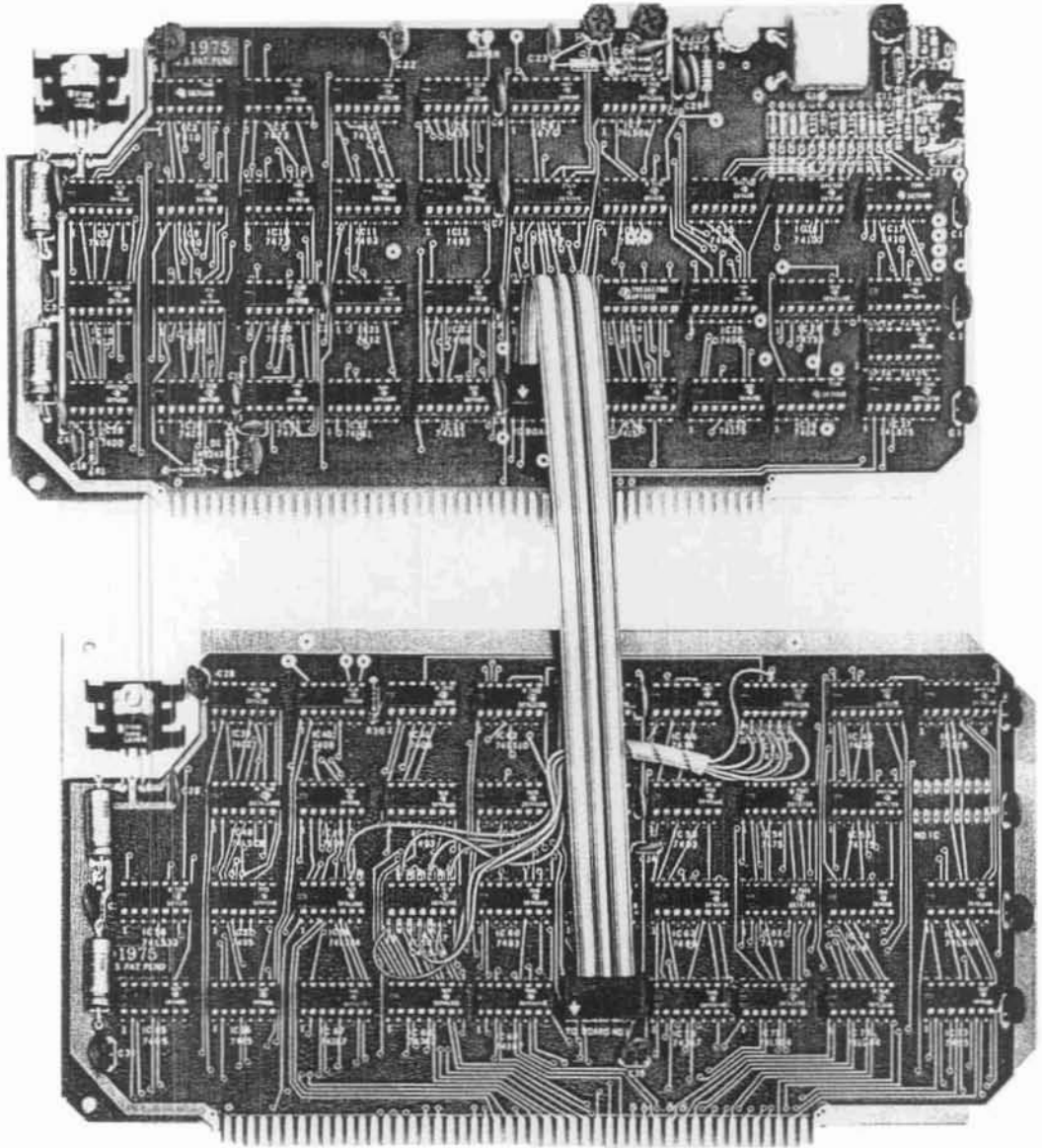# Cromemco
DAZZLER®

U.S. Patent No. 4121283

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C Cromemco
i n c o r p o r a t e d
Specialists in computers and peripherals
280 BERNARDO AVE., MOUNTAIN VIEW, CA

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Section 1

Technical Information

Technical Information

Introduction

The TV DAZZLER® color graphics module provides a general purpose interface between your computer and your color TV. The DAZZLER® can be used to generate games, animated displays, educational learning drills or even light shows, all in full color. The DAZZLER® is manufactured by Cromemco Inc., 280 Bernardo Ave., Mountain View, CA 94040.

The DAZZLER® is built on two boards designed to plug directly into any computer using the S-100 microcomputer bus. The video output of the DAZZLER® can be connected directly to the video input of a color TV set. By using an optional RF modulator, the DAZZLER® can be conveniently connected to the antenna terminals of the TV set, rather than the input of the video amplifier.

With the DAZZLER® interface, TV games that are either unavailable, or available only in black and white, can now be programmed in full color. A football can now sail over a bright green playing field under the software control of your computer. Rocket ships can spew red-yellow flames against a brilliantly blue sky. Or perhaps you wish to challenge your computer to a game of checkers or chess on a red and black playing board—again generated on your TV screen by the TV DAZZLER® interface.

If you use your computer for business or accounting purposes, the DAZZLER® interface can be used to display multi-colored graphs of the data stored in your computer. Your computer can be used to process and format the raw data while histograms, charts or graphs of the data are displayed on your color TV.

The DAZZLER® interface can also turn your color TV into a TV terminal. Alphanumeric characters entered from a teletype or ASCII keyboard can be displayed directly on the screen of your TV using our DAZZLEWRITER software for character generation. Messages can also be generated internally in your computer and displayed—in full color. Alphanumeric messages, titles or comments can similarly be displayed in conjunction with DAZZLER® games or DAZZLER® graphic displays.

A new interface board from Cromemco, our D+7A I/O, is particularly useful for inputting analog signals for use in conjunction with the DAZZLER®. Analog signals from joysticks, for example, can be input to the computer with the D+7A module for use in controlling a DAZZLER®-generated display.

Another use of the DAZZLER® interface is in computerized instruction either at home or in the classroom. Word recognition tests, "flash card" arithmetic drills, and memory training can all be carried out with the excitement of a full-color display. Games can be interspersed with learning exercises to maintain student interest and enthusiasm. (For more information on the use of the DAZZLER® see the December 1976 issue of BYTE magazine, "The Cybernetic Crayon," pp. 24-29, 138-141, and the September 1978 issue of PERSONAL COMPUTING, "DAZZLER® Graphics," pp. 58-72.)

Design

The DAZZLER® interface is a very advanced design using over 70 MOS and TTL integrated circuits on two printed boards. Yet the DAZZLER® kit is easy to build. A special varnish or "solder mask" is used to guard against shorts during board construction. And a legend mask is silk-screened directly on the board to show precisely where each component is placed.

