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SNRG Block™ System 1 and 2

User Manual

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Disclaimer: Products are supplied for laboratory use only and should not be used for any household, medical or therapeutic application. **AnalytiChem** presumes that only trained and qualified individuals, familiar with procedures suitable for the safe operation of these instruments, will handle them. Our customers are solely responsible for the safe operation, handling and use of these products.

Certified to comply with the following EMC and safety requirements standards: ICES-001 Issue 5 July 2020; FCC 47 CFR Part 15, Subpart B; FCC 47 CFR Part 15 Subpart C, §15.247; RSS-247, Issue 2, Feb 2017, Section 5; CE EMC: EN61326-1:1021; CE Safety: EN 61010-1; CE Safety: EN61010-2-010; UL: 61010-1/CSA22.2 NO 61010-1; RoHS 3 :EU 2015/863.

Manufactured in Canada

Table of Contents

1 Introduction

The **SNRG Block**™ digestion blocks are designed for laboratory use in the digestion and evaporation of a variety of samples such as water, wastewater, soil, and sludge samples.

The digestion block is available in two sizes, **System 1** and **System 2**, both blocks have interchangeable inserts for 3 tubes sizes; 15, 50 and 100 ml. **System 1** uses one insert, while **System 2** uses two inserts. The maximum temperature for both sizes of the digestion block is 240°C.

The digestion blocks include a detachable 7" touch screen display that can be magnetically attached to the fume hood or placed outside the fume hood using the kickstand. Programming and execution of a digestion profile can be performed on the touch screen or over a secure WiFi connection using an internet browser. Downloading digestion data, service logs, can be performed over the secure WiFi connection or can be done using a an USB cable and an application on a windows compute.

Note	*Wifi only available in limited locations.*
Warning	*If the SNRG digestion block is used in a manner not specified by the manufacturer, the protection provided by the unit may be impaired.*

2 Safety information

2.1 Warnings and notes are included throughout this manual

⚠ **Warning**	*Emphasize information about dangerous or hazardous conditions relating to the operations, cleaning or maintenance of the instrument that may result in serious personal injury.*
⚠ **Caution**	*Emphasize information pertaining to procedures that, if not strictly followed, may result in damage to the instrument.*

⚠ **Caution**	*Emphasize information pertaining to procedures that, if not strictly followed, may result in damage to the instrument.*
⚠ **Hot Surface**	*Emphasize the presence of surfaces that are hot to the touch and may cause burns or other injuries if touched.*

2.2 Safety

The safety notes and warnings should be followed when operating, maintaining or repairing the **SNRG Block** digestion block. Failure to follow these warnings and notes in this manual can affect the designed safety of this unit to the user.

> ⚠️ **Caution**
> *For indoor use only.*

2.2.1 Ground connection

The digestion blocks must be plugged into a three-prong, grounded outlet to ensure proper grounding of the system.

2.2.2 Servicing

The unit should only be serviced by a qualified technician. Disassembly and part replacement must be performed with the mains power supply disconnected.

> ⚠️ **Warning**
> *Disconnect mains power supply before any service, no serviceable parts inside.*

2.2.3 Power and voltage requirement

Before connecting the mains AC power to the equipment check the required voltage. Check the voltage selector to ensure it matches the mains voltage. The rated load of the socket must not be lower than required by the digestion block.

> ⚠️ **Caution**
> *Mains power source suitable for the equipment shall be provided at the installation location.*

2.2.4 Placement of the system

The touch display should not be placed in the fume hood to avoid corrosion of the electronics. The digestion block must be placed on a non-flammable surface with a clearance of 102 mm (4") on all sides. The digestion block should be operated in a fume hood with a recommended average face velocity of 70 fpm (feet per minute) or 0.356 m/s.

2.2.5 Symbols used on instrument or manual

Hot Surface	*Do not touch top surface when block temperature is higher than 80°C.*	**Caution**	*For indoor use only and do not use the instrument if damaged.* *Only use a power cable with the same or better ratings as provided with the instrument.* *Disconnect mains power supply before any service, no serviceable parts inside.* *Following all safety instructions/ warnings is for safe operation, cleaning or maintenance of the instrument and not following it may result in serious personal injury.* *Do not place the SNRG Block™ System on a surface containing flammable material.* *SNRG Block™ Systems require a clearance of 102 mm (4") on all sides.* *SNRG Block™ System should be operated in a fume hood.* *SNRG Block™ System must be plugged into a three-prong grounded outlet.*
⏚	Protective conductor terminal	115V 230V	Line voltage selector
🖥	Display screen connector	Fuse symbol **F16A 250VH**	Fuse
🌡	External temperature sensor connector		

3 Warranty

AnalytiChem warrants this product free from defects in workmanship and materials for one (1) year from the date on which the equipment departs the manufacturer's facility.

Should the unit malfunction, contact **AnalytiChem**'s service department, or your local distributor, and a service representative will instruct you on how to proceed.

There are no user-serviceable parts in this unit. The warranty is void if the unit shows evidence of being tampered with, of being subjected to excessive moisture, heat, or corrosion, or of other misuse.

The temperature sensor (option) is a consumable product.

AnalytiChem shall not be responsible for any damage or losses, however caused, which may be experienced because of the improper installation or use of this product.

This product is not warranted for, nor has it been tested for, use with perchloric acid. The user accepts all responsibility if this product is used with perchloric acid.

<u>   4</u> Specifications

4.1 Size and weight

	SNRG Block System 1	SNRG Block System 2
Width	43.3 cm (17″)	52.8 cm (20.8″)
Depth	36.7 cm (14.5″)	47.3 cm (18.6″)
Height	19.4 cm (7.6″)	19.4 cm (7.6″)
Weight	17 kg	24 kg

4.2 Environmental

Relative Humidity	30% to 80%
Altitude	Up to 2000 meter
Installation	Overvoltage Category II
Pollution	Degree 2
Ambient Operating Temperature	15°C to 40°C
Mains supply voltage fluctuation	+/- 10%

4.3 Electrical

	SNRG Block System 1	SNRG Block System 2
Voltage	115/230V	115/230V
Power	1500W	1900W
Frequency	50/60Hz	50/60Hz

Replace fuse with the same type and rating: F16A250VH 20x5 mm Quick-Acting.

Note

4.4 Declaration of conformity

We declare that this product conforms with the technical requirement of the following standards:

ICES-001 Issue 5 July 2020

FCC 47 CFR Part 15, Subpart B

FCC 47 CFR Part 15 Subpart C, §15.247

RSS-247, Issue 2, Feb 2017, Section 5

CE EMC: EN61326-1:1021

CE Safety: EN 61010-1

CE Safety: EN61010-2-010

UL: 61010-1/CSA22.2 NO 61010-1

RoHS 3 :EU 2015/863

5 Installation

5.1 System Overview

The digestion block requires one graphite insert for **System 1** and two graphite inserts for **System 2**. To accommodate 15 ml, 50 ml and 100 ml vessels, 3 different inserts are available with matching racks. The digestion block has a detachable touch screen controller that can be placed on the outside of the fume hood by either attaching it to a magnetic surface, such as the side of a fume hood, or by placing it on the bench using the kick stand. The digestion block can be used at 115V or at 230V and selection of the right voltage is performed using the voltage selector on the back of the instrument. We recommend, when possible, to use the higher voltage to operate the digestion block.

Programming and starting a digestion can be performed from the touch screen controller or from a remote device with an internet browser over secure WiFi.

The front and sides of the digestion block have LED indication bars that display the status of the instrument. A blue status bar indicates the digestion block is at ambient or low temperature. As the digestion block heats up during use, the status bar will progressively turn from blue to red. At 90°C the status bar will be fully red.

System 1

System 2
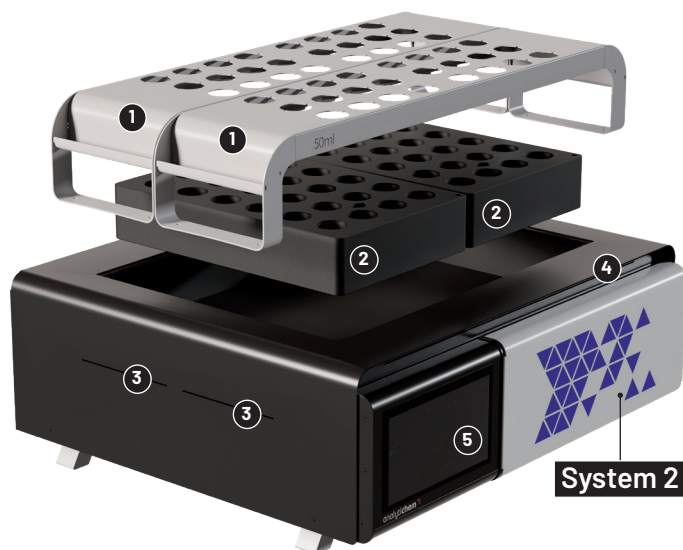
1. Rack
2. Insert
3. Side LED indication bar

4. Front LED indication bar
5. Touch screen display

6 Unpacking

Open the box at the top and remove the supporting material.

