TELEMARK

XIAD, ST-55, ST-3000
SAINTECH ION BEAM SYSTEM

OPERATION MANUAL

This manual covers the operation of these Ion Beam Systems; XIAD, ST-55, ST-3000. For information on installation procedures, refer to separate Installation Manual.

January, 2013

www.telemark.com

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WARRANTY

Telemark warrants the company's products to be free of functional defects in material workmanship for a period of twelve (12) months from date of first delivery.

The abovementioned warranty is conditional upon the product being installed and operated in accordance with instructions provided by Saintech Ion Beam Systems

This warranty is in lieu of all other warranties, expressed or implied and constitutes fulfillment of Telemark's liabilities to the purchaser. Telemark does not warrant the product for use in applications other than that implied by the product specifications.

USER RESPONSIBILITY

The user is responsible for proper operation and ordinary maintenance of the equipment following procedures described in this manual including reference documents. Proper operation includes timely replacement of parts that are missing, broken, or plainly worn. If the user has a reasonable doubt about understanding the use or installation of a component, Telemark or your local representative should be called.

It is vitally important that the user properly install the equipment as described in the Installation manual, with particular attention to the correct grounding methods described.

The Warranty will be void if the equipment is improperly installed and/or grounded.

CUSTOMER SERVICE INFORMATION

When contacting the above for service, please provide the Source Model Number and Serial Number and the Power Unit Serial Number. The source model and serial numbers are engraved on the source shroud. To assist with the diagnosis of any problems it is useful to include all operating parameters such as anode voltage, gas flows as well as the mode of operation. For example; **Pulse** or **Continuous Beam, anode voltages, chamber pressure, gas flow and species of gas**, etc.

IMPORTANT NOTE

Each Saintech Ion Beam System is factory fitted with a Water Flow Monitor. This device is provided to protect the equipment against use of the Ion Beam Equipment in the event of insufficient cooling-water flowing. The devices are factory-set for the flow considered to be the minimum required to ensure damage will not occur within the power range of the Ion Beam System.

The equipment is not warranted against damage that may occur should the water flow device be removed or tampered with, set-points altered, disconnected or improperly installed and maintained.

Picture shows an ST55 anode after running the source for a few minutes without cooling water. The anode was not repairable and the rare earth magnet and anode insulator required replacement

SAFETY REQUIREMENTS

The equipment used in this process produces voltages and electrical currents at levels high enough to present extreme hazard. Only persons suitably qualified to work on such equipment should do so.

The Power Supply is equipped with an interlock system which disables the supply if all connected interlocks are not enabled e.g. vacuum and chamber door interlocks.

The interlock system is provided to protect both personnel and equipment. It is highly recommended that the interlock system should never be bypassed *See Section on Installation*

1

SYSTEM DESCRIPTION

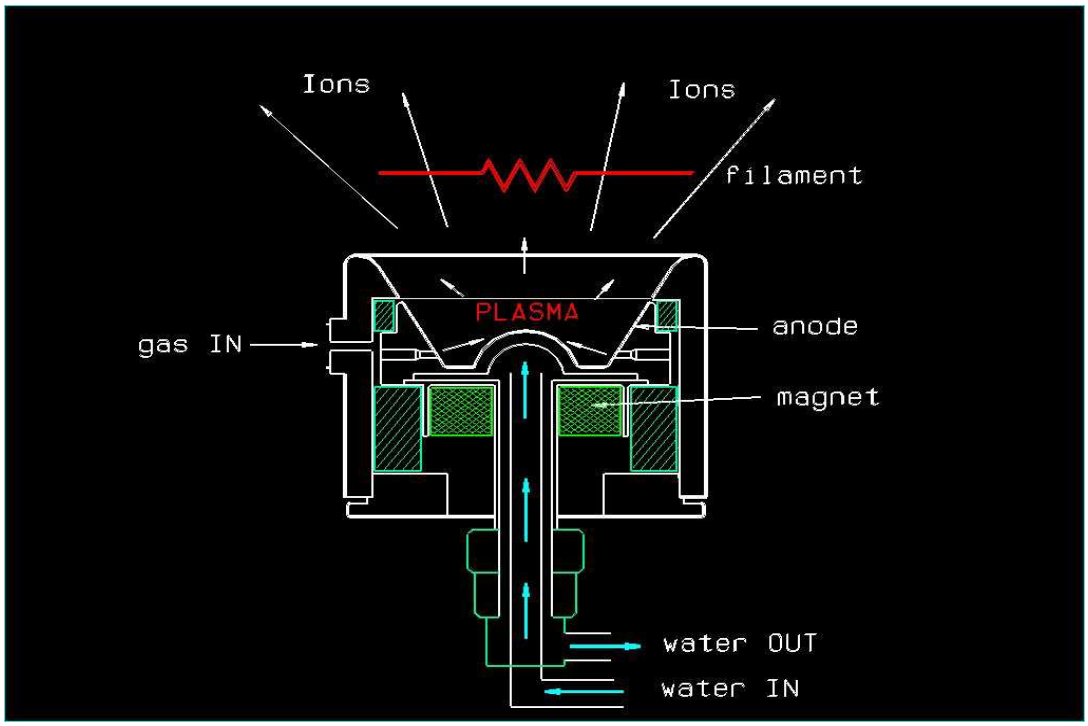
The SainTech Ion System comprises a high-energy broad beam ion source and a dedicated and integrated power system. The ion source is mounted in a vacuum system and can direct a beam of positively charged gas particles toward a target area – typically, the substrates.

Ion Source. A plasma of the process gas is produced in the conical volume of the ion source. Positive ions, produced in the plasma, are accelerated from the source under the influence of electrostatic and magnetic fields. The plasma is initiated and maintained by accelerating a high current of electrons from a heated cathode to the anode. Gas is injected through a series of ports located within the anode and into a region coincident with the primary electron beam. The same cathode also serves to maintain beam charge neutrality by emitting an excess of electrons to that required to produce the desired beam current.

Gas Flow. The Mass Flow Controller supplies the process gas to the ion source to a factory set maximum flow. The flow controller is powered by the electronic system and the flow can be controlled by the touch screen. The gas flow bears a direct relationship to the beam current and the resulting ion current.

