Vibrating Microtome

9000SMZ

Campden Instruments

Contents

01 Introduction

The 9000SMZ Vibrating Microtome by Campden Instruments is an oscillating blade microtome and is the result of more than 40 years of experience in the design and manufacture of tissue slicers.

The 9000SMZ is a programmable unit that allows the instrument to replicate a cutting cycle input by the operator and then repeat that cycle a desired number of times. The cycle may have a varying speed/distance profile so that regions of tissue can be sliced at different speeds.

Researchers have found that certain combinations of vibration frequency, amplitude and advance speed can give superior slice quality for a given tissue type. The 9000SMZ allows these combinations to be developed solely by input to the keypad.

For instrument stability and longevity, the vibration amplitude value is related to the vibration frequency – the larger the amplitude, the lower the maximum frequency available and vice versa.

Experienced users of vibrating microtomes will no doubt be aware that large amplitudes and/or high vibration frequencies can lead to excessive vibration being transmitted to the tissue being sliced and its surrounding fluid. The 9000SMZ instrument diminishes this issue by being built on a heavy, rigid cast base, giving exceptional protection from secondary vibration transmission.

The purpose of this manual is to allow the user to achieve expertise in the use of the 9000SMZ instrument. Please read and understand the information contained in this manual before using the instrument. Only competent and capable personnel should use the instrument.

This document should be retained for future reference, as it contains the name and address of the manufacturer.

02 Packaging

Please retain the original packaging for future use.

Instruments will not be accepted for service or repair unless the unit has been adequately and properly packaged. Additionally, instruments will not be accepted without prior authorisation and have been certified as being decontaminated of any material that may be hazardous to the health of service personnel. A Returns Authorisation and Decontamination Certificate blank form is included at the end of this manual and may be photocopied as required. Blank forms can also be obtained by contacting Campden Instruments directly.

NOTE: where the instrument has been used in a BSL-3 equivalent or higher lab and/or on applications requiring **thin film isolation** it may **NOT** be returned for servicing.

Packing Location	Item	Quantity
Transit Crate*		1
	9000SMZ Vibrating Microtome	1
	Mains lead†	1
	Tissue bath assembly	1
	Outer bath assembly with drain accessories	1
Toolkit Case		1
	2.5mm hexagonal driver (A/F)	1
	1.5mm hexagonal driver (A/F)	1
	Standard Tissue Mount	1
	Rectangular Tissue Mount (dual specimen)	1
	Adjustable Angle Tissue Mount	1
	Tissue Mount Spanner	1
	Opti-Cal Blade Calibration unit	1
	USB Flash Drive	1
	Splash Plate	1
	Blade Holder	1
	Blade Handling Tool	1
	Blade Guard	1
	Spare Screws and Washers for Blade Holding	1
	Sample Box containing 2 Ceramic Blades and 10 Stainless Steel Blades	1
	Box of 50 Stainless steel blades	1
Manual and Instructions Folder (Back-up on USB)		1
	9000SMZ Manual	1
	9000SMZ QuickStart Instructions	1
	Unpacking instructions	1

*Option to order wheeled Transport Case (CI.9000-CASE) in place of wooden Transit Crate

†Mains lead type specified by order subject to country of intended use.

Optional Accessories: See Section 18 & 24

03 Safety Warnings

Before operating this equipment, all users should read this manual fully.

Risks to personnel mentioned in the following sections will be denoted by the following:

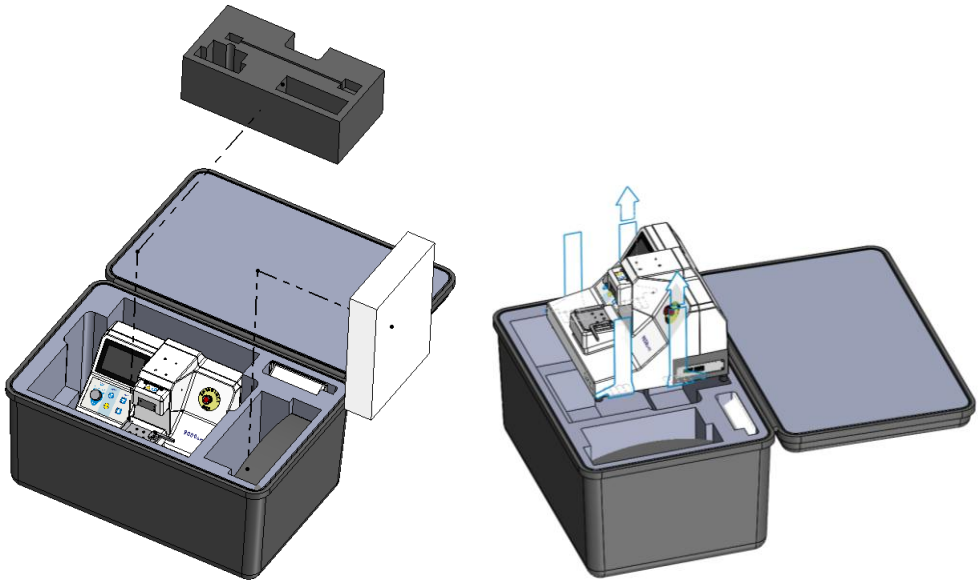
Risk to the equipment and important information will be denoted by the following:

1. If at any point when using the 9000SMZ you feel that the blade, advance or stage drive is likely to cause a collision with any body part or another fixed object, immediately press the emergency stop button on the top right-hand side of the instrument. Follow onscreen instructions to recover.

2. The 9000SMZ alone weighs 32kg and requires a two person lift during removal from transit case/crate and placement onto a suitable work bench.

Unpacking Step 1: Remove Foam insert and Accessories Box



	Unpacking Step 2: Two people are required for this step, remove the 9000SMZ with one person lifting from either side. It is imperative that a person does not try to lift the 9000SMZ on their own.

3. The 9000SMZ with accessories can weigh as much as 35kg. Therefore, it should be placed on a secure, level bench with suitable non-slip surface characteristics to ensure that the instrument cannot be inadvertently moved, giving rise to a falling object hazard to the user or other laboratory personnel.

4. Users must keep fingers clear of the Blade/Blade Holder area when loading the Bath accessory to avoid finger crush hazard.

5. When loading and using the Opti-Cal Blade Alignment accessory, the equipment operates with very close clearances between the blade and the Opti-Cal unit. This presents a crushing/cut hazard; thus, hands and fingers must be kept clear of this area.

6. Take care when fitting the blade into the blade holder. Use the Blade Handling Tool supplied in the toolkit (see page 15).

7. Users must keep fingers clear of the Bath area during operation since both the horizontal Blade Advance drive and vertical rising table mechanisms are capable of very high thrust forces and therefore gives rise to a potential finger cut and crush hazards between the Blade/Blade Holder and the Specimen Holder/stainless steel bath.

8. The blade edge is exposed during operation; hence users must keep fingers away from the tissue specimen cutting area. Where tissue slices require manipulation after slicing, it is recommended that this be done with a soft brush.

9. When not in use, place the magnetic Blade Guard supplied in the toolkit over the Blade Holder, to reduce risk of accidental contact with the blade edge by you or other laboratory personnel (see Section 8 for an example).

10. The 9000SMZ machines are designed for indoor laboratory use only; the machines are resistant to fluid ingress and foreign object ingress when operated as intended and as further instructed in this manual. The operating temperature limits for this machine are +5°C to +40°C with a maximum relative humidity of 50%. Should this machine be operated in an environment outside these specifications user safety protection may be impaired.

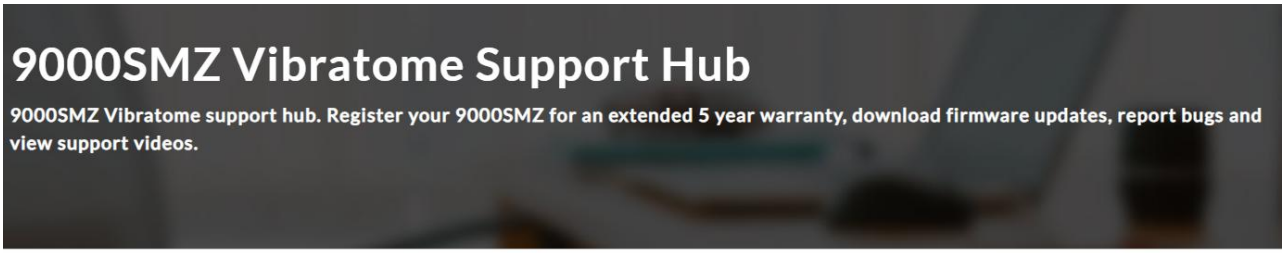
11. All relevant laboratory hygiene and bio-hazard protocols are adhered to when preparing tissue samples, operating this equipment, and the disposal of tissues samples and bath fluids.

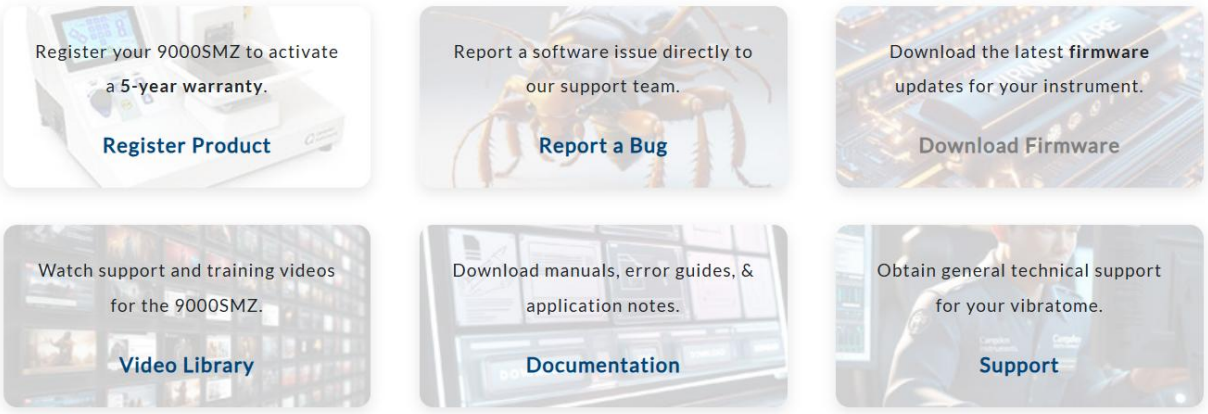
04 Registering the 9000SMZ

Immediately after unpacking, scan the QR Code with a suitable reader to go to the Campden Instruments' 9000SMZ support hub webpage **https://9000SMZ.support**

To register and receive the 5-year extended warranty, the primary user or lab PI must complete the product registration form. A valid email address will be needed in order to receive notifications of firmware updates.

After registering the 9000SMZ, access to training, support, regular firmware updates will be made accessible on the support hub webpage.





In addition to filling out the first level service and support form in the hub, for issues relating to machine operation the user can also email: techsupport@campdeninstruments.com

05 Installation

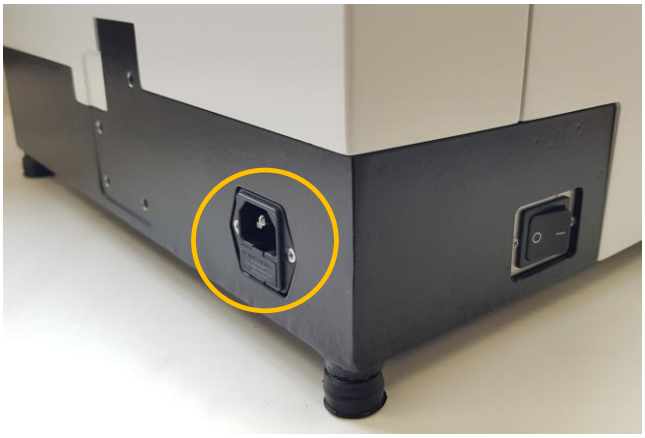
	Potential crush/Musculo-skeletal injury and risk of damage to equipment warning – when lifting the 9000SMZ onto a bench or moving the machine short distances, due to the high mass of the 9000SMZ, a two-person lift is required.
	Potential crush injury and risk of damage to equipment warning – Due to the high mass of the 9000SMZ care is to be taken by user that the machine is placed on a sturdy bench with a level non-slip surface.

The unit should be placed on a sturdy bench. Although the unit has a very high static mass to vibrating mass ratio and absorbent rubber feet, a rigid support bench will enhance protection from secondary vibration transmission and maintain slice quality and consistency.

