Technical Reference

SOME OF THE MAIN TOPICS IN THIS CHAPTER ARE

- General Information
- Award BIOS Error Codes
- AMI BIOS Error Codes
- Phoenix BIOS Error Codes
- Microid Research (MR) BIOS Error Codes
- IBM BIOS Beep and Alphanumeric Error Codes
- ROM BIOS Hard Drive Parameters
- Modem Control Codes
- DOS Command Reference

General Information

ASCII Character Code Charts

Figure 1 lists ASCII control character values. Figure 2 shows the IBM extended ASCII line-drawing characters in an easy-to-use format. I frequently use these extended ASCII line-drawing characters for visual enhancement in documents I create.

DEC	HEX	CHAR	NAME		CONTROL CODE
0	00		Ctrl-@	NUL	Null
1	01	☺	Ctrl-A	SOH	Start of Heading
2	02	●	Ctrl-B	STX	Start of Text
3	03	♥	Ctrl-C	ETX	End of Text
4	04	♦	Ctrl-D	EOT	End of Transit
5	05	♣	Ctrl-E	ENQ	Enquiry
6	06	♠	Ctrl-F	ACK	Acknowledge
7	07	•	Ctrl-G	BEL	Bell
8	08	◘	Ctrl-H	BS	Back Space
9	09	○	Ctrl-I	HT	Horizontal Tab
10	0A	◙	Ctrl-J	LF	Line Feed
11	0B	♂	Ctrl-K	VT	Vertical Tab
12	0C	♀	Ctrl-L	FF	Form Feed
13	0D	♪	Ctrl-M	CR	Carriage Return
14	0E	♫	Ctrl-N	SO	Shift Out
15	0F	☼	Ctrl-O	SI	Shift In
16	10	►	Ctrl-P	DLE	Data Line Escape
17	11	◄	Ctrl-Q	DC1	Device Control 1
18	12	↕	Ctrl-R	DC2	Device Control 2
19	13	‼	Ctrl-S	DC3	Device Control 3
20	14	¶	Ctrl-T	DC4	Device Control 4
21	15	§	Ctrl-U	NAK	Negative Acknowledge
22	16	■	Ctrl-V	SYN	Synchronous Idle
23	17	↨	Ctrl-W	ETB	End of Transmit Block
24	18	↑	Ctrl-X	CAN	Cancel
25	19	↓	Ctrl-Y	EM	End of Medium
26	1A	→	Ctrl-Z	SUB	Substitute
27	1B	←	Ctrl-[	ESC	Escape
28	1C	∟	Ctrl-\	FS	File Separator
29	1D	↔	Ctrl-]	GS	Group Separator
30	1E	▲	Ctrl-^	RS	Record Separator
31	1FA	▼	Ctrl-_	US	Unit Separator

Figure 1 ASCII control codes.

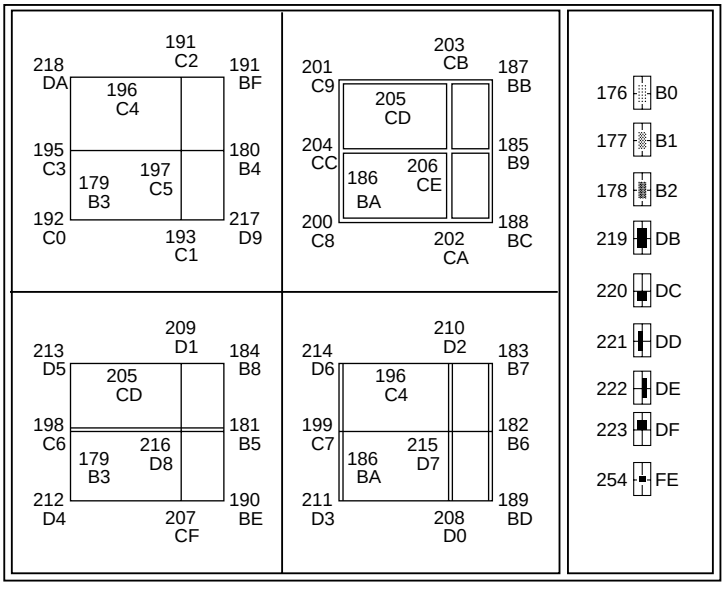

Figure 2 Extended ASCII line-drawing characters.

Hexadecimal/ASCII Conversions

Table 1 Hexadecimal/ASCII Conversions

Dec	Hex	Octal	Binary	Name	Character
0	00	000	0000 0000	blank	
1	01	001	0000 0001	happy face	☺
2	02	002	0000 0010	inverse happy face	☻
3	03	003	0000 0011	heart	♥
4	04	004	0000 0100	diamond	♦
5	05	005	0000 0101	club	♣
6	06	006	0000 0110	spade	♠
7	07	007	0000 0111	bullet	•
8	08	010	0000 1000	inverse bullet	◘
9	09	011	0000 1001	circle	o
10	0A	012	0000 1010	inverse circle	◦
11	0B	013	0000 1011	male sign	♂
12	0C	014	0000 1100	female sign	♀
13	0D	015	0000 1101	single note	♪
14	0E	016	0000 1110	double note	♫
15	0F	017	0000 1111	sun	☼
16	10	020	0001 0000	right triangle	►
17	11	021	0001 0001	left triangle	◄
18	12	022	0001 0010	up/down arrow	↕

(continues)

Table 1 Continued

Dec	Hex	Octal	Binary	Name	Character
19	13	023	0001 0011	double exclamation	!!
20	14	024	0001 0100	paragraph sign	¶
21	15	025	0001 0101	section sign	§
22	16	026	0001 0110	rectangular bullet	■
23	17	027	0001 0111	up / down to line	↕
24	18	030	0001 1000	up arrow	↑
25	19	031	0001 1001	down arrow	↓
26	1A	032	0001 1010	right arrow	→
27	1B	033	0001 1011	left arrow	←
28	1C	034	0001 1100	lower left box	└
29	1D	035	0001 1101	left / right arrow	↔
30	1E	036	0001 1110	up triangle	▲
31	1F	037	0001 1111	down triangle	▼
32	20	040	0010 0000	space	Space
33	21	041	0010 0001	exclamation point	!
34	22	042	0010 0010	quotation mark	“
35	23	043	0010 0011	number sign	#
36	24	044	0010 0100	dollar sign	$
37	25	045	0010 0101	percent sign	%
38	26	046	0010 0110	ampersand	&
39	27	047	0010 0111	apostrophe	‘
40	28	050	0010 1000	opening parenthesis	(
41	29	051	0010 1001	closing parenthesis	)
42	2A	052	0010 1010	asterisk	*
43	2B	053	0010 1011	plus sign	+
44	2C	054	0010 1100	comma	,
45	2D	055	0010 1101	hyphen or minus sign	-
46	2E	056	0010 1110	period	.
47	2F	057	0010 1111	slash	/
48	30	060	0011 0000	zero	0
49	31	061	0011 0001	one	1
50	32	062	0011 0010	two	2
51	33	063	0011 0011	three	3
52	34	064	0011 0100	four	4
53	35	065	0011 0101	five	5
54	36	066	0011 0110	six	6
55	37	067	0011 0111	seven	7
56	38	070	0011 1000	eight	8
57	39	071	0011 1001	nine	9
58	3A	072	0011 1010	colon	:
59	3B	073	0011 1011	semicolon	;
60	3C	074	0011 1100	less-than sign	<
61	3D	075	0011 1101	equal sign	=

Dec	Hex	Octal	Binary	Name	Character
62	3E	076	0011 1110	greater-than sign	>
63	3F	077	0011 1111	question mark	?
64	40	100	0100 0000	at sign	@
65	41	101	0100 0001	capital A	A
66	42	102	0100 0010	capital B	B
67	43	103	0100 0011	capital C	C
68	44	104	0100 0100	capital D	D
69	45	105	0100 0101	capital E	E
70	46	106	0100 0110	capital F	F
71	47	107	0100 0111	capital G	G
72	48	110	0100 1000	capital H	H
73	49	111	0100 1001	capital I	I
74	4A	112	0100 1010	capital J	J
75	4B	113	0100 1011	capital K	K
76	4C	114	0100 1100	capital L	L
77	4D	115	0100 1101	capital M	M
78	4E	116	0100 1110	capital N	N
79	4F	117	0100 1111	capital O	O
80	50	120	0101 0000	capital P	P
81	51	121	0101 0001	capital Q	Q
82	52	122	0101 0010	capital R	R
83	53	123	0101 0011	capital S	S
84	54	124	0101 0100	capital T	T
85	55	125	0101 0101	capital U	U
86	56	126	0101 0110	capital V	V
87	57	127	0101 0111	capital W	W
88	58	130	0101 1000	capital X	X
89	59	131	0101 1001	capital Y	Y
90	5A	132	0101 1010	capital Z	Z
91	5B	133	0101 1011	opening bracket	[
92	5C	134	0101 1100	backward slash	\
93	5D	135	0101 1101	closing bracket	]
94	5E	136	0101 1110	caret	^
95	5F	137	0101 1111	underscore	_
96	60	140	0110 0000	grave	`
97	61	141	0110 0001	lowercase A	a
98	62	142	0110 0010	lowercase B	b
99	63	143	0110 0011	lowercase C	c
100	64	144	0110 0100	lowercase D	d
101	65	145	0110 0101	lowercase E	e
102	66	146	0110 0110	lowercase F	f
103	67	147	0110 0111	lowercase G	g
104	68	150	0110 1000	lowercase H	h

(continues)

Table 1 Continued

Dec	Hex	Octal	Binary	Name	Character
105	69	151	0110 1001	lowercase I	i
106	6A	152	0110 1010	lowercase J	j
107	6B	153	0110 1011	lowercase K	k
108	6C	154	0110 1100	lowercase L	l
109	6D	155	0110 1101	lowercase M	m
110	6E	156	0110 1110	lowercase N	n
111	6F	157	0110 1111	lowercase O	o
112	70	160	0111 0000	lowercase P	p
113	71	161	0111 0001	lowercase Q	q
114	72	162	0111 0010	lowercase R	r
115	73	163	0111 0011	lowercase S	s
116	74	164	0111 0100	lowercase T	t
117	75	165	0111 0101	lowercase U	u
118	76	166	0111 0110	lowercase V	v
119	77	167	0111 0111	lowercase W	w
120	78	170	0111 1000	lowercase X	x
121	79	171	0111 1001	lowercase Y	y
122	7A	172	0111 1010	lowercase Z	z
123	7B	173	0111 1011	opening brace	{
124	7C	174	0111 1100	vertical line	|
125	7D	175	0111 1101	closing brace	}
126	7E	176	0111 1110	tilde	~
127	7F	177	0111 1111	small house	Δ
128	80	200	1000 0000	C cedilla	Ç
129	81	201	1000 0001	u umlaut	ü
130	82	202	1000 0010	e acute	é
131	83	203	1000 0011	a circumflex	â
132	84	204	1000 0100	a umlaut	ä
133	85	205	1000 0101	a grave	à
134	86	206	1000 0110	a ring	å
135	87	207	1000 0111	c cedilla	ç
136	88	210	1000 1000	e circumflex	ê
137	89	211	1000 1001	e umlaut	ë
138	8A	212	1000 1010	e grave	è
139	8B	213	1000 1011	I umlaut	ï
140	8C	214	1000 1100	I circumflex	Î
141	8D	215	1000 1101	I grave	Ì
142	8E	216	1000 1110	A umlaut	Ä
143	8F	217	1000 1111	A ring	Å
144	90	220	1001 0000	E acute	É
145	91	221	1001 0001	ae ligature	æ
146	92	222	1001 0010	AE ligature	Æ
147	93	223	1001 0011	o circumflex	ô

Dec	Hex	Octal	Binary	Name	Character
148	94	224	1001 0100	o umlaut	ö
149	95	225	1001 0101	o grave	ò
150	96	226	1001 0110	u circumflex	û
151	97	227	1001 0111	u grave	ù
152	98	230	1001 1000	y umlaut	ÿ
153	99	231	1001 1001	O umlaut	Ö
154	9A	232	1001 1010	U umlaut	Ü
155	9B	233	1001 1011	cent sign	¢
156	9C	234	1001 1100	pound sign	£
157	9D	235	1001 1101	yen sign	¥
158	9E	236	1001 1110	Pt	₧
159	9F	237	1001 1111	function	*f*
160	A0	240	1010 0000	a acute	á
161	A1	241	1010 0001	I acute	Í
162	A2	242	1010 0010	o acute	ó
163	A3	243	1010 0011	u acute	ú
164	A4	244	1010 0100	n tilde	ñ
165	A5	245	1010 0101	N tilde	Ñ
166	A6	246	1010 0110	a macron	ā
167	A7	247	1010 0111	o macron	ō
168	A8	250	1010 1000	opening question mark	¿
169	A9	251	1010 1001	upper-left box	⌐
170	AA	252	1010 1010	upper-right box	¬
171	AB	253	1010 1011	1 / 2	½
172	AC	254	1010 1100	1 / 4	¼
173	AD	255	1010 1101	opening exclamation	¡
174	AE	256	1010 1110	opening guillemets	«
175	AF	257	1010 1111	closing guillemets	»
176	B0	260	1011 0000	light block	▒
177	B1	261	1011 0001	medium block	▒
178	B2	262	1011 0010	dark block	▒
179	B3	263	1011 0011	single vertical	│
180	B4	264	1011 0100	single right junction	┤
181	B5	265	1011 0101	2 to 1 right junction	╡
182	B6	266	1011 0110	1 to 2 right junction	╢
183	B7	267	1011 0111	1 to 2 upper-right	╖
184	B8	270	1011 1000	2 to 1 upper-right	╕
185	B9	271	1011 1001	double right junction	╣
186	BA	272	1011 1010	double vertical	║
187	BB	273	1011 1011	double upper-right	╗
188	BC	274	1011 1100	double lower-right	╝
189	BD	275	1011 1101	1 to 2 lower-right	╜
190	BE	276	1011 1110	2 to 1 lower-right	╛
191	BF	277	1011 1111	single upper-right	┐

(continues)

Table 1 Continued

Dec	Hex	Octal	Binary	Name	Character
192	C0	300	1100 0000	single lower-left	└
193	C1	301	1100 0001	single lower junction	┴
194	C2	302	1100 0010	single upper junction	┬
195	C3	303	1100 0011	single left junction	├
196	C4	304	1100 0100	single horizontal	─
197	C5	305	1100 0101	single intersection	┼
198	C6	306	1100 0110	2 to 1 left junction	╞
199	C7	307	1100 0111	1 to 2 left junction	╟
200	C8	310	1100 1000	double lower-left	╚
201	C9	311	1100 1001	double upper-left	╔
202	CA	312	1100 1010	double lower junction	╩
203	CB	313	1100 1011	double upper junction	╦
204	CC	314	1100 1100	double left junction	╠
205	CD	315	1100 1101	double horizontal	=
206	CE	316	1100 1110	double intersection	╬
207	CF	317	1100 1111	1 to 2 lower junction	╧
208	D0	320	1101 0000	2 to 1 lower junction	╨
209	D1	321	1101 0001	1 to 2 upper junction	╤
210	D2	322	1101 0010	2 to 1 upper junction	╥
211	D3	323	1101 0011	1 to 2 lower-left	╙
212	D4	324	1101 0100	2 to 1 lower-left	╘
213	D5	325	1101 0101	2 to 1 upper-left	╒
214	D6	326	1101 0110	1 to 2 upper-left	╓
215	D7	327	1101 0111	2 to 1 intersection	╫
216	D8	330	1101 1000	1 to 2 intersection	╪
217	D9	331	1101 1001	single lower-right	┘
218	DA	332	1101 1010	single upper-right	┐
219	DB	333	1101 1011	inverse space	▉
220	DC	334	1101 1100	lower inverse	▄
221	DD	335	1101 1101	left inverse	▌
222	DE	336	1101 1110	right inverse	▐
223	DF	337	1101 1111	upper inverse	▀
224	E0	340	1110 0000	alpha	α
225	E1	341	1110 0001	beta	β
226	E2	342	1110 0010	Gamma	Γ
227	E3	343	1110 0011	pi	π
228	E4	344	1110 0100	Sigma	Σ
229	E5	345	1110 0101	sigma	σ
230	E6	346	1110 0110	mu	µ
231	E7	347	1110 0111	tau	τ
232	E8	350	1110 1000	Phi	Φ
233	E9	351	1110 1001	theta	θ
234	EA	352	1110 1010	Omega	Ω

Dec	Hex	Octal	Binary	Name	Character
235	EB	353	1110 1011	delta	δ
236	EC	354	1110 1100	infinity	∞
237	ED	355	1110 1101	phi	ϕ
238	EE	356	1110 1110	epsilon	ε
239	EF	357	1110 1111	intersection of sets	∩
240	F0	360	1111 0000	is identical to	≡
241	F1	361	1111 0001	plus / minus sign	±
242	F2	362	1111 0010	greater / equal sign	≥
243	F3	363	1111 0011	less / equal sign	≤
244	F4	364	1111 0100	top half integral	⌠
245	F5	365	1111 0101	lower half integral	⌡
246	F6	366	1111 0110	division sign	÷
247	F7	367	1111 0111	approximately	≈
248	F8	370	1111 1000	degree	°
249	F9	371	1111 1001	filled-in degree	•
250	FA	372	1111 1010	small bullet	·
251	FB	373	1111 1011	square root	√
252	FC	374	1111 1100	superscript n	ⁿ
253	FD	375	1111 1101	superscript 2	²
254	FE	376	1111 1110	box	■
255	FF	377	1111 1111	phantom space	ˇ

Extended ASCII Keycodes for ANSI.SYS

Table 2 Extended ASCII Keycodes for ANSI.SYS

Code	Keystroke	Code	Keystroke
0;1	Alt+Esc	0;28	Alt+Enter
0;3	Null Character	0;30	Alt+A
0;14	Alt+Backspace	0;31	Alt+S
0;15	Shift+Tab	0;32	Alt+D
0;16	Alt+Q	0;33	Alt+F
0;17	Alt+W	0;34	Alt+G
0;18	Alt+E	0;35	Alt+H
0;19	Alt+R	0;36	Alt+J
0;20	Alt+T	0;37	Alt+K
0;21	Alt+Y	0;38	Alt+L
0;22	Alt+U	0;39	Alt+;
0;23	Alt+I	0;40	Alt+‘
0;24	Alt+O	0;41	Alt+‘
0;25	Alt+P	0;43	Alt+\
0;26	Alt+[	0;44	Alt+Z
0;27	Alt+]	0;45	Alt+X

(continues)

Table 2 Continued

Code	Keystroke	Code	Keystroke
0;46	Alt+C	0;95	Ctrl+F2
0;47	Alt+V	0;96	Ctrl+F3
0;48	Alt+B	0;97	Ctrl+F4
0;49	Alt+N	0;98	Ctrl+F5
0;50	Alt+M	0;99	Ctrl+F6
0;51	Alt+,	0;100	Ctrl+F7
0;52	Alt+.	0;101	Ctrl+F8
0;53	Alt+ /	0;102	Ctrl+F9
0;55	Alt+Keypad *	0;103	Ctrl+F10
0;59	F1	0;104	Alt+F1
0;60	F2	0;105	Alt+F2
0;61	F3	0;106	Alt+F3
0;62	F4	0;107	Alt+F4
0;63	F5	0;108	Alt+F5
0;64	F6	0;109	Alt+F6
0;65	F7	0;110	Alt+F7
0;66	F8	0;111	Alt+F8
0;67	F9	0;112	Alt+F9
0;68	F10	0;113	Alt+F10
0;71	Home	0;114	Ctrl+Print Screen
0;72	Up Arrow	0;115	Ctrl+Left Arrow
0;73	Page Up	0;116	Ctrl+Right Arrow
0;74	Alt+Keypad -	0;117	Ctrl+End
0;75	Left Arrow	0;118	Ctrl+Page Down
0;76	Keypad 5	0;119	Ctrl+Home
0;77	Right Arrow	0;120	Alt+1
0;78	Alt+Keypad +	0;121	Alt+2
0;79	End	0;122	Alt+3
0;80	Down Arrow	0;123	Alt+4
0;81	Page Down	0;124	Alt+5
0;82	Insert	0;125	Alt+6
0;83	Delete	0;126	Alt+7
0;84	Shift+F1	0;127	Alt+8
0;85	Shift+F2	0;128	Alt+9
0;86	Shift+F3	0;129	Alt+0
0;87	Shift+F4	0;130	Alt+-
0;88	Shift+F5	0;131	Alt+=
0;89	Shift+F6	0;132	Ctrl+Page Up
0;90	Shift+F7	0;133	F11
0;91	Shift+F8	0;134	F12
0;92	Shift+F9	0;135	Shift+F11
0;93	Shift+F10	0;136	Shift+F12
0;94	Ctrl+F1	0;137	Ctrl+F11

Code	Keystroke	Code	Keystroke
0;138	Ctrl+F12	0;151	Alt+Home
0;139	Alt+F11	0;152	Alt+Up Arrow
0;140	Alt+F12	0;153	Alt+Page Up
0;141	Ctrl+Up Arrow	0;155	Alt+Left Arrow
0;142	Ctrl+Keypad -	0;157	Alt+Right Arrow
0;143	Ctrl+Keypad 5	0;159	Alt+End
0;144	Ctrl+Keypad +	0;160	Alt+Down Arrow
0;145	Ctrl+Down Arrow	0;161	Alt+Page Down
0;146	Ctrl+Insert	0;162	Alt+Insert
0;147	Ctrl+Delete	0;163	Alt+Delete
0;148	Ctrl+Tab	0;164	Alt+Keypad /
0;149	Ctrl+Keypad /	0;165	Alt+Tab
0;150	Ctrl+Keypad *	0;166	Alt+Keypad Enter

EBCDIC Character Codes

Table 3 EBCDIC Character Codes

Dec	Hex	Octal	Binary	Name	Character
0	00	000	0000 0000	NUL	
1	01	001	0000 0001	SOH	
2	02	002	0000 0010	STX	
3	03	003	0000 0011	ETX	
4	04	004	0000 0100	SEL	
5	05	005	0000 0101	HT	
6	06	006	0000 0110	RNL	
7	07	007	0000 0111	DEL	
8	08	010	0000 1000	GE	
9	09	011	0000 1001	SPS	
10	0A	012	0000 1010	RPT	
11	0B	013	0000 1011	VT	
12	0C	014	0000 1100	FF	
13	0D	015	0000 1101	CR	
14	0E	016	0000 1110	SO	
15	0F	017	0000 1111	SI	
16	10	020	0001 0000	DLE	
17	11	021	0001 0001	DC1	
18	12	022	0001 0010	DC2	
19	13	023	0001 0011	DC3	
20	14	024	0001 0100	RES/ENP	
21	15	025	0001 0101	NL	
22	16	026	0001 0110	BS	
23	17	027	0001 0111	POC	