Filament Power. An AC current supplied by the power system heats the filament. The filament power can be preset to an optimum value and does not normally require regular adjustment. The lifetime of cathodes depends on the species of process gas used. In pure oxygen, cathodes have typical lifetimes of between 6 to 12 hours depending on beam power, and many more hours in less reactive gases such as nitrogen or argon.

The figure below shows schematically the principle of operation of the grid-less ion source


Ions
Ions
filament
PLASMA
gas IN
anode
magnet
water OUT
water IN

2

DESCRIPTION OF THE ION SOURCE POWER SYSTEM

Initial Power Up.

Before applying power to the ion beam system for the first time check that all connections have been made as outlined in the Installation Manual and that the ion source has been installed correctly in the vacuum environment. Check also that a filament(s) have been installed correctly in the ion source.

Switch on the power switch located on the lower left-hand front panel. The Touch Screen will be seen to power up within a few seconds. Once powered up, the screen below will be presented (the numbers in various boxes may be different from shown).

Figure above shows the main screen. This screen provides all functions to operate the Ion Beam System in the normal continuous mode.

Notes on Functions – starting from top left counter-clockwise:

1. "**ST55 1.5kW**" refers to the model of the ion beam system – not active

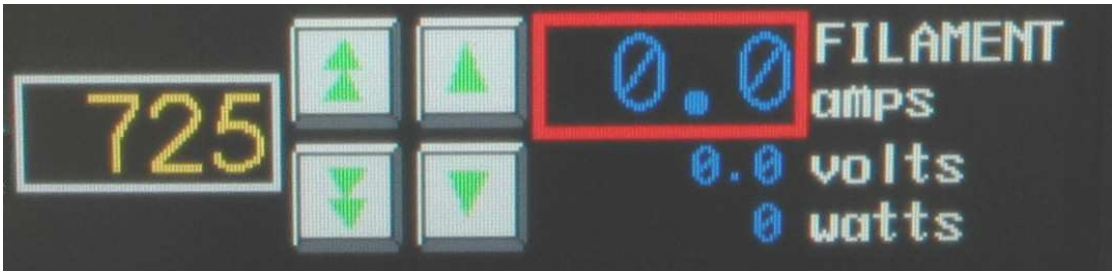
2. "**NO ALARM**" status of alarm. If the alarm is activated at any time, the power supply will be disabled. The alarm icon will change to a red flashing icon. Touching the ALARM icon will display another screen indicating the ALARM error message. For a list of ALARM messages – see Installation & Maintenance Manual

3. "**FCO**" remains a white icon whilever the first filament is still functioning. The icon changes to green when the filament fails (for a single filament) or the first filament fails and the second filament is now in use for a Dual Filament system (not available with XIAD)

4. "**MODE**" Touching the MODE button presents the operator with a new window where other functions and operational modes can be preset or made operational. Refer below for a detailed description of the Mode Select window.

5. "**START**" The START button is used to activate the power to the ion source. It should be noted that, for safety reasons, the START button requires <u>two touches in quick succession</u> to power the system. This avoids unsafe practice where the high voltage may be inadvertently switched ON and cause injury to personnel or possible damage to equipment. Once activated, the START button changes to a STOP "flashing" button. At any time, a single touch will power down the system.

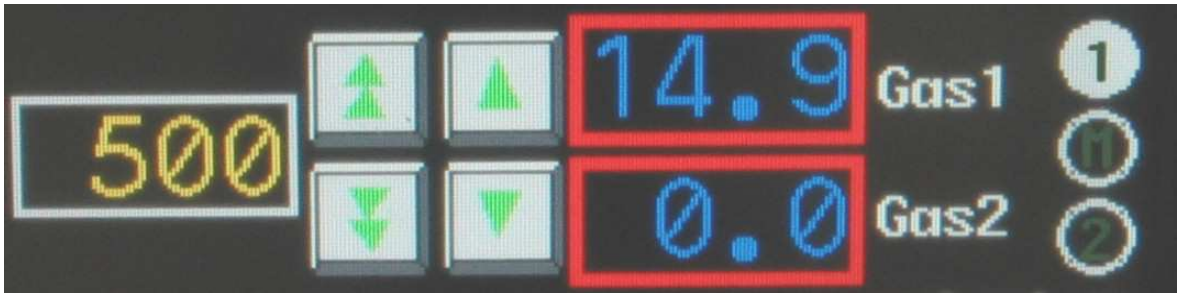
6. "**FILAMENT**" power control. This section of the Main Screen is for the control of the filament and is shown below for convenience. The red bordered button displays the instantaneous filament heating current in amps. There are two



ways to set the filament power. One is to use the UP/DOWN arrows to increment the filament power with the double arrows providing coarse increments and the single arrows fine control. The other method is to "touch" the white bordered 725 button which will open up a key-pad. The required power set point can be typed in. Press "Enter" to activate the selection. Also on this screen is the display of the instantaneous filament "volts" and filament power "watts". During operation, these filament power settings remain active so that changes can be implemented 'on the fly'.

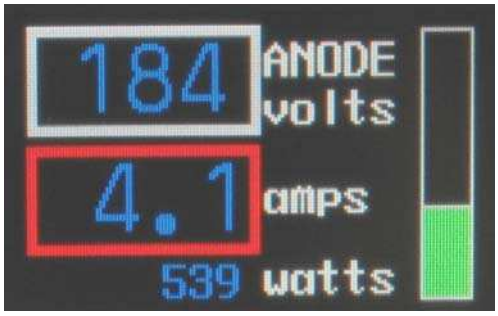
7. "**WATER L/m**" The instantaneous cooling water flow is continuously displayed in litres per minute. Should the water flow drop below an acceptable limit, an ALARM will be raised. If the ALARM is triggered while the power supply is powered on (START ON) the power supply will be shut down. If the power supply is in standby, the ALARM status will change and the START function will be de-activated.

8. "**Gas**" flow control. As per the Filament power control, the gas flow control can be similarly set. The UP/DOWN arrows can be used to increment the selected gas flow and the white bordered ("500") button, when touched, will bring up a numeric keypad from which can be entered the required gas flow.



