- TMD1 (TriMoDal 1)

  Binary sampling is performed on the center sections of marks on concnetric circles in an image with trimodal density distribution (three peaks appear in the histogram) using threshold values SL1 and SL2.

- TMD2 (TriMoDal 2)

  Binary sampling is performed on the whole marks (including center sections) on concentric circles in an image with trimodal density distribution (three peaks appear in the histogram) using threshold values SL1 and SL2.

② SL1 (SLice 1)

Set the threshold value as a percentage for binary conversion using the jog dial in the entry or cursor mode.

③ SL2 (SLice 2)

Set the second threshold value as a percentage for binary conversion using the jog dial in the entry or cursor mode.

This setting must be made when BMD2, TMD1, or TMD2 are selected.

④ OGRY (Object GRaYting)

Use the function keys to select whether the image mark density distribution will be brighter or darker than the threshold value.

- BLAK (BLAcK)

  Selected when the mark density is to be darker than the threshold value (smaller of SL1 and SL2 when SEGM and BMD1 are selected).

- GRAY

  Selected when the mark center density is to be between SL1 and SL2.

- WHIT (WHITe)

  Selected when the mark density is to be brighter than the threshold value (same as for BLAK when BMD1 or BMD2 are selected, larger of SL1 and SL2 when TMD1 or TMD2 is selected).

⑤ BGRY (Background GRaYting)

Use the function keys to select whether the image background density distribution is to be brighter or darker than the threshold value.

If BMD1 or BMD2 is selected, it is sufficient to set either OGRY or BGRY.

- BLAK (BLAcK)

  Selected when the background density is to be darker than the threshold value.

- GRAY

  Selected when TMD1 or TMD2 is selected and the background density is to be between SL1 and SL2.

- WHIT (WHITe)

  Selected when the background density is to be brighter than the threshold value.

⑥ FILT (FILTer)

Use the function keys to select one of three sizes of two types (total of seven settings including off) to remove isolated points of noise due to scratches or other problems from binary images.

- OFF

  Selected setting when the filters are not used.

- OBJ3 (OBJect 3)

  Eliminates scratches (isolated black points) of up to three pixels from the mark (white pattern).

- OBJ5 (OBJect 5)

  Eliminates scratches (isolated black points) of up to five pixels from the mark (white pattern).

- OBJ7 (OBJect 7)

  Eliminates scratches (isolated black points) of up to seven pixels from the mark (white pattern).

- BAK3 (BAcK 3)

  Eliminates scratches (isolated white points) of up to three pixels from the background (black region).

- BAK5 (BAcK 5)

  Eliminates scratches (isolated white points) of up to five pixels from the background (black region).

- BAK7 (BAcK 7)

  Eliminates scratches (isolated white points) of up to seven pixels from the background (black region).

5.4.4 CAMEra

This is the block of parameters for the cameras and it has the following block structure.

