Cromemco®

TSDI

Instruction Manual

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This manual was produced using a Cromemco System Three computer running under the Cromemco Cromix® Operating System. The text was edited with the Cromemco Cromix Screen Editor. The edited text was proofread by the Cromemco SpellMaster™ Program and formatted by the Cromemco Word Processing System Formatter II. Camera-ready copy was printed on a Cromemco 3355B printer.

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Chapter 1

SYSTEM CONFIGURATION AND OVERVIEW

The TSDI software is a subroutine module that, when linked with Cromemco's Standard High Resolution Software and a user program, enables a Cromemco microcomputer system to host and drive a multiple-SDI graphics interface. Such a configuration is capable of simultaneously displaying 4096 colors in the medium resolution mode (378h x 241v) or 8 colors in the high resolution mode (756h x 482v).

1.1 HARDWARE

The hardware required for the TSDI system is the main system boards that are included in a Cromemco computer such as the System One or Three:

ZPU
64FDC
64KZ-II

along with three single page SDI modules, each module consisting of an SDI graphics interface and a 48KTP two port RAM. The total graphics requirement is:

3 SDI Graphics interface board sets (6 boards total)
3 48KTP RAMS

Also needed, and supplied with the TSDI graphics package, is the cabling required to sync-lock the 3 SDIs together, and to feed the 3 SDIs into a single RGB color monitor.

The switch settings of the 9 graphics boards and the cabling details are covered in Chapter 5. The three 48KTP RAMs work together to form a single **Frame Buffer** (picture memory). Each 48KTP holds color data for one of the three primary colors red, green or blue. The

48KTP that contains red data, for example, resides in bank 5, and supplies data to its dedicated SDI which, in turn, feeds the red gun of the RGB color monitor. The green and blue 48KTP'S reside in banks 6 and 7. Each **SDI Module** (the SDI and its 48KTP) has its 48KTP addressed at a different bank (bank 5, 6, or 7) and its SDI addressed at a different port (port D4h, D8h, or DCh).

1.2 SOFTWARE

The TSDI graphics software is a set of library subroutines which look very much like the graphics calls in the regular SDI High Resolution Graphics Software package. The differences are:

1. The TSDI calls take a color parameter which can be an integer as large as 4095.

2. The TSDI package contains a few calls not included in the regular SDI High Resolution Graphics Software package.

3. The TSDI **.com** utilities, such as disk loading and saving routines, are designed for use with this special multiple SDI system configuration.

4. The TSDI library does not include those subroutines found in the regular SDI Graphics Software package that involve multi-page operations or windowing.

For the most part, a program written using TSDI software will look very much like a standard graphics program. There will be a few extra calls at the beginning of the program and the graphics calls throughout the main program will have slightly different names: XLINE8 (instead of XLINE), XREAD8 (instead of XREAD), and so on.

Chapter 2

SUBROUTINE LIBRARY

Each of the primary colors in a TSDI system is controlled by a separate 48KTP/SDI module. This means that the color of a pixel on the screen is influenced by the values stored in the three different 48KTP boards. To draw a dot, therefore, it is necessary to access each of the 48KTP boards. You do not have to be concerned with how the separate graphics modules are loaded to cause the pixel to take on the desired color. The TSDI software does the work for you. You only give the call

```
XDOT8(100,100,2087)
```

and the pixel at coordinates 100,100 takes on the color value 2087.

2.1 INITIALIZATION CALLS

The calls in this category are

```
CALL SDIS(n)
CALL COLR4K
```

SDIS(n) This call is required to tell the system how many SDIs are being utilized. Normally, the parameter **n** will be 3. But it is possible to use only 2 or 1 SDI modules. If you include the statement CALL SDIS(1), you are declaring a single SDI system and then only have access to those calls in the standard SDI High Resolution Graphics Software package.

COLR4K This call is necessary to set the color maps of the 3 SDIs to a standard setting. The TSDI configuration does not support true color mapping and most applications will then

dictate this standard color map setting which gives 4095 colors in medium resolution mode and 8 colors in high resolution mode.

To be able to predict which color codes will produce which color values on the monitor screen, please refer to Section 2.3.

2.2 GRAPHICS CALLS

In most cases each graphics call in the TSDI library, has a direct and obvious counterpart in the regular SDI Graphics Library. For example the call XLINE8(x1,y1,x2,y2,COL) corresponds to the call XLINE(x1,y1,x2,y2,COL) of the regular graphics package. The only difference is that the color parameter, COL, can vary from 0 to 4095 in TSDI rather than its usual variation of 0-15 in the standard SDI Graphics package. The calls below are supported in TSDI and to the right of each call is its standard SDI graphics call. Please refer to the SDI HIGH RESOLUTION GRAPHICS SOFTWARE manual for a detailed explanation of each call. The only difference in the TSDI call is the expanded range of the color parameter, COL.