Only the highest quality parts are used in the DAZZLER® interface. The printed circuit boards are double-sided glass-epoxy with plated-through holes and gold plated edge contacts. IC sockets are used for all dual-in-line ICs. And carbon film resistors are used for high-speed operation and temperature stability.

The two DAZZLER® boards may be plugged directly into two adjacent slots in your computer. A 16-conductor ribbon cable, with DIP plugs on each end, is used to interconnect the two boards. Alternatively Board 2 may be mounted "piggyback" on Board 1 so that only one slot is required. In this configuration, seven additional jumper wires must be used to interconnect Board 1 with Board 2.

Software

Cromemco provides software support for the DAZZLER® interface. Two basic software packages are provided; DAZZLER® GAMES and DAZZLER® GRAPHICS.

The DAZZLER® games package consists of a Cromemco DAZZLER® Games Instruction Manual and sixteen games (see box below) on either a 5" diskette (model FDG-S), or an 8" diskette (model FDG-L). Either package is available from Cromemco, Inc. for $95.

The DAZZLER® graphics package allows the user to display graphs, graphics and alphanumerics on a color TV set. It consists of a DAZZLER® Graphics Instruction Manual and the graphics pro-

gram on either a 5" diskette (model DGR-S), or an 8" diskette (model DGR-L). Either package is available from Cromemco, Inc. for $95.

Operation

The DAZZLER® interface uses high-speed direct memory access (DMA) to read the memory of the host computer and translates the information in the memory into a color TV signal. The key advantage of using DMA is that the DAZZLER® can display a picture while at the same time the computer is executing either a related or unrelated program. Only a 15% slow-down of the computer execution is realized during the DAZZLER® operation.

DAZZLER® Games

- CHASE!** — the cross chases the circle.
- DAZZLE DOODLE* — draw a picture using a joystick.
- DAZZLE-MATION — for creating animated displays.
- MAGENTA MARTINI — an amusing DAZZLE-MATION example.
- DOGFIGHT** — an aerial battle game.
- 4D TIC-TAC-TOE — a 4D extension of TIC-TAC-TOE.
- GOTCHA!** — two players vie to occupy territory.
- KALEIDOSCOPE — for captivating color displays.
- LIFE — an instructive game by John Conway.
- XLIFE — a particularly attractive LIFE display.
- SPACEWAR** — a cosmic fight to the death.
- TRACK* — maneuver through a difficult maze.
- DAZZLECHESS — play chess with a tireless opponent.
- AMBUSH* — take pot shots at an enemy convoy.
- SOLO** — plays a tune on the JS-1 console.
- TANK WAR** — tanks fight in a mine field.

* *Requires a single JS-1 joystick.*
** *Requires two JS-1 joysticks.*

A functional block diagram of the DAZZLER® interface is shown below. A 3.579545 MHz crystal oscillator is used to generate the color video subcarrier. The video output amplifier delivers a standard 1 V negative sync composite video signal into a 52 ohm load. A six-foot length of 52 ohm coax cable is supplied with every DAZZLER®.

While the video output signal is generated by Board 1, Board 2 is used to communicate with the computer. A high speed (one million bytes per second) DMA controller is the heart of this board. The controller issues a "Hold" command when it is ready to access the computer memory. When the computer finishes the current machine cycle it issues a "Hold Acknowledge" signal to begin DMA.

In addition to the high-speed DMA data link, two output ports and one input port are built into DAZZLER® Board 2 for the exchange of control signals between the computer and DAZZLER®. These are output ports ØEH and ØFH and input port ØEH.

The most significant bit of output port ØEH is used to enable or disable the DAZZLER®. A "1" at this bit location turns the DAZZLER® on. A "Ø" turns the DAZZLER® off. The DAZZLER® can

Functional Block Diagram

Dazzler Board No. 1   Dazzler Board No. 2
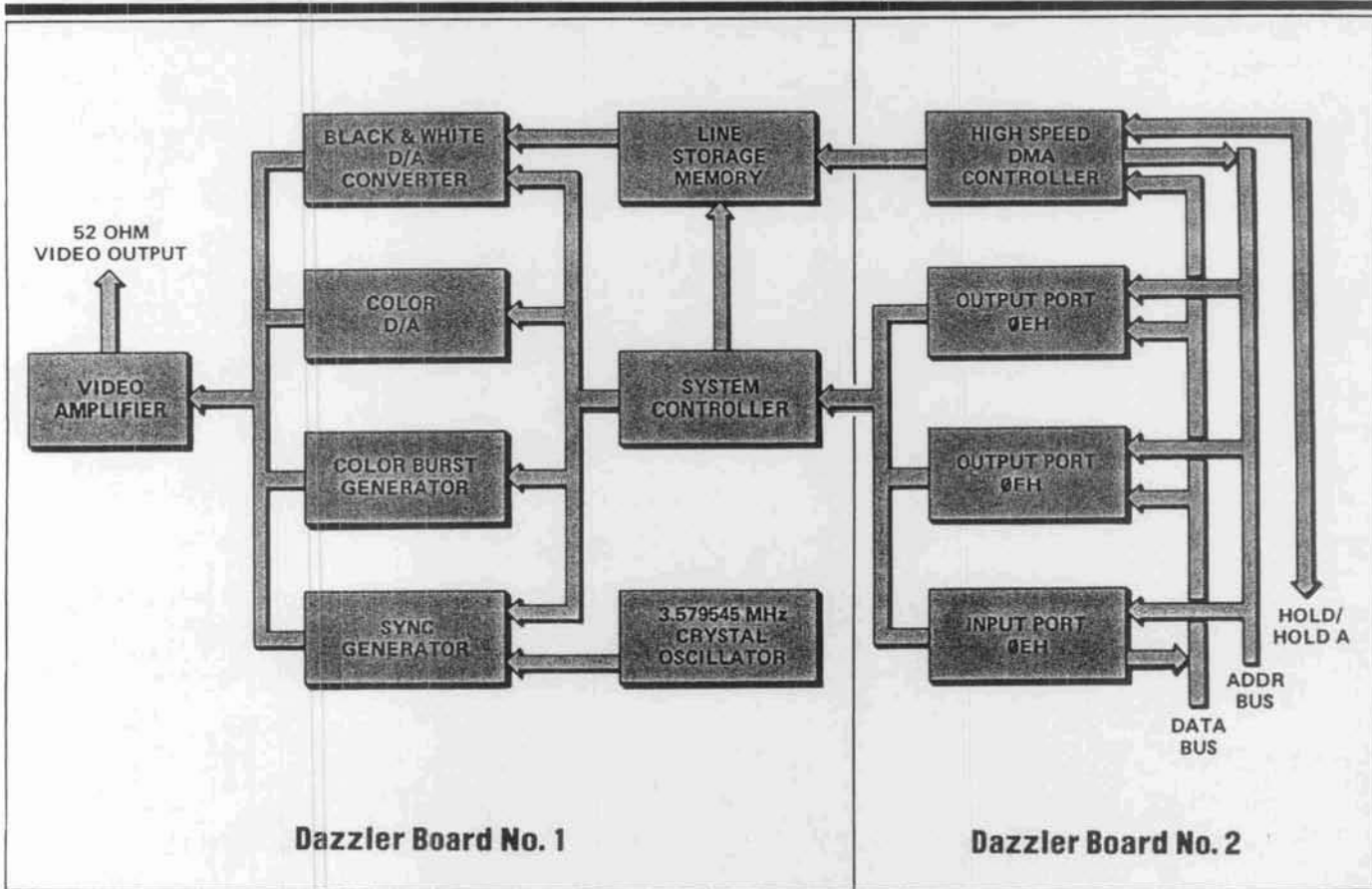
also be turned off manually by depressing the "clear" switch on the computer front panel. The remaining seven bits of output port ØEH are used to set the starting location of the picture to be displayed in the computer's memory. As will be discussed below, the picture may require 512 bytes of memory or 2K bytes of memory depending on the mode in which the DAZZLER® is operating. In any event, this must be static memory with an access time of 1 microsecond or faster. A summary of the use of outpot port ØEH is shown below.

