0101-9028-0

Temescal

TemEbeam Controller Technical Manual

FerroTec

Revision H, December 2016

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Revision History
0101-9028-0

Rev.	Description	Application/Reason for Change	Date	Appvd. By
A	First published version of manual	Applies to EBC units with software revision 3.x.x.	June 2013	IA
B	Updated page references to *EBC Installation Guide.* Added pin IDs and signal descriptions to Section 5.	Internal review only	Fall 2013	IA
C	Incorporated all material from *EBC Installation Guide* into manual and added Sections 6-10.	Internal review and preliminary display to one customer rep.	Aug. 2104	IA
D	Incorporates minor corrections pursuant to internal review.	Applies to EBC units with main processor: software revision 1.5.1.	Sept 2012	IA
E	Minor corrections to Sections 1–5 and 10. Extensive corrections to Sections 7–9.	Pursuant to Field Service Review of Rev. D. Applies to main processor software revision 1.5.4.	July 2015	IA
F	Minor changes to Sections 1, 2, 4.1, 4.4 through 4.9, 7, 10, and 11. Major changes to section 2.5.2, 3.2, 3.3, 3.4, 4.3, 8.2.3, Added new sections 2.4.3, 3.5.3, 5.6.2, 9. Former Sections 9 and 10 renumbered as Sections 10 and 11, respectively.	Corrections entered pursuant to Field Service review. Document updated to apply accurately to software revision 1.6.3.	Sept. 2015	IA
G	BCD coding shown in Table 8-5 was changed to match that shown in Table 2-4 of TRC-3460 manual, Rev. A.	Error noted by Maria Ho. Correction verified by Lloyd Scroggins.	April 2016	IA
H	Replaced screen shots throughout to reflect Rev. 1.6.5 UI changes. former Section 4 became Section 2, former Section 2 became Section 3, former Section 3 became Section 4. Added new sections 2.2 and 4.2. Former section 2.5 became 2.9. Minor revisions to sections 3.4.2, 4.6.1, 4.7, 5 and 6. Major revisions to sections 4.6.2, 6, 7, 8. Completely revised section 4.6.3. Added Figures 2-1, 2-2, 3-9, 3-10, 4-13, 4-19 through 4-21, 4-25, 4-27 through 4-29, 4-31, 6-1, 6-2, 7-1, 7-3 through 7-6, and 8-5 through 8-7. Extensively revised Figures 8-1 through 8-3 and Tables 8-1, 8-4, and 8-6.	Applies to EBC units with main processor software Rev. 1.6.5. Revised Sections 1-4 to cover Rev. 1.6.5 UI changes. Revised Sections 6-8 per input from Temescal Field Service.	Dec. 2016	IA

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Terms and Conditions

1. **Delivery**. Unless otherwise stated, shipments of Ferrotec Temescal Electron Beam Gun and Systems products quoted and/or produced at the Livermore, CA factory site will be made Ex-Works, Livermore, CA Incoterms. Shipping date as are approximate and are based on conditions at the time of acceptance and prompt receipt of all necessary information from the Buyer. Pro- Rata payments shall become due as shipments are made. Items held of Buyer shall be at the risk and expense of the Buyer.

2. **Title**.
   A. This subsection applies in jurisdictions where the laws provides a purchase-money security interest, or similar rights, in favor of the seller, including but not limited to the U.S., Canada, and Mexico: Title and risk of loss or damage passes to Buyer when the goods are put into possession of the freight carrier for delivery to Buyer. Seller retains a security interest in the goods to ensure payment in full. Buyer agrees not to take any action with respect to the goods that would interfere with Seller's security interest until the goods are fully paid for.

   B. This sub-section applies in all other jurisdictions: Risk of loss or damage passes to Buyer when the goods are put into possession of the freight carrier for delivery to Buyer. Seller retains sufficient title in the goods to ensure the goods are fully paid for. Buyer agrees not to take any action with respect to the goods that would interfere with Seller's title until the goods are fully paid for.

3. Delays in Deliveries. Seller shall not be liable for failure to fill any order when due to: fires; riots; strikes; freight embargoes or transportation delays; shortage of labor; inability to secure fuel, material, supplies or power at current price or on account of shortages thereof; acts of God or of the public enemy; any existing or future laws or acts of the federal or of any state or local government (including specifically but not exclusively any orders, rules or regulations issued by an official or agency of any such government) affecting the conduct of Seller's business with which Seller in its judgment and discretion deems it advisable to comply as a legal or patriotic duty; or to any cause beyond Seller's reasonable control. Seller is not liable for damages attributed to delays in delivery.

4. Taxes. Prices quoted herein shall be subject to an additional charge to cover any existing or future Manufacturers, Sales, Use, Value Added or similar tax which may be applicable and any administrative costs for required governmental permits, inspections and the life.

5. Special Order Equipment. Where buyer shall furnish special order equipment, Buyer shall bear the cost of alterations made thereon, except such as Seller may make for its own convenience. Buyer shall furnish drawings and specific information as to variations permissible between equipment and drawings. Shipping and crating charges on said equipment to and from Seller's facilities shall be borne by buyer. Seller shall have no responsibility for loss or damage to said equipment, except when due to careless handling or negligence on the part of Seller. Cost of insurance on special orders will be borne by buyer, and same are held at Buyer's risk.

6. Seller's Warranty. Seller's standard published warranty in effect at the time of shipment for the particular product shall apply. THIS WARRANTY IS EXCLUSIVE AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESS, IMPLIED OR STATUTORY, INCLUDING THE WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. Seller's liability shall not in any case exceed the cost of repair or replacement of any defective product as stated in the warranty and upon expiration of the warranty period all such liability shall terminate. Seller shall in no event be liable for consequential damages of any kind.

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A. Cancellations:

i. For custom/modified products:

When cancellation notice received:	**Charge is:**
1-30 days prior to shipment	100% of product sales price
31-60 days prior to shipment	75% of product sales price
61-90 days prior to shipment	50% of product sales price
91 days or more prior to shipment	10% of product sales price

ii. For standard products: To be negotiated

B. Reschedules:

i. For completed custom/modified product rescheduled	1.5% per month x sales price of product
ii. Incomplete custom/modified product, parts rescheduled	1.5% per month x sales price of products which are stocked or ordered.

iii. Restocking: Only standard products may be restocked. 25% of dollar value returned to Seller's stock, plus all freight charges. All restocking is subject to Seller's approval and inspection.

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11. Export Licenses. Items quoted herein may constitute a controlled commodity requiring export licenses from the U.S. Department of Commerce prior to transshipment. Buyer shall be responsible for obtaining any such licenses required.

12. Exclusive Statement. The terms and conditions contained in Seller's Order Acknowledgement will be the complete and exclusive statement of the terms of agreement between the parties. If the terms of said Acknowledgement differ in any way from the terms of Buyer's order, the provisions of said Acknowledgement shall prevail and be controlling.

13. State Laws. This contract shall be governed in all respects by the laws of the State of New Hampshire and the State of California.

1**4**. **This contract is governed by Incoterms 2010.**

FERROTEC (USA) CORPORATION'S ACCEPTANCE OF THE REFERENCED PURCHASE ORDER IS EXPRESSLY MADE CONDITIONAL ON THE PARTY'S ASSENT (WHO SUBMITTED THE REFERENCED PURCHASE ORDER) TO FERROTEC'S ADDITIONAL OR DIFFERENT TERMS IN THIS ORDER ACKNOWLEDGEMENT. IF NO ANSWER IS RECEIVED FROM THE PARTY SUBMITTING THE REFERENCED PURCHASE ORDER WITHIN A REASONABLE TIME AFTER RECEIPT OF THIS ORDER ACKNOWLEDGEMENT, IT WILL BE ASSUMED THAT THEIR INCLUSION HAS BEEN ASSENTED TO.

Limited Warranty

1. **Parties Covered**. This limited warranty is given by Ferrotec (USA) Corporation hereinafter called the “Warrantor” to the buyer of the above described item(s) and extends to Buyer only and is not transferable to nor enforceable by any transferee, subsequent purchaser or successor of buyer.

2. **Term of Limited Warranty**. The term of this limited warranty shall be one year from the date of shipment of the above items(s). Warrantor shall not have liability or responsibility under this limited warranty or under any warranties implied by law or otherwise, for defects ensuring or claims asserted after the expiration of the term of this Limited Warranty.

2. **Limitations of warranties**. The only express or implied warranties of Warrantor are those expressed in this instrument.

   A. WITHOUT LIMITATION, WARRANTOR HEREBY DISCLAIMS ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. THERE ARE NO WARRANTIES WHICH EXTEND BEYOND THE EXPRESS WARRANTIES SET FORTH HERIN. THE TERM OF ANY WARRANTY OR WARRANTOR IMPLIED BY LAW SHALL END ON THE TERMINATION DATE OF THIS LIMITED WARRANTY SPECIFIED IN SECTION 2.

   B. Warranty duration for out of warranty items repaired by Ferrotec shall be ninety (90) days from date of shipment post repair “Ex-works”.

4. **Warranty Coverage**. Subject to the exclusions set forth in Section 5, the item(s) described above is/(are) warranted against defects in material or workmanship. Warrantor shall, at its option, repair or replace at its cost any defective item during the warranty period. Warrantor may repair the item at any of its worldwide service locations.

5. **Exclusions from coverage**. Warrantor expressly disclaims responsibility for any of the following, each of which is expressly EXCLUDED from this limited warranty.

   A. Ordinary wear and tear, damage or defects due to abuse, misuse, failure to use according to instruction, or exposure to temperatures and conditions in excess of those referred to in the Notes and instructions delivered herewith. If different operating temperatures or conditions are specified in documentation specific to your product, these supersede those on the enclosed Notes and instructions.

   B. Damage or defects caused by Acts of God, the elements, natural disasters, or by the wrongful or negligent act or omission of anyone other than the Warrantor.

   C. Damage or defects to any product disassembled, modified, repaired or replaced by any party other than the warrantor or its expressed authorized representative, whether or not damage was caused by said disassembly or modification.

   D. Incidental, consequential or special damages of any kind.

6. **Claims Procedure**. Buyer shall promptly notify warrantor in writing of a claim under this Limited Warranty or any warranty implied by law. Buyer is responsible for freight charges for shipment of product to Warrantor. Warrantor will pay for the freight charges for shipment of product back to Buyer where the product is found to be defective.

7. **Severability: No Waiver**. In the event any of the provisions hereof shall be invalid, the remainder of the provisions of this Limited Warranty shall remain in full force and effect. No waiver by Warrantor of the provisions hereof at any time shall constitute a waiver of any such provisions at any subsequent time or of any other provisions at any time.

SAFETY INSTRUCTIONS FOR OPERATING AND SERVICE PERSONNEL

Operators and service personnel should always wear safety glasses. Operators shall not enter areas intended for service access only. Only experienced service personnel should enter such areas, and only after taking the preliminary precautions described in paragraphs 1 through 11 below.

DANGER

Potentially lethal voltages may exist within this unit, even with the line power switched off. Service should only be attempted by qualified personnel. Failure to observe all safety precautions may result in personal injury.

This component is designed to operate as part of a system containing high-voltage equipment. Observe the precautions described below when servicing this system, especially when servicing components where high voltages may be present.

1. Before servicing or operating this equipment, read all the component manuals supplied with the system, paying special attention to safety instructions.
2. Post HIGH VOLTAGE WARNING signs in conspicuous locations within the service area.
3. Remove rings, watches, bracelets, and any other metal jewelry before working around high voltage.
4. DO NOT WORK ALONE!
5. Be sure that all equipment is connected to a power receptacle having the correct polarity and grounding, as prescribed by the local electrical codes. Refer to the power supply portion of the documentation to determine the proper electrical ground for high-voltage components.
6. Before servicing any high-voltage component, switch off the electrical power at the component's main power switch. This switch should have a lockout feature. Lock the power off and keep the key with you while you are working on the equipment.
7. Certain electrical parts (e.g., electrolytic capacitors) hold a lethal voltage even after the power is switched off. Before entering any service area, use a grounding hook to discharge such parts. Be sure that these parts are discharged before starting any repairs.
8. DO NOT touch high-voltage leads unless power is off and a grounding hook is connected to the parts to be serviced.
9. The high-voltage components of the system should be equipped with electrical interlocks to protect personnel from injury. DO NOT ATTEMPT TO DEFEAT, OVERRIDE, OR BYPASS THESE PROTECTIVE DEVICES!
10. Never leave loose ends on high-voltage connections.
11. Observe the following warning if the system employs Radio Frequency (RF) power.

DANGER

RF radiation—even at modest power levels—can cause serious injury. If any of the RF components (e.g., the RF power supply, the RF matching network, or the RF electrodes or shielding inside the product chamber) are moved or changed in any way, the RF energy may be radiated outside the equipment. Monitor the equipment to assure that external RF radiation is below the levels prescribed by any and all applicable safety codes.

Special Amendment for United Kingdom Users

All Electrical Power Sources: Safety Precautions

This component is designed to be used in an extra-high-voltage system. Only authorized personnel should be permitted to carry out work on this system.

Prior to any servicing, grounding hooks should be used to short out all high-voltage parts and conductors in both the vacuum system and the high-voltage power supply. Screens protecting extra-high-voltage conductors should be removed only if appropriate action has been taken to ensure that extra-high-voltage conductors are dead and cannot be reenergized inadvertently.

In addition, all personnel should be aware of:

1. The Electricity (Factories Act) Special Regulations (1908 and 1944), in particular, Regulations 18(d) and 28 of the 1980 Regulations, as amended; and

2. The employer's responsibility to set up suitable systems to safeguard the health and safety of employees, according to the Health & Safety at Work etc. Act (1974).

USER RESPONSIBILITY

This equipment will perform in accordance with the instructions and information contained in the user's manual and its referenced documents when such equipment is installed, operated, and maintained in compliance with such instructions. The equipment must be checked periodically. Defective equipment shall not be used. Parts that are broken, missing, plainly worn, distorted, or contaminated, shall be replaced immediately. Should such repair or replacement become necessary, a telephone or written request for service should be made to Temescal, Livermore, CA, a division of Ferrotec (USA) Corp.

The equipment, or any of its parts, shall not be altered without the prior written approval of Temescal. The user and/or purchaser of this equipment shall have the sole responsibility for any malfunction which results from improper use, faulty maintenance, damage, improper repair, or alteration by any party other than Temescal.

GUIDELINES AND GOOD PRACTICES

1. Follow applicable clean room procedures (smocks, masks, gloves, etc.).
2. Do not expose the vent and purge valves to excessive pressures. The nitrogen line regulator is factory set at 15 psi and must not be adjusted above 20 psi.
3. PRevFnt oil, grease, water, sweat, etc. from getting into the vacuum chamber.
4. Replace the source tray shield correctly to ensure that the ceramic parts or the high voltage feedthroughs are protected from being coated.
5. Clean all mechanical parts and seals with lint-free paper/cloth soaked with isopropyl alcohol (IPA). Dispose all IPA-exposed cleaning paper/cloth in a fireproof container, while ensuring proper safety precautions are being followed.
6. Polish scratched surfaces with Scotch-Brite, taking care not to produce any cross scratches.
7. Shaft seals are all ferromagnetic. No lubrication is required.
8. Check the chamber door's seal and sealing surfaces each time before closing it.
9. Check and clean with IPA the source tray seals and sealing surfaces each time before raising the source tray into place.
10. Train staff by competent personnel. DO NOT allow staff to operate or do maintenance and recovery work on the machine until they are trained by competent personnel.
11. Document all alarms, deviations, breakdowns, and servicings done on either a hardcopy or an electronic equipment-log system.

HEALTH HAZARD

The condensates deposited on the tank walls of a vacuum system are generally in the form of extremely fine particles. The nature, as well as the form, of the materials poses the following potential health hazards:

a) Inhaling fine particles (powder) may cause damage to the lungs. To help prevent this, wear a protective respirator mask with fine filter that has been approved by the National Institute for Occupational Safety and Health (NIOSH) and the federal Mine Safety and Health Administration (MSHA).

b) Some substances are toxic and inhaling them should be avoided. Take steps to ascertain whether or not the material being deposited is a known toxic substance. Refer to the Material Safety Data Sheet(s) covering the evaporant(s) in question.

c) Certain powders (titanium, for instance) can cause flash fires when exposed to oxygen or other oxidizers. Therefore, when opening the chamber door after a deposition cycle, exercise extreme caution and allow time for the coating surface to oxidize. Breakage of some of the more reactive condensates may be hazardous, even when the above precautions are observed. In this situation, fire-protective clothing should be worn.

Certain powders (platinum, for instance) are known to catalyze methyl alcohol vapors upon contact, generating heat in the process and possibly causing a fire to erupt. Therefore, never use methyl alcohol to wipe down or clean any internal tank surfaces of a vacuum system. Use isopropyl alcohol (IPA), instead. Dispose of all IPA-exposed lint-free paper/cloth into a fireproof container, while ensuring all proper safety procedures and precautions are being followed.

1 Introduction to the TemEbeam Controller

1.1 Section Overview

This section provides a physical description of the TemEbeam Controller and overviews of how its user interfaces operate. The topics covered are:

1.2 Product Description

1.2.1 Hardware Applications and Functional Capabilities

The TemEbeam Controller (EBC) is a rack-mountable unit designed to control three or more components in an e-beam deposition system. In its current configuration, the TemEbeam Controller enables control in any of four operating modes over the following devices/functions:

- Temescal CV-6SLX and CV-12SLX e-beam power supplies
- Temescal turret indexer; the EBC controls the rotation of any compatible e-beam source with up to 8 pockets
- E-beam guns capable of +4 A to –4 A coil current output; the EBC controls beam position and sweep.

The EBC enables the user to define beam position limits and to design ten sweep programs per pocket for use in Local Mode. In Remote Mode, up to 8 sweep programs per pocket can be selected from a higher-level controller. Programmable sweep parameters include lateral and longitudinal frequency, amplitude, and waveform. Available sweep waveforms are sine, clipped, saw tooth, ramped, and arbitrary.

1.2.2 Main Components

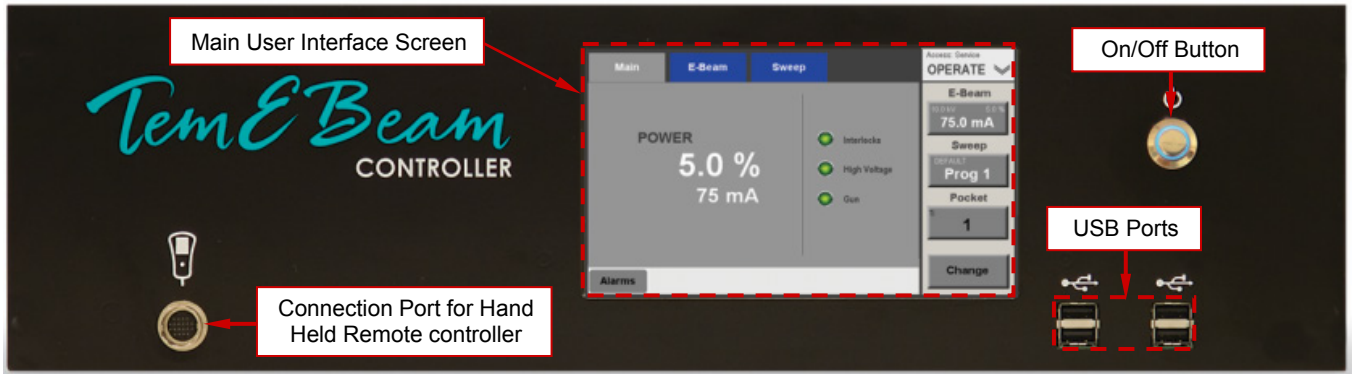
The main components of the TemEbeam Controller are its rack-mountable main control unit and its hand-held remote controller (see Figure 1-2). Figure 3.4 shows its rear-panel.

Figure 1-1 EBC Main Control Unit and Hand-Held Controller

The EBC Main Control Unit

The front panel of the EBC control unit includes the unit's On/Off button, its control touch-screen, a connection port for the hand-held remote controller, and two USB ports.

Figure 1-2 EBC Front Panel



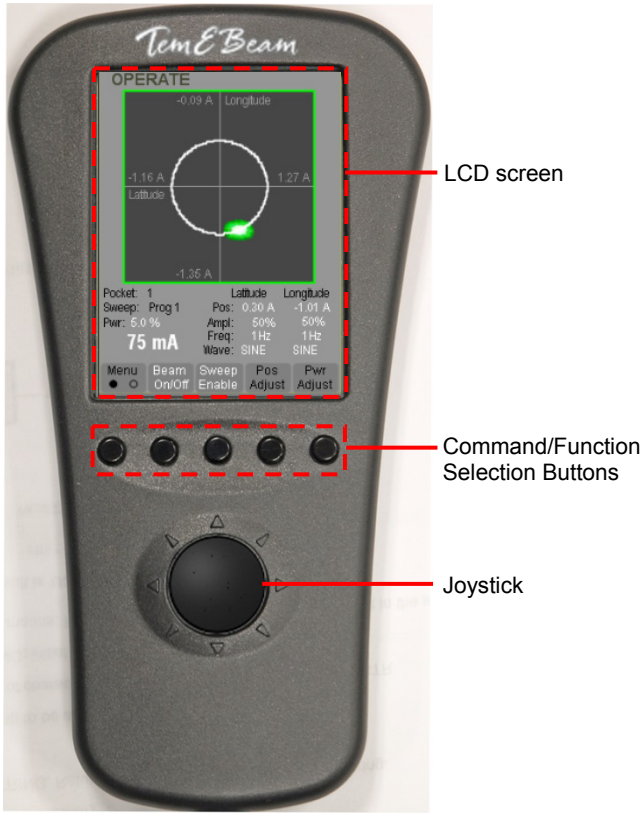
Hand-Held Remote Controller

The main function of the hand-held remote controller is to enable the user to configure sweep patterns while observing actual beam motion through a viewport. The control/display features of the hand-held controller (see Figure 1-3) are:

- the LCD screen
- five command buttons, whose functions vary depending on which screen is currently displayed on the LCD screen
- a joystick that allows the user to control e-beam power, beam spot position (or pattern center position), forward/reverse turret jogging, and sweep amplitude and frequency.

For detailed functional information about these features, see section 1.4.

Figure 1-3 Control/Display Features of Hand Held Remote Controller

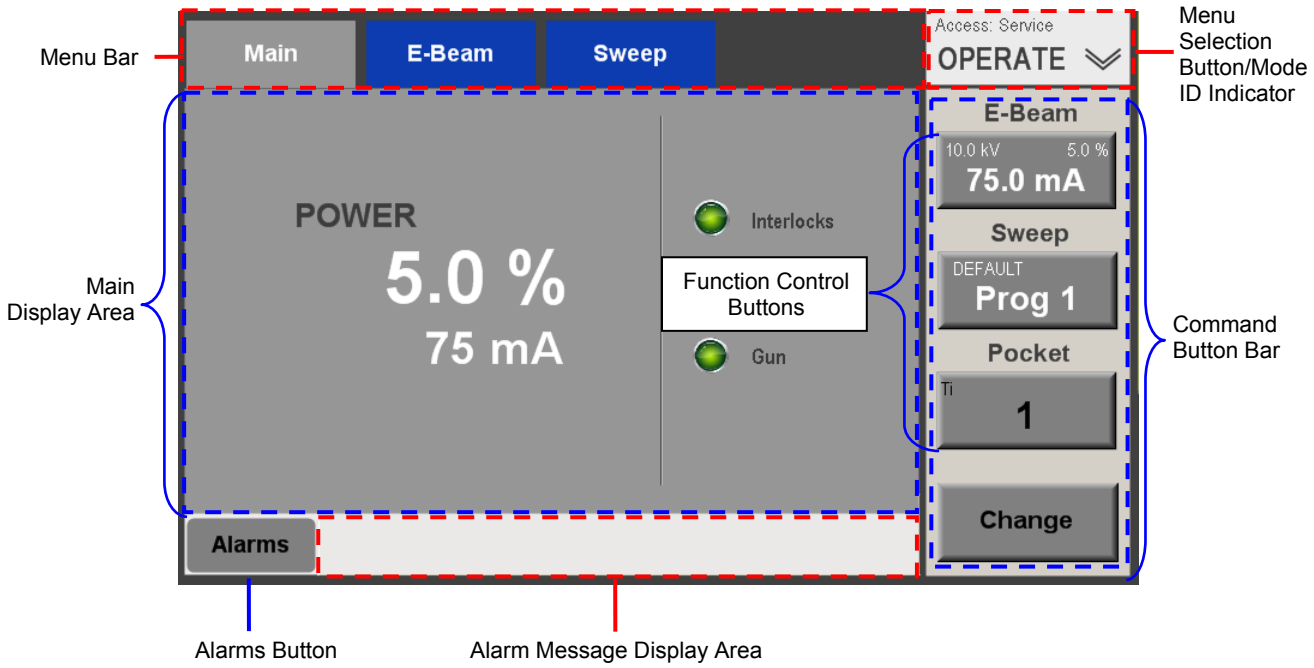


1.3 The Main Control Unit's Touch Screen

1.3.1 Functional Overview

The main control unit's touch screen comprises the EBC's main user interface. Figure 1-4 identifies the functionally distinct areas of the touch screen, which are defined below the illustration.

Figure 1-4 Functionally Distinct Areas of Main Controller's Touch Screen

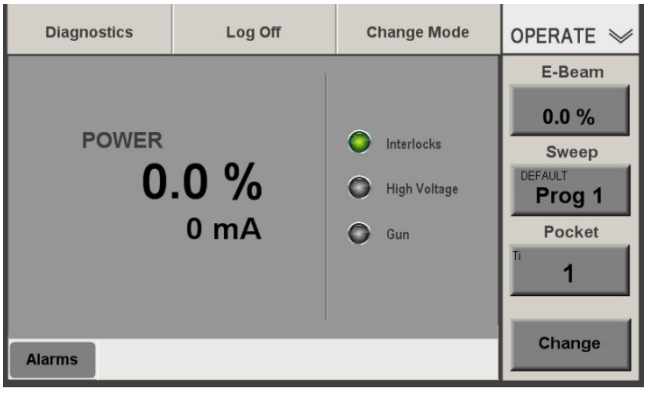


- **Menu Selection Button**: This button enables the user to select either the Main Menu or the Auxiliary Menu for display in the menu bar.
- **Menu bar**: Displays either the Main Menu (see Figure 1-4) or the Auxiliary Menu (see Figure 1-5).
- **Main Display Area**: This area displays the mode-specific screens available via the Main Menu Bar (see Figures 1-8 through 1-10), as well as the Diagnostics screen (see Figure 1-13), the Alarms screen (see Figure 1-12), the Change Mode and Mode Change popups (see Figures 2-8 and 2-10), and on-screen numeric keypads that allow users to enter parameter values.
- **Command Button Bar**: The Function Control buttons on this button bar allow the user to initiate turret rotation and to switch the e-beam and the sweep on and off. In conjunction with the **CHANGE** button, Function Control buttons also enable the user to change the beam's percent-power value and to change the sweep program and pocket selections. For detailed information about how these buttons function, see section 2.6.
- **Alarm Message Display Area:** Displays notifications of currently active alarm messages.
- **ACK** button: Enables the user to acknowledge active alarms.

1.3.2 The Main and Auxiliary Menus

In all operating modes, the user can display either the Main Menu, as in Figure 1-4, or the Auxiliary Menu, as in Figure 1-5. The Main Menu allows the user to display the screens that are functionally unique to the operating mode in question. In all modes, the Auxiliary Menu enables the user to change the EBC operating mode. In Operations, Configuration, and Manual modes, the Auxiliary Menu also provides access to the Diagnostics screen (see Figure 1-13). For detailed information about the Diagnostics screen, see section 10.2.

Figure 1-5 Operations>Main Screen with Auxiliary Menu Displayed

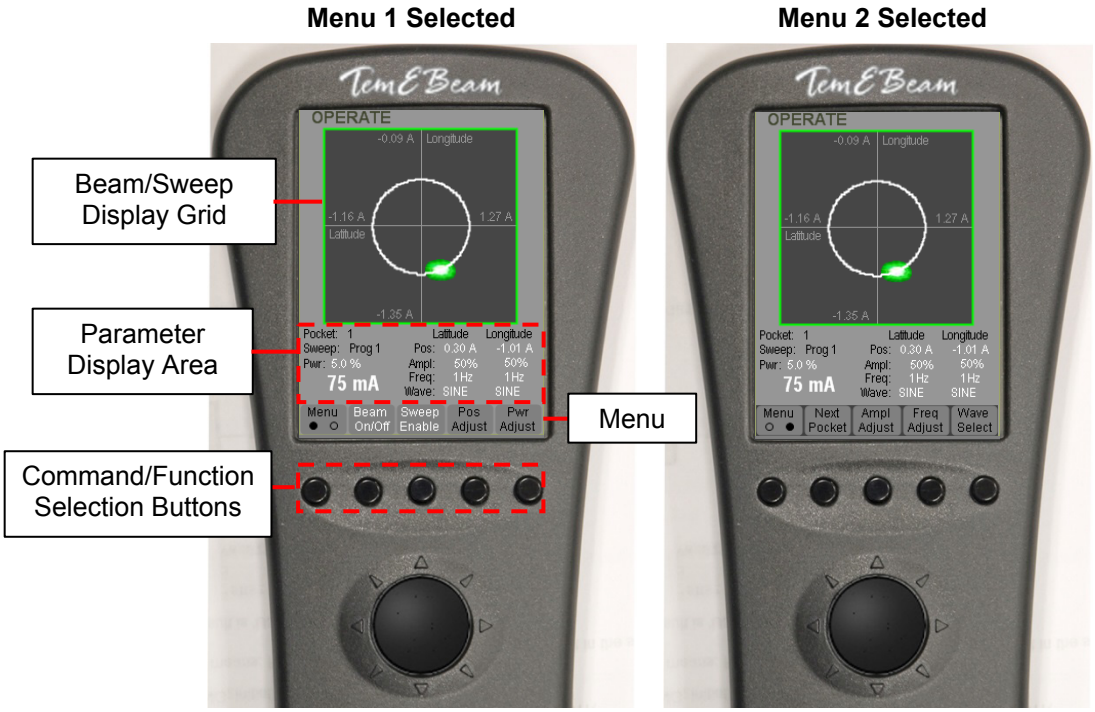


1.4 Control/Display Features of the Remote Controller

1.4.1 LCD screen

The screens displayed on the remote controller vary depending on which operating mode is currently selected via the EBC touch screen. Figure 1-6 shows the remote controller's LCD screen as it appears in Operations mode. Figure 1-6 also shows the three functional areas into which the LCD screen is organized. Figure 1-7 shows how that screen appears in Configuration mode. Note that the remote controller screen is blank when the EBC is in Service Mode. Note also that if a given EBC command module is configured as either Remote or EtherCAT, the on-screen features related to that module are display-only; no command functions related to that command module are active.

Figure 1-6 The Remote Controller Screen in Operations Mode



These functional areas are:

Beam/Sweep Display Grid. If the sweep is not enabled, this grid displays the current position of the beam or beam spot. When the sweep is enabled, it displays the sweep pattern currently in operation. The appearance and function of this grid are identical in Configuration, Operations, and Manual modes.

Parameter Display Area. Displays the number of the pocket and sweep program currently selected, the beam power in percentage and milliamp terms if the beam is on, and the parameters (including waveform) of the sweep program currently selected. Identical parameters are displayed in Configuration, Operations, and Manual modes.

Menu. The menu segment on the extreme left allows the user to select either Menu 1 or Menu 2 when the EBC is in Operations or Manual mode (see Figure 1-6). When the unit is in Configuration mode, this segment allows the user to select Menu 1, 2, or 3, as shown in Figure 1-6. Each of the other four menu segments indicates the function of the command/function selection button immediately below it.

The Remote Controller's Screen in Configuration Mode

When the EBC is in Configuration mode, the user can select any of the three menus shown in Figure 1-7. As in Operations and Manual modes, the beam/sweep display grid and the parameter display area function identically regardless of which menu is selected. For detailed information about using the remote controller in Configuration Mode, see sections 4.2.4 and 4.6.3.

Figure 1-7 Remote Controller Menus Available in Configuration Mode

Menu 1 Selected **Menu 2 Selected** **Menu 3 Selected**

Changes to Hand-Held Controller's Screen Depending on Configuration State

When a given control module is configured as Offline, **Hardware Not Activated** is displayed on the LCD screen of the hand-held controller. When a given control module is configured as **Remote I/O**, the command buttons on the hand-held controller related to that function are disabled, and the spaces above command buttons related to that control module are blank.

1.4.2 The Command/Function Selection Buttons

The remote controller's command buttons (see Figure 1-6) include a **Menu** button and four other buttons. The functions available via those four buttons vary depend on whether the unit is in Configuration or Operations Mode and which menu is selected via the remote controller's **Menu** button. When the EBC is in Configuration Mode, clicking the **Menu** button steps between Menus 1 and 3 (see Figure 1-7). When the EBC is in Operations Mode, clicking the remote controller's **Menu** button toggles between the two menus shown in see Figure 1-6.

Each of the other four command buttons allows the user either to select or activate the function identified directly above it on the remote controller's display screen. For complete details about the functioning of these buttons in Configuration and Operations Modes, see sections 3 and 5.7, respectively.

1.4.3 The Joystick

The remote controller's joystick enables the user to:

- vary beam power and beam spot/pattern-center position when the EBC is in Operations Mode and in Configuration Mode
- vary sweep amplitude and frequency when the EBC is in Operations Mode
- jog the turret when the EBC is in Configuration Mode.

For information about using the joystick in Operations Modes, see sections 5.7. For information on its functions in Configuration mode, see sections 4.5.4 and 4.6.3.

1.5 EBC Operating Modes

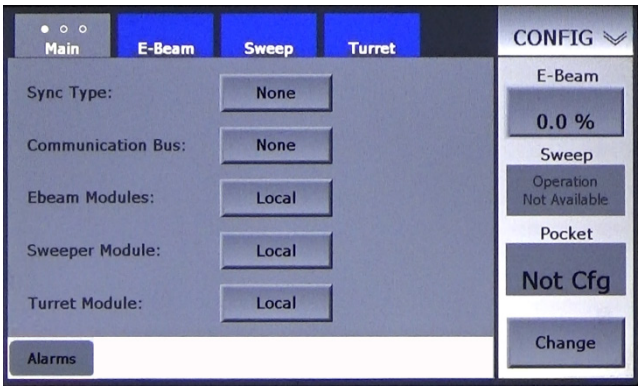
The EBC's operating modes are Configuration Mode, Operations Mode, Service Mode and Manual Mode. EBC operation in these modes is described briefly below. For detailed information about EBC information in Operations mode, see Section 5. For details about Configuration mode, see Section 4 and for detailed information about Service mode, see section 10.

1.5.1 Configuration Mode

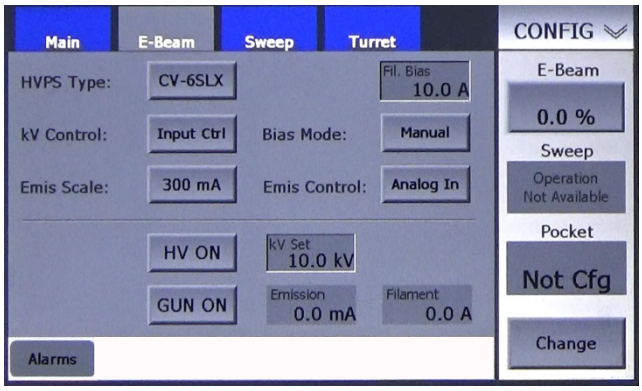
Figure 1-8 shows the Configuration Mode screens. The EBC's Configuration Mode enables the user to configure the E-Beam, Turret, and Sweep control modules, to set the system date and time, to assign material names or abbreviations to specific pockets, and to enable the log-in manager and assign user passwords and permissions. For complete details about the use of Configuration Mode, see Section 4.

Figure 1-8 Configuration Mode Screens (All Control Modules Configured as Local)

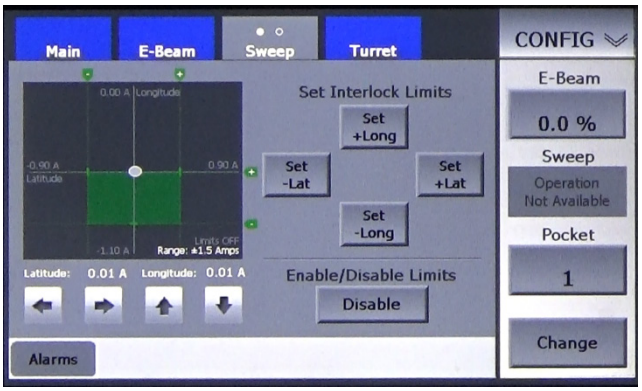
Config>Main Screen



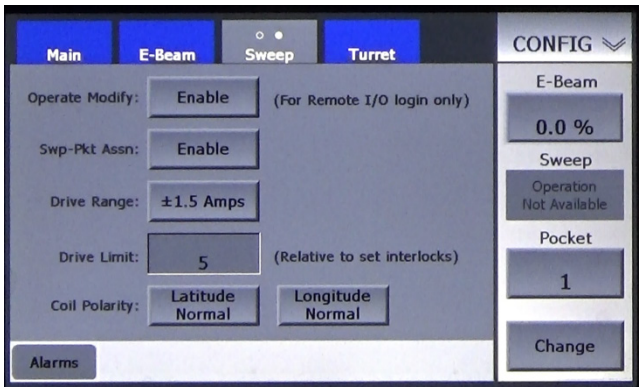
Config>E-Beam Screen



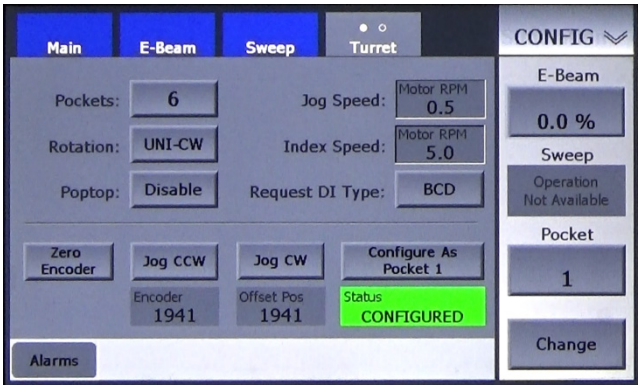
Config>Sweep Screen, page 1



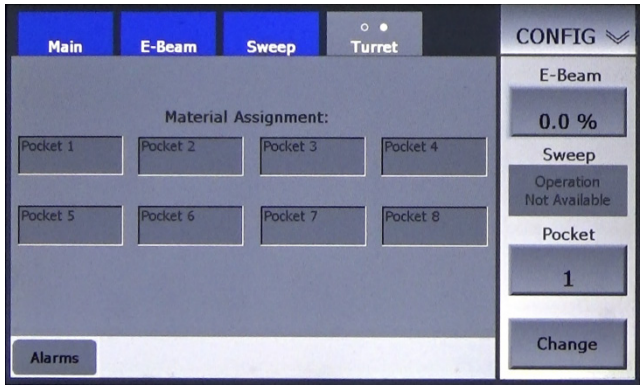
Config>Sweep Screen, page 2



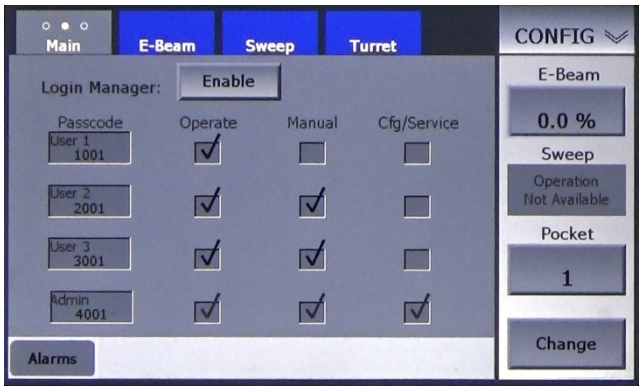
Config>Turret Screen



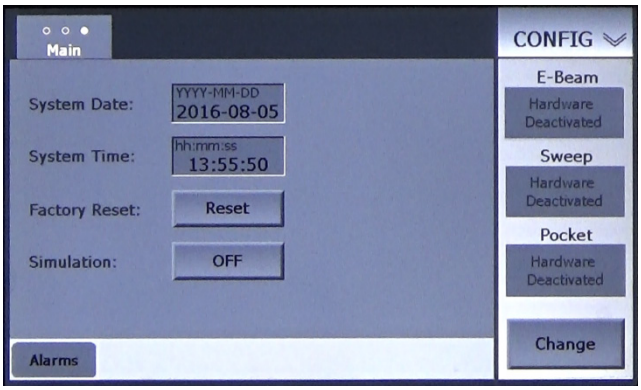
Material Assignment Page



LogIn Manager Screen, Login Manager Enabled



System Date/Time Page



In Configuration Mode, the Command Button Bar (see Figure 1-4) allows the user to:

- Switch the beam and the sweeper on and off
- Select the emission current output (as a percentage of the maximum emission current)
- Select the sweep program
- Rotate the turret to a user-selected pocket.

For complete details about the use of the Command Button Bar, see section 2.6.

1.5.2 Operations Mode

Use of Operations Mode when all Control Modules Are Configured as *Local*

Figure 1-9 shows the Operations mode screens when all three control modules are configured as **Local**. Under those conditions, Ops mode screens enable the user to program beam sweep patterns, switch the HV and the gun on and off independently of each other, and set the kV output of the e-beam power supply.

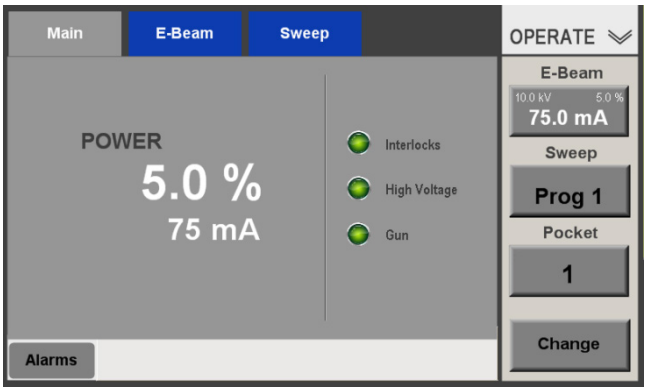
In Operations Mode, the Command Button Bar enables the user to:

- Switch the beam and the sweeper on and off
- Select the emission current output (as a percentage of the configured maximum emission current)
- Select the sweep program
- Rotate the turret to a user-selected pocket

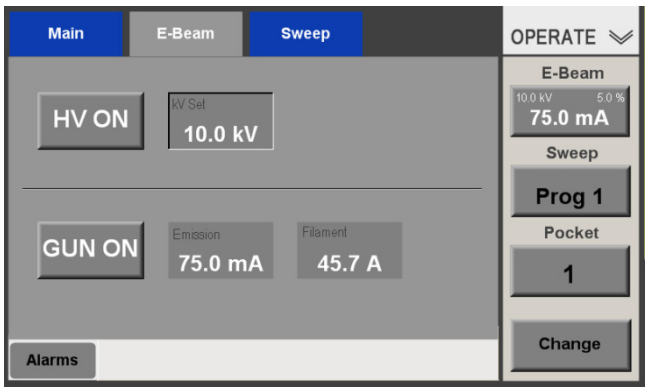
For complete details about the use of the Command Button Bar, see section 1.4. For information about all other aspects of EBC operation when all control modules are configured as **Local**, see Section 5.

Figure 1-9 Operations Mode Screens, All Control Modules Configured as *Local*

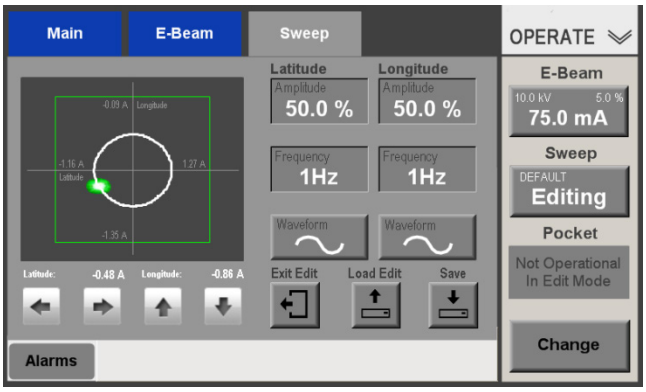
Operations>Main Screen



Operations>E-Beam Screen



Operations>Sweep Screen



Function of Operations Mode when Control Modules Are Configured as Either *Remote I/O* or *EtherCAT*

A given control module is configured as either **Remote I/O** or **EtherCAT** when that module is to be controlled by a higher-level controller, with can be either a deposition controller or a PLC-based system controller. If the higher-level controller communicates with the EBC via its rear-panel AUX I/O connector, the control module(s) to be controlled by the higher-level controller must be configured as **Remote I/O**. When communication between the higher-level control and the EBC is via an EtherCAT link, the control modules to be controlled by the higher-level controller are configured as **EtherCAT**.

For detailed information about Operations mode functionality when all control modules are configured as either **Remote I/O** or **EtherCAT**, see section 8.4.

1.5.3 Service Mode

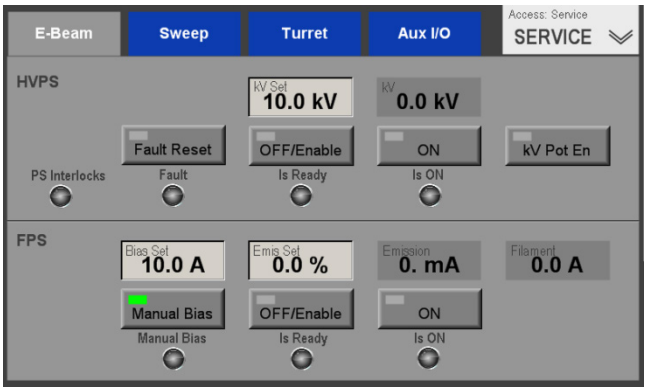
Figure 1-10 shows the screens accessible in Service Mode. The Service>E-Beam, Service>Sweep, and Service>Turret screens enable the user to test individual outputs. In addition, those screens display the True/False status of inputs from the controlled devices and the status of inputs from a higher-level controller, if the TemEbeam Controller is connected to

such a control system. The Aux I/O screen allows the user to test input pins on the rear-panel AUX I/O connector and to determine the status of the e-beam power supply's external interlocks. Note that if the inputs for these interlock signals are jumpered together, as described in Figure 2-7, these LED indicators will all turn red when any switch in the interlock string is not made. If these inputs are wired individually to the appropriate pins, as also shown in Figure 2-7, only the LED representing a currently unmade interlock and the LEDs representing those below that interlock in the interlock string will turn red.

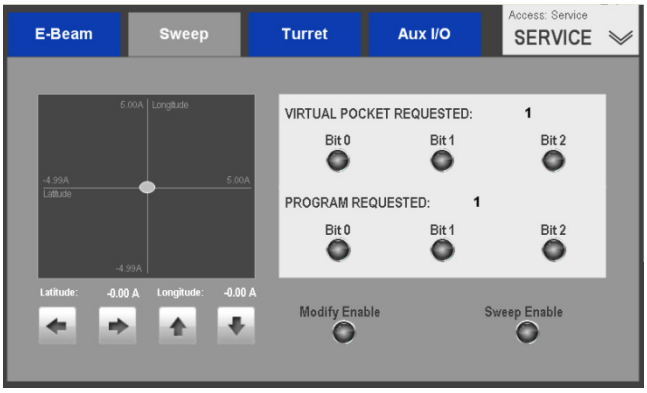
For additional information about using the Service mode screens, see section 10.3.

Figure 1-10 Service Mode Screens

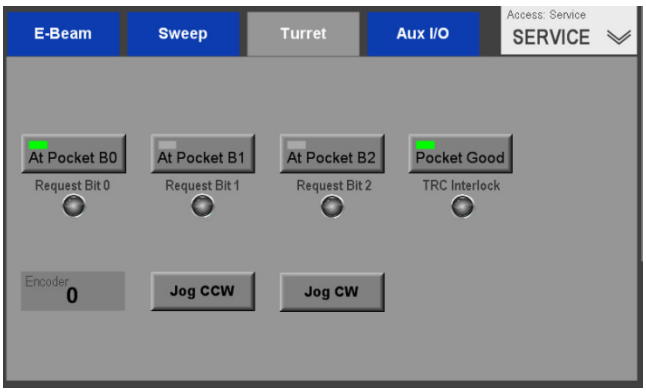
Service>E-Beam Screen



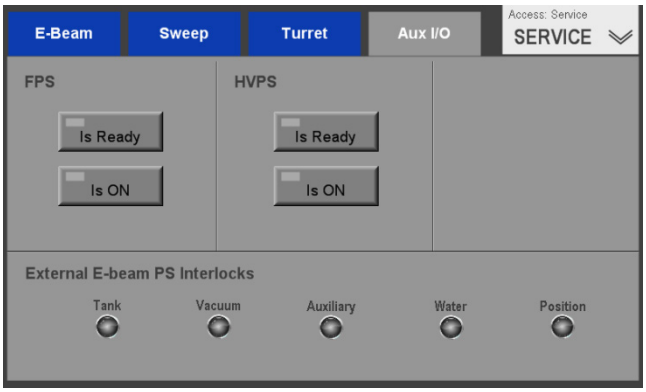
Service>Sweep Screen



Service>Turret Screen



Service>Aux I/O Screen



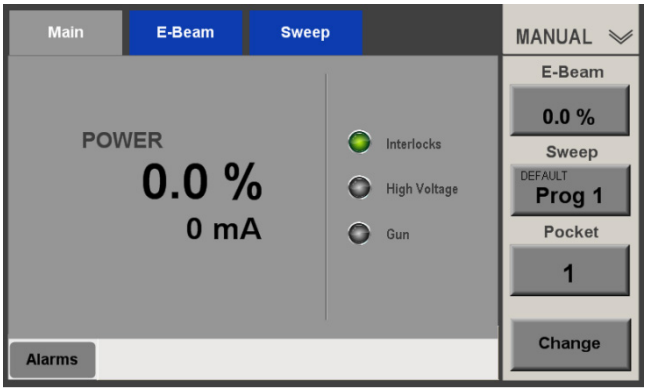
1.5.4 Manual Mode

Figure 1-11 shows the Manual mode screens, which allows an operator to exert local control when one or more control modules are configured as **Remote I/O** or **EtherCAT**. Selection of Manual Mode locks out all control inputs from any higher-level controller, whether a deposition controller or a PLC-based system controller. When the EBC is in Manual mode, a control module configured as either **Remote I/O** or **EtherCAT** provides functions exactly as though it were in Operations mode and configured as Local.

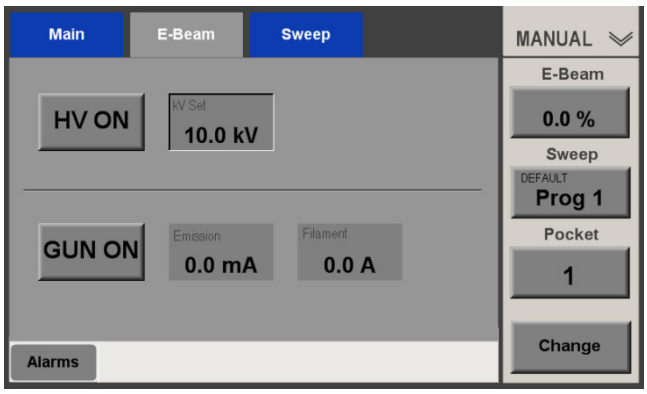
Users wishing to employ the full functionality of Manual mode must take care not to do so during recipe processing, as switching EBC modes during a process run will abort the process.