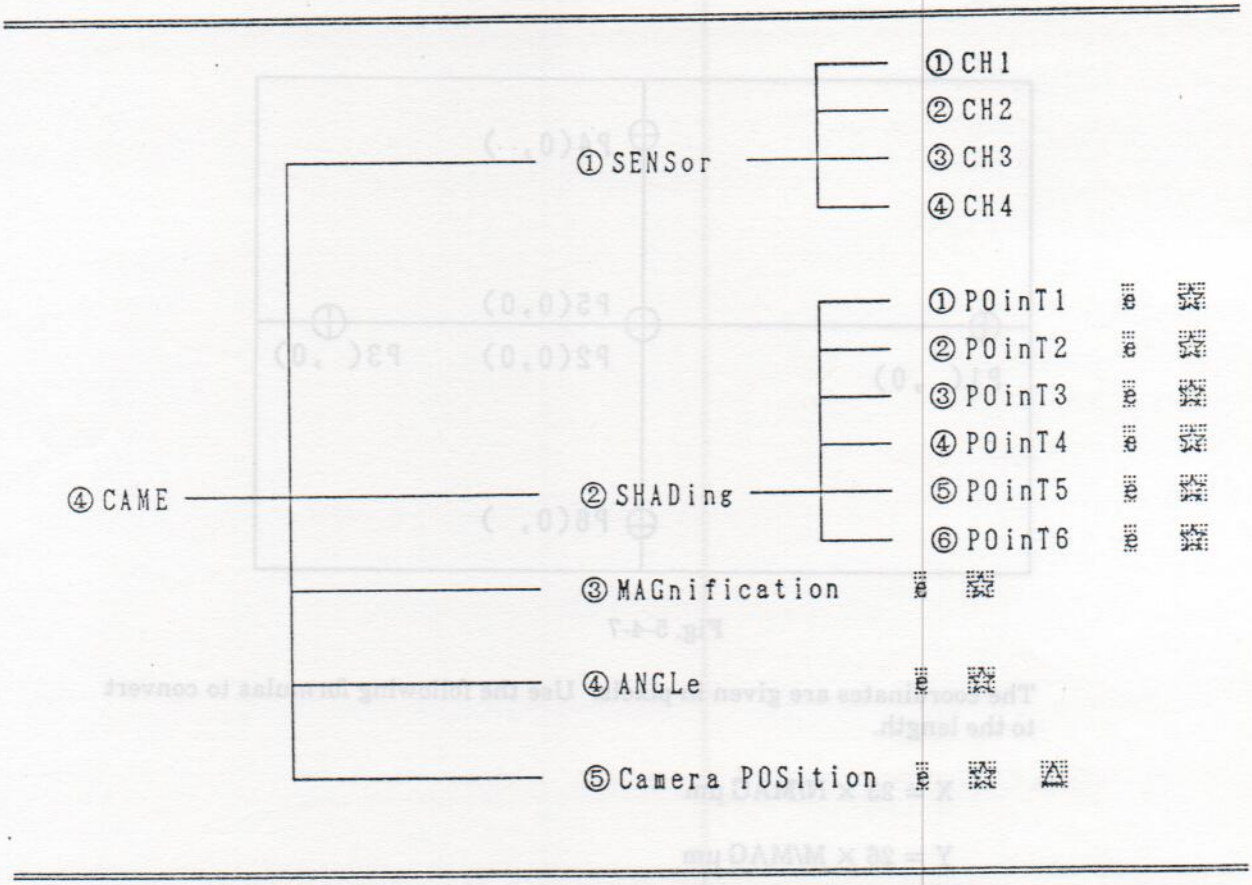


Fig. 5-4-6

- e indicates that values are set in the entry mode.
- ☆ indicates that channel A or channel B has to be selected with the CAMERA CH keys of the SELECT group of keys. (Both channels can also be selected together.)
- △ indicates that the X- or Y-axis has to be selected with the AXIS keys. (Both axes can also be selected together.)

① SENS (SENSor)

Use the CH1 to CH4 function keys to assign channels selected using the CAMERA CH switches of the SELECT group onthe front panel to SENSOR channel connectors on the rear panel.

② SHAD (SHADing)

To calculate the compensation function for shading compensation, select from among the six density points below (when a workpiece of homogeneous material is being measured) using the function keys to specify the position, and then set the density of the selected point using the jog dial in the entry mode.

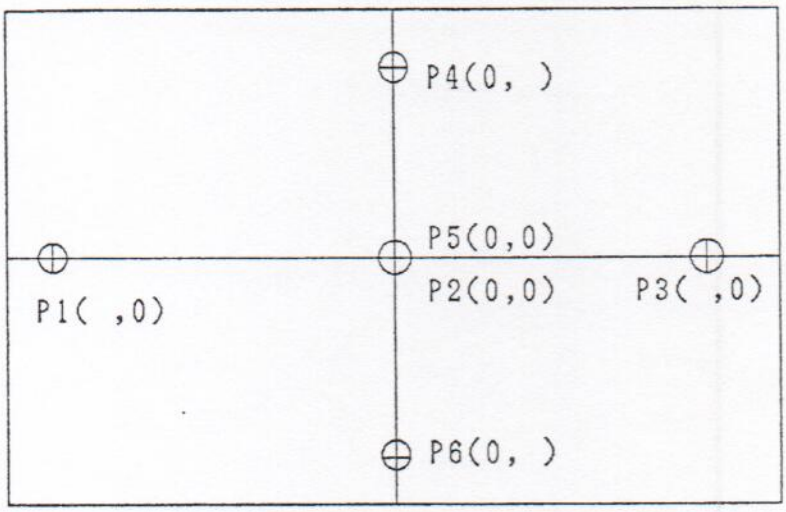


Fig. 5-4-7

The coordinates are given in pixels. Use the following formulas to convert to the length.

$$X = 23 \times N/MAG\ \mu m$$

$$Y = 26 \times M/MAG\ \mu m$$

where N and M are the X and Y coordinates, respectively.

③ MAG (MAGnification)

Set the optical magnification of the cameras using the jog dial in the entry mode.

④ ANGL (ANGLe)

Set the coordinate rotation angle of the camera X-axis and the table X-axis using the camera X-axis as base in the entry mode.

⑤ CPOS (Camera POSition)

In the entry mode, set channel A to the coordinates of the center of rotation of the table, and set channel B to the coordinates of the channel-B camera in the coordinate system around the center of the channel-A camera field of vision as the origin.

