The DOC document title is:

Telidon Videotex Presentation Level Protocol: Augmented Picture Description Instructions

CRC Technical Note 709

and further information can be obtained through:

Department of Communications
Information Services
300 Slater St.
Ottawa, Ontario K1A 0C8

EIA STANDARDS

The two other standards referenced in this guide are published by the Electronic Industries Association (EIA). They are not necessary to the understanding of their application to the display generator, but like the videotex standards mentioned above, they are listed here if you need technical details in their respective areas.

1. EIA RS-232-C
   Interface Between Data Terminal Equipment and Data Communication Equipment Employing Serial Binary Data Interchange

2. EIA RS-170
   Electrical Performance Standards - Monochrome Television Studio Facilities

further information on either of these standards can be obtained through:

Electronic Industries Association
Engineering Department
2001 Eye Street, N.W.
Washington D.C. 20006

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FIGURES

DRAWINGS

CHAPTER 1 GENERAL INFORMATION

INTRODUCTION

This user's guide provides information on the Colour Raster Display Generator (CRDG) Mk3 Circuit Card Assembly designed and manufactured by Norpak Limited. The guide consists of three chapters (general information, hardware and software descriptions) and two appendices. Read the unpacking warning notes on page 6 before handling the circuit card.

The (CRDG) is a single circuit card assembly with a 6809 microprocessor interface operating with alphanumeric/geometric videotex software in ROM. The card has a variety of applications, such as in process control systems to create and display flow diagrams and control symbology, as a colour output device to generate user-originated graphics and text, or to communicate through a modem with a database to select and display pages of information. The card contains interfaces for a keypad or keyboard input device, and full-duplex serial communications.

The alphanumeric/geometric software uses the Picture Description Instruction (PDI) protocol defined in the American AT&T Presentation Level Protocol Videotex Standard, and the Canadian Department of Communications' Technical Note 709, Videotex Presentation Level Protocol: Augmented Picture Description Instructions. These functionally identical documents define the PDI set used by the software to decode user keyboard inputs for computer graphics applications or the database videotex codes. Refer to the Appendix B.

SYSTEM DEFINITION

The Colour Raster Display Generator is intended for use in business or home systems containing at least an RGB colour monitor and a keypad or keyboard, for graphics generation when connected to a host processor, and a communications modem for videotex data base access.

A keypad or keyboard is required to interact with the database or host computer. In the Telidon videotex mode the user will issue commands to instruct the database to search forward or backward for an index or page of information, display a previous index or page, pause, erase or resend current page.

VIDEOTEX

Videotex is the name for two-way (interactive) public access information services that disseminate information or provide for transactional services from public information suppliers. The alpha-geometric Telidon system uses simple geometric shapes, called primitives, and text characters to define the image, so that the picture is built up in finely detailed areas rather than line by line. See Example in Chapter 3. The geometric shapes and text characters are described by Picture Description Instructions (PDIs).

PICTURE DESCRIPTION INSTRUCTIONS

The PDIs are codes formed from the 7-bit, 128-character ASCII subset and are used to define geometric primitives for video display. They define graphical and textual information in a concise alphanumeric/geometric code set which comprises the primitive identifier, its attribute and numeric location data. The primitive is the graphic shape; the attribute is its colour and whether it is to be drawn in outline or filled, and the text size; the numeric location data defines the screen co-ordinates on which the primitive is to be located. The PDIs are described in greater detail in Chapter 3.

The defined geometric primitives are summarized below.

POINT - sets the drawing point to any position in the display space and optionally displays a dot.

LINE - draws a line based on its endpoints.

ARC - draws a circular arc based on the endpoints of the arc and a point on the arc. The endpoints of the arc may optionally be joined by a chord and the area so defined filled in. If more points are given, they define a higher level ARC, a curvilinear line defined by a SPLINE function. A circle is described as an arc whose endpoints coincide and whose intermediate point (with the endpoints) defined the diameter.

RECTANGLE - draws a rectangular outline or fills in an area of specified length and width.

POLYGON - draws a polygonal outline or fills in the circumscribed area based on a series of defined vertices.

CONTROL - provides control over the modes of the drawing commands. One of its major functions is to set up a value or colour of an object.

UNPACKING

The Colour Raster Generator Card is supplied in a cardboard package, and is protected by a bubble-foam wrapping and an anti-static bag. A separate bag in the box contains the coaxial connectors.

WARNING

Do not remove the circuit card from the anti-static bag until you and the anti-static bag have been grounded.

Static electrical discharges can cause damage to electronic components and RAM.

Do not touch the gold-plated edge connector finger (the acid on the skin surface can cause corrosion on the connector fingers, resulting in poor connections.

CHAPTER 2
HARDWARE DESCRIPTION

INTRODUCTION

This chapter provides hardware specifications, circuit card dimensions, connector pin-outs, logic schematic diagram, parts location diagram and part lists. Connector pin assignments, signal names and voltage levels are given in Tables 1 to 3. The listed parts can be obtained at any commercial electronics supplier. However, the four PROMs, two masked ROMs and the EPROM (Figure 3, U4N, U5N, U5L to U9L) contain the Telidon videotex software and must be purchased from Norpak.

SPECIFICATIONS

Environmental

The Colour Raster Display Generator is designed for a normal business or home operating environment of 10 degrees to 40 degrees C (50 to 104 degrees F) at a humidity of 10 to 90% non-condensing.

Power

The dc power requirements are:

5 V, 1.5 A
12 V, 0.4 A
-12 V, 0.05 A

Communications

- RS-232-C full duplex serial communication through Cannon connector DB 25P (see Figure 3)
- Baud rates, independent transmit/receive, 8 strap-selectable rates (see Table 1) at 75, 150 300, 600, 1200, 2400, 4800, 9600.
- Parity, strap selectable (see Table 2), at odd, even or no parity (mark or space).

Display

- 200 (y axis) by 256 (x axis) by 4-bit high speed raster video RAM
- 8 gray levels (black to white), blinking white and transparent pixel content.
- 6 colours: blue, red, magenta, green, cyan, yellow
- 8 character sizes, with a maximum of 20 lines of 40 characters
- RS-170 level RGB video and composite sync outputs through BNC connectors. Flicker free RGB is 526 line, 60 Hz

ASSEMBLY

Because the six coaxial connectors can be mounted on the card, as shown in Figure 2, or in a convenient place on an enclosure in which the card is housed, the connectors and miscellaneous hardware are supplied in a separate bag.

If the connectors are to be mounted on the card they should be loosely assembled on the strip supplied, then located on the card with the flat ground pin on the card solder side and the round conductor pin on the component side. The pins should be centred on the rectangular solder pads, then soldered to both sides of the card. Do not use excessive or prolonged heat. When the soldered joints have cooled, tighten the connector securing nuts.

If the connectors are to be mounted on an enclosure they should be connected to the card through suitable lengths of RG-59U coaxial cable.

The miscellaneous hardware is for use on the multi-pin connectors P1 and P2, as required.

BLOCK DIAGRAM DESCRIPTION

The block diagram, Figure 1, shows the card functions in simplified form. The microprocessor (6809 uP) accesses the Monitor Controller, RAM and ROM through the Control/Address/Data Bus. The Monitor Controller produces signals for the RAM address for video refresh, and for video timing (horizontal and vertical sync and blanking). RAM contains the program and display memory and ROM contains the video decoding memory. The video circuit decodes the data signals to provide the RGB video signal outputs.

An Asynchronous Communications Interface Adapter (ACIA) converts the bus parallel data to a serial bit stream for transmission on a serial data line. It also converts received serial data to parallel data for processing in the uP. Similarly, a Parallel Interface Adapter (PIA) interfaces the keypad or keyboard data before it is applied to the bus.

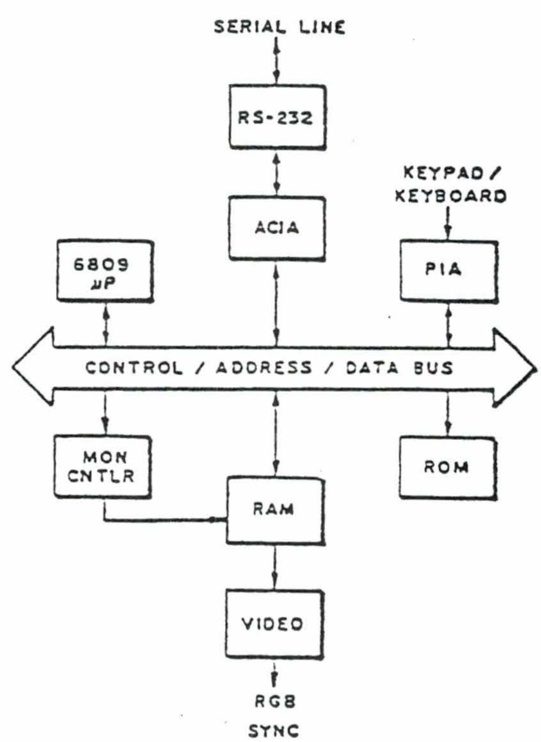


Figure 1 Colour Raster Display Generator, Block Diagram

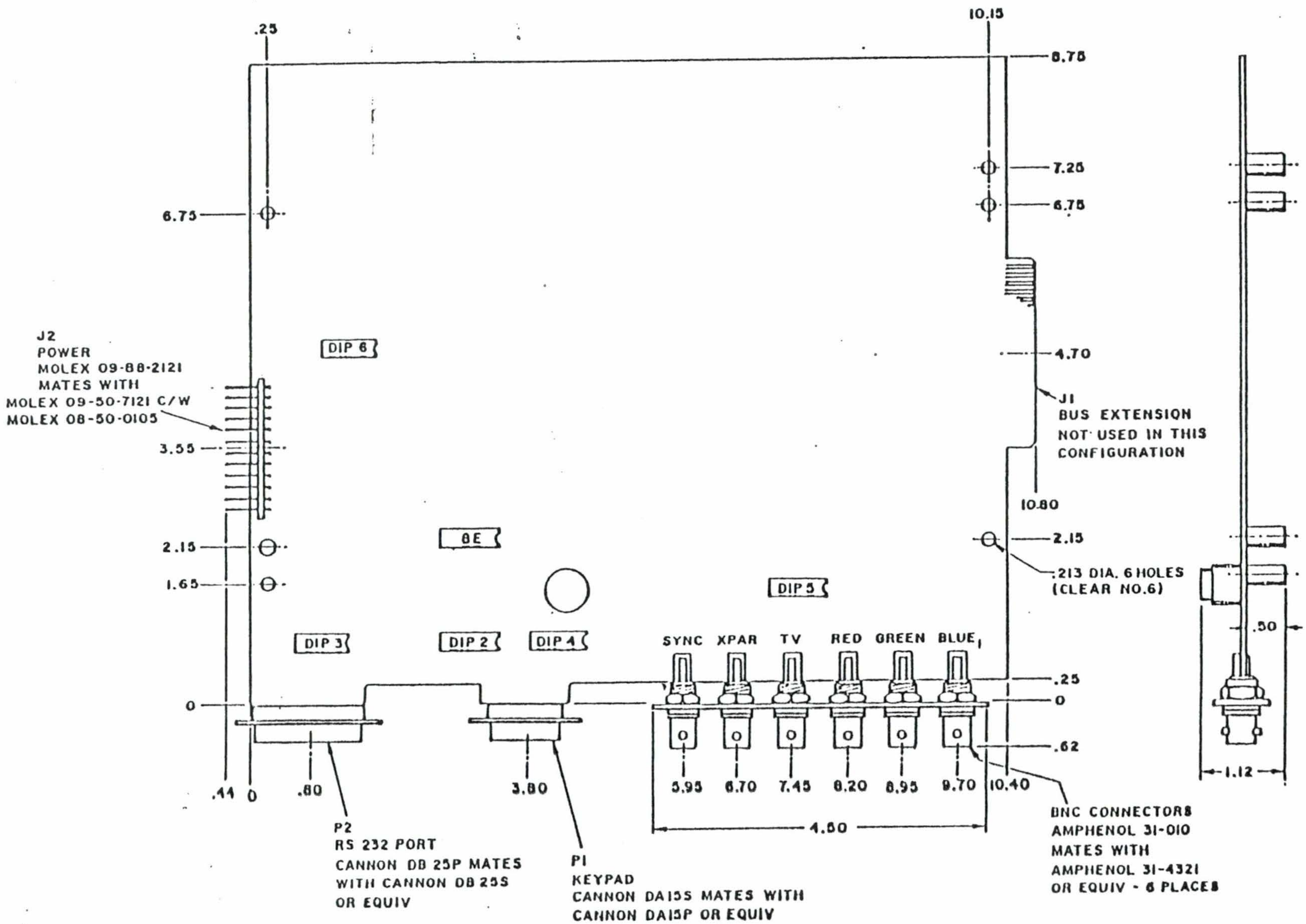


Figure 2 Card Dimensions and Connector Types

Table 1 Connector Pin Functions

PIN NO.	VOLTAGE / SIGNAL	
J2 POWER		
10,11,12	+12V 0.5 AMP	CURRENTS
8,9	−12V 0.1 AMP	
5,6,7	+5V 1.5 AMP	
1,2,3,4	GND	
P1 KEYPAD		
1	DATA BIT 0H (LSB)-INPUT	-ALL LEVELS ARE TTL
2	1	
3	2	
4	3	
5	4	
6	5	
7	6	
8	DATA BIT 7H (MSB)-INPUT	
9	STROBE L -INPUT	
10	NOT USED	
11	GND	
12	+5V	
13	+12V	
14	−12V	
15	GND	
P2 RS232 PORT		
1	GND	-ALL LEVELS ARE EIA RS232-C
2	TRANSMIT DATA-OUTPUT (TX)	
3	RECEIVE DATA-INPUT (RX)	
4	REQUEST TO SEND-OUTPUT (RTS)	
5	CLEAR TO SEND-INPUT (CTS)	
6	NOT USED	
7	GND	
8	DATA CARRIER DETECTED-INPUT (DCD)	
9,10,11	NOT USED	
12	NOT USED	
13,14,15,16,17	NOT USED	
18	−12V	
19	NOT USED	
20	DATA TERMINAL READY-OUTPUT (DTR)	
21,22,23,24	NOT USED	
25	NOT USED	

