

# SETUP PATTERNS FOR DISPLAY MEASUREMENTS—VERSION 1.0

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U.S. DEPARTMENT OF COMMERCE  
Donald L. Evans, Secretary

NATIONAL INSTITUTE OF STANDARDS  
AND TECHNOLOGY  
Karen H. Brown, Acting Director



# SETUP PATTERNS FOR DISPLAY MEASUREMENTS— VERSION 1.0

In our work in the laboratory developing methods to measure displays as well as work on standards committees, we have developed a number of targets for use in setting up displays, making measurements on displays, and giving demonstrations of displays to visitors. We place these targets composed of images and patterns in the public domain to be used as desired. (See Reference 1.) In Section 1, the first target in the setup series provides basic information about the use and construction of the targets. Section 2 provides some of the construction details for a number of pixel arrays. Section 3 provides the naming conventions used for any bit-mapped renderings of these images. Section 4 shows the setup file sequence, and Section 5 shows special bit-mapped patterns. The setup sequence is available (as of this writing) at <ftp:fpdl.nist.gov/pub/patterns> as files NISTSU.\* and the bitmaps are in NISTBM.ZIP.

## 1. DETAILS OF FIRST TARGET (INTRO)

The first target (see Fig. 1) in the series of setup targets explains the usage of the setup targets, discusses how the gray scales were rendered, and provides a disclaimer regarding their use.

### A. USAGE:

The following explanation of usage of these setup targets is placed on the first target in the series (see Fig. 1): These patterns are provided for setting up and examining an electronic display. If the display has adjustments and the manufacturer doesn't specify how to set the display up, adjust the display settings (contrast, brightness, etc.) to obtain the most acceptable performance according to how the display is intended to be used. The settings established with this method should not be changed during the course of other measurements serving to characterize the display, unless the display is used in a manner that optimizes the display performance for each measurement performed.

### B. RENDERING GRAY LEVELS AT A LOWER GRAY-SCALE RESOLUTION:

Table 1 shows the levels selected from 256 levels (0 – 255) to make some of the patterns. The following explanation of how the gray scales were generated in software from a larger set of bit levels is placed on the introduction target: Bits in software are associated with discrete levels of electrical signals to produce various shades of gray on the screen. These bit levels are called gray levels or command levels. The relationship between the gray level (bits in software) and the gray shade is the gray scale or the electro-optical transfer function—sometimes called the “gamma” because of the historical usage of the term. The number of gray shades actually produced will not necessarily be the same as the number of gray levels depending upon the characteristics of the display used. Given  $n$  gray levels that can be employed to present gray shades on a screen, there are  $w = n - 1$  gray levels above zero with gray-level 0 for black and gray-level  $w = n - 1$  for white. We want to select a subset of  $m$  levels ( $m < n$ ) that are relatively evenly spaced within this larger set of  $n$  levels. The interval between the  $w$  levels to create  $m$  levels is  $\Delta V = w/(m-1)$ , which may not be an integer. The  $m$  levels we select are the (integer) values given by  $V_i = \text{int}[(i-1)\Delta V]$  for  $i = 1, 2, \dots, m$ ; or  $V_i = 0, \text{int}(\Delta V), \text{int}(2\Delta V), \text{int}(3\Delta V), \dots, \text{int}[(m-1)\Delta V]$ , with  $\text{int}[(m-1)\Delta V] = w$  for white. For example, in an 8-bit gray scale, there are  $n = 256 = 2^8$  levels with the white level as  $w = 255$ . Suppose we want to select  $m = 8$  gray levels that are evenly spaced. The needed interval is  $\Delta V = 36.4286$ , and the chosen levels are: 0, 36, 73, 109, 146, 182, 219, 255. If we wanted to select  $m = 32$  levels from the 256 levels, we'd use  $\Delta V = 8.2258$  to give levels: 0, 8, 16, 25, 33, 41, 49, 58, 66, 74, 82, 90, 99, 107, 115, 123, 132, 140, 148, 156, 165, 173, 181, 189, 197, 206, 214, 222, 230, 239, 247, 255.

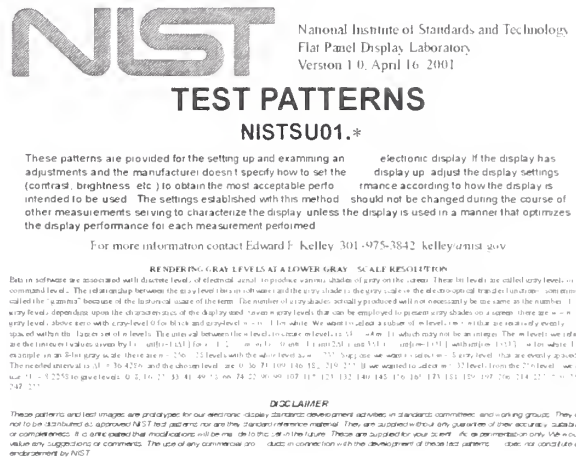


Fig. 1. First target in setup series (named INTRO).

**Table 1**

Selection of Levels from  $n = 2^8 = 256$  Levels  
Sh = Shade #, Lv = Level out of 0 to 255

64 Gray Shades		32 Gray Shades		16 Gray Shades		8 Gray Shades		5 Gray Shades		4 Gray Shades	
Sh	Lv	Sh	Lv	Sh	Lv	Sh	Lv	Sh	Lv	Sh	Lv
1	0	1	0	1	0	1	0	1	0	1	0
2	4										
3	8	2	8								
4	12										
5	16	3	16								
				2	17						
6	20										
7	24	4	24								
8	28										
9	32	5	32								
				3	34						
10	36					2	36				
11	40										
		6	41								
12	44										
13	48										
		7	49								
				4	51						
14	52										
15	56										
		8	57								
16	60							2	63		
17	64										
		9	65								
18	68			5	68						
19	72					3	72				
		10	74								
20	76										
21	80										
		11	82								
22	85			6	85					2	85
23	89										
		12	90								
24	93										
25	97										
		13	98								
26	101										
				7	102						
27	105										
		14	106								
28	109					4	109				
29	113										
		15	115								
30	117										
				8	119						
31	121										
		16	123								

**Table 1 Continued**

64 Gray Shades		32 Gray Shades		16 Gray Shades		8 Gray Shades		5 Gray Shades		4 Gray Shades		
Sh	Lv	Sh	Lv	Sh	Lv	Sh	Lv	Sh	Lv	Sh	Lv	
32	125								3	127		
33	129											
		17	131									
34	133											
				9	136							
35	137											
		18	139									
36	141											
37	145							5	145			
		19	148									
38	149											
39	153					10	153					
		20	156									
40	157											
41	161											
		21	164									
42	165											
43	170					11	170				3	170
		22	172									
44	174											
45	178											
		23	180									
46	182							6	182			
47	186											
						12	187					
		24	189									
48	190											
										4	191	
49	194											
		25	197									
50	198											
51	202											
						13	204					
		26	205									
52	206											
53	210											
		27	213									
54	214											
55	218							7	218			
						14	221					
56	222	28	222									
57	226											
58	230	29	230									
59	234											
60	238	30	238	15	238							
61	242											
62	246	31	246									
63	250											
64	255	32	255	16	255	8	255	5	255	4	255	

Grayed cells indicate a larger interval from black to white than  $\Delta V$ .

