
ELECTRON BEAM PROGRAMMABLE SWEEP

INSTRUCTION MANUAL

Version 1



NILES ELECTRONICS

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GENERAL DESCRIPTION

Functional Description

The Niles Electronics Programmable Sweep is intended for use with electron beam guns that use magnetic deflection.

The Programmable Sweep outputs user-definable patterns to move E-Beam. A Sweep is needed for positioning and moving the E-Beam around the pocket in a defined pattern. The beam movement helps heat (and evaporate) the crucible pocket's material more evenly. Also, larger pockets can be used to allow more material in the vacuum chamber per evaporation run. Running current through magnetic coils of E-Beam gun accomplishes sweeping. The magnetic fields control the position/motion of the electron beam.

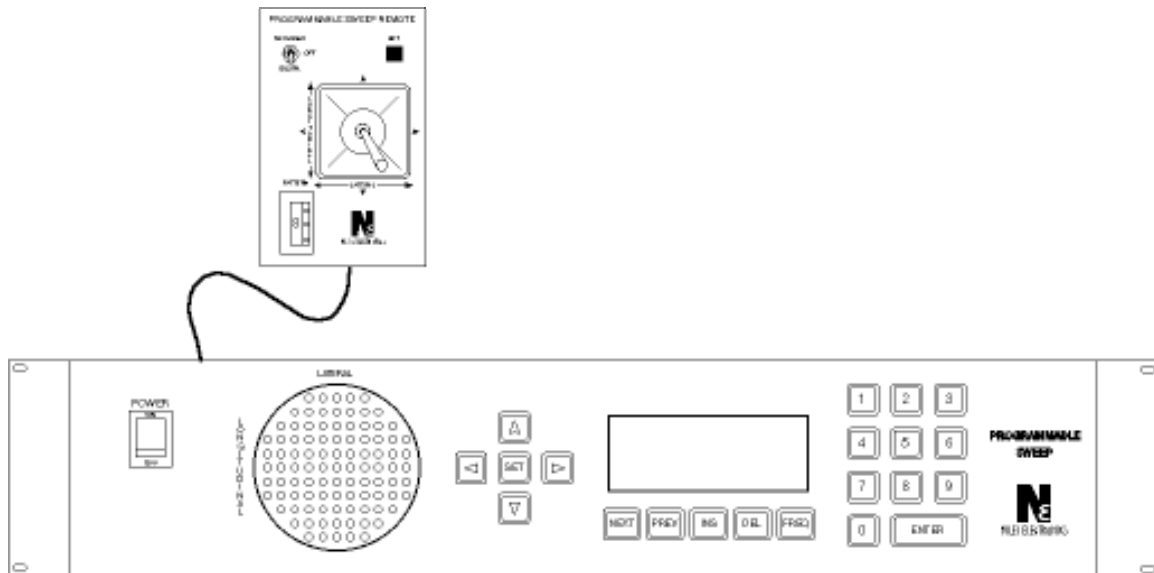
A simple front panel keypad combined with joystick interface is used to create and run EB sweep patterns. A LED (light-emitting diode) array display allows for easy visualization through the various steps of a normal operation. The Programmable Sweep can also calculate, display and allows the user to change the frequency as well as the center position of the currently running sweep pattern.

System Components

The Electron Beam Sweep consists of the following:

- Sweep Main Module
- Remote Unit – Joystick and Thumbwheel Pattern Selection Cabling
- Cable Between the Two Units

Figure 1-A General View



2

SPECIFICATIONS

Sweep

- Input voltage: 120/240 volts, 1-phase, 60 Hz. (230 Volts, 50 Hz for European Countries)
- Output current: Dual Channel (Longitudinal and Lateral): plus or minus (+/-) 1.5 amp, maximum, into a load with impedance equal to or less than 10 ohms.
- Output voltage: Plus or minus (+/-) 15v peak into coils with impedance greater than 10 ohms.

Control

- PLC input: Binary coded input to select running pattern.
- 120 Patterns
- 100 Steps/Pattern.
- 1-8 Unit dwell time for each step
- Minimum time unit: $0.5 \text{ ms} \times 1 \times 1 = 1.5\text{ms}$
- Maximum dwell time: $0.5\text{ms} \times 31 \times 8 = 124 \text{ ms}$

3

INSTALLATION

Introduction

The Electron Beam Gun Programmable Sweep is designed to be mounted in a standard 19 inch electronic instrument cabinet. Height is 2 unit high (3.5"). The installation procedures are described below.

Please see Figure 3-A and 3-B

Standard Handheld Sweep Remote Control

A standard handheld remote with position control, some programming functions and pattern selection of the sweep should be plugged into the 15 pin D-sub and 9 pin D-sub connectors on the rear panel. (It can also be plugged into the front panel, depending on the version you purchased.) The joystick can control the beam position when analogue mode is selected and simulates the direction keys when digital mode is selected. The thumbwheel switch selects the pattern to run via binary input to the 9 pin D-sub PLC connector.

Rear Panel

1 AC Input Jack and Fuse:

American Version – The AC voltage input has two ranges, either 120 or 240 VAC. (Do NOT select 100v or 230v). This is selectable at the jack/fuse-holder by pulling out the tiny circuit board with needle-nose pliers. The board is labeled with four (4) choices, and should be turned one way or the other, depending on the available line voltage. For 120v usage, use a 2A slow-blow fuse; for 240v usage, a 1A slow-blow fuse.