5.4.5 TABLe

This is the block of parameters for the table and it has the following tree structure.

All four tables have the same tree structure to their groups of parameters, so only that for TBL1 is given below.

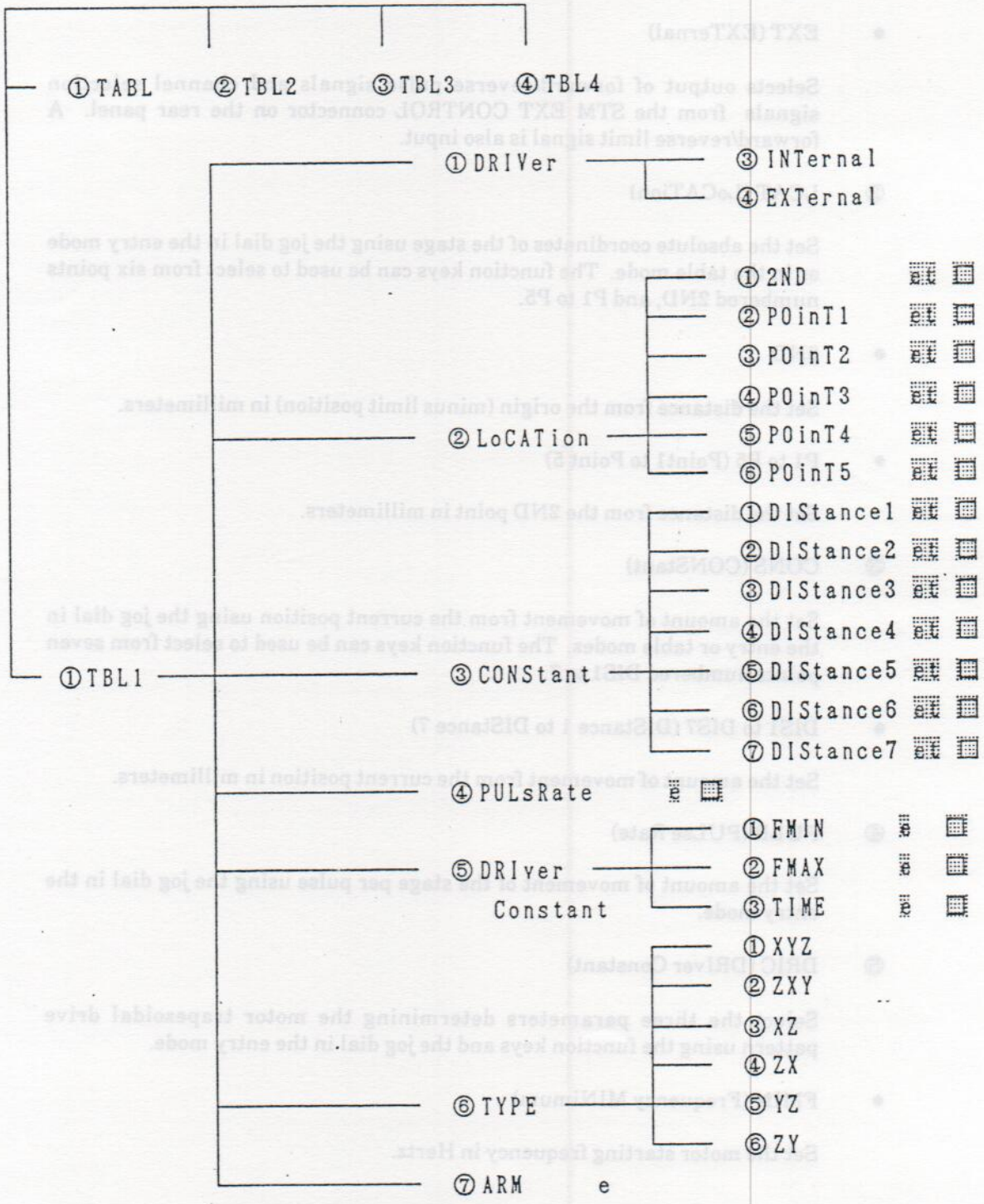


Fig. 5-4-8

- e indicates that values are set in the entry mode, and et in the entry or table modes.
- □ indicates that the three axes can be set together using the X, Y and θ keys.

① DRIV (DRIVer)

Use the following function keys to select the built-in driver (TN-011) or an external driver for the motor driver.

- INT (INTernal)

  Selects output of dual-phase stepper motor constant-current bipolar drive signal from the STM DRIVE connector on the rear panel.

- EXT (EXTernal)

  Selects output of forward/reverse pulse signals and channel selection signals from the STM EXT CONTROL connector on the rear panel. A forward/reverse limit signal is also input.

