0101-9028-0

Temescal

# TemEbeam Controller Technical Manual


FerroTec

**Revision N, December 2020**

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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. | Sept2 012 | 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. | Table incorrect in previous revs. | 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 |
| J | Added new Sections 9 and 10 and Appendices A and B to cover EtherCAT and RS-232 configuration and oper-ration. Renumbered former Sections 9-11 as Sections 11-13. Added Section 4.5.4 to cover configuration of Custom crucibles. Added section 2.9 to describe backup and restore function. Updated Section 4.6 to cover revised **kV Control, Bias Mode,** and **Emis Control** options. Added Section 4.8 to cover configuration of Profiles. Updated screen illustrations throughout. | Applies to units with EBC control software version 2.8.08 and the following control module firmware versions:<br>HVPS: 1.3.6.<br>FPS: 1.5.6.<br>Turret: 1.5.6.<br>Sweep: 2.0.107 | Feb. 2019 | IA |
| K | Inserted new safety warning on page 7-3 pertaining to Figures 7-2 and 7-3. | Figures 7-2 and 7-3 pertain only to systems with PopTop e-guns. | April 2019 | IA |
| L | Section 11 extensively revised to incorporate revised Master/Slave procedures. | Applies to all units with software Revision 3.9.4 | Nov. 2019 | IA |
| M | Revised Section 8 as follows to indicate how pocket selection works when the Turret Control module is configured for a Custom crucible: Added Tables 8-6 through 8-9; renamed Tables 8-2 through 8-5; revised the Description in Row 1 of Table 8-1; added 3 paragraphs following Table 8-1. | Notification of necessary revisions from Temescal Software Engineering | Feb. 2020 | IA |
| N | Reorganized and revised portions of sections 3.3.1 and 3.4.2. Modified section 11.2. Filled in blanks in Table 12.5. Created new sections 13.3.1 and 13.3.2. | Updated information from Temescal Engineering. | Dec. 2020 | 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.

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|---|---|
| 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

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| | |
|---|---|
| i. For completed custom/modified product rescheduled | 1.5% per month x sales price of product |
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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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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 HEREIN. 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.

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   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 product line 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. Prevent 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

## What's In This Manual . . .

This manual covers EBC installation and operation across all possible applications, including:

- Stand-alone operation
- Operation under the control of XTC/3S and XTC/3M deposition controllers
- Operation under the control of a PLC-based system controller

Sections 1 and 2 provide an introduction to the EBC and a general functional overview of its main display screen and hand-held controller.

Sections 3 and 4 describe basic installation and configuration procedures. The installation procedures in Section 3 apply to all installation types (i.e., stand-alone, deposition controller controlled, and PLC controlled). The configuration procedures in Section 4 apply to stand-alone installations and, with minor modifications to deposition controller controlled and PLC controlled installations.

Section 5 describes stand-alone EBC operation in Operations and Manual modes. Sections 6 and 7 describe EBC installation, configuration, and operation when the unit is to be under the control of a deposition controller. Section 6 describes the XTC/3S case, and Section 7 describes the XTC/3M case.

Sections 8, 9, and 10 describe EBC installation, configuration, and operation when the unit is to be under the control of a PLC-based system controller. These three sections cover installation cases that differ depending on the communication medium between the EBC and the PLC. Section 8 covers installations in which EBC-PLC communications are transmitted/received via the EBC's rear-panel sub-D connectors. Section 8 applies to installations in which EBC-PLC communications are transmitted/received via an EtherCAT link, and Section 9 covers installation in which those communications and handled via an RS-232 link.

Section 11 describes how to configure dual EBC units for Master/Slave operation.

Section 12 describes how to use the EBC's Service mode screens and is Details screen in troubleshooting procedures.

Section 13 describes two maintenance procedures, replacement of control module PC boards and replacement of the unit's hard drive.

# 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 functional elements of an e-beam deposition system:

- the electron beam power supply, specifically, Temescal CV-6SLX and CV-12SLX power supplies
- electron beam position in e-guns capable of +4 A to –4 A coil current output
- rotation control over any compatible e-beam source with up to 60 conventional circular pockets, turrets with banana-shaped pockets, continuous-trough crucibles, and 'skillet'-type evaporant holders

The EBC can be configured to operate as a stand-alone controller or to operate under the control of XTC/3S and XTC/3M deposition controllers as well as PLC-based system controllers. The unit can be configured to communication with such a PLC-based controller via the EBC's rear-panel sub-D connectors or via EtherCAT or RS-232 links.

## 1.2.2 Input Power Requirements

Min. = 100 VAC, 6.3 A @ 47-63 Hz. Max. = 240 VAC, 3.15 A @ 47-63 Hz

## 1.2.3 Main Components

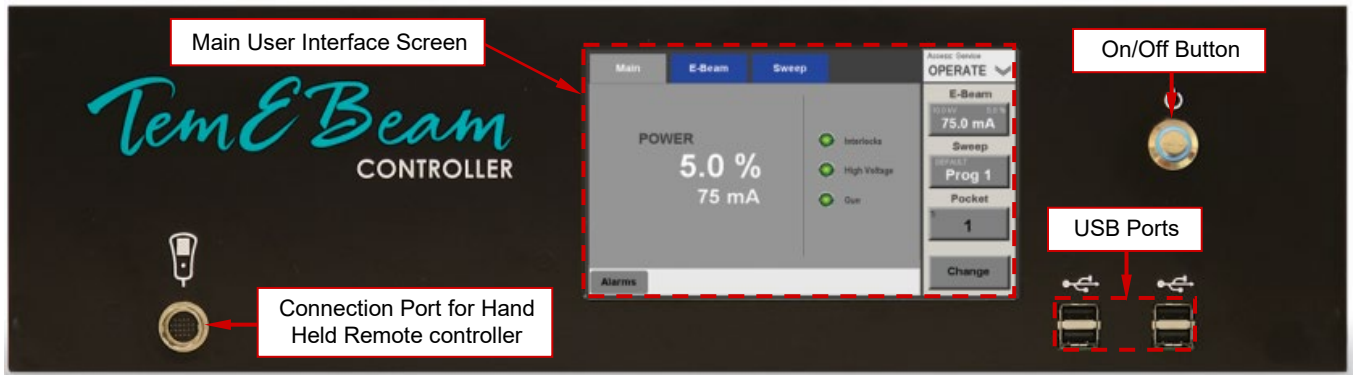
The main components of the TemEbeam Controller are its rack-mountable main control unit and its hand-held remote controller (see Figure 1-2). Figure 3.4 shows its rear-panel.

**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

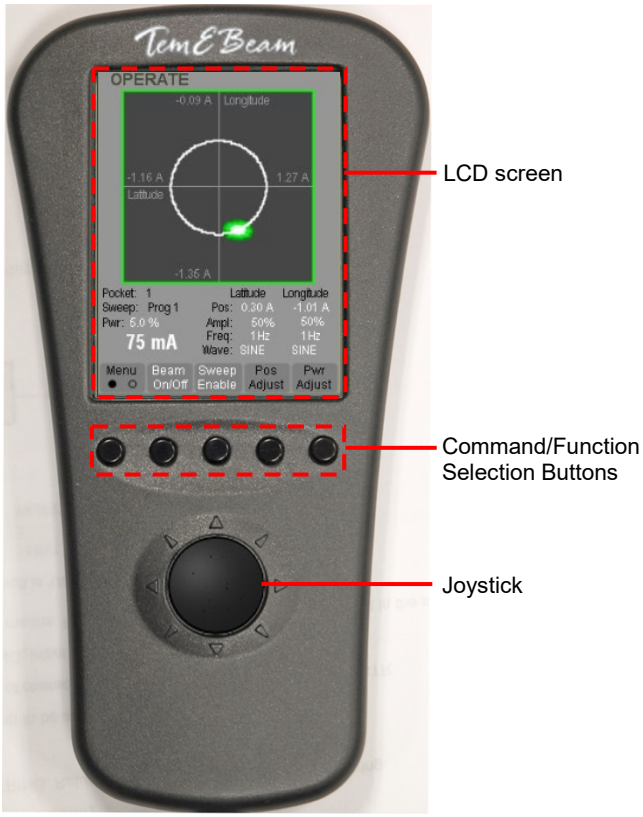
The main function of the hand-held remote controller is to enable the user to configure sweep patterns while observing actual beam motion through a viewport. The control/display features of the hand-held controller (see Figure 1-3) are:

- 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

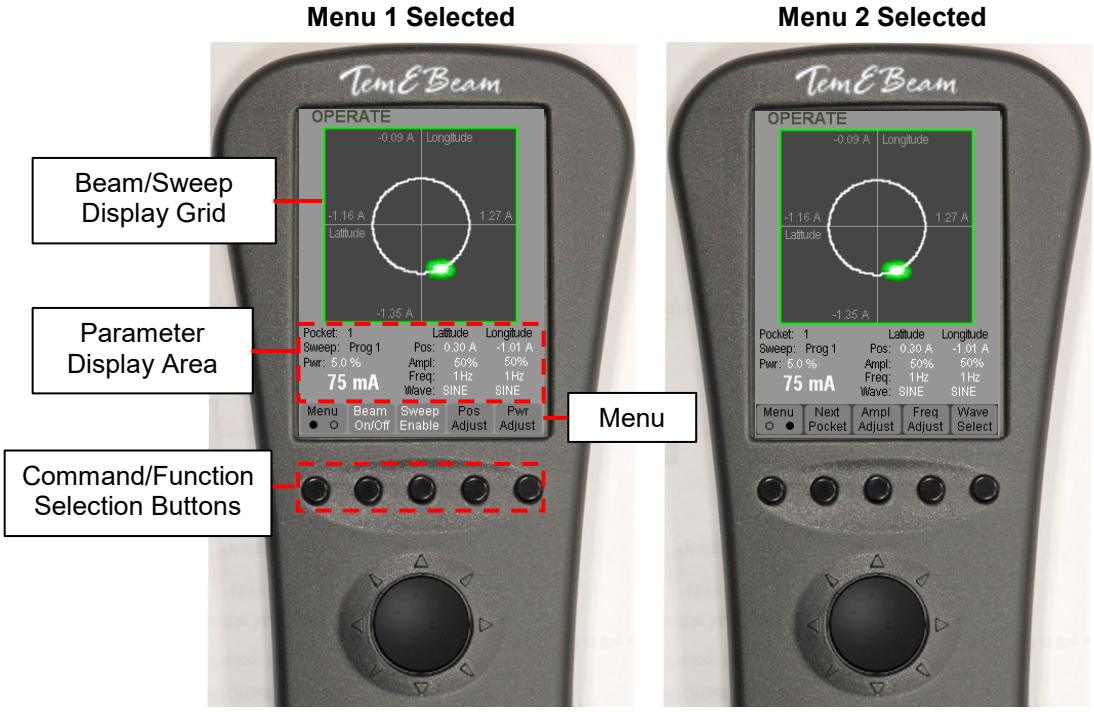
For a detailed functional description of the touch screen, see section 2.5.

## 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 1-4 shows the remote controller's LCD screen as it appears in Operations mode. Figure 1-4 also shows the three functional areas into which the LCD screen is organized. Figure 1-5 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 1-4 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 1-4). When the unit is in Configuration mode, this segment allows the user to select Menu 1, 2, or 3, as shown in Figure 1-4. 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 1-5. 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 1-5 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**, **EtherCAT,** or **RS-232**, the command buttons on the hand-held controller related to the functions controlled by that module 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 1-4) 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 1-5). When the EBC is in Operations Mode, clicking the remote controller's **Menu** button toggles between the two menus shown in see Figure 1-4.

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 details about the functioning of these buttons in Operations and Configuration Modes, see sections 3 and 4, 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 section 5.5. For information about its functions in Configuration mode, see sections 4.5.6.

## 1.5 EBC Operating Modes

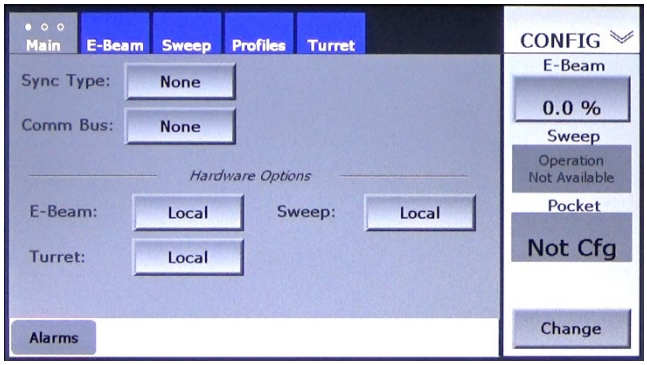
The EBC's operating modes are Configuration Mode, Operations Mode, Service Mode and Manual Mode. EBC operation in these modes is described briefly below. For detailed information about EBC operation in Operations mode, see Section 5. For details about the use of Configuration mode, see Section 4. See section 12.3 for detailed information about Service mode.

### 1.5.1 Configuration Mode

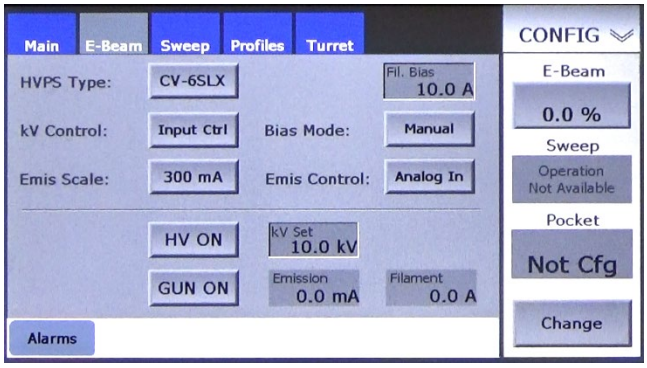
The EBC's Configuration mode enables the user to set the system date and time, to configure the E-Beam, Turret, and Sweep control modules, to configure Profiles, and to enable the log-in manager and assign user passwords and permissions. Basic configuration procedures are described in Section 4. Figure 1-6 shows how Configuration screens appear when all control modules are configured as **Local**.

**Figure 1-6 Configuration Mode Screens When All Control Modules Are Configured as Local**

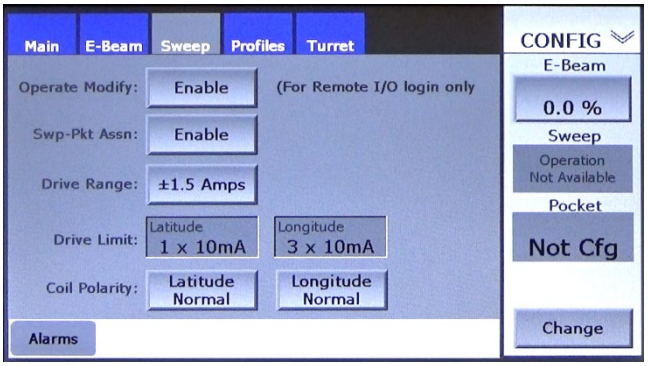
**Config>Main Screen**



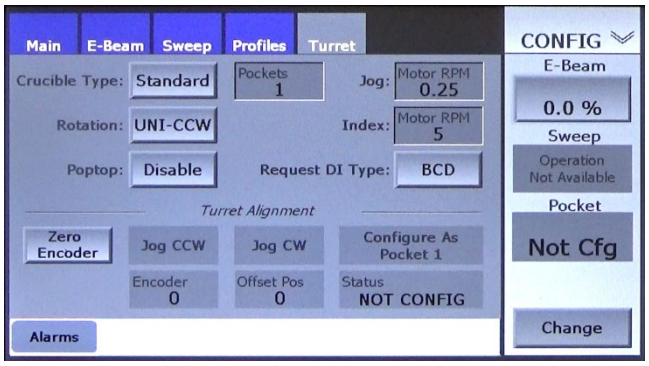

**Config>E-Beam Screen**



**Config>Sweep Screen**

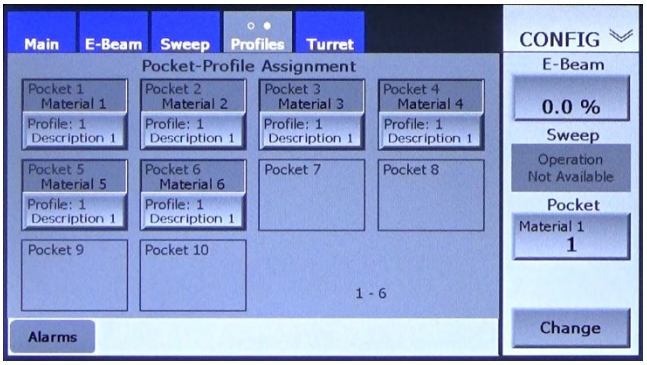



**Config>Turret Screen**

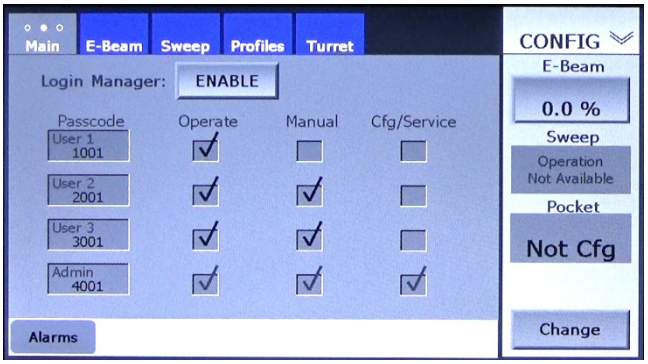



**Profiles Screen, Page 1**

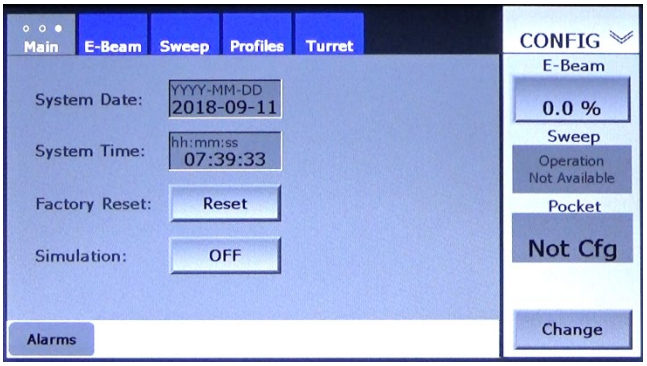

**Profiles Screen, Page 2**




**LogIn Manager Screen, Login Manager Enabled**




**System Date/Time Page**




In Configuration Mode, the Command Button Bar (see Figure 2-11) allows the user to:

- switch the beam and the sweeper on and off
- determine the emission current output
- select sweep programs
- rotate the turret.

For more complete information 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 1-7 shows the Operations mode screens when all 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:

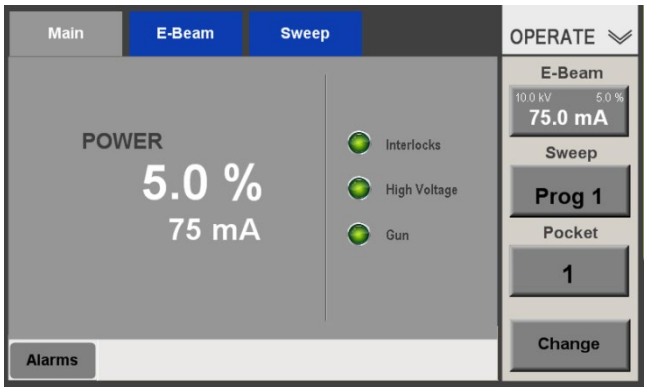
- switch the beam and the sweeper on and off
- determine the emission current output
- select sweep programs
- rotate the turret.

For complete information about EBC operation when all control modules are configured as **Local**, see Section 5. For information about EBC operations with a single-layer deposition controller, see Section 6. For information about operation with a multilayer deposition controller, see Section 7. For information about EBC operation under the control of a PLC-based system controller, see:

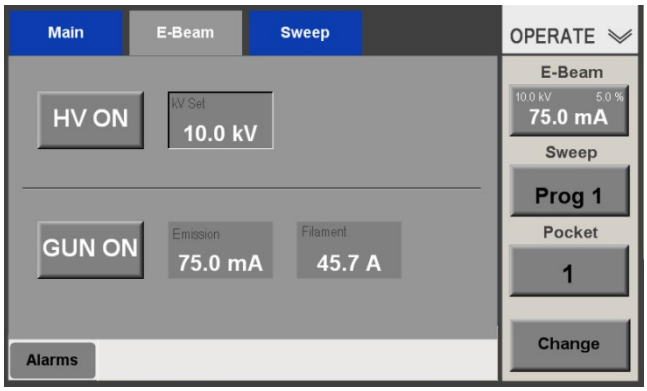
- Section 8 if EBC-PLC communication is via EBC rear-panel sub-D connectors
- Section 9 if EBC-PLC communication is via EtherCAT link
- Section 10 if EBC-PLC communication is via RS-232 link.

**Figure 1-7 Operations Mode Screens, All Control Modules Configured as *Local***

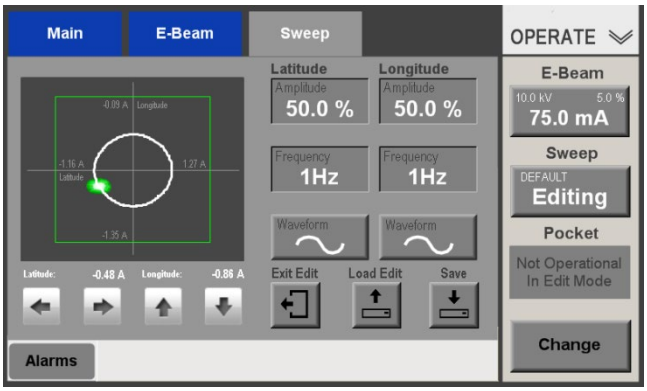
**Operations>Main Screen**




**Operations>E-Beam Screen**




**Operations>Sweep Screen**

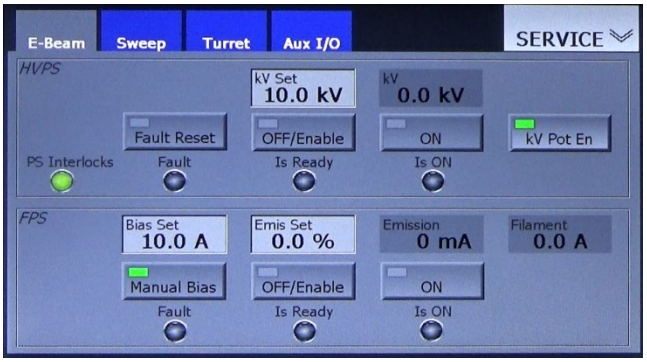



## 1.5.3 Service Mode

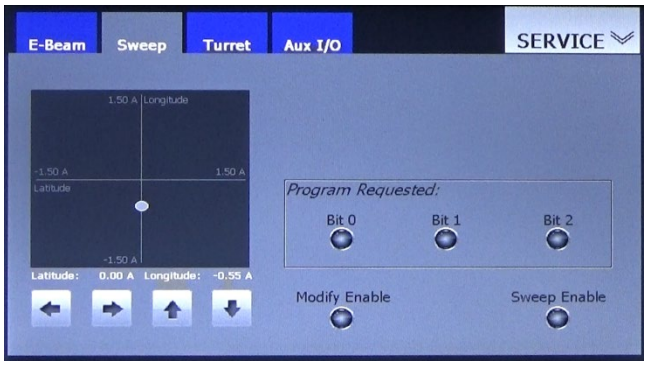
Figure 1-8 shows the Service mode screens.

**Figure 1-8 Service Mode Screens**

**Service>E-Beam Screen**

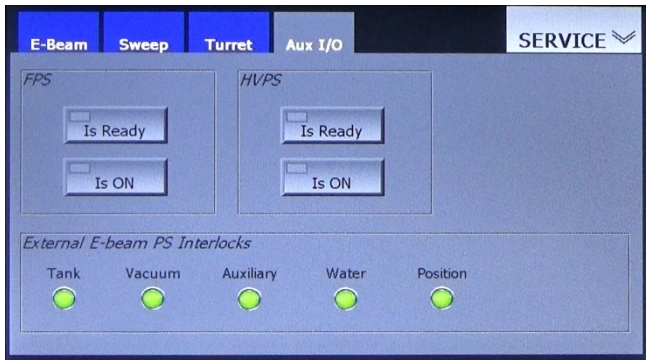



**Service>Sweep Screen**




**Service>Turret Screen**


**Service>Aux I/O Screen**




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 EBC is connected to such a control system.

The Service>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 the use of Service mode screens, see section 12.3.

### 1.5.4 Manual Mode

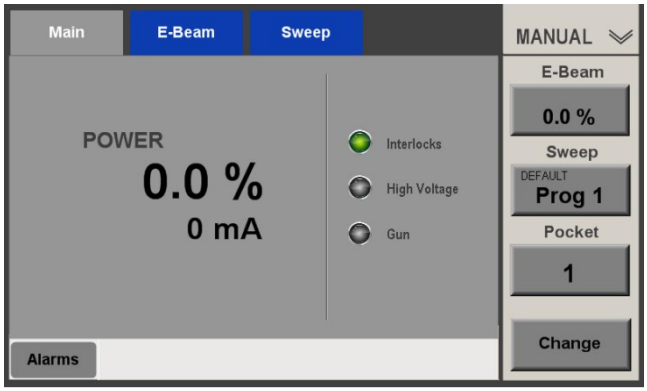
Figure 1-9 shows the Manual mode screens, which permit user control when one or more control modules are configured as **Remote I/O**, **EtherCAT,** or **RS-232**. Selection of Manual mode locks out all control inputs from any higher-level controller, whether a deposition controller or a PLC-based system controller. When the EBC is in Manual mode, a control module configured as

either **Remote I/O, EtherCAT,** or **RS-232** functions as though it were in configured as **Local** and in Operations mode.

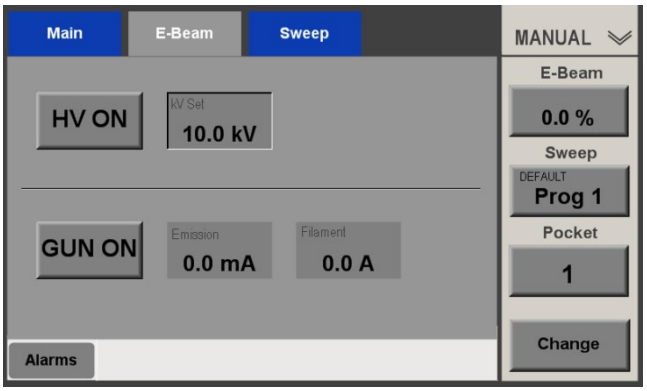
Users wishing to employ the full functionality of Manual mode must take care not to do so during recipe processing, as switching EBC modes during a process run will abort the process.

**Figure 1-9 Manual Mode Screens**

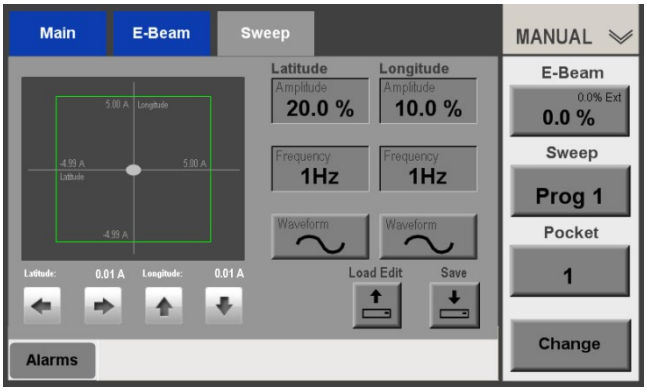
**Manual Mode Main Screen**




**Manual Mode E-Beam Screen**



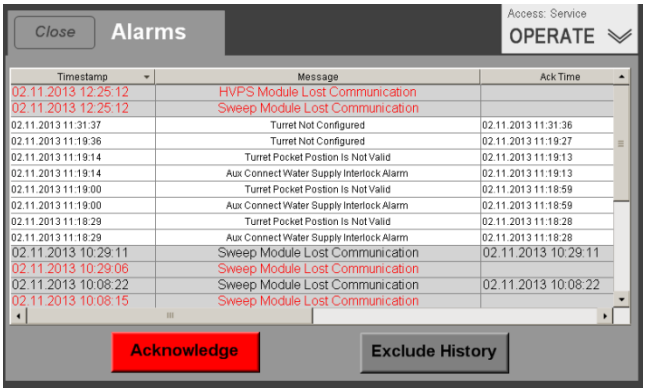

**Manual Mode Sweep Screen**




## 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 1-10), the Details screen (see Figure 1-11), and the Software/Firmware Version ID screen (see Figure 1-12).

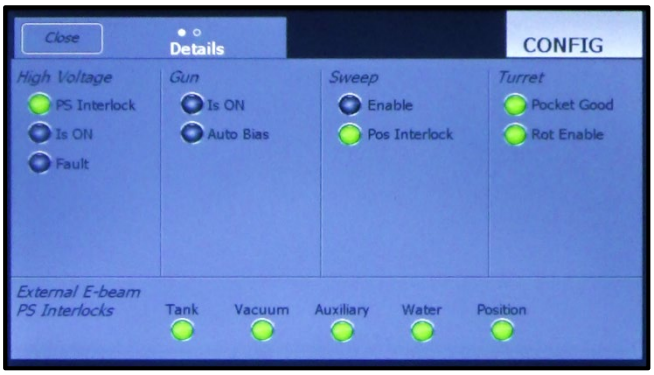
**Figure 1-10 The Alarms Screen, *Include History* Selected**




The Alarms and Details screens are available in all EBC operating modes except for Service Mode. The Software/Firmware Version ID screen is page 2 of the Details screen. For detailed information about the Alarms screen and procedures for responding to alarms, see section 2.8. For detailed information about the Details screen, see section 12.2.

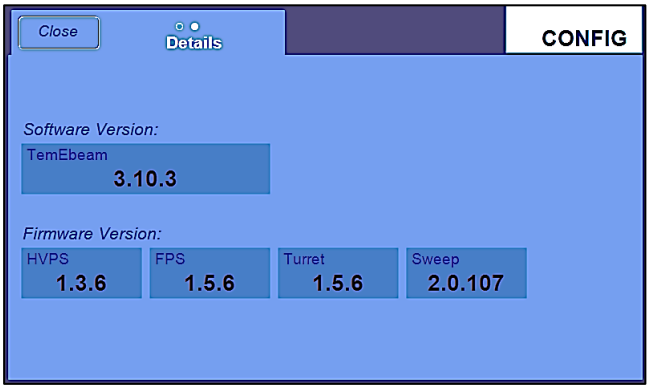
**Figure 1-11 The Details Screen**

**All Control Modules Configured as Local**




**All Control Modules Configured as Remote I/O**


**Figure 1-12 The Software/Firmware Version ID Screen (Details Screen, Page 2)**



# 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 menu screen shown in Figure 2-3.

**Figure 2-1 Rear Panel On/Off Switch**

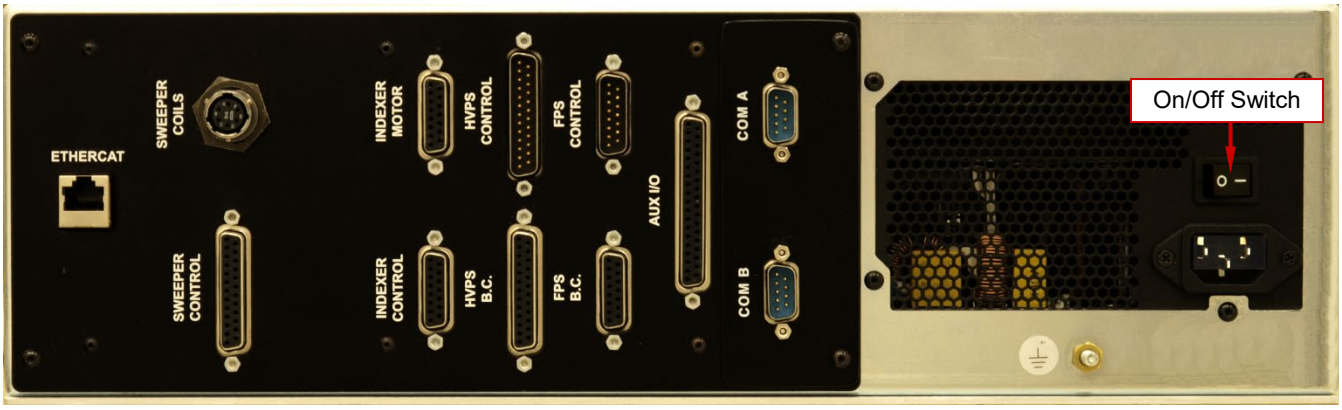
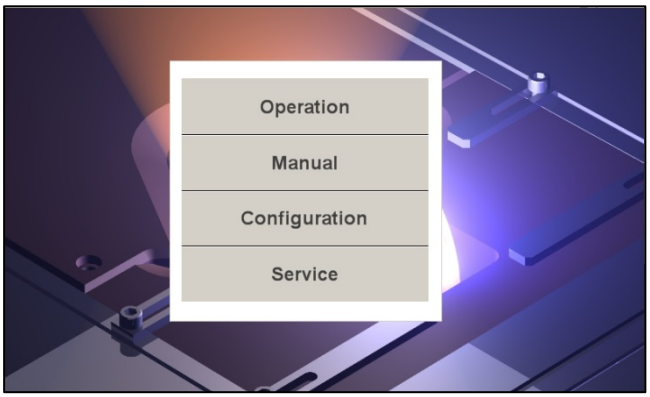



**Figure 2-2 Front Panel On/Off Switch**


**Figure 2-3 EBC Menu Screen upon Initial Boot-Up**



# 2.3 Logging In and Logging Out

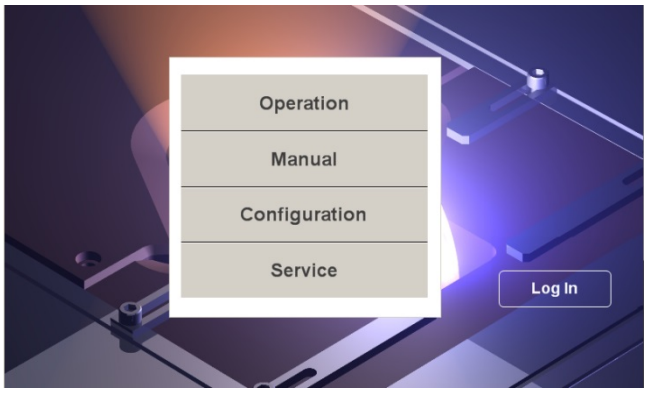
## 2.3.1 Entering the System when the LogIn Manager Is Disabled

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 menu screen.

## 2.3.2 Logging In When the LogIn Manager Is Enabled

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

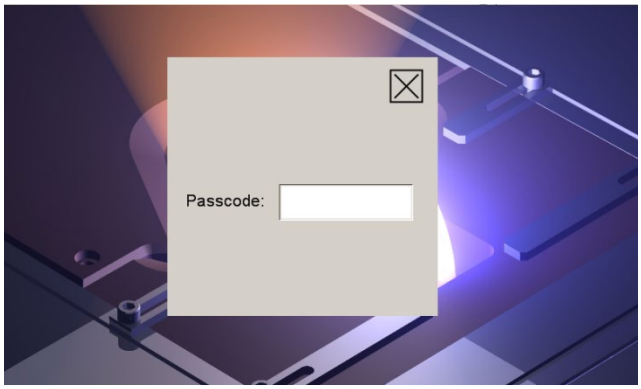
**Figure 2-4 Menu Screen with Log-In Button Displayed**




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

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

**Figure 2-5 Menu 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 menu screen shown in Figure 2-3.

### 2.3.3 Logging Out

To log out, follow the procedure described below.

| Step | Action |
|---|---|
| 1 | Touch the Mode ID label/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**

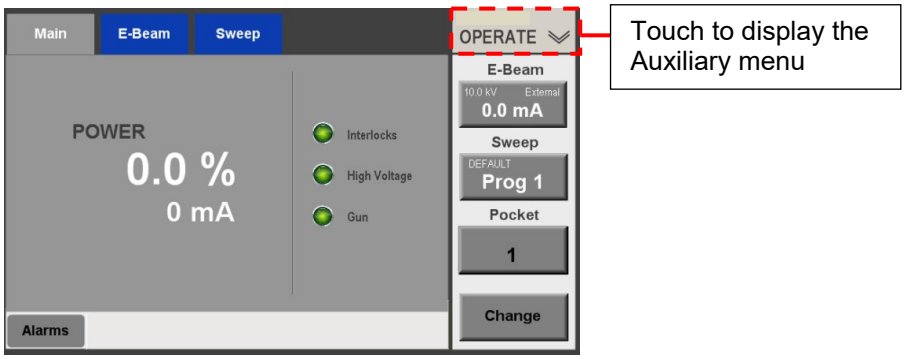
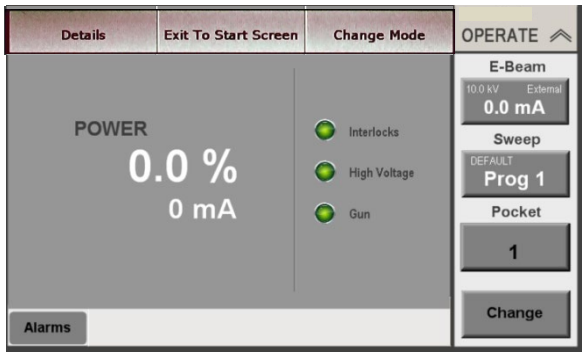
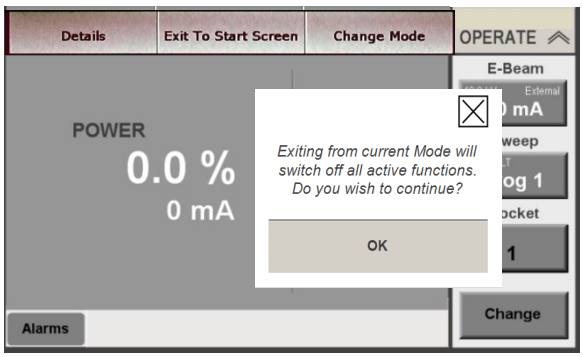



**Figure 2-7 Operations>Main Screen with Auxiliary Menu Displayed**



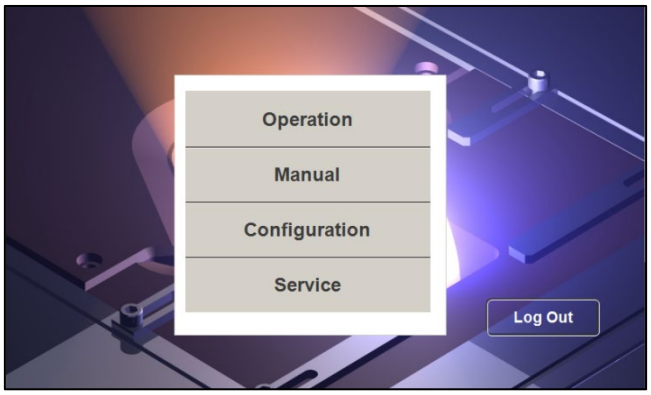

| | |
|---|---|
| 2 | Touch the **Exit to Start Screen** button. The unit will then display the warning popup shown below. |

**Figure 2-8 Operations>Main Screen Displaying Mode-Change 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 Menu screen shown below.

**Figure 2-9 Menu Screen Displaying Log Out Button**



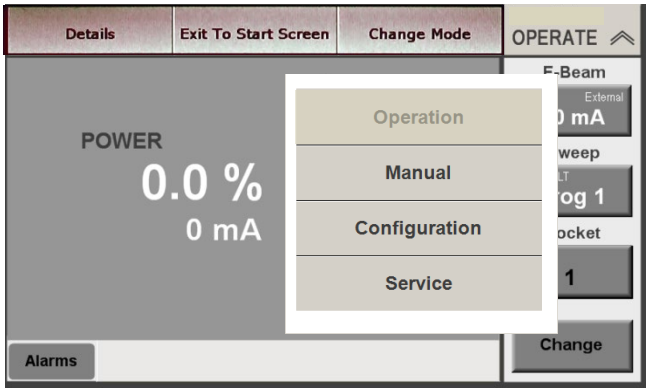

4 Touch the **Log Out** button. The Menu screen will appear as shown in Figure 2-4.

## 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 Mode ID label/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 Operations>Main Screen with Change Mode Popup Displayed**



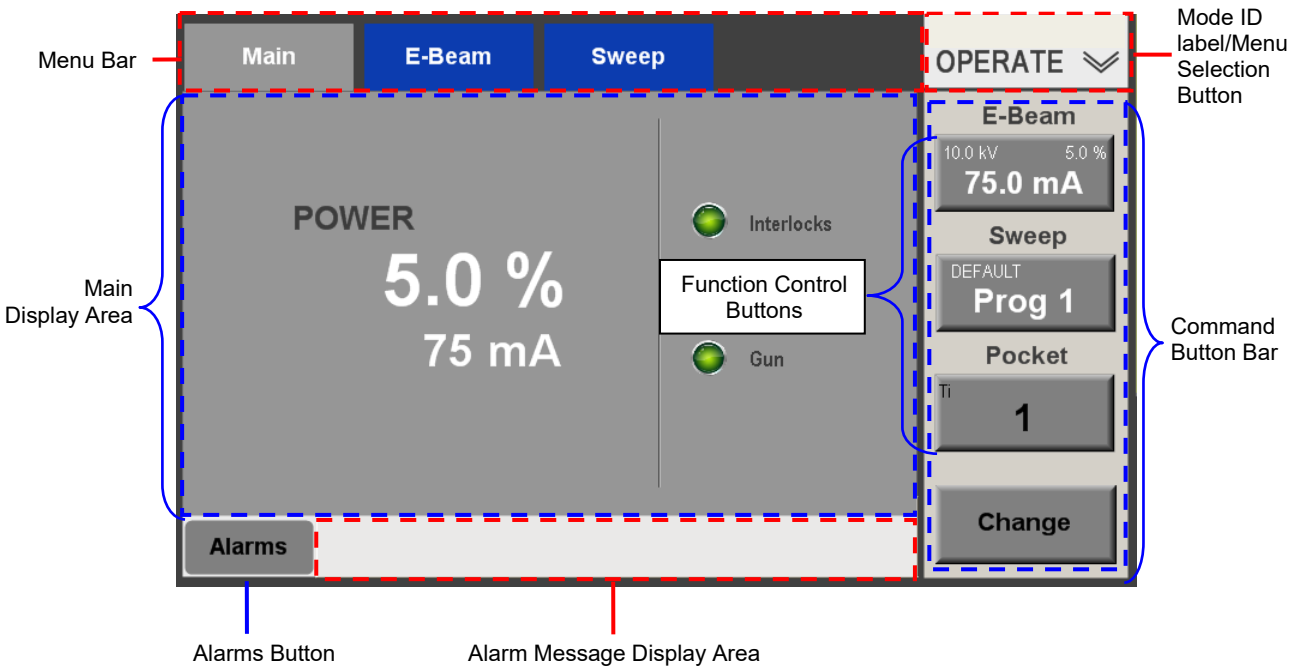
4 Touch the button for the desired mode. The EBC will then switch to that mode.

## 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 2-11 identifies the functionally distinct areas of the touch screen, which are defined below the illustration.

**Figure 2-11 Functional Areas of Main UI Screen**



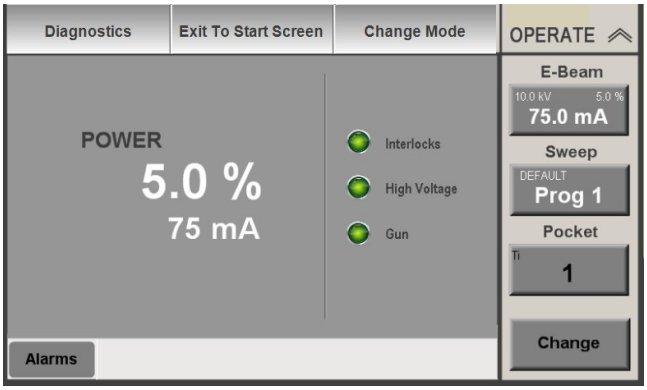

- **Menu Selection Button**: This button enables the user to select either the Main Menu or the Auxiliary Menu for display in the menu bar.
- **Menu bar**: Displays either the Main Menu or the Auxiliary Menu. Figure 2-11 shows the Main Menu, while Figure 2-12 shows the Auxiliary Menu.
- **Main Display 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 Details 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 2-20).

### 2.5.2 The Main and Auxiliary Menus

In all operating modes, the user can display either the Main Menu, as in Figure 2-11, or the Auxiliary Menu, as in Figure 2-12. 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 Details screen (see Figure 1-13). For detailed information about the Details screen, see section 12.2.

**Figure 2-12 Operations>Main Screen with Auxiliary Menu Displayed**




## 2.6 Use of the Command Button Bar

The buttons on the Command Button Bar (see Figure 2-11) 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.

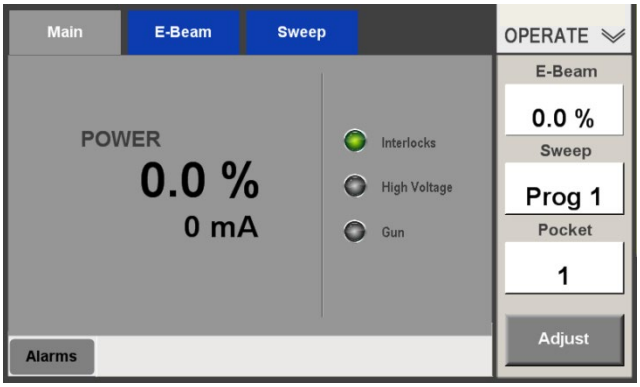
Each Function Control button displays the current operating value of the device/function in question. Thus, the **E-Beam On/Off** button displays the percentage of e-beam power applied as well as the kV value, while the **Sweep Enable** button displays number of the sweep program currently selected and 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.

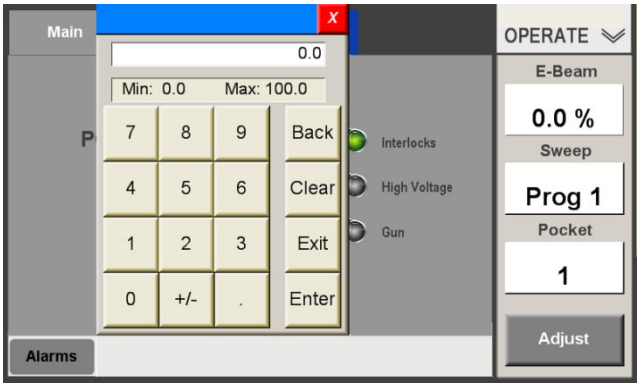
| Step | Action |
|---|---|
| 1 | Press the **ADJUST** button. Doing so turns the Function Control buttons white (see Figure 2-13), indicating that the parameters selectable via all three buttons can be modified. |

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



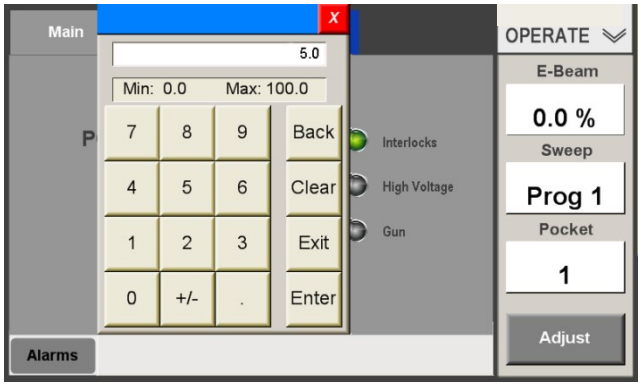

2 Touch the button controlling the desired function to display a numbered keypad (e.g., Figure 2-14) that will allow you enter a different value. The keypad displayed indicates the maximum and minimum values for the parameter you have selected for modification. In Figure 2-14, the user has opened a keypad 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**



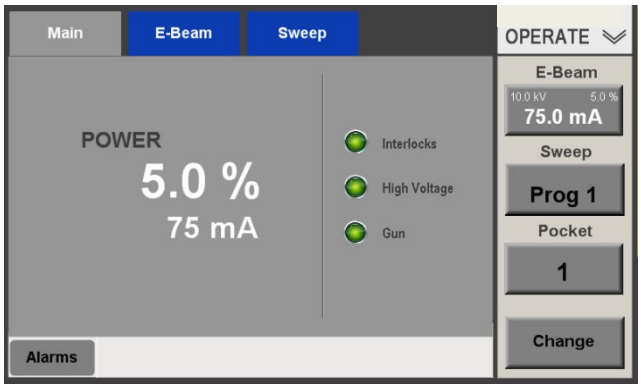

3 Enter the desired operating value. For e-beam power, enter a value between 0.1% and 100%. For sweep program number, enter a value between 1 and 32. For pocket number, enter a value between 1 and the highest-numbered pocket in your turret source. In Figure 2-15 the user has entered 5% as an e-beam power setpoint.

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




4 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 2-16, the **E-**Beam button displays 5.0%, reflecting the change made in Figure 2-15. 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.

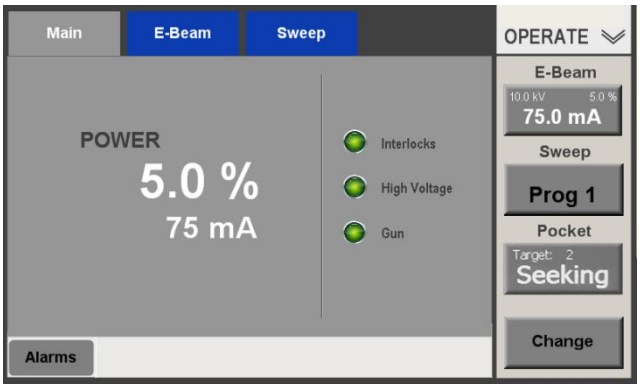
### Rotating the Turret

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*** above it, where *Y* = the number of the target pocket. In Figure 2-17, 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)

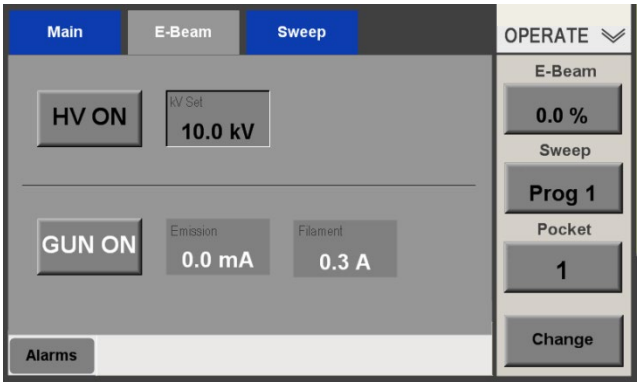
Parameter value-entry buttons look similar to parameter-display rectangles, but the former have white borders and turn white when pressed. Examples are the **Amplitude** and **Frequency** buttons on the Local>Sweep screen and the **kV Set** buttons on the Sweep screens in Local and Configuration Modes. 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 2-18. 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**



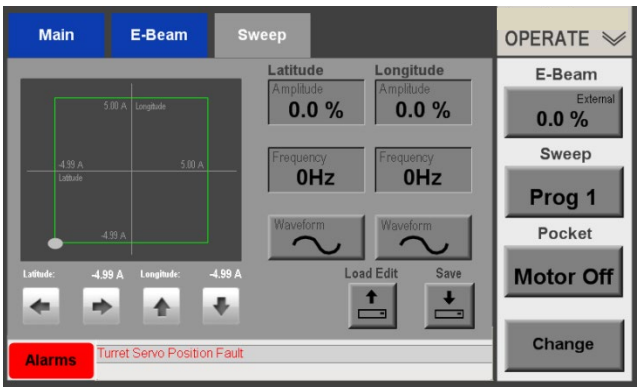

**Output Asserted/Not Asserted Indicators on Service Mode Screens**

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 12-5).

## 2.8 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 2-19. To clear the alarm, first correct the condition and then click the **Alarms** button.

