

# Stage Keypad Operation Manual





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## **1.0 Introduction**

The LEP Stage Keypad Console allows the programming and operation of LEP XY stages and Z-axis motors. The modular nature of the MAC controllers allows for a wide variance of configurations.

The console consists of a 20 character by 4 line vacuum fluorescent display with a 25 button keypad. The key caps are labeled at the time of manufacture according to the configuration of the system.

## **2.0 Installation**

The keypad console connects to the rear of a MAC controller on the Interface Module via the round female connector labeled "KEYPAD".

## **3.0 Configuration**

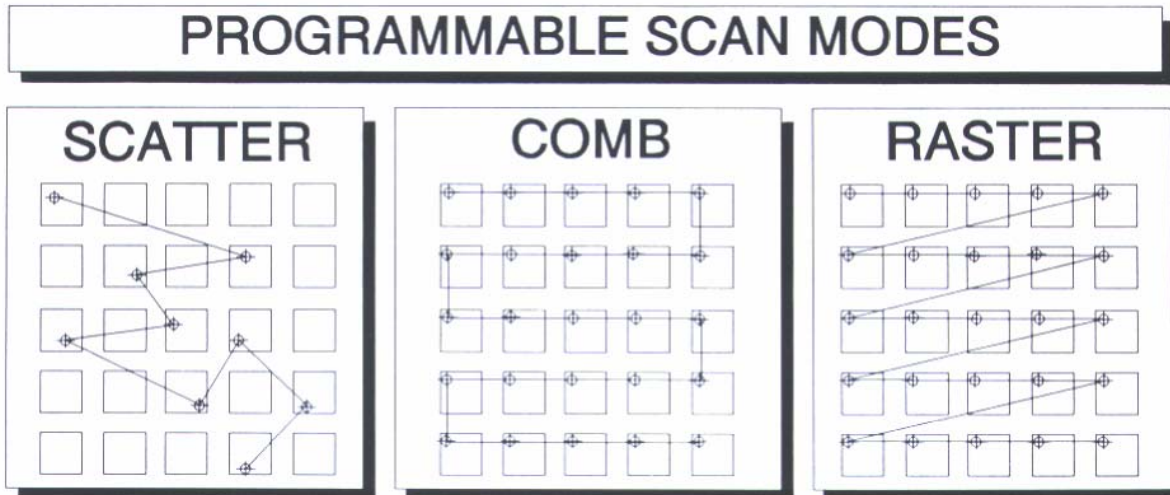
The keypad console is self-configuring. The system checks for specific MAC modules in the controller and determines from the predefined addresses and the module identification what the functions the keypad will enable.

## **4.0 Stage Functionality**

Control and setup of the stage program is achieved by using a combination of menus and dual-function keys. The menus offer a simple method of selecting options from lists. At every point the user is prompted for the most logical next step response.

The Stage Keypad Console programming provides a flexible and friendly means for programming simple or complex stage patterns. The programming is accomplished in two levels: program level and repeat pattern level.

The program level is defined by either a RASTER, COMB or SCATTERED POINT mode. The RASTER and COMB modes are similar in that they both will move the stage to cover a rectangular area. They differ only in the sequence of the scanning. The SCATTERED POINT mode allows the user to set up individual points for scanning. The program will sequentially move through this point program.



The repeat pattern is a sub-program mode that is executed at each program position. The repeat patterns have the same modes as the program level except that the positions must be stored relative to a program position. In program execution the repeat pattern is executed in its entirety before continuing to the next program point.

The Stage Keypad Console has a feature for skewing the stage coordinates to the specimen on the stage. This is a very important feature which allows a specimen to be placed on the stage without precise positioning and fixturing.

This memory can hold up to 128 programs of varying size. The actual number of programs depends largely upon the type of program.

## 5.0 Deskew

Normally, a stage operates in a cartesian coordinate system where the X and Y axes are perpendicular to one another. The manual refers to this as absolute position coordinates. If it were possible to place a specimen on the stage in exactly the same position with no angular error then absolute stage coordinates will always coincide with the programmed coordinates of the specimen. In reality, for precise positioning, this is not possible. To counter this problem a method of mathematically calculating the X and Y offset and the angular error of the specimen coordinates relative to absolute coordinates and making the necessary corrections is employed. This function is known as the deskew function.

The deskew function is based on calculating the angle and the XY offset of two points on the specimen. The only assumption made by the system is that the two points lie on the same X-axis on the sample. When programming the two alignment points, by default the

stage is in absolute mode. The coordinates of the two alignment points are stored as stage coordinates. Once the deskew is complete, all positions are displayed as specimen coordinates.

When the system is in SKEW mode, all coordinates are in specimen coordinates. Care should be taken that no points are programmed in normal mode if the deskew feature is to be used.

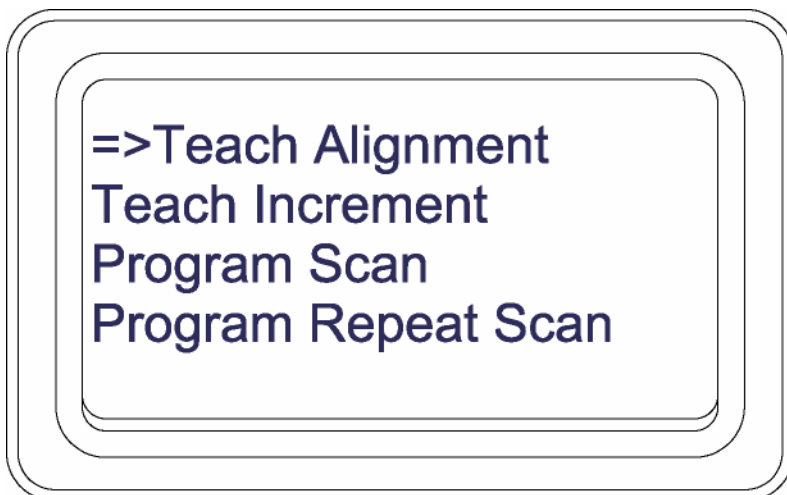
Once a program is created with the system in SKEW mode, the SKEW process will automatically be executed at the beginning of execution.

## 6.0 Programming

The programming sequence consists of a series of steps where the various program parameters are either taught or entered from the keypad. During programming and editing, DEL key takes on different functions. In most cases it will back up one step in the current process. If a menu is displayed the DEL key will back out of the menu to the previous screen or menu. The DEL key will also delete positions when storing points in the SCATTERED POINTS mode. The ENTER key will return the stage to the previous position. Of course, the ENTER key will also terminate input when entering numerical data. At all times the arrow keys will move the stage the programmed distance in the direction of the arrow. START/STOP will immediately halt the stage if the stage is moving, or start or stop the execution of a program if the stage is idle.

Several functions can be programmed directly by pressing the labeled keys on the keypad. Prompt SPEED, DELAY will cause the system to prompt for input. The current value will be displayed and taken as the default entry.

To begin programming the stage position functions, the PRGM key will activate a menu. The complete menu is as follows:



*Note: Options "Load Position" and "Other Parameters" are not shown here since they are at the end of the menu not shown in the display.*

Initially the cursor is pointing to the "Teach Alignment" option. The menu order is specifically set up to be followed in sequential order.

Teaching positions is accomplished by manually moving to the site and pressing STORE. The joystick or track-ball is used for this purpose. To quickly move the stage, press the button on top of the joystick and deflect joystick. The joystick is not active when the stage is busy moving to a position or the stage is at the end of travel.

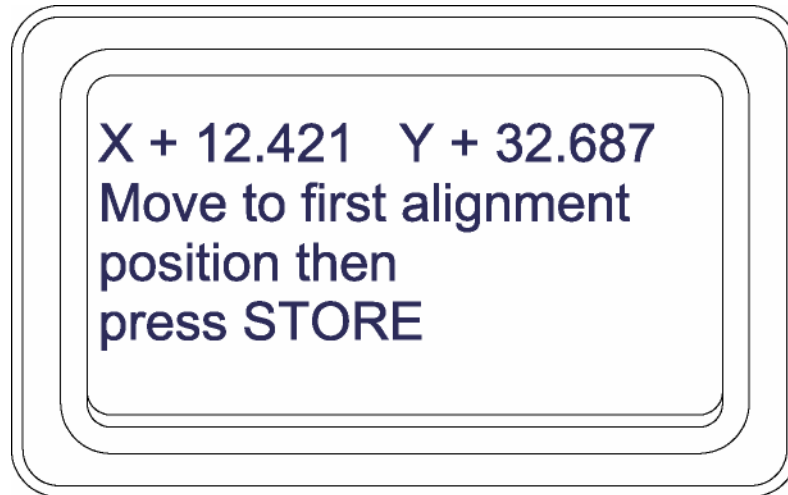
Joystick direction can be altered to suit the microscope or application. Refer to the MAC Controller Configuration manual for this information.

Program types can be changed at any time while the program is in working memory. For example, if the system is programmed for RASTER scanning, it can be changed to POINT scanning by simply teaching a point pattern. The data from the RASTER program is held in memory until the program is stored. If it is necessary to switch back to RASTER from POINT, then simply go to the RASTER menu then exit.