(continues)

Table 3 Continued

Dec	Hex	Octal	Binary	Name	Character
24	18	030	0001 1000	CAN	
25	19	031	0001 1001	EM	
26	1A	032	0001 1010	UBS	
27	1B	033	0001 1011	CU1	
28	1C	034	0001 1100	IFS	
29	1D	035	0001 1101	IGS	
30	1E	036	0001 1110	IRS	
31	1F	037	0001 1111	IUS/ITB	
32	20	040	0010 0000	DS	
33	21	041	0010 0001	SOS	
34	22	042	0010 0010	FS	
35	23	043	0010 0011	WUS	
36	24	044	0010 0100	BYP/INP	
37	25	045	0010 0101	LF	
38	26	046	0010 0110	ETB	
39	27	047	0010 0111	ESC	
40	28	050	0010 1000	SA	
41	29	051	0010 1001	SFE	
42	2A	052	0010 1010	SM/SW	
43	2B	053	0010 1011	CSP	
44	2C	054	0010 1100	MFA	
45	2D	055	0010 1101	ENQ	
46	2E	056	0010 1110	ACK	
47	2F	057	0010 1111	BEL	
48	30	060	0011 0000		
49	31	061	0011 0001		
50	32	062	0011 0010	SYN	
51	33	063	0011 0011	IR	
52	34	064	0011 0100	PP	
53	35	065	0011 0101	TRN	
54	36	066	0011 0110	NBS	
55	37	067	0011 0111	EOT	
56	38	070	0011 1000	SBS	
57	39	071	0011 1001	IT	
58	3A	072	0011 1010	RFF	
59	3B	073	0011 1011	CU3	
60	3C	074	0011 1100	DC4	
61	3D	075	0011 1101	NAK	
62	3E	076	0011 1110		
63	3F	077	0011 1111	SUB	
64	40	100	0100 0000	SP	
65	41	101	0100 0001	RSP	
66	42	102	0100 0010		

Dec	Hex	Octal	Binary	Name	Character
67	43	103	0100 0011		
68	44	104	0100 0100		
69	45	105	0100 0101		
70	46	106	0100 0110		
71	47	107	0100 0111		
72	48	110	0100 1000		
73	49	111	0100 1001		
74	4A	112	0100 1010		¢
75	4B	113	0100 1011		.
76	4C	114	0100 1100		<
77	4D	115	0100 1101		(
78	4E	116	0100 1110		+
79	4F	117	0100 1111		|
80	50	120	0101 0000		&
81	51	121	0101 0001		
82	52	122	0101 0010		
83	53	123	0101 0011		
84	54	124	0101 0100		
85	55	125	0101 0101		
86	56	126	0101 0110		
87	57	127	0101 0111		
88	58	130	0101 1000		
89	59	131	0101 1001		
90	5A	132	0101 1010		!
91	5B	133	0101 1011		$
92	5C	134	0101 1100		*
93	5D	135	0101 1101		)
94	5E	136	0101 1110		;
95	5F	137	0101 1111		ø
96	60	140	0110 0000		-
97	61	141	0110 0001		/
98	62	142	0110 0010		
99	63	143	0110 0011		
100	64	144	0110 0100		
101	65	145	0110 0101		
102	66	146	0110 0110		
103	67	147	0110 0111		
104	68	150	0110 1000		
105	69	151	0110 1001		
106	6A	152	0110 1010		|
107	6B	153	0110 1011		,
108	6C	154	0110 1100		%
109	6D	155	0110 1101		-
110	6E	156	0110 1110		>

(continues)

Table 3 Continued

Dec	Hex	Octal	Binary	Name	Character
111	6F	157	0110 1111		?
112	70	160	0111 0000		
113	71	161	0111 0001		
114	72	162	0111 0010		
115	73	163	0111 0011		
116	74	164	0111 0100		
117	75	165	0111 0101		
118	76	166	0111 0110		
119	77	167	0111 0111		
120	78	170	0111 1000		
121	79	171	0111 1001		‘
122	7A	172	0111 1010		:
123	7B	173	0111 1011		#
124	7C	174	0111 1100		@
125	7D	175	0111 1101		‘
126	7E	176	0111 1110		=
127	7F	177	0111 1111		“
128	80	200	1000 0000		
129	81	201	1000 0001		a
130	82	202	1000 0010		b
131	83	203	1000 0011		c
132	84	204	1000 0100		d
133	85	205	1000 0101		e
134	86	206	1000 0110		f
135	87	207	1000 0111		g
136	88	210	1000 1000		h
137	89	211	1000 1001		i
138	8A	212	1000 1010		
139	8B	213	1000 1011		
140	8C	214	1000 1100		
141	8D	215	1000 1101		
142	8E	216	1000 1110		
143	8F	217	1000 1111		
144	90	220	1001 0000		
145	91	221	1001 0001		j
146	92	222	1001 0010		k
147	93	223	1001 0011		l
148	94	224	1001 0100		m
149	95	225	1001 0101		n
150	96	226	1001 0110		o
151	97	227	1001 0111		p
152	98	230	1001 1000		q
153	99	231	1001 1001		r

Dec	Hex	Octal	Binary	Name	Character
154	9A	232	1001 1010		
155	9B	233	1001 1011		
156	9C	234	1001 1100		
157	9D	235	1001 1101		
158	9E	236	1001 1110		
159	9F	237	1001 1111		
160	A0	240	1010 0000		
161	A1	241	1010 0001		~
162	A2	242	1010 0010		s
163	A3	243	1010 0011		t
164	A4	244	1010 0100		u
165	A5	245	1010 0101		v
166	A6	246	1010 0110		w
167	A7	247	1010 0111		x
168	A8	250	1010 1000		y
169	A9	251	1010 1001		z
170	AA	252	1010 1010		
171	AB	253	1010 1011		
172	AC	254	1010 1100		
173	AD	255	1010 1101		
174	AE	256	1010 1110		
175	AF	257	1010 1111		
176	B0	260	1011 0000		
177	B1	261	1011 0001		
178	B2	262	1011 0010		
179	B3	263	1011 0011		
180	B4	264	1011 0100		
181	B5	265	1011 0101		
182	B6	266	1011 0110		
183	B7	267	1011 0111		
184	B8	270	1011 1000		
185	B9	271	1011 1001		
186	BA	272	1011 1010		
187	BB	273	1011 1011		
188	BC	274	1011 1100		
189	BD	275	1011 1101		
190	BE	276	1011 1110		
191	BF	277	1011 1111		
192	C0	300	1100 0000		{
193	C1	301	1100 0001		A
194	C2	302	1100 0010		B
195	C3	303	1100 0011		C
196	C4	304	1100 0100		D
197	C5	305	1100 0101		E

(continues)

Table 3 Continued

Dec	Hex	Octal	Binary	Name	Character
198	C6	306	1100 0110		F
199	C7	307	1100 0111		G
200	C8	310	1100 1000		H
201	C9	311	1100 1001		I
202	CA	312	1100 1010	SHY	
203	CB	313	1100 1011		
204	CC	314	1100 1100		
205	CD	315	1100 1101		
206	CE	316	1100 1110		
207	CF	317	1100 1111		
208	D0	320	1101 0000		}
209	D1	321	1101 0001		J
210	D2	322	1101 0010		K
211	D3	323	1101 0011		L
212	D4	324	1101 0100		M
213	D5	325	1101 0101		N
214	D6	326	1101 0110		O
215	D7	327	1101 0111		P
216	D8	330	1101 1000		Q
217	D9	331	1101 1001		R
218	DA	332	1101 1010		
219	DB	333	1101 1011		
220	DC	334	1101 1100		
221	DD	335	1101 1101		
222	DE	336	1101 1110		
223	DF	337	1101 1111		
224	E0	340	1110 0000		\
225	E1	341	1110 0001	NSP	
226	E2	342	1110 0010		S
227	E3	343	1110 0011		T
228	E4	344	1110 0100		U
229	E5	345	1110 0101		V
230	E6	346	1110 0110		W
231	E7	347	1110 0111		X
232	E8	350	1110 1000		Y
233	E9	351	1110 1001		Z
234	EA	352	1110 1010		
235	EB	353	1110 1011		
236	EC	354	1110 1100		
237	ED	355	1110 1101		
238	EE	356	1110 1110		
239	EF	357	1110 1111		

Dec	Hex	Octal	Binary	Name	Character
240	F0	360	1111 0000		0
241	F1	361	1111 0001		1
242	F2	362	1111 0010		2
243	F3	363	1111 0011		3
244	F4	364	1111 0100		4
245	F5	365	1111 0101		5
246	F6	366	1111 0110		6
247	F7	367	1111 0111		7
248	F8	370	1111 1000		8
249	F9	371	1111 1001		9
250	FA	372	1111 1010		
251	FB	373	1111 1011		
252	FC	374	1111 1100		
253	FD	375	1111 1101		
254	FE	376	1111 1110		
255	FF	377	1111 1111	EO	

Metric System (SI) Prefixes

Table 4 Metric System Prefixes

Multiplier	Exponent Form	Prefix	SI Symbol
1 000 000 000 000 000 000 000 000	10^{24}	yotta	Y
1 000 000 000 000 000 000 000	10^{21}	zetta	Z
1 000 000 000 000 000 000	10^{18}	exa	E
1 000 000 000 000 000	10^{15}	peta	P
1 000 000 000 000	10^{12}	tera	T
1 000 000 000	10^{9}	giga	G
1 000 000	10^{6}	mega	M
1 000	10^{3}	kilo	k
100	10^{2}	hecto	h
10	10^{1}	deca	da
0.1	10^{-1}	deci	d
0.01	10^{-2}	centi	c
0.001	10^{-3}	milli	m
0.000 001	10^{-6}	micro	µ
0.000 000 001	10^{-9}	nano	n
0.000 000 000 001	10^{-12}	pico	p
0.000 000 000 000 001	10^{-15}	femto	f
0.000 000 000 000 000 001	10^{-18}	atto	a
0.000 000 000 000 000 000 001	10^{-21}	zepto	z
0.000 000 000 000 000 000 000 001	10^{-24}	yocto	y

U.S.—Metric Units of Length Conversions

Table 5 Conversions from U.S. to Metric

1 inch = 2.54 centimeters = 25.4 millimeters
1 foot = 30.48 centimeters = .3048 meter
1 yard = .914 meter
1 mile = 1.609 kilometers

Table 6 Conversions from Metric to U.S.

1 millimeter = .03937 inch
1 centimeter = .3937 inch
1 meter = 3.2808 feet = 1.0936 yards = 39.37 inches
1 kilometer = .621 mile

Powers of 2

Table 7 Powers of 2

n	2^n	Hexadecimal
0	1	1
1	2	2
2	4	4
3	8	8
4	16	10
5	32	20
6	64	40
7	128	80
8	256	100
9	512	200
10	1,024	400
11	2,048	800
12	4,096	1000
13	8,192	2000
14	16,384	4000
15	32,768	8000
16	65,536	10000
17	131,072	20000
18	262,144	40000
19	524,288	80000
20	1,048,576	100000
21	2,097,152	200000
22	4,194,304	400000

n	2^n	Hexadecimal
23	8,388,608	800000
24	16,777,216	1000000
25	33,554,432	2000000
26	67,108,864	4000000
27	134,217,728	8000000
28	268,435,456	10000000
29	536,870,912	20000000
30	1,073,741,824	40000000
31	2,147,483,648	80000000
32	4,294,967,296	100000000
33	8,589,934,592	200000000
34	17,179,869,184	400000000
35	34,359,738,368	800000000
36	68,719,476,736	1000000000
37	137,438,953,472	2000000000
38	274,877,906,944	4000000000
39	549,755,813,888	8000000000
40	1,099,511,627,776	10000000000
41	2,199,023,255,552	20000000000
42	4,398,046,511,104	40000000000
43	8,796,093,022,208	80000000000
44	17,592,186,044,416	100000000000
45	35,184,372,088,832	200000000000
46	70,368,744,177,664	400000000000
47	140,737,488,355,328	800000000000
48	281,474,976,710,656	1000000000000
49	562,949,953,421,312	2000000000000
50	1,125,899,906,842,624	4000000000000
51	2,251,799,813,685,248	8000000000000
52	4,503,599,627,370,496	10000000000000
53	9,007,199,254,740,992	20000000000000
54	18,014,398,509,481,984	40000000000000
55	36,028,797,018,963,968	80000000000000
56	72,057,594,037,927,936	100000000000000
57	144,115,188,075,855,872	200000000000000
58	288,230,376,151,711,744	400000000000000
59	576,460,752,303,423,488	800000000000000
60	1,152,921,504,606,846,976	1000000000000000
61	2,305,843,009,213,693,952	2000000000000000
62	4,611,686,018,427,387,904	4000000000000000
63	9,223,372,036,854,775,808	8000000000000000
64	18,446,744,073,709,551,616	10000000000000000

Award BIOS Error Codes

Award BIOS Text Error Messages and Beep Codes

During the power on self test (POST), if the BIOS detects an error requiring you to do something, it will either sound a beep code or display a message. If a message is displayed, it will be accompanied by the following:

```
PRESS F1 TO CONTINUE, CTRL-ALT-ESC OR DEL TO ENTER SETUP
```

Currently there is only one beep code in the Award BIOS. A single long beep followed by two short beeps indicates that a video error has occurred and the BIOS cannot initialize the video screen to display any additional information.

One or more of the following messages may be displayed if the BIOS detects an error during the POST. Table 8 includes Award BIOS messages for both the ISA and the EISA BIOS.

Table 8 Award BIOS Error Messages (ISA and EISA BIOS)

Error Message	Description
BIOS ROM checksum error – System halted	The checksum of the BIOS code in the BIOS chip is incorrect, indicating the BIOS code may have become corrupt. Replace the BIOS.
CMOS battery failed	CMOS battery is no longer functional. Replace battery.
CMOS checksum error - Defaults loaded	Checksum of CMOS is incorrect, so the system loads the default equipment configuration. A checksum error may indicate that CMOS has become corrupt. This error might have been caused by a weak battery. Check the battery and replace if necessary.
CMOS CHECKSUM ERROR DISK BOOT FAILURE, INSERT SYSTEM DISK AND PRESS ENTER	Checksum of CMOS is incorrect. This can indicate that CMOS has become corrupt. This error may have been caused by a weak battery. Check the battery and replace if necessary.
CPU at nnnn	Displays the running speed of the CPU.
DISKETTE DRIVES OR TYPES MISMATCH ERROR - RUN SETUP	Type of diskette drive installed in the system is different from the CMOS definition. Run Setup to reconfigure the drive type correctly.
Display switch is set incorrectly.	The display switch on the motherboard can be set to either monochrome or color. This message indicates the switch is set to a different setting than indicated in Setup. Determine which setting is correct, and then either turn off the system and change the jumper; or, enter Setup and change the VIDEO selection.
DISPLAY TYPE HAS CHANGED SINCE LAST BOOT	Since last powering off the system, the display adapter has been changed. You must configure the system for the new display type.
EISA Configuration Checksum Error	The EISA nonvolatile RAM checksum is incorrect or cannot correctly read the EISA slot. This can indicate either the EISA nonvolatile memory has become corrupt or the slot has been configured incorrectly. Also be sure the card is installed firmly in the slot.
EISA Configuration Is Not Complete	The slot configuration information stored in the EISA nonvolatile memory is incomplete.
ERROR ENCOUNTERED INITIALIZING HARD DRIVE	Hard drive cannot be initialized. Be sure the adapter is installed correctly and all cables are correctly and firmly attached. Also be sure the correct hard drive type is selected in Setup.
ERROR INITIALIZING HARD DISK CONTROLLER	Cannot initialize controller. Make sure the cord is correctly and firmly installed in the bus. Be sure the correct hard drive type is selected in Setup. Also check to see if any jumper needs to be set correctly on the hard drive.

Error Message	Description
FLOPPY DISK CNTRLR ERROR OR NO CNTRLR PRESENT	Cannot find or initialize the floppy drive controller. Make sure the controller is installed correctly and firmly. If there are no floppy drives installed, be sure the Diskette Drive selection in Setup is set to NONE.
Floppy disk(s) fail	Cannot find or initialize the floppy drive controller or the drive. Make sure the controller is installed correctly. If no floppy drives are installed, be sure the Diskette Drive selection in Setup is set to NONE or AUTO.
HARD DISK initializing	Please wait a moment... Some hard drives require extra time to initialize.
HARD DISK INSTALL FAILURE	Cannot find or initialize the hard drive controller or the drive. Make sure the controller is installed correctly. If no hard drives are installed, be sure the Hard Drive selection in Setup is set to NONE.
Hard disk(s) diagnosis fail	The system may run specific disk diagnostic routines. This message appears if one or more hard disks return an error when the diagnostics run.
Invalid EISA Configuration	The nonvolatile memory containing EISA configuration information was programmed incorrectly or has become corrupt. Rerun EISA configuration utility to correctly program the memory.
Keyboard error or no keyboard present	Cannot initialize the keyboard. Make sure the keyboard is attached correctly and no keys are being pressed during the boot. If you are purposely configuring the system without a keyboard, set the error halt condition in Setup to HALT ON ALL, BUT KEYBOARD. This will cause the BIOS to ignore the missing keyboard and continue the boot.
Keyboard is locked out - Unlock the key	This message usually indicates that one or more keys have been pressed during the keyboard tests. Be sure no objects are resting on the keyboard.
Memory Address Error at...	Indicates a memory address error at a specific location. You can use this location along with the memory map for your system to find and replace the bad memory chips.
Memory parity Error at...	Indicates a memory parity error at a specific location. You can use this location along with the memory map for your system to find and replace the bad memory chips.
MEMORY SIZE HAS CHANGED SINCE LAST BOOT	Memory has been added or removed since the last boot. In EISA mode, use configuration utility to reconfigure the memory configuration. In ISA mode, enter Setup and enter the new memory size in the memory fields.
Memory Test	This message displays during a full memory test, counting down the memory areas being tested.
Memory test fail:	If POST detects an error during memory testing, additional information appears giving specifics about the type and location of the memory error.
Memory Verify Error at...	Indicates an error verifying a value already written to memory. Use the location along with your system's memory map to locate the bad chip.
No boot device was found.	This could mean that either a boot drive was not detected or the drive does not contain proper system boot files. Insert a system disk into drive A: and press Enter. If you assumed the system would boot from the hard drive, make sure the controller is inserted correctly and all cables are properly attached. Also be sure the disk is formatted as a boot device. Then reboot the system.
OFFENDING ADDRESS NOT FOUND	This message is used in conjunction with the I/O CHANNEL CHECK and RAM PARITY ERROR messages when the segment that has caused the problem cannot be isolated.
OFFENDING SEGMENT:	This message is used in conjunction with the I/O CHANNEL CHECK and RAM PARITY ERROR messages when the segment that has caused the problem has been isolated.

(continues)

Table 8 Continued

Error Message	Description
Override enabled - Defaults loaded	If the system cannot boot using the current CMOS configuration, the BIOS can override the current configuration with a set of BIOS defaults designed for the most stable, minimal-performance system operations.
PRESS A KEY TO REBOOT	This will be displayed at the bottom of the screen when an error occurs that requires you to reboot. Press any key to reboot the system.
Press ESC to skip memory test	You can press Esc to skip the full memory test.
PRESS F1 TO DISABLE NMI, F2 TO REBOOT	When BIOS detects a non-maskable interrupt condition during boot, this will allow you to disable the NMI and continue to boot; or you can reboot the system with the NMI enabled.
Press TAB to show POST screen	System OEMs may replace the Award BIOS POST display with their own proprietary display. Including this message in the OEM display permits the operator to switch between the OEM display and the default POST display.
Primary master hard disk fail	POST detects an error in the primary master IDE hard drive.
Primary slave hard disk fail	POST detects an error in the secondary master IDE hard drive.
RAM PARITY ERROR - CHECKING FOR SEGMENT...	Indicates a parity error in RAM.
Resuming from disk, Press TAB to show POST screen	Award offers a save-to-disk feature for notebook computers. This message may appear when the operator restarts the system after a save-to-disk shutdown. See the Press Tab... message earlier for a description of this feature.
Secondary master hard disk fail	POST detects an error in the primary slave IDE hard drive.
Secondary slave hard disk fail	POST detects an error in the secondary slave IDE hard drive.
Should Be Empty But EISA Board Found	A valid board ID was found in a slot that was configured as having no board ID.
Should Have EISA Board But Not Found	The board installed is not responding to the ID request, or no board ID has been found in the indicated slot.
Slot Not Empty	Indicates that a slot designated as empty by the EISA configuration utility actually contains a board.
SYSTEM HALTED, (CTRL-ALT-DEL) TO REBOOT...	Indicates the present boot attempt has been aborted and the system must be rebooted. Press and hold down the Ctrl and Alt keys and press Del.
Wrong Board In Slot	The board ID does not match the ID stored in the EISA nonvolatile memory.

Award BIOS POST Codes

Award BIOS POST Codes are shown in Table 9.

Table 9 Award BIOS POST Codes

POST (Hex)	Name	Description
C0h	Turn Off Chipset Cache	OEM specific-cache control
01h	Processor Test 1	Processor Status (1FLAGS) Verification. Tests the following processor status flags: carry, zero, sign, overflow. The BIOS will set each of these flags, verify they are set, and then turn each flag off and verify it is off.
02h	Processor Test 2	Read / write / verify all CPU registers except SS, SP, and BP with data pattern FF and 00.