▶ When removing the unit from the box, lift it by grabbing the bottom sides. There is a hand space in the bottom support of the instrument to create a space for the hands.

▶ Verify that all components on the packaging list have been included. If any item is missing contact **AnalytiChem** or your local service provider.

▶ Inspect the products for shipping damage, if the instrument has been damaged in shipping, contact the freight carrier to report damage and to file a damage report. Also contact your designated service provider or **AnalytiChem** to report damage and request service information.

Note	*Never lift the unit by the top cover!*
Caution	*Do not use the instrument if damaged.*
Note	*Retain all packaging material to ship the instrument for service.*
Warning	*Only use a power cable with the same or better ratings as provided with the instrument.*

7 Setup

7.1 Overview

Place the digestion block in a vented hood, with air flow according to local regulations, leaving 4" space between the wall(s) and the instrument. The control screen must be placed outside the vented hood and can be attached to the exterior of the hood with the built-in magnets or can be placed on a flat surface beside the hood using the kickstand.
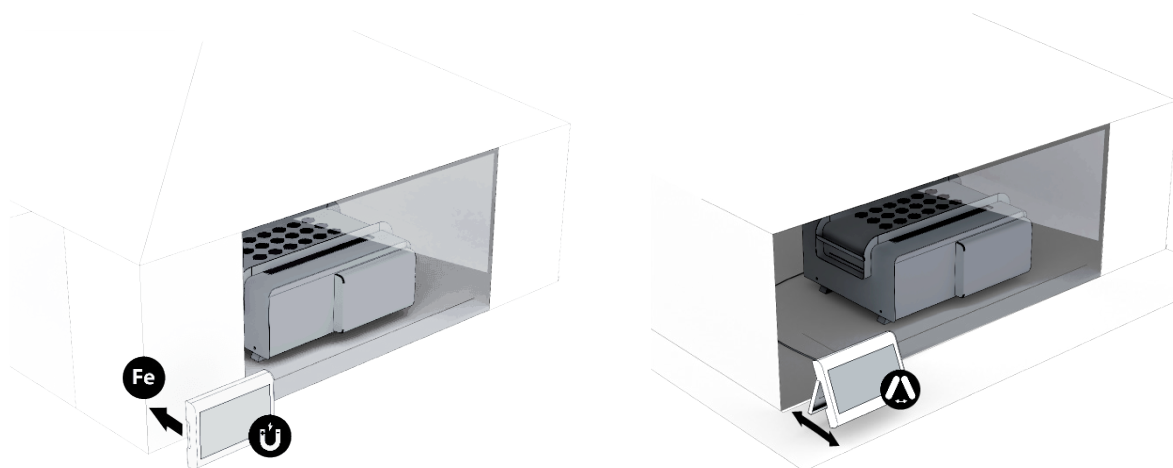
▶ Check the voltage selector and ensure it is set to the correct voltage. The recommended voltage for the digestion block is 230V.

▶ Connect the control screen to the back of the digestion block.

▶ Plug in the line cord into the base cord and into the power grounded outlet. The base cord is connected to the power receptacle on the back of the instrument.

▶ Connect the optional external temperature sensor, or move to the next step if not utilizing.
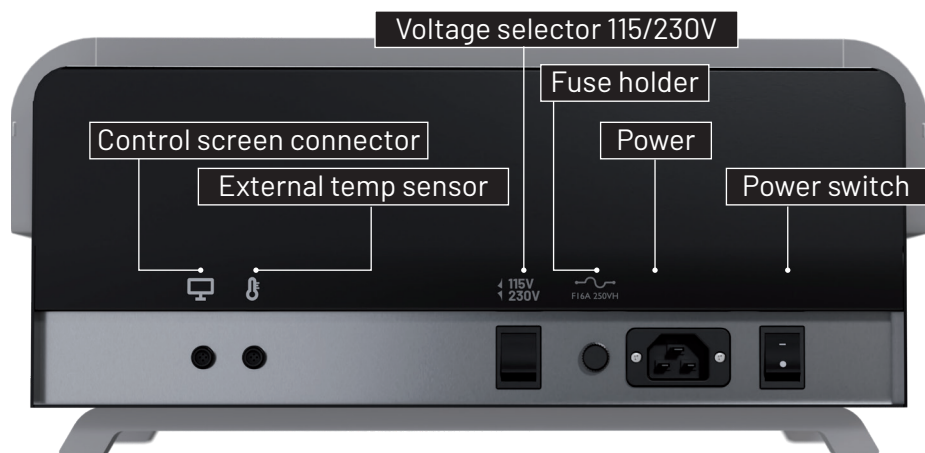
External connectors on the back of **System 1** *and* **2**.

7.2 Placing and Removing Graphite Inserts

▶ System 1 and System 2 are designed to function with 1 and 2 inserts respectively. Using either System without inserts is not supported and will void the warranty.

> *To ensure temperature stability, always use two inserts in System 2.*
>
> **Note**

▶ The included insert removal tool can be used to place and remove the inserts from the digestion blocks. Each insert has two cutouts on the top surface, slide the insert removal tool into these cutouts until it reaches the bottom of the hole and turn them by 90° in either direction. Always use two insert removal tools to lift the insert.
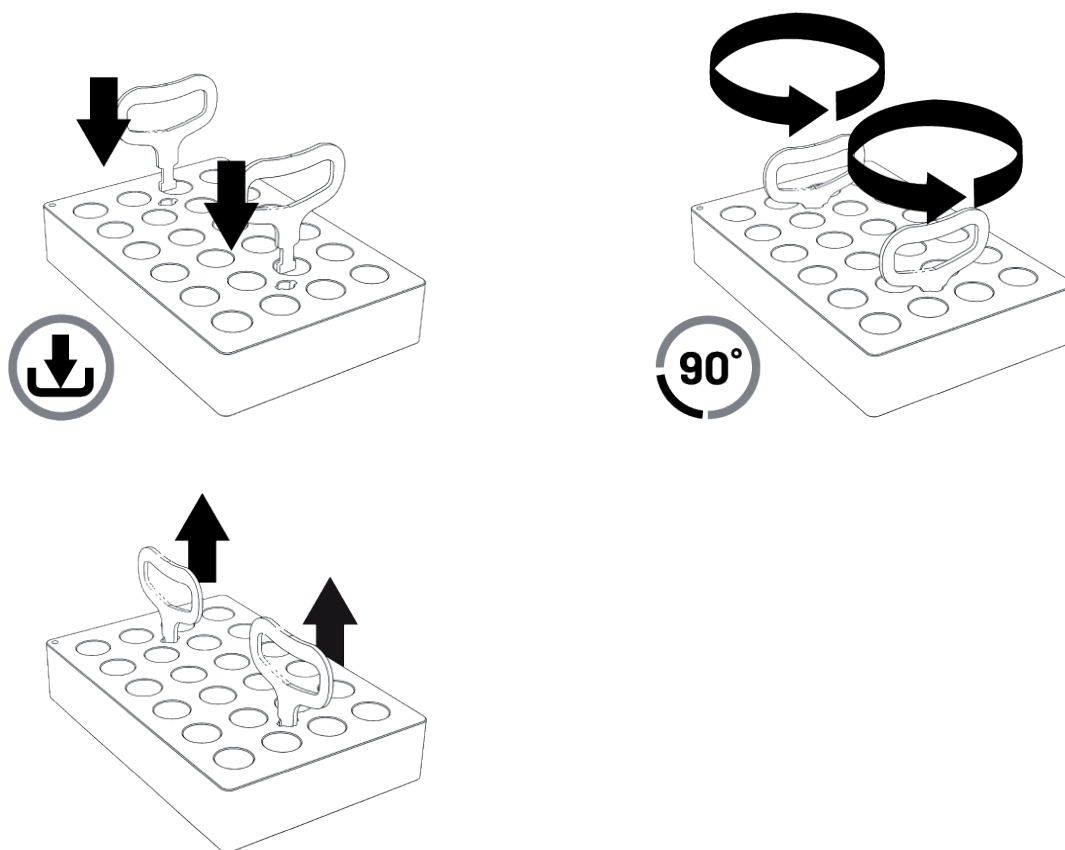
The system is now ready to be plugged in and turned on. Please refer to the Instrument Operation section for operating instructions.

7.3 External Temperature Sensor

An optional external temperature sensor can be used with the digestion block. This sensor allows the direct control of the sample temperature, increasing temperature accuracy for critical applications. The sensor is placed in a control sample containing the same matrix and volume as the samples. The temperature measured by this external temperature probe is then used by the controller to regulate the digestion block temperature.

