to prevent the KCl reference buffer from evaporating from the probe, which can cause the KCl to crystallize in the probe. The KCl buffer should be approximately 10 mm below the filling port (**Figure 11**).

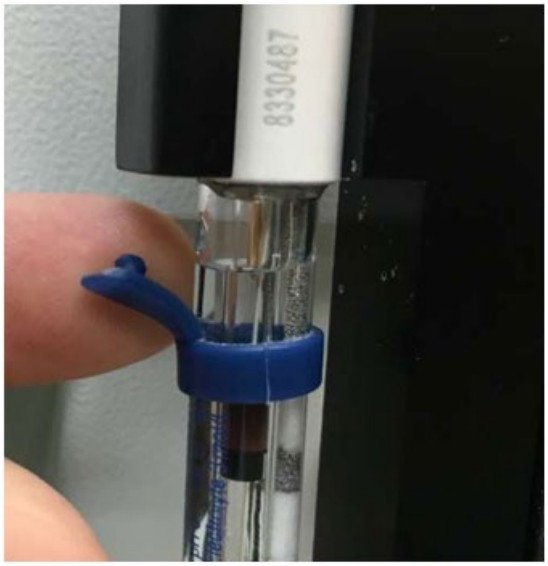


Figure 11. Buffer in Probe Filling Port

4. Software Installation

The Innovate pHALCON can be configured and controlled with the Innovate pHALCON Software ("InnovatePHALCON.exe"), a Windows-based program. Double-click the icon on the desktop to run the software and follow the on-screen instructions.



4.1 Prerequisites

The Innovate pHALCON Software requires the following:

- Windows 10 / 11 (64-bit edition only)
- .NET 8 Runtime

4.2 Computer Interface

TCP/IP

The software version number can be found at the bottom of the **Settings** screen once installation is complete.

See *Connection* section for instructions on how to connect the Innovate pHALCON Software to the Innovate pHALCON instrument.

See *Points* section for instructions on calibrating Buffer, Dry, Wash, and Nest positions.

5. Main Screen

Power up the Innovate pHALCON instrument before starting the software. When the software opens, the **Main Screen** (**Figure 12**) provides access to instrument movement, run setup, calibration, data, and system settings.

Press **Home** to home the instrument's X, Y, and Z axes. After the instrument has been homed, pressing **Home** again moves the probe to the buffer position. Use the **Maintenance Position** when the probe must be safely removed or replaced.

From the Main Screen, you can access **Plate Data** and **Settings**, switch between **Run Mode** and **Calibrate Mode**, and use the **Start** button to begin an operation. Before a run or calibration, settings such as **Plate Type**, **Wash Type**, **Heated Nest**, **Sample Temperature**, and **Read Order** can be configured. Wells can be selected individually or by using **Select All** and **Clear All**.

During operation, the **Probe Cursor** tracks the hardware probe's position, while the **Status Bar** displays the current instrument status. The Main Screen also displays the **Last Calibrated** date, instrument **Connection** status, and the number of installed **Probes**.

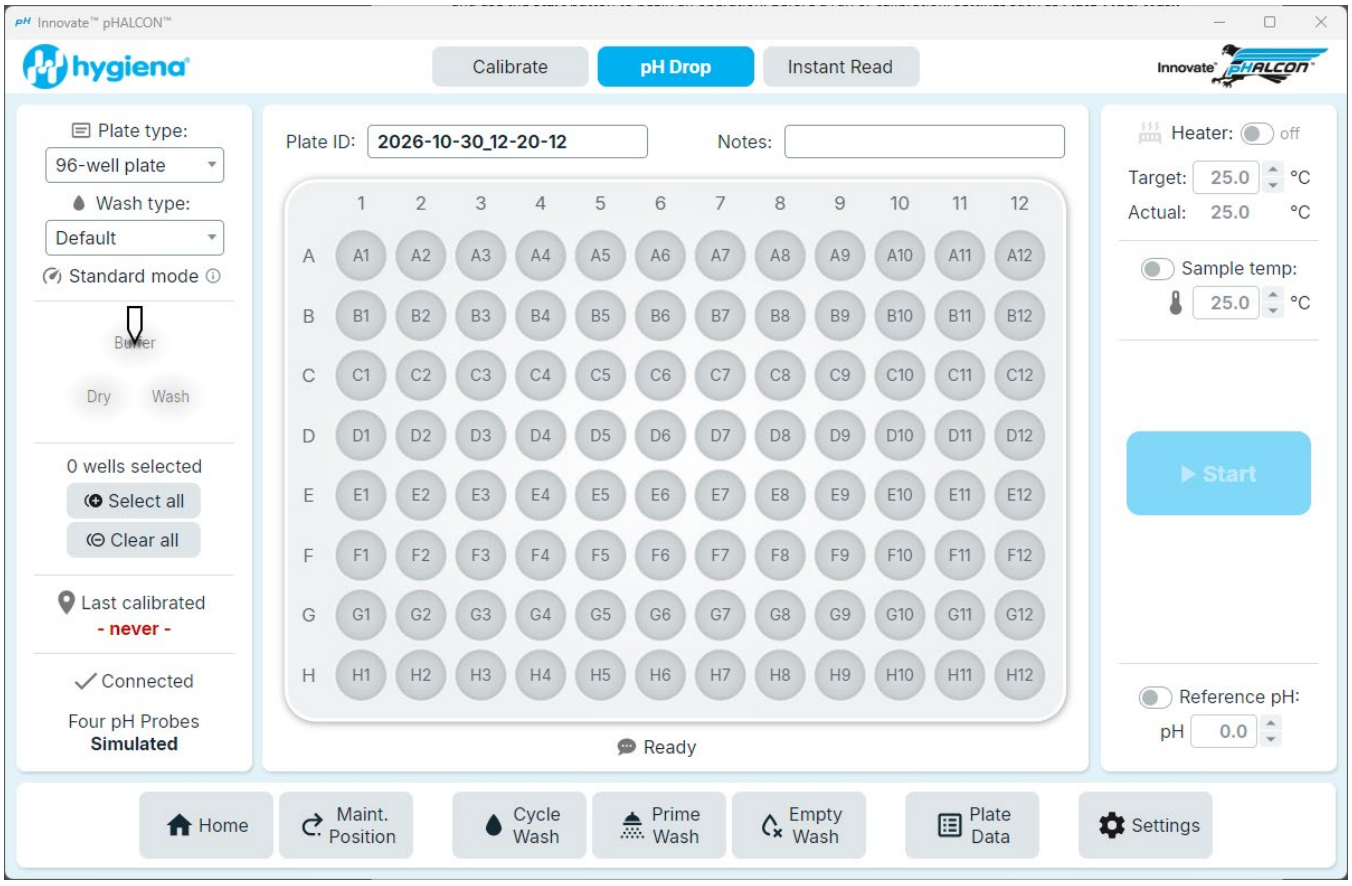
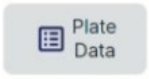
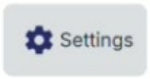
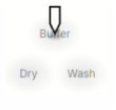


Figure 12 Main Screen, Innovate pHALCON

Each of the buttons displayed on the **Main Screen** is explained below

Home 	Moves the probe to the home position location in the buffer well. This is where the probe rests before and after testing is performed.
Maintenance Position 	Moves the instrument to a position where the probe can be safely removed or replaced. This location has the probe raised to the highest elevation and moved to the far-left position.
Wash Functions	Cycle, Prime, and Empty Wash steps.
Plate Data 	Displays a searchable list of plate runs with detailed views of well data, analysis, metadata, and export options.
Settings 	Opens **Settings** screen where instrument settings and plate definitions can be adjusted.
Start 	Run a plate of samples to read their pH.
Calibrate Mode	Opens Calibration Mode screen.
Run Mode	Opens Run Mode Screen.
Plate-Type	Defines plate type to be used in next run.
Wash Type	Select washing protocol.
Probe Cursor 	Pointer signifies position of probe in Buffer, Dry, or Wash position.
Select All	Selects all wells for analysis in next run.
Clear All	Clears selected wells.
Last Calibrated	Displays the date of last calibration.
Connected	Displays device connection status.
Probe	Displays number of probes used (“Single probe” or “Four probe”).
Heated Nest	Toggles Heated Nest and Heated Nest Settings.
Sample Temperature	User-defined estimated sample temperature.
Read Order	Defines order in which wells will be analyzed.
Status Bar	Displays run status. Located beneath plate map.

The Innovate pHALCON Software includes a simulation mode that provides access to data for training or testing. Simulation mode can be activated on the Settings screen.

5.1 Wash Functions

The wash system uses water and a blast of air to clean the probe and help prevent contamination between samples. The **Wash Function** controls on the Main Screen allow you to manually cycle, prime, or empty the wash system as needed.

Use **Cycle Wash** to refresh the wash station, **Prime Wash** to fill the wash line and remove air, and **Empty Wash** when the wash station must be drained, such as before long-term storage (**Figure 13**).



Figure 13. Software Wash Selections

Wash Functions

Cycle Wash	Empty and refill the wash station.
Prime Wash	Force air out of the line and fill the water system.
Empty Wash	This can be used to empty the wash station for long-term storage. The wash station is automatically emptied at the end of each run.

5.2 Heated Nest

All Innovate pHALCON units are equipped with a **Heated Nest**, which can be used to control the temperature of the labware during operation. The **Set Nest Temperature** window is accessed from the controls at the top right of the **Main Screen**.

From this window, you can turn the **Heated Nest** on or off, set a **Target** temperature, monitor the **Actual** temperature, and optionally provide a **Sample temperature** override. The Heated Nest can be set between ambient temperature and 45°C. Allow sufficient time for the nest to reach the selected temperature before beginning an operation (**Figure 14**).

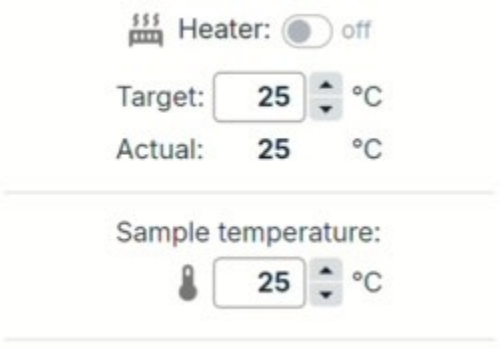


Figure 14. Setting Temperature of Heated Nest

Heated Nest Functions

Heat on/off	Turns off the nest and allows it to return to room temperature. The Set Point will be set to 0 °C.
Target	The target temperature of the Heated Nest
Actual	Current temperature of the Heated Nest
Sample temperature	User-defined estimated sample temperature

6. Plate Data

The **Plate Data** screen (**Figure 15**) allows you to review, search, visualize, export, and manage data from previous runs. When the screen is opened, results from the most recently completed run are displayed automatically.

Use the panel on the left to search for and select previous runs. Details for the selected run are displayed at the top of the **View Data** screen, while the results can be viewed as a **Plate graphic**, **Data table**, **Statistics**, or **Metadata**.