Several patterns refer to percentages of white. Such gray levels (sometimes called command values) come from the analog-signal world where use is made of a gray scale based upon an analog signal in percent of the difference between the white signal level and the black signal level. An accurate correspondence between the percent-of-white gray-shade and the 256-level gray shade cannot be obtained to perfectly match the percentages desired in the pattern. We propose the following rule to get approximate bit-levels in a  $n = 256$  gray scale with white specified by  $w = n - 1$  and 0 for black: The bit level  $V$  associated with the percentage  $p$  (fractional quantity) is  $V = \text{int}(wp) = \text{int}(255 \times \text{percentage}/100 \%)$ . This amounts to rounding all the fractional values down. See Table 2 for the various levels used in the patterns.

### C. DISCLAIMER

The following disclaimer is placed on the INTRO target and would apply to this publication: These patterns and test images are prototypes for our electronic-display standards development activities in standards committees and working groups. They are not to be distributed as approved NIST test patterns nor are they standard reference materials. They are supplied without any guarantee of their accuracy, suitability, or completeness. It is anticipated that modifications will be made to this set in the future. These are supplied for your scientific experimentation only. We would value any suggestions or comments. The use of any commercial products in connection with the development of these test patterns does not constitute an endorsement by NIST.

## 2. CONSTRUCTION DETAILS

Table 3 shows some of the specifications for various circles and boxes encountered in the bit-mapped version of any of the patterns. In the array-names row, "GA" stands for graphics array, "V" stands for video, "S" is for super, "X" is for extended, and "U" is for ultra. The pixel (abbreviated "px") is the smallest element of the display that can present the fully range of color capabilities of the display. Often the pixel is composed of three subpixels, (RGB for red, green, and blue). The variables used in the table are:  $d$  is the diameter and  $r$  is the radius of a circle;  $D$  is the diagonal of the screen (here expressed in pixels),  $H$  is the horizontal number of pixels,  $V$  is the vertical number of pixels, and  $N_T = HV$  is the total number of pixels that compose the screen. In color displays, the pixel is the picture element that can display the full color gamut of the display—often the pixel is composed of subpixels of RGB (red green and blue) for many color display types. Note the use of the term "pixel array" to avoid confusion with "resolution" and "addressability." Resolution should only refer to how well the eye can resolve the pixels displayed. Addressability refers to how many pixels can be addressed and can be different than the pixel array (although it is most often the same as the pixel array).

*Table 2  
Percent of White  
vs. Gray Level*

%	Level
0 %	0
5 %	13
10 %	25
15 %	38
20 %	51
25 %	63
30 %	76
40 %	102
48 %	122
50 %	127
51 %	130
53 %	135
60 %	153
70 %	178
75 %	191
80 %	204
85 %	216
90 %	229
95 %	242
100 %	255

*Table 3*

**LOCATIONS AND DIMENSIONS OF MAJOR OBJECTS**

Pixel Array	<b>640x480</b>	<b>800x600</b>	<b>1024x768</b>	<b>1280x1024</b>	<b>1600x1200</b>	
Array Name	VGA	SVGA	XVGA	SXVGA	UGA	
Diagonal, $D$	800	1000	1280	1639.2	2000	
$H$	640	800	1024	1280	1600	
$V$	480	600	768	1024	1200	
$N_T$ (square px = px <sup>2</sup> )	307200	480000	786432	1310720	1920000	
Values often adjusted to reflect even numbers via $2\text{int}(x/2)$ :						
3 % $d(r)$	24 (12)	30 (14)	38 (18)	48 (24)	60 (30)	
5 % $d(r)$	40 (20)	50 (24)	64 (32)	80 (40)	100 (50)	
20 % (1/5) Box (px <sup>2</sup> )	110	138	177	228	277	
Top left corner of centered 20 % (1/5) box:	(256, 192)	(320, 240)	(410, 308)	(512, 410)	(640, 480)	
Corner of highlight box (30 px square)	(304, 224)	(380, 280)	(487, 359)	(608, 480)	(760, 560)	
Box	% of $A$	Area Obtained (Location of top left corner in parentheses.)				
5 %	0.25 %	<b>32 x 24</b>	<b>40 x 30</b>	<b>50 x 38</b>	<b>64 x 50</b>	<b>80 x 60</b>
		(304, 228)	(380, 286)	(488, 366)	(608, 488)	(760, 570)
10 %	1.00 %	<b>64 x 48</b>	<b>80 x 60</b>	<b>102 x 76</b>	<b>128 x 102</b>	<b>160 x 120</b>
		(288, 216)	(360, 270)	(462, 346)	(576, 462)	(720, 540)
15 %	2.25 %	<b>96 x 72</b>	<b>120 x 90</b>	<b>152 x 114</b>	<b>192 x 152</b>	<b>240 x 180</b>
		(272, 204)	(340, 256)	(436, 328)	(544, 436)	(680, 510)
20 %	4.00 %	<b>128 x 96</b>	<b>160 x 120</b>	<b>204 x 152</b>	<b>256 x 204</b>	<b>320 x 240</b>
		(256, 192)	(320, 240)	(410, 308)	(512, 410)	(640, 480)
25 %	6.25 %	<b>160 x 120</b>	<b>200 x 150</b>	<b>256 x 192</b>	<b>320 x 256</b>	<b>400 x 300</b>
		(240, 180)	(300, 226)	(384, 288)	(480, 384)	(600, 450)
30 %	9.00 %	<b>192 x 144</b>	<b>240 x 180</b>	<b>306 x 230</b>	<b>384 x 306</b>	<b>480 x 360</b>
		(224, 168)	(280, 210)	(360, 270)	(448, 360)	(560, 420)
40 %	16.00 %	<b>256 x 192</b>	<b>320 x 240</b>	<b>408 x 306</b>	<b>512 x 408</b>	<b>640 x 480</b>
		(192, 144)	(240, 180)	(308, 232)	(384, 308)	(480, 360)
50 %	25.00 %	<b>320 x 240</b>	<b>400 x 300</b>	<b>512 x 384</b>	<b>640 x 512</b>	<b>800 x 600</b>
		(160, 120)	(200, 150)	(256, 192)	(320, 256)	(400, 300)
60 %	36.00 %	<b>384 x 288</b>	<b>480 x 360</b>	<b>614 x 460</b>	<b>768 x 614</b>	<b>960 x 720</b>
		(128, 96)	(160, 120)	(206, 154)	(256, 206)	(320, 240)
70 %	49.00 %	<b>448 x 336</b>	<b>560 x 420</b>	<b>716 x 536</b>	<b>896 x 716</b>	<b>1120 x 840</b>
		(96, 72)	(120, 90)	(154, 116)	(192, 154)	(240, 180)
80 %	64.00 %	<b>512 x 384</b>	<b>640 x 480</b>	<b>818 x 614</b>	<b>1024 x 818</b>	<b>1280 x 960</b>
		(64, 48)	(80, 60)	(104, 78)	(128, 104)	(160, 120)
90 %	81.00 %	<b>576 x 432</b>	<b>720 x 540</b>	<b>920 x 690</b>	<b>1152 x 920</b>	<b>1440 x 1080</b>
		(32, 24)	(40, 30)	(52, 40)	(64, 52)	(80, 60)

