EBS-530

Electron Beam Sweep Controller

PN 074–622–P1B

INFICON

EBS–530

Electron Beam Sweep Controller

PN 074–622–P1B

INFICON Instruments for Intelligent Control®

Trademarks

The trademarks of the products mentioned in this manual are held by the companies that produce them.

Windows® is a registered trademark of Microsoft Corporation.

LabVIEW^{TM} is a trademark of National Instruments Corporation.

All other brand and product names are trademarks or registered trademarks of their respective companies.

Disclaimer

The information contained in this manual is believed to be accurate and reliable. However, INFICON assumes no responsibility for its use and shall not be liable for any special, incidental, or consequential damages related to the use of this product.

Due to our continuing program of product improvements, specifications are subject to change without notice.

Copyright

INFICON

This is to certify that this equipment, designed and manufactured by:

INFICON Inc.
Two Technology Place
East Syracuse, NY 13057
USA

Meets the essential safety requirements of the European Union and is placed on the market accordingly. It has been constructed in accordance with good engineering practice in safety matters in force in the Community and does not endanger the safety of persons, domestic animals or property when properly installed and maintained and used in applications for which it was made.

Equipment Description: **EBS-530 Electron Beam Sweep Controller**
(includes all versions of sweeper)

Applicable Directives: 2014/35/EU (LVD)

2014/30/EU (General EMC)

2011/65/EU (RoHS2)

Applicable Standards:

Safety: EN 61010-1: 2010 3rd Edition
Safety Requirements for Electrical Equipment For Measurement, Control, And Laboratory Use. PART 1: General Requirements

Emissions: EN 61326-1: 2013 (Radiated & Conducted Emissions)
(EMC – Measurement, Control & Laboratory Equipment)
CISPR 11/EN 55011 Edition 2009-12 Emission standard for industrial, scientific, and medical (ISM) radio RF equipment\

FCC Part 15 Class A emissions requirement (USA)

Immunity: EN 61326-1: 2013 (Industrial EMC Environments)
Immunity
(EMC – Measurement, Control & Laboratory Equipment)

RoHS2:   Fully Compliant

CE Implementation Date: **10/17/14 (updated 5/29/15)**

Authorized Representative:

Thin Film Business Line Manager
INFICON, Inc.

ANY QUESTIONS RELATIVE TO THIS DECLARATION OR TO THE SAFETY OF INFICON'S PRODUCTS SHOULD BE DIRECTED, IN WRITING, TO THE AUTHORIZED REPRESENTATIVE AT THE ABOVE ADDRESS.

Warranty

WARRANTY AND LIABILITY - LIMITATION: Seller warrants the products manufactured by it, or by an affiliated company and sold by it, and described on the reverse hereof, to be, for the period of warranty coverage specified below, free from defects of materials or workmanship under normal proper use and service. The period of warranty coverage is specified for the respective products in the respective Seller instruction manuals for those products but shall not be less than two (2) years from the date of shipment thereof by Seller. Seller's liability under this warranty is limited to such of the above products or parts thereof as are returned, transportation prepaid, to Seller's plant, not later than thirty (30) days after the expiration of the period of warranty coverage in respect thereof and are found by Seller's examination to have failed to function properly because of defective workmanship or materials and not because of improper installation or misuse and is limited to, at Seller's election, either (a) repairing and returning the product or part thereof, or (b) furnishing a replacement product or part thereof, transportation prepaid by Seller in either case. In the event Buyer discovers or learns that a product does not conform to warranty, Buyer shall immediately notify Seller in writing of such non-conformity, specifying in reasonable detail the nature of such non-conformity. If Seller is not provided with such written notification, Seller shall not be liable for any further damages which could have been avoided if Seller had been provided with immediate written notification.

THIS WARRANTY IS MADE AND ACCEPTED IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, WHETHER OF MERCHANTABILITY OR OF FITNESS FOR A PARTICULAR PURPOSE OR OTHERWISE, AS BUYER'S EXCLUSIVE REMEDY FOR ANY DEFECTS IN THE PRODUCTS TO BE SOLD HEREUNDER. All other obligations and liabilities of Seller, whether in contract or tort (including negligence) or otherwise, are expressly EXCLUDED. In no event shall Seller be liable for any costs, expenses or damages, whether direct or indirect, special, incidental, consequential, or other, on any claim of any defective product, in excess of the price paid by Buyer for the product plus return transportation charges prepaid.

No warranty is made by Seller of any Seller product which has been installed, used or operated contrary to Seller's written instruction manual or which has been subjected to misuse, negligence or accident or has been repaired or altered by anyone other than Seller or which has been used in a manner or for a purpose for which the Seller product was not designed nor against any defects due to plans or instructions supplied to Seller by or for Buyer.

This manual is intended for private use by INFICON® Inc. and its customers. Contact INFICON before reproducing its contents.

NOTE: These instructions do not provide for every contingency that may arise in connection with the installation, operation or maintenance of this equipment. Should you require further assistance, please contact INFICON.

INFICON

www.inficon.com   reachus@inficon.com

Table Of Contents

Chapter 3

Operation

Chapter 4

Software

Chapter 5

Communications

Chapter 6

Maintenance and Troubleshooting

Chapter 1
Introduction and Specifications

1.1 Introduction

EBS-530 electron beam (e-beam) sweep controller delivers precise e-beam sweep pattern control to provide optimal deposition material heating.

EBS-530 produces a sweep pattern that will drive most e-beam deposition sources.

Four standard patterns and up to 32 user-defined sweep patterns can be stored within EBS-530. These patterns can be selected from the front panel touch screen, the included handheld sweep remote, or through the RS-232 or RS-485 computer interface.

Figure 1-1 EBS-530 e-beam sweep controller

1.1.1 Related Manuals

Thin film deposition controllers and high voltage power supplies are covered in separate manuals. The following manuals are available on the Thin Film Instrument and Sensor Manuals CD (PN 074-5000-G1), part of the ship kit:

- PN 074-505-P1—IC6 Thin Film Deposition Controller

- PN 074-545-P1—Cygnus 2 Thin Film Deposition Controller

- PN 074-446-P1—XTC/3 Thin Film Deposition Controller

- PN 074-550-P1—SQC-310 Thin Film Deposition Controller

- PN 074-584-P1—IQM-233 Thin Film Deposition Controller

- PN 074-622-P1—HVPS/SC High Voltage Power Supply with Integrated Source Control

1.2 Instrument Safety

1.2.1 Definition of Notes, Cautions, and Warnings

When using this manual, please pay attention to the NOTES, CAUTIONS, and WARNINGS found throughout. For the purposes of this manual they are defined as follows:

NOTE: Pertinent information that is useful in achieving maximum EBS-530 efficiency when followed.

⚠️ **CAUTION**

> **Failure to heed these messages could result in damage to EBS-530.**

⚠️ **WARNING**

> **Failure to heed these messages could result in personal injury.**

⚡ **WARNING - Risk Of Electric Shock**

> **Dangerous voltages are present which could result in personal injury.**

1.2.2 General Safety Information

⚡ **WARNING - Risk Of Electric Shock**

> **Dangerous voltages may be present whenever the power cord or external input/relay connectors are present.**
>
> **Refer all maintenance to qualified personnel.**

⚠️ **CAUTION**

> **EBS-530 contains delicate circuitry which is susceptible to transient power line voltages. Disconnect the line cord whenever making any interface connections.**

1.2.3 Earth Ground

EBS-530 is connected to earth ground through a sealed three-core (three-conductor) power cable, which must be plugged into a socket outlet with a protective earth terminal. Extension cables must always have three conductors including a protective earth terminal.

⚠ WARNING - Risk Of Electric Shock

Never interrupt the protective earth circuit.

Any interruption of the protective earth circuit, inside or outside EBS-530, or disconnection of the protective earth terminal is likely to make EBS-530 dangerous.
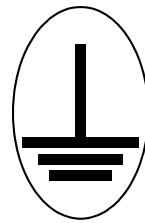
This symbol indicates where the protective earth ground is connected inside EBS-530. Never unscrew or loosen this connection.

⚠ CAUTION

There are no user-serviceable components within the EBS-530 case.

Refer all maintenance to qualified personnel.

1.3 How To Contact INFICON

Worldwide customer support information is available under **Support >> Support Worldwide** at www.inficon.com:

◆ Sales and Customer Service

◆ Technical Support

◆ Repair Service

If experiencing a problem with EBS-530, please have the following information readily available:

◆ The Sales Order or Purchase Order number of EBS-530 purchase.

◆ The version of EBS-530 firmware.

◆ The version of Windows operating system.

◆ A description of the problem.

◆ An explanation of any corrective action that may have already been attempted.

◆ The exact wording of any error messages that may have been received.

1.3.1 Returning EBS-530

Do not return any component of EBS-530 to INFICON before speaking with a Customer Support Representative and obtaining a Return Material Authorization (RMA) number. EBS-530 will not be serviced without an RMA number.

Packages delivered to INFICON without an RMA number will be held until the customer is contacted. This will result in delays in servicing EBS-530.

If returning EBS-530 with a component potentially exposed to process materials, prior to being given an RMA number, a completed Declaration Of Contamination (DOC) form will be required. DOC forms must be approved by INFICON before an RMA number is issued. INFICON may require that the component be sent to a designated decontamination facility, not to the factory.

PN 074-622-P1B

1.4 Specifications

1.4.1 Output

Output Connections . . . . 5 pin circular connector

Coil Output Current . . . . -5.0 to 5.0 A peak per coil
(3.5 A RMS)

Coil Configurations . . . . Two coils with one side grounded
Two coils with each side floating

Output Frequency Response (X and Y) . . . . 500 Hz for coils <8 mH
200 Hz for coils = 33 mH

Maximum Coil Impedance @ 5 A . . . . Peak 10 Ohms (Ω)

Nominal Cable Length . . . . 6.1 m (20 ft.)

1.4.2 Patterns

Predefined Patterns . . . . Circle, figure-8, line, point

User Patterns 32

X/Y Points per User Pattern 255

1.4.3 Pattern Parameters

Gain . . . . 0 to 110%

Power Profile . . . . -10 to 10

Shape . . . . Circle, figure-8, line, point, user-defined

Spin Speed (rate of shape rotation) . . . . 0 to 1000 RPM

Shape Speed (time to draw one shape) . . . . 0 to 1000 ms

1.4.4 General

User Interface . . . . 240 x 64 backlit LCD touch screen
Dedicated system keys

Handheld Sweep Remote PS/2

Communications RS-232/RS-485

Regulatory Compliance . . . . CE, RoHS

1.4.5 Digital I/O

Digital Inputs. 9

Digital Input Functions . . . . Interlock
Remote Mode
Pattern Select (1 to 32)
Sweep On/Off

Input Rating . . . . Contact closure resistance <1 kΩ for active, >500 kΩ for inactive (see section 2.3.2 on page 2-10)

> **NOTE:** The potential provided by EBS-530 is within 5 V (dc) of chassis ground

Relay Outputs. 3

Relay Output Functions . . . . Sweep Ready
Sweep On
Beam In Pocket

Relay Rating. . . . . SPST, 30 V (dc) or RMS, 2 A

1.4.6 Power

Rated Supply Voltage. . . . . 85 to 250 V (ac) ±15%, 50/60 Hz
475 VA (10 Ω coil R,
5 A peak current in each coil)

Fuse Rating

Input Line . . . . 4 A

X/Y Coil Lines. . . . . 5 A (maximum)

Mains Power Cable Rating

US Power Cable. . . . . 10 A, 125 V

European Power Cable . . . . 10 A, 250 V

Power Consumption. . . . . less than 10 W

Power Factor . . . . 0.99 at maximum coil current

Overvoltage . . . . Category II

Temporary Overvoltage

Short Term . . . . 1200 V, <5 s

Long Term . . . . 250 V, >5 s

1.4.7 Operating Environment

Usage . . . . Indoor use only

Operating Temperature . . . . 0 to 50°C (32 to 122°F)

Storage Temperature . . . . -10 to 60°C (14 to 140°F)

Humidity . . . . Up to 85% RH, non-condensing

Altitude . . . . Up to 2000 meters

Pollution Degree. 2

Cooling . . . . Forced air, one internal fan

1.4.8 Size and Weight

Size (H x W x D). . . . . 8.9 x 42.9 x 29.2 cm
(3.5 x 16.9 x 11.5 in.)

Weight . . . . 4.5 kg (10 lb.)

1.5 Unpacking and Inspection

1   If EBS-530 has not been removed from its packaging, do so now.

2   Carefully examine EBS-530 for damage that may have occurred during shipping. It is especially important to note obvious rough handling on the outside of the container. *Immediately report any damage to the carrier and to INFICON.*

3   Do not discard the packaging material until inventory has been taken and installation has been successful.

4   Refer to the invoice to take inventory (see section 1.6).

5   To install EBS-530, see Chapter 2.

6   For additional information or technical assistance, contact INFICON (refer to section 1.3 on page 1-4).

1.6 Parts and Options Overview

1.6.1 Base Configuration

EBS-530 Electron Beam Sweep Controller . . . . PN EBS-530

6.1 m (20 ft.) Sweeper Cable . . . . PN 783-500-125

Ship Kit . . . . PN 783-516-019-G1

1.6.2 Accessories

The following accessories are included in the EBS-530 ship kit:

Thin Film Instrument and Sensor Manuals CD . . . . PN 074-5000-G1

Rack Mount Ears . . . . PN 783-016-012

10-32 Screws . . . . PN 090-062

RS-232 Cable. . . . . PN 783-506-170-P1

US Power Cable. . . . . PN 068-0433

European Power Cable . . . . PN 068-0434

3 A Fuse. . . . . PN 783-356-016

1.5 A Fuse . . . . PN 783-356-017

5 A Fuse. . . . . PN 783-356-018

4 A Fuse. . . . . PN 783-356-092

9-Pin D-Sub Connector . . . . PN 783-404-056

15-Pin D-Sub Connector . . . . PN 783-402-389

Handheld Sweep Remote . . . . PN 783-500-237-G1

Chapter 2
Installation

2.1 Properly Grounding the e-Beam Vacuum Deposition System

See Figure 2-1 for a diagram of a properly grounded electron beam vacuum deposition system.

Figure 2-1 Typical e-beam vacuum system
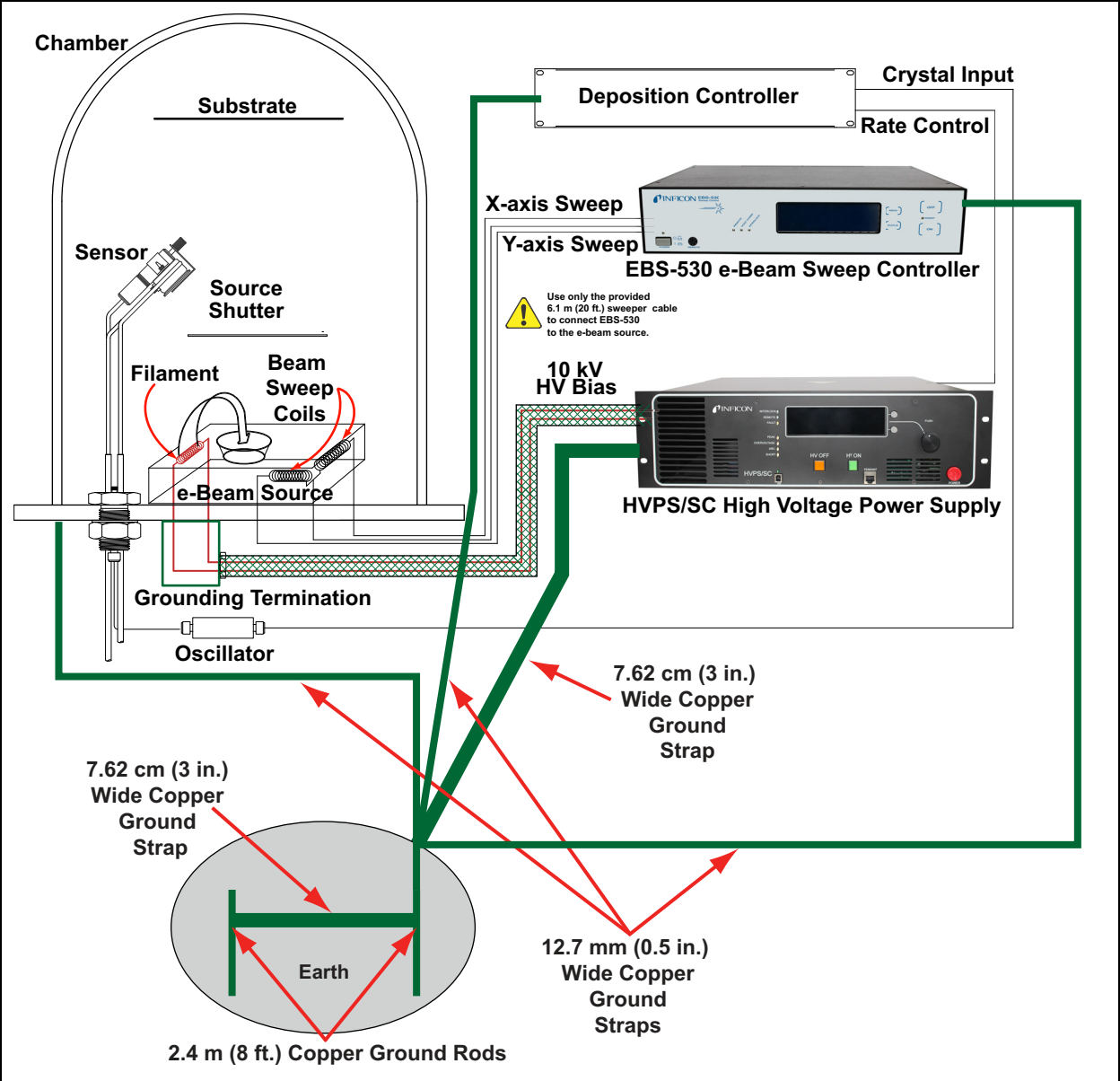
2.1.1 Ground Requirements

- ◆ The crystal sensor is grounded to the wall of the vacuum system. Connect a copper strap between the crystal sensor feedthrough and the common ground point on the vacuum system.

  NOTE: The oscillator is grounded to the deposition controller and crystal sensor through the BNC cables.

- ◆ Each instrument chassis in the control rack and the common ground point on the vacuum chamber must be connected by a separate, ground strap to a common local ground (a *star* configuration).

  NOTE: Do not use braided wire. Use a solid copper strap.

- ◆ A ground post is provided on the EBS-530 rear panel. This point should be connected to the common local ground with a dedicated grounding strap. Use a strap of the shortest possible length, minimum width of 12.7 mm (0.5 in.), approximately 0.56 mm (0.022 in.) thick.

- ◆ The common local ground must be connected to earth ground. (See section 2.1.2 for the earth ground requirement.)

2.1.2 Establishing Earth Ground

⚠ **WARNING - Risk Of Electric Shock**

Follow local electrical regulations and codes.

1 Install two 3 m (10 ft.) long copper-clad steel ground rods into the soil, spaced at least 1.9 m (6.2 ft.) apart. The ideal distance between the rods is 6.1 m (20 ft.) (twice the rod length).

2 Pour a solution of magnesium sulfate or copper sulfate around each rod to reduce resistance to earth ground.

3 Test the ground rods using a ground resistance tester specifically designed for that purpose.

  NOTE: Do not use a common ohmmeter.

4 After verifying that a good earth ground has been achieved, connect the rods together with a solid copper strap. Use a strap of the shortest possible length, minimum width of 12.7 mm (0.5 in.), approximately 0.56 mm (0.022 in.) thick.

  NOTE: Do not use braided wire. Use a solid copper strap.

2.1.2.1 Alternative Earth Ground

Grounded structural steel of the building may be used as an earth ground if EBS-530 is to be installed in an area without access to the twin rods installed in section 2.1.2.

NOTE: Do not use water pipes to establish a ground connection.

> ⚠ **WARNING - Risk Of Electric Shock**
>
> **Follow local electrical regulations and codes.**

1 Bolt a solid copper strap to clean, bare, grounded structural steel of the building. Use a strap of the shortest possible length, minimum width of 12.7 mm (0.5 in.), approximately 0.56 mm (0.022 in.) thick.

   NOTE: Do not use braided wire. Use a solid copper strap.

2 Test the grounded structural steel using a ground resistance tester specifically designed for that purpose.

   NOTE: Do not use a common ohmmeter.

3 After verifying that a good earth ground has been achieved, connect the copper strap to the common local ground.

2.1.3 Rack Mounting Procedure

EBS-530 is designed to mount in a standard 48.3 cm (19 in.) rack, using included rack mount ears, or can be used on a benchtop.

2.1.3.1 Inventory

   ◆ Two rack mount ears (PN 783-016-012)
   ◆ Four 10-32 screws (PN 090-062)

2.1.3.2 Installation

1 Install one of the rack mount ears using two of the four screws provided and the predrilled holes on the EBS-530 chassis.

2 Align the circular predrilled holes on one of the rack mount ears with the predrilled holes closest to the EBS-530 front panel (see Figure 2-2).

Figure 2-2 EBS-530 aligned rack mount ear
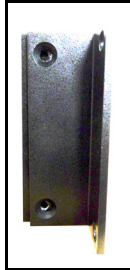
3 Insert one of the screws into each of the two circular holes once aligned.

4 Tighten the screws (see Figure 2-3).

Figure 2-3 EBS-530 attached rack mount ear

5 Install the second rack mount ear using the remaining two screws provided, the remaining rack mount ear, and the predrilled holes on the EBS-530 chassis.

6 Align the circular predrilled holes on one of the rack mount ears with the predrilled holes closest to the EBS-530 front panel (see Figure 2-4).

