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IBM PC*jr* Speech Attachment Technical Reference

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IBM PC*jr* SPEECH ATTACHMENT

First Edition (June 1984)

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Contents

Speech Attachment

The Speech Attachment is a side mounted attachment that adds speech capability to the PC*jr*. It contains a program accessible vocabulary of words, phrases, and sound effects and accepts audio input from external sources.

Description

The Speech Attachment provides two technologies for speech reproduction:

- Speech encoding (speech-to-data) and decoding (data-to-speech) using a continuously variable slope delta (CVSD) modulation technique.

- Speech synthesis using linear predictive coding (LPC).

An internal ROM module contains the BIOS necessary to control the Speech Attachment.

CVSD

CVSD allows the user to encode speech using a microphone and store the resulting uncompressed speech data in system memory (RAM), on diskette, or another storage device. The stored speech data may then be decoded with the resulting speech output available through the audio channel of the PC*jr*.

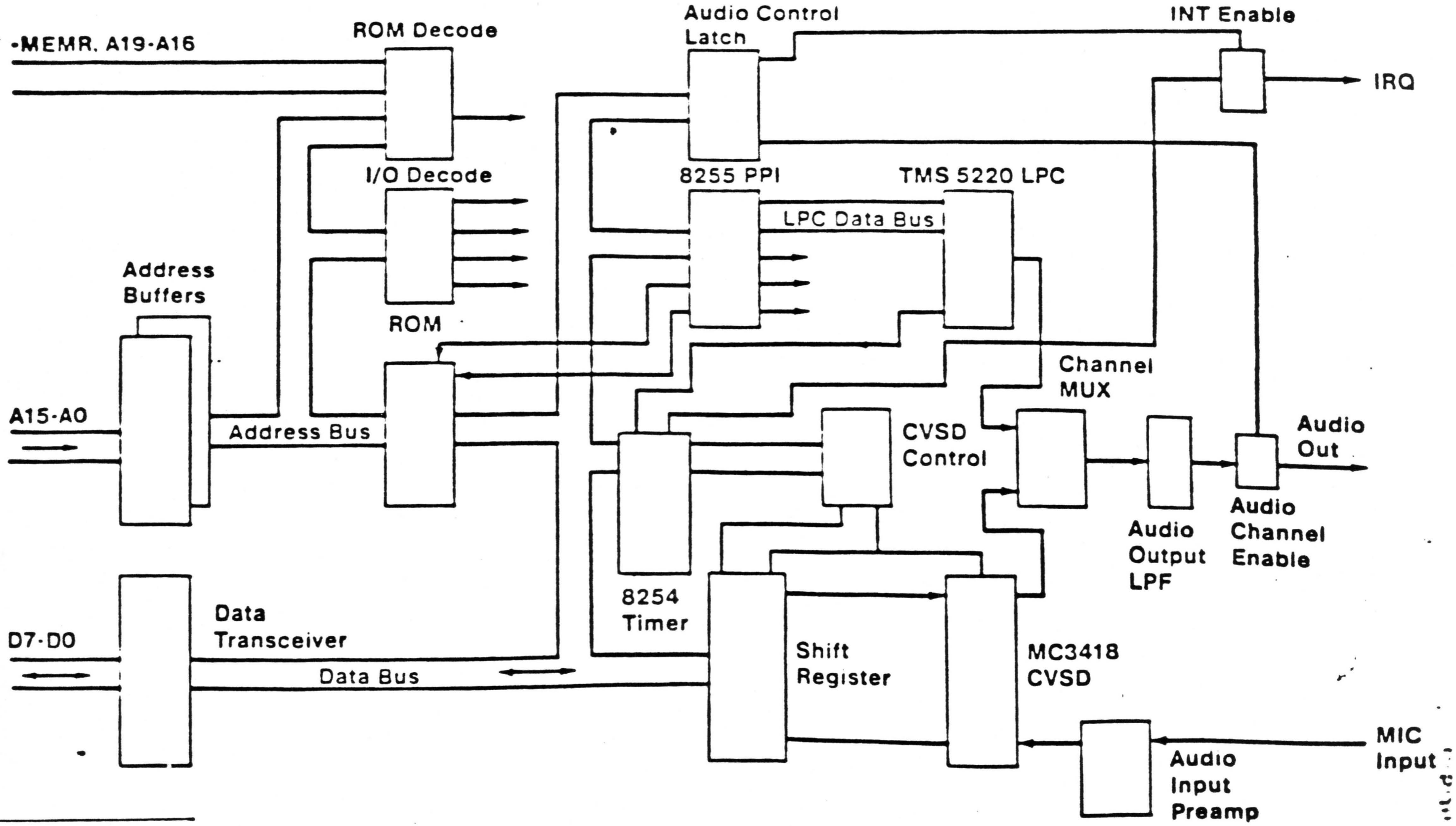
LPC

LPC synthesizes speech from compressed speech data on the internal ROM module. LPC speech data may also reside on program cartridges or may be placed in RAM from a diskette or another storage device.

Microphone

An external microphone jack is provided at the rear of the attachment.

The following is a block diagram of the Speech Attachment.


-MEMR. A19-A16
ROM Decode
Audio Control
Latch
INT Enable
IRQ
I/O Decode
8255 PPI
TMS 5220 LPC
LPC Data Bus
Address
Buffers
ROM
Channel
MUX
A15-A0
Address Bus
CVSD
Control
Audio
Out
Audio
Output
LPF
Audio
Channel
Enable
Data
Transceiver
8254
Timer
D7-D0
Data Bus
Shift
Register
MC3418
CVSD
MIC
Input
Audio
Input
Preamp

The Speech Attachment uses a 32K by 8 bit ROM module, which contains the standard vocabulary and BIOS support. This module appears as normal system memory at hex CE000 through CFFFF.

Vocabulary

There are 196 words, phrases, and sound effects encoded in the standard vocabulary on the ROM module of the Speech Attachment. The following is a list of these showing their corresponding index numbers.

1 danger
2 time has expired
3 laughing
4 get ready
5 go
6 up
7 down
8 left
9 right
10 warning
11 well done
12 gotcha
13 zero
14 one
15 two
16 three
17 four
18 five
19 six
20 seven
21 eight
22 nine
23 ten
24 a
25 b
26 c
27 d
28 e
29 f
30 g
31 h
32 i
33 j
34 k
35 l
36 m
37 n
38 o
39 p
40 q
41 r
42 s
43 t
44 u
45 v
46 w
47 x
48 y
49 z
67 cent
68 control
69 date
70 disk
71 day
72 dollar
73 down
74 do
75 excellent
76 eleven
77 -ez
78 -ed (past tense
morpheme)
79 echo
80 equals
81 enter
82 end
83 first
84 from
85 false
86 file
87 fif--
88 function
89 go
90 green
91 good
92 hundred
93 hold
94 hour
95 home
96 is
97 it
98 key
99 last
100 lose
101 list
102 less
103 left
104 ok
105 or
106 period
107 plus
108 please
109 program
110 press
111 p m.
112 per
113 point
114 run
131 -teen
132 true
133 to
134 -ty
135 this
136 twelve
137 thousand
138 that
139 than
140 then
141 time
142 type
143 thing
144 try
145 turn
146 the
147 twenty
148 word
149 white
150 wait
151 wrong
152 what
153 yes
154 you
155 yellow
156 year
157 your
158 space
159 delete
160 page
161 cursor
162 name
163 letter
164 board
165 any
166 sign
167 spell
168 win
169 pause
170 bar
171 insert
172 look
173 lock
174 3 frames of silence
175 minus
176 million
177 month
178 minute
179 move

(Part 1 of 2) **Standard Vocabulary**

50 an
51 again
52 all
53 add
54 am
55 are
56 a.m.
57 ahead
58 answer
59 back
60 by
61 brake
62 at
63 as
64 and
65 code
66 computer
115 read
116 red
117 right
118 release
119 start
120 stop
121 -s (plural morpheme)
122 save
123 second
124 sorry
125 screen
126 score
127 select
128 -th
129 third
130 thir-
180 no
181 negative
182 number
183 not
184 alternate
185 up
186 -ing
187 chime 1
188 bat hitting ball
189 ball being caught
190 gunshot
191 laser
192 phaser
193 buzz
194 tic
195 toc
196 fast chime

(Part 2 of 2) **Standard Vocabulary**

I/O Address Decode

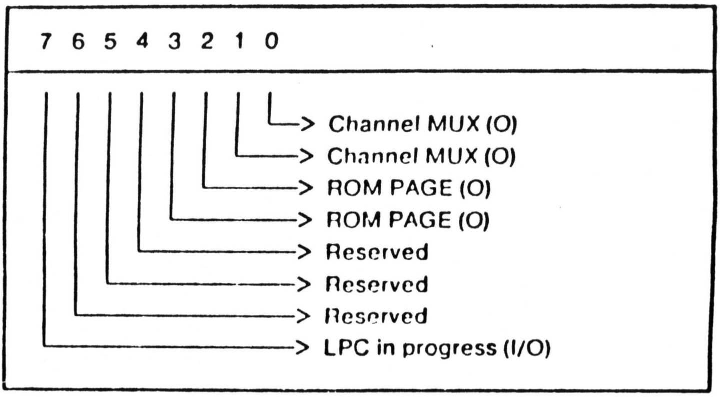
The Speech Attachment uses the following ports:

Device	Address	Port
8255 PPI	FB98 FB99 FB9A FB9B	Port A Data Port B Data Port C Data Mode Register
8254 Timer	FB9C FB9D FB9E FB9F	Channel 0 Channel 1 Channel 2 Control Word Register
Shift Register	FF98	Shift Register
Audio Control Latch	FF9F	Audio Control Latch

I/O Port Addresses

Programmable Peripheral Interface (8255)

The Speech Attachment uses an 8255 Programmable Peripheral Interface (PPI) for control and status. The following figures show the bit definitions for ports A, B, and C of the PPI.



Port A

Bit 7 — A 1 on this bit indicates that LPC is currently running in the background.

Bits 6-4 — Reserved

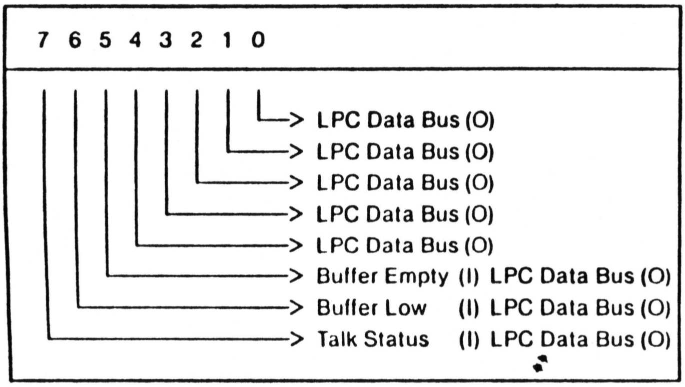
Bits 3-2 — ROM PAGE

00	Page 0
01	Page 1
10	Page 2
11	Page 3

Note: Page 0 is the default.

Bits 1-0 CHANNEL MUX

00	LPC
01	CVSD
10	8254 Audio
11	Test Signal


7 6 5 4 3 2 1 0
LPC Data Bus (O)
LPC Data Bus (O)
LPC Data Bus (O)
LPC Data Bus (O)
LPC Data Bus (O)
Buffer Empty (I) LPC Data Bus (O)
Buffer Low (I) LPC Data Bus (O)
Talk Status (I) LPC Data Bus (O)

Port B

Bits 7-0 Bits 7 through 0 are used to send commands to the LPC chip. LPC status is returned in bits 7 through 5.

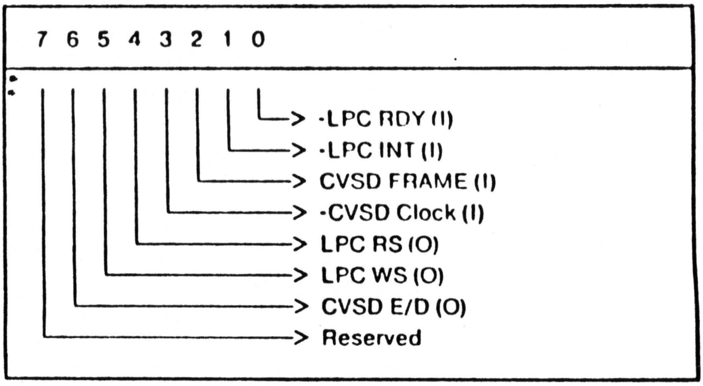
Port B is used as the LPC data bus. Its direction (input or output) is changed by issuing Mode commands to the PPI as follows.

	Port Definition	Mode	

LPC Output	A=Output
	B=Output
	C0-C3=Input
	C4-C7=Output
		81H	Normal State

LPC Input	A=Input
	B=Input
	C0-C3=Input
	C4-C7=Output
		83H	Used when reading LPC status

Note: All output signals are reset when a Mode command is issued. Mode is normally hex 81. It is only changed during LPC speech. If a particular line is needed in a non-reset state, it must be explicitly set. ROM PAGE should be set after a mode change.



Port C

Bit 7 Reserved

Bit 6 CVSD E/D—A 0 on this bit indicates CVSD decode (out, playback) and a 1 indicates CVSD encode (in, record).

Bit 5 LPC WS—A 0 on this bit indicates LPC write is inactive and a 1 indicates that it is active.

Bit 4 LPC RS—A 0 on this bit indicates LPC read is inactive and a 1 indicates that it is active.

Bit 3 -CVSD CLOCK—This signal is the inverted form of the clock used by CVSD for the bit sample rate. It is used to clock serial data into and out of the Shift Register.

Bit 2 CVSD FRAME—The negative going edge of this bit is used to read the Shift Register (S/R) during CVSD encode and the positive going edge is used to write to S/R during CVSD decode. CVSD FRAME is -CVSD CLK divided by 8.

Bit 1 -LPC INT—A 0 on this bit indicates an interrupt.

Bit 0 -LPC RDY—A 1 on this bit indicates a busy state and a 0 indicates a completed state.

Timer

The Speech Attachment uses an 8254 Timer to create the various clock signals required. CVSD circuits use channels 0 and 1 and channel 2 creates the LPC interrupt pulse. Channel 2 may also be gated onto the audio channel.

All clock signals are derived from the 4.77MHz system clock (XCLK).

Channel 0 (CVSD CLOCK)

Channel 0 has the following functions:

- Channel 0 divides the system clock signal to provide the CVSD bit sample rate. The positive going edge of this signal is used by the MC3418 to latch the digital serial data. The shift register uses the positive edge of the inverted CVSD CLOCK to clock the serial data.

- Channel 0 is inverted and is used by channel 1 to generate the CVSD FRAME signal.

  Note: The Speech Attachment initializes channel 0 in the square wave mode and holds the channel 0 gate active.

Channel 1 (CVSD FRAME)

This channel divides the inverted CVSD CLOCK by eight. It counts the CVSD CLOCK periods and goes low for one period every eight clocks. Programs use the positive edge of this signal to write data to the Shift Register during CVSD decoding. Programs poll this channel for sync signals during both CVSD encoding and decoding.

> Note: The Speech Attachment initializes channel 1's divisor to 8. It also initializes channel 1 in the rate generator mode and holds the channel 1 gate active.

Channel 2 (INT CLOCK)

Channel 2 has two functions:

- Channel 2 creates an interrupt pulse during LPC operations.
- Channel 2 can be routed to the audio channel and heard on external audio devices.

These functions are selected by the state of the interrupt enable signal on the Audio Control Latch (ACL) port as follows.

-INT ENA	**Channel 2 Function**
1	Interrupt Mode
0	Audio Mode

When used for interrupts, the Speech Attachment initializes channel 2's divisor to 8 and channel 2 to the hardware retriggerable one-shot mode. Then the channel 2 gate goes high when -INT goes low and interrupts are enabled.

> **Note:** The -INT ENA signal on the ACL port is set active for channel 2 to function in this manner.

Interrupt Mode (Interrupt Enabled)

During LPC operations, channel 2 transforms the positive edge of the LPC interrupt signal into a short negative-going pulse. This negative-going pulse is applied to the IRQ1 line and the system senses an interrupt on the positive edge of this signal. Use of this pulse allows sharing of the system interrupt line and prevents the disabling of local interrupts from causing a false interrupt.

Audio Mode (Interrupt Disabled)

The channel 2 output may be multiplexed onto the audio channel. When the -INT ENA bit on the ACL port is cleared, the channel 2 gate is held active.

The Speech Attachment initializes channel 2 to be used in the interrupt mode.

Linear Predictive Coding (LPC)

The Speech Attachment uses a TMS5220 for LPC synthesis. This device operates at an 8kHz sample rate. Programs, driving this device, may be interrupt driven or may poll the hardware.

Interrupt The interrupt signal, -LPC INT, is enabled and is used to generate interrupts.

Polled -LPC INT is disabled.

Continuously Variable Slope Delta (CVSD) Modulation

The Speech Attachment uses a Motorola MC3418 for CVSD modulation and demodulation. This device, along with two low-pass filters, a shift register, discrete CODEC filter elements, and appropriate clock signals provides for both encode and decode CVSD functions.

Shift Register

The Speech Attachment uses the shift register to serialize and deserialize CVSD data. It is a tri-stated device capable of both serial-to-parallel and parallel-to-serial conversions.

Decode (Playback) Mode

The following is a typical programming procedure:

- Set CVSD E/D low (decode).
- Activate audio channel.

D/F-86

- Do for all bytes
  - Wait for positive edge of CVSD FRAME.
  - Output data byte to the shift register.
  - Do any "housekeeping" needed.
- End do

Encode (Record) Mode

The following is a typical programming procedure:

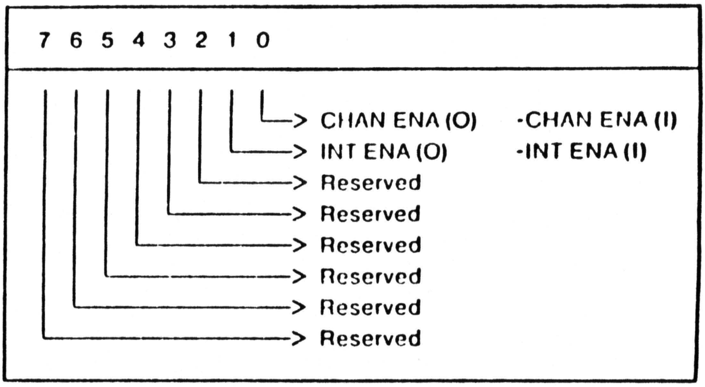
- Set CVSD E/D high (encode).
- Do for all bytes
  - Wait for the negative edge of CVSD FRAME.
  - Input data byte from the shift register.
  - Do any "housekeeping" needed.
- End do

Audio Filters

The Speech Attachment has two audio circuits: output and input. The audio output low-pass filter provides a signal compatible with the system's audio channel. The input preamp provides the amplification and filtering needed to attach a low-level microphone to the Speech Attachment.

Audio Control Latch (ACL)

The following are bit definitions for the Audio Control Latch.



Audio Control Latch

Bits 7-2 Reserved

Bit 1 INT ENA (O)

0 Disabled

1 Enabled

-INT ENA (I)

0 Enabled

1 Disabled

Bit 0 CHAN ENA (O)

0 Disabled

1 Enabled

-CHAN ENA (I)

0 Enabled

1 Disabled

Programs that use the Speech Attachment are responsible for sharing the audio channel. Before using the audio channel, the Speech Attachment BIOS must perform the following steps:

1. Issue 32 Disable Channel commands (00H) to each of the possible 32 audio control latches as shown in the following figure.

2. Read the Speech Attachment's audio control latch. -CHAN ENA should be inactive.

3. Enable the Speech Attachment's audio control channel by setting +CHAN ENA active.

4. When read, -CHAN ENA should be active.

The following shows Audio Control Latch addresses.

Device	ACL (hex)	Device	ACL (hex)
1	079F	17	879F
2	0F9F	18	8F9F
3	179F	19	979F
4	1F9F	20	9F9F
5	279F	21	A79F
6	2F9F	22	AF9F
7	379F	23	B79F
8	3F9F	24	BF9F
9	479F	25	C79F
10	4F9F	26	CF9F
11	579F	27	D79F
12	5F9F	28	DF9F
13	679F	29	E79F
14	6F9F	30	EF9F
15	779F	31	F79F
16	7F9F	32	FF9F

A program must read the Speech Attachment's ACL each time it needs the channel. If the channel is not enabled, another device has control. The program should either post an error or regain control of the channel.

Audio Multiplexers

Before the Speech Attachment begins speech synthesis, it's BIOS sets the following control devices so that audio, generated by the Speech Attachment, will be heard on the PC*jr*'s audio output.

- The Audio Channel Enable bit in the ACL

- The Audio Channel Multiplexer (points to the intended speech source)

- The PC*jr* Sound Multiplexer (points to the external audio channel)

D/F-8C

> **Note:** It is the responsibility of the program to restore the state of these devices.

Linear Predictive Coding (LPC)

There are two possible modes of LPC speech synthesis: background and foreground.

Background

This mode returns control to the calling program while speech synthesis is in progress with the following restrictions:

- The system cannot perform diskette or other operations that disable hardware interrupts for an extended period during speech synthesis.
- The system must not change environments during LPC background; for instance, changing from DOS to BASIC.

Foreground

In this mode control is not returned to the system until after the speech synthesis is completed.

> **Note:** BIOS continuously polls the system during speech synthesis and updates when necessary.

Interrupt Hex 04D

Software interrupt hex 04D provides low level BIOS support for CVSD and LPC. The following lists the uses of this interrupt.

AH = 0 Reset Adapter

AH = 1 CVSD

CVSD Record (using speed table)

DS:SI segment:offset

BL Table speed

0 = 1800 Bytes/Sec

1 = 2400 Bytes/Sec

2 = 3000 Bytes/Sec

3 = 3600 Bytes/Sec

4 = 4200 Bytes/Sec

5 = 4800 Bytes/Sec

CX Byte count

AL = 1 CVSD Playback (using speed table)

DS:SI segment:offset

BL Table speed

0 = 1800 Bytes/Sec

1 = 2400 Bytes/Sec

2 = 3000 Bytes/Sec

3 = 3600 Bytes/Sec

4 = 4200 Bytes/Sec

5 = 4800 Bytes/Sec

CX Byte count

AL = 2 CVSD Record (using user speed)

DS:SI segment:offset

BX User speed divisor

CX Byte count

AL = 3 CVSD Playback (using user speed)

DS:SI segment:offset

BX User speed divisor

CX Byte count

AH = 2 LPC (Background)

AL = 0 LPC Status

AL = 1 LPC Speak - INTR (index)

BX Word number from index (BX ≥ 1)

AL = 2 LPC Speak - INTR (buffer)

DS:SI Beginning of buffer (segment:offset)

CX Number of bytes in the LPC word to be spoken. CX must not be larger than 4095 bytes.

AH = 3 Polled LPC (foreground)

AL = 0 LPC Status

AL = 1 LPC Speak - INTR (index)

BX Word number from index (BX ≥ 1)

AL = 2 LPC Speak - INTR (buffer)

DS:SI Beginning of buffer (segment:offset)

CX Number of bytes in the LPC word to be spoken. CX must not be larger than 4095 bytes.

Note: During this call, all registers except AX are preserved.

AL returns:

00H OK

01H Undefined command

02H LPC Speak in progress

03H Speech Attachment ACL error (stuck)

04H LPC index out of range

05H CVSD speed out of range

06H Timeout waiting for LPC READY

Specifications

The following are specifications of the Speech Attachment:

- Size

Width	32 millimeters (1.26 inches)
Depth	290 millimeters (11.42 inches)
Height	96.5 millimeters (3.80 inches)

- Environment

  – Temperature

System On	15.6 to 32.2 degrees C (60 to 90 degrees F)
System Off	10 to 43 degrees C (50 to 110 degrees F)

  – Humidity

System On	8 to 80%
System Off	8 to 80%

- Power

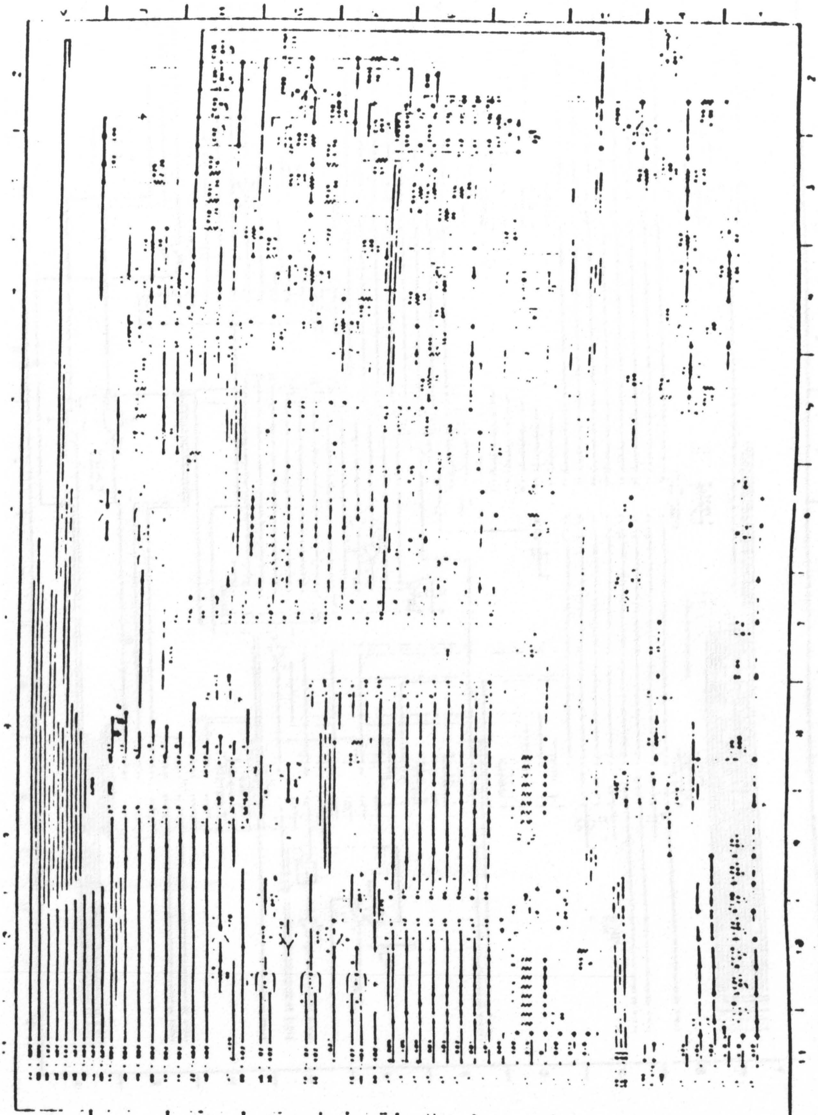
  – +5Vdc with 150 milliamps maximum current

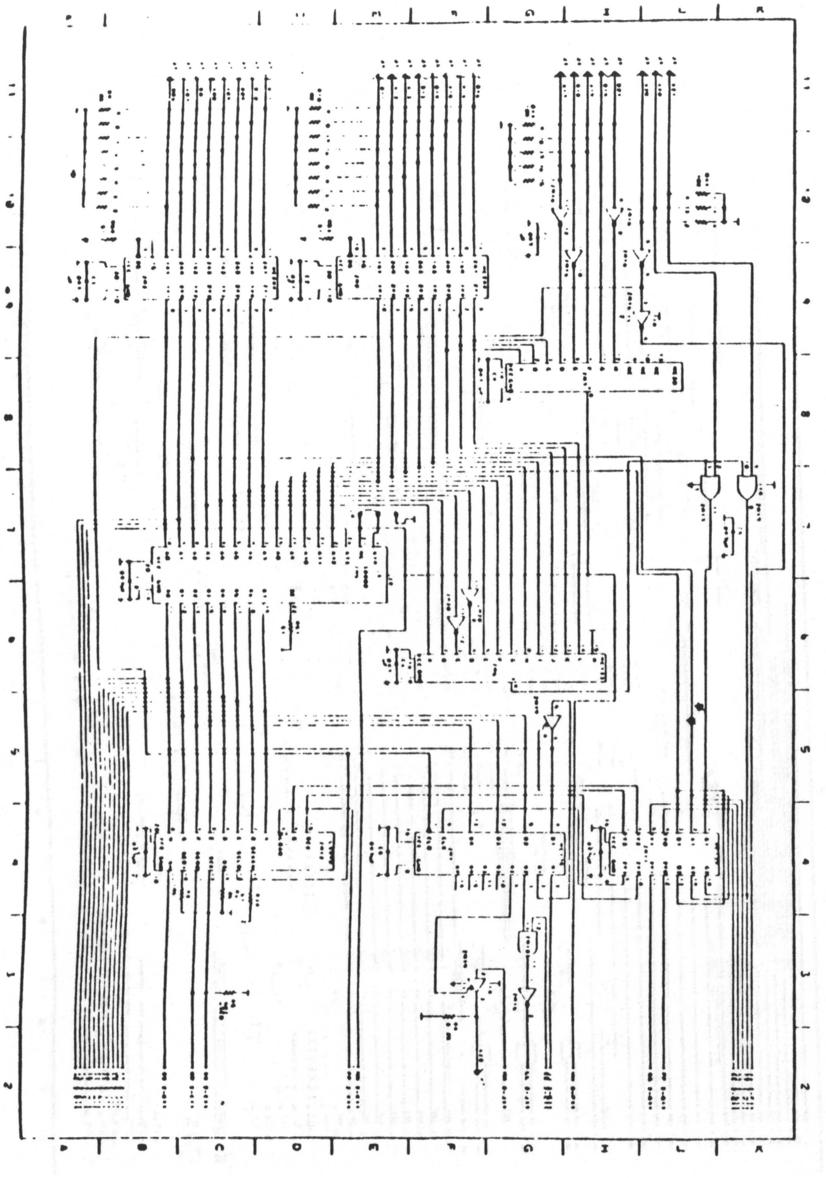
  – +12Vdc with 60 milliamps maximum current