### 3. NAMING AND FILE CONVENTIONS

Naming the targets (images and patterns) is a touchy task since just after you think you've come up with a good naming convention, you find a pattern that doesn't fit in with what you've invented. Table 4 is what we are using for bitmapped files that must be named separately.



Table 4

**FILE & PATTERN NAMING CONVENTIONS:  
PATTERN\_####x####.TYP**

**NUMBERING CONVENTIONS: (To specify colors and gray levels of pattern or component parts.)**

#	When a single number (e.g., FS2), it refers to one of eight levels equally spaced from full luminance = 7 to black = 0.
##	When a two-digit number (e.g., FS26), it refers to the level in percent of full luminance.
-##	When a two-digit number preceded by a dash (e.g., FS-12), it refers to one of sixteen levels equally spaced from full luminance =15 to black = 0.
###	When a three-digit number (e.g., 123), it refers to the ### 8-bit level out of 255 available levels.
###-###-###	When three three-digit numbers (e.g., 123-050-012), it refers to a 24-bit RGB setting (###,###,###). Should a greater or lesser bit depth than 24 be required, the bit depth used for each color can be explicitly indicated by using the underscore character and a sufficient number of characters to accommodate the largest number; e.g., for 8 bits of red, 10 bits of green, 6 bits of blue use ### 8_#### 10_## 6.

**FILE PIXEL ARRAY SPECIFICATION**

_####x####	(underscore separator) Horizontal number of pixels × Vertical number of pixels ( $H \times V$ ) using at least four digits for each number.
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**TYPE CONVENTIONS:**

PDF	Adobe Portable Document Format®.
PNG	Portable Network Graphics (as of this writing see <a href="http://www.libpng.org/pub/png/">http://www.libpng.org/pub/png/</a> ) is in the public domain and is used for all bit-mapped images and patterns connected with this document.
PPT	Microsoft PowerPoint®.

**DESCRIPTION CONVENTIONS**

1. When we say a box is a certain percentage of the diagonal, e.g., 20 %, we are implying the box aspect ratio is the same as the aspect ratio of the screen; e.g.,  $0.20H \times 0.20V$ , as best as can be generated at the pixel level.
2. When speaking of the 10 % periphery, we mean the imaginary box made at  $0.10H$  and  $0.10V$  away from the outer edges of the screen. Usually this is used to locate measurement points symmetrically placed about the center of the screen. In the case of nine measurement points, they will be at the center and then at the corners and centers of the 10 % periphery box. In the case of 25 points, they will be at the nine points and symmetrically between them making a  $5 \times 5$  symmetrical matrix.

**PATTERN NAMING CONVENTIONS (Format at left, examples at right in first column):**

$nXn?...$	<b>CHECKERBOARD:</b> Specified with color = ? in the upper left corner (K or W assumes a black and white checkerboard). If a color designation is left off, it will be a white-black checkerboard with white in the upper left corner. C specifies alignment circles in all rectangles. C# ( $\# < n$ ) means symmetrically placed, but not in all rectangles.
3X3K	$3 \times 3$ checkerboard with black upper left corner.
4X4GM	$4 \times 4$ checkerboard with green at upper left alternating with magenta.
2X2WC	$2 \times 2$ checkerboard with white in upper left corner and alignment circles centered in all rectangles.
5X5KC9	$5 \times 5$ checkerboard with alignment circles in nine locations at the center, corners, and centers of the edges.
AT..., P, N	<b>ALIGNMENT TARGETS:</b> Provided to identify locations of cardinal points on the display surface and are supplied in positive (dark lines on white) or negative (light lines on black) formats.
AT01P, N	Alignment target #01 in positive (negative) format: Concentric circles of 5 % and 3 % of screen diagonal are placed at nine locations around the 10 % periphery, and 3 % circles are

	placed at 25 positions. Boxes of 5 % size are placed on a cross pattern and on the periphery. Diagonal lines connect the corner measurement points.
<b>CAT...</b>	<b>CENTERING &amp; ALIGNMENT TARGETS:</b> Provided also in bit mapped versions where the center target is a specified diameter and does not scale with the image size.
CAT01A	This is the non-bitmapped version of CAT01 (see below) where the center target is replaced with a crosshairs.
<b>CBV, CBH ...</b>	<b>COLOR BARS VERTICAL, HORIZONTAL:</b> If no level is specified via a number designation (##) then it is assumed at 100 % level.
CBV50	Color bars at 50 % level.
CBV-32SH01	Vertical color bars at 100 % saturation with 32-level horizontal gray scales. pattern #01.
<b>CINV...</b>	<b>COLOR INVERSION targets:</b>
CINV01	Color inversion target #01 where eight gray levels are displayed in a pie pattern placed on a 50 % (127/255) background. Within each pie piece is a colored pie composed of the gray level plus a 36-bit level increase in red, then green, then blue—except for the white pie that has the same color pie as the previous gray level (6) pie piece. The main pie pattern is reduced in size and replicated at all nine points. The pattern can be used for spotting color and gray-scale inversions. See Reference 2.
<b>CS, CSS...</b>	<b>COLOR SCALES:</b>
CSSR##, G, B	Color scales snaking from fully saturated red (or green or blue, etc.) to black displaying ## evenly spaced colors.
CSGRAD01	Gradients from white to black through the saturated primary and secondary colors (also two flesh tones).
CSD01	Discrete color scales from white to black through the saturated primary and secondary colors.
<b>F...</b>	<b>FULL-SCREEN color:</b> 1. W=white, K=black, R=red, G=green, B=blue, C=cyan, M=magenta, Y=yellow, 2. S=gray scale and denotes level and intended shade. Because patterns FS... may have their level written in the lower left hand corner, FS0 may be slightly different from FK and FS7 may be slightly different from FW, and so forth. This writing is included because it is not often immediately obvious exactly what gray level is being displayed when using a full-screen display mode. 3. C# (e.g., #=5, 9, 25) indicates that # alignment circles are included and placed symmetrically centered in rectangles as if there were a checkerboard present (e.g., if #=9, then a 3×3 checkerboard is imagined; if #=25, then a 5×5 is imagined). L10 means that 10 % (of diagonal) locations are used in the periphery (not at imaginary checkerboard center locations). Any other circle arrangements (such as a weighting near center) will be given unique names.
FW, FK, FG, FY	Full-screen white, black, green, yellow.
F###-###-###	Full-screen RGB color ###-###-###.
F123-207-035	Full-screen RGB color with R=123/255, G=207/255, B=35/255.
FG3	Full-screen green at level (or intended color) of 3 out of 8 (73/255).
FM-13	Full-screen magenta at level (or intended color) of 13 out of 16 (204/255).
FWC9	Full-screen white with nine alignment circles centered in an imaginary 3×3 checkerboard.
FWC9L10	Full-screen white with nine alignment circles placed at center and the remaining eight at the 10 % (H & V) periphery locations.
FS5	Full-screen gray scale (level or intended shade) for level 5 of 8 shades (182/255).
FS50	Full-screen gray scale (level or intended shade) of 50 % (127/255) = FS127 = F127-127-127.
FS067	Full-screen gray scale (level or intended shade) for level 67/255.
<b>G...</b>	<b>GEOMETRIC patterns:</b> Often these will be line patterns. Adding "M" to the end of the name denotes markers are included to identify many of the measurement points including the center. Often, when the pattern is complicated, the center is always identified. Adding "H" denotes the use of heavier lines. For the pixel generated equivalent of these, see P#L <sub>n</sub> × <sub>m</sub> .