**Figure 2-19 Main User Interface Displaying an Alarm Message**




### 2.8.1 The Alarms Screen

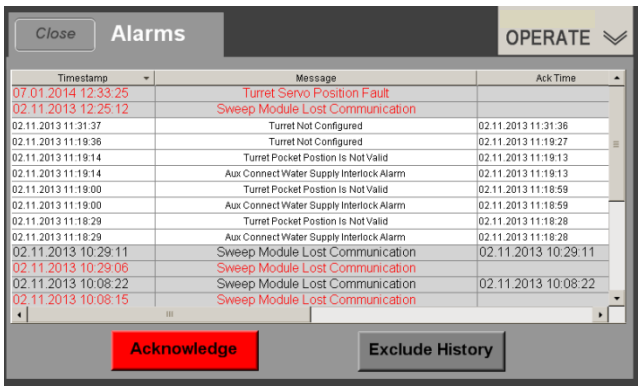
The Alarm screen allows the user to view active and/or past alarms and to acknowledge active alarms. The Alarms screen is available from any Configuration, Operations, or Manual mode screen. To access the Alarms screen from any such screen, press its **Alarms** button. Figures

Figure 2-20 and Figure 2-21 show how the Alarms screen would appear if the user touched the **Alarms** button on the screen shown in Figure 2-19. If **Exclude History** was previously selected via the **Alarms** screen, the Alarms screen would appear as shown in Figure 2-20. If **Include History** was previously selected, then the Alarms screen would appear similar to that shown in Figure 2-21.

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

**Figure 2-20 Alarm Details Screen with Active Alarms, *Exclude History* Selected**


**Figure 2-21 Alarm Details Screen with Active Alarms, *Exclude History* Selected**




## 2.9 Backing Up and Restoring Files

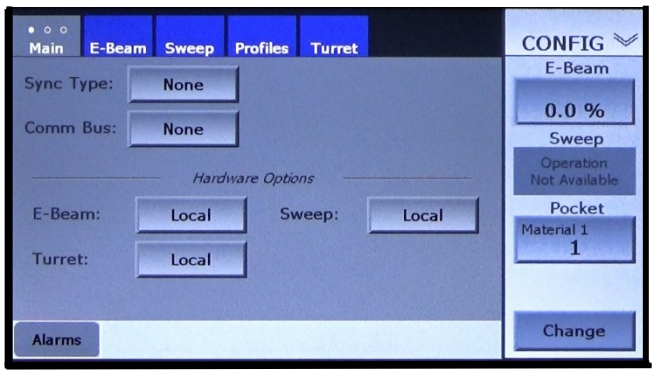
This subsection describes how to back up and restore sweep program files and the unit's configuration.

### 2.9.1 Backing up Files

To back up sweep program files and the unit's configuration, perform the procedure described below.

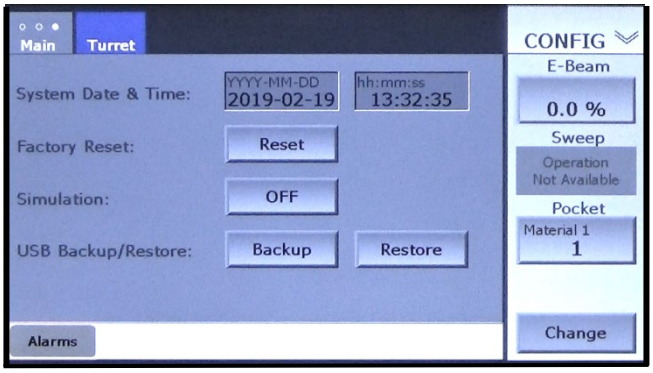
| Step | Action |
|---|---|
| 1 | Display the Config>Main screen (see Figure 2-22). |

**Figure 2-22 Config>Main Screen**



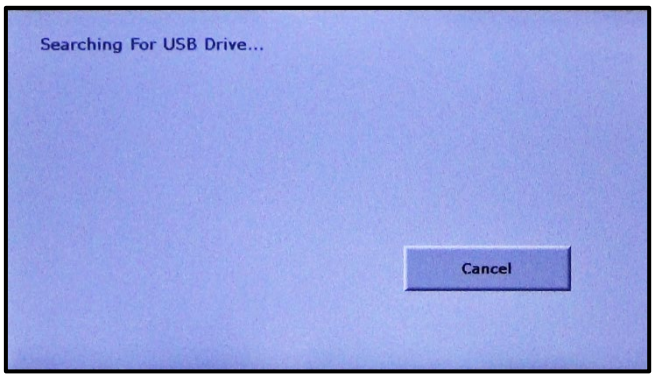

2 Press the screen's tab twice to display the Date-Time/Backup-Restore screen (see Figure 2-23).

**Figure 2-23 The Date-Time/Backup-Restore Screen**



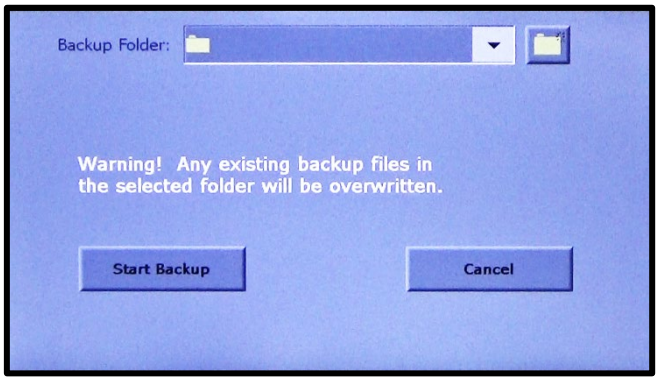

3 Touch the **Backup** button. If the USB drive has not been inserted, the EBC will display the screen shown below. If so, you will see the screen shown in Figure 2-25.

**Figure 2-24 Initial Backup Screen, USB Drive Not Inserted**



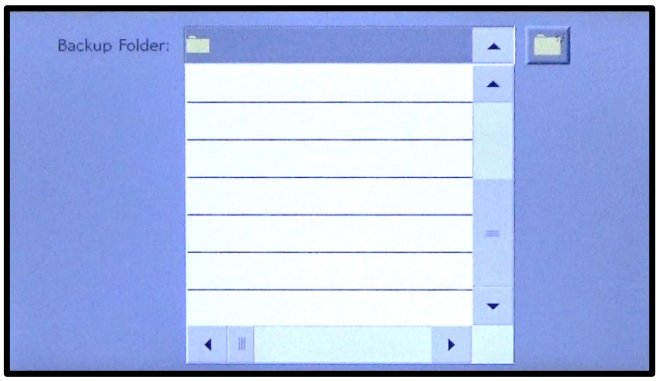
4 Insert the USB drive onto which you wish to back up the files. The EBC will then display the screen shown below.

**Figure 2-25 Initial Backup Screen After USB Drive Is Inserted**




5 When the EBC displays the screen shown above, touch the **Backup Folder** entry box to display a list of folders on the USB drive (see Figure 2-26). If you wish to back the files up into the folder listed in the **Backup Folder** entry box, skip this step and the following step

**Figure 2-26 Backup Screen Displaying Folders on USB Drive**




6 Select the folder into which you wish to back up the files. That file's name will then appear in the **Backup Folder** entry box.

7 If you wish to create a new folder, touch the button outlined below to display a popup keyboard (see Figure 2-28).

**Figure 2-27 Folder Creation Button on Backup Screen**

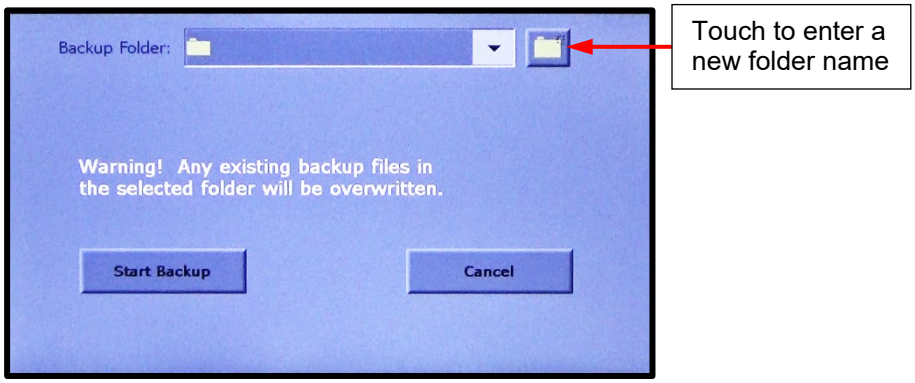
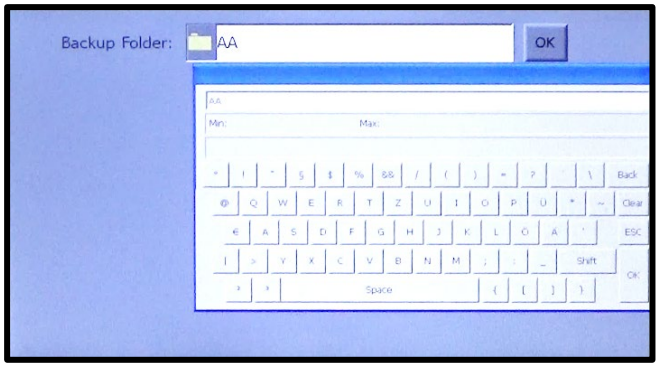



**Figure 2-28 Backup Screen Displaying Popup Keyboard**

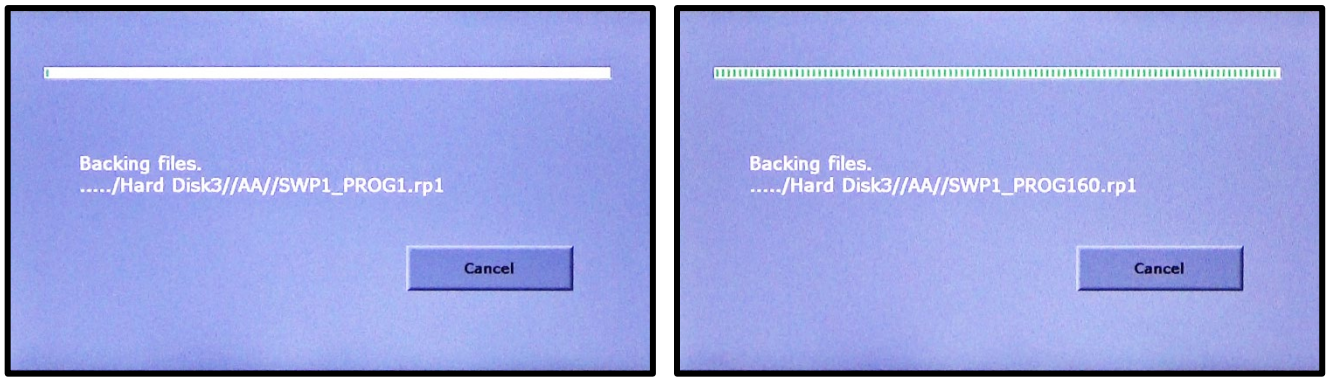



8 Use the keyboard to enter the desired folder name. As you do so, the folder name will appear in the **Backup Folder** entry box, as shown above. When you've finished entering the folder name, touch the **OK** button next to the **Backup Folder** entry box to close the keyboard.

9 After the desired folder is selected, touch the **Start Backup** button. The backup screen will then list the files as it saves them to the target folder, as shown below.

**Figure 2-29 Backup In Progress**

**EBC Backing up Sweep Program 1** **EBC Backing up Sweep Program 160**




10 When the backup is completed the EBC will redisplay the Date-Time/Backup-Restore screen, as shown below.

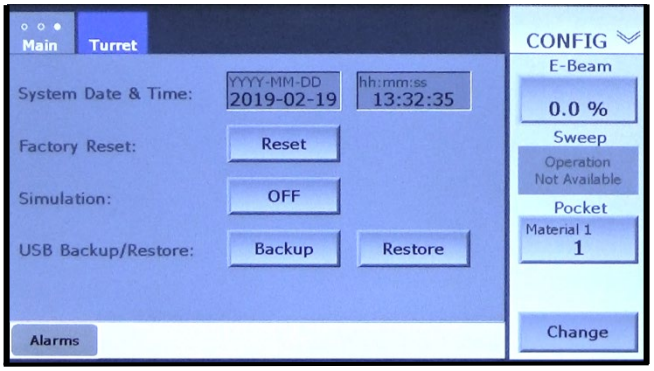
**Figure 2-30 Date-Time/Backup-Restore Screen After Backup Completed**


## 2.9.2 Restoring Backed Up Files

To restore backed up files to the EBC, perform the procedure described below.

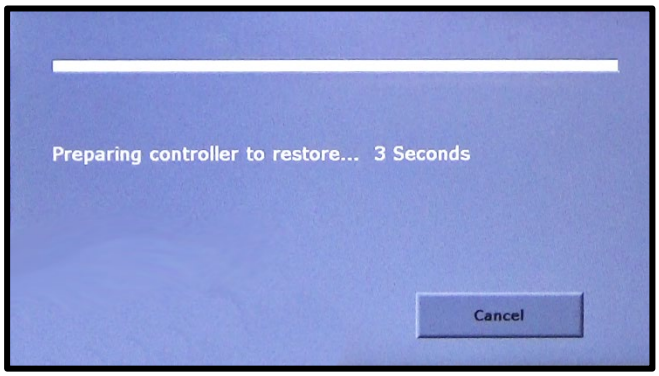
| Step | Action |
|---|---|
| 1 | Display the Date-Time/Backup-Restore screen (see Figure 2-31) and touch its **Restore** button. |

**Figure 2-31 Date-Time/Backup Restore Screen**



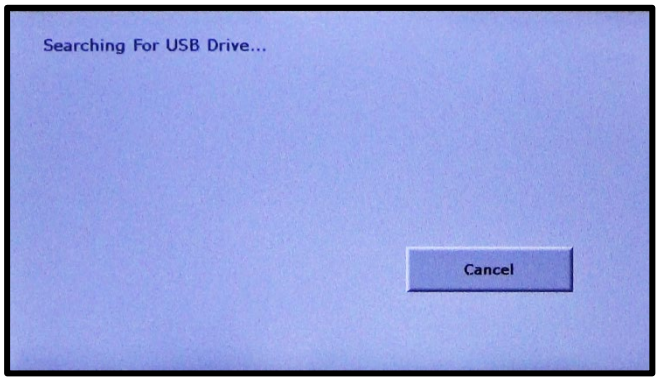

2 The EBC will then initiate a shutdown, initially displaying the screen shown below.

**Figure 2-32 Restore Selected, Shutdown Initiated**



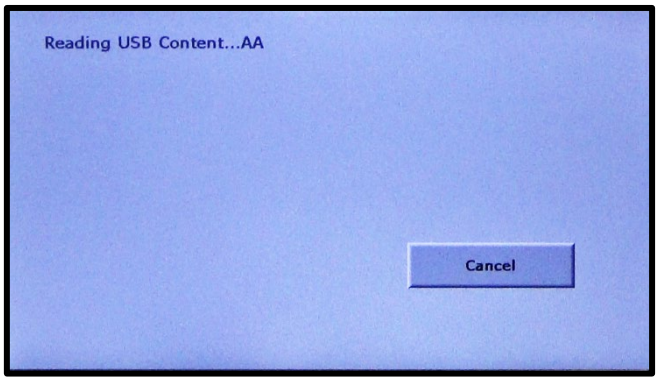

3 When the shutdown routine is completed, the EBC will display the message shown below if no USB drive is inserted into the unit. In that event, insert the USB drive containing the backed up files.

**Figure 2-33 Screen Displaying 'Insert USB' Prompt**



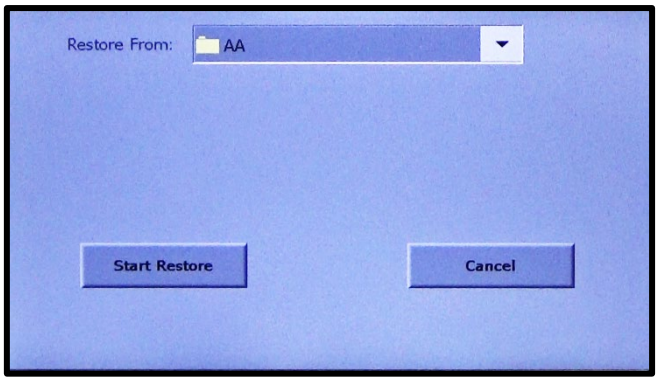
4 Once the USB drive is inserted, the screen will display the message shown below, listing the name of each folder on the drive as it reads them.

**Figure 2-34 Screen Displaying Message *Reading USB Content***



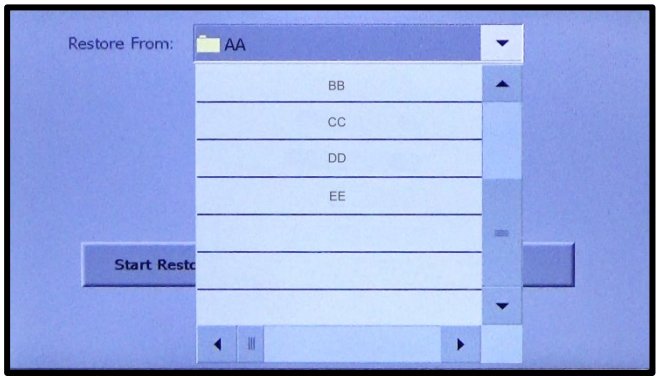

5 After the EBC finishes reading the USB drive's contents, it will display the screen shown below.

**Figure 2-35 Restore Screen After EBC Has Read Contents of USB Drive**




6 If you wish to restore from the folder whose name is displayed in the **Restore From** entry box, skip this step and Step 7 and proceed to Step 8. To select a different folder, touch anywhere in that entry box to display a folder directory like the one shown below.

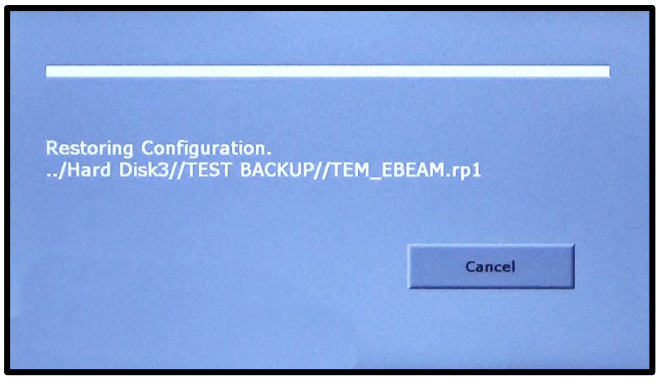
**Figure 2-36 Restore Screen Displaying List of Folders on USB Drive**




7 Touch the name of the folder that contains the files to be restored. That name will then appear in the **Restore From** entry box.

8 When the name of the desired folder is displayed, touch the **Start Restore** button. The restoration will then begin, listing files as it restores them, starting with the configuration file, as shown below.

**Figure 2-37 Restore Screen, Restoration of Configuration File in Progress**




9 The EBC will then restore the sweep program files, listing them in order as it goes, as shown below.

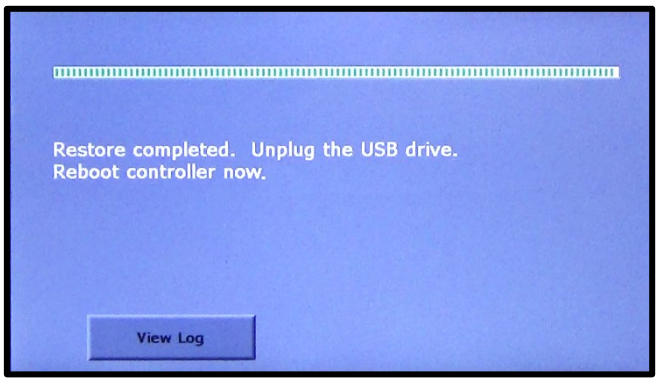
**Figure 2-38 Restoration of Sweep Program Files In Progress**

**EBC Restoring Sweep Program 2** **EBC Restoring Sweep Program 160**



10 When this screen appears, either unplug the USB drive and reboot the EBC or touch the **View Log** button to save the log file. If you reboot, you can resume normal EBC operation after the reboot is complete. If you select the latter, you can save the file the EBC has created to log the restoration, as described in section 2.9.4.

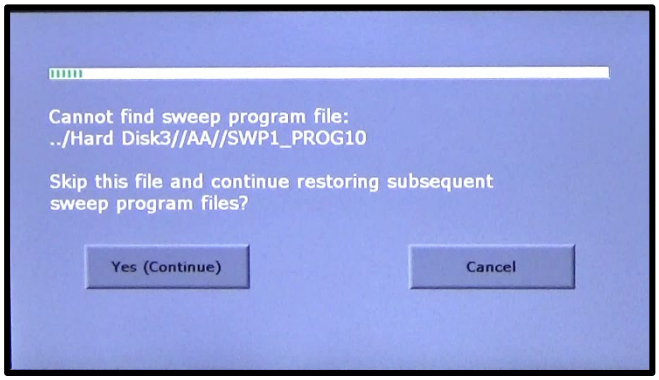
**Figure 2-39 Restoration Completed, User Prompted to Reboot**




## 2.9.3 Canceling Restoration or Skipping Files Not Found on the USB Drive

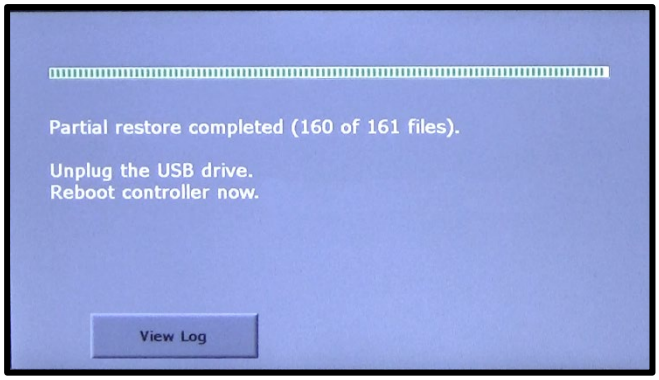
During the restoration, if the restore routine finds that a file is missing from the expected sequence, the EBC will display a screen like the one shown in Figure 2-40. When that occurs, the user has the option to either skip the missing file or cancel the restoration, as described below. In the example shown in Figure 2-40, the restore routine has been unable to find sweep program file number 10.

**Figure 2-40 Screen Displayed if Restore Routine Has Been Unable to Find a File**




| Step | Action |
|---|---|
| 1 | If you wish to resume the restoration, touch the **Yes (Continue)** button. If not, touch the **Cancel** button, in which case the restoration will be terminated. If you elect to continue the restoration, then at its conclusion the EBC will display a screen similar to the one shown below, indicating the number of missing files encountered. |

**Figure 2-41 Partial Restoration Completed**



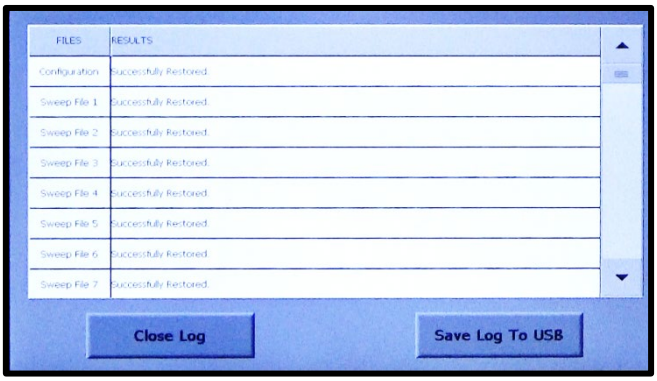

| | |
|---|---|
| 2 | When this screen appears, either unplug the USB drive and reboot the EBC or touch the **View Log** button to save the log file. If you reboot, you can resume normal EBC operation after the reboot is complete. If you select the latter, you can save the file the EBC has created to log the restoration, as described in section 2.9.4. |

## 2.9.4 Saving the Log File to a USB Directory

While performing a restoration, the EBC creates a log file, which can be saved to a directory on the USB drive. The following procedure describes how to save such a log file.

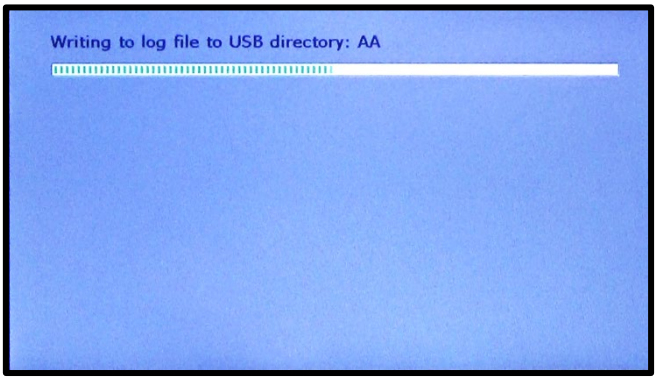
| Step | Action |
|---|---|
| 1 | To save the log file from a just-completed restoration, first touch the **View Log** button on the screen announcing completion of the restore operation (see Figures 2-39 and 2-41). |

**Figure 2-42 Log Contents Displayed**



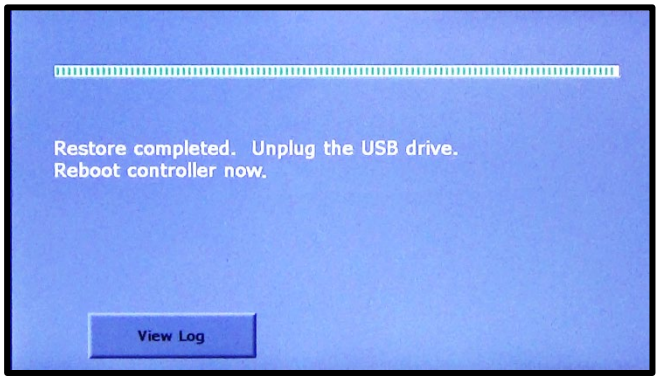

| | |
|---|---|
| 2 | If you wish to save the log file to the USB drive, touch the **Save Log To USB** button. The EBC will then display the screen shown below as the log file is saved. Note that the log file is written to the directory from which the files were restored. |

**Figure 2-43 EBC Writing Log File to USB Drive**




| | |
|---|---|
| 3 | When the log file has been saved, the EBC will again display the messages shown below. When it does so, unplug the USB drive and reboot the EBC. |

**Figure 2-44 Log File Saved to USB Drive, User Prompted to Reboot**




After the reboot is completed, normal EBC operation can be resumed.

# 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:



These procedures also apply, with some modifications, to installations in which the EBC is to operate under the control of a either a deposition controller or a PLC-based system controller. 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 if EBC-PLC communication is via the EBC's rear panel sub-D connectors
- section 9.2 if EBC-PLC communication is via EtherCAT link
- section 10.2 if EBC-PLC communication is via RS232 link.

## 3.2 Package Contents

Two versions of the TemEBeam Controller (EBC) are available:

- EBC with HVPS, FPS, and sweep control modules (PN 0620-7492-2)
- EBC with HVPS, FPS, sweep, and turret control modules (PN 0620-7492-3).

EBC PN 0620-7493-3 includes all the parts shown in Figure 3-1. EBC PN 0620-7493-2 includes all parts shown in that illustration, except the Indexer Drive Kit (PN 0629-5560-1).

## Figure 3-1 EBC Visual Component Identification


**0629-5595-2**
**Main EBC Control Unit**

**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 0629-5560-1; not included with EBC PN 0620-7492-2)

**0629-0364-10**
**INDEXER DRIVE ASSEMBLY**

**9015-9121-3**
**FLEXIBLE COUPLING FOR 1/4" SHAFTS WITH FLATS**

**9018-2030-0**
**INDEXER MOTOR DRIVE BELT**

**0620-7612-0**
**INDEXER MOTOR CABLE, 30'**

# 3.3 Hardware Installation

## 3.3.1 Install the Optional Indexer Drive Motor Assembly

Installation of optional Indexer Drive assembly varies slightly but critically depending on whether it is being installed in support of an XL gun or in support of any other Temescal turret source. Figures 3-2 and 3-3 illustrate the difference. For XL gun installations, the Indexer Drive assembly must be mounted with the large washer supplied with the rotary feedthrough place between the flange of that feedthrough and the top of the Indexer Drive assembly's cover (see Figure 3-2). When installing an Indexer drive assembly to drive any other turret source, that washer should be mounted in the usual way, directly above the attachment nut, as shown in Figure 3-3.

**Figure 3-2 Indexer Drive Assy. Mounted to Rotary Feedthrough in XL Gun Installations**

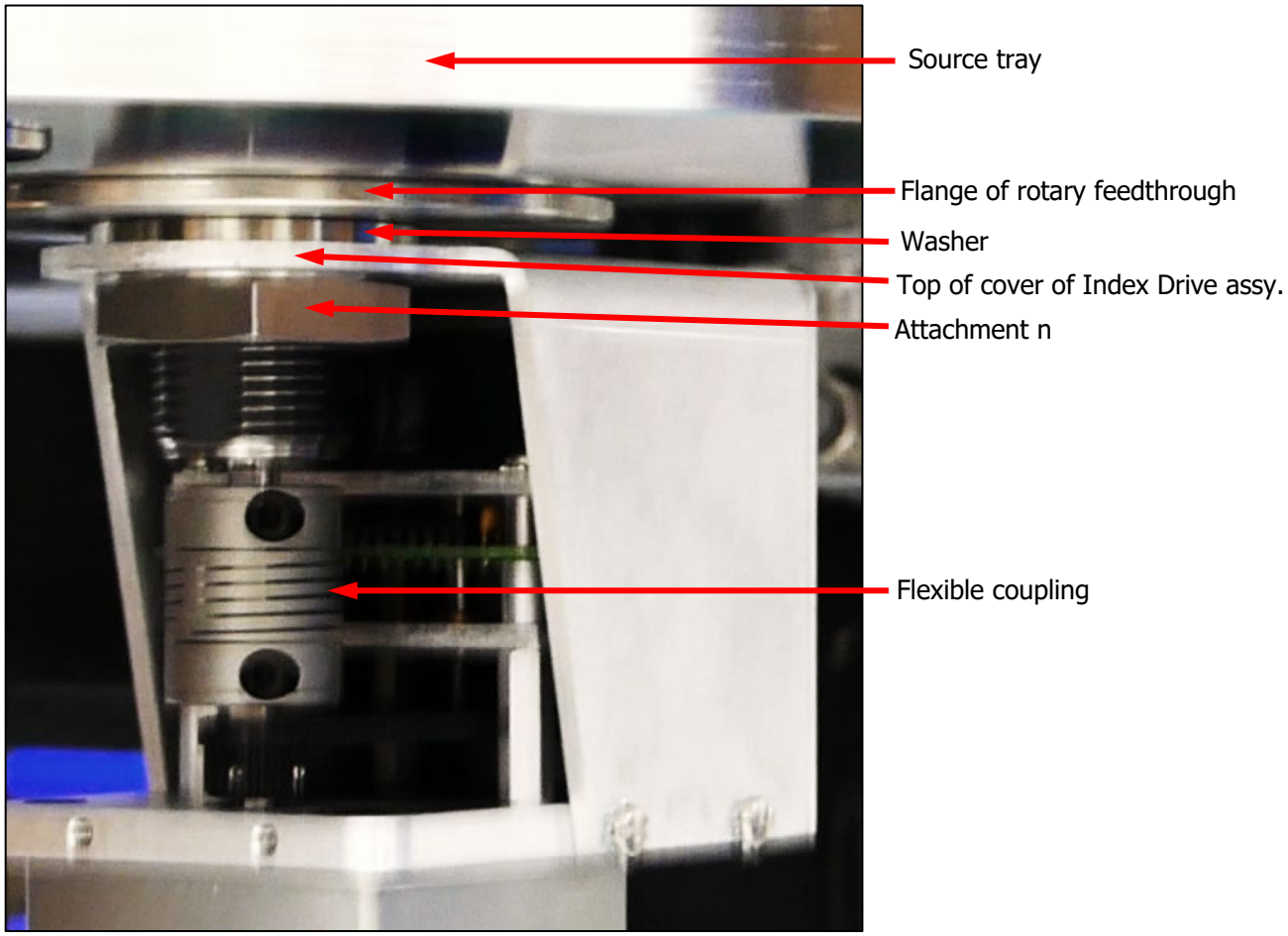
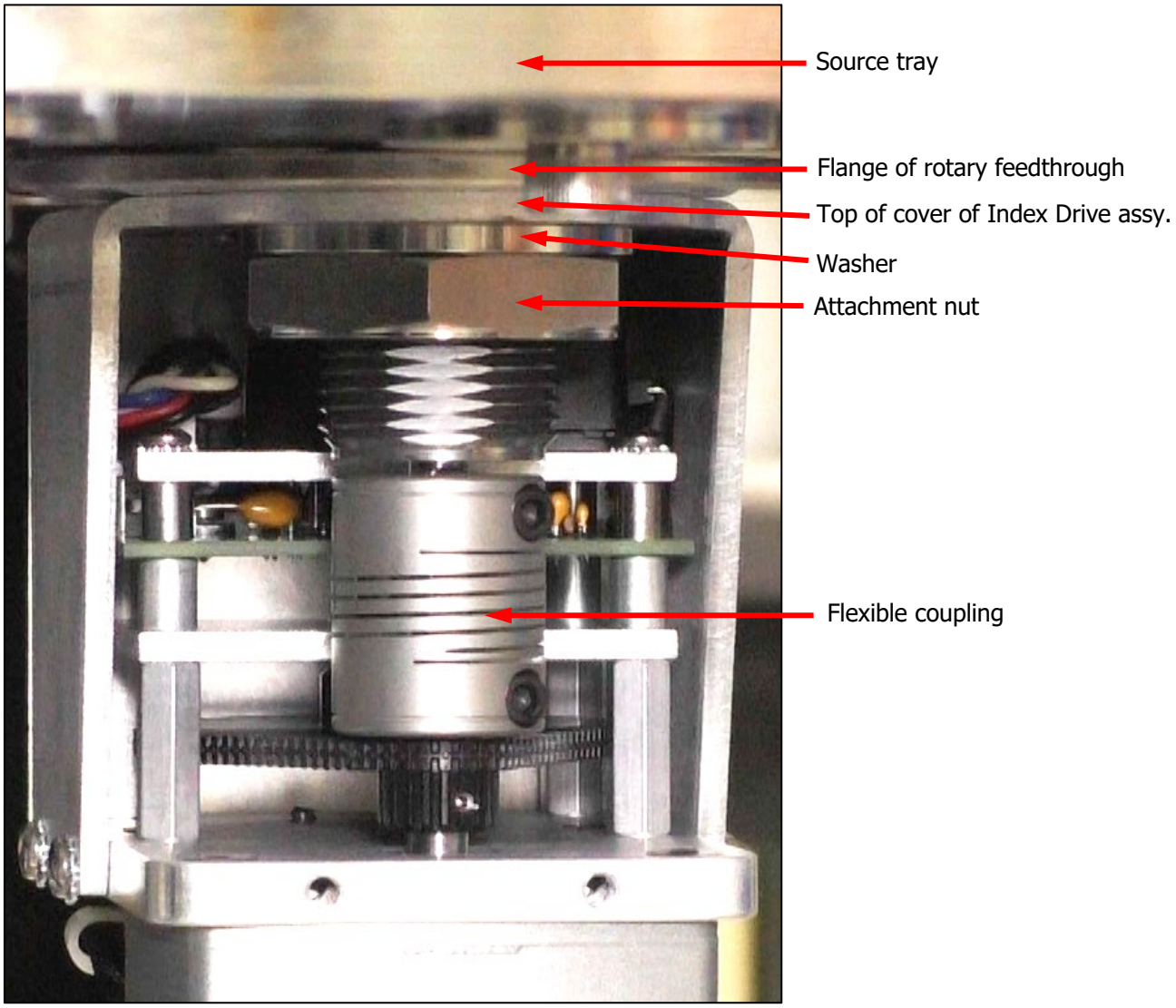


**Figure 3-3 Indexer Drive Assy. Mounted to Rotary FT in All Other Turret Gun Installations**




**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.<br>a) Make sure that the high-voltage power supply is switched OFF.<br>b) Lock and tag out the facility breaker supplying power to the HVPS, following facility-specific procedures and observing local safety codes.<br>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 a flexible coupling in place over the rotary feedthrough's input shaft and secure the coupling to that shaft with the coupling's upper set screw. |
| 7 | Tighten this 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.

| | |
|---|---|
| 8 | Remove the screws that secure the Indexer Drive assembly's front-side cover and remove the cover. |
| 9 | If you are installing the Indexer Drive in support of an XL gun, hold the washer supplied with the rotary feedthrough in place against the flange of the rotary feedthrough. Otherwise, place that washer in the usual position, as described in Step 11 below. |
| 10 | Raise the Indexer Drive assembly into position so that the rotary feedthrough's threaded shaft extends through the hole in the top cover of the Index Drive assembly. As you do so, make sure that the drive unit's output shaft inserts properly into the flexible coupling, rotating the turret if necessary in order to do so. |
| 11 | Lower the index drive unit enough so that you can screw the attachment nut one or two threads onto the threaded portion of the |

feedthrough. If you are installing Index Drive to drive any turret source besides an XL, place the washer above the attachment nut.

12 Move the drive assembly back to the position described in Step 10 of this procedure.

13 Screw the attachment nut all the way onto the threads on the rotary feedthrough and tighten it to approximately 10 ft.-lbs.

14 Tighten the set screw that secures the flexible coupling to the output shaft of the Index Drive assembly's motor.

15 Replace the indexer drive assembly's front cover and secure it with the mounting screws you removed in Step 8 of this procedure.

Installation of the indexer drive assembly is completed. If you are going to configure the EBC's turret control function next, as described in section 4.5, 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 3-4 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:

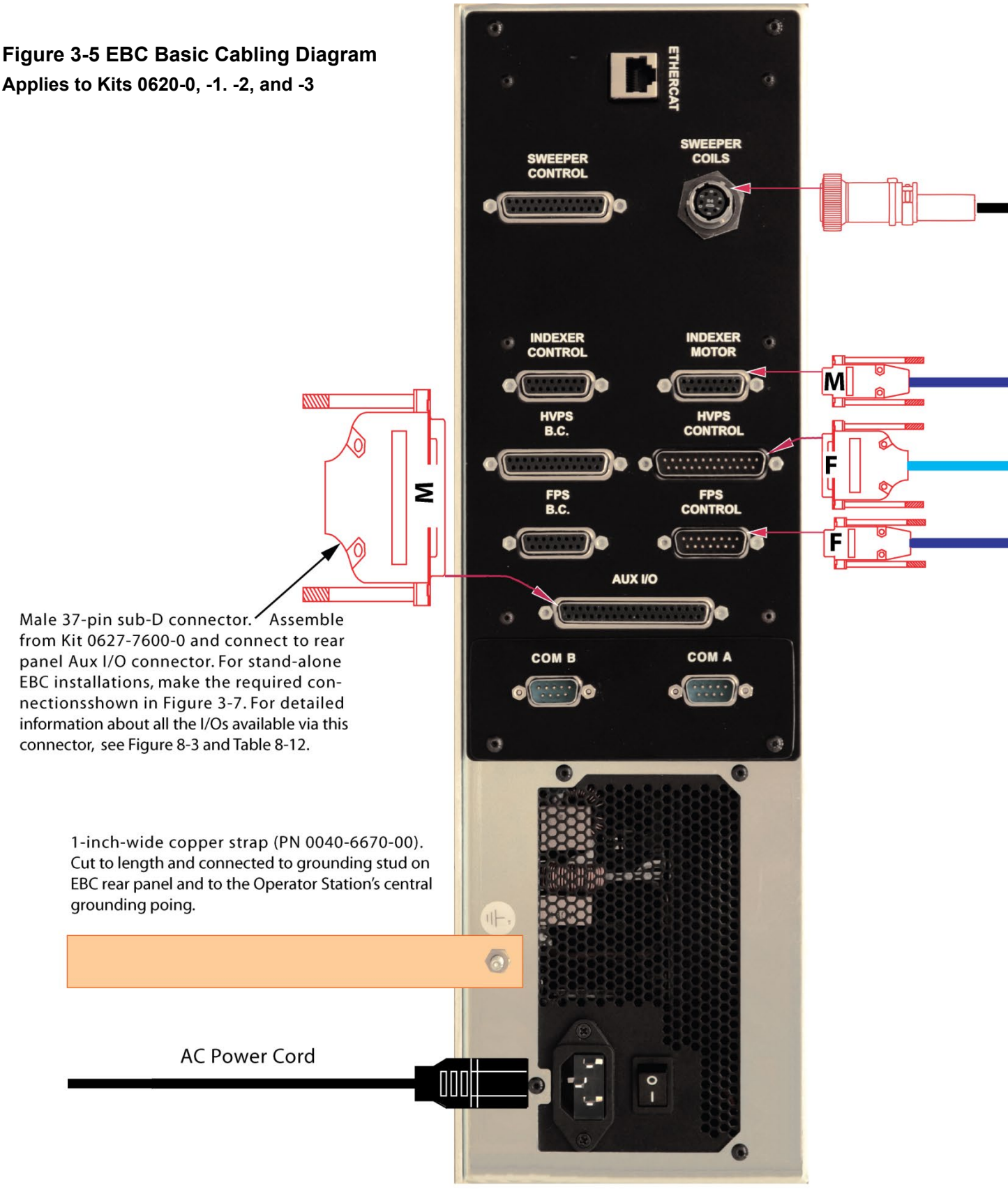
- section 8.2 if EBC-PLC communication is via the EBC's rear panel sub-D connectors
- section 9.2 if EBC-PLC communication is via EtherCAT link
- section 10.2 if EBC-PLC communication is via RS232 link...

**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 3-5 EBC Basic Cabling Diagram

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



Sweep Drive Coil Cable
(PN 0620-9103-30)

**Connect to octal feedthrough, following the instructions described below in section 3.4.2.**

Indexer Motor Cable
(PN 6338-2884-0)

HVPS Control Cable
(PN 0620-6682-0)

FPS Control Cable
(PN 0620-6672-2)

Plug into male 25-pin sub-D connector on indexer drive assy.

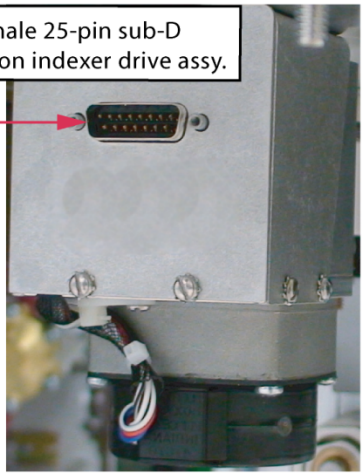
F

M

M

Plug into connector **J101** on filament power supply.

Plug into connector **J4** on CV6-SLX or CV12-SLX HVPS

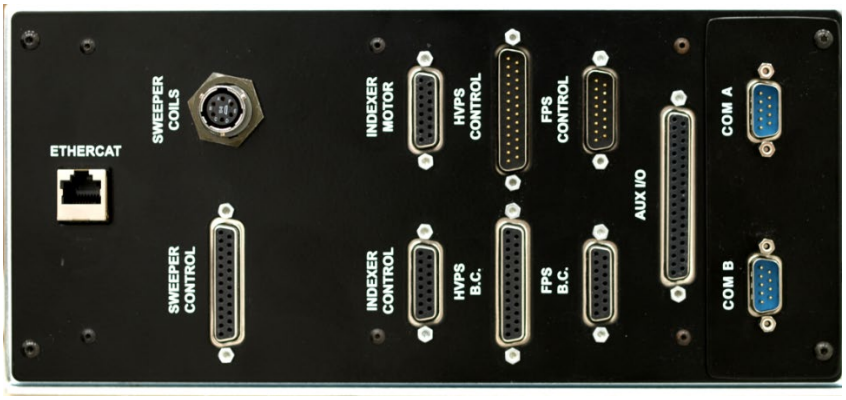


Indexer Drive Assembly

## 3.4.2 Basic Cabling Procedures

The following procedures describe how to make connections between the EBC's rear panel connectors (see Figure 3-5) and the components controlled by the EBC.

**Figure 3-6 EBC Rear Panel Connectors**




**Making Sweep Coil Connections: Replacing an SS64 with an EBC**

Perform the following procedure if you are replacing a Temescal SS64 beam sweep controller with an EBC.

| Step | Action |
|---|---|
| 1 | Switch off the input power to the SS64, unplug its power cable, and disconnect the ground wire connected to its rear panel. |
| 2 | Disconnect the Sweep Coil Drive cable from the SS64 rear panel. |
| 3 | Remove the SS64 from the operator station. |
| 4 | Connect the Sweep Coil Drive cable to the EBC's rear panel **SWEEPER COILS** connector (see Figure 3-5) |

**Making Sweep Coil Connections on Systems without an SS64**

Perform the following procedure if you are installing an EBC with a sweep control board in a system without an SS64.

| Step | Action |
|---|---|
| 1 | Connect the amphenol connector on one end of the Sweep Coil Drive cable (PN 0620-9102-0) to the **SWEEPER COILS** connector on the EBC rear panel. |
| 2 | If you are installing the EBC in a modern Temescal system with a Beckoff control system, connect the female Molex connector (labeled SWEEPPG) on the other end of the Sweep Coil Drive cable to the male Molex connector (also labeled SWEEPPG) on the end of a cable whose conductors on the other end are connected to the octal feedthrough. |
| 3 | If you are installing the EBC in an older Temescal system or in a non-Temescal system, perform the following steps: |

a) Remove the black connector that is attached to the underside (i.e., the atmosphere side) of the body of the octal feedthrough.

b) Remove the metal cap from this connector. To do so, insert a flat-bladed screwdriver into one of the rectangular slots at the top of the cap and gently pry against the flange that forms the top of the connector. Pry the cap loose as far as you can using this slot, then insert your screwdriver in the other slot in the cap and repeat the process. If necessary, once a gap is visible between the cap's top edge and the connector's top flange, you can insert the screwdriver into this gap and pry the cap the rest of the way loose. When prying, take care not to damage either the thin metal cap or the connector body.

c) Cut the Molex connector (labeled SWEEPPG) from the end of the EBC's Sweep Coil Drive Cable, leaving the ends of the cable's four wires exposed.

d) Strip about 1/8" of insulation from the ends of these four wires.

e) Solder the stripped ends of these wires to Pins 1-4 of the atmosphere side of the octal feedthrough as follows:

- Pin 1: Green wire
- Pin 2: White wire
- Pin 3: Black wire
- Pin 4: Red wire

f) Snap the metal cap back into place on the plastic connector and push this assembly back onto the bottom of the feedthrough. Note that the shaft in the center of the feedthrough is keyed, so that the connector can only go on one way. If necessary, tighten the clamp screws on the bottom of the metal cap.

### Making Connections to the EBC's *Indexer Motor* Connector

| Step | Action |
|---|---|
| 1 | If you obtained an Indexer Drive unit along with the EBC unit and have installed it, skip this step and proceed to Step 2. 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 indexer controller.

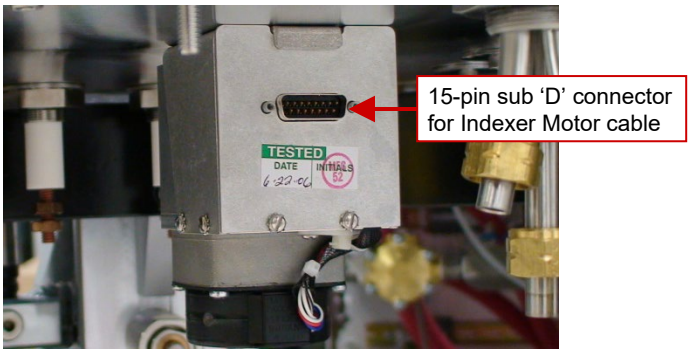
b) Disconnect that controller's power cable and ground wire from its rear panel.

c) Disconnect the cable that is connected to the **MOTOR** connector on the TRC-3460 rear panel.

d) Disconnect the other end of that cable from the male 15-pin connector on the Indexer Drive unit.

| | |
|---|---|
| 2 | Connect the male end of the Indexer Motor Cable (PN 0620-7613-0) supplied with the EBC to the **INDEXER MOTOR** connector on the EBC rear panel (see Figure 3-5). |
| 3 | 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 3-7 Indexer Drive Unit Mounted Under Source Tray**




### Making Connections to the EBC's *HVPS CONTROL* and *FPS CONTROL* Connectors

Follow the steps described below to make connections to the EBC's rear panel **HVPS Control** and **FPS Control** connectors. If you installing a Temescal e-beam power supply along with the EBC, first install the 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 Control** cable (PN 0620-6683-0) and the **FPS Control** cable (PN 0620-6673-2). Instead, perform the following procedure.

| Step | Action |
|---|---|
| 1 | Connect the male connector on one end of the **HVPS Control** cable to HVPS rear panel connector J4. |
| 2 | Connector the female connector on the other end of this cable to the **HVPS CONTROL** connector on the EBC rear panel. |
| 3 | Connect the male connector on one end of the **FPS Control** cable to FPS connector J101. |
| 4 | Connect the female connector on the other end of this cable to the **FPS CONTROL** connector on the EBC rear panel. |

### Implementing a Rotation Interlock

**NOTE**

The following procedures apply only if you are installing an EBC that is to control a Temescal -2PT or -3PT source. If you are installing an EBC that is to control a Temescal XL gun, see the TBEU manual for instructions on making the required connections to the **Indexer Control** connector.

Of the two procedures described below, perform the applicable one only if you wish to implement a rotation interlock controlled by the TCS. If you do not wish to implement such a rotation interlock, leave the EBC's **Indexer Control** connector unconnected to any cable.

**Installation in a Temescal System with a Beckoff PLC.** If you are installing an EBC in a Temescal system that has a Beckoff PLC, perform the following steps.

| Step | Action |
|---|---|
| 1 | Within the Operator station, find an unconnected cable with a male 15-pin connector on its end. |
| 2 | Plug that 15-pin connector into the EBC's **Indexer Control** connector. |

**Installation in a Temescal System with an Allen-Bradley PLC.** If you are installing an EBC in a Temescal system that has an Allen-Bradley PLC, perform the following steps.

| Step | Action |
|---|---|
| 1 | Disconnect the cable that is currently connected to the **I/O (Optoisolated)** connector on the TRC-3460 rear panel. |
| 2 | Plug that cable into the EBC's **Indexer Control** connector. |

### Making Connections to the EBC's Rear Panel *AUX I/O* Connector

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. Figure 3-7 shows a diagram of the required connections. For detailed descriptions of the signals transmitted via those connections, see Table 3-1. For complete pinout information about the AUX I/O connector, see Figure 8-3 and Table 8-12.

