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HOME VIDEO GAME SYSTEM

This documentation describes the Bally Home Video Game System. The description begins with a discussion of the major sub-sections of the system. Following this, each sub-section is presented in greater detail, with detailed particulars, such as calling sequences and resource use.

The major sub-sections of the system are:

The User Program Interface...which allows cassettes to reference the system routines through a standard interface. Includes an interpreter.

The Screen Handler...a complex of routines for creating screen images. Includes facilities for initialization, pattern, and character display, co-ordinate conversion, and object vectoring.

The Interrupt Processor...decrements timers, plays music, and produces sounds.

The Human Interface...reads keypad and control handles, inputs game selection and options.

Math Routines...a package of routines for manipulating floating BCD numbers.

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USER PROGRAM INTERFACE

The User Program Interface (UPI) is a set of procedures and conventions, which are utilized by a cassette program to access the facilities provided by the home video game system. By adhering to these conventions a cassette program will be system independent, thus allowing improvements to be made to later versions of the system and on-board games, while maintaining upward compatability.

The basic rule for using the UPI is:

With exception to the system DOPE vector, no cassette should ever address system ROM directly, or expect a given cell to always equal a certain value.

The mechanism for calling a system routine is:

```
RST      #
DEFB     (routine # + option)
```

where routine number is an even number specifying which sub-routine to transfer to, symbolic identifiers, which are equated to routine numbers, are provided in HVGLIB.

Option is used to specify how arguments are being passed to the system routine. If option equals zero, the arguments are presumed to exist in CPU registers; if option equals 1, the arguments are taken to follow in line after the routine number/option byte. These arguments are loaded into the CPU registers automatically before the called routine is entered. The arguments required by each system routine are given in the routine's detail documentation.

The SYSTEM macro generates the sequence previously mentioned with option = 0:

```
SYSTEM (routine #)
```

(example)

```
SYSTEM FILL
```

The SYSSUK macro generates the sequence previously mentioned with option = 1:

```
SYSSUK (routine #)
```

Frequently it is desirable to string several system routine calls together. If four or more calls follow in sequence, it is more efficient to utilize the interpreter. By using the interpreter we void the overhead of the RST 56 instruction by expecting a call index to immediately follow the call index or arguments used by the previous system routine.

Special call indexes are used to enter and exit interpretive mode:

Example:

SYSTEM	INTPC	;BEGIN INTERPRETING
DO	FILL	;DO FILL ROUTINE
DEFW	NDIEM	;STARTING AT TOP OF SCREEN
DEFW	92*BYTEPL	;CONTINUING FOR 92 LINES
DEFB	0	;FILLED WITH ZEROS
DO	CHRDIS	;DO CHARACTER DISPLAY ROUTINE
DEFB	0	;Y-AXIS POSITION OF CHARACTER
DEFB	10	;X-AXIS POSITION OF CHARACTER
DEFB	8	;OPTIONS-PLOP,10-ON,00-OFF
DEFB	'A'	;CHARACTER TO BE DISPLAYED
EXIT		;EXIT INTERPRETER

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A block of call indexes have been set aside for the internal use of cassette programs. If a negative call index is encountered, the user's macro routine address table and argument table are utilized. The user is responsible for storing the addresses of these tables into dedicated system RAM cells.

All UPI routines are re-entrant.

Registers which are not defined as containing output parameters will not change.

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SYSTEM ROUTINE CONVENTIONS

A system routine is coded like a conventional machine language subroutine, with the exception that output parameters are not passed through registers, but rather through the context block.

The context block is created by the RST 56 call. The user's register set (AF, BC, DE, HL, IX, IY) is pushed onto the stack. Register IY is set to point at this stack frame. Thus a copy of the input arguments exists in RAM which the system routine may refer to as needed. These arguments are also present in the registers when the system routine is entered, hence it is only necessary to refer to the context block when one has clobbered an input argument.

An output argument is returned to the caller by setting it in the context block. If a register was changed, but the associated cell in the context block was not, then the register will have its old value on return. Thus a system routine is free to use any of the registers it needs without concern to saving and restoring. Moreover, the user can assume that no registers will change except those defined as returning an output argument.

The following illustration describes the context block and equates provided in HVGLIB for each field.

Four tables are used by the UPI in the control transfer process. The first two tables give the routines starting address indexed via call number. The systems table is named SYSDPT. The user may extend this table by storing the address of his extended table into USERTB, USERTB+1. This address should point 128 bytes before the first entry.

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The other two tables describe what in line arguments a call that specifies in line arguments should expect. This table gives a one-byte bitstring, also indexed via call number. The systems name is MRARGT, the user's address is in UMARGT, UMARGT must point 64 bytes ahead. Arguments must follow the call in a specified order.

Note that the context contains additional information not shown. This information exists both above and below the context. User programs should never use this information or even assume that it exists. The user should only address this area by using IY.

DISPLACEMENT	MEMORY CELL	EQUATE NAME
0		CB IYL
1		CB IYH
2		CB IXL
3		CB IXH
4		CB E
5		CB D
6		CB C
7		CB B
8	FLAGS	CB FLAG
9	A	CB A
A	L	CB L
B	H	CB H

CONTEXT BLOCK FORMAT

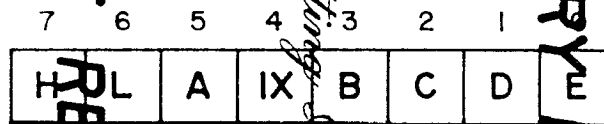
IN LINE ARGUMENT MASK TABLE ENTRY

TABLES MRARGT and UMARGT

If a bit corresponding to a register is set, the register is loaded.
The order in which the arguments must appear is:

IX (L then H), E, D, C, B, A, L, H

If an argument isn't specified, it is omitted.



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UPI INTPC
BEGIN INTERPRETING

Calling Sequence: SYSTEM INTPC
Aruguments: None
Notes: None
Description:

See UPI description for explanation of interpretation

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UPI XINTC
EXIT INTERPRETER

Calling Sequence: EXIT
Arguments: None

Description:
This code causes the interpreter to exit. Execution of machine instructions proceeds at the following location.

Restrictions:
This routine should only be called using the interpreter. A direct system call would produce unpredictable (and catastrophic) results.

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UPI RCALL
CALL ASSEMBLY LANGUAGE SUBROUTINE

Calling Sequence: DO RCALL
or
DONT RCALL
DEFW (routine address)
Arguments: HL=address of routine call

Description:

RCALL may be used to call any assembly language subroutine from the interpreter. When the subroutine returns, interpretation proceeds at the next instruction.

When the assembly language routine receives control, HL will point at the routine's starting address, the other registers will contain their current values. Any changes made to the register set by the subroutine will not be passed along. To pass an output parameter, the subroutine must alter the context block, which is pointed at by IY.

Restrictions:

Assembler routine must not destroy IY.

Example: DEFB RCALL
DEFW CLRAC
.
.
.
CLRAC: XOR A
RET

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UPI MJUMP
 INTERPRETER JUMP

Calling Sequence: DO MJUMP
 or
 DONT MJUMP
 DEFW (goto address)

Arguments: HL=Go to address

Description:

The current interpretive program counter is set to the contents of HL.
 The next instruction is fetched from that address.

Restrictions:

MJUMP must be called from the interpreter. The targets of all JUMPS
 must also be interpreted sequentially.

Example:

	SYSTEM	INTPC	ENTER INTPC STEP
	.	.	.
	.	.	.
	DO	MJUMP	;JUMP TO END OF
	DEFW	END	;INTPC STEP
	.	.	.
	.	.	.
END:	DEFB	XINTC	;EXIT INTERPRETER

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UPI MRET
RETURN FROM INTERPRETIVE SUBROUTINES

Calling Sequence: DO MRET
Arguments: None

Description:

MRET causes execution to proceed at the instruction following the corresponding MCALL instruction. See MCALL for more information.

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SCREEN HANDLER

The screen handler is a group of routines for generating frame buffer images. Included are entries for filling sections of the screen with constant data, the animation of figures, and the display of alpha-numeric.

Many of these routines utilize the MAGIC functions provided by the custom chips. Since the status of these chips cannot be context-switched, many of these routines are not re-entrant. The user is responsible for preventing conflicts. This can be done by disabling interrupt, or implementing a semaphore.

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SCREEN SETOUT
SET DISPLAY PORTS

Calling Sequence: SYSTEM SETOUT
 or
 SYSSUK SETOUT
 DEFB BLINE*2
 DEFB HORIZX/4
 DEFB INMOD

Arguments: A=Data to output to INMOD (port EH)
 B=Data to output to HOP (port 9H)
 D=Data to output to VEP (port AH)

Output: None

Description: Outputs above data to ports
 See hardware writeup for discussion of
 above ports.

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SCREEN FILL
FILL A CONTIGUOUS AREA WITH CONSTANT

Calling Sequence: SYSTEM FILL
 or
 SYSSUK FILL
 DEFW (first byte)
 DEFW (number of bytes)
 DEFB (data to fill with)
Arguments: A =Data to fill with
 BC=number of bytes to fill
 DE=address to begin filling at

Description:
This routine sets the memory range DE to (DE+B-1) to the specified constant.

Notes:
Fill can be used for screen clearing, or initialization of scratchpad RAM. It is re-entrant.

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DO NOT REPRODUCE

SCREEN RECTAN
PAINT A RECTANGLE

Calling Sequence: SYSTEM RECTAN
or

SYSSUK RECTAN
DEFB (X co-ordinate)
DEFB (Y co-ordinate)
DEFB (C size)
DEFB (D size)
DEFB (E color mask)

Arguments: A =Color mask to write rectangle with
B =Y-size of rectangle in pixels
C =X-size of rectangle in pixels
D =Y co-ordinate for UL corner of rectangle
E =X co-ordinate for UL corner of rectangle

Description:
A rectangle of specified size of color mask is written at X,Y. RECTAN uses the MAGIC functions and is non re-entrant.

Example: Put up a 3 X 4 rectangle of color 2 at 15,13.
DO RECTAN
DEFB 15
DEFB 13
DEFB 3
DEFB 4
DEFB 10101010B

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SCREEN WRITE ROUTINES

Virtually every video game involves the manipulation of animated figures. These figures are composed of patterns which are arbitrary pixel arrays. The write routines are used to transfer such patterns to the screen.

Five hierarchical levels of call are supported. The levels differ in the amount of preprocessing required by the user before calling. The highest level assumes that most of the parameters reside in a standard data structure, while the lowest level presumes that all arguments are in registers with all attendant transformations (such as relative-to-absolute conversion) already accomplished. The five levels are:

- (1) Write from a Vector
- (2) Write Relative
- (3) Write Variable Pattern
- (4) Write
- (5) Write Absolute

Two transformations of the pattern may be performed prior to writing. They are FLOP and EXPAND. FLOP is mirroring the pattern on the X-axis. EXPAND is the translation of a 1-bit per pixel pattern into a 2-bit per pixel pattern. Since many patterns are only two-color, this allows for more efficient pattern storage. FLOP and EXPAND can both be done at the same time.

Three writing modes may be used. They are PLOP, OR, and XOR. PLOP is a conventional store into RAM. If OR is optioned, the data being written is ORed bit by bit with whatever was already there. Similarly, if XOR is set, the pattern is XORed with that beneath. Use of OR or XOR takes slightly longer since a read before write must be performed.

Note that ROTATE is not currently supported in software due to space considerations.

STANDARD CALLING SEQUENCE

Every write routine uses a subset of the following argument/register assignment:

A = Magic Register
 B = Y Pattern Size
 C = X Pattern Size in Bytes
 D = Y Co-ordinate (0 - 101)
 E = X Co-ordinate (0 - 159)
 H = Pattern Address
 I = Vector Address

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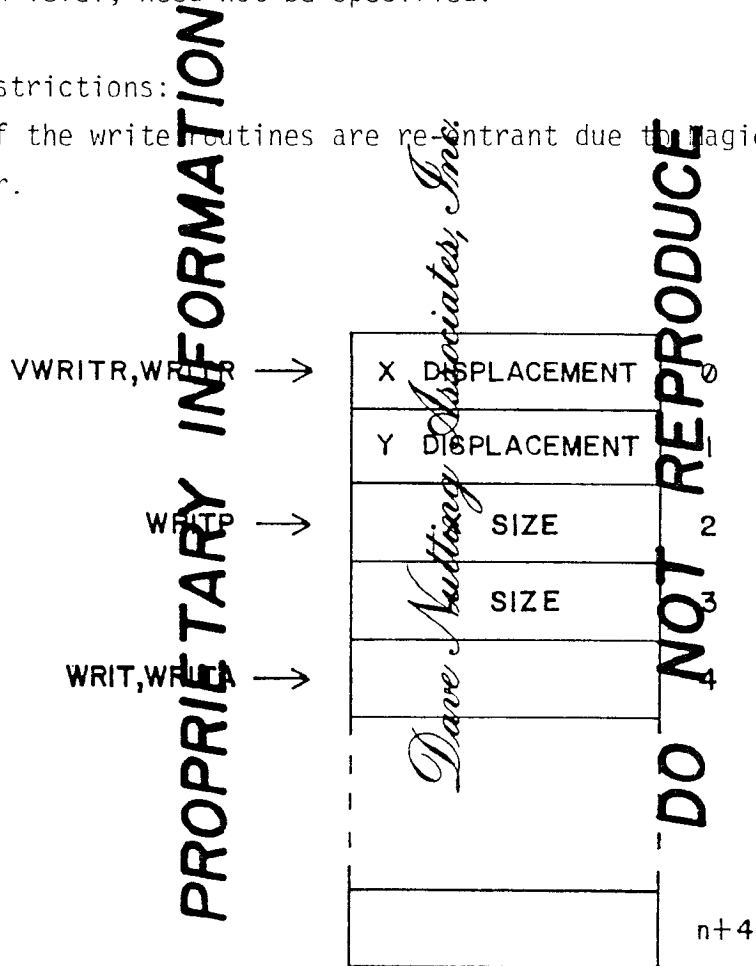
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PATTERN REPRESENTATION

The higher the level of the write routine, the more ancillary information is stored with the pattern. The following diagram shows what each level expects. Any bytes of lower address than the pointer for a given level, need not be specified.

Use Restrictions:

None of the write routines are re-entrant due to the Magic Register/Expander clobber.



SCREEN WRITE VWRITR
WRITE RELATIVE FROM VECTOR

Calling Sequence: SYSTEM VWRITR
or

SYSSUK VWRITR
DEFW (vector)
DEFW (pattern)

Arguments: HL=Pattern address
IX=Vector Address

Output: DE=Absolute address used
A =Magic register used

Description:

The co-ordinates and magic register are loaded from the specified vector. (See vector routine document) The relative co-ordinates stored with the pattern are added to the co-ordinates from the vector. The pattern size is also taken from the pattern and writing proceeds.

Notes:

If expansion is to be done, the ON/OFF color must be set by the user before calling VWRITR.

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SCREEN WRITE WRITR
WRITE RELATIVE

Calling Sequence: SYSTEM WRITR
or

SYSSUK WRITR
DEFB (X co-ordinate)
DEFB (Y co-ordinate)
DEFB (Magic Register)
DEFW (Pattern address)

Arguments: HL=Pattern address
A =Magic register
D =Y co-ordinate
E =X co-ordinate

Output: DE=Screen Address Used
A = Magic Register Used

Description:

The relative co-ordinates stored with the pattern are added to the co-ordinates passed in DE. Pattern size is taken from the pattern.

Notes:

If expansion is to be done, the ON/OFF color must be set by the user before calling WRITR.

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SCREEN WRITE WRITP
WRITE WITH PATTERN SIZE SCARE UP

Calling Sequence: SYSTEM WRITP
or
SYSSUK WRITP

DEFB (X co-ordinate)
DEFB (Y co-ordinate)
DEFB (Magic Register)
DEFW (Pattern address)

Arguments: HL=Pattern Address
A =Magic register
D =Y co-ordinate
E =X co-ordinate

Output: DE=Screen Address Used
A =Magic Register Used

Description:
The pattern size is taken from the pattern.

Notes:
User must worry about ON/OFF color if expansion is used.

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SCREEN WRITE WRIT
WRITE PATTERN

Calling Sequence: SYSTEM WRIT
or

SYSSUK WRIT
DEFB (X co-ordinate)
DEFB (Y co-ordinate)
DEFB (X pattern size)
DEFB (Y pattern size)
DEFB (Magic Register)
DEFW (Pattern address)

Arguments: HL=Pattern Address
A =Magic Register to use
B =Y pattern size
C =X pattern size
D =Y co-ordinate
E =X co-ordinate
Output: DE=Absolute address used
A =Magic Register used

Notes:
User must set ON/OFF color if using expansion.

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SCREEN WRITE WRITA
WRITE ABSOLUTE

Calling Sequence: SYSTEM WRITA

or

SYSSUK WRITA

DEFW (Absolute address)

DEFB (X pattern size)

DEFB (Y pattern size)

DEFB (Magic Register)

DEFW (Pattern address)

Arguments:

HL=Pattern Address

A =Magic Register

B =Y Pattern size

C =X Pattern size

DE=Absolute screen address of upper left-hand corner of where to write

Notes:

This entry can be used for pattern writing to non-magic memory.

The value in A is not output to (MAGIC); it is only interrogated to decide whether FLOP or EXPAND.

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*Date: 11/11/83
Author: J. J. ...*

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SCREEN SAVE
SAVE AREA

Calling Sequence: SYSTEM SAVE
or

SYSSUK SAVE
DEFW (save area)
DEFB (X size)
DEFB (Y size)
DEFW Screen address

Arguments:

B = Y size of area to save
C = X size of area to save (in bytes)
DE = Address of save area
HL = Absolute address of upper left-hand corner
of area to save

Description:

SAVE is used to preserve what is 'underneath' a moving pattern. SAVE copies the indicated area of the screen to the save area. The sizes of the area which was saved is preserved in the first two bytes of the save area.

The save area size must be greater than or equal to the X-size times the Y-size plus 2.

The save area may be MAGIC or non-MAGIC.

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SCREEN RESTORE
RESTORE AREA

Calling Sequence: SYSTEM RESTOR
or

SYSSUK RESTOR

DEFW (Save area)

DEFW (Screen address)

Arguments:

DE=Save area to restore from

HL=Absolute address of upper left-hand corner
of area to restore

Description:

RESTORE is the inverse of SAVE. The size of the area to restore is taken from the first two bytes of the save area.

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DO NOT REPRODUCE

SCREEN BLANK
BLANK AREA

Calling Sequence: SYSTEM BLANK
or

SYSSUK BLANK

DEFB (X size)

DEFB (Y size)

DEFB (Blank to)

DEFW (Blank address)

Arguments: HL=Blank address (not MAGIC)

B =Data to blank to

D =Y size

E =X size

Description:

The specified area is blanked to whatever is passed in B.

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DO NOT REPRODUCE

SCREEN SCROLL
 SCROLL WINDOW

Calling Sequence: SYSTEM SCROLL
 or

SYSSUK SCROLL
 DEFW (line increment)
 DEFB (# of bytes)
 DEFB (# of lines)
 DEFW (first byte)

Arguments: B =Number of lines to scroll
 C =Number of bytes on line to scroll
 DE=Line increment
 HL=First byte to scroll

Description:

This routine copies NBYTES from first line +INC to first line.
 Thus to scroll upward, HL points at the first line (which is over-
 written) and the line increment would be positive. To scroll downward
 HL points at the next line and the line increment would be negative.
 The value in HL is an absolute address calculated by:
 BASE OF SCREEN + NBYTES IN X OFFSET + (#lines offset*byte per line)

Note:

This routine can only be used to scroll one line at a time.

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SCREEN ALPHANUMERIC
ALPHANUMERIC DISPLAY ROUTINES

HVGSYS provides several routines for the display of alphanumeric information. This section provides information which is common to all of the alphanumeric display routines.

The ASCII character code is used to represent all strings, with the following extensions:

Characters with hex equivalents in the range 1 - 1F are interpreted as tabulation codes which cause the character display routines to skip over N character positions before writing the following characters.

The characters 20H to 63H are displayed as 5 X 7 standard graphics with 3 pixels of horizontal spacing and 1 pixel of vertical spacing.

The characters between 64H and 7FH are interpreted by STRDIS as control codes which cause the contents of registers C, DE, and IX to be changed to the value that follow the string. See table accompanying STRDIS.

The characters between 80H and FFH are taken as references to a user supplied alternate character font.

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The following argument/register combinations are used by all of the alphanumeric display routines.

Register C contains the options byte formatted as shown below.

ENLARGE FACTOR specifies if the character is to be enlarged in size. The table below defines the possible values for this parameter.

XOR/OR WRITE - all writes are performed through magic memory. Use of one of these options causes the character to be ORed/XORed with what was beneath.

ON/OFF COLOR - all characters are stored one bit per pixel, but are written two bits per pixel by use of the expander. This field specifies the pixel values to translate the one bit per pixel representation into. For example, the value 1101 specifies that the foreground color is 11, and the background color is 01.



ENLARGE FACTOR	HOW MANY TIMES LARGER	ENLARGED SIZE OF SINGLE PIXEL
00	1	1 X 1
01	2	2 X 2
10	4	4 X 4
11	8	8 X 8

D register contains the Y co-ordinate and the E register contains the X co-ordinate. These co-ordinates give the address of the upper left-hand corner where the first character will appear. Upon return, these registers are updated to give the address of the character to the right, (or below if no more space exists on the line). This simplifies the composition of complex messages.

IX register contains the Alternate Font Descriptor. It is required only if alternate font is referenced in call. Each character must be stored in one-bit per pixel format.

The small (3 X 5) character set is displayed using this facility. A word in the system DOPE vector points at a standard alternate font descriptor for this character set.

The format of the alternate font descriptor is shown below.

IX → 0	BASIC CHARACTER	EQUAL TO FIRST CHARACTER IN TABLE
1	X FRAME SIZE	CHARACTER SIZE IN BITS + X SPACING
2	Y FRAME SIZE	CHARACTER SIZE IN BITS + Y SPACING
3	X PATTERN SIZE	EACH CHARACTER TABLE ENTRY SHOULD BE OF SIZE X PATTERN*Y PATTERN SIZE
4	Y PATTERN SIZE	
5	CHARACTER TABLE ADDRESS	
6		

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DO NOT REPRODUCE

SCREEN ALPHANUMERIC CHRDIS
DISPLAY CHARACTER

Calling Sequence: SYSTEM CHRDIS
or

SYSSUK CHRDIS
DEFB (X co-ordinate)
DEFB (Y co-ordinate)
DEFB (options)
DEFB (Character)

Arguments: A =ASCII character to display
C =Standard options byte
DE=Standard Y,X co-ordinates to begin at
*NOT LOADED IX=Optional alternate font descriptor address
Outputs: DE=Updated to next frame

Description:
This is the basic character display primitive. If tabulation is specified, the co-ordinates are updated but no actual writing occurs.

Notes:
Observe that IX is not loaded by the UPI SUCK facility. If alternate font is used, IX must be loaded with alternate font descriptor address.

Since this routine uses magic memory, it is not re-entrant.

PROPRIETARY INFORMATION

Dave Nutting Associates, Inc.

DO NOT REPRODUCE

SCREEN ALPHANUMERIC STRDIS
DISPLAY STRING

Calling Sequences: SYSTEM STRDIS
or

SYSSUK STRDIS

DEFB (X co-ordinate)

DEFB (Y co-ordinate)

DEFB (Options)

DEFW (String)

Arguments: HL=String address

C =Standard Options

DE=Standard Co-ordinates

*NOT LOADED IX=Alternate Font Descriptor Address

Outputs: DE=Update to next frame

Description:

The string pointed to by HL is displayed as optioned. The string is terminated by a zero byte.

Notes:

IX is not loaded by SUCK. STRDIS is not re-entrant.

PROPRIETARY INFORMATION

Dave Nutting Associates Inc.

DO NOT REPRODUCE

STRDIS INTERPRETATION OF CODES 64H to 7FH

STRDIS responds to the character codes between 64H and 7FH. These codes are taken to specify that certain registers in the context block are to be set to new values. This facility is useful for changing size, write mode, screen co-ordinates, or fonts, during a single STRDIS call.

The following table specifies which registers are loaded for a given code. The order in which the new register data follows the code, is also represented.

64H	C	74H	IX,D
65H	E	75H	IX,E,D
66H	D,C	76H	IX,C
67H	E,D,C	77H	IX,E,C
68H	NONE	78H	IX,D,C
69H	E	79H	IX,E,D,C
6AH	D	7AH	IX
6BH	E	7BH	IX,E
6CH	C	7CH	IX,D
6DH	E	7DH	IX,E,D
6EH	D	7EH	IX,C
6FH	E,D,C	7FH	IX,E,C
70H	I		
71H	IX,E		

PROPRIETARY INFORMATION

Dave Nutting Associates, Inc.

DO NOT REPRODUCE

SCREEN VECTORING - VECTORING ROUTINES

Most games involve moving patterns. Most moving patterns move along a line. The home video game operating system provides the vectoring routines to facilitate programming such pattern motion.

The vectoring routines work with a memory array called a vector. Represented within this vector are the co-ordinates of an object, the velocities of the object, and the necessary status information to control the object. By periodically invoking the vectoring routine, this data is updated and can be used to direct the motion of a pattern.

More formally, a vectored object possesses an X and Y co-ordinate. Associated with these co-ordinates are velocities ΔX and ΔY , which are added to X and Y every time increment. Since the screen is finite, there also exists two upper and two lower limits X_{LU} , X_{LL} , Y_{LU} , and Y_{LL} , the attainment of which requires some response.

The HVGSYS vectoring routine allows for two different responses to a limit attained. Either the sign of the delta is reversed or vectoring is stopped for this co-ordinate. This is specified by a flag byte. When attainment occurs this fact is indicated by a status byte. Also the co-ordinate is set equal to the limit that was attained, preventing over-shoot.

Utilization of the vectoring routines involves a number of user responsibilities. The user must properly initialize certain fields in the vector array. He must increment the time base byte, and periodically call the vectoring routine. Status bits must be checked and writing must be done.

To insure high-accuracy, co-ordinates and deltas are double-precision. The assumed binary "decimal point" is between the high and low order byte.

The following diagrams explain the layout of the vector array and the attendant user responsibilities.

PROPRIETARY INFORMATION
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 DO NOT REPRODUCE

VECTOR BLOCK

BYTE	FUNCTION	HVGLIB NAME			
0	MAGIC REGISTER	VBMR	- DO NOT USE BIT 7		
1	VECTOR STATUS	VBSTAT			
2	TIME BASE	VBTIMB	- INCREMENTED BY USER		
3	PROPRIETARY INFORMATION <i>Dave Nutting Associates, Inc.</i>	VBDXL	DO NOT REPRODUCE		
4		VBDXH			
5		VBXL			
6		VBXH			
7		X CHECKS MASK		VBXCHK	
8				VBDYL	
9				VBDYH	
10				VBYL	
11				VBYH	
12		Y CHECKS MASK		VBYCHK	
13		OLD SCREEN ADDRESS		VBOAL	- MAINTAINED BY USER
14				VBOAH	

VECTOR STATUS DETAIL

ACTIVE VBSACT	BLANK VBBLNK	NOT USED				
------------------	-----------------	----------	--	--	--	--

ACTIVE

Set by user to indicate that vector is active. The vectoring routines will do no processing if reset.

BLANK

Must be initialized by user to reset state. Thereafter this bit is maintained by the LIMIT and VBLANK system routines.

CHECKS MASK DETAIL

NOT USED		LIMIT ATTAINED VBCLAT	NOT USED	REVERSE DELTA SIGN VBCREV	LIMIT CHECK VBCLMT
----------	--	-----------------------------	-------------	------------------------------------	--------------------------

LIMIT CHECK

Set by user to indicate that this co-ordinate is to be limit checked.

REVERSE DELTA

Set by user to indicate that when this co-ordinate attains it's limit, the sign of the associated delta is to be reversed. This can be used to cause objects to 'bounce' off barriers.

LIMIT ATTAINED

Set by system if the limit was attained this call. Otherwise it is reset. If the delta was not changed, either by Reverse Delta or user, this bit will stay set.

PROPRIETARY INFORMATION
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 DO NOT REPRODUCE

SCREEN VECTORING VECT
VECTOR OBJECT IN TWO DIMENSIONS

Calling Sequence: SYSTEM VECT
or
SYSSUK VECT
DEFW (Vector address)
DEFW (Limit table)

Arguments: HL=Limit table address
IX=Vector address (points at VBMR)

Output: C =Time base used
Z =True, if it did not move

Description:

If the vector is inactive, control is returned immediately. Otherwise VECTC is called for X, then Y. The zero status is determined by comparing the new co-ordinate value with it's old value. If the high-order byte changed, then the object moved. Zero status set if object did not move, reset if object moved.

PROPRIETARY INFORMATION

Dave Nutting Associates, Inc.

DO NOT REPRODUCE

SCREEN VECTORING VECTC
VECTOR A CO-ORDINATE

Calling Sequence: SYSTEM VECTC

or

SYSSUK VECTC

DEFW (co-ordinate address)

DEFW (Limit table)

Arguments: IX=Pointer to low-order element of delta for co-ordinate
HL=Limits table for this co-ordinate (if required)
C =Time base to use

Description:

This routine operates on the subset of the vector array associated with a single co-ordinate. This subset consists of the delta co-ordinate and checks mask. This entry is provided so special vectoring schemes may be implemented such as 1 dimensional or 3 dimensional vectoring.

This entry adds the delta to the co-ordinate time base times. It then performs the limit checks for the co-ordinate if optioned.

Note that this entry does not interrogate or alter any bytes in the vector array outside of the defined subset. Hence the active bit isn't checked.

PROPRIETARY INFORMATION

Dave Nutting Associates, Inc.

DO NOT REPRODUCE

SCREEN RELABS
 CONVERT RELATIVE CO-ORDINATES TO ABSOLUTE MAGIC ADDRESS AND
 SET UP MAGIC REGISTER

Calling Sequence: SYSTEM RELABS

or

SYSSUK RELABS

DEFB (Magic register value)

Arguments:

A =Magic register value to set

D =Y co-ordinate

E =X co-ordinate

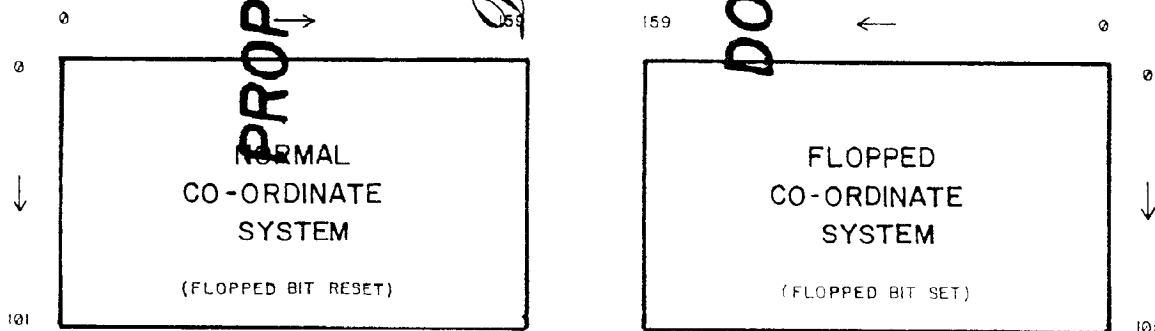
Output:

A =Magic register value, with proper shift amount set

DE=Absolute memory addresses (MAGIC)

Description:

The low-order two bits of the X co-ordinate are inserted into the magic register value bit string. The absolute memory address corresponding to the co-ordinate is computed, taking into consideration the value of the flopped bit. The co-ordinate systems used are shown below.



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SCREEN RELAB1

CONVERT RELATIVE ADDRESS TO ABSOLUTE NORMAL ADDRESS

Calling Sequence: SYSTEM RELAB1

or

SYSSUK RELAB1

DEFB (Magic register value)

Arguments: A =Magic register value to combine with shift amount

D =Y co-ordinate

E =X co-ordinate

Output:

A =Combined magic register value

DE=Absolute normal address (not magic)

Description:

This routine is identical to RELAB except that a non-magic address is returned and the hardware magic register is not set. The flopped bit is interrogated and the flopped co-ordinate system is used, if optioned.

PROPRIETARY INFORMATION

Dave Nutting Associates Inc.

DO NOT REPRODUCE

SCREEN COLSET
SET COLOR REGISTERS

Calling Sequence: SYSTEM COLSET
or
SYSSUK COLSET
DEFW (Address of color list)
Inputs: HL=Color list laid out

COL3L=first t
COLOR last : COLOR would be at a higher
address than COL3L

Description:
This routine sets color registers and saves address of colors for
use by PIZBRK and PLAKOUT for color restoration

PROPRIETARY INFORMATION

Dave Nutting Associates, Inc.

DO NOT REPRODUCE

HUMAN INCSCR
INCREMENT SCORE AND COMPARE TO END SCORE

Calling Sequence: SYSTEM INCSCR
or

SYSSUK INCSCR
DEFW (address of score)

Arguments: HL=Address of score (must be 3 bytes long)

Output: Score incremented and optionally game over bit set

Description:

The 3 byte score pointed at by HL (BCD with low order byte at lowest address) is incremented (by 1) and compared to the end score (ENDSCR). If the end score bit (GSBSCR) was set in the game status byte (GAMSTB) and end score has been reached, then the game over bit (GSBEND) is set in the game status byte.

PROPRIETARY INFORMATION

Dave Nutting Associates, Inc.

DO NOT REPRODUCE

HUMAN PAWS

PAUSE

Calling Sequence: SYSTEM PAWS
 or
 SYSSUK PAWS
 DEFB (number of interrupts)
 Arguments: B=Number of interrupts to wait

Description:
 This routine provides for a pause for certain number of interrupts.
 If used with ACT=01, 60 will be a 1-second pause. This routine
 does an EI upon entry and assumes interrupts will occur.

PROPRIETARY INFORMATION

Dave Nutting Associates, Inc

DO NOT REPRODUCE

HUMAN KEYBOARD KCTASC
KEY CODE TO ASCII

Calling Sequence: SYSTEM KCTASC
Arguments: B=Key code (not loaded)
Output: A=ASCII equivalent of keycode
Description: This routine does a table look-up

KEYCODE	NAME	GRAPHIC	HEX VALUE
1	Clear	C	48
2	Up Arrow	↑	54
3	Down Arrow	↓	56
4	Percent	%	5C
5	Roll	MR	60
6	Store	MS	62
7	Change sign	C	64
8	Divide	÷	66
9	7	7	67
10	8	8	38
11	9	9	39
12	Tens	X	2A
13	4	4	34
14	5	5	35
15	6	6	36
16	M	-	2D
17	1	1	31
18	2	2	32
19	3	3	33
20	Plus	+	2B
21	Clear Entry	CE	26
22	0	0	30
23	Decimal point	.	2E
24	Equals	=	3D

PROPRIETARY INFORMATION
Dave Nutting Associates, Inc.

DO NOT REPRODUCE

HUMAN CONTROLS & KEYPAD SENTRY
SENSE TRANSITION

Calling Sequence: SYSTEM SENTRY
or
SYSSUK SENTRY
DEFW (Key mask address)
Arguments: DE=Keypad mask table

Description:
SENTRY checks for changes in the potentiometer (pots), control handles, triggers, keypad, semipres and counter/timers. It also takes care of blackout. Blackout is the automatic blacking-out of the screen after 25 seconds without a change. If SENTRY isn't called then the game will not black out.

SENTRY checks if TIMOUT equals 0 on entry and if zero, it goes to PIZBRK. If a key has gone down or a control handle changed, then TIMOUT is set to FFH.

HL should point at a keypad mask. The keypad consists of 6 rows by 4 columns.

Example mask of DEFB 011100B
just 0 - 9 DEFB 111100B
DEFB 011100B
DEFB 000000B

See diagram on following page.

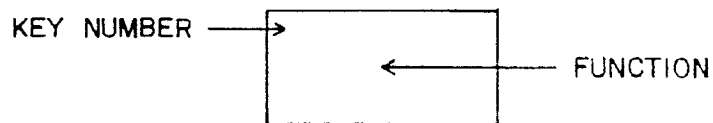
PROPRIETARY INFORMATION

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DO NOT REPRODUCE

1	C	2	↑	3	↓	4	%	0	
5	MR	6	S	7	H	8		1	
9	7	10	8	11	9	12	X	2	
13	4	14	5	15	6	16	REPRODUCE	3	MASK BIT NUMBER
17	1	18	2	19	3	20	NOT	4	
21	CE	22	1	23	.	24	DO	5	
	1	2		3		4			

MASK BYTE NUMBER



Output: A=Return code
B=Extended code

<u>PRIORITY</u>	<u>A=</u>	<u>MEANING</u>
	SNUL	Nothing changed
1		Counter/timer 0 decremented to 0
1		Counter/timer 7 decremented to 0
2		SMI4S bit 0 was 1
2		SMI4S bit 7 was 1
4		1 second has elapsed since the last SSEC
5		Keypad went from down to up B=0
5		Key is down B=key number
3		Pot 0 changed B=new value
3		Pot 3 changed B=new value
6		Joystick 0 changed B=new value
6		Joystick 3 changed B=new value
6		Trigger 0 changed B=new value
6		Trigger 3 changed B=new value

PROPRIETARY INFORMATION
 Dave Nutting Associates, Inc.

DO NOT REPRODUCE

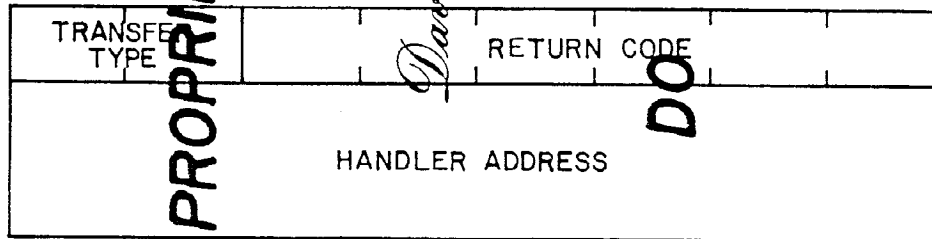
Notes:

The potentiometers (pots) are debounced. New trigger value=Trigger off (0) or trigger on (10H). When switches are actuated simultaneously the order of return is: SCT7 to SCT0, SF7 to SF0, SP0 to SP3, SSEC, SKYU, SKYD, SJ0, ST0, SJ1, ST1, SJ2, ST2, SJ3, ST3.

HUMAN CONTROL DOIT
 RESPOND TO INPUT TRANSITION

Calling Sequence: SYSTEM DOIT
 or
 SYSSUK DOIT
 DEFW (Do table)
 Arguments: A =SENTRY return code
 B =Extended return code
 HL=Do table address

Description:
 The SENTRY return code is used to search the DOTABLE. If the transition is present in DOTABLE, then control is transferred to the associated handling routine. The handling routine may be MACRO or machine instructions. The routine receives registers as they are on DOIT entry. If no transition is found, execution continues at the first instruction following call. The DOTABLE is a linear list composed of 3 byte entries, 1 entry per SENTRY return code.



Where transfer type designates how handler address is to be transferred to. The codes are: 00=JMP to machine language routine and pop context; 01=RCALL machine language routine in current context; 10=MCALL interpreter routine in current context. Mode 01 and 10 expect the returned-to point to be interpretive, mode 0 expects it to be machine instructions.

End of list is indicated by a terminator byte which is greater than or equal to C0H.

PROPRIETARY INFORMATION

DO NOT REPRODUCE

Dave Nutting Associates, Inc.

HUMAN CONTROL PIZBRK
"COFFEE BREAK" BLACK OUT SCREEN AND WAIT FOR KEY

Calling Sequence: SYSTEM PIZBRK

or

SYSSUK PIZBRK

Input: NONE

Output: NONE

Description:

This routine black out the screen and waits for either a key press or a trigger or a joystick change.

This function should be called whenever a "hold until further notice" is needed.

All keys on the keypad are enabled. Interrupts are disabled on entry and enabled on exit. It is a good idea to reset any 60th of a second timers on exiting PIZBRK.

PROPRIETARY INFORMATION

Dave Nutting Associates, Inc.

DO NOT REPRODUCE

HUMAN CONTROLS EXAMPLE

This routine echoes number keys and takes a coffee break on trigger
 Ø being pulled. Assumes SP is set and screen erases.

PROPRIETARY INFORMATION

```

SYSTEM  INTPC
LØØB:   DO      SENTRY
        DEFW    NUMBAS
        DO      DONT
        DEFW    DAB
        DO      MUMP
        DEFW    LOOP
NUMBAS: DEFB    01100B      ;NUMBER KEYS ONLY
        DEFB    10100B
        DEFB    01100B
        DEFB
DAB:    MC      STD,SHOW    ;ON KEY DOWN MACRO CALL
        MC      STØ,PBREAK+END ;ON TO MACRO CALL
SHOW:   DO      XASC      ;CONVERT TO ASCII
        DO      SUCK
        DEFB    00000111B   ;X,Y=Ø=DE
        DEFB    11001100B  ;OPTIONS=C
        DONT    CHRDIS     ;DISPLAY CHAR
        MRET
PBREAK: DO      PIZBRK     ;COFFEE BREAK
        DO      MRET      ;BACK TO LOOP

```

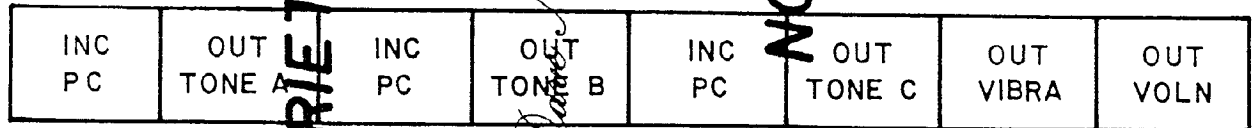
DO NOT REPRODUCE

INTERRUPT MUSIC PROCESSOR

The music processor can be thought of as an independent CPU handling all output to the music/noise ports. The MUZCPU has 4 registers:

- MPC: Like all program counters, points to the next data byte to fetch.
- MSP: Like a stack pointer, points to return addresses on the stack.
- DURATION: Is loaded at the start of a note and then decremented every 60th of a second.
- VOICES: Is a status register. It tells which voices (tones) to load with what data.