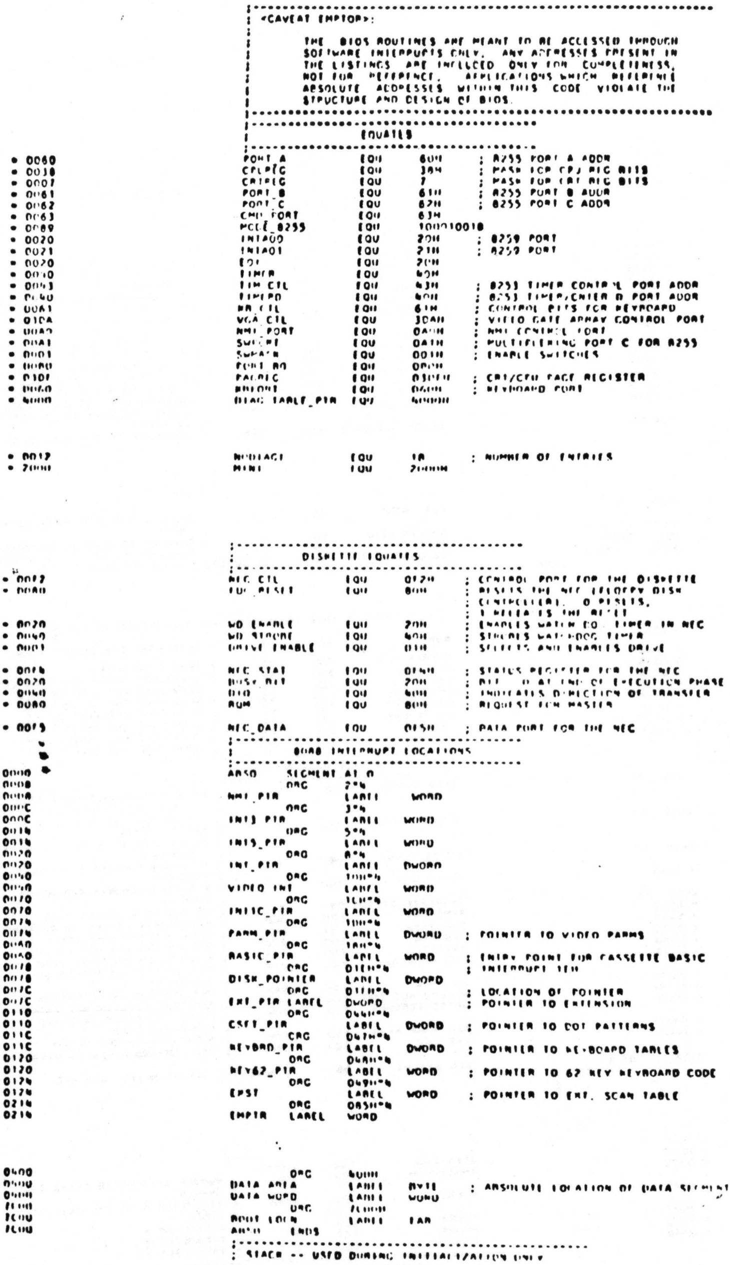
- Microphone Input

  – Miniature phone jack

  – 500 ohm nominal impedance







```
                                ;------------------------------------------------------
                                ; <CAVEAT EMPTOR>:
                                ;
                                ;       THE  BIOS ROUTINES ARE MEANT TO BE ACCESSED THROUGH
                                ;       SOFTWARE INTERRUPTS ONLY.  ANY ADDRESSES PRESENT IN
                                ;       THE LISTINGS  ARE INCLUDED  ONLY FOR  COMPLETENESS,
                                ;       NOT FOR  REFERENCE.    APPLICATIONS WHICH  REFERENCE
                                ;       ABSOLUTE  ADDRESSES  WITHIN THIS  CODE  VIOLATE THE
                                ;       STRUCTURE AND DESIGN OF BIOS.
                                ;------------------------------------------------------
                                ;-------------------------------------
                                ;               EQUATES
                                ;-------------------------------------
 = 0060                         PORT_A          EQU     60H      ; 8255 PORT A ADDR
 = 0038                         CPUREG          EQU     38H      ; MASK FOR CPU REG BITS
 = 0007                         CRTREG          EQU     7        ; MASK FOR CRT REG BITS
 = 0061                         PORT_B          EQU     61H      ; 8255 PORT B ADDR
 = 0062                         PORT_C          EQU     62H      ; 8255 PORT C ADDR
 = 0063                         CMD_PORT        EQU     63H
 = 0089                         MODE_8255       EQU     10001001B
 = 0020                         INTA00          EQU     20H      ; 8259 PORT
 = 0021                         INTA01          EQU     21H      ; 8259 PORT
 = 0020                         EOI             EQU     20H
 = 0040                         TIMER           EQU     40H
 = 0043                         TIM_CTL         EQU     43H      ; 8253 TIMER CONTROL PORT ADDR
 = 0040                         TIMER0          EQU     40H      ; 8253 TIMER/CNTER 0 PORT ADDR
 = 0061                         KB_CTL          EQU     61H      ; CONTROL BITS FOR KEYBOARD
 = 03DA                         VGA_CTL         EQU     3DAH     ; VIDEO GATE ARRAY CONTROL PORT
 = 00A0                         NMI_PORT        EQU     0A0H     ; NMI CONTROL PORT
 = 00A1                         SWITCH          EQU     0A1H     ; MULTIPLEXING PORT C FOR 8255
 = 0001                         SWMATCH         EQU     001H     ; ENABLE SWITCHES
 = 00B0                         PORT_B0         EQU     0B0H
 = 03DF                         PAGREG          EQU     03DFH    ; CRT/CPU PAGE REGISTER
 = 0060                         KBPORT          EQU     060H     ; KEYBOARD PORT
 = 4000                         DIAG_TABLE_PTR  EQU     4000H


 = 0012                         NUMDIAG         EQU     18       ; NUMBER OF ENTRIES
 = 2000                         MINI            EQU     2000H



                                ;-------------------------------------
                                ;          DISKETTE EQUATES
                                ;-------------------------------------
 = 00F2                         NEC_CTL         EQU     0F2H     ; CONTROL PORT FOR THE DISKETTE
 = 0080                         FDC_RESET       EQU     80H      ; RESETS THE NEC (FLOPPY DISK
                                                                 ; CONTROLLER).  0 RESETS,
                                                                 ; 1 RELEASES THE RESET
 = 0020                         WD_ENABLE       EQU     20H      ; ENABLES WATCH DOG TIMER IN NEC
 = 0040                         WD_STROBE       EQU     40H      ; STROBES WATCHDOG TIMER
 = 0001                         DRIVE_ENABLE    EQU     01H      ; SELECTS AND ENABLES DRIVE

 = 00F4                         NEC_STAT        EQU     0F4H     ; STATUS REGISTER FOR THE NEC
 = 0020                         BUSY_BIT        EQU     20H      ; BIT = 0 AT END OF EXECUTION PHASE
 = 0040                         DIO             EQU     40H      ; INDICATES DIRECTION OF TRANSFER
 = 0080                         RQM             EQU     80H      ; REQUEST FOR MASTER

 = 00F5                         NEC_DATA        EQU     0F5H     ; DATA PORT FOR THE NEC
                                ;-------------------------------------
                                ;       8088 INTERRUPT LOCATIONS
                                ;-------------------------------------
 0000                           ABS0    SEGMENT AT 0
 0008                                   ORG     2*4
 0008                           NMI_PTR         LABEL   WORD
 000C                                   ORG     3*4
 000C                           INT3_PTR        LABEL   WORD
 0014                                   ORG     5*4
 0014                           INT5_PTR        LABEL   WORD
 0020                                   ORG     8*4
 0020                           INT_PTR         LABEL   DWORD
 0040                                   ORG     10H*4
 0040                           VIDEO_INT       LABEL   WORD
 0070                                   ORG     1CH*4
 0070                           INT1C_PTR       LABEL   WORD
 0074                                   ORG     1DH*4
 0074                           PARM_PTR        LABEL   DWORD    ; POINTER TO VIDEO PARMS
 0060                                   ORG     18H*4
 0060                           BASIC_PTR       LABEL   WORD     ; ENTRY POINT FOR CASSETTE BASIC
 0078                                   ORG     01EH*4           ; INTERRUPT 1EH
 0078                           DISK_POINTER    LABEL   DWORD
 007C                                   ORG     01FH*4           ; LOCATION OF POINTER
 007C                           EXT_PTR LABEL   DWORD            ; POINTER TO EXTENSION
 0110                                   ORG     044H*4
 0110                           CSET_PTR        LABEL   DWORD    ; POINTER TO DOT PATTERNS
 011C                                   ORG     047H*4
 011C                           KEYBRD_PTR      LABEL   DWORD    ; POINTER TO KEYBOARD TABLES
 0120                                   ORG     048H*4
 0120                           KEY62_PTR       LABEL   WORD     ; POINTER TO 62 KEY KEYBOARD CODE
 0124                                   ORG     049H*4
 0124                           EXST            LABEL   WORD     ; POINTER TO EXT. SCAN TABLE
 0214                                   ORG     085H*4
 0214                           EMPTR   LABEL   WORD


 0400                                   ORG     400H
 0400                           DATA_AREA       LABEL   BYTE     ; ABSOLUTE LOCATION OF DATA SEGMENT
 0400                           DATA_WORD       LABEL   WORD
 7C00                                   ORG     7C00H
 7C00                           BOOT_LOCN       LABEL   FAR
 7C00                           ABS0    ENDS
                                ;----------------------------------------------
                                ; STACK -- USED DURING INITIALIZATION ONLY
```

```
                                    ;----------------------------------------------
0000                                STACK   SEGMENT AT 30H
0000      80 [                              DW      128 DUP(?)
                ????
                     ]

0100                                TOS     LABEL   WORD
0100                                STACK   ENDS
                                    ;----------------------------------------
                                    ;       ROM BIOS DATA AREAS
                                    ;----------------------------------------
0000                                DATA    SEGMENT AT 40H
0000      04 [                      RS232_BASE      DW      4 DUP(?) ; ADDRESSES OF RS232 ADAPTERS
                ????
                     ]

0008      04 [                      PRINTER_BASE    DW      4 DUP(?) ; ADDRESSES OF PRINTERS
                ????
                     ]

0010  ????                          EQUIP_FLAG      DW      ?       ; INSTALLED HARDWARE
0012  ??                            KBD_ERR         DB      ?       ; COUNT OF KEYBOARD TRANSMIT ERRORS
0013  ????                          MEMORY_SIZE     DW      ?       ; USABLE MEMORY SIZE IN K BYTES
0015  ????                          TRUE_MEM        DW      ?       ; REAL MEMORY SIZE IN K BYTES
                                    ;----------------------------------------
                                    ;       KEYBOARD DATA AREAS
                                    ;----------------------------------------
0017  ??                            KB_FLAG         DB      ?
                                    ;----- SHIFT FLAG EQUATES WITHIN KB_FLAG
 = 0040                             CAPS_STATE      EQU     40H     ; CAPS LOCK STATE HAS BEEN TOGGLED
 = 0020                             NUM_STATE       EQU     20H     ; NUM LOCK STATE HAS BEEN TOGGLED
 = 0008                             ALT_SHIFT       EQU     08H     ; ALTERNATE SHIFT KEY DEPRESSED
 = 0004                             CTL_SHIFT       EQU     04H     ; CONTROL SHIFT KEY DEPRESSED
 = 0002                             LEFT_SHIFT      EQU     02H     ; LEFT SHIFT KEY DEPRESSED
 = 0001                             RIGHT_SHIFT     EQU     01H     ; RIGHT SHIFT KEY DEPRESSED

0018  ??                            KB_FLAG_1       DB      ?       ; SECOND BYTE OF KEYBOARD STATUS
 = 0080                             INS_SHIFT       EQU     80H     ; INSERT KEY IS DEPRESSED
 = 0040                             CAPS_SHIFT      EQU     40H     ; CAPS LOCK KEY IS DEPRESSED
 = 0020                             NUM_SHIFT       EQU     20H     ; NUM LOCK KEY IS DEPRESSED
 = 0010                             SCROLL_SHIFT    EQU     10H     ; SCROLL LOCK KEY IS DEPRESSED
 = 0008                             HOLD_STATE      EQU     08H     ; SUSPEND KEY HAS BEEN TOGGLED
 = 0004                             CLICK_ON        EQU     04H     ; INDICATES THAT AUDIO FEEDBACK IS
                                                                    ; ENABLED
 = 0002                             CLICK_SEQUENCE  EQU     02H     ; OCURRNCE OF ALT-CTRL-CAPSLOCK HAS


                                                                    ; OCCURED

0019  ??                            ALT_INPUT       DB      ?       ; STORAGE FOR ALTERNATE KEYPAD
                                                                    ; ENTRY
001A  ????                          BUFFER_HEAD     DW      ?       ; POINTER TO HEAD OF KEYBOARD BUFF
001C  ????                          BUFFER_TAIL     DW      ?       ; POINTER TO TAIL OF KEYBOARD BUFF
001E      10 [                      KB_BUFFER       DW      16 DUP(?) ; ROOM FOR 15 ENTRIES
                ????
                     ]


                                    ;------ HEAD = TAIL INDICATES THAT THE BUFFER IS EMPTY

 = 0045                             NUM_KEY         EQU     69      ; SCAN CODE FOR NUMBER LOCK

 = 0046                             SCROLL_KEY      EQU     70      ; SCROLL LOCK KEY
 = 0038                             ALT_KEY         EQU     56      ; ALTERNATE SHIFT KEY SCAN CODE
 = 001D                             CTL_KEY         EQU     29      ; SCAN CODE FOR CONTROL KEY
 = 003A                             CAPS_KEY        EQU     58      ; SCAN CODE FOR SHIFT LOCK
 = 002A                             LEFT_KEY        EQU     42      ; SCAN CODE FOR LEFT SHIFT
 = 0036                             RIGHT_KEY       EQU     54      ; SCAN CODE FOR RIGHT SHIFT
 = 0052                             INS_KEY         EQU     82      ; SCAN CODE FOR INSERT KEY
 = 0053                             DEL_KEY         EQU     83      ; SCAN CODE FOR DELETE KEY
                                    ;----------------------------------------
                                    ;       DISKETTE DATA AREAS
                                    ;----------------------------------------
003E  ??                            SEEK_STATUS     DB      ?       ; DRIVE RECALIBRATION STATUS
                                                                    ; BIT 0 = DRIVE NEEDS RECAL BEFORE
                                                                    ;   NEXT SEEK IF BIT IS = 0
003F  ??                            MOTOR_STATUS    DB      ?       ; MOTOR STATUS
                                                                    ; BIT 0 = DRIVE 0 IS CURRENTLY
                                                                    ;   RUNNING
0040  ??                            MOTOR_COUNT     DB      ?       ; TIME OUT COUNTER FOR DRIVE
                                                                    ; TURN OFF
 = 0025                             MOTOR_WAIT      EQU     37      ; 2 SECS OF COUNTS FOR MOTOR
                                                                    ; TURN OFF
0041  ??                            DISKETTE_STATUS DB      ?       ; RETURN CODE STATUS BYTE
 = 0080                             TIME_OUT        EQU     80H     ; ATTACHMENT FAILED TO RESPOND
 = 0040                             BAD_SEEK        EQU     40H     ; SEEK OPERATION FAILED
 = 0020                             BAD_NEC         EQU     20H     ; NEC CONTROLLER HAS FAILED
 = 0010                             BAD_CRC         EQU     10H     ; BAD CRC ON DISKETTE READ
 = 0009                             DMA_BOUNDARY    EQU     09H     ; ATTEMPT TO DMA ACROSS 64K
                                                                    ; BOUNDARY
 = 0008                             BAD_DMA         EQU     08H     ; DMA OVERRUN ON OPERATION
 = 0004                             RECORD_NOT_FND  EQU     04H     ; REQUESTED SECTOR NOT FOUND
 = 0003                             WRITE_PROTECT   EQU     03H     ; WRITE ATTEMPTED ON WRITE
                                                                    ; PROTECTED DISK
 = 0002                             BAD_ADDR_MARK   EQU     02H     ; ADDRESS MARK NOT FOUND
 = 0001                             BAD_CMD         EQU     01H     ; BAD COMMAND GIVEN TO DISKETTE I/O

0042      07 [                      NEC_STATUS      DB      7 DUP(?) ; STATUS BYTES FROM NEC
                ??
                     ]



 = 0020                             SEEK_END        EQU     20H
 = 012C                             THRESHOLD       EQU     300     ; NUMBER OF TIMER-0 TICKS TILL
                                                                    ; ENABLE
 = 00AF                             PARM0           EQU     0AFH    ; PARAMETER 0 IN THE DISK_PARM
                                                                    ; TABLE
 = 0003                             PARM1           EQU     3       ; PARAMETER 1
 = 0019                             PARM9           EQU     25      ; PARAMETER 9
 = 0004                             PARM10          EQU     4       ; PARAMETER 10
                                    ;----------------------------------------
                                    ;       VIDEO DISPLAY DATA AREA
                                    ;----------------------------------------
0049  ??                            CRT_MODE        DB      ?       ; CURRENT CRT MODE
004A  ????                          CRT_COLS        DW      ?       ; NUMBER OF COLUMNS ON SCREEN
004C  ????                          CRT_LEN         DW      ?       ; LENGTH OF REGEN IN BYTES
004E  ????                          CRT_START       DW      ?       ; STARTING ADDRESS IN REGEN BUFFER
0050      08 [                      CURSOR_POSN     DW      8 DUP(?) ; CURSOR FOR EACH OF UP TO 8 PAGES
                ????
                     ]

0060  ????                          CURSOR_MODE     DW      ?       ; CURRENT CURSOR MODE SETTING
```

```
0062  ??                ACTIVE_PAGE     DB      ?       ; CURRENT PAGE BEING DISPLAYED
0063  ????              ADDR_6845       DW      ?       ; BASE ADDRESS FOR ACTIVE DISPLAY
                                                        ; CARD
0065  ??                CRT_MODE_SET    DB      ?       ; CURRENT SETTING OF THE
                                                        ; CRT MODE REGISTER
0066  ??                CRT_PALLETTE    DB      ?       ; CURRENT PALLETTE MASK SETTING
                        ;-------------------------------------
                        ;       CASSETTE DATA AREA
                        ;-------------------------------------
0067  ????              EDGE_CNT        DW      ?       ; TIME COUNT AT DATA EDGE
0069  ????              CRC_REG         DW      ?       ; CRC REGISTER
006B  ??                LAST_VAL        DB      ?       ; LAST INPUT VALUE
                        ;-------------------------------------
                        ;       TIMER DATA AREA
                        ;-------------------------------------
006C  ????              TIMER_LOW       DW      ?       ; LOW WORD OF TIMER COUNT
006E  ????              TIMER_HIGH      DW      ?       ; HIGH WORD OF TIMER COUNT
0070  ??                TIMER_OFL       DB      ?       ; TIMER HAS ROLLED OVER SINCE LAST
                                                        ; READ
                        ;-------------------------------------
                        ;       SYSTEM DATA AREA
                        ;-------------------------------------
0071  ??                BIOS_BREAK      DB      ?       ; BIT 7=1 IF BREAK KEY HAS BEEN HIT
0072  ????              RESET_FLAG      DW      ?       ; WORD 1234H IF KEYBOARD RESET
                                                        ; UNDERWAY
                        ;-------------------------------------
                        ;       EXTRA DISKETTE DATA AREAS
                        ;-------------------------------------
0074  ??                TRACK0          DB      ?
0075  ??                TRACK1          DB      ?
0076  ??                TRACK2          DB      ?
0077  ??                                DB      ?
= 0020                  NE62            EQU     20H     ; 62 KEY NUM LOCK STATE


                        ;                       40H     ; RESERVED
                        ;                       80H     ; RESERVED FOR FUTURE USE
                        ;-------------------------------------------
                        ;       PRINTER AND RS232 TIME-OUT VARIABLES
                        ;-------------------------------------------
0078      04 [          PRINT_TIM_OUT   DB      4 DUP(?)
                 ??
                      ]

007B                                    ORG     $-1
007B  ??                DK_INDEX        DB      ?
= 0080                  MATCH_BIT       EQU     80H     ; INDICATES FIRST KEYSTROKE IN
                                                        ; ..A DEAD KEY SEQUENCE
007C      04 [          RS232_TIM_OUT   DB      4 DUP(?)
                 ??
                      ]

                        ;-------------------------------------
                        ;       ADDITIONAL KEYBOARD DATA AREA
                        ;-------------------------------------
0080  ????              BUFFER_START    DW      ?
0082  ????              BUFFER_END      DW      ?
0084  ??                INTR_FLAG       DB      ?       ; FLAG TO INDICATE AN INTERRUPT
                                                        ; HAPPENED
                        ;-------------------------------------
                        ; 62 KEY KEYBOARD DATA AREA
                        ;-------------------------------------
0085  ??                CUR_CHAR        DB      ?       ; CURRENT CHARACTER FOR TYPAMATIC
0086  ??                VAR_DELAY       DB      ?       ; DETERMINES WHEN INITIAL DELAY IS
                                                        ; OVER
= 000F                  DELAY_RATE      EQU     0FH     ; INCREASES INITIAL DELAY
0087  ??                CUR_FUNC        DB      ?       ; CURRENT FUNCTION
0088  ??                KB_FLAG_2       DB      ?       ; 3RD BYTE OF KEYBOARD FLAGS
= 0004                  RANGE           EQU     4       ; NUMBER OF POSITIONS TO SHIFT
                                                        ; DISPLAY
                        ;-------------------------------------
                        ;  BIT ASSIGNMENTS FOR KB_FLAG_2
                        ;-------------------------------------
= 0080                  FN_FLAG         EQU     80H
= 0040                  FN_BREAK        EQU     40H
= 0020                  FN_PENDING      EQU     20H
= 0010                  FN_LOCK         EQU     10H
= 0008                  TYPE_OFF        EQU     08H
= 0004                  HALF_RATE       EQU     04H
= 0002                  INIT_DELAY      EQU     02H
= 0001                  PUTCHAR         EQU     01H
0089  ??                HORZ_POS        DB      ?       ; CURRENT VALUE OF HORIZONTAL
                                                        ; START PARM
008A  ??                PAGDAT          DB      ?       ; IMAGE OF DATA WRITTEN TO PAGREG
008B                    DATA    ENDS
                        ;-------------------------------------
                        ;       EXTRA DATA AREA
                        ;-------------------------------------


0000                    XXDATA  SEGMENT AT 50H
0000  ??                STATUS_BYTE     DB      ?
                        ; THE FOLLOWING AREA IS USED ONLY DURING DIAGNOSTICS
                        ; (POST AND ROM RESIDENT)
0001  ??                DCP_MENU_PAGE   DB      ?       ; TO CURRENT PAGE FOR DIAG. MENU
0002  ????              DCP_ROW_COL     DW      ?       ; CURRENT ROW/COLUMN COORDINATES
                                                        ; FOR DIAG MENU
0004  ??                WRAP_FLAG       DB      ?       ; INTERNAL/EXTERNAL 8250 WRAP
                                                        ; INDICATOR
0005  ??                MFG_TST         DB      ?       ; INITIALIZATION FLAG
0006  ????              MEM_TOT         DW      ?       ; WORD EQUIV. TO HIGHEST SEGMENT IN
                                                        ; MEMORY
0008  ????              MEM_DONES       DW      ?       ; CURRENT SEGMENT VALUE FOR
                                                        ; BACKGROUND MEM TEST
000A  ????              MEM_DONEO       DW      ?       ; CURRENT OFFSET VALUE FOR
                                                        ; BACKGROUND MEM TEST
000C  ????              INT1CO          DW      ?       ; SAVE AREA FOR INTERRUPT 1C
                                                        ; ROUTINE
000E  ????              INT1CS          DW      ?
0010  ??                MENU_UP         DB      ?       ; FLAG TO INDICATE WHETHER MENU IS
                                                        ; ON SCREEN (FF=YES, 0=NO)
0011  ??                DONE128         DB      ?       ; COUNTER TO KEEP TRACK OF 128 BYTE
                                                        ; BLOCKS TESTED BY BGMEM
0012  ????              KBDONE          DW      ?       ; TOTAL K OF MEMORY THAT HAS BEEN
                                                        ; TESTED BY BACKGROUND MEM TEST
                        ;-------------------------------------
                        ;       POST DATA AREA
                        ;-------------------------------------
0014  ????              IO_ROM_INIT     DW      ?       ; POINTER TO OPTIONAL I/O ROM INIT
                                                        ; ROUTINE
0016  ????              IO_ROM_SEG      DW      ?       ; POINTER TO IO ROM SEGMENT
0018  ??                POST_ERR        DB      ?       ; FLAG TO INDICATE ERROR OCCURRED
```

```
                                                        ; DURING POST
 0019                        MODEM_BUFFER   DB      9 DUP(?) ; MODEM RESPONSE BUFFER
              ]

                                                        ; (MAX 9 CHARS)
 0022  ????                  MFG_RTN        DW      ?       ; POINTER TO MFG. OUTPUT ROUTINE
 0024  ????                                 DW      ?
                             ;--------------------------------------
                             ;     SERIAL PRINTER DATA
                             ;--------------------------------------
 0026  ????                  SP_FLAG        DW      ?
 0028  ??                    SP_CHAN        DB      ?
 0029  ??                    DCP_RUNNING    DB      ?       ; FLAG TO TELL E_MSG WHERE IT IS
                                                            ; BEING CALLED FROM
 002A                        XXDATA  ENDS
                             ;--------------------------------------
                             ;     DISKETTE DATA AREA
                             ;--------------------------------------
 0000                        DKDATA  SEGMENT AT 60H
                             ;     FORMAT ID


 0000      08 [              TK_HD_SC       DB      8 DUP(0,0,0,0)  ;TRACK,HEAD,SECTOR
                 00
                 00
                 00
                 00
                    ]

                                                        ; SECTOR
                             ;     BUFFER FOR READ AND WRITE OPERATION
 = 0200                      DK_BUF_LEN     EQU     512     ; 512 BYTES/SECTOR
 0020  ??                    DIAG_RETRY     DB      ?
 0021  0200 [                READ_BUF       DB      DK_BUF_LEN DUP(0)
                 00
                    ]

 0221  0100 [                WRITE_BUF      DB      (DK_BUF_LEN/2) DUP(6DH,0BH)
                 6D
                 0B
                    ]

 0421      07 [              UNEC_STATUS    DB      7 DUP(?)
                 ??
                    ]

 0428                        DKDATA  ENDS
                             ;--------------------------------------
                             ;     VIDEO DISPLAY BUFFER
                             ;--------------------------------------
 0000                        VIDEO_RAM      SEGMENT AT 0B800H
 0000  4000 [                       DB      16384 DUP(?)
                 ??
                    ]

 4000                        VIDEO_RAM      ENDS

                             ;**************************************************
                             ; TKR_SEG1.INC
                             ;       THIS MODULE CONTAINS SEGMENT DEFINITION 1.

                             ;       DUMMY IS THE SEGMENT LOCATED AT ABSOLUTE
                             ;       LOCATION 0 HOLDING THE INTERRUPT VECTORS.
                             ;**************************************************

 0000                        DUMMY    SEGMENT AT 0

 0024                                 ORG     09H*4         ;INT 9H
 0024                        LPC_PTR    LABEL   WORD        ;POINTER TO LPC CODE
 0024                        OLDKBD_PTR LABEL   WORD        ;OLD POINTER TO KBD CODE

 0134                                 ORG     04DH*4        ;INT 4DH
 0134                        TALKER_PTR LABEL   WORD        ;POINTER TO BIOS CODE

 0138                                 ORG     04EH*4        ;INT 4EH
 0138                        KBD_PTR    LABEL   WORD        ;NEW POINTER TO KBD CODE



 013C                                 ORG     04FH*4        ;INT 4FH
 013C                        BFR_PTR    LABEL   WORD        ;POINTER TO LPC BUFR, COUNTER

 0248                                ORG     092H*4         ;INT 92H
 0248                        TALKER_DIAG_PTR LABEL   WORD   ;POINTER FOR DIAG CODE ENTRY

 0248                        DUMMY    ENDS

                             ;8255 PORTS - I/O ADDRESSES

 = 1B98                      PORTA      EQU     01B98H      ;8255 PORT A
 = 1B99                      PORTB      EQU     01B99H      ;8255 PORT B
 = 1B9A                      PORTC      EQU     01B9AH      ;8255 PORT C
 = 1B9B                      CWREG      EQU     01B9BH      ;8255 CONTROL WORD REGISTER

                             ;---------------------------------------------------------------
                             ;PORT A  (OUTPUT)
                             ;---------------------------------------------------------------
                             ;
                             ;PORT A:    | PA7 | PA6 | PA5 | PA4 | PA3 | PA2 | PA1 | PA0 |
                             ;           |_____|_____|_____|_____|_____|_____|_____|_____|

                             ;PA7 - LPC SPEAK IN PROGRESS FLAG
 = 0080                      TALK_LPC   EQU     10000000B   ;LPC SPEAK IN PROGRESS FLAG

                             ;PA6 - UNUSED

                             ;PA5,PA4 - RESERVED

                             ;PA3,PA2 - ROM PAGE

 = 0000                      PAGE0      EQU     00000000B   ;ROM PAGE 0
 = 0004                      PAGE1      EQU     00000100B   ;ROM PAGE 1
 = 0008                      PAGE2      EQU     00001000B   ;ROM PAGE 2
 = 000C                      PAGE3      EQU     00001100B   ;ROM PAGE 3

                             ;PA1,PA0 - CHANNEL MUX

 = 0000                      LPC        EQU     00000000B   ;LPC
```

```
  = 0001                              CVSD        EQU     00000001B     ;CVSD
  = 0002                              AUDIO8254   EQU     00000010B     ;8254 AUDIO

  = 00F3                              CLR_PAGE    EQU     11110011B     ;CLEAR ROM PAGE
  = 00FC                              CLR_MUX     EQU     11111100B     ;CLEAR CHANNEL MUX
  = 00F0                              CLR_MXPG    EQU     11110000B     ;CLEAR ROM PAGE & CH MUX

                                      ;------------------------------------------------------------


                                      ;PORT B  (INPUT/OUTPUT)
                                      ;------------------------------------------------------------
                                      ;
                                      ;PORT B:      | PB7 | PB6 | PB5 | PB4 | PB3 | PB2 | PB1 | PB0 |
                                      ;
                                      ;PB7-PB0  - LPC BUS
                                      ;
                                      ;PORT C:      | PC7 | PC6 | PC5 | PC4 | PC3 | PC2 | PC1 | PC0 |
                                      ;
                                      ; ---> PORT C - UPPER  (OUTPUT)

                                      ;PC7 - UNUSED

                                      ;PC6 - CVSD ENCODE/DECODE

                                      ;PC5 - LPC WRITE

                                      ;PC4 - LPC READ

                                      ; ---> PORT C - LOWER  (INPUT)

                                      ;PC3 - UNUSED

                                      ;PC2 - CVSD ENCODE/DECODE
  = 0004                              FRAME_HI    EQU     00000100B     ;CVSD FRAME HI            (+)

                                      ;PC1 - LPC INTERRUPT
  = 0002                              LPC_INT     EQU     00000010B     ;LPC INTERRUPT            (-)

                                      ;PC0 - LPC READY
  = 0001                              LPC_READY   EQU     00000001B     ;LPC BUSY  (0 => READY)   (-)

                                      ;MODE DEFINITION FORMAT
                                      ;
                                      ;CONTROL WORD REG:    | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 |
                                      ;
                                      ;D7 - MODE SET FLAG
  = 0080                              MODE_SET    EQU     10000000B     ;MODE SET FLAG (1 = ACTIVE)

                                      ;D6,D5 - PORT A - MODE SELECTION
  = 0000                              MODE0_A     EQU     00000000B     ;PORT A MODE 0
  = 0020                              MODE1_A     EQU     00100000B     ;PORT A MODE 1


  = 0040                              MODE2_A     EQU     01000000B     ;PORT A MODE 2

                                      ;D4 - PORT A
  = 0000                              PORTA_OUT   EQU     00000000B     ;PORT A OUTPUT
  = 0010                              PORTA_IN    EQU     00010000B     ;PORT A INPUT

                                      ;D3 - PORT C (UPPER)
  = 0000                              PORTCU_OUT  EQU     00000000B     ;PORT C - UPPER OUTPUT
  = 0008                              PORTCU_IN   EQU     00001000B     ;PORT C - UPPER INPUT

                                      ;D2 - MODE SELECTION - PORT B
  = 0000                              MODE0_B     EQU     00000000B     ;PORT B MODE 0
  = 0004                              MODE1_B     EQU     00000100B     ;PORT B MODE 1

                                      ;D1 - PORT B
  = 0000                              PORTB_OUT   EQU     00000000B     ;PORT B OUTPUT
  = 0002                              PORTB_IN    EQU     00000010B     ;PORT B INPUT

                                      ;D0 - PORT C (LOWER)
  = 0000                              PORTCL_OUT  EQU     00000000B     ;PORT C - LOWER OUTPUT
  = 0001                              PORTCL_IN   EQU     00000001B     ;PORT C - LOWER INPUT

  = 0080                              LPC_IN0     EQU     MODE_SET+MODE0_A+PORTA_OUT+PORTCU_OUT
  = 0003                              LPC_IN1     EQU     MODE0_B+PORTB_IN+PORTCL_IN
  = 0083                              LPC_IN      EQU     LPC_IN0+LPC_IN1

  = 0080                              LPC_OUT0    EQU     MODE_SET+MODE0_A+PORTA_OUT+PORTCU_OUT
  = 0001                              LPC_OUT1    EQU     MODE0_B+PORTB_OUT+PORTCL_IN
  = 0081                              LPC_OUT     EQU     LPC_OUT0+LPC_OUT1

                                      ;BIT SET/RESET FORMAT
                                      ;
                                      ;CONTROL WORD REG:    | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 |
                                      ;
                                      ;D7 - BIT SET/RESET FLAG       (0 - ACTIVE)

                                      ;D6,D5,D4 - UNUSED

                                      ;D3,D2,D1 - BIT SELECT
                                      ;               100  =>  BIT 4 - LPC READ
                                      ;               101  =>  BIT 5 - LPC WRITE
                                      ;               110  =>  BIT 6 - CVSD DECODE/ENCODE
                                      ;               111  =>  BIT 7 - UNUSED

                                      ;D0 - BIT SET/RESET   (1 - BIT SET)

  = 0008                              LPCR_OFF    EQU     00001000B     ;LPC READ OFF
  = 0009                              LPCR_ON     EQU     00001001B     ;LPC READ ON

  = 000A                              LPCW_OFF    EQU     00001010B     ;LPC WRITE OFF
```

D. F-8C

```
                                   LPCW ON      EQU     00000101B     ;LPC WRITE ON
         000D                      ENCODE       EQU     00001101B     ;ENCODE (RECORD)
       = 000C                      DECODE       EQU     00001100B     ;DECODE (SPEAK)

                                   ;8254 PORTS - I/O ADDRESSES

         FF9C                      CVSD CLK     EQU     0FF9CH        ;8254 CTR 0 - CVSD BIT CLOCK
       = FF9D                      CVSD FRAME   EQU     0FF9DH        ;8254 CTR 1 - CVSD FRAME
         FF9E                      INTR CTR     EQU     0FF9EH        ;8254 CTR 2 - INTR PULSE CTR
       = FF9F                      CWR_8254     EQU     0FF9FH        ;8254 CONTROL WORD REGISTER

                                   ;CONTROL WORD FORMAT
                                   ;
                                   ;                     ----------------------------------------
                                   ;CONTROL WORD REG:    | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 |
                                   ;                     ----------------------------------------

                                   ;D7,D6 - SELECT COUNTER

       = 0000                      CTR0         EQU     00000000B     ;SELECT COUNTER 0
       = 0040                      CTR1         EQU     01000000B     ;SELECT COUNTER 1
       = 0080                      CTR2         EQU     10000000B     ;SELECT COUNTER 2
       = 00C0                      RD BACK      EQU     11000000B     ;READ BACK COMMAND

                                   ;D5,D4 - READ/WRITE

       = 0000                      CTR LATCH    EQU     00000000B     ;COUNTER LATCH COMMAND
       = 0010                      RW LSB       EQU     00010000B     ;READ/WRITE LEAST SIG BYTE ONLY
       = 0020                      RW MSB       EQU     00100000B     ;READ/WRITE MOST SIG BYTE ONLY
       = 0030                      RW LSBMSB    EQU     00110000B     ;READ/WRITE LSB FIRST,THEN MSB

                                   ;D3,D2,D1 - MODE

       = 0000                      MD0          EQU     00000000B     ;MODE 0 - INTR ON TERM CNT
       = 0002                      MD1          EQU     00000010B     ;MODE 1 - HARDWARE ONE-SHOT
       = 0004                      MD2          EQU     00000100B     ;MODE 2 - RATE GENERATOR
       = 0006                      MD3          EQU     00000110B     ;MODE 3 - SQUARE WAVE MODE
       = 0008                      MD4          EQU     00001000B     ;MODE 4 - SOFTWARE TRIG. STROBE
       = 000A                      MD5          EQU     00001010B     ;MODE 5 - HARDWARE TRIG. STROBE

                                   ;D0 - BINARY/BCD COUNTER

       = 0000                      BINARY       EQU     00000000B     ;BINARY COUNTER
       = 0001                      BCD          EQU     00000001B     ;BCD COUNTER

                                   ;ATTACHMENT ENABLE PORT

       = FF9A                      TKR_ACL      EQU     0FF9AH        ;TALKER II AUDIO CONTROL LATCH

       = 0001                      CHN ON       EQU     01H           ;ENABLE CHANNEL    (OUTPUT)


       = 0000                      CHN_OFF      EQU     00H           ;DISABLE CHANNEL   (OUTPUT)
       = 0001                      ACL OFF      EQU     001H          ;ACL DISABLED      (INPUT)
                                   ;NOTE: NOTICE THERE IS A DIFFERENCE IN POLARITIES BETWEEN

                                   ;       ENABLING/DISABLING THE ACL (OUTPUT) AND READING THE
                                   ;       STATUS OF THE ACL (INPUT).

                                   ;CVSD SHIFT REGISTER

       = FF98                      SHIFTREG     EQU     0FF98H        ;CVSD SHIFT REGISTER

                                   ;SYSTEM'S 8255 PORT B - PORT 61H

       = 0061                      PORT 61H     EQU     061H          ;8255 PORT B
       = 009F                      CLR SPKSW    EQU     10011111B     ;CLEAR SPKR SWITCH BITS (PB6,PB5)
       = 0040                      AUDIO_CHN    EQU     01000000B     ;I/O AUDIO CHANNEL IN

                                   ;SYSTEM'S 8259

       = 0020                      PORT 20H     EQU     020H          ;8259 OPERATION CNTL PORT
       = 0021                      PORT 21H     EQU     021H          ;8259 MASK REGISTER
       = 00FD                      INT1 ON      EQU     0FDH          ;ENABLE INTR 1  (AND)
       = 0002                      INT1 OFF     EQU     002H          ;DISABLE INTR 1  (OR)
       = 0061                      INT1_EOI     EQU     01100001B     ;SPECIFIC EOI CMD

                                   ;SYSTEM NMI PORT

       = 00A0                      NMI_PORT     EQU     0A0H          ;NMI PORT

                                   ;CVSD SPEED EQUATES

       = 0000                      SPEED 0      EQU     00H           ;SPEED = 1800 BYTES/SEC  (1802)
       = 0001                      SPEED 1      EQU     01H           ;SPEED = 2400 BYTES/SEC  (2396)
       = 0002                      SPEED 2      EQU     02H           ;SPEED = 3000 BYTES/SEC  (2997)
       = 0003                      SPEED 3      EQU     03H           ;SPEED = 3600 BYTES/SEC  (3593)
       = 0004                      SPEED 4      EQU     04H           ;SPEED = 4200 BYTES/SEC  (4201)
       = 0005                      SPEED 5      EQU     05H           ;SPEED = 4800 BYTES/SEC  (4811)
       = 0005                      SPEED_MAX    EQU     05H           ;MAXIMUM VALUE FOR SPEED DECODE
                                   ; FUNCTION DECODES & ERRORS

                                   ; FUNCTION VALUE IN AH

       = 0000                      RST_FN       EQU     00H           ;RESET CARD FUNCTION
       = 0001                      CVSD FN      EQU     01H           ;CVSD FUNCTION
       = 0002                      LPC_FN       EQU     02H           ;LPC FUNCTION (BACKGROUND)
       = 0003                      LPC_FN FORE  EQU     03H           ;LPC FOREGROUND FUNCTION

                                   ; SUB-FUNC IO    E IN AL

       = 0000                      LPC_STATUS  .Q       00H           ;LPC STATUS
       = 0001                      LPC_INDEX    EQU     01H           ;LPC SPEAK - INDEX


       = 0002                      LPC_BUFFER   EQU     02H           ;LPC SPEAK - BUFFER

       = 0000                      CVSDR        EQU     00H           ;CVSD RECORD INDICATOR
       = 00FF                      CVSDW        EQU     0FFH          ;CVSD PLAYBA K INDICATOR

       = 0000                      CVSDR_TBL    EQU     00H           ;CVSD RECORD USING TABLE SPEED
       = 0001                      CVSDW TBL    EQU     01H           ;CVSD PLAYBACK USING TABLE SPEED
       = 0002                      CVSDR USER   EQU     02H           ;CVSD RECORD USING USER SPEED
       = 0003                      CVSDW USER   EQU     03H           ;CVSD PLAYBACK USING USER SPEED

                                   ; RETURN CODES (VALUE IN AL)
```

```
= 0001                         BAD_CMD     EQU    01H          ;UNDEFINED COMMAND
= 0002                         LPC_INPROG  EQU    02H          ;LPC SPEAK IN PROGRESS
= 0003                         ACT_ERROR   EQU    03H          ;ACT STUCK ON CARD
= 0004                         INDEX_ERR   EQU    04H          ;LPC INDEX OUT OF RANGE
= 0005                         SPEED_ERR   EQU    05H          ;SPEED OUT OF RANGE
= 0006                         LPRDY_ERR   EQU    06H          ;TIMEOUT WAITING FOR LPC READY

                               ; USED INTERRUPTS

= 004D                         TALKER      EQU    04DH         ;BIOS INTERRUPT
= 004E                         FDD         EQU    04EH         ;FDD INTR MOVED TO 04EH

                               ; 5220 COMMANDS

= 0060                         SPK_EXT     EQU    01100000B    ;SPEAK EXTERNAL CMD (X110XXXX)
= 00FF                         RST_5220    EQU    11111111B    ;RESET CMD (X111XXXX)

                               ; 5220 STATUS

= 0080                         TALK_ON     EQU    80H          ;TS - TALK STATUS ACTIVE
= 0040                         BFR_LOW     EQU    40H          ;BL - BUFFER LOW
= 0020                         BFR_EMPTY   EQU    20H          ;BE - BUFFER EMPTY

= 00FF                         STOP_CODE   EQU    0FFH         ;5220 SPEAK STOP CODE

                               ;       POST ERROR CODE
                               ;
= 004A                         CUST_ER          EQU    'J'     ;CUSTOMER ER. CODE
= 0028                         SERV_ER          EQU    28H     ;SERVICE ER. CODE
= 2833                         RESET_ER         EQU    2833H   ;SERVICE LEVEL ERROR
                                                               ;WHEN CARD RESET FAILS
= 0001                         ER_CODE8255      EQU    01H     ;ER. CODE ON THE 8255
= 0002                         ER_CODE8254      EQU    02H     ;ER. CODE ON THE 8254
                               ;
                               ;       DIAGNOSTIC ERROR CODE FOR LPC AND CVSD
                               ;
                               ;               CUSTOMER LEVEL
                               ;
= 0042                         ER_LPC_C1        EQU    'B'     ;RESET FAIL, PROBABLY BAD CARD
= 0043                         ER_LPC_C2        EQU    'C'     ;LPC ERROR


= 0044                         ER_CVSD_C1       EQU    'D'     ;CVSD PLAYBACK ERROR
= 0045                         ER_CVSD_C2       EQU    'E'     ;CVSD RECORD ERROR
                               ;
                               ;               SERVICE LEVEL
                               ;
= 0010                         ER_LPC_S1        EQU    10H     ;RESET FAIL, PROBABLY BAD CARD
= 0011                         ER_LPC_S2        EQU    11H     ;LPC ERROR
= 0012                         ER_CVSD_S1       EQU    12H     ;CVSD PLAYBACK ERROR
= 0013                         ER_CVSD_S2       EQU    13H     ;CVSD RECORD ERROR
= 0014                         ER_CVSD_S3       EQU    14H     ;CVSD PLAYBACK AFTER RECORD ERROR
                               ;
  0007                         ICN_WIDTH        EQU    07H      ;TALKER ICON WIDTH
                               ;
                               ;       CURSOR POSITION TO PUT TALKER ICON, SELECTION
                               ;
= 0710                         SPEAKER_POS      EQU    0710H  ;CURSOR AT ROW 7 COL 16
= 0A15                         WAVE_POS         EQU    0A15H  ;   "          10  " 21

= 0812                         MIC_POS          EQU    0812H  ;   "          8   " 18
= 8900                         ARROW_POS1       EQU    8900H  ;   "          9   " 13 BIT
                                                              ; SET FOR SPECIAL ATTRIBUTE
= 8900                         ARROW_POS2       EQU    08900H ;   "          9   " 13 BIT
                                                         ; SET FOR SPECIAL ATTRIBUTE AND BEEP
                               ;
                               ;       ROUTINE USED FROM SYSTEM BIOS
                               ;
= 0081                         LOCATE           EQU    81H     ;LOCATE ROUTINE TO PUT ICON
= 0082                         PRINT            EQU    82H     ;PRINT ROUTINE TO PUT ICON

0000                           TMRSEG  SEGMENT

                                       ASSUME  CS:TMRSEG,DS:DUMMY

0000                                   ORG     0
0000  55 AA                    H       DB      055H,0AAH       ;POS INDICATOR
0002  10                               DB      010H            ;LENGTH

0003                           INIT    PROC    FAR
0003  EB 2A                            JMP     SHORT INIT1     ;GO TO BEG OF INIT CODE
0005  00                               DB      PAGE0           ;BANK 0 IDENTIFIER
0006  00                               DB      00H             ;CMD NAME LENGTH
                               ;                               ;COPYRIGHT INFORMATION
0007  36 31 38 31 37 33                DB      '6181736 COPR. IBM 1984'
      36 20 43 4F 50 52
      2E 20 49 42 4D 20
      31 39 38 34


                               ;TABLE OF DIVISORS FOR DIFFERENT CVSD RATES

0010  014B                     SPEED_TBL    DW      331        ;SPEED = 1800 BYTES/SEC
0012  00F9                                  DW      249        ;SPEED = 2400 BYTES/SEC
0014  00C7                                  DW      199        ;SPEED = 3000 BYTES/SEC
0016  00A6                                  DW      166        ;SPEED = 3600 BYTES/SEC
0018  008E                                  DW      142        ;SPEED = 4200 BYTES/SEC



001A  007C                                  DW      124        ;SPEED = 4800 BYTES/SEC

001C  0C90 R                                DW      OFFSET WORDS_BEGIN ;POINTER TO THE END OF
                                                               ;DUPLICATED CODE

                               ;********************************************************************
                               ; DESCRIPTION:
                               ;       TEST CODE IS LOADED INTO RAM AT SEGMENT 1000H AND
                               ;       THE SAME OFFSET IT HAS IN THIS ROM MODULE
                               ;       CONTROL IS PASSED TO THIS RAM CODE
                               ;       THE 8255 PPI IS TESTED.
                               ;       BANK SWITCHING IS TESTED, AND ALL FOUR BANKS ARE
                               ;       CHECKSUMMED
                               ;       IF AN ERROR IS ENCOUNTERED, IT IS PROCESSED AND
                               ;       CONTROL IS RETURNED DIRECTLY TO THE SYSTEM (RATHER
                               ;       THAT TO THE FEATURE ROM)
                               ;       IF NO ERROR IS ENCOUNTERED, RAM IS RESTORED TO ZEROS UPON
                               ;       RETURN.
                               ;
                               ; ENTRY CONDITIONS:
                               ;       BC LEN MUST EQUAL THE # OF WORDS
                               ;       TO BE MOVED. BE START MUST EQ AT THE OFFSET OF THE
                               ;       BEGINNING OF THE CODE TO MOVE
```

```
                                        ; ON EXIT:
                                        ;       ALL REGS BUT BX,DX,SP, AND SS ARE DESTROYED.
                                        ;
                                        ;.................................................................
 002B  01AA R                           BCLOC   DW      OFFSET BANK_TEST_START
 002D  0100                                     DW      0100H           ;RAM STARTING LOCATION OF THE CODE.
 002F                                   INIT1:
 002F  B8 0100                                  MOV     AX,0100H                ;LOAD CODE ON THE 4K BOUND
 0032  8E C0                                    MOV     ES,AX                   ;
 0034  BF 0172 R                                MOV     DI,OFFSET BC_START
 0037  57                                       PUSH    DI                      ;SAVE DI FOR LATER
 0038  8B F7                                    MOV     SI,DI                   ;ES:DI=LOCATION TO PUT CODE
 003A  0E                                       PUSH    CS
 003B  1F                                       POP     DS                      ;DS:SI LOC OF CODE TO LIFT
 003C  B9 0081 90                               MOV     CX,BCLEN                ;NUMBER OF WORDS TO MOVE
 0040  51                                       PUSH    CX                      ;SAVE CX FOR LATER USE
 0041  F3/ A5                                   REP     MOVSW                   ;MOVE THE CODE TO RAM

 0043  06                                       PUSH    ES                      ;SAVE REGS ADDRESSING RAM

 0044  2E: FF 1E 002B R                         CALL    DWORD PTR BCLOC         ;CALL RAM CODE

 0049  07                                       POP     ES                      ;RESTORE REGS ADDRESSING
 004A  59                                       POP     CX                      ;RAM
 004B  5F                                       POP     DI
 004C  33 C0                                    XOR     AX,AX                   ;AX=0

 004E  F3/ AB                                   REP     STOSW                   ;RESTORE USED RAM TO ZEROS



                                        ;.........................................................
                                        ;       THIS CODE LOADS THE NEEDED INTERRUPT VECTORS
                                        ;.........................................................
 0050  33 C0                                    XOR     AX,AX
 0052  8E D8                                    MOV     DS,AX
 0054  C7 06 0134 R 02D4 R                      MOV     WORD PTR TALKER_PTR,OFFSET START
 005A  8C 0E 0136 R                             MOV     WORD PTR TALKER_PTR+2,CS
 005E  C7 06 0248 R 07FF R                      MOV     WORD PTR TALKER_DIAG_PTR,OFFSET TALKER2_DIAG
 0064  8C 0E 024A R                             MOV     WORD PTR TALKER_DIAG_PTR+2,CS

                                        ;..............................................................|
                                        ; POWER ON SELF TEST                                            |
                                        ;                                                               |
                                        ; DESCRIPTION:                                                  |
                                        ;       TIMER CHANNELS ON THE 8254 ARE TESTED FOR STUCK BITS.   |
                                        ;       TIMER 1'S RESPONSE TO TIMER 0 IS CHECKED.               |
                                        ;       HARDWARE ON THE CARD IS RESET (SEE BIOS RESET COMMAND)  |
                                        ;                                                               |
                                        ; ERROR CODES:  (SOME MAY BE PASSED BY CODE PREVIOUSLY EXECUTED|
                                        ;               FROM RAM)                                       |
                                        ;       CUSTOMER LEVEL: J                                       |
                                        ;       SERVICE LEVEL:  28XX                                    |
                                        ;                  XX = 01 PORT A FAIL MODE 83H                 |
                                        ;                       02   "  B   "    "   "                  |
                                        ;                       03   "  C   "    "   "                  |
                                        ;                       04   "  A   "    "  81H                 |
                                        ;                       05   "  C   "    "   "                  |
                                        ;                                                               |
                                        ;                       10 STUCK BIT IN TIMER CHANNEL 0         |
                                        ;                       11 STUCK BIT IN TIMER CHANNEL 1         |
                                        ;                       12 STUCK BIT IN TIMER CHANNEL 2         |
                                        ;                       13 CVSD FRAME NOT CHANGING              |
                                        ;                       14 CVSD CLOCK NOT CHANGING              |
                                        ;                       15 CVSD FRAME NOT RESPONDING TO         |
                                        ;                            CVSD CLOCK AS EXPECTED             |
                                        ;                       23 ACL ERROR DURRING CARD RESET         |
                                        ;                       26 TIMEOUT WAITING FOR  LPC             |
                                        ;                            COMPLETION DURRING CARD            |
                                        ;                            RESET                              |
                                        ;                                                               |
                                        ;       PORT A = F898H                                          |
                                        ;       PORT B = F899H                                          |
                                        ;       PORT C = F89AH                                          |
                                        ;..............................................................|

                                        ;---------------------------------------------------------------
                                        ; TEST:                                                         |
                                        ;       8254 PROGRAMMABLE INTERVAL TIMER TEST                   |
                                        ;                                                               |
                                        ; DESCRIPTION:                                                  |
                                        ;       TEST FOR STUCK BITS IN TIMER CHANNELS 0, 1, AND 2.      |
                                        ;       TEST TO SEE THAT THE OUTPUT OF TIMER 0 IS WORKING       |
                                        ;       VERIFY THAT VIMER 1 DIVIDES TIMER 0 BY 8                |



                                        ; NOTES:                                                        |
                                        ;       COUNTER 0 = CVSD BIT CLOCK                              |
                                        ;       COUNTER 1 = CVSD FRAME                                  |
                                        ;       COUNTER 2 = LPC INTERRUPT CLOCK                         |
                                        ;---------------------------------------------------------------
 0068                                   POST    PROC    FAR

                                        ;---------------------------------------------------------------
                                        ;       RESET HARDWARE INTO A KNOWN STATE                       :
                                        ;---------------------------------------------------------------
 0068  E8 0308 R                                CALL    RST_TALKER      ;INIT 8255, 8254, ACL
 006B  0A C0                                    OR      AL,AL           ;AL = 00  PASSED, ELSE FAILED
 006D  74 03                                    JZ      T8254           ;PASSED
 006F  E9 0110 R                                JMP     CARD_RESET_ER   ;REPORT CARD RESET ERROR
                                        ;
                                        ; SET INITIAL COUNT FOR CTRS 0, 1, AND 2 TO TEST FOR STUCK BITS
                                        ;
 0072                                   T8254:
 0072  B0 36                                    MOV     AL,CTR0+RW_LSBMSB+MD3+BINARY    ;FOR CWR 8254
 0074  B9 F89C                                  MOV     CX,CVSD_CLK     ;COUNTER 0
 0077  BB FFFF                                  MOV     BX,0FFFFH       ;INITIAL COUNT FOR COUNTER 0
 007A  E8 011D R                                CALL    INIT_TIMER      ;SET INITIAL COUNT

 007D  B0 74                                    MOV     AL,CTR1+RW_LSBMSB+MD2+BINARY    ;FOR CWR 8254
 007F  41                                       INC     CX              ;COUNTER 1 HAS CVSD FRAME ADDR
 0080  B7 00                                    MOV     BH,00           ;INITIAL COUNT FOR CTR 1 IS 00FF
 0082  E8 011D R                                CALL    INIT_TIMER      ;SET INITIAL COUNT

 0085  B0 B4                                    MOV     AL,CTR2+RW_LSBMSB+MD2+BINARY    ;FOR LPC INT TIMER
 0087  41                                       INC     CX              ;COUNTER 2 HAS INTR CTR ADDR
                                                                        ;INITIAL COUNT IS 00FF
 0089  E8 011D R                                CALL    INIT_TIMER      ;SET INITIAL COUNT
```

```
                           ;
                           ; CHECK IF ALL BITS GO ON/OFF IN COUNTER 0 (CVSD_CLK)
                           ;
008B  B0 06                        MOV     AL,CTR0+CTR_LATCH+MD3+BINARY      ;FOR CWR 8254
008D  BA FF9C                      MOV     DX,CVSD_CLK        ;COUNTER 0
0090  E8 012C R                    CALL    BITS_ON_OFF        ;SEE THAT ALL BITS GO ON AND OFF
0093  B3 10                        MOV     BL,10H             ;ERROR CODE FOR COUNTER 0 IS 10
0095  72 0C                        JC      TIMER_ERROR        ;POST MESSAGE IF ERROR FOUND
                           ;
                           ; CHECK IF ALL BITS GO ON/OFF IN TIMER 1 (CVSD_FRAME)
                           ;
0097                       COUNTER_CK:
0097  B0 44                        MOV     AL,CTR1+CTR_LATCH+MD2+BINARY      ;FOR CWR 8254
0099  BA FF9D                      MOV     DX,CVSD_FRAME      ;COUNTER 1
009C  E8 012C R                    CALL    BITS_ON_OFF        ;CHECK BITS
009F  B3 11                        MOV     BL,11H             ;ERROR CODE COUNTER 1 IS 11
00A1  73 07                        JNC     CHECK_COUNTER_2    ;IF NO ERROR GO ON
                                                              ;OTHERWISE FALL THROUGH AND


                                                              ;POST AN ERROR
00A3                       TIMER_ERROR:
00A3  B4 4A                        MOV     AH,CUST_ER         ;CUSTOMER ER. CODE FOR IS "J"
00A5  B7 20                        MOV     BH,SERV_ER         ;SERVICE ERROR CODE IS 20XX
00A7  E9 0211 R                    JMP     NEAR PTR E_MSG_B   ;DISPLAY ERROR MESSAGE
                           ;
                           ; CHECK IF ALL BITS GO ON/OFF IN TIMER 2 (INTR_CTR )
                           ;
00AA                       CHECK_COUNTER_2:
00AA  B0 84                        MOV     AL,CTR2+CTR_LATCH+MD2+BINARY      ;FOR LPC INT TIMER
00AC  BA FF9E                      MOV     DX,INTR_CTR        ;COUNTER 2
00AF  E8 012C R                    CALL    BITS_ON_OFF        ;CHECK BITS
00B2  B3 12                        MOV     BL,12H             ;ERROR CODE COUNTER 2 IS 12
00B4  72 ED                        JC      TIMER_ERROR        ;POST ERROR MESSAGE
                           ;
                           ; SET INITIAL COUNT FOR COUNTERS 0 AND 1
                           ;
00B6  B0 36                        MOV     AL,CTR0+RW_LSBMSB+MD3+BINARY
00B8  BA FF9C                      MOV     DX,CVSD_CLK        ;COUNTER 0 INIT
00BB  BB 03FF                      MOV     BX,03FFH           ;COUNT DOWN FROM 03FFH
00BE  E8 0110 R                    CALL    INIT_TIMER

00C1  B0 74                        MOV     AL,CTR1+RW_LSBMSB+MD2+BINARY
00C3  42                           INC     DX                 ;COUNTER 1 INIT
00C4  BB 0008                      MOV     BX,8               ;DIVIDE BY 8
00C7  E8 0110 R                    CALL    INIT_TIMER

00CA  BA FF9A                      MOV     DX,PORTC           ;PORT ADDRESS OF PORT C
                                                              ;THE OUTPUT OF TIMERS 0 AND 1 CAN
                                                              ;BE READ ON PORT C
00CD  B3 13                        MOV     BL,13H             ;ERROR CODE
00CF  33 C9                        XOR     CX,CX              ;TIMEOUT

00D1                       TEST_FRAME_HI:
00D1  EC                           IN      AL,DX              ;GET COUNTER OUTPUT VALUES
00D2  A8 04                        TEST    AL,00000100B       ;TEST CVSD FRAME BIT
00D4  E1 FB                        LOOPZ   TEST_FRAME_HI      ;IF FRAME IS LOW LOOP BACK

00D6  E3 CB                        JCXZ    TIMER_ERROR        ;TIMEOUT, NO CVSD FRAME
                                                              ;ERROR CODE 13
00D8  33 C9                        XOR     CX,CX

00DA                       TEST_FRAME_LO:
00DA  EC                           IN      AL,DX
00DB  A8 04                        TEST    AL,00000100B       ;TEST CVSD FRAME BIT
00DD  E0 FB                        LOOPNZ  TEST_FRAME_LO      ;LOOP BACK UNTIL FRAME GOES LOW

00DF  E3 C2                        JCXZ    TIMER_ERROR        ;IF FRAME DOESN'T GO LOW, ERROR
                                                              ;ERROR CODE 13
00E1  43                           INC     BX                 ;INCREMENT ERROR TO 14

00E2  B9 0008                      MOV     CX,8
00E5                       TRANSIT:
00E5  51                           PUSH    CX                 ;WE WILL WATCH 8 CYCLES OF TIMER 0



00E6  33 C9                        XOR     CX,CX
00E8                       LTH:
00E8  EC                           IN      AL,DX
00E9  A8 08                        TEST    AL,00001000B       ;LOOK AT OUTPUT OF TIMER 0
00EB  E1 FB                        LOOPZ   LTH                ;LOOP UNTIL LO TO HI TRANSIT MADE
00ED  E3 13                        JCXZ    CT_EP              ;IF TIMEOUT, TIMER IS TOO SLOW
                                                              ;ERROR CODE 14
00EF  33 C9                        XOR     CX,CX
00F1                       HTL:
00F1  EC                           IN      AL,DX
00F2  A8 08                        TEST    AL,00001000B       ;LOOK AT OUTPUT OF TIMER 0
00F4  E0 FB                        LOOPNZ  HTL                ;LOOP UNTIL HI TO LO TRANSIT MADE
00F6  E3 0A                        JCXZ    CT_EP              ;ERROR 14 IF TIMEOUT

00F8  59                           POP     CX
00F9  A8 04                        TEST    AL,00000100B       ;IS THE CVSD FRAME BIT HIGH?
00FB  E0 E8                        LOOPNZ  TRANSIT            ;IT SHOULD BE FOR 8 CLOCK CYCLES

00FD  43                           INC     BX                 ;INCREMENT ERROR BYTE TO 15
00FE  E3 05                        JCXZ    LO                 ;IF CX IS NOT 0 A TIMER IS BROKEN
0100  EB A1                        JMP     SHORT TIMER_ERROR

0102                       CT_EP:
0102  58                           POP     AX                 ;BALANCE STACK FOR RETURN
0103  EB 9E                        JMP     TIMER_ERROR

0105                       LO:
0105  A8 04                        TEST    AL,00000100B       ;IS THE CVSD FRAME HIGH?
0107  75 9A                        JNZ     TIMER_ERROR        ;IF SO, IT IS BROKEN

                           ;---------------------------------------------------------------
                           ;       RESET HARDWARE INTO A KNOWN STATE                      :
                           ;---------------------------------------------------------------
0109  E8 0300 R                    CALL    RST_TALKER         ;INIT 8255, 8254, ACL
010C  0A C0                        OR      AL,AL              ;AL = 00  PASSED, ELSE FAILED
010E  74 0C                        JZ      EXIT_POST
0110                       CARD_RESET_ER:
0110  B4 4A                        MOV     AH,CUST_ER         ;SET ERROR CODES IN CASE OF FAILURE
0112  B7 20                        MOV     BH,20H             ;HIGH PART OF SERVICE ERR. = 20
0114  8A D8                        MOV     BL,AL              ;AL IS ERROR CODE RETURNED BY RESET
0116  80 CB 20                     OR      BL,20H             ;BL = 21 OR 26.
0119  E9 0211 R                    JMP     NEAR PTR E_MSG_B   ;PUT ERROR MESSAGE
011C                       EXIT_POST:
011C  C3                           RET

011D                       POST    ENDP
```