POST (Hex)	Name	Description
03h	Initialize Chips	Disable NMI, PIE, AIE, UEI, SQWV. Disable video, parity checking, DMA. Reset math coprocessor. Clear all page registers, CMOS shutdown byte. Initialize timer 0, 1, and 2, including set EISA timer to a known state. Initialize DMA controllers 0 and 1. Initialize interrupt controllers 0 and 1. Initialize EISA extended registers.
04h	Test Memory Refresh Toggle	RAM must be periodically refreshed in order to keep the memory from decaying. This function ensures that the memory refresh function is working properly.
05h	Blank video, Initialize keyboard	Keyboard controller initialization.
06h	Reserved	
07h	Test CMOS Interface and Battery Status	Verifies CMOS is working correctly, detects bad battery.
Beh	Chipset Default Initialization	Program chipset registers with power on BIOS defaults.
C1h	Memory presence test	OEM-specific test to size onboard memory.
C5h	Early Shadow	OEM-specific early shadow; enable for fast boot.
C6h	Cache presence test	External cache size detection.
08h	Setup low memory	Early chip set initialization, memory presence test, OEM chip set routines, clear low 64KB of memory, test first 64KB memory.
09h	Early Cache Initialization	Cyrix CPU initialization, cache initialization.
0Ah	Setup Interrupt Vector Table	Initialize first 120 interrupt vectors with SPURIOUS_INT_HDLR and initialize INT 00h-1Fh according to INT_TBL.
0Bh	Test CMOS RAM Checksum	Test CMOS RAM Checksum; if bad, or Insert key is pressed, load defaults.
0Ch	Initialize keyboard	Detect type of keyboard controller (optional), set NUM_LOCK status.
0Dh	Initialize Video Interface	Detect CPU clock. Read CMOS location 14h to find out type of video in use. Detect and initialize video adapter.
0Eh	Test Video Memory	Test video memory, write sign-on message to screen. Setup shadow RAM. Enable shadow according to Setup.
0Fh	Test DMA Controller 0	BIOS checksum test. Keyboard detect and initialization.
10h	Test DMA Controller 1	Test DMA Controller.
11h	Test DMA Page Registers	Test DMA Page Registers.
12h	13 Reserved	None.
14h	Test Timer Counter 2	Test 8254 Timer 0 Counter 2.
15h	Test 8259-1 Mask Bits	Verify 8259 Channel 1 masked interrupts by alternately turning off and on the interrupt lines.
16h	Test 8259-2 Mask Bits	Verify 8259 Channel 2 masked interrupts by alternately turning off and on the interrupt lines.
17h	Test Stuck 8259's Interrupt Bits	Turn off interrupts then verify no interrupt mask register is on.
18h	Test 8259 Interrupt Functionality	Force an interrupt and verify the interrupt occurred.
19h	Test Stuck NMI Bits (Parity / IO Check)	Verify NMI can be cleared.
1Ah	Display CPU clock	None.

(continues)

Table 9 Continued

POST (Hex)	Name	Description
1B–1Eh	Reserved	None.
1Fh	Set EISA Mode	If EISA nonvolatile memory checksum is good, execute EISA initialization. If not, execute ISA tests and clear EISA mode flag. Test EISA Configuration Memory Integrity (checksum and communication interface).
20h	Enable Slot 0	Initialize slot 0 (System Board).
21-2Fh	Enable Slts 1–15	Initialize slots 1 through 15.
30h	Size Base and Extended Memory	Size base memory from 256KB–640KB and extended memory above 1MB.
31h	Test Base and Extended Memory	Test base memory from 256KB–640KB and extended memory above 1MB using various patterns. *Note:* This will be skipped in EISA mode and can be "skipped" with Esc key in ISA mode.
32h	Test EISA Extended Memory initialization	If EISA mode flag is set then test EISA memory found in slots. *Note:* This will be skipped in ISA mode and can be "skipped" with Esc key in EISA mode.
33–3Bh	Reserved	None.
3Ch	Setup Enabled	None.
3Dh	Initialize and Install Mouse	Detect if mouse is present, initialize mouse, install interrupt vectors.
3Eh	Setup Cache Controller	Initialize cache controller.
3Fh	Reserved	
BFh	Chipset Initialization	Program chipset registers with Setup values.
40h	Virus Protect	Display virus protect disable or enable.
41h	Initialize Floppy Drive and Controller	Initialize floppy disk drive controller and any drives.
42h	Initialize Hard Drive and Controller	Initialize hard drive controller and any drives.
43h	Detect and Initialize Serial / Parallel Ports	Initialize any serial and parallel ports (also game port).
44h	Reserved	None.
45h	Detect and Initialize Math Coprocessor	Initialize math coprocessor.
46h	Reserved	None.
47h	Reserved	None.
48–4Dh	Reserved	None.
4Eh	Manufacturing POST Loop or Display Messages	Reboot if manufacturing POST loop pin is set. Otherwise display any messages (that is, any non-fatal errors that were detected during POST) and enter Setup.
4Fh	Security Check	Ask password security (optional).
50h	Write CMOS	Write all CMOS values back to RAM and clear screen.
51h	Pre-boot Enable	Enable parity checker. Enable NMI. Enable cache before boot.
52h	Initialize Option ROMs	Initialize any option ROMs present from C8000h–EFFFFh. *Note:* When FSCAN option is enabled, will initialize from C8000h–F7FFFh.
53h	Initialize Time Value	Initialize time value in 40h: BIOS area.
60h	Setup Virus Protect	Setup virus protect according to Setup.

POST (Hex)	Name	Description
61h	Set Boot Speed	Set system speed for boot.
62h	Setup NumLock	Setup NumLock status.
63h	Boot Attempt	Set low stack boot via INT 19h.
B0h	Spurious	If interrupt occurs in protected mode.
B1h	Unclaimed NMI	If unmasked NMI occurs, display Press F1 to disable NMI, F2 reboot.
E1–Efh	Setup Pages	E1- Page 1, E2 - Page 2, etc.
FFh	Boot	None.

AMI BIOS Error Codes

AMI BIOS Text Error Messages

Table 10 AMI BIOS Text Error Messages

Message	Explanation
Bad PnP Serial ID Checksum	The Serial ID checksum of a Plug-and-Play card is invalid.
Floppy Disk Controller Resource Conflict	The floppy disk controller has requested a resource that is already in use.
NVRAM Checksum Error, NVRAM Cleared	The extended system configuration data (ESCD) was reinitialized because of an NVRAM checksum error. Clear CMOS and ESCD RAM and reboot.
NVRAM Cleared By Jumper	The Clear CMOS jumper has been moved to the Clear position. CMOS RAM and ESCD have been cleared.
NVRAM Data Invalid, NVRAM Cleared	Invalid data found in the ESCD, which might mean that you have changed devices in the system. When this message is displayed, the BIOS has already rewritten the ESCD with current configuration data.
Parallel Port Resource Conflict	The parallel port requested a resource that is already in use.
PCI Error Log is Full	More than 15 PCI conflict errors have been detected and no additional PCI errors can be logged.
PCI I/O Port Conflict	Two devices requested the same I/O address, resulting in a conflict.
PCI IRQ Conflict	Two devices requested the same IRQ, resulting in a conflict.
PCI Memory Conflict	Two devices requested the same memory resource, resulting in a conflict.
Primary Boot Device Not Found	The designated primary boot device (hard disk drive, floppy disk drive, CD-ROM drive) could not be found.
Primary IDE Controller Resource Conflict	The primary IDE controller has requested a resource that is already in use.
Primary Input Device Not Found	The designated primary input device (keyboard, mouse, or other device if input is redirected) could not be found.
Secondary IDE Controller Resource Conflict	The secondary IDE controller has requested a resource that is already in use.
Serial Port 1 Resource Conflict	Serial Port 1 has requested a resource that is already in use.
Serial Port 2 Resource Conflict	Serial Port 2 has requested a resource that is already in use.
Static Device Resource Conflict	A card that is not Plug-and-Play ISA has requested a resource that is already in use.
System Board Device Resource Conflict	A card that is not Plug-and-Play ISA has requested a resource that is already in use.

(continues)

Table 10 Continued

Message	Explanation
A20 Error	Gate A20 on the keyboard controller is not working.
Address Line Short!	Error in the address decoding circuitry on the motherboard.
CMOS Battery State Low	The battery power is low; replace battery.
CMOS Checksum Invalid	After CMOS RAM values are saved, a checksum value is generated for error checking. The previous value is different from the current value.
Run Setup	CMOS system options not set The values stored in CMOS RAM are either corrupt or nonexistent. Run Setup.
CMOS Display Type Mismatch	The video type in CMOS RAM does not match the type detected by the BIOS. Run Setup.
CMOS Memory Size Mismatch	The amount of memory on the motherboard is different from the amount indicated in CMOS RAM. Run Setup.
CMOS Time and Date Not Set	Run Setup to set the date and time in CMOS RAM.
Diskette Boot Failure	The boot disk in floppy drive A: is corrupt. It cannot be used to boot the system. Use another boot disk and follow the screen instructions.
DMA Error	Error in the DMA controller.
DMA #1 Error	Error in the first DMA controller.
DMA #2 Error	Error in the second DMA controller.
FDD Controller Failure	The BIOS cannot communicate with the floppy disk drive controller. Check all appropriate cables and connections.
HDD Controller Failure	The BIOS cannot communicate with the hard disk drive controller. Check all appropriate cables and connections.
Insert Bootable Media	The BIOS cannot find a bootable medium. Insert a bootable floppy disk or CD-ROM.
INTR #1 Error	Interrupt controller 1 failed POST.
INTR #2 Error	Interrupt controller 2 failed POST.
Invalid Boot Diskette	The BIOS can read the disk in floppy drive A:, but cannot boot the system from it. Use another boot disk.
KB/Interface Error	There is an error in the keyboard connector.
Keyboard Error	There is a timing problem with the keyboard.
Keyboard Stuck Key Detected	A stuck keyboard key was detected.
Off Board Parity Error	Parity error in memory installed in an expansion slot. The format is: OFF BOARD PARITY ERROR ADDR (HEX) = (*XXXX*), where *XXXX* is the hex address where the error occurred.
On Board Parity Error	Parity error in memory installed on the motherboard. The format is: ON BOARD PARITY ERROR ADDR (HEX) = (*XXXX*), where *XXXX* is the hex address where the error occurred.
Parity Error	Parity error in system memory at an unknown address.
System Halted!	An error caused the computer to halt.
Timer Channel 2 Error	There is an error in counter/timer 2.
Uncorrectable ECC Error	An uncorrectable ECC memory error was detected.
Undetermined NMI	An undetermined NMI was detected.
Memory Parity Error at *xxxxx*	Memory failed. If the memory location can be determined, it is displayed as *xxxxx*. If not, the message is Memory Parity Error ????.
I/O Card Parity Error at *xxxxx*	An expansion card failed. If the address can be determined, it is displayed as *xxxxx*. If not, the message is I/O Card Parity Error ????.
DMA Bus Time-out	A device has driven the bus signal for more than 7.8 microseconds.

AMI BIOS Beep Codes

Table 11 AMI BIOS Beep Codes

Beeps	Error Message	Description
1	DRAM Refresh Failure	The memory refresh circuitry on the motherboard is faulty.
2	Parity Error	A parity error occurred in system memory.
3	Base 64KB (First Bank) Memory Failure	Memory failure in the first bank of memory.
4	System Timer Failure	Memory failure in the first bank of memory, or timer 1 on the motherboard is not functioning.
5	Processor Error	The processor on the motherboard generated an error.
6	Keyboard Controller Gate A20 Failure	The keyboard controller might be bad. The BIOS cannot switch to protected mode.
7	Virtual Mode Processor Exception Interrupt Error	The processor generated an exception interrupt.
8	Display Memory Read / Write Error	The system video adapter is either missing or its memory is faulty.
9	ROM Checksum Error	ROM checksum value does not match the value encoded in BIOS.
10	CMOS Shutdown Register Read / Write Error	The shutdown register for CMOS RAM failed.
11	Cache Error / L2 Cache Bad	The L2 cache is faulty.
1 long, 3 short	Conventional / extended memory failure	The motherboard memory is faulty.
1 long, 8 short	Display / retrace test failed	The video card is faulty, try reseating or moving to a different slot.

AMI POST Codes

Table 12 AMI BIOS POST Codes

Code	POST Operation In Progress
00h	Give control to ROM in flash and execute boot.
00h	Execute boot.
02h	Disable internal cache. Keyboard controller test.
08h	Disable DMA controller #1, #2. Disable interrupt controller #1, #2. Reset video display.
0Dh	Check for signature of the board manufacturing company.
0Dh	If default jumper is set, go to Load CMOS Default.
0Eh	Check the validity of CMOS; if there is anything wrong or invalid, force to default.
0Fh	Load default CMOS settings.
10h	Clear error register, clear CMOS pending interrupt, check and set clock rate, check and set base memory size 512KB or 640KB.
10h	If base memory size is 640KB, allocate extended BIOS data area (EBDA). Otherwise, calculate the EBDA.

(continues)

Table 12 Continued

Code	POST Operation In Progress
10h	Set up overlay environment. Update setup Flags with current operating environment. Initialize interrupt vector pointing to the error handlers. Update setup Flags in EBDA. Initialize CMOS pointers in EBDA.
13h	Program all chipset registers.
15h	Initialize system timer.
1Bh	Go to real memory base 64KB test.
20h	16KB base RAM test.
23h	Hook made available prior to initializing the interrupt vector table.
23h	Setup interrupt vectors.
24h	Initialize and load interrupt vectors.
25h	Video rows initialization.
28h	Set monochrome mode.
29h	Set color display—color mode set.
2Ah	Clear parity status, if any.
2Bh	Custom video initialization required internally by some chipsets before video initialization.
2Ch	Test optional video ROM.
2Dh	Initialize registers internal to chipset after video initialization.
2Eh	Check for video ROM.
2Fh	Display memory read / write test.
30h	Test video horizontal and vertical tracing.
31h	Display video memory read / write test.
32h	Test video horizontal and vertical tracing. Beep if no video controller installed. Check for MDA.
34h	Setup video configuration (column x row). Display copyright message.
36h	Initialize messaging services. Clear the screen.
37h	Display the first screen sign-on.
39h	Update screen pointer. Display setup message. Display keyboard sign on. Display mouse sign-on.
40h	Memory test starting segment at 00000h.
43h	Calculate the memory size left to be tested.
4Fh	Disable caching. Check if the system memory size is larger than zero. Test and initialize to zero all DRAM. Remap memory partition if necessary. Test 1MB of memory. Update counter onscreen. Repeat memory test for each MB of memory until done.
52h	ChipsetAdjustMemorySize. Adjust any base of extended memory size because of chipset.
61h	Test DMA master page registers.
62h	Test DMA slave page registers.
65h	Program DMA controllers.
66h	Clear DMA write control registers.
67h	Unmask timer and NMI. Update master mask register.
80h	Run keyboard detection. Run mouse detection.
80h	Read interrupt mask; set up diskette ISR, #2, keyboard, and timer.
81h	8042 interface test; enable keyboard interrupt if keyboard is detected.
82h	Enable interrupt.
83h	Check and set keyboard lock bit.
88h	Floppy unit initialization. Floppy controller and data setup.

Code	POST Operation In Progress
8Ch	Set up interface between the BIOS POST and the device initialization management (DIM).
8Fh	Read interrupt mask. Unmask floppy interrupt. Setup floppy controller and data setup.
92h	Set up COM port and LPT port timeout values. Display wait message if setup key is pressed.
96h	Clear to bottom of the screen. Perform chipset initialization required before option ROM scans. Give control to ROM in flash.
97h	Verify and give control to optional ROM.
98h	Perform any chipset initialization required after option ROM scans; give control to ROM in flash.
9Ah	Adds MP entries for buses, I/O APIC, I/O INTRs, and LINTs.
9Dh	Timer data area initialization—set time and date.
A0h	Set up printer base addresses.
A0h	Enable internal cache.
A1h	Set COM base addresses. Keyboard stuck key check.
A2h	Reset floating point unit.
A3h	Log and display POST errors if any. Check to see if computer is in manufacturing mode. If there are POST errors, display setup key and boot key options.
A6h	Call Setup program if setup was requested.
A7h	Load and wait for the valid password; unmask INT-0A redirection.
ABh	Custom floating point unit initialization.
ACh	Initialize internal floating point unit.
ADh	Update CMOS with floating point unit presence.
ADh	A fatal error results in a continuous echo of 'DEAD' to port 80h—echo 'DE' (wait 1 sec.), echo 'AD' (wait 1 sec.).
AEh	Set typematic rate.
AFh	Read keyboard ID.
B0h	Process POST errors.
B1h	Test cache memory.
B3h	Set up display mode (40 × 25, 80 × 25).
B4h	Jump to PreOS (pre-operating system) module.
BBh	Perform work before registers and circular keyboard buffer are cleared. Reinitialize message services. Initialize APM. Perform post-SMI initialization. Circumvents EMM386's attempts to utilize the lower 32KB area base.
BBh	Fix CMOS read and CMOS write so that every call does not set NMI off. Shadow product information in the compatibility segment. Give a beep for boot. Handle chipset specific manipulation before boot. Check keyboard for data before MP manipulation.
D0h	Initialize DS, ES, GS, and FS. Check if keyboard system- bit is set. Check whether a hard or soft reset has occurred.
D1h	Power on initialization. Initialize special chipsets in power on/hard reset. Check cache size and type, write reserved cache size information to CMOS, determine processor speed (optional).
D2h	Disable NMI reporting.
D3h	Reset video adapter.
D4h	If the microprocessor is in protected mode, load GDT 4GB segment—ChipsetPreInit(). Disable L1 and L2 cache; perform any initialization required before the main chipset configuration is done.
D5h	System validity check. Calculate checksum.
D6h	Provides capability to do any special chipset initialization required before keyboard controller testing can begin.

(continues)

Table 12 Continued

Code	POST Operation In Progress
D7h	Flush the keyboard input buffer.
D8h	Issue keyboard BAT command.
D9h	Retrieve 8042 KBC output buffer.
DAh	If keyboard initialization failed, display error message and halt.
DBh	Provides capability to do any special chipset initialization after KBC test.
DDh	Initialize keyboard controller command byte.
DEh	A fatal error results in a continuous echo of 'DEAD' to port 80h, echo 'DE' (wait 1 sec.), and echo 'AD' (wait 1 sec).
DFh	Disable master/slave DMA controllers.
E0h	Initialize master/slave programmable interrupt controllers.
E1h	ChipsetInit. Preset any defaults needed to chipset registers.
E1h	Start the refresh timer(s) running.
E1h	Size all L2/L3 cache (if present/required).
E1h	Detect EDO memory module.
E1h	Size memory partition boundaries.
E1h	Disable all memory holes.
E1h	The 512–640KB must be DRAM mapped.
E1h	Gate A20 must be set and left set for POST.
E2h	Initialize timer channel 2 for speaker.
E3h	Initialize timer channel 0 for system timer.
E4h	Clear pending parity errors; disable and clear parity, reactivate parity.
E5h	Enter flat mode.
E6h	Test the first 2MB of system memory.
E7h	Get minimum memory partition size and test memory.
E8h	Remap SIMMs if failure detected and remapping supported.
E8h	Display error message and halt if remapping not supported.
E9h	After memory test, clear pending parity errors. Disable and clear parity, set bits to reactivate parity.
EAh	Set up stack for POST. Enable enhanced POST. Shadow FE00h block.
EBh	Look for the location of dispatcher in the packing list.
EBh	Call decompression dispatcher Init function.
ECh	Make F000h DRAM R/W enabled. Force use of EDI.
EDh	Actively dispatch BIOS.
F0h	Initialize I/O cards in slots.
F1h	Enable extended NMI sources.
F2h	Test extended NMI sources.
F3h	Display EISA error message, if any. Get keyboard controller vendor; program the keyboard controller.
F4h	Enable extended NMI sources.
F5h	Initialize mouse.

Note

Some port 80 codes are listed more than once because they test multiple functions. For example, code 0EBh tests both for the location of dispatcher in the packing list and for calling the decompression dispatcher Init function.

Phoenix BIOS Error Codes

Phoenix BIOS Text Error Messages

Table 13 Phoenix BIOS Text Error Messages

Error Message	Explanation
Diskette drive A error	Drive A: is present but fails the POST diskette tests. Check that the drive is defined with the proper diskette type in Setup and that the disk drive is installed correctly.
Extended RAM Failed at offset: nnnn	Extended memory not working or not configured properly at offset nnnn.
Failing Bits: nnnn	The hexadecimal number nnnn is a map of the bits at the RAM address (System, Extended, or Shadow memory) that failed the memory test. Each 1 in the map indicates a failed bit.
Fixed Disk 0 Failure Fixed Disk 1 Failure Fixed Disk Controller Failure	Fixed disk is not working or not configured properly. Check to see if fixed disk is installed properly. Run Setup to be sure the fixed-disk type is correctly identified.
Incorrect Drive A type - run SETUP	Type of diskette drive for drive A: not correctly identified in Setup.
Invalid NVRAM media type	Problem with NVRAM (CMOS) access.
Keyboard controller error	The keyboard controller failed test. Try replacing the keyboard.
Keyboard error	Keyboard not working.
Keyboard error nn	BIOS discovered a stuck key and displays the scan code nn for the stuck key.
Keyboard locked – Unlock key switch	Unlock the system to proceed.
Monitor type does not match CMOS - Run SETUP	Monitor type not correctly identified in Setup.
Operating system not found	Operating system cannot be located on either drive A: or C:. Enter Setup and see if fixed disk and drive A: are properly identified.
Parity Check 1	Parity error found in the system bus. BIOS attempts to locate the address and display it on the screen. If it cannot locate the address, it displays ????.
Parity Check 2	Parity error found in the I/O bus. BIOS attempts to locate the address and display it onscreen. If it cannot locate the address, it displays ????.
Press <F1> to resume, <F2> to Setup	Displayed after any recoverable error message. Press F1 to start the boot process or F2 to enter Setup and change any settings.
Real-time clock error	Real-time clock fails BIOS test. Might require motherboard repair.
Shadow RAM Failed at offset: nnnn	Shadow RAM failed at offset nnnn of the 64KB block at which the error was detected.
System battery is dead - Replace and run SETUP	The CMOS clock battery indicator shows the battery is dead. Replace the battery and run Setup to reconfigure the system.
System cache error – Cache disabled	RAM cache failed the BIOS test. BIOS disabled the cache.
System CMOS checksum bad - run SETUP	System CMOS RAM has been corrupted or modified incorrectly, perhaps by an application program that changes data stored in CMOS. Run Setup and reconfigure the system either by getting the default values or making your own selections.
System RAM Failed at offset: nnnn	System RAM failed at offset nnnn of the 64KB block at which the error was detected.
System timer error	The timer test failed. Requires repair of system motherboard.