Figure 1-11 Manual Mode Screens

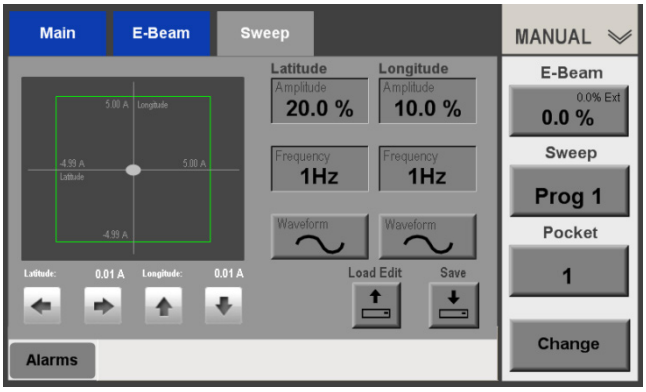
Manual Mode Main Screen



Manual Mode E-Beam Screen



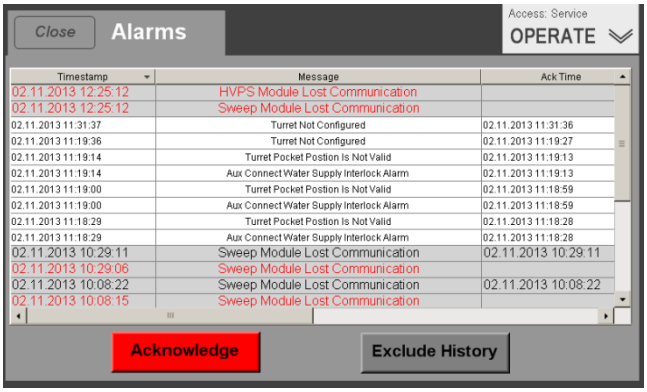
Manual Mode Sweep Screen



1.6 Main Controller Screens Accessible in Multiple Modes

Three EBC main controller screens are available in multiple operating modes. These are the Alarms screen (see Figure 1-12), the Diagnostics screen (see Figure 1-13), and the Software/Firmware Version ID screen (see Figure 1-14).

Figure 1-12 The Alarms Screen, *Include History* Selected



The Alarms and Diagnostics screens are available in all EBC operating modes except for Service Mode. To access the Software/Firmware Version ID screen, touch and 'peel back' the lower right-hand corner of the Diagnostics screen. For detailed information about the Alarms screen and procedures for responding to alarms, see section 2.9. For detailed information about the Diagnostics screen, see section 10.2.

Figure 1-13 Diagnostics Screen when Sweep and Turret Control Modules Are Configured as Remote

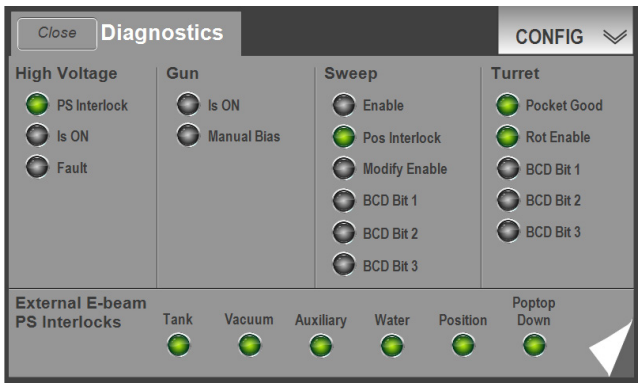
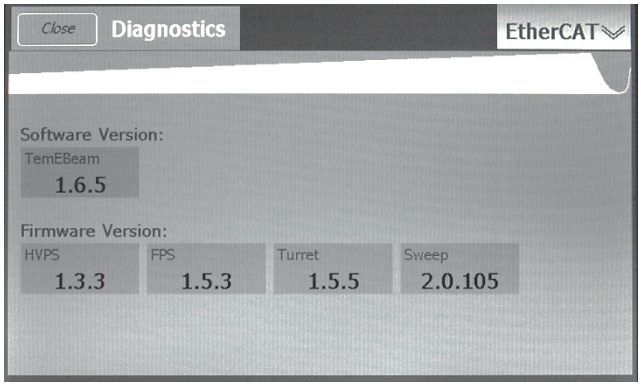


Figure 1-14 The Software/Firmware Version ID Screen



2 Operational Overview

2.1 Section Overview

This section provides describes basic EBC operational procedures and details about the main user interface (i.e., the main controller's touchscreen). For information about the control/display features of the hand-held controller, see section 1.4. The topics covered in this section are:

2.2 Powering Up the EBC

To power up the EBC, first make sure the rear-panel On/Off switch (see Figure 2-1) is in the ON position. Then press the front panel On/Off switch (see Figure 2-2). After the unit boots up, it will display the splash screen shown in Figure 2-3.

Figure 2-1 Rear Panel On/Off Switch

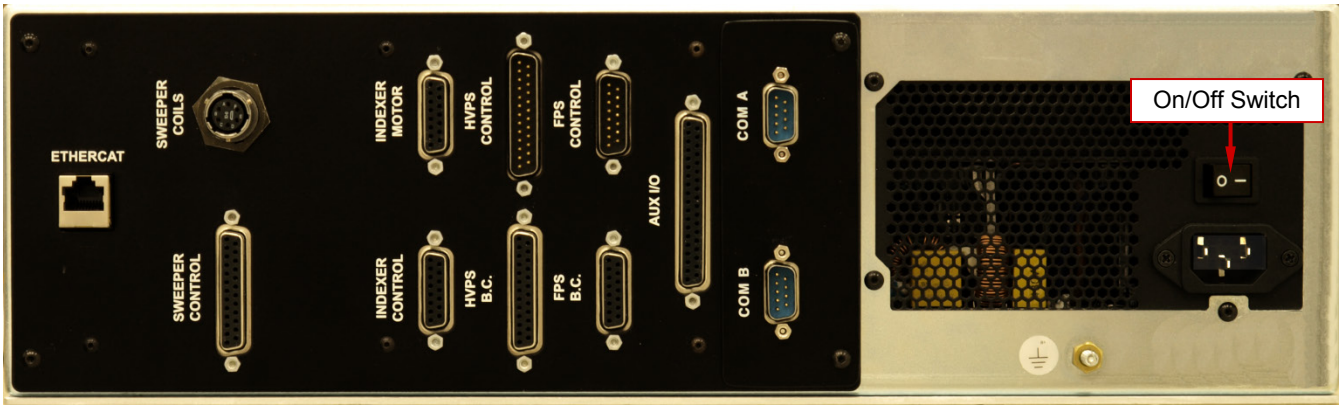


Figure 2-2 Front Panel On/Off Switch

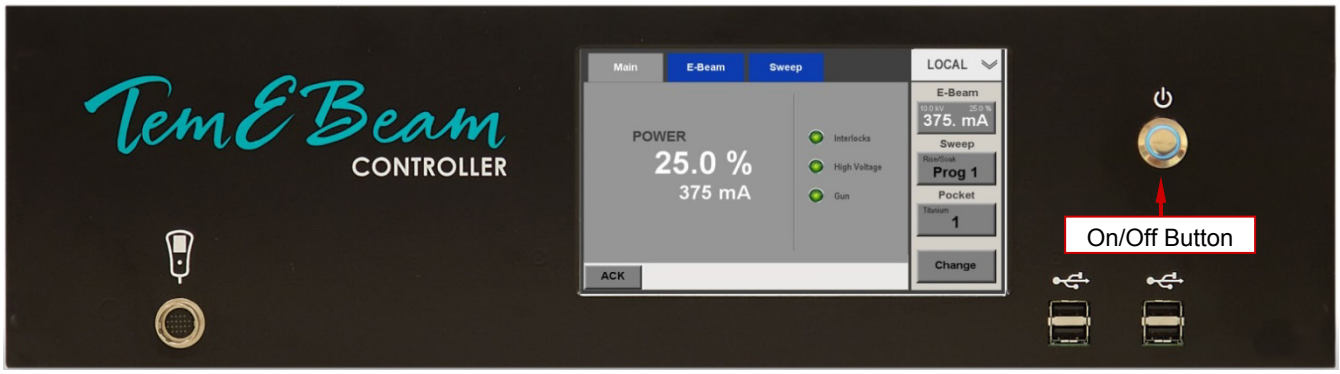
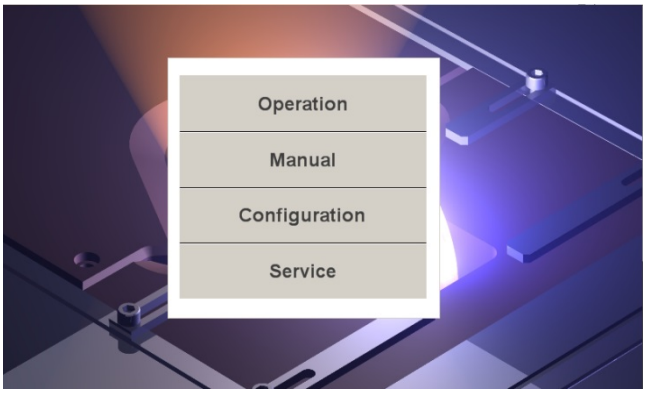


Figure 2-3 EBC Splash Screen Upon Initial Boot-Up



2.3 Logging In and Logging Off

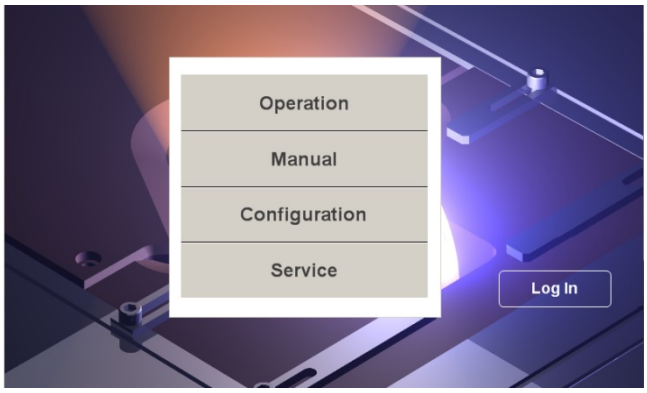
2.3.1 Entering the System when the LogIn Manager Is Disabled

When the LogIn manager is disabled, it is not necessary to log in. You can enter the desired operating mode by touching the appropriate mode-selection button on the splash screen.

2.3.2 Logging In When the LogIn Manager Is Enabled

When the LogIn manager is enabled, the initial splash screen will display a login popup, as shown in Figure 2-4.

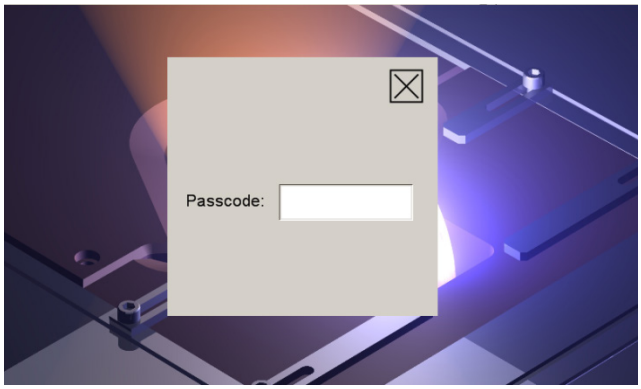
Figure 2-4 Splash Screen with Log In Button Displayed



To log-in, perform the following procedure**.**

Step	Action
1	Touch the **Log In** button. A password entry box will then appear on the splash screen, as shown in Figure 2-5.

Figure 2-5 Splash Screen with LogIn Popup Displayed



2	Enter your passcode and then touch the X in the upper right-hand corner of the popup to close it.

The unit will then display the splash screen shown in Figure 2-3.

2.3.3 Logging Out

To log out, follow the procedure described below.

Step	Action
1	Touch the Menu Selection button (see Figure 2-6) to display the Auxiliary Menu bar (see Figure 2-7).

Figure 2-6 Operations>Main Screen with Standard Menu Bar Displayed

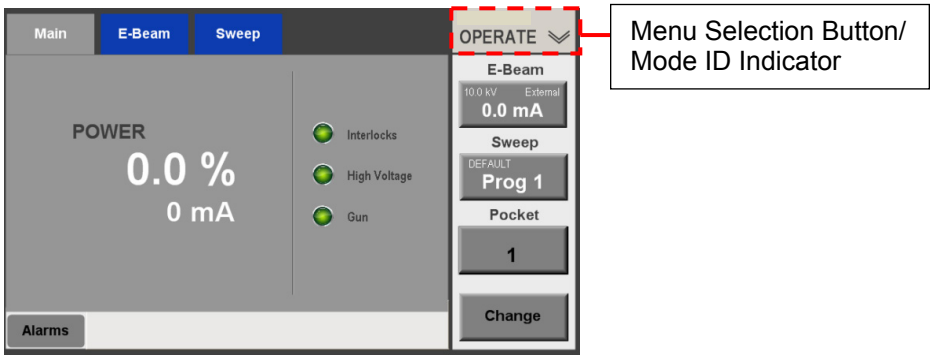
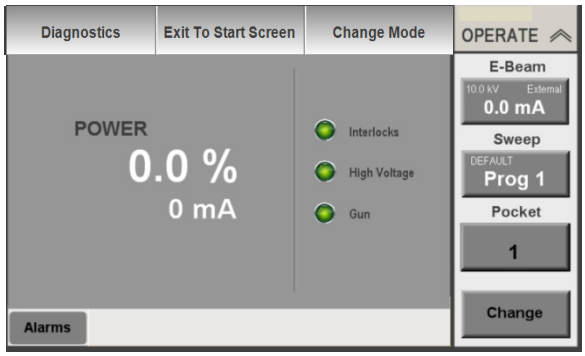
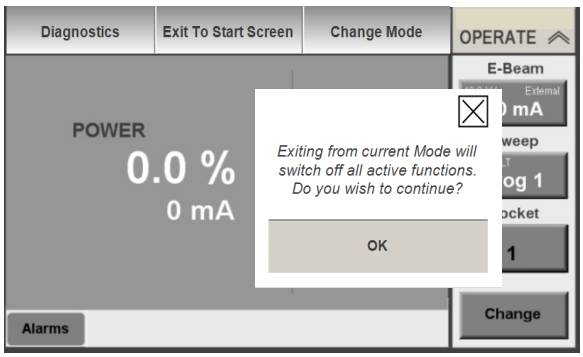


Figure 2-7 Operations>Main Screen with Auxiliary Menu Displayed



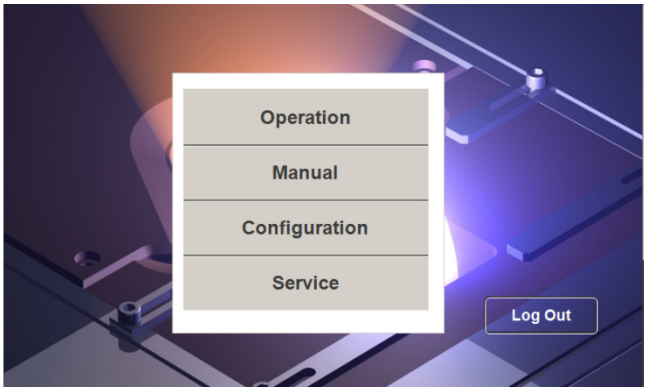
2	Touch the **Exit to Start Screen** button. The unit will then display the warning popup shown below.

Figure 2-8 Operations>Main Screen Displaying Exit-from-Mode Warning Popup



3 If you're sure it's O.K. to exit from the current operating mode, touch the **OK** button. The EBC will then display the splash screen shown below.

Figure 2-9 Splash Screen Displaying Log Out Button



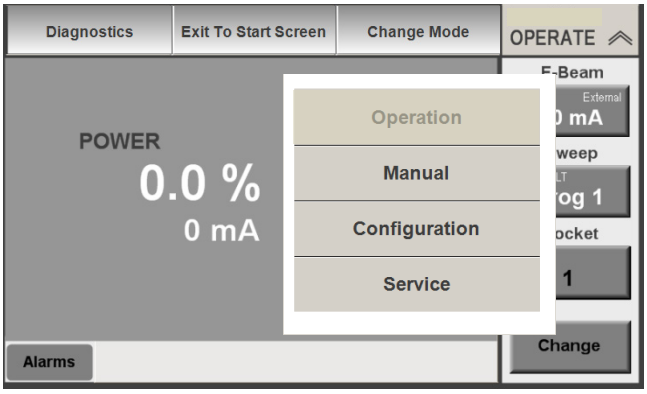
4 Touch the **Log Out** button. The splash screen will appear as shown in Figure 2-4.

2.4 Navigating Between Operating Modes

The following procedure describes how to switch from one EBC operating mode to any other.

Step	Action
1	Touch the Menu Selection button (see Figure 2-6) to display the Auxiliary Menu bar (see Figure 2-7).
2	Touch the **Change Mode** button to display the Change Mode warning popup shown in Figure 2-8.
3	If you're sure it's O.K. to exit from the current operating mode, touch the **OK** button. The EBC will then display the mode-selection popup shown below.

Figure 2-10 Local>Main Screen with Change Mode Popup Displayed



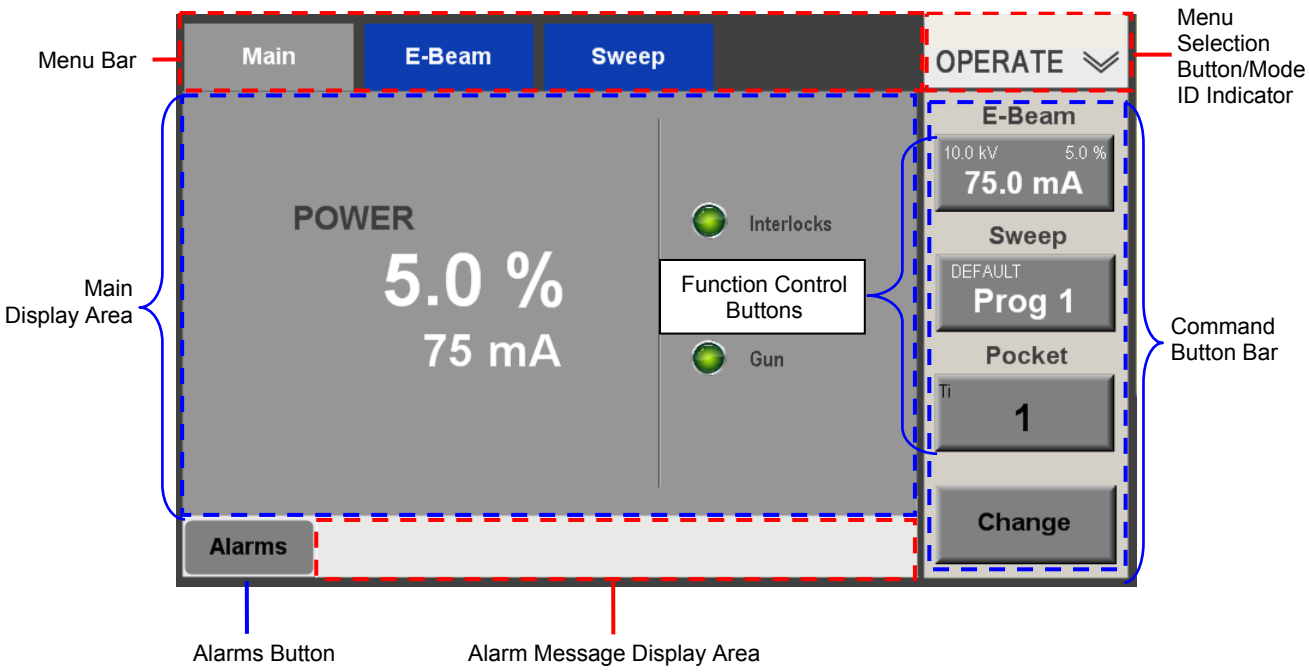
4 Touch the button for the desired mode. The EBC will then switch to that mode.

2.5 Overview of the EBC Touch Screen

2.5.1 Functional Overview

The main control unit's touch screen comprises the EBC's main user interface. Figure 2-12 identifies the functionally distinct areas of the touch screen, which are defined below the illustration.

Figure 2-11 Functional Areas of Main UI Screen



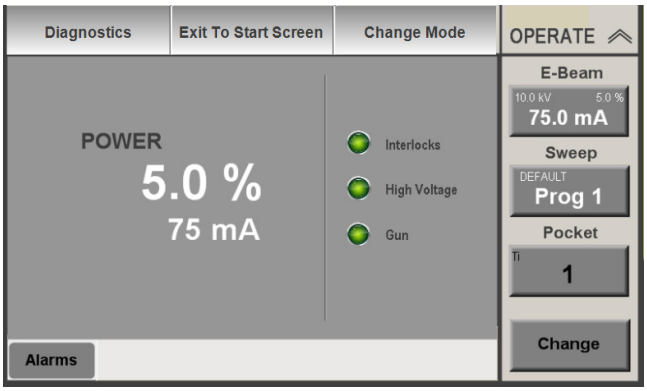
- **Menu Selection Button**: This button enables the user to select either the Main Menu or the Auxiliary Menu for display in the menu bar.
- **Menu bar**: Displays either the Main Menu or the Auxiliary Menu. Figure 2-12 shows the Main Menu, while Figure 2-13 shows the Auxiliary Menu.
- **Main Display Area**: This area displays the function-specific core areas of the screens available in the EBC's various operating modes (see Figures 1-8 through 1-11), as well as the Diagnostics screen (see Figure 1-13), the Alarm screen (see Figure 1-12), the various on-screen popups, and numeric keypads that allow users to enter parameter values. For detailed information about this area's control/display features, see section 2.7.
- **Command Button Bar**: The Function Control buttons on this button bar allow the user to initiate turret rotation and to switch the e-beam and the sweep on and off. In conjunction with the **CHANGE** button, the Function Control buttons also enable the user to change the beam's percent-power value and to change the sweep program and pocket selections. For detailed information about how these buttons function, see section 2.6.

- **Alarm Message Display Area:** Displays notifications of currently active alarm messages.
- **Alarms** button: Touch to display the Alarms screen (see Figure 2-28).

2.5.2 The Main and Auxiliary Menus

In all operating modes, the user can display either the Main Menu, as in Figure 2-12, or the Auxiliary Menu, as in Figure 2-13. The Main Menu allows the user to display the screens that are functionally unique to the operating mode in question. In all modes, the Auxiliary Menu enables the user to change the EBC operating mode. In Operations, Configuration, and Manual modes, the Auxiliary Menu also provides access to the Diagnostics screen (see 1-13). For detailed information about the Diagnostics screen, see section 10.2.

Figure 2-12 Local>Main Screen with Auxiliary Menu Displayed



2.6 Use of the Command Button Bar

The buttons on the Command Button Bar (see Figure 2-12) include the **CHANGE** button and three Function Control buttons, which enable the user to:

- change the operating value of the function controlled by the button in question (i.e., change the percentage of power applied when the e-beam is switched on, change the sweep program selection, and change the pocket selection). For detailed instructions, see section 2.6.1.
- activate the function in question (i.e., switch the e-beam and the sweep on/off and rotate the turret). For detailed instructions, see section 2.6.2.

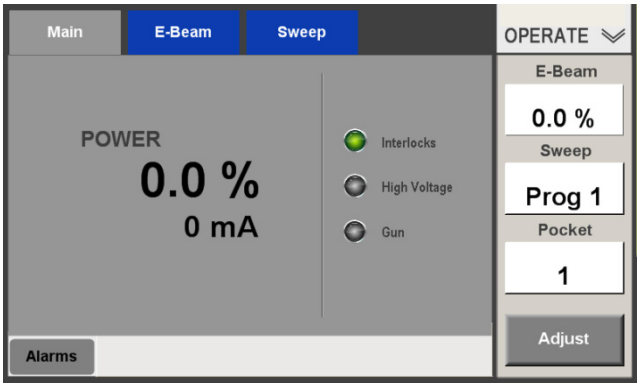
Each Function Control button displays the current operating value of the device/function in question. Thus, the **E-Beam On/Off** button displays the percentage of e-beam power applied as well as the kV value, while the **Sweep Enable** button displays number of the sweep program currently selected and the **Next Pocket** button displays the number of the pocket currently selected). The legend on a given button turns white when the function controlled by that button is operating.

2.6.1 Using the Function Control Buttons to Alter Operating Values

To change the operating value for any of the three functions controlled by the unit, perform the following procedure.

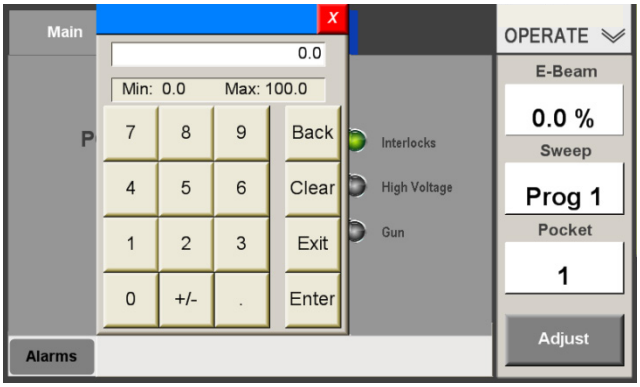
Step	Action
1	Press the **ADJUST** button. Doing so turns the Function Control buttons white (see Figure 2-14), indicating that the parameters selectable via all three buttons can be modified.

Figure 2-13 Command Button Bar After User Presses the CHANGE Button



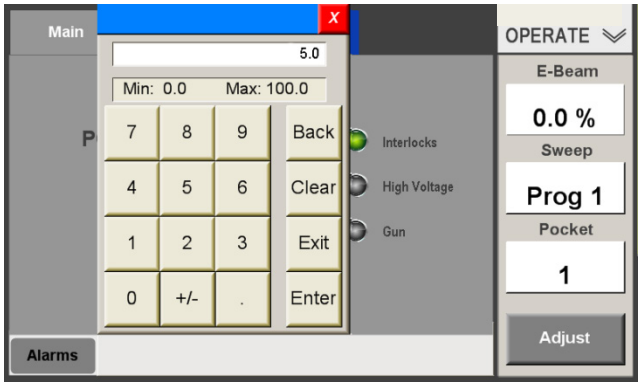
1 Touch the button controlling the desired function to display a numbered keypad (e.g., Figure 2-15) that will allow you enter a different value. The keypad displayed indicates the maximum and minimum values for the parameter you have selected for modification. In Figure 2-15, the user has opened a keypad by touching the **E-Beam** button, so the Min. and Max. values are 0.0 and 100.0, respectively.

Figure 2-14 Numeric Keypad for Entering a Beam Power Percentage Setpoint



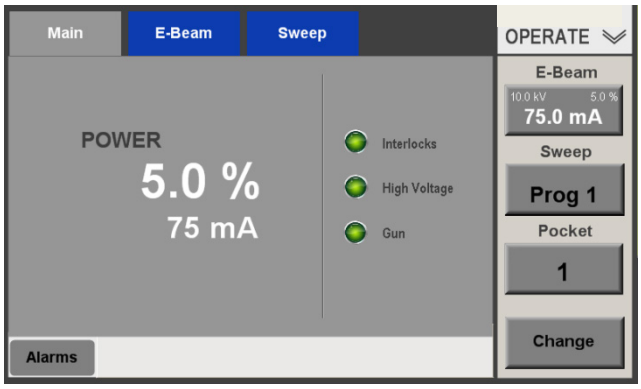
2 Enter the desired operating value. For e-beam power, enter a value between 0.1% and 100%. For sweep program number, enter a value between 1 and 32. For pocket number, enter a value between 1 and the highest-numbered pocket in your turret source. In Figure 2-16 the user has entered 5% as an e-beam power setpoint.

Figure 2-15 User Has Entered 5% Power Setpoint via Numeric Keypad



3 Touch the keypad's **Enter** button to close it. The white highlighting will then disappear from the function-control button(s), and the new operating value will be displayed on the button controlling the function whose operating value you changed. In Figure 2-17, the **E-**Beam button displays 5.0%, reflecting the change made in Figure 2-16. If you have changed the pocket selection, the turret will begin rotating to the target pocket as soon you press the **Enter** button. Note that you can change the target pocket while the turret is rotating.

Figure 2-16 E-Beam Button After User Sets 5% as Beam Power Setpoint



2.6.2 Using the Function Control Buttons to Activate and Deactivate Controlled Devices

To activate a given device function at the operating value currently displayed, simply touch the button controlling that function when the function-control buttons are not highlighted in white.

Switching the E-Beam On/Off

You can use the **E-Beam On/Off** button in either of two ways to switch on the e-beam, depending on whether the power setpoint is a nonzero value or not.

1. **Power setpoint = 0%**: If you press the **E-Beam On/Off** button when the power setpoint is zero, the button will turn white, indicating that the beam is on. You must then follow the procedure described above to enter a nonzero setpoint. After you click **Enter** to close the on-screen keypad, the unit will ramp up the beam power to the setpoint value you entered.
2. **Nonzero power setpoint already entered**. If you have already performed the above procedure to enter a nonzero power setpoint, that value will appear in black on the **E-Beam On/Off** button. At that point, pressing that button will switch on the beam and ramp the power up to the indicated setpoint.

When the gun is on, the current percent-power setpoint appears in white. To switch the beam off when it is on, touch the **E-Beam On/Off** button. The power setpoint will then default to zero percent, and **0%** will appear on the button.

Switching the Sweep On/Off

To switch on the beam sweep when it is off, touch the **Sweep Enable** button. The EBC will then activate the sweep program whose number is currently displayed on that button. The legend **Prog *N*** will then turn white, indicating that the beam sweep is active. To switch off the beam sweep when it is operating, touch the **Sweep Enable** button again. The legend **Prog *N*** will then turn black again.

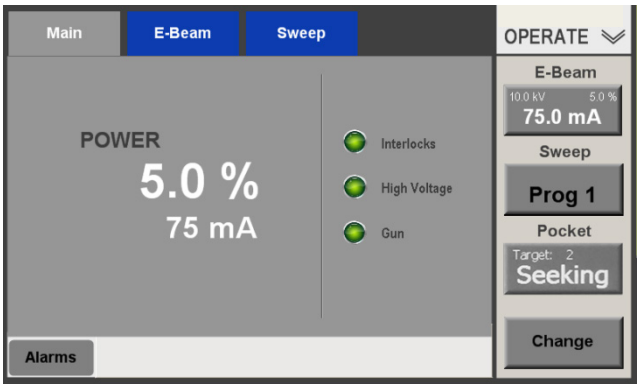
Rotating the Turret

There are two methods of rotating the turret, depending on whether you wish to rotate it to next pocket or to some other pocket position.

1. To rotate the turret to the next pocket, simply touch the **Pocket** button. It is not necessary to display the keypad and enter the number of the next pocket.
2. To rotate the turret to any pocket position other than the next pocket in ascending order, first enter the desired pocket number, following the procedure described in section 2.6.1. When you touch **Enter** to close the numeric keypad, the turret will begin to rotate to the pocket whose number you entered.

While the turret is rotating, the word **SEEKING** appears in white on the **Pocket** button, with the smaller legend **Target: *Y*** (where *Y* = the number of the target pocket) above it. In Figure 2-18, the target pocket is *2*. When the turret reaches the target pocket position, the legend **Target: *Y*** disappears, and the number of the current pocket again appears on the button.

Figure 2-17 Pocket Button When Turret Is Rotating



2.7 Control/Display Features of the Main Display Area

In addition to those on the Command Button Bar, user-controllable command buttons appear on numerous mode-specific screens accessible via the Main Menu, including:

- On/Off toggle buttons like those that serve to switch on/off the gun and HV on the E-Beam screen in all operating modes
- the arrow buttons on the Sweep screen in Configuration, Operations>Local, and Service Modes that enable the user to move the beam or the sweep pattern
- press-once command buttons like the **Set** buttons on the Configuration>Sweep screen that enable the user to set the beam position limits
- press-and-hold-down command keys like the **Jog CW** and **Jog CCW** buttons that appear on the Turret screens in Configuration, Operations>Local, and Service Modes
- the screen navigation buttons that appear on the Main Menu bar in all operating modes

As previously described, the Mode ID/menu selection button operates as a toggle button.

2.7.1 Parameter Selection and Parameter Value Entry Buttons

Parameter entry and parameter selection buttons appear on the Command Button Bar, as described in section 2.5, and on the screens accessible via the Main Menu Bar. Parameter selection buttons include:

- two-state toggle buttons like the **Bias Mode** and **HV PS** Type buttons on the Configuration>E-Beam screen
- multiple-selection that the user presses repeatedly to step through the available selections (e.g., the **Rotation**, **Jog Speed**, and **Index Speed** buttons on the Configuration>Turret screen and the **Waveform** buttons on the Local>Sweep screen)

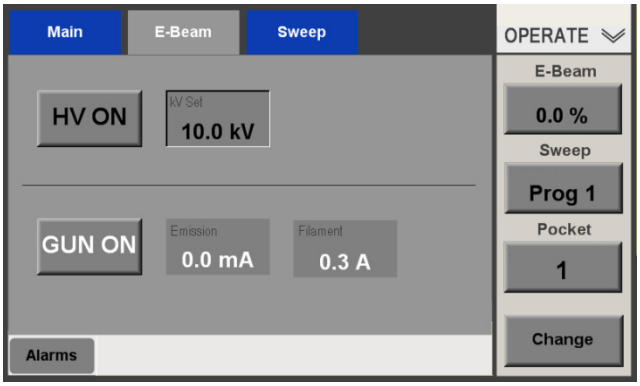
Parameter value-entry buttons look similar to parameter-display rectangles, but the former have white borders and turn white when pressed. Examples are the **Amplitude** and **Frequency** buttons on the Local>Sweep screen and the **kV Set** buttons on the Sweep screens in Local and Configuration Modes. When one of these buttons is pressed, the screen displays a numeric keypad that allows the user to enter the desired parameter value. Section 2.6.1 describes a typical value-entry procedure using one of these buttons.

2.7.2 ON/OFF Indicators

Standard On/Off indicators

In general, when a given function is off, the button-top labels and value-display numerals pertaining to that function are black. When that function is switched on, the relevant button-top labels and value-display numerals turn white. For example, when the gun is on, the **Gun ON** button's label and the values displayed in the **Emission** and **Filament** parameter display boxes are all white, as shown in Figure 2-19. When the gun is off, the **Gun ON** button's label and the values displayed in the **Emission** and **Filament** boxes are black.

Figure 2-18 Operations>E-Beam Screen when HV is Off and Gun is On



Output Asserted/Not Asserted Indicators on Service Mode Screens

Service Mode screens have numerous command buttons that enable the user to assert or de-assert a given EBC output. A small square in the upper left-hand corner of such buttons turns green when the output in question is asserted. Examples of such buttons are the **At Pocket** and **Pocket Good** buttons on the Service>Turret screen and the **OFF/Enable** and **On** buttons on the Service>E-Beam screen (see Figure 1-10).

2.8 Changes in Main UI Screens Depending on Configuration

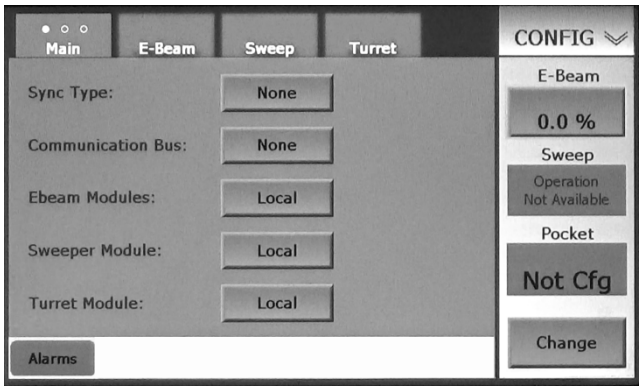
The screens displayed by EBC's main UI change in numerous ways depending on how a given unit is configured.

2.8.1 Screen Changes Resulting from a Given Control Module Being Configured as *Offline*

Figures 2-20 through 2-23 illustrate how various screens change in appearance when a given control module is configured as **Offline**. As Figure 2-20 shows, when the sweep control module is configured as **Offline**, the Config>Sweep screen and its screen tab in the main menu bar disappear. In addition, the legend **Hardware Deactivated** appears in place of **Operation Not Available** in the rectangle beneath the label that ordinarily identifies the **Sweep** button. Likewise, Figure 2-21 shows that the Ops>Sweep screen and its Main menu tab disappear under the same conditions and that a flat rectangle with the legend **Hardware Deactivated** replaces the **Sweep** in the control button bar. Figure 2-22 shows that when the turret control module is offline, the Service Turret screen and its Main menu tab also disappear. On the Diagnostics screen, a gray rectangle bearing the legend **Not Installed** replaces all sweep-related LEDs when the sweep control module is offline (see Figure 2-23).

Figure 2-19 Changes to Config>Main Screen When Sweep Module Is Configured as Offline

Config>Main Screen, All Modules *Local* **Config>Main Screen, Sweep Module *Offline***



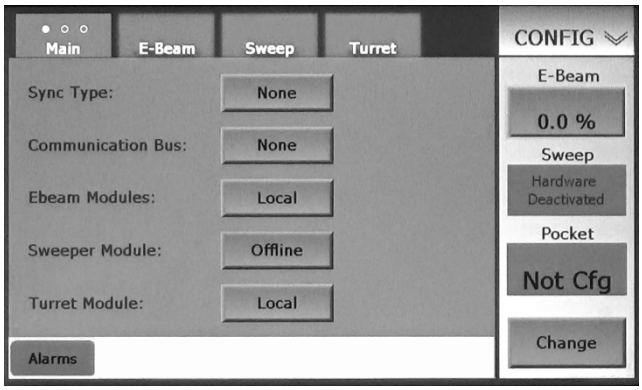
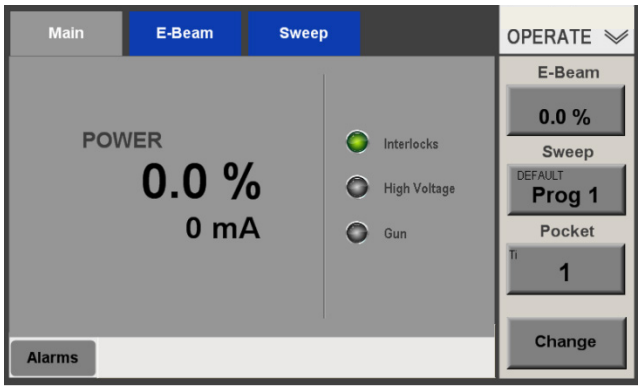


Figure 2-20 Changes to Ops>Main Screen When Sweep Module Is Configured as Offline

Ops>Main Screen, All Modules Local **Ops>Main Screen, Sweep Module Offline**



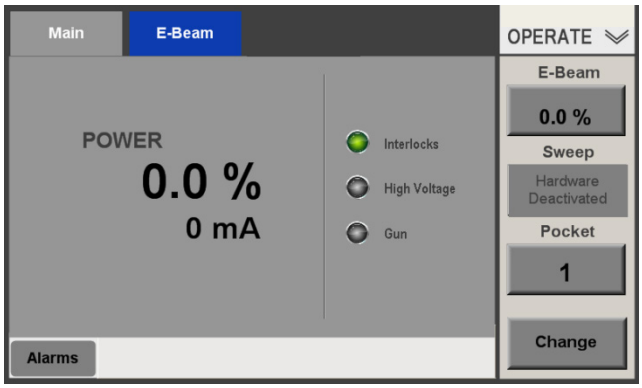
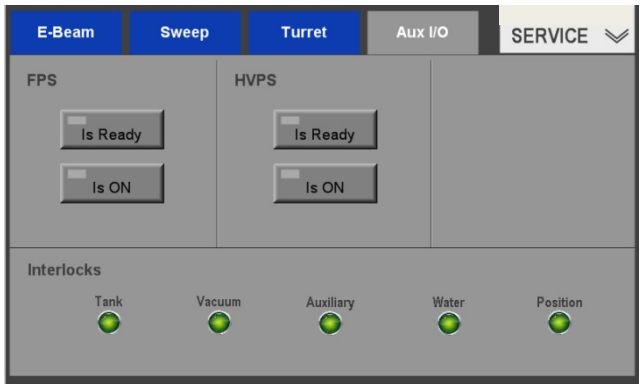


Figure 2-21 Changes to Service>Aux I/O Screen When Turret Module Is Configured as Offline

Service>Aux I/O Screen, All Modules Local **Service>Aux I/O Screen, Turret Module Offline**



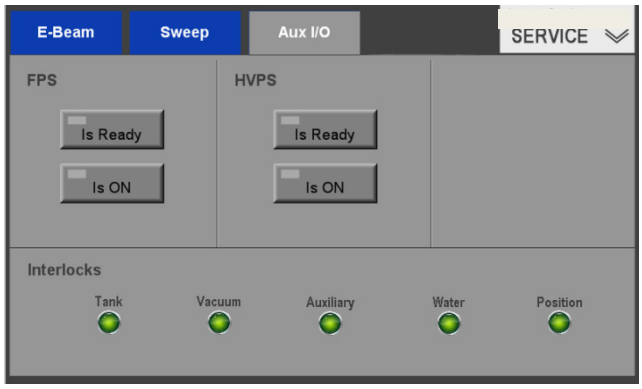
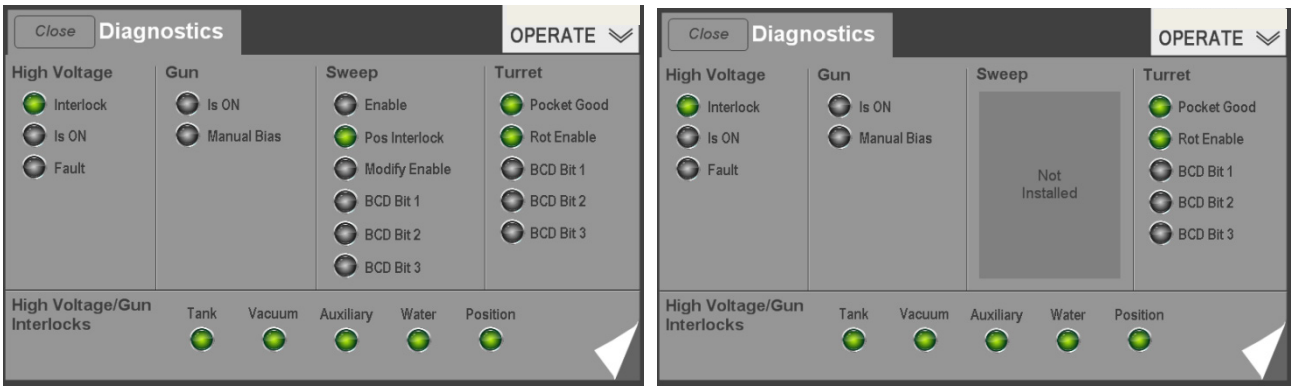


Figure 2-22 Changes to Diagnostics Screen When Sweep Module Is Configured as Offline

Diagnostics Screen, All Modules Remote **Diagnostics Screen, Sweep Module Offline**



2.8.2 Screen Changes Resulting from a Given Control Module Being Configured as Remote

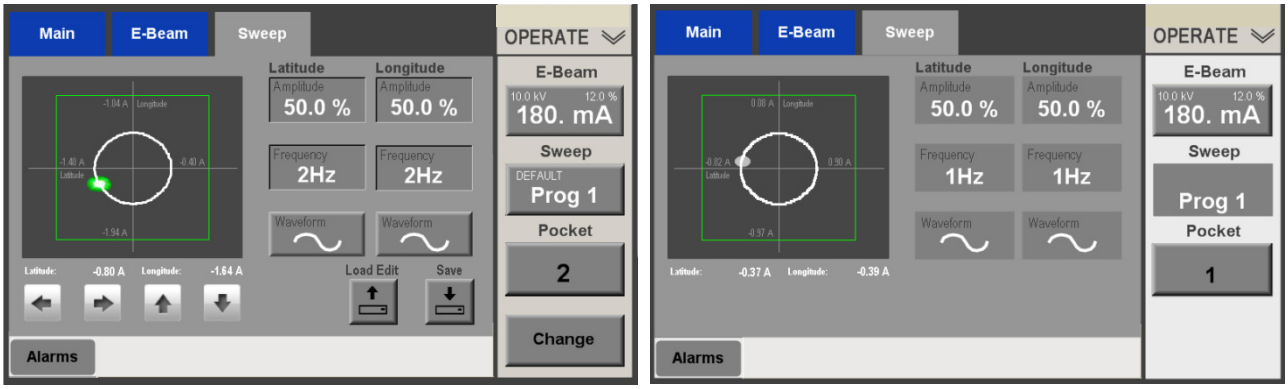
When a given control module is configured as Remote, the following changes in screen appearance occur:

1. The function-control button for the function in question becomes a flat parameter-value display rectangle.
2. All parameter-value entry rectangles relating to the function in question likewise become flat parameter-value display rectangles.
3. All on-screen control buttons relating to that function disappear from the screen.

These changes can be seen clearly in Figure 2-24. For additional examples of how Operations mode screens appear when a control module is configured as **Remote I/O**, see Section 7. To see how those screens appear when all control modules are configured as **Remote I/O**, see Section 84.

Figure 2-23 Changes to Ops>Sweep Screen When Sweep Module Is Configured as Remote I/O

Sweep Module Configured as Local **Sweep Module Configured as Remote I/O**

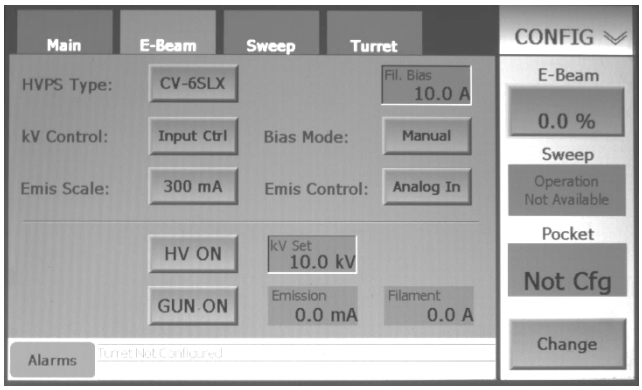


2.8.3 Screen Changes Dependent on the Setting of a Single Configuration Parameter

Figures 2-25 and 2-26 show how the Config>E-Beam and Ops>E-Beam screen change when **kV Control** on the Config>E-Beam screen is set to **Pot Control**. As the left-hand screen shot in Figure 2-25 shows, when **kV Control** is set to **Input Control**, the Config>E-Beam screen has a recessed **kV Set** button next to its **HV ON** button. When the user touches the **KV Set** button, the unit displays a numeric keypad that allows the user to enter a new kV setpoint. The right-hand screen shot in Figure 2-25 shows the Config>E-Beam screen when **kV Control** is set to **Pot Control**. When that is the case, the recessed **KV Set** button is replaced by a flat rectangle that displays the kV setpoint plus the legend **KV Pot**, which indicates that the kV setpoint is under the control of a potentiometer dial on the high-voltage power supply. As Figure 2-26 shows, the **kV Set** button on the Ops>E-Beam screen is also replaced by a flat parameter-display rectangle when **kV Control** is set to **Pot Control**.

Figure 2-24 Changes to Config>E-Beam Screen When *kV Control* Is Set to *Pot Ctrl*

Config>E-Beam Screen when *kV Control* IsSet to *Input Ctrl*



Config>E-Beam Screen when *kV Control* Is Set to *Pot Ctrl*

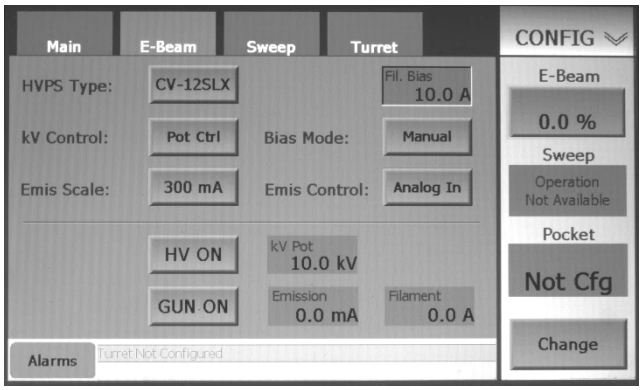
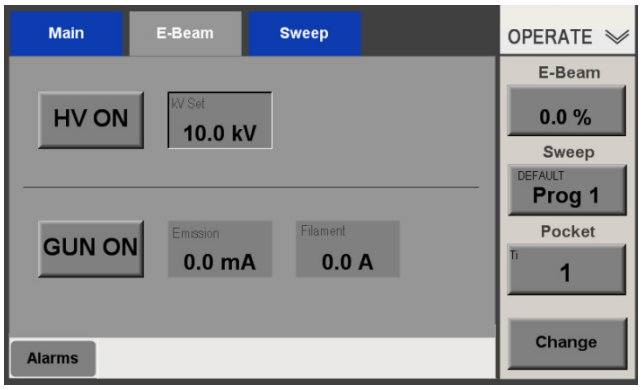
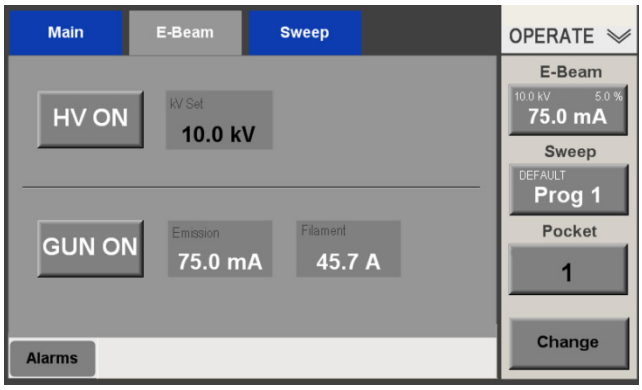


Figure 2-25 Changes to Ops>E-Beam Screen When kV Control Is Set to Pot Ctrl

Ops>E-Beam Screen when kV Control Is Set to Input Control



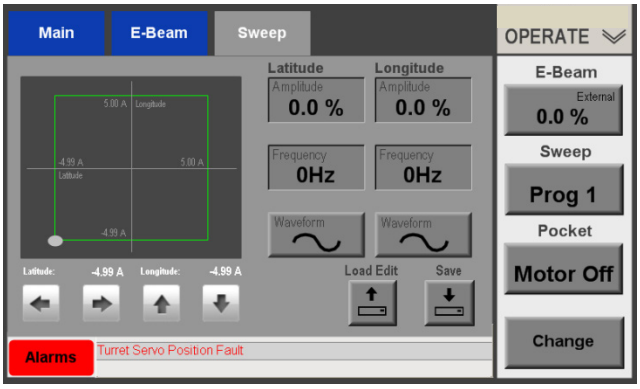
Ops>E-Beam Screen when kV Control Is Set to Pot Control



2.9 Responding to Alarms

When an EBC alarm occurs, the main UI displays an alarm message and the **Alarms** button turns red, as shown in Figure 2-27. To clear the alarm, first correct the condition and then click the **Alarms** button.

Figure 2-26 Main User Interface Displaying an Alarm Message



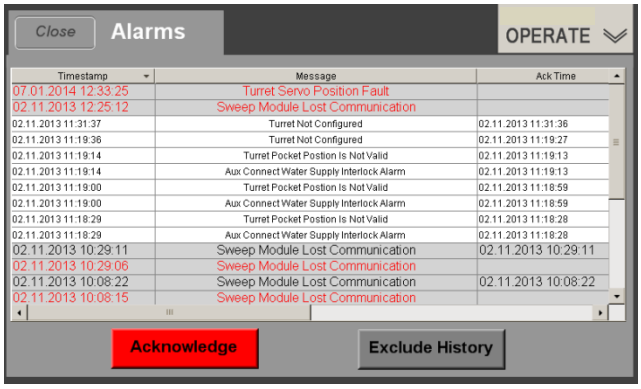
2.9.1 The Alarms Screen

The Alarm screen allows the user to view active and/or past alarms and to acknowledge active alarms. The Alarms screen is available from any Configuration, Operations, or Manual mode screen. To access the Alarms screen from any such screen, press its **Alarms** button. Figures Figure 2-28 and Figure 2-29 show how the Alarms screen would appear if the user touched the **Alarms** button on the screen shown in Figure 2-27. If **Exclude History** was previously selected via the **Alarms** screen, the Alarms screen would appear as shown in Figure 2-28. If **Include History** was previously selected, then the Alarms screen would appear similar to that shown in Figure 2-29.

To acknowledge all active alarms, simply touch the red **Acknowledge** button.

Figure 2-27 Alarm Details Screen With Active Alarms, *Exclude History* Selected

Figure 2-28 Alarm Details Screen with Active Alarms, *Exclude History* Selected



3 Basic Installation Procedures

3.1 Section Overview

This section describes the procedures involved in installation of an EBC as a stand-alone controller. The topics covered are:

For additional details about installing an EBC on a system with an XTC/3S single-layer deposition controller, see section 6.2. For details about installing an EBC on a system with an XTC/3M multilayer deposition controller, see section 7.3. For details about installing an EBC on a system with PLC-based system controller, see section 8.2.

3.2 Package Contents

Two versions of the TemEBeam EBC Integrated Controller are available:

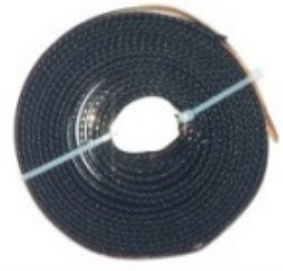
- EBC with HVPS, FPS, and sweep control modules (PN 0620-7493-0)
- EBC with HVPS, FPS, sweep, and turret control modules (PN 0620-7493-1).