D. F-8C

```
                                   ;***********************
                                   ;SUBROUTINES FOR POST  |
                                   ;***********************

                                   ;-------------------------------------------------------------
                                   ; INIT_TIMER       SUBROUTINE -                               |


                                   ;        SET COUNTER TO INITIAL COUNT                         :
                                   ; ENTRY:                                                      :
                                   ;        CX = COUNTER 0 OR 1 OR 2 ADDRESS                     :
                                   ;        AL = CONTROL WORD REGISTER (CWR)                     :
                                   ;        BX = INITIAL COUNT                                   :
                                   ;                BH = MSB COUNT                               :
                                   ;                BL = LSB COUNT                               :
                                   ; EXIT:                                                       :
                                   ;        DX = COUNTER ADDRESS                                 :
                                   ;        AL = HI BYTE OF INITIAL COUNT                        :
                                   ;        OTHER REGISTERS ARE UNCHANGED
                                   ;-------------------------------------------------------------
0110                               INIT_TIMER          PROC     NEAR
0110  51                                   PUSH    CX                  ;SAVE COUNTER ADDRESS
011E  BA FB9F                              MOV     DX,CWR_8254         ;CONFIGURE CWR FOR COUNTER
0121  EE                                   OUT     DX,AL
0122  5A                                   POP     DX                  ;RESTORE COUNTER ADDRESS
0123  8A C3                                MOV     AL,BL               ;LOAD LSB
0125  EE                                   OUT     DX,AL
0126  50                                   PUSH    AX                  ;PAUSE
0127  58                                   POP     AX
0128  8A C7                                MOV     AL,BH               ;LOAD MSB
012A  EE                                   OUT     DX,AL
012B  C3                                   RET
012C                               INIT_TIMER          ENDP

                                   ;-------------------------------------------------------------
                                   ; BITS_ON_OFF     SUBROUTINE -                                :
                                   ;        USED TO DETERMININE IF A COUNTER'S BITS GO ON         :
                                   ;        AND OFF AS THEY SHOULD.                              :
                                   ; ENTRY:                                                      :
                                   ;        CX = COUNTER 0 OR 1 OR 2 ADDRESS                     :
                                   ;        AL = CONTROL WORD REGISTER (CWR)                     :
                                   ; EXIT:                                                       :
                                   ;        CF = 1 IF FAILED                                     :
                                   ;        CF = 0 IF PASSED                                     :
                                   ; REGISTER AX,BX,CX,DX,SI ARE ALTERED                         :
                                   ;-------------------------------------------------------------
012C                               BITS_ON_OFF         PROC     NEAR
012C  51                                   PUSH    CX                  ;SAVE COUNTER ADDRESS
012D  BA FB9F                              MOV     DX,CWR_8254         ;CONFIGURE CWR FOR COUNTER
0130  EE                                   OUT     DX,AL
0131  33 DB                                XOR     BX,BX               ;INITIALIZE REGISTER
0133  33 F6                                XOR     SI,SI               ;1ST PASS - SI = 0
0135  5A                                   POP     DX                  ;RESTORE COUNTER ADDRESS
0136                               OUTER_LOOP:
0136  B9 0008                              MOV     CX,8                ;OUTER LOOP COUNTER
0139                               INNER_LOOP:
0139  51                                   PUSH    CX
013A  33 C9                                XOR     CX,CX               ;INNER LOOP COUNTER
013C                               TEST_BITS:
013C  EC                                   IN      AL,DX               ;READ COUNTER LSB
013D  0B F6                                OR      SI,SI

013F  75 19                                JNE     SECOND              ;SECOND PASS
0141  0C 01                                OR      AL,01H              ;TURN LS BIT ON
0143  0A D8                                OR      BL,AL               ;TURN 'ON' BITS ON
0145  EC                                   IN      AL,DX               ;READ COUNTER MSB
0146  0A F8                                OR      BH,AL               ;TURN 'ON' BITS ON
0148  81 FA FB9C                           CMP     DX,CVSD_CLK         ;
014C  75 06                                JNE     CNT1_TEST_BITS       ;TEST BITS OF COUNTER 1
014E  81 FB FFFF                           CMP     BX,0FFFFH           ;ARE ALL COUNTER BITS ON?
0152  EB 00                                JMP     SHORT TST_CMP       ;DON'T CHANGE FLAGS
0154                               CNT1_TEST_BITS:
0154  81 FB 00FF                           CMP     BX,00FFH            ;LOW NIBBLE BITS ON?
0158  EB 07                                JMP     SHORT TST_CMP       ;DON'T CHANGE FLAGS
015A                               SECOND:
015A  22 D8                                AND     BL,AL               ;CHECK FOR ALL BITS OFF
015C  EC                                   IN      AL,DX               ;READ MSB
015D  22 F8                                AND     BH,AL               ;TURN OFF BITS
015F  0B DB                                OR      BX,BX               ;ALL OFF?
0161                               TST_CMP:
0161  74 07                                JE      CHK_END             ;YES, SEE IF DONE
0163  E2 D7                                LOOP    TEST_BITS           ;TRY AGAIN
0165  59                                   POP     CX                  ;RESTORE OUTER LOOP COUNTER
0166  E2 D1                                LOOP    INNER_LOOP          ;TRY AGAIN
0168  F9                                   STC                         ;ALL TRIES EXHAUSTED - FAILED
0169  C3                                   RET
016A                               CHK_END:
016A  59                                   POP     CX                  ;FORMER OUTER LOOP COUNTER
016B  46                                   INC     SI
016C  83 FE 02                             CMP     SI,2
016F  75 C5                                JNE     OUTER_LOOP          ;CHECK FOR ALL BITS TO GO OFF
0171  C3                                   RET                         ;CARRY FLAG IS RESET
0172                               BITS_ON_OFF         ENDP

                                   ;

0172                               BC_START:
                                   ;-------------------------------------------------------------
                                   ; PORT_TST                                                    :
                                   ;        THIS PROC DOES A WRITE READ TEST TO A PORT           :
                                   ; ENTRY:                                                      :
                                   ;        DX = PORT TO TEST                                    :
                                   ;        BL IS ERROR CODE. IT IS INCREMENTED.                 :
                                   ;-------------------------------------------------------------
0172                               PORT_TST            PROC     NEAR
0172  43                                   INC     BX
0173  2B C0                                SUB     AX,AX               ;TEST PATTERN SEED = 0000
0175  8A C4                        PA:     MOV     AL,AH               ;SAVE PATTERN TO COMPARE
0177  EE                                   OUT     DX,AL               ;WRITE PATTERN TO PORT A
0178  EB 00                                JMP     $+2                 ;PAUSE
017A  EC                                   IN      AL,DX               ;READ PATTERN FROM PORT A
017B  3A C4                                CMP     AL,AH               ;DATA EXPECTED?
017D  75 04                                JNE     PA_E                ;NO, ERROR
017F  FE C4                                INC     AH                  ;NEW PATTERN
0181  75 F2                                JNZ     PA                  ;LOOP TILL 255 PATTERNS DONE


0183  C3                                   RET                         ;CARRY FLAG IS RESET
0184  F9                           PA_E:   STC                         ;ERROR RETURN
```

```
0185  C3                              RET
0186                          PORT_TST        ENDP

                              ;-----------------------------------------------------------
                              ; PORTC_TST                                                 :
                              ;       THIS PROC DOES A WRITE READ TEST TO PORT C. (FB9AH)  :
                              ;-----------------------------------------------------------
0186                          PORTC_TST       PROC    NEAR
0186  BA FB9A                         MOV     DX,PORTC        ;PORT C ADDRESS
0189  EC                              IN      AL,DX           ;READ PORT C
018A  24 0F                           AND     AL,00001111B    ;MASK LOWER PORT C
                                                              ;(C0 - C3 = INPUT)
018C  8A F8                           MOV     BH,AL           ;SAVE LOWER BITS IN BH
018E  B4 00                           MOV     AH,0            ;BEGINNING PATTERN TO WRITE
0190  43                              INC     BX              ;INCREMENT ERROR INDICATOR

0191  8A C4                   PC:     MOV     AL,AH           ;OUTPUT PATTERN FOR PORT C
0193  0A C7                           OR      AL,BH           ;TURN ON LOWER BITS AS APPROPRIATE
                                                              ;(LOWER C IS THE SAME)
0195  EE                              OUT     DX,AL           ;WRITE TO PORT C
0196  50                              PUSH    AX
0197  58                              POP     AX              ;TIME DELAY
0198  EC                              IN      AL,DX           ;READ PORT
0199  24 F0                           AND     AL,11110000B    ;TURN OFF UNNEEDED BITS
019B  3A C4                           CMP     AL,AH           ;DATA EXPECTED?
019D  75 E5                           JNE     PA_E            ;NO, ERROR

019F  80 C4 10                        ADD     AH,00010000B    ;GET NEXT TEST PATTERN
01A2  73 ED                           JNC     PC
01A4  F8                              CLC                     ;GOOD RETURN
01A5  C3                              RET
01A6                          PORTC_TST       ENDP

                              ;-----------------------------------------------------------
                              ; TEST:                                                     :
                              ;       8255 PROGRAMMABLE PERIPHERAL INTERFACE TEST         :
                              ;                                                           :
                              ; DESCRIPTION:                                              :
                              ;       PERFORM WRITE/READ TEST TO PORT A, B, AND C IN      :
                              ;       MODE 83H. DO THE SAME TEST FOR PORTS A & C IN MODE 81H.:
                              ;           MODE 83H: PORT A = OUTPUT                       :
                              ;                          B = OUTPUT                       :
                              ;                          C0-C3 = INPUT                    :
                              ;                          C4-C7 = OUTPUT                   :
                              ;           MODE 81H: PORT A = OUTPUT                       :
                              ;                          B = INPUT                        :
                              ;                          C0-C3 = INPUT                    :
                              ;                          C4-C7 = OUTPUT                   :
                              ;           PORT A = FB98H                                  :
                              ;           PORT B = FB99H                                  :


                              ;           PORT C = FB9AH                                  :
                              ;-----------------------------------------------------------

01A6                          BC      PROC    FAR
01A6                          BANK_TEST_START:
01A6  33 DB                           XOR     BX,BX           ;INITIALIZE ERROR FLAG
01A8  BA FB9B                         MOV     DX,CWREG        ;CONTROL WORD REGISTER
01AB  B0 81                           MOV     AL,LPC_OUT      ;MODE 81H. PORT A,B:OUTPUT,

                                                              ;C(LOW) INPUT, C(HI)=OUTPUT
01AD  EE                              OUT     DX,AL           ;CONFIGURES I/O PORT
                              ;
01AE  BA FB98                         MOV     DX,PORTA
01B1  E8 0172 R                       CALL    PORT_TST        ;TEST PORT A
01B4  72 54                           JC      EX              ;ERROR 01 IF TEST FAILS
                              ;
01B6  42                              INC     DX              ;DX PORT B ADDRESS
01B7  E8 0172 R                       CALL    PORT_TST        ;TEST PORT B
01BA  72 4E                           JC      EX              ;ERROR 02 IF TEST FAILS
                              ;
01BC  E8 0186 R                       CALL    PORTC_TST       ;TEST PORT C
01BF  72 49                           JC      EX              ;ERROR 03 IF TEST FAILS
                              ;
01C1  BA FB9B                         MOV     DX,CWREG        ;CONTROL WORD REGESTER
01C4  B0 83                           MOV     AL,LPC_IN       ;MODE 83H. PORT A OUTPUT,B=INPUT
                                                              ;C(LOW) INPUT, C(HI)=OUTPUT
01C6  EE                              OUT     DX,AL           ;CONFIGURES I/O PORT
                              ;
01C7  BA FB98                         MOV     DX,PORTA
01CA  E8 0172 R                       CALL    PORT_TST        ;TEST PORT A
01CD  72 3B                           JC      EX              ;ERROR 04 IF TEST FAILS

01CF  E8 0186 R                       CALL    PORTC_TST       ;TEST PORT C
01D2  72 36                           JC      EX              ;ERROR 05 IF TEST FAILS
                              ;*******************
                              ; BANK SWITCH TEST
                              ;*******************
01D4  BA FB98                         MOV     DX,PORTA        ;GET PORT A ADDR
01D7  FC                              CLD                     ;CLEAR DIRECTION FLAG
01D8  B3 0C                           MOV     BL,PAGE3        ;START WITH PAGE 3
01DA                          BTL:
                              ;----------SELECT BANK----------
01DA  EC                              IN      AL,DX           ;READ PORT
01DB  24 F3                           AND     AL,CLR_PAGE     ;CLEAR PAGE BITS
01DD  0A C3                           OR      AL,BL           ;SET BITS TO SELECT DESIRED PAGE
01DF  EE                              OUT     DX,AL           ;SELECT PAGE
01E0  EB 00                           JMP     $+2             ;DELAY FOR HARDWARE RESPONSE
                              ;--------VERIFY CORRECT BANK-------
01E2  BE 0005                         MOV     SI,5            ;ADDRESS BANK IDENTIFIER BYTE
01E5  8A 04                           MOV     AL,[SI]         ;READ IT
01E7  3A C3                           CMP     AL,BL           ;IS IT AS EXPECTED?
01E9  75 19                           JNZ     BSE             ;IF NOT, BANK SWITCH ERROR
                              ;----------CHECKSUM BANK----------
01EB  B9 2000                         MOV     CX,8192         ;8K BYTES



01EE  33 F6                           XOR     SI,SI           ;INIT POINTERS
01F0  8A E6                           MOV     AH,SI
01F2                          ADDL:
01F2  AC                              LODSB                   ;READ BYTE
01F3  02 E0                           ADD     AH,AL           ;RUNNING TOTAL IN AH
01F5  E2 FB                           LOOP    ADDL
01F7  75 0F                           JNZ     BSUE            ;IF CHECKSUM <> 0 BANK SUM ERROR
                              ;----SEE IF BOTH BANKS HAVE BEEN TESTED---
01F9  80 FB 00                        CMP     BL,PAGE0        ;DID WE TEST PAGE 0?
01FC  74 05                           JZ      BTD             ;IF SO BANK TEST DONE
01FE  80 EB 04                        SUB     BL,PAGE1        ;IF NOT TEST NEXT BANK
0201  EB D7                           JMP     SHORT BTL       ;
0203                          BTD:
0203  CB                              RET                     ;RETURN TO ROM
```

D, F-8C

```
0204  B3 30                    MOV     BL,30H          ;SERVICE ERROR 2830 IF BANK
                                                       ;SWITCH ERROR
0206  EB 02                    JMP     SHORT ER
0208                   RSUE:
0208  B3 31                    MOV     BL,31H          ;SERVICE ERROR 2831 IF BANK
                                                       ;SUM ERROR
020A                   ER:
020A  B4 4A                    MOV     AH,CUST_ER      ;ERROR J IN CUSTOMER MODE.
020C  B7 28                    MOV     BH,SERV_ER
020E  83 C4 0A                 ADD     SP,10           ;ADJUST STACK, WE ARE GOING TO
                                                       ;FALL INTO THE ERROR MESSAGE CODE
                                                       ;AND RETURN TO SYSTEM FROM THERE
0211                   RC      ENDP

                       ;------------------------------------------------------------
                       ;       THIS SUBROUTINE IS THE GENERAL ERROR HANDLER FOR THE POST
                       ;
                       ; ENTRY REQUIREMENTS:
                       ;       AH = ASCII CUSTOMER LEVEL ERROR CODE
                       ;-      BX= ERROR CODE FOR MANUFACTURING OR SERVICE MODE
                       ;       REGISTERS ARE NOT PRESERVED
                       ;       LOCATION "POST ERR" IS SET NON-ZERO IF AN ERROR OCCURS IN
                       ;       CUSTOMER MODE
                       ;       SERVICE/MANUFACTURING FLAGS AS FOLLOWS: (HIGH NIBBLE OF
                       ;       PORT 201)
                       ;       0000 = MANUFACTURING (BURN-IN) MODE
                       ;       0001 = MANUFACTURING (SYSTEM TEST) MODE
                       ;       0010 = SERVICE MODE (LOOP POST)
                       ;       0100 = SERVICE MODE (SYSTEM TEST)
                       ;------------------------------------------------------------
                       ; FOLLOWON FEATURES MUST BE SURE TO SETUP MEMORY LOCATIONS
                       ; AS DESCRIBED BELOW
                       ;
                       ;       XXDATA  SEGMENT AT      50H
                       ;               ORG     10H
                       ;       POST ERR DB     ?
                       ;       XXDATA  ENDS




                       ;
                       ;------------------------------------------------------------
= 0040                 TIMER   EQU     40H
= 0061                 PORT_B  EQU     61H

0211                   E_MSG_B         PROC    FAR

0211  BA 0011                  MOV     DX,11H          ;
0214  8A C7                    MOV     AL,BH           ;
0216  EE                       OUT     DX,AL           ; SEND HI BYTE ERROR CODE
0217  42                       INC     DX              ;
0218  8A C3                    MOV     AL,BL           ;
021A  EE                       OUT     DX,AL           ; SEND LO BYTE ERROR CODE

021B  BA 0201                  MOV     DX,201H
021E  EC                       IN      AL,DX           ; GET MODE BITS
021F  24 F0                    AND     AL,0F0H         ; ISOLATE BITS OF INTEREST
0221  8B E8                    MOV     BP,AX           ; SAVE MODE

0223  53                       PUSH    BX              ; SAVE ERROR AND MODE FLAGS

0224  50                       PUSH    AX
0225  52                       PUSH    DX
0226  B7 07                    MOV     BH,7            ; PAGE 7
0228  B4 02                    MOV     AH,2            ; SET CURSOR
022A  BA 1521                  MOV     DX,1521H        ; ROW 21, COL.33
022D  CD 10                    INT     10H
022F  BE 0293 R                MOV     SI,OFFSET ERROR_ERR
0232  B9 0005                  MOV     CX,5            ; PRINT WORD "ERROR"
0235  2E: 8A 04        EM_0:   MOV     AL,CS:[SI]
0238  46                       INC     SI
0239  E8 02CB R                CALL    PRT_HEX
023C  E2 F7                    LOOP    EM_0
                       ; LOOK FOR A BLANK SPACE TO POSSIBLY PUT CUSTOMER LEVEL ERRORS (IN
                       ; CASE OF MULTI ERROR)
023E  B6 16                    MOV     DH,16H
0240  B4 02            EM_1:   MOV     AH,2            ; SET CURSOR
0242  CD 10                    INT     10H             ; ROW 22, COL33 (OR ABOVE, IF
                                                       ; MULTIPLE ERRS)
                                                       ; DIFFERENT FOR MANUF MODE
0244  B4 08                    MOV     AH,8            ; READ CHARACTER THIS POSITION
0246  CD 10                    INT     10H
0248  FE C2                    INC     DL              ; POINT TO NEXT POSITION
024A  3C 20                    CMP     AL,' '          ; BLANK?
024C  75 F2                    JNE     EM_1            ; GO CHECK NEXT POSITION, IF NOT
024E  5A                       POP     DX              ; RECOVER ERROR POINTERS
024F  58                       POP     AX
0250  5B                       POP     BX
0251  8B D5                    MOV     DX,BP           ; RETRIEVE RUN MODE
0253  80 FA 40                 CMP     DL,01000000B    ; SERVICE MODE ?
0256  75 28                    JNZ     CUST_OUT        ; OUTPUT BYTE TO SCREEN
0258                   SERV_OUT:                       ;
0258  8A C7                    MOV     AL,BH           ; PRINT MSB
025A  53                       PUSH    BX



025B  E8 02DA R                CALL    XPC_BYTE        ; DISPLAY IT
025E  5B                       POP     BX
025F  8A C3                    MOV     AL,BL           ; PRINT LSB
0261  E8 02DA R                CALL    XPC_BYTE
0264  FA                       CLI
0265  B2 02                    MOV     DL,2            ; 2 BEEPS
0267  B3 01            EB:     MOV     BL,1            ; SHORT BEEP
0269  E8 0298 R                CALL    BEEP            ;
026C  E2 FE            EBO:    LOOP    EBO             ; WAIT (BEEPER OFF)
026E  FE CA                    DEC     DL              ; DONE YET?
0270  75 F5                    JNZ     EB              ; LOOP IF NOT
0272                   TOTLTPO
0272  FA                       CLI                     ; DISABLE INTS.
0273  E4 61                    IN      AL,PORT_B       ;
0275  24 FC                    AND     AL,0FCH         ;
0277  E6 61                    OUT     PORT_B,AL       ; KILL HEARTBEAT
0279  2A C0                    SUB     AL,AL           ;
027B  E6 F2                    OUT     0F2H,AL         ; STOP DISKETTE MOTOR
027D  E6 A0                    OUT     0A0H,AL         ; DISABLE NMI
027F  F4                       HLT                     ; HALT

0280                   CUST_OUT:                       ;
0280  8A C4                    MOV     AL,AH           ; GET ERROR CHARACTER
0282  E8 02CB R                CALL    PRT_HEX         ; DISPLAY IT
                               ASSUME  DS:XXDATA
0285  1E                       PUSH    DS
```

```
0286  50                                      PUSH    AX
0287  B8  ---- R                              MOV     AX,XXDATA
028A  8E D8                                   MOV     DS,AX
028C  FE 06 0018 R                            INC     POST_ERR         ; SET ERROR FLAG NON-ZERO
0290  58                                      POP     AX
0291  1F                                      POP     DS
                                              ASSUME  DS NOTHING
0292  CB                                      RET                      ; RETURN TO CALLER
0293                            E MSG B               ENDP

0293  45 52 52 4F 52            ERROR ERR             DB       "ERROR"

                                ;-----------------------------------------
                                ;       ROUTINE TO SOUND BEEPER
                                ; THIS PROC WILL SOUND THE BEEPER FOR A
                                ; TIME DETERMINED BY THE CONTENTS OF BL.
                                ; ON EXIT: AX AND BL ARE DESTROYED
                                ;-----------------------------------------
0298                            BEEP    PROC    NEAR
0298  B0 B6                             MOV     AL,10110110B     ; SEL TIM 2,LSB,MSB,BINARY
029A  E6 43                             OUT     TIMER+3,AL       ; WRITE THE TIMER MODE REG
029C  B8 0533                           MOV     AX,533H          ; DIVISOR FOR 1000 HZ
029F  E6 42                             OUT     TIMER+2,AL       ; WRITE TIMER 2 CNT - LSB
02A1  8A C4                             MOV     AL,AH
02A3  E6 42                             OUT     TIMER+2,AL       ; WRITE TIMER 2 CNT - MSB
02A5  E4 61                             IN      AL,PORT_B        ; GET CURRENT SETTING OF PORT
02A7  8A E0                             MOV     AH,AL            ; SAVE THAT SETTING


02A9  0C 03                             OR      AL,03            ; TURN SPEAKER ON
02AB  E6 61                             OUT     PORT_B,AL
02AD  33 C9                             XOR     CX,CX            ; SET DELAY COUNT
02AF  E2 FE                     G7:     LOOP    G7               ; DELAY BEFORE TURNING OFF
02B1  FE CB                             DEC     BL               ; DELAY CNT EXPIRED?
02B3  75 FA                             JNZ     G7               ; NO - CONTINUE BEEPING SPK
02B5  8A C4                             MOV     AL,AH            ; RECOVER VALUE OF PORT
02B7  E6 61                             OUT     PORT_B,AL
02B9  C3                                RET                      ; RETURN TO CALLER
02BA                            BEEP    ENDP

                                ;--------------------------------------------------------
                                ; XPC_BYTE
                                ;       PROC TO PRINT A HEX BYTE TO THE SCREEN.
                                ;       THE CURSOR POSITION MUST BE SET ALREADY.
                                ;       PASS:
                                ;               AX      = BYTE TO PRINT
                                ;       RETURNS:
                                ;               CX AND AX DESTROYED, FLAGS TOO
                                ;--------------------------------------------------------
          H
02BA                            XPC_BYTE        PROC    NEAR
02BA  50                                        PUSH    AX
02BB  B1 04                                     MOV     CL,4
02BD  D2 E8                                     SHR     AL,CL
02BF  E8 02C5 R                                 CALL    XLAT_PR
02C2  58                                        POP     AX
02C3  24 0F                                     AND     AL,0FH
02C5                            XLAT_PR PROC NEAR
02C5  04 90                                     ADD     AL,090H
02C7  27                                        DAA
02C8  14 40                                     ADC     AL,40H

02CA  27                                        DAA
02CB                            PRT_HEX PROC NEAR
02CB  53                                        PUSH    BX
02CC  B4 0E                                     MOV     AH,14
02CE  B7 00                                     MOV     BH,0
02D0  CD 10                                     INT     10H
02D2  5B                                        POP     BX
02D3  C3                                        RET
02D4                            PRT_HEX ENDP
02D4                            XLAT_PR ENDP
02D4                            XPC_BYTE        ENDP

= 0081                          BCLEN   =       ($-BC_START+1)/2

02D4                            INIT    ENDP

                                ;*************************************************************
                                ;*                  SOFTWARE INTERRUPT - 04CH                *
                                ;*************************************************************
                                ;*                                                           *
                                ;* PURPOSE:  To provide low-level BIOS support for           *


                                ;*           CVSD and LPC                                    *
                                ;*                                                           *
                                ;*************************************************************
                                ;*                                                           *
                                ;*      AH = 0    RESET CARD                                 *
                                ;*                                                           *
                                ;*                                                           *
                                ;*      AH = 1    CVSD (Continously variable Slope Delta)    *
                                ;*                                                           *
                                ;*                AL = 0  - CVSD RECORD (using speed table)  *
                                ;*                      DS:SI  - segment:offset              *
                                ;*                               (note 1 below)              *
                                ;*                         BL  - table speed                 *
                                ;*                               = 0 => 1800 bytes/sec       *
                                ;*                               = 1 => 2400 bytes/sec       *
                                ;*                               = 2 => 3000 bytes/sec       *
                                ;*                               = 3 => 3600 bytes/sec       *
                                ;*                               = 4 => 4200 bytes/sec       *
                                ;*                               = 5 => 4800 bytes/sec       *
                                ;*                         CX  - Byte count (note 2 below)   *
                                ;*                                                           *
                                ;*                AL = 1  - CVSD PLAYBACK  (using speed table) *
                                ;*                      DS:SI  - segment:offset              *
                                ;*                               (note 1 below)              *
                                ;*                         BL  - table speed                 *
                                ;*                               = 0 => 1800 bytes/sec       *
                                ;*                               = 1 => 2400 bytes/sec       *
                                ;*                               = 2 => 3000 bytes/sec       *
                                ;*                               = 3 => 3600 bytes/sec       *
                                ;*                               = 4 => 4200 bytes/sec       *
                                ;*                               = 5 => 4800 bytes/sec       *
                                ;*                         CX  - Byte count (note 2 below)   *
                                ;*                                                           *
                                ;*                AL = 2  - CVSD RECORD (using user speed)   *
                                ;*                      DS:SI  - segment:offset              *
                                ;*                               (note 1 below)              *
                                ;*                         BX  - user speed divisor          *
                                ;*                               (note 3 below)              *
                                ;*
```