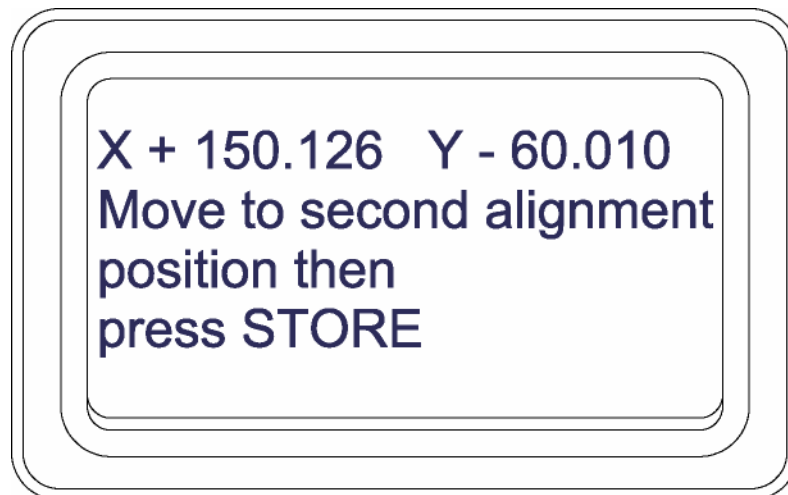
## 6.1 Teach Alignment

The "Teach Alignment" option will allow the set up of the specimen alignment positions for the SKEW function. If no alignment is required, this can be ignored.

Teaching the alignment is a two-step process where the first and second alignment positions are taught.



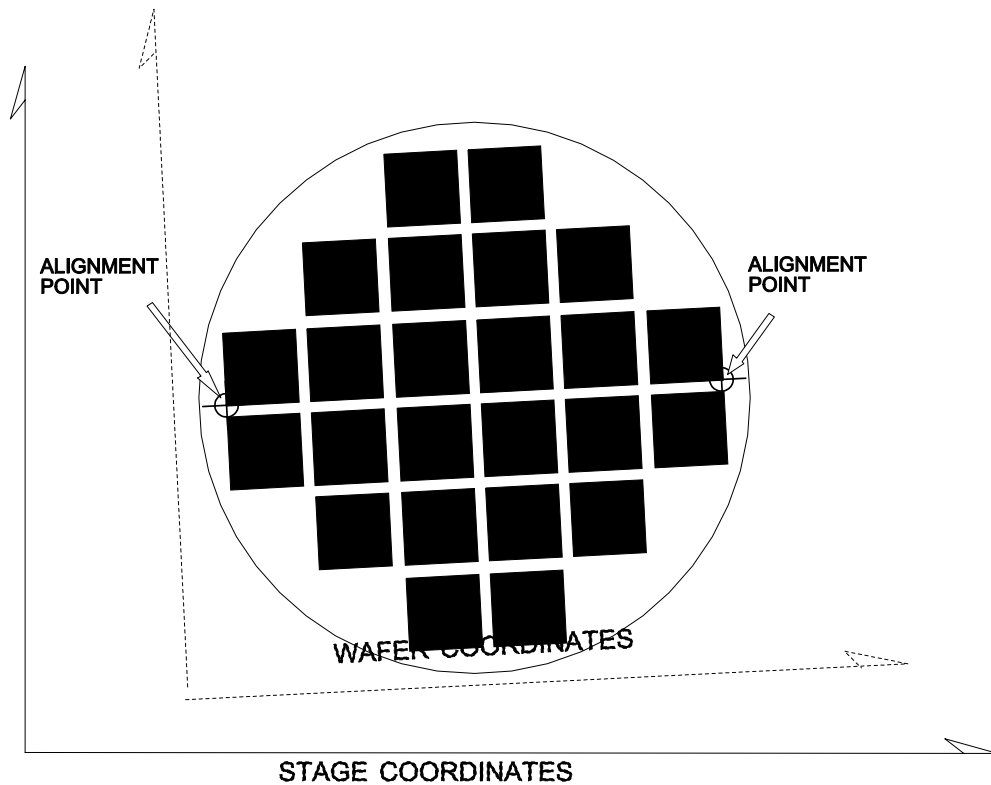
*The two alignment positions are assumed to be on the same X axis with respect to the specimen. Normally, the first alignment position is on the left-hand side of the specimen.*



*The second alignment position should be as far away from the first point as possible. When they are too close, the accuracy of the skew algorithm will be adversely affected.*

By example refer to the figure below. A typical application involves semiconductor wafers with a regular rectangular pattern die. The two alignment points shown are along the same X axis and are as far apart on the wafer as possible. The actual alignment points need not be the corners of a die but can be any easily aligned feature. The first alignment point will become the origin of the sample coordinates, that is once the SKEW process is complete the display will read 0,0 when the stage is at the first alignment point.





Alignment Point Positions

**ACTIVE KEYS:**

- STORE:** Stores the current position as either the first or second alignment position.
- ENTER:** Moves the stage to the previously programmed alignment position, if available.
- DEL:** Exits the current screen to the previous screen. If teaching the first alignment point, the PRGM menu is shown and alignment points are NOT taught.
- GOTO:** Will prompt the user for an XY coordinate. The coordinate will be in absolute stage units.
- ARROWS:** Will move the stage an increment distance in that direction, not skewed.
- START/STOP:** Exits the teach alignment process and shows the PRGM menu.

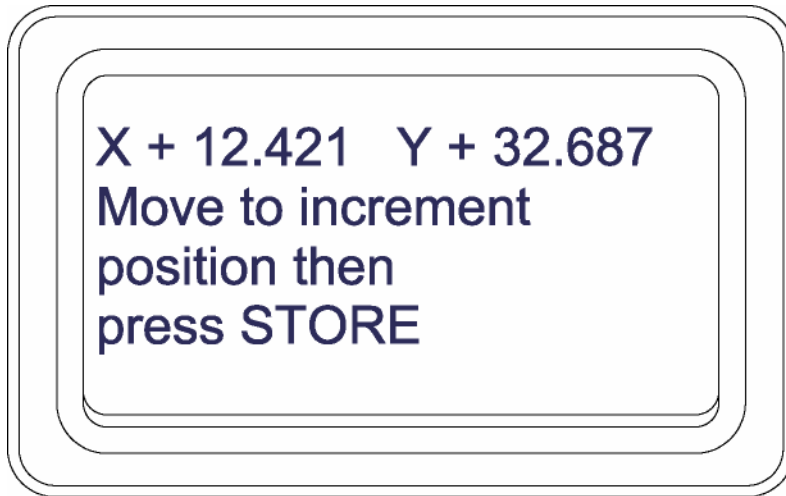
Once the two alignment points are taught, all other positions are stored as skewed specimen coordinates.

In skew mode the first alignment point becomes the reference point (0,0) for the stage.

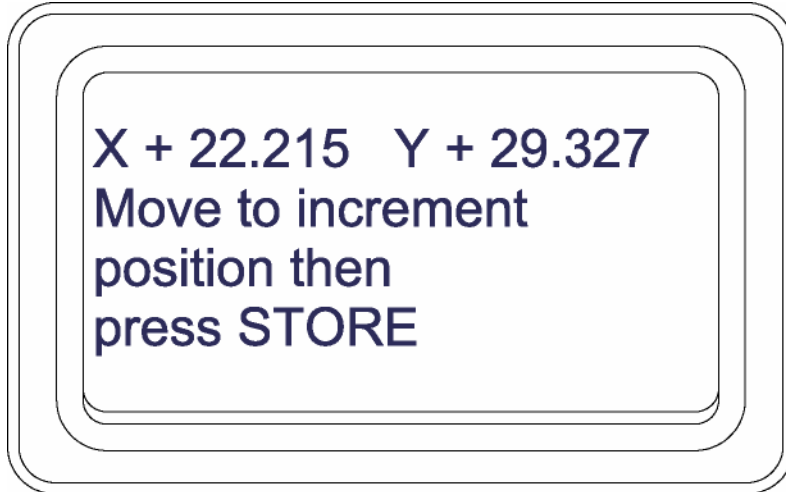
## 6.2 Teach Increment

The arrow keys on the keypad will move the stage a specified distance in that direction. The teach increment function allows teaching that exact distance to coincide with a repeating pattern on the specimen.

The Teach Increment option is a two-step process where the corners of two adjacent rectangular areas are stored: one corner as the reference and the other as the distance.