② LCAT (LoCATion)

Set the absolute coordinates of the stage using the jog dial in the entry mode or in the table mode. The function keys can be used to select from six points numbered 2ND, and P1 to P5.

- 2ND

  Set the distance from the origin (minus limit position) in millimeters.

- P1 to P5 (Point1 to Point 5)

  Set the distance from the 2ND point in millimeters.

③ CONS (CONStant)

Set the amount of movement from the current position using the jog dial in the entry or table modes. The function keys can be used to select from seven points numbered DIS1 to 7.

- DIS1 to DIS7 (DIStance 1 to DIStance 7)

  Set the amount of movement from the current position in millimeters.

④ PULR (PULse Rate)

Set the amount of movement of the stage per pulse using the jog dial in the entry mode.

⑤ DRIC (DRIver Constant)

Select the three parameters determining the motor trapezoidal drive pattern using the function keys and the jog dial in the entry mode.

- FMIN (Frequency MINimum)

  Set the motor starting frequency in Hertz.

- FMAX (Frequency MAXimum)

  Set the motor maximum drive frequency in Hertz.

- TIME

  Set the acceleration time from the starting frequency to the maximum drive frequency in milliseconds. The time for deceleration from the maximum drive frequency to the starting frequency is the same as the acceleration time.

⑥ TYPE

Select the type of the stage to be used for alignment from the following six types.

- XYZ

  An XYθ three-axis stage with the θ-axis at the lowest level.

- ZXY

  An XYθ three-axis stage with the θ-axis at the highest level.

- XZ

  An Xθ two-axis stage with the θ-axis at the lowest level.

- ZX

  An Xθ two-axis stage with the θ-axis at the highest level.

- YZ

  A Yθ two-axis stage with the θ-axis at the lowest level.

- ZY

  An Yθ two-axis stage with the θ-axis at the highest level.

⑦ ARM

Use the following equation to calculate the amount of movement per θ-axis pulse.

Set the ARM value in millimeters using the jog dial in the entry mode.

$$\theta = \tan^{-1}(PRAT/ARM \times 10^{-3}) \text{ rad}$$

5.4.6 COUN (COUNter)

This is the block of parameters for the counter. It has the following tree structure.

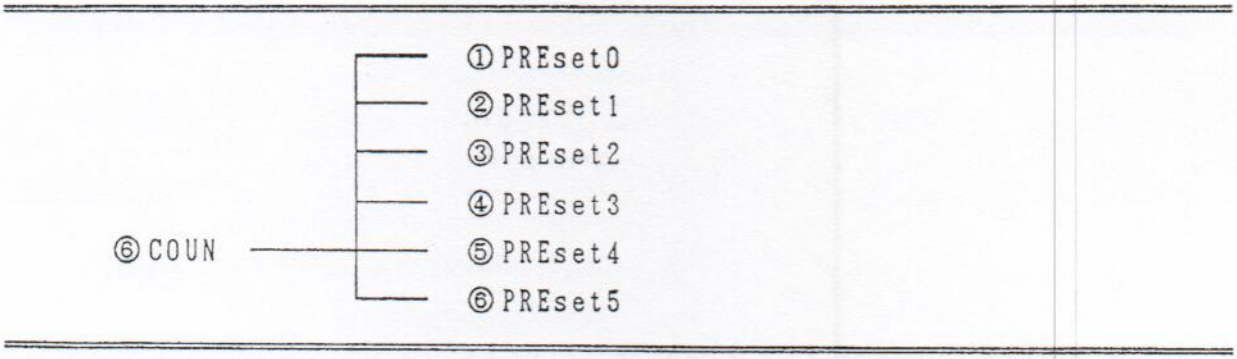


Fig. 5-4-9

If the function keys are pressed following the tree structure above from ⑥ to ①, the following display will appear at the bottom of the CRT screen. The prompt indicates that the entry mode is selected.

```
MANU COUN PRE0                    entry
  A-->   X: 00067    Y:           Z:
  B-->   X:          Y:           Z:
  PRE0 PRE1 PRE2 PRE3 PRE4 PRE5 PRE6 EXIT
```

Select PRE0 to PRE6 with the function keys.