D.I-8C

```
              :*                                                             *
              :*           AL = 3 - CVSD PLAYBACK (using user speed)        *
              :*                    DS:SI = segment offset                  *
              :*                            (note 1 below)                  *
              :*                       BX = user speed divisor              *
              :*                            (note 3 below)                  *
              :*                       CX = byte count (note 2 below)       *
              :*                                                             *
              :*           LPC (Linear Predictive Coding)                   *
              :*                                                             *
              :*    AH = 2 Interrupt Driven LPC (Background)                *
              :*                                                             *
              :*           AL = 0 - LPC Status                              *


              :*                                                             *
              :*           AL = 1 - LPC SPEAK - INTN (INDEX)                *
              :*                    DX = word number from index             *
              :*                    ( 1 <= DX <= 126 )                      *
              :*                                                             *
              :*           AL = 2 - LPC SPEAK - INTN (POINTER)              *
              :*                    DS:SI = top of LPC (seg offset)         *
              :*                            (note 1 below)                  *
              :*                    CX = number of bytes in the LPC         *
              :*                    word to be spoken. CX must not be       *
              :*                    larger than [illegible] bytes           *
              :*    AH = 3 Polled LPC (Foreground)                          *
              :*                                                             *
              :*           AL = 0 - LPC STATUS                              *
              :*                                                             *
              :*           AL = 1 - LPC SPEAK - NTN (INDEX)                 *
              :*                    DX = word number from index             *
              :*                    ( 1 <= DX <= 126 )                      *
              :*                                                             *
              :*           AL = 2 - LPC SPEAK - INTN (POINTER)              *
              :*                    DS:SI = top of LPC (seg offset)         *
              :*                            (note 1 below)                  *
              :*                    CX = number of bytes in the LPC         *
              :*                    word to be spoken. CX must not be       *
              :*                    larger than [illegible] bytes           *
              :*                                                             *
              :**************************************************************

              :**************************************************************
              :* Note 1 - DS:SI must be set up by the user to address valid  *
              :*          memory locations. Checking for valid parameters    *
              :*          is not done in the BIOS                            *
              :*                                                             *
              :* Note 2 - CX is the byte count in CVSD. If CX = 0 then 64K   *
              :*          bytes will be processed                            *
              :*                                                             *
              :* Note 3 - BX = User speed divisor when AH = 1 and AL = 2 or  *
              :*          3 (CVSD). Here BX is the number which the timer    *
              :*          counts down from between CVSD samples. The clock   *
              :*          frequency is 1.19MHz. This frequency divided by    *
              :*          the (divisor*8) gives the byte sampling rate.      *
              :*          Speeds slower than 1800 bytes per second (BX=100H) *
              :*          or faster than 6400 bytes per second (BX=20H)      *
              :*                                                             *
              :*          are not supported                                  *
              :*                                                             *
              :* Note 4 - registers preserved during this call:              *
              :*          CS,SS,DS,ES,SI,DI,DX,CX,BX,BP                      *
              :*          All other registers destroyed                      *
              :*                                                             *
              :* Note 5 - AL returns:                                        *
              :*          00H - if everything o.k.                           *
              :*          01H - if undefined command                         *


              :*          02H - if LPC speak in progress                     *
              :*          03H - if ACL error (stuck)                         *
              :*          04H - if LPC index out of range                    *
              :*          05H - if CVSD speed out of range                   *
              :*          06H - if timeout waiting for LPC READY             *
              :*                                                             *
              :**************************************************************
0204                          START   PROC    FAR

                              ; -> CLEAR DIRECTION FLAG & SAVE REGISTERS

0204  FC                              CLD                     ;CLEAR DIRECTION FLAG
0205  55                              PUSH    BP              ;
0206  56                              PUSH    SI              ;SAVE REGISTERS
0207  57                              PUSH    DI              ;
0208  52                              PUSH    DX              ;
0209  51                              PUSH    CX              ;
020A  53                              PUSH    BX              ;

                              ; -> DECODE REQUESTED FUNCTION & BRANCH TO APPROPIATE CODE

020B  33 ED                           XOR     BP,BP           ;BP INDICATES LPC BACK/FOREGROUND
020D  80 FC 01                        CMP     AH,LPC_FG_FUNC  ;LPC FOREGROUND FUNCTION ?
0210  75 03                           JNE     F00             ;NO, CONTINUE DECODE OF FUNCTION
0212  E9 04AD R                       JMP     LPCDOO          ;YES, GO TO HANDLE LPC
0215                          F00:
0215  80 FC 02                        CMP     AH,LPC_FN       ;LPC FUNCTION ?
0218  75 03                           JNE     F0              ;NO, CONTINUE DECODE OF FUNCTION
021A  E9 04AE R                       JMP     LPCOO           ;YES, GO TO HANDLE LPC

021D  80 FC 03                F0:     CMP     AH,CVSD_FN      ;CVSD FUNCTION ?
0220  75 03                           JNE     F1              ;NO, CONTINUE DECODE OF FUNCTION
0222  E9 0368 R                       JMP     CVSDOO          ;YES, GO TO HANDLE CVSD

0225  80 FC 00                F1:     CMP     AH,RST_FN       ;RESET CARD FUNCTION ?
0228  75 05                           JNE     ERROR           ;NO, GO TO SET ERROR CODE
022A  E8 0318 R                       CALL    RST_TALKER      ;YES, GO TO HANDLE CARD RESET
022D  EB 02                           JMP     SHORT EXIT      ;GO TO EXIT CODE

022F  B0 01                   ERROR:  MOV     AL,BAD_CMD      ;SET AL = BAD COMMAND

                              ; -> RESTORE REGISTERS & EXIT

0231  5B                      EXIT:   POP     BX              ;RESTORE REGISTERS
0232  59                              POP     CX              ;
0233  5A                              POP     DX              ;
```

```
0304  5F                                      POP     DI              ;
0305  5E                                      POP     SI              ;
0306  5D                                      POP     BP              ;


0307  CF                                      IRET

0308                                 START    ENDP

                                     ;*****************************************************
                                     ;*                                                   *
                                     ;*      NAME:  RESET CARD                            *
                                     ;*                                                   *
                                     ;*   PURPOSE:  SET HARDWARE INTO A KNOWN STATE       *
                                     ;*                                                   *
                                     ;*   LINKAGE:  SOFTWARE INTERRUPT   (INT 06DH  WITH AH = 0)
                                     ;*             - OR -                                *
                                     ;*             BY SUBROUTINE CALL   (CALL  RST_TALKER)
                                     ;*                                                   *
                                     ;*    INPUTS:  AH = 0 IF USING 06DH INTERRUPT LINKAGE
                                     ;*                                                   *
                                     ;*   OUTPUTS:  AL CONTAINS A RETURN CODE             *
                                     ;*             00H - IF EVERYTHING O.K               *
                                     ;*             03H - IF ACL ERROR (STUCK)            *
                                     ;*             06H - TIMEOUT WAITING FOR LPC READY   *
                                     ;*                                                   *
                                     ;*      EXIT:  RETURN FROM SUBROUTINE                *
                                     ;*             WITH RETURN CODE SET IN AL            *
                                     ;*                                                   *
                                     ;*   PROCESS:  (1) - MASK OFF INTR 1 ON THE SYSTEM'S 8259
                                     ;*             (2) - DISABLE ALL 32 ATTACHMENTS ACLS &
                                     ;*                   ENABLE ACL                      *
                                     ;*             (3) - SET 8255 MODE:  PORT A  - OUT   *
                                     ;*                                   PORT B  - OUT   *
                                     ;*                                   PORT CL - IN    *
                                     ;*                                   PORT CU - OUT   *
                                     ;*             (4) - SET ROS PAGE 0 & SET CHANNEL MUX = LPC
                                     ;*             (5) - SET CVSD DECODE ON              *
                                     ;*             (6) - WRITE 10 RESET CMDS TO 5220     *
                                     ;*             (7) - SET CVSD SPEED COUNTER MODE TO  *
                                     ;*                   SQUARE WAVE MODE (MODE 3)       *
                                     ;*                   READ/WRITE LSB FIRST, THEN MSB  *
                                     ;*                   BINARY COUNTER                  *
                                     ;*             (8) - INITIALIZE CVSD SPEED COUNTER TO
                                     ;*                   3000 BYTES/SEC                  *
                                     ;*             (9) - SET CVSD FRAME COUNTER MODE TO: *
                                     ;*                   RATE GENERATOR (MODE 2)         *
                                     ;*                   READ/WRITE LSB FIRST, THEN MSB  *
                                     ;*                   BINARY COUNTER                  *
                                     ;*            (10) - INITIALIZE CVSD FRAME COUNTER TO
                                     ;*                   DIVIDE-BY-8                     *
                                     ;*            (11) - SET INTR PULSE COUNTER MODE TO: *
                                     ;*                   HARDWARE ONE-SHOT (MODE 1)      *
                                     ;*                   READ/WRITE LSB FIRST, THEN MSB  *
                                     ;*                   BINARY COUNTER                  *
                                     ;*            (12) - INITIALIZE INTR PULSE COUNTER TO 8
                                     ;*                                                   *
                                     ;*            (13) - SET AL = RETURN CODE & EXIT     *
                                     ;*                                                   *
                                     ;*****************************************************
                                     ;*    NOTES: - THE FOLLOWING REGISTERS ARE DESTROYED:
                                     ;*               IF SUBROUTINE LINKAGE:  AX, CX & DX *
                                     ;*               IF INTERRUPT LINKAGE:  AX.          *
                                     ;*****************************************************

0308                                 RST_TALKER PROC NEAR

                                     ; -> MASK OFF INTR 1 ON THE SYSTEM'S 8259

0308  E4 21                                   IN      AL,PORT_21H     ;MASK OFF INTR 1
030A  0C 02                                   OR      AL,INT1_OFF     ;
030C  E6 21                                   OUT     PORT_21H,AL     ;


                                     ; -> DISABLE ALL 32 ATTACHMENTS ACLS & ENABLE CARD ACL

030E  E8 0357 R                               CALL    ATTACH_ACL      ;DISABLE ALL ATTACHMENTS ACLS
                                                                      ;& ENABLE CARD ACL
                                                                      ;ANY ERRORS ?
0311  72 43                                   JC      RST_XX          ;YES, RETURN WITH ERROR CODE


                                     ; -> SET 8255 MODE

0313  B0 81                                   MOV     AL,LPC_OUT      ;SET 8255:   PORT A  - OUT
0315  BA FB9B                                 MOV     DX,CWREG        ;            PORT B  - OUT
0318  EE                                      OUT     DX,AL           ;            PORT CU - OUT
                                     ;                                ;            PORT CL - IN


                                     ; -> SET ROS PAGE 0 & SET CHANNEL MUX =  LPC

0319  52                                      PUSH    DX              ;SAVE CWREG
031A  BA FB98                                 MOV     DX,PORTA        ;SET CHANNEL MUX = LPC
031D  B0 00                                   MOV     AL,LPC+PAGE0    ;& SELECT ROS PAGE 0
031F  EE                                      OUT     DX,AL           ;
0320  5A                                      POP     DX              ;RESTORE CWREG


                                     ; -> SET 8255 PORT C - CVSD DECODE ON

0321  B0 0C                                   MOV     AL,DECODE       ;SET CVSD DECODE ON
0323  EE                                      OUT     DX,AL           ;

                                     ; -> WAIT FOR LPC TO FINISH PROCESSING DATA IN BUFFER

0324  E8 037A R                               CALL    WAIT_FOR_LPC
0327  75 0C                                   JNZ     LPC_RDY_ERR

                                     ; -> WRITE 10 RESET CMDS TO 5220


0329  B9 000A                                 MOV     CX,10           ;SET RESET CMD CNT TO 10
032C  B0 FF                                   MOV     AL,RST_5220     ;ISSUE RESET COMMAND TO 5220
032E  E8 065D R                      WRT_FF:  CALL    LPCW_10         ;REPEAT IF NO ERRORS (LOOPZ)
0331  E1 FB                                   LOOPZ   WRT_FF          ;
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D. F-80

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0333                          [illegible] ENDP
0335  B0 06                          MOV     AL,LPCRDY_ERR     ;SET ERROR CODE IN AL & EXIT
0337  C3                             RET                       ;(ERROR WAITING FOR LPC READY)

                              ; -> SET MODE FOR SPEED COUNTER (EVSO CLK)

0338                          RS120:
0338  B9 109C                         MOV     CX,EVSO_CLK       ;SET CX [illegible] IN AL INITIALIZED
033B  8B 0021 R                       MOV     BX,CS:[OFFSET SPEED_SETING]    ;SPEED FOR INIT
033C  8B D8                           MOV     BX,AX                          ;INTO BX
0340  B0 36                           MOV     AL,CTR0_MODE [illegible]       ;MODE INIT AL
0342  E8 0110 R                       CALL    INIT_TIMER        ;CALL ROUTINE TO INIT TIMER

0345  41                              INC     CX                ;SET CX EVSO FRAME
0346  BB 000A                         MOV     BX,A              ;DIVISOR
0349  B0 74                           MOV     AL,CTR1_MODE [illegible]
034B  E8 0110 R                       CALL    INIT_TIMER        ;INIT TIMER CHANNEL 1

034E  41                              INC     CX                ;SET CX LPC INTERRUPT TIMER
                                                                ;BX = A FROM LAST INIT
034F  B0 B2                           MOV     AL,CTR2_MODE [illegible]
0351  E8 0110 R                       CALL    INIT_TIMER        ;INIT TIMER CHANNEL 2

                              ; -> SET AL = RETURN CODE & RETURN

0354  B0 00                           MOV     AL,OK             ;SET O.K. RETURN CODE IN AL
0356  C3                      RST_RR: RET                       ;RETURN

0357                          RST_TALKER ENDP

                              ;*************************************************************
                              ;*                                                           *
                              ;*  ATTACH ACL: THIS PROCEDURE ACCOMPLISHES THE FOLLOWING:   *
                              ;*              - DISABLES ALL ATTACHMENTS ACL               *
                              ;*              - MAKES SURE CARD ACL IS DISABLED            *
                              ;*              - ENABLES ACL                                *
                              ;*              - MAKES SURE CARD ACL IS ENABLED             *
                              ;*              - IF ERROR, 'ACL ERROR' IS RETURNED IN AL    *
                              ;*                AND CARRY FLAG IS SET                      *
                              ;*              THIS PROCEDURE DESTROYS REGISTERS AL, CX & DX *
                              ;*                                                           *
                              ;*************************************************************
                              ;*                                                           *
                              ;*  CHKTKR ACL: THIS PROCEDURE ACCOMPLISHES THE FOLLOWING:   *
                              ;*              - MAKES SURE CARD ACL IS ENABLED             *
                              ;*              - IF ERROR, 'ACL ERROR' IS RETURNED IN AL    *
                              ;*                AND CARRY FLAG IS SET                      *


                              ;*              THIS PROCEDURE DESTROYS REGISTERS AL & DX    *
                              ;*                                                           *
                              ;*************************************************************

0357                          ATTACH ACL PROC NEAR

                              ; -> DISABLE ALL 32 ATTACHMENTS ACLS

0357  B9 0020                         MOV     CX,32             ;DISABLE ALL ATTACHMENTS ACLS
035A  BA FF9F                         MOV     DX,TKR ACL        ;
035D  B0 00                           MOV     AL,CMD OFF        ;

035F  EE                      NXT_ACL: OUT    DX,AL             ;
0360  81 EA 0800                      SUB     DX,800H           ;
0364  E2 F9                           LOOP    NXT ACL           ;

                              ; -> MAKE SURE ACL IS DISABLED

0366  EC                              IN      AL,DX             ;
0367  A8 01                           TEST    AL,ACL OFF        ;ACL DISABLED ?
0369  74 0B                           JZ      ERROR 0           ;NO, ERROR

                              ; -> ENABLE ACL

036B  24 FD                           AND     AL,0FDH           ;
036D  EE                              OUT     DX,AL             ;ENABLE ACL

036E                          CHKTKR ACL PROC NEAR

                              ; -> MAKE SURE ACL IS ENABLED

036E  BA FF9F                         MOV     DX,TKR ACL        ;READ ACL
0371  EC                              IN      AL,DX             ;
0372  A8 01                           TEST    AL,ACL OFF        ;ACL ENABLED ?
0374  74 03                           JZ      RET 0             ;YES, RETURN

0376  B0 03                   ERROR_0: MOV    AL,ACL_ERROR      ;SAVE ERROR CODE IN AL
0378  F9                              STC                       ;SET CARRY (ERROR) FLAG ON
0379  C3                      RET_0:  RET                       ;RETURN

037A                          CHKTKR_ACL ENDP

037A                          ATTACH ACL ENDP

                              ;*************************************************************
                              ;* WAIT FOR LPC                                              *
                              ;*      THIS PROC WAITS FOR TS ON THE 5220 TO INDICATE LPC   *
                              ;*      SPEECH PROCESSING COMPLETION. IT WILL RETRY ONLY A   *
                              ;*      LIMITED NUMBER OF TIMES.                             *
                              ;*      ON ENTRY: NO REQUIREMENTS                            *
                              ;*      ON EXIT: AX,BX,CX,DX ARE DESTROYED                   *


                              ;*              ZERO FLAG SET IF LPC DID NOT COMPLETE IN TIME *
                              ;*              ZERO FLAG RESET IF LPC COMPLETED             *
                              ;*************************************************************

037A                          WAIT_FOR_LPC    PROC    NEAR
037A  B9 1000                         MOV     CX,1000H          ;LOOP COUNT
037D                          LPC_BUF NOT EMPTY:
037D  E8 0A2C R                       JMP     SETUP FLAG
0380                          FLAG SETUP:
0380  75 05                           JNZ     LPC CHIP FAIL
0382  F6 C4 80                        TEST    AH,TALK ON        ;WAIT FOR TS TO GO INACTIVE LOW
0385  E0 F6                           LOOPNE  LPC BUF NOT EMPTY
0387                          LPC CHIP FAIL:
0387  C3                              RET
0388                          WAIT FOR LPC    ENDP
                              ;*************************************************************
                              ;*                                                           *
;*       NAME:  CVSD DRIVER                                           *
;*                                                                    *
;*    PURPOSE:  TO PROVIDE LOW-LEVEL BIOS SUPPORT                     *
;*              CVSD                                                  *
;*                                                                    *
;*    LINKAGE:  SOFTWARE INTERRUPT   (INT 040H  WITH AH = 1)          *
;*                                                                    *
;*     INPUTS:  AL - CONTAINS THE CVSD FUNCTION                       *
;*                   =0  FOR CVSD RECORD (SPEED TABLE)                *
;*                   =1  FOR CVSD PLAYBACK (SPEED TABLE)              *
;*                   =2  FOR CVSD RECORD (USER SPEED)                 *
;*                   =3  FOR CVSD PLAYBACK (USER SPEED)               *
;*              BX - USER SPEED DIVISOR (IF AL = 2 OR 3)              *
;*                        HERE BX IS THE NUMBER WHICH THE TIMER       *
;*                        COUNTS DOWN FROM BETWEEN CVSD SAMPLES.      *
;*                        THE A CLOCK FREQUENCY IS 4.77MHZ. THIS      *
;*                        FREQUENCY DIVIDED BY THE (DIVISOR*8)        *
;*                        GIVES THE BYTE SAMPLING RATE.               *
;*              BL - TABLE SPEED  (IF AL = 0 OR 1)                    *
;*                   = 0 => 1800 BYTES/SEC                            *
;*                   = 1 => 2400 BYTES/SEC                            *
;*                   = 2 => 3000 BYTES/SEC                            *
;*                   = 3 => 3600 BYTES/SEC                            *
;*                   = 4 => 4200 BYTES/SEC                            *
;*                   = 5 => 4800 BYTES/SEC                            *
;*            CX  - BYTE COUNT (LENGTH) OF SPEECH BUFFER              *
;*         DS:SI  - SEGMENT:OFFSET OF SPEECH BUFFER                   *
;*                                                                    *
;*    OUTPUTS:  AL CONTAINS A RETURN CODE                             *
;*              00H - IF EVERYTHING O.K.                              *
;*              01H - IF UNDEFINED COMMAND                            *
;*              02H - IF LPC SPEAK IN PROGRESS                        *
;*              03H - IF CARD ACI ERROR (STUCK)                       *
;*              05H - IF CVSD SPEED OUT OF RANGE                      *
;*                                                                    *
;*       EXIT:  INTERRUPT RETURN WITH RETURN CODE SET IN AL           *


;*                                                                    *
;*    PROCESS:  (1) - DECODE CVSD FUNCTION AND SET CVSD FLAG          *
;*                    IN DI=0000H IF CVSD RECORD (AL = 0 OR 2)        *
;*                          00FFH IF CVSD PLAYBACK (AL = 1 OR 3)      *
;*                  - IF INVALID FUNCTION, EXIT WITH RETURN           *
;*                    CODE IN AL = 01H                                *
;*              (2) - CHECK FOR LPC IN PROGRESS.  IF SO, EXIT         *
;*                    WITH RETURN CODE IN AL = 02H                    *
;*              (3) - IF CVSD PLAYBACK (AL = 1 OR 3), MAKE SURE       *
;*                    ACI IS ENABLED.  IF NOT, EXIT                   *
;*                    WITH RETURN CODE IN AL = 03H                    *
;*              (4) - SET CVSD SPEED.  IF SPEED OUT OF RANGE,         *
;*                    EXIT WITH RETURN CODE IN AL = 05H               *
;*              (5) - SET CHANNEL MUX = CVSD                          *
;*              (6) - SET SYSTEM SPEAKER SWITCH (PORT 61H)            *
;*                    TO AUDIO CHANNEL                                *
;*              (7) - DISABLE ALL INTERRUPTS AND SAVE TIME OF         *
;*                    DAY                                             *
;*              (8) - SEE IF CVSD RECORD OR PLAYBACK:                 *
;*                    * IF CVSD RECORD                                *
;*                      (A) - TURN OFF AUDIO CHANNEL                  *
;*                      (B) - SET CVSD ENCODE ON                      *
;*                      (C) - WAIT FOR FRAME 1 -> 0                   *
;*                      (D) - READ DATA BYTE                          *
;*                      (E) - CHECK FOR SYNC CHARACTER                *
;*                      (F) - DO STEPS (B) - (D) WHILE SYNC           *
;*                            SEQUENCE FOUND  WAIT FOR AT MOST        *
;*                            9600 SAMPLES.                           *
;*                      (G) - WAIT FOR FRAME 1 -> 0                   *
;*                      (H) - READ DATA BYTE & SAVE IN BUFFER         *
;*                      (I) - POINT TO NEXT BUFFER LOCATION           *
;*                      (J) - DO STEPS (F) - (H) UNTIL COUNT          *
;*                            EXHAUSTED                               *
;*                    * IF CVSD PLAYBACK:                             *
;*                      (A) - SET CVSD DECODE ON                      *
;*                      (B) - WAIT FOR FRAME 0 -> 1                   *
;*                      (C) - WRITE DATA BYTE                         *
;*                      (D) - POINT TO NEXT DATA BYTE                 *
;*                      (E) - DO STEPS (B) - (D) UNTIL COUNT          *
;*                            EXHAUSTED                               *
;*                      (F) - WAIT FOR FRAME 0 -> 1                   *
;*                      (G) - WRITE A BYTE OF 55H (SILENCE)           *
;*                      (H) - WAIT FOR FRAME 0 -> 1                   *
;*              (9) - SET CVSD DECODE ON                              *
;*             (10) - ENABLE INTERRUPTS AND RESTORE TIME OF DAY       *
;*             (11) - EXIT WITH RETURN CODE IN AL = 00H               *
;*                                                                    *
;**********************************************************************
;*     NOTES: - REGISTERS PRESERVED DURING THIS CALL:                 *
;*              CS,SS,DS,ES,SI,DI,DX,CX,BX                            *
;*              ALL OTHER REGISTERS DESTROYED.                        *
;**********************************************************************


                        ; -> SAVE FUNCTION
0388                    CVSD00:
0388  55                        PUSH    BP              ;SAVE BP
0389  06                        PUSH    ES              ;SAVE ES
038A  50                        PUSH    AX              ;SAVE CVSD FUNCTION TEMPORARILY

                        ; DECODE CVSD FN & SET DI = 0000H FOR CVSD RECORD (AL = 0 OR 2)
                        ;                          00FFH FOR CVSD PLAYBACK (AL = 1 OR 3)

038B  BF 0000                   MOV     DI,CVSDR        ;SET DI = CVSD RECORD
038E  3C 00                     CMP     AL,CVSDR_TBL    ;CVSD RECORD USING TABLE SPEED ?
0390  74 15                     JE      CVSD20          ;YES  CONTINUE
0392  3C 02                     CMP     AL,CVSDR_USER   ;CVSD RECORD USING USER SPEED ?
0394  74 11                     JE      CVSD20          ;YES  CONTINUE
0396  BF 00FF                   MOV     DI,CVSDP        ;SET DI = CVSD PLAYBACK
0399  3C 01                     CMP     AL,CVSDP_TBL    ;CVSD PLAYBACK USING TABLE SPEED ?
039B  74 0A                     JE      CVSD20          ;YES  CONTINUE
039D  3C 03                     CMP     AL,CVSDP_USER   ;CVSD PLAYBACK USING USER SPEED ?
039F  74 06                     JE      CVSD20          ;YES  CONTINUE
03A1  58                        POP     AX              ;RE-ADJUST STACK
03A2  B0 01                     MOV     AL,BAD_CMD      ;SET AL = BAD COMMAND
03A4  E9 04A8 R                 JMP     CVSD40          ;GO TO EXIT

                        ; -> CHECK FOR 'LPC IN PROGRESS'

03A7  BA FB98           CVSD20: MOV     DX,PORTA        ;READ 8255 PORT A
03AA  EC                        IN      AL,DX           ;
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D. F-80

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03AD  74 05                       TEST   AL,TALK_LPC        ;LPC IN PROGRESS ?
03AF  58                          JZ     CVSD25             ;NO, CONTINUE
03B0  B0 02                       POP    AX                 ;ADJUST STACK
03B2  E9 04AB R                   MOV    AL,LPC_INPROG      ;SET AL = LPC IN PROGRESS (02H)
                                  JMP    CVSD90             ;GO TO EXIT

                          ; -> MAKE SURE ACL IS ENABLED IF CVSD PLAYBACK

03B5  83 FF 00            CVSD25: CMP    DI,CVSDR           ;CVSD RECORD ?
03B8  74 10                       JE     CVSD30             ;YES, CONTINUE
03BA  E8 035E R                   CALL   CHKFOR_ACL         ;ACL ENABLED ?
03BD  73 0B                       JNC    CVSD30             ;YES, CONTINUE
03BF  51                          PUSH   CX                 ;SAVE SPEECH BYTE CNT
03C0  E8 0357 R                   CALL   ATTACH_ACL         ;RESET ALL ACLS
                          ;                                 ;& ENABLE ACL
03C3  59                          POP    CX                 ;RESTORE SPEECH BYTE CNT
                          ;                                 ;ERROR ?
03C4  73 04                       JNC    CVSD30             ;NO, CONTINUE
03C6  58                          POP    AX                 ;ADJUST STACK
03C7  E9 04AB R                   JMP    CVSD90             ;YES, EXIT

                          ; -> SET SPEED


03CA  58                  CVSD30: POP    AX                 ;GET CVSD FUNCTION IN AX
03CB  3C 01                       CMP    AL,CVSDW_TBL       ;CVSD SPEED FROM TABLE ?
03CD  8B C3                       MOV    AX,BX              ;PICK UP USER SPEED IN AX
03CF  77 13                       JA     CVSD50             ;GO TO SET CVSD SPEED

03D1  80 FB 05            CVSD60: CMP    BL,SPEED_MAX       ;SPEED WITHIN RANGE ?
03D4  76 05                       JBE    CVSD65             ;YES, GO TO SET SPEED
03D6  B0 05                       MOV    AL,SPEED_ERR       ;SET SPEED OUT OF RANGE ERROR
03D8  E9 04AB R                   JMP    CVSD90             ;EXIT CODE

03DB  B7 00               CVSD65: MOV    BH,0               ;PICK UP SPEED IN AX
03DD  D0 E3                       SHL    BL,1               ;
03DF  2E: 8B 87 0010 R            MOV    AX,CS:[BX+OFFSET SPEED_TBL]
03E4  BA FB9C             CVSD50: MOV    DX,CVSD_CLK        ;OUTPUT SPEED (LSB, THEN MSB)
03E7  EE                          OUT    DX,AL              ;
03E8  EB 00                       JMP    $+2                ;(DELAY)
03EA  8A C4                       MOV    AL,AH              ;
03EC  EE                          OUT    DX,AL              ;

                          ; -> SET 8255 PORT A CVSD ON

03ED  BA FB98                     MOV    DX,PORTA           ;READ PORT A
03F0  EC                          IN     AL,DX              ;
03F1  24 FC                       AND    AL,CLR_MUX         ;CLEAR CHANNEL MUX
03F3  0C 01                       OR     AL,CVSD            ;TURN CVSD ON
03F5  EE                          OUT    DX,AL              ;OUTPUT TO PORT A

                          ; -> SET SYSTEM SPEAKER SWITCH TO AUDIO CHANNEL

03F6  E4 61                       IN     AL,PORT_61H        ;READ & SAVE PORT 61H
03F8  24 9F                       AND    AL,CLR_SPKSW       ;CLEAR SPEAKER SWITCH BITS
03FA  0C 40                       OR     AL,AUDIO_CON       ;OR IN 'AUDIO CHANNEL' BITS
03FC  E6 61                       OUT    PORT_61H,AL        ;OUTPUT TO PORT 61H

                          ; -> DISABLE ALL INTERRUPTS

03FE  53                          PUSH   BX
03FF  B3 FF                       MOV    BL,0FFH            ;MASK ALL INTERRUPTS ON 8259
0401  E8 0990 R                   CALL   NMIOFF             ;MASK EVERYTHING
0404  8B D3                       MOV    DX,BX              ;SAVE ORIG. 8259 MASK
0406  5B                          POP    BX
0407  50                          PUSH   AX                 ;SAVE TIMER VALUE ON STACK
0408  52                          PUSH   DX                 ;SAVE 8259 MASK

                          ; -> CHECK FOR CVSD RECORD/PLAYBACK

                          ;     NOTE: PLAYBACK  = DECODE
                          ;           RECORD    = ENCODE

0409  8B C7                       MOV    AX,DI              ;GET CVSD FN INDICATOR IN AX


040B  3C 00                       CMP    AL,CVSDR           ;CVSD RECORD ?
040D  74 40                       JE     READ               ;YES, GO TO CVSD RECORD CODE
040F  EB 1A                       JMP    SPOKE_WRITE        ;NO, GO TO CVSD PLAYBACK CODE

                          ; NOTES: - FRAME_01 IS A PROCEDURE TO WAIT FOR A 0 TO 1
                          ;          TRANSITION ON CVSD FRAME
                          ;        - BP = 8255 PORT C
                          ;        - AH = FRAME BIT
                          ;        - AX & DX REGISTERS ARE DESTROYED BY THIS CALL

0411                      FRAME_01 PROC   NEAR

0411  8B D5                       MOV    DX,BP              ;SET DX = 8255 PORT C
0413  EC                  WAIT0:  IN     AL,DX              ;READ CVSD FRAME
0414  22 C4                       AND    AL,AH              ;FRAME LOW ?
0416  75 FB                       JNZ    WAIT0              ;NO, WAIT FOR FRAME LOW
0418  EC                  WAIT1:  IN     AL,DX              ;READ CVSD FRAME
0419  22 C4                       AND    AL,AH              ;FRAME HIGH ?
041B  74 FB                       JZ     WAIT1              ;NO, WAIT FOR FRAME HIGH
041D  C3                          RET

041E                      FRAME_01 ENDP


                          ; NOTES: - FRAME_10 IS A PROCEDURE TO WAIT FOR A 1 TO 0
                          ;          TRANSITION ON CVSD FRAME
                          ;        - BP = 8255 PORT C
                          ;        - AH = FRAME BIT
                          ;        - AX & DX REGISTERS ARE DESTROYED BY THIS CALL

041E                      FRAME_10 PROC  NEAR

041E  8B D5                       MOV    DX,BP              ;SET DX = 8255 PORT C
0420  EC                  WAIT_1: IN     AL,DX              ;READ CVSD FRAME
0421  22 C4                       AND    AL,AH              ;FRAME HIGH ?
0423  74 FB                       JZ     WAIT_1             ;NO, WAIT FOR FRAME HI
0425  EC                  WAIT_0: IN     AL,DX              ;READ CVSD FRAME
0426  22 C4                       AND    AL,AH              ;FRAME LOW ?
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0428  75 FB                     JNZ     WAIT_0          ;NO, WAIT FOR FRAME LO
042A  C3                        RET

042B                    FRAME_10 ENDP


                        ; NOTE: - CAUTION MUST BE TAKEN WHEN CHANGING THIS PART OF
                        ;           THE CODE SINCE IT IS VERY TIME DEPENDENT

042B                    WRITE:

042B  B0 0C                     MOV     AL,DECODE       ;SET CVSD DECODE ON



042D  BA FF9B                   MOV     DX,CWREG        ;
0430  EE                        OUT     DX,AL           ;

0431  BD FF9A                   MOV     BP,PORTC        ;SET BP = 8255 PORT C
0434  B4 04                     MOV     AH,FRAME_HI     ;SET AH = FRAME HI
0436  BF FF98                   MOV     DI,SHIFTREG     ;SET DI = SHIFTREG

0439  E8 0411 R         WRITEX: CALL    FRAME_01        ;WAIT FOR FRAME 0 -> 1
043C  8B D7                     MOV     DX,DI           ;SET DX = SHIFT REG
043E  AC                        LODSB                   ;GET DATA BYTE IN AL & INCR SI
043F  EE                        OUT     DX,AL           ;WRITE DATA BYTE
0440  E2 F7                     LOOP    WRITEX          ;CONTINUE UNTIL CNT EXHAUSTED

0442  E8 0411 R                 CALL    FRAME_01        ;WAIT FOR FRAME 0 -> 1
0445  8B D7                     MOV     DX,DI           ;SET DX = SHIFT REG
0447  B0 55                     MOV     AL,055H         ;SET AL = 055H (LAST BYTE)
0449  EE                        OUT     DX,AL           ;WRITE DATA BYTE

044A  E8 0411 R                 CALL    FRAME_01        ;WAIT FOR FRAME 0 -> 1

044D  EB 46                     JMP     SHORT CVSDXA    ;GO TO EXIT CVSD CODE


                        ; NOTE: - CAUTION MUST BE TAKEN WHEN CHANGING THIS PART OF
                        ;           THE CODE SINCE IS VERY TIME DEPENDENT


044F                    READ:

044F  E4 61                     IN      AL,PORT_61H     ;TURN OFF AUDIO CHANNEL
0451  24 9F                     AND     AL,CLR_SPKSW    ;
0453  E6 61                     OUT     PORT_61H,AL     ;

0455  B0 0D                     MOV     AL,ENCODE       ;SET CVSD ENCODE ON
0457  BA FF9B                   MOV     DX,CWREG        ;
045A  EE                        OUT     DX,AL           ;

045B  1E                        PUSH    DS              ;SET ES = DS
045C  07                        POP     ES              ;
045D  BD FF9A                   MOV     BP,PORTC        ;SET BP = 8255 PORT C
0460  B4 04                     MOV     AH,FRAME_HI     ;SET AH = FRAME HI
0462  8B FE                     MOV     DI,SI           ;SAVE OFFSET TEMP IN DI
0464  BE FF98                   MOV     SI,SHIFTREG     ;SET SI = SHIFTREG
0467  BB 2580                   MOV     BX,4800*2       ;WAIT WITH QUIET BUS FOR
                                                        ;AT MOST 2 SECONDS WHEN
                                                        ;RUNNING AT 4800 BYTES PER
                                                        ;SECOND. (5.33 SEC AT 1800)

046A  4B                FSYNC:  DEC     BX              ;DECREMENT COUNTER
046B  74 10                     JZ      Q_TIM_OUT       ;QUIET TIME OUT IF ZERO
046D  E8 041E R                 CALL    FRAME_10        ;WAIT FOR FRAME 1 -> 0
0470  8B D6                     MOV     DX,SI           ;SET DX = SHIFT REG
0472  EC                        IN      AL,DX           ;READ DATA BYTE


0473  88 05                     MOV     [DI],AL         ;STORE DATA BYTE

0475  3C 55                     CMP     AL,055H         ;WAIT FOR SYNC
0477  74 F1                     JE      FSYNC           ;
0479  3C AA                     CMP     AL,0AAH
047B  74 ED                     JE      FSYNC
047D                    Q_TIM_OUT:
047D  47                        INC     DI
047E  EB 10                     JMP     SHORT SFIRST

0480                    TLOOP:                          ;WAIT FOR FRAME 1 -> 0
0480  8B D5                     MOV     DX,BP           ;SET DX = 8255 PORT C
0482  EC                WAITX1: IN      AL,DX           ;READ CVSD FRAME
0483  22 C4                     AND     AL,AH           ;FRAME HIGH ?
0485  74 FB                     JZ      WAITX1          ;NO, WAIT FOR FRAME HI
0487  EC                WAITX0: IN      AL,DX           ;READ CVSD FRAME
0488  22 C4                     AND     AL,AH           ;FRAME LOW ?
048A  75 FB                     JNZ     WAITX0          ;NO, WAIT FOR FRAME LO
048C  8B D6                     MOV     DX,SI           ;SET DX = SHIFT REG
048E  EC                        IN      AL,DX           ;READ DATA BYTE
048F  AA                        STOSB                   ;STORE DATA BYTE & INCR DI
0490  E2 EE             SFIRST: LOOP    TLOOP           ;CONTINUE UNTIL CNT EXHAUSTED

0492  E8 041E R                 CALL    FRAME_10        ;WAIT FOR FRAME 1 -> 0
0495                    CVSDXA:
0495  B1 00                     MOV     CL,OK           ;SET OK RETURN CODE IN CL


                        ; NOTE: - BEFORE COMING TO CVSDX, WE MUST SET RETURN CODE IN CL
                        ;         BEFORE COMING TO CVSDX0, WE MUST SET RETURN CODE IN AL

0497  B0 0C             CVSDX:  MOV     AL,DECODE       ;SET CVSD DECODE ON
0499  BA FF9B                   MOV     DX,CWREG        ;
049C  EE                        OUT     DX,AL           ;

049D  8A C1                     MOV     AL,CL           ;SET AL = RETURN CODE

                        ; ENABLE NMI AND 8259 INTERRUPTS

049F  5B                        POP     BX              ;RECOVER 8259 MASK
04A0  5E                        POP     SI              ;RECOVER TIMER VALUE
04A1  50                        PUSH    AX
04A2  8B C6                     MOV     AX,SI           ;TIMER VALUE INTO AX
04A4  E8 09A5 R                 CALL    NMION           ;ENABLE ALL INTERRUPTS
04A7  58                        POP     AX              ;AND RESTORE TIME OF DAY CLOCK

04A8                    CVSDX0:
04A8  07                        POP     ES              ;RESTORE ES
04A9  5D                        POP     BP              ;RESTORE BP
04AA  E9 0301 R                 JMP     EXIT            ;EXIT

                        ;*****************************************************************
                        ;*
```

D/F-80

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                          ;*     PURPOSE:   TO PROVIDE LOW-LEVEL BIOS SUPPORT FOR              *
                          ;*                LPC                                                *
                          ;*                                                                   *
                          ;*     LINKAGE:   SOFTWARE INTERRUPT (INT 50H WITH AH = 2 OR 3)      *
                          ;*                IF AH = 3, ENTRY WILL BE MADE AT LPC000. THIS      *
                          ;*                IS FOR LPC FOREGROUND                              *
                          ;*                IF AH = 2, ENTRY WILL BE MADE AT LPC00. THIS IS    *
                          ;*                FOR LPC BACKGROUND                                 *
                          ;*                                                                   *
                          ;*      INPUTS:   AL = CONTAINS THE LPC FUNCTION                     *
                          ;*                     = 0  FOR LPC STATUS                           *
                          ;*                     = 1  FOR LPC SPEAK (INDEX)                    *
                          ;*                     = 2  FOR LPC SPEAK (POINTER)                  *
                          ;*                BX = WORD NUMBER FROM INDEX  (FOR AL = 1)          *
                          ;*                CX = NUMBER OF BYTES IN ENCODED WORD               *
                          ;*             DS:SI = SEG. OFFSET OF SPEECH BIN  (FOR AL = 2)       *
                          ;*                                                                   *
                          ;*     OUTPUTS:   AL CONTAINS A RETURN CODE                          *
                          ;*                00H - IF EVERYTHING O.K.                           *
                          ;*                01H - IF UNDEFINED COMMAND                         *
                          ;*                02H - IF LPC SPEAK IN PROGRESS                     *
                          ;*                03H - IF ALL ERROR (STUCK)                         *
                          ;*                04H - IF LPC INDEX OUT OF RANGE                    *
                          ;*                06H - IF TIMEOUT WAITING FOR LPC READY             *
                          ;*                                                                   *
                          ;*        EXIT:   INTERRUPT RETURN WITH RETURN CODE SET IN AL        *
                          ;*                                                                   *
                          ;*     PROCESS: (1) - IF THIS IS A STATUS REQUEST, THEN CHECK        *
                          ;*                    STATUS OF LPC (IS IT CURRENTLY RUNNING?)       *
                          ;*                    EXIT WITH STATUS INFO IN AL                    *
                          ;*              (2) - MASK ALL INTERRUPTS (NOT STATUS REQ.)          *
                          ;*                    READ LPC IN PROGRESS BIT. IF LPC RUNNING,      *
                          ;*                    REENABLE INTERRUPTS AND EXIT WITH STATUS       *
                          ;*              (3) - SET LPC IN PROGRESS FLAG AND REENABLE          *
                          ;*                    INTERRUPTS                                     *
                          ;*              (4) - MAKE SURE ALL IS ENABLED.  IF                  *
                          ;*                    NOT, EXIT WITH RETURN CODE IN AL = 03H         *
                          ;*              (5) - CHECK TO SEE IF LPC INTR VECTOR HAS BEEN       *
                          ;*                    SET.  IF NOT, MOVE KB VECTOR INTR TO           *
                          ;*                    USER AND SET LPC INTR VECTOR. NMI AND          *
                          ;*                    OTHER HARDWARE INTERRUPTS ARE MASKED FOR       *
                          ;*                    THIS DURATION. THIS IS NOT DONE IF THE         *
                          ;*                    REQUEST IS FOR LPC FOREGROUND.                 *
                          ;*              (6) - DECODE LPC FUNCTION.  IF INVALID FUNCTION,     *
                          ;*                    EXIT WITH RETURN CODE IN AL = 01H              *
                          ;*              (7) - IF SPEAK LPC INDEX FUNCTION, SET PROPER        *
                          ;*                    ROS CALL.  IF INDEX OUT OF RANGE, EXIT         *
                          ;*                    WITH RETURN CODE IN AL = 04H                   *
                          ;*              (8) - SET DS:SI TO POINT TO BUFFER                   *
                          ;*              (9) - ISSUE SPEAK EXTERNAL COMMAND TO THE 5220       *
                          ;*             (10) - SET SYSTEM SPEAKER SWITCH (PORT 61H) BITS      *

                          ;*                    TO AUDIO CHANNEL                               *
                          ;*             (11) - SET CHANNEL MUX = LPC                          *
                          ;*                                                                   *
                          ;*             (12) - ENABLE INTR 1 ON SYSTEM 8259 AND ENABLE        *
                          ;*                    LPC INTR ON CARD.  THIS IS NOT DONE IF THE     *
                          ;*                    REQUEST IS FOR LPC FOREGROUND                  *
                          ;*             (13) - DISABLE NMI INTR (KBD) & OTHER INTRS           *
                          ;*             (14) - CALL LOAD BUFFER ROUTINE TO LOAD 16 BYTES      *
                          ;*                    OF DATA, SAVE THE COUNT AND POINTERS           *
                          ;*             (15) - REENABLE INTERRUPTS.                           *
                          ;*             (16) - IF LPC FOREGROUND, REPEAT THE FOLLOWING        *
                          ;*                    STEPS UNTIL THE WORD IS COMPLETE               *
                          ;*                    -TEST BUFFER LOW UNTIL LOW TO HI TRANSIT       *
                          ;*                    -SEND 8 MORE BYTES TO LPC BUFFER               *
                          ;*                    WHEN WORD IS DONE, WAIT TO RETURN UNTIL        *
                          ;*                    THE TALK STATUS BIT GOES HI TO LOW             *
                          ;*                                                                   *
                          ;*                    IF LPC BACKGROUND, RETURN TO USER WHILE        *
                          ;*                    INTERRUPT HANDLER UPDATES LPC BUFFER           *
                          ;*                                                                   *
                          ;*********************************************************************
                          ;*      NOTES: - REGISTERS PRESERVED DURING THIS CALL:               *
                          ;*               CS,SS,DS,ES,SI,DI,DX,CX,BX                          *
                          ;*               ALL OTHER REGISTERS DESTROYED                       *
                          ;*********************************************************************

                          ; -> SAVE AX & DS
 04AD                     LPC000:
 04AD  45                         INC     BP                  ;BP 1 INDICATES FOREGROUND LPC
 04AE  1E                 LPC00:  PUSH    DS                  ;SAVE DS
 04AF  50                         PUSH    AX                  ;SAVE AX

                          ; -> CHECK TO SEE TYPE OF INTERRUPT, IF STATUS, NO NMI MASK.