Figure 2-4 EBS-530 aligned rack mount ear

7 Insert one of the screws into each of the two circular holes once aligned.

PN 074-622-P1B

8 Tighten the screws (see Figure 2-5).

Figure 2-5 EBS-530 attached rack mount ear

9 Mount EBS-530 by sliding the entire assembly (as shown in Figure 2-6) into an empty 2U rack-mount space (8.9 x 48.3 cm [3.5 x 19 in.]).

Figure 2-6 EBS-530 rack mount assembly

10 Align the predrilled holes on the EBS-530 assembly with the predrilled holes on the front mounting rails of the rack.

11 Insert one #10 or matching machine screw into each of the four holes once aligned.

12 Tighten the screws.

2.2 Rear Panel Description

Figure 2-7 EBS-530 rear panel
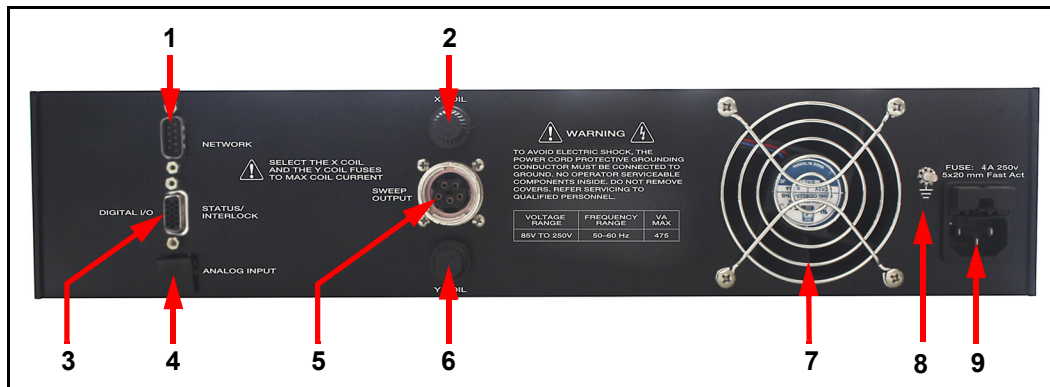
⚠️ **CAUTION**

Connecting cables must be routed away from any potential source of electrical noise.

1 RS-232/RS-485 Network

Provides a 9-pin RS-232 or RS-485 communications port.

2 X Coil Line Fuse

Provides a 5 A (maximum) output fuse for the X coil line (dependent on source).

3 Digital I/O Connection

Provides a 15-pin, high-density, D-type connector for 3 relay outputs and 9 inputs (see section 2.3).

4 Analog Input

Provides a plug as a placeholder. Analog Input is not offered at this time.

5 X, Y Current Output

Provides a 5 pin, circular connector for current output.

6 Y Coil Line Fuse

Provides a 5 A (maximum) output fuse for the Y coil line (dependent on source).

7 Fan Outlet

Provides exhaust opening for fan. *Do not block exhaust fan.*

8 Ground Post

Provides a point to attach a solid copper strap to the common local ground.

9 AC Power Inlet, Fuse, and Mains Switch

Provides a common connector for international plug sets and a 4 A input fuse.

2.3 Digital Inputs and Outputs

EBS-530 includes I/O capabilities through a 15-pin, high-density, D-type connector to interface with a control system and controlled remotely. (See Figure 2-8 for a pinout diagram of the rear panel, female connector and Table 2-1 for pin numbers.)

Table 2-2 provides binary encoding of Pattern Select (PSEL_X) 0 to 4.

Figure 2-8 15-pin Input/Output pinout
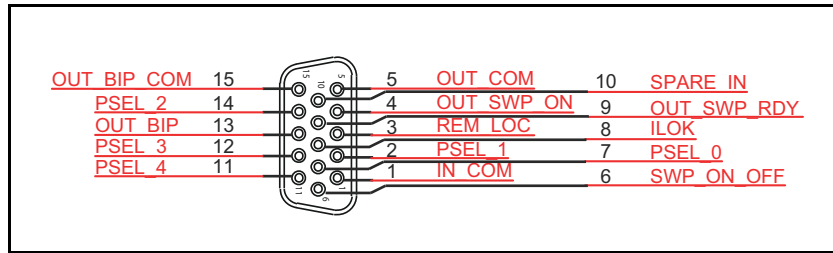
Table 2-1 Input/Output pin numbers

Pin#	Pin Name	Description
1	IN_COM	Input common pin. Individual inputs must connect to this pin through relay or switch contacts. A closed relay (continuity between an input pin and Pin 1) sets the input true.
2	PSEL_1	Input: Pattern select D1 (#2 weight). This input is ignored when EBS-530 is not in remote mode (see Table 2-2 for pattern select binary encoding).
3	REM_LOC	Input: Remote/Local request. When this input is true, EBS-530 enters remote mode. Pattern select and sweep on/off are controlled through the remote interface and not the front panel.
4	OUT_SWP_ON	Output: Continuity between this pin and Pin 5 indicates EBS-530 is on.
5	OUT_COM	Common pin for EBS-530 relay outputs, Pin 4 and Pin 9.
6	SWP_ON_OFF	Input: Sweep request. This input is ignored when EBS-530 is not in remote mode. When true, EBS-530 is turned on if not interlocked. When false, EBS-530 is turned off.
7	PSEL_0	Input: Pattern select D0 (#1 weight). This input is ignored when EBS-530 is not in remote mode (see Table 2-2 for pattern select binary encoding).
8	ILOK	Input: Interlock. This input must be true to turn EBS-530 on in any mode. To protect coils, connect this interlock to the cooling water on signal.
9	OUT_SWP_READY	Output: Continuity between this pin and Pin 5 indicates EBS-530 is in remote mode and is sweeping or is ready to sweep (no errors).
10	SPARE_IN	Input: Unused/no function assigned.
11	PSEL_4	Input: Pattern select D4 (#16 weight). This input is ignored when EBS-530 is not in remote mode (see Table 2-2 for pattern select binary encoding).
12	PSEL_3	Input: Pattern select D3 (#8 weight). This input is ignored when EBS-530 is not in remote mode (see Table 2-2 for pattern select binary encoding).

Table 2-1 Input/Output pin numbers (continued)

Pin#	Pin Name	Description
13	OUT_BIP	Output: Continuity between this pin and Pin 15 indicates the selection programmed for B.I.P. Axis Select, on the System Configuration screen (see section 3.3.5 on page 3-17), is generating enough current to center the beam in the pocket and is safe to turn on. If the current generated is between -0.5 and 0.5 A, the relay is deactivated.
14	PSEL_2	Input: Pattern select D2 (#4 weight). This input is ignored when EBS-530 is not in remote mode (see Table 2-2 for pattern select binary encoding).
15	OUT_BIP_COM	Common pin for EBS-530 relay output, Pin 13.

Table 2-2 Binary encoding of pattern select lines

PSEL_4	PSEL_3	PSEL_2	PSEL_1	PSEL_0	Selects Pattern#
1 = input true (activated), 0 = input false (deactivated)					
0	0	0	0	0	1
0	0	0	0	1	2
0	0	0	1	0	3
0	0	0	1	1	4
0	0	1	0	0	5
0	0	1	0	1	6
0	0	1	1	0	7
0	0	1	1	1	8
0	1	0	0	0	9
0	1	0	0	1	10
0	1	0	1	0	11
0	1	0	1	1	12
0	1	1	0	0	13
0	1	1	0	1	14
0	1	1	1	0	15
0	1	1	1	1	16
1	0	0	0	0	17
1	0	0	0	1	18
1	0	0	1	0	19
1	0	0	1	1	20
1	0	1	0	0	21
1	0	1	0	1	22

Table 2-2 Binary encoding of pattern select lines (continued)

PSEL_4	PSEL_3	PSEL_2	PSEL_1	PSEL_0	Selects Pattern#
1	0	1	1	0	23
1	0	1	1	1	24
1	1	0	0	0	25
1	1	0	0	1	26
1	1	0	1	0	27
1	1	0	1	1	28
1	1	1	0	0	29
1	1	1	0	1	30
1	1	1	1	0	31
1	1	1	1	1	32

2.3.1 Relay Outputs

EBS-530 has three floating relay contact outputs (see Table 2-3). Pin 9 corresponds to Sweep Ready, and Pin 4 corresponds to Sweep On. The common pin of both relays are connected internally, and come out to only one pin, Pin 5. Pin 13 is the Beam In Pocket (BIP) relay that uses Pin 15 as the common pin. This can be used as a bias current status relay typically for e-beam source guns without permanent magnets.

The output relay contact specifications allow a maximum of 120 W and 120 V. Aggregate current on Pin 5 must not exceed the rating of the connector.

Table 2-3 Relay outputs

Relay Number	Description	Pin Numbers
1	Sweep Ready	9, 5
2	Sweep On	4, 5
3	Beam In Pocket	13, 15

2.3.2 Digital Inputs

EBS-530 has 9 optically isolated inputs for remote control that are activated by contact closure to the common pin (see Table 2-4). The common pin of the inputs are connected internally and come out to only one pin, Pin 1, that provides 5 V (dc) from EBS-530.

Pin 1 is current limited to provide short protection, but should only be connected to relays or other high side switching devices.

Table 2-4 Digital inputs

Input Number	Description	Pin Numbers
1	Interlock	8, 1
2	Remote Mode	3, 1
3	Pattern Select 0	7, 1
4	Pattern Select 1	2, 1
5	Pattern Select 2	14, 1
6	Pattern Select 3	12, 1
7	Pattern Select 4	11, 1
8	Sweep On/Off	6, 1
9	Spare Input	10, 1

NOTE: External equipment providing a source of drive to the anode inputs (for example, ILOK) relative to earth ground will also produce a working circuit.

⚠ **CAUTION**

The 15-pin HD, D-type connector does not have a ground pin. It is not recommended to use a logic drive source signal.

2.3.3 Connection to a Deposition Controller

EBS-530 can be controlled remotely through the digital I/O using a deposition controller (refer to section 2.3 on page 2-7).

The deposition controller can be wired to EBS-530 using the pinout diagram (refer to Figure 2-8 on page 2-7). The deposition controller can close a relay to send a request for a sweep pattern (refer to Table 2-2).

NOTE: REM_LOC (Pin 3) is required to program EBS-530 to remote mode to allow the deposition controller to request patterns.

For systems using 2 patterns or less . . . . PSEL_0 (Pin 7) is required.

For systems using 3 to 4 patterns . . . . PSEL_0 (Pin 7) and PSEL_1 (Pin 2) are both required.

For systems using 5 to 8 patterns . . . . PSEL_0 (Pin 7), PSEL_1 (Pin 2), and PSEL_2 (Pin 14) are required.

For systems using 9 to 16 patterns . . . . PSEL_0 (Pin 7), PSEL_1 (Pin 2), PSEL_2 (Pin 14), and PSEL_3 (Pin 12) are required.

For systems using 17 to 32 patterns . . . . PSEL_0 (Pin 7), PSEL_1 (Pin 2), PSEL_2 (Pin 14), PSEL_3 (Pin 12), and PSEL_4 (Pin 11) are required.

2.4 Sweep Output Connector

A circular 5-pin connector supplies the connections to the sweeping coils of the source. The pinout of the sweep output connector on the EBS-530 rear panel is displayed in Figure 2-9.

Figure 2-9 Sweep output connector
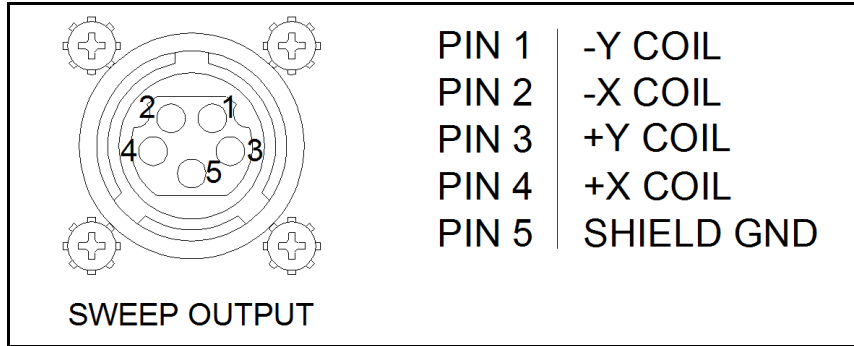
A 6.1 m (20 ft.) cable is provided to connect EBS-530 to a 2, 3, or 4-wire e-beam source gun (see Figure 2-10 for wiring).

⚠ **CAUTION**

> **To maintain proper EBS-530 performance, use only the provided 6.1 m (20 ft.) cable to connect EBS-530 to the e-beam source gun.**

NOTE: If a longer or shorter length cable is required, contact INFICON (refer to section 1.3 on page 1-4).

⚠ **WARNING - Risk Of Electric Shock**

> *Do not lengthen or shorten the cable.* **This will cause personal injury, damage to EBS-530, and affect performance. The cable *must* be maintained as provided by INFICON or the warranty will be void.**

Figure 2-10 Cable wiring example for common grounded coils
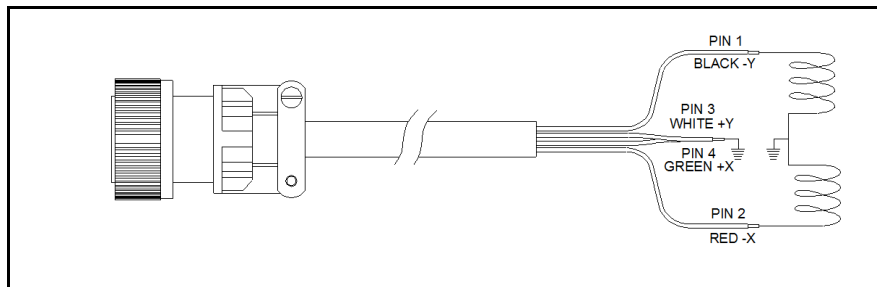
2.5 Coil Line Fuses

⚠️ **CAUTION**

Before operating EBS-530, the proper fuses must be installed, and the maximum currents for the e-beam source coils must be programmed on the System Configuration screen.

Refer to the e-beam source manual for the recommended current of the X and Y coils.

EBS-530 can operate with a maximum output current of 5 A for the X coil and 5 A for the Y coil.

EBS-530 has internal monitoring and current limiting protection. Two output fuses (X and Y coil line fuse) located on the rear panel (refer to Figure 2-7 on page 2-6) are also provided for internal protection.

If an output fuse fails, there may be a short in the vacuum chamber or the sweep coils may be improperly wired. After the cause of the short is removed, replace the fuse with a similar type fuse (5 A maximum).

This page is intentionally blank.

Chapter 3
Operation

3.1 Front Panel Description

Figure 3-1 EBS-530 front panel
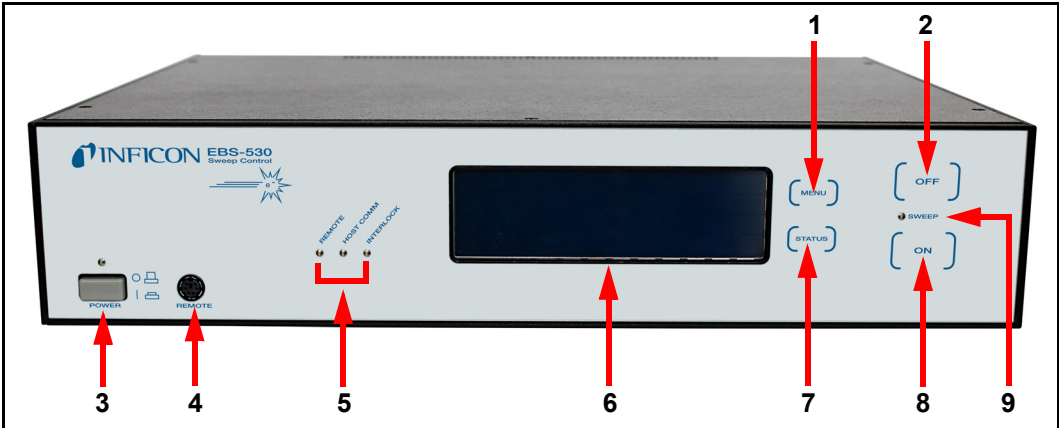
1 Menu

Displays the menu on the touch screen LCD.

2 Off

Stops the sweeping operation. Extinguishes the Sweep indicator.

3 Power

Controls the power supplied to EBS-530, switched between off and on. Indicator illuminates when EBS-530 is on.

4 Remote

Provides a PS/2 connection for the handheld sweep remote (see section 3.1.1 for functions of the handheld sweep remote).

5 Status Indicators

Remote . . . . Illuminates to indicate EBS-530 is controlled remotely through the Digital I/O interface (refer to section 2.3 on page 2-7).

Host Comm . . . . Flashes to indicate EBS-530 is connected and communicating with a host computer.

Interlock . . . . Illuminates to indicate the safety interlock requirement is satisfied and EBS-530 may operate.

6 Touch Screen LCD

Provides selection, programming, and display of the EBS-530 functions. Alternate screens are displayed in response to user selections (see section 3.3 on page 3-5 for a complete description of screens and functions).

NOTE: The screen is intended to be used with fingers, soft objects, or soft input devices. The use of sharp objects may damage the display surface.

7 Status

Displays the **Status** screen.

8 On

Starts the sweeping operation. Illuminates the Sweep indicator.

9 Sweep Indicator

Illuminated . . . . Indicates EBS-530 is sweeping.

Extinguished. . . . . Indicates EBS-530 is not sweeping.

Flashing . . . . Indicates the interlock input (refer to section 2.3 on page 2-7) has not been satisfied or sweep has been remotely aborted.

3.1.1 Handheld Sweep Remote Functions

The handheld sweep remote has two selection buttons, a trigger button, and a trackball that can be used to select and edit parameters on the EBS-530 front panel. Included on the handheld sweep remote are two additional buttons and a wheel button with no function when used with EBS-530 (see Figure 3-2).

Figure 3-2 Handheld sweep remote

The selection buttons, located on either side of the wheel button, are used to select parameters on many of the display screens.

The trigger button is used to change user shape point locations or parameter values. Press and hold the trigger button and rotate the trackball to increment or decrement parameter values or to move points in user shapes (see section 3.3.6.2, Creating or Editing a Shape, on page 3-22).

The handheld sweep remote allows for changes to be made to parameters and the location of the e-beam while viewing a vacuum system. The handheld sweep remote is an alternate input device to the front panel for many parameters.

3.2 Operation

Before operating EBS-530:

- ◆ Install the proper fuses. Use fuses that are rated appropriately to protect the e-beam source (typically 1 A, 3 A, or 5 A).

- ◆ Program the maximum currents for the e-beam source coils (see section 3.3.5 on page 3-17).

⚠ **CAUTION**

Refer to the e-beam source manual for the recommended current and fuse ratings of the e-beam source.

Press the **Power** button on the front panel (refer to Figure 3-1 on page 3-1) to turn EBS-530 on. A self-test screen will display, followed by a screen displaying the firmware version. When startup is complete, the **Status** screen will display (see section 3.3.1).

For first-time operation, or after making changes to the e-beam source, calibration of the system may be required (see section 3.3.4 on page 3-12).

Press the **On** button on the front panel (refer to Figure 3-1 on page 3-1) to begin sweeping. The green Sweep indicator will illuminate while EBS-530 is sweeping.

NOTE: If the interlock input is not satisfied, the Sweep indicator will flash, and the **Status** screen will change from OFF to Local Standby.

Press the **Off** button on the front panel (refer to Figure 3-1 on page 3-1) to stop sweeping. The green Sweep indicator will extinguish when EBS-530 is not sweeping.

3.3 Screens

EBS-530 has eight main screens: **Status**, **Main Menu**, **Edit Pattern**, **Calibrate**, **System Configuration**, **Edit Shape**, **Manual Mode**, and **Diagnostic**.

To move from one screen to another, press the **Menu** or **Status** button on the front panel (refer to Figure 3-1 on page 3-1) and tap the touch screen LCD.

3.3.1 Status

Status screen 1 (see Figure 3-3) provides information about the current pattern selected. This includes the pattern number and name, gain, speed, spin, shape number and ID, and a preview of the shape currently selected. The **Status** screen can indicate that EBS-530 is not sweeping by displaying the word OFF. When EBS-530 is sweeping, the word OFF will not be displayed.

Press the **Status** button on the front panel (refer to Figure 3-1 on page 3-1) to enter the **Status** screen.

Figure 3-3 Status screen 1
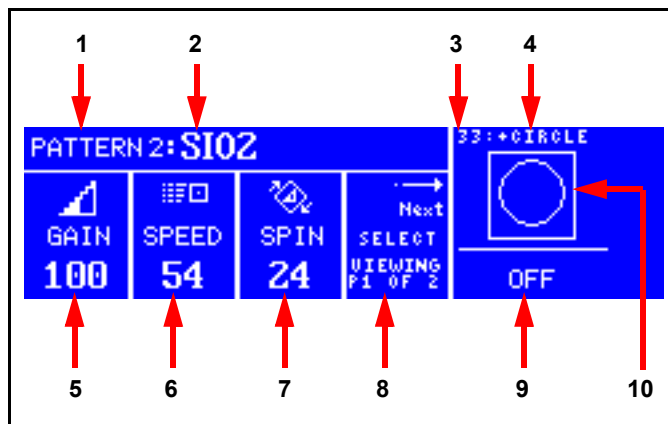
1 **Pattern number**

Displays the active pattern number, 1 to 32.

2 **Pattern name**

Displays the active pattern name, can be assigned by the user (see section 3.3.3 on page 3-10).

3 **Shape number**

Displays user-defined shape number 1 to 32, displays predefined shape numbers as 33 for circle, 34 for line, 35 for figure 8, 36 for dead, and 37 for point.

