Automatic Roll Heat Sealer a4S

Operation Manual

Version: 2.8

CE

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4titude® From Research to Molecular Diagnostics

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Declaration of Conformity

Product Name: a4S Automatic Roll Heat Sealer

Model Name: a4S

This product complies with the following European standards:

- **EMC: Low voltage Directive**
  EN 61326/1997+A1/1998+A2/2001+A3/2003
  EN 61010-2-010
- **Emission**
  EN 55022/2006 CC15PR 22/2005 Class B
  EN 61000-3-2/2000+A2/2005
  EN 61000-3-6-3/1995+A1/2001+A2/2005
- **Immunity**
  IEC 61000-4-2/2001 IEC 6100-4-3/2006
  IEC 61000-4-4/2006 IEC 61000-4-5/2006

Name: James Bulbeck
Position: Director of Quality Assurance
Issue Date: September, 30, 2014

Safety Information

This instruction manual contains important operating and maintenance instructions which must be read, understood, and followed by the product user. Failure to use this product according to this instruction manual may degrade or defeat the protection normally provided by this product. Read this instruction manual prior to product use and keep this instruction manual for future reference.

Danger Symbols

Caution – Risk of danger
Caution, there is material in the instruction manual which must be read, understood, and followed in order to preserve product safety features.

Caution – Hot Surface
Caution, the platen and other internal components may be too hot to touch

Warnings

Personal Injury

- Do not use this product in a manner other than as stated in the Operating Conditions section of this manual as the protection provided by the equipment may be impaired.
- This product is designed for use in laboratory environments by persons knowledgeable in safe laboratory practices.
- Always wear safety glasses and other appropriate protective equipment when operating this product.

Electric Shock

- This product must be connected to a grounded power outlet for safe functioning.
- Use only the power cord supplied with the product.
- The power cord is the device available for full disconnect from mains input.
- Position the product for use so that the power cord can be easily disconnected without having to move the product.
- Disconnect the power cord before moving or cleaning the unit.

Product Damage

- Keep the product dry and clean.
- Do not immerse the product in liquid for cleaning.
- This unit is not explosion or spark proof.
- Do not operate this product near volatile or flammable materials.

General Operation Safety

- When using infectious, radioactive, toxic and other solutions which may pose health risks, please observe the appropriate safety precautions.
- Do not use this machine in a potentially explosive environment or with potentially explosive chemicals.
- Install the machine in a location free of excessive dust.
- Avoid placing the machine in direct sunlight.
- Choose a flat, stable surface capable of withstanding the weight of the machine.
- Install the machine in the room temperature 10 – 30˚C, relative humidity 0 – 85%.
- Do not block the air vents.
- Make sure the power source conforms to the required power supply specifications.
- To avoid electric shock, make sure the machine is plugged into a grounded electric outlet.
- Do not allow water or any foreign objects to enter the various openings of the machine.
- Switch off the power switch before cleaning or performing any service on the machine, such as replacing the fuses.
- To guarantee sufficient ventilation, ensure that the sealer has at least 30cm of free space on all sides, including the rear.
- Repair should be carried out by authorized service personnel only.
- Use original spare parts and accessories only.

Table of Contents

1 a4S Introduction

The a4S is a device that applies a heat seal on the top of a microplate to seal the individual wells of the microplate. Sealing the wells protects the contents from evaporation and cross- contamination during experimentation, transportation and storage.

It is a compact, bench-top heat sealer which is suitable for both research and clinical laboratories and does not require an external compressed air supply. It has a wide compatibility with different sealing films/foils and microplates.

When using the a4S for the first time, please read this entire operating manual carefully. To guarantee problem free and safe operation, it is essential to observe the following information.

1.1 Unpacking (Packing / Contents Listing)

The device is delivered in an external carton and an internal carton with protective PE foam cushions. Remove the a4S from each carton. All packaging should be retained until it has been established that the a4S is working properly.

Open the Automatic Heat Sealer package and confirm that all items are included:

- a4S Device
- Power Cord
- Operation Manual incl. Warranty Statement


Roll Holder


Seal Loading Tool


Plate Support Adapter A

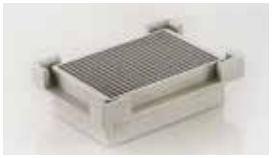


Plate Support Adapter B

Vacuum Cups


Spare fuse fitted in fuse holder
(either 240V or 110V, depending on territory)


Plastic Tweezers

If there are any items missing, damaged, or not according to your order, please contact your distributor or sales representative immediately.

Please refer to section 8, page 40 to see the ordering information of the a4S accessories.

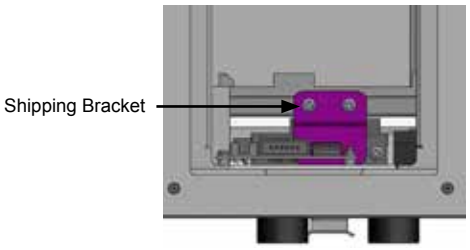
Note: Please read the important product information on page 9!

Important

Shipping Bracket

The a4S is shipped with a transportation bracket to prevent the plate carrier moving during shipping. It is essential that this bracket is removed before the unit is powered up for the first time.

To remove the shipping bracket, first open the inspection door on the left side of the unit. Locate the coloured bracket on the side of the carrier as shown in the following image:

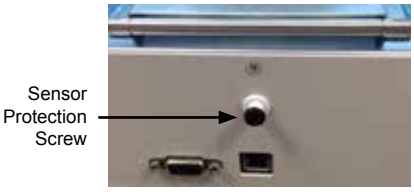


Using a Phillips screw driver, carefully remove the screws holding the bracket in place.

Sensor Protection Screw

To protect the rear foil sensor during transportation, the a4S is shipped with a protective screw highlighted with a white washer, inserted into the rear of the instrument.

Before the unit is switched on, please make sure that the screw is removed from the instrument and retained with the other transportation packaging.



Note: Please make sure you retain the shipping bracket and screws as well as the sensor protection screw in a safe place.
It is essential that the shipping bracket and sensor protection screw are replaced, should the unit need to be shipped in the future.
For details please refer to section 10, Appendix D: Shipping Instruction.

1.2 Hardware Overview

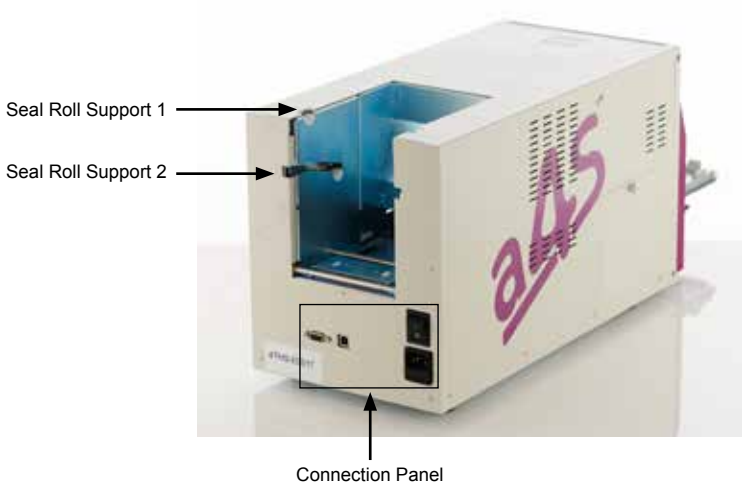
1.2.1 Front Features

The following picture shows the front of the a4S. The table below describes the features shown.

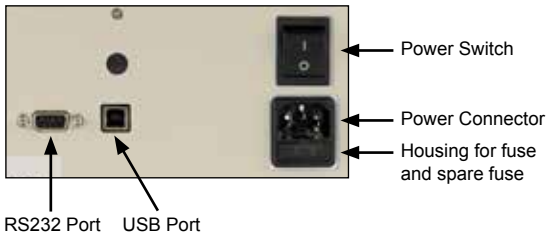
Feature	Description
Touch Screen	The interface that allows you to specify the sealing parameters, start and stop the seal cycle.
Plate Carrier	The metal platform on which microplates and microplate adapters are loaded.
Door (opened)	The movable structure that opens when the plate carrier is extended and closes when the plate carrier retracts.
Inspection Door	The removable panel that provides quick accessibility to the sealing chamber.
Ventilation Area	The structure for heat ventilation. ***Note: Please do not block!***
Roll Support	The holder to support the seal roll.