EBC PN 0620-7493-1 includes all the parts shown in Figure 3-1. EBC PN 0620-7493-0 includes all parts shown there except the Indexer Drive Kit (PN 0629-5560-0).

Figure 3-1 EBC Visual Component Identification

0629-5595-0, -1, -2, or -3
EBC Control Unit (see section 3.3.2)

0629-4004-0
HANDHELD REMOTE CONTROLLER



0040-6670-0
RF GROUND STRAP KIT, 1" × 12'

0620-9103-30
SWEEP COIL DRIVE CABLE, 30'

0620-7600-0
37-PIN D-SUB ADAPTER KIT

0620-7613-0
HARDWARE INSTALLATION KIT

6338-1724-0
POWER CORD 120VAC

Indexer Drive Kit (PN 0629-5560-0)

0629-0364-0
INDEXER DRIVE ASSEMBLY

9015-9121-2
FLEXIBLE COUPLING FOR 1/4" SHAFTS

9018-2030-0
INDEXER MOTOR DRIVE BELT

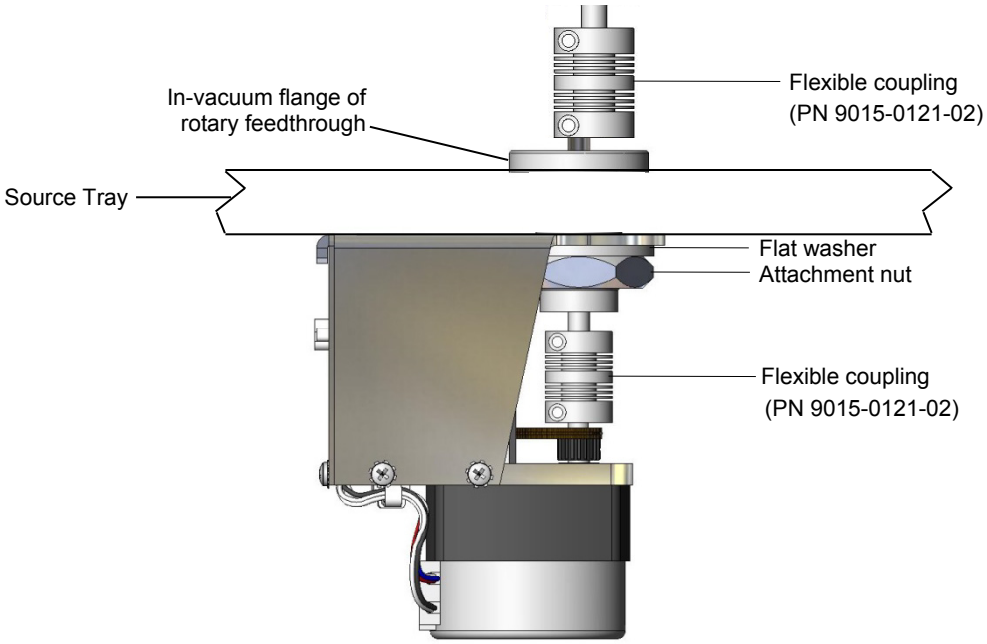
0620-7613-0
INDEXER MOTOR CABLE, 30'

3.3 Hardware Installation

3.3.1 Install the Optional Indexer Drive Motor Assembly

To install the optional indexer drive assembly (PN 0629-0364-0), follow the instructions provided below. Figure 3-2 shows the indexer drive assembly properly installed on the underside of the source tray, with its front cover removed to reveal the installation detail. The drive unit is held in place by the large nut that also secures the 1-inch-diameter rotary feedthrough to the source tray.

Figure 3-2 Indexer Drive Assembly Mounted to 1-inch-dia. Rotary Feedthrough



DANGER: HIGH VOLTAGE

If the vacuum system in which this assembly is to be installed already has a functioning HV power supply, observe all applicable high-voltage precautions in performing the installation. These precautions include making sure that the high-voltage is switched OFF, (b) electrical power to the HVPS is locked and tagged out, and (c) using a properly connected grounding rod to neutralize any residual charge on the structures on and around the source tray. For complete safety instructions, consult your power supply manual.

Step	Action
1	Perform the following substeps only if the indexer drive assembly is to be installed in a vacuum system in which a high-voltage power supply is already operational. Otherwise, proceed to step 3.

a) Make sure that the high-voltage power supply is switched OFF.

b) Lock and tag out the facility breaker supplying power to the HVPS, following facility-specific procedures and observing local safety codes.

c) If the power supply is equipped with a keylock, remove it and keep it in your pocket while you complete this procedure.

2 Vent the vacuum chamber.

3 Lower the source tray, open the vacuum enclosure's access doors, and swing the source tray out from the enclosure.

4 Using a properly connected grounding hook, touch the source tray and the frame of the vacuum enclosure in several places to neutralize any residual high-voltage charge.

5 Remove the attachment nut and flat washer (see Fig. 3-7) from the rotary feedthrough.

6 Put the flexible coupling (PN 9015-0121-02) in place over the rotary feedthrough's input shaft and secure the coupling to that shaft with the coupling's upper set screw.

WARNING

To prevent binding during source rotation and to minimize alignment problems, it is essential to use the same type of flexible coupling to connect the feedthrough's output shaft to the source's drive shaft, as shown in Figure 3-2.

7 Remove the two screws that secure the indexer drive assembly's front-side cover and remove it.

8 Place the indexer drive assembly against the underside of the source tray so that the feedthrough's threaded shaft extends through the hole in the yoke that spans the top of the drive unit. As you do so, make sure that the drive unit's output shaft inserts properly into the hole in the flexible coupling.

9 Lower the index drive unit enough so that you can put the flat washer and attachment nut back in place on the rotary feedthrough and screw the nut one or two threads onto the threaded portion of the feedthrough. Then move the drive assembly back to the position described in Step 8 of this procedure.

10 Screw the attachment nut all the way on and tighten it to approximately 10 ft.-lbs.

11 Loosen the screw that secures the lower flexible coupling to the input shaft of the rotary feedthrough.

12 Loosen the set screw that secures the upper flexible coupling to the turret's drive shaft and to the output shaft of the rotary feedthrough.

13 Turn both flexible couplings so that their set screws are facing in the direction of easiest access.

14 Tight both set screws on both of the flexible couplings.

15 Replace the indexer drive assembly's front cover and secure it with the two mounting screws you removed in Step 7.

Installation of the indexer drive assembly is completed. If you are proceeding to configure the EBC's turret control function (see section 3.4), leave the source tray in the swung-out position.

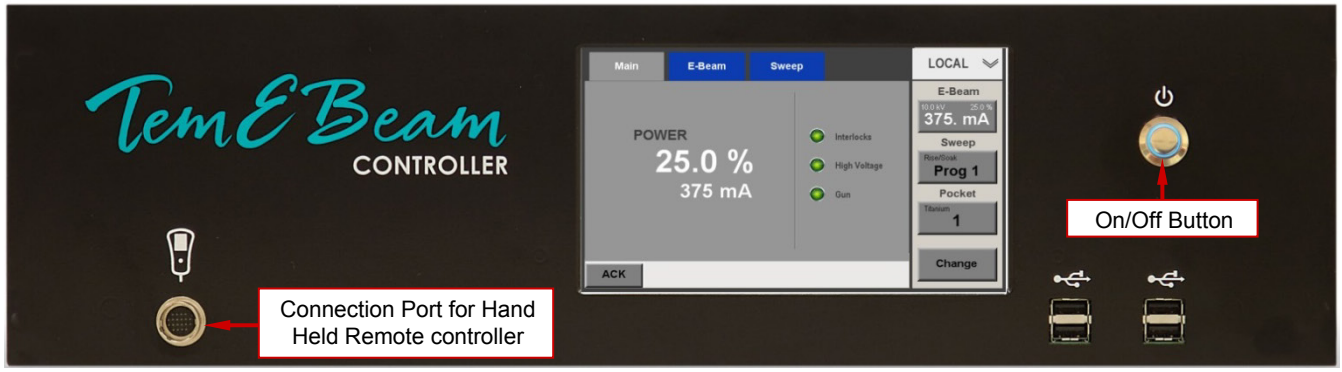
3.3.2 Rack Mount the EBC Main Controller

Using the mounting hardware supplied, install the EBC controller in a standard 19-inch rack.

3.3.3 Connect the Hand-Held Remote Controller

Plug the connector on the end of the remote controller's cable into the port indicated in Figure 3-3.

Figure 3-3 EBC Front Panel, Showing Connections Port for Hand Held Remote Controller



3.4 Making Cable Connections in to Components Controlled by the EBC

3.4.1 Cabling Overview

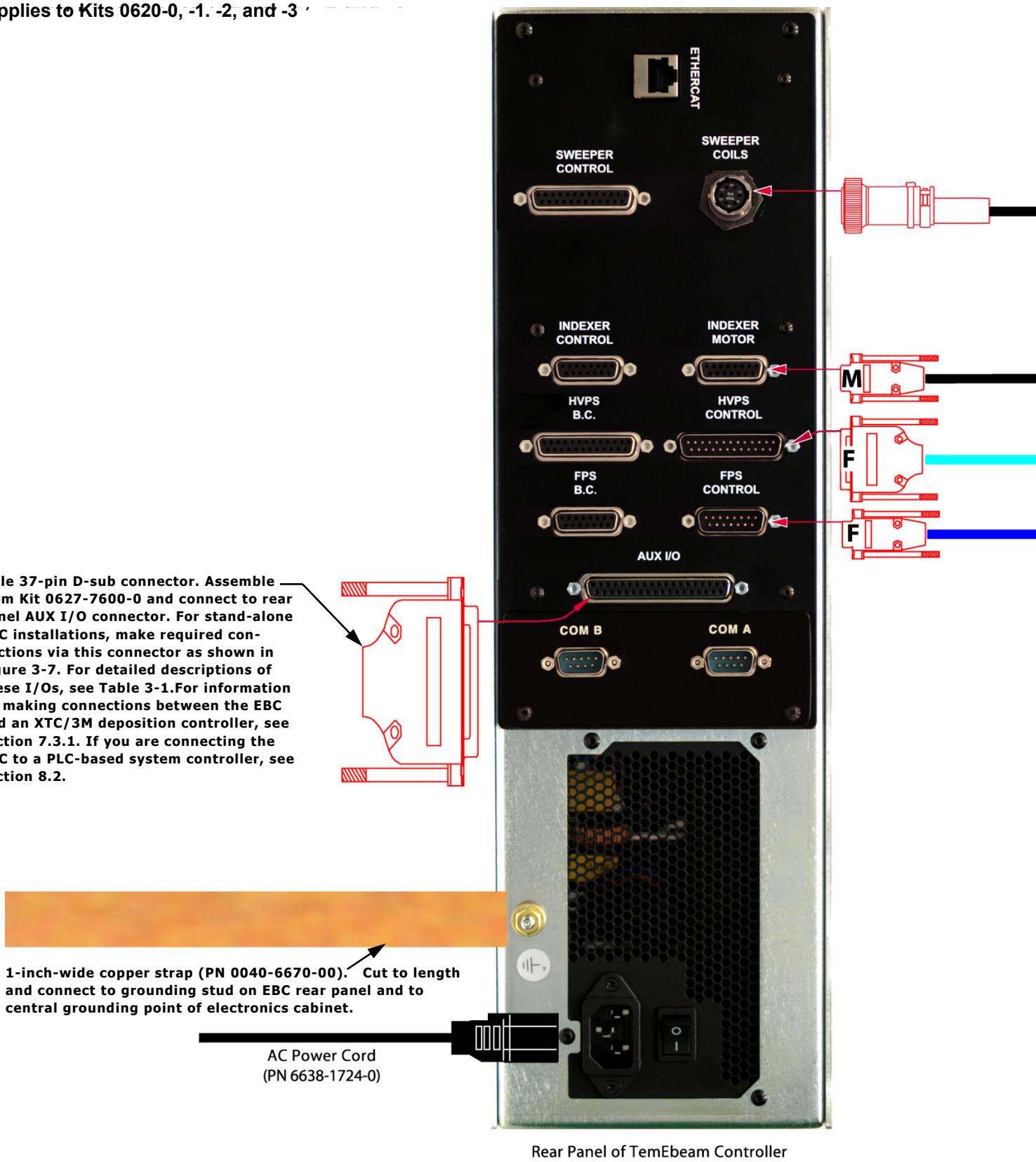
Section 3.4.2 describes how make cable connections between the EBC and controlled components and how to make the required connections to the AUX I/O connector in systems without a higher-level controller (i.e., either a deposition controller or a PLC-based system controller). For a detailed illustration of these cabling connections, see Figure 3-4. For instructions on cabling the EBC to an XTC/3S deposition controller, see section 6.2. For instructions on cabling the unit to an XTC/3M, see section 7.3.1. For instructions on making cable connections to a PLC-based system controller, see section 8.2.

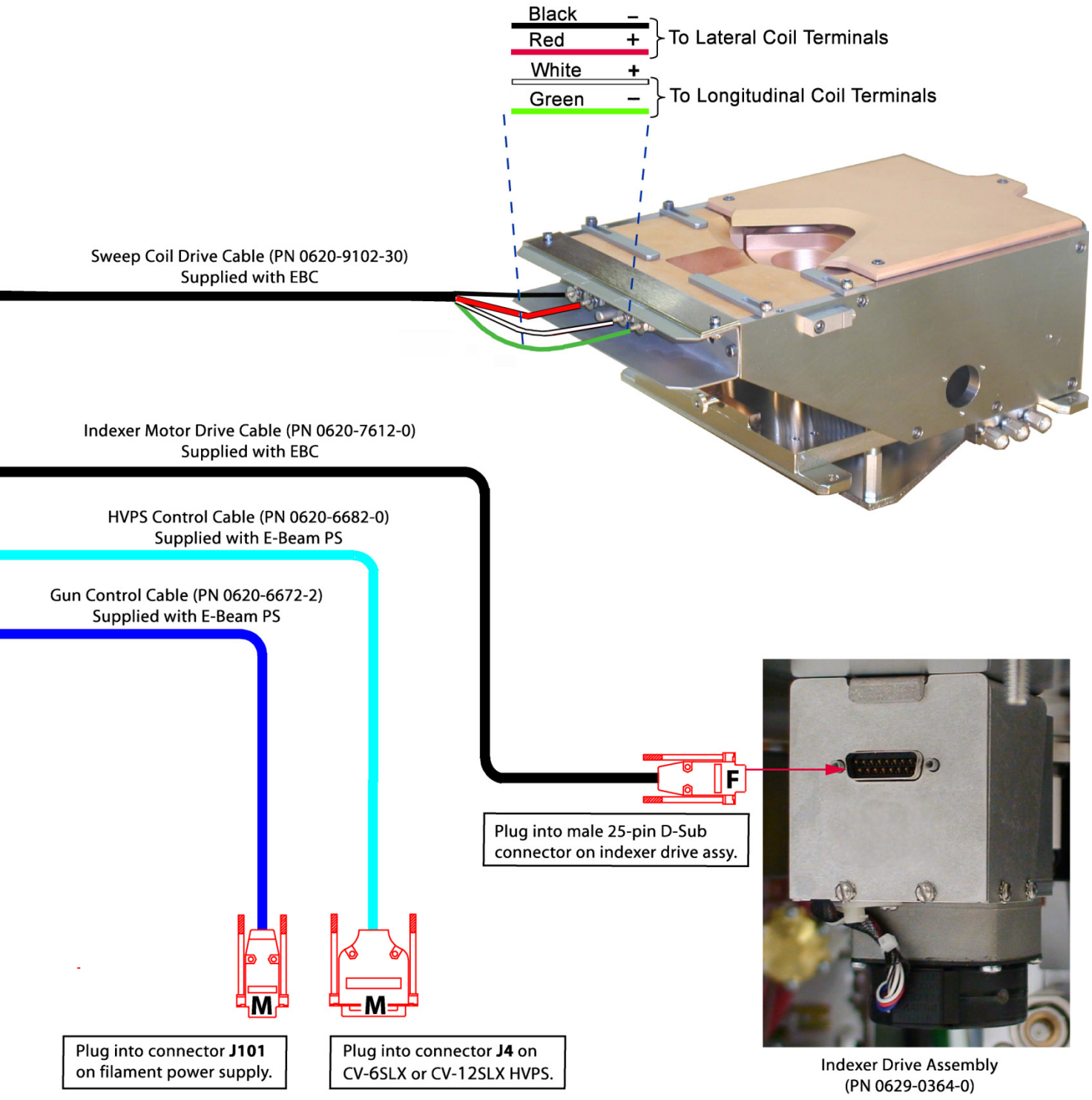
WARNING

Connect the EBC's rear panel SWEEPER COILS connector only to Temescal e-beam guns or to other e-guns with four terminals connected to beam-drive coils of ±4 A capacity in both the longitudinal and lateral axes.

Figure 3-4 EBC Basic Cabling Diagram

Applies to Kits 0620-0, -1. -2, and -3




Black –
Red +
To Lateral Coil Terminals
White +
Green –
To Longitudinal Coil Terminals
Sweep Coil Drive Cable (PN 0620-9102-30)
Supplied with EBC
Indexer Motor Drive Cable (PN 0620-7612-0)
Supplied with EBC
HVPS Control Cable (PN 0620-6682-0)
Supplied with E-Beam PS
Gun Control Cable (PN 0620-6672-2)
Supplied with E-Beam PS
F
Plug into male 25-pin D-Sub connector on indexer drive assy.
M
M
Plug into connector J101 on filament power supply.
Plug into connector J4 on CV-6SLX or CV-12SLX HVPS.
Indexer Drive Assembly
(PN 0629-0364-0)

3.4.2 Basic Cabling Procedure

Step	Action
1	If you have purchased a Temescal power supply along with the EBC, perform the substeps a) through e) below. Otherwise skip this step and proceed to Step 2 of this procedure.
	a) Install the e-beam power supply, following the instructions in Section 3 of the power supply's manual. However, disregard the instructions in sections 3.6.4 and 3.6.5 pertaining to the HVPS I/O cable (PN 0620-6683-0) and the FPS I/O cable (PN 0620-6673-2). Instead, perform Substeps b) through e) below.
	b) Connect the male connector on one end of the HVPS I/O cable to HVPS rear panel connector J4.
	c) Connector the female connector on the other end of this cable to the HVPS CONTROL connector on the EBC rear panel.
	d) Connect the male connector on one end of the FPS I/O cable to FPS connector J101.
	e) Connect the female connector on the other end of this cable to the FPS CONTROL connector on the EBC rear panel.
2	If you are replacing a Temescal SS64 beam sweep controller with an EBC, perform substeps a) through d) below. Otherwise, skip this step and proceed to Step 3 of this procedure.
	f) Switch off the input power to the SS64 and unplug its power cable.
	g) Disconnect the Sweep Coil Drive cable from the SS64 rear panel.
	h) Remove the SS64 from the electronics cabinet.
	i) Connect the Sweep Coil Drive cable to the EBC's rear panel **SWEEPER COILS** connector (see Figure 3-5).
3	If you are installing an EBC unit with a sweep control board in a system without an SS64, perform sub-steps a) and b) below. If not, skip this step and proceed to Step 4.
	a) Connect the amphenol connector on one end of the Sweep Coil Drive cable (PN 0620-9103-0) to the **SWEEPER COILS** connector on the EBC rear panel.
	b) Connect the leads on the other end of this cable to the appropriate terminals on the octal feedthrough that connects to the gun's beam drive coils. The four leads on the end of the Sweep Coil Drive cable must be connected through the feedthrough to the source as shown in Figure 3-4.
4	If you obtained an Indexer Drive unit along with the EBC unit and have installed it, skip this step and proceed to Step 5. If you are connecting a previously installed TRC-3460 indexer drive motor assembly to the EBC, perform the following sub-steps:

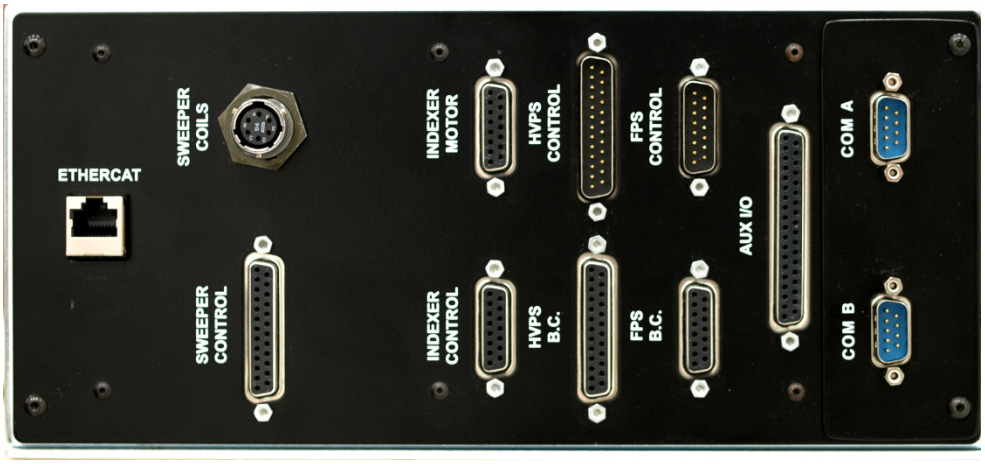
a) Switch off the input power to the TRC-3460 controller.

b) Disconnect the controller's power cable from its rear panel.

c) Disconnect the cable that connects the Indexer Drive assembly to the TRC-3460 controller. Disconnect this cable from the **MOTOR** connector on the controller's rear panel.

d) Connect that end of the cable to the **INDEXER MOTOR** connector on the EBC rear panel (see Figure 3-5).

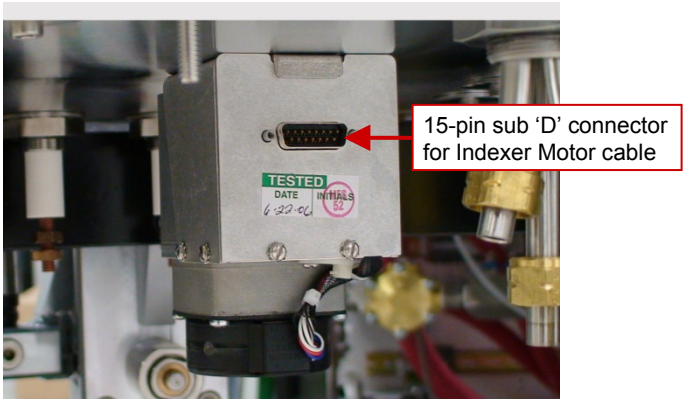
Figure 3-5 EBC Rear Panel Connectors



5 Connect the male end of the 30-ft. Indexer Motor Cable (PN 0620-7613-0), supplied with the EBC Basic package) to the **INDEXER MOTOR** connector on the EBC rear panel (see Figure 3-5).

6 Connect the other end of this cable to the male 15-pin sub-D connector on the Indexer Drive assembly (see Figure 3-6).

Figure 3-6 Indexer Drive Unit Mounted Under Source Tray



7 Connect the FPS I/O Cable (PN 0620-6673-2) to the **FPS CONTROL** connector on the EBC rear panel (see Figure 3-5).

8 Connect the other end of this cable to connector J101 on the filament power supply.

9 Connect the HVPS I/O cable (PN 0620-6683-0) to the **HVPS CONTROL** connector on the EBC rear panel (see Figure 3-5).

10 Connect the other end of this cable to connector J4 on the rear panel of your CV-6SLX or CV-12SLX power supply.

11 Connect a suitable length of the 1-in.-wide copper grounding strap to the EBC's rear panel grounding stud and to the central grounding point for the electronics cabinet in which that EBC is installed. This grounding point must be properly connected to a low-impedance ground. For instructions on correctly installing a system low-impedance ground, see sections 3.5.1 and 3.5.2 of your power supply manual.

12 Using the 37-pin sub-D adapter kit (PN 0620-7600-0) supplied with the EBC Basic package, make the required connections between the vacuum system and the EBC's rear panel **AUX I/O connector**. For a detailed diagram of these required connections, see Figure 3-7. For detailed descriptions of the required I/O signals, see Table 3-1.

Figure 3-7 Required Connections to Rear Panel AUX I/O Connector

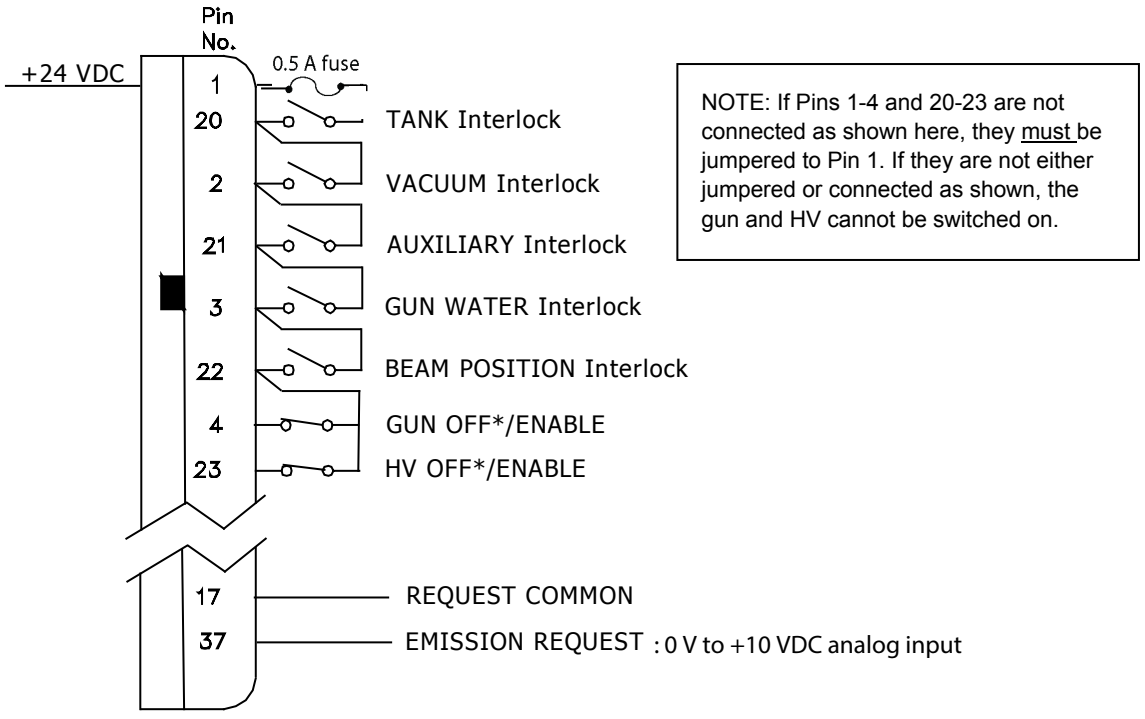


Table 3-1 Signal Definitions for Required Connections to Aux I/O Connector

Signal Name	Pin No.	Definition
+24 VDC Output	1	+24 VDC output for use with Pins 3-4 and 20-23.
TANK Interlock	20	+24 VDC digital input supplied via normally-open contact closure prevents the gun from being switched on unless all vacuum system doors and covers are closed and locked.
VACUUM Interlock	2	+24 VDC digital input supplied via normally-open contact closure ensures that vacuum chamber ion gauge is on before gun is switched on.
AUXILIARY Interlock	21	+24 VDC digital input supplied via normally-open contact closure, user defined.
GUN WATER Interlock	3	+24 VDC digital input supplied via normally-open contact closure prevents the gun from being switched on unless it is receiving sufficient cooling water. Signal to be supplied by a customer-installed flow switch.
BEAM POSITION Interlock	22	+24 VDC digital input supplied via normally-open contact closure switches off the gun if the beam travels beyond the sweeper's programmed position limits. Provided for EBC use on systems with an independent beam sweep controller.
GUN OFF*/ENABLE Input	4	+24 VDC digital input supplied via normally-closed external contact closure. When gun is on, a momentary open pulse switches it off. If all gun interlocks are made, the gun can then be switched on again. NOTE: If not connected to a remote contact closure, this pin must be jumpered together to Pin 1, or the gun cannot be switched on.
HV OFF*/ENABLE Input	23	+24 VDC digital input supplied via normally-closed external contact closure. When HV is on, a momentary open pulse switches it off. If all HV interlocks are made, the HV can then be switched on again. NOTE: If not connected to a remote contact closure, this pin must be jumpered together to Pin 1, or the HV cannot be switched on.
REQUEST COMMON Input	17	Common for Pin 37. Connect to appropriate output from deposition controller.
EMISSION REQUEST Input	37	Analog input request; 0-10 VDC = 0-100% beam power. Connect to appropriate output from deposition controller. When the EBC is in Remote Mode, or when it is in Local Mode with EXTERNAL selected via the Config>E-Beam screen, this input controls the beam power request.

3.4.3 Assembling and Installing the EBC Basic I/O Kit (PN 0631-2412-0)

This section describes the assembly of EBC Basic I/O Kit (PN 0631-2412-0), whose hardware facilitates connection of the required system interlocks (see Figure 3-7) to the EBC's rear panel **AUX I/O** connector. In the following procedure, item numbers refer to items listed in BoM 0631-2412-0 and illustrated in schematic 0620-2412. Steps 1-13 describe how the kit's basic components (i.e., minus wiring) are assembled on the kit's DIN rail (Item 3) from left to right.

Step	Action
1	Unpack the bags containing the kit's piece parts and open those bags.
2	Lay out the kit's DIN rail (Item 3) on suitable work surface.
3	Attach an end stop (Item 8) about three inches from the left-hand end of the DIN rail.
4	Install the fuse (Item 4) into the fuse terminal block (Item 14) and attach the latter to the DIN next to the end stop.
5	Attach two end stops (Item 8) to the DIN rail, on the other side of the fuse terminal block.

6 Next to these two end blocks, attach the 37-pin breakout board (Item 5) to the DIN rail.

7 Next to Item 5, attach two end stops (Item 8) to the DIN rail.

8 Sandwich five terminal blocks (Item 13) between two terminal block end plates (Item 11) and attach these items to the DIN rail, next to the end stops you attached in Step 7.

9 Next to the outer end plate you installed in Step 8, attach two end stops (Item 8) to the DIN rail.

10 Sandwich another five terminal blocks (Item 13) between two terminal block end plates (Item 11) and attach these items to the DIN rail, next to the end stops you attached in Step 9.

11 Next to the outer end plate you installed in Step 10, attach two end stops (Item 8) to the DIN rail.

12 Sandwich 12 terminal blocks (Item 13) between two terminal block end plates (Item 11) and attach these items to the DIN rail, next to the end stops you attached in Step 11.

13 Next to the outer end plate that you installed in Step 12, attach one end block (Item 8) to the DIN rail.

14 From the prenumbered (F1-F10) terminal number strip (Item 10), break off the label marked F1.

15 Attach this label to the fuse terminal block (Item 14).

16 From two of the prenumbered (1-10) sets of terminal number strips (Item 6), break out the labels marked from 1-5.

17 Affix one of these two sets of 1-5 labels to the five terminal blocks in the terminal board labeled **24VTB** (see Figure 3-8).

18 Affix the other set of 1-5 labels to the five terminal blocks in the terminal board labeled **GNDTB** (see Figure 3-8)

19 Break apart the third set of prenumbered (1-10) terminal number strips (Item 6) and attached these labels to terminal blocks 1-10 in the 13-block terminal board labeled **INTLKTB**.

20 From the prenumbered (11-20) terminal number strips (Item 7), break out the labels marked 11 and 13.

21 Affix these labels to terminal blocks 11 and 12 in the 13-block terminal board labeled **INTLKTB** (see Figure 3-8).

22 Place the four group marker carriers (Item 9) on your work surface.

23 Remove the following labels from the label kit (Item 1) and affix one of them to each of the four group marker carriers:

- AUX I/O
- 24VTB
- GNDTB
- INTLKTB

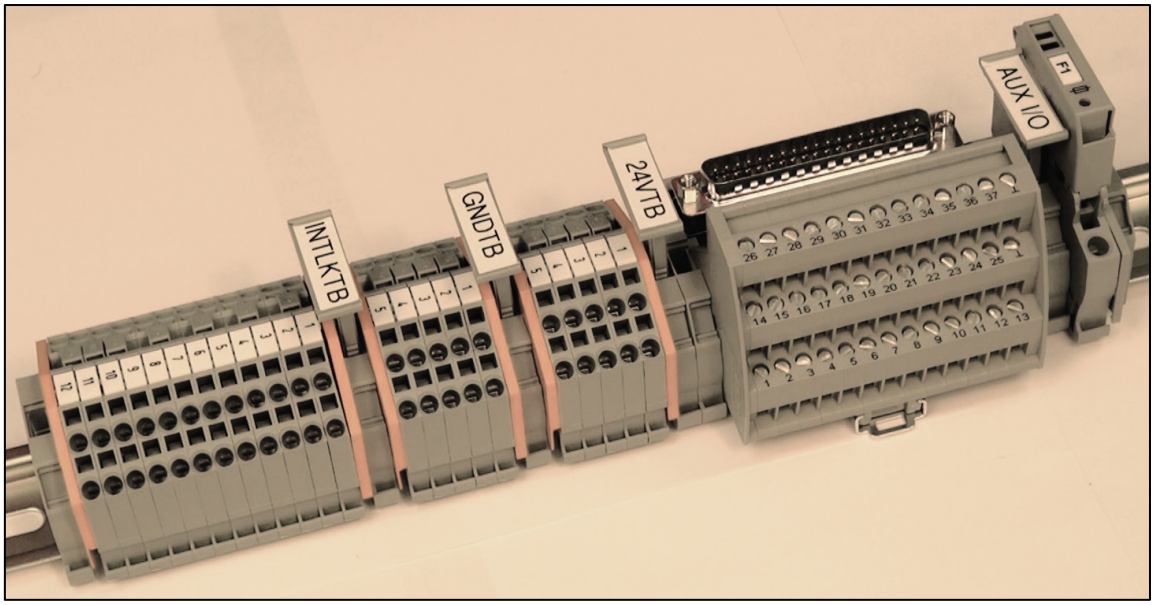
24 Install these four group marker carriers where shown in Figure 3-8.

25 Using the jumpers supplied (Item 12), jumper together the following terminal blocks:

- all five terminal blocks in the terminal board labeled **24VTB**.
- all five terminal blocks in the terminal board labeled **GNDTB**.
- the following pairs of terminal blocks in the terminal board labeled **INTLKTB**: terminal blocks 2-3, 4-5, 6-7, 8-9, 10-11, 11-13.

Figure 3-8 shows the Basic I/O Kit after the completion of Step 25.

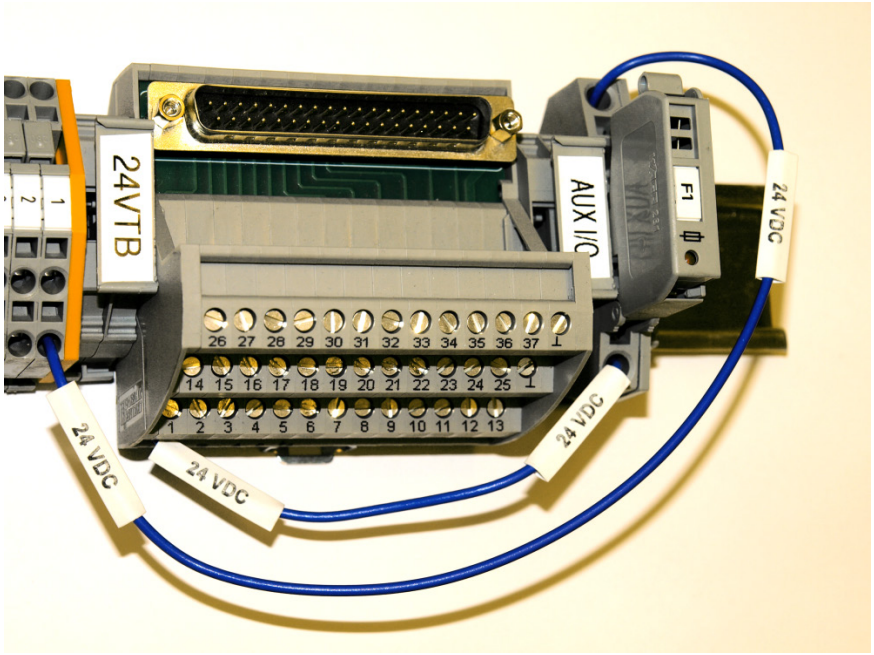
Figure 3-8 Kit 0620-0214 Fully Assembled Except for Interconnecting Wires



26 Cut and end-strip a wire of suitable length to connect the right-hand terminal of fuse holder F1 to Pin 1 on the 37-pin breakout (see Figure 3-9). Onto each end of this wire, slide a label marked **24 VDC** and connect the stripped ends to the terminals indicated above.

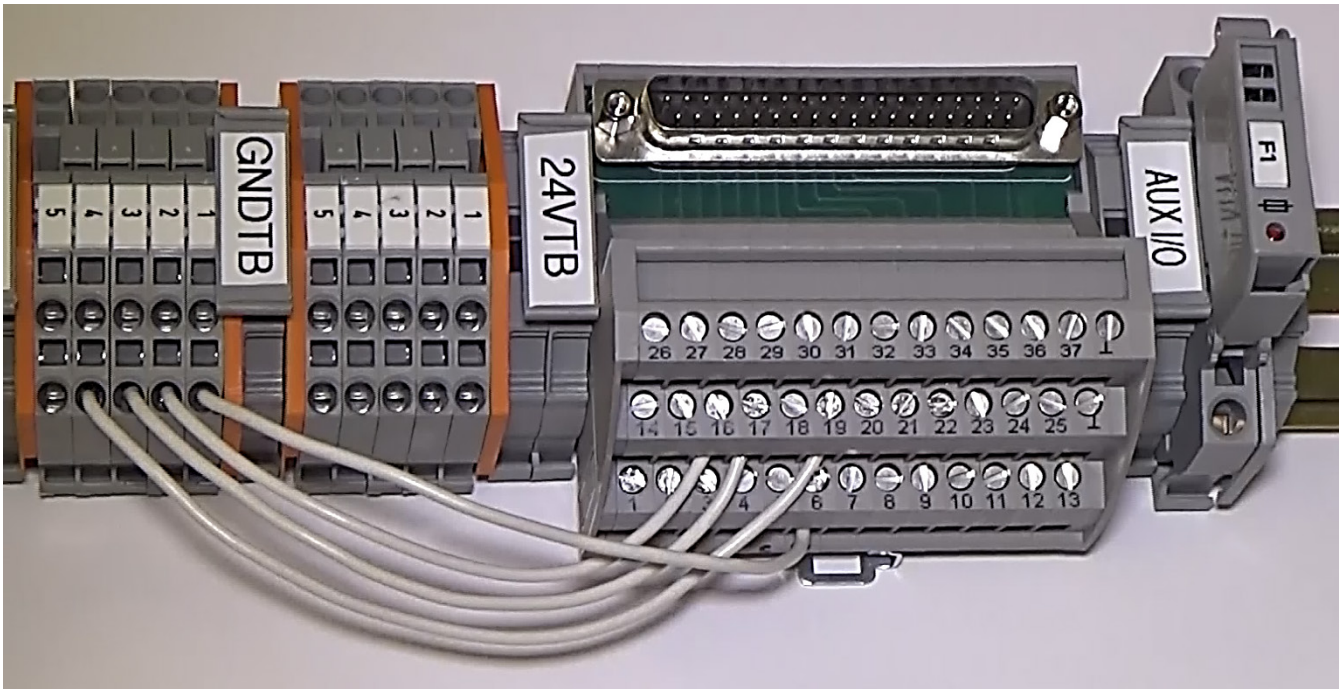
27 Cut and end-strip a wire of suitable length to connect the terminal on the other side of fuse block F1 to terminal 1 on the terminal board labeled **24VDCTB**. Over each end of this wire, slide a label marked **24 VDC** and connect the stripped ends to the terminals indicated above. Figure 3-9 shows both **24 VDC** wires connected correctly to fuse F1.

Figure 3-9 Both 24VDC Wires Correctly Connected



28 Using white wires, connect Pins 6, 16, 17, and 19 on the 37-pin breakout board to any pins on the **GNDTB** terminal board. Figure 3-10 shows these connections in isolation from other wiring.

Figure 3-10 Wiring Between GNDTB Terminal Board and Pins 6, 16, 17, and 19 on AUX I/O Terminal Board Shown in Isolation



29 Cut and end-strip a length of blue wire of suitable length to connect any pin on the **24VTB** terminal board to Pin 1 on the **INTLKTB** terminal board. Slide labels marked **24 VDC** over the ends of these wires and attach the stripped ends to the terminals indicated above.

30 After applying the labels indicated in the table below to the appropriate blue wires, make the following connections between the 37-pin **AUX I/O** breakout board and the **INTLKTB** terminal board:

Pin on 37-Pin Breakout	Label Text	Pin on INTLKTB
2	VAC I/L	4
3	WATER I/L	8
20	TANK I/L	2
21	AUX I/L	6
22	POS I/L	10

31 Use a heat gun to shrink-wrap the labels to their wires.

32 Install the completed DIN rail assembly in either the system's vacuum cubicle or the control console/operator's station.

33 Connect the female end of the 37-conductor cable (Item 15) to the 37-pin **AUX I/O** terminal board on the DIN rail.

34 Connect the male end of the same cable to the EBC's rear panel **AUX I/O** connector.

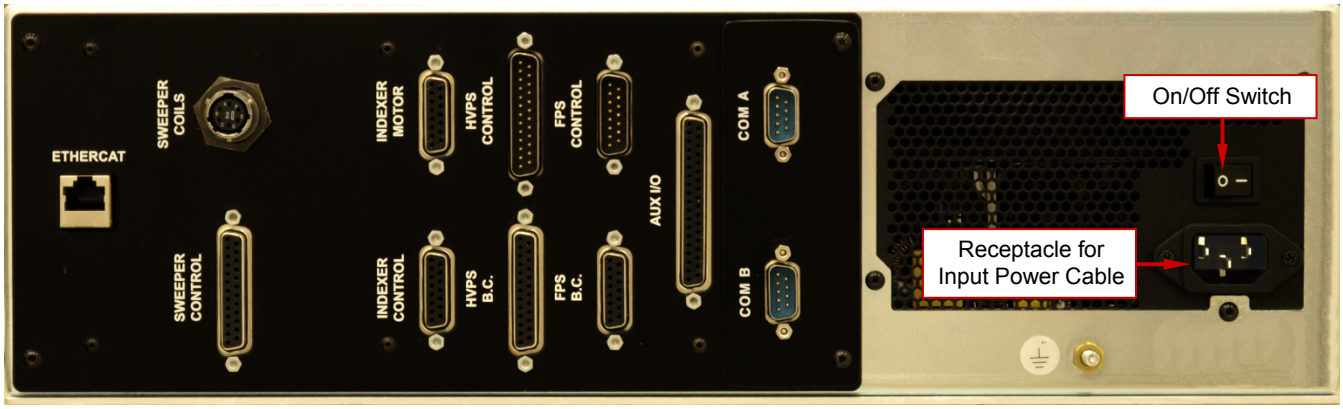
35 Make connections between the system's interlock switches and the appropriate pins on the **INTLKTB** terminal board.

3.5 Connecting the AC Power Cable and Powering Up the EBC

Perform the following procedure to supply AC power to the EBC chassis

Step	Action
1	Make sure that the rear-panel On/Off switch (see Figure 3-11) is in the Off position.

Figure 3-11 EBC Input Power Cable Receptacle and Rear Panel On/Off Switch



2 Plug the unit's power cable into the rear-panel input power receptacle and into an appropriate receptacle supplying AC power.

3 Put the rear-panel On/Off switch in the On position.

4 Press the front-panel On/Off button (see Figure 3-3). The unit will then display the Start screen (see Figure 4-1).

4 Basic Configuration Procedures

4.1 Section Overview

This section describes how to configure the EBC for operation as a stand-alone controller. The procedures included here assume that the EBC has been correctly installed and cabled up to controlled components and that the unit is powered up. Specific topics covered in this section are:

Section 4.2 Making Selections via the Configuration>Main Screen
Section 4.3 Setting the System Date and Time
Section 4.4 Configuring the E-Beam Control Module
Section 4.5 Configuring the Turret Control Module
Section 4.6 Configuring the Sweep Control Module
Section 4.7 Enabling the LogIn Manager and Assigning User Passwords (Optional)
Section 4.8 Optional Assignment of Material Names to Pockets
Section 4.9 Exiting Configuration Mode and Saving Configuration Changes

For additional details about configuring an EBC on a system with an XTC/3S deposition controller, see section 6.3. For details about configuring an EBC on a system with an XTC/3M deposition controller, see section 7.3.3. For details about configuring an EBC on a system with PLC-based system controller, see section 8.3.

4.2 Making Selections via the Configuration>Main Screen

To begin configuring the EBC for stand-alone operation, perform the following steps:

Step	Action
1	When the EBC is first booted up, the main controller screen displays the Start screen (see Figure 4-1). Touch this screen's Configuration button to display the screen shown in Figure 4-2.

Figure 4-1 EBC Start Screen

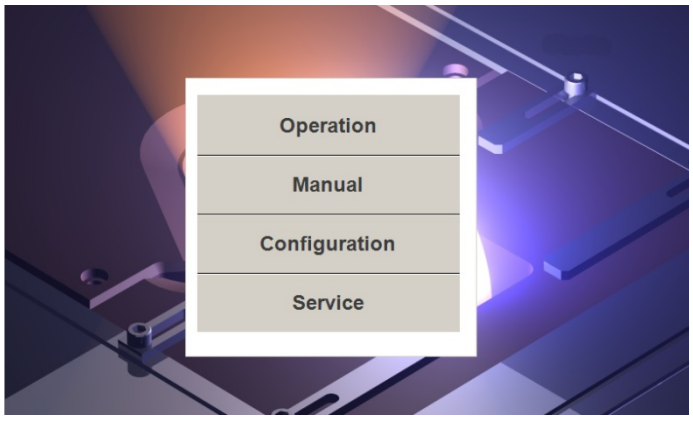
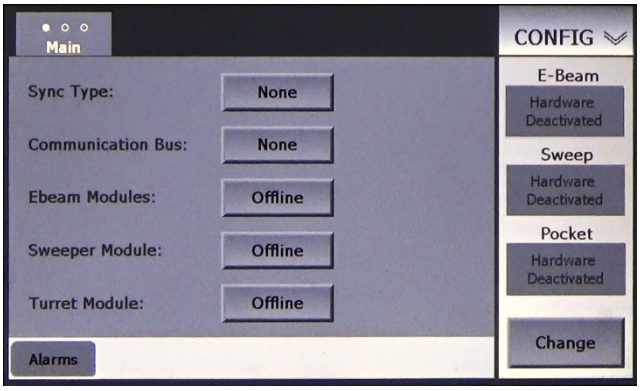


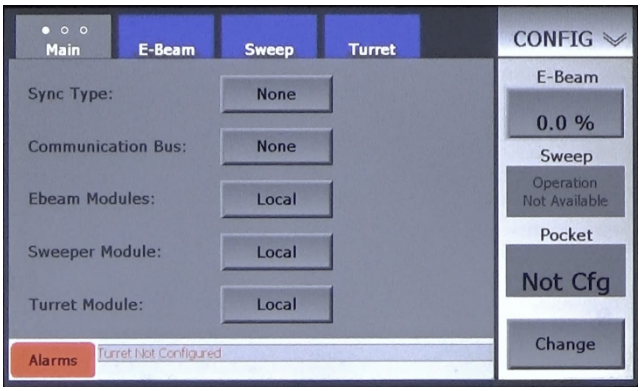
Figure 4-2 Config>Main Screen on an Unconfigured Unit



Because the Ebeam, Sweeper, and Turret control modules are initially configured as **Offline**, **Hardware Deactivated** is displayed on the **E-Beam**, **Sweep**, and **Pocket** buttons on the command button bar**.**

2 To configure all three control modules for Local mode operation, touch each module button once to display **Local** on each button, as shown in Figure 4-3.

Figure 4-3 Config>Main Screen with all Control Modules Configured as *Local*



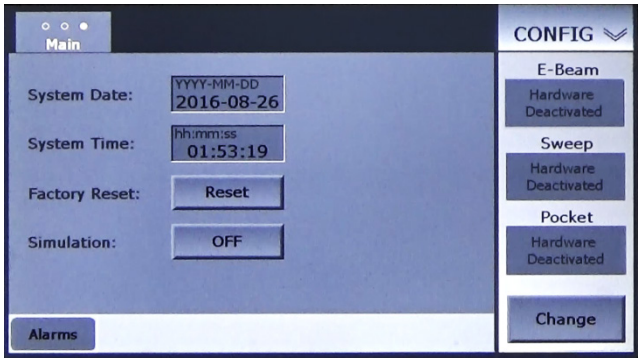
3 Leave **None** selected for **Synch Type** and **Communications Bus**.

4.3 Setting the System Date and Time

Perform the following steps to set the system date and time.

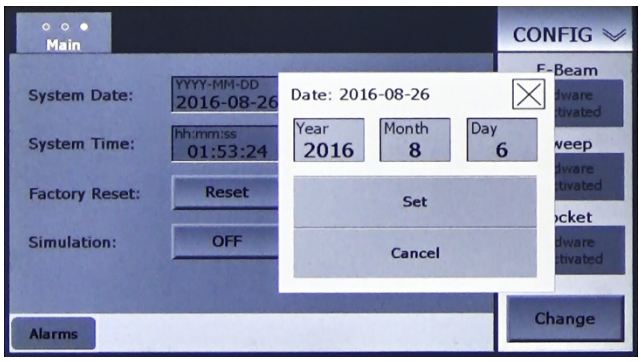
Step	Action
1	Touch the Config>E-beam screen's screen tab twice to open the screen show in Figure 4-4.

Figure 4-4 System Date/Time Screen



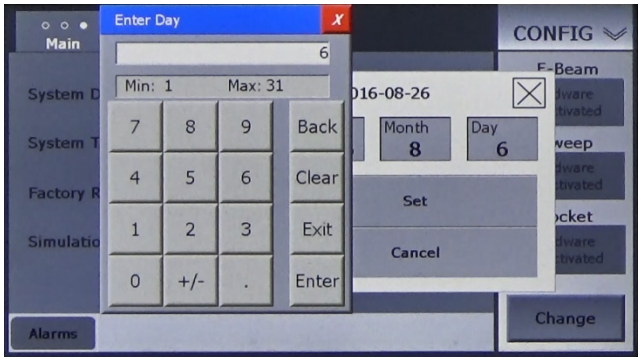
2 To change the system date, touch the recessed button bearing the system date to display the popup shown in Figure 4-5.

Figure 4-5 System Date/Time Screen with Date-Change Popup Displayed



3 Touch any of the individual boxes labeled **Year**, **Month**, and **Day** to display a numeric keypad (see Figure 4-6).

Figure 4-6 System Date/Time Screen with Numeric Keypad Displayed



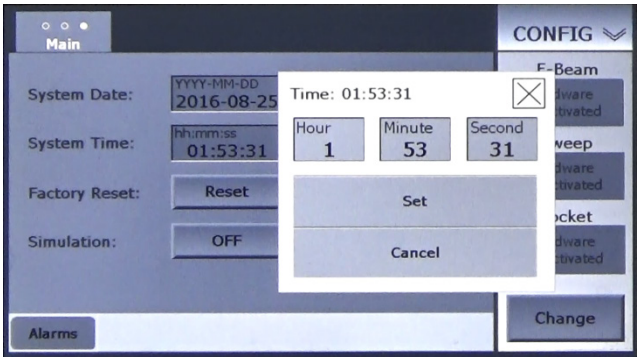
4 Use this numeric keypad to enter the correct number.

5 Touch the keypad's Enter number.

6 Repeat Steps 3-5 as necessary to complete the correction of the date.

7 To change the system time, touch the recessed button bearing the system time to display the popup shown in Figure 4-7.

Figure 4-7 System Date/Time Screen with Time-Change Popup Displayed



8 Touch any of the individual boxes labeled **Hour**, **Minute**, and **Date** to display a numeric keypad similar to that shown in Figure 4-6.