NOTE: Dead is a shape similar to a point that applies no current to the coils, such as the calibration X and Y offsets, or the pattern offsets. The beam will be positioned the same as when sweeping is disabled. Dead can be used to satisfy interlocks connected to a high voltage power supply to turn off when sweeping is disabled.

4 Shape ID

Displays a user-defined alphanumeric identifier or the fixed name of a predefined shape (+CIRCLE, +LINE, +FIG 8, +DEAD,+POINT) (see section 3.3.6 on page 3-20).

5 Gain

Displays power/size of the pattern (0 to 110%).

6 Shape Speed

Displays number of milliseconds the e-beam takes to complete one shape. Speed is dependent on the shape and the number of points in the shape.

7 Spin Speed

Displays shape rotation in revolutions per minute. Spin is dependent on the shape and the number of points in the shape.

8 Next

Tap **Next** or the right-half of **Select** on the LCD to enter the second **Status** screen (see Figure 3-4).

9 Status Messages (OFF/Local Standby)

OFF is displayed to indicate sweeping is off. OFF is not displayed when sweeping is on. Local Standby is displayed to indicate that the interlock input (refer to section 2.3 on page 2-7) has not been satisfied. (See section 6.2 on page 6-2, for additional status messages.)

10 Shape Preview

Displays a visual representation of the shape currently selected.

Status screen 2 retains pattern number and name, shape number and ID, and a preview of the shape currently selected from **Status** screen 1 (see Figure 3-3).

NOTE: The large pattern indicates sweeping is enabled. If spin is on, the pattern is animated in rotational motion. If sweeping is disabled, the Shape Preview pane will contain status messages.

In addition, **Status** screen 2 provides information on power profile and X and Y offset.

Figure 3-4 Status screen 2
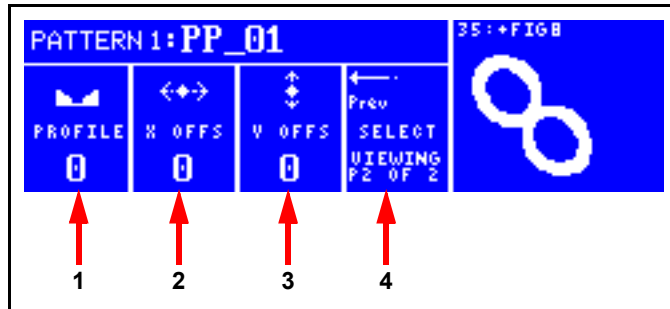
1 **Profile**

Displays power distribution from the center to the outside edge of the crucible. Default setting is 0.

2 **X Offset**

Displays offset of the pattern along the X-axis.

3 **Y Offset**

Displays offset of the pattern along the Y-axis.

4 **Previous**

Tap **Prev** or left-half of **Select** on the LCD to display the **Status** screen 1 (refer to Figure 3-3).

3.3.1.1 Changing a Pattern Parameter while Sweeping

Tap the parameter name on the LCD or click the selection buttons on the handheld sweep remote to select a parameter and display arrows that will allow the value of the selected parameter to be incremented or decremented while sweeping (see Figure 3-5).

Figure 3-5 Status screen 1 while sweeping
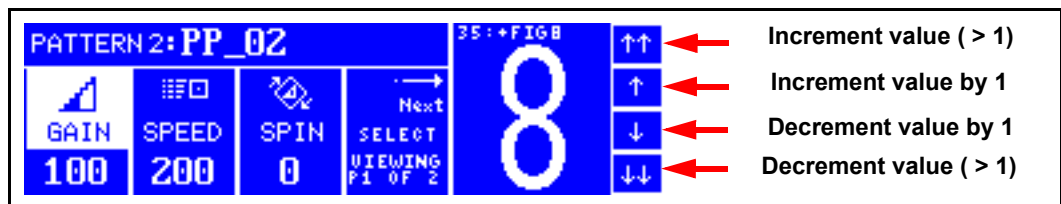
Tap the arrows on the LCD or press and hold the trigger button while rotating the trackball on the handheld sweep remote to edit the value.

3.3.1.2 Selecting a Pattern

Tap the pattern number on the LCD to display arrows that will allow the selection of another pattern as the local active pattern (see Figure 3-6).

NOTE: If remote mode is enabled, the active pattern cannot be selected from the front panel.

Figure 3-6 Status screen with pattern number selected
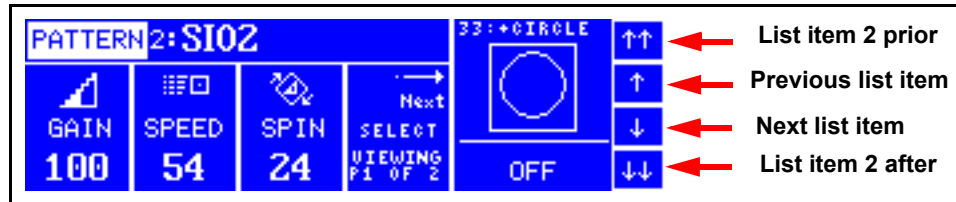
Tap the arrows on the LCD to display another pattern stored in the list of existing patterns. Holding down an arrow will continuously increment or decrement the value until a lower or upper limit is reached.

NOTE: See section 3.3.3 on page 3-10 to edit patterns or create new patterns.

3.3.1.3 Selecting a Shape

Tap the shape number on the LCD to display arrows that will allow the selection of another shape to be associated with the active pattern (see Figure 3-7).

Figure 3-7 Status screen with shape number selected
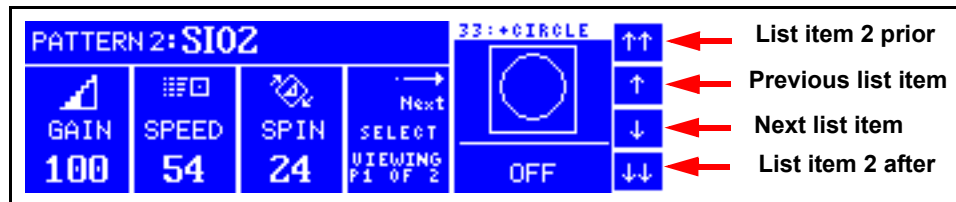
Tap the arrow keys on the LCD to display another shape stored in the list of existing shapes.

NOTE: See section 3.3.6 on page 3-20 to edit shapes or create new shapes.

3.3.2 Main Menu

Press the **Menu** button on the front panel (refer to Figure 3-1 on page 3-1) to exit the **Status** screen and display the **Main Menu** screen (see Figure 3-8).

Figure 3-8 Main Menu screen

Tap the name of the submenu on the LCD to display the selected screen.

- ◆ **Edit Pattern** screen (see section 3.3.3)

- ◆ **Calibrate** screen (see section 3.3.4 on page 3-12)

- ◆ **System Configuration** screen (see section 3.3.5 on page 3-17)

- ◆ **Edit Shape** screen (see section 3.3.6 on page 3-20)

- ◆ **Manual Mode** screen (see section 3.3.7 on page 3-25)

- ◆ **Diagnostic** screen (see section 3.3.8 on page 3-26)

Press the **Status** button on the front panel (refer to Figure 3-1 on page 3-1) to exit the **Main Menu** screen and display the last **Status** screen viewed.

3.3.3 Edit Pattern

From the **Main Menu** screen (refer to section 3.3.2), tap **Edit Pattern** on the LCD to edit an existing pattern or to create new patterns.

The **Edit Pattern** screen provides information about the pattern selected for editing (see Figure 3-9). This includes the menu path, the pattern number selected for editing, the active pattern number, and the calibration value for the pattern currently selected for editing.

NOTE: Changes to the edit pattern will have an immediate effect on the sweep if the active pattern number is the same as the edit pattern number.

Figure 3-9 Edit Pattern screen
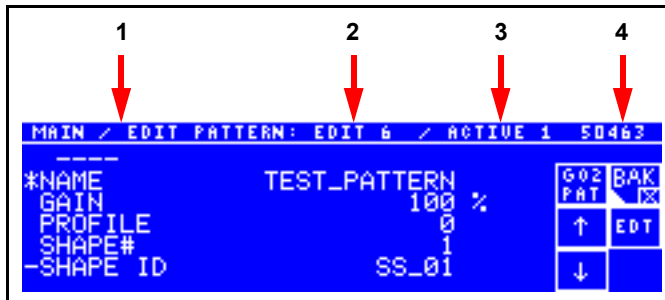
1 Menu Path

Displays the menu navigation to access the **Edit Pattern** screen.

2 Pattern Selected for Edit

Displays the pattern number of the pattern selected for editing. To select a different pattern for editing, tap **GO2 PAT** on the LCD and select pattern 1 to 32 using the number pad on the following screen. Tap **ENT** to display the new selection on the **Edit Pattern** screen or **BAK** to return to the **Edit Pattern** screen for the previously selected pattern.

3 Active Pattern

Displays the pattern number of the active pattern selected and displayed on the **Status** screen (refer to section 3.3.1 on page 3-5).

4 Pattern CRC Checksum

Displays the CRC checksum for the pattern selected for editing. This value is determined by the value of all the parameters for the pattern except the name. It is used to determine the contents of a pattern parameters. A change to any parameter of a pattern will result in a different CRC value.

The following pattern parameters are displayed on the **Edit Pattern** screen:

Name . . . . Up to 16 characters

Identifier for the pattern. Only the first 11 to 12 characters of the pattern name are displayed on the **Status** screen.

NOTE: Name is not used to calculate the pattern CRC checksum.

Gain . . . . 0 to 110%

Power/size of the pattern. 100% is full size.

Profile . . . . -10 to 10

Power distribution from the center to the outside edge of the crucible. Positive numbers bias the power toward the outside edge, negative numbers bias the power toward the center. This parameter is used to control tunneling. Default setting is 0 (no power distribution changes).

Shape # . . . . 1 to 37

Identifier for the shape used for the pattern. The shape can be a user-defined shape (1 to 32) or one of the predefined shapes (33 to 37).

Shape ID . . . . Available for editing user shapes 1 to 32 on the **Edit Shape** screen (see section 3.3.6 on page 3-20).

A user-defined alphanumeric identifier or the fixed name of a predefined shape (+CIRCLE, +LINE, +FIG 8, +DEAD,+POINT).

Speed. . . . . 0 to 1000 milliseconds

Number of milliseconds the e-beam takes to complete one shape.

Spin . . . . 0 to 1000 revolutions per minute

Controls the speed of shape rotation.

Tilt . . . . 0 to 359 degrees

Angular orientation of the shape.

Pat: X Offset . . . . -120 to 120

Pattern offset along the X-axis.

Pat: Y Offset . . . . -120 to 120

Pattern offset along the Y-axis.

3.3.3.1 Editing a Pattern Parameter

1 Tap the arrows on the LCD to select a parameter.

>   **NOTE:** The asterisk (✳) indicates the currently selected parameter.

2 Tap **EDT** on the LCD to edit the selected parameter. The next screen will display the value range for the parameter.

3 Tap **CHG** on the LCD to edit the value.

4 Enter the new value using the LCD numeric or alphanumeric keypad.

5 Tap **ENT** to save the changes and return to the **Edit Pattern** value range screen.

>   **NOTE:** Tap **BAK** to return to the **Edit Pattern** value range screen without saving changes.

6 Tap **BAK** to return to the **Edit Pattern** screen.

3.3.4 Calibrate

From the **Main Menu** screen (refer to section 3.3.2 on page 3-9), tap **Calibrate** on the LCD to calibrate EBS-530 with the e-beam source.

⚠️ **WARNING**

>   **During calibration, normal sweeper usage is interrupted.**

The **Calibrate** screen provides calibration for distortion and orientation (see Figure 3-10). The distortion adjustment is used to compensate for non-uniformities in the magnetic field of the e-beam source. The orientation adjustment is used to center the shape and adjust the angular orientation of the shape to account for variations between the vacuum system and the EBS-530 display. If orientation is properly calibrated, the shape displayed on the **Status** screen (refer to section 3.3.1 on page 3-5) will be consistent with the shape swept into the deposition material inside the vacuum chamber.

NOTE: The sweeper operation must be on prior to calibration.

Figure 3-10 Calibrate screen
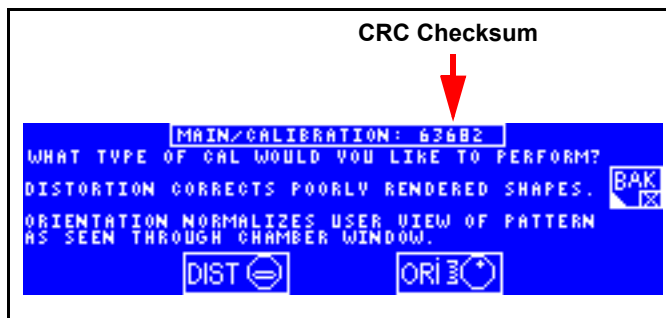
CRC Checksum . . . . A CRC checksum of current calibration values. This value can be used to determine if a different calibration has occurred since the last process was run.

> **NOTE:** Default is set to 63682.

Distortion . . . . Tap **DIST** to compensate for non-uniformities in the magnetic field of an e-beam source (see section 3.3.4.1).

Orientation . . . . Tap **ORI** to center the shape and adjust the angular orientation of the shape to account for variations between the vacuum system and the EBS-530 display (see section 3.3.4.2 on page 3-16).

Back. . . . . Tap **BAK** to return to the previous screen.

Press the **Status** button on the front panel (refer to Figure 3-1 on page 3-1) to exit the **Calibrate** screen and display the **Status** screen.

3.3.4.1 Distortion

From the **Calibrate** screen (refer to section 3.3.4), tap **DIST** on the LCD to begin calibrating distortion. Distortion calibrates EBS-530 to account for variations in the magnetic field of the e-beam source. Follow the steps below for distortion calibration.

1 Read and accept the warning message.

   Distortion Calibration screen 1 displays a warning message that during calibration, normal sweeper usage is interrupted (see Figure 3-11).

Figure 3-11 Distortion Calibration screen 1
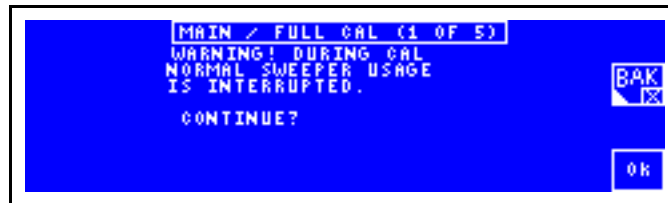
Tap **OK** to accept this message and continue. Tap **BAK** to return to the previous screen.

2 Center the e-beam in the crucible.

Distortion Calibration screen 2 allows the user to center the e-beam in the crucible containing the deposition material (see Figure 3-12).

Figure 3-12 Distortion Calibration screen 2

⚠ **WARNING - Risk Of Electric Shock**

Refer to the high voltage power supply manual for recommendations and safety precautions pertinent to adjustment.

Tap the arrows on the LCD to adjust X and Y offset until the e-beam is centered in the crucible. Tap **OK** to continue. Tap **BAK** to return to the previous screen.

3 Adjust the gain.

Distortion Calibration screen 3 allows the user to calibrate the gain to expose the e-beam to the greatest amount of deposition material within the constraints of the crucible (see Figure 3-13).

Figure 3-13 Distortion Calibration screen 3
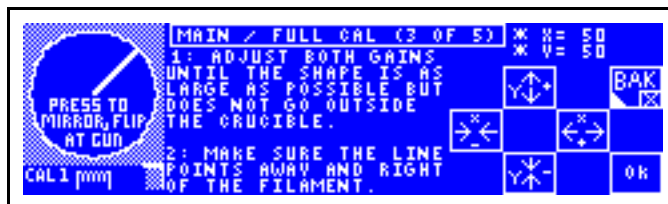
Tap the arrows to increment or decrement the gain of the e-beam in both the X and Y directions to stretch or compress the shape to a size that is within the constraints of the crucible. This will ensure maximum e-beam exposure to the deposition material in the crucible.

NOTE: Changes to calibration values on this screen will affect calibrations previously performed on Distortion Calibration screens 4 and 5. Recalibration on screens 4 and 5 is required.

⚠ **CAUTION**

Do not allow the e-beam to travel beyond the constraints of the crucible.

PN 074-622-P1B

Tap **PRESS TO MIRROR, FLIP AT GUN** to invert the polarity and match the orientation of the e-beam to the visual representation on **Distortion Calibration** screen 3. Tap **OK** to continue. Tap **BAK** to return to the previous screen.

4 Adjust the size of the shape.

Distortion Calibration screen 4 allows the user to adjust the size of the shape to account for variations in the magnetic field of the e-beam source (see Figure 3-14).

NOTE: This calibration step is typically only necessary for large crucibles.

Figure 3-14 Distortion Calibration screen 4
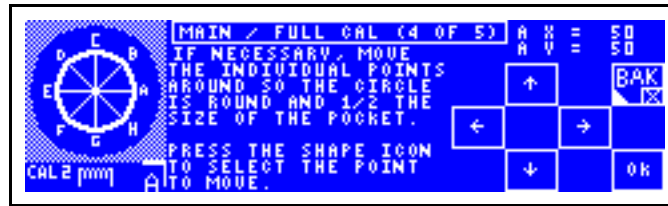
Tap the circle on the left side of the screen to cycle alphabetically through each point on the circle (A through H). The current point selection is shown on the bottom left side of the screen. Tap the arrows to adjust the location of the selected point, then tap the circle to select the next point. Adjust each point until the circle is uniform and approximately half the diameter of the crucible. Do not tap **OK** until all points are calibrated. When all points are calibrated, tap **OK** to continue. Tap **BAK** to return to the previous screen.

5 Adjust the edges of the shape.

Distortion Calibration screen 5 allows the user to adjust the locations of the edges of the shape to expose the e-beam to the greatest amount of deposition material within the constraints of the crucible (see Figure 3-15).

Figure 3-15 Distortion Calibration screen 5
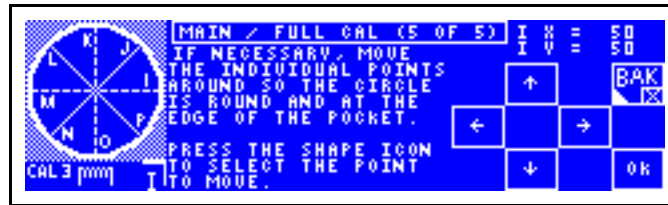
Tap the circle on the left side of the screen to cycle alphabetically through each point on the circle (I through P). The current point selection is shown on the bottom left side of the screen. Tap the arrows to adjust the location of the selected point, then tap the circle to select the next point. Adjust each point until the circle is uniform and approximately the same diameter as, but still within the constraints of, the crucible. This will ensure maximum e-beam exposure to the deposition material in the crucible. Do not tap **OK** until all points are calibrated.

If a clipping error message is displayed, the current needed exceeds the maximum set in the system configuration (see section 3.3.5 for information on adjusting the maximum current).

NOTE: If the e-beam source does not allow a higher value, it may not be possible to sweep the entire crucible.

⚠ **CAUTION**

Refer to the e-beam source manual for the recommended current of the X and Y coils.

Tap **OK** to complete distortion calibration and return to the **Main Menu** screen. Tap **BAK** to return to the previous screen.

3.3.4.2 Orientation

The **Orientation Calibration** screen allows the user to center the shape and adjust the angular orientation to account for variations between the vacuum system and the EBS-530 display (see Figure 3-16). This adjustment also allows compensation for different e-beam source architectures.

NOTE: For best results, verify the shape of the e-beam in the vacuum chamber during orientation calibration.

Figure 3-16 Orientation Calibration screen
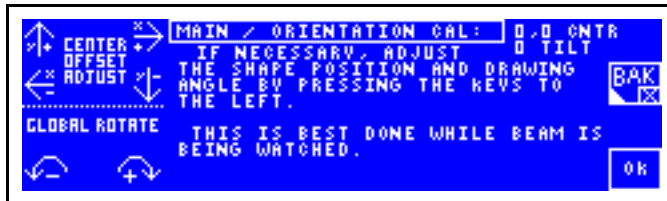
Tap the **Center Offset Adjust** arrows on the LCD to adjust X and Y offset until the shape is centered in the crucible.

Tap the Global Rotate arrows to adjust the angular orientation of the shape until the shape is centered in the crucible.

Tap **OK** to return to the **Main Menu** screen. Tap **BAK** to return to the previous screen.

3.3.5 System Configuration

⚠ **CAUTION**

> **Proper fuse selection is crucial to avoid safety hazards or damage to the e-beam source.**
>
> **Refer to the e-beam source manual for the recommended fuse rating of the e-beam source.**
>
> **Before operating EBS-530, the proper fuses must be installed, and the maximum currents for the e-beam source coils must be programmed on the System Configuration screen.**
>
> **Refer to the e-beam source manual for the recommended current of the X and Y coils.**
>
> **EBS-530 can operate with a maximum output current of 5 A for the X coil and 5 A for the Y coil.**

From the **Main Menu** screen (refer to section 3.3.2), tap **System Config** to display the **System Configuration** screen.

The **System Configuration** screen provides adjustable parameters to configure general EBS-530 operation as well as configure EBS-530 with the e-beam source (see Figure 3-17). The menu path and system configuration CRC checksum are also displayed.

EBS-530 offers three available locks to prevent unauthorized or inadvertent modification of process parameters.

Figure 3-17 System Configuration screen
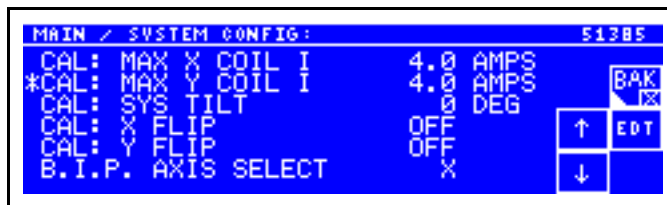
The following system parameters are displayed on the **System Configuration** screen:

System Lock Code . . . . 0 to 9999

Prevents editing of the **System Configuration** screen, **Calibrate** screen, pattern and shape parameters.

