White Paper

Agilent
Trusted Answers

Agilent 8890, 8860, and 9000 GC Browser Interface: A Tutorial

Introduction

The Agilent Smart GC systems (Agilent Intuvo 9000 GC, and Agilent 8890, and 8860 GCs)[1] provide the user with three ways to interact with the instrument: the local touch screen user interface, the data system (through a connected computer), and the browser interface. The concept of a local user interface is familiar to GC practitioners acquainted with Agilent GCs, such as Agilent 7890 and 7820 GCs, even though the 9000, 8890, and 8860 embody it in the form of a touch screen display. The data system interface is also familiar to GC practitioners. The third interface, the browser interface, is a new way to interact with the latest generation of Agilent GCs. The browser interface offers the user the ability to perform maintenance and diagnostic tests, receive real-time status updates, access in-depth help information, and make runs (including full sequences) from the instrument itself – all without the need of a connected data system.

What the browser interface is

The browser interface is an application that is delivered by the firmware (FW) of the GC, is hosted on the GC itself, and is accessible through a Web browser interface such as Microsoft Edge.

What the browser interface is not

The browser interface is not a Web browser or cloud-based application hosted externally from the GC itself, and it is not a data system.

How to access the browser interface

Because the browser interface is not a Web application, no outside Internet is required to access it. Rather, a user only needs to be able to communicate to the instrument itself either (a) with a computer connected directly to the GC by a LAN cable, or (b) by placing the GC on their corporate IT infrastructure. As a result, access to the GC's browser interface remains behind the corporate firewall and all security protection it provides; the smart GC can be thought of as analogous to a network printer containing its own embedded application page. If the GC is put on the user's corporate IT infrastructure, then any device allowed to access that infrastructure (e.g., through a VPN connection) can be used to see the GC's browser interface; such devices include desktops, laptops, tablets, or phones. Likewise, with the GC on the corporate IT infrastructure, any external device not allowed to access the infrastructure will not be allowed to access the GC. By putting the GC on a corporate IT infrastructure, the user is limiting access to the instrument to only those personnel who have access to the corporate IT infrastructure. Furthermore, the GC owner can limit which personnel with access to the corporate IT infrastructure can access the GC by setting a PIN unique to each GC.

To connect to the browser interface of your GC, you will first need to know the GC's host name or IP address; both of which can be found from the unit's touch screen (Figure 1).

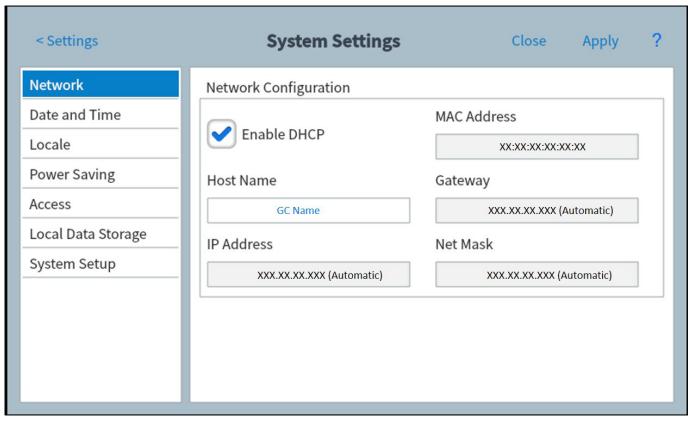


Figure 1. Network Configuration window on the Agilent 8890 and 9000 GC touch screen. Navigation path: Settings > System Settings > Network.

If **Enable DHCP** is selected, only the Host Name user-entry field is editable. If **Enable DHCP** is deselected, the user can manually type into the Host Name, IP Address, Gateway, and Net Mask user-entry fields.

With the GC host name or IP address known, open a Web browser on a device that is connected to the same gateway as the GC.

Note: no Internet connection is required. Supported browsers include Google Chrome, Apple Safari (from a tablet), and Microsoft Edge. Then, type the IP address (or host name) of the GC in the corresponding user-entry field using the format http://xxx.xx.xx.xxx, where xxxx.xx.xx.xxx is the GC's IP address or host name.

The user can also be directed to the browser interface from within the data system by clicking the Browser Interface link within the data system's Method Editor (Figure 2).

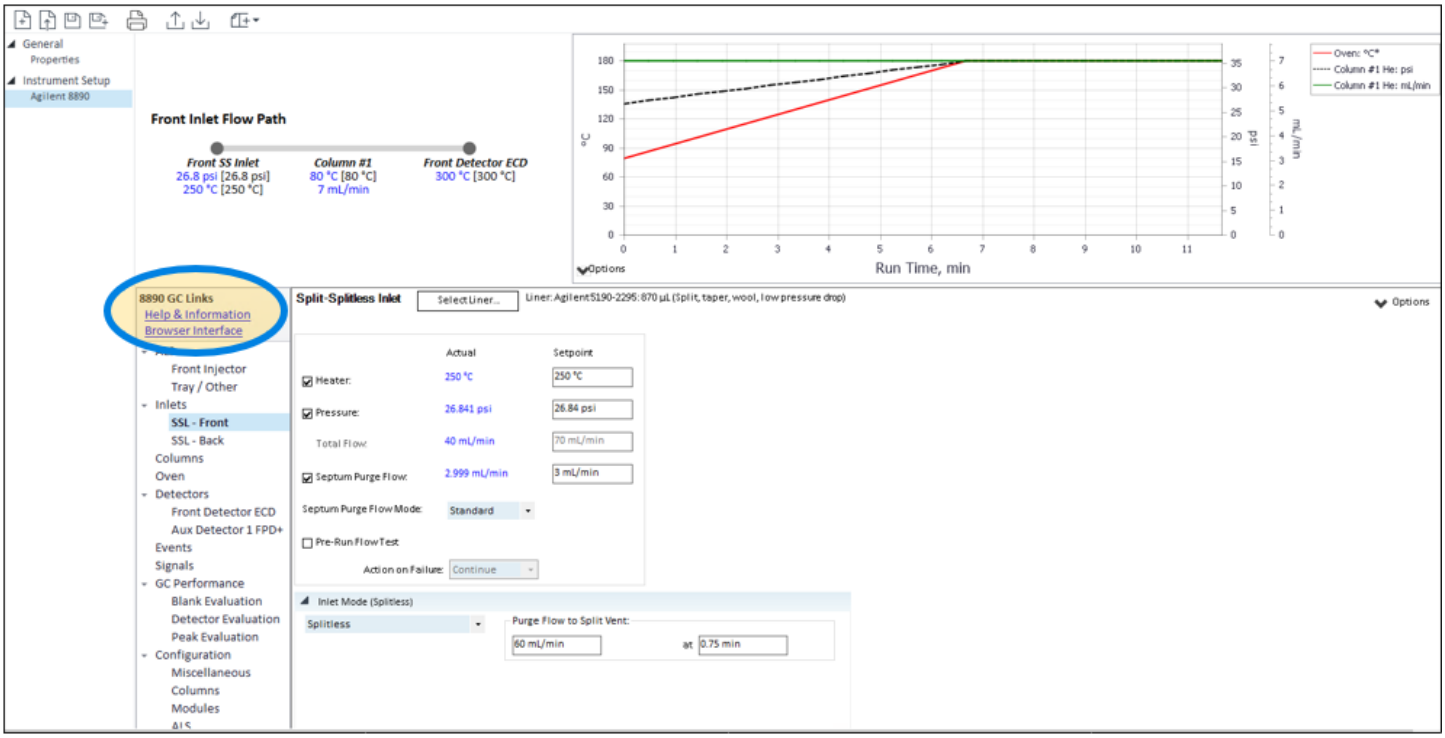


Figure 2. Link to the browser interface from within the data system. **Note:** Agilent OpenLab CDS 2.6 shown.

What you can do with the browser interface

The browser interface is the most flexible user interface for interacting with the 9000, 8860, and 8890 GCs. The browser provides functionality in the following areas:

- **Browser home screen:** view instrument flow path configurations and overall status.
  - Check detailed instrument status including the Instrument Actuals Table in the status listing.
  - View a live plot of your detector or diagnostic signals.
- **Method:** create, save, and apply methods.
- **Sequences:** create, save, and run sequences.
- **Diagnostics:** execute automated diagnostic tests and access reports from blank, detector, and peak evaluations.
- **Maintenance:** access and execute on-board, guided maintenance procedures.
  - Monitor and manage instrument and consumable use with early maintenance feedback (EMF).
- **Logs:** view instrument logs (Maintenance, Run, System, and Sequence logs, and the comprehensive Run History log).
- **Settings:** review instrument information and access the instrument's Scheduler.
- **Help:** access the extensive Help and Information window, including all PDF manuals, which are stored directly on the GC.

Each of these areas will be explored in more detail in the following sections. Please note, this document describes the features and functionality of the browser as of FW revision 2.5.

Features

Browser home screen: view instrument flow path configurations and overall status

The home screen of the browser interface can be thought of as the landing page of your instrument. Figure 3 highlights the interactive components of the browser interface overall and shows the flow path view tab of the home screen. From the home screen, the user can navigate between three view tabs (Flow Path view, Instrument Actuals Table, and real-time plot) as well as to each of the menu tabs at the top of the screen.

The Flow Path view shows the actuals for key components of the flow path(s) configured on the instrument. Also, if a data system is remotely connected to the instrument, the name of the computer hosting the data system is displayed on the status bar.

The status bar at the bottom of the home screen is color-coded to match the readiness state of the instrument (green: ready, orange: not ready, red: fault, purple: rerun, and blue: run). In addition, the status bar also provides the name of the sequence, method, and sample being run and the amount of time remaining in the current run. Expanding the status bar using the caret symbol provides detailed status information, including the run status of the instrument (Figure 4).

The Instrument Actuals Table, shown in Figure 5, contains a user-editable table of actuals, setpoints, and signals (both detector and diagnostic) for quick reference. The **Add** and **Delete** buttons at the top of the page provide the means to select which parameters to add or remove from the list.

The real-time plot tab allows the plotting of up to four signals at a time, whether they are detector signals, diagnostic signals, or a combination of both (Figure 6). Drag-to-zoom is supported and axis scales can be user-defined using the signal settings menu. Consistent with the data system, when a run begins, a vertical line is displayed on the real-time plot, indicating t = 0 for that run.

From any of the three home screen views, and from within the menu windows themselves, the menu tabs across the top of the screen are available. The following sections explore each of the menu tabs in more detail.

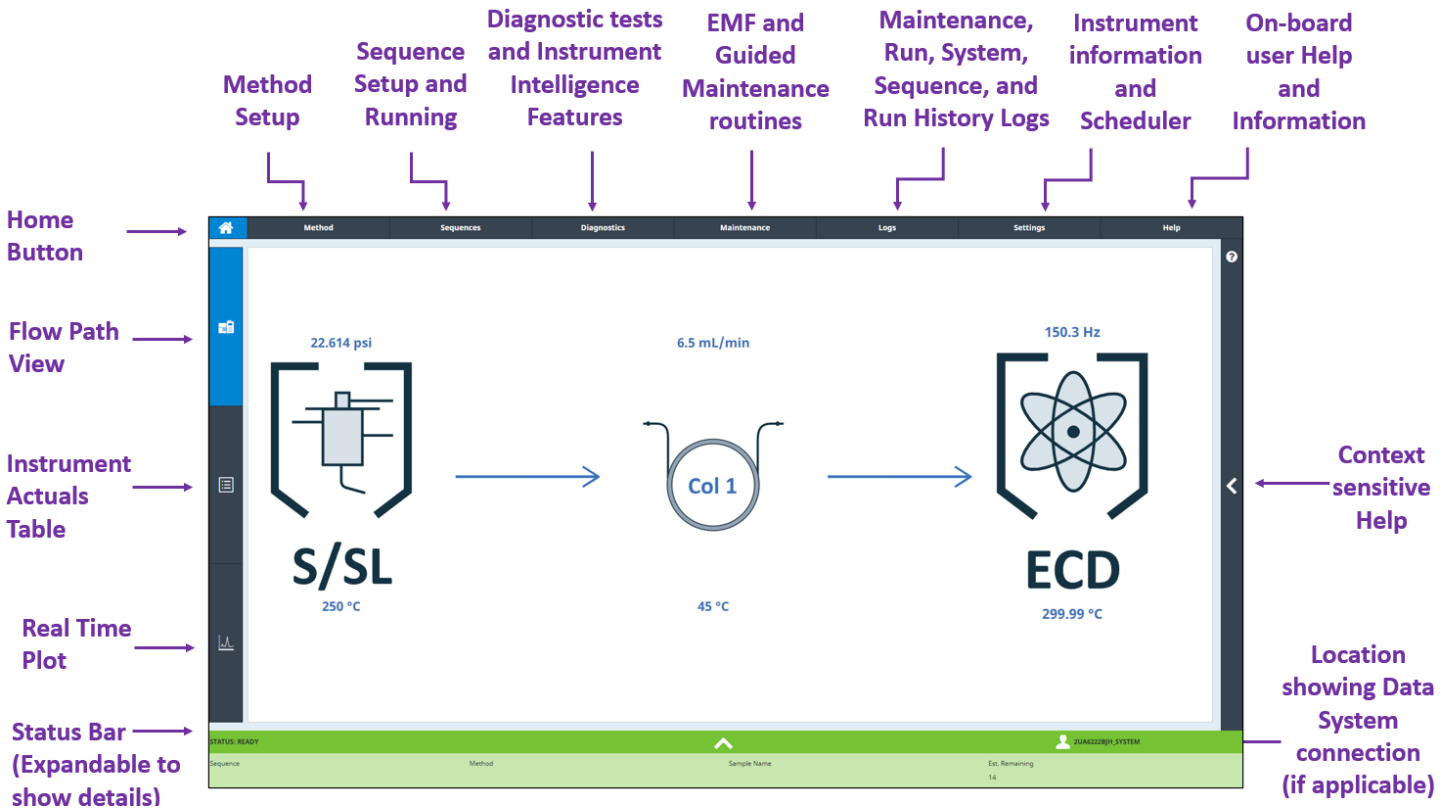


Figure 3. Browser home screen and menu tab identification; flow path view tab shown.

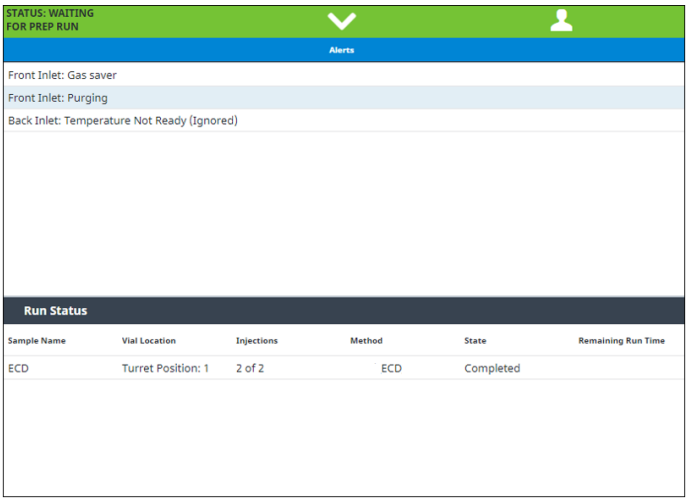


Figure 4. Detailed status information found in the expanded status bar.