9 Use this numeric keypad to enter the correct number.

10 Touch the keypad's Enter number.

11 Repeat Steps 8-10 as necessary to complete the correction of the date.

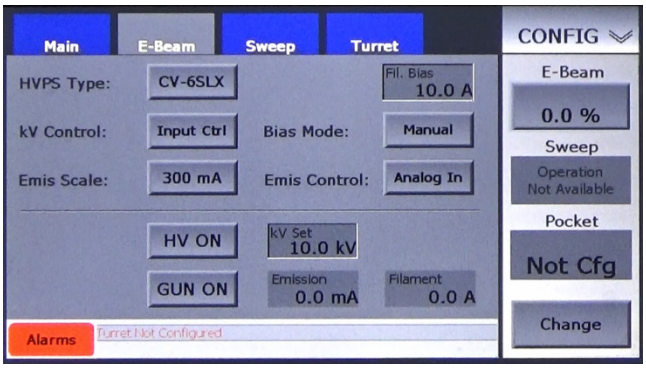
4.4 Configuring the E-Beam Control Module

To configure the EBC for your system's e-beam power supply, perform the procedure described below.

Step Action

1 Touch the Menu Bar's E-Beam button to display the Config>E-Beam screen (see Figure 4-8).

Figure 4-8 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 **HVPS Type** button to toggle between **CV-12SLX** and **CV-6SLX**.

3 Toggle the KV Control button to toggle from **Input Ctrl** to **Pot Ctrl**. If the E-Beam control module is configured as **Local**, select **Pot Ctrl**. If the E-beam power supply is to be under the control of a higher-level control system with a KV SET output, select **Input Ctrl**.

4 If you have selected **Input Ctrl** opposite **kV Control**, 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 Select the emission scale. To do so, touch the **Emis Scale** button to step through the following emission scale options, stopping when the button displays the desired value:

- **300 mA** (= 0 to 300 mA)
- **600 mA** (= 0 to 600 mA)
- **1000 mA** (= 0 to 1000 mA, default setting for Temescal CV-6SLX)
- **1500 mA** (= 0 to 1500 mA, default setting for Temescal CV-12SLX)
- **2000 mA** (= 0 to 2000 mA, default setting for Temescal Simba2)

6 If necessary, change the bias mode selection. To do so, touch the **Bias Mode** button to toggle between **Manual** and **Auto**. If **Manual** is selected, the filament current's bias value is determined by the value the user enters via the **Fil Bias** button on this screen. If **Auto** is selected, then the default bias value is determined by an input from the HVPS.

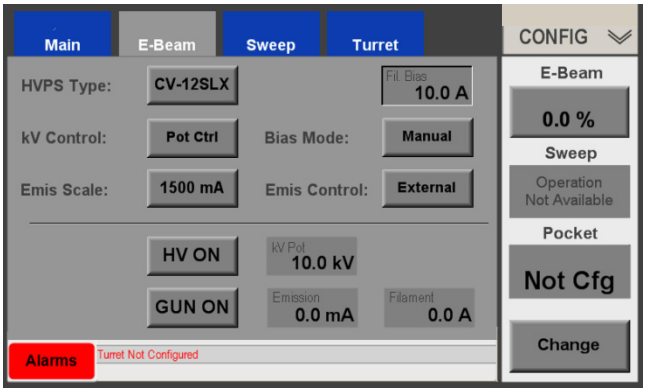
7 If you have selected **Manual** for **Bias Mode**, you can change the filament bias current level by doing the following:

a) Touch the **Fil Bias** button to display a numeric keypad.
a) Use that keypad to enter the desired value
b) Touch the keypad's **Enter** button to close it. The value you entered will then appear in the **Fil Bias** button.

8 Touch the **Emis Control** button to toggle from **Analog In** to **Internal**. If **Internal** is selected, then the emission power setpoint is determined by user input via the EBC. If **Analog In** is selected, that setpoint is determined by input from a higher-level controller (i.e., either a deposition controller or a PLC-based system controller).

Configuration of the E-Beam control module is now complete. Figure 4-9 shows the Configuration>E-Beam screen after the user has reconfigured the EBC for use with a CV12-SLX power supply with an emission scale of 0-1500 mA and a filament bias current level of 18.0 A. The default kV value (10 kV) has not been changed, **Manual** has been selected for **Bias** Mode, and **Pot Ctrl** has been selected for kV **Control**. Note that when this selection is made, what was a parameter-entry button labeled **kV Set** becomes a parameter value display rectangle labeled **kV Pot**.

Figure 4-9 Typical Config>E-Beam Screen, Configuration of E-Beam Control Module Completed



If you have completed all the configuration changes you wish to make at this time, save them, following the procedure described in section 4.9. If not, proceed to section 4.5.

4.5 Configuring the Turret Control Module

4.5.1 Overview of Turret Control Configuration Procedures

For nearly all users, configuration of the Turret Control module entails:

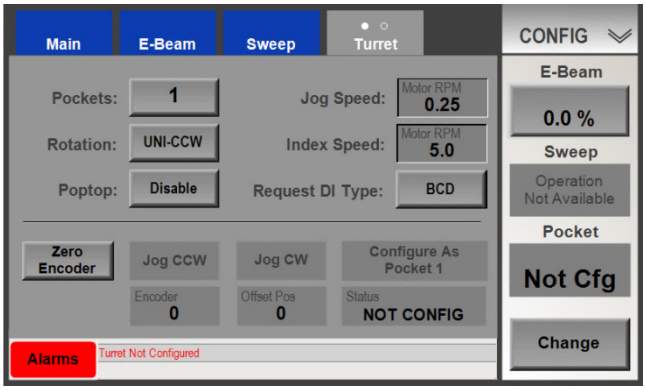
1. selecting the number of pockets in the e-gun to be controlled
2. selecting the direction and mode of turret rotation,
3. enabling or disabling the Poptop Down LED on the Diagnostics screen
4. setting the jog and index speeds
5. determining which pocket will be Pocket 1 and configuring its home positon.

Operations 1-4 must be performed via the Config>Turret screen (see Figure 4-8), whose control/display features are described in detail in section 4.5.2. Configuration of Pocket 1 can be performed from either that screen, as described in section 4.5.3 or from the hand-held remote controller (see section 4.5.4).

4.5.2 Overview of the Config>Turret Screen

Figure 4-8 shows the Config>Turret screen as it appears when opened after the EBC is first booted up.

Figure 4-10 Config>Turret Screen at Initial Boot-Up



The features on this screen enable the user to configure:

- Rotation direction/mode. The selectable options are:
  - UNI-CCW (= unidirectional rotation + counterclockwise pocket numbering)
  - UNI-CW (= unidirectional rotation + clockwise pocket numbering)
  - BI-CCW (= Bidirectional rotation + counterclockwise pocket numbering)
  - BI-CW (= Bidirectional rotation + clockwise pocket numbering)
- Number of pockets (1-8)
- Jog speed (0-7 RPM). This is the speed at which the turret drive motor turns when the user presses either the **Jog CCW** or the **Jog CW** button on this screen)
- Motor indexing speed (0-7 RPM). This is the speed at which the drive motor turns during ordinary pocket-to-pocket rotation.

> NOTE
> The drive motor rotates four times as fast as the turret, so for **Jog Speed** or **Index Speed**, enter an RPM that is one fourth of the desired turret rotation speed.

- Enabling/Disabling the Diagnostic Screen's **Poptop down** LED
- **Request DI Type** button: This configuration item is provided for the use of one OEM user. For all other users, leave **BCD** selected**.**
- Configuration of the Home position for the pocket designated as Pocket 1. Features on the Configuration>Turret screen dedicated to this function are:
  - **Zero Encoder** button
  - **Jog CCW** button
  - **Jog CW** button
  - **Encoder** display box, which indicates encoder counts
  - **Offset Pos**ition display box, which also indicates encoder counts
  - **Cfg Pocket 1** command button
  - **Status** indicator box

The functions of these screen features are explained detail in Step 6 of the following procedure.

4.5.3 Turret Module Configuration Procedure

This section describes how to configure the Turret Control module from the Config>Turret screen. This procedure is most easily accomplished with the source tray lowered and swung out from the system and with the source shutter removed. Note that Step 6 of this procedure can also be performed from the hand-held remote controller, following the procedure described in section 4.5.4. That method allows you to set the Home position for Pocket 1 while observing the source through the system's viewport, making it unnecessary to lower and swing out the source tray.

Step	Action
1	First select the number of pockets. To do so, touch the **Pockets** button repeatedly until the button displays the number of pockets in your turret source.

NOTE

To configure the Turret Control module for use with a 'skillet'-type crucible, enter **1** for the number of pockets. Then, when the higher-level controller downloads BCD Bit 0 as true and BCD Bits 1 and 2 as false, the crucible will rotate clockwise at the Jog speed currently configured.

2 Next select the desired rotation direction and mode (i.e., either unidirectional or bidirectional). The available selections are:

- **UNI-CCW** = Unidirectional counterclockwise
- **UNI-CW** = Unidirectional clockwise
- **BI-CCW** = Bidirectional counterclockwise
- **BI-CW** = Bidirectional clockwise

If the default, **BI-CCW**, is appropriate for your application, skip this step and proceed to Step 3. To change the rotation mode and direction, touch the **Rotation** button repeatedly until the desired selection is displayed on that button.

3 Opposite **Poptop**, either accept the default, **Disable**, or press the button once to select **Enable**. If you select **Enable**, the Diagnostics screen displays an LED labeled **Poptop Down**. That LED is lit when the gun's PopTop Down limit switch is made, assuming that that limit switch is properly connected to the EBC via its rear-panel AUX I/O connector. If you accept **Disable**, the **Poptop Down** LED does not appear on the Diagnostics page.

4 If desired, change the **Jog Speed**. This is the speed at which the turret will rotate when you press either the **Jog CCW** or the **Jog CW** button on this screen. To change the Jog Speed:

a) Touch the recessed **Jog Speed** button to display a popup keypad and use that keypad to enter the desired value.

b) Touch the keypad's **Enter** button to close it. The value you entered will then appear on the **Jog Speed** button.

5 If desired, change the **Index Speed**. This is the speed at which the turret drive motor will turn during ordinary pocket-to-pocket rotation. To change the Index Speed:

a) Touch the **Index Speed** button to display a popup keypad and use it to enter the desired value.

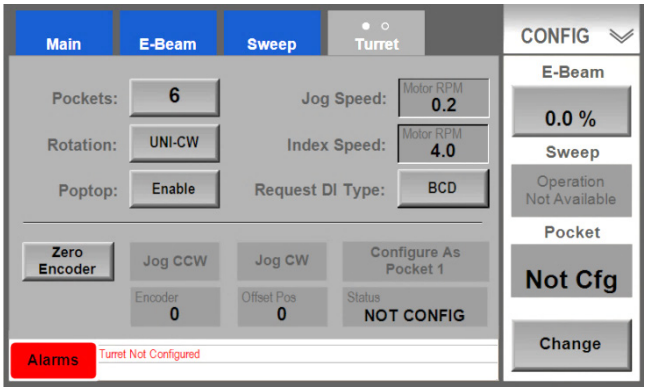
b) Touch the keypad's **Enter** button to close it. The value you entered will then appear on the **Index Speed** button.

NOTE

The drive motor rotates four times as fast as the turret, so for **Jog Speed** or **Index Speed**, enter an RPM that is one fourth of the desired turret rotation speed.

In Figure 4-11, the user has changed the number of pockets to 6, selected unidirectional clockwise for **Rotation**, enabled the Poptop Down LED, changed the Jog Speed to 0.2 RPM, and changed the Indexing Speed to 4.0 RPM.

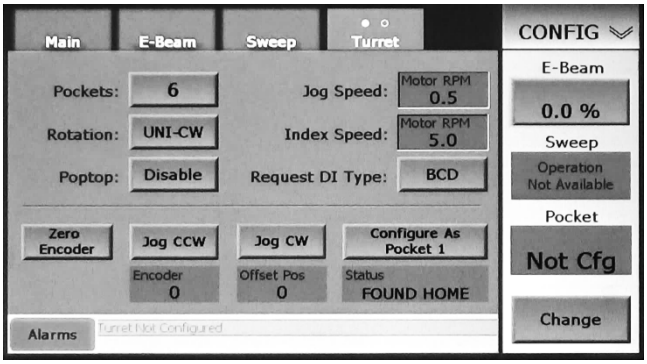
Figure 4-11 Config>Turret Screen After User Changes the Pocket Number, Rotation Mode and Direction, and Jog Speed, and Index Speed



6 Now configure the home position for Pocket 1. To do so:

a) Touch the **Zero Encoder** button. The Config>Turret screen now appears as shown in Figure 4-12. The **Status** indicator reads **FOUND HOME,** while the **Encoder** and **Offset Pos** value remain zero.

Figure 4-12 Config>Turret Screen After User Zeroes the Encoder



b) Determine which pocket is to be designated as Pocket 1.

c) Using the **Jog CCW** and/or the **Jog CW** button, rotate this pocket so that it is precisely centered in evaporation position, as shown in Figure 4-13.

Figure 4-13 Pocket in Evaporation Position

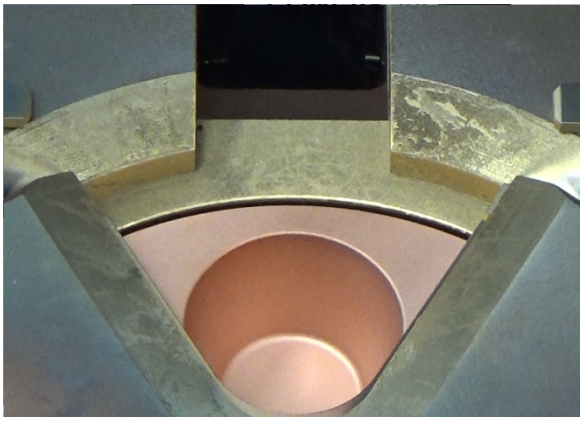
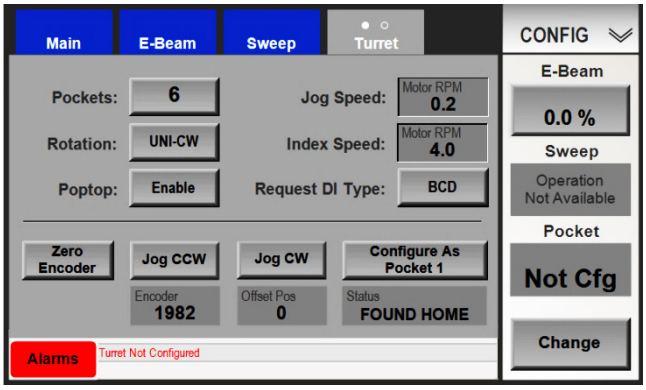


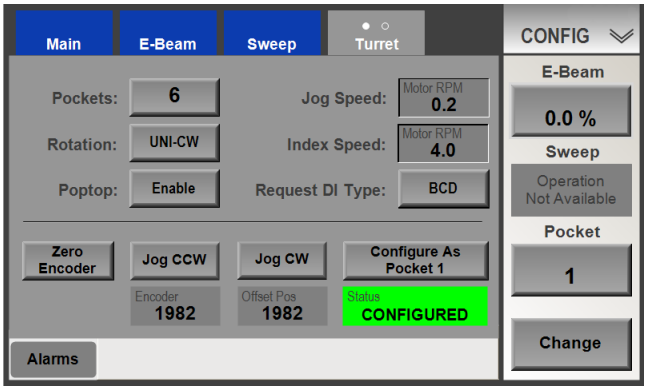
Figure 4-14 shows the Config>Turret screen as it might appear following this jogging. The **Encoder** value is now a nonzero value, while the **Offset Pos** value is still zero.

Figure 4-14 Config>Turret Screen After User Jogs Turret Pocket into Evaporation Position



d) When the target Pocket 1 is in the correct position, touch the **Configure as Pocket 1** button. As Figure 4-15 shows, the **Status** indicator now displays **CONFIGURED**, identical values are displayed for **Encoder** and **Offset Pos**, and the **Pocket** button displays **1**. In addition the Alarm message **Turret Not Configured** has disappeared.

Figure 4-15 Config>Turret Screen After User Touches the *Configure As Pocket 1* Button



7 If you have lowered and swung out the source tray in order to perform this procedure:

a) Replace the source shutter.

b) Swing the source tray back into place and raise it back up to its operational position.

c) Pump vacuum chamber down to the desired pressure.

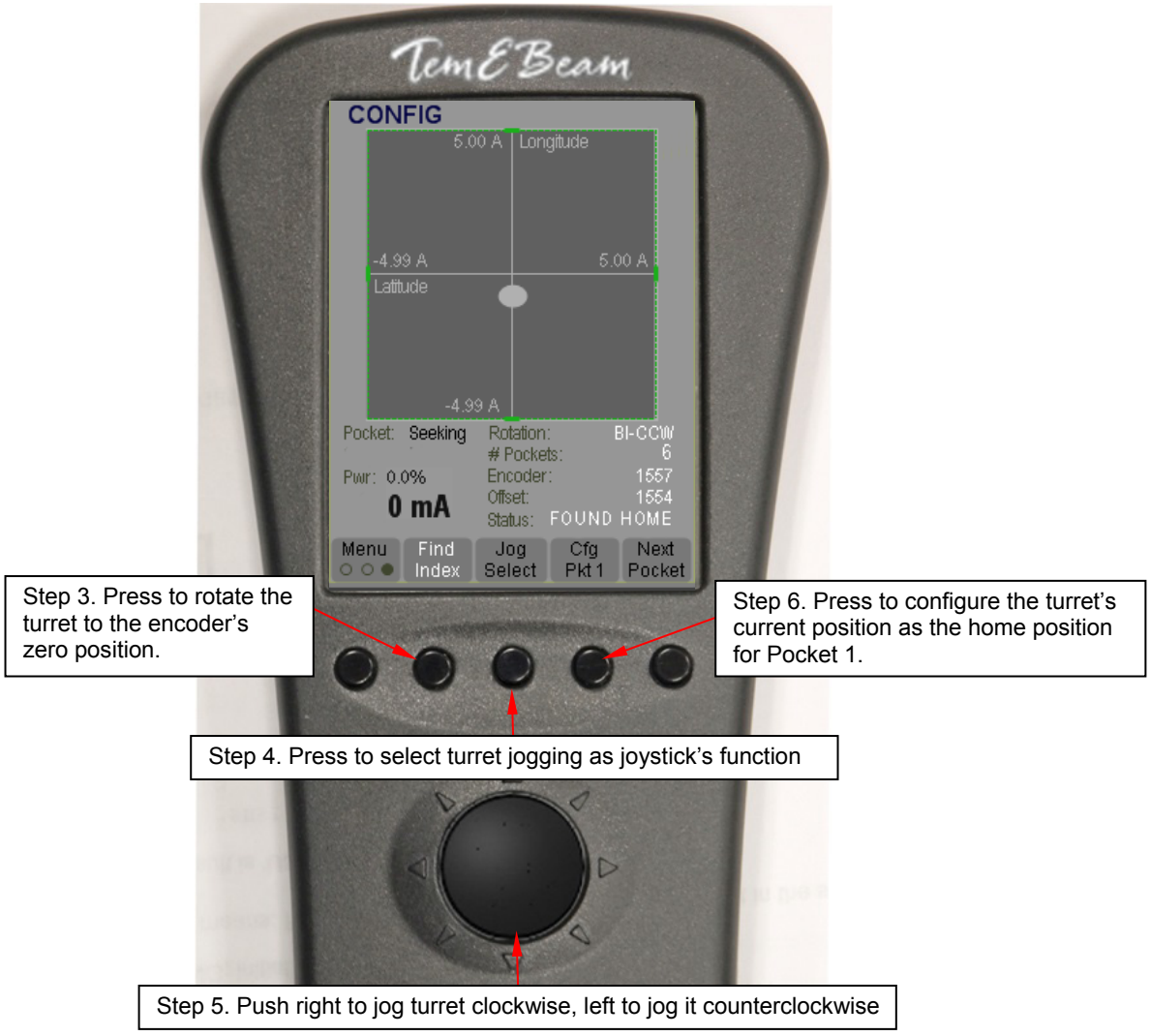
The Turret Control module is now configured. For instructions on assigning material names to specific pockets, see section 4.8. If you have made all the configuration changes you wish to make at this time, exit from Configuration Mode to save your changes (see section 4.9). If not, proceed to section 4.6.

4.5.4 Using the Remote Controller to Configure the Home Position for Pocket 1

You can also use the hand-held remote controller to configure the Home position for Pocket 1. This method makes it possible to configure the Pocket 1 home position without lowering and swinging out the source tray. Instead you can observe the turret through a viewport while performing the procedure described below.

Step	Action
1	Perform Steps 1-5 of the procedure described in section 4.5.3.
2	Press the remote controller's **Menu** button twice to display Menu 3, which is shown in Figure 4-16.

Figure 4-16 Using Config Screen's Menu 3 to Configure the Home Position for Pocket 1



3 Touch the **Find Index** button to rotate the turret to the encoder's zero position. After the turret rotates to that position, **FOUND HOME** will appear in white opposite **Status**, a nonzero value will appear opposite **Offset**, and **0** (zero) will be displayed opposite **Encoder**.

4 Touch the remote controller's **Jog Select** button to put the joystick in control of turret rotation.

5 Use the joystick to rotate the turret to the correct Home position for Pocket 1 (see Figure 4-13). Push the joystick to the left for counter-clockwise rotation and to the right for clockwise rotation.

6 When the target Pocket 1 is precisely centered in evaporation position, touch the controller's **Cfg Pkt 1** button. **CONFIGURED** will then be displayed opposite **Status**, and identical values will be displayed opposite **Encoder** and **Offset**.

7 If you have broken vacuum and lowered the source tray in order to configure Pocket 1:

a) Replace the source shutter.
b) Swing the source tray back into place and raise it back up to its operational position.
c) Pump vacuum chamber down to the desired pressure.

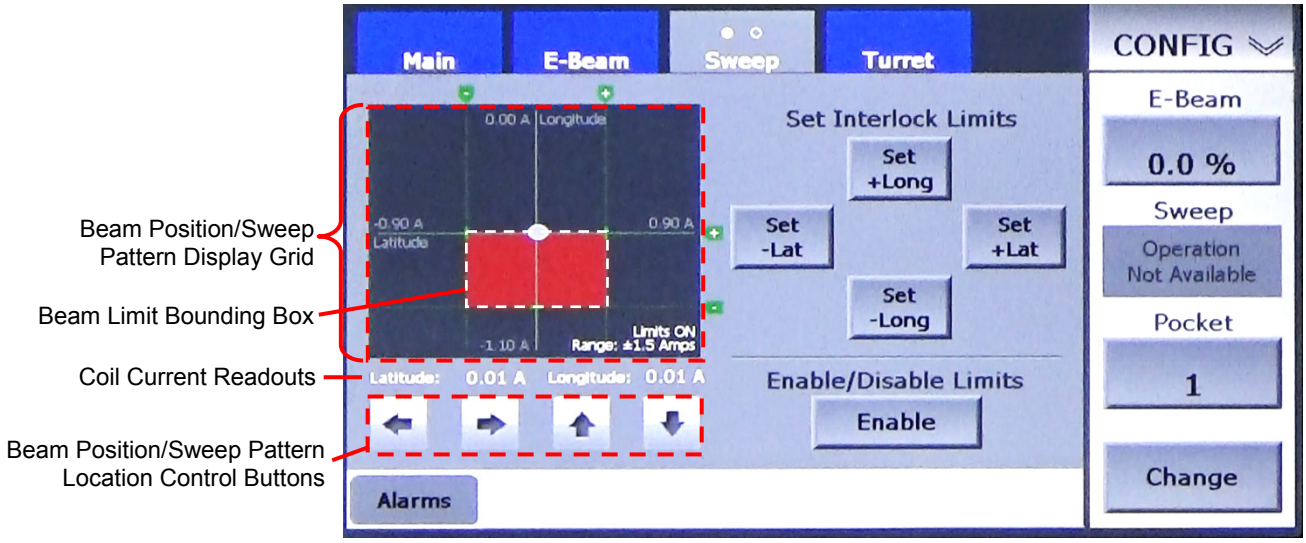
8 If you have made all the configuration changes you wish to make at this time, save your changes, as described in section 4.9. If not, proceed to section 4.6.

4.6 Configuring the Sweep Control Module

4.6.1 Control/Display Features on Config>Sweep Screen, Page 1

Page 1 of the Config>Sweep screen enables the user to set limits for the beam position interlock. Figure 4-17 shows this screen as it appears when the EBC is first booted up.

Figure 4-17 Page 1 of Config>Sweep Screen at Initial Boot-Up



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

- **Beam/pattern display grid:** 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.
- **Beam Limit Bounding Box.** This rectangle illustrates the area bounded by the beam position limits currently in effect. When those limits are enabled and the beam is outside this rectangle, it is red in color, as shown above. When the beam limits are enabled and the beam is within the rectangle, the bounding box is green.
- **Coil current output readouts:** Indicate the coil current outputs at the beam's current position.
- **Beam/pattern location control buttons:** Enable the user to move the beam or the sweep pattern up/down or up/down.

- **Set Interlock Limits** buttons: Pressing one of these buttons sets a beam position limit at the beam's current position.
- **Enable/Disable Limits button.** Allows user to toggle the beam limits on and off. The beam limits are enabled when **Enable** is selected and disabled when **Disable** is selected. Note that selecting **Disable** disables the beam limits only in Configuration mode. The effects of either enabling or disabling the beam limits are described in detail below.

Effect of Enabling/Disabling Limits

Beam Limits Enabled: Under these conditions, if the user attempts to drive the beam beyond any of the four beam position limits, the following events occur: (1) The beam limit bounding box turns red, (2) the beam is switched off, and (3) the EBC issues beam-position alarm, which must be acknowledged and cleared before the beam can be switched back on. Note that these effects can occur when the user is resetting a given beam limit to a position within the former boundaries of the bounding box. In order to resume the configuration procedure with the beam on, the user must then acknowledge the beam position alarm, move the beam spot back inside the bounding box, select the desired beam power level, and switch the beam back on.

Beam Limits Disabled: If the user drives the beam beyond any of the four beam position limits, the EBC does not issuing a beam position error, which switches off the beam. Therefore, the area within the beam limit bounding box remains green.

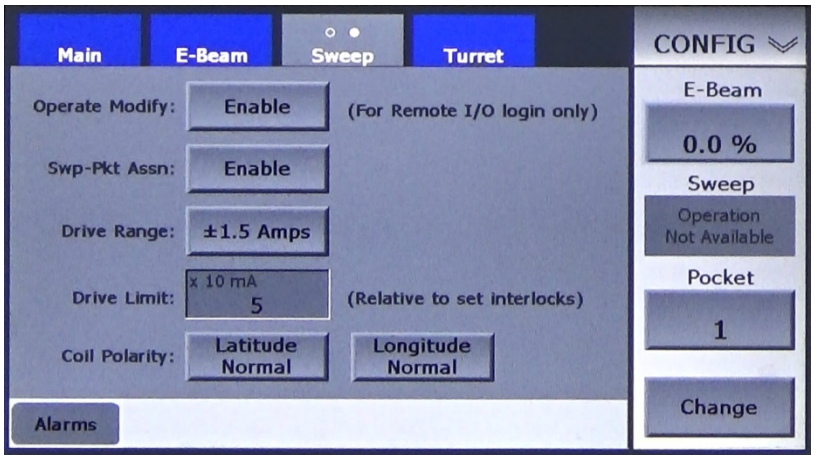
CAUTION

When beam limits are disabled and the EBC is in Configuration Mode, it is possible to drive the beam onto the uncooled copper surface of the e-gun, potentially damaging it. Under these conditions, it is critical to set a **Drive Limit** value (see section 4.6.2) that protects the gun.

4.6.2 Parameters on Config>Sweep Screen, Page 2

Figure 4-18 shows page 2 of the Config>Sweep screen. To access this screen, touch the **Sweep** screen tab above Page 1 of the Config>Sweep Screen. The configurable parameters on page 2 of the Config>Sweep screen are described in detail below.

Figure 4-18 Config>Sweep Screen, Page 2



Operate Modify button: Using this button, the user can toggle between **Enable** and **Disable**. When the Sweep control module is configured as **Remote I/O** and the Log-In manager is enabled, selecting **Disable** prevents users who have only Operations mode access from changing sweep programs. Under these conditions, all other users can modify sweep programs when the EBC is in either Operations or Manual mode. When the Sweep control module is configured as **Remote I/O** and the Log-In Manager is disabled, all users, including those with only Operations mode access, can modify sweep programs when the EBC is in either Operations or Manual mode.

Selecting **Disable** has no effect when the Sweep Control module is configured as **Local**. In that case, all users are allowed to modify sweep programs whenever the EBC is in either Operations or Manual mode.

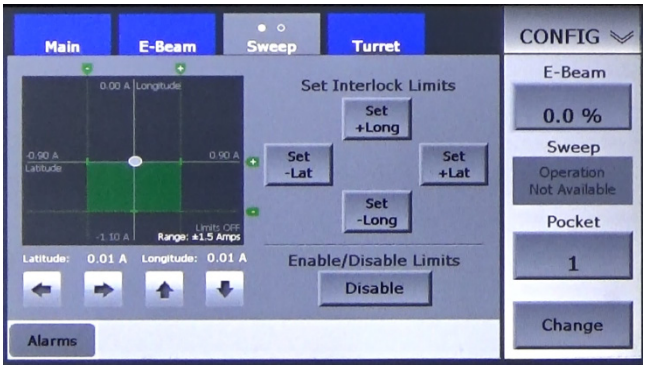
Swp-Pkt Assn button: Allows the user to select either **Enable** or **Disable**. When **Enable** is selected, the default association between pockets and sweep patterns remains in force. Under this scheme, the user can associate up to eight unique sweep programs with each pocket. For a four-pocket source, this scheme permits the use of up to 32 unique sweep programs. For a six pocket gun, the total number of selectable sweep programs would be 48.

If **Disable** is selected, the association between pockets and sets of sweep programs is nullified, and only eight sweep programs could be selected. However, any of these eight programs could be selected for used with any pocket.

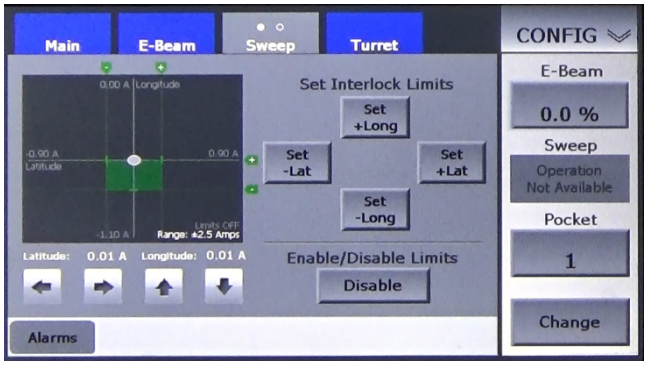
Drive Range button: Pressing this button allows the user to change maximum current output of the longitudinal and lateral beam-sweep/beam-position coils to a value higher than the default, ±1.5 A. The available selections are ±1.5 A, ±2.0 A, ±2.5 A, and ±3.0 A. When the EBC is in Configuration mode with the beam limits disabled, the **Drive Range** function can be used to limit beam travel in either axis, thus protecting the uncooled portions of the e-gun. Limiting the coils' drive range can also reduce the likelihood of coil overheating when the beam limits are disabled. Note that increasing the **Drive Range** value decreases the size of the bounding box on Config>Sweep page 1 defined by the beam limit values (see Figure 4-19). Note also that the **Drive Range** value affects the operation of the Sweep control module only when the EBC is in Configuration mode.

Figure 4-19 Change in Size of Bounding Box Depending on the *Drive Range* Value

Bounding Box With Drive Range Set To ±1.5 A



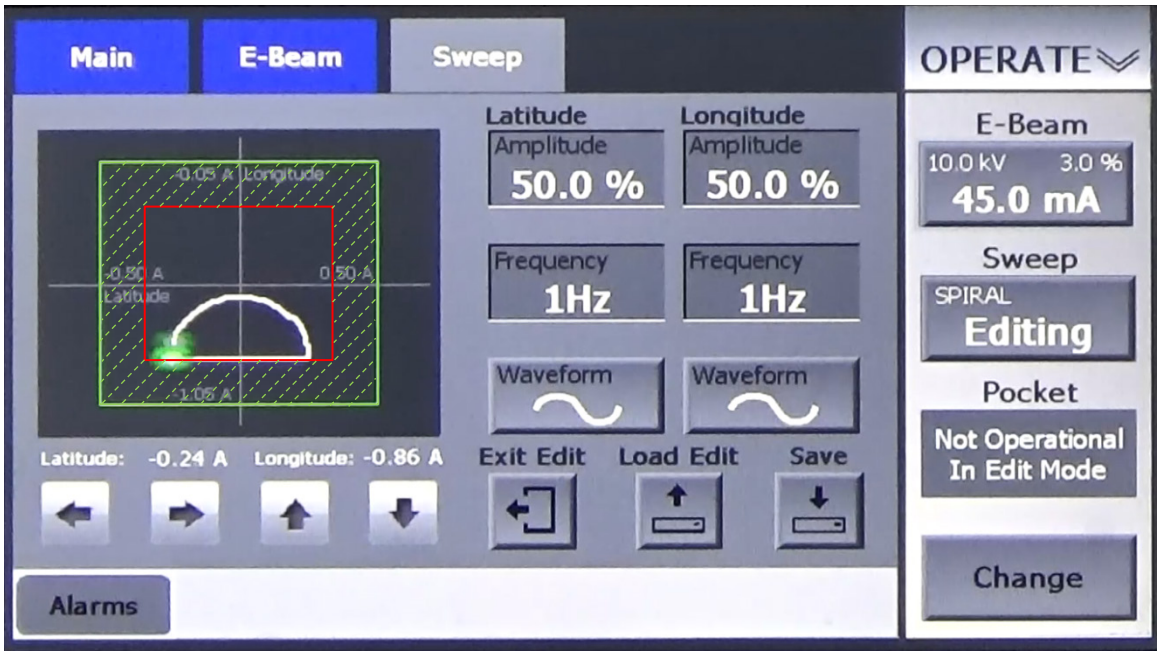
Bounding Box With Drive Range Set To ±2.5 A



Drive Limit button: Press this button to display a numeric keypad that allows you to change the **Drive Limit** value, which is displayed in the center of the button. Note that the actual **Drive Limit** is 10 times the value you will enter. Thus, if you enter **20**, the actual **Drive Limit** value is 200 mA. With the **Drive Limit** set to this value, the EBC's Sweep Control module creates a buffer 200 mA wide within the

bounding box defined by the hard beam positon limits. In Figure 4-20, the green dotted lines define this buffer zone, while the red rectangle shows its inner limits.

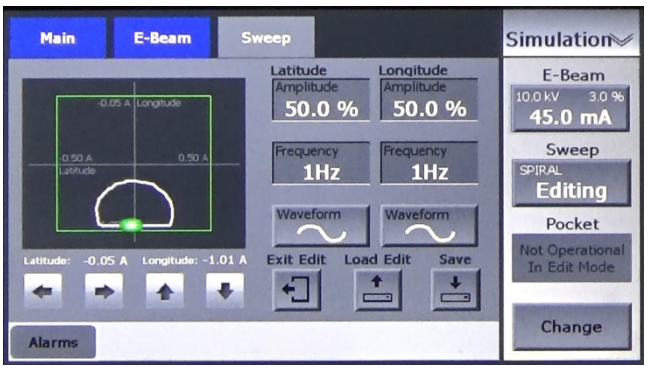
Figure 4-20 Buffer Zone Defined by the Drive Limit Value

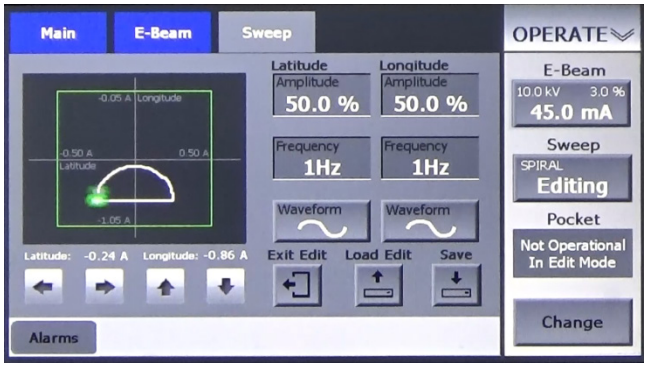


When a beam sweep pattern meets this buffer zone, it is clipped along its inner edge and travels along that edge until it reaches the point at which the sweep pattern would direct it back inside the area bordered by the buffer zone. Figure 4-21 shows this clipping effect in two cases, one in which the **Drive Limit** value is set to ±50 mA and the other in which that value equals 200 mA.

Figure 4-21 'Clipping' of Beam Sweep Pattern Depending on the *Drive Limit* Value

Drive Limit Value Set To ±50 mA **Drive Limit Value Set To ±200 mA**





Due to this clipping effect, the **Drive Limit** value prevents the beam from being switched off in cases in which it would otherwise travel outside the user-set beam limits. Unlike the **Drive Range** setting, the **Drive Limit** value affects the operation of the Sweep control module in all EBC operating modes.

Coil Polarity buttons: These buttons enable the user to toggle between normal and reverse polarity for the gun's latitudinal and longitudinal beam position coils, in cases where the coil current leads have been connected backwards or in cases where the user wishes to reverse coil polarity for any other reason. Note that the coil polarity selections affect beam-motion control in all EBC operating modes.

4.6.3 Resetting the Beam Position Interlock Limits

When the EBC is delivered from the factory, the beam limits are set to the following values:

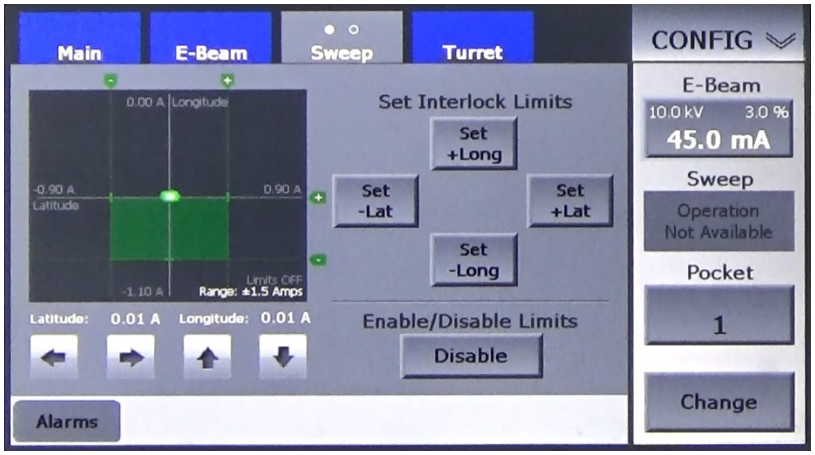
- Positive lateral limit: +0.90A
- Negative lateral limit: –0.90 A
- Positive longitudinal limit: 0.00 A
- Negative longitudinal limit: –1.10 A

If these limits are suitable for your e-gun, skip the remainder of this section and proceed to section 4.6.4. However, if you need to reset one or more of the beam position limits, perform the following procedure.

CAUTION
Before beginning this procedure, make sure that there is an appropriate amount of material in the exposed pocket and that it is pre-melted.

Step	Action
1	Touch the Menu Bar's **Sweep** button to display page 1 of the Config>Sweep screen (see Figure 4-18).
2	Touch this screen's **Enable/Disable Limits** button once so that the button's label reads Disable. Doing this disable, all four default beam position limits, which will likely save you time as you reset the limits, as each time you move the beam beyond one of the four limits, you will not have to acknowledge the beam position alarm, move the beam spot back inside the bounding box, and switch the beam back on. Note that selecting **Disable Limits** disables the beam limits only in Configuration mode.
3	Next display Page 2 of the Config>Sweep screen (see Figure 4-18) and if necessary change the **Drive Range** value. This value paces a hard limit on beam motion in both axes. Set a value that ensures that the gun is protected while the beam position interlock limits are disabled.
4	Open the shutter, so that the pocket in evaporation position is visible through the viewport.
5	Switch on the beam at a low power level (3-5%), so that the beam is just visible through the viewport. Figure 4-22 shows page 1 of the Config>Sweep screen as it appears with beam limits disabled and the beam on at power level of 3% (=45 mA).

Figure 4-22 Config>Sweep Screen, Beam Position Limits at Default Values, Beam Switched On



6 Watching the beam through the viewport, press the right-arrow button and check to see that the beam moves to the right. If it moves to the left, display page 2 of the Config>Sweep screen and touch the **Latitude Normal** button to select **Latitude Reverse**.

7 Return to Config>Sweep screen, page 1, and press the up-arrow button. The beam should then move away from the emitter. If it moves in toward the emitter, return to Page 2 and touch the **Longitude Normal** button to select **Longitude Reverse**.

NOTE
The coil-polarity selection affects beam-motion control in all EBC operating modes.

8 When you have finished checking the direction of beam motion, leave the beam on at the same low power level and in the approximate center of the evaporant pool.

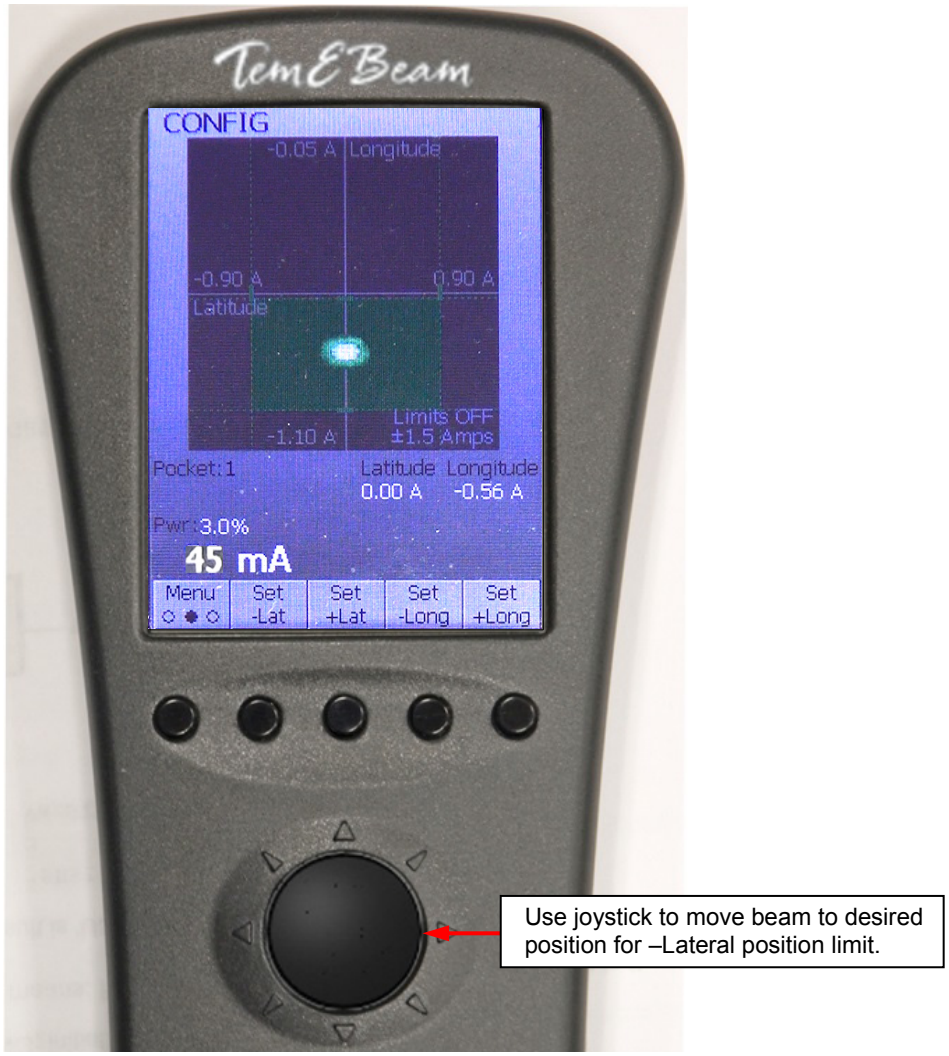
9 Pick up the remote controller and view the beam through the viewport. If the remote controller's Menu 1 is not selected, press its **Menu** button until its screen appears as shown in Figure 4-23.

Figure 4-23 Remote Controller in Config Mode, Menu 1 Selected and Beam on at 3% (45 mA)

10 Touch the remote controller's **Pos Adjust** button, enabling joystick control over beam position.

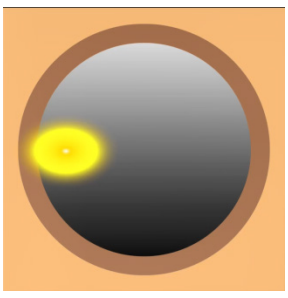
11 Press the remote controller's **Menu** button to select Menu 2. The remote controller's screen will then appear as shown in Figure 4-24.

Figure 4-24 Remote Controller, Beam On @ 5%, Config Mode, Menu 1 and *Pos Adjust* Selected



12 Watching the beam through the viewport, use the remote controller's joystick button to move the beam to the desired position for the negative latitudinal beam position limit. This is the point at which the beam's outer edge just touches the left-hand edge of the evaporant pool, as illustrated in Figure 4-25.

Figure 4-25 Beam at Correct Position for Negative Latitudinal Limit



13 Press the hand-held controller's **Set –Lat** button to set the negative latitude limit. The screen will then appear as shown in Figure 4-26, with a white dashed line demarcating the limit you have just set.

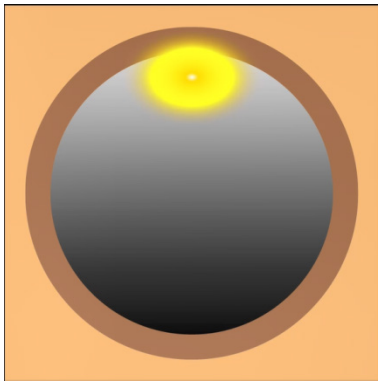
Figure 4-26 Remote Controller in Config Mode with Menu 2 Selected, User Setting the -Lat Position Limit

14 Use the joystick to move the beam to the position desired for the positive latitudinal limit. This is the point at which the beam's outer edge touches the right-hand edge of the evaporant pool.

15 Press the hand-held controller's **Set +Lat** button.

16 Use the joystick to re-center the beam. Then move it away from the emitter, until it reaches the correct point for the positive longitudinal limit. This is the point at which the beam's upper edge touches the edge of the evaporant pool that is farthest from the emitter (see Figure 4-27).

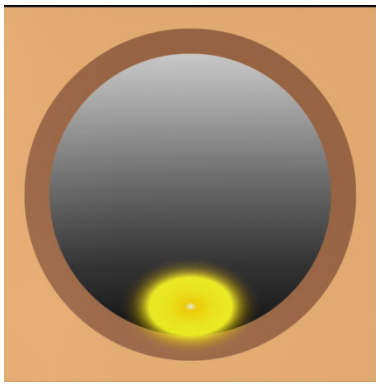
Figure 4-27 Beam at Correct Position for Positive Longitudinal Beam Limit



17 Press the hand-held controller's **Set +Long** button.

18 Then move the beam toward the emitter, until it reaches the correct point for the negative longitudinal limit. This is the point at which the beam's lower edge touches the edge of the evaporant pool nearest to the emitter (see Figure 4-28).

Figure 4-28 Beam at Correct Position for Negative Longitudinal Beam Limit

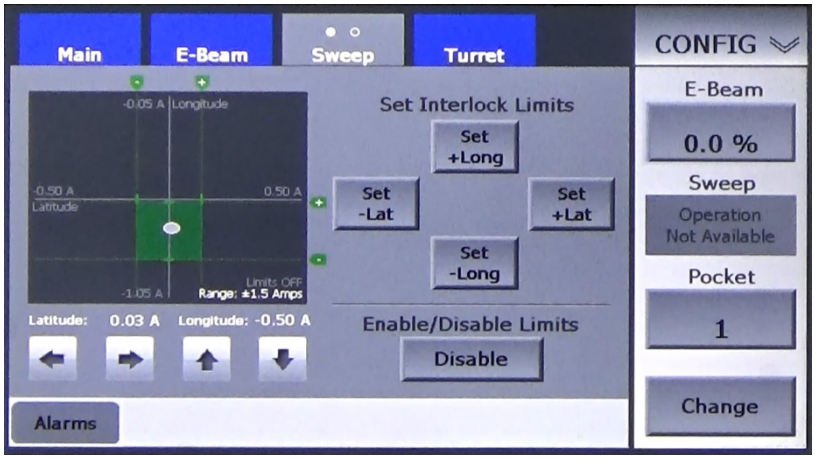


19 Press the hand-held controller's **Set -Long** button.

20 Select the hand-held controller's Menu 1 and press its **Beam On/Off** button to switch off the beam.

This completes the adjustment of the beam position limits. Figure 4-29 shows page 1 of the Config>Sweep screen after all four beam limits have been set to the values used in this sample procedure. Note also that these beam-limit values have been chosen arbitrarily and do not necessarily correspond to those appropriate for a six-pocket source.

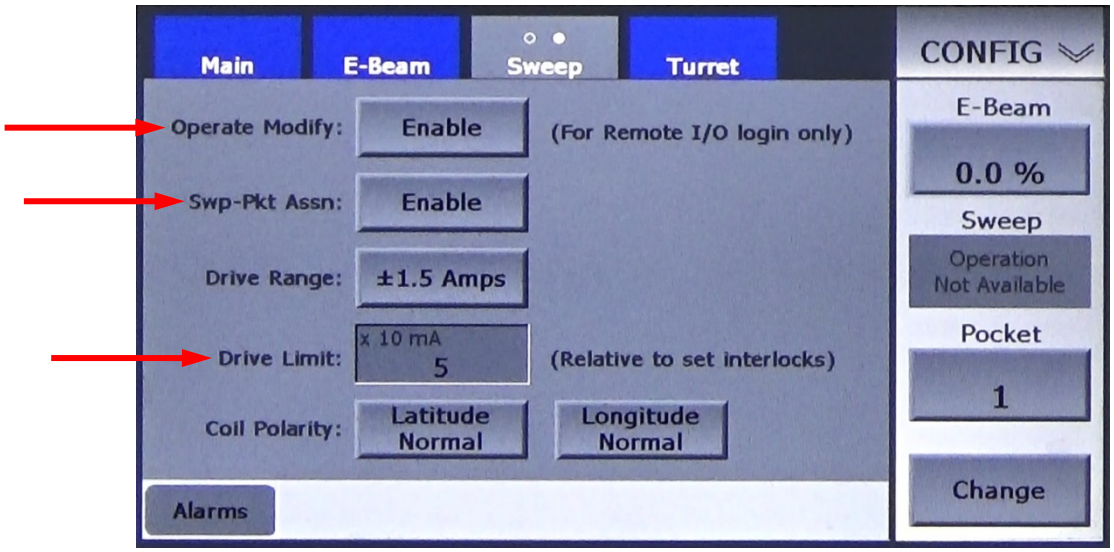
Figure 4-29 Cfg>Sweep Screen Showing Beam Position Limits Values Set in this Example



4.6.4 Setting the Remaining Parameters on Config>Sweep Screen, Page 2

After adjusting the beam position limits, reset the remaining parameters on Config>Sweep screen, page 2 (see Figure 4-30) as necessary. To do so, perform the procedure described below. For detailed functional explanations of these parameters, see section 4.6.2.

Figure 4-30 Remaining Parameters To Be Set on Config>Sweep Screen, Page 2



Step	Action
1	If your EBC's Sweep Control module is configured as **Remote I/O**, you can press this screen's **Operate Modify** button to select **Disable**.
2	If desired, press the **Swp-Pkt Assn** button to select **Disable**.

3	If desired, reset the **Drive Limit** value. To do so, press the **Drive Limit** button to display a numeric keypad. Use that keypad to enter the desired **Drive Limit** value. For a detailed functional explanation of the **Drive Limit** parameter, see section 4.6.3.

This completes the basic configuration procedure. If you wish to enable the login manager and assign user passwords, proceed to section 4.7. For instructions on assigning material names to specific pockets, see section 4.8. If you have entered all the configuration changes you wish to make at this time, then save your configuration changes, following the procedure described in section 4.9.

4.7 Enabling the LogIn Manager and Assigning User Passwords (Optional)

As described above, the initial configuration procedure has proceeded without the LogIn Manager being enabled and without any user passwords assigned. When this is the case, the EBC will open to an Operations mode screen whenever any user touches the **LogIn** button on the LogIn screen (see Figure 4-1), and all users will have Service-level access. To enable the LogIn manage and assign user passwords, perform the procedure described below. Note that any Service level user can assign or change user passwords for all Service and Operator level users.

Step	Action
1	To reveal the LogIn Manager page, touch the **Main** screen tab (see Figure 4-31). The LogIn Manager screen will then appear as shown in Figure 4-32.