Note	*When using the external temperature sensor, the set temperature must be lower than the boiling point of the Matrix.*

The external temperature sensor is held by the temperature sensor holder, with a separate size holder for the 15, 50 and 100 ml **DigiTube**. The holders are placed over the threaded part of the **DigiTube** and secured on these vessels with a plastic set screw. The temperature sensor is held in the center of the vessel by the holder and the depth of the sensor in the vessel is secured with a second set screw on the holder. An included polypropylene watch glass, with a center hole for the temperature probe, can be used to minimize evaporative losses. The ideal depth of the temperature sensor in vessels is when the sensor tip is 1 mm from the bottom of the tube.

The external temperature sensor can also be used to monitor liquid height in the vessel. If liquid falls below the tip of the sensor the FW will switch off the heating.

The temperature sensor can be calibrated from the controller, See section "Settings\Internal Temperature Sensor Calibration", page 28.

7.4 Inserts and Racks

There are 3 separate rack types per System, one for each vessel size, 15, 50 or 100 ml. **System 1** uses one rack to load all the vessels while **System 2** uses two racks to load all the vessels.

Inserts for 15, 50 and 100 ml vessels.

The standard rack orientation in both systems is from side to side. However, **System 2** can also be staged with inserts for two different volume vessels at the same time.

In such a configuration, racks in the front-to-back configuration are required, one per insert. An alternative rack is available for this configuration.
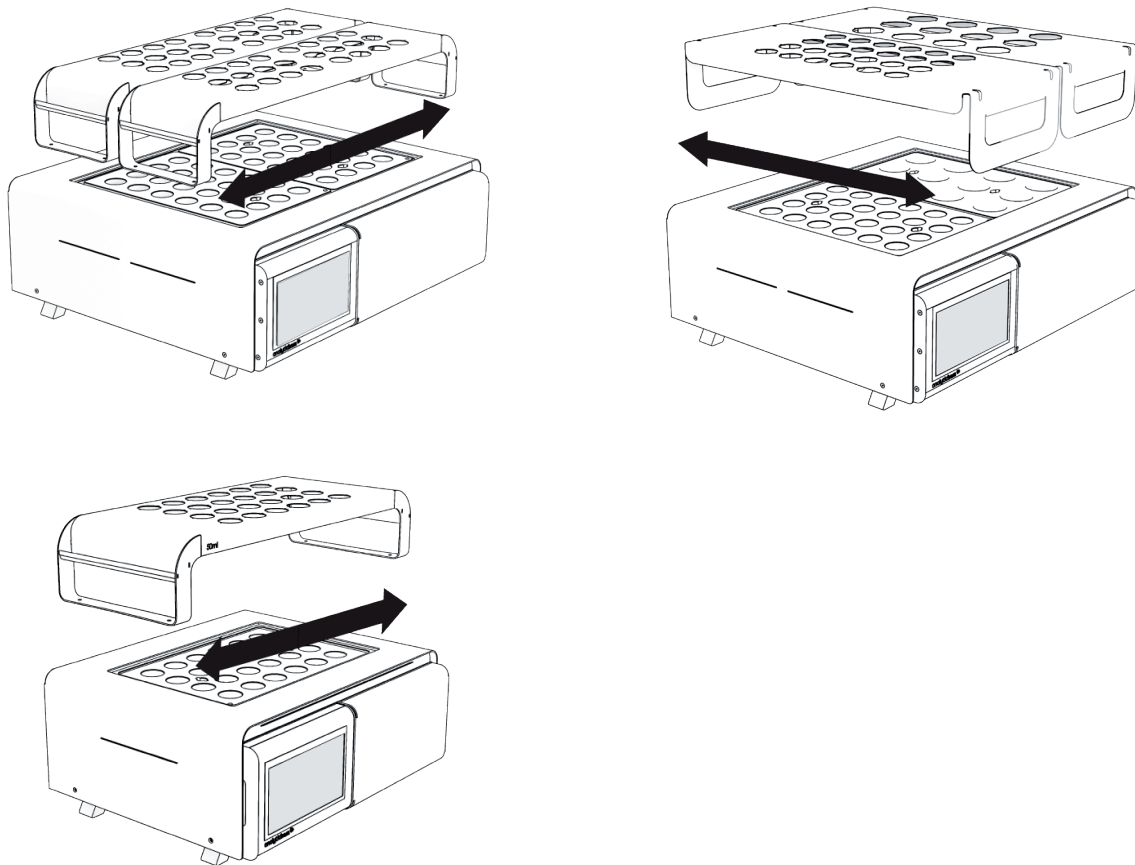
Rack placement on **System 1** *and* **System 2**. **System 2** *has racks for the side to side as well as the front to back configuration.*

7.5 Instrument Configurations

Vessel size	System 1		System 2		
	Graphite Insert part#	Standard Rack part#	Graphite Insert part#	Standard Rack part#	Front to back Rack
15 ml	012-201-030	012-201-040	012-201-030	012-201-041	012-201-046
50 ml	012-201-032	012-201-042	012-201-032	012-201-043	012-201-047
100 ml	012-201-034	012-201-044	012-201-034	012-201-045	012-201-048

Description	Part Number
External volume/temperature sensor	012-201-050
SNRG Temp Sensor Holder, 15 ml **DigiTube**	012-201-051
SNRG Temp Sensor Holder, 50 ml **DigiTube**	012-201-052
SNRG Temp Sensor Holder, 100 ml **DigiTube**	012-201-053
SNRG Insert removal Tool	012-202-051
SNRG Line cord Type B, 250V	012-201-061
SNRG Line cord Type B, 125V	012-201-062
SNRG Line cord Type E & F, 250V	012-201-063
SNRG Line cord Type G, 250V	012-201-064
SNRG Line cord Type J, 250V	012-201-065
SNRG Line cord Type L, 250V	012-201-066
SNRG Line cord Type M, 250V	012-201-067
SNRG Line cord Type N, 250V	012-201-068
SNRG Line cord Type I, 250V	012-201-069

8 Instrument Operation

After start-up, the user interface will open on the home page. On the right-hand side of the screen are the selection of the four sections, Home, Methods, WiFi and Instrument Settings. The digestion blocks can be controlled from the touch screen display or can be controlled remotely.

8.1 From Touch Screen Display

8.1.1 Home

On the Home Page 🏠 , the user can select a saved method from the drop-down list and start a digestion using the selected method. The home page displays the block temperature and a graphical representation of the selected method. During a run, both actual and the programed temperature profile are displayed.
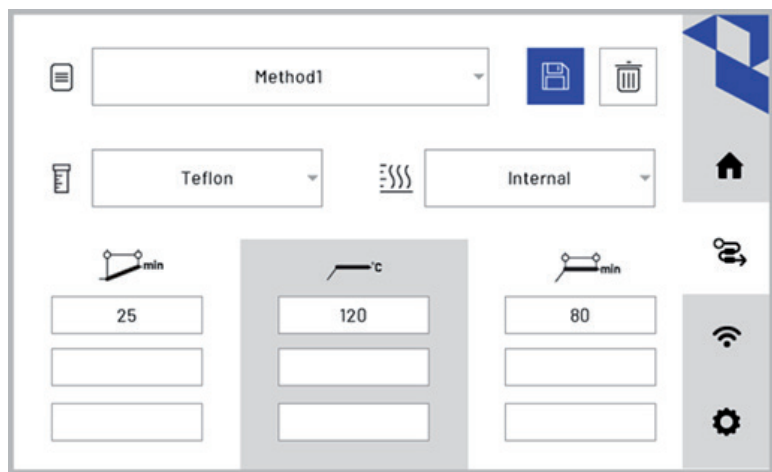
The home screen also displays the tube type and temperature sensor selections, defined in the method. The selected temperature sensor can be the internal standard temperature sensor or the optional external temperature sensor.
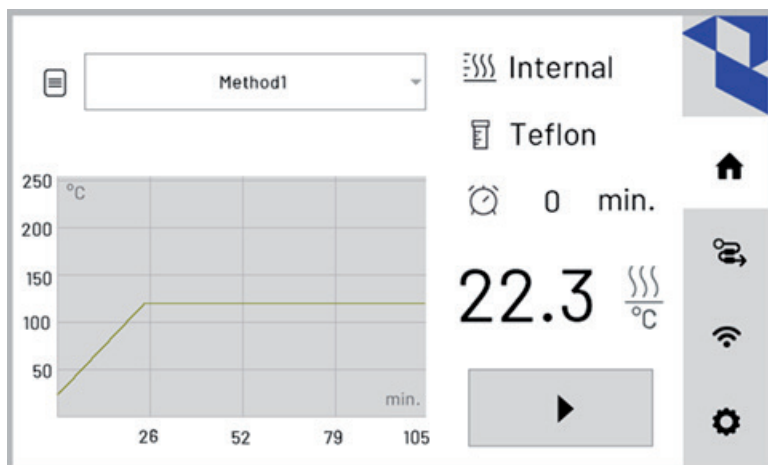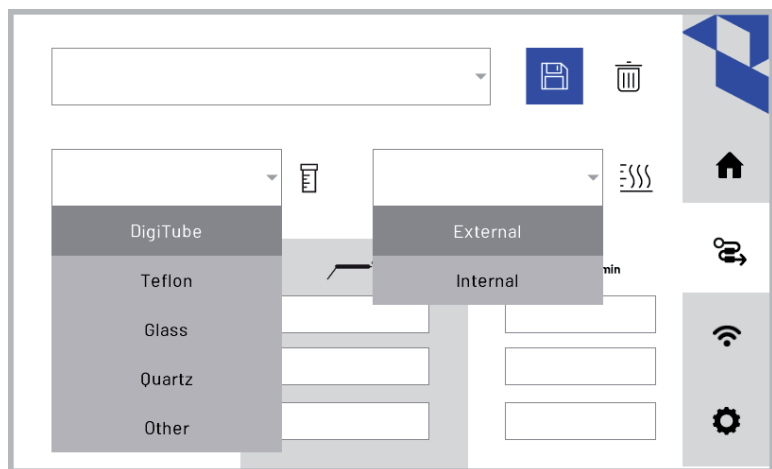
After pressing the Start button ▶ , the run time counter will start, and the start button icon will change to a Stop button ■ icon.