The voices status register is shown below. Execution proceeds right-to-left. Make sure that you always have at least one PC incrementing bit or load on.



PROPRIETARY INFORMATION
 Dave Nutting Associates, Inc.

DO NOT REPRODUCE

MUZCPU INSTRUCTION SET

<u># OF BYTES</u>	<u>MNEMONIC</u>	<u>COMMENT</u>
2	VOICES,(data)	;VOICES=(data)
2	MASTER,(data)	;TONEØ=(data)
3	CAT,(address)	;(SP)=(PC+3) PC=address
1	REF	;PC=(SP++)
3	JR,(address)	;PC=address
2	NOTE1	;Duration note or data (D1)
3	NOTE2	;Duration D1,D2
4	NOTE3	;Duration D1,D2,D3
5	NOTE4	;Duration D1,D2,D3,D4
6	NOTE5	;Duration D1,D2,D3,D4,D5
2	REST	;Duration in 60ths of a second ;Pauses silently (except legato)
1	QUIET	;Stops music and sets volume=Ø
2	OUTPUT	;Port # Data
9	OUTPUT	;SNDBX,DATA1Ø,D11,D12,D13,D14,D15,D16,D17
3	VOLUME	;(VOLAB),(VOLMC) sets volume for notes
1	PUSHM	;Push # between 1-16 onto the stack
1	CALL	;Call relative to next instruction
3	DSOBY	;decrement stack top and jump ;if not Ø, else pop stack
1	LEGATO	;flips between STACATO and LEGATO modes ;STACATO is clipped 1/60th before the ;end of each note ;LEGATO allows one note to run into ;the next

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PROPRIETARY INFORMATION

DO NOT REPRODUCE

Note: All durations are limited to a maximum of 127

MUSIC SCORE EXAMPLE

VOICES 11010100B ;ABC=Data 1

MASTER 0A1H ;ABC= $\frac{1}{2}$

VOLUME 88H,08H

NOTE1 12,A1

NOTE1 12,C2

NOTE1 24,E2

NOTE1 12,C2

NOTE1 12,E2

REST 6

VOICES 11110110B ;Suck in vibrato, AB and C bytes

NOTE3 12,14,A2,E

QUANT

PROPRIETARY INFORMATION

Dave Nutting Associates, Inc.

DO NOT REPRODUCE

INTERRUPTS MUSIC BMUSIC
 BEGIN PLAYING MUSIC

Calling Sequence: SYSTEM BMUSIC
 or

SYSSUK BMUSIC
 DEFW (Music stack)
 DEFB (voices byte)
 DEFW (Score)

Arguments: A =Voices to start with
 HL=Music P (Score)
 IX=Music

Description:

Quiets any previous music, then interprets "score". See music processor for more information.

PROPRIETARY INFORMATION

Dave Nutting Associates, Inc.

DO NOT REPRODUCE

INTERRUPTS MUSIC EMUSIC
STOP MUSIC

Calling Sequence: SYSTEM EMUSIC
or

SYSSUK EMUSIC

Arguments: NONE

Outputs: NONE

Description:

Outputs 0 to volume ports and halts music processor.

PROPRIETARY INFORMATION

Dave Nutting Associates, Inc.

DO NOT REPRODUCE

INTERRUPTS ACTINT
ACTIVE INTERRUPTS

Calling Sequence: SYSTEM ACTINT

or

SYSSUK ACTINT

Input: NONE

Output: NONE

Function: Sets IM=2, INLIN=200, sets I reg + INFBK
Calls TIMX and TIMEY
Enables interrupts

Description:

Once ACTINT is called, it provides interrupt service completely automatically. It runs the second timer, the game timer, the music processor, and black-out timers, plus CT0, CT1, CT2, CT3. Functions as 60th of a second timers.

PROPRIETARY INFORMATION

Dave Nutting Associates, Inc.

DO NOT REPRODUCE

INTERRUPTS TIMERS DECCTS
 DECREMENT COUNTER/TIMERS

Calling Sequence: SYSTEM DECCTS

or

SYSSUK DECCTS

DEFB (Mask)

Input: C=Mask indicative which counters to decrement.

Output: Sentry will notify the program.

Description:

Decrements counter if they are not zero. If any go from 1 to 0, sentry is notified.

PROPRIETARY INFORMATION

Dave Nutting Associates, Inc.

DO NOT REPRODUCE

INTERRUPTS TIMERS CTIMER

Calling Dequence: CALL CTIMER

Input: HL=Address of custom time base
 B =Value to load into time base 1 to 0 transition
 C =CT mask as in DECCTS

Description:

HL is loaded and incremented. If it is not = 0, then a return is executed. Else, HL is loaded with B and DECCTS is called.

Registers HL, DE, BC, and AF are undefined upon exit.

PROPRIETARY INFORMATION

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DO NOT REPRODUCE

INTERRUPTS TIMERS STIMER
DECREMENT TIMERS

Calling Sequence: PUSH AF
 PUSH BC
 PUSH DE
 PUSH HL
 CALL STIMER
 POP HL
 POP BC
 POP AF
Input: NONE

Description: STIMER keeps track of game time. If it hits 0, then the SBEND bit in the game status byte is set.

Uses: AF, BC, DE, HL

Calls: Music processor on note (duration) expiration.

Note: Sets bit 7 of key sex to 1 on every second.

PROPRIETARY INFORMATION

Dave Nutting Associates, Inc.

DO NOT REPRODUCE

MOVE MOVE BYTES

Calling Sequence: SYSTEM MOVE

or

SYSSUK MOVE

DEFW (Destination)

DEFW (Number of bytes)

DEFW (Source)

Arguments:

DE=Destination address

HL=Source address

BC=Number of bytes to transfer

Description:

MOVE uses DIR to copy bytes from source to destination.

PROPRIETARY INFORMATION

Dave Nutting Associates, Inc.

DO NOT REPRODUCE

INDEXN INDEX NIBBLE

Calling Dequence: SYSTEM INDEXN

or

SYSSUK INDEXN

DEFW (Base Address)

Arguemnts: C =Nibble displacement (0 - 255)

HL=Base address of table

Output: A =Nibble value

Description:

INDEXN is used to look up a given nibble in a linear list.

The indexing works like:

BASE ADDRESS

1	1	0
2	3	2
3	5	4
4	7	6

PROPRIETARY INFORMATION

Dave Nutting Associates, Inc

DO NOT REPRODUCE

STOREN STORE NIBBLE

Calling Dequence: SYSTEM STOREN
or

SYSSUK STOREN

DEFW (Base address)

Arguments:

C =Nibble displacement *NOT LOADED

HL=Base address

A =Nibble value to store *NOT LOADED

Description:

STOREN is the inverse of INDEXN.
STOREN works as with INDEXN.

PROPRIETARY INFORMATION

Dave Nutting Associates, Inc.

DO NOT REPRODUCE

INDEXW INDEX WORD

Calling Sequence: SYSTEM INDEXW

or

SYSSUK INDEXW

DEFW (Base address)

Arguments:

A =Displacement (0 - 255)

*NOT LOADED

HL=Base address of table

Output:

DE=Entry looked up

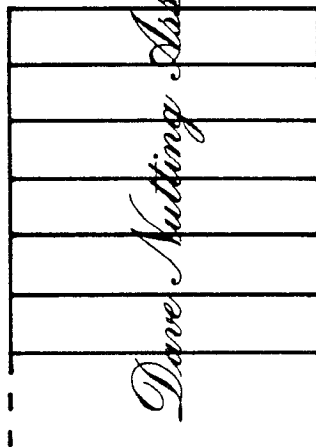
HL=Address of entry looked up

Description:

Indexing looks like:

BASE ADDRESS

PROPRIETARY INFORMATION



DISPLACEMENT

DO NOT REPRODUCE

0
1
2
.

INDEXB INDEX BYTE

Calling Sequence: SYSTEM INDEXB

or

SYSSUK INDEXB

DEFW (Base address)

Arguments: A =Displacement (0 - 255)

HL=Base address of table

Output: A =Entry looked up

HL=Address of entry looked up

Notes:

INDEXB returns the byte at address
(Base address) + (Displacement)

PROPRIETARY INFORMATION

Dave Nutting Associates, Inc.

DO NOT REPRODUCE

SETB STORE BYTE

Calling Sequence: SYSTEM SETB

or

SYSSUK SETB

DEFB (Value to store)

DEFW (Address)

Arguments:

A =Byte value to store

HL=Address to be set

Description:

Stores an 8-bit value at a specified address.

PROPRIETARY INFORMATION

Dave Nutting Associates, Inc.

DO NOT REPRODUCE

SETW STORE WORD

Calling Sequence: SYSTEM SETW

or

SYSSUK SETW

DEFW (Value to store)

DEFW (Address)

Arguments:

DE=Word value to store

HL=Address to be set

Description:

Stores a 16-bit value at a specified address.

PROPRIETARY INFORMATION

Dave Nutting Associates, Inc.

DO NOT REPRODUCE

CASSETTE CONVENTIONS

Two types of cassettes may be used with the Bally Professional Arcade. The first type, called an autostart cassette, is entered immediately after reset. The only initialization that is performed before entry is the set-up of the stack pointer to point just below system RAM and the establishment of "consumer mode" in the custom chips. RAM is not altered in this mode.

The second type, called a standard cassette, is entered after a game selection process is completed. Considerably more initialization is done by the system before control transfer.

- 1) System RAM is cleared to 0.
- 2) The ACTINT interrupt routine is enabled.
- 3) The MENU colors are set in the left color map.
- 4) Vertical blank is set at line 96, horizontal boundary at 41, and interrupt mode at 8.
- 5) The screen displays the menu frame.
- 6) The shifter is cleared.

An autostart cassette is indicated by a jump instruction (opcode C3H) at location 2000H. This jump instruction should branch to the starting address of the cassette.

A standard cassette is indicated by a sentinel byte of 55H at location 2000H. Following this byte is the first node of the cassette's menu data structure. This data structure gives the name and starting address of each program in the cassette. (See MENU)

PROPRIETARY INFORMATION

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When the user has selected a cassette game, control is transferred to the starting address with the address of the program name string in the registers. The cassette program will use the GETPAR system routine to prompt for game parameters such as score to play to, game time limit or number of layers.

The cassette has access to the six unused restart instructions. See the following cassette diagram for the transfer vectors.

PROPRIETARY INFORMATION

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BYTE

2000

	0	1	0	1	0	1	0	1
1	NEXT MENU NODE							
2								
3	STRING ADDRESS FOR FIRST GAME							
4								
5	START ADDRESS FOR FIRST GAME							
6								
7								
8	RST 8 JUMP VECTOR							
9								
A								
B	RST 16							
C								
D								
E	RST 24							
F								
2010								
1	RST 32							
2								
3								
4	RST 40							
5								
6								
7	RST 48							
8								
9								
A	SENTRY HOOK TRANSFER VECTOR							
B	USED FOR DEMO PROGRAMS							

SENTINEL

MENU NODE FOR
FIRST GAME ON
CASSETTE

PROPRIETARY INFORMATION

DO NOT REPRODUCE

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THESE CELLS
MAY BE USED
FOR PROGRAM
IF THE
ASSOCIATED
RST OR HOOK
IS NOT USED

HUMAN GETPAR
GET GAME PARAMETER

Calling Sequence: SYSTEM GETPAR
or

SYSSUK GETPAR
DEFW (Prompt)
DEFB (Digits)
DEFW (Parameter)

Arguments: A =Number of digits to get
BC=Address of prompt string
DE=Title string address *NOT LOADED
HL=Address of parameter to get

Description:

A menu frame is created displaying the title passed in DE at the top. The message "ENTER" is displayed in the center of the screen followed by the prompt string. GETNUM is entered with feedback specified in 2X enlarged characters. After entry is complete, GETPAR pauses for ¼ second to allow user to see his entry and then returns.

Notes:

See entry conditions and resource requirements for menu.

Prompt string example: "# OF PLAYERS"

The title string address (DE) is usually the title returned from MENU. The address of parameter to get (HL), HL points at the low-order byte of BCD number in RAM.

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HUMAN MENU
 DISPLAY MENU AND BRANCH ON SELECTION

Calling Sequence: SYSTEM MENU
 or

SYSSUK MENU
 DEFW (Title)
 DEFW (List)

Arguments: DE=Address of menu title string
 HL=Address of menu list

Output: DE=String address of selection mode

Description:

The title is displayed at the top of the screen. Each entry in the menu list is then displayed with a preceding number supplied by MENU. GETNUM is called to get the selection number. The menu list is searched for the selected node and it is jumped to.

Notes:

A maximum of eight entries may appear.

On entry, MENU expects interrupts to be enabled, colors and boundaries to be set up. MENU uses 96 lines of screen, creates the alternate set, and requires three levels of context. MENU calls SENTRY and thus 'eats' all irrelevant transitions.

NEXT
STRING
GO TO

ADDRESS OF NEXT NODE ON LIST
 ZERO IF THIS NODE IS LAST

ADDRESS OF NAME OF THIS SELECTION
 THIS IS WHAT IS PASSED IN DE

WHERE TO BRANCH TO IF THIS
 SELECTION IS SELECTED

PROPRIETARY INFORMATION

DO NOT REPRODUCE

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HUMAN GETNUM
GET NUMBER

Calling Sequence: SYSTEM GETNUM
or

SYSSUK GETNUM
DEFB (X address)
DEFB (Y address)
DEFB (CARDIS options)
DEFB (GETNUM options)
DEFW (Number address)

Arguments: B =Display number routine options
C =Character display routine options
DE=Y,X coordinate for feedback
HL=Address of where to enter number

Description:

This routine inputs a number from either the keypad or the pot on control handle of player one. Keypad entry has priority. The routine exits when the specified number of digits were entered or = is pressed on the keypad.

Pot entry is enabled by pressing the trigger. The current pot value is then shown. Twist the pot until the number you want is shown. Then press the trigger again to complete entry. The pot can only enter 1 or 2 digits. If a group of numbers is being entered, the user must enable entry for each new number.

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DO NOT REPRODUCE

DISPLAY NUMBER OPTIONS

ZERO SUPP	ALF FON	NUMBER OF DIGITS TO DISPLAY/ACCEPT			
-----------	---------	------------------------------------	--	--	--

CHARACTER DISPLAY OPTIONS

ENLARG FACTOR	XOR	OR	ON COLOR	OFF COLOR
---------------	-----	----	----------	-----------

PROPRIETARY INFORMATION

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DO NOT REPRODUCE

HUMAN MSKTD
JOYSTICK MASK TO DELTAS

Calling Sequence: SYSTEM MSKTD

or

SYSSUK MSKTD

DEFW (X Delta)

DEFB (Flop-flag)

DEFW (Y Delta)

Arguments:

B = Joystick mask

*NOT LOADED

C = Flop flag

DE=X positive delta

HL=Y positive delta

Output:

DE=X Delta

HL=Y Delta

Description:

This routine uses the joystick mask and flop flag to conditionally modify the passed deltas. If negative direction is indicated, the delta is 2's complemented. If no direction is indicated, 0 is returned.

Note:

B is not checked.

PROPRIETARY INFORMATION

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DO NOT REPRODUCE

MATH RANGED
RANGED RANDOM NUMBER

Calling Sequence: SYSTEM RANGED
or

SYSSUK RANGED
DEFB (N)

Arguments: A=N where 0 is less than or equal to a random
number less than N
(ie: for a random number of 0,1,or 2, N=3)

Output: A=Random Number

Notes;

If N is a power of 2 it is considerably faster to use N=0 which causes
an 8-bit value to be returned without ranging. Use an AND instruction
to range it yourself.

This routine uses a polynomial shift register RANSHT in system RAM.
RANGED is called if GETNUM while waiting for game selection/parameter
entry. Thus each execution of a program will receive different random
numbers. For 'predictable' random numbers, alter RANSHT yourself after
parameter acceptance.

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INTRODUCTION

The Bally Professional Arcade is a full-color video game system based on the mass-ram-buffer technique. A mass-ram-buffer system is one in which one or more bits of RAM are used to define the color and intensity of a pixel on the screen. The picture on the screen is defined by the contents of RAM and can easily be changed by modifying RAM.

The system uses a 68000 Microprocessor as its main control unit. The system ROM has software for four games: Gunfight, Checkmate, Scribbling, and Calculator. Additional ROM can be accessed through the silicon cassette connector. Three custom chips are used for the video interface, special video processing functions, keyboard and control handle interface, and audio generation.

The system exists in both high-resolution and low-resolution models. The three custom chips can operate in either mode. The mode of operation is determined by bit 0 of output port 8H. It must be set to 0 for low-resolution and 1 for high-resolution. This bit is not set to 0 at power up and must be set by software before any RAM operations can be performed.

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MEMORY MAP

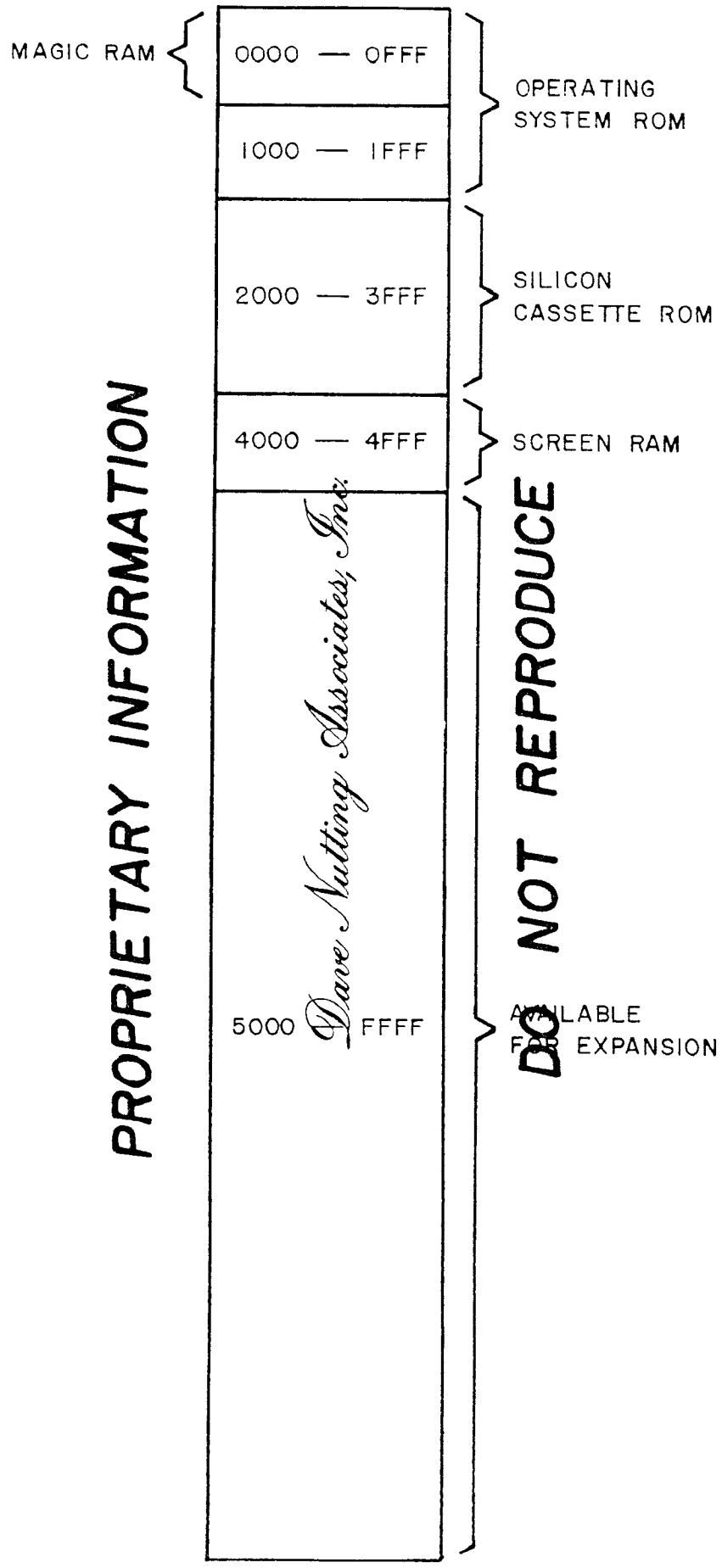
In both the low and high resolution models, the operating system ROM is in the first 8K of memory space. The silicon cassette ROM is in the space from 8K to 16K. The standard screen RAM begins at 16K. In the low-resolution unit, standard screen RAM is 4K bytes; in the high-resolution unit it is 16K bytes. Magic screen RAM begins at location 0. It is the same size as standard screen RAM. All memory above 32K is available for expansion. In the low-resolution unit, memory space 20K - 32K is available for expansion.

When data is read from a memory location between 0 and 16K the data comes from the ROM. When data is written in a memory location (X) between 0 and 16K the system actually writes a modified form of the data in location X+16K. The modification is performed by the magic system in the Data Chip and Address Chip. Thus the RAM from 0 to 16K is called Magic Memory.

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PROPRIETARY INFORMATION

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DO NOT REPRODUCE

MAGIC RAM

0000 — 1FFF

OPERATING
SYSTEM ROM

2000 — 3FFF

PROPRIETARY INFORMATION

4000 — 7FFF

DO NOT REPRODUCE

SCREEN RAM

Dave Nutting Associates, Inc.

8000 — FFFF

AVAILABLE
FOR EXPANSION

SCREEN MAP

In the Bally Professional Arcade, two bits of RAM are used to define a pixel on the screen. One 8-bit byte of RAM therefor defines four pixels on the screen.

In the low-resolution model there are 40 bytes used to define a line of data. This gives a horizontal resolution of 160 pixels. The vertical resolution is 102 lines. The screen therefor requires $102 \times 40 = 4,080$ bytes. The remaining 16 bytes of the 4K RAM are used for scratch pad. More of the RAM can be used for scratchpad by blanking the screen before the 102nd line. This will be described later.

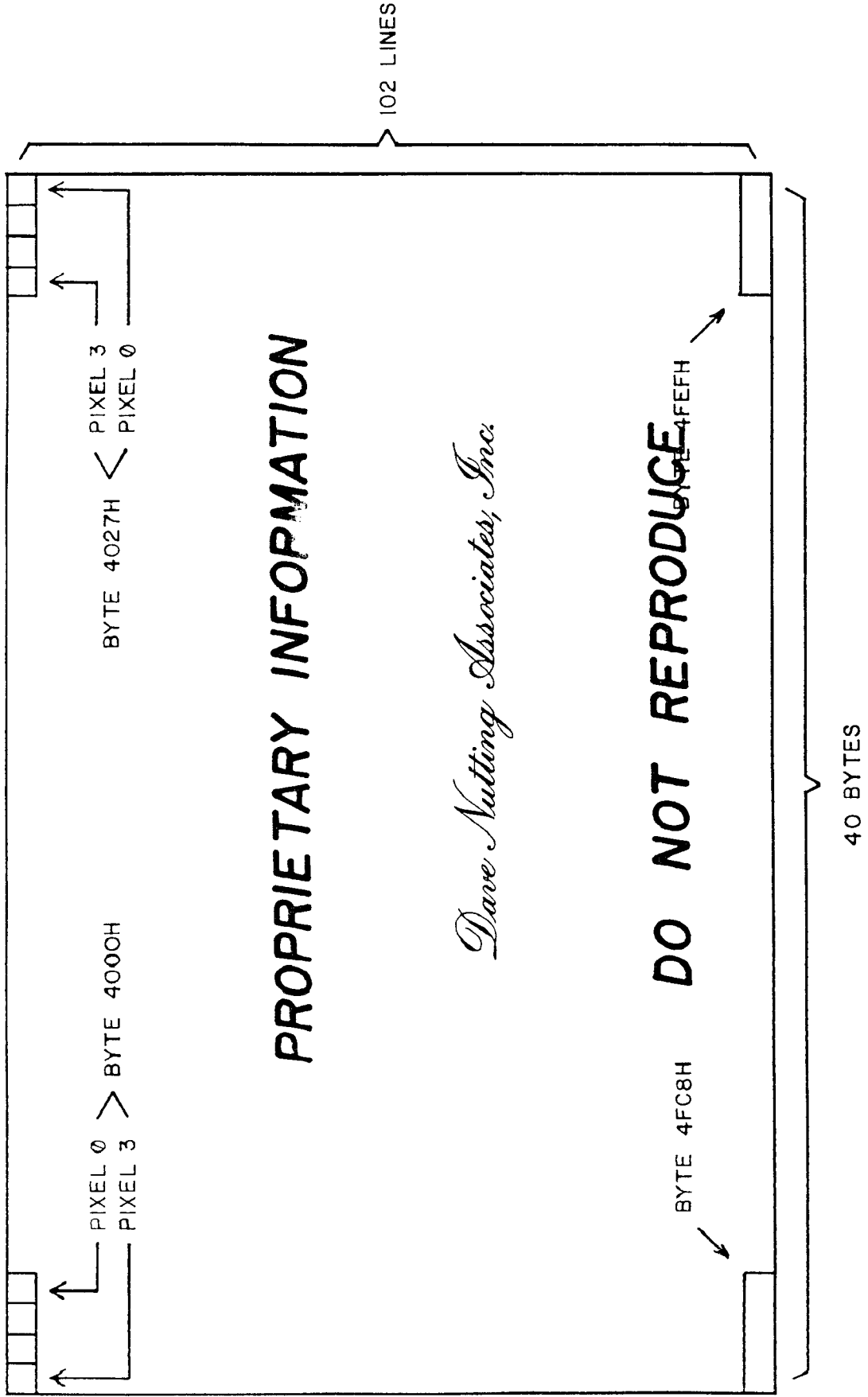
In the high-resolution model there are 80 bytes and 320 pixels per line. The 204 lines require 16,320 bytes of RAM. 64 bytes of the 16K RAM are left for scratch pad.

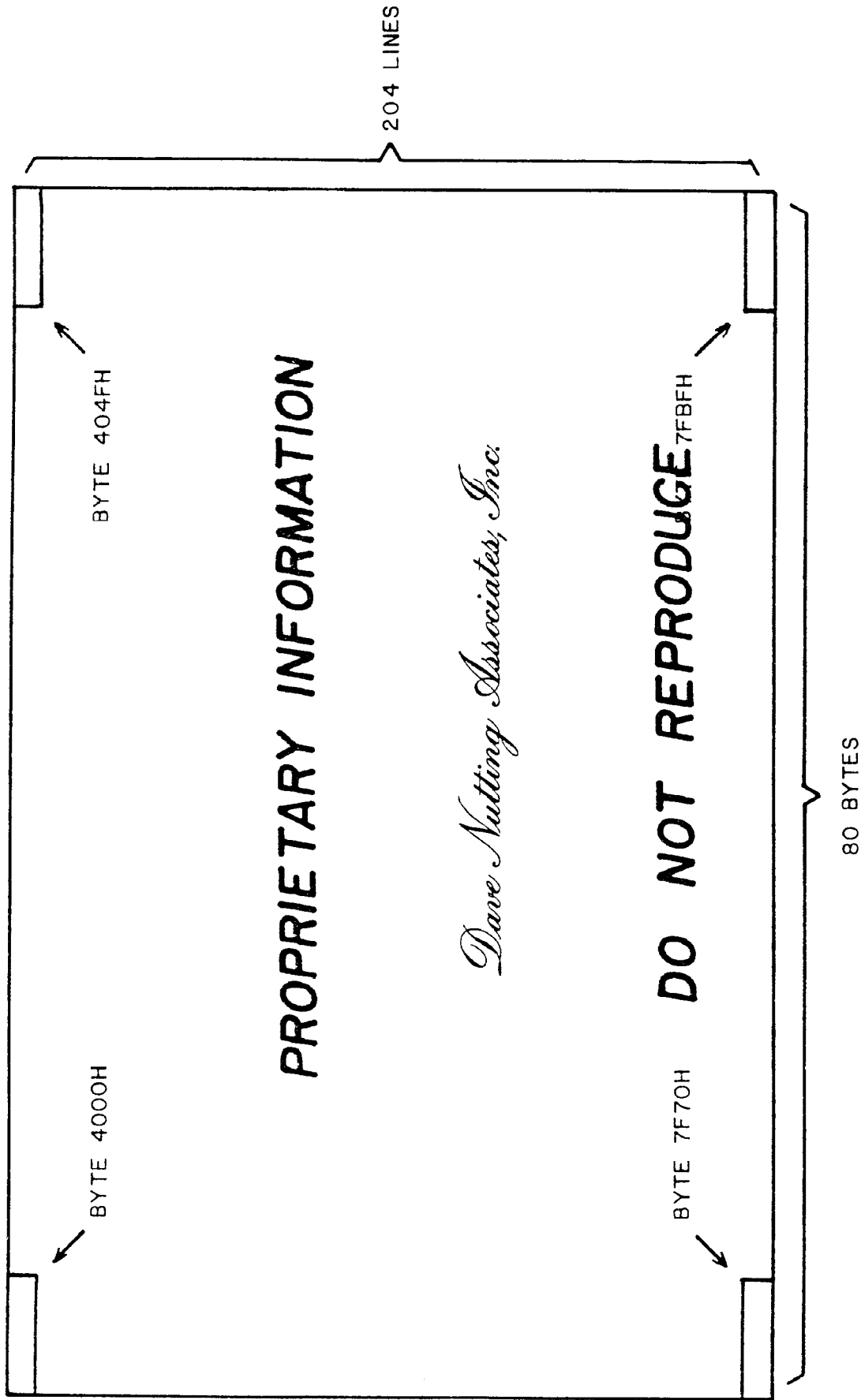
In both models the first byte of RAM is in the upper left-hand corner of the screen. As the RAM address increases, the position on the screen moves in the same directions as the TV scan; from left-to-right and from top-to-bottom. The four pixels in each byte are displayed with the least significant pixel, the one defined by bits 0 and 1, on the right.

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COLOR MAPPING

Two bits are used to represent each pixel on the screen. These two bits, along with the LEFT/RIGHT bit which is set by crossing the horizontal color boundary, map each pixel to one of eight different color registers. The value in the color register then defines the color and intensity of the pixel on the screen. The intensity of the pixel is defined by the three least significant bits of the register, 000 for darkest and 111 for lightest. The color is defined by the five most significant bits. The color registers are at output ports 0 through 7; register 0 at port 0, register 1 at port 1, etc.

The color registers can be accessed as individual ports or all eight can be accessed by the OTIR instruction. The OTIR instruction is to port BH (register =BH) and register B should be set to 8. The eight bytes of data pointed to by HL will go to the color registers

HL →	Memory Location X	Color Register 7
	X+1	Color Register 6
	X+2	Color Register 5
	X+3	Color Register 4
	X+4	Color Register 3
	X+5	Color Register 2
	X+6	Color Register 1
	X+7	Color Register 0

The horizontal color boundary (bits 0-5 of port 9) defines the horizontal position of an imaginary vertical line on the screen. The boundary line can be positioned between any two adjacent bytes in the low-resolution system. The line is immediately to the left of the byte whose number is sent to bits 0-5 of port 9. For example, if the horizontal color boundary is set to 0, the line will be just to the left of byte 0; if it is set to 20, the line will be between bytes 19 and 20 in the center of the screen.

If a pixel is to the left of the boundary, its LEFT/RIGHT bit is set to 1. The LEFT/RIGHT bit is set to 0 for pixels to the right of the boundary. Color registers 0-3 are used for pixels to the right of the boundary and registers 4-7 are used for pixels to the left of the boundary.

In the high-resolution system, the boundary is placed in the same position on the screen but between different bytes. If the value X is sent to the horizontal color boundary, then the boundary will be between bytes 2X and 2X-1. If the value 20 is sent, the boundary will be between 39 and 40, in the center of the screen.

To put the entire screen, including the right side background, on the left side of the boundary, set the horizontal color boundary to 44.

BACKGROUND COLOR

On most television, the area defined by RAM is slightly smaller than the screen. There is generally extra space on all four sides of the RAM area. The color and intensity of this area is defined by the background color number (bits 6 and 7 of port 9). These two bits, along with the LEFT/RIGHT bit point to one of the color registers which determines the color and intensity.

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VERTICAL BLANK

The Vertical Blank Register (output port AH) contains the line number on which vertical blanking will begin. In the low-resolution system bit 0 should be set to 0 and the line number should be in bits 1-7. In the high-resolution system the line number is in bits 0-7. The background color will be displayed from the vertical blank line to the bottom of the screen. This allows the RAM that would normally be displayed in that area to be used for scratch pad. If the vertical blank register is set to 0 the entire RAM can be used for scratch pad. In a low-resolution system the register must be set to 101 or less; in a high-resolution system it must be set to 211 or less.

SUMMARY

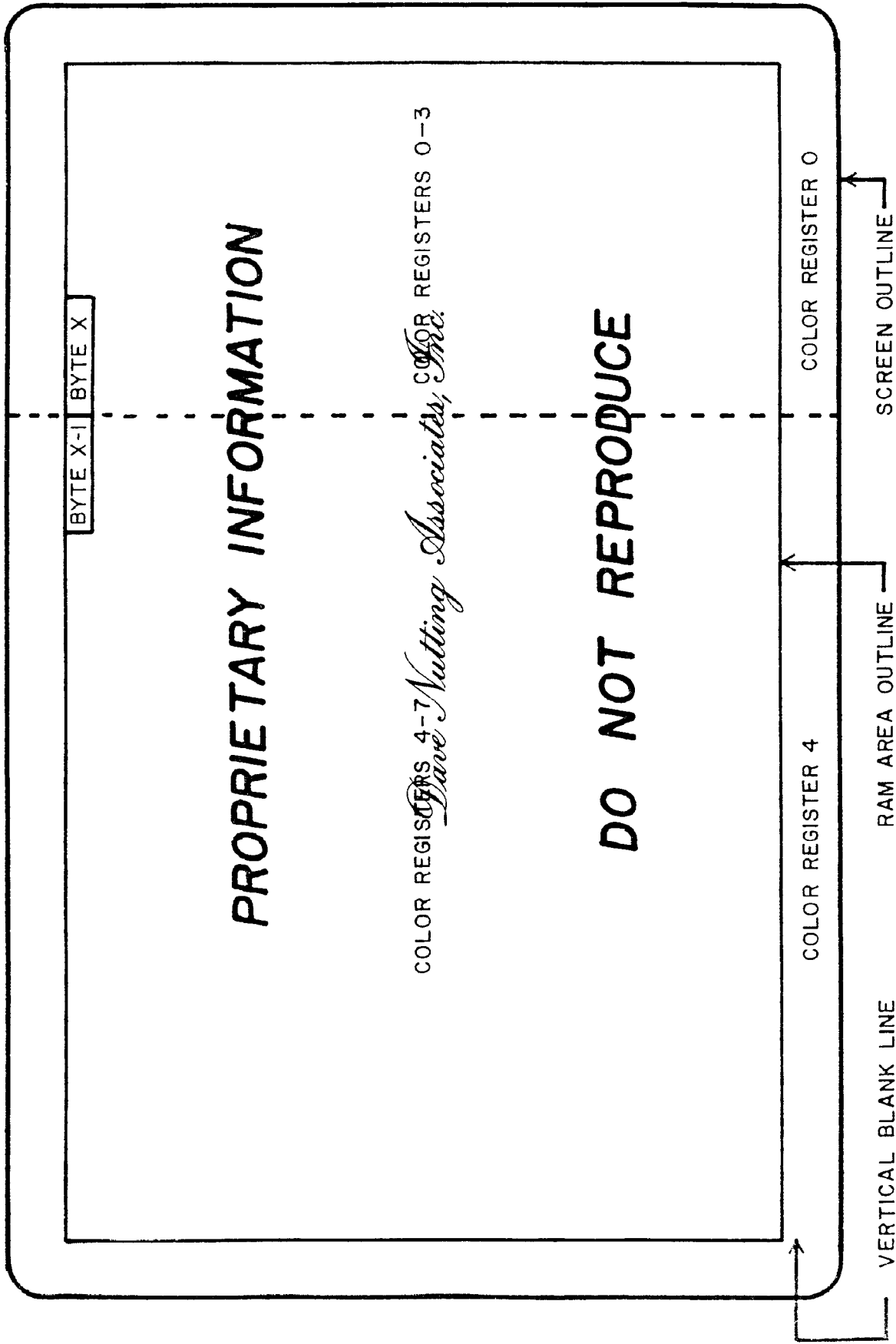
The following color register map shows which color registers are used to define colors in different areas of the screen. The map assumes the background color is set to 0. If it were set to 1 then color registers 1 and 5 would be used for background instead of 0 and 4. In the low-resolution system the color boundary is between bytes X and X-1. In the high-resolution system the boundary is between bytes 2X and 2X-1.

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HORIZONTAL COLOR BOUNDARY = X



BYTE X-1

BYTE X

PROPRIETARY INFORMATION

COLOR REGISTERS 4-7 *Dove Nutting Associates, Inc.* COLOR REGISTERS 0-3

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COLOR REGISTER 4

COLOR REGISTER 0

VERTICAL BLANK LINE

RAM AREA OUTLINE

SCREEN OUTLINE

INTERRUPT FEEDBACK

When the Z-80 acknowledges an interrupt it reads 8 bits of data from the data bus. It then uses this data as an instruction or an address. In the Bally Professional Arcade this data is determined by the contents of the interrupt feedback register (output port DH). In responding to a screen interrupt the contents of the interrupt feedback register are placed directly on the data bus. In responding to a light pen interrupt the lower four bits of the data bus are set to 0 and the upper four bits are the same as the corresponding bits of the feedback register.

INTERRUPT CONTROL BITS

In order for the Z-80 to be interrupted the internal interrupt enable flip-flop must be set by an EI instruction and one or two of the external interrupt enable bits must be set on output port 17. If bit 1 is set, light pen interrupts can occur. If bit 3 is set, screen interrupts can occur. If both bits are set, both interrupts can occur and the screen interrupt has higher priority.

The interrupt mode bits determine what happens if an interrupt occurs when the Z-80's interrupt enable flip-flop is not set. Each of the two interrupts may have a different mode. In mode 0 the Z-80 will continue to be interrupted until it finally enables interrupts and acknowledges the interrupt. In mode 1 the interrupt will be discarded if it is not acknowledged by the next instruction after it occurred. If mode 1 is used the software must be designed such that the system will not be executing certain Z-80 instructions when the interrupt occurs. The opcodes of these instructions begin with CBH, DDH, EDH, and FDH.

The mode bit for light pen interrupt is bit 0 of port EH and the mode bit for screen interrupt is bit 2 of port EH.

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SCREEN INTERRUPT

The purpose of the screen interrupt is to synchronize the software with the video system. The software must send a line number to the interrupt line register (output port FH). In the low-resolution system bit 0 is set to 0 and the line number is sent to bits 1-7. In the high-resolution system the line number is sent to bits 0-7. If the screen interrupt enable bit is set, the Z-80 will be interrupted when the video system completes scanning the line in the interrupt register. This interrupt can be used for timing since each line is scanned 60 times a second. It can also be used in conjunction with the color registers to make as many as 256 color-intensity combinations appear on the screen at the same time.

LIGHT PEN INTERRUPT

The light pen interrupt occurs when the light pen trigger is pressed and the video scan crosses the point on the screen where the light pen is. The interrupt routine can read two registers to determine the position of the light pen. The line number is read from the vertical feedback register (input port E7). In the high-resolution system the line number is in bits 0-7. In the low-resolution system the line number is in bits 1-7, bit 0 should be ignored. The horizontal position of the light pen can be determined by reading input port FH and subtracting 8. In the low-resolution system the resultant value is the pixel number, 0 to 159. In the high-resolution system the resultant must be multiplied by two to give the pixel number, 0 to 358.

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MAGIC REGISTER

As described earlier, the Magic System is enable when data is written to a memory location (X) from 0 to 16K. A modified form of the data is actually written in memory location X+16K. The magic register (output port CH) determines how the data is modified. The purpose of each bit of the magic register is shown below.

Bit 0	LSB of shift amount
1	MSB of shift amount
2	Rotate
3	Expand
4	OR
5	XOR
6	Flop

The order in which magic functions are performed is as follows: Expansion is done first; rotating or shifting; chopping; OR or XOR. As many as four can be used at any one time and any function can be bypassed. Rotate and shift as well as OR and XOR cannot be done at the same time.

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EXPAND

The expander is used to expand the 8 bit data bus into 8 pixels (or 16 bits). It expands a 0 on the data bus into a two-bit pixel and a 1 into another two-bit pixel. Thus, two-color patterns can be stored in ROM in half the normal memory space.

During each memory write instruction using the expander, either the upper half or the lower half of the data bus is expanded. The half used is determined by the expand flip-flop. The flip-flop is reset by an output to the magic register and is toggled after each magic memory write. The upper half of the data bus is expanded when the flip-flop is 0, and the lower half when the flip-flop is 1.

The expand register (output port 9H) determines the pixel values into which the data bus will be expanded. A 0 on the data bus will be expanded into the pixel defined by bits 0 and 1 of the expand register. A 1 on the data bus will be expanded into the pixel defined by bits 2 and 3 of the expand register.

The pixels generated by bit 0 or 1 of the data bus will be the least significant pixel of the expanded byte. The most significant pixel will come from bit 6 or 7.

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SHIFTER

The shifter, flopper, and rotator operate on pixels rather than bits. Each byte is thought of as containing four pixels, each of which has one of four values. The four pixels are referred to as P0, P1, P2, and P3. P0 is composed of the first two bits of the byte.

The shifter shifts data 0, 1, 2, or 3 pixels to the right. The shift amount is determined by bits 0 and 1 of the magic register. The pixels that are shifted out of one byte are shifted into the next byte. 0's are shifted into the first byte of a sequence. The shifter assumes the first byte of a sequence is the first magic memory write after an output to the magic register. Each sequence must be initialized by an output to the magic register and data cannot be sent to the magic register in the middle of a sequence.