1.2.2 Rear Features

The following picture shows the rear side of the a4S. The table below describes the features shown.



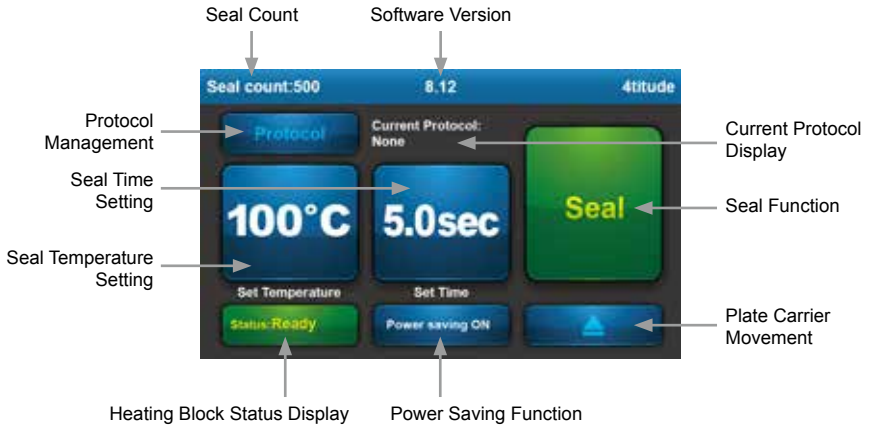
Feature	Description
Connection Panel	This area includes power switch, power connector, USB port and RS232 port as well as the housing for the fuse and spare fuse. Please refer to the picture below.
Seal Roll Support 1	The holder to support the seal roll with larger diameter (<265mm)
Seal Roll Support 2	The holder to support the seal roll with small diameter (<140mm)



1.3 Touch Screen Overview

The following section provides an introductory overview of the icons on the touch screen of the a4S.

Eight functional icons, as well as the status display areas, are present on the touch screen of the a4S. The table below describes the features shown in the following diagram.



Feature	Description
Seal Time Setting	Adjusts the sealing time, between 0.1and 10 seconds, in 0.1 second increments.
Seal Temperature Setting	Adjusting range 100~200 ˚C
Seal Function	Initiates sealing. When the temperature of the heating block reaches the set temperature, the color of this icon is green and the sealing process can be initiated. When the color of this icon is grey, it means the unit is in the heating or cooling stage and the sealing process cannot be started.
Power Saving Function	The Power Saving Function can help you plan your experiment by reducing the power consumption.
Protocol Management	Touch this icon to enter the protocol management function.
Plate Carrier Movement	Touch this icon to retrieve the plate carrier for closing the unit or replacing a seal roll.
Current Protocol Display	Displays the name of the current sealing protocol.
Heating Block Status Display	Indicates the status of the heating block. Red colour – the heating block is in the heating stage Green colour – the heating block has reached the set temperature Blue colour – the heating block is in cooling status
Seal Count	The total number of seals that the instrument has accomplished.
Software Version	The software version currently loaded onto the instrument (disappears after 3 seconds).

2 a4S Operation

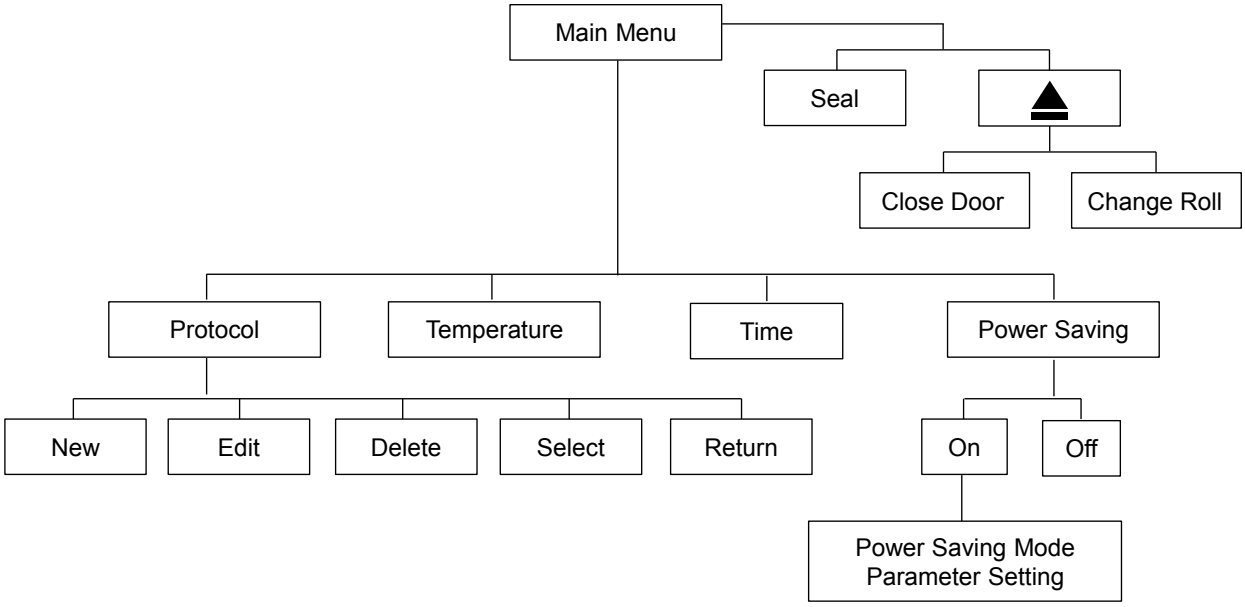
2.1 Basic Steps for Operation

Note: Remember to first remove the shipping bracket and the sensor protection screw as described on page 8 before powering on the unit.

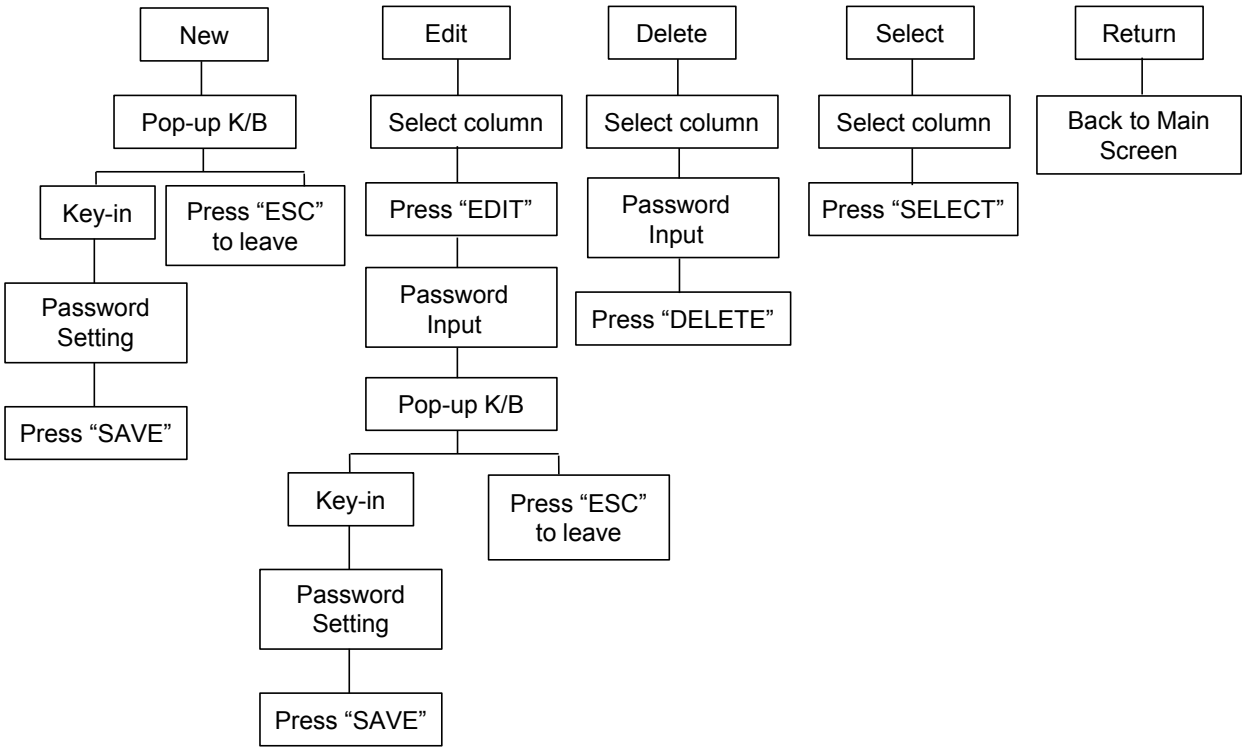
The basic steps for the a4S operation as a standalone device are presented as below:

1) Connect the power cord.
2) Turn on the device.
3) Place the seal roll, along with its holder, on the device (Please refer to page 15).
4) Perform the seal roll loading procedure (Please refer to page 15).
5) Optimise sealing conditions.
   A) Adjust temperature setting (Please refer to page 22).
   B) Adjust time setting (Please refer to page 23).
6) Seal.

2.2 Workflow of Main Screen



2.3 Workflow of Protocol Management

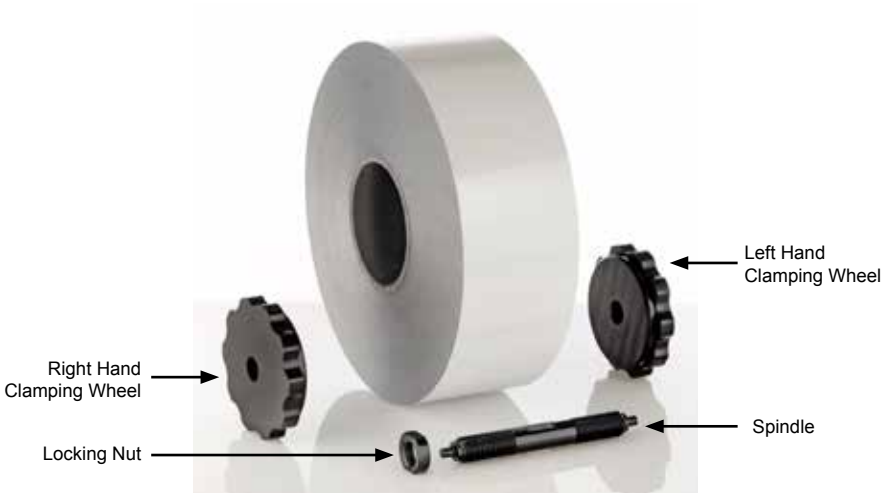


2.4 Seal Roll Loading Procedure

This section explains how to load a seal roll on the a4S. Before you start please ensure you have the roll holder component and the seal loading tool, as shown below.

Install Seal Roll on Roll Holder

1) Four parts are required for the roll holder, two clamping wheels, one spindle and one locking nut
2) Rotate the Locking Nut, followed by the left hand Clamping Wheel onto the spindle. **Do not tighten the Locking Nut against the Clamping Wheel at this point.** Place the spindle through the centre of the roll (left hand side) and rotate the right hand Clamping Wheel onto the Spindle, pinching it up against the side of the roll. Do not tighten the Wheels at this point



3) Adjust the Spindle by rotating it backwards and forwards until the sealing material is central to ends of the Spindle, or an equal amount of threads can be seen at each end of the Spindle. Once in the correct position, clasp the end of the Spindle protruding from the left hand Clamping Wheel and remove the right hand Clamping Wheel.
4) Tighten the Locking Nut up against the left hand Clamping Wheel, fixing it place. Re-insert the Spindle through the centre of the roll and tighten the right hand Clamping Wheel; locking the roll in position.

Loading Procedure

1) Place the roll holder on the device locating the ends of the Spindle in either Seal Roll Support 1 or 2, depending on the size of the roll. The picture below shows the correct orientation of the seal roll (The orientation of the seal roll should be as indicated by the purple arrow). Incorrect orientation can cause damage to the heating block.

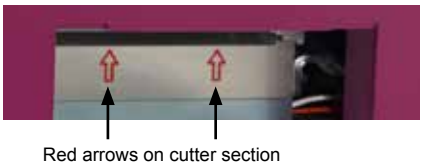
2) Turn on the a4S.

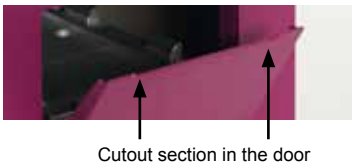
3) On the touch screen a warning message, **"No seal detected. Press OK to perform the Seal Loading Process"**, will appear as shown below. Touch OK to perform the seal loading process.

4) On the touch screen a warning message, **"Remove any micro-plate and plate adapter from the plate shuttle and press OK"**, will appear as shown below. Ensure the plate carrier is free from any micro-plate and touch OK to start the seal loading process.

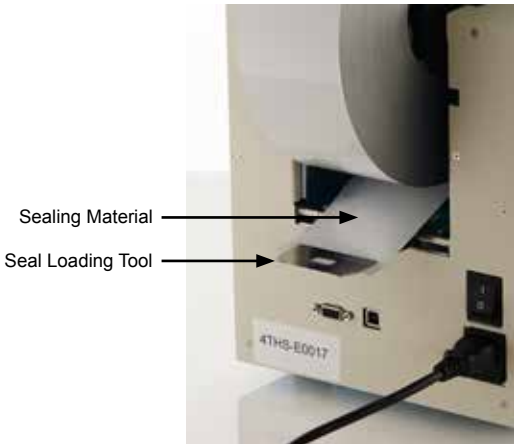
5) The plate carrier will move to seal loading position. On the touch screen a warning message, **"Please conduct the Seal Loading Process and on completion press OK"**, will appear.

6) Slide the Seal Loading Tool into the unit through the foil gripper and cutting section (using the red arrows on the cutter section for guidance) and until it appears at the rear of the device. Maintaining the Seal Loading Tool parallel with the Plate Carrier is essential, using the cutout section in the door for guidance.





7) Hold the end tab of the sealing material and slot it into the gripper at the end of the Seal Loading Tool.



8) Carefully withdraw the Seal Loading Tool and it will bring the seal out through the front of the device (Please ensure the seal comes out with the tool). Once the Seal Loading Tool is clear of the instrument, separate the seal from the loading tool.

9) On the touch screen a warning message, **"Please confirm the seal loading tool has been removed from the unit!"**, will appear. **Lightly** holding the end of the seal in one hand and making sure it is central to the cutout section of the door, touch OK on the touch screen.

Note: Please do not pull the seal material at this step!

The plate carrier will move to the outside position.

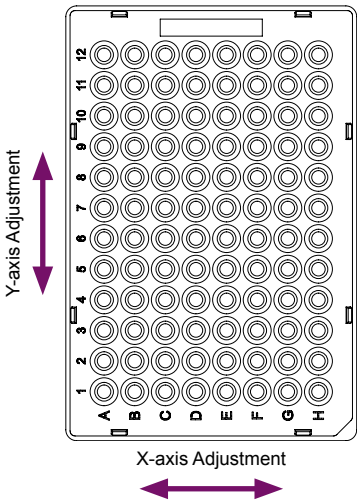
10) As the operation is completed, the excess sealing material will be cut off. On the touch screen a message, **"Please remove the waste seal and press OK"**, will appear. At this point, remove the excess sealing material. Touch OK on the touch screen to complete the seal loading process.

11) On the touch screen a message, **"Roll loading completed."**, will appear for 3 seconds.

12) You may now begin with the optimization of the sealing procedure. Please refer to section 2.5, page 20.

2.5 Fine Adjustment of the Seal Position

The a4S allows sealing of a large variety of plates and sealing materials. Seal rolls with a width between 75–85mm can be loaded in either of the two roll positions, depending on roll length and available space.