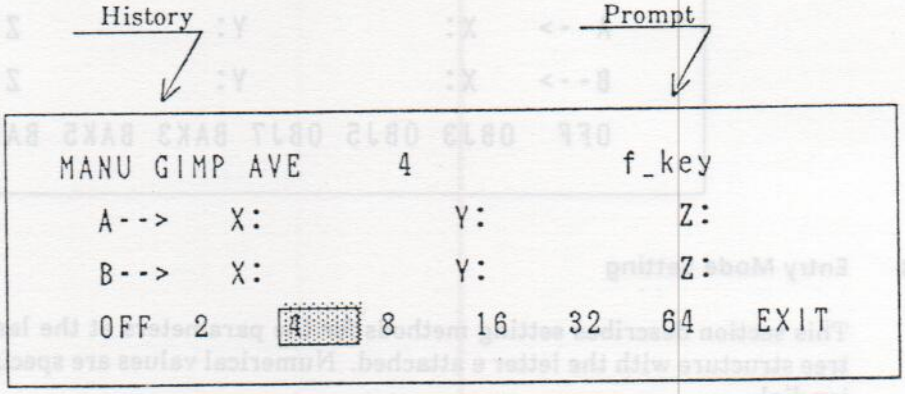
In the above example, 00067 on the edit line is the current setting, and this value is incremented or decremented by turning the jog dial. The value can be stored by pressing the SET key.

5.4.7 f_key Mode Setting

When the final node of the tree structure is reached, use the function keys to set the f_key mode in response to the f_key prompt.

Example 1 AVE Setting

(1) Press 2 GIMP and then 1 AVE to display the following at the bottom of the CRT screen. (If not at the first level of the tree, press the EXIT function key to come back one level at a time, or press the MANUAL switch in the SET group of MODE switches again.)



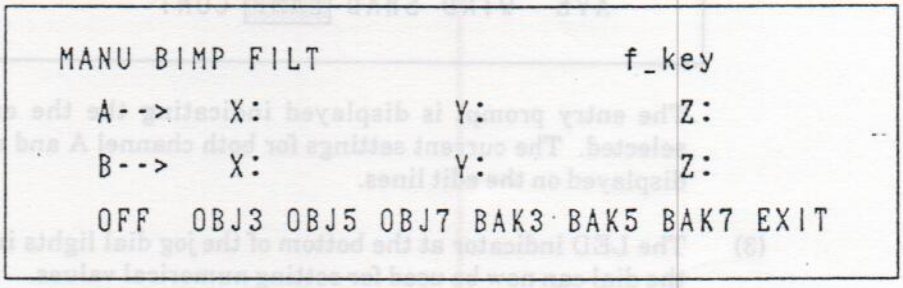
The 4 above function key 3 is highlighted indicating that the current number of averages setting is four.

(2) Set the required number of averages using the function keys. The value is highlighted indicating that setting is complete.

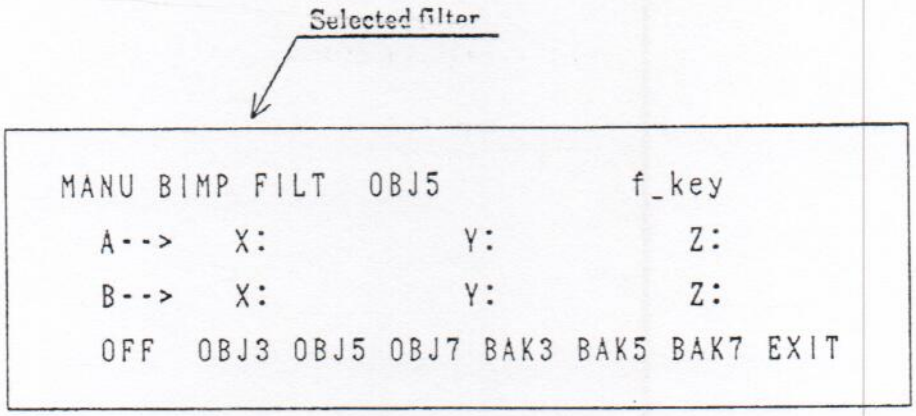
Example 2 FILT Setting (A and B can be set separately)

(1) Select the channel using the CAMERA CH switches of the SELECT group. Press the switch for the desired channel so that both LEDs light to select both A and B.

(2) Follow the tree structure to press the 3 BIMP and then 6 FILT function keys, and the following display will appear at the bottom of the CRT screen. See Fig. 5-4-5.



(3) Select the required filter using the function keys. The type of filter selected is displayed at the end of the history display.



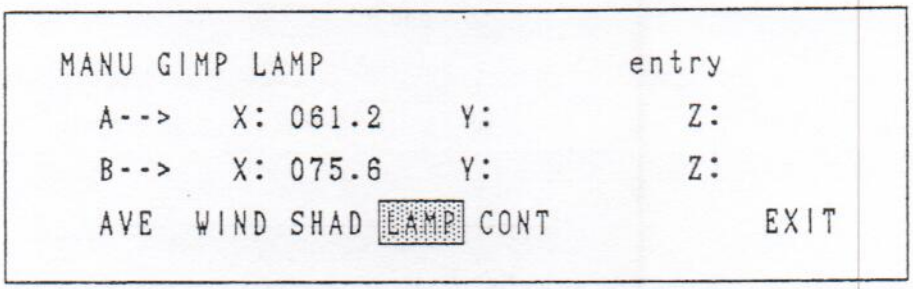
5.4.8 Entry Mode Setting

This section describes setting methods for the parameters at the last level of the tree structure with the letter e attached. Numerical values are specified using the jog dial.