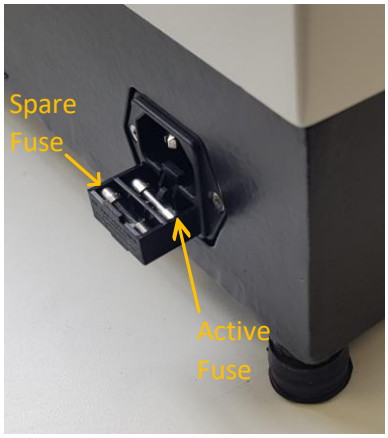
If any accessories – microscope/magnifier attachment or light source - have been supplied with the instrument, reference should be made in section 18 of this manual for the installation procedure.

The 9000SMZ will automatically adapt to the mains voltage of any country in which it is being used. No user intervention is required before the 9000SMZ is switched on.

The IEC C14 power inlet socket is located at the rear-left of the instrument (see below) and is fused in line with CE safety standards. In the event of the fuse needing replacement, the fuse holder drawer may be prized open with a flat bladed screwdriver and the blown active fuse in the inner slot of the drawer replaced with the spare fuse in the outer slot of the drawer.



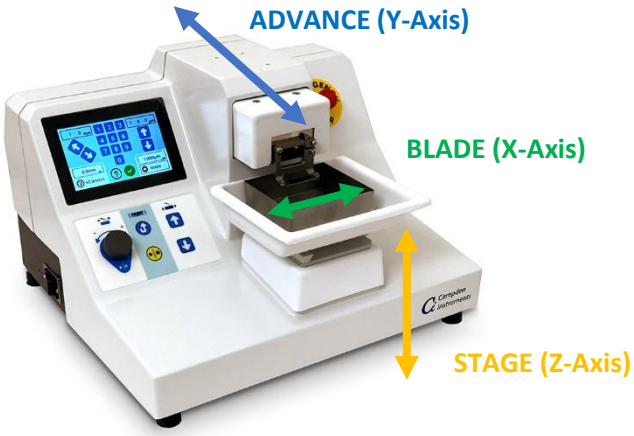
IEC C14 Power Inlet Socket



Fuse drawer extended showing spare fuse position.

The IEC C14 power inlet socket accepts a standard IEC C13 plug. Where possible a standard mains lead suitable for the country of intended use will have been supplied with the instrument. The instrument must not be operated unless it is connected to a suitably earthed (grounded) mains supply.

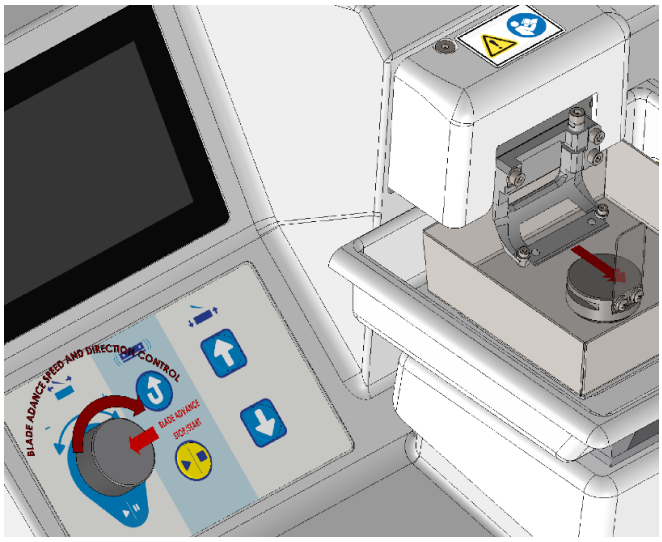
06 Description of the Instrument

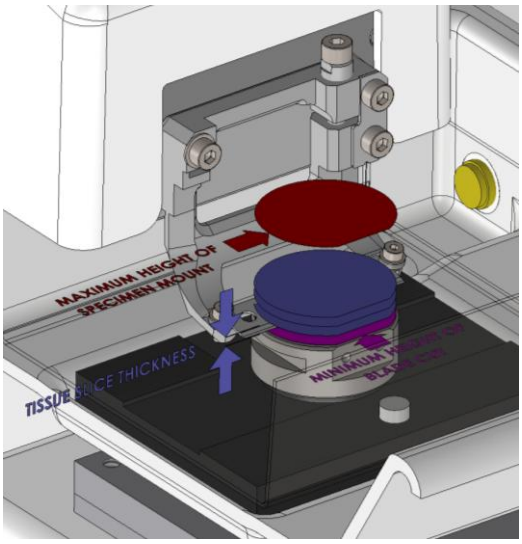


The 9000SMZ instrument features a removable cutting head (Blade Holder) mounted on a deep section parallel leaf spring assembly giving exceptional resistance to vertical (z axis) deflections and motion errors.

Blade motion is via a contactless drive, ensuring a high degree of immunity from out-of-plane forces whilst allowing variable oscillation frequencies and amplitudes to be selected by the user.

6.1 General Operation During Tissue Slicing





There are many elements that must be considered to achieve consistently high-quality slices. The speed at which the blade traverses into the tissue is known as the "**Advance speed**". The blade advance speed is controlled by the user via the **Blade Advance Dial**. This rotary control enables the user to adjust the blade Advance speed (in both Forward and Reverse directions) at any point during the tissue slicing process. This is particularly useful when different areas of tissue need to be cut at different speeds. Blade Advance start/stop may be toggled by the user at any position during a slicing operation via a momentary push on the Blade Advance Dial. Upon completion of a tissue slice, the uncut tissue specimen is lowered 100 microns away from the blade to eliminating the possibility of damage to the uncut tissue by the blade being dragged across. The blade retracts at maximum speed; after which the tissue sample is raised to the level required for the user-specified slice thickness on the next slice.

Accurate control of the **Tissue Mount** height ensures that quality and consistency of specimen slice thickness is maintained.

Dynamic feedback on the vibration (frequency and amplitude) and Advance (speed and position) encompassing the slicing parameters eliminate extraneous variation during operation apart from what is explicitly selected by the user.

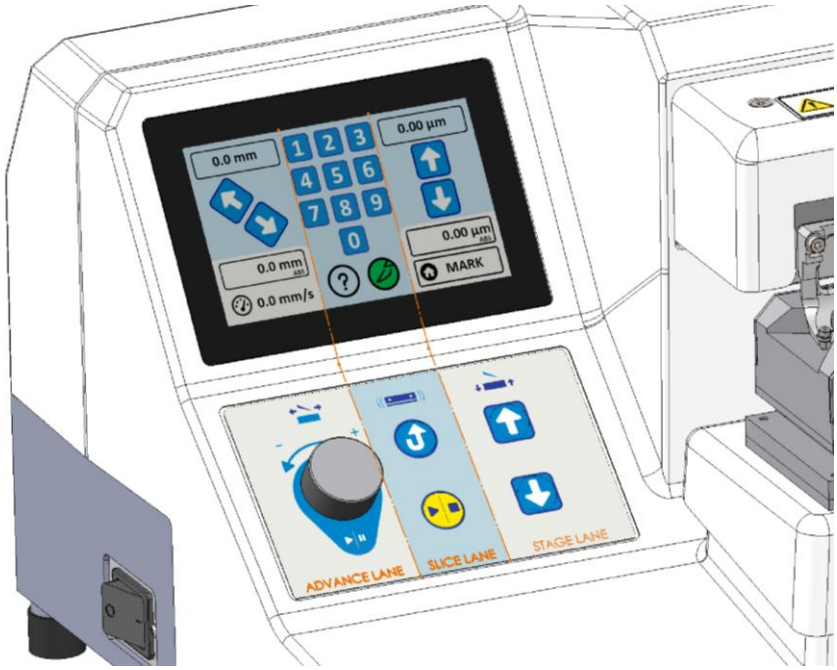
The 9000SMZ can retain user-defined start and finish points of a slice to define a "**Slice Window**", allowing automatic successive slicing between these fixed points. Additionally, the 9000SMZ has the ability to remember the user-controlled blade Advance speed variations to create a "**Slice Profile**" between the user-defined start and finish points, which may be auto-repeated on successive slices.

6.2 Touchscreen/Keypad Layout

A sealed Touchscreen display and membrane keypad allows the user to control the instrument and set the following parameters: blade frequency, amplitude, advance speed and slice thickness. Since the 9000SMZ can be operated under fully automatic control, an emergency stop button is provided.

To provide the user with easy to access and intuitive controls when operating in "**Slice**" or "**Move**" modes, the Touchscreen display is divided into three dedicated vertical lanes aligned with the Keypad. Keypad and Touchscreen controls located within a lane will only control the function of that lane.

- ADVANCE LANE: The first lane, or the advance, controls the speed of the advance.
- SLICE LANE: The second controls the slicing elements.
- STAGE LANE: Lastly, the third controls the stage movement.



The entire instrument is enclosed in a molded enclosure giving protection against liquid ingress from spillage and thus is tolerant of most commonly used tissue bath salt solutions.

07 Microtome Blade Selection

Irrespective of the selected blade vibration frequency, amplitude and Advance speed parameters, the quality of the tissue slice can be enhanced by a good blade. Correspondingly, slice quality can be degraded when using a poor quality or damaged blade. A typical razor blade consists of a triple bevel on both faces of a thin foil made from either carbon or stainless steel. The triple bevel terminates in a relatively nonacute angle and is not specifically designed for the precision cutting of tissue. Moreover, the thin foil construction of a razor blade will almost certainly flex when clamped into a blade holder.

Carbon steel is relatively hard compared to stainless steel and a carbon steel blade will keep its cutting edge longer when used in a clean and dry application; however, it has the inherent disadvantage that it will rust quickly when exposed to moisture. Hence to prevent rusting in storage, carbon steel blades have a film of oil that must be removed before the blade can be used. The corrosion process is, of course, accelerated significantly in saline such as artificial cerebral spinal fluid (aCSF).

For these reasons, normal razor blades and carbon steel blades are not recommended for precision tissue sectioning. Campden Instruments supply two types of blades for the 9000SMZ vibrating microtome:

CI.7550-1-SS/50 Stainless-Steel Blades

Made from surgical quality stainless steel, these blades are double bevelled on both faces and are honed to an acute cutting edge. Because of the relative softness of stainless steel, for optimum performance it is recommended that stainless steel blades should only be used once per tissue sample undergoing slicing or changed at the beginning of each day. Notes on best practice may be found on the 9000SMZ Support Hub webpage.

CI.7550-1-C Ceramic Blades

Made from ultra-hard zirconium, this is a material that can be lapped to the finest of edges. The body of the blade is very rigid which maintains a straight cutting edge. The result is that slice quality is substantially improved with prolonged slice life, especially in the most difficult tissues. Additionally, the blade has a much longer life due to the ultra-hard cutting edge not losing its sharpness and being impervious to corrosion.

For studies where the deposition of metal into the slice would have undesirable effects, the benefit of ceramic blades is clear. The initial higher cost of the ceramic blade is more than offset by its longevity.

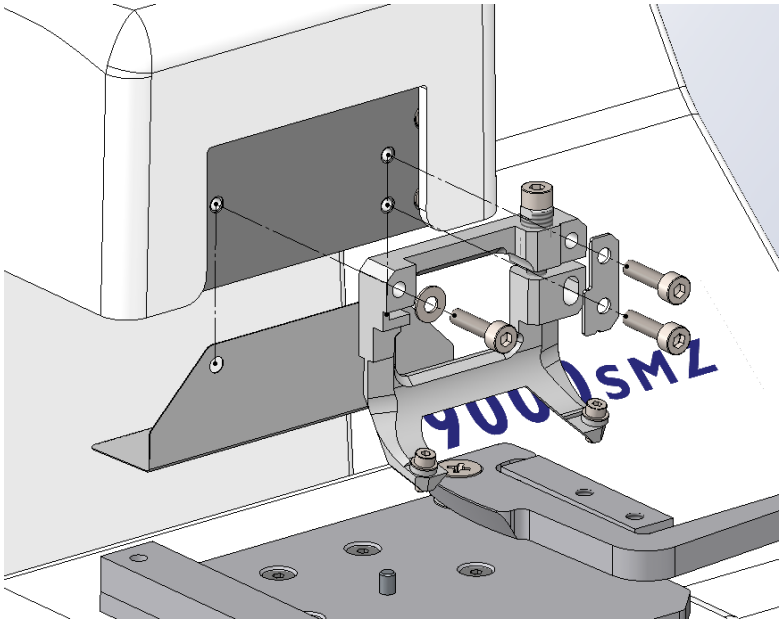
To facilitate the fitting of the narrow blades a special blade holder tool is provided. This helps ensure correct blade alignment and reduces the risk of personal injury when fitting the blade. Further details are shown in Section 8.