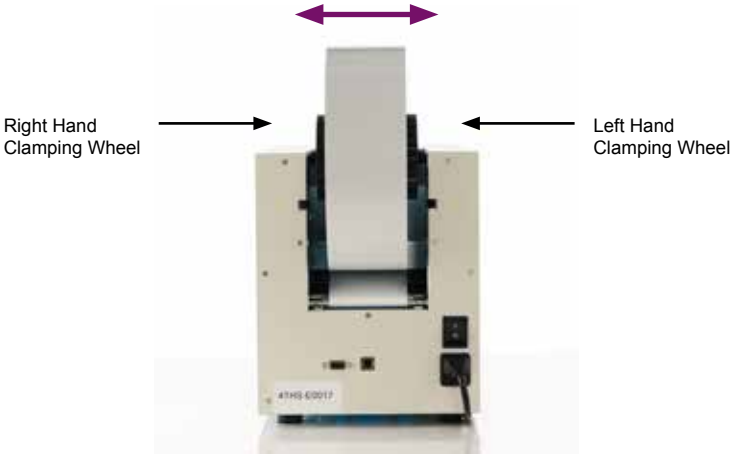
Best sealing results are achieved if the seal is placed right in the center of the plate. To achieve this, it may be necessary to make fine adjustments to the X- or Y-axis of the seal position to improve sealing efficiency.

X-axis Fine Adjustment

The locking nut of the Roll Holder should not be tightened before the final seal position is correct. X-axis adjustment of the seal position can be achieved by slighly moving the seal roll on the roll holder to the left or to the right, respectively.

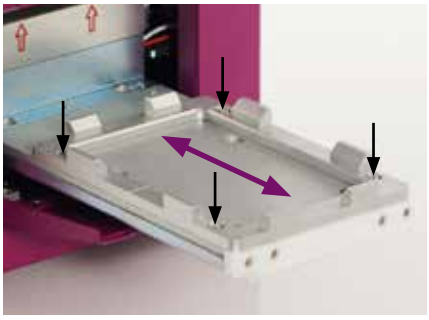
For this, rotate the left and right hand Clamping Wheels of the roll holder in opposite direction until the seal is placed at the desired position on the plate. Please check the position of the seal by running 3 or 4 sample plates. If necessary, redo the procedure.

Once the seal is in the right place, carefully take off the seal roll, remove the left hand Clamping Wheel (the one not close to the locking nut), and then tighten the locking nut and reassemble.



Y-axis Fine Adjustment

For Y-axis adjustment of the seal position, the frame of the plate carrier can be moved slighly. Using a Phillips screw driver, carefully loosen the four screws holding the frame in place as shown below. Move the frame to the desired position and fasten the screws again. The position of the seal can be checked by sealing a sample plate. If necessary, redo the procedure.



2.6 Seal Roll Unloading Procedure

In order to remove the seal roll from the a4S please use the following procedure:

1) Touch “Plate Carrier Movement” ⏏ on the touch screen.

2) A warning message, **"To proceed, remove the plate adapter and select one of the following options:** Close door , Chg roll , Esc **"**, will appear as shown below. Touch Chg roll to start the seal unloading procedure. The device will release the seal and a message **"It is now safe to remove the roll"** will appear.

3) Rotate the seal roll to pull out the seal material from the device. Please note you will experience some resistance to this, as though the material is still gripped, but this is quite normal.

3) Once the material is clear of the rear of the sealer, the message **"It is now safe to remove the roll"** will disappear to be replaced by the message **"No seal detected. Press OK to perform the Seal Loading Process"**.

2.7 Closing the Door

Under certain circumstances, e.g. if the instrument will not be used for a certain time, it may be advisable to close the door of the unit.

1) Touch “Plate Carrier Movement” [⏏] on the touch screen.
2) A warning message, **"To proceed, remove the plate adapter and select one of the following options:** [Close door] , [Chg roll] , [Esc] **"**, will appear as shown below. Remove any plate adapter from the unit and touch [Close door] .

   WARNING! At this point, the plate carrier will close and the device will cut and drop a seal on to the plate carrier. Please remember to remove this cut seal from the carrier when the draw is re-opened (you will be prompted to do this on the screen).
   If a cut seal cannot be found on the plate carrier then it is likely to have fallen off the side. This MUST be removed to protect the shuttle from being blocked and causing subsequent errors.

3) To reopen, touch “Plate Carrier Movement” [⏏] on the touch screen.

2.8 Setting the Sealing Parameters

Adjusting the sealing parameters is essential to create a high quality plate seal.

Time Setting

The time setting is a measure of the amount of dwell time, the time in which the heat seal block will remain in contact with the sealing material on the microplate.

The time setting can be adjusted as follows:

1) Select the icon on the touch screen showing the current sealing time. The time adjustment window will pop-up as shown below.

2) Touch [▲] / [▼] to adjust the time setting to your desired sealing time. Pressing the touch screen repeatedly will adjust the time in 0.5 second intervals. Pressing and holding your finger on the screen will initiate scrolling through the time settings.
3) Touch [Yes] to confirm the displayed setting, or [Esc] to revert to the original setting.
4) The newly set time will now appear on the main screen.

Temperature Setting

The temperature setting adjusts the temperature that the internal heating block is held at prior to sealing a plate. Temperature settings can be adjusted as follows:

1) Select the icon on the touch screen showing the current sealing temperature. The temperature adjustment window will pop-up as shown below.

2) Touch [▲] / [▼] to adjust the temperature setting to your desired sealing temperature. Pressing the touch screen repeatedly will adjust the temperature in 1 degree intervals. Pressing and holding your finger on the touch screen will initiate scrolling through the temperature settings.

3) Touch [Yes] to confirm the displayed setting, or [Esc] to revert to the original setting.

4) The newly set temperature will now appear on the main screen.

2.9 Loading a Plate

1) Place the plate to be sealed on the plate carrier, using an appropriate adapter if necessary (see section 3.2).

2) Wait for the heating block to reach the set temperature. The heating status can be observed in the bottom left-hand corner of the screen.

3) The [Seal] icon will remain grey while the unit is heating or cooling. Once the set temperature is reached, the icon will turn green. Sealing can then commence by touching [Seal].

2.10 Power Saving Function

The Power Saving Function can help you plan your experiment, reduce the power consumption and increase the longevity of the heating block. The Power Saving Function is turned on as the default setting (1 hour, 100˚C), when you receive the instrument. You can touch [Power Saving] to turn off this function.

How to set Power Saving Parameters

The two parameters of the Power Saving Function can be adjusted to suit your needs. When you touch [Power Saving] for over 5 seconds, the pop-up screen below will appear.

The first parameter to set is the idle time before powersaving is activated. You can then touch [▲] / [▼] for adjusting either the time or temperature settings. The minimum time duration which can be set is 0.5 hour, the maximum duration is 12 hours. Adjustment can be made in 0.5 hour intervals.

The other power saving parameter is the temperature at which the heating block is held once the power saving duration starts. There are three options: heater off, 50˚C or 100˚C. You can step through the three settings using [▲] / [▼] and then save your setting by touching [Yes].

2.11 Protocol and Password Settings

It is possible to save the heat sealing settings that are created for different microplates or heat seals by using the Protocol Management Function. It is possible to protect these protocol settings with a password. In addition to this it is also possible to protect a selected protocol from change without the use of a password using a Protocol Security Level.

To access the protocol window, touch [Protocol] in the left hand corner of the touch screen. A protocol list with five functional icons ([New] , [Edit] , [Delete] , [Select] , [Return]) will appear on the screen.

Creating a Protocol

1) Touch [Protocol] in the left hand corner of the main screen.
2) Touch [New] to create a new protocol.
3) Touch the first column and key-in the desired name of the protocol.
4) Touch the second column and key-in the desired sealing temperature.
5) Touch the third column and key-in the desired sealing time.
6) Touch the fourth column to add any additional information to your protocol.
7) Touch [Save] to store your protocol.
8) A protocol security level selection image will then pop-up. You can decide the security level for your protocol, there are three levels. If your protocol does not need a password for protection, do not click [🔒] and touch [Enter] to leave this window (Please refer to the Setting Protocol Security Level section, page 26).
9) Touch [Select] to go back to the main screen.

