MEGATEK SPECIFICATION

MEGATEK 7000 SERIES

VECTOR GENERATOR

TUNE-UP PROCEDURE

04-0004

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1. VECTOR GENERATOR TUNE UP PROCEDURE

1.1 GENERAL

This tune up procedure, along with the three referenced documents, provides the information required to adjust the vector generator portion of a Model 7000 Series Graphics Processor such that it operates properly within itself and in optimum harmony with an associated display unit.

The procedure is divided into two sections called Rough Tune Up Procedure and Fine Tune Up Procedure. When a vector generator is first turned on after assembly or replacement of a major component, the major portion of the tune up procedure is to normalize and balance the vector generator for the tolerances in its components. For a later substitution of a similar display unit, or change in the length of the interconnecting cable, or long term drift in the display unit, a simpler adjustment procedure will generally suffice.

The shorter procedure is isolated as the Fine Tune Up Procedure and will provide well for the minor changes previously identified. However, since the pattern gives a visual display of all significant misalignments or faults that degrade performance, key personnel should read through this total proceudre to learn how to recognize and correct all pattern defects.

The procedures described in Sections 1.2 through 1.4 are directed towards the tune up of a vector generator with a magnetic deflection monitor. See Section 1.5 for the slight differences relative to the use of an electrostatic deflection monitor.

1.2 REFERENCE DOCUMENTS AND FIGURES

1.2.1 Fig. 1 Tune Up Components

Fig. 1 is a simplified layout drawing, showing the location of adjustable components in the X,Y, and Z axis circuits and the two time delay adjustment resistors, which are used in the tune up procedure. Each of these components is identified in Fig. 1 by letters and numbers which relate to their function rather than their component type and numerical order. For example, one of the resistors is identified as CX because it relates to a function called "catch up" in the X axis. In these identities, G refers to "gain", O to "offset", B to "backup", C to "catch up", R to "rate", N to "neutralization," J to "jumper", and TD to "time delay".

1.2.2 Fig. 2 Test Pattern

Fig. 2 is a test pattern which was designed to provide for the optimization of vector generator operation with any particular display unit. The separate areas of interest are circled and identified with a number, or with a number and a letter if there is more than one region manifesting a particular effect. Their significance is treated in the body of this procedure.

1.2.3 Fig. 3 Typical Test Pattern Distortions for Large Misadjustments of BX, BY, CX, and CY.

Fig. 3 contains drawings of regions 10,3, and 11, depicting the effect of large misadjustments of BX, BY, CX, and CY on those patterns. One will normally seldom see evidence of such large misadjustments, but examples of large misadjustments are required to illustrate the trends of misadjustments in either direction.

1.3 ROUGH TUNE UP PROCEDURE

1.3.1 General

The tune up procedures apply to a graphics processor and display unit that are working in their normal operating range. Although the test pattern can give valuable information in the event of a device or component failure, other procedures and skills are required to localize and repair defects.

The procedures are developed in a sequence that is applicable to a vector generator being tuned for the first time, where almost everything is out of adjustment. In this case, it has to be roughed in to get a workable pattern, and then refined. The sequence is not vital however, and the more experienced operator will recognize specific abberations and go directly to the procedure and adjustable component that will correct it.

The backup potentiometers, BX and BY, affect the beginnings of vectors. The catch up potentiometers, CX and CY, affect the ends of vectors. The rate potentiometers, RX and RY, affect the rates of beam travel in the X and Y directions.

1.3.2 Time Delay Adjustment

These adjustments need only be made the first time a new vector generator is tuned up, or if the vector generator is being used beyond its normal range.

1.3.2.1 TD1 Adjustment

Connect an oscilloscope to pin 13 of U53. The positive-going pulse should be 1.5+.1 usec long. If it is not, adjust the TD1 potentiometer for that pulse width.

1.3.2.2 TD2 Adjustment

Connect an oscilloscope to pin 5 of U53. The positive-going pulse should be 500±20 nsec long. If it is not, adjust the TD2 potentiometer for that pulse width.

1.3.3 Regions 1A and 1B on the Test Pattern

Adjust BX so that each of the lines in 1B begins at approximately the same X coordinate. The beginnings of the six lines in 2A should also be in line. Disregard the other ends of these two groups of horizontal lines.

1.3.4 Regions 2A and 2B on the Test Pattern

Adjust BY so that each of the lines in 2B begins at approximately the same Y coordinate. The beginning of the six lines in 2A should also be in line. Disregard the other ends of these two groups of horizontal lines.