 04B0  BA F898                    MOV     DX,PORTA            ;8255 PORT A ADDRESS
 04B3  0A C0                      OR      AL,AL               ;STATUS UPDATE?
 04B5  75 0B                      JNZ     MASK_NMI            ;IF NOT, JUMP

                          ; -> HANDLE STATUS INQUIRY

 04B7  EC                         IN      AL,DX               ;READ PORT A
 04B8  A8 80                      TEST    AL,TALK_LPC         ;CHECK LPC IN PROGRESS BIT
 04BA  58                         POP     AX                  ;RESTORE STACK
 04BB  75 17                      JNZ     LPC02A              ;REPORT LPC IN PROGRESS
 04BD  B0 00                      MOV     AL,0H               ;REPORT ALL OK WITH LPC
 04BF  E9 064A R                  JMP     LPCX                ;EXIT LPC BIOS

                          ; -> MASK NMI AND HARDWARE INTERRUPTS
 04C2                     MASK_NMI:
 04C2  B0 10                      MOV     AL,10H
 04C4  E6 A0                      OUT     NMI_PORT,AL         ;MASK NMI
 04C6  FA                         CLI                         ;MASK HARDWARE INT'S

                          ; -> CHECK FOR LPC IN PROGRESS


 04C7  EC                         IN      AL,DX               ;
 04C8  A8 80                      TEST    AL,TALK_LPC         ;LPC IN PROGRESS ?

 04CA  58                         POP     AX                  ;RESTORE REQUEST
 04CB  74 0C                      JZ      LPC03               ;IF LPC NOT IN PROG, SPEAK

 04CD  FB                         STI                         ;ENABLE HARDWARE INT'S
```

```
04CE  E4 A0                        IN      AL,NMI_PORT
04D0  B0 80                        MOV     AL,80H
04D2  E6 A0                        OUT     NMI_PORT,AL      ;ENABLE NMI
04D4                        LPC02A:
04D4  B0 02                        MOV     AL,LPC_INPROG    ;SET AL = LPC IN PROGRESS (02H)
04D6  E9 064A R                    JMP     LPCX             ;GO TO EXIT

04D9                        LPC03:

04D9  50                           PUSH    AX               ;SAVE LPC FN REQUEST

                            ; -> SET LPC IN PROGRESS FLAG (8255 PORT A)

04DA  BA F098                      MOV     DX,PORTA         ;SET LPC IN PROG FLAG
04DD  EC                           IN      AL,DX            ;
04DE  0C 80                        OR      AL,TALK_LPC      ;
04E0  EE                           OUT     DX,AL            ;

                            ; -> REENABLE NMI AND HARDWARE INTERRUPTS

04E1  FB                           STI                      ;ENABLE HARDWARE INT'S
04E2  E4 A0                        IN      AL,NMI_PORT
04E4  B0 80                        MOV     AL,80H
*04E6 E6 A0                        OUT     NMI_PORT,AL      ;ENABLE NMI

                            ; -> MAKE SURE ACL IS ENABLED

04E8  E8 036E R                    CALL    CHPTER_ACL       ;ACL ENABLED ?
04EB  73 0B                        JNC     LPC04            ;YES. CONTINUE
04ED  51                           PUSH    CX
04EE  E8 0357 R                    CALL    ATTACH_ACL       ;RESET ALL ACLS
04F1  59                           POP     CX
                            ;                               ;& ENABLE CARD ACL
04F2  73 04                        JNC     LPC04            ;IF NO ERRORS THEN CONTINUE
04F4  58                           POP     BX               ;ADJUST STACK
04F5  E9 059A R                    JMP     LPC_ERR_EXIT     ;ACL ERROR EXIT

04F8                        LPC04:
04F8  0B ED                        OR      BP,BP            ;FORE OR BACKGROUND?
04FA  75 36                        JNZ     LPC10            ;IF FORE, DON'T TOUCH VECTORS

                            ; -> SET DS = 0

04FC  33 C0                        XOR     AX,AX            ;SET DS = 0
04FE  8E D8                        MOV     DS,AX



                                   ASSUME DS:DUMMY

                            ; -> CHECK TO SEE IF LPC INTR VECTOR HAS BEEN SET

0500  A1 0024 R                    MOV     AX,WORD PTR LPC_PTR      ;LOOK AT INT 9 VECTOR
0503  3D 06D2 R                    CMP     AX,OFFSET LPC_XX         ;POINTING AT LPC CODE?
0506  75 08                        JNE     LPC05                    ;IF NOT, SETUP INT 9
0508  8C C8                        MOV     AX,CS                    ;SEGMENT ADDR CORRECT?
050A  3B 06 0026 R                 CMP     AX,WORD PTR LPC_PTR+2    ;IF NOT, SETUP INT 9
050E  74 22                        JE      LPC10

                            ; -> KBD INTR VECTOR ->  0AEH INTR
                            ; -> DISABLE INTERRUPTS (NMI & OTHERS)

0510                        LPC05:
0510  B0 10                        MOV     AL,10H           ;DISABLE NMI & HOLD REQUEST
0512  E6 A0                        OUT     NMI_PORT,AL      ;
0514  FA                           CLI                      ;DISABLE INTERRUPTS

0515  A1 0024 R                    MOV     AX,WORD PTR OLDKBD_PTR
0518  A3 0138 R                    MOV     WORD PTR KBD_PTR,AX      ;SAVE OLD KBD PTR
051B  A1 0026 R                    MOV     AX,WORD PTR OLDKBD_PTR+2
051E  A3 013A R                    MOV     WORD PTR KBD_PTR+2,AX    ;SETUP NEW INT 9 PTR

                            ;-> SET LPC INTR VECTOR

0521  C7 06 0024 R 06D2 R          MOV     WORD PTR LPC_PTR,OFFSET LPC_XX
0527  8C 0E 0026 R                 MOV     WORD PTR LPC_PTR+2,CS


                            ;-> ENABLE INTERRUPTS (NMI & OTHERS)

052B  FB                           STI                      ;ENABLE INTERRUPTS
052C  E4 A0                        IN      AL,NMI_PORT      ;RESET LATCH
052E  B0 80                        MOV     AL,80H           ;MASK TO ENABLE NMI
0530  E6 A0                        OUT     NMI_PORT,AL      ;ENABLE NMI
0532                        LPC10:

                            ; -> DECODE LPC FUNCTION

0532  58                           POP     AX               ;RESTORE AX  (LPC FUNCTION)
0533  3C 01                        CMP     AL,LPC_INDEX     ;SPEAK LPC INDEX FUNCTION ?
0535  74 09                        JE      LPC20            ;YES. GO TO SPEAK LPC INDEX CODE
0537  3C 02                        CMP     AL,LPC_BUFFER    ;SPEAK LPC BUFFER FUNCTION ?
0539  74 51                        JE      LPC25            ;YES. GO TO SPEAK LPC BFR CODE
053B  B0 01                        MOV     AL,BAD_CMD       ;SET ERROR CODE IN AL
053D  EB 5B 90                     JMP     LPC_ERR_EXIT     ;EXIT LPC CODE

                            ; SET PROPER ROS PAGE  (SPEAK LPC INDEX FUNCTION)

0540  0B DB                 LPC20: OR      BX,BX            ;INDEX = 0 ? (INVALID)
0542  74 28                        JE      LPC22            ;YES. EXIT



0544  80 FF 00                     CMP     BH,0             ;BX < 256?
0547  75 23                        JNZ     LPC22            ;IF NOT, INDEX ERROR

0549  B1 00                        MOV     CL,PAGE0         ;SET CL = ROS PAGE 0
054B  81 FB 0029                   CMP     BX,PG0_MAX       ;IS WORD IN PAGE 0 ?
054F  72 20                        JB      LPC23            ;YES. GO TO SET ROS PAGE
0551  43                           INC     BX               ;INCREMENT BX TO ADJUST FOR
                                                            ;END PAGE ENTRIES IN TABLE

0552  B1 04                        MOV     CL,PAGE1         ;SET CL = ROS PAGE 1
0554  81 FB 005D                   CMP     BX,PG1_MAX       ;IS WORD IN PAGE 1 ?
0558  72 17                        JB      LPC23            ;YES. GO TO SET ROS PAGE
055A  43                           INC     BX               ;INCREMENT BX TO ADJUST FOR
                                                            ;END PAGE ENTRIES IN TABLE

055B  B1 08                        MOV     CL,PAGE2         ;SET CL = ROS PAGE 2
055D  81 FB 0091                   CMP     BX,PG2_MAX       ;IS WORD IN PAGE 2 ?
0561  72 0E                        JB      LPC23            ;YES. GO TO SET ROS PAGE
0563  43                           INC     BX               ;INCREMENT BX TO ADJUST FOR
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07F-880

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0566  81 FB 00FA                         [illegible]  CX,FA..3          ;SET CX  ... S PAGE 3
056A  72 05                              CMP   BX,FCT_MAX              ;IS ... IN PAGE 1 ?
                                         JB    LPC23                   ;YES, GO TO SET BUS PAGE

056C  B0 04                     LPC22:   MOV   AL,INDEX_ERR            ;SET AL = INDEX ERROR
056E  E9 2A 90                           JMP   LPC_ERR_EXIT            ;GO TO EXIT CODE

0571  BA FB98                   LPC23:   MOV   DX,PORTA                ;SET PROPER BUS PAGE
0574  EC                                 IN    AL,DX                   ;
0575  24 F3                              AND   AL,CLR_PAGE             ;
0577  0A C1                              OR    AL,CL                   ;
0579  EE                                 OUT   DX,AL                   ;

                                ; SET DS:SI TO POINT TO BUFFER  (SPEAK LPC INDEX FUNCTION)

057A  0E                                 PUSH  CS                      ;SET DS:SI -> SPEECH BFR
057B  1F                                 POP   DS                      ;
057C  D1 E3                              SHL   BX,1                    ;
057E  8B B7 0AFE R                       MOV   SI,[BX+OFFSET TABLE...]
0582  8B CE                              MOV   CX,SI
0584  F7 D9                              NEG   CX                      ;WE ARE GETTING THE WORD'S BYTE
0586  03 8F 0B00 R                       ADD   CX,[BX+OFFSET TABLE]    ;COUNT FROM THE DIFFERENCE
                                                                       ;BETWEEN TABLE OFFSETS
058A  EB 02                              JMP   SHORT LPC30             ;CONTINUE

                                ; SET DS:SI TO POINT TO BUFFER   (SPEAK LPC BUFFER FUNCTION)

058C  1F                        LPC25:   POP   DS                      ;SET DS:SI -> SPEECH BFR
058D  1E                                 PUSH  DS                      ;
                                                                       ;CX = LEN OF WORD
                                ; SET 5220 SPEAK EXTERNAL COMMAND



058E  B0 60                     LPC30:   MOV   AL,SPK_EXT              ;SET SPEAK EXTERNAL MODE
0590  E8 065D R                          CALL  LPCW_IO                 ;WRITE COMMAND TO 5220
                                                                       ;[illegible] WAITING FOR LPC READY ?
0593  74 4B                              JZ    LPC35                   ;NO, CONTINUE
0595                            LPC33:
0595  E8 037A R                          CALL  WAIT_FOR_LPC            ;RETURN WHEN SPEECH IS COMPLETE
0598  B0 06                              MOV   AL,LPCRDY_ERR           ;YES, SET ERROR CODE IN AL

                                ; THIS IS THE GENERAL EXIT PATH FOR LPC BIOS

059A                            LPC_ERR_EXIT:
059A  50                                 PUSH  AX

059B  E4 21                              IN    AL,PORT_21H
059D  0C 02                              OR    AL,INT1_OFF
059F  E6 21                              OUT   PORT_21H,AL
05A1  BA FF9F                            MOV   DX,IRR_ACT              ;DISSABLE INTERRUPTS BOTH
05A4  EC                                 IN    AL,DX                   ;ON SYSTEM AND FEATURE CARD
05A5  24 FD                              AND   AL,11111101B
05A7  0C 01                              OR    AL,00000001B
05A9  EE                                 OUT   DX,AL

05AA  B0 10                              MOV   AL,10H
05AC  E6 A0                              OUT   NMI_PORT,AL             ;MASK NMI
05AE  FA                                 CLI                           ;MASK HARDWARE INT'S

                                ; -> CHECK TO SEE IF LPC INTR VECTOR HAS BEEN SET

05AF  33 C0                              XOR   AX,AX                   ;RESTORE KEYBOARD INT VECTOR
05B1  8E D8                              MOV   DS,AX                   ;ONLY IF NEEDED

05B3  A1 0024 R                          MOV   AX,WORD PTR LPC_PTR
05B6  3D 06?2 R                          CMP   AX,OFFSET LPC_KB ; DOES INT 9 POINT AT LPC?
05B9  74 08                              JE    LPC34                   ;IF SO, RESTORE WITH SAVED
05BB  8C C8                              MOV   AX,CS                   ;VECTOR
05BD  3B 06 0026 R                       CMP   AX,WORD PTR LPC_PTR+2
05C1  75 0C                              JNE   LPC34A
05C3                            LPC34:
05C3  A1 0138 R                          MOV   AX,KBD_PTR
05C6  A3 0024 R                          MOV   WORD PTR OLDKBD_PTR,AX
05C9  A1 013A R                          MOV   AX,KBD_PTR+2    ;RESTORE INT 9 WITH SAVED
05CC  A3 0026 R                          MOV   WORD PTR OLDKBD_PTR+2,AX       ;VECTOR
05CF                            LPC34A:
05CF  BA F878                            MOV   DX,PORTA
05D2  EC                                 IN    AL,DX
05D3  24 7F                              AND   AL,OFFH-TALK_LPC
05D5  EE                                 OUT   DX,AL                   ;TURN OFF LPC IN PROC FLAG

05D6  FB                                 STI                           ;ENABLE HARDWARE INT'S
05D7  E4 A0                              IN    AL,NMI_PORT
05D9  B0 80                              MOV   AL,80H
05DB  E6 A0                              OUT   NMI_PORT,AL     ;ENABLE NMI



05DD  58                                 POP   AX
05DE  EB 6A                              JMP   SHORT LPCX              ;GO TO EXIT

                                ; SET SYSTEM SPEAKER SWITCH TO AUDIO CHANNEL

05E0  E4 61                     LPC35:   IN    AL,PORT_61H             ;READ SYSTEM'S PORT 61H
05E2  24 9F                              AND   AL,CLR_SPKSW            ;CLEAR SPEAKER SWITCH BITS
05E4  0C 40                              OR    AL,AUDIO_CHN            ;OR IN 'AUDIO CHANNEL' BITS
05E6  E6 61                              OUT   PORT_61H,AL             ;OUTPUT TO PORT 61H

                                ; SETUP CHANNEL MUX FOR LPC SPEECH

05E8  BA F829                            MOV   DX,PORTA                ;ADDRESS PORT A
05EB  EC                                 IN    AL,DX                   ;READ IT
05EC  24 FC                              AND   AL,CLR_MUX              ;SET CHANNEL MUX BITS TO 0
05EE  EE                                 OUT   DX,AL                   ;OUTPUT TO PORT

05EF  0B ED                              OR    BP,BP                   ;TONE OR BACKGROUND
05F1  75 0D                              JNZ   LPC40                   ;IF TONE, DON'T ENABLE INT'S

                                ; ENABLE INTR 1 ON SYSTEM 8259

05F3  E4 21                              IN    AL,PORT_21H             ;ENABLE INTR 1
05F5  24 FD                              AND   AL,INT1_ON              ;
05F7  E6 21                              OUT   PORT_21H,AL             ;

                                ; ENABLE LPC INTR W/O DISABLING THE CHANNEL

05F9  BA FF21                            MOV   DX,IRR_ACT              ;ENABLE LPC INTR
05FC  EC                                 IN    AL,DX                   ;
05FD  0C 01                              OR    AL,1                    ;
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05FF  EE                            OUT     DX,AL           ;

0600                        LPC40:
0600  BB 0010                       MOV     BX,16           ;LOAD BUFFER WITH 16 DATA BYTES
0603                        LPC45:

                            ; LOAD LPC BUFFER WITH OF DATA

0603  B0 10                         MOV     AL,10H
0605  E6 A0                         OUT     NMI PORT,AL     ;MASK NMI INTERRUPT
0607  FA                            CLI                     ;MASK HARDWARE INTERRUPTS

0608  E8 0675 R                     CALL    LOAD_BFR_HNDLR ;SEND BYTES TO LPC, SAVE PTR
                                                            ;AND COUNT INFO

060B  FB                            STI                     ;ENABLE OTHER INTERRUPTS
060C  E4 A0                         IN      AL,NMI_PORT     ;RESET NMI LATCH
060E  B0 80                         MOV     AL,80H
0610  E6 A0                         OUT     NMI_PORT,AL     ;ENABLE NMI

                                                            ;ERROR WAITING FOR LPC READY ?


0612  72 B1                         JC      LPC33           ;YES, GO TO SET ERROR & EXIT

0614  0B ED                         OR      BP,BP           ;FORE OR BACKGROUND
0616  74 30                         JZ      LPC_BACKGROUND ;EXIT, LET BACKGROUND TAKE OVER

                            ; -> FOREGROUND LPC IS PROCESSED HERE

0618  0B C9                         OR      CX,CX           ;ARE ALL BYTES SENT TO LPC?
061A  74 18                         JZ      FOREGROUND_COMPLETE ;IF SO, GO ON

061C  51                            PUSH    CX
061D  B9 2000                       MOV     CX,2000H
0620                        TEST_HALF_BUF_BIT:
0620  E8 075C R                     CALL    READ PORTB      ;READ LPC STATUS
0623  F6 C4 40                      TEST    AH,01000000B    ;LOOK AT BUF HALF FULL BIT
0626  E1 F8                         LOOPZ   TEST_HALF_BUF_BIT ;GO ON WHEN BUF HALF FULL
0628  E3 06                         JCXZ    FGND_ERR
062A  59                            POP     CX

062B  BB 0008                       MOV     BX,8            ;SEND 8 BYTES TO LPC
062E  EB D3                         JMP     LPC45           ;LOOP BACK FOR ANOTHER ROUND

0630                        FGND_ERR:
0630  59                            POP     CX
0631                        LPC33_LINK:
0631  E9 0595 R                     JMP     LPC33

0634                        FOREGROUND_COMPLETE:
0634  BA FB98                       MOV     DX,PORTA
0637  EC                            IN      AL,DX
0638  24 7F                         AND     AL,0FFH-TALK_LPC
063A  EE                            OUT     DX,AL           ;TURN OFF LPC IN PROGRESS FLAG
063B  B9 5000                       MOV     CX,5000H
063E                        FOR_COMP:
063E  E8 075C R                     CALL    READ PORTB      ;
0641  F6 C4 80                      TEST    AH,10000000B    ;READ LPC SPEAKING BIT
0644  E0 F8                         LOOPNZ  FOR_COMP        ;LOOP BACK UNTIL LPC
                                                            ;HAS PROCESSED ALL DATA
0646  E3 E9                         JCXZ    LPC33_LINK

                            ; -> EXIT LPC CODE

0648                        LPC_BACKGROUND:

0648  B0 00                         MOV     AL,OK           ;SET LPC STATUS TO O.K.
064A  1F                    LPCX:   POP     DS              ;RESTORE ORIGINAL DS
064B  E9 0301 R                     JMP     EXIT            ;

                            ; WAIT_RDY: - THIS PROCEDURE WAITS FOR LPC READY (LOW ACTIVE)
                            ;           - IT DESTROYS REGISTERS AL & DX
                            ;           - THIS PROCEDURE MUST BE FOLLOWED BY A CHECK OF
                            ;             THE ZERO FLAG:
                            ;               IF ON, => NO ERRORS


                            ;               IF OFF => ERROR WAITING FOR LPC READY
                            ;                         (SET AL = LPCRDY_ERR & EXIT)
064E                        WAIT_RDY PROC   NEAR

064E  51                            PUSH    CX              ;SAVE CX
064F  33 C9                         XOR     CX,CX           ;CLEAR CX
0651  51                    WAIT00: PUSH    CX              ;DELAY
0652  59                            POP     CX              ;DELAY
0653  BA FB9A                       MOV     DX,PORTC        ;READ READY
0656  EC                            IN      AL,DX           ;
0657  24 01                         AND     AL,LPC_READY    ;TURN OFF ALL BITS EXCEPT READY
                                                            ;READY ?
0659  E0 F6                         LOOPNZ  WAIT00          ;NO, KEEP CHECKING
065B  59                            POP     CX              ;RESTORE CX
065C  C3                            RET                     ;RETURN

065D                        WAIT_RDY ENDP

                            ; LPCW_10  THIS PROCEDURE WRITES TO PORT B THE VALUE
                            ;          CONTAINED IN AL BY TURNING LPC WRITE LINE
                            ;          ON & THEN OFF
                            ;        - AL SHOULD CONTAIN VALUE TO BE WRITTEN TO
                            ;          PORT B.
                            ;        - IT DESTROYS REGISTERS AL & DX
                            ;        - THIS PROCEDURE MUST BE FOLLOWED BY A CHECK OF
                            ;          THE ZERO FLAG:
                            ;          IF ON, => NO ERRORS
                            ;          IF OFF => ERROR WAITING FOR LPC READY
                            ;                    (SET AL = LPCRDY_ERR & EXIT)
065D                        LPCW_10  PROC   NEAR

065D  BA FB99                       MOV     DX,PORTB        ;LPC WRITE (ON -> OFF)
0660  EE                            OUT     DX,AL           ;
0661  B0 0B                         MOV     AL,LPCW_ON      ;
0663  BA FB9B                       MOV     DX,CWREG        ;
0666  EE                            OUT     DX,AL           ;
0667  E8 064E R                     CALL    WAIT_RDY        ;
066A  75 08                         JNZ     LPCW_R          ;(TIMEOUT WAITING FOR LPC RDY)
066C  B0 0A                         MOV     AL,LPCW_OFF     ;
066E  BA FB9B                       MOV     DX,CWREG        ;
0671  EE                            OUT     DX,AL           ;
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D. F-80

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                                LPCW_EX:  RET

                                LPCW_IO   ENDP

                                ;****************************************************************
                                ; LOAD_BFR_HANDLER
                                ; DESCRIPTION



                                ;       THE REMAINING NUMBER OF BYTES IN THE LPC WORD TO BE OUTPUT
                                ;       IS COMPARED TO THE MAXIMUM NUMBER OF OUTPUT BYTES ALLOWED.
                                ;       IF THERE ARE MORE BYTES LEFT TO BE OUTPUT THAN CAN BE SENT
                                ;       OUT WITH THIS CALL THEN
                                ;          THE MAXIMUM ALLOWED NUMBER OF BYTES IS SENT OUT TO THE
                                ;          LPC CHIP, AND
                                ;          THE POINTER TO THE NEXT BYTE TO OUTPUT (SEGMENT AND
                                ;          OFFSET) AND
                                ;          THE REMAINING COUNT ARE FOLDED INTO TWO WORDS AND SAVED,
                                ;          AND
                                ;          THE CARRY FLAG IS RESET TO INDICATE NO ERROR
                                ;       IF ALL REMAINING BYTES TO BE OUTPUT CAN BE HANDLED THIS
                                ;       TIME THEN
                                ;          THEY ARE SENT,
                                ;          A BYTE OF 00 IS SENT, AND
                                ;          THE CARRY FLAG IS SET TO INDICATE END OF SPEECH DATA
                                ;          OUTPUT.
                                ;
                                ; ON ENTRY
                                ;       BX = MAXIMUM ALLOWED NUMBER OF BYTES TO BE OUTPUT.
                                ;       CX = REMAINING NUMBER OF BYTES TO BE OUTPUT IN THE LPC
                                ;       WORD.
                                ;       DS:SI = POINTER TO LPC DATA
                                ;       DFL = 0 (DIRECTION FLAG RESET TO INCREMENT)
                                ;
                                ; ON EXIT
                                ;       INTERRUPT VECTOR LOCATION 4FH = THE COMPRESSED VERSION OF
                                ;       THE POINTER AND COUNT INFORMATION DESCRIBING THE REMAINING
                                ;       DATA TO BE OUTPUT FOR THE LPC WORD BEING PROCESSED
                                ;          0:13C = LMMM WHERE L IS A HEX DIGIT REPRESENTING AN
                                ;             OFFSET, MMM IS A 3 HEX DIGIT COUNT OF REMAININ  BYTES
                                ;          0:13E = PPPP WHERE PPPP IS THE SEGMENT ADDRESS OF THE
                                ;             NEXT LPC DATA TO BE OUTPUT.
                                ;             PPPP:L POINTS AT THE NEXT LPC DATA TO BE OUTPUT
                                ;             MMM IS THE REMAINING NUMBER OF BYTES TO BE OUTPUT
                                ;
                                ;       REGISTERS AX, BX,CX, DX, AND SI ARE ALTERED.
                                ;
                                ;****************************************************************

 0675                           LOAD_BFR_HNDLR  PROC    NEAR
 0675  3B CB                            CMP     CX,BX           ;IS REMAINING COUNT LESS THAN MAX?
 0677  7C 16                            JL      COMPLETE_OUTPUT ;IF SO, FINISH WORD
 0679  7F 03                            JG      CONTINUE_OUTPUT ;IF MORE THAN THE LIMIT,SEND LIMIT
 067B  80 EB 04                         SUB     BL,04           ;IF EXACTLY THE LIMIT REMAINS,
                                                                ;OUTPUT 4 LESS THAN LIMIT TO AVOID
                                                                ;OVER RUNNING THE BUFFER.
 067E                           CONTINUE_OUTPUT:
 067E  51                               PUSH    CX
 067F  8B CB                            MOV     CX,BX           ;LOAD MAXIMUM BYTE COUNT

 0681  E8 069F R                        CALL    LOAD_BFR        ;LOAD BYTES INTO 5220
 0684  59                               POP     CX
 0685  75 16                            JNZ     LOAD_BFR_ERR    ;JUMP IF ERROR ENCOUNTERED



 0687  2B CB                            SUB     CX,BX           ;ADJUST COUNT FOR BYTES OUTPUT
 0689                           UPDATE_COMPLETE:                ;THIS TIME
 0689  E8 06AA R                        CALL    SAVE_POINTER

 068C  F8                               CLC                     ;CLEAR CARRY INDICATES NO ERRORS
                                                                ;SPEAKING.
 068D  EB 0F                            JMP     SHORT EXIT_BFR_HNDLR

 068F                           COMPLETE_OUTPUT:
 068F  E8 069F R                        CALL    LOAD_BFR        ;LOAD LAST BYTES
 0692  75 09                            JNZ     LOAD_BFR_ERR    ;BRANCH IF ERROR
 0694  B0 00                            MOV     AL,0
 0696  E8 065D R                        CALL    LPCW_IO         ;SEND BYTE OF 0 TO 5220
 0699  33 C9                            XOR     CX,CX           ;REMAINING COUNT = 0
 069B  EB EC                            JMP     UPDATE_COMPLETE ;SAVE POINTER, CLEAR CARRY, RETURN
 069D                           LOAD_BFR_ERR:
 069D  F9                               STC                     ;SET CARRY TO INDICATE SPEECH END
 069E                           EXIT_BFR_HNDLR:
 069E  C3                               RET
 069F                           LOAD_BFR_HNDLR  ENDP

                                ; NOTES: - PRIOR TO CALLING THE LOAD_BFR PROCEDURE, WE MUST HAVE:
                                ;            CX = # OF BYTES TO LOAD
                                ;            DS:SI = SEGMENT:OFFSET OF DATA
                                ;          - THIS PROCEDURE DESTROYS REGISTERS AL & DX
                                ;          - THIS PROCEDURE MUST BE FOLLOWED BY A CHECK OF
                                ;            THE ZERO FLAG:
                                ;            IF ON, => NO ERRORS
                                ;            IF OFF => ERROR WAITING FOR LPC READY
                                ;                      (SET AL = LPCRDY_ERR & EXIT)
                                ;
 069F                           LOAD_BFR PROC   NEAR

 069F  AC                       LOADOO: LODSB                   ;LOAD BFR WITH CX BYTES OF DATA
 06A0  E8 065D R                        CALL    LPCW_IO         ;
 06A3  75 04                            JNZ     LOADXX          ;(TIMEOUT WAITING FOR LPC RDY)
 06A5  E2 F8                            LOOP    LOADOO          ;
 06A7  32 C0                            XOR     AL,AL           ;SET THE ZERO FLAG
 06A9  C3                       LOADXX: RET                     ;

 06AA                           LOAD_BFR ENDP

                                ;****************************************************************
                                ; SAVE POINTER
                                ; THIS PROC FOLDS THE OFFSET AND COUNT FOR LPC INTO TWO WORDS
                                ; SEE DOCUMENTATION ON LOAD_BFR_HNDLR FOR MORE INFO.
                                ;****************************************************************

 06AA                           SAVE_POINTER    PROC    NEAR
 06AA  0B ED                            OR      BP,BP           ;ARE WE IN FOREGROUND?
 06AC  75 23                            JNZ     NO_POINTER_SAVE ;IF SO, DON'T DO THIS SAVE
```

```
06AE  06                         PUSH    ES
06AF  33 C0                      XOR     AX,AX
06B1  8E C0                      MOV     ES,AX
                                 ASSUME  ES:DUMMY          ;ADDRESS PTR AND COUNT SAVE LOCS

06B3  8B C1                      MOV     AX,CX             ;SAVE COUNT IN LOW 3 NIBS OF AX
06B5  B1 04                      MOV     CL,4
06B7  D3 CE                      ROR     SI,CL             ;ROTATE NIBS OF SI
                                                           ;(4,3,2,1 --> 1,4,3,2)
06B9  56                         PUSH    SI                ;SAVE THIS NEW VERSION

06BA  81 E6 F000                 AND     SI,0F000H         ;MASK LOW 3 NIBS(MOST SIGNIFICANT)
06BE  0B C6                      OR      AX,SI             ;OR IN WITH COUNT
06C0  26: A3 013C R              MOV     ES:WORD PTR BFR_PTR,AX   ;STORE PACKED WORD FOR USE
                                                           ;NEXT TIME

06C4  8C D8                      MOV     AX,DS
06C6  5B                         POP     BX                ;RESTORE ALTERED VERSION OF SI
06C7  80 E7 0F                   AND     BH,0FH            ;MASK LEFTMOST
                                                           ;(LOWEST SIGNIFICANCE)
06CA  03 C3                      ADD     AX,BX             ;ADD INTO SEGMENT
06CC  26: A3 013E R              MOV     ES:WORD PTR BFR_PTR+2,AX ;STORE NEW VERSION OF
                                                           ;SEGMENT ADDR

06D0  07                         POP     ES                ;RESTORE ES
06D1                     NO_POINTER_SAVE:
06D1  C3                         RET
06D2                     SAVE_POINTER    ENDP
                         ;*********************************************************
                         ;*                                                       *
                         ;*        NAME:  LPC INTERRUPT HANDLER                   *
                         ;*                                                       *
                         ;*     PURPOSE:  TO PROVIDE SUPPORT FOR LPC HARDWARE INTR *
                         ;*                                                       *
                         ;*     LINKAGE:  HARDWARE INTR 1 (8259)                  *
                         ;*                                                       *
                         ;*      INPUTS:  VECTOR AREA FOR SOFTWARE INTR 04FH MUST *
                         ;*               CONTAIN THE LPC BUFFER POINTER          *
                         ;*                                                       *
                         ;*     OUTPUTS:  NONE                                    *
                         ;*                                                       *
                         ;*        EXIT:  INTERRUPT RETURN                        *
                         ;*                                                       *
                         ;*     PROCESS:  (1) - CHECK TO SEE IF LPC OR KBD INTERRUPT. *
                         ;*                     IF KBD, ISSUE KBD INTERRUPT & RETURN *
                         ;*                     IF LPC, CONTINUE                  *
                         ;*               (2) - MASK NMI AND OTHER HARDWARE INTERRUPTS. *
                         ;*               (3) - CHECK TYPE OF LPC INTERRUPT. IF STRAY, *
                         ;*                     GO ON. IF BUFFER LOW, CALL ROUTINE TO *
                         ;*                     SEND 8 MORE BYTES TO LPC CHIP. IF OTHER. *
                         ;*                     TURN OFF LPC AND LPC IN PROCESS FLAG. *
                         ;*               (4) - ISSUE EOI CMD TO INT 1 OF THE 8259 *
                         ;*               (5) - REENABLE NMI AND OTHERS           *
                         ;*               (6) - ISSUE IRET                        *


                         ;*                                                       *
                         ;*********************************************************

                         ; -> SAVE SOME REGISTERS

06D2  50                 LPC_XX: PUSH    AX                ;SAVE AX & DX
06D3  52                         PUSH    DX                ;

                         ; -> CHECK TO SEE IF LPC OR KBD INTERRUPT
                         ;    IF LPC, GO TO LPC INTR HANDLER CODE
                         ;    IF KBD, ISSUE KBD INTERRUPT & RETURN

06D4  B0 0B                      MOV     AL,0BH
06D6  E6 20                      OUT     PORT_20H,AL       ;SYSTEM 8259 CONTROL PORT
06D8  EB 00                      JMP     $+2
06DA  E4 20                      IN      AL,PORT_20H
06DC  A8 02                      TEST    AL,02             ;LPC INTR ?
06DE  75 05                      JNZ     LPCX00            ;YES, CONTINUE

06E0  5A                         POP     DX                ;RESTORE AX & DX
06E1  58                         POP     AX                ;
06E2  CD 4E                      INT     KBD               ;ISSUE KBD INTR
06E4  CF                         IRET                      ;RETURN

                         ;*********************************************************
                         ;*****************   LPC INTERRUPT HANDLER   *************
                         ;*********************************************************

                         ; -> SAVE OTHER REGISTERS

06E5  B0 10              LPCX00: MOV     AL,10H
06E7  E6 A0                      OUT     NMI_PORT,AL       ;DISSABLE NMI
06E9  FA                         CLI                       ;DISSABLE HARDWARE INTERRUPTS

06EA  E9 0A95 R                  JMP     SETUP_FLAG2
06ED                     FLAG_SETUP2:
06ED  56                         PUSH    SI                ;SAVE REGISTERS
06EE  57                         PUSH    DI                ;
06EF  55                         PUSH    BP

06F0  33 ED                      XOR     BP,BP             ;BP 0 MEANS LPC BACKGROUND

                         ; -> READ 8255 PORT B (5220 STATUS REG) & SAVE IN AH

06F2  E8 075C R                  CALL    READ_PORTB

                         ; -> DECODE TYPE OF LPC INTERRUPT

06F5  80 E4 E0                   AND     AH,0E0H           ;ZERO OUT BITS OF NO INTEREST
06F8  80 FC 80                   CMP     AH,10000000B      ;STRAY INTERRUPT?
06FB  74 4B                      JZ      LPCX95            ;IF SO END INTERRUPT AND RETURN
06FD  80 FC C0                   CMP     AH,11000000B      ;BUFFER LOW INTERRUPT?
0700  75 1D                      JNZ     LPCX90            ;IF NOT, EITHER LPC WORD IS DONE



                                                           ;OR SOMETHING'S WRONG. IN ANY CASE,
                                                           ;DISCONTINUE LPC PROCESSING.

                         ; -> BUFFER LOW INTR  => LOAD 8 MORE BYTES

0702  33 C0              LPCX30: XOR     AX,AX             ;SET DS:SI TO POINT TO LPC DATA
0704  8E D8                      MOV     DS,AX             ;
0706  C5 36 013C R               LDS     SI,DWORD PTR[BFR_PTR] ;GET PTR AND COUNT INTO
                                                           ;DS:SI

070A  56                         PUSH    SI                ;SAVE SI
070B  B1 0C                      MOV     CL,12
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U/F-86

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                                        JZ      LPCX95          ;IF COUNT IS 0, DO A 1 UPDATE
0717  BB 0008                           MOV     BX,8            ;BATCH = MULTIPLE OF 8 BYTES
071A  E8 0675 R                         CALL    LOAD_BFR_UNDER  ;FILL 8 UPDATE TO 5220
071D  73 29                             JNC     LPCX95          ;IF NO ERROR, JUMP
                                                                ;IF ERROR OR END OF SPEECH, GO ON
                              ; -> TURN OFF 'LPC IN PROGRESS' FLAG.