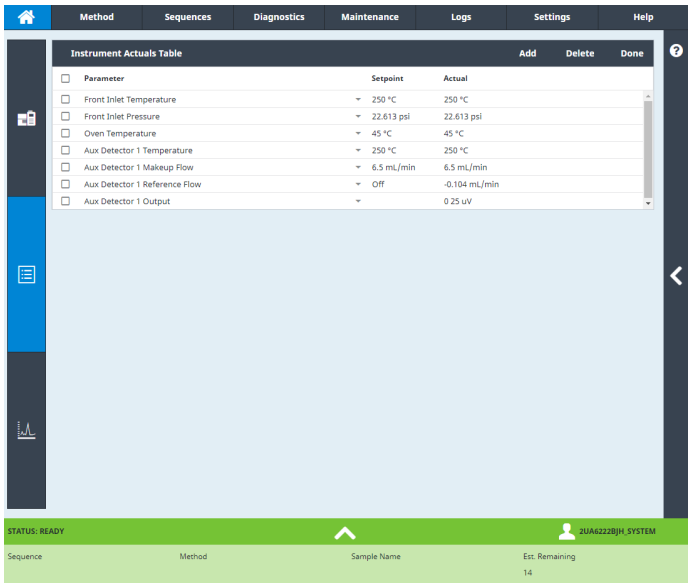


Figure 5. Browser home screen; Instrument Actuals Table shown.

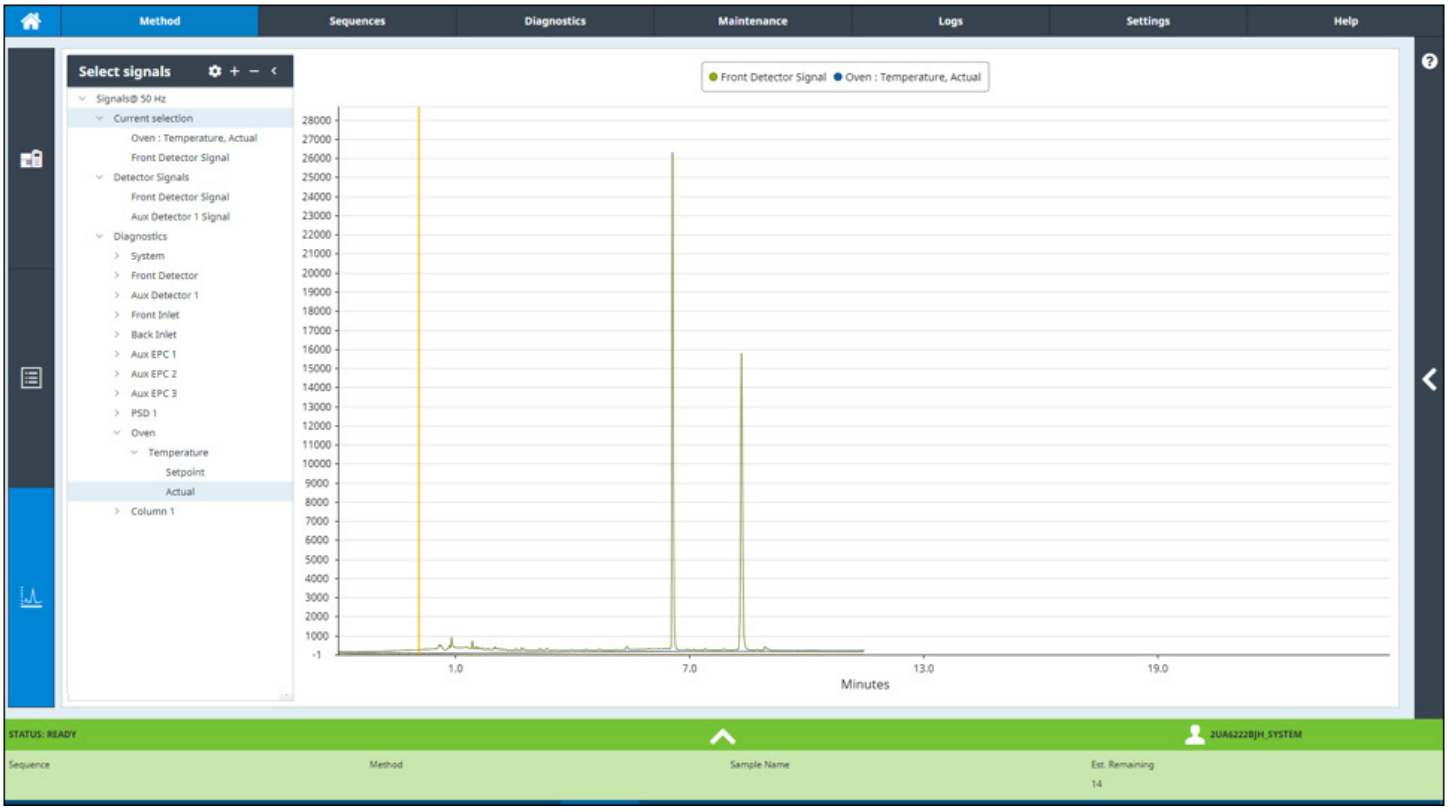


Figure 6. Browser home screen; real-time plot tab shown.

Method: create, save, and apply methods

The layout of the browser's Method Editor window is like the layout found in Agilent OpenLab CDS. Buttons at the top of the page provide the ability to edit and save method parameters and to download them to and upload them from the instrument. Also, like OpenLab CDS, the Method menu is located on the left side of the page, and selecting a specific component (e.g., oven) exposes the related setpoints and actuals on the right. The fully featured Method Editor allows the setup of run-time events and the configuration of components that do not require the user to be physically at the instrument. Figure 7 provides an overview of the browser's Method Editor interface.

Methods created and saved using the browser's Method Editor are stored on the instrument itself, independently from methods created and saved from a data system. However, the upload and download capability allows efficient interplay between the data system and the browser, where a method created on the browser could be transferred to the data system by first downloading the method from the browser to the instrument then uploading the method from the instrument to the data system and vice versa.

One benefit provided by the browser Method Editor is contextual help and information that is present in each window to help guide users. With the help content contained within the FW on the instrument itself, relevant sections of the help can be displayed selectively; this is referred to as contextual help. Figure 8 shows an example of contextual help where information related to configuration within the Method Editor can be displayed alongside the editor itself.

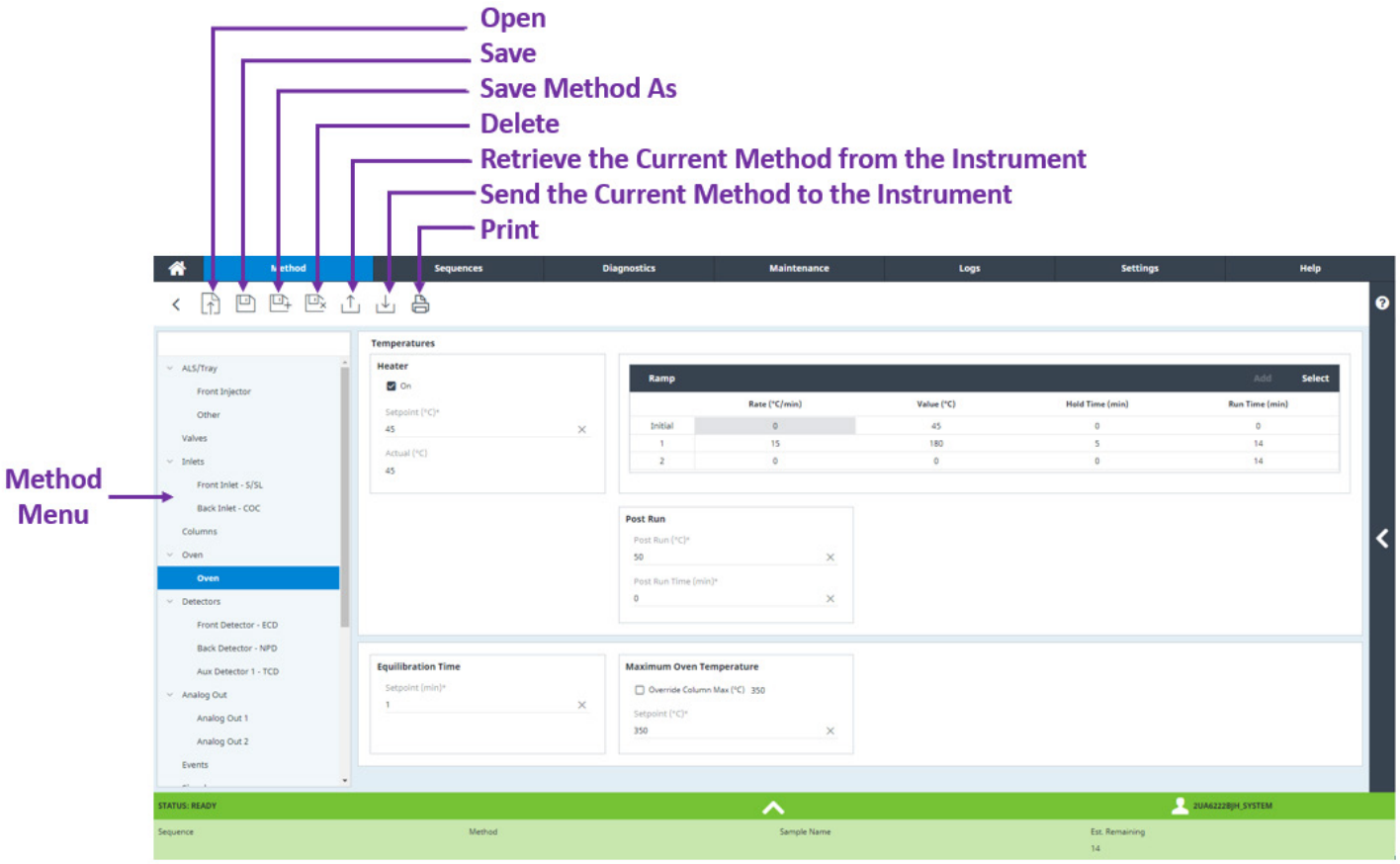


Figure 7. The browser's Method Editor; the layout, iconography, and navigation are consistent with Agilent OpenLab CDS.

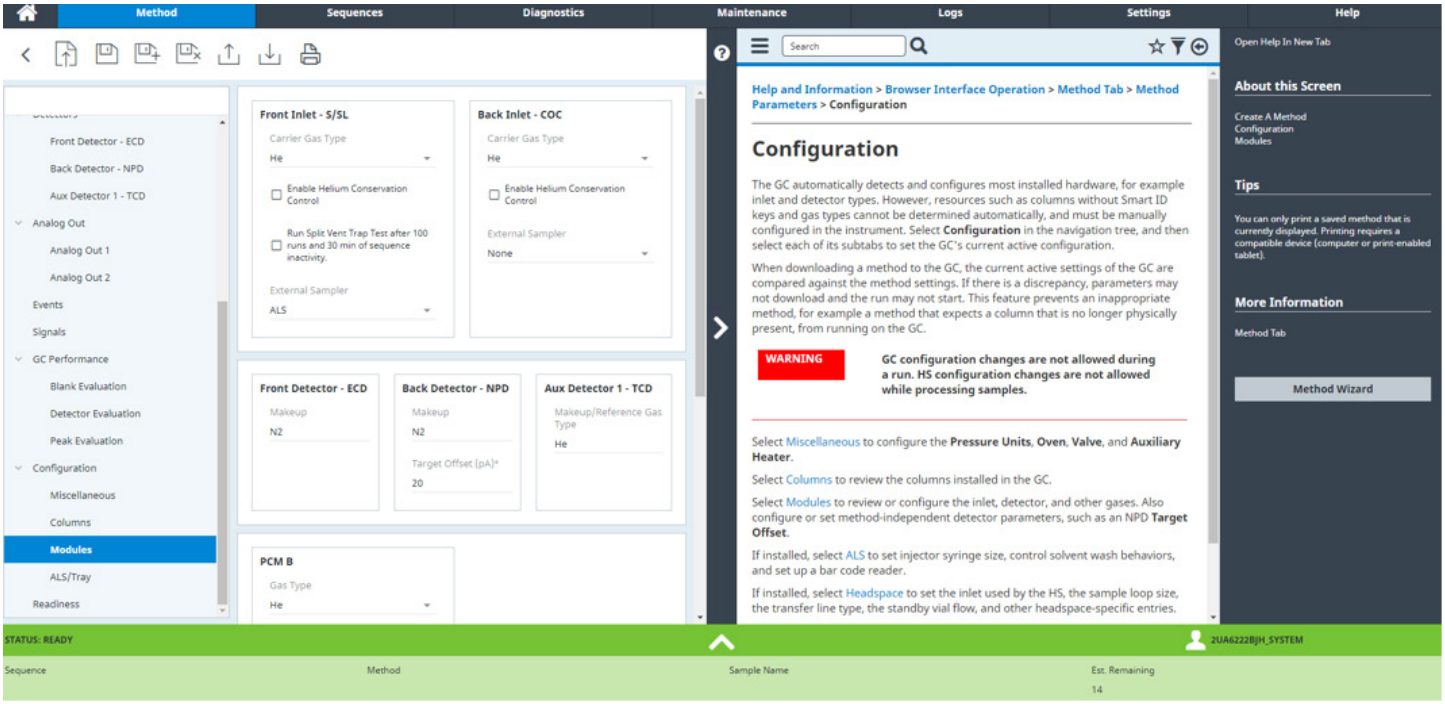


Figure 8. Example of contextual help using the Configuration section of the Method Editor.

Sequences: create, save, and run sequences

The browser's Sequences tab allows users to create and save sequences, which are executed directly from the instrument, without the need of a data system. The user will find the sequence-editing functionality to be like OpenLab CDS. It is important to note that when a data system is communicating with the instrument, sequences cannot be run from the browser. As shown in Figure 9, the disabling of this functionality is achieved by greying out the **Run**, **Pause**, **Resume**, and **Abort** buttons at the top of the Sequences window.

As the sequence is progressing, the status bar will change color to reflect the instrument's state (e.g., blue while in a run) and display relevant information, including the sequence name, the method being used, which sample is being processed, and the time remaining in the current run. This is shown in Figure 10.

Note that sequences run from the browser will have their resulting data stored locally on the instrument itself. Data management on the instrument, including the file location of stored data, is handled in the Systems Settings section of the Settings tab, which is discussed in "Settings: review instrument information" on page 24. In brief, data saved to the instrument can be copied from the instrument and read by OpenLab CDS for processing by a data analysis program.