1.3.5 Region 3

Region 3 contains a hexagonal O with centrally contained crossing vertical and horizontal lines. At the intersection of the crossing lines there should be a bright dot. If the dot is displaced from the crossing, adjust NIX and NIY to bring it to the center of the cross.

1.3.6 Regions 4A, 4B, and 4C

4A, 4B, and 4C are three maximum length vertical lines that are each composed of one line written upwards and a second superimposed line written downward. If they do not appear as single lines, adjust ROX so that the center vertical line 4B appears as a single line. The outer lines, if split at either end, should not be separated by more than one line width at the widest separation, and each should be straight.

1.3.7 Regions 5A, 5B, and 5C

Regions 5A, 5B, and 5C are three maximum length horizontal lines that are each composed of a line written to the right with a superimposed line written to the left. If they do not appear as single lines, adjust ROY so that the center horizontal line 5B appears as a single line. The outer lines, if split at either end, should not be separated by more than one line width at the widest separation, and each should be straight.

1.3.8 Regions 6A and 6B

6A and 6B are two maximum length diagonal lines that are each composed of a line written in one direction and a superimposed line written in the opposite direction. If either diagonal line appears as two parallel lines, adjust either RX or RY so that both pairs of diagonal lines appear as single diagonal lines. If you run out of range on the selected R potentiometer, use the other to complete the adjustment.

1.3.9 Regions 7A and 7B

7A and 7B are regions containing horizontal lines which are composed of approximately 3/16 inch vectors connected end to end, with two lines written in one direction and two in the other direction. The portion between 7A and 7B are composed of 3 longer vectors and a gap, and do not apply to this procedure.

Ideally 7A and 7B should each appear as four smoothly continuous lines. It is the goal to strive for, though not quite achievable, in this procedural step. Begin by adjusting GX such that the spacing or overlap between successive short vectors in the bottom line in 7B is the same as in the bottom line in 7A. Next, adjust OX so that the spacing between short vectors in the bottom lines of 7A and 7B is the same as the spacing between the short vectors in the second line from the bottom in 7A and 7B. With successive adjustment between the G potentiometer and the O potentiometer, strive for the ideal mentioned earlier. Since it is not quite achievable-typically there will be more space between vectors at the left (7B) than the right (7A)-the final adjustment in this procedural step is to make the spacing between short vectors, in each of the four lines in 7B, as equal as possible to each other. When this is done, it will be seen that the same thing has occurred in 7A except the spacing is usually narrower. If the spacing between short vectors is very wide or very overlapped, the ease and precision of this adjustment can be augmented by adjusting CX to close or open the distance between all short vectors to about one line width at the beginning step.

1.3.10 Regions 8A and 8B

What was written in 1.3.9 about regions 7A and 7B applies to regions 8A and 8B. The only differences are that potentiometer GY is used instead of GX, and OY is used instead of OX. Region 8B, like region 7B, tends to have larger spacing than the 8A region.

1.3.11 Regions 9A and 9B

Up to this point, the procedures have encompassed the roughing in process. As a final step in the Rough Tune Up Procedure, accurate reproduction of the simple geometric shapes shown in regions 9A and 9B will be produced by careful adjustments of the BX, CX, BY, and CY potentiometers.

BX controls the starts of horizontal vectors. Turn the BX adjust screw clockwise and observe the starts of horizontal vectors in regions 9A and 9B extending. Note that it may be the right end or left end, depending on where the vector begins and the direction it travels. Then adjust BX so that the start point of the horizontal vector coincides with the appropriate vertical member with which it is to intersect.

CX controls the ends of horizontal vectors. Turn the CX adjust screw clockwise and observe the ends of horizontal vectors in regions 9A and 9B extending. Note that it may be the right or left end, depending on where the vector begins and the direction it travels. Then adjust CX so that the end points of horizontal vectors coincide with the appropriate vertical members with which they are to intersect.

BY and CY control the starts and ends of vertical vectors as BX and CX control the starts and ends of horizontal vectors. Adjust BY and CY so that the starts and ends of vertical vectors in regions 9A and 9B intersect with the appropriate horizontal vectors. The three-segemented rectangles should now be geometrically correct, with sharp corners, no protruding vectors, and no gaps.

If, at this point, it is observed that regions 6A and 6B manifest double lines, a slight adjustment on RX and/or RY will make them single lines again.