071F                          LPCX90:
071F  E8 037A R                         CALL    WAIT_FOR_LPC    ;WAIT FOR LPC TO COMPLETE
0722  BA FB98                           MOV     DX,PORTA        ;TURN OFF LPC IN PROG. FLAG
0725  EC                                IN      AL,DX
0726  24 7F                             AND     AL,OFFH-TALK_LPC
0728  EE                                OUT     DX,AL           ;TURN OFF LPC IN PROGRESS FLAG

0729  E4 21                             IN      AL,PORT_21H
072B  0C 02                             OR      AL,INT1_OFF
072D  E6 21                             OUT     PORT_21H,AL
072F  BA FF9F                           MOV     DX,10H_ACC      ;DISABLE INTERRUPTS BOTH
0732  EC                                IN      AL,DX           ;ON SYSTEM AND FEATURE CARD
0733  24 FD                             AND     AL,11111101B
0735  0C 01                             OR      AL,00000001B
0737  EE                                OUT     DX,AL

                                        ASSUME  DS:DUMMY
0738  33 C0                             XOR     AX,AX           ;RESTORE KEYBOARD INTERRUPT VECTOR
073A  8E D8                             MOV     DS,AX
073C  A1 0138 R                         MOV     AX,KBD_PTR
073F  A3 0024 R                         MOV     WORD PTR OLDKBD_PTR,AX
0742  A1 013A R                         MOV     AX,KBD_PTR+2
0745  A3 0026 R                         MOV     WORD PTR OLDKBD_PTR+2,AX

                              ; -> ISSUE INTR 1 EOI (END OF INTR) CMD

0749  B0 61                   LPCX95:   MOV     AL,INT1_EOI     ;INT 1 EOI CMD
074A  E6 20                             OUT     PORT_20H,AL     ;

074C  E4 A0                             IN      AL,NMI_PORT     ;RESET NMI LATCH
074E  B0 80                             MOV     AL,80H


0750  E6 A0                             OUT     NMI_PORT,AL     ;ENABLE NMI
0752  FB                                STI                     ;ENABLE OTHER HARDWARE INTERRUPTS

                              ; -> RESTORE REGISTERS & RETURN

0753  5D                                POP     BP              ;RESTORE REGISTERS
0754  5F                                POP     DI              ;
0755  5E                                POP     SI              ;
0756  1F                                POP     DS              ;
0757  59                                POP     CX              ;
0758  5B                                POP     BX              ;
0759  5A                                POP     DX              ;
075A  58                                POP     AX              ;
075B  CF                                IRET                    ;RETURN

                              ;***********************************************************
                              ; READ_PORTB
                              ;       THIS PROC READS PORT B AND SAVES IT IN AH
                              ; DESCRIPTION
                              ;       FIRST PORT A IS SAVED (WHEN 8255 MODE SET O CHANGE ALL
                              ;       OUTPUTS GO HIGH)
                              ;       THE 8255 MODE IS SET TO LPC IN MODE (PORT B INPUT)
                              ;       THE LPC READ BIT IS SET
                              ;       WE WAIT FOR READY TO GO HIGH
                              ;       WE SAVE PORT B IN AH
                              ;       RESET LPC READ BIT
                              ;       RETURN 8255 TO PORT B OUTPUT MODE
                              ;       RESTORE PORT A AND RETURN
                              ; ON EXIT:
                              ;       DX,AX,BH ARE DESTROYED
                              ;       AH HOLDS VALUE OF LPC STATUS REGISTER
                              ;***********************************************************
075C                          READ_PORTB        PROC    NEAR
075C  BA FB98                           MOV     DX,PORTA        ;READ 8255 PORT A
075F  EC                                IN      AL,DX           ;
0760  8A F8                             MOV     BH,AL           ;SAVE IN BH

0762  B0 83                             MOV     AL,LPC_IN       ;SET PORT B AS INPUT
0764  BA FB9B                           MOV     DX,CWREG        ;
0767  52                                PUSH    DX              ;SAVE CWREG ADDRESS
0768  EE                                OUT     DX,AL           ;
0769  B0 09                             MOV     AL,LPCR_ON      ;READ PORT B
076B  EE                                OUT     DX,AL           ;
076C  E8 064E R                         CALL    WAIT_RDY        ;
076F  BA FB99                           MOV     DX,PORTB        ;
0772  EC                                IN      AL,DX           ;
0773  8A E0                             MOV     AH,AL           ;SAVE VALUE IN AH
0775  B0 08                             MOV     AL,LPCR_OFF     ;
0777  5A                                POP     DX              ;RESTORE CWREG
0778  EE                                OUT     DX,AL           ;

0779  B0 81                             MOV     AL,LPC_OUT      ;SET PORT B AS OUTPUT
077B  EE                                OUT     DX,AL           ;



077C  8A C7                             MOV     AL,BH           ;RE-WRITE 8255 PORT A
077E  BA FB98                           MOV     DX,PORTA        ;
0781  EE                                OUT     DX,AL           ;
0782  C3                                RET
0783                          READ_PORTB        ENDP

                              ;*************************************************************
                              ;*                                                           *
                              ;*                     DIAGNOSTIC CODE                       *
                              ;*                                                           *
                              ;* THIS CODE IS ACCESSED VIA INTERRUPT 9:H                   *
                              ;*************************************************************
                              ; ERRORS:                                                    *
                              ;       CUSTOMER LEVEL  | SERVICE LEVEL  | SYMPTOM           *
                              ;       ---------------------------------------------------  *
                              ;             B         |       10XH     | RESET FAILURE     *
                              ;             C         |       11XH     | LPC ERROR         *
                              ;             D         |       12XH     | CVSD PLAYBACK ERROR *
                              ;             E         |       13XH     | CVSD RECORD ERROR *
                              ;             D         |       14XH     | CVSD PLAYBACK-AFTER-*
                              ;                                        | RECORD ERROR      *
                              ;                          XX IS THE BIOS RETURN CODE        *
```

```
                                        ;*************************************************************
                                        ;
                                        ; DATA
                                        ;
0783  17                                T2_ICON         DB      T2_I-T2_ICON
0784  0A 0A 0B 05 2F BA                                 DB      10,10,11,5,47,186,11,-4
      0B FC
078C  C9 CD 20 BA 0B FC                                 DB      201,205,32,186,11,-4
0792  C8 CD 20 BA 0B FE                                 DB      200,205,32,186,11,-2
0798  5C BA                                             DB      92,186
= 079A                                  T2_I            =       $
079A  FF                                                DB      -1
079B  07                                T2_ABC          DB      T2_A-T2_ABC
079C  41 0B FD                                          DB      'A',11,-3
079F  42 0A                                             DB      'B',10
07A1  43                                                DB      'C'
= 07A2                                  T2_A            =       $
07A2  FF                                                DB      -1
07A3  0B                                T2_SELECT       DB      T2_S-T2_SELECT
07A4  87 4E 07 2C 87 4F                                 DB      87H,'N',07H,',',87H ,'O',07H,',',87H,'P'
      07 2C 87 50
= 07AE                                  T2_S            =       $
07AE  A2 A2 A2 A2 A2 FD                                 DB      161+1,161+1,161+1,161+1,161+1,-3,40-9
      11
07B5  7C FC                                             DB      121+3,-4
07B7  17                                T2_WAVE         DB      T2_W-T2_WAVE
07B8  20 2D 20 3E 0B FC                                 DB      '--->',11,-4
07BE  20 2D 20 3E 0B FC                                 DB      '--->',11,-4
07C4  20 2D 20 3E 0B FC                                 DB      '--->',11,-4
07CA  20 2D 20 3E                                       DB      '--->'


= 07CE                                  T2_W            =       $
07CE  FF                                                DB      -1
07CF  23                                MIC_ICON        DB      MIC_I-MIC_ICON
07D0  B0 B0 0B FE                                       DB      176,176,11,-2
07D4  B0 B0 0B FE                                       DB      176,176,11,-2
07D8  B0 B0 0B FE                                       DB      176,176,11,-2
07DC  B3 B3 0B FE                                       DB      179,179,11,-2
07E0  B3 B3 0B FE                                       DB      179,179,11,-2
07E4  B3 B3 0B FE                                       DB      179,179,11,-2
07E8  B3 B3 0B FE                                       DB      179,179,11,-2
07EC  B3 B3 0B FE                                       DB      179,179,11,-2
07F0  C0 D9                                             DB      192,217
= 07F2                                  MIC_I           =       $
07F2  FF                                                DB      -1
07F3  04                                ARROW           DB      A-ARROW
07F4  2D 3E 3C                                          DB      '-><'
= 07F7                                  A               =       $
07F7  03 01 FD 27 7D 01                                 DB      3,1,-3,40-1,121+4,1,3,-4
      03 FC

                                        ;****************************************
                                        ;       DIAGNOSTIC ENTRY POINT
                                        ;****************************************
07FF                                    TALKER2_DIAG    PROC    FAR
07FF  80 FC 01                                  CMP     AH,01           ;CALL FOR SCREEN SETUP?
0802  76 12                                     JBE     TALKER_ICON
0804  80 FC 4E                                  CMP     AH,'N'          ;CALL FOR LPC TEST?
0807  74 2D                                     JZ      LPC_TEST
0809  80 FC 4F                                  CMP     AH,'O'          ;CALL FOR CVSD PLAYBACK?
080C  74 75                                     JZ      CVSD_TEST
080E  80 FC 50                                  CMP     AH,'P'          ;CALL FOR CVSD RECORD?
0811  75 22                                     JNZ     GOODBYE         ;
0813  E9 0803 R                                 JMP     CVSD_REC

                                        ;****************
                                        ; SCREEN SETUP
                                        ;****************
                                        ; PUT THE ICON AND ITS SELECTION CHARATER ON THE DCP MENU
                                        ;
0816                                    TALKER_ICON:
0816  B4 07                                     MOV     AH,TLK_WIDTH    ;WIDTH OF THE ICON
0818  BD 0783 R                                 MOV     BP,OFFSET T2_ICON
081B  CD 81                                     INT     LOCATE          ;LOCATE POSITION ON MENU
081D  52                                        PUSH    DX              ;SAVE IT
081E  CD 82                                     INT     PRINT           ;PUT ICON ON SCREEN
0820  BD 079B R                                 MOV     BP,OFFSET T2_ABC
0823  5A                                        POP     DX              ;TO ADJUST ROW & COL FOR 'ABC'
0824  52                                        PUSH    DX              ;SAVE AGAIN
0825  81 C2 0309                                ADD     DX,0309H        ;
0829  CD 82                                     INT     PRINT           ;PUT 'ABC'
082B  BD 07A3 R                                 MOV     BP,OFFSET T2_SELECT
082E  5A                                        POP     DX              ;ROW & COL FOR THE SELECTION ID


082F  81 C2 0803                                ADD     DX,0803H        ;
0833  CD 82                                     INT     PRINT           ;PUT SELECTION ID ON SCREEN
0835                                    GOODBYE:
0835  CF                                        IRET                    ;RETURN TO DCP

                                        ;*************************************************************
                                        ; LPC DIAGNOSTIC
                                        ;       SPEAK THE FIRST 10 WORDS IN THE ROM VOCABULARY
                                        ;*************************************************************
0836                                    LPC_TEST:
0836  E8 0966 R                                 CALL    RESET           ;RESET CARD
0839  72 4D                                     JC      DIAG_RESET_ERR  ;ERROR
083B                                    LPC_SPEAK:
083B  BD 0783 R                                 MOV     BP,OFFSET T2_ICON
083E  BA 070E                                   MOV     DX,SPEAKER_POS  ;START CURSOR AT ROW 8 COL 16
0841  CD 82                                     INT     PRINT           ;PUT ICON ON SCREEN
0843  BD 07B7 R                                 MOV     BP,OFFSET T2_WAVE
0846  BA 0A15                                   MOV     DX,WAVE_POS     ;ROW & COL FOR SOUND WAVE
0849  CD 82                                     INT     PRINT           ;PUT SOUND WAVE
084B  B9 000A                                   MOV     CX,10           ;COUNTER FOR SPEAKING 10 WORDS
084E  BB 0005                                   MOV     BX,5            ;BEGIN WITH WORD 6
0851                                    SPEAK:
0851  51                                        PUSH    CX
0852  B8 0201                                   MOV     AX,0201H        ;LPC SPEAK WITH WORD INDEX
0855  43                                        INC     BX              ;NEXT WORD INDEX
0856  CD 4D                                     INT     TALKER          ;SPEAK ....
0858  3C 00                                     CMP     AL,00           ;PASSED?
085A  74 09                                     JE      STATUS_CK       ;YES, WAIT TILL LPC SPEAK DONE
085C                                    LPC_ERR:
085C  59                                        POP     CX
085D  B6 43                                     MOV     DH,ER_LPC_C2    ;ERROR 'C' IN CUSTOMER LEVEL
085F  B7 11                                     MOV     BH,ER_LPC_S2    ;ERROR 1100 IN SERVICE LEVEL
0861  8A D8                                     MOV     BL,AL
0863  EB 15                                     JMP     SHORT TK_ER_LINK1
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D/P-80

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0865  33 C9                      XOR     CX,CX              ;SET FOR MAXIMUM # OF TIMES
0867                     STATUS_CK2:
0867  B0 00                      MOV     AL,0
0869  E6 A0                      OUT     NMI_PORT,AL        ;MASK NMI
086B  B4 02                      MOV     AH,02              ;LPC STATUS FUNCTION (AH=02H)
086D  CD 40                      INT     TALKER             ;BIOS CALL
086F  3C 00                      CMP     AL,0H              ;LPC READY TO SPEAK?
0871  E0 F4                      LOOPNE  STATUS_CK2         ;NO, WAIT...
0873  E3 E7                      JCXZ    LPC_ERR            ;IF CX=0 THEN TIMEOUT ERROR
0875  59                         POP     CX
0876  E2 D9                      LOOP    SPEAK              ;SPEAK NEXT WORD
0878                     GOOD_TEST_END:
0878  32 F6                      XOR     DH,DH              ;ZERO DH FOR GOOD RETURN
087A                     TP_ER_LINK1:
087A  E4 A0                      IN      AL,NMI_PORT
087C  B0 80                      MOV     AL,80H
087E  E6 A0                      OUT     NMI_PORT,AL        ;ENABLE NMI


0880  E9 0960 R                  JMP     TP_ER              ;EXIT

                         ;******************
                         ; CVSD PLAYBACK
                         ;******************
0883                     CVSD_TEST:
0883  E8 0766 R                  CALL    RESET              ;RESET CARD
0886  73 09                      JNC     CONTINUE_CVSD_TEST
0888                     DIAG_RESET_ERR:
0888  B6 42                      MOV     DH,ER_LPC_CT       ;RESET ERROR "B"
088A  B7 10                      MOV     BH,ER_LPC_ST       ;SERVICE LEVEL RESET ERR
088C  8A D8                      MOV     BL,AL              ;BIOS RETURN CODE
088E  E9 0960 R                  JMP     TP_ER

0891                     CONTINUE_CVSD_TEST:
0891  BD 0783 R                  MOV     BP,OFFSET I2_ICON
0894  BA 070E                    MOV     DX,SPEAKER_POS
0897  CD 82                      INT     PRINT              ;PRINT SPEAKER

0899  BD 0787 R                  MOV     BP,OFFSET I2_WAVE
089C  BA 0A15                    MOV     DX,WAVE_POS
089F  CD 82                      INT     PRINT              ;PRINT WAVE

08A1  B8 0100                    MOV     AX,100H            ;START ON 4K BOUNDARY
08A4  8E D8                      MOV     DS,AX              ;THAT IS 100:0
08A6  8E C0                      MOV     ES,AX
08A8  33 FF                      XOR     DI,DI              ;BEGIN AT OFFSET 0
08AA  33 F6                      XOR     SI,SI
08AC  FC                         CLD
08AD  B9 0640                    MOV     CX,4800*4/12       ;LOAD ENOUGH BYTES TO SOUND A TONE
                                                            ;FOR 4 SECONDS
08B0  33 C0                      XOR     AX,AX
08B2                     LOAD_LOOP:
08B2  AB                         STOSW                      ;FILL RAM WITH PATTERN FOR TONE
08B3  AB                         STOSW                      ;THIS LOADS 6 BYTES OF 00'S
08B4  AB                         STOSW
08B5  48                         DEC     AX
08B6  AB                         STOSW                      ;THIS LOADS 6 BYTES OF FF'S
08B7  AB                         STOSW
08B8  AB                         STOSW
08B9  40                         INC     AX
08BA  E2 F6                      LOOP    LOAD_LOOP

08BC  B9 4B00                    MOV     CX,4800*4          ;SOUND A TONE FOR 4 SECONDS
08BF  B8 0101                    MOV     AX,0101H           ;CVSD WRITE
08C2  B3 05                      MOV     BL,5               ;AT 4800 BPS
08C4  CD 40                      INT     TALKER             ;GO AND TALK

08C6  0A C0                      OR      AL,AL              ;ERROR OCCURRED?
08C8  74 AE                      JZ      GOOD_TEST_END      ;IF NOT, GO ON AND EXIT

08CA  B6 44                      MOV     DH,ER_CVSD_CT      ;SETUP FOR ERROR RETURN
08CC  B7 12                      MOV     BH,ER_CVSD_ST



08CE  8A D8                      MOV     BL,AL
08D0                     TP_ER_LINK2:

08D0  E9 0960 R                  JMP     TP_ER              ;EXIT TALKER DIAGNOSTIC

                         ;***********************
                         ; CVSD RECORD TEST
                         ;***********************

08D3                     CVSD_REC:
08D3  E8 0766 R                  CALL    RESET              ;RESET CARD
08D6  72 B0                      JC      DIAG_RESET_ERR     ;ERROR

08D8  BA 0812                    MOV     DX,MIC_POS
08DB  BD 07CF R                  MOV     BP,OFFSET MIC_ICON
08DE  CD 82                      INT     PRINT              ;PUT UP MICROPHONE ON SCREEN
08E0  BA 0920                    MOV     DX,ARROW_POS1
08E3  B3 87                      MOV     BL,87H             ;BLINKING, NORMAL INTENSITY ATTRIB
08E5  BD 07F3 R                  MOV     BP,OFFSET ARROW
08E8  CD 82                      INT     PRINT              ;PUT UP BLINKING ARROWS ON SCREEN

08EA  B9 003C                    MOV     CX,60              ;DELAY
08ED  E8 0976 R                  CALL    DELAY

08F0  E4 61                      IN      AL,PORT_61H
08F2  24 9F                      AND     AL,CLR_SPKSW
08F4  E6 61                      OUT     PORT_61H,AL        ;POINT SYSTEM SOUND MUX AT BEEPER
08F6  BA 0930                    MOV     DX,ARROW_POS2
08F9  B3 00                      MOV     BL,00
08FB  CD 82                      INT     PRINT              ;BLANK ARROW
08FD  B3 01                      MOV     BL,1               ;SETUP FOR SHORT BEEP
08FF  E8 0298 R                  CALL    BEEP

0902  B8 0100                    MOV     AX,0100H           ;SELECT CVSD READ
0905  B3 05                      MOV     BL,5               ;4800 BYTES PER SECOND
0907  B9 5DC0                    MOV     CX,4800*5          ;5 SECONDS RECORDING TIME
090A  BE 0100                    MOV     SI,100H            ;BEGIN ON THE 4K BOUNDARY
090D  8E DE                      MOV     DS,SI
090F  33 F6                      XOR     SI,SI              ;OFFSET OF ZERO
0911  56                         PUSH    SI
0912  1E                         PUSH    DS
0913  51                         PUSH    CX
0914  53                         PUSH    BX
0915  CD 40                      INT     TALKER

0917  0A C0                      OR      AL,AL              ;ERROR OCCURRED?
0919  74 03                      JZ      RECORD_OK          ;IF NO ERROR OCCURRED, GO ON
```

```
                                                      ;OTHERWISE FALL THROUGH
091B  83 C4 08                  ADD     SP,8          ;ADJUST STACK FOR EXIT
091E  B6 45                     MOV     DH,ER_CVSD_C2
0920  B7 13                     MOV     BH,ER_CVSD_S2  ;SETUP ERROR RETURN CODES
0922  EB 36                     JMP     SHORT TK_EXT
0924                    RECORD_OK:


0924  33 C0                     XOR     AX,AX
0926  CD 10                     INT     10H           ;CLEAR SCREEN
0928  B4 01                     MOV     AH,1
092A  B5 20                     MOV     CH,20H
092C  CD 10                     INT     10H           ;TURN OFF CURSOR

092E  BD 0783 R                 MOV     BP,OFFSET T2_ICON
0931  BA 070E                   MOV     DX,SPEAKER_POS
0934  CD 82                     INT     PRINT         ;PUT UP SPEAKER ON THE SCREEN
0936  B3 01                     MOV     BL,1          ;SETUP FOR SHORT BEEP
0938  E8 0258 R                 CALL    BEEP

093B  B9 0028                   MOV     CX,40         ;DELAY .8 OF SECOND
093E  E8 0976 R                 CALL    DELAY         ;DELAY BEFORE PLAYBACK

0941  BD 0787 R                 MOV     BP,OFFSET T2_WAVE
0944  BA 0A15                   MOV     DX,WAVE_POS
0947  CD 82                     INT     PRINT         ;PUT UP ARROWS COMING FROM SPEAKER

0949  5B                        POP     BX
094A  59                        POP     CX
094B  1F                        POP     DS
094C  5E                        POP     SI
094D  B8 0101                   MOV     AX,0101H
0950  CD 40                     INT     TALKER        ;PLAYBACK

0952  0A C0                     OR      AL,AL
0954  74 08                     JZ      PLAYBACK_OK   ;ERROR OCCURRED ON PLAYBACK?
                                                      ;IF NOT GO ON
0956  B6 44                     MOV     DH,ER_CVSD_C1  ;IF SO FALL THROUGH
0958  B7 14                     MOV     BH,ER_CVSD_S3
095A                    TK_EXT:
095A  8A D8                     MOV     BL,AL
095C  EB 02                     JMP     SHORT TK_EX
095E                    PLAYBACK_OK:
095E  B6 00                     MOV     DH,0          ;SETUP NO ERROR RETURN

                        ;--------------------------------------------------------
                        ; RETURN TO DCP                                         :
                        ;       TEST PASSED:                                    :
                        ;               DH = 0                                  :
                        ;       TEST FAILED:                                    :
                        ;               DH = ASCII ERROR CODE IN CUSTOMER LEVEL :
                        ;               BX = ERROR CODE IN SERVICE LEVEL        :
                        ;--------------------------------------------------------

0960                    TK_EX:
0960  B2 00                     MOV     DL,0
0962  F9                        STC
0963  CA 0002                   RET     2
0966                    TALKER2_DIAG    ENDP

                        ;--------------------------------------------------------
                        ; RESET                                                 :
                        ;       RESET CARD TO NORMAL CONDITION                  :
                        ;--------------------------------------------------------

0966                    RESET   PROC    NEAR
0966  33 C0                     XOR     AX,AX         ;CLEAR AH
0968  CD 40                     INT     TALKER
                                                      ;TO RESET CARD
096A  3C 00                     CMP     AL,OK         ;RESET OK?
096C  74 07                     JZ      RESET_OK      ;YES
096E  B6 42                     MOV     DH,ER_LPC_C1  ;ERROR 'B' IN CUSTOMER LEVEL
0970  B7 10                     MOV     BH,ER_LPC_S1  ;ERROR 10XX IN SERVICE LEVEL
0972  8A D8                     MOV     BL,AL
0974  F9                        STC
0975                    RESET_OK:
0975  C3                        RET
0976                    RESET   ENDP

                        ;--------------------------------------------------------
                        ; DELAY                                                 :
                        ;       THIS ROUTINE WAITS APPROXIMATELY CX * .10 SECONDS :
                        ;       BEFORE RETURNING                                :
                        ; ON ENTRY:                                             :
                        ;       CX = DELAY TIME                                 :
                        ; ON EXIT:                                              :
                        ;       DX = 0                                          :
                        ;--------------------------------------------------------

0976                    DELAY   PROC    NEAR
0976                    DEL10:
0976  51                        PUSH    CX
0977  B9 3340                   MOV     CX,13120      ;DECIMAL VALUE TO GIVE WAIT TIME
                                                      ;OF .1 SECOND
097A                    DEL20:
097A  E2 FE                     LOOP    DEL20
097C  59                        POP     CX
097D  E2 F7                     LOOP    DEL10
097F  C3                        RET
0980                    DELAY   ENDP
                                ASSUME  DS:DATA
                        ;------------------------------------------------
                        ;NMIOFF
                        ;       THIS PROCEDURE IS CALLED TO DISABLE NMI AND SELECTED
                        ;       INTERRUPTS ON THE 8259.
                        ;INPUT:
                        ;       BL=MASK TO DISABLE 8259 INTERRUPTS
                        ;OUTPUT
                        ;       AX=INITIAL TIMER1 VALUE
                        ;       BL=ORIGIONAL 8259 MASK
                        ;------------------------------------------------
0980                    NMIOFF  PROC    NEAR

                        ;--------------------------------------------------------


                        ;***NOTE***
                        ;ALL INTERRUPTS ARE ABOUT TO BE DISABLED.  THERE IS A POTENTIAL
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D7F-86

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                              ;         WILL BE MISSED. THIS INFORMATION IS USED AFTER THE
                              ;         OPERATION TO UPDATE THE TIME OF DAY.
                              ;-------------------------------------------------------------
0980  B0 10                             MOV     AL,10H          ; DISABLE NMI
0982  E6 A0                             OUT     NMI_PORT,AL     ; NO KEYBOARD INTERRUPT
0984  B0 70                             MOV     AL,70H          ; SELECT TIMER1,LSB-MSB, MODE 0,
                                                                ; BINARY COUNTER
0986  E6 43                             OUT     TIM_CTL,AL      ; INIT THE COUNTER
0988  50                                PUSH    AX              ; DELAY
0989  58                                POP     AX
098A  B0 FF                             MOV     AL,0FFH         ; INITIAL COUNT
098C  E6 41                             OUT     TIMER+1,AL      ; OUTPUT LEAST SIGNIFICANT BYTE
098E  50                                PUSH    AX              ; DELAY
098F  58                                POP     AX
0990  E6 41                             OUT     TIMER+1,AL      ; OUTPUT MOST SIGNIFICANT BYTE
0992  E8 0A2D R                         CALL    CLOCK_WAIT      ; WAIT IF TIMER0 IS ABOUT TO
                                                                ; INTERRUPT

0995  B0 30                             MOV     AL,30H          ; SELECT TIMER1 INPUT FROM TIMER0
                                                                ; OUTPUT
0997  E6 A0                             OUT     NMI_PORT,AL
                              ;------ READ TIMER1 NOW AND SAVE THE INITIAL VALUE
0999  E8 0A41 R                         CALL    READ_TIME       ; GET TIMER1 VALUE IN AX
099C  50                                PUSH    AX              ; SAVE INITIAL VALUE FOR CLOCK
099D  E4 21                             IN      AL,INTA01       ; READ CURRENT MASK
099F  86 C3                             XCHG    AL,BL           ; SAVE OLD AND NEW MASKS
09A1  E6 21                             OUT     INTA01,AL       ; OUTPUT NEW MASK TO THE 8259
09A3  58                                POP     AX
09A4  C3                                RET
09A5                          NMIOFF    ENDP

                              ;--------------------------------------------------
                              ;NMION
                              ;         THIS PROCEDURE IS CALLED TO ENABLE NMI AND SELECTED
                              ;         INTERRUPTS ON THE 8259 AND UPDATE THE TOD
                              ;INPUT
                              ;         AX INITIAL TIMER1 VALUE FROM NMIOFF
                              ;         BL 8259 MASK
                              ;OUTPUT
                              ;         NMI & 8259 ARE ENABLED AND TOD IS UPDATED
                              ;--------------------------------------------------
09A5                          NMION     PROC    NEAR
09A5  1E                                PUSH    DS
09A6  53                                PUSH    BX
09A7  50                                PUSH    AX
09A8  B8 0040                           MOV     AX,40H          ; POINT DS AT BIOS DATA SEGMENT
09AB  8E D8                             MOV     DS,AX
09AD  E8 0A2D R                         CALL    CLOCK_WAIT      ; WAIT IF TIMER0 IS CLOSE TO


                                                                ; WRAPPING
09B0  E8 0A41 R                         CALL    READ_TIME
09B3  5B                                POP     BX              ; GET THE INITIAL VALUE OF TIMER1
09B4  2B D8                             SUB     BX,AX           ; UPDATE NUMBER OF INTERRUPTS
                                                                ; MISSED
09B6  B0 0A                             MOV     AL,0AH          ; SEE IF THERE IS A PENDING
09B8  E6 20                             OUT     INTA00,AL       ; INTERRUPT FROM TIMER 0
09BA  E4 20                             IN      AL,INTA00
09BC  24 01                             AND     AL,1
09BE  74 15                             JZ      J16_2
09C0  83 EB 01                          SUB     BX,1            ; YES ACCOUNT FOR IT
09C3  73 10                             JNC     J16_2           ; OR IF IT GETS < 0
09C5  33 DB                             XOR     BX,BX
09C7  53                                PUSH    BX              ; SAVE 0 AS COUNT IN ISSUING USER
                                                                ; TIMER INTERRUPTS
09C8  83 2E 006C R 01                   SUB     TIMER_LOW,1     ; SUBTRACT 1 FROM TIMER
09CD  73 31                             JNC     J16_5           ; OR IF NO BORROW
09CF  FF 0E 006E R                      DEC     TIMER_HIGH
09D3  EB 28                             JMP     SHORT   J16_5

09D5  53                      J16_2:    PUSH    BX              ; SAVE IT FOR USE IN ISSUING USER
                                                                ; TIMER INTERRUPTS
09D6  01 1E 006C R                      ADD     TIMER_LOW,BX    ; ADD NUMBER OF TIMER INTERRUPTS TO
                                                                ; TOD
09DA  73 04                             JNC     J16_4           ; JUMP IF TIMER_LOW DID NOT CYCLE
                                                                ; OVER TO TIMER_HI
09DC  FF 06 006E R                      INC     TIMER_HIGH
09E0  83 3E 006E R 18         J16_4:    CMP     TIMER_HIGH,018H ; TEST FOR COUNT TOTALING 24 HOURS
09E5  75 19                             JNZ     J16_5           ; JUMP IF NOT 24 HOURS
09E7  81 3E 006C R 00B0                 CMP     TIMER_LOW,0B0H  ; LOW VALUE = 24 HOUR VALUE?
09ED  7C 11                             JL      J16_5           ; NOT 24 HOUR VALUE?
                              ;------ TIMER HAS GONE 24 HOURS
09EF  C7 06 006E R 0000                 MOV     TIMER_HIGH,0    ; ZERO OUT TIMER HIGH VALUE
09F5  81 2E 006C R 00B0                 SUB     TIMER_LOW,0B0H  ; VALUE REFLECTS CORRECT TICKS PAST
                                                                ; 00:00
09FB  C6 06 0070 R 01                   MOV     TIMER_OFL,1     ; INDICATES 24 HOUR THRESHOLD
0A00  58                      J16_5:    POP     AX              ; RECOVER COUNT

0A01  5B                                POP     BX              ;RECOVER 8259 MASK
0A02  50                                PUSH    AX              ; SAVE COUNT
0A03  E8 0A52 R                         CALL    ENABLE          ; ENABLE ALL INTERRUPTS
0A06  59                                POP     CX              ; CX, AX, COUNT FOR NUMBER OF USER
                                                                ; TIME INTERRUPTS
0A07  E3 0A                             JCXZ    J16_61          ; IF ZERO DO NOT ISSUE ANY
                                                                ; INTERRUPTS
0A09  1E                                PUSH    DS              ; SAVE ALL REGISTERS SAVED PRIOR TO
                                                                ; INT 1C CALL FROM TIMERINT
0A0A  50                                PUSH    AX              ; THIS PROVIDES A COMPATIBLE
                                                                ; INTERFACE TO 1C
0A0B  52                                PUSH    DX              ;
0A0C                          J16_6:
0A0C  CD 1C                             INT     1CH             ; TRANSFER CONTROL TO USER
                                                                ; INTERRUPT


0A0E  E2 FC                             LOOP    J16_6           ; DO ALL USER TIMER INTERRUPTS
0A10  5A                                POP     DX
0A11  58                                POP     AX
0A12  1F                                POP     DS              ; RESTORE REGISTERS
                              ;------ CLOCK IS UPDATED AND USER INTERRUPTS 1C HAVE BEEN ISSUED
                              ;       CHECK IF KEYSTROKE OCCURED
0A13  0A C0                   J16_61:   OR      AL,AL           ; AL WAS SET DURING CALL TO ENABLE
0A15  74 14                             JZ      J16_7           ; NO KEY WAS PRESSED WHILE SYSTEM
                                                                ; WAS MASKED
                              ;-------CLEAR SHIFT STATES-DONT LEAVE POSSIBILITY OF DANGLING STATES
                              ;       OF MISSED BREAKS, AND NOTIFY USER OF MISSED KEYBOARD INPUT
                              ;       CLEAR ALT,CTRL,LEFT AND RIGHT SHIFTS
                              ;       CLEAR POTENTIAL BREAK OF INS,CAPS,NUM AND SCROLL SHIFT
0A17  81 26 0017 R F0F0                 AND     WORD PTR KB_FLAG,0F0F0H
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0A1D  80 26 0088 R 1F                  AND     KB_FLAG_2,1FH     ;CLEAR FUNCTION STATES
0A22  BB 0080                          MOV     BX,80H            ;BEEP DURATION
0A25  B9 0048                          MOV     CX,48H            ;BEEP HALF CYCLE FREQUENCY
0A28  E8 0A74 R                        CALL    KB_NOISE          ;INDICATE MISSED KEY
0A2B                           J16_7:
0A2B  1F                               POP     DS
0A2C  C3                               RET
0A2D                           NMI_INT ENDP

                               ;---------------------------------------------------
                               ;CLOCK_WAIT
                               ;       THIS PROCEDURE IS CALLED WHEN THE TIME OF DAY
                               ;       IS BEING UPDATED.  IT WAITS IF TIMER0 IS ALMOST
                               ;       READY TO WRAP UNTIL IT IS SAFE TO READ AN ACCURATE
                               ;       TIMER1.
                               ;INPUT
                               ;       NONE.
                               ;OUTPUT
                               ;       NONE. AX IS DESTROYED.
                               ;---------------------------------------------------
0A2D                           CLOCK_WAIT      PROC    NEAR
0A2D  32 C0                            XOR     AL,AL
0A2F  E6 43                            OUT     TIM_CTL,AL        ; READ MODE TIMER0 FOR 8253
0A31  50                               PUSH    AX                ; OUTPUT TO THE 8253
0A32  58                               POP     AX
                                                                 ; WAIT FOR 8253 TO INITIALIZE
0A33  E4 40                            IN      AL,TIMER0         ; ITSELF
0A35  86 C4                            XCHG    AL,AH             ; READ LEAST SIGNIFICANT BYTE
0A37  E4 40                            IN      AL,TIMER0         ; SAVE IT
0A39  86 C4                            XCHG    AL,AH             ; READ MOST SIGNIFICANT BYTE
0A3B  3D 012C                          CMP     AX,THRESHOLD      ; REARRANGE FOR PROPER ORDER
0A3E  72 ED                            JC      CLOCK_WAIT        ; IS TIMER0 CLOSE TO WRAPPING?
0A40  C3                               RET                       ; JUMP IF CLOCK IS WITHIN THRESHOLD
0A41                           CLOCK_WAIT      ENDP              ; OK TO READ TIMER1

                               ;------------------------------------------------------------------
                               ;THIS ROUTINE WILL READ TIMER1.  THE VALUE READ IS RETURNED IN AX.
0A41                           ;------------------------------------------------------------------
                               READ_TIME PROC NEAR


0A41  B0 40                            MOV     AL,40H            ; LATCH TIMER1
0A43  E6 43                            OUT     TIM_CTL,AL
0A45  50                               PUSH    AX
0A46  58                               POP     AX                ; WAIT FOR 8253 TO INIT ITSELF
0A47  E4 41                            IN      AL,TIMER+1
0A49  8A E0                            MOV     AH,AL             ; READ LSB
0A4B  50                               PUSH    AX                ; SAVE IT IN HIGH BYTE
0A4C  58                               POP     AX                ; WAIT FOR 8253 TO INIT ITSELF
0A4D  E4 41                            IN      AL,TIMER+1
0A4F  86 C4                            XCHG    AL,AH             ; READ MSB
0A51  C3                               RET                       ; PUT BYTES IN PROPER ORDER
0A52                           READ_TIME       ENDP
                               ;---------------------------------------------------
                               ; ENABLE
                               ;       THIS PROC ENABLES ALL INTERRUPTS.  IT ALSO SETS THE 8253 TO
                               ;       THE MODE REQUIRED FOR KEYBOARD DATA DESERIALIZATION.
                               ;       BEFORE THE LATCH FOR KEYBOARD DATA IS RESET, BIT 0 OF THE
                               ;       8255 IS READ TO DETERMINE WHETHER ANY KEYSTROKES OCCURED
                               ;       WHILE THE SYSTEM WAS MASKED OFF.
                               ; INPUT
                               ;       BL=8259 MASK
                               ; OUTPUT
                               ;       AL=1 MEANS A KEY WAS STRUCK DURING DISKETTE I/O.  (OR NOISE
                               ;            ON THE LINE)
                               ;       AL=0 MEANS THAT NO KEY WAS PRESSED.
                               ;       AX IS DESTROYED.  ALL OTHER REGISTERS REMAIN INTACT.
0A52                           ;---------------------------------------------------
                               ENABLE          PROC    NEAR
0A52  52                               PUSH    DX                ; SAVE DX
                               ;------ RETURN TIMER1 TO STATE NEEDED FOR KEYBOARD I/O
0A53  B0 76                            MOV     AL,01110110B      ;
0A55  E6 43                            OUT     TIM_CTL,AL
0A57  50                               PUSH    AX
0A58  58                               POP     AX
                                                                 ; WAIT FOR 8253 TO INITIALIZE
0A59  B0 FF                                                      ; ITSELF
0A5B  E6 41                            MOV     AL,0FFH           ; INITIAL VALUE FOR 8253
0A5D  50                               OUT     TIMER+1,AL        ; LSB
0A5E  58                               PUSH    AX
0A5F  E6 41                            POP     AX                ; WAIT
                                       OUT     TIMER+1,AL        ; MSB
                               ;------ CHECK IF ANY KEYSTROKES OCCURED DURING DISKETTE TRANSFER
0A61  E4 62                            IN      AL,62H            ; READ PORT C OF 8255
0A63  24 01                            AND     AL,01H            ; BIT=1 MEANS KEYSTROKE HAS OCCURED
0A65  50                               PUSH    AX                ; SAVE IT ON THE STACK
                               ;----- ENABLE ALL INTERRUPTS WHICH WERE ENABLED BEFORE TRANSFER
0A66  8A C3                            MOV     AL,BL             ; GET MASK
0A68  E6 21                            OUT     INTA01,AL
0A6A  FB                               STI
                               ;------ ENABLE NMI INTERRUPTS
0A6B  E4 A0                            IN      AL,NMI_PORT       ; RESET LATCH
0A6D  B0 80                            MOV     AL,80H            ; MASK TO ENABLE NMI
0A6F  E6 A0                            OUT     NMI_PORT,AL       ; ENABLE NMI
0A71  58                               POP     AX                ; PASS BACK KEY STROKE FLAG