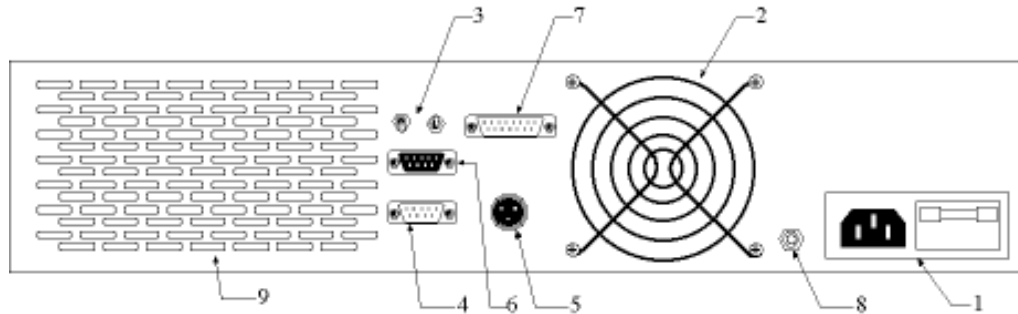
European Version: 5 x 20 mm fuse is used. The voltage selection has 220v and 110v. Use 800 ma fuse for 230v and 1.6 amp for 115v in case sweep is using 110v or 100v AC power. A spare fuse is stored in the fuse holder drawer.

NOTE: Since a switching power supply is used in this sweep, there will be a surge current that flows through the fuse when power is turned on. Therefore, the fuse must be a slow-blow type. Never use fast acting fuse with higher current rating.

2 Fan:

The fan must be running when the power is on. Do not use this sweep if the fan does not run.

Figure 3-A Rear View



3 Output-polarity toggle switches:

These switches can reverse the output axis. Down is normal. The left switch is Longitudinal (Y-axis, near/far) The right switch is Lateral (X-axis, left/right)

4 9-pin female D-sub remote PLC port pattern selection input.

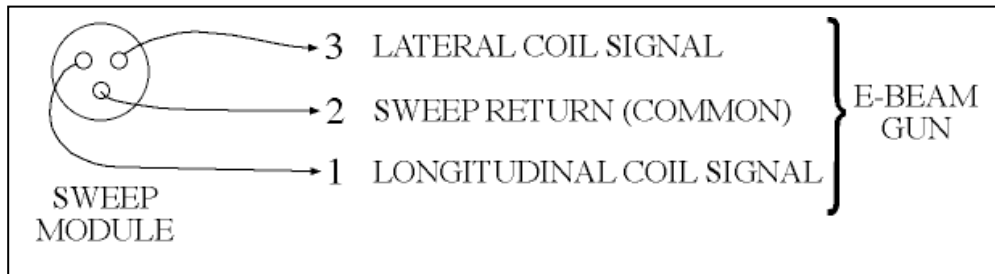
5 Sweep output connector: (See Figure 3-B)

Connection of the sweep generator to the electron beam gun coils is shown in Figure 3-B, Sweep Output Connections. The horizontal and lateral coils should be brought out of the tank by way of a feed through and connected to pins 1,2,3 Sweep Output Connector as shown. The interconnecting wire must

be capable of passing a minimum of three amperes. The return wire is shared by both longitudinal and lateral coils. The sweep voltage is not grounded inside the sweep for flexibility. However, you should connect the return wire to ground at the E-Gun end. To leave the return wire ungrounded could damage the sweep.

Normally one side of each coil is connected to ground at the electron beam gun. The return wire is connected to the same spot inside the tank.

Figure 3-B Sweep Output Connections



- 6** PC RS-232 Connector
- 7** Joy Stick Remote Control Connector
- 8** Ground
- 9** Ventilation Holes

4

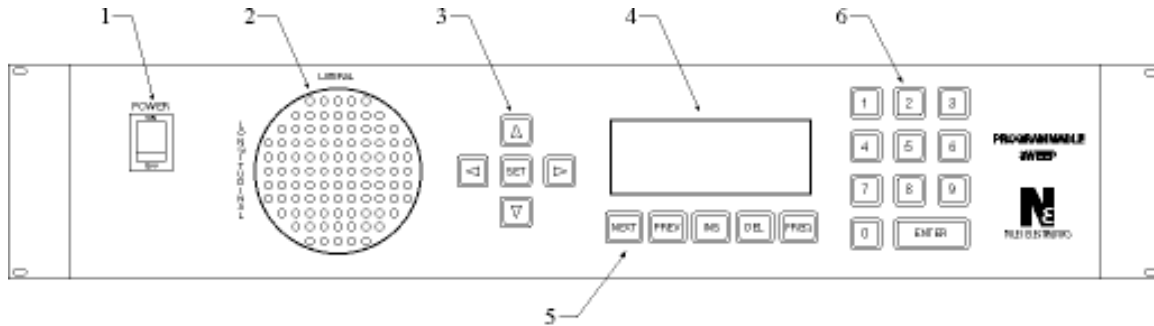
CONTROLS AND INDICATORS

Controller

Please see Figure 4-A

- 1** AC input power ON/OFF switch. American Version: on/off; European Version: 1/0
- 2** LED Array: These lights show step by step the pattern being run. They run at a fixed frequency and evenly spaced dwell time. It is not synchronized with real beam movement. Also used for pattern editing and modification.
- 3** Direction Arrow Keys (Arrows pointing left & right are $-X$ & $+X$ Lateral axis respectively; up/down = far/near = $+Y/-Y$ Longitudinal axis) & **SET** key.
- 4** LCD Display: This offers command menu choices and operation guide. Step-by-step procedures and error messages are shown. Check the LCD for operation hints.
- 5** Function Keys
NEXT, PREV INS, DEL, FREQ [explained in next chapter]
- 6** Numerical Keys & Enter Key

Figure 4-A Sweep Chassis



Handheld Remote

- 1 Joystick wand lever controls beam position if analogue mode is selected: left [-] & right [+] (“lateral”) is the X-axis; near [-] (as seen from the e-gun filament) & far [+] (“longitudinal”) is the Y-axis. The Joystick duplicates the front panel arrow keys (up = far, down = near) if digital mode is selected.