8.1.2 Methods

Methods 🔀 are created or changed in this section. Each method requires the selection of the vessel type, the temperature sensor, a target temperature with corresponding ramp and hold times. Each method can have up to three separate target temperatures.

A new method is created by selecting "+..." in the dropdown menu. Alternatively, an existing method can be selected and edited.

Select a vessel type: the selections are, **DigiTube**, Quartz, Teflon™ or other. Based on the selected vessel type, the maximum target temperature is limited. This is to prevent melting certain types of vessels during digestion. Polypropylene vessels have a temperature limit of 110°C while Quartz, Borosilicate or Teflon™ vessels can be used up to the block's maximum temperature of 240°C. A warning is shown with **DigiTube**s if the selected temperature is higher than 110°C.

Do not use the polypropylene tubes above 110°C.

Caution

You can select between two temperature sensors for the control source: the integrated internal temperature sensor or the optional plugged-in external temperature sensor. The external temperature sensor is used to regulate the temperature of the digestion block according to the measured sample temperature. Care must be taken to ensure that all temperatures defined in the method are lower than the boiling temperature of the liquid.

Vessel type and temperature sensor must be selected first when defining a method. Failing to select these will result in a popup window warning the user of the skipped selections.
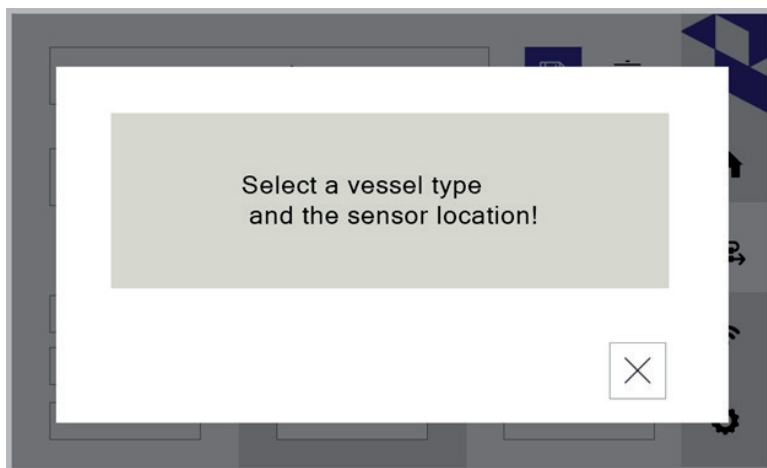
For each target temperature, the ramp and the hold time must be defined. Up to three different Target Temperatures can be set in each method.

In the method table, the first column is for the Time to the Target Temperature (called the Ramp Time), the second column is the Target Temperature, and the last column is the time at the target temperature or Hold Time. All columns for a stage must be defined before proceeding to the next stage. A popup window with a warning to input all the required data will be displayed if information is missing.
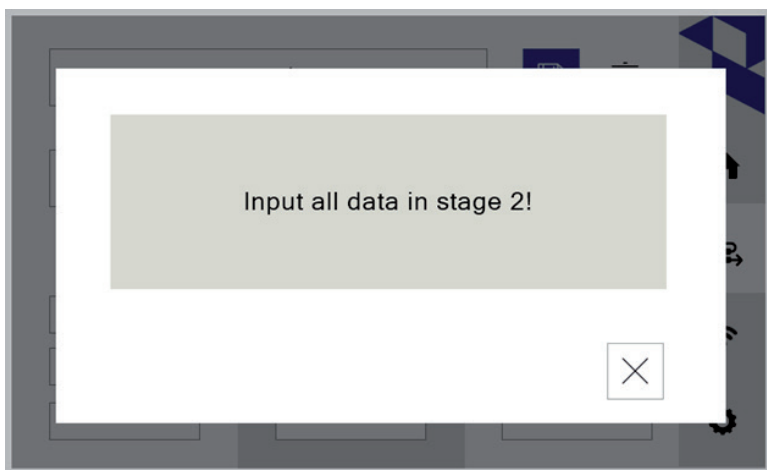
If no subsequent stage is defined, the run will end after completing the Hold Time.

The minimum achievable ramp time is dependent on many variables: the digestion block type (**System 1** or **System 2**), the sample load; including number of samples, the sample volume and sample matrix, and heat loss due to environmental conditions; such as laboratory temperature and airflow. If the desired ramp time is set lower than the minimum achievable ramp time to reach the target temperature, the block will automatically utilize its maximum heating rate. The hold time will only start after the digestion block reaches the target temperature.

Once the method is created or changed, it must be saved using the Save button. When the Save button is clicked, a popup window will appear to confirm the saving of the file.
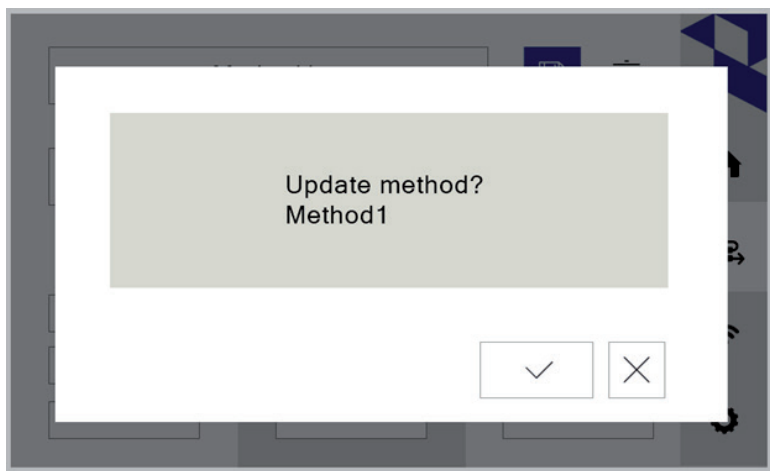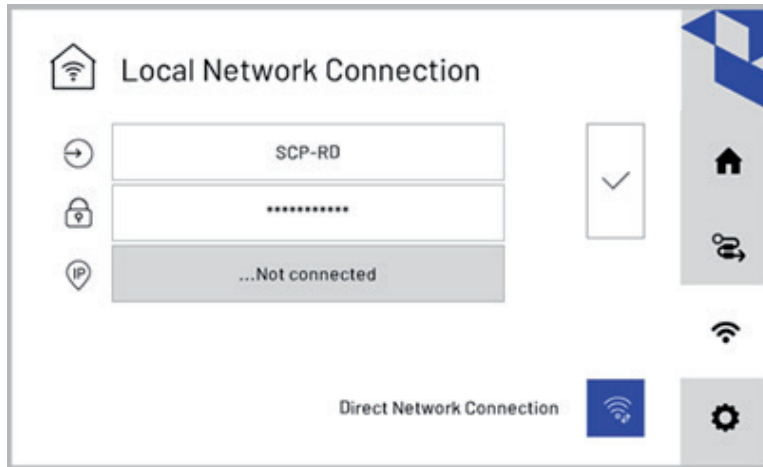
When trying to delete an existing method a popup window will ask to confirm the deletion of the method.
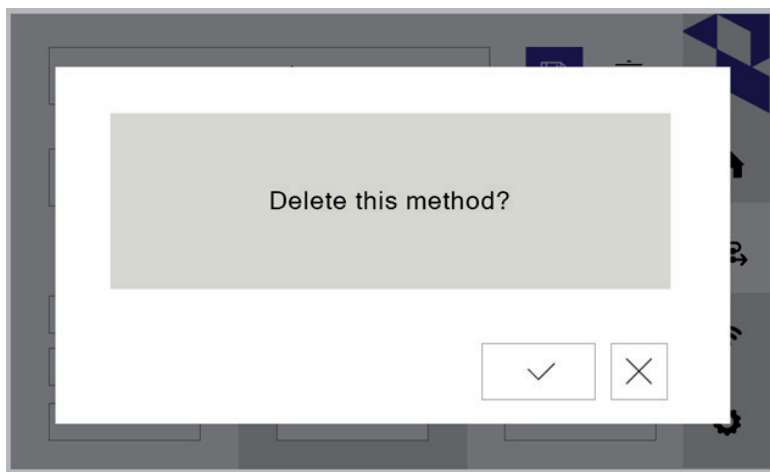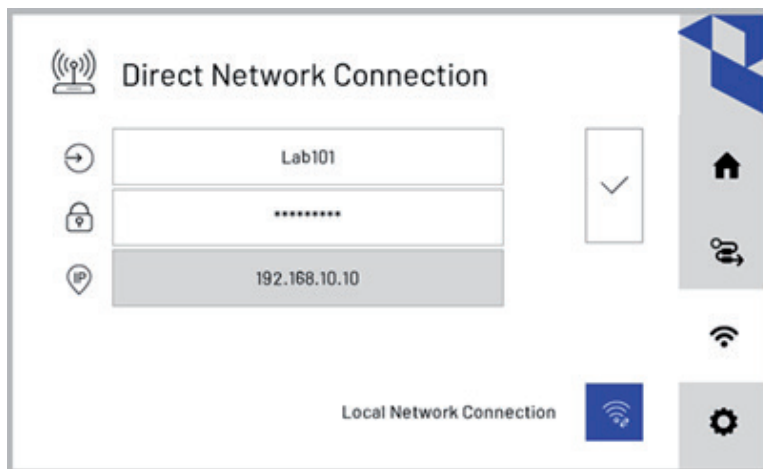
8.2 WiFi Settings