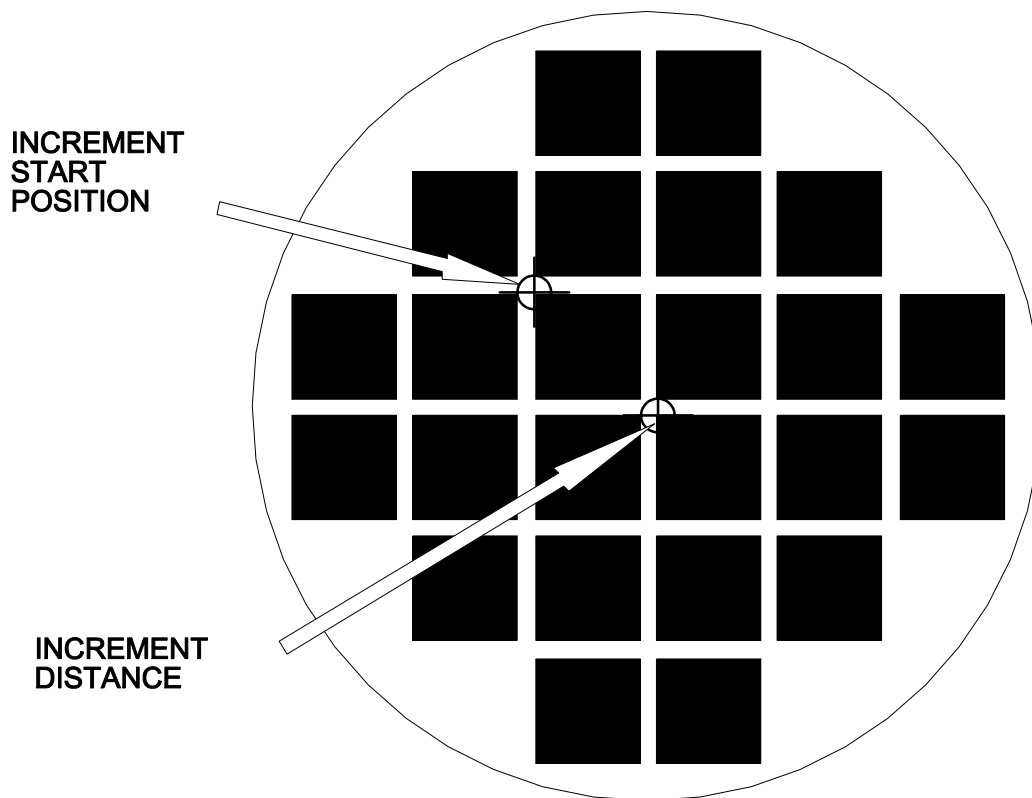


*This position is the base position for teaching the increment.*



*Moving diagonally from the base position will teach the X and Y axis increment simultaneously.*

Again using the example of a wafer, the positions used for teaching the increment are shown. The relative position of one to the other is of no importance since the stage will always move in the direction of the key on the keypad.



Setting Increment

**ACTIVE KEYS:**

**STORE:** Stores the current position of either the reference or the distance.

**ENTER:** Moves the stage to the last stored position.

**DEL:** Exits the current screen to the previous screen. If teaching the first corner, the PRGM menu is shown and increment is NOT taught.

**GOTO:** Will prompt the user for an XY coordinate. The coordinate will be in absolute stage units for the first corner, and relative units for the second, opposite corner.

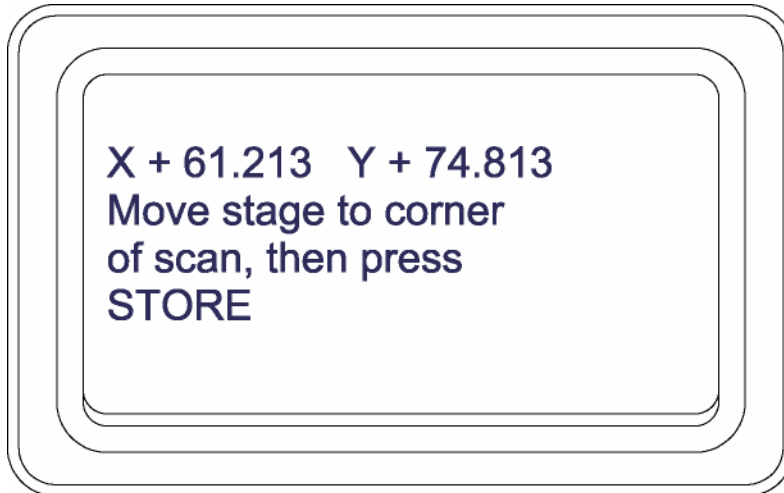
**ARROWS:** Will move the stage on increment distance in that direction. Until the new increment is taught the distance will be the previous value. If the stage is in SKEW mode, the movement will be in specimen coordinates.

**START/STOP:** Exits the teach alignment process and shows the PRGM menu.

After the two corners are taught, the new increment value is available.

### 6.3 Program Scan

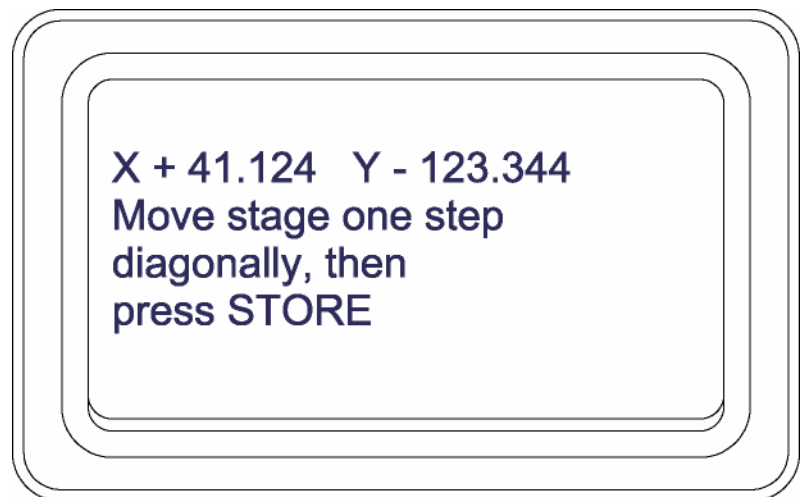
Programming the RASTER and COMB scans are exactly identical. The four-step process involves teaching the corner of the rectangular area, the step and the opposite corner of the scan area. After the positions are taught, the user is prompted for the scan speed.



*Sets the corner of the scan area. Normally this is the upper left of the scan. Position stage with joystick and press STORE.*

*Note: The field of view of the microscope is not taken into account by the software when programming area scans.*

*Programs the step increment at which the area is scanned. The stage will stop after each increment and wait for the programmed delay time.*

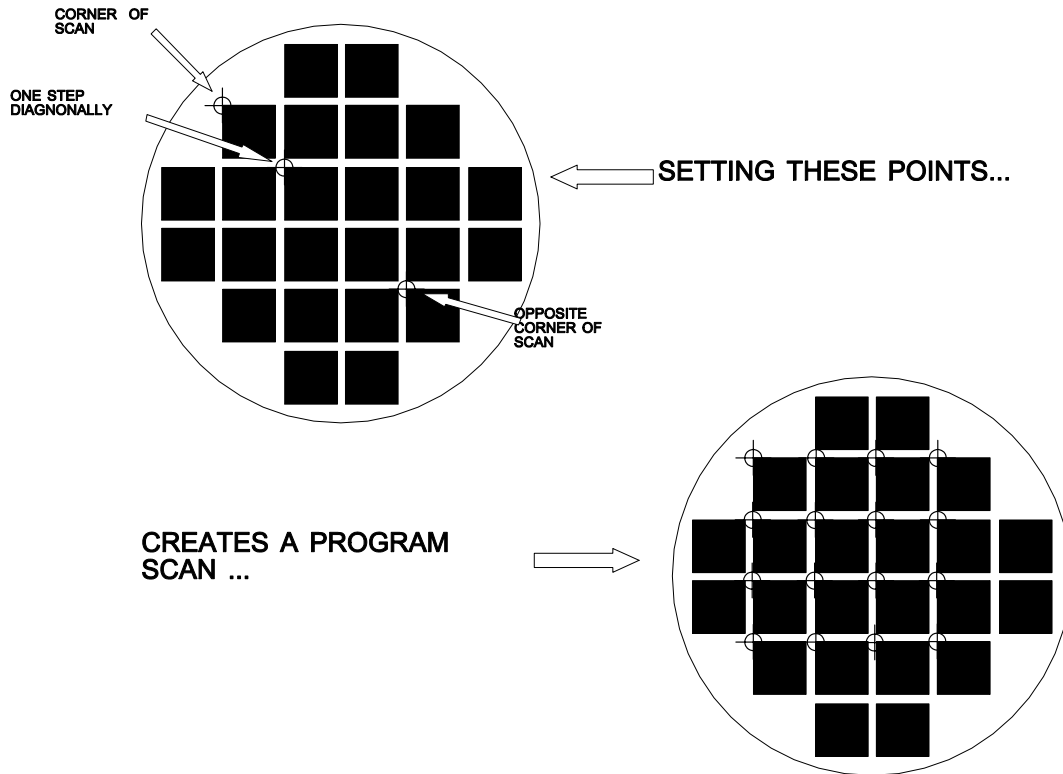


**X + 12.421 Y - 32.687**  
**Move stage to opposite**  
**corner of area**  
**then press STORE**

*The opposite corner completes the definition of the area to be scanned. This position is used to calculate the number of steps to make to complete the scan.*

*This speed is the speed at which the stage moves while scanning this area. It is not the same as the stage speed which is set using the SPEED key. Very slow speeds, less than 0.1mm/sec, are programmable in this mode.*

**Enter area scan**  
**speed : 25 mm/sec**



RASTER and COMB Scan Points

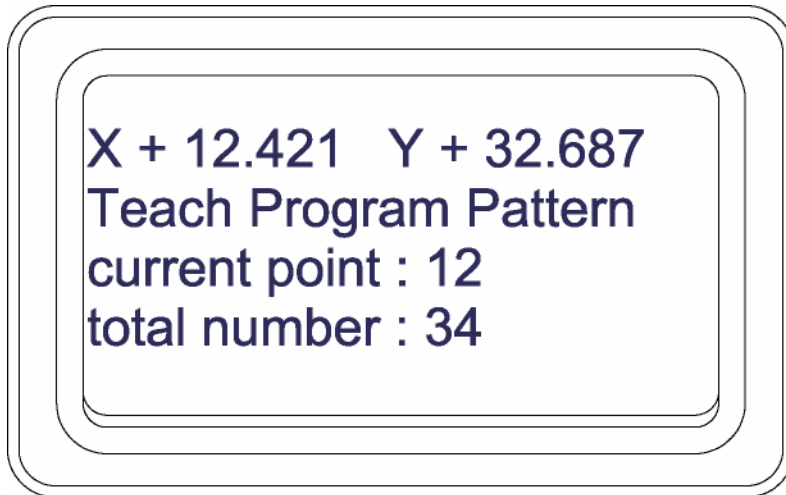
In the example, the points used for teaching the program scan, either RASTER or COMB are shown. The points are shown to move to each die located between the opposite corners of the scan area.