MSB							LSB
ON/OFF	A15	A14	A13	A12	A11	A10	A9

**STARTING ADDRESS OF PICTURE**
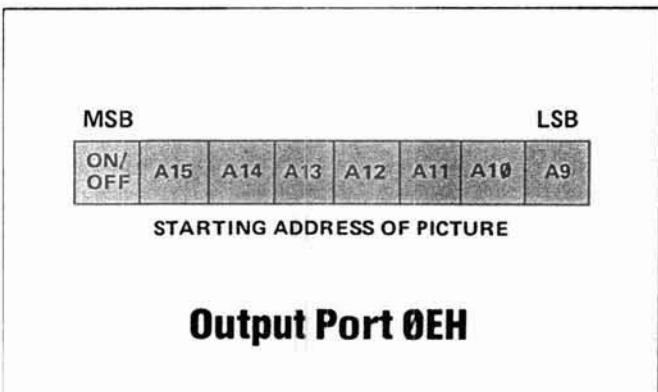
Output Port ØEH

Output port ØFH is used to set the format of the TV picture. The function of each of the eight bits of this output port is shown in this table:

D7 — Not used.

D6=1 — Resolution X 4. Color and intensity set by D4 to D0:

D6=0 — Normal resolution. (32X32 for 512-byte picture. 64X64 for 2K-byte picture.) Color and intensity of each picture element set by 4-bit words in the computer memory.

D5=1 — Picture in 2K bytes of memory.

D5=0 — Picture in 512 bytes of memory.

D4=0 — Black-and-White picture.

D4=1 — Color picture.

D3=1 — High intensity color.

D3=0 — Low intensity color.

D2=1 — Blue

D2=0 — No blue

D1=1 — Green

D1=0 — No green

D0=1 — Red

D0=0 — No red

In resolution X 4 black-and-white mode, D3 is the most significant bit of 4-bit intensity control word.

Bit D0 is the least significant bit.

Output Port ØFH

Bit D7 is not used. Bit D6 is used to set normal resolution (32 x 32 element picture for 512 bytes or 64 x 64 element picture for 2K bytes) or resolution X 4 (64 x 64 element picture for 512 bytes or 128 x 128 element picture for 2K bytes). Bit D5 sets the amount of computer memory (starting at the location given to output port ØEH) allocated to the picture. When D5 is "1," 2K bytes of memory are used. When D5 is "Ø," 512 bytes are used. Bit D4 is used to select between a black-and-white display and a color display. Bits D3-DØ are used in resolution X 4 mode to set the color of a color picture or the intensity of a black-and-white picture. Bits D3-DØ are not used in normal resolution mode.

Only two bits of input port ØEH are used. Bit D7 is low during odd lines and high during even lines. Bit D6 goes low for 4 ms between frames to indicate end of frame.

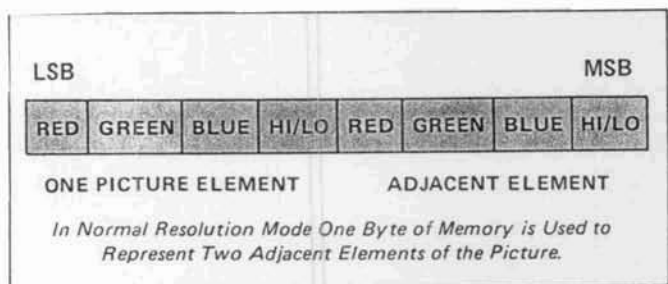| D7 ODD LINE/EVEN LINE	D6 END OF FRAME

Only Two Bits of Input Port are Used.
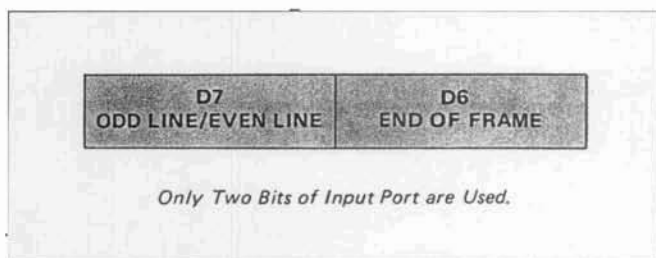
In order to generate a TV picture with DAZ-ZLER®, the information that the DAZZLER® reads from the computer memory must be properly formatted. In resolution X 4 mode, each point on the TV screen is controlled by just one bit in the computer memory. When that bit is a "1" the corresponding element of the picture is on. When that bit is a "Ø" the picture element is off. In resolution X 4 mode, the color and intensity of the picture is set by bits DØ to D3 of the control word at output port ØFH. For full color in resolution X 4 mode, multiple frames of different colors must be interleaved.

In normal resolution mode, the color and intensity of each element of the TV picture are controlled by a four-bit "nybble" in the computer memory. Two elements of the picture are thus stored in each byte (8 bits) of memory. (For this reason, a 64 x 64 picture in normal resolution mode requires 2K of memory.) The lowest order bit of each nybble (DØ) determines whether the corresponding element of the picture contains red (1) or no red (Ø). Similarly, D1 controls green, D2 controls blue, and D3 sets
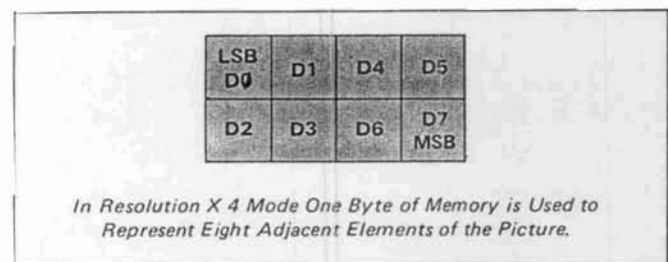
either high intensity or low intensity color. In black-and-white mode these four bits are instead used to specify one of 16,levels of grey.