G#X#WK	Rectangular #×# grid in both the horizontal and vertical directions from edge to edge with white (or other color) lines on black (or other color).
G11X11WKM	11×11 grid of white lines on black with markers included.
GV##WKH	## vertical heavy white lines on black from edge to edge (left to right).
GH##WK	## horizontal white lines on black from edge to edge (top to bottom).
H##	<b>HALATION</b> pattern, black centered rectangle in white background. ## refers to linear size of rectangle in percent of diagonal. H20 is a 20 % black rectangle in white, a shorthand equivalent to pattern X20KW.
H05	Halation pattern of a centered black rectangular box 0.05H×0.05V on a white background.
INTRO	<b>INTRODUCTION</b> image and title page with specifications for creation of gray scale.
I...	<b>IMAGE</b> , bit-mapped, of various subjects.
IHF01	Image of human face #01.
INS01	Image of natural scenes #01.
IHF01	Image of human face and color bars #01.
L##	<b>LOADING</b> pattern, white centered rectangle in black background. ## refers to linear size of rectangle in percent of diagonal. L20 is a 20 % white rectangle in black, a shorthand equivalent to pattern X20WK.
L60	Loading pattern of a centered white rectangular box 0.60H×0.60V on a black background.
P...,	<p><b>PIXEL</b> patterns: It is not always possible to assure exactly even spacing and centering of lines and dots because of the discreteness of the pixel array. Sometimes these pixelated patterns can be somewhat adequately simulated in presentation software that scales an image rather than creating a perfect bit-mapped image; in such a case the suffix "sim" will be added to the pattern name to distinguish it from a true bit-mapped pixel image of the pattern. Such scaling presentation software that does not create the pixel-based image precisely cannot generally be used to display grilles or pixel-level checkerboards correctly. The simulated grid and dot patterns, however, may be adequate for geometric measurements of distortions of the intended screen geometry.</p> <p><b>PG</b> = <b>pixel grille patterns</b> in horizontal H or vertical V directions. <math>n \times m</math> specifies an <math>n \times m</math> pixel grille with <math>n</math> pixels in one color and <math>m</math> pixels in another color. The color is specified after the <math>n \times m</math> descriptor. No color designation implies white and black pixels used starting with white in the left or top position. More than two lines can be specified.</p> <p><b>Pn×n</b> without the "G" implies a pixel checkerboard of <math>n \times n</math> pixels. If no color specifications are made, a white-black checkerboard is assumed with white in the upper left corner. Otherwise the first color specified after the notation is in the upper left corner.</p> <p><b>PLn×m, P2Ln×m, P#Ln×m ...</b> = <b>grids</b> of one, two, and # pixels wide lines in an <math>n \times m</math> pattern from edge to edge and top to bottom. Usually this will be single or double pixel lines. White lines on black is assumed unless a color designation is supplied after the <math>n \times m</math> specification to denote the line color on the background color.</p> <p><b>PD, P2D, ...</b> = <b>dots</b> of one, two, ... pixels in horizontal and vertical size (i.e., square clusters) placed in a <math>n \times m</math> grid pattern. White dots on black are assumed unless a color designation is supplied after the <math>n \times m</math> specification to denote the dot color on the background color. Usually these dots will have the size of one or two pixels.</p>
PGV2X3GR	Vertical 2×3 pixel grille, 2 green pixels by 3 red pixels.
PGH3X3	Horizontal 3×3 pixel grille, 3 white pixels (at top) by 3 black pixels.
PGV1X1	Vertical 1×1 pixel grille of white (at left) and black pixels.
PGH3X2X1GKW	Pixel horizontal grille, 3 green pixels by 2 black pixels by 1 white pixel.
PL11X11	Single pixel lines in an 11×11 grid pattern, white lines on black assumed.
PL11X11KW	Single pixel lines in an 11×11 grid pattern, black lines on white.
PD11X11GK	Single pixel green dots on black in an 11×11 matrix pattern.
P2L11X11G	Double pixel green lines on black (assumed) in an 11×11 grid pattern.