**ACTIVE KEYS:**

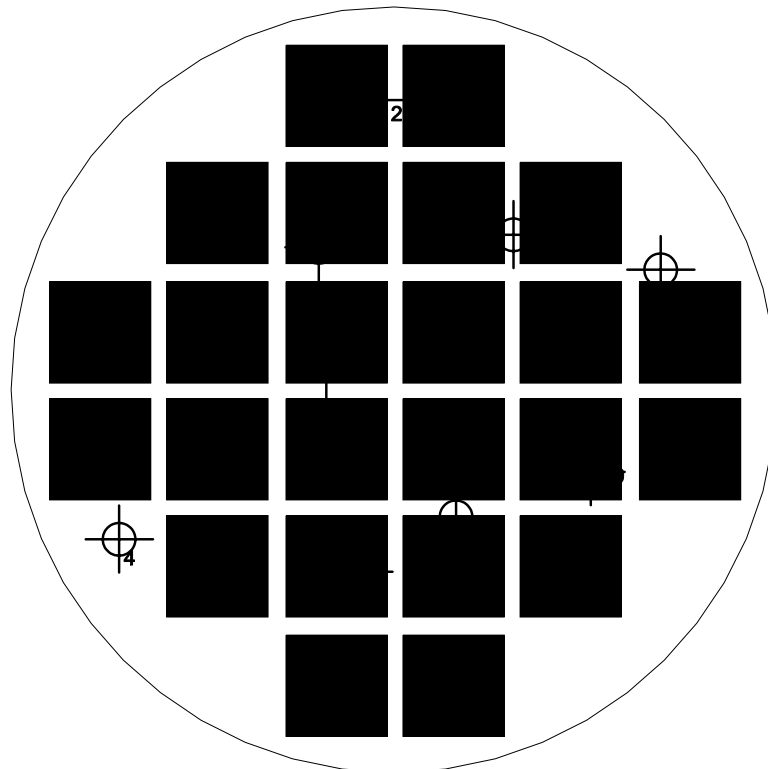
- STORE: Stores the current position of the corners or step.
- ENTER: Moves the stage to the previously programmed position.
- DEL: Exits the current screen to the previous screen.
- GOTO: Will prompt the user for an XY coordinate. The coordinates will be either SKEW or absolute stage coordinates.
- ARROWS: Will move the stage an increment distance in that direction.
- START/STOP: Terminates the teach RASTER or COMB scan menus and exits to the PRGM menu.
- Joystick: Provides manual control of stage position

## 6.4 Program Scattered Points

Programming the SCATTERED POINTS mode is somewhat different. A single screen shows the current position, the number of points, and the current point. By using various editing keys, points can be added, inserted, and deleted from the list of points. A scattered point is stored as a discrete XY point. It has no relationship to the other points other than the fact that it shares a common coordinate system and origin.



*Points are stored by pressing STORE. The points can be edited using DEL, NEXT, and LAST. To exit back to the program menu, press START/STOP.*



SCATTERED Points

The above example show 11 points scattered on the wafer. The exact order has no importance.

## **ACTIVE KEYS:**

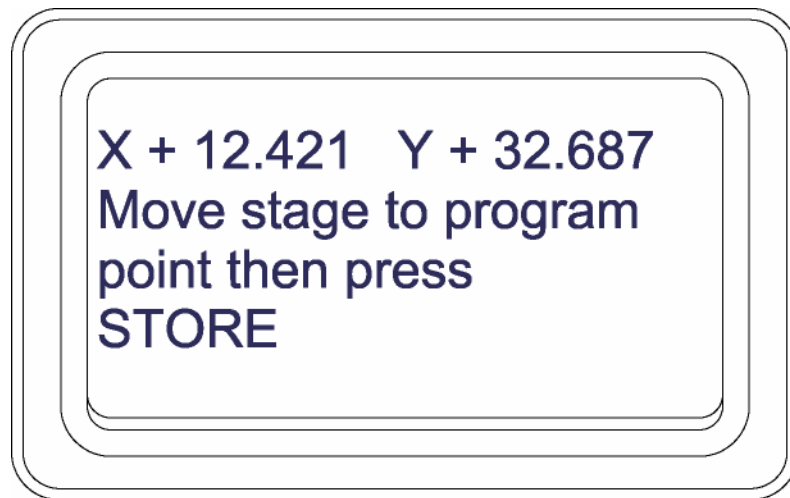
|             |  |
|-------------|--|
| STORE:      | Stores the stage position and increments the number of points. If the CURRENT point is not the last point, the point is inserted into the list of points at the CURRENT point. |
| ENTER:      | Moves the stage to the previously programmed CURRENT position.   |
| DEL:        | Deletes the CURRENT point from the list of points.   |
| GOTO:       | Will prompt the user for an XY coordinate. The coordinates will be either SKEW or absolute stage coordinates.  |
| ARROWS:     | Will move the stage an increment distance in that direction.   |
| NEXT:       | Will move the stage to the point after the CURRENT point, and that point will then become the CURRENT point.   |
| LAST:       | Will move the stage to the point before the CURRENT point, and that point will then become the CURRENT point.  |
| START/STOP: | Terminates point editing and storage. The PRGM menu is displayed.  |
| Joystick:   | Provides manual control of stage position  |



## 6.5 Program Repeat Scan

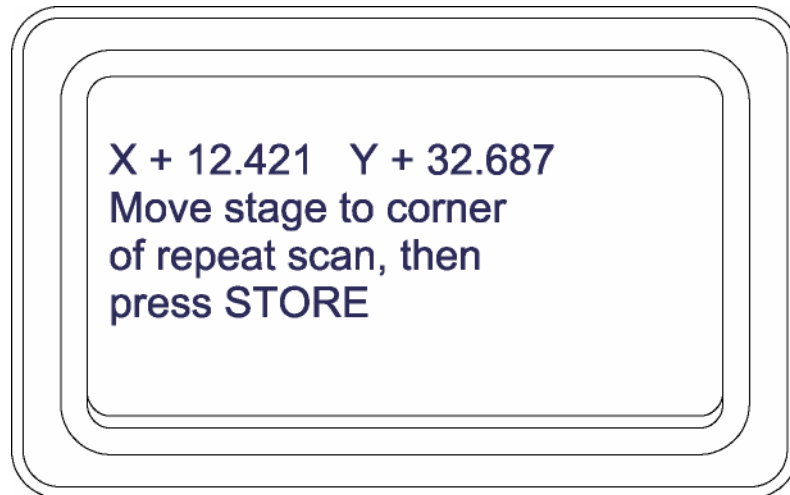
Programming the repeat pattern is very similar to programming the program pattern. Since the repeat pattern programming stored relative positions, a few additional steps are necessary.

As with the program pattern, programming the RASTER and COMB scans are exactly identical. The five-step process involves teaching the corner of the rectangular area, the step and the opposite corner of the scan area. After the positions are taught, the user is prompted for the scan speed.