Figure 4-31 The Config>Man Screen After All Control Modules Are Activated and Configured

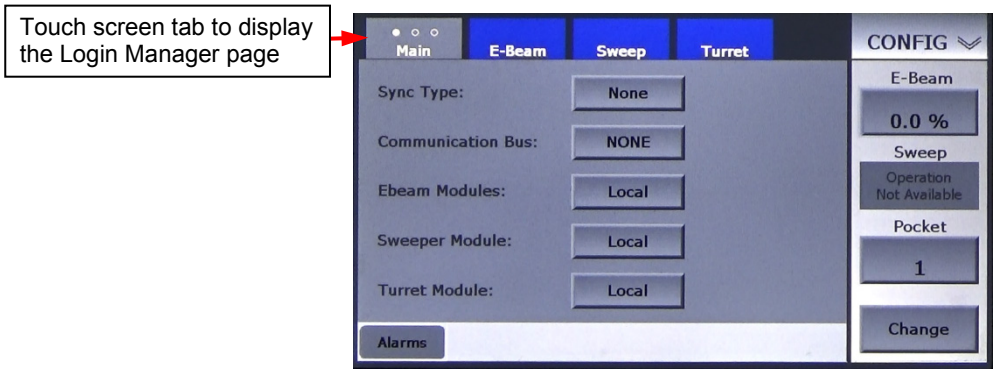
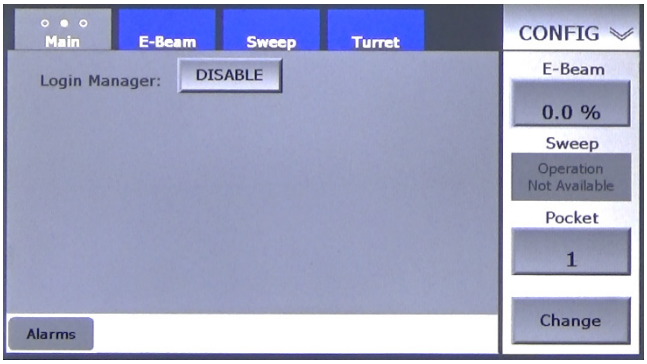
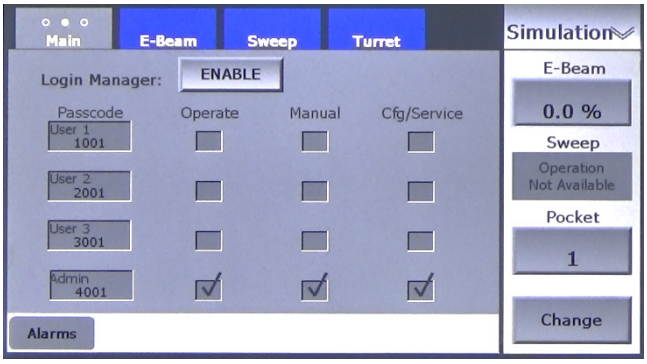


Figure 4-32 The LogIn Manager Screen When Initially Displayed



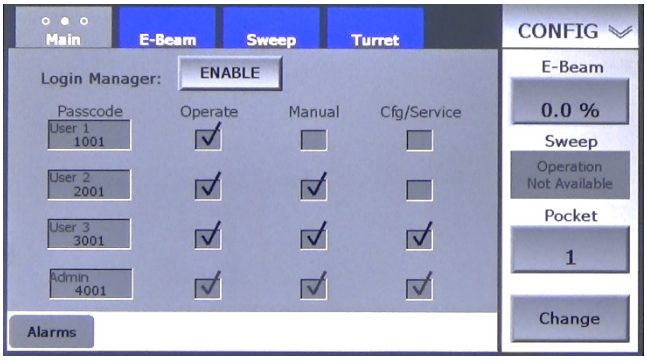
2 Touch the button labeled **DISABLE** to enable the LogIn Manager. The Login Manager screen will then appear as shown in Figure 4-33, with a default user password and permissions assigned for the Admin user.

Figure 4-33 LogIn Manager Screen After User Touches the *DISABLE* Button



3 Figure 4-34 shows the Login Manager screen in its initial (i.e., default) state. Change passwords and check or uncheck permission checkboxes as desired. If at any time you wish to disable the Login Manager, simply touch the **ENABLE** button.

Figure 4-34 LogIn Manager Screen After Additional Passwords and Access Permissions Are Assigned



4 If you wish to assign material names to specific pockets, perform the procedure described in 4.8. If you have finished (re)configuring the unit, save your changes, following the procedure described in section 4.9.

4.8 Optional Assignment of Material Names to Pockets

The EBC enables you to associate material names to specific pockets. To do so, follow the procedure described below.

Step	Action
1	To display the material assignment page, first display the Config>Turret screen (see Figure 4-35). Then touch its screen tab which is labeled **Turret**. The Material Assignment page (see Figure 4-36) will then appear.

Figure 4-35 Config>Turret Screen After Turret Configuration Is Completed

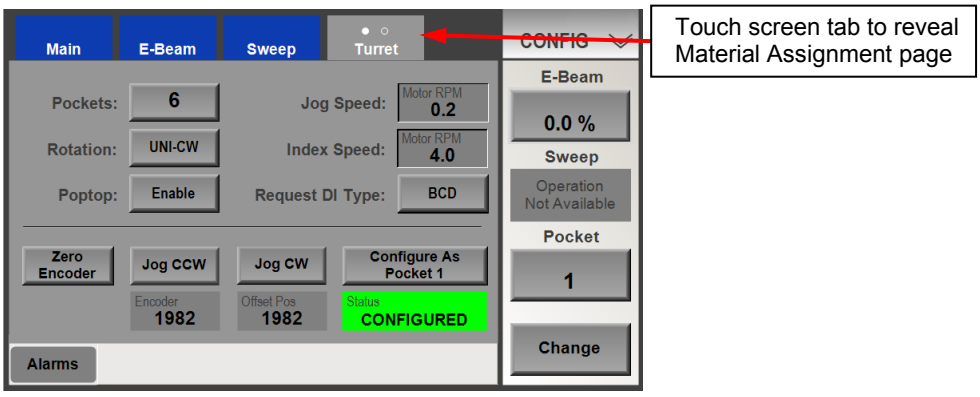
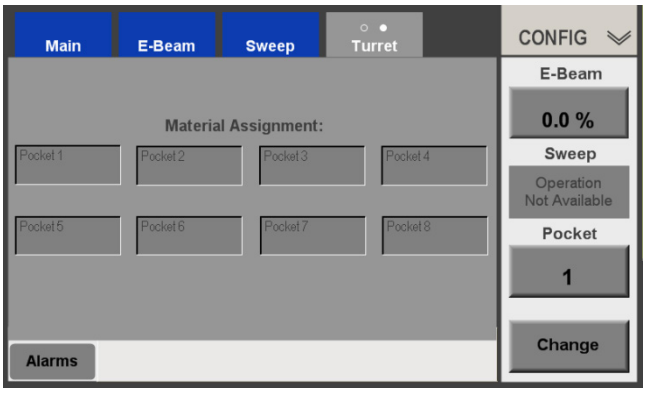


Figure 4-36 Material Assignment Page

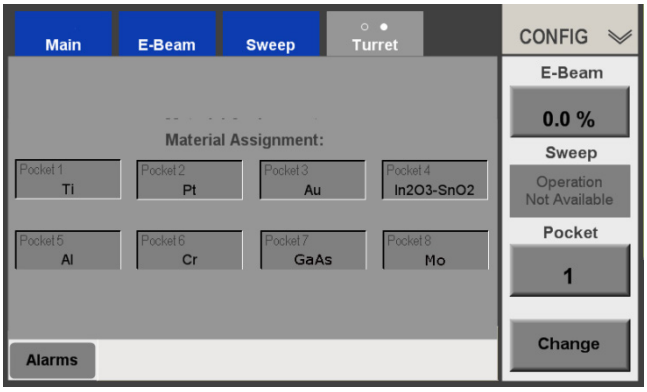


2 Touch the **Pocket 1** button on the material assignment page to open an on-screen alphanumeric keyboard.

3 Use this keyboard to enter the desired material name or abbreviation.

4 Touch the keyboard's **Enter** button to close it. The name you entered will now appear on the **Pocket 1** button, as shown in Figure 4-37.

Figure 4-37 Material Assignment Page; User Has Assigned Material Names for All Eight Pockets



5 Repeat Steps 1-4 of this procedure to assign material names for the remaining pockets.

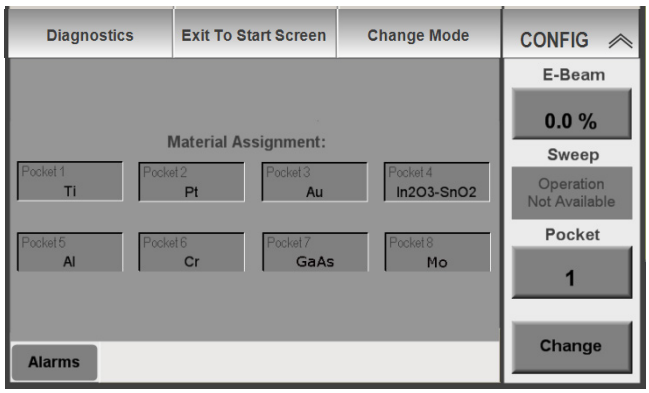
6 If you have made all the configuration change you wish to make at this time, save your changes, following the procedure described in section 4.9.

4.9 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 **Config** button to display the Auxiliary Menu, which is shown in Figure 4-38. That illustration shows the Auxiliary Menu above the Material Assignment page of the Config>Turret screen. However, you can exit from Configuration mode from any Configuration Mode screen.

Figure 4-38 Material Assignment Completed, Auxiliary Menu Displayed

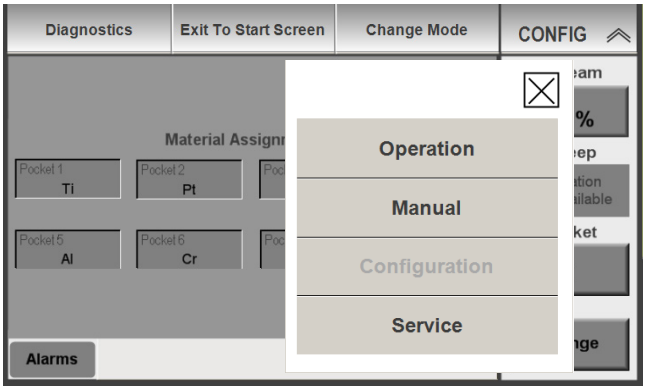


Note

The drop-down Auxiliary menu retracts if the user does not touch any of its buttons within 3 seconds. If it does so, simply touch the menu-select/mode ID button again to drop it down again.

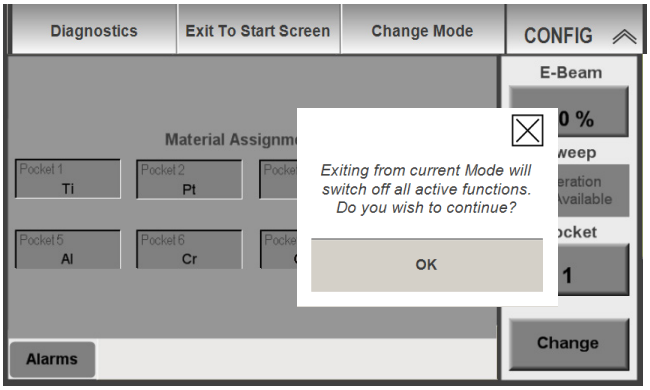
2 Touch the Auxiliary Menu's **Change Mode** button to display the popup window shown in Figure 4-39.

Figure 4-39 User Has Touched the *Change Mode* Button, Displaying Exit Warning Popup



3 If you wish to exit from Configuration Mode, touch the popup's **OK** button. The unit will then display the mode selection popup shown Figure 4-40.

Figure 4-40 User Exiting Configuration Mode, Mode Selection Popup Displayed



4 Touch the name of the mode you wish to enter.

The configuration changes you entered will be changed as the EBC exits from Configuration mode. The EBC is then ready for normal operation.

5 Stand Alone EBC Operation

5.1 Section Overview

This section describes how to operate the EBC in as a stand-alone controller (i.e., when the EBC is not connected to a higher-level controller). The topics covered in this section are:

5.2 Installation and Configuration

Installation and cabling for stand-alone EBC operation is described in Section 3 of this manual. Configuration for stand-alone operation is described in Section 4.

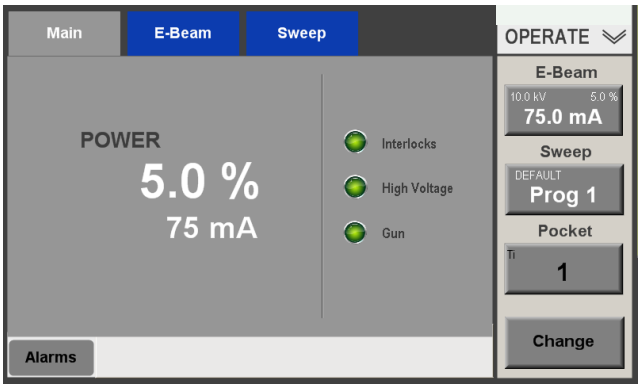
5.3 Use of the Function Control Buttons on the Touchscreen's Main Button Bar

For a complete explanation of the functions of these buttons, see section 2.6.

5.4 Display Features of the Operations>Main Screen

Figure 5-1 shows the Operations>Main screen.

Figure 5-1 Operations>Main Screen



This core portion of this screen (i.e., minus the command button bar and the menu bar) has no control features. Its display features are:

- The **POWER** readouts, which appear in percentage and milliampere terms. When the beam is on, these readouts are white.

> NOTE
> The power setpoint represents a percentage of the emission current scale for which the unit is currently configured. For information about the available emission current scales, see section 4.4.

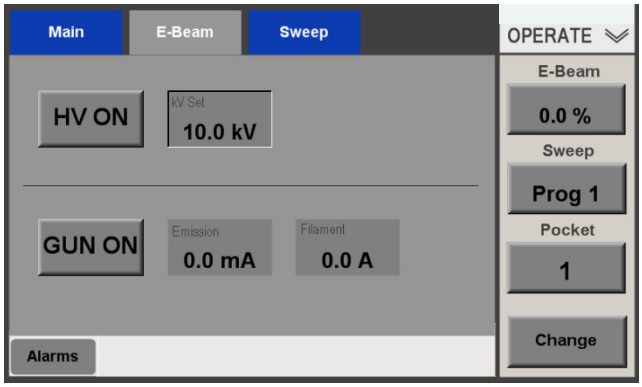
- The **Interlocks** LED, which is green when all interlocks are made and turns red when any interlock is not made. When that occurs, check the Diagnostics screen (see Figure 10-2) to begin troubleshooting the problem.
- The **High Voltage** LED, which turns green when the HV is switched on. In addition, the legend **High Voltage** next to the LED turns white when the HV is on.
- The **GUN** LED, which turns green when the gun is switched on. The legend **GUN** next to the LED is white when the gun is on.

5.5 Operating and Monitoring the E-Beam Power Supply

5.5.1 Overview of the EBC's Operations>E-Beam Screen

You can use the **E-BEAM** button on its touch screen (see Figure 5-2) to switch the beam on and off. The **HV ON** and **Gun ON** buttons on the Operations>E-Beam screen allow you to switch the HV and gun on/off independently of each other. Note that if **kV Control** is set to **Input Ctrl** on the EBC's Config>E-Beam screen, then the **kV Set** button on the Operations>E-Beam screen allows the user to change the HV operating level from the default setting (10.0 kV). If **kV Control** is set to **Pot Ctrl**, then the **kV Set** button becomes a flat display rectangle like those labeled **Emission** and **Filament**, which indicate emission and filament current, respectively.

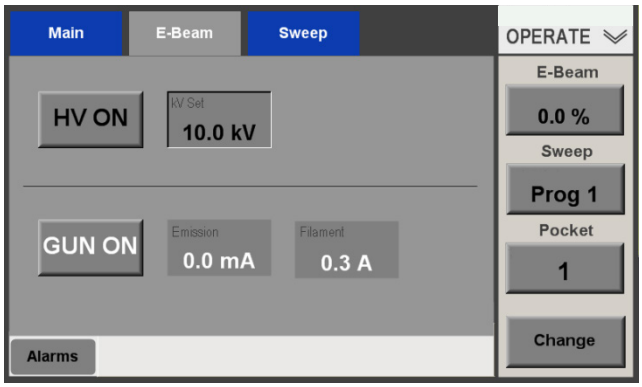
Figure 5-2 Operations>E-Beam Screen when Gun and HV Are Both Switched Off



5.5.2 Switching on the HV and Gun Independently of Each Other

Figure 5-3 shows the Operations E-Beam screen when the gun is on but the HV is off. To switch the HV on/off independently of the gun, simply touch the **HV ON** button. Likewise, to switch the gun on/off independently of the HV, touch the **GUN ON** button. You can also switch on the beam by touching the **HV ON** and **GUN ON** buttons in either order.

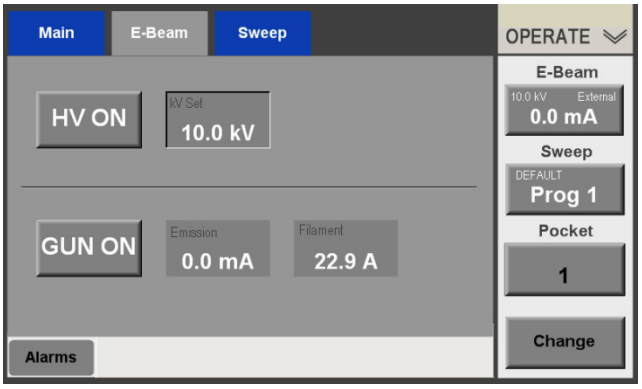
Figure 5-3 Operations>E-Beam Screen when Gun is On and HV is Off



5.5.3 Using the E-BEAM ON/OFF Button to Switch the Beam On/Off

As noted above, when the beam is off you can switch it on by simply touching the **E-BEAM** button, assuming that you have already entered a nonzero percent-power setpoint. This applies when both HV and gun are off, when the HV alone is on, and when the gun alone is on. Touching the **E-BEAM** button when the beam is on switches the HV and the gun off. Figure 5-4 shows the Operations>E-Beam screen when the beam is on.

Figure 5-4 Operations>E-Beam Screen, Bean On at 0.0 mA



NOTE

You can also switch the beam on and off from the hand-held remote controller. To do so, select Menu 1 (see Figure 5-30) and press the **Beam On/Off** button.

5.5.4 Setting the Beam Power Level

To set the beam power level, first touch the **Change** button, then touch the **E-Beam** button. The EBC will then display a keypad screen, which you can use to enter a percent-power setpoint. After you do so and touch **Enter** to close the keypad, the power supply will ramp up to that power setpoint. In Figure 5-5, the user has used the keypad to enter **5.** Figure 5-6 shows the Ops>E-Beam screen after the user has closed the numeric keypad, with the beam now operating at 5% power (= 75 mA). Note that the beam power level can be set or changed either with beam on or with it off.

Figure 5-5 Operations E-Beam Screen with Numeric Keypad Displayed

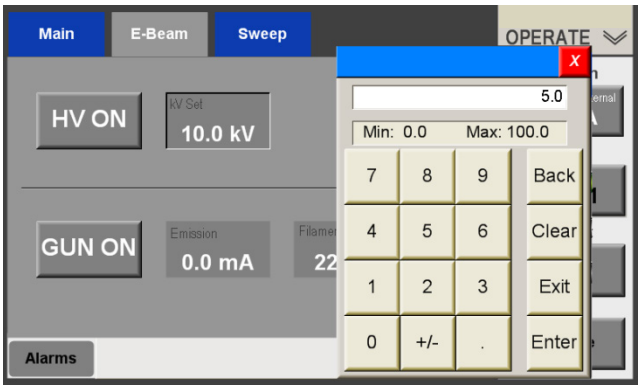
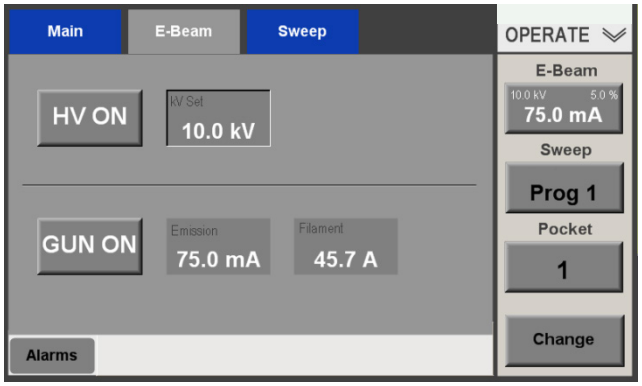


Figure 5-6 Operations>E-Beam Screen, Beam on at 5% Power



5.5.5 Changing the HV Operating Level

If **kV Control** is set to **Input Ctrl** on the EBC's Config>E-Beam screen, you can change the operating voltage of the HVPS at any time, regardless of whether the HV is on or off. To change the kV value:

Step	Action
1	Touch the rectangle labeled kV Set to open a numeric keypad.
2	Use the keypad to enter the desired kV value.
3	Touch the keypad's Enter button to close it.

If the HV is on when you perform this procedure, the HVPS will begin operating at the new kV value as soon as you touch the **OK** button. If the button is off, the HV will begin operating at the new value the next time it is switched on.

5.6 Creating and Modifying Beam Sweep Programs from the Operations>Sweep Screen

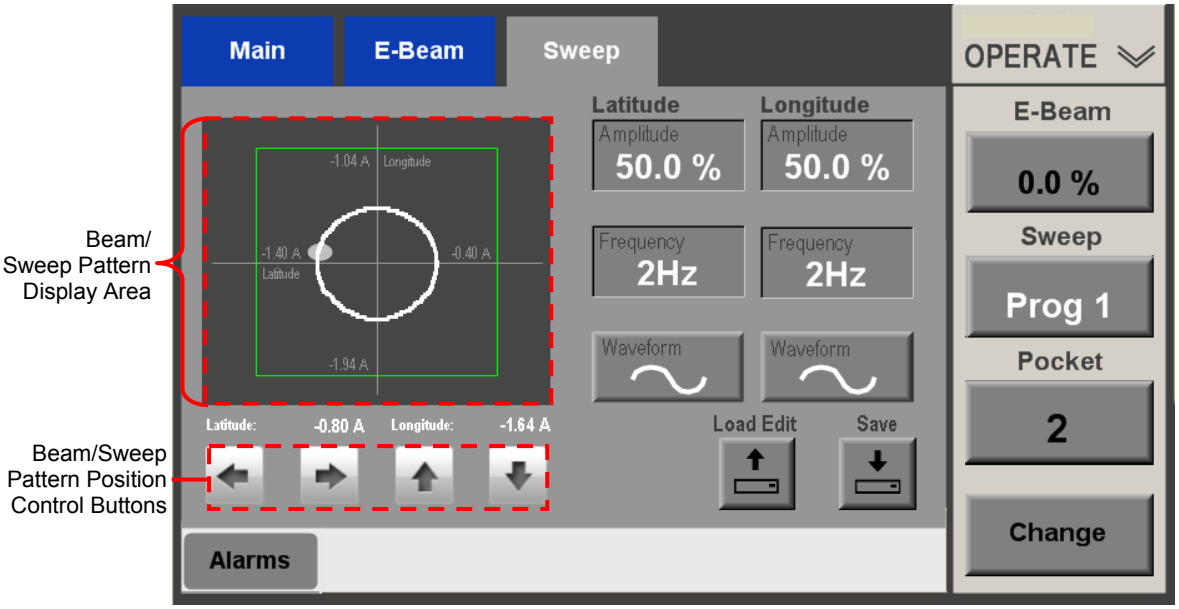
5.6.1 Control/Display Features of the Operations>Sweep Screen

The Operations>Sweep screen (see Figure 5-7) allows you to:

- configure sweep parameters
- observe the sweep pattern (regardless of whether the beam is on or not), and
- change either the beam's static location (if the sweep is disabled) or the center point of the selected sweep pattern.

As described above, the **SWEEP** button allows you to select a sweep program and to switch it on/off.

Figure 5-7 Operations>Sweep Screen, Beam Off, Sweep On



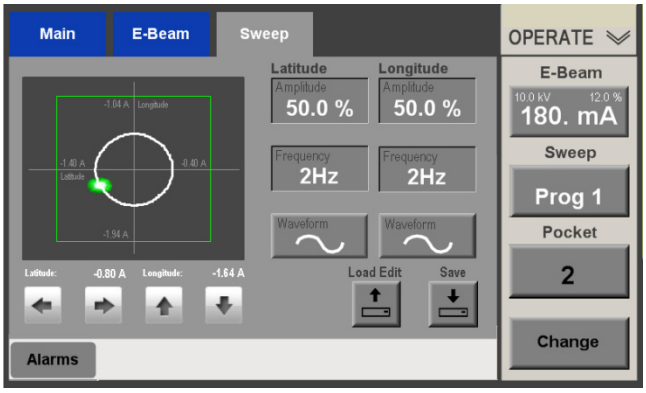
Beam/Sweep Pattern Display Area. If the sweep is disabled, this grid displays the beam's current position, as determined by the coil-drive outputs from unit's sweep control board. If the sweep is enabled, the sweep pattern is displayed in this area, based on the same coil-drive outputs. If the beam is off, beam position is represented by a white oval, as shown in Figure 5-7. If the beam is on, the oval appears as shown in Figure 5-8. The short bars across the *X* and *Y* axes indicate the current locations of the beam-position interlock limits, and the values displayed near the outer ends of the four axes indicate the coil-drive outputs, in amperes, required to drive the beam to those limits.

Current Beam Position Readout. The values displayed in white below the beam/sweep pattern display area indicate the values, in amperes, of the longitudinal and latitudinal coil-drive outputs that determine the beam's current position.

Beam/Sweep Pattern Location Control Buttons. If the sweep is disabled, touching one of these buttons moves the beam in the direction indicated. That beam position becomes the center point of the sweep pattern when the sweep is enabled. If the sweep is enabled, touching one of these buttons moves the sweep pattern as a whole in the direction indicated.

Latitudinal and **Longitudinal** sweep parameter entry/selection buttons. Touching either of the **Amplitude** and **Frequency** buttons opens a numeric keypad that allows you to enter the desired value for the parameter in question. Touching either of the **Waveform** buttons selects the next waveform. The waveform options, in order of display, are Sine ( ), Ramped ( ), Sawtooth ( ), Clipped ( ), and arbitrary.

Figure 5-8 Ops>Sweep Screen, Beam and Sweep Both ON



NOTE

The values displayed on the **Amplitude** buttons represent a percentage of the range between the +/- limits currently set for the axis in question. Thus, a Latitudinal amplitude of 50% would limit beam motion to a range equal to half the distance between the current –Latitude position limit and the current +Latitude position limit. If the sweep pattern is moved too far up or down or to the right or left, a position interlock fault will occur.

NOTE

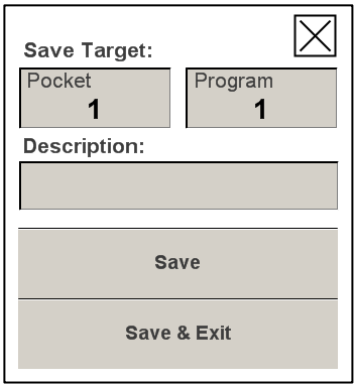
You can also change amplitude and frequency values from the hand-held remote controller. For instructions on doing so, see Figure 5-31.

NOTE

You can also change the sweep waveform from the hand-held remote controller. To do so, select Menu 2 (see Figure 5-31), and press the **Wave Select** button repeatedly until the name of the desired waveform is displayed in the remote controller's status lines. Note that when using the remote controller to select waveforms, you cannot change the longitudinal and lateral waveforms independently of each other.

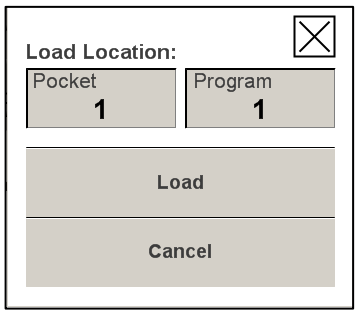
Save button. Touching this button displays the **Save Target** popup (see Figure 5-9) , which allows the user to save a given set of sweep parameters, either under the current Pocket and Program numbers or to a different target Pocket and/or Program.

Figure 5-9 The *Save Target* Popup



Load Edit button. Touching this button displays the **Load Location** popup (see Figure 5-10) and puts the EBC into Edit mode. Doing this enables you to edit a target sweep program other than the one currently displayed and makes it possible to edit one or more programs while the currently selected one is operating, even if the beam is on.

Figure 5-10 The *Load Location* Popup

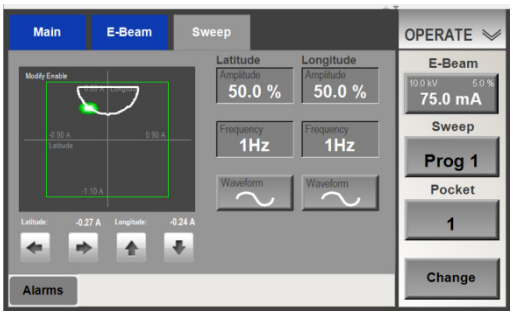


Exit Edit button. This button enables the user to exit from Edit mode without saving any changes made to sweep programs during the current editing session. Note that this button appears only when the EBC is in sweep-edit mode.

5.6.2 'Clipping Effect' on the Beam Sweep Function

When the EBC is in either Operations or Manual Mode, the beam cannot be driven beyond any of the four beam limits. Therefore, the EBC issues no alarm(s) if the beam is driven to a given limit point. Instead, when the beam arrives at such a point, the sweep control module imposes a 'clipping effect'. If the user is attempting to drive the beam beyond a given limit, this 'clipping effect' simply stops the beam at the point at which it would have crossed the limit in question. If a sweep program is designed such that it would drive the beam beyond a given limit, the 'clipping effect' causes the beam to run along the edge of the beam limit in question until it reaches the point at which the beam pattern would cross back inside the beam limit bounding box. Beam sweep then resumes and proceeds normally until the sweep pattern encounters the same or another beam position limit, at which point the 'clipping effect' occurs again. Figure 5-11 shows an example of this 'clipping effect' when the EBC is in Operations mode, with beam and beam sweep activated, and beam limits disabled.

Figure 5-11 Ops>Sweep Screen with Beam Sweep Displaying the 'Clipping Effect'



Note

Figure 5-11 illustrates the 'clipping effect' when the EBC is in Operations or Manual mode and the beam sweep pattern has a sinusoidal waveform. Note that a sweep pattern with a sawtooth or triangular waveform, a sufficiently high frequency, and sufficiently large amplitude can sometimes override the clipping effect, causing the beam to beam to be switched off when it encounters a beam limit and triggering a beam position alarm.

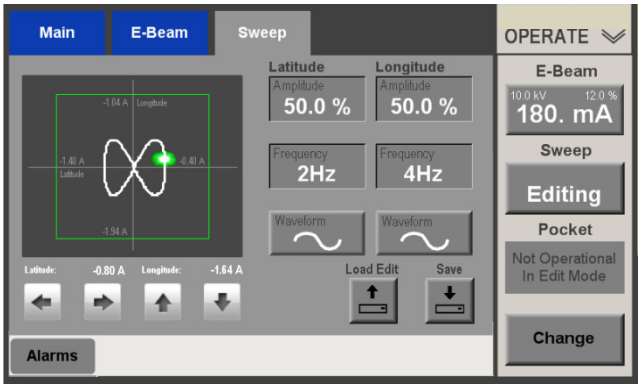
5.6.3 Modifying Sweep Programs from the Operations>Sweep Screen

Modifying the Sweep Program Currently Displayed

To modify the sweep program currently displayed, perform the procedure described below. Note that this procedure assumes that the EBC is properly configured and that the Operations>Sweep screen is displayed on the EBC touch screen.

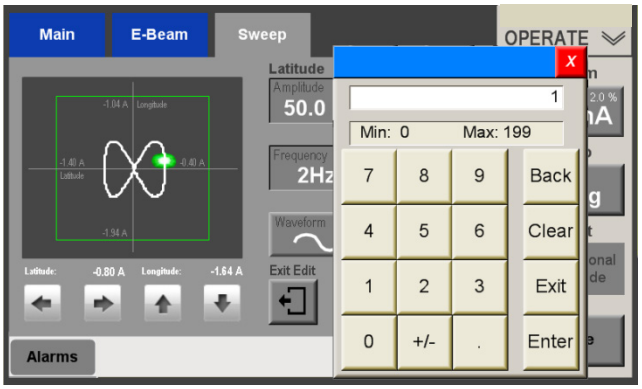
Step	Action
1	If necessary, rotate the turret to the desired pocket and select the sweep program that you wish to modify. If you wish to modify a sweep program associated with the currently selected pocket, other than the program currently displayed, select the number of the desired program.
2	Switch on the beam and sweep, if they are currently not operating. Figure 5-12 shows the Operations>Sweep screen in this state. In this example, the sweep program's parameters define the 'bow-tie' pattern displayed on the screen's sweep pattern grid.

Figure 5-12 Operations>Sweep Screen, Beam and Sweep On



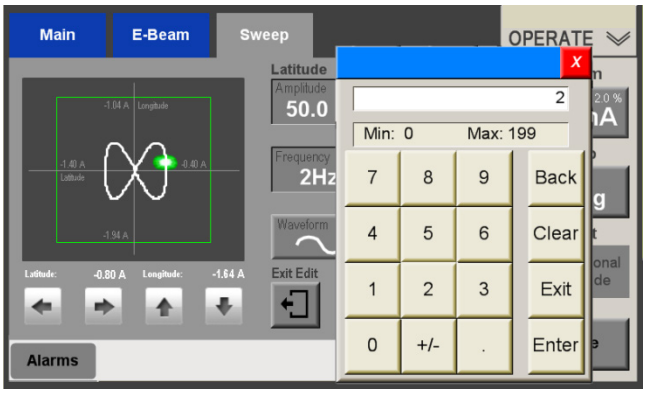
3 Touch the box for the sweep parameter you wish to modify. In Figure 5-13 the user has touched the **Latitude>Frequency** button to display the keypad shown.

Figure 5-13 Ops>Sweep Screen After User Touches the Latitude Frequency Button to Change the Value of that Sweep Parameter



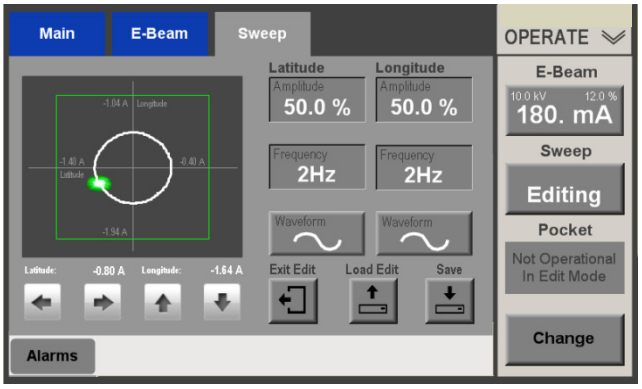
4 Enter the value desired for this parameter. In Figure 5-14 the user has entered **2**.

Figure 5-14 Ops>Sweep Screen, User Has Entered *2* as New Longitude Frequency Value



5 Touch the keypad's **Enter** button. The screen will then appear as shown in Figure 5-15. Note that the EBC is still in Edit mode.

Figure 5-15 Ops>Sweep Screen After Lateral Frequency Is Changed to *2*



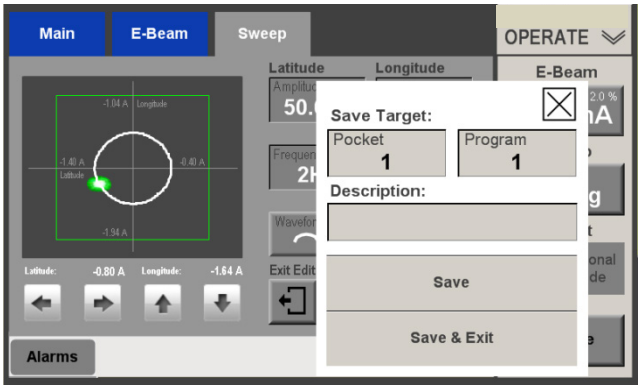
6 Repeat Steps 3-6 to modify any other numeric parameters you wish to change. If you wish to change either the Lateral or Longitudinal waveform, simply touch the appropriate **Waveform** button repeatedly until it displays the desired waveform.

NOTE

If you select *Arbitrary* as the waveform, you must select and import the desired sweep pattern file. For instructions on doing so, see "Importing and Modifying Sweep Patterns with Arbitrary Waveforms," the last heading in this subsection.

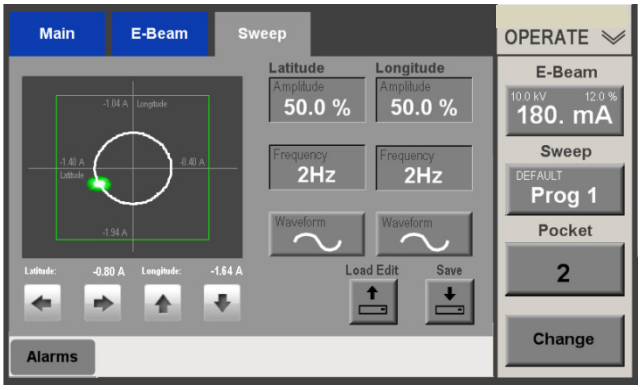
7 When you have made all the changes you wish to make to this program, touch the screen's **Save** button to display the **Save Target** popup shown in Figure 5-16.

Figure 5-16 User Saving Change Made to Currently Operational Program



8 If you wish to save the changes you have entered to the same target program, touch the popup's **Save & Exit** button. After you do so, the screen will then appear as shown in Figure 5-17.

Figure 5-17 Ops>Sweep Screen After User Saves Change(s) to Currently Displayed Program and Exits from Edit Mode

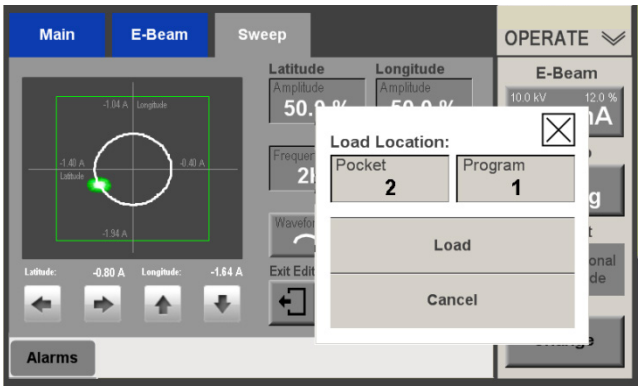


Modifying a Sweep Program Other than the Program Currently Displayed

There are two different ways to modify a sweep program other than the one currently displayed. You can either: (1) Select the target program, using the **Sweep** and, if necessary, **Pocket** buttons and then perform the procedure described above (see "Modifying the Sweep Program Currently Displayed," or (2) perform the procedure described below, which can eliminate an otherwise necessary turret rotation.

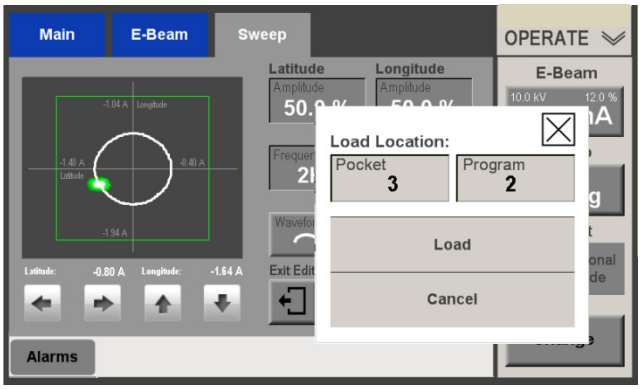
Step	Action
1	Open the Operations>Sweep screen with any sweep program displayed, for example, the program shown in Figure 5-17.
2	Touch the screen's **Load Edit** button to display the **Load Location** popup (see Figure 5-18). When that popup initially appears, its **Pocket** and **Program** boxes will display the Pocket and Program identifiers of the sweep program currently displayed.

Figure 5-18 Ops>Sweep Screen with *Load Location* Popup Displayed



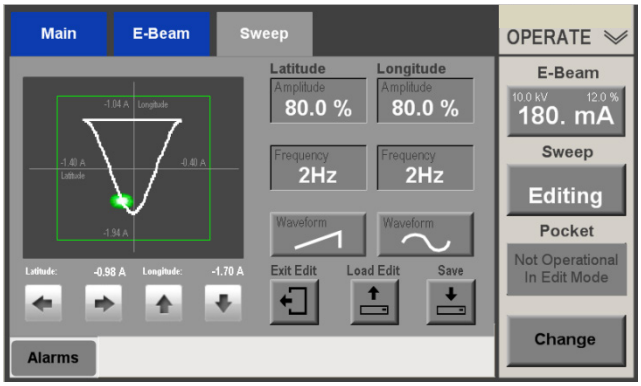
3	In the **Pocket** and/or **Program** boxes, enter the numbers designating the sweep program you wish to modify. In Figure 5-19 the user has entered **3** in the **Pocket** box and **2** in the **Program** box.

Figure 5-19 Load Location Popup with Pocket 3, Program 2 Entered



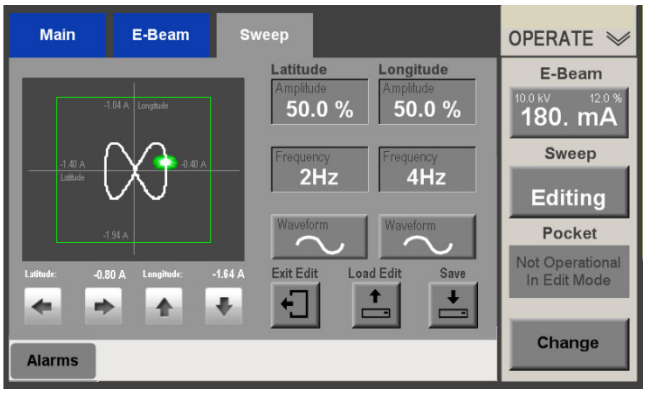
4 Touch the popup's **Load** button. In this example, the screen would now appear as in Figure 5-20, with Program 2 for Pocket 3 displayed for background editing. Note that if Program 1, Pocket 2 was operating when this procedure began, it would still be operating, with the beam still on if it was initially on.

Figure 5-20 Ops>Sweep Screen After Pocket 3, Program 2 Loaded For Background Editing



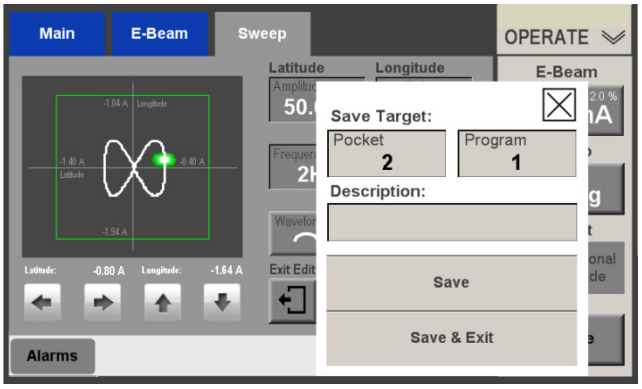
5 Edit the displayed sweep program as desired. As an example, in Figure 5-21 the user has changed the latitudinal frequency to 2 Hz and the latitudinal waveform to sine, yielding a 'bowtie' pattern.

Figure 5-21 The Program 3, Pocket 2 Sweep Pattern After User Makes Parameter Changes



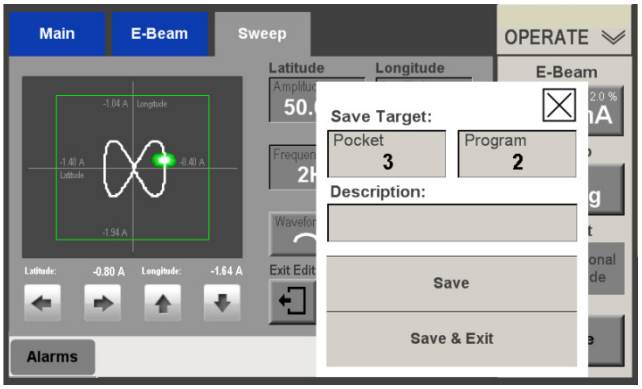
6 Touch the screen's **Save** button to display the **Save Target** popup. Note that this popup, when it first appears in this sequence of operations, displays the Pocket and Program numbers of the sweep program displayed by the Operations>Sweep screen when the procedure began. In this example, the **Save Target** popup displays Pocket 2 and Program 1 (see Figure 5-22).

Figure 5-22 *Save Target* Popup Displaying the Procedure's Original Pocket and Program



7 Change the entries in the popup's **Pocket** and **Program** boxes to the desired numbers. In Figure 5-23 the user has entered **3** for **Pocket** and **2** for **Program**, but any Pocket and Program combination can be entered, including those defining 'virtual' sweep programs.

Figure 5-23 *Save Target* Popup After User Enters *3* for Pocket and *2* for Program



8 When the desired Target is defined in the popup, touch the **Save Exit** button. After you do so, the Operations>Sweep screen will again display the sweep program which was displayed when this procedure began and which may have been operating throughout the procedure. In this example, Figure 5-17 would reappear.

Making Multiple Copies of a Sweep Pattern

The EBC makes it possible to create one or more backup copies of a sweep pattern to 'virtual' Pocket/Program designations. To do so, simply use the **Load Edit** button to save a sweep pattern to Program 1-10 of any pocket for which your EBC is not configured. For example, if your system's e-gun has 6 pockets, you can save sweep patterns to Programs 1-10 of Pockets 7-10, yielding a capacity of 40 'virtual' sweep programs. You can later use the **Load Edit**

button to call up a virtual program in Edit mode and then assign it an operational Pocket and Program number.

To create a 'virtual' copy of a given sweep program, perform the procedure described below.

Step	Action
1	Select the sweep program that you want to copy multiple times. If desired, perform a procedure similar that described above to modify the sweep pattern.
2	Touch the **Save** button to display the **Save Target** popup, which will appear similar to Figure 5-16, but with the Pocket/Program numbers of the original program displayed.
3	Change the numbers in the popup's Pocket and **Program** boxes as desired.
4	Touch the popup's **Save** button. Doing this saves the sweep pattern to the target defined in the **Pocket** and **Program** boxes without causing the EBC to exit from Edit mode.
5	Repeat Steps 3 and 4 as many times as desired. To create one or more virtual sweep programs, enter a Program number between 1 and 10.
6	When you have created all the copies you wish to make of this sweep pattern, touch the popup's **Save Exit** button.

The screen will then appear as it did at the beginning of this procedure, with the initial Pocket and Program numbers displayed and that program's parameters displayed unaltered. Note that all the copies created this way will have identical sweep parameters.

Importing and Modifying Sweep Patterns with Arbitrary Waveforms

The EBC enables you to import a selected Arbitrary waveform and save it as a given sweep program for a given pocket. Note that once you have selected an Arbitrary waveform, you can still change both Amplitude values but only the Latitudinal Frequency value (see Figure 5-24). Note also that such patterns can be imported only from a flash memory device or from an external hard drive connected to the EBC via one of its four front-panel USB ports.

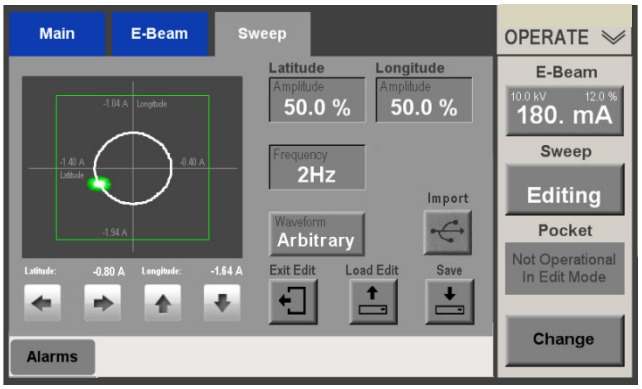
Perform the following procedure to import a sweep pattern with an Arbitrary waveform.

Step	Action
1	Make sure that a flash memory device or an external hard drive is inserted into one of the EBC's front-panel USB ports.
2	Open the Operations>Sweep screen with any sweep program displayed. As an example, Figure 5-17 displays Program 1 of Pocket 2.

3 Touch the screen's **Latitude Waveform** button repeatedly until the legend **Arbitrary** appears on that button. If you started from the screen shown in Figure 5-17, the screen would now appear as it does in Figure 5-24.

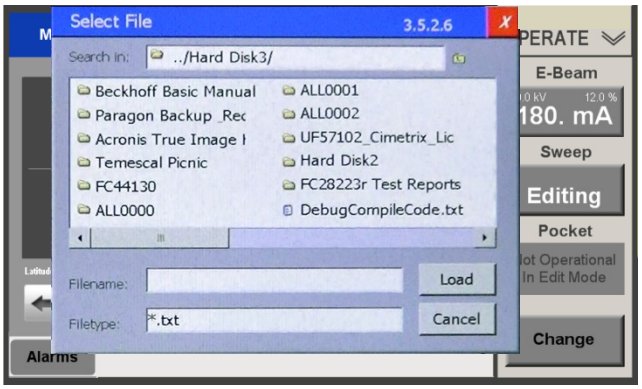
NOTE
You can also change the waveform via the hand-held remote controller by selecting Menu 2 and pressing the **Wave Select** button (see Figure 5-31).

Figure 5-24 Ops>Sweep After Arbitrary Waveform Is Selected for Pocket 2, Program 1



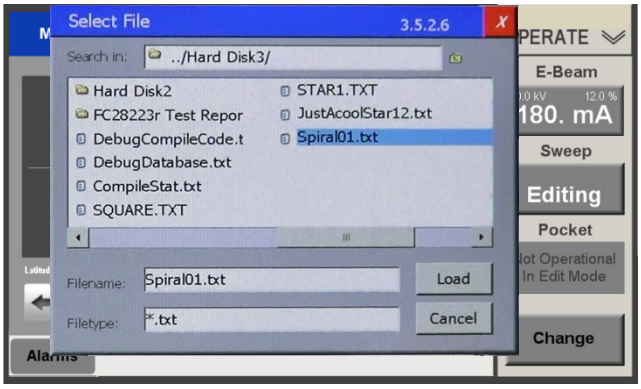
4 Touch the screen's **Import** button to display the dialog box shown in Figure 5-25.

Figure 5-25 *Select File* Dialog Box for Artitrary Waveforms When Initially Displayed



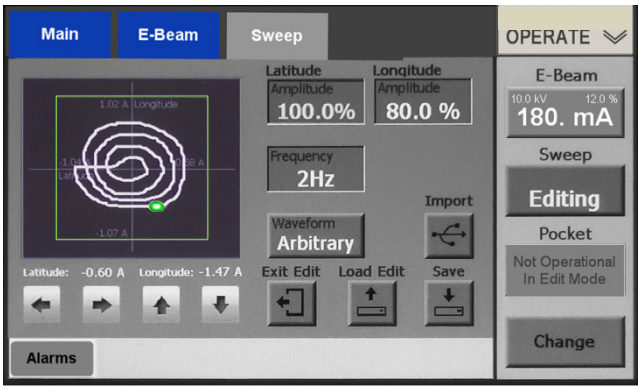
5 Select the filename of the arbitrary pattern you wish to import. In Figure 5-26 the user has selected *Spiral01.txt.*

Figure 5-26 *Select File* Dialog Box, User Has Selected *Spiral01.txt*



6 Touch the popup's **Load** button to close the popup and load the selected file. The screen will then appear to that shown in Figure 5-27.

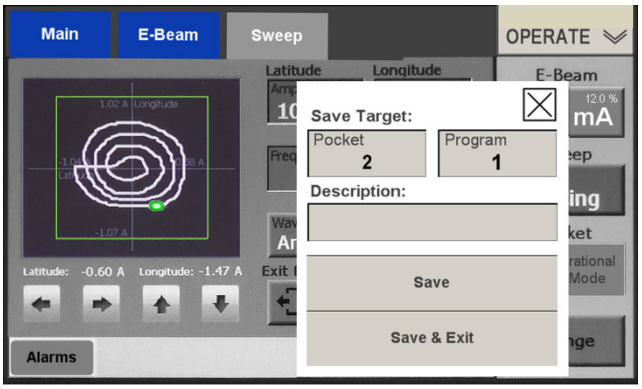
Figure 5-27 Ops>Sweep Screen Displaying Spiral01 Arbitrary Waveform, Unsaved



7 Modify the pattern's sweep parameters as desired.

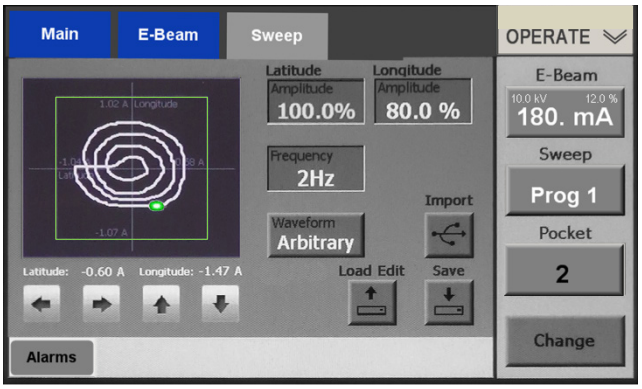
8 Touch the screen's **Save** button. The screen will then display a **Save Target** popup with the Pocket and Program numbers of the original sweep program, as shown in Figure 5-28.