1.4 FINE TUNING PROCEDURE

1.4.1 General

The purpose of the fine tuning procedure is to optimize the vector generator-display unit pair for small geometric figures, and to that end the figures in regions 10,3, and 11 were created. It is simple in that only four potentiometers, BX, CX, BY, and CY are used. It is difficult because the hexagonal O and the five stroke S are the most difficult characters to accurately produce, and the procedure required to optimize them can not be adequately described in a step by step development without going into inappropriate detail about diagonal vector generation. One must develop skill by turning the various potentiometer screws and observing what happens. The following section in this Fine Tuning Procedure will attempt to shorten the learning experience by informing you what you might expect to see. Fig. 3 will also help.

1.4.2 BX, BY, CX, and CY Adjustment

If, in 1.3.11, regions 9A and 9B were very carefully done, there is a good probability that the rectangle with the nine inner sections in region 10 will look very good. There is also a good probability that the hexagonal O of region 3 and the five sided S of region 11 will show nonsymmetry and, either or both, gaps and excessive vector lengths. The reason is that in rectangular figures with interconnecting horizontal and vertical vectors the ideal interconnection is obscured by the width of the beam. The diagonal structures in the hexagonal O and the five sided S are much more sensitive to deviations from the ideal and manifest this by nonsymmetry, gaps, and more often, excessive vector lengths.

In the fine tuning adjustments one must watch all three referenced figures at the same time, or in continuous sequence, but the most important and useful one is the hexagonal O. The horizontal and vertical lines that cross in the center are written to cross in exact center, with equal X's on both sides of center, and longer but equal Y's on both sides of center. They are useful in establishing the symmetry, which is primarily governed by BX and BY. A good procedure is to adjust BX to improve symmetry and, at the same time, make the lower end of the upper left side of the O coincide with the middle left side of the O; i.e., make the upper left vector start point be on the middle left vector. Then go to BY to improve the symmetry. Proceed to CX to adjust diagonal vector lengths, and then to CY to adjust vertical vector lengths. Another pass or two through the preceeding should result in a good O. Keep an eye on the S while making these adjustments. The goal is to wind up with a good O and good S, but it may take a compromise of a pretty good O and a pretty good S, rather than a perfect O and a not so good S, for the best adjustment.

Regions 13A and 13B are slightly larger and more complex geometric figures than those of regions 10, 3, and 11. They provide examples of the precision to be expected of general figures of their size and complexity and are used in the Z axis adjustments. In addition, the more experienced operator may find them useful in making small refinements in the procedure to optimize the tune up for slightly larger geometric figures.

1.4.3 Intensity - Z Axis - Adjustments

1.4.3.1 General

Although any particular vector is written at constant velocity, there can be moderate differences between individual vector velocities. The network which compensates intensity for this variation is optimum at only one intensity level setting due to the nonlinear CRT grid characteristic. Although it is quite good over several levels of intensity variation an adjustment of grid bias level and video gain is appropriate for operation at low intensity levels.

1.4.3.2 Grid Bias and Video Gain Adjustments

Vary the intensity adjustment on the front of the display unit for the desired lower intensity and observe regions 13A, 13B, 14A, and 14B. If 13B and 14B become too light, or if some of the lines in any of these patterns becomes significantly lighter than others in the same pattern, adjust GZ on the vector generator board to correct the condition. An increase in the display unit intensity adjustment will probably be needed after, or during, the GZ adjustment, to maintain the desired intensity level. A repetition of these two adjustments should result in a constant intensity display. Note that 13B and 14B which are written at intensity level 10, in contrast with 13A and 14A which are written at intensity level 15, are more sensitive to these adjustments and should receive the greater amount of attention.

OZ is an offset adjustment, which is similar in effect to the display unit intensity adjustment. It is generally unnecessary to use it, and should not be, unless display quality demands it. If it has not been used, all that is necessary to return to the original settings is to restore the ambient lighting to the average good visibility level, set the display unit intensity control to maximum clockwise, and adjust GZ for good vector intensity balance in regions 13A, 13B, 14A, and 14B.

If OZ has been adjusted, the return to good high intensity operation is a bit longer. Restore the ambient light to the average good visibility level, set the display unit intensity control to maximum clockwise, and adjust both GZ and OZ alternately so that vector intensity balance is restored, being careful not to raise the intensity beyond the focus control's ability to focus the beam sharply. The admonition against using OZ, unless it is really needed, is because once the setting is changed, it is more difficult to get back to the original condition than with the simpler GZ plus display unit intensity adjust procedure. Do not be reluctant to use OZ, if necessary. It is there so that its contribution to display excellence can be made, however, try the simpler approach first.