TSDI ROUTINE	STANDARD SDI ROUTINE
XDOT8(x,y,COL)	XDOT(x,y,COL)
HXDOT8(x,y,COL)	HXDOT(x,y,COL)
XLINE8(x1,y1,x2,y2,COL)	XLINE(x1,y1,x2,y2,COL)
HXLIN8(x1,y1,x2,y2,COL)	HXLINE(x1,y1,x2,y2,COL)
XAREA8(x1,y1,x2,y2,COL)	XAREA(x1,y1,x2,y2,COL)
HXARE8(x1,y1,x2,y2,COL)	HXAREA(x1,y1,x2,y2,COL)
XREAD8(x,y,COL)	XREAD(x,y,COL)
HXREA8(x,y,COL)	HXREAD(x,y,COL)
XCIRC8(x,y,rad,COL)	XCIRC(x,y,rad,COL)
HXCIR8(x,y,rad,COL)	HXCIRC(x,y,rad,COL)
XFCIR8(x,y,rad,COL)	XFCIR(x,y,rad,COL)
HXFCI8(x,y,rad,COL)	HXFCIR(x,y,rad,COL)
XPOLY8(COL,array)	XPOLY(COL,array)
HXPOL8(COL,array)	HXPOLY(COL,array)
XFPOL8(COL,array)	XFPOLY(COL,array)
XTEXT8(x,y,COL,'Text ')	XTEXT(x,y,COL,'Text ')
HXTEX8(x,y,COL,'Text ')	HXTEXT(x,y,COL,'Text ')

The following calls are identical in name and function in both the TSDI system and the standard single SDI graphics package:

INIT
RES(n)
CLIP
UNCLIP
SCALE(l,r,b,t)
UNSCAL
SCRON
SCROFF
WAITVS
WAITVG
WAITHG
WAITOD
PAGE

2.3 COLOR CODES

2.3.1 Low Resolution

The integer codes representing the color values in the graphics calls, such as the 'c' in the CALL XLINE8(x1,y1,2,y2,c), can be an integer from 0 to 4095. The color that results is understood by knowing the hexadecimal value of the color code. For example, if the color parameter has the value 2d9 HEX then the color which results will have red intensity=9, green intensity=d, and blue intensity=2. Thus each of the 4096 colors is defined by its primary values which may vary between 0 and 15. Black would be 000 HEX and white FFF HEX, for example.

Some examples of color codes are listed below, along with their description.

Code in HEX (BGR)	Code in Decimal	Color
000	0	black
00F	15	red
500	1280	dark blue
0AA	170	yellow
FFF	4095	white

If you are programming in FORTRAN, you may give the parameter using the hexadecimal notation:

```
Call XLINE8(4,21,100,80,Z'0AA')
```

or the decimal notation

```
CALL XLINE8(4,21,100,80,170)
```

In a C program the call using the hex color code would be:

```
XLINE(4,21,100,100,0X0AA)
```

The result will be the same, a yellow line. Hex notation is more intuitive from the standpoint of being able to 'read' the expected color from the program, but some programmers prefer to stick to decimal notation. A handy way to compose the color within a decimal framework is shown now. Suppose the color we wish to use is made up of the components

```
red=15 (medium red)
green=8 (medium green)
blue=4 (low blue)
```

This could be accomplished by the following program segment:

```
nred=15
ngreen=8 * 16
nblue=4 * 256

ncode=nred+ngreen+nblue

call xdot8(x,y,ncode)
```

2.3.2 High Resolution

In high resolution there are 8 possible color values:

BLACK
RED
GREEN
BLUE
YELLOW
CYAN
MAGENTA
WHITE

Each value has a color code associated with it as follows (using either the decimal or HEX code):

Color	Decimal	Hex
black	0	000
red	15	00f
green	240	0f0
blue	3840	f00
cyan	4080	ff0
magenta	3855	f0f
yellow	255	0ff
white	4095	fff

These codes apply to the read call HXREA8 as well as writing calls HXDOT8, HXLIN8, etc.

Thus, to draw a high resolution blue line give the call

```
CALL HXLIN8(10,10,300,280,3840)
```

When reading a pixel with the call

```
CALL HXREA8(100,100,val)
```

if the returned value is VAL=15, the pixel is red; if the return value is VAL=4080, the pixel is cyan, etc.