8E JUMPERS 0 - OUT
1 - IN

PIN 2-15	1-16	PARITY	
1	1	SPACE *	ALL 7 DATA BITS
1	0	MARK *	1 STOP BIT
0	1	EVEN **	
0	0	ODD **	

3-14	VIDEO
0	60 HZ

* VALUE OF BIT 8 FOR TRANSMISSION, RECEIVE IS NO PARITY

** PARITY FOR TRANSMISSION AND RECEPTION

Table 2 DIP Functions

DIP 2		
1,16	+5V	
2,15	RESET L	
3,14	RX DATA L	
4,13	TX DATA L	
5,12		
6,11	NOT USED	
7,10		
8,9	GND	

DIP 3		
1	TX	RS232-C LEVELS
2	DTR	
3	RX	
4	OH	
5	RTS	
6	CTS	
7	DCD	
8	SDCD	
9	SRTS	
10—15	GND	
16	SEL Ø L	TTL LEVEL

DIP 4		
1	DATA BIT 0 H (LSB)-INPUT	TTL LEVELS
2	1	
3	2	
4	3	
5	4	
6	5	
7	6	
8	DATA BIT 7 H (MSB)-INPUT	
9	STROBE L -INPUT	
10	NOT USED	
11	GND	
12	+5V	
13	+12V	
14	-12V	
15	GND	
16	+5V	

DIP 5		
1	A4 COLOUR / GREY	TTL LEVELS
2	A3 BIT 2	
3	A2 BIT 1	
4	A1 BIT 0	
5	BLINK L	
6	ALPHA / $\overline{GRAPH}$	
7	A5 BLANK H	
8	ALT VIDEO L	
9—12	GND	
13	HS IN H	
14	HS OUT	
15	VS IN H	
16	VS OUT	

DIP 6		
1	75	TTL LEVELS
2	300	
3	1200	
4	2400	
5	9600	
6	NOT USED	
7	RX CLK IN	
8,9	NOT USED	
10	TX CLK IN	
11,12	NOT USED	
13	4800	
14	RX CLK IN	
15	600	
16	150	

DIP 6 3-14 1200 baud

7-10

DIP 2 2-15
3-14
4-13

Tel.Co 3
2 ——— 2
3 ——— 4
5 ——— 20
8 ——— 7
7 ——— 7

Table 3 Coaxial Connector Functions

Connector	Function
RGB	Colour signals, 75 ohm, RS-170 (0.7 V).
SYNC	Composite sync signal, 75 ohm, RS-170 (0.3 V), NTSC compatible - no serration or equalization pulses.
TV	Not applicable; used only for special monitor (Electrohome C50). (TTL, control - high during Telidon mode, low during TV mode.)
XPAR	Not applicable; used to control a graphic overlay keying device.

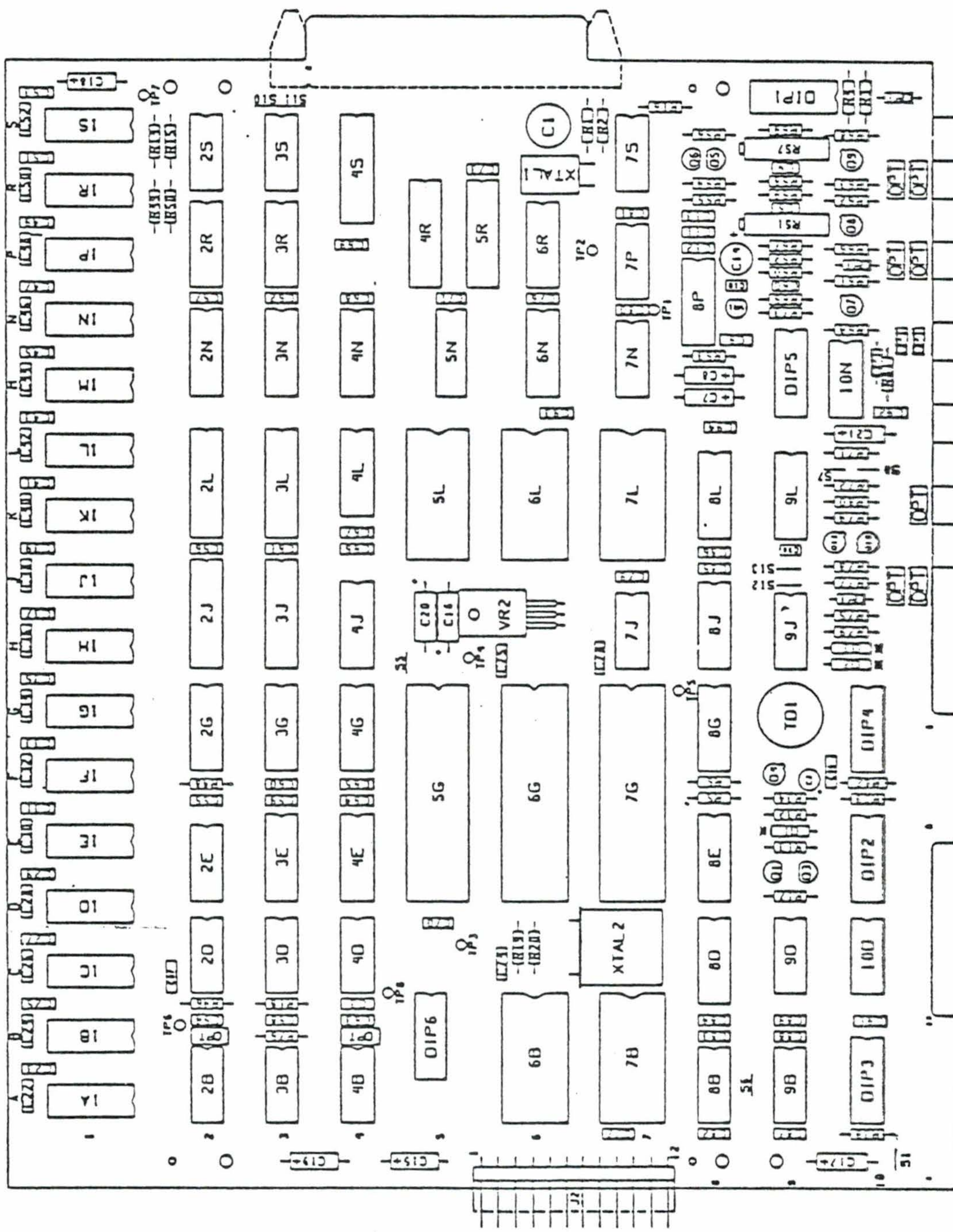
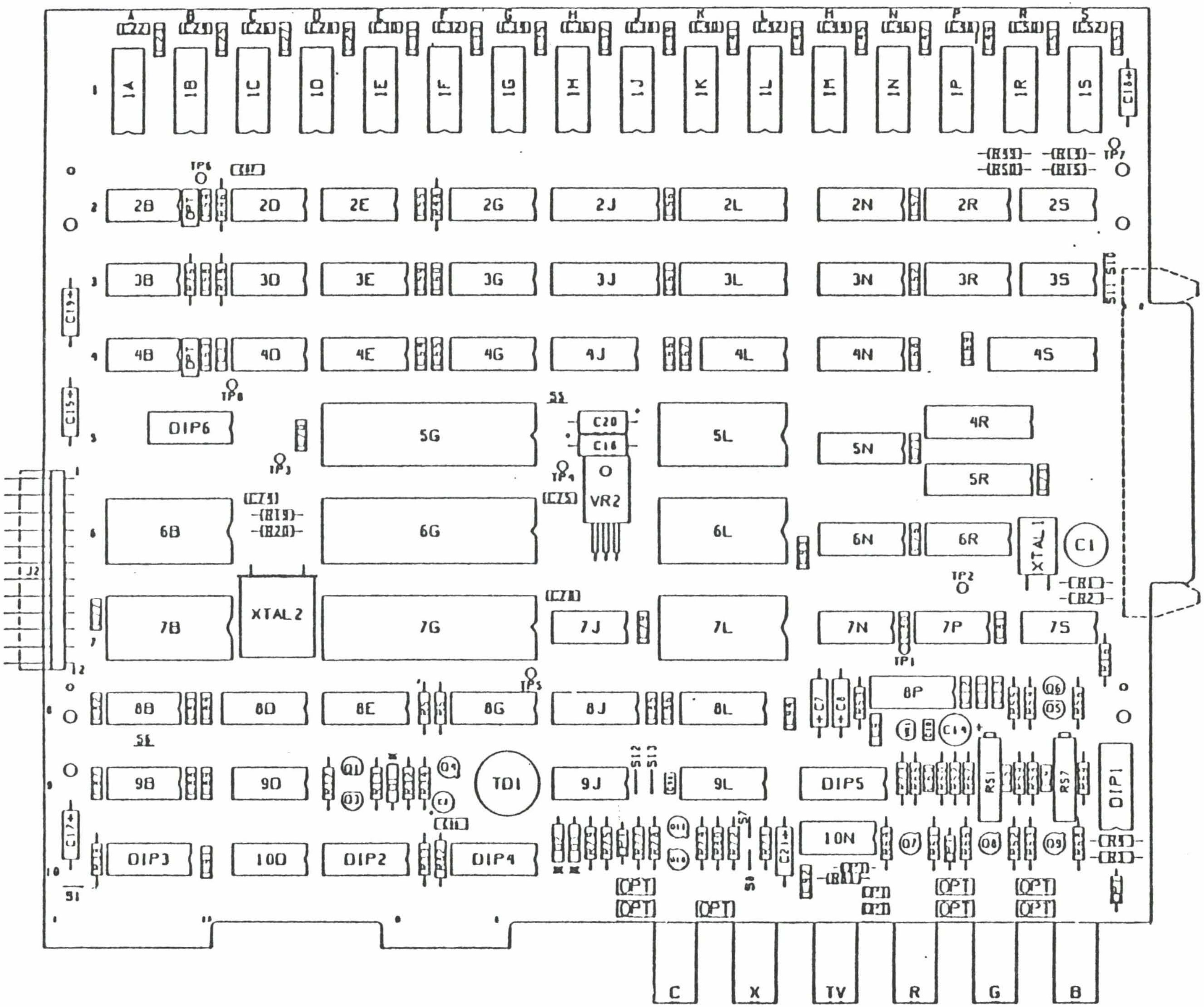
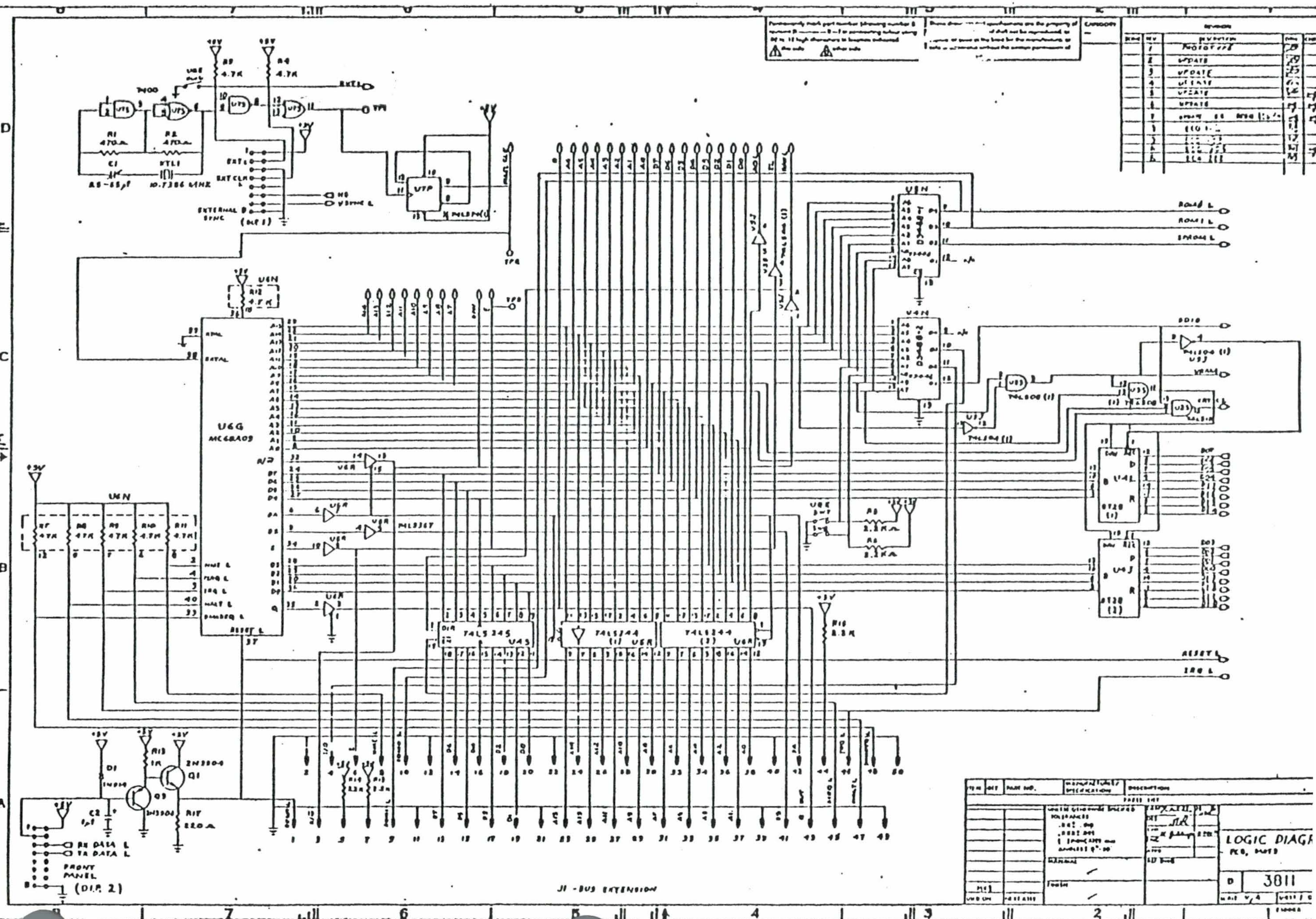
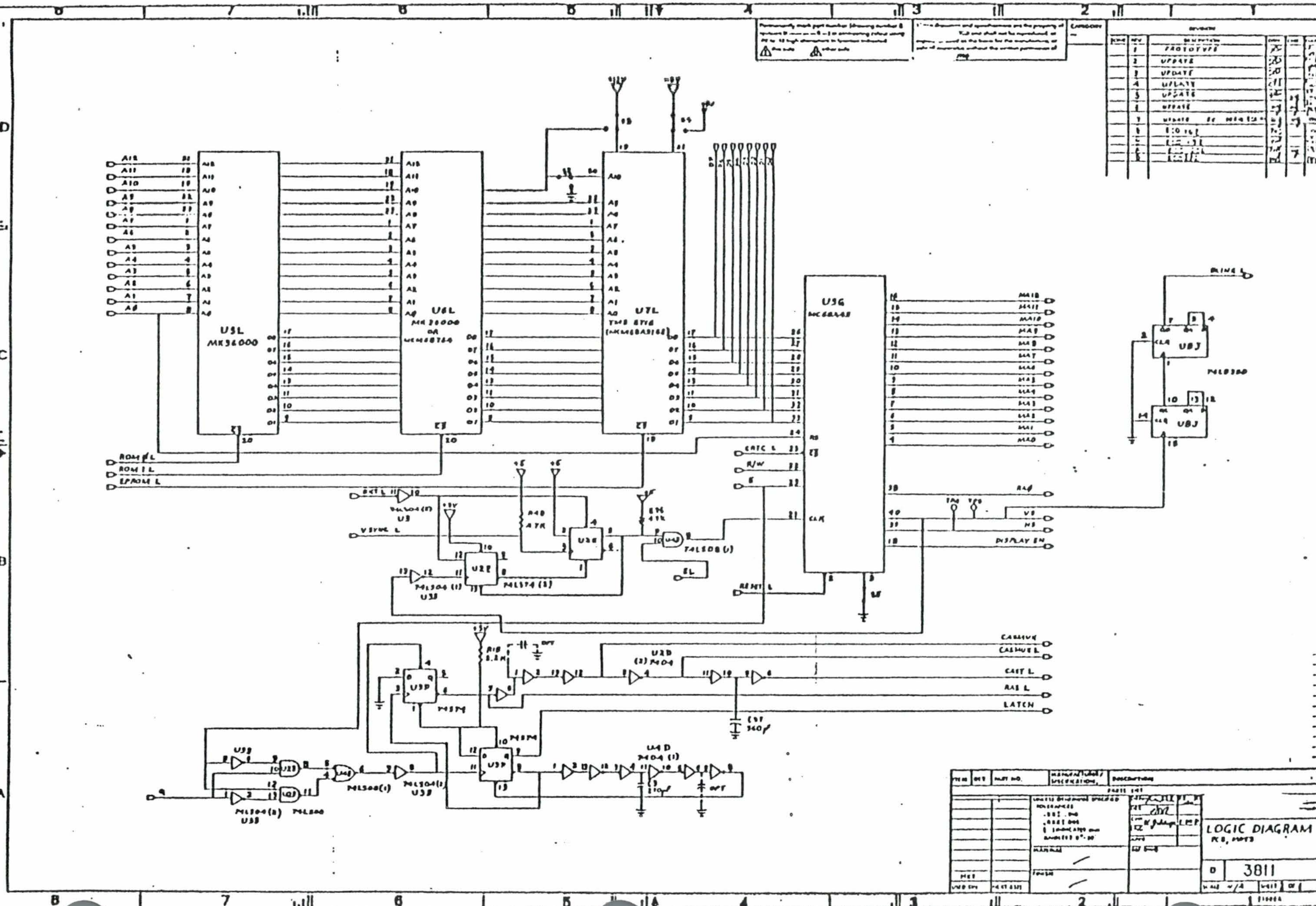