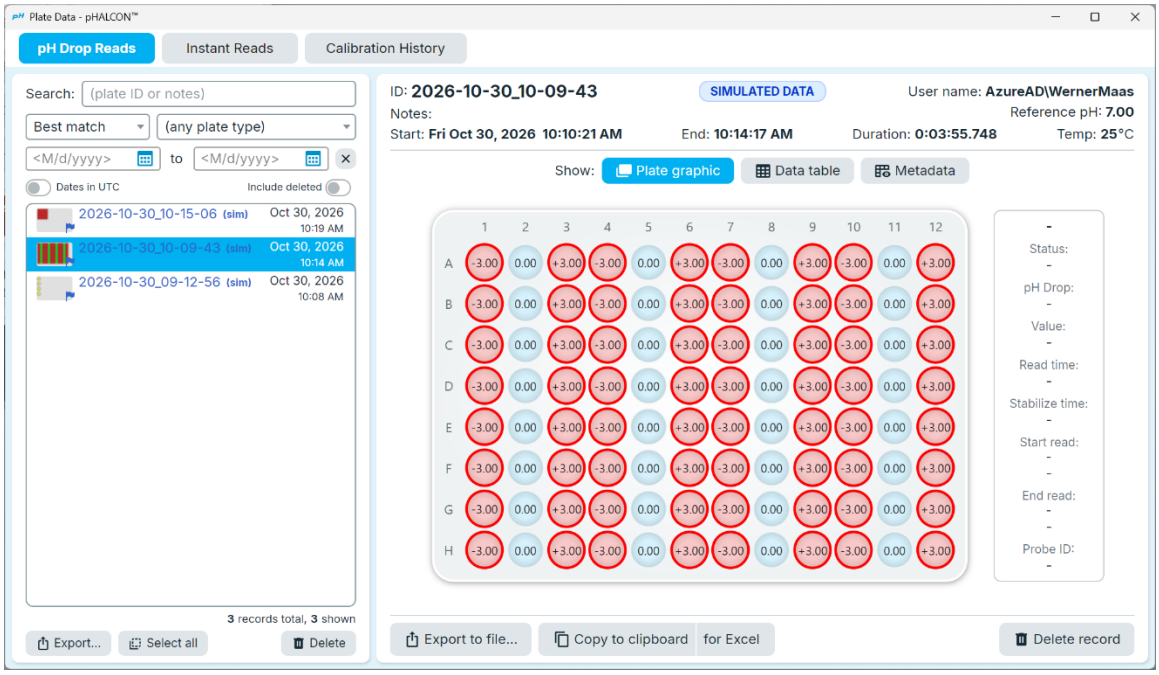


Figure 15. Plate Data Screen

Plate ID	The plate's identifier.
User name	The user who started the run.
Notes	User-defined notes relating to the plate run.
Start/End	Time and data of run beginning and completion.
Duration	Time taken to complete the run.
Description	An optional short description of the run.
Read Order	The order in which the wells were read.
Sample Temperature	The manually recorded sample temperature from the start of the run.
Temp.	The chosen Header Nest temperature at the start of the run.

Data can be visualized in the following formats:

- Plate graphic (default)
- Data table
- Statistics
- Metadata

6.1 Export Data

The **Export Data** button allows the data from the currently viewed run to be exported in several formats. Pressing the **Export Data** button opens a "Save As" window that lets you save the data as a pH XML, CSV, SAM, Excel, or JSON file.

***Note**: SAM is a text-based format that is similar to Sample ID Input files.*

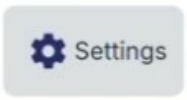
On the "Save As" window, choose a filename and directory, choose your preferred file format, and then click the "Save" button to export the data.

6.2 Delete Data

The **Delete** and **Delete record** buttons will remove that log from the list on the left or the currently displayed run on the left and right panels, respectively (**Figure 15**).

Note: For compliance reasons, data that is "deleted" *will not be removed* from the database. "Deleted" data will not usually be visible in the **Plate records** dialog box (**Figure 15**), but it will still exist in the database. Deleted runs can always be recovered by toggling the "**Include deleted**" box (**Figure 15**).

6.3 Settings



Access the Settings screen by clicking the **Settings** button located at the bottom right of the **Main Screen**. The following tabs are available within the Settings screen.

General	Configure overall system behavior and default run settings.
Connection	Define and manage communication settings between the software and instrument.
Plate types	Create and edit plate definitions that determine well layout and probe positioning.
Wash & dry	Configure wash and drying methods used to clean the probe between measurements.
Points	Calibrate and adjust probe position locations for accurate movement and measurement
Application	Configure interface appearance, accent effects, and optional warning notifications
Probes	View properties of currently installed probes.
Standards	Define and manage buffer solutions used for calibration and verification.
Tolerances	Set acceptable limits for calibration and measurement validation criteria.

The software version number is found at the bottom of the **Settings** screen.

Save & close: You do not need to save changes after editing each **Settings** tab. Navigate between tabs and make all required changes, as needed. When you are finished, click **Save & close** to save your changes and exit the **Settings** screen.

6.4 General Settings

The **General** tab (**Figure 16**) allows you to control default run behavior, Plate ID settings, Sample ID file handling, and automatic data export.

Use **Well Reading** settings to define how many measurements are taken from each well and what the software should do if a stable reading cannot be obtained. **Plate ID** settings determine how runs are identified and can also be used to associate a run with a corresponding **Sample ID File**. **Input Files** control how sample names are loaded before a run, while **Output Files** control whether completed run data is exported automatically and how those files are formatted.

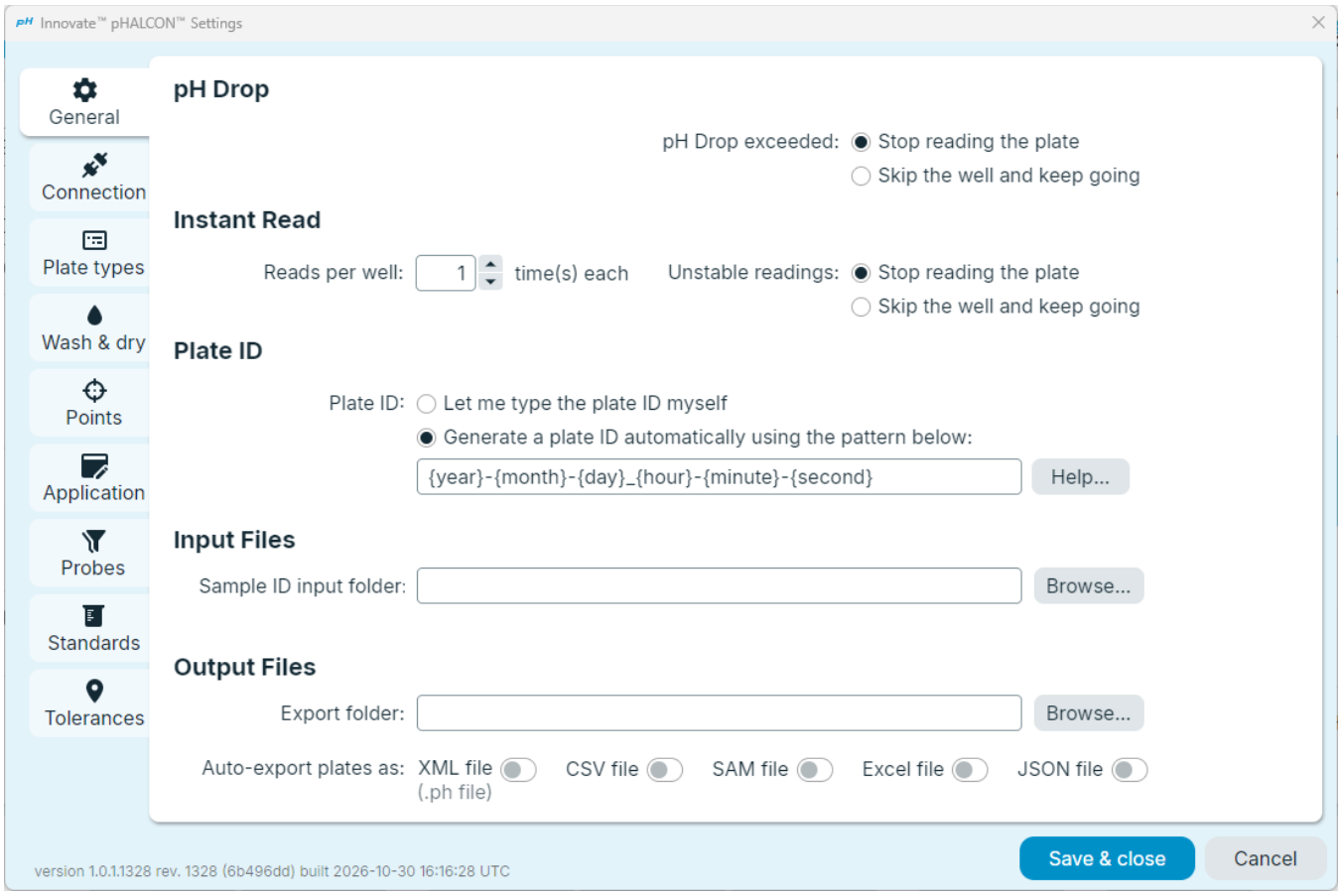


Figure 16. General Settings Tab

6.4.1 Well reading

Define **Reads per well** for each run. Each well will be read the chosen number of times to produce an average pH. Increasing this count may improve accuracy, but it may also increase the duration of the run.

Occasionally, the probe may have trouble obtaining a stable reading for a given sample. (One common cause is insufficient volume in the well.) You can define actions upon the occurrence of unstable readings:

- Stop reading the plate
- Skip the well and keep going

6.4.2 Plate ID

Define plate ID or define automatic plate ID settings. Default uses “year-month-day-hour-minute-second” format.

6.4.3 Input Files

A Sample ID is a name or description assigned to each well. Sample IDs can be applied before a run by creating a CSV file (“Sample ID File”) and saving it in the Sample ID Input Folder, which may be located on the Innovate pHALCON computer or on a network drive.

Sample names are included in exported data files after the run and are displayed as tooltips on the **Run Mode** and **Plate Data** screens when hovering over the corresponding well.

The sample ID file is a simple comma-separated values (CSV) file. Each line should contain a well location ("A##," etc.) followed by the name of the sample, separated by a comma, as shown in the example below:

Sample ID File Format:

- A01,Sample 1
- A02,Sample 2
- B01,ph4 Buffer
- B02,ph5 Buffer

CSV files can be created with Notepad, with Microsoft® Excel, or with any standard text editor. If Excel is used to create a CSV file, each well location should be placed in column A, and each sample name in column B. Use "Save As" to save the spreadsheet but change the file type to "CSV (MS-DOS)".

Note: *You must close the file in Excel (or your editor) after saving it. The Innovate pHALCON Software cannot read it if it is open in another application.*

All Sample ID files must be saved in the directory specified in the Sample ID Input Folder, which may be located on the Innovate pHALCON computer or on a network drive.

The filename given to the sample ID file must match the barcode of the plate it will be used with. When running a plate, the first field at the top of the screen, Plate ID, will determine which sample ID file is used. For example, if the sample ID file is saved as "AB1234.csv", then typing "AB1234" (without the .csv extension) into the Plate Barcode field will load the sample names from this file.

If barcode-based Sample ID files are used, the plate barcode can be scanned with a hand-held scanner (ensure the cursor is in the Plate Barcode field), and the software will automatically populate the field with the scanned value.

The software searches the Sample ID directory for a file named "<barcode>.csv"; if found, the selected wells will match the file, and sample names will be included in the output file after the run.

If the "Required Sample ID File" check box is not checked but the field for Sample ID Input Folder has a directory path, the software will look for the file name and data associated with information entered in the Plate Barcode field.

To force runs to use a sample ID file, check **"Require a file that contains sample IDs for each plate"**. This checkbox will prevent a run from proceeding unless a sample ID file with a matching name is found.

6.4.4 Output Files

You can enable automatic export of run data files containing pH results to a specified folder, eliminating the need to manually export data from the **Plate Data** window (**Figure 15**).

If no Export Folder is selected, the files will be exported to the running application's directory (typically "C:\Program Files\Hygiena\Innovate pHALCON").

You can define the exported file type:

- XML file
- CSV file
- SAM file
- Excel file
- JSON file

You may select more than one file type option to generate multiple files. If no option is selected, data will not be exported automatically.

You can also define the layout of the exported data within the exported file:

- Plate layout - provides a grid of values corresponding to the plate
- Simple list
- List in read order

6.5 Connection

The **Connection** tab determines how the Innovate pHALCON Software communicates with the instrument. These settings typically only need to be configured once. When the software starts, it automatically attempts to connect using the settings defined here.

Use **Connect via network** to connect to a physical instrument over Ethernet, click **Test connection** to verify communication, and select **Simulated device** when the software must be used without a connected instrument. The **API server** can also be enabled when the system is being controlled by an external automation platform.

After connecting via Ethernet, select Connect via network and enter the **Hostname/IP** address of the Innovate pHALCON instrument (**Figure 17**).

Note: USB is used to communicate with the instrument for maintenance and firmware updates only. USB connection is not currently supported in Innovate pHALCON Software.