Figure 5-28 *Save Target* Popup Displaying Pocket and Program Numbers of Program Displayed at Beginning of Procedure



9 If you wish to overwrite that original program's pattern with the new arbitrary pattern, simply touch the popup's **Save Exit** button. If you wish to save this arbitrary to some other target Pocket/Program, enter the desired numbers in the popup's **Pocket** and/or **Program** boxes and then touch the **Save Exit** button. Figure 5-29 shows the screen after the user has touched **Save Exit** with Pocket 2 and Program 1 selected in the popup.

Figure 5-29 Spiral01 Arbitrary Waveform Saved as Program 1 of Pocket 2



Changing the Material Associated with a Given Pocket

You may now wish to change the material associated with Pocket 2. To do so, perform the procedure described below.

Step	Action
1	Change to Configuration Mode, following the procedure described in section 2.4.
2	With the Config>Main screen displayed, touch the Main Menu's **Turret** button to display the Config>Turret screen.

3 Change the material assignment of the target pocket, following the procedure described in section 4.8.

4 Exit from Configuration mode and save the configuration change, following the procedure described in section 4.9.

5.7 Use of the Hand-Held Controller in Operations Mode

This section describes the use of the hand-held remote controller when all control modules are configured as **Local** and the EBC is in Operations mode. For detailed information about using the hand-held controller in Configuration mode, see section 4.5.4 and 4.6.3.

5.7.1 Control Functions Available Via the Remote Controller when the EBC Is In Operations Mode

With the E-Beam, Sweeper, and Turret Control modules all configured as **Local** and the EBC in Operations mode, the following functions can be controlled from the hand-held remote controller:

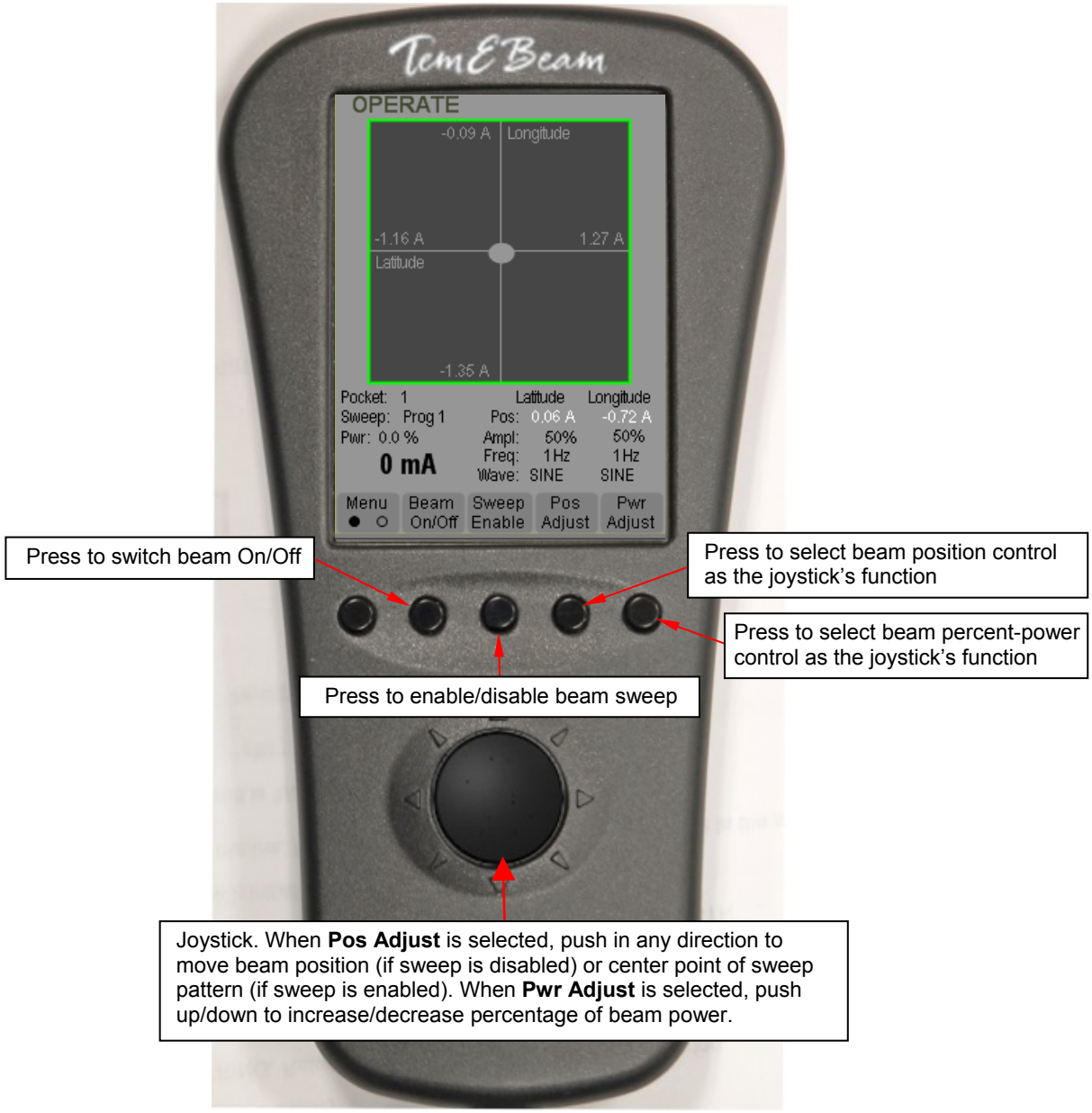
- E-beam on/off
- E-beam power level (0-100%)
- E-beam position
- Sweep enable/disable
- Turret rotation to next pocket in ascending order
- Configuration of sweep parameters (amplitude, frequency, and wave-form)

These functions are available via two different screen menus, Menu 1 (see Figure 5-30) and Menu 2 (see Figure 5-31).

5.7.2 Control Functions Available Via Menu 1

Figure 5-30 shows the remote controller in Operation>Local Mode with Menu 1 displayed. Local Mode Menu 1 enables the user to switch the beam and the sweep on and off, to adjust the percentage of e-beam power when the beam is on, and to adjust the position of the beam in *X* and *Y*. Note that users wishing to switch off the gun but not the HV must do so via the main UI screen.

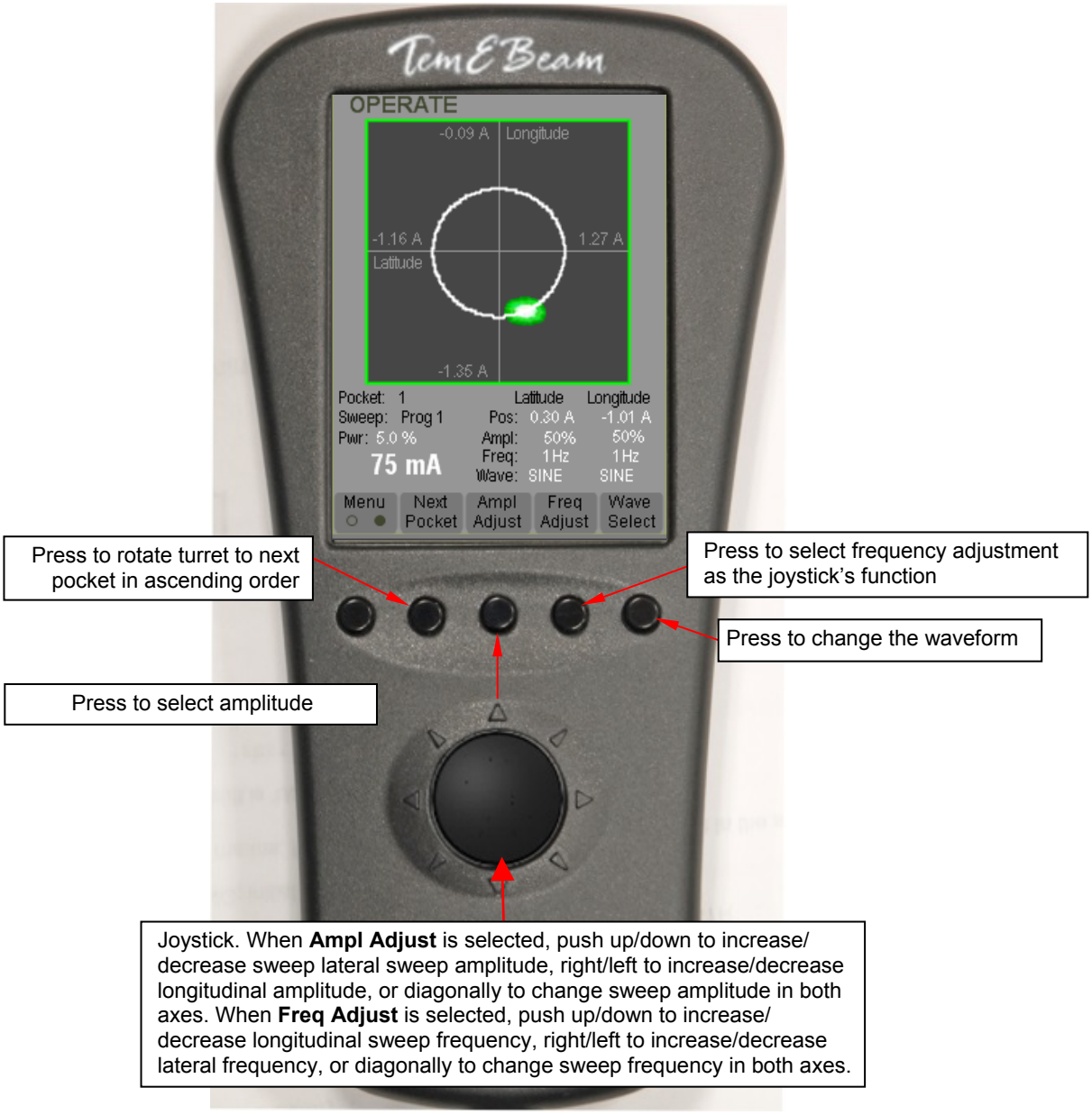
Figure 5-30 Remote Controller's LOCAL Screen, Menu 1 Selected, Beam and Sweep Off



5.7.3 Control Functions Available Via Menu 2

Figure 5-31 shows the remote controller in Local Mode and with Menu 2 displayed and the beam switched on. Local Mode Menu 2 enables the user to rotate the turret to the next pocket and to alter sweep program parameters (amplitude, frequency, and waveform). Sweep program selection must also be done from the main UI screen. Likewise, turret rotation to any pocket other than the next pocket in ascending order can be done only from the main UI screen.

Figure 5-31 Remote Controller's LOCAL Screen, Menu 2 Selected, Beam and Sweep On



6 EBC Operation with an XTC/3S Deposition Controller

6.1 Section Overview

This section describes how to operate the EBC in conjunction with an XTC/3S deposition Controller. The topics covered are:

Section 6.2 Modifications to Installation Procedure
Section 6.3 Modification to Configuration Procedure
Section 6.4 General Operating Methods
Section 6.5 Executing a Film Deposition

6.2 Modifications to Installation Procedure

EBC installation to support operation with a single-layer deposition controller is nearly identical to the installation procedure described in Section 3 of this manual, with the modifications described below.

Step	Action
1	Perform the basic installation procedure described in Section 3.
2	Make sure that the XTC/3S is properly installed.
3	Connect Pins 6 and 37 the EBC's **Aux I/O** connector to the **Source 1** BNC connector on the XTC/3S rear panel, as shown in Figure 6-1. These connections are most easily made with the use of a Digikey adapter (see Figure 6-2).

Figure 6-1 XTC/3 to EBC Emission Control Connections

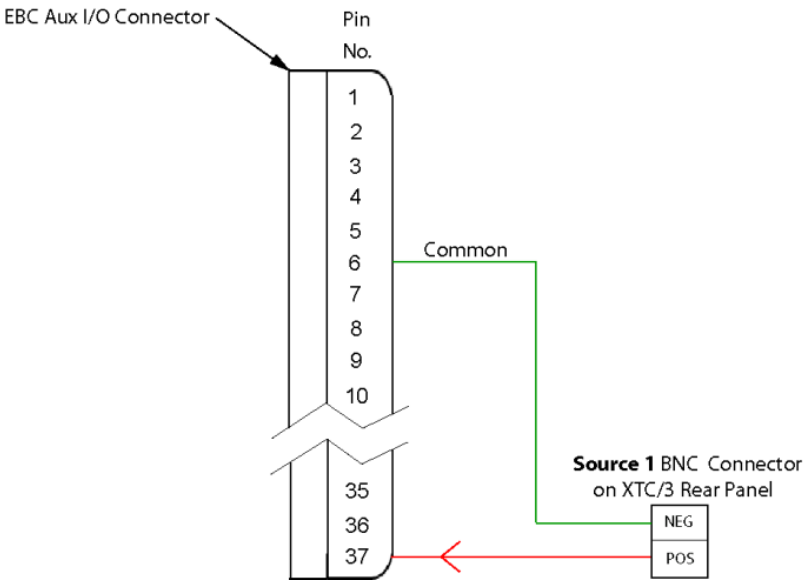
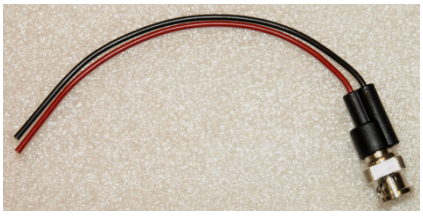


Figure 6-2 Digikey Adapter



6.3 Modification to Configuration Procedure

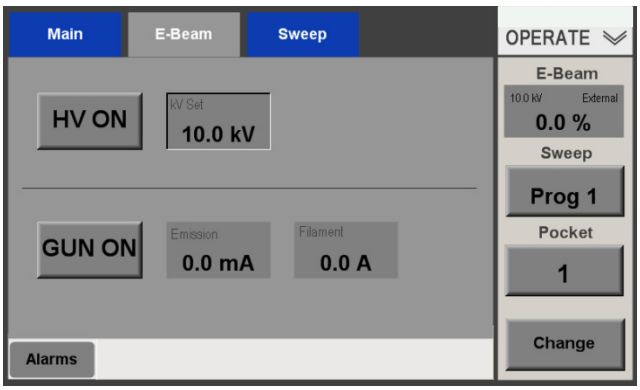
EBC configuration for use with the XTC/3S is virtually identical to the procedure described in Section 4 of this manual. The sole exception is described below.

Step	Action
1	Perform the procedures described in sections 4.2 and 4.3
2	Perform Steps 1-6 of the procedure described in section 4.4.
3	In Step 7 of that procedure, select **External** for **Emis Control**.
4	Perform the procedures described in sections 4.5 and 4.6.
5	If desired, perform the optional procedures described in sections 4.7 and 4.8
6	Save your configuration procedures by exiting from Configuration mode, as described in section 4.9.

6.4 General Operating Methods

When the EBC is configured as described in section 6.3, the EBC's main UI screens appear as shown in section 1.5. General operating methods are as described in Section 5, except that when the EBC is in Operations mode, the user cannot select the emission power level from the main UI screen or from the hand-held remote controller. On the main UI screen, the **E-Beam** button on the Command Button Bar becomes a flat value-display rectangle like that shown in Figure 6-2.

Figure 6-3 Operations E-Beam Screen when Emis Control Is Configured as Remote



The user can still set the emission power level and switch on the beam from any Configuration mode screen and set the emission power level from the Service>E-Beam screen (see Figure 1-10). Likewise, the can still switch on the gun and HV independently using the **HV ON** and **GUN ON** buttons on the Operations>E-Beam screen and the **ON** buttons in the **HVPS** and **FPS** sections of the Service>E-Beam screen. In addition, with the EBC in any operating mode, the HV output of the HVPS remains under the operator's control, either via the **kV Set** button on the E-Beam screen in any EBC operating mode or via the **Adjust** pot on the power supply's front panel, depending on whether **KV Control** is set to **Input Control** or **Pot Control** via the Config>E-Beam screen.

The user also has the option of temporarily putting the EBC into Manual Mode, which provides full control (including emission current control) from the EBC screen. This mode of operation is generally used for predeposition evaporant conditioning.

6.5 Executing a Film Deposition

To perform a film deposition using the EBC in conjunction with the XTC/3S, follow the procedure described below. This procedure assumes that:

- the EBC and the XTC/3S are both installed correctly and powered up
- the **Source 1** connector on the XTC/3S is correctly connected to Pins 6 and 37 of the EBC's **Aux I/O** connector
- the XTC/3S is correctly configured to open the source shutter and that the required connections are made between the XTC/3S and the source shutter relay
- the EBC is in Operations mode
- the XTC/3S has the desired film layer properly programmed and selected for execution.

Step	Action
1	Display the EBC's Operations>E-Beam screen, if it is not already displayed.
2	Use the **Pocket** button in the EBC's Command Button Bar to select the pocket desired for the film layer you are about to deposit.
3	Using the Command Button Bar's **Sweep** button, select the sweep program desired for this film layer.
4	Use the **HV ON** and **GUN ON** buttons on the Operations>E-Beam screen to switch on the HV and the gun. After a 10-second ramp-up, the emission current will reach its bias level.
5	Make sure the XTC/3S is in either **READY** or **IDLE** mode.
6	Press the **START** button on the XTC/3S front panel.
7	When the film layer is completed, use the **HV ON** and **GUN ON** buttons on the Operations>E-Beam screen to switch off the HV and the gun.

7 EBC Operation with an XTC/3M Deposition Controller

7.1 Section Overview

This section describes the installation and use of the EBC in conjunction with either an XTC/3M or an IC5 multilayer deposition controller. The topics covered are:

7.2 Additional Interconnection Hardware Requirements

In addition to the components and cables supplied with the EBC, the following hardware items will be required to connect the EBC to the XTC/3M:

- One 37-pin breakout with integral 37-pin male sub-D connector (available from Temescal under PN 6149-2315-146, Qty. 1)
- One 25-pin breakout with integral 25-pin male sub-D connector (available from Temescal under PN 6149-2293-637, Qty. 2)
- One 15-pin breakout with integral 15-pin male sub-D connector (available from Temescal under PN 6149-2293-624, Qty 2)
- A 37-conductor cable of suitable length with male and female 37-pin sub-D connectors (Available from Temescal under PN 6338-2890-15, length 15 ft.)
- A 25-conductor cable of suitable length with male and female sub-D 25-pin connectors (Available from Temescal under PN 6338-2886-0, Qty. 2, length 20 ft.)
- A 15-conductor cable of suitable length with male and female sub-D 15-pin connectors (Available from Temescal under PN 6338-2884-0, Qty. 2, length 20 ft.)
- A minimum of three 24-VDC relays to serve as the HV Go On, Gun Go On, and Crucible Valid relays shown in Figure 7-2. If your system's Source Shutter solenoid is +24-VCD, you will need a fourth 24-VDC relay to function as the Source Shutter relay. These relays are available from Temescal under PN 6149-2966-475 (Qty. 6). If the source shutter solenoid is 120 VDC, a 120-VDC relay is also available from Temescal (PN 6149-2966-524, Qty. 6)
- Terminal blocks to function as the 24-VDC and O-V terminal blocks shown in Figure 7-2
- A suitable quantity of 18 Ga. wire. Such wire is available from Temescal in 23-ft. coils in white and blue (both PN 6338-5000-6)
- A DIN rail on which to mount the breakouts, relays, and terminal blocks

Together, Temescal's Basic and Extended I/O kits for the EBC (PNs 0624-2412-0 and 0620-4180—0, respectively) provide all of these items.

7.3 Installation and Configuration

This section describes how to install the EBC and connect it to an XTC/3M, configure the EBC for operation under XTC/3M control, and reprogram the necessary XTC/3M inputs and outputs relays whose signals are exchanged via its rear panel **Sys I/O** connector. These procedures assume that the XTC/3M is already properly installed and otherwise properly configured for operation. Section 7.3.1 describes an installation procedure that represents the most straightforward case and is therefore not be applicable in all systems in which the EBC is to be controlled by an XTC/3M. Likewise, the procedure described in section 7.3.2 may not be applicable on systems where the XTC/3M's inputs and output relays are already program to serve other functions.

Figures 7-1 through 7-6 illustrate this method of interconnecting to EBC and the XTC/3M. Figure 7-1 shows how the EBC Basic and Extended I/O kits are used to connect the EBC's 37-pin **Aux I/O** connector and the **Sys I/O** and **Source 1** connectors on the XTC/3M rear panel. Figure 7-1 shows only the cabling connections between these components, while Figures 7-2 through 7-6 illustrate the necessary wiring connections in detail.

Figure 7-1 EBC Connected to XTC/3M via EBC Basic and Extended I/O Kits

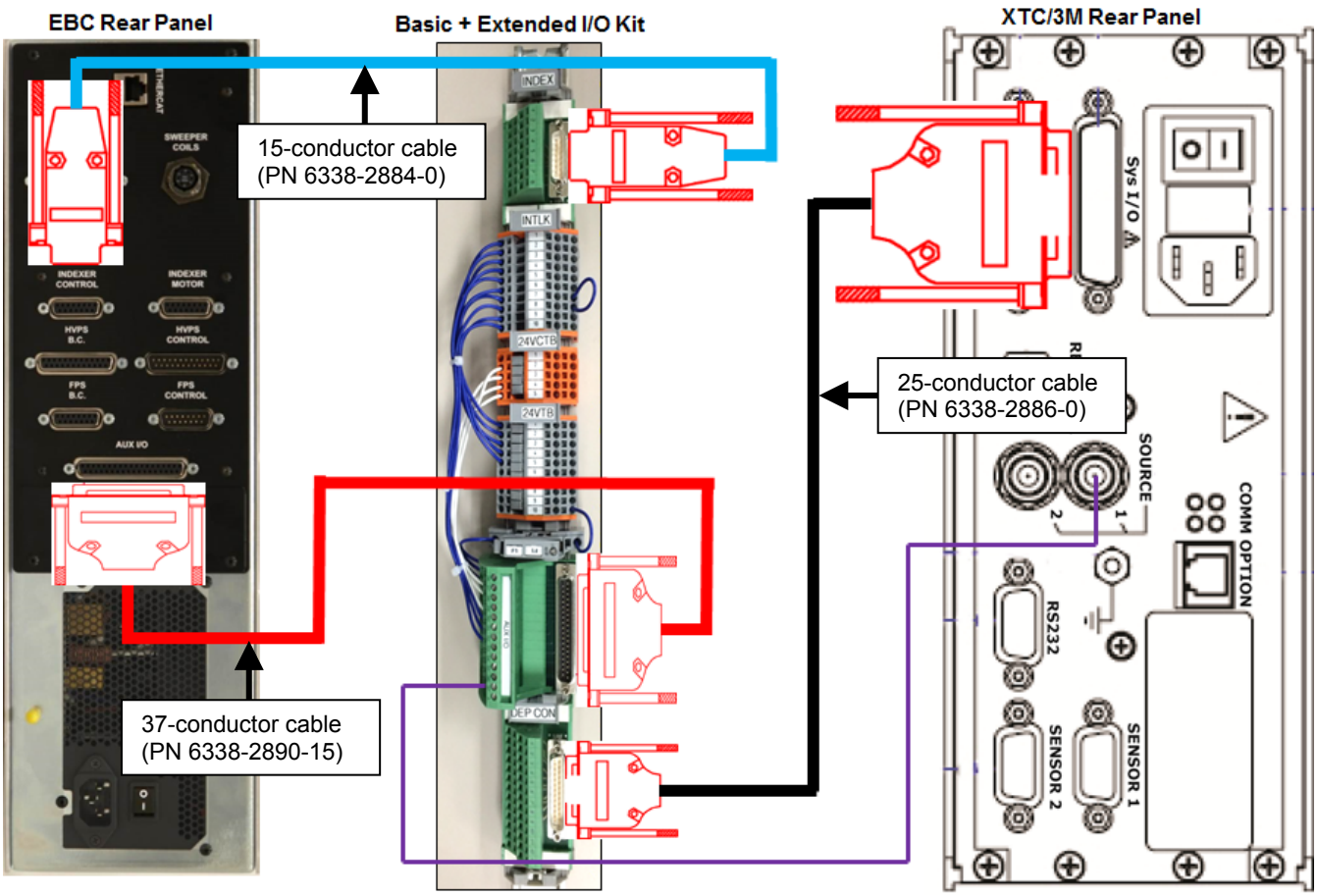


Figure 7-2 illustrates the connections to be made between (1) the following components available in the Basic EBC I/O Kit (PN 0624-2412-0):

- a 37-pin breakout connected to the EBC's rear panel Aux I/O connector
- the 24 VDC and 0 volt terminal blocks;

and (2) between those components and the following components available in Temescal's EBC Extended I/O Kit (PN 0620-4180-0):

- a 25-pin breakout connected to the XTC/3M's rear panel **Sys I/O** connector
- a 15-pin breakout
- three (or four) +24 VDC relays (PN 6149-2961-121) for the HV and Gun Go On circuits, the source shutter control circuit, and an optional crucible valid circuit.

Also shown in Figure 7-2 are direct connections between the 37-pin breakout and the XTC/3M's rear panel **Source 1** BNC connector.

For greater clarity, Figures 7-3 through 7-6 show the connections illustrated in Figure 7-2 isolated into separate circuits by function. Figure 7-3 shows the connections required so that state changes in the XTC/3M's **In Layer** command will switch the HV and gun on and off. Figure 7-4 illustrates the connections required so that the XTC/3M controls pocket selection and turret rotation. Figure 7-5 shows the connections between the 25-pin breakout and the optional crucible valid relay. Figure 7-6 shows the connections required so that the state of the XTC/3M's **Src Shutter 1** command opens and closes the source shutter.

NOTE

If your system's source shutter is to be controlled by the +24 VDC supplied via Pin 1 of **Aux I/O** connector, the relay controlling that solenoid must be equipped with a one-way diode.

NOTE

You can energize or more of the circuits shown in Figure 7-2 from a +24 VDC source other than the one supplied via Pin 1 on the **Aux I/O** connector. However, if you do so, it is imperative to tie the ground of that external +24 VDC supply to Pin 6 on the **Aux I/O** connector.

Figure 7-2 EBC to XTC/3M Wiring Diagram

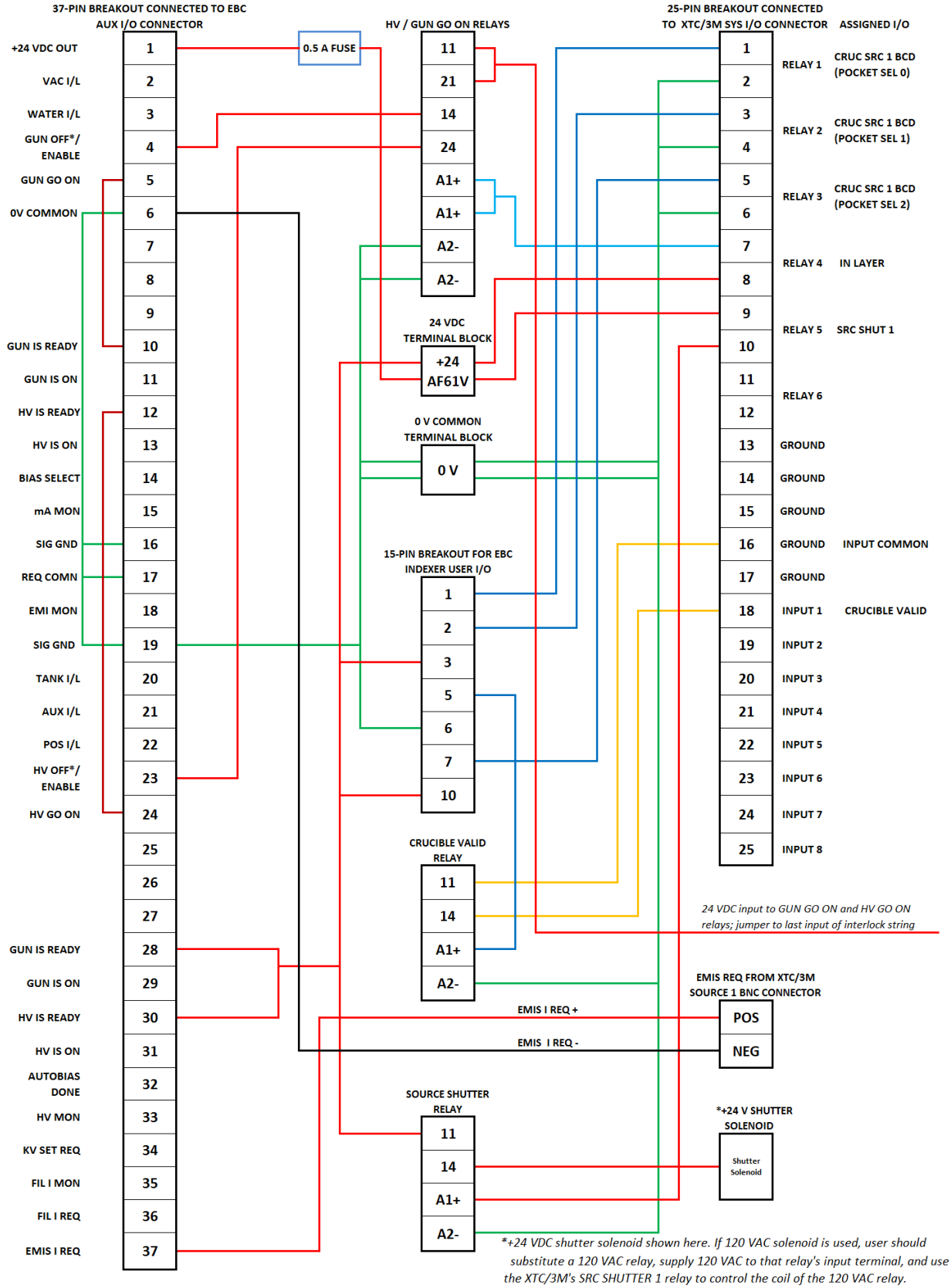


Figure 7-3 *HV GO ON* and *GUN GO ON* Connections

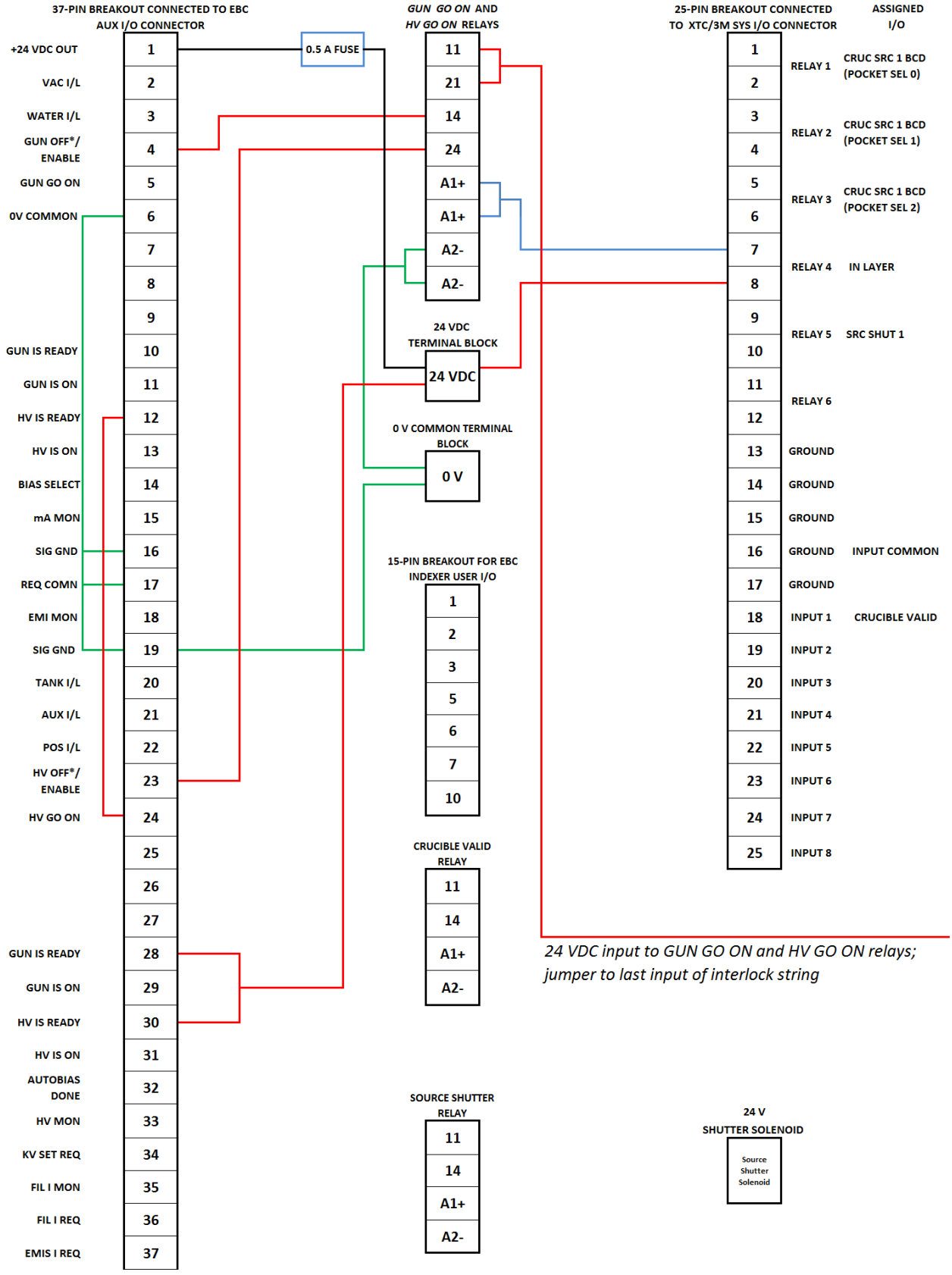


Figure 7-4 Pocket Selection/Turret Rotation Connections

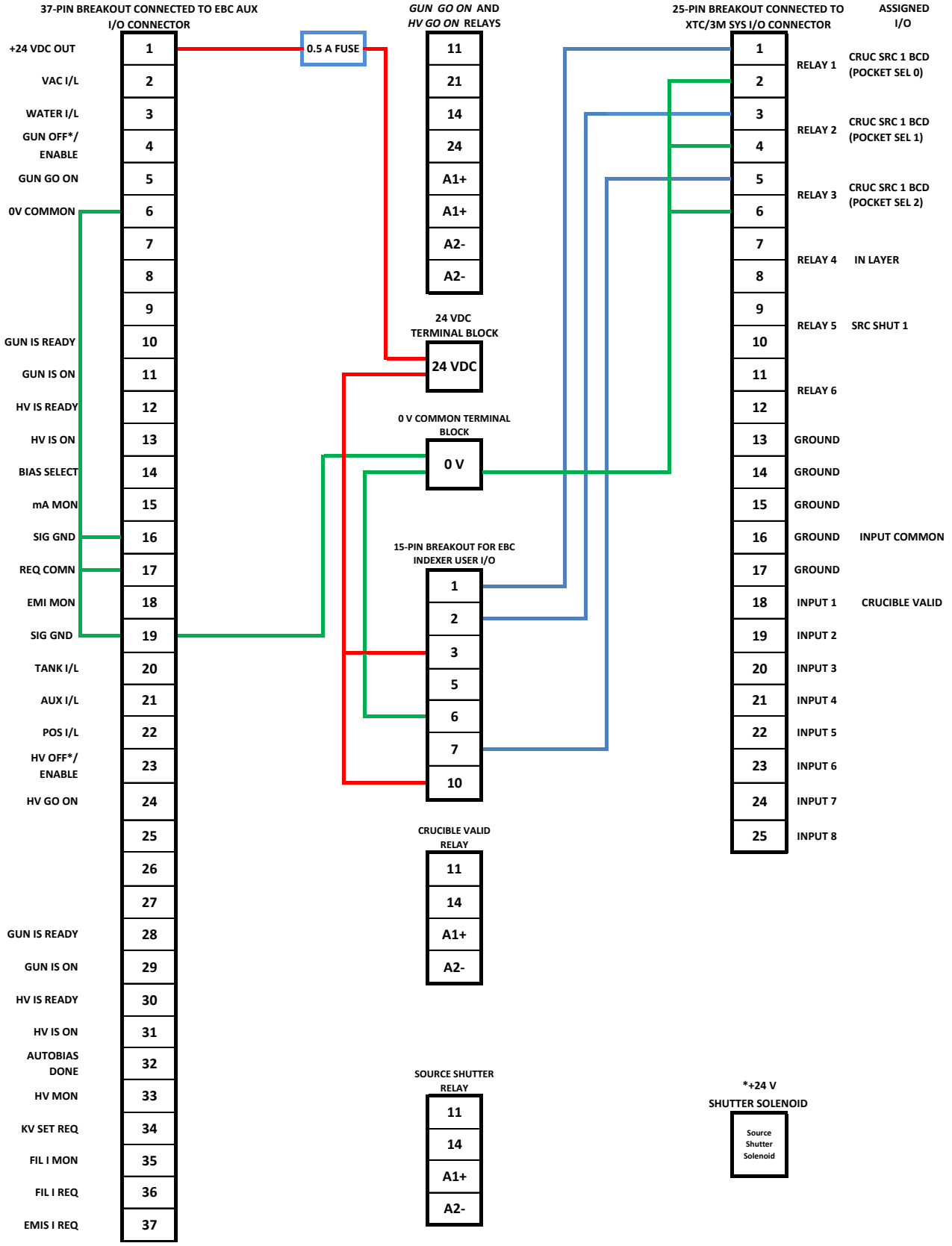


Figure 7-5 Connections to Crucible Valid Relay

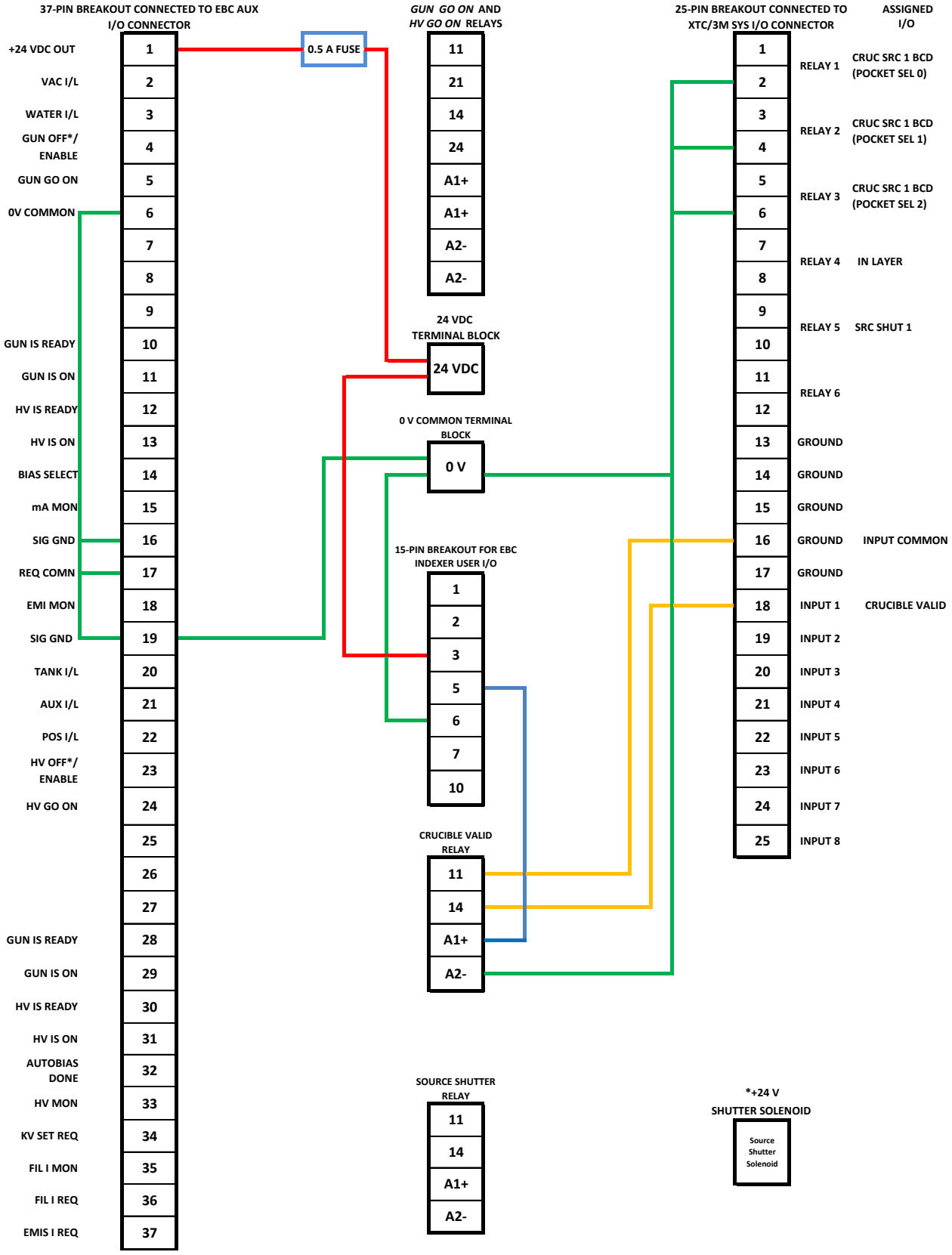
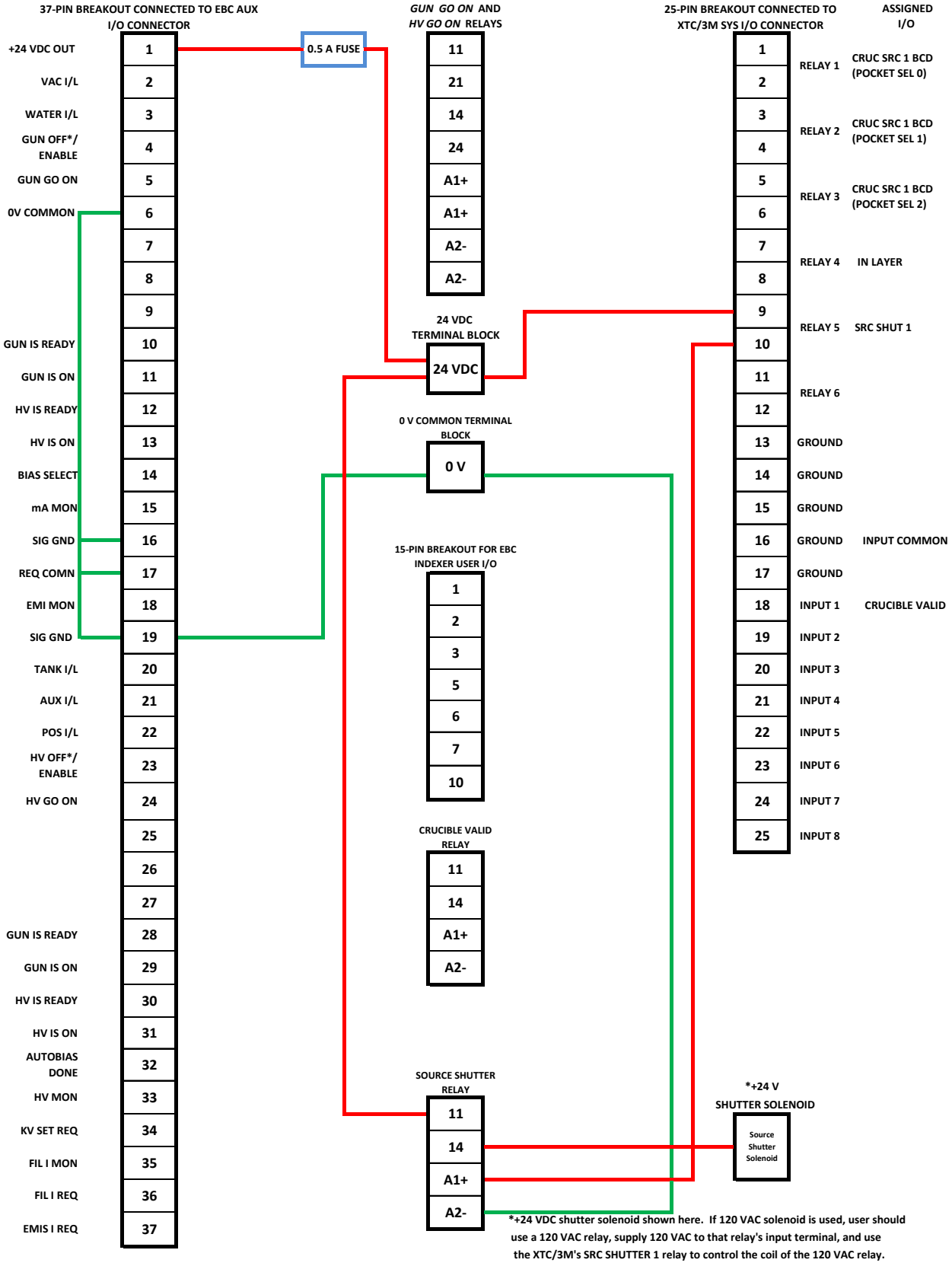


Figure 7-6 Connections to the Source Shutter Relay and Solenoid



7.3.1 Modified Installation Procedure

After completing the procedures described in sections 3.3 and 3.4 of this manual, perform the procedure described below. This procedure assumes you are using the Basic and Extended I/O kits for the EBC (PNs 0624-2412-0 and 0620-4180-0) that the XTC/3M's I/O will be programmed as described in section 7.3.2.

Step	Action
1	Assemble the EBC Basic I/O kit, following the procedure described in section 3.4.3.
2	Jumper together the following pins on the 37-pin breakout that is part of this I/O kit: • Pins 5 and 10 • Pin 6 and Pins 16, 17, and 19 • Pins 12 and 24
3	Install 15-pin and 25-pin breakouts on the same DIN rail.
4	Install this DIN rail assembly somewhere in your system's control console.
5	Attach two 24 VCD mini-relays (PN 6149-2961-121) to spring bases (PN 6149-2966-472) and attach the spring bases on the DIN rail. These relays will function as the HV GO ON and GUN GO ON relays shown in Figure 7-1.
6	Connect Pin 7 on the 25-pin breakout to the HV GO ON and GUN GO ON relays, as shown in Figure 7-3.
7	Connect Pin 8 on the 25-pin breakout to the Basic I/O Kit's 24 VDC terminal block, as shown in Figure 7-3.
8	Connect the last output of the interlock string to the HV GO ON and GUN GO ON relays, as shown in Figure 7-3.

NOTE

In the row of boxes labeled *GUN GO ON* AND *HV GO ON* RELAYS, the box numbered **21** represents Pin 11 on HV GO ON relay.

9	Make the connections shown in Figure 7-2 between the 37-pin breakout and the following components: • the HV GO ON and GUN GO ON relays • the Basic I/O Kit's 24 VDC terminal block • the Basic I/O Kit's 0 volt terminal block

NOTE

In the row of boxes labeled GUN GO ON AND HV GO ON RELAYS, the box numbered 24 represents Pin 14 on HV GO ON relay.

10 Make the following connections, which are shown in Figure 7-4.

a) Connect Pins 1, 3, and 5 on the 25-pin breakout to Pins 1, 2, and 7 on the 15-pin breakout.

b) Connect Pins 2, 4, and 6 on the 25-pin breakout to the 0 volt terminal block.

c) Connect Pin 6 on the 15-pin breakout to the 0 volt terminal block.

d) Connect Pins 3 and 10 on the 15-pin breakout to the 24 VDC terminal block.

11 If you are implementing the Crucible Valid relay, attach an additional +24 VDC relay to the DIN rail. shown in Figure 7-5. Then make the connections shown in Figure 7-5 between that relay, the 25-pin breakout, the 15-pin breakout, and the 0 volt terminal block.

12 Attach a relay to the DIN rail to serve as the Source Shutter relay shown in 7-6. If your system has a +24 VDC source shutter solenoid, attach an additional 24 VDC mini-relay to a spring base and attach this spring base to the DIN rail. If your system has a 120 VAC shutter solenoid, use the 120 VAC relay (PN 6149-2966-524) supplied with the EBC Extended I/O Kit, and supply 120 VAC to its input terminal. Use the output of the XTC/3M's **SRC SHUTTER 1** relay to control the coil of the 120 VAC relay, as shown in Figure 7-6.

13 Make the connections shown in Figure 7-6 between the Source Shutter relay, the 25-pin breakout, the 24 VDC terminal block, and the 0 volt terminal block.

14 Make the connections shown in Figure 6-1 between the XTC/3M's rear panel **SOURCE 1** BNC connector and Pins 6 and 37 on the 37-pin breakout you installed in Step 2 of this procedure.

15 Using one of the 25-pin cables included in the EBC Extended I/O Kit, connect the XTC/3M's rear-panel **SYS I/O** connector to the 25-pin breakout shown in Figure 7-2.

16 Using one of the 15-pin cables included in the EBC Extended I/O Kit, connect the 15-pin breakout shown in Figure 7-2 to the EBC's rear-panel **INDEXER CONTROL** connector. For a pinout diagram of that connector, see Figure 8-1. For functional definitions of its I/Os, see Table 8-1. For a breakdown of the BCD coding for the POCKET SELECT signals that must be input via Pins 1, 2, and 7 of that connector, see Table 8-2.

17 Using the 37-pin cable included in the EBC Basic I/O Kit, connect the 37-pin breakout to the EBC's rear-panel **AUX I/O** connector. For a pinout diagram of that connector, see Figure 8-3. For functional definitions of its I/Os, see Table 8-6.

7.3.2 Reprogramming XTC/3M's I/Os

Program the following inputs and relay outputs that are exchanged via the XTC/3M's rear panel **Sys I/O** connector. For instructions on assigning input functions, see section 4.5.2 of the XTC/3 manual. For instructions on assigning output functions to relays, see section 4.5.3 of that manual.

Step	Action
1	For Input 1, select the function **Cruc 1 Valid**.
2	For Relays 1 through 3, select the output function **Cruc Src 1 BCD**.

NOTE
The BCD code that are the output of Relays 1-3 must conform to that shown in Table 8-4 of this manual.

3	For Relay 4, select the output function **In Layer**.
4	For Relay 5, select the output function **Source Shut 1**.

7.3.3 EBC Configuration

Perform the following procedure when configuring the EBC to operate in conjunction with an XTC/3M.

Step	Action
1	Perform the procedure described in section 4.2. In this instance, configure the Sweep Control module as **Local** and the E-beam and Turret Control modules as **Remote I/O**. Leave **None** selected for **Synch Type** and **Communication Bus**.
2	Set the system date and time, following the procedure described in section 4.3.
3	Perform Steps 1-6 of the procedure described in section 4.4.
4	In Step 7 of that procedure, select **External** for **Emis Control**.
5	Perform the procedures described in sections 4.5 and 4.6.
6	If desired, perform the optional configuration procedures described in section 4.7 and 4.8
7	Save your configuration procedures by exiting from Configuration mode, as described in section 4.9.