PIX1, K	Single-pixel checkerboard with white (black) pixel in upper left corner. PIX1 and PIX1W are the same.
P3X3YM	3×3 pixel checkerboard composed of yellow and magenta pixels starting with yellow in the upper left corner.
RT...	<b>REFLECTION TARGETS:</b> Targets #01 and #02 are based upon symmetrized versions of the reflection targets specified in the ISO 9241 series where 80 % loading of white or black is suggested. See Reference 3.
RT01AP	Reflection target #01-A in positive format (background of white with black rectangles).
RT02BN	Reflection target #02-B in negative (background of black with white rectangles).
S, SE, SCX, SS...	<b>GRAY-SCALE SHADE</b> patterns: S means gray-scale pattern, SE means gray-scale ends, SCX is concentric boxes, SS is snaking. We use "S" to denote the level or the intended shade in the gray scale to avoid confusion with green.
SET01S###	Gray-scale ends displayed in pattern #01 on a background of a gray-level ###/255. Pattern #01 has two small horizontal gray scales at the top and bottom with four adjoining boxes of gray levels in white and four in black placed near the center having levels at 100 %, 95 %, 90 %, 85 % and 0 %, 5 %, 10 %, 15 %. See Reference 4.
SET01W	Gray-scale ends pattern #01 on white.
SET01K	Gray-scale ends pattern #01 on black.
SECX01K	Gray-scale ends in centered concentric boxes, pattern #01, having the six levels at each end of the gray scale on a black background.
SECX01W	Gray-scale ends in centered concentric boxes, pattern #01, having the six levels at each end of the gray scale on a white background.
SVP32S01	Gray-scale ends pattern with 32 gray-levels in "V" pattern. Gray level ends are in concentric boxes covering six levels at both ends of the 32-level gray scale.
SXP32S01	Gray-scale ends pattern with 32 gray-levels in "X" pattern. Gray level ends are in concentric boxes covering six levels at both ends of the 32-level gray scale.
SCXK64	Concentric boxes of 64 gray shades with black center to white perimeter.
SCXW64	Concentric boxes of 64 gray shades with white center to black perimeter.
SCXKW64	Concentric boxes of 64 gray shades with black center left side and white center right side.
SSW64	Snaking 64 gray shades from white upper left to black lower right.
SSW256	Snaking 256 gray shades from white upper left to black lower right.
TXT..., P, N	<b>TEXT TARGETS:</b> Various text targets are supplied in positive (black text on white) or negative (white text on black) formats.
TXT01P	Text pattern #01 in positive format.
X##??	<b>BOX,</b> centered, ## % of diagonal in size with color of box (color = ?) specified and background (color = ?). Use underline separator for clarity if needed (? _ ?).
X20WB	20 % white box centered on blue screen.
X05B213R117	5 % blue 213/255 box centered on red 117/255 screen.
X05KW	5 % black box centered on white screen.
<b>SPECIAL BIT-MAPPED TARGETS:</b>	
BUSY01	Pixel-specific composite pattern of different grilles, checkerboards, and blocks in gray.
BUSY01R	Same as BUSY01 but in red only.
BUSY01G	Same as BUSY01 but in green only.
BUSY01B	Same as BUSY01 but in blue only.
CAT01	Centering and alignment target with red arrows locating the direction toward the center and a 60-pixel diameter center target with red border (outside the 60-pixel target).
HICON01	30-pixel square white box at the center of a black screen for making highlight-contrast measurements.

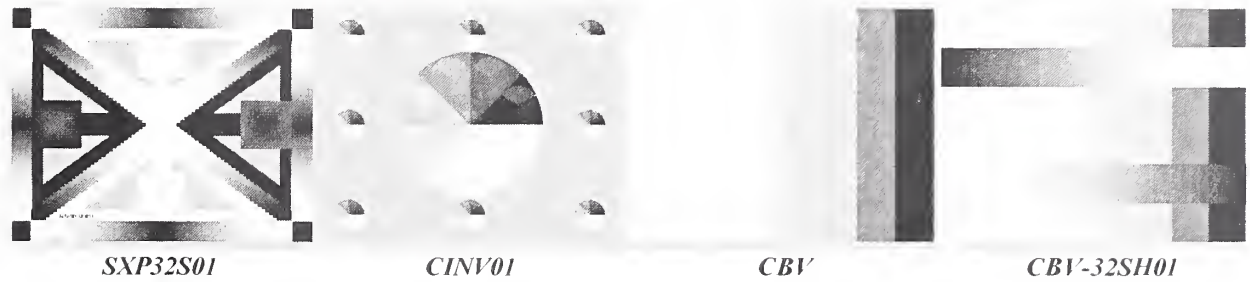
## 4. SETUP FILE SEQUENCE

Here are the setup targets found in NISTSU.\*.

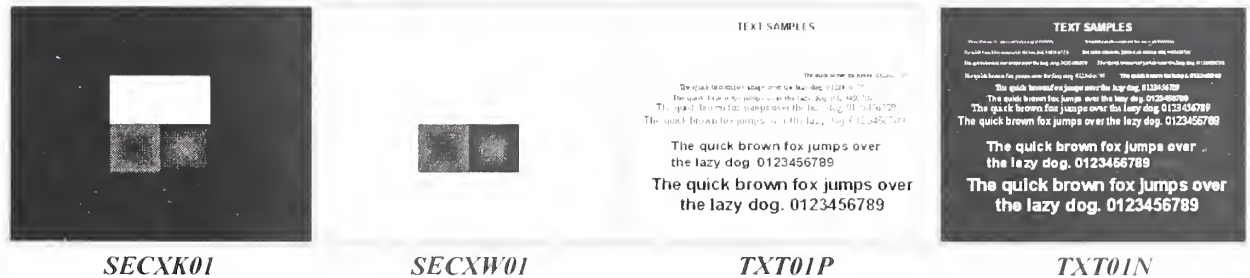
A. Introduction target, alignment target, and images for adjustment of display controls.



B. 32-level gray scale, color inversion target, and color bars.



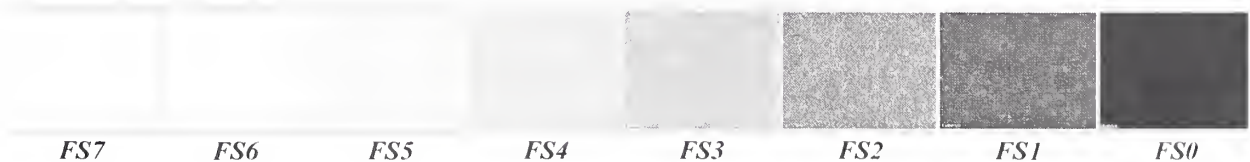
C. Gray-scale ends and text samples.