**Figure 3-8 Required Connections to Rear Panel AUX I/O Connector**

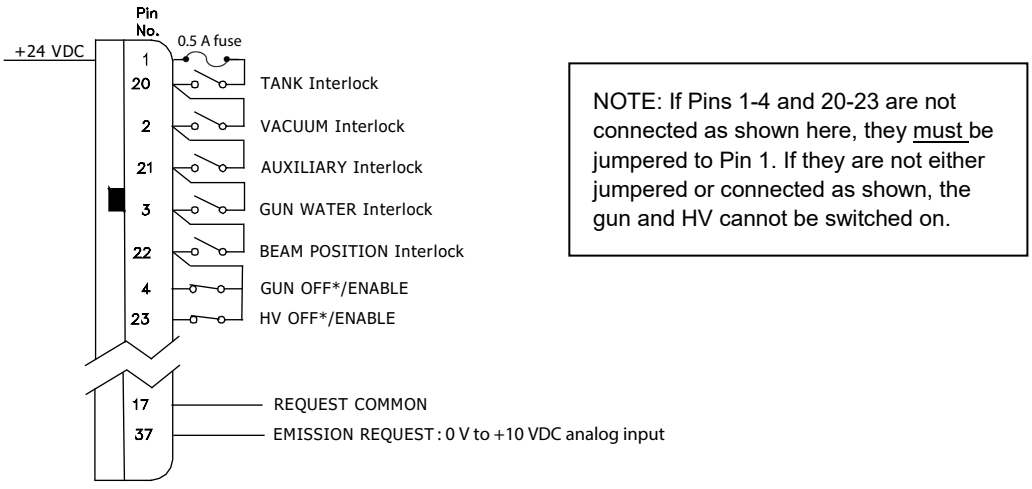


**Table 3-1 Signal Definitions for Required Connections to Aux I/O Connector**

| 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 E-Beam control module is configured as **Remote I/O**, or when that module is configured as **Local** with **Analog In** selected for **Emis Control** on the Config>E-Beam screen, this input controls the beam power request. |

### Connecting the EBC's Ground Wire

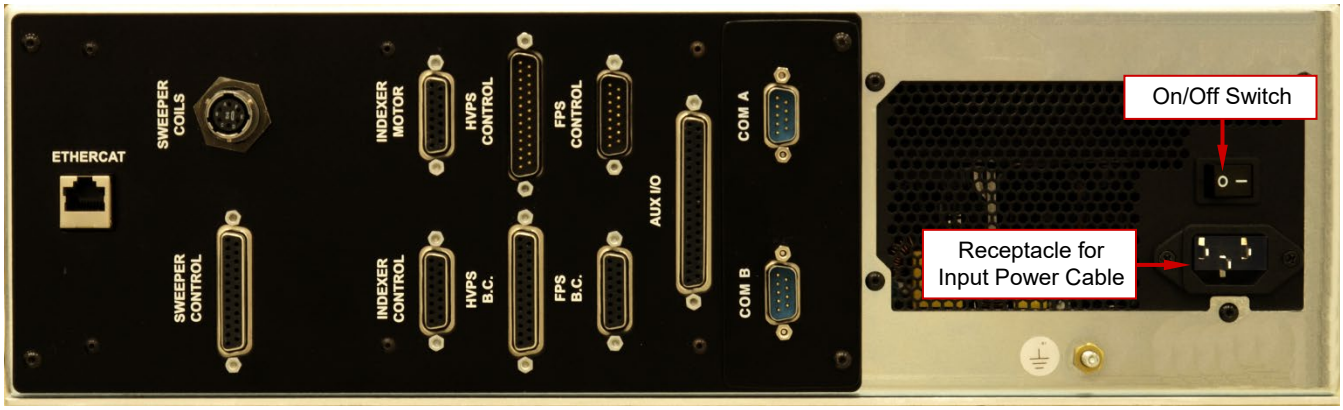
Connect a suitable length of the 1-in.-wide copper grounding strap to the EBC's rear panel grounding stud and to the central grounding point for the electronics cabinet in which that EBC is installed. This grounding point must be properly connected to a low-impedance ground. For instructions on correctly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

## 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 3-8) is in the OFF position. |

**Figure 3-9 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. Topics covered are:



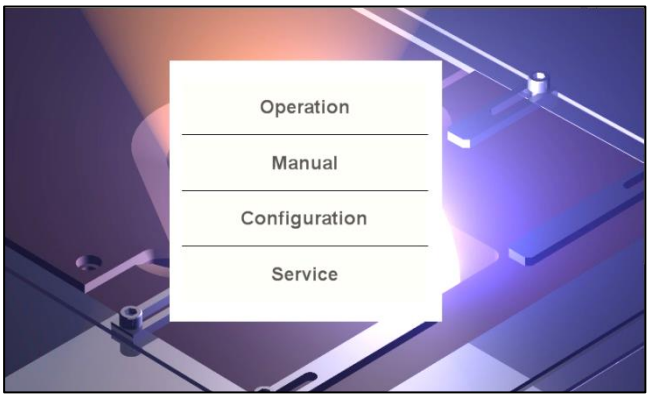
With minor modifications, the procedures described in this section are also applicable to installations in which the EBC is to operate under the control of a higher-level controller, either a deposition controller or a PLC-based system controller. The deposition controller can be either a single-layer type or a multilayer type, and the PLC-EBC communication can be convey in any of three different types of connections. The table below indicates which section of this manual to consult for the modified configuration instructions that apply in each of these cases.

| Higher-Level Controller | EBC to Higher Level Controller Communications Interface | Configuration Selection for EBC Control Modules | Section Reference |
|---|---|---|---|
| Single-Layer Dep. Ctlr. | EBC Rear Panel Sub-D Connectors | Local (Emis Ctl. = Analog In) | Section 6.3 |
| Multilayer Dep. Ctlr. | EBC Rear Panel Sub-D Connectors | Remote I/O | Section 7.3.3 |
| PLC System Ctlr. | EBC Rear Panel Sub-D Connectors | Remote I/O | Section 8.3 |
| PLC System Ctlr. | EtherCAT Link | EtherCAT | Section 9.3 |
| PLC System Ctlr. | RS-232 Link | RS-232 | Section 10.3 |

## 4.2 Configuring Control Modules

When first booted up, the EBC displays the screen shown in Figure 4-1.

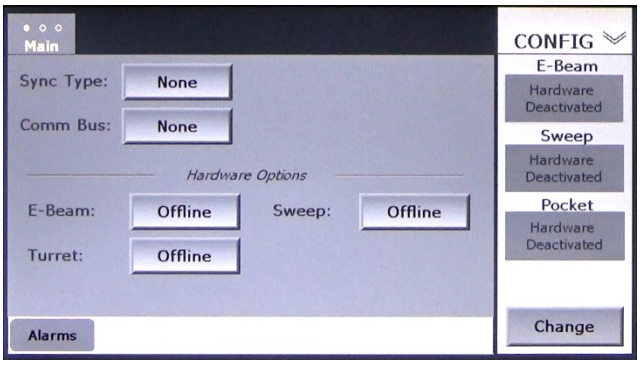
**Figure 4-1 EBC Boot-Up Screen**




To put the unit into Configuration Mode and configure the EBC's control modules, perform the procedure described below.

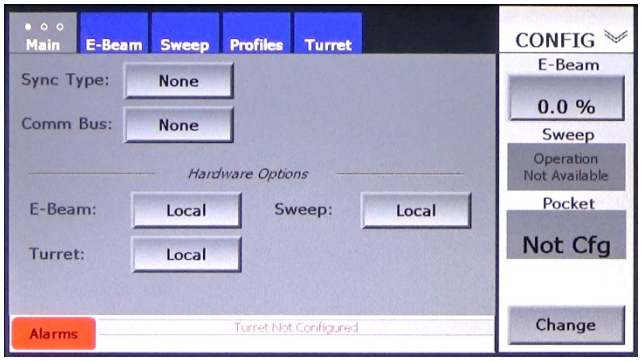
| Step | Action |
|---|---|
| 1 | Touch the boot-up screen's **Configuration** button. The unit will then display the Configuration>Main screen (see Figure 4-2). |

**Figure 4-2 Config>Main Screen After Initial Boot-Up**




| | |
|---|---|
| 2 | Configure the E-Beam control module. To configure this module for stand-alone operation, touch its configuration button once to select **Local**. If the E-Beam control module is not to be implemented in your installation, leave **Offline** in place. |
| 3 | Do the same for the Sweep and Turret control modules. Figure 4-3 shows how the Configuration>Main screen looks when all three control modules are configured as **Local**. |

**Figure 4-3 Configuration>Main Screen with All Control Modules Configured as Local**




**NOTE**

The procedures described in sections 4.5 through 4.8 assume that all control modules are configured as **Local**. However, if **Offline** remains selected for a given control module, skip the procedure(s) pertaining to that module.

## 4.3 Enabling the LogIn Manager and Assigning User Passcodes (Optional)

To enable the LogIn manage and assign user passcodes, perform the procedure described below. Note that any Service level user can assign or change user passcodes for all Service and Operator level users. Note also that when the Login Manager is disabled, all users have Service-level access.

| Step | Action |
|---|---|
| 1 | To reveal the LogIn Manager page, touch the **Main** screen tab (see Figure 4-4). The LogIn Manager screen will then appear as shown in Figure 4-5. |

**Figure 4-4 Displaying the LogIn Manager Screen**

Touch screen tab to display the Login Manager page

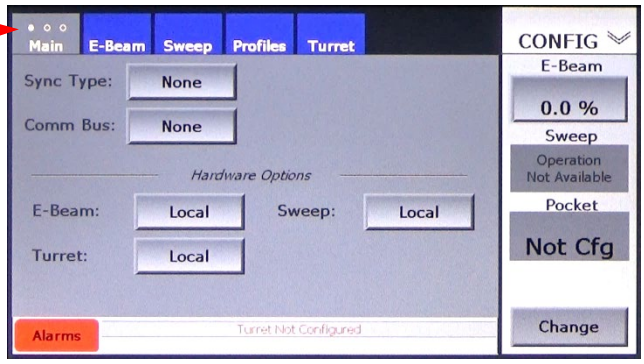
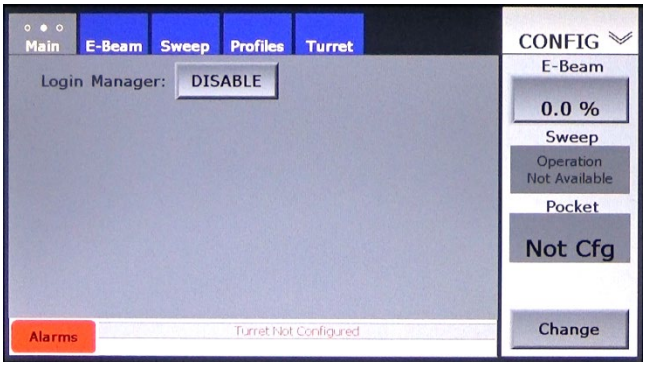
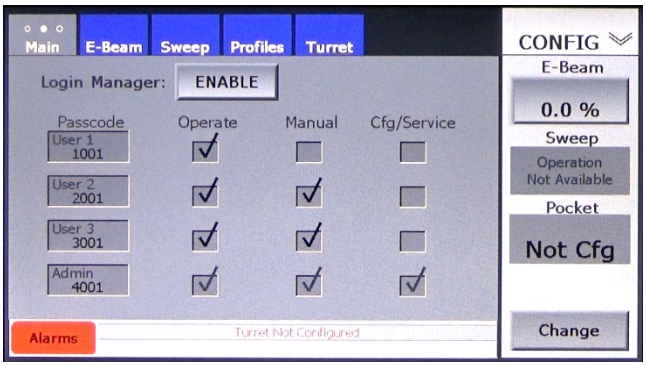


**Figure 4-5 The LogIn Manager Screen When Initially Displayed**




2 Touch the button labeled **DISABLE** to enable the LogIn Manager. The Login Manager screen will then appear as shown in Figure 4-6, with a default passcode and default permissions assigned for each user.

**Figure 4-6 LogIn Manager Screen After User Touches the *DISABLE* Button**




3 To change a user's passcodes, touch the recessed entry box for that user's passcode to display a numeric keypad and use that keypad to enter the desired passcode. To change a user's permissions, simply touch permission checkboxes to check or uncheck them as desired. To disable the Login Manager, touch the **ENABLE** button on this screen.

## 4.4 Setting the System Time and Date

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

| Step | Action |
|---|---|
| 1 | Touch the screen tab above the Config>Main screen's screen (see Figure 4-7) to open the System Date/Time screen (see Figure 4-8). |

**Figure 4-7 Displaying the System Date/Time Screen**

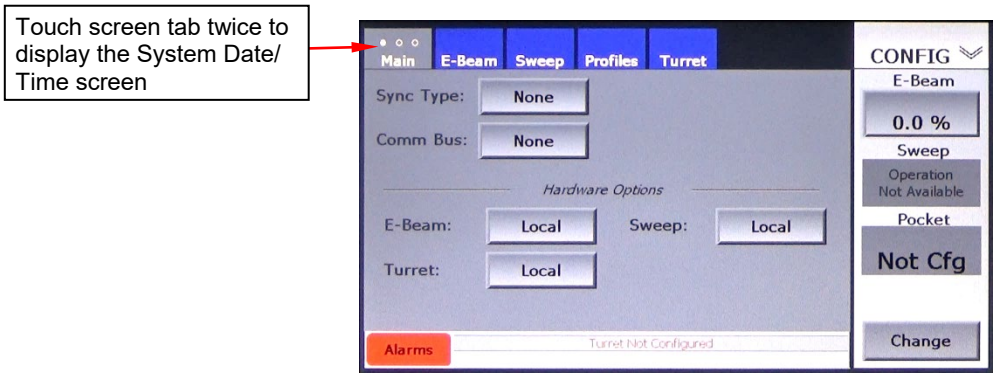
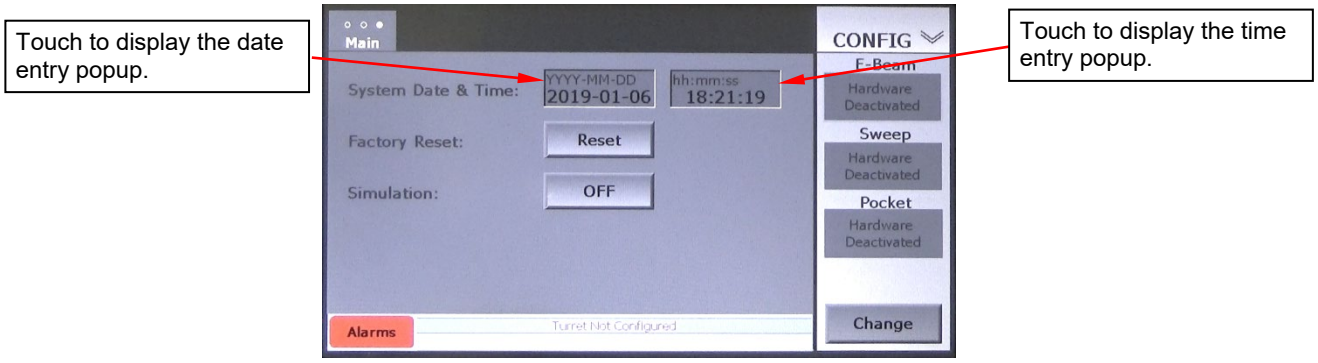
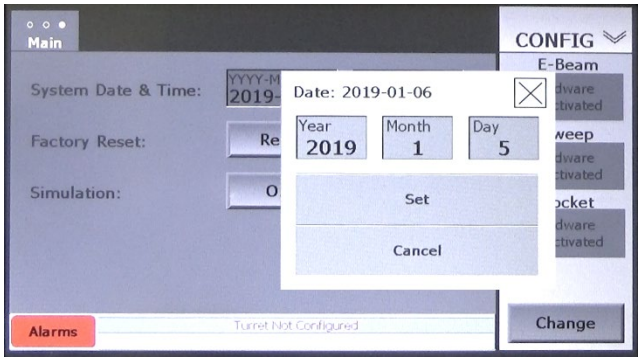



**Figure 4-8 System Date/Time Screen**




2 To change the system date, touch the recessed button bearing the system date to display the popup shown in Figure 4-9.

**Figure 4-9 System Date/Time Screen with Date-Entry Popup Displayed**




3 Touch any of the individual boxes labeled **Year**, **Month**, and **Day** to display a numeric keypad.

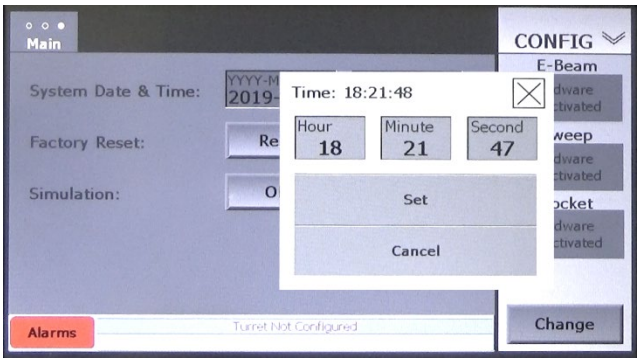
4 Use this keypad to enter the current year, month, or day, as the case may be.

5 Touch the keypad's **Enter** button.

6 Repeat Steps 4-5 as necessary to complete the correction of the date. When finished, touch the date-entry popup's **Set** button and then touch the **X** in the popup's upper right-hand corner to close it.

7 To change the system time, touch the recessed button bearing the system time to display the popup shown in Figure 4-10.

**Figure 4-10 System Date/Time Screen with Time-Entry Popup Displayed**




8 Touch any of the individual boxes labeled **Hour**, **Minute**, and **Date** to display a numeric keypad.

9 Use this numeric keypad to enter the correct number.

10 Touch the keypad's **Enter** button.

11 Repeat Steps 8-10 as necessary to complete the correction of the time. When finished, touch the time-entry popup's **Set** button and then touch the **X** in the popup's upper right-hand corner to close it.

# 4.5 Configuring the Turret Control Module

## 4.5.1 Overview of Turret Control Configuration Procedures

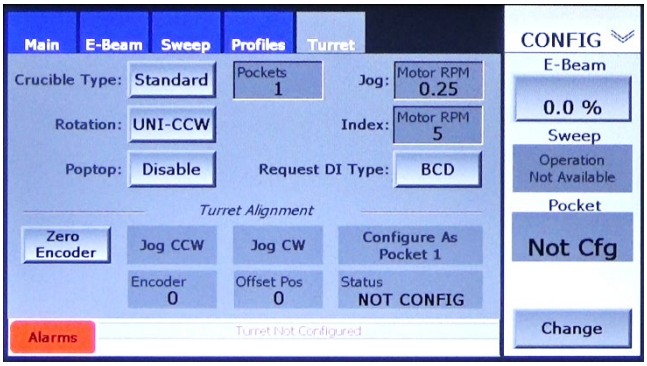
Turret Control module configuration is performed from the Config>Turret screen, which is described in detail in section 4.5.2. Turret module configuration consists of the following steps:

1. Selecting the crucible type, either **Standard** or **Custom**. For instructions, see section 4.5.3.
2. Selecting the number of pockets in the e-gun to be controlled (see section 4.5.3)
3. Selecting the direction and mode of turret rotation (see section 4.5.3)
4. Enabling or disabling the **Poptop Down** LED on the Details screen
5. Setting the jog and index speeds (see section 4.5.3)
6. Configuring a custom crucible (see section 4.5.4)
7. Configuring a selected pocket as Pocket 1 (see section 4.5.5).

## 4.5.2 Overview of the Config>Turret Screen

Figure 4-25 shows the Config>Turret screen as it appears after the EBC is first booted up.

**Figure 4-11 Config>Turret Screen at Initial Boot-Up**




The features on this screen enable the user to select:

- Crucible type, either **Standard** or **Custom** (see below for definitions)
- Number of pockets in the crucible: Max. 60 for standard crucibles, max. 4 for custom crucibles
- Rotation direction/mode. The available selections 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)
- Jog speed (0-7 RPM). Value entered here determines 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). Value entered here determines the speed at which the turret drive motor turns during ordinary pocket-to-pocket rotation or during continuous rotation of continuous-trough and 'skillet'-type crucibles.

> 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.

- **Poptop Enable/Disable**: Allows user to enable or disable the **Poptop down** LED on the Details screen (see Figures 12-2, through 12-4) and the Service Aux I/O Screen (see Figures 12-8 and 12-9). Note: Selecting **Disable** here does not disable the actual PopTop cover.
- **Request DI Type** button: Allows selection of either **BCD** or **BCD-1**. For information about BCD and BCD-1 codes, see Figures 8-2 through 8-5.

In addition, a number of features on the Config>Turret screen pertain to the configuration of the Home position for the pocket designated as Pocket 1. Those features are:

- the **Zero Encoder** button
- the **Jog CCW** button
- the **Jog CW** button
- the **Cfg As Pocket 1** command button
- the **Encoder** display box, which indicates encoder counts
- the **Offset Position** display box, which also indicates encoder counts
- the **Status** indicator box

For functional information about these features, see section 4.5.3.

**Standard vs. Custom Crucibles: Definitions**

**Standard Crucible:** For crucibles with two or more pockets, the term *Standard Crucible* refers to a crucible containing only conventional circular pockets. When **1** is selected **Pockets**, the Turret Control module operates in a mode designed to support either a continuous-trough crucible or a 'skillet'-type crucible. In either case, when rotation is commanded to go on, the crucible rotates continuously in the direction selected opposite **Rotation** and at the configured **Index** speed.

**Custom crucible:** Custom crucibles contain varying combinations of standard and banana-shaped pockets. This generally means two standard pockets and one 'banana', but Custom crucibles can be configured for up to four pockets.

## 4.5.3 Setting Globally Applicable Turret Module Parameters

The following procedure describes how to configure the parameters that apply to Standard as well as Custom crucibles. For instructions on configuring parameters unique to Custom crucibles, see section 4.5.4.

| Step | Action |
|---|---|
| 1 | First select the crucible type, using the **Crucible Type** button. To select a standard crucible containing only circular pockets, accept the default selection, **Standard**. To select a crucible that can contain a mixture of standard circular pockets and banana-shaped evaporant holders, press the **Crucible Type** button once to display **Custom**. |
| 2 | Next select the number of pockets. To do so, touch the **Pockets** button to display a numeric keypad and use it enter the number of pockets in the turret source, up to a maximum of 60. |

**NOTE**

To configure the Turret Control module for use with either a continuous-trough crucible or a 'skillet'-type crucible, select **Standard** and enter **1** for **Pockets**.

| | |
|---|---|
| 3 | Next select the desired rotation direction and mode (i.e., either unidirectional or bidirectional). The available selections are:<br>• **UNI-CCW** = Unidirectional counterclockwise<br>• **UNI-CW** = Unidirectional clockwise<br>• **BI-CCW** = Bidirectional counterclockwise<br>• **BI-CW** = Bidirectional clockwise<br>If the default, **BI-CCW**, is appropriate for your application, skip this step and proceed to Step 4. To change the rotation mode and direction, touch the **Rotation** button repeatedly until the desired selection is displayed on that button. |
| 4 | Opposite **Poptop**, either accept the default, **Disable**, or press the button once to select **Enable**. If you select **Enable**, the Details 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 Details page.

5 If desired, change the **Jog Speed**. This is the speed at which the turret rotates 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 numeric 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.

6 If desired, change the **Index Speed**. This is the speed at which the turret drive motor will turn during ordinary pocket-to-pocket rotation or continuous rotation, in the case of continuous-trough and skillet-type crucibles. To change the Index Speed:

a) Touch the **Index Speed** button to display a numeric 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.

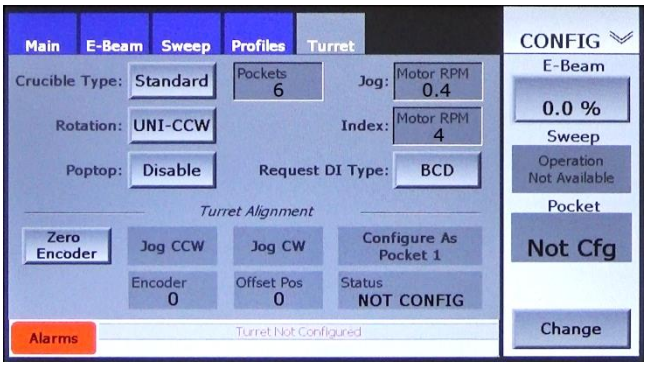
NOTE

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 the example shown in Figure 4-12, the user has changed the number of pockets to 6, changed the Jog Speed to 0.4 RPM, and changed the Indexing Speed to 4 RPM.

7 If necessary, touch **Request DI Type** button to toggle from **BCD** to **BCD-1**. Tables 8-2 through 8-5 show the differences between BCD and BCD-1 coding.

**Figure 4-12 Config>Turret Screen After User Changes Pocket Number, Jog Speed, Index Speed**

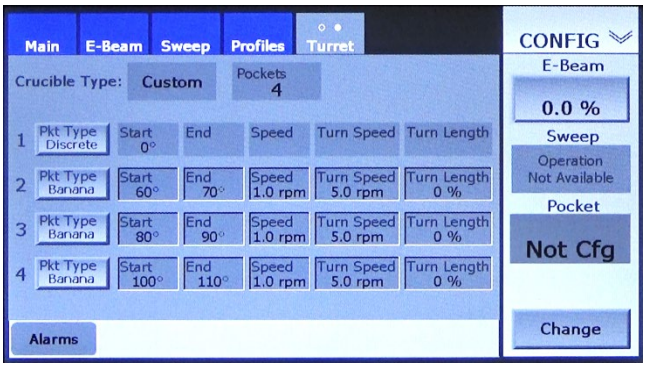


## 4.5.4 Configuring Custom Crucibles

### Overview of Config>Turret Screen, Page 2

Figure 4-13 shows Page 2 of the Config>Turret screen in its default state, and its on-screen features are defined in detail following that illustration. Config>Turret screen, page 2, enables the user to configure custom crucibles. By default, the pocket defined in Row 1 is always a Discrete pocket (i.e., standard circular pocket), and the pocket defined by that row is identical to **Pkt 1** as configured on Page 1 of the Config>Turret screen. The pockets defined by rows 2-4 on page 2 of that screen can include one banana-shaped pocket and one or more standard pockets.

**Figure 4-13 Config>Turret Screen, Page 2, as It Appears at Initial Boot-up**




**Pkt Type** button: Press to toggle between **Discrete** (= a circular pocket) and **Banana** (= a banana-shaped pocket).

**Start** entry box: For a Discrete pocket, the **Start** point is the pocket's center point, as shown in Figure 4-14. By default, the Start point of Pocket 1 equals zero degrees rotation, and Pocket 1 must always be a Discrete pocket. Figure 4-14 also illustrates the **Start** point of a banana-shaped pocket. That point is indicated the cross-hairs near the banana's leading edge (with respect to rotation direction), and it coincides with a circle whose diameter equals the width of the banana drawn so that its leading edge coincides with that of the banana. In Figure 4-14, the banana's **Start** point is at 90° rotation, while the **Start** point for Pocket 3 is at 270° rotation.

**End** entry box: In Figure 4-14, the banana's **End** point is the cross-hairs near the banana's trailing edge (with respect to rotation direction), and it is at 190° rotation. Note that the concept of an End point does not apply to Discrete (i.e., circular) pockets.

**Speed** entry box: Value entered here determines the speed at which the banana moves through most of its oscillation, (i.e., when the turnaround zone defined by the **Turn Length** is not centered beneath the beam's longitudinal axis).

**Turn Speed** entry box: Value entered here determines the banana's oscillation speed during the turnaround segment defined by the **Turn Length** value. This speed is generally higher than that defined in the **Speed** entry box.

**Turn Length** entry box: Value entered here determines size of the banana's turnaround segment, during which the crucible oscillates at the **Turn Speed**. This value is entered as a percentage of the arc length of the banana in question. In Figure 4-15, the areas outlined in red show Turn Lengths of 2.5% and 5%, as applied to a 90° banana.

**Figure 4-14 Start and End Points of Pockets in a Custom Crucible**

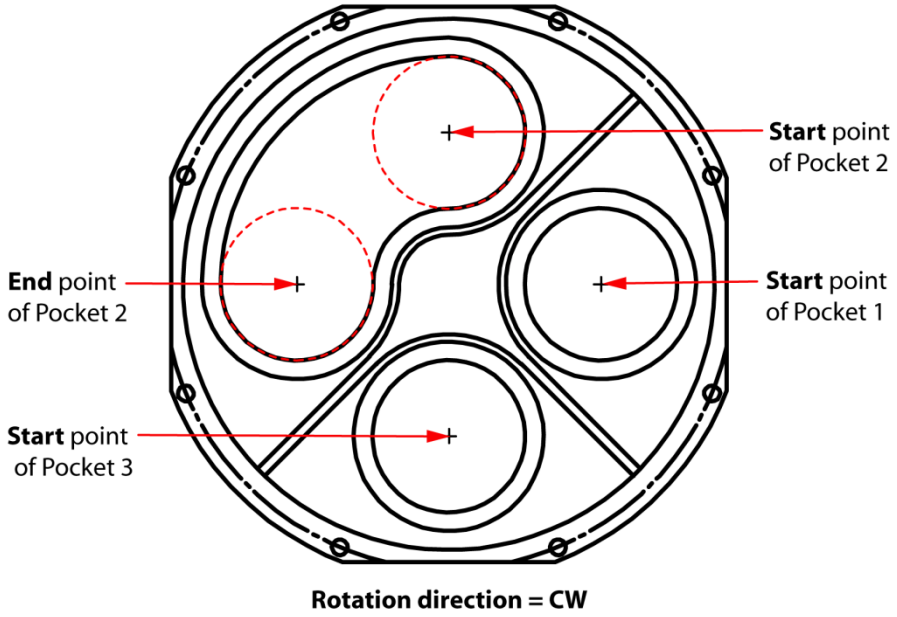
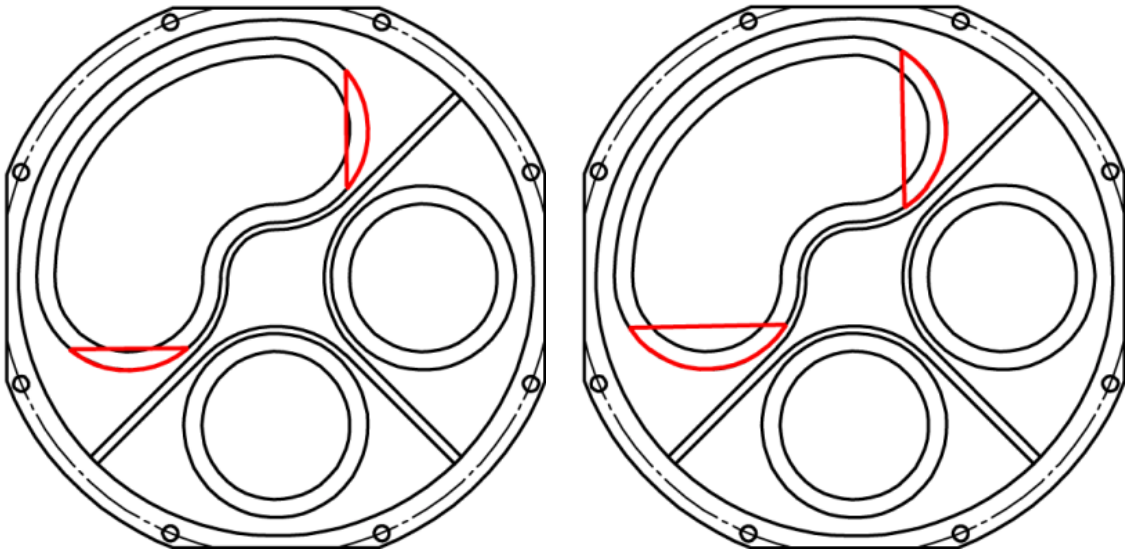



**Figure 4-15 Size of Turnaround Zone As a Function of Turn Length**

**Turn Length Set to 2.5%** **Turn Length Set to 5%**

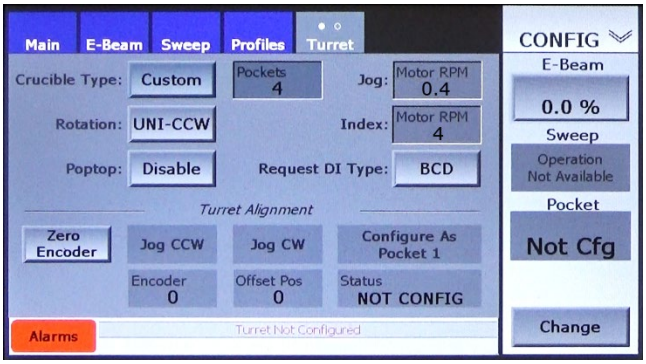


### Custom Crucible Configuration Procedure

This following procedure describes how to configure a Custom crucible containing at least one banana-shaped pocket.

| Step | Action |
|---|---|
| 1 | When performing Step 1 of the procedure described in section 4.5.3, select **Custom**. The Config>Turret screen will then appear as shown in Figure 4-16, with two dots in its screen tab. |

**Figure 4-16 Config>Turret Screen, Page 1, After User Selects *Custom* for *Crucible Type***

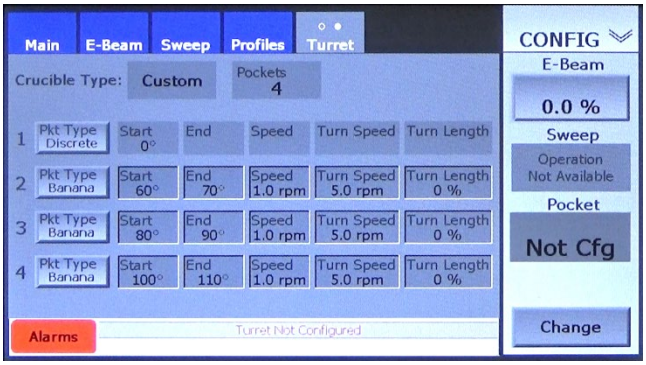



2 Touch the **Pockets** entry box to display a numeric keypad.

3 Use that keypad to enter the number of pockets in the target crucible and then touch **Enter** to close the keypad. The **Pockets** entry box will then will than display the number you entered.

4 Touch the screen tab to open Page 2 of the Config>Turret screen, which will appear as shown in Figure 4-13, assuming that you have selected **4** for **Pockets** on Page 1.

**Figure 4-17 Config>Turret Screen, Page 2, in its Default State**



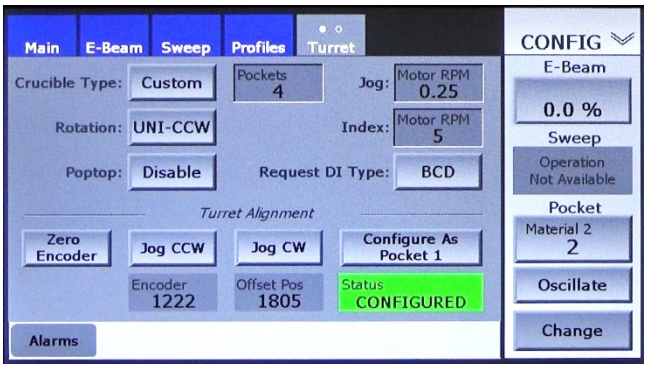

5 If necessary, touch the **Pkt Type** button for any of pocket rows 1-4 to select **Discrete**.

6 Enter values (in degrees of rotation) defining **Start** points for Discrete pockets. By default, Pocket 1 must be a discrete pocket, and its center point is defined as zero degrees rotation.

For pockets defined as bananas, enter the appropriate values for **Start, End, Speed, Turn Speed,** and **Turn Length**. These parameters are defined above, under the heading Overview of Config>Turret Screen, Page 2. After Custom crucible configuration is completed, the user can manually command a banana-shaped pocket to oscillate. To do so, first touch the **Pocket** button on the Command Button bar to rotate the crucible to the 'banana' in question. The Command Button bar will then display an

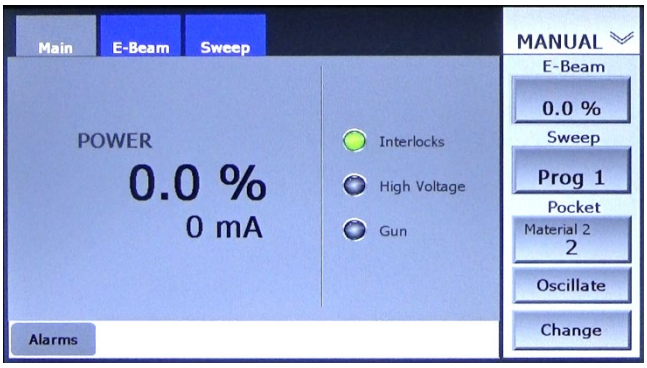
**Oscillate** button, as shown in Figure 4-18. Touching that button starts the selected 'banana' oscillating. Touching the same button again stops the oscillation.

**Figure 4-18 Config>Turret Screen, Page 1, Displaying the *Oscillate* Button**




Note that when a banana-shaped pocket is in evaporation position, the **Oscillate** button also appears on the Command Button bar in Manual mode, as shown in Figure 4-19.

**Figure 4-19 Manual Main Screen, *Oscillate* Button Displayed on the Command Button Bar**

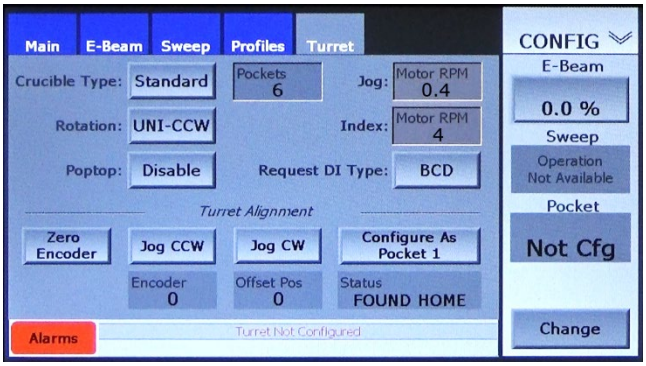



## 4.5.5 Configuring Pocket 1 from the Config>Turret Screen

The following procedure describes how to configure a user-selected pocket as Pocket 1. 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 this procedure can also be performed from the hand-held remote controller, following the procedure described in section 4.5.6. 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 | Touch the **Zero Encoder** button. The Config>Turret screen now appears as shown in Figure 4-20, with the **Jog CCW, Jog CW,** and **Configure As Pocket 1** buttons now active. In addition, the **Status** indicator reads **FOUND HOME**, while the **Encoder** and **Offset Pos** values remain zero. |

**Figure 4-20 Config>Turret Screen After User Zeroes the Encoder**




2 Determine which pocket is to be designated as Pocket 1.

3 Use the **Jog CCW** and/or the **Jog CW** button to rotate this pocket so that it is precisely centered in evaporation position, as shown in Figure 4-21.

**Figure 4-21 Pocket in Evaporation Position**

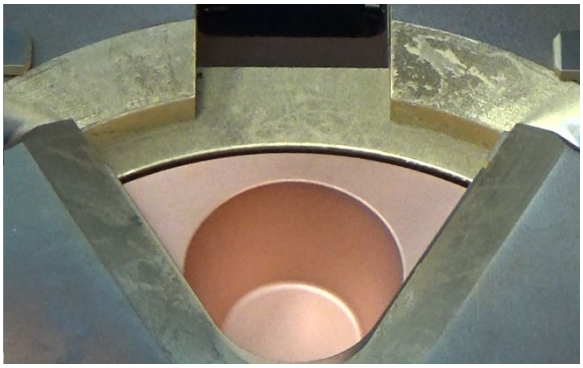
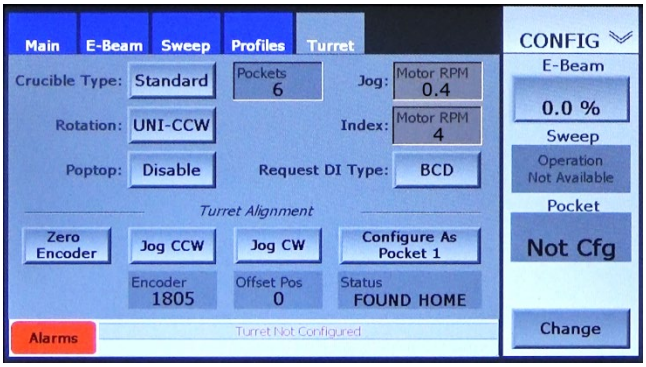


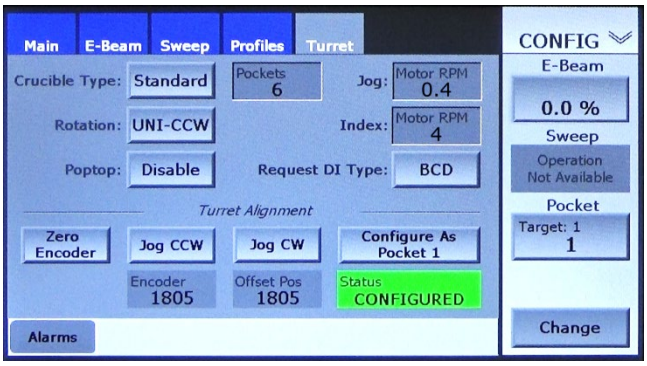
Figure 4-22 shows the Config>Turret screen as it would appear after Pocket 1 is jogged into evaporation position, with a nonzero **Encoder** value and the **Offset Pos** value still zero.

**Figure 4-22 Config>Turret Screen After User Jogs Turret Pocket into Evaporation Position**



4 With the target Pocket 1 in evaporation position, touch the **Configure as Pocket 1** button. The screen now appears as shown in Figure 4-23. The **Status** indicator displays **CONFIGURED**, identical values are displayed for **Encoder** and **Offset Pos**, and **1** is displayed on the **Pocket** button. In addition the Alarm message **Turret Not Configured** has disappeared.

**Figure 4-23 Config>Turret Screen After User Touches the *Configure As Pocket 1* Button**




5 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 the vacuum chamber down to the desired pressure.

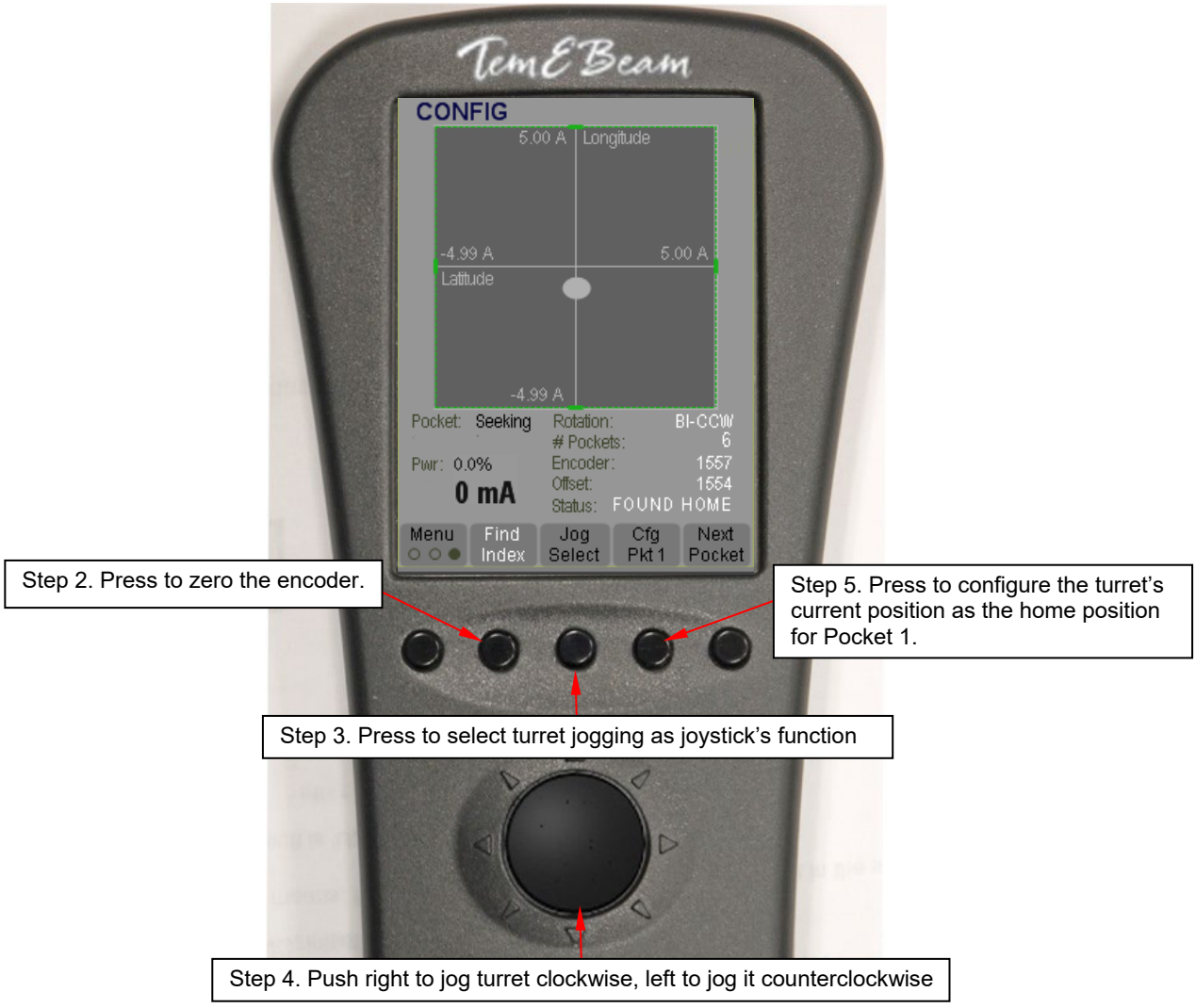
The Turret Control module is now configured. If you have made all the configuration changes you wish to make at this time, exit from Configuration Mode to save your changes, as described in section 4.9. If not, proceed to section 4.6.

### 4.5.6 Configuring Pocket 1 Using the Hand-Held Controller

You can also use the hand-held remote controller to configure the Home position for Pocket 1. This method makes it possible to configure home position for the Pocket 1 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 | Press the remote controller's **Menu** button twice to display Menu 3, which is shown in Figure 4-24. |

**Figure 4-24 Using Config Screen's Menu 3 to Configure the Home Position for Pocket 1**




2 Touch the **Find Index** button to zero the encoder. **FOUND HOME** will appear in white opposite **Status**, a nonzero value will appear opposite **Offset**, and **0** (zero) will be displayed opposite **Encoder**.

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

4 Use the joystick to jog the turret to the correct Home position for Pocket 1 (see Figure 4-21). Push the joystick to the left for counter-clockwise rotation and to the right for clockwise rotation.

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

6 If you have broken vacuum and lowered 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 the vacuum chamber down to the desired pressure.

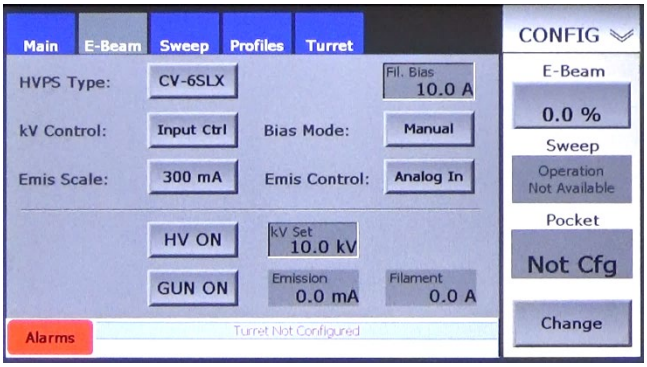
7 If you have made all the configuration changes you wish to make at this time, save your changes, as described in section 4.9. If not, proceed to section 4.6.

## 4.6 Configuring the E-Beam Control Module

Perform the procedure described below to configure the EBC for operation with your system's e-beam power supply.

| Step | Action |
|---|---|
| 1 | Touch the Menu Bar's E-Beam button to display the Config>E-Beam screen (see Figure 4-25). |

**Figure 4-25 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 from **CV-6SLX** to **CV-12SLX**.

3 Use the **KV Control** button to select **Manual**, **Pot Ctrl** or **Profiles**. If **Manual** is selected, you can use the recessed **kV Set** button on this screen to enter a kV setpoint. If you select **Pot Ctrl**, the kV setpoint can be set via the potentiometer on the HVPS front panel. In that case, this screen's **kV Set** button is replaced by a flat rectangle displaying the kV setpoint, as shown in Figure 4-26. If you select **Profiles**, this screen's **kV Set** button is also replaced by a flat display rectangle. In that case, the kV setpoint is adjusted via a **kV Set** button that appears on Profiles Page 1 when that screen is in Edit Mode A (see 4-33).

4 If you have selected **Manual** for **kV Control**, you can use the **kV Set** button to change the kV setpoint. To do so:

a) Touch the **kV Set** button to display a numeric keypad.
b) Use that keypad to enter the desired value.

c) Touch **Enter** to close the keypad. The value you entered will then appear on the **kV Set** button.

Follow the same steps when adjusting the kV setpoint via the **kV Set** button that appears on Profiles Page 1 when it is in Edit Mode A (see 4-33).

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 Use the **Bias Mode** button to select either **Manual**, **Auto**, or **Profiles**. If **Manual** is selected, you can use the recessed **Fil Bias** button on this screen to set the filament current's bias setpoint. If **Auto** is selected, the **Fil Bias** button disappears from this screen, and the default bias value is determined by an input from the HVPS. If you select **Profiles**, this screen's **Fil Bias** button likewise disappears, and the kV setpoint is adjusted via a recessed **Fil Bias** button that appears on Profiles Page 1 when that screen is in Edit Mode A (see 4-33).

6 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

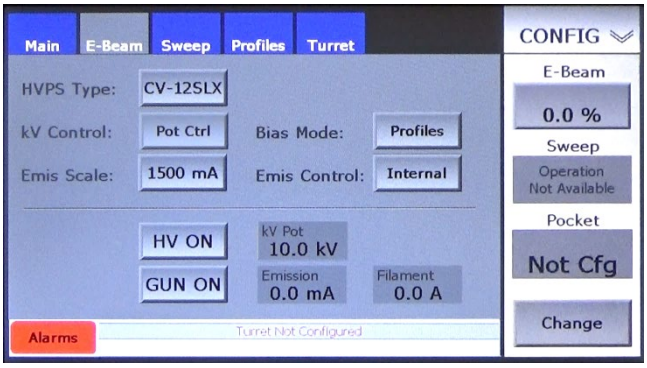
b) Touch the keypad's **Enter** button to close it. The value you entered will then appear in the **Fil Bias** button.

Follow the same steps when adjusting the bias setpoint via the **Fil Bias** button that appears on Profiles Page 1 when it is in Edit Mode A (see 4-33).

7 Use the **Emis Control** button to select either **Analog In** or **Internal**. If **Internal** is selected, then the emission power setpoint is determined by user input via the EBC's Command Button bar. If you select **Analog In**, that setpoint is determined by an input from a higher-level controller (i.e., either a deposition controller or a PLC-based system controller). That input is transmitted to the EBC via Pin 37 of the EBC's rear panel Aux I/O connector.

Configuration of the E-Beam control module is now complete. Figure 4-26 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. The setpoint for the filament bias current level is set to 18.0 A, and the default kV value (10 kV) has not been changed, **Profiles** has been selected for **Bias** Mode, and **Pot Ctrl** has been selected for **kV Control**.

**Figure 4-26 Typical Config>E-Beam Screen, E-Beam Control Module Configuration Completed**

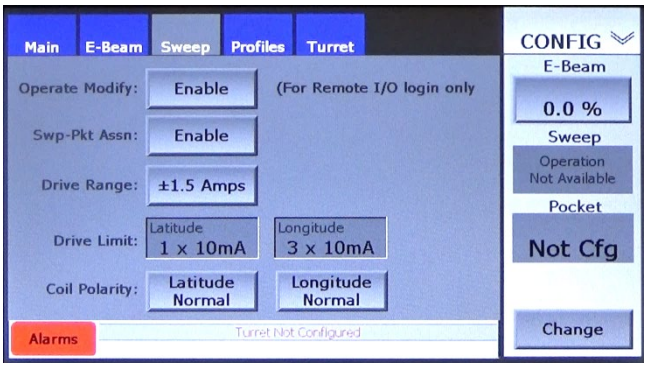



If you have completed all the configuration changes you wish to make at this time, save them, following the procedure described in section 4.9. If not, proceed to section 4.5.

## 4.7 Configuring the Sweep Control Module

Figure 4-27 shows the Config>Sweep screen. The configurable parameters on this screen are described in detail below the illustration.

**Figure 4-27 Config>Sweep Screen**



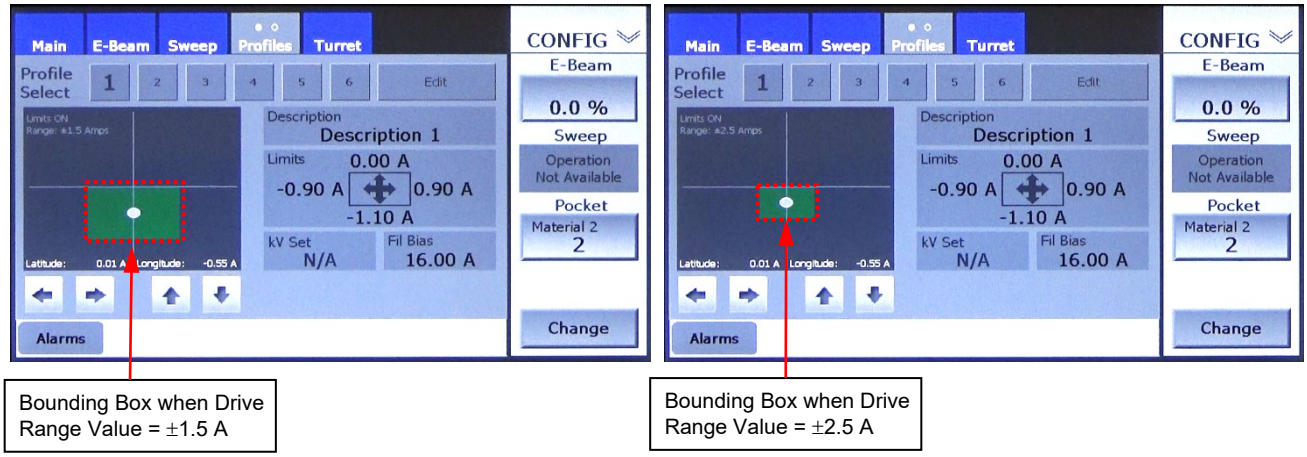

**Operate Modify** button: Touch this button, to toggle between **Enable** and **Disable**. When the Sweep control module is configured as **Remote I/O** and the Log-In manager is enabled, selecting **Disable** prevents users who have only Operations mode access from changing sweep programs. When the 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: Touch this button to toggle between **Enable** and **Disable**. When **Enable** is selected, the user can associate up to 10 unique sweep programs with each pocket. If **Disable** is selected, a total of eight sweep programs are available for use with any pocket. Note that enabling **Swp-Pkt Assn** has no effect when the Turret Control module is configured for a crucible with more than 16 pockets.