The number to be entered is within a range of 0 to 1000 where 1000 represents the maximum flow of the selected MFC. In the example shown above, a number of 500 sets the flow of Gas 1 (selected) to be one half of the maximum flow of 30 sccm (= 15 sccm). The three small buttons to the right of the active area marked as "1", "M" and "2" are provided to select either of the pure installed gases, Gas 1 or Gas 2, or Mixed gases of the two installed gases. This two gas facility is only available if the Dual Gas Option (DG) is installed. For a detailed description of setting the Dual Gas Mixtures, see further in this manual under Dual Gas Control.

9. **Anode Current & Beam Power Monitoring**. This section of the Main screen provides instantaneous monitoring of the Anode (or plasma) current as well as the beam power. The beam power is calculated as the instantaneous product of the anode current and the RMS anode voltage and is displayed as watts. In the current example, the product of the RMS of 184 volts and multiplied by 4.1 amps = 539 watts. For visual convenience, the instantaneous power is also displayed in the green bar graph to the right of the screen. As the power level increases the green 'bar' rises in the window. In the event that the maximum allowable power is achieved, the green display changes to red and the "**amps**" flashes in red. Any attempt to further increase beam power by increasing gas flow will be unsuccessful.

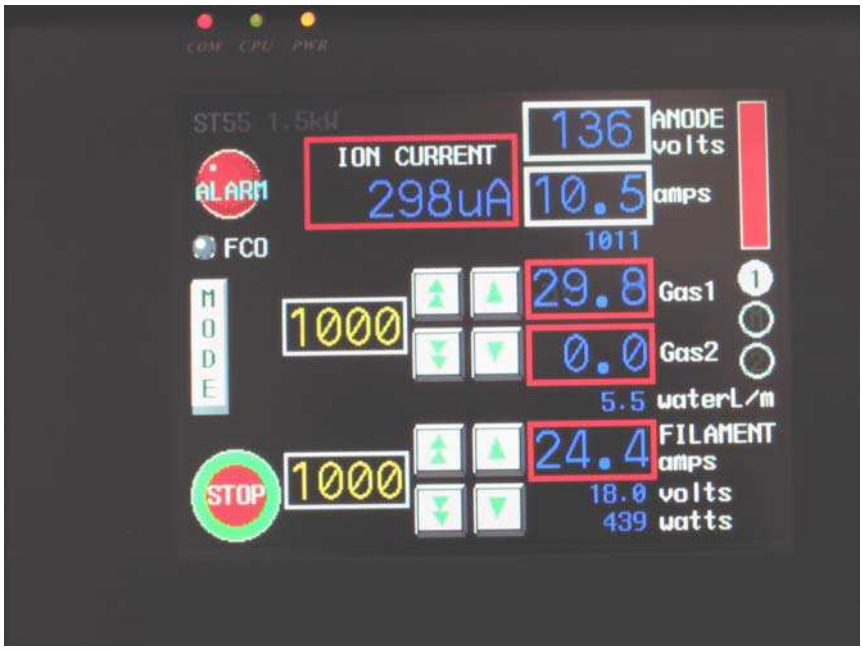


Additional notes on Maximum Power There are two separate maximum power levels:

1500 watts Max Power. When using the two highest anode voltages, i.e. 180 and 225 volts, the maximum allowable power is 1500 watts. At these anode voltages, the maximum anode current is limited to 7 to 8 amps.

1000 watts Max. Power. When using the three lower anode voltages, the maximum power is limited to 1000 watts. This is designed to protect the system against excessively high anode current. At this power level the anode current will be limited to not much more than 10 amps

Image shows the various parameters when maximum power has been reached at an anode voltage of 140 volts. Note that the power bar scale is now red and the power is registering “1011” watts.



10. “ANODE” Voltage Select. To change the Anode voltage, simply touch the white bordered Anode Volts button on the Main screen. This action will bring up an Anode Volts selection menu as shown ⇨. To make the selection, touch the appropriate voltage button. The new selection will appear immediately, however, it will not be applied until the next time the START button is activated. This means that, if the anode voltage change is made while the power is ON, the change will not be effected until the STOP button is first touched and START is initiated again.

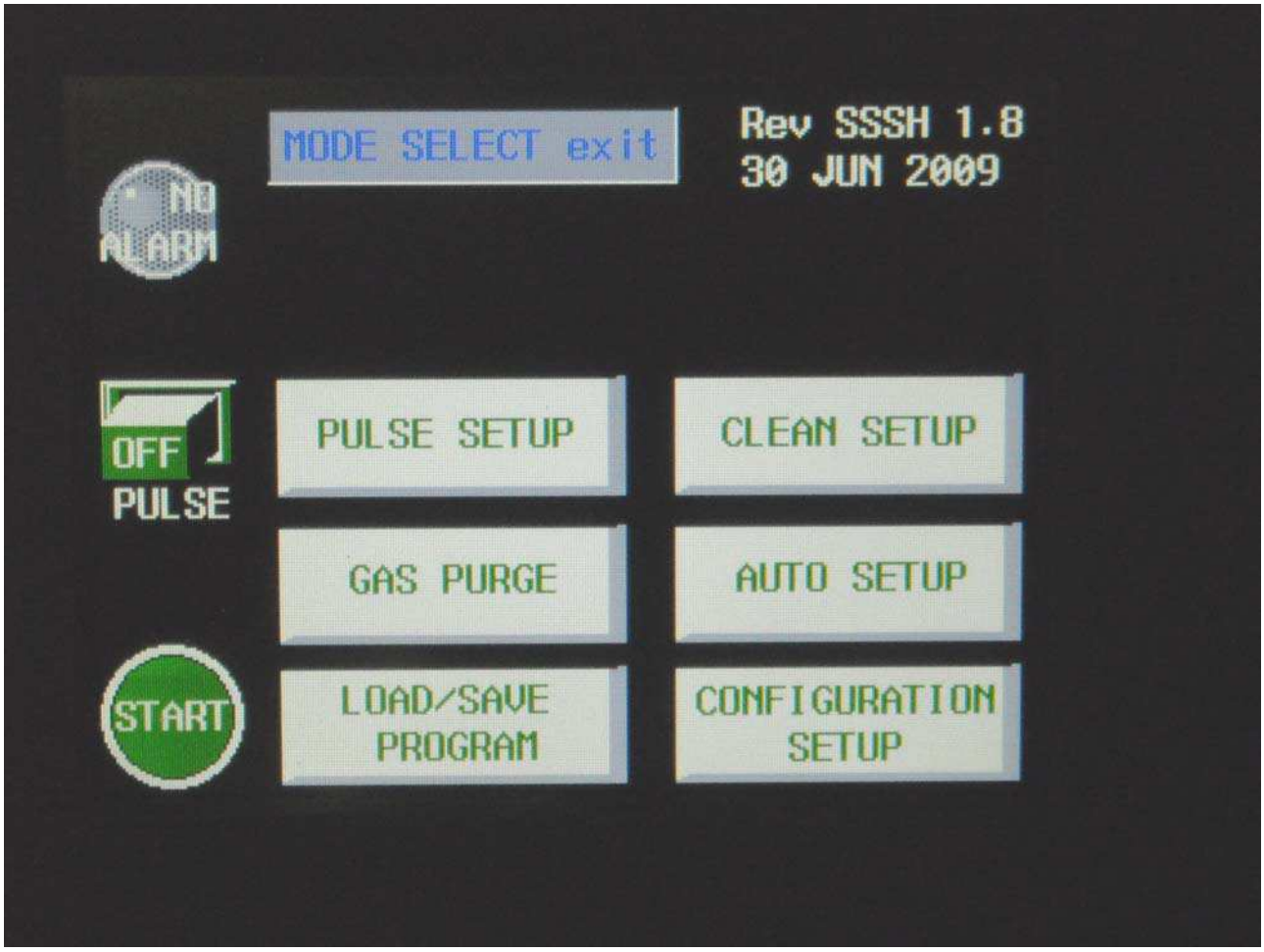
Note that the voltage displayed while the power supply is in standby, is the ‘nominal’ anode voltage. The actual and instantaneous anode voltage is shown once the power is ON. The voltage shown will then be the peak anode voltage and will generally be slightly higher than the nominal voltage when no beam current is produced. It is normal for the anode voltage to reduce as beam current increases and may be seen to be lower than the nominal voltage at high power levels.