FLOPPER

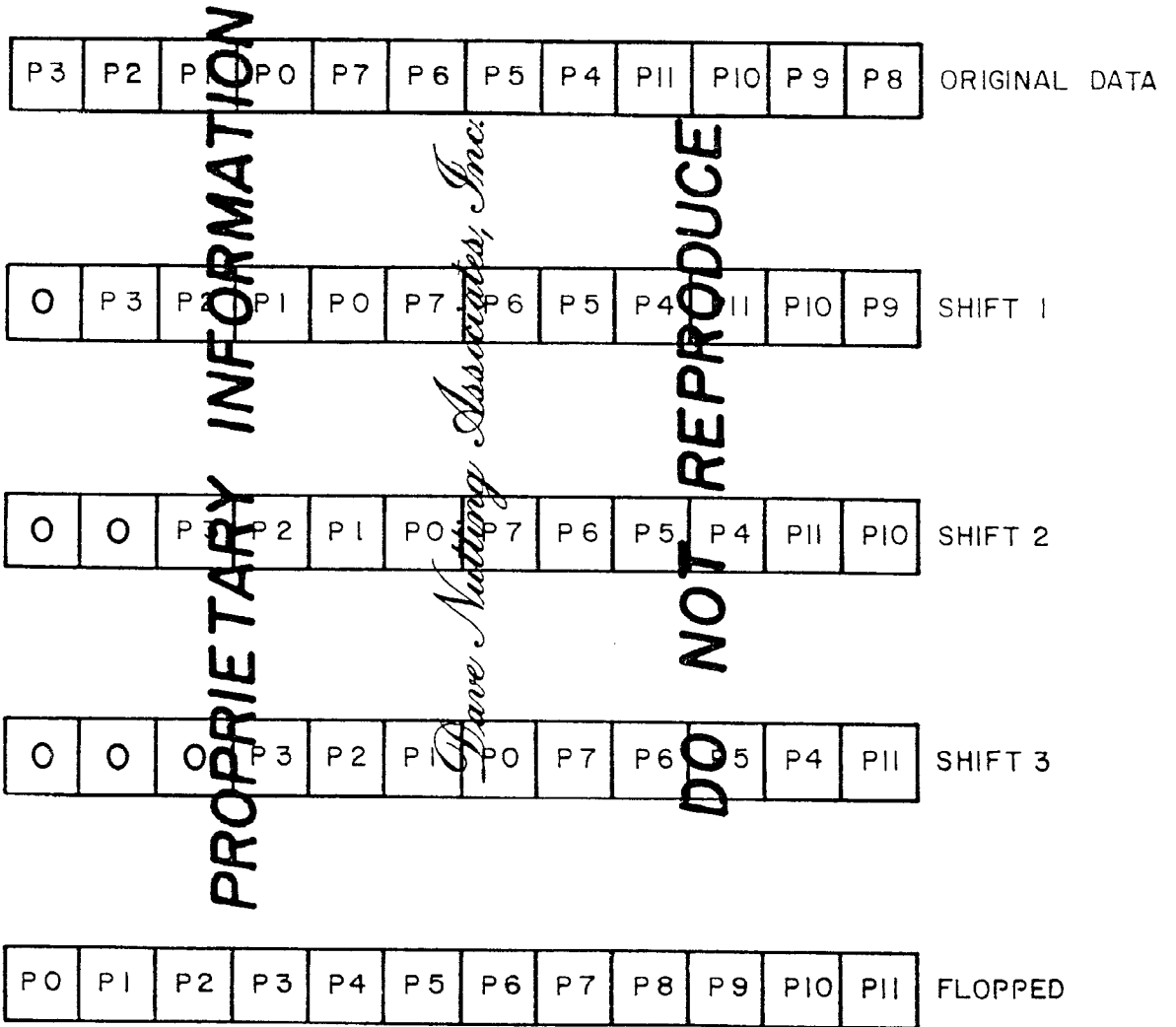
The output of the flopper is a mirror image of its input. Pixel 0 and 3 exchange values as do pixel 1 and 2.

The diagrams on the following page show examples of shifting and flopping.

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ROTATOR

The rotator is used to rotate a 4 X 4 pixel image 90° in a clockwise direction. The rotator is initialized by an output to the magic register and will re-initialize itself after every eight writes to magic memory. To perform a rotation, the following procedure must be performed twice. Write the top byte of the unrotated image to a location in magic memory. Write the next byte to the first location plus 80, the next byte to the first location plus 160, and the last byte to the first location plus 240. After eight writes the data will appear in RAM and on the screen rotated 90° from the original image.

The rotator can only be used in commercial mode.

The diagram on the following page shows an example of rotating.

PROPRIETARY INFORMATION

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PROPRIETARY INFORMATION

P 3	P 2	P 1	P 0
P 7	P 6	P 5	P 4
P 11	P 10	P 9	<i>Dagg</i>
P 15	P 14	P 13	P 12

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P 15	P 11	P 7	P 3
P 14	P 10	P 6	P 2
<i>P 13</i>	<i>P 9</i>	P 5	P 1
P 12	P 8	P 4	P 0

ORIGINAL ^{ROTATED}

DO NOT REPRODUCE

OR AND XOR

These functions operate on a byte as 8-bits rather than four pixels. When the OR function is used in writing data to RAM, the input to the OR circuit is ORed with the contents of the RAM location being accessed. The resultant is then written in RAM.

The XOR function operates in the same way except that the data is XORed instead of ORed.

INTERCEPT

Software reads the intercept register (input port 8H) to determine if an intercept occurred on an OR or XOR write. An intercept is defined as the writing of a non-zero pixel in a pixel location that previously contained a non-zero pixel. A non-zero pixel is a pixel with a value of 01, 10, or 11. A 1 in the intercept register means an intercept has occurred. Bits 0 - 3 give the intercept information for all OR or XOR writes since the last input from the intercept register. An input from the intercept register resets these bits. A bit is set to 1 if an intercept occurs in the appropriate position and will not be reset until after the next intercept register input.

Bit

- 0 Intercept in pixel 3 in an OR or XOR write since last reset
- 1 Intercept in pixel 2 in an OR or XOR write since last reset
- 2 Intercept in pixel 1 in an OR or XOR write since last reset
- 3 Intercept in pixel 0 in an OR or XOR write since last reset
- 4 Intercept in pixel 3 in last OR or XOR write
- 5 Intercept in pixel 2 in last OR or XOR write
- 6 Intercept in pixel 1 in last OR or XOR write
- 7 Intercept in pixel 0 in last OR or XOR write

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PLAYER INPUT

The system will accommodate up to four player control handles at once. Each handle has five switches and a potentiometer. The switches are read by the Z-80 on input ports 10H - 13H and are not debounced. The switches are normally open and normally feedback 0's.

The signals from the potentiometers are changed to digital information by an 8-bit Analog-to-Digital Converter. The four pots are on input ports 1CH - 1FH. All 0's are feedback when the pot is turned fully counter-clockwise and all 1's when turned fully clockwise.

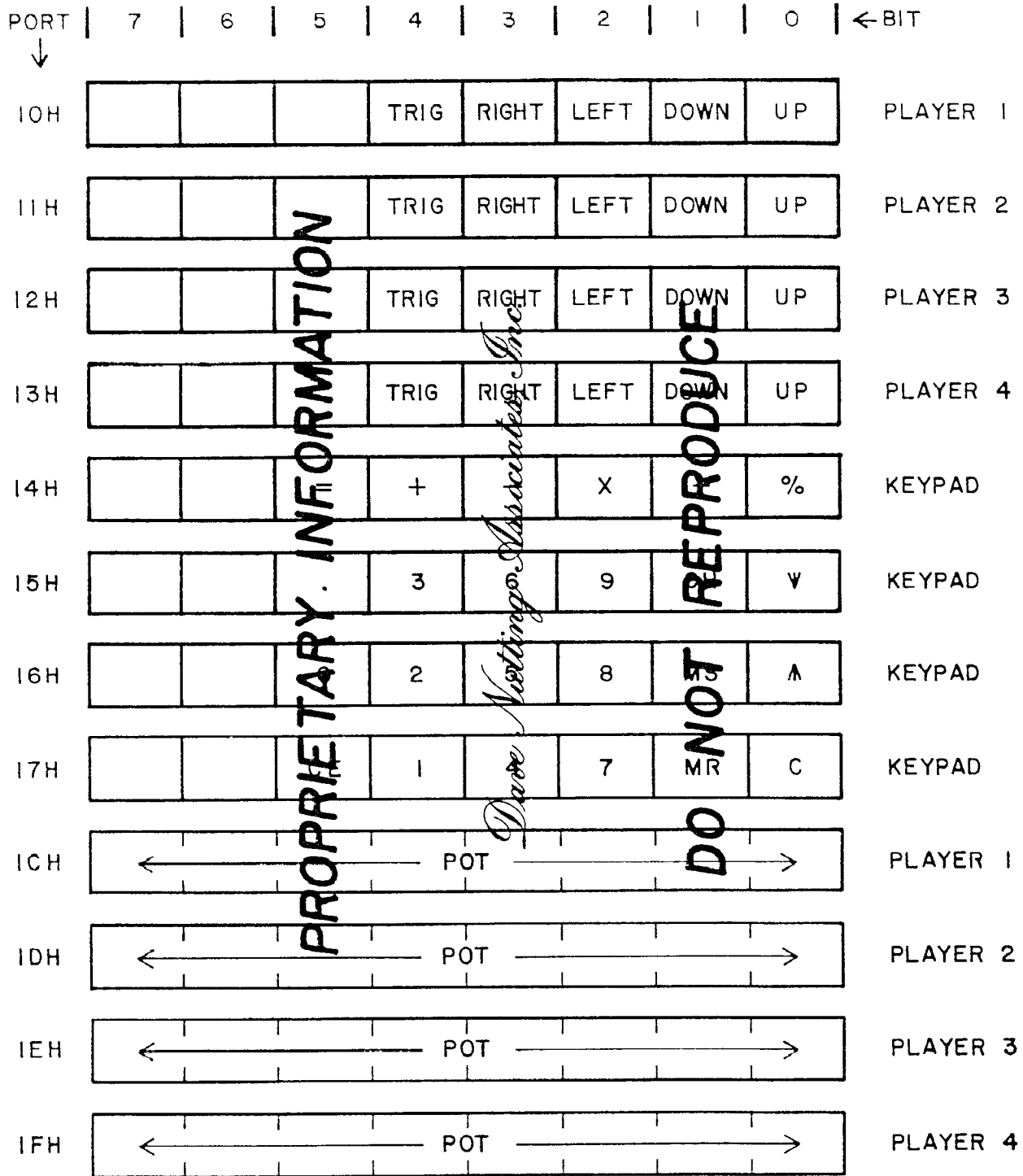
The 24-button keypad is read on bits 0-5 of ports 14H-17H. The data is normally 0 and if more than one button is depressed, the data should be ignored. The keypad will not send back the proper data if any of the player control switches are closed. Hereafter, the buttons are not debounced.

Player control inputs are shown on the following page.

PROPRIETARY INFORMATION

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PROPRIETARY INFORMATION
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PLAYER INPUT

MASTER OSCILLATOR

The frequency of the master oscillator is determined by the contents of several output ports. Port 10H sets the master frequency. It is given by the following formula:

$$F_m = \frac{1789}{\text{PORT } 10H + 1} \text{ KHz}$$

If bit 4 of output port 15H is set to 1, the master oscillator frequency will be modulated by noise. The amount of modulation will be set by the 8-bit noise volume register, output port 17H.

If bit 4 of output port 15H is set to 0, the frequency of the master oscillator will be modulated by a constant value to give a vibrato effect. The amount of modulation will be set by the vibrato depth register (the first 6 bits of output port 14H). The speed of modulation is set by the vibrato speed register (upper 2 bits of output port 14H); 00 for fastest and 11 for slowest.

Frequency modulation is accomplished by adding a modulation value to the contents of port 10H and sending the result to the master oscillator frequency generator. In noise modulation, the modulation value is an 8-bit word from the noise generator. If a bit in the noise volume register is set to 1, the corresponding bit in the modulation value word will be set to 1. In vibrato modulation, the modulation value alternates between 0 and the contents of the vibrato volume register.

Modulation can be completely disabled by setting the master volume to 0 if noise modulation is being used, or by setting the vibrato depth to 0 when vibrato is used.

TONES

The system contains three tone generators each clocked by the same master oscillator. The frequency of Tone A is set by output port 11H, Tone B by output port 12H, and Tone C by output port 13H. The frequency is given by the following formula:

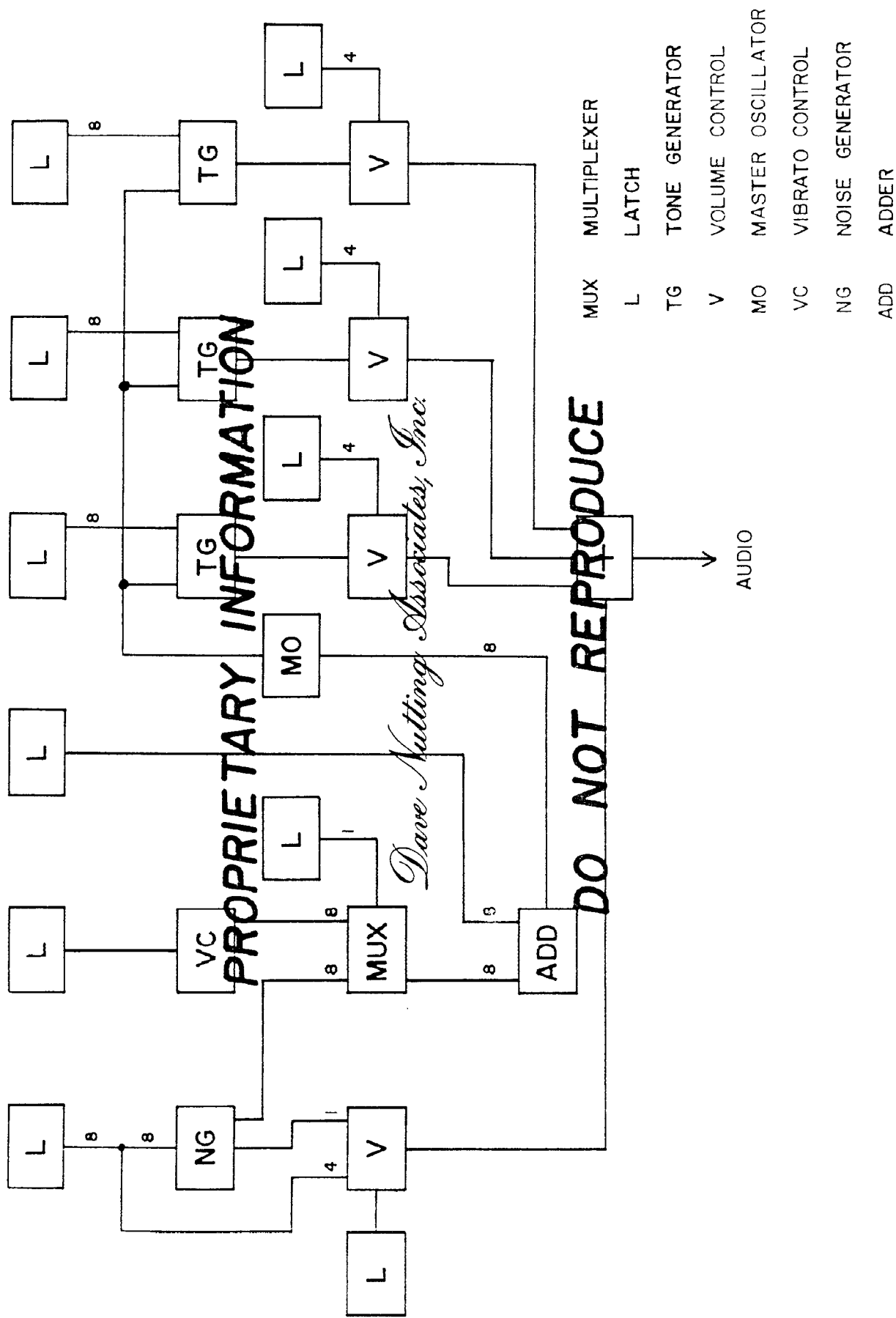
$$F_f = \frac{F_m}{2(\text{contents of TONE PORT} + 1)} = \frac{894}{(\text{PORT } 10H + 1)(\text{contents of TONE PORT} + 1)} \text{ KHz}$$

The tone volumes are controlled by output ports 15H and 16H. The lower 4 bits of port 16H set Tone A Volume, the upper 4 bits sets Tone B Volume. The lower 4 bits of port 15H sets Tone C Volume. Noise can be mixed with the tones by setting bit 5 of port 15H to 1. In this case the noise volume is given by the upper 4 bits of port 17H. In all cases a volume of 0 is silence and a volume of all 1's is loudest.

SOUND BLOCK TRANSFER

All 8 bytes of sound control can be sent to the audio circuit with one OTIR instruction. Register C should be sent to 18H, register B to 8H and HL pointing to the 8 bytes of data. The data pointed to by HL goes to port 17H and the next 7 bytes of data goes to ports 16H through 10H.

HL →	Memory Location	X	Data-to-port	17H
		X+1	Data-to-port	16H
		X+2	Data-to-port	15H
		X+3	Data-to-port	14H
		X+4	Data-to-port	13H
		X+5	Data-to-port	12H
		X+6	Data-to-port	11H
		X+7	Data-to-port	10H



AUDIO GENERATOR BLOCK DIAGRAM

OUTPUT PORTS

<u>PORT NUMBER</u>	<u>FUNCTION</u>
0H	Color Register 0
1H	Color Register 1
2H	Color Register 2
3H	Color Register 3
4H	Color Register 4
5H	Color Register 5
6H	Color Register 6
7H	Color Register 7
8H	Low/High Resolution
9H	Horizontal Color Boundary, Background Color
AH	Vertical Blank Register
BH	Color Block Transfer
CH	Magic Register
DH	Interrupt Feedback Register
EH	Interrupt Enable and Mode
FH	Interrupt Line
10H	Master Oscillator
11H	Tone A Frequency
12H	Tone B Frequency
13H	Tone C Frequency
14H	Vibrato Register
15H	Tone C Volume, Noise Modulation Control
16H	Tone A Volume, Tone B Volume
17H	Noise Volume Register
18H	Sound Block Transfer
19H	Expand Register

PROPRIETARY INFORMATION**DO NOT REPRODUCE**

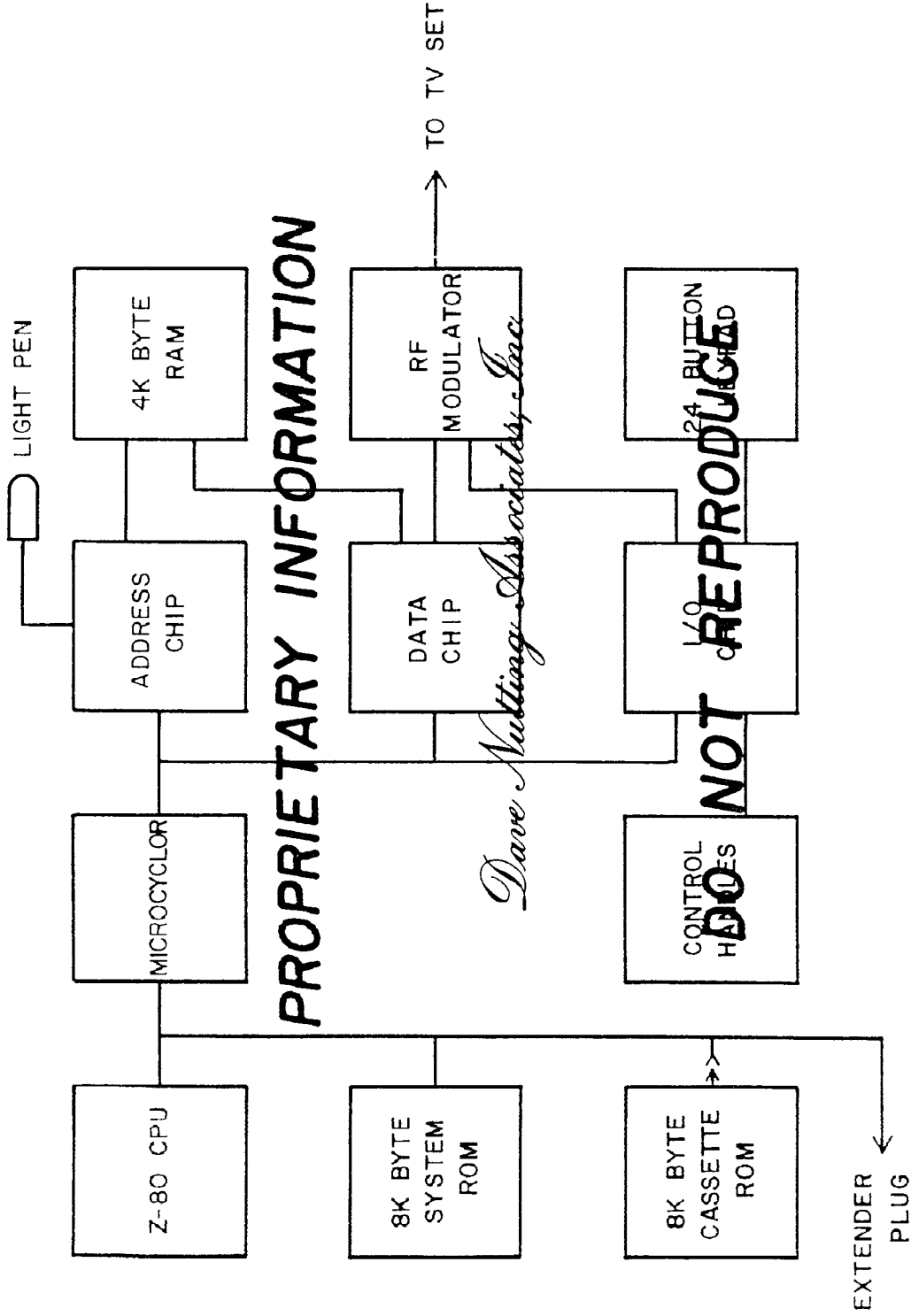
INPUT PORTS

<u>PORT NUMBER</u>	<u>FUNCTION</u>
8H	Intercept Feedback
EH	Vertical Line Feedback
FH	Horizontal Address Feedback
10H	Player 1 Handle
11H	Player 2 Handle
12H	Player 3 Handle
13H	Player 4 Handle
14H	Keypad Column 0 (right)
15H	Keypad Column 1
16H	Keypad Column 2
17H	Keypad Column 3 (left)

PROPRIETARY INFORMATION

Dave Nutting Associates, Inc.

DO NOT REPRODUCE



SYSTEM BLOCK DIAGRAM

MICROCYCLER

The purpose of the microcycler is to combine the 16-bit Address Bus and the 8-bit Data Bus from the Z-80 into one 8-bit Microcycle Data Bus to the Data Chip, Address Chip, and I/O Chip. This was done to reduce the pin count on the custom chips.

The Microcycle Data Bus can be in any of four modes. Its mode is controlled by MC0 and MC1 coming from the Data Chip and RFSH from the Z-80. The modes are shown below.

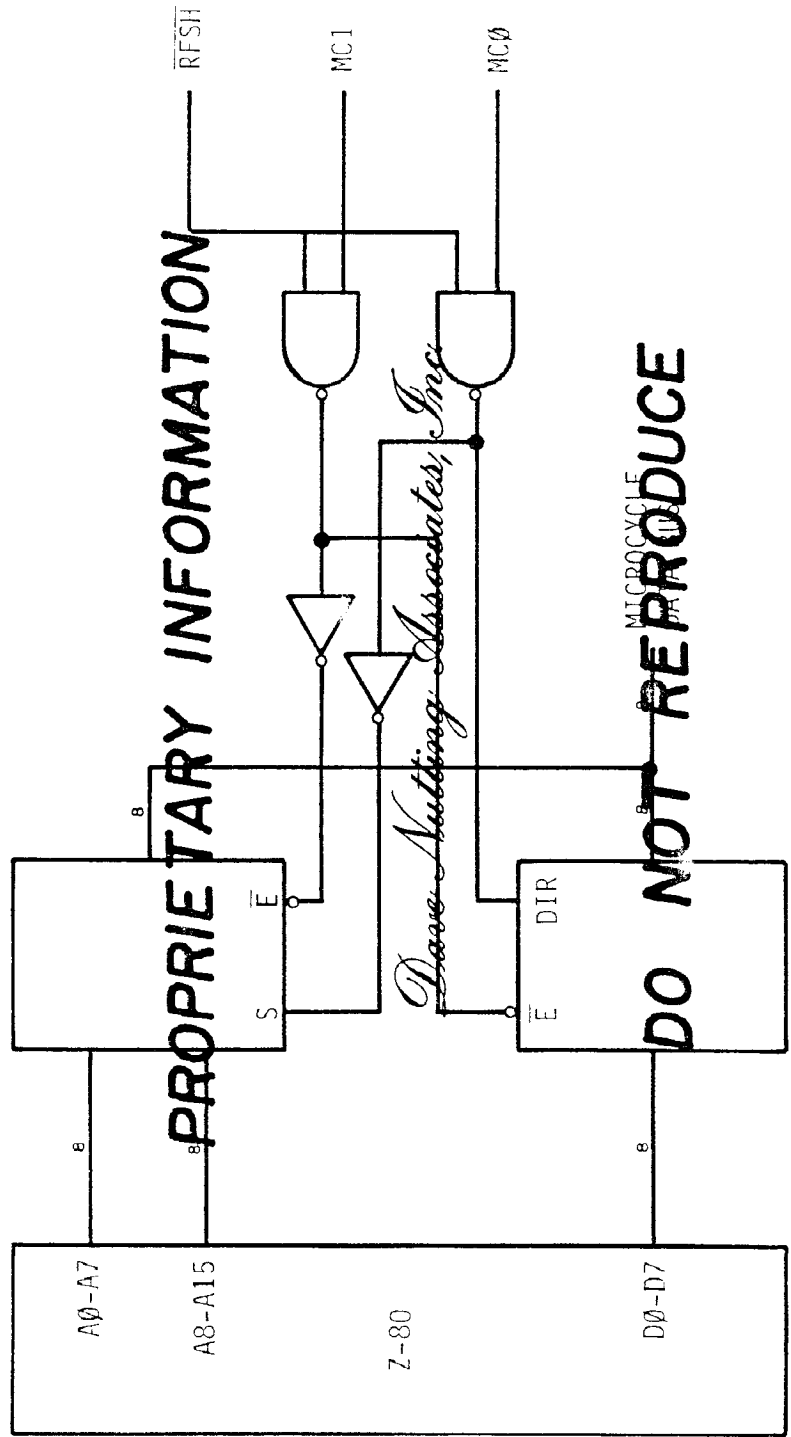
<u>RFSH</u>	<u>MC0</u>	<u>MC1</u>	<u>Microcycle Data Bus Contents</u>
0	0	0	A0 - A7 from Z-80
0	0	1	A0 - A7 from Z-80
0	1	0	A0 - A7 from Z-80
0	1	1	A0 - A7 from Z-80
1	0	0	A0 - A7 from Z-80
1	0	1	A8 - A15 from Z-80
1	1	0	D0 - D7 from Z-80
1	1	1	D0 - D7 to Z-80

MC0 and MC1 change 140 nsec after the rising edge of ϕ . Their changes are shown in the timing diagrams of various instruction cycles.

PROPRIETARY INFORMATION

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MICROCYCLER BLOCK DIAGRAM

ADDRESS CHIP DESCRIPTION

The Microcycle Decoder generates twelve bits of Z-80 address from the 8-bit Microcycle Data Bus. This address is then fed through MUX I and MUX II to MA0-5 which go to the RAM. The Scan Address Generator generates a 12-bit address which is used to read video data from the RAM. This address goes from 0 to FFFH once every frame (1/60 sec.).

MUX I sends either the Scan Address or Z-80 Address to its 12 outputs. An output of the Scan Address Generator controls MUX I. If the Scan Address Generator and the Z-80 request a memory cycle at the same time, the Scan Address Generator will have higher priority and the Z-80 will be required to wait (by the $\overline{\text{WAIT}}$ output). The Scan Address Generator never requires the memory for more than one consecutive memory cycle, so the Z-80 is never required to wait for the memory for more than one cycle. HORIZ DR and VERT DR synchronize the Scan Address Generator with the Data Chip and the TV Scan.

The purpose of MUX II is to multiplex its 12 inputs to the six address bits in the two time slots required for 4K x 16 pin RAMS.

The Memory Cycle Generator controls memory cycles generated by either the Z-80 or Scan Address Generator. $\overline{\text{MREQ}}$, $\overline{\text{RD}}$, $\overline{\text{MI}}$, $\overline{\text{RFSH}}$, and A12-A15 are from the Z-80. A12-A15 are fed directly from the Z-80 because if they were brought out of the microcycle decoder, they would arrive too late in the memory cycle. The RAS0 - RAS3 outputs are used to activate memory cycles. In the consumer game, only RAS0 is used to one bank of RAM (4K x 8). In the commercial game, all four RAS's are used to control four banks of RAM (16K x 8). WRCTL and LTCHDO are control signals to the Data Chip. WRCTL tells the Data Chip when to place data to be written to memory on the memory data bus. LTCHDO tells the Data Chip when valid data from RAM is present on the memory data bus.

PROPRIETARY INFORMATION

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As mentioned earlier, $\overline{\text{WAIT}}$ is generated when the Z-80 and Scan Address Generator both request memory at the same time. $\overline{\text{WAIT}}$ is also generated for one cycle every time the Z-80 requests a memory access, even if there is no conflict with the Scan Address. This is because the microcycle slows down Z-80 memory accesses. The Z-80 address bus and data bus must time share the microcycle bus so the Z-80 data reaches the microcycle bus very late in the memory cycle.

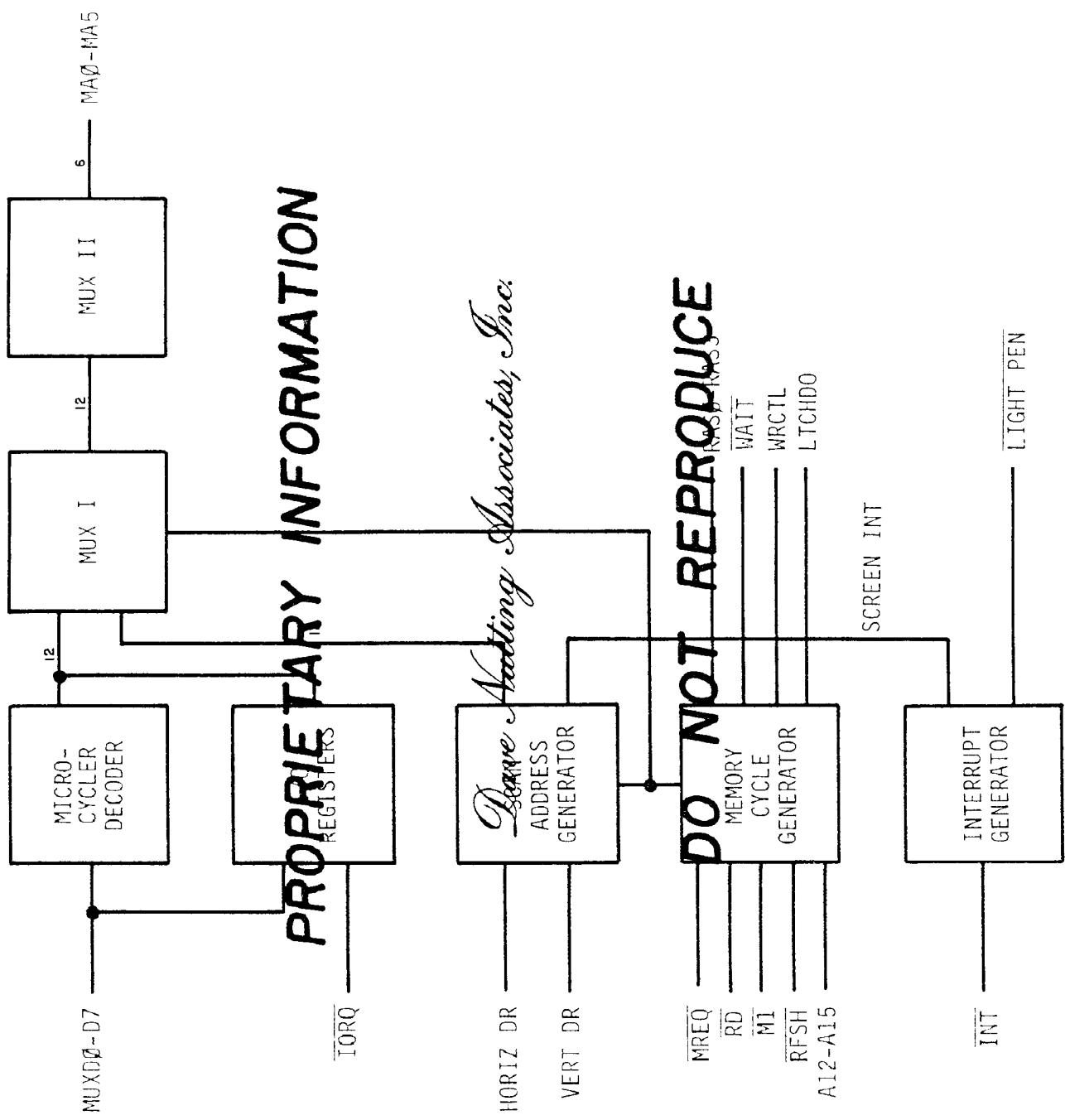
The INT Generator generates two types of interrupts for the Z-80; Light Pen and Screen interrupts. A screen interrupt is generated when screen interrupts are enabled and the TV scan completes a certain line on the screen (from 0 to 255). The line at which the interrupt will occur is determined by the Z-80. This interrupt can be used for timing since the TV rescans every line once every 1/60 s. A light pen interrupt occurs when the light pen interrupt is enabled and $\overline{\text{LIGHT PEN}}$ goes low. The current scan address is saved in latches in the Scan Address Generator. The Z-80 can read the contents of these latches to determine the scan address at the time $\overline{\text{LIGHT PEN}}$ was activated and thus the position of the light pen on the screen.

The I/O Decode circuit is used during Z-80 input and output instructions. Z-80 input instructions are used to read the scan address after light pen interrupts. Output instructions are used to enable the two interrupts and set the line number for screen interrupts.

PROPRIETARY INFORMATION

Dave Nutting Associates, Inc.

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ADDRESS CHIP BLOCK DIAGRAM

DATA CHIP DESCRIPTION

The TV Sync Generator uses $7M$ and $\overline{7M}$ (7.159090 Mhz square waves) to generate NTSC standard sync and blank to be sent to the Video Generator. It also generates HORIZ DR and VERT DR for synchronization with the Address Chip. HORIZ DR occurs once every horizontal line (63.5 usec), and VERT DR occurs once every frame (16.6 msec).

The Shift Register loads parallel data from the memory data bus (MD \emptyset - MD7) and shifts it out of it two serial outputs. The TV Sync Generator controls when data is loaded or shifted. In a consumer game, the two outputs of the shift register are sent through MUX I to MUX II. In a commercial game, SERIAL \emptyset and SERIAL 1 are sent through the MUX I to MUX II. The two bits from MUX I select 8 bits to be sent through MUX II to the Video Generator. These 8 bits then determine the analog values of VIDEO, R-Y, and B-Y. 2.5V is a 2.5V D C reference level.

The Clock Generator generates $\emptyset G$ and PX from $7M$. These are the clocks for the rest of the system. The frequency of \overline{PX} is half that of $7M$ and the frequency of $\emptyset G$ is half that of \overline{PX} .

The Microcycle Generator generates the microcycle control bits, MC \emptyset and MC1, from \overline{IORQ} , \overline{MREQ} , P_0 , and $\overline{M1}$, all from the Z-8 \emptyset .

In memory write cycles WRCTL is activated and the Memory Control circuit generates \overline{DATEN} . The Magic Function Generator takes the data from the Z-8 \emptyset on MUXD \emptyset - D7 and transfers it to MD \emptyset - MD7. If a Magic write is being done, the Magic Function Generator will modify the data as required before it places it on the memory data bus.

PROPRIETARY INFORMATION

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A Magic write is a memory write cycle in which data is written to a location, (X) from 0 to 16K. All memory from 0 to 16K is ROM and cannot be modified. The data is modified by the Magic Function Generator and is written to location X + 16K. The way in which the data is modified is determined by the 7 bits coming from the I/O registers.

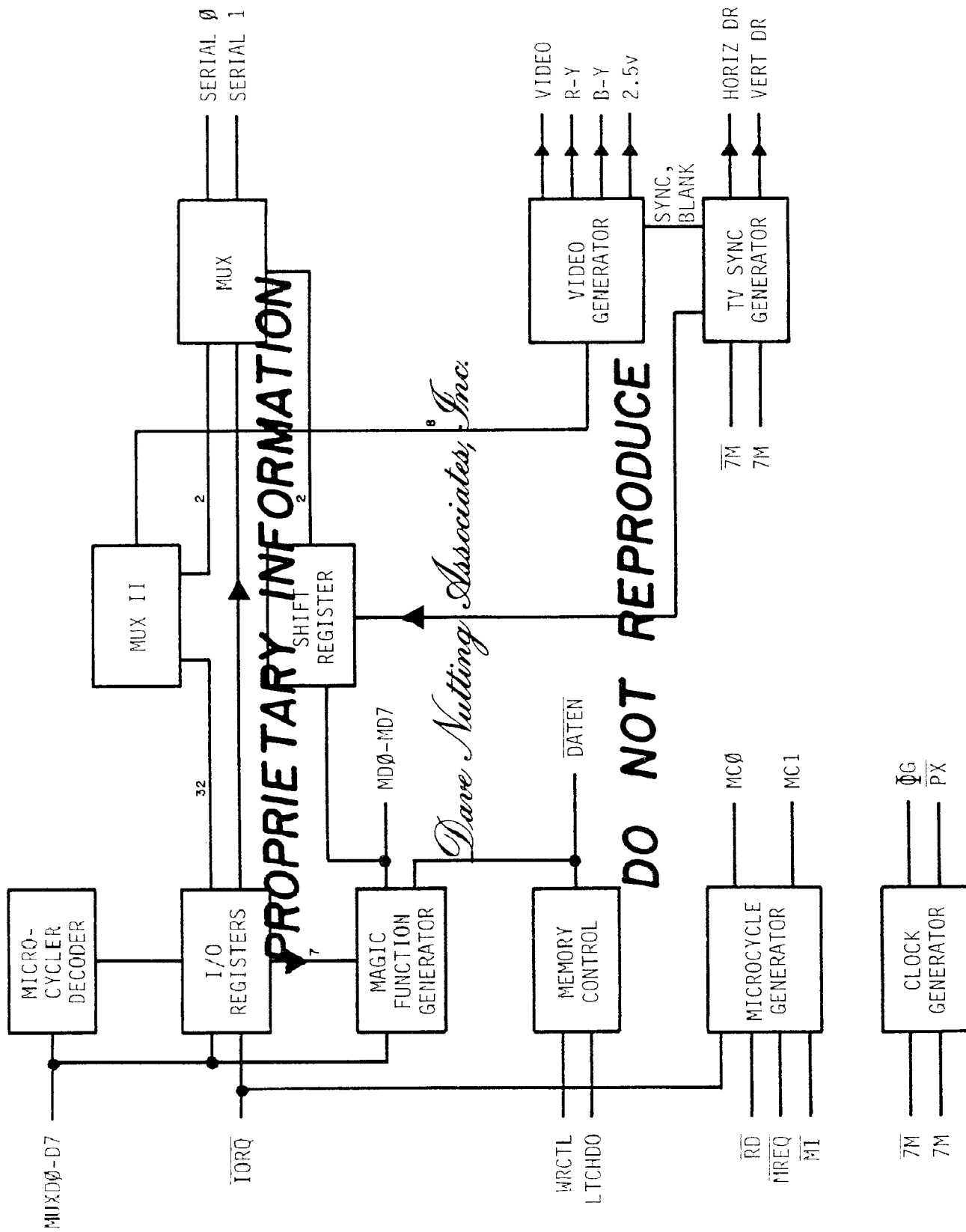
In memory reads, data is transferred from MD0 - MD7 to MUXD0 - MUXD7. Also, LTCHDO is activated which causes the data from RAM to be latched up in a register in the Magic Function Generator. This latched data is used in some magic functions.

The I/O registers are loaded by output instructions from the Z-80 just as in the Address Chip.

PROPRIETARY INFORMATION

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DATA CHIP BLOCK DIAGRAM

I/O CHIP DESCRIPTION

The Z-80 communicates with the I/O Chip through input and output instructions. The state of an 8 x 8 switch matrix can be read through the Switch Scan circuit. When an input instruction is executed, one of the S00-S07 lines will be activated. When a line is activated, the switch matrix will feed back eight bits of data on SI0-SI7. This data is in turn fed to the Z-80 through MUXD0 - MUXD7.