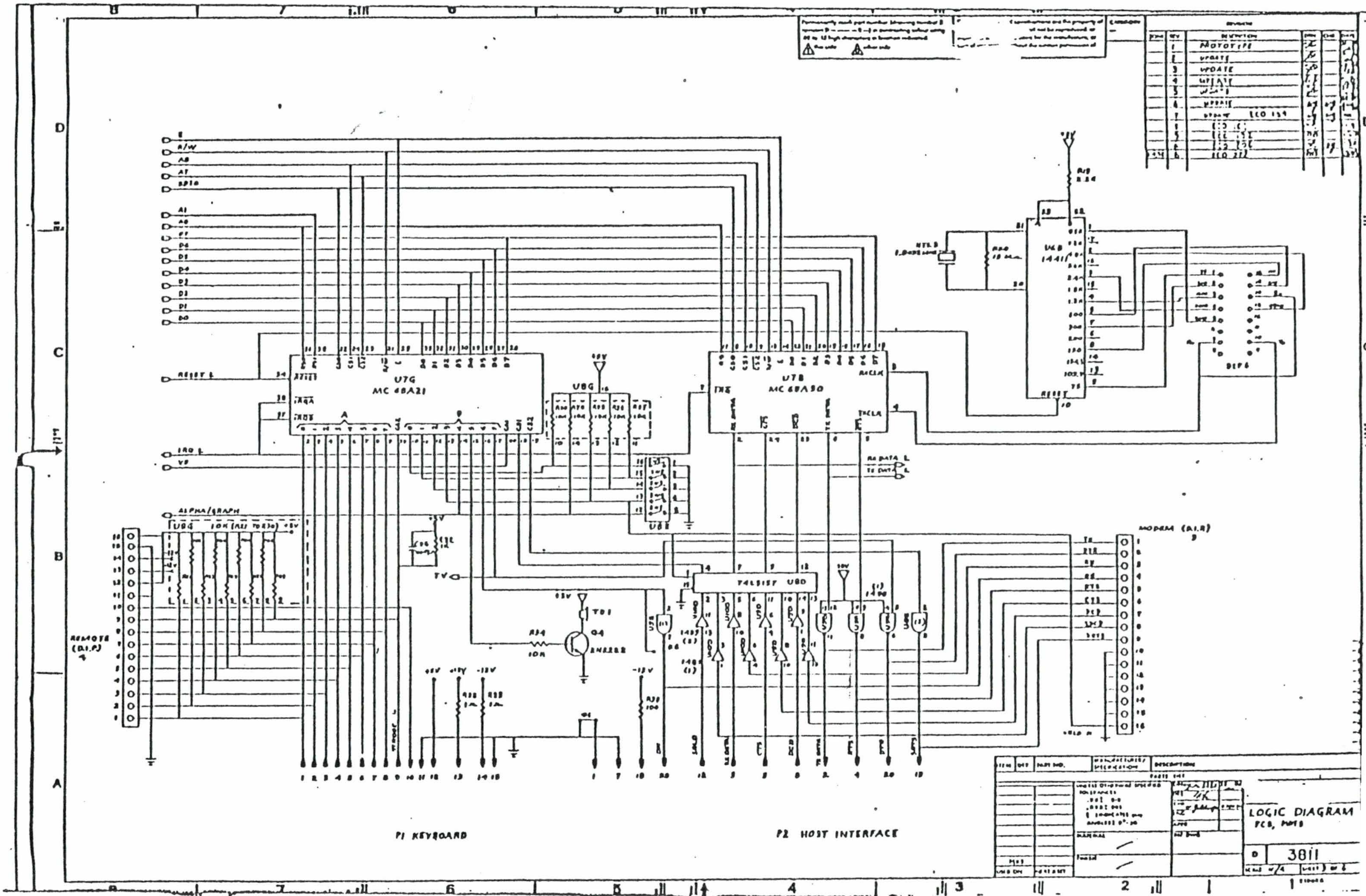
Figure 3 Parts Location

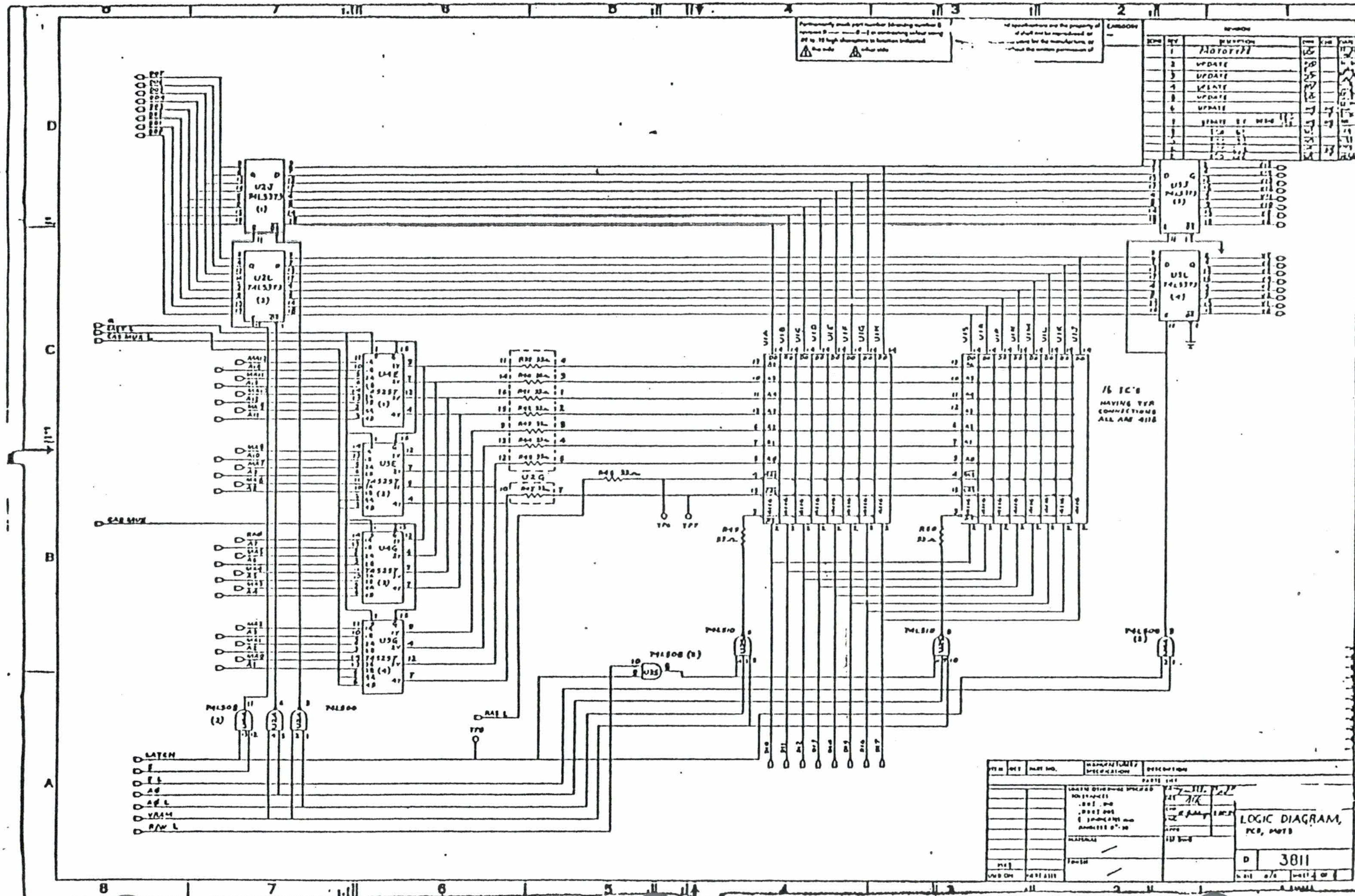

1A 1B 1C 1D 1E 1F 1G 1H 1J 1K 1L 1M 1N 1P 1R 1S
2B 2D 2E 2G 2J 2L 2N 2R 2S
3B 3D 3E 3G 3J 3L 3N 3R 3S
4B 4D 4E 4G 4J 4L 4N 4S
DIP6
5G
5L
5N
4R
5R
C20
C16
VR2
6B
6G
6L
6N
6R
XTAL 1
C1
XTAL 2
7B
7G
7J
7L
7N
7P
7S
8P
8B 8D 8E 8G 8J 8L
9B 9D TD1 9J 9L DIP5
DIP1
R51
R57
10N
DIP3 10D DIP2 DIP4
OPT
J2
C17
C18
C19
C15
C21
TP1
TP2
TP3
TP4
TP5
TP6
TP7
TP8
C
X
TV
R
G
B