0A72  5A                               POP     DX
0A73  C3                               RET
0A74                           ENABLE          ENDP
                               ;------------------------------------------------------------------
                               ;KB_NOISE
                               ;       THIS ROUTINE IS CALLED WHEN GENERAL BEEPS ARE REQUIRED FROM
                               ;       THE SYSTEM.
                               ;INPUT
                               ;       BX=LENGTH OF THE TONE
                               ;       CX=CONTAINS THE FREQUENCY
                               ;OUTPUT
                               ;       ALL REGISTERS ARE MAINTAINED.
                               ;HINTS
                               ;       AS CX GETS LARGER THE TONE PRODUCED GETS LOWER IN PITCH
                               ;------------------------------------------------------------------
0A74                           KB_NOISE        PROC    NEAR
0A74  FB                               STI
0A75  50                               PUSH    AX
0A76  53                               PUSH    BX
0A77  51                               PUSH    CX
0A78  E4 61                            IN      AL,061H           ; GET CONTROL INFO
0A7A  50                               PUSH    AX                ; SAVE
0A7B                           LOOP01:
0A7B  24 FC                            AND     AL,0FCH           ; TURN OFF TIMER GATE AND SPEAKER
                                                                 ; DATA
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D. F-80

```
                                   [illegible] CX          ; WAIT [illegible] TIME [illegible]
0A80  E2 FE                        LOOP   $                ; SPEAKER OFF
0A82  0C 02                        OR     AL,2             ; TURN ON SPEAKER BIT
0A84  E6 61                        OUT    061H,AL          ; OUTPUT TO CONTROL
0A86  59                           POP    CX
0A87  51                           PUSH   CX               ; RETRIEVE FREQUENCY
0A88  E2 FE                        LOOP   $                ; ANOTHER HALF CYCLE
0A8A  4B                           DEC    BX               ; TOTAL TIME COUNT
0A8B  59                           POP    CX               ; RETRIEVE FREQ
0A8C  75 ED                        JNZ    LOOPOUT          ; DO ANOTHER CYCLE
0A8E  58                           POP    AX               ; RECOVER CONTROL
0A8F  E6 61                        OUT    061H,AL          ; OUTPUT THE CONTROL
0A91  59                           POP    CX
0A92  5B                           POP    BX
0A93  58                           POP    AX
0A94  C3                           RET
0A95                    BN_NOISE          ENDP

0A95                    SETUP_FLAGP:
0A95  FC                           CLD                     ;CLEAR DIRECTION FLAG
0A96  53                           PUSH   BX
0A97  51                           PUSH   CX               ;SAVE REGISTERS
0A98  1E                           PUSH   DS
0A99  E9 06ED R                    JMP    FLAG_SETUP2      ;RETURN

0A9C                    SETUP_FLAG:


0A9C  FA                           CLI
0A9D  E8 075C R                    CALL   READ_POWER
0AA0  FB                           STI
0AA1  E9 03B0 R                    JMP    FLAG_SETUP

0B00                               ORG    0B00H
= 0B00                  TABIDX     EQU    $
0B00  0C90 R                       DW     OFFSET A0006
0B02  0D01 R                       DW     OFFSET A0019
0B04  0EAE R                       DW     OFFSET A0020
0B06  100C R                       DW     OFFSET A0022
0B08  116C R                       DW     OFFSET A0023
0B0A  1107 R                       DW     OFFSET A0024
0B0C  1219 R                       DW     OFFSET A0025
0B0E  12A8 R                       DW     OFFSET A0026
0B10  130F R                       DW     OFFSET A0027
0B12  1370 R                       DW     OFFSET A0029
0B14  13F8 R                       DW     OFFSET A0033
0B16  14A9 R                       DW     OFFSET A0034
0B18  1505 R                       DW     OFFSET B0001
0B1A  1588 R                       DW     OFFSET B0002
0B1C  15F5 R                       DW     OFFSET B0003
0B1E  1643 R                       DW     OFFSET B0004
0B20  16B7 R                       DW     OFFSET B0005
0B22  1705 R                       DW     OFFSET B0006
0B24  1781 R                       DW     OFFSET B0007
0B26  17C9 R                       DW     OFFSET B0008
0B28  1849 R                       DW     OFFSET B0009
0B2A  18B8 R                       DW     OFFSET B0010
0B2C  18F7 R                       DW     OFFSET B0011
0B2E  1920 R                       DW     OFFSET B0012
0B30  1979 R                       DW     OFFSET B0013
0B32  19CB R                       DW     OFFSET B0014
0B34  1A27 R                       DW     OFFSET B0015
0B36  1A5B R                       DW     OFFSET B0016
0B38  1AC7 R                       DW     OFFSET B0017
0B3A  1B07 R                       DW     OFFSET B0018
0B3C  1B48 R                       DW     OFFSET B0019
0B3E  1BB5 R                       DW     OFFSET B0020
0B40  1C27 R                       DW     OFFSET B0021
0B42  1CA1 R                       DW     OFFSET B0022
0B44  1D17 R                       DW     OFFSET B0023
0B46  1DA1 R                       DW     OFFSET B0024
0B48  1E20 R                       DW     OFFSET B0025
0B4A  1EC7 R                       DW     OFFSET B0026
0B4C  1EF5 R                       DW     OFFSET B0027
0B4E  1F83 R                       DW     OFFSET B0028
0B50  1FFB R                       DW     OFFSET END_PGM
= 0B52                  TABB       EQU    $
0B52  0C90 R                       DW     OFFSET B0029-2000H
0B54  0D20 R                       DW     OFFSET B0030-2000H
0B56  0D50 R                       DW     OFFSET B0031-2000H



0B58  0DAA R                       DW     OFFSET B0032-2000H
0B5A  0E1C R                       DW     OFFSET B0033-2000H
0B5C  0E82 R                       DW     OFFSET B0034-2000H
0B5E  0F1A R                       DW     OFFSET B0035-2000H
0B60  0F70 R                       DW     OFFSET B0036-2000H
0B62  1000 R                       DW     OFFSET B0037-2000H
0B64  1036 R                       DW     OFFSET B0038-2000H
0B66  1062 R                       DW     OFFSET B0039-2000H
0B68  10D8 R                       DW     OFFSET B0040-2000H
0B6A  1116 R                       DW     OFFSET B0041 2000H
0B6C  117C R                       DW     OFFSET B0042-2000H
0B6E  11E0 R                       DW     OFFSET B0043-2000H
0B70  122A R                       DW     OFFSET B0044-2000H
0B72  12D0 R                       DW     OFFSET B0045-2000H
0B74  1352 R                       DW     OFFSET B0046-2000H
0B76  13CA R                       DW     OFFSET B0047-2000H
0B78  141A R                       DW     OFFSET B0048-2000H
0B7A  148A R                       DW     OFFSET B0049-2000H
0B7C  14E0 R                       DW     OFFSET B0050-2000H
0B7E  150F R                       DW     OFFSET B0051-2000H
0B80  1594 R                       DW     OFFSET B0052-2000H
0B82  1604 R                       DW     OFFSET B0053-2000H
0B84  1670 R                       DW     OFFSET B0054-2000H
0B86  170C R                       DW     OFFSET B0055-2000H
0B88  1766 R                       DW     OFFSET B0056-2000H
0B8A  17EE R                       DW     OFFSET C0001-2000H
0B8C  1844 R                       DW     OFFSET C0002-2000H
0B8E  18AA R                       DW     OFFSET C0003-2000H
0B90  1918 R                       DW     OFFSET C0004-2000H
0B92  1953 R                       DW     OFFSET C0005-2000H
0B94  1942 R                       DW     OFFSET C0006-2000H
0B96  19F3 R                       DW     OFFSET C0007-2000H
0B98  1A57 R                       DW     OFFSET C0008-2000H
0B9A  1AD2 R                       DW     OFFSET C0009-2000H
0B9C  1B0F R                       DW     OFFSET C0010-2000H
0B9E  1B49 R                       DW     OFFSET C0011-2000H
0BA0  1B88 R                       DW     OFFSET C0012-2000H
0BA2  1BE9 R                       DW     OFFSET C0013-2000H
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0BA4   1C68 R                         DW      OFFSET C0014-2000H
0BA6   1C9E R                         DW      OFFSET C0015-2000H
0BA8   1CF1 R                         DW      OFFSET C0016-2000H
0BAA   1D4C R                         DW      OFFSET C0017-2000H
0BAC   1D8E R                         DW      OFFSET C0018-2000H
0BAE   1E25 R                         DW      OFFSET C0019-2000H
0BB0   1E4C R                         DW      OFFSET C0020-2000H
0BB2   1E8B R                         DW      OFFSET C0021-2000H
0BB4   1F12 R                         DW      OFFSET C0022-2000H
0BB6   1F70 R                         DW      OFFSET C0023-2000H
0BB8   1FFE R                         DW      OFFSET END_PG1-2000H
= 0BBA                        TAB1    EQU     $
0BBA   0C90 R                         DW      OFFSET C0024-4000H
0BBC   0D15 R                         DW      OFFSET C0025-4000H
0BBE   0D6F R                         DW      OFFSET C0026-4000H


0BC0   0D06 R                         DW      OFFSET C0027-4000H
0BC2   0E18 R                         DW      OFFSET C0028-4000H
0BC4   0E80 R                         DW      OFFSET C0029-4000H
0BC6   0ECA R                         DW      OFFSET C0030-4000H
0BC8   0FDE R                         DW      OFFSET C0031-4000H
0BCA   0F9C R                         DW      OFFSET C0032-4000H
0BCC   100D R                         DW      OFFSET C0033-4000H
0BCE   1079 R                         DW      OFFSET C0034-4000H
0BD0   10DA R                         DW      OFFSET C0035-4000H
0BD2   1118 R                         DW      OFFSET C0036-4000H
0BD4   117E R                         DW      OFFSET C0037-4000H
0BD6   11D7 R                         DW      OFFSET C0038-4000H
0BD8   123D R                         DW      OFFSET C0039-4000H
0BDA   12A5 R                         DW      OFFSET C0040-4000H
0BDC   1332 R                         DW      OFFSET C0041-4000H
0BDE   13DE R                         DW      OFFSET C0042-4000H
0BE0   1421 R                         DW      OFFSET C0043-4000H
0BE2   14D3 R                         DW      OFFSET C0044-4000H
0BE4   151E R                         DW      OFFSET C0045-4000H
0BE6   1567 R                         DW      OFFSET C0046-4000H
0BE8   15A7 R                         DW      OFFSET C0047-4000H
0BEA   1629 R                         DW      OFFSET C0048-4000H
0BEC   1689 R                         DW      OFFSET C0049-4000H
0BEE   16E9 R                         DW      OFFSET C0050-4000H
0BF0   175D R                         DW      OFFSET C0051-4000H
0BF2   17A8 R                         DW      OFFSET C0052-4000H
0BF4   17FF R                         DW      OFFSET C0053-4000H
0BF6   1821 R                         DW      OFFSET C0054-4000H
0BF8   1898 R                         DW      OFFSET C0055-4000H
0BFA   18F1 R                         DW      OFFSET C0056-4000H
0BFC   1969 R                         DW      OFFSET C0057-4000H
0BFE   19D4 R                         DW      OFFSET C0058-4000H
0C00   1A20 R                         DW      OFFSET C0059-4000H
0C02   1A87 R                         DW      OFFSET D0001-4000H
0C04   1AAA R                         DW      OFFSET D0002-4000H
0C06   1B26 R                         DW      OFFSET D0003-4000H
0C08   1B5E R                         DW      OFFSET D0004-4000H
0C0A   1B9F R                         DW      OFFSET D0005-4000H
0C0C   1BF7 R                         DW      OFFSET D0006-4000H
0C0E   1C26 R                         DW      OFFSET D0007-4000H
0C10   1C4E R                         DW      OFFSET D0008-4000H
0C12   1C93 R                         DW      OFFSET D0009-4000H
0C14   1D15 R                         DW      OFFSET D0010-4000H
0C16   1DBD R                         DW      OFFSET D0011-4000H
0C18   1E23 R                         DW      OFFSET D0012-4000H
0C1A   1E82 R                         DW      OFFSET D0013-4000H
0C1C   1F20 R                         DW      OFFSET D0014-4000H
0C1E   1F88 R                         DW      OFFSET D0015-4000H
0C20   1FD9 R                         DW      OFFSET END_PG2-4000H
= 0C22                        TAB2    EQU     $
0C22   0C90 R                         DW      OFFSET D0016-6000H
0C24   0D08 R                         DW      OFFSET D0017-6000H
0C26   0D6B R                         DW      OFFSET D0018-6000H


0C28   0DAE R                         DW      OFFSET D0019-6000H
0C2A   0E27 R                         DW      OFFSET D0020-6000H
0C2C   0E73 R                         DW      OFFSET D0021-6000H
0C2E   0EBE R                         DW      OFFSET D0022-6000H
0C30   0F04 R                         DW      OFFSET D0023-6000H
0C32   0F6C R                         DW      OFFSET D0024-6000H
0C34   0FC7 R                         DW      OFFSET D0025-6000H
0C36   1010 R                         DW      OFFSET D0026-6000H
0C38   1078 R                         DW      OFFSET D0027-6000H
0C3A   10C2 R                         DW      OFFSET D0028-6000H
0C3C   1114 R                         DW      OFFSET D0029-6000H
0C3E   1193 R                         DW      OFFSET D0030-6000H
0C40   11F9 R                         DW      OFFSET D0031-6000H
0C42   1263 R                         DW      OFFSET D0032-6000H
0C44   128D R                         DW      OFFSET D0033-6000H
0C46   1316 R                         DW      OFFSET D0034-6000H
0C48   137E R                         DW      OFFSET D0035-6000H
0C4A   13E7 R                         DW      OFFSET D0036-6000H
0C4C   1440 R                         DW      OFFSET D0037-6000H
0C4E   14BF R                         DW      OFFSET D0038-6000H
0C50   14F6 R                         DW      OFFSET D0039-6000H
0C52   1576 R                         DW      OFFSET D0040-6000H
0C54   15EE R                         DW      OFFSET D0041-6000H
0C56   1663 R                         DW      OFFSET D0042-6000H
0C58   16EA R                         DW      OFFSET D0043-6000H
0C5A   1763 R                         DW      OFFSET D0044-6000H
0C5C   17CF R                         DW      OFFSET D0045-6000H
0C5E   180F R                         DW      OFFSET D0046-6000H
0C60   186E R                         DW      OFFSET D0047-6000H
0C62   1879 R                         DW      OFFSET D0048-6000H
0C64   18E8 R                         DW      OFFSET D0049-6000H
0C66   1980 R                         DW      OFFSET D0050-6000H
0C68   19EF R                         DW      OFFSET D0051-6000H
0C6A   1A5B R                         DW      OFFSET D0052-6000H
0C6C   1ABE R                         DW      OFFSET D0053-6000H
0C6E   1B3B R                         DW      OFFSET D0054-6000H
0C70   1BC1 R                         DW      OFFSET D0055-6000H
0C72   1C5A R                         DW      OFFSET D0056-6000H
0C74   1C9E R                         DW      OFFSET D0057-6000H
0C76   1D24 R                         DW      OFFSET D0058-6000H
0C78   1D4F R                         DW      OFFSET D0059-6000H
0C7A   1D97 R                         DW      OFFSET E0001-6000H
0C7C   1E02 R                         DW      OFFSET E0002-6000H
0C7E   1E31 R                         DW      OFFSET E0003-6000H
0C80   1E59 R                         DW      OFFSET E0004-6000H
0C82   1EDD R                         DW      OFFSET E0006-6000H
0C84   1F16 R                         DW      OFFSET E0007-6000H
0C86   1F37 R                         DW      OFFSET E0008-6000H
0C88   1F80 R                         DW      OFFSET E0010-6000H
0C8A   1F90 R                         DW      OFFSET E0011-6000H
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U/P-80

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                                        TAB3      EQU      $

= 0029                                  PG0 MAX EQU        ((TAB0-TAB1D0)/2)
= 0050                                  PG1 MAX EQU        ((TAB1-TAB1D0)/2)
= 0091                                  PG2 MAX EQU        ((TAB2-TAB1D0)/2)
= 00CA                                  PG3 MAX EQU        ((TAB3-TAB1D0)/2)
= 0C90                                  WORDS BEGIN        EQU      $
- 0C90                                  A0006     EQU      $      ; DANGER
0C90   0F E9 C0 F0 1A D3                          DB       [illegible]
       8C 93 1D
0C99   96 53 6D 33 41 71                          DB       [illegible]
       5B 4E B1
0CA2   C0 3A DA B4 39 D7                          DB       [illegible]
       55 A9 DC
0CAB   B1 6A 64 A3 7A C6                          DB       [illegible]
       E6 AC 97
0CB4   45 41 71 D7 51 53                          DB       [illegible]
       E6 24 D5
0CBD   45 A4 19 D5 74 C4                          DB       [illegible]
       2A D1 74
0CC6   E5 DB 4E 25 91 D4                          DB       [illegible]
       35 CC DA
0CCF   C6 22 4E 56 DF 67                          DB       [illegible]
       A1 A4 75
0CD8   5D 7D 0D AD 9A 97                          DB       [illegible]
       79 0D 35
0CE1   2E 7A 4A D6 35 D6                          DB       [illegible]
       E9 F8 29
0CEA   59 D0 50 9A 61 A6                          DB       [illegible]
       6C 09 43
0CF3   B4 BE B3 92 C1 F6                          DB       [illegible]
       67 C8 09
0CFC   A9 57 16 FF 3F                             DB       [illegible]

= 0D01                                  A0019     EQU      $      ; TIME HAS EXPIRED
0D01   0F 68 C4 24 D7 63                          DB       [illegible]
       E8 5A 97
0D0A   27 63 7F B1 BA 4C                          DB       [illegible]
       87 34 7D
0D13   A6 94 33 A5 B3 E9                          DB       [illegible]
       59 77 E8
0D1C   52 EF BE 67 CD A9                          DB       [illegible]
       4B 23 E6
0D25   9C 35 E5 49 F5 EE                          DB       [illegible]
       74 AE E2
0D2E   6B CC 75 F3 39 73                          DB       [illegible]
       AC 76 8D
0D37   4D E7 2C D9 CB 27                          DB       [illegible]
       56 AF 2B
0D40   17 2D 8F 9E B5 EE                          DB       [illegible]
       D7 A4 F4
0D49   7A 55 B9 63 D6 EE
       AE 1B E3                                   DB       [illegible]
0D52   2E 41 32 3A 2B 95                          DB       [illegible]
       AB 7A 8A
0D5B   2B 9D E4 AE 6B A5                          DB       [illegible]
       5C 33 85
0D64   3B A3 91 32 ED 34                          DB       [illegible]
       EE 8C 56
0D6D   32 35 DB 8B 23 7B                          DB       [illegible]
       D9 91 CC
0D76   E2 BE 62 39 54 22                          DB       [illegible]
       69 D9 93
0D7F   E3 62 8F 34 6A 7B                          DB       [illegible]
       85 D2 C4
0D88   93 11 70 47 2D D9                          DB       [illegible]
       1A A9 F7
0D91   8A 33 35 6F 61 F5                          DB       [illegible]
       61 CE 5A
0D9A   8C 87 6F C5 39 6B                          DB       [illegible]
       2D E6 B5
0DA3   39 F5 AC 25 6B FA                          DB       [illegible]
       E5 E4 B3
0DAC   D5 A4 C9 D7 73 CE                          DB       [illegible]
       CA FC 95
0DB5   47 CD 3F 7B 71 69                          DB       [illegible]
       EA FE 64
0DBE   ED D5 A7 A9 D5 99                          DB       [illegible]
       72 74 29
0DC7   26 DA 57 CA 51 BD                          DB       [illegible]
       AA 72 2E
0DD0   0E D7 59 4A A7 FA                          DB       [illegible]
       C5 D9 53
0DD9   B7 6A BD 0F BD BB                          DB       [illegible]
       27 29 D5
0DE2   C1 36 B5 64 EF 91                          DB       [illegible]
       87 CF D4
0DEB   87 F9 77 CF 39 63                          DB       [illegible]
       89 66 DE
0DF4   37 FB F4 AD AA 5A                          DB       [illegible]
       E7 EC DD
0DFD   37 EC 12 1B 17 51                          DB       [illegible]
       1F 5C BA
0E06   AB DB 06 01 D4 76                          DB       [illegible]
       11 8D A6
0E0F   5C DD F0 6C BB 01                          DB       [illegible]
       9E 47 75
0E18   C0 33 AE 06 7A 7C                          DB       [illegible]
       0C 01 9B
0E21   8F 71 70 3F 33 9C                          DB       [illegible]
       6D 69 64
0E2A   2D 69 BA 56 9C D5                          DB       [illegible]
       46 D7 13
0E33   9B BD D7 1C DB A4                          DB       [illegible]
       6A CF 19
0E3C   7B 7C 7B 7E 19 FA                          DB       [illegible]
       EC 75 76
0E45   B5 7A 97 73 56 97                          DB       [illegible]


       E9 A9 5B
0E4E   CE 55 BD BB 97 6F                          DB       [illegible]
       5E 57 7B
0E57   6A 5A BE 64 5C 35                          DB       [illegible]
       7A E7 54
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0160  E7 71 17 C1 96 1B               DB      0E7H,071H,017H,0C1H,096H,01BH,0ABH,0DBH,050H
      AB DB 50
0169  22 79 AC B7 1A 57               DB      022H,079H,0ACH,0B7H,01AH,057H,0A9H,0A4H,095H
      A9 A4 95
0172  BE A6 50 29 53 74               DB      0BEH,0A6H,050H,029H,053H,074H,0C7H,0E6H,076H
      C7 E6 76
017B  27 C7 11 98 89 DB               DB      027H,0C7H,011H,098H,089H,0DBH,093H,0A5H,0A5H
      93 A5 A5
0184  4C CE 11 BF 91 9A               DB      04CH,0CEH,011H,0BFH,091H,09AH,063H,095H,080H
      63 95 80
018D  30 42 78 76 49 02               DB      030H,042H,078H,076H,049H,02H,016H,028H,05AH
      16 28 5A
0196  31 11 89 CA DF AD               DB      031H,011H,089H,0CAH,0DFH,0ADH,0B0H,079H,028H
      B0 79 28
019F  2A 7F 76 6A DE 75               DB      02AH,07FH,076H,06AH,0DEH,075H,031H,030H,039H
      31 30 39
01A8  8A E4 54 AC EF 07               DB      08AH,0E4H,054H,0ACH,0EFH,07H

= 01AE                        A0020   EQU     $       ; LAUGHING - 2.5 SECONDS
01AE  0C 68 8A 52 00 20               DB      0CH,068H,08AH,052H,00H,020H,079H,0AH,0A0H
      79 0A A0
01B7  C4 AC A6 14 C9 E6               DB      0C4H,0ACH,0A6H,014H,0C9H,0E6H,0E9H,0C9H,086H
      E9 C9 86
01C0  10 85 79 96 25 28               DB      010H,085H,079H,096H,025H,028H,052H,052H,0ECH
      52 52 EC


Segments and groups:

                N a m e                         Size    align   combine class

ABS0 . . . . . . . . . . . . . . . . .          7C00    AT      0000
DATA . . . . . . . . . . . . . . . . .          0088    AT      0040
DFDATA . . . . . . . . . . . . . . . .          0428    AT      0060
DUMMY. . . . . . . . . . . . . . . . .          0248    AT      0000
STACK. . . . . . . . . . . . . . . . .          0100    AT      0030
TKRSEG . . . . . . . . . . . . . . . .          7FFF    PARA    NONE
VIDEO RAM. . . . . . . . . . . . . . .          4000    AT      B800
KBDATA . . . . . . . . . . . . . . . .          002A    AT      0050

Symbols:

                N a m e                         Type    Value   Attr

A. . . . . . . . . . . . . . . . . . .          Number  07F7    TKRSEG
A0006. . . . . . . . . . . . . . . . .          Number  0C90    TKRSEG
A0019. . . . . . . . . . . . . . . . .          Number  0001    TKRSEG
A0020. . . . . . . . . . . . . . . . .          Number  01AE    TKRSEG
A0022. . . . . . . . . . . . . . . . .          Number  100C    TKRSEG
A0023. . . . . . . . . . . . . . . . .          Number  116C    TKRSEG
A0024. . . . . . . . . . . . . . . . .          Number  11D7    TKRSEG
A0025. . . . . . . . . . . . . . . . .          Number  1219    TKRSEG
A0026. . . . . . . . . . . . . . . . .          Number  12A8    TKRSEG
A0027. . . . . . . . . . . . . . . . .          Number  130F    TKRSEG
A0028 . . . . . . . . . . . . . . . .           Number  1370    TKRSEG
A0033. . . . . . . . . . . . . . . . .          Number  13E8    TKRSEG
A0034 . . . . . . . . . . . . . . . .           Number  14A9    TKRSEG
ACL ERROR. . . . . . . . . . . . . . .          Number  0003
ACL OFF. . . . . . . . . . . . . . . .          Number  0001
ACTIVE PAGE. . . . . . . . . . . . . .          L BYTE  0062    DATA
ADD. . . . . . . . . . . . . . . . . .          L NEAR  01F2    TKRSEG
ADDR 6845. . . . . . . . . . . . . . .          L WORD  0063    DATA
ALT INPUT. . . . . . . . . . . . . . .          L BYTE  0019    DATA
ALT KEY. . . . . . . . . . . . . . . .          Number  0038
ALT SHIFT. . . . . . . . . . . . . . .          Number  0008
ARROW. . . . . . . . . . . . . . . . .          L BYTE  0713    TKRSEG
ARROW POS1 . . . . . . . . . . . . . .          Number  890D
ARROW POS2 . . . . . . . . . . . . . .          Number  8A0D
ATTACH ACL . . . . . . . . . . . . . .          N PROC  0357    TKRSEG  Length  0023
AUDIO8254. . . . . . . . . . . . . . .          Number  0002
AUDIO CHN. . . . . . . . . . . . . . .          Number  0040
B0001. . . . . . . . . . . . . . . . .          Number  1505    TKRSEG
B0002. . . . . . . . . . . . . . . . .          Number  158B    TKRSEG
B0003. . . . . . . . . . . . . . . . .          Number  15F5    TKRSEG
B0004. . . . . . . . . . . . . . . . .          Number  1643    TKRSEG
B0005. . . . . . . . . . . . . . . . .          Number  16B9    TKRSEG
B0006. . . . . . . . . . . . . . . . .          Number  1705    TKRSEG
B0007. . . . . . . . . . . . . . . . .          Number  1781    TKRSEG
B0008. . . . . . . . . . . . . . . . .          Number  17C9    TKRSEG
B0009. . . . . . . . . . . . . . . . .          Number  1849    TKRSEG


B0010. . . . . . . . . . . . . . . . .          Number  188B    TKRSEG
B0011. . . . . . . . . . . . . . . . .          Number  18F7    TKRSEG
B0012. . . . . . . . . . . . . . . . .          Number  1920    TKRSEG
B0013. . . . . . . . . . . . . . . . .          Number  1999    TKRSEG
B0014. . . . . . . . . . . . . . . . .          Number  19CB    TKRSEG
B0015. . . . . . . . . . . . . . . . .          Number  1A27    TKRSEG
B0016. . . . . . . . . . . . . . . . .          Number  1A50    TKRSEG
B0017. . . . . . . . . . . . . . . . .          Number  1AC7    TKRSEG
B0018 . . . . . . . . . . . . . . . .           Number  1B07    TKRSEG
B0019. . . . . . . . . . . . . . . . .          Number  1B6B    TKRSEG
B0020. . . . . . . . . . . . . . . . .          Number  1BB5    TKRSEG
B0021. . . . . . . . . . . . . . . . .          Number  1C27    TKRSEG
B0022. . . . . . . . . . . . . . . . .          Number  1CA1    TKRSEG
B0023. . . . . . . . . . . . . . . . .          Number  1D17    TKRSEG
B0024. . . . . . . . . . . . . . . . .          Number  1DA1    TKRSEG
B0025. . . . . . . . . . . . . . . . .          Number  1E20    TKRSEG
B0026. . . . . . . . . . . . . . . . .          Number  1EC7    TKRSEG
B0027. . . . . . . . . . . . . . . . .          Number  1F15    TKRSEG
B0028. . . . . . . . . . . . . . . . .          Number  1F83    TKRSEG
B0029. . . . . . . . . . . . . . . . .          Number  2C93    TKRSEG
B0030. . . . . . . . . . . . . . . . .          Number  2020    TKRSEG
B0031. . . . . . . . . . . . . . . . .          Number  2050    TKRSEG
B0032. . . . . . . . . . . . . . . . .          Number  20AA    TKRSEG
B0033. . . . . . . . . . . . . . . . .          Number  211C    TKRSEG
B0034. . . . . . . . . . . . . . . . .          Number  2182    TKRSEG
B0035. . . . . . . . . . . . . . . . .          Number  21FA    TKRSEG
B0036. . . . . . . . . . . . . . . . .          Number  2170    TKRSEG
B0037. . . . . . . . . . . . . . . . .          Number  [illegible]    TKRSEG
B0038 . . . . . . . . . . . . . . . .           Number  [illegible]    TKRSEG
B0039. . . . . . . . . . . . . . . . .          Number  [illegible]    TKRSEG
B0040. . . . . . . . . . . . . . . . .          Number  3008    TKRSEG
B0041. . . . . . . . . . . . . . . . .          Number  311A    TKRSEG
B0042. . . . . . . . . . . . . . . . .          Number  3174    TKRSEG
B0043 . . . . . . . . . . . . . . . .           Number  31F0    TKRSEG
B0044. . . . . . . . . . . . . . . . .          Number  322A    TKRSEG
B0045. . . . . . . . . . . . . . . . .          Number  32D0    TKRSEG
B0046. . . . . . . . . . . . . . . . .          Number  3352    TKRSEG
B0047. . . . . . . . . . . . . . . . .          Number  33CA    TKRSEG
B0048. . . . . . . . . . . . . . . . .          Number  341A    TKRSEG
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D/F-60

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  . . . . . . . . . . . . . . . .     Number   35A4    ROMSEG
B0053. . . . . . . . . . . . . . .    Number   3690    ROMSEG
B0054. . . . . . . . . . . . . . .    Number   3670    ROMSEG
B0055. . . . . . . . . . . . . . .    Number   370C    ROMSEG
B0056. . . . . . . . . . . . . . .    Number   3766    ROMSEG
BAD ADDR MARK. . . . . . . . . . .    Number   0002
BAD CMD. . . . . . . . . . . . . .    Number   0001
BAD CRC. . . . . . . . . . . . . .    Number   0010
BAD DMA. . . . . . . . . . . . . .    Number   0008
BAD NEC. . . . . . . . . . . . . .    Number   0020
BAD_SEEK . . . . . . . . . . . . .    Number   0040


BANK_TEST_START. . . . . . . . . .    L NEAR   01A6    ROMSEG
BASIC_PTR. . . . . . . . . . . . .    L WORD   0060    ABS0
BC . . . . . . . . . . . . . . . .    F PROC   01A5    ROMSEG  Length =00C0
BCD. . . . . . . . . . . . . . . .    Number   0001
BCLEN. . . . . . . . . . . . . . .    Number   0083
BCLOC. . . . . . . . . . . . . . .    L WORD   0028    ROMSEG
BC_START . . . . . . . . . . . . .    L NEAR   0172    ROMSEG
BEEP . . . . . . . . . . . . . . .    N PROC   029A    ROMSEG  Length =0052
BFR_EMPTY. . . . . . . . . . . . .    Number   0020
BFR_LOW. . . . . . . . . . . . . .    Number   0040
BFR_PTR. . . . . . . . . . . . . .    L WORD   013C    DUMMY
BINARY . . . . . . . . . . . . . .    Number   0000
BIOS_BREAK . . . . . . . . . . . .    L BYTE   0071    DATA
BITS_ON_OFF. . . . . . . . . . . .    N PROC   012C    ROMSEG  Length =0056
BOOT_LOCN. . . . . . . . . . . . .    L FAR    7C00    ABS0
BSE. . . . . . . . . . . . . . . .    L NEAR   0204    ROMSEG
BSUF . . . . . . . . . . . . . . .    L NEAR   0208    ROMSEG
BTP. . . . . . . . . . . . . . . .    L NEAR   0203    ROMSEG
BTT. . . . . . . . . . . . . . . .    L NEAR   010A    ROMSEG
BUFFER_END . . . . . . . . . . . .    L WORD   0082    DATA
BUFFER_HEAD. . . . . . . . . . . .    L WORD   001A    DATA
BUFFER_START . . . . . . . . . . .    L WORD   0080    DATA
BUFFER_TAIL. . . . . . . . . . . .    L WORD   001C    DATA
BUSY_BIT . . . . . . . . . . . . .    Number   0020
C0001. . . . . . . . . . . . . . .    Number   37E1    ROMSEG
C0002. . . . . . . . . . . . . . .    Number   3844    ROMSEG
C0003. . . . . . . . . . . . . . .    Number   38AA    ROMSEG
C0004. . . . . . . . . . . . . . .    Number   3818    ROMSEG
C0005. . . . . . . . . . . . . . .    Number   3953    ROMSEG
C0006. . . . . . . . . . . . . . .    Number   39A2    ROMSEG
C0007. . . . . . . . . . . . . . .    Number   39F3    ROMSEG
C0008. . . . . . . . . . . . . . .    Number   3A57    ROMSEG
C0009. . . . . . . . . . . . . . .    Number   3AD2    ROMSEG
C0010. . . . . . . . . . . . . . .    Number   3B0F    ROMSEG
C0011. . . . . . . . . . . . . . .    Number   3B59    ROMSEG
C0012. . . . . . . . . . . . . . .    Number   3B8B    ROMSEG
C0013. . . . . . . . . . . . . . .    Number   3BF9    ROMSEG
C0014. . . . . . . . . . . . . . .    Number   3C4B    ROMSEG
C0015. . . . . . . . . . . . . . .    Number   3C78    ROMSEG
C0016. . . . . . . . . . . . . . .    Number   3CE1    ROMSEG
C0017. . . . . . . . . . . . . . .    Number   3D4C    ROMSEG
C0018. . . . . . . . . . . . . . .    Number   3D8F    ROMSEG
C0019. . . . . . . . . . . . . . .    Number   3E25    ROMSEG
C0020. . . . . . . . . . . . . . .    Number   3E4C    ROMSEG
C0021. . . . . . . . . . . . . . .    Number   3EB8    ROMSEG
C0022. . . . . . . . . . . . . . .    Number   3F12    ROMSEG
C0023. . . . . . . . . . . . . . .    Number   3F78    ROMSEG
C0024. . . . . . . . . . . . . . .    Number   4C70    ROMSEG
C0025. . . . . . . . . . . . . . .    Number   4015    ROMSEG
C0026. . . . . . . . . . . . . . .    Number   4061    ROMSEG
C0027. . . . . . . . . . . . . . .    Number   4006    ROMSEG
C0028. . . . . . . . . . . . . . .    Number   411A    ROMSEG
C0029. . . . . . . . . . . . . . .    Number   41A0    ROMSEG


C0030. . . . . . . . . . . . . . .    Number   41CA    ROMSEG
C0031. . . . . . . . . . . . . . .    Number   4101    ROMSEG
C0032. . . . . . . . . . . . . . .    Number   419C    ROMSEG
C0033. . . . . . . . . . . . . . .    Number   500D    ROMSEG
C0034. . . . . . . . . . . . . . .    Number   5079    ROMSEG
C0035. . . . . . . . . . . . . . .    Number   50DA    ROMSEG
C0036. . . . . . . . . . . . . . .    Number   511A    ROMSEG
C0037. . . . . . . . . . . . . . .    Number   5171    ROMSEG
C0038. . . . . . . . . . . . . . .    Number   5107    ROMSEG
C0039. . . . . . . . . . . . . . .    Number   5210    ROMSEG
C0040. . . . . . . . . . . . . . .    Number   52A5    ROMSEG
C0041. . . . . . . . . . . . . . .    Number   5132    ROMSEG
C0042. . . . . . . . . . . . . . .    Number   5101    ROMSEG
C0043. . . . . . . . . . . . . . .    Number   5421    ROMSEG
C0044. . . . . . . . . . . . . . .    Number   5403    ROMSEG
C0045. . . . . . . . . . . . . . .    Number   5511    ROMSEG
C0046. . . . . . . . . . . . . . .    Number   5567    ROMSEG
C0047. . . . . . . . . . . . . . .    Number   55A7    ROMSEG
C0048. . . . . . . . . . . . . . .    Number   5629    ROMSEG
C0049. . . . . . . . . . . . . . .    Number   5689    ROMSEG
C0050. . . . . . . . . . . . . . .    Number   5619    ROMSEG
C0051. . . . . . . . . . . . . . .    Number   5750    ROMSEG
C0052. . . . . . . . . . . . . . .    Number   57A8    ROMSEG
C0053. . . . . . . . . . . . . . .    Number   57EF    ROMSEG
C0054. . . . . . . . . . . . . . .    Number   5821    ROMSEG
C0055. . . . . . . . . . . . . . .    Number   5870    ROMSEG
C0056. . . . . . . . . . . . . . .    Number   58E1    ROMSEG
C0057. . . . . . . . . . . . . . .    Number   5969    ROMSEG
C0058. . . . . . . . . . . . . . .    Number   5904    ROMSEG
C0059. . . . . . . . . . . . . . .    Number   5A20    ROMSEG
CAPS_KEY . . . . . . . . . . . . .    Number   003A
CAPS_SHIFT . . . . . . . . . . . .    Number   0040
CAPS_STATE . . . . . . . . . . . .    Number   0040
CARD_RESET_ER. . . . . . . . . . .    L NEAR   0110    ROMSEG
CHECK_COUNTER_2. . . . . . . . . .    L NEAR   00AA    ROMSEG
CHKTBR_ACL . . . . . . . . . . . .    N PROC   0161    ROMSEG  Length =000C
CHK_END. . . . . . . . . . . . . .    L NEAR   016A    ROMSEG
CHN_OFF. . . . . . . . . . . . . .    Number   0000
CHN_ON . . . . . . . . . . . . . .    Number   0001
CLICK_ON . . . . . . . . . . . . .    Number   0004
CLICK_SEQUENCE . . . . . . . . . .    Number   0002
CLOCK_WAIT . . . . . . . . . . . .    N PROC   0A10    ROMSEG  Length =0016
CLR_MIN. . . . . . . . . . . . . .    Number   001C
CLR_MSEC . . . . . . . . . . . . .    Number   0010
CLR_FACE . . . . . . . . . . . . .    Number   0013
CLR_TERSW. . . . . . . . . . . . .    Number   0091
CMD_PORT . . . . . . . . . . . . .    Number   00A3
CNTL_TEST_BITS . . . . . . . . . .    L NEAR   0154    ROMSEG
COMPLETE_OUTPUT. . . . . . . . . .    L NEAR   0681    ROMSEG
CONTINUE_EVEN_TEST . . . . . . . .    L NEAR   0A91    ROMSEG
CONTINUE_OUTPUT. . . . . . . . . .    L NEAR   0671    ROMSEG
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COUNTER_CK . . . . . . . . . . . . . .      L NEAR  0097      TKRSEG
CPUREG . . . . . . . . . . . . . . . .      Number  0038


CRC REG. . . . . . . . . . . . . . . .      L WORD  0069      DATA
CRTREG . . . . . . . . . . . . . . . .      Number  0007
CRT_COLS . . . . . . . . . . . . . . .      L WORD  004A      DATA