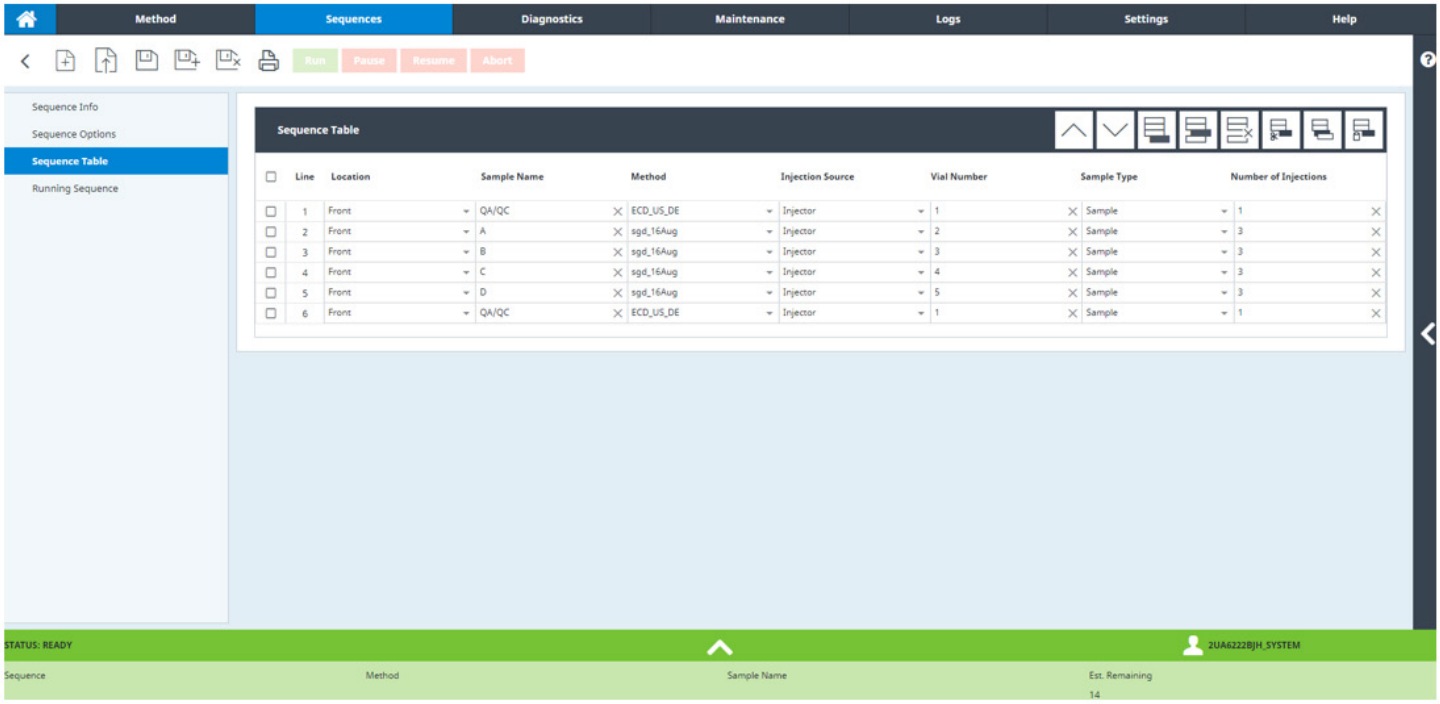


Figure 9. Browser's Sequences window.

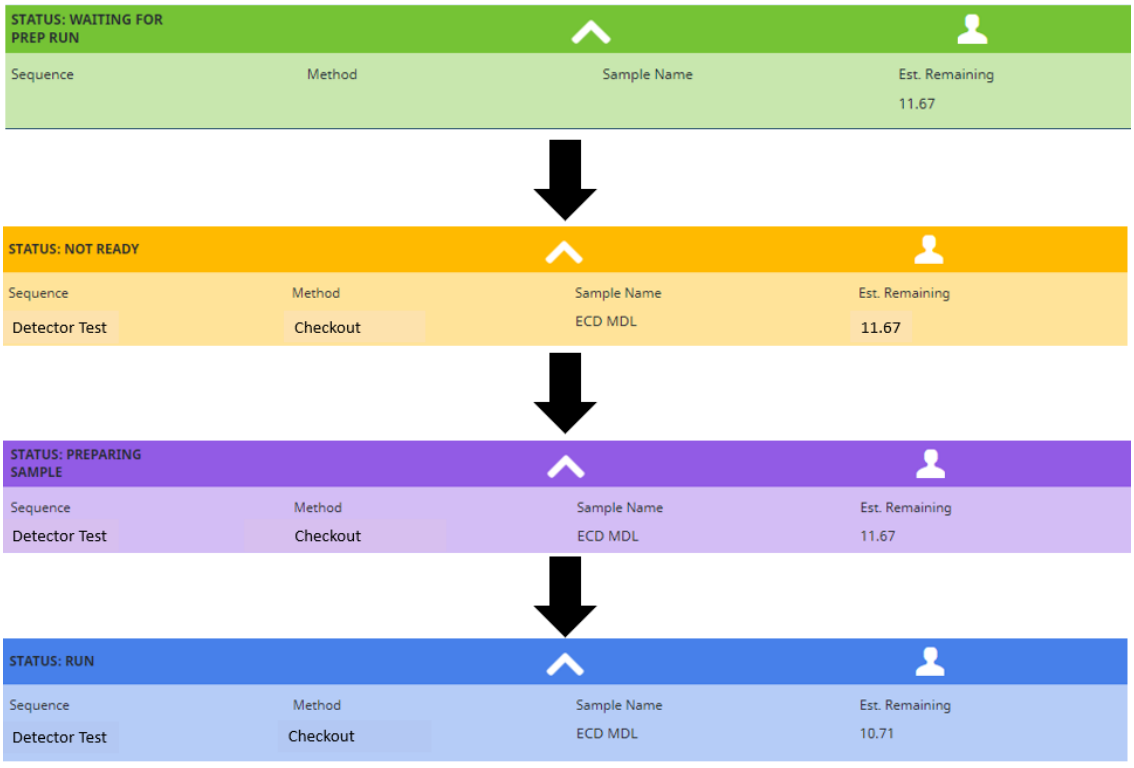


Figure 10. States of the browser status bar.

Diagnostics: access and execute automated diagnostic tests

The 8890, 8860, and 9000 GCs have features built into their control code that allow users to monitor the performance of their instrument, be notified if problems are detected, and be guided through resolving issues should they occur. Features exist for inlets, detectors, and other integrated components, including tests that are performed by the operator, and tests that are automated and performed by the GC without operator intervention. These diagnostic capabilities are accessed within the browser from the Diagnostics tab, as shown in Figure 11.

Note: The Blank, Detector, Peak Evaluations, Manage Reference Chromatograms, and Troubleshooting options are not supported for the 8860.

If an instrument has a warning or error state to communicate to the user, a small circle, referred to as an icon badge, will appear on the Diagnostics tab indicating to the user that a diagnostic condition exists. Orange badges indicate a warning while red badges indicate an error. Once the user goes to the Diagnostic tab, the default selection from the sidebar menu on the left is the Warnings and Errors option, which, when selected, will show any active errors and warnings. Selecting an active error or warning will display additional information related to the occurrence. The GC performs continuous, automated testing of the following items to determine whether to indicate an error or warning:

- **Detector:** supply voltage, ADC readings, FID flameout, ignitor open/short, collector short, TCD filament open/short, and NPD bead open/short
- **Pneumatic:** pressure or flow shutdowns
- **Thermal:** sensor open/short, missing heater, wrong heater, and heater current
- **Configuration:** mismatch (e.g. hot swapped modules)
- **Integrated Agilent 8697 headspace sampler:** motors, sensor open/short, wrong heater, thermal zones too hot/cold, EPC, tray and gripper, and supply voltage

If a failure occurs, an alert appears on the GC, the failure is documented in the appropriate log, and additional details are provided on the Diagnostic tab.

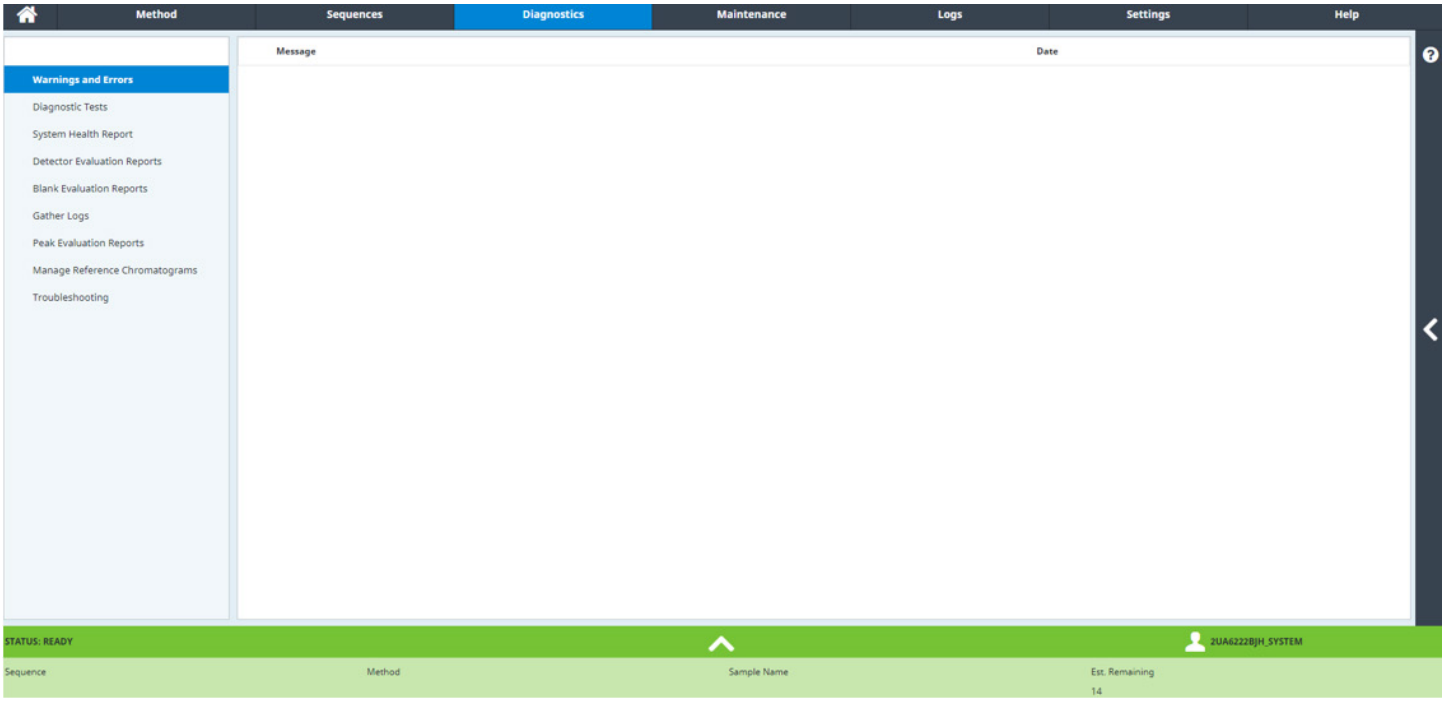


Figure 11. Diagnostics tab window of the Agilent 8890 and 9000 GC browser interface.

Diagnostic tests: The next menu item in the Diagnostics tab is Diagnostics Tests, which is a list of procedures that the GC itself can automatically run or guide the user through for the hardware (HW) configured on the instrument (Figure 12).

Because the list of available tests is module-specific, the list of diagnostic tests will vary across instruments based on the GC's configuration. Supported self-guided diagnostic tests include:

- **Inlets:** Gas identification test, gas supply pressure check, lean and restriction test, pressure decay test, septum purge test, and split vent restriction test
- **Detectors:** FID jet restriction test, leakage current test, and FPD dark current check
- **Headspace sampler:** crossport leak test, gas supply pressure check, manual operations, restriction and pressure decay test, six-port rotor orientation test, transfer line leak and restriction test, and user vial leak test
- **Instrument:** hydrogen sensor calibration and ELVDS loopback test

Note: not every module has a diagnostic test.

When a diagnostic test is executed, the result of the test is shown to the user and is also recorded on the GC itself to aid in monitoring the performance of the instrument over time. The user can access historical diagnostic test results by clicking **Diagnostic Plot** in the upper right corner of the page, selecting the appropriate filters on the left (Device, Test, Parameters, and Date Range) and clicking **Load**. An example plotting the pressure decay results from the front inlet over a three-month period is shown in Figure 13.

While the data used to generate the plot are stored on the instrument, the plot itself is not. Instead, the plot is created on demand using the filters on the left side. If a specific plot needs to be recreated in the future, the user can re-enter the same filters. For archiving purposes, the plot can be printed to either hard copy or an electronic copy using the print icon and the Web browser's (e.g., Google Chrome) printing capability.

The legend at the bottom of the plot contains four entries. The red Troubleshooting line indicates a limit where values beyond it represent a failing result requiring troubleshooting of the problem. The blue Value line represents data points for the requested parameter. The purple Method/Config line would present itself as a vertical line whenever the method or configuration of the instrument is changed. If a method or configuration change occurred during the time window being plotted, the purple indicator line cannot be disabled. The blue Maintenance line would be present to indicate that a maintenance procedure was completed, either done manually or as part of a maintenance procedure (see "Maintenance: access and execute onboard, guided maintenance procedures" on page 21).

Note: If the maintenance was done manually, the user will need to also reset the appropriate EMF counter manually. Also note that any data value point can be hovered over for more details and clicked to expose a pop-up where an annotation can be inserted by the user. When a trend plot is printed, all annotations applicable to the time range shown on the plot will also be printed as will the details of any method changes that are indicated on the plot.

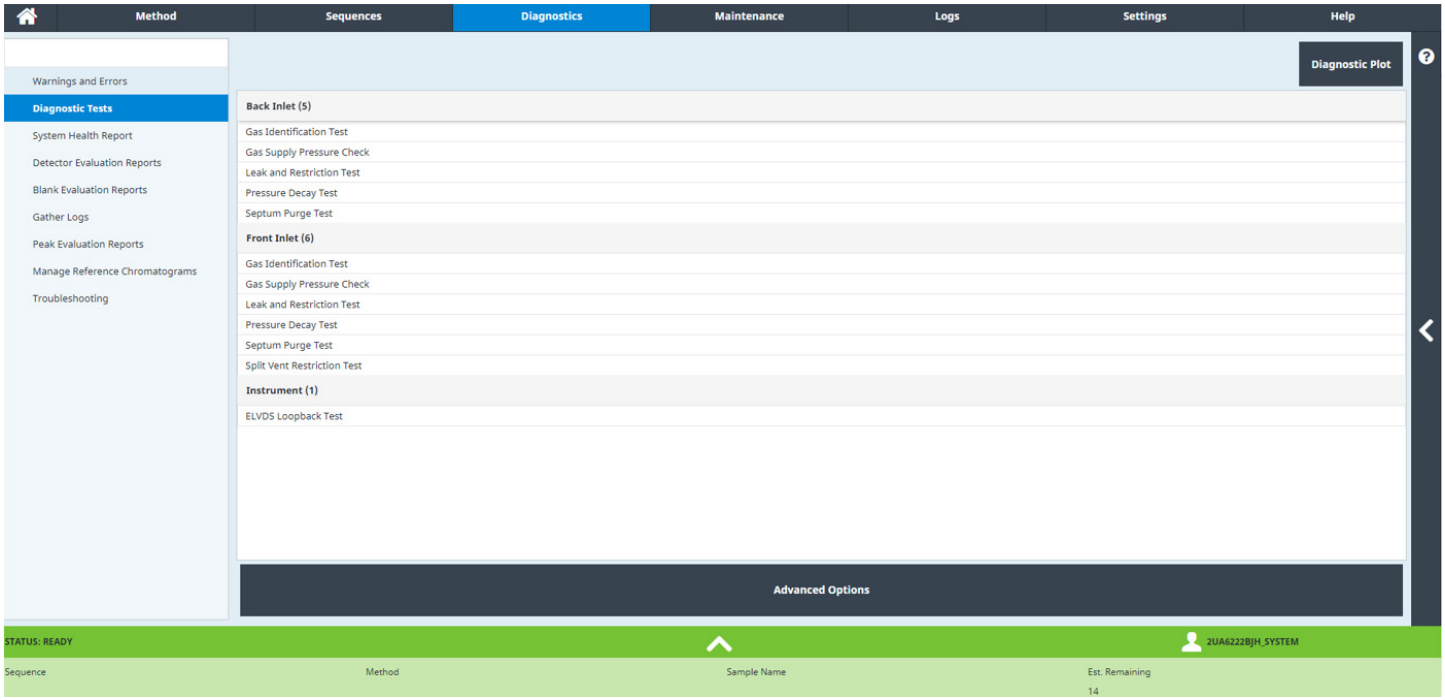


Figure 12. Diagnostic tests available for the HW configured on the GC are listed under Diagnostic Tests in the Diagnostics window.