LOGIC DIAGRAM
D 3011

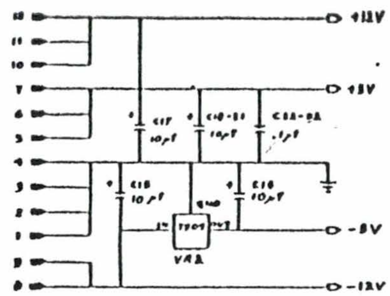

U5L
MK36000
U6L
MK36000
OR
MCM68764
U7L
TMS 2716
(MCM68A316E)
U5G
MC6845
ROM ØL
ROM 1 L
EPROM L
VSYNC L
CRTC L
R/W
E
RESET L
MA13
MA12
MA11
MA10
MA9
MA8
MA7
MA6
MA5
MA4
MA3
MA2
MA1
MA0
RA0
VS
HS
DISPLAY EN
BLINK L
CASMUX
CASMUX L
CAST L
RAS L
LATCH
UBJ
74LS390
74LS08 (1)
74LS74 (1)
74LS04 (1)
74LS00 (1)
LOGIC DIAGRAM
D
3811
PROTOTYPE
UPDATE


U7G
MC 68A21
U7B
MC 68A50
U6B
1441
74LS157 U8D
UBG
U8E
Q4
2N2222
RESET L
IRQ L
VP
ALPHA/GRAPH
REMOTE (D.I.P.)
MODEM (D.I.R.)
RS DATA L
TX DATA L
DIP 6
TV
P1 KEYBOARD
P2 HOST INTERFACE
MOTOTYPE
UPDATE
ECO 134
ECO 212
LOGIC DIAGRAM
PCB, MPTB
3811


U2J
74LS373
U2L
74LS373
U4E
U3E
U4G
U3G
74S257
U2G
16 IC'S
HAVING TYP
CONNECTIONS
ALL ARE 4116
U3J
74LS373
U3L
74LS373
74LS08
74LS00
74LS10
LATCH
VRAM
R/W L
CAS MUX
RAS L
Motorola
UPDATE
LOGIC DIAGRAM,
PCB, MOTO
D
3811

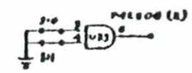
ECN	REV	DESCRIPTION			
	1	PROTOTYPE			
	2	UPDATE			
	3	UPDATE			
	4	UPDATE			
	5	UPDATE			
	6	UPDATE			
	7	UPDATE [illegible]			
	8	ECO [illegible]			
	9	ECO [illegible]			
	A	ECO 106			
	B	ECO 111			

MOLEX PWR CONNECTOR J2



SPECIAL PARTS - POWER					
PARTS	+5V	+12V	-12V	-5V	GND
1488		14	1		7
1489	14				7
4116	9	8		1	16
68A09	7				1
68A21	20				1
68A45	20				1
68A50	12				1
8T28	16				8
2716*	24	18		21	12
14411	24				12
MK36000	24				12
93446	16				8

* THE 2716 HAS JUMPERS IN CERTAIN SUPPLY LINES. SEE SCHEMATIC



NOTES:

1 – THE 4116'S ARE DECOUPLED WITH 2 - .1µf CAPACITORS PER CHIP. ONE ON THE +12V AND THE OTHER ALTERNATELY ON + OR -5V.
2 – REGULAR TTL AND "LS" IS DECOUPLED WITH ONE .1µf CAP PER TWO CHIPS.
3 – "S" TTL AND ALL OTHER CHIPS ARE DECOUPLED WITH .1µf CAPACITORS TO GROUND ON EACH OF THEIR SUPPLIES
4 – CARE SHOULD BE TAKEN WITH THE TAB OF THE 7905. IT CONNECTS DIRECTLY TO THE -12 INPUT VOLTAGE.
5 – THERE SHOULD BE APPROX. 4 – 10µf ELECTROLYTIC CAPACITORS DISTRIBUTED OVER THE BOARD FOR +5 VOLTS.
6 – DASHED LINES AROUND RESISTORS INDICATE THEY ARE PART OF A PACKAGED DIP
7 – 10µf ELECTROLYTIC DECOUPLING CAPACITORS ARE NUMBERED C18-31 INCLUSIVE
8 – .1µf CERAMIC DECOUPLING CAPACITORS ARE NUMBERED C32-105 INCLUSIVE

LAST
R = 19
J = 8
P = 3
A = 11
C = 16
U = 11
RLY = 2
D = 3
VR = 2
SW = 8
TP = 8

UNUSED
Q 12
R 17

ITEM	QTY	PART NO.	MANUFACTURER/SPECIFICATION	DESCRIPTION

PARTS LIST

UNLESS OTHERWISE SPECIFIED TOLERANCES .XX ± .010 .XXX ± .005 ∠ ± ANGLES 0°-30'

MATERIAL

FINISH

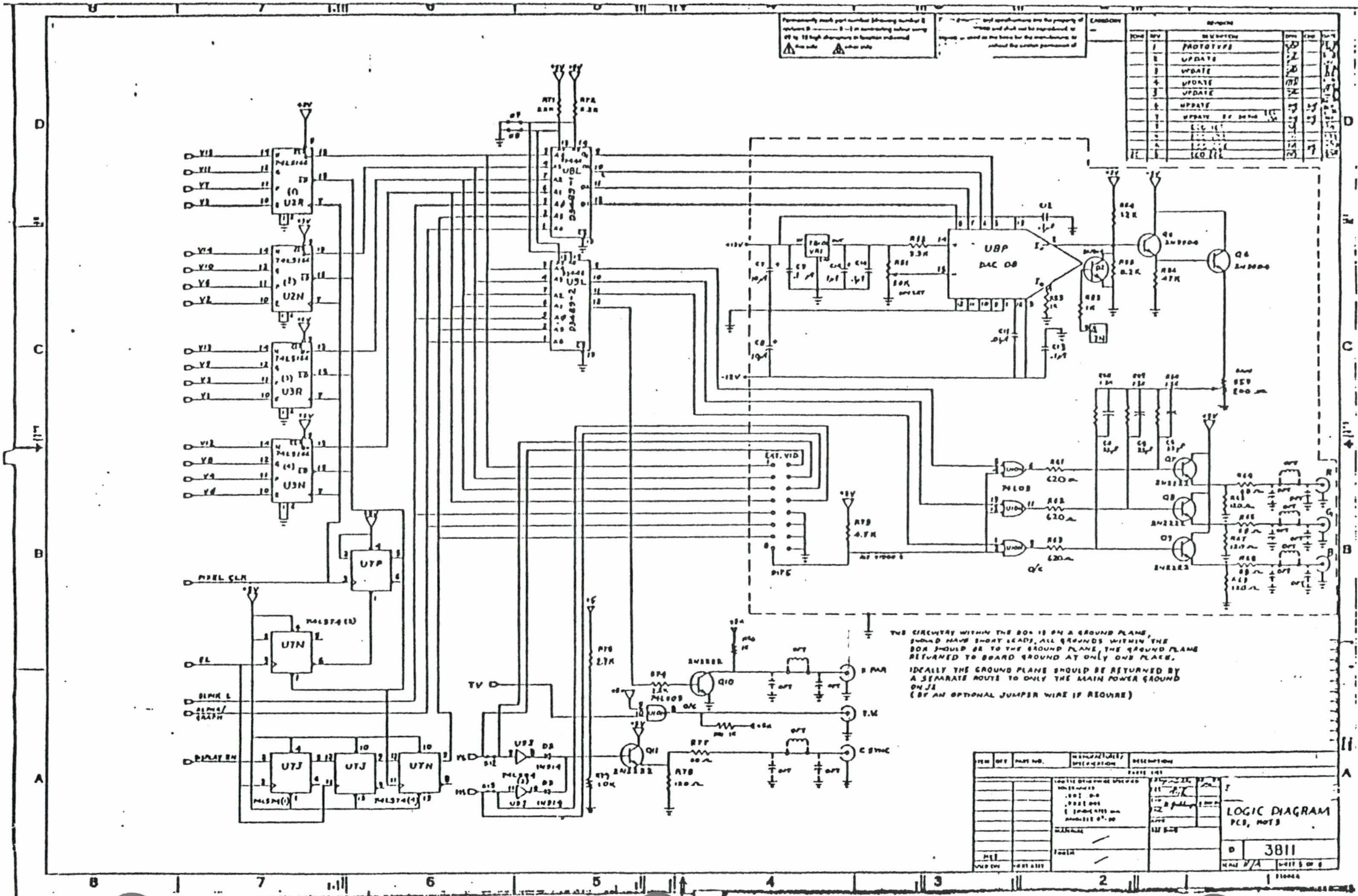
USED ON

NEXT ASSY

LOGIC DIAGRAM
PCB, MOTS

D 3811

SCALE N/A SHEET 8 OF [illegible]


U2R
U2N
U3R
U3N
U8L
U9L
U8P
DAC 08
U7P
U7N
U7J
EXT. VID
PIXEL CLK
TV
74LS174
74LS164
74LS08
R.PAR
C SYNC
LOGIC DIAGRAM
PCB, MOT3
3811
THE CIRCUITRY WITHIN THE BOX IS ON A GROUND PLANE, SHOULD HAVE SHORT LEADS, ALL GROUNDS WITHIN THE BOX SHOULD BE TO THE GROUND PLANE, THE GROUND PLANE RETURNED TO BOARD GROUND AT ONLY ONE PLACE.
IDEALLY THE GROUND PLANE SHOULD BE RETURNED BY A SEPARATE ROUTE TO ONLY THE MAIN POWER GROUND ON J1
(BY AN OPTIONAL JUMPER WIRE IF REQUIRE)