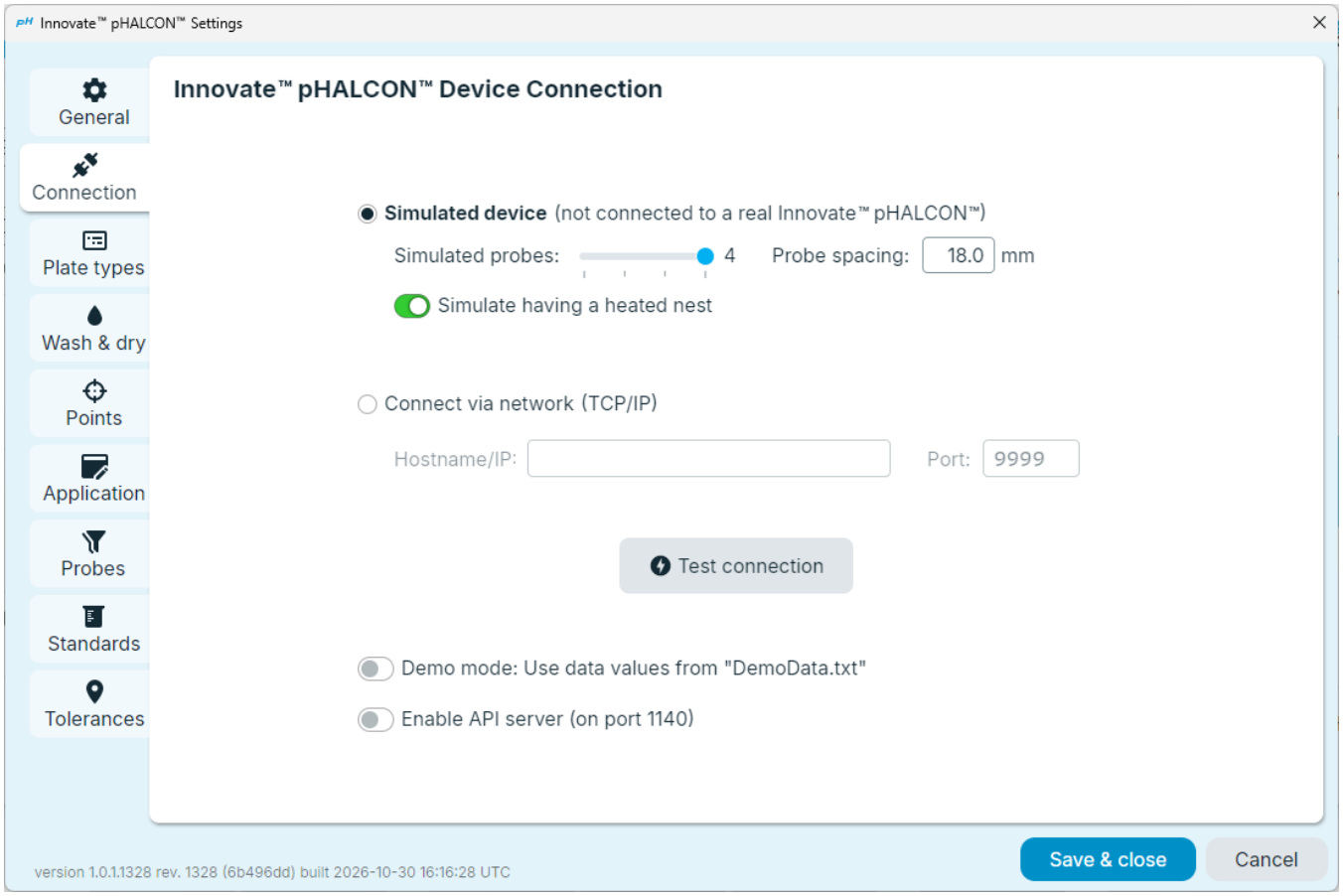
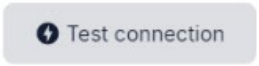


Figure 17. Device Connection

Port	The port number used for communication between the Innovate pHALCON instrument and software. The default port is 9999.
Test connection	Verifies communication between the instrument and the software. 
Demo mode	Allows the software to be used without a connected instrument for training and demonstrations without running samples.
Enable API server	Launches the service required for third-party API control, allowing the Innovate pHALCON to connect with automated workstations and external automation systems.

6.5.1 Simulated device

If the Innovate pHALCON is not available (i.e., if you are not connected to the instrument), it is still possible to view the various settings tabs and use the software by checking the **Simulated device** checkbox at the top of the panel. You can also define:

- Number of simulated probes
- Simulation of **Heated Nest**

Every software feature will be available, but the data from any runs and/or calibrations performed while in simulate mode will be marked as “simulated.”

6.6 Plate Types

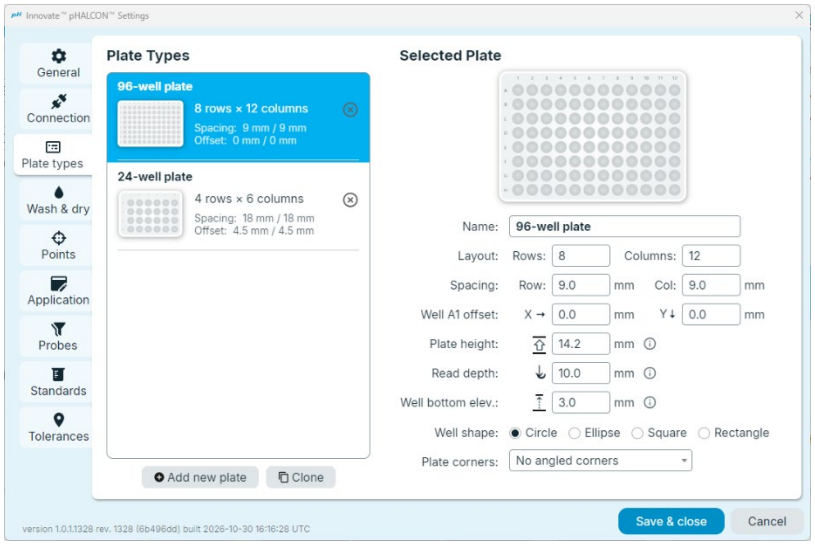
From the **Plate Types** tab, you can select existing plate types or create new ones for use during experimental runs. Standard 96-, 48-, and 24-well ANSI/SLAS plate configurations are provided by default (**Figure 18**).

A “plate type” is a collection of parameters that define the size and layout of a plate. These parameters are used to calculate the movement of the probe as it performs well reads. When creating a new plate type, you can define the **Name**, **Layout**, **Spacing**, **Well A1 Offset**, **Plate Height**, **Read Depth**, **Well Shape**, and **Plate Corners**.

The maximum height of the microplate or labware is 52 mm and must fit within the bounds of the nest.

The probe will always move up to its maximum height of about 55 mm before it moves sideways. You must ensure that there is clearance between the top of the labware and the bottom tip of the probe.

Plate manufacturers typically provide detailed specifications of plate types available on their websites. A ruler, micrometer or caliper will be needed for custom labware formats, like racks holding test tubes. Standard microplates may have slightly different features, such as flat, rounded, or coned bottoms, so ensure that the parameters are calculated as accurately as possible.



Note: *Changing the plate type definition, including* ***Well Shape*** *and* ***Plate Corners****, changes how the UI presents the plate in the read and calibrate tabs.*

Note: *Improper calculation of plate-type parameters can result in damage to the probe.*

Figure 18. Plate Type Settings

Setting Up a New Plate

Name	The name that will be used to select the plate from the calibrate and run menus.
Layout	Define the number of Rows and Columns.
Spacing	**Row:** The distance in millimeters between the center of each adjacent well along the short side of the plate.
	Column: The distance in millimeters between the center of each adjacent well along the long side of the plate.
Well A1 Offset	**X offset:** The relative distance along the long side of the plate (going left and right) between the center of a standard 96-well ANSI/SLAS microplate and the center of the plate's first well. This value is 0 for a 96-well plate. In a lower-density plate with larger wells, such as a 24-well plate, this value would be a positive number, such as 4.5.
	Y offset: The relative distance along the short side of the plate (going forward and backward) between the center of a standard 96-well ANSI/SLAS microplate and the center of the plate's first well. This value is 0 for a 96-well plate. In a lower-density plate with larger wells, such as a 24-well plate, this value would be a positive number, such as 4.5.
Plate Height	The total height of the plate, from the bottom of the plate to the top, in millimeters. **Note:** The plate cannot be taller than the wash station (~52 mm).

Read Depth	The distance in millimeters below the top of the plate that the probe reaches to take its readings. Assign this parameter based on the well depth and the desired probe depth in the sample.
Well Shape	**Circle** OR **Ellipse** OR **Square** OR **Rectangle.**
Plate Corners	Define the corner style of the plate for positioning and compatibility.

Note: *Custom plate formats must not exceed the density of a standard ANSI/SLAS 96-well microplate. Higher well densities are not compatible with the probe size.*

6.7 Wash and Dry

During a run, a wash method is performed between well readings to clean the probe before it moves to the next sample. Wash methods can be customized to meet the requirements of different applications and sample types.

To create a new wash method, click **+ Add New Wash** beneath the **Wash Methods** section. To create a copy of an existing method, click **Clone** (**Figure 19**).

The **Run When** drop-down menu allows you to configure how frequently the selected wash method is performed during a run:

- **Before every read:** Performs the wash method before each individual measurement, including multiple reads of the same well.
- **Once before each well:** Performs the wash method before the first measurement of each well. No wash is performed between multiple reads of the same well.
- **Once for the entire plate:** Performs the wash method once at the start of the run, before the first well is measured.

Regardless of the selected wash frequency, the probe is washed at the end of the run before returning to the buffer position.

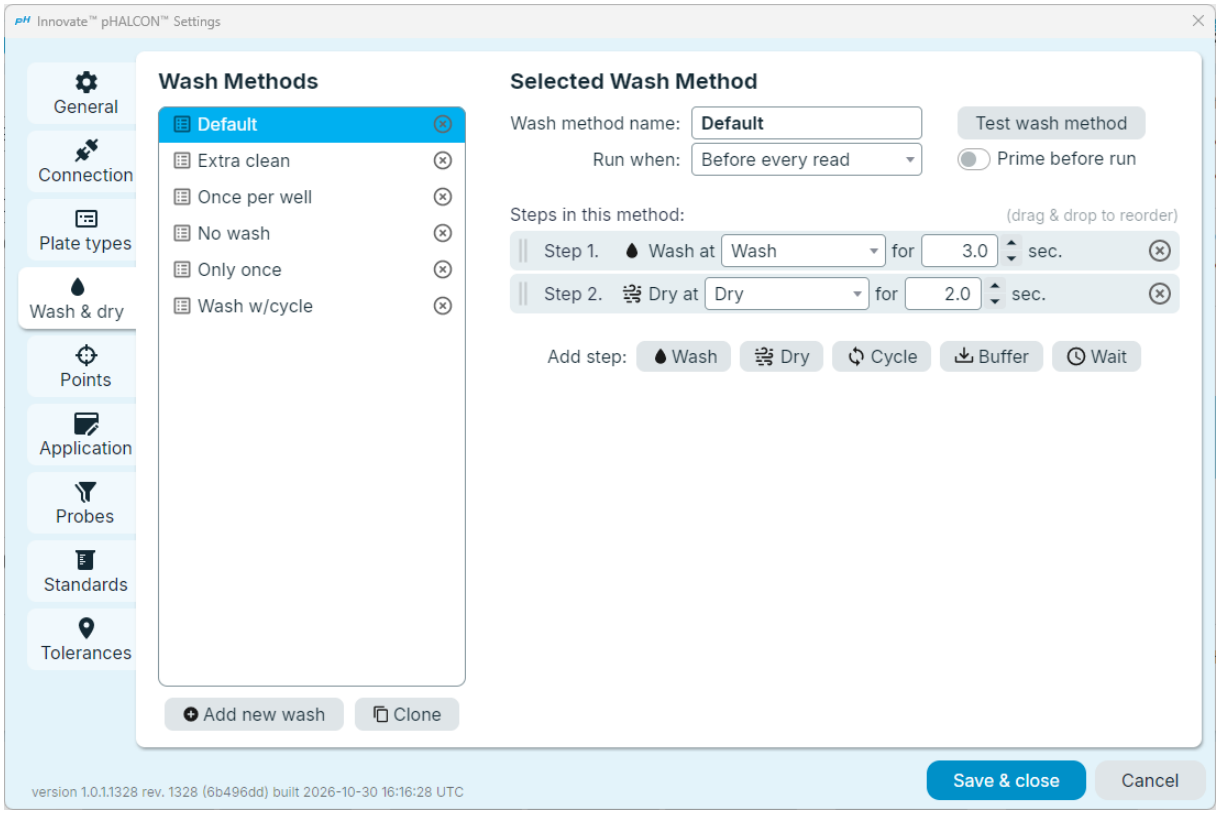


Figure 19. Wash Method Settings

Wash methods are built by combining one or more of the following steps:

Wash	Rinses the probe with water. On systems equipped with **Power Wash**, the probe moves into the wash block while water is sprayed onto the probe. During the wash cycle, the Z-axis gradually raises the probe at a rate determined by the wash step duration.
Dry	Dries the probe using a blast of air.
Cycle	Empties and refills the wash station. (Not applicable to high viscosity wash stations).
Buffer	Returns the probe to the buffer position for a user-defined period of time.
Wait	Hovers at travel height over the "Buffer" position for a user-defined period of time.