- Example 1 LAMP Setting (A and B settings can be made separately)

(1) Select the channel using the CAMERA CH group of SELECT switches. Press the switch for the desired channel so that both LEDs light to select both A and B.

(2) Follow the tree structure to press the 3 BIMP and then 6 FILT function keys, and the following display will appear at the bottom of the CRT screen. See Fig. 5-4-4.



The entry prompt is displayed indicating the the entry mode is selected. The current settings for both channel A and channel B are displayed on the edit lines.

(3) The LED indicator at the bottom of the jog dial lights indicating that the dial can now be used for setting numerical values.

The value (both values if channels A and B are selected) on the edit lines will be incremented if the jog dial is turned clockwise, and the illumination will increase. Conversely, the value will be decremented as the dial is turned counterclockwise, and illumination will decrease. The steps at which the values are incremented or decremented is selected using the DIGIT switches. The step increases when the → key is pressed, and decreases when the ← is pressed.

(4) After adjusting to the optimum brightness press the SET key. This completes the setting.

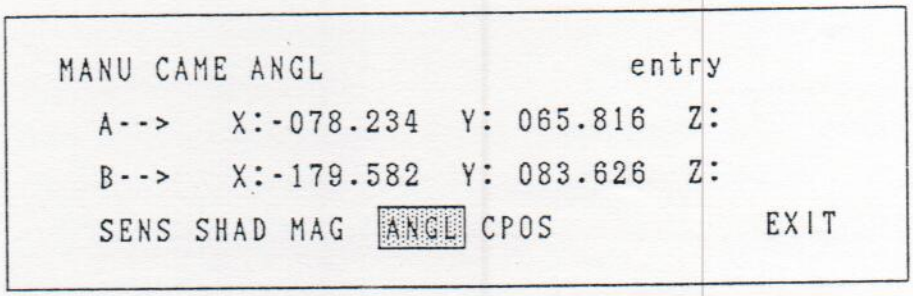
- Example 2 CPOS Setting (X- and Y-axis settings have to be made)

(1) Select the channel using the CAMERA CH group of SELECT switches. Press the switch for the desired channel so that both LEDs light to select both A and B.

(2) Select the axis using the AXIS keys below the jog dial.

(Both X- and Y-axis can be set together.)

(3) Follow the tree structure to press the 4 CAME and then the 5 CPOS function keys, and the following display will appear at the bottom of the CRT screen. See Fig. 5-4-6,



The current channel A and B X- and Y-coordinates are displayed on the edit lines.

(4) The values on the edit lines will be incremented or decremented as the jog dial is turned clockwise or counterclockwise, respectively.

(5) Press the SET key to complete setting once the required values have been reached.

(6) Only the axis of the selected channel is set, so repeat steps (2), (4), and (5) to set the required channel.

5.4.9 Cursor Mode Setting

This section describes setting methods for the parameters at the last level of the tree structure with the letter c attached. Numerical values are specified using the jog dial.

- Example 1 WIND Setting

(1) Select the channel using the CAMERA CH SELECT switch. Press both switches to select both A and B, and the two LEDs will light.

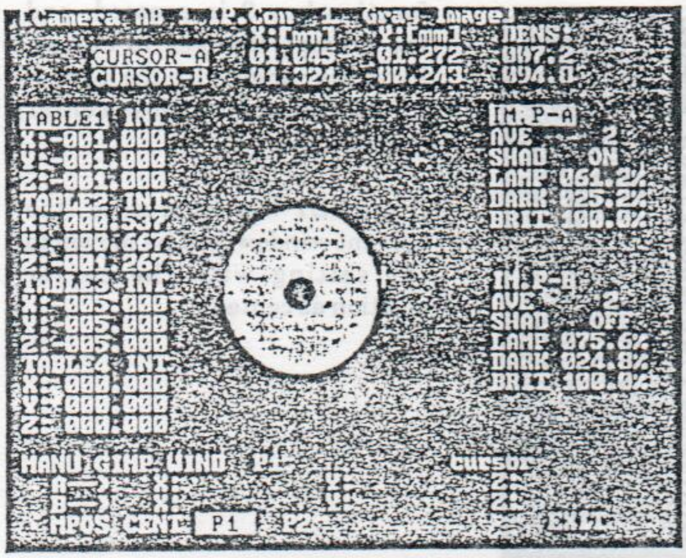
(2) Select GRAY IMAGE or BINARY IMAGE for DISPLAY.

