

# FerroTec

## Genius II

# Quick Start Guide



Revision B, December 2015

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## Revision History, 0101-9031-0

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A	First released version of document.	Applies to all Genius II units sold after November 2015	Dec. 2015	IA
B	Correct internal cross-references on pp. 7 and 8. Also deleted former (and redundant) Figure 2.	Applies to all Genius II units sold after November 2015	Dec. 2015	IA

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## Liability

The manufacturer's liability for the Genius II is based on the principles of German law. The manufacturer accepts no liability for damage and losses due to:

- improper use
- operation by unauthorised personnel
- failure to follow safety regulations
- failure to comply with the instructions in this manual.

## Translation

If the machine is sold to a country in the EEA, this manual must be translated into the language of the country in which the machine is to be used. Should the translated text be unclear, the original manual (in English) must be consulted or the manufacturer contacted for clarification.

## Intended Use

This manual is intended for all who may use or work on the Genius II controller, especially the operating personnel. The mounting instruction contains an exact description of the product, but does not warrant certain properties or success of use. The instruction handbook was inspected carefully before publication. The authors guarantee that the mounting instruction does not contain errors that cancel or reduce the value or suitability of the device for its intended use. The publishers, however, accept neither explicitly nor implicitly any liability for damage or consequential losses resulting from use of this manual. We are thankful for notification of errors and for recommendations and criticism. Where not stated otherwise, the technical state at the time of joint delivery of product and manual is definitive. We reserve the right to make technical changes without prior notice. All previous revisions of this manual then lose their validity.

The Genius II controller is part of a group of devices for the operation of an electron beam evaporator installed in a vacuum chamber. This group of devices consists of:

1. a high voltage power supply (HVPS)
2. the Genius II controller, including hand-held remote control
3. a filament power supply (FPS)
4. a grounding rod

Use of the Genius II controller other than in combination with this group of devices is not allowed. The Genius II is intended solely for the control of this group of devices. Use of the Genius II for any other purpose requires the approval of the manufacturer. This Manual deals only with the design and operation of the Genius II. Please see the relevant user manuals regarding operation of the other devices in the group. These devices were developed, designed, and built solely for commercial/industrial use. Proper use in accordance with its designated use includes compliance with the manufacturer's operating, maintenance, and repair instruction.



### **WARNING!**

Access to the electron beam evaporator is to be secured by the unit controller in such a way that it is possible to ensure that both the rotary crucible movement and the high-voltage power supply are stopped. To this end, external connection options are available at the high-voltage supply and at the Genius II controller. The person setting up the entire unit is required to integrate this safety function in accordance with the performance level determined in the functional safety.



## **DANGER!**

The evaporation controller Genius II is intended solely for the purpose described above. Any other use or modification of the evaporation controller Genius II without the written consent of the manufacturer is deemed improper. The manufacturer accepts no liability for resultant damage. The risk is borne solely by the operator.

## **NOTICE**

Per EMC Directive 2004/108/EG in the manufacturer's declaration, the Genius II controller may be operated only in Industrial environments.



## **DANGER!**

The materials/media required for operation of the electron beam evaporator in compliance with its intended use are procured and used by the operator of the electron beam evaporator. Proper handling of these materials/media and the related dangers are the sole responsibility of the operator. The operator must supply his operating personnel with information and instructions on dangers and disposal. The safety data sheets of the material/media manufacturers must be observed

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## **Publisher**

Should you have any questions or problems the installation or initial operation of the Genius II, please contact us. We will be glad to help you.

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## **Explanations of Safety Symbols and Notifications**



## **DANGER!**

Warns of dangerous actions situations that could result in severe injury or death. Avoid such actions and situations.

## **CAUTION**

Warns of actions that could lead to damage to the Genius II or other equipment associated with the evaporation system. Avoid such actions.



Indicates danger of burns .



Indicates danger of hands being crushed or injured.



Indicates danger from magnetism.



Indicates danger to people with cardiac pacemakers, people with insulin pumps, and people with active or passive prostheses and ferromagnetic or conductive foreign bodies.



These symbols mark the sites of protective conductor connections.



Environment sign indicates actions to protect the environment.



This symbol reminds personnel to wear personal safety equipment, including safety glasses.



This instruction handbook is an integral part of the deposition controller and must be kept readily at hand for the operating personnel at all times. The safety instructions contained in it must be obeyed. If the deposition controller is resold, the instruction handbook must always be delivered along with it.

# **Manufacturer's Warranty**

## **Conditions of the warranty**

FerroTec products are produced and inspected in accordance with our quality management system. Warranty must be claimed immediately after the notice of the failure including the serial number of the deposition controller. The manufacturer guarantees warranty of the product of 12 months to be free on defects caused by material failure or failures caused by the manufacturing process. If a fault occurs during this time period the manufacturer guarantees free of charge repair in regards of parts and labor time.

## **Warranty exclusions**

Damages caused by improper or not intended use or unauthorized alterations into the Genius II are excluded from this warranty.





# 1 *Genius II Quick Start Guide*

## 1.1 Contents of Genius II Kits

Your Genius II kit contains the following components:

- Genius II Control Unit, containing Ebeam, Turret, and Sweep Control Modules
- Hand-held controller with 10-ft. connection cable
- Mounting hardware for installation in a standard 19-inch rack
- Magnet-connection cable (PN 1-9500003)
- Input power cable (PN 1-9500024)
- Grounding cable (PN 1-9500001)

## 1.2 Basic Hardware Installation

Step	Action
1	Using the mounting hardware supplied, install the Genius II controller in a standard 19-inch rack.
2	Plug the connector on the end of the remote controller's cable into the port indicated in Figure 1.

Figure 1 Genius II Front Panel, Showing Connections Port for Hand Held Remote Controller



## 1.3 Making Cable Connections

### 1.3.1 Cabling Overview

Section 1.3.2 describes how to connect the Genius II to the components it controls and to the required interlock switches. For instructions on making connections between the Genius II and a PLC-based system controller, see section 1.3.3.