Phoenix BIOS Beep Codes

Table 14 Phoenix BIOS Beep Codes

Beeps	Port 80h Code	Explanation
1-2-2-3	16h	BIOS ROM checksum
1-3-1-1	20h	Test DRAM refresh
1-3-1-3	22h	Test keyboard controller
1-3-3-1	28h	Autosize DRAM
1-3-3-2	29h	Initialize POST memory manager
1-3-3-3	2Ah	Clear 512KB base RAM
1-3-4-1	2Ch	RAM failure on address line *xxxx*
1-3-4-3	2Eh	RAM failure on data bits *xxxx* of low byte of memory bus
1-4-1-1	30h	RAM failure on data bits *xxxx* of high byte of memory bus
2-1-2-2	45h	POST device initialization
2-1-2-3	46h	Check ROM copyright notice
2-2-3-1	58h	Test for unexpected interrupts
2-2-4-1	5Ch	Test RAM between 512–640KB
1-2	98h	Search for option ROMs. One long and two short beeps on checksum failure

Phoenix BIOS POST Codes

Table 15 Phoenix BIOS POST Codes

Code	POST Operation in Progress
02h	Verify real mode
03h	Disable non-maskable interrupt (NMI)
04h	Get processor type
06h	Initialize system hardware
08h	Initialize chipset with initial POST values
09h	Set IN POST flag
0Ah	Initialize CPU registers
0Bh	Enable CPU cache
0Ch	Initialize caches to initial POST values
0Eh	Initialize I/O component
0Fh	Initialize the local bus IDE
10h	Initialize power management
11h	Load alternate registers with initial POST values
12h	Restore CPU control word during warm boot
13h	Initialize PCI bus mastering devices
14h	Initialize keyboard controller
16h	BIOS ROM checksum
17h	Initialize cache before memory autosize
18h	8254 timer initialization
1Ah	8237 DMA controller initialization

Code	POST Operation in Progress
1Ch	Reset programmable interrupt controller
20h	Test DRAM refresh
22h	Test keyboard controller
24h	Set ES segment register to 4GB
26h	Enable A20 line
28h	Autosize DRAM
29h	Initialize POST memory manager
2Ah	Clear 512KB base RAM
2Ch	RAM failure on address line *xxxx**
2Eh	RAM failure on data bits *xxxx** of low byte of memory bus
2Fh	Enable cache before system BIOS shadow
30h	RAM failure on data bits *xxxx** of high byte of memory bus
32h	Test CPU bus-clock frequency
33h	Initialize POST dispatch manager
34h	Test CMOS RAM
35h	Initialize alternate chipset registers
36h	Warm start shut down
37h	Reinitialize the chipset (motherboard only)
38h	Shadow system BIOS ROM
39h	Reinitialize the cache (motherboard only)
3Ah	Autosize cache
3Ch	Configure advanced chipset registers
3Dh	Load alternate registers with CMOS valuesnew
40h	Set Initial CPU speed new
42h	Initialize interrupt vectors
44h	Initialize BIOS interrupts
45h	POST device initialization
46h	Check ROM copyright notice
47h	Initialize manager for PCI option ROMs
48h	Check video configuration against CMOS RAM data
49h	Initialize PCI bus and devices
4Ah	Initialize all video adapters in system
4Bh	Display QuietBoot screen
4Ch	Shadow video BIOS ROM
4Eh	Display BIOS copyright notice
50h	Display CPU type and speed
51h	Initialize EISA motherboard
52h	Test keyboard
54h	Set key click if enabled
56h	Enable keyboard
58h	Test for unexpected interrupts
59h	Initialize POST display service
5Ah	Display prompt `Press F2 to enter SETUP`

(continues)

Table 15 Continued

Code	POST Operation in Progress
5Bh	Disable CPU cache
5Ch	Test RAM between 512–640KB
60h	Test extended memory
62h	Test extended memory address lines
64h	Jump to UserPatch1
66h	Configure advanced cache registers
67h	Initialize multiprocessor APIC
68h	Enable external and processor caches
69h	Setup System Management mode (SMM) area
6Ah	Display external L2 cache size
6Ch	Display shadow area message
6Eh	Display possible high address for UMB recovery
70h	Display error messages
72h	Check for configuration errors
74h	Test real-time clock
76h	Check for keyboard errors
7Ah	Test for key lock on
7Ch	Set up hardware interrupt vectors
7Eh	Initialize coprocessor if present
80h	Disable onboard Super I/O ports and IRQs
81h	Late POST device initialization
82h	Detect and install external RS232 ports
83h	Configure non-MCD IDE controllers
84h	Detect and install external parallel ports
85h	Initialize PC-compatible PnP ISA devices
86h	Reinitialize onboard I/O ports
87h	Configure motherboard configurable devices
88h	Initialize BIOS data area
89h	Enable non-maskable interrupts (NMIs)
8Ah	Initialize extended BIOS data area
8Bh	Test and initialize PS/2 mouse
8Ch	Initialize diskette controller
8Fh	Determine number of ATA drives
90h	Initialize hard-disk controllers
91h	Initialize local-bus hard-disk controllers
92h	Jump to UserPatch2
93h	Build MPTABLE for multiprocessor boards
94h	Disable A20 address line (Rel. 5.1 and earlier)
95h	Install CD-ROM for boot
96h	Clear huge ES segment register
97h	Fix up multiprocessor table
98h	Search for option ROMs
99h	Check for S.M.A.R.T. drive

Code	POST Operation in Progress
9Ah	Shadow option ROMs
9Ch	Set up power management
9Eh	Enable hardware interrupts
9Fh	Determine number of ATA and SCSI drives
A0h	Set time of day
A2h	Check key lock
A4h	Initialize typematic rate
A8h	Erase F2 prompt
AAh	Scan for F2 key stroke
ACh	Enter SETUP
AEh	Clear IN POST flag
B0h	Check for errors
B2h	POST done; prepare to boot operating system
B4h	One short beep before boot
B5h	Terminate QuietBoot
B6h	Check password (optional)
B8h	Clear global descriptor table
B9h	Clean up all graphics
Bah	Initialize DMI parameters
BBh	Initialize PnP Option ROMs
BCh	Clear parity checkers
BDh	Display MultiBoot menu
BEh	Clear screen (optional)
BFh	Check virus and backup reminders
C0h	Try to boot with INT 19h
C1h	Initialize POST Error Manager (PEM)
C2h	Initialize error logging
C3h	Initialize error display function
C4h	Initialize system error handler
E0h	Initialize the chipset
E1h	Initialize the bridge
E2h	Initialize the processor
E3h	Initialize system timer
E4h	Initialize system I/O
E5h	Check force recovery boot
E6h	Checksum BIOS ROM
E7h	Go to BIOS
E8h	Set huge segment
E9h	Initialize multiprocessor
EAh	Initialize OEM special code
EBh	Initialize PIC and DMA
ECh	Initialize memory type
EDh	Initialize memory size

(continues)

Table 15 Continued

Code	POST Operation in Progress
EEh	Shadow boot block
EFh	System memory test
F0h	Initialize interrupt vectors
F1h	Initialize runtime clock
F2h	Initialize video
F3h	Initialize beeper
F4h	Initialize boot
F5h	Clear huge segment
F6h	Boot to mini-DOS
F7h	Boot to full DOS

*If the BIOS detects error 2C, 2E, or 30 (base 512KB RAM error), it displays an additional word-bitmap (*xxxx*) indicating the address line or bits that failed. For example,* 2C 0002 *means address line 1 (bit one set) has failed.* 2E 1020 *means data bits 12 and 5 (bits 12 and 5 set) have failed. The BIOS also sends this bitmap to the port-80 LED display. It first displays the check point code, followed by a delay, the high-order byte, another delay, and then the low-order byte of the error. It repeats this sequence continuously. Even with this information, normally you won't be able to replace the individual chips that are bad; you'll have to replace the entire bank of memory instead.*

Microid Research (MR) BIOS Error Codes

Microid Research Beep Codes

The MR BIOS generates patterns of high and low beeps to signal an error condition. The beep codes are shown in Table 16.

Table 16 Microid Research Beep Codes

Port 80h Code	Beep Codes	Error Messages
03h	LH-LLL	ROM-BIOS Checksum Failure
04h	LH-HLL	DMA Page Register Failure
05h	LH-LHL	Keyboard Controller Selftest Failure
08h	LH-HHL	Memory Refresh Circuitry Failure
09h	LH-LLH	Master (16-bit) DMA Controller Failure
09h	LH-HLH	Slave (8-bit) DMA Controller Failure
0Ah	LH-LLLL	Base 64KB Pattern Test Failure
0Ah	LH-HLLL	Base 64KB Parity Circuitry Failure
0Ah	LH-LHLL	Base 64KB Parity Error
0Ah	LH-HHLL	Base 64KB Data Bus Failure
0Ah	LH-LLHL	Base 64KB Address Bus Failure
0Ah	LH-HLHL	Base 64KB Block Access Read Failure
0Ah	LH-LHHL	Base 64KB Block Access Read / Write Failure
0Bh	LH-HHHL	Master 8259 (Port 21) Failure
0Bh	LH-LLLH	Slave 8259 (Port A1) Failure

Port 80h Code	Beep Codes	Error Messages
0Ch	LH-HLLH	Master 8259 (Port 20) Interrupt Address Error
0Ch	LH-LHLH	Slave 8259 (Port A0) Interrupt Address Error
0Ch	LH-HHLH	8259 (Port 20/A0) Interrupt Address Error
0Ch	LH-LLHH	Master 8259 (Port 20) Stuck Interrupt Error
0Ch	LH-HLHH	Slave 8259 (Port A0) Stuck Interrupt Error
0Ch	LH-LHHH	System Timer 8254 CH0/IRQ0 Interrupt Failure
0Dh	LH-HHHH	8254 Channel 0 (System Timer) Failure
0Eh	LH-LLLLH	8254 Channel 2 (Speaker) Failure
0Eh	LH-HLLLH	8254 OUT2 (Speaker Detect) Failure
0Fh	LH-LHLLH	CMOS RAM Read/Write Test Failure
0Fh	LH-HHLLH	RTC Periodic Interrupt/IRQ8 Failure
10h	LH-LLHLH	Video ROM Checksum Failure at Address *XXXX*, Mono Card Memory Error at Address *XXXX*, Mono Card Memory Address Line Error at Address *XXXX*, Color Graphics Card Memory Error at Address *XXXX*, Color Graphics Card Address Line Error at Address *XXXX*
11h	(None)	Real Time Clock (RTC) Battery is Discharged
11h	(None)	Battery Backed Memory (CMOS) is Corrupt
12h	LH-HLHLH	Keyboard Controller Failure
14h 18h 19h	LH-LHHLH	Memory Parity Error
14h 18h 19h	LH-HHHLH	I/O Channel Error
14h 18h 19h	(None)	RAM Pattern Test Failed at *XXXX*, Parity Circuit Failure in Bank *XXXX*, Data Bus Test Failed: Address *XXXX*, Address Line Test Failed at XXXX, Block Access Read Failure at Address *XXXX*, Block Access Read/Write Failure: Address *XXXX*, Banks Decode to Same Location: *XXXX* and *YYYY*
12h	(None)	Keyboard Error - Stuck Key Keyboard Failure or no 15hKeyboard Present
17h	LH-LLLHH	A20 Test Failure Due to 8042 Timeout
17h	LH-HLLHH	A20 Gate Stuck in Disabled State (A20=0)
17h	(None)	A20 Gate Stuck in Asserted State (A20 Follows CPU)
1Ah	LH-LHLHH	Real Time Clock (RTC) is Not Updating
1Ah	(None)	Real Time Clock (RTC) Settings are Invalid
1Eh	(None)	Diskette CMOS Configuration is Invalid, Diskette Controller Failure, Diskette Drive A: Failure, Diskette Drive B: Failure
1Fh	(None)	Fixed Disk CMOS Configuration is Invalid, Fixed Disk C:(80) Failure, Fixed Disk D:(81) Failure, Please Wait for Fixed Disk to Spin Up

(continues)

Table 16 Continued

Port 80h Code	Beep Codes	Error Messages
20h	(None)	Fixed Disk, Diskette, Serial Port, Parallel Port, Video, Memory, or Numeric Coprocessor Configuration Change
21h	(None)	System Key is in Locked Position - Turn Key to Unlocked Position
29h	(None)	Adapter ROM Checksum Failure at Address *XXXX*

L = Low tone

H = High tone

Microid Research POST Codes

Table 17 Microid Research POST Codes

POST Code	Meaning
00h	Cold-Boot commences. (Not seen with warm boot).
01h	HOOK 00. OEM specific, typically resets chipset to default.
02h	Disable critical I/O: 6845s, 8237s, 765, and parity latches.
03h	BIOS checksum test.
04h	Page register test. (Ports 81–8F).
05h	8042 (Keyboard Controller) Selftest.
06h	Gang Port Init: 8237 m/s, 8254 ch2/1, RTC REG F/A, 8259 m/s.
07h	HOOK 01. OEM specific, typically disables cache, shadow.
08h	Refresh toggle test (PORTB).
09h	Pattern test master/slave 8237s, eight 16-bit regs each.
0Ah	Base 64KB memory test.
0Bh	Pattern test master/slave 8259 mask regs.
0Ch	8259/IRQ tests, purge powerup ints.
0Dh	8254 channel-0 test and initialization.
0Eh	8254 channel-2 toggle test, test speaker circuitry.
0Fh	RTC tests/inits: Init REG-B, write/readback NVRAM, PIE test.
13h	HOOK 02. OEM specific, select 8MHz bus.
10h	Video Initialization.
11h	CMOS checksum test.
12h	Signon msg, Accept KB BAT, perform first try KB init, cold-boot delay.
14h	Size/Test base memory (low 64KB already done).
15h	Perform second try KB init, if necessary.
16h	HOOK 03. OEM specific. Size/test cache.
17h	Test A20 gate, off then on.
18h	Size/Test extended memory.
19h	HOOK 04 and Size/Test system memory (“special” OEM memory).

POST Code	Meaning
1Ah	Test RTC Update-In-Progress and validate time.
1Bh	Serial port determination, off-board / onboard.
1Ch	Parallel port determination, off-board / onboard.
1Dh	Coprocessor determination / initialization.
1Eh	Floppy controller test / determination, CMOS validation.
1Fh	Fixed Disk controller test / determination, CMOS validation.
20h	Rigorous CMOS parameter validation, display other config. changes.
21h	Front-Panel lock check, wait for user to acknowledge errors.
22h	Set NumLock, Password-Security Trap, dispatch to Setup utility.
23h	HOOK 05. OEM specific.
24h	Set typematic rate.
28h	HOOK 06. OEM specific, typically enables shadow, cache, turbo.
25h	Floppy subsystem initialization.
26h	Fixed subsystem initialization.
27h	ACK errors, set primary adapter video mode.
29h	Disable A20-gate, set low stack, install C800-E000 ROMs.
2Ah	ACK errors, set video mode, set DOS time variables from RTC.
2Bh	Enable parity checking and NMI.
2Ch	Install E000 ROM.
2Dh	ACK errors.
2Eh	HOOK 07. OEM specific. Log-in EMS (if built-in).
2Fh	Pass control to INT19 (boot disk).

IBM BIOS Beep and Alphanumeric Error Codes

After completing the POST, an audio code indicates either a normal condition or that one of several errors has occurred.

Table 18 IBM POST Audio Error Codes

Audio Code	Sound Graph	Description
1 short beep	•	Normal POST—system OK
2 short beeps	••	POST error—error code on display
No beep		Power supply, system board
Continuous beep	————	Power supply, system board
Repeating short beeps	••••••	Power supply, system board
1 long, 1 short beep	–•	System board
1 long, 2 short beeps	–••	Video adapter (MDA / CGA)
1 long, 3 short beeps	–•••	Video adapter (EGA / VGA)
3 long beeps	– – –	3270 keyboard card

IBM has developed a system in which the first part of the error code indicates the device the error involves, and the last part indicates the exact error meaning. One of the biggest problems with these error codes is that IBM does not publish a complete list of the errors in any single publication; instead, it details specific error codes in many different publications. I have researched these codes for many years; the following table represents all the codes I have found meanings for. These codes have been selected from a number of sources, including all IBM's technical-reference and hardware-maintenance service manuals.

Table 19 IBM POST and Diagnostics Error Codes

Code	Description
1xx	**System Board Errors**
101	System board interrupt failure (unexpected interrupt).
102	System board timer failure.
102	PS/2; real-time clock (RTC)/64 byte CMOS RAM test failure.
103	System board timer interrupt failure.
103	PS/2; 2KB CMOS RAM extension test failure.
104	System board protected mode failure.
105	System board 8042 keyboard controller command failure.
106	System board converting logic test failure.
107	System board non-maskable interrupt (NMI) test failure; hot NMI.
108	System board timer bus test failure.
109	System board memory select error; low MB chip select test failed.
110	PS/2 system board parity check error (PARITY CHECK 1).
111	PS/2 I/O channel (bus) parity check error (PARITY CHECK 2).
112	PS/2 Micro Channel Arbitration error; watchdog time-out (NMI error).
113	PS/2 Micro Channel Arbitration error; DMA arbitration time-out (NMI error).
114	PS/2 external ROM checksum error.
115	Cache parity error, ROM checksum error or DMA error.
116	System board port read/write failure.
118	System board parity or L2-cache error during previous power-on.
119	"E" Step level 82077 (floppy controller) and 2.88MB drive installed (not supported).
120	Microprocessor self-test error.
121	256KB ROM checksum error (second 128KB bank).
121	Unexpected hardware interrupts occurred.
131	PC system board cassette port wrap test failure.
131	Direct memory access (DMA) compatibility registers error.
132	Direct memory access (DMA) extended registers error.
133	Direct memory access (DMA) verify logic error.
134	Direct memory access (DMA) arbitration logic error.
151	Battery or CMOS RAM failure.
152	Real-time clock or CMOS RAM failure.
160	PS/2 system board ID not recognized.
161	CMOS configuration empty (dead battery).

Code	Description
1xx	**System Board Errors**
162	CMOS checksum error or adapter ID mismatch.
163	CMOS error; date and time not set (clock not updating).
164	Memory size error; CMOS setting does not match memory.
165	PS/2 Micro Channel adapter ID and CMOS mismatch.
166	PS/2 Micro Channel adapter time-out error (card busy).
167	PS/2 CMOS clock not updating.
168	CMOS configuration error (math coprocessor).
169	System board and processor card configuration mismatch. Run Setup.
170	ASCII setup conflict error.
170	PC Convertible; LCD not in use when suspended.
171	Rolling-bit-test failure on CMOS shutdown address byte.
171	PC Convertible; base 128KB checksum failure.
172	Rolling-bit-test failure on NVRAM diagnostic byte.
172	PC Convertible; diskette active when suspended.
173	Bad CMOS/NVRAM checksum.
173	PC Convertible; real-time clock RAM verification error.
174	Bad configuration.
174	PC Convertible; LCD configuration changed.
175	Bad EEPROM CRC #1.
175	PC Convertible; LCD alternate mode failed.
176	Tamper evident.
177	Bad PAP (privileged-access password) CRC.
177	Bad EEPROM.
178	Bad EEPROM.
179	NVRAM error log full.
180x	Sub Address data error, where *x* = the slot number that caused the error.
181	Unsupported configurations.
182	Privileged-access switch (JMP2) is not in the write-enable position.
183	PAP is needed to boot from the system programs.
183	Privileged-access password required.
184	Bad power-on password checksum—erase it.
184	Bad power-on password.
185	Bad startup sequence.
186	Password-protection hardware error.
187	Serial number error.
188	Bad EEPROM checksum CRC #2.
189	Excessive incorrect password attempts.
191	82385 cache controller test failure.
194	System board memory error.
199	User indicated INSTALLED DEVICES list is not correct.

(continues)

Table 19 Continued

Code	Description
2xx	**Memory (RAM) Errors**
20x	Memory error.
201	Memory test failure; error location might be displayed.
202	Memory address error; lines 00–15.
203	Memory address error; lines 16–23 (ISA) or 16–31 (MCA).
204	Memory remapped due to error (run diagnostics again).
205	Base 128KB memory error; memory remapped.
207	ROM failure.
210	System board memory parity error.
211	PS/2 memory; base 64KB on system board failed.
212	Watchdog time-out error (reported by NMI interrupt handler).
213	DMA bus arbitration time-out (reported by NMI interrupt handler).
215	PS/2 memory; base 64KB on daughter/SIP 2 failed.
216	PS/2 memory; base 64KB on daughter/SIP 1 failed.
221	PS/2 memory; ROM to RAM copy failed (ROM shadowing).
225	PS/2 memory; wrong-speed memory on system board, unsupported SIMM.
230	Overlapping adapter and planar memory (Family 1).
231	Non-contiguous adapter memory installed (Family 1).
231	2/4-16MB Enhanced 386 memory adapter; memory module 1 failed.
235	Stuck data line on memory module, microprocessor or system board.
241	2/4-16MB Enhanced 386 memory adapter; memory module 2 failed.
251	2/4-16MB Enhanced 386 memory adapter; memory module 3 failed.
3xx	**Keyboard Errors**
301	Keyboard reset or stuck key failure (SS 301, SS = scan code in hex).
302	System unit keylock is locked.
303	Keyboard-to-system board interface error; keyboard controller failure.
304	Keyboard or system board error; keyboard clock high.
305	Keyboard +5v dc error; PS/2 keyboard fuse (on system board) error.
306	Unsupported keyboard attached.
341	Keyboard error.
342	Keyboard cable error.
343	Keyboard LED card or cable failure.
365	Keyboard LED card or cable failure.
366	Keyboard interface cable failure.
367	Keyboard LED card or cable failure.
4xx	**Monochrome Display Adapter (MDA) Errors**
4xx	**PS/2 System Board Parallel Port Errors**
401	Monochrome memory, horizontal sync frequency, or video test failure.
401	PS/2 system board parallel port failure.
408	User indicated display attributes failure.

Code	Description
4xx	**PS/2 System Board Parallel Port Errors**
416	User indicated character set failure.
424	User indicated 80525 mode failure.
432	Parallel port test failure; monochrome display adapter.
5xx	**Color Graphics Adapter (CGA) Errors**
*501	CRT error.
501	CGA memory, horizontal sync frequency, or video test failure.
503	CGA adapter controller failed.
508	User indicated display attribute failure.
516	User indicated character set failure.
524	User indicated 80×25 mode failure.
532	User indicated 40×25 mode failure.
540	User indicated 320×200 graphics mode failure.
548	User indicated 640×200 graphics mode failure.
556	User indicated light-pen test failed.
564	User indicated paging test failure.
6xx	**Floppy Drive/Controller Errors**
601	Floppy drive/controller POST failure; disk drive or controller error.
602	Diskette boot sector is not valid.
603	Diskette size error.
604	Non-media sense.
605	Diskette drive locked.
606	Diskette verify test failure.
607	Write-protect error.
608	Drive-command error.
610	Diskette initialization failure; track 0 bad.
611	Drive time-out error.
612	Controller chip (NEC) error.
613	Direct memory access (DMA) error.
614	Direct memory access (DMA) boundary overrun error.
615	Drive index timing error.
616	Drive speed error.
621	Drive seek error.
622	Drive cyclic redundancy check (CRC) error.
623	Sector not found error.
624	Address mark error.
625	Controller chip (NEC) seek error.
626	Diskette data compare error.
627	Diskette change error.
628	Diskette removed.
630	Index stuck high; drive A:.