When writing programs for DAZZLER® displays it is important to remember that the TV picture is stored as a special coded sequence in the computer memory. The DAZZLER® simply interprets this code to form a TV picture. Two different codes are used depending on whether the DAZZLER® is used in normal resolution mode or in resolution X 4 mode (as set by the control word sent to output port ØFH).

In normal resolution mode four bits of computer memory are used to code each element of the picture. A 32 x 32 picture requires 512 bytes of memory. A 64 x 64 picture requires 2K bytes of memory. The following diagram shows how the 4-bit code works:

LSB							MSB
RED	GREEN	BLUE	HI/LO	RED	GREEN	BLUE	HI/LO

ONE PICTURE ELEMENT   ADJACENT ELEMENT

In Normal Resolution Mode One Byte of Memory is Used to Represent Two Adjacent Elements of the Picture.
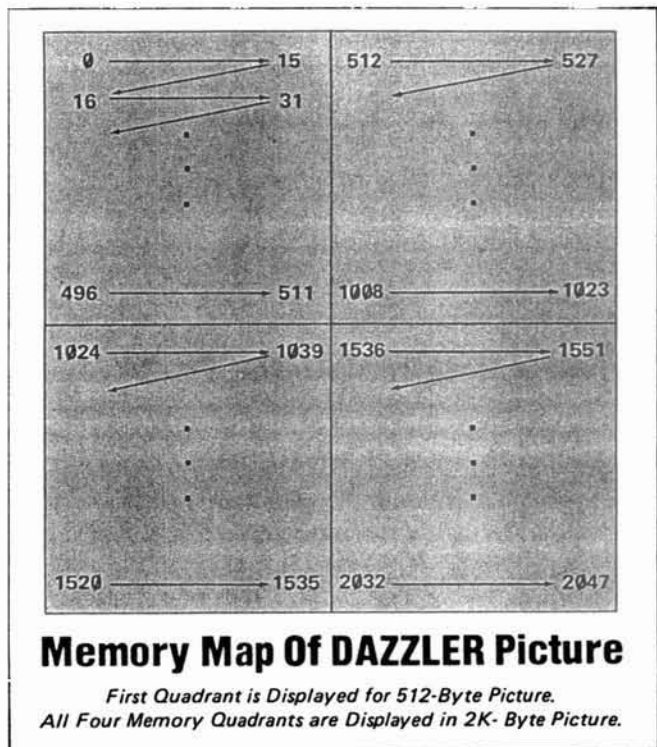
In resolution X 4 mode each bit of the memory is used to either turn on or off a single element of the picture. The eight picture elements controlled by a single byte have the following geometric relationship:

LSB D0	D1	D4	D5
D2	D3	D6	D7 MSB

In Resolution X 4 Mode One Byte of Memory is Used to Represent Eight Adjacent Elements of the Picture.

The 2K byte DAZZLER® picture is stored in memory as four quadrants. Each quadrant of the picture occupies one 512-byte page of memory. Only one page of memory is displayed for a 512-byte picture. The sequence in which memory is scanned in making a 2K byte picture is shown below:

Memory Map Of DAZZLER Picture

First Quadrant is Displayed for 512-Byte Picture.
All Four Memory Quadrants are Displayed in 2K- Byte Picture.

TV Connection

A length of RG174U coaxial cable is provided to connect the DAZZLER® to your TV. The center conductor of the cable should be soldered to the pad labelled "OUT" of Board 1. The shield of the cable should be soldered to the adjacent foil ground. The other end of this cable can be connected to the input of the video amplifier of the TV, being sure to terminate the cable in a 52-ohm impedance.

If you prefer to connect to the antenna terminals of the TV, rather than to the video amplifier input, an RF modulator is required. One such modulator is the Pixieverter Model PXV-2A available for $8.50 from ATV RESEARCH, 13th and Broadway, Dakota City, Nebraska, 68731. If you use a Pixieverter you must also use a matching transformer between the output of the Pixieverter and the TV set. A standard 75 ohm to 300 ohm matching transformer, available at TV supply stores, will provide the required matching. (Radio Shack stores carry such a transformer for $2.59, model 15-1140).

Using Two DAZZLERS In Your Computer

If you wish to control two TV sets simultaneously, you can use two DAZZLERS® in your computer at the same time. To synchronize the DAZZLERS®, remove the jumper wire connecting "SYNC IN" to "G" on Board 1 of one of the DAZZLERS®. Now connect "SYNC OUT" from the other DAZZLER® to the SYNC IN pad that used to be connected to "G". The two DAZZLERS® are synchronized with this connection so that they may be operated simultaneously in the same computer.

Test Program

The following program is useful for testing the operation of the DAZZLER® and is useful for initial tune-up. To operate this program you must have at least 2K bytes of memory beginning at location zero in memory. The test program and tune-up procedure makes use of the front panel switches (at input port FF) of the Cromemco Z-1 computer.

This program begins by putting the bit sequence "10000000" into the accumulator and outputting it to port 0EH. This turns on the DAZZLER® and tells it that the picture that it is to display begins at location zero in memory. Next the program uses the front panel sense switches to set the control word sent to output port 0FH. This allows the user to experiment with different output formats and appreciate the fantastic versatility of the DAZZLER® display. When sense switch A12 is raised the DAZZLER® goes into color mode, and a colorful quilt-like pattern will appear on the TV screen.

Tune Up

The tune-up procedure for the DAZZLER® is straightforward. Begin by loading and running the above test program. Raise SSW A12. Adjust R29 for a stable picture on your screen. Now raise SSWs 10, 11, 12, 13, 14. Adjust C17 for the brightest blue color on your screen. Now lower SSW A10 and raise A9. Adjust R28 for the brightest green. Finally lower SSW A9 and raise SSW A8. Adjust R27 for the brightest red. The tune-up of DAZZLER® is now complete.