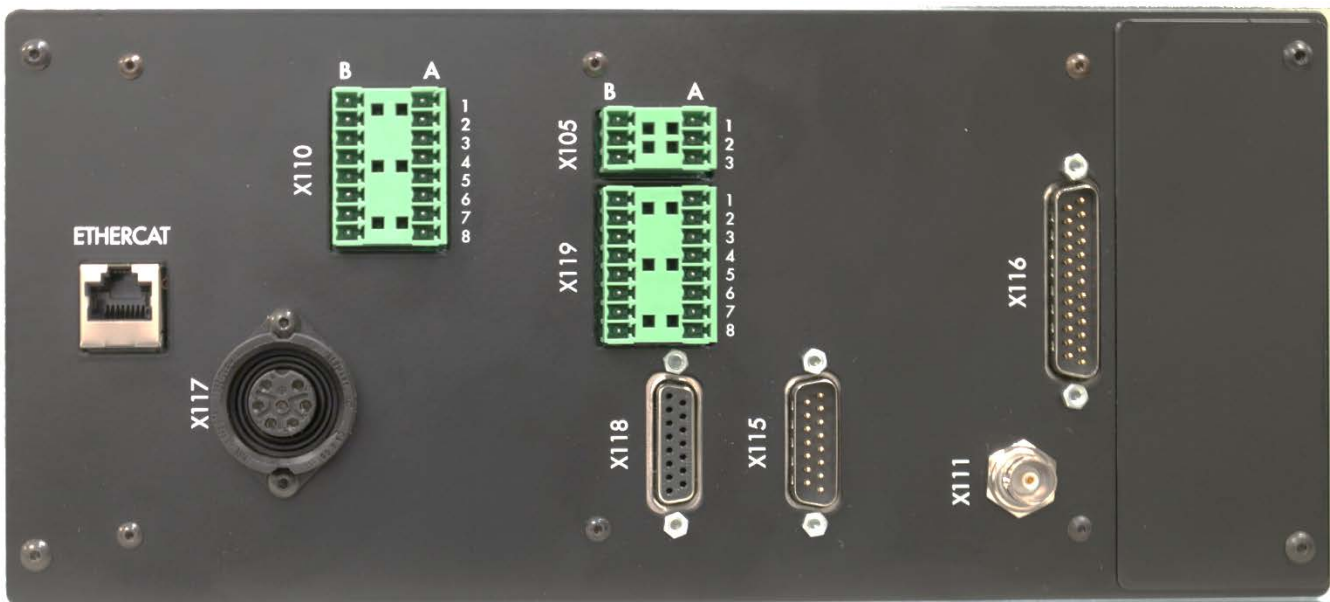
#### WARNING

Connect the Genius II's rear panel SWEEPER COILS connector only to e-beam guns with beam-drive coils of  $\pm 3$  A capacity in both the longitudinal and lateral axes.

### 1.3.2 Basic Cabling Procedure

Figure 2 shows the connectors on the Genius II rear panel. The following procedure describes the basic cabling connections to be made to via those connectors, and Figure 3 illustrates those cabling connections. For additional details about connections to be made via rear panel connector X110, see Figure 4 and Table 1. For details about connections to be made via rear panel connector X119, see Figures 6 and 7.

**Figure 2 Connectors on Genius II Rear Panel**



Step	Action
1	Plug the male 9-pin connector on the Y-end of Cable 1-950040 into Carrera rear-panel connector X302, as shown in Figure 3.
2	Plug the female 15-pin connector on the Y-end of Cable 1-950040 into Carrera rear-panel connector X303.

- 3 Plug the female 15-pin connector on the other end of this cable to the Genius II rear panel connector X115 (see Figure 3).
- 4 Plug the female 25-pin sub-D connector on one end of cable 1-950013 into Genius II rear-panel connector X116 (see Figure 3).
- 5 Plug the male connector on the other end of this cable into connector X202 on the rear panel of the filament power supply (see Figure 3).
- 6 Plug the circular connector on one end of the cable 1-950003 into connector X117 on the Genius II rear panel (see Figure 3).
- 7 Plug the connector on the other end of this cable to the in-atmosphere end of octal feedthrough mounted on the vacuum system's source tray (see Figure 3).
- 8 Plug the male 15-pin connector on one end of cable 1-950054 into Genius II rear panel connector X118 (see Figure 3).
- 9 Connect the female 15-pin sub-D connector on the other end of this cable to the male 15-pin connector on the turret-drive unit mounted beneath the source tray (see Figure 3).
- 10 Connect one end of the grounding cable (PN 1-9500001) to the grounding stud on the Genius II rear panel (see Figure 3).
- 11 Connect the other end of the grounding cable to the system's central grounding point.
- 12 Connect the required water, vacuum, and vacuum chamber door interlock switches to Genius II rear-panel connector X110, as shown in Figure 4.

**NOTE**

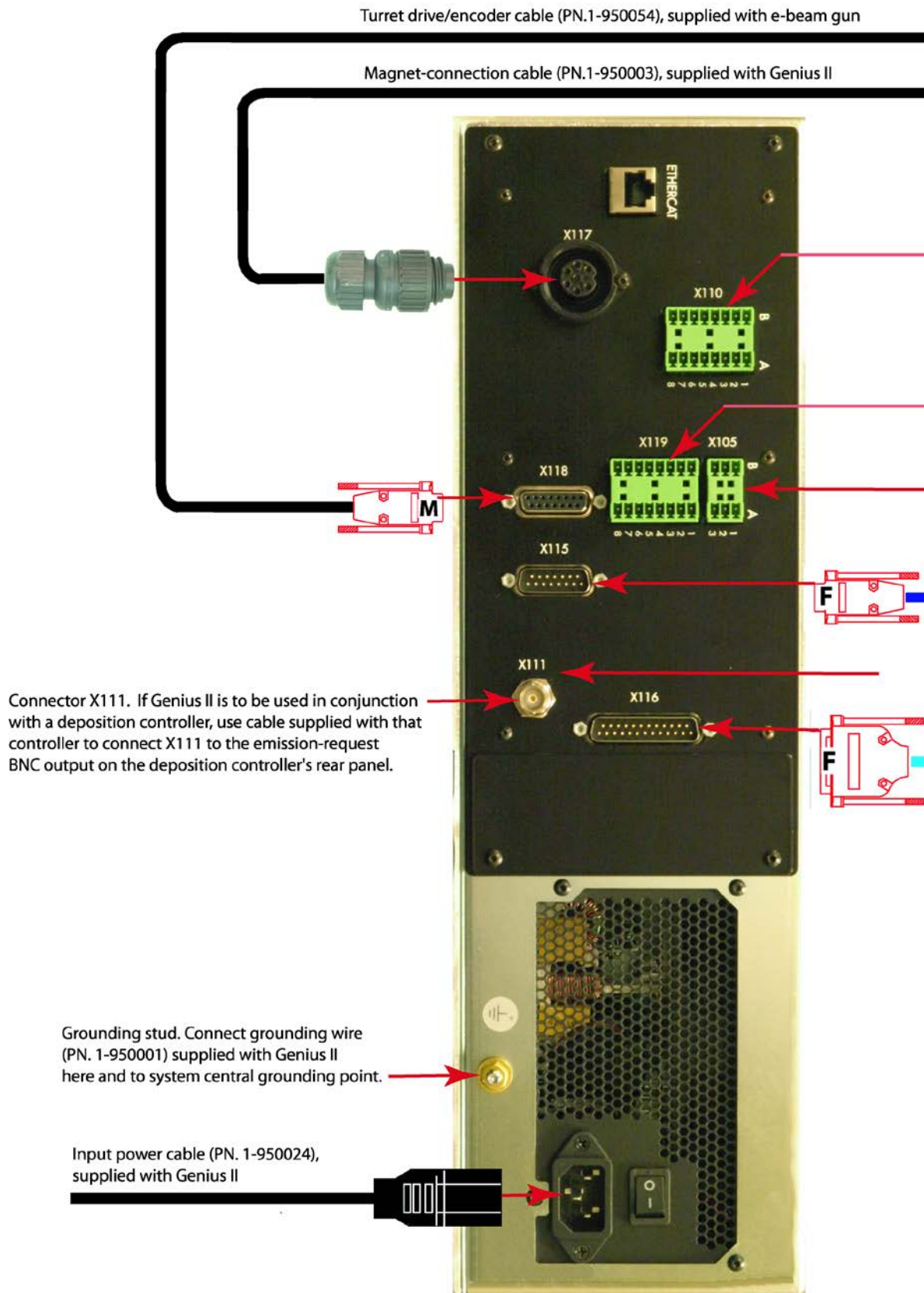
To ensure equipment and personnel safety, these interlock switch connections are required in all Genius II installations. Optionally, Pin A4 may be connected to an additional user-defined interlock, as shown in **Error! Reference source not found..**