Note also that selection of the “OFF” button will return a zero anode voltage. This may be useful when setting other operational parameters without the need to operate the source.

3

MODE SELECTION

Touching the “MODE” button on the Main Screen will open the following screen:



Mode Select Screen. To return to Main Screen simply touch “**MODE SELECT exit**” at the top of the screen. The Mode Select screen provides access to other windows for setting parameters for the various Modal Operations, e.g. Pulse Mode, Gas Purge, Clean, etc.

"**PULSE SETUP**" Touch this button to open the parameter set screen for the Pulse Mode.

"**GAS PURGE**" - Touch this button to set the Gas Purge function.

"**LOAD/SAVE PROGRAM**" This button provides access to the screen where regularly used programs can be saved and loaded.

"**CLEAN SETUP**" Touch this button to open the Clean Function screen.

"**AUTO SETUP**" *Not available at this stage*

"**CONFIGURATION SETUP**" Open this screen to set various operational modes.

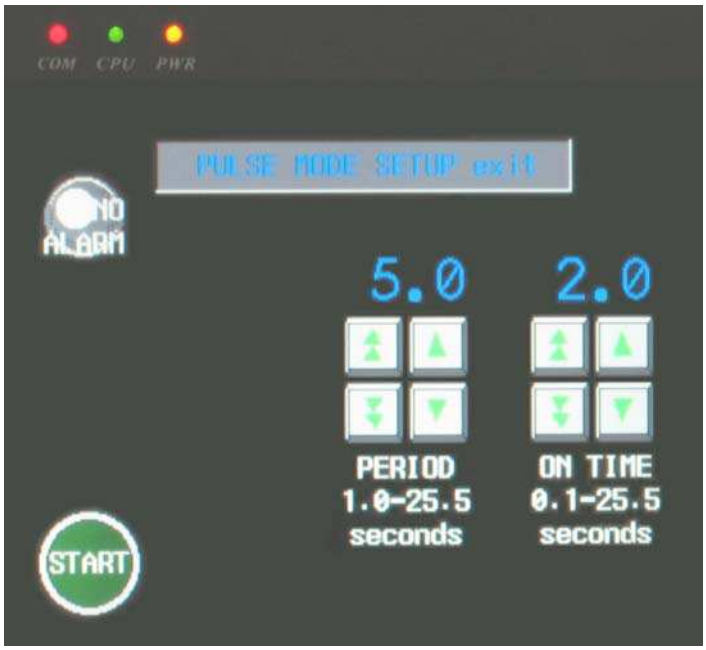
The following pages of this manual will describe each of the functions available through this screen.

Note that this screen also displays the version of software currently installed.

4

PULSE MODE SETUP

From the MODE SELECT screen touching the “PULSE SETUP” button will bring up the parameter setup screen for the Pulse Mode operation.



Two parameters may be set with this window as shown in the figure.

The “PERIOD” is the time for a complete cycle, i.e. the time from the start of one pulse, or ON time, to the start of the next pulse. The maximum period is 25 seconds. The “ON TIME” is the actual time that the Mass Flow Controller (MFC) is activated. This time can be set to a maximum of 25 seconds although it should be noted that the Pulse ON time should be less than the Period. In general, it is normal to select an ON time that is no more than about 60% of the Period.

The other factor to be considered is the response time of the system. The response time is influenced by several factors such as:

- Speed of response of the MFC. This can vary considerably between different MFCs however, Saintech supply MFCs with fast response times of the order << 1 second and typically 100msec.
- Length and volume of gas delivery lines (tubing) between the MFC and the ion source. Saintech IBS always recommends the mounting of the MFC to be as close to the gas feedthrough as practicable. Saintech IBS also recommends the use of small gauge tubing to transport the gas between the MFC and the ion source. The optimum size is 1/8” stainless steel. Smaller size tubing does not provide any further benefit due to the reduced conductance.

When establishing the Pulse ON time, the preferred technique to monitor the ON time is to use a Cathode Ray Oscilloscope (CRO). The CRO signal can be obtained from the Anode Current signal available from the BNC connector located on the right-hand front panel. It is difficult to establish the true settings by observing the pulsing behaviour of the Anode Current because of the refresh rate of the digital display.

