

Astrocade 8K Bally ROM Source

1. Table of Contents		
Storage Area (N.A.)		
1-1 Table of Contents		1 page
2. Assembly header (equates and macros)		
Storage Area (N.A.)		
2-15 Equates and macros		14 pages
3. Subroutines, Character Set, and all else		
Storage Area (\$0000-\$0E18)		
16-82 Assembly Listing		67 pages
83-94 Bally ROM Cross Reference		12 pages
4. Scribbling		
Storage Area (\$0E19-\$1013)		
95-103 Assembly Listing		9 pages
104-111 Scribbling Cross Reference		9 pages
5. Calculator		
Storage Area (\$1020-\$1323)		
112-123 Assembly Listing		12 pages
124-131 Calculator Cross Reference		8 pages
6. Checkmate		
Storage Area (\$1028-\$17D9)		
132-151 Assembly Listing		20 pages
152-161 Checkmate Cross Reference		10 pages
7. Gunfight		
Storage Area (\$17DE-\$1FEE)		
162-197 Listing		36 pages
198-207 Gunfight Cross Reference		10 pages

```

30 ; *****
31 ; * HOME VIDEO GAME EQUATES *
32 ; *****
33 ;
34 ; ASSEMBLY CONTROL
35 ;
>0001 36 XPNDON EQU 1 ; ** SET TO 1 WHEN HARDWARE EXP
>0001 37 NWHDWR EQU 1 ; ** SET TO 1 WHEN NEW HARDWARE
38 ;
39 ; GENERAL GOODIES
>4000 40 NORMEM EQU 4000H
>2000 41 FIRSTC EQU 2000H ; FIRST ADDRESS IN CASSETTE
>0000 42 SCREEN EQU 0
>0028 43 BYTEPL EQU 40 ; BYTES PER LINE
>0040 44 BITSPL EQU 160 ; BITS PER LINE
45 ; STUFF IN SYSTEM DOPE VECTOR
>0200 46 STIMEQ EQU 200H ; SECONDS AND GAME TIME, MUSIC
>0203 47 CTIMEQ EQU 203H ; CUSTOM TIMERS
>0206 48 FNTYEQ EQU 206H ; SYSTEM FONT DESCRIPTOR
>020D 49 FNTSEQ EQU 20DH ; SMALL FONT DESCRIPTOR
>0214 50 ALKKEYS EQU 214H ; KEYMASK OF ALL KEYS
>0218 51 MENMST EQU 218H ; HEAD OF ONBOARD MENU
>021E 52 MXSCOR EQU 21EH ; ADDRESS OF 'MAX SCORE'
>0228 53 NOPLER EQU 228H ; ADDRESS OF '# OF PLAYERS'
>0235 54 NOGAMES EQU 235H ; ADDRESS OF '# OF GAMES'
55 ; BITS IN PROCESSOR FLAG BYTE
>0007 56 PSW7 EQU 7 ; SIGN BIT
>0006 57 PSW6 EQU 6 ; ZERO BIT
>0002 58 PSW2 EQU 2 ; PARITY OVERFLOW
>0000 59 PSW0 EQU 0 ; CARRY
60 ; BITS IN GAME STATUS BYTE
>0000 61 GSBT0 EQU 0
>0001 62 GSBSCR EQU 1
>0007 63 GSBEND EQU 7
64 ; STANDARD VECTOR DISPLACEMENTS AND BITS
>0000 65 VBMR EQU 0 ; MAGIC REGISTER
>0001 66 VBSTA EQU 1 ; STATE
>0002 67 VBTMR EQU 2 ; TIME BASE
>0003 68 VBDLX EQU 3 ; DELTA X LO
>0004 69 VBDXH EQU 4 ; DELTA X HI
>0005 70 VBXL EQU 5 ; X COORD LO
>0006 71 VBXH EQU 6 ; X COORD HI
>0007 72 VBXC EQU 7 ; X CHECK FLAGS
>0008 73 VBDLY EQU 8 ; DELTA Y LO
>0009 74 VBDSL EQU 09H ; DELTA Y HI
>000A 75 VBYL EQU 0AH ; Y COORD LO
>000B 76 VBYS EQU 0BH ; Y COORD HI
>000C 77 VBYSR EQU 0CH ; Y CHECK FLAGS
>000D 78 VBDLH EQU 0DH ; OLD ADDRESS L. O.
>000E 79 VBDLH EQU 0EH ; OLD ADDRESS H. O.
80 ; DISPLACEMENTS FROM START OF COORDINATE AREA
>0000 81 VBDCL EQU 0 ; LO DELTA
>0001 82 VBDCH EQU 1 ; HI DELTA
>0002 83 VBCL EQU 2 ; LO COORD
>0003 84 VBCH EQU 3 ; HI COORD
>0004 85 VBCCHK EQU 4 ; CHECK BITS
  
```

PROPRIETARY INFORMATION

Dave Nutting Associates, Inc.