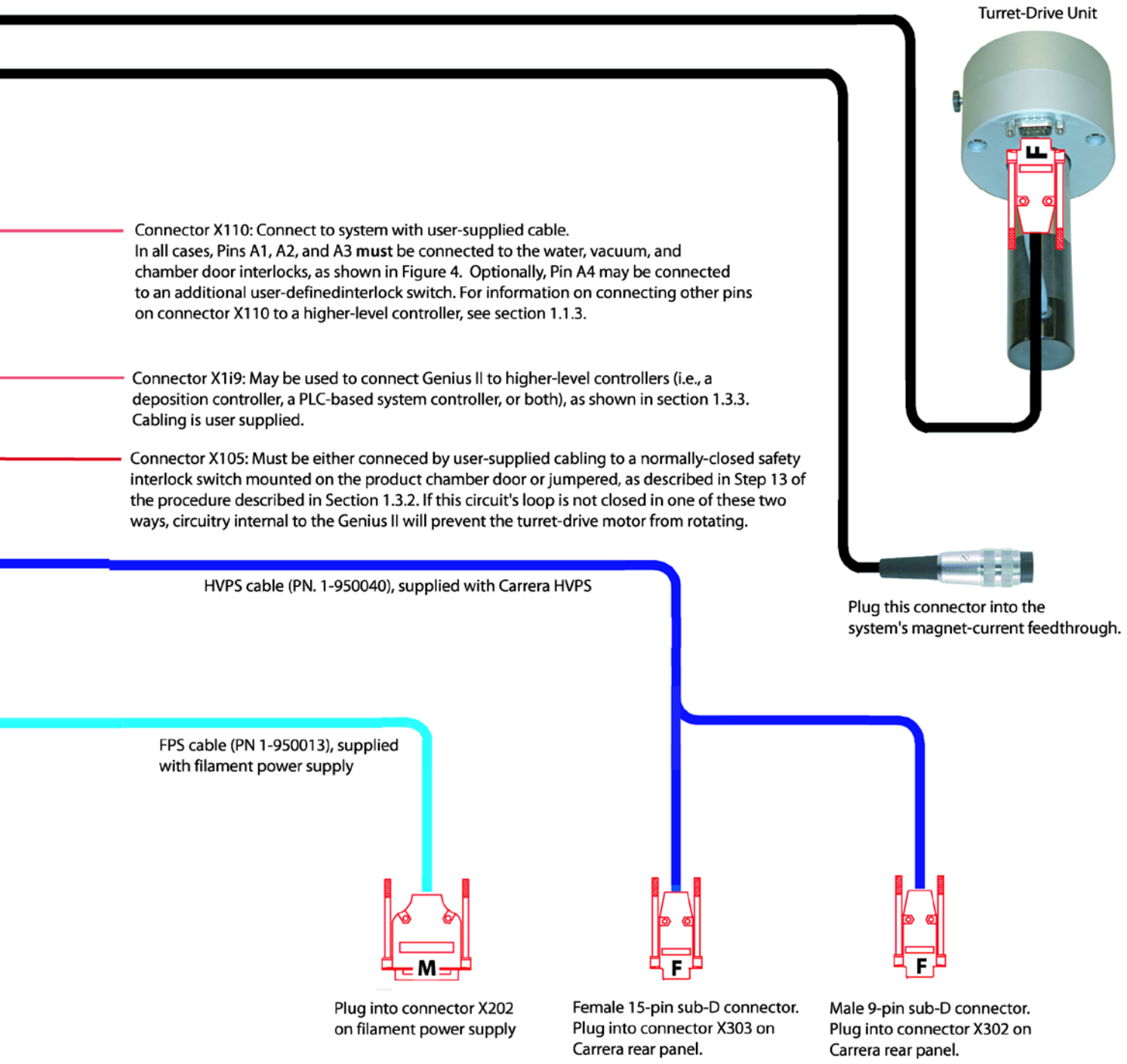
- 13 Connect Pins A2 and B2 on rear panel connector X105 to the poles of a normally-closed safety switch mounted on the product chamber door. That switch then prevents turret rotation whenever the door is open.

**NOTE**

If X105 Pins A2 and B2 are not connected to a safety switch, as described above, X105 Pin B1 must be connected to Pin B2. If X102 is not either connected to a safety switch or jumpered as indicated, the turret cannot rotate.

Figure 3 Genius II Cabling Diagram





### 1.3.3 Making Connections to a PLC-Based System Controller

#### Making Connections to Rear Panel Connector X110

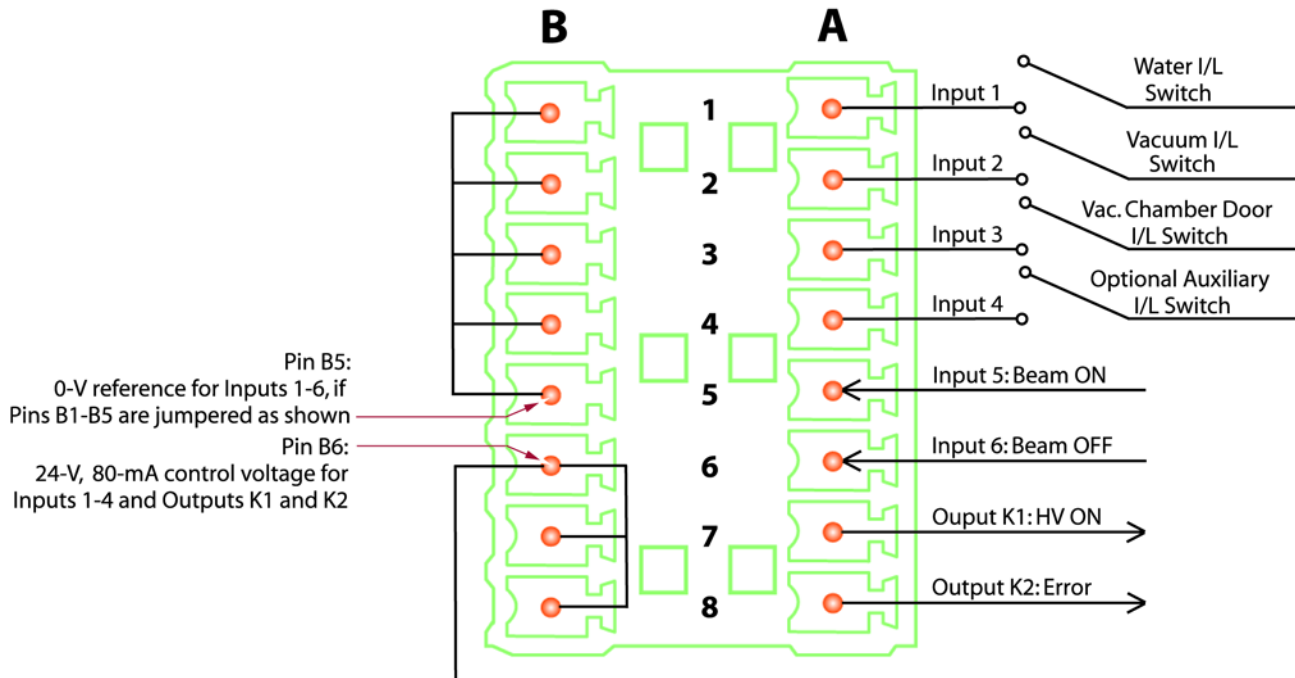
When making connections between rear panel connector and a deposition controller, perform the procedure described below.