XXXX is displayed on the **System Configuration** screen if a non-zero lock code is entered.

Pattern Lock Code . . . . 0 to 9999

Prevents editing of pattern and shape parameters.

If there is a system lock code stored, that code must be entered to unlock the **System Configuration** screen to allow access to the pattern lock value.

Run Screen Locked . . . . 1 (off), 2 (On)

Prevents editing of the parameters on the **Status** screen during operation.

LCD Contrast . . . . 1 to 10

Adjusts the appearance of the LCD.

Keyboard Beep . . . . 1 (off), 2 (On)

Turns the audible beeper on or off.

SMDP Com Address . . . . 16 to 254

Serial communication address for EBS-530. If the SMDP address is 16, EBS-530 uses RS-232 electrical signaling. Otherwise, EBS-530 uses RS-485 signaling (see Chapter 5).

SMDP Net Speed . . . . 1 (Low), 2 (Medium), 3 (High)

Serial communications network speed. EBS-530 performs serial communication using SMDP protocol at a baud rate of 9600 bps for Low speed (1), 38400 bps for Medium speed (2), or 115200 bps for High speed (3).

Cal: X Center . . . . -120 to 120

System offset along the X-axis.

Cal: Y Center . . . . -120 to 120

System offset along the Y-axis.

Cal: Max X Coil I . . . . 0.0 to 5.0 A

Maximum output current for the X coil. Only positive values are able to be entered. Maximum output current has a range of -5.0 to 5.0 A.

NOTE: Refer to the e-beam source manual for the recommended current of the X coil.

Cal: Max Y Coil I . . . . 0.0 to 5.0 A

Maximum output current for the X coil. Only positive values are able to be entered. Maximum output current has a range of -5.0 to 5.0 A.

NOTE: Refer to the e-beam source manual for the recommended current of the Y coil.

Cal: Sys Tilt . . . . 0 to 359 degrees

Angular orientation of all shapes.

Cal: X Flip . . . . On, Off

Inverts the polarity of the maximum output current for the X coil to provide access to the full range of -5.0 to 5.0 A.

Cal: Y Flip . . . . On, Off

Inverts the polarity of the maximum output current for the Y coil to provide access to the full range of -5.0 to 5.0 A.

B.I.P. Axis Select . . . . None, X, Y

The axis (or none) used to reference the current to determine if the e-beam is centered and in pocket. This is used with Relay 3 to activate or deactivate the e-beam (refer to section 2.3.1 on page 2-9).

3.3.5.1 Editing a System Parameter

1 Tap the arrows on the LCD to select a parameter.

  NOTE: The asterisk (✳) indicates the currently selected parameter.

2 Tap **EDT** on the LCD to edit the selected parameter. The next screen will display the value range for the parameter.

3 Tap **CHG** on the LCD to edit the value.

4 Enter the new value using the LCD numeric keypad.

5 Tap **ENT** to save the changes and return to the **System Configuration** value range screen.

  NOTE: Tap **BAK** to return to the **System Configuration** value range screen without saving changes.

6 Tap **BAK** to return to the **System Configuration** screen.

3.3.6 Edit Shape

From the **Main Menu** screen (refer to section 3.3.2 on page 3-9), tap **Edit Shape** on the LCD to edit an existing pattern or to create new patterns.

The **Edit Shape** screen provides information about the shape selected for editing (see Figure 3-18). This includes the shape number and ID of the shape selected for editing, the active shape number, and X/Y points assigned for the selected shape.

Figure 3-18 Edit Shape screen
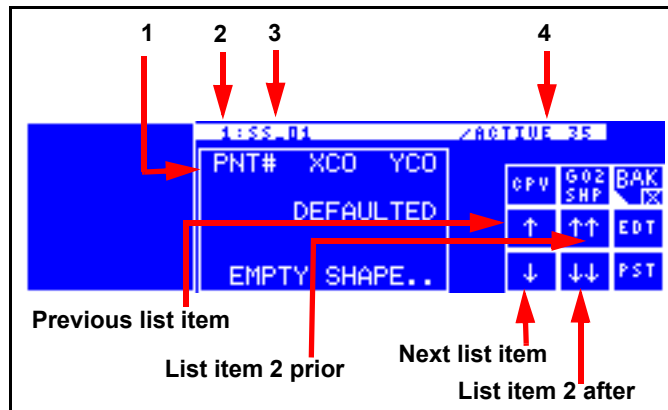
1 **X/Y Points**

Point numbers (PNT#) are displayed for the selected shape. Points are composed of X coordinate (XCO) and Y coordinate (YCO).

NOTE: If the shape has not been defined, **EMPTY SHAPE..** will be displayed. If the shape has been cleared, **DEFAULTED** will display.

2 **Shape Number**

Displays the shape number of the shape selected for editing. To select a different shape for editing, tap **GO2 SHP** on the LCD and select shape 1 to 32 using the number pad on the following screen. Tap **ENT** to display the new selection on the **Edit Shape** screen or **BAK** to return to the **Edit Shape** screen for the previously selected pattern.

3 **Shape ID**

Displays the alphanumeric identifier of the shape selected for editing. Tap the shape ID and then tap **EDT** to edit the shape ID of the selected shape. Use the on-screen keyboard to enter the new shape ID and then tap **ENT** to save.

4 **Active Shape Number**

Displays the shape number of the active shape selected and displayed on the **Status** screen (refer to section 3.3.1 on page 3-5).

3.3.6.1 Copy and Paste a Shape

Use the following procedure to copy and paste a shape as a new shape number:

1 Tap **CPY** on the LCD to copy the currently selected shape.

2 Tap **GO2 SHP** on the LCD and use the number pad on the touch screen LCD to enter the shape number of the shape to be edited and tap **ENT** to display the shape. Tap **BAK** to return to the **Edit Shape** screen without saving changes.

3 Tap **PST** on the LCD. Confirm the paste by tapping **PST YES**. Coordinate values for the selected shape will be overwritten with the values of the copied shape. Tap **PST NO** or **BAK** to abort the paste.

3.3.6.2 Creating or Editing a Shape

1 Select a shape number with or without existing points (refer to for information on selecting a shape number).

2 Tap in the Point Box and then tap **EDT** to add or edit points (see).

Figure 3-19 Edit Shape screen-edit point box
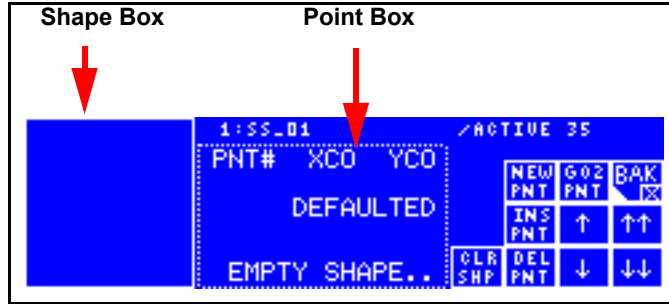
The point marker (›) indicates the selected point. Tap the single up/down arrows to rotate through points sequentially. Tap the double up/down arrows to quickly rotate through points. The following options are available to edit points:

New Pnt . . . . Tap to insert a new point (0,0) at the end of the list of points, where XCO is 0 and YCO is 0.

Ins Pnt . . . . Tap to insert a new point (0,0) above the selected point, where XCO is 0 and YCO is 0. The inserted point becomes the selected point.

Del Pnt . . . . Tap to delete the selected point.

Clr Shp . . . . Tap to clear the selected shape. Confirm by tapping **CLR YES.** Abort by tapping **CLR NO** or **BAK**. **EMPTY SHAPE...** will display.

Go2 Pnt . . . . Tap to use the number pad to move directly to a specific point number.

Bak . . . . Tap to return to the previous screen.

2a Tap in the Shape Box or select the Shape Box using the selection buttons on the handheld sweep remote to add or edit points (see Figure 3-20).

Figure 3-20 Edit Shape screen-edit shape box
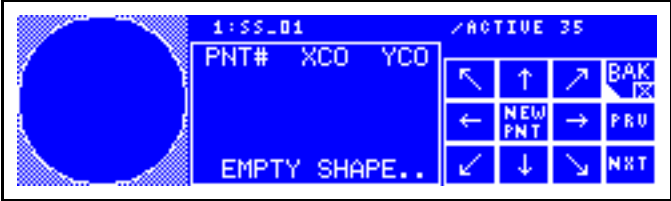
The point marker (›) indicates the selected point on the list. The flashing point indicates the selected point in the Shape Box. The following options are available to edit points from the EBS-530 front panel:

New Pnt . . . . Tap to insert a new point (0,0), where XCO is 0 and YCO is 0, if it is the first point inserted.

Tap to insert a new point at the end of the list. The new point will begin with the same XCO and YCO values as the last point in the list.

Prv . . . . Tap to select the previous point from the list of points.

Nxt . . . . Tap to select the next point from the list of points.

Bak . . . . Tap to return to the previous screen.

The point marker (›) indicates the selected point on the list. The flashing point indicates the selected point in the Shape Box. The following options are available to edit points with the handheld sweep remote:

Add a New Point . . . . With the Shape Box selected, press the selection button while holding the trigger button.

Move a Point . . . . With the Shape Box selected, press and hold the trigger button while rotating the trackball.

Select Another Point . . . . With the Point Box selected, rotate the trackball to select a new point.

NOTE: Pressing the selection button alone will toggle between the Shape Box and Point Box

3 Tap in the Shape Box to determine the position of existing points (see Figure 3-21).

Figure 3-21 Edit Shape screen-edit shape box points
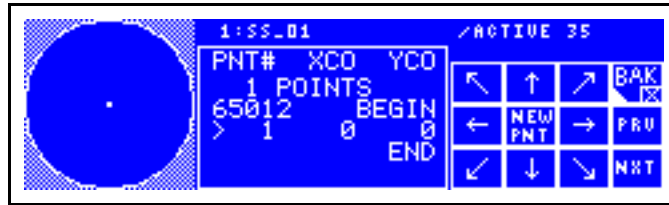
The point marker (›) indicates the selected point on the list. The flashing point indicates the selected point in the Shape Box. The values for the selected point location can be edited by tapping the on-screen arrow keys or by pressing and holding the trigger button while rotating the trackball on the handheld sweep remote.

The Shape Box will display the point in the location chosen, and the Point Box will display values for XCO and YCO correlating to the location of the point (see Figure 3-22).

Figure 3-22 Edit Shape screen-edit shape box position
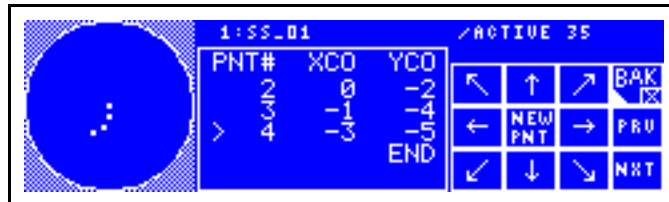
Tap **PRV** or **NXT** to select another point in the shape box, or tap the Point Box and tap the arrows to select a point on the list of points. Using the handheld sweep remote, with the Point Box selected, rotate the trackball to select a new point.

3.3.7 Manual Mode

From the **Main Menu** screen (refer to section 3.3.2 on page 3-9), tap **Manual Mode** on the LCD to enter manual e-beam positioning.

⚠️ **WARNING**

Programmed EBS-530 operation is interrupted.

Manual mode is available to condition the pocket or to manually adjust the position of the e-beam. Follow the steps below for manual mode.

1 Read and accept the warning message.

Manual Mode screen 1 displays a warning message that during manual mode, normal sweeper usage is interrupted (see Figure 3-23).

Figure 3-23 Manual Mode screen 1
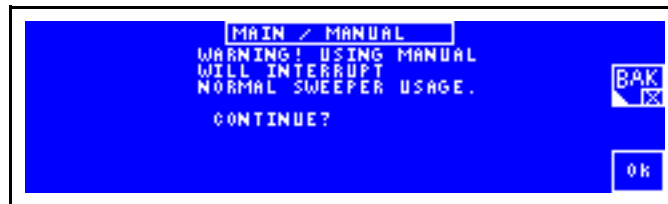
Tap **OK** to accept this message and continue. Tap **BAK** to return to the previous screen.

2 Position the e-beam.

Press **On** on the front panel (refer to section 3.1 on page 3-1) to engage the e-beam sweep.

Manual Mode screen 2 allows the user to position the e-beam in the crucible containing the deposition material (see Figure 3-24).

Figure 3-24 Manual Mode screen 2

Tap the arrows on the LCD to manually adjust the position of the e-beam. The X and Y offset values will be displayed. The handheld sweep remote can also be used to manually adjust the position of the e-beam. Press and hold the trigger button while rotating the trackball (refer to section 3.1.1 on page 3-3 for a description on handheld sweep remote buttons and functions). Tap **BAK** to exit manual mode and return to the **Main Menu** screen.

3.3.8 Diagnostic

From the **Main Menu** screen (refer to section 3.3.2 on page 3-9), tap **Diagnostic** on the LCD to enter the **Diagnostic** screen.

Diagnostic screen 1 displays information useful for troubleshooting (see Figure 3-25). This includes the firmware version number, build number, serial number, and any hardware failure codes.

Figure 3-25 Diagnostic screen 1


```
MAIN / DIAGNOSTICS:
VRSN BSLPB00.13 BUILD 8B94                BAK
SN/BT 00002753/0003                       [X]
BOOTLOADER BUILD 2012
EC: 0,0
H/W FAILCODE: 0
                                          MOR
PAGE 1 OF 3: VERSION INFO
```

VRSN BUILD	Firmware version number and build number (CRC of the firmware)
SN/BT	Serial Number and Build Type
	Serial number is a unique identifier of the unit and the firmware.
	NOTE: The internal serial number is not the same as the unit serial number located on the rear panel.
	Build type is an internal identifier programmed into the unit during manufacturing.
Bootloader Build	Bootloader identifier
EC	Error Code
	Troubleshooting code. Properly working units have 0,0 displayed.
	NOTE: To clear error codes, tap the upper and lower left of **Diagnostic** screen 1 at the same time. An audible beep will be heard, different than tapping one area of the screen. After successfully tapping the two areas, leave the screen and then return, the error code will be cleared.
H/W Failcode.	Hardware Failure Code
	Troubleshooting code. Properly working units have 0 displayed. Contact INFICON if a non-zero number is displayed (refer to section 1.3 on page 1-4).

Tap **MOR** to enter **Diagnostic** screen 2. Tap **BAK** to return to the **Main Menu** screen.

Diagnostic screen 2 displays information necessary when contacting INFICON for technical support (refer to section 1.3, How To Contact INFICON, on page 1-4). This includes the status of the internal power supply, coil line fuses, and output current (see Figure 3-26).

Figure 3-26 Diagnostic screen 2
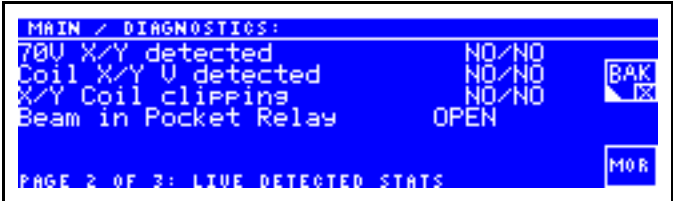
70V X/Y detected . . . . Yes/No (for each X and Y)

Status of internal power supply. No is displayed if sweeper operation is off.

Coil X/Y V detected. . . . . Yes/No (for each X and Y)

Status of X and Y coils. Yes is displayed if voltage is present at the coil output. No is displayed if a coil line fuse is blown, the e-beam source output shorted, or sweeper operation is off.

X/Y Coil clipping . . . . Yes/No (for each X and Y)

Status of X and Y output current. Yes is displayed if the pattern requires a current that is greater than the maximum current setting on the **System Configuration** screen (refer to section 3.3.5 on page 3-17). Yes indicates that the sweeper is clipping the output current to protect the coils. This can be the result of a poorly calibrated system (refer to section 3.3.4 on page 3-12).

Beam in Pocket Relay . . . . Open/Closed

Describes the state of Relay 3, Pin 13 (refer to section 2.3.1 on page 2-9).

Tap **MOR** to enter **Diagnostic** screen 3. Tap **BAK** to return to the **Main Menu** screen.

Diagnostic screen 3 displays voltage and current status information. This includes X coil output current, Y coil output current, digital I/O drive voltage, digital I/O cathode voltage, and digital I/O common pin voltage.

NOTE: Remote Analog (V) is not functional in EBS-530. There is no external connection.

Figure 3-27 Diagnostic screen 3
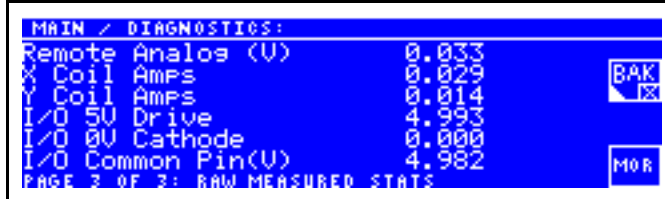
NOTE: The X and Y Coil Amps (output current going through coils) may not show 0 when sweeper is off due to offset in measurement circuitry.

Tap **MOR** to display **Diagnostic** screen 1. Tap **BAK** to return to the **Main Menu** screen.

INFICON

Chapter 4
Software

4.1 Introduction

EBS-530 is capable of RS-232 and RS-485 serial communication. To connect EBS-530 to a computer via RS-232, use the serial cable included in the ship kit, PN 783-506-170-P1.

EBS-530 can be programmed offline and the offline settings can be saved. EBS-530 supports Sycon Multi-Drop Protocol (SMDP) for faster communication, and multiple instruments on the same RS-485 link (see Chapter 5).

To use INFICON EBS-530 PatternMaker software, first install the SMDP Server and LabVIEW Run-Time engine (see section 4.2.1), and then install the INFICON EBS-530 PatternMaker software (see section 4.2.2).

4.2 Installing INFICON EBS-530 PatternMaker Software

INFICON EBS-530 PatternMaker software supports one EBS-530.

4.2.1 Installing the SMDP Server

1 Insert the **Thin Film Manuals CD** into the CD drive of the computer that will be connected to EBS-530.

2 Click **Windows Explorer** or **File Explorer >> Computer >> (CD drive letter:) >> Common Software**.

3 Double click **setup_smdp_svr_lv.exe**. The **Zip Self-Extractor** window will display.

4 Click **Unzip**. The **SMDP Serial Protocol Server** window will display.

5 On the **Destination Directory** pane, click **Browse** to select the location all software will be installed, or use the default location.

6 Click **Next**.

7 Read the license agreement.

8 Click **I accept License Agreement(s)**.

9 Click **Next**.

10 Review the summary of information.

11 Click **Next**. **Installation Complete** will display.

12 Click **Next**. The **Setup Wizard** pane will display.

13 Click **Next**. The **Confirm Installation** pane will display.

14 Click **Next**.

15 Read the license agreement.

16 Click **I Agree**.

17 Click **Next**. **Installation Complete** will display.

18 Click **Close**.

19 Click **Close** on the **Zip Self-Extractor**.

4.2.2 Installing INFICON EBS-530 PatternMaker Software

1 Insert the **Thin Film Manuals CD** into the CD drive of the computer that will be connected to EBS-530.

2 Click **Windows Explorer** or **File Explorer >> Computer >> (CD drive letter:) >> EBS-530 >> TOOLS >> PatternMaker**.

3 Double click **setup_INFICON_patnmake.exe**. The **Zip Self-Extractor** window will display.

4 Click **Unzip**. The **INFICON PatnMake** window will display.

5 On the **Destination Directory** pane, click **Browse** to select the location all software will be installed, or use the default location.

6 Click **Next**.

7 Review the summary of information.

8 Click **Next**. **Installation Complete** will display.

9 Click **Finish**.

4.2.3 Starting INFICON EBS-530 PatternMaker Software

4.2.3.1 Starting the Software in Windows XP or Windows 7

1 Click **Start >> All Programs >> INFICON >> PatnMaker**.

2 The **PatnMake.vi** window will display (see Figure 4-1).

Figure 4-1 EBS-530 PatnMake.vi initial display
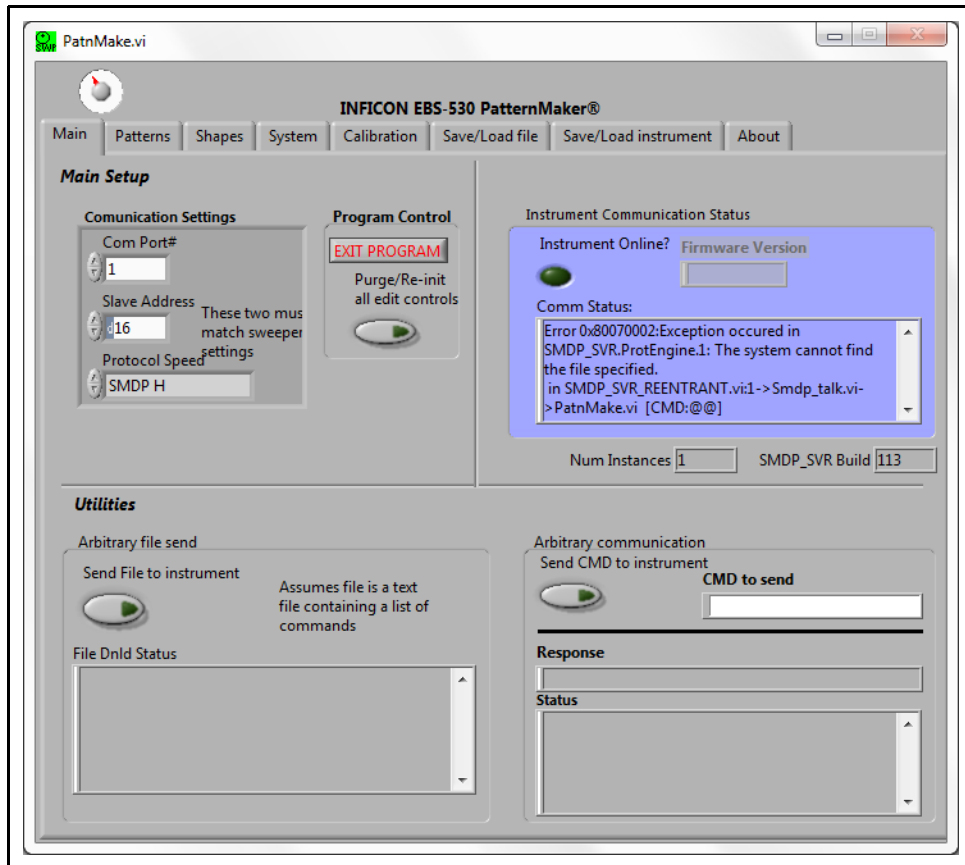
4.2.3.2 Starting the Software in Windows 8

1 In the **Start** window, click the **INFICON EBS-530 PatternMaker** icon.

2 If the icon cannot be found:

2a Click **Search >> Apps**.