PARTS LIST

DESCRIPTION	MANUFACTURER	COMMERCIAL NUMBER	CIRCUIT REFERENCE
IC,TTL,7400,NAND,2INPUT	FAIRCHILD MFG	7400PC	U7S
IC,TTL,74LS00,NAND,2INPUT	FAIRCHILD MFG	74LS00PC	U29
IC,TTL,74LS03,NAND,2INPUT,OC	FAIRCHILD MFG	74LS03PC	U10N
IC,TTL,7404,HEX,INVERTER	FAIRCHILD MFG	7404PC	U2D,U4D
IC,TTL,74LS04,HEX,INVERTER	FAIRCHILD MFG	74LS04PC	U9J,U3B
IC,TTL,74LS08,AND,2INPUT	FAIRCHILD MFG	74LS08PC	U3S,U4B
IC,TTL,74LS10,NAND,3INPUT	FAIRCHILD MFG	74LS10PC	U2S
IC,TTL,74LS74,FLIP,FLOP,DUAL,D	FAIRCHILD MFG	74LS74PC	U7P,U2E,U7N,U7J
IC,TTL,74S74,DUALD,FLIP,FLOP	FAIRCHILD MFG	74S74PC	U3D
IC,TTL,74LS157,QUAD,2INPUT,MPX	FAIRCHILD MFG	74LS157PC	U8D
IC,TTL,74LS166,8BIT,SHIFT,REG	FAIRCHILD MFG	74LS166PC	U2N,U3N,U2R,U3R
IC,TTL,74LS244,OCTAL,BUSDRIVER	FAIRCHILD MFG	74LS244PC	U5R,U4R
IC,TTL,74LS245,OCTAL,TRANSCEIV	FAIRCHILD MFG	74LS245PC	U4S
IC,TTL,74S257,QUAD,2INPUT,MPX,	FAIRCHILD MFG	74S257PC	U4E,U3E,U3G,U4G
IC,TTL,74LS367,HEX,BUSDRIV,TRI	FAIRCHILD MFG	74LS367PC	U6R
IC,TTL,74LS373,OCTAL,LATCH	FAIRCHILD MFG	74LS373PC	U3J,U3L,U2J,U2L
IC,TTL,74LS390,DUAL,DECADE,COU	FAIRCHILD MFG	74LS390PC	U8J
IC,UP,68A09,8BIT,MICRO,1.5MHZ	MOTOROLA MFG	MC68A09	U6G
IC,UP,68A21,PERIPHERAL,I/O	MOTOROLA MFG	MC68A21	U7G
IC,UP,68A45,CRTC	MOTOROLA MFG	MC68A45	U5G
IC,UP,68A50,ACIA	MOTOROLA MFG	MC68A50	U7B
IC,DIG,CMOS,MC14411,BIT-RATE,F	MOTOROLA MFG	MC14411	U6B
IC,INTF,DIG,QUAD,75188,RS232,D	MOTOROLA MFG	MC1488	U8B,U9B
IC,INTF,DIG,QUAD,75189,RS232,R	MOTOROLA MFG	MC1489	U9D,U10D
IC,INTF,DIG,8T28QUAD,BUSTRANS	NO VENDOR FOUND	NO COMM. P/N FOUND	U4L,U4J
IC,RAM,4116,16KX1,150,1375NS	MOTOROLA MFG	MCM4116BP-15	ALL U1'S
TRANSISTOR,NPN,TO-18	HAMILTON AVNET M	2N914	Q2
TRANSDUCER,3-12V,40MA,260OHM,7	PANASONIC MFG	A14R06C	TD1
XTAL,1.8432MHZ,.02%,H17W	CTS MFG	MP018	XTL2
XTAL,10.739MHZ	CTS MFG	S1032-2-BA	XTL1
IC,DAC,8BIT,135NS,MULTIPLYING	NATIONAL MFG	DAC080QLCN	U8P
IC,REG,8V,TO-92	MOTOROLA MFG	MC78L08	VR1
IC,REG,-5V,TO-220	TO BE INPUT AT L	LM7905C	VR2
DIODE,SIGNAL,DO-35	HAMILTON AVNET M	1N914	D1,D2,D3
TRANSISTOR,NPN,TO-18	HAMILTON AVNET M	2N2222	Q4,Q7-11
TRANSISTOR,NPN,TO-92	HAMILTON AVNET M	2N3904	Q1,5,6
TRANSISTOR,PNP,TO-92	HAMILTON AVNET M	2N3906	Q3
CONN,D/SUB,15PIN,FEMALE	CANNON MFG	DA15S	P1
CONN,D/SUB,25PIN,MALE	CANNON MFG	DB25P	P2
CONN,BNC,RECEP,ISOLATED	AMPHENOL MFG	31-010	S,X,TV,R,G,B
CONN,WAFER,.156,12PIN,MALE,R.A	MOLEX MFG	09-88-2121	J2
CONN,SOCKET,IC,24P,DIP,LOW,TIN	CAMBION MFG	703-5324-01-04-12	U5L,U6L,U7L
CONN,SOCKET,IC,16P,DIP,TIN,CLI	ROBERTSON-NUGENT	ICN-163-S3-T	DIP3,4
RES,VAR,50K,10T,1/4W,CER,TOP	BECKMAN MFG	68WR50K	R51
RES,VAR,200/OHM,10T,1/4W,CER,T	BECKMAN MFG	66WR200	R57
RES,FIXED,33/OHM,TRANS,16PIN,D	ALLEN BRADLEY MF	316B330	U2G
RES,FIXED,4.7K,PULLUP,16PIN,DI	ALLEN BRADLEY MF	316A472	U6N
RES,FIXED,10K/OHM,PULLUP,16PIN	ALLEN BRADLEY MF	316A103	U8G
RES,FIXED,1/OHM,5%,1/4W,CAR	PHILIPS MFG	CR25TOLS/1 OHM	R32,R33
RES,FIXED,33/OHM,5%,1/4W,CAR	PHILIPS MFG	CR25TOLS/33 OHM	R46,49,50
RES,FIXED,68/OHM,5%,1/4W,CAR	PHILIPS MFG	CR25TOLS/68 OHM	R64,R68,R66,R77
RES,FIXED,100/OHM,5%,1/4W,CAR	PHILIPS MFG	CR25TOLS/100 OHM	R38,80
RES,FIXED,120/OHM,5%,1/4W,CAR	PHILIPS MFG	CR25TOLS/120 OHM	R65,67,69,78
RES,FIXED,220/OHM,5%,1/4W,CAR	ALLEN BRADLEY MF	CB-221-5	R17
RES,FIXED,620/OHM,5%,1/4W,CAR	PHILIPS MFG	CR25TOLS/620 OHM	R61,62,63
RES,FIXED,470/OHM,5%,1/4W,CAR	PHILIPS MFG	CR25TOLS/470 OHM	R1,2
RES,FIXED,1K/OHM,5%,1/4W,CAR	ALLEN BRADLEY MF	CB-102-5	R13,R53,81,82,79,83
RES,FIXED,1.3K/OHM,5%,1/4W,CAR	PHILIPS MFG	CR25TOLS/1.3K	R58,59,60
RES,FIXED,2.2K/OHM,5%,1/4W,CAR	PHILIPS MFG	CR25TOLS/2K2	R5,6,14,15,16,18, 19,71,72,74
RES,FIXED,3.3K/OHM,5%,1/4W,CAR	PHILIPS MFG	CR25TOLS/3K3	R52
RES,FIXED,4.7K/OHM,5%,1/4W,CAR	ALLEN BRADLEY MF	CB-472-5	R3,4,48,73,76
RES,FIXED,10K/OHM,5%,1/4W,CAR	ALLEN BRADLEY MF	CB-103-5	R34
RES,FIXED,47K/OHM,5%,1/4W,CAR	PHILIPS MFG	CR25TOLS/47K	R56
RES,FIXED,15M/OHM,5%,1/4W,CAR	PHILIPS MFG	CR25TOLS/15M OHM	R20
RES,FIXED,1.2K/OHM,5%,1/4W,CAR	PHILIPS MFG	CR25TOLS/1K2	R54
RES,FIXED,2.7K/OHM,5%,1/4W,CAR	ALLEN BRADLEY MF	CB-272-5	R75
RES,FIXED,8.2K/OHM,5%,1/4W,CAR	PHILIPS MFG	CR25TOLS/8K2	R55
CAP,CER,RADIAL,560PF,10%,1000V	CENTRALAB MFG	DD-561	C97
CAP,CER,RADIAL,0.01UF,20%,50V	ERIE MFG	8121-050-651-103M	C11
CAP,CER,RADIAL,0.1UF,20%,50V,Z	ERIE MFG	8121-050-Z5U-104M	C9,C10,C12,C13 C22-71,C73-95
CAP,TANT,RADIAL,1UF,20%,35V	ITT MFG	TAG1.0M35	C2,14
CAP,ALUM,AXIAL,10UF,50/10%,50V	SIEMENS MFG	B41313-A5106-T	C7,8,15,16-21
PROG,EPROM,MK3,PDI+,COMMON,8K#	NORPAK LTD	36-05383-02	U5L
PROG,EPROM,MK3,PDI+,COMMON,8K#	NORPAK LTD	36-05383-01	U6L
PROG,EPROM,MK3,PDI+,2K,60HZ	NORPAK LTD	36-05382-01	U7L
PROG,ROM,RGB,DECODER,1	NORPAK LTD	36-03489-01	U8L
PROG,ROM,RGB,DECODER,2	NORPAK LTD	36-03487-02	U9L
PROG,ROM,ADDRESS,DECODER	NORPAK LTD	36-03488-01	U5N
PROG,ROM,ADDRESS,DECODER	NORPAK LTD	36-03408-02	U4N
CONN,SOCKET,CLIP,16P,RETAINING	ROBERTSON-NUGENT	RC-76	DIP3,4
CONN,SCREW,LOCK,D/SUB,FEMALE	AMP MFG	205817-1	P1,P2
CAP,CER,RADIAL,33PF,10%,1K,52L	CENTRALAB MFG	DD-330	C1,4-6
CAP,CER,RADIAL,220PF,10%,1000V	CENTRALAB MFG	DD-221	C96
COIL,FIXED,2.2UH,10%	DELEVAN MFG	1537-20	L1
CAP,CER,RADIAL,4700PF,10%,100V	ERIE MFG	CK05BX472K	F1
CAP,CER,RADIAL,270PF,10%,1000V	CENTRALAB MFG	DD-271	C3

CHAPTER 3
SOFTWARE DESCRIPTION

INTRODUCTION

This chapter is divided into two sections. The first section provides details of the keypad or keyboard code functions, code entry and the screen header page. The second section provides a description of picture description instructions. The description is a condensed version of the data available through the CRC Technical Note No. 709 referenced in Appendix B, and should provide sufficient information to satisfy the needs of most users.

FUNCTION CODES

The function codes that manipulate the data base are listed in Table 4, which provides the hexadecimal code, its symbol and data base instruction.

Table 4 Function Codes

CODE	SYMBOL	FUNCTION
* E0		TV or Telidon (default) mode. The code will clear video screen to black, set XPAR and TV signal low, and deactivates DTR on the RS-232 interface. If the code is issued twice, it sets DTR, TV and XPAR high and displays the header page.
E1		-
E2	//	Resend current page (redisplay)
E3	<	Display previous page
E4	1	
E5	4	
E6	7	
E7	F	A database requirement
E8		-
E9		-
* EA	▭	Erase displayed page
EB	>	Display next page
EC	2	
ED	5	
EE	8	
EF	0	
F0	S	Transmits F5 "Proceed"
F1		-
* F2	▽	Pause
F3	^	Display previous index
F4	3	
F5	6	
F6	9	
F7	.	
F8	R	Transmits F6 "Proceed"
F9		-
FA	⌫	Clears all entries since last "Proceed"
FB		-
FC		-
FD		-
FE		-
FF	⊡	Proceed (entry terminator)

Notes: - = not used
* = not locally echoed

CODE ENTRY

Keypad

Except for the codes for TV, [illegible] and V (E0, EA and F2) all the codes are echoed locally as entered and displayed as a character, digit or symbol in the bottom left corner of the screen.

The digits 0 to 9 and page movement symbols F, ., <, >, // and ^ are record activated; that is, they are echoed on screen as entered, but are not transmitted through the serial port until [illegible] (Proceed) is entered.

Keyboard

If a keyboard is used, there is no local echo of the characters. The codes are as defined in the 7-bit ASCII table, Figure 5, and the MSB is zero. Transmissions are character activated; that is, each character is transmitted as its relevant key is pressed.

HEADER PAGE

When the EO code is issued twice the screen will display a header page in the format shown below. The screen will clear, then display a black screen with a white line border with 16 rectangles across the bottom of the bordered area. The leftmost rectangle will display black, followed by six shades of gray, then white, then blue, red, magenta, green, cyan, yellow, blinking white and XPAR. The product name, software number and version level are displayed to the right of the colour bar. After a few seconds the screen clears and the system is ready for use.

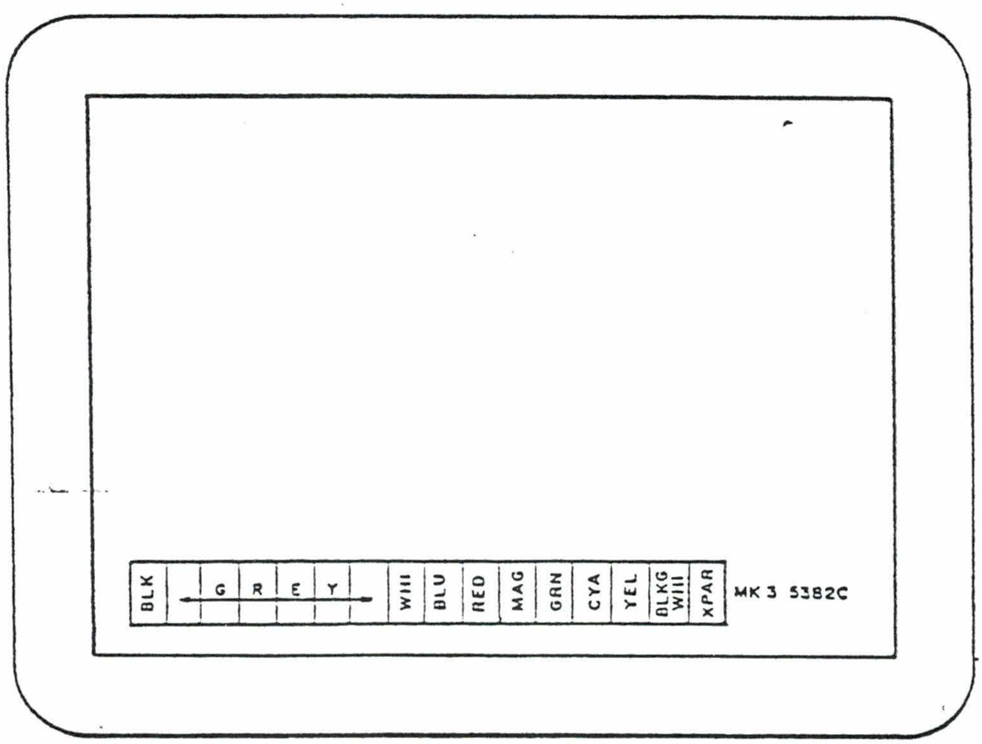


Figure 4 Header Page

PICTURE DESCRIPTION INSTRUCTIONS

INTRODUCTION

This section describes the method of storing and communicating visual images and textual information through the use of Picture Description Instructions, and associated data, such that the resolution of stored images is virtually independent of terminal configurations, communication networks and data base construction.

The storing and communication protocol is a major subset of the North American Videotex coding standard adopted in principle by the American National Standards Institute (ANSI) and the Canadian Standards Association (CSA). It represents the interim level of implementation specified by the Canadian Videotext Consultative Committee (CVCC).

Pictures are essentially described by a set of geometric drawing primitives (such as point, line, arc) specified in various locations in the picture to be displayed. Similarly, text is described as a group of charactars to be displayed at certain locations on the screen. Therefore, PDIs can describe practically all textual and graphical images.

Only a few basic instructions, each with numeric operands, are needed to describe practically all graphic images. These basic geometric primitives were chosen because of their simplicity and their ability to define practically all image types.

A command is also required to change from graphic to alphanumeric mode for textual messages. This function is performed by the Shift In (SI) command from a set of control codes universally used in the transmission of textual messages. Similarly, the Shift Out (SO) control code is used to change back to the graphics mode. The alphanumeric mode is the mode of operation entered by default, or the way in which a terminal should operate when first switched on. In this way, a subset of the PDI code can be used for business or simple alphanumeric terminals which may only respond to textual information.

CODING

The (CRDG) PDI instructions are a set of codes operating in the 7-bit environment. TEXT is defined by CSA Standard Z 243.4.-1973 (identical to ASCII). The ASCII code table is shown in Figure 5. The code is defined to include the code table positions 2/0 and 7/15 within the definitions of the individual code tables. The nomenclature N/n indicates a single character from column N, row n; e.g., 1/11 is ESC. The characters in columns 0 and 1 surrounded by a heavy black border are reserved for communication transmission protocol. Only the controls DC1 (flow control pause) and DC3 (flow control resume) have an effect on the terminal. The shaded characters in columns 2 to 7 are those that may vary between national versions of this code table. (In Canada, an alternate code table can be defined where these characters are replaced by French characters.)

Figure 6 shows the code extension technique used to establish alternate meanings for the 7-bit code combinations.