**NOTE**

Before performing this procedure, complete the basic cabling procedure described in section 1.3.2.

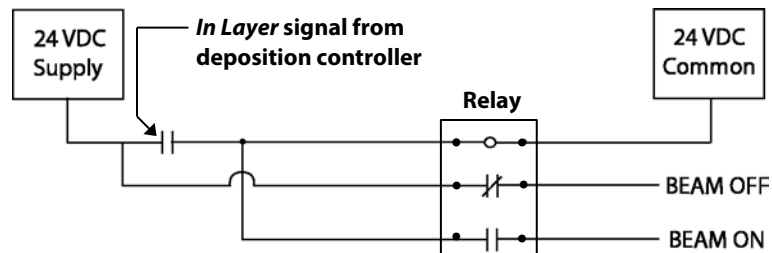
- | <b>Step</b> | <b>Action</b>   |
|-------------|---|
| 1           | Using the BNC cable provided with the deposition controller, connect Genius II rear-panel connector X111 to the BNC connector on the deposition controller rear panel which outputs the emission current request. If you are connecting the Genius II to either an Inficon XTC/3S or an XTC/3M, connect the BNC connector to the XTC's <b>SOURCE 1</b> connector. If a BNC cable was not supplied with your deposition controller, use a standard 50-ohm coaxial cable. |
| 2           | Make connections between the PLC-based higher-level controller and Genius II rear panel connector X110 rear-panel, as shown in 4. Table 1 provides functional definitions of the I/Os shown in that illustration.   |

**Figure 4 Connections To Be Made via Rear Panel Connector X110**



**Table 1 Functional Descriptions of Pins on Rear Panel Connector X110**

Pin No.	Functional Description
A1	Input 1: Status of water interlock (1 = OK); connect to water interlock switch.
A2	Input 2: Status of vacuum interlock (1 = OK); connect to vacuum interlock switch.
A3	Input 3: Status of vacuum chamber door interlock (1 = OK); connect to vacuum chamber door interlock switch.
A4	Input 4: Status of auxiliary interlock (1 = OK); connect to optional user-defined interlock switch.
A5	Input 5: BEAM ON input (Positive slope). Within the Genius II, this input, when true, switches on the HV and the gun. Connect Pin A5 to a user-determined output from the higher-level controller. For example, if you are using the Genius II in a system equipped with an XTC/3M deposition controller, you can create a circuit similar to that shown in Figure 5, which illustrates the use of the XTC/3M's IN LAYER output to provide both the BEAM ON and BEAM OFF inputs.
A6	Input 6: BEAM OFF input (HV OFF = 1). When, this input switches off the HV and the gun. Connect Pin A6 to a user-determined output from the higher-level controller. Figure 5 shows how this input could be supplied by an XTC/3M deposition controller, using its IN LAYER output.
A7	Output K1: Relay contact with Pin B7; default function = HV ON status (HV ON = 1).
A8	Output K2: Relay contact with Pin B7; default function = Genius II ERROR indicator (ERROR = 1).
B1	Ground reference for Pin A1; jumper to Pin B5.
B2	Ground reference for Pin A2; jumper to Pin B5.
B3	Ground reference for Pin A3; jumper to Pin B5.
B4	Ground reference for Pin A4; jumper to Pin B5.
B5	0 V reference for Pins A1-A5
B6	24 V, 80 mA output; can be used as control voltage for Inputs 1-4.
B7	Relay contact with Pin A7; jumper to Pin B6.
B8	Relay contact with Pin A8; jumper to Pin B6.

**Figure 5 Sample Circuit Supplying BEAM ON and BEAM OFF Inputs via X110 Pins 5 and 6****Making Connections to Rear Panel Connector X119**

When making connections from rear panel connector X119 and a higher-level controller (i.e., either a deposition controller or a PLC-based system controller), perform the procedure described below.

**NOTE**

Before performing this procedure, complete the basic cabling procedure described in section 1.3.2.

**Step****Action**

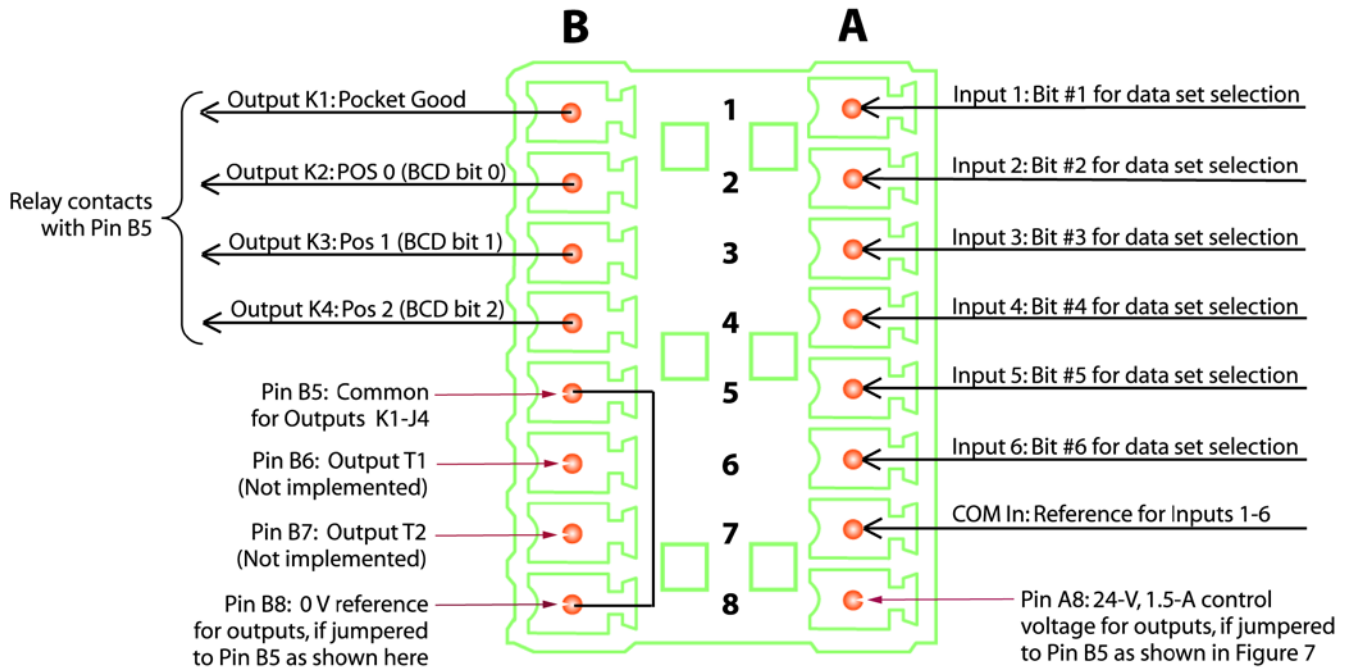
1

If you have not already done so, make the connections between the higher-level controller and connector X110 shown in Figure 4.