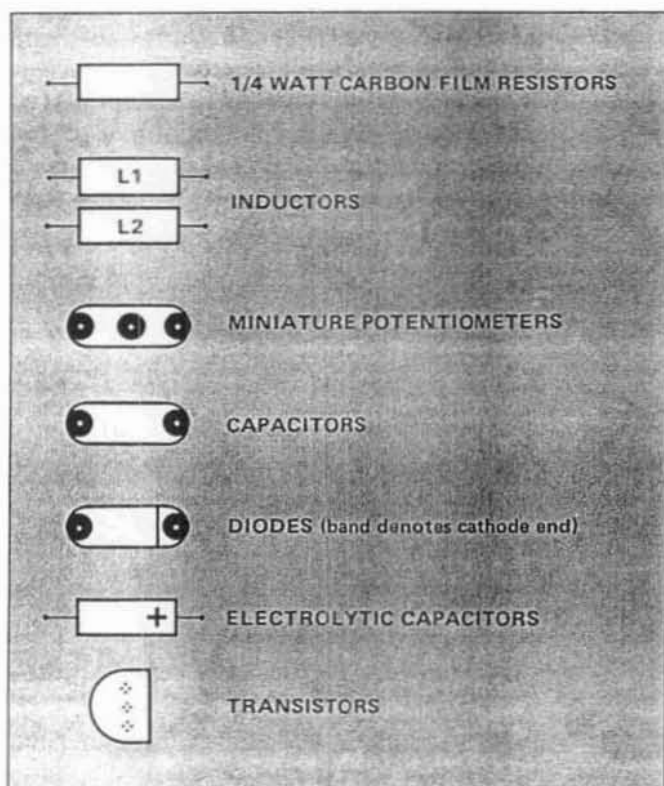| ADDR	OBJECT	MNEMONICS		COMMENTS
0000	3E80	TEST: LD	A, 80H	; 10000000B TO REG. A
0002	D30E	OUT	0EH, A	; OUTPUT TO PORT 0E
0004	DBFF	IN	A, 0FFH	; INPUT FROM SENSE SWITCHES
0006	D30F	OUT	0FH, A	; OUTPUT TO PORT 0F
0008	C30000	JP	TEST	; REPEAT

Section 2

Assembly Instructions

Assembly Instructions

The assembly of the DAZZLER® kit requires about one evening. All components are mounted on the component side of the pc boards and soldered to the foil on the opposite side. Be sure to use high-quality rosin core solder for the assembly and a fine-tipped low wattage soldering iron. IC sockets must be used for all ICs (except for the voltage regulators IC1 and IC38).

To facilitate the assembly of your DAZZLER® kit, the part number of every component is printed in position on the component side of each pc board. The following symbols are used on the pc board:

1/4 WATT CARBON FILM RESISTORS

INDUCTORS

MINIATURE POTENTIOMETERS

CAPACITORS

DIODES (band denotes cathode end)

ELECTROLYTIC CAPACITORS

TRANSISTORS

Assembly Of DAZZLER Board No. 1

☐ Solder in position IC sockets for ICs 2 through 37. Solder a 16 pin IC socket in the position labeled "TO BOARD NO. 2."

☐ With a heatsink mounted between IC1 (LM340T-5.0 voltage regulator) and the pc board, secure this IC in position using 6-32 hardware. Solder the three leads in place.

☐ Solder in position capacitors C1-C14 (0.1µF disc ceramic capacitors).

☐ Solder in position filter capacitors C15 and C16 taking care to orient the positive (+) lead of each capacitor towards the bottom of the pc board.

☐ Solder in position the variable capacitor, C17. Note that the lead on the capacitor marked with an arrow goes in the hole location farthest from the XTAL. If the capacitor does not fit easily into its mounting holes, gently crimp the leads on the capacitor with a pair of needle-nose pliers before inserting it.

☐ Solder in position the disc ceramic capacitors C18 (180pF); C19, 20, 21 (560pF); C22 (.001); C23, 24 (220pF); C25, 26 (.001); C27 (56pF).

☐ Solder in place a small jumper wire, as shown, between the pads labeled "IN" and "G" on the opposite side of the board.

☐ Solder in place the 1N5242 Zener diode (D1) taking care to position the cathode end of the diode toward the top of the pc board. The cathode end of the diode is marked with a band.

☐ Solder in position diode D2 (1N914). Take care to orient the diode so that the cathode (banded) end is toward the top of the board.

☐ Solder in place the inductors L1 and L2. The inductors L1 and L2 are identical.

☐ Solder in position the ¼ watt 5% carbon film resistors R1-R26 (see Resistor Color Codes, box, page 9).

☐ Solder in position the three 500-ohm miniature potentiometers R27, R28 and R29. These three potentiometers are identical.

☐ Solder in position transistor Q1 (2N3906) taking care to position the flat face of the transistor toward the top of the pc board.

□ Solder in position transistors Q2 and Q3 (2N-3904) taking care to position the flat face of the transistors toward the bottom of the pc board.

□ Solder in place the 3579.545 KC crystal (XTAL). The crystal should be mechanically secured in place by running a small piece of bare wire from the pad just under the crystal, over the top of the crystal to the pad just above the crystal. The wire should be pulled tight and soldered at each pad.

□ Insert the ICs from envelope No. 1 into their sockets on Board 1. *Take special care to see that every IC is properly oriented in its socket and that each pin of every IC is properly engaged in the socket.*

Assembly Of DAZZLER Board No. 2

□ Solder in position IC sockets for ICs 39 through 74. Solder a 16 pin IC socket in the position labeled "TO BOARD NO. 1." **Do not** solder IC socket in the position labeled "NO IC."

□ With a heatsink mounted between IC38 (LM-340T-5.0 voltage regulator) and the pc board, secure this IC in position using 6-32 hardware. Solder the three leads in place.

□ Solder in position capacitors C28-C39 (0.1µF disc ceramics).

□ Solder in position the filter capacitors C40 and C41 taking care to orient the positive (+) lead of each capacitor toward the bottom of the pc board.

□ Solder in position capacitor C42, a 330pF disc.

□ Solder in position R30 (1K, ¼ watt) and R31 (270 ohms, ¼ watt).

□ Solder in position the seven port selection jumper wires. The jumper wires should connect pad J1 to J1, J2 to J2, J3 to J3, etc.

□ Insert the ICs from envelope No. 2 into their sockets on Board 2. *Take special care to see that*

every IC is properly oriented in its socket and that each pin of every IC is properly engaged in the socket.

Interboard Connection

□ A 16-conductor cable, with plugs on each end, is provided to connect Board 1 to Board 2. The cable should be plugged into the socket labeled "TO BOARD NO. 2" on the front of Board 1, be routed over the top of Board 1 down the front of Board 2 and into the socket on Board 2 labeled "TO BOARD NO. 1."

TV Connection

□ A length of RG174/U cable is provided to connect the DAZZLER® to your TV. The center conductor of the cable should be soldered to the terminal labeled "OUT" on Board 1 (see Note below). The shield of the cable should be soldered to the adjacent foil ground. The other end of this cable can be coupled to the input of the video amplifier of a TV. If you prefer to connect to the antenna terminals of the set rather than to the video amplifier input, an RF modulator is required. The most cost-effective modulator that we know of is the Pixieverter available for $8.50 from ATV Research, 13th and Broadway, Dakota City, Nebraska 68731.