DO NOT REPRODUCE

	86				; BITS IN STATUS BYTE
>0007	87	VBSACT	EQU 7		; VECTOR ACTIVE STATUS
>0006	88	VBBLNK	EQU 6		; BLANK STATUS
	89				; BITS IN CHECK BIT MASK
>0000	90	VBCLMT	EQU 0		; DO LIMIT CHECKING
>0001	91	VBCREV	EQU 1		; REVERSE DELTA ON LIMIT ATTAIN
>0003	92	VBCLAT	EQU 3		; COORDINATE IS AT LIMIT
	93				; FONT TABLE DISPLACEMENTS FOR NEW CHARACTER DISPLAY ROUT
>0000	94	FTBASE	EQU 0		; BASE CHARACTER
>0001	95	FTFSX	EQU 1		; X FRAME SIZE
>0002	96	FTFSY	EQU 2		; Y FRAME SIZE
>0003	97	FTBYTE	EQU 3		; X SIZE OF CHAR IN BYTES
>0004	98	FTYSIZ	EQU 4		; Y SIZE IN BITS
>0005	99	FTPTL	EQU 5		; PATTERN TABLE ADDRESS LO
>0006	100	FTPTH	EQU 6		; PATTERN TABLE ADDRESS HI
	101				; BITS FOR MAGIC REGISTER WRITE OPTION BYTE
>0006	102	MRFLD	EQU 6		; WRITE WITH FLOP
>0005	103	MRXOR	EQU 5		; WRITE WITH EXCLUSIVE OR
>0004	104	MROR	EQU 4		; WRITE WITH OR
>0003	105	MRXP	EQU 3		; WRITE WITH EXPAND
>0002	106	MRRD	EQU 2		; WRITE WITH ROTATE
>0003	107	MRSHT	EQU 03H		; MASK SHIFT AMOUNT
	108				; BITS OF CONTROL HANDLE INPUT PORT
>0004	109	CHTRIG	EQU 4		; TRIGGER
>0003	110	CHRTRIG	EQU 3		; JOYSTICK RIGHT
>0002	111	CHLEF	EQU 2		; JOYSTICK LEFT
>0001	112	CHDOWN	EQU 1		; DOWN
>0000	113	CHUP	EQU 0		; UP
	114				; CONTEXT BLOCK REGISTER DISPLACEMENTS
>0000	115	CBIXL	EQU 0		; IX
>0001	116	CBIXH	EQU 1		; IX
>0002	117	CBIXL	EQU 2		; IX
>0003	118	CBIXH	EQU 3		; IX
>0004	119	CBE	EQU 4		; DE
>0005	120	CBDE	EQU 5		; DE
>0006	121	CBC	EQU 6		; BC
>0007	122	CBB	EQU 7		; BC
>0008	123	CBFLA	EQU 8		; AF
>0009	124	CBA	EQU 9		; AF
>000A	125	CBL	EQU 0AH		; HL
>000B	126	CBH	EQU 0BH		; HL
	127				; SECURITY RETURN CODES EQUATES:
>0000	128	SNUL	EQU 0		; NOTHING HAPPENED
>0001	129	SCT0	EQU 1		; COUNTER-TIMER 1 THRU 3
>0002	130	SCT1	EQU 2		
>0003	131	SCT2	EQU 3		
>0004	132	SCT3	EQU 4		
>0005	133	SCT4	EQU 5		
>0006	134	SCT5	EQU 6		
>0007	135	SCT6	EQU 7		
>0008	136	SCT7	EQU 8		
>0009	137	SF0	EQU 9		; FLAG BIT 0
>000A	138	SF1	EQU 0AH		
>000B	139	SF2	EQU 0BH		
>000C	140	SF3	EQU 0CH		
>000D	141	SF4	EQU 0DH		
>000E	142	SF5	EQU 0EH		

PROPRIETARY INFORMATION

Dove Nutting Associates, Inc.