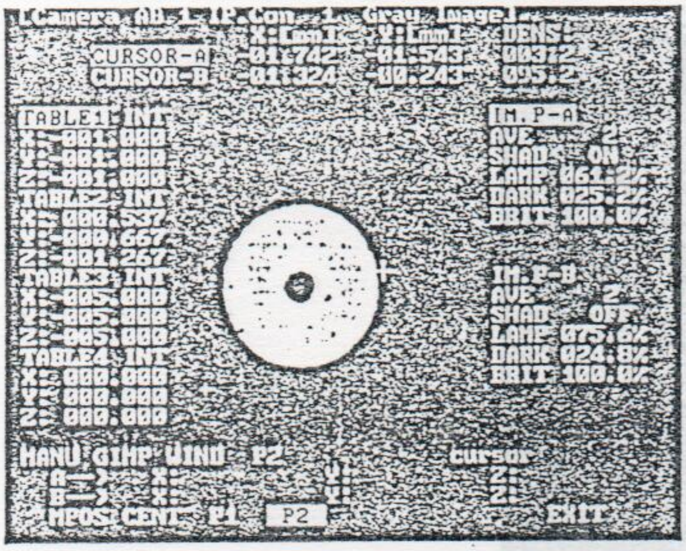
(3) Follow the tree structure to press the 2 GIMP and then 2 WIND function keys, and the following display will appear at the bottom of the CRT screen. See Fig. 5-4-4.

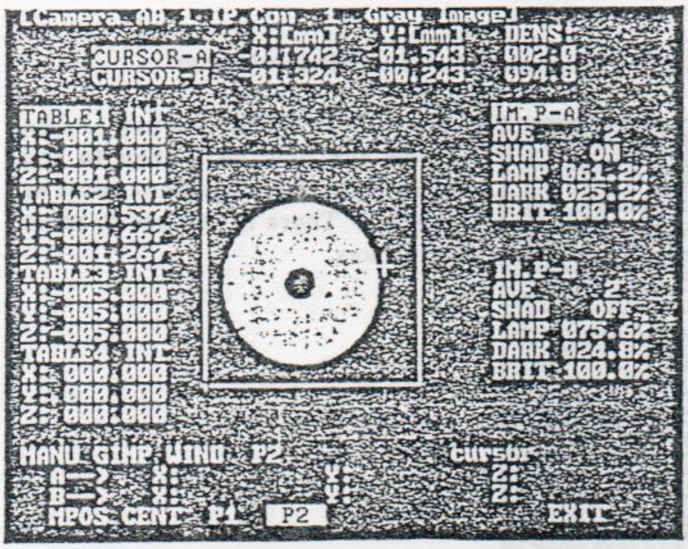
There are three ways to make the window setting.

```
MANU GIMP WIND                    entry
  A-->   X:          Y:           Z:
  B-->   X:          Y:           Z:
  MPOS CENT P1   P2                    EXIT
```

(4) Set the end points of the window diagonal using the cursor.







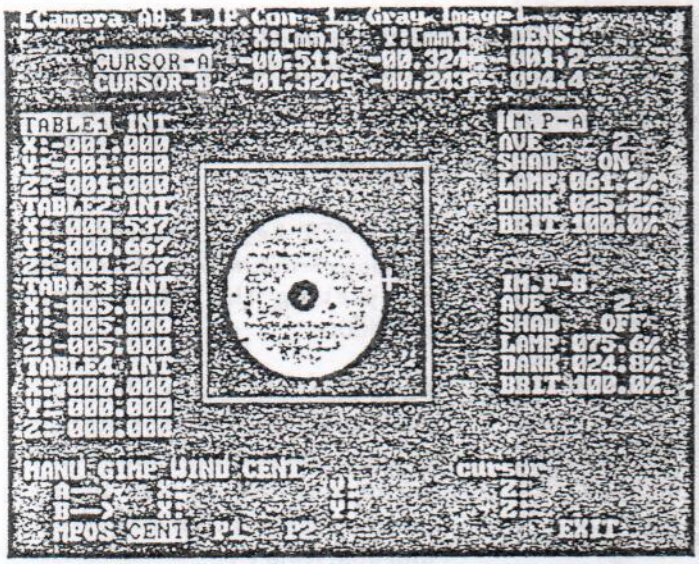
1) P1 is highlighted when function key 3 is pressed, and the prompt changes to cursor. Move the cursor with the jog dial. (Select the direction and speed using the AXIS and DIGIT keys, respectively.)

   If the SET key is pressed, the previous window will be deleted completing the P1 setting procedure.