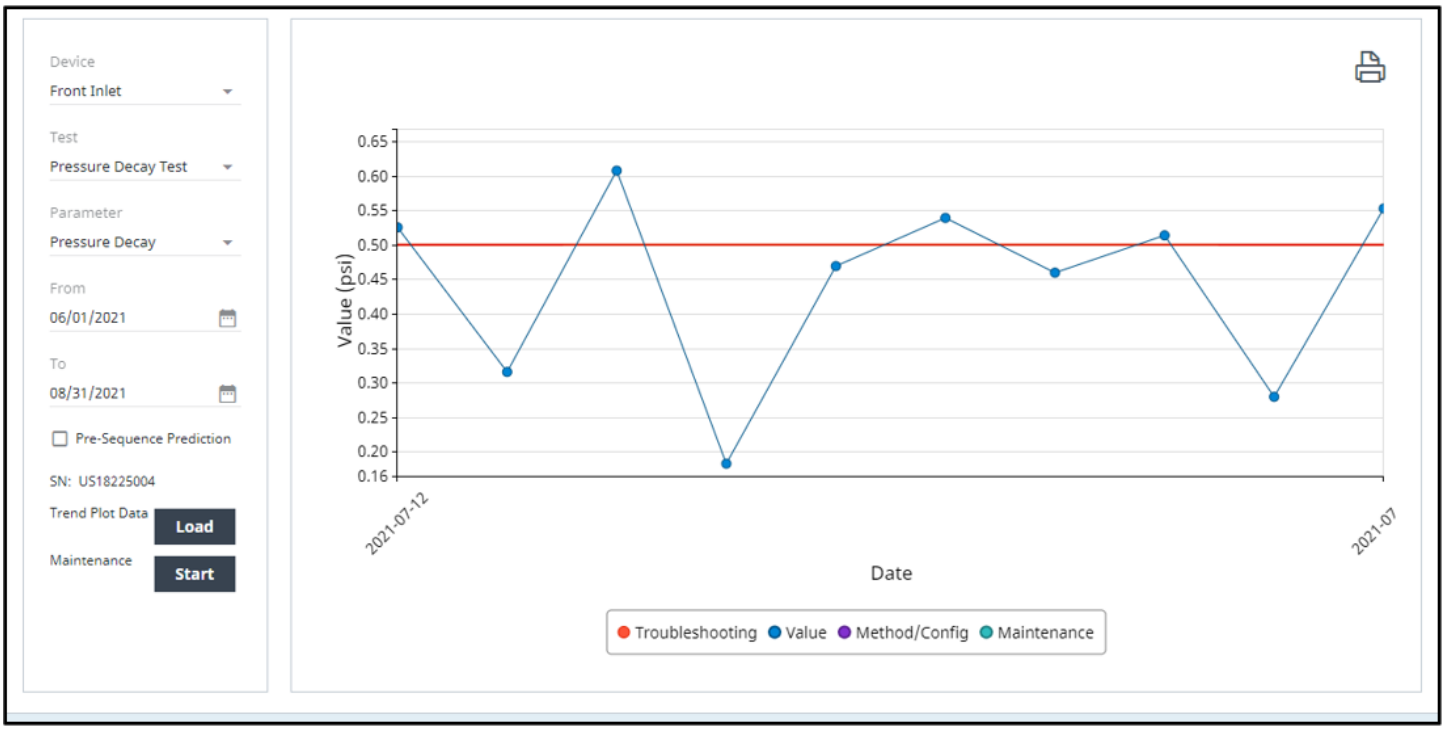


Figure 13. Diagnostic plot of a GC's front inlet pressure decay results.

System Health Report: The System Health Report provides a concise summary of information pertinent to the GC and can be useful when troubleshooting. The report is comprised of the following sections: system information, system configuration details, network (internal) information, past instrument alerts, resolved instrument alerts, column details, maintenance information, EMF details, diagnostic test results, calibration results, installation history, and status snapshot information. The top portion of an example System Health Report is shown in Figure 14.

The System Health Report is generated by the instrument, on demand, with the time stamp of generation included below the title of the report. For archiving purposes, a System Health Report can be printed using the print icon in the upper-right corner of the page using the printing capability of the Web browser being used to access the instrument.

Detector Evaluation: Detector Evaluation is one of the GC Performance features within the GC FW. It directs the user to run an Agilent-prescribed sample using a specified list of consumables and method setpoints. The acquired chromatographic results are then compared against the expected results to evaluate whether the system is operating at the expected level of performance.

The user can access the necessary set of conditions for their instrument's HW by starting another browser session and typing http://gcipaddress/checkout, where gcipaddress is the IP or host name of their instrument. Detector Evaluation is enabled in the GC Performance section of the Method Editor and is executed every time the method with Detector Evaluation enabled is run. The results are summarized in the Detector Evaluation Report, which is accessible from the Diagnostics tab of the browser interface.

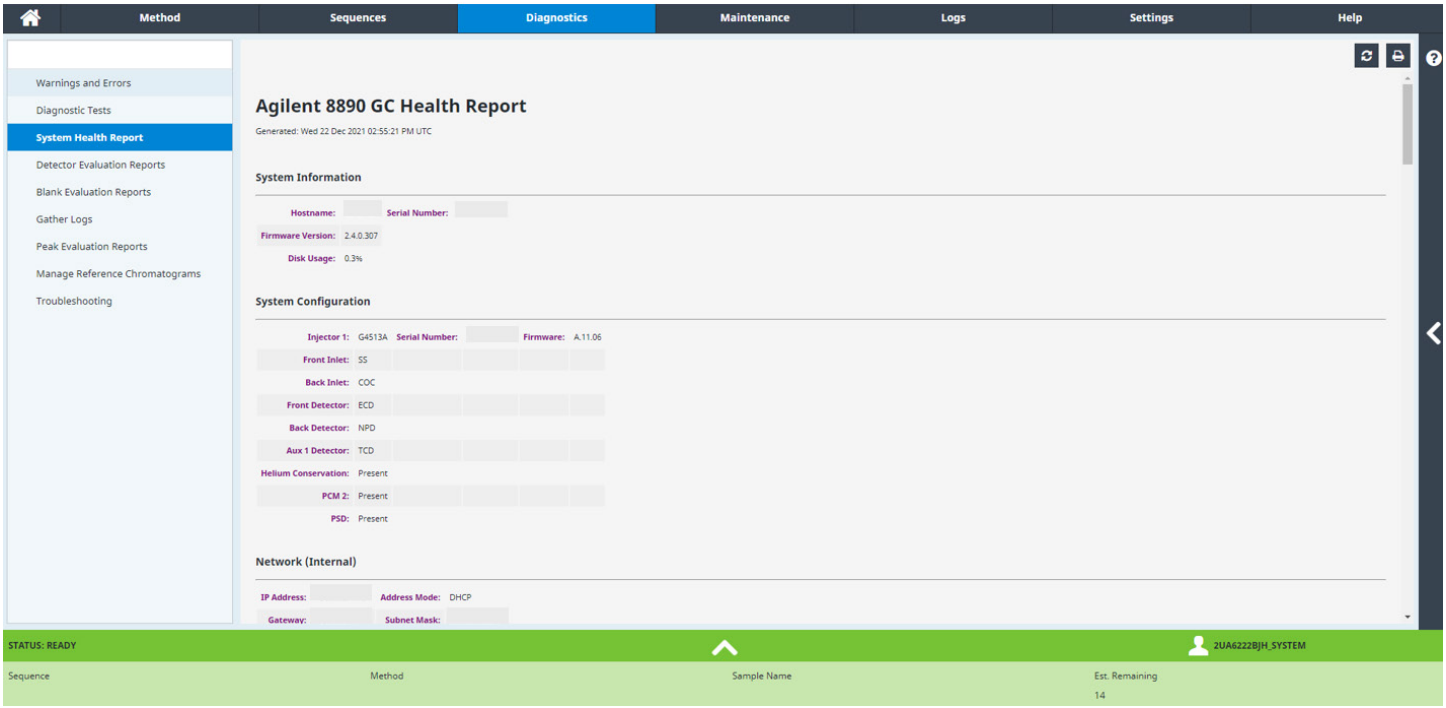


Figure 14. Example of the System Health Report; only the first three sections are visible.

Whenever a Detector Evaluation is executed, the results are added to the list of evaluations shown on the Diagnostics tab. The last 50 Detector Evaluation Reports are stored on the instrument, sorted by date. Highlighting a given report will expand it to display the information (shown in Figure 15) where a portion of a Detector Evaluation Report is illustrated.

The overall result of the test is shown in the top line of the report with the corresponding criteria highlighted (pass or fail in green or red, respectively). Figure 15 shows a portion of an example Detector Evaluation Report, where the detector evaluation failed because neither peak from the ECD checkout sample was detected. The Detector Evaluation Report can be printed for archiving purposes.

In addition, a trend plot of parameters associated with detector evaluation can be created to show the performance of the system over time by clicking **Chromatographic Trend Plot** in the upper-right corner of the screen. The top-level filter used to determine what data to plot is the method where Detector Evaluation was enabled; after that, the signal identified in the method and the analytes from the prescribed checkout mix can be chosen along with what parameter to plot (e.g., peak area) and over what timeframe. An example of a Detector Evaluation trend plot is shown in Figure 16.

The values in the legend are the same as described for the Diagnostic Test plot. The plot in Figure 16 shows a maintenance action that occurred over the course of the two weeks' worth of data being plotted. Using the time from this plot, the Maintenance Log on the instrument can be searched to learn more about the maintenance that was performed. Additionally, as with the Diagnostic Test trend plot, annotations can be added to make later interpretations easier. For example, while the system will log when maintenance was done, a note could be added to a specific data point to indicate why maintenance was done.

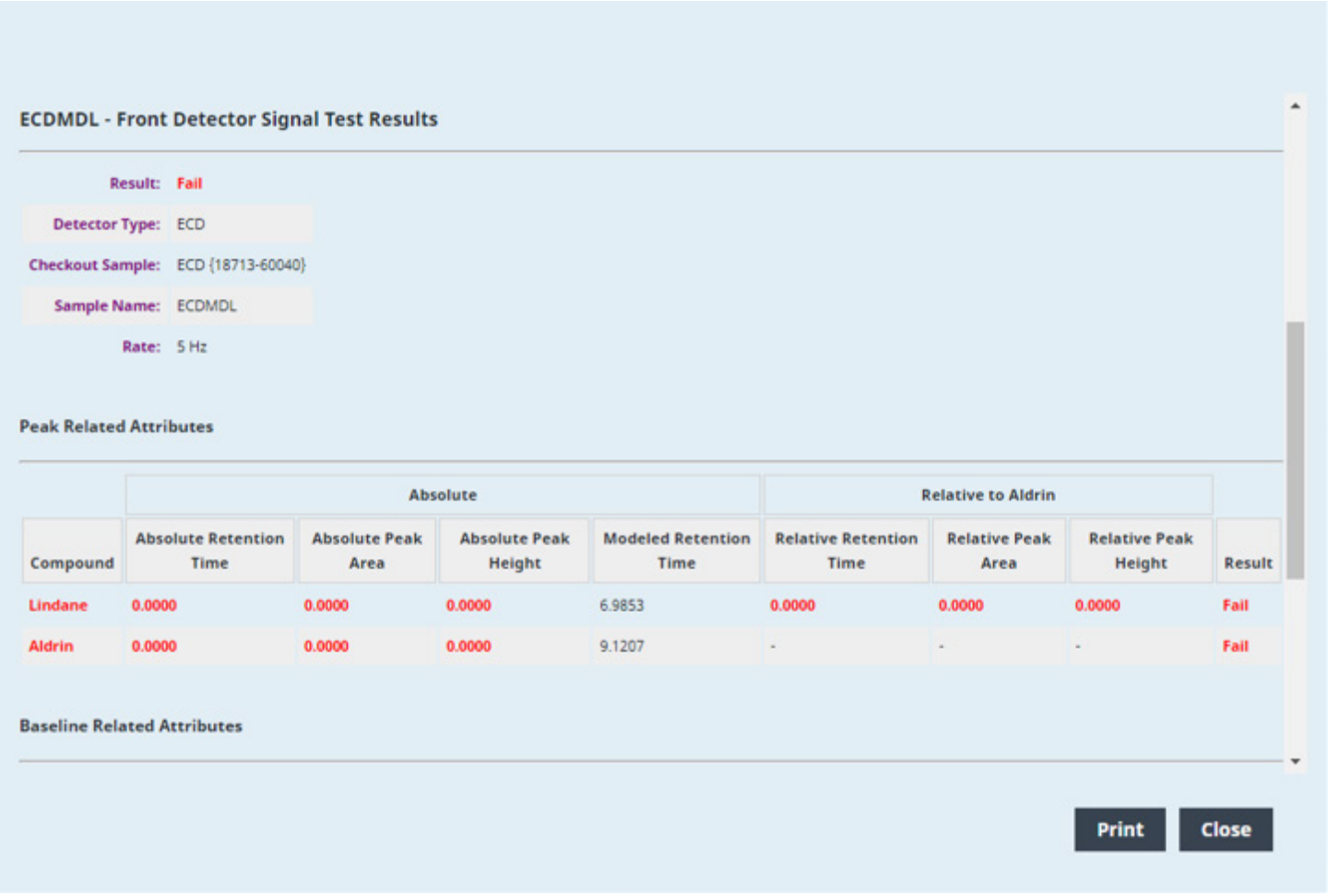


Figure 15. Detector Evaluation Report: an example report for a failed detector evaluation is shown.

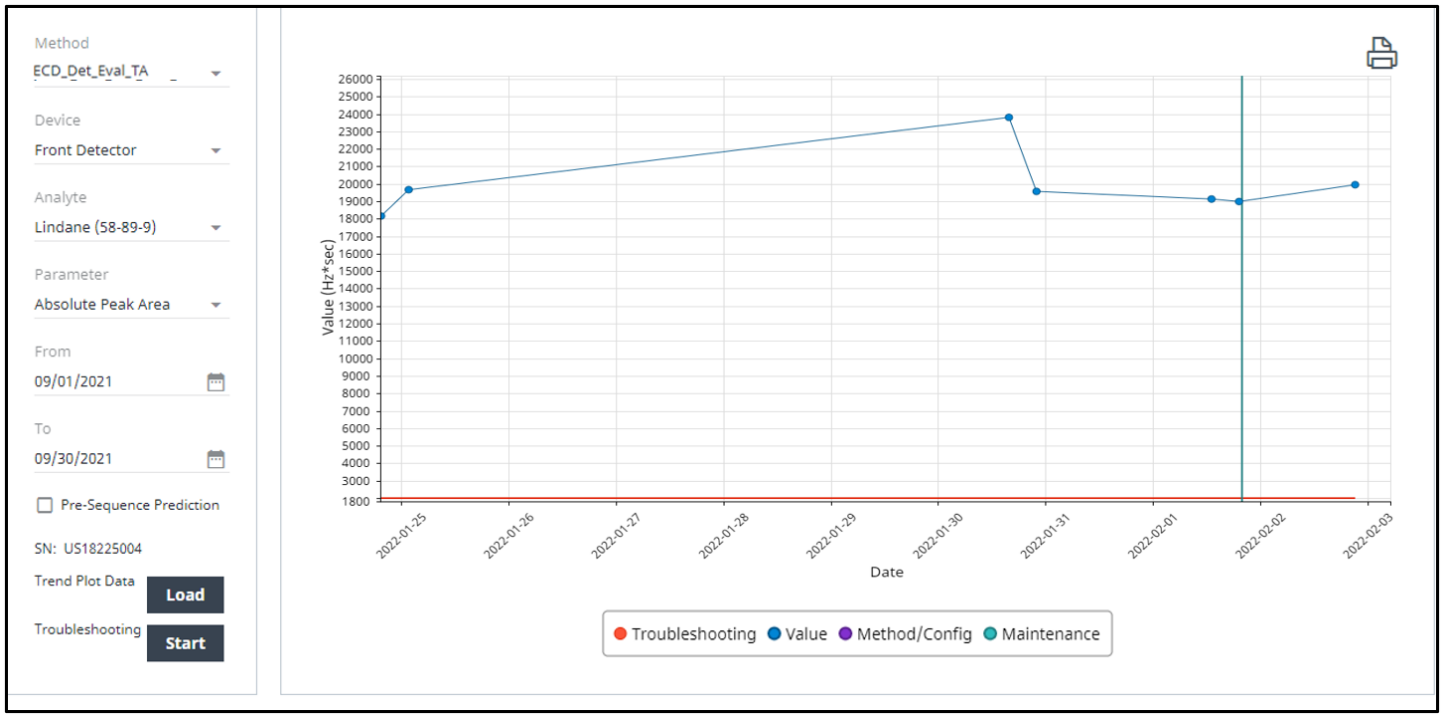


Figure 16. Detector evaluation trend plot example.