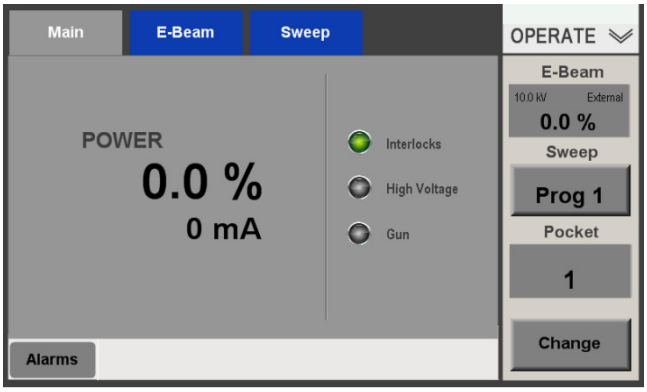
7.4 General Operating Methods

7.4.1 Appearance of Main UI Screens in this Configuration Mode

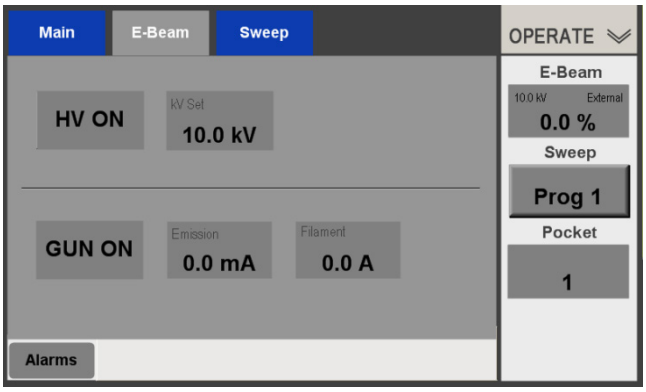
With the E-Beam and Turret Control modules configured as **Remote I/O** and the Sweep Control module configured as **Local**, the EBC's Configuration mode screens appear as shown in Figure 1-8, and its Service mode screens appear as shown in Figure 1-10. Operations mode screens appear as shown in Figure 7-2.

Figure 7-7 Ops Mode Screens, E-Beam and Turret Control Modules Configured as Remote I/O

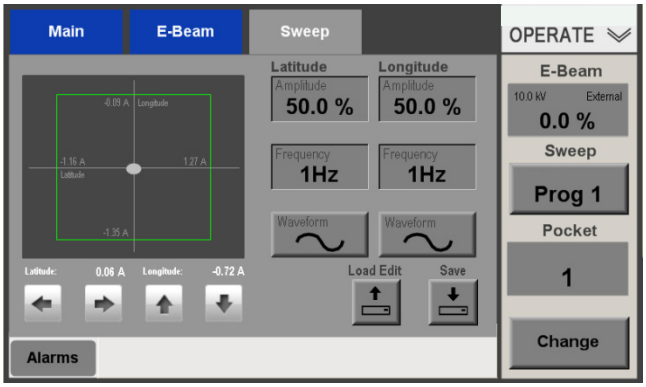
Operations>Main Screen



Operations>E-Beam Screen



Operations>Sweep Screen



7.4.2 Operations Available in this Configuration Mode

When configured as described in section 7.3.3, the EBC operates in Configuration mode as described in Section 4 and in Service mode as described in Section 19. In Operations mode, the only tasks that can be performed from the EBC's touch screen are:

- Sweep program selection
- sweep program creation
- sweep program modification.

For detailed instructions on performing these functions, see section 5.6.3.

The user also has the option of temporarily putting the EBC into Manual Mode, which provides full control (including emission current control) from the touch screen. However, users wishing to employ the full functionality of Manual mode must take care not to do so during recipe processing, as switching EBC modes during a process run will trigger alarms that will abort the process.

7.4.3 Executing a Deposition Process

Numbering Sweep Patterns for a Multipocket Deposition Process

When the EBC operates under the control of a multilayer deposition controller, sweep programs are programmed and modified normally, as described in section 5.6.3. However, the XTC/3M cannot select sweep programs. Sweep program selection for multilayer processes must therefore proceed according to the EBC's default method, which is that the sweep program number remains unchanged from pocket to pocket unless changed by the user.

Assuming that **Enable** is selected for **Swp-Pkt Assn** on page 2 of the Config>Sweep screen, up to eight sweep programs, numbered 1 through 8, can be assigned to each pocket in the turret source. For multilayer, multipocket processes, the user the user must assign the same sweep program number for use with each pocket to be employed in the process. Since the Sweep Control module is configured as **Local**, the user can select a different sweep program in mid-process. Following such a change, an identically numbered sweep program will be employed during the deposition of the film layers that follow, regardless if which pockets are used.

Sweep Program Modification and Numbering for Multilayer Processes

Step	Action
1	Using the main UI's command button bar, select the sweep program to be used for Layer 1 of the process. If necessary, create a new sweep pattern or modify an existing sweep pattern.
2	If you have created a new sweep program, save it as any of Programs 1 through 8 for the pocket that will contain the material for layer 1.
3	Program or select the sweep pattern to be used for the material that will be evaporated from the pocket used in Layer 2 of the process.
4	Save this sweep pattern for the target pocket, using the same sweep Program number you assigned in Step 2 of this procedure.
5	Repeat Steps 3 and 4 as necessary until you have created and saved sweep programs for each of the materials to be deposited in this process. In each case, assign the same program number that you assigned in Step 2. Thus, if the process is to deposit material from Pockets 1, 2, and 3, and if you assigned Program number 1 to the sweep program for Pocket 1, then the sweep program for Pocket 2 must also be saved as Program 1, and likewise with Pocket 3.

Executing a Multilayer Film Process

To perform a multilayer film deposition process using an EBC under the control of an XTC/3M, follow the procedure described below. This procedure assumes that the EBC and the XTC/3M are both installed and configured correctly and that both are powered up.

Step	Action
1	Using the controls on the XTC/3 front panel, program the film process to be executed.
2	Put the XTC/3M into either its READY mode or its IDLE mode.
3	Use the **Sweep** button on the EBC's command button bar to select the number of the sweep program to be used in Layer 1 of the process.
4	Switch on the sweep.
5	Press the **START** button on the XTC/3M front panel.
6	When the programmed process run is completed, switch off the sweep.

8 EBC Operation With a PLC-Based System Controller

8.1 Section Overview

This section describes the configuration and operation of the EBC when it is under the control of a PLC-based system controller such as the Temescal Control System (TCS). The subsections are:

8.2 Modifications to the Basic Installation Procedure

8.2.1 Additional Interconnection Hardware Requirements

In addition to the components and cables supplied with the EBC, connecting the unit to the PLC-based system controller will require the items listed in section 7.2. Together, Temescal's Basic and Extended I/O kits for the EBC (PNs 0624-2412-0 and 0620-4180—0, respectively) provide all of the necessary additional items plus extra components to meet unusual requirements.

8.2.2 Modified Installation Procedure

When installing an EBC to operate under the control of a PLC-based system controller, follow the procedure described below, which assumes that you are using the Basic and Extended I/O Kits for the EBC.

Step	Action
1	Perform the basic installation procedure described in Section 3.
2	Attach 15-pin and 25-pin breakouts to the DIN rail of the EBC Basic I/O Kit.
3	Connect the male end of the 15-pin cable (PN 6338-2882-0) to the EBC's rear-panel **Indexer Control** connector.
4	Connect the other end of this cable to the 15-pin breakout you installed in Step 2 of this procedure.
5	Determine which of the I/Os shown in Figure 8-1 and described in detail in Table 8-1 you wish to implement.
6	Make connections between the 15-pin breakout's terminal board and a system terminal strip wired to provide these I/Os.
7	Connect the male end of the 25-pin cable (PN 6338-2886-0) to the EBC's rear-panel **Sweeper Control** connector.
8	Connect the other end of this cable to the 25-pin breakout you installed in Step 2.
9	Determine which of the I/Os shown in Figure 8-2 and described in detail in Table 8-4 you wish to implement.
10	Make connections between the 25-pin breakout's terminal board and a system terminal strip wired to provide these I/Os.
11	Connect the male end of the 37-pin cable (PN 6338-2890-15) to the EBC's rear-panel **AUX I/O** connector.
12	Connect the other end of this cable to the 37-pin breakout supplied as part of the EBC Basic I/O Kit.
13	Determine which of the I/Os shown in Figure 8-3 and described in detail in Table 8-6 you wish to implement.
14	Make connections between the 37-pin breakout's terminal board and a system terminal strip wired to provide these I/Os

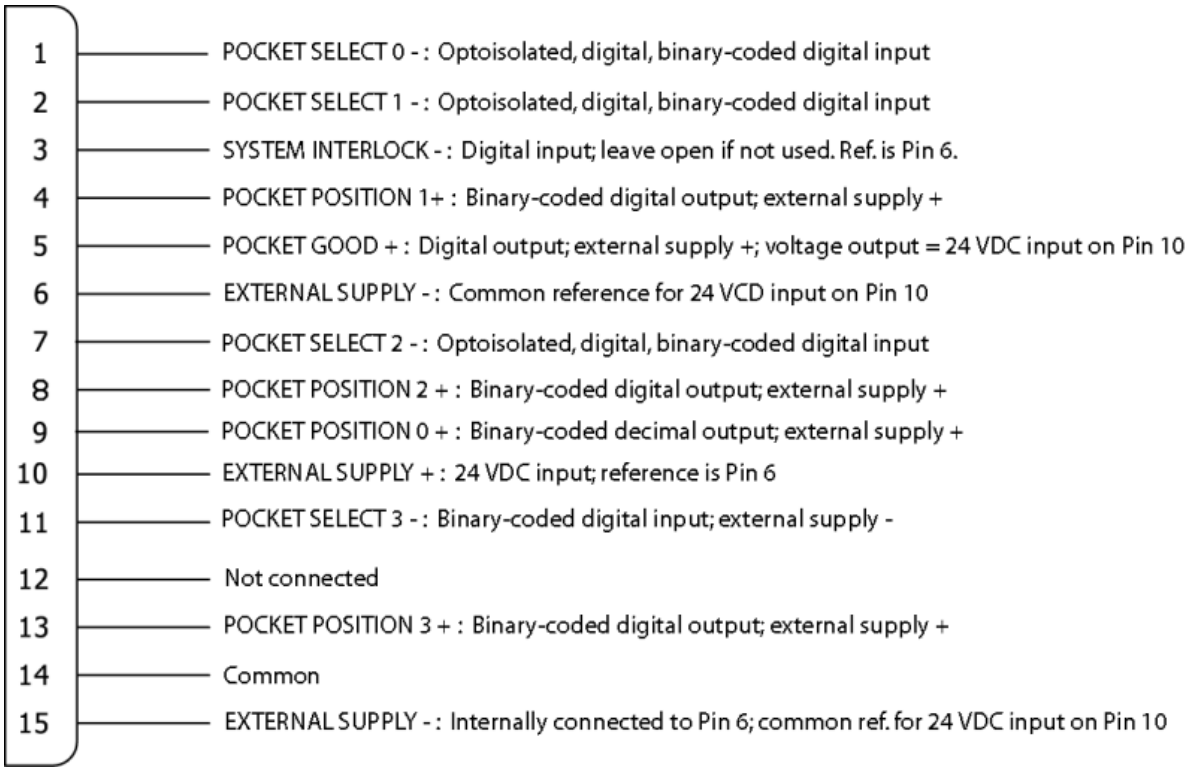
8.2.3 Pinout Details for EBC Rear Panel Connections Required for this Installation

This section provides pinout information about the EBC rear-panel connectors used to make connections between the EBC and a PLC-based system controller. These include connections made the 25-pin **SWEEPER CONTROL** connector, the 15-pin **INDEXER CONTROL** connector, and the 37-pin **AUX I/O** connector.

The INDEXER CONTROL Connector

Figure 8-1 is a pinout diagram of the 15-pin **INDEXER CONTROL** connector. Table 8-1 provides functional definitions of the signals exchanged via the same connector. The BCD coding of the pocket request inputs and the current-pocket-position outputs is shown in Tables 8-3 and 8-4, respectively.

Figure 8-1 Signals Exchanged via the Rear Panel INDEXER CONTROL Connector



CAUTION

Connecting the inputs to an optoisolator backwards (i.e., connecting a minus to a plus input) will damage the input device due to overcurrent.

Table 8-1 Signals Exchanged via the INDEXER CONTROL Connector

Signal Name	Pin(s)	Function
POCKET SELECT 0–, 1–, and 2–	1,2,7	Optoisolated digital inputs. When the Turret Control module is configured as either Remote I/O or EtherCAT, these binary-coded-decimal (BCD) inputs from the higher-level controller select the pocket. When active, this input signal must be the same as the reference input on Pin 6 for externally supplied +24 VDC.
SYSTEM INTERLOCK –	3	User-defined interlock input. The drive motor cannot turn when this signal is grounded. Reference for this input should be Pin 6. If open or if 24 VDC is applied, the turret can turn. NOTE: Must be left open if not used.
POCKET POSITION 0+, 1+, and 2+	9,4,8	Optoisolated digital outputs. When the Turret Control module is configured as either Remote I/O or EtherCAT, these binary-coded-decimal (BCD) outputs indicate which pocket is currently in evaporation position.

Signal Name	Pin(s)	Function
POCKET GOOD +	5	This digital output is high when the selected pocket is within 5° of its calibrated home position. To use this signal as the indexer's interlock, connect pin 5 to the e-beam power supply in such a way that the beam is switched off when POCKET GOOD goes low. Voltage of this output is determined by the voltage applied to Pin 10.
External Supply –	6	External supply input; common reference for voltage input via Pin10; should also be used as reference for Pins 1, 2, 3, and 7. Internally connected to Pin 15. This input should be used for pocket selection and interlock inputs.
External Supply +	10	Externally supplied analog input; voltage supplied via this pin can be used to power the signals transmitted via Pins 9, 4, and 8 (i.e., POCKET POS 0, 1, and 2).
Not Connected	11-14	Not used
External Supply –	14	Internally connected to Pin 6

Table 8-2 BCD Coding of the POCKET SELECT Signals Received via Pins 1, 2, and 7

Pocket Selected	SEL 0 Input (Pin 1)	SEL 1 Input (Pin 2)	SEL 2 Input (Pin 7)
1	0	0	0
2	1	0	0
3	0	1	0
4	1	1	0
5	0	0	1
6	1	0	1
7	0	1	1
8	1	1	1

Table 8-3 BCD Coding of the POCKET POSITION Signals Transmitted via Pins 4, 8, and 9

Current Pocket Position	POS 0 Input (Pin 9)	POS 1 Input (Pin 4)	POS 2 Input (Pin 8)
1	0	1	1
2	1	0	1
3	0	0	1
4	1	1	0
5	0	1	0
6	1	0	0
7	0	0	0
8	1	1	1

The SWEEPER CONTROL Connector

Figure 8-2 is a pinout diagram of the 25-pin **SWEEPER CONTROL** connector. Table 8-4 provides functional definitions of the signals exchanged via that connector. Table 8-5 shows the BCD coding of the program-select inputs received via Pins 3, 5, and 7.

Figure 8-2 Pinout Diagram of the Rear Panel SWEEPER CONTROL Connector

***NOTE:**
If the EBC's Sweep Control module is configured as either **Remote I/O** or **EtherCAT**, Pin 12 on the SWEEPER CON-TROL connector must be connected to Pin 3 on the AUX I/O connector, and Pin 13 on the SWEEPER CONTROL connector must be connected to Pin 22 on the AUX I/O connector. If these connections are not made as specified, then the position interlock will not function. If the EBC is to be operated only in Local (i.e., stand-alone) mode, these connections do not need to be made, and the pins in question should be connected as shown in Figures 8-1 and 8-3 and described in Tables 8-1 and 8-6, and the position interlock will function correctly.

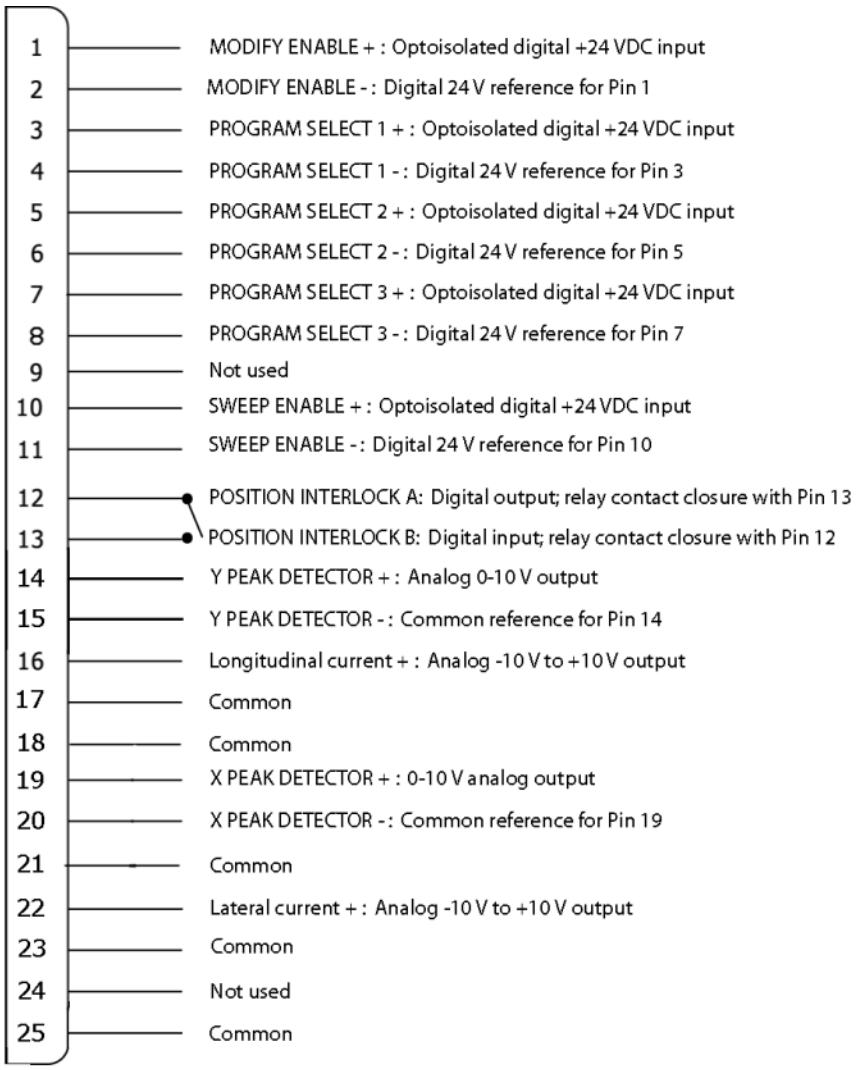


Table 8-4 Signals Exchanged via the SWEEPER CONTROL Connector

Signal Name	Pin(s)	Function
MODIFY ENABLE +	1	Optoisolated digital +24 VDC input supplied by a host computer or another customer-supplied switching device. This input can be used to prevent undesired modification of sweep programs.
MODIFY ENABLE –	2	Digital +24 VDC reference for Pin 1
PROGRAM SELECT 1+, 2+, and 3+	3, 5, 7	Optoisolated digital +24 VDC inputs; binary-coded decimal signals that effect sweep program selection when the Sweep Control module is configured as either Remote I/O or EtherCAT.
PROGRAM SELECT 1–, 2–, and 3–	4, 6, 8	Digital 24 VDC references for Pins 3, 5, and 7, respectively
Not Used	9	
SWEEP ENABLE +	10	Optoisolated digital +24 VDC input; when true, this signal enables the beam sweep function when the Sweep Control module is configured as either Remote I/O or EtherCAT. Under those conditions, when this input is low, the beam is stationary, and its position is determined by the position parameters of the sweep program currently operating.
SWEEP ENABLE –	11	Digital 24 VDC reference for Pin 10
POSITION INTERLOCK A	12	Digital output; relay contact closure with Pin 13. Normally-open contact closure provided to prevent the beam from being switched on when the longitudinal coil current is beyond the user-set limits.
POSITION INTERLOCK B	13	Digital input; relay closure with Pin 12
Y-Axis Peak Detector +	14	Analog 0–10 VDC output
Y-Axis Peak Detector –	15	Common reference for Pin 14
Longitudinal current +	16	Analog -10 V to +10 V output indicates longitudinal coil current output
Common	17, 18, 21, 23, and 25	
X-Axis Peak Detector +	19	Analog 0–10 VDC output
X-Axis Peak Detector –	20	Common reference for Pin 19
Lateral Current +	22	Analog -10 V to +10 V output indicates of lateral coil current output
Not Used	24	

Table 8-5 BCD Coding of the PROGRAM SELECT 0, 1, and 2 Inputs (Sel 0, 1, and 2)

Sweep Program Selected	SEL 0 Input (Pin 1)	SEL 1 Input (Pin 2)	SEL 2 Input (Pin 7)
1	0	0	0
2	1	0	0
3	0	1	0
4	1	1	0
5	0	0	1
6	1	0	1
7	0	1	1
8	1	1	1

Figure 8-3 Pinout of Rear Panel AUX I/O Connector

NOTE: If you are not connecting system interlocks as shown below, you must jumper Pin 1 to Pins 2, 3, 20, 21, and 22, as shown in Figure 2-7 of this manual. If these connections are not made, the gun cannot be enabled and cannot be switched on.

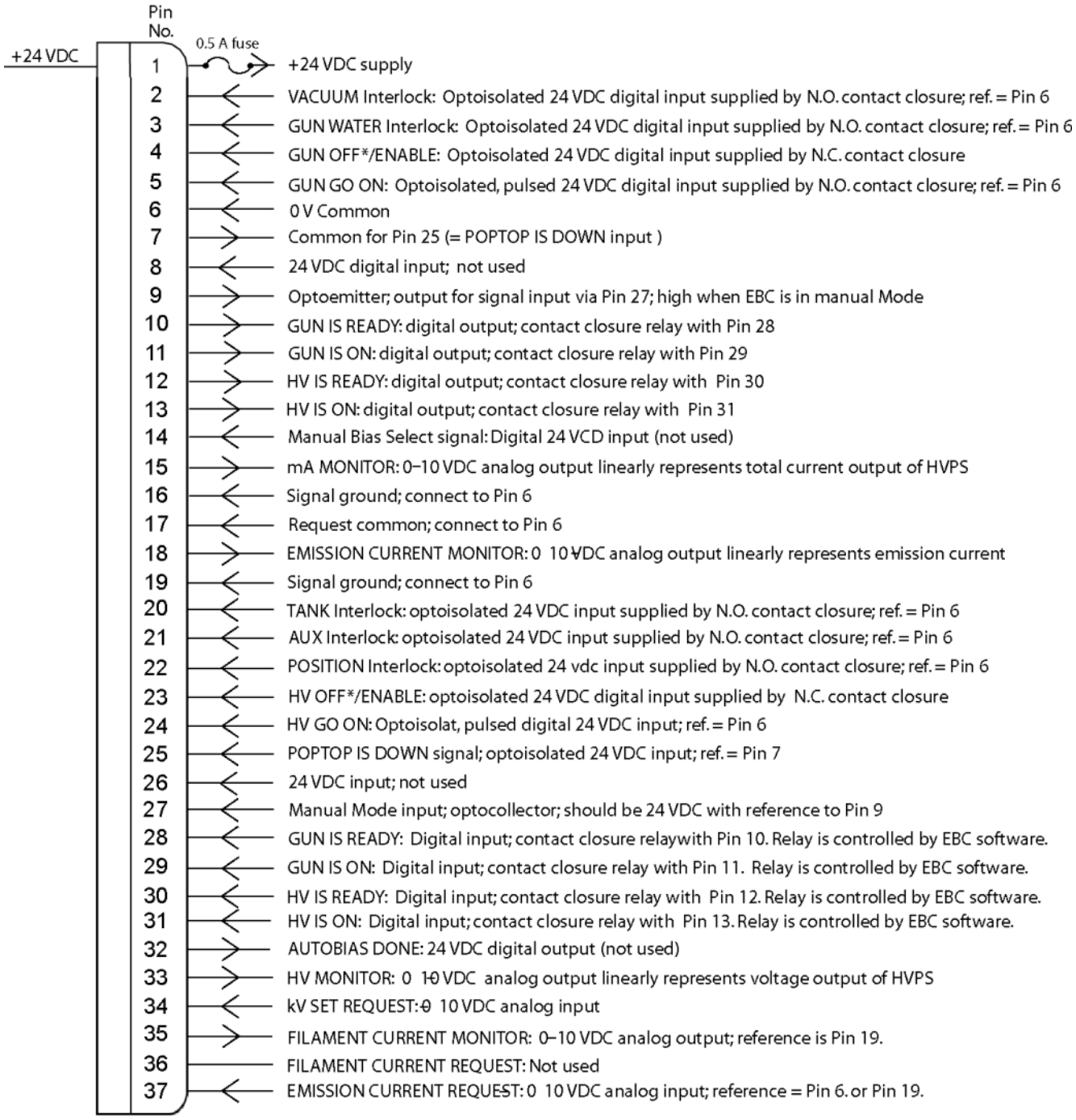


Table 8-6 Signals Exchanged via the AUX I/O Connector

Signal Name	Pin	Function
24 VDC supply	1	This 24 VDC analog output; if used, should have an external resettable fuse rated at 0.5A
VACUUM Interlock	2	This optoisolated digital input should be +24 VDC reference to Pin 6 or 19; externally supplied by a normally-open contact closure; ensures that vacuum chamber ion gauge is on before gun is switched on.
GUN WATER Interlock	3*	This optoisolated digital input should be +24 VDC with reference to Pin 6 or 19; externally supplied by a normally-open contact closure; prevents the gun from being switched on unless it is receiving sufficient cooling water. Signal to be supplied by a customer-installed flow switch.
GUN OFF*/ENALBE	4	This optoisolated digital input should be +24 VDC with reference to Pin 6 or 19; externally supplied by a normally-closed external contact closure. When the gun is on, a momentary open pulse switches it off. If all gun interlocks are made, the gun can then be switched on again. NOTE: If not connected to a remote contact closure, this pin must be jumpered to Pin 1, or the gun cannot be switched on.
GUN ON	5	This optoisolated digital input should be +24 VDC with reference to Pin 6 or 19. If all gun control interlocks are made and GUN GO OFF*/ENABLE loop is true, a 2-sec. contact closure across these pins 5 and 6 or 5 and 19 switches on the gun.
0 Volt common –	6	Common; reference for 24 VDC inputs; should be jumpered to Pins 16, 17, and 19
Poptop Down common	7	Common reference for Pin 25
Not used	8	Digital 24 VDC input
MANUAL MODE output	9	Optoemitter. When user puts EBC into Manual mode, this digital output goes from a low (0 Volts) to a high (i.e., whatever voltage is input via Pin 27). On TCS systems, this output is used to enable turret rotation when the EBC is in Manual mode.
GUN IS READY	10	Digital output; relay contact closure with Pin 28. Relay is controlled by the EBC software. Its closure indicates that all gun control interlocks are made and that the GUN GO OFF*/ENABLE signal is true, so the gun can be switched on.
GUN IS ON	11	Digital output; relay closure with Pin 29. Relay is controlled by the EBC software. Its closure indicates that the gun is switched on.
HV IS READY	12	Digital output; relay contact closure with Pin 30. Relay is controlled by the EBC software. Its closure indicates that all HV control interlocks are made and that the HV GO OFF*/ENABLE signal is true, so the HV is ready to be switched on.
HV IS ON	13	Digital output; relay contact closure with Pin 31. Relay is controlled by the EBC software. Its closure indicates that the HV IS ON signal is high.
MANUAL BIAS SEL	14	Digital 24 VDC input; not used
mA MONITOR	15	Analog 0–10 VDC output. Signal comes from the HVPS and linearly represents its total current output; reference is Pin 16.
Signal ground –	16	Common reference for Pin 15; can be connected to Pins 6, 17, and 19
Request common	17	Common reference; can be connected to Pins 6, 16, and 19
EMISSION CURRENT MONITOR	18	Analog 0–10 VDC output that linearly represents the emission current. Signal comes from the FPS; reference is Pin 19. Range of this output varies depending on HVPS and maximum current selected via Scale switch on FPS rear-panel. Defaults are: for CV-6SLX, 0–10 V = 0–600 mA; for CV-12SLX, 0–10 V = 0–1200 mA.
Signal ground –	19	Common reference for Pin 18; can be connected to Pins 6, 16, and 17
TANK Interlock	20	This optoisolated 24 VDC digital input should be +24 VDC with reference to Pin 6 or 19; prevents the gun from being switched on unless all interlock switches on vacuum system doors and covers are made.
AUXILIARY Interlock	21	This optoisolated 24 VDC digital input should be +24 VDC with reference to Pin 6 or 19; externally supplied, user-defined.
POSITION Interlock	22*	This optoisolated 24 VDC digital input should be +24 VDC with reference to Pin 6 or 19; switches off the gun if the beam travels beyond the sweeper's programmed position limits.

Signal Name	Pin	Function
HV OFF*/ENABLED	23	This optoisolated digital input should be +24 VDC with reference to Pin 6 or 19. Externally supplied by a normally-closed remote contact closure. When HV is on, a momentary open pulse switches HV off. If HV READY is true, the HV can then be switched on again. NOTE: If not connected to a remote contact closure, this pin must be jumpered to Pin 1, or the HV cannot be switched on.
HV GO ON	24	This optoisolated digital input should be +24 VDC with reference to Pin 6 or 19. Externally supplied by a normally-open contact closure. If all HV interlocks are made and HV GO OFF*/ENABLE is true, a momentary closure of the normally-open contacts switches on the high voltage.
POPTOP DOWN	25	This optoisolated digital input should be +24 VDC with reference to Pin 7. Signal is true when the POPTOP DOWN interlock switch on a Poptop gun is made.
Not used	26	24 VDC digital input
MANUAL MODE input	27	Optocollector. This digital input should be +24 VDC with reference to Pin 9.
GUN IS READY	28	Digital input; relay contact closure with Pin 10. Relay is controlled by the EBC software.
GUN IS ON	29	Digital input; relay contact closure with Pin 11. Relay is controlled by the EBC software.
HV IS READY	30	Digital input; relay contact closure with Pin 12. Relay is controlled by the EBC software.
HV IS ON	31	Digital input; relay contact closure with Pin 13. Relay is controlled by the EBC software.
AUTOBIAS DONE	32	Digital 24 VDC output; not used
HV MONITOR	33	Analog 0–10 VDC output. Signal comes from the HVPS and linearly represents its output voltage. Range: 0–10 V = 0–10 kV
kV SET REQUEST +	34	Analog 0–10 VDC input; linearly controls the voltage output of the HVPS when the **kV SET** button on Config>E-Beam screen is set to **Input Ctrl**. Range: 0–10 V = 0–10 kV
FILAMENT CURRENT MONITOR +	35	This analog 0–10 VDC putput linearly represents the AC filament current; reference is Pin 19. Signal comes from the FPS. Range: 0–10 V = 0–50 A
FILAMENT CURRENT REQUEST	36	Not used
EMISSION CURRENT REQUEST +	37	Analog 0–10 VDC input; reference is Pin 6 or 19. When the E-Beam control module is configured as either **Remote I/O** or **EtherCAT**, or when that control module is configured as **Local,** with **Emis Control** on the Config>E-Beam screen set to **EXTERNAL**, this input linearly controls emission current, whose maximum depends on the setting of the Scale pot. on the FPS front panel. Default range for CV-6SLX PS: 0–10 V = 0–600 mA. Default range for CV-12SLX PS: 0–10 V = 0–1200 mA.

***NOTE:**
If either the Sweep Control or E-Beam Control module is configured as **Remote I/O** or **EtherCAT**, the position interlock must be connected to Pins 12 and 13 on the EBC's rear panel SWEEPER CONTROL connector. If these connections are not made as specified, then the position interlock will not function.

8.3 Modifications to Basic Configuration Procedures

When configuring the EBC to operate under the control of a PLC-based system controller, follow the procedure described below.

Step	Action
1	Perform the procedure described in section 4.2.
2	Perform the procedure described in section 4.3, configuring all control modules as either **Remote I/O** or **EtherCAT**. To configure the control modules as **EtherCAT**, simply select **EtherCAT** for **Communications Bus**.
3	Perform Steps 1-6 of the procedure described in section 4.4.

4 In Step 7, select **External** for **Emis Control**.

5 Perform the procedures described in section 4.5 through 3.9.

8.4 Operating the EBC Under PLC Control

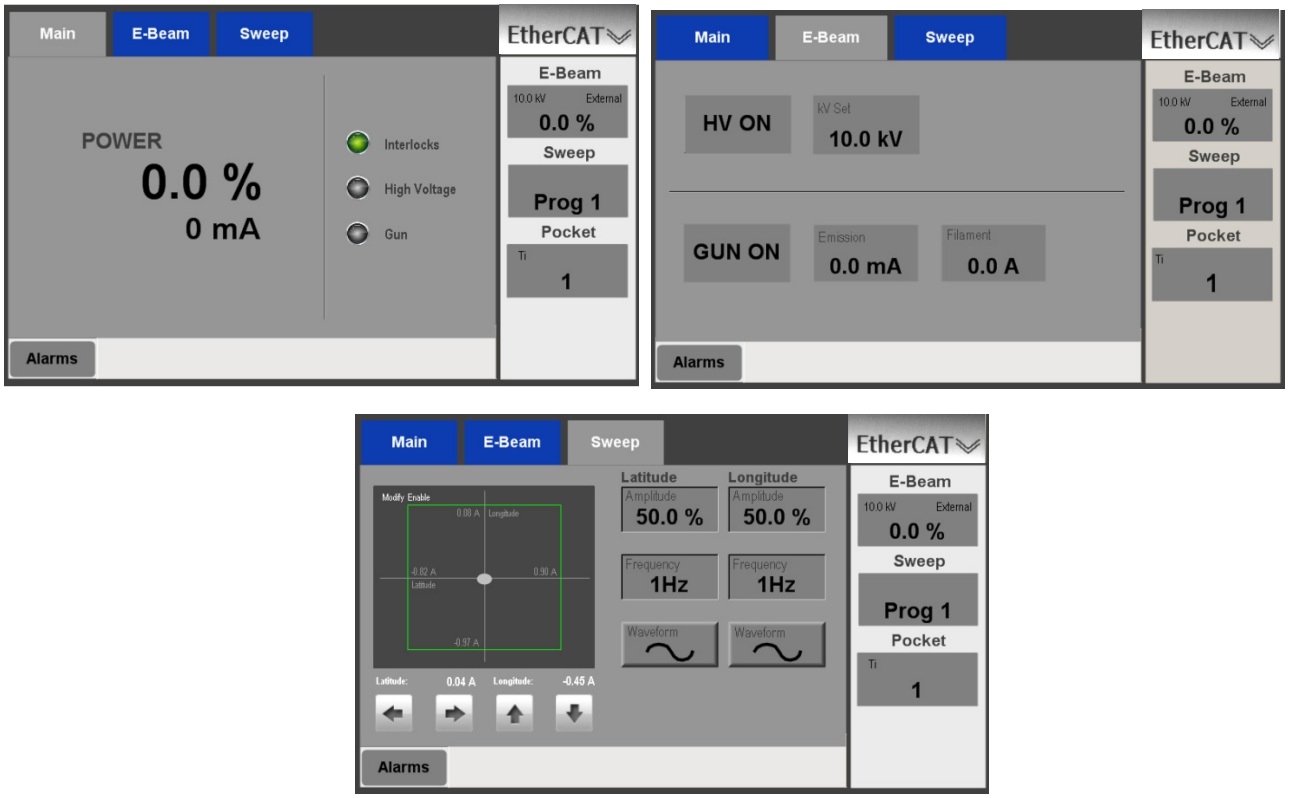
This section describes how the EBC operates when all three control modules are configured as either **EtherCAT** or **Remote**, as they must be for operation under the control of a PLC-based system controller.

8.4.1 Appearance of UI Screens when all Control Modules Are Configured as Either Remote I/O or EtherCAT

When the all the EBC control modules are configured as either **Remote I/O** or **EtherCAT**, the Configuration mode screens appear as shown in Figure 1-8, and Service mode screens appear as shown in Figure 1-10. When all control modules are configured as **Remote I/O**, the operations mode screens appear as shown in Figure 8-4. When all control modules are configured as **EtherCAT**, those screens appear as shown in Figure 8-5. Functionally, the Ops mode screens are identical whether all control modes are configured as **Remote I/O** or **EtherCAT**. All screen features are display-only; no commands that affect controlled devices can be issued from any Operations mode screen.

Figure 8-4 Appearance of Operations Mode Screens when All EBC Control Modules Are Configured as *Remote I/O*

Figure 8-5 Appearance of Operations Mode Screens when All EBC Control Modules Are Configured as *EtherCAT*



8.4.2 Operation Under PLC Control

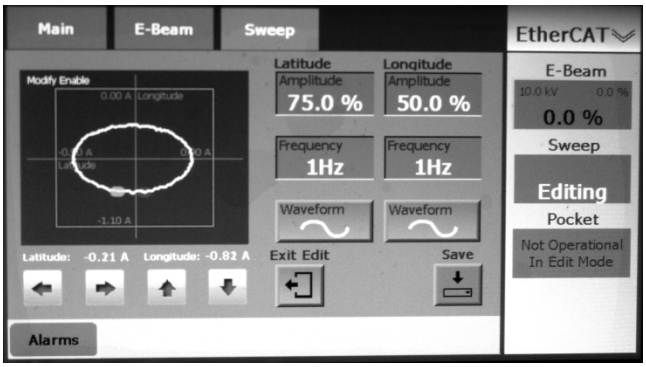
When all three EBC control modules are configured as either **EtherCAT** or **Remote I/O**, the EBC is completely under the control of the PLC-based system controller, except when that controller asserts the MODIFY ENABLE signal via Pin 1 of the EBC's rear panel **SWEEPER CONTROL** connector. When MODIFY ENABLE is true, an EBC user with appropriate permissions can modify the currently selected sweep program—and that program alone— using the Operations>Sweep screen. For a details regarding sweep modification procedures, see "Modifying the Sweep Program Currently Displayed" in section 5.6.3 of this manual. Note that the program can be saved under a different pocket and sweep program number, as described there.

The Operations>Sweep Screen When MODIFY ENABLE Is True

When MODIFY ENABLE is true, the Operations>Sweep screen displays a message to that effect, as shown in Figure 8-6. If the user then begins to modify any sweep parameter, the **Exit Edit** and **Save** buttons both appear, and the legend **Editing** is displayed in the rectangle where the **Sweep** button normally appears.

Figure 8-6 The EtherCAT>Sweep Screen when MODIFY ENABLE Is True

Figure 8-7 EtherCAT>Sweep Screen, User Editing Sweep Program



8.4.3 Use of Manual Mode When the EBC when the EBC Is Configured for Use with a PLC-Based System Controller

The user also has the option of temporarily putting the EBC into Manual Mode, which provides full control from the EBC screen.

9 Operating Dual EBC Units as Master and Slave

9.1 Section Overview

This document describes how to install and configure two EBC units for Master/Slave operation and Master/Slave operation in the EBC's Operations mode. Specific topics covered are:

Section 9.2 Additional Cable Connections Required for Master/Slave Operation
Section 9.3 Setting Up Master/Slave Communication Between Dual EBC Units
Section 9.4 Configuring Control Modules on Master and Slave Units
Section 9.5 Operating Master/Slave EBC Units in Operations Mode

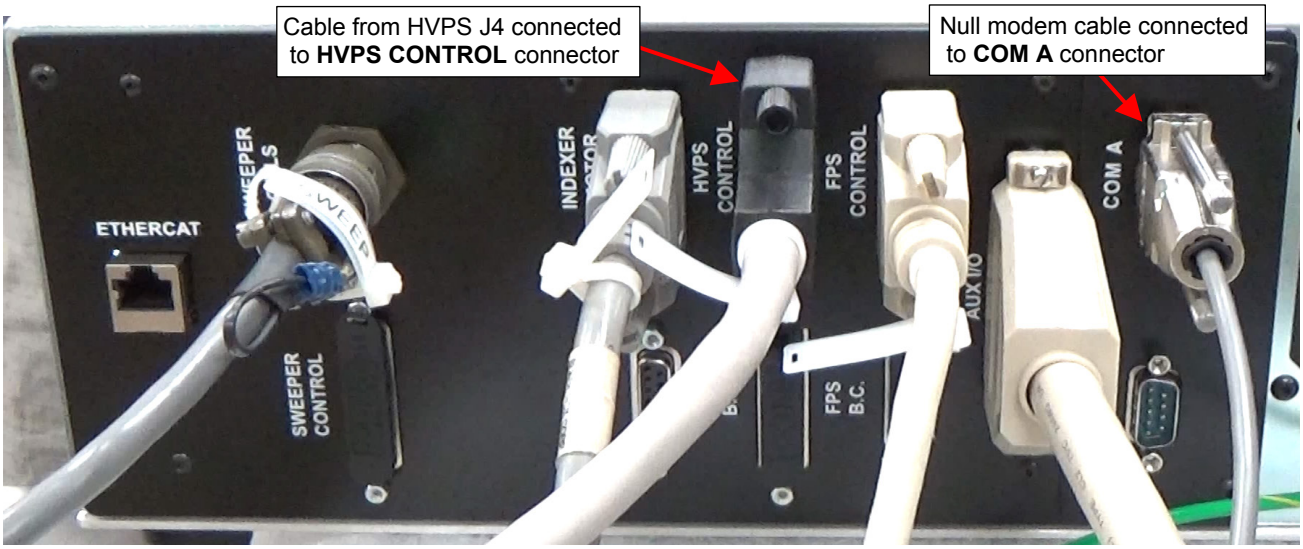
9.2 Cable Connections Required for Master/Slave Operation

In addition to the standard cable connections described in Section 3.4, the following cable connections must be made:

1. The female connector on the end of the DB-25 cable plugged into HVPS rear panel connector J4 must be connected to the rear-panel **HVPS Control** connector on the EBC unit that is to be configured as the Master.
2. A null modem DB-9 cable must be securely connected between the two units' rear panel **COM A** connectors.

Figure 9-1 shows the cable connections on the unit that is to be configured as Master.

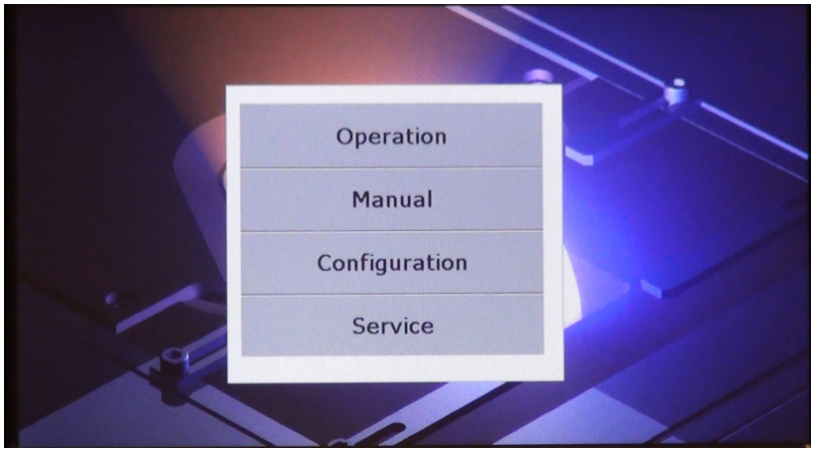
Figure 9-1 Rear Panel Cable Connections on Master EBC Unit



9.3 Setting Up Master/Slave Communication Between Dual EBC Units

Step	Action
1	If both units are not already powered up, press their front panel On/Off buttons.
2	After the two EBC units are booted up, they will both display the initial start screen shown Figure 9-2. On this screen, press the **Configuration** button on both units.

Figure 9-2 Initial Spash Screen on Both Units



3	Both units will then display the Configuration>Main screen (see Figure 9-3). On the EBC unit to be configured as the Master, touch the **System Type** button once to select **Master**. On the EBC unit to be used as the slave, touch the same button twice to select **Slave**. The Config>Main screens on the two units screen will then appear as shown in Figure 9-4.

Figure 9-3 Config>Main Screen on Both Units After Boot-Up

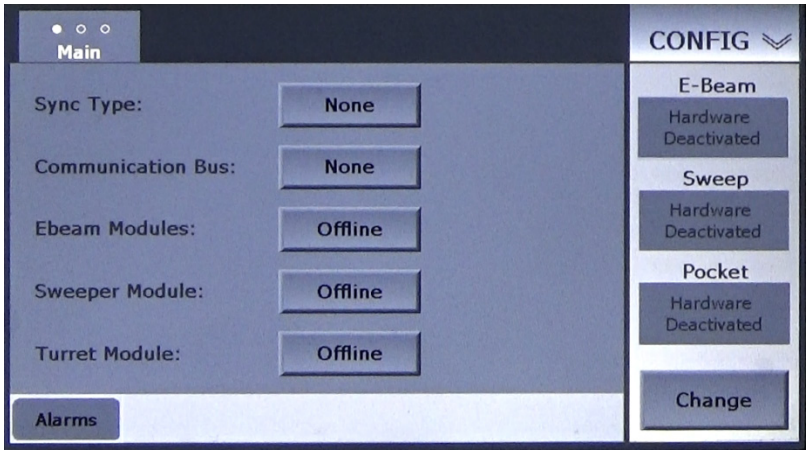
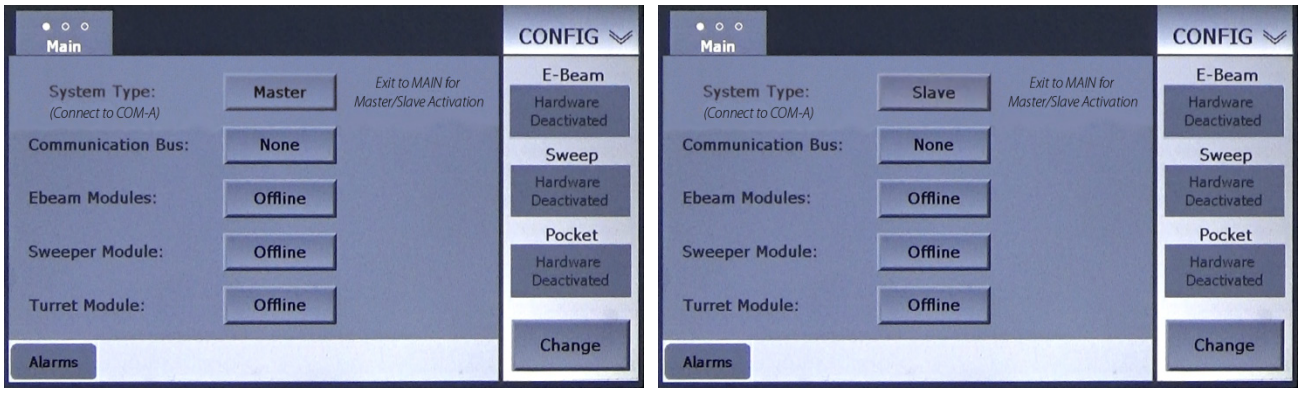


Figure 9-4 Config>Main Screens After Selection of *Master* and *Slave* for *System Type*

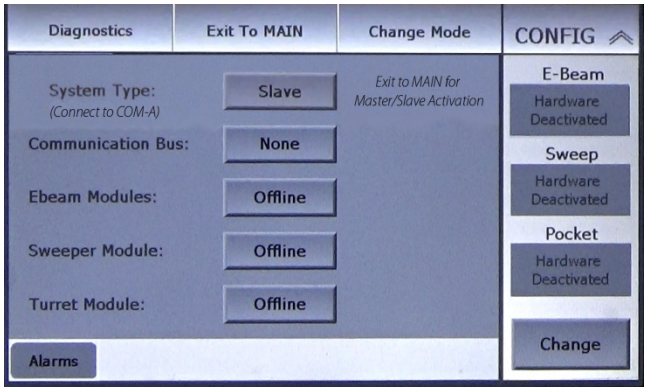
Config>Main Screen on Master Unit **Config>Main Screen on Slave Unit**



4 Leave **None** selected for **Communication Bus**.

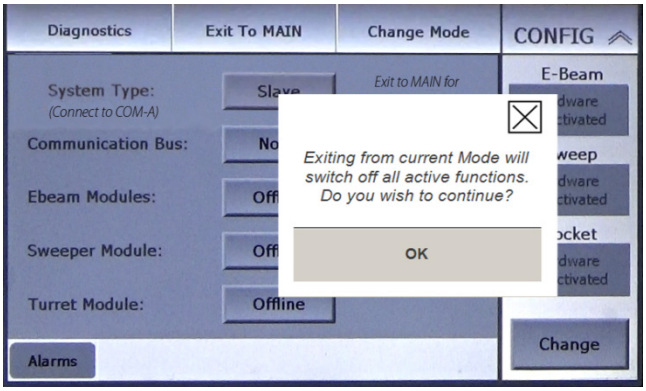
5 Next, display the Start screen on the Slave unit, as prompted by the italicized text next to the **System Type** button. To do so, first touch the **CONFIG** button on the Slave unit's Config>Main screen to display the auxiliary menu. Figure 9-5 shows the Slave unit's Config>Main screen after you have done so.

Figure 9-5 Config>Main Screen with Auxiliary Menu Displayed



6 Now touch the button labeled **Exit to Start Screen** to display the popup window shown in Figure 9-6.

Figure 9-6 Config>Main Screen Displaying Exit OK Popup



7 Touch the popup's **OK** button to display the start screen, which will now appear as shown in Figure 9-7. Note the message W*aiting For Cable Connection!* , which indicates that the Slave unit is waiting for the user to activate Master/Slave interconnectivity from the Master unit, that functionality having already been activated on the Slave.

Figure 9-7 Slave Unit's Start screen After User Has Designated First Unit as Slave

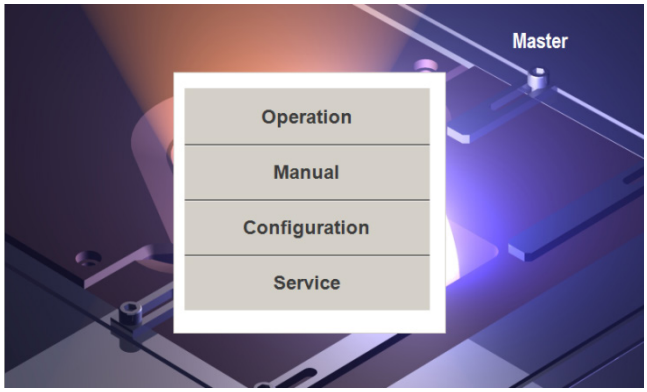
8 Repeat Steps 5 through 7 on the unit you have designated as Master. After you do so, both units' start screens will appear as shown in Figure 9-8.

Figure 9-8 Start Screen on Both Units After User Has Designated Second Unit as Master

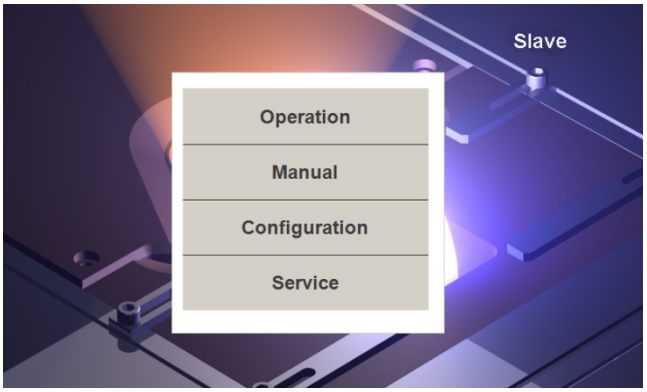
9 On either unit, touch the button labeled **Operate As Master/Slave** to initiate full Master/Slave operation. The start screens on the two units will then appear as shown in Figure 9-9.

Figure 9-9 Start screens After Full Master-Slave Operation Is Established

Start screen on Master Unit



Start screen on Slave Unit



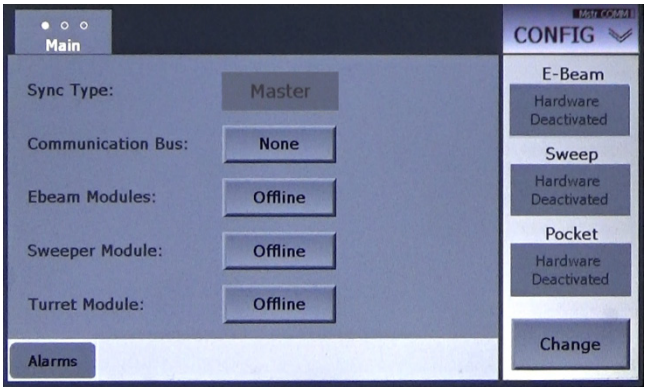
10 On both units, touch the **Configuration** button to display the Configuration>Main screen. The Config>Main screens of the Master and Slave units now display bars that read **Mstr COMM** and **Slave COMM**, respectively (see Figure 9-10).

NOTE

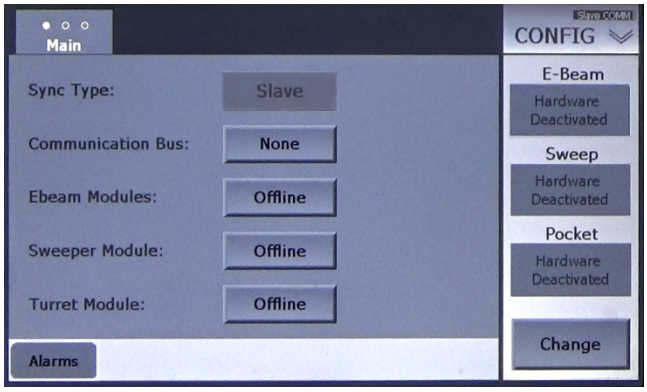
The **COMM** bars indicate that two-way Master/Slave communication has been established between the two units and that Master/Slave functionality is in effect on both units. If Master/Slave intercommunication is lost for any reason, the black color will appear to 'drain' from these bars from right to left, leaving the bars white in color. Loss of communication is generally due to a lost or faulty cable connection at the rear-panel **COM A** connector on one or both units. When intercommunication is restored between the two units, the black color will appear to flow back into the on-screen **COMM** bars from left to right.