2) P2 is highlighted when function key 4 is pressed, and the prompt changes to cursor. Move the cursor with the jog dial to the position of the other end of the diagonal from P1.

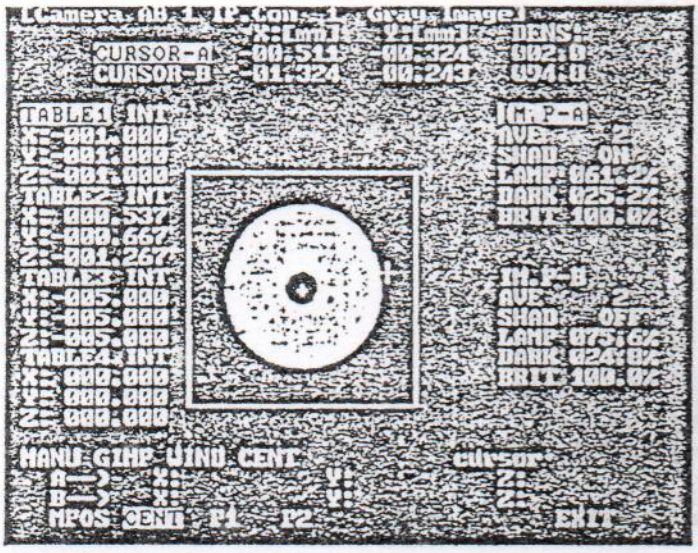
3) Now press the SET key to complete the setting of the rectangular window determined by P1 and P2.

(5) Procedure for Moving Cursor to Window Center



1) CENT is highlighted when function key 2 is pressed, and the prompt changes to cursor. Move the cursor with the jog dial to the desired window center position.

If the SET key is pressed, the current window will be moved to the setting with the cursor position as center.



(6) Procedure for Setting Alignment Point to Window Center

Press the MPOS function key 1. The window can now be moved to the position with the alignment point as its center. There is no need to press the SET key.

(7) Perform the operations in (1) above to change the channel setting.

Repeat the operations in (4) to (6) to set other channels. (Channels A and B can be set together.)

- Example 2 POSP Setting (Either entry or cursor mode can be used.)

(1) Select the channel using the CAMERA CH SELECT switch.

(2) Select the axis using the AXIS key.

(3) Follow the tree structure and press the POSI function key (1) and the POSP function key 6 to bring up the following displays at the bottom of the CRT screen.

```
MANU POSI POSP                          cursor
  A-->   X:-00.195   Y:-00.194   Z:
  B-->   X:-01.573   Y:-00.179   Z:
  PMOD STEP ERR. AREA LIMI [POSP] TABL EXIT
```

```
MANU POSI POSP                          entry
  A-->   X:-00.195   Y:-00.194   Z:
  B-->   X:-01.573   Y:-00.179   Z:
  PMOD STEP ERR. AREA LIMI [POSP] TABL EXIT
```

The prompt alternates between cursor and entry when function key 6 is pressed. Select the required mode. The cursor mode cannot be selected in modes other than display, gray image, and binary image.)

(4) Cursor Mode Setting

The CURSOR LED below the jog dial lights indicating that the dial can be used for moving the cursor. Turn the jog dial to move the cursor to the optimal position. Press the SET key to move the display mark of the alignment point to that position, and this completes the setting.

(5) Entry Mode Setting

The ENTRY LED below the jog dial lights indicating that the dial can be used for numerical value setting. Turn the jog dial to increment or decrement the values of the channel and axis selected in steps (1) and (2) above. Press the SET key when the desired values are reached, and the display mark of the alignment point moves completing the setting.

(6) Perform the operations in (1) and (2) to change the channel and axis settings.

Repeat steps (4) and (5) to make settings for another channel.

- Example 3 CONT Setting (Possible in entry and cursor modes)

(1) Select the channel using the CAMER CH group of SELECT switches.

(2) Follow the tree structure and press the GIMP function key 2 and then the CONT function key 5 to bring up the following display at the bottom of the CRT screen. Refer to Fig. 5-4-4.

```
MANU GIMP CONT                    f_key
  A-->   X: 056.4    Y:             Z:
  B-->   X: 075.6    Y:             Z:
  DARK BRIT INIT                    EXIT
```

In this case, 56.4 is the DARK value, and 75.6 is the BRIT value.

(3) Press the INIT function key 3 to initialize the contrast compensation values (DARK = 0%, BRIT = 100%). There is no need to press the SET key now.

(4) When function key 1 is pressed, DARK will be highlighted indicating that the DARK setting mode is entered. The prompt will alternate between cursor and entry when function key 1 is pressed. Select the necessary mode. (The cursor mode can only be selected when the display mode is HIST GRAM.)