**Drive Range** button: Pressing this button allows the user to change the maximum current output of the e-gun's longitudinal and lateral sweep coils. 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 beam limits disabled, the **Drive Range** function can be used to limit beam travel in both axes, thus protecting the uncooled portions of the e-gun. Limiting the drive range also reduces the likelihood of coil overheating when beam limits are disabled.

As Figure 4-28 shows, increasing the **Drive Range** value decreases the size of the bounding box on Profiles page 1 that reflects the beam limit values as currently set. Note also that the **Drive Range** value does not affect the size of the bounding box in the Manual>Sweep or Operations>Sweep screens.

**Figure 4-28 Change in Size of Bounding Box on Profiles Page 1 as *Drive Range* Value Increases**




**Drive Limit** button: The **Drive Limit** value determines the width of a buffer zone within the bounding box determined by the beam position interlock limits. This buffer zone limits beam motion toward the beam limits. In Figure 4-29, the green dotted lines define this buffer zone, while the red rectangle shows its inner limits. The green rectangle is the bounding box defined by the beam position interlock limits. In this example, the Drive Limit value is set to 200 mA.

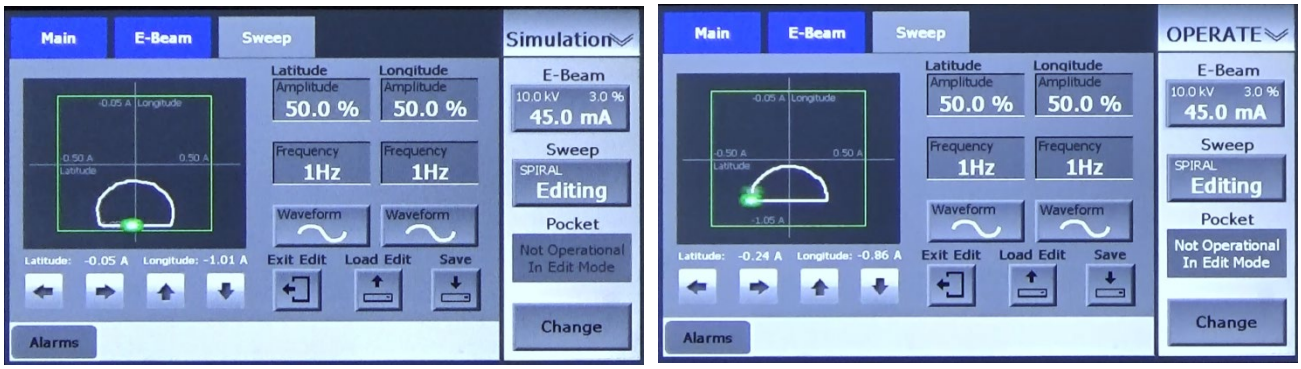
When a beam sweep pattern drives the beam to the inner edge of this buffer zone, the sweep pattern is clipped along its inner edge, and the beam travels along that edge until it reaches the point at which the sweep pattern would direct the beam back inside the area bounded by the buffer zone. As a result of 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. Figure 4-30 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.

The width of the buffer is proportional to milliamperes of coil-drive output. To change the Drive Limit value, touch the **Drive Limit** button to display a numeric keypad and use it to enter a new value. After you touch **Enter** to close the keypad, the new value will be displayed in the recessed **Drive Limit** button. Note that the effective Drive Limit value is 10 times that displayed in the **Drive Limit** button. Thus, if displayed value is **20**, the effective **Drive Limit** value is 200 mA. Note also that unlike the **Drive Range** setting, the **Drive Limit** value affects the operation of the Sweep Control module in all EBC operating modes.

**Figure 4-29 Buffer Zone Defined by the Drive Limit Value**


**Figure 4-30 Variation in 'Clipping' Effect Pattern Depending on the Drive Limit Value**

**Drive Limit Value = ±50 mA** **Drive Limit Value = ±200 mA**




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

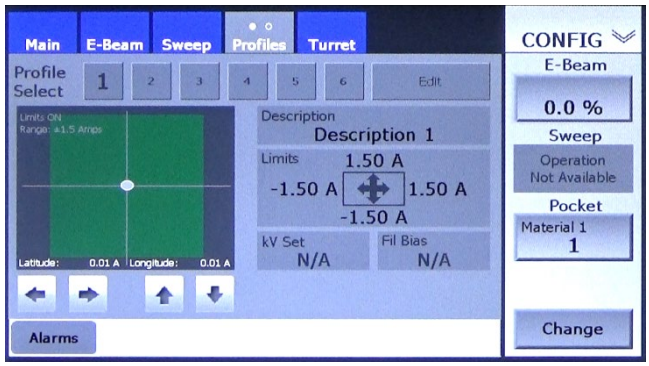
# 4.8 Configuring Profiles

Profiles Pages 1 and 2 (see Figure 4-31) enable the user to:

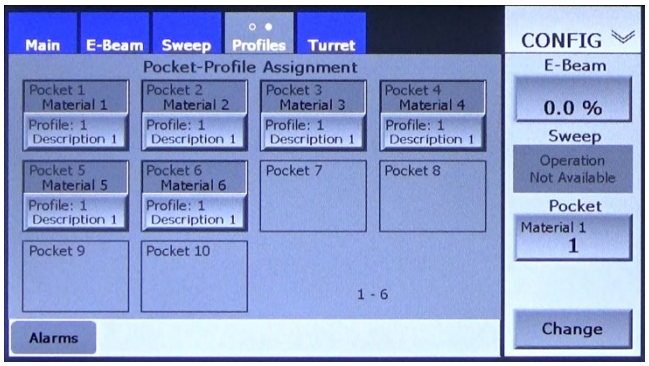
- create up to six profiles consisting of suites of power supply parameters (i.e., kV and filament bias settings) and beam limits, and
- apply any of these profiles to one or more of the pockets in the controlled turret source.

**Figure 4-31 Profiles Pages 1 and 2**

**Profiles Page 1**




**Profiles Page 2**




Profile configuration entails two separate procedures. The user first employs control and parameter-entry features on Profiles page 1 to assign specific power supply operating parameters and beam position interlock limits to each of the profiles that are to be configured. A descriptive word or title can also be assigned to each profile. These procedures are covered in sections 4.8.2 and 4.8.3.

Then, employing Profiles page 2, the user assigns each of the configured profiles to one or more pockets. Optionally, the user can also assign a material name or other descriptive character string to each pocket. These procedures are described in detail in sections 4.8.4 and 4.8.5.

## 4.8.1 Overview of Profiles Page 1

Profiles Page 1 (see Figure 4-32) enables the user to configure up to six profiles, each of which can be associated with one or more pockets in a multipocket source. For each such profile, Profiles page 1 allows the user to:

- set beam position interlock limits
- determine the voltage at which the HV will operate for that profile, assuming that **Profiles** was selected for **kV Control** on the Config>E-Beam screen
- determine the filament bias current for that profile, if **Profiles** was selected for **Bias Mode** on the Config>E-Beam screen

These parameter values are applied to any pocket to which the profile in question is assigned. Profiles Page 1 also enables the user to apply a descriptive title or other text string to each profile.

**Figure 4-32 Profiles Page 1, in its Initial State**


Touching this screen's **Edit** button displays Profiles Page 1 in Editing Mode A (see Figure 4-33). Editing Mode A allows the user to enter descriptive text in the **Description** field. In addition, if **Profiles** is selected for **kV Control** as well as **Bias Mode** on the Config>E-Beam screen, the **kV Set** and **Fil Bias** rectangles on Profiles Page 1 become active parameter-entry buttons, allowing the user to adjust the kV operating and filament bias values via that screen. Figure 4-33 shows Profiles Page 1 in that state.

**Figure 4-33 Profiles Page 1 in Editing Mode A, kV Set and Fil Bias Buttons Available**

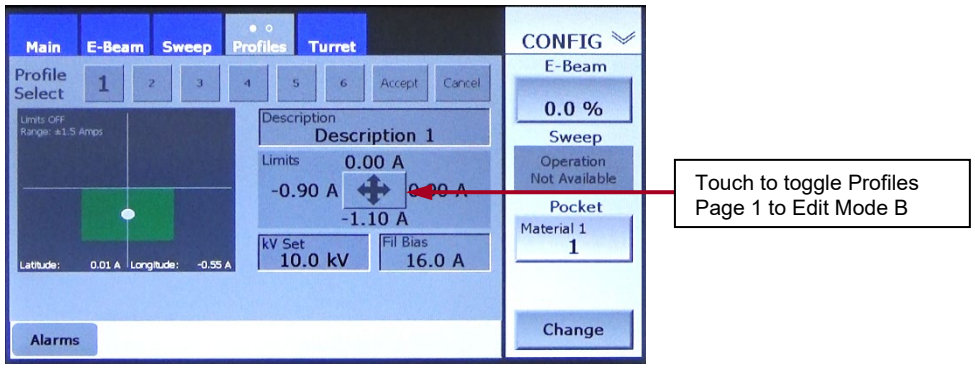
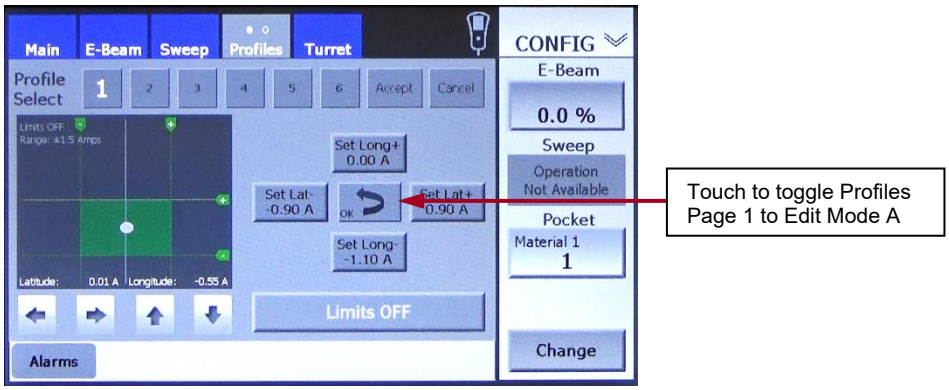



Figure 4-34 shows Profiles Page 1 in Editing Mode B, whose features enable adjustment of the beam position interlock limits. To toggle between these two editing modes, touch the button indicated in Figures 4-33 and 4-34.

**Figure 4-34 Profiles Page 1 in Editing Mode B**



### 4.8.2 Entering kV Set and Fil Bias Values and Optional Profile Descriptions

Perform the following procedure to adjust **kV Set** and **Fil Bias** values. Note that this procedure assumes that **Profiles** was selected for **kV Set** as well as **Bias Mode** on the Config>E-Beam screen.

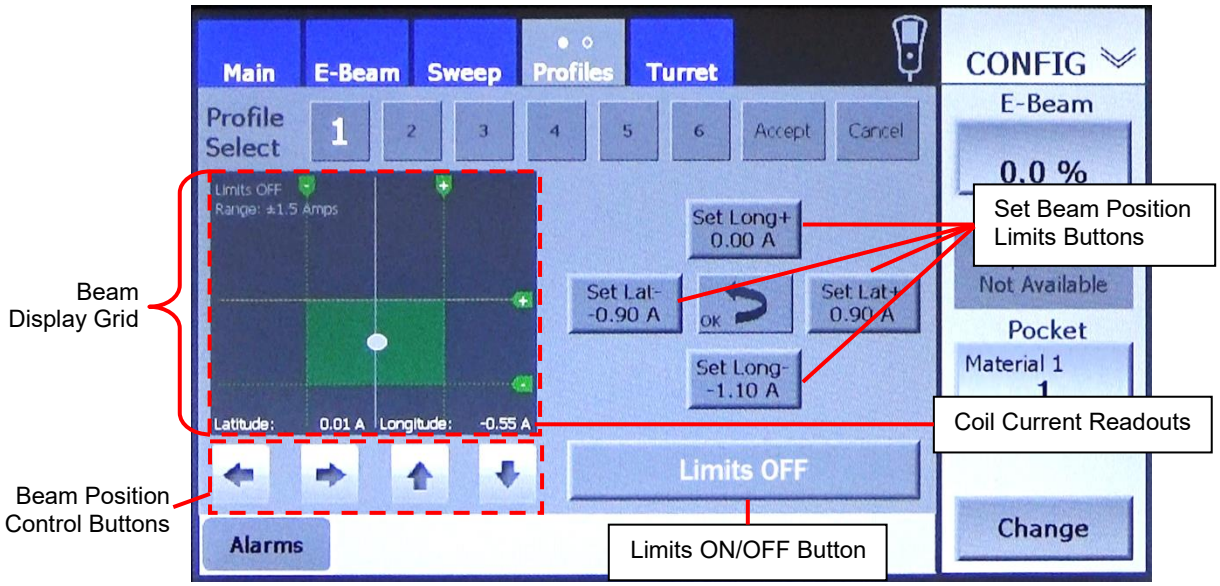
| Step | Action |
|---|---|
| 1 | Touch the **Edit** button on Profiles Page 1 in Edit Mode A, if it is not already in that state. |
| 2 | Touch the recessed entry button for the parameter (i.e., either **kV Set** or **Fil Bias**) whose value you wish to adjust. |
| 3 | The system will then display a numeric keypad. Use that keypad to enter the desired value. |
| 4 | Touch the keypad's **Enter** button to close it. The new value will then appear in the recessed button you touched in Step 1. |
| 5 | To enter descriptive text in the **Description** field, touch the recessed **Description** button to display an alphanumeric keyboard and use it to enter the desired text. The text you entered will then appear in the Description button. |

### 4.8.3 Setting Beam Position Interlock Limits

#### Features on Profile Page 1 Used in Setting Beam Position Interlock Limits

Figure 4-35 shows Profiles Page 1 in Editing Mode B and identifies the features that are used to adjust beam position limits.

**Figure 4-35 Profiles Page 1 Features that Enable Beam Limit Adjustment when in Edit Mode B**



Those features are:

- **Beam display grid:** Displays the beam's current position.
- **Coil current readouts:** Indicate the coil current outputs at the beam's current position.
- **Beam position control buttons:** Enable the user to move the beam up/down right/left.
- **Set beam position limit buttons**: Pressing one of these buttons sets a beam position interlock limit at the beam's current position.
- **Limits ON/OFF** button: Enables the user to enable/disable the beam position interlock limits.

**NOTE**

When the beam is switched on, the screen's beam spot appears as shown in Figure 4-36 only when the active profile is selected. When any other profile is selected with the beam on, its position is shown accurately, but it is represented as an inactive beam spot, as in Figure 4-35.

### Effect of Enabling/Disabling Limits

**Beam Limits ON:** When **Limits ON** is selected, the following events occur if the user attempts to drive the beam beyond any of the four beam position limits:

- The beam is switched off.
- The green beam limit bounding box turns red.
- The EBC issues a beam-position alarm, which must be acknowledged and cleared before the beam can be switched back on.

In order to resume operations with the beam on, the user must acknowledge the beam position alarm, move the beam spot back inside the bounding box, re-enter the desired beam power level, and switch the beam back on.

**Beam Limits OFF:** When **Limits OFF** is selected, the beam is now switched off if the user drives the beam beyond any of the four beam position limits, so beam position alarm is issued.

**CAUTION**

When the EBC is in Configuration Mode with beam limits disabled and, 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 Range** value that protects the gun.

### Setting Beam Position Interlock Limits for Conventional Circular Pockets

| Step | Action |
|---|---|
| 1 | Select a circular pocket whose beam limits you wish to set and make sure it is in evaporation position, as shown in Figure 4-21. |
| 2 | Open the shutter so that the pocket in evaporation position is visible through the viewport. |
| 3 | Switch on the beam at a power level at which the beam is just visible through the viewport. Figure 4-36 shows Profiles Page 1 with the beam on at 3% (= 45 mA). |

**Figure 4-36 Profiles Page 1, Beam On at 45 mA**

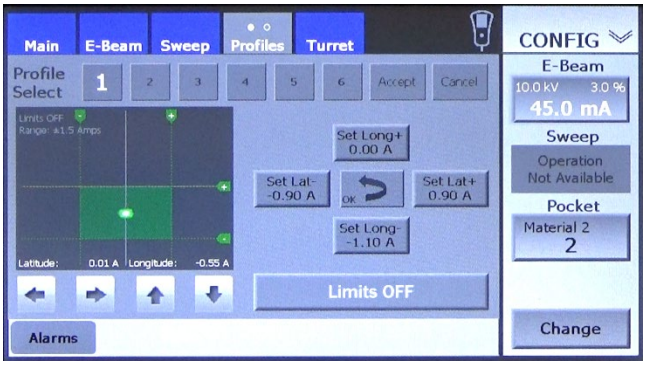

4 Display the Config>Sweep screen (see Figure 4-27) and, if necessary, change the **Drive Range** value. Set a value that ensures that the gun is protected when the beam position interlock limits are disabled. In this example, the user has accepted the default, ± 1.5 A.

5 Display Profiles Page 1 and select the number of the Profile you wish to associate with the target pocket. In Figure 4-37 the user has selected Profile 1.

6 Touch the screen's **Edit** button. Then touch the Mode A/Mode B toggle button (see Figure 4-33) to display the page in Editing Mode B.

7 Touch the **Limits ON** button to switch off the beam limits. The screen will then appear as shown in Figure 4-37.

**Figure 4-37 Profiles Page 1 in Edit Mode B, Beam On at 45 mA, Beam Limits OFF, Drive Range = ± 1.5 A, Pocket 2 and Profile 1 Selected**




8 Watching the beam through the viewport, push the hand-held controller's joystick to the right and check to see whether the beam moves to the right. If it moves to the left, display the Config>Sweep screen and touch the **Latitude Normal** button to toggle it to **Latitude Reverse**.

9 Now push the hand-held controller's joystick upward. The beam should then move away from the emitter. If it moves in toward the emitter, touch the **Longitude Normal** button to toggle it to **Longitude Reverse**.

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

10 Using the remote controller's joystick, center the beam in the pocket.

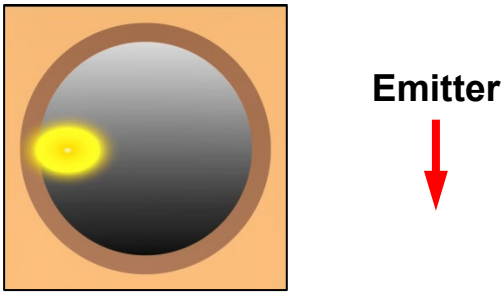
11 If you displayed the Config>Sweep screen, return to Profiles Page 1.

12 Retrieve the hand-held remote controller and, if its Menu 2 is not selected, press its **Menu** button once to select that menu. The remote controller's screen will then appear as shown in Figure 4-38.

**Figure 4-38 Remote Controller in Config Mode, Beam On at 5%, Menu 2 Displayed**

13 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 4-41.

**Figure 4-39 Beam at Correct Position for Negative Latitudinal Limit**



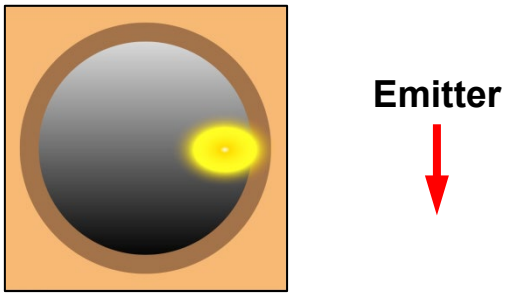

14 Press the remote controller's **Set –Lat** button to set the –Latitude position limit at this point. The remote controller's screen will then appear as shown in Figure 4-40, with a white dashed line indicating the limit you have just set.

**Figure 4-40 Remote Controller Screen After User Sets the -Lat Beam Position Interlock Limit**


15 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

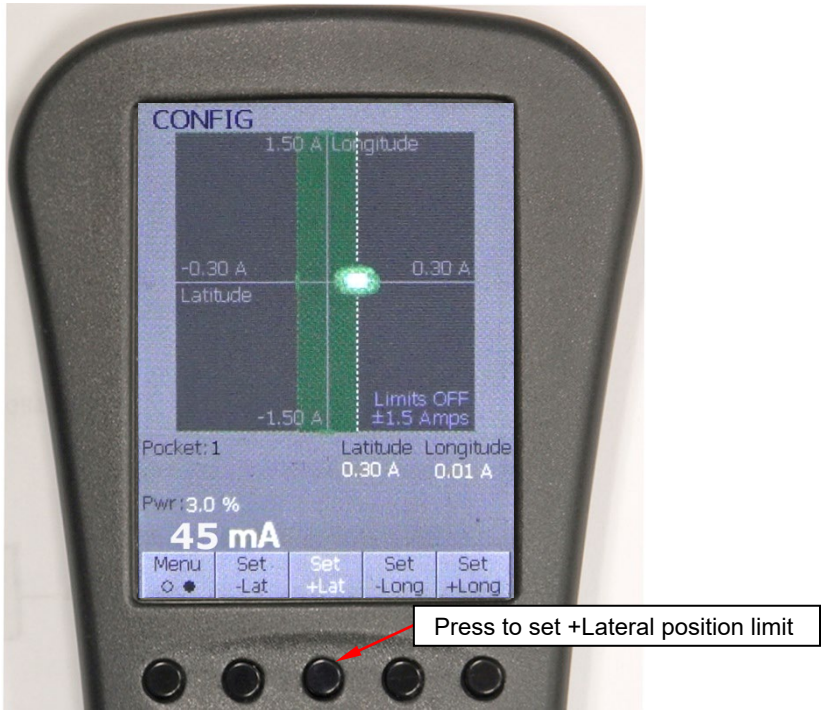
edge touches the right-hand edge of the evaporant pool (see Figure 4-41).

**Figure 4-41 Beam at Correct Position for Positive Latitudinal Limit**



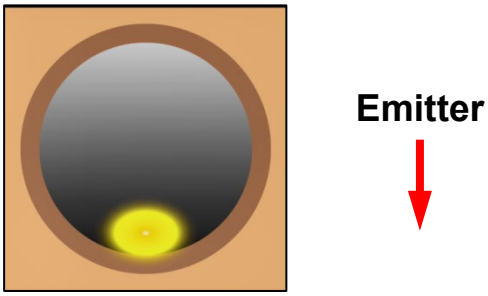

16 Press the remote controller's **Set +Lat** button. Its screen will then appear as shown in Figure 4-42.

**Figure 4-42 Remote Controller Screen After User Sets +Lat Beam Position Interlock Limit**




17 Use the joystick to re-center the beam. Then move the beam to 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 4-43).

**Figure 4-43 Beam at Correct Position for Negative Longitudinal Beam Limit**

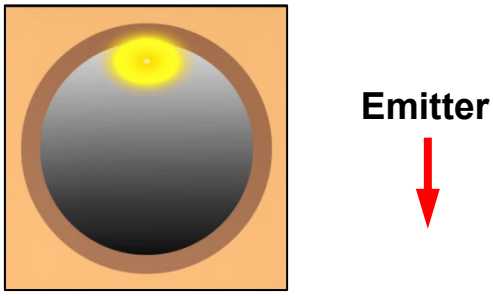



18 Press the remote controller's **Set –Long** button. Its screen will then appear as shown in Figure 4-44.

**Figure 4-44 Remote Controller Screen After User Sets -Long Beam Position Interlock Limit**


19 Finally, move the beam to 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 farthest from the emitter, as shown in Figure 4-45.

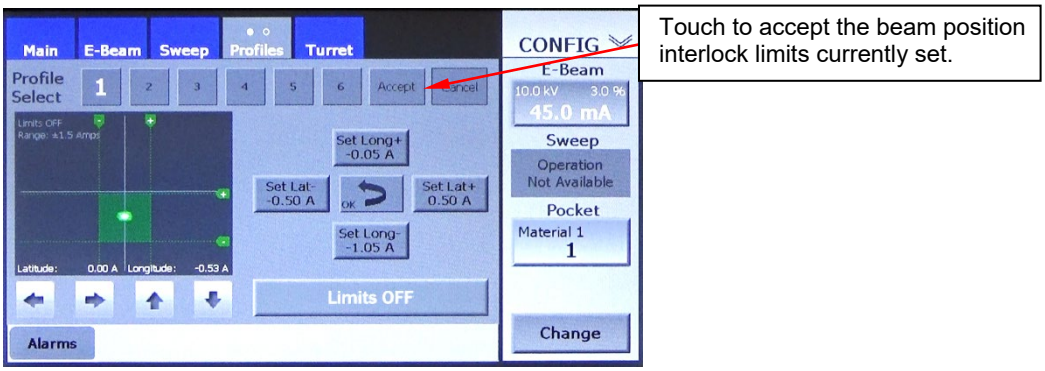
**Figure 4-45 Beam at Correct Position for Positive Longitudinal Beam Limit**




20 Press the remote controller's **Set +Long** button. The remote controller's screen will then appear as shown in Figure 4-46, and Profiles Page 1 will appear as shown in Figure 4-47.

**Figure 4-46 Remote Controller Screen After User Sets +Long Beam Position Interlock Limit**

**Figure 4-47 Profiles Page 1 After All Four Beam Position Interlock Limits Are Reset**




21 Touch the **Accept** button to apply the beam position interlock limits you have set to the Profile currently selected. Profiles Page 1 will then appear as shown in Figure 4-48, with the beam position limits for this Profile indicated above, below, and on either side of the Mode A/Mode B toggle button.

**Figure 4-48 Profiles Page 1 After User Accepts the New Beam Position Interlock Limits**


22 Select the next Profile whose beam limits you wish to set.

23 Rotate the turret to a pocket to which you plan to apply that Profile.

24 Touch the **Edit** button on Profiles Page 2 and switch to Edit Mode B.

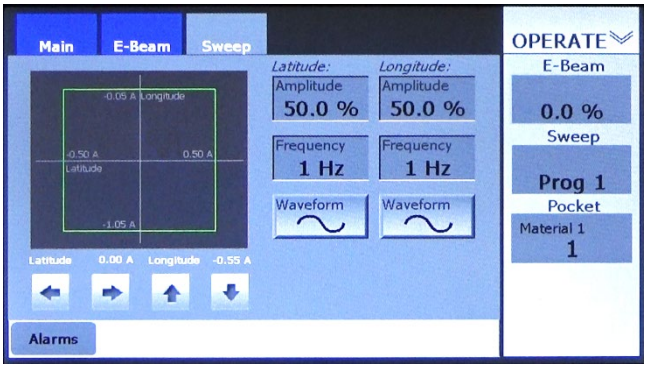
25 Repeat Steps 13-21 to configure beam position limits for the selected Profile.

26 If you have configured all the Profiles you wish to configure at this time, touch the **Limits OFF** button to switch the beam limits on.

27 Display Profiles Page 2 and apply the Profiles you have configured to the desired pockets. In doing so, follow the procedure described in section 4.8.4.

Figure 4-49 shows how the Operations>Sweep screen will appear when any pocket associated with Profile 1 is selected, with beam limits for that Profile set as described above. Note that the area demarcated by those beam position limits (outlined in green in Figure 4-49) occupies most of the beam position/beam sweep grid, regardless of the size of the bounding box displayed in Configuration mode.

**Figure 4-49 Operations>Sweep Screen After Beam Position Limits Are Set**

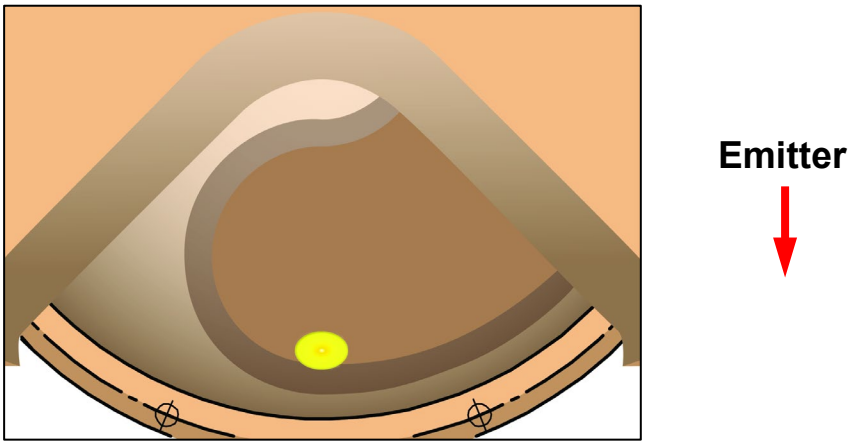



### Setting Beam Position Interlock Limits for Banana-Shaped Pockets

To set beam position interlock limits for a banana-shaped pocket, perform the procedure described below.

| Step | Action |
|---|---|
| 1 | Select the 'banana' whose beam limits you wish to configure and make sure that its Start point is centered in evaporation position. |
| 2 | Perform Steps 2-12 of the procedure described above, under the heading Setting Beam Position Interlock Limits For Circular Pockets. |
| 3 | Center the beam laterally and then move the beam to the correct point for the negative longitudinal limit. This is the point at which the beam's nearer edge extends just beyond the edge of the beam that is nearest to the emitter, as shown in Figure 4-50. |

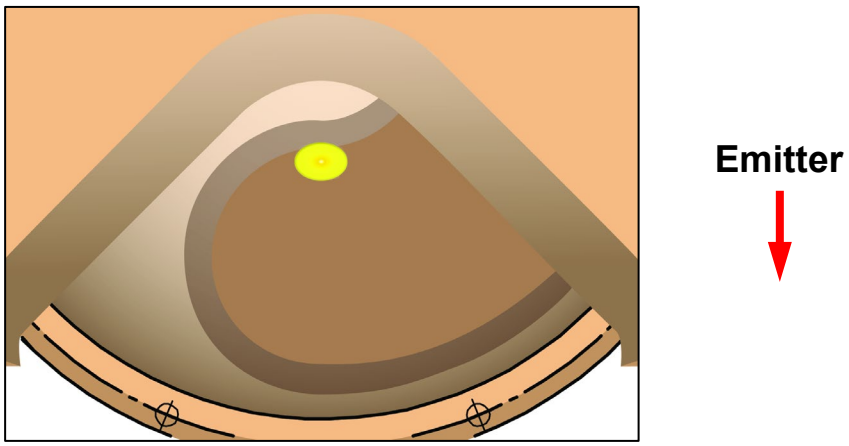
**Figure 4-50 Correct Position for Negative Longitudinal Beam Interlock Limit**




4 Press the remote controller's **Set –Long** button. The remote controller's screen will then appear as shown in Figure 4-44.

5 Keeping the beam centered laterally, move the beam to the correct point for the positive longitudinal limit. This is the point at which the beam's farther edge extends just beyond the edge of the evaporant that is farthest from the emitter, as shown in 4-51.

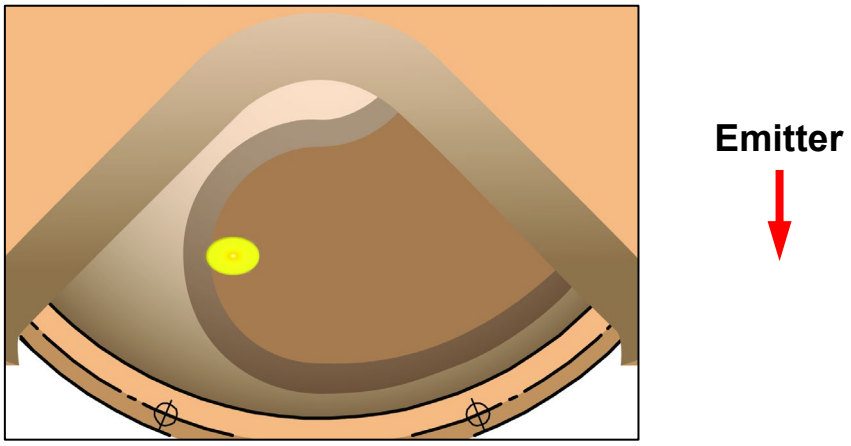
**Figure 4-51 Correct Position for Positive Longitudinal Beam Interlock Limit**




6 Press the remote controller's **Set +Long** button. The remote controller's screen will than appear as shown in Figure 4-46.

7 Center the beam longitudinally and then move the beam to the maximum point for the negative longitudinal limit. This is the point at which the left-hand edge of the beam extends just beyond the left-hand edge of the evaporant, as shown in Figure 4-52.

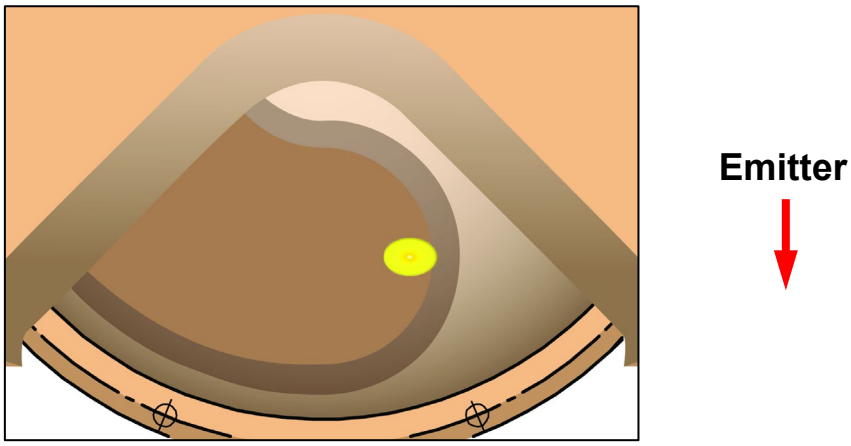
**Figure 4-52 Maximum Position for Positive Longitudinal Beam Interlock Limit**




8 Press the remote controller's **Set –Lat** button. The remote controller's screen will than appear as shown in Figure 4-42

9 Finally, jog the banana to its End point and then move the beam to the maximum point for the positive longitudinal limit. This is the point at which the right-hand edge of the beam extends just beyond the right-hand edge of the evaporant, as shown in Figure 4-53.

**Figure 4-53 Maximum Position for Negative Longitudinal Beam Interlock Limit**




**NOTE**

Figures 4-52 and 4-53 show the maximum positions for the +Lat and –Lat beam position limits. However, it may be desirable to set narrower lateral beam limits, as the banana will be oscillating beneath the beam sweep pattern.

10 Press the remote controller's **Set +Lat** button. The remote controller's screen will then appear as shown in Figure 4-40.

11 Return to Profiles Page 1 and touch the **Accept** button to apply the beam position interlock limits you have set to the Profile currently selected. Profiles Page 1 will then appear as shown in Figure 4-48,

with the beam position limits for this Profile indicated above, below, and on either side of the Mode A/Mode B toggle button.

12 If you have configured beam limits for all the Profiles you wish to configure at this time, touch the **Limits OFF** button to switch the beam limits on.

13 Display Profiles Page 2 and apply the Profile whose beam limit you just set to the target banana. To do so, follow the procedure described in section 4.8.4.

### Setting Beam Position Interlock Limits for Continuous-Trough Crucibles

The procedure for setting beam position interlock limits for continuous-trough crucibles is similar to the procedure for setting beam limits for banana-shaped pockets. The correct position for the -Longitudinal beam limit is at edge of the evaporant nearest to the emitter (see Figure 4-54), as it would be in the case of a circular or a banana-shaped pocket.

Setting the +Longitudinal limit can be more of judgment call, depending on the width of the continuous trough the magnetics of your e-gun. The ideal position for the +Longitudinal limit is at the inner edge of the evaporant, as shown in Figure 4-55. However, that position for the +Longitudinal limit may not be compatible with your e-gun's performance characteristics and the application for the continuous trough. In that case, set the +Longitudinal limit at the farthest point from the emitter that is compatible with your gun's magnetics, the **Drive Range** value you have set for this Profile, and beam density you wish to obtain at the +Longitudinal limit.

Latitudinal limits can be set to almost any desired width permitted by the **Drive Range** setting. However, because the evaporant will be rotating continuously beneath the beam sweep pattern, it may be desirable to set fairly narrowly latitudinal beam limits.

**Figure 4-54 -Longitudinal Beam Position Interlock Limit for a Continuous-Trough Crucible**

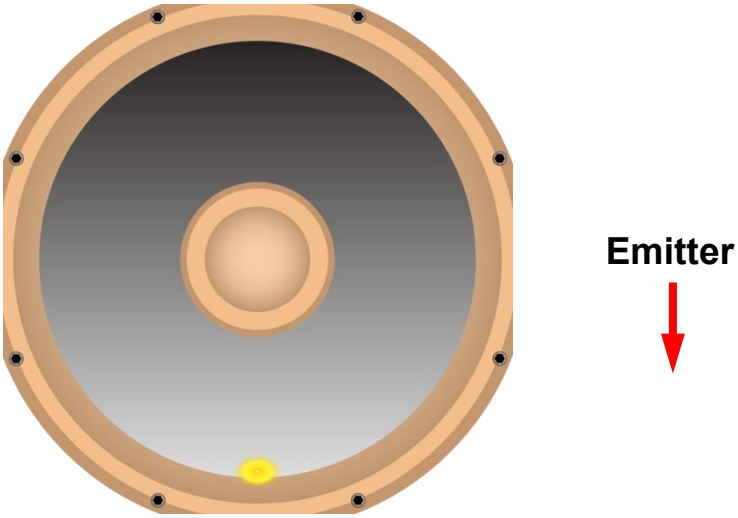
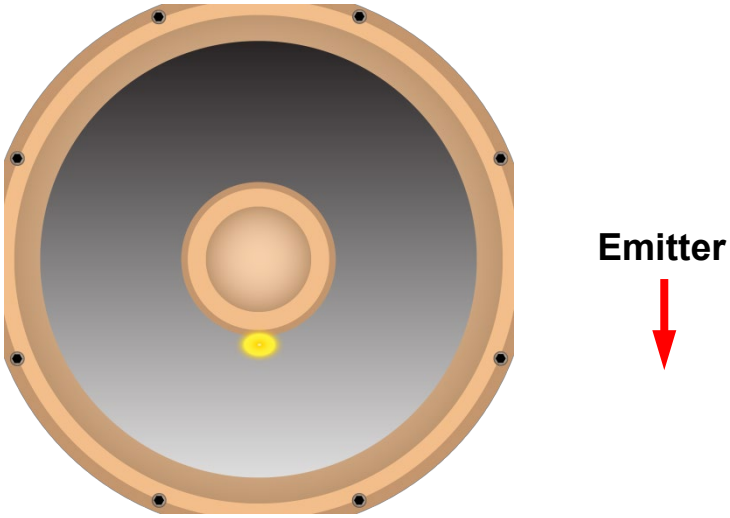


**Figure 4-55 Ideal Position for +Longitudinal Beam Limit for a Continuous-Trough Crucible**

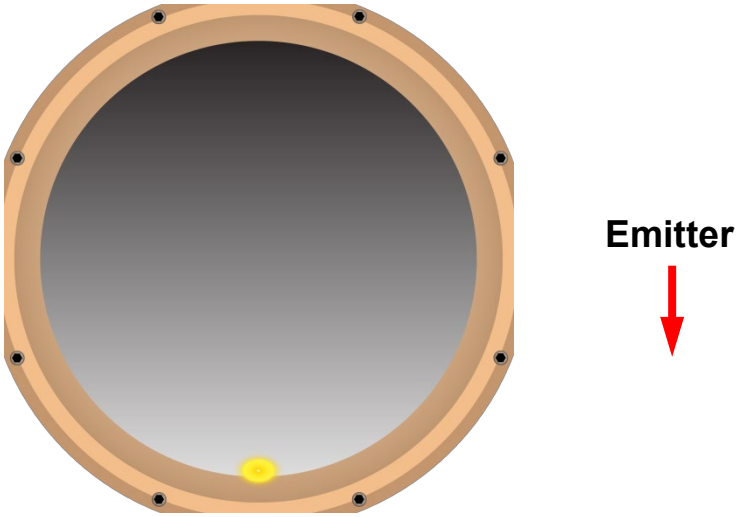



### Setting Beam Position Interlock Limits for Skillet-Type Crucibles

The procedure for setting beam interlock positions for a skillet-type crucible is similar to the procedure for setting beam limits for a continuous-trough crucible. The -Longitudinal limit should be set at the edge of the evaporant nearest to the emitter, as shown in Figure 4-56. The +Longitudinal limit should be set at the farthest point from the emitter that is compatible with your gun's magnetics, the **Drive Range** value you have set for this Profile, and beam density you wish to obtain at the +Longitudinal limit.

The Latitudinal beam limits can be set to any values permitted by the **Drive Range** value you have set for this Profile and your e-gun's magnetics. Here again, however, it may be desirable to set fairly narrow latitudinal limits, as the evaporant will be continuously rotating beneath the beam sweep pattern.

**Figure 4-56 Correct –Long Beam Position Limit for a Skillet-Type Crucible**



### 4.8.4 Assigning Profiles to Pockets

Profiles Page 2 enables the user to assign any given profile to one or more pockets. Initially, Profile 1 is initially assigned by default to all available pockets, as shown in Figure 4-57. To change a pocket's profile assignment, touch the button labeled **Profile: 1** below that pocket's number as many times as required to display the number of the profile you wish to assign to that pocket. In Figure 4-58, the user has assigned Profile 3 to of Pocket 1. However, that profile could be assigned to multiple pockets.

**Figure 4-57 Profiles Page 2 at Initial Boot-Up**

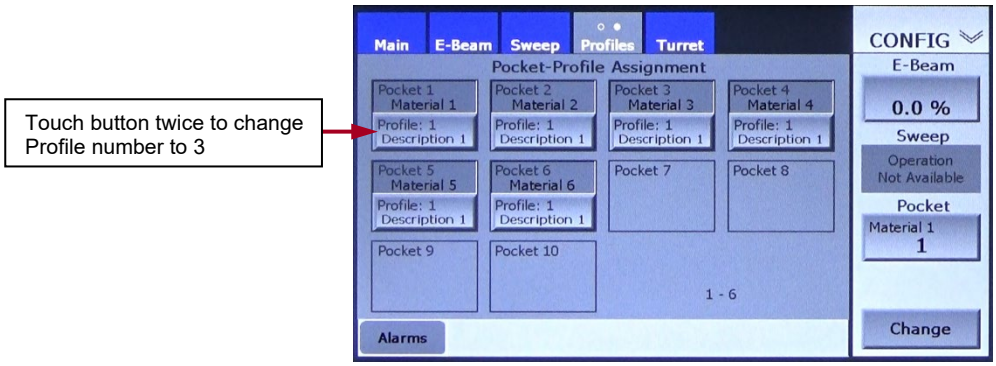
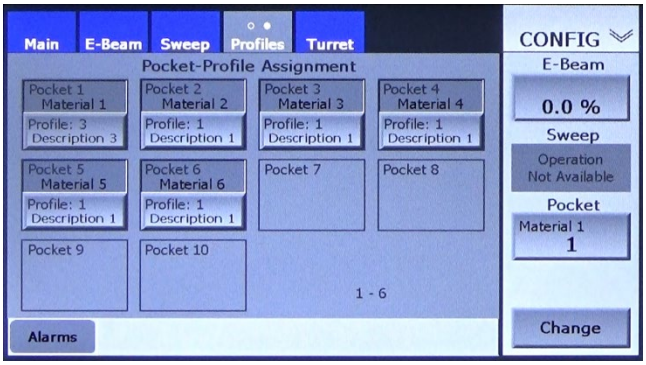



**Figure 4-58 Profiles Page 2 After Profile 3 Is Assigned to Pocket 1**

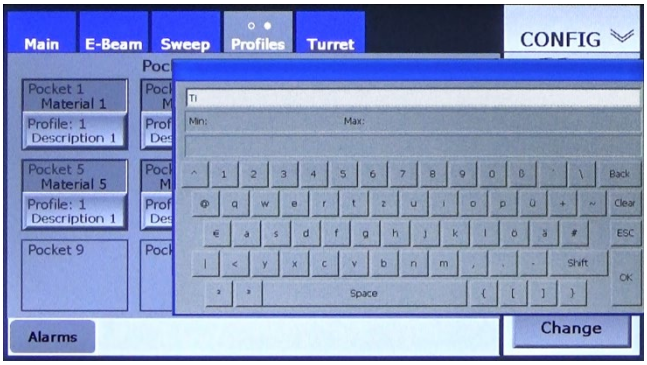



### 4.8.5 Associating Material Names with Pockets (Optional)

Perform the procedure described below to assign material names or other descriptive text strings to specific pockets.

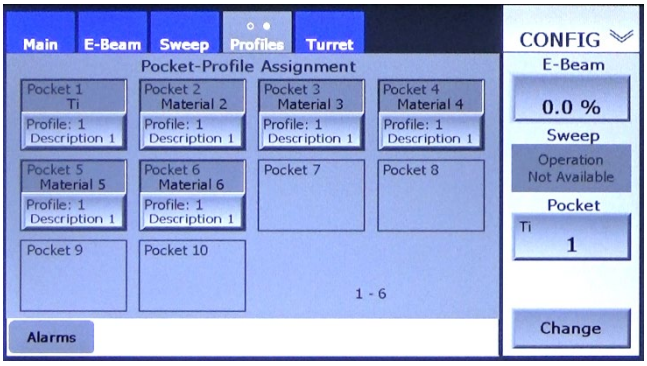
| Step | Action |
|---|---|
| 1 | Display Profiles Page 2, if it is not already displayed. |
| 2 | To enter a material name for Pocket 1, touch the recessed **Pocket 1** button on this page to display an on-screen alphanumeric keyboard. |
| 3 | Use this keyboard to enter the desired material name or abbreviation. In Figure 4-59, the user has entered **Ti**. |

**Figure 4-59 Keyboard After User Enters *Ti***




4 Touch the keyboard's **OK** button to close it. The name you entered now appears on the **Pocket 1** button, as shown in Figure 4-60. **Ti** now also appears in the recessed **Pocket 1** button on Profiles Page 2.

**Figure 4-60 Profiles Page 2 Showing *Ti* as the Material for Pocket 1**




5 Repeat Steps 2-4 as desired to assign material names to other pockets.

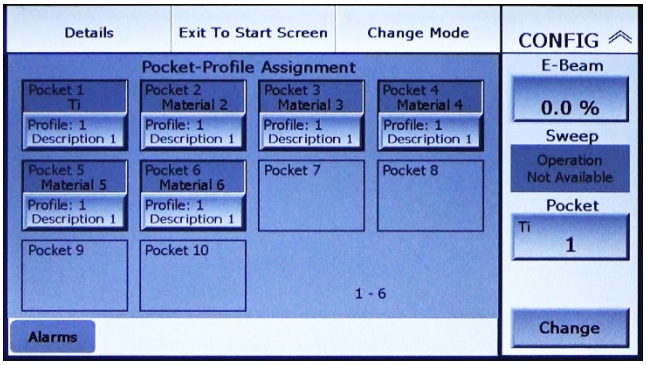
Profile configuration is now completed. If you have completed the necessary configuration procedures, exit from Configuration mode and save your configuration changes, as described in section 4.9.

## 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 Mode ID label/Menu Select button (labeled **CONFIG** in this instance) to display the Auxiliary Menu, which is shown in Figure 4-61. That illustration shows the Auxiliary Menu displayed Profiles Page 1. However, you can exit from Configuration mode from any Configuration mode screen. |

**Figure 4-61 Profiles Page 2 with Auxiliary Menu Displayed**

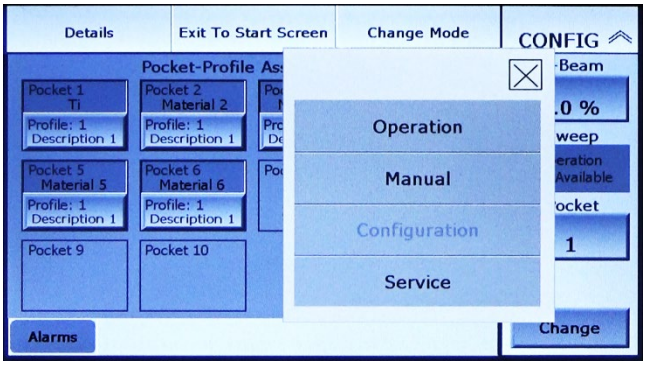



**Note**

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 4-62.

**Figure 4-62 User Has Touched the *Change Mode* Button, Exit Warning Popup Displayed**




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

The configuration changes you entered are saved as the EBC exits from Configuration mode. If the procedures described in this section have been completed, the EBC is ready for operation in stand-alone mode, as described in Section 5. For information on additional configuration procedures required to operate the EBC in conjunction with a higher-level controller, see the table at the bottom of page 4-1.

# 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 not under the control of a higher-level controller). Topics covered in this section are:

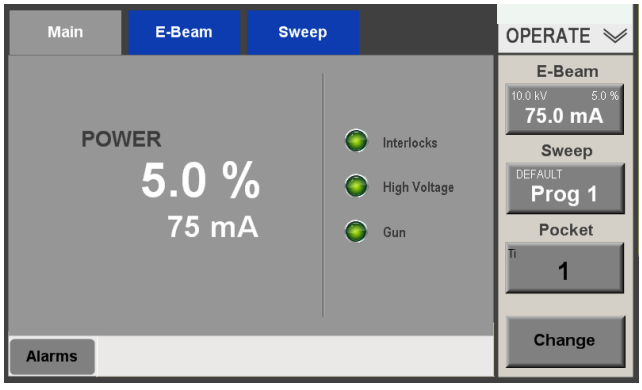


The descriptions in this section assume that the EBC has been correctly installed, as described in Section 3, and configured as described in Section 4.

## 5.2 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 4.6.

- 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 Details screen (see section 12.2) 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.

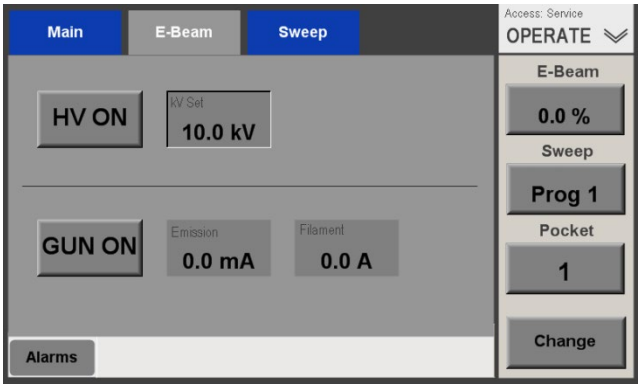
## 5.3 Operating/Monitoring the E-Beam PS from the Ops>Ebeam Screen

### 5.3.1 Overview of the Operations>E-Beam Screen

The control/display features of the Operations>E-Beam screen (see Figure 5-2) are:

- **kV Set** entry button: Press this button to display a numeric keypad that enables you to adjust the kV output of the HVPS. For details see section 5.3.2. Note that this button appears only when **kV Control** on the Config>E-Beam screen is set to **Manual**. If **kV Control** is set to either **Profiles** or **Pot Ctrl**, then a flat display rectangle, like those on this screen labeled **Emission** and **Filament**, appears in place of the **kV Set** button.
- **HV ON** and **Gun ON** buttons: These buttons allow you to switch the HV and gun on/off independently of each other. For further details see section 5.3.3.
- The value displayed in the **Emission** rectangle indicates the emission current output by the filament power supply.
- The value displayed in the **Filament** rectangle indicates the filament current output by the filament power supply.