Note: This is a special joystick without a spring-return to center. Therefore it can be left in any preferred position to control the center position of running pattern when analogue mode is selected. However, in digital mode it should be left in the center when not being used, so as not to interfere with the “set” switch or other functions. *We strongly suggest setting the mode to “off” selection when the joystick is not being used.*

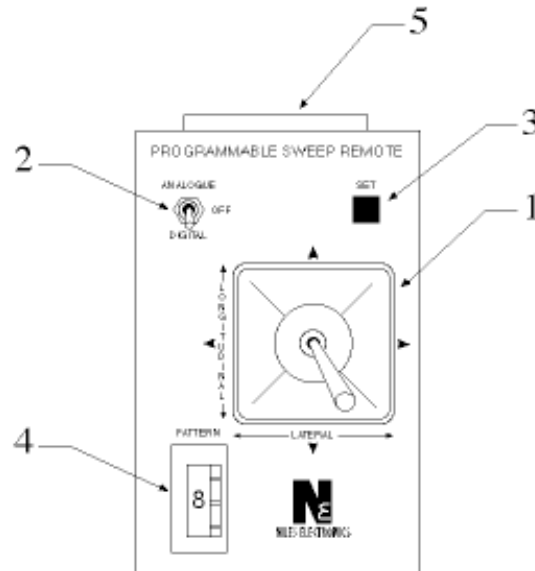
- 2 Mode Selection Switch:

Digital: (switch down position). Joystick corresponds to Direction Arrow Keys, and each flexing of the joystick results in one pattern step motion (in the direction of the joystick motion) as displayed on the LED array, and a beep from the Sweep. This mode can also be used for changes in pattern frequency or position by moving the joystick by combining the use of the **FREQ** or **INS** keys on front panel.

Off: (switch center position). Joystick and **SET** key do not function.

Analogue: (switch up position). The joystick adds analogue signals to control the e-beam position, allowing the user to precondition the material manually or change the center of running pattern without changing the center information stored in the RAM. This mode supplements the center position of the programmed sweeping patterns. The LED array does not display this supplementation. LED array only shows the running pattern so the user can understand the running pattern without looking into the vacuum chamber

Figure 4-B Handheld Remote



- 3** Set Switch is connected in parallel with the front panel **SET** key. It can set a pattern step's position or set the step's dwell time (increasing the dwell with each push). See "Creating a Pattern." It is functioning only if the cable is connected and if the mode setting is digital. When mode is off, the LED light will go off also.

- 4** Pattern selection Thumbwheel Switch provides a simple use of the PLC jack (9-pin D-sub) on the back panel. It allows nine specific patterns to be manually selected at the flip of the switch. There is also a '0' zero position which gives the pattern selection power to the front panel while the cable is connected since PLC input has higher priority. The zero position allows manual entry of pattern numbers by pushing number keys & **ENTER**, or **PREV**, or **NEXT**.

NOTE: If the wheel switch is left in a pattern position other than zero, that pattern will run within 1.5 seconds. If a new pattern is entered numerically or the **PREV** or **NEXT** key is pushed the new pattern will run within 0.006 seconds, but in the following poll the pattern number of the wheel switch will re-engage. This happens as the sweep constantly polls the PLC jack for a pattern selection command.

- 5** The Handheld has a 25-pin D-sub Male connector. The other end of the cable splits the 25 conductors to two (2) jacks – the 15 pin for joystick and the 9-pin for PLC pattern selection.

5

OPERATION

NOTE: Before initial turn on, the voltage selector on the back panel should be checked that it matches the line voltage and use appropriate fuse.

Introduction

Power-On

When the front panel ON/OFF switch is turned on, the LCD lights up with an opening Main menu of command choices. (Note: Some commands may appear abbreviated, e.g., “pattern” is often shown as “ptrn” to fit in the limited space on the LCD.) The LED array has the center light on. (Note: If the sweep was last turned off with valid PLC input and this input is still the same when the sweep is turned on, the sweep will run the last running patterns without going to the main menu. This feature gives the user the convenience of not needing to key in from the front panel if the sweep needs to be turned off for any reason.)

Also, turn on the power supply HV & Emission. Set the Hi-Voltage at the level necessary for the E-Beam Gun, but set the Emission low enough to barely see a beam. That way Programmable Sweep pattern settings can be judged and finalized without affecting the material, or damaging the gun.

Power-Off

Go to the Main menu before turning off main power. This best ensures enough time for memory to finish setting up. In particular, try not to turn off power when doing memory-writing functions, such as Copy Pattern, Delete Pattern, Create Pattern. Power loss during operations such as these could result in corruption or loss of some parts of memory. *Exception: It is OK to turn off the sweep while it is running a pattern.*

When the front panel ON/OFF switch is turned off, all lights and outputs go off. All patterns are stored in memory. The last pattern used will be the current selection when the unit is turned back on.

Programming

Pattern Structure

Each pattern consists of individual steps. Each step defines a position and dwelling time for the electron beam. The pattern can contain up to 100 steps. The end of the pattern is marked by a final step, which always has a dwell time of zero (0). If 100 steps were actually used, the 100th step would have to dwell at zero (0).

Nonvolatile Memory

The Programmable Sweep has an internal 32 Kbyte memory.

Pattern-Count Identification

The Programmable Sweep can hold up to 120 patterns. A corresponding number identifies each pattern. If the user commands to run a pattern that is not stored, the LCD gives the error message “Pattern Not Valid.” (See “Running a Pattern” and “PLC Interface”)

Calculation of Frequency

When a pattern is created, the dwell time of each step is defined as 1 to 8 time-units of variable length. Each time-unit can vary from 0.5mS to 15.5mS long (0.5mS X 1 ~ 0.5mS X 31), in increments of 0.5mS determined by frequency setting. The length of the time-unit can be changed at run-time; this changed corresponds to a change in frequency. The Programmable Sweep calculates the frequency by summing the dwell time of the pattern steps, and then taking the inverse of the sum.

The initial frequency that appears in a new pattern is a function of the number of steps in the pattern. Therefore, the more steps included in the pattern, the slower the initial frequency. Once the patter is running, however, the frequency can easily be modified. (See “Running a Pattern”) So a typical 20-step pattern, if each step had a minimum dwell time (of 1 time-unit), would result in a pattern frequency of 100 Hz once the frequency was reduced to minimum (where the time-unit is 0.5mS) by using the **FREQ** function.