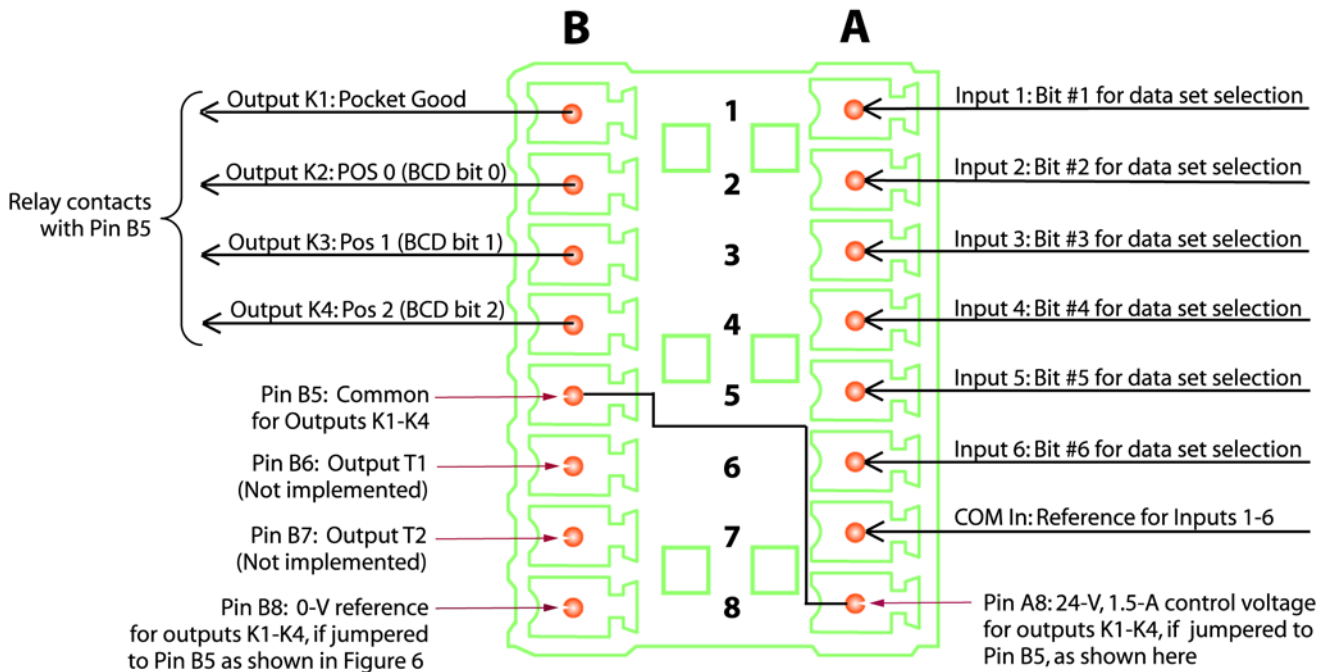


- 2 Make the required connections between the higher-level controller and rear panel connector X119. This wiring can follow either of two configurations, as shown in Figures 6 and 7. Table 2 provides functional descriptions of the I/Os exchanged via connector X119.

**Figure 6 Connections to Rear Panel Connector X119, Configuration #1**



**Figure 7 Connections to Rear Panel Connector X119, Configuration #2**





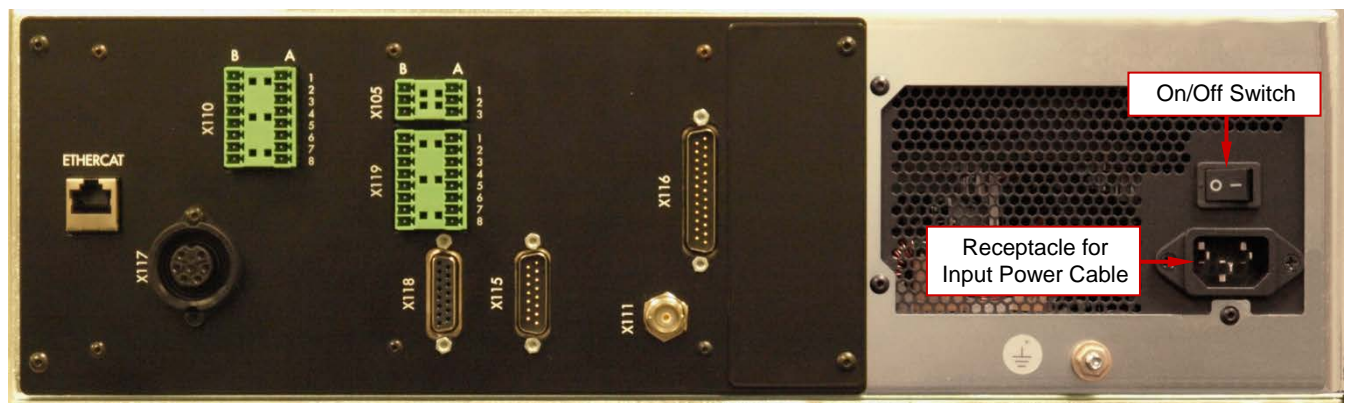
**Table 2 Functional Descriptions of Pins on Rear Panel Connector X119**

Pin	Functional Description
A1	Input 1: Data-set-selection Bit 1
A2	Input 2: Data-set-selection Bit 2
A3	Input 3: Data-set-selection Bit 3
A4	Input 4: Data-set-selection Bit 4
A5	Input 5: Data-set-selection Bit 5
A6	Input 6: Data-set-selection Bit 6
A7	COM IN; ground reference for inputs 1-6
A8	24 V, 1.5 A output; can be connected to Pin B5 to provide control voltage for outputs K1-K4.
B1	Output K1: Relay contact with B5; function = POCKET IN POSITION output.
B2	Output K2: Relay contact with B5; function = POS 0 (BCD bit 0)
B3	Output K3: Relay contact with B5; function = POS 1 (BCD bit 1)
B4	Output K4: Relay contact with B5; function = POS 2 (BCD bit 2)
B5	COM OUT: Function: Either 0 V reference for Outputs K1-K4, if jumpered to Pin B8, or 1.5-A control voltage for the same outputs, if jumpered to Pin A8
B6	Output T1: Transistorized output not implemented on Genius II
B7	Output T2: Transistorized output not implemented on Genius II
B8	Internally connected to ground; can be connected to Pin B5 to provide 0 V reference for outputs K1-K4

## 1.4 Connecting the AC Power Cable and Powering Up the Genius II

Perform the following procedure to supply AC power to the Genius I.

Step	Action
1	Make sure that the rear-panel On/Off switch (see Figure 8) is in the Off position.

**Figure 8 Genius II Input Power Cable Receptacle and Rear Panel On/Off Switch**

- 1 Plug the unit's power cable into the rear-panel input power receptacle and into an appropriate source of AC power.