1.5 VECTOR GENERATOR TUNE UP WITH ELECTROSTATIC DEFLECTION MONITORS

1.5.1 General

All that was described in Sections 1.2 through 1.4 relative to tuning a vector generator with a magnetic deflection monitor applies directly to a tune up with an electrostatic monitor.

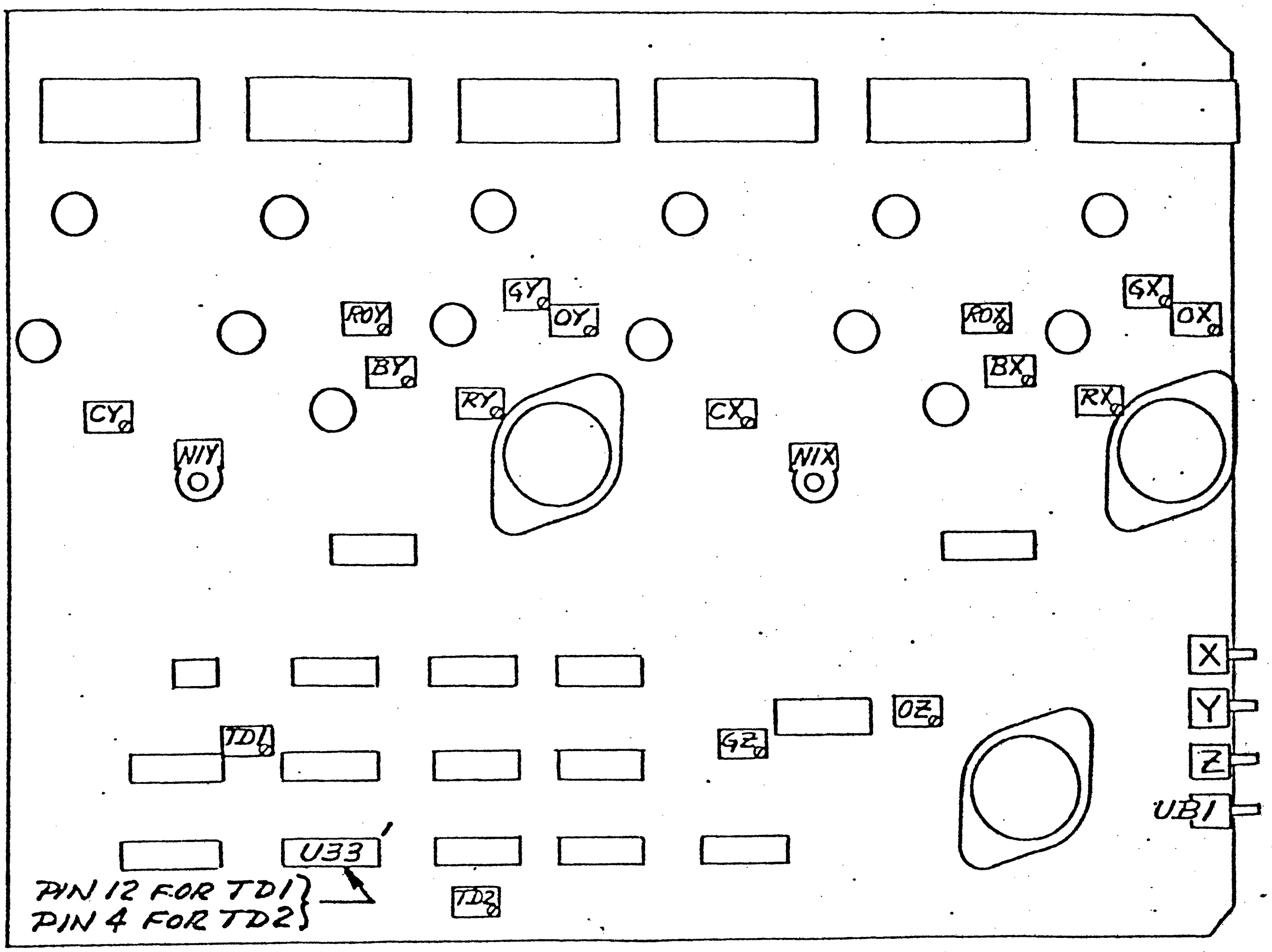
The primary differences are in the jumper connections identified in Fig. 1. For an optimum display, it is advisable, though not necessary, to change the jumpers to correspond to those identified with the heading ELECTROSTATIC before beginning the tune up.