DO NOT REPRODUCE

ADDR	OBJECT	STMT	LABEL	OPCODE	OPERAND	COMMENT
>000F		143	SF6	EQU	0FH	
>0010		144	SF7	EQU	10H	
>0011		145	SSEC	EQU	11H	; SECONDS TIMER HAS COUNTED DOW
>0013		146	SKYD	EQU	13H	; KEY IS DOWN
>0012		147	SKYU	EQU	12H	; YES IS UP
>001C		148	SP0	EQU	1CH	; POT 0
>001D		149	SP1	EQU	1DH	; POT 1
>001E		150	SP2	EQU	1EH	; POT 2
>001F		151	SP3	EQU	1FH	; POT 3
>0014		152	ST0	EQU	14H	; TRIGGER 0
>0015		153	SJ0	EQU	15H	; JOYSTICK 0
>0016		154	ST1	EQU	16H	; SIMILARLY FOR 1-3
>0017		155	SJ1	EQU	17H	
>0018		156	ST2	EQU	18H	
>0019		157	SJ2	EQU	19H	
>001A		158	ST3	EQU	1AH	
>001B		159	SJ3	EQU	1BH	

PROPRIETARY INFORMATION

Dave Nutting Associates, Inc.

DO NOT REPRODUCE

```

161 ; *****
162 ; * HOME VIDEO GAME PORT EQUATES *
163 ; *****
164 ; OUTPUT PORTS FOR VIRTUAL COLOR
>0000 165 COLOR EQU 0 ; COLOR 0 RIGHT
>0001 166 COL1R EQU 1 ; COLOR 1 RIGHT
>0002 167 COL2R EQU 2 ; COLOR 2 RIGHT
>0003 168 COL3R EQU 3 ; COLOR 3 RIGHT
>0004 169 COL0L EQU 4 ; COLOR 0 LEFT
>0005 170 COL1L EQU 5 ; COLOR 1 LEFT
>0006 171 COL2L EQU 6 ; COLOR 2 LEFT
>0007 172 COL3L EQU 7 ; COLOR 3 LEFT
>0008 173 COLBX EQU 0BH ; COLOR BLOCK OUTPUT PORT
>0009 174 HORCB EQU 9 ; HORIZONTAL COLOR BOUNDARY
>000A 175 VERBL EQU 0AH ; VERTICAL BLANKING LINE
176 ; OUTPUT PORTS FOR MUSIC AND SOUNDS ✓
>0010 177 TONM EQU 10H ; TONE MASTER OSCILLATOR
>0011 178 TONEA EQU 11H ; TONE A OSC.
>0012 179 TONEB EQU 12H ; TONE B OSC.
>0013 180 TONEC EQU 13H ; TONE C OSC.
>0014 181 VIBRA EQU 14H ; VIBRATO
>0016 182 VOLAB EQU 16H ; TONE A, B VOLUME
>0015 183 VOLC EQU 15H ; TONE C VOLUME
>0017 184 VOLN EQU 17H ; NOISE VOLUME
>0018 185 SNDB EQU 18H ; SOUND BLOCK OUTPUT PORT
186 ; INTERRUPT AND CONTROL OUTPUT PORTS ✓
>000D 187 INFB EQU 0DH ; INTERRUPT FEEDBACK
>000E 188 INMD EQU 0EH ; INTERRUPT MODE
>000F 189 INLF EQU 0FH ; INTERRUPT LINE
>0008 190 CONG EQU 8 ; CONSUMER COMMERCIAL
>000C 191 MAGR EQU 0CH ; MAGIC REGISTER
>0019 192 XPAN EQU 19H ; EXPANDER PIXEL DEFINITION POR
193 ; INTERRUPT AND INTERCEPT INPUT PORTS ✓
>0003 194 INTS EQU 3 ; INTERCEPT STATUS
>000E 195 VERAF EQU 0EH ; VERTICAL ADDRESS FEEDBACK
>000F 196 HORAF EQU 0FH ; HORIZONTAL ADDRESS FEEDBACK
197 ; HAND CONTROLS INPUT PORTS ✓
>0010 198 SW0 EQU 10H ; PLAYER 0 HAND CONTROL
>0011 199 SW1 EQU 11H ; PLAYER 1 HAND CONTROL
>0012 200 SW2 EQU 12H ; PLAYER 2 HAND CONTROL
>0013 201 SW3 EQU 13H ; PLAYER 3 HAND CONTROL
>001C 202 POT0 EQU 1CH ; PLAYER 0 POT
>001D 203 POT1 EQU 1DH ; PLAYER 1 POT
>001E 204 POT2 EQU 1EH ; PLAYER 2 POT
>001F 205 POT3 EQU 1FH ; PLAYER 3 POT
206 ; KEYBOARD INPUT PORTS ✓
>0014 207 KEY0 EQU 14H ; KEYBOARD COLUMN 0
>0015 208 KEY1 EQU 15H ; KEYBOARD COLUMN 1
>0016 209 KEY2 EQU 16H ; KEYBOARD COLUMN 2
>0017 210 KEY3 EQU 17H ; KEYBOARD COLUMN 3
  
```

PROPRIETARY INFORMATION

Dave Nutting Associates, Inc.