Fixed Base Time Interval = 0.5mS

This value is preset by design.

Factor Changed by Frequency = 1~31

This factor is set for whole pattern.

The product of these two makes time-unit.

Factor Changed by Dwell = 1~8
point.

This can be set for every individual

Creating a Pattern

- 1 From the Main menu, press 1 for the Create/Modify pattern option.

```
1. Create/Modify
2. Delete/Copy
3. Run Pattern
4. Link with PC
```

- 2 From the Create/Modify menu, Press 1 to Create a Pattern

```
Create/Modify
1. Create a pattern
2. Modify a pattern
3. Return to Main
```

- 3 The next available (unused) pattern number is automatically displayed on the LCD. If desired, use the numerical keys to change to a different number that is not currently assigned to a pattern. Press **ENTER**. If you try to change to a pattern that is already used, an error message will be displayed.

```
Create ptrn:      001
Ptrn already exists
Any key to continue
```

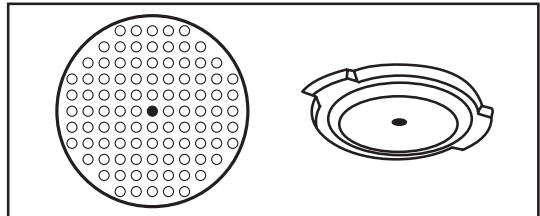
Valid pattern numbers ranged from 001 to 120 (enter three digits). LCD says:

Press **ENTER** to accept the displayed number. Pressing any keys other than a number or **ENTER** returns to the Main menu. Once accepting a pattern number, LCD says:

```
Create ptrn:      001
NUM keys to change
ENTER to confirm
Other key to cancel
```

- 4 The center LED is blinking. While looking at the electron-beam striking the pocket, use the joystick (in program mode) or direction arrow keys to move

```
Create ptrn:      001
Move beam to center
```



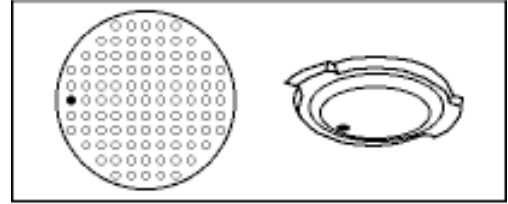
the beam to the center of the pocket. Push the **SET** button (on front panel or Handheld) to finalize the position. The center LED goes off and an edge LED blinks.

The pocket edge LED display representing each axis extreme will NOT move as the beam is moved around the pocket. As each point is fixed [SET], the Led will move to the next extreme, and the LCD will keep listing them as finished, in this order, and ask for setting the next extreme.

- 5 Repeat the previous creation-step to move to and set the positions of the $-X$, $+X$, $-Y$ and $+Y$ axis extremes of the sweep area. (See the Joystick explanation I n Section One: Model Overview.) The LED display indicates which direction to go, watch the crucible pocket to see the beam move to the corresponding position, as illustrate. These axis extremes should correspond to points where the e-beam strikes the edges of the pocket. You **MUST** set these points to the specific pocket. (*NOTE: The actual XY shape of the Programmable Sweep is octagonal. When it is imposed on a circular pocket, the extremes of the e-beam output should be adjusted to the corners of the octagonal output remain inside the pocket.*) At each point, **SET** is again pushed.

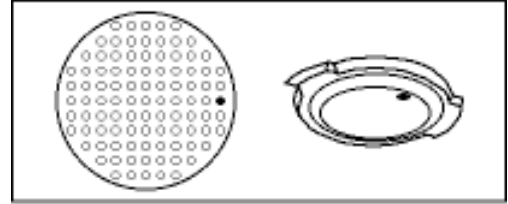
```

Create ptrn:      001
Center done !
Move to -X extreme
  
```



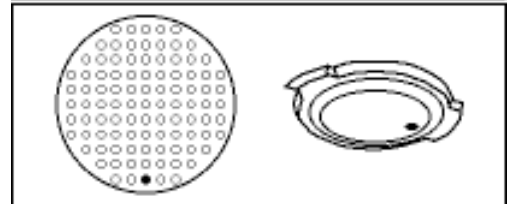
```

Create ptrn:      001
CNTR, -X done !
Move to +X extreme
  
```



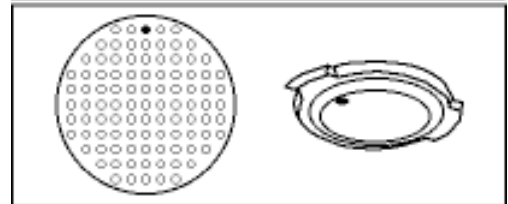
```

Create ptrn:      001
CNTR, -X, +X done !
Move to -Y extreme
  
```



```

Create ptrn:      001
CNTR, -X, +X, -Y done !
Move to +Y extreme
  
```



After the final command step, locations of a new pattern can be put in.

To Specify Steps (Input Location) Press **ENTER** to access current step.)

```
Create ptrn:      001
CN, -X, +X, -Y, +Y done !
Please input loc
Any key to continue
```

6 Using the joystick (in program mode) or direction arrow keys, move the beam to the desired position (the LED's will show positioning) and push **SET** (on the Handheld Joystick or front panel). The step position is finalized

```
Create ptrn:      001
Current step :001
```

7 The dwell time of the step defaults to 1. To increase the dwell, push the joystick **SET** button to increment by 1's or push a numerical key. Valid dwell times range from 1 to 8. The Programmable Sweep accepts the currently displayed dwell time when you either press **ENTER** or change the step position by flexing the joystick or pushing a direction arrow key. To re-define the position of the current step, press **DEL** to go back.

```
Create ptrn:      001
Current step :001
Dwelling time:5
```