Both the Period and ON times may be set or adjusted by incrementing the times using the UP/DOWN arrows. The double arrows provide increments of 1 second and the single arrows 0.1 second.

Once adjustments have been made, exit the Pulse Mode Setup by touching the EXIT bar at the top of the screen.

Pulse Mode parameters are saved with all other parameters when the SAVE FILE functions are used – see below for further information on saving files.

The system may be powered on from the Pulse Setup screen by double touching “START” as normal. Once started, it may be stopped from this screen by touching the “STOP” button.

Once the Pulse parameters have been set, exiting this screen will return to the MODE SELECT screen. On this screen, the Pulse Mode switch can be activated. The next time the power supply is powered ON, it will be in Pulse Mode.

5

GAS PURGE MODE

This function is provided to ensure the integrity of the process gas. The Gas Purge Mode is entered by touching the Gas Purge button on the Mode Select screen.

The following recommendation is worth consideration.

Recommendation

It is very important that the purity of the gas is always maintained. At the start of each day or shift or at any time where the ion system has not been used regularly, the gas lines should be purged to ensure high purity gas is being introduced to the plasma.

Remember, the IAD process will ionize any condensable gas - including impurities

The Gas Purge window is shown below.

Purge Timeout

Once started, the Purge operation will be terminated by either of two timeouts.

- Preset timeout – max. 15 minutes
- Gas flow limit (1%) achieved

The purge timeout can be preset to a maximum of 15 minutes. Generally, this time will be set to the 'normal' time required to pump out the gas in delivery lines between the gas storage facility and the MFC. This will vary considerably between different installations. Initially, the purge timeout should be set to 15 minutes and the time noted when the gas flow reaches approx. 1-2% of the initial flow. Set the

timeout for about 1 minute longer. In the event that a flow of 1 – 2% cannot be reached the possibility of a leak should be investigated.

The purge facility offers an easy method to check the integrity of the gas delivery system. For example, if the purge time is typically 3 minutes but on some occasion the purge is not complete by the timeout, suspect a leak somewhere in the gas delivery lines.

Using the Gas Purge facility

The Gas purge screen provides the facility to purge either or both of the installed gases. Note that both gases can be purged at the same time (for a Dual Gas Facility). The gas to be purged is simply selected by engaging either “Gas 1 ON” or “Gas 2 ON”. Touch the “START PURGE” green button and the gas flow(s) will be shown in the appropriate windows. Note that, to speed up the purge process, the MFCs will be set to operate at the maximum flow as set by the manufacturer. The MFCs supplied by Saintech IBS normally have a full flow range of 50 sccm although they are set to operate at 30sccm (oxygen) or 20sccm (argon) under software control. For the purge operation they are operated at the full 50sccm and 74sccm for the argon MFC.

Routine Purging

The Saintech Digital system makes the purging operation very simple. Simply shut off the valve at the point of the gas source, e.g. gas regulator, open the Gas purge window and touch the START PURGE button. When finished, do not forget to re-open the gas supply valve.

6

LOAD/SAVE PROGRAM

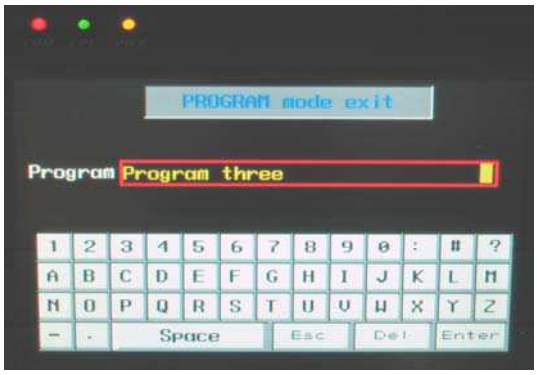
The LOAD/SAVE program facility is provided to allow saving regularly used operational procedures. This saves valuable time and ensures consistency of product in production facilities by loading already saved programs. Up to 15 programs can be stored.

The LOAD/SAVE screen is accessed by touching the **LOAD/SAVE PROGRAM** button on the **Mode Select** screen. The following screen is shown:

Saving a Program Name. The program Name can have up to 30 alpha numeric characters.

To enter a new program name, first touch the name bar which will open up a keypad – see figure below. Enter the file name and, when finished, touch 'ENTER'. The keypad disappears although the file parameters are not yet saved. Now touch the SAVE button. Upon touching the SAVE button the word "DONE" will appear momentarily on the screen. All operational parameters are now saved under the new file name.

Loading a Pre-saved Program. First, enter the LOAD/SAVE screen as above. All saved programs will have a File Number between 0 and 15. There are two ways to display the required File Number. If the File Number is known, simply touch the File Number button (3 in this example) A numeric keypad will appear – type in the required File Number. Otherwise, use the UP/Down arrows to scan the available files.



Once the required File is displayed, touch LOAD. The word “DONE” will momentarily appear. The File is loaded and in operation.

Exit the Load/Save screen by touching the PROGRAM MODE exit button on the top of the screen