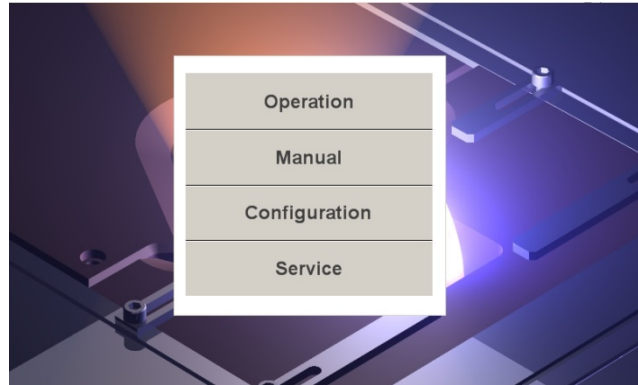
- 2 Put the rear-panel On/Off switch in the On position.
- 3 Press the front-panel On/Off button (see Figure 1). The unit will then boot up and display the Start screen (see Figure 9).

## 1.5 Configuring the Control Modules

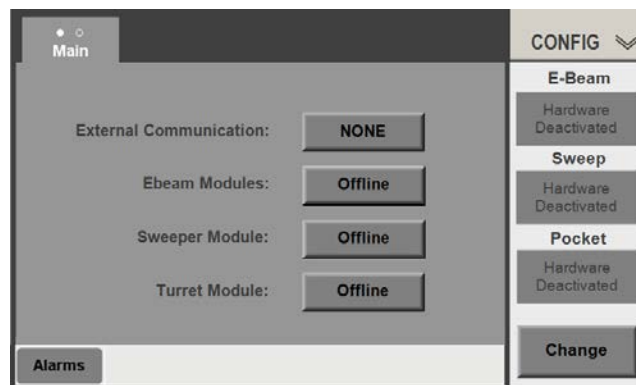
### 1.5.1 Configuring All Module Control Modules for Remote Control

Step	Action
1	When the Genius II is first booted up, the main controller screen displays the Start screen (see Figure 9). To put the unit into Configuration Mode, touch this screen's <b>Configuration</b> button. The unit will then display the Configuration>Main screen (see Figure 10).

**Figure 9 Genius II Start Screen**



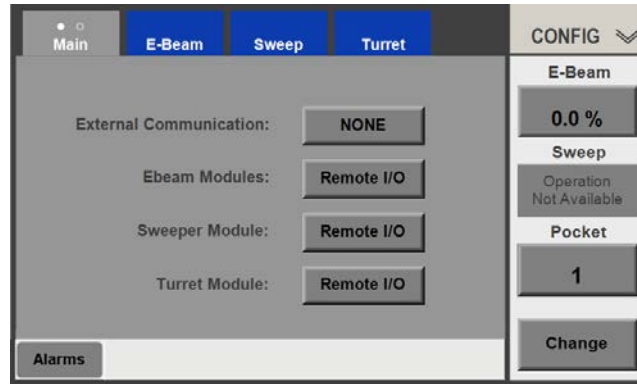
**Figure 10 Config>Main Screen After Initial Boot-Up**



Note that **Hardware Deactivated** is displayed on the **E-Beam**, **Sweep**, and **Pocket** buttons on the command button bar. This is because all three control modules are factory-configured as **Offline**.

- 2 Touch the buttons opposite **Ebeam modules**, **Sweeper Module**, and **Turret Module** twice each to select **Remote I/O** for all three control modules. The Config>Main screen will then appear as shown in Figure 11

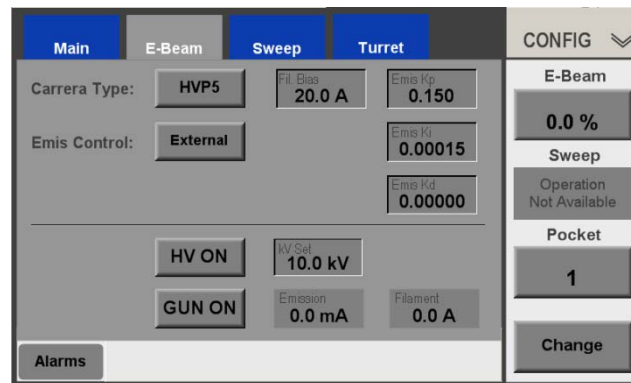
**Figure 11 Configuration>Main Screen After User Configures All Control Modules as *Remote I/O***



## 1.5.2 Configuring the EBeam Control Module

- | Step | Action   |
|------|--|
| 1    | Touch the Menu Bar's <b>E-Beam</b> button to display the Config>E-Beam screen (see Figure 12). |

**Figure 12 Configuration E-Beam Screen After Initial Boot-Up**



- 2 Select the desired power supply, if it is not already selected. To do so, touch the **Carrera Type** button to toggle between the four power supply options.
- 3 Leave **EXTERNAL** selected opposite **Emis Control**.
- 4 If desired, you can change the default kV value. To do so:
  - a) Touch the **kV Set** button to display a numeric keypad.
  - b) Use that keypad to enter the desired default value.
  - c) Touch **Enter** to close the keypad. The value you entered will then appear on the **kV Set** button.

- 5 If desired, you can also change the filament current bias level. To do so:
  - a) Touch the **Fil Bias** button to display a numeric keypad.
  - b) Use that keypad to enter the desired bias value.
  - c) Touch Enter to close the keypad. The value you entered will then appear on the **Fil Bias** button.
- 6 Enter the desired values for **Emis Kp**, **Emis Ki**, and **Emis Kd**, following the procedure analogous to that described in sub-steps 5a), 5b), and 5c) above.

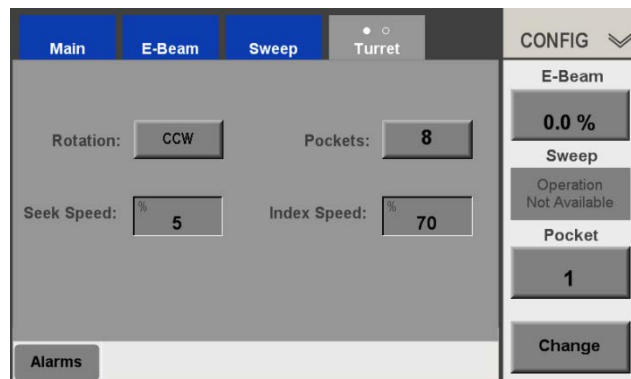
Configuration of the E-Beam PS parameters is now complete. If you have made all the configuration changes you wish to make at this time, exit Configuration Mode to save the configuration (see section 1.5.5 for detailed instructions). If not, proceed to section 1.5.3.

### 1.5.3 Configuring the Turret Control Module

#### Overview of the Config>Turret Screen

Figure 13 shows the Configuration>Turret screen as it appears when the Genius II is first booted up.

**Figure 13 Config>Turret Screen at Initial Boot-Up**



The features on this screen enable the user to configure the essential turret-related parameters, including:

- Rotation direction, either clockwise (CW) or counterclockwise (CCW).
- Number of pockets (3-8)
- Motor seek speed, in percentage terms.
- Motor indexing speed, also as a percentage.