CRT LEN. . . . . . . . . . . . . . . .      L WORD  004C      DATA
CRT MODE . . . . . . . . . . . . . . .      L BYTE  0049      DATA
CRT MODE SET . . . . . . . . . . . . .      L BYTE  0065      DATA
CRT PALLETTE . . . . . . . . . . . . .      L BYTE  0066      DATA
CRT START. . . . . . . . . . . . . . .      L WORD  004E      DATA
CSET_PIN . . . . . . . . . . . . . . .      L DWORD 0110      ABSO
CTL_KEY. . . . . . . . . . . . . . . .      Number  0010
CTL SHIFT. . . . . . . . . . . . . . .      Number  0004
CTR0 . . . . . . . . . . . . . . . . .      Number  0000
CTR1 . . . . . . . . . . . . . . . . .      Number  0040
CTR2 . . . . . . . . . . . . . . . . .      Number  0080
CTR LATCH. . . . . . . . . . . . . . .      Number  0000
CT IP. . . . . . . . . . . . . . . . .      L NEAR  0102      TKRSEG
CURSOR MODE. . . . . . . . . . . . . .      L WORD  0060      DATA
CURSOR POSN. . . . . . . . . . . . . .      L WORD  0050      DATA    Length =0008
CUR CHAR . . . . . . . . . . . . . . .      L BYTE  0085      DATA
CUR FUNC . . . . . . . . . . . . . . .      L BYTE  0087      DATA
CUST_IR. . . . . . . . . . . . . . . .      Number  004A
CUST_OUT . . . . . . . . . . . . . . .      L NEAR  0280      TKRSEG
CVSD . . . . . . . . . . . . . . . . .      Number  0001
CVSD00 . . . . . . . . . . . . . . . .      L NEAR  0389      TKRSEG
CVSD20 . . . . . . . . . . . . . . . .      L NEAR  03A7      TKRSEG
CVSD25 . . . . . . . . . . . . . . . .      L NEAR  03B5      TKRSEG
CVSD30 . . . . . . . . . . . . . . . .      L NEAR  03CA      TKRSEG
CVSD40 . . . . . . . . . . . . . . . .      L NEAR  03D1      TKRSEG
CVSD45 . . . . . . . . . . . . . . . .      L NEAR  03D8      TKRSEG
CVSD50 . . . . . . . . . . . . . . . .      L NEAR  03E4      TKRSEG
CVSDR. . . . . . . . . . . . . . . . .      Number  0000
CVSDR_TBL. . . . . . . . . . . . . . .      Number  0000
CVSDR_USER . . . . . . . . . . . . . .      Number  0002
CVSDW  . . . . . . . . . . . . . . . .      Number  00FF
CVSDW TBL. . . . . . . . . . . . . . .      Number  0001
CVSDW_USER . . . . . . . . . . . . . .      Number  0003
CVSDX. . . . . . . . . . . . . . . . .      L NEAR  0497      TKRSEG
CVSDXO . . . . . . . . . . . . . . . .      L NEAR  04A8      TKRSEG
CVSDXA . . . . . . . . . . . . . . . .      L NEAR  0495      TKRSEG
CVSD CLK . . . . . . . . . . . . . . .      Number  FB9C
CVSD EN. . . . . . . . . . . . . . . .      Number  0001
CVSD FRAME . . . . . . . . . . . . . .      Number  FB9D
CVSD REC . . . . . . . . . . . . . . .      L NEAR  08D3      TKRSEG
CVSD TEST. . . . . . . . . . . . . . .      L NEAR  0883      TKRSEG
CWREG. . . . . . . . . . . . . . . . .      Number  FB9B
CWR 8254 . . . . . . . . . . . . . . .      Number  FB9F
D0001. . . . . . . . . . . . . . . . .      Number  5A87      TKRSEG
D0002. . . . . . . . . . . . . . . . .      Number  5AAA      TKRSEG
D0003. . . . . . . . . . . . . . . . .      Number  5B26      TKRSEG
D0004. . . . . . . . . . . . . . . . .      Number  5B5E      TKRSEG
D0005. . . . . . . . . . . . . . . . .      Number  5B9F      TKRSEG
D0006. . . . . . . . . . . . . . . . .      Number  5BF7      TKRSEG
D0007. . . . . . . . . . . . . . . . .      Number  5C26      TKRSEG
D0008. . . . . . . . . . . . . . . . .      Number  5C4E      TKRSEG
D0009. . . . . . . . . . . . . . . . .      Number  5C93      TKRSEG
D0010. . . . . . . . . . . . . . . . .      Number  5D15      TKRSEG
D0011. . . . . . . . . . . . . . . . .      Number  5D8D      TKRSEG
D0012. . . . . . . . . . . . . . . . .      Number  5E23      TKRSEG
D0013. . . . . . . . . . . . . . . . .      Number  5E82      TKRSEG
D0014. . . . . . . . . . . . . . . . .      Number  5F20      TKRSEG
D0015. . . . . . . . . . . . . . . . .      Number  5F88      TKRSEG
D0016. . . . . . . . . . . . . . . . .      Number  6C90      TKRSEG
D0017. . . . . . . . . . . . . . . . .      Number  6D08      TKRSEG
D0018. . . . . . . . . . . . . . . . .      Number  6D68      TKRSEG
D0019. . . . . . . . . . . . . . . . .      Number  6DAE      TKRSEG
D0020. . . . . . . . . . . . . . . . .      Number  6E27      TKRSEG
D0021. . . . . . . . . . . . . . . . .      Number  6E73      TKRSEG
D0022. . . . . . . . . . . . . . . . .      Number  6EBE      TKRSEG
D0023. . . . . . . . . . . . . . . . .      Number  6F04      TKRSEG
D0024. . . . . . . . . . . . . . . . .      Number  6F6C      TKRSEG
D0025. . . . . . . . . . . . . . . . .      Number  6FC7      TKRSEG
D0026. . . . . . . . . . . . . . . . .      Number  7010      TKRSEG
D0027. . . . . . . . . . . . . . . . .      Number  7078      TKRSEG
D0028. . . . . . . . . . . . . . . . .      Number  70C2      TKRSEG
D0029. . . . . . . . . . . . . . . . .      Number  7114      TKRSEG
D0030. . . . . . . . . . . . . . . . .      Number  7193      TKRSEG
D0031. . . . . . . . . . . . . . . . .      Number  71F9      TKRSEG
D0032. . . . . . . . . . . . . . . . .      Number  7263      TKRSEG
D0033. . . . . . . . . . . . . . . . .      Number  72B0      TKRSEG
D0034. . . . . . . . . . . . . . . . .      Number  7316      TKRSEG
D0035. . . . . . . . . . . . . . . . .      Number  737E      TKRSEG
D0036. . . . . . . . . . . . . . . . .      Number  73E7      TKRSEG
D0037. . . . . . . . . . . . . . . . .      Number  7440      TKRSEG
D0038. . . . . . . . . . . . . . . . .      Number  748F      TKRSEG
D0039. . . . . . . . . . . . . . . . .      Number  74F6      TKRSEG
D0040. . . . . . . . . . . . . . . . .      Number  7576      TKRSEG
D0041. . . . . . . . . . . . . . . . .      Number  75EE      TKRSEG
D0042. . . . . . . . . . . . . . . . .      Number  7663      TKRSEG
D0043. . . . . . . . . . . . . . . . .      Number  76EA      TKRSEG
D0044. . . . . . . . . . . . . . . . .      Number  7763      TKRSEG
D0045. . . . . . . . . . . . . . . . .      Number  77CF      TKRSEG
D0046. . . . . . . . . . . . . . . . .      Number  780F      TKRSEG
D0047. . . . . . . . . . . . . . . . .      Number  786E      TKRSEG
D0048. . . . . . . . . . . . . . . . .      Number  7879      TKRSEG
D0049. . . . . . . . . . . . . . . . .      Number  78E8      TKRSEG
D0050. . . . . . . . . . . . . . . . .      Number  7990      TKRSEG
D0051. . . . . . . . . . . . . . . . .      Number  79EF      TKRSEG
D0052. . . . . . . . . . . . . . . . .      Number  7A58      TKRSEG
D0053. . . . . . . . . . . . . . . . .      Number  7ABE      TKRSEG
D0054. . . . . . . . . . . . . . . . .      Number  7B18      TKRSEG
D0055. . . . . . . . . . . . . . . . .      Number  7BCF      TKRSEG
D0056. . . . . . . . . . . . . . . . .      Number  7C5A      TKRSEG
D0057. . . . . . . . . . . . . . . . .      Number  7C9E      TKRSEG
D0058. . . . . . . . . . . . . . . . .      Number  7D24      TKRSEG
D0059. . . . . . . . . . . . . . . . .      Number  7D4F      TKRSEG
DATA_AREA. . . . . . . . . . . . . . .      L BYTE  0400      ABSO


DATA WORD. . . . . . . . . . . . . . .      L WORD  0400      ABSO
DCP MENU PAGE. . . . . . . . . . . . .      L BYTE  0001      KBDATA
DCP ROW COL. . . . . . . . . . . . . .      L WORD  0002      KBDATA
DCP RUNNING. . . . . . . . . . . . . .      L BYTE  0029      KBDATA
DECODE . . . . . . . . . . . . . . . .      Number  000C
DELIO. . . . . . . . . . . . . . . . .      L NEAR  0976      TKRSEG
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DEL KEY. . . . . . . . . . . . . . . .        Number  0001
DIAG RESET ERR . . . . . . . . . . . .        Number  0053
DIAG RETRY . . . . . . . . . . . . . .        L NEAR  0088    TDRSEG
DIAG TABLE_PTR . . . . . . . . . . . .        L BYTE  0020    DBDATA
DIO. . . . . . . . . . . . . . . . . .        Number  6000
DISKETTE STATUS. . . . . . . . . . . .        Number  0040
DISK POINTER . . . . . . . . . . . . .        L BYTE  0041    DATA
DK_BUF_LEN . . . . . . . . . . . . . .        L DWORD 007A    ABS0
DK_INDEX . . . . . . . . . . . . . . .        Number  0200
DMA BOUNDARY . . . . . . . . . . . . .        L BYTE  0078    DATA
DNLL STATUS. . . . . . . . . . . . . .        Number  0009
DONE_PR. . . . . . . . . . . . . . . .        L BYTE  0021    DBDATA  Length  0002
DRIVE_ENABLE . . . . . . . . . . . . .        L BYTE  0011    RRDATA
E0001. . . . . . . . . . . . . . . . .        Number  0001
E0002. . . . . . . . . . . . . . . . .        Number  7097    TDRSEG
E0003. . . . . . . . . . . . . . . . .        Number  7102    TDRSEG
E0004. . . . . . . . . . . . . . . . .        Number  7111    TDRSEG
E0006. . . . . . . . . . . . . . . . .        Number  7159    TDRSEG
E0007. . . . . . . . . . . . . . . . .        Number  7100    TDRSEG
E0008. . . . . . . . . . . . . . . . .        Number  7116    TDRSEG
E0010. . . . . . . . . . . . . . . . .        Number  7137    TDRSEG
E0011. . . . . . . . . . . . . . . . .        Number  7180    TDRSEG
E0012. . . . . . . . . . . . . . . . .        Number  7190    TDRSEG
EB . . . . . . . . . . . . . . . . . .        Number  71A0    TDRSEG
EBO. . . . . . . . . . . . . . . . . .        L NEAR  0267    TDRSEG
EDGE_CNT . . . . . . . . . . . . . . .        L NEAR  026C    TDRSEG
EMPTY. . . . . . . . . . . . . . . . .        L WORD  0067    DATA
EM 0 . . . . . . . . . . . . . . . . .        L WORD  0216    ABS0
EM 1 . . . . . . . . . . . . . . . . .        L NEAR  0215    TDRSEG
ENABLE . . . . . . . . . . . . . . . .        L NEAR  0290    TDRSEG
ENCODE . . . . . . . . . . . . . . . .        N PROC  0A52    TDRSEG  Length  0002
END PG0. . . . . . . . . . . . . . . .        Number  0000
END PG1. . . . . . . . . . . . . . . .        Number  1118    TDRSEG
END PG2. . . . . . . . . . . . . . . .        Number  3111    TDRSEG
END PG3. . . . . . . . . . . . . . . .        Number  5119    TDRSEG
EOI. . . . . . . . . . . . . . . . . .        Number  7119    TDRSEG
EQUIP FLAG . . . . . . . . . . . . . .        Number  0020
ERROR. . . . . . . . . . . . . . . . .        L WORD  0010    DATA
ERROR 0. . . . . . . . . . . . . . . .        L NEAR  0277    TDRSEG
ERROR ERR. . . . . . . . . . . . . . .        L NEAR  0176    TDRSEG
ER CODE8250. . . . . . . . . . . . . .        L BYTE  0293    TDRSEG
ER CODE8255. . . . . . . . . . . . . .        Number  0002
ER CVSD_C1 . . . . . . . . . . . . . .        Number  0001
ER CVSD_C2 . . . . . . . . . . . . . .        Number  0044
                                              Number  0045

ER CVSD_S1 . . . . . . . . . . . . . .        Number  0012
ER CVSD_S2 . . . . . . . . . . . . . .        Number  0011
ER CVSD_S3 . . . . . . . . . . . . . .        Number  0014
ER LPC C1. . . . . . . . . . . . . . .        Number  0042
ER LPC_C2. . . . . . . . . . . . . . .        Number  0043
ER LPC_S1. . . . . . . . . . . . . . .        Number  0010
ER LPC_S2. . . . . . . . . . . . . . .        Number  0011
EX . . . . . . . . . . . . . . . . . .        L NEAR  020A    TDRSEG
EXIT . . . . . . . . . . . . . . . . .        L NEAR  0101    TDRSEG
EXIT BFR UNDER . . . . . . . . . . . .        L NEAR  0C01    TDRSEG
EXIT POST. . . . . . . . . . . . . . .        L NEAR  011C    TDRSEG
EXST . . . . . . . . . . . . . . . . .        L WORD  0124    ABS0
EXT_PTR. . . . . . . . . . . . . . . .        L DWORD 007C    ABS0
F_MSG_R. . . . . . . . . . . . . . . .        F PROC  0211    TDRSEG  Length  0002
F0 . . . . . . . . . . . . . . . . . .        L NEAR  021D    TDRSEG
F00. . . . . . . . . . . . . . . . . .        L NEAR  0215    TDRSEG
F1 . . . . . . . . . . . . . . . . . .        L NEAR  0215    TDRSEG
FDC RESET. . . . . . . . . . . . . . .        Number  0080
FEND ERR . . . . . . . . . . . . . . .        L NEAR  0610    TDRSEG
FLAG SETUP . . . . . . . . . . . . . .        L NEAR  0180    TDRSEG
FLAG SETUP2. . . . . . . . . . . . . .        L NEAR  0610    TDRSEG
FN BREAK . . . . . . . . . . . . . . .        Number  0040
FN FLAG. . . . . . . . . . . . . . . .        Number  0090
FN LOCK. . . . . . . . . . . . . . . .        Number  0010
FN PENDING . . . . . . . . . . . . . .        Number  0020
FOREGROUND COMPLETE. . . . . . . . . .        L NEAR  0614    TDRSEG
FOR COMP . . . . . . . . . . . . . . .        L NEAR  0611    TDRSEG
FRAME 01 . . . . . . . . . . . . . . .        N PROC  0511    TDRSEG  Length  0000
FRAME 1C . . . . . . . . . . . . . . .        N PROC  051F    TDRSEG  Length  0001
FRAME_HI . . . . . . . . . . . . . . .        Number  0004
FSYNC. . . . . . . . . . . . . . . . .        L NEAR  05AA    TDRSEG
G7 . . . . . . . . . . . . . . . . . .        L NEAR  02A1    TDRSEG
GOODBYE. . . . . . . . . . . . . . . .        L NEAR  0815    TDRSEG
GOOD TEST_END. . . . . . . . . . . . .        L NEAR  0878    TDRSEG
HALF RATE. . . . . . . . . . . . . . .        Number  0004
HOLD STATE . . . . . . . . . . . . . .        Number  0004
HORZ_POS . . . . . . . . . . . . . . .        L BYTE  0082    DATA
HTL. . . . . . . . . . . . . . . . . .        L NEAR  0011    TDRSEG
INDEX_ERR. . . . . . . . . . . . . . .        Number  0004
INIT . . . . . . . . . . . . . . . . .        F PROC  0003    TDRSEG  Length  0201
INIT1. . . . . . . . . . . . . . . . .        L NEAR  0021    TDRSEG
INIT_DELAY . . . . . . . . . . . . . .        Number  0002
INIT_TIMER . . . . . . . . . . . . . .        N PROC  0110    TDRSEG  Length  0001
INNER LOOP . . . . . . . . . . . . . .        L NEAR  0139    TDRSEG
INS KEY. . . . . . . . . . . . . . . .        Number  0052
INS SHIFT. . . . . . . . . . . . . . .        Number  0080
INTIC0 . . . . . . . . . . . . . . . .        L WORD  000C    RRDATA
INTIC5 . . . . . . . . . . . . . . . .        L WORD  000E    RRDATA
INTIC_PTR. . . . . . . . . . . . . . .        L WORD  0070    ABS0
INTI EOI . . . . . . . . . . . . . . .        Number  0061
INTI OFF . . . . . . . . . . . . . . .        Number  0002
INTI_ON. . . . . . . . . . . . . . . .        Number  0010
INT3_PTR . . . . . . . . . . . . . . .        L WORD  000C    ABS0

INT5 PTR . . . . . . . . . . . . . . .        L WORD  0014    ABS0
INTA00 . . . . . . . . . . . . . . . .        Number  0020
INTA01 . . . . . . . . . . . . . . . .        Number  0021
INTR CTR . . . . . . . . . . . . . . .        Number  F0?1
INTR FLAG. . . . . . . . . . . . . . .        L BYTE  0084    DATA
INT PTR. . . . . . . . . . . . . . . .        L DWORD 0020    ABS0
IO ROM INIT. . . . . . . . . . . . . .        L WORD  0014    RRDATA
IO ROM SEG . . . . . . . . . . . . . .        L WORD  0018    RRDATA
J16 2  . . . . . . . . . . . . . . . .        L NEAR  0205    TDRSEG
J16 4. . . . . . . . . . . . . . . . .        L NEAR  0210    TDRSEG
J16 5  . . . . . . . . . . . . . . . .        L NEAR  0A00    TDRSEG
J16 6. . . . . . . . . . . . . . . . .        L NEAR  0A0C    TDRSEG
J16 61 . . . . . . . . . . . . . . . .        L NEAR  0A13    TDRSEG
J16 7. . . . . . . . . . . . . . . . .        L NEAR  0A2B    TDRSEG
KBD  . . . . . . . . . . . . . . . . .        Number  0054
KBDONE . . . . . . . . . . . . . . . .        L WORD  0012    RRDATA
KBD ERR. . . . . . . . . . . . . . . .        L BYTE  0012    DATA
KBD PTR  . . . . . . . . . . . . . . .        L WORD  0130    DUMMY
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KBDOUT . . . . . . . . . . . . . .      Number  0060
KB BUFFER. . . . . . . . . . . . .      L WORD  001E     DATA    Length =0010
KB CTL . . . . . . . . . . . . . .      Number  0061
KB FLAG. . . . . . . . . . . . . .      L BYTE  0017     DATA
KB FLAG 1. . . . . . . . . . . . .      L BYTE  0018     DATA
KB FLAG 2. . . . . . . . . . . . .      L BYTE  0088     DATA
KB NOISE . . . . . . . . . . . . .      N PROC  0A74     TKRSEG  Length =0021
KEY62 PTR. . . . . . . . . . . . .      L WORD  0120     ABS0
KEYBRD PTR . . . . . . . . . . . .      L DWORD 011C     ABS0
LAST VAL . . . . . . . . . . . . .      L BYTE  006B     DATA
LD . . . . . . . . . . . . . . . .      L NEAR  0105     TKRSEG
LEFT KEY . . . . . . . . . . . . .      Number  002A
LEFT SHIFT . . . . . . . . . . . .      Number  0002
LOADHO . . . . . . . . . . . . . .      L NEAR  069F     TKRSEG
LOADHR . . . . . . . . . . . . . .      L NEAR  06A9     TKRSEG
LOAD BFR . . . . . . . . . . . . .      N PROC  069F     TKRSEG  Length =000B
LOAD BFR ERR . . . . . . . . . . .      L NEAR  067D     TKRSEG
LOAD BFR HNDLR . . . . . . . . . .      N PROC  0675     TKRSEG  Length =002A
LOAD LOOP. . . . . . . . . . . . .      L NEAR  0882     TKRSEG
LOCATE . . . . . . . . . . . . . .      Number  0081
LOOPOUT. . . . . . . . . . . . . .      L NEAR  0A7B     TKRSEG
LPC. . . . . . . . . . . . . . . .      Number  0000
LPC00. . . . . . . . . . . . . . .      L NEAR  04AE     TKRSEG
LPC000 . . . . . . . . . . . . . .      L NEAR  04AD     TKRSEG
LPC02A . . . . . . . . . . . . . .      L NEAR  0404     TKRSEG
LPC03. . . . . . . . . . . . . . .      L NEAR  0409     TKRSEG
LPC04. . . . . . . . . . . . . . .      L NEAR  0418     TKRSEG
LPC05. . . . . . . . . . . . . . .      L NEAR  0510     TKRSEG
LPC10. . . . . . . . . . . . . . .      L NEAR  0532     TKRSEG
LPC20. . . . . . . . . . . . . . .      L NEAR  0540     TKRSEG
LPC22. . . . . . . . . . . . . . .      L NEAR  056C     TKRSEG
LPC23. . . . . . . . . . . . . . .      L NEAR  0571     TKRSEG
LPC25. . . . . . . . . . . . . . .      L NEAR  058C     TKRSEG
LPC30. . . . . . . . . . . . . . .      L NEAR  058E     TKRSEG
LPC33. . . . . . . . . . . . . . .      L NEAR  0595     TKRSEG


LPC33_LINK . . . . . . . . . . . .      L NEAR  0631     TKRSEG
LPC34. . . . . . . . . . . . . . .      L NEAR  05C3     TKRSEG
LPC34A . . . . . . . . . . . . . .      L NEAR  05CF     TKRSEG
LPC35. . . . . . . . . . . . . . .      L NEAR  05E0     TKRSEG
LPC40. . . . . . . . . . . . . . .      L NEAR  0600     TKRSEG
LPC45. . . . . . . . . . . . . . .      L NEAR  0603     TKRSEG
LPCRDY ERR . . . . . . . . . . . .      Number  0006
LPCR OFF . . . . . . . . . . . . .      Number  0008
LPCR ON. . . . . . . . . . . . . .      Number  0009
LPCW 10. . . . . . . . . . . . . .      N PROC  065D     TKRSEG  Length =0018
LPCW OFF . . . . . . . . . . . . .      Number  000A
LPCW ON. . . . . . . . . . . . . .      Number  000B
LPCW X . . . . . . . . . . . . . .      L NEAR  0674     TKRSEG
LPCX . . . . . . . . . . . . . . .      L NEAR  064A     TKRSEG
LPCX00 . . . . . . . . . . . . . .      L NEAR  0615     TKRSEG
LPCX30 . . . . . . . . . . . . . .      L NEAR  0702     TKRSEG
LPCX90 . . . . . . . . . . . . . .      L NEAR  071F     TKRSEG
LPCX95 . . . . . . . . . . . . . .      L NEAR  0748     TKRSEG
LPC BACKGROUND . . . . . . . . . .      L NEAR  0648     TKRSEG
LPC BUFFER . . . . . . . . . . . .      Number  0002
LPC BUF NOT EMPTY. . . . . . . . .      L NEAR  037D     TKRSEG
LPC CHIP_FAIL. . . . . . . . . . .      L NEAR  0387     TKRSEG
LPC ERR. . . . . . . . . . . . . .      L NEAR  085C     TKRSEG
LPC ERR_EXIT . . . . . . . . . . .      L NEAR  059A     TKRSEG
LPC IN . . . . . . . . . . . . . .      Number  0002
LPC IN FORE. . . . . . . . . . . .      Number  0003
LPC IN . . . . . . . . . . . . . .      Number  0083
LPC IN0. . . . . . . . . . . . . .      Number  0080
LPC IN1. . . . . . . . . . . . . .      Number  0003
LPC INDEX. . . . . . . . . . . . .      Number  0001
LPC INPROG . . . . . . . . . . . .      Number  0002
LPC INT. . . . . . . . . . . . . .      Number  0002
LPC OUT. . . . . . . . . . . . . .      Number  0081
LPC OUT0 . . . . . . . . . . . . .      Number  0080
LPC OUT1 . . . . . . . . . . . . .      Number  0001
LPC PTR. . . . . . . . . . . . . .      L WORD  0024     DUMMY
LPC RDY ERR. . . . . . . . . . . .      L NEAR  0335     TKRSEG
LPC READY. . . . . . . . . . . . .      Number  0001
LPC SPEAK. . . . . . . . . . . . .      L NEAR  0838     TKRSEG
LPC STATUS . . . . . . . . . . . .      Number  0010
LPC TEST . . . . . . . . . . . . .      L NEAR  0936     TKRSEG
LPC XX . . . . . . . . . . . . . .      L NEAR  0602     TKRSEG
LTH. . . . . . . . . . . . . . . .      L NEAR  001B     TKRSEG
MASK NMI . . . . . . . . . . . . .      L NEAR  04C2     TKRSEG
MATCH_BIT. . . . . . . . . . . . .      Number  0080
M00. . . . . . . . . . . . . . . .      Number  0000
M01. . . . . . . . . . . . . . . .      Number  0002
M02. . . . . . . . . . . . . . . .      Number  0004
M03. . . . . . . . . . . . . . . .      Number  0006
M04. . . . . . . . . . . . . . . .      Number  0008
M05. . . . . . . . . . . . . . . .      Number  000A
MEMORY SIZE. . . . . . . . . . . .      L WORD  0013     DATA
MEM DONE0. . . . . . . . . . . . .      L WORD  000A     XXDATA


MEM DONES. . . . . . . . . . . . .      L WORD  0008     XXDATA
MEM TOT. . . . . . . . . . . . . .      L WORD  0006     XXDATA
MENU UP. . . . . . . . . . . . . .      L BYTE  0010     XXDATA
MIC RTN. . . . . . . . . . . . . .      L WORD  0022     XXDATA
MIC TST. . . . . . . . . . . . . .      L BYTE  0005     XXDATA
MIC T. . . . . . . . . . . . . . .      Number  07E2     TKRSEG
MIC ICON . . . . . . . . . . . . .      L BYTE  07CF     TKRSEG
MIC POS. . . . . . . . . . . . . .      Number  0812
MINT . . . . . . . . . . . . . . .      Number  2000
MODE0 A. . . . . . . . . . . . . .      Number  0000
MODE0 B. . . . . . . . . . . . . .      Number  0000
MODE1 A. . . . . . . . . . . . . .      Number  0020
MODE1 B. . . . . . . . . . . . . .      Number  0004
MODE2 A. . . . . . . . . . . . . .      Number  0040
MODEM BUFFER . . . . . . . . . . .      L BYTE  0019     XXDATA  Length =0009
MODE 8255. . . . . . . . . . . . .      Number  0089
MODE SET . . . . . . . . . . . . .      Number  0080
MOTOR COUNT. . . . . . . . . . . .      L BYTE  0040     DATA
MOTOR STATUS . . . . . . . . . . .      L BYTE  003F     DATA
MOTOR WAIT . . . . . . . . . . . .      Number  0025
NEC CTL. . . . . . . . . . . . . .      Number  0012
NEC DATA . . . . . . . . . . . . .      Number  0015
NEC STAT . . . . . . . . . . . . .      Number  0014
NEC STATUS . . . . . . . . . . . .      L BYTE  0042     DATA    Length =0007
NEC2 . . . . . . . . . . . . . . .      Number  0020
NMIOFF . . . . . . . . . . . . . .      N PROC  0980     TKRSEG  Length =0025
NMION. . . . . . . . . . . . . . .      N PROC  07A5     TKRSEG  Length =0088
NMI PORT . . . . . . . . . . . . .      Number  00A0
NMI PTR. . . . . . . . . . . . . .      L WORD  0008     ABS0
NODIAG1. . . . . . . . . . . . . .      Number  0012
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D'. I -8C

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                                                  [illegible]  00?1   TD[illegible]
NUM KEY. . . . . . . . . . . . . . . . .          Number      0045
NUM SHIFT. . . . . . . . . . . . . . . .          Number      0020
NUM STATE. . . . . . . . . . . . . . . .          Number      0320
NXT ACL. . . . . . . . . . . . . . . . .          L NEAR      0151   TDRSEG
OFF1 . . . . . . . . . . . . . . . . . .          Number      1361
OFF2 . . . . . . . . . . . . . . . . . .          Number      3161
OFF3 . . . . . . . . . . . . . . . . . .          Number      5161
OK . . . . . . . . . . . . . . . . . . .          Number      0000
OLDEND PTR . . . . . . . . . . . . . . .          L WORD      0026   DUMMY
OUTER_LOOP . . . . . . . . . . . . . . .          L NEAR      0116   TDRSEG
PA . . . . . . . . . . . . . . . . . . .          L NEAR      0175   TDRSEG
PACKAT . . . . . . . . . . . . . . . . .          L BYTE      009A   DATA
PAGE0  . . . . . . . . . . . . . . . . .          Number      0000
PAGE1  . . . . . . . . . . . . . . . . .          Number      0004
PAGE2. . . . . . . . . . . . . . . . . .          Number      0008
PAGE3. . . . . . . . . . . . . . . . . .          Number      000F
PAGREG . . . . . . . . . . . . . . . . .          Number      0101
PARITY.  . . . . . . . . . . . . . . . .          Number      00AF
PATHT. . . . . . . . . . . . . . . . . .          Number      0001
PARM10 . . . . . . . . . . . . . . . . .          Number      0004
PARMJ. . . . . . . . . . . . . . . . . .          Number      0019
PARM_PTR . . . . . . . . . . . . . . . .          L DWORD     0074   ABS0


PA 1   . . . . . . . . . . . . . . . . .          L NEAR      0195   TDRSEG
PC.    . . . . . . . . . . . . . . . . .          L NEAR      0121   TDRSEG
PG0 MAX. . . . . . . . . . . . . . . . .          Number      0029
PG1 MAX. . . . . . . . . . . . . . . . .          Number      0050
PG2 MAX. . . . . . . . . . . . . . . . .          Number      0031
PG3 MAX. . . . . . . . . . . . . . . . .          Number      000A
PLAYBACK OK. . . . . . . . . . . . . . .          L NEAR      0251   TDRSEG
PORTA  . . . . . . . . . . . . . . . . .          Number      FF08
PORTA IN . . . . . . . . . . . . . . . .          Number      0010
PORTA OUT. . . . . . . . . . . . . . . .          Number      0000
PORTB  . . . . . . . . . . . . . . . . .          Number      FF09
PORTB IN . . . . . . . . . . . . . . . .          Number      0002
PORTB OUT. . . . . . . . . . . . . . . .          Number      0000
PORTC  . . . . . . . . . . . . . . . . .          Number      FF0A
PORTCL IN. . . . . . . . . . . . . . . .          Number      0001
PORTCL OUT . . . . . . . . . . . . . . .          Number      0000
PORTCU IN. . . . . . . . . . . . . . . .          Number      0008
PORTCU OUT . . . . . . . . . . . . . . .          Number      0000
PORTC_TST. . . . . . . . . . . . . . . .          N PROC      01B6   TDRSEG   Length  0020
PORT 20H . . . . . . . . . . . . . . . .          Number      0020
PORT 21H . . . . . . . . . . . . . . . .          Number      0021
PORT 61H . . . . . . . . . . . . . . . .          Number      0061
PORT A . . . . . . . . . . . . . . . . .          Number      0060
PORT B . . . . . . . . . . . . . . . . .          Number      0061
PORT B0. . . . . . . . . . . . . . . . .          Number      0080
PORT C . . . . . . . . . . . . . . . . .          Number      0062
PORT TST . . . . . . . . . . . . . . . .          N PROC      0172   TDRSEG   Length  0016
POST . . . . . . . . . . . . . . . . . .          F PROC      006A   TDRSEG   Length  0005
POST ERR . . . . . . . . . . . . . . . .          L BYTE      0018   DDDATA
PRINT. . . . . . . . . . . . . . . . . .          Number      0002
PRINTER BASE . . . . . . . . . . . . . .          L WORD      0008   DATA     Length  0004
PRINT TIM OUT. . . . . . . . . . . . . .          L BYTE      0078   DATA     Length  0004
PRT HEX. . . . . . . . . . . . . . . . .          N PROC      02CB   TDRSEG   Length  0007
PUTCHAR. . . . . . . . . . . . . . . . .          Number      0011
Q TIM OUT. . . . . . . . . . . . . . . .          L NEAR      0570   TDRSEG
RANGE. . . . . . . . . . . . . . . . . .          Number      0006
RD BACK. . . . . . . . . . . . . . . . .          Number      0010
READ . . . . . . . . . . . . . . . . . .          L NEAR      0441   TDRSEG
READ BUF . . . . . . . . . . . . . . . .          L BYTE      0021   DDDATA   Length  0200
READ PORTB . . . . . . . . . . . . . . .          N PROC      075C   TDRSEG   Length  0017
READ TIME. . . . . . . . . . . . . . . .          N PROC      0A41   TDRSEG   Length  0011
RECORD NOT END . . . . . . . . . . . . .          Number      0006
RECORD OK. . . . . . . . . . . . . . . .          L NEAR      0726   TDRSEG
RESET  . . . . . . . . . . . . . . . . .          N PROC      0756   TDRSEG   Length  0010
RESET ER . . . . . . . . . . . . . . . .          Number      2813
RESET FLAG . . . . . . . . . . . . . . .          L WORD      0072   DATA
RESET OK . . . . . . . . . . . . . . . .          L NEAR      0275   TDRSEG
RET 0. . . . . . . . . . . . . . . . . .          L NEAR      0179   TDRSEG
RIGHT KEY. . . . . . . . . . . . . . . .          Number      0016
RIGHT SHIFT. . . . . . . . . . . . . . .          Number      0001
ROM. . . . . . . . . . . . . . . . . . .          Number      0080
RS232 BASE . . . . . . . . . . . . . . .          L WORD      0000   DATA     Length  0004
RS232 TIM OUT. . . . . . . . . . . . . .          L BYTE      007C   DATA     Length  0004


RST 0. . . . . . . . . . . . . . . . . .          L NEAR      0118   TDRSEG
RST 5220 . . . . . . . . . . . . . . . .          Number      00FF
RST IN . . . . . . . . . . . . . . . . .          Number      0000
RST TALKER . . . . . . . . . . . . . . .          N PROC      010A   TDRSEG   Length  0004
RST ER . . . . . . . . . . . . . . . . .          L NEAR      0156   TDRSEG
RW LSB . . . . . . . . . . . . . . . . .          Number      0010
RW LSBMSB. . . . . . . . . . . . . . . .          Number      0030
RW MSB . . . . . . . . . . . . . . . . .          Number      0020
SAVE POINTER . . . . . . . . . . . . . .          N PROC      06AA   TDRSEG   Length  002A
SCROLL KEY . . . . . . . . . . . . . . .          Number      0046
SCROLL SHIFT . . . . . . . . . . . . . .          Number      0010
SECOND . . . . . . . . . . . . . . . . .          L NEAR      015A   TDRSEG
SEEK END . . . . . . . . . . . . . . . .          Number      0020
SEEK STATUS. . . . . . . . . . . . . . .          L BYTE      003E   DATA
SERV ER. . . . . . . . . . . . . . . . .          Number      0028
SERV OUT . . . . . . . . . . . . . . . .          L NEAR      025A   TDRSEG
SETUP FLAG . . . . . . . . . . . . . . .          L NEAR      0A9C   TDRSEG
SETUP FLAG2. . . . . . . . . . . . . . .          L NEAR      0A95   TDRSEG
SETEST . . . . . . . . . . . . . . . . .          L NEAR      0590   TDRSEG
SHIFTREG . . . . . . . . . . . . . . . .          Number      FF98
SPEAK  . . . . . . . . . . . . . . . . .          L NEAR      0A51   TDRSEG
SPEAKER POS. . . . . . . . . . . . . . .          Number      0701
SPEED 0. . . . . . . . . . . . . . . . .          Number      0000
SPEED 1. . . . . . . . . . . . . . . . .          Number      0001
SPEED 2. . . . . . . . . . . . . . . . .          Number      0002
SPEED 3. . . . . . . . . . . . . . . . .          Number      0003
SPEED 4. . . . . . . . . . . . . . . . .          Number      0004
SPEED 5. . . . . . . . . . . . . . . . .          Number      0005
SPEED ERR  . . . . . . . . . . . . . . .          Number      0005
SPEED MAX. . . . . . . . . . . . . . . .          Number      0005
SPEED TBL. . . . . . . . . . . . . . . .          L WORD      0010   TDRSEG
SEK EXT. . . . . . . . . . . . . . . . .          Number      0040
SF CHAN. . . . . . . . . . . . . . . . .          L BYTE      002A   DDDATA
SF FLAG. . . . . . . . . . . . . . . . .          L WORD      002A   DDDATA
START. . . . . . . . . . . . . . . . . .          F PROC      0209   TDRSEG   Length  0034
STATUS BYTE. . . . . . . . . . . . . . .          L BYTE      0000   DDDATA
STATUS ER  . . . . . . . . . . . . . . .          L NEAR      0A65   TDRSEG
STATUS ER2 . . . . . . . . . . . . . . .          L NEAR      0A67   TDRSEG
STOP CODE. . . . . . . . . . . . . . . .          Number      00FF
SWMASK . . . . . . . . . . . . . . . . .          Number      0001
SWITCH . . . . . . . . . . . . . . . . .          Number      00A1
T2 A . . . . . . . . . . . . . . . . . .          Number      07A2   TDRSEG
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T2 ADC. . . . . . . . . . . . . . . .      L BYTE  0798    TKRSEG
T2 I . . . . . . . . . . . . . . . .       Number  079A    TKRSEG
T2 ICON. . . . . . . . . . . . . . .       L BYTE  07A1    TKRSEG
T2 S . . . . . . . . . . . . . . . .       Number  07AE    TKRSEG
T2 SELECT. . . . . . . . . . . . . .       L BYTE  07A3    TKRSEG
T2 W . . . . . . . . . . . . . . . .       Number  07CE    TKRSEG
T2 WAVE. . . . . . . . . . . . . . .       L BYTE  07B7    TKRSEG
TA-54. . . . . . . . . . . . . . . .       L NEAR  0072    TKRSEG
TAB0 . . . . . . . . . . . . . . . .       Number  0052    TKRSEG
TAB1 . . . . . . . . . . . . . . . .       Number  008A    TKRSEG
TAB2 . . . . . . . . . . . . . . . .       Number  0C22    TKRSEG


TAB3 . . . . . . . . . . . . . . . .       Number  0C90    TKRSEG
TABLEA . . . . . . . . . . . . . . .       Number  0000    TKRSEG
TALKER . . . . . . . . . . . . . . .       Number  004D
TALKER_DIAG. . . . . . . . . . . . .       F PROC  07EE    TKRSEG  Length  0167
TALKER DIAG PTR. . . . . . . . . . .       L WORD  0248    DUMMY
TALKER ICON. . . . . . . . . . . . .       L NEAR  0816    TKRSEG
TALKER PTR . . . . . . . . . . . . .       L WORD  0134    DUMMY
TALK EFC . . . . . . . . . . . . . .       Number  0090
TALK ON. . . . . . . . . . . . . . .       Number  0080
TEST BITS. . . . . . . . . . . . . .       L NEAR  013C    TKRSEG
TEST FRAME HI. . . . . . . . . . . .       L NEAR  00D1    TKRSEG
TEST FRAME LO. . . . . . . . . . . .       L NEAR  00DA    TKRSEG
TEST HALF BUF BIT. . . . . . . . . .       L NEAR  0620    TKRSEG
THRESHOLD. . . . . . . . . . . . . .       Number  012C
TIMER. . . . . . . . . . . . . . . .       Number  0040
TIMER0 . . . . . . . . . . . . . . .       Number  0040
TIMER ERROR. . . . . . . . . . . . .       L NEAR  00A3    TKRSEG
TIMER HIGH . . . . . . . . . . . . .       L WORD  006E    DATA
TIMER LOW. . . . . . . . . . . . . .       L WORD  006C    DATA
TIMER OFF. . . . . . . . . . . . . .       L BYTE  0070    DATA
TIME OUT . . . . . . . . . . . . . .       Number  0080
TIM CTL. . . . . . . . . . . . . . .       Number  0043
TKR ACT. . . . . . . . . . . . . . .       Number  FF9F
TK EX. . . . . . . . . . . . . . . .       L NEAR  0960    TKRSEG
TK EXT . . . . . . . . . . . . . . .       L NEAR  095A    TKRSEG
TK EX LINK1. . . . . . . . . . . . .       L NEAR  087A    TKRSEG
TK EX LINK2. . . . . . . . . . . . .       L NEAR  0800    TKRSEG
TK HD SC . . . . . . . . . . . . . .       L BYTE  0000    DKDATA  Length =0008
TLK WIDTH. . . . . . . . . . . . . .       Number  0007
TLOOP. . . . . . . . . . . . . . . .       L NEAR  0480    TKRSEG
TOS. . . . . . . . . . . . . . . . .       L WORD  0100    STACK
TOTLTPO. . . . . . . . . . . . . . .       L NEAR  0272    TKRSEG
TRACK0 . . . . . . . . . . . . . . .       L BYTE  0074    DATA
TRACK1 . . . . . . . . . . . . . . .       L BYTE  0075    DATA
TRACK2 . . . . . . . . . . . . . . .       L BYTE  0076    DATA
TRANSIT. . . . . . . . . . . . . . .       L NEAR  00E5    TKRSEG
TRUE MEM . . . . . . . . . . . . . .       L WORD  0015    DATA
TST CMP. . . . . . . . . . . . . . .       L NEAR  0161    TKRSEG
TYPE OFF . . . . . . . . . . . . . .       Number  0008
UPDATE COMPLETE. . . . . . . . . . .       L NEAR  0689    TKRSEG
VAR DELAY. . . . . . . . . . . . . .       L BYTE  0086    DATA
VGA CTL. . . . . . . . . . . . . . .       Number  010A
VIDEO INT. . . . . . . . . . . . . .       L WORD  0040    ABS0
WAIT0  . . . . . . . . . . . . . . .       L NEAR  0413    TKRSEG
WAIT00 . . . . . . . . . . . . . . .       L NEAR  0651    TKRSEG
WAITT. . . . . . . . . . . . . . . .       L NEAR  0418    TKRSEG
WAITR0 . . . . . . . . . . . . . . .       L NEAR  0497    TKRSEG
WAITR1 . . . . . . . . . . . . . . .       L NEAR  0482    TKRSEG
WAIT_0 . . . . . . . . . . . . . . .       L NEAR  0425    TKRSEG
WAIT_1 . . . . . . . . . . . . . . .       L NEAR  0420    TKRSEG
WAIT_FOR_LPC . . . . . . . . . . . .       N PROC  037A    TKRSEG  Length  0001
WAIT_RDY . . . . . . . . . . . . . .       N PROC  064E    TKRSEG  Length  0001
WAVE_POS . . . . . . . . . . . . . .       Number  0A15


WD ENABLE  . . . . . . . . . . . . .       Number  0020
WD STROBE. . . . . . . . . . . . . .       Number  0040
WORDS BEGIN. . . . . . . . . . . . .       Number  0C90    TKRSEG
WRAP FLAG. . . . . . . . . . . . . .       L BYTE  0004    DKDATA
WRITE. . . . . . . . . . . . . . . .       L NEAR  0628    TKRSEG
WRITER . . . . . . . . . . . . . . .       L NEAR  0439    TKRSEG
WRITE BUF. . . . . . . . . . . . . .       L BYTE  0221    CDDATA  Length  0100
WRITE PROTECT. . . . . . . . . . . .       Number  0003
WRT FF . . . . . . . . . . . . . . .       L NEAR  032E    TKRSEG
X  . . . . . . . . . . . . . . . . .       L BYTE  0600    TKRSEG
XLAT PR. . . . . . . . . . . . . . .       N PROC  02C5    TKRSEG  Length  [illegible]
XLC BYTE . . . . . . . . . . . . . .       N PROC  02BA    TKRSEG  Length  001A
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