Blank Evaluation: Blank Evaluation is a GC Performance feature designed to verify that the system is sufficiently clean to run samples. Users can enable Blank Evaluation in their acquisition method and define acceptable absolute minimum, maximum, and noise limits for initial baseline (i.e., at the beginning of a run or temperature program) and final baseline (i.e., at the end of a run or temperature program) as well as overall baseline performance (i.e., total peak area or height) across a specified time range.

Method acquisition parameters are not prescribed by Agilent and can be completely defined by the user. But, like Detector Evaluation, at the completion of an acquisition method where Blank Evaluation was enabled and executed, the results are stored on the instrument and able to be recalled in a Blank Evaluation Report, where the last 50 are stored on the instrument and listed on the Diagnostic tab. An example Blank Evaluation Report is shown in Figure 17.

The overall status of the evaluation (i.e., pass or fail) is indicated at the top of the report and the results of each baseline attribute is shown in the table.

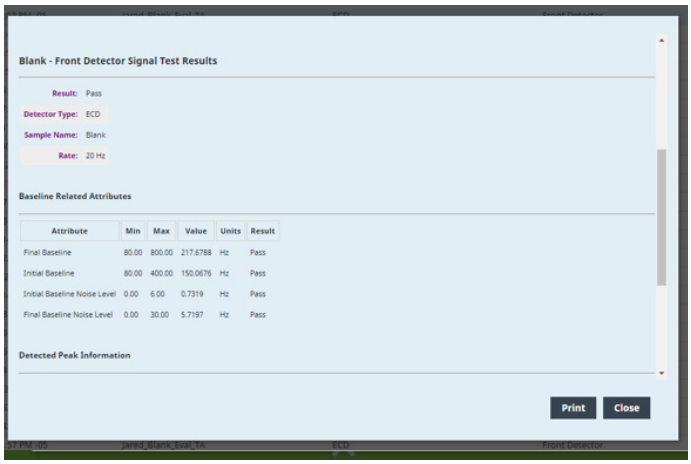


Figure 17. Blank Evaluation Report example.

A historical perspective of the baseline performance can also be presented by clicking **Chromatographic Trend Plot** at the top right of the screen and selecting the appropriate method where Blank Evaluation was enabled (Figure 18).

In this Blank Evaluation trend plot example, the observed baseline noise level over the time period selected is well below the limit where troubleshooting would be required.

Gather Logs: The Gather Logs feature, as shown in Figure 19, will bundle all relevant log files and data into a convenient package file, which can be shared with Agilent. This information will be used to diagnose and resolve issues experienced with the instrument.

When telling the instrument to gather its logs, there are five different options to select regarding what information to gather: Get Normal Logs, Get Active Method, Get Run Info Logs, Get Run Data Logs, and Trend Analysis Database. Each choice can be selected individually, all five choices can be selected at once, or any combination of choices can be selected. Once a comment is entered, click **Start Gathering** to begin the gathering process.

Normal logs consist of the Run, System, Maintenance, Sequence, and Run History Logs. Selection of **Get Active Method** will include setpoints and instrument configuration information. Selection of **Get Run Info Logs** will include the last five runs of sample information. Selection of **Get Run Data Logs** will include the last five data runs. Selection of **Trend Analysis Database** will include EMF, diagnostic, peak evaluation, detector evaluation, and blank evaluation data. Selecting more logs to gather and include in the package will increase the time needed to generate the accumulated log file.

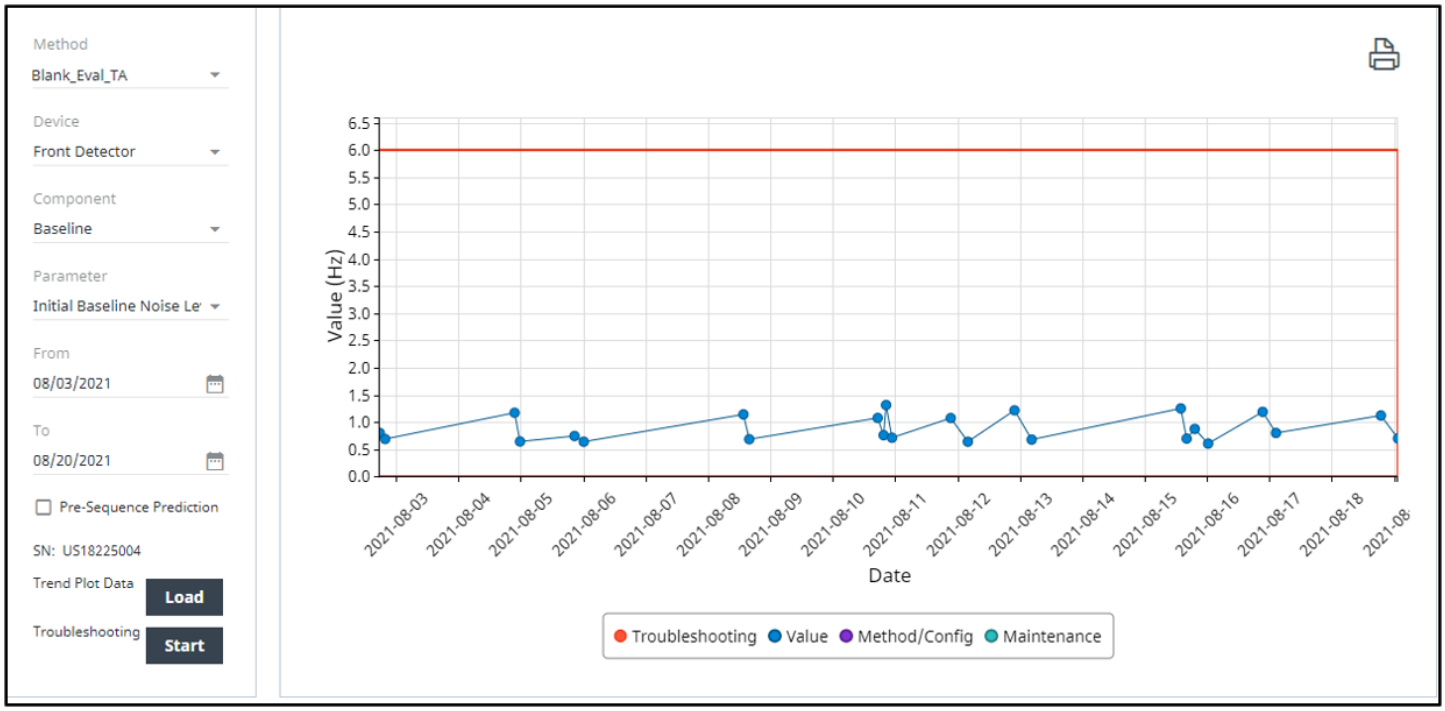


Figure 18. Blank evaluation trend plot example.

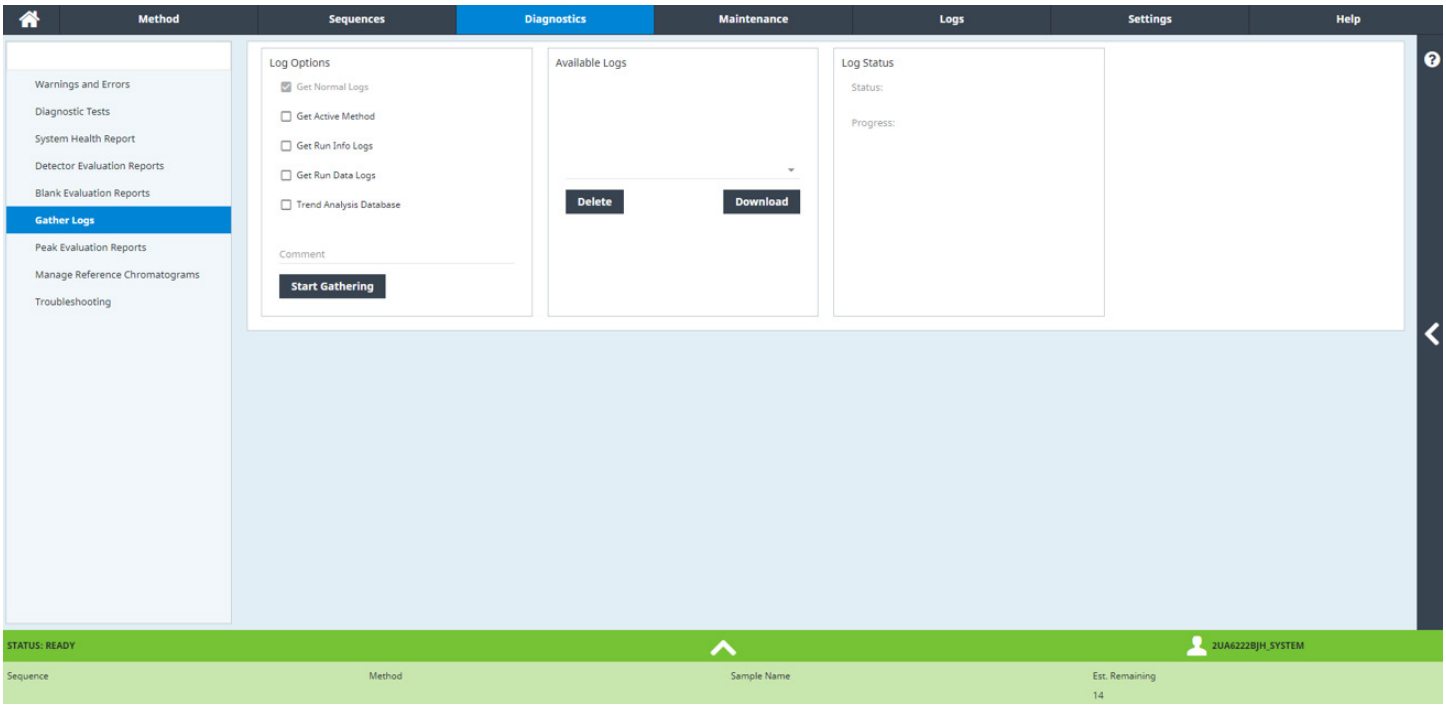


Figure 19. Gather Logs window of the browser interface.

Peak Evaluation: The Peak Evaluation feature is like the Detector Evaluation feature in that chromatographic attributes such as retention time, area, and peak height are monitored by the instrument and compared against acceptance criteria. However, unlike Detector Evaluation, Peak Evaluation allows users to use their own sample, method, and performance criteria to define what results are acceptable and establish a reference chromatogram for future comparison. The reference chromatogram creation, integration, and annotation are facilitated by Manage Reference Chromatograms in the Diagnostics tab of the browser interface. Figure 20 illustrates the Manage Reference Chromatograms feature.

Users can integrate (or reintegrate) their reference chromatograms from the interface using the integrator built into the FW on the GC itself. Captured peaks can be annotated (either uniquely or anonymously) to create a peak list. Finally, the reference chromatogram can be applied to an acquisition method where the user can customize the acceptance criteria associated with attributes of the reference chromatogram (e.g., retention time, area, height, width, symmetry, and resolution).

With a reference chromatogram applied to and enabled within an acquisition method, each time the method is run the peaks from the reference chromatogram peak table are evaluated against their corresponding peaks from the newly acquired chromatogram and the results of the Peak Evaluation are captured on the GC. It is important to note that Peak Evaluation is a function of the acquisition method. A list of available Peak Evaluations is provided on the Diagnostics tab, and selecting a row will open the associated Peak Evaluation Report, as shown in Figure 21.

Each Peak Evaluation Report contains the user-defined compounds of interest, their pass/fail criteria, their quantitative performance observed in that acquisition run, and the result of the peak evaluation assessment itself.

To provide historical context across several discrete Peak Evaluation Reports, results from Peak Evaluation can also be plotted over time by clicking **Chromatographic Trend Plot** at the top right of the screen. Data will be available on the GC itself from every time an acquisition method with Peak Evaluation enabled is executed whether run from the browser or a data system, for those analytes that were identified in the reference chromatogram's Peak List and for attributes chosen by the user when setting up the acquisition method. Figure 22 shows an example Peak Evaluation trend plot of absolute peak area over a one-month duration.

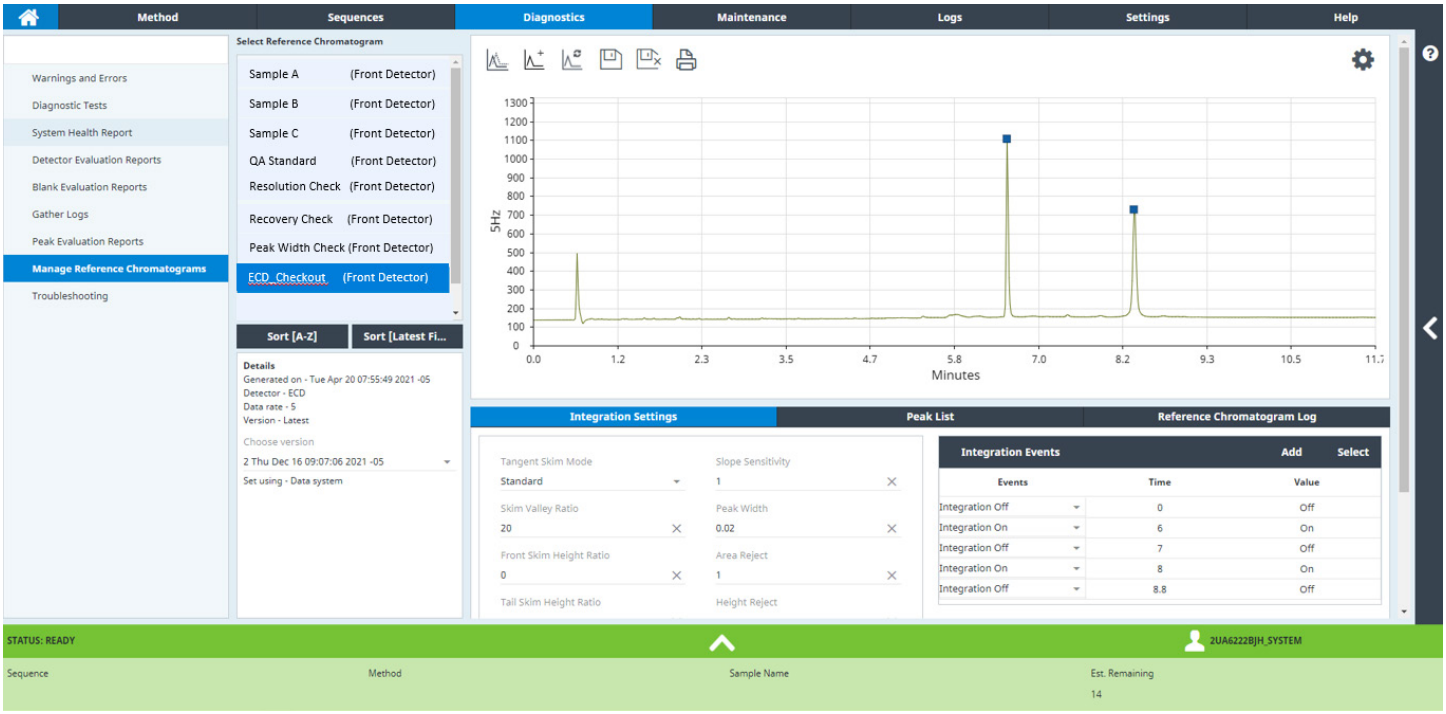
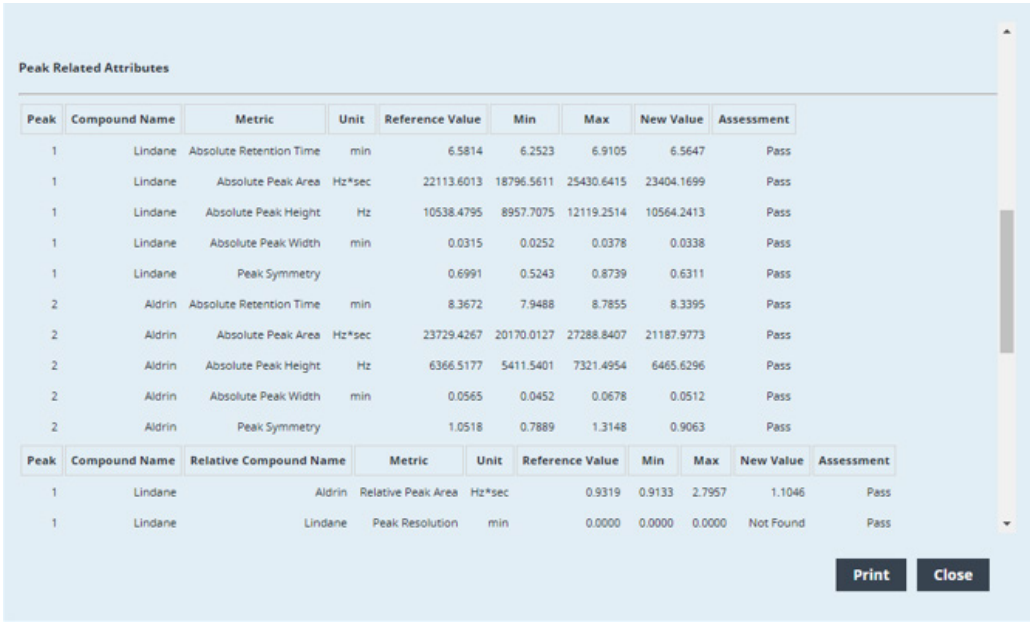