D. Full-screen white, black, dark grays, and colors.



E. Full-screen gray 8-level gray scale.



F. Targets especially useful for projection displays.



G. Targets for manifesting halation (contamination of darks with surrounding light areas).



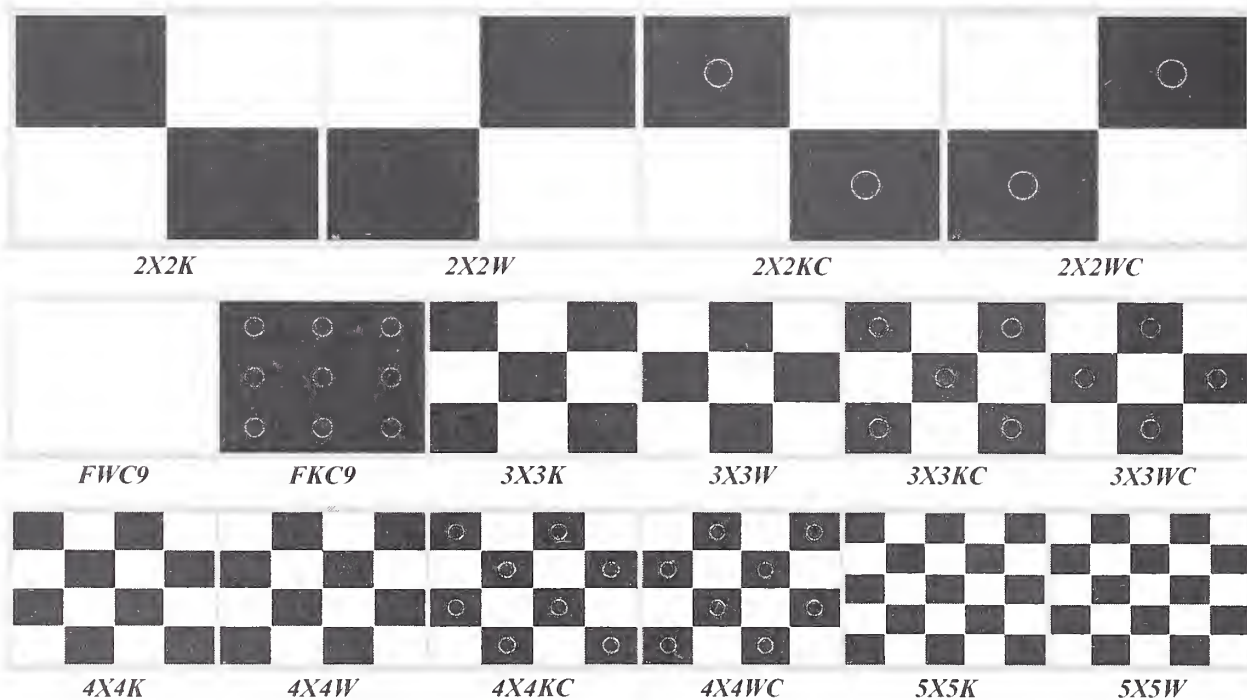
H. Targets for manifesting loading (change in luminance with size of white area).

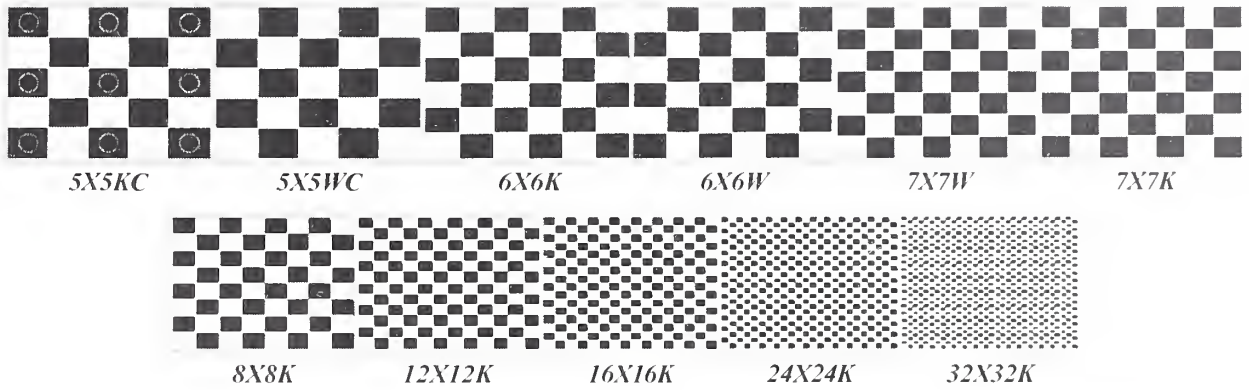


I. Reflection targets.

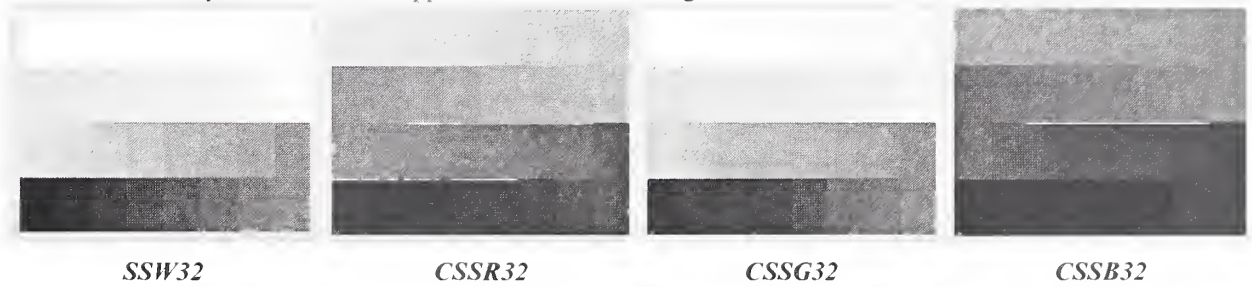


J. Checkerboards (with and without circles), black and white with circles in checkerboard center positions, and with two extra targets similar to above.

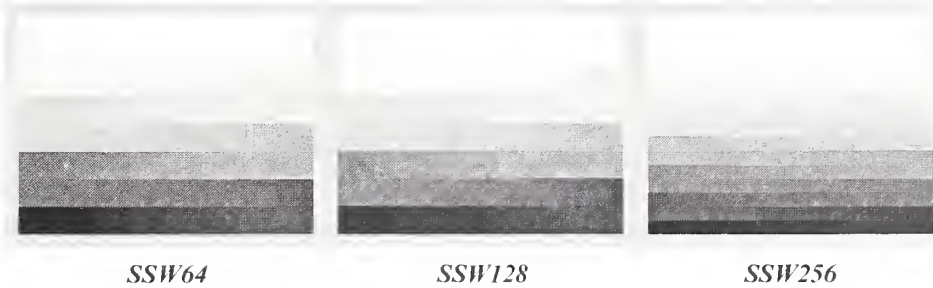




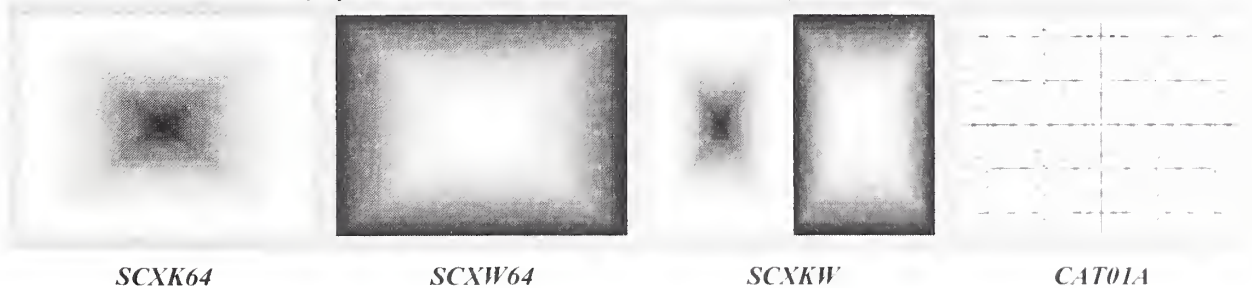
K. Snaking gray shades with 32 gray levels starting with white in the upper left corner and snaking color scales with 32 levels from fully saturated in the upper left corner, all ending with black in the lower left corner.