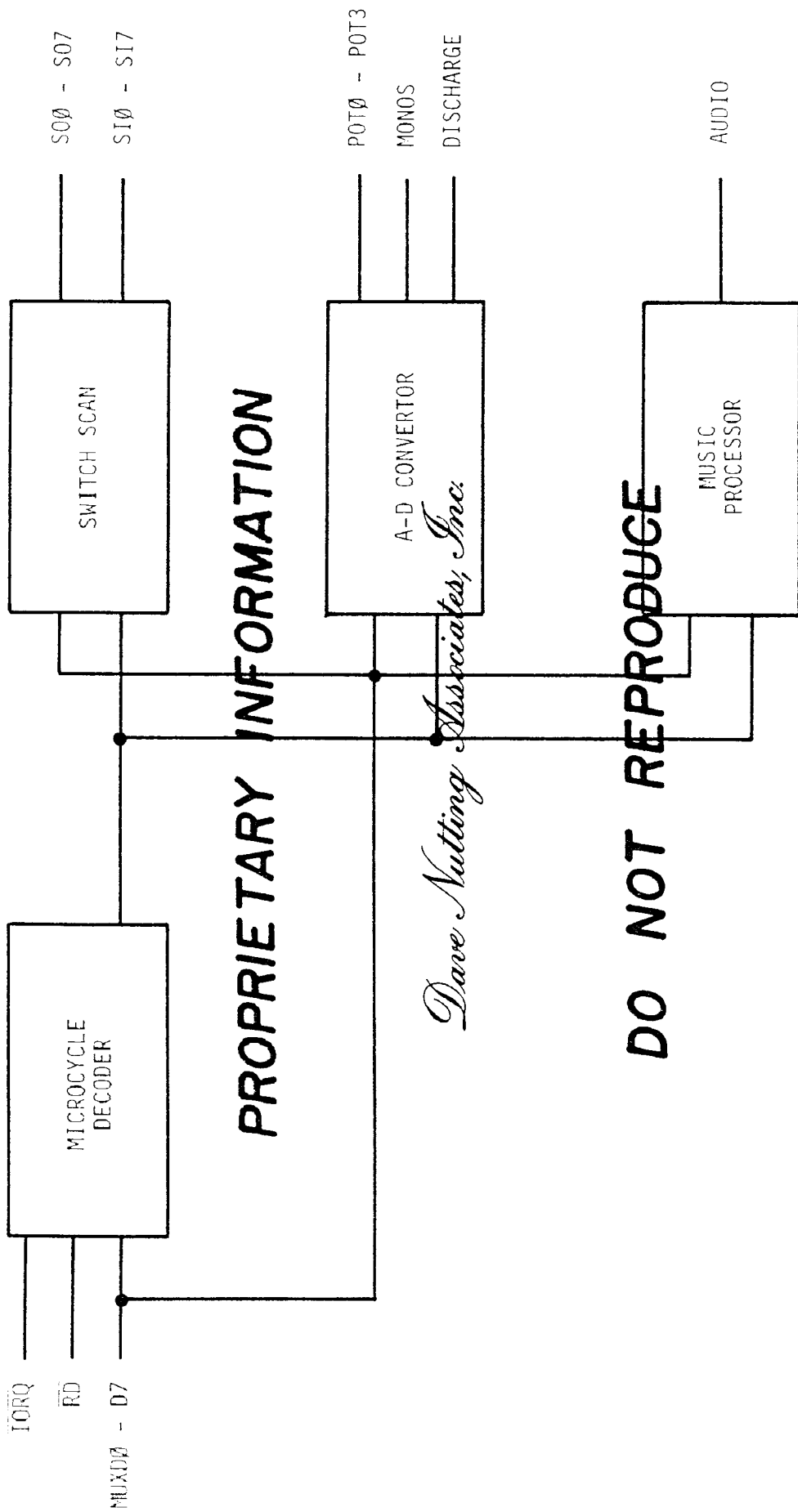
The Z-80 can read the position of four potentiometers (pots) through the A-D Converter circuit. The pots are continuously scanned by the A-D Converter and the results of the conversions are stored in a RAM in the A-D Converter circuit. The Z-80 simply reads this RAM with input instructions.

The Z-80 loads data into the Music Processor with output instructions. This data determines the characteristics of the audio that is generated. The Music Processor is described in detail below.

PROPRIETARY INFORMATION

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I/O CHIP BLOCK DIAGRAM

MUSIC PROCESSOR

The music processor can be divided into two sections. The first section generates the Master Oscillator Frequency and the second section uses the Master Oscillator Frequency to generate tone frequencies and the analog audio output. The contents of all registers in the Music Processor are set by output instructions from the Z-80.

Master Oscillator Frequency is a square wave whose frequency is determined by the 8 binary inputs to the Master Oscillator. The 8-bit word is the sum of the contents of the Master Oscillator Register and the output of the MUX. The MUX is controlled by MUX REG.

If MUX REG contains 0, then data from the Vibrato System will be fed through the MUX. The two bits from the Vibrato Frequency Register determine the frequency of the square wave output of the Low Frequency Oscillator. The 6-bit word at the output of the AND gates oscillates between 0 and the contents of the Vibrato Register. The frequency of oscillation is determined by the contents of the Vibrato Frequency Register. The 6-bit word, along with two ground bits are fed through the MUX to the Adder. This causes the Master Oscillator Frequency to be modulated between two values thus giving a vibrato effect.

If MUX REG contains 1, then data from the Noise System will be fed through the MUX. The 8-bit word from the Noise Volume Register determines which bits from the Noise Generator will be present at the output of the AND gates.

If a bit in the Noise Volume Register is 0, then the corresponding bit at the output of the AND gates will be 0. If a bit in the Noise Volume Register is 1, then the corresponding bit at the output of the AND gates will be noise from the Noise Generator. This 8-bit word is sent through the MUX to the Adder. The Master Oscillator Frequency is modulated by noise.

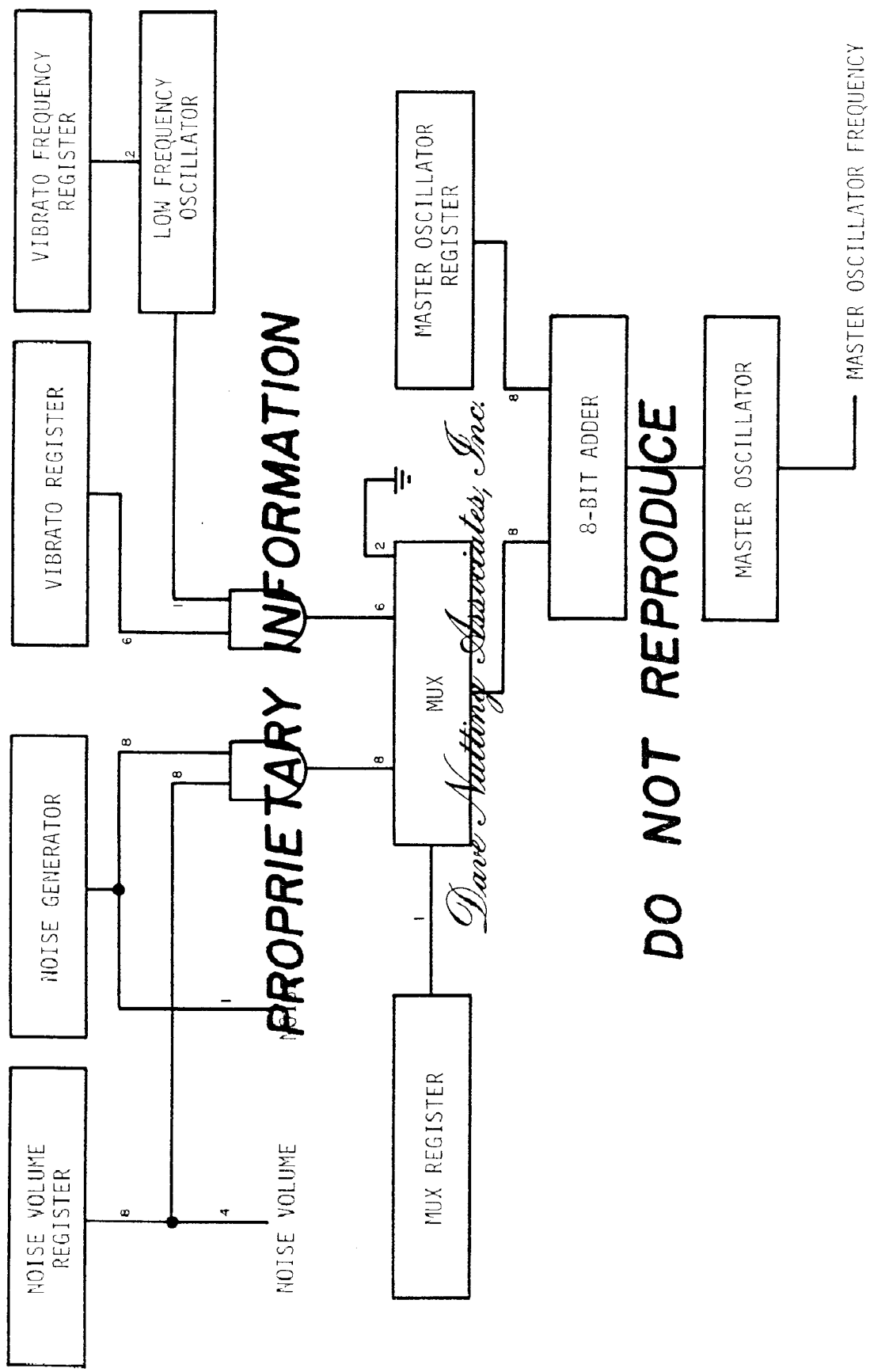
In the second part of the Music Processor, the square wave from the Master Oscillator is fed to three Tone Generator circuits which produce square waves at their outputs. The frequency of their outputs is determined by the contents of their Tone Generator Register and Master Oscillator Frequency. The 4-bit words at the output of the AND gates oscillate between 0 and the contents of the Tone Volume Register. These 4-bit words are sent to D-A Converters whose outputs oscillate between GND and a positive analog voltage determined by the contents of the Tone Volume Register.

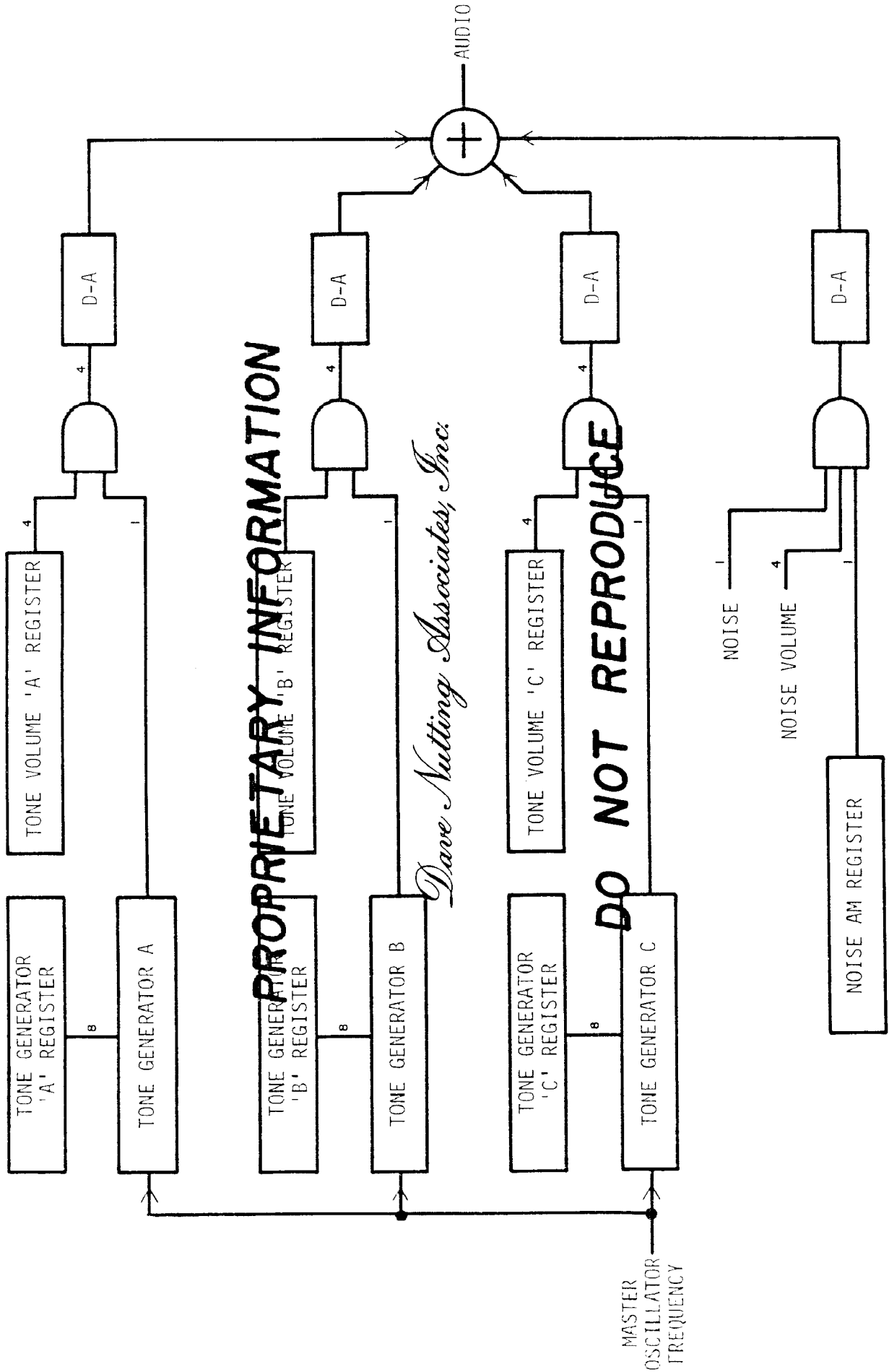
One Noise bit and four Noise Volume bits from the first section of the Music Processor are fed to a set of AND gates. This set of AND gates operates the same way as the AND gates for the tones except that the Noise AM Register must contain a 1 for the outputs of the AND gates to oscillate. The analog outputs of the four D-A Converters are summed to produce the single audio output.

PROPRIETARY INFORMATION

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CUSTOM CHIP TIMING

The following diagrams show the relationship of various signals in the system during different types of operations. Delays are shown to be zero nsec from the clock edge which causes the transition. The actual delay is given in "Electrical Specification for Midway Custom Circuits".

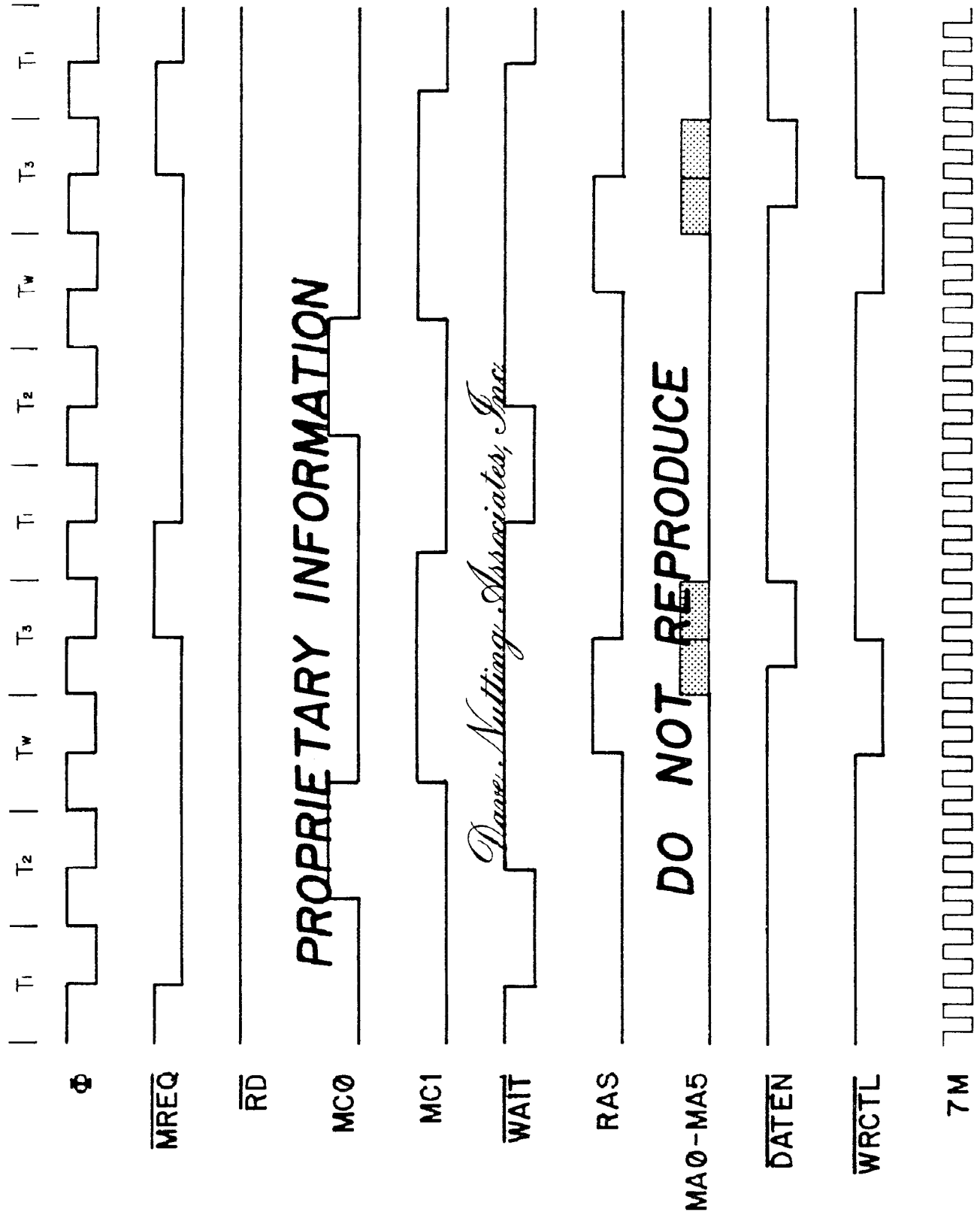
MUXD0 - MUXD7 is a 8 bit bidirectional address and data bus for the custom chips. By using this technique 16 bits of address and 8 bits of data can be sent to the custom chips on 8 wires. The state of the bus is determined by MC0 and MC1 from the data chip and RFSH from the Z-6.

<u>RFSH</u>	<u>MC1</u>	<u>MC0</u>	
L	L	L	A0 - A7 to custom chips.
L	L	H	A0 - A7 to custom chips
L	H	L	A0 - A7 to custom chips
L	H	H	A0 - A7 to custom chips
H	L	L	A0 - A7 to custom chips
H	L	H	A8 - A15 to custom chips
H	H	L	D0 - D7 to custom chips
H	H	H	D0 - D7 from custom chips

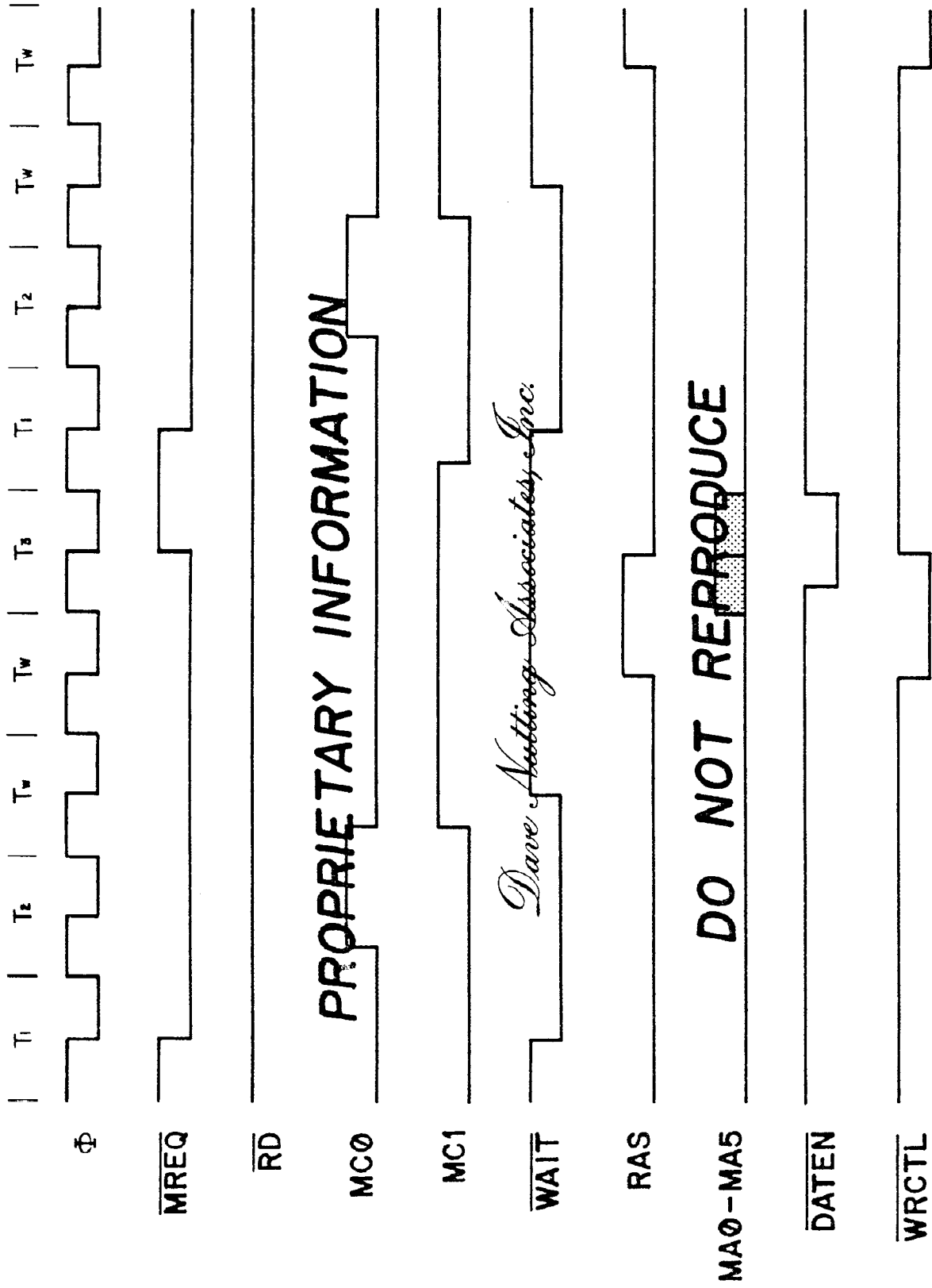
PROPRIETARY INFORMATION

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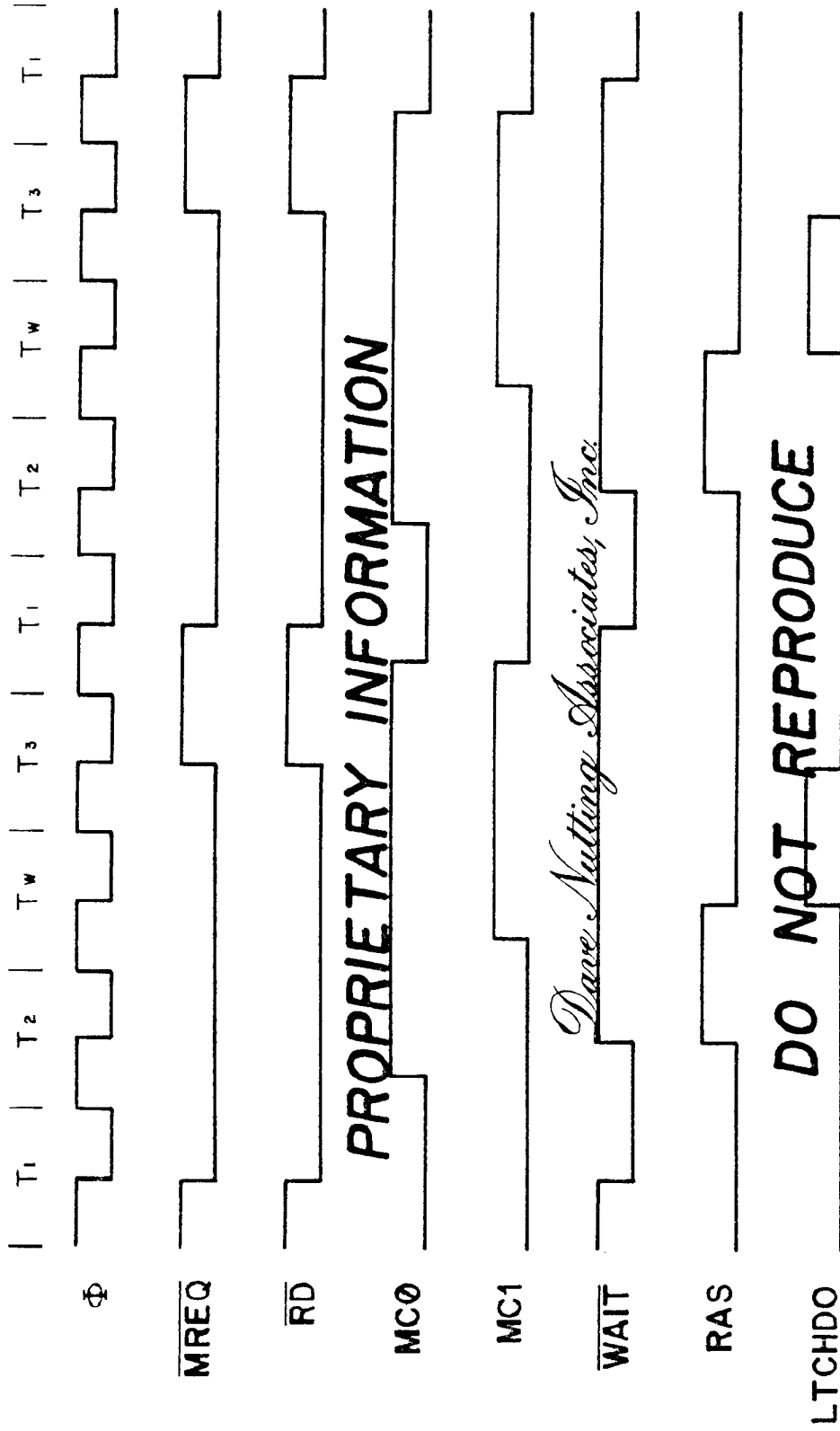
DO NOT REPRODUCE



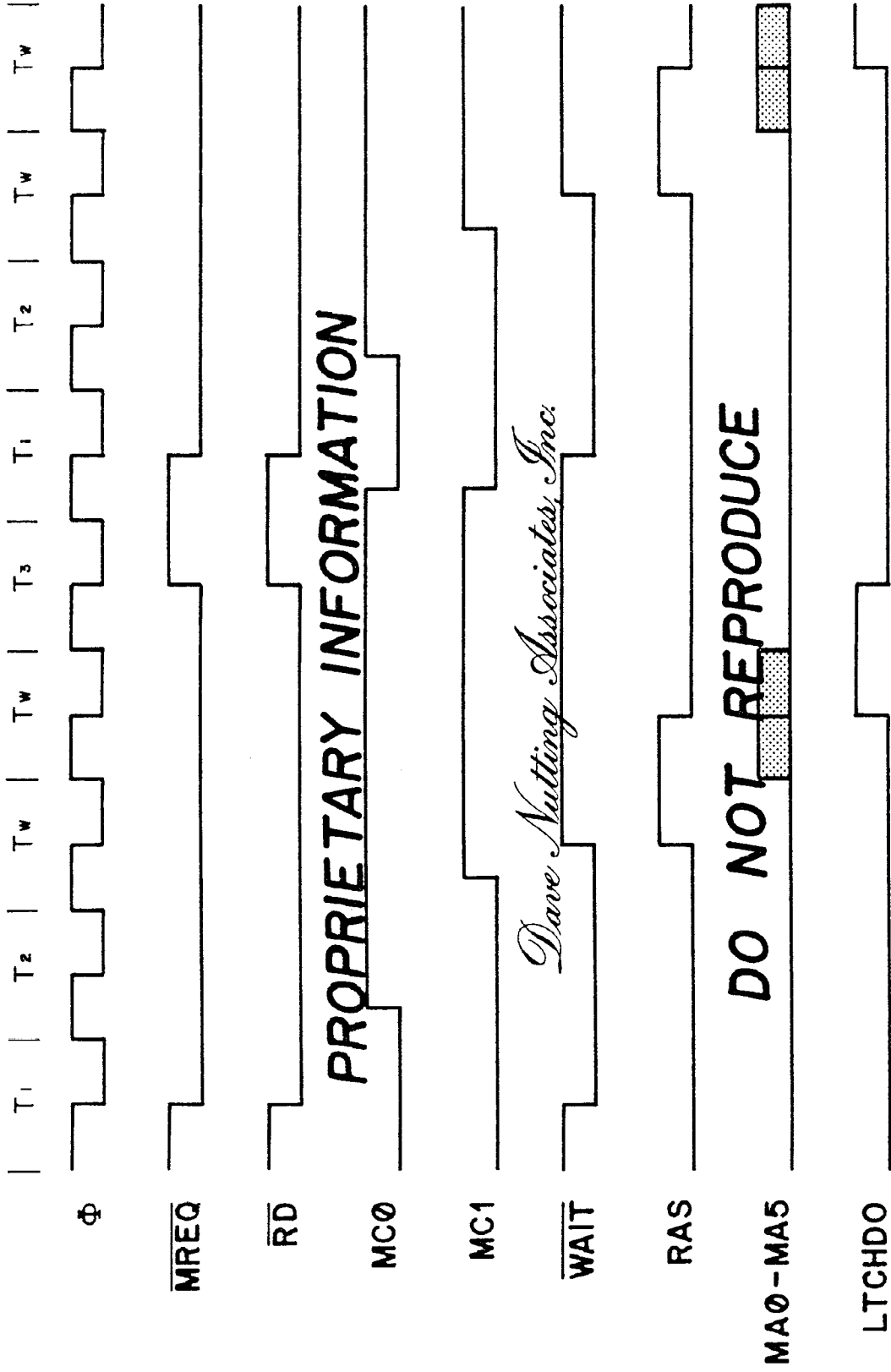
MEMORY WRITE WITHOUT EXTRA WAIT STATE



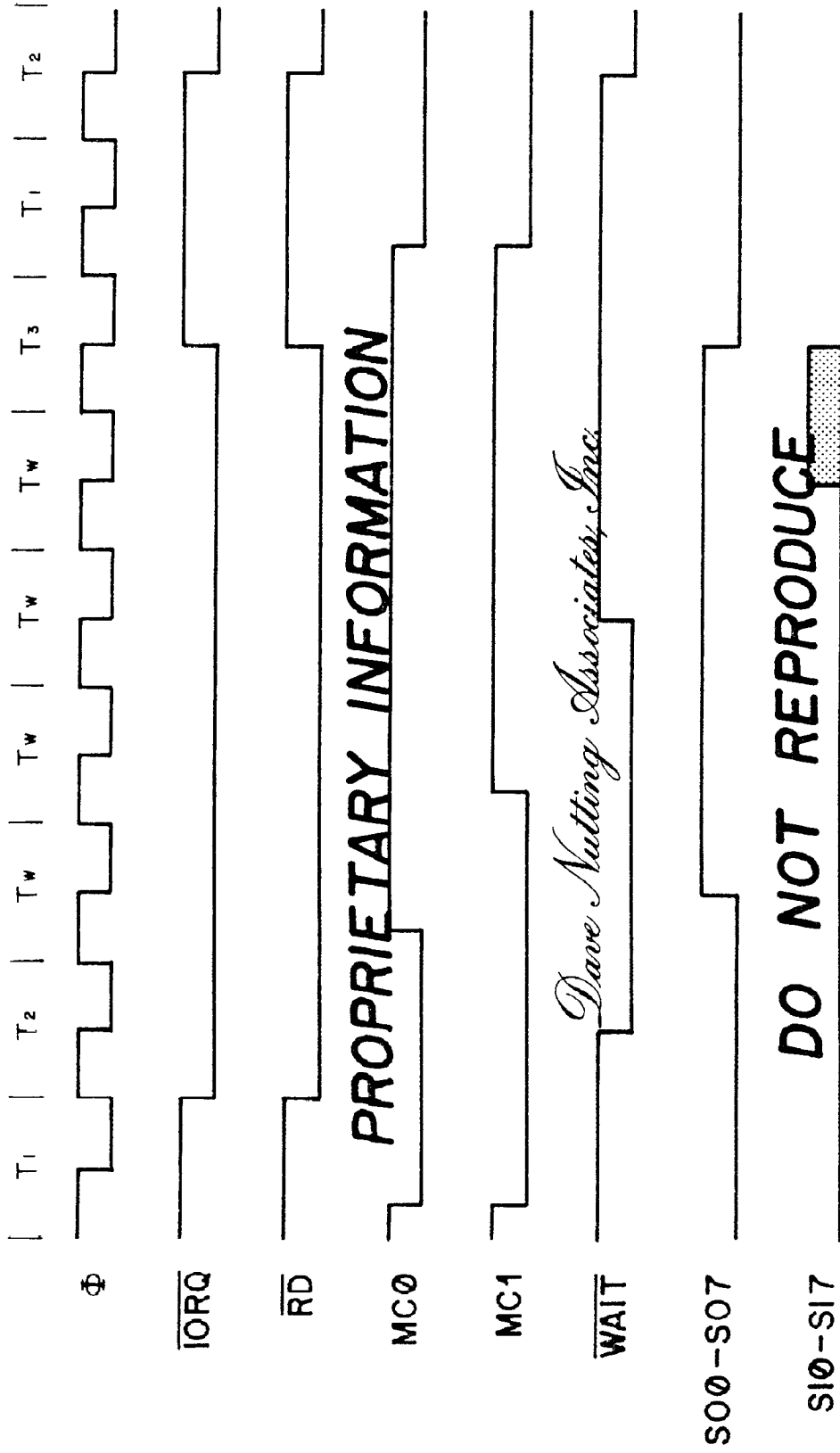
MEMORY WRITE WITH VIDEO WAIT STATE



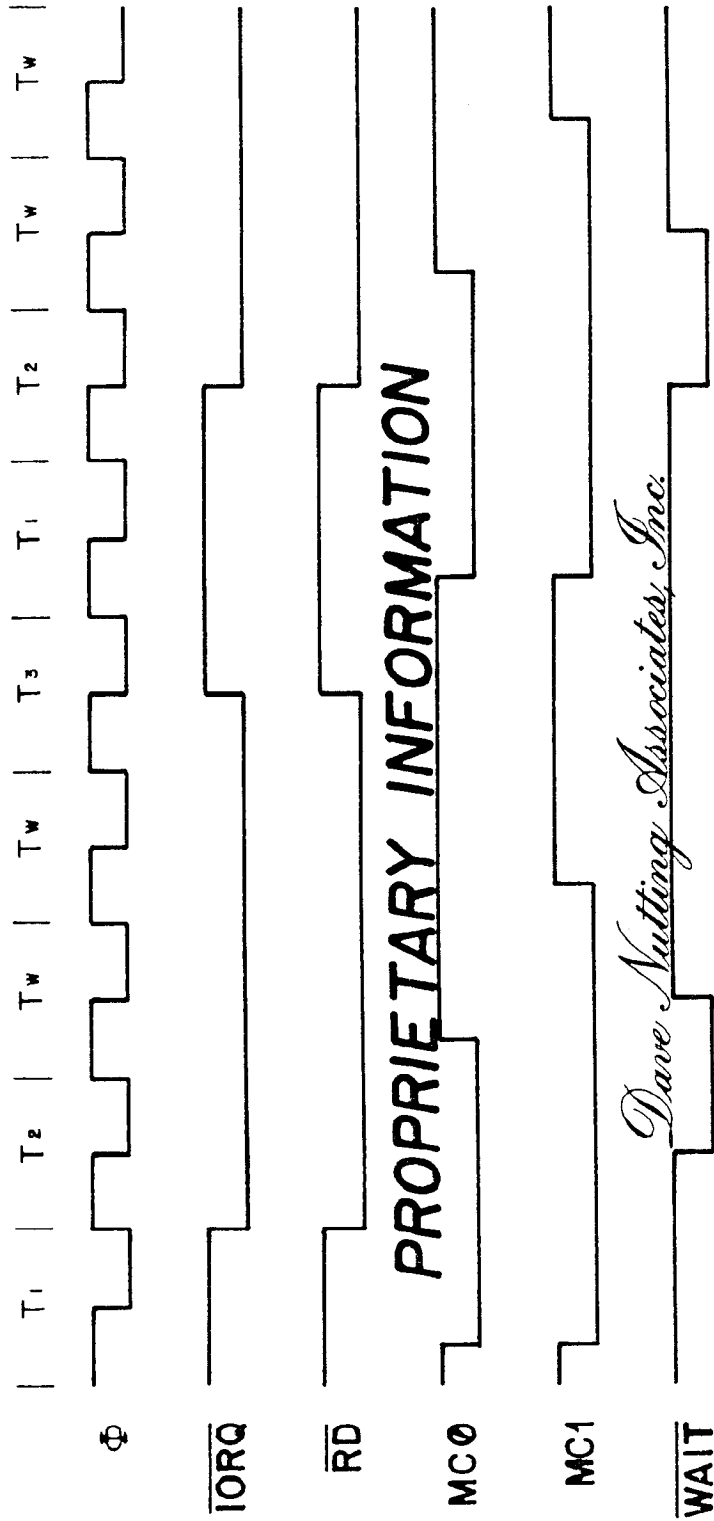
MEMORY READ WITHOUT EXTRA WAIT STATE



MEMORY READ WITH VIDEO WAIT STATE



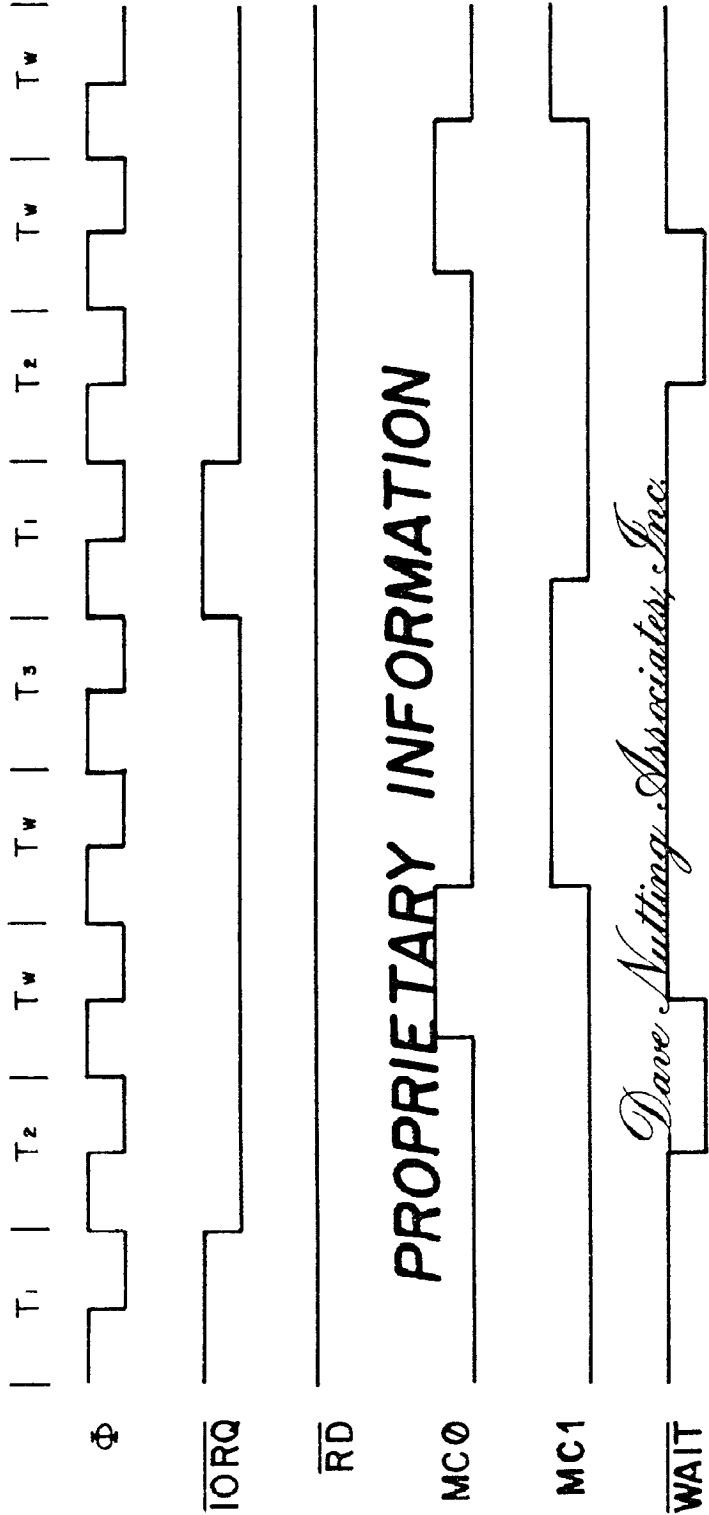
I/O READ FROM PORT 10H-17H



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DO NOT REPRODUCE

I/O READ FROM OTHER THAN PORT 10H-17H



DO NOT REPRODUCE

I/O WRITE

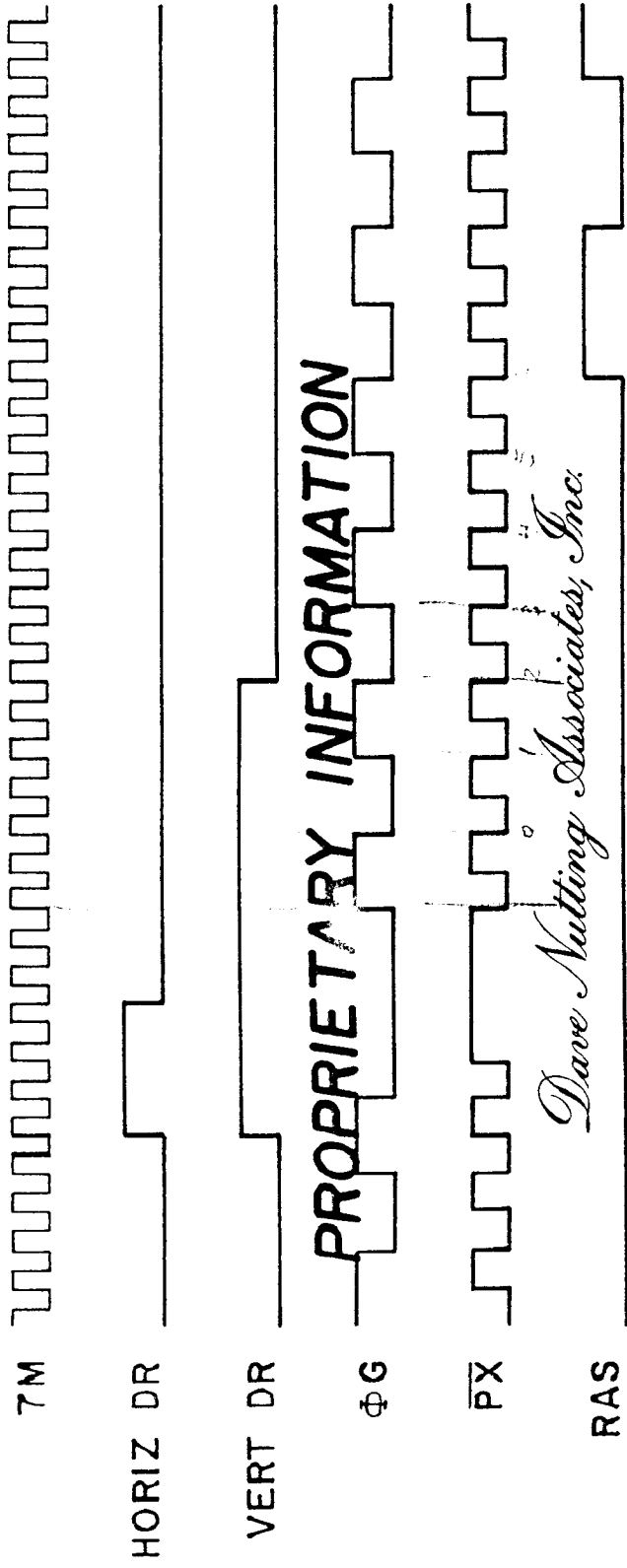
VIDEO TIMING

The frequency of \overline{PX} is half that of 7M and the \emptyset is one-fourth 7M. There are 455 cycles of 7M per horizontal line and $113 \frac{3}{4}$ \emptyset cycles per line. Because of the extra $\frac{3}{4}$ cycle \emptyset must be resynchronized at the beginning of each line. This is done by stalling \emptyset for 3 cycles of 7M. \overline{PX} is also stalled for the same amount of time. The timing relationship is shown below. The diagram also shows the relationship of VERT DR to HORIZ DR. The two RAS pulses shown are the first two video RAS signals of a line, each line contains forty.