Chapter 3

UTILITY PROGRAMS (SAVE3, LOAD3, PXSAVE5, PXSAVE6, PXSAVE7, PXLOAD5 PXLOAD6, PXLOAD7 AND CLEAR3)

Saving and loading files in the TSDI system is similar to doing this in a single SDI system. The easiest way to save a picture is with the .cmd file SAVE3. To invoke this program use the batch command @ as follows

```
@ SAVE3 filename
```

This invocation will cause 3 .PXS files to be generated, with the names **filename5, filename6** and **filename7.** In other words SAVE3 tags on a one digit suffix to the name specified in the command line. This corresponds to the bank that the file belongs in when loaded. The user can be ignorant of this naming convention however, because to load the file back into memory, merely call the **.cmd** file LOAD3 as follows:

```
@ LOAD3 filename
```

and the 3 files generated by SAVE3 will be properly loaded.

If you wish to save and load banks separately yourself, you may use the 3 programs PXLOAD5, PXLOAD6 and PXLOAD7 for loading, and the programs PXSAVE5, PXSAVE6 and PXSAVE7 for saving. Thus to store the red component of the loaded image into a file and name it **imagered.pxs** give the command

```
PXSAVE5 imagered
```

Before using PXLOAD5, PXLOAD6 or PXLOAD7 it is advisable to clear the image planes with the program CLEAR3 as follows:

```
CLEAR3
PXLOAD5 IMAGERED
PXLOAD6 IMAGEGRN
PXLOAD7 IMAGEBLU
```

Chapter 4

LINKING PROGRAMS

The procedure for linking your programs with TSDI is nearly the same as for single SDI programs. The TSDI module is included between your user program and the graphics module GRAF2 in the link list. For example, if your program is called PCON, a FORTRAN generated **.rel** file, the link command line should look like:

```
LINK FGRAF1,PCON,TSDI/s,GRAF2/s,PCON/n/e
```

for programs written in FORTRAN, RATFOR, or Z80 Assembler and like:

```
LINK CGRAF1, ...
```

for programs written in C language.

Note that the **.rel** files GRAF1 and GRAF2 are part of the SDI Graphics Software package. TSDI should be linked with standard SDI Graphics Software version 1.08 or greater.

Chapter 5

SWITCH SETTINGS AND CABLING

Two steps should be followed for the TSDI System to operate properly. First, the switches on the graphics board should be set properly. Second, the cables, which are supplied with this package, should be connected properly.