For temporary operation of an electrostatic deflection monitor, a fairly acceptable display may be achieved without changing the jumpers from the normal magnetic deflection monitor mode. All that is required is to set both CX and CY maximum counterclockwise at the point in the procedure where it calls for adjustment of CX and CY. Without any "catch-up" the normally very fast electrostatic deflection monitor will manifest a display with the end point and the start point of successive vectors superimposed. That point, or dot, will have the cumulative brightness of both vectors.

For the best display, changing the jumpers to the electrostatic mode will result in a level of performance that is the next step beyond the normal goal of having the end point and start point of successive vectors exactly coincide. It provides for slight separation of the end point and the start point of successive vectors to minimize the otherwise resultant overlap. This is done at the point in the procedure where it calls for adjustment of CX and CY.

1.5.2 TD2, BX, and BY Considerations

Due to the fast response of electrostatic deflection monitors, the required relationship between TD2 and BX and BY is slightly different than with magnetic deflection monitors. If the adjustments of BX and BY, as called for in the procedures, seem to provide inadequate range, return to item 1.3.2.2. Reduce the pulse-width called for in 1.3.2.2 by 100 to 200 nanoseconds and repeat the rest of the tune up procedure.



FUNCTION	REF. DES
OX	R168
GX	R170
ROX	R141
RX	R171
BX	R146
CX	R144
NIX	C79
OY	R65
GY	R67
ROY	R38
RY	R68
BY	R43
CY	R41
NIY	C28