Insert/Edit Steps

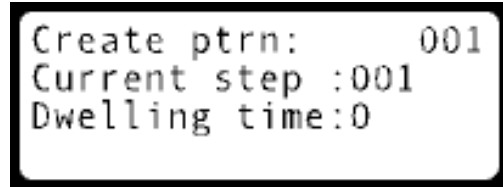
8 To re-define previous steps, press **PREV** to go back. At each step, use the joystick/arrow keys to re-define the position. Use **INS** to insert a step ahead of the present position, but with the same position (which can then be changed) and dwell time; or use **DEL** to delete the current step. When inserting, pushing the joystick **SET** button (or pushing the **SET** key) once sets the step position, then additional pushes allow the dwell time to be altered. Each step must have a valid dwell time to be complete. When deleting, the LCD will ask for zero (0) if the step is to be deleted. If so, press 0. Pressing any other key aborts the deletion. Press **NEXT** to go forward as necessary. **PREV** and **NEXT** allow travel within pattern creation. Plus, the first and last pattern steps wrap-around to go from one

end of the pattern to the other. This provides easier access to the early pattern steps after completing the pattern, in case dwell times, etc. need to be edited. (See Modify a Pattern on page 5-10)

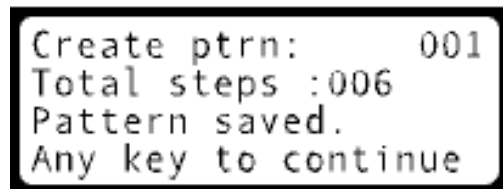
To End Pattern Creation

Note: If power is lost (or turned off) while creating a pattern, the current pattern being created will not be saved.

- 9 There is a limit to the number of steps (100) in a pattern. After all the steps of the pattern have been defined, create another step of arbitrary position (it can even be the same as the previous step), as in creation-step #6 above. When the position is SET, the step will still default to a 1 dwell time. Use the numerical key zero to enter a dwell time of 0 (press 0). Press **ENTER**. *This extra step indicates the end of the pattern and will not show up in the actual e-beam sweep.*



```
Create ptrn: 001
Current step :001
Dwelling time:0
```



```
Create ptrn: 001
Total steps :006
Pattern saved.
Any key to continue
```

Now the pattern is complete and saved. Return to the Main menu.

NOTE: Once the user is accustomed to this setup operation, it is an easy task to create patterns simply by looking at the LED array, and stepping/dwelling through the necessary shapes. No output has to be connected to the Programmable Sweep. The centering/extremes setting can be moved through with or without moving the joystick. The joystick/arrows could set them, but without coils (thus the e-beam moving in the pocket), there is no appropriate pocket-size reference. So push a “set” repeatedly until the pattern’s first step is requested.

However, in order to safely run the pattern on the e-gun, you **MUST** re-check the position of the beam as it strikes the pocket. You can temporarily center a running beam with the joystick in sweep mode, but it is best to use the section “Modify a Pattern” to correctly set the program-digital center and axis extremes.

Then exit back out of the section by hitting **FREQ**, etc. since the pattern steps are already set.

If during a coating process, areas of the pocket are found to be melting unevenly; it may be necessary to watch the pocket while creating a pattern, in order to use step dwell-times to appropriately heat those areas.



CAUTION: While moving through the pattern, if a dwell-time of zero is set (by pushing the numerical 0 key); the Programmable Sweep will recognize this as the last step, and discard all the steps that follow. On the other hand, this is a good way to shorten a long pattern, instead of deleting many steps, set that dwell-time 0 somewhere in the middle. (See also “Deleting a Pattern”)

Running a Pattern

- 1 From the Main menu, press 3 for the “Run a Pattern” option.
- 2 The most recent pattern number accessed (run) is on the LCD. If desired, use the numerical keys to choose a different pattern number. Valid pattern numbers range from 001 to 120 (enter 3 digits). Press **ENTER** to accept the displayed number. (Any other key would cancel the request to run.)
- 3 The specified pattern will now be sent to the e-beam gun. The LCD says:

(Press **DEL** to stop and return to the Main menu at any time. The pattern will stop, i.e. e-beam will not sweep.) The pattern will always begin with the first step and begin to sequence. The LEDs will run the pattern shape.

```
1. Create/Modify
2. Delete/Copy
3. Run a pattern
4. Link with PC
```

```
Run pattern:      001
NUM keys to change
ENTER to confirm
Other key to cancel
```

```
Running ptrn no:001

Press DEL to stop
```

Changing Pattern Center (Beam Position)

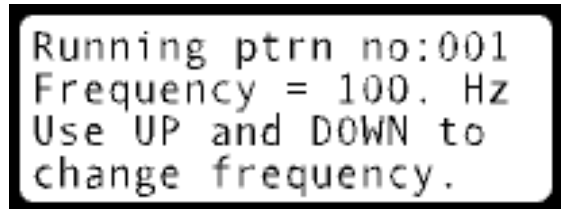
- 4 It is possible to edit the center point of the pattern while running (a change “on-the-fly”). This may be necessary to compensate for voltage changes, material

evaporation, etc. While running a pattern, press INS. Then use the arrow keys or joystick (in program mode) to move the pattern over, in any of the four axis directions. Unlike the "create" sections where the joystick can be held down to move the set point, in this center-editing mode the joystick will only allow a one-step movement (and beep) per key/joystick press. (This protects against accidental re-centering when steady joystick pressure is applied.) Press a SET to hold the position. The pattern automatically remembers the new center point. The pattern continues to run.

To check the beam center position, press DEL to stop the pattern. (CAUTION: Emission may need to be turned down, and will affect the process in progress.) Watch the beam's position to help decide how much adjustment it will take. Then press 3 and ENTER again to run the same pattern. Now repeat this step if further re-centering is required. Note the pattern size has remained the same. Care must be used to ensure the beam does not move out of the pocket once re-centering has taken place. Should that pattern have to be resized, go to the "modify section."