(continues)

Table 19 Continued

Code	Description
6xx	**Floppy Drive/Controller Errors**
631	Index stuck low; drive A:.
632	Track 0 stuck off; drive A:.
633	Track 0 stuck on; drive A:.
640	Index stuck high; drive B:.
641	Index stuck low; drive B:.
642	Track 0 stuck off; drive B:.
643	Track 0 stuck on; drive B:.
645	No index pulse.
646	Drive track 0 detection failed.
647	No transitions on read data line.
648	Format test failed.
649	Incorrect media type in drive.
650	Drive speed error.
651	Format failure.
652	Verify failure.
653	Read failure.
654	Write failure.
655	Controller error.
656	Drive failure.
657	Write-protect stuck protected.
658	Changeline stuck changed.
659	Write-protect stuck unprotected.
660	Changeline stuck unchanged.
7xx	**Math Coprocessor Errors**
701	Math coprocessor presence/initialization error.
702	Exception errors test failure.
703	Rounding test failure.
704	Arithmetic test 1 failure.
705	Arithmetic test 2 failure.
706	Arithmetic test 3 (80387 only) failure.
707	Combination test failure.
708	Integer load/store test failure.
709	Equivalent expressions errors.
710	Exception (interrupt) errors.
711	Save state (FSAVE) errors.
712	Protected mode test failure.
713	Special test (voltage/temperature sensitivity) failure.
9xx	**Parallel Printer Adapter Errors**
901	Printer adapter data register latch error.
902	Printer adapter control register latch error.

Code	Description
9xx	**Parallel Printer Adapter Errors**
903	Printer adapter register address decode error.
904	Printer adapter address decode error.
910	Status line(s) wrap connector error.
911	Status line bit 8 wrap error.
912	Status line bit 7 wrap error.
913	Status line bit 6 wrap error.
914	Status line bit 5 wrap error.
915	Status line bit 4 wrap error.
916	Printer adapter interrupt wrap error.
917	Unexpected printer adapter interrupt.
92x	Feature register error.
10xx	**Alternate Parallel Printer Adapter Errors**
1001	Printer adapter data register latch error.
1002	Printer adapter control register latch error.
1003	Printer adapter register address decode error.
1004	Printer adapter address decode error.
1010	Status line(s) wrap connector error.
1011	Status line bit 8 wrap error.
1012	Status line bit 7 wrap error.
1013	Status line bit 6 wrap error.
1014	Status line bit 5 wrap error.
1015	Status line bit 4 wrap error.
1016	Printer adapter interrupt wrap error.
1017	Unexpected printer adapter interrupt.
102x	Feature register error.
11xx	**Primary Async Communications (Serial COM1:) Errors**
1101	16450/16550 chip error; serial port A error.
1102	Card selected feedback error.
1102	PC Convertible internal modem test failed.
1103	Port 102h register test failure.
1103	PC Convertible internal modem dial tone test 1 failed.
1104	PC Convertible internal modem dial tone test 2 failed.
1106	Serial option cannot be put to sleep.
1107	Cable error.
1108	Interrupt request (IRQ) 3 error.
1109	Interrupt request (IRQ) 4 error.
1110	16450/16550 chip register failure.
1111	Internal wrap test of 16450/16550 chip modem control line failure.
1112	External wrap test of 16450/16550 chip modem control line failure.
1113	16450/16550 chip transmit error.

(continues)

Table 19 Continued

Code	Description
11xx	**Primary Async Communications (Serial COM1:) Errors**
1114	16450/16550 chip receive error.
1115	16450/16550 chip receive error; data not equal to transmit data.
1116	16450/16550 chip interrupt function error.
1117	16450/16550 chip baud rate test failure.
1118	16450/16550 chip receive external data wrap test failure.
1119	16550 chip first-in/first-out (FIFO) buffer failure.
1120	Interrupt enable register error; all bits cannot be set.
1121	Interrupt enable register error; all bits cannot be reset.
1122	Interrupt pending; stuck on.
1123	Interrupt ID register; stuck on.
1124	Modem control register error; all bits cannot be set.
1125	Modem control register error; all bits cannot be reset.
1126	Modem status register error; all bits cannot be set.
1127	Modem status register error; all bits cannot be reset.
1128	Interrupt ID error.
1129	Cannot force overrun error.
1130	No modem status interrupt.
1131	Invalid interrupt pending.
1132	No data ready.
1133	No data available interrupt.
1134	No transmit holding interrupt.
1135	No interrupts.
1136	No received sine status interrupt.
1137	No receive data available.
1138	Transmit holding register not empty.
1139	No modem status interrupt.
1140	Transmit holding register not empty.
1141	No interrupts.
1142	No interrupt 4.
1143	No interrupt 3.
1144	No data transferred.
1145	Maximum baud rate error.
1146	Minimum baud rate error.
1148	Time-out error.
1149	Invalid data returned.
1150	Modem status register error.
1151	No data set ready and delta data set ready.
1152	No data set ready.
1153	No delta data set ready.
1154	Modem status register not clear.
1155	No clear to send and delta clear to send.

Code	Description
11xx	**Primary Async Communications (Serial COM1:) Errors**
1156	No clear to send.
1157	No delta clear to send.
12xx	**Alternate Async Communications (Serial COM2:, COM3:, and COM4:) Errors**
1201	16450/16550 chip error.
1202	Card selected feedback error.
1203	Port 102h register test failure.
1206	Serial option cannot be put to sleep.
1207	Cable error.
1208	Interrupt request (IRQ) 3 error.
1209	Interrupt request (IRQ) 4 error.
1210	16450/16550 chip register failure.
1211	Internal wrap test of 16450/16550 chip modem control line failure.
1212	External wrap test of 16450/16550 chip modem control line failure.
1213	16450/16550 chip transmit error.
1214	16450/16550 chip receive error.
1215	16450/16550 chip receive error; data not equal to transmit data.
1216	16450/16550 chip interrupt function error.
1217	16450/16550 chip baud rate test failure.
1218	16450/16550 chip receive external data wrap test failure.
1219	16550 chip first-in first-out (FIFO) buffer failure.
1220	Interrupt enable register error; all bits cannot be set.
1221	Interrupt enable register error; all bits cannot be reset.
1222	Interrupt pending; stuck on.
1223	Interrupt ID register; stuck on.
1224	Modem control register error; all bits cannot be set.
1225	Modem control register error; all bits cannot be reset.
1226	Modem status register error; all bits cannot be set.
1227	Modem status register error; all bits cannot be reset.
1228	Interrupt ID error.
1229	Cannot force overrun error.
1230	No modem status interrupt.
1231	Invalid interrupt pending.
1232	No data ready.
1233	No data available interrupt.
1234	No transmit holding interrupt.
1235	No interrupts.
1236	No received sine status interrupt.
1237	No receive data available.
1238	Transmit holding register not empty.
1239	No modem status interrupt.

(continues)

Table 19 Continued

Code	Description
12xx	**Alternate Async Communications (Serial COM2:, COM3:, and COM4:) Errors**
1240	Transmit holding register not empty.
1241	No interrupts.
1242	No interrupt 4.
1243	No interrupt 3.
1244	No data transferred.
1245	Maximum baud rate error.
1246	Minimum baud rate error.
1248	Time-out error.
1249	Invalid data returned.
1250	Modem status register error.
1251	No data set ready and delta data set ready.
1252	No data set ready.
1253	No delta data set ready.
1254	Modem status register not clear.
1255	No clear to send and delta clear to send.
1256	No clear to send.
1257	No delta clear to send.
13xx	**Game Control Adapter Errors**
1301	Game control adapter test failure.
1302	Joystick test failure.
14xx	**Matrix Printer Errors**
1401	Printer test failure.
1402	Printer not ready error.
1403	Printer no-paper error.
1404	System board time-out.
1405	Parallel adapter failure.
1406	Printer presence test failed.
15xx	**Synchronous Data Link Control (SDLC) Communications Adapter Errors**
1501	SDLC adapter test failure.
1510	8255 Port B failure.
1511	8255 Port A failure.
1512	8255 Port C failure.
1513	8253 Timer #1 did not reach terminal count.
1514	8253 Timer #1 stuck on.
1515	8253 Timer #0 did not reach terminal count.
1516	8253 Timer #0 stuck on.
1517	8253 Timer #2 did not reach terminal count.

Code	Description
15xx	**Synchronous Data Link Control (SDLC) Communications Adapter Errors**
1518	8253 Timer #2 stuck on.
1519	8273 Port B error.
1520	8273 Port A error.
1521	8273 command/read time-out.
1522	Interrupt Level 4 failure.
1523	Ring Indicate stuck on.
1524	Receive Clock stuck on.
1525	Transmit Clock stuck on.
1526	Test Indicate stuck on.
1527	Ring Indicate not on.
1528	Receive Clock not on.
1529	Transmit Clock not on.
1530	Test Indicate not on.
1531	Data Set Ready not on.
1532	Carrier Detect not on.
1533	Clear to Send not on.
1534	Data Set Ready stuck on.
1535	Carrier Detect stuck on.
1536	Clear to Send stuck on.
1537	Interrupt Level 3 failure.
1538	Receive interrupt results error.
1539	Wrap data compare error.
1540	Direct memory access Channel 1 error.
1541	Direct memory access Channel 1 error.
1542	8273 error-checking or status-reporting error.
1547	Stray interrupt Level 4.
1548	Stray interrupt Level 3.
1549	Interrupt presentation sequence time-out.
16xx	**Display Station Emulation Adapter (DSEA) Errors (5520, 525x)**
1604	DSEA or twinaxial network error.
1608	DSEA or twinaxial network error.
1624	DSEA error.
1634	DSEA error.
1644	DSEA error.
1652	DSEA error.
1654	DSEA error.
1658	DSEA error.
1662	DSEA interrupt level error.
1664	DSEA error.
1668	DSEA interrupt level error.

(continues)

Table 19 Continued

Code	Description
16xx	**Display Station Emulation Adapter (DSEA) Errors (5520, 525x)**
1669	DSEA diagnostics error; use 3.0 or higher.
1674	DSEA diagnostics error; use 3.0 or higher.
1674	DSEA station address error.
1684	DSEA device address error.
1688	DSEA device address error.
17xx	**ST-506/412 Fixed Disk and Controller Errors**
1701	Fixed disk general POST error.
1702	Drive / controller time-out error.
1703	Drive seek error.
1704	Controller failed.
1705	Drive sector not found error.
1706	Write fault error.
1707	Drive track 0 error.
1708	Head select error.
1709	Error correction code (ECC) error.
1710	Sector buffer overrun.
1711	Bad address mark.
1712	Internal controller diagnostics failure.
1713	Data compare error.
1714	Drive not ready.
1715	Track 0 indicator failure.
1716	Diagnostics cylinder errors.
1717	Surface read errors.
1718	Hard drive type error.
1720	Bad diagnostics cylinder.
1726	Data compare error.
1730	Controller error.
1731	Controller error.
1732	Controller error.
1733	BIOS undefined error return.
1735	Bad command error.
1736	Data corrected error.
1737	Bad track error.
1738	Bad sector error.
1739	Bad initialization error.
1740	Bad sense error.
1750	Drive verify failure.
1751	Drive read failure.
1752	Drive write failure.
1753	Drive random read test failure.
1754	Drive seek test failure.

Code	Description
17xx	**ST-506/412 Fixed Disk and Controller Errors**
1755	Controller failure.
1756	Controller error-correction code (ECC) test failure.
1757	Controller head-select failure.
1780	Seek failure; drive 0.
1781	Seek failure; drive 1.
1782	Controller test failure.
1790	Diagnostic cylinder read error; drive 0.
1791	Diagnostic cylinder read error; drive 1.
18xx	**I/O Expansion Unit Errors**
1801	I/O expansion unit POST failure.
1810	Enable/disable failure.
1811	Extender card wrap test failure; disabled.
1812	High-order address lines failure; disabled.
1813	Wait state failure; disabled.
1814	Enable/disable could not be set on.
1815	Wait state failure; disabled.
1816	Extender card wrap test failure; enabled.
1817	High-order address lines failure; enabled.
1818	Disable not functioning.
1819	Wait request switch not set correctly.
1820	Receiver card wrap test failure.
1821	Receiver high order address lines failure.
19xx	**3270 PC Attachment Card Errors**
20xx	**Binary Synchronous Communications (BSC) Adapter Errors**
2001	BSC adapter test failure.
2010	8255 Port A failure.
2011	8255 Port B failure.
2012	8255 Port C failure.
2013	8253 Timer #1 did not reach terminal count.
2014	8253 Timer #1 stuck on.
2015	8253 Timer #2 did not reach terminal count.
2016	8253 Timer #2 output stuck on.
2017	8251 data set ready failed to come on.
2018	8251 clear to send not sensed.
2019	8251 data set ready stuck on.
2020	8251 clear to send stuck on.
2021	8251 hardware reset failure.
2022	8251 software reset failure.
2023	8251 software “error reset” failure.
2024	8251 transmit ready did not come on.

(continues)

Table 19 Continued

Code	Description
20xx	**Binary Synchronous Communications (BSC) Adapter Errors**
2025	8251 receive ready did not come on.
2026	8251 could not force “overrun” error status.
2027	Interrupt failure; no timer interrupt.
2028	Interrupt failure; transmit; replace card or planar.
2029	Interrupt failure; transmit; replace card.
2030	Interrupt failure; receive; replace card or planar.
2031	Interrupt failure; receive; replace card.
2033	Ring indicate stuck on.
2034	Receive clock stuck on.
2035	Transmit clock stuck on.
2036	Test indicate stuck on.
2037	Ring indicate stuck on.
2038	Receive clock not on.
2039	Transmit clock not on.
2040	Test indicate not on.
2041	Data set ready not on.
2042	Carrier detect not on.
2043	Clear to send not on.
2044	Data set ready stuck on.
2045	Carrier detect stuck on.
2046	Clear to send stuck on.
2047	Unexpected transmit interrupt.
2048	Unexpected receive interrupt.
2049	Transmit data did not equal receive data.
2050	8251 detected overrun error.
2051	Lost data set ready during data wrap.
2052	Receive time-out during data wrap.
21xx	**Alternate Binary Synchronous Communications (BSC) Adapter Errors**
2101	BSC adapter test failure.
2110	8255 Port A failure.
2111	8255 Port B failure.
2112	8255 Port C failure.
2113	8253 Timer #1 did not reach terminal count.
2114	8253 Timer #1 stuck on.
2115	8253 Timer #2 did not reach terminal count.
2116	8253 Timer #2 output stuck on.
2117	8251 Data set ready failed to come on.
2118	8251 Clear to send not sensed.
2119	8251 Data set ready stuck on.
2120	8251 Clear to send stuck on.
2121	8251 Hardware reset failure.

Code	Description
21xx	**Alternate Binary Synchronous Communications (BSC) Adapter Errors**
2122	8251 Software reset failure.
2123	8251 Software "error reset" failure.
2124	8251 Transmit ready did not come on.
2125	8251 Receive ready did not come on.
2126	8251 Could not force "overrun" error status.
2127	Interrupt failure; no timer interrupt.
2128	Interrupt failure; transmit; replace card or planar.
2129	Interrupt failure; transmit; replace card.
2130	Interrupt failure; receive; replace card or planar.
2131	Interrupt failure; receive; replace card.
2133	Ring indicate stuck on.
2134	Receive clock stuck on.
2135	Transmit clock stuck on.
2136	Test indicate stuck on.
2137	Ring indicate stuck on.
2138	Receive clock not on.
2139	Transmit clock not on.
2140	Test indicate not on.
2141	Data set ready not on.
2142	Carrier detect not on.
2143	Clear to send not on.
2144	Data set ready stuck on.
2145	Carrier detect stuck on.
2146	Clear to send stuck on.
2147	Unexpected transmit interrupt.
2148	Unexpected receive interrupt.
2149	Transmit data did not equal receive data.
2150	8251 detected overrun error.
2151	Lost data set ready during data wrap.
2152	Receive time-out during data wrap.
22xx	**Cluster Adapter Errors**
23xx	**Plasma Monitor Adapter Errors**
24xx	**Enhanced Graphics Adapter (EGA) or Video Graphics Array (VGA) Errors**
2401	Video adapter test failure.
2402	Video display error.
2408	User indicated display attribute test failed.
2409	Video display error.
2410	Video adapter error; video port error.
2416	User indicated character set test failed.

(continues)

Table 19 Continued

Code	Description
24xx	**Enhanced Graphics Adapter (EGA) or Video Graphics Array (VGA) Errors**
2424	User indicated 80×25 mode failure.
2432	User indicated 40×25 mode failure.
2440	User indicated 320×200 graphics mode failure.
2448	User indicated 640×200 graphics mode failure.
2456	User indicated light-pen test failure.
2464	User indicated paging test failure.
25xx	**Alternate Enhanced Graphics Adapter (EGA) Errors**
2501	Video adapter test failure.
2502	Video display error.
2508	User indicated display attribute test failed.
2509	Video display error.
2510	Video adapter error.
2516	User indicated character set test failed.
2524	User indicated 80×25 mode failure.
2532	User indicated 40×25 mode failure.
2540	User indicated 320×200 graphics mode failure.
2548	User indicated 640×200 graphics mode failure.
2556	User indicated light-pen test failure.
2564	User indicated paging test failure.
26xx	**XT or AT/370 370-M (Memory) and 370-P (Processor) Adapter Errors**
2601	370-M adapter error.
2655	370-M adapter error.
2657	370-M adapter error.
2668	370-M adapter error.
2672	370-M adapter error.
2673	370-P adapter error.
2674	370-P adapter error.
2677	370-P adapter error.
2680	370-P adapter error.
2681	370-M adapter error.
2682	370-P adapter error.
2694	370-P adapter error.
2697	370-P adapter error.
2698	XT or AT/370 diagnostic diskette error.
27xx	**XT or AT/370 3277-EM (Emulation) Adapter Errors**
2701	3277-EM adapter error.
2702	3277-EM adapter error.
2703	3277-EM adapter error.

Code	Description
28xx	**3278/79 Emulation Adapter or 3270 Connection Adapter Errors**
29xx	**Color/Graphics Printer Errors**
30xx	**Primary PC Network Adapter Errors**
3001	Processor test failure.
3002	ROM checksum test failure.
3003	Unit ID PROM test failure.
3004	RAM test failure.
3005	Host interface controller test failure.
3006	±12v test failure.
3007	Digital loopback test failure.
3008	Host detected host interface controller failure.
3009	Sync failure and no Go bit.
3010	Host interface controller test okay and no Go bit.
3011	Go bit and no command 41.
3012	Card not present.
3013	Digital failure; fall through.
3015	Analog failure.
3041	Hot carrier; not this card.
3042	Hot carrier; this card!
31xx	**Secondary PC Network Adapter Errors**
3101	Processor test failure.
3102	ROM checksum test failure.
3103	Unit ID PROM test failure.
3104	RAM test failure.
3105	Host interface controller test failure.
3106	[p/m]12v test failure.
3107	Digital loopback test failure.
3108	Host detected host interface controller failure.
3109	Sync failure and no Go bit.
3110	Host interface controller test okay and no Go bit.
3111	Go bit and no command 41.
3112	Card not present.
3113	Digital failure; fall through.
3115	Analog failure.
3141	Hot carrier; not this card.
3142	Hot carrier; this card!
32xx	**3270 PC or AT Display and Programmed Symbols Adapter Errors**
33xx	**Compact Printer Errors**

(continues)

Table 19 Continued

Code	Description
35xx	**Enhanced Display Station Emulation Adapter (EDSEA) Errors**
3504	Adapter connected to Twinaxial cable during offline test.
3508	Workstation address error.
3509	Diagnostic program failure.
3540	Workstation address invalid.
3588	Adapter address switch error.
3599	Diagnostic program failure.
36xx	**General-Purpose Interface Bus (GPIB) Adapter Errors**
3601	Adapter test failure.
3602	Serial poll mode register write error.
3603	Adapter address error.
3610	Adapter listen error.
3611	Adapter talk error.
3612	Adapter control error.
3613	Adapter standby error.
3614	Adapter asynchronous control error.
3615	Adapter asynchronous control error.
3616	Adapter error; cannot pass control.
3617	Adapter error; cannot address to listen.
3618	Adapter error; cannot unaddress to listen.
3619	Adapter error; cannot address to talk.
3620	Adapter error; cannot unaddress to talk.
3621	Adapter error; cannot address to listen with extended addressing.
3622	Adapter error; cannot unaddress to listen with extended addressing.
3623	Adapter error; cannot address to talk with extended addressing.
3624	Adapter error; cannot unaddress to talk with extended addressing.
3625	Write to self error.
3626	Generate handshake error.
3627	Cannot detect `Device Clear` message error.
3628	Cannot detect `Selected Device Clear` message error.
3629	Cannot detect end with end of identify.
3630	Cannot detect end of transmission with end of identify.
3631	Cannot detect end with 0-bit end of string.
3632	Cannot detect end with 7-bit end of string.
3633	Cannot detect group execute trigger.
3634	Mode 3 addressing error.
3635	Cannot recognize undefined command.
3636	Cannot detect remote, remote changed, lockout, or lockout changed.
3637	Cannot clear remote or lockout.
3638	Cannot detect service request.
3639	Cannot conduct serial poll.
3640	Cannot conduct parallel poll.

Code	Description
36xx	**General-Purpose Interface Bus (GPIB) Adapter Errors**
3650	Adapter error; direct memory access (DMA) to 7210.
3651	Data error; error on direct memory access (DMA) to 7210.
3652	Adapter error; direct memory access (DMA) from 7210.
3653	Data error on direct memory access (DMA) from 7210.
3658	Uninvoked interrupt received.
3659	Cannot interrupt on address status changed.
3660	Cannot interrupt on address status changed.
3661	Cannot interrupt on command output.
3662	Cannot interrupt on data out.
3663	Cannot interrupt on data in.
3664	Cannot interrupt on error.
3665	Cannot interrupt on device clear.
3666	Cannot interrupt on end.
3667	Cannot interrupt on device execute trigger.
3668	Cannot interrupt on address pass through.
3669	Cannot interrupt on command pass through.
3670	Cannot interrupt on remote changed.
3671	Cannot interrupt on lockout changed.
3672	Cannot interrupt on service request In.
3673	Cannot interrupt on terminal count on direct memory access to 7210.
3674	Cannot interrupt on terminal count on direct memory access from 7210.
3675	Spurious direct memory access terminal-count interrupt.
3697	Illegal direct memory access configuration setting detected.
3698	Illegal interrupt level setting detected.
37xx	**System Board SCSI Controller Error**
38xx	**Data Acquisition Adapter Errors**
3801	Adapter test failure.
3810	Timer read test failure.
3811	Timer interrupt test failure.
3812	Delay; binary input 13 test failure.
3813	Rate; binary input 13 test failure.
3814	Binary output 14; interrupt status—interrupt request test failure.
3815	Binary output 0; count-in test failure.
3816	Binary input strobe; count-out test failure.
3817	Binary output 0; binary output clear to send test failure.
3818	Binary output 1; binary input 0 test failure.
3819	Binary output 2; binary input 1 test failure.
3820	Binary output 3; binary input 2 test failure.
3821	Binary output 4; binary input 3 test failure.
3822	Binary output 5; binary input 4 test failure.
3823	Binary output 6; binary input 5 test failure.