Steps can be added to a wash method by dragging and dropping them into the Wash Method editor. Any combination of Wash, Dry, Cycle, Buffer, and Wait steps can be used. Steps may be rearranged by dragging them to a new position within the method, and unwanted steps can be removed by clicking the “X” icon.

Wash at or **Dry at** allows you to define the location where specific steps are to be performed.

Note: Using a Cycle step may increase total run time, but it minimizes the possibility of contamination from the previous sample remaining in the wash solution. A full 96-well plate may use approximately 800 mL of water when Cycle is used before each wash. You should evaluate whether this option is necessary for the application.

After you have finished designing a wash method, click **Save and Close** to add the new wash method to the list of available wash methods.

To edit a wash method, select it from the list of established **Wash Methods** and make changes before clicking **Save and Close**.

6.8 Points

6.8.1 Probe Position Overview

The **Points tab** is where the probe can be positioned or repositioned in the microplate Nest, Wash, Dry, and Buffer (storage) positions.

Probes can vary in length by up to 3 mm. Removing the rubber gasket on the probe may also prevent the probe's ceramic junction from being covered by the sample, leading to poor results. Because of these physical variations, **the positions must be retaught each time a probe is installed in the probe mount to ensure proper readings.**

Figure 20 shows the wash and dry locations on the wash block.

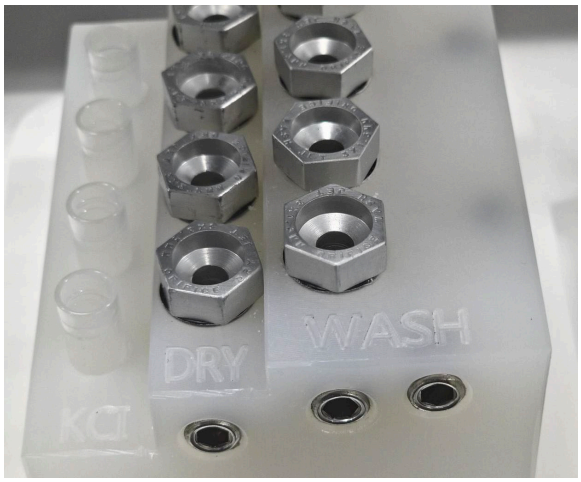


Figure 20. Wash Block

During the teaching process, remove the probe before familiarizing yourself with each of the positions to ensure the points are close to where the probe should be. **Do not move the probe if you are unfamiliar with the set positions.** Once familiar with the set positions, add the probe to begin the teaching process.

The Innovate pHALCON has a collision-detection sensor that stops the probe to reduce the possibility of damaging the probe. The probe mount also slides vertically if it hits an object to reduce the possibility of damaging the probe. All movement is done at the speed set in the **Motion Speed** Slider.

6.8.2 Position Teaching Controls

On the **Points** tab, each position (Buffer, Dry, Wash, Nest) is shown with its coordinates, and each has three buttons: **Move above, Move to** and **Teach**.

To check the accuracy of the probe positions, first click **Move Above.** If major adjustments are required, click **Teach**. If minor adjustments are needed, click the Move To button, then click Teach at the desired position, and the probe will move to that position.

- **Move Above**: Moves above the taught point without lowering it to the final Z position. This allows you to verify the X and Y coordinates before committing to the full move.
- **Move To:** Moves the probe to the defined position. Reduce probe speed if you are uncertain about the safety of the previously set position.
- **Teach:** Brings up a dialog where the probe can be moved in small increments, and where the point can be taught.

Note: Both **Move Above** and **Move To** automatically use a safe travel path, moving up and across before moving to the selected position. It is not necessary to click **Move Above** before clicking **Move To**.

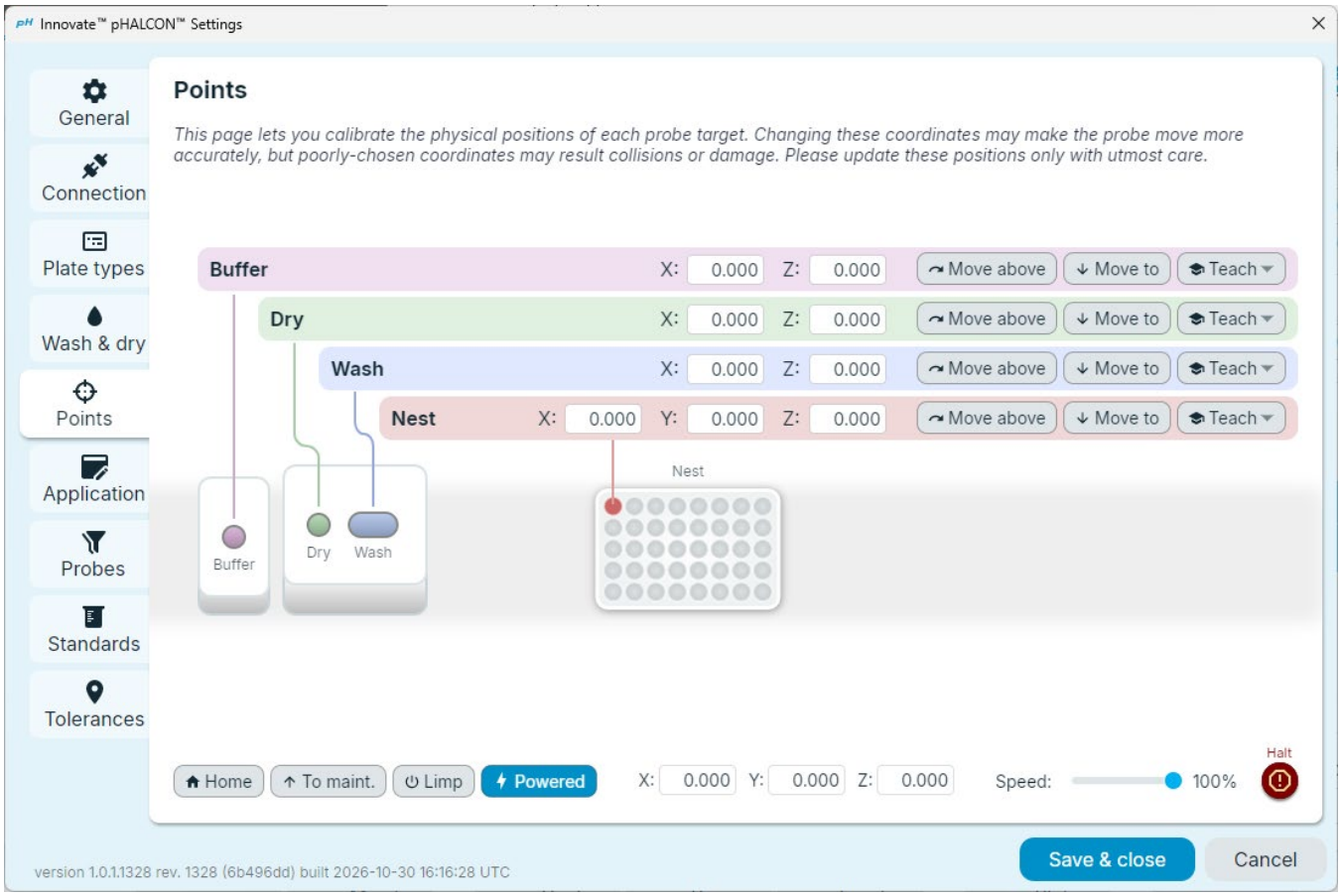


Figure 21. Points Settings

6.8.3 Dry Position Calibration

The dry position is the probe's position in the drying station. Click **Move Above** and look straight down from above the probe mount. Visually decide how to adjust the position while looking down from above. Adjust the Y position manually by holding the black probe mount and carefully turning the probe left or right. Then adjust the X position using the X adjustment buttons. Click **Teach**.

The Dry position is small, so X movements should only be in 0.25 - 0.5 mm increments.

Set the probe depth in the drying station slightly deeper than at the wash station, so that the entire “washed” portion of the probe tip is properly dried. Depth may need to be adjusted if using deep-well plates, tubes or vials to remove samples. Be careful not to hit the bottom of the well.

6.8.4 Wash Position Calibration

The Wash position is the position of the probe when centered in the wash station and sufficiently deep to immerse the probe tip.

Click the **Move Above** button. If the position looks close to the proper X position, click **Move To** before clicking **Teach**.

When using deep-well plates, ensure that the probe goes deep enough into the distilled water to rinse all of the sample off the probe, taking care to stay above the waste pump interface.

6.8.5 Buffer Position Calibration

The buffer position is the probe's location in the storage buffer area (where the probe will sit in the KCl solution between runs).

Set the probe depth in the Storage Buffer deep enough to compensate for overnight KCl evaporation.

6.8.6 Nest Position Calibration

This is the position of well “A1” on a standard ANSI/SLAS format 96-well plate. The tip of the probe should be in the center of well A1, and as close to the nest (black surface) as possible without touching it. Click the **Move Above** button. Then click **Teach**.

Tip: Use a piece of paper to slide between the probe and the deck of the nest to verify the probe is as low as possible without touching.

To maintenance: Moves the probe to the maintenance position, raises it and moves it to the left so the probe mount can be easily removed from the arm.

Motion Speed: Adjust the movement speed across all axes when teaching points.

6.8.7 Static Wash Bath Position Calibration

The static wash positions contain the static wash fluid, which can include cleaning degreasers, detergents, solvents or enzymatic cleansers. If a static wash is used, it will typically include a cleaning agent to clean the probe. As you did for the wash station, make sure the position is centered in the static wash well and that it is sufficiently deep to fully immerse the probe tip.

6.9 Application

The Application tab allows you to customize how the software looks and acts (**Figure 22**).

Use the **User interface theme** settings to adjust the visual appearance of the software. **Optional Warnings** control which conditions require user acknowledgment before continuing, while **Play a sound every time a warning is displayed** controls whether an audible alert accompanies warning messages.

Optional warnings are grouped into **Auto-export**, **Calibration**, **Miscellaneous**, **Sample IDs**, and **Wash & heater** categories.

6.9.1 User Interface Theme

Select a theme, accent, and contrast that suits your preference and viewing conditions.

- **Theme:** The light and dark display themes. Each theme interacts with the accent differently.
- **Accent:** A color effect on the theme.
- **Contrast:** A contrast change on the theme and accent.

6.9.2 Optional Warnings

Optional warnings appear when a notable condition is detected and require you to acknowledge the message before continuing. They are intended to make the decision to proceed a deliberate one, but they do not prevent you from continuing. Optional warnings are enabled by default and can be disabled by selecting **Do not show me again** in the warning message.