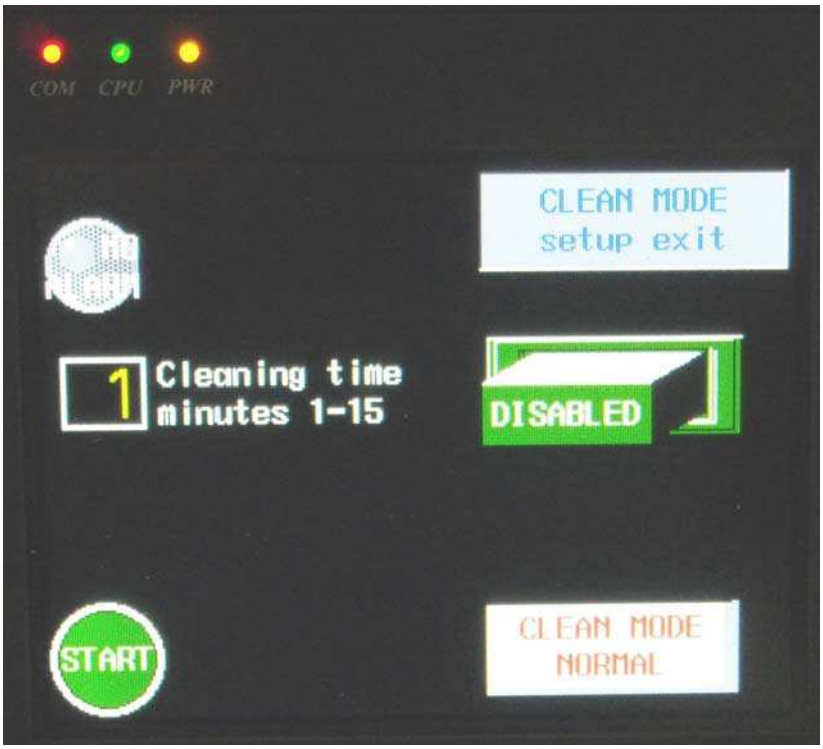
7

CLEAN MODE

For almost every thin film deposition, it is normal practice to carry out a pre-deposition bombardment of the substrates. The purpose and benefit of this practice is very well documented although the primary function is to remove remaining surface contaminants as an aid to promote film adhesion.

Due to the importance of this routine operation, Saintech IBS has included a separate function that can be pre-set and activated with the touch of the touch screen.

The Clean Mode function can be initiated by selecting the CLEAN SETUP from the MODE SELECT screen. The following window will be opened:



The required pre-deposition bombardment time can be set by touching the white bordered button 4. This will open a numeric keypad. Type the required time (max. 15 mins.) and touch 'ENTER' on the keypad.

When ready for the operation to be started, touch the DISABLED button. This will ENABLE the timing mode. Press START to operate. When the process times out, the beam turns OFF and the CLEAN Mode will automatically DISABLE.

To establish a program that will automatically enable the CLEAN Mode whenever the ion beam is started up, touch the "CLEAN MODE NORMAL" button. Activating this

button will maintain the ion beam system in the “CLEAN MODE”. This means the ion beam will operate for the set time and power off every time the START button is activated. This function would be of value for metal depositions where the ion beam operation is only required to pre-clean the substrates.

Whilever the CLEAN MODE is activated, the Main Screen will show “CLEAN” as a flashing display.

Figure at right shows the Main Screen with the “CLEAN” indicator

Exit the CLEAN MODE setup by touching the CLEAN MODE setup exit bar at the top of the screen.

8

FIRST TIME OPERATION

Recommended Procedures for First Time Operation

First Step - Purge the gas delivery line.

1. Shut off gas supply at gas source. This may be a gas pressure regulator
2. Open Gas Purge window at power supply
3. Touch gas purge
4. Wait till all gas pumped and Purge function is complete
5. Open gas supply
6. Return to Main Screen

Second Step – Start up power to obtain beam

1. Select zero anode voltage from Main Screen
2. Start power supply – requires double touch
3. Check that the filament power is controlling. Adjust filament current to 20 amps
4. Check gas flow is controlling. Adjust flow to 6 sccm (XIAD); 10 sccm (ST55); 12 sccm (ST3000)
5. Select anode volts to 180 (XIAD & ST55); 200 volts (ST3000)
6. Power OFF and re-start – (this step required to invoke anode voltage change)
7. After about 10-12 seconds beam should be established

Alternate start up procedure for Second Step above.

1. From the Main Screen select MODE
2. From MODE screen select LOAD/SAVE PROGRAM
3. Scroll the available saved programs and select and LOAD “Standard Conditions”*
4. Return to Main Screen and press START (double touch required)

* “Standard Conditions” are a set of parameters pre-loaded to one of the memory slots. The various parameters are considered best suited for each model that will ensure operation within a safe o0perating range for the particular model. With experience, the operator may decide on a modified parameter set that better suits their application. The new parameter set may be saved over the original for later use.

9

AUTO MODE SETUP

Note. This AUTO MODE is currently de-activated. Further refinement of this function is currently being undertaken and new software will be offered as it becomes available.

10

DUAL GAS MODE

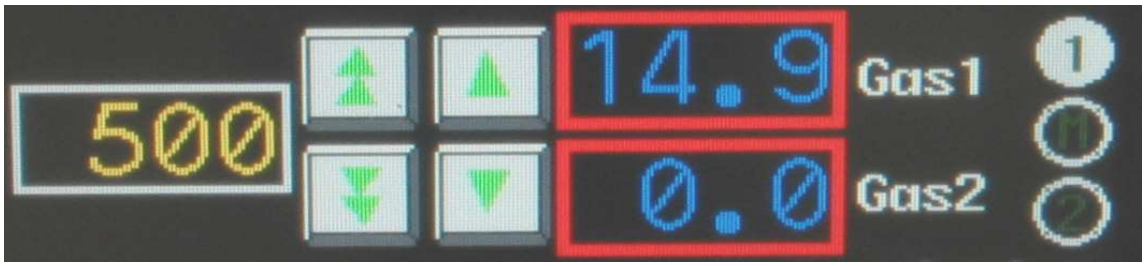
Option: Dual Gas Mode Operation – Mixed Gas Ratios

(All Model)

The Dual Gas option, if installed, provides the facility to operate the ion beam system using either of the installed gases alone – as pure gases or both gases together in a fixed, pre-set mixture.

Select Pure gases

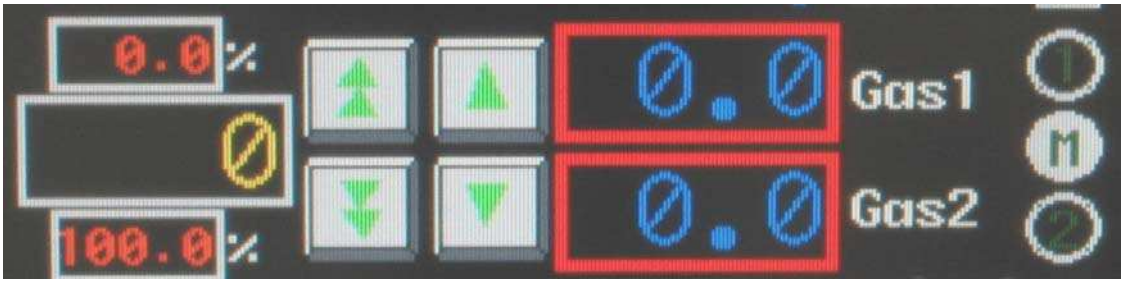
Either of the two installed gases can be used as pure gases. Simply select Gas 1 (O2) or Gas 2 (Ar). The following section of the Main screen shows the use of Gas 1:



To use Gas 2 (argon) simply touch the Gas 2 2 button. Gas flow adjustments will now relate only to argon gas. Note that, if the source gas is changed (Gas 2 → Gas 1), the last used Gas 1 setting will now be selected.