NOTE:
The TV "OUT" pad is located in the upper right corner of Board 1. Do not confuse this with the SYNC output near the center of the board.

□ Before using your DAZZLER®, carefully inspect your work. The notch on every IC should be on the left (with pin 1 of each IC toward the lower left). Be sure that all components are in the proper positions and properly oriented. Also check to be sure that you have installed the small jumper wire shown near the top of Board 1. For instructions on tuning up your DAZZLER® refer to page 6 of this manual.

Resistor Color Codes

10	BROWN – BLACK – BLACK – GOLD
39	ORANGE – WHITE – BLACK – GOLD
150	BROWN – GREEN – BROWN – GOLD
220	RED – RED – BROWN – GOLD
270	RED – VIOLET – BROWN – GOLD
330	ORANGE – ORANGE – BROWN – GOLD
470	YELLOW – VIOLET – BROWN – GOLD
820	GREY – RED – BROWN – GOLD
1K	BROWN – BLACK – RED – GOLD
1.5K	BROWN – GREEN – RED – GOLD
7.5K	VIOLET – GREEN – RED – GOLD
9.1K	WHITE – BROWN – RED – GOLD
10K	BROWN – BLACK – ORANGE – GOLD
15K	BROWN – GREEN – ORANGE – GOLD
18K	BROWN – GREY – ORANGE – GOLD
30K	ORANGE – BLACK – ORANGE – GOLD
36K	ORANGE – BLUE – ORANGE – GOLD
62K	BLUE – RED – ORANGE – GOLD

Foil Diagram Board No. 1

Schematic Diagram Board No.

Cromemco Dazzler

U.S. Patent No. 4121283

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WARNING COMPONENT MATCHING E

LEGEND

A. [ ] 100-PIN ALTAIR BUS (S100)
B. [ ] PIN INTERCONNECT

1. REQUEST DATA
2. VERT ENABLE

VIDEO DATA
3.
4. FROM
5. BOARD No. 2
6.

7. PORT 16 CLOCK
8. GROUND
9. 128×128 ENABLE
10. COLOR ENABLE
11. ENABLE DAZZLER
12. 4×4×4 ENABLE
13. 1.79 MHz DMA CLOCK
14. HALT HH
15. VERT CLOCK
16. BYTE — WIBBLE (SINGLE CONTROL)

DAZZLER IS A REGISTERED TRADEMARK OF CROMEMCO

Foil Diagram Board No. 2

Schematic Diagram Board No. 2

Cromemco Dazzler™ BOARD No. 2, Rev. D

U.S. Patent No. 4121283

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WARNING COMPONENT MATCHING ESSENTIAL

DAZZLER IS A REGISTERED TRADEMARK OF CROMEMCO

Parts List

BOARD 1			BOARD 2		
Integrated Circuits		Part No.	Integrated Circuits		Part No.
IC1	7805	012-0001	IC38	7805	012-0001
IC2	7410	010-0026	IC39	7402	010-0031
IC3	7473	010-0020	IC40	7408	010-0027
IC4	7432	010-0033	IC41	7404	010-0030
IC5	7430	010-0023	IC42	74LS10	010-0063
IC6	7474	010-0019	IC43-44	7474	010-0019
IC7	74LS04	010-0066	IC45	74LS30	010-0059
IC8	7408	010-0027	IC46	74157	010-0009
IC9	7400	010-0000	IC47	74175	010-0006
IC10	7473	010-0020	IC48	74LS08	010-0064
IC11-12	7493	010-0016	IC49	7404	010-0030
IC13	74157	010-0009	IC50-51	7493	010-0016
IC14-15	7400	010-0000	IC52	7408	010-0027
IC16-18	7410	010-0026	IC53	7493	010-0016
IC19	7404	010-0030	IC54	7475	010-0018
IC20	7420	010-0025	IC55	74175	010-0006
IC21	7432	010-0033	IC56	74LS32	010-0058
IC22	7408	010-0027	IC57	7495	010-0015
IC23	7474	010-0019	IC58-59	74LS04	010-0066
IC24	3417	011-0007	IC60	7483	010-0017
IC25	7408	010-0027	IC61	7475	010-0018
IC26	74151	010-0010	IC62	7483	010-0017
IC27	74157	010-0009	IC63	7475	010-0018
IC28	74175	010-0006	IC64	74LS04	010-0066
IC29	7400	010-0000	IC65-66	7405	010-0039
IC30	7420	010-0025	IC67-70	74367	010-0080
IC31	7473	010-0026	IC71-72	74LS04	010-0066
IC32-33	74161	010-0008	IC73	7405	010-0039
IC34	74157	010-0009	IC74	7474	010-0019
IC35	74175	010-0006			
IC36	7404	010-0030			
IC37	74LS75	010-0054			

Parts List

Resistors		Part No.
R1	270	001-0011
R2	150	001-0008
R3-4	1K	001-0018
R5	9.1K	001-0029
R6	36K	001-0036
R7	18K	001-0032
R8	7.5K	001-0028
R9	15K	001-0031
R10	62K	001-0038
R11	30K	001-0034
R12	10K	001-0030
R13	15K	001-0031
R14-16	10K	001-0030
R17	15K	001-0031
R18	820	001-0017
R19	1.5K	001-0020
R20	330	001-0012
R21	220	001-0010
R22	39	001-0002
R23	10	001-0000
R24	330	001-0012
R25	470	001-0014
R26	330	001-0012
R27-29	500 POT	002-0002
R30	1K	001-0018
R31	270	001-0011

Capacitors		Part No.
C1-14	.1μF DISC	004-0030
C15-16	10μF/50V	004-0031
C17	7-25pF VAR.	004-0033
C18	180pF	004-0012
C19-21	560pF	004-0018
C22	.001μF	004-0022
C23-24	220pF	004-0013
C25-26	.001μF	004-0022
C27	56pF	004-0006
C28-39	.1μF DISC	004-0030
C40-41	10μF/50V	004-0031
C42	330pF	004-0035

Inductors		Part No.
L1-L2	22μH	007-0000

Transistors		Part No.
Q1	2N3906	009-0002
Q2-Q3	2N3904	009-0001

Diodes		Part No.
D1	1N5242	008-0005
D2	1N914	008-0002

| Miscellaneous	Part No.
CRYSTAL 3.579 MHz	026-0000
50 - SOCKETS, 14 PIN	017-0001
25 - SOCKETS, 16 PIN	017-0002
RIBBON CABLE	019-0004
1 FT. RG 174/U	019-0005
2 - 6x32 SCREWS	015-0000
2 - 6x32 NUTS	015-0013
2 - HEATSINKS	021-0016
DAZZLER® PC BOARD #1	020-0005
DAZZLER® PC BOARD #2	020-0006
DAZZLER® INSTRUCTION MANUAL	023-0003

Warranty

Your factory-built DAZZLER® is warranted against defects in materials and workmanship for a period of 90 days from the date of delivery. We will repair or replace products that prove to be defective during the warranty period provided that they are returned to Cromemco. No other warranty is expressed or implied. We are not liable for consequential damages.