DO NOT REPRODUCE

```

212 ; *****
213 ; * HOME VIDEO GAME SYSTEM CALL INDEXES *
214 ; *****
215 ; USER PROGRAM INTERFACE
>0000 216 UPISTR EQU 0
>0000 217 INTPC EQU UPISTR ; INTERPRET WITH CONTEXT CREATE
>0002 218 XINTC EQU INTPC+2 ; EXIT INTERPRETER WITH CONTEXT
>0004 219 RCALL EQU XINTC+2 ; CALL ASM LANGUAGE SUBROUTINE
>0006 220 MCALL EQU RCALL+2 ; CALL INTERPRETER SUBROUTINE
>0008 221 MRET EQU MCALL+2 ; RETURN FROM INTERPRETER SUBRO
>000A 222 MJUMP EQU MRET+2 ; MACRO JUMP
>000C 223 SUCK EQU MJUMP+2 ; SUCK INLINE ARGS INTO CB
224 ; SCHEDULER ROUTINES
>000C 225 SCHEDR EQU SUCK
>000E 226 ACTINT EQU SCHEDR+2 ; SET SUB TIMER
>0010 227 DECCTS EQU ACTINT+2 ; DEC CT'S UNDER MASK
228 ; MUSIC AND SOUNDS
>0012 229 MUZAK EQU DECCTS+2
>0012 230 BMUSIC EQU MUZAK ; BEGIN PLAYING MUSIC
>0014 231 EMUSIC EQU BMUSIC+2 ; STOP PLAYING MUSIC
232 ; SCREEN HANDLER ROUTINES
>0016 233 SCRSTR EQU EMUSIC+2
>0016 234 SEASZT EQU SCRSTR ; SET SCREEN SIZE
>0018 235 COLSET EQU SEASZT+2 ; SET COLORS
>001A 236 FILLM EQU COLSET+2 ; FILL MEMORY WITH CONSTANT DAT
>001C 237 RECTAN EQU FILLM ; PAINT RECTANGLE
>001E 238 VWCTR EQU RECTAN+2 ; WRIT RELATIVE FROM VECTOR
>0020 239 WRTR EQU VWCTR+2 ; WRIT RELATIVE
>0022 240 WRTP EQU WRTR+2 ; WRIT WITH PATTERN SIZE LOOKU
>0024 241 WRTE EQU WRTP+2 ; WRIT WITH SIZES PROVIDED
>0026 242 WRTA EQU WRTE+2 ; WRIT ABSOLUTE
>0028 243 VBLANK EQU WRTA+2 ; BLANK AREA FROM VECTOR
>002A 244 BLANK EQU VBLANK+2 ; BLANK AREA
>002C 245 SAVE EQU BLANK+2 ; SAVE AREA
>002E 246 RESTOR EQU SAVE+2 ; RESTORE AREA
>0030 247 SCROLL EQU RESTOR+2 ; SCROLL AREA OF SCREEN
248
>0032 249 CHRDIS EQU SCROLL+2 ; NEW DISPLAY CHARACTER
>0034 250 STRDIS EQU CHRDIS+2 ; NEW DISPLAY STRING
>0036 251 DISNUM EQU STRDIS+2 ; DISPLAY NUMBER
252
>0038 253 RELABS EQU DISNUM+2 ; RELATIVE TO ABSOLUTE CONVERSI
>003A 254 RELAB1 EQU RELABS+2 ; NONMAGIC RELABS
>003C 255 VECTC EQU RELAB1+2 ; VECTOR SINGLE COORDINATE
>003E 256 VECTC2 EQU VECTC+2 ; VECTOR COORDINATE PAIR
257 ; HUMAN INTERFACE ROUTINES
>0040 258 HUMANR EQU VECTC+2
>0040 259 KCTASC EQU HUMANR ; KEY CODE TO ASCII
>0042 260 SENTRY EQU KCTASC+2 ; SENSE TRANSITION
>0044 261 DOIT EQU SENTRY+2 ; BRANCH TO TRANSITION HANDLER
>0046 262 DOITB EQU DOIT+2 ; USE B INSTEAD OF A
>0048 263 PIZBRK EQU DOITB+2 ; TAKE A BREAK
>004A 264 MENU EQU PIZBRK+2 ; DISPLAY A MENU
>004C 265 GETPAR EQU MENU+2 ; GET GAME PARAMETER FROM USER
>004E 266 GETNUM EQU GETPAR+2 ; GET NUMBER FROM USER
>0050 267 PAWS EQU GETNUM+2 ; PAUSE