PROPRIETARY INFORMATION

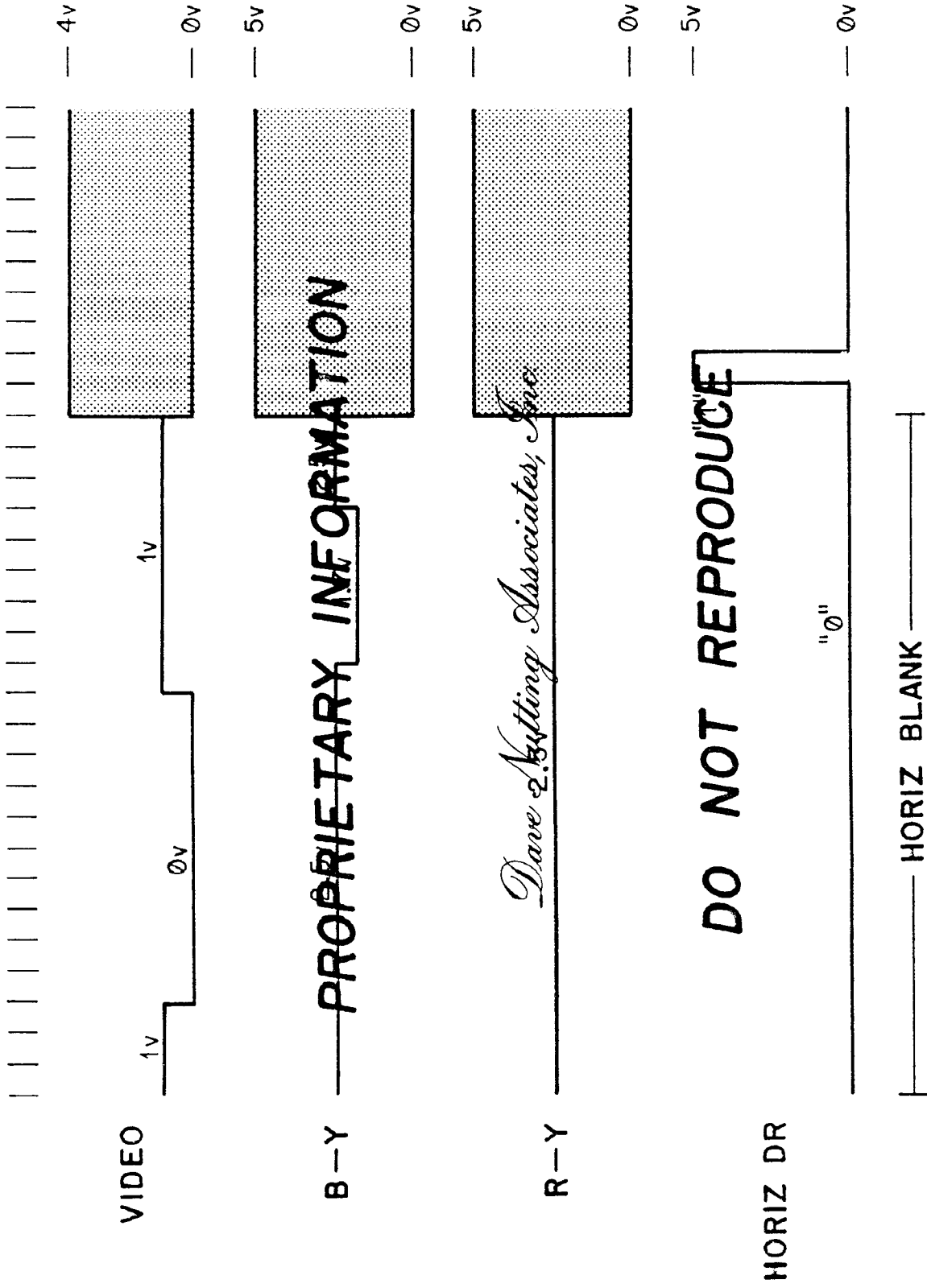
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RELATIONSHIP BETWEEN 7M, HORIZ DR, VERT DR, ΦG , \overline{PX} AND RAS

DO NOT REPRODUCE

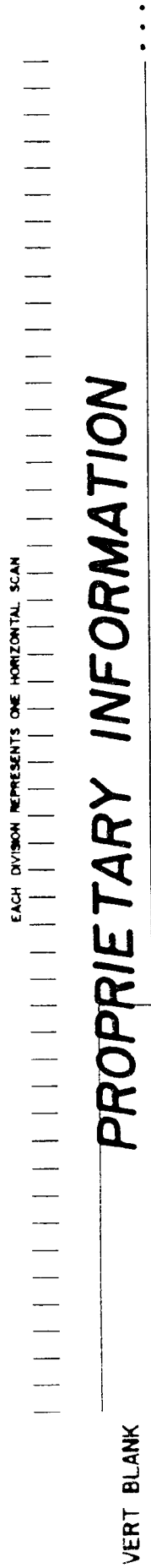


RELATIONSHIP BETWEEN HORIZ DR, HORIZ BLANK, HORIZ SYNC AND COLOR BURST

EACH HORIZONTAL DIVISION IS EQUAL TO 3 1/2 CYCLES OF 7M

THE PATTERN REPEATS EVERY 455 CYCLES OF 7M

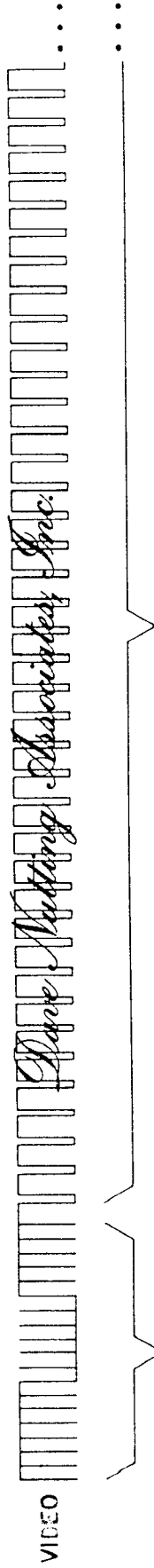
SHADED AREA VOLTAGE DETERMINED BY THE DATA IN RAM



VERT BLANK



VERT DRIVE



VIDEO

VERTICAL SYNC
WITH
EQUALIZATION PULSES

HORIZONTAL SYNC

DO NOT REPRODUCE

RELATIONSHIP BETWEEN VERTICAL SYNC, VERTICAL BLANK AND VERTICAL DRIVE
 EACH HORIZONTAL DIVISION REPRESENTS ONE HORIZONTAL SCAN

1/14/77
1/27/77
3/25/77
7/6/77

N/C
A 135
B
C

ELECTRICAL SPECIFICATION FOR MIDWAY CUSTOM CIRCUITS

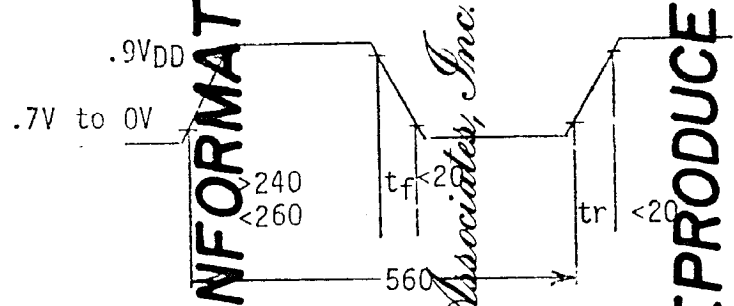
I. GENERAL SYSTEM PARAMETERS

I. A. Power Supplies

- 1. VDD=+5.0V $\pm 5\%$
- 2. VGG=+10.0V $\pm 5\%$
- 3. VSS=0.0V

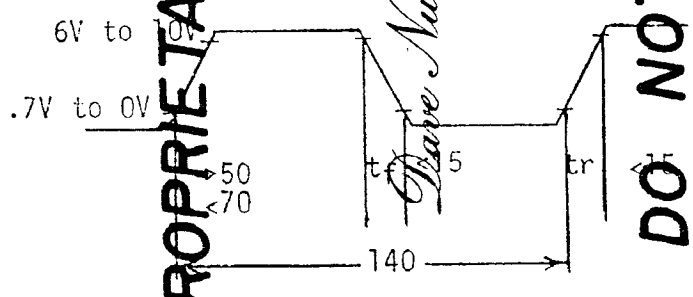
I. B. Timing Signals

- 1. ϕ & $\bar{\phi}$ Period = 560nsec, High time* 240nsec to 260nsec.
 ϕ and $\bar{\phi}$ have zero level crossover +1 volt -0 volts
 t_r, t_f^* less than 20nsec



(Times are in nsec)

- 2. $7M$ & $7\bar{M}$; Period = 140nsec, High time 50nsec to 70nsec
 $7M$ & $7\bar{M}$ have zero level crossover +1 volt -0 volt
 t_r, t_f^+ less than 15nsec



(Times are in nsec)

Dead time 5nsec
Max C Load = 20pf

+Note
 1) High time is time clock at $\geq .6V$.
 2) Rise time from zero level to one level.

PROPRIETARY INFORMATION

DO NOT REPRODUCE

I. B. (Continued)

*Note:

1. High time is time between 50% points.
2. Clock signals are generated by low power Shottky Logic (series 74LS). Full level swing on clock signals to be achieved through external resistor to VDD. Zero level .7V to 0V.
3. Rise time from zero level to .9VDD.

I. C. Z80 Data Bus (MUXD0-MUXD7)

1. Z80 Data Bus interface requires a three-state output/input buffer. The three states are defined below.
2. Logic 0: .5V + noise generated by chip, noise for address chip is .15V @ -430 μ A
3. Logic 1: 2.7V @ +70 μ A
4. High Impedance: Leakage at either logic 0 or 1 to be less than 5 μ A.
5. Transient Response: Transition from High Impedance to logic 0 or 1 will be complete within 442nsec at the 90% point of $\bar{\phi}$ of the last wait state of input cycle or 442nsec of the 90% point of $\bar{\phi}$ of the second wait state of the interrupt acknowledge cycle. The maximum load will be 80pf. This includes 14pfd for two custom chips.
6. Exception: The path through the Data chip connecting the RAM bus with the Z80 bus shall introduce a maximum of 160nsec of delay.
7. The low address byte will be valid on the Z80 Data Bus at least 62nsec before $\bar{\phi}$. The high address byte will be valid at least 79nsec before $\bar{\phi}$. The data byte will be valid 55nsec before $\bar{\phi}$.

PROPRIETARY INFORMATION
 Dave's Notting Associates, Inc.

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I. D. RAM Data Bus (MDO-MD7) - Home Game

1. The RAM Data Bus will require three state logic buffers.
2. Logic 0: .5V @ -25 μ A
3. Logic 1: 2.7V @ +25 μ A
4. High Impedance: 5 μ A maximum leakage at either logic 0 or 1.
5. Transient Response: The outputs shall transition from High Impedance to 0 or 1 within 120nsec of 7M. The outputs shall transition from 1 or 0 to high impedance within 20nsec of 7M. Maximum load will be 20pf.

I. E. RAM Data Bus (MDO-MD7) - Commercial Game

1. The RAM Data Bus will require three state logic buffers.
2. Logic 0: .5V @ -200 μ A
3. Logic 1: 2.7V @ +25 μ A
4. High Impedance: 5 μ A maximum leakage of either logic 0 or 1.
5. Transient Response: The output shall transition from High Impedance to 0 or 1 within 120nsec of 7M. The output shall transition from 1 or 0 to High Impedance within 2nsec of 7M. Maximum load will be 10pf.

I. F. Ambient operating temperature $\geq 0^{\circ}\text{C}$, $\leq 70^{\circ}\text{C}$.

I. G. Storage temperature $\geq -65^{\circ}\text{C}$, $\leq 150^{\circ}\text{C}$.

I. H. Packing 40 pin plastic.

II. CUSTOM CIRCUIT SPECIFICATION

This specification defines the terminal characteristics for each of the custom circuits. These specifications shall take precedence in case of conflict. All $\bar{\phi}$ references refer to the $\bar{\phi}$ and $\bar{\phi}$ inputs to the address and I/O chip.

PROPRIETARY INFORMATION
Dave Nutting Associates, Inc.

DO NOT REPRODUCE

II. A. Data Chip

1. Input Pin List	V_0 (V)	V_1 (V)	t_d (Low) ¹ (nsec)	t_d (High) ¹ (nsec)	Ref.
<u>MREQ</u>	.5	2.45	132	6	7M
<u>RD</u>	.5	2.45	12	6	7M
<u>IORQ</u>	.5	2.45	112	126	7M
<u>7M</u>	See Section I.B.				
<u>7M</u>	"				
<u>WRCTL</u>	.5	3.1	82	82	7M
<u>MT</u>	.5	2.45	12	82	7M
<u>LTCHDO</u>	.5	3.1	120	120	7M
<u>Serial 0</u>	.5	2.45	30	30	7M
<u>Serial 1</u>	.5	2.45	30	30	7M

2. Power Supplies
See Section I. A.

3. Bus Connections

<u>MXD0</u>	See Z80 Data Bus Spec. Section I.C.
<u>MXD1</u>	"
<u>MXD2</u>	"
<u>MXD3</u>	"
<u>MXD4</u>	"
<u>MXD5</u>	"
<u>MXD6</u>	"
<u>MXD7</u>	"
<u>MD0</u>	See RAM Data Bus Spec Section I.D.
<u>MD1</u>	"
<u>MD2</u>	"
<u>MD3</u>	"
<u>MD4</u>	"
<u>MD5</u>	"
<u>MD6</u>	"
<u>MD7</u>	"

PROPRIETARY INFORMATION

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DO NOT REPRODUCE

- 5 -

4. Outputs	$\frac{VO}{(V)}$	$\frac{IO}{(\mu A)}$	$\frac{VI}{(V)}$	$\frac{II}{(\mu A)}$	$\frac{CAP}{(pf)}$	$\frac{tp}{(nsec)}$	Ref.
VIDEO*	*				10	100	7M
R-Y*	*				10	600	
B-Y*	*				10	600	
HORIZ DR	Note 4	400	2.7	20	20	20	7M
VERT DR	Note 4	400	2.7	20	20	20	7M
2.5V ⁶	--	--	--	--	--	DC	
\emptyset	Note 4	400	2.7	20	10	100	7M
PXCLK	Note 4	400	2.7	20	10	100	7M
MCO	Note 4	400	2.7	20	10	120	7M
MC1	Note 4	400	2.7	20	10	120	7M
DATEN	Note 4	400	2.7	20	10	90	7M

*Video R-Y, B-Y are analog outputs at 140nsec rate. Video, must switch from 10% to 90% of black to white in 140nsec. R-Y and B-Y transitions not to exceed .6 μ sec.

- 1 t_d (Low) and t_d (High) is maximum time in nsec except where a minimum is shown.
- 2 For IORQ RE to \emptyset t_d (Low)=132nsec t_d (High)=6nsec.
- 3 Serial 0 and Serial 1 will operate at 7MHz.
- 4 .5V + noise generated by chip.
- 5 Tap on both resistor chains for a capacitor. Will become test input with voltage applied > 8V.
- 6 The Z80 \emptyset generated by this signal with a clock driver which introduces a delay of <20nsec.

PROPRIETARY INFORMATION
 Dave Nutting Associates, Inc.
 DO NOT REPRODUCE

II. B. I/O Chip

1. Input Pin List	<u>V0</u>	<u>V1</u>	<u>Ref</u>	<u>t_d (High)</u> (nsec)	<u>t_d (Low)</u> (nsec)
Reset	.5	2.45			
MONOS	Note 1				
RD	.5	2.45	Ø or Ø	166	172 Ø or Ø
IORQ	.5	2.45	Ø ⁶	146 Ø	132 Ø
Ø	See Section	I.B.			
Ø	"	"	"		
SIØ	.5	3.3			Note 3
SI1	.5	3.3			Note 3
SI2	.5	3.3			Note 3
SI3	.5	3.3			Note 3
SI4	.5	3.3			Note 3
SI5	.5	3.3			Note 3
SI6	.5	3.3			Note 3
SI7	.5	3.3			Note 3
TEST		5.0			DC
2. Power Supplies					
See Section I.A.					
3. Bus Connections					
MUXDØ	See Z80 Data	Bus Spec	Section I.C.		
MUXD1	"		"		
MUXD2	"		"		
MUXD3	"		"		
MUXD4	"		"		
MUXD5	"		"		
MUXD6	"		"		
MUXD7	"		"		
4. Outputs					
	<u>V0</u>	<u>I0</u>	<u>V1</u>	<u>I1</u>	
	(V)	(µA)	(V)	(µA)	
Audio	Note 4	Fmax -	20KHz		
Discharge	Note 5	.5V	4V		
SØØ	Note 3	Note 7	200	4V	1650
SØ1	Note 3	Note 7	200	4V	1650
SØ2	Note 3	Note 7	200	4V	1650
SØ3	Note 3	Note 7	200	4V	1650
SØ4	Note 3	Note 7	200	4V	1650
SØ5	Note 3	Note 7	200	4V	1650
SØ6	Note 3	Note 7	200	4V	1650
SØ7	Note 3	Note 7	200	4V	1650
POT Ø	Note 2		5	VDD-.5	50
POT 1	Note 2		5	VDD-.5	50
POT 2	Note 2		5	VDD-.5	50
POT 3	Note 2		5	VDD-.5	50

PROPRIETARY INFORMATION

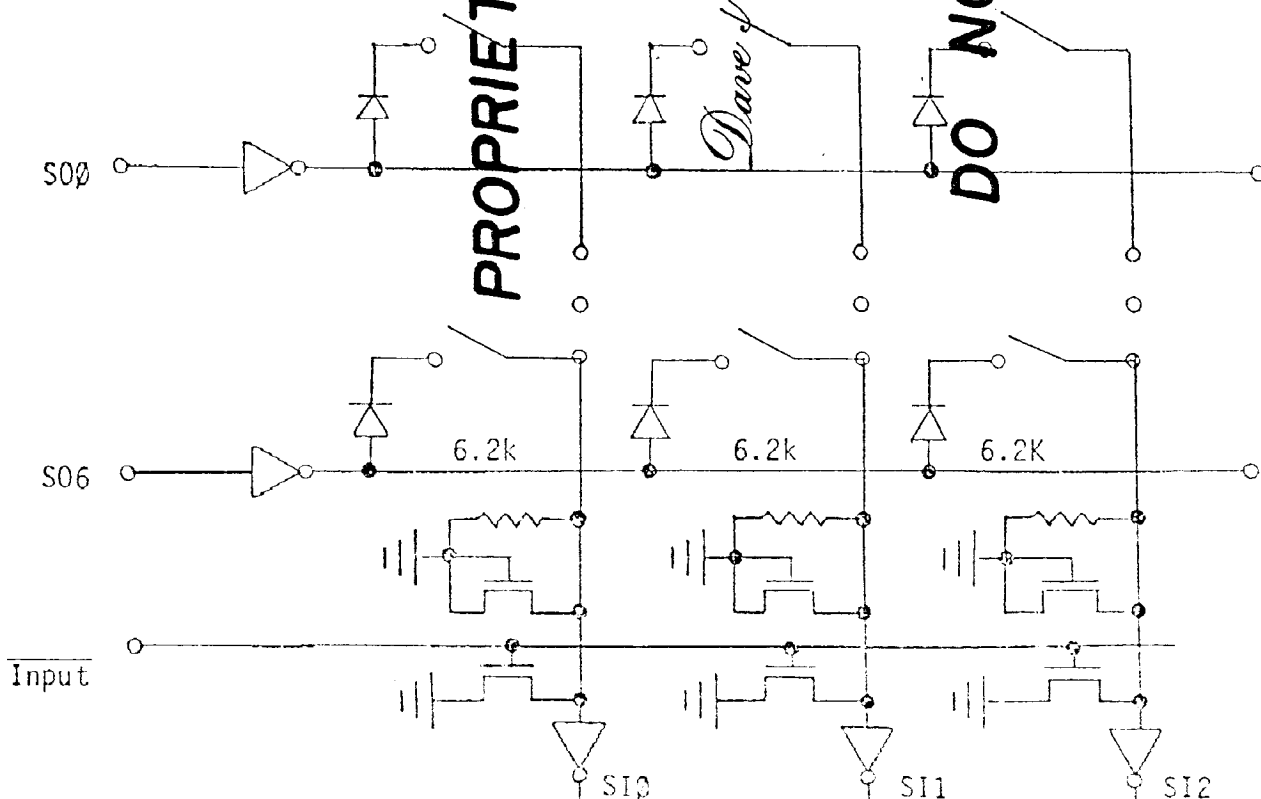
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- Note 1 MONOS triggers at 2.1 volts $\pm 2\%$ \pm noise voltage when the supply is 5.25V.
- Note 2 Open source-Voltage measured with 0.2ma.
- Note 3 Time from load of address into microcycle register to data valid on MUX data bus from SI inputs (data path through address decoder, out on S0 outputs, through closed switch and isolation diode, into SI input to MUX Data Bus) shall be 2 μ sec max. Drop of isolation diode will be 0.7V max. S0 must drive 2k Ω in the high level. Max C load of S0 shall be 300 pf. SI input shall have kill device enabled by INPUT.
- Note 4 Audio voltage oscillates between 0V and one of the following voltages; .33, .67, 1.00, 1.33, 1.67, 2.00, 2.33, 2.67, 3.00, 3.33, 3.67, 4.00, 4.33, 4.67 and 5.00. These voltages should be $\pm 6\%$. The load shall be 1000pf and 100k Ω .
- Note 5 Discharge is open drain to V_{cc} Discharges .01 μ fd capacitor to .2 τ in 144 μ sec.
- Note 6 For IOREQ Ref. t_d (Low) = 2nsec t_d (High) = 166nsec.
- Note 7 .5V + noise generated by I/O chip.

Miscellaneous Timing

Time for Address - 20 ma



No more than three switches on each S0 are closed at one time.

II. C. Address Chip

1. Input Pin List

	V0 (V)	V1 (V)	t _{pd} (Low) (nsec)	t _{pd} (High) (nsec)	REF
<u>RFSH</u>	.5	2.45	222 \emptyset	216	\emptyset
<u>MREQ</u>	.5	2.45	152 \emptyset	166	\emptyset or $\overline{\emptyset}$
<u>RD</u>	.5	2.45	172 \emptyset or $\overline{\emptyset}$	166	\emptyset or $\overline{\emptyset}$
<u>MI</u>	.5	2.45	176 \emptyset	242	\emptyset
<u>A12¹</u>	.5	2.45			\emptyset
<u>A13¹</u>	.5	2.45			\emptyset
<u>A14¹</u>	.5	2.45			\emptyset
<u>A15¹</u>	.5	2.45			\emptyset
<u>IORQ</u>	.5	2.45	132 \emptyset	146	\emptyset^2
<u>LIGHT</u>	.5	2.45	Asyn		
<u>TEST</u>	.5	5.0	DC		
<u>HORIZ. DR.</u>	.5	2.45	Note 3		$\overline{\emptyset}$
<u>VERT. DR.</u>	.5	2.45	Note 4		\emptyset
\emptyset					
\emptyset					

2. Power Supplies

See Section I.A.

3. Bus Connections

MXD0	See Z80 Data Bus Spec Section I.E.
MXD1	"
MXD2	"
MXD3	"
MXD4	"
MXD5	"
MXD6	"
MXD7	"

4. Outputs

	V0 (V)	I0 (μ A)	V1 (V)	I1 (μ A)	CAP (pf)	t _{pd} (Low) (nsec)	t _{pd} (High) (nsec)	REF
<u>LATCHDO</u>	Note 7	Note 6	3.1	Note 6	10	280	140	$\overline{\emptyset}^5$
<u>WAIT</u>	"	"	400	2.4	20	490	490	$\overline{\emptyset}$
<u>MA0-MA5</u>	"	"	400	2.4	20	242	240	\emptyset or $\overline{\emptyset}$
<u>INT</u>	"	"	400	2.4	20	490	572	\emptyset
<u>RAS0-RAS3</u>	"	"	400	2.4	20	382	382	$\overline{\emptyset}$
<u>WRCTL</u>	"	"	Note 6	3.1	Note 6	10	382	\emptyset

1. Time from High Impedance to 1 or 0 is 200nsec. (from \emptyset_1 of T₁)
2. For IORQ Ref to \emptyset t_d (Low)=152nsec t_d (High)=166nsec. $\overline{\emptyset}$
3. Horizontal Drive time from low to high is 40nsec after $\overline{\emptyset}$.
Time from high to low is 100nsec before rising edge of \emptyset .
4. Vertical Drive will transition from low to high 40nsec after falling edge of \emptyset . Its width will be 2.1 μ sec max. 1.54 μ sec min. It will go from high to low 100nsec before falling edge of \emptyset .
5. Reference t_{pd} (High) is \emptyset .
6. MOS to MOS signal.
7. .5V + noise generated by Address Chip (15V) = .6V

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See Section I.E.

III. I/O MODE DECODE

I/O Parts

<u>HEX</u>	<u>Out</u>	<u>Input</u>
0	Color Ø Right	
1	" 1 "	
2	" 2 "	
3	" 3 "	
4	" 0 Left	
5	" 1 "	
6	" 2 "	
7	" 3 "	
8	Consumer/Commercial	Intercept Feedback
9	Horiz Color Bndry	
A	Vertical Blank	
B	Color Block T	
C	Logic Reg	
D	Interrupt Feedback	
E	Interrupt Mode	Vertical Addr Feedback
F	Interrupt Line.	Horizontal Addr Feedback
10	Tone Master OSC	SW Bank 0
11	Tone A	1
12	" B	2
13	" C	3
14	Tremello	4
15	Tone C Volume	5
16	Tone A,B Volume	6
17	Misc Volume	7
18	Sound Block T	
19		
1A		
1B		
1C		
1D		POT 0
1E		" 1
1F		" 2
20		" 3
21		" 4
22		" 5
23		" 6
24		" 7
.		
.		
2F		

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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 ; START
>0002 67 VBTM EQU 2 ; TIME BASE
>0003 68 VBDL EQU 3 ; DELTA X LO
>0004 69 VBDKH 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 VBDY EQU 8 ; DELTA Y LO
>0009 74 VB DY EQU 09H ; DELTA Y HI
>000A 75 VBYL EQU 0AH ; Y COORD LO
>000B 76 VB YH EQU 0BH ; Y COORD HI
>000C 77 VB YC EQU 0CH ; Y CHECK FLAGS
>000D 78 VBDL EQU 0DH ; OLD ADDRESS L. O.
>000E 79 VBOAH 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
  
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PROPRIETARY INFORMATION

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	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	CBBC	EQU	6	; BC
>0007	122	CBBC	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

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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

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```

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 ✓
>0008 194 INTS EQU 8 ; INTERCEPT STATUS
>000E 195 VERFB EQU 0EH ; VERTICAL ADDRESS FEEDBACK
>000F 196 HORFB 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
  
```

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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 VECTP EQU VECTC+2 ; VECTOR COORDINATE PAIR
257 ; HUMAN INTERFACE ROUTINES
>0040 258 HUMANR EQU VECTP+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	NEG+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

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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

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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

```

>00C0

PROPRIETARY INFORMATION

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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

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DO NOT REPRODUCE

```

460          ENDIF
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      ; CR RELATIVE 0-5 BEYOND SE
484  CR      MACR #BY
485          DEFB 0D0H+#BY.AND.0FH
486          ENDM
487      ; DS INZ STACK TOP AND JNZ
488  DSINZ  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 #TIM
497          DEFB 0E1H
498          DEFB #TIM
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

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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 ; BLANKOUT 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

```

642
643          LIST S,X,T,M
644          NLIST I
645          ; *****
646          ; * HVGSYS *
647          ; *****

>0008      649 PFUG      EQU 09H          ; POT FUDGE FACTOR
>17DE      650 GFSTRT   EQU 17DEH       ; GUN FIGHT START ADDRESS
>1328      651 CMSTRT   EQU 1328H       ; CHECKMATE START ADDRESS
>1020      652 CALCST   EQU 1020H       ; CALCULATOR START ADDRESS
>0E19      653 SCBST:   EQU 0E19H       ; SCRIBBLING START ADDRESS

655          ; *****
656          * POWER UP RESTART *
657          ; *****
658          ORG 0
0000 00     659          NOP              ; WAIT FOR THINGS TO SETTLE DOW
0001 F3     660          DI
0002 AF     661          XOR A
0003 D308   662          OUT (CONSOLE),A    ; *** SET CONSUMER MODE ***
0005 C3610C 663          JP PWRUP

665          ORG 8
0008 C30720 666          TRANSFER CONTROL TO RESTART HANDLER
667          JP 2007H          ; VECTOR OUT

000B 1C     669 NUMBRS:  DEFB 1CH
000C 3C     670          DEFB 3CH
000D 1C     671          DEFB 1CH
000E 20     672          DEFB 20H

674          ORG 16
0010 C30A20 675          JP 200AH          ; RESTART 2
0013 06     676 MENUCL:  DEFB 06H          ; MENU COLORS
0014 FB     677          DEFB 0FBH
0015 07     678          DEFB 07H
0016 52     679          DEFB 52H

681          ORG 24
0018 C30D20 682          JP 200DH          ; RESTART 3
  
```

PROPRIETARY INFORMATION

Dave Nutting Associates, Inc.

DO NOT REPRODUCE

	684	:	NAME:	PAUSE
	685	:	PURPOSE:	HALT # OF INTERRUPTS
	686	:	INPUT:	B = # OF INTERRUPTS
001B	FB		MPAUSE:	EI
001C	76			HALT
001D	10FD			DJNZ -1
001F	C9			RET

PROPRIETARY INFORMATION

Dave Nutting Associates, Inc.

DO NOT REPRODUCE

0020 C31020 692 ORG 32
 693 JP 2010H ; RESTART 4

695 ; NAME: SET WORD
 696 ; (HL)=DE
 0023 73 697 MSETW: LD (HL),E
 0024 23 698 INC HL
 0025 72 699 LD (HL),D
 0026 C9 700 RET

0028 C31320 702 ORG 40
 703 JP 2013H ; RESTART 5

002B 210000 705 CONG LD HL,0 ; ZERO OUT HL
 002E C9 706 RET

0030 C31620 708 ORG 48
 709 JP 2016H ; RESTART 6

0033 00 711 CKSUM DEFB 0 ; CHECKSUM

0034 8B01 713 ITAB DEFW MACTIB ; INTERRUPT TRANSFER
 0036 01 714 DEFB 1 ; ** SYSTEM REVISION LEVEL

716 ORG 56
 717 ; NAME: USER PROGRAM INTERFACE
 718 ; PURPOSE: TRANSFER OF CONTROL FROM USER TO SYSTEM
 719 ; INPUT: ROUTINE # FOLLOWS INLINE AFTER RST INSTR
 720 ; L. O. BIT SET, LOAD ARGUMENTS INLINE F
 721 ; OUTPUT: NONE
 722 ; STACK USE: 16 BYTES TOTAL, 16 BYTES ON EXIT
 723 ; SIDE EFFECTS: REGISTERS AF, BC, DE, HL, IX, AND OLD IY SAV
 724 ; EXPLANATION:
 725 ; REGISTERS AF, BC, DE, HL, IX, AND PREVIOUS IY ARE PUSHED
 726 ; THE NUMBER FOLLOWING THE RST 56 INSTRUCTION IS USED TO
 727 ; EXEC A JUMP VECTOR GIVING THE STARTING ADDRESS OF THE
 728 ; SYSTEM ROUTINE CALL. IF OBTAINED, INLINE ARGUMENTS
 729 ; ARE COPIED INTO THE CONTEXT AREA. FOR ARGUMENT ORDERIN
 730 ; SEE INTERPRETER DOCUMENTATION AND APPROP. TABLES
 731 ; A DUMMY RETURN IS INSERTED WHICH, WHEN RETURNED TO BY
 732 ; SYSTEM ROUTINE, WILL RESTORE THE REGISTER CONTENTS AND
 733 ; RETURN TO THE USER PROGRAM

PROPRIETARY INFORMATION
 Data Molding Associates, Inc.

DO NOT REPRODUCE

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734 ;
735 ; *** THE UPI HAS BEEN EXTENDED TO SUPPORT USER SUPPLI
736 ; ROUTINES. IF THE CALL INDEX PROVIDED IS NEGATIVE
737 ; THEN THE USERS DISPATCH TABLE POINTER (USERTB) IS US
738 ; NOTE THAT THE SIGN BIT ISN'T ZAPPED BEFORE BEING
739 ; USED AS AN INDEX. THIS MEANS THAT THE USERS DISPATCH
740 ; TABLE POINTER SHOULD POINT 128 BYTES BEFORE THE FIRS
741 ; EX (SP),HL ; RETURN ADDRESS TO HL
0039 E3 742 PUSH AF ; CREATE CONTEXT
003A C5 743 PUSH BC
003B D5 744 PUSH DE
003C DDE5 745 PUSH IX
003E FDE5 746 PUSH IY
0040 FD210000 747 LD IY,0 ; POINT IY AT CONTEXT
0044 FD39 748 ADD IY,SP
0046 7E 749 LD A,(HL) ; LOAD OPCODE
0047 23 750 INC HL
0048 117A02 751 LD DE,RETN ; DE = RETURN POINT
004B 1F 752 RRA ; SUCK WANTED?
004C 3836 753 JR C,MINTO-$ ; JUMP IF YES
004E E5 754 INT PUSH HL ; SAVE PC
004F D5 755 PUSH DE ; SAVE DUMMY RETURN
0050 21CB00 756 LD HL,SYOPT
0053 07 757 RLCA
0054 5F 758 LD E,A
0055 1600 759 LD D,0
0057 17 760 RLA ; USE TABLE WANTED?
0058 3003 761 JR NC,PUSH1-$
005A 2AFD4F 762 LD HL,(USERTB) ; YES LOAD IT
005D 19 763 PUSH ADD HL,DE
005E 5E 764 LD E,(HL)
005F 23 765 INC HL
0060 56 766 LD D,(HL)
0061 D5 767 PUSH DE
0062 FD660B 768 LD H,(IY+6H)
0065 FD6E0A 769 LD L,(IY+6L)
0068 FD5603 770 REL LD D,(IY+6IHX)
006B FD5E02 771 LD E,(IY+6IYL)
006E D5 772 PUSH DE
006F DDE1 773 POP IX
0071 FD7E09 774 LD A,(IY+6BA)
0074 FD5605 775 DEL LD D,(IY+6BD)
0077 FD5E04 776 LD E,(IY+6BE)
007A C9 777 RET ; CALL VIA RETURN
  
```

PROPRIETARY INFORMATION

David Anthony Associates, Inc.

DO NOT REPRODUCE

```

779 ; NAME:          MACRO INTERPRETER
780 ; PURPOSE:       INTERPRETING SEQUENCES OF SYSTEM CALLS
781 ; INPUT:         ADDRESS OF STRING TO INTERPRET PASSED ON
782 ; STACK USE:     NO INCREASE IN DEPTH
783 ; EXPLANATION:   IF OPTIONED (BIT 0 OF CALL INDEX SET) THE
784 ; ARGUMENT TABLE (MRARGT) IS INDEXED GIVING A MASK WHICH
785 ; SPECIFIES HOW TO TRANSFER INLINE ARGUMENTS INTO THE CO
786 ; BLOCK. THIS MASK IS FORMATED AS FOLLOWS:
787 ;
788 ;
789 ; *****
790 ; * 7 * 6 * 5 * 4 * 3 * 2 * 1 * 0 *
791 ; *****
792 ; * H * L * A * IX * B * C * D * E *
793 ; *****
794 ; ARGUMENTS MUST FOLLOW THE CALL INDEX IN THE FOLLOWING
795 ; (OMITING UNUSED ARGUMENTS, OF COURSE)
796 ; (INDEX), IXL, IXH, E, D, C, B, A, L, H
797 ;
798 ; THE SIMULATED PC IS SAVED AND A DUMMY RETURN IS
799 ; INSERTED ON THE STACK. THE UPI DISPATCHING ROUTINE IS
800 ; THEN ENTERED AT 'INTPE', WHICH EFFECTS A CONTROL TRANS
801 ; TO THE CALLED ROUTINE. WHEN THE CALLED ROUTINE RETURN
802 ; IT WILL COME BACK HERE TO INTERPRET THE NEXT MACRO INS
803 ; NOTE THAT THIS ROUTINE IS RE-ENTRANT, THEREFORE THE CAL
804 ; ROUTINE MAY RETURN BACK THROUGH HERE, IF IT FEELS LIKE IT.
805 ; * THE UPI HAS BEEN EXTENDED TO SUPPORT USER PROVIDED
806 ; SYSTEM ROUTINES. IF A NEGATIVE CALL INDEX IS ENCOUNTER
807 ; BY THE INTERPRETER, AND 'S' IN 'INLINE' IS OPTIONED, THE
808 ; USER MACRO ROUTINE ARGUMENT TABLE IS INDEXED FOR A
809 ; PARAMETER MASK. THE ADDRESS OF THIS TABLE IS ASSUMED
810 ; TO BE IN (UMARGT), (UMARGT+). THIS POINTER SHOULD
811 ; POINT 64 BYTES BEFORE THE FIRST REAL ENTRY.
812 ; I. E. LD HL, USERMT-64 ; WHERE USERMT POINTS AT
813 ; LD (UMARGT), HL
007B D1 814 MINTO: POP DE ; DISCARD DUMMY RETURN FROM UPI
007C 815 RENTER:
007E E1 816 POP HL ; POP OFF PC

818 ; NAME:          NCALL
819 ; PURPOSE:       CALL INTERPRETER SUBROUTINE
820 ; INPUT:         PC = ROUTINE ADDRESS
821 ; NOTES:        ROUTINE MAY BE CALLED FROM MACHINE LANGUAGE
822 ; ANOTHER INTERPRETED SEQUENCE
823 ; STACK DEPTH INCREASED BY 4 BY CALL
007D 7E 824 MNCALL: LD A, (HL) ; GET OPCODE
007E 23 825 INC HL
007F CB3F 826 SRL A
0081 117C00 827 LD DE, RENTER ; LOAD INTERPRETER DUMMY RETURN
0084 D5 828 MINTO: PUSH DE ; SAVE DUMMY RETURN
0085 4F 829 LD C, A ; INDEX TO C
0086 3012 830 JR NC, MINT2-$ ; JUMP IF NO LOAD WANTED
0088 EB 831 EX DE, HL
0089 0600 832 LD B, 0
  
```

PROPRIETARY INFORMATION
 Nothing

DO NOT REPRODUCE

```

008B 214B01 833 LD HL, MRARGT ; LOAD SYSTEM ARG TABLE
008E CB77 834 BIT 6, A ; USE USER TABLE?
0090 2803 835 JR Z, MINT1-$ ; JUMP IF NO
0092 2AFB4F 836 LD HL, (UMARGT)
0095 09 837 MINT1: ADD HL, BC ; INDEX TABLE
0096 46 838 LD B, (HL)
0097 CDA800 839 CALL MSUCK1 ; CALL SUCK ROUTINE
009A D1 840 MINT2: POP DE ; DUMMY RETURN TO DE, HL = PC
009B 79 841 LD A, C ; GET CALL INDEX BACK
009C FD4607 842 LD B, (IY+CBB) ; RESTORE CLOBBERED REGISTERS
009F FD4E06 843 LD C, (IY+CBC)
00A2 18AA 844 JR INTPE-$ ; JOIN NORMAL UPI DISPATCH SEQU

846 ; NAME: SUCK INLINE ARGUMENTS
847 ; PURPOSE: TRANSFER OF INLINE ARGS INTO CONTEXT BLO
848 ; INPUT: B = ARG LOAD MASK (SEE INTERPRETER COMME
849 ; OUTPUT: HL = UPDATED PC
850 ; EXPLANATION: THIS ROUTINE IMPLEMENTS A MACRO LOAD INST
851 ; IT IS USED BY THE INTERPRETER AS WELL. A ONE BIT IN T
852 ; THE LINE LOAD MASK MEANS TRANSFER THE NEXT INLINE BYTE I
853 ; ZERO BIT MEANS 'ADVANCE CONTEXT BLOCK POINTER'
854 ; TWO ENTRY POINTS ARE DEFINED ONE FOR THE SUCK MACRO I
855 ; THE OTHER FOR THE INTERPRETER TO USE
856 ; SUCK MACRO ENTRY
00A4 E1 857 MSUCK1: POP HL ; RETURN ADDRESS TO HL
00A5 D1 858 POP DE ; POP OFF PC
859 ; ** BYTE SAVING TRICK *** REPLACE WITH LD HL, REENTRY
00A6 23 860 INC HL ; ADVANCE TO REENTRY (MINTO)
00A7 E5 861 PUSH HL
862 ; CALL INTO ...
00A8 CB60 863 MSUCK2: BIT 4, B ; IX BIT WANTED?
00AA 280A 864 JR Z, MSUCK2-$ ; MSUCK2 IF NOT
00AC 1A 865 LD A, (DE)
00AD 13 866 INC DE
00AE FD7702 867 LD (IY+CHXL), A
00B1 1A 868 LD A, (DE)
00B2 13 869 INC DE
00B3 FD7703 870 LD (IY+CHXH), A
00B6 FDE5 871 MSUCK3: PUSH IY ; LET IY = IY
00B8 E1 872 POP HL
00B9 23 873 INC HL ; + 4
00BA 23 874 INC HL
00BB 23 875 INC HL
00BC 23 876 INC HL
00BD CBA0 877 RES 4, B ; KILL IX BIT
878 ; SUCK IN LOOP
00BF CB38 879 MSUCK4: SRL B
00C1 3003 880 JR NC, MSUCK5-$ ; MSUCK5 IF NOT THIS TIME
00C3 1A 881 LD A, (DE) ; GET INLINE BYTE
00C4 13 882 INC DE
00C5 77 883 LD (HL), A ; STUFF INTO CB
00C6 23 884 MSUCK5: INC HL ; BUMP CB POINTER
885 ; ** THIS CODE ASSUMES THAT STATUS OF 'SRL' IS PRESERVE
00C7 20F6 886 JR NZ, MSUCK3-$ ; JUMP BACK IF MORE TO DO
00C9 EB 887 EX DE, HL ; HL = PC
00CA C9 888 RET ; THEN QUIT
  
```

PROPRIETARY INFORMATION

Dave Nutting Associates, Inc.