2b Type **PatnMaker** in the **Search** text box.

2c Click the **INFICON EBS-530 PatternMaker** icon.

4.3 INFICON EBS-530 PatternMaker

Figure 4-2 EBS-530 PatnMake.vi
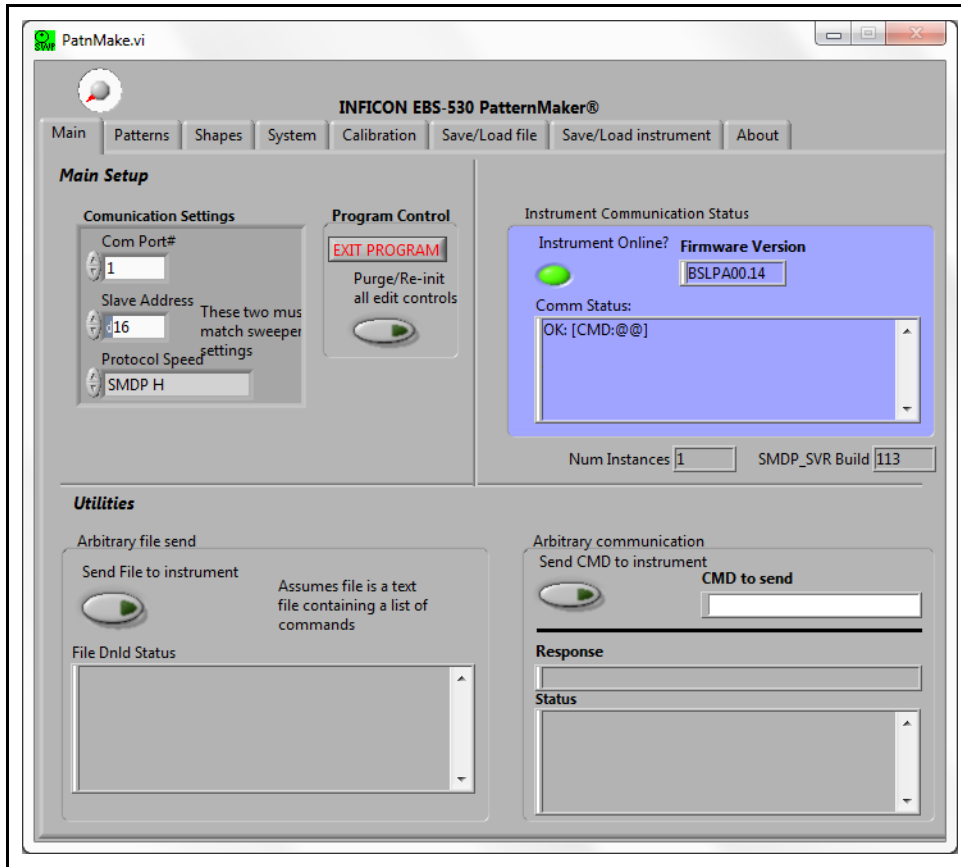
- ◆ **Main** tab (see section 4.3.1)

- ◆ **Patterns** tab (see section 4.3.2 on page 4-8)

- ◆ **Shapes** tab (see section 4.3.3 on page 4-11)

- ◆ **System** tab (see section 4.3.4 on page 4-16)

- ◆ **Calibration** tab (see section 4.3.5 on page 4-20)

- ◆ **Save/Load file** tab (see section 4.3.6 on page 4-23)

- ◆ **Save/Load instrument** tab (see section 4.3.7 on page 4-24)

- ◆ **About** tab (see section 4.3.8 on page 4-26)

4.3.1 Main Tab

Communication and utilities are accessed on the **Main** tab (refer to Figure 4-2).

NOTE: Right-clicking on a value, parameter, or control button and then clicking **Description and Tip** may display additional information about that value or parameter.

4.3.1.1 Main Setup Pane

Communication Settings

Com Port# . . . . 1 to 255

Sets the communications port that EBS-530 is communicating through on a Windows computer. A fixed port or a USB serial adapter can be used.

Slave Address. . . . . 16 to 254

SMDP address the software will use for serial communication with EBS-530.

If the SMDP address is 16, EBS-530 uses RS-232 electrical signaling. Otherwise, EBS-530 uses RS-485 signaling (see Chapter 5).

This value must match the SMDP Address setting on the System Configuration screen of EBS-530 (refer to section 3.3.5 on page 3-17).

Protocol Speed . . . . SMDP L (9.6 kbps), SMDP M (38.4 kbps), SMDP H (115.2 kbps).

Adjustable baud rate.

NOTE: All RS-485 connected instruments must have the same baud rate.

This value must match the Comm Protocol setting on the System Configuration screen of EBS-530 (refer to section 3.3.5 on page 3-17).

Program Control

Exit Program . . . . Click to safely stop communications and exit the software program.

NOTE: Save parameters prior to exiting (see section 4.3.6 on page 4-23).

Purge/Re-Init all edit controls . . . . Returns all parameters edited using the software to default values.

Instrument Communication Status

Instrument Online? . . . . Indicator to display communication status. With established communication, the indicator will illuminate a light green color. Without established communication, the indicator will illuminate a dark green color (see Figure 4-3).

Figure 4-3 Instrument online indicator
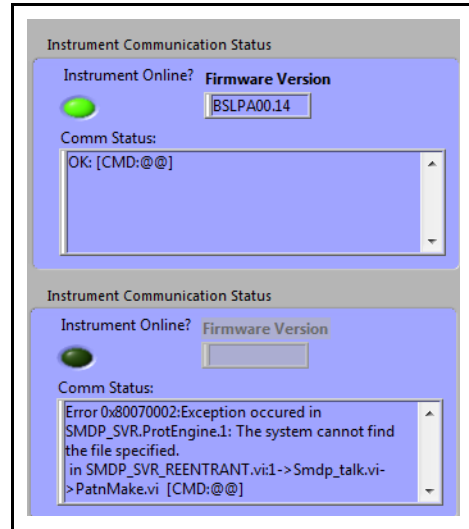
Firmware Version . . . . Displays the firmware version of the connected EBS-530.

Comm Status: . . . . Displays communications error messages. If communications have been established without error, **OK: [CMD:@@]** will be displayed.

Num Instances . . . . Shows number of Windows applications using the SMDP Server. SMDP server can support multiple applications using the same or multiple ports. Each application that connects to the SMDP Server uses an instance.

SMDP_SVR Build . . . . Build or version ID of the communication server.

4.3.1.2 Utilities Pane

Arbitrary file send

Send File to instrument . . . . Selects a parameter file (*.PPF) to send to EBS-530.

File Dnld Status . . . . Displays status of file download to EBS-530. Error messages and comments will be displayed after a file is selected for transmission. The error log displays the most recent status/error or comment at the top of the list. Earlier messages are at the bottom of the list.

Arbitrary communication

Send CMD to instrument . . . . Click to send remote command.

CMD to send . . . . Enter command in the **CMD to send** box (see) for remote serial communications commands.

Response . . . . Receives the reply from the command sent.

Status . . . . Displays communications error messages. **OK: [CMD:@@]** or the command that was sent will be displayed with established communications without error.

4.3.2 Patterns Tab

Figure 4-4 Patterns tab
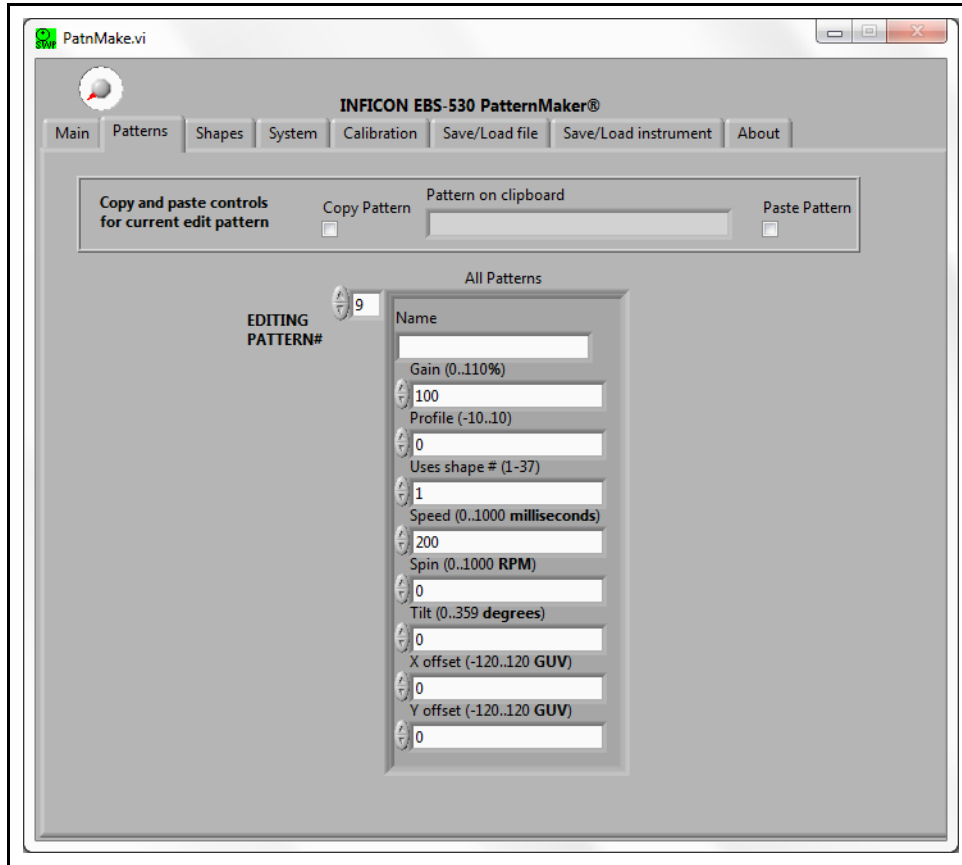
NOTE: Right-clicking on a value or parameter and then clicking **Description and Tip** may display additional information about that value or parameter.

Copy and paste controls for current edit pattern pane

Copy Pattern. . . . . Click to copy the parameter values for the current pattern number displayed and place the parameter values on the clipboard.

Pattern on clipboard . . . . Displays the pattern number and name that has been copied and is in queue.

Paste Pattern . . . . Click to paste the pattern parameters for the displayed pattern in the pattern on clipboard box onto the current pattern parameters displayed, thereby replacing the values for the current pattern.

All Patterns pane

Use the spin box to increment or decrement the values for each of the parameters listed below or enter numeric values.

EDITING PATTERN#. . . . . 1 to 32

Name . . . . Up to 16 characters

> Alphanumeric identifier for the pattern.

> Only the first 11 to 12 characters of the pattern name are displayed on the **Status** screen of EBS-530 (dependent on the characters used).

Gain . . . . 0 to 110%

> Power/size of the pattern. 100% is full size.

Profile . . . . -10 to 10

> Power distribution from the center to the outside edge of the crucible. Positive numbers bias the power toward the outside edge, negative numbers bias the power toward the center. This parameter is used to control tunneling. Default setting is 0 (no power distribution changes).

Uses shape # . . . . 1 to 37

> Identifier for the shape used for the pattern. The shape can be a user-defined shape (1 to 32), or one of the predefined shapes (33 to 37).

Speed . . . . 0 to 1000 milliseconds

Number of milliseconds the e-beam takes to complete one shape.

NOTE: This parameter is adjusted automatically in EBS530 and may result in a value that is different from the value entered in the **Patterns** tab. Sweep using the pattern in the e-beam system to confirm the values and then upload and save the actual parameter settings (see section 4.3.7 on page 4-24).

Spin . . . . 0 to 1000 revolutions per minute

Allowable shape rotation.

NOTE: This parameter is adjusted automatically in EBS530 and may result in a value that is different from the value entered in the **Patterns** tab. Sweep using the pattern in the e-beam system to confirm the values and then upload and save the actual parameter settings (see section 4.3.7 on page 4-24).

Tilt . . . . 0 to 359 degrees

Angular orientation of the shape.

X Offset . . . . -120 to 120

Pattern offset along the X-axis.

Y Offset . . . . -120 to 120

Pattern offset along the Y-axis.

4.3.3 Shapes Tab

Figure 4-5 Shapes tab
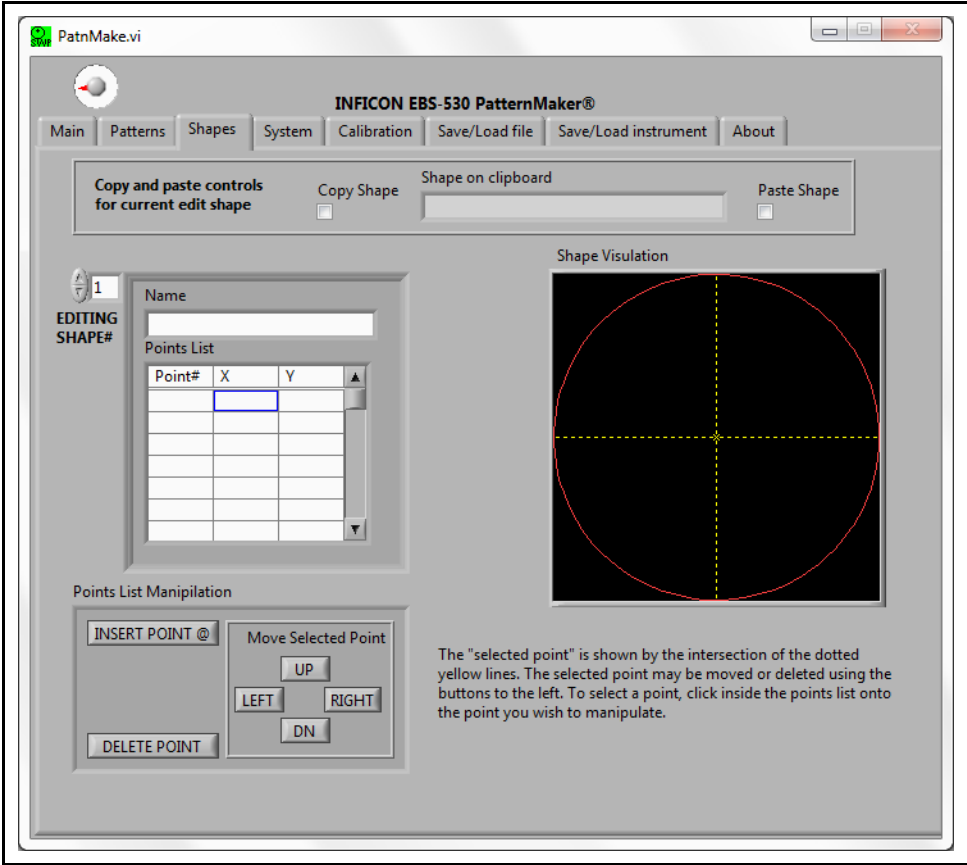
NOTE: Right-clicking on a value or parameter and then clicking **Description and Tip** may display additional information about that value or parameter.

Copy and paste controls for current edit shape pane

Copy Shape. . . . . Click to copy the current shape displayed to the clipboard.

Shape on clipboard . . . . Displays the shape number and name that has been copied to the clipboard.

Paste Shape . . . . Click to paste the parameters for the displayed shape in the **Shape on clipboard** box onto the current shape parameters displayed, thereby replacing the values for the current shape.

Editing Shape pane

EDITING SHAPE# . . . . 1 to 32

Use the spin box to increment or decrement the value or enter the numeric value.

Name . . . . Up to 16 characters

Alphanumeric identifier for the shape.

NOTE: Only the first 8 to 9 characters of the shape name are displayed on the **Status** screen of EBS-530.

Points List

Point# . . . . 1 to 255

Click in the first **Point#** cell and enter the number 1, or click **INSERT POINT @** to insert the origin point, 0,0.

Click in the first empty **Point#** cell to enter the next point number to be added or click **INSERT POINT @** to insert a point at the location specified on the **Shape Visulation** pane.

NOTE: Point numbers can only be entered sequentially.

X . . . . -15 to 15

Click in the **X** cell to enter a value for the X coil offset or to edit an existing value, or click **LEFT** or **RIGHT** to increment or decrement the existing value.

Y . . . . -15 to 15

Click in the **Y** cell to enter a value for the Y coil offset or to edit an existing value, or click **UP** or **DN** to increment or decrement the existing value.

Right-click in the **Point List** table to display the **Points List** menu (see).

Figure 4-6 Points List menu
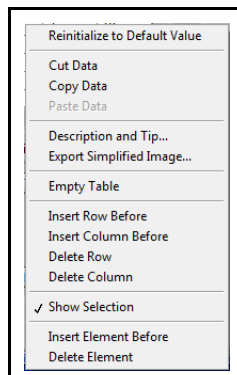
Reinitialize to Default Value . . . . . Clears all cell values.

Cut Data. Click and drag to select **Point#**, **X**, and **Y** values to remove and place on the clipboard. **Point#**, **X**, and **Y** values will move up the list to replace the cut values.

Copy Data . . . . Click and drag to copy **X** and/or **Y** values to the clipboard.

Paste Data. . . . . Click and drag to select **Point#**, **X**, and **Y** values to replace with the values on the clipboard.

                                                       NOTE: The selection size on the table must match the selection size on the clipboard.

Description and Tip . . . . Displays the **Description and Tip** window and provides additional information.

Export Simplified Image . . . . Bitmap, encapsulated postscript, or enhanced metafile of the **Points List** table may be saved to a file.

                                                       NOTE: Export to clipboard is an invalid entry.

Empty Table . . . . Clears all **Point#**, **X**, and **Y** values.

Insert Row Before. . . . . Moves the selected row down one point in the list and displays a row with **X** and **Y** values of 0.

Insert Column Before. . . . . Moves the selected column to the right and displays a column with values of 0.

Delete Row . . . . Removes **Point#**, **X**, and **Y** values of the selected row. **X** and **Y** values will move up one point and the points will be renumbered sequentially.

Delete Column . . . . Moves the selected column and all columns to the right of the selected column to the left and displays a column with values of 0.

Show Selection. . . . . Enables selected cells to be outlined by clicking and dragging the mouse.

Insert Element Before . . . . Clears all **Point#**, **X**, and **Y** values.

Delete Element . . . . Clears all **Point#**, **X**, and **Y** values.

Points List Manipilation pane

INSERT POINT @. . . . . Click to insert a new point into the list of existing points in the **Points List** after the location specified on the **Shape Visulation** pane.

DELETE POINT . . . . Click to delete the selected point (see Figure 4-7).

Figure 4-7 Selected point marker
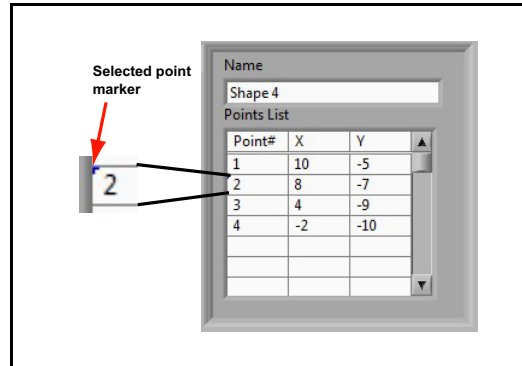
UP . . . . Click to increment the Y offset of the selected point (refer to Figure 4-7) by one. The selected point is also displayed on the **Shape Visulation** pane at the intersection of the dotted lines (refer to Figure 4-5 on page 4-11).

RIGHT . . . . Click to increment the X offset of the selected point (refer to Figure 4-7) by one. The selected point is also displayed on the **Shape Visulation** pane at the intersection of the dotted lines (refer to Figure 4-5 on page 4-11).

DN . . . . Click to decrement the Y offset of the selected point (refer to Figure 4-7) by one. The selected point is also displayed on the **Shape Visulation** pane at the intersection of the dotted lines (refer to Figure 4-5 on page 4-11).

LEFT . . . . Click to decrement the X offset of the selected point (refer to Figure 4-7) by one. The selected point is also displayed on the **Shape Visulation** pane at the intersection of the dotted lines (refer to Figure 4-5 on page 4-11).

Shape Visulation pane

Displays each point on the **Points List** with the selected point displayed at the intersection of the dotted lines.

4.3.3.1 Creating or Editing a Shape

1 Select an **EDITING SHAPE#** with or without existing points (refer to section 4.3.3 for information on selecting a shape number).