(continues)

Table 19 Continued

Code	Description
38xx	**Data Acquisition Adapter Errors**
3824	Binary output 7; binary input 6 test failure.
3825	Binary output 8; binary input 7 test failure.
3826	Binary output 9; binary input 8 test failure.
3827	Binary output 10; binary input 9 test failure.
3828	Binary output 11; binary input 10 test failure.
3829	Binary output 12; binary input 11 test failure.
3830	Binary output 13; binary input 12 test failure.
3831	Binary output 15; analog input CE test failure.
3832	Binary output strobe; binary output GATE test failure.
3833	Binary input clear to send; binary input HOLD test failure.
3834	Analog input command output; binary input 15 test failure.
3835	Counter interrupt test failure.
3836	Counter read test failure.
3837	Analog output 0 ranges test failure.
3838	Analog output 1 ranges test failure.
3839	Analog input 0 values test failure.
3840	Analog input 1 values test failure.
3841	Analog input 2 values test failure.
3842	Analog input 3 values test failure.
3843	Analog input interrupt test failure.
3844	Analog input 23 address or value test failure.
39xx	**Professional Graphics Adapter (PGA) Errors**
3901	PGA test failure.
3902	ROM1 self-test failure.
3903	ROM2 self-test failure.
3904	RAM self-test failure.
3905	Cold start cycle power error.
3906	Data error in communications RAM.
3907	Address error in communications RAM.
3908	Bad data reading / writing 6845-like register.
3909	Bad data in lower E0h bytes reading / writing 6845-like registers.
3910	Graphics controller display bank output latches error.
3911	Basic clock error.
3912	Command control error.
3913	Vertical sync scanner error.
3914	Horizontal sync scanner error.
3915	Intech error.
3916	Look-up table address error.
3917	Look-up table red RAM chip error.
3918	Look-up table green RAM chip error.
3919	Look-up table blue RAM chip error.

Code	Description
39xx	**Professional Graphics Adapter (PGA) Errors**
3920	Look-up table data latch error.
3921	Horizontal display error.
3922	Vertical display error.
3923	Light-pen error.
3924	Unexpected error.
3925	Emulator addressing error.
3926	Emulator data latch error.
3927	Base for error codes 3928–3930 (Emulator RAM).
3928	Emulator RAM error.
3929	Emulator RAM error.
3930	Emulator RAM error.
3931	Emulator horizontal/vertical display problem.
3932	Emulator cursor position error.
3933	Emulator attribute display problem.
3934	Emulator cursor display error.
3935	Fundamental emulation RAM problem.
3936	Emulation character set problem.
3937	Emulation graphics display error.
3938	Emulation character display problem.
3939	Emulation bank select error.
3940	Adapter RAM U2 error.
3941	Adapter RAM U4 error.
3942	Adapter RAM U6 error.
3943	Adapter RAM U8 error.
3944	Adapter RAM U10 error.
3945	Adapter RAM U1 error.
3946	Adapter RAM U3 error.
3947	Adapter RAM U5 error.
3948	Adapter RAM U7 error.
3949	Adapter RAM U9 error.
3950	Adapter RAM U12 error.
3951	Adapter RAM U14 error.
3952	Adapter RAM U16 error.
3953	Adapter RAM U18 error.
3954	Adapter RAM U20 error.
3955	Adapter RAM U11 error.
3956	Adapter RAM U13 error.
3957	Adapter RAM U15 error.
3958	Adapter RAM U17 error.
3959	Adapter RAM U19 error.
3960	Adapter RAM U22 error.
3961	Adapter RAM U24 error.

(continues)

Table 19 Continued

Code	Description
39xx	**Professional Graphics Adapter (PGA) Errors**
3962	Adapter RAM U26 error.
3963	Adapter RAM U28 error.
3964	Adapter RAM U30 error.
3965	Adapter RAM U21 error.
3966	Adapter RAM U23 error.
3967	Adapter RAM U25 error.
3968	Adapter RAM U27 error.
3969	Adapter RAM U29 error.
3970	Adapter RAM U32 error.
3971	Adapter RAM U34 error.
3972	Adapter RAM U36 error.
3973	Adapter RAM U38 error.
3974	Adapter RAM U40 error.
3975	Adapter RAM U31 error.
3976	Adapter RAM U33 error.
3977	Adapter RAM U35 error.
3978	Adapter RAM U37 error.
3979	Adapter RAM U39 error.
3980	Graphics controller RAM timing error.
3981	Graphics controller read/write latch error.
3982	Shift register bus output latches error.
3983	Addressing error (vertical column of memory; U2 at top).
3984	Addressing error (vertical column of memory; U4 at top).
3985	Addressing error (vertical column of memory; U6 at top).
3986	Addressing error (vertical column of memory; U8 at top).
3987	Addressing error (vertical column of memory; U10 at top).
3988	Base for error codes 3989–3991 (horizontal bank latch errors).
3989	Horizontal bank latch errors.
3990	Horizontal bank latch errors.
3991	Horizontal bank latch errors.
3992	RAG/CAG graphics controller error.
3993	Multiple write modes, nibble mask errors.
3994	Row nibble (display RAM) error.
3995	Graphics controller addressing error.
44xx	**5278 Display Attachment Unit and 5279 Display Errors**
45xx	**IEEE Interface Adapter (IEEE-488) Errors**
46xx	**A Real-Time Interface Coprocessor (ARTIC) Multiport/2 Adapter Errors**
4611	ARTIC adapter error.
4612	Memory module error.

Code	Description
46xx	**A Real-Time Interface Coprocessor (ARTIC) Multiport/2 Adapter Errors**
4613	Memory module error.
4630	ARTIC adapter error.
4640	Memory module error.
4641	Memory module error.
4650	ARTIC interface cable error.
48xx	**Internal Modem Errors**
49xx	**Alternate Internal Modem Errors**
50xx	**PC Convertible LCD Errors**
5001	LCD display buffer failure.
5002	LCD font buffer failure.
5003	LCD controller failure.
5004	User indicated PEL/drive test failed.
5008	User indicated display attribute test failed.
5016	User indicated character set test failed.
5020	User indicated alternate character set test failure.
5024	User indicated 80×25 mode test failure.
5032	User indicated 40×25 mode test failure.
5040	User indicated 320×200 graphics test failure.
5048	User indicated 640×200 graphics test failure.
5064	User indicated paging test failure.
51xx	**PC Convertible Portable Printer Errors**
5101	Portable printer interface failure.
5102	Portable printer busy error.
5103	Portable printer paper or ribbon error.
5104	Portable printer time-out.
5105	User indicated print-pattern test error.
56xx	**Financial Communication System Errors**
70xx	**Phoenix BIOS/Chipset Unique Error Codes**
7000	Chipset CMOS failure.
7001	Chipset shadow RAM failure.
7002	Chipset CMOS configuration error.
71xx	**Voice Communications Adapter (VCA) Errors**
7101	Adapter test failure.
7102	Instruction or external data memory error.
7103	PC to VCA interrupt error.
7104	Internal data memory error.
7105	Direct memory access (DMA) error.

(continues)

Table 19 Continued

Code	Description
71xx	**Voice Communications Adapter (VCA) Errors**
7106	Internal registers error.
7107	Interactive shared memory error.
7108	VCA to PC interrupt error.
7109	DC wrap error.
7111	External analog wrap and tone-output error.
7112	Microphone to speaker wrap error.
7114	Telephone attachment test failure.
73xx	**3 1/2-Inch External Diskette Drive Errors**
7301	Diskette drive/adapter test failure.
7306	Disk changeline failure.
7307	Diskette is write-protected.
7308	Drive command error.
7310	Diskette initialization failure; track 0 bad.
7311	Drive time-out error.
7312	Controller chip (NEC) error.
7313	Direct memory access (DMA) error.
7314	DMA boundary overrun.
7315	Drive index timing error.
7316	Drive speed error.
7321	Drive seek error.
7322	Drive cyclic redundancy check (CRC) error.
7323	Sector not found error.
7324	Address mark error.
7325	Controller chip (NEC) seek error.
74xx	**IBM PS/2 Display Adapter (VGA Card) Errors**
74xx	**8514/A Display Adapter Errors**
7426	8514 display error.
7440	8514/A memory module 31 error.
7441	8514/A memory module 30 error.
7442	8514/A memory module 29 error.
7443	8514/A memory module 28 error.
7444	8514/A memory module 22 error.
7445	8514/A memory module 21 error.
7446	8514/A memory module 18 error.
7447	8514/A memory module 17 error.
7448	8514/A memory module 32 error.
7449	8514/A memory module 14 error.
7450	8514/A memory module 13 error.
7451	8514/A memory module 12 error.
7452	8514/A memory module 06 error.

Code	Description
74xx	**8514/A Display Adapter Errors**
7453	8514/A memory module 05 error.
7454	8514/A memory module 02 error.
7455	8514/A memory module 01 error.
7460	8514/A memory module 16 error.
7461	8514/A memory module 27 error.
7462	8514/A memory module 26 error.
7463	8514/A memory module 25 error.
7464	8514/A memory module 24 error.
7465	8514/A memory module 23 error.
7466	8514/A memory module 20 error.
7467	8514/A memory module 19 error.
7468	8514/A memory module 15 error.
7469	8514/A memory module 11 error.
7470	8514/A memory module 10 error.
7471	8514/A memory module 09 error.
7472	8514/A memory module 08 error.
7473	8514/A memory module 07 error.
7474	8514/A memory module 04 error.
7475	8514/A memory module 03 error.
76xx	**4216 PagePrinter Adapter Errors**
7601	Adapter test failure.
7602	Adapter error.
7603	Printer error.
7604	Printer cable error.
84xx	**PS/2 Speech Adapter Errors**
85xx	**2MB XMA Memory Adapter or XMA Adapter/A Errors**
850x	Adapter error.
851x	Adapter error.
852x	Memory module error.
8599	Unusable memory segment found.
86xx	**PS/2 Pointing Device (Mouse) Errors**
8601	Pointing device error; mouse time-out.
8602	Pointing device error; mouse interface.
8603	Pointing device or system-bus failure; mouse interrupt.
8604	Pointing device or system board error.
8611	System bus error—I/F between 8042 and TrackPoint II.
8612	TrackPoint II error.
8613	System bus error or TrackPoint II error.
89xx	**Musical Instrument Digital Interface (MIDI) Adapter Errors**

(continues)

Table 19 Continued

Code	Description
91xx	**IBM 3363 Write-Once Read Multiple (WORM) Optical Drive/Adapter Errors**
96xx	**SCSI Adapter with Cache (32-Bit) Errors**
100xx	**Multiprotocol Adapter/A Errors**
10001	Presence test failure.
10002	Card selected feedback error.
10003	Port 102h register rest failure.
10004	Port 103h register rest failure.
10006	Serial option cannot be put to sleep.
10007	Cable error.
10008	Interrupt request (IRQ) 3 error.
10009	Interrupt request (IRQ) 4 error.
10010	16550 chip register failure.
10011	Internal wrap test of 16550 chip modem control line failure.
10012	External wrap test of 16550 chip modem control line failure.
10013	16550 chip transmit error.
10014	16550 chip receive error.
10015	16550 chip receive error; data not equal to transmit data.
10016	16550 chip interrupt function error.
10017	16550 chip baud rate test failure.
10018	16550 chip receive external data wrap test failure.
10019	16550 chip first-in/first-out (FIFO) buffer failure.
10026	8255 Port A error.
10027	8255 Port B error.
10028	8255 Port C error.
10029	8254 timer 0 error.
10030	8254 timer 1 error.
10031	8254 timer 2 error.
10032	Binary sync data set ready response to data terminal ready error.
10033	Binary sync clear to send response to ready to send error.
10034	8251 hardware reset test failed.
10035	8251 function error.
10036	8251 status error.
10037	Binary sync timer interrupt error.
10038	Binary sync transmit interrupt error.
10039	Binary sync receive interrupt error.
10040	Stray interrupt request (IRQ) 3 error.
10041	Stray interrupt request (IRQ) 4 error.
10042	Binary sync external wrap error.
10044	Binary sync data wrap error.
10045	Binary sync line status/condition error.
10046	Binary sync time-out error during data wrap test.

Code	Description
100xx	**Multiprotocol Adapter/A Errors**
10050	8273 command acceptance or results ready time-out error.
10051	8273 Port A error.
10052	8273 Port B error.
10053	SDLC modem status change logic error.
10054	SDLC timer interrupt request (IRQ) 4 error.
10055	SDLC modem status change interrupt request (IRQ) 4 error.
10056	SDLC external wrap error.
10057	SDLC interrupt results error.
10058	SDLC data wrap error.
10059	SDLC transmit interrupt error.
10060	SDLC receive interrupt error.
10061	Direct memory access (DMA) channel 1 transmit error.
10062	Direct memory access (DMA) channel 1 receive error.
10063	8273 status detect failure.
10064	8273 error detect failure.
101xx	**300/1200bps Internal Modem/A Errors**
10101	Presence test failure.
10102	Card selected feedback error.
10103	Port 102h register test failure.
10106	Serial option cannot be put to sleep.
10108	Interrupt request (IRQ) 3 error.
10109	Interrupt request (IRQ) 4 error.
10110	16450 chip register failure.
10111	Internal wrap test of 16450 modem control line failure.
10113	16450 transmit error.
10114	16450 receive error.
10115	16450 receive error data not equal transmit data.
10116	16450 interrupt function error.
10117	16450 baud rate test failure.
10118	16450 receive external data wrap test failure.
10125	Modem reset result code error.
10126	Modem general result code error.
10127	Modem S registers write/read error.
10128	Modem turn echo on/off error.
10129	Modem enable/disable result codes error.
10130	Modem enable number/word result codes error.
10133	Connect results for 300 baud not received.
10134	Connect results for 1200 baud not received.
10135	Modem fails local analog loopback test at 300 baud.
10136	Modem fails local analog loopback test at 1200 baud.
10137	Modem does not respond to escape/reset sequence.
10138	S-Register 13 does not show correct parity or number of data bits.

(continues)

Table 19 Continued

Code	Description
104xx	**ESDI or MCA IDE Fixed Disk or Adapter Errors**
10139	S-Register 15 does not reflect correct bit rate.
10450	Read/write test failed.
10451	Read verify test failed.
10452	Seek test failed.
10453	Wrong drive type indicated.
10454	Controller sector buffer test failure.
10455	Controller invalid failure.
10456	Controller diagnostic command failure.
10461	Drive format error.
10462	Controller head select error.
10463	Drive read/write sector error.
10464	Drive primary defect map unreadable.
10465	Controller; error-correction code (ECC) 8-bit error.
10466	Controller; error-correction code (ECC) 9-bit error.
10467	Drive soft seek error.
10468	Drive hard seek error.
10469	Drive soft error count exceeded.
10470	Controller attachment diagnostic error.
10471	Controller wrap mode interface error.
10472	Controller wrap mode drive select error.
10473	Read verify test errors.
10480	Seek failure; drive 0.
10481	Seek failure; drive 1.
10482	Controller transfer acknowledge error.
10483	Controller reset failure.
10484	Controller; head select 3 error.
10485	Controller; head select 2 error.
10486	Controller; head select 1 error.
10487	Controller; head select 0 error.
10488	Controller; read gate—command complete 2 error.
10489	Controller; write gate—command complete 1 error.
10490	Diagnostic area read error; drive 0.
10491	Diagnostic area read error; drive 1.
10492	Controller error, drive 1.
10493	Reset error, drive 1.
10499	Controller failure.
107xx	**5 1/4-Inch External Diskette Drive or Adapter Errors**
112xx	**SCSI Adapter (16-bit without Cache) Errors**
113xx	**System Board SCSI Adapter (16-Bit) Errors**

Code	Description
129xx	**Processor Complex (CPU Board) Errors**
129005	DMA error.
12901	Processor board; processor test failed.
12902	Processor board; cache test failed.
12904	Second level cache failure.
12905	Cache enable/disable errors.
12907	Cache fatal error.
12908	Cache POST program error.
12912x	Hardware failure.
12913x	Micro channel bus time-out.
12914x	Software failure.
12915x	Processor complex error.
12916x	Processor complex error.
12917x	Processor complex error.
12918x	Processor complex error.
12919x	Processor complex error.
12940x	Processor complex failure.
12950x	Processor complex failure.
129900	Processor complex serial-number mismatch.
149xx	**P70/P75 Plasma Display and Adapter Errors**
14901	Plasma display adapter failure.
14902	Plasma display adapter failure.
14922	Plasma display failure.
14932	External display failure.
152xx	**XGA Display Adapter/A Errors**
164xx	**120MB Internal Tape Drive Errors**
165xx	**6157 Streaming Tape Drive or Tape Attachment Adapter Errors**
16520	Streaming tape drive failure.
16540	Tape attachment adapter failure.
166xx	**Primary Token-Ring Network Adapter Errors**
167xx	**Alternate Token-Ring Network Adapter Errors**
180xx	**PS/2 Wizard Adapter Errors**
18001	Interrupt controller failure.
18002	Incorrect timer count.
18003	Timer interrupt failure.
18004	Sync check interrupt failure.
18005	Parity check interrupt failure.
18006	Access error interrupt failure.
18012	Bad checksum error.

(continues)

Table 19 Continued

Code	Description
180xx	**PS/2 Wizard Adapter Errors**
18013	Micro Channel interface error.
18021	Wizard memory compare or parity error.
18022	Wizard memory address line error.
18023	Dynamic RAM controller failure.
18029	Wizard memory byte enable error.
18031	Wizard memory-expansion module memory compare or parity error.
18032	Wizard memory-expansion module address line error.
18039	Wizard memory-expansion module byte enable error.
185xx	**DBCS Japanese Display Adapter/A Errors**
194xx	**80286 Memory-Expansion Option Memory-Module Errors**
200xx	**Image Adapter/A Errors**
208xx	**Unknown SCSI Device Errors**
209xx	**SCSI Removable Disk Errors**
210xx	**SCSI Fixed Disk Errors**
210PLSC	"PLSC" codes indicate errors P = SCSI ID number (Physical Unit Number or PUN) L = Logical unit number (LUN, usually 0) S = Host Adapter slot number C = SCSI Drive capacity: A = 60MB B = 80MB C = 120MB D = 160MB E = 320MB F = 400MB H = 1,024MB (1GB) I = 104MB J = 212MB U = Undetermined or Non IBM OEM Drive
211xx	**SCSI Tape Drive Errors**
212xx	**SCSI Printer Errors**
213xx	**SCSI Processor Errors**
214xx	**SCSI Write-Once Read Multiple (WORM) Drive Errors**
215xx	**SCSI CD-ROM Drive Errors**
216xx	**SCSI Scanner Errors**
217xx	**SCSI Magneto Optical Drive Errors**

Code	Description
218xx	**SCSI Jukebox Changer Errors**
219xx	**SCSI Communications Errors**
243xxxx	**XGA-2 Adapter/A Errors**
I998xxxx	**Dynamic Configuration Select (DCS) Information Codes**
I998001x	Bad integrity of DCS master boot record.
I988002x	Read failure of DCS master boot record.
I988003x	DCS master boot record is not compatible with the planar ID.
I988004x	DCS master boot record is not compatible with the model/submodel byte.
I988005x	Bad integrity of CMOS/NVRAM (or internal process error).
I988006x	Read failure of header/mask/configuration record.
I988007x	Bad integrity of header/mask/configuration record.
I988008x	Hard disk does not support the command to set the maximum RBA.
I988009x	DCS master boot record is older than system ROM.
I9880402	Copyright notice in E000 segment does not match the one in DCS MBR.
I9880403	DCS MBR is not compatible with the system board ID or model/submodel byte.
I99900xx	**Initial Microcode Load (IML) Error**
I999001x	Invalid disk IML record.
I999002x	Disk IML record load error.
I999003x	Disk IML record incompatible with system board.
I999004x	Disk IML record incompatible with processor/processor card.
I999005x	Disk IML not attempted.
I999006x	Disk stage II System Image load error.
I999007x	Disk stage II image checksum error.
I999008x	IML not supported on primary disk drive.
I999009x	Disk IML record is older than ROM.
I99900x1	Invalid diskette IML record.
I99900x2	Diskette IML record load error.
I99900x3	Diskette IML record incompatible with system board.
I99900x4	Diskette IML record incompatible with processor card.
I99900x5	Diskette IML recovery prevented (valid password and CE override not set).
I99900x6	Diskette stage II image load error.
I99900x7	Diskette stage II image checksum error.
I99900x9	Diskette IML record older than ROM.
I99903xx	**No Bootable Device, Initial Program Load (IPL) Errors**
I9990302	Invalid disk boot record, unable to read IPL boot record from disk.
I9990303	IML system partition boot failure.
I9990304	No bootable device with ASCII console.
I9990305	No bootable media found.
I9990306	Invalid SCSI Device boot record.

(continues)

Table 19 Continued

Code	Description
I99904xx	**IML-to-System Mismatch**
I9990401	Unauthorized access (manufacturing boot request with valid password).
I9990402	Missing ROM IBM copyright notice.
I9990403	IML boot record incompatible with system board / processor card.
I99906xx	**IML (boot) Errors**

Disk Software Interfaces and Error Codes

The operating system has to talk to the disk drives through the BIOS. Normally the OS calls on the BIOS via a standard software interface called INT13h. INT13h represents a series of functions that the BIOS can perform, regardless of the type of drive. This allows the same operating systems software to work on different types of drives such as IDE or SCSI, even though at a hardware and direct software command level their interfaces are different. The device drivers for the respective drives or controllers translates the INT13h commands into the low-level commands that actually operate the drive. Figure 3 shows a representation of the relationship between different disk software interfaces at work in a typical PC system. This figure shows the chain of command from the hardware, which is the actual drive controller, to the BIOS, OS, and, finally, the application programs.