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



### 5.3.2 Changing the HV Operating Level

If **kV Control** on the EBC's Config>E-Beam screen is set to **Manual**, 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:

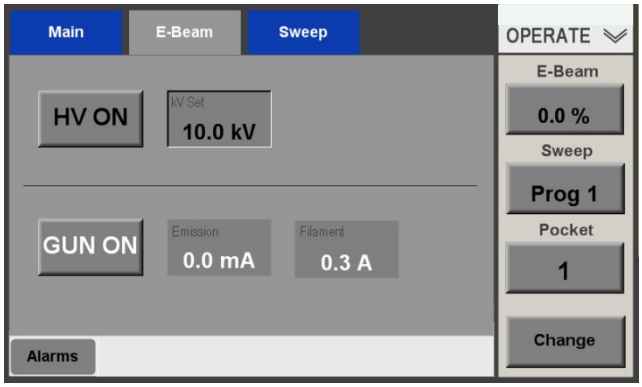
| Step | Action |
|---|---|
| 1 | Touch the **kV Set** button to open a numeric keypad. |
| 2 | Use the keypad to enter the desired kV value. |
| 3 | Touch the keypad's Enter button to close it. |

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.

### 5.3.3 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**




### 5.3.4 Using the E-BEAM Button on the Command Button Bar

If **Internal** is selected for **Emis Control** on the Config>E-Beam screen, you can switch the beam on/off by simply touching the Command Button bar's **E-BEAM** button. This applies when both HV and gun are off, when the HV alone is on, and when the gun alone is on. Figure 5-5 shows the Operations>E-Beam screen when the beam power is set to zero. To set a nonzero power setpoint, touch the **Change** button and then the **E-Beam** button. The unit will then display a numeric keypad that you can use to enter the desired setpoint value, as a percentage of total power supply output. This can be done either before or after you switch on the beam.

If **Analog In** is selected for **Emis Control**, the Command button bar's **E-Beam** button becomes a flat display rectangle.

**NOTE**
You can also switch the beam on and off from the hand-held remote controller. To do so, select Menu 1 (see Figure 5-27) and press the **Beam On/Off** button.

# 5.4 Creating and Modifying Beam Sweep Programs

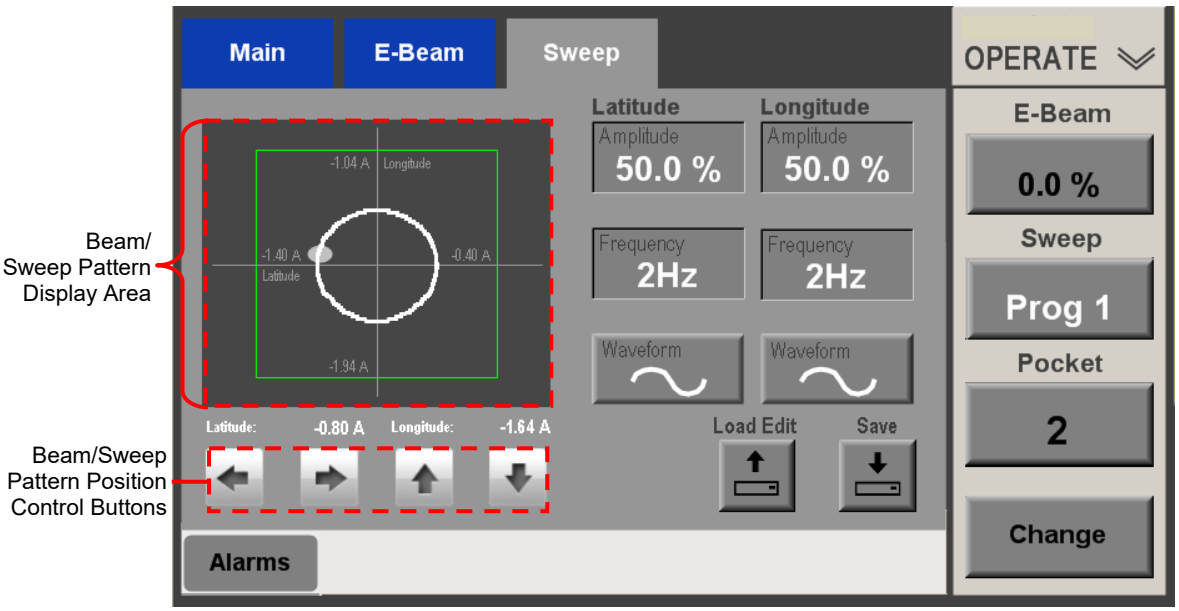
## 5.4.1 Control/Display Features of the Operations>Sweep Screen

The Operations>Sweep screen (see Figure 5-4) 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 5-4 Operations>Sweep Screen, Beam Off, Sweep On**



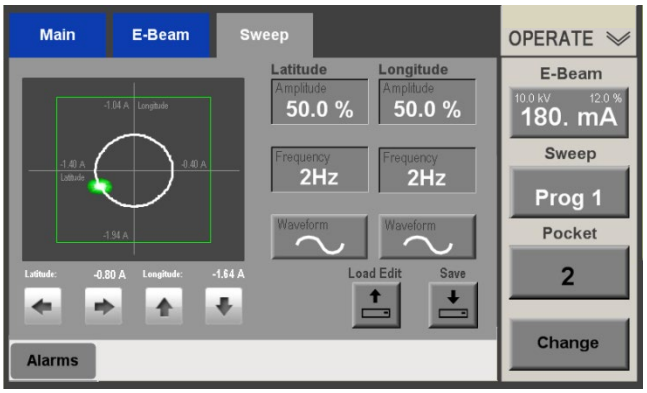

**Beam/Sweep Pattern Display Area.** If the sweep is disabled, this grid displays the beam's current position, as determined by the coil-drive outputs from unit's sweep control board. If the sweep is enabled, the sweep pattern is displayed in this area, based on the same coil-drive outputs. If the beam is off, beam position is represented by a white oval, as shown in Figure 5-4. If the beam is on, the oval appears as shown in Figure 5-5. 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 5-5 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

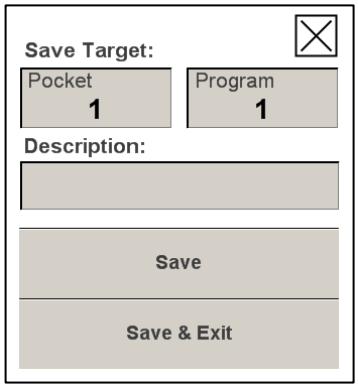
You can also change amplitude and frequency values from the hand-held remote controller. For instructions on doing so, see Figure 5-28.

NOTE

You can also change the sweep waveform from the hand-held remote controller. To do so, select Menu 2 (see Figure 5-28), 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.

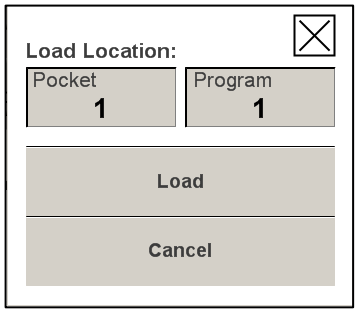
**Save** button. Touching this button displays the **Save Target** popup (see Figure 5-6) , which allows the user to save a given set of sweep parameters, either under the current Pocket and Program numbers or to a different target Pocket and/or Program.

**Figure 5-6 The *Save Target* Popup**




**Load Edit** button. Touching this button displays the **Load Location** popup (see Figure 5-7) 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 5-7 The *Load Location* Popup**

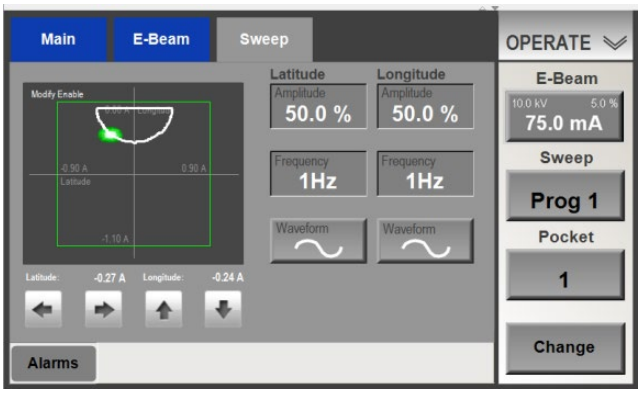



**Exit Edit** button. This button enables the user to exit from Edit mode without saving any changes made to sweep programs during the current editing session. Note that this button appears only when the EBC is in sweep-edit mode.

## 5.4.2 '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 5-8 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 5-8 Ops>Sweep Screen with Beam Sweep Displaying the 'Clipping Effect'**




**Note**

Figure 5-8 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.

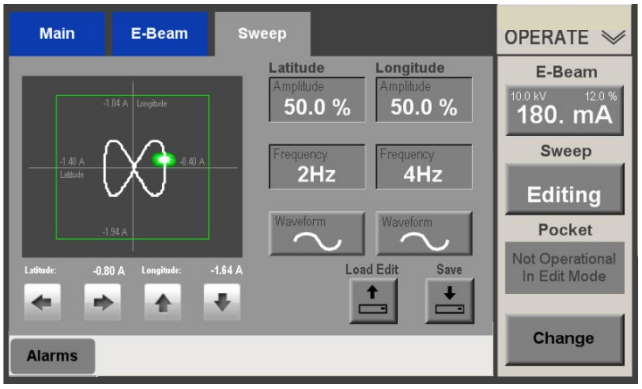
## 5.4.3 Modifying Beam Sweep Programs

### 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.

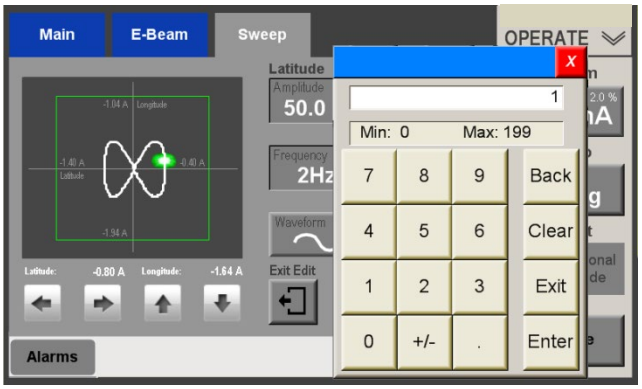
| Step | Action |
|---|---|
| 1 | If necessary, rotate the turret to the desired pocket and select the sweep program that you wish to modify. If you wish to modify a sweep program associated with the currently selected pocket, other than the program currently displayed, select the number of the desired program. |
| 2 | Switch on the beam and sweep, if they are currently not operating. Figure 5-9 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 5-9 Operations>Sweep Screen, Beam and Sweep On**



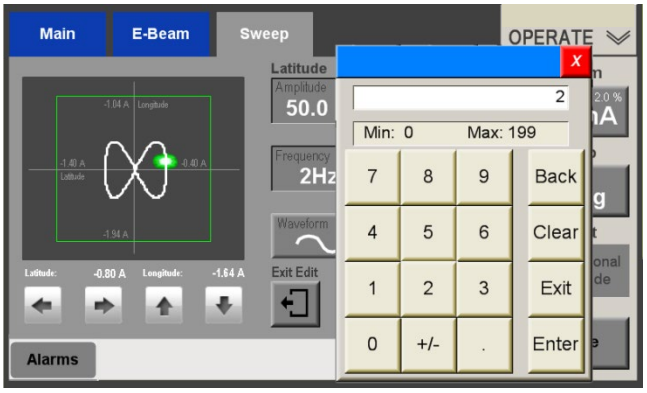

3 Touch the box for the sweep parameter you wish to modify. In Figure 5-10 the user has touched the **Latitude>Frequency** button to display the keypad shown.

**Figure 5-10 Ops>Sweep Screen After User Touches the Latitude Frequency Button to Change the Value of that Sweep Parameter**



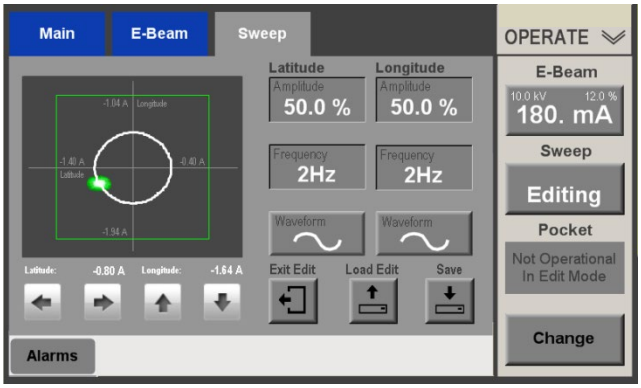

4 Enter the value desired for this parameter. In Figure 5-11 the user has entered **2**.

**Figure 5-11 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 5-12. Note that the EBC is still in Edit mode.

**Figure 5-12 Ops>Sweep Screen After Lateral Frequency Is Changed to *2***



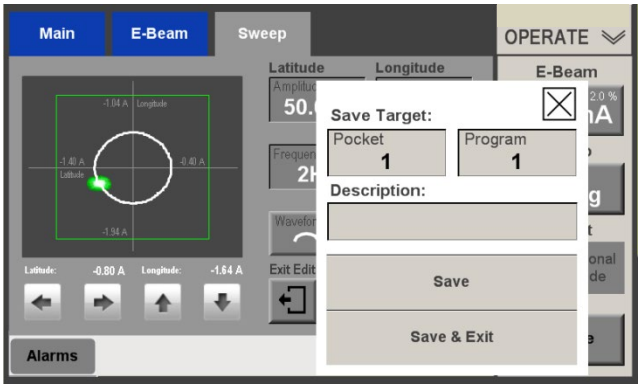

6 Repeat Steps 3-6 to modify any other numeric parameters you wish to change. If you wish to change either the Lateral or Longitudinal waveform, simply touch the appropriate **Waveform** button repeatedly until it displays the desired waveform.

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.

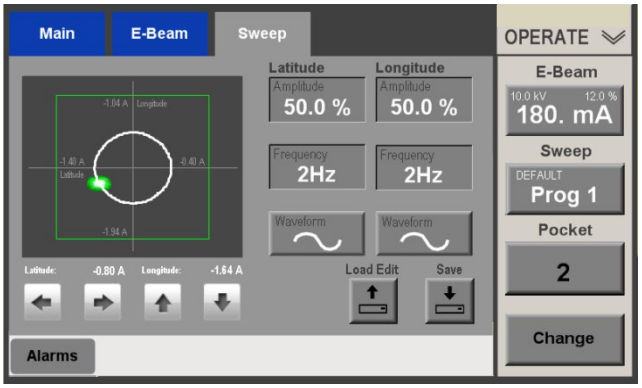
7 When you have made all the changes you wish to make to this program, touch the screen's **Save** button to display the **Save Target** popup shown in Figure 5-13.

**Figure 5-13 User Saving the Change(s) 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 5-14.

**Figure 5-14 Ops>Sweep Screen After User Saves Change(s) to Currently Displayed Program and Exits from Edit Mode**

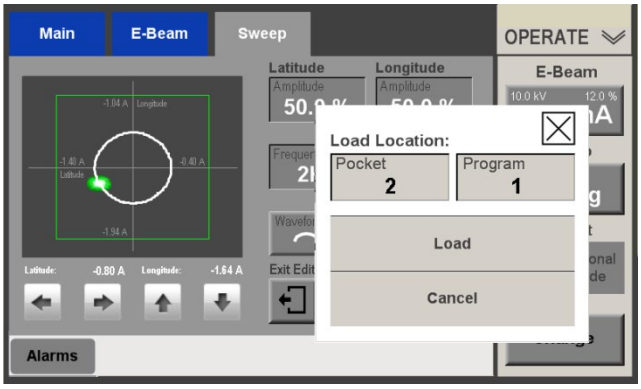



### Modifying a Sweep Program Other than the Program Currently Displayed

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.

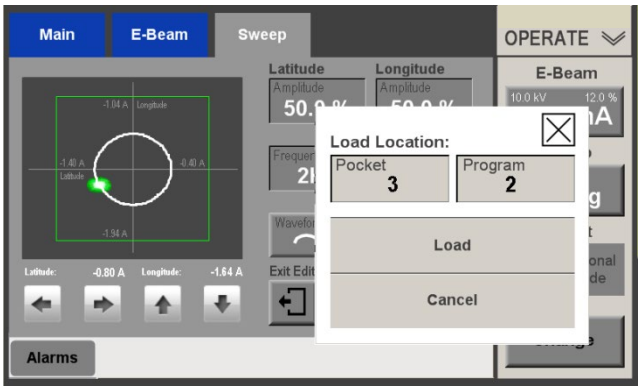
| Step | Action |
|---|---|
| 1 | Open the Operations>Sweep screen with any sweep program displayed, for example, the program shown in Figure 5-14. |
| 2 | Touch the screen's **Load Edit** button to display the **Load Location** popup (see Figure 5-15). When that popup initially appears, its **Pocket** and **Program** boxes will display the Pocket and Program identifiers of the sweep program currently displayed. |

**Figure 5-15 Ops>Sweep Screen with *Load Location* Popup Displayed**



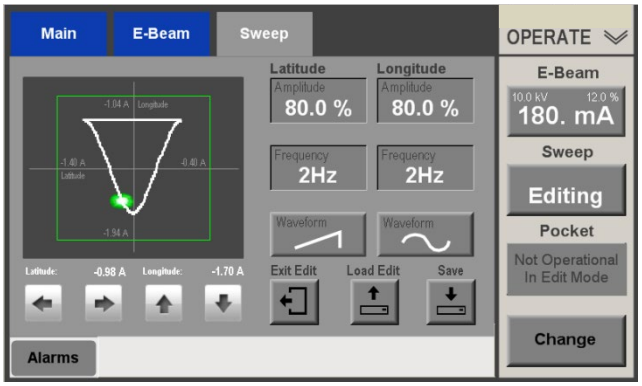

3 In the **Pocket** and/or **Program** boxes, enter the numbers designating the sweep program you wish to modify. In Figure 5-16 the user has entered **3** in the **Pocket** box and **2** in the **Program** box.

**Figure 5-16 Load Location Popup with Pocket 3, Program 2 Entered**



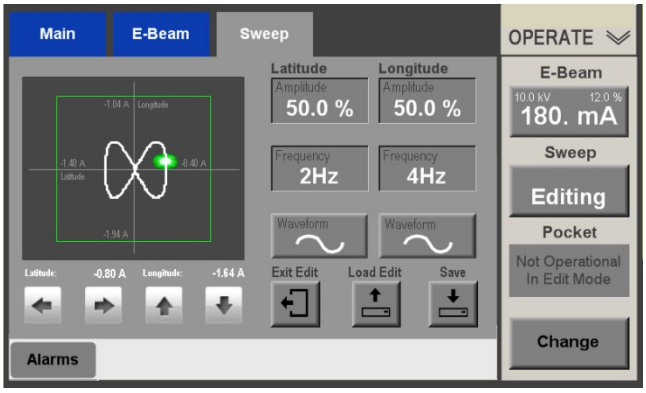

4 Touch the popup's **Load** button. In this example, the screen would now appear as in Figure 5-17, with Program 2 for Pocket 3 displayed for background editing. Note that if Program 1, Pocket 2 was operating when this procedure began, it would still be operating, with the beam still on if it was initially on.

**Figure 5-17 Ops>Sweep Screen After Pocket 3, Program 2 Loaded For Background Editing**



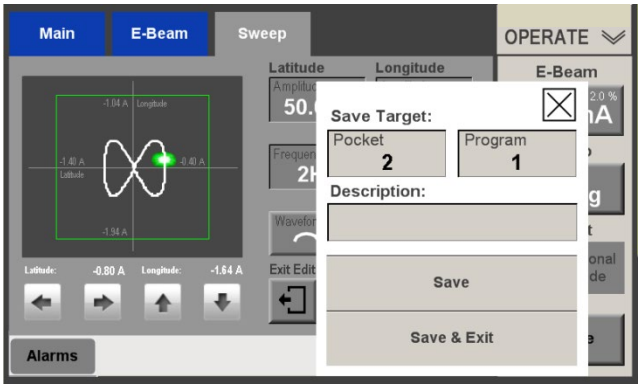

5 Edit the displayed sweep program as desired. As an example, in Figure 5-18 the user has changed the latitudinal frequency to 2 Hz and the latitudinal waveform to sine, yielding a 'bowtie' pattern.

**Figure 5-18 The Program 3, Pocket 2 Sweep Pattern After User Makes Parameter Changes**



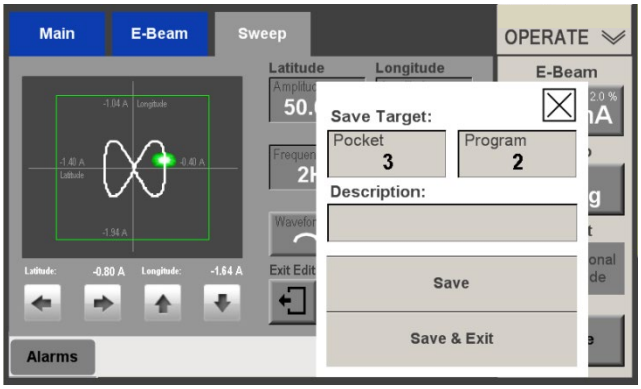

6 Touch the screen's **Save** button to display the **Save Target** popup. Note that this popup, when it first appears in this sequence of operations, displays the Pocket and Program numbers of the sweep program displayed by the Operations>Sweep screen when the procedure began. In this example, the **Save Target** popup displays Pocket 2 and Program 1 (see Figure 5-19).

**Figure 5-19 *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 5-20 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 5-20 *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 5-14 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 5-13, 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 5-21). 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.

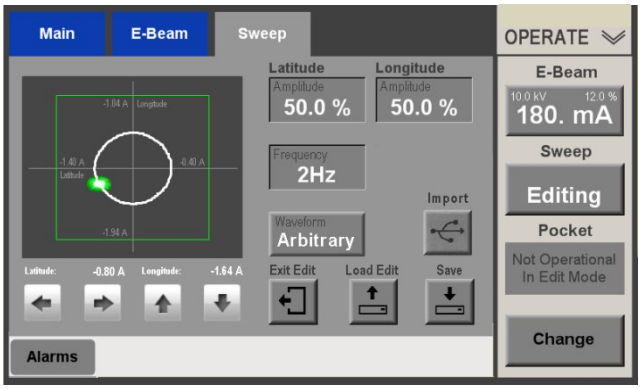
Perform the following procedure to import a sweep pattern with an Arbitrary waveform.

| 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 5-14 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 5-14, the screen would now appear as it does in Figure 5-21.

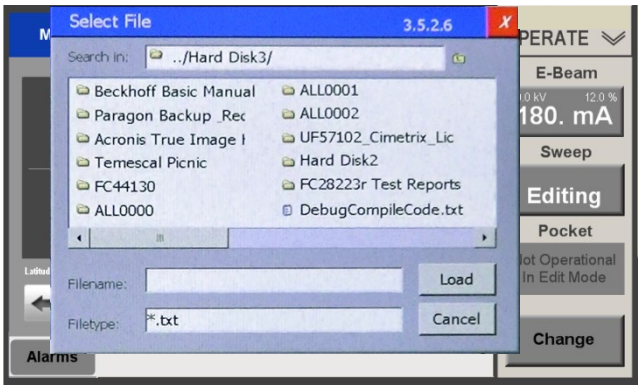
NOTE
You can also change the waveform via the hand-held remote controller by selecting Menu 2 and pressing the **Wave Select** button (see Figure 5-28).

**Figure 5-21 Ops>Sweep After Arbitrary Waveform Is Selected for Pocket 2, Program 1**



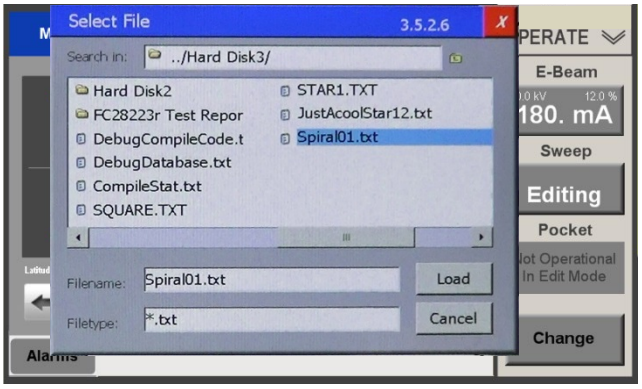

4 Touch the screen's **Import** button to display the dialog box shown in Figure 5-22.

**Figure 5-22 *Select File* Dialog Box for Artitrary Waveforms When Initially Displayed**



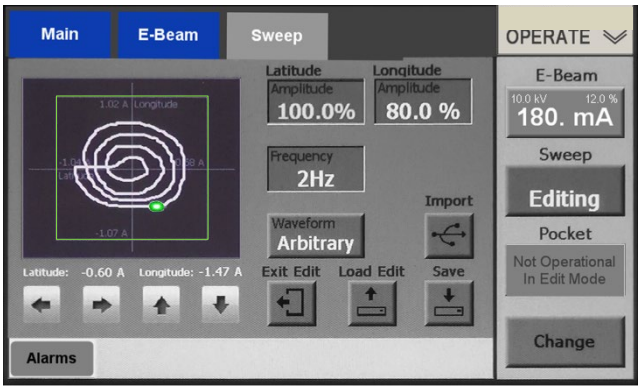

5 Select the filename of the arbitrary pattern you wish to import. In Figure 5-23 the user has selected *Spiral01.txt.*

**Figure 5-23 *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 5-24.

**Figure 5-24 Ops>Sweep Screen Displaying Spiral01 Arbitrary Waveform, Unsaved**



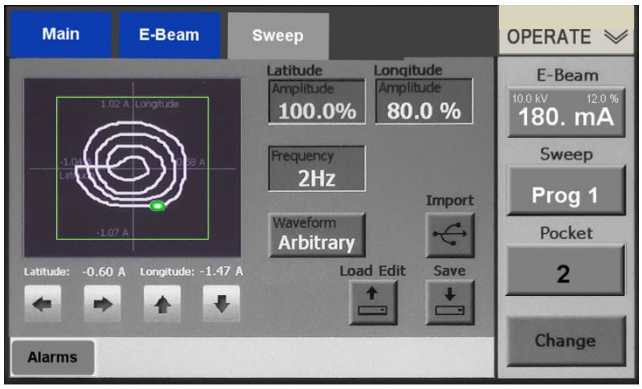

7 Modify the pattern's sweep parameters as desired.

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 5-25.

**Figure 5-25 *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 5-26 shows the screen after the user has touched **Save Exit** with Pocket 2 and Program 1 selected in the popup.

**Figure 5-26 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 4.8.5.

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

## 5.5 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 sections 4.5.6 and 4.8.3.

### 5.5.1 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 5-27) and Menu 2 (see Figure 5-28).

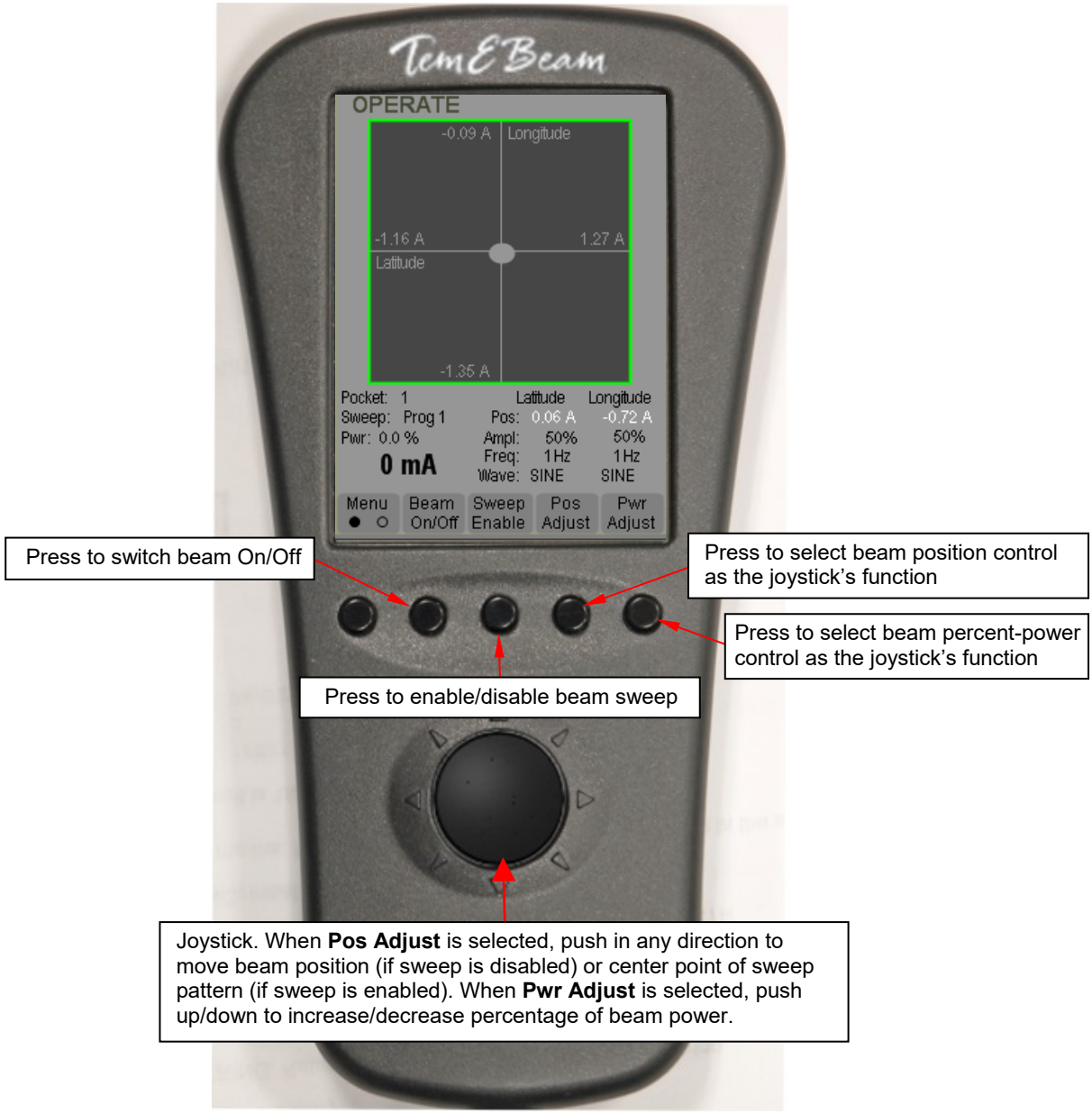
**Note**

If **Analog In** is selected for **Emis Control** on the Config>E-Beam screen, the user cannot switch the e-beam on/off or set a beam power setpoint from the hand-held controller.

### 5.5.2 Control Functions Available Via Menu 1

Figure 5-27 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.

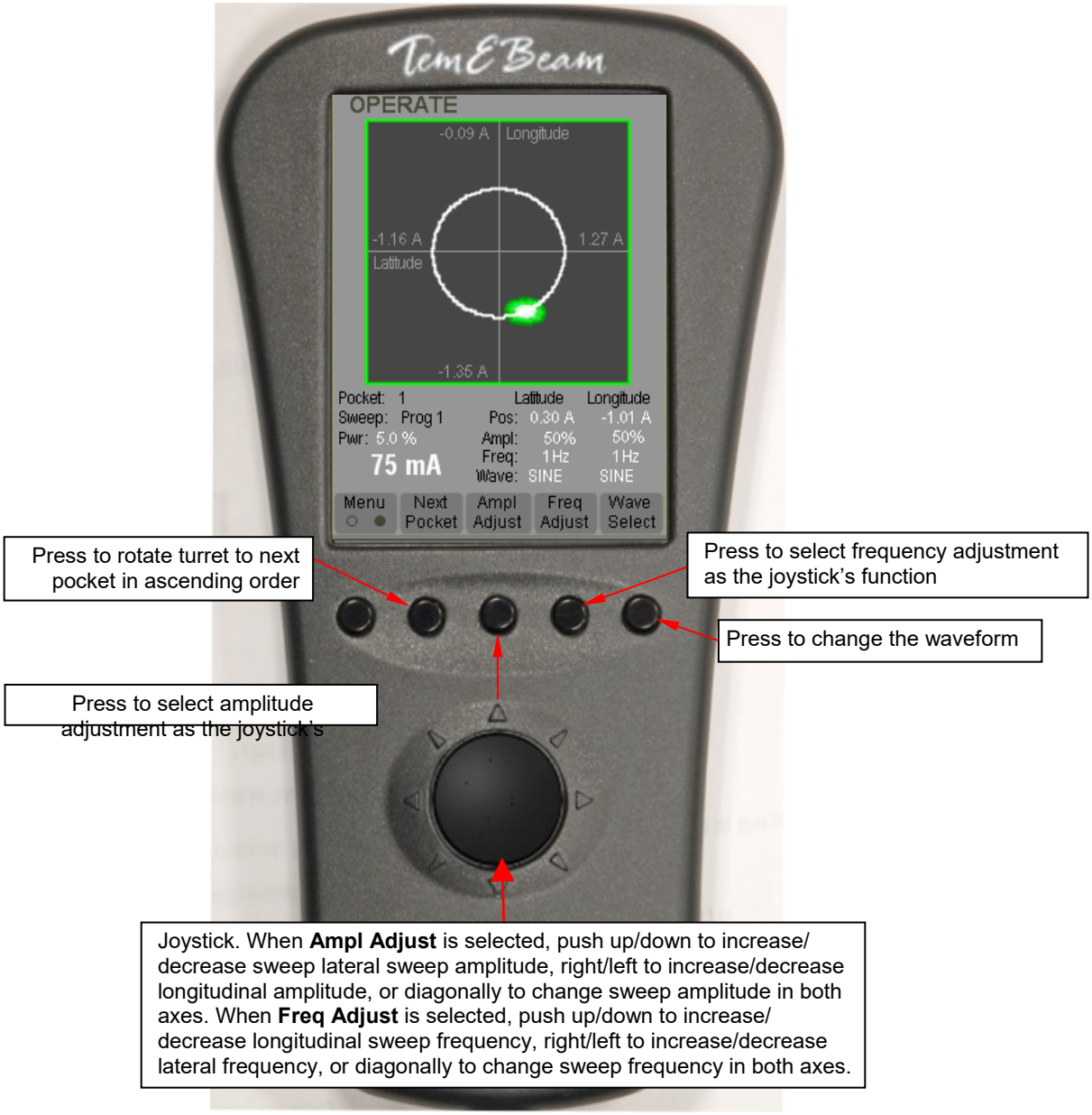
**Figure 5-27 Remote Controller's LOCAL Screen, Menu 1 Selected, Beam and Sweep Off**




## 5.5.3 Control Functions Available Via Menu 2

Figure 5-28 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 5-28 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 procedures 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**

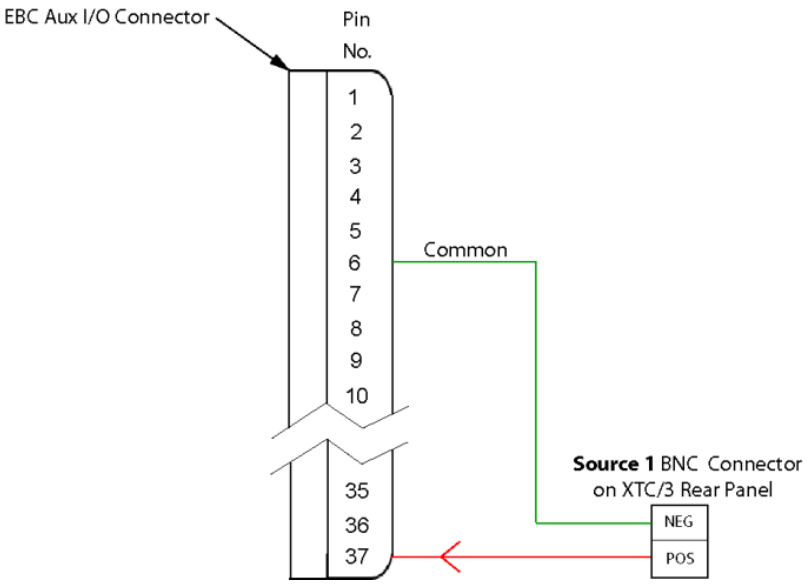
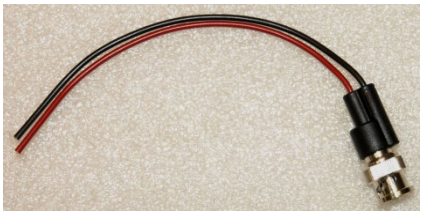


**Figure 6-2 Digikey Adapter**



## 6.3 Modification to Configuration Procedure

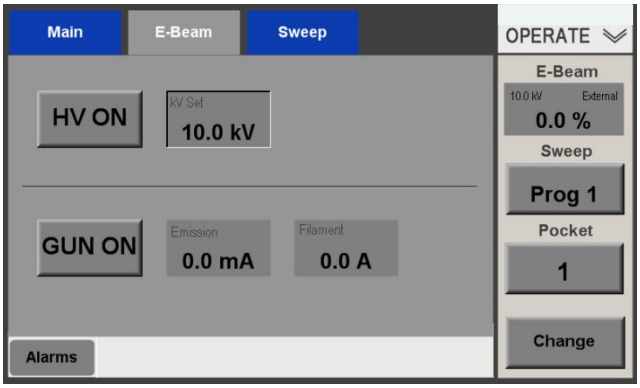
EBC configuration for use with the XTC/3S is virtually identical to the procedure described in Section 4 of this manual. The sole exception is described below.

| Step | Action |
|---|---|
| 1 | Perform the procedures described in sections 4.2 through 4.5. |
| 2 | Perform Steps 1-7 of the procedure described in section 4.6. |
| 3 | In Step 8 of that procedure, select **Analog In** for **Emis Control**. |
| 4 | Perform the procedures described in sections 4.7 and 4.8. |
| 5 | 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 Operations mode screens appear as shown in section 1.5.2, except that the **E-Beam** button on the Command Button bar becomes a flat display rectangle (see Figure 6-3). In Operations mode, operating methods are as described in Section 5, except that in Operations mode the user cannot select the emission power level from the button bar or from the hand-held remote controller.

**Figure 6-3 Command Button Bar when *Analog In* Is Selected for *Emis Control***



**Manual Mode Operation**

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 EBC is configured as described in section 6.3.
- 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 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 **Change** and **Sweep** buttons, select the sweep program desired for this film layer. |
| 4 | Press the **Sweep** button to start the selected sweep program. |
| 5 | 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. |
| 6 | Make sure the XTC/3S is in either **READY** or **IDLE** mode. |
| 7 | Press the **START** button on the XTC/3S front panel. |
| 8 | 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

The EBC Extended I/O kit (PN 0620-4180—0) available from Temescal provides 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 Extended I/O kit is 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 Required Connections Between EBC and XTC/3M, Using the EBC Extended I/O Kit**

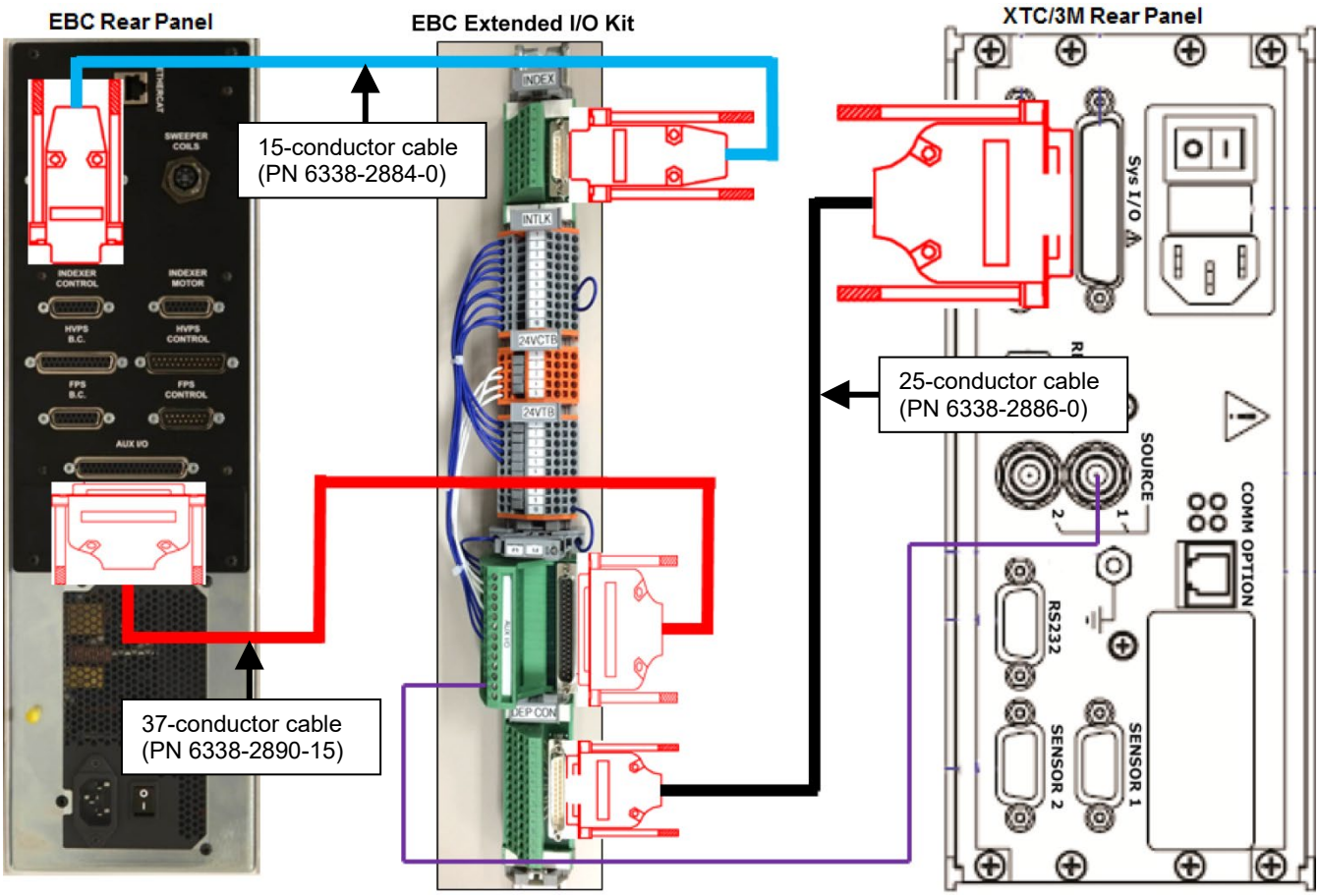


Figure 7-2 illustrates the connections to be made between (1) the following components available in the EBC Extended I/O Kit (PN 0620-4180-0):

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

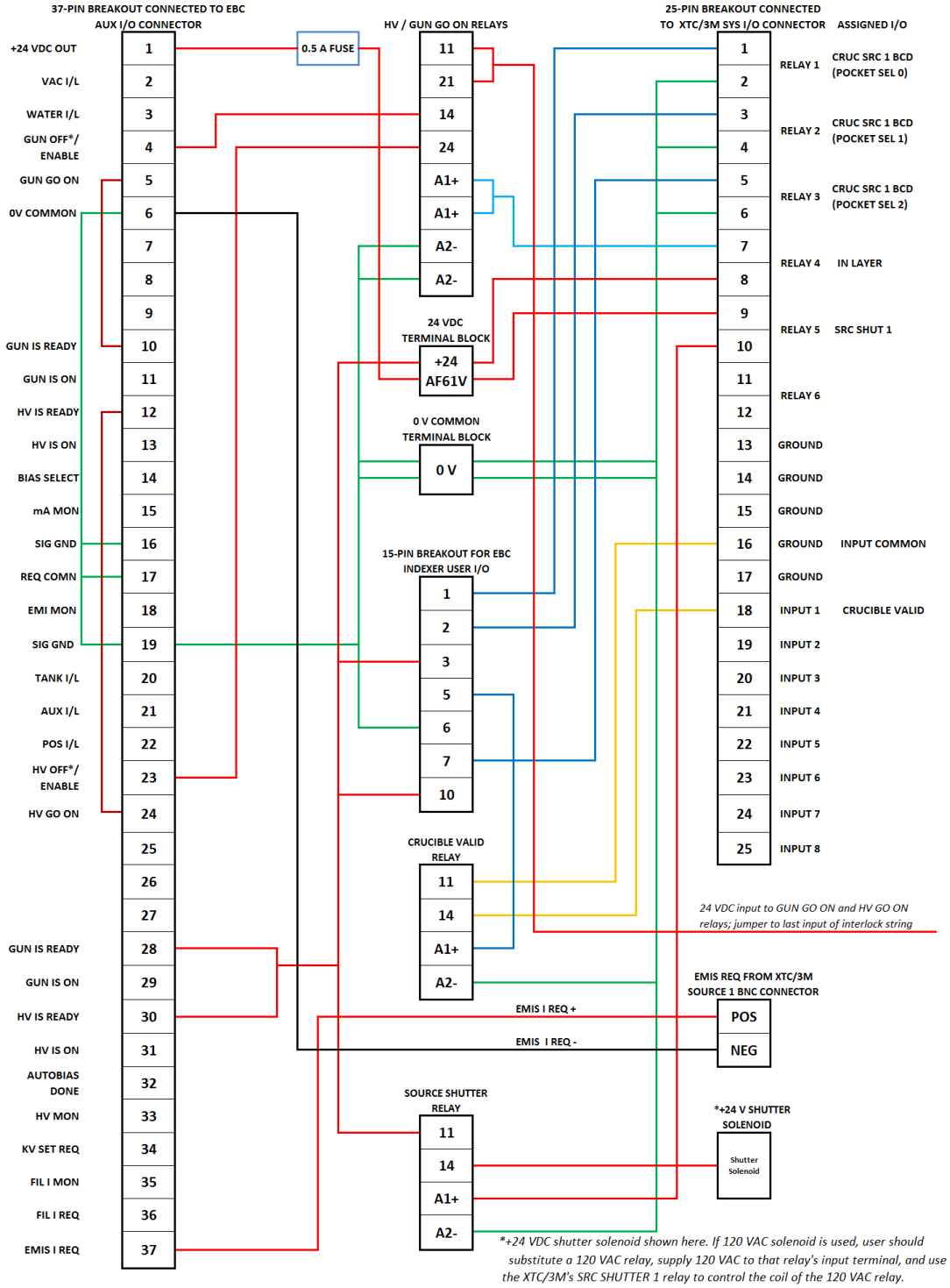
**NOTE**

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.

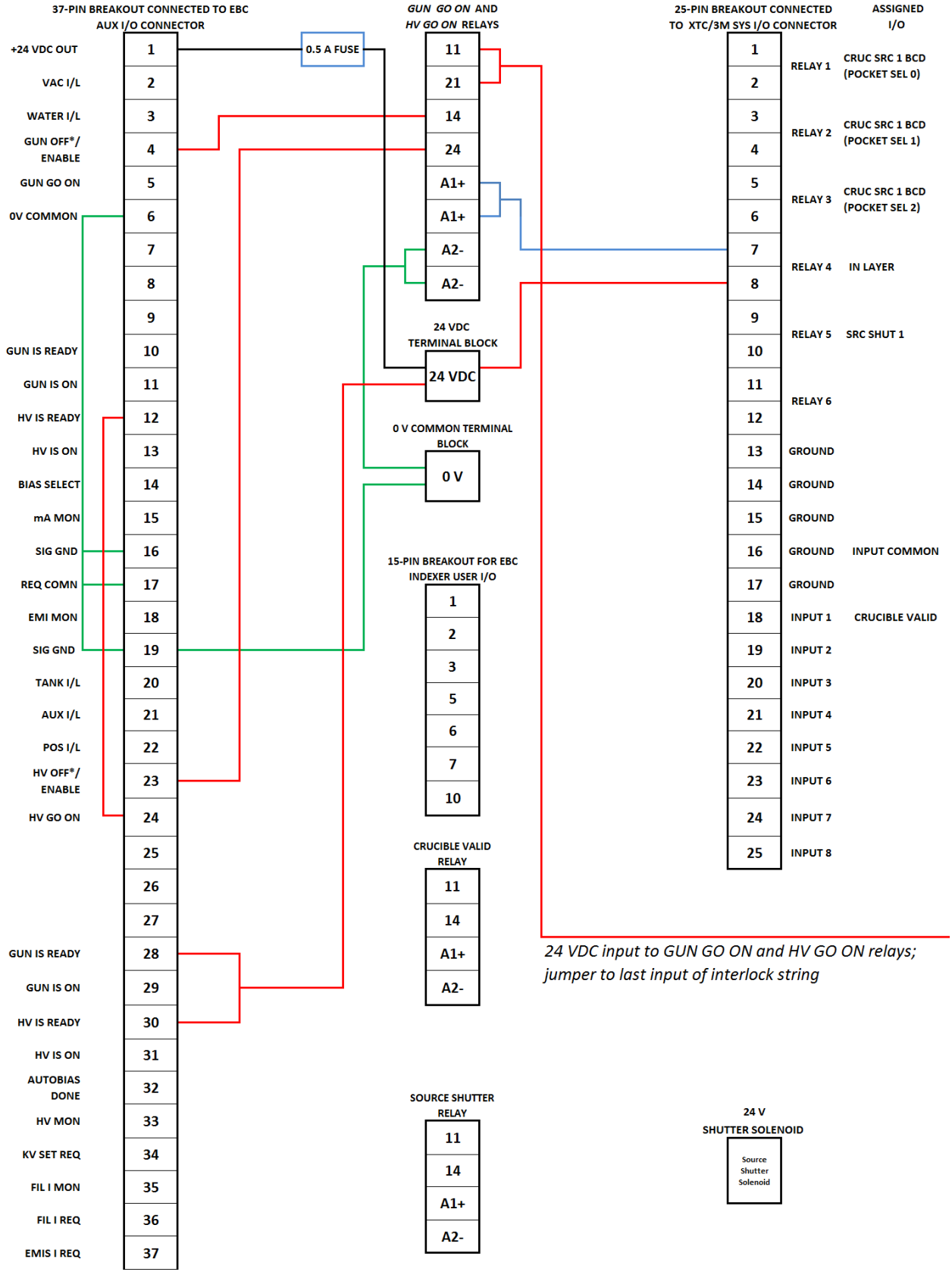
## Figure 7-2 EBC to XTC/3M Wiring Diagram

**DANGER: HIGH VOLTAGE**

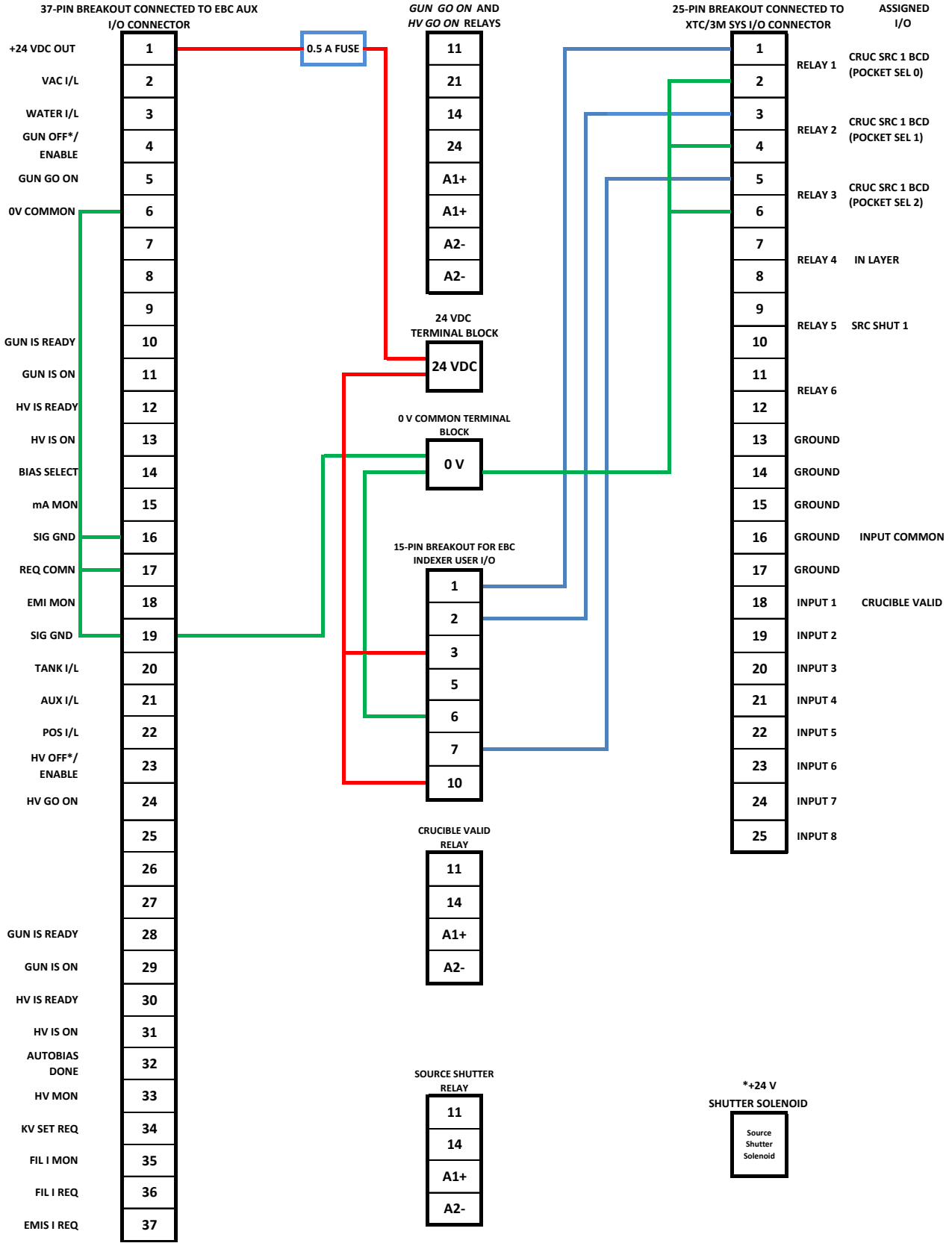
Figure 7-2 pertains only to systems with Temescal PopTop e-guns. If you are installing an EBC on a system with any other type of e-gun, contact Temescal customer service for this wiring information. Under those conditions, do NOT make EBC-XTC/3 connections per Figure 7-2. If you do so, the HV will not be switched off when the Tank interlock is not made (i.e., when the product chamber door is open.)