Changing Frequency (Pattern Speed)

A pattern runs initially at a speed dependent on the number of steps. To change the frequency, press **FREQ**. The current frequency will be displayed on the LCD. Move the joystick (in program mode) towards you (near) or push the bottom direction arrow key (pointing down) to decrease the frequency. Joystick-away or arrow-up increases the frequency. The sweep beeps with each motion and subsequent change of frequency. Keep repeating the motion-to-beep until the desired frequency is reached (holding down the joystick or button won't sequence changes like it does for positioning). The new frequency is displayed, the sweep beeps, and the new frequency is automatically saved. Press **FREQ** again (or **ENTER**) to exit the frequency-altering mode. (Each pattern has an independent frequency, and altering it has **NO** effect on the speed of other patterns.)



Running ptrn no:001
Frequency = 100. Hz
Use UP and DOWN to
change frequency.

NOTE: LED array has a fixed running rate. It is intended to show the pattern position/shape. It will not show the differences between step-to-step dwell-times. Also, when using the **FREQ** mode to change speed, the LED

speed does not change. The actual output pattern of the e-beam will change speed in the pocket. Check the e-beam to make sure the new frequency is appropriate. ALSO, it is a simple matter to copy the pattern into different pattern number locations, and set each copy at a different frequency. See “Copying a Pattern” on page 5-11.

Changing Patterns

- 6 There are two (2) ways to manually change patterns while running a pattern. (This is a change “on-the-fly.”)
- A** The simplest way is to press **PREV** or **NEXT**. This changes to the previous or next available pattern number in sequence. Therefore, it skips pattern numbers, which are empty. It does NOT recall the last pattern you ran, it just goes forward or backward in sequence. This is also valid for wrapping-around from the last pattern to the first, etc. See also “PLC Interface” on page 5-14.
- B** The second way to change to another pattern on-the-fly, use the numerical keys, always entering three digits, and push **ENTER**. For example, pattern #9 would be 009, while #25 would be 025, while #120 would be 120. If a pattern number is requested but is empty, i.e. no pattern has been created with that identity number, the LCD will say invalid pattern: 00x, and the current pattern (prior to the invalid entry) will continue to run. The pattern doesn’t actually change until the **ENTER** key is pushed. See also “PLC Interface” page 5-14.
- NOTE: The position of the e-beam impact depends on the surface shape of the material in the pocket. As the evaporation process progresses and the surface changes, it may be necessary to switch to a different pattern to accommodate the change.

Quitting a Pattern

- 7 At any time, press **DEL** to stop and instantly return to the Main menu. The pattern will stop, i.e. the e-beam will not sweep. When quitting a pattern (or changing to another on-the-fly), the last frequency is automatically saved. Once the pattern stops, selection “3” on the Main menu again picks the “run” menu, where you enter a pattern number (three digits) and push the **ENTER** key to run a new pattern.

When turning off the unit, it is best to return to the Main menu first.

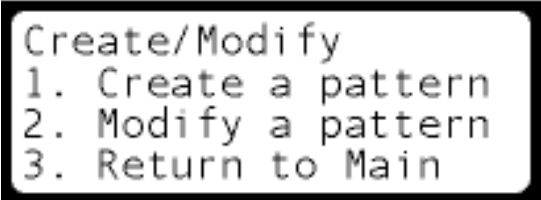
Modifying a Pattern

- 1 From the Main menu, press 1 for the Create/Modify pattern option.



```
1. Create/Modify
2. Delete/Copy
3. Run Pattern
```

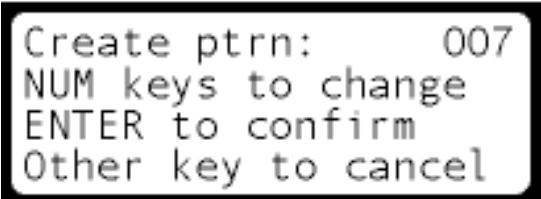
- 2 From the Create/Modify menu, press 2 to Modify a Pattern.



```
Create/Modify
1. Create a pattern
2. Modify a pattern
3. Return to Main
```

- 3 The last accessed pattern number is displayed on the LCD. If desired, use the numerical keys to choose a different pattern number. Valid pattern numbers range from 001 to 120 (enter three digits). Press ENTER to accept the displayed number.

- 4 Check the e-beam. If necessary, use the joystick or direction arrow keys to adjust the beam to the center of the pocket. Push the joystick SET button (or press the SET key) to fix the position.



```
Create ptrn: 007
NUM keys to change
ENTER to confirm
Other key to cancel
```

- 5 Repeat the previous task to adjust the +/-, X/Y extremes. See “Creating a Pattern” on page 5-3.

NOTE: Modification steps #4 & 5 can be rushed straight through if the positions do not need to be changed – keep pressing **SET**. Be sure to view the beam placement in the pocket. This is also a chance to re-size or scale a pattern. The same pattern may be expanded or contracted, depending on the +/-, X/Y extremes. This is very important if the crucible pocket size has changed. But it also allows having a pattern stored in different sizes, relative to pocket size. The pattern can even be stretched out of shape, if one axis-set is modified disproportionately to the other. See also “Copying a Pattern” on page 5-11.

- 6 Use **PREV** or **NEXT** to go backward or forward step-by-step. The first and last steps wrap-around. At each step, use the joystick/arrow keys to modify the position; and/or use **INS** to insert before the current step; or use **DEL** to eliminate the current step. Then press the **SET** key or push the joystick **SET** button to fix any step position. Then the dwell-time can be modified by pushing a number key or augmenting with pushes of a **SET** button (increments of 1) [each push beeps]. Valid dwell-times range from 1 to 8. To go back and modify the current step, press **DEL**. Any modified step is finalized and saved when the dwell-time is entered by pushing **ENTER** or moving the joystick in the direction of the next step. **CAUTION:** remember – entering zero (0) for dwell and “entering” it will end the pattern, deleting any steps that follow!

- 7 To exit the pattern, press **FREQ**. The modified pattern is now saved to memory. The LCD message may be “press any key to save.” The Main menu returns. To immediately test this modified pattern, press 3, the **ENTER**. The pattern just modified runs.