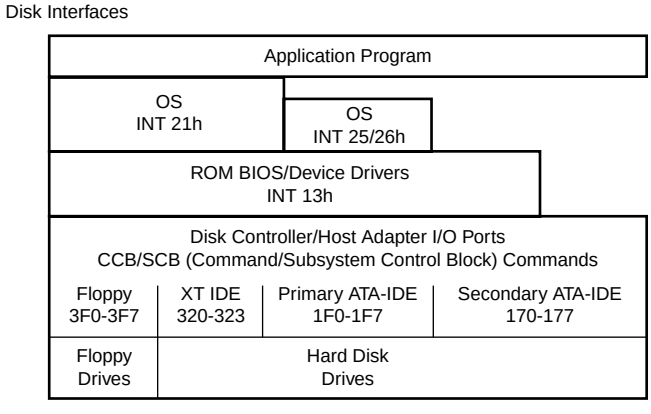

Figure 3 Disk software interface levels and relationships.

INT13h provides several standard functions which the operating system (or in some cases applications that require more direct disk access) can use. Table 20 shows the different functions available at the Interrupt 13h BIOS interface. Some functions are available to floppy drives or hard drives only, and others are available to both types of drives.

Table 20 Int13h BIOS Disk Functions

Function	Floppy Disk	Hard Disk	Description
00h	✓	✓	Reset disk system
01h	✓	✓	Get status of last operation
02h	✓	✓	Read sectors
03h	✓	✓	Write sectors
04h	✓	✓	Verify sectors
05h	✓	✓	Format track
06h		✓	Format bad track
07h		✓	Format drive
08h	✓	✓	Read drive parameters
09h		✓	Initialize drive characteristics
0Ah		✓	Read long
0Bh		✓	Write long
0Ch		✓	Seek
0Dh		✓	Alternate hard disk reset
0Eh		✓	Read sector buffer
0Fh		✓	Write sector buffer
10h		✓	Test for drive ready
11h		✓	Recalibrate drive
12h		✓	Controller RAM diagnostic
13h		✓	Controller drive diagnostic
14h		✓	Controller internal diagnostic
15h	✓	✓	Get disk type
16h	✓		Get floppy disk change status
17h	✓		Set floppy disk type for format
18h	✓		Set media type for format
19h		✓	Park hard disk heads
1Ah		✓	ESDI—Low-level format
1Bh		✓	ESDI—Get manufacturing header
1Ch		✓	ESDI—Get configuration

Often, diagnostics programs use the INT13h interface to talk more directly to the drive, bypassing the operating system and working directly with the BIOS. An example of this type of program would be hard disk low-level format programs or the DiskEdit program that comes with the Norton Utilities, and which allows direct editing of disk sectors, file allocation tables, directories, etc. This type of access is accomplished by sending INT13h commmands directly instead of working with the higher level INT21h operating system commands. INT21h commands are file-oriented, while INT13h commands are cylinder, head, and sector oriented.

Anytime a program uses INT13h commands, an error status is returned after each command. If an error occurs, the status will be reported as a number other than 00h, and most programs will then attempt to display this error to the user. Table 21 shows the error codes that might be returned by the BIOS INT13h routines. In some cases you may see these codes referred to when running a low-level format program, disk editor, or other program that can directly access a disk drive through the BIOS.

Table 21 INT13h BIOS Error Codes

Code	Description
00h	No error
01h	Bad command
02h	Address mark not found
03h	Write protect
04h	Request sector not found
05h	Reset failed
06h	Media change error
07h	Initialization failed
09h	Cross 64KB DMA boundary
0Ah	Bad sector flag detected
0Bh	Bad track flag detected
10h	Bad ECC on disk read
11h	ECC corrected data error
20h	Controller has failed
40h	Seek operation failed
80h	Drive failed to respond
AAh	Drive not ready
BBh	Undefined error
CCh	Write fault
0Eh	Register error
FFh	Sense operation failed

Most of these errors indicate a problem with the disk media, the drive hardware, cable, or controller.

ROM BIOS Hard Drive Parameters

The following explains the column headings used in Tables 22 to 26.

Type = Drive type number

Cylinders = Total number of cylinders

Heads = Total number of heads

WPC = Write precompensation starting cylinder

65535 = No write precompensation

0 = Write precompensation on all cylinders

Ctrl = Control byte, with values according to the following table.

Bit Number	Hex	Meaning
Bit 0	01h	Not used (XT = drive step rate)
Bit 1	02h	Not used (XT = drive step rate)
Bit 2	04h	Not used (XT = drive step rate)
Bit 3	08h	More than eight heads

Bit Number	Hex	Meaning
Bit 4	10h	Not used (XT = embedded servo drive)
Bit 5	20h	OEM defect map at (cylinders +1)
Bit 6	40h	Disable ECC retries
Bit 7	80h	Disable disk access retries

LZ = Landing-zone cylinder for head parking

S/T = Number of sectors per track

Meg = Drive capacity in megabytes

M = Drive capacity in millions of bytes

Table 22 IBM AT and PS/2 BIOS Hard Disk Table

Type	Cylinders	Heads	WPC	Ctrl	LZ	S/T	Meg	M
1	306	4	128	00h	305	17	10.16	10.65
2	615	4	300	00h	615	17	20.42	21.41
3	615	6	300	00h	615	17	30.63	32.12
4	940	8	512	00h	940	17	62.42	65.45
5	940	6	512	00h	940	17	46.82	49.09
6	615	4	65535	00h	615	17	20.42	21.41
7	462	8	256	00h	511	17	30.68	32.17
8	733	5	65535	00h	733	17	30.42	31.90
9	900	15	65535	08h	901	17	112.06	117.50
10	820	3	65535	00h	820	17	20.42	21.41
11	855	5	65535	00h	855	17	35.49	37.21
12	855	7	65535	00h	855	17	49.68	52.09
13	306	8	128	00h	319	17	20.32	21.31
14	733	7	65535	00h	733	17	42.59	44.66
15	0	0	0	00h	0	0	0	0
16	612	4	0	00h	663	17	20.32	21.31
17	977	5	300	00h	977	17	40.55	42.52
18	977	7	65535	00h	977	17	56.77	59.53
19	1024	7	512	00h	1023	17	59.50	62.39
20	733	5	300	00h	732	17	30.42	31.90
21	733	7	300	00h	732	17	42.59	44.66
22	733	5	300	00h	733	17	30.42	31.90
23	306	4	0	00h	336	17	10.16	10.65
24	612	4	305	00h	663	17	20.32	21.31
25	306	4	65535	00h	340	17	10.16	10.65
26	612	4	65535	00h	670	17	20.32	21.31
27	698	7	300	20h	732	17	40.56	42.53
28	976	5	488	20h	977	17	40.51	42.48
29	306	4	0	00h	340	17	10.16	10.65
30	611	4	306	20h	663	17	20.29	21.27

(continues)

Table 22 Continued

Type	Cylinders	Heads	WPC	Ctrl	LZ	S/T	Meg	M
31	732	7	300	20h	732	17	42.53	44.60
32	1023	5	65535	20h	1023	17	42.46	44.52
33	614	4	65535	20h	663	25	29.98	31.44
34	775	2	65535	20h	900	27	20.43	21.43
35	921	2	65535	20h	1000	33	29.68	31.12
36	402	4	65535	20h	460	26	20.41	21.41
37	580	6	65535	20h	640	26	44.18	46.33
38	845	2	65535	20h	1023	36	29.71	31.15
39	769	3	65535	20h	1023	36	40.55	42.52
40	531	4	65535	20h	532	39	40.45	42.41
41	577	2	65535	20h	1023	36	20.29	21.27
42	654	2	65535	20h	674	32	20.44	21.43
43	923	5	65535	20h	1023	36	81.12	85.06
44	531	8	65535	20h	532	39	80.89	84.82
45	0	0	0	00h	0	0	0.00	0.00
46	0	0	0	00h	0	0	0.00	0.00
47	0	0	0	00h	0	0	0.00	0.00

The landing zone (LZ) and sectors per track (S/T) fields are not used in the 10MB (original) controller and contain 00h values for each entry.

Table entry 15 is reserved to act as a pointer that indicates the type is greater than 15. Older IBM systems do not have every entry in this table. The maximum usable type number varies for each particular ROM version.

Most IBM PS/2 systems were supplied with hard disk drives that have the defect map written as data on the cylinder one cylinder beyond the highest reported cylinder. This special data is read by the IBM PS/2 Advanced Diagnostics low-level format program. This process automates the entry of the defect list and eliminates the chance of human error, as long as you use only the IBM PS/2 Advanced Diagnostics for hard disk low-level formatting.

This type of table does not apply to IBM ESDI or SCSI hard disk controllers, host adapters, and drives. Because the ESDI and SCSI controllers or host adapters query the drive directly for the required parameters, no table-entry selection is necessary. Note, however, that the table for the ST-506/412 drives can still be found currently in the ROM BIOS of most of the PS/2 systems, even if the model came standard with an ESDI or SCSI disk subsystem.

Table 23 Compaq Deskpro 386 Hard Disk Table

Type	Cylinders	Heads	WPC	Ctrl	LZ	S/T	Meg	M
1	306	4	128	00h	305	17	10.16	10.65
2	615	4	128	00h	638	17	20.42	21.41
3	615	6	128	00h	615	17	30.63	32.12
4	1024	8	512	00h	1023	17	68.00	71.30

Type	Cylinders	Heads	WPC	Ctrl	LZ	S/T	Meg	M
5	940	6	512	00h	939	17	46.82	49.09
6	697	5	128	00h	696	17	28.93	30.33
7	462	8	256	00h	511	17	30.68	32.17
8	925	5	128	00h	924	17	38.39	40.26
9	900	15	65535	08h	899	17	112.06	117.50
10	980	5	65535	00h	980	17	40.67	42.65
11	925	7	128	00h	924	17	53.75	56.36
12	925	9	128	08h	924	17	69.10	72.46
13	612	8	256	00h	611	17	40.64	42.61
14	980	4	128	00h	980	17	32.54	34.12
15	0	0	0	00h	0	0	0	0
16	612	4	0	00h	612	17	20.32	21.31
17	980	5	128	00h	980	17	40.67	42.65
18	966	6	128	00h	966	17	48.11	50.45
19	1023	8	65535	00h	1023	17	67.93	71.23
20	733	5	256	00h	732	17	30.42	31.90
21	733	7	256	00h	732	17	42.59	44.66
22	805	6	65535	00h	805	17	40.09	42.04
23	924	8	65535	00h	924	17	61.36	64.34
24	966	14	65535	08h	966	17	112.26	117.71
25	966	16	65535	08h	966	17	128.30	134.53
26	1023	14	65535	08h	1023	17	118.88	124.66
27	966	10	65535	08h	966	17	80.19	84.08
28	748	16	65535	08h	748	17	99.34	104.17
29	805	6	65535	00h	805	26	61.32	64.30
30	615	4	128	00h	615	25	30.03	31.49
31	615	8	128	00h	615	25	60.06	62.98
32	905	9	128	08h	905	25	99.43	104.26
33	748	8	65535	00h	748	34	99.34	104.17
34	966	7	65535	00h	966	34	112.26	117.71
35	966	8	65535	00h	966	34	128.30	134.53
36	966	9	65535	08h	966	34	144.33	151.35
37	966	5	65535	00h	966	34	80.19	84.08
38	611	16	65535	08h	611	63	300.73	315.33
39	1023	11	65535	08h	1023	33	181.32	190.13
40	1023	15	65535	08h	1023	34	254.75	267.13
41	1023	15	65535	08h	1023	33	247.26	259.27
42	1023	16	65535	08h	1023	63	503.51	527.97
43	805	4	65535	00h	805	26	40.88	42.86
44	805	2	65535	00h	805	26	20.44	21.43
45	748	8	65535	00h	748	33	96.42	101.11
46	748	6	65535	00h	748	33	72.32	75.83
47	966	5	128	00h	966	25	58.96	61.82

Table 24 AMI ROM BIOS (286 BIOS Version 04/30/89) Hard Disk Table

Type	Cylinders	Heads	WPC	Ctrl	LZ	S/T	Meg	M
1	306	4	128	00h	305	17	10.16	10.65
2	615	4	300	00h	615	17	20.42	21.41
3	615	6	300	00h	615	17	30.63	32.12
4	940	8	512	00h	940	17	62.42	65.45
5	940	6	512	00h	940	17	46.82	49.09
6	615	4	65535	00h	615	17	20.42	21.41
7	462	8	256	00h	511	17	30.68	32.17
8	733	5	65535	00h	733	17	30.42	31.90
9	900	15	65535	08h	901	17	112.06	117.50
10	820	3	65535	00h	820	17	20.42	21.41
11	855	5	65535	00h	855	17	35.49	37.21
12	855	7	65535	00h	855	17	49.68	52.09
13	306	8	128	00h	319	17	20.32	21.31
14	733	7	65535	00h	733	17	42.59	44.66
15	0	0	0	00h	0	0	0	0
16	612	4	0	00h	663	17	20.32	21.31
17	977	5	300	00h	977	17	40.55	42.52
18	977	7	65535	00h	977	17	56.77	59.53
19	1024	7	512	00h	1023	17	59.50	62.39
20	733	5	300	00h	732	17	30.42	31.90
21	733	7	300	00h	732	17	42.59	44.66
22	733	5	300	00h	733	17	30.42	31.90
23	306	4	0	00h	336	17	10.16	10.65
24	925	7	0	00h	925	17	53.75	56.36
25	925	9	65535	08h	925	17	69.10	72.46
26	754	7	526	00h	754	17	43.81	45.94
27	754	11	65535	08h	754	17	68.85	72.19
28	699	7	256	00h	699	17	40.62	42.59
29	823	10	65535	08h	823	17	68.32	71.63
30	918	7	874	00h	918	17	53.34	55.93
31	1024	11	65535	08h	1024	17	93.50	98.04
32	1024	15	65535	08h	1024	17	127.50	133.69
33	1024	5	1024	00h	1024	17	42.50	44.56
34	612	2	128	00h	612	17	10.16	10.65
35	1024	9	65535	08h	1024	17	76.50	80.22
36	1024	8	512	00h	1024	17	68.00	71.30
37	615	8	128	00h	615	17	40.84	42.82
38	987	3	805	00h	987	17	24.58	25.77
39	987	7	805	00h	987	17	57.35	60.14
40	820	6	820	00h	820	17	40.84	42.82
41	977	5	815	00h	977	17	40.55	42.52
42	981	5	811	00h	981	17	40.72	42.69
43	830	7	512	00h	830	17	48.23	50.57

Type	Cylinders	Heads	WPC	Ctrl	LZ	S/T	Meg	M
44	830	10	65535	08h	830	17	68.90	72.24
45	917	15	65535	08h	918	17	114.18	119.72
46	1224	15	65535	08h	1223	17	152.40	159.81
47	0	0	0	00h	0	0	0.00	0.00

Table 25 shows the Award ROM BIOS (286 BIOS version 04/30/89) (Modular 286, 386SX, and 386 BIOS version 3.05) hard disk parameters.

Table 25 Award ROM BIOS Version 3.05 Hard Disk Table

Type	Cylinders	Heads	WPC	Ctrl	LZ	S/T	Meg	M
1	306	4	128	00h	305	17	10.16	10.65
2	615	4	300	00h	615	17	20.42	21.41
3	615	6	300	00h	615	17	30.63	32.12
4	940	8	512	00h	940	17	62.42	65.45
5	940	6	512	00h	940	17	46.82	49.09
6	615	4	65535	00h	615	17	20.42	21.41
7	462	8	256	00h	511	17	30.68	32.17
8	733	5	65535	00h	733	17	30.42	31.90
9	900	15	65535	08h	901	17	112.06	117.50
10	820	3	65535	00h	820	17	20.42	21.41
11	855	5	65535	00h	855	17	35.49	37.21
12	855	7	65535	00h	855	17	49.68	52.09
13	306	8	128	00h	319	17	20.32	21.31
14	733	7	65535	00h	733	17	42.59	44.66
15	0	0	0	00h	0	0	0	0
16	612	4	0	00h	663	17	20.32	21.31
17	977	5	300	00h	977	17	40.55	42.52
18	977	7	65535	00h	977	17	56.77	59.53
19	1024	7	512	00h	1023	17	59.50	62.39
20	733	5	300	00h	732	17	30.42	31.90
21	733	7	300	00h	732	17	42.59	44.66
22	733	5	300	00h	733	17	30.42	31.90
23	306	4	0	00h	336	17	10.16	10.65
24	977	5	65535	00h	976	17	40.55	42.52
25	1024	9	65535	08h	1023	17	76.50	80.22
26	1224	7	65535	00h	1223	17	71.12	74.58
27	1224	11	65535	08h	1223	17	111.76	117.19
28	1224	15	65535	08h	1223	17	152.40	159.81
29	1024	8	65535	00h	1023	17	68.00	71.30
30	1024	11	65535	08h	1023	17	93.50	98.04
31	918	11	65535	08h	1023	17	83.82	87.89
32	925	9	65535	08h	926	17	69.10	72.46

(continues)

Table 25 Continued

Type	Cylinders	Heads	WPC	Ctrl	LZ	S/T	Meg	M
33	1024	10	65535	08h	1023	17	85.00	89.13
34	1024	12	65535	08h	1023	17	102.00	106.95
35	1024	13	65535	08h	1023	17	110.50	115.87
36	1024	14	65535	08h	1023	17	119.00	124.78
37	1024	2	65535	00h	1023	17	17.00	17.83
38	1024	16	65535	08h	1023	17	136.00	142.61
39	918	15	65535	08h	1023	17	114.30	119.85
40	820	6	65535	00h	820	17	40.84	42.82
41	1024	5	65535	00h	1023	17	42.50	44.56
42	1024	5	65535	00h	1023	26	65.00	68.16
43	809	6	65535	00h	808	17	40.29	42.25
44	820	6	65535	00h	819	26	62.46	65.50
45	776	8	65535	00h	775	33	100.03	104.89
46	0	0	0	00h	0	0	0.00	0.00
47	0	0	0	00h	0	0	0.00	0.00

Table 26 shows the Phoenix 286 ROM BIOS (80286 ROM BIOS version 3.01, dated 11/01/86) hard disk parameters.

Table 26 Phoenix 286 (80286 ROM BIOS Version 3.01) Hard Disk Table

Type	Cylinders	Heads	WPC	Ctrl	LZ	S/T	Meg	M
1	306	4	128	00h	305	17	10.16	10.65
2	615	4	300	00h	638	17	20.42	21.41
3	615	6	300	00h	615	17	30.63	32.12
4	940	8	512	00h	940	17	62.42	65.45
5	940	6	512	00h	940	17	46.82	49.09
6	615	4	65535	00h	615	17	20.42	21.41
7	462	8	256	00h	511	17	30.68	32.17
8	733	5	65535	00h	733	17	30.42	31.90
9	900	15	65535	08h	901	17	112.06	117.50
10	820	3	65535	00h	820	17	20.42	21.41
11	855	5	65535	00h	855	17	35.49	37.21
12	855	7	65535	00h	855	17	49.68	52.09
13	306	8	128	00h	319	17	20.32	21.31
14	733	7	65535	00h	733	17	42.59	44.66
15	0	0	0	00h	0	0	0.00	0.00
16	612	4	0	00h	633	17	20.32	21.31
17	977	5	300	00h	977	17	40.55	42.52
18	977	7	65535	00h	977	17	56.77	59.53
19	1024	7	512	00h	1023	17	59.50	62.39
20	733	5	300	00h	732	17	30.42	31.90
21	733	7	300	00h	733	17	42.59	44.66

Type	Cylinders	Heads	WPC	Ctrl	LZ	S/T	Meg	M
22	733	5	300	00h	733	17	30.42	31.90
23	0	0	0	00h	0	0	0.00	0.00
24	0	0	0	00h	0	0	0.00	0.00
25	0	0	0	00h	0	0	0.00	0.00
26	0	0	0	00h	0	0	0.00	0.00
27	0	0	0	00h	0	0	0.00	0.00
28	0	0	0	00h	0	0	0.00	0.00
29	0	0	0	00h	0	0	0.00	0.00
30	0	0	0	00h	0	0	0.00	0.00
31	0	0	0	00h	0	0	0.00	0.00
32	0	0	0	00h	0	0	0.00	0.00
33	0	0	0	00h	0	0	0.00	0.00
34	0	0	0	00h	0	0	0.00	0.00
35	0	0	0	00h	0	0	0.00	0.00
36	1024	5	512	00h	1024	17	42.50	44.56
37	830	10	65535	08h	830	17	68.90	72.24
38	823	10	256	08h	824	17	68.32	71.63
39	615	4	128	00h	664	17	20.42	21.41
40	615	8	128	00h	664	17	40.84	42.82
41	917	15	65535	08h	918	17	114.18	119.72
42	1023	15	65535	08h	1024	17	127.38	133.56
43	823	10	512	08h	823	17	68.32	71.63
44	820	6	65535	00h	820	17	40.84	42.82
45	1024	8	65535	00h	1024	17	68.00	71.30
46	925	9	65535	08h	925	17	69.10	72.46
47	1024	5	65535	00h	1024	17	42.50	44.56

Modem Control Codes

This section lists the command and control codes for popular modems. Most modems use a standard AT command set that was developed by Hayes and augmented by U.S. Robotics. Table 27 comes in handy when you need to reconfigure a modem without the original manual. Even if your modem is not Hayes or U.S. Robotics, it probably follows most of these commands because this command set has become somewhat of a standard. S-register values listed at the end of the table are also somewhat standard but are more subject to variation in the defaults by brand and model.