The 9000SMZ instrument is supplied with a fixed angle titanium blade holder suitable for the CI.7550-1-SS/50 stainless steel and CI.7550-1-Cceramic blades. Sample blades are included with each instrument.

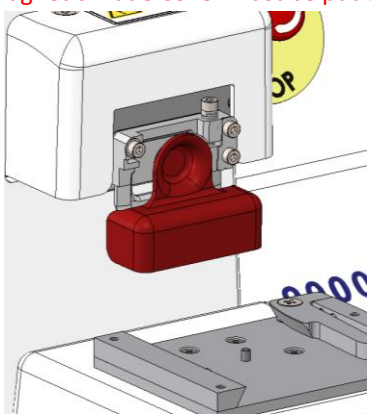
08 Mounting the Blade Holder and Blade

The Blade Holder is to be mounted to the Faceplate of the vibrating head assembly via three stainless steel screws. The provided "**Splash Plate**" should also be fitted to help prevent ingress of cutting solution into the vibrating mechanism. It should be slid between the vibrating head cover and the Faceplate prior to fitting the Blade Holder. The Blade Holder mounting screws are to be tightened with the 2.5mm hexagonal driver supplied in the Toolkit.

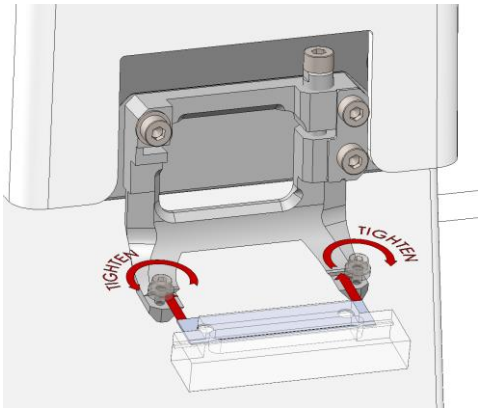
⚠	The three mounting screws may be tightened to a maximum torque of 30-40 cNm. To prevent damage to the Blade Holder assembly, DO NOT over-tighten these screws.



The Blade Holder will accept either Campden Instruments' Stainless Steel Blade or Ceramic Blades. Both types of blades are fitted in the same manner. NOTE: for ease of handling, user safety, and to protect the Blade edge, the blade should be held in the white Blade Handling Tool when fitting. The rear edge of the blade should be in contact with the alignment face of the Blade Holder, and the blade should then be clamped by the underside of the white acetal washers.

⚠	When the 9000SMZ is not in use, to protect the laboratory staff and the blade edge, the supplied magnetic Blade Cover must be put on over the blade holder as shown below. 

Note: the left clamping screw is left-threaded and thus is tightened by turning anticlockwise (counter-clockwise). The 1.5mm hexagonal driver included in the Toolkit is to be used. Tightening the screw in the wrong direction could strip the thread in the blade holder resulting in a costly replacement!



09 Startup - Powering on the Instrument

Please complete sections 5, 7 and 8 prior to powering on.

Turn on using the switch located on the left-hand side at the rear (see image below).

The Startup Screen will appear on the touch screen; the Stage and Advance will move to the loading position (see below).

Once the stage and advance are fully retracted, the Startup Screen (see below) is only displayed when the instrument is switched on. Thereafter the Slice Screen and Menu Screen is used to access CUSTOM and PREPARATION.

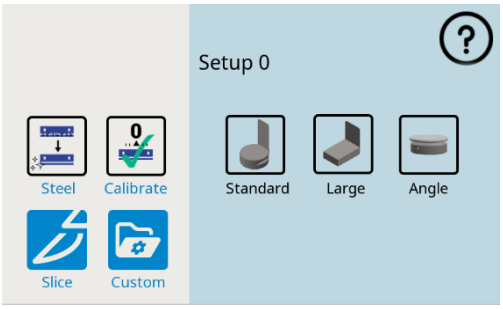
From here Select either:

1. SLICE: Choose this option to quickly start slicing without changing the Custom Setup, Blade or Tissue Mount. Note: A tissue bath must be fitted to continue. This option takes the user to the Move Screen (see section 13).
2. CUSTOM: Change to a different Custom Setup.
   The Custom Setup holds user set slice parameters such as blade frequency and amplitude. See section 15 for a more detailed explanation.
3. PREPARATION: Change the blade, calibrate the z-axis alignment or select a different Tissue Mount.
   Slice or Custom can also be accessed from this screen (see section 10).

	If this is the first time using this instrument, you will need to calibrate the blade, select the blade type and choose the tissue mount. Select PREPARATION out of the three options. CUSTOM will be irrelevant for now as the 9000SMZ has factory defaults set.

10 Preparation

The purpose of the Preparation screen is to set the instrument up ready for Slicing.



The Preparation screen can be entered from the Startup screen and the Slice screen:

1. Press the PREPARATION button in the Startup Screen.
2. When entering the Preparation screen from the Slice Screen (press and hold the Preparation button),

The Stage and Advance axis of the instrument are moved to the "**Load**" position (the stage and advance are fully retracted).

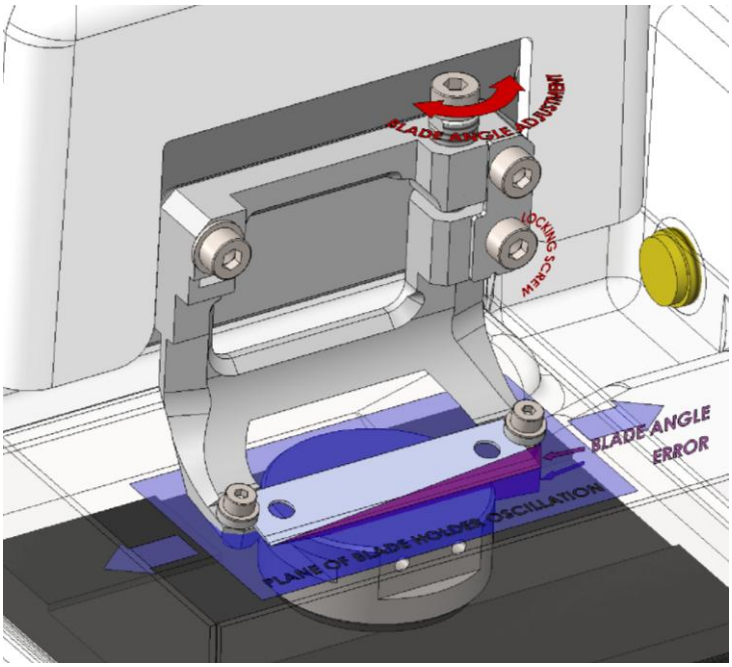
From the Preparation screen, the following options can be found:

1. Blade Type: Select the blade button if you require a different type of blade (default is set to "**Steel**"). This will allow the Opti-Cal to function correctly and adjust the instrument's datums.
2. Calibrate: Select to set the blade edge parallel to the cutting plane for optimum slice quality. See Blade Alignment in section 11.
3. Change Tissue Mount type: touch the image corresponding to the correct Tissue Mount to select. This allows the instrument to adjust the slice datums according to the different dimensions of the Tissue Mount. Default is set to "**Standard**".
4. Slice: Select to Load the tissue bath to the home position and begin slicing. A tissue bath must be fitted to proceed. See section 13 to position the blade ready for the first slice.
5. Custom: Select load a different Custom Setup. See section 15. The current setup is displayed on screen.

11 Blade Alignment

Before the 9000SMZ is used to cut tissue, the blade misalignment, otherwise known as z-axis deflection, should be minimized to optimize tissue slice quality.

The blade angle can be adjusted within the blade holder to ensure the blade edge is parallel to the plane of oscillatory motion, or in other words is flat along the z-axis. By doing so, there will be minimal damage to the surface of the tissue resulting in a cleaner slice. Parallelism, also known as the z-axis deflection of the blade edge, is checked prior to slicing using the included "**Opti-Cal**" accessory which provides non-contact measurement of the blade angle.



Blade Holder Features

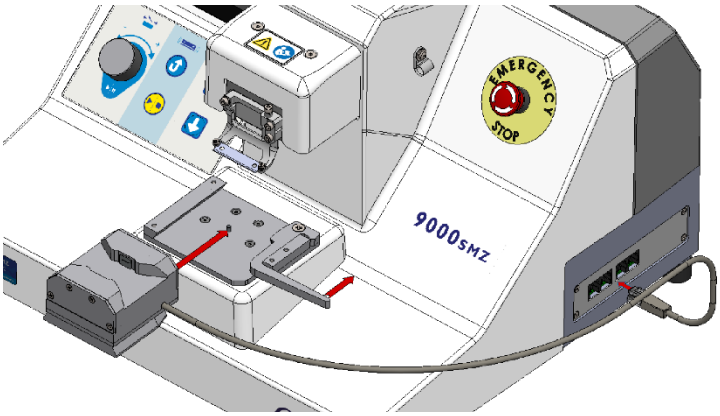
When the Opti-Cal is correctly mounted, the 9000SMZ allows the calibration mode to be entered via the Touchscreen.

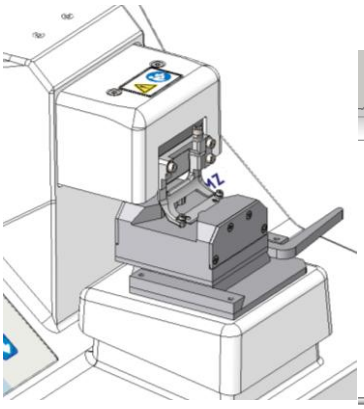
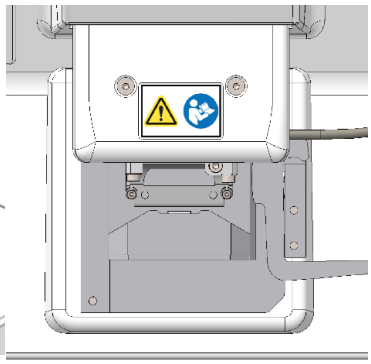
$$blade\ misalignment\ error\ relative\ to\ calibration\ amplitude = \tan(blade\ angle\ error)\ x\ (calibration\ amplitude)$$

The blade alignment calibration is performed using the following procedure and is accessed from the slice and preparation screen:

1. Ensure that the blade type (either stainless steel or ceramic) is selected on the Touchscreen. To change the blade type, select the blade button on the left-hand side of the screen. **Note: It is crucial that the correct blade type is selected prior to calibration, to ensure optimal blade alignment.**

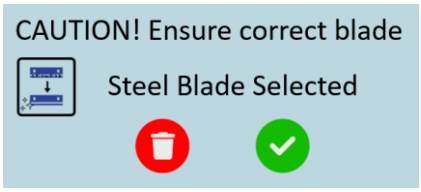
2. To load the 9000SMZ Opti-Cal Calibration Unit, the spring-loaded lever should be pushed rearward. Slide the Opti-Cal with the dovetail arrangement until a positive stop is met. When it cannot be inserted further, releasing the lever holds the Opti-Cal in place.



3. Plug the Opti-Cal's electrical connector into any available port on the right side of the 9000SMZ; pushing the lever, allows for easy removal of the Opti-Cal unit.

4. Upon selecting the blade calibration button on the Touchscreen, the blade type prompt screen will appear. If required, select the Blade Change Button to change blade type (ceramic or stainless steel) type to match the blade fitted, select the Accept button to continue.

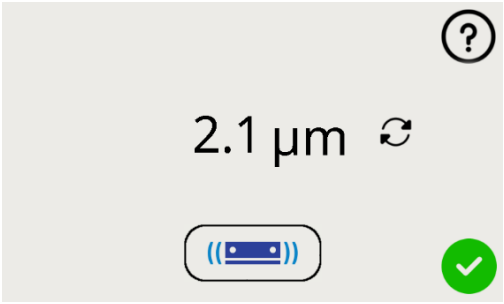


5. Upon selection of the accept button the Blade Advance and the Stage/Opti-Cal combination will rise to the optimal blade alignment position.