Figure 20. Manage Reference Chromatogram of the browser interface.



Peak Related Attributes

Peak	Compound Name	Metric	Unit	Reference Value	Min	Max	New Value	Assessment
1	Lindane	Absolute Retention Time	min	6.5814	6.2523	6.9105	6.5647	Pass
1	Lindane	Absolute Peak Area	Hz*sec	22113.6013	18796.5611	25430.6415	23404.1699	Pass
1	Lindane	Absolute Peak Height	Hz	10538.4795	8957.7075	12119.2514	10564.2413	Pass
1	Lindane	Absolute Peak Width	min	0.0315	0.0252	0.0378	0.0338	Pass
1	Lindane	Peak Symmetry		0.6991	0.5243	0.8739	0.6311	Pass
2	Aldrin	Absolute Retention Time	min	8.3672	7.9488	8.7855	8.3395	Pass
2	Aldrin	Absolute Peak Area	Hz*sec	23729.4267	20170.0127	27288.8407	21187.9773	Pass
2	Aldrin	Absolute Peak Height	Hz	6366.5177	5411.5401	7321.4954	6465.6296	Pass
2	Aldrin	Absolute Peak Width	min	0.0565	0.0452	0.0678	0.0512	Pass
2	Aldrin	Peak Symmetry		1.0518	0.7889	1.3148	0.9063	Pass

Peak	Compound Name	Relative Compound Name	Metric	Unit	Reference Value	Min	Max	New Value	Assessment
1	Lindane	Aldrin	Relative Peak Area	Hz*sec	0.9319	0.9133	2.7957	1.1046	Pass
1	Lindane	Lindane	Peak Resolution	min	0.0000	0.0000	0.0000	Not Found	Pass

Print Close

Figure 21. Peak Evaluation Report accessible from the browser interface.

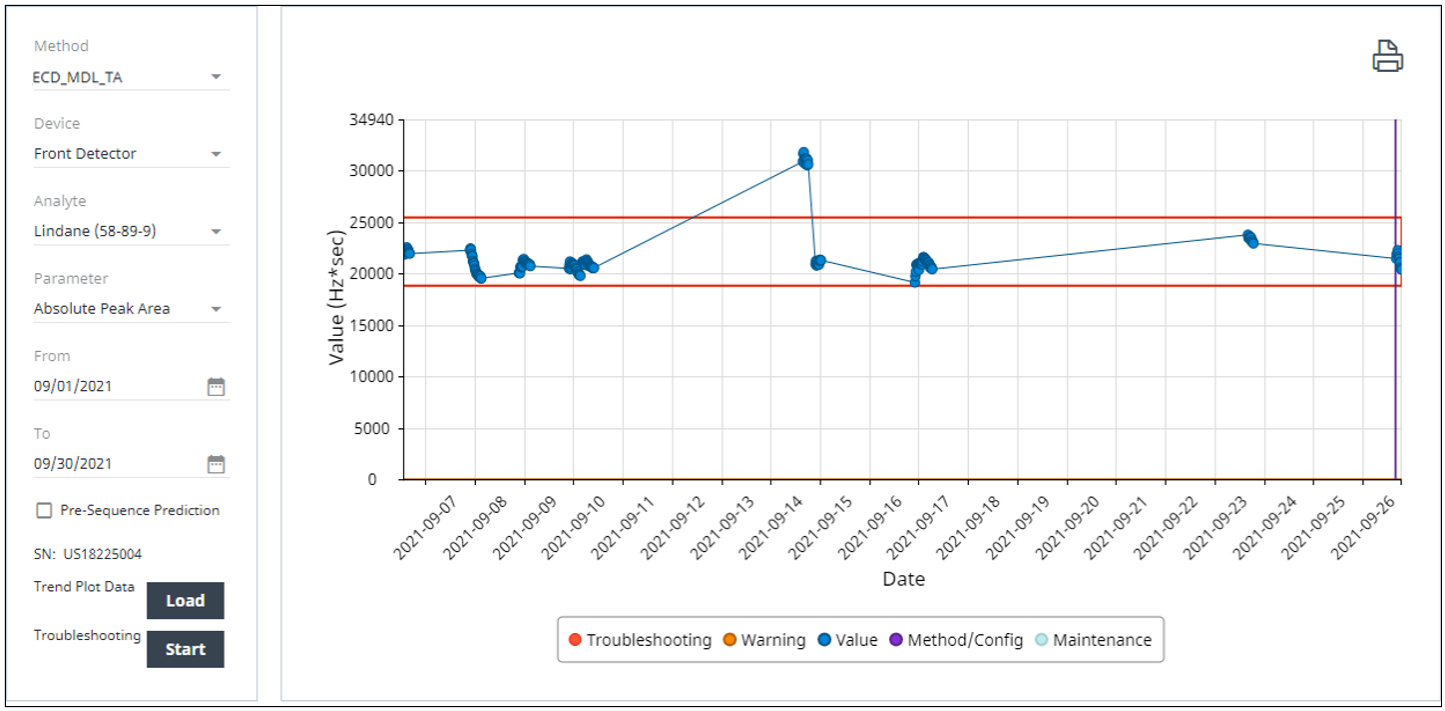


Figure 22. Peak evaluation trend plot available on the browser interface.

Troubleshooting: Troubleshooting provides a set of guided procedures that can help diagnose issues observed in a chromatogram. The following chromatographic symptoms are supported by the on-board Troubleshooting feature:

- No peaks
- Low response
- High response
- Retention time shift
- Loss of resolution
- Peak areas not repeatable
- Peak tailing
- Peak fronting
- Contamination/carryover

A troubleshooting session can be started at any time, as shown in Figure 23.

Troubleshooting can be initiated by the user if they observe a problem with their chromatographic results. Troubleshooting can also be suggested by the instrument following a failed blank, detector, or peak evaluation. When initiated by a failed evaluation, the diagnostic condition will suggest which symptom to address and the troubleshooting starting page will have the issue field prepopulated.

Once started, each troubleshooting routine will step through a detailed series of questions and tests designed to identify and resolve common causes for the selected symptom. The user will be asked to check and confirm specific HW details that cannot be autonomously determined by the instrument, for example, visually verify that the correct sample vial is in the designated sampler location. During the troubleshooting session, if changes are made to the instrument, the user can make a verification run to verify whether the issue has been resolved or not. If the method being used during troubleshooting had Blank, Detector, or Peak Evaluation enabled, the evaluation will be run to further help verify a successful troubleshooting effort.

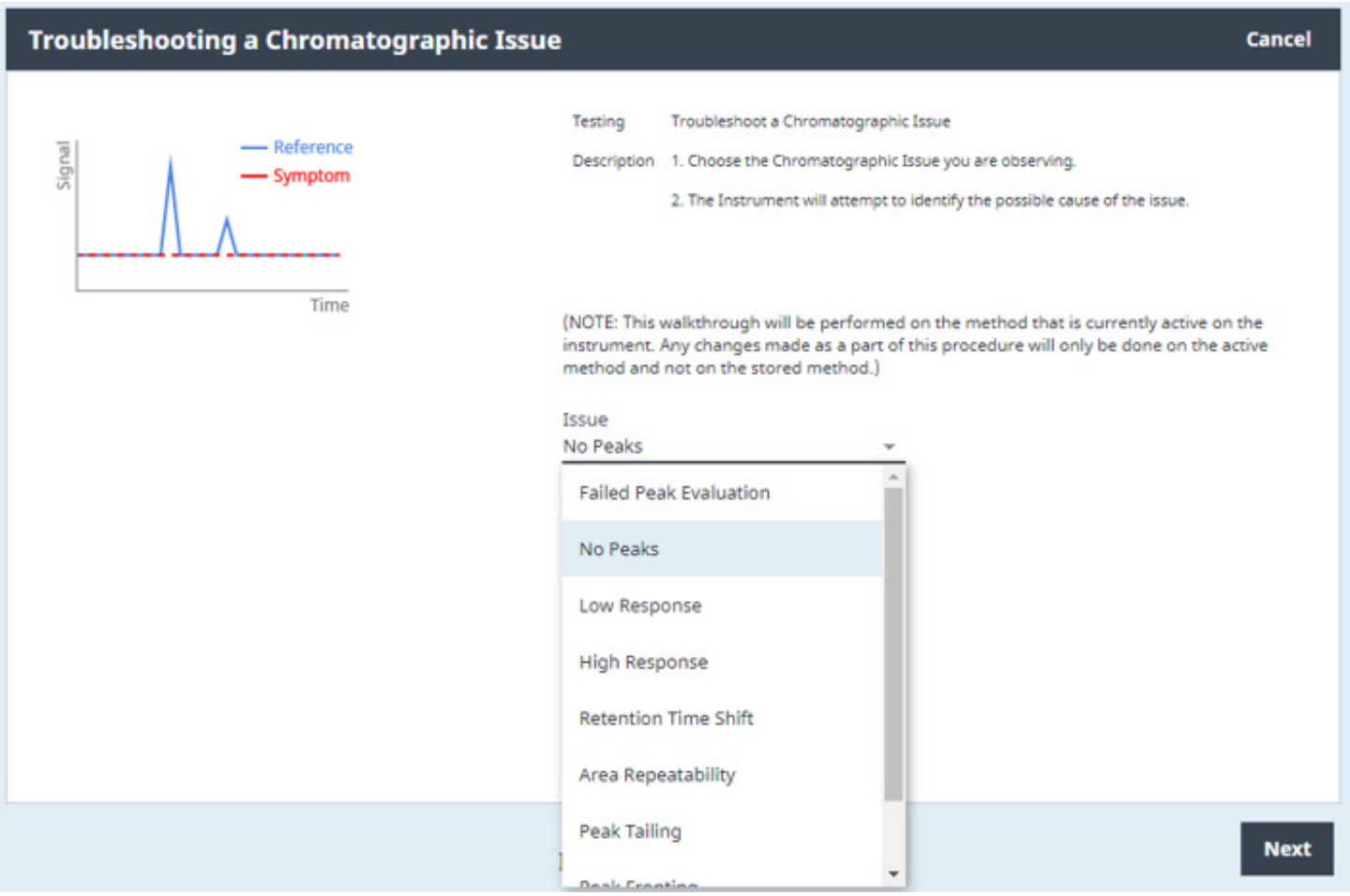


Figure 23. Starting page of the browser's troubleshooting feature.

Each troubleshooting session is captured in a report, which is listed on the Diagnostics tab. Each troubleshooting report contains the list of all steps taken during the session and the outcomes of any automated diagnostic or maintenance tasks executed while troubleshooting. Additionally, if any verification runs were made during the troubleshooting session, their resulting chromatograms are also included in the troubleshooting report.

Gas and Power Use: Gas and Power Use is a diagnostic feature designed to provide a visual, read-only representation of the resource use of the instrument. The feature shows the day-to-day consumption of power and gas used to operate the GC over the time period specified by the user. An example of daily nitrogen gas consumption over a three-month period is shown in Figure 24.

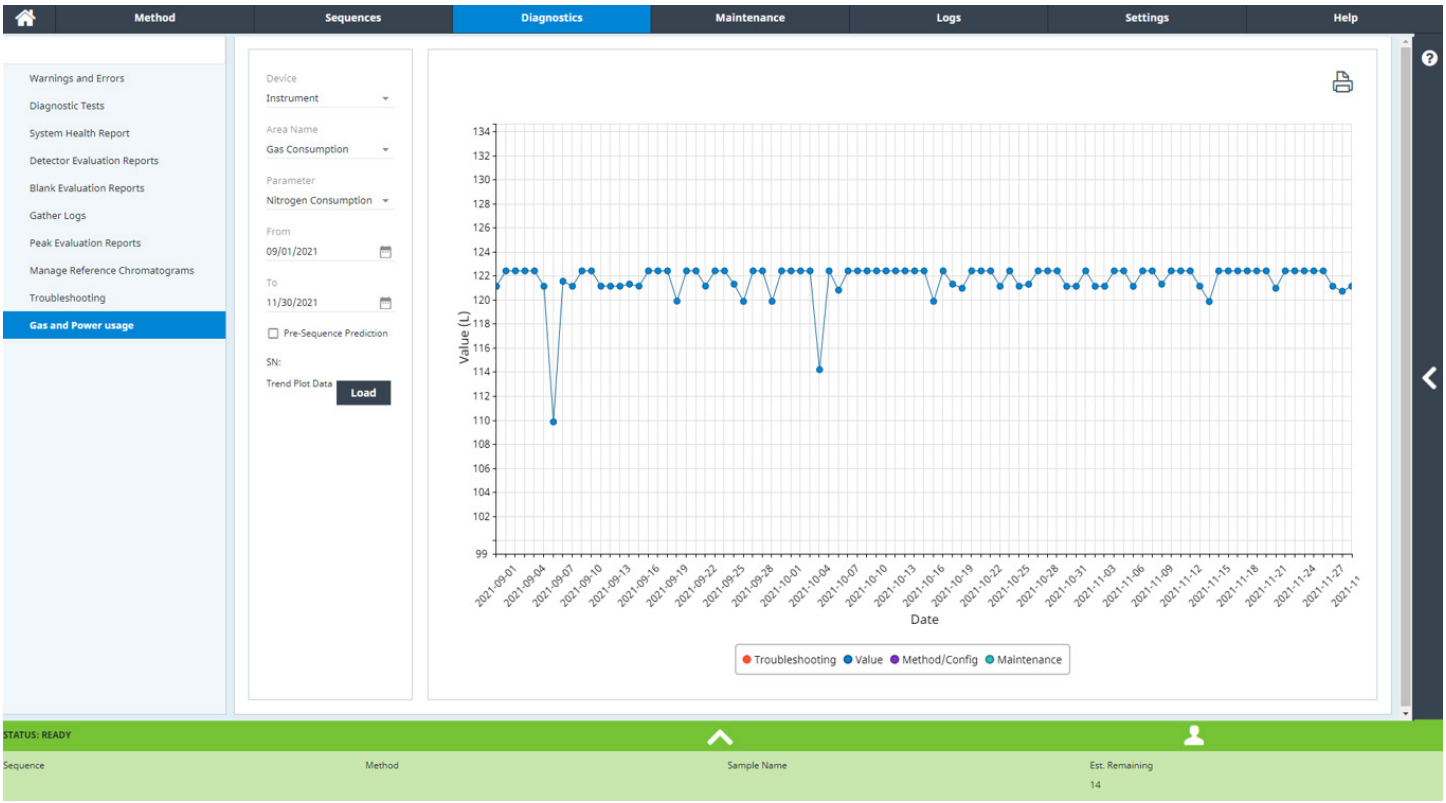


Figure 24. Gas and power use plot showing daily nitrogen consumption over a three-month period.