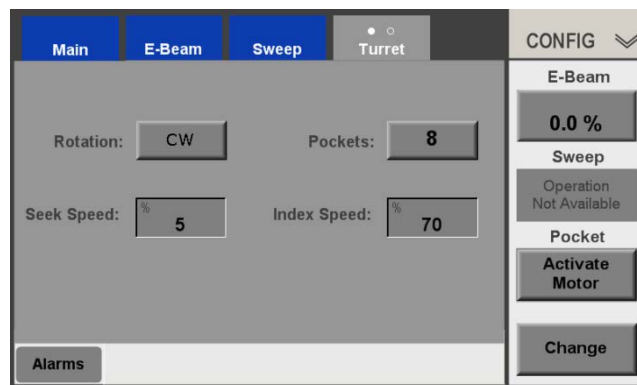
#### Setting the Turret Drive Parameters

Perform the following procedure to set the required turret drive parameters from the Genius II's touch screen. This procedure is most easily accomplished with the source tray lowered and swung out from the system.

- | Step | Action   |
|------|--|
| 1    | First select the desired rotation direction and mode (i.e., either unidirectional or bidirectional). If the default ( <b>CCW</b> ) is appropriate, skip this step and proceed to Step 2. To change the rotation direction, touch the <b>Rotation</b> button to toggle to <b>CW</b> .   |
| 2    | Next select the number of pockets. To do so, touch the <b>Pockets</b> button repeatedly until the button displays the correct number.  |
| 3    | Set the index motor's seek speed. If the default jog speed value (5 %) is acceptable, skip this step and proceed to Step 4. To change the value: <ol style="list-style-type: none"> <li>Touch the <b>Seek Speed</b> button to display a keypad popup and use it to enter the desired value.</li> <li>Touch the keypad's <b>Enter</b> button to close it and set the new jog speed value. The value you entered will then appear on the <b>Seek Speed</b> button. NOTE: The drive motor's rotation speed is four times that of the turret.</li> </ol> |
| 4    | Select the drive motor's index speed. To do so: <ol style="list-style-type: none"> <li>Touch the <b>Index Speed</b> button to display a keypad popup and use it to enter the desired value.</li> <li>Touch the keypad's <b>Enter</b> button to close it and set the new jog speed value. The value you entered will then appear on the <b>Index Speed</b> button.</li> </ol>   |

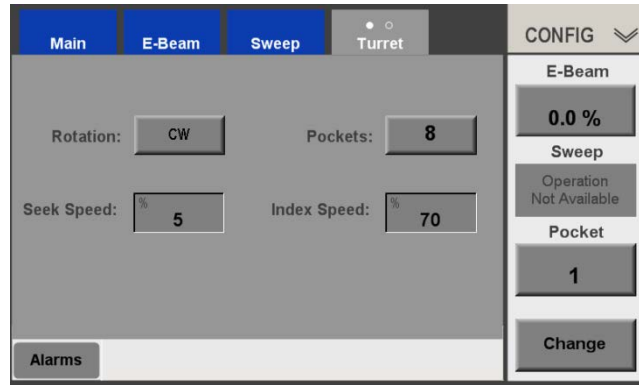
In Figure 14, the user has changed the **Rotation** to clockwise, the **Seek Speed** to 3 %, and the **Index Speed** to 85%.

**Figure 14 Config>Turret Screen After User Alters Rotation, Seek Speed, and Index Speed**



- Touch the **Activate Motor** button. The Config>Turret screen will now appear as shown in Figure 15, with **1** displayed on the **Pocket** button.

**Figure 15 Config>Turret Screen After Turret Configuration Procedure is Completed**



- 6 If you have lowered and swung out the source tray in order to perform this procedure:
  - a) Swing the source tray back into place and raise it back up to its operational position.
  - b) Pump vacuum chamber down to the desired pressure.

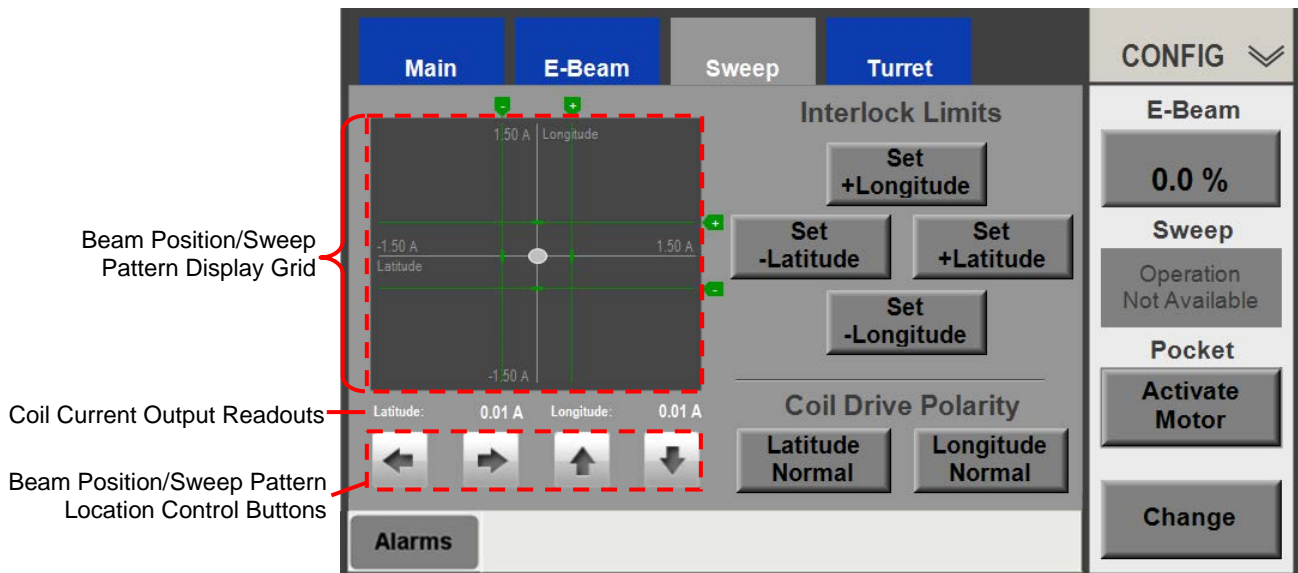
The basic turret configuration procedure is now completed. If you have made all the configuration changes you wish to make at this time, exit Configuration Mode to save the configuration (see section 1.5.5 for detailed instructions). If not, proceed to section 1.5.4.

### 1.5.4 Configuring the Sweep Control Module

#### Overview of the Config>Sweep Screen

The Config>Sweep screen enables the user to set the limits for the beam position interlocks. Figure 16 shows this screen as it appears when the Genius II is first booted up.