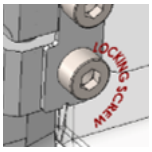
	Potential crush injury and risk of damage to equipment warning - Users to keep fingers clear of Opti-Cal. The Opti-Cal/Rising table combination will be driven automatically to the approximate blade measurement position. This may be stopped by pressing either the pause button or the Emergency Stop button.

6. When the blade edge has been detected by the Opti-Cal sensor and its position has been optimized, the calibration screen will appear.

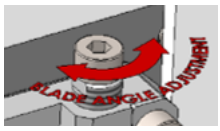
7. Selecting the  calibrate button will initiate the blade to vibrate for a duration of approximately 3 seconds. The screen will then display the blade misalignment in microns. The screen will also display the direction to turn the Adjustment Screw on the Blade Holder.



8. To align the blade, first use the 2.5mm hexagonal driver supplied in the Toolkit to loosen the lower locking cap head screw on the blade holder. One turn anticlockwise is sufficient.



9. Using the same 2.5mm hexagonal driver, turn the Adjustment Screw, the vertical screw on the top right-hand corner of the blade holder by the smallest practical increment (less than 5°) in the direction indicated on the Touchscreen.



10. Lightly re-tighten the lower locking screw.

11. Select the calibrate button on the Touchscreen.

12. Repeat steps 8 - 11 until minimum blade alignment error has been achieved. This should be within a range of 0.1-0.3µm. **Note: 0.0 is not physically possible to obtain.**

⚠	Once the blade is within acceptable limits the lower locking screw may be tightened to a firm finger tightness. Do not over-tighten.

Blade Alignment Troubleshooting

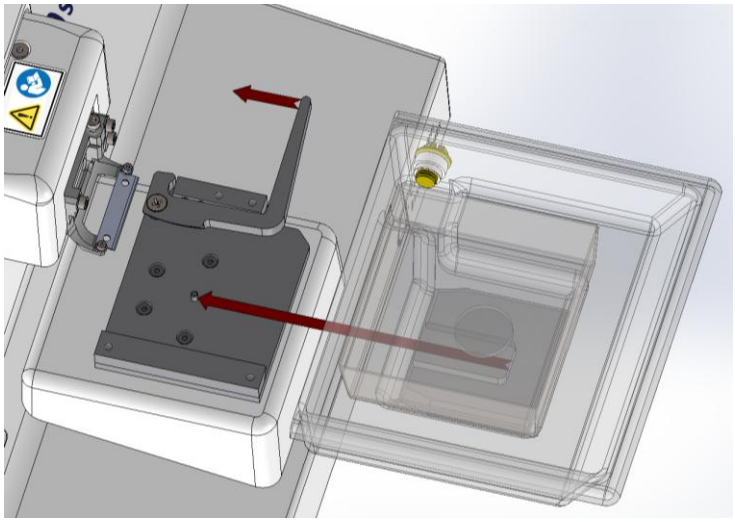
Reduction of blade alignment error to an acceptable level may not be possible if the blade or the blade holder has been damaged. The replacement of the blade with a new blade should rectify this most of the time. Check cleanliness of blade, and the blade to Blade Holder interface (acetal washers).

With the blade alignment error minimized, the 9000SMZ is now ready to accept the Outer Bath. Press the accept button on the Touchscreen. The instrument will return to the Preparation screen and move to the load position. Remove the Opti-Cal when the Advance and Stage are fully retracted.

12 Loading the Bath and Bath Assembly Options

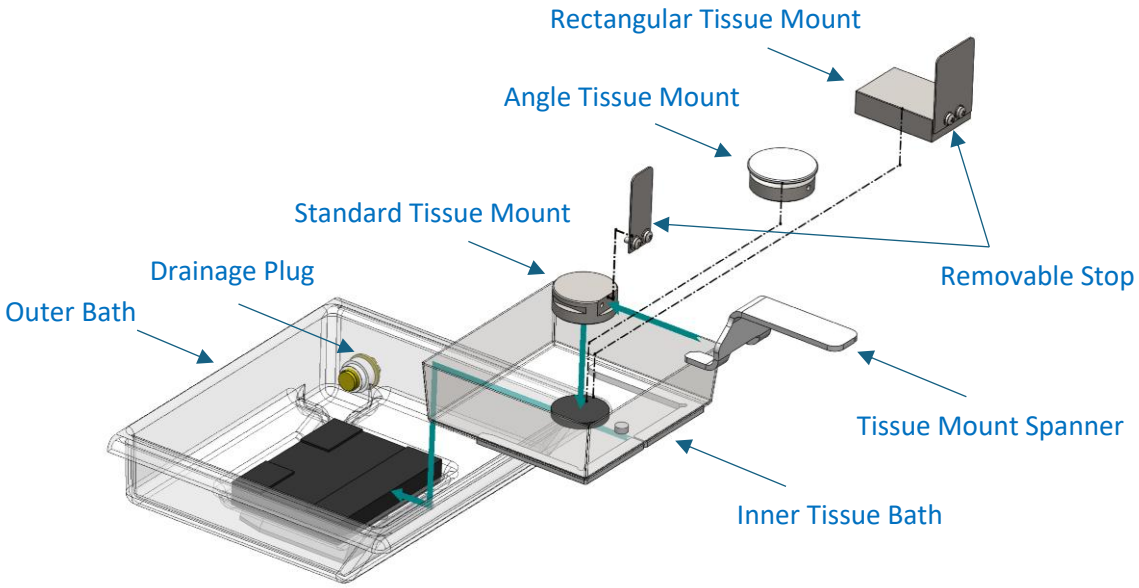
The Tissue Bath Assembly can be loaded to the Stage when the instrument is in either the Startup or Preparation screens. In these screens, the Stage and Advance axis will be fully retracted.

The spring-loaded lever should be pushed rearward. Slide the Tissue Bath Assembly with the dovetail arrangement until a positive stop is met. When it cannot be inserted further, releasing the lever holds the bath in place.



The instrument is supplied with an Inner Tissue Bath which has a ceramic magnet to place and retain the Tissue Mount. Three Tissue Mounts are included: a Standard Mount, a Rectangular Mount for use with multiple or larger samples, and an Adjustable Angle Mount are supplied as standard.

A Spanner is provided for ease of handling of the Standard Mount, thereby avoiding contact with the prepared tissue specimen. Typically, the Inner Bath and a tissue Mount with the prepared tissue specimen are fitted into the Outer Bath Assembly prior to loading onto the Stage.

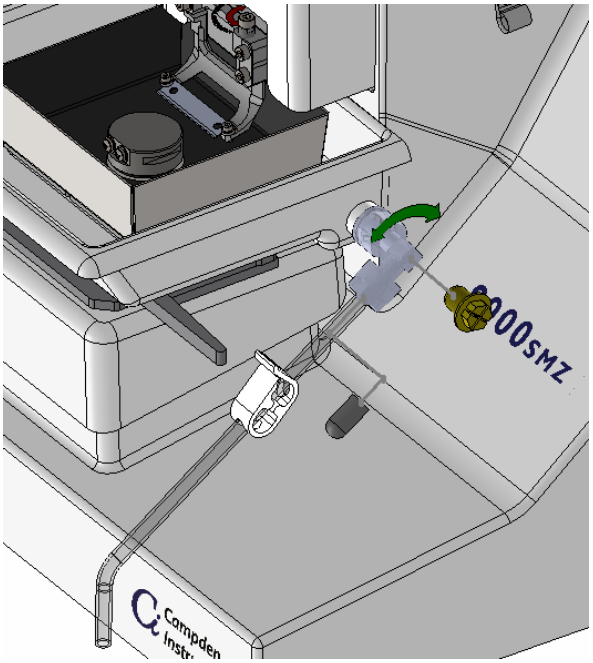


If the Tissue Mount type has not been used in the previous session, ensure the correct mount has been selected in the Preparation screen.

The Standard and rectangular Tissue Mounts have removable stops to provide support to the tissue when slicing. To add/remove the stops, use the 1.5mm Hex driver supplied in the toolkit, on the M2.5x5 stainless steel button head screws. There is a washer also for each screw.

⚠	When slicing, if the blade hits the removable stop, the inner tissue bath is designed to slide with the advance as a safety feature. This will of course damage the edge of the blade edge where it makes contact. To avoid doing this set the limits (see section 14) and reduce the speed at the end of a slice. Ensure the inner tissue bath is pushed back (all the way in) fully before slicing.
⚠	Potential risk of damage to equipment and specimen warning – If the Adjustable Angle Mount is to be used, extra care is required to prevent blade contact with the tissue mount during Move/Slicing operations.

When crushed ice is used in the surrounding outer bath, the need to regularly drain the excess water is present when refilling the ice. For drainage, the option to replace the screw-in drain plug with an elbow swivel connector and drain tube is supplied as standard. The tube may be shut off by using the pinch-clip supplied, or by replacing the tube and pinch-clip with a cap over the barbed end of the elbow swivel connector also included.



⚠	Users wanting to customize the Outer Bath/Inner Bath/Tissue Mount assembly must ensure that the total weight including contents does not exceed 800g to prevent overloading of the Stage drive motor.

Once the bath assembly has been loaded, select the Slice button to load the bath to the “Home” position and enter the Move screen (see section 13).

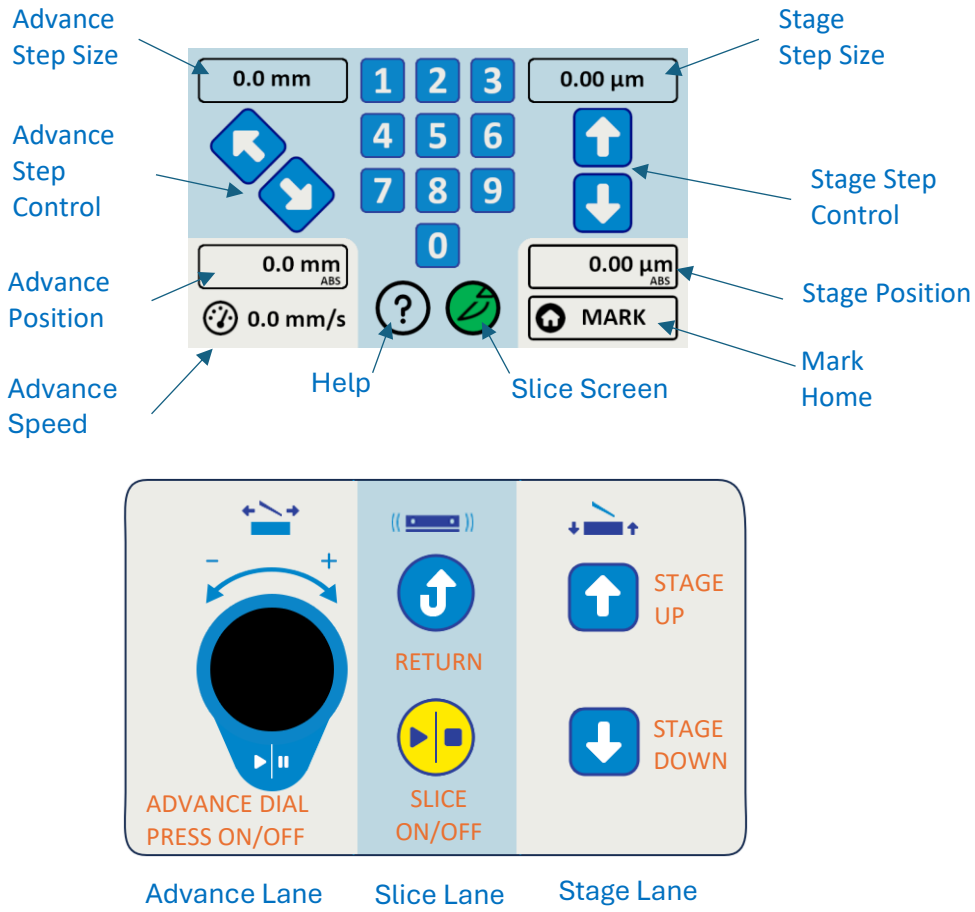
13 Blade/Tissue Specimen Positioning

From the Startup screen or Preparation screen, select the Slice button.

Ensure the bath is loaded, see section 12.

The instrument will move the bath and blade to the 'Home' position. ‘Home’ positions the blade in line with the rear edge of the selected specimen holder and the stage moves to a convenient height (this height can be preset). The instrument will enter the Move Screen.