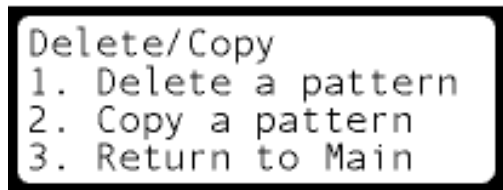
CAUTION: Going back to a previously defined step and inputting a dwell-time of zero (by pressing the numerical key 0) tells the Sweep this pattern has ended. The Programmable Sweep always recognizes this as the last step and discards all the steps that follow. See “Creating a Pattern on page 5-3. See also “Deleting a Pattern” on page 5-11.

Copying a Pattern

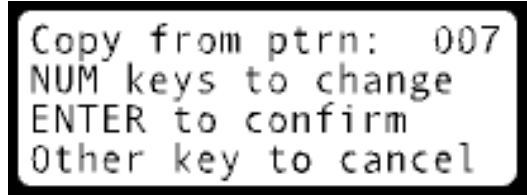
- 1 From the Main menu, press 2 for the Copy/Delete pattern option.



- 2 From the Copy/Delete menu, press 2 to Copy a Pattern.



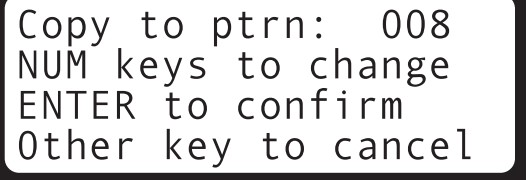
- 3 The last accessed pattern number is displayed on the LCD. The LCD says:



```
Copy from ptrn: 007
NUM keys to change
ENTER to confirm
Other key to cancel
```

If desired, use the numerical keys to choose a different pattern number. Valid pattern numbers range from 001 to 254 (use three digits). Press **ENTER** to accept the displayed number. (Pressing any other key will cancel the request to copy.)

- 4 The LCD says: *Copy to ptrn: 00x* and automatically shows the first available empty pattern number. If desired, use the numerical keys to choose a different pattern number. Valid pattern numbers range from 001 to 120 (enter three digits).



```
Copy to ptrn: 008
NUM keys to change
ENTER to confirm
Other key to cancel
```

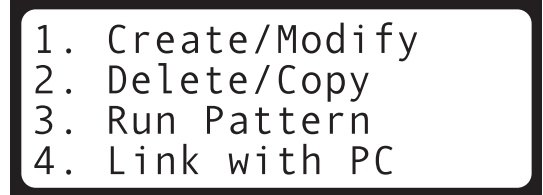
Press **ENTER** to accept the displayed number. If the new pattern number selected is already used, the LCD says, *Ptrn already exists, Any key to continue*. This cancels the copy request and jumps back to the Copy/Delete menu. It is not possible to overwrite a pattern already stored. To reuse a full pattern number, that pattern must first be deleted, then it can be copied to.

However, a higher unused pattern number CAN be selected, if the default automatic first choice (lowest empty available number) is not preferred. Whether the default or that higher number is selected, pressing **ENTER** copies the program. LCD says, *Pattern copied. Any key to continue*.

Pushing any of the keys jumps out of the Main menu. Now the original and the preferred copy number contain identical programs. At that point, either may be edited (see page 5-9, "Modify a Pattern.") Different versions (altered size, speed, center-point, number of steps or their dwell-times, etc.) of patterns may be stored as different pattern numbers. This allows pre-set modified versions to be immediately recalled.

Deleting a Pattern

- 1 From the Main menu, press 2 for the Copy/Delete pattern option.



```
1. Create/Modify
2. Delete/Copy
3. Run Pattern
4. Link with PC
```

- 2 From the Copy/Delete menu, press 1 for the Delete a Pattern option.

```
Delete/Copy
1. Delete a pattern
2. Copy a pattern
3. Return to Main
```

- 3 The last accessed pattern number is displayed. If desired, use the numerical keys to choose a different pattern number. Valid pattern numbers range from 001 to 254 (enter three digits). Press **ENTER** to accept the displayed number.

```
Delete ptrn:      007
NUM keys to change
ENTER to confirm
Other key to cancel
```

- 4 The LCD panel now reads:

```
Delete ptrn:      007
Are you sure?
0. Yes, delete it.
Other key to cancel
```

Press zero (0) to confirm the deletion. Pressing any of the other keys will cancel request for deletion and jump back to the *Delete ptrn: 00x* screen. To abort the deletion, again press any key except **ENTER**. For deletion to continue, once a pattern number is entered and confirmed for deletion (by pressing **ENTER**), the LCD says:

```
Delete ptrn:      007
Pattern deleted.
Any key to continue
```

Pushing any of the keys will jump out to the Main menu. The deleted pattern is not recoverable. The empty pattern location can now have a pattern created in it or copied to it.

PLC (Programmable Logic Control) Interface

Programming Explanation

When the Programmable Sweep is running a pattern, it polls the PLC Interface port every 1.5 seconds for a new pattern number. If a valid pattern number is detected, the Programmable Sweep will switch to the new pattern right after the poll, beginning with step 1. This is the remote version of changing pattern on-the-fly.

Binary signals in a Hexadecimal pattern must be used. The port is the 9-pin D-sub connector on the back panel, with pin 5 the Ground. Pin 1 is the least significant bit (B0), while pin 9 is the most significant (B7). Because the D-sub alternates its pins on a ribbon cable, the bits correspond respectively to pins 1, 6, 2, 7, 3, 8, 4, and 9. (See explanation and table below.)

The Thumbwheel

The Thumbwheel is a mechanical substitute for PLC, and provides the user with quick remote access to patterns 1 through 9. The Thumbwheel switch should not be used simultaneously with actual PLC input. Switch patterns exactly correspond to the wheel number, i.e. poss. 2 is pattern 2, etc. Position zero (0) on the wheel is off or neutral, in that it allows the front panel pattern selection controls (three digit number & **ENTER**, or **PREV**, or **NEXT**) to be used. (This works because the Thumbwheel switch controls four of the eight PLC inputs as if it were four plain switches – see binary counting below.)