In the alpha-geometric coding, the display is composed of pictorial drawings that are defined as geometric primitives transmitted to the terminal as drawing commands.

Geometric Primitives

The pictorial coding scheme is based on geometric primitives. Each drawing primitive is specified as cartesian coordinates to describe the positions, end-points, or vertices of each drawing operation. Geometric drawings are defined as the drawing primitives: POINT, LINE, ARC, RECTANGLE and POLYGON.

Drawing Position

Drawings are positionally independent, therefore, drawing primitives may overlay each other and redefine the drawing at that position.

				b_7	0	0	0	0	1	1	1	1
				b_6	0	0	1	1	0	0	1	1
				b_5	0	1	0	1	0	1	0	1
b_4	b_3	b_2	b_1	column / row	0	1	2	3	4	5	6	7
0	0	0	0	0	NUL	TC_7 (DLE)	SP	0	@	P	`	p
0	0	0	1	1	TC_1 (SOH)	DC_1	!	1	A	Q	a	q
0	0	1	0	2	TC_2 (STX)	DC_2	"	2	B	R	b	r
0	0	1	1	3	TC_3 (ETX)	DC_3	#	3	C	S	c	s
0	1	0	0	4	TC_4 (EOT)	DC_4	$	4	D	T	d	t
0	1	0	1	5	TC_5 (ENQ)	TC_8 (NAK)	%	5	E	U	e	u
0	1	1	0	6	TC_6 (ACK)	TC_9 (SYN)	&	6	F	V	f	v
0	1	1	1	7	BEL	TC_{10} (ETB)	'	7	G	W	g	w
1	0	0	0	8	FE_0 APB (BS)	CAN	(	8	H	X	h	x
1	0	0	1	9	FE_1 APF (HT)	SS2 (EM)	)	9	I	Y	i	y
1	0	1	0	10	FE_2 APD (LF)	SUB	*	:	J	Z	j	z
1	0	1	1	11	FE_3 APU (VT)	ESC	+	;	K	[	k	{
1	1	0	0	12	FE_4 CS (FF)	IS (FS)	,	<	L	\	l	|
1	1	0	1	13	FE_5 APR (CR)	SS3 IS (GS)	-	=	M	]	m	}
1	1	1	0	14	SO	IS APH (RS)	.	>	N	^	n	‾
1	1	1	1	15	SI	IS (US)	/	?	O	_	o	DEL

Figure 5 ASCII Code Table

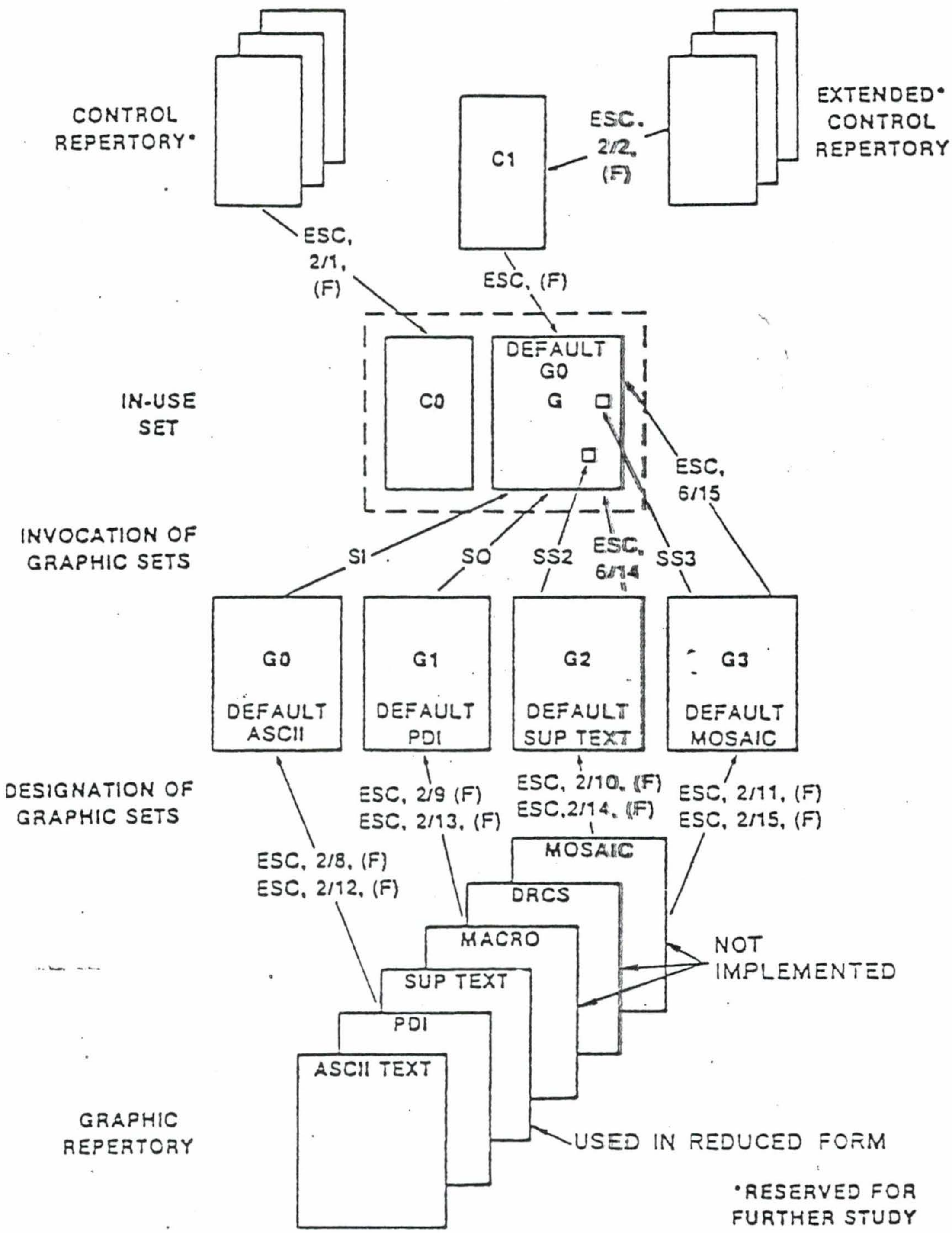


Figure 6 Code Extension in a 7-Bit Environment

Coordinate System

The coordinate specifications are based on a Cartesian 0 to 1 numbering scheme.

The numbering system is referenced to the display screen and consists of coordinates ranging from 0 to 1 in both x and y axes, with coordinate values being specified as fractions of this range. The coordinates are encoded in two's complement notation and specified as signed numbers to a minimum accuracy of 3 bits, including the sign bit. Increased accuracy is obtained by additional increments of 3 bits. Unused least significant bits are truncated when the coordinates are defined to a greater accuracy than can be handled by the terminal.

The display for television screens which have non-square visible areas map into the square drawing area number system so that the origin (0,0) remains in the lower left corner within the screen margins. On a television-like display with a 4:3 aspect ratio, this corresponds to a range of 0 to 0.99 in the x axis, and 0 to approximately 0.75 in the y axis. Drawing commands addressing the entire square 0 to 1 grid are permissible, but only the circumscribed 4:3 area is visible.

Picture Resolution

Any number of physical picture elements may be implemented. Hence, picture resolution depends on terminal manufacturers. The resolution implemented on the colour raster generator is 256 pixels in the x axis and 200 in the y axis.

DRAWING COMMANDS

General

Drawing commands consist of Operational Codes (opcodes) and their associated parameters.

Opcodes describe the types of drawing operation. Following the opcode byte is one block, or more, of additional bytes of data to describe one or more (x,y) coordinate positions. Each block of data for the (x,y) coordinates normally (by default) contains 3 bytes (9 bits accuracy), however, from 1 to 8 bytes may be used depending on the degree of resolution desired.

Figure 7 shows the code table for the opcodes and numeric data bytes.

b4	b3	b2	b1	column / row	0	1	2	3	4	5	6	7
				b7	0	0	0	0	1	1	1	1
				b6	0	0	1	1	0	0	1	1
				b5	0	1	0	1	0	1	0	1
0	0	0	0	0			CONTROL	RECT	NUMERIC DATA			
0	0	0	1	1								
0	0	1	0	2								
0	0	1	1	3								
0	1	0	0	4			POINT	POLY				
0	1	0	1	5								
0	1	1	0	6								
0	1	1	1	7								
1	0	0	0	8			LINE	INCREMENT				
1	0	0	1	9								
1	0	1	0	10								
1	0	1	1	11								
1	1	0	0	12			ARC	CONTROL				
1	1	0	1	13								
1	1	1	0	14								
1	1	1	1	15								

No esc needed

Figure 7 Operation Code and Data Field Assignments

Opcode Byte

The structure of the opcode byte is shown in Figure 8.

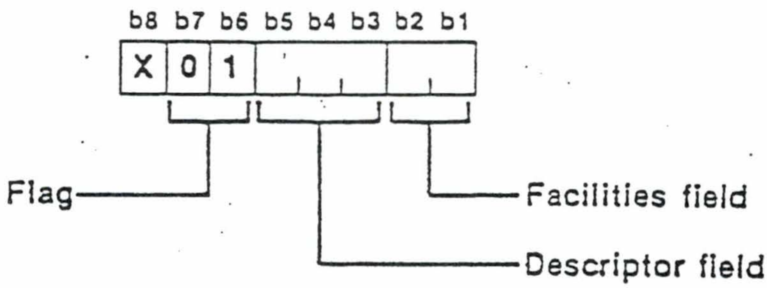


Figure 8 8-bit Opcode Byte

Opcode Definitions

POINT -sets the drawing point to any position in the display space and optionally draws a dot.

LINE -draws a line based on the two given end points.

ARC -draws a circular arc based on three points; the start point, a point on the arc and the end point of the arc. A circle results when the start and end points are coincidental and the point on the arc defines the opposite end of the diameter. If only 2 points are transmitted then a circle is drawn in which the end point is assumed to be identical to the first point. If additional numeric data is transmitted beyond the end point of the arc, then a curvilinear spline is drawn, with each operand treated as a point on the spline and given as a relative displacement from the last point. The arc (spline) may be drawn either in outline, or the area enclosed by the arc (spline) and the chord may be filled

RECTANGLE - draws a rectangle based on a specified width and height. The rectangle may be in outline or may be a filled-in area.

POLYGON -draws a closed polygon or arbitrary shape specified by the vertices. The polygon may be in outline or may be a filled-in area. The maximum number of vertices is limited to 255. 25

CONTROL - provides control over the modes or attributes of the drawing commands.

OPCODE FACILITIES

Each geometric primitive opcode has four variants; these are defined by the facility bits (b2 and b1) as shown in Figure 9. Facility field interpretations are given below.

OPCODE	FLAG b8	b7 b6	DESCRIPTOR FIELD b5 b4 b3	b2 0	b2 1	b1 0	b1 1
CONTROL	X	01	000				
POINT	X	01	001	INVS	VIS	ABS	REL
LINE	X	01	010	JOIN	SET	ABS	REL
ARC	X	01	011	JOIN	SET	OUTLINE	FILL
RECTANGLE	X	01	100	JOIN	SET	OUTLINE	FILL
POLYGON	X	01	101	JOIN	SET	OUTLINE	FILL
INCREMENTAL	X	01	110				
CONTROL	X	01	111				

(FACILITY FIELD: b2, b1)

Figure 9 Opcode Facilities

<u>If b2 is binary 1</u>

a) POINT — a visible point is drawn on the display screen.

b) LINE, ARC, RECTANGLE, POLYGON — the initial drawing position is specified within the data bytes as absolute (x,y) coordinates, i.e., the initial point is Set.

<u>If b2 is binary 0</u>

a) POINT — an invisible point is located on the display screen.

b) LINE, ARC, RECTANGLE, POLYGON — the initial drawing position is the same point as the final drawing position of the previous opcode, i.e., the current drawing is joined to the previous drawing.

<u>If b1 is binary 1</u>

a) POINT — the (dx,dy) coordinates are relative displacements to the preceding coordinate specifications.

b) LINE — the (dx,dy) coordinates for the final drawing position of a line segment are relative displacements from the initial drawing position of that line segment.

c) ARC, RECTANGLE, POLYGON — the interior areas established are filled.

<u>If b1 is binary 0</u>

a) POINT — the (x,y) coordinates of the point are absolute values.

b) LINE — the (x,y) coordinates of the final drawing position of the line segment are absolute values.

c) ARC, RECTANGLE, POLYGON — the drawings are outlined.

OPCODE NUMERIC DATA

The numeric data bytes associated with an opcode immediately follow the opcode byte and are recognized when the flag bit (b7) is binary 1. Any number of blocks of data bytes defining pairs of coordinates or drawing displacements may follow the drawing opcode. Any presentation level code other than from the numeric data portion of the code table terminates the sequence of data blocks. Transmission level codes have no effect at the presentation level as they should have been removed by lower layer processes.

The default number of data bytes that forms a block that defines a pair of x,y coordinates is 3. The structure of the data block is shown in Figure 10.