The purpose of the Move screen is to get to the start of a slice faster using gross movement of the Advance and Stage axis. Once the blade is in place, the precise slicing can take place.



The Move screen and keypad

Positioning of the Stage (Tissue Mount) and Advance (blade edge) may be achieved in a combination of two ways:

Step Method: (Using Touchscreen buttons)

1. Press the Step Size button on the Touchscreen
2. Enter the Step Size via the central number-pad in the centre of the touchscreen.
3. Use Step Control buttons to move the desired Advance and/or Stage to the desired position.

Continuous Method: (Using the Keypad controls)

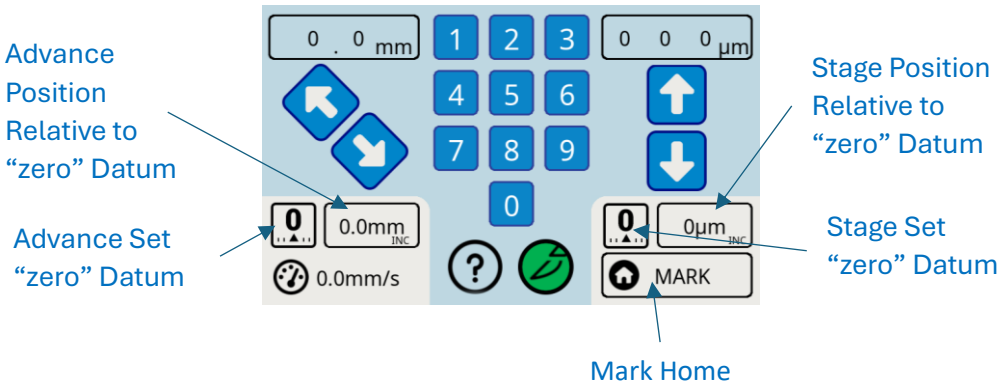
1. Move the Advance position using the Rotary dial. Rotate to select speed, and then momentary press the Rotary Dial to toggle start/stop. The Advance speed may be adjusted whilst the blade edge is in motion or stationary.
2. Move the Stage position using the Up / Down buttons. Press and hold to move, release to stop.

The positions of the Advance or Stage may be read from the "position" buttons; pressing the position button toggles between Absolute position (ABS), and Incremental (INC):

Advance Position ABS: the distance of blade edge from the rear edge of the specimen holder. Selecting the Advance Position Window toggles the display to INC, showing the blade edge position relative to any user defined position. To set this user datum, whilst the position button is displaying INC, position the blade edge as required and select the 0 button.

Stage Position ABS – distance from the top face of Tissue Mount to the blade edge. Selecting the Stage Position Window toggles the display to INC, showing the blade edge position relative to any user defined position. To set this user datum, whilst the position button is displaying INC, position the Specimen holder as required and select the "0" button.

In the Incremental position mode, the position can be zeroed to better visualize and plan the movement trajectory.



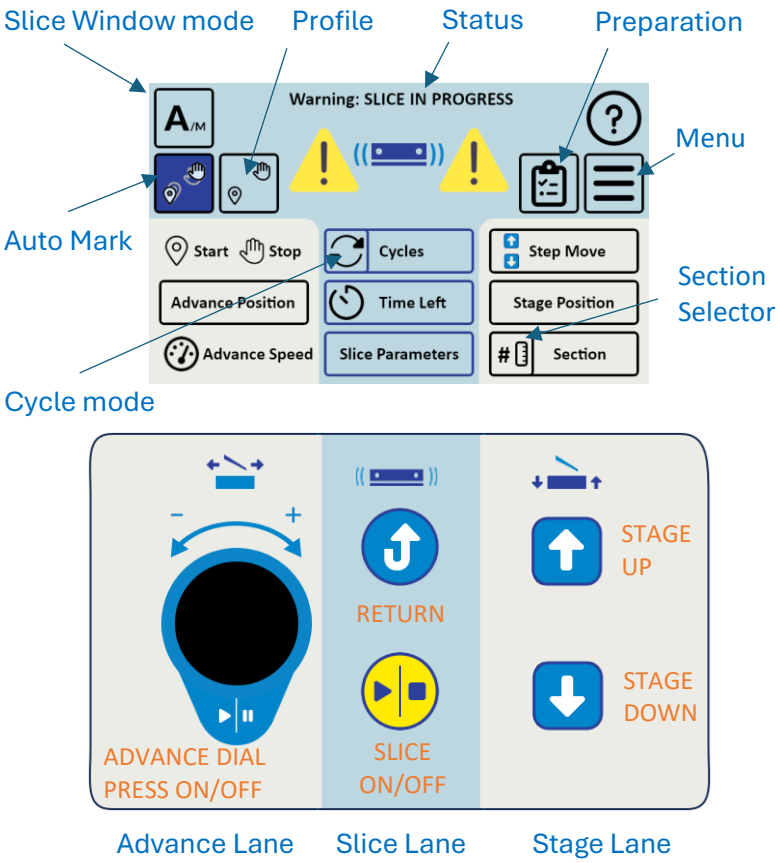
The Move Screen with both axis set to INC

Mark Home (Optional) – select MARK to save the stage position for the next slice. When loading the bath, this will be the new default position the stage will rise to. Optimal positions of the Tissue Mount saved via Custom Setup prior to slicing (see section 15), ensure that it is saved or written down for future reference.

When the desired position of the blade edge relative to the tissue specimen has been found, select the slice button to proceed to the Slice Screen (see section 14). It is possible to return to the Move Screen at any point by selecting Advance position or Stage position.

14 Tissue Specimen Slicing

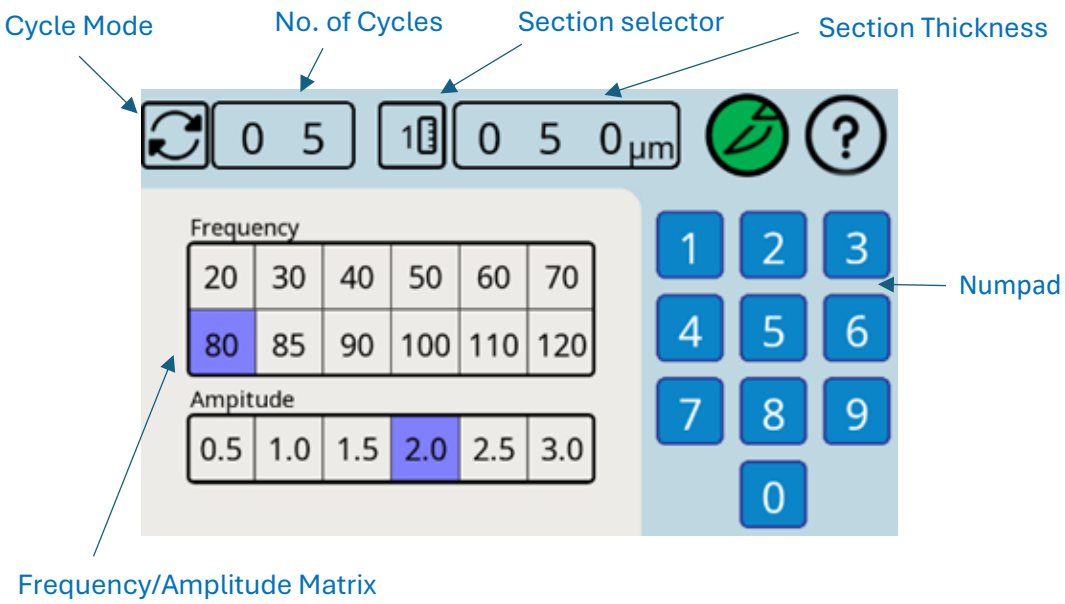
When the blade is optimized and positioned correctly relative to tissue specimen, the slicing can proceed.



The slice screen & Keypad

14.1 Slice parameters

Slice parameters are all displayed on the slice screen and can be updated by pressing the desired parameter button (Cycles, Slice Parameters and Section). This will open the Slice Parameters Screen. Slice parameters can be stored as part of the Custom Setup as described in Section 15.



Section

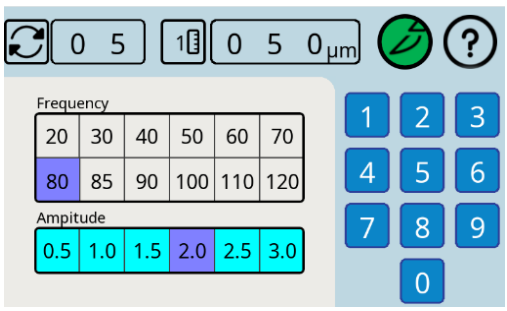
The Section selection button, allows the sequential selection of three section thicknesses (denoted by the number 1-3 with the ruler); each slice thickness option may be edited within a range of 001µm to 999µm using the number pad. See Section 14.5.

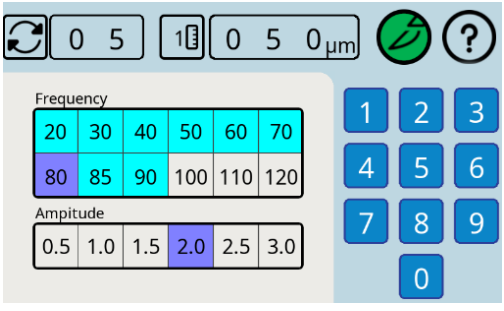
Cycles

See section 14.6

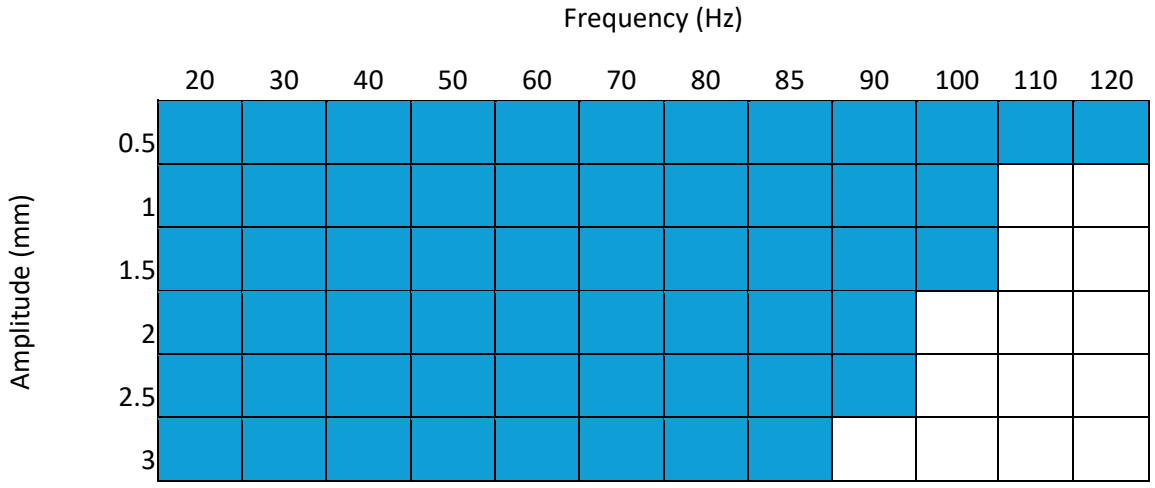
Frequency/Amplitude Matrix

Within the Parameters Screen selecting the desired frequency will highlight the available amplitudes in cyan. Alternatively selecting the desired amplitude first will highlight the available frequencies in light blue. The selected frequency and amplitude will be highlighted in dark blue.





Note: for the higher frequencies, only the lower amplitudes are possible, see the table below.



Select the Slice button to return to the Slice Screen.

14.2 First Pass

Fine tuning of the blade position relative to the mounted tissue specimen may be achieved prior to taking a slice by operating the Blade Advance Rotary Dial. The stage height can be adjusted using the up and down buttons on the keypad. This will move the stage respectively and the Stage position will be updated on the screen. Pressing the Step move button will change the adjustment value. Note. For the first pass, the section value will not be affected by this adjustment.

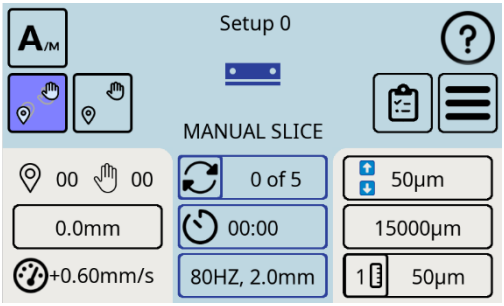
14.3 Return to start

Selecting the return button after a slice, the blade advance will retract to the selected Start position. As part of the return move, the stage is retracted slightly to avoid rubbing across the specimen. When the Start position is reached the stage will be incremented by the selected specimen thickness, ready for the next slice.