2 Enter a shape name in the **Name** box.

> **2a** Enter a **1** in the first **Point#** cell, click **INSERT POINT @** , or enter a value in the **X** and/or **Y** cell to add a new point (refer to Figure 4-5 on page 4-11).
>
> **2b** Click in any **Point#**, **X**, or **Y** cell to select a point to edit and enter a new value or click the buttons in the **Points List Manipilation** pane to edit a selected point (refer to section 4.3.3 on page 4-11).

3 Click **INSERT POINT @** to insert a point after the currently selected point with the same X and Y coordinates as the selected point. The new point overlaps the inserted point on the **Shape Visulation** pane. If the list is empty, a point with X and Y coordinates of (0,0) will be inserted. Refer to step 2b to edit the inserted point. The shape being generated will be displayed in the **Shape Visulation** pane (see Figure 4-8).

Figure 4-8 Generated shape
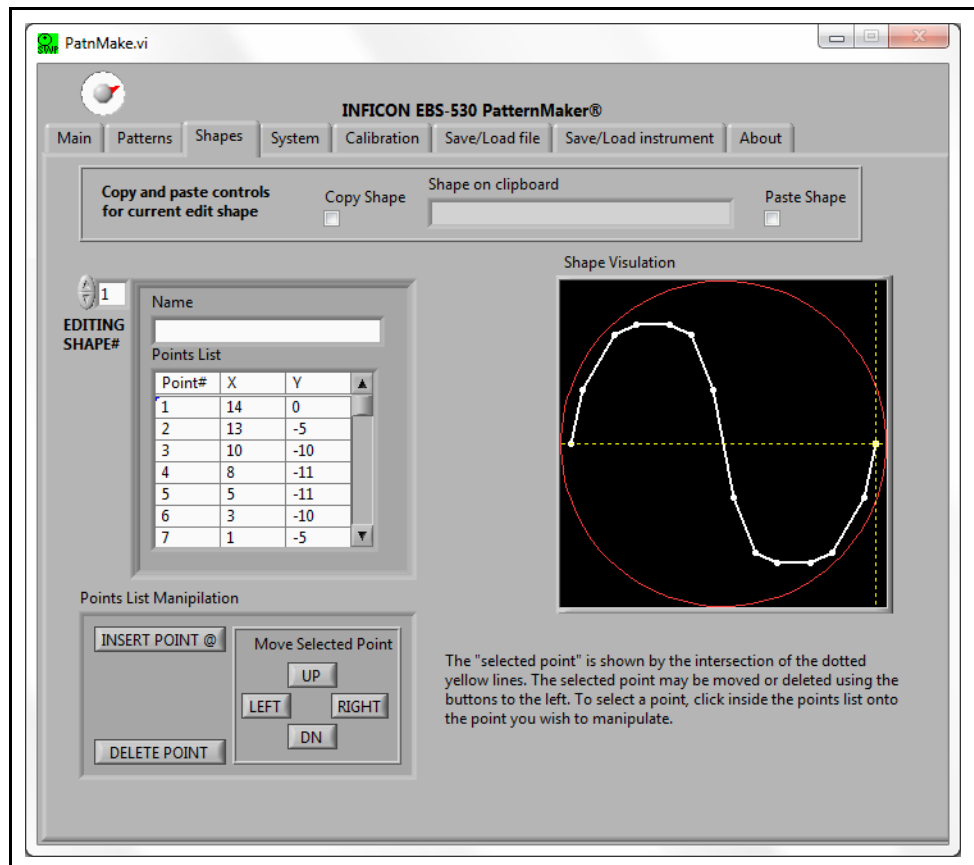
4 Repeat steps 2 and 3 until the complete shape has been generated.

> **4a** Save the shape as a file (see section 4.3.6 on page 4-23).
>
> **4b** Write the shape to the connected EBS-530 (see section 4.3.7 on page 4-24).

4.3.4 System Tab

Figure 4-9 System tab
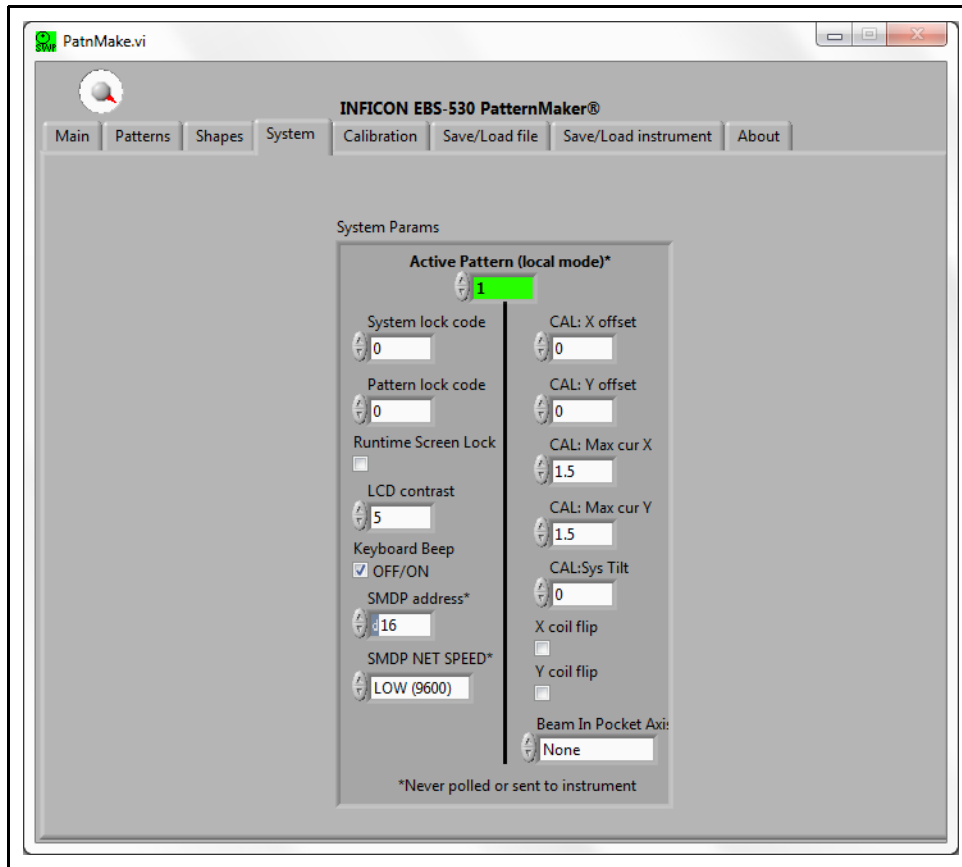
NOTE: Right-clicking on a value or parameter and then clicking **Description and Tip** may display additional information about that value or parameter.

System Params pane

Use the spin box to increment or decrement the values for each of the parameters listed below or enter numeric values. Use the spin box to select SMDP NET SPEED and Beam in Pocket Axis from the list of items. Click to select or clear the Runtime Screen Lock, Keyboard Beep, X coil flip, and Y coil flip.

Active Pattern (local mode)* . . . . . 1 to 32

> **NOTE:** This parameter is neither transmitted to nor received from EBS-530.

System lock code . . . . 0 to 9999

Prevents **System Configuration** screen, **Calibration** screen, pattern and shape parameter editing from EBS-530.

NOTE: When a non-zero system lock code is entered XXXX is displayed on the **System Configuration** screen until unlocked.

Pattern lock code . . . . 0 to 9999

Prevents editing of pattern and shape parameters from EBS-530.

NOTE: If there is a system lock code stored, that code must be entered to unlock the **System Configuration** screen to allow access to the pattern lock value.

Runtime Screen Lock. . . . . Prevents editing of **Status** screen parameters from EBS-530.

LCD Contrast . . . . 1 to 10

Adjusts the appearance of the EBS-530 LCD.

Keyboard Beep . . . . OFF, ON

Turns the audible beeper on the EBS-530 LCD on or off.

SMDP Address . . . . 16 to 254

Serial communication mode for EBS-530. If the SMDP address is 16, EBS-530 uses RS-232 electrical signaling; otherwise EBS-530 uses RS-485 signaling.

NOTE: This parameter is neither transmitted to nor received from EBS-530.

SMDP NET SPEED . . . . LOW (9600), MED (38.4K), HIGH

Serial communications network speed. EBS-530 performs serial communication using SMDP protocol at a baud rate of 9600, 38400, or 115200 bps.

NOTE: This parameter is neither transmitted to nor received from EBS-530.

Tilt . . . . 0 to 359 degrees

Angular orientation of the shape.

CAL: X offset . . . . -120 to 120

System offset along the X-axis. This adjusts the X position of all patterns and is added to the X offset of each individual pattern.

CAL: Y offset . . . . -120 to 120

System offset along the Y-axis. This adjusts the Y position of all patterns and is added to the Y offset of each individual pattern.

Cal: Max cur X . . . . 0.0 to 5.0

Maximum output current for the X coil. Only positive values are able to be entered. Maximum output current has a range of -5.0 to 5.0 A.

NOTE: Refer to the e-beam source manual for the recommended current of the X coil.

Cal: Max cur Y . . . . 0.0 to 5.0

Maximum output current for the Y coil. Only positive values are able to be entered. Maximum output current has a range of -5.0 to 5.0 A.

NOTE: Refer to the e-beam source manual for the recommended current of the Y coil.

Cal: Sys Tilt. . . . . 0 to 359

Angular orientation of all shapes.

X coil flip . . . . Inverts the polarity of the output current for the X coil to reflect around the Y axis to display correct e-beam deflection as viewed by the user. Allows for X coil wiring polarity reversals.

Y coil flip . . . . Inverts the polarity of the output current for the Y coil to reflect around the X axis to display correct e-beam deflection as viewed by the user. Allows for Y coil wiring polarity reversals.

PN 074-622-P1B

Beam In Pocket Axis . . . . None, X coil, Y coil

The axis (or none) used to reference the current to determine if the e-beam is centered and in pocket. Used with Relay 3 to activate or deactivate the e-beam (refer to).

4.3.5 Calibration Tab

Figure 4-10 Calibration tab
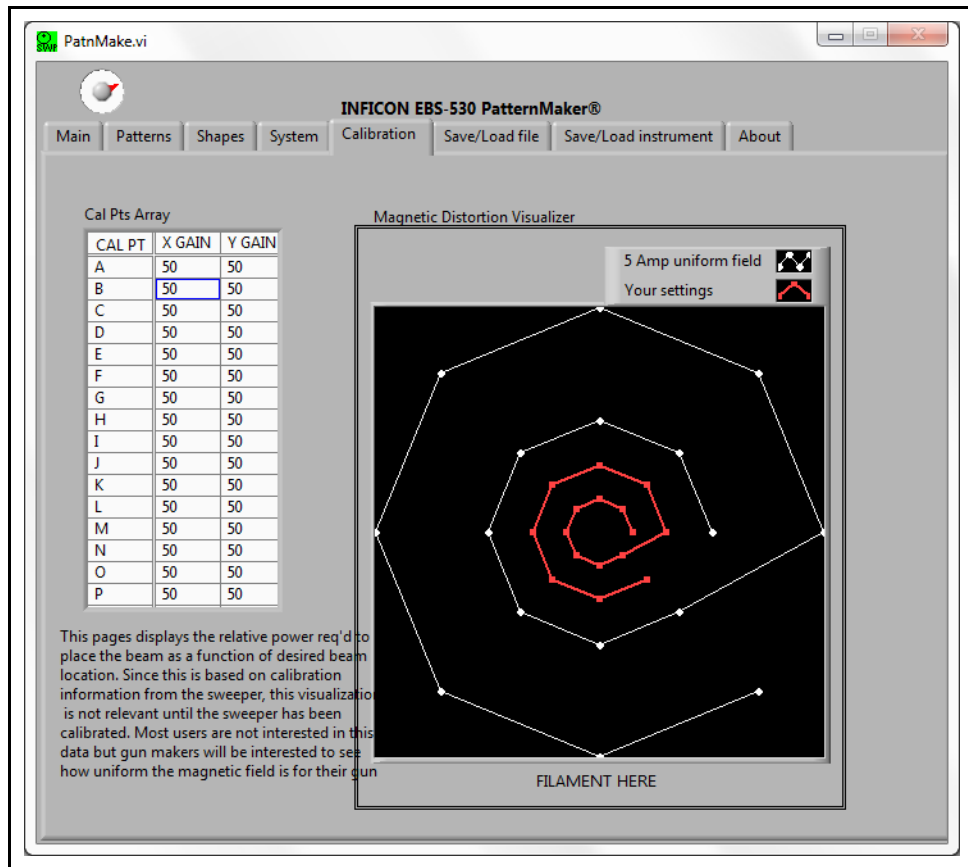
Cal Pts Array pane

CAL PT . . . . A to P

Fixed calibration points used to compensate for non-uniformities in the magnetic field of the e-beam source.

X GAIN . . . . 0 to 169

Relative power required to position the beam along the X axis.

Y GAIN . . . . 0 to 169

          Relative power required to position the beam along the Y axis.

Right-click in the **Cal Pts Array** table to display the **Cal Pts Array** menu (see Figure 4-11).

Figure 4-11 Cal Pts Array menu

| Reinitialize to Default Value |
| Cut Data |
| Copy Data |
| Paste Data |
| Description and Tip... |
| Export Simplified Image... |
| Empty Table |
| Insert Row Before |
| Insert Column Before |
| Delete Row |
| Delete Column |
| ✓ Show Selection |
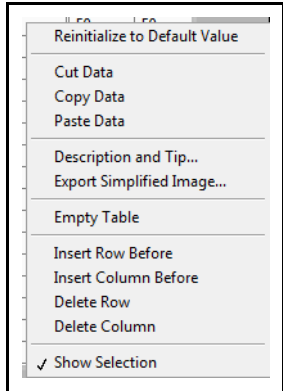
Reinitialize to Default Value . . . . . Replaces all **X GAIN** and **Y GAIN** values in the **Cal Pts Array** table with a value of 50.

Cut Data . . . . Click and drag to select **X GAIN** and **Y GAIN** values to remove and place on the clipboard. **X GAIN** and **Y GAIN** values will move up the list to replace the cut values and rows at the end of the list will be replaced with a value of 50.

Copy Data . . . . Click and drag to select **X GAIN** and/or **Y GAIN** values and place them on the clipboard.

Paste Data . . . . Click and drag to select **X GAIN** and **Y GAIN** values to replace with the values on the clipboard.

          NOTE: The selection size on the table must match the selection size on the clipboard.

Description and Tip . . . . Displays the **Description and Tip** window. No additional information will be displayed.

Export Simplified Image . . . . Bitmap, encapsulated postscript, or enhanced metafile of the **Cal Pts Array** table may be saved to a file.

          NOTE: Export to clipboard is an invalid entry.

Empty Table . . . . Replaces all **X GAIN** and **Y GAIN** values in the **Cal Pts Array** table with a value of 50.

Insert Row Before. . . . . Moves the selected row down one point (A to P) in the list and displays a row with **X GAIN** and **Y GAIN** values of 50.

Insert Column Before. . . . . Replaces all **X GAIN** and **Y GAIN** values in the **Cal Pts Array** table with a value of 50.

Delete Row . . . . Removes **X GAIN** and **Y GAIN** values of the selected row. **X GAIN** and **Y GAIN** values of the following points will move up one point to replace the deleted row and the P row at the end of the list will display **X GAIN** and **Y GAIN** values of 50.

Delete Column . . . . Removes selected column and replaces **X GAIN** and **Y GAIN** values from left to right with the values that were entered in the column not selected for removal.

Show Selection. . . . . Enables selected cells to be outlined.

Magnetic Distortion Visualizer pane

Displays a 5 A uniform magnetic field and the calibration settings of points A to P.

NOTE: The **Magnetic Distortion Visualizer** is based on calibration information obtained from EBS-530 (refer to section 3.3.4 on page 3-12).

4.3.6 Save/Load file Tab

Save a, INFICON EBS-530 PatternMaker parameter file as *.PPF or load a
parameter file from this tab (see Figure 4-12).

Figure 4-12 Save/Load file tab
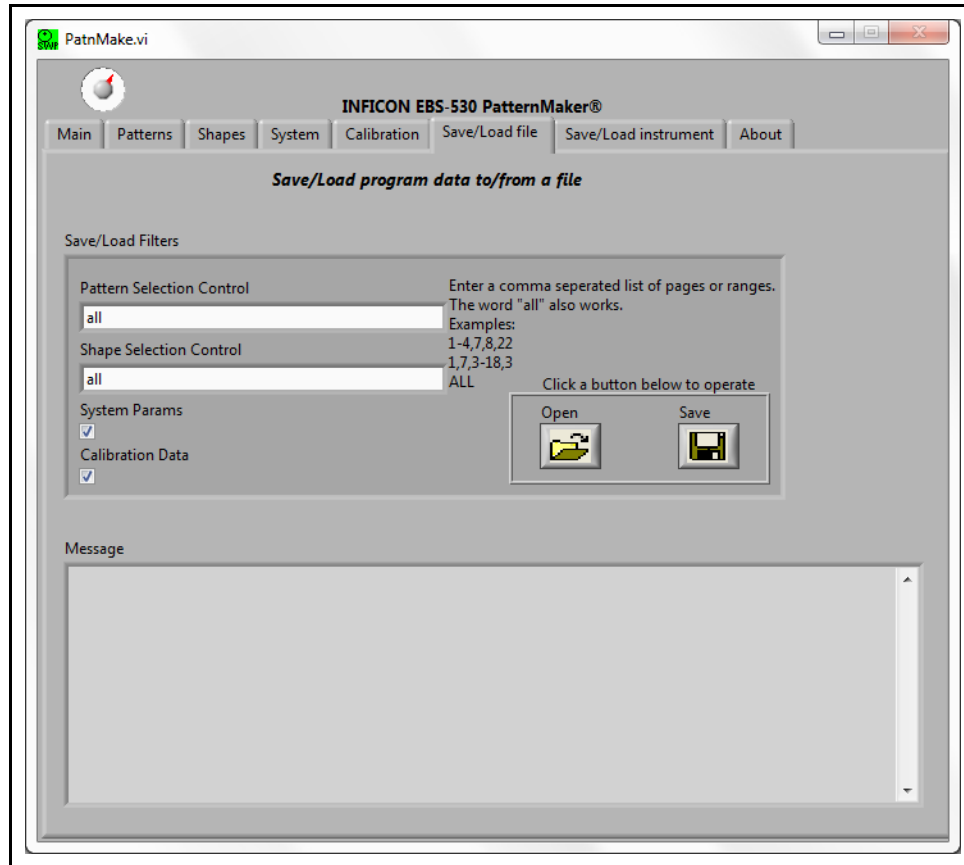
NOTE: Right-clicking on a value or parameter and then clicking **Description and
Tip** may display more information about that value or parameter.

Pattern Selection Control . . . . A comma separated list of pattern numbers
or ranges of pattern numbers to Save/Load.
Type **all** to Save/Load all patterns or ranges
of pattern numbers.

Shape Selection Control . . . . A comma separated list of shapes numbers
or ranges of shape numbers to Save/Load.
Type **all** to Save/Load all shape numbers or
ranges shape numbers.

System Params . . . . Select to enable to Save/Load system
parameters in addition to pattern and/or
shape parameters.

Calibration Data . . . . Select to enable to Save/Load calibration parameters in addition to pattern and/or shape parameters.

Open . . . . Click to browse and select the location of a file to open and load.

Save . . . . Click to browse and select the location to save the current EBS-530 configuration selections.

Message . . . . Displays error messages or comments regarding the saving or loading of EBS-530 configuration files.

4.3.7 Save/Load instrument Tab

This tab is used to upload a configuration from EBS-530 into the INFICON EBS-530 PatternMaker software. It will also download the configuration to EBS-530 (see Figure 4-13).

Figure 4-13 Save/Load instrument tab

NOTE: Right-clicking on a value or parameter and then clicking **Description and Tip** may display additional information about that value or parameter.

Pattern Selection Control . . . . A comma separated list of pattern numbers or ranges of pattern numbers to Save/Load. Type **all** to Save/Load all patterns or ranges of pattern numbers.

Shape Selection Control . . . . A comma separated list of shapes numbers or ranges of shape numbers to Save/Load. Type **all** to Save/Load all shape numbers or ranges shape numbers.

System Params . . . . Select to enable to Save/Load system parameters in addition to pattern and/or shape parameters.

Calibration Data . . . . Select to enable to Save/Load calibration parameters in addition to pattern and/or shape parameters.

Read from SWP . . . . Click to upload a configuration file from EBS-530 into the INFICON EBS-530 PatternMaker software.

Write to SWP . . . . Click to download the configuration parameters from the INFICON EBS-530 PatternMaker software into EBS-530.

Message . . . . Displays error messages or comments regarding the saving or loading of EBS-530 configuration files.

4.3.8 About Tab

Displays copyright, version history, and software version number (see Figure 4-14).