*Since the repeat pattern positions are relative to a programmed point, the relative position must be set prior to set up of the repeat scan area. Pressing ENTER will move the stage to the first programmed point.*

*Note: The position display will change to REL after this point. Changing back to ABS will not affect the repeat pattern programming.*



*Sets the corner of the scan area. Normally this is the upper left of the scan. Position stage with joystick and press STORE*

*Note: The field of view of the microscope is not taken into account by the software when programming area scans.*

**X + 12.421 Y + 32.687**  
**Move stage one step**  
**diagonally, then**  
**press STORE**

*Programs the step increment at which the area is scanned. The stage will stop after each increment and wait for the programmed delay time.*

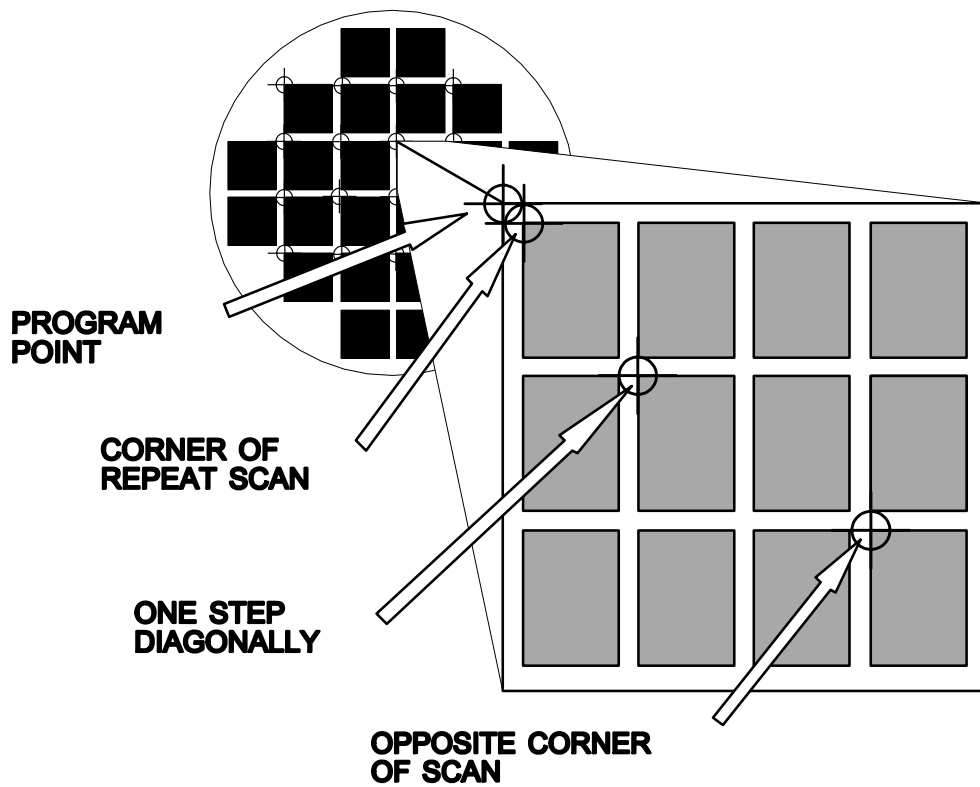
**X + 12.421 Y + 32.687**  
**Move stage to opposite**  
**corner of area**  
**then press STORE**

*The opposite corner completes the definition of the area to be scanned. This position is used to calculate the number of steps to make to complete the scan.*

**Enter repeat scan**  
**speed : 24 mm/sec**

*This speed is the speed at which the stage moves while scanning this area. It is not the same as the stage speed which is set using the SPEED key. Very slow speeds, less than 0.1mm/sec, are programmable in this mode.*

Completing our example the figure below shows the positions used for programming a repeat pattern. The illustration shows a regular pattern of features within the die. Once the reference position is set, the programming process is identical to the above program scan.



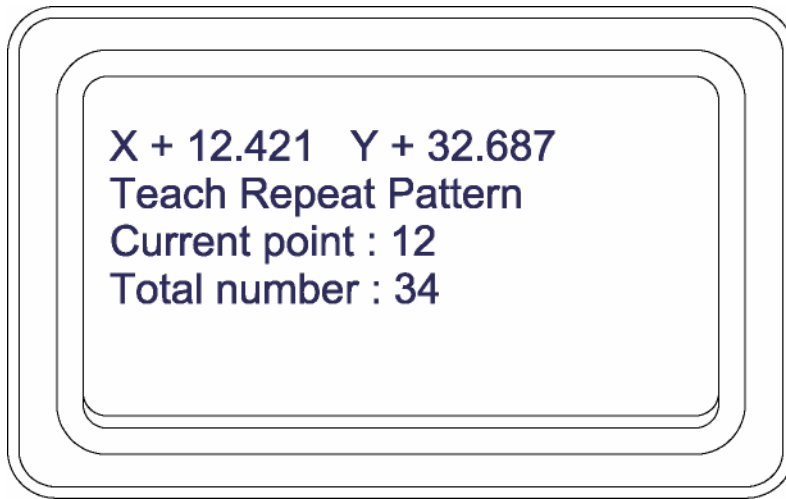
### Repeat Programming

#### ACTIVE KEYS:

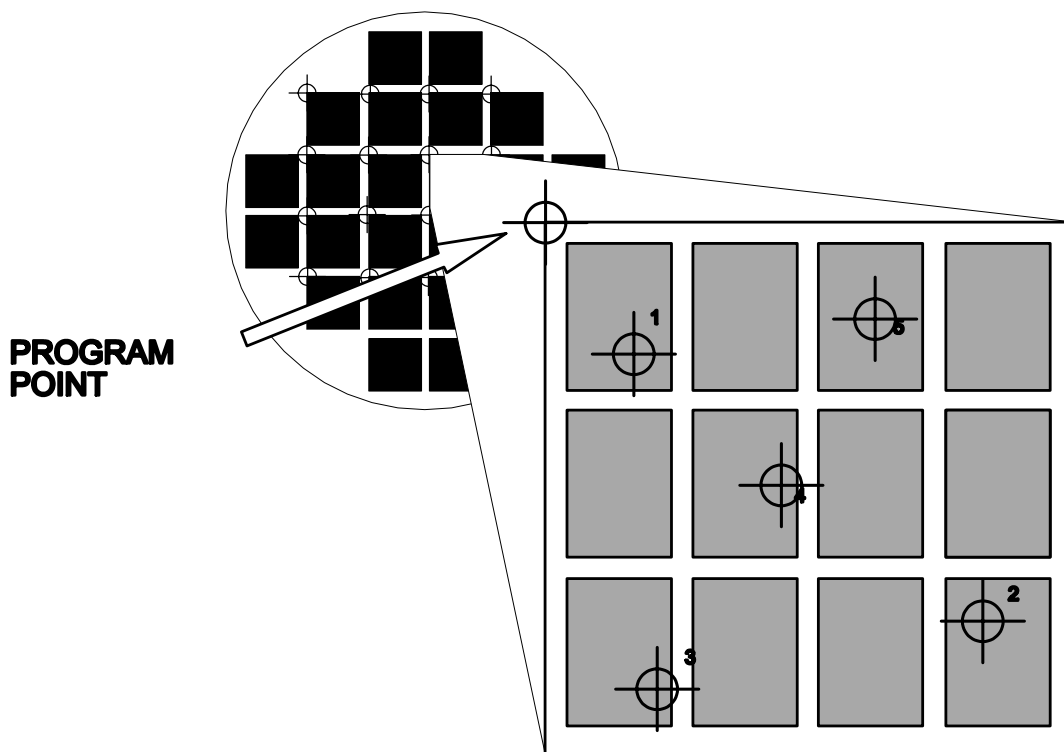
- STORE:** Stores the current position of the corners or step.
- ENTER:** Moves the stage to the previously programmed position.
- DEL:** Exits the current screen to the previous screen.
- GOTO:** Will prompt the user for an XY coordinate. The coordinates will be either SKEW or absolute stage coordinates.
- ARROWS:** Will move the stage an increment distance in that direction.
- RESET:** Resets the current position as the relative origin. All points stored after this will be referenced to this point. All points stored previously will be not be corrected.
- START/STOP:** Terminates the teach RASTER or COMB scan menus and exits to the PRGM menu.
- Joystick:** Provides manual control of stage position

## 6.6 Program Repeat Scattered Points

Programming the repeat SCATTERED POINTS mode is somewhat different. A single screen shows the current position, the number of points and the current point. By using various editing keys, points can be added, inserted, and deleted from the list of points.



*Points are stored by pressing STORE. The points can be edited using DEL, NEXT and LAST. To exit back to the program menu, press START/STOP.*



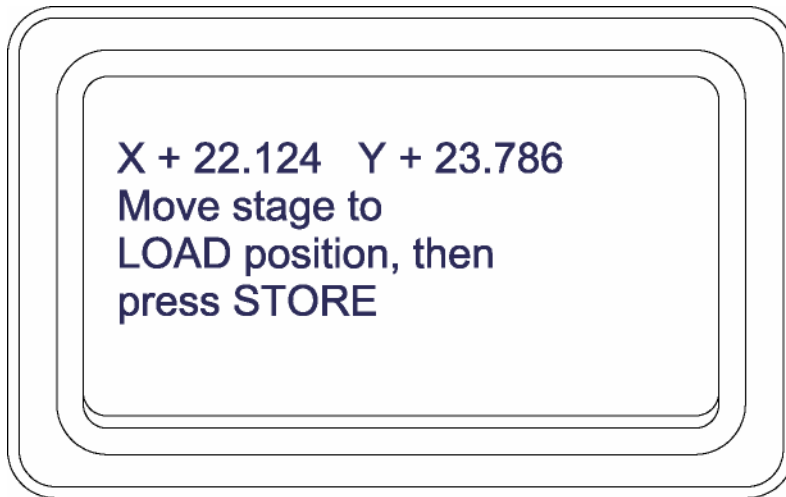
The above example shows 5 scattered points within a die. The program point is the corner of the die as shown.