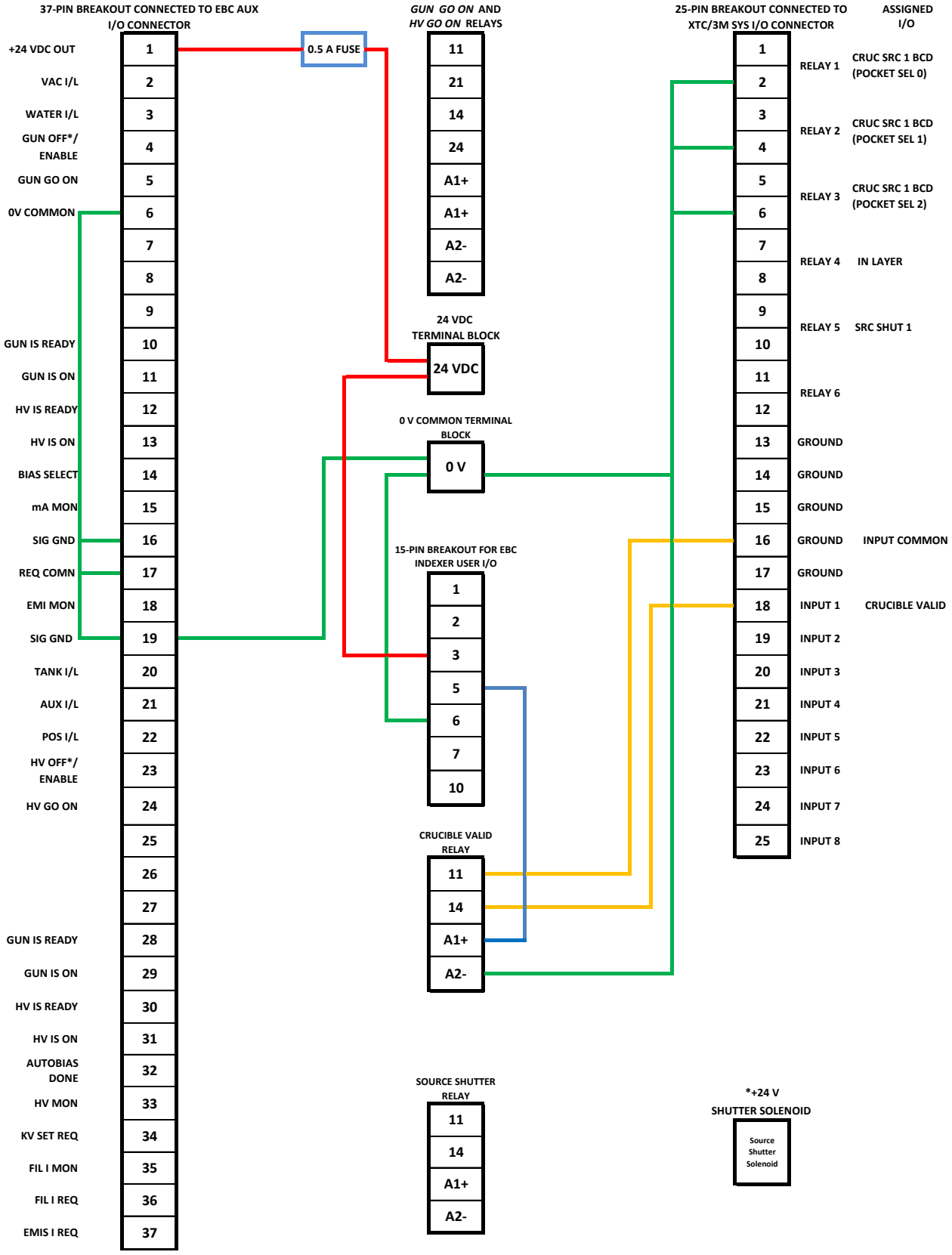
## Figure 7-3 *HV GO ON* and *GUN GO ON* Connections



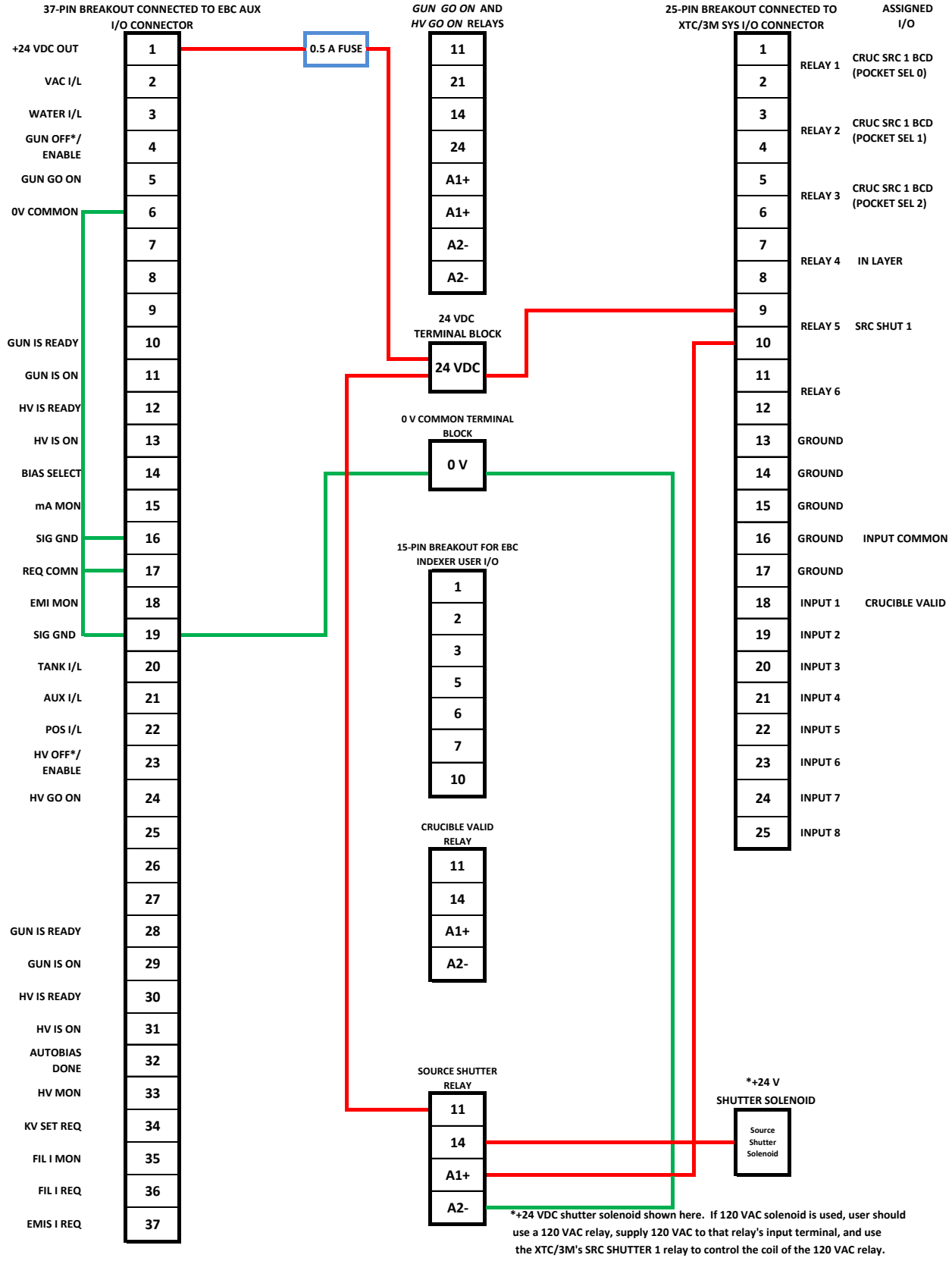
## Figure 7-4 Pocket Selection/Turret Rotation Connections



## 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 basic installation procedures described in Section 3 of this manual, perform the procedure described below. This procedure assumes you are using the EBC Extended I/O Kit (0620-4180-0) and that the XTC/3M's I/O will be programmed as described in section 7.3.2.

| Step | Action |
|---|---|
| 1 | Make sure that the following pins on the Extended I/O kit's 37-pin breakout are jumpered together:<br>• Pins 5 and 10<br>• Pin 6 and Pins 16, 17, and 19<br>• Pins 12 and 24 |
| 2 | Install the Extended I/O Kit in a convenient location on your system. |
| 3 | Ensure that two 24 VDC mini-relays (PN 6149-2961-121) and their spring bases (PN 6149-2966-472) are mounted on the I/O Kit's DIN rail. These relays will function as the HV GO ON and GUN GO ON relays shown in Figure 7-1. |
| 4 | Connect Pin 7 on the 25-pin breakout to the HV GO ON and GUN GO ON relays, as shown in Figure 7-3. |
| 5 | Connect Pin 8 on the 25-pin breakout to the I/O Kit's 24 VDC terminal block, as shown in Figure 7-3. |
| 6 | 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.

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

| | |
|---|---|
| 8 | Make the following connections, which are shown in Figure 7-4.<br>a) Connect Pins 1, 3, and 5 on the 25-pin breakout to Pins 1, 2, and 7 on the 15-pin breakout.<br>b) Connect Pins 2, 4, and 6 on the 25-pin breakout to the 0 volt terminal block.<br>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.

9 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.

10 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.

11 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.

12 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.

13 Using one of the 25-pin cables included in the 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.

14 Using one of the 15-pin cables included in the 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. For a breakdown of the BCD-1 coding for the POCKET SELECT signals that would be input via the same pins, see Table 8-4

15 Using the 37-pin cable included in the Extended 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 8-8.

### 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 Step 2 of that procedure, select **Local** for the Sweep Control module and **Remote I/O** for the E-beam and Turret Control modules. Leave **None** selected for **Synch Type** and **Communication Bus**. |
| 2 | Perform the procedures described in sections 4.3 through 4.5. |
| 3 | Perform Steps 1-6 of the procedure described in section 4.6. |
| 4 | Skip Step 7 of that procedure, as **Emis Control** automatically defaults to Analog In when the E-Beam control module is configured as **Remote I/O**. |
| 5 | Perform the 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. |

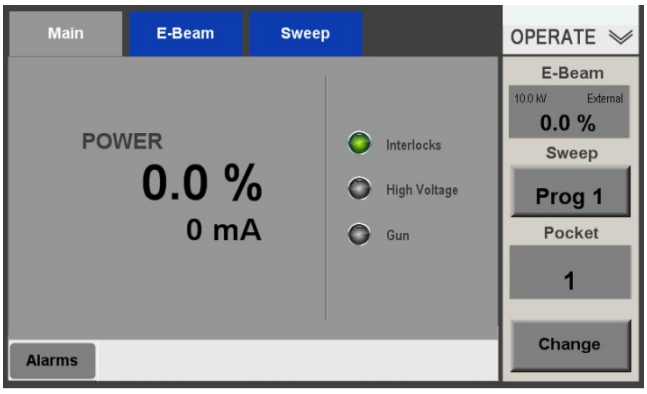
## 7.4 General Operating Methods

### 7.4.1 Appearance of Main UI Screens in this Configuration State

When the EBC is configured as described in section 7.3.3, the EBC's Operations mode screens appear as shown in Figure 7-7. Note that when **Emis Control** defaults to **Analog In**, the **E-Beam** button on the Command Button bar becomes a flat display rectangle. That being the case, operating methods in Operations mode are as described in Section 5, except that in the user cannot select the emission power level from the Command button bar or from the hand-held remote controller.

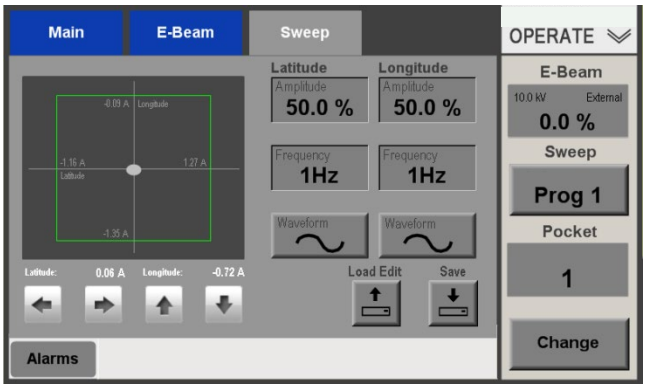
**Figure 7-7 Ops Mode Screens when the EBC Is Configured per Section 7.3.3**

**Operations>Main Screen**




**Operations>E-Beam Screen**


**Operations>Sweep Screen**




## 7.4.2 EBC Operation in this Configuration State

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 12.3. 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 from the main EBC screen, see section 5.4. For information on doing so from the hand-held controller, see section 5.5.

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

### Sweep Program Selection for Multipocket Deposition Processes

When the EBC operates under the control of a multilayer deposition controller, sweep programs are programmed and modified normally, as described in section 5.4. However, since the XTC/3M cannot select sweep programs, the sweep program selection remains unchanged as the turret rotates from pocket to pocket during a multilayer process, unless changed manually by the user each time the turret rotates.

If the e-gun involved in the multilayer process has 16 or fewer pockets, the user can enable **Swp-Pkt Assn** on page 2 of the Config>Sweep screen. In that case, up to 10 sweep programs, numbered 1 through 10, can be assigned to each pocket. If the user is not going to interrupt the multilayer process, the same sweep program number must be programmed for use with each pocket to be employed in the process.

**Swp-Pkt Assn** is not an option for e-guns with more than 16 pockets. Instead, any of 10 sweep programs can be selected for use with any pocket. In this case, the user must interrupt the process to select the appropriate sweep program between each turret rotation.

### Sweep Program Numbering for Multilayer Processes when *Swp-Pkt Assn* Is Enabled

| Step | Action |
|---|---|
| 1 | Rotate the turret to the pocket containing the material to be deposited in Layer 1 of the process. |
| 2 | Using the Command button bar, select the sweep program to be applied in Layer 1. If necessary, create a new sweep pattern or modify an existing sweep pattern. If you have created a new sweep program, save it as any of Programs 1 through 8 for this pocket. |
| 3 | Rotate the turret to the pocket containing the material to be deposited in Layer 2. |
| 4 | Program or select the sweep pattern to be used in Layer 2. |
| 5 | Save this sweep program using the same sweep Program number you assigned in Step 2 of this procedure. |
| 6 | Repeat Steps 4-6 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. |

### Executing a Multilayer Film Process When *Swp-Pkt Assn* Is Enabled

To perform a multilayer film deposition process when **Swp-Pkt Assn** is enabled, follow the procedure described below. This procedure assumes that:

- the EBC and the XTC/3M are both installed and configured correctly,
- both are powered up, and

- the sweep programs to be applied used for the pockets to be employed in the process have been programmed and assigned identical program numbers

| 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. |

### Executing a Multilayer Film Process When *Swp-Pkt Assn* Is Not Enabled

To perform a multilayer film deposition process when **Swp-Pkt Assn** not is enabled, follow the procedure described below. This procedure assumes that:

- the EBC and the XTC/3M are both installed and configured correctly, and
- both are powered up, and
- the sweep programs to be applied used for the pockets to be employed in the process have been programmed and assigned different program numbers, up to a maximum of 10.

| 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 execution of Layer 1 has been completed, press the **Stop** button on the XTC/3M front panel. |
| 7 | Using the Command button bar's **Pocket** button, rotate the turret to the pocket containing the material to be deposited in Layer 2. |
| 8 | Press the XTC/3M's **Start** button. |
| 9 | Repeat Steps 6-8 until the process is completed. |

# 8 Remote I/O Configuration and Operation

## 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 with all control modules configured as Remote I/O. The subsections are:

Section 8.2 Modifications to the Basic Installation Procedure
- Section 8.2.1 Additional Interconnection Hardware Requirements
- Section 8.2.2 Modified Installation Procedure
- Section 8.2.3 Pinout Details for EBC Rear Panel Connections Required for this Installation

Section 8.3 Modifications to Basic Configuration Procedures

Section 8.4 EBC Operation
- Section 8.4.1 Appearance of Operations Mode Screens when All Control Modules Are Configured as Remote I/O
- Section 8.4.2 Operation Under PLC Control
- Section 8.4.3 Use of Manual Mode When the EBC when the EBC

## 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. The EBC Extended I/O Kit (PN 0620-4180—0) provides 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 EBC Extended I/O Kit.

| Step | Action |
|---|---|
| 1 | Perform the basic installation procedure described in Section 3.3. |
| 2 | Perform the basic cabling procedures described in section 3.4.2, except for those under the headings "Making Connections to the EBC's Rear Panel **Indexer Control** Connector" and "Making Connections to the EBC's Rear Panel **AUX I/O** Connector." |
| 3 | Connect the male end of the 25-pin cable (PN 6338-2886-0) included in the Extended I/O Kit to the EBC's rear-panel **Sweeper Control** connector. |
| 4 | Connect the other end of this cable to the Extended I/O Kit's 25-pin breakout. |
| 5 | Determine which of the I/Os shown in Figure 8-2 and described in detail in Table 8-10 you wish to implement. |
| 6 | Make connections between the 25-pin breakout's terminal board and a system terminal strip wired to provide these I/Os. |
| 7 | Connect the male end of the 37-pin cable (PN 6338-2890-15) included in the Extended I/O Kit to the EBC's rear-panel **AUX I/O** connector. |
| 8 | Connect the other end of this cable to the Extended I/O Kit's 37-pin breakout. |
| 9 | Determine which of the I/Os shown in Figure 8-3 and described in detail in Table 8-12 you wish to implement. |
| 10 | Make connections between the 37-pin breakout's terminal board and a system terminal strip wired to provide these I/Os |

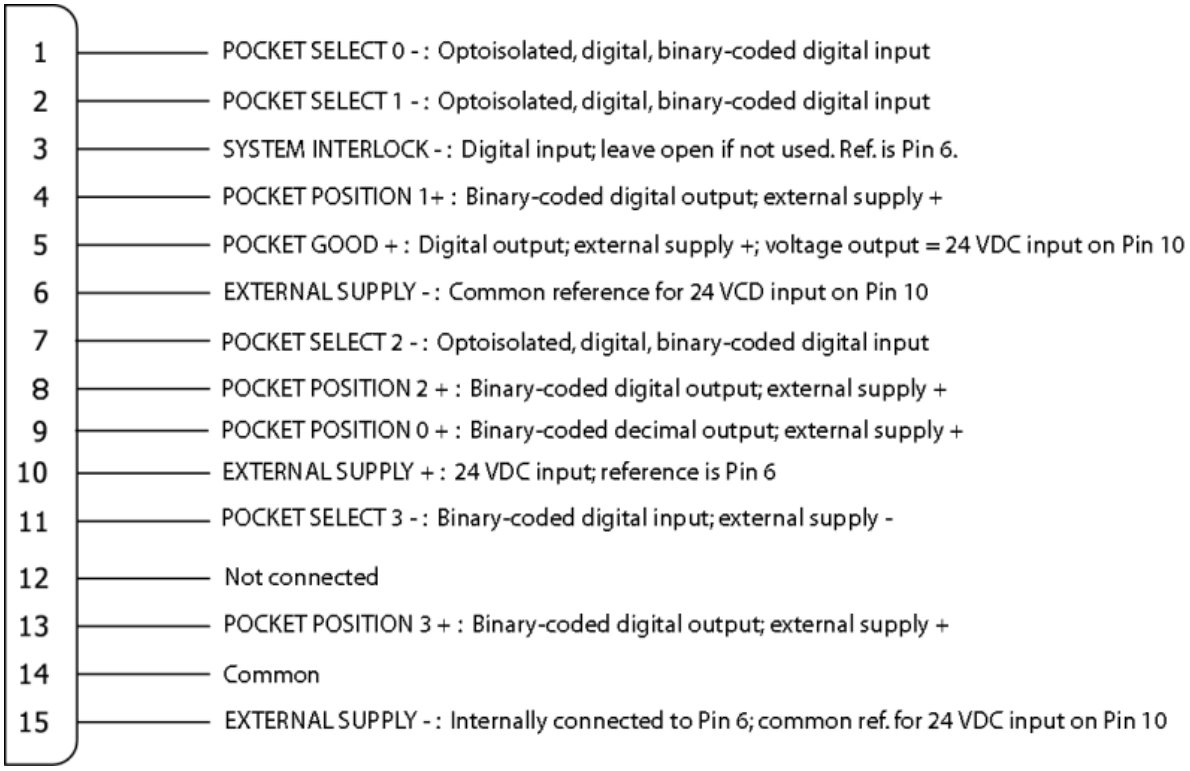
## 8.2.3 Pinout Details for EBC Rear Panel Connections Required for this Installation

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 that connector.

## 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–, 2–, and 3– | 1,2,7, 11 | Optoisolated digital inputs used when the Turret Control module is controlled by a higher-level controller (i.e., when **Remote I/O** is selected for **Comm Bus** on the Config>Main screen). These inputs can be either binary-coded-decimal (BCD) or BCD-1 signals (see Tables 8-2 through 8-9). Their function varies depending on whether **Standard** or **Custom** is selected as the **Crucible Type** (see section 4.5 and the paragraph following this table). When active (= high), these signals 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+, 2+, and 3+ | 9,4,8, 13 | Optoisolated digital outputs used when the Turret Control module is controlled by a higher-level controller (i.e., when either **Remote I/O**, **EtherCAT**, or **RS232** is selected for **Comm Bus** on the Config>Main screen). These outputs, which can be either binary-coded-decimal (BCD) or BCD-1, indicate which pocket is currently in evaporation position. |
| 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. |

| Signal Name | Pin(s) | Function |
|---|---|---|
| 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 |

### BCD and BCD-1 Coding of the *POCKET SELECT* and *POCKET POSITION* Signals

The functions of POCKET SELECT inputs (Pins 1, 2, 7, and 11) and POCKET POSITION outputs (Pins 4, 8, 9, and 12) vary depending on whether **Standard** or **Custom** is selected for **Crucible Type** on the Configuration>Turret page (see Figure 4-11).

When **Standard is** selected as the **Crucible Type**, the POCKET SELECT inputs and the POCKET POSITION outputs refer exclusively to pocket selection and current-pocket position. Table 8-2 shows the BCD coding for the POCKET SELECT inputs when **Crucible Type** = **Standard**, and Table 8-3 shows the BCD-1 coding for those inputs. Table 8-4 shows the BCD coding for the POCKET POSITION outputs when **Crucible Type** = **Standard**, and Table 8-5 shows the BCD-1 coding for those outputs.

When **Custom** I selected as the **Crucible Type**, POCKET SELECT inputs 0, 1, and 2 (Pins 1, 2, and 7) serve to select the pocket, while a high signal on POCKET SELECT input 3 (Pin 11) serves to select oscillating motion for the selected pocket. Oscillating motion can be selected for any pocket but should only be applied if to banana-shaped pockets. Table 8-6 shows the BCD coding for the POCKET SELECT inputs when **Crucible Type** = **Custom**, and Table 8-7 shows the BCD-1 coding for those inputs. Table 8-8 shows the BCD coding for the POCKET POSITION outputs when **Crucible Type** = **Custom**, and Table 8-9 shows the BCD-1 coding for those outputs.

## Table 8-2 Standard Crucible Selected: BCD Coding for POCKET SELECT Signals

| Pocket Selected | SEL 0 Input (Pin 1) | SEL 1 Input (Pin 2) | SEL 2 Input (Pin 7) | SEL 3 Input (Pin 11) |
|---|---|---|---|---|
| 1 | 0 | 0 | 0 | 0 |
| 2 | 1 | 0 | 0 | 0 |
| 3 | 0 | 1 | 0 | 0 |
| 4 | 1 | 1 | 0 | 0 |
| 5 | 0 | 0 | 1 | 0 |
| 6 | 1 | 0 | 1 | 0 |
| 7 | 0 | 1 | 1 | 0 |
| 8 | 1 | 1 | 1 | 0 |
| 9 | 0 | 0 | 0 | 1 |
| 10 | 1 | 0 | 0 | 1 |
| 11 | 0 | 1 | 0 | 1 |
| 12 | 1 | 1 | 0 | 1 |
| 13 | 0 | 0 | 1 | 1 |
| 14 | 1 | 0 | 1 | 1 |
| 15 | 0 | 1 | 1 | 1 |
| 16 | 1 | 1 | 1 | 1 |

## Table 8-3 Standard Crucible Selected: BCD-1 Coding of the POCKET SELECT Signals

| Pocket Selected | SEL 0 Input (Pin 1) | SEL 1 Input (Pin 2) | SEL 2 Input (Pin 7) | SEL 3 Input (Pin 11) |
|---|---|---|---|---|
| * | 0 | 0 | 0 | 0 |
| 1 | 1 | 0 | 0 | 0 |
| 2 | 0 | 1 | 0 | 0 |
| 3 | 1 | 1 | 0 | 0 |
| 4 | 0 | 0 | 1 | 0 |
| 5 | 1 | 0 | 1 | 0 |
| 6 | 0 | 1 | 1 | 0 |
| 7 | 1 | 1 | 1 | 0 |
| 8 | 0 | 0 | 0 | 1 |
| 9 | 1 | 0 | 0 | 1 |
| 10 | 0 | 1 | 0 | 1 |
| 11 | 1 | 1 | 0 | 1 |
| 12 | 0 | 0 | 1 | 1 |
| 13 | 1 | 0 | 1 | 1 |
| 14 | 0 | 1 | 1 | 1 |
| 15 | 1 | 1 | 1 | 1 |

* Invalid selection

## Table 8-4 Standard Crucible Selected: BCD Coding for POCKET POSITION Signals

| Current Pocket Position | POS 0 Output (Pin 9) | POS 1 Output (Pin 4) | POS 2 Output (Pin 8) | POS 3 Output (Pin 13) |
|---|---|---|---|---|
| 1 | 0 | 1 | 1 | 1 |
| 2 | 1 | 0 | 1 | 1 |
| 3 | 0 | 0 | 1 | 1 |
| 4 | 1 | 1 | 0 | 1 |
| 5 | 0 | 1 | 0 | 1 |
| 6 | 1 | 0 | 0 | 1 |
| 7 | 0 | 0 | 0 | 1 |
| 8 | 1 | 1 | 1 | 0 |
| 9 | 0 | 1 | 1 | 0 |
| 10 | 1 | 0 | 1 | 0 |
| 11 | 0 | 0 | 1 | 0 |
| 12 | 1 | 1 | 0 | 0 |
| 13 | 0 | 1 | 0 | 0 |
| 14 | 1 | 0 | 0 | 0 |
| 15 | 0 | 0 | 0 | 0 |
| 16 | 1 | 1 | 1 | 1 |

## Table 8-5 Standard Crucible Selected: BCD-1 Coding for POCKET POSITION Signals

| Current Pocket Position | POS 0 Output (Pin 9) | POS 1 Output (Pin 4) | POS 2 Output (Pin 8) | POS 3 Output (Pin 13) |
|---|---|---|---|---|
| * | 0 | 1 | 1 | 1 |
| 1 | 1 | 0 | 1 | 1 |
| 2 | 0 | 0 | 1 | 1 |
| 3 | 1 | 1 | 0 | 1 |
| 4 | 0 | 1 | 0 | 1 |
| 5 | 1 | 0 | 0 | 1 |
| 6 | 0 | 0 | 0 | 1 |
| 7 | 1 | 1 | 1 | 1 |
| 8 | 0 | 1 | 1 | 0 |
| 9 | 1 | 0 | 1 | 0 |
| 10 | 0 | 0 | 1 | 0 |
| 11 | 1 | 1 | 0 | 0 |
| 12 | 0 | 1 | 0 | 0 |
| 13 | 1 | 0 | 0 | 0 |
| 14 | 0 | 0 | 0 | 0 |
| 15 | 1 | 1 | 1 | 1 |

* Invalid selection

### Table 8-6 Custom Crucible Selected: BCD Coding for POCKET SELECT Signals

| Pocket Selected | SEL 0 Input (Pin 1) | SEL 1 Input (Pin 2) | SEL 2 Input (Pin 7) | SEL 3 Input (Pin 11) |
|---|---|---|---|---|
| 1 | 0 | 0 | 0 | 0 = Stationary<br>1 = Oscillate |
| 2 | 1 | 0 | 0 | 0 = Stationary<br>1 = Oscillate |
| 3 | 0 | 1 | 0 | 0 = Stationary<br>1 = Oscillate |
| 4 | 1 | 1 | 0 | 0 = Stationary<br>1 = Oscillate |

### Table 8-7 Custom Crucible Selected: BCD-1 Coding for POCKET SELECT Signals

| Pocket Selected | SEL 0 Input (Pin 1) | SEL 1 Input (Pin 2) | SEL 2 Input (Pin 7) | SEL 3 Input (Pin 11) |
|---|---|---|---|---|
| * | 0 | 0 | 0 | 0 |
| 1 | 1 | 0 | 0 | 0 = Stationary<br>1 = Oscillate |
| 2 | 0 | 1 | 0 | 0 = Stationary<br>1 = Oscillate |
| 3 | 1 | 1 | 0 | 0 = Stationary<br>1 = Oscillate |
| 4 | 0 | 0 | 1 | 0 = Stationary<br>1 = Oscillate |

### Table 8-8 Custom Crucible Selected: BCD Coding for POCKET POSITION Signals

| Current Pocket Position | POS 0 Output (Pin 9) | POS 1 Output (Pin 4) | POS 2 Output (Pin 8) | POS 3 Output (Pin 13: Not used) |
|---|---|---|---|---|
| 1 | 0 | 1 | 1 | 0 |
| 2 | 1 | 0 | 1 | 0 |
| 3 | 0 | 0 | 1 | 0 |
| 4 | 1 | 1 | 0 | 0 |

### Table 8-9 Custom Crucible Selected: BCD-1 Coding for POCKET POSITION Signals

| Current Pocket Position | POS 0 Output (Pin 9) | POS 1 Output (Pin 4) | POS 2 Output (Pin 8) | POS 3 Output (Pin 13: Not used) |
|---|---|---|---|---|
| * | 0 | 1 | 1 | 0 |
| 1 | 1 | 0 | 1 | 0 |
| 2 | 0 | 0 | 1 | 0 |
| 3 | 1 | 1 | 0 | 0 |
| 4 | 0 | 1 | 0 | 0 |

### The SWEEPER CONTROL Connector

Figure 8-2 is a pinout diagram of the 25-pin **SWEEPER CONTROL** connector. Table 8-10 provides functional definitions of the signals exchanged via that connector. Table 8-11 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**

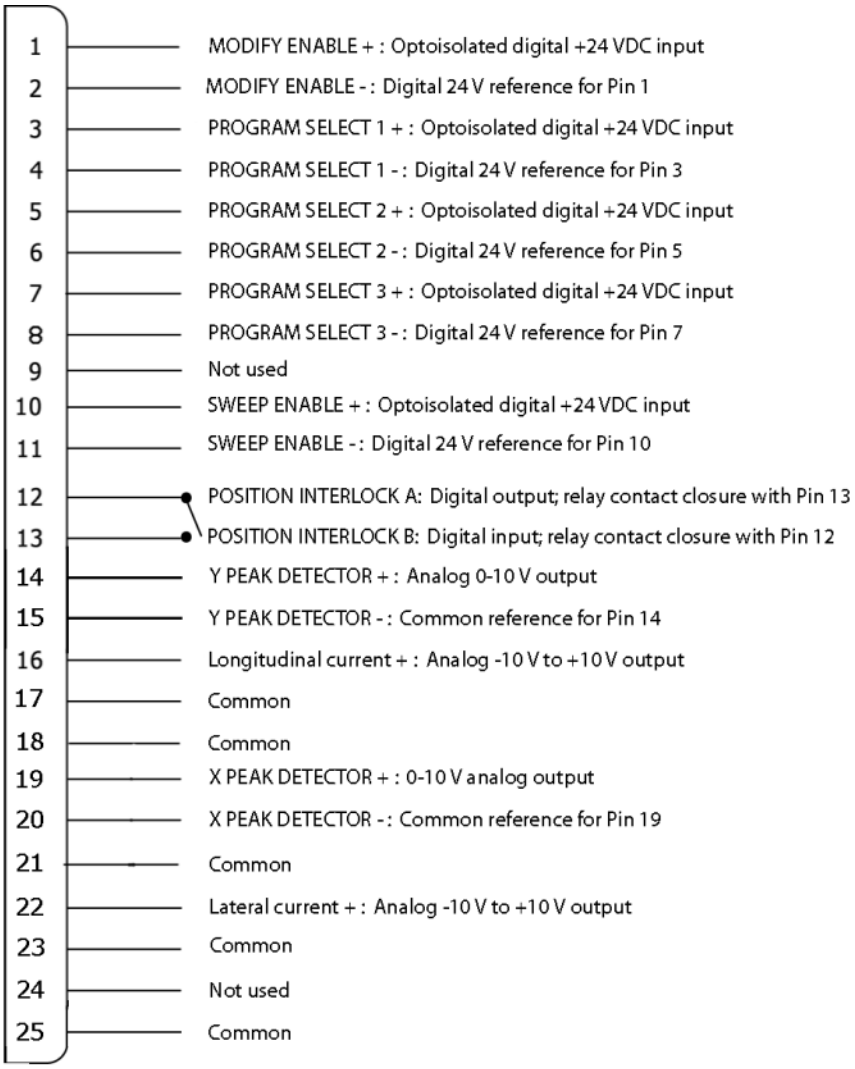



**Table 8-10 Signals Exchanged via the SWEEPER CONTROL Connector**

| 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. |

| Signal Name | Pin(s) | Function |
|---|---|---|
| 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 | |

**NOTE**

If the EBC's Sweep Control module is configured as either **Remote I/O** or **EtherCAT**, Pin 12 on the SWEEPER CONTROL 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.

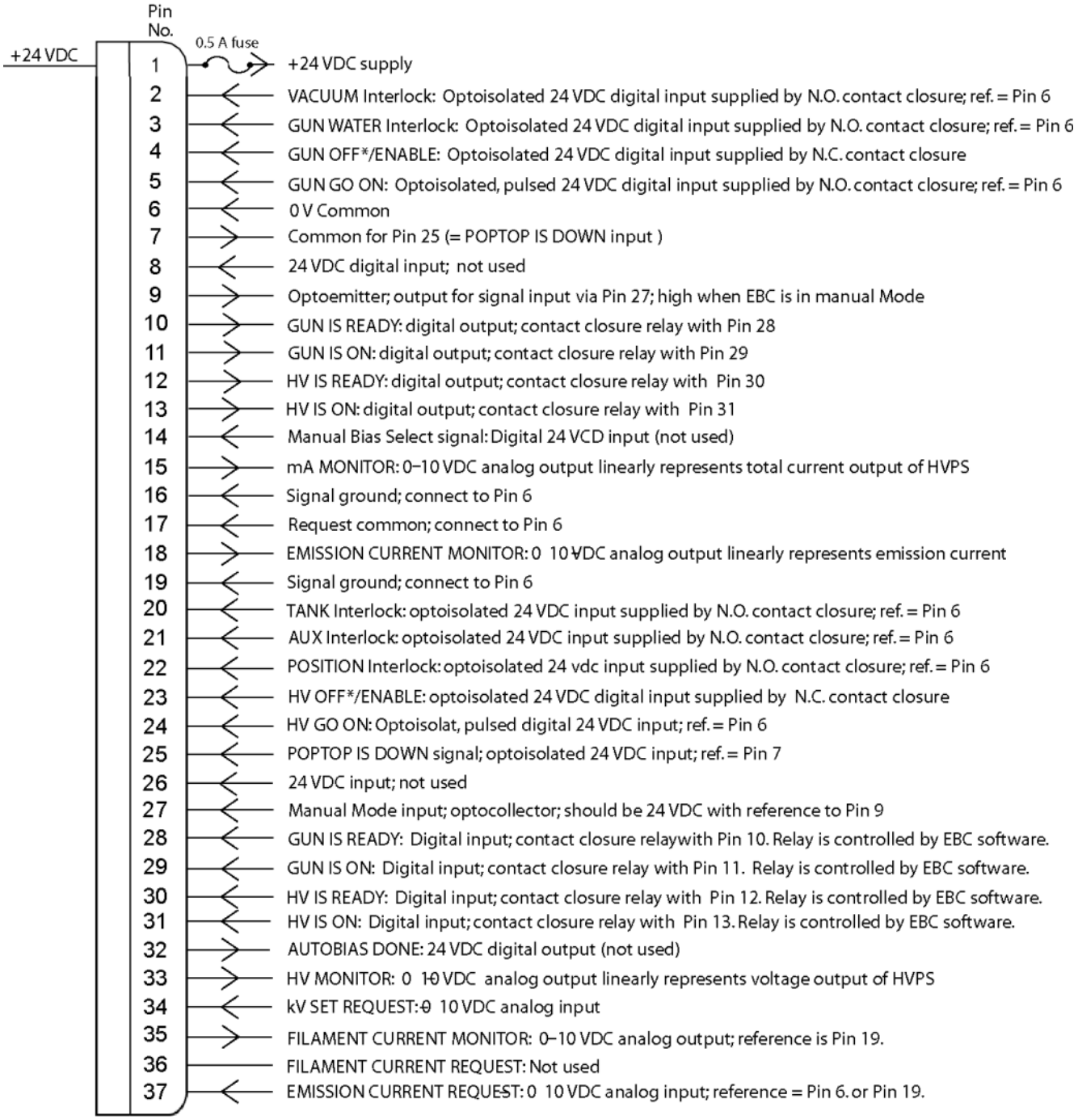
## Table 8-11 BCD Coding of the PROGRAM SELECT 0, 1, and 2 Inputs (SEL 0, 1, and 2)

| 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 |

**NOTE**

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 3-7 of this manual. If these connections are not made, the gun cannot be enabled and cannot be switched on.

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



## Table 8-12 Signals Exchanged via the AUX I/O Connector

| Signal Name | Pin | Function |
|---|---|---|
| 24 VDC supply | 1 | This 24 VDC analog output comes from the FPS and has a 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*/ENABLE | 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 | Analog common reference for 24 VDC input; 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 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 **Emis Control** on the Config>E-Beam screen set to **Analog In**, 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 HVPS is 0–10 V = 0–600 mA. Default range for CV-12SLX HVPS is 0–10 V = 0–1200 mA. |

*NOTE: If either the Sweep Control or E-Beam Control module is configured as Remote I/O, 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 procedures described in section 4.2, configuring all control modules as **Remote I/O**. |
| 2 | Perform the procedure described in sections 4.3 through 4.5. |
| 3 | Perform Steps 1-6 of the procedure described in section 4.6. Skip Step 7 of that procedure, as **Emis Control** defaults to **Analog In** when the E-Beam control module is configured as Remote I/O. |
| 4 | Perform the procedures described in sections 4.7 through 4.9. |

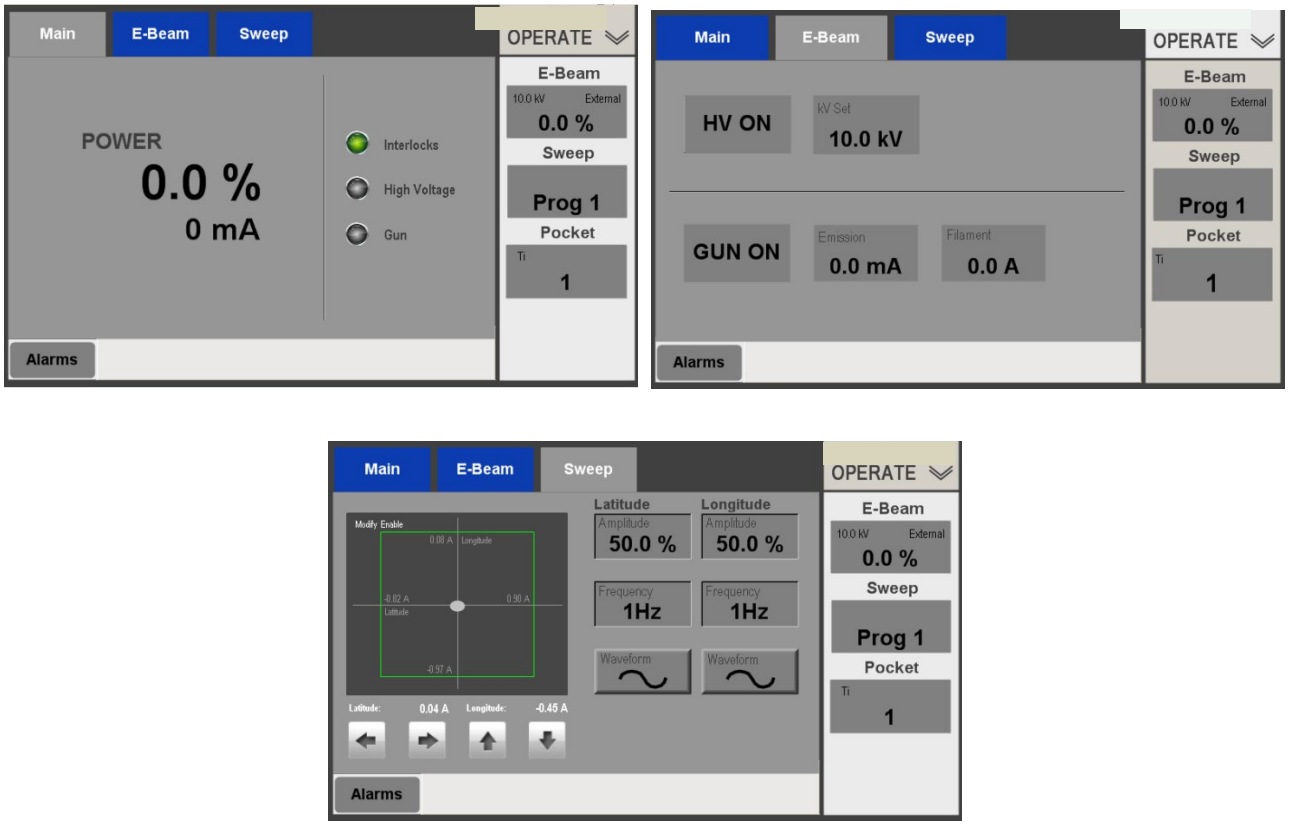
# 8.4 EBC Operation Under PLC Control: All Control Modules *Remote I/O*

This section describes how the EBC operates when it is under PLC control with all three control modules configured as **Remote I/O**.

## 8.4.1 Appearance of Operations Mode Screens when All Control Modules Are Configured as Remote I/O

When the all the EBC control modules are configured as either **Remote I/O**, the Configuration mode screens appear as shown in Figure 1-8, and Service mode screens appear as shown in Figure 1-10. The Ops>Main and Ops>E-Beam screens appear as shown in Figure 8-4. The Ops>Sweep screen appears either as shown in Figure 8-4 or in Figure 8-5, depending on whether **Modify Enable** is true.

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




## 8.4.2 Operation Under PLC Control

When all three EBC control modules are configured as **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.

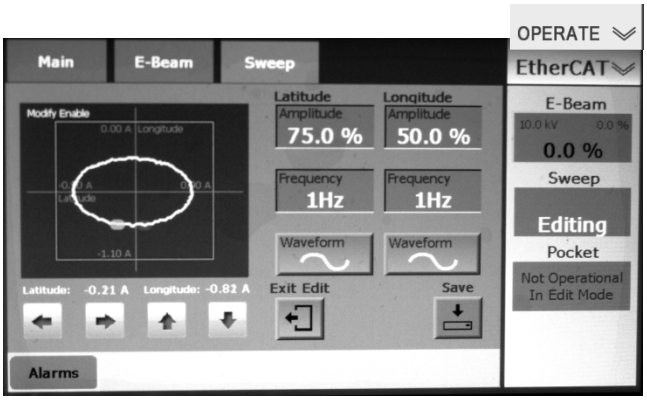
When MODIFY ENABLE is true, an EBC user with appropriate permissions can modify the currently selected sweep program—and that program alone— using the Operations>Sweep screen. For a details regarding sweep modification procedures, see "Modifying the Sweep Program Currently Displayed" in section 5.4.3 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 8-5. If the user then begins to modify any sweep parameter, the **Exit Edit** and **Save** buttons both appear, as shown in and the legend **Editing** is displayed in the rectangle where the **Sweep** button normally appears.

**Figure 8-5 The Ops>Sweep Screen when MODIFY ENABLE Is True**


**Figure 8-6 The Ops>Sweep Screen after User Begins Editing a Sweep Program**




## 8.4.3 Use of Manual Mode When the EBC when the EBC Under PLC Control with all Control Modules Configured as *Remote I/O*

In this configuration/operational mode, the user also has the option of temporarily putting the EBC into Manual Mode, which provides full control from the Command Button bar and via the active features on the Manual>E-Beam and Manual>Sweep screens. In this configuration mode, the Manual mode screens appear as shown in Figure 1-11.

# 9 EtherCAT Configuration and Operation

## 9.1 Section Overview

This section describes the configuration and operation of the EBC when it is under the control of a PLC-based system controller with all control modules configured as EtherCAT. The topics covered are:



## 9.2 Modifications to the Basic Installation Procedure

### 9.2.1 Modified Installation Procedure

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

| Step | Action |
|---|---|
| 1 | Perform the basic installation procedure described in Section 3. |
| 2 | Connect a standard ETHERCAT cable to the EBC's rear panel **EtherCAT** connector and to the ETHERCAT connector on the AnyBus gateway whose other side is connected to the PLC. |

## 9.3 Modifications to Basic Configuration Procedures

When configuring the EBC to operate under the control of a PLC-based system controller, with all modules configured as **EtherCAT**, follow the procedure described below.

| Step | Action |
|---|---|
| 1 | Perform Step 1 of the procedure described in section 4.2. Then select **EtherCAT** for **Communications Bus** and skip the remainder of that procedure. |
| 2 | Perform the procedure described in sections 4.3 through 4.5. |
| 3 | Perform Steps 1-6 of the procedure described in section 4.6. |
| 4 | In Step 7, select **EtherCAT** for **Emis Control**. |
| 5 | Perform the procedures described in sections 4.7 through 4.9. |

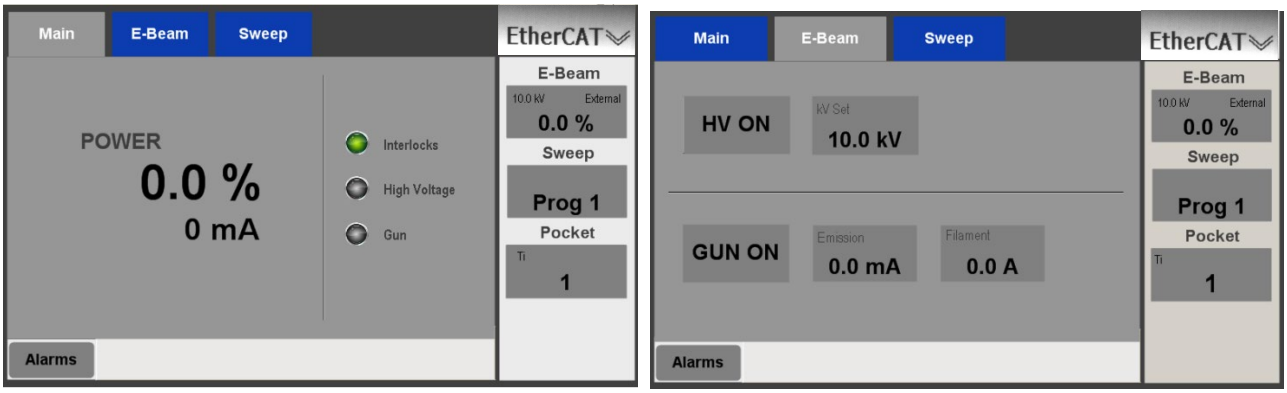
## 9.4 EBC Operation Under PLC Control: All Modules *EtherCAT*

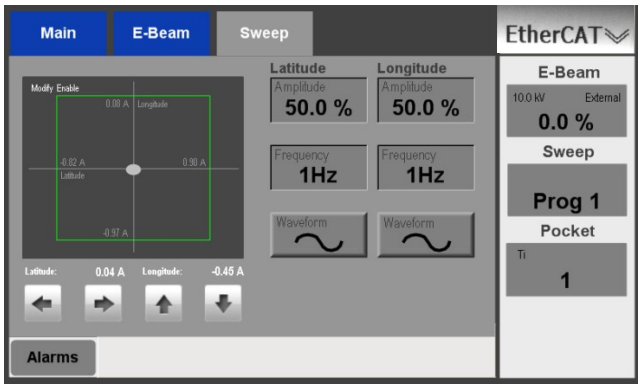
This section describes EBC operation under PLC control when all three control modules are configured as **ETHERCAT**.

### 9.4.1 Appearance of EBC Screens when all Control Modules Are Configured as EtherCAT

When the all the EBC control modules are configured as **ETHERCAT**, the Configuration mode screens appear as shown in Figure 1-8, and Service mode screens appear as shown in Figure 1-10. In Operations mode, the Menu Selection button/ Mode ID label bears the legend *EtherCAT*, as shown in Figure 9-1. The EtherCAT>Main and EtherCAT>E-Beam screens appear as shown in that illustration. The EtherCAT>Sweep appears as shown either in Figure 9-1 or in Figure 9-2, depending on whether Modify Enable is true.

**Figure 9-1 Appearance of Operations Mode Screens when All EBC Control Modules Are Configured as *ETHERCAT***






## 9.4.2 EBC Operation Under PLC Control when All Control Modules Are Configured as *EtherCAT*

When all three EBC control modules are configured as either **EtherCAT**, 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 5.4.3 of this manual. Note that the program can be saved under a different pocket and sweep program number, as described there.

### The EtherCAT>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 9-2. 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 (see Figure 9-3).

**Figure 9-2 The EtherCAT>Sweep Screen when MODIFY ENABLE Is True**

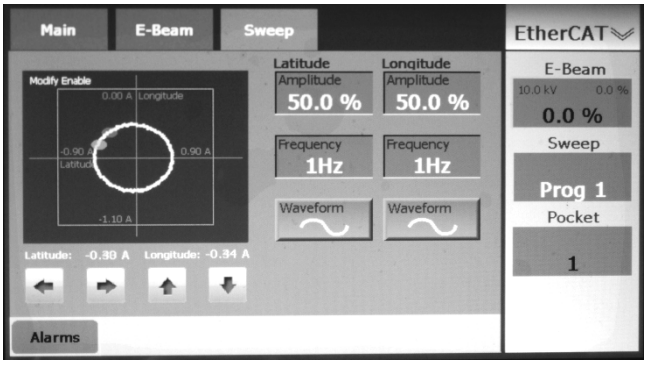
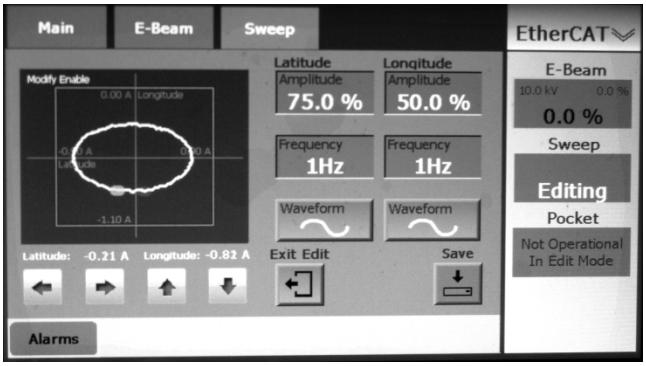


**Figure 9-3 EtherCAT>Sweep Screen, User Editing Sweep Program**




## 9.4.3 Use of Manual Mode when All Control Modules Are Configured as *ETHERCAT*

The user also has the option of temporarily putting the EBC into Manual mode, which provides full control from the Command Button bar and the active features on the Manual>E-Beam and Manual>Sweep Screens. When all control modules are configured as EtherCAT, the Manual mode screens appear as shown in Figure 1-11.