**Figure 16 Config>Sweep Screen, Beam Position Limits Unconfigured, Initial State**



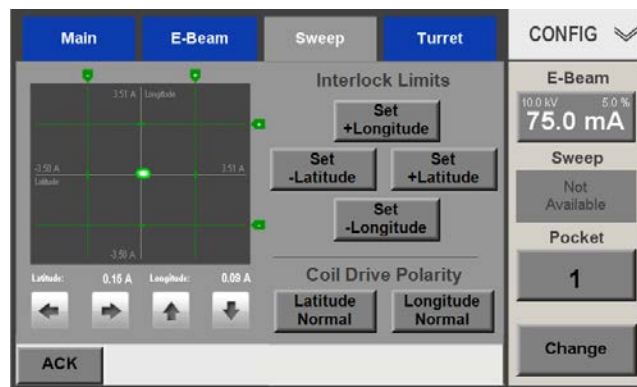
The control/display features of the Config>Sweep screen are:

- **Beam/pattern display grid**, which displays the current beam position or the beam pattern currently operating. The values displayed at the edges of this grid indicate the coil current values of the four beam position limits currently set.
- **Coil current output readouts**, which indicate the coil current outputs at the beam's current position.
- **Beam/pattern location control buttons**, which enable the user to move the beam or the sweep pattern up/down or up/down.
- **Set buttons**: Pressing one of these buttons sets a beam position limit at the beam's current position.
- **Coil Drive Polarity buttons**, which enable the user to reverse the polarity of the sweep-drive coils, if that is required.

### Sweep Module Configuration Procedure

Step	Action
1	Touch the Menu Bar's <b>Sweep</b> screen to display the Config>Sweep screen.
2	Open the shutter so that the pocket in evaporation position is visible through the viewport.
3	Switch on the beam at a power level (3-5%) at which the beam is just visible through the viewport. The Config>Sweep screen will then appear as shown in Figure 17.

**Figure 17 Config>Sweep Screen, Beam Position Limits Unconfigured, Beam Switched On**



- 4 If desired, touch either the **Latitude Normal** button or the **Longitude Normal**, or both, to reverse the polarity of the sweep coil(s) in question.
- 5 Pick up the remote controller and view the beam through the viewport. If the remote controller's Menu 1 is not selected, press its **Menu** button until its screen appears as shown in Figure 18.

Figure 18 Remote Controller in Config Mode with Menu 1 Selected and Beam on at 5%,



- 6 Touch the remote controller's **Pos Adjust** button. The remote controller's screen will then appear as shown in Figure 19.



**Figure 19 Remote Controller, Beam On @ 5%, Config Mode, Menu 1 and *Pos Adjust* Selected**



- 7 Watching the beam through the viewport, use the remote controller's joystick to move the beam to the desired position for the –Latitude beam position interlock limit.
- 8 Press the remote controller's **Menu** button to select Menu 2, which is shown in Figure 20.
- 9 With Menu 2 displayed, press the **Set –Lat** button to set the –Latitude beam position limit at this position. The screen will then appear as shown in Figure 20, with a white dashed line indicating the limit you have just set.

**Figure 20 Remote Controller in Config Mode with Menu 2 Selected, User Setting the -Lat Position Limit**

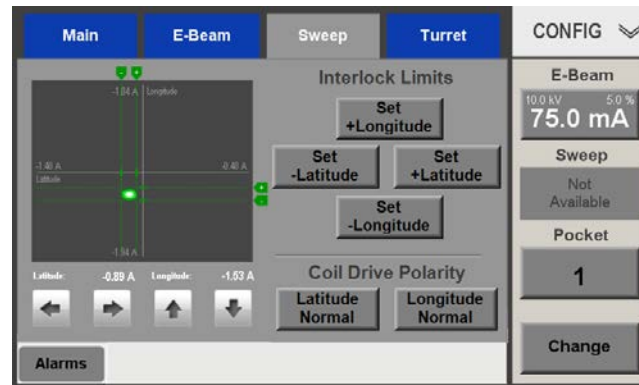


- 10 Use the joystick to move the beam to the position desired for the +Latitude beam position limit.
- 11 When the beam is at the position desired for the +latitude limit, press the **Set +Lat** button.
- 12 Use the joystick to move the beam to the position desired for the +Longitude beam position limit.
- 13 When the beam is at the position desired for the +longitude limit, press the **Set +Long** button.
- 14 Use the joystick to move the beam to the position desired for the -Longitude beam position limit.

- 15 When the beam is at the position desired for the –longitude limit, press the **Set -Long** button.

When all four position limits have been set, the main controller's touch screen will appear similar to that shown in Figure 21.

**Figure 21 Config>Sweep Screen After All Four Limits Are Set**



- 16 Touch the **E-Beam** button to switch off the beam.

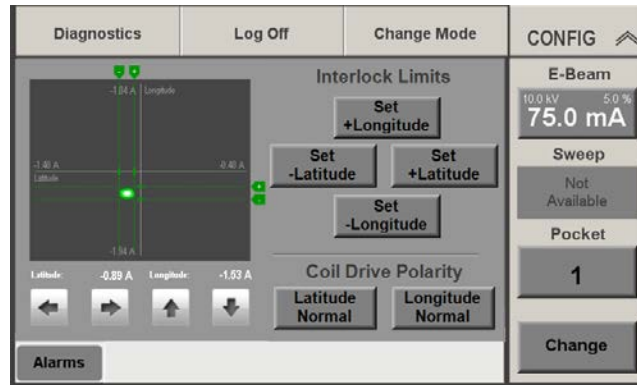
Configuration of the Sweep Control module is now completed. If you have finished configuring all three control modules, follow the procedure described in section 1.5.5 to exit from Configuration Mode and save your configuration parameters. However, if you wish to assign specific materials to specific pockets, follow the instructions provided in section 3.8 of the *Genius II User Manual* before exiting from Configuration mode. Likewise, if you wish to enable the LogIn manager and assign user passcodes and permissions, follow the instructions provided in section 3.7 of the *Genius II User Manual* before proceeding to section 1.5.5.

## 1.5.5 Exiting Configuration Mode and Saving Configuration Changes

Configuration changes are automatically saved when you exit from Configuration Mode. To do so, perform the procedure described below.

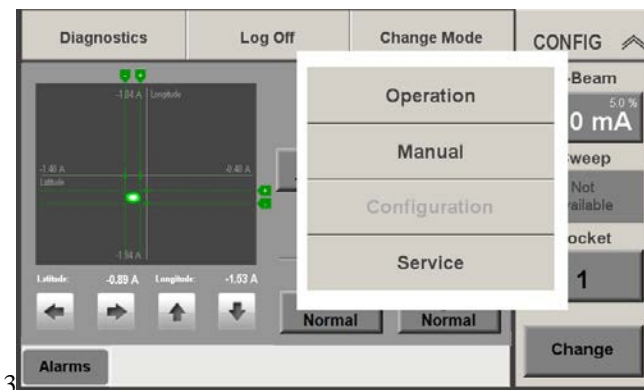
- | Step | Action  |
|------|---|
| 1    | Touch the Menu Bar's <b>Config</b> button to display the Auxiliary Menu, which is shown in Figure 22. That illustration shows the Config>Sweep screen as it appears after configuration of the Sweep Control module is completed. However, you can exit from Configuration mode from any Configuration Mode screen. |

Figure 22 Config&gt;Sweep Screen, Configuration Completed, Auxiliary Menu Displayed



- 2 Touch the Auxiliary Menu's **Change Mode** button to display the mode-select popup, which is shown in Figure 23.

Figure 23 User Exiting Configuration Mode, Mode Select Popup Displayed



- 3 To exit from Configuration Mode and save your changes, touch any active button on this popup. The Genius II will then enter the selected mode.

The unit is now ready for normal system operation.