```

PROPRIETARY INFORMATION
 DO NOT REPRODUCE

ADDR	OBJECT	STMT	LABEL	OPCODE	OPERAND	COMMENT
>0052		268	DISTIM	EQU	PAWS+2	; DISPLAY TIME
>0054		269	INCSCR	EQU	DISTIM+2	; INC SCORE
		270	; MATH	ROUTINES		
>0056		271	MATH	EQU	INCSCR+2	
>0056		272	INDEXN	EQU	MATH	; INDEX NIBBLE
>0058		273	STOREN	EQU	INDEXN+2	
>005A		274	INDEXW	EQU	STOREN+2	; INDEX WORD
>005C		275	INDEXB	EQU	INDEXW+2	; INDEX BYTE
>005E		276	MOVE	EQU	INDEXB+2	; BLOCK TRANSFER
>0060		277	SHIFTU	EQU	MOVE+2	; SHIFT UP A DIGIT
>0062		278	BCDADD	EQU	SHIFTU+2	; BCD ADD
>0064		279	BCDSUB	EQU	BCDADD+2	; BCD SUBTRACT
>0066		280	BCDMUL	EQU	BCDSUB+2	; BCD MULTIPLY
>0068		281	BCDDIV	EQU	BCDMUL+2	; BCD DIVIDE
>006A		282	BCDCHS	EQU	BCDDIV+2	; BCD CHANGE SIGN
>006C		283	BCDNEG	EQU	BCDCHS+2	; BCD NEGATE
>006E		284	DABS	EQU	BCDNEG+2	; DECIMAL ADD
>0070		285	DSM	EQU	DADD+2	; CONVERT TO SIGN MAGNITUDE
>0072		286	DABS	EQU	DSMG+2	; DECIMAL ABSOLUTE VALUE
>0074		287	NEG	EQU	DABS+2	; NEGATE
>0076		288	RANGED	EQU	NEGT+2	; RANGED RANDOM NUMBER
>0078		289	QUIT	EQU	RANGED+2	; QUIT CASSETTE EXECUTION
>007A		290	SETB	EQU	QUIT	; SET BYTE
>007C		291	SETW	EQU	SETB+2	; SET WORD
>007E		-292	MSK	EQU	SETW+2	; MASK TO DELTAS

PROPRIETARY INFORMATION

Dave Nutting Associates, Inc.

DO NOT REPRODUCE

```

294 ; *****
295 ; * MACROS *
296 ; *****
297 ; MACROS TO DEFINE PATTERNS
298 DEF2 MACR #AA, #AB
299 DEFB #AA
300 DEFB #AB
301 ENDM
302 DEF3 MACR #BA, #BB, #BC
303 DEFB #BA
304 DEFB #BB
305 DEFB #BC
306 ENDM
307 DEF4 MACR #CA, #CB, #CC, #CD
308 DEFB #CA
309 DEFB #CB
310 DEFB #CC
311 DEFB #CD
312 ENDM
313 DEF5 MACR #DA, #DB, #DC, #DD, #DE
314 DEFB #DA
315 DEFB #DB
316 DEFB #DC
317 DEFB #DD
318 DEFB #DE
319 ENDM
320 DEF6 MACR #EA, #EB, #EC, #ED, #EE, #EF
321 DEFB #EA
322 DEFB #EB
323 DEFB #EC
324 DEFB #ED
325 DEFB #EE
326 DEFB #EF
327 ENDM
328 DEF8 MACR #GA, #GB, #GC, #GD, #GE, #GF, #GG, #GH
329 DEFB #GA
330 DEFB #GB
331 DEFB #GC
332 DEFB #GD
333 DEFB #GE
334 DEFB #GF
335 DEFB #GG
336 DEFB #GH
337 ENDM
338 ; MACROS TO COMPUTE CONSTANT SCREEN ADDRESSES
339 XYRE MACR #R, #X, #Y ; RELATIVE LOAD
340 LD #R, .RES. (#Y).SHL.8+(#X)
341 ENDM
342 ; MACRO TO GENERATE SYSTEM CALL
343 SYSTEM MACR #NUMBA
344 RST 56
345 DEFB #NUMBA
346 IF #NUMBA.EQ.INTPC
347 INTP@ DEFL 1
348 ENDF
349 ENDM
  
```

PROPRIETARY INFORMATION

Dave Nutting Associates, Inc.