Select Mixed Gases

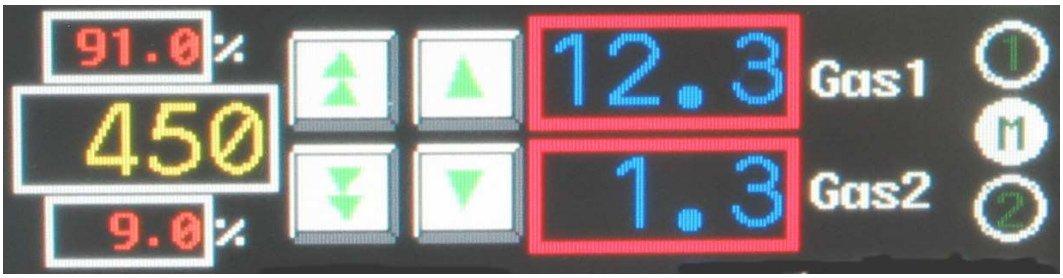
To use Mixed Gases, touch M and the following screen will appear:



To establish the ratio between the two gases, touch either of the 0.0 % buttons. A numeric keypad will open. Enter the percentage value for the gas, e.g. 25% of gas 1. Once entered, Gas 2 will be set to [100 – 25]% = 75%.

The percentages relate to the actual gas flow in sccm. This means that for 100% of the total gas flow entering the ion source, 25% will be Gas1.

Example: Set Gas 2 at 9% (thus making Gas 1 to be 91%). Now (double) touch START and establish a beam. The beam should stabilize within a few seconds. As can be seen below, there is a total of 13.6sccm of gas flowing. A simple calculation will verify that 91% of 13.6sccm is close to 12.3sccm within the accuracy of the MFCs



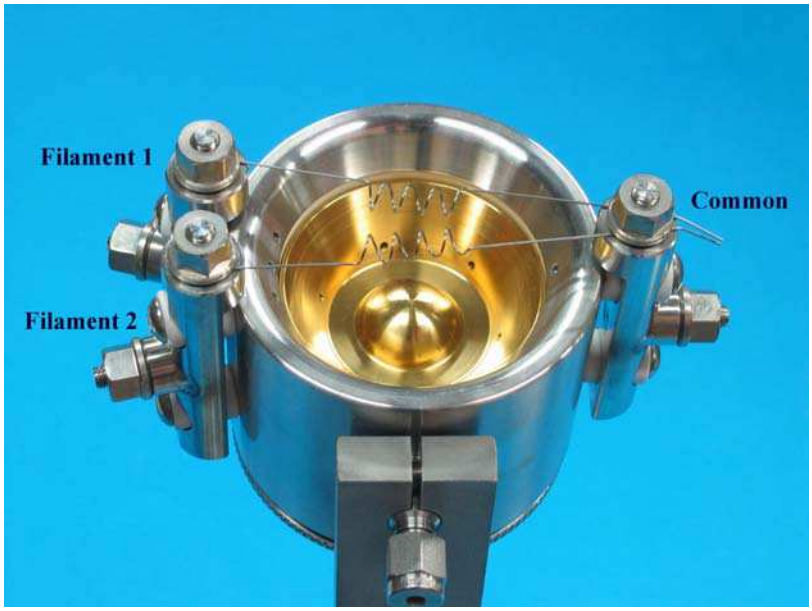
11

DUAL FILAMENT FACILITY
(ST3000 & ST55 only)

If your ion beam system is fitted with the Dual Filament option the power supply will continuously monitor the status of the first filament. When the first filament fails, the power supply will automatically re-establish power to the second filament at the same power setting as the first filament. The operation of changeover can be expected to take up to about 8 - 10 seconds. The icon on the Main screen labelled FCO (filament changeover) will turn to green to indicate to the operator that the second filament is now in use. If the second filament fails, the system will power OFF and an ALARM will occur.

The photo below shows the correct assembly of the coiled filaments. Install the hooked end of the filaments around filament legs 1 and 2. The straight end of the filaments are clamped at the common filament post. Slightly extend both ends at the common filament post before clamping. This maintains a slight tension in the filaments so that they will remain straight when heated for the first time.