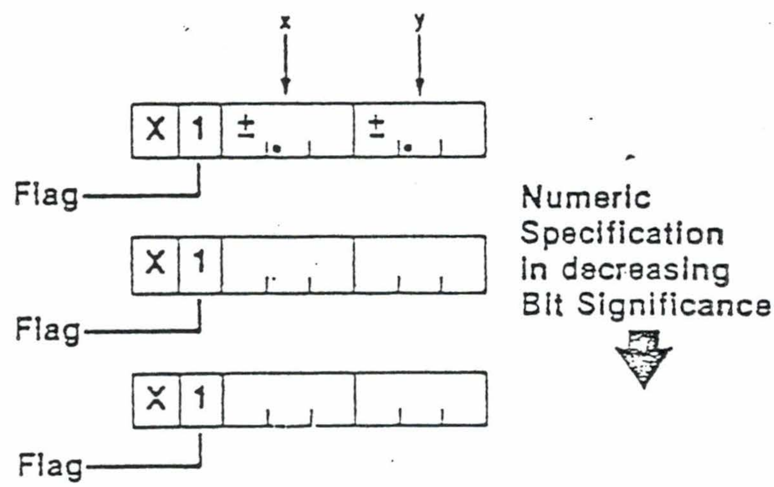


Figure 10 Structure of a Block of 3 Data Bytes

REPEATED OPCODE OPERATION

For each of the POINT, LINE and RECTANGLE opcodes, repeated drawing operations will automatically be effected if the numerical data field following the opcode byte contains more than one complete set of coordinate specifications. The repeated drawing feature allows concatenated drawings to be effected without having to repeat the opcode.

FIELD

The FIELD PDI establishes a rectangular active drawing area (field) on the screen, which is used by commands such as Text. The first block of data following the opcode gives the coordinates of the origin of the rectangular active drawing area. The next (and last) block of data gives the dimensions of the field as dx and dy. After a Field PDI is executed, the current drawing point is set to the origin point of the area.

GEOMETRIC CONTROL OPCODES

General

The Control opcodes establish the display attributes and drawing states of the terminal for subsequent pictorial drawing, text or other presentation level commands. The eight Control opcodes are given in Figure 11.

RESET is used to selectively reinitialize the drawing state and attribute parameters and to perform the function of clearing the display screen and other defined tables.

DOMAIN is used to establish operand parameter length and the logical pixel size.

TEXT is used to control parameters related to the attributes of TEXT characters.

TEXTURE provides control of texture attributes that determine the method of filling areas for subsequent drawing commands and that determine the texture for lines and outlines.

SET COLOUR specifies colour values for use in drawing commands or for insertion into the colour map.

WAIT causes a delay of a specific time in processing data.

Select - Colour

Blink

OPCODE	b8-	b7- b6- FLAG	b5- b4- b3- DESCRIPTOR FIELD	b2- b1- FACILITY FIELD	
RESET	X	01	000	00	32
DOMAIN	X	01	000	01	33
TEXT CONTROL	X	01	000	10	34
TEXTURE	X	01	000	11	35
SET COLOUR	X	01	111	00	60
WAIT	X	01	111	01	61
SELECT COLOUR	X	01	111	10	62
BLINK	X	01	111	11	63

Figure 11 Control Opcodes

Attributes

A number of drawing attributes may be applied to the drawing commands, and where appropriate, to the other text and graphic commands. Attributes are defined by appropriately coded sequences as described below. Once an attribute is defined, it remains valid until the attribute is redefined or cleared to its default state. In the implementation of attributes, the levels of sophistication and complexity are left to the discretion of the implementer.

Domain

The integer value of bits b1 and b2 of the first byte of the operand (plus one) gives the length of subsequent single-value operands (such as colour map table addresses) in bytes. The integer value of bits b3, b4, b5, of the first byte of the operand (plus one) gives the length of subsequent multi-value operands (such as coordinate specifications) in bytes.

Bit 6 of the first byte of the operand gives the dimensionality of the coordinate specification. Zero indicates two dimensional (2D) mode, and one indicates three dimensional (3D) mode. The definition of 3D mode is reserved for further study and the card defaults to 2D mode.

If an operand is shorter than the specified operand length, then the operand is padded with zeros. If the operand is longer than the specified operand length, then the command is repeated with the subsequent numeric data taken as the new operand.

Text

Bits 1 and 2 of the first byte of the operand determine the rotation of text characters, as shown in the table below and in Figure 12.

b2	b1	Rotation (degrees)	
0	0	0	(default)
0	1	90	
1	0	180	
1	1	270	

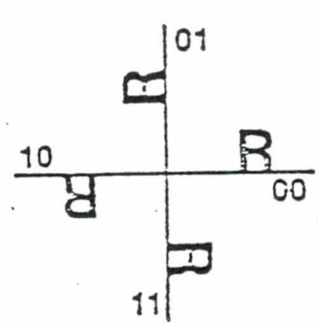


Figure 12 Character Rotation

Bits 3 and 4 of the first byte determine the direction of the text cursor path, as follows:

b4	b3	cursor movement
0	0	right (default)
0	1	left
1	0	up
1	1	down

Bits 5 and 6 of the first byte determine the inter-character spacing in units of the character field dimension lying parallel to the character path, as follows:

b6	b5	inter-character spacing
0	0	1 (default)
0	1	1.25
1	0	1.5
1	1	proportional spacing

Bits 1 and 2 of the second byte determine the inter-row spacing in units of the character field dimension lying perpendicular to the character path, as follows:

b2	b1	inter-row spacing
0	0	1 (default)
0	1	1.25
1	0	1.5
1	1	2

Bits 3 and 4 of the second byte determine the relationship between movement of the text cursor and movement of the graphics drawing point, as follows:

b4	b3	move parameters
0	0	move together (default)
0	1	cursor leads
1	0	drawing point leads
1	1	move independently

Bits 5 and 6 of the second byte determine the cursor display style, as follows:

b6	b5	cursor style
0	0	underscore (default)
0	1	block
1	0	cross hair
1	1	custom (manufacturer defined)

The remaining bytes specify the dimensions of the character field dx (width) and dy (height). This continuous text size specification maps to the nearest available size.

The supplementary character set of accents and diacritical marks can provide the ability to accent any text character by using the non-spacing accents specified below:

\`(4/1) ´(4/2) ^(4/3) ~(4/4) ¨ (4/8) ,(4/11)

In addition, these spacing characters can be implemented:

¡ (2/1) ¿ (3/15) << (2/11) >> (3/11)

These characters reside by default in code table G2 and can be accessed by the SS2 code (1/9 in CO set) followed by the code indicated above.

Figure 13 illustrates a range of text sizes that can be established based on only two character shape tables which differ by a factor of approximately 1.5, and the double and half size of each. This provides a psychologically pleasing aproximation to a continuous range of character sizes.

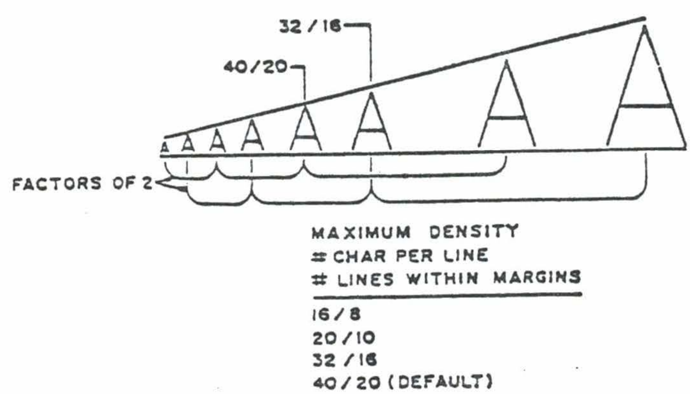


Figure 13 Discrete Text Sizes

The text character origin is located at the bottom left of the full character font, below any danglers, and not at the base of the upper case character.

Texture

Bits 1 and 2 of the first byte of the operand determine the line texture attributes as follows:

b2	b1	line texture
0	0	solid (default)
0	1	dotted
1	0	dashed
1	1	dot dashed

The line texture pattern is referenced to the absolute coordinate grid of the display screen so that the texture pattern aligns between drawing commands.

If bit 3 of the first byte is 1, then filled rectangles, arcs and polygons are highlighted by explicitly drawing the perimeter. If bit 3 of the first byte is 0, then there is no highlight.

Bits 4, 5 and 6 determine the texture pattern for filled rectangles, arcs and polygons, as follows:

b6	b5	b4	texture pattern
0	0	0	solid (default)
0	0	1	vertical hatching
0	1	0	horizontal hatching
0	1	1	cross hatching
1	0	0	dot pattern
1	0	1	+45 degree lines
1	1	0	-45 degree lines
1	1	1	45 degree cross hatching

Set Colour

The set colour opcode specifies the colour attribute of the drawings or text that follows. The code is flexible and permits the future definition of colours defined as shades of the basic colours. However, this card uses only 6 fixed colours and 8 gray shades, ranging from black to white inclusive.

The number of data bytes is variable and the sequence is terminated on the appearance of another opcode. Less significant bits for colour information are truncated where they are not used. The bit assignments of the data bytes are shown in Figure 14.

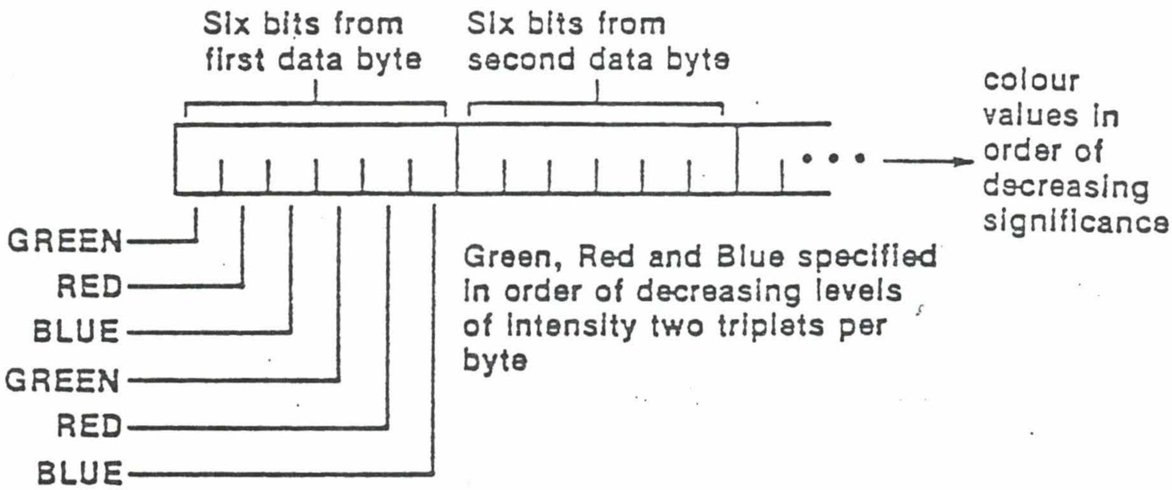


Figure 14 Set Colour Operand

Wait

The Wait command causes a delay of a specific time in processing and display.

The length of wait is specified in tenths of a second by the first associated parameter byte (6 bits for up to 6.3 seconds). Each additional parameter byte causes an additional delay.

Reset

If bit 1 of the first byte is 1, then the domain parameters are reset to their default values.

Bits 2 and 3 of byte 1 determine the colour mode and/or the in-use colour, as follows:

b3	b2	
0	0	no action
0	1	select colour mode 0 and initialize implicit colour map
1	0	reserved for
1	1	additional colours

Bits 4, 5 and 6 of byte 1 clear the screen and/or border areas, as follows:

b6	b5	b4	
0	0	0	no action
0	0	1	clear screen to black
0	1	0	clear screen to in-use drawing colour
0	1	1	clear border to black*
1	0	0	clear border to in-use drawing colour*
1	0	1	clear screen and border* to in-use drawing colour
1	1	0	clear screen to in-use drawing colour-border* to black
1	1	1	clear screen and border to black

(* reserved for control of a screen border; not implemented on this card)

If b1 of the second byte is 1, the text parameters are set to their default values and the cursor is sent to the home position (top left character position on the screen).

If b4 of the second byte is 1, the texture attributes are set to their default values.

If no operand follows the Reset command, a complete reset is indicated (i.e., as if both operand bytes were set to all ones).

If one operand follows the Reset command, the second byte is padded with zeros.

Control (Status) Sub-commands

To comply with the existing international standard recommendations, an additional method of defining several of the control commands is implemented. These commands produce the same effects or combination of effects as the control opcodes. They are merely alternate ways of accessing the same functions.

The Wait control opcode may be interpreted as a control status code which introduces a number of sub-commands. The numerical data byte following the opcode indicates the sub-command. The Wait function operates as one of the sub-commands.

The Control Status control commands begin with a Control Status opcode followed by a code chosen from Figure 15. The tone control code defines a shade of gray as consecutive bits of gray level intensity rather than as RGB levels. The Text Format code permits text parameters to be defined explicitly. For text format control, b5 specifies word break, and b4 and b3 the text rotation; b2 and b1 of an additional data byte specify spacing. Bits b3, b2 and b1 define the text character size as tabulated in Figure 13. Bit b6 indicates double height. For Text Set, two additional French characters can be specified by a binary 2 in bits b2 and b1.

				b	0	0	0	0	1	1	1	1
				b	0	0	1	1	0	0	1	1
				b	0	1	0	1	0	1	0	1
b	b	b	b	column / row	0	1	2	3	4	5	6	7
0	0	0	0	0					CLEAR (To Black)	LINE CONTROL (Solid)	TEXT FORMAT (Character Format)	
0	0	0	1	1					CLEAR (To Transparent)	LINE CONTROL (Dotted)	TEXT FORMAT (Character Size)	
0	0	1	0	2					CLEAR (To Black & Initialize)	LINE CONTROL (Dashed)	TEXT FORMAT (Character Set)	
0	0	1	1	3					CLEAR (Current Colour)	LINE CONTROL (Dot-Dashed)		
0	1	0	0	4					DOMAIN (9 Bits)	FILL (Pattern)		
0	1	0	1	5					DOMAIN (12 Bits)			
0	1	1	0	6					DOMAIN (15 Bits)	FILL (Highlight Black)		
0	1	1	1	7					DOMAIN (18 Bits)			
1	0	0	0	8					DRAWING Blink OFF Transp OFF			
1	0	0	1	9					DRAWING Blink OFF Transp ON			
1	0	1	0	10					DRAWING Blink ON Transp OFF			
1	0	1	1	11					DRAWING Blink ON Transp ON			
1	1	0	0	12					TONAL CONTROL (Colour)	WAIT		
1	1	0	1	13				CONTROL STATUS	TONAL CONTROL (Grey)			
1	1	1	0	14								
1	1	1	1	15								

Figure 15 Status Commands Accessed through the Control (Status) Opcode

C1 CONTROL SET

The C1 Control Set code table shown in Figure 16 provides additional control facilities, many of which are reserved for additional features. The control commands are described below.