## ACTIVE KEYS:

- STORE: Stores the stage position and increments the number of points. If the CURRENT point is not the last point, the point is inserted into the list of points at the CURRENT point.
- ENTER: Moves the stage to the previously programmed CURRENT position.
- DEL: Deletes the CURRENT point from the list of points.
- GOTO: Will prompt the user for an XY coordinate. The coordinates will be either SKEW or absolute stage coordinates.
- ARROWS: Will move the stage an increment distance in that direction.
- NEXT: Will move the stage to the point after the CURRENT point, and that point will then become the CURRENT point.
- LAST: Will move the stage to the point before the CURRENT point, and that point will then become the CURRENT point.
- START/STOP: Terminates point editing and storage. The PRGM menu is displayed.
- RESET: Resets the current position as the relative origin. All points stored after this will be referenced to this point. All points stored previously will be not be corrected.

## 6.7 Program Load Position

To facilitate easy loading and unloading of samples, the loading position can be taught. Any position that gives easy access can be used. This position is never stored as a SKEW coordinate.



### ACTIVE KEYS:

- STORE: Stores the current position as the load position.
- ENTER: Moves the stage to the previously programmed load position.
- DEL: Exits the current screen to the previous screen.
- GOTO: Will prompt the user for an XY coordinate. The coordinates will be either SKEW or absolute stage coordinates.
- ARROWS: Will move the stage on increment distance in that direction.
- START/STOP: Terminates the teach load and exits to the PRGM menu.

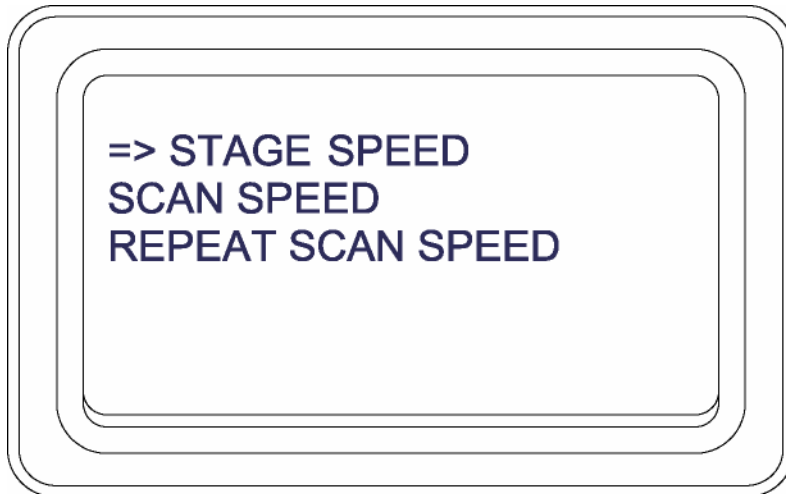
## 6.8 Stage Speed

The stage speed menu option allows for easy changing of the stage speeds. There are three speeds at which the stage can move.

The top speed is the STAGE SPEED. The top speed is used when the stage is moving to a load position, alignment position or moving in the raster retrace fashion. Usually this speed set for the top speed of the stage.

The Program scan is the speed that the stage moves between program points. This speed can vary depending on the type of program desired.

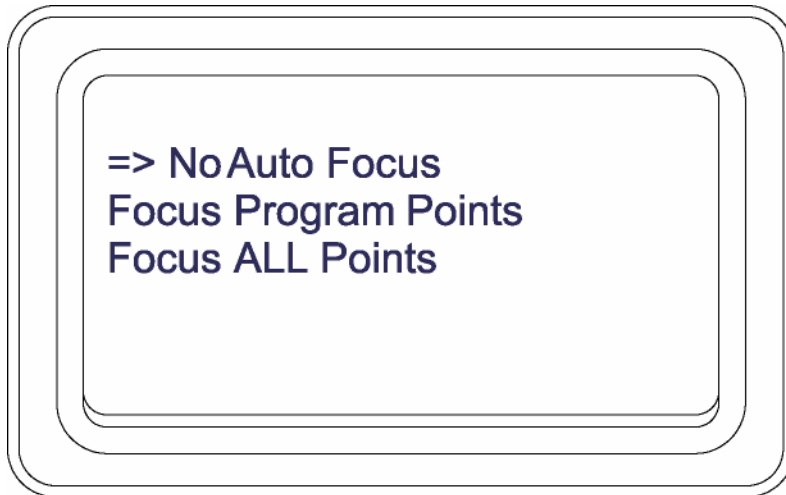
Finally the Repeat scan speed is used when the stage is executing a repeat pattern. This speed is usually slow because it is associated with visual tracking either by eyepiece or video.



## 6.9 Other Parameters

Depending upon the exact configuration of your system, other parameters can be set with this option. Typically, the stage speed, delay time, and focus parameters can be set here. The speed and delay can be set directly from the keypad in operate mode.

The focus menu is only available if there is a video autofocus module installed in the MAC Controller. Setting the focus parameters involves a single menu:



*The optimum focus option is to focus on program points. Repeat pattern scans a large area. It may be useful to focus on all points.*

"No Auto Focus" disables the autofocus feature. The autofocus can only be initiated manually using the FOCUS key.

Focus on PRGM points will initiate focus at each program point. Repeat pattern points are not focused. This is useful if the repeat pattern points are near the program point and in the same focus plane. Time will be saved by not having to focus at each point.

Focus on ALL points will initiate autofocus at each and every position. This is time consuming and should only be used when necessary.

The autofocus will focus with the range selected on the front of the controller. The LOW range will take more time to focus and is suited for objective lenses less than 5X. MED range is suitable for lenses 10x to 50x. The HIGH range setting is required for lenses 50X and greater.

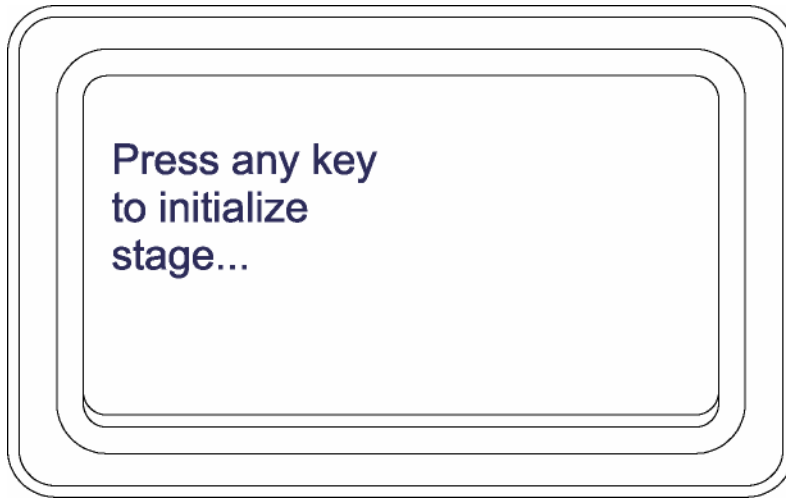
## 6.10 Editing Programs

Periodically, it will be necessary to update and alter programs. Each programming sequence has an editing feature. When the system is prompting for a position to be stored, pressing the ENTER key will position the stage to the last stored position. Once the stage is at the previously stored position, the point can be restored by pressing the STORE key. If the store key is pressed, the position is updated in memory even if the sequence is aborted before completion.



## 7.0 Operation

At power-up the Stage Keypad Console will beep and display the following message:



*This message indicates that all memory is intact and communication has been established with the stage.*

When a key is pressed, the stage will seek the opposite limits and then finally move to the center. At this point the console sets the proper speeds, acceleration rates, and determines the limits of travel for the stage. During this process the screen will display some messages indicating the sequence of initialization.

The system at power-up has no program loaded into the working memory. Therefore, the system can do little more than display position until it is taught or a program is loaded from the battery-backed memory to working memory. Some defaults are programmed for safety. The speed and arrow keys are loaded with some reasonable values.

Once the working memory has a program, either by loading from battery backed memory or by teaching, the system can be used. To execute the program in memory press the START/STOP key. The execution of the program will proceed as programmed. Specific functions such as delay, speed, focus mode, and increment size are determined by how the program was set up.

If the program in memory has alignment points programmed, the stage will move to the two alignment positions before the program begins. This is necessary because the program positions are stored in SKEW coordinates.

Normally the program will move from point to point with a programmed delay for inspection between moves. When the program is waiting, the display will show the amount of time left before the next motion on the display. If it is desired to move without waiting for the delay, pressing the NEXT key will move to the next point and begin the delay process again.

At any point during the execution of a program the START/STOP key can be pressed to halt the execution. The program will then be indefinitely halted at this point until the START/STOP key is pressed again. When the program is idle, the GOTO key, joystick, and arrow keys can be used to manually move the stage for non-programmed inspection.

If it is desired to reset the program to the beginning, pressing the RESET key will do this. If a program is executing, it will be halted and the display will indicate that the program is at the beginning.

When the program is complete the LOAD key will move the stage to the programmed load position. The load position is to be set up so the stage moves to a location that is easily accessible. When this key is pressed, the program is reset and the alignment position is cleared, requiring realignment and restarting of the program.