DO NOT REPRODUCE


```
350 ; MACRO TO GENERATE SYSTEM CALL WITH SUCK OPTION ON
351 SYSSUK MACR #UMBA
352 RST 56
353 DEFB #UMBA+1
354 IF #UMBA.EQ.INTPC
355 INTPe DEFL 1
356 ENDIF
357 ENDM
358 ; MACROS TO GENERATE MACRO INSTRUCTION CALLS
359 ; FILL SCREEN WITH CONSTANT DATA
360 FILL? MACR #START, #BYTES, #DATA
361 DEFB FILL+1
362 DEFW #START
363 DEFW #BYTES
364 DEFB #DATA
365 ENDM
366 ; EXIT INTERPRETER WITH CONTEXT RESTORE
367 EXIT MACR
368 DEFB XINTC
369 INTPe DEFL 0
370 ENDM
371 ; INTERPRET WITH INLINE SUCK
372 DO MACR #CID
373 DEFB #CID+1
374 ENDM
375 ; INTERPRET WITHOUT INLINE SUCK
376 DONT MACR #CID
377 DEFB #CID
378 ENDM
379 ; MACRO CALL FROM DOIT TABLE
380 END EQU 0COH
381 MC MACR #A, #B, #E
382 DEFB #A+80H
383 DEFW #B
384 IF 0#E
385 DEFB 0#E
386 ENDIF
387 ENDM
388 ; REAL CALL FROM DOIT TABLE
389 RC MACR #A, #B, #E
390 DEFB #A+40H
391 DEFW #B
392 IF 0#E
393 DEFB 0#E
394 ENDIF
395 ENDM
396 ; REAL JUMP FROM DOIT TABLE
397 JMP MACR #A, #B, #E
398 DEFB #A
399 DEFW #B
400 IF 0#E
401 DEFB 0#E
402 ENDIF
403 ENDM
404 ; DISPLAY A STRING
405 TEXT MACR #A, #B, #C, #D
406 DEFB STRDIS+1
```

>0000

PROPRIETARY INFORMATION

Dave Nutting Associates, Inc.

DO NOT REPRODUCE

```

407          DEFB #B
408          DEFB #C
409          DEFB #D
410          DEFW #A
411          ENDM

413          ; *****
414          ; MUSIC MACROS
415          ; NOTE DURATION, FREQ(S)
416 NOTE1    MACR #DUR, #N1
417          DEFB #DUR&7FH
418          DEFB #N1
419          ENDM
420 NOTE2    MACR #DUR, #N1, #N2
421          DEFB #DUR&7FH
422          DEFB #N1
423          DEFB #N2
424          ENDM
425 NOTE3    MACR #DUR, #N1, #N2, #N3
426          DEFB #DUR
427          DEFB #N1
428          DEFB #N2
429          DEFB #N3
430          ENDM
431 NOTE4    MACR #DUR, #N1, #N2, #N3, #N4
432          DEFB #DUR
433          DEFB #N1
434          DEFB #N2
435          DEFB #N3
436          DEFB #N4
437          ENDM
438 NOTE5    MACR #DUR, #N1, #N2, #N3, #N4, #N5
439          DEFB #DUR
440          DEFB #N1
441          DEFB #N2
442          DEFB #N3
443          DEFB #N4
444          DEFB #N5
445          ENDM
446 MASTER   MACR #OFFSET
447          DEFB 80H
448          DEFB #OFFSET
449          ENDM
450          ; SPUFF OUTPUT PORT#, DATA OR
451          ; OUTPUT SNDBX, DATA10, D11, . . . , DATA17
452 OUTPUT    MACR #PORT, #D0, #D1, #D2, #D3, #D4, #D5, #D6, #D7
453          IF .NOT. (#PORT=18H)
454          DEFB 80H+(#PORT&7FH)
455          DEFB #D0
456          ENDF
457          IF #PORT=18H
458          DEFB 88H
459          DEF8 #D7, #D6, #D5, #D4, #D3, #D2, #D1, #D0
  
```

PROPRIETARY INFORMATION

Dave Nutting Associates, Inc.