The Thumbwheel cable from the handheld remote terminated in the 9-pin D-sub cable, and it should not be plugged onto the back panel if external PLC will be used. (PLC would have to be connected there at the 9-pin)



CAUTION: A second or two of beam staying at one spot could still be enough to blast the material.

If the Thumbwheel is put in a pattern position (1through 9), then quickly switched back to zero, the pattern may continue to run. Moving to the zero position does not cause a

change. But moving across patterns, i.e. other wheel numbers, may cause a pattern change if the PLC happens to be polled at that moment.

Binary Examples

Binary was chosen instead of BCD (Binary Coded Decimal) since for the 9-pin connector {where one pin is used for ground}, only 99 patterns could be achieved in BCD with the remaining eight pins. While the Binary can choose up to 255 patterns in theory.

Bit arrangement of connector pins:

Signal	Gnd	B7	B6	B5	B4	B3	B2	B1	B0
D-sub pin #	5	9	4	8	3	7	2	6	1

Any pin, from B0 to B7 connects to pin 5, common, is 0. When left not connected is 1.

Pattern upon changing Thumbwheel positions:

Wheel Pos. #	1		2		3		4		5	
Pattern #	1		2		3		4		5	
Binary Code	B7	B0	B7	B0	B7	B0	B7	B0	B7	B0
	0000	0001	0000	0010	0000	0011	0000	0100	0000	0101

Wheel Pos. #	6		7		8		9	
Pattern #	6		7		8		9	
Binary Code	B7	B0	B7	B0	B7	B0	B7	B0
	0000	1010	0000	0111	0000	1000	0000	1001

Defragmenting or Re-initializing the Internal Memory

If for some reason the internal memory becomes corrupted beyond convenience, for example, blanked or merged patterns, it can be repaired or erased from the Main menu by entering the fatal key sequence:

DEL, DEL, DEL, ENTER

This brings up a hidden menu. Two choices:

```
Memory functions
1. Clear all memory
2. Return to Main
```

1 CLEAR ALL MEMORY

This choice on the hidden menu requires caution:

The top menu choice is 1, **CLEAR ALL MEMORY**, which then gives another menu for verification:

```
Clear all memory
Are you sure?
0. Yes, proceed
Other key to cancel
```



CAUTION!! If you press zero (0), this choice will erase every pattern in memory, so it is **ONLY** for emergency use only. Everything will be lost. All patterns will be empty. Nothing is saved or can be recovered.

If you change your mind at this point (the last chance), pressing any other key to cancel throws you back out to the Main menu.

However, when selecting the erase/clear option (0), you push any key to move back out to the Main menu.

2 RETURN TO MAIN

The bottom menu choice is 2, which returns to Main menu, in case you change your mind.

PC LINK

Introduction

The Programmable Sweep can work alone perfectly. However, Niles Electronics makes it even more flexible by giving it the capability to link with a PC.

There is software stored on a CD, a standard accessory called “PSLink,” that can be installed on the PC Windows platform. Since this software is installed in the PC and used to link with PS (Programmable Sweep), that is why this software is named as PSLink instead of PCLink.

The software stored on the CD consists of two files. The first part is executable file named PSLinkinstall###.exe where ### is the version number. The second part is code file named PSLinkinstall###.W02.

Why PSLink ?

The software PSLink allows the user to Create, Modify, Copy sweep patterns on the computer screen instead of the Programmable Sweep front panel. Also user can store the patterns to the hard disk drive or load patterns from the hard disk drive. Eventually, the user can transfer patterns between the PC and the PS. This capability allows the user to store the patterns that created at the production site into the computer or transfer the patterns from one Programmable Sweep to another.

Install PSLink software to your PC or Workstation

1st step: Put the CD into the CD-DRIVE.

2nd step: Copy the contents of CD to the “temp” folder.

3rd step: Click on the executable file PSLinkinstall###.exe and follow the instructions.

After the PSLink is installed, a shortcut icon will be created on the “desktop” of your PC or Workstation screen.

Run the PSLink Software

Double click on the PSLink icon that will start the PSLink software and a window will appear.

The window has “function buttons” and pulldown menu. It is self-explanatory. Just follow the instructions that listed under the crucible pocket, you will be guided to do what you intend to do.

Link with PS (Programmable Sweep):

Make sure that the PS side already choose the “PC link” mode before you push the “PS link” button on the window or you will see a message to remind you that the PS side is not ready to link.

WARRANTY

The Electron Beam Programmable Sweep is guaranteed against faulty materials, function, and workmanship for a period of 12 months after delivery from the Niles Electronics facility. This warranty is valid only for normal use when regular maintenance is performed as instructed. This warranty shall not apply if repair has been performed or an alteration made by anyone other than an authorized Niles Electronics service representative or if damage occurs through abuse, misuse, negligence, or accident. No charge will be made for repairs performed under warranty at a Niles Electronics service facility during the warranty period. Simply return the malfunctioning module, freight prepaid. Niles Electronics reserves the right for final warranty adjustment.

USER RESPONSIBILITY

The user is responsible for proper operation and ordinary maintenance of the equipment, following procedure described in this manual. If the user has a reasonable doubt about understanding the use or installation of a component, your Niles Electronics representative or the manufacturing facility should be called.

It is vitally important that the user properly install the equipment as described in Chapter 3 (installation) of this manual. *The warranty will be void if the equipment is improperly installed and/or improperly grounded.* Alteration of the design or any function of the equipment voids the warranty and is entirely the responsibility of the user.

SAFETY WARNING

High (Potentially Lethal) voltage is present within this equipment. Great Care must always be exercised when working with this equipment. Do not attempt to repair module, send it back to the manufacturing facility for service. There are highly specialized components that drive the module that must be handled with extreme care.