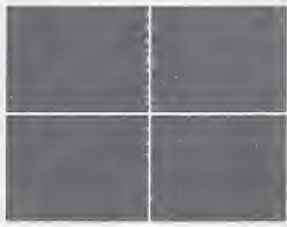
L. Snaking gray shades with 64, 128, and the full 256 gray levels, all starting with white in the upper left corner and ending with black in the lower left corner.



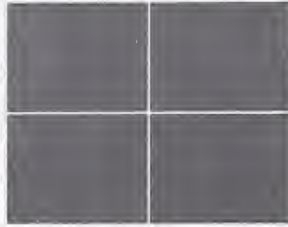
M. Concentric boxes of 64 gray levels and a centering and alignment target.



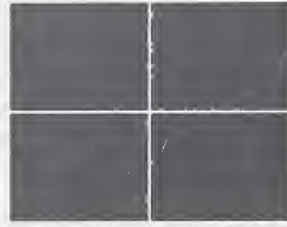
N. Grid and line patterns with both thin and heavy line patterns included (both are not printed here).



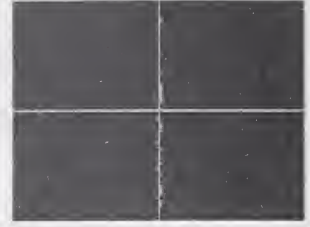
*G3X3WK, ...H*



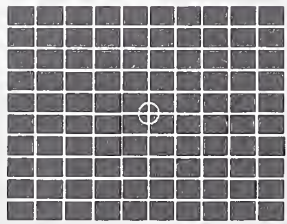
*G3X3RK, ...H*



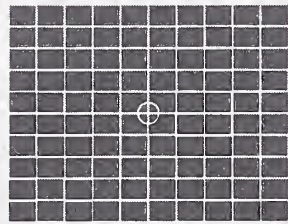
*G3X3GK, ...H*



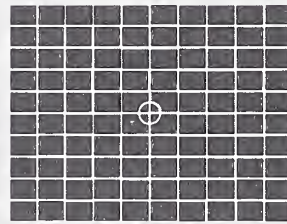
*G3X3BK, ...H*



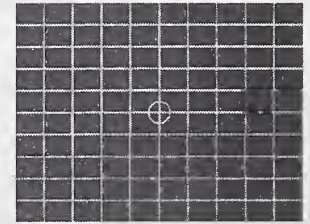
*G11X11WK, ...H*



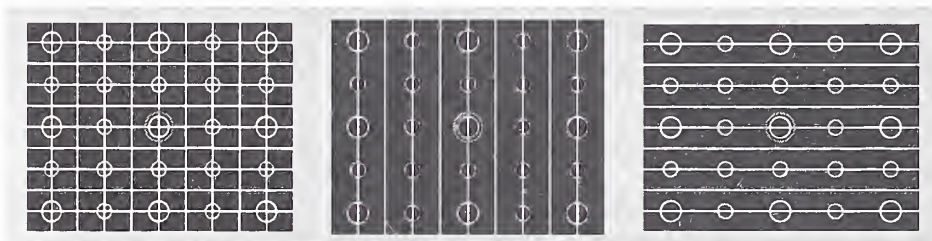
*G11X11RK, ...H*



*G11X11GK, ...H*



*G11X11BK, ...H*

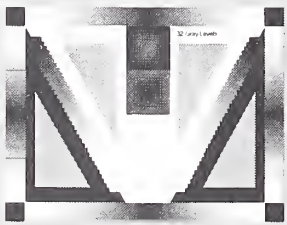


*G11X11WKM, ...H*

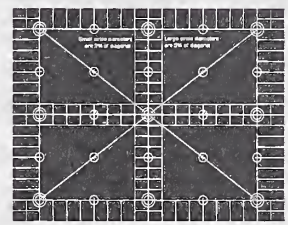
*GV11WKM, ...H*

*GH11WKM, ...H*

O. Miscellaneous patterns.



*SVP32S01*



*AT01N*



*CSD01*

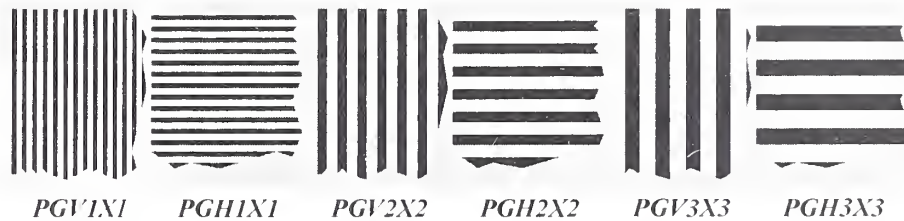


*CSGRAD01*

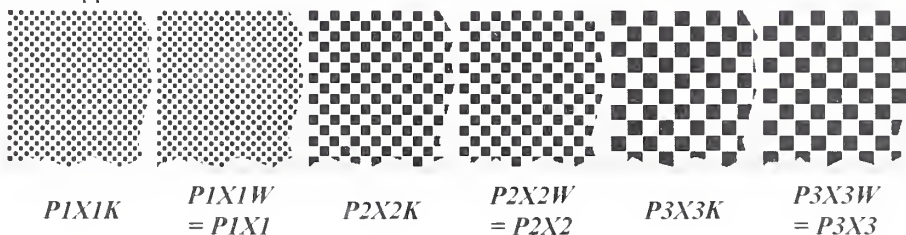


## 5. BITMAPPED PATTERNS

A. Grilles (magnified for demonstration purposes). Unless specified otherwise, these will always start with white at left or top.



B. Pixel-based checkerboards (magnified for demonstration purposes). Unless specified otherwise, these will always start with white at the upper-left corner.