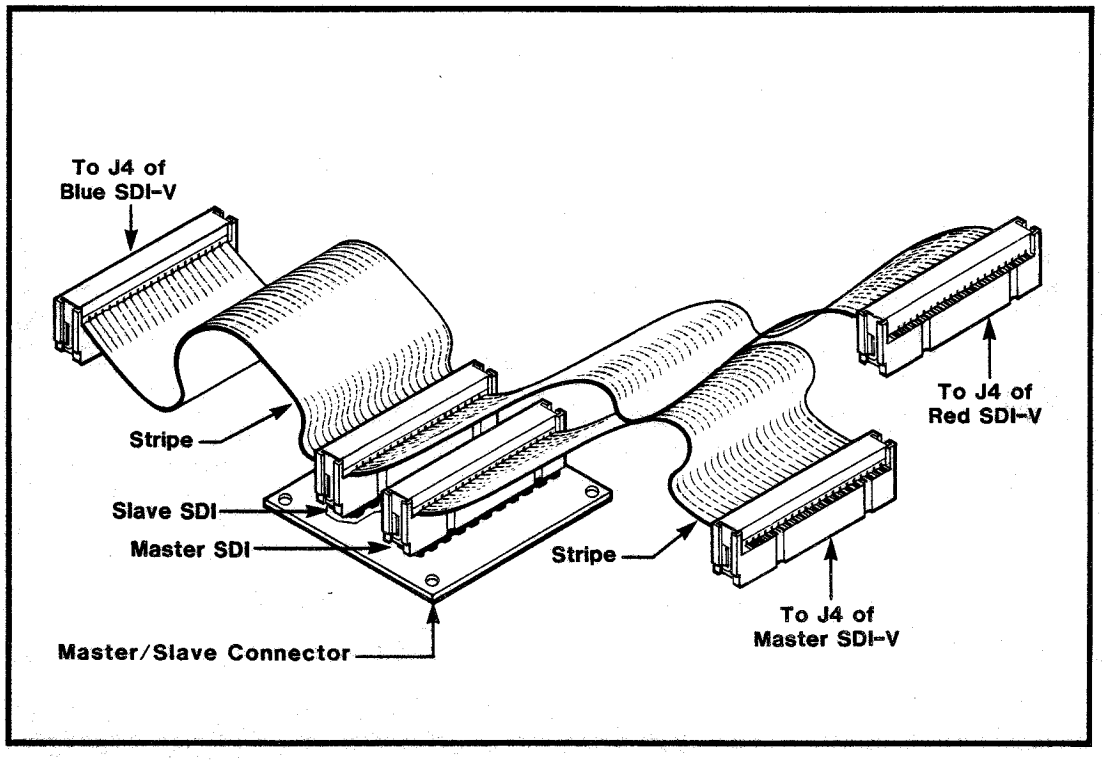
5.1 SWITCH SETTINGS

The diagram in Appendix A gives all the switch settings for each of the 9 graphics boards in the system. System boards should be set as in any SDI system; see the SDI hardware manual for switch settings of system cards.

5.2 CABLING

To sync lock the 3 SDIs, the **green** SDI (port D8h) is treated as the master and the **red** and **blue** SDI (ports D4h and DCh) are considered slaves. This involves connecting edge connector J4 on the video board (SDI-V) of the master SDI to connector J4 on each of the 2 slave SDIs. A master/slave connector is used for this purpose, as shown in the following figure. It is important that the striped side of the cables be connected to pin 1 of connector J4 on the boards.

The master/slave connector must be Revision A1. For Revision A modifications see the Service Note titled TSDI Master/Slave Connector Modifications (part number 023-9105).

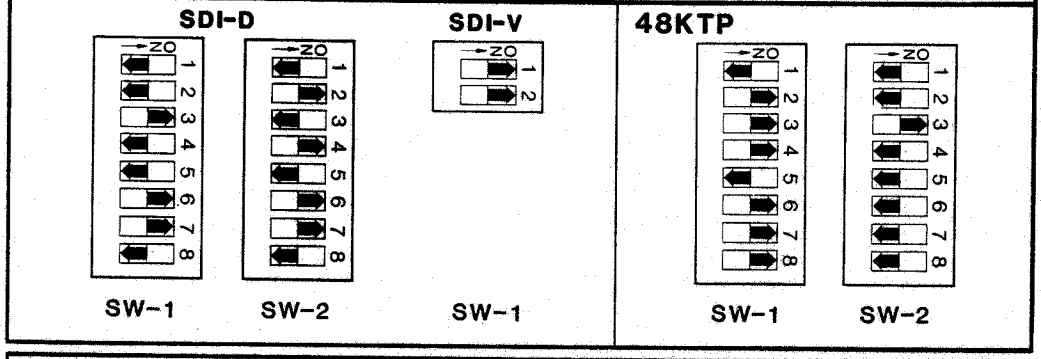

To J4 of
Blue SDI-V
Stripe
Slave SDI
Master SDI
Master/Slave Connector
Stripe
To J4 of
Red SDI-V
To J4 of
Master SDI-V

Appendix A

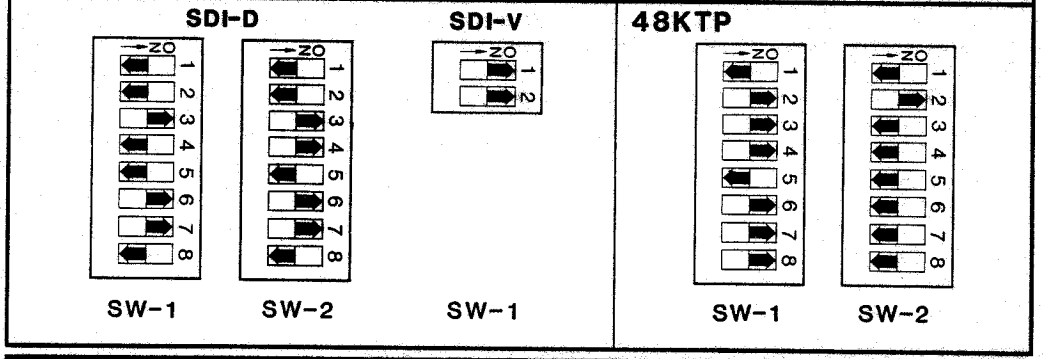
SWITCH SETTINGS

Switch Settings For TSDI Software

Module 1 Red D4



Module 2 Green D8



Module 3 Blue DC