REPEAT

The last text character received is repeated a specified number of times. Bits b6 through b1 of the next character received specify the repeat count.

REPEAT to EOL

The last Text character received is repeated to the last character position along the current character path, within the screen or active drawing area.

REVERSE VIDEO

Enter reverse video mode. Any Text character received subsequent to this control code is complemented within the current character field prior to its display.

NORMAL VIDEO

Enter normal video mode. The action of the Reverse Video control code is terminated.

SMALL TEXT

Reserved

MED TEXT

The character field dimensions are set to dx = 0.03125, dy = 0.047 (approx) to provide a 16 row by 32 character display.

NORMAL TEXT

The character field dimensions are set to their default values of dx = 0.025, dy = 0.0375 (approx) to provide a 20 row by 40 character display.

DOUBLE HEIGHT

The vertical dimension of the character field is set to twice its default size. The horizontal dimension of the character field is set to its default size.

DOUBLE SIZE

The horizontal and vertical dimensions of the character field are set to twice their respective default sizes.

WORD WRAP ON

Enter word wrap mode. All text is broken on word boundaries at end of line conditions. A word boundary is delineated by a space character, a format effector control character, a drawing command from the geometric sets, a maximum line length, or, optionally a punctuation character.

WORD WRAP OFF

Exit word wrap mode. All text is broken at character boundaries at end of line conditions.

SCROLL ON

Enter scroll mode. If an APD or an APU would cause the text cursor to be advance past the edge of the active drawing area, the entire contents of the display are scrolled to bring the cursor back within the active drawing area.

SCROLL OFF

Exit scroll mode. If an APD or an APU would cause the text cursor to be advanced past the edge of the active drawing area, it is instead moved to the opposite edge of the active drawing area.

UNDERLINE START

Enter underline mode. All characters received from the alphanumeric or supplementary graphics set will be displayed underlined.

UNDERLINE STOP

Exit underline mode.

BLINK START

Establish blinking colour. Any text or graphics codes received while in this colour and mode will cause the resulting text or graphic to flash intermittently. Blink is terminated when another colour is specified.

b4	b3	b2	b1	row \ column	0 (b7=0, b6=0, b5=0)	1 (b7=0, b6=0, b5=1)
0	0	0	0	0		
0	0	0	1	1		
0	0	1	0	2		
0	0	1	1	3		
0	1	0	0	4		
0	1	0	1	5		WORD WRAP ON
0	1	1	0	6	REPEAT	WORD WRAP OFF
0	1	1	1	7	REPEAT TO EOL	SCROLL ON
1	0	0	0	8	REVERSE VIDEO	SCROLL OFF
1	0	0	1	9	NORMAL VIDEO	UNDER LINE START
1	0	1	0	10	SMALL TEXT	UNDER LINE STOP
1	0	1	1	11	MED TEXT	FLASH CURSOR
1	1	0	0	12	NORMAL TEXT	STEADY CURSOR
1	1	0	1	13	DOUBLE HEIGHT	CURSOR OFF
1	1	1	0	14	BLINK START	
1	1	1	1	15	DOUBLE SIZE	

Figure 16 C1 Control Set

CO TEXT CURSOR CONTROL CODES

CO Character Name	Code Table Position	Effect on Text Cursor Location	Action on Text Cursor Crossing Unit Screen of Active Drawing Area
APB (BS)	(0/8)	Move in the opposite direction to the character path a distance equal to the dimension of the character field lying parallel to the character path	Position the cursor to opposite edge of screen or drawing area (along the character path) and execute an automatic VT
APF(HT)	(0/9)	Move in the direction of the character path a distance equal to the dimension of the character field lying parallel to the character path	Position the cursor to opposite edge of screen or drawing area (along the character path) and execute an automatic LF
APD(LF)	(0/10)	Move the direction perpendicular to the character path (-90) a distance equal to the dimension of the character field lying perpendicular to the character path	Special action taken dependent on whether scroll mode is in effect or not
APU(VT)	(0/11)	Move in the direction perpendicular to the character path (-90) a distance equal to the dimension of the character field lying perpendicular to the character path	Special action taken dependent on whether scroll mode is in effect or not
CS(FF)	(0/12)	Position cursor to upper left character position on screen	n/a — also clears screen
APR(CR)	(0/13)	Position cursor to first character position within the unit screen (or drawing area) along the character path	n/a

DEFAULT CONDITIONS

The default conditions for the alphanumeric coding scheme attributes are summarized below:

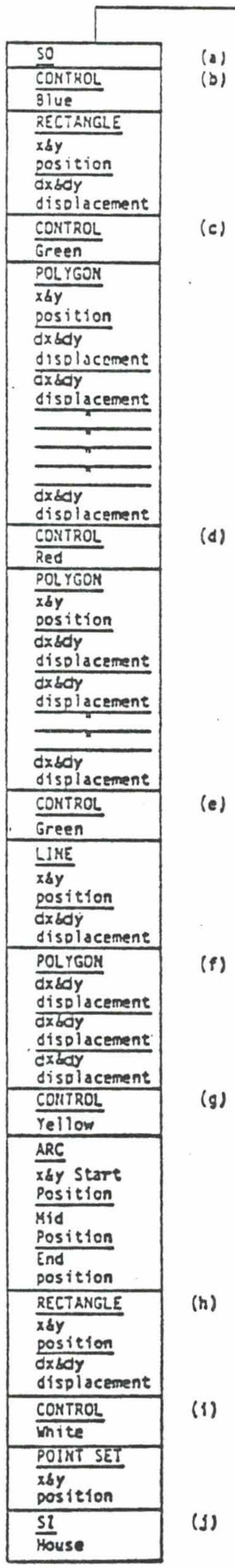
Colour mode:	0
In-use colour:	White
Single-value length (colour map address):	1 byte
Multi-value length (coordinate data):	3 bytes
Dimensionality:	2 D
Text rotation:	0 (horizontal)
Character path:	To the right
Inter-character spacing:	1 (width of current character field)
Inter-row spacing:	1 (height of current character field)
Move parameters:	Text cursor and graphics drawing point move together
Cursor style:	Underscore
Cursor display:	Off
Character field dimensions:	dx = 0.025, dy = 0.04 (approx)
Line texture:	Solid
Texture pattern:	Solid
Highlight:	No highlight
Texture mask size:	dx = 0.025, dy = 0.04 (approx)
Underline mode:	Off
Word wrap mode:	Off

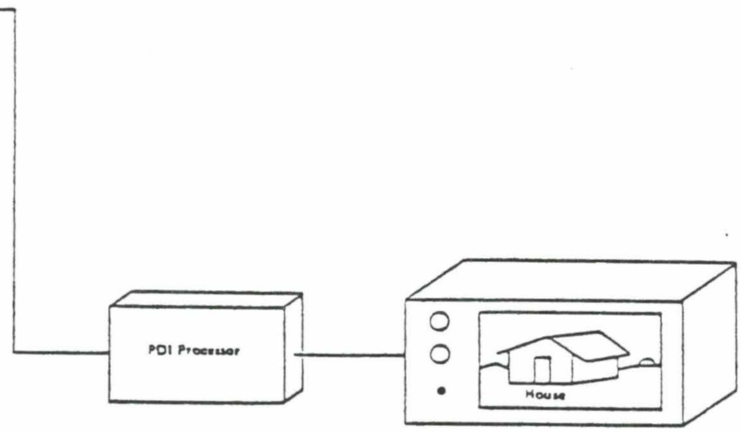
EXAMPLE

An example of the drawing sequence for a single picture is shown in Figure 17.

596 on for prop

7 6 5 4 3 2 1 0





(a) Shift Out (SO) to graphics mode

(b) Draw a blue background covering entire display area

(c) Draw a green foreground using a filled 8-sided polygon instruction

(d) Draw the walls of the house in red using a filled 6-sided polygon instruction

(e) Draw a green line to define the edge of the roof

(f) Proceeding from the present beam position draw the remainder of the roof using a filled 4-sided polygon instruction

(g) Draw a yellow sun using the arc instruction. Fill in the area between the chord and the end points of the arc.

(h) Draw a yellow door

(i) Set the colour to white and reposition the beam ready for text

(j) Shift In (SI) to alphanumeric mode and write "House".

NOTE 1. Positional and dimensional data is transmitted as 3 byte operands of sequential information to provide a resolution of one part in ±256.

NOTE 2. Sequential PDIs specify the order in which the total image is drawn. Thus, newly defined areas may overlay previously drawn parts of the image and allows more efficient coding of the total picture.

NOTE 3. The simple drawing shown above can be described with 108 bytes of information using PDIs.

Figure 17 Sequential PDIs Defining an Image

APPENDIX A

GLOSSARY

Absolute coordinates - an ordered pair of signed numbers between -1 and 1 (non-inclusive) that specify the new location of the drawing point with respect to the origin of the unit screen. Note that only positive absolute coordinate specifications lie within the unit screen.

ASCII - American Standard Code for Information Interchange, a table of text character codes. The Canadian standard CSA Z243.4-1973 is identical to ASCII.

Attribute - A settable parameter to be applied to subsequent TEXT characters or geometric graphic primitives.

Border area - the area of the physical display screen which is outside of the addressable display area.

C set - control set. There are two control sets, C0 and C1, each of which comprises 32 character positions arranged in 2 columns of 16 rows.

Character field - the rectangular display area within which a TEXT character is defined.

Code extension - techniques for expanding the absolute character address space of a byte oriented code into a larger virtual address space.

Code table - the set of unambiguous rules that define the mapping between received bit combinations and presentation level characters.

Cursor - a logical indicator of the screen position at which the next TEXT character is to be displayed. This position may or may not be marked by a cursor symbol.

Display area - the addressable area of the physical display screen onto which the unit screen is mapped.

Drawing point - a logical indicator of the screen position at which the next geometric graphic primitive will commence execution.

Escape sequence - a two, three or four byte code extension sequence beginning with the ESC character. A three character escape sequence contains an intermediate character (I) and ends with a final character (F), and is used primarily to designate a set from the graphics repertory as one of the four active G sets. Two character escape sequences contain only a final character (F) and are one method by which code sets are invoked into the in-use table.

Final character - the last character of an escape sequence.

G set - There are four G sets, G0, G1, G2, and G3, each of which comprises 96 character positions arranged in 6 columns of 16 rows.

Geometric graphic primitive - a locally stored picture drawing algorithm that can be called via a specified opcode and associated operand(s).

Graphic repertory - the collection of available code tables that are subject to designation as one of the G sets.

In-use - refers to the code sets or attributes that will be used to interpret or be applied to subsequently received commands.

Intermediate character - the character which occurs between the ESC character and the final character in an escape sequence.

Invoke - to bring one of the four active G sets into the in-use code table.

Opcode - a one byte, presentation level character that initiates the execution of a locally stored geometric primitive or control operation. An opcode may be followed by one or more operands.

Operand - a single or multiple byte string from the numeric data field of the PDI set that is used to specify control, attribute, or coordinate parameters required by the opcode.

PDI - Picture Description Instruction. A PDI is composed of an opcode followed by one or more operands and constitutes an executable picture drawing or control command.

Pixel - The smallest graphical unit that can be displayed on a screen (also called a pel).

Relative coordinates - an ordered pair of signed numbers between -1 and 1 (non-inclusive) that specify (in two's complement arithmetic) either the new location of the drawing point with respect to the old location of the drawing point, when used with a geometric primitive PDI, or the dimensions of a given field when used with one of the control commands.

Single shift - an invocation of a code set into the in-use table that affects only the interpretation of the next character received. Interpretation then automatically reverts to the previous contents of the table. (This is also referred to as non-locking shift.)

TEXT - pre-defined pixel patterns which, when called, are drawn with a set of pre-selected attributes at positions on the screen indicated by the cursor.

Unit screen - the virtual display address space within which all PDIs are executed and TEXT characters are displayed. The dimensions of the unit screen are 0 to 1 in the horizontal (x) and vertical (y) dimensions.

APPENDIX B

REFERENCED DOCUMENTS

VIDEOTEX

To promote compatibility in videotex information techniques the Bell System has adopted a presentation level protocol for use with the Canadian-designed Telidon videotex system. The protocol is defined in two functionally identical documents, one American and one Canadian, concerned with the "formats, rules, and procedures adopted for the encoding of text, graphics and display control information for videotex applications". The documents are highly technical and will not be of general interest. Chapter 3 of this guide provides a condensed version of the PDI structure at a level adequate for most users.

Should you be interested in the technical details of videotex protocol, further details can be obtained from either of the following sources.

The AT&T document title is:
Presentation Level Protocol
Videotex Standard

Bell System, May 1981,

and further information can be obtained through:

Manager, Information Management Planning
and Development
American Telephone and Telegraph Company
5 Wood Hollow Road
Parsippany NJ 07054