Maintenance: access and execute onboard, guided maintenance procedures

The GC FW contains helpful maintenance features designed to guide the user through maintenance tasks related to installed components and monitor the lifetime of key consumables.

The contents of the Maintenance tab are customized based on the HW that is installed on the GC. For example, if no auxiliary detector is installed, then it would not be listed on the Maintenance tab. Clicking a particular module opens a new screen where the components of that module are listed, as shown in Figure 25.

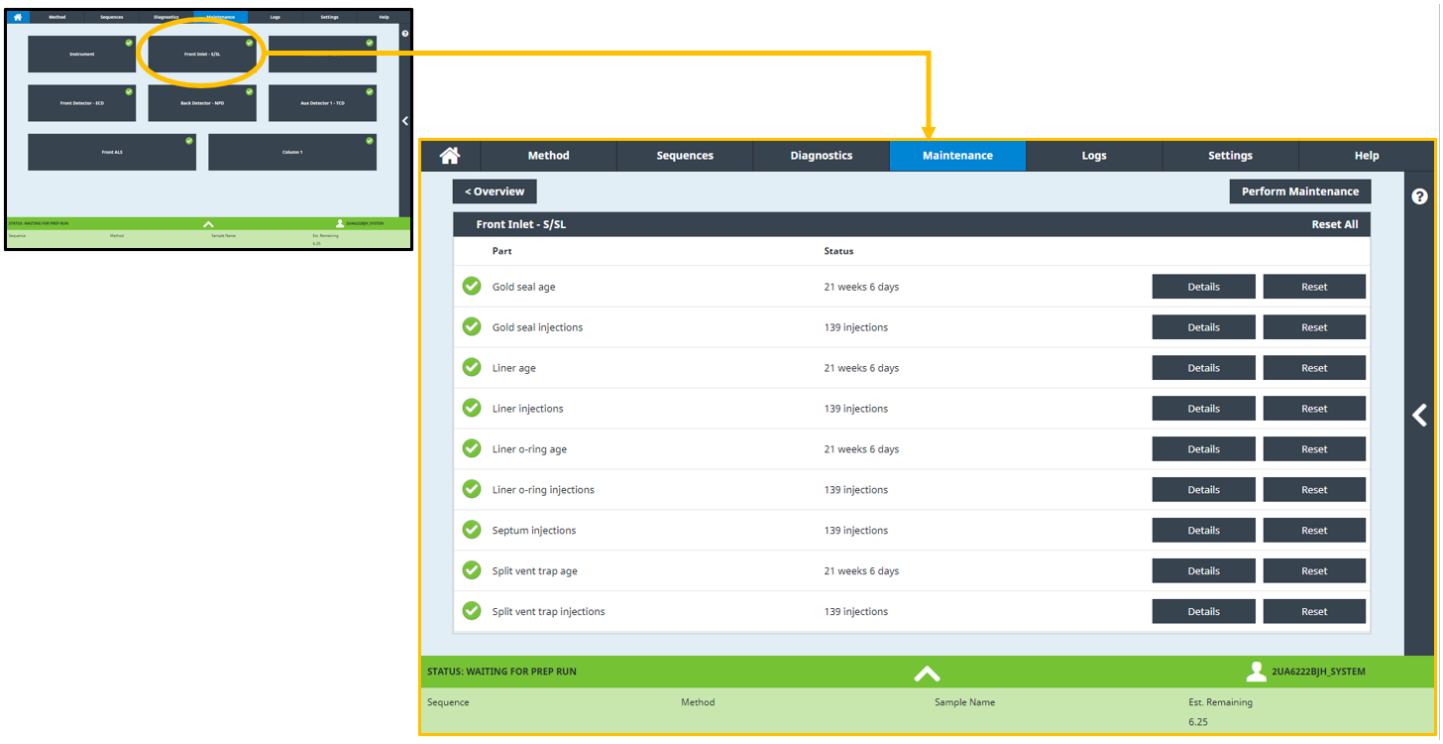


Figure 25. Maintenance tab of the browser interface showing the Front Inlet - S/SL window.

The list of components for a module provides a quick dashboard of each item's status where the component's age in time, number of injections, or both is displayed.

For instruction on how to maintain a listed component, the user can click **Perform Maintenance** in the upper right corner. For a historical view of a component's use, as well as the opportunity to define use limits (also referred to as EMF), the user can click **Details** for a given component. Both operations are illustrated in Figure 26.

The EMF plot will show the last 10 reset events and indicate (through color coding) whether the component's counter was reset manually (e.g., an operator replaced an inlet septum on their own) or as part of a maintenance procedure (e.g., an operator was guided through the Replace Split Vent Trap procedure). The Service Warning and Service Due limits serve to monitor the lifetime of consumables and allow proactive maintenance to be planned. When either limit is reached, the instrument is not prevented from running, but rather a diagnostic condition is raised to notify the user.

Initiating a guided maintenance procedure will allow the instrument to walk the user step by step through the selected process. The instrument will cool down heated zones appropriately, notifying the user when it is safe to proceed. Relevant diagrams and pictures will be shown to help guide the user through the steps. Upon completion of the maintenance routine, automated diagnostic tests will be run where appropriate to confirm that the maintenance procedure was completed correctly and the Maintenance Log will be updated automatically. Example excerpts from the Replace Liner maintenance procedure are shown in Figure 27.

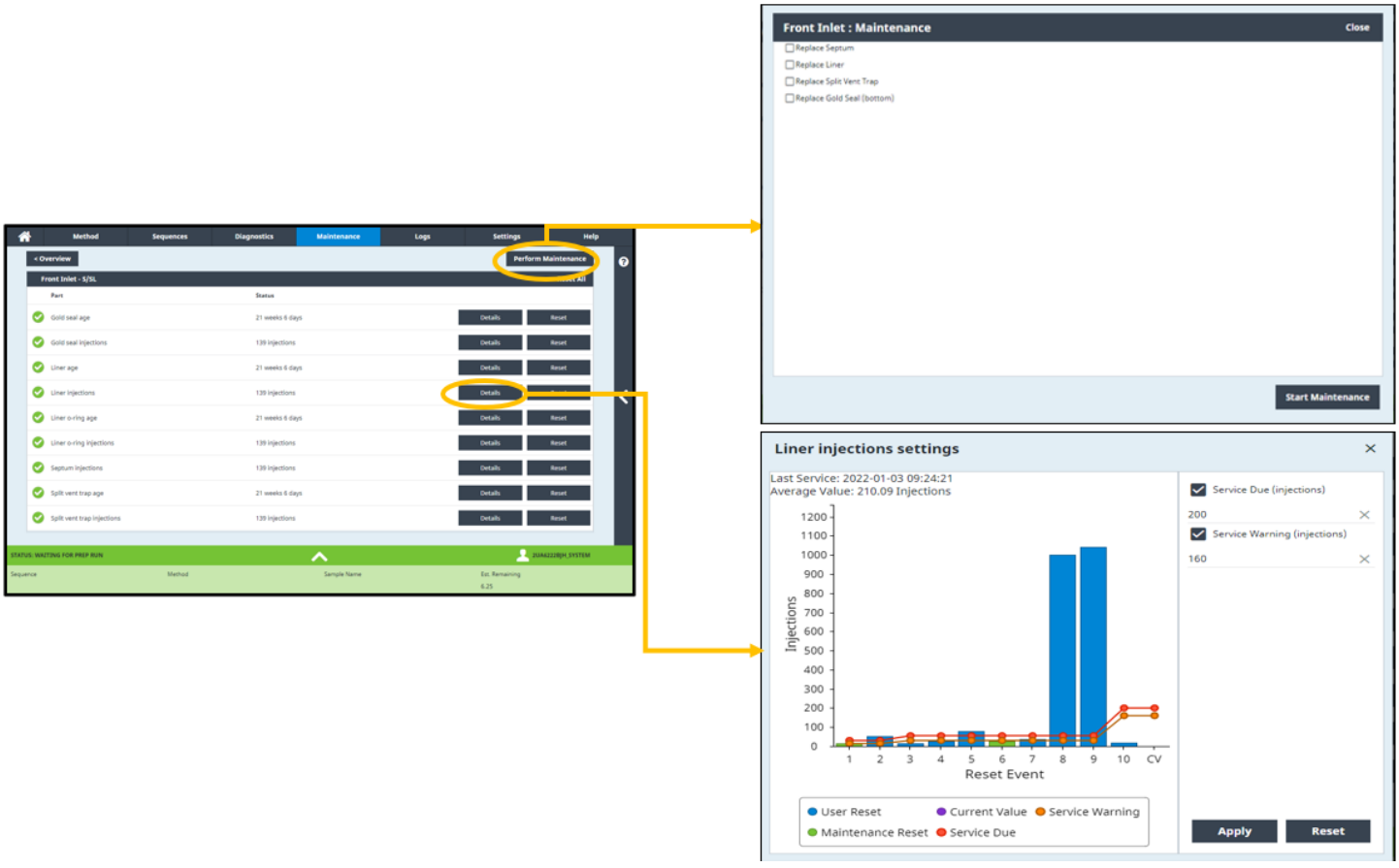


Figure 26. From within a specific component, the user can choose a guided maintenance procedure (top right) or view the past use of a component and enable limits for tracking use (lower right).

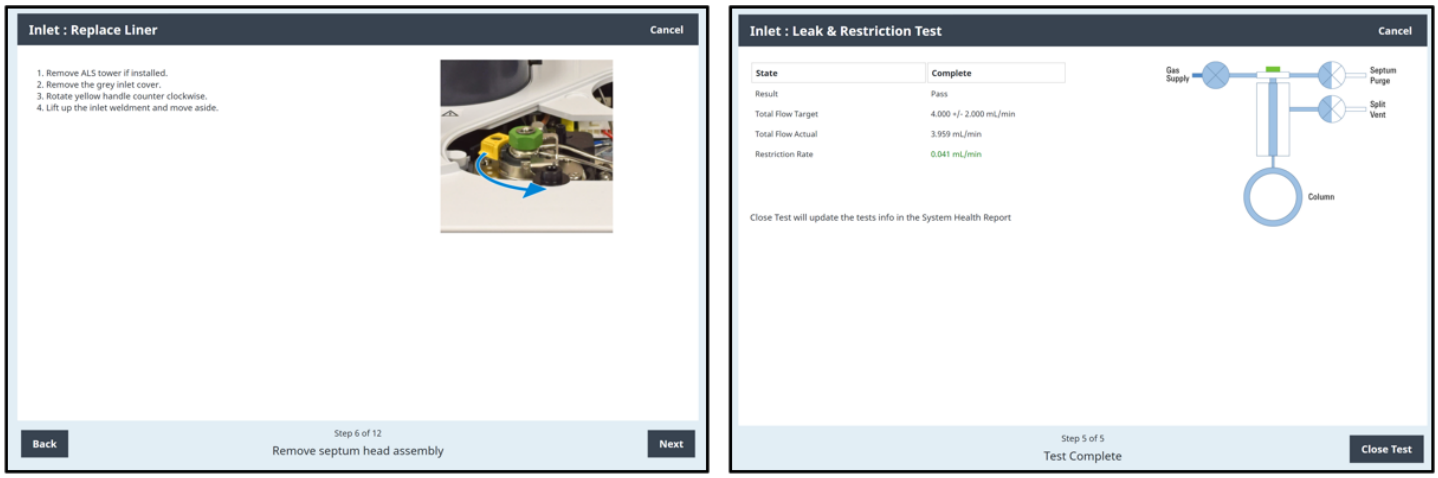


Figure 27. Relevant pictures are used during maintenance procedures to guide users (left) and automated diagnostic tests are used at the completion of a maintenance procedure to verify it was done correctly (right).

Logs: view instrument logs (Maintenance, Run, System, and Sequence Logs and the comprehensive Run History Log)

The GC contains logs designed to track the instrument's use, conditions, and events (both current and historic). Specific logs can be viewed by selecting the log of interest at the top of the logs screen. Entries into each log are captured in table format, with the most recent entries added to the top of the list, as shown in Figure 28.

- The Maintenance Log lists all maintenance actions performed on the GC using one of the GC's automated maintenance procedures (e.g., changing a liner).
- The Run Log lists all event and conditions that occurred during the most recent run executed on the GC.
- The System Log lists all system-level events that may occur outside the context of a single run (Smart ID key installation/removal, power cycling, etc.).

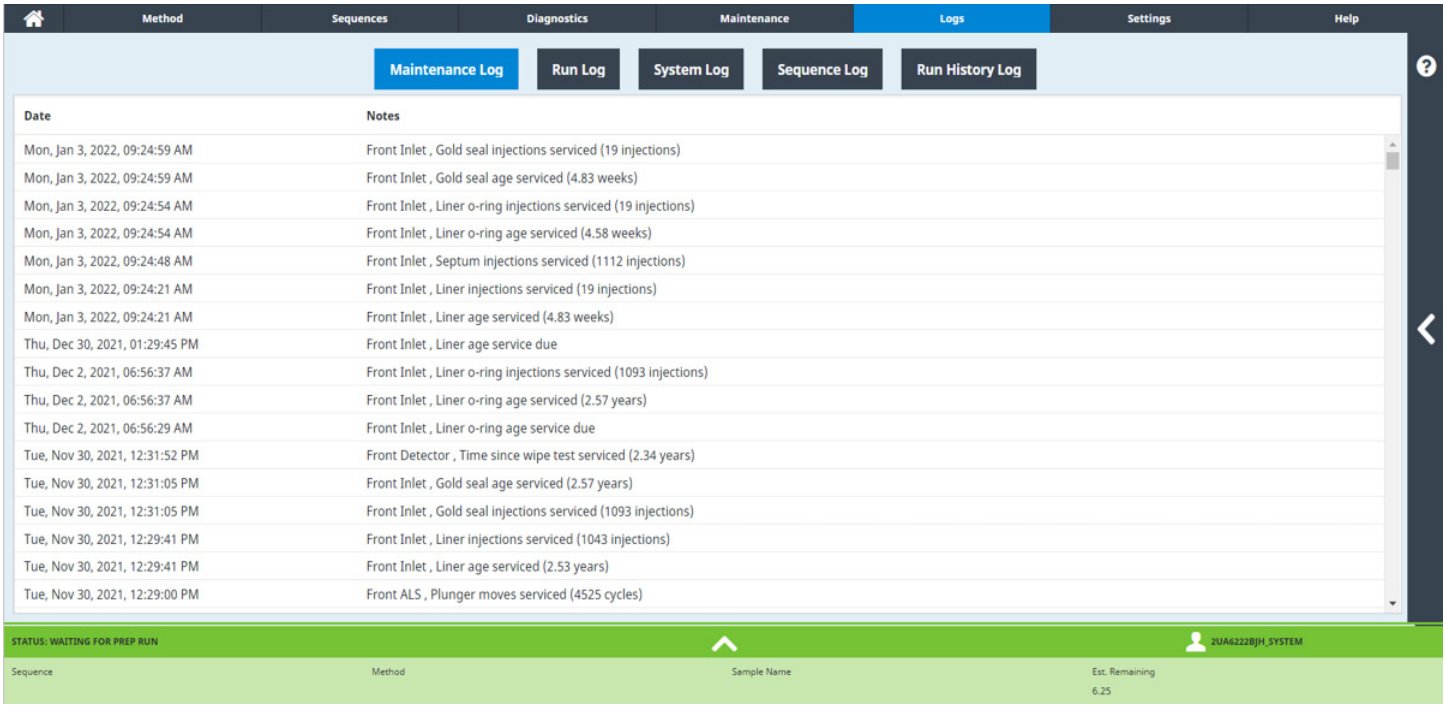


Figure 28. Logs window of the browser interface.