- Auto-export
  - **Warn me if I'm about to overwrite an output file.** Appears before a run begins if the output directory already contains a file with a name that matches the Plate ID (see **General** settings tab).
  - **Warn me that the auto-export path is not writable.** Appears before a run begins if the software cannot create a file named with the Plate ID in the selected output directory (see **General** settings).
- Calibration
  - **Warn me if the last calibration was more than minutes, hours/days/weeks/months/years ago.** Appears in the main UI window as the last calibrated date, in red.
  - **Warn me if the unit has never been calibrated.** Appears in the main UI window as "never calibrated", in red.
  - **Warn me if the unit's calibration does not match the last recorded calibration.** Appears before the start of a run when the calibration slope and offset stored within the instrument do not match the last recorded calibration.
- Miscellaneous
  - Remind me to insert a plate when I click **Start** or **Calibrate**. This warning appears at the start of a calibration or run.
  - Warn me if I try to close the application while a read is in progress.
  - After a read, highlight wells below "X" pH or above "Y" pH.
- Sample IDs
  - **Warn me if there is no sample ID file.** Appears before the start of a run when the Sample ID folder does not contain a file with the name Plate ID (see **General settings**).
  - **Warn me if the sample ID file is missing sample IDs.** Appears before the start of a run when the Sample ID file does not define sample names for all selected wells.
  - **Warn me if the sample ID file cannot be read.** Appears before the start of a run when the Sample ID file cannot be opened.
- Wash & Heater
  - **Warn me if my wash method needs wash stations that my device doesn't have.** Appears before the start of a calibration or run when the selected wash station contains a wash station name that doesn't exist.

- **Warn me if I've turned on the Heated Nest but my unit doesn't have a Heated Nest.** Appears before the start of a calibration or run when the heater nest is set to on, but the hardware does not have one.
- **Warn me if the Heated Nest is "X" °C below or "Y" °C above the target temperature.** Appears before the start of a calibration or run when the heated nest is not within the temperature range.

- Play a sound every time a warning is displayed

Note: *This setting applies to all warning messages and is not limited to Optional warnings. The warning sound can be enabled or disabled independently.*

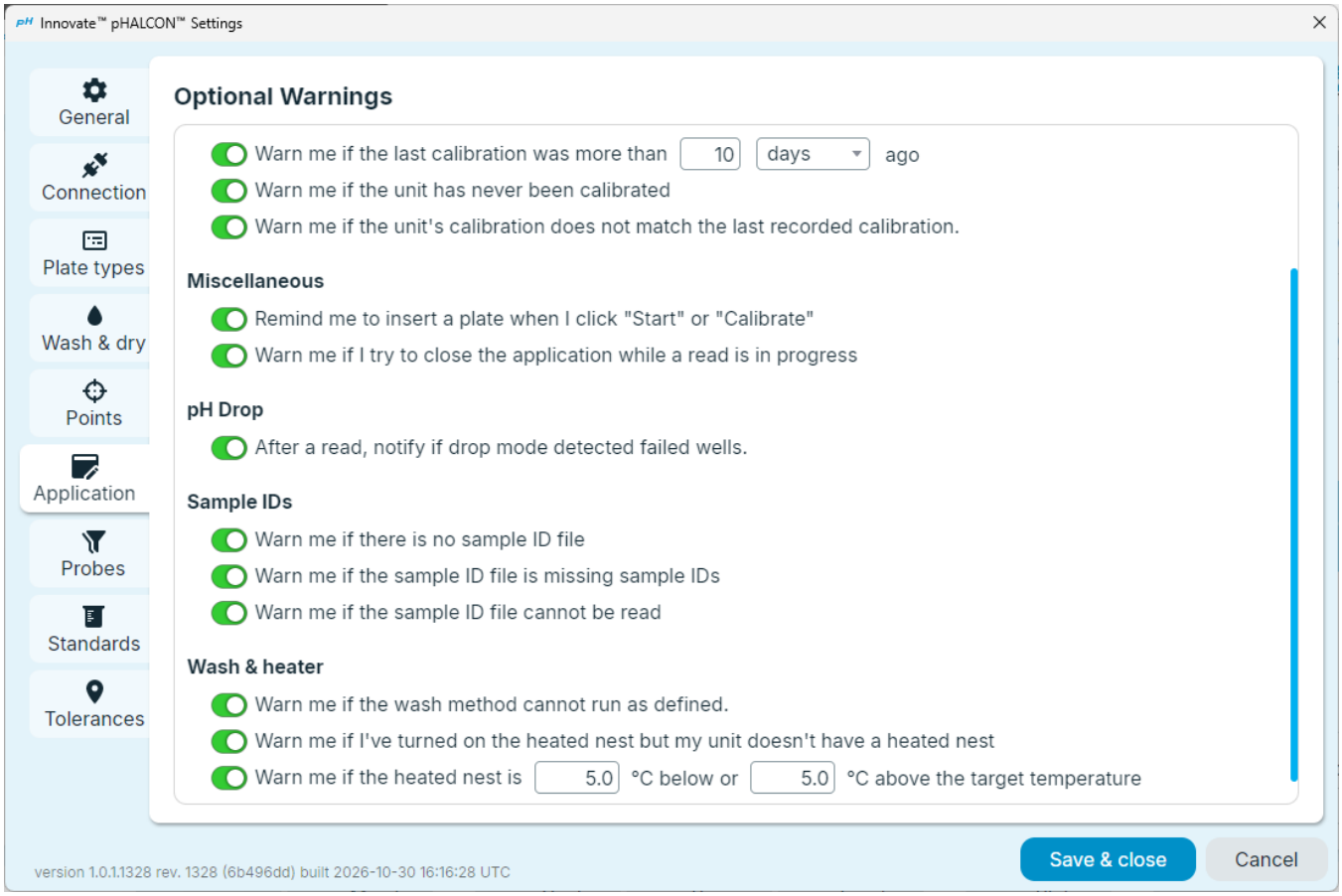


Figure 22. Application Settings

6.10 Probes

The Probes tab shows the properties of currently installed probes (**Figure 23**).

Probe Properties include **Name**, **ID**, **Type**, and **Serial No**.

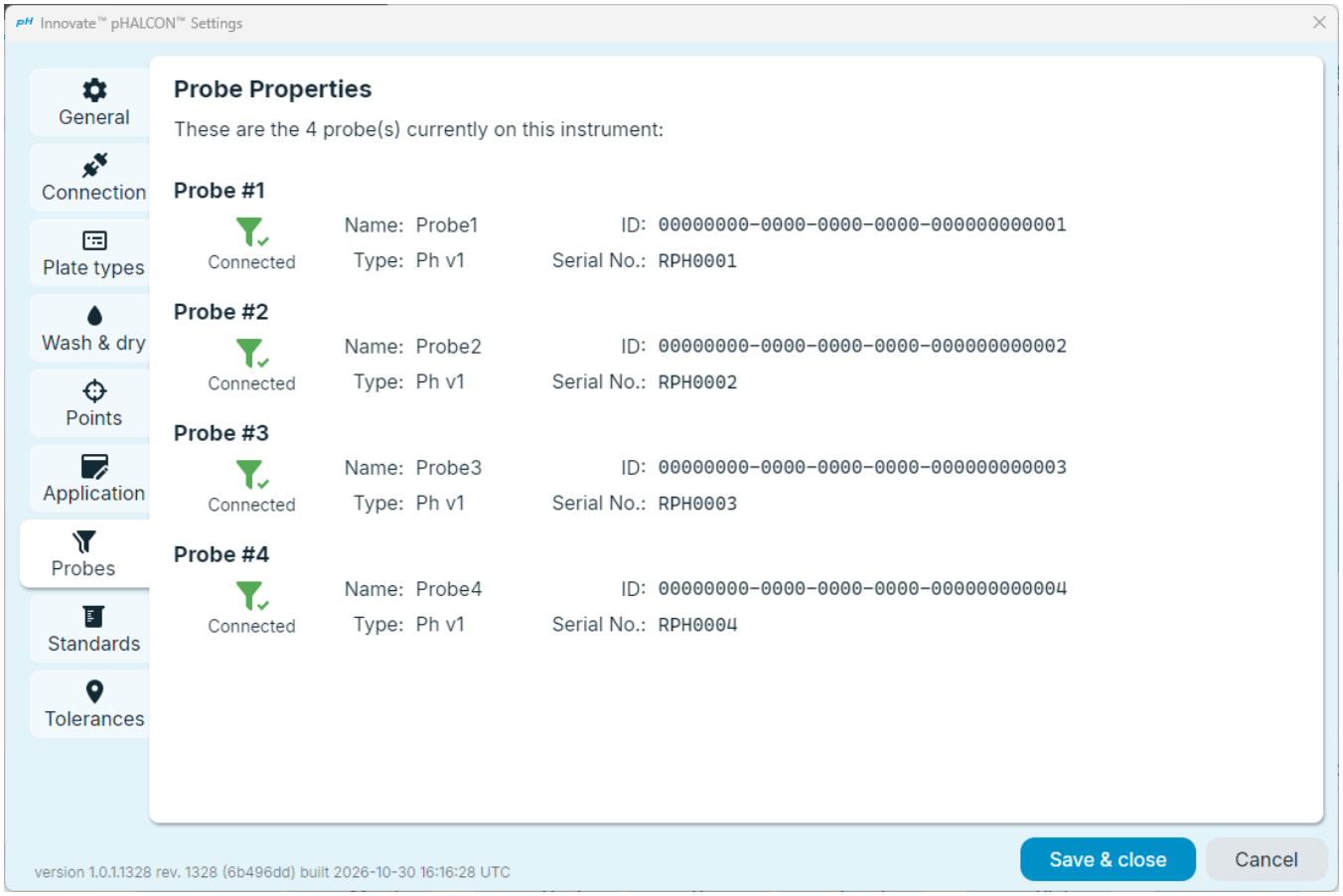


Figure 23. Probe Settings

6.11 Standards Settings

This tab is where calibration standards can be added, modified, or removed. It is particularly useful when working with a variety of buffers or standards with defined pH values (**Figure 24**).

+ Add a new standard at the bottom of the window allows you to define a new buffer with the following characteristics:

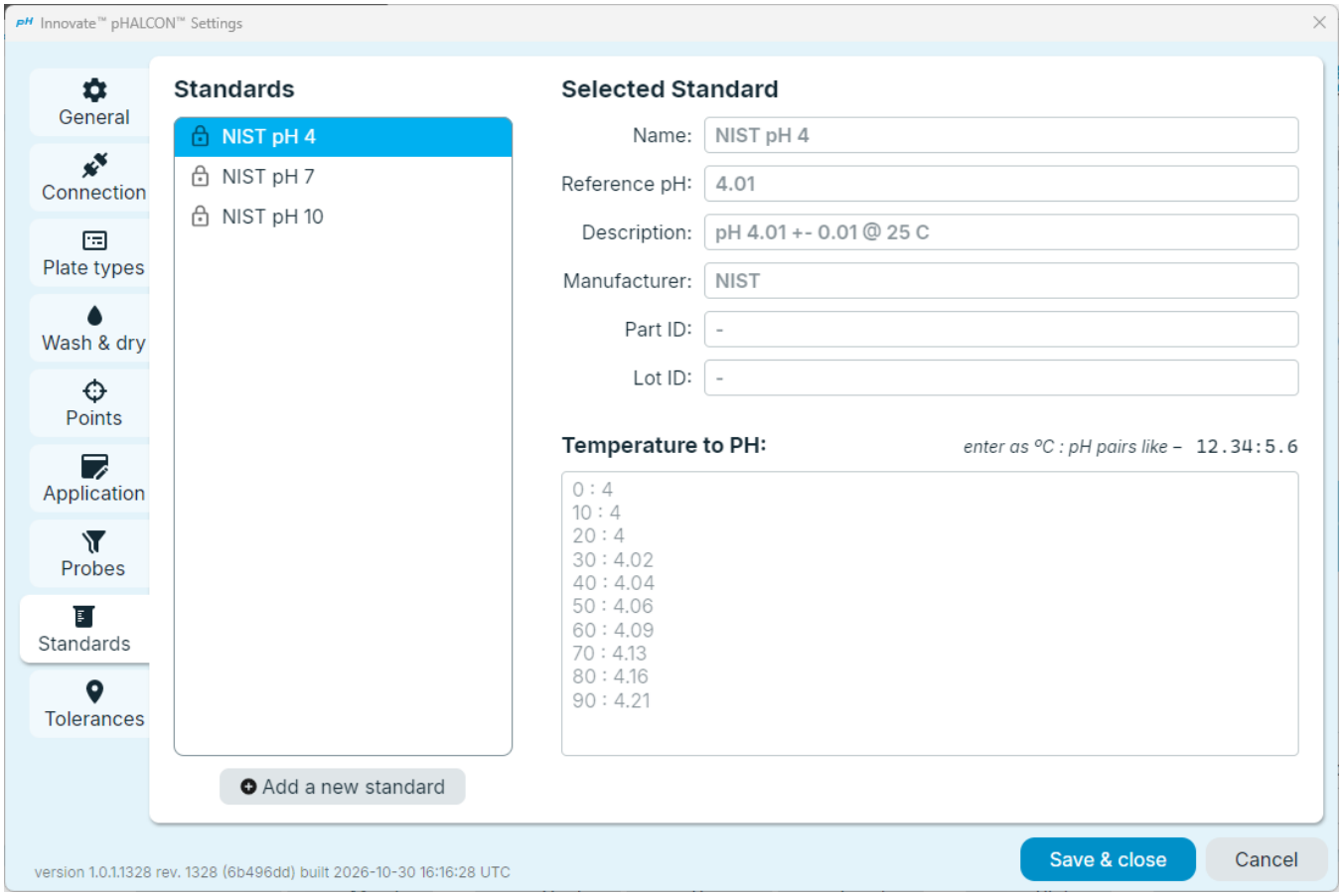


Figure 24. Standards Settings

Settings

Name	A unique identifier for the buffer.
Reference pH	The nominal pH value of the buffer.
Description	Additional details about the buffer.
Manufacturer	The buffer manufacturer.
Part ID	The manufacturer's part number for the buffer.
Lot ID	The buffer lot or batch identifier.
Temperature to pH	The relationship between temperature and pH for the buffer. Enter values as "°C : pH" Example "12.34 : 5.6".