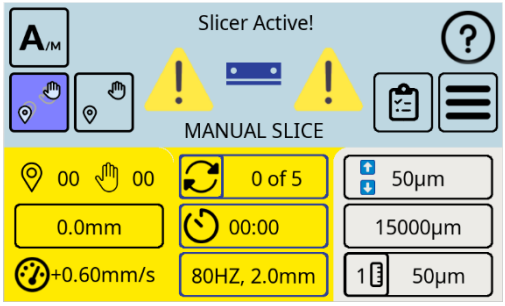
14.4 Slice Mode

Two Slice Window modes are available and can be selected by toggling the Slice Window mode button between **A**utomatic slice window/profile and **M**anual slice window. Automatic is the default setting, though this may be changed as part of the Custom Setup (see section 15). The following list shows how the different slice modes operate:

1. **+ Automatic Mark and recording an Image (Default)**
   When first entering the slice screen, this mode is set by default. Automatic Slice Mode facilitates the "Auto-marking" of Start and Finish points by recording them during an active slice.

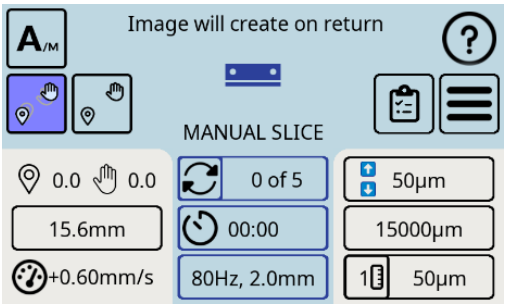


Press the Slice button on the keypad. As the slice is being taken, the user has full control of the blade advance speed and the ability to pause the Advance via the Rotary Dial.

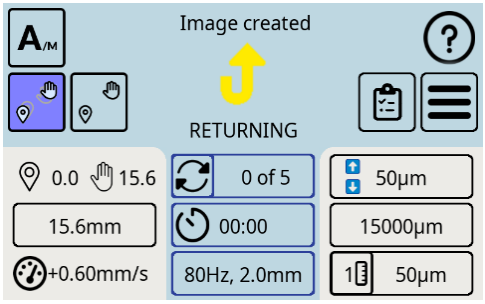


When the blade has advanced through the tissue, press the Slice button on the keypad to stop the slice – an "image" will be recorded for this slice. NOTE: The "image" of the slice contains the slice's Start and Finish points, plus the variations in the Advance speed made by the user during the slice.

The touchscreen will prompt "Image will create on return".



Press the Return button on the keypad – the recorded “image” will be stored from this slice and be available for subsequent slices.

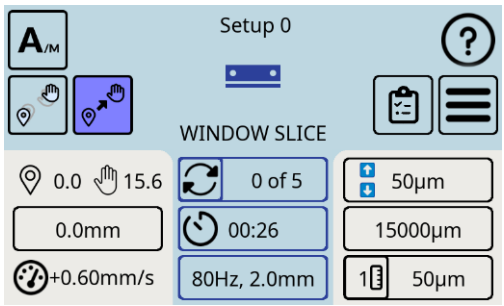


Alternatively, if the image is not required, press the Auto-Mark button. Take another slice, the touchscreen will then prompt “Set mark to create image on return”. When Return is pressed the image will be discarded. The previously saved image will still be available.

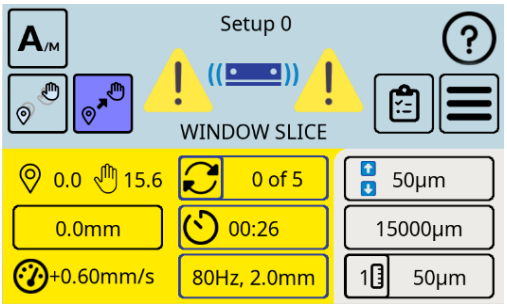
2. + + Automatic Window Slice Procedure

This mode uses the Start and Finish points of the most recently stored image. An image must be available. The advance speed between these points is controlled by the user.
Select the profile button until the “window icon” appears in blue. This button toggles between manual slice, window slice and profile slice. Note: Ensure that Auto-Mark button is deselected if you do not wish to overwrite the ‘slice image’.

If required, select the desired Cycle option, refer to section 14.6.

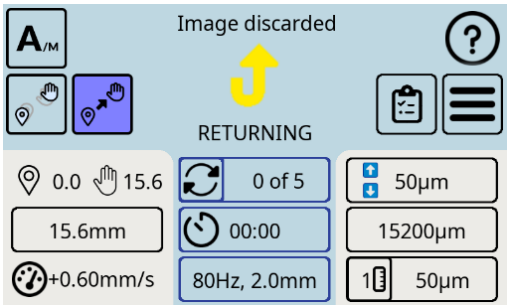


Press the Slice button on the keypad.



Adjust Advance speed as desired during slicing via the Rotary Dial.

Prompt “Image discarded” will be displayed on the Touchscreen for all subsequent slice images created; to overwrite and store with the most recent slice image, select the Auto-Mark button (note: Auto-Mark cannot be selected whilst slicing is “active”).



Repeat slices may be taken until the Limit of Stage travel has been reached.

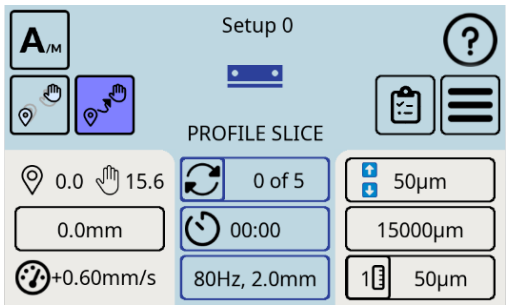
3. + Automatic Profile Slice Procedure

From the most recently stored image, Start, Finish points and the Advance speed profile across the slice may be used for subsequent slices.

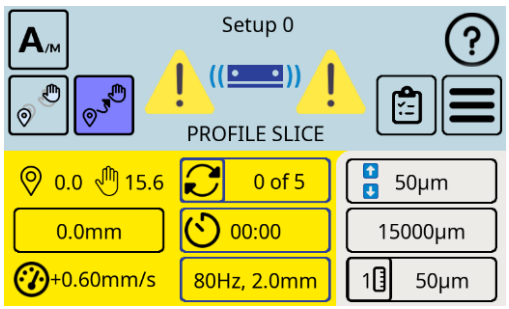
When the slicing is “active” the user can pause the Advance by momentarily pushing on the Rotary Dial; but will be unable to adjust the Advance speed. To return to manual control during a slice, toggle the window/profile button to deselect. The speed advance speed is now controlled by the speed knob.

Select the Profile (window/profile) button (this will highlight in blue).

Note: Ensure that Auto-Mark button is deselected if you do not wish to overwrite the ‘slice image’.



Press the Slice button on the keypad.



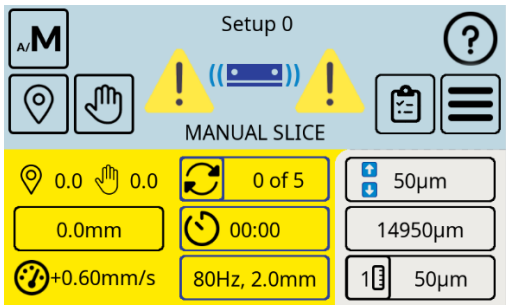
Repeat slices may be taken until the Limit of Stage travel has been reached.

4. Manual Slice Procedure

In this mode it allows you to set Start and finish limits manually when a slice is taken.

Before slicing, a Start limit can be created by pressing and holding the Start limit button. Momentary pressing this button toggles the set limit on and off (ON =).

Press the slice button on the keypad to take a slice.



When the slice has been taken it is possible to mark a Finish point by pressing and holding the Finish button. Momentary pressing this button toggles the set limit on and off (ON =).

Press the Return button on the Keypad to return to the Start Limit. If a limit is not set, then the blade will return to the blade advance home position.

If the Finish limit has been set, subsequent slices will be Windowed. It is possible to select a cycle mode (see section 14.6). The home position will be used as the start limit if none is set/selected.

Repeat slices may be taken until the Limit of Stage travel has been reached.

14.5 Section Thickness.

There are three preset Section thickness available, they are selected by pressing the section selector button. The preset values can be set in the Slice Parameters Screen (see section 14.1).

The section thickness will automatically be added to the stage travel after a Return operation. Making changes after this will automatically readjust the stage height to suit.

There are three ways to make a quick change (Note: this is not possible on the first pass). If the pre-set value is not used, changing the value will move the section selection to #.

a. Using the keypad up/ down buttons will adjust the Section thickness in steps by the value indicated in Step Move. Pressing the Step move button will change the adjustment value.
b. Press Section to enter the Slice Parameters Screen. In the Section display, make sure # is selected (toggle through). Enter the desired section thickness. Pre-set values can also be edited here and saved to the Custom Setup (see section 15).
c. Press Stage position to enter the Move screen. Adjust the section thickness as required.

14.6 Repeat Cycles, Stop at Start and Stop at Finish.

It is possible to enable a fully automatic repeat slice operation, a Stop at start operation and a Stop at Finish operation. They are available for both Automatic and Manual slice modes. A + / M + Window or A + Profile repeat must have been selected to enable these modes.

Mode selection

The selected mode is indicated on the Cycle mode button. Pressing this button will enable the function. To change the mode, Press the large cycles display to enter the Slice Parameters screen (see section 14.1). Toggle the Cycles icon here to select the mode and enter the number of cycles for the repeat function using the numpad. These parameters can be saved to the Custom Setup (see section 15).

Repeat Cycles

With this mode enabled the slicer will continually repeat the windowed or profile slice operation for the number of cycles indicated.

Stop at Start

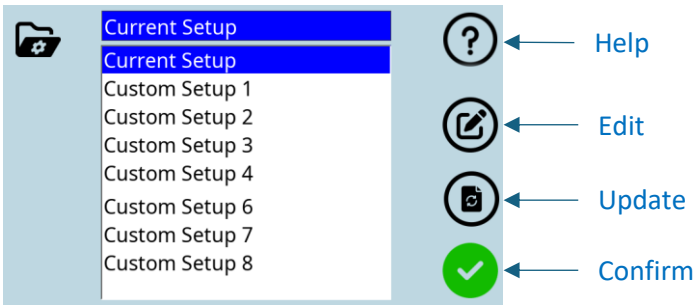
With this mode enabled, on pressing the slice button the instrument will take either a window slice or a Profile slice. At the finish point, the slice will automatically return to Start ready for the next slice operation.

Stop at finish

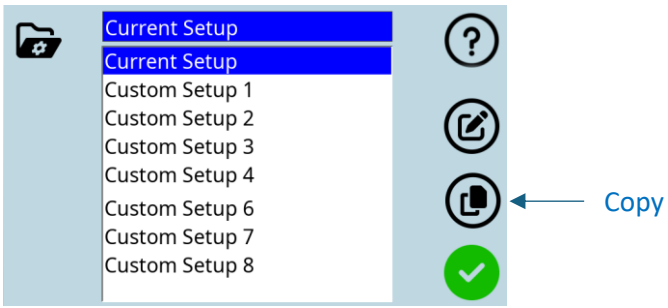
With this mode enabled, on pressing the slice button the instrument will take either a window slice or a Profile slice. At the finish point, the slice will stop. Pressing slice at this point, the instrument will Return to the Start point and begin taking the next slice. Pressing Return when at the finish point will make a return move only.

15 Custom Setup

Enter the Custom Setup screen via the Startup screen, the Preparation screen or the Menu screen.

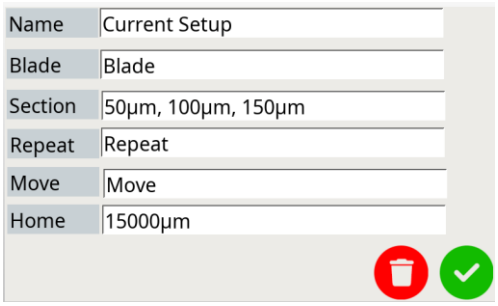


The screen opens with the current setup highlighted in the selection list. If any parameters have been updated during the current slice session the profile can be updated by pressing the update button. Another setup can be overwritten with the current setup by selecting from the list and pressing the copy button.