WiFi settings are not available in all countries due to local regulations. An activation code is required to enable the WiFi. See section "8.6 Settings\System Information", page 26. The connection to the instrument can be through a local WiFi network or can be by direct network connection from any WiFi capable device that can run a web browser. In both cases a device name and password must be created. Click the "WiFi Connection Type" button to switch between a Local Network Connection and a Direct Network Connection. Fill in the Device Name and password, then click the "Accept" button to save the settings before attempting to log in using WiFi.

8.3 Local Network Connection mode.

Connecting the heating block to a local WiFi network:

1. Click the WiFi symbol on the LCD screen to enter this mode. The spinning icon indicates that the equipment is scanning for available local WiFi networks.

2. Once the spinning stops, you can click the drop-down menu to select the local WiFi network you want to connect to.

3. Enter the password for that network and click the check mark button and the device will connect to the network.

4. If no connect to the network can be established, clicking the button to connect again.

5. After successful connection, the IP address will appear in the IP box. The small dot next to the WiFi symbol indicates that the connection is active.

6. If your computer or mobile device is connected to the same network, or has access to the connected network, you can open a web browser on your device and enter the IP address in the address bar. A web page will be displayed allowing you to manage your equipment remotely.

> **Note**
>
> *Not all mobile devices can open the web page or control devices, depending on your mobile device's settings. Most laptops will work without an issue.*
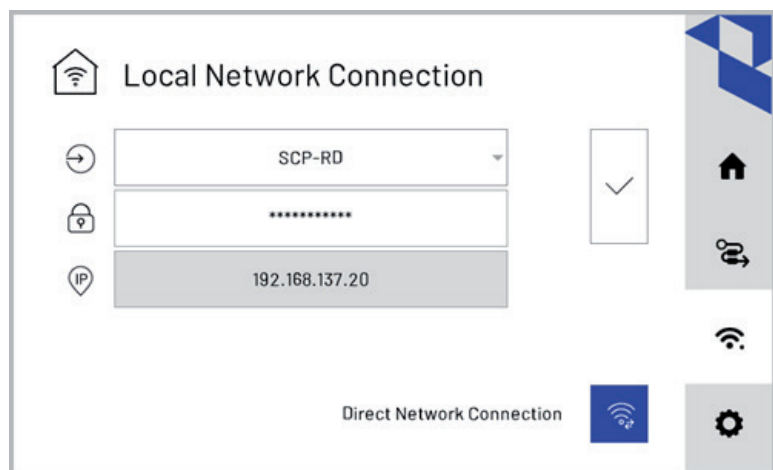
Alternatively, a 2.4GHz WiFi mobile hotspot can be created on a computer or mobile device to create a local network. The heating block can connect to the hotspot following the same steps as to the local network.

8.4 Direct Network mode.

Connecting to the heating block using direct WiFi connection:

1. In this mode, the heating block acts as a WiFi source so your computer or mobile device can connect to it. The default WiFi name is "AC-BLOCK" and the default password is "123456789".

2. To change the WiFi name and password, input the new name and password and select the check mark button to save.

3. The new WiFi network will be created after a few seconds. Once the network is created, it will always be available, even after restarting the heating block.
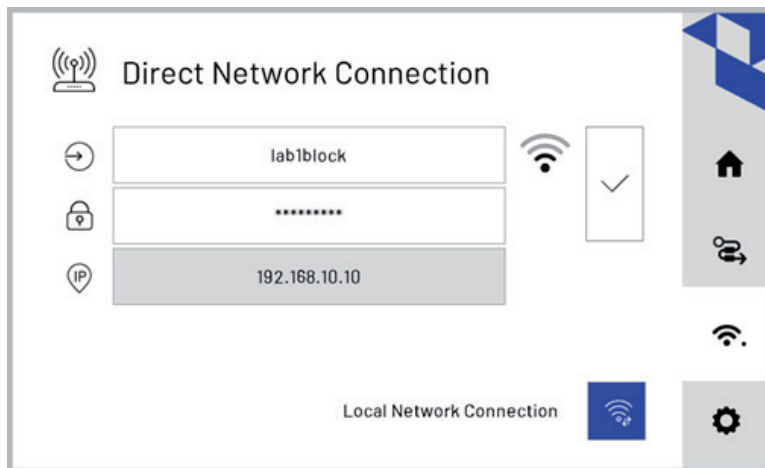
4. The IP address is fixed and is: 192.168.10.10.

5. On a computer, under available networks, select the WiFi name of the heating block.

6. Enter the password, it will take a few moments before a connection is established.

7. Open a web browser, on the computer connected to the heating block, and enter the IP address 192.168.10.10 in the address bar. A web page will be displayed with controls to manage the heating device. See the manual for additional information.

The Local Network Connection mode and the Direct Network Connection mode can work at the same time. This means, more than one computer can be connected to the same equipment using the different modes, or one computer can connect to multiple heating blocks.

If a WiFi connection can't be established, restart the heating block by turning on and off the power. If the issue persists, restarting the WiFi router may be necessary.

8.5 Instrument Settings

In the "Settings tab" are the buttons to view "System Information", "Language", " Date and Time", "Internal Temperature Sensor Calibration" and "External Temperature Sensor Calibration".
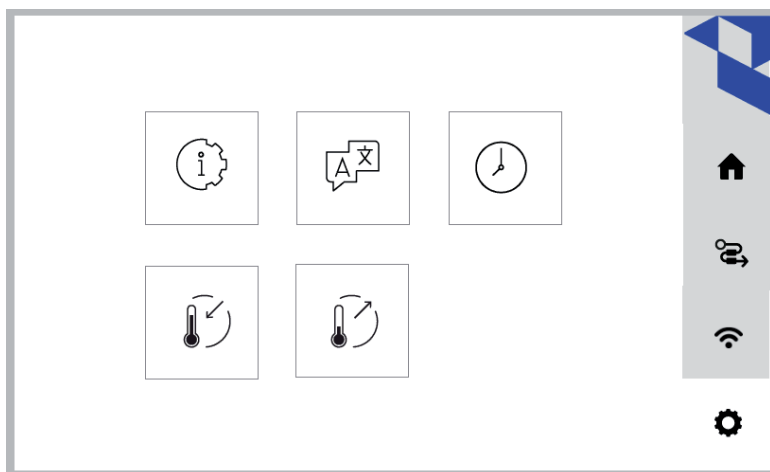
8.6 Settings\System Information

The system information screen provides details regarding the serial number and firmware installed on both the controller and the display and provides information regarding the connected line voltage.