Editing a Stored Protocol

1) Touch [Protocol] in the left hand corner of screen.
2) Touch the column you would like to edit.
3) Key-in the desired temperature, time or note.
4) Touch [Save] to store your new settings.
5) Touch [Return] to go back to the main screen.

Selecting a Protocol

1) Touch the desired protocol in the list (you can use the scroll bar if there are more protocols than fit on the screen).
2) Touch [Select].
3) Touch [Return] to return to the main screen.
4) The protocol setting will appear on the main screen.

Deleting a Stored Protocol

1) Touch the protocol you want to delete in the list.
2) Touch [Delete].
3) A warning message will appear for confirmation.
4) Touch [Yes] and the protocol will be deleted.
5) Touch [Esc] if you don't want to delete the protocol.

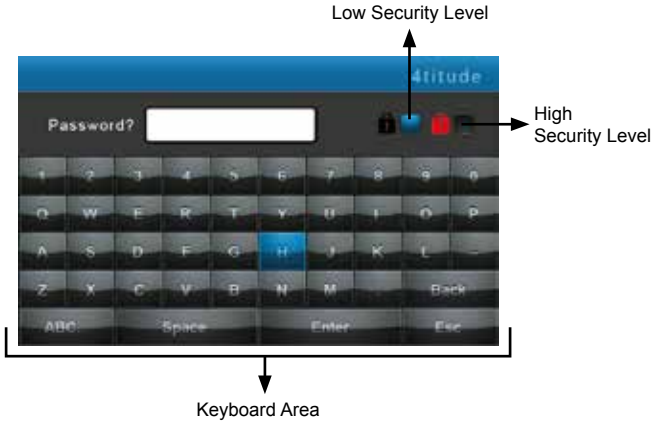
Note: You may need to enter a password depending on the level of security that was set with any particular protocol.

Keying-in the password is required for editing, deleting or selecting a protected protocol.

Setting Protocol Security Level

Three security levels are available for the protocol protection on the a4S: no password protection [open black padlock], low level security [closed black padlock] and high level security [closed red padlock].

After a protocol is created and Save is touched a password setting image will be shown. If a password setting is not required, touch Save again. If protocol protection is required, select the security level by touching the box next to the padlock. Please refer to the picture below.



A black lock icon represents a low security protection. When a protocol is protected under low security level, it is still possible to select different protocols from the main protocol menu but editing of any protocols saved with the black lock security will require the appropriate password to be entered.

A red lock icon represents a higher level of security protection. It has been designed to avoid unauthorized adjustment of the sealer during a production run. When a protocol is protected under high security level, you are not able to change any sealing parameter or change between protocols without first entering the required password. Also, the password input is required for leaving the main screen.

Note: The maximum number of letters for a password is four.

Security level	No password protection	Low level security	High level security
Select protocol	OK	OK	Password required
Change between protocols	OK	OK	Password required
Edit protocol	OK	Password required	Password required

Protocol Management

The a4S has a built-in page, named “Administrator”, which can be used to manage the protocol. It is on the top of the protocol list. The default password is 8888. Please change this when you receive the instrument.

On entering the Administrator page, you will be able to delete the protected protocol or change the password of the exiting protocol. It allows a lab manager to reorganize the protocol list in the device.

Protocol List

The a4S has been set up with a number of protocols already stored in the Protocol List. These are typical settings for our most popular sealing materials valid for two-component 96well and 384well PCR plates. These protocols are not password protected and are for guidance only.

Name	Temperature (°C)	Time (sec)	Information	Protection
4ti-0520	175	3	Peel Seal	
4ti-0530	175	3	Pierce Seal	
4ti-0535	175	3	Foil Seal	
4ti-0540	175	3	Clear Seal	
4ti-0573	170	3	Clear Weld Seal Mark II	
4ti-0580	170	3	Clear Seal 3730	
4ti-0585	175	3	DMSO Resistant Peel Seal	
4ti-0590	175	3	Thermal Bond	
4ti-0598	175	3	Gas Permeable Heat Seal Mk2	

Note: 4titude® suggests that these settings should form the basis of your sealing optimization experiment, this will enable you to create the optimal seal for both the material and also the plate type that you are using.

3 Optimizing Seal Quality

3.1 Plate Requirements

The a4S accommodates plates made from a variety of materials and plate designs. For a complete list of the acceptable sealing materials, please see section 3.4, page 29.

The a4S is designed to accommodate plates which meet the standard established by the Society of Biomolecular Sciences (SBS). These include but are not limited to deep-well plates, PCR and standard microplate in the 96, 384 and 1536 well formats.

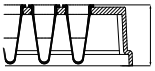
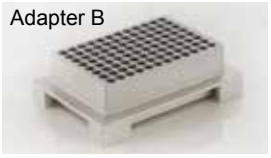
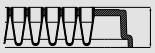
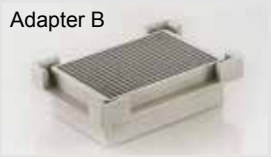
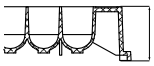
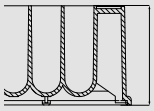
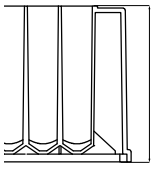
In accessing the suitability of a plate for heat sealing, it is important to look at its design and the quality of manufacturing. In general terms, it is important for the plate design to have raised rims around each well, giving a defined sealing ring around each well. When assessing the seal quality, it is important to study a recently removed seal looking for a regular pattern of sealing rings from one end of the plate to the other.

Incomplete sealing, indicates that the plate is either not perfectly flat (or not flattened during the sealing process) or that the plate is not supported adequately in the plate holder.

3.2 Plate Adapters

The a4S is designed to seal microplates from 4mm to 53mm in height. Plates less than 34mm in height must first be placed in an appropriate adapter to bring the sealing surface into the correct height range for the sealer. In addition to this, PCR plates require an adapter to support the plate precisely enough to produce an even seal. With a 96 and 384well PCR plate it is necessary to support each well completely, whereas with standard microplates, it is only necessary to support the underside of the well but not the skirt.

Please see the following table to select the correct adapter for the plate you wish to seal.

Plate Type	Plate Height	Adapter / Side of adapter to use	
96well PCR plates		 Adapter B	Side with 96 holes
384well PCR plates		 Adapter B	Side with 384 holes
1536well plates, standard height plates	 4mm – 20mm	Adapter B (see above)	Side with 384 holes
Mid-height plates	 14mm – 33mm	 Adapter A	
Deep well plates	 34mm – 53mm	No adapter needed	

Note: Custom sealing blocks are available on request. For details please contact 4titude®.

3.3 Heat Seal Materials

The a4S is compatible with the widest range of heat sealing materials available on the market. Details of available materials can be found in the following table, the 4titude® catalog, or by visiting the 4titude® website *www.4ti.co.uk.*

Note: 4titude® also offers sample rolls for evaluation purposes. Please refer to the following table.