6.12 Tolerances

The Tolerances tab (**Figure 25**) allows the configuration of the acceptable limits used to validate probe calibration and measurement accuracy. These settings determine when the Innovate pHALCON Software displays warnings or fails a calibration or measurement if results fall outside the defined limits.

Tolerance settings are grouped into **Calibration Tolerances**, **Verification Tolerances**, **Reading Tolerances**, and **Stabilization Timing**. Where applicable, separate **Warning** and **Fail** thresholds can be configured. A warning identifies a result that is outside the preferred range, while a fail condition indicates that the result has exceeded the defined failure limit.

Note: *These are advanced settings that affect calibration and reading reliability. Hygiena recommends using the default values unless instructed otherwise.*

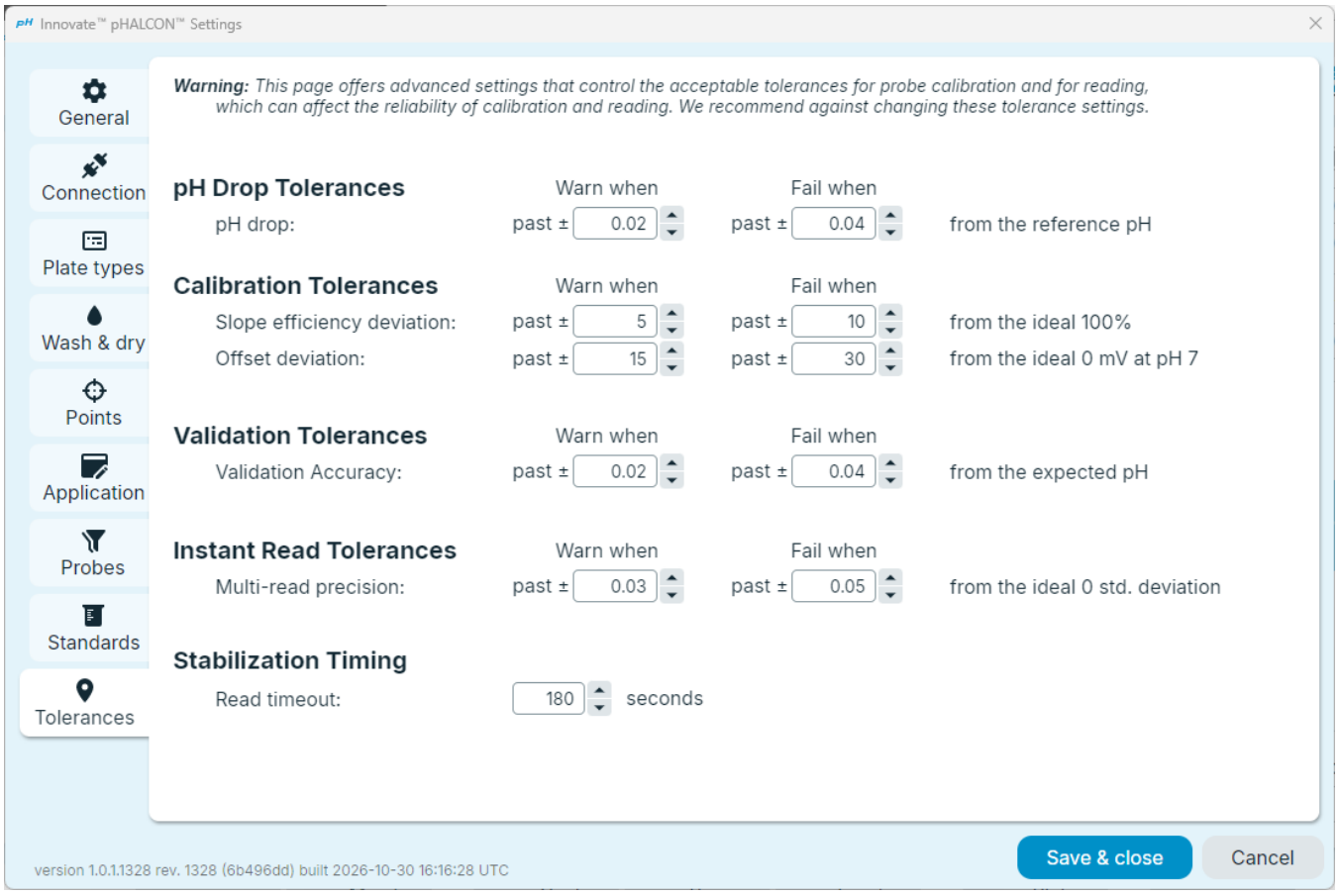


Figure 25. Tolerance Settings

Setting Information

Calibration Tolerances	**Slope efficiency deviation:** Defines the allowable deviation of the calibration slope from the ideal 100%. Separate thresholds can be set for Warning and Fail conditions. **Default:** Warn when: ± 5%. Fail when: ± 10%.
	Offset deviation: Defines the allowable deviation from the ideal mV measurement expected at pH 7.00. Separate thresholds can be set for Warning and Fail conditions. **Default:** Warn when: ± 15 mV. Fail when: ± 30 mV.
Verification Tolerances	**Accuracy:** Sets the maximum permitted deviation between the measured pH and the expected pH during verification. Separate thresholds can be set for Warning and Fail conditions. **Default:** Warn when: ± 0.02 pH. Fail when: ± 0.04 pH.
Reading Tolerances	**Multi-read precision:** Defines the acceptable variation between repeated measurements during a standard sample read. Separate thresholds can be set for Warning and Fail conditions. **Default:** Warn when: ± 0.03 Std. Deviation. Fail when: ± 0.05 Std. Deviation.
Stabilization Timing	**Read timeout:** The amount of time the software waits for a measurement to complete before it stops waiting for a response from the instrument. If the timeout is reached, the run stops. **Default:** Read timeout 180 seconds.

7. Calibration

Navigate to the **Calibrate Mode** screen. The button is located at the top center of the **Main Screen**. The Calibrate screen (**Figure 26**) shows the layout of the current plate type.

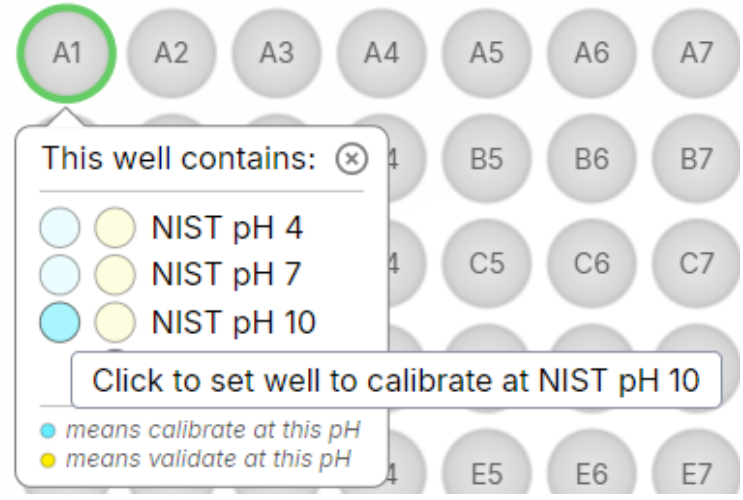
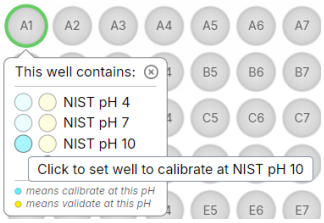


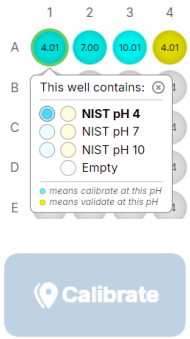
Figure 26. View of Plate on 'Calibrate' Screen.

The usual calibration uses pH buffers in Calibration wells to adjust how the probe reads and interprets the pH values of samples. If a validation is required (checking the pH of additional samples after a calibration is done), extra wells can be defined as validation wells to check the accuracy of the calibration. The verification step is optional.

1. Before calibration, turn on the air source and verify that the source bottle has distilled or deionized water in it based on your laboratory requirements.
2. Click the **Plate type** dropdown at the top left of the screen to select the correct labware. The screen will automatically adjust to match the chosen plate definition.
3. The temperature used for calibration is determined by the firmware. If a Sample Temperature is provided, that value is used. Otherwise, the firmware uses the temperature measured by the hardware.
4. Select **Wash type** using the dropdown menu located beneath **Plate type.**
5. Select **Read mode** using the dropdown menu located beneath **Wash type.**
    - **Standard** Read mode utilizes quicker stabilization criteria.
    - **Strict** Read mode utilizes longer but more accurate stabilization criteria.
6. Enable or Disable Heated Nest
    - Heat On/Off: Enable or disable the Heated Nest; when turned off, the nest returns to room temperature and the set point is reset to 0°C.
    - Target: Set the desired temperature for the Heated Nest.
    - Actual: Displays the current temperature of the Heated Nest.
    - Sample Temperature: Optional temperature that overrides the hardware-derived value used for calibration.



7. Prepare the plate using 250 µL or more of the desired calibration buffers, then load the plate into the nest. Available buffers are defined in the **Standards** tab. Default NIST buffers are provided, and you can also define custom buffers.
8. To assign your buffers to specific wells:
    - Click on the desired well or click and drag to change/select/assign more than one well at a time.
    - To the left of the calibration standard's name, select the blue dot to mark that well as a calibration well, or select the yellow dot to mark it as a validation well.
    - Select the appropriate pH value to correspond with the buffer or verification sample present in each well.



9. Click the **Calibrate** button on the right of the screen to begin the calibration.
    - The status of the operation will display beneath the plate map.

Note: *We recommend running calibration before each new day of experiments and repeating as needed. The calibration requirements will be defined by the types of samples being analyzed and by the logistical requirements of the test itself.*

7.1 Viewing Calibration Data

When the calibration is complete, the results can be viewed by clicking on the **Plate Data** button at the bottom of the Main Screen, then clicking the **Calibration History** tab in the **Plate Data** window (**Figure 27**). From this tab, you can visualize the calibration results as a **Calibration Graph**, **Plate graphic**, or **Data table**, and can also view the associated **Metadata**. From any view within the **Calibration History** tab, you can select the plate data you want to view by selecting the appropriate plate from the list on the left.

The following information can be found at the top of the **Calibration History** tab.

ID	Plate ID.
User name	The user who performed the calibration.
Start	The date and time the calibration began.
End	The time the calibration was completed.
Duration	The total time required to complete the calibration.
Temp	The temperature used during the calibration.



Figure 27. Calibration Data

7.2 Understanding Probe Calibration Results

A probe's calibration is measured against the theoretical Nernst slope and theoretical potential at pH 7. The theoretical slope changes based on calibration temperature; at 25 °C, it is -59.16 mV per pH unit. The theoretical potential does not vary with temperature and is 0 mV at pH 7.