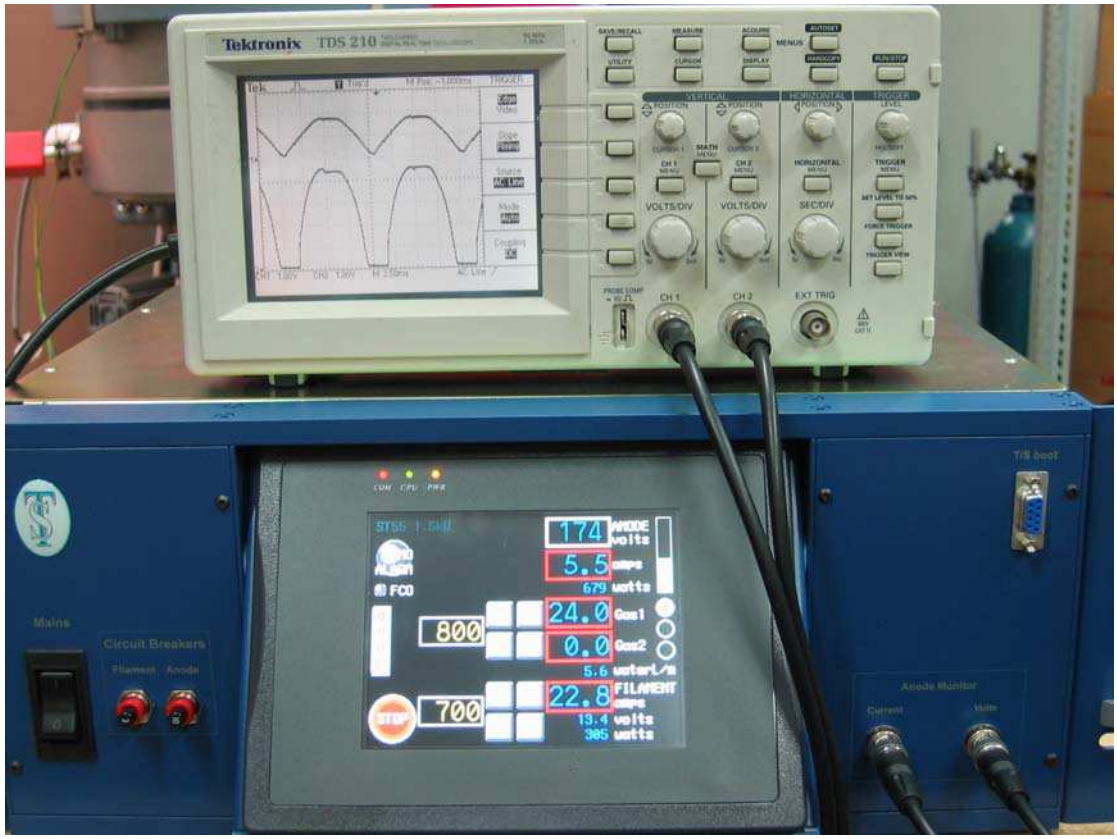
Be aware that tungsten wire becomes very brittle once heated to emission temperatures. Any attempt to re-shape a filament once used will most likely break the filament.



12

BEAM DIAGNOSTICS & MONITORING

Provision is made for monitoring the Anode Voltage and Anode Current. BNC connectors are located on the right hand front panel that provide scaled signals suitable for display on a cathode ray oscilloscope (CRO) or similar voltage-time display. Valuable information is available by visualizing either or both of these parameters. The voltage waveforms provide information on neutralization and allow the operator to optimize ion source performance.



The above photo shows both anode voltage and current waveforms displayed on a Dual Beam CRO. The upper trace is the anode voltage.

Both signals are scaled. The Anode Voltage is scaled by 1:100 and the Anode Current scaled to 1 volt per amp.

If using the Pulse Mode of operation, it is useful to view the Anode Current signal (the lower trace on the CRO above). This waveform will very precisely indicate when the beam is on and off.

13

CONFIGURING THE ION BEAM SYSTEM

Various function and operational procedures can be properly configured by opening the Configuration window.

From the Main Window, select the Mode button. From the MODE Select screen, select

CONFIGURATION SETUP. The Configuration Setup window will open as shown below:

“SINGLE GAS CONTROL” This button is used to toggle between use of one MFC or Dual MFCs (if available and connected). If only one MFC is in use select “SINGLE GAS CONTROL” and then select which gas is in use i.e. argon or oxygen. Be sure to connect the correct cable to either Gas 1 (oxygen or nitrogen) or Gas 2 (argon).

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INSTALLING THE INTEGRATED ION CURRENT MONITOR

If the Saintech Ion Beam System was purchased with the optional Integrated ICM. Installation of the ICM with the power supply is very simple. Install a BNC terminated coax cable to the BNC socket located on the rear panel

When the power supply is powered on the next time, it will recognize the installation automatically. The bias voltage can be adjusted over the full range by adjusting the small potentiometer located adjacent to the BNC connector on the rear panel.

For instruction regarding the ICM installation refer to the ICM manual.

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ION CURRENT MONITOR INTEGRATION

If the Saintech ion beam system is to be used with a Saintech Ion Current Monitor (ICM), as shown in the figure to the right, the ICM can be inter-connected by use of a special connecting cable (supplied with the ICM).

Interconnect the 9-pin D type connector located at the rear panel of the ST series III Ion Beam Power Supply to the 15-pin D type connector located on the rear panel of the ICM.

Once the connection is made, the power supply will recognise the attachment

The Main Screen will now show the ICM monitor signal displayed as shown below (showing 0.5uA in this example)

The digital data from the ICM is auto-ranging and covers the range from 1 microamp to 2 milliamps. The data displayed is the RMS ion current as measured in the **ICM** sensor.

For further information on the ICM, refer to the supplied ICM manual.

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TROUBLESHOOTING

For a complete listing of Error Messages, refer to the “Installation Manual”

Problem	Possible Cause	Remedy
No Beam Current	▪ No gas flow ▪ No electron emission ▪ Filament broken ▪ No anode voltage ▪ Magnet de-magnetised	▪ Check regulator pressure,. Also check chamber pressure increases with MFC ▪ Check filament current ▪ Check anode connections ▪ Check anode circuit breaker ▪ Check for magnetic field strength
Ion beam unstable, fluctuating (It may be noticed that more gas flow is required to achieve the same beam current)	▪ Anode surface coated ▪ Gas delivery volume too high ▪ Chamber pressure fluctuating	▪ Clean anode ▪ Shorten line between MFC & chamber, reduce volume of delivery line ▪ Fluctuations can result from evaporation methods
Power does not come on when START button pressed	▪ Water flow too low	▪ Check water flow on screen. ▪ Minimum of 2.5 l/min required (ST55)

Anode circuit breaker trips when START button pressed	▪ Rectifiers or power control devices faulty	▪ Check & replace as necessary
Variable film properties, poor adhesion of metal films	▪ Beam not neutralised ▪ Gases contaminated	▪ Check neutralisation procedures ▪ Check for contamination
Plasma glow discharge in chamber, beam cannot be established	▪ Magnet may be de-magnetised. If ion source has been overheated, the magnet may be reduced in strength. This may occur if the magnet has been raised to above 120 °C ▪ Chamber pressure too high	▪ Check magnet field strength and replace magnet or re-magnetise as appropriate. ▪ Check source of high chamber pressure ▪ Check pumping speed of high vacuum pump ▪ Ensure that ion source electrical leads are not unnecessarily long
Filament life too short	▪ Filament power set too high	▪ Check proper operating parameters

If the above tips do not sufficiently answer your problem please contact Saintech for advice.