Code	Description	Dimensions	No. of seals	Qty.
4ti-0540	Clear Heat Seal, roll	500m x 78mm	4,200	1
4ti-0540/80	Clear Heat Seal, roll	80m x 78mm	640	1
4ti-0540S	Clear Heat Seal, *sample roll*	5m x 78mm	40	1
4ti-0573	Clear Weld Heat Seal Mark 2, roll	610m x 78mm	5,000	1
4ti-0573/122	Clear Weld Heat Seal Mark 2, roll	122m x 78mm	1,000	1
4ti-0573S	Clear Weld Heat Seal Mark 2, *sample roll*	5m x 78mm	40	1
4ti-0580	Clear Heat Seal 3730, roll	610m x 78mm	5,000	1
4ti-0580/122	Clear Heat Seal 3730, roll	122m x 78mm	1,000	1
4ti-0580S	Clear Heat Seal 3730, *sample roll*	5m x 78mm	40	1
4ti-0549	Clear Heat Seal Plus, roll	250m x 78mm	2,100	1
4ti-0549/S	Clear Heat Seal Plus, *sample roll*	5m x 78mm	40	1
4ti-0520	Peel Heat Seal, roll	610m x 78mm	5,000	1
4ti-0520/122	Peel Heat Seal, roll	122m x 78mm	1,000	1
4ti-0520S	Peel Heat Seal, *sample roll*	5m x 78mm	40	1
4ti-0523	Universal Peel Heat Seal, roll	610m x 78mm	5,000	1
4ti-0523S	Universal Peel Heat Seal, *sample roll*	5m x 78mm	40	1
4ti-0585	DMSO Resistant Peel Heat Seal, roll	500m x 78mm	4,200	1
4ti-0585/100	DMSO Resistant Peel Heat Seal, roll	100m x 78mm	800	1
4ti-0585S	DMSO Resistant Peel Heat Seal, *sample roll*	5m x 78mm	40	1
4ti-0530	Pierce Heat Seal, roll	610m x 78mm	5,000	1
4ti-0530/122	Pierce Heat Seal, roll	122m x 78mm	1,000	1
4ti-0530S	Pierce Heat Seal, *sample roll*	5m x 78mm	40	1
4ti-0538	Pierce Heat Seal Strong, roll	610m x 78mm	5,000	1
4ti-0538S	Pierce Heat Seal Strong, *sample roll*	5m x 78mm	40	1
4ti-0535	Foil Heat Seal, roll	610m x 78mm	5,000	1
4ti-0535/122	Foil Heat Seal, roll	122m x 78mm	1,000	1
4ti-0535S	Foil Heat Seal, *sample roll*	5m x 78mm	40	1
4ti-0545	Polystyrene Foil Heat Seal, roll	610m x 78mm	5,000	1
4ti-0545/122	Polystyrene Foil Heat Seal, roll	122m x 78mm	1,000	1
4ti-0545S	Polystyrene Foil Heat Seal, *sample roll*	5m x 78mm	40	1
4ti-0590	Thermal Bond Heat Seal, roll	500m x 78mm	4,200	1
4ti-0590/100	Thermal Bond Heat Seal, roll	100m x 78mm	800	1
4ti-0590S	Thermal Bond Heat Seal, *sample roll*	5m x 78mm	40	1
4ti-0598	Gas Permeable Heat Seal Mark 2, roll	610m x 78mm	5,000	1
4ti-0598/122	Gas Permeable Heat Seal Mark 2, roll	122m x 78mm	1,000	1
4ti-0598S	Gas Permeable Heat Seal Mark 2, *sample roll*	5m x 78mm	40	1
4ti-0540/SLIT	Gas Permeable Clear Heat Seal, roll	450m x 78mm	3,800	1

3.4 Optimize Sealing Parameters

Once you have established that your plate quality is sufficient, you are using the correct plate carrier and you have chosen your sealing material, it will be necessary to optimize the sealing parameters of time and temperature. This can be achieved using empty plates.

You will find a set of sealing protocols already stored on the instrument. These are for guidance only but should form a good starting point for adjusting the settings for your chosen sealing material and plate type.

In general terms it is sensible to keep one of the parameters constant and vary the other when optimising. For example, set the sealing time to 2 seconds and gradually increase the temperature , monitor the results until you are satisfied with the quality of the resulting seal. You can then further fine tune the quality by adjusting the time, maintaining your desired temperature, in 0.1 second increments.

The following sealing temperatures and times are for guidance only. Sealing efficiency varies depending on the plate type used.

Code	Description	Sealing temperature (°C) / Dwell time (sec)	
		96well PCR plates*	384well PCR plates*
4ti-0540	Clear Heat Seal	175 / 3	175 / 3
4ti-0573	Clear Weld Heat Seal Mark 2	170 / 3	170 / 3
4ti-0580	Clear Heat Seal 3730	170 / 3	170 / 3
4ti-0549	Clear Heat Seal Plus	175 / 3	175 / 3
4ti-0520	Peel Heat Seal	175 / 3	175 / 3
4ti-0523	Universal Peel Heat Seal	175 / 3	175 / 3
4ti-0585	DMSO Resistant Peel Heat Seal	175 / 3	175 / 3
4ti-0530	Pierce Heat Seal	175 / 3	175 / 3
4ti-0538	Pierce Heat Seal Strong	175 / 3	175 / 3
4ti-0535	Foil Heat Seal	175 / 3	175 / 3
4ti-0545	Polystyrene Foil Heat Seal	175 / 3	175 / 3
4ti-0590	Thermal Bond Heat Seal	175 / 3	175 / 3
4ti-0598	Gas Permeable Heat Seal Mark 2	175 / 3	175 / 3
4ti-0540/SLIT	Gas Permeable Clear Heat Seal	175 / 3	175 / 3

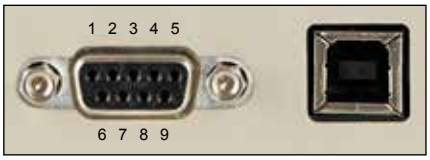
* These values are for two-component PCR plates. For one-piece polypropylene plates, increase dwell time by one second.

Note: These values are for guidance only. It is advisable to conduct trials depending on the plate type being sealed.

All sealing parameters were estimated using software version 1.02.

4 Remote Communication

The a4S device can be remotely controlled via its RS232 or USB port in the rear of the instrument (Please refer to the following figure).



The a4S remote communication is shown below (All the communication is via ASCII).

Note: Please contact 4titude® for details.

Serial Port Setup

Parameter	Setup
Baud rate	19200
Dta bits	8
Parity	None
Stip bits	1
Flow control	None

Basic Commands

Function	Operation	ASCII
Seal	Conduct seal action	*00GS=zz!
Temperature Setting	Adjust seal to be 100 degree	*00DH=0100zz!
Time Setting	Adjust seal time to be 5 sec	*00DT=005zz!

Status of Process

Status	Description
0	Idle
1	Single Work
2	Repeat Work
3	Error
4	Finish

5 Routine and Preventive Maintenance

5.1 Cleaning the Heating Block

During the sealing process the heating block inside the sealing chamber descends and presses the seal onto the plate surface. Although the heating block is coated with non-stick material, seal material, residue and dirt can accumulate on the heating block over time and this can affect the sealing quality. It is therefore necessary to regularly monitor the heating block, and if necessary clean it, to maintain optimal and reliable performance.

Material need for cleaning the heating block

- Soft and anti-scratch cloth
- Cleaning solution (70% ethanol)

Method for cleaning the heating block

1) Ensure the power to the unit is turned off and the heating block is at room temperature.
2) Open the inspection door on the side of the unit.
3) Dampen the anti-scratch cloth with cleaning solution.
4) Wipe the heating block via the inspection door.
5) Close the inspection door.

Note: It is important not to damage the coating on the heating block as this will affect the sealing performance.

5.2 Cleaning the Touch Screen

A lint-free cloth is required for touch screen cleaning. Please do not use fluid cleaners on the touch screen. Any fluid that gets between the screen and the screen frame can damage the device.

5.3 Replacing the Vacuum Cups

Ensure the heating block temperature is set to OFF.

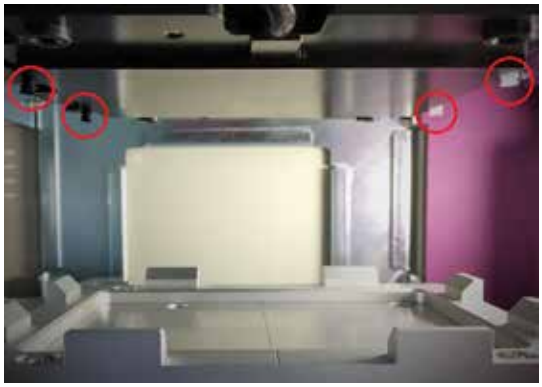
Please see section **2.8 Setting the Sealing Parameters** and refer to sub title **Temperature setting**.

Once the heating block has cooled, please switch the unit off.