Figure 4-14 About tab
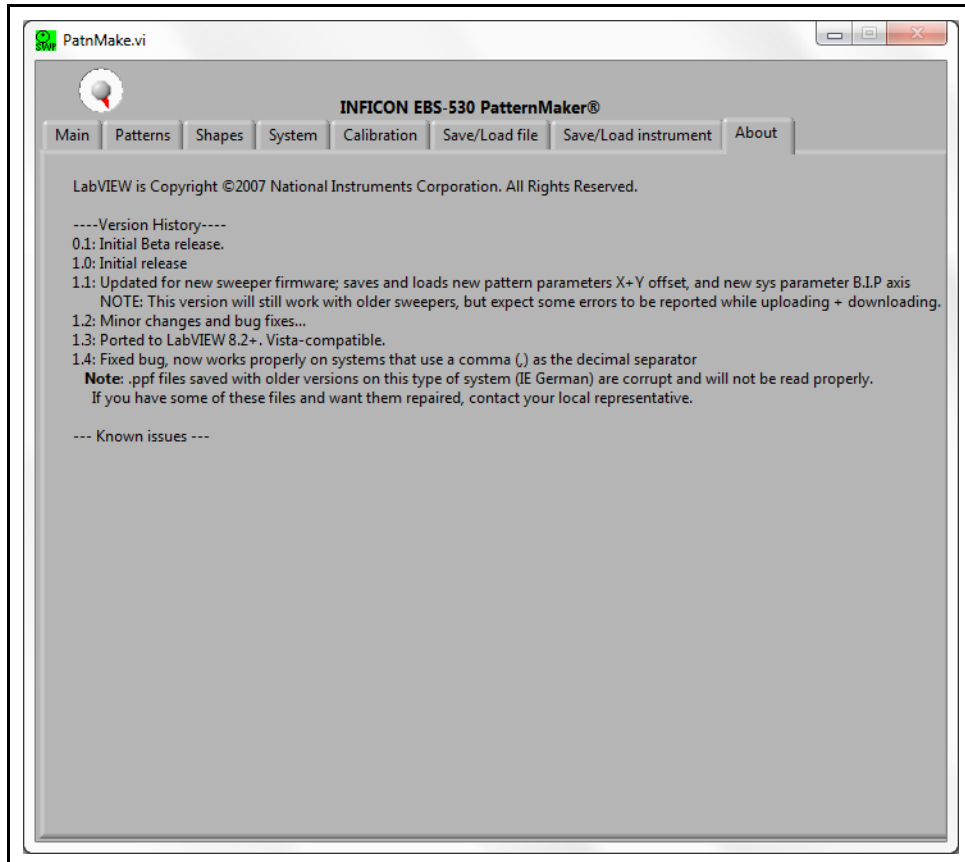
This page is intentionally blank.

Chapter 5
Communications

5.1 Communications Connections

EBS-530 can be controlled remotely with RS-232 or RS-485 through the SMDP cable provided in the ship kit, PN 783-506-170-P1.

5.1.1 Network Connection

RS-232 and RS-485 serial communication ports are accessed through the Network connection (see Figure 5-1).

Figure 5-1 EBS-530 Network connection

5.1.2 RS-232 Point-to-Point Mode

EBS-530 can be set to RS-232 point-to-point mode for a single host-slave connection by selecting SMDP address 16 (hexadecimal 10).

Point-to-point mode can be set to one of three baud rates (high-115200, medium-38400, low-9600) from the **System Configuration** screen (refer to section 3.3.5 on page 3-17). This supports a three wire (transmit, receive, common ground) interface that can be directly connected to most RS-232 ports of a computer or controller. The protocol is standard 10 bit (1 start bit, 8 data bits, 1 stop bit) (see section 5.2 on page 5-3).

The RS-232 pin assignments on the EBS-530 rear panel are Pin 2 (RXD), Pin 3 (TXD), and Pin 5 (Signal GND). RXD and TXD are receive and transmit directions relative to EBS-530. PN 783-506-170-P1 is a null modem cable, where Pin 2 on the cable is crossed to connect to Pin 3 on EBS-530 and Pin 3 on the cable is crossed to connect to Pin 2 on the EBS-530 rear panel.

5.1.3 RS-485 TTL Differential Signaling Mode

RS-485 TTL differential signaling mode is selected by SMDP address values 17 through 254. In TTL differential signaling mode, two wires are time-shared (half-duplex) between a master and 1 to N slaves. Slaves monitor the state of the A/B differential signals, looking for the master to transmit a frame (start-data-stop-start-data-stop-etc.). When a slave receives a frame that is addressed for it (address byte value 17 to 254), the slave will drive the A/B wire pair differentially with its own reply frame, which the master (and all other slaves) will see. Since the reply has an address byte embedded in it, other slaves will ignore the reply. The host will decode and verify (via checksum) the reply. If acceptable, the reply will be used by the master.

A user-supplied cable is required for RS-485 communication. The pin assignments relative to the EBS-530 rear panel are Pin 2 (non-inverting signal), Pin 3 (inverting signal), and Pin 5 (Signal GND). The RS-485 / TIA-485 standard does not specify pin assignments. A modification may be needed at the cable end connected to the RS-485 card. Refer to the RS-485 card operating manual to determine which pins are inverting and non-inverting.

NOTE: If the inverting and non-inverting signal connections to the RS-485 card are reversed, the RS-485 link will not communicate; EBS-530 and the RS-485 card will not be damaged.

⚠️ **CAUTION**

The RS-485 communications interface must be wired properly with the same baud rate used for all EBS-530 on the same network. A unique SMDP address must be used for each connected instrument using the SMDP Server on the same network.

5.1.4 Electrical

The EBS-530 SMDP interface is two-wire RS-485 providing a single master, multi-slave, half-duplex network. EBS-530 can also implement this protocol over an RS-232 interface. This allows EBS-530 to be used for RS-232 or RS-485 networks and makes an upgrade path from point-to-point.

In point-to-point RS-232 mode, the transmit and receive data lines are converted to logic levels with a standard RS-232 transceiver.

In RS-485 bus mode, a two-wire bus uses lines designated as inverting and non-inverting and carries complementary Transistor-Transistor Logic (TTL) level differential signals, time-shared (half-duplex) for messages to and from the master. When the line is idle, the non-inverting signal line is at a TTL high.

5.1.5 RS-485 Line Signal

The first bit, a start bit, is a data zero value, with the non-inverting signal line going to a logic low (<1 volt). The opposite differential signal (inverting RS-485) goes to a logic high (>2 volts) during the same start bit time.

NOTE: After the start bit, the eight data bits are presented in order from least significant bit (D0) through most significant bit (D7), and then followed with a stop bit (logic 1 value).

The values of the ASCII code bits as 1 or 0 are represented as normal logic (1 is high TTL, 0 is low TTL) on the non-inverting RS-485 line.

For example, the opening protocol character STX (ASCII 0x02) is transmitted on the non-inverting RS-485 wire START0-0-1-0-0-0-0-0-0-STOP1. This can be examined on an oscilloscope.

5.1.6 Bit Time

At baud rate of 115200 bps, for example, a bit time is 8.68 microseconds (μs). The start and LSB zero values together would hold the line low for 2*8.68 μs or 17.36 μs. The D1 bit value of one would take the line high for 8.68 μs.

The remainder of the frame data bits are a zero value, until the final stop bit one value returns the line to the Idle / 1 / Marking state. At the end of the master transmission, the line driver for the master enters a high-impedance, inactive state, so that the slave can reply over the same two wires by sending back a similarly encoded frame. This master/slave, command/reply interaction is the basis of the protocol.

5.2 Sycon Multi-Drop Protocol (SMDP)

SMDP is a byte-packet, binary protocol. All eight bits of the data of a byte/character are used. Standard asynchronous serial conventions apply. The link must be configured for one start bit, eight data bits, and one or more stop bits. The logic polarity and bit order adopt the standard used for asynchronous serial communications (refer to section 5.1.5). A packet begins with STX (ASCII hexadecimal 02) and ends with CR (carriage return, hexadecimal 0D).

The SMDP specification provides several common, mandated command codes. EBS-530 responds to these common messages. For example, the reset command will cause EBS-530 to reboot, as though power was cycled. Another common command queries the product type or ID. This command (hexadecimal 30) will return an ASCII integer code that identifies the product type (see section 5.2.1.2 on page 5-6). This allows a master computer to poll a network and locate devices by their types and ensure that the proper connection and commands are used for the appropriate product.

NOTE: Each field in angle brackets (< >) is a byte, and is not optional. Fields in regular brackets ([ ]) are optional. Ellipses (...) mean one or more of the previous.

5.2.1 Command Format

<STX><ADDR><CMD_RSP>[<DATA>...]<CKSUM1><CKSUM2><CR>

STX . . . . Start of text character (hexadecimal 02)

Multiple STX characters in a row are allowed. Data between STX characters is ignored. A single STX character initializes the receiver to receive a new message, purging any data collected since the last STX character or carriage return received.

ADDR . . . . . . One byte address field

The address (ADDR) byte identifies the SMDP address (refer to section 3.3.5 on page 3-17) in order to select which device the command/query is sent to.

NOTE: RS-485 communication limits the number of attached devices to 32. Each connected instrument must be assigned a unique address. The slave reply repeats the address when it replies to the master, verifying the address of the instrument receiving the command.

The range of values are hexadecimal 10 to FE (16 to 254 decimal).

Address hexadecimal FF is reserved. It is used as an extension to indicate another byte of address information follows for products that have an address range higher than an address of hexadecimal FE.

CMD_RSP . . Command/Response field

When a command is sent from master to slave, the RSPF bit is zero and the RSP field (3 bits) is zero. The upper four bits (CMD3 to CMD0) hold the <CMD> value 1 to 8 (see section 5.2.1.2 on page 5-6).

When a command is received from a slave to a master, CMD bits are the same as in the message that was sent (see section 5.2.1.2), but the RSP2 through RSP0 field will be non-zero, indicating actual unit response status (see section 5.2.1.3). The slave will set or clear the RSPF flag bit in the reply CMD_RSP frame to indicate an unacknowledged slave reset. This bit only has meaning when a command is going from slave to master. If this bit is 1, the slave has been reset since the last AckPF, acknowledge power fail flag command was received (see Table 5-1).

Table 5-1 Command/Response

D7	D6	D5	D4	D3	D2	D1	D0
CMD3	CMD2	CMD1	CMD0	RSPF	RSP2	RSP1	RSP0

PN 074-622-P1B

DATA . . . . . . Optional data

STX and carriage return characters are not allowed in the data field.

To send a data byte valued as hexadecimal 02, send the protocol escape character (hexadecimal 07) followed by ASCII zero (hexadecimal 30).

To send a data byte valued at hexadecimal 0D, send the protocol escape character (hexadecimal 07) followed by ASCII one (hexadecimal 31).

To send a data value of hexadecimal 07, send the protocol escape character followed by ASCII two (hexadecimal 32).

The protocol escape character (hexadecimal 07) cannot be sent as a single byte, but can only be sent as the first byte of a pair, followed by an ASCII 0, 1, or 2.

If the protocol escape character is seen but is not followed by an ASCII 0, 1, or 2, the entire command packet is invalid and is ignored.

CKSUM1,2 . . Checksum characters for the message

This is the mod-256 checksum of the command binary message data. The checksum does not include STX and carriage return, and it is calculated using the raw data before escape character byte stuffing (see section 5.2.1.1).

5.2.1.1 Checksum

◆ Compute the mod 256 checksum of ADDR, CMD_RSP, and DATA fields, before byte stuffing with escape characters. This is the logical content (payload) of the command.

◆ CKSUM1 is the upper (most significant) four bits of the checksum (read as a nibble, 0 through 15, or right justified) plus hexadecimal 30 (ASCII zero). This yields an ASCII character from zero (hexadecimal 30) to ? (hexadecimal 3F).

◆ CKSUM2 is the lower (least significant) four bits of the checksum plus hexadecimal 30 (ASCII zero). This yields an ASCII character from zero (hexadecimal 30) to ? (hexadecimal 3F).

NOTE: If the checksum of the command is invalid (in form or value), the packet is invalid and is ignored.

⚠ CAUTION

Invalid commands (bad checksum, too short, corrupt data, bad escape sequences) are ignored by slaves (and masters). No response is sent by the slave.

5.2.1.2 Command Packet Format

```
<STX><ADDR><CMD_RSP>[<DATA>...]<CKSUM1><CKSUM2><CR>
```

Where <CMD> is:

1	BOOT_API	Prefix for commands exclusively used to communicate with a sandal-loader/bootloader parser running on a target platform. **NOTE:** EBS-530 will consider this to be invalid (Err_Inv_Cmd).
2	Reserved	Reserved for future use in protocol stack.
3	Prod_id	Product identifier, returned as decimal string. **NOTE:** The value for EBS-530 is 8 decimal.
4	Version	Request slave to return software version string.
5	Reset	Request slave to reset/reboot.
6	AckPF	Request slave to acknowledge power failure flag and clear RSPF bit.
7	PROTV	Request slave to return protocol stack version as decimal string.
8	Product_Specific	Application API prefix to precede EBS-530 commands (see section 5.5 on page 5-12).

NOTE: SMDP will respond to commands in the range of 1 through 7. Commands 2 through 7 are handled in the protocol, at the protocol layer. Applications are not to use commands 2 through 7 except to implement the protocol specification.

5.2.1.3 Response Packet Format

```
<STX><ADDR><CMD_RSP>[<DATA>...]<CKSUM1><CKSUM2><CR>
```

NOTE: In the CMD_RSP byte, the CMD bits are unchanged from the master, but the RSP bits are filled in according to the status of the slave.

Where <RSP> is:

1	OK	Command understood and executed.
2	Err_Inv_cmd	Illegal command (CMD code not valid).
3	Err_syntax	Syntax error (too many bytes in data field, not enough bytes).
4	Err_range	Data range error.
5	Err_inh	Inhibited.
6	Err_obso	Obsolete command. No action taken.

5.2.2 Optional Serial Command Mode

SMDP (version 3 and greater) allows for a serial number in the command to associate a command from the master with the correct response. This detects errors in serial communications ports where commands are queued and sent out of order. The protocol structure is nearly identical to section 5.2, Sycon Multi-Drop Protocol (SMDP), on page 5-3, except:

◆ A serial number byte must be placed before the checksum bytes. This must be a value greater than or equal to hexadecimal 10 (16) (see section 5.2.2.1). This byte is summed as a part of the packet payload in computing the packet checksum value.

◆ The checksum character base must be hexadecimal 40 (@), instead of hexadecimal 30 (0) to inform the slave that it is receiving a packet with the extra SRLNO field postamble. This makes the last two characters of the command (the checksums) range from @ (hexadecimal 40) through the letter, O (hexadecimal 4F).

◆ For a response, the slave places the corresponding SRLNO byte into its response packet just before the two reply packet checksum characters, also hexadecimal 40 based.

In order for this serial command mode to be effective, the master should generate a new SRLNO value for each command that it sends (modulo 255, and greater than hexadecimal 10). This allows for 240 unique serial number values before repeating. The value could be an incrementing tag that rolls over from 255 to 16 with the understanding that there would never be 240 outstanding messages. Alternatively, the tag could have a unique value or range of values for each line of communication to the product at a specific address. This will allow the responses to be received by the proper line of communication.

NOTE: When an SMDP response packet is received by the master, verify the SRLNO value and use it to associate it with the source of the command/query. This will prevent out-of-sequence replies from being misinterpreted and invalid results being generated.

5.2.2.1 Optional Serial Command Format

<STX><ADDR><CMD_RSP>[<DATA>...]<SRLNO><ACKSM1><ACKSM2><CR>

SRLNO . . . . . Serial Number

Associates a command from the master with the correct response. The value must be greater than or equal to hexadecimal 10 (16) in order to not be mistaken as a framing or escape character byte.

ACKSM1, 2 . Alternate hexadecimal 40 based checksum characters

This has a range of values from @ (hexadecimal 40) through the letter, O (hexadecimal 4F).

NOTE: Refer to section 5.2.1 on page 5-4 for additional information identifying the bytes in this command string.

5.3 Communication Library

SMDP control is an ActiveX library that implements SMDP.

SMDP is built as an out-of-process server, and automatically manages multiple sessions with multiple programs. All programs that use SMDP control can share the communication link without interference or crosstalk. It is possible to have multiple programs communicating with the same instrument, transparent to the user.

Using SMDP control is a standard ActiveX control for Windows computers.

NOTE: Since all programming environments have different ways to integrate ActiveX controls, linking to the control will not be covered.

Most programming environments can use ActiveX controls (i.e., Delphi, Visual Studio (vb,vc++, etc.), LabVIEW, and many others). SMDP_SVR is the name of the ActiveX control library for all programming environments.

An instance of the control should be initiated for each instrument being controlled and communicated with remotely, the parameters set accordingly, and DoTransaction called to do the communications.

SMDP control handles multiple instances on the same communications port and multiple instances for the same instrument.

5.3.1 Methods

Open . . . . (file name)

> Attempts to acquire communications port and allocate resources. Open does not need to be called; if the port was not opened it will automatically be opened when the DoTransaction function is called.

DoTransaction . . . . (addr, SmdpCmd, Msg, Rsp, resetflag)

> Initiates communication with EBS-530 and waits for a reply (or timeout) before returning.
>
> In: addr is the SMDP address of target instrument. Values range from 16 to 254 decimal.
>
> In: SmdpCmd is the SMDP command opcode enumeration constant. The value to use is based on the CMD_RSP most significant nibble value, less one. For example, a hexadecimal 60 AckPF command will pass a value of 5 as the SmdpCmd code.
>
> **NOTE:** All command codes for DoTransaction SmdpCmd argument are one less than the CMD3 to CMD0 bit field used in the SMDP packet (refer to Table 5-1 on page 5-4).
>
> In: Msg is the message to send, may be a string or byte array.
>
> Out: Rsp is string response from instrument.
>
> Out: Boolean resetflag is true if instrument has been reset since the flag was acknowledged last.

Close() . . . . . Clears resources associated with the instance. Will also close the communications port if there are no instances communicating on the port.

> **NOTE:** In most cases it is not necessary to call this function. The programming environment will unload the control when it is finished, and the control automatically closes the resources when it is unloaded.

5.3.2 Communication Properties

ComPortNo . . . . The communications port to use for communication to EBS-530.

Baud . . . . The baud rate. Valid baud rates are 9600, 38400, or 115200 bps.

Protocol. . . . . The protocol to use (0 - SMDP).

DoPacketStamp . . . . Set true to use SMDP-II protocol.

   NOTE: This should always be true.

TimeoutMS . . . . Sets the number of milliseconds to wait for the instrument to respond before the control displays a timeout error during DoTransaction(). The valid range is 150 to 20000 milliseconds.

   NOTE: If this is set near the minimum value, timeout errors can occur due to delays in processing speeds of the computer or EBS530.

LastTimeTransSec . . . . The amount of time the last DoTransaction() call took to complete, in floating point (real) seconds. Typical values are in the range of 0.002 to 0.014 seconds.

   NOTE: Some behaviors take longer to execute.

5.3.3 Other Properties

Numinstances. . . . . Shows number of Windows applications using the SMDP Server. SMDP server can support multiple applications using the same or multiple ports. Each application that connects to the SMDP Server uses an instance.

Build . . . . The build number of SMDP OCX DLL software (unique version identifier).

These properties are read only and return the same value across all instances.

5.4 Windows/SMDP Server Implementation

SMDP server on Windows message timeout is typically 150 milliseconds. That is, after the host sends a command, it waits 150 milliseconds for a reply. If no complete reply is returned from EBS-530 in that time, the message is considered lost. This could indicate the following:

◆ EBS-530 is offline.

◆ The cable is disconnected.

◆ The baud rate is invalid/mismatched.

◆ There is noise corrupting the packet/checksum integrity.

After 150 milliseconds have elapsed, the host can try again.

NOTE: Once a valid connection to EBS-530 is made, the command/response exchange will proceed at the fastest speed, sending a new command as soon as the prior answer has come back to the host.

If there is a loss of a packet due to noise, software error, or power loss to EBS-530, the loss will be detected when a valid reply packet is not returned within the 150 millisecond timeout.

Retries or resending commands can continue to take place until a valid reply is returned once the 150 millisecond timeout has been reached.

5.5 Communications Commands

EBS-530 uses command prefix hexadecimal 80 to introduce command sequences. The data that follows hexadecimal 80 are standard ASCII character sequences (see section 5.2.1, Command Format, on page 5-4).

Common commands have the same initial character sequences, and are distinguished by variable numeric arguments which further specify the intended action or target of the command/query.

Therefore, only the data payload content which distinguishes these commands are found in this section.

All responses conform to the SMDP specification (refer to section 5.2 on page 5-3) with the lower four bits of the returned <CMD_RSP> byte being a non-zero value in the range of 1 to 15. The upper 4 bits are the same as the host command group (CmdOpcode_xxx), 3 to 8. The lower three bits have the value 1 to 7 as defined in section 5.2.1.3 on page 5-6. This value indicates whether the receiver could process the query or found fault with it. If the address is not matched with a slave, the checksum of the frame fails, or the command is otherwise improper, no response is returned by the slave.

The fourth bit (D3, 8 weight) is a power fail flag bit, and the slave replies with this bit set when the platform has been reset, until such a time as the master sends the following:

◆ Acknowledge-power-fail command (CmdOpcode_ACKPF 0x60), low level SMDP message

The message from the master clears the power fail flag such that the status bit, D3, of all subsequent replies is now zero. This allows the master to detect at the earliest transaction (first valid communications after reboot/reset) that the slave device has been reset and needs to be re-synchronized. This might be considered a fatal error (power supply was reset and system state harmed), a soft error which can be recovered from, or a non-issue requiring no intervention.

NOTE: All of the following commands must be prefixed by a **@** symbol, as displayed in the syntax of each command. This provides an extra level of protection to differentiate communication sent to EBS-530 from other products with the same protocol.

5.5.1 Command: @

Command Type . . . . Query

Command Structure . . . . EXCT_whatv

Syntax. . . . . @@

    Description . . . . Queries the version.

    Reply Example BSLPA00.14

Syntax. . . . . @@0

    Description . . . . Queries the version. Same as @ command.

    Reply Example BSLPA00.14

Syntax. . . . . @@1

    Description . . . . Queries serial number and build type.

    Reply Example 02793/002

Syntax. . . . . @@2

    Description . . . . Queries hexadecimal value for application CRC.

    Reply Example . . . . EEAF

Syntax. . . . . @@3

    Description . . . . Queries hexadecimal value for bootloader.

    Reply Example 4B8D

5.5.2 Command: ^

Command Type . . . . Query

Command Structure . . . . EXCT_trapinfo

Syntax. . . . . @^?