To change between setups. Highlight the desired setup and confirm. Note: without saving any changes to the current setup, any changes will be lost.

To edit a setup, highlight the required setup and press edit. Select the field in the Custom Setup Details Screen and it will display an on-screen keyboard.
Note: Only the setup name can be changed, it is not currently possible to edit any other parameters from this screen.



Custom Setup Details

16 Specifications

Dimensions	
Bench space requirement (excluding light source and microscope):	Width: 410 mm Depth: 400 mm Height: 270 mm
9000SMZ Weight (excluding accessories)	32 Kg
Boxed shipping weight and dimensions (including accessories and wheeled Transport Case)	50 Kg – 83cm x 55cm x 44cm
Tissue bath size	80 mm x 90 mm x 25 mm (nominal)
Tissue bath volume (with specimen holder)	160 ml (nominal)

Slice table and cutting head	
Bath table rise and fall speed	1.0 mm/sec maximum
Maximum (vertical) travel of bath table	20 mm
Cutting head advance speed	Minimum: - 4.0 mm/sec (- 1.00 during slicing) Maximum: +4.0 mm/sec (+1.00 during slicing)
Cutting head retraction speed	4.5 mm/sec
Maximum travel of cutting head	40 mm (nominal)

Blade	
Section thickness step size	0.001 mm
Blade oscillation frequency (9000SMZ)	Minimum: 20 Hz Maximum: 120 Hz (amplitude dependent)
Frequency step size	10 Hz
Blade oscillation amplitude (peak to peak)	Minimum: 0.5 mm (nominal) Maximum: 3.0 mm (nominal)
Amplitude step size	0.5 mm (nominal)

Power	
Power requirements	115 VAC 60Hz - 230 VAC 50Hz
Power rating (AC Typ.)	100 W
Fuse rating (115V -230V Universal)	T1.25A
Light source	8 VDC 3W

17 Cleaning, Sterilizing and Autoclaving

The blade holder can be fitted or removed from the vibrating head using the 2.5mm hexagonal driver supplied in the Toolkit. The blade holder may be autoclaved using standard procedures. Replacement blade holders are available for purchase should the original items be lost, damaged or an extra is required for continual use.

The stainless-steel inner bath and tissue mounts are made from magnetic stainless steel. This steel is not completely immune from the effects of salt buffers and the items should be thoroughly rinsed with clean water after use.

The tissue mounts and the inner stainless steel bath are autoclavable. The tissue mount is located by a circular magnet to the inner bath, and the two may be separated by simply pulling the items apart. Similarly, the Inner Bath is also located in the Outer Bath by magnets and may be separated by pulling them apart.

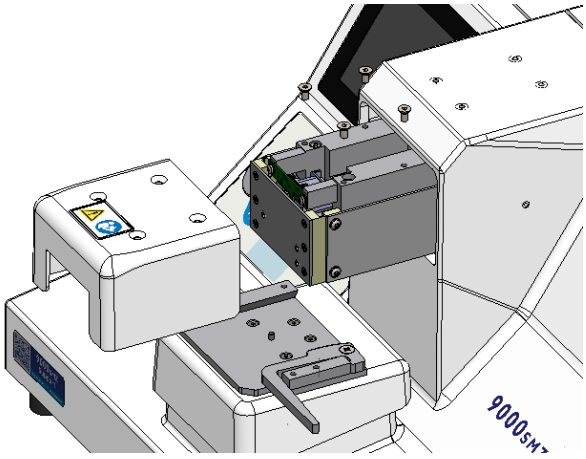
Autoclaving of the tissue mounts and inner bath may be carried out using standard procedures. The outer bath and its associated parts are not autoclavable, nor should they be dismantled.

Additional or replacement outer baths, inner baths, and tissue mounts are available for purchase.

Should the vibrating head require cleaning due to splashing or build-up of aerosol residue from bath solutions, the cover must be removed.

Procedure to remove the Cover:

1. Remove the Blade from the Blade Holder.
2. Remove the Blade Holder.
3. Using the Move Screen commands lower the Stage/Outer Bath to the lowest possible position. BOTTOM will be displayed on the Stage position window and advance the blade position to its maximum forward position so that FRONT will be displayed on the Advance position window.
4. Switch OFF the 9000SMZ and unplug from the mains supply. The blade advance and Stage will remain in their current position.
5. Remove the Outer Bath.
6. Remove the four retaining screws on the cover using the 2.5mm hexagonal driver supplied in the Toolkit.



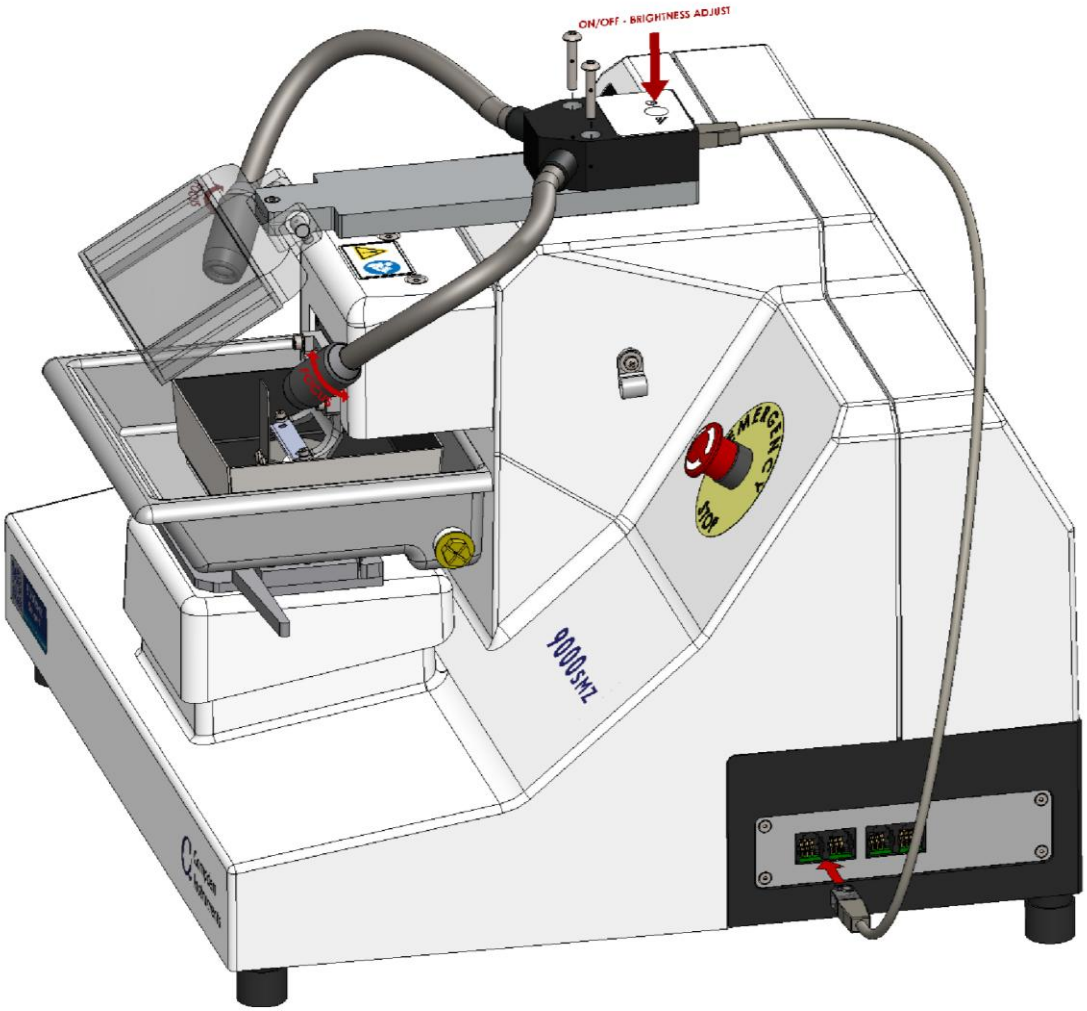
7. Clean the front and rear faces of the Blade Holder mounting plate, and inside the cover using soapy water and a soft cloth. DO NOT use chlorinated bleach or anything that could be corrosive.

8. Check that the clearances between the drive magnets, hinges, and leaf springs are free of dust and salt residue.
9. Refit the cover with the four fixing screws.
10. Plug in and switch the 9000SMZ ON and the Advance and Stage mechanisms will return to their “Home” positions.

18 Optional Accessories

18.1 Cold Light Source

The 9000SMZ Instrument may be (optionally) supplied with a LED cold light source. The light source should be fixed to either the top of the instrument cover or may be fixed to the top of to the magnifier mounting bracket. The screws supplied with the light Source should be tightened using the 2.5mm hexagonal driver supplied in the Toolkit. Do not over-tighten the screws. The Light Source is powered via the RJ11 connection. The light Source may be plugged into any of the four available ports on the side of the 9000SMZ.

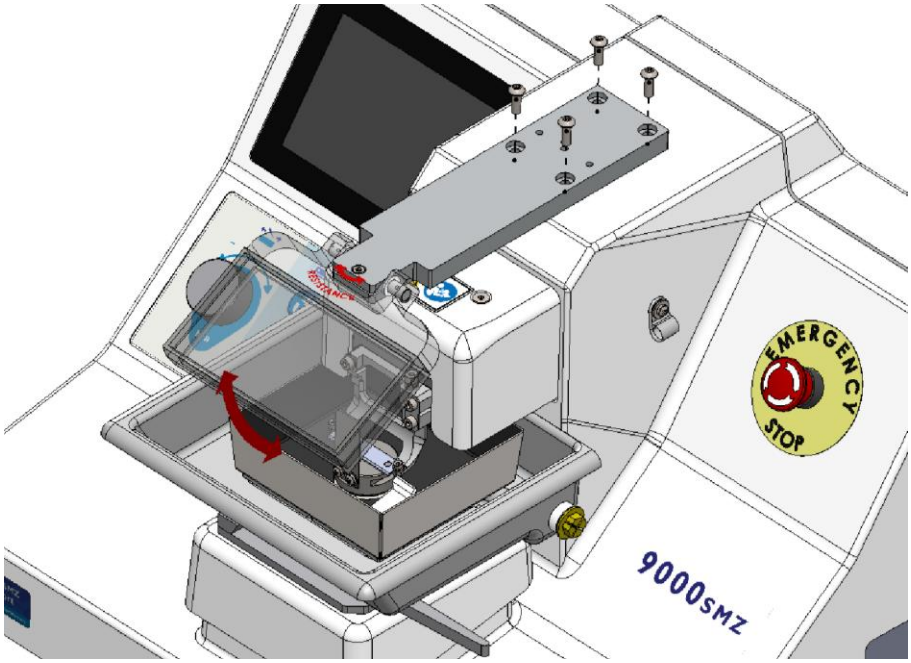


The light source can be switched on/off and the light intensity controlled via a sequential pressing of the button on top of the body of the light source. A brief press will switch the unit On or Off, whilst a sustained press will cycle through the light intensities available. Once the preferred light intensity is reached, release

the button. The unit will remember the chosen intensity for the next use. The output beams may be focused by rotating the lens ferrule at the end of each flexible arm.

18.2 Magnifier

The 9000SMZ Instrument may be (optionally) supplied with a low power magnifier (2x magnification).



The magnifier is to be fixed to the top of the instrument cover using the screws provided. The screws should be tightened using the 2.5mm hexagonal driver supplied in the toolkit. Do not over-tighten the screws.

To ease the lens' resistance to the inclination adjustment, loosen the tightening screw using the (2.5mm hexagonal driver supplied in the toolkit), and pivot the lens as required. Re-tighten the screws once in the optimal position.

The optional Cold Light Source may be fitted on top of the Magnifier as shown in 15.1.

18.3 Microscope Mounting Point

A microscope can be attached to the instrument with four bolts to the dedicated mounting area on the base casting on the rear of the instrument, which ensures a rigid mount, rendering the microscope free from vibration. An adapter block can be purchased from Campden Instruments to use with an existing standard microscope assembly. Contact Sales for more information.