The Reboot button will restart the firmware on the controller.
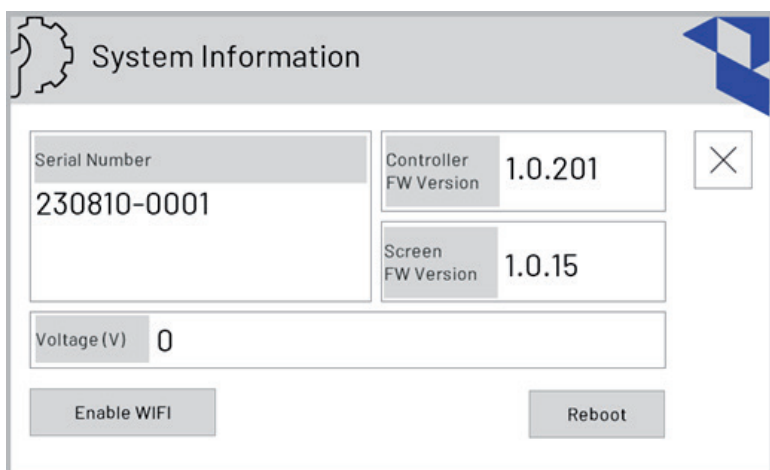
A WiFi unlock code will be provided in certified countries or regions. After pressing the "Enable WiFi" button, a popup will appear to input the unlock code.

The installed Firmware Version for he Controller and the Screen are only displayed here. Updating the firmware and downloading data can be performed through the USB port, on the touch screen using a software tool that can be downloaded from the **AnalytiChem** website.

8.7 Settings\Language

The default language is English, other languages can be selected from the dropdown menu. Some languages are supported, but require a Firmware update. Please see the **AnalytiChem** website for a full list.
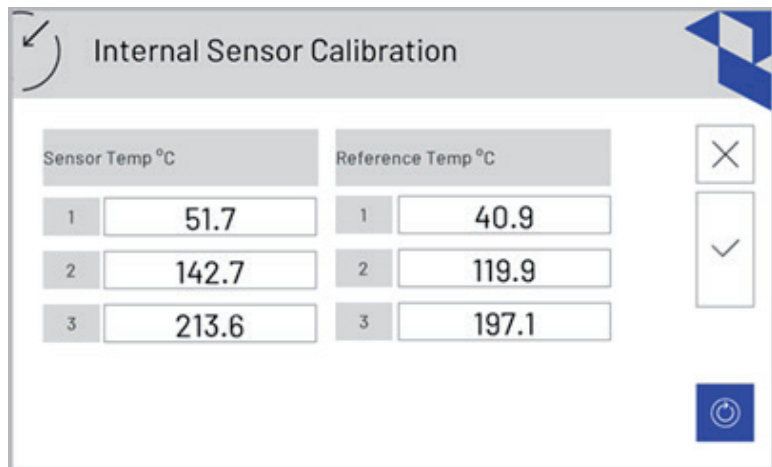
8.8 Settings\Date and Time

The date and time are automatically set when connecting to WiFi, alternatively they can be set here manually.
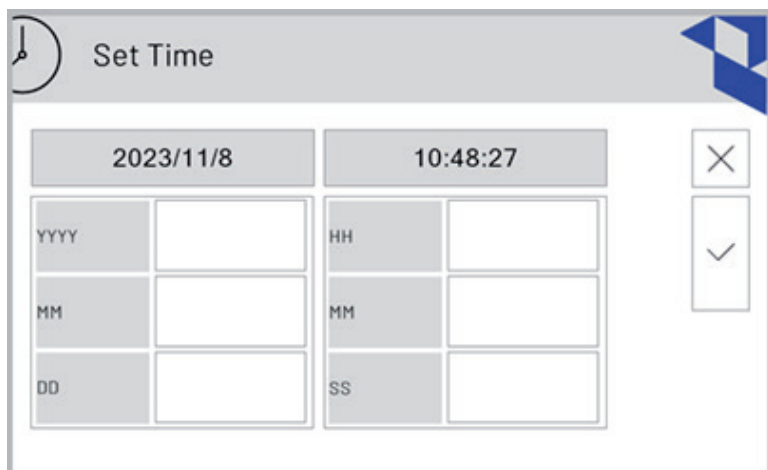
8.9 Settings\Internal Temperature Sensor Calibration

The internal temperature sensor can be recalibrated as necessary. See section "9.13 Temperature Calibration", page 36 to learn how to obtain the raw temperature values needed to create a new calibration.

Input the measured sensor and reference temperature, as described in the Temperature Calibration section of the manual and press the Acknowledge button ✓ .

To load the factory default values, press the Reload button ⟳ . Acknowledgement of the reset is required in a popup as shown below.

8.10 Settings\External Temperature Sensor Calibration

The external temperature sensor can be recalibrated as necessary. Please check the Temperature Calibration section in this manual to learn how to obtain the raw temperature values needed to create a new calibration.

Input the measured sensor and reference temperature, as described in the Temperature Calibration section of the manual and press the Acknowledge button ✓ .

To load the factory default values, press the Reload button ⟳ . Acknowledgement of the reset is required in a popup as shown below.

8.11 Display Log Data

The log data of the run can be reviewed directly on the display. To review, use a single tap of the **AnalytiChem** geometric pattern in the top right corner of the screen, a list icon will apear in the bottom left corner and after a single tap on this icon the log data sceen will be displayed.
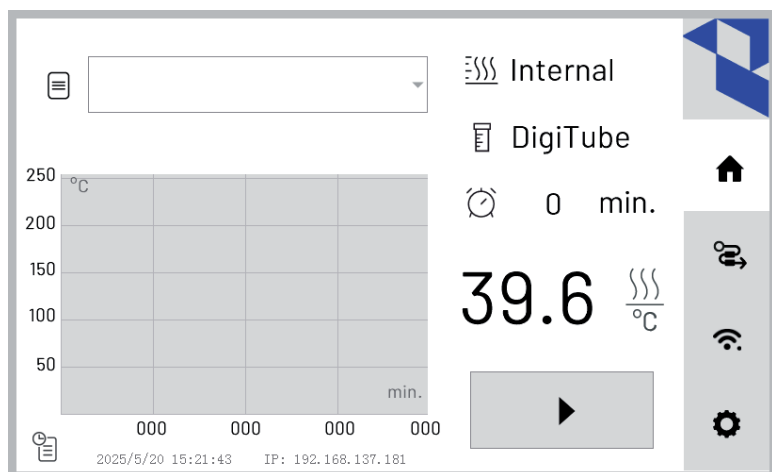
In the log data screen log files saved on the controller can be displayed using the dropdown file selector.
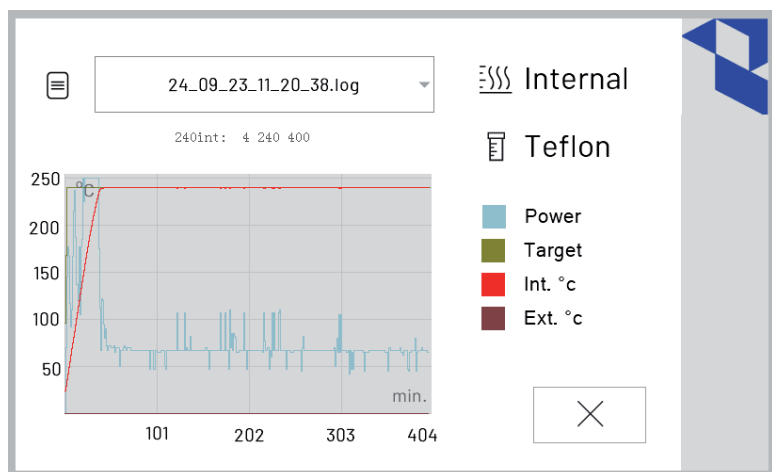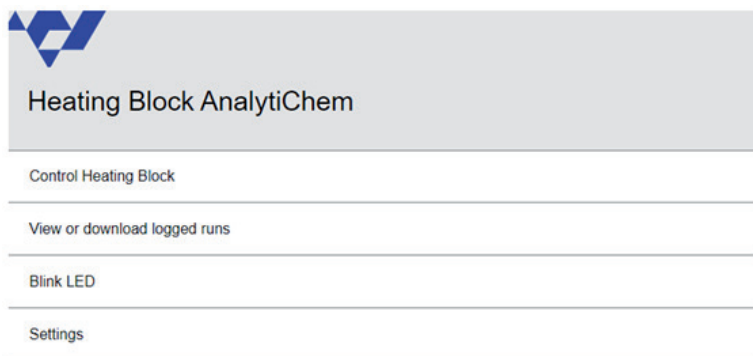
<u>9</u> Remote Control

The digestion block can be controlled from a WiFi-capable device running an up-to-date web browser. If the controller is accessed over a WiFi network with external internet access, the libraries needed to display the temperature progression graphs will be loaded automatically by the browser. If the controller is accessed by direct WiFi or without access to an external internet, then the libraries needed to display the graphs must be downloaded separately. See section "9.11 Download Graph Libraries", page 35 .