## 8.0 Software Configuration

The software has certain parameters that are hardware dependent and affect the operation of the system. The parameters are the ratio of the number of motor steps per millimeter of travel for the X, Y axes. The ratio can easily be calculated based on the following formula:

$$STEPS/mm = \frac{MOTORSTEPS/REVOLUTION}{LEADSCREW PITCH}$$

or more easily from the following table:

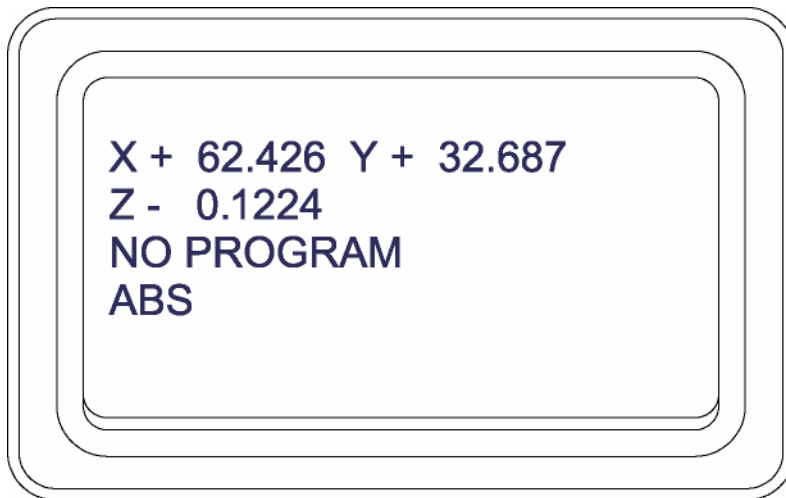
**Step ratio Table**

| Leadscrew -><br>Motor | 1 mm pitch screw | 2 mm pitch screw | 4 mm pitch screw |
|-----------------------|------------------|------------------|------------------|
| 10,000 steps/rev      | 10,000           | 5,000            | 2,500            |
| 20,000 steps/rev      | 20,000           | 10,000           | 5,000            |
| 2,000 steps/rev       | 2,000            | 1,000            | 500              |

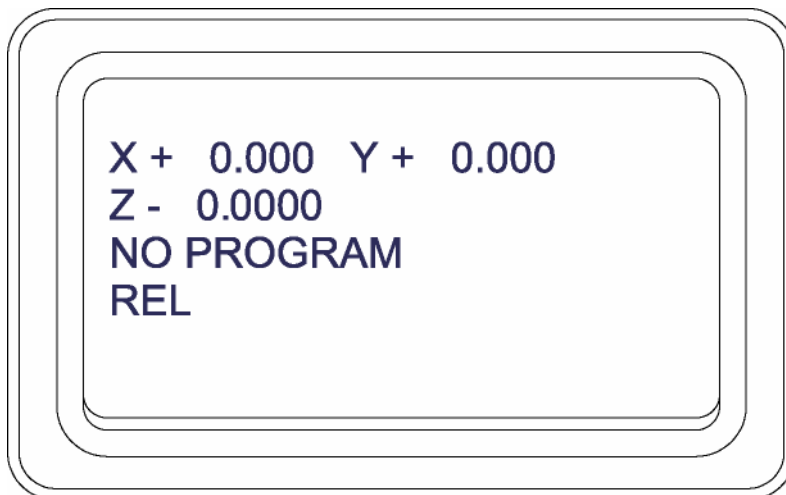
All stage positions are stored in the minimum stage units, not measurement units. Stage programs therefore cannot be set up on a system and taken to another system with different stage step ratio.

## 9.0 Position Display

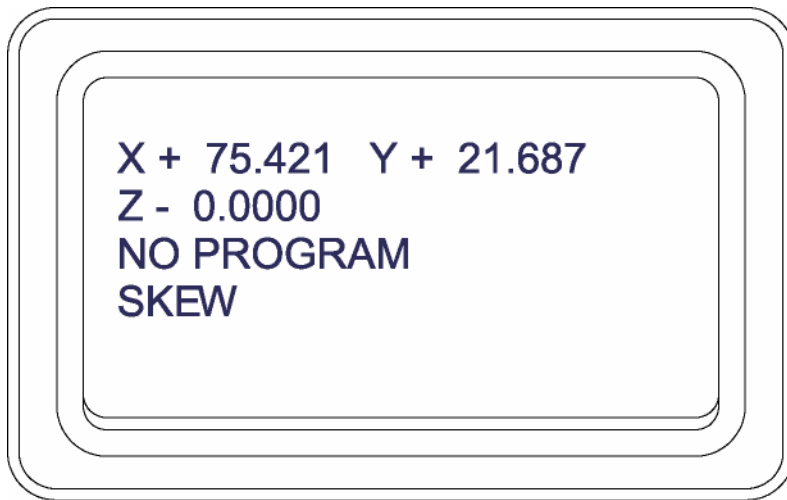
The main screen displays the status of the system. Since the system can take several different forms depending upon what is installed in the controller, the screen may appear differently.



At the top of the display are the current X and Y positions. This position display is dependent upon the current mode of the position tracking. The lower line of the screen is the status line, and the ABS indicates that the position is ABSolute which is relative to the home or 0,0 position. When the ABS/REL key is pressed, the display will switch to REL mode which shows position relative to the position where the ABS/REL key was pressed.

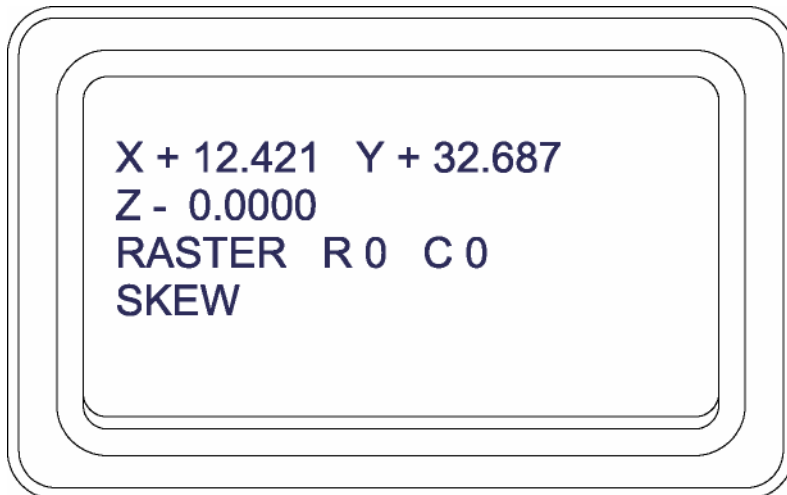


The third display mode involves the deskew feature. When the deskew mode is on the display shows position in deskewed coordinates. The ABS/REL key still functions but all positions are in deskewed coordinates.



The Z-axis position is dependent upon an optional Z-axis control or video autofocus.

The third line of the screen shows the current program status. In the above examples, no program is loaded. When a program is loaded, it will display the program type and the current status of that program. There are three different types of programs: RASTER, COMB, and POINT. The following example will illustrate the screens for a RASTER program. Screens for POINT and COMB programs will be similar. The example will first illustrate the screens in a simple program mode, then with the addition of a repeat pattern.



When a program is loaded or first set up, the display will appear as above. The program type is RASTER; the current row (shown by the number following the 'R') is 0; and the current column is also 0.

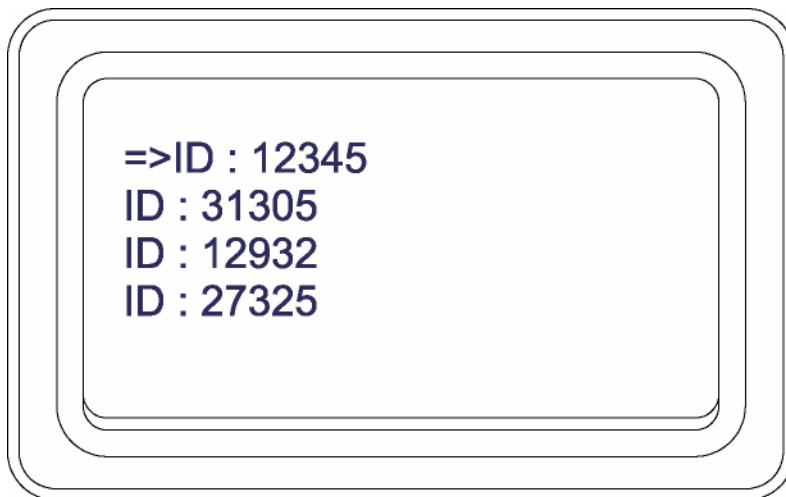
## 10.0 Filing Programs

Parameters and programs can be filed in nonvolatile memory. The following data is stored in memory and can be programmed differently for each program:

- XY arrow key increment
- Stage Speed
- Stage Acceleration ramp
- XY Load position
- Program type and position data
- Repeat pattern type and position data
- Autofocus mode
- Alignment positions
- File ID, size, etc.

### 10.1 Loading a File

To load a program press the FILE key. If there are any programs in memory, a list of available files will be presented in menu fashion with a cursor pointing to the first one. The list will show the file ID and the file type.



*The screen displays a window into the longer list of all files. Up to 128 files can be stored. The cursor identifies the selected file.*

Position the cursor to the desired file. Select the file with the ENTER key. The file will be loaded into memory for execution. All data and programs in working memory will be lost.