DO NOT REPRODUCE

```

      890 ; *****
      891 ; * UPI ROUTINE ADDRESS TABLE *
      892 ; *****
00CB 7E00 893 SYSOPT: DEFW MINTPC
00CD 7902 894 DEFW MXINTC
00CF 3206 895 DEFW MRCALL
00D1 7D00 896 DEFW MMCALL
00D3 730E 897 DEFW MMRET
00D5 C40A 898 DEFW MMJUMP
00D7 A400 899 DEFW MSUCK
00D9 9E01 900 DEFW MACTIN
00DB 7E04 901 DEFW TIMEY
00DD 0805 902 DEFW MUZSET
00DF FC05 903 DEFW MUZSTP
00E1 CF03 904 DEFW MSETUP
00E3 DE01 905 DEFW MCOLOR
00E5 EE0A 906 DEFW Mfill
00E7 B206 907 DEFW MPAINT
00E9 FE06 908 DEFW MVWRIT
00EB 0B07 909 DEFW MWRITR
00ED 1507 910 DEFW MWRITP
00EF 1907 911 DEFW MWRIT
00F1 1C07 912 DEFW MWRIT
00F3 7D07 913 DEFW MVBLAN
00F5 9E07 914 DEFW MBLANK
00F7 B903 915 DEFW MSAVE
00F9 AD07 916 DEFW MREST
00FB 6A02 917 DEFW MSCROL
00FD E107 918 DEFW DISPCH
00FF C407 919 DEFW STRNEW
0101 EB0E 920 DEFW BCDIS
0103 F60A 921 DEFW MRELAR
0105 FB0A 922 DEFW MRELA1 ; RELAR
0107 5606 923 DEFW MVECTC
0109 3306 924 DEFW MVECT
010B C90A 925 DEFW MKCTAS
010D AC01 926 DEFW MENTRY ; SENT
010F 0C06 927 DEFW MDOIT ; DOIT
0111 0B06 928 DEFW MDOITB
0113 BA01 929 DEFW MPIZBK ; PIZBK
0115 970C 930 DEFW MMENU
0117 FB0C 931 DEFW MGETP
0119 310D 932 DEFW MGETA
011B 1E00 933 DEFW MPAUSE ; PAUSE
011D CC0E 934 DEFW MDISTI ; DISPLAY TIME
011F 150C 935 DEFW MINCSC ; INC SCORE
0121 760B 936 DEFW INXNIB ; INDEXN
0123 900E 937 DEFW PUTNIB ; STOREN
0125 AC0B 938 DEFW MINDW ; INDEXW
0127 BDOE 939 DEFW MINDB ; INDEXB
0129 4E0E 940 DEFW MMOVE ; MOVE
012B AA0D 941 DEFW MSHFTU
012D 2103 942 DEFW BCDAD
012F 1F03 943 DEFW BCDSB
0131 DE02 944 DEFW BCDML
0133 8402 945 DEFW BCDDV
  
```

PROPRIETARY INFORMATION

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0135 6403 946
 0137 4103 947
 0139 6E03 948
 013B 2903 949
 013D 5603 950
 013F 4C03 951
 0141 7F03 952
 0143 410C 953
 0145 6C03 954
 0147 2300 955
 0149 4002 956

DEFW BCDCS
 DEFW BCDNG
 DEFW SDADD
 DEFW SDSMG
 DEFW SDABS
 DEFW SNEGT
 DEFW MRANGE
 DEFW MQUIT
 DEFW MSETB
 DEFW MSETW
 DEFW MMTD.

958 ; MACRO ROUTINES ARGUMENT MASK TABLE

959 ; FORMAT:

960 ; *****

961 ; * 6 * 5 * 4 * 3 * 2 * 1 * 0 *

962 ; *****

963 ; H * L * A * IX * B * C * D * E *

964 ; *****

965 ; ARGUMENTS MUST FOLLOW THE CALL INDEX IN THE FOLLOWING

966 ; (LISTING UNUSED ARGUMENTS, OF COURSE)

967 ; (INDEX), IXL, IXH, D, C, B, A, L,

014B 00 968
 014C 00 969
 014D C0 970
 014E C0 971
 014F 00 972
 0150 C0 973
 0151 08 974
 0152 00 975
 0153 04 976
 0154 F0 977
 0155 00 978
 0156 2A 979
 0157 C0 980
 0158 2F 981
 0159 2F 982
 015A D0 983
 015B E3 984
 015C E3 985
 015D EF 986
 015E EF 987
 015F 13 988
 0160 CB 989
 0161 CF 990
 0162 C3 991
 0163 CF 992
 0164 27 993
 0165 C7 994
 0166 CF 995
 0167 20 996
 0168 20 997
 0169 D4 998

MRANGE DEFB 0 ; INT
 DEFB 0 ; XINT
 DEFB 11000000B ; RCALC
 DEFB 11000000B ; MCALEN
 DEFB 0 ; MRE
 DEFB 11000000B ; MJUM
 DEFB 00001000B ; SUCR
 DEFB 0 ; ACT
 DEFB 00000100B ; DEC
 DEFB 11110000B ; BMUSIC
 DEFB 0 ; EMUSIC
 DEFB 00101000B ; SET
 DEFB 11000000B ; COL
 DEFB 00101111B ; FIL
 DEFB 00101111B ; RECT
 DEFB 11010000B ; VWRITR
 DEFB 11100001B ; WRITR
 DEFB 11100001B ; WRITR
 DEFB 11100001B ; WRITR
 DEFB 11101111B ; WRITR
 DEFB 00010011B ; VBLANK
 DEFB 11001011B ; BLANK
 DEFB 11001111B ; SAVE
 DEFB 11000011B ; RESTORE
 DEFB 11001111B ; SCROLL
 DEFB 00100111B ; NEW DISCHR
 DEFB 11000111B ; NEW DISSTR
 DEFB 11001111B ; DISNUM
 DEFB 00100000B ; RELABS
 DEFB 00100000B ; RELAB1
 DEFB 11010100B ; VECTC

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```

016A D0      999      DEFB 11010000B ; VECT
016B 00     1000     DEFB 0           ; KCTASC
016C 03     1001     DEFB 00000011B ; SENTRY
016D C0     1002     DEFB 11000000B ; DOIT
016E C0     1003     DEFB 11000000B ; DOITB
016F 00     1004     DEFB 0           ; PIZBRK
0170 C3     1005     DEFB 11000011B ; MENU
0171 EC     1006     DEFB 11101100B ; GET PARAMETER
0172 CF     1007     DEFB 11001111B ; GET NUMBER
0173 08     1008     DEFB 00001000B ; PAUSE
0174 07     1009     DEFB 00000111B ; DISTIM
0175 C0     1010     DEFB 11000000B ; INCSCR
0176 C0     1011     DEFB 11000000B ; INDEXN
0177 C0     1012     DEFB 11000000B ; STOREN
0178 C0     1013     DEFB 11000000B ; INDEXW
0179 C0     1014     DEFB 11000000B ; INDEXB
017A CF     1015     DEFB 11001111B ; MOVE
017B C8     1016     DEFB 11001000B ; SHIFTU
017C CB     1017     DEFB 11001011B ; BCDADD
017D CB     1018     DEFB 11001011B ; BCDSUB
017E CB     1019     DEFB 11001011B ; BCDMUL
017F CB     1020     DEFB 11001011B ; BCDIV
0180 C8     1021     DEFB 11000000B ; BCDCHS
0181 0B     1022     DEFB 00001011B ; BCDNEG
0182 CB     1023     DEFB 11001011B ; DADD
0183 0B     1024     DEFB 00001011B ; DSUB
0184 0B     1025     DEFB 00001011B ; DADD
0185 C8     1026     DEFB 11000000B ; NEXT
0186 20     1027     DEFB 00100000B ; RANED
0187 00     1028     DEFB 00000000B ; QU
0188 E0     1029     DEFB 11000000B ; SET BYTE
0189 C3     1030     DEFB 11000011B ; SET WORD
018A C7     1031     DEFB 11000111B ; MAKE TO DELTAS
  
```

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```

1033 ; PAGES 4 60TH SET COUNTERS IN CTO-3
018B F3     1034 ; MAKE SURE INTERRUPT IS DISABL
018C F5     1035 ;
018D C5     1036 ;
018E D5     1037 ;
018F E5     1038 ;
0190 ED5E   1039 ;
0192 3E00   1040 ;
0194 ED47   1041 ;
0196 3EC9   1042 ;
0198 D30F   1043 ;
019A 3E34   1044 ;
019C D30D   1045 ;
019E CDA004 1046 ; UPDATE TIMEOUT, MUSIC AND SECON
01A1 0E0F   1047 ; USE CTO-3
01A3 CD7E04 1048 ; DEC CTO-3
01A6 E1     1049 ;
01A7 D1     1050 ;
01A8 C1     1051 ;
  
```

; PAGES 4 60TH SET COUNTERS IN CTO-3
 ; MAKE SURE INTERRUPT IS DISABL

```

01A9 F1      1052      POP  AF
01AA FB      1053      EI
01AB C9      1054      RET

1056 ; ROUTINE: SENTRY
1057 ; PURPOSE: TO WAIT FOR CHANGE OF PROGRAM STATUS
1058 ; IN EITHER THE PORTS OR THE TIMER-COUNTERS.
1059 ; IN ADDITION IT CHECKS TIMEOUT FOR LONG PERIODS OF IN-
1060 ; ACTIVITY.
1061 ; ** IS VECTOR OUT FLAG SET??
01AC 3AFA4F  1062 MENTRY: LD  A, (SENFLG)
01AF FEAA    1063      CP   0AAH
01B1 CA1920  1064      JP   Z, 2019H      ; YES - JUMP OUT
01B4 3AEC4F  1065      LD  A, (TIMOUT)    ; CHECK IF TIME TO BLAKOUT
01B7 B7      1066      OR   A
01B8 202B    1067      JR   NZ, TTEST-*
01BA AF      1068 MPI: XOR  A      ; TIME TO SHUT DOWN
01BB F3      1069      DI
01BC D315    1070      OUT (VOLC), A      ; TURN OFF SOUNDS
01BE D316    1071      OUT (VOLAR), A
01C0 010B08  1072      LD  BC, COLBX+8*256
01C3 ED79    1073      OUT (C), A        ; PAINT IT BLACK
01C5 10FC    1074      DJNZ -2
01C7 111402  1075 PBL: LD  DE, AKES
01CA CDF40C  1076      CALL FINDL3      ; CALL STORE DE INTO CONTEXT RO
01CD CDE501  1077      CALL TTEST      ; WAIT FOR SOMETHING TO HAPPEN
01D0 3C      1078      INC  A
01D1 20E7    1079      JR   NZ, MPBK-*
01D3 FD360900 1080      LD  (IY+DE), 0
01D7 FB      1081      EI
01D8 2AE84F  1082      LD  HL, (COLLST)  ; GET SAVED COLORS
01DB 22E84F  1083 MCOLR: LD  (COLL3), HL ; SAVE COLORS FOR FUTURE
01DE 010B08  1084      LD  BC, 800+COLBX
01E1 EDB3    1085      OTIR      ; RESET THE COLORS
01E3 AF      1086      XOR  A
01E4 C9      1087      RET
01E5 CDEC03  1088 TTEST: CALL TRCHK
01E8 FD7709  1089      LD  (IY+CB), A
01EB FD7007  1090      LD  (IY+CB), B
01EE FE13    1091      CP   SKYD
01F0 D8      1092      RET  C
01F1 FE1C    1093      CP   POTO
01F3 D0      1094      RET  NC
01F4 3EFF    1095      LD  A, OFFH
01F6 32EC4F  1096      LD  (TIMOUT), A
01F9 C9      1097      RET

```

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01FA C40D 1099 CALCL: DEFW SCBL
 01FC DD0D 1100 DEFW PNCALC
 01FE 2010 1101 DEFW CALCST ; START OF CALCULATOR

1103 ; SYSTEM ROUTINES JUMP VECTOR
 1104 ORG 200H
 0200 C3A004 1105 JP TIMEZ ; DO TIMER & MUSIC
 0203 C37B04 1106 JP TIMEX ; DECTMR

0206 20 1108 SYSFNT: DEFB 20H
 0207 08 1109 DEFB 8
 0208 08 1110 DEFB 8
 0209 01 1111 DEFB 1
 020A 07 1112 DEFB 7
 020B E408 1113 DEFW LRGCHR

020D A0 1115 SMLCHR: DEFB 0A0H
 020E 04 1116 DEFB 4
 020F 06 1117 DEFB 6
 0210 01 1118 DEFB 1
 0211 05 1119 DEFB 5
 0212 BFOA 1120 DEFW SMLCHR

1122 ; ALL KEYS MASK
 0214 3F 1123 AKEY: DEFB 3FH
 0215 3F 1124 DEFB 3FH
 0216 3F 1125 DEFB 3FH
 0217 3F 1126 DEFB 3FH

1128 ; HEAD OF ONBOARD MENU
 0218 BE0D 1129 GUNLINK: DEFW CML
 021A CA0D 1130 DEFW PNGF
 021C DE17 1131 DEFW GFSTR
 021E 4D415820 1132 DEFM 'MAX SCORE'
 0227 00 1133 DEFB 0
 0228 23204F46 1134 DEFM '# OF PLAYERS'
 0234 00 1135 DEFB 0
 0235 23204F46 1136 DEFM '# OF GAMES'
 023F 00 1137 DEFB 0

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```

1139 ; NAME: CONVERT MASK TO DELTAS
1140 ; INPUT: B = JOYSTICK MASK
1141 ; C = FLOP STATUS (MR FLOP BIT SET IF FLOP
1142 ; DE = X POSITIVE DELTA
1143 ; HL = Y POSITIVE DELTA
0240 CD5602 1144 MMTD: CALL CONCPL ; HANDLE Y
0243 EB 1145 EX DE, HL
0244 CB71 1146 BIT MRFLOP, C ; FLOP SET?
0246 2907 1147 JR Z, MMTD2-$ ; YES - DO IT
0248 78 1148 LD A, B ; NO - GET MASK
0249 E603 1149 AND 3
024B 2901 1150 JR Z, MMTD1-$
024D 2F 1151 CPL ; INVERT IF NOT ZERO
024E 47 1152 MMTD1: LD B, A
024F CD5602 1153 MMTD2: CALL CONCPL ; PROCESS X
0252 EB 1154 EX DE, HL
0253 C3B80B 1155 JP STHLDE ; STORE HL, DE AND QUIT

1157 ; SUBROUTINE TO CONDITIONALLY COMPLEMENT OR ZERO HL
0256 CB08 1158 CONCPL: RRC B
0258 300A 1159 JR NC, CONC1-$ ; JUMP IF NOT UP
025A 7D 1160 LD A, L
025B 2F 1161 CPL
025C 6F 1162 LD L, A
025D 7C 1163 LD A, H
025E 2F 1164 CPL
025F 67 1165 LD H, A
0260 23 1166 INC HL
0261 CB08 1167 RRC B
0263 C9 1168 RET
0264 CB08 1169 CONC1: RRC B ; DOWN GET?
0266 D8 1170 RET C ; QUIT IF SO
0267 C32B00 1171 JP CONC2 ; JUMP TO ZERO OUT

1173 ; NAME: SCROLL MEMORY BUFFER
1174 ; INPUT: B = NUMBER OF LINES TO SCROLL
1175 ; C = NUMBER OF BYTES ON LINE TO SCROLL
1176 ; DE = LINE INCREMENT
1177 ; HL = FIRST LINE TO SCROLL
026A AF 1178 MSCRL: XOR A
026B C5 1179 MSCRL: PUSH BC ; SAVE COUNTERS
026C D5 1180 PUSH DE
026D 47 1181 LD B, A
026E EB 1182 EX DE, HL
026F 19 1183 ADD HL, DE ; ADD INCREMENT TO LINE
0270 E5 1184 PUSH HL
0271 ED80 1185 LDIR
0273 E1 1186 POP HL
0274 D1 1187 POP DE
0275 C1 1188 POP BC
0276 10F3 1189 DJNZ MSCRL1-$
0278 C9 1190 RET
  
```

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1192 ; NAME: MACRO INTERPRETER EXIT WITH CONTEXT REST
1193 ; PURPOSE: QUIT INTERPRETING AND GO HOME
0279 E1 1194 MXINTC: POP HL ; THROW OUT DUMMY RETURN
1195 ; NAME: RETURN FROM SYSTEM CALL
1196 ; PURPOSE: RETURNING TO USER AND RESTORATION OF REG
027A E1 1197 RETN: POP HL ; RETURN ADDRESS TO HL
027B FDE1 1198 POP IY
027D DDE1 1199 POP IX
027F D1 1200 POP DE
0280 C1 1201 POP BC
0281 F1 1202 POP AF
0282 E3 1203 EX (SP),HL ; STK=RETURN, HL=OLD HL
0283 C9 1204 RET
  
```

```

1206 ; NAME: BCD DIVIDE
1207 ;
0284 CDC002 1208 BCD: CALL GNACC ; GENERATE ACCUMULATOR
0287 E3 1209 EX (SP),HL ; HL = ACC, TOP = ARG2
0288 C5 1210 PUSH BC
0289 0600 1211 LD B,0
028B 79 1212 LD A,C
028C CB39 1213 SRL C
028E 09 1214 ADD HL,BC
028F 4F 1215 LD C,A
0290 EB 1216 EX DE,HL ; HL = ARG1, DE = ACC
0291 ED80 1217 LDIR ; HL = ARG1 FLAG+1
0293 C1 1218 POP BC
0294 D1 1219 POP DE
0295 2B 1220 DEC HL
0296 E3 1221 EX (SP),HL ; HL = ARG2, TOP = ARG1 FLAG
0297 C5 1222 PUSH BC
0298 0600 1223 LD B,0
029A 09 1224 ADD HL,BC ; HL = ACC+SIZE/2
029B C1 1225 POP BC
029C 0D 1226 DEC C ; DECREMENT SIZE
029D EB 1227 EX DE,HL ; HL = ARG2, DE = ACC, TOP = AR
029E 1B 1228 DEC DE
029F 1B 1229 DIV: DEC DE
02A0 AF 1230 XOR A
02A1 1231 SYSTEM NEG ; ARG2 = -ARG2 (10S COMP)
02A1 FF 1231 + RST 56
02A2 74 1231 + DEFB NEG
1231 + IF NEG. EQ. INTPC
1231 + ENDIF
02A3 1232 DIV: SYSTEM DADD ; SUBTRACT UNTIL BORROW
02A3 FF 1232 + RST 56
02A4 6E 1232 + DEFB DADD
1232 + IF DADD. EQ. INTPC
1232 + ENDIF
02A5 380A 1233 JR C, DIV3-$
02A7 3C 1234 INC A ; OR UNTIL LOOP COUNT > 99
02A8 27 1235 DAA
  
```

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```

02A9 20F8      1236      JR    NZ, DIV2-*
02AB E1        1237      POP   HL
02AC 36FF      1238      LD   (HL), OFFH
02AE C1        1239      POP   BC
02AF 186A      1240      JR    MULT6-*
02B1          1241  DIV3:  SYSTEM NEG
02B1 FF        1241 +    RST  56
02B2 74        1241 +    DEFB NEG
                1241 +    IF  NEG. EQ. INTPC
                1241 +    ENDIF
02B3          1242      SYSTEM DADD
02B3 FF        1242 +    RST  56
02B4 6E        1242 +    DEFB DADD
                1242 +    IF  DADD. EQ. INTPC
                1242 +    ENDIF
02B5 E3        1243      EX   (SP), HL      ; HL = ARG1
02B6 2B        1244      DEC  HL
02B7 77        1245      LD   (HL), A      ; SAVE ANSWER IN ARG1
02B8 E3        1246      EX   (SP), HL
02B9 0D        1247      DEC  C
02BA 20E3      1248      JR    NZ, DIV1-*
02BC E1        1249      POP   HL
02BD C1        1250      POP   BC
02BE 1855      1251      JR    DIV4-*
                1252 ; SUBROUTINE TO GENERATE ACCUMULATOR ON THE STACK
02C0 DDE1      1253  GND:   POP   IX
02C2 AF        1254      XOR  A
02C3 4F        1255      LD   C, A
02C4          1256      SYSTEM DABS      ; ARG1=ABS VALUE
02C4 FF        1256 +    RST  56
02C5 72        1256 +    DEFB DABS
                1256 +    IF  DABS. EQ. INTPC
                1256 +    ENDIF
02C6 EB        1257      EX   DE, HL
02C7          1258      SYSTEM DABS      ; ARG2=ABS VALUE
02C7 FF        1258 +    RST  56
02C8 72        1258 +    DEFB DABS
                1258 +    IF  DABS. EQ. INTPC
                1258 +    ENDIF
02C9 EB        1259      EX   DE, HL      ; FLAG IF NEG ANS, ELSE POS
02CA 67        1260      LD   H, A
02CB 6F        1261      LD   L, A
02CC 78        1262      LD   A, B
02CD E5        1263  MUL:   PUSH  HL      ; GENERATE ACC ON STACK
02CE 10FD      1264      DJNZ MULT1-*
02D0 47        1265      LD   B, A      ; RESTORE SIZE
02D1 39        1266      ADD  HL, SP
02D2 C5        1267      PUSH BC      ; SAVE SIGN
02D3 E5        1268      PUSH HL      ; SAVE STACK POINTER
02D4 E5        1269      PUSH HL      ; SAVE ACC POINTER
02D5 FD660B    1270      LD   H, (IY+CBH) ; RESTORE ARG2 POINTER
02D8 FD6E0A    1271      LD   L, (IY+CBL)
02DB 48        1272      LD   C, B
02DC DDE9      1273      JP   (IX)
                1274      ; DECIMAL MULTIPLY
                1275      ; GIVEN:  DE>ARG1, HL>ARG2, B=SIZE/2
                1276      ;          (SIZE/2-1 ASSUMED EVEN)

```

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```

1277 ; RETURNED: ARG1=ANSWER, C<0 ON OVERFLOW
1278 ;
1279 ;
02DE CDC002 1280 BCDML: CALL GNACC ; GENERATE ACCUM
02E1 7E 1281 MULT2 LD A, (HL) ; A=MULT LOOP COUNT
02E2 23 1282 INC HL
02E3 E3 1283 EX (SP), HL ; HL>DEC ACC
02E4 A7 1284 AND A ; IF A=0, SKIP MULT LOOP
02E5 2809 1285 JR Z, MULT4-$
02E7 EB 1286 EX DE, HL
02E8 1287 MULT3: SYSTEM DADD ; ELSE MULTIPLY
02E8 FF 1287 + RST 56
02E9 6E 1287 + DEFB DADD
1287 + IF DADD. EQ. INTPC
1287 + ENDIF
02EA A7 1288 AND A ; CLEAR THE CARRY BIT
02EB 3D 1289 DEC A ; DECIMAL DECREMENT
02EC 27 1290 DAA
02ED 20F9 1291 JR NZ, MULT3-$
02EF EB 1292 EX DE, HL
02F0 23 1293 MULT4: INC HL ; INCREMENT DECIMAL ACC
02F1 E3 1294 EX (SP), HL ; HL>DEC2
02F2 0D 1295 DEC C
02F3 20EC 1296 JR NZ, MULT2-$
02F5 E1 1297 POP HL
02F6 E1 1298 POP HL ; RESTORE STACK POINTER
02F7 C1 1299 POP BC ; RESTORE SIGN
02F8 D5 1300 PUSH DE
02F9 C5 1301 PUSH BC
02FA 48 1302 LD C, B
02FB 0600 1303 LD B, 0
02FD CB39 1304 SRL C
02FF 09 1305 ADD HL, BC
0300 CB21 1306 SLA C
0302 EDB0 1307 LDIR
0304 C1 1308 POP BC
0305 C5 1309 PUSH BC ; CHECK FOR OVERFLOW
0306 CB38 1310 SRL B
0308 AF 1311 XOR A
0309 B6 1312 MULT5: OR (HL)
030A 23 1313 INC HL
030B 10FC 1314 DJNZ MULT5-$
030D A7 1315 AND A ; SET FLAGS
030E 2803 1316 JR Z, MULT7-$
0310 3EFF 1317 LD A, OFFH
0312 12 1318 LD (DE), A
0313 C1 1319 MULT6: POP BC ; CHECK SIGN AND
0314 E1 1320 POP HL
0315 CB41 1321 DI BIT 0, C ; NEGATE ARG1 IF NECESSARY
0317 2802 1322 JR Z, MULT6-$
0319 1323 SYSTEM BCDCHS
0319 FF 1323 + RST 56
031A 6A 1323 + DEFB BCDCHS
1323 + IF BCDCHS. EQ. INTPC
1323 + ENDIF
031B E1 1324 MULT6: POP HL ; RESTORE ORIGINAL STACK POINTER
031C 10FD 1325 DJNZ MULT6-$

```

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*MODCOMP Z-80 CROSS ASSEMBLER* HOME VIDEO GAME SYSTEM PAGE 31
ADDR OBJECT STMT LABEL OPCODE OPERAND COMMENT

031E C9 1326 RET
1327 ;BCD SUBTRACT & ADD
1328 ;
1329 ; GIVEN: DE>ARG1, HL>ARG2
1330 ; B=SIZE/2+1
1331 ; RETURNED: ARG1=ANSWER
031F 1332 BCDSB: SYSTEM BCDCHS
031F FF 1332 + RST 56
0320 6A 1332 + DEFB BCDCHS
1332 + IF BCDCHS.EQ.INTPC
1332 + ENDIF
0321 1333 BCDAD: SYSTEM BCDNEG
0321 FF 1333 + RST 56
0322 6C 1333 + DEFB BCDNEG
1333 + IF BCDNEG.EQ.INTPC
1333 + ENDIF
0323 EB 1334 EX DE,HL
0324 1335 SYSTEM BCDNEG
0324 FF 1335 + RST 56
0325 6C 1335 + DEFB BCDNEG
1335 + IF BCDNEG.EQ.INTPC
1335 + ENDIF
0326 EB 1336 EX DE,HL
0327 1337 SYSTEM DADD
0327 FF 1337 + RST 56
0328 6E 1337 + DEFB DADD
1337 + IF DADD.EQ.INTPC
1337 + ENDIF
1338 ; AND FALL INTO
1339 ;
1340 ;
1341 ; DECIMAL SIGNED MAGNITUDE
1342 ;
1343 ; GIVEN: DE>ARG (10'S COMPLEMENT)
1344 ; B=SIZE/2+1
1345 ; RETURNED: ARG (SIGNED MAGNITUDE)
1346 ;
0329 68 1347 SDSMG LD L,B ;HL>ARG-1 (SIGN BYTE)
032A 2D 1348 DEC L
032B 2600 1349 LD H,0
032D 19 1350 ADD HL,DE
032E 7E 1351 LD A,(HL) ;IF POS (SIGN NIBBLE<5)
032F FE50 1352 CP 50H
0331 D8 1353 RET C ;EXIT
0332 EB 1354 EX DE,HL
0333 3E00 1355 SDSMG LD A,0 ;ELSE 10'S COMPLEMENT
0335 9E 1356 SBC A,(HL)
0336 27 1357 DAA
0337 77 1358 LD (HL),A
0338 23 1359 INC HL
0339 10F8 1360 DJNZ SDSMG1-$
033B 2B 1361 DEC HL ;AND SET SIGN BIT
033C 7E 1362 LD A,(HL)
033D F680 1363 OR 80H
033F 77 1364 LD (HL),A
0340 C9 1365 RET
1366 ;

```

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```

1367 ;
1368 ; BCD NEGATE
1369 ;
1370 ; GIVEN: DE>ARG (SIGNED MAGNITUDE)
1371 ; B=SIZE/2+1
1372 ; RETURNED: ARG (10'S COMPLEMENT)
1373 ;
0341 68 1374 BCDNG: LD L, B ; HL>ARG+B-1 (SIGN BYTE)
0342 2D 1375 DEC L
0343 2600 1376 LD H, 0
0345 19 1377 ADD HL, DE
0346 CB7E 1378 BIT 7, (HL) ; EXIT IF POS
0348 C8 1379 RET Z
0349 3600 1380 LD (HL), 0 ; CLEAR SIGN BYTE
034B EB 1381 EX DE, HL
034C AF 1382 SNEGT: XOR A ; CLEAR CARRY
034D 3E00 1383 BCDNG: LD A, 0 ; ELSE 10'S COMPLEMENT
034F 9E 1384 SBC A, (HL)
0350 27 1385 DAA
0351 77 1386 LD (HL), A
0352 23 1387 INC HL
0353 10F8 1388 DJNZ BCDNG1
0355 C9 1389 RET
1390 ;
1391 ;
1392 ; DECIMAL ABSOLUTE
1393 ;
1394 ; GIVEN: DE>ARG (SIGNED MAGNITUDE)
1395 ; B=SIZE/2+1
1396 ; RETURNED: ARG+1 IF SIGN BIT CLEARED
1397 ;
0356 68 1398 SDABS: LD L, B
0357 2600 1399 LD H, 0
0359 2D 1400 DEC L
035A 19 1401 ADD HL, DE
035B CB7E 1402 BIT 7, (HL)
035D C8 1403 RET Z
035E 3600 1404 LD (HL), 0
0360 FD3406 1405 INC (IY+CB)
0363 C9 1406 RET
1407 ;
1408 ;
1409 ; BCD CHANGE SIGN
1410 ;
1411 ; GIVEN: HL>ARG B=SIZE/2+1
1412 ; (SIGNED MAGNITUDE)
1413 ; RETURNED: ARG SIGN BIT COMPLEMENTED
1414 ;
0364 48 1415 BCDC: LD C, B
0365 0600 1416 LD B, 0
0367 0D 1417 DEC C
0368 09 1418 ADD HL, BC
0369 7E 1419 LD A, (HL)
036A EE80 1420 XOR 80H
1421 ; NAME: SET BYTE
036C 77 1422 MSETB: LD (HL), A
036D C9 1423 RET

```

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1424 ;
1425 ;
1426 ; DECIMAL ADD
1427 ;
1428 ; GIVEN: DE>ARG1 HL>ARG2 (10'S COMPLEMENT)
1429 ; B=SIZE/2+1
1430 ; RETURNED: ARG1=ANSWER (10'S COMPLIMENT)
1431 ;
036E AF 1432 SDADD: XOR A
036F 1A 1433 SDADD1: LD A, (DE)
0370 8E 1434 ADC A, (HL)
0371 27 1435 DAA
0372 12 1436 LD (DE), A
0373 13 1437 INC DE
0374 23 1438 INC HL
0375 10F8 1439 DJNZ SDADD1-$
0377 FE99 1440 CP 99H
0379 17 1441 RLA
037A 2F 1442 CPL
037B FD7708 1443 LD (IY+CBFLAG), A ; SEND BACK STATUS FROM DADD
037E C9 1444 RET

1446 ; NAME: RANGED RANDOM NUMBER
1447 ; INPUT: A RANGE
1448 ; OUTPUT: A RANDOM NUMBER (0 TO RANGE-1)
037F F5 1449 MRAND: PUSH AF
0380 2AEF4F 1450 LD HL, (RANSHT)
0383 CDAC03 1451 CALL SHIFTR
0386 011700 1452 LD BC, 23
0389 09 1453 ADD HL, BC
038A 8A 1454 ADC A, D
038B 22EF4F 1455 LD (RANSHT), HL
038E 2AF14F 1456 LD HL, (RANSHT+2)
0391 5F 1457 LD E, A
0392 CDAC03 1458 CALL SHIFTR
0395 19 1459 ADD HL, DE
0396 22F14F 1460 LD (RANSHT+2), HL
0399 5A 1461 LD E, D
039A EB 1462 EX DE, HL
039E F1 1463 POP AF
039C A7 1464 AND A
039D 4F 1465 LD C, A
039E 7A 1466 LD A, D
039F 2808 1467 JR Z, R3-$
03A1 AF 1468 XOR A
03A2 19 1469 R1: ADD HL, DE
03A3 3001 1470 JR NC, R2-$
03A5 3C 1471 INC A
03A6 0D 1472 R2: DEC C
03A7 20F9 1473 JR NZ, R1-$
03A9 C3D10A 1474 R3: JP QFROG
03AC 44 1475 SHIFTR: LD B, H
03AD 4D 1476 LD C, L
03AE AF 1477 XOR A
03AF 1607 1478 LD D, 7

```

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03B1 29      1479 SH1:   ADD  HL,HL
03B2 17      1480      RLA
03B3 15      1481      DEC  D
03B4 20FB    1482      JR   NZ,SH1-$
03B6 09      1483      ADD  HL,BC
03B7 8A      1484      ADC  A,D
03B8 C9      1485      RET
  
```

```

1487 ; NAME:      SAVE AREA
1488 ; INPUT:     HL = SCREEN ADDRESS
1489 ;           DE = SAVE AREA ADDRESS
1490 ;           BC = Y, X SIZE OF AREA TO SAVE
1491 ; NOTES:    THE SIZES OF THE OBJECT ARE SAVED IN THE
1492 ;           FIRST TWO BYTES OF THE SAVE AREA.
  
```

```

03B9 EB      1493 MSAVE:  EX  DE,HL
03BA 71      1494      LD  (HL),C      ; SET X SIZE
03BB 23      1495      INC HL
03BC 70      1496      LD  (HL),B      ; SET Y SIZE
03BD 23      1497      INC HL
03BE AF      1498      XOR  A
03BF EB      1499      EX  DE,H
03C0 CBF4    1500      SET 6,H      ; SET NONMAGIC ADDRESS
03C2 C5      1501 MSAVE:  PUSH BC
03C3 E5      1502      PUSH HL
03C4 47      1503      LD  B,A
03C5 EDB0    1504      LDIR
03C7 E1      1505      POP  HL
03C8 0E28    1506      LD  C,BYTEHL
03CA 09      1507      ADD  HL,BC
03CB C1      1508      POP  BC
03CC 10F4    1509      DJNZ MSAVE,X$
03CE C9      1510      RET
  
```

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1512 ; NAME:  PREGAME OUTPUT PORT SETUP
1513 ; PURPOSE: TO SET INCOM, VERBL & C
1514 ; INPUTS: B=HORCE D=VERBL, A=INMOD
03CF 0E09    1515 MSET:  LD  C,HORCE      ; GET HORSE PORT NUMBER
03D1 ED41    1516      OUT (C),B      ; HORCE
03D3 0C      1517      INC  C
03D4 ED51    1518      OUT (C),D      ; VERBL
03D6 D30E    1519      OUT (INMOD),A
03D8 C9      1520      RET
  
```

```

1522 ; NAME:  TEST FOR TRANSITIONS
1523 ; FUNCTION: TO LOOK FOR CHANGES IN THE PORTS &TC.
1524 ; RETURNS : A= 0 NO CHANGE
1525 ; 1-8 COUNTER TIMER#N HIT 0
1526 ; 9-C = POTO-3 CHANGED
1527 ; D = A SECONDS UP
1528 ; E= KEYBOARD CHANGED (B=0-24)
1529 ; F-16 : TRIGO!JOYO - T3!J3
  
```

ADDR	OBJECT	STMT	LABEL	OPCD	OPERAND	COMMENT
		1530				; RETURNS NEW VALUE IN B
03D9	5E	1531	CTLPL	LD	E, (HL)	
03DA	010108	1532		LD	BC, 301H	
03DD	79	1533	CCTLPL	LD	A, C	; GET MASK
03DE	0F	1534		RRCA		
03DF	4F	1535		LD	C, A	
03E0	A3	1536		AND	E	; CHECK IF CT BIT =1
03E1	2003	1537		JR	NZ, CCT1-\$	
03E3	10F8	1538		DJNZ	CCTLPL-\$	
03E5	C9	1539		RET		
03E6	AB	1540	CCT1:	XOR	E	; MASK OUT BIT IN QUESTION
03E7	77	1541		LD	(HL), A	; PUT BACK THE CTFLAGS OR SEMI4
03E8	78	1542		LD	A, B	
03E9	82	1543		ADD	A, D	
03EA	E1	1544		POP	HL	; OLD RET ADDR
03EB	C9	1545		RET		
03EC	2825	1546	TRCPT	JR	Z, TSEX-\$	; SKIP COUNTER-TIMERS AND POTS?
03EE	21DD4F	1547		LD	HL, CNT	; GET COUNTER TIMERS STATUS
03F1	1600	1548		LD	D, 0	
03F3	CDD903	1549		CALL	CTLPL	; COUNTER TIMERS
03F6	1608	1550		LD	D, 8	
03F8	23	1551		INC	HL	
03F9	CDD903	1552		CALL	CTLPL	; SEMI4
03FC	011C04	1553		LD	BC, 400H+POTO	
03FF	23	1554	TPLPL	INC	HL	; -> AUTO
0400	ED73	1555		IN	A, (C)	
0402	5E	1556		LD	E, (HL)	; GET PHOT
0403	93	1557		SUB	E	
0404	3805	1558		JR	C, PHOT-\$	; NEW ONE LESS THAN OLD
0406	D608	1559		SUB	PFUG	; FUDGE BOUNCE FACTOR
0408	3806	1560		JR	C, EPL-\$	; NEW MORE THAN OLD+4
040A	3C	1561		INC	A	
040B	83	1562	PHOT:	ADD	A, E	
040C	77	1563		LD	(HL), A	
040D	47	1564		LD	B, A	
040E	79	1565		LD	A, C	
040F	C9	1566		RET		
0410	0C	1567	EPLQP	INC	C	
0411	10EC	1568		DJNZ	TPLOP-	
		1569				; NOW TEST SECONDS
0413	21E34F	1570	TSEX	LD	HL, KEYSEX	; HL = KEYSEX
0416	7E	1571		LD	A, (HL)	
0417	CB7F	1572		BIT	7, A	
0419	2806	1573		JR	Z, TKEY3-\$	
041B	CBBF	1574		RES	7, A	
041D	77	1575		LD	(HL), A	
041E	3E11	1576		LD	A, SSEC	; SECS
0420	C9	1577		RET		
		1578				; NOW TEST KEYBOARD
0421	E5	1579	TKEYS:	PUSH	HL	
0422	CD7400	1580		CALL	DELOAD	
0425	EB	1581		EX	DE, HL	
0426	011704	1582		LD	BC, 400H+KEY3	
0429	1100FF	1583		LD	DE, OFFO0H	; SET BIT COUNTER+COLUMNN
042C	ED73	1584	MSK1:	IN	A, (C)	
042E	A6	1585		AND	(HL)	; CHECK AGAINST MASK
042F	200A	1586		JR	NZ, MSNK2-\$	

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ADDR	OBJECT	STMT	LABEL	OPCODE	OPERAND	COMMENT
0431	0D	1587		DEC	C	; NEXT PORT
0432	1C	1588		INC	E	; AND COLUMN
0433	23	1589		INC	HL	; AND MASK
0434	10F6	1590		DJNZ	MSK1-\$	
0436	78	1591		LD	A, B	; NOTHING DOWN
0437	1E12	1592		LD	E, SKYU	
0439	180B	1593		JR	MSENKE-\$	
043B	14	1594	MSENK2	INC	D	; BIT COUNTER
043C	0F	1595		RRCA		
043D	30FC	1596		JR	NC, MSENK2-\$	
043F	7A	1597		LD	A, D	
0440	07	1598		RLCA		; KEY=BIT*4
0441	07	1599		RLCA		
0442	83	1600		ADD	A, E	; + COLUMN
0443	3C	1601		INC	A	; PLUS 1
0444	1E13	1602		LD	E, SKYD	
0446	E1	1603	MSENKE	POP	HL	
0447	AE	1604		XOR	(HL)	; KEY=OKEY?
0448	E67F	1605		AND	7FH	
044A	2807	1606		JR	Z, HANDLE-\$	
044C	AE	1607		XOR	(HL)	
044D	77	1608		LD	(HL)	
044E	E67F	1609		AND	07FH	
0450	47	1610		LD	B, A	
0451	7B	1611		LD	A, E	; KEYBOARD RETURN CODE
0452	C9	1612		RET		
		1613				; NO TEST HANDLES
0453	011004	1614	HANDLE:	LD	BC, 40H+SWO	
0456	23	1615	SWLOP	INC	HL	; -> SWO
0457	ED78	1616		IN	A, (C)	
0459	AE	1617		XOR	(HL)	; COMPARE THE 2
045A	2005	1618		JR	NZ, SWBIT-\$	
045C	0C	1619		INC	C	
045D	10F7	1620		DJNZ	SWLOP-\$	; NO CHANGE
045F	78	1621		LD	A, B	; RETURN 0
0460	C9	1622		RET		
0461	CB67	1623	SWHI	BIT	4, A	; TEST TRIGGER
0463	280C	1624		JR	Z, JOY-\$	; NO TRIG MUST BE JOYSTICK
0465	E610	1625		AND	10H	; FILTER OUT TRIGGER
0467	AE	1626		XOR	(HL)	; UPDATE VALUE
0468	77	1627		LD	(HL)	
0469	E610	1628		AND	10H	
046B	47	1629		LD	B, A	
046C	79	1630		LD	A, C	; GET PORT NUMBER
046D	07	1631		RLCA		; *2
046E	D60C	1632		SUB	OCH	
0470	C9	1633		RET		
0471	AE	1634	JOY	XOR	(HL)	
0472	77	1635		LD	(HL), A	; NO CHANGE IN TRIG SO STORE ST
0473	E60F	1636		AND	0FH	; TAKE OFF TRIGGER
0475	47	1637		LD	B, A	
0476	79	1638		LD	A, C	
0477	07	1639		RLCA		; *2
0478	D60B	1640		SUB	OBH	
047A	C9	1641		RET		

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1643 ; TIMEX
1644 ; INPUTS HL-> TIME BASE IN RAM
1645 ; B=TIME BASE MODULUS
1646 ; C=MASK AS IN DECCTS
1647 ; PURPOSE: TO DECR TIMEBASE AND IF 0 RESET IF AND DECR
1648 ; COUNTER TIMERS
047B 35 1649 TIMEX: DEC (HL) ; DEC TIMEBASE
047C C0 1650 RET NZ
047D 70 1651 LD (HL),B ; RESET TIMEBASE
  