Figure 9-10 Config>Main Screens After Master-Slave Connectivity Is Established

Config>Main Screen on Master Unit, *Mstr COMM* Bar Displayed



Config>Main Screen on Slave Unit, *Slave COMM* Bar Displayed



At this point, mode selection is reciprocal between the two units. Thus, when a new mode selection is made on either unit, the other unit immediately displays the same screen and mode as the unit from which the mode change was initiated.

11 On both units, touch the selection buttons for all three control modules to select **Local** as the operating mode for all three. The two units' Config>Main screens will then appear as shown in Figure 9-11.

Figure 9-11 Config>Main Screens After All Control Modules Are Configured as Local

Config>Main Screen on Master Unit

Config>Main Screen on Slave Unit

12 Proceed to configure the individual modules on the two units, as described in Section 9.4.

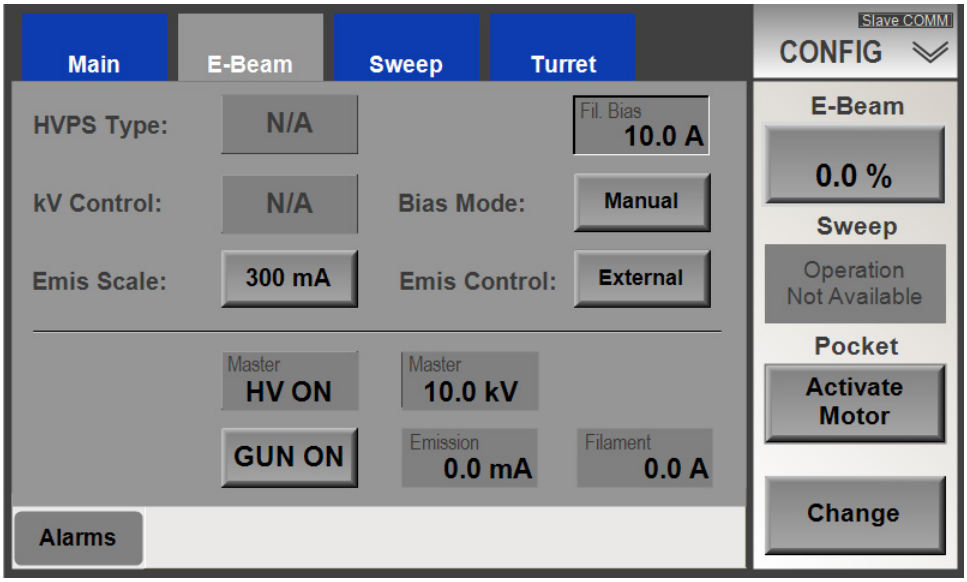
9.4 Configuring Control Modules on Master and Slave Units

9.4.1 Configuring the Master Unit's Control Modules

On the Master unit, the configuration procedures for the E-Beam, Turret, and Sweep control module are exactly as described in sections 4.4 through 4.6 of this manual.

Configuration of the Slave unit's control modules is performed identically, except that there are no **HVPS Type** and **KV Control** buttons on the Slave unit's Config>E-Beam screen (see Figure 9-12) This is because when two EBC units are configured for Master/Slave operation, the Master unit has sole control over the high voltage.

Figure 9-12 Config>E-Beam Screen as It Appears on the Slave EBC Unit



9.5 Operation of Master/Slave EBC Units in Operations Mode

Once the two units are properly configured as Master and Slave and their respective control modules are configured, their operation in Operations and Manual modes is as described in Sections 2 and 5, with the following exceptions:

1. The high voltage for the Slave as well as the Master unit is exclusively controlled by the Master unit. HV control features are disabled on the UI of the Slave unit, which is not even connected to the output of the HVPS.
2. Mode selection—but not screen selection--is reciprocal between the two units. Thus when the mode is changed from one mode to another (e.g., from Operations to Service) on one unit, the same mode change is simultaneously made on the other. However, the user can display different screens within that mode on the two EBC units.
3. As noted above, if Master/Slave communication is lost between the two units, the black color appears to drain out of the **Master COMM** and **Slave COMM** indicators in the mode ID/menu selection buttons on the two units' screens. The loss of Master/Slave communication is generally due to a faulty cable connection at one or both **COM A** connectors or to a faulty null modem cable. Note that both units remain configured for Master/Slave operation, even if physical communication is lost.
4. The user can exit at any time from Master/Slave mode by exiting to the start screen and pressing the **Operate as Stand Alone** button (see Figure 9-8). After the user makes this selection, both units can then be operated normally, except that there is no way to switch on the beam from the EBC unit formerly designated as the Slave.

10 Troubleshooting

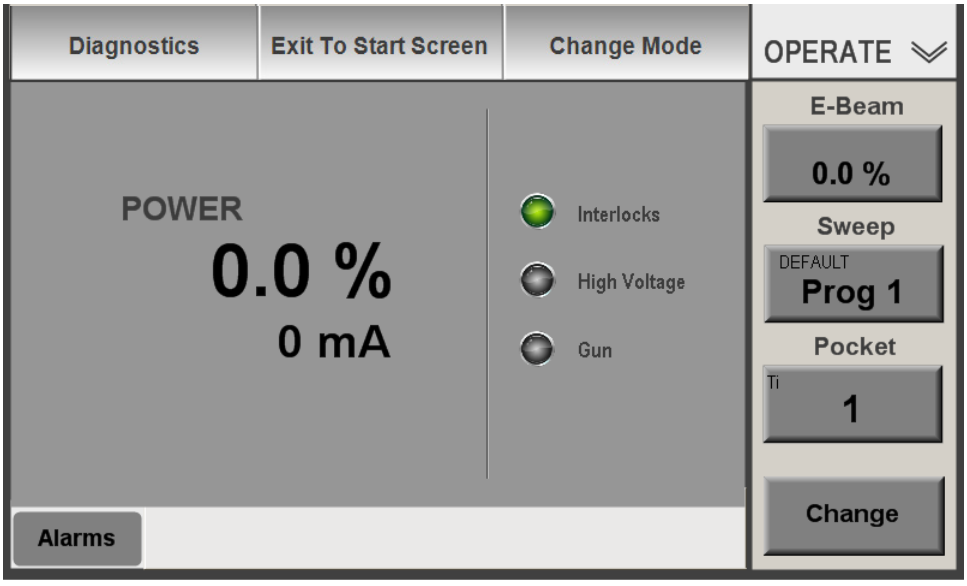
10.1 Section Overview

This section describes the main UI screens dedicated that aid in troubleshooting procedures. The subsections are:

10.2 The Diagnostics Screen

Figure 10-1 shows the Operations>Main screen when the auxiliary menu is displayed. To open the Local Mode's Diagnostics screen when this menu is displayed, touch the menu's **Diagnostics** button.

Figure 10-1 Operations>Main Screen with Auxiliary Menu Displayed, All Modules Local



Figures 10-2 shows the Diagnostics screen when all control modules are configured as Local. Figure 10-3 show the same screen as it appears when the Sweep and Turret control modules are configured as Remote. Section 10.2.1 provides functional definitions of the LEDs on the Remote mode version of this screen.

Figure 10-2 Diagnostics Screen, All Modules Configured as Local

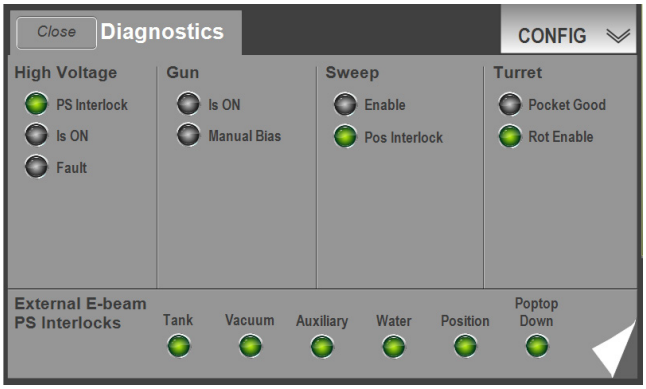
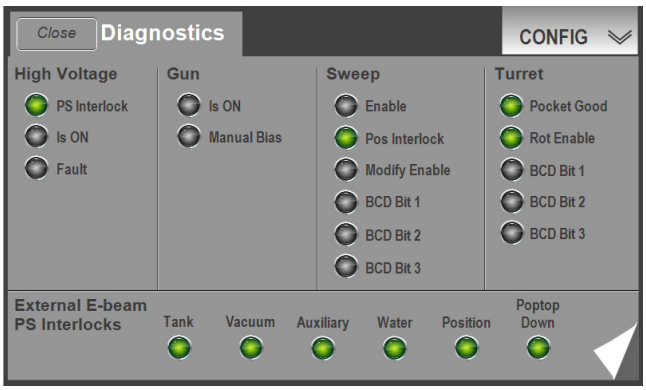


Figure 10-3 Diagnostics Screen, Sweep and Turret Control Modules Configured as Remote



10.2.1 Functional Definitions of LED Indicators on the Diagnostics Screen

Except where noted, the indicators on this screen are gray (off) when the signal in question is false and green when it is true.

High Voltage Section

- **Interlock** LED: Status of the HV interlock input from the HVPS
- **HV Ready** LED: Status of the HV READY input from the HVPS
- **HV is ON** LED: Status of the IS ON input from the HVPS
- **Fault** LED: On systems with CV6-SLX and CV12-SLX HV power supplies, this LED indicates the status of the HV FAULT input from the HVPS. It is green when that input is false and red when that signal is true, indicating that a latching power supply fault has occurred. For additional information about latching HVPS faults, see section 6.2.1 of the power supply manual.

Gun Section

- **Is Ready** LED: Status of the IS READY input from the FPS
- **Is ON** LED: Status of the IS ON input from the FPS

- **Manual Bias** LED: Off (gray) when autobias is selected via the Configuration>E-Beam screen and green when manual bias is selected.
- **Auto Bias** LED: Green when autobias is selected via the Configuration>E-Beam screen and off (gray) when manual bias is selected.

Sweep Section

- **Enable** LED: When lit, this LED indicates that the remotely supplied SWEEP ENABLE signal is true.
- **Pos Interlock** LED: Indicates the state of the beam position interlock, as determined by the EBC's internal sweep-control board. Indicator is green when the coil-drive output is within the user-set interlock limits and red when the coil-drive output is beyond any of the four limits. If the beam and the sweep are both on, the EBC switches off the beam as soon as it goes beyond any of the four position limits. However, as long as the sweep is enabled, the **Pos interlock** indicator alternates between green and red as the coil drive output goes from a level that is within limits to a level that is beyond a given limit and back.
- **Modify Enable** LED: Active only if the EBC is connected to a higher-level, PLC-based control system. Off (gray) when the MODIFY input from the higher-level controller is false, and green when it is true, indicating that sweep programs can be modified from the EBC's Remote>Sweep screen.
- LEDs for **BCD Bits 1-3**: When lit, each of these LEDs indicates that the BCD bit in question is currently true.

Turret Section

- **Pocket Good** LED: When lit, this LED indicates that the POCKET GOOD input from the mechanical turret drive unit is true.
- **Rot Enable** LED: Active only on systems equipped with a PopTop source. When lit, this LED indicates that the POPTOP DOWN input from the source is true.
- LEDs for **BCD Bits 1-3**: When lit, each of these LEDs indicates that the BCD bit in question is currently true.

High Voltage/Gun Interlocks Section

The **Tank, Vacuum, Auxiliary, Water,** and **Position** LEDs indicate the state of the corresponding inputs from the HVPS and the FPS, which in turn reflect that state of the external interlock switches that must be made before the gun or HV can be enabled. The **PopTop Down** LED, when green, indicates that the PopTop interlock is made. Note that if this interlock is not enabled via the Config>Turret screen (see Figure 3-6), this LED does not appear on the Diagnostics screen.

10.3 EBC Service Mode Screens

10.3.1 The Service>E-Beam Screen

Figure 10-4 shows the Service>E-Beam screen. Section 5.2.1 describes the features in the **HVPS** section of this screen, and section 5.2.2 describes the features in the **FPS** section. Table 10-1 correlates the screen's features to pins on the EBC's rear panel **HVPS CONTROL** and **FPS CONTROL** connectors.

Figure 10-4 The Service>E-Beam Screen

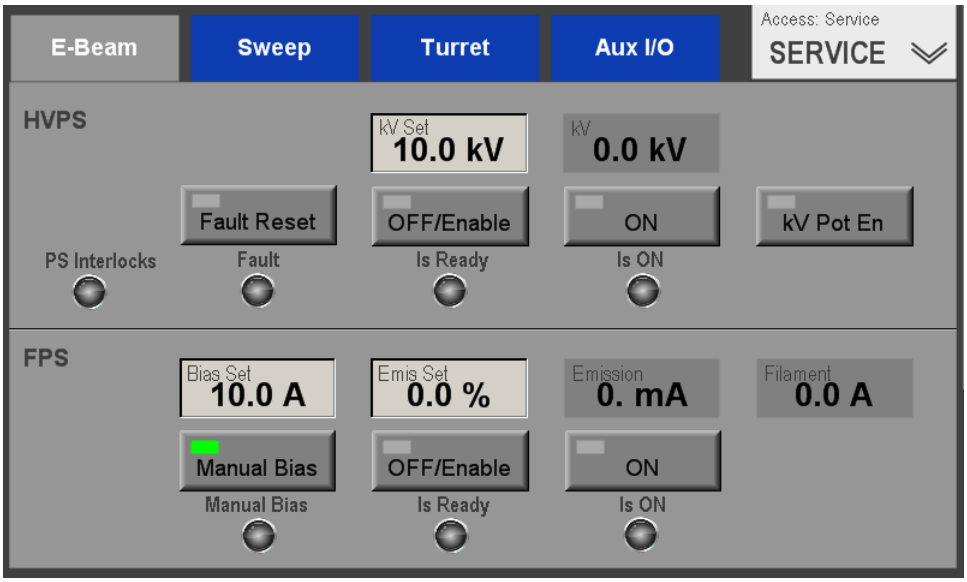


Table 10-1 Rear Panel Connector Pinout for Features on the Service>E-Beam Screen

HVPS Section. Pin numbers refer to pins on rear panel HVPS CONTROL connector.		
Feature on Service>E-Beam Screen	**Pin(s)**	**Signal Name (as indicated on 0620-7352)**
Fault Reset button and indicator rectangle	10,11	RESET+ (Pin 10) and RESET- (Pin 11)
Fault LED indicator	13	FAULT
kV Set user-entry box	1	KV SET
HV OFF/ENABLE button and indicator rectangle	17,18	HV OFF+ (Pin 17) and HV OFF- (Pin 18)
Is Ready LED indicator	14	READY
KV display rectangle	3	KV MON
ON button and indicator rectangle	8,9	HV ON+ (Pin 8) and HV ON- (Pin 9)
Is ON LED indicator	12	HV IND
HV Interlock LED indicator	24,25	REM INTLK IN (Pin 24) and REM INTLK OUT (Pin 25)

FPS Section. Pin numbers refer to pins on rear panel FPS CONTROL connector.		
Feature on Service>E-Beam Screen	**Pin(s)**	**Signal Name (as indicated on 0620-7352)**
Bias Set user-entry box	12	BIASSET
Manual Bias button and indicator rectangle	5	BIASSELECT
Manual Bias LED indicator	13	AUTOBIASIND
Emis Set user-entry box	10	EMISREQ
OFF/ENABLE button and indicator rectangle	6	GUNENABLE
Is Ready LED indicator	7	GUNISREADY

ON button and indicator rectangle	15	GUNGOON
Emis Current display rectangle	9	EMISMON
Is ON LED indicator	14	GUNISON
Filament display rectangle	11	IFIL

HVPS Section

The active features on this section of the Service>E-Beam screen enable the user to perform the following HVPS-related operations:

- change the kV output of the HVPS*
- assert and test the EBC's RESET FAULT output
- assert and test the EBC's HVPS OFF/ENABLE output
- assert and test the EBC's HV ON output

*Only if the EBC is connected to a PLC-based system controller via the rear panel **HVPS CONTROL** connector

The light-gray rectangles in the upper left-hand corners of the **Fault Reset, OFF/Enable,** and **ON** buttons turn green to indicate that the outputs in question are true at the EBC's rear panel **HVPS Control** connector. If the EBC is connected to a PLC-based system controller via the rear panel **HVPS CONTROL** connector, this screen's **Fault, Is Ready, Is ON,** and **HV Interlock** LEDs turn green when the corresponding inputs in question are true at that connector.

FPS Section

The active features in the **FPS** section of the Service>E-Beam screen enable the user to:

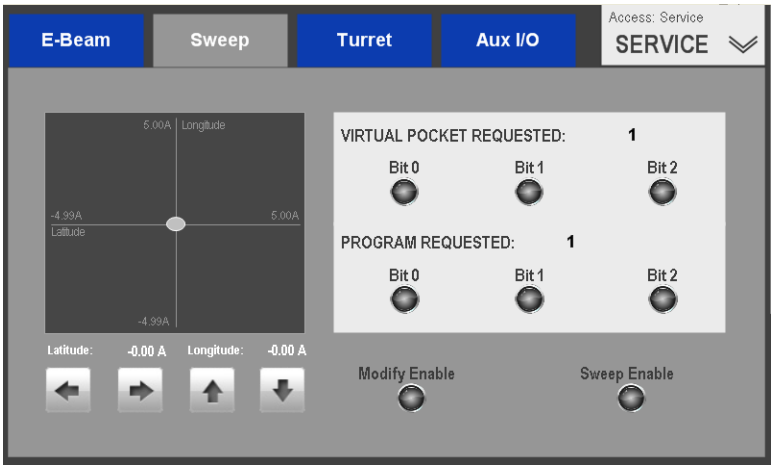
- change the bias current setpoint
- change the emission current setpoint
- assert and test the EBC's MANUAL BIAS output
- assert and test the EBC's GUN OFF/ENABLE output
- assert and test the EBC's GUN ON output

Note that the user can change values via the **Bias Set** and **Emis Set** boxes only if the EBC is connected to a PLC-based system controller via the rear panel **FPS CONTROL** connector. The **Emis Current** and **Filament** display boxes indicate the emission and filament current values only under the same conditions. Likewise, the **Manual Bias, Is Ready,** and **Is ON** indicate whether those inputs are true at the EBC's rear panel **FPS Control** connector only if that connector is cabled to a PLC-based system controller.

10.3.2 The Service>Sweep Screen

Figure 10-5 shows the Service>Sweep screen. The features within and below this screen's sweep pattern/beam position display grid function the same as the identical features on the Local>E-Beam screen. For detailed functional descriptions of those features, see section 4.4.1 of this manual.

Figure 10-5 The Service>E-Sweep Screen



The **Bit 1, Bit 2,** and **Bit 3** LEDs in the **PROGRAM REQUEST** section of this screen are operational only if the EBC is connected to a PLC-based system controller, in which case these LEDs turn green when the BCD-coded input(s) in question are true at the EBC's rear panel **SWEEPER CONTROL** connector. Likewise, the **Modify Enable** and **Sweep Enable** LEDs functions only if the EBC is connected to a higher-level, PLC-based controller. In that case, those LEDs are green when the input in question (i.e., either MOD ENABLE or SWP ENABLE) is true at the unit's rear panel **SWEEPER CONTROL** connector. Table 10-2 correlates these LED indicators to pins on the rear panel **SWEEPER CONTROL** connector.

Table 10-2 SWEEPER CONTROL Connector Pinout for LED Indicators on Service>Sweep Screen

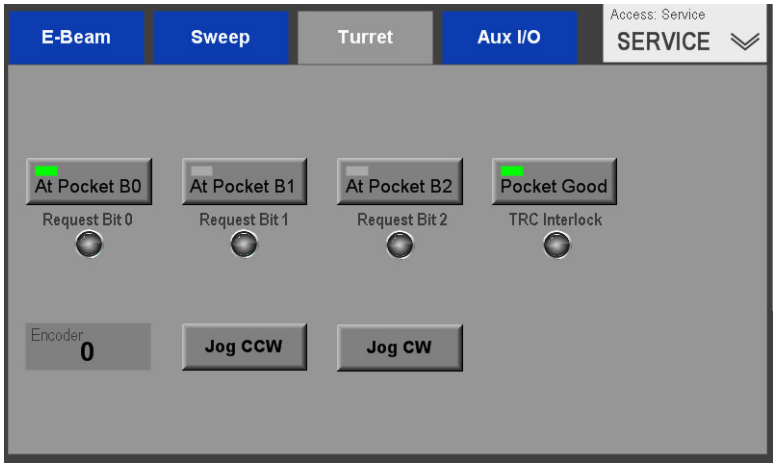
Feature on Service>Sweep Screen	Pin(s)	Signal Name (as indicated on 0620-7352)
Bit 0 LED indicator	3,4	SLCT1+ (Pin 3) and SLCT1- (Pin 4)
Bit 1 LED indicator	5,6	SLCT2+ (Pin 5) and SLCT2- (Pin 6)
Bit 2 LED indicator	7,8	SLCT3+ (Pin 7) and SLCT3- (Pin 8)
Modify Enable LED indicator	1,2	MOD ENABLE+ (Pin 1) and MOD ENABLE- (Pin 2)
Sweep Enable LED indicator	10,11	SWP ENABLE+ (Pin 10) and SWP ENABLE- (Pin 11)

10.3.3 The Service>Turret Screen

Figure 10-6 shows the Service>Turret screen. The buttons on this screen provide the following command functions.

- The **Jog CW** button enables user to jog turret clockwise
- The **Jog CCW** button enables user to jog turret counterclockwise
- The **At Pocket B0, At Pocket B1,** and **At Pocket B2** buttons allow user to assert and test BCD-coded pocket-select inputs 0, 1, and 2
- The **Pocket Good** button enables the user to assert and test the POCKET GOOD input

Figure 10-6 The Service>Turret Screen



The rectangles in the upper left-hand corners of the **At Pocket B0, At Pocket B1, At Pocket B2,** and **Pocket Good** buttons turn green to indicate that the input(s) in question are true at the EBC's rear panel **INDEXER CONTROL** connector. If the EBC is connected to a PLC-based system controller, the **Request Bit0, Request Bit1, Request Bit2,** and **TRC Interlock** LEDs turn green when the inputs in question are true at the same rear panel connector. Table 5-3 correlates these active on-screen features to pins on the **INDEXER CONTROL** connector.

Table 10-3 INDEXER CONTROL Connector Pinout for Features on Service>Turret Screen, Except for *Encoder, Jog CCW,* and *Jog CW*

Feature on Service>Turret Screen	Pin	Signal Name (as indicated on 0620-7352)
At Pocket B0 button and indicator rectangle	9	POS0+
At Pocket B1 button and indicator rectangle	4	POS1+
At Pocket B2 button and indicator rectangle	8	POS2+
Pocket Good button and indicator rectangle	5	PGOOD
Request Bit 0 LED indicator	1	SEL0-
Request Bit 1 LED indicator	2	SEL1-
Request Bit 2 LED indicator	7	SEL2-
TRC Interlock LED indicator	3	ILCK-

10.3.4 The Service Aux I/O Screen

Figure 10-7 shows the Service Aux I/O screen. The LED indicators in the **Interlocks** section of this screen display the status of gun/HV interlock inputs at the rear panel **AUX I/O** connector. The buttons in the **FPS** and **HVPS** sections enable the user to test the **Is Ready** and **Is ON** inputs at the same rear panel connector. Table 10-4 correlates these screen features to pins on the **AUX I/O** connector. Note that the features in the **Shutter** section of this screen are not currently implemented.

Figure 10-7 The Service>Aux I/O Screen

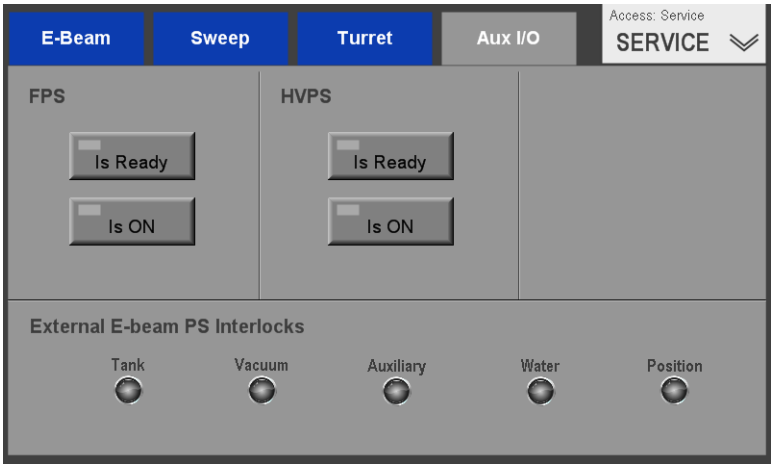


Table 10-4 AUX I/O Connector Pinout for Active Features on the Service>Aux I/O Screen

Feature on Service>Aux I/O Screen	Pin(s)	Signal Name (as indicated on 0620-7352)
[FPS] Is Ready button and indicator rectangle	28,10	DO1A (Pin 28) and DO1B (Pin 10)
[FPS] Is On button and indicator rectangle	29,11	DO2A (Pin 29) and DO2B (Pin 11)
[HVPS] Is Ready button and indicator rectangle	30,12	DO3A (Pin 30) and DO3B (Pin 12)
[HVPS] Is On button and indicator rectangle	31,13	DO4A (Pin 31) and DO4B (Pin 13)
Tank LED indicator	20	DI1
Vacuum LED indicator	2	DI2
Auxiliary LED indicator	21	DI3
Water LED indicator	3	DI4
Position LED indicator	22	DI5

The LED indicators in the **Interlocks** section of this screen are operational only if the appropriate pins on the **AUX I/O** connector are connected to external interlock switches. In that case, each LED is green when the corresponding interlock input is true and gray when that input is false. However, if these interlock inputs are jumpered, all five LEDs are always green.

10.4 Alarm Messages

Table 10-5 Alarm Messages

Alarm Text	Explanation
Power Supply Faulted Alarm	Any one of the latching HVPS faults has occurred.
HV Not Ready Timeout	After issuing the HV GO ON signal, the EBC failed to receive the HV READY signal from the HVPS within 3 seconds.

Alarm Text	Explanation
HV Go On Timeout	After receiving the HV READY signal, EBC failed to receive the HV ON signal from the HVPS within some 3 seconds.
HV Is On Failure	After HV IS ON was received from the HVPS, that signal was lost by the EBC, meaning that the HV was switched off due to a latching HVPS fault.
HVPS Interlock Not True	Signal (input or output?) is not true at Pin 25 [or is it Pin 24?] of the rear panel HVPS Control connector.
Gun Go On Timeout	After issuing the GUN GO ON signal, the EBC failed to receive the GUN IS ON signal from the FPS within 3 seconds.
Gun Is On Failure	After the GUN IS ON signal was received from the FPS, that signal was lost by the EBC, meaning that the gun was switched off due to a fault.
Gun Ready Interlock	EBC is prevented from issuing the GUN READY output because the user has commanded the turret to rotate. Turret then rotates to the target pocket, after which the EBC automatically issues the GUN READY output, assuming that state is still true.
Gun Go On Interlock	EBC is prevented from issuing the GUN GO ON signal because the user has commanded the turret to rotate. Turret then rotates to the target pocket, after which user must touch the GUN GO ON command to switch gun on.
Gun Is On Interlock	EBC has switched off the gun because the user has commanded the turret to rotate. Turret then rotates to the target pocket, after which user must touch the GUN GO ON command to switch gun back on.
FPS Interlock Not True	[Explanation to be supplied]
Encoder Home Position Not Found	During the configuration procedure, the encoder's Home position could not be found.
Turret Not Configured	Turret not yet configured; issued only during one phase of turret configuration.
Turret Failed to Find Position	During turret rotation in Local mode operation, the encoder position for the target pocket could not be found.
Turret Position Is Not Valid	Turret has rotated to an encoder position that does not correspond to any encoded pocket home position.
POCKET GOOD Signal Not True	[Explanation to be supplied]
Turret Is Rotating Interlock	EBC cannot switch on the gun because turret is rotating.
Turret Servo Position Fault	Turret motor has been switched off and encoder's target value has been lost, usually because user has manually rotated the turret too far out of the target position. Fix is to acknowledge the alarm and command the turret to rotate to another target pocket.
Turret Interlock Input Not True	Turret cannot be rotated because the ILCK input at Pin 3 of the EBC's rear panel Indexer Control connector is not true.
Sweep Interlock Position Limit Fault	EBC has turned off the gun because the beam has gone beyond on of the user-programmed position limits.
Sweep Position Interlock	External POSITION interlock input is not true.

Alarm Text	Explanation
Fault	
Water Supply Interlock Fault	External WATER interlock input is not true.
Aux Interlock Fault	External AUX interlock input is not true.
Vacuum Interlock Fault	External VACUUM interlock input is not true.
Tank Interlock Fault	External TANK interlock input is not true.
FPS Module Lost Communication	Communication has been lost between the FPS control module and the EBC's mother board.
HVPS Module Lost Communication	Communication has been lost between the HVPS control module and the EBC's mother board.
Turret Module Lost Communication	Communication has been lost between the turret control module and the EBC's mother board.
Sweep Module Lost Communication	Communication has been lost between the sweep control module and the EBC's mother board.
Sweep Communication Not OK Interlock	EBC cannot switch on gun because Alarm #29 has been issued. This alarm is also issued if gun was on when Alarm #29 was issued.

11 Maintenance Procedures

11.1 Section Overview

This section describes the main UI screens dedicated that aid in troubleshooting procedures. The subsections are:

Section 11.2 Replacing a Control Module

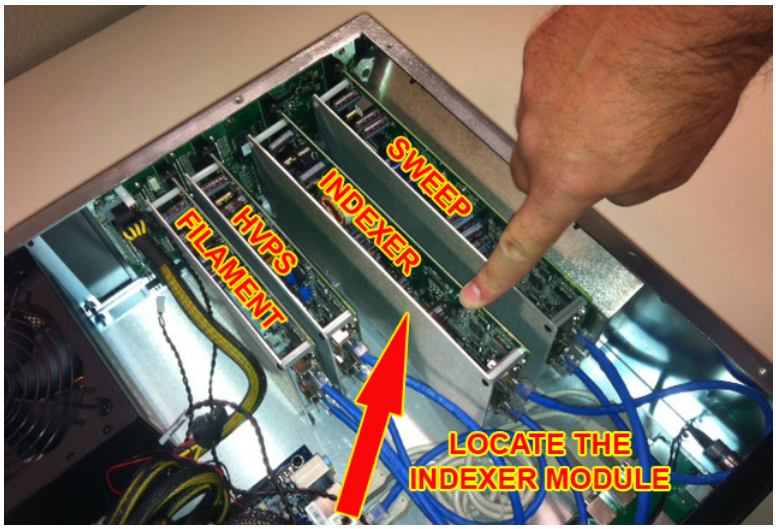
Section 11.3 Replacing the Hard Drive

11.2 Replacing a Control Module

This section describes how to replace one of the EBC's four control modules, taking the Indexer Control module as an example.

Step	Action
1	Use the EBC's rear-panel On/Off switch (see Figure 2-8) to power down the unit
2	Unplug the power cable from its rear panel receptacle.
3	Detach all cables and the ground wire from the EBC rear panel.
4	Remove the 10 screws securing the unit's top cover to its chassis and remove the top cover.
5	Referring to Figure 11-1, identify the control module that you wish to remove.

Figure 11-1 Idetification of EBC Control PCBs



6 Unplug the top and bottom cables that are connected to the target module (see Figures 11-2 and 11-3). Label these as Top and Bottom.

Figure 11-2 Unplugging the Upper Cable from the Indexer Control Module

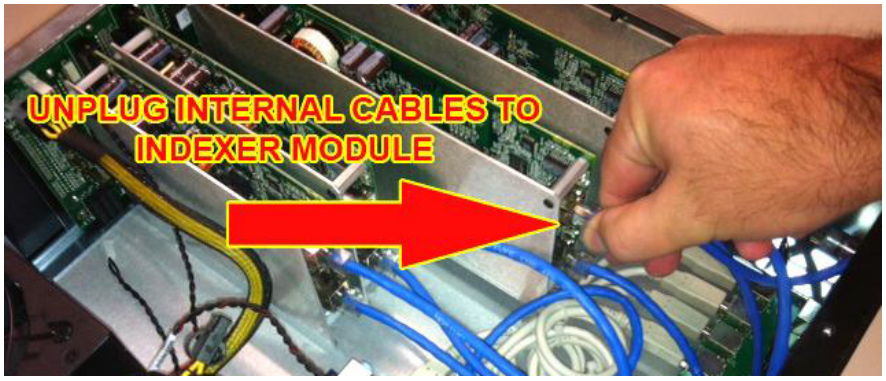
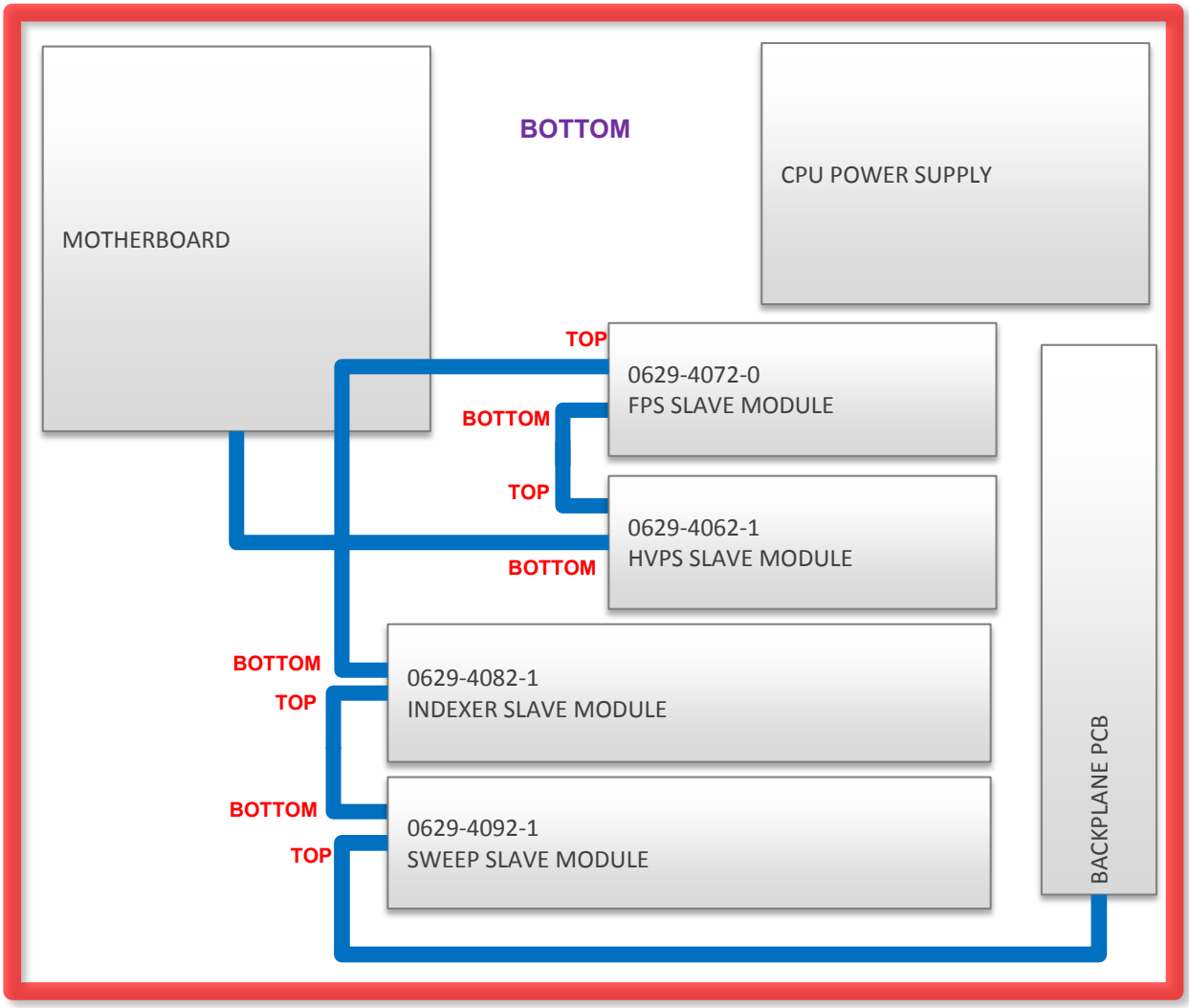
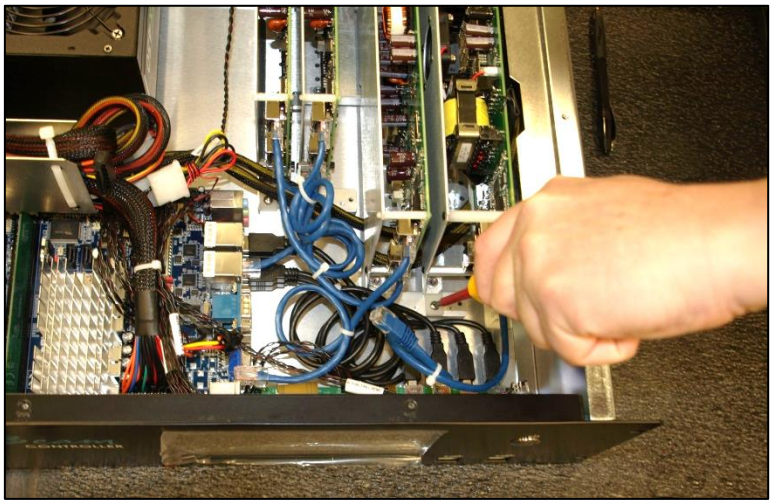


Figure 11-3 EtherCat Connections Between Internal EBC Components



7 Remove the screw that secures the control module you are replacing to the base of the EBC chassis (see Figure 11-4).

Figure 11-4 Removing Screw Securing Control Module in Place



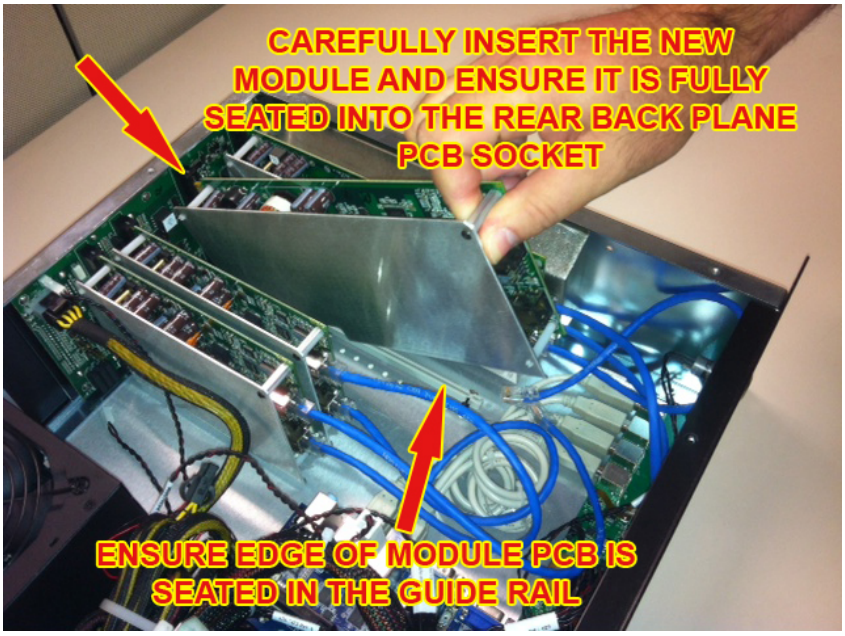
8 Grasp the control module by its upper front standoff and carefully lift the module out of the chassis, as shown in Figure 11-5.

Figure 11-5 Removing the Control Module from the EBC Chassis

9 Carefully install the new control module (see Figure 11-6), ensuring that the bottom of the PCB is properly seated in the guide rail.

NOTE
Make sure that the PCB is fully seated in its socket in the back plane.

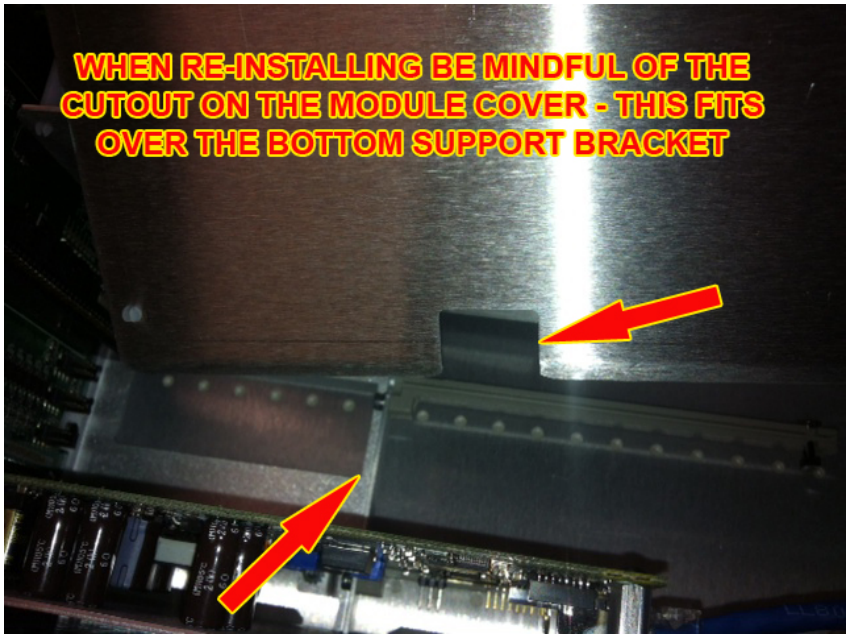
Figure 11-6 Installing the New Control Module



NOTE

Figure 11-7 shows the cutout in the bottom of the module's metal case. This cutout fits over the support rail in the bottom of the EBC chassis.

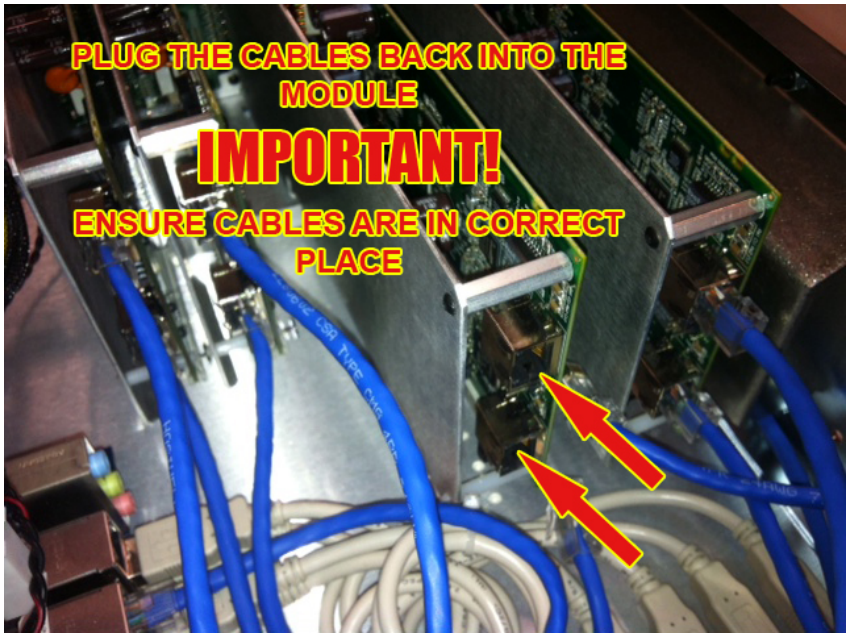
Figure 11-7 Cutout in Bottom of Control Module



10 Plug the cable into the connectors near the top and bottom of the control module (see Figure 11-8).

NOTE
Make sure each cable is plugged into the correct connector.

Figure 11-8 Plugging Cables into the New Control Module



11 Replace the screw that you removed in Step 7 of this procedure.

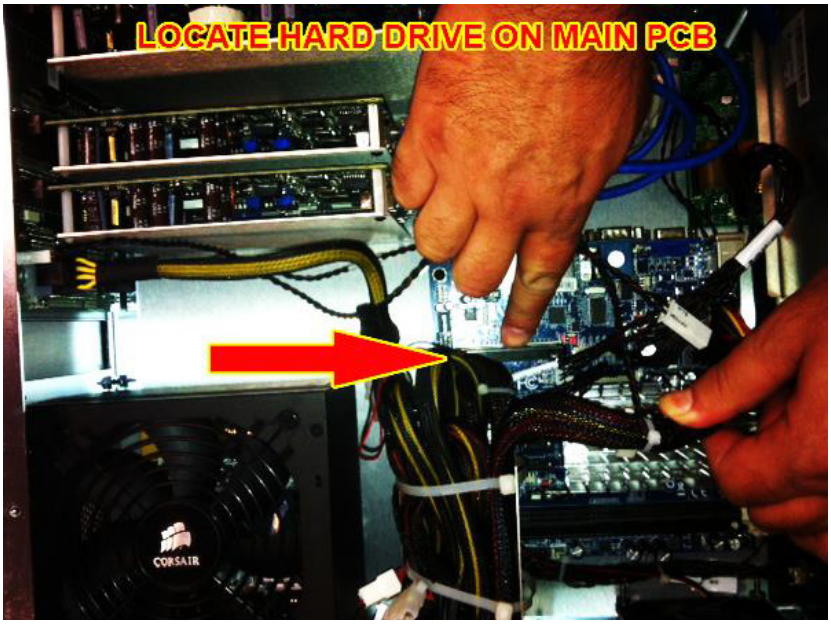
12 If the maintenance procedure is completed, reverse Steps 1-4 of this procedure (in reverse order) and resume EBC operation.

11.3 Replacing the Hard Drive

Follow the steps described below when replacing the unit's hard drive.

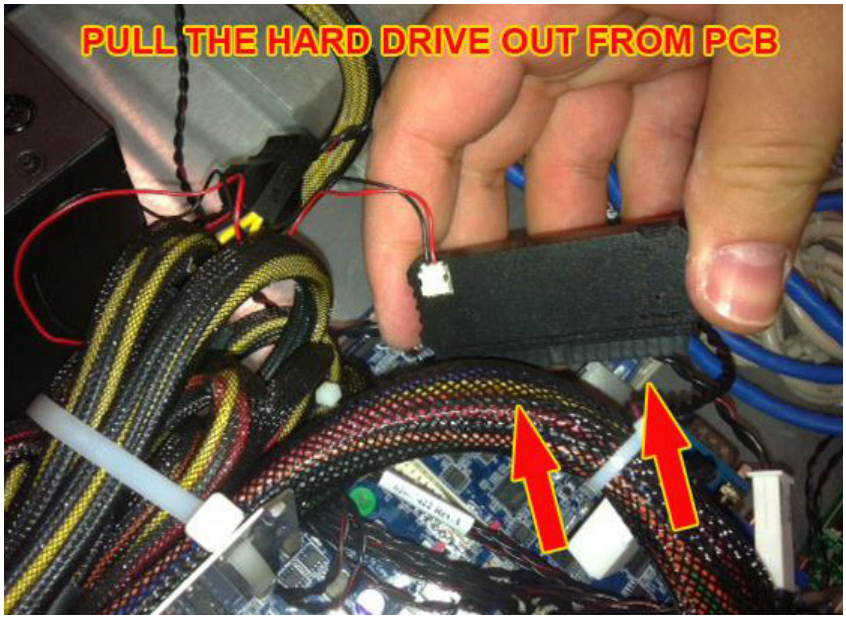
Step	Action
1	Use the EBC's rear-panel On/Off switch (see Figure 2-8) to power down the unit
2	Unplug the power cable from its rear panel receptacle.
3	Detach all cables and the ground wire from the EBC rear panel.
4	Remove the 10 screws securing the unit's top cover to its chassis and remove the top cover.
5	Locate the hard drive, which is plugged into the mother board (see Figure 11-9).

Figure 11-9 Location of Hard Drive on Mother Board



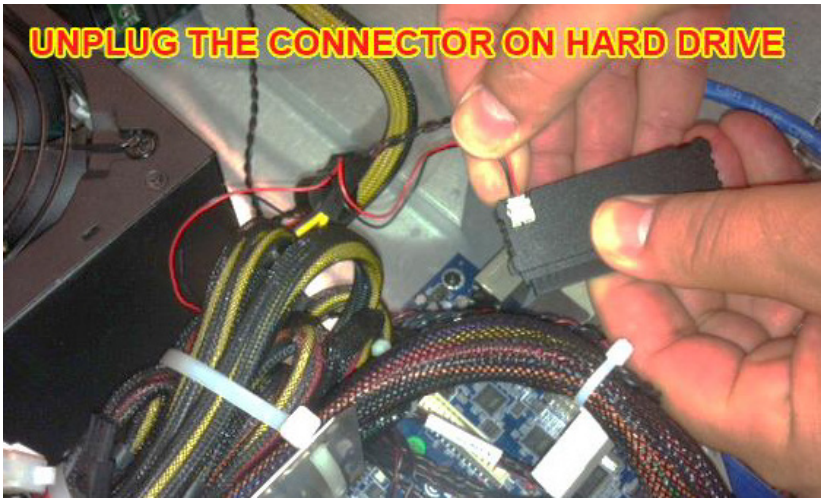
6 Remove the hard drive from the mother board. To do so, grasp both sides of the hard drive and pull it straight up and out of its socket (see Figure 11-10).

Figure 11-10 Removing the Hard Drive from the Mother Board



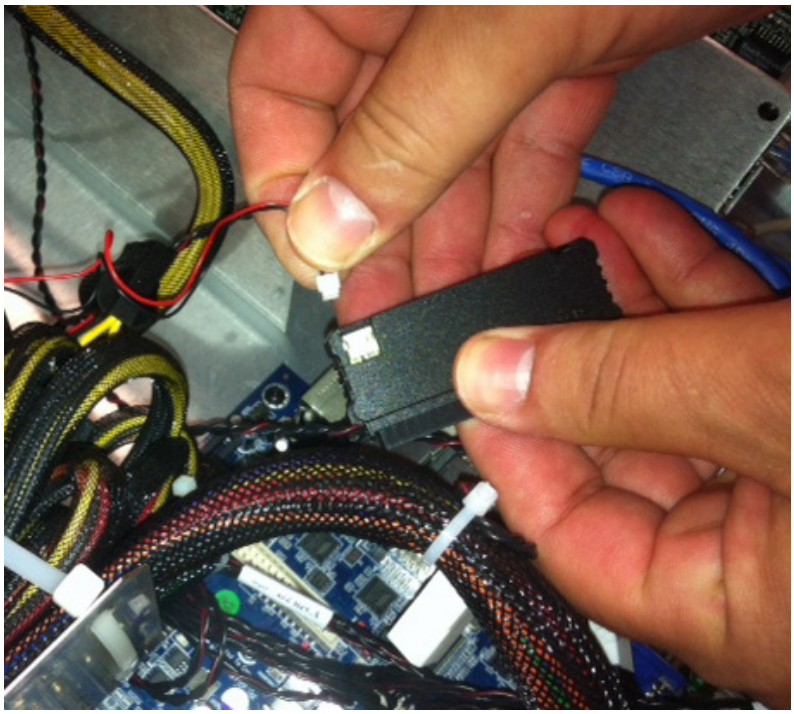
7 Unplug the cable that is plugged into the top of the hard drive (see Figure 11-11).

Figure 11-11 Unplugging the Hard Drive Cable



8 Plug the hard drive cable into the cable on the new hard drive (see Figure 11-12).

Figure 11-12 Plugging the Hard Drive Cable into the New Hard Drive



9 Plug the new hard drive into its socket in the motherboard, as shown in Figure 1-13.

NOTE
Be aware that the hard drive and the socket are both keyed, and make sure that these keyed are properly lined up, as it is possible to misalign the pins.

Figure 11-13 Plugging the New Hard Drive into its Socket in the Mother Board

10 Double-check to verify that the hard drive is properly seated in its socket.

11 If the maintenance procedure is completed, reverse Steps 1-4 of this procedure (in reverse order) and resume EBC operation.