Locating the Vacuum Cups

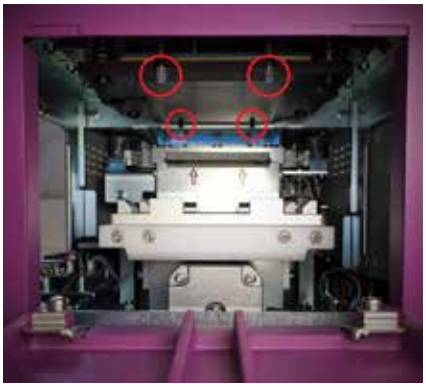
Start by removing the side inspection door.

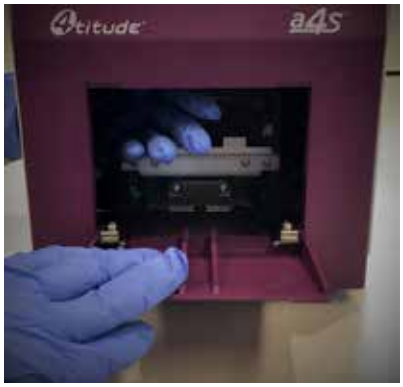
This will enable you to locate the vacuum cups by looking inside the unit. Looking inside the unit you will locate four vacuum cups. Two situated towards the rear (black) and two situated towards the front (clear). Due to the black and clear vacuum cups being different sizes it is essential that they are fixed in these positions. See photos below:



View from the side inspection door

To locate the vacuum cups from the front, pass your left hand through the side inspection door and push the front door open. With your right hand hold the door open carefully and remove your left hand from inside the unit. See photos below:



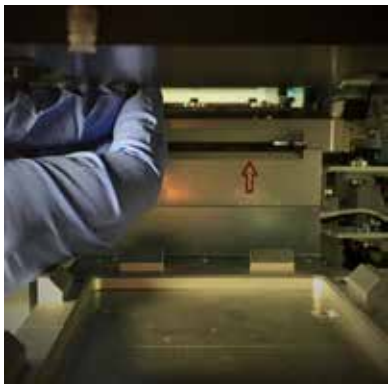


View from the front (front door open)

Removing the Rear Vacuum Cups

1) Start by removing the damaged/worn rear (black) vacuum cups.

   Carefully put your hand inside the side inspection door and simply pinch and pull them off the pins that hold them in place. See photos below:

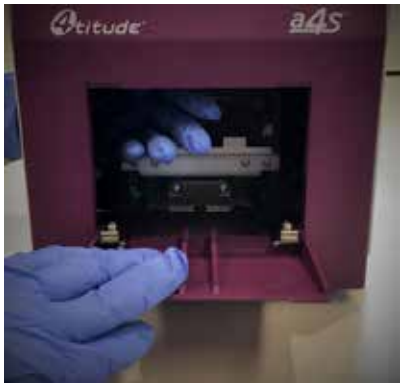



2) Once the damaged/worn vacuum cups have been removed. Replace them with the spare vacuum cups provided with the unit; these are found in your accessories box.

3) Replace the cups in the same way you removed them earlier, pushing the cups all the way onto the pins that hold them in place. You can further ensure the cups are fixed properly by applying gentle force to the cup, pushing up with the tip of your finger. See photo below:

Removing the Front Vacuum Cups

1) Repeat the same procedure you did to locate the front vacuum cups.



2) Hold the door open with your left hand and remove the vacuum cups with your right hand. Simply pinch and pull them off the pins that hold them in place. See photo below:

3) Replace the cups in the same way you removed them earlier, pushing the cups all the way onto the pins that hold them in place. You can further ensure the cups are fixed properly by applying gentle force to the cup, pushing up with the tip of your finger. See photo below:

4) Check that all vacuum cups are fixed properly and fully in place. A light will help in this instance.

5) Once you are happy that all vacuum cups are fitted correctly, fix the inspection door in place, turn the unit back on and set the temperature you require; again referring to Section 2.8.

6 Troubleshooting

6.1 Hardware Problem

Symptom	Possible Cause	Solution
The seal loading tool cannot pass through the rear clamp.	The loading tool is not inserted through the clamping mechanism in the correct way.	Pull the tool out. Re-insert the tool. The gap for the tool to pass through has red arrows indicating the insertion position.
	The plate carrier isn't located at the correct position for loading.	Reboot the unit by switching it off and on and the carrier will return to its home position.
Sealing material does not pull through the machine.	The sealing material is not properly inserted to the seal loading tool.	Please reinsert the sealing material in the clip of the loading tool.
The sealing material doesn't cut correctly.	The sealing material has not been properly loaded.	Re-load the roll.
	The cutting module may be damaged due to incorrect loading process.	Please contact your 4titude® service representative.
During the sealing process, the sealing material falls onto the plate carrier repeatedly.	The vacuum cup may have been damaged.	The vacuum cup is a consumable. Please contact your 4titude® service representative for replacements.
Unit doesn't seal properly or poor sealing.	Incompatible seal/plate selection	Please refer to 4titude®s heat sealing film and foil comparison table chart.
	Sealing parameters are not optimized.	Please refer to 4titude®s heat sealing film and foil comparison table.
Display screen freezes	Continuously rebooting the unit without shutting it down correctly.	Switch the a4S off and back on again after >1 minute.

6.2 Warning Messages

Seal Loading	Action User / *Instrument*
	Touch OK to perform the seal loading process. *Before the plate carrier is moving, the seal (roll) sensor does not detect a seal.*
	Ensure the plate carrier is free from any micro-plate and touch OK to start the seal loading process. *The plate carrier moves to the seal loading position*
	Conduct seal loading procedure by sliding the Seal Loading Tool into the unit.
	Ensure the Seal Loading Tool is clear of the instrument. Lightly holding the end of the seal in one hand and making sure it is central to the cutout section of the door, touch OK on the touch screen. ***Note: Please do not pull the seal material at this step!*** *The heating block moves down to cut off the seal.* *The plate carrier moves to the outside position.*
	Remove the excess sealing material. Touch OK on the touch screen to complete the seal loading process. *The plate carrier goes back into the machine. The front clamp closes to grip the seal film. The plate carrier goes to the outside position.*
	No action required, the message will disappear after 3 seconds.

Protocol Management	Action User / *Instrument*
	Ensure the area is clear and touch OK to confirm. Touch ⏏ to open the plate carrier.
	Inspection door not closed. Close the inspection door and touch OK to proceed with sealing.
	Create a protocol name before saving a protocol.

Protocol Management *(continued)*	**Action User / *Instrument***
	Ensure the time value is in the correct range.
	Ensure the temperature value is in the correct range.
	Press [Delete] in protocol management section
	Select a new protocol name and save the protocol.

General	**Action User / *Instrument***
	The inspection door was opened during running. Close the inspection door and power off the unit. Repower the unit and start the seal loading procedure.
	No or unsuitable plate adapter on plate carrier, heating block module cannot detect the plate when pressing down. Choose suitable plate adapter (please refer to section 3.2) and touch [OK] to resume.
	No seal can be detected by the rear sensor. Pull out the remaining seal and reboot the unit to proceed with the seal loading procedure.
	Check if the seal roll has run out. YES - Touch [OK] to proceed with the seal loading process. NO - Touch [Continue] to proceed with sealing.
	Select one of the following options Touch [Close door] to close the door of the instrument. Touch [Chg roll] to start the seal unloading procedure. Touch [Esc] to proceed with sealing.

General *(continued)*	**Action User / *Instrument***
	After touching [Close door] the unit will close the door and cut a seal which will drop to the plate carrier. This cut seal needs to be removed before proceeding. Touch [OK] to check and remove the cut seal. *The door opens and the plate carrier goes to the outside position.*
	The sealing film is not in position for the next sealing run. Possible cause: 1. The sealing film has run out, please replace the seal roll. 2. The sealing film has been dropped. Please check if the vacuum cups are intact or need replacing.
	Reminder to close the inspection door.
	Reminder to reboot the unit.
	Reminder that the sealing roll can be removed safely.
	Touch “Plate Carrier Movement” [⏏] to move the plate carrier to outside position for the next sealing process.