# 10 RS-232 Configuration and Operation

## 10.1 Section Overview

This section describes the configuration and operation of the EBC when it is under the control of a PLC-based system controller with all control modules configured as **RS-232**. The subsections are:

Section 10.2 Modifications to the Basic Installation Procedure

Section 10.3 Modifications to Basic Configuration Procedure

Section 10.4 EBC Operation

- Section 10.4.1 Appearance of UI Screens when all Control Modules Are Configured as RS-232
- Section 10.4.2 EBC Operation Under PLC Control when All Control Modules Are Configured as RS-232
- Section 10.4.3 Use of Manual Mode when All Control Modules Are Configured as RS-232

## 10.2 Modifications to the Basic Installation Procedure

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

| Step | Action |
|---|---|
| 1 | Perform the basic installation procedure described in Section 3. |
| 2 | Connect a standard RS-232 null-modem (crossover) cable to the EBC's rear panel **COM A** connector and to the host computer's RS-232 connector. |

## 10.3 Modifications to Basic Configuration Procedure

When configuring the EBC to operate under the control of a PLC-based system controller, with all modules configured as **RS-232**, follow the procedure described below.

| Step | Action |
|---|---|
| 1 | Perform Step 1 of the procedure described in section 4.2. Then select **RS-232** for **Comm Bus** and skip the remainder of that procedure |

2 Perform the procedure described in section 4.3 through 4.5.

3 Perform Steps 1-6 of the procedure described in section 4.6.

4 In Step 7, select **RS-232** for **Emis Control**.

5 Perform the procedures described in sections 4.7 through 4.9.

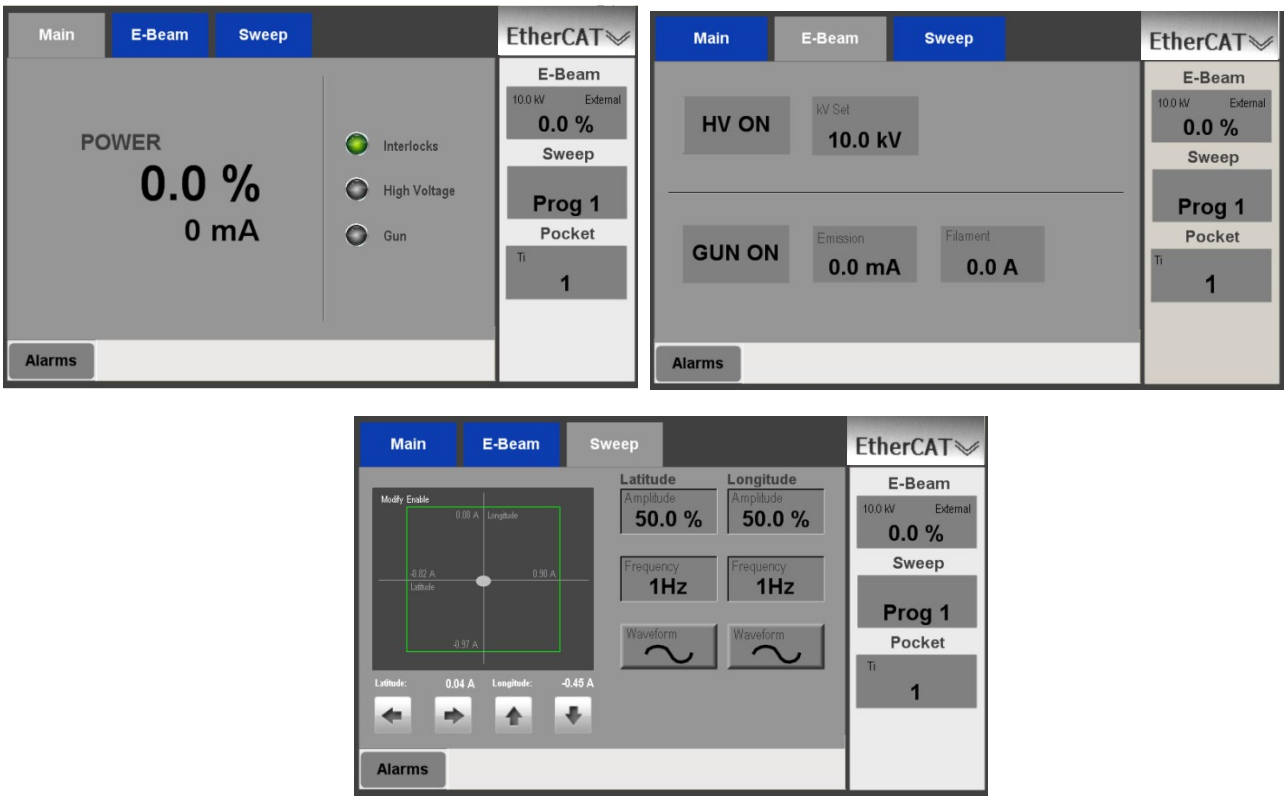
## 10.4 EBC Operation Under PLC Control: All Modules *RS-232*

This section describes EBC operation under PLC control when all three control modules are configured as **RS-232**.

### 10.4.1 Appearance of UI Screens when all Control Modules Are Configured as RS-232

When the all the EBC control modules are configured as **RS-232**, the Configuration mode screens appear as shown in Figure 1-8, and Service mode screens appear as shown in Figure 1-10. In Operations mode, the Menu Selection button/ Mode ID label bears the legend *RS-232*, as shown in Figure 10-1. The Ops>E-Main and Ops>E-Beam screens appear as shown in that illustration. The Ops>Sweep screen appears either as shown in Figure 10-1 or as shown in Figure 10-2, depending on whether Modify Enable is true.

**Figure 10-1 Appearance of Operations Mode Screens when All EBC Control Modules Are Configured as *RS-232***



### 10.4.2 EBC Operation Under PLC Control when All Control Modules Are Configured as *RS-232*

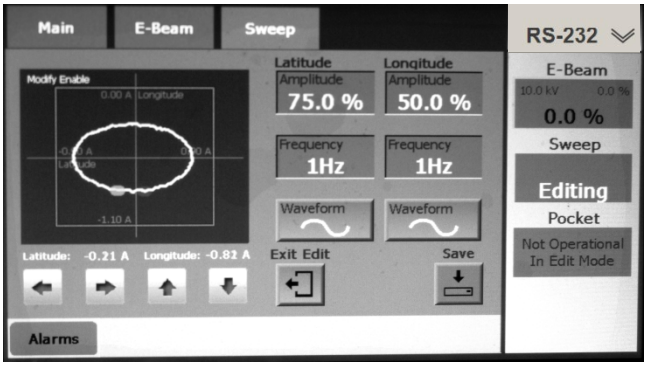
When all three of its control modules are configured as **RS-232**, the EBC is designed to operate completely under the control of the PLC-based system controller, except when that controller asserts the MODIFY ENABLE signal via Pin 1 of the EBC's rear panel **SWEEPER CONTROL** connector. When MODIFY 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 5.4.3. Note that after modification, the program can be saved under a different pocket and sweep program number.

#### 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 10-2. 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 (see Figure 10-3).

**Figure 10-2 The EtherCAT>Sweep Screen when MODIFY ENABLE Is True**


**Figure 10-3 RS-232>Sweep Screen, User Editing Sweep Program**



### 10.4.3 Use of Manual Mode when All Control Modules Are Configured as RS-232

When the EBC is under PLC control, the user also has the option of temporarily putting the EBC into Manual Mode, which provides full control from either the Command Button bar or active features on the Manual>E-Beam or Manual>Sweep screens. The Manual mode screens appear as shown in Figure 1-11.

# 11 Master/Slave Configuration and Operation

## 11.1 Section Overview

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

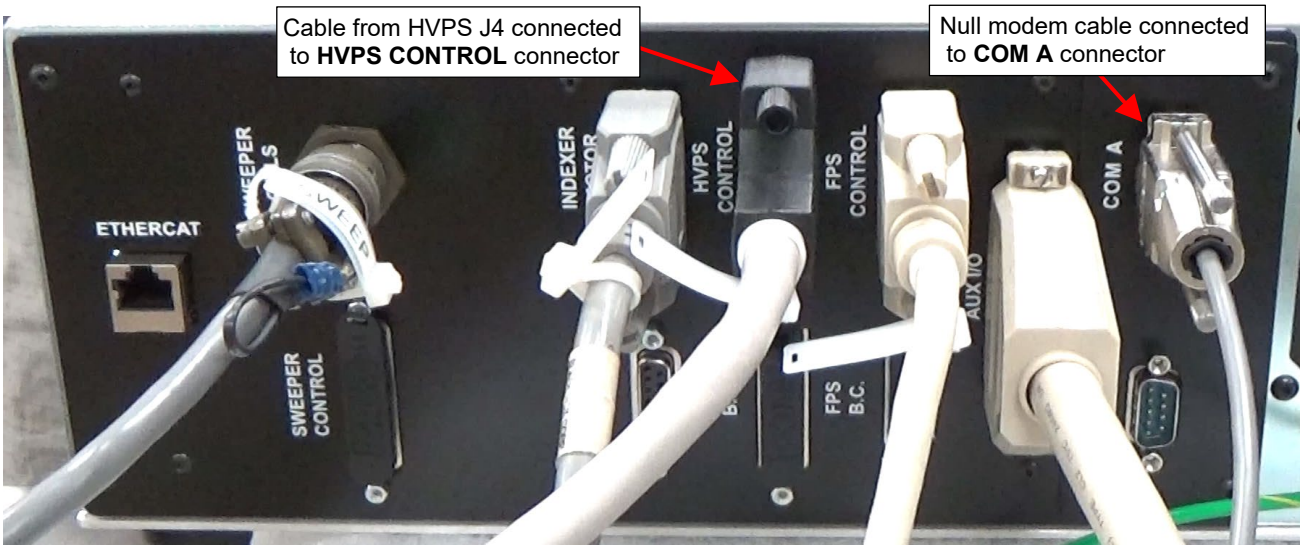
Section 11.2 Cable Connections Required for Master/Slave Operation
Section 11.3 Configuring Dual EBC Units Master/Slave for Master/Slave Operation
Section 11.4 Standard Configuration Procedures on Master and Slave Units
Section 11.5 Operation of Master/Slave EBC Units

## 11.2 Modified Installation Procedures for Master/Slave Operation

| Step | Action |
|---|---|
| 1 | On the EBC unit that is to be the Master, perform all of the basic installation procedures described in Section 3. |
| 2 | Perform the same procedures on the EBC unit that is to be the Slave, but make no connection to its rear-panel **HVPS Control** connector. |
| 3 | Connect a null-modem DB-9 cable securely between the two units' rear panel **COM A** connectors (. |

Figure 11-1 shows the cable connections on the unit that is to be configured as Master.

**Figure 11-1 Rear Panel Cable Connections on Master EBC Unit**



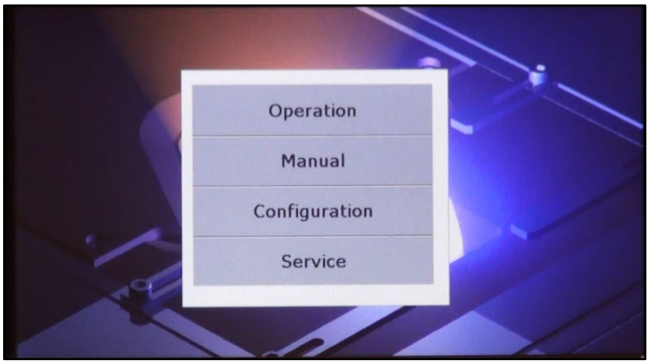
## 11.3 Configuring Dual EBC Units Master/Slave for Master/Slave Operation

**NOTE**

The following procedure assumes that both EBC units are correctly installed, as described in Section 3 of this manual, and that a null-modem cable is corrected connected to the **COM A** connectors on both units' rear panels.

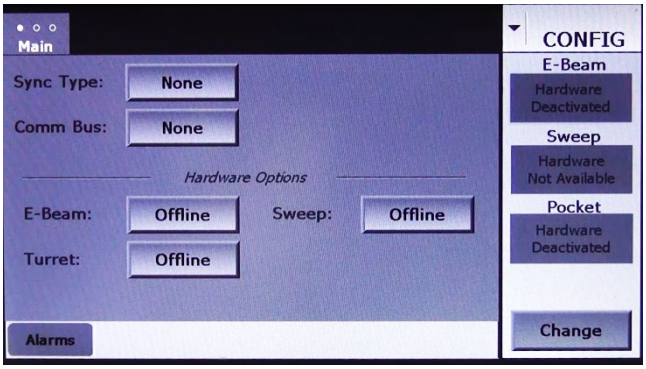
| Step | Action |
|---|---|
| 4 | If the two EBC units are not already powered up, press their front panel On/Off buttons. |
| 5 | After both EBC units are booted up, they will both display the start screen shown Figure 11-2. On this screen, press the **Configuration** button on both units. |

**Figure 11-2 Start Screen As It Intially Appears on Both Units**




| | |
|---|---|
| 6 | Both units will then display the Configuration>Main screen, as shown in Figure 11-3. On the EBC unit to be configured as the Master, touch the **System Type** button once to select **Master**. An alarm message will then appear on that unit. |

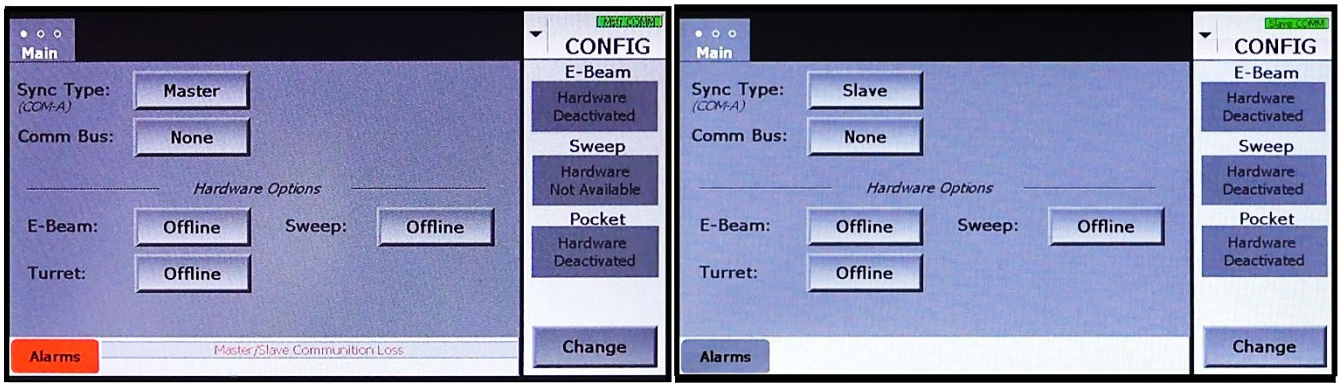
**Figure 11-3 Config>Main Screen on Both Units as Initially Displayed**



7 On the EBC unit to be used as the slave, touch the **System Type** button twice to select **Slave**. The two units will then appear as shown in Figure 11-4. The Master unit will then display a green bar labeled **Mstr COMM** in the upper right-hand corner of the screen, while the Slave unit will display a green bar labeled **Slave COMM** in the same location. The presence of these green bars indicates that two-way communication has been established between them.

**Figure 11-4 Config>Main Screens After Selection of *Master* and *Slave* for *System Type***

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




8 Clear the alarm on the Master unit. To do so:

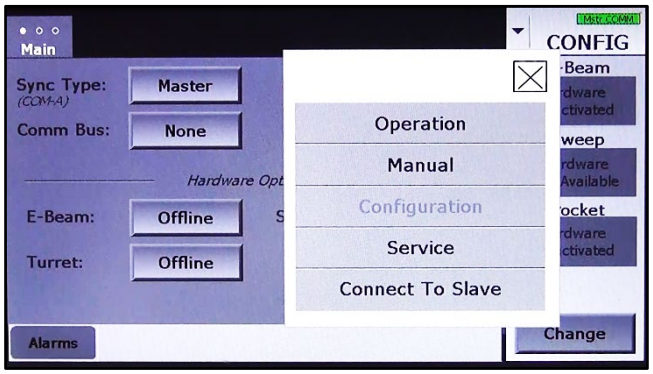
a) Touch the **Alarms** button to display the Alarms screen.

b) Touch that screen's **Acknowledge** button.

c) Touch that screen's **Close** button.

9 Touch the Master unit's Mode ID button and then then select **Change Mode** to display a drop-down menu (see Figure 11-5).

**Figure 11-5 Cfg>Main Screen on Master Unit after User Displays Drop-Down Menu**




10 Select **Connect to Slave** from that menu to return to the start screen, which will now display the message "Cable is connected. Waiting for Slave to connect," a **Go Stand Alone** button, and an

inactive button labeled **Initiate Master/Slave Control** (see Figure 11-6).

**Figure 11-6 Master's Start Screen after User Selects *Connect to Master* from Drop-Down Menu**


11 If you decide to suspend the Master/Slave setup at this point and initiate stand-alone operation on the Master unit, press the **Go Stand Alone** button.

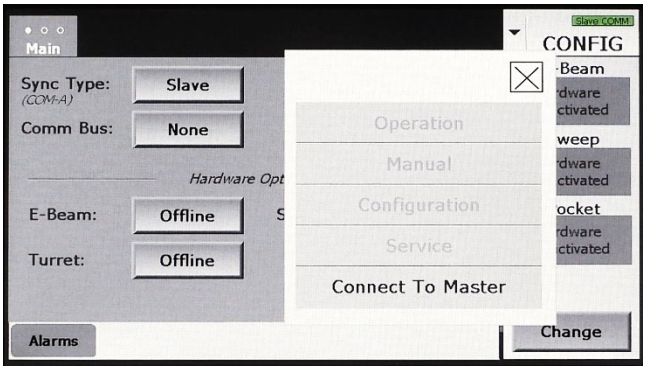
12 Then touch the **Configuration** button to display to the Configuration>Main screen.

13 Touch that screen's **Sync Type** button twice to select **None**. At that point, the Master unit will no longer display a COMM bar, and the green color will drain from the Slave unit's COMM bar.

14 Finally, touch the Slave unit's **Sync Type** button once to select **None**. You can then configure the Master unit normally and operate it in stand-alone mode.

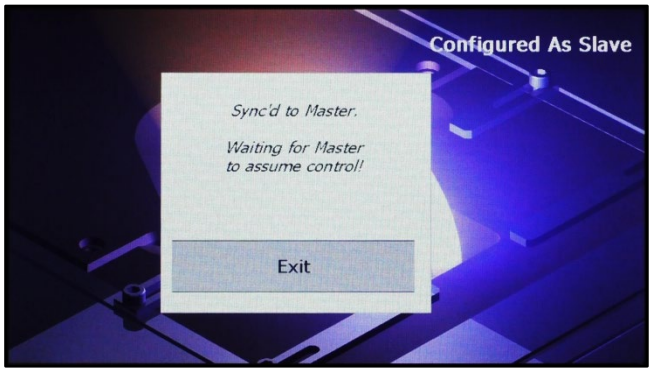
15 To complete the Master/Slave setup, touch the Slave unit's Mode ID button and then the **Change Mode** button to display the drop-down menu shown in Figure 11-7.

**Figure 11-7 Slave Unit's Cfg>Main Screen after User Displays Drop-Down Menu**



16 Select **Connect to Master** from that menu. The Slave unit unit's start screen will then open, displaying the message "Sync'd to Master," the blinking message "Waiting for Master to assume control," and an **Exit** button (see Figure 11-8). You can touch that button if you decide to suspend the Master/Slave setup at this point.

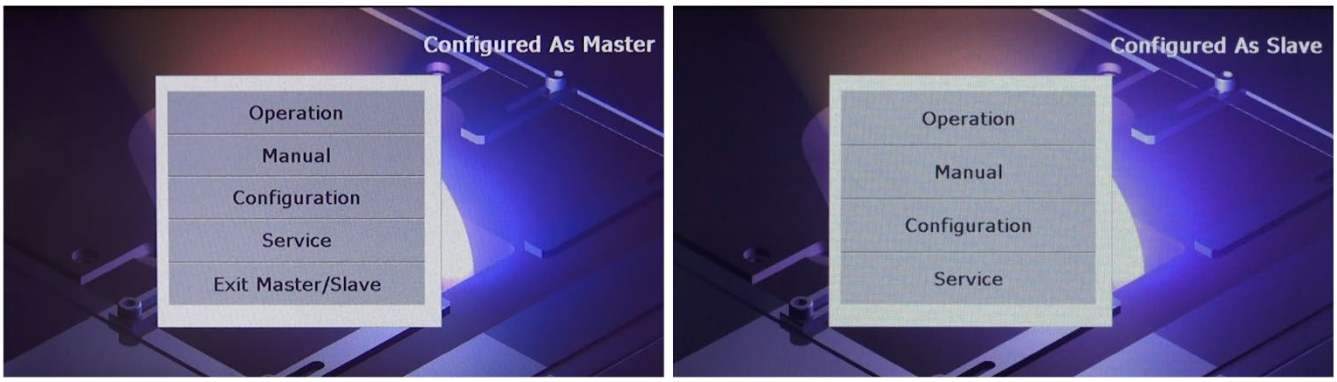
**Figure 11-8 Slave's Start Screen after User Selects *Connect to Master* from Drop-Down Menu**




17 Otherwise, touch the **Initiate Master/Slave Control** button, which will now be active on the Master unit. The Slave unit's start screen will then display a mode-selection menu, while the Master unit displays a mode-selection menu with an additional button labeled **Exit Master/Slave** (see Figure 11-9).

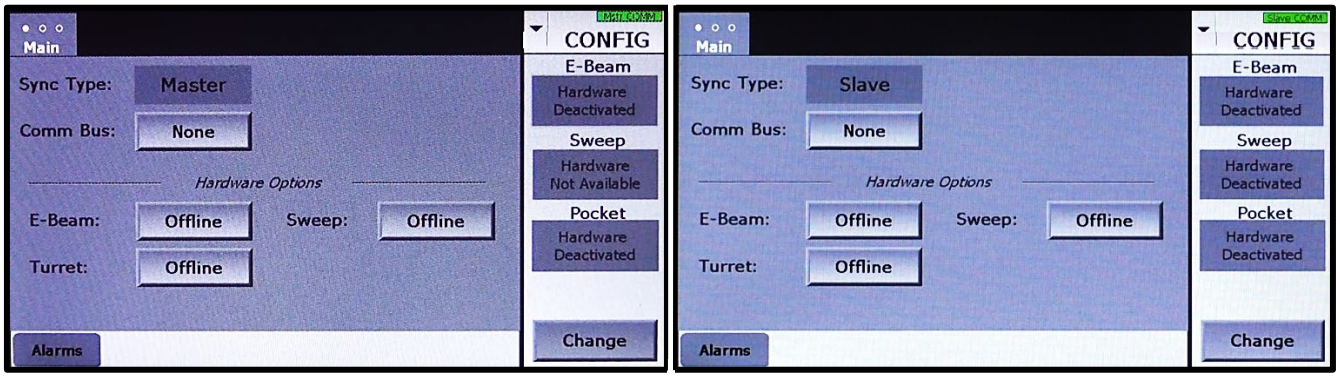
**Figure 11-9 Start Screens after User Selects *Initiate Master/Slave* on Master Unit**

**Start Screen on Master Unit** **Start Screen on Slave Unit**




18 Finally, touch the **Configuration** button on either unit to display the Configuration>Main screens on both. Note that the **Master** and **Slave** buttons opposite **Sync Type** on the two units are now replaced by flat display rectangles, as shown in Figure 11-10.

**Figure 11-10 Cfg>Main Screens on Both Units After Master/Slave Configuration Is Completed**



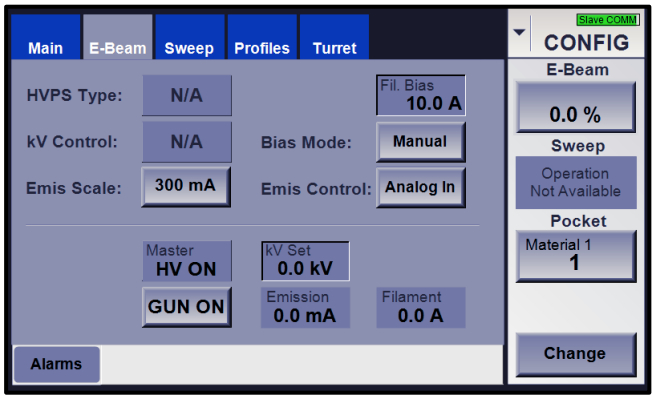

19 Master/Slave setup is now complete. Next perform the configuration procedures described in section 11.4.

## 11.4 Standard Configuration Procedures on Master and Slave Units

On the Master unit, the configuration procedures for the E-Beam, Turret, and Sweep control module are exactly as described in sections 4.5 through 4.7 of this manual. Then perform the procedures described in section 4.8 to configure Profiles.

Perform the analogous configuration procedures on the Slave unit, skipping those that pertain to the E-Beam control module. Note that there are no **HVPS Type**, **KV Control**, or **HV ON/HV OFF** buttons on the Slave unit's Config>E-Beam screen (see Figure 11-11). In addition, the display rectangles labeled **HV ON/HV OFF** and **10.0 kV** bear the legend **Master** in their upper right-hand corners, as shown in Figure 11-11.

**Figure 11-11 Config>E-Beam Screen as It Appears on the Slave EBC Unit**




## 11.5 Operation of Master/Slave EBC Units

Once the two units are properly configured as Master and Slave and the control modules on each unit are configured, the user can operate both of them normally in Operations and Manual

modes, with the following exceptions:

1. The Master unit controls the high voltage for that unit as well as the Slave unit.
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 mode to Manual mode) on one unit, the same mode change simultaneously occurs on the other. However, the user can display different screens within that mode on the two EBC units.

### Restoring Master/Slave Operation Following Loss of Two-Way Communication

If Master/Slave communication is lost between the two units, the green color will appear to drain out of the **Mstr COMM** and **Slave COMM** indicators on the two units' screens. In addition, the Master Unit will display the alarm message "Master/Slave Communication Lost." Loss of Master/Slave communication is generally due to a faulty cable connection at the **COM A** connectors one or both units or to a faulty null modem cable. Note that both units remain configured for Master/Slave operation when physical communication is lost.

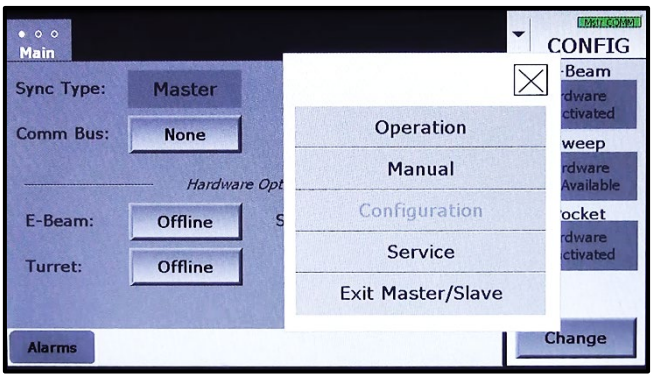
| Step | Action |
|---|---|
| 1 | First correct the communications problem, which will restore the green color to the COMM bars on both units. |
| 2 | Then clear the alarm on the Master unit. |

### Restoring Stand-Alone Operation After Master/Slave Operation Is Established

To revert to Stand-Alone Operation after establishing Master/Slave Operation, perform the following procedure.

| Step | Action |
|---|---|
| 1 | First touch the Master unit's Mode ID button to display the auxiliary menu. Then select **Change Mode** to display the drop-down menu shown in Figure 11-12. |

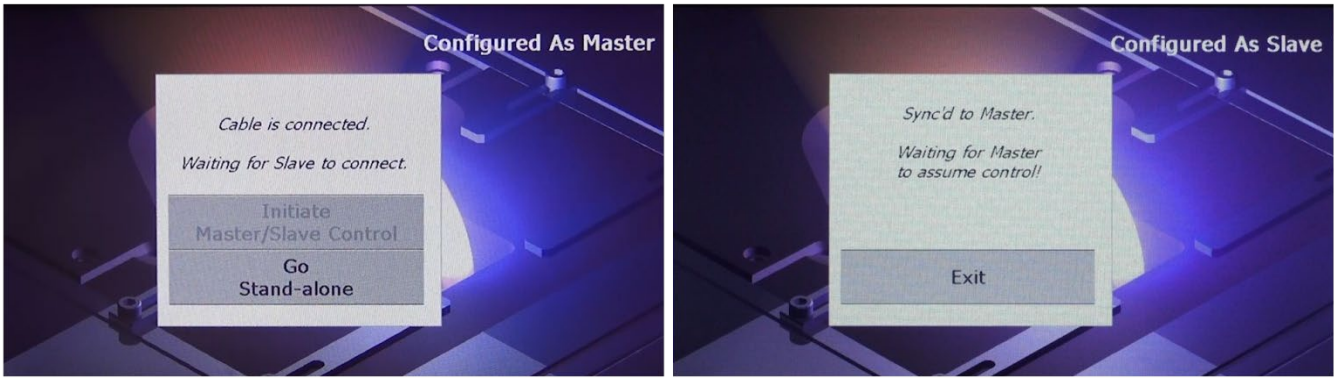
**Figure 11-12 Master Unit Displaying Drop-Down Menu with *Exit Master/Slave* Button**




| | |
|---|---|
| 2 | Select **Exit Master/Slave** from that menu. Both units will then display their start screens, which appear as shown in Figure 11-13. |

**Figure 11-13 Start Screens after User Selects *Exit Master/Slave* on Master Unit**

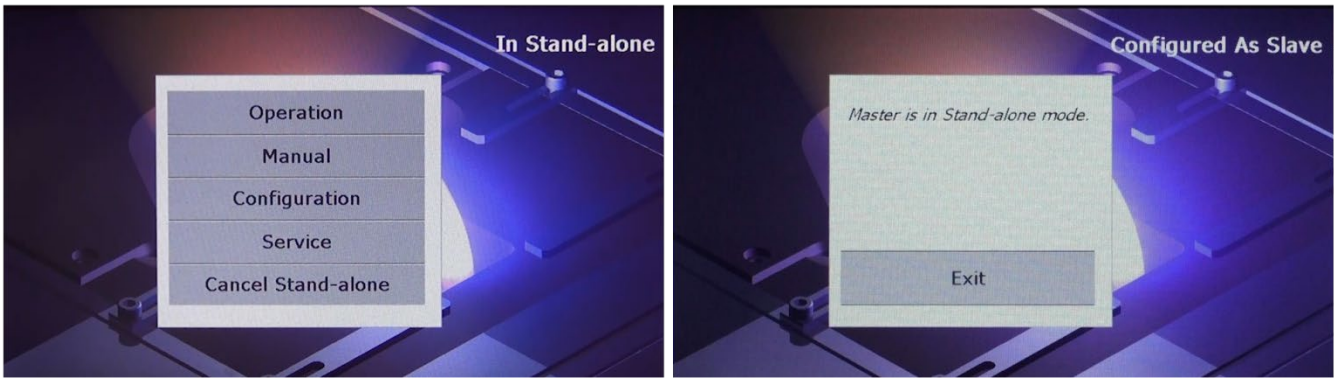
**Start Screen on Master Unit** **Start Screen on Slave Unit**




3 On the Master unit, touch the **Go Stand-Alone** button. That unit will then display **In Stand Alone** in place of **Configured as Master**, as well as a mode-selection menu with a **Cancel Stand-Alone** button (see Figure 11-14). Touch that button if you decide to remain in Master/Slave mode.

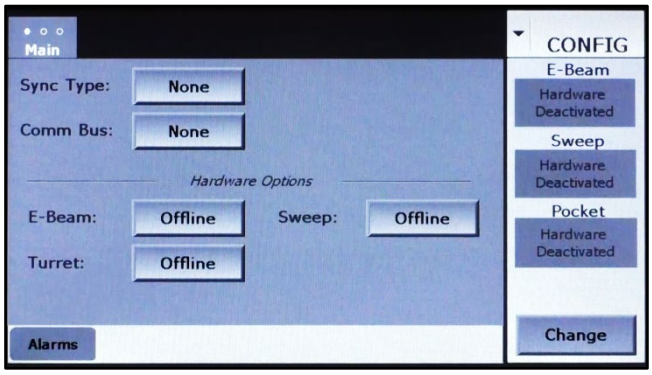
**Figure 11-14 Start Screens after User Selects *Go Stand Alone* on Master Unit**

**Start Screen on Master Unit** **Start Screen on Slave Unit**



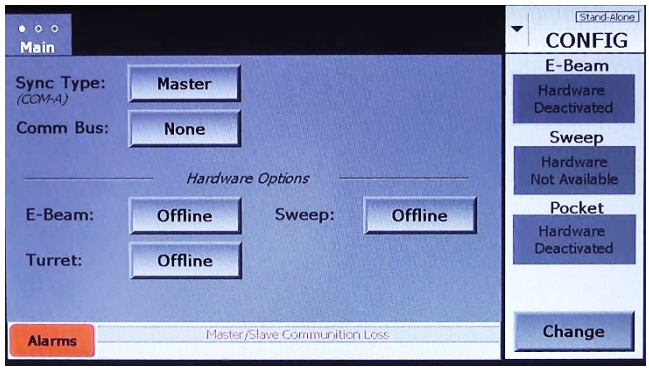

4 Otherwise, touch the Slave unit's **Exit** button to display the Configuration>Main screen, which now displays **None** for **Sync Type** (see Figure 11-15).

**Figure 11-15 Slave Unit's Config>Main Screen After User Selects *Exit* on Start Screen**



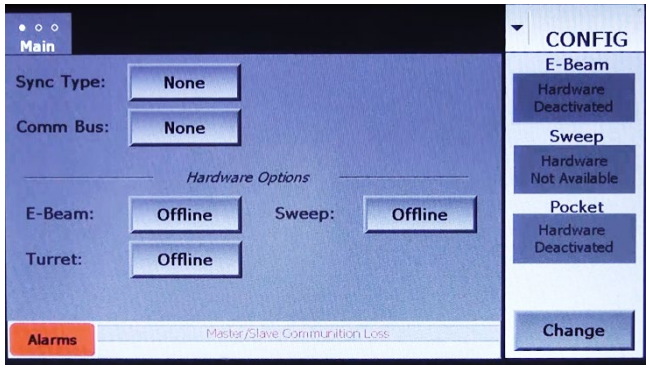

5 Touch the **Configuration** button on the Master unit to display its Config>Main screen, which now appears as shown in Figure 11-16.

**Figure 11-16 Master Unit's Config>Main Screen After User Exits from Master/Slave Operation**




6 On that screen, touch the **Sync Type** button twice to select **None**. The screen will now appear as shown in Figure 11-17.

**Figure 11-17 Master Unit's Config>Main Screen After User Selects *None* for *Sync Type***




7 Finally, cancel the alarm message displayed on that screen.

Both units can now be operated normally, except that the former Slave unit has no control over the E-beam gun.

# 12 Troubleshooting

## 12.1 Section Overview

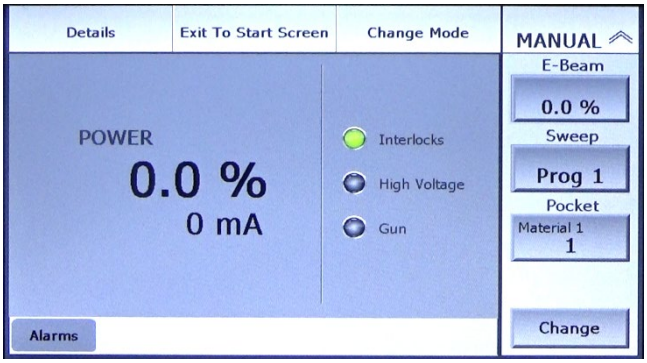
This section describes the main UI screens dedicated that aid in troubleshooting procedures. The subsections are:



## 12.2 The Details Screen

Figure 12-1 shows the Operations>Main screen when the auxiliary menu is displayed. To open the Local Mode's Details screen when this menu is displayed, touch the menu's **Details** button.

**Figure 12-1 Operations>Main Screen with Auxiliary Menu Displayed, All Modules Local**




Figures 12-2 shows the Details screen when all control modules are configured as Local and the **Poptop Down** LED is not enabled. Figure 12-3 shows the same screen when the **Poptop Down** LED is enabled. Figure 12-4 show that screen as it appears when the Sweep and Turret control modules are configured as Remote. Section 12.2.1 provides functional definitions of the LEDs shown in Figure 12-4. For information on enabling the **Poptop Down** LED, see section 4.5.2.

**Figure 12-2 Details Screen When All Modules Configured as Local, EtherCAT, or RS-232; Poptop LED not Enabled**

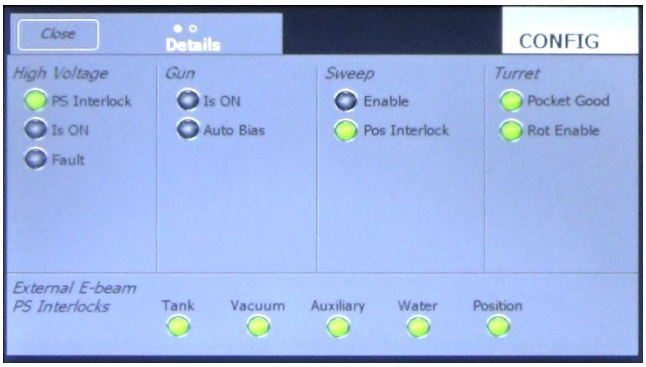



**Figure 12-3 Details Screen when the Poptop LED Is Enabled**

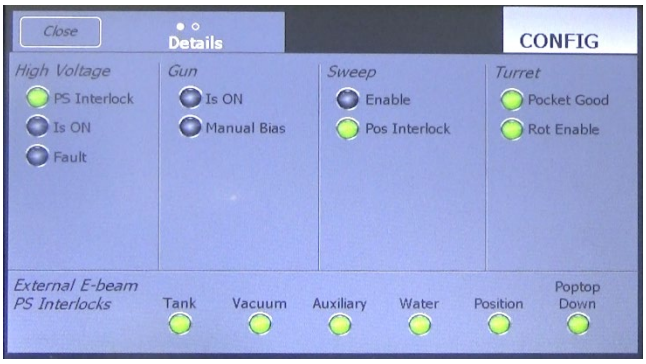



**Figure 12-4 Details Screen, Sweep and Turret Control Modules Configured as Remote I/O**


### 12.2.1 Functional Definitions of LED Indicators on the Details 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

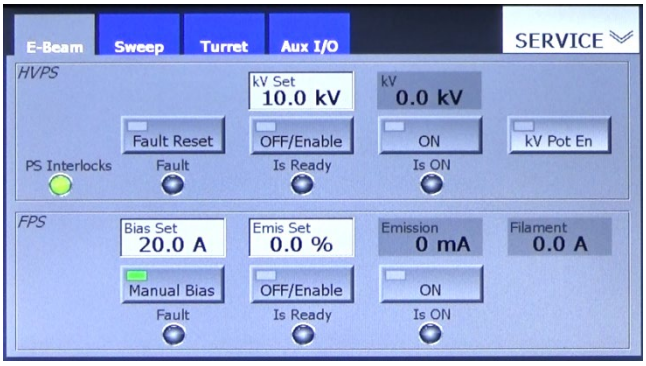
The **Tank, Vacuum, Auxiliary, Water,** and **Position** LEDs indicate the state of the corresponding inputs from the HVPS and the FPS, which in turn reflect that state of the external interlock switches that must be made before the gun or HV can be enabled. The **PopTop Down** LED, when green, indicates that the PopTop interlock is made. Note that if this interlock is not enabled via the Config>Turret screen (see Figure 4-11), this LED does not appear on the Details screen.

## 12.3 EBC Service Mode Screens

### 12.3.1 The Service>E-Beam Screen

Figure 12-5 shows the Service>E-Beam screen. Features in the **HVPS** and **FPS** sections of this screen are described below the screen illustration. Table 12-1 correlates the screen's features to pins on the EBC's rear panel **HVPS CONTROL** and **FPS CONTROL** connectors.

**Figure 12-5 The Service>E-Beam Screen**




#### 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 **Fault, Is Ready,** and **Is ON** LEDs indicate whether those inputs are true at the EBC's rear panel **FPS Control** connector only if that connector is connected by cable to a PLC-based system controller.

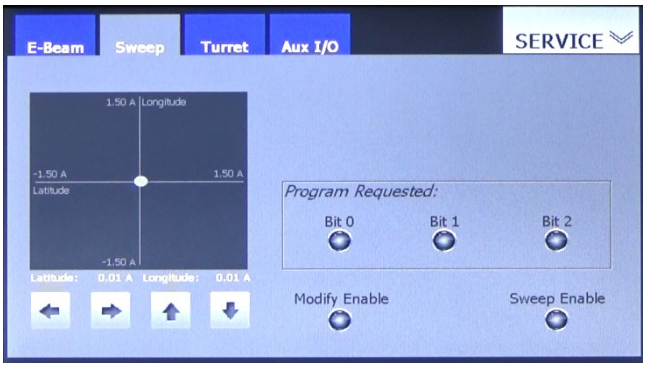
## Table 12-1 Rear Panel Connector Pinout for Features on the Service>E-Beam Screen

| **HVPS Section. Pin numbers refer to pins on EBC 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 EBC 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 |

## 12.3.2 The Service>Sweep Screen

Figure 12-6 shows the Service>Sweep screen. The sweep pattern/beam position display grid, and the coil current readouts and arrow buttons below that grid function the same as identical features on Config>Profiles Page 1. For functional descriptions of those features, see section 4.8.3 of this manual.

**Figure 12-6 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 12-2 correlates these LED indicators to pins on the rear panel **SWEEPER CONTROL** connector.

**Table 12-2 SWEEPER CONTROL Connector Pinout for LEDs 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) |

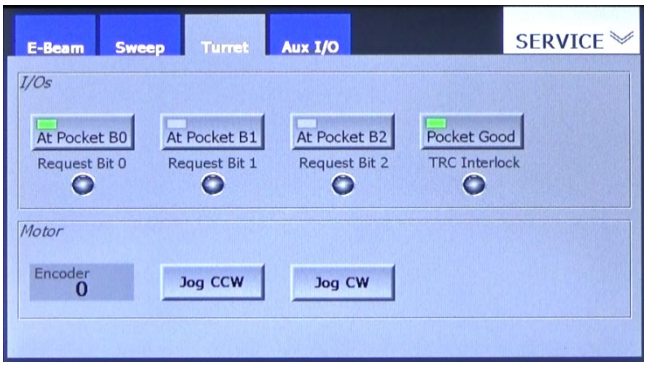
## 12.3.3 The Service>Turret Screen

Figure 12-7 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 12-7 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 12-3 correlates these active on-screen features to pins on the **INDEXER CONTROL** connector.

**Table 12-3 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- |

## 12.3.4 The Service Aux I/O Screen

Figures 12-8 and 12-9 show 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 12-4 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 12-8 The Service>Aux I/O Screen When Poptop LED Is Not Enabled**

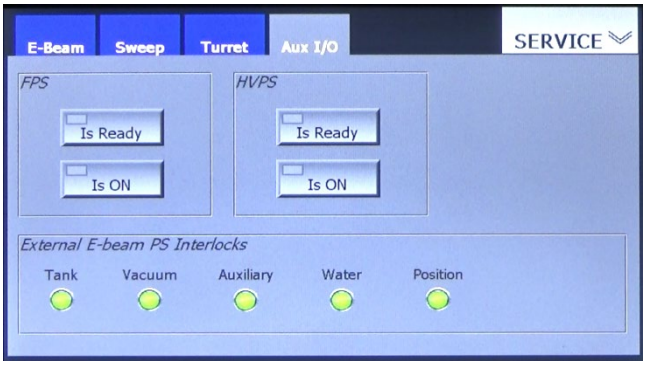



**Figure 12-9 The Service>Aux I/O Screen When Poptop LED Is Enabled**

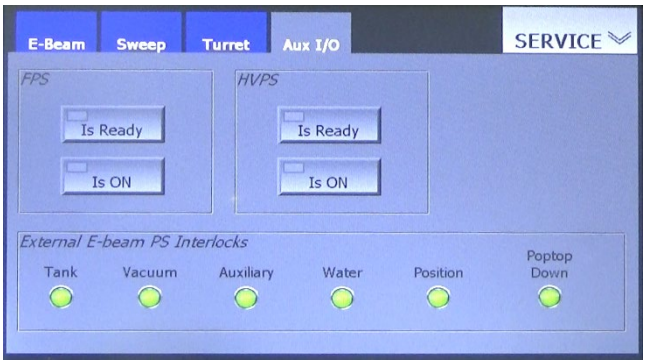



**Table 12-4 AUX I/O Connector Pinout for Active Features on the Service>Aux I/O Screen**

| 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 | 20 | DI1 |
| **Vacuum** LED | 2 | DI2 |
| **Auxiliary** LED | 21 | DI3 |
| **Water** LED | 3 | DI4 |
| **Position** LED | 22 | DI5 |
| **Poptop Down** LED | 25 | DI6 |

The LED indicators in the *External E-Beam PS 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 the case of the **Poptop Down** LED, **Enable** must also be selected via the **Poptop** button on the Config>Turret screen, as described in section 4.5.2. Each LED is green when the

corresponding interlock input is true and gray when that input is false. However, if the **Tank, Vacuum, Auxiliary, Water,** and **Position** interlocks are jumpered, those five LEDs are always green.

## 12.4 Alarm Messages

**Table 12-5 EBC Alarm Messages**

| Alarm Text | Explanation |
|---|---|
| **AnyBus Gateway Lost Communication** | Communication has been lost between the EBC controller and the HMS Anybus X-Gateway. Check the CAT5 cable connection and reboot the EBC. |
| **Aux Connect Aux Interlock Alarm** | External AUX interlock input is not true. |
| **Aux Connect Poptop Not Down Alarm** | The FPS is commanded ON, but the Poptop is not down. Check the status of the POPTOP DOWN input to the Aux I/O connector. |
| **Aux Connect Sweep Position Interlock Alarm** | The FPS is commanded ON, but the Sweep Position is invalid. Check the status of the POSITION interlock input to the Aux I/O connector. |
| **Aux Connect Tank Interlock Alarm** | External TANK interlock input is not true. |
| **Aux Connect Vacuum Interlock Alarm** | External VACUUM interlock input is not true. |
| **Aux Connect Water Supply Interlock Alarm** | External WATER interlock input is not true. |
| **Comm Loop Back Not Detected** | Communication handshake between the EBC and the PLC has been lost. Check the PLC and its communication link to the HMS Anybus X-Gateway. |
| **FPS Gun Ctrl 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. |
| **FPS Gun Ctrl 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. |
| **FPS Module Lost Communication** | Communication has been lost between the FPS control module and the EBC's mother board. |
| **FPS Ready Interlock Alarm** | 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. |
| **HVPS Faulted Alarm** | An HVPS fault has occurred. Follow the instructions in the e-beam power supply manual to identify and correct the fault. |
| **HVPS Go On Timeout** | After receiving the HV READY signal, EBC failed to receive the HV ON signal from the HVPS within some 3 seconds. |
| **HVPS 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 Module Lost Communication** | Communication has been lost between the HVPS control module and the EBC's mother board. |

| Alarm Text | Explanation |
|---|---|
| **HVPS 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. |
| **HVPS Type Configuration Missing** | The HVPS type is not configured. |
| **HVPS/FPS Missing Interlock Interconnect Wire** | HVPS-FPS interconnect interlock signal is invalid. |
| **Master/Slave Communication Lost** | Communications lost between the Master and Slave EBCs. Check the null-modem cable connected between the two EBCs' COM A connectors. |
| **Serial Communication Watchdog Lost** | Communication handshake between the EBC and the PC has been lost. Check the PC and the EBC's COM port. |
| **Sweep Coil Over Current Fault (Requires Reboot)** | An overcurrent fault has occurred on the Sweep board. Check to see whether the e-gun's sweep have shorted to ground. If so, correct the fault and reboot the EBC. |
| **Sweep Communication Not OK Interlock** | The Sweep board's internal communication has been lost. |
| **Sweep Interlock Position Limit** | External POSITION interlock input 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 Module Lost Communication** | Communication has been lost between the sweep control module and the EBC's mother board. |
| **Turret Configuration, Encoder Index Not Found** | The index signal on the turret's motor encoder is not found. Check to see whether the motor is rotating. |
| **Turret Failed to Find Position** | During turret rotation in Local mode operation, the encoder position for the target pocket could not be found. |
| **Turret Interlock Position Not Valid** | Turret has rotated to an encoder position that does not correspond to any encoded pocket home position. |
| **Turret Is Rotating Interlock** | EBC cannot switch on the gun because turret is rotating. |
| **Turret Missing Interlock Wire** | Signal allowing turret motor rotation is invalid. |
| **Turret Module Lost Communication** | Communication has been lost between the turret control module and the EBC's mother board. |
| **Turret Motor Stalled** | Turret motor has stalled. |
| **Turret Poptop Is Down** | Turret is commanded to rotate, but the PopTop is down. Check the Poptop's actuating pneumatics and the status of the POPTOWN DOWN input to the Aux I/O connector. |
| **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. |

# 13 Maintenance Procedures

## 13.1 Section Overview

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

Section 13.2 Replacing a Control Module

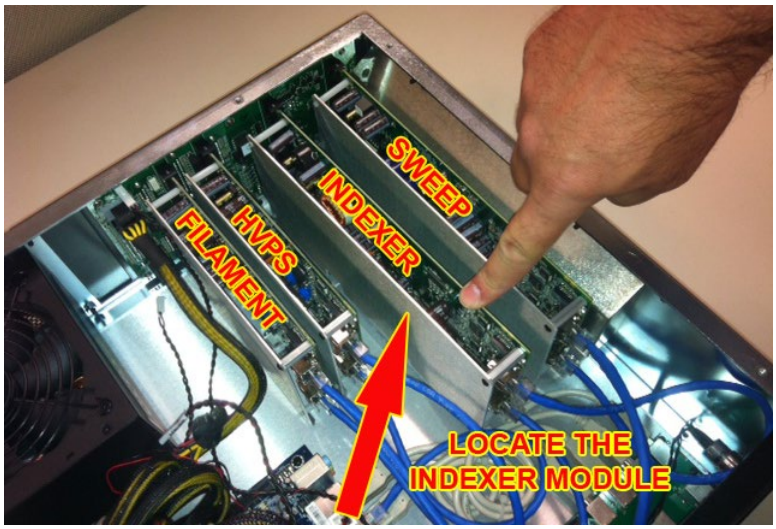
Section 13.3 Replacing the Flash Drive

## 13.2 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 2-1) to power down the unit |
| 2 | Detach all cables and the ground wire from the EBC rear panel. |
| 3 | Remove the EBC from the rack. |
| 4 | Remove the 10 screws securing the unit's top cover to its chassis and remove the top cover. |
| 5 | Referring to Figure 13-1, identify the control module that you wish to remove. |

**Figure 13-1 Identification of EBC Control PCBs**



6 Unplug the top and bottom cables that are connected to the target module (see Figures 13-2 and 13-3). Label these as Top and Bottom.