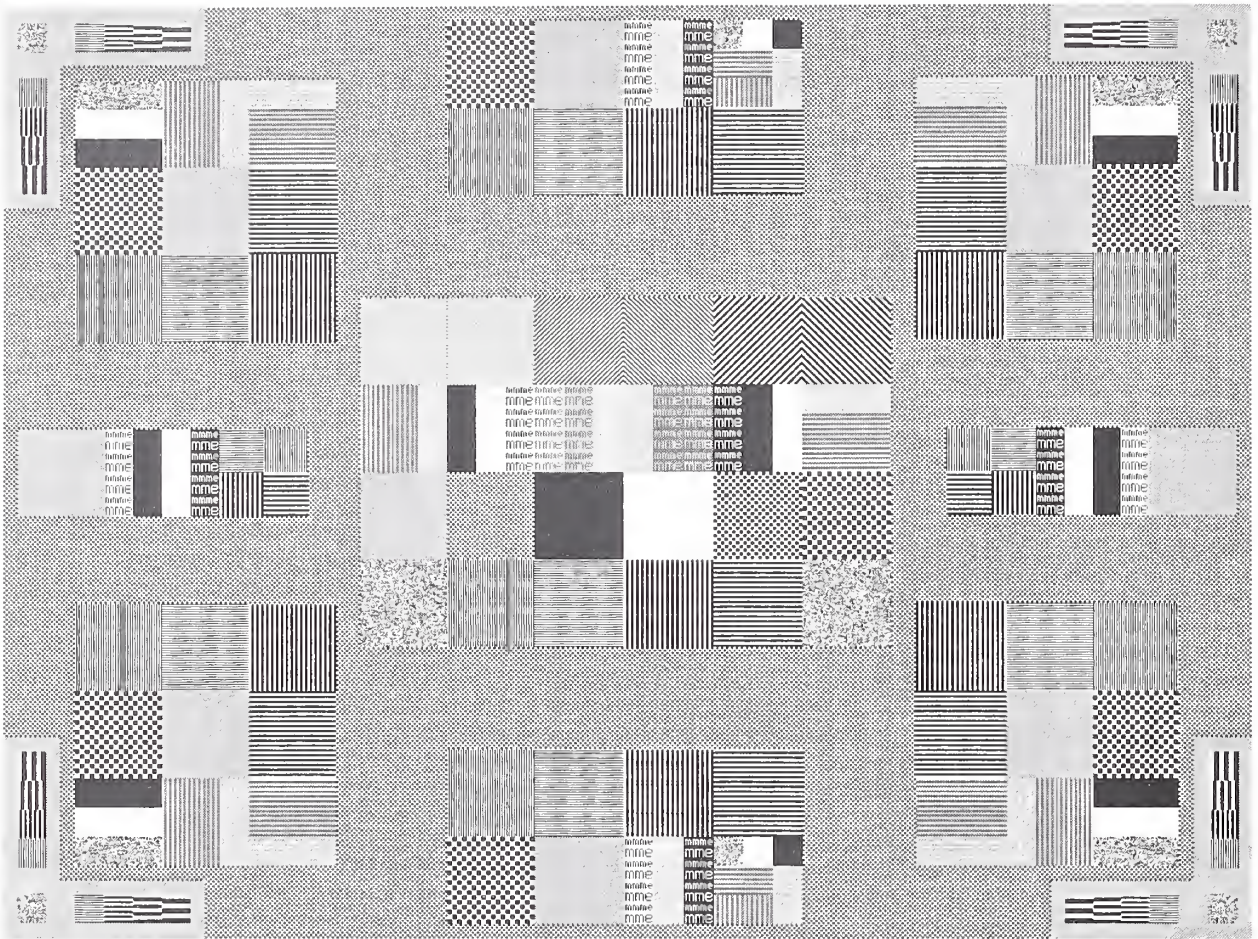
C. Busy pattern (BUSY01). A busy pattern is designed to tax the display's capabilities in several ways. A variety of targets are used within—grilles, single and double-pixel checkerboards, diagonals, noise blocks, black and white blocks, and text samples. The largest blocks are 72 px square, and the smallest blocks are 36 px square. There are five gray levels used out of 256: 0, 63, 127, 191, 255 for 2 × 2 grilles and text samples. Noise blocks are single pixels randomly generated covering the range of 0 to 255 gray levels. (Image is on next page.)

D. Centering and alignment target (CAT01) having a 60 px diameter round center black target. This pattern is useful when using detectors having a narrow field of view in order to quickly find the center of the screen. (Image is on next page.)

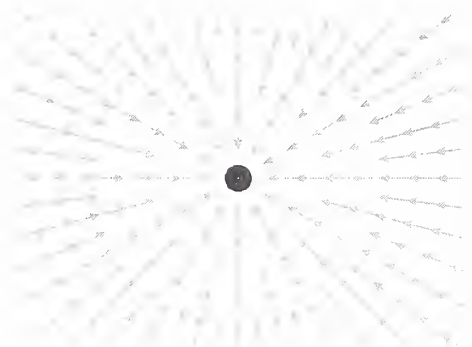
E. Highlight contrast pattern with a 30 px square center box of white on a black background. (Image is on next page.)

### REFERENCES

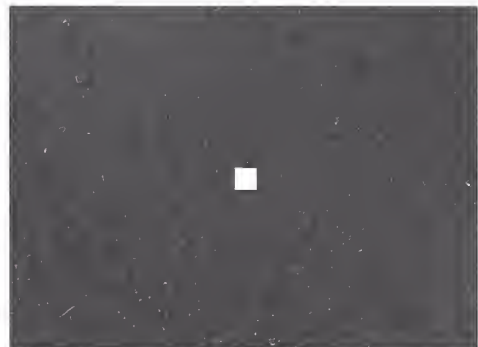
1. Patterns similar to this collection may be found associated with the Video Electronics Standards Association, Flat Panel Display Measurements Standard (referred to as FPDM), Ver. 2, 2001; obtainable via [www.vesa.org](http://www.vesa.org).
2. The color inversion target CINV01 has been referred to as the Brill-Kelley chart and was first published by Michael H. Brill, "LCD Color Reversal at a Glance," *Information Display*, Vol. 16, No. 6, pp. 36, 37, June 2000, where a preliminary version of the target was inadvertently published. The corrected pattern (shown in this document) is noted in the erratum in Vol. 16, No. 10, p. 46, October 2000 of *Information Display*.
3. International Organization for Standards (ISO), 9241-7, Ergonomic requirements for office work with visual display terminals (VDTs), Part 7, Display requirements with reflections, 1997-02-15.
4. Pattern SET01W is a variation of a pattern used in ANSI/PIMA IT7.227-1998 Electronic Projection-Variable Resolution Projectors (PIMA is Photographic and Imaging Manufacturers Association, Inc.) and ANSI/NAPM IT7.228-1997 Electronic Projection-Fixed Resolution Projectors (NAPM is National Association of Photographic Manufacturers, now changed to PIMA). Patterns SET01S50 and SET01K are variations of patterns proposed to PIMA by the National Information Display Laboratory of the Sarnoff Corporation in Princeton, N.J., used by permission. We have added full 32-level gray scales at the top and bottom.



*BUSY01*



*CAT01*



*HICON01*