### 10.2 Deleting a File

Files may be deleted by pressing the FILE key and positioning the cursor to the desired entry. Pressing the DEL key will prompt for verification of the deletion. Responding with Yes will erase that file from memory.

### **10.3 Replacing a File**

To store a file over an existing file, press the FILE key and select an entry. Press the STORE key, the system will prompt for verification.

### **10.4 Creating a New File**

Creating a new file is similar to replacing files. Press the FILE key, position the cursor to the last entry in the list "<NEW FILE>", press STORE. The system will prompt for a new ID number, and then store the data in the new file. The file ID must be unique otherwise an error will be displayed, and the file will not be stored.

After each file operation, a display of the available memory is briefly shown on the screen.

## **11.0 Error Messages**

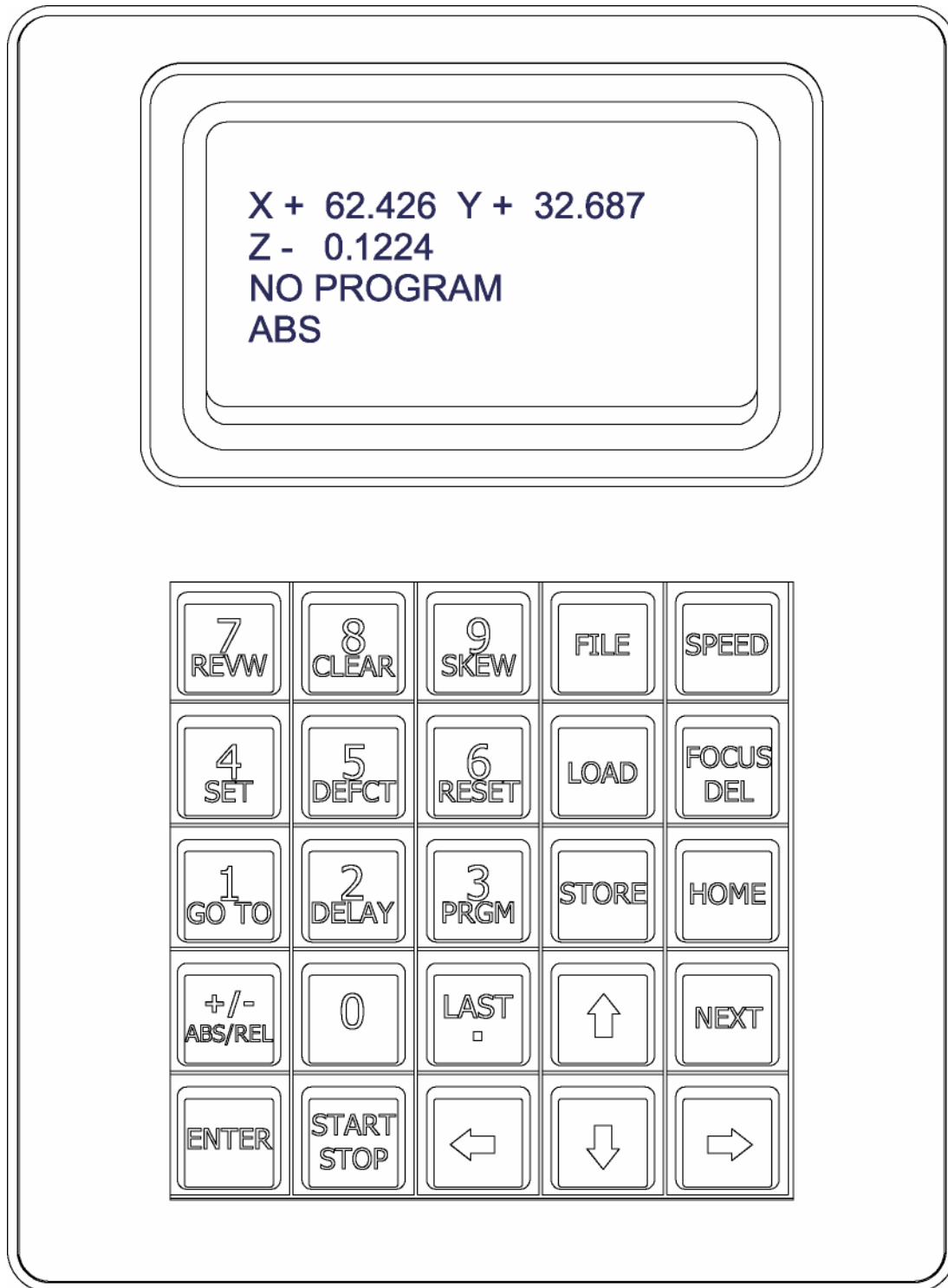
**Out of Memory:** Attempt to store a program without enough available memory.

**Too many files:** The number of files already stored is 128. No more can be stored without deleting or overwriting existing files.

**Trouble with System:**  
Communication fault between the controller and the console on power-up. Power down and retry. If problem persists, there is most likely a defective module in the MAC controller or a configuration error.

**Communication Error:**  
An error has occurred in the communication between the MAC controller and the console. Investigate for loose cables.

## 12.0 Keypad Layout



## 12.1 Key Definitions

### **ENTER Key:**

When executing a program, pressing the ENTER key will move the stage back to the last programmed position. This function also can be used in conjunction with the STORE key.

When responding to a prompt, the ENTER key will terminate input.

In selecting a menu entry or a file, the ENTER key selects the entry pointed to by the cursor.

### **DEL Key:**

During entry of numeric data from the keypad, the DELETE key will erase the last input number and move the cursor accordingly.

In the process of program selection using the FILE key, DELETE will cause the selected file to be deleted. Before deletion the user is prompted to verify the deletion.

### **UP/DOWN Keys:**

When in normal mode or executing a program the stage will move up or down a single increment distance. The increment distance is programmed as a function of the PRGM key.

When the system prompts for a yes or no response, the UP key will change the response to a YES; DOWN will change it to NO.

When selecting a menu entry or selecting a program, the UP/DOWN keys will move the cursor up or down.

### **LEFT/RIGHT Keys:**

Similar to the UP/DOWN keys, the LEFT/RIGHT keys will move the stage a single increment either left or right.

When the system prompts for a yes or no response, the LEFT key will change the response to a NO; RIGHT will change it to YES.

### **START/STOP Key:**

The START/STOP key will immediately halt the stage if it is in motion. It also affects the autofocus.

The START key will begin or resume the execution of a program if there is one in memory. If a program has been started and stopped, the START/STOP key will resume where it was left off.



**NEXT Key:**

The NEXT key will move the stage to the next programmed position. The sequence will follow the exact sequence of the normal program.

**LAST Key:**

Similar to the NEXT key, the LAST key will move the stage to the previous programmed position.

**FOCUS Key:**

The FOCUS key activates the autofocus if installed. If no autofocus is found, the key has no function. The FOCUS key will use the switch position on the front panel to select the range.

**FILE Key:**

Pressing the FILE key will bring up a menu of the files (or programs) stored in memory. Using the UP/DOWN keys the cursor is moved to select a specific file:

The DELETE key will erase the file at the cursor.

The STORE key will save the current data in memory to the selected file.

The ENTER key will load the file into working memory.

**CLEAR Key:**

The CLEAR key erases all program and data from the working memory and resets it to the power-up defaults.

**RESET Key:**

When executing a program, the RESET key will reset the point position counters to zero so the program will execute from the beginning of a program.

When teaching repeat pattern positions, the RESET key will change the relative position reference to the current position.

**SKEW Key:**

If the alignment positions are taught, the SKEW key will initiate the SKEW process. If the alignment positions are not taught, an error message is displayed.

If the stage is in SKEW mode, the stage is returned to normal mode.

**SPEED Key:**

The SPEED key allows the operator to change the speed of the stage. Only the high speed is alterable. The repeat pattern and program scan speeds are not accessible from this function.

**DELAY Key:**

At each programmed position, the stage program will pause for a programmed period of time. The delay period is entered in seconds.

**ABS/REL Key:**

When the ABS/REL key is pressed, the stage position display will change to reflect the respective display mode. The display mode is indicated in the lower left corner of the console. When entering the RELative mode, the display will show position relative to the point at which it was pressed. This is active at any time.

**LOAD Key:**

The LOAD key will halt stage program execution and move the stage to the programmed load position. The stage will return to normal (non-skew).

**HOME Key:**

The HOME key will move to the stage 0,0 position. The coordinates are to the center for the X and Y travel of the stage.

**GOTO Key:**

This key allows the operator to enter a coordinate for positioning the stage. The current coordinate will be displayed as the default entry value. The coordinates are either REL, ABS or SKEW depending upon the current position display mode.

**STORE Key:**

This key allows teach positions to be store in programs and files to be stored from working memory to nonvolatile memory.

**PRGM Key:**

This key allows the stage to programmed for different scan patterns.

**DEFCT Key:**

During a stage program, specific points can be marked and saved for later review.

**RE VW Key:**

After a stage program has been completed, the RE VW key can be used to review any marked points made by the DEFCT key.

**SET Key:**

This key allows the operator to access the stage parameters of the console.

# NOTES

Ludl Electronic Products designs and manufactures a wide range of automation accessories for microscopes and instrumentation.

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