DO NOT REPRODUCE

```

460          ENDF
461          ENDM
462      ; SET VOICE BYTE
463      ; THE FORMAT OF THE VOICE BYTE IS
464      ; *I*A*I*B*I*C*V*N*
465      ; WHERE N = LOAD NOISE WITH DATA AT PC AND INC PC
466      ; V = LOAD VIBRATO AND INC PC
467      ; I = INC PC
468      ; A,B,C = LOAD TONE A,B,C WITH DATA AT PC
469  VOICES  MACR #MASK
470          DEFB 90H
471          DEFB #MASK
472          ENDM
473      ; PUSH NUMBER ONTO STACK
474  PUSHN   MACR #NUMB
475          DEFB 0A0H+((#NUMB-1).AND.0FH)
476          ENDM
477      ; SET VOLUMES
478  VOLUME  MACR #BA,#MC
479          DEFB 0B0H
480          DEFB #BA
481          DEFB #MC
482          ENDM
483      ; RELATIVE 0-5 BEYOND SECT 1
484  CR      MACR #BY
485          DEFB 0D0H+#BY.AND.0FH
486          ENDM
487      ; SET STACK TOP AND JNZ
488  DSJNZ   MACR #ADD
489          DEFB 0C0H
490          DEFW #ADD
491          ENDM
492      ; FLIP LEGATO STACATO
493  LESSTA  MACR
494          DEFB 0E0H
495          ENDM
496  REST    MACR #TIME
497          DEFB 0E1H
498          DEFB #TIME
499          ENDM
500  QU      MACR
501          DEFB 0F0H
502          ENDM
503      *****
504      MUSIC EQUATES *
505      *****
506      NOTE VALUES
507  GO      EQU 253
508  GS      EQU 238
509  AO      EQU 225
510  ASO     EQU 212
511  BO      EQU 200
512  C1      EQU 189
513  CS1     EQU 178
514  D1      EQU 168
515  DS1     EQU 159
516  E1      EQU 150

```

>00FD
 >00EE
 >00E1
 >00D4
 >00C3
 >00BD
 >00B2
 >00A8
 >009F
 >0096

PROPRIETARY INFORMATION

Dave Nutting Associates, Inc.

DO NOT REPRODUCE

>0080		517	F1	EQU	141	
>0085		518	FS1	EQU	133	
>007E		519	G1	EQU	126	
>0077		520	GS1	EQU	119	
>0070		521	A1	EQU	112	
>006A		522	AS1	EQU	106	
>0064		523	B1	EQU	100	
>005E		524	C2	EQU	94	
>0059		525	CS2	EQU	89	
>0054		526	D2	EQU	84	
>004F		527	DS2	EQU	79	
>004A		528	E2	EQU	74	
>0046		529	F2	EQU	70	
>0042		530	FS2	EQU	66	
>003E		531	G2	EQU	62	
>003B		532	GS2	EQU	59	
>0037		533	A2	EQU	55	
>0034		534	AS	EQU	52	
>0031		535	B2	EQU	49	
>002E		536	C3	EQU	46	
>002C		537	CS3	EQU	44	
>0029		538	D3	EQU	41	
>0027		539	DS	EQU	39	
>0025		540	E3	EQU	37	
>0022		541	F3	EQU	34	
>0020		542	FS	EQU	32	
>001F		543	G3	EQU	31	
>001D		544	GS	EQU	29	
>001B		545	A3	EQU	27	
>001A		546	AS	EQU	26	
>0018		547	B3	EQU	24	
>0017		548	C4	EQU	23	
>0015		549	CS4	EQU	21	
>0014		550	D4	EQU	20	
>0013		551	DS	EQU	19	
>0012		552	E4	EQU	18	
>0011		553	F4	EQU	17	
>0010		554	FS	EQU	16	
>000F		555	G4	EQU	15	
>000E		556	GS4	EQU	14	
>000D		557	A4	EQU	13	
>000B		558	C5	EQU	11	
>000A		559	CS	EQU	10	
>0009		560	DS	EQU	9	
>0008		561	F5	EQU	8	
>0007		562	G5	EQU	7	
>0006		563	A5	EQU	6	
>0005		564	C6	EQU	5	
>0004		565	DS	EQU	4	
>0003		566	G6	EQU	3	
>0002		567	C7	EQU	2	
>0001		568	G7	EQU	1	
>0000		569	G8	EQU	0	
		570				; MASTER OSCILATOR OFFSETS
>00FE		571	OB0	EQU	254	
>00F1		572	OC0	EQU	241	
>00D6		573	OD1	EQU	214	

PROPRIETARY INFORMATION

Dave Nutting Associates, Inc.

DO NOT REPRODUCE

>00BF		574	OE1	EQU	191	
>00B4		575	OF1	EQU	180	
>00A0		576	OG1	EQU	160	
>008F		577	OA1	EQU	143	
>0047		578	OA2	EQU	71	
>0023		579	OA3	EQU	35	
>0011		580	OA4	EQU	17	
>0008		581	OA5	EQU	8	

PROPRIETARY INFORMATION

Dave Nutting Associates, Inc.