**Figure 13-2 Unplugging the Upper Cable from the Indexer Control Module**

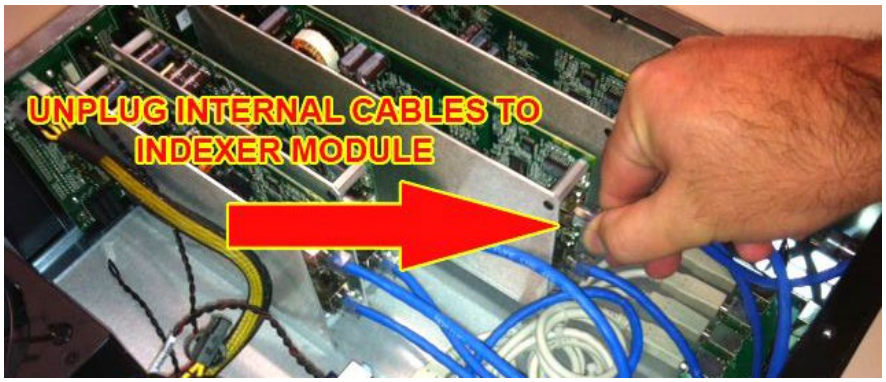
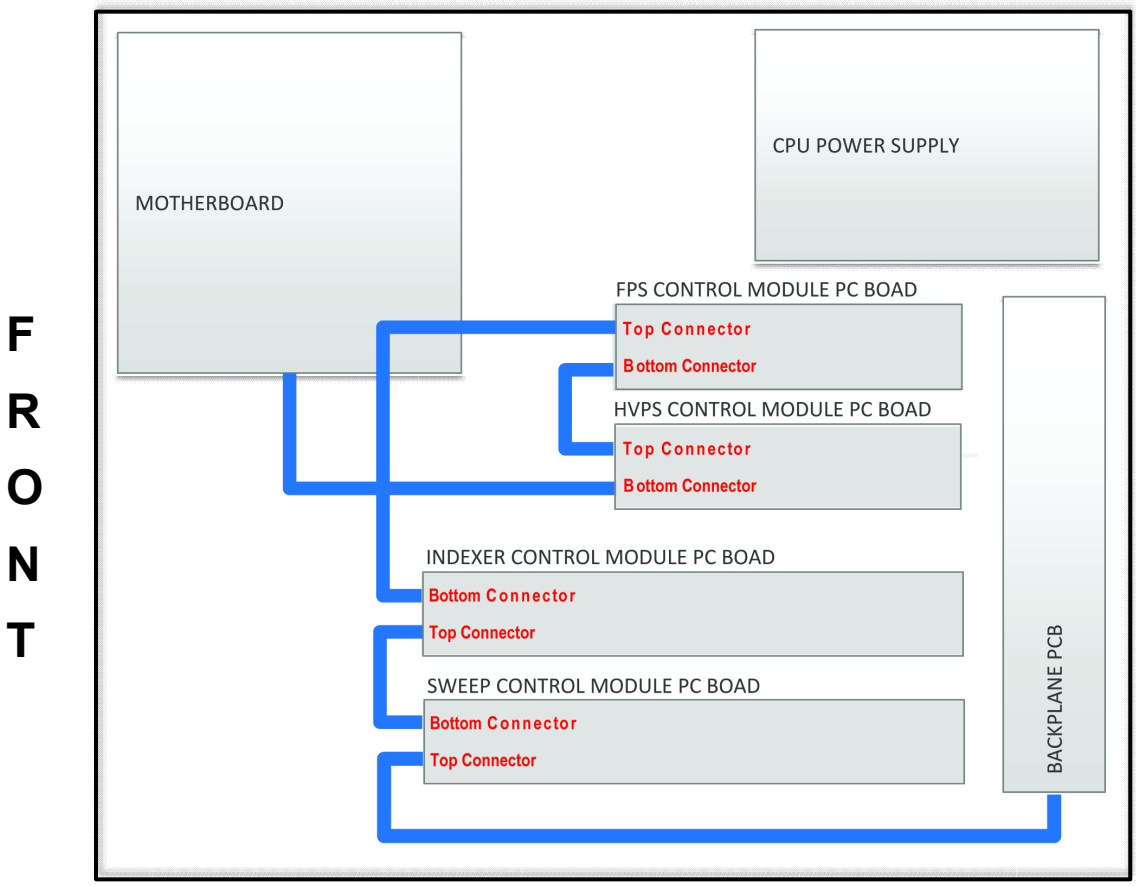
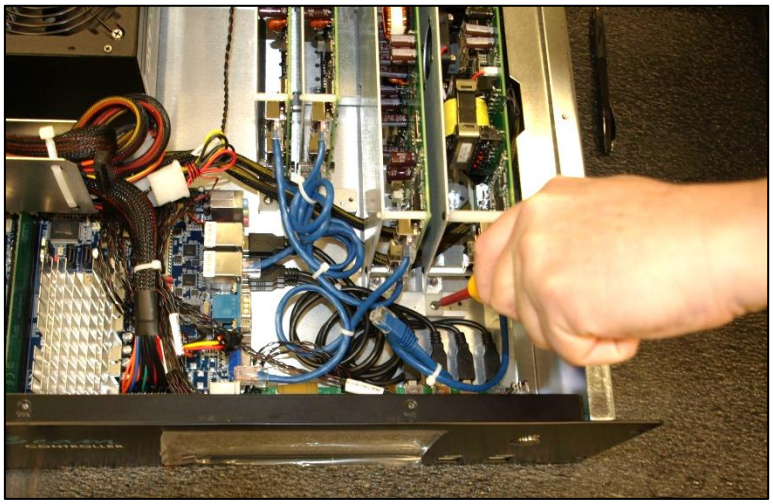



**Figure 13-3 EtherCat Connections Between Internal EBC Components**



7 Remove the screw that secures the control module you are replacing to the base of the EBC chassis (see Figure 13-4).

**Figure 13-4 Removing Screw Securing Control Module in Place**



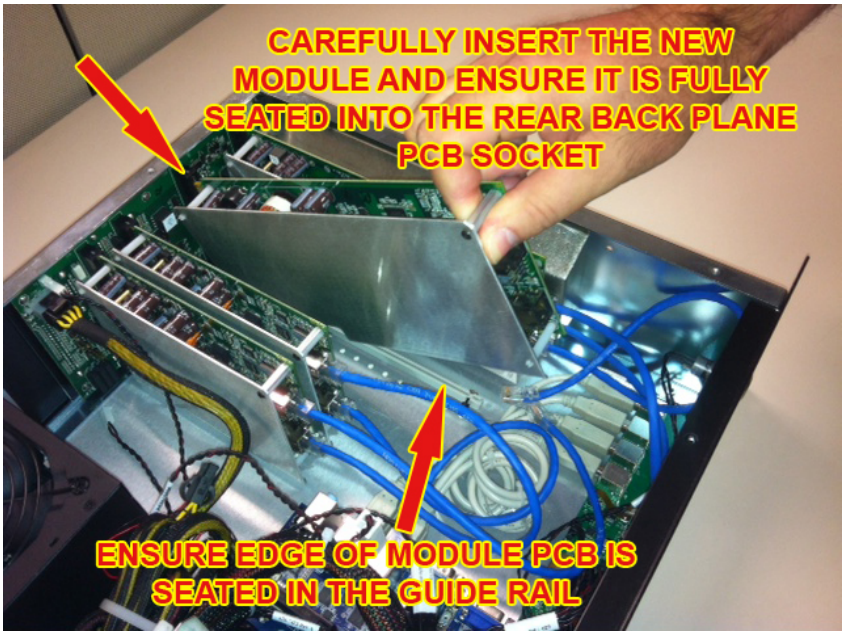
8 Grasp the control module by its upper front standoff and carefully lift the module out of the chassis, as shown in Figure 13-5.

**Figure 13-5 Removing the Control Module from the EBC Chassis**


9 Carefully install the new control module (see Figure 13-6), 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. |

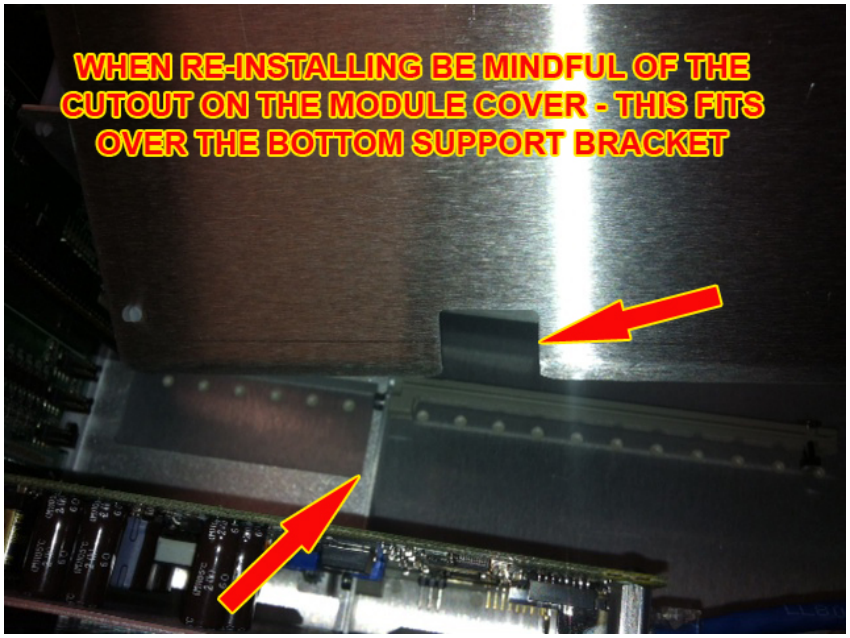
**Figure 13-6 Installing the New Control Module**




NOTE

Figure 13-7 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.

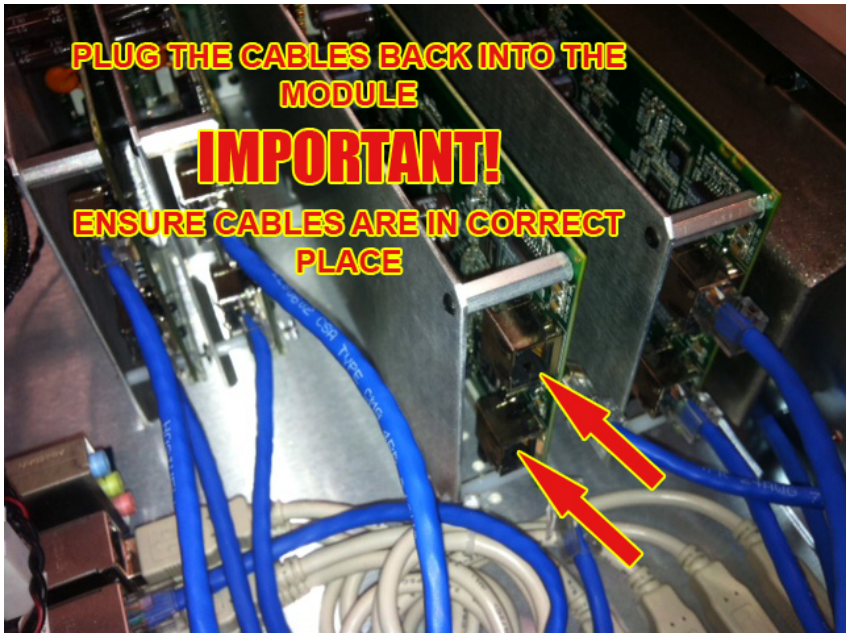
**Figure 13-7 Cutout in Bottom of Control Module**




10 Plug the cable into the connectors near the top and bottom of the control module (see Figure 13-8).

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

**Figure 13-8 Plugging Cables into the New Control Module**




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

12 Replace the unit's top cover, securing it in place with all 10 screws.

13 Reinstall the EBC in the rack.

14 Reattach the ground wires and plug all cables to the unit's rear panel.

15 Flip the unit's rear-panel power switch to the ON position.

## 13.3 Replacing the Flash Drive

### 13.3.1 Replacing the IDE Drive on an EPIA M860 Mother Board with a SATA DOM Drive

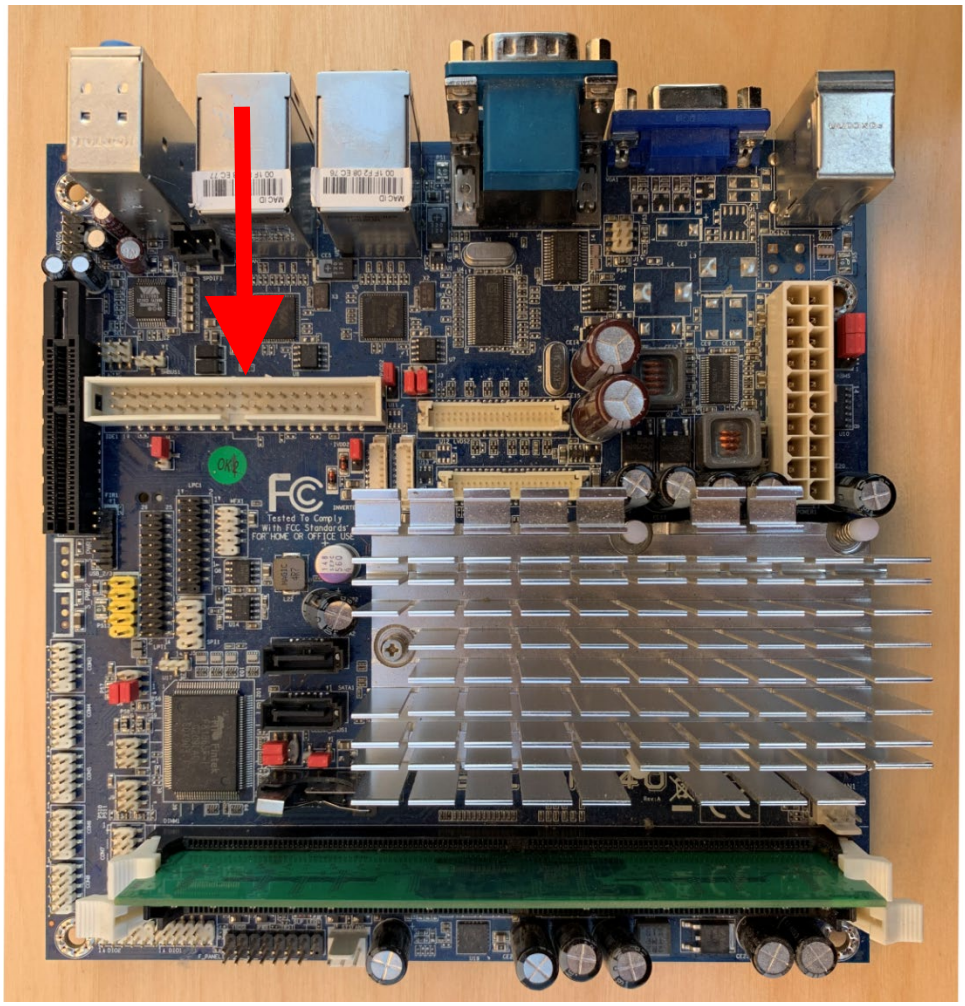
Follow the steps described below when replacing an IDE flash drive on an EPIA M860 board with a SATA DOM drive.

| Step | Action |
| --- | --- |
| 1 | Power down the unit by flipping the EBC's rear-panel OM/OFF switch (see Figure 2-1) to the OFF position. |
| 2 | Detach all cables and the ground wire from the EBC rear panel. |
| 3 | Remove the EBC from the rack. |

4 Remove the 10 screws securing the unit's top cover to its chassis and remove the top cover.

5 Remove the IDE hard drive, which is plugged into the mother board I the slot pointed out in Figure 13-9. To do so, grasp both sides of the hard drive and pull it straight up and out of its socket.

**Figure 13-9 Installation Slot for IDE Hard Drive on M860 Mother Board**

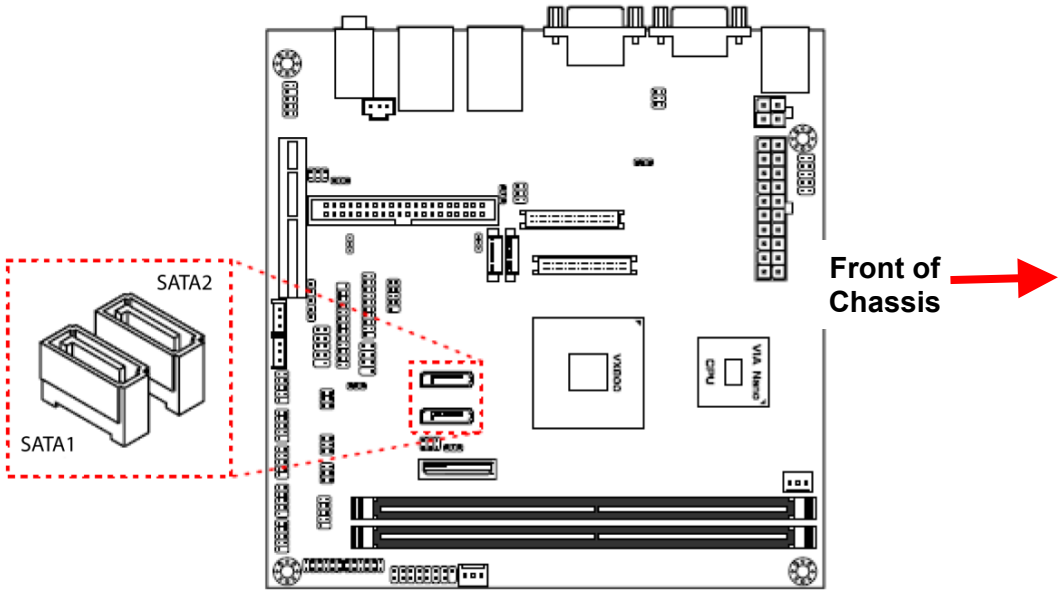


6 Unplug the cable that is plugged into the top of the hard drive.

7 Loosen the two nuts that secure the air diverter plate to the left side of the EBC chassis. You must be able to move the diverter slightly in order to install the flash drive.

8 Plug the SATA DOM drive into power connector SATA2, whose location is shown in Figure 13-10.

**Figure 13-10 Locations of SATA1 and SATA2 Power Connectors on Mother Board**




9 Next install a jumper across rear four pins of J7, a shown in Figure 13-11.

**Figure 13-11 Location of J7 on Mother Board and Required Jumper Arrangement**

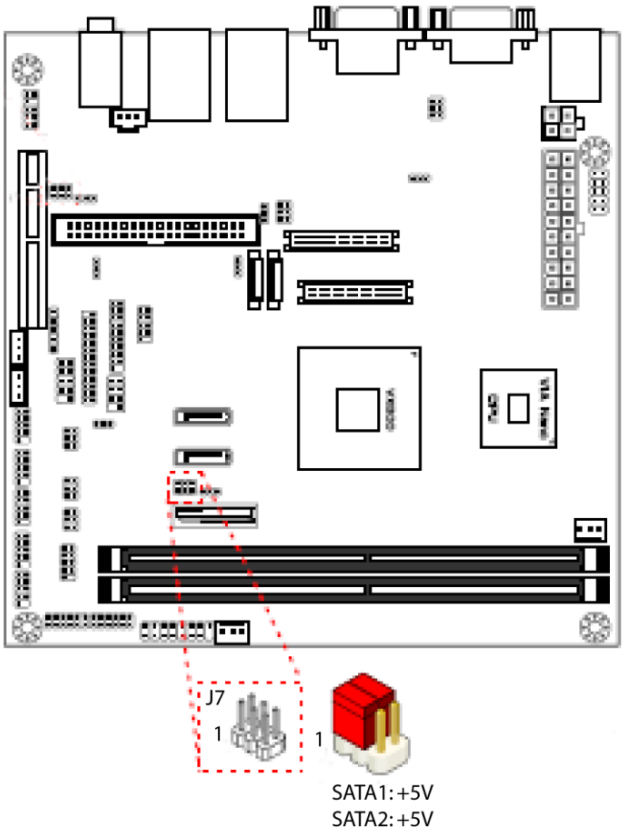
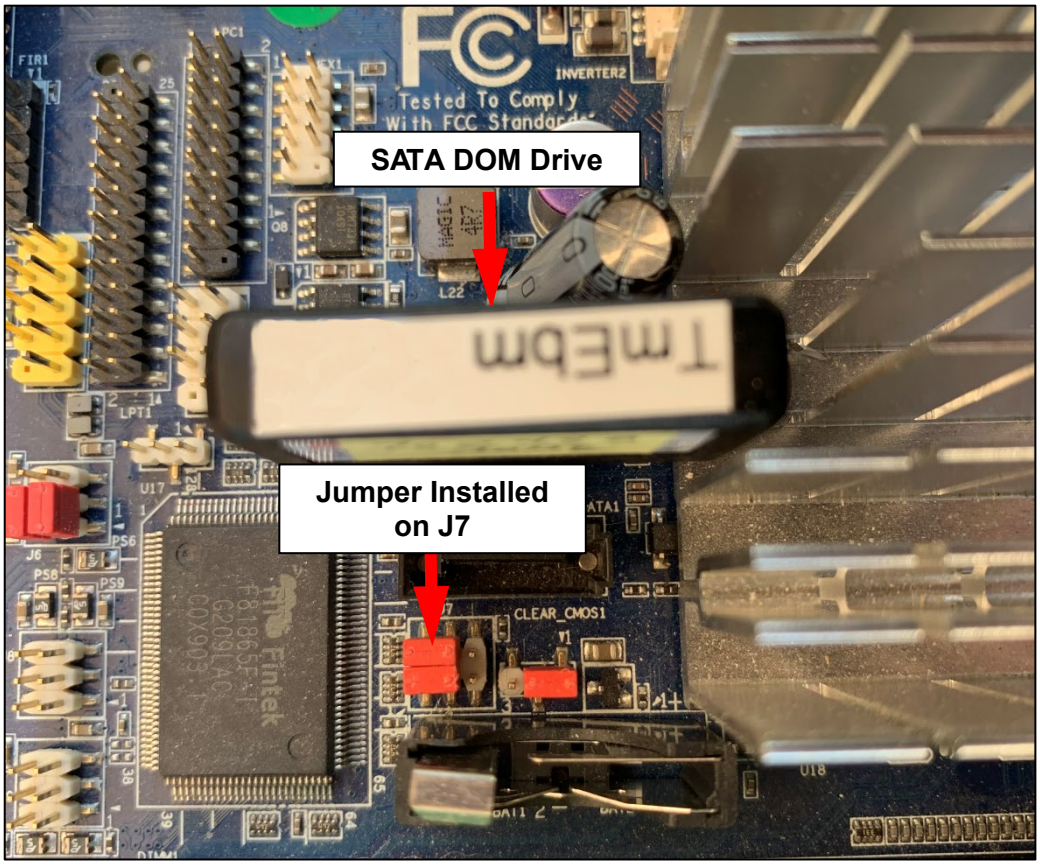


Figure 13-12 shows the jumper and the SATA DOM drive after they are installed.

**Figure 13-12 SATA DOM Drive and Jumper Installed on Mother Board**




10 Retighten the two bolts that secure the air diverter plate to the side of the chassis.

11 Replace the unit's top cover, securing it in place with all 10 screws.

12 Reinstall the EBC in the rack.

13 Reattach the ground wires and plug all cables to the unit's rear panel.

14 Flip the unit's rear-panel power switch to the ON position.

## 13.3.2 Replacing the SATA DOM Drive on an EPIA M910 Mother Board

Follow the procedure described below when replacing the SATA DOM flash drive on an EPIA M910 board.

| Step | Action |
|---|---|
| 1 | Power down the unit by flipping the EBC's rear-panel OM/OFF switch (see Figure 2-1) to the OFF position. |

2 Detach all cables and the ground wire from the EBC rear panel.

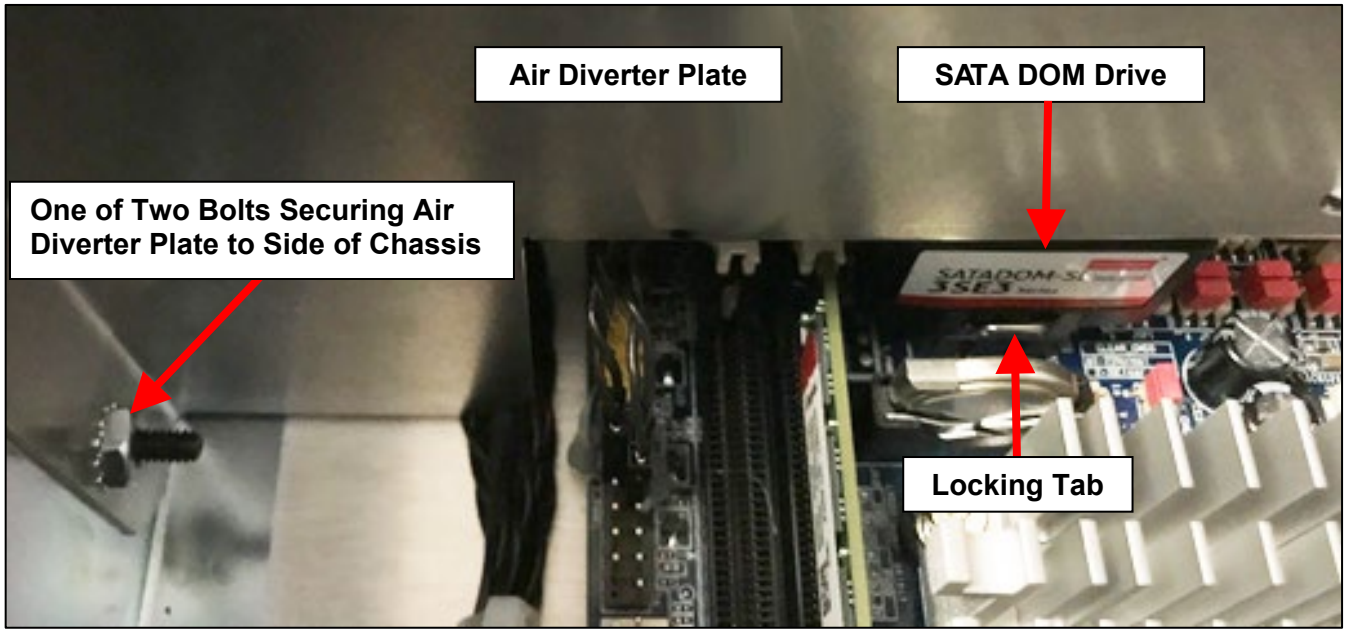
3 Remove the EBC from the rack.

4 Remove the 10 screws securing the unit's top cover to its chassis and remove the top cover.

5 Loosen the two nuts that secure the air diverter plate to the left side of the EBC chassis. To perform the replacement, you must be able to move the diverter enough to access the flash drive, which is installed directly beneath a cutout in the diverter plate.

6 Figure 13-12 shows the metal locking tab that secures the flash drive in place. Press that tab toward the drive and remove it.

**Figure 13-13 SATA DOM Flash Drive on M910 Mother Board**




7 Install the new SATA DOM drive in the same receptacle.

**NOTE**
The receptacle is keyed, so the drive can only be installed in one orientation

8 Retighten the bolts that secure the air diverter plate to the chassis.

9 Replace the unit's top cover, securing it in place with all 10 screws.

10 Replace the EBC in the rack.

11 Reattach the ground wires and plug all cables into the unit's rear panel.

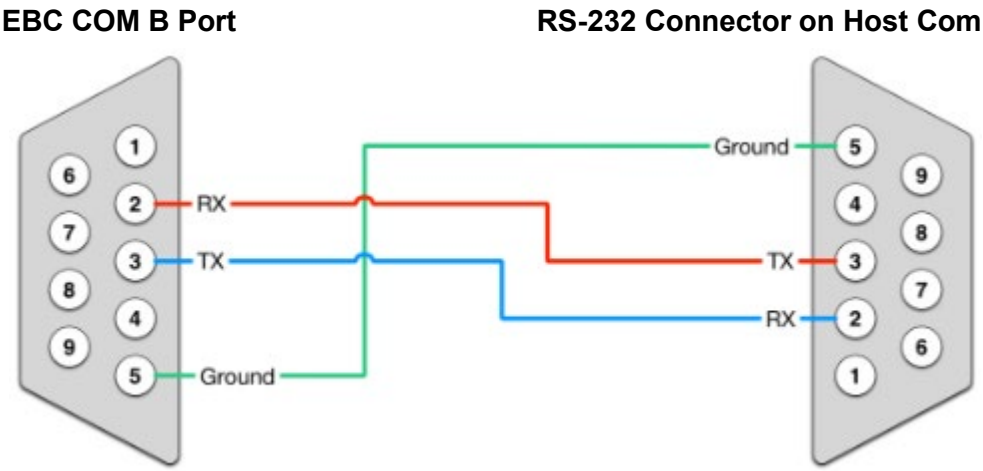
12 Flip the unit's rear-panel power switch to the ON position.

# Appendix A: Host Computer to EBC RS-232 Communications Protocol

## Port Configuration

Connect a standard null modem (crossover) cable to the host computer and to the rear panel **COM B** port on the EBC. The diagram below shows the pinout.

**Figure A-1 Connections: EBC COM B Port to RS-232 Connector on Host Computer**




Set your computer to a baud rate of **38400, no parity, 8 data bits and 1 stop bit**.

## General Message Format

General message format, whether message sent to CONTROLLER or received from CONTROLLER:

<ESC>XX $P_0$ $P_n$<CR>

Detail:

<ESC> = Escape character, ASCII $27_{10}$ = $1B_{16}$. This character is not expected by the receiver, but it should cause the receiver to clear its receive buffer.

<CR> = Carriage Return character, ASCII $13_{10}$ = $0D_{16}$

<LF> = Line Feed character, ASCII $10_{10}$ = $0A_{16}$. Line Feed characters are not required but may appear anywhere in a message and are ignored by the receiver.

XX = two letter command code, see below "Command Codes".

$P_0$ = First parameter, typically 1 to 5 decimal digits.

$P_n$ = Subsequent parameter(s), if any, typically 1 to 5 decimal digits.

Space character, ASCII $32_{10}$ = $20_{16}$. A single space character must appear between the command code and first parameter (if any), as well as between all parameters.

## Command Codes

GV = Get Value: Host requests the current value of a particular variable in the CONTROLLER.

SV = Set Value: Hosts requests that a particular variable in the CONTROLLER be set to the specified value.

## Command GV Detail

Host to CONTROLLER:

<ESC>GV $P_{id}$<CR>

$P_{id}$ = Parameter ID (from table). $P_{id}$ = 0 means "report all CONTROLLER variables".

CONTROLLER to host:

<ESC>gv $P_{id}$ V<CR>

V = Value (unsigned decimal number, 1 to 5 digits).

Note: if $P_{id}$ is unrecognized, then V is omitted in the response.

## Command SV Detail

Host to CONTROLLER:

<ESC>SV $P_{id}$ V<CR>

Pid = Parameter ID (from table).

V = Value (unsigned decimal number, 1 to 5 digits).

CONTROLLER to host:

<ESC>sv $P_{id}$ V<CR>

V = Value (unsigned decimal number, 1 to 5 digits).

Note: if $P_{id}$ is unrecognized, then V is omitted in the response. If the value V is out of range or otherwise invalid, the CONTROLLER shall set the value of $P_{ID}$ to the nearest acceptable value and return that value as V.

# Table A-1: System and Module-Specific Parameters and Interlocks

| $P_{id}$ | GV | SV | Tem-Ebeam | Genius2 | Function | Range | Units/ Count | Comment |
|---|---|---|---|---|---|---|---|---|
| 0 | ✓ | | ✓ | ✓ | Get All Parameters | 0 .. 1 | | |
| | | | | | **SYSTEM PARAMETERS** | | | |
| 1 | ✓ | | ✓ | ✓ | Comm Watchdog Rx | 0 .. 1 | | Comm Bit Reveive |
| 2 | ✓ | ✓ | ✓ | ✓ | Comm Watchdog Tx | 0 .. 1 | | Comm Bit Transmit, echo response of Tx with the Rx value (Tx = Rx) |
| 3 | ✓ | | ✓ | ✓ | Get Login Enable | 0 .. 1 | | 0=disabled, 1=enabled |
| 4 | ✓ | | ✓ | ✓ | Get User 1 Privileges | 0 .. 7 | | 00000001b=operate, 00000010b=manual, 00000100b=cfg/service |
| 5 | ✓ | | ✓ | ✓ | Get User 2 Privileges | 0 .. 7 | | 00000001b=operate, 00000010b=manual, 00000100b=cfg/service |
| 6 | ✓ | | ✓ | ✓ | Get User 3 Privileges | 0 .. 7 | | 00000001b=operate, 00000010b=manual, 00000100b=cfg/service |
| 7 | ✓ | | ✓ | ✓ | Get User Admin Privileges | 0 .. 7 | | 00000001b=operate, 00000010b=manual, 00000100b=cfg/service |
| 8 | ✓ | ✓ | ✓ | ✓ | Reset Alarms | 0 .. 1 | | Rising Edge Trigger |
| 9 | ✓ | | ✓ | ✓ | Alarms | 0 .. 1 | | 0= no alarm, 1= one or more alarms present |
| 10 | ✓ | | ✓ | ✓ | Get Mode | 0 .. 6 | | 0=Null, 1=Reserved, 2=Reserved, 3=Operation (RS232), 4=Manual, 5=Configuration, 6=Service |
| … | | | | | | | | |
| 19 | ✓ | | ✓ | ✓ | System Alarms | 0,1,2…15 bits | | See Alarm Table below |
| | | | | | **HVPS/FPS INTERLOCKS** | | | |
| 20 | ✓ | | ✓ | ✓ | HVPS/FPS Interlock Alarms | 0,1,2…15 bits | | See Alarm Table below |
| 21 | ✓ | | ✓ | ✓ | H2O Interlock Ok | 0 .. 1 | | 0 = false, 1 = true |
| 22 | ✓ | | ✓ | ✓ | External Interlock Ok | 0 .. 1 | | 0 = false, 1 = true |
| 23 | ✓ | | ✓ | ✓ | Vacuum Interlock Ok | 0 .. 1 | | 0 = false, 1 = true |
| 24 | ✓ | | ✓ | ✓ | Tank Interlock Ok | 0 .. 1 | | 0 = false, 1 = true |
| 25 | ✓ | | ✓ | ✓ | Poptop Is Down | 0 .. 1 | | 0 = false, 1 = true |
| | | | | | **HVPS/FPS PARAMETERS** | | | The Ebeam option must be configured for RS232 and the controller is set to "operate" mode. |
| 30 | ✓ | | ✓ | ✓ | HVPS/FPS Alarms | 0,1,2…31 bits | | See Alarm Table below |
| 31 | ✓ | ✓ | ✓ | ✓ | HVPS Go On | 0 .. 1 | | 0 = off, 1 = on |
| 32 | ✓ | | ✓ | ✓ | HVPS Is On | 0 .. 1 | | 0 = off, 1 = on |
| 33 | ✓ | | ✓ | ✓ | HVPS Is Faulted | 0 .. 1 | | 0 = false, 1 = true |
| 34 | ✓ | ✓ | ✓ | ✓ | HVPS Voltage Setpoint | 0 .. 1000 | 10V | |
| 35 | ✓ | | ✓ | ✓ | HVPS Voltage Actual | 0 .. 1000 | 10V | |
| 36 | ✓ | ✓ | N/A | ✓ | Filament Select | 1 .. 3 | | |
| 37 | ✓ | ✓ | ✓ | ✓ | FPS Go On | 0 .. 1 | | 0 = off, 1 = on |
| 38 | ✓ | | ✓ | ✓ | FPS Is On | 0 .. 1 | | 0 = off, 1 = on |
| 39 | ✓ | ✓ | ✓ | ✓ | FPS Emission Setpoint | 0 .. 10000 | 0.01% | |
| 40 | ✓ | | ✓ | ✓ | FPS Emission Actual | 0 .. 10000 | 0.01% | |
| 41 | ✓ | | ✓ | ✓ | FPS Emission Actual | 0 .. 10000 | 0.1 mA | |
| 42 | ✓ | | ✓ | ✓ | FPS Actual Filament Current | 0 .. 5000 | 0.01 A | |

| $P_{id}$ | GV | SV | Tem-Ebeam | Genius2 | Function | Range | Units/ Count | Comment |
|---|---|---|---|---|---|---|---|---|
| | | | | | **TURRET PARAMETERS** | | | The Turret option must be configured for RS232 and the controller is set to Operate mode. |
| 50 | ✓ | | ✓ | ✓ | TRC Alarms | 0,1,2…15 bits | | See Alarm Table below |
| 51 | ✓ | ✓ | ✓ | ✓ | TRC Pocket Select | 1 .. 8 | | 1 .. 8 = Pocket Request (Actuates if sweep program is NOT in edit) |
| 52 | ✓ | | ✓ | ✓ | TRC Pocket Actual | 0 .. 8 | | 0 = Unknown Position, 1 .. 8 = Actual Pocket |
| 53 | ✓ | | ✓ | ✓ | TRC Pocket Is Good | 0 .. 1 | | 0 = false, 1 = true |
| 54 | ✓ | | ✓ | ✓ | TRC Motor Is ON | 0 .. 1 | | 0 = false, 1 = true |
| 55 | ✓ | ✓ | ✓ | N/A | TRC Activate Motor | 0 .. 1 | | 0 = false, 1 = true |
| 56 | ✓ | | ✓ | N/A | TRC Motor Is Activated | 0 .. 1 | | 0 = false, 1 = true |
| 57 | ✓ | ✓ | ✓ | ✓ | TRC In-Pocket Jog Go ON | 0 .. 1 | | 0 = off, 1 = on |
| 58 | ✓ | ✓ | ✓ | ✓ | TRC In-Pocket Jog Speed | 0 .. 100 | .1RPM 1% | Controller (0–100 = 0–10.0 RPM). Genius2 (0-100 = 0-100 %) |
| | | | | | **SWEEP PARAMETERS** | | | The Sweep option must be configured for RS232 and the controller is set to Operate mode. |
| 60 | ✓ | | ✓ | ✓ | Sweep Alarms | 0,1,2…15 bits | | See Alarm Table below |
| 61 | ✓ | ✓ | N/A | ✓ | Sweep Source Select | 1 .. 3 | | |
| 62 | ✓ | ✓ | ✓ | ✓ | Sweep Enable | 0 .. 1 | | 0 = disabled, 1 = enabled |
| 63 | ✓ | ✓ | ✓ | ✓ | Sweep Modify Enable | 0 .. 1 | | 0 = disabled, 1 = enabled |
| 64 | ✓ | ✓ | ✓ | ✓ | Sweep Program Select | 1 .. 10 | | |
| 65 | ✓ | | ✓ | ✓ | Sweep Program Actual | 1 .. 10 | | |
| 66 | ✓ | | ✓ | ✓ | Sweep Latitude Current | 0 .. 2000 | 0.01A | 0 = -10.00A, 2000 = +10.00A |
| 67 | ✓ | | ✓ | ✓ | Sweep Longitude Current | 0 .. 2000 | 0.01A | 0 = -10.00A, 2000 = +10.00A |
| 68 | ✓ | | ✓ | ✓ | Sweep Position Interlock | 0 .. 1 | | 0 = Not Ok, 1 = OK |
| 69 | ✓ | | ✓ | ✓ | Sweep Program Is In Edit | 0 .. 1 | | 0 = Not Edit, 1 = Editing |

## Table A-2: System and Module-Specific Alarms

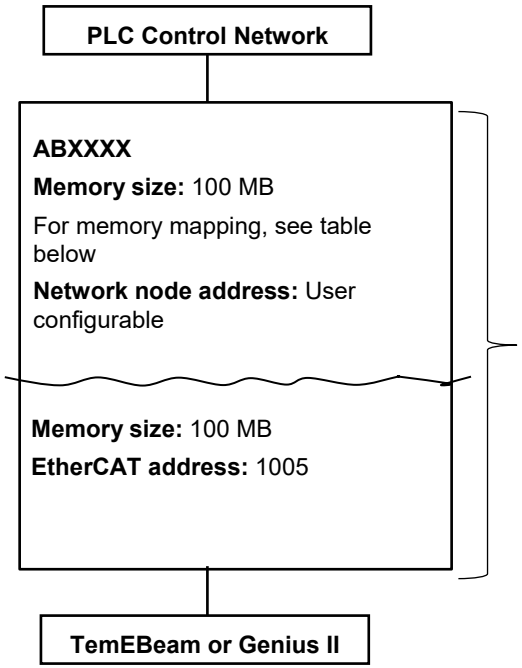
| **System Alarms (GVID 19)** | |
|---|---|
| **Bit** | **Alarm Description** |
| 0 | Master/Slave Communication Loss |
| 15 | Null |
| **HVPS/FPS Interlock Alarms (GVID 20)** | |
| **Bit** | **Alarm Description** |
| 0 | Aux Connect Aux Interlock Alarm |
| 1 | Aux Connect Poptop Not Down Interlock Alarm |
| 2 | Aux Connect Sweep Position Interlock Alarm |
| 3 | Aux Connect Tank Interlock Alarm |
| 4 | Aux Connect Vacuum Interlock Alarm |
| 5 | Aux Connect Water Supply Interlock Alarm |
| 15 | Null |

## Table A-2: System and Module-Specific Alarms (Continued)

| HVPS/FPS Block 1 Alarms (GVID 30) | |
|---|---|
| **Bit** | **Alarm Description** |
| 0 | FPS Gun Ctrl Is On Failure |
| 1 | FPS Gun Ctrl Go On Timeout |
| 2 | FPS Missing Interlock Wire |
| 3 | FPS Module Lost Communication |
| 4 | HVPS Faulted Alarm |
| 5 | HVPS Go On Timeout |
| 6 | HVPS Is On Failure |
| 7 | HVPS Missing Interlock Wire |
| 8 | HVPS Module Lost Internal Communication |
| 9 | HVPS Not Ready Timeout |
| 10 | HVPS Type Configuration Missing |
| 11 | Turret Interlock Position Not Valid |
| 12 | Turret Is Rotating Interlock |
| 13 | Sweep Communication Not OK Interlock |
| 14 | Sweep Interlock Position Limit |
| 15 | Serial Comm Loop Back Not Detected |
| **HVPS/FPS Block 2 Alarms (GVID 31)** | |
| **Bit** | **Alarm Description** |
| … 31 | Null |
| **TRC Alarms (GVID 50)** | |
| **Bit** | **Alarm Description** |
| 0 | Turret Configuration, Encoder Index Not Found |
| 1 | Turret Failed To Find Position |
| 2 | Turret Missing Interlock Wire |
| 3 | Turret Module Lost Internal Communication |
| 4 | Turret Motor Stalled |
| 15 | Null |
| **Sweep Alarms (GVID 60)** | |
| **Bit** | **Alarm Description** |
| 0 | Sweep Coil Over Current Fault |
| 1 | Sweep Module Lost Internal Communication |
| 15 | Null |

# Appendix B: Gateway Selection and Memory Map for PLC Control Network Implementation

## Table B-1 AnyBus Gateway Selection




AnyBus gateway. See table to right for or specific model numbers

| AnyBus Model Number | PLC Network Type |
|---|---|
| AB7682 | Ethernet /IP slave |
| AB7684 | PROFINET I/O slave |
| AB7685 | PROFIBUS slave |
| AB7686 | DeviceNet slave |
| AB7687 | ControlNet slave |
| AB7688 | FIP slave |
| AB7689 | Interbus slave Cu |
| AB7690 | Interbus slave Fo |
| AB7691 | CANopen slave |
| AB7692 | Modbus RTU slave |
| AB7693 | Modbus Plus slave |
| AB7694 | CC Link |
| AB7695 | LONWorks |
| AB7900 | EtherCAT slave |
| AB7901 | Ethernet MBTCP slave |
| AB7961 | CC-Link IE Field Slave |

# Table B-2 Memory Map: EtherCAT Interface for Genius II and TemEbeam

**Supportive Genius II Software Version: TemEbeam-Genius2 (AnyBus) v1.6.1 or higher**
**Supportive TemEbeam Software Version: EBC 1.6.x or higher**

**General** (Set parameters)

| Function | Word | Byte | Bit | Data Type | Range | Comment |
|---|---|---|---|---|---|---|
| Alarm Acknowledge | 0 | 0 | 0 | Bool | 0,1 | Positive Edge Trigger (Minimum 50 milliseconds pulse) |
| Comm Loopback Tx | 0 | 0 | 7 | Bool | 0,1 | Need to set "Loopback Return = Loopback Receive" |
| | 0 | 1 | N/A | USINT | Not Used | |
| | 1 | 2,3 | N/A | UINT | Not Used | |
| | 2 | 4,5 | N/A | UINT | Not Used | |

(Works only works when Ebeam control module is in "EtherCAT" Operations mode.)

**Ebeam** (Set parameters)

| Function | Word | Byte | Bit | Data Type | Range | Comment |
|---|---|---|---|---|---|---|
| HVPS Go On | 3 | 6 | 0 | Bool | 0,1 | 0=OFF, 1=ON |
| FPS Go On | 3 | 6 | 1 | Bool | 0,1 | 0=OFF, 1=ON |
| | 3 | 7 | N/A | USINT | Reserved | |
| HVPS Voltage Set | 4 | 8,9 | N/A | UINT | 0 ... 10,000 | 0 ... 10 kV (resolution = 0.001 kV) |
| FPS Emission Set | 5 | 10,11 | N/A | UINT | 0 ... 10,000 | 0 … 100% (resolution = 0.01%) |
| | 6 | 12,13 | N/A | UINT | Not Used | |

(Works only when Turret control module is in "EtherCAT" operations mode.)

**Turret** (Set parameters)

| Function | Word | Byte | Bit | Data Type | Range | Comment |
|---|---|---|---|---|---|---|
| Turret In-Pocket Jog Go On | 7 | 14 | 0 | BOOL | 0,1 | |
| Turret Pocket Select | 7 | 15 | N/A | USINT | 1 … 8 | |
| Turret In-Pocket Jog Speed Set | 8 | 16 | N/A | USINT | 0 … 100 | 0 … 100 % (resolution = 1%) |
| | 8 | 17 | N/A | USINT | Not Used | |

(Works only when Sweep control module is in "EtherCAT" Operations mode.)

**Sweep** (Set parameters)

| Function | Word | Byte | Bit | Data Type | Range | Comment |
|---|---|---|---|---|---|---|
| Sweep Enable | 9 | 18 | 0 | Bool | 0,1 | |
| Sweep Modify Enable | 9 | 18 | 1 | Bool | 0,1 | |
| Sweep Go On | 9 | 18 | 2 | Bool | 0,1 | Not Available |
| Sweep Program Select | 9 | 19 | N/A | USINT | 1 … 10 | |
| | 10 | 20,21 | N/A | UINT | Not Used | |

**General** (query parameters)

| Function | Word | Byte | Bit | Data Type | Range | Comment |
|---|---|---|---|---|---|---|
| Login Is Enabled | 0 | 0 | 0 | Bool | 0,1 | 0=disabled, 1=enabled |
| Alarm Status | 0 | 0 | 2 | Bool | 0,1 | 0= no alarm, 1= in alarm(s) |
| Parameter(s) Out of Range | 0 | 0 | 3 | Bool | 0,1 | 0= No error, 1= Out of range |
| Comm Loopback Rx | 0 | 0 | 7 | Bool | 0,1 | Loopback receive |
| Current MODE | 0 | 1 | N/A | USINT | 0 … 3 | 0-6 = Null, Standby, MasterSlave, Operate, Manual , Config, Service |
| Administrator Password | 1 | 2,3 | N/A | UINT | 0 … 65535 | |
| | 2 | 4,5 | N/A | UINT | Reserved | |
| Alarm Block 1 | 3,4 | 6,7, 8,9 | N/A | DWORD | 0,1,2 ... 32 bits | See **Alarm Block 1** table below |
| Alarm Block 2 | 5,6 | 10,11, 12,13 | N/A | DWORD | Not Used | |
| | 7,8 | 14,15, 16,17 | N/A | DWORD | Not Used | |
| | 9,10 | 18,19, 20,21 | N/A | DWORD | Not Used | |

**Ebeam** (query parameters)

| Function | Word | Byte | Bit | Data Type | Range | Comment |
|---|---|---|---|---|---|---|
| HVPS Is Faulted | 11 | 22 | 0 | Bool | 0,1 | |
| HVPS Is On | 11 | 22 | 1 | Bool | 0,1 | |
| FPS Is On | 11 | 22 | 2 | Bool | 0,1 | |
| | 11 | 23 | N/A | USINT | Not Used | |
| | 12 | 24,25 | N/A | UINT | Not Used | - |
| HVPS Actual Voltage | 13 | 26,27 | N/A | UINT | 0 ... 10,000 | 0 ... 10 kV (resolution =1 V) |
| FPS Actual Filament Current | 14 | 28,29 | N/A | UINT | 0 … 5,000 | 0 … 50 A (resolution = 0.01 A) |
| FPS Actual Emission (in mA) | 15 | 30,31 | N/A | UINT | 0 ... 10,000 | 0 … 1,000 mA (resolution = 0.1 mA) |
| | 16 | 32,33 | N/A | UINT | Not Used | |

**Interlocks** (query parameters)

| Function | Word | Byte | Bit | Data Type | Range | Comment |
|---|---|---|---|---|---|---|
| $H_2O$ Interlock Ok | 17 | 34 | 0 | Bool | 0,1 | |
| Aux Interlock Ok | 17 | 34 | 1 | Bool | 0,1 | |
| Vacuum Interlock Ok | 17 | 34 | 2 | Bool | 0,1 | |
| Tank Interlock Ok | 17 | 34 | 3 | Bool | 0,1 | |
| Poptop Is Down | 17 | 34 | 4 | Bool | 0,1 | (TemEbeam Only) |
| | 17 | 35 | N/A | USINT | Not Used | |

**Turret** (query parameters)

| Function | Word | Byte | Bit | Data Type | Range | Comment |
|---|---|---|---|---|---|---|
| Turret Pocket Is Valid | 18 | 36 | 0 | Bool | 0,1 | |
| Turret Motor Is ON | 18 | 36 | 1 | Bool | 0,1 | |
| Turret Motor Is Activated | 18 | 36 | 2 | Bool | 0,1 | |
| Turret Actual Pocket Position | 18 | 37 | N/A | USINT | 0 … 50 | 0=unknown position, 1 … 50 = Actual Pocket |
| | 19 | 38,39 | N/A | UINT | Reserved | |
| | 20 | 40,41 | N/A | UINT | Not Used | |

**Sweep** (query parameters)

| Function | Word | Byte | Bit | Data Type | Range | Comment |
|---|---|---|---|---|---|---|
| Sweep Position Interlock | 21 | 42 | 0 | Bool | 0,1 | 0= Interlock Not OK, 1= Interlock OK |
| Sweep Program Is In Edit | 21 | 42 | 1 | Bool | 0,1 | |
| Sweep Program Actual | 21 | 43 | N/A | USINT | 1 … 10 | |
| Sweep Latitude Current | 22 | 44,45 | N/A | UINT | 0 ... 2,000 | -5 ... 5 A (resolution = 0.005 A) |
| Sweep Longitude Current | 23 | 46,47 | N/A | UINT | 0 ... 2,000 | -5 ... 5 A (resolution = 0.005 A) |
| | 24 | 48,49 | N/A | UINT | Not Used | |

**Alarms Block 1**

| Bit | Alarm Description |
|---|---|
| 0 | HVPS Go On Timeout |
| 1 | HVPS Is On Failure |
| 2 | HVPS Faulted Alarm |
| 3 | FPS Gun Ctrl Go On Timeout |
| 4 | FPS  Fail To Detect Emission |
| 5 | Turret Failed To Find Position |
| 6 | Turret Missing Interlock Wire |
| 7 | Water Supply Interlock Alarm |
| 8 | Aux Interlock Alarm |
| 9 | Vacuum Interlock Alarm |
| 10 | Tank Interlock Alarm |
| 11 | Sweep Communication Interlock Alarm |
| 12 | FPS Module Lost Communication |
| 13 | HVPS Module Lost Communication |
| 14 | Turret Module Lost Communication |
| 15 | Sweep Module Lost Communication |
| 16 | AnyBus Gateway Lost Communication |
| 17 | Comm Loop Back Not Detected |
| 18 | Comm Loop Back Interlock Alarm |
| 19 | Null |
| 20 | Null |
| 21 | Null |
| 22 | Null |
| 23 | Null |
| 24 | Null |
| 25 | Null |
| 26 | Null |
| 27 | Null |
| 28 | Null |
| 29 | Null |
| 30 | Null |
| 31 | Null |