9.1 Main Page

The main page on the browser shows the different sections accessible by remote access. The user can start a digestion, download or view logged files, update the display or the controller firmware, upload configuration files, manage the files on the controller, create new configurations and download libraries to display charts.

9.2 Control Digestion Block

The digestion block can be configured, started and stopped using the remote connection. Methods can be selected and started from the browser and the progression can be followed.

The numbers shown in "Method" are the Ramp Time, Target Temperature and Hold Time respectively.
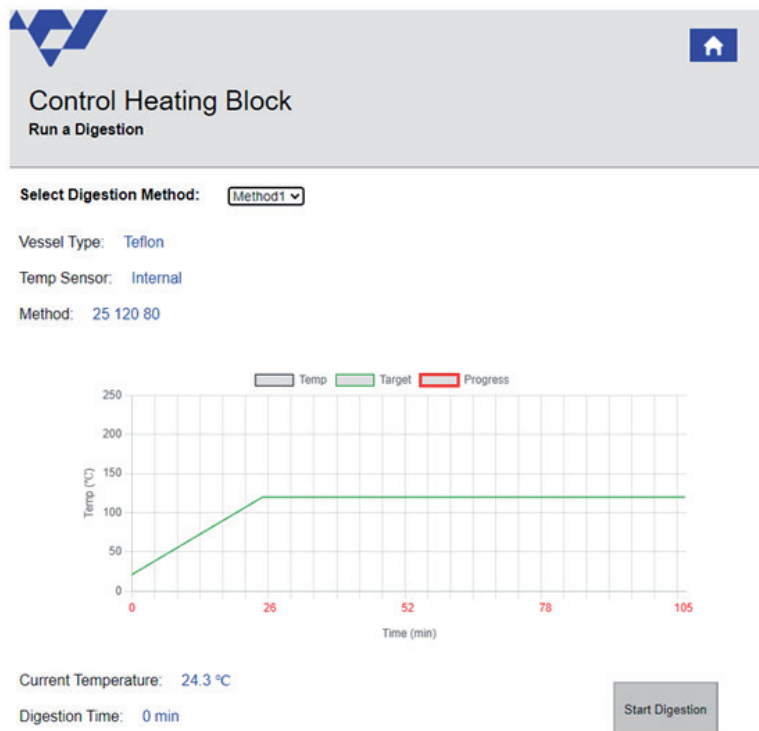
9.3 View or Download Logged Runs

Saved digestion data can be viewed directly in the browser or can be downloaded from the Controller onto the connected device.

9.4 Blink LED

The "Blink LED" function allows the user to identify the digestion block to which the remote device is connected to, when multiple blocks systems are available. When pressed, the connected system will switch the LED status bar on and off for about 10 seconds.

9.5 Settings
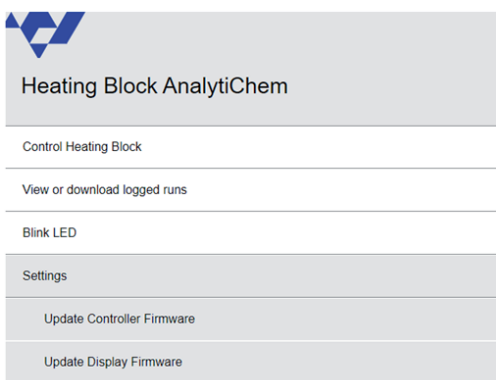
Settings has five sections:

Update Controller Firmware

Update Display Firmware

Upload Configuration Files
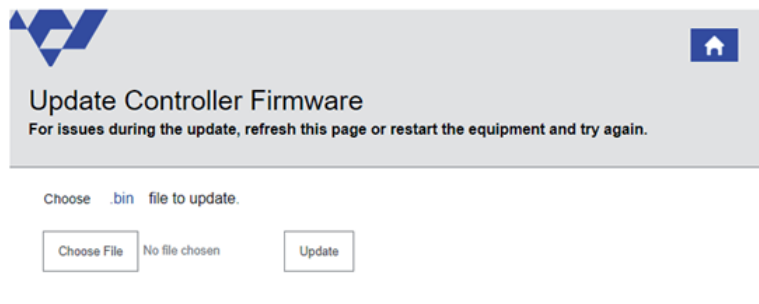
Manage Files

Save System files

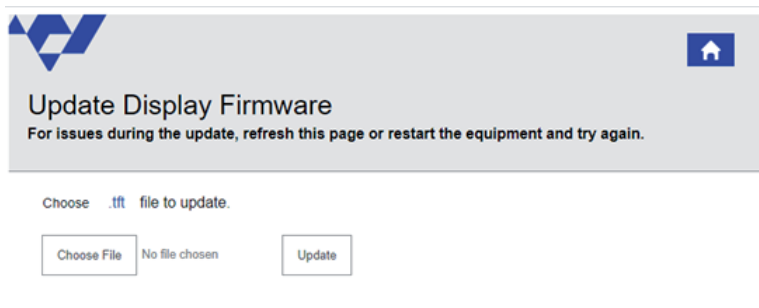**Download Graph Libraries**

9.6 Update Controller Firmware

To update the controller firmware, download the latest version from the **AnalytiChem** website. In the web browser, select the downloaded update with the extension .bin and click the Update button. If a problem occurs during the update, refresh the webpage or restart the digestion block.
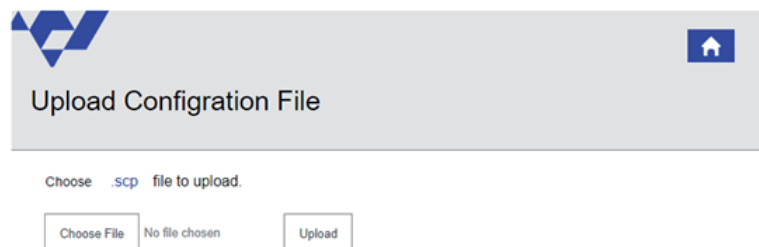

9.7 Update Display Firmware

To update the display firmware, download the latest version from the **AnalytiChem** website. In the web browser, select the downloaded update with the extension .bin and click the Update button. If a problem occurs during the update, refresh the webpage or restart the digestion block.

9.8 Upload Configuration File

Configuration files can be uploaded to the controller, the configuration files have a .scp extension.

9.9 Manage Files

Selection of logfiles for download or deletion can performed by selecting the check box in front of the filename. All files can be selected by checking the box in the header of the table.

9.10 Save system Files

All the system files can be saved to the remote device.

9.11 Download Graph Libraries

The Graph Libraries only need to be loaded from the controller when using a direct WiFi connection.

9.12 USB connection

Update of both screen and controller firmware can performed using using the USB A port at the bottom of the touch screen display. To access the USB port, the touch screen must be removed from the digestion system and the kickstand must be opened. Insert a USB A to USB A cable into the port and insert the other side of the cable in a Windows computer.

Download the "Heating Block Terminal" program and the USB UART windows drivers from the **AnalytiChem** website.

Unzip the USB UART driver folder and install the drivers by double-clicking the CP210xVCPinstaller_x64 software icon. The Heating Block Terminal program can be started by double-clicking on the HBterminal software icon. The serial port is automatically selected and opened if available.

To update the controller or display firmware, simply select the latest version of the firmware downloaded from the **AnalytiChem** download site and press the Update button.

To upload Method files, select the file on the computer and press the Upload button.

Log files can also be downloaded using this tool. Select individual files or all log files and press Download Selected Files.
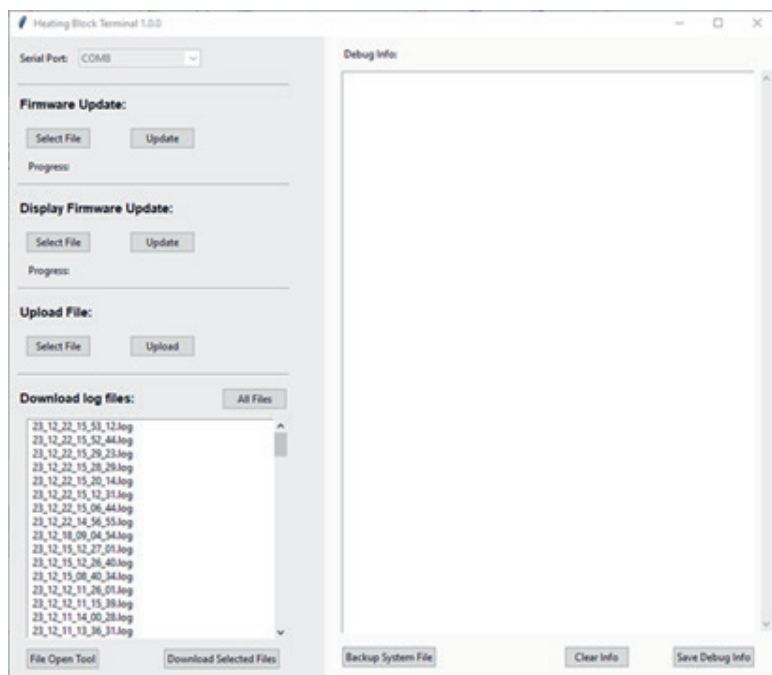
9.13 Temperature Calibration