Should your factory-built DAZZLER® fail after the warranty period, it will be repaired, provided that it is returned to Cromemco, for a fixed service fee. We reserve the right to refuse to repair any product that in our opinion has been subject to abnormal electrical or mechanical abuse. The service fee is currently $70 and is subject to change without notice.

Your assembled DAZZLER® kit will be repaired, provided that it is returned to Cromemco, for a fixed service fee. We reserve the right to refuse repair of any kit that in our opinion has not been assembled in a workmanlike manner or has been subject to abnormal electrical or mechanical abuse. Payment of the service fee must accompany the returned merchandise. The service fee is currently $70 and is subject to change without notice.
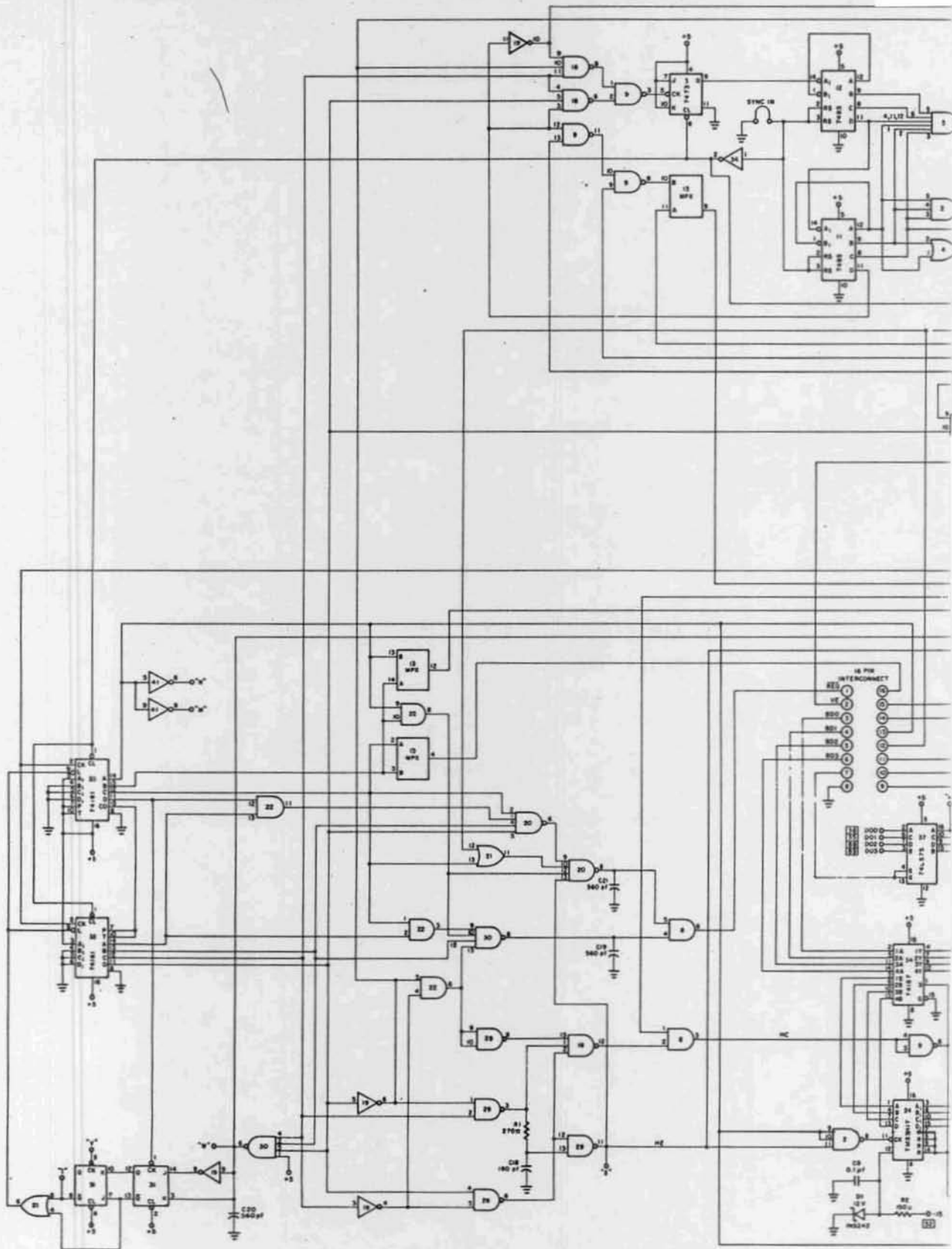
Cromemco Dazzler ™ BOARD No. 1 Rev. D