```

```

1653 ; NAME: DECREMENT COUNTER TIMERS
1654 ; INPUTS: C=MASK
1655 ; USED BY ACTINT AND DECCTS TO DECREMENT CTS UNDER MASK
1656 ; MASK= *76543210*, IF BIT=1 THEN DEC CORRESPONDING
1657 ; CT IF BIT=0 LEAVE CT# ALONE
1658 ; NOTE: ALL COUNTERS ARE RUN IN BCD FOR EASY DISPLAY
047E 0608 1659 TIMEX LD B,8 ; NO OF BITS
0480 21D54F 1660 LD HL,CTO ; -> TO COUNTER TIMERS
0483 1600 1661 LD D,0 ; RESULTS
0485 CB39 1662 TIMEX SRL C ; CHANGE THIS TIMER?
0487 300A 1663 JR NC,ETL ;
0489 7E 1664 LD A,(HL) ; GET THE TIMER
048A B7 1665 OR A ; IS ZERO ALREADY?
048B 2906 1666 JR Z,ETL ;
048D 3D 1667 DEC A
048E 27 1668 DAA
048F 2001 1669 JR NZ,+3
0491 37 1670 SCF
0492 77 1671 LD (HL), ; STORE NEW VALUE
0493 23 1672 ETL: INC HL
0494 CB1A 1673 RR D ; ROTATES IN CARRY FLAG
0496 10ED 1674 DJNZ TIMLP ; COUNTER UPDATE&NUMBER TRACKER
0498 3ADD4F 1675 LD A,(CNT)
049B B2 1676 OR D
049C 32DD4F 1677 LD (CNT),A
049F C9 1678 RET
  
```

```

1680 ; NAME: TIMER ROUTINE
1681 ; PURPOSE: TO UPDATE GAME TIME, TIMEOUT AND MUSIC
1682 ; INPUTS OUTPUTS: NONE
1683 ; NOTE: PUSH YOUR REGISTERS (AF, BC, DE, HL)
1684 TIMEX: ; ASSUMES YOU PUSH DA REGS
04A0 21F94F 1685 LD HL,PRIOR ; PRIORITY=TICKS
04A3 CB4E 1686 BIT 1,(HL) ; CHECK IF TICKS OVERRUN
04A5 C0 1687 RET NZ ; RETURN
04A6 CBCE 1688 SET 1,(HL)
04A8 EB 1689 EX DE,HL
1690 ; *SIXTIETH OF A SECOND INTERRUPT*
04A9 21EA4F 1691 LD HL,DURAT ; NOTE TIMER
04AC 7E 1692 LD A,(HL) ; =0 SKIP
04AD B7 1693 OR A
  
```

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04AE 281C 1694 JR Z,SIXY-$
04B0 35 1695 DEC (HL)
04B1 200B 1696 JR NZ,STAKO-$
04B3 E5 1697 PUSH HL
04B4 DDE5 1698 PUSH IX
04B6 CD1405 1699 CALL MUZCPU ; =0 DO NEXT NOTE
04B9 DDE1 1700 POP IX
04BB E1 1701 POP HL
04BC 180E 1702 JR SIXY-$
04BE EB 1703 STAKO: EX DE,HL
04BF CB7E 1704 BIT 7,(HL)
04C1 EB 1705 EX DE,HL
04C2 2008 1706 JR NZ,SIXY-$
04C4 3D 1707 DEC A
04C5 3D 1708 DEC A ; =1 QUIET NOTE
04C6 2004 1709 JR NZ,SIXY-$
1710 ; A
04C8 D316 1711 OUT (VOLAB),A
04CA D315 1712 OUT (VOLC),A
04CC 23 1713 SIXY: INC HL
04CD 35 1714 DEC (HL) ; IF(--TMR60<0)
04CE F20205 1715 JP P,GOUT ; ELZ FORWARD
04D1 363B 1716 LD (HL),G ; THEN TMR60=59
04D3 23 1717 INC HL ; -> TIMEOUT
04D4 EB 1718 EX DE,HL
04D5 21E34F 1719 LD HL,KEYEX ; SET SECONDS UP
04D8 CBFE 1720 SET 7,(HL)
04DA EB 1721 EX DE,HL
04DB 7E 1722 LD A,(HL) ; CHECK IF ZERO
04DC B7 1723 OR A
04DD 2801 1724 JR Z,GT01-$
04DF 35 1725 DEC (HL) ; DEC TIMEOUT
1726 ; *GAME TIMER ONCE A SECOND ROUTINE*
1727 ; IF (SEC != 0 & MIN !=0)
1728 ; IF (SEC == 0
1729 ; SEC=59; --MIN
1730 ; ELSE --SEC
1731 ; ELSE GAMETIMEUP
04E0 23 1732 GTIMER: INC HL ; ->GTSECS
04E1 7E 1733 LD A,(HL) ; IF (SEC==0
04E2 23 1734 INC HL ; ->GTMINS
04E3 B6 1735 OR (HL) ; & MIN!=0)
04E4 2813 1736 JR Z,GT01-$
04E6 2B 1737 DEC HL ; ->GTSECS AGAIN
04E7 7E 1738 LD A,(HL) ; IF (SEC==0)
04E8 B7 1739 OR A
04E9 2009 1740 JR NZ,GT01-$
04EB 3659 1741 LD (HL),59H ; THEN SEC=59BCD
04ED 23 1742 INC HL ; ->GTMINS AGAIN
04EE 7E 1743 LD A,(HL) ; --MIN
04EF 3D 1744 DEC A
04F0 27 1745 DAA
04F1 77 1746 LD (HL),A
04F2 180E 1747 JR GOUT-$
04F4 3D 1748 GT01: DEC A ; ELSE --SEC
04F5 27 1749 DAA
04F6 77 1750 LD (HL),A
  
```

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04F7 1809      1751      JR      GOUT-#
04F9 21F84F   1752  GT02:  LD      HL,GAMSTB ; ELSE GAMETIMEUP=1
04FC CB46      1753      BIT     GSBTIM,(HL)
04FE 2802      1754      JR      Z,GOUT-#
0500 CBFE      1755      SET     GSBEND,(HL)
0502 21F94F   1756  GOUT   LD      HL,PRIOR
0505 CB8E      1757      RES     1,(HL)
0507 C9        1758      RET

; RETURN TO BACKGND OR LO LEVEL
  
```

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1760 ; NAME: START MUZCPU
1761 ; PURPOSE: TO START MUSIC PLAYING (ALSO NOISES)
1762 ; INPUTS: HL -> SCORE
1763 ; A=VOICES
1764 ; NOTE: YOU SHOULD LOAD MUZSP IF YOU DO CALLS
0508 32D44F 1765 MUZSET LD (VOICES),A
050B DD22D04F 1766 LD (MUZSP),IX
050F CDFC05 1767 CALL MUZSTP
0512 1803 1768 JR MUZCP1-$

1769 ; NAME: MUZCPU
1770 ; PURPOSE: PLAYING MUSIC AND NOISES.
1771 ; NOTE: DURAT=0 WHEN CALLED
1772 ; OUTPUT: NONE
1773 ; *MUSIC PROCESSOR*
1774 ; FETCH OPCODE
1775 ; IF (OPCODE < 80H)
1776 ; SET NOTE DURATION ETC
1777 ; ELSE
1778 ; SWITCH (OPCODE & OFOH)
1779 ; CASE 80H:
1780 ; IF (MASK=8) STUFF SNDB,PC=PC+9
1781 ; ELSE OUTI (MASK)=DATA
1782 ; CASE 90H:
1783 ; VOICES=DATA
1784 ; CASE A0H:
1785 ; (—SP)=DATA IN NIBBLE, OP +1
1786 ; CASE B0H:
1787 ; SET VOLUME = DATA, DATA
1788 ; CASE C0H:
1789 ; SWITCH (MASK)
1790 ; CASE D: MPCL=(MSP+); MPCH=(MSP++); BREAK
1791 ; CASE E: (—MSP)=MPCH; (—MSP)=MPCL
1792 ; CASE F: IF (—(SP)=) THEN SP++
1793 ; CASE 3: MPC=DATA16
1794 ; CASE D0H: CALL RELATIVE
1795 ; CASE E0: DURAT=DATA
1796 ; CASE F0: VOICES=0, PORTS=0
0514 2ACE4F 1797 MUZCP1 LD HL, (MUZPC) ; LOOK LIKE NORMAL LOOP RETURN
0517 DD2AD04F 1798 MUZCP1 LD IX, (MUZSP) ; FETCH STACK POINTER
051B 7E 1799 OPLD LD A, (HL) ; OPCODE FETCH
051C 23 1800 INC HL ; -> OPERAND, DATA
051D B7 1801 OR A ; TEST FOR 80H OR MORE
051E FA5B05 1802 JP M, MOO
1803 ; NORMAL NOTE OPERATOR
0521 32EA4F 1804 LD (DURAT), A
0524 3AD44F 1805 LD A, (VOICES)
0527 011808 1806 LD BC, 800H+SNDBX
052A CB3F 1807 SRL A ; SET NOISE
052C 3002 1808 JR NC, +4
052E EDA3 1809 OUTI
0530 0605 1810 LD B, 5 ; -> VIBRATO
0532 CB3F 1811 SRL A
0534 3002 1812 JR NC, +4
0536 EDA3 1813 OUTI ; SET VIBRATO
0538 0604 1814 LD B, 4 ; -> NOTE C
053A CB3F 1815 M81: SRL A ; CHECK C, B, A
  
```

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ADDR	OBJECT	STMT	LABEL	OPCD	OPERAND	COMMENT
053C	3009	1816		JR	NC, M82-\$	
053E	EDA3	1817		OUTI		
0540	CB3F	1818	M815	SRL	A	; CHECK IF INC PC WAS ON
0542	3807	1819		JR	C, M83-\$	
0544	2B	1820		DEC	HL	; RESTORE PC
0545	1804	1821		JR	M83-\$	
0547	05	1822	M82	DEC	B	
0548	23	1823		INC	HL	
0549	18F5	1824		JR	M815-\$	
054B	B7	1825	M83	OR	A	
054C	20EC	1826		JR	NZ, M81-\$	
		1827			; PLAY NOTE	
054E	3AD24F	1828		LD	A, (PVOLAB)	
0551	D316	1829		OUT	(VOLAB), A	
0553	3AD34F	1830		LD	A, (PVOLMC)	
0556	D315	1831		OUT	(VOLC), A	
0558	C3F405	1832		JP	MUZ999	
055B	FE90	1833	MO0	CP	90H	
055D	3015	1834		JR	NC, MO1-\$	
		1835			STUFF PORT OR SOUND BLOCK	
055F	CB5F	1836		BIT	3, A	; IF (STUFF SNDBLK)
0561	2808	1837		JR	Z, MO0-\$	
0563	78	1838		LD	A, B	; SAVE (VSN)
0564	011808	1839		LD	BC, 8+256+SNDBX	; B=C=SNDBX
0567	EDB3	1840		OTIR		; HL->NEXT OPCODE WHEN DONE
0569	1380	1841		JR	OPLOOP-\$	
056B	E607	1842	MO0	AND	7	; ISOLATE PORT NUMBER
056D	F610	1843		OR	10H	; PORTS 10H-17H
056F	4F	1844		LD	C, A	; SET PORT REGISTER
0570	EDA3	1845		OUTI		
0572	18A7	1846		JR	OPLOOP-\$	
0574	2007	1847	MO1	JR	NZ, MO-\$	
0576	7E	1848		LD	A, (HL)	; GET NEW VOICES
0577	23	1849		INC	HL	
0578	32D44F	1850		LD	(VOICES), A	
057B	189E	1851		JR	OPLOOP-\$	
057D	FE80	1852	MO2	CP	OBOH	
057F	3006	1853		JR	NC, MO-\$	
0581	E60F	1854		AND	0FH	
0583	5F	1855		LD	E, A	
0584	1C	1856		INC	E	
0585	183E	1857		JR	MO45-\$	
0587	FEC0	1858	MO3	CP	OCON	; SET VOL ETC
0589	3009	1859		JR	NC, M8-\$	
		1860			; LD PVOLS	
058B	11D24F	1861		LD	DE, PVOLAB	
058E	EDA0	1862		LDI		; DONT CARE ABOUT BC
0590	EDA0	1863		LDI		
0592	1387	1864	OPL2	JR	OPLOOP-\$	
0594	200B	1865	MO4	JR	NZ, MO40-\$	
0596	DD3500	1866		DEC	(IX+0)	; DEC STACK TOP
0599	200A	1867		JR	NZ, MO41-\$	
059B	DD23	1868		INC	IX	
059D	23	1869		INC	HL	
059E	23	1870		INC	HL	
059F	18F1	1871		JR	OPLP2-\$	
05A1	FED0	1872	MO40	CP	O00H	; PC SP STUFF

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05A3	3027	1873		JR	NC, M05-\$	
05A5	E60F	1874	M041	AND	OFH	; ISOLATE MASK
05A7	FE09	1875		CP	9	; RETURN
05A9	200C	1876		JR	NZ, M043-\$	
05AB	DD6E00	1877		LD	L, (IX+0)	
05AE	DD23	1878		INC	IX	
05B0	DD6600	1879		LD	H, (IX+0)	
05B3	DD23	1880		INC	IX	
05B5	18DB	1881		JR	OPLP2-\$	
05B7	5E	1882	M043:	LD	E, (HL)	; PCL=
05B8	23	1883		INC	HL	
05B9	56	1884		LD	D, (HL)	; PCH=
05BA	23	1885		INC	HL	
05BB	EB	1886		EX	DE, HL	; SET THE PC
05BC	FE04	1887		CP	4	; IS IT A JMP?
05BE	38D2	1888		JR	C, OPLP2-\$	; IT IS
05C0	DD2B	1889	M044	DEC	IX	; ITS A CALL
05C2	DD7200	1890		LD	(IX+0), D	; (--SP)=PCH
05C5	DD2B	1891	M043	DEC	IX	
05C7	DD7300	1892		LD	(IX+0), E	; (--SP)=PCL
05CA	18C6	1893		JR	OPLP2-\$	
05CC	FEE0	1894	M043	CP	0E0H	
05CE	300A	1895		JR	NC, M05-\$	
05D0	E60F	1896		AND	OFH	
05D2	0600	1897		LD	B, 0	
05D4	4F	1898		LD	C, A	
05D5	54	1899		LD	D, H	
05D6	5D	1900		LD	E, L	
05D7	09	1901		ADD	HL, BC	
05D8	18E6	1902		JR	M044	; CALL
05DA	200A	1903	M043	JR	NZ, M041-\$	
05DC	3AF94F	1904		LD	A, (PCH OR)	; LE STA
05DF	EE90	1905		XOR	80H	
05E1	32F94F	1906		LD	(PRIOR), A	
05E4	18AC	1907		JR	OPLP2-\$	
05E6	FEF0	1908	M043	CP	OFOH	; REST VOICE (OR SUSTAIN)
05E8	2812	1909		JR	Z, MUZSTP-\$	
05EA	7E	1910		LD	A, HL	
05EB	32EA4F	1911		LD	(DURAT), A	; SET DURATION OF QUIET
05EE	23	1912		INC	HL	
05EF	AF	1913		XOR	A	
05F0	D316	1914		OUT	(VOLDB), A	
05F2	D315	1915		OUT	(VOLC), A	
		1916			END OF MUZCPU PROCESSOR	
05F4	22CE4F	1917	MUZCPU:	LD	(MUZPC), HL	; SAVE THE PC
05F7	DD22D04F	1918		LD	(MUZSP), IX	; SAVE THE STACK POINTER
05FB	C9	1919		RET		
		1920			NAME MUZSTP	
		1921			PURPOSE: STOP MUZCPU, SET PORTS TO 0	
05FC	AF	1922	MUZSTP:	XOR	A	
05FD	32EA4F	1923		LD	(DURAT), A	
0600	32F94F	1924		LD	(PRIOR), A	
0603	011808	1925		LD	BC, 800H+SNDBX	
0606	ED79	1926		OUT	(C), A	
0608	10FC	1927		DJNZ	-2	
060A	C9	1928		RET		

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1930 ; NAME: DO IT
1931 ; PURPOSE: TRANSFER CONTROL TO USER STATE TRANSITION
1932 ; INPUT: A = RETURN CODE FROM SENTRY ROUTINE
1933 ; HL = DO IT TABLE ADDRESS
1934 ; OUTPUT:
1935 ; DESCRIPTION: THIS ROUTINE IS USED WITH THE SENTRY ROUT
1936 ; IT IS USED FOR DISPATCHING TO A STATE TRANSITION
1937 ; ROUTINE. THE RETURN CODE FROM SENTRY IS USED TO
1938 ; SEARCH THE DOIT TABLE. IF A MATCH IS FOUND, CONT
1939 ; TRANSFERRED. IF NO MATCH IS FOUND, THE ROUTINE RE
1940 ; THE DOIT TABLE IS MADE UP OF THREE BYTE ENTRIES:
1941 ; BYTE 0 BIT 7: IF SET - DO A MCALL TO THIS HANDLER
1942 ; BYTE 0 BIT 6: IF SET - DO A RCALL TO THIS HANDLER
1943 ; BYTE 0 BITS 5-0: RETURN CODE THIS ROUTINE IS TO PR
1944 ; BYTE 1 AND 2: THE ADDRESS TO TRANSFER TO.
1945 ; THE LIST IS TERMINATED BY A BYTE WHICH IS .GE. OC
060B 78 1946 MDOITB LD A,B
060C D5 1947 MDOI PUSH DE
060D 57 1948 LD D,A
060E 7E 1949 MDOI LD A,(HL) ; GET RETURN CODE FOR THIS ENTR
060F 4F 1950 LD C,A ; C = CURRENT ENTRY
0610 FEC0 1951 CP COH ; LIST TERMINATOR?
0612 3802 1952 JR C,MDOI1-* ; NO JUMP
0614 D1 1953 POP DE ; YES RETURN
0615 C9 1954 RET
0616 23 1955 MDOI INC HL
0617 E63F 1956 AND 3FH
0619 BA 1957 CP D ; NORMAL MATCH?
061A 2804 1958 JR Z,MDOI2-* ; JUMP IF SO
061C 23 1959 MDOI INC HL ; NO MATCH - SKIP OVER
061D 23 1960 INC HL ; GO TO ADDRESS
061E 18EE 1961 JR MDOI3
0620 D1 1962 MDOI2: POP DE
0621 5E 1963 MDOI3: LD E,(HL) ; DE = AUTO ADDR
0622 23 1964 INC HL
0623 56 1965 LD D,(HL)
0624 EB 1966 EX DE,HL
0625 CB79 1967 BIT 7,C ; MCALL?
0627 C27D00 1968 JP NZ,MDOI4 ; JUMP IF SO
062A CB71 1969 BIT 6,C ; RCALL?
062C 2004 1970 JR NZ,MRCALL-* ; MUST BE JUMP
062E D1 1971 POP DE
062F F1 1972 POP AF
0630 E5 1973 PUSH HL
0631 EB 1974 EX DE,HL
; RCALL ROUTINE
0632 E9 1975 MRCALL: JP (HL)
1977 ; *****
1978 ; * VECTORIZING ROUTINES *
1979 ; *****
1980 ; NAME: VECTOR X AND Y COORDINATES
1981 ; PURPOSE: UPDATE X,Y COORDINATES AND LIMIT CHECK
1982 ; INPUT: IX = VECTOR PACKET
1983 ; HL = LIMITS TABLE
1984 ; OUTPUT: C = TIME BASE USED
1985 ; NONZERO STATUS SET IF OBJECT MOVED

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1986 ; NOTES:
1987 ; THIS ROUTINE WORKS WITH A 'VECTOR PACKET', WHICH LOG
1988 ; *****
1989 ; *BYTE* CONTENTS * NAME *
1990 ; *****
1991 ; * 00 * MAGIC REGISTER * VBMR *
1992 ; *****
1993 ; * 01 * VECTOR STATUS * VBSTAT *
1994 ; *****
1995 ; * 02 * TIME BASE * VBTIMB *
1996 ; *****
1997 ; * 03 * DELTA X * VBDXL *
1998 ; * 04 * * VBDXH *
1999 ; *****
2000 ; * 05 * X COORDINATE * VBXL *
2001 ; * 06 * * VBXH *
2002 ; *****
2003 ; * 07 * X CHECKS MASK * VBXCHK *
2004 ; *****
2005 ; * 08 * DELTA Y * VBDYL *
2006 ; * 09 * * VBDYH *
2007 ; *****
2008 ; * 0A * Y COORDINATE * VBYL *
2009 ; * 0B * * VBYH *
2010 ; *****
2011 ; * 0C * Y CHECKS MASK * VBYCHK *
2012 ; *****
2013 ;
2014 ; OPTIONS BYTE:
2015 ; B1 MEANING
2016 ; -----
2017 ; 7 VECTOR IS ACTIVE
2018 ;
2019 ; CHECKS BYTE:
2020 ; B1 MEANING
2021 ; -----
2022 ; 0 DO LIMIT CHECKS
2023 ; 1 REVERSE COORDINATES ON LIMIT ATTAINMENT
2024 ; 2 TARGET ATTAINED (OUTPUT)
2025 ; 3 IF THE VECTOR IS ACTIVE, AND THE TIME BASE IS NONZER
2026 ; THEN THE UPDATE COORDINATE ROUTINE IS CALLED FOR THE X
2027 ; AND Y PORTIONS OF THE PACKET.
0633 FDCB08F6 2028 MVECB SET PSWZD,(IX+CBFLAG) ; SET ZERO FLAG
0637 DDCB017E 2029 BIT VBSAD,(IX+VBSTAT) ; IS VECTOR ACTIVE?
063B DD4E02 2030 LD C,(IX+VBTIMB) ; TIME BASE TO C
063E DD360200 2031 LD (IX+VBTIMB),0 ; ZERO TIME BASE
0642 FD7106 2032 LD (IX+CBC),C ; PASS BACK TIME BASE
0645 C8 2033 RET Z
0646 79 2034 LD A,C
0647 A7 2035 AND A ; IS TIME BASE ZERO?
0648 C8 2036 RET Z ; QUIT IF SO
0649 110300 2037 LD DE,VBDXL ; ADVANCE TO FIRST
064C DD19 2038 ADD IX,DE
064E CD5606 2039 CALL MVECTC ; UPDATE FIRST COORDINATE
0651 110500 2040 LD DE,VBDYL-VBDXL ; TO Y
0654 DD19 2041 ADD IX,DE
2042 ; AND FALL INTO ...

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2043 ; NAME: VECTOR COORDINATE
2044 ; PURPOSE: UPDATE OF SINGLE COORDINATE
2045 ; INPUT: IX = POINTER TO L. O. DELTA BYTE OF VECTOR
2046 ; C = TIME BASE
2047 ; HL = LIMITS PACKET (IF USED)
2048 ; OUTPUT: NONZERO STATUS SET IF MOTION OCCURED
2049 ; (SHOULD BE SET ON CALL, SINCE IT IS NOT S
2050 ; NOTES:
2051 ; THIS ROUTINE OPERATES ON A SUBSET OF THE VECTOR PACK
2052 ; (BETWEEN L. O. DELTA BYTE AND CHECKS BYTE).
2053 ; THE DELTA IS ADDED TO THE COORDINATE TIME-BASE TIMES
2054 ; IF OPTIONED, LIMIT CHECKING IS DONE. IF THE CHECK FAI
2055 ; THE COORDINATE IS SET TO THE LIMIT.
2056 ; WHEN THIS HAPPENS, THE LIMIT ATTAINED BIT IS SET
0656 E5 2057 MVECTC: PUSH HL
0657 DD5601 2058 LD D, (IX+VBDCH) ; LOAD DELTA
065A DD5E00 2059 LD E, (IX+VBDCL)
065D DD6603 2060 LD H, (IX+VBCH) ; LOAD COORDINATE
0660 DD6E02 2061 LD L, (IX+VBCL)
0663 7C 2062 LD A, H ; SAVE OLD COORDINATE FOR MOTIO
0664 41 2063 LD B, C
0665 19 2064 MVECTA: ADD HL, DE ; ADD DELTA TO COORD
0666 10FD 2065 DJNZ MVECTB, * ; TIME-BASE TIMES
2066 ; IS MOTION OCCURED?
0668 BC 2067 CP H
0669 2904 2068 JR Z, MVECTA-* ; JUMP TO SKIP TESTS IF SO
066B FDCB08B6 2069 RES PSWZRO, (IX+CBFLAG) ; SET MOVED STATUS
2070 ; LIMIT CHECK WANTED?
066F DDCB0446 2071 MVECTA: BIT VBCLMT, (IX+VBCCHK)
0673 2931 2072 JR Z, MVECTB-* ; MVECTB IF NOT
2073 ; PERFORM LIMIT CHECK
0675 7C 2074 LD A, H
0676 E3 2075 EX (SP), H
0677 46 2076 LD B, (HL) ; LIMIT TO B
0678 23 2077 INC HL
2078 ; HANDLE SLIGHTLY LESS THAN ZERO CASE
0679 FECF 2079 CP 207 ; MIDPOINT BETWEEN 160 AND 0
067B 3007 2080 JR NC, MVECT2-* ; JUMP TO FAIL IF >207
067D B8 2081 CP B ; DO COMPARE
067E 3804 2082 JR C, MVECT2-* ; JUMP ON FAIL
0680 46 2083 LD B, (HL) ; UPPER LIMIT CHECK
0681 B8 2084 CP B
0682 3820 2085 JR C, MVECT3-* ; JUMP ON PASS
0684 23 2086 MVECT2: INC HL
2087 ; A LIMIT WAS EXCEEDED - SET COORDINATE AT LIMIT
0685 DD7003 2088 LD (IX+VBCH), B
0688 DD360200 2089 LD (IX+VBCL), 0
068C DDCB04DE 2090 SET VBCLAT, (IX+VBCCHK) ; SET LIMIT ATTAINED
2091 ; IS REVERSE DELTA OPTION SET?
0690 F1 2092 POP AF ; CLEAN UP STACK
0691 DDCB044E 2093 BIT VBCREV, (IX+VBCCHK)
0695 C8 2094 RET Z ; QUIT IF NOT
2095 ; REVERSE THE BIMBO
0696 7A 2096 LD A, D
0697 2F 2097 CPL
0698 57 2098 LD D, A
0699 7B 2099 LD A, E

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MODCOMP Z-80	CROSS	ASSEMBLER	HOME VIDEO GAME SYSTEM	PAGE	46	
ADDR	OBJECT	STMT	LABEL	OPCD	OPERAND	COMMENT
069A	2F	2100		CPL		
069B	5F	2101		LD	E, A	
069C	13	2102		INC	DE	
069D	DD7300	2103		LD	(IX+VBDCL), E ;	STORE BACK
06A0	DD7201	2104		LD	(IX+VBDCH), D	
06A3	C9	2105		RET		
06A4	23	2106	MVECT3:	INC	HL	; STEP PAST LIMIT
06A5	E3	2107		EX	(SP), HL	; HL = COORDINATE AGAIN
06A6	DD7502	2108	MVECT6:	LD	(IX+VBCL), L ;	STORE BACK COORDINATES
06A9	DD7403	2109		LD	(IX+VBCH), H	
06AC	E1	2110		POP	HL	; RESTORE LIMITS POINTER
06AD	DDCB049E	2111		RES	VBCLAT, (IX+VBCCHK) ;	CLEAR ATTAINED BIT
06B1	C9	2112		RET		

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2114 ; *****
2115 ; * PAINT RECTANGLE ROUTINE *
2116 ; *****
2117 ; NAME:          PAINT RECTANGLE
2118 ; INPUT:         A = COLOR MASK TO WRITE
2119 ;                B = Y SIZE
2120 ;                C = X SIZE
2121 ;                D = Y COORDINATE
2122 ;                E = X COORDINATE
06B2 AF      2123 MPAINT: XOR   A
06B3 CD4E0B  2124          CALL  RELTA1
06B6 EB      2125          EX    DE, HL
06B7 CBF4    2126          SET   6, H
06B9 D30C    2127          OUT  (MAGIC), A ; UNMAGIC THE ADDRESS
                XOR   A
06BB FD5E09  2129          LD   E, (IY+CBA)
06BE 79      2130          LD   A, C
06BF 0F      2131          RRCA
06C0 0F      2132          RRCA
06C1 E63F    2133          AND  3FH
06C3 3C      2134          INC  A
06C4 57      2135          LD   D, A
06C5 15      2136 MPT1:  DEC  D
06C6 2907    2137          JR   Z, MPT2-4
06C8 3EFF    2138          LD   A, OFFH
06CA CDE206  2139          CALL STRIPE
06CD 18F6    2140          JR   MPT1-4
06CF 79      2141 MPT2:  LD   A, C
06D0 E603    2142          AND  03H
06D2 3C      2143          INC  A
06D3 4F      2144          LD   C, A
06D4 AF      2145          XOR  A
06D5 0D      2146 MPT3:  DEC  C
06D6 2806    2147          JR   Z, MPT4-4
06D8 0F      2148          RRCA
06D9 0F      2149          RRCA
06DA C6C0    2150          ADD  A, 11000000B
06DC 18F7    2151          JR   MPT3-4
06DE CDE206  2152 MPT4:  CALL STRIPE
06E1 AF      2153          XOR  A
2154 ; AND    LL INTO ...
2155 ; STRIP PAINTER
2156 ; HL    ADDRESS OF STRIPE A = DATA B = MASK B = ITERATIONS
2157 ; OUT  L=HL+1 A = COORDERED
06E2 E3      2158 STRIP: PUSH HL
06E3 C5      2159          PUSH BC
06E4 32FF0F  2160          LD   (WASTE), A
06E7 3AFF4F  2161          LD   A, (WASTE+4000H)
06EA 4F      2162          LD   C, A
06EB 7B      2163 STRP1: LD   A, E
06EC AE      2164          XOR  (HL)
06ED A1      2165          AND  C
06EE AE      2166          XOR  (HL)
06EF 77      2167          LD   (HL), A
06F0 7D      2168          LD   A, L
06F1 C628    2169          ADD  A, BYTEPL
  
```

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06F3 6F      2170      LD    L, A
06F4 7C      2171      LD    A, H
06F5 CE00    2172      ADC  A, 0
06F7 67      2173      LD    H, A
06F8 10F1    2174      DJNZ STRP1-#
06FA C1      2175      POP  BC
06FB E1      2176      POP  HL
06FC 23      2177      INC  HL
06FD C9      2178      RET
```

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2180 ; *****
2181 ; * WRITE ROUTINES *
2182 ; *****
2183 ; NOTES: THE GENERAL CALLING SEQUENCE FOR THE WRI
2184 ; INPUT: HL = PATTERN ADDRESS
2185 ; D = Y COORDINATE
2186 ; E = X COORDINATE
2187 ; B = Y SIZE
2188 ; C = X SIZE
2189 ; A = MAGIC REGISTER
2190 ; OUTPUT: DE = SCREEN ADDRESS USED
2191 ; THESE ROUTINES ARE NESTED, FOR EXAMPLE
2192 ; WRITP, WHICH FALLS INTO WRIT, WHICH FALL
2193 ; ENTRY: WRITE FROM VECTOR
2194 ; INPUT: HL = PATTERN ADDRESS
2195 ; IX = VECTOR ADDRESS
2196 ; OUTPUT: DE, A
2197 ; SIDE EFFECTS: BLANK BIT SET IN VECTOR STATUS BYTE
06FE DD7E00 2198 MWRIT: LD A, (IX+VBMR) ; LOAD MR
0701 DD560B 2199 LD D, (IX+VBXH) ; LOAD Y
0704 DD5E06 2200 LD E, (IX+VBXH) ; LOAD X
0707 DDCB01F6 2201 SET VBBLNK, (IX+VBSTAT) ; SET BLANK BIT
2202 ; ENTRY: WRITE RELATIVE
2203 ; PURPOSE: WRITING RELATIVE PATTERNS
2204 ; INPUT: HL, DE, A
2205 ; OUTPUT: DE
2206 ; NOTES: PATTERN IS PRECEDED BY RELATIVE DISPLAC
2207 ; (X FIRST, THEN Y) AND PATTERN SIZE
070B F5 2208 MWRIT: PUSH AF ; SAVE MR
070C 7E 2209 LD A, (HL) ; GET HL X
070D 23 2210 INC HL
070E 83 2211 ADD A, E ; ADD TL SUPERIOR X
070F 5F 2212 LD E, A
0710 7E 2213 LD A, (HL) ; SAME MEMORY FOR Y
0711 23 2214 INC HL
0712 82 2215 ADD A, D
0713 57 2216 LD D, A
0714 F1 2217 POP AF
2218 ; ENTRY: WRITE WITH PATTERN SIZE SCARE-UP
2219 ; PURPOSE: WRITING VARIABLE SIZED PATTERNS
2220 ; INPUT: HL, DE, A
2221 ; OUTPUT: DE
2222 ; NOTES: FIRST TWO BYTES POINTED AT BY HL ARE TAK
2223 ; BE PATTERN SIZES (X SIZE FIRST)
0715 4E 2224 MWRIT: LD C, (HL) ; GET X SIZE
0716 23 2225 INC HL
0717 46 2226 LD B, (HL) ; AND Y
0718 23 2227 INC HL
2228 ; ENTRY: WRITE WITH COORDINATE CONVERSION
2229 ; INPUT: HL, DE, BC, A
2230 ; OUTPUT: DE
0719 CDF60A 2231 MWRIT: CALL MRELAB ; DO CONVERSION
2232 ; ENTRY: WRITE ABSOLUTE
2233 ; INPUT: HL, BC, A AS ABOVE
2234 ; DE = ABSOLUTE SCREEN ADDRESS
071C CB77 2235 MWRITA: BIT MRFLOP, A ; FLOP WRITE WANTED?

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ADDR	OBJECT	STMT	LABEL	OPCODE	OPERAND	COMMENT
071E	202C	2236		JR	NZ, MWRTFL-\$; MWRTFL IF SO
0720	CB5F	2237		BIT	MRXPND, A	; EXPAND WANTED?
0722	2011	2238		JR	NZ, MWX-\$	; JUMP IF SO
		2239			DO NORMAL? WRITE	
0724	AF	2240		XOR	A	
0725	C5	2241	MWRT:	PUSH	BC	
0726	D5	2242		PUSH	DE	
0727	47	2243		LD	B, A	; ZERO REGISTER B
0728	EDB0	2244		LDIR		; WRITE A LINE
072A	12	2245		LD	(DE), A	; CLEAR THE SHIFTER
072B	D1	2246		POP	DE	
072C	EB	2247		EX	DE, HL	; ADVANCE TO NEXT LINE
072D	0E28	2248		LD	C, BYTEPL	
072F	09	2249		ADD	HL, BC	
0730	EB	2250		EX	DE, HL	
0731	C1	2251		POP	BC	
0732	10F1	2252		DJNZ	MWRT-\$	; LOOP IF MORE GOODIES
0734	C9	2253		RET		
		2254			EXPANDED	
0735	EB	2255	MWX1	EX	DE, HL	
0736	C5	2256	MWX1	PUSH	BC	
0737	E5	2257		PUSH	HL	
0738	41	2258		LD	B, C	
0739	1A	2259	MWX2	LD	A, (DE)	
073A	13	2260		INC	DE	
073B	77	2261		LD	(HL), A	
073C	23	2262		INC	HL	
073D	77	2263		LD	(HL), A	
073E	23	2264		INC	HL	
073F	10F8	2265		DJNZ	MWX2-\$	
0741	70	2266		LD	(HL), A	
0742	23	2267		INC	HL	
0743	70	2268		LD	(HL), B	
0744	E1	2269		POP	HL	
0745	0E28	2270		LD	C, BYTEPL	
0747	09	2271		ADD	HL, BC	
0748	C1	2272		POP	BC	
0749	10EB	2273		DJNZ	MWX1	
074B	C9	2274		RET		
		2275			ROUTINE TO HANDLE FLOPPED CA	
074C	CB5F	2276	MWRT:	BIT	MRXPND, A	; EXPANDED FLOPPED WRITE WANTED
074E	2016	2277		JR	NZ, MWX-\$	; JUMP IF YEP
0750	AF	2278		XOR	A	
0751	C5	2279	WRFL1	PUSH	BC	
0752	D5	2280		PUSH	DE	
0753	47	2281		LD	B, A	
0754	EDA0	2282	WRFL1	LDI		
0756	1B	2283		DEC	DE	
0757	1B	2284		DEC	DE	
0758	EA5407	2285		JP	PE, WRFL2	
075B	12	2286		LD	(DE), A	
075C	D1	2287		POP	DE	
075D	EB	2288		EX	DE, HL	; SAME AS NORMAL NOW ON
075E	0E28	2289		LD	C, BYTEPL	
0760	09	2290		ADD	HL, BC	
0761	EB	2291		EX	DE, HL	
0762	C1	2292		POP	BC	

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0763 10EC      2293          DJNZ WRFL1-*
0765 C9       2294          RET
                2295 ; WRITE EXPANDED FLOPPED ROUTINE
0766 EB       2296 MWXF:   EX   DE, HL
0767 C5       2297 MWXF1:  PUSH BC
0768 E5       2298          PUSH HL
0769 41       2299          LD   B, C
076A 1A       2300 MWXF2:  LD   A, (DE)
076B 13       2301          INC  DE
076C 77       2302          LD   (HL), A
076D 2B       2303          DEC  HL
076E 77       2304          LD   (HL), A
076F 2B       2305          DEC  HL
0770 10F8     2306          DJNZ MWXF2-*
0772 70       2307          LD   (HL), B
0773 2B       2308          DEC  HL
0774 70       2309          LD   (HL), B
0775 E1       2310          POP  HL
0776 0E28     2311          LD   C, BYTEPL
0778 09       2312          ADD  HL, BC
0779 C1       2313          POP  BC
077A 10EB     2314          DJNZ MWXF1-*
077C C9       2315          RET
                2316 ; NAME:          BLANK FROM VECTOR
                2317 ; PURPOSE:       BLANK WITH INFO LOAD FROM VECTOR
                2318 ; INPUT:        IX = VECTOR
                2319 ;              E = X SIZE
                2320 ;              D = Y SIZE
                2321 ; NOTES:        THIS ROUTINE BLANKS TO 00
                2322 ;              THIS ROUTINE INTERROGATES THE BLANK BIT
                2323 ;              AND REFRAINS FROM BLANKING IF NOT SET
                2324 ;              IF IT WAS SET, IT IS THEN RESET
077D DDCB0176 2325 MVBLAN: BIT  VBBLNK (IX+VBSTAT) ; IS BLANK BIT SET?
0781 C8       2326          RET  Z          ; QUIET IF NOT
0782 DDCB01B6 2327          RES  VBBLNK (IX+VBSTAT) ; KILL BLANK BIT
0786 DD660E   2328          LD   H, (IX+BOAH) ; LOAD BLANK ADDRESS
0789 DD6E0D   2329          LD   L, (IX+BOAL)
078C DDCB0076 2330          BIT  MRFLOR (IX+VBMR) ; IS FLOP SET?
0790 2808     2331          JR   Z, MVBLA1-* ; JUMP IF NOT
0792 7B       2332          LD   A, E          ; X STATE TO A
0793 ED44     2333          NEG          ; TWO'S COMPLEMENT AND ADD 1
0795 3C       2334          INC  A
0796 4F       2335          LD   C, A
0797 06FF     2336          LD   B, OFF
0799 09       2337          ADD  HL, BC          ; USE B BACK UP SCREEN ADDRESS
                2338 ; UMMAGIC THE BLANK ADDRESS
079A         2339 MVBLA1:
079A CBF4     2340          SET  6, H
079C 0600     2341          LD   B, 0          ; ASSUME BLANK TO ZERO
                2342 ; NAME:          BLANK AREA
                2343 ; PURPOSE:       SETTING N X M REGION TO CONSTANT
                2344 ; INPUT:        HL = BLANK ADDRESS
                2345 ;              E = X SIZE
                2346 ;              D = Y SIZE
                2347 ;              B = DATA TO FILL WITH
079E 3E28     2348 MBLANK: LD   A, BYTEPL ; COMPUTE LINE INCREMENT
07A0 93       2349          SUB  E
  