    Description . . . . Queries the major/minor error codes for troubleshooting purposes.

    Reply Example . . . . Properly working units have 0,0 displayed. Contact INFICON if a non-zero number is displayed (refer to section 1.3 on page 1-4).

Syntax. . . . . @^!

    Description . . . . Resets the major/minor error codes to 0,0 with no error history.

5.5.3 Command: A/B

Command Type . . . . Query

Command Structure . . . . EXCT_rdpp

Syntax . . . . @Ap,n

    Description . . . . Queries the pattern parameters, where p is pattern number 1 to 32, n is parameter 1 to 9, and value represents the data used to update the parameter.

Command Type . . . . Update

Command Structure . . . . EXCT_wrpp

Syntax . . . . @Bp,n=value

    Description . . . . Updates the pattern parameters, where p is pattern number 1 to 32 and n is parameter 1 to 9.

Parameters. (See Table 5-2.)

> **NOTE:** The speed and spin parameters of the active shape/pattern are corrected as necessary to make a valid combination, causing an immediate effect.

Table 5-2 A/B command

#	Name	Description	Comment
1	PNAME	Pattern Name	Value string of up to sixteen characters from set {A-Z0-9_ } or an empty string.
2	GAIN	Pattern gain value	Range 0 to 110%
3	PROFL	Pattern power distribution	Range -10 to 10 in whole numbers. 0 is no power distribution changes.
4	SHAPIX	Shape index	Number of the shape associated with a patterns 1 to 37.
5	SHAPSP	Shape speed	Range 0 to 1000 ms
6	SPINSP	Spin speed	Range 0 to 1000 RPM
7	TILT	Tilt angle	Range 0 to 359° clockwise
8	PXOFFS	Pattern specific X offset	Range -120 to 120
9	PYOFFS	Pattern specific Y offset	Range -120 to 120

5.5.4 Command: C/D

Command Type . . . . Query

Command Structure . . . . EXCT_rdsp

Syntax. . . . . @Cn

    Description . . . . Queries the system parameters, where n is parameter 1 to 16.

Command Type . . . . Update

Command Structure . . . . EXCT_wrsp

Syntax. . . . . @Dn=value

    Description . . . . Updates the pattern parameters, where n is parameter 1 to 16 and value represents the data used to update the parameter.

Parameters. . . . . (See Table 5-3.)

> **NOTE:** The system parameters will cause an immediate effect if they affect the active shape or pattern or communications settings.

Table 5-3 C/D command

#	Name	Description	Comment
1	ACTLPTN	Active local pattern	Active pattern 1 to 32 when I/O is not in use
2	LOCKSYS	System lock code	0 — Off 1 to 9999 — System parameters locked
3	LOCKPAT	Pattern lock code	0 — Off 1 to 9999 — Pattern parameters locked
4	RUNLOCK	Status lock	0 — Off 1 — On
5	CONTRAST	LCD contrast	Range 1 to 10
6	BEEP	Audible keyboard beeper	0 — Off 1 — On
7	SMDPADRS	SMDP address	Range 16 to 254
8	BAUDRATE	Communication speed	0 — Slow (9.6 kbps) 1 — Medium (38.4 kbps) 2 — Fast (115.2 kbps)
9	XCNTR	System X offset	Range -120 to 120
10	YCNTR	System Y offset	Range -120 to 120

Table 5-3 C/D command (continued)

#	Name	Description	Comment
11	XMAX_I	Maximum X output current	Range 0.0 to 5.0 A
12	YMAX_I	Maximum Y output current	Range 0.0 to 5.0 A
13	ANGOFF	System tilt angle	Range 0 to 359° clockwise
14	XFLIP	Inverse of X output current	0 False/No 1 True/Yes
15	YFLIP	Inverse of Y output current	0 False/No 1 True/Yes
16	LONGAX	Beam in pocket longitudinal axis selection	0 none 1 X 2 Y

5.5.5 Command: F

Command Type . . . . Query

Command Structure . . . . EXCT_rstat

Syntax . . . . @Fn

    Description . . . . Queries the system status, where n is parameter 1 to 14.

Parameters. . . . . (See Table 5-4.)

Table 5-4 F command

#	Name	Description	Comment
1	VMEMS	Verify memory state	0 No memory loss 1 Pattern, system, and calibration parameter loss 2 Shape memory loss **NOTE:** Use the Q command to verify if a shape has been defaulted or cleared (see section 5.5.12 on page 5-22). 3 Total memory loss
2	ACTPATN	Active pattern	Range 1 to 32 Local active pattern or the remote digital I/O selected pattern, if in REMOTE mode.

Table 5-4 F command (continued)

#	Name	Description	Comment
3	ACTSHAPE	Active shape	Range 1 to 37 1 to 32 User-created shape 33 Circle 34 Line 35 Figure 8 36 Dead 37 Point
4	ILOKSAT	Interlock satisfied	0 False/No 1 True/Yes
5	DRAWRUN	Drawing engine is operating (sweeping)	0 False/No 1 True/Yes
6	MACHSTAT	Machine state	Numeric value of machine state. Value 0 to 2, 4 to 6, 8, 11, 12, 64, 66, 128, or 255 (see section 5.5.5.1).
7	FAULTY	Hardware failure	Troubleshooting code. Properly working units have 0 displayed. Contact INFICON if a non-zero number is displayed (refer to section 1.3 on page 1-4).
8	STOPCODE	Stopcode class enumeration	0 Working properly 1 70 V failure 2 X coil line fuse failure 3 Y coil line fuse failure
9	REMOTE	Remote mode	0 False/No 1 True/Yes
10	REMPAT	Remote requested pattern number	Range 1 to 32 for binary inputs 0 to 31 (hexadecimal 00 to 1F)
11	REMRUN	Remote requested sweeper state	0 False 1 True/Sweep On requested
12	XCLIPD	Status of X output current	0 False 1 True/Pattern requires a current greater than the maximum X current
13	YCLIPD	Status of Y output current	0 False 1 True/Pattern requires a current greater than the maximum Y current
14	BEAMINPK	Beam in pocket	0 False/No 1 True/Relay 3 is active

PN 074-622-P1B

5.5.5.1 Machine State

Off/Local. 0
Sweeping disabled. Local mode.

On/Local. 1
Sweeping enabled. Local mode.

Standby/Local. 2
Interlock removed.

Off/Remote Mode. 4
Sweeping disabled. Remote mode.

On/Remote Mode. 5
Sweeping enabled. Remote mode.

Aborted/Remote Mode. 6
Sweeping aborted in Remote mode. Reboot (see section 5.5.9 on page 5-20), remove input(s) (Remote, Interlock, or Sweep On/Off), or press **ON** from the EBS-530 front panel to clear.

Standby/Remote Mode. 8
Interlocks are not satisfied and prevent remote sweep from being enabled.

Calibration Mode On 11
Sweeping enabled and available for calibration.

Calibration Mode Off 12
Sweeping stopped with the front panel or RS-232 commands. Calibration is disabled.

Memory Failure 64
Requires front panel or remote command acknowledgement (see section 5.5.7 on page 5-20), EBS-530 is off, sweeping is disabled, or EBS-530 is not in a ready state.

Hardware Failure 66
Troubleshooting code. Contact INFICON if displayed (refer to section 1.3 on page 1-4).

Startup State. 128
EBS-530 is powering up. May not be reported.

Unknown 255
Troubleshooting code. Contact INFICON if displayed (refer to section 1.3 on page 1-4).

5.5.6 Command: H

Command Type . . . . Query

Command Structure . . . . EXCT_epoll

Syntax. . . . . @Hn

Description . . . . Queries the event history of EBS-530, where n is parameter 1 to 6.

Parameters. . . . . (See Table 5-5.) Event reply is 1 if one or more events have occurred since the last poll. This poll will then be cleared to 0 for future polls until a new event occurs.

Table 5-5 H command

#	Name	Description	Comment	
1	RMT_ON	Enable sweeper in local mode	0 1	No events since last poll Events since last poll
2	RMT_OFF	Disable sweeper in local mode	0 1	No events since last poll Events since last poll
3	RMT_ABORT	Abort/stop sweeper in remote mode	0 1	No events since last poll Events since last poll
4	MLACK	Memory loss acknowledgement	0 1	No events since last poll Events since last poll
5	XCLIP	Current required greater than maximum X current	0 1	No events since last poll Events since last poll
6	YCLIP	Current required greater than maximum Y current	0 1	No events since last poll Events since last poll

5.5.7 Command: I

Command Type . . . . Event

Command Structure . . . . EXCT_etrig

Syntax . . . . @In

    Description . . . . Causes an event, where n is event 1 to 4.

Parameters. (See Table 5-6.)

Table 5-6   I command

#	Name	Event
1	RMT_ON	Enable sweeper in local mode
2	RMT_OFF	Disable sweeper in local mode
3	RMT_ABORT	Abort/stop sweeper in remote mode **NOTE:** **Remote Abort** message will display on the Status screen. Reboot, remove input(s) (Remote, Interlock, or Sweep On/Off), or press ON from the EBS-530 front panel to clear.
4	MLACK	Memory loss acknowledgement

5.5.8 Command: J

Command Type . . . . Query

Command Structure . . . . EXCT_rsig

Syntax . . . . @Jn

    Description . . . . Queries the 16 bit CRC signature value ranging from 0 to 65535, based on programmed parameters. Used to detect changes in programmed parameters.

    Parameters. . . . . 1 to 32 (pattern number), 33 (distortion calibration points A to P, refer to section 3.3.4.1 on page 3-13), or 34 (**System Configuration** screen)

5.5.9 Command: K

Command Type . . . . Reboot

Command Structure . . . . EXCT_kill

Syntax . . . . @K=530

    Description . . . . Executes a complete hardware reset within approximately 400 milliseconds.

5.5.10 Command: M/N

Command Type . . . . Query

Command Structure . . . . EXCT_readSIP

Syntax. . . . . @Ms,1

    Description . . . . Queries the shape name, where s is shape number 1 to 32.

Command Type . . . . Update

Command Structure . . . . EXCT_writSIP

    Syntax. . . . . @Ns,1=value

    Description . . . . Updates the shape name, where s is shape number 1 to 32 and value is a string of up to sixteen characters from set {A-Z0-9_ } or an empty string.

5.5.11 Command: P

Command Type . . . . Query

Command Structure . . . . EXCT_point

Syntax. . . . . @Pn

    Description . . . . Queries X and Y coordinate for a given point, where n is the point 1 to 255.

    Reply Example . . . . X coordinate, Y coordinate (for example, 2,-2)

Command Type . . . . Update

Command Structure . . . . EXCT_point

Syntax. . . . . @Pn=x,y

    Description . . . . Updates X coil and Y coil offset for a given point, where n is the point 1 to 255, x is the X coil offset (-15 to 15), and y is the Y coil offset (-15 to 15).

NOTE: Updating the location of a point does not cause it to be included in the shape when the S command is executed (see section 5.5.14). Use the U command to first define the length of the shape (see section 5.5.15 on page 5-23).

5.5.12 Command: Q

Command Type . . . . Query

Command Structure . . . . EXCT_qryshpsig

Syntax . . . . @Qs

  Description . . . . Queries the 16 bit CRC signature value ranging from 0 to 65535, where s is the shape number 1 to 32. Based on programmed shape parameters. Used to detect changes in programmed shape parameters.

  Reply Example . . . . Ranges from 0 to 65535, based on number of points and defined X and Y offset.

    ♦ 21930 is a defaulted empty shape

    ♦ 43605 is a shape of 0 points that was intentionally entered

    ♦ 65012 is a shape with one point at 0,0

5.5.13 Command: R

Command Type . . . . Copy

Command Structure . . . . EXCT_readshp

Syntax . . . . @Rs

  Description . . . . Copies the programmed shape parameters (x/y offset and size) of a shape number into the clipboard, where s is the shape number 1 to 32.

5.5.14 Command: S

Command Type . . . . Save

Command Structure . . . . EXCT_saveshp

Syntax . . . . @Ss

  Description . . . . Saves the copied shape parameters (x/y offset and size) to set length, if the shape number is the same as the copied shape number, or pastes the copied shape parameters to another shape number, where s is the shape number 1 to 32.

5.5.15 Command: U

Command Type . . . . Query

Command Structure . . . . EXCT_slength

Syntax. . . . . @U

    Description . . . . Queries the length/size of the shape currently copied or saved on the clipboard.

    Reply Example . . . . Ranges from 0 (empty) to 255 (all points)

Command Type . . . . Update

Command Structure . . . . EXCT_slength

Syntax. . . . . @U=n

    Description . . . . Updates the length and size of the shape currently copied or saved on the clipboard, where n is the number of points 0 to 255.

        NOTE: The shape must be saved with the S command (refer to section 5.5.14) to retain effect changes to shape storage.

5.5.16 Command: X

Command Type . . . . Clear

Command Structure . . . . EXCT_serase

Syntax. . . . . @X

    Description . . . . Clears the shape clipboard to a length of 0 and all points are cleared to 0,0 (XCO,YCO).

5.5.17 Command: c

Command Type . . . . Query

Command Structure . . . . EXCT_caldata

Syntax . . . . @cd,f?

    Description . . . . Queries the distortion calibration points A to P for the X or Y value, where d is a distortion point, A to P (refer to section 3.3.4.1 on page 3-13) and f is the ordinate selection ID, X or Y. For example, @cA,X?

    NOTE: Any number of spaces can be between the syntax elements.

Command Type . . . . Update

Command Structure . . . . EXCT_caldata

Syntax . . . . @cd,f=g

    Description . . . . Updates the distortion calibration points A to P with X and Y gain values, where d is a distortion point, A to P (refer to section 3.3.4.1 on page 3-13), f is the offset, X or Y, and g is the gain, 0 to 169. For example, @cA,X=22

    NOTE: Any number of spaces can be between the syntax elements. However, no spaces may follow the gain value.

5.5.18 Command: j

Command Type . . . . Clear

Command Structure . . . . EXCT_flush

Syntax . . . . @j=5309 (or @j = 5309)

    Description . . . . Resets the memory to default values after approximately 2 seconds. The Status screen will require an acknowledgement from the front panel or a remote command, @I4 (refer to section 5.5.7 on page 5-20).
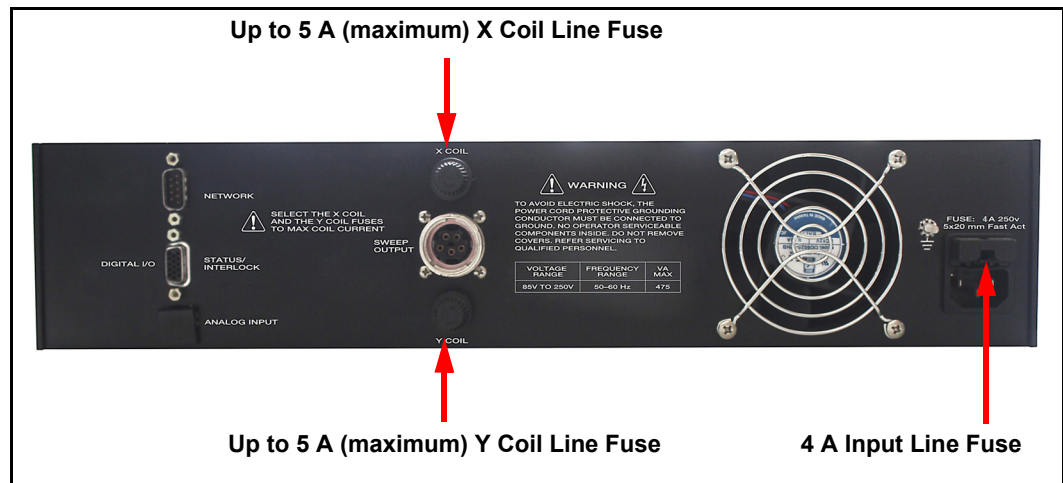
Chapter 6
Maintenance and Troubleshooting

6.1 Fuses

The input line fuses are located in a fuse holder just above the power cable connection (see Figure 6-1). Replace only with the proper type of 4 A fuses.

Figure 6-1 EBS-530 rear panel

Up to 5 A (maximum) X Coil Line Fuse

Up to 5 A (maximum) Y Coil Line Fuse   **4 A Input Line Fuse**

> ⚠ **CAUTION**
>
> **Before operating EBS-530, the proper fuses must be installed, and the maximum currents for the e-beam source coils must be programmed on the System Configuration screen.**
>
> **Refer to the e-beam source manual for the recommended current of the X and Y coils.**
>
> **EBS-530 can operate with a maximum output current of 5 A for the X coil and 5 A for the Y coil.**

EBS-530 has internal monitoring and current limiting protection. Two output fuses (X and Y coil line fuse) located on the rear panel (refer to Figure 2-7 on page 2-6) are also provided for internal protection.

If an output fuse fails, there may be a short in the vacuum chamber or the sweep coils may be improperly wired. After the cause of the short is removed, replace the fuse with a similar type fuse (5 A rating maximum).

6.2 Status Messages

Status messages are displayed on the **Status** screen (refer to section 3.3.1 on page 3-5). Table 6-1 indicates status messages that may be displayed. If there are multiple status messages, EBS-530 will only display one. When the displayed status message is satisfied, and other status messages have been detected, the next status message will appear.

Table 6-1 Status and Error Messages

STATUS MESSAGE	CAUSE	REMEDY
OFF	EBS-530 sweeping disabled	EBS-530 operating properly; no request to enable sweeping was received
ON	EBS-530 sweeping enabled	EBS-530 operating properly
70 V FAIL	Internal power supply failure	Contact INFICON (refer to section 1.3 on page 1-4)
X FUSE ABORT	X coil fuse not detected or not working properly	Replace X coil fuse (refer to section 6.1)
Y FUSE ABORT	Y coil fuse not detected or not working properly	Replace Y coil fuse (refer to section 6.1)
LOCAL STANDBY	Remote mode disabled, sweep on requested through RS-232 or front panel, EBS-530 waiting for interlocks to be satisfied	Satisfy all interlocks to begin sweeping
REMOTE ABORT	Remote mode enabled, Off button pressed on front panel	Press On button from the front panel to continue sweeping
REMOTE STANDBY	Remote mode enabled, sweep on requested, EBS-530 waiting for interlocks to be satisfied	Satisfy all interlocks to begin sweeping
HARDWARE FAILURE	Permanent failure of hardware	Contact INFICON (refer to section 1.3 on page 1-4)

PN 074-622-P1B

6.3 Troubleshooting Guide

If EBS-530 fails to work, or appears to have diminished performance, the following Symptom, Cause, Remedy charts may be helpful.

- **General EBS-530 Troubleshooting** (see section 6.3.1)

- **Computer Communications Troubleshooting** (see section 6.3.2 on page 6-5)

> ⚠️ **CAUTION**
>
> **There are no user serviceable components within the EBS-530 case.**
>
> **EBS-530 contains delicate circuitry which is susceptible to transient power line voltages. Disconnect the line cord whenever making any interface connections.**
>
> **Refer all maintenance to qualified personnel.**

6.3.1 General EBS-530 Troubleshooting

Table 6-2 General EBS-530 troubleshooting

SYMPTOM	CAUSE	REMEDY
Power on LED not illuminated	Blown fuse/circuit breaker tripped	Have qualified personnel replace fuse/reset circuit breaker
	Electrical cord unplugged from wall or back of EBS-530	Reconnect power cord
	Incorrect line voltage	Have qualified personnel verify line voltage and verify the EBS-530 is connected with the correct power cord
EBS-530 locks up	Cover or back panel not attached to EBS-530	Ensure all covers and panels are in place and securely fastened
	High electrical noise environment	Reroute RF cables (25.4 cm [1 ft.] away from high power conducting lines), keep all ground wires short with large surface area to minimize ground impedance
	Poor grounds or poor grounding practice	Verify proper earth ground, use appropriate ground strap, eliminate ground loops by establishing the correct system grounding, verify proper EBS-530 grounding (refer to section 2.1.1 on page 2-2)
EBS-530 does not retain parameters on power down (loss of parameters on power up)	Faulty non-volatile RAM	Contact INFICON (refer to section 1.3 on page 1-4)
Some keys on front panel function while others do not or touch screen LCD fails to function	Faulty touch screen LCD or faulty keypad ribbon cable	Contact INFICON (refer to section 1.3 on page 1-4)
LCD display dull or blank	LCD contrast adjustment required	Adjust LCD contrast (refer to section 3.3.5 on page 3-17)
	LCD or power supply problem	Contact INFICON (refer to section 1.3 on page 1-4)

PN 074-622-P1B

6.3.2 Computer Communications Troubleshooting

Table 6-3 Computer communications troubleshooting

SYMPTOM	CAUSE	REMEDY
Communications cannot be established between the host computer and EBS-530	Improper cable connection	Verify for correct cable wiring as described in section 5.1 on page 5-1
	Baud rate in host computer not the same as EBS-530	Verify baud rate in the application program operating on the host computer matches SMDP net speed of EBS-530 (refer to section 3.3.5 on page 3-17)
	Incompatible SMDP address being used for network connection	Verify SMDP address in the application program operating on the host computer matched SMDP com address of EBS-530 (refer to section 3.3.5 on page 3-17) 16 for RS-232 17 to 254 for RS-485
Error code returned	2 = Illegal Command	Command code not valid; some commands may not be in use **NOTE:** Examine software source code and command syntax.
	3 = Syntax Error	The command sent is not valid; too many or too few bytes in syntax (refer to section 5.2.1 on page 5-4) **NOTE:** Examine software source code and command syntax.
	4 = Data Range Error	The value sent is outside the range for the given parameter, verify the range for the parameter
	5 = Command Inhibited	Some commands may not be in use
	6 = Obsolete Command	No action taken; some commands may not be in use

This page is intentionally blank.