U.S. Patent No. 4121283

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WARNING COMPONENT MATCHING ESSENTIAL
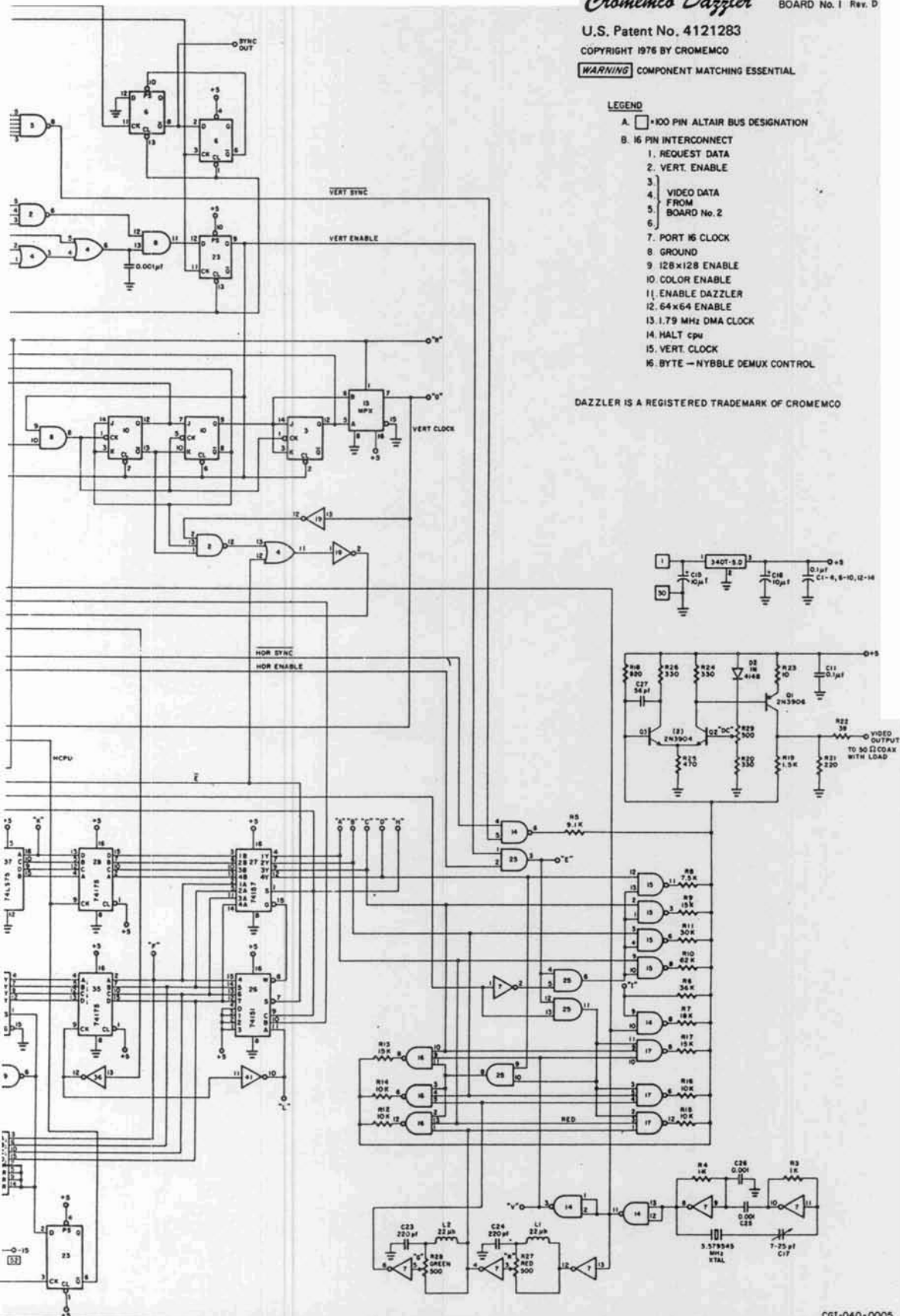
LEGEND

A. ☐ = 100 PIN ALTAIR BUS DESIGNATION

B. 16 PIN INTERCONNECT

1. REQUEST DATA
2. VERT. ENABLE
3. ⎫
4. ⎬ VIDEO DATA FROM BOARD No. 2
5. ⎪
6. ⎭
7. PORT 16 CLOCK
8. GROUND
9. 128×128 ENABLE
10. COLOR ENABLE
11. ENABLE DAZZLER
12. 64×64 ENABLE
13. 1.79 MHz DMA CLOCK
14. HALT cpu
15. VERT. CLOCK
16. BYTE → NYBBLE DEMUX CONTROL

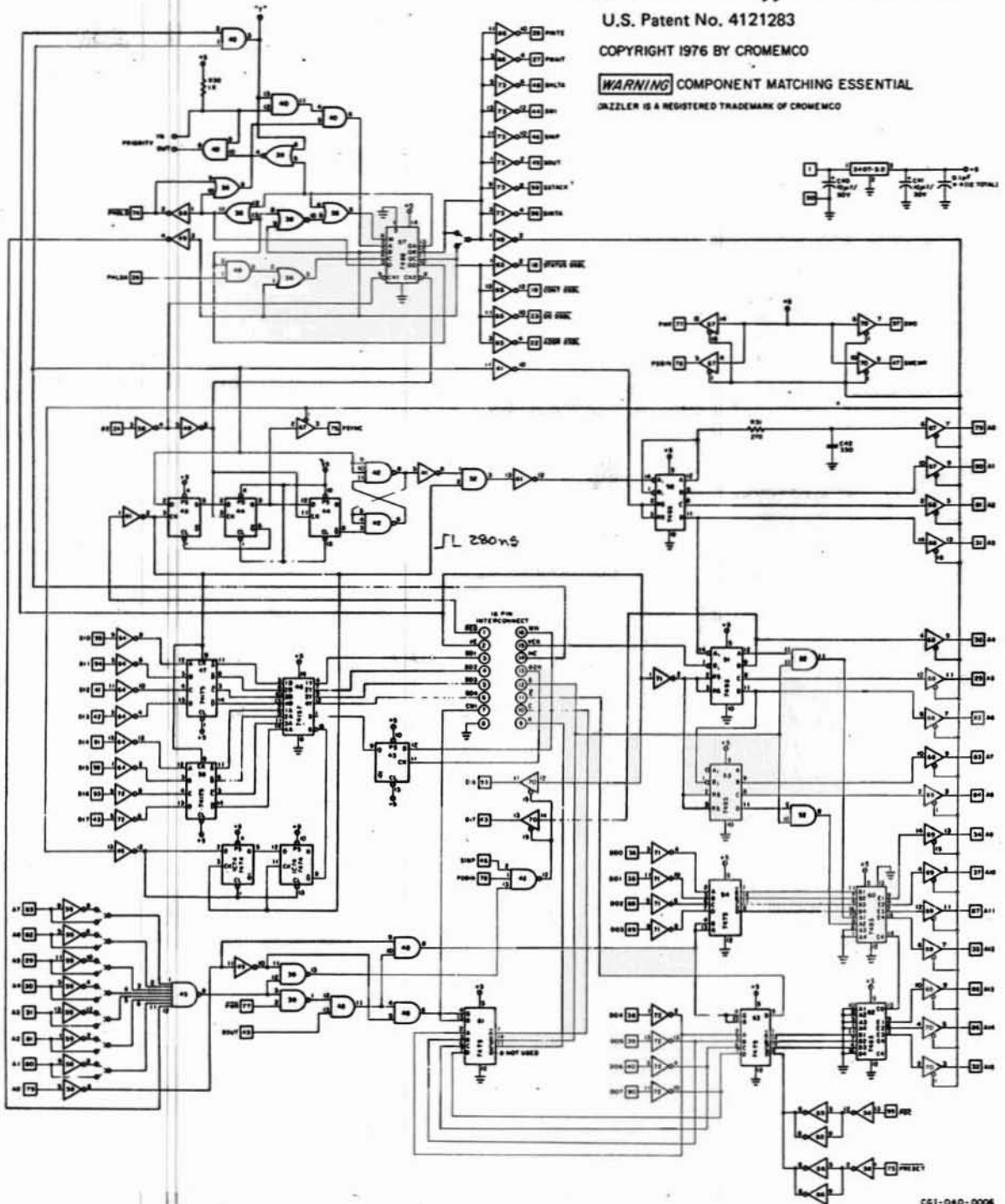DAZZLER IS A REGISTERED TRADEMARK OF CROMEMCO

CGI-040-0005

Cromemco

Schematic Diagram Board No. 2

Cromemco Dazzler ™ BOARD No. 2, Rev. D

U.S. Patent No. 4121283

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