6.3 Error Messages

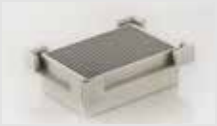
Error	Operation	ASCII
Error 1	Heater temperature rises over 210°C in any condition.	Please contact your 4titude® service representative.
Error 2	Touch [Seal] but heater can’t move up	Please contact your 4titude® service representative.
Error 3	Touch [Seal] or [⏏] but the plate carrier does not close.	Please contact your 4titude® service representative.
Error 4	Touch [Seal] or [⏏] but the plate carrier does not open.	Please contact your 4titude® service representative.
Error 5	Temperature detect abnormal.	Please contact your 4titude® service representative.
Error 6	Temperature does not reach the set value.	Please contact your 4titude® service representative.
Error 7	Temperature inaccuracy.	Please contact your 4titude® service representative.
Error 9	Over-current occurred in the plate carrier motor driver.	Please contact your 4titude® service representative.
Error 10	Over-current occurred in the heater motor driver	Please contact your 4titude® service representative.
Error 11	No detection at heating block’s home sensor.	Please contact your 4titude® service representative.

7 Appendix A: Technical Specifications

Model	Technical Specification
Dimension (W x L x H)	230 x 507 x 276 mm *Please note: Additional space is required if large seal rolls are used*
Sealing Temperature Range	100 – 195˚C
Sealing Time Range	0.1 – 10 sec
Weight (without roll)	27 kg
Power Supply	V in: AC100 – 240 V V out: DC 24 V 320 W
Power Consumption	700 W (max)
Working Temperature Range	10 – 30˚C
Operating Humidity (RH)	0 – 85%
Connection	RS-232 serial port, USB port

Note: Specifications are subject to change without prior notice.

8 Appendix B: Ordering Information / Accessories

Code	Description		Quantity
4ti-0665	a4S Automated Heat Sealer		1
4ti-0665-1	Seal Loading Tool		1
4ti-0665-2	Plate Support Adapter A		1
4ti-0665-3	Plate Support Adapter B		1
4ti-0665-4	Roll Holder		1
4ti-0665-5	Vacuum Cups, front (clear)		2
4ti-0665-6	Vacuum Cups, rear (black)		2
4ti-0665-7	Plastic Tweezers		1
4ti-0665-8	Clear Plastic Dust Cover for enclosing the sealing roll *Note: Only applicable for smaller rolls (product code 4ti-xxxx/80, /100, /122), please refer to section 3.3, page 29.*		1

9 Appendix C: Warranty

4titude® warrants that the a4S automated heat sealer (4ti-0665) should be free from defects in materials and workmanship for a period of **24 months** from the date of purchase. The purchase date is determined by the invoice date from 4titude® to the customer. If the instrument is being incorporated into an automated system by a third party, the warranty period may be extended by a maximum of 6 months or the date the system is commissioned, whichever is the shorter. For this automation extension to be valid, 4titude® must be notified of this requirement along with the details of the integrator at the point of purchase.

Each a4S Automatic Heat Sealer is tested and documented by the manufacturer before shipping. 4titude® Ltd's Quality Control System guarantees that the performance of the a4S Automatic Heat Sealer you have purchased is within its specifications.

The warranty covers all parts (other than the vacuum cups) and labour costs associated with a repair of the unit within the first 24 months. The need for returning a unit for service must first be agreed with 4titude® via telephone support. Once it is established a return is necessary, 4titude® will issue a returns number, details of which must be returned with the unit.

The warranty does not cover defects caused by excessive wear and tear or damage due to shipping, accident, abuse, misuse, problems with electrical power, or usage not in accordance with product instructions, if other than original spare parts supplied by the manufacturer have been used, or if other than original 4titude® seal rolls have been used.

The warranty does not automatically cover shipping charges. Shipping costs (both ways) will be covered by 4titude® where a returns number is issued within 8 weeks of the original delivery date (as confirmed by the invoice date). Shipping costs after this period will need to be covered by the customer.

Once returned to a 4titude® designated service centre, the unit will be inspected and repaired accordingly and a report provided to the customer. 4titude® would expect to carry out this work and return the unit within 10 working days of receiving the unit.

Onsite service or a swap out service (where a loaner instrument is shipped to the customer whilst theirs is repaired) can be arranged at extra cost. Please contact 4titude® if you are interested in this service.

This standard warranty can be extended to 36 or 48 months respectively.

Extended warranty must be purchased within 4 weeks of the original invoice address.

Code	Description
4ti-0665-10	Standard warranty (24 months)
4ti-0665-11	Warranty extension year 3
4ti-0665-12	Warranty extension year 3 and 4
4ti-0665-113	Warranty extension year 4

Please contact 4titude® or your local distributor for pricing details.

The warranty does not cover any damage to the set of 4 vacuum cups which can be replaced by a customer, please refer to section 5.3 of this operation manual. A set of 4 replacement vacuum cups are provided with each new unit.

The warranty does not cover damage caused to the unit in shipping due to unsuitable or insufficient packing being used. Wherever possible, the original shipping box should be retained by the customer and used for returning the unit.

Note: Any shipment of an a4S must be palletised. For details please refer to section 10, Appendix D: Shipping Instruction.

10 Appendix D: Shipping Instruction

In the event the instrument should be shipped from one destination to another e.g. returned to 4titude® for servicing, you should follow these instructions to safeguard the a4S during its journey. 4titude® warranty does not cover shipping costs or damage caused by shipping. Warranty for your unit will be declared void should you fail to follow these instructions fully. Please also refer to section 9, Appendix C: Warranty.

Shipping Bracket and Rear Sensor Protection Screw

Before boxing your unit up you must ensure that the shipping bracket and rear sensor protection screw are fixed in place fully. The shipping bracket locks the shuttle in place and restricts movement during transit, whilst the rear sensor protection screw limits movement of the rear pendulum sensor.

Rear Sensor Protection Screw

Shipping Bracket

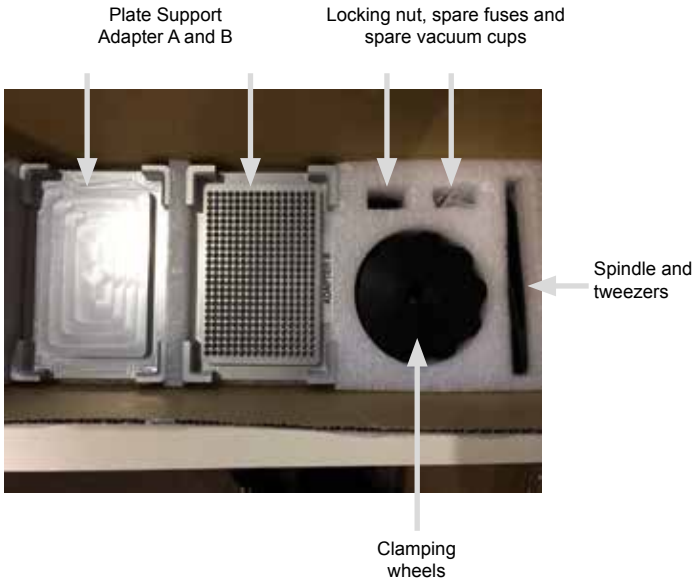
Packing the a4S into the Shipping Box

Step 1: Once the shuttle and rear pendulum sensor are locked in place the unit is ready to be placed inside the shipping box. The a4S is very heavy (27 kg) so great care should be taken when lifting and placing the unit inside the box. Ensure the a4S is sitting within the cut out section of the protective foam.

Note: Ensure adapters are removed from the unit prior to boxing the a4S.

Step 2: Add the top layer of protective foam packaging, securing the unit in place

Step 3: Collect all adapters and accessories, packing them in the supplied accessories box



Step 4: Add the accessories box, power lead and seal loading tool in the following manner

Packing the a4S onto a pallet

The a4S MUST BE wrapped and strapped onto a pallet before being shipped from one destination to another. Ensure no boxes are stacked on top of the a4S box.