In practice, a calibration rarely matches the theoretical slope and theoretical offset at pH 7. To quantify the probe's quality, the slope efficiency is calculated as the percentage of the calibration points' slopes relative to

the theoretical Nernst slope at the calibration temperature. To rate the offset, the mV at pH 7 from the calibrated slope is measured against the theoretical 0 mV.

Probes that calibrate with a slope efficiency ± 5% from the theoretical slope (100%) and an offset at pH 7 of ± 15 mV from the theoretical offset (0 mV) are within specification. Probes that calibrate with a slope efficiency ± 10% or an offset of ± 30 mV will not provide accurate results and should be cleaned, serviced, or replaced.

Note: New probes may not have a perfect theoretical slope or offset. This is due to physical differences in probes. This is normal.

7.2.1 Calibration Graph

The graph displayed in the center of the window shows the relationship between the calibrated data points (mV) and pH (**Figure 27**).

The calibration results for the selected probe are displayed in the right panel of the Calibration Graph (**Figure 28**). In this example, the calibration produced a slope of -58.56 mV/pH, an offset of +2.89 mV, and a slope efficiency of 98.98%.

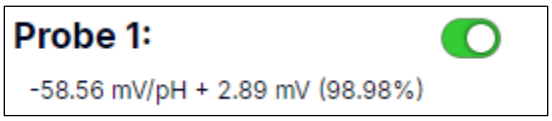


Figure 28. Probe Calibration Data

The following display options can be toggled on or off in the bottom right of the screen:

- Theoretical slope
- Calibration slope
- Validation measurements
- 25 °C compensation

7.3 Plate Graphic

The **Plate graphic** tab displays an illustration of the labware used during the calibration process (**Figure 29**). Calibration wells configured with pH buffer standards will display the measured mV reading and known pH of that buffer. Wells not used for calibration remain grey.

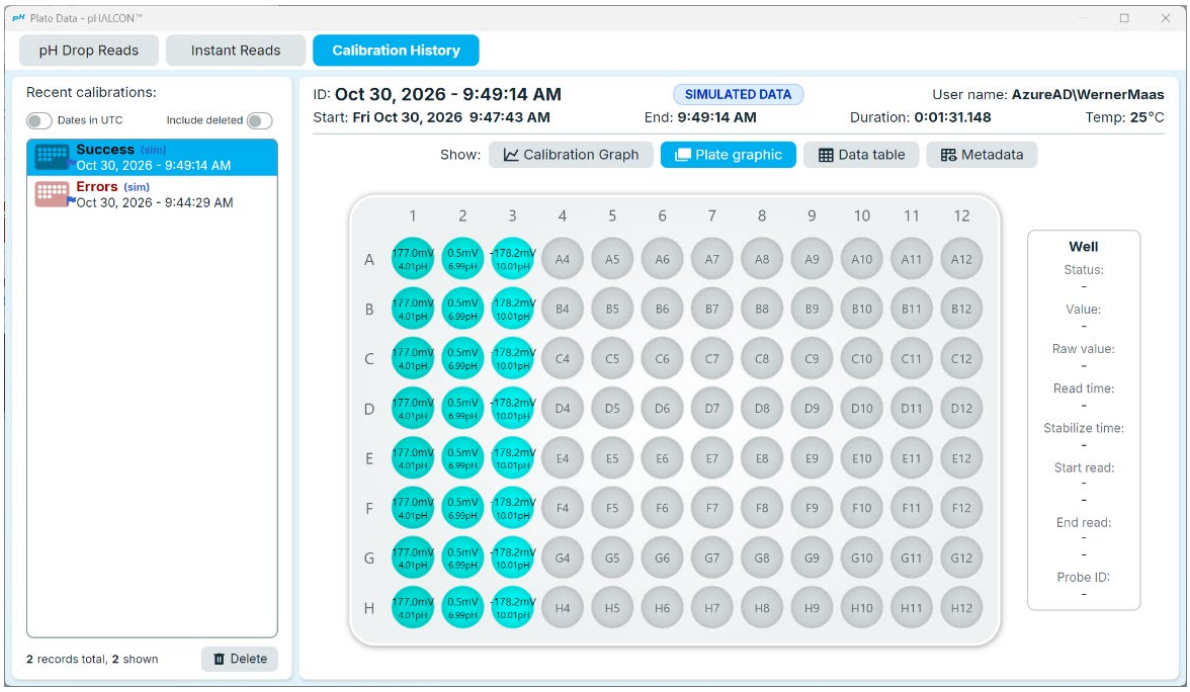


Figure 29. Plate Layout Graphic

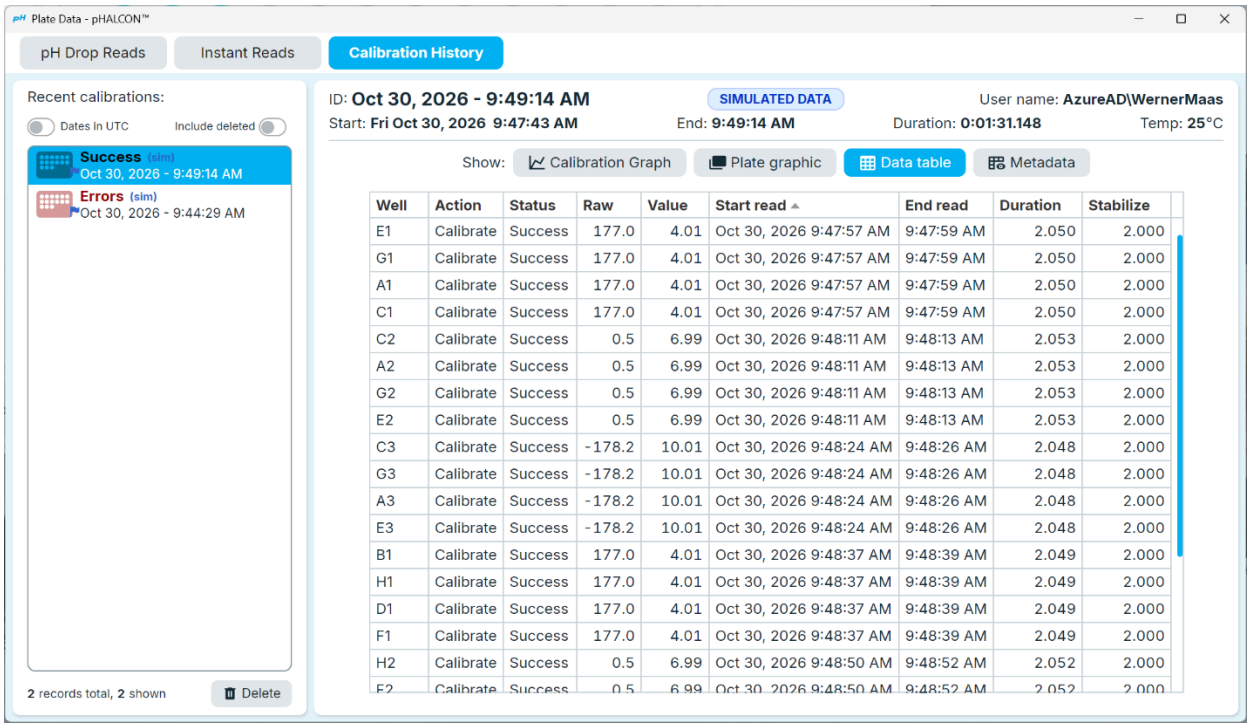
When a calibration well is selected, additional information for that well is displayed in the right panel of the window.

Display:

Status	The user who performed the calibration.
Value	The pH value being calibrated or validated against.
Raw	The raw mV measurement.
Stabilize time	The total time it took the probe measurement to stabilize.
Start read	The date and time the calibration began.
End read	The date and time the calibration was completed.
Probe ID	Identifier for the selected probe.

7.4 Data table

All information in the **Plate Graphic** is also displayed here, but in a table view format (**Figure 30**). Each line supports copyable text for easy export of a single calibration data point.



Well	Action	Status	Raw	Value	Start read	End read	Duration	Stabilize
E1	Calibrate	Success	177.0	4.01	Oct 30, 2026 9:47:57 AM	9:47:59 AM	2.050	2.000
G1	Calibrate	Success	177.0	4.01	Oct 30, 2026 9:47:57 AM	9:47:59 AM	2.050	2.000
A1	Calibrate	Success	177.0	4.01	Oct 30, 2026 9:47:57 AM	9:47:59 AM	2.050	2.000
C1	Calibrate	Success	177.0	4.01	Oct 30, 2026 9:47:57 AM	9:47:59 AM	2.050	2.000
C2	Calibrate	Success	0.5	6.99	Oct 30, 2026 9:48:11 AM	9:48:13 AM	2.053	2.000
A2	Calibrate	Success	0.5	6.99	Oct 30, 2026 9:48:11 AM	9:48:13 AM	2.053	2.000
G2	Calibrate	Success	0.5	6.99	Oct 30, 2026 9:48:11 AM	9:48:13 AM	2.053	2.000
E2	Calibrate	Success	0.5	6.99	Oct 30, 2026 9:48:11 AM	9:48:13 AM	2.053	2.000
C3	Calibrate	Success	-178.2	10.01	Oct 30, 2026 9:48:24 AM	9:48:26 AM	2.048	2.000
G3	Calibrate	Success	-178.2	10.01	Oct 30, 2026 9:48:24 AM	9:48:26 AM	2.048	2.000
A3	Calibrate	Success	-178.2	10.01	Oct 30, 2026 9:48:24 AM	9:48:26 AM	2.048	2.000
E3	Calibrate	Success	-178.2	10.01	Oct 30, 2026 9:48:24 AM	9:48:26 AM	2.048	2.000
B1	Calibrate	Success	177.0	4.01	Oct 30, 2026 9:48:37 AM	9:48:39 AM	2.049	2.000
H1	Calibrate	Success	177.0	4.01	Oct 30, 2026 9:48:37 AM	9:48:39 AM	2.049	2.000
D1	Calibrate	Success	177.0	4.01	Oct 30, 2026 9:48:37 AM	9:48:39 AM	2.049	2.000
F1	Calibrate	Success	177.0	4.01	Oct 30, 2026 9:48:37 AM	9:48:39 AM	2.049	2.000
H2	Calibrate	Success	0.5	6.99	Oct 30, 2026 9:48:50 AM	9:48:52 AM	2.052	2.000
F2	Calibrate	Success	0.5	6.99	Oct 30, 2026 9:48:50 AM	9:48:52 AM	2.052	2.000

Figure 30. Data Table Graphic

Display

Action	Marks well as calibrated or validated.
Status	Indicates whether the reading successfully stabilized.
Raw	The raw mV measurement.
Value	The pH value being calibrated or validated.
Start read	The date and time the calibration began.
End read	The date and time the calibration was completed.
Duration	The total time required to complete the calibration.
Stabilize	Stabilized mV measurement.

7.5 Metadata

All information pertaining to the calibration is included here. This includes the complete set of text-based information stored with the calibration record (**Figure 31**). Data here may also be presented more clearly in other calibration views, as well as additional informational details that are retained with the record but are not displayed elsewhere.