FUNCTION	REF. DES
GZ	R208
OZ	R210
TD1	R222
TD2	R225

JUMPERS

Magnetic 2,3,6,7

Electrostatic 1,4,5,8

FIGURE 1

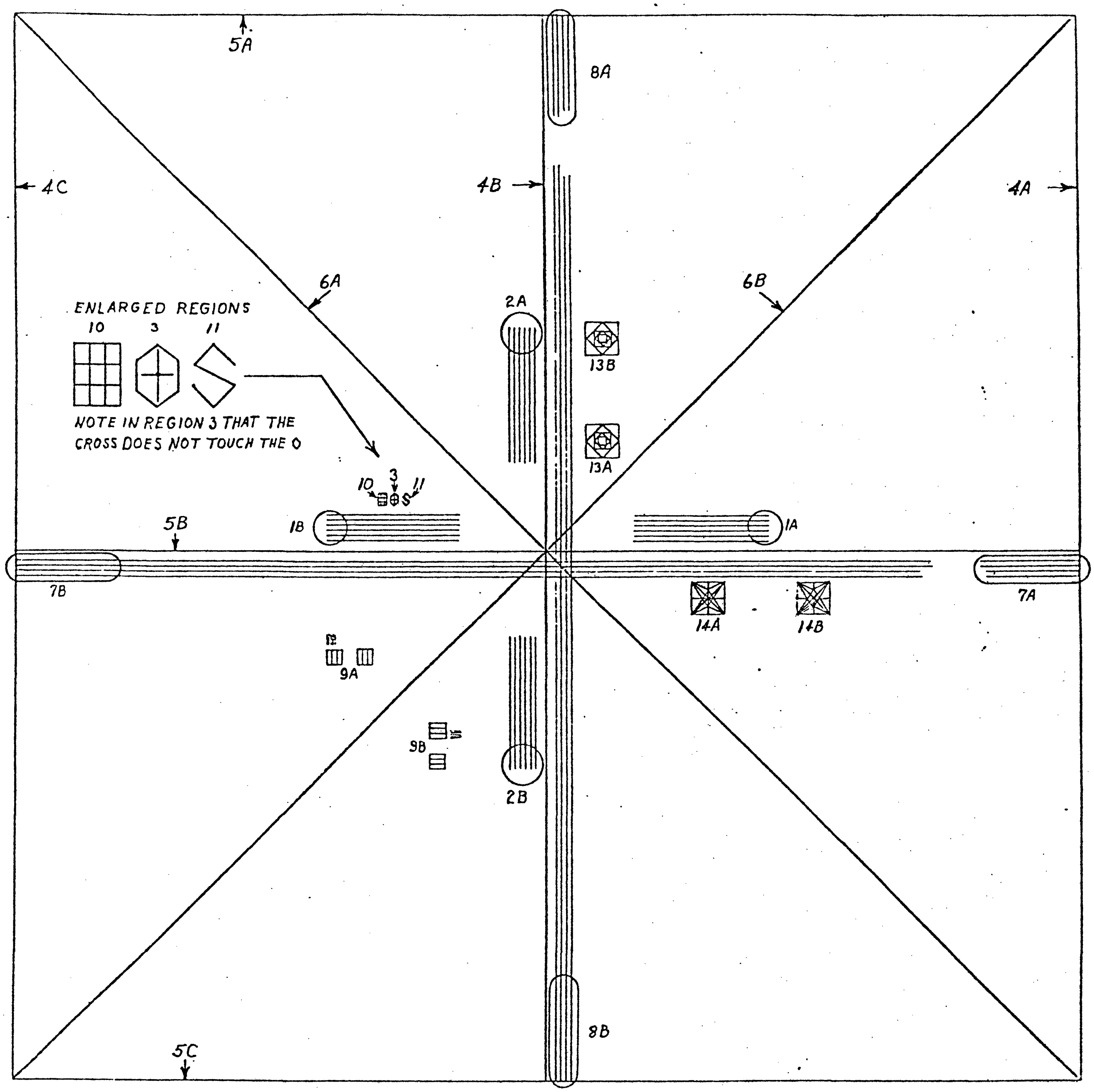


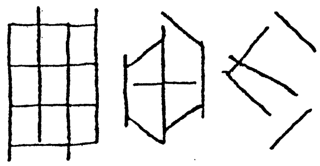
Figure 2
Test Pattern

Item	Region	Symptom of Misadjustment	Adjust
1	1A, 1B	Beginnings of lines staggered	BX
2	2A, 2B	Beginnings of lines staggered	BY
3	3	Bright dot not where center lines cross	NIX, NIY
4	4A, 4B, 4C	4B appearing as two lines, excessive separation in 4A and 4C	ROX
5	5A, 5B, 5C	5B appearing as two lines, excessive separation in 5A and 5C	ROY
6	6A, 6B	6A or 6B appearing as two parallel lines	RX, RY
7	7A, 7B	Bottom line of 7A separations very different from bottom line of 7B	GX
		Bottom lines of 7A and 7B separations different from second lines from bottom	OX
8	8A, 8B	Right most line of 8A separations very different from right most line of 8B	GY
		Right most lines of 8A and 8B different from lines second from the right	OY
9	9A, 9B	Gaps or overshoots at intersections of lines	BX, BY, CX, CY
10	10, 3, 11	Gaps or overshoots at line intersections, non-symmetry, distortion	BX, BY, CX, CY
11	13A, 13B, 14A, 14B	Some lines seem significantly brighter than others	GZ and Display Unit Intensity Control (and OZ if necessary)

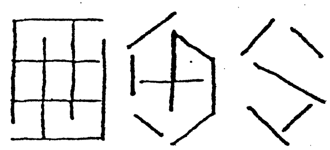
TYPICAL TEST PATTERN DISTORTIONS

FOR

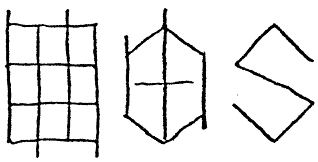
LARGE MISADJUSTMENTS OF BX, BY, CX AND CY



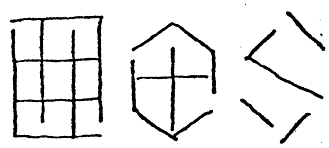
TOO MUCH BY



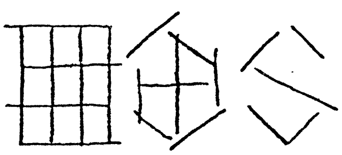
TOO LITTLE BY



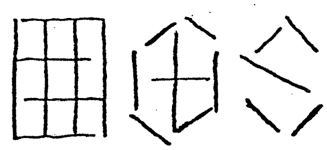
TOO MUCH CY



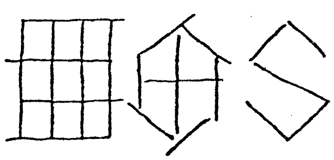
TOO LITTLE CY



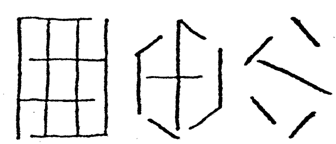
TOO MUCH BX



TOO LITTLE BX



TOO MUCH CX



TOO LITTLE CX

FIGURE 3