– The Sequence Log lists events related to executing sequences (start of a sequence, start of a run, skipped vials, etc.). If any automated tests were executed during the sequence (e.g., Peak Evaluation), an entry will also be added to the Sequence Log.
– The Run History Log is a comprehensive log that captures every instance of a run that is carried out by the GC, regardless of the genesis of the start (manual press of the start button, a sequence executed from the browser, or a run made from a connected data system).

Settings: review instrument information

As shown in Figure 29, the Settings tab contains a menu of options that provide user access to instrument-specific information related to installed modules, network settings, instrument FW, and convenient features such as the Scheduler.

– Service Mode allows the user to provide information for unconfigured modules. For example, oven cryogen type can be specified. Other configuration details for modules in the instrument can be found on the touch screen's Settings window.
– Calibration allows the user to fine-tune inlets, detectors, and the oven. For example, users can manually autozero pressure and flow sensors or apply an oven offset.
– About provides the FW revision, help/information revision data, and manufacturing date and serial number of the GC.
– System Settings provides the address to stored run data, the ability to change the local language, the opportunity to launch the System Setup (which is a guided introduction to the GC), and the ability to turn on the capability to execute Sequences from the local user interface.

  Note: the ability to delete data from the GC itself is only accessible from the System Settings menu on the GC's touch screen.
– Tools contains the ability to acquire and manage column compensations.
– Scheduler facilitates the use of wake, sleep, and conditioning methods in a user-settable schedule to help conserve resources while allowing the instrument to be ready to operate when needed.

Help: access extensive help and information

One significant advantage to the 8890 and 9000 series GCs is that their HW contains help and information, and the browser interface allows the user to access the content directly from the GC itself. The Help and Information Home includes help for the browser interface, HTML versions of all GC manuals (operation, maintenance, troubleshooting, installation, site preparation, and safety, and familiarization topics), and the ability to download PDF versions of the manuals.

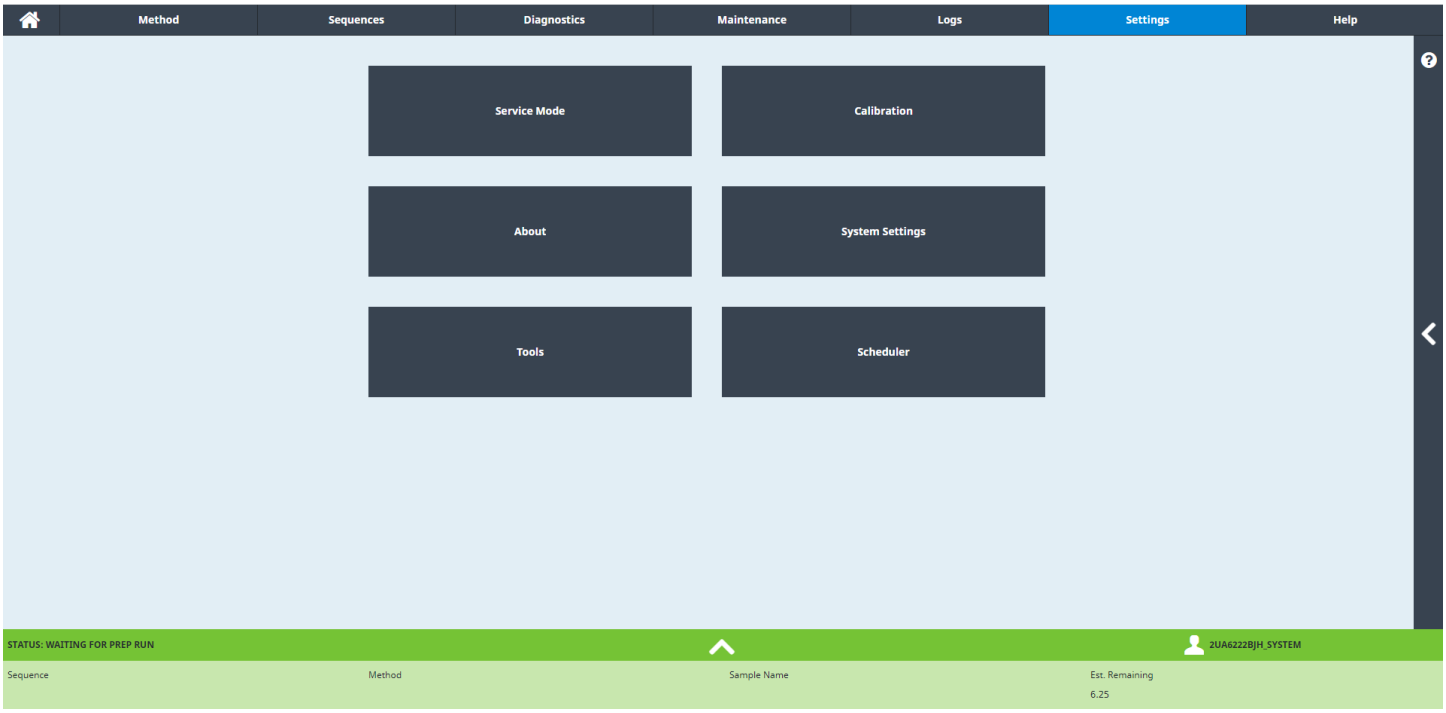


Figure 29. Settings tab of the browser interface.

As shown in Figure 30, the help and information content is searchable and grouped according to seven different categories: Knowledge base, Getting Started, GC Maintenance, touch screen Operation, Browser Interface Operation, Diagnostics, and Online Resources.

Note: only Online Resources require access to the outside Internet.

Users can find information for site preparation and instrument installation, manuals and exploded parts views of GC components, application notes and Agilent contact information, and much more. Here is a brief description of the content found in each of the tiles of the Help window shown in Figure 30.

- **Knowledge base:** Contains manuals, site preparation details, troubleshooting suggestions, and instructional content related to instrument operation.
- **Getting started:** Provides links to the Help and Information Tutorial (see below) as well as introductory material like the Quick Start Poster, eIntroduction, and a feature tour.
- **GC maintenance:** Offers material related to maintaining the instrument and its components, including integrated parts breakdowns, cleaning and bake-out instructions, and list of available consumable parts.
- **Touch screen operation:** Includes instructions related to navigating the menus on the touch screen, entering data, and how to use the status and plot pages.
- **Browser interface operation:** Provides the user with descriptions of the browser interface, similar to what was covered in this document where instructions from setting up methods, executing sequences, and checking instrument status to executing maintenance procedures and accessing help are discussed.
- **Diagnostics:** Describes an overview of the builtin diagnostics and provides a detailed explanation of what each diagnostic test evaluates.
- **Online resources:** Identifies resources beyond those included in the GC FW, which may be of help to users; including Agilent University, Agilent Community, and Agilent YouTube channel, webinars, support, application notes, online store, and contact information.

The help and information contained on the instrument is comprehensive, and while the navigation through the material is intuitive, it is still advisable to view the on-board tutorial within the Getting Started menu, as shown in Figure 31.

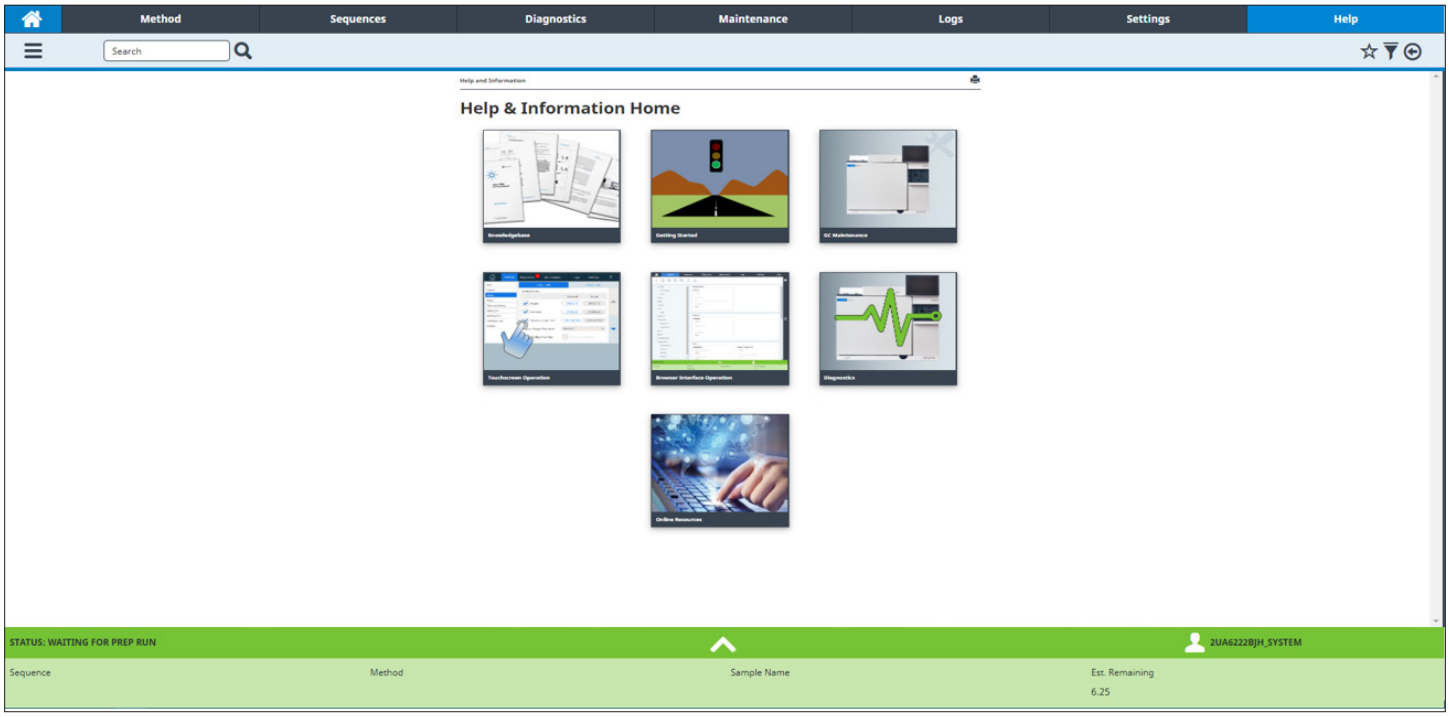


Figure 30. Help tab of the browser interface.

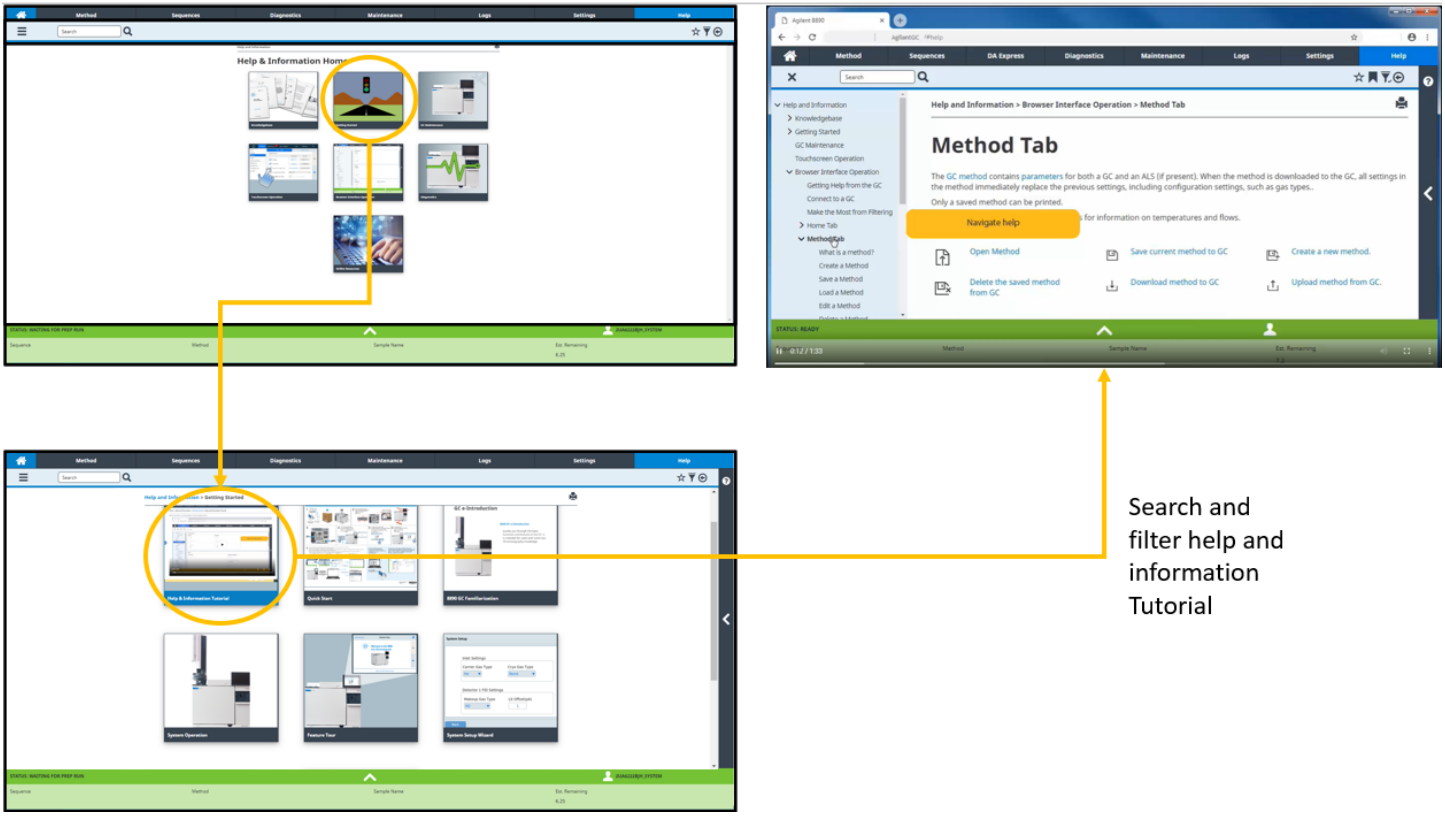


Figure 31. Help tutorials are available on the instrument, accessible from the browser interface.

References

1. GC Intelligence | Agilent

www.agilent.com

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