To recalibrate the internal and external temperature sensor, first 3 methods must be created with 3 hold temperatures. Choose 3 temperatures, one at low temperature (40°C) one in the middle of the working range and one at the maximum or slightly above the maximum working temperature. If the maximum block temperature is used, use 240°C as the highest temperature calibration point. The hold time needed to get a stable temperature reading is dependent on the airflow in the fume hood and the selected temperature. Higher temperatures will take longer to fully stablize. Place a calibration jig with a calibrated reference temperature sensor into a well near the center of the digestion block.
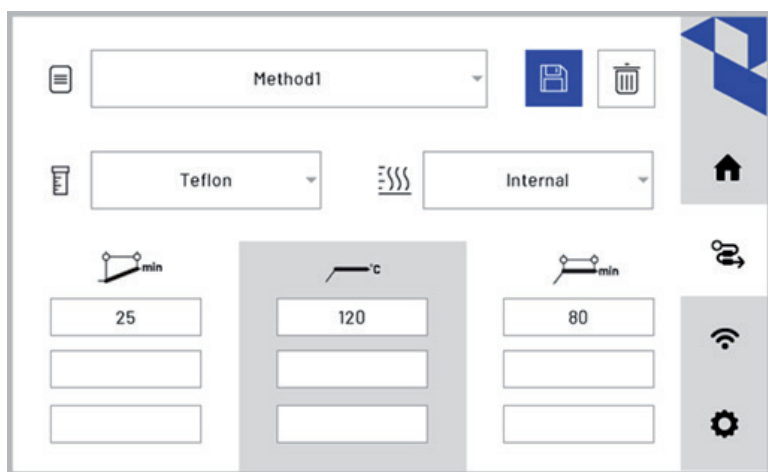
On the display, tap the List icon ▤ 3 times in a row, the raw temperature values of both the internal and external temperature will be displayed as shown below. Record the raw data from both the internal and external sensor and from the reference temperature at each of the 3 set temperatures. Ensure that the readings for all 3 sensors, internal, external and reference, are stable. The suggested 3 methods are: 0 min ramp time 40°C 60 min hold time, 0 min ramp time 120°C 60 min hold time and 0 min ramp time 200°C and 60 min hold time.
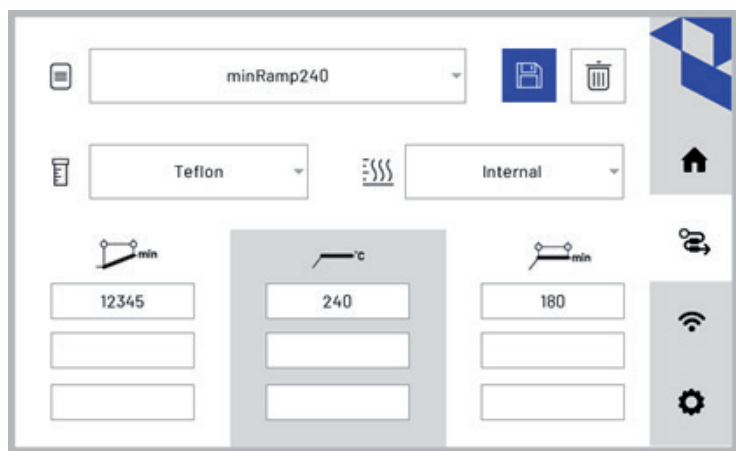
With the recorded values, the calibration of the temperature sensors can be updated as described in sections "Settings\Internal Temperature Sensor Calibration" and "Settings\External Temperature Sensor Calibration" of this manual.
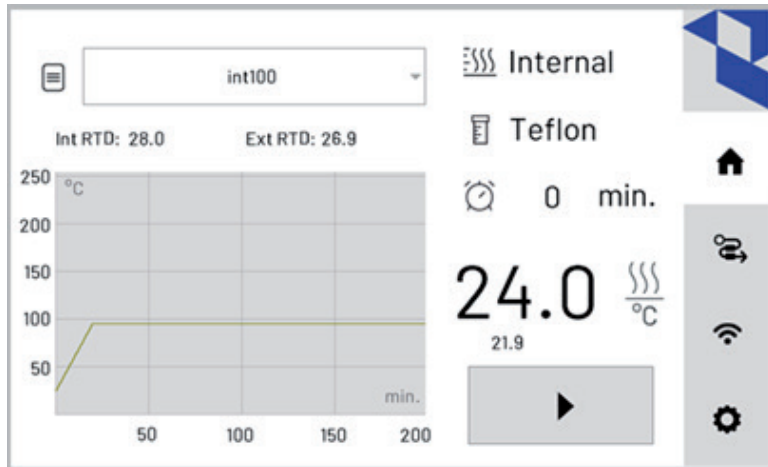
9.14 Minimum Ramp time calibration

When the user creates a new method there are three (3) user defined parameters, the ramp time the hold temperature and the hold time. The ramp time is the time used to get to the hold temperature. If the entered ramp time is less then the minimum ramp time the FW will automatically use the minimum ramp time. Due to power limitation, the temperature cannot rise faster than the minimum ramp time. Please note that the ramp time is only used with the internal temperature sensor since the external sensor ramp time is depending on many other factors such as vessel type and sample volume.

When the equipment is shipped, the minimum ramp time is set at the factory. If you find that the minimum ramp time is inaccurate, a calibration is required. Alternatively, a larger minimum ramp time must be used when creating a method.

To calibrate the ramp time, create a method where the ramp time is "12345", to indicate to the firmware it is a minimum ramp time calibration, a hold temperature of 240°C and a 180 min hold time. Select "Teflon" as the vessel material, and "Internal" for the sensor type.

Start the method at room temperature, if the unit is not at room temperature the calibration will not be accurate. Digestion will stop when the program finds the minimum ramp time.

9.15 Self-learning for external temperature sensor control

Temperature control of the heating block using the internal temperature sensor can lead to too low digestion temperatures. The difference between the heating block temperature and the sample temperature is due to heat transfer insufficiencies between the graphite and the vessel, sample volume, evaporative cooling of the sample, use of watch glass and temperature difference between boiling point of the sample and the set temperature.

The temperature of the sample can be measured directly with an external probe however precise external temperature sensor control is quite challenging due of the large delay between applied power and temperature change in the sample vessel. To still have fast and precise control with the external temperature sensor, the firmware has a self-learning algorithm. This self-learning algorithm is method-based, that is, as long as the same method, the same sample volume and the similar starting temperature are used, the optimal ramp speed and temperature control will be reached after running the same method 2 or 3 times. The optimized parameters for a method are saved with the method file, deleting or updating of the method will lead to loss of these parameters.

9.16 Self-learning for temperature ramping at high temperatures

For internal sensor control, due to power limitation, you may notice that the temperature curve cannot follow the ramp curve when the target temperature is above 150°C. We introduced a self-learning algorithm to overcome the mismatched temperature curve. After several digestions under the same conditions, the actual ramp time will be close to the set ramp time (or minimum ramp time).

10   Safety Messages

10.1 Temperature Outside the Normal Range

When operating, the controller will monitor the internal temperature sensor, and the external temperature sensor, if used, by the digestion block. If any of these values are outside of the normal range, the heating will be switched off and a warning message with relevant information will be displayed.

The following messages can be displayed:

Message	Possible Solution
External temperature sensor temperature is not changing	Check if the external sensor is inside the liquid of the sensor vessel
External sensor temperature is dropping	Check the liquid level of the temperature sensor vessel
External sensor temperature is not increasing	Verify that set temperature is lower than the boiling temperature of the liquid
No external temperature sensor connected	Check the connection of the external temperature sensor with the digestion block
Defective internal temperature sensor	Contact your service provider
Defective Heating element	Contact your service provider
Target temperature cannot be reached	Check for excessive air flow around the digestion block. Use the racks to stage the vessels in the digestion block. This will reduce the heat loss at the top of the digestion block. Check location of the voltage selection switch, selecting the wrong voltage can create this error

11 Maintenance

Immediately clean up any spill in the digestion block, the inserts can be taken out of the digestion block to accommodate cleaning.

> ⚠️ **Caution**
>
> *Cool down the digestion block and inserts before cleaning.*

Do not soak the inserts in water. To clean, wash with a mild detergent and rinse.

Only clean the touch screen with a soft damp cloth.

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