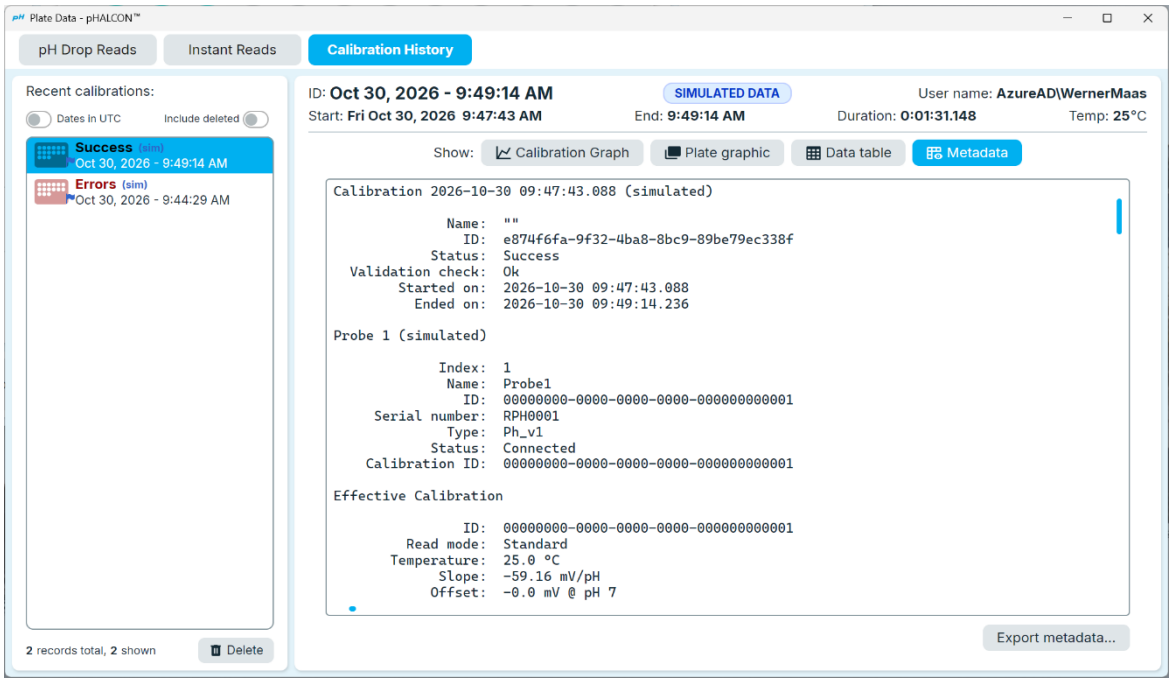


Figure 31. Calibration Record

8. How to Measure Samples

The following is a quick outline of how to use Innovate pHALCON Software to analyze the pH of a set of samples. This does not include Calibration, which Hygiena recommends performing before each new day of experiments or as required. A stepwise protocol for performing Calibration is outlined (see *Calibration* section).

Before starting a run, turn on the air source and verify that the source bottle contains deionized or distilled water.

Sample Preparation:

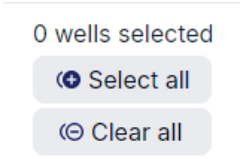
Parameter	Specification
Recommended sample volume (standard 96-well microplate)	200-300 µL
Typical volume for optimum reproducibility (standard 96-well microplate)	200-250 µL
Minimum sample volume (half-area 96-well microplate)	Typically 100 µL*

Notes on sample volume requirements:

- Recommended sample volume depends on plate geometry, measurement height, and probe position.
- The probe reference junction must be fully submerged during measurement. As a general guideline, maintain approximately 1-3 mm of liquid above the reference junction.
- Sample volumes may require optimization for different microplate formats, well geometries, and sample matrices to achieve the desired measurement performance.
- In a standard 96-well microplate, 200 µL has been successfully validated, but 250-300 µL typically provides the most robust and reproducible measurements.
- Half-area and other low-volume plates can support lower sample volumes (typically ~100 µL), provided the probe junction remains fully immersed and measurement performance has been verified for the specific plate type.

8.1 Sample Measurement

1. Select **Run Mode** on the **Main Screen**, located at the top center of the screen.
2. Select the appropriate **Plate Type** and **Wash Type**, both located at the top left corner of the **Main Screen**.
3. Select sample wells to be analyzed. Analyzed wells will be highlighted in green. Unanalyzed wells will remain gray. This can be performed in several ways:
    - Clicking individual wells.
    - Clicking and dragging across the plate to select multiple wells.
    - Clicking a column number will select that entire column.
    - Clicking a row letter will select that entire row.
    - Clicking **Select all** on the left of the screen will select all wells.
    - **Clear all** will deselect all wells.

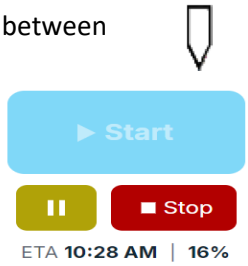


4. Enter plate and sample ID
    - If a sample ID file is being used, set the plate ID to match the sample ID file name. This will select only the samples with defined IDs.
        - After the sample ID/ file is loaded, hovering the mouse pointer over the wells will show the descriptions of the wells entered in the file.
    - Plate barcodes can also be scanned to populate the Plate ID field and load the corresponding Sample ID file, when available.
5. Enter any plate notes in the **Notes** window
    - The **Plate Data** search function searches for matching text within these notes, allowing them to be used as free-form comments, searchable tags, or a combination of both.
6. Enable or Disable Heated Nest
    - Heat On/Off: Enable or disable the Heated Nest; when turned off, the nest returns to room temperature and the set point is reset to 0 °C.
    - Target: Set the desired temperature for the Heated Nest.
    - Actual: Displays the current temperature of the Heated Nest.
    - Sample Temperature: Optional user-defined temperature used for converting the probe's mV reading to pH. If no value is entered, the instrument determines the temperature from its hardware.

7. Set well read order: Toggle using tools at the bottom right of the **Main Screen**
    - **Row forward:** Reads wells across each row from left to right (e.g., A1 to A12, B1 to B12…).
        - This is the default setting.
    - **Row reverse:** Reads wells across each row from right to left, starting from the last row (e.g., H12 to H1, G12 to G1…).
    - **Column forward:** Reads wells down each column from top to bottom (e.g., A1 to H1, A2 to H2…).
    - **Column reverse:** Reads wells up each column from bottom to top, starting from the last column (e.g., H12 to A12, H11 to A11…).

Note: *On multi-probe systems, well read order is optimized based on the probes installed on the head and the wells each probe can reach. If the selected wells cannot be completed using the chosen read order, the software will display an error.*

8. Click **Start** to begin the run
    - The on-screen probe cursor follows the hardware probe's position as it moves between sample measurements, wash steps, and other configured positions throughout the run.
    - The current state is displayed beneath the plate map.
    - Click the yellow pause button to temporarily stop the run at the next safest stop or state.
    - Click the red stop button to terminate the current operation, execute one last wash, and return to the buffer position.



With default settings, the instrument primes and fills the wash station, prepares the probe, and then begins measurements. As each well is read, its background color updates to reflect the measured pH (e.g., red = acidic, green = neutral, blue = basic).

The measured pH value is displayed within each well; hovering over a well provides an enlarged view.

Upon completion, click Return to exit the run and return to the **Main Screen**.

Note: *The application window can be minimized during a run, allowing measurements to continue while the computer is used for other tasks*.

9. Errors and Warnings

Errors and Warnings appear beneath the microplate graphic in place of the instrument status/state. Errors appear with a red background. Errors usually require immediate attention or intervention before the instrument or software can be used again. Warnings appear with a blue background. Warnings will not prevent you from using the instrument or software; rather, they serve to alert you that one or more flags have been raised, which could result in skewed measurements, missing data, or bad hardware states.

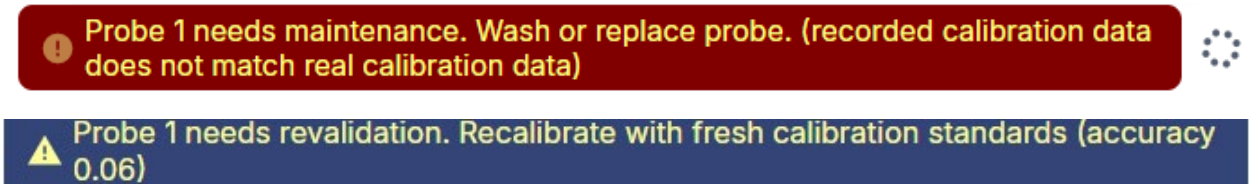


Figure 32. Error Messages

10. Probe Care, Storage, and Maintenance

10.1 Probe Storage

10.1.1 Short-Term/Between Readings

In between readings, the probe is automatically placed in a tube on the left side of the wash station. Please ensure that the tube is not taller than the wash station.

For short-term storage, keep the sensing membrane and junction immersed in **pH 4 or pH 7 buffer**, or in another short-term storage solution specifically approved for the installed electrode. We recommend replacing the storage solution daily.

Do not allow the electrode to dry out.

Periodically verify that the probe is securely attached to the probe mount and that the electrical connection is secure.

10.1.2 Long-Term Probe Storage

For weekends or other extended periods of non-use, remove the probe from the Innovate pHALCON instrument and complete the following steps.

1. Rinse the electrode thoroughly with **deionized water**.
2. Close the **SafeLock™** or electrolyte refilling opening.
3. Fill the protective storage tube with the **reference electrolyte solution specified for the electrode (i.e., Mettler-Toledo InLab® Micro reference electrolyte 3 mol/L KCl**).
4. Ensure the glass membrane remains fully hydrated.
5. Store the electrode **upright at room temperature**.

The original electrode packaging may be used to protect the electrode during storage.

Never store the electrode:

- Dry.
- In deionized or distilled water.
- In a sample solution.

***Note*:** It is also recommended to periodically check that the probe is secure by verifying its connection to the probe mount.

10.1.3 Using the Probe After Storage

Before using a stored electrode:

1. Remove the wetting cap.
2. Inspect the electrode for visible damage or contamination.
3. Gently shake the electrode downward, similar to shaking a thermometer, to remove air bubbles.
4. Rinse the electrode thoroughly with deionized water.
5. Blot excess water gently with lint-free tissue. Do not rub the glass membrane.

6. Open the SafeLock™ before measurement.
7. Verify that the reference electrolyte volume is adequate.
8. Confirm that the sensing membrane and junction are free of visible deposits.
9. Confirm that electrical connectors are clean and dry.
10. Connect the electrode.
11. Perform calibration before sample measurement.

10.2 Removing or Replacing the Probe

For long-term storage of the probe, or replacement of a defective probe, turn off the Innovate pHALCON instrument first, and then carefully remove the probe by first removing the probe mount from the probe arm, and then gently pulling the probe out of the probe mount. Removing or installing the probe while the unit is powered on could damage the probe or unit. (See the *Probe Installation* procedure for information on how the probe and the probe mount are connected to the probe arm).

Note: When removing the probe, make sure to grip the probe by the white plastic top portion. Do not apply pressure to the glass part of the probe, as this may damage the probe.

10.3 Membrane Reconditioning and Regeneration

Regeneration should be used primarily when calibration and troubleshooting indicate deterioration of the pH-sensitive glass membrane and normal cleaning or rehydration has not restored acceptable performance.

1. Clean contamination before regeneration

If deposits or contamination are visible, perform the appropriate cleaning treatment before regenerating the membrane.

2. Rehydrate first when appropriate

If the electrode has been stored dry or the hydrated gel layer is suspected to be depleted:

1. Immerse the sensing portion of the electrode in the appropriate electrolyte **(Mettler-Toledo InLab® Micro reference electrolyte 3 mol/L KCl**).
2. Allow sufficient time for rehydration according to the electrode manufacturer's instructions.
3. Rinse and recalibrate the electrode.
4. Evaluate slope, offset, response time, and stability.

3. Regenerate the glass membrane when required

1. Follow all applicable chemical-safety precautions and the Regeneration solution manufacturer's SDS and instructions. Wear appropriate PPE.
2. Use a container compatible with the Regeneration solution.
3. Immerse only the pH-sensitive glass membrane.
4. Do not immerse the glass membrane in a Regeneration solution for more than 2 minutes, unless an electrode-specific manufacturer procedure explicitly specifies otherwise.
5. Rinse the electrode thoroughly with deionized water.
6. Recondition the electrode in the appropriate electrolyte.
7. Recalibrate and evaluate performance.

4. Replace the electrode when necessary

Replace the electrode when:

- The glass membrane or shaft is physically damaged.
- Calibration slope remains below approximately 85% or above 105%.
- Cleaning, rehydration, and regeneration fail to restore acceptable response.
- Readings remain unstable after other causes have been eliminated.

10.4 Probe Cleaning and Junction Maintenance

Select the appropriate cleaning procedure based on the suspected cause of the clogged junction.

Contamination	Recommended cleaning treatment	Approximate treatment time
Silver sulfide	Thiourea cleaning solution	5–60 minutes, until discoloration disappears
Protein contamination	Pepsin/HCl cleaning solution	More than 1 hour
Protein contamination, alternative	2% NaOH	Approximately 20 minutes
Oils or lipophilic substances	Ethanol or acetone, when compatible with the electrode	Approximately 30 minutes
Calcium or scale	Acetic acid	Approximately 30 minutes
Soaps or surfactants	Hot water, approximately 80°C	Approximately 12 hours
Unknown contamination, first treatment	0.1 mol/L HCl	Approximately 12 hours

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