Table 27 Modem AT Commands and S-Register Features

Command	Modem Functions and Options
&	See Extended Command Set
%	See Extended Command Set
A	Force Answer mode when modem has not received an incoming call
A/	Reexecute last command once

(continues)

Table 27 Continued

Command	Modem Functions and Options	
A>	Repeat last command continuously	
Any key	Terminate current connection attempt; exit Repeat mode	
AT	Attention: must precede all other commands, except A/, A>, and +++	
Bn	Handshake options	
	B0	CCITT answer sequence
	B1	Bell answer tone
Cn	Transmitter On/Off	
	C0	Transmitter Off
	C1	Transmitter On—Default
Dn	Dial number *n* and go into originate mode	
	Use any of these options:	
	P	Pulse dial—Default
	T	Touch-tone dial
	,	(Comma) Pause for two seconds
	;	Return to command state after dialing
	"...	Dial the letters that follow
	!	Flash switch-hook to transfer call
	W	Wait for second dial tone (if X3 or higher is set)
	@	Wait for an answer (if X3 or higher is set)
	R	Reverse frequencies
	S	Dial stored number
DL	Dial the last-dialed number	
DSn	Dial number stored in NVRAM at position	
En	Command mode local echo; not applicable after a connection has been made	
	E0	Echo Off
	E1	Echo On
Fn	Local echo On/Off when a connection has been made	
	F0	Echo On (Half duplex)
	F1	Echo Off (Full duplex)—Default
Hn	On/Off hook control	
	H0	Hang up (go on hook)—Default
	H1	Go off hook
In	Inquiry	
	I0	Return product code
	I1	Return memory (ROM) checksum
	I2	Run memory (RAM) test
	I3	Return call duration/real time
	I4	Return current modem settings
	I5	Return NVRAM settings
	I6	Return link diagnostics
	I7	Return product configuration
Kn	Modem clock operation	
	K0	ATI3 displays call duration—Default
	K1	ATI3 displays real time; set with ATI3=HH:MM:SSK1

Command	Modem Functions and Options
Ln	Loudness of speaker volume
	L0 Low
	L1 Low
	L2 Medium
	L3 High
Mn	Monitor (speaker) control
	M0 Speaker always Off
	M1 Speaker On until carrier is established—Default
	M2 Speaker always On
	M3 Speaker On after last digit dialed, Off at carrier detect
O	Return online after command execution
	O0 Return online, normal
	O1 Return online, retrain
P	Pulse dial
Qn	Result codes display
	Q0 Result codes displayed
	Q1 Result codes suppressed (quiet mode)
	Q2 Quiet in answer mode only
Sr=n	Set Register commands: r is any S-register; n must be a decimal number between 0 and 255.
Sr.b=n	Set bit .b of register r to n (0/Off or 1/On)
Sr?	Query register r
T	Tone dial
Vn	Verbal/Numeric result codes
	V0 Numeric mode
	V1 Verbal mode
Xn	Result code options
Yn	Long space disconnect
	Y0 Disabled
	Y1 Enabled; disconnects after 1 1/2-second break
Z	Software reset
+++	Escape code sequence, preceded and followed by at least one second of no data transmission
/(Slash)	Pause for 125 msec
>	Repeat command continuously or up to 10 dial attempts, Cancel by pressing any key
$	Online Help—Basic command summary
&$	Online Help—Ampersand command summary
%$	Online Help—Percent command summary
D$	Online Help—Dial command summary
S$	Online Help—S-register summary
<Ctrl>-S	Stop/restart display of Help screens
<Ctrl>-C	Cancel display Help screens
<Ctrl>-K	Cancel display Help screens

(continues)

Table 27 Continued

Command	Modem Functions and Options
Extended Command Set	
&An	ARQ result codes 14–17, 19
	&A0 Suppress ARQ result codes
	&A1 Display ARQ result codes—Default
	&A2 Display HST and V.32 result codes
	&A3 Display protocol result codes
&Bn	Data Rate, terminal-to-modem (DTE / DCE)
	&B0 DTE rate follows connection rate—Default
	&B1 Fixed DTE rate
	&B2 Fixed DTE rate in ARQ mode; variable DTE rate in non-ARQ mode
&Cn	Carrier Detect (CD) operations
	&C0 CD override
	&C1 Normal CD operations
&Dn	Data Terminal Ready (DTR) operations
	&D0 DTR override
	&D1 DTR Off; goes to command state
	&D2 DTR Off; goes to command state and on hook
	&D3 DTR Off; resets modem
&F	Load factory settings into RAM
&Gn	Guard tone
	&G0 No guard tone; U.S., Canada—Default
	&G1 Guard tone; some European countries
	&G2 Guard tone; U.K., requires B0
&Hn	Transmit Data flow control
	&H0 Flow control disabled—Default
	&H1 Hardware (CTS) flow control
	&H2 Software (XON / XOFF) flow control
	&H3 Hardware and software control
&In	Received Data software flow control
	&I0 Flow control disabled—Default
	&I1 XON / XOFF to local modem and remote computer
	&I2 XON / XOFF to local modem only
	&I3 Host mode, Hewlett-Packard protocol
	&I4 Terminal mode, Hewlett-Packard protocol
	&I5 ARQ mode-same as &I2; non-ARQ mode; look for incoming XON / XOFF
&Jn	Telephone jack selection
	&J0 RJ-11 / RJ-41S / RJ-45S
	&J1 RJ-12 / RJ-13
&Kn	Data compression
	&K0 Disabled
	&K1 Auto enable / disable—Default
	&K2 Enabled
	&K3 V.42bis only

Command	Modem Functions and Options
Extended Command Set	
&Ln	Normal/Leased line operation
	&L0 Normal phone line—Default
	&L1 Leased line
&Mn	Error Control/Synchronous Options
	&M0 Normal mode, no error control
	&M1 Sync mode
	&M2 Sync mode 2—stored number dialing
	&M3 Sync mode 3—manual dialing
	&M4 Normal/ARQ mode—Normal if ARQ connection cannot be made—Default
	&M5 ARQ mode—hang up if ARQ connection cannot be made
&Nn	Data Rate, data link (DCE/DCE)
	&N0 Normal link operations—Default
	&N1 300bps
	&N2 1,200bps
	&N3 2,400bps
	&N4 4,800bps
	&N5 7,200bps
	&N6 9,600bps
	&N7 12Kbps
	&N8 14.4Kbps
&Pn	Pulse dial make/break ratio
	&P0 North America—Default
	&P1 British Commonwealth
&Rn	Received Data hardware (RTS) flow control
	&R0 CTS tracks RTS
	&R1 Ignore RTS—Default
	&R2 Pass received data on RTS high; used Pass received data on RTS high Extended Command Set
&Sn	Data Set Ready (DSR) override
	&S0 DSR override (always On—Default)
	&S1 Modem controls DSR
	&S2 Pulsed DSR; CTS follows CD
	&S3 Pulsed DSR
&Tn	Modem testing
	&T0 End testing
	&T1 Analog loopback
	&T2 Reserved
	&T3 Digital loopback
	&T4 Grant remote digital loopback
	&T5 Deny remote digital loopback
	&T6 Initiate remote digital loopback

(continues)

Table 27 Continued

Command	Modem Functions and Options
Extended Command Set	
	&T7 Remote digital loopback with self-test
	&T8 Analog loopback with self-test
&W	Write current settings to NVRAM
&Xn	Synchronous timing source
	&X0 Modem's transmit clock—Default
	&X1 Terminal equipment
	&X2 Modem's receiver clock
&Yn	Break handling. Destructive breaks clear the buffer; expedited Breaks are sent immediately to remote system
	&Y0 Destructive, but don't send break
	&Y1 Destructive, expedited—Default
	&Y2 Nondestructive, expedited
	&Y3 Nondestructive, unexpedited
&Zn=L	Store last-dialed phone number in NVRAM at position
&Zn=s	Write phone number(s) to NVRAM at position n (0-3); 36 characters maximum
&Zn?	Display phone number in NVRAM at position n (n=0-3)
%Rn	Remote access to Rack Controller Unit (RCU)
	%R0 Disabled
	%R1 Enabled
%T	Enable Touch-tone recognition
Modem S-Register Functions and Defaults	
S0	Number of rings before automatic answering when DIP switch 5 is UP. Default = 1. S0 = 0 disables Auto Answer, equivalent to DIP switch 5 Down
S1	Counts and stores number of rings from incoming call
S2	Define escape code character. Default = +
S3	Define ASCII carriage return
S4	Define ASCII line feed
S5	Define ASCII Backspace
S6	Number of seconds modem waits before dialing
S7	Number of seconds modem waits for a carrier
S8	Duration (sec) for pause (,) option in Dial command and pause between command reexecutions for Repeat (>) command
S9	Duration (.1 sec units) of remote carrier signal before recognition
S10	Duration (.1 sec units) modem waits after loss of carrier before hanging up
S11	Duration and spacing (ms) of dialed touch-tones
S12	Guard time (in .02 sec units) for escape code sequence (+++)
S13	Bitmapped register:
	1 Reset when DTR drops
	2 Auto answer in originate mode
	4 Disable result code pause
	8 DS0 on DTR low-to-high

Command	Modem Functions and Options	
Modem S-Register Functions and Defaults		
	16	DS0 on power up, ATZ
	32	Disable HST modulation
	64	Disable MNP Level 3
	128	Watchdog hardware reset
S15	Bitmapped register:	
	1	Disable high-frequency equalization
	2	Disable online fallback
	4	Force 300bps back channel
	8	Set non-ARQ transmit buffer to 128 bytes
	16	Disable MNP Level 4
	32	Set Del as Backspace key
	64	Unusual MNP incompatibility
	128	Custom applications only
Bitmapped Register		
1	Analog loopback	
2	Dial test	
4	Test pattern	
8	Initiate remote digital loopback	
16	Reserved	
32	Reserved	
64	Reserved	
128	Reserved	
S18	&Tn Test timer, disabled when set to 0	
S19	Set inactivity timer in minutes	
S21	Length of Break, DCE to DTE, in 10ms units	
S22	Define ASCII XON 17	17
S23	Define ASCII XOFF 19	19
Modem S-Register Functions and Defaults		
S24	Duration (20ms units) of pulsed DSR when modem is set to &S2 or &S3	
S25	Delay to DTR in 10ms units	
S26	Duration (10ms units) of delay between RTS and CTS, synchronous mode	
S27	Bitmapped register:	
	1	Enable V.21 modulation, 300bps
	2	Enable unencoded V.32 modulation
	4	Disable V.32 modulation
	8	Disable 2100Hz answer tone
	16	Disable MNP handshake
	32	Disable V.42 Detect phase
	64	Reserved
	128	Unusual software incompatibility
S28	Duration (.1 sec units) of V.21/V.23 handshake delay	

(continues)

Table 27 Continued

Command	Modem Functions and Options	
Modem S-Register Functions and Defaults		
S32	Voice / Data switch options: 1	
	0	Disabled
	1	Go off hook in originate mode
	2	Go off hook in answer mode
	3	Redial last-dialed number
	4	Dial number stored at position 0
	5	Auto answer toggle On / Off
	6	Reset modem
	7	Initiate remote digital loopback
S34	Bitmapped register:	
	1	Disable V.32bis
	2	Disable enhanced V.32 mode
	4	Disable quick V.32 retrain
	8	Enable V.23 modulation
	16	Change MR LED to DSR
	32	Enable MI / MIC
	64	Reserved
	128	Reserved
S38	Duration (sec) before disconnect when DTR drops during an ARQ call	

ARQ = Automatic repeat request
ASCII = American Standard Code for Information Interchange
BPS = Bits per second
CCITT = Consultative Committee for International Telephone and Telegraph
CD = Carrier detect
CRC = Cyclic redundancy check
DCE = Data communications equipment
DTE = Data terminal equipment
EIA = Electronic Industries Association
HDLC = High-level data link control
HST = High-speed technology
Hz = Hertz
LAPM = Link access procedure for modems
MI/MIC = Mode indicate/Mode indicate common
MNP = Microcom networking protocol
NVRAM = Non-volatile memory
RAM = Random access memory
ROM = Read-only memory
SDLC = Synchronous Data Link Control
MR = Modem ready
LED = Light-emitting diode

DTR = Data terminal ready
CTS = Clear to send
RTS = Ready to send
DSR = Data set ready

DOS Command Reference

Even if the systems you support, upgrade, and repair are all running the latest version of Windows, you will inevitably find yourself occasionally troubleshooting these systems from the DOS command line. With that in mind, I have included this brief DOS command reference to aid you when you are at the command line.*

**This DOS command reference is based substantially on material found in Paul McFedries'* Windows 98 Unleashed Professional Reference Edition*, copyright 1998 Sams Publishing, all rights reserved. Used with permission.*

DOS Commands Found in DOS 6.22, Windows 95, and Windows 98

Windows 95 and Windows 98 both still include DOS commands. The version of DOS with Windows 95 is called 7.0 and the version with Windows 98 is called 7.1. For the most part, DOS 7.x commands are just a subset of the commands found in DOS 6.22. However, DOS 7.x does have a few new features not found in DOS 6.x, so the new DOS is not the same as the old DOS. Here's a partial list of improvements:

- You can start Windows programs from the DOS prompt and even from within batch files.
- The new DOS includes support for long filenames.
- Reduced reliance on real-mode drivers means that more conventional memory is available for DOS programs.
- Each DOS program can have its own settings and environment (CONFIG.SYS and AUTOEXEC.BAT). These are controlled via property sheets, so there's no need to create program information files (PIFs) from scratch for each program.
- You can run DOS programs in MS-DOS mode if they need full access to the computer's resources.
- The DOS session window has a toolbar for easy access to common features.
- You can access shared network folders via the command prompt.
- Most DOS commands are now native Windows 98 commands.

Windows 98 is, for the most part, the operating system on your machine. Yes, it comes with some real-mode components (such as IO.SYS) that are DOS-like, but they really just handle a few chores until Windows 98 can get itself into protected mode. After Windows 98 is running, however, "DOS" is just two things:

- COMMAND.COM, which provides the DOS prompt and a collection of internal DOS commands (such as COPY and DIR)
- A few external DOS commands, such as FORMAT.COM and XCOPY.EXE

For Windows 95 (and, so, Windows 98), Microsoft enhanced some of these commands, dropped other commands, and made a few of the dropped commands available on the CD-ROM.

Table 28 lists the internal DOS commands available within the DOS 6.22, Windows 95, and Windows 98 versions of COMMAND.COM.

Table 28 The Windows 98 Internal DOS Commands

Command	Description
BREAK	Sets or clears extended Ctrl+C checking.
CD	Changes to a different directory or, if run without parameters, displays the name of the current directory.
CHCP	Displays the number of the active character set (code page). You can also use this command to change the active character set for all devices that support character-set switching.
CHDIR	Takes the same action as the CD command.
CLS	Clears the screen.
COPY	Copies one or more files to the location you specify.
CTTY	Changes the terminal device used to control the computer.
DATE	Displays or sets the current date.
DEL	Deletes the files you specify.
DIR	Displays a list of the files and subfolders that exist in the current or specified folder.
ERASE	Deletes the files you specify.
EXIT	Quits COMMAND.COM and returns to the program that started the command interpreter, if one exists.
LH	Loads a program into upper memory.
LOADHIGH	Takes the same action as the LH command.
LOCK	Enables direct disk access.
MD	Creates a folder or subfolder.
MKDIR	Takes the same action as the MD command.
PATH	Specifies which folders Windows 98 should search for executable files.
PROMPT	Changes the appearance of the command prompt.
RD	Deletes a folder.
REN	Changes the name of the specified file or files.
RENAME	Takes the same action as the REN command.
RMDIR	Takes the same action as the RD command.
SET	Displays, sets, or removes environment variables.
TIME	Displays or sets the current time.
TYPE	Displays the contents of the specified text file.
UNLOCK	Disables direct disk access.
VER	Displays the operating system version number.
VERIFY	Directs the operating system to verify that files are written correctly to a disk and displays the status of verification.
VOL	Displays the volume label and serial number for a disk.

The DOS external commands are located in the COMMAND subfolder of the main Windows 95/98 folder. Table 29 lists the external DOS commands that ship with Windows 95/98.

Table 29 The Windows 98 External DOS Commands

Command	Description
ATTRIB.EXE	Displays or changes the attributes of the specified files.
CHKDSK.EXE	Checks a disk for (and optionally repairs) lost and cross-linked clusters. ScanDisk does a better job at finding and repairing these errors.
CHOICE.COM	Used in batch files to present the user with a list of options.
COMMAND.COM	Starts a new instance of the command interpreter. This file is usually found in the root directory of the boot drive.
CSCRIPT.EXE	(Windows 98 only) Runs Windows Script Host scripts.
CVT.EXE	(Windows 95 OSR 2 and Windows 98 only) Converts FAT drives to FAT32.
DEBUG.EXE	Tests and edits executable files.
DELTREE.EXE	Deletes a folder and all its files and subfolders.
DISKCOPY.COM	Makes an exact copy of a floppy disk.
DOSKEY.COM	A memory-resident program that recalls commands, edits previous command lines, and runs macros.
EDIT.COM	Starts a text editor you can use to create and edit ASCII text files.
EXTRACT.EXE	(Windows 95/98 only) Extracts files from a compressed cabinet (CAB) file.
FC.EXE	Compares two files and displays the differences between them.
FDISK.EXE	Starts the FDISK utility.
FIND.EXE	Searches files for a specified text string.
FORMAT.COM	Formats a disk.
IEXTRACT.EXE	Extracts a file from an Internet Explorer backup information (DAT) file.
KEYB.COM	Configures a keyboard for a specific language.
LABEL.EXE	Creates or modifies the volume label of a disk.
MEM.EXE	Displays the amount of used and free memory on the computer.
MODE.COM	Configures a printer, serial port, or display adapter; sets the keyboard repeat rate; redirects printer output from a parallel port to a serial port; prepares, selects, refreshes, or displays the numbers of the character sets (code pages) for parallel printers or the keyboard and screen; and displays the status of all the devices installed on the computer.
MORE.COM	Pauses command output to display one screen at a time.
MOVE.EXE	Moves files and renames folders.
MSCDEX.EXE	Loads the real-mode CD-ROM driver.
NLSFUNC.EXE	Loads country-specific information for national language support.
SCANDISK.EXE	The real-mode version of ScanDisk.
SCANREG.EXE	(Windows 98 only) Scans the Registry for damage.
SORT.EXE	Reads input, sorts data, and writes the results to the screen, a file, or another device.
START.EXE	Enables you to set various parameters for running Windows programs from the DOS prompt.
SUBST.EXE	Substitutes a drive letter for a path name.
SYS.COM	Creates a bootable disk by copying Windows 98's system files and COMMAND.COM to the disk.
XCOPY.EXE	The extended copy command.
XCOPY32.EXE	(Windows 95 and Windows 98 only) The 32-bit version of XCOPY.

DOS 6.22 Commands Not Installed by Windows 95/98 but Available on the CD-ROM

Microsoft deleted quite a few DOS commands when it put together the Windows 98 package. Most of these commands were either obsolete (such as EGA.SYS) or dangerous (such as RECOVER). Three of these commands, however, can be found on the Windows 98 CD-ROM in the \TOOLS\OLDMSDOS\ folder. I've summarized them in Table 30.

Table 30 Old DOS Commands Available on the Windows 98 CD-ROM

Command	Description
HELP.COM	Displays descriptions, syntax, and examples for all DOS commands. HELP.HLP is also available.
MSD.EXE	Runs the Microsoft Diagnostics program used to gather system information for troubleshooting. Superseded by the System Information utility in Windows 98.
QBASIC.EXE	The programming environment for creating QBASIC applications. QBASIC.HLP is also available.

Table 31 lists commands that were available in the Windows 95 CD-ROM in the \OTHER\OLDMSDOS folder. These were commands that were available in DOS 6.22 but were not installed by Windows 95 because they are obsolete.

Table 31 Old DOS Commands Available on the Windows 95 CD-ROM

Command	Description
APPEND.EXE	Establishes a DOS search path for data files.
CHKSTATE.SYS	A device driver used by MemMaker to optimize memory use. You cannot use this driver.
EXPAND.EXE	Extracts a file from compressed format on the DOS distribution disks to a usable uncompressed form.
GRAPHICS.COM	Enables the Print Screen key to print the contents of a graphics screen on a suitable printer.
HELP.COM	Launches a full screen online help utility for the DOS commands.
INTERLNK.EXE	Client device driver for an InterLnk network.
INTERSVR.EXE	Server device driver for an InterLnk network.
LOADFIX.COM	Forces a program to load into the second 64KB of memory.
MEMMAKER.EXE	Utility for optimizing memory usage by device drivers and other programs loaded by CONFIG.SYS and AUTOEXEC.BAT.
MSD.EXE	Runs the Microsoft Diagnostics program used to gather system information for troubleshooting.
PRINT.EXE	Print spooler for ASCII text files.
QBASIC.EXE	Starts the Microsoft QuickBASIC development environment, a program for writing and running BASIC language programs.
REPLACE.EXE	Replaces or adds files to a subdirectory.
RESTORE.EXE	Restores files created by the BACKUP program from one disk to another.
SIZER.EXE	A program used by MemMaker to optimize memory use. You cannot use this program.
TREE.EXE	Displays the subdirectory stricture of a disk.
UNDELETE.EXE	Undeletes a file or group of files.

DOS 6.22 Commands Not Available in Windows 95 or Windows 98

Finally, Table 32 is a list of DOS 6.22 commands that are gone for good and won't be found in either Windows 95 or Windows 98.

Table 32 DOS 6.22

Command	Description
ASSIGN	In DOS 2–5, attached an alias drive letter to an existing drive. Replaced by SUBST in DOS 6 and later.
BACKUP	A utility to back up files from a hard disk to a series of floppy disks. Replaced by MSBACKUP in DOS 6 and with the GUI version of Backup for Windows 95 and Windows 98.
COMP	Compares two sets of disk files of the same name and same length. Included in DOS 1–5 but only on supplemental disk in DOS 6.
DOSSHELL	In DOS 4–6, a full screen menu driven shell for the DOS command line. Included only on the supplemental disk for DOS 6.2.
EDLIN	In DOS 1–5, edits an ASCII file, replaced by EDIT. Only on supplemental disk in DOS 6.
FASTHELP	Returns the same help information as including the /? switch with a DOS command.
FASTOPEN	A utility that sped up the process of opening files in DOS.
GRAFTABL	A DOS 3–5 utility for loading tables of additional character sets for CGA adapters. Only on the supplemental disk in DOS 6.
JOIN	In DOS 3.1–5, connects one drive to a subdirectory of another. Only on the supplemental disk in DOS 6.
MIRROR	In DOS 5, records information about the FAT, the root directory, and optionally the partition table which can be used by UNFORMAT and UNDELETE. Only on the supplemental disk in DOS 6.
MSAV	Microsoft Anti-Virus for Windows 3.x.
MSBACKUP	Microsoft Backup for Windows 3.x.
POWER	Controls use of APM in laptop systems and other APM-enabled systems.
RECOVER	A file recovery utility with DOS 2–5 that was not distributed with DOS 6 or later. Not recommended for use with any version.
SETVER	DOS version control program that reports a different DOS version number to programs requiring a specific version of DOS to run.
SHARE	File sharing and locking capabilities for DOS.
SMARTMON	SMARTDrive monitoring and configuration program for Windows 3.x.
UNFORMAT	Recovers a disk that was accidentally formatted. Note that using the /U switch with the FORMAT command will prevent the UNFORMAT command from being able to recover the disk.
VSAFE	A memory resident utility that warns you of virus-like activity.