DO NOT REPRODUCE

```

583 ; *****
584 ; * SYSTEM RAM MEMORY CELLS *
585 ; *****
>OFFF 586 WASTE EQU OFFFH
>OFFF 587 WASTER EQU WASTE
588 ;
589 ; THE FOLLOWING ORG SHOULD BE SET TO THE VALUE OF
590 ; THE TAG 'SYSRAM', THIS WILL CAUSE SYSTEM RAM
591 ; TO RESIDE AT THE HIGHEST POSSIBLE ADDRESS
592 ;
593 ORG 4FC9H
4FC8 594 DEFS 6 ; GOT SOME LEFT STILL
>4FCE 595 BEGRAM EQU *
596 ; USED BY MUSIC PROCESSOR
4FCE 597 MUZPC: DEFS 2 ; MUSIC PROGRAM COUNTER
4FD0 598 MUZSP: DEFS 2 ; MUSIC STACK POINTER
4FD2 599 PVOL: DEFS 1 ; PRESET VOLUME FOR TONES A AND
4FD3 600 PVOL: DEFS 1 ; PRESET VOLUME FOR MASTER OSC
4FD4 601 VOICES: DEFS 1 ; MUSIC VOICES
602 ; COUNTER TIMERS (USED BY DECCTS,ACTINT,CTIMER)
4FD5 603 CT0: DEFS 1 ; COUNTER TIMER 0
4FD6 604 CT1: DEFS 1 ; 1
4FD7 605 CT2: DEFS 1 ; 2
4FD8 606 CT3: DEFS 1 ; 3
4FD9 607 CT4: DEFS 1 ; 4
4FDA 608 CT5: DEFS 1 ; 5
4FDB 609 CT6: DEFS 1 ; 6
4FDC 610 CT7: DEFS 1 ; 7
611 ; USED BY SENTRY TRACK CONTROLS
4FDD 612 CNT: DEFS 1 ; COUNTER UPDATE&NUMBER TRACKING
4FDE 613 SEM: DEFS 1 ; FLAG BITS
4FDF 614 OPOT0: DEFS 1 ; POT 0 TRACKING
4FE0 615 OPOT1: DEFS 1 ; POT 1 TRACKING
4FE1 616 OPOT2: DEFS 1 ; POT 2 TRACKING
4FE2 617 OPOT3: DEFS 1 ; POT 3 TRACKING
4FE3 618 KEYSB: DEFS 1 ; KEYBOARD TRACKING BYTE
4FE4 619 OSW0: DEFS 1 ; SWITCH 0 TRACKING
4FE5 620 OSW1: DEFS 1 ; SWITCH 1 TRACKING
4FE6 621 OSW2: DEFS 1 ; SWITCH 2 TRACKING
4FE7 622 OSW3: DEFS 1 ; SWITCH 3 TRACKING
4FE8 623 COLL: DEFS 2 ; COLOR LIST ADDRESS FOR P. B. A
624 ; USED BY STIMER
4FEA 625 DUR: DEFS 1 ; NOTE DURATION
4FEB 626 TMR6: DEFS 1 ; SIXTETHS OF SEC
4FEC 627 TIMO: DEFS 1 ; BLANKET TIMER
4FED 628 GTSEC: DEFS 1 ; GAME TIME SECONDS
4FEE 629 GTMIN: DEFS 1 ; GAME TIME MINUTES
630 ; USED BY MENU
4FEF 631 RANS: DEFS 4 ; RANDOM NUMBER SHIFT REGISTER
4FF3 632 NUMPLY: DEFS 1 ; NUMBER OF PLAYERS
4FF4 633 ENDSCR: DEFS 3 ; SCORE TO 'PLAY TO'
4FF7 634 MRLOCK: DEFS 1 ; MAGIC REGISTER LOCK OUT FLAG
4FF8 635 GAMSTB: DEFS 1 ; GAME STATUS BYTE
4FF9 636 PRIOR: DEFS 1 ; MUSIC PROTECT FLAG
4FFA 637 SENFLG: DEFS 1 ; SENTRY CONTROL SEIZURE FLAG
4FFB 638 UMARGT: DEFS 2

```

PROPRIETARY INFORMATION

Dave Nutting Associates, Inc.

DO NOT REPRODUCE

4FFD 639 USERTB: DEFS 2
04FCE 640 SYSRAM EQU (5000H-(\$-BEGRAM+1))

PROPRIETARY INFORMATION

Dave Nutting Associates, Inc.

DO NOT REPRODUCE