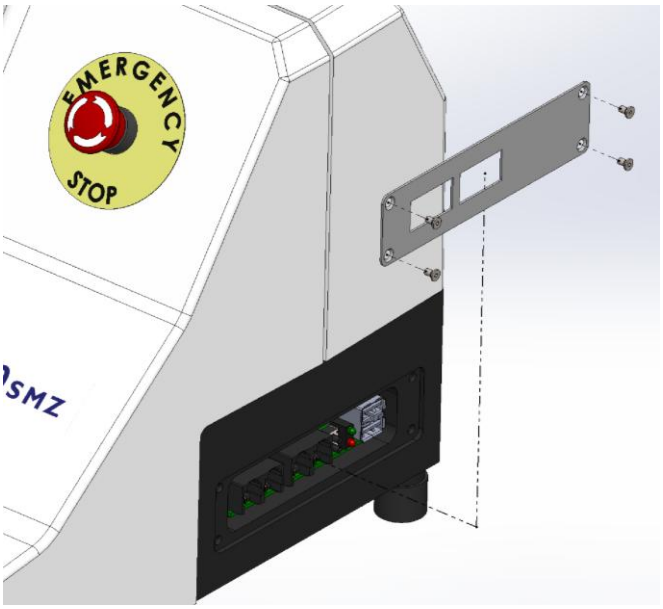
Note: The Campden cold light source (referenced in 18.1) can be fitted directly to the top of the 9000SMZ independently of the microscope. For ease of access, the light source should be fitted before fitting the microscope.

19 Updating Firmware

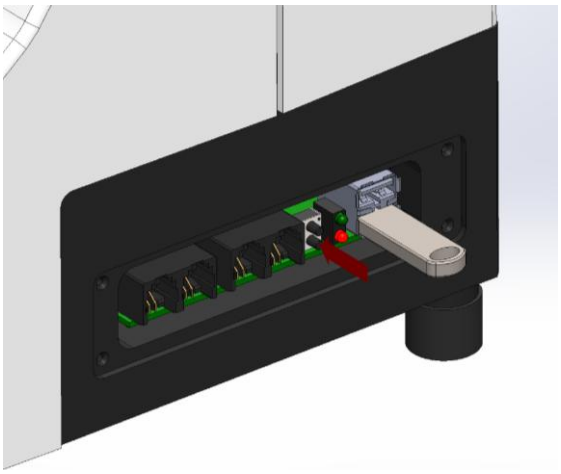
The 9000SMZ is supplied with a suitably formatted **USB Flash Drive (CI.9000-USB)**, inside the Toolkit. The latest releases of the Main Board and User Board firmware may be downloaded on to this, from the Support Hub webpage (see section 4).

Please follow the procedure below to update the 9000SMZ to the latest firmware versions:

1. Switch the 9000SMZ OFF.
2. Remove the Port Cover Pate using the 1.5mm hexagonal driver supplied in the Toolkit. Remove the four screws.



3. Place supplied USB Flash Drive into the lower USB port on the 9000SMZ.
4. Press and hold the bottom button.
5. Whilst holding the bottom button, switch ON the 9000SMZ. The red LED will illuminate.



6. Release the lower button. The red LED will flash indicating the firmware being downloaded. Please note that the Touchscreen will be OFF for a short period of time while the firmware is being updated.

7. Wait until the red LED stops flashing (turns OFF) and the home screen is displayed on the touchscreen.

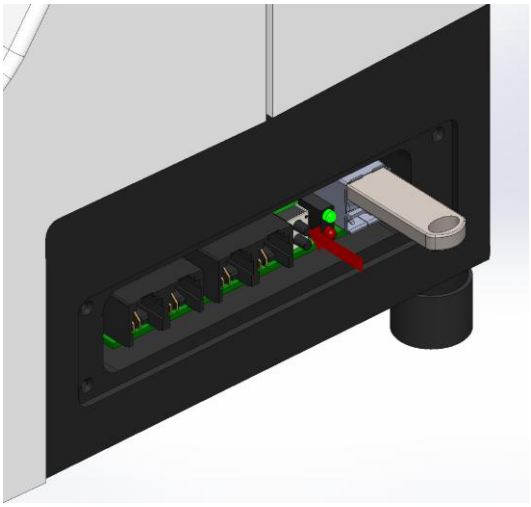
8. Check that the Touchscreen in top left-hand corner displays M** (where ** is the new firmware revision number). The Main Board firmware has now been updated). **DO NOT remove USB flash drive whilst the 9000SMZ is ON.**

9. Switch the 9000SMZ OFF.

10. Remove USB flash drive from the lower port and now insert it into the upper USB port.

11. Press and hold the upper button.

12. Whilst holding the upper button, switch ON the 9000SMZ. The green LED will illuminate.



13. Release upper button and the green LED will flash indicating the firmware being download. Once again, the Touchscreen will be OFF for an extended time while the update occurs.

14. Wait for the green LED to stop flashing (turns OFF) and for the home screen to be displayed.

15. Check that the Touchscreen in top left-hand corner displays U**. The User board firmware has now been updated. **DO NOT remove USB flash drive whilst 9000SMZ is ON.**

16. Switch the 9000SMZ OFF and remove the USB flash drive from the upper port.

17. Replace the Port Cover Pate using the 1.5mm hexagonal driver supplied in the Toolkit to screw-in the four screws.

20 Maintenance and Service

The 9000SMZ Instrument has been designed to give reliable, trouble-free use. When the equipment has been in service for a number of years it may be advisable to have a comprehensive service, Campden Instruments or its local agents will be pleased to advise on this and operate a fast turnaround on the equipment returned for servicing or repairs.

Instruments will not be accepted for service or repair unless the unit has been adequately and properly packaged. Additionally, instruments will not be accepted without prior authorisation and have been certified as being uncontaminated with any material that may be hazardous to the health of service personnel.

Before returning the instrument, contact Campden Instruments to obtain a Returns Authorisation Number. A Returns Authorisation and Decontamination Certificate blank is shown in section 23. The form may be photocopied as required. Further blanks can be obtained by contacting Campden Instruments directly.

NOTE: Where the instrument has been used in an application requiring thin film isolation it may NOT be returned for servicing.

21 Technical Support

Should any problems with the instrument be experienced, Campden Instruments has online Technical Support facilities.

https://campdeninstruments.com/pages/Vibrotome_Support

Before contacting Technical Support, it is strongly advised to have registered the 9000SMZ in question using the QR as described in Section 4 to access all on-line support material.

When contacting Campden Instruments for technical support, it is helpful to have the following information available:

Service checklist	Necessary information	Location
☐	Instrument model	On the CE label on the rear the instrument 
☐	Serial number	
☐	Main (MX) and User (UX) firmware number	Left-hand corner of the start screen 
☐	Number of error code witnessed (See section 22)	If possible, provide a video.

Please note that technical Support can only help with queries relating to the instrument function, queries regarding instrument application should be directed to the sales department at Campden Instruments or the local sales agents.

22 Campden Returns Authority and Decontamination Certificate

Note: You must complete the following form before returning the equipment, failure to do so may result in a refusal to accept the shipment and may cause delays in processing the service or repair.

_____ _____
Returns (RMA) Number Date

_____ _____
Customer Address

_____ _____
Contact Name Contact Details

_____ _____
Product/Serial Number Product Name/Description

_____ _____
Contact Name Contact Details

Description of problem/reason for return. (continue on separate page if necessary)

_____

_____

_____

Note: Blade must be removed from blade holder. Returns from outside the EU must be state as "Returns of Nominal Value." Failure to do so will incur customs charges.

The following Declaration of Decontamination status applies to all items returned to Campden Instruments. If the answers to Section A2 and all of the question in Section B are NO, then ignore Sections D to F. Otherwise all Sections must be completed. You must complete and sign the Declaration.

A	1. Has the package been opened?	YES	NO
	2. Has the product been used?	YES	NO
B	Has the product been exposed internally or externally to any of the following?		
	1. Biological Hazards (pathogenic viruses, bacteria, fungi etc.)	YES	NO
	2. Radioactive Sources (If yes, DO NOT RETURN)	YES	NO
	3. Chemical Hazard (mercury, salts, acids, bases etc.)	YES	NO
	4. Rabies, BSE, CJD, nCJD etc.	YES	NO

5. Any Other Hazard (specify in section D) YES NO

C Does your laboratory contain animals that need to be shielded against pathogens? YES NO

D Provide details of any indicated hazards. Include details of names and quantities of agents, Material Safety Data Sheets and First Aid Information.

_____

_____

_____

E Describe your methods of decontamination, including agents used for this purpose.

_____

_____

_____

F Are there likely to be any areas of residual contamination? Please be specific.

_____

_____

_____

Declaration

I declare that the information given above is true and complete to the best of my knowledge and belief, and that I have taken all reasonable steps to ensure its accuracy. If there is any subsequent outbreak of an infectious agent in my laboratory, I will inform Campden Instruments immediately.

_____ _____

Authorised Signature Date

_____ _____

Name (Print) Position

_____ _____

Phone Fax

Return Address

Campden Instruments, 4, Park Road, Sileby, Loughborough. LE12 7TJ. U.K.

23 Spare Parts and Accessories

When ordering, please order by part number and description.

Product	Model
Magnification	
Magnifier(2X)	CI.7000-1-3 (From Jan 2026: CI.VM-MF-01)
Microscope Bracket	CI.7000-1-1-1 (From Jan 2026: CI.VM-MS-01)
Illumination	
Cold light source	CI.CL200 (From Jan 2026: CI.VM-CL-01)
Tissue bath assemblies	
Outer bath assembly	CI.9000-OB (From Jan 2026: CI.VM-OB-01)
Inner tissue bath assembly	CI.7000-3-2A (From Jan 2026: CI.VM-TB-01)
Tissue Mounts	
Replacement Standard Tissue Mount	CI.7000-4-1A (From Jan 2026: CI.VM-TM-01)
Replacement adjustable specimen holder	CI.7000-4-2A (From Jan 2026: CI.VM-TM-02)
Replacement rectangular specimen holder	CI.7000-4-3A (From Jan 2026: CI.VM-TM-03)
Blade holder	
Blade holder	CI.9000-BH (From Jan 2026: CI.VM-BH-01)
Replacement blade clamp fixings for VM-BH-01 *(Left and righthand screws with acetal washers)*	CI.7000-5-4 (From Jan 2026: CI.VM-BF-01)
Fixing Screws	CI.9000-FS (From Jan 2026: CI.VM-BS-01)
Splash Plate	CI.9000-SP (From Jan 2026: CI.VM-SP-01)
Blade alignment equipment	
Opti-Cal Blade Calibration unit	CI.9000-OS (From Jan 2026: CI.VM-OS-01)
Blade Handling	
Blade Handling Tool	CI.7000-7-1 (From Jan 2026: CI.VM-BT-01)
Blade guard	CI.7000-7-2 (From Jan 2026: CI.VM-BG-01)
Blades	
Stainless steel blades *(pack of 50)*	CI.7550-1-SS/50
Ceramic blades *(pack of 5)*	CI.7550-1-C
Miscellaneous	
Wooden Crate	200107 (From Jan 2026: CI.VM-CW-01)
Transit Case	CI.9000-Case (From Jan 2026: CI.VM-CP-01)
USB Flash Drive	CI.9000-USB (From Jan 2026: CI.VM-FD-01)
IEC Mains Inlet Fuse	1008184 (From Jan 2026: CI.VM-IF-01)

24 EC Declaration of Conformity

Name and address of Manufacturer
Campden Instruments Limited
PO Box 8148
Loughborough LE12 7XT
UK

Description of Instrument
Oscillating Blade Microtome

Model Type/Number
9000SMZ

The instrument specified above complies with the relevant health and safety requirements of the following:

1. EC Directive(s)

The Machinery Directive 89/392/EEC as amended by
Directive 91/368/EEC
Directive 93/44/EEC
Electromagnetic Compatibility Directive 89/336/EEC
The Low Voltage Directive 73/23/EEC

2. UK Regulations

The Supply of Machinery (Safety) Regulations 1992 (SI 1992/3073)
Electricity at Work Regulations 1989

3. European Standards

EN 50081-1: 1992 Electromagnetic compatibility generic emissions standard part 1
EN 50082-1: 1992 Electromagnetic compatibility generic immunity standard part 1

Additionally, the health and safety requirements of the following British and harmonised European Standards have been incorporated in the design of the above instrument:

BS 2771: part 1:1986 (EN 60 204: part 1:1985)
BS 5304:1988

Signed: 

Name: I. Davies
Position: Director
Date: 15th July 2025

Campden Instruments

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