```

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07A1 4F      2350      LD  C, A
07A2 78      2351      LD  A, B           ; A = DATA TO FILL WITH
07A3 43      2352  MBLAN1: LD  B, E
07A4 77      2353  MBLAN2: LD  (HL), A
07A5 23      2354      INC  HL
07A6 10FC    2355      DJNZ MBLAN2-*
07A8 09      2356      ADD  HL, BC
07A9 15      2357      DEC  D
07AA 20F7    2358      JR   NZ, MBLAN1-*
07AC C9      2359      RET

2360      ; NAME:          RESTORE AREA
2361      ; INPUT:        HL = SCREEN ADDRESS TO RESTORE TO
2362      ;             DE = SAVE AREA ADDRESS
2363      ; NOTE:       SIZES ARE LOADED FROM THE SAVE AREA
07AD EB      2364  MREST:  EX  DE, HL
07AE 4E      2365      LD  C, (HL)
07AF 23      2366      INC  HL
07B0 46      2367      LD  B, (HL)
07B1 23      2368      INC  HL
07B2 CBF2    2369      SET  6, D           ; MAKE SURE WE ARE NONMAGIC
07B4 AF      2370      XOR  A
07B5 C5      2371  MREST1: PUSH BC
07B6 D5      2372      PUSH DE
07B7 47      2373      LD  B, A
07B8 EDB0    2374      LDIR
07BA EB      2375      EX  DE, HL
07BB E1      2376      POP  HL
07BC 0E28    2377      LD  C, BTEPL
07BE 09      2378      ADD  HL, C
07BF EB      2379      EX  DE, HL
07C0 C1      2380      POP  B
07C1 10F2    2381      DJNZ MREST1-*
07C3 C9      2382      RET
  
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2384 ; *****
2385 ; * CHARACTER DISPLAY ROUTINES *
2386 ; *****
2387 ; NAME:          DISPLAY STRING
2388 ; PURPOSE:       MESSAGE DISPLAY
2389 ; INPUT:         E, D = X, Y COORDINATES
2390 ;               HL = STRING ADDRESS
2391 ;               IX = FONT DESCRIPTOR
2392 ; OUTPUT:        D, E ALTERED AS IN DISPLAY CHARACTER
2393 ; STACK USE:     4 BYTES (EXCLUDING USE BY SYSPCH)
2394 ; EXPLANATION:  AS EACH CHARACTER IS BROUGHT IN, IT
2395 ; IS TESTED FOR BEING A LIST TERMINATOR ( CHAR = 0)
2396 ; IF IT ISN'T, DISPLAY CHARACTER IS CALLED AND THE
2397 ; TEST IS REPEATED FOR THE NEXT CHARACTER.  THUS
2398 ; A NULL STRING IS HANDLED PROPERLY.
07C4 7E 2399 STRNEW: LD  A, (HL)      ; GET CHARACTER
07C5 A7 2400      AND  A              ; BE IT A TERMINATOR?
07C6 C3 2401      RET  Z              ; QUIT IF SO
07C7 FACE07 2402      JP  M, STRD1         ; DISPLAY IF ALT FONT
07CA FE64 2403      CP  64H             ; SUCK IN STRING?
07CC 3006 2404      JR  NC, STRD2-#    ; JUMP IF YES
07CE CDE107 2405 STRD1: CALL DISPCH      ; SHOW CHAR
07D1 23 2406      INC  HL              ; ADVANCE TO NEXT CHAR
07D2 18F0 2407      JR  STRNEW*         ; AND LOOP
07D4 E617 2408 STRD2: AND  10111B        ; MAKE SUCK MASK
07D6 47 2409      LD  B, A
07D7 23 2410      INC  HL
07D8 EB 2411      EX  DE, HL
07D9 CDA800 2412      CALL MSUCK
07DC CD6800 2413      CALL RELD
07DF 18E3 2414      JR  STRNEW*         ; GO AFTER NEXT CHARACTER
2415 ; *****
2416 ; * CHARACTER DISPLAY ROUTINE *
2417 ; *****
2418 ; INPUT:        A CHARACTER
2419 ;               C OPTIONS
2420 ;               D Y COORDINATE
2421 ;               E X COORDINATE
2422 ;               I FONT DESCRIPTOR
2423 ;               (ONLY IF ALTERNATE FONT USED)
2424 ; OUTPUT:       DE UPDATED TO POINT AT NEXT CHARACTER FROM
2425 ; NOTES:        THE OPTION BYTE IS FORMATTED AS FOLLOWS:
2426 ;             BITS  CONTENTS
2427 ;             ----  -----
2428 ;             0-1   OFF COLOR FOR EXPANSION
2429 ;             2-3   ON COLOR FOR EXPANSION
2430 ;             4     OR OPTION
2431 ;             5     XOR OPTION
2432 ;             6-7   ENLARGEMENT FACTOR (N+1)X
2433 ;
2434 ; CHARACTERS BETWEEN 1 AND 1FH, AND BETWEEN 91H AND 9FH
2435 ; ARE INTERPRETED AS TAB CHARACTERS.  THEY CAUSE THE
2436 ; CURSOR REPRESENTED BY D AND E TO BE SPACED OVER N
2437 ; CHARACTER POSITIONS, WHERE N = CHAR. AND. 7FH
2438 ; CHARACTERS BETWEEN 20H AND 7FH ARE TAKEN AS REFERENCES
2439 ; THE SYSTEM STANDARD 5 X 7 CHARACTER FONT.  CHARACTERS
  
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2440 ; BETWEEN OAOH AND OFFH REFER TO THE USER SUPPLIED ALTERN
2441 ; CHARACTER FONT. THIS FONT IS DESCRIBED BY A FONT
2442 ; DESCRIPTOR TABLE OF THE FOLLOWING FORMAT:
2443 ; *****
2444 ; * 0 * BASE CHARACTER VALUE *
2445 ; *****
2446 ; * 1 * X FRAME SIZE *
2447 ; *****
2448 ; * 2 * Y FRAME SIZE *
2449 ; *****
2450 ; * 3 * X PATTERN SIZE (BYTES) *
2451 ; *****
2452 ; * 4 * Y PATTERN SIZE *
2453 ; *****
2454 ; * 5 * PATTERN TABLE *
2455 ; * 6 * ADDRESS *
2456 ; *****
07E1 C5 2457 DISCH1: PUSH BC
07E2 E5 2458 PUSH HL
07E3 DDE5 2459 PUSH IX
07E5 A7 2460 AND A
07E6 FAED07 2461 JP M,DISCH1 ; JUMP IF YES
07E9 DD210602 2462 LD IX,S
07ED FE20 2463 DISCH1: CP 20H ; IS CHAR < 20H?
07EF 300D 2464 JR NC,DISCH1B-$ ; JUMP IF NOT
07F1 F5 2465 DISCH1A: PUSH AF ; LOAD TO SPACE OVER
07F2 CD4E08 2466 CALL NXTFRM
07F5 CDF40C 2467 CALL FINDL ; STORE IT BACK
07F8 F1 2468 POP AF
07F9 3D 2469 DEC A
07FA 20F5 2470 JR NZ,DISCH1A-$
07FC 183B 2471 JR DISCH1-$ ; JUMP TO EXIT
07FE DD9600 2472 DISCH1B: SUB (IX+FTBASE) ; SUBTRACT BASE CHAR
0801 5F 2473 LD E,A
0802 1600 2474 LD D,0
0804 210000 2475 LD HL,0
0807 DD4E03 2476 LD C,(IX+FTBYTE) ; MULTIPLY CHARACTER
080A DD4604 2477 DISCH2: LD B,(IX+FTYSIZ) ; BY PATTERN SIZE
080D 19 2478 DISCH3: ADD HL,DE
080E 10FD 2479 DJNZ DISCH3-$
0810 0D 2480 DEC C
0811 20F7 2481 JR NZ,DISCH2-$
0813 DD5606 2482 LD D,(IX+FTPTH) ; ADD TO TABLE START
0816 DD5E05 2483 LD E,(IX+FTPTL)
0819 19 2484 ADD HL,DE
2485 ; COMPUTE POSITION WHERE NEXT CHARACTER WOULD GO
2486 ; AND SAVE
081A CD4E08 2487 CALL NXTFRM ; STEP COORDINATES TO NEXT FRAM
081D D5 2488 PUSH DE ; SAVE
081E DD4604 2489 LD B,(IX+FTYSIZ)
0821 C5 2490 DISCH4: PUSH BC
0822 E5 2491 PUSH HL
0823 CD6C08 2492 CALL WRTLIN
0826 E1 2493 POP HL
0827 DD4E03 2494 LD C,(IX+FTBYTE) ; STEP TO NEXT LINE OF PATTERN
082A 09 2495 ADD HL,BC
082B C1 2496 POP BC
  
```

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082C FD7E05 2497 LD A, (IY+ CBD) ; ADVANCE Y COORDINATE
082F 81 2498 ADD A, C
0830 FD7705 2499 LD (IY+ CBD), A
0833 10EC 2500 DJNZ DISCH4-#
0835 D1 2501 POP DE ; RESTORE NEW POSITION
0836 CDF40C 2502 CALL FINDL3 ; STUFF DE BACK INTO CONTEXT
0839 DDE1 2503 DISCH5: POP IX
083B E1 2504 POP HL
083C C1 2505 POP BC
083D C9 2506 RET
2507 ; SUBROUTINE TO CONVERT ENLARGEMENT FACTOR TO ITERATION C
2508 ; INPUT: MODE BYTE FROM CONTEXT SAVE AREA
2509 ; OUTPUT: B, A = ITERATION COUNT
083E FD7E06 2510 DCLCTB: LD A, (IY+ CBC) ; GET MODE BYTE
0841 07 2511 RLCA
0842 07 2512 RLCA
0843 E603 2513 AND 03 ; ISOLATE ENLARGEMENT FACTOR
0845 3C 2514 INC A
0846 47 2515 LD B, A
0847 AF 2516 XOR A
0848 37 2517 SCF
0849 9F 2518 DCLCTC: ADC A, A
084A 10FD 2519 DJNZ DCLCTB-#
084C 47 2520 LD B, A
084D C9 2521 RET
2522 ; SUBROUTINE TO UPDATE COORDINATES TO POINT AT NEXT CHARA
2523 ; FRAME:
2524 ; INPUT: COORDINATES TAKEN FROM CBD, CBE IN CONTEXT
2525 ; OUTPUT: UPDATED COORDINATES RETURNED IN D AND E
2526 ; C = CLOBBERED C = ENLARGE FACTOR CONVERT
084E CD3E08 2527 NXTFRM: CALL DCLCTB ; GET ITERATION COUNT
0851 48 2528 LD C, B ; SAVE
0852 FD5605 2529 LD D, (IY+ CBD) ; GET X COORD
0855 FD7E04 2530 LD A, (IY+ CBE) ; GET Y COORD
0858 DD8601 2531 NXTFRX: ADD A, (IX+ TFSX) ; ADD X FRAME SIZE
085B 10FB 2532 DJNZ NXTFRM-# ; 2**ENLARGE TIMES
085D FEA0 2533 CP 160 ; PASS RIGHT EDGE OF SCREEN?
085F 3809 2534 JR C, NXTFRY-#
0861 7A 2535 LD A, D
0862 41 2536 LD B, C
0863 DD8602 2537 NXTFRY: ADD A, (IX+ TFSY) ; YEP - ADVANCE VERTICAL
0866 10FB 2538 DJNZ NXTFRX-#
0868 57 2539 LD D, A
0869 AF 2540 XOR A
086A 5F 2541 NXTFRY: LD E, A
086B C9 2542 RET
2543 ; SUBROUTINE TO WRITE ONE LINE OF A PATTERN WITH ENLARGE
2544 ; AND EXPAND
2545 ; ENTRY: HL = SOURCE IX = FONT TABLE
086C DD4E03 2546 WRTLIN: LD C, (IX+ FTBYTE)
086F 0600 2547 LD B, 0
0871 DDE5 2548 PUSH IX ; CAPTURE STACK POINTER
0873 DD210000 2549 LD IX, 0
0877 DD39 2550 ADD IX, SP
0879 DDE5 2551 PUSH IX ; SAVE CAPTURED STACK
087B D1 2552 POP DE ; DE = CAPTURED STACK
087C 3E0C 2553 LD A, 0CH ; SET EXPAND TO 00, 11
  
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ADDR	OBJECT	STMT	LABEL	OPCODE	OPERAND	COMMENT
087E	D319	2554		OUT	(XPAND), A	
0880	3E08	2555		LD	A, 08H	; SET EXPAND BIT
0882	D30C	2556		OUT	(MAGIC), A	
0884	FD7E06	2557		LD	A, (IY+CBC)	; GET CONTROL BYTE
0887	E6C0	2558		AND	0C0H	; ISOLATE ENLARGE AMOUNT
0889	2821	2559		JR	Z, WRTL3-\$	; JUMP IF ZERO
088B	07	2560		RLCA		
088C	07	2561		RLCA		
088D	EB	2562	WRTL1:	EX	DE, HL	
088E	A7	2563		AND	A	; CLEAR CARRY BIT
088F	ED42	2564		SBC	HL, BC	; COMPUTE STACK FRAME SIZE
0891	ED42	2565		SBC	HL, BC	
0893	F9	2566		LD	SP, HL	; SEIZE STACK SPACE
0894	CBB4	2567		RES	6, H	; MAGICIFY THE ADDRESS
0896	F5	2568		PUSH	AF	
0897	41	2569		LD	B, C	
0898	1A	2570	WRTL2:	LD	A, (DE)	; GET SOURCE BYTE
0899	13	2571		INC	DE	
089A	77	2572		LD	(HL), A	; EXPAND IT
089B	23	2573		INC	HL	
089C	77	2574		LD	(HL), A	
089D	23	2575		INC	HL	
089E	10F8	2576		DJNZ	WRTL3-\$	
08A0	CB21	2577		SLA	C	
08A2	F1	2578		POP	AF	
08A3	210000	2579		LD	HL, 0	; CAPTURE STACK TOP AGAIN
08A6	39	2580		ADD	HL, SP	
08A7	54	2581		LD	D, H	; SET DE=HL
08A8	5D	2582		LD	E, L	; FOR NEXT DEST COMBO
08A9	3D	2583		DEC	A	
08AA	20E1	2584		JR	NZ, WRTL1-\$	
		2585				; NOW DO WRITE TO SCREEN
08AC	CD3E08	2586	WRTL3:	CALL	DCLCTB	; GET ITERATION COUNTER
08AF	CD7400	2587		CALL	DELOB	
08B2	FD7E06	2588		LD	A, (IY+CBC)	
08B5	D319	2589		OUT	(XPAND), A	
08B7	E630	2590		AND	030H	
08B9	F608	2591		OR	8	
08BB	CD080B	2592		CALL	RELT	
08BE	EB	2593		EX	DE, HL	
08BF	F5	2594	WRTL4:	PUSH	AF	
08C0	C5	2595		PUSH	BC	
08C1	D5	2596		PUSH	DE	
08C2	E5	2597		PUSH	HL	
08C3	41	2598		LD	B, C	
08C4	1A	2599	WRTL5:	LD	A, (DE)	
08C5	13	2600		INC	DE	
08C6	77	2601		LD	(HL), A	
08C7	23	2602		INC	HL	
08C8	77	2603		LD	(HL), A	
08C9	23	2604		INC	HL	
08CA	10F8	2605		DJNZ	WRTL5-\$	
08CC	FD7E04	2606		LD	A, (IY+CBE)	
08CF	E603	2607		AND	03	
08D1	2801	2608		JR	Z, WRTL6-\$	
08D3	70	2609		LD	(HL), B	
08D4	E1	2610	WRTL6:	POP	HL	; STEP TO NEXT LINE

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08D5 0E28      2611      LD      C, BYTEPL
08D7 09        2612      ADD     HL, BC
08D8 D1        2613      POP     DE
08D9 C1        2614      POP     BC
08DA F1        2615      POP     AF
08DB D30C     2616      OUT    (MAGIC), A
08DD 10E0     2617      DJNZ   WRTL4-#
08DF DDF?     2618      LD      SP, IX      ; RESTORE STACK
08E1 DDE1     2619      POP     IX
08E3 C9        2620      RET
  
```

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2622      ; MACRO TO GENERATE CHARACTER PATTERN TABLE ENTRY
2623 DEFCHR MACR #A, #B, #C, #D, #E, #F, #G
2624      DEFB #A
2625      DEFB #B
2626      DEFB #C
2627      DEFB #D
2628      DEFB #E
2629      DEFB #F
2630      DEFB #G
2631      ENDM
  
```

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2633      ; LARGE CHARACTER SET (8 X 8)
08E4      2634 LRG  DEFCHR 000H, 000H, 000H, 000H, 000H, 000H, 000H, 000H ; SPACE
08E4 00    2635 +  DEFB 000H
08E5 00    2635 +  DEFB 000H
08E6 00    2635 +  DEFB 000H
08E7 00    2635 +  DEFB 000H
08E8 00    2635 +  DEFB 000H
08E9 00    2635 +  DEFB 000H
08EA 00    2635 +  DEFB 000H
08EB      2636 DEFCHR 020H, 020H, 020H, 020H, 020H, 000H, 020H ; !
08EB 20    2636 +  DEFB 020H
08EC 20    2636 +  DEFB 020H
08ED 20    2636 +  DEFB 020H
08EE 20    2636 +  DEFB 020H
08EF 20    2636 +  DEFB 020H
08F0 00    2636 +  DEFB 000H
08F1 20    2636 +  DEFB 020H
08F2      2637 DEFCHR 050H, 050H, 050H, 000H, 000H, 000H, 000H ; "
08F2 50    2637 +  DEFB 050H
08F3 50    2637 +  DEFB 050H
08F4 50    2637 +  DEFB 050H
08F5 00    2637 +  DEFB 000H
08F6 00    2637 +  DEFB 000H
08F7 00    2637 +  DEFB 000H
08F8 00    2637 +  DEFB 000H
08F9      2638 DEFCHR 048H, 048H, 0FCH, 048H, 0FCH, 048H, 048H ; #
08F9 48    2638 +  DEFB 048H
08FA 48    2638 +  DEFB 048H
08FB FC    2638 +  DEFB 0FCH
08FC 48    2638 +  DEFB 048H
  
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08FD	FC	2638	+	DEFB	0FCH	
08FE	48	2638	+	DEFB	048H	
08FF	48	2638	+	DEFB	048H	
0900		2639		DEFCHR	020H, 078H, 080H, 070H, 008H, 0F0H, 020H ; \$	
0900	20	2639	+	DEFB	020H	
0901	78	2639	+	DEFB	078H	
0902	80	2639	+	DEFB	080H	
0903	70	2639	+	DEFB	070H	
0904	08	2639	+	DEFB	008H	
0905	F0	2639	+	DEFB	0F0H	
0906	20	2639	+	DEFB	020H	
0907		2640		DEFCHR	0C0H, 0C8H, 010H, 020H, 040H, 098H, 018H ; %	
0907	C0	2640	+	DEFB	0C0H	
0908	C8	2640	+	DEFB	0C8H	
0909	10	2640	+	DEFB	010H	
090A	20	2640	+	DEFB	020H	
090B	40	2640	+	DEFB	040H	
090C	98	2640	+	DEFB	098H	
090D	18	2640	+	DEFB	018H	
090E		2641		DEFCHR	060H, 090H, 0A0H, 040H, 0A8H, 090H, 068H ; &	
090E	60	2641	+	DEFB	060H	
090F	90	2641	+	DEFB	090H	
0910	A0	2641	+	DEFB	0A0H	
0911	40	2641	+	DEFB	040H	
0912	A8	2641	+	DEFB	0A8H	
0913	90	2641	+	DEFB	090H	
0914	68	2641	+	DEFB	068H	
0915		2642		DEFCHR	060H, 060H, 060H, 000H, 000H, 000H ;	
0915	60	2642	+	DEFB	060H	
0916	60	2642	+	DEFB	060H	
0917	60	2642	+	DEFB	060H	
0918	00	2642	+	DEFB	000H	
0919	00	2642	+	DEFB	000H	
091A	00	2642	+	DEFB	000H	
091B	00	2642	+	DEFB	000H	
091C		2643		DEFCHR	010H, 020H, 020H, 020H, 020H, 010H ; (
091C	10	2643	+	DEFB	010H	
091D	20	2643	+	DEFB	020H	
091E	20	2643	+	DEFB	020H	
091F	20	2643	+	DEFB	020H	
0920	20	2643	+	DEFB	020H	
0921	20	2643	+	DEFB	020H	
0922	10	2643	+	DEFB	010H	
0923		2644		DEFCHR	040H, 020H, 020H, 020H, 020H, 040H ;)	
0923	40	2644	+	DEFB	040H	
0924	20	2644	+	DEFB	020H	
0925	20	2644	+	DEFB	020H	
0926	20	2644	+	DEFB	020H	
0927	20	2644	+	DEFB	020H	
0928	20	2644	+	DEFB	020H	
0929	40	2644	+	DEFB	040H	
092A		2645		DEFCHR	000H, 0A8H, 070H, 0D8H, 070H, 0A8H, 000H ; *	
092A	00	2645	+	DEFB	000H	
092B	A8	2645	+	DEFB	0A8H	
092C	70	2645	+	DEFB	070H	
092D	D8	2645	+	DEFB	0D8H	
092E	70	2645	+	DEFB	070H	

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ADDR	OBJECT	STMT	LABEL	OPCD	OPERAND	COMMENT
092F	A8	2645	+	DEFB	0A8H	
0930	00	2645	+	DEFB	000H	
0931		2646		DEFCHR	000H, 020H, 020H, 0F8H, 020H, 020H, 000H ; +	
0931	00	2646	+	DEFB	000H	
0932	20	2646	+	DEFB	020H	
0933	20	2646	+	DEFB	020H	
0934	F8	2646	+	DEFB	0F8H	
0935	20	2646	+	DEFB	020H	
0936	20	2646	+	DEFB	020H	
0937	00	2646	+	DEFB	000H	
0938		2647		DEFCHR	000H, 000H, 000H, 060H, 060H, 020H, 040H ; ,	
0938	00	2647	+	DEFB	000H	
0939	00	2647	+	DEFB	000H	
093A	00	2647	+	DEFB	000H	
093B	60	2647	+	DEFB	060H	
093C	60	2647	+	DEFB	060H	
093D	20	2647	+	DEFB	020H	
093E	40	2647	+	DEFB	040H	
093F		2648		DEFCHR	000H, 000H, 000H, 0F8H, 000H, 000H, 000H ; -	
093F	00	2648	+	DEFB	000H	
0940	00	2648	+	DEFB	000H	
0941	00	2648	+	DEFB	000H	
0942	F8	2648	+	DEFB	0F8H	
0943	00	2648	+	DEFB	000H	
0944	00	2648	+	DEFB	000H	
0945	00	2648	+	DEFB	000H	
0946		2649		DEFCHR	000H, 000H, 000H, 000H, 060H, 060H ;	
0946	00	2649	+	DEFB	000H	
0947	00	2649	+	DEFB	000H	
0948	00	2649	+	DEFB	000H	
0949	00	2649	+	DEFB	000H	
094A	00	2649	+	DEFB	000H	
094B	60	2649	+	DEFB	060H	
094C	60	2649	+	DEFB	060H	
094D		2650		DEFCHR	000H, 008H, 010H, 020H, 040H, 080H, 000H ;	
094D	00	2650	+	DEFB	000H	
094E	08	2650	+	DEFB	008H	
094F	10	2650	+	DEFB	010H	
0950	20	2650	+	DEFB	020H	
0951	40	2650	+	DEFB	040H	
0952	80	2650	+	DEFB	080H	
0953	00	2650	+	DEFB	000H	
0954		2651		DEFCHR	070H, 088H, 088H, 088H, 088H, 088H, 070H ; 0	
0954	70	2651	+	DEFB	070H	
0955	88	2651	+	DEFB	088H	
0956	88	2651	+	DEFB	088H	
0957	88	2651	+	DEFB	088H	
0958	88	2651	+	DEFB	088H	
0959	88	2651	+	DEFB	088H	
095A	70	2651	+	DEFB	070H	
095B		2652		DEFCHR	020H, 060H, 020H, 020H, 020H, 020H, 070H ; 1	
095B	20	2652	+	DEFB	020H	
095C	60	2652	+	DEFB	060H	
095D	20	2652	+	DEFB	020H	
095E	20	2652	+	DEFB	020H	
095F	20	2652	+	DEFB	020H	
0960	20	2652	+	DEFB	020H	

PROPRIETARY INFORMATION

Dave Nutting Associates, Inc.

DO NOT REPRODUCE

0961	70	2652	+	DEFB	070H	
0962		2653		DEFCHR	070H, 088H, 008H, 070H, 080H, 030H, 0F8H ;	2
0962	70	2653	+	DEFB	070H	
0963	88	2653	+	DEFB	088H	
0964	08	2653	+	DEFB	008H	
0965	70	2653	+	DEFB	070H	
0966	80	2653	+	DEFB	080H	
0967	80	2653	+	DEFB	080H	
0968	F8	2653	+	DEFB	0F8H	
0969		2654		DEFCHR	070H, 088H, 008H, 030H, 008H, 088H, 070H ;	3
0969	70	2654	+	DEFB	070H	
096A	88	2654	+	DEFB	088H	
096B	08	2654	+	DEFB	008H	
096C	30	2654	+	DEFB	030H	
096D	08	2654	+	DEFB	008H	
096E	88	2654	+	DEFB	088H	
096F	70	2654	+	DEFB	070H	
0970		2655		DEFCHR	010H, 030H, 050H, 090H, 0F8H, 010H, 010H ;	4
0970	10	2655	+	DEFB	010H	
0971	30	2655	+	DEFB	030H	
0972	50	2655	+	DEFB	050H	
0973	90	2655	+	DEFB	090H	
0974	F8	2655	+	DEFB	0F8H	
0975	10	2655	+	DEFB	010H	
0976	10	2655	+	DEFB	010H	
0977		2656		DEFCHR	0F8H, 080H, 0F0H, 088H, 008H, 088H, 070H ;	5
0977	F8	2656	+	DEFB	0F8H	
0978	80	2656	+	DEFB	080H	
0979	F0	2656	+	DEFB	0F0H	
097A	08	2656	+	DEFB	008H	
097B	08	2656	+	DEFB	008H	
097C	88	2656	+	DEFB	088H	
097D	70	2656	+	DEFB	070H	
097E		2657		DEFCHR	030H, 040H, 080H, 0F8H, 088H, 088H, 070H ;	6
097E	30	2657	+	DEFB	030H	
097F	40	2657	+	DEFB	040H	
0980	80	2657	+	DEFB	080H	
0981	F0	2657	+	DEFB	0F0H	
0982	88	2657	+	DEFB	088H	
0983	88	2657	+	DEFB	088H	
0984	70	2657	+	DEFB	070H	
0985		2658		DEFCHR	0F8H, 008H, 010H, 020H, 040H, 040H, 040H ;	7
0985	F8	2658	+	DEFB	0F8H	
0986	08	2658	+	DEFB	008H	
0987	10	2658	+	DEFB	010H	
0988	20	2658	+	DEFB	020H	
0989	40	2658	+	DEFB	040H	
098A	40	2658	+	DEFB	040H	
098B	40	2658	+	DEFB	040H	
098C		2659		DEFCHR	070H, 088H, 088H, 070H, 088H, 088H, 070H ;	8
098C	70	2659	+	DEFB	070H	
098D	88	2659	+	DEFB	088H	
098E	88	2659	+	DEFB	088H	
098F	70	2659	+	DEFB	070H	
0990	88	2659	+	DEFB	088H	
0991	88	2659	+	DEFB	088H	
0992	70	2659	+	DEFB	070H	

PROPRIETARY INFORMATION

DO NOT REPRODUCE

Dave Nutting Associates, Inc.

ADDR	OBJECT	STMT	LABEL	OPCD	OPERAND	COMMENT
0993		2660		DEFCHR	070H, 088H, 088H, 079H, 008H, 010H, 060H ;	9
0993	70	2660	+	DEFB	070H	
0994	88	2660	+	DEFB	088H	
0995	88	2660	+	DEFB	088H	
0996	78	2660	+	DEFB	078H	
0997	08	2660	+	DEFB	008H	
0998	10	2660	+	DEFB	010H	
0999	60	2660	+	DEFB	060H	
099A		2661		DEFCHR	000H, 060H, 060H, 000H, 060H, 060H, 000H ;	:
099A	00	2661	+	DEFB	000H	
099B	60	2661	+	DEFB	060H	
099C	60	2661	+	DEFB	060H	
099D	00	2661	+	DEFB	000H	
099E	60	2661	+	DEFB	060H	
099F	60	2661	+	DEFB	060H	
09A0	00	2661	+	DEFB	000H	
09A1		2662		DEFCHR	060H, 060H, 000H, 060H, 060H, 020H, 040H ;	:
09A1	60	2662	+	DEFB	060H	
09A2	60	2662	+	DEFB	060H	
09A3	00	2662	+	DEFB	000H	
09A4	60	2662	+	DEFB	060H	
09A5	60	2662	+	DEFB	060H	
09A6	20	2662	+	DEFB	020H	
09A7	40	2662	+	DEFB	040H	
09A8		2663		DEFCHR	010H, 020H, 040H, 080H, 040H, 020H, 010H ;	<
09A8	10	2663	+	DEFB	010H	
09A9	20	2663	+	DEFB	020H	
09AA	40	2663	+	DEFB	040H	
09AB	80	2663	+	DEFB	080H	
09AC	40	2663	+	DEFB	040H	
09AD	20	2663	+	DEFB	020H	
09AE	10	2663	+	DEFB	010H	
09AF		2664		DEFCHR	000H, 000H, 0F8H, 000H, 0F8H, 000H, 000H ;	=
09AF	00	2664	+	DEFB	000H	
09B0	00	2664	+	DEFB	000H	
09B1	F8	2664	+	DEFB	0F8H	
09B2	00	2664	+	DEFB	000H	
09B3	F8	2664	+	DEFB	0F8H	
09B4	00	2664	+	DEFB	000H	
09B5	00	2664	+	DEFB	000H	
09B6		2665		DEFCHR	040H, 020H, 010H, 000H, 010H, 020H, 040H ;	>
09B6	40	2665	+	DEFB	040H	
09B7	20	2665	+	DEFB	020H	
09B8	10	2665	+	DEFB	010H	
09B9	08	2665	+	DEFB	008H	
09BA	10	2665	+	DEFB	010H	
09BB	20	2665	+	DEFB	020H	
09BC	40	2665	+	DEFB	040H	
09BD		2666		DEFCHR	070H, 088H, 008H, 010H, 020H, 000H, 020H ;	?
09BD	70	2666	+	DEFB	070H	
09BE	88	2666	+	DEFB	088H	
09BF	08	2666	+	DEFB	008H	
09C0	10	2666	+	DEFB	010H	
09C1	20	2666	+	DEFB	020H	
09C2	00	2666	+	DEFB	000H	
09C3	20	2666	+	DEFB	020H	
09C4		2667		DEFCHR	070H, 088H, 088H, 0A8H, 0B8H, 080H, 079H ;	@

PROPRIETARY INFORMATION

Dave Nutting Associates, Inc.

DO NOT REPRODUCE

ADDR	OBJECT	STMT	LABEL	OPCD	OPERAND	COMMENT
09C4	70	2667	+	DEFB	070H	
09C5	88	2667	+	DEFB	088H	
09C6	B8	2667	+	DEFB	0B8H	
09C7	A8	2667	+	DEFB	0A8H	
09C8	B8	2667	+	DEFB	0B8H	
09C9	80	2667	+	DEFB	080H	
09CA	78	2667	+	DEFB	078H	
09CB		2668		DEFCHR	070H, 088H, 088H, 0F8H, 088H, 088H, 088H ;	A
09CB	70	2668	+	DEFB	070H	
09CC	88	2668	+	DEFB	088H	
09CD	88	2668	+	DEFB	088H	
09CE	F8	2668	+	DEFB	0F8H	
09CF	88	2668	+	DEFB	088H	
09D0	88	2668	+	DEFB	088H	
09D1	88	2668	+	DEFB	088H	
09D2		2669		DEFCHR	0F0H, 088H, 088H, 0F0H, 088H, 088H, 0F0H ;	B
09D2	F0	2669	+	DEFB	0F0H	
09D3	88	2669	+	DEFB	088H	
09D4	88	2669	+	DEFB	088H	
09D5	F0	2669	+	DEFB	0F0H	
09D6	88	2669	+	DEFB	088H	
09D7	88	2669	+	DEFB	088H	
09D8	F0	2669	+	DEFB	0F0H	
09D9		2670		DEFCHR	070H, 088H, 080H, 080H, 080H, 088H, 070H ;	C
09D9	70	2670	+	DEFB	070H	
09DA	88	2670	+	DEFB	088H	
09DB	80	2670	+	DEFB	080H	
09DC	80	2670	+	DEFB	080H	
09DD	80	2670	+	DEFB	080H	
09DE	88	2670	+	DEFB	088H	
09DF	70	2670	+	DEFB	070H	
09E0		2671		DEFCHR	0F0H, 088H, 088H, 088H, 088H, 088H, 0F0H ;	D
09E0	F0	2671	+	DEFB	0F0H	
09E1	88	2671	+	DEFB	088H	
09E2	88	2671	+	DEFB	088H	
09E3	88	2671	+	DEFB	088H	
09E4	88	2671	+	DEFB	088H	
09E5	88	2671	+	DEFB	088H	
09E6	F0	2671	+	DEFB	0F0H	
09E7		2672		DEFCHR	0F8H, 080H, 080H, 0E0H, 080H, 080H, 0F8H ;	E
09E7	F8	2672	+	DEFB	0F8H	
09E8	80	2672	+	DEFB	080H	
09E9	80	2672	+	DEFB	080H	
09EA	E0	2672	+	DEFB	0E0H	
09EB	80	2672	+	DEFB	080H	
09EC	80	2672	+	DEFB	080H	
09ED	F8	2672	+	DEFB	0F8H	
09EE		2673		DEFCHR	0F8H, 080H, 080H, 0E0H, 080H, 080H, 080H ;	F
09EE	F8	2673	+	DEFB	0F8H	
09EF	80	2673	+	DEFB	080H	
09F0	80	2673	+	DEFB	080H	
09F1	E0	2673	+	DEFB	0E0H	
09F2	80	2673	+	DEFB	080H	
09F3	80	2673	+	DEFB	080H	
09F4	80	2673	+	DEFB	080H	
09F5		2674		DEFCHR	070H, 088H, 080H, 080H, 098H, 088H, 078H ;	G
09F5	70	2674	+	DEFB	070H	

PROPRIETARY INFORMATION

Dave Nutting Associates, Inc.

DO NOT REPRODUCE

09F6	88	2674	+	DEFB	088H	
09F7	80	2674	+	DEFB	080H	
09F8	80	2674	+	DEFB	080H	
09F9	98	2674	+	DEFB	098H	
09FA	88	2674	+	DEFB	088H	
09FB	78	2674	+	DEFB	078H	
09FC		2675		DEFCHR	088H, 088H, 088H, 0F8H, 088H, 088H, 088H ;	H
09FD	88	2675	+	DEFB	088H	
09FE	88	2675	+	DEFB	088H	
09FF	F8	2675	+	DEFB	0F8H	
0A00	88	2675	+	DEFB	088H	
0A01	88	2675	+	DEFB	088H	
0A02	88	2675	+	DEFB	088H	
0A03		2676		DEFCHR	070H, 020H, 020H, 020H, 020H, 020H, 070H ;	I
0A03	70	2676	+	DEFB	070H	
0A04	20	2676	+	DEFB	020H	
0A05	20	2676	+	DEFB	020H	
0A06	20	2676	+	DEFB	020H	
0A07	20	2676	+	DEFB	020H	
0A08	20	2676	+	DEFB	020H	
0A09	70	2676	+	DEFB	070H	
0A0A		2677		DEFCHR	008H, 008H, 008H, 008H, 088H, 070H ;	J
0A0A	08	2677	+	DEFB	008H	
0A0B	08	2677	+	DEFB	008H	
0A0C	08	2677	+	DEFB	008H	
0A0D	08	2677	+	DEFB	008H	
0A0E	08	2677	+	DEFB	008H	
0A0F	88	2677	+	DEFB	088H	
0A10	70	2677	+	DEFB	070H	
0A11		2678		DEFCHR	088H, 090H, 0A0H, 0A0H, 090H, 088H ;	K
0A11	88	2678	+	DEFB	088H	
0A12	90	2678	+	DEFB	090H	
0A13	A0	2678	+	DEFB	0A0H	
0A14	C0	2678	+	DEFB	0C0H	
0A15	A0	2678	+	DEFB	0A0H	
0A16	90	2678	+	DEFB	090H	
0A17	88	2678	+	DEFB	088H	
0A18		2679		DEFCHR	080H, 080H, 080H, 080H, 080H, 0F8H ;	L
0A18	80	2679	+	DEFB	080H	
0A19	80	2679	+	DEFB	080H	
0A1A	80	2679	+	DEFB	080H	
0A1B	80	2679	+	DEFB	080H	
0A1C	80	2679	+	DEFB	080H	
0A1D	80	2679	+	DEFB	080H	
0A1E	F8	2679	+	DEFB	0F8H	
0A1F		2680		DEFCHR	088H, 0D8H, 0A8H, 0A8H, 088H, 088H, 088H ;	M
0A1F	88	2680	+	DEFB	088H	
0A20	D8	2680	+	DEFB	0D8H	
0A21	A8	2680	+	DEFB	0A8H	
0A22	A8	2680	+	DEFB	0A8H	
0A23	88	2680	+	DEFB	088H	
0A24	88	2680	+	DEFB	088H	
0A25	88	2680	+	DEFB	088H	
0A26		2681		DEFCHR	088H, 0C8H, 0A8H, 098H, 088H, 088H, 088H ;	N
0A26	88	2681	+	DEFB	088H	
0A27	C8	2681	+	DEFB	0C8H	

PROPRIETARY INFORMATION

Dave Nutting Associates, Inc

DO NOT REPRODUCE

0A28	A8	2681	+	DEFB	0A8H	
0A29	98	2681	+	DEFB	098H	
0A2A	88	2681	+	DEFB	088H	
0A2B	88	2681	+	DEFB	088H	
0A2C	88	2681	+	DEFB	088H	
0A2D		2682		DEFCHR	0F8H, 0E8H, 0D8H, 0C8H, 0B8H, 0A8H, 0F8H ;	0
0A2D	F8	2682	+	DEFB	0F8H	
0A2E	88	2682	+	DEFB	088H	
0A2F	88	2682	+	DEFB	088H	
0A30	88	2682	+	DEFB	088H	
0A31	88	2682	+	DEFB	088H	
0A32	88	2682	+	DEFB	088H	
0A33	F8	2682	+	DEFB	0F8H	
0A34		2683		DEFCHR	0F0H, 0E8H, 0D8H, 0C8H, 0B8H, 0A8H, 080H ;	P
0A34	F0	2683	+	DEFB	0F0H	
0A35	88	2683	+	DEFB	088H	
0A36	88	2683	+	DEFB	088H	
0A37	F0	2683	+	DEFB	0F0H	
0A38	80	2683	+	DEFB	080H	
0A39	80	2683	+	DEFB	080H	
0A3A	80	2683	+	DEFB	080H	
0A3B		2684		DEFCHR	070H, 068H, 058H, 048H, 0A8H, 090H, 068H ;	Q
0A3B	70	2684	+	DEFB	070H	
0A3C	88	2684	+	DEFB	088H	
0A3D	88	2684	+	DEFB	088H	
0A3E	88	2684	+	DEFB	088H	
0A3F	A8	2684	+	DEFB	0A8H	
0A40	90	2684	+	DEFB	090H	
0A41	68	2684	+	DEFB	068H	
0A42		2685		DEFCHR	0F0H, 0E8H, 0D8H, 0C8H, 0A0H, 090H, 088H ;	R
0A42	F0	2685	+	DEFB	0F0H	
0A43	88	2685	+	DEFB	088H	
0A44	88	2685	+	DEFB	088H	
0A45	F0	2685	+	DEFB	0F0H	
0A46	A0	2685	+	DEFB	0A0H	
0A47	90	2685	+	DEFB	090H	
0A48	88	2685	+	DEFB	088H	
0A49		2686		DEFCHR	070H, 068H, 060H, 070H, 008H, 088H, 070H ;	S
0A49	70	2686	+	DEFB	070H	
0A4A	88	2686	+	DEFB	088H	
0A4B	80	2686	+	DEFB	080H	
0A4C	70	2686	+	DEFB	070H	
0A4D	08	2686	+	DEFB	008H	
0A4E	88	2686	+	DEFB	088H	
0A4F	70	2686	+	DEFB	070H	
0A50		2687		DEFCHR	0F8H, 020H, 020H, 020H, 020H, 020H, 020H ;	T
0A50	F8	2687	+	DEFB	0F8H	
0A51	20	2687	+	DEFB	020H	
0A52	20	2687	+	DEFB	020H	
0A53	20	2687	+	DEFB	020H	
0A54	20	2687	+	DEFB	020H	
0A55	20	2687	+	DEFB	020H	
0A56	20	2687	+	DEFB	020H	
0A57		2688		DEFCHR	088H, 088H, 088H, 088H, 088H, 088H, 070H ;	U
0A57	88	2688	+	DEFB	088H	
0A58	88	2688	+	DEFB	088H	
0A59	88	2688	+	DEFB	088H	

PROPRIETARY INFORMATION

Dave Nolling Associates, Inc.

DO NOT REPRODUCE

ADDR	OBJECT	STMT	LABEL	OPCODE	OPERAND	COMMENT
0A5A	38	2688	+	DEFB	088H	
0A5B	38	2688	+	DEFB	088H	
0A5C	38	2688	+	DEFB	088H	
0A5D	70	2688	+	DEFB	070H	
0A5E		2689		DEFCHR	088H, 088H, 088H, 050H, 050H, 020H, 020H ;	V
0A5E	38	2689	+	DEFB	088H	
0A5F	38	2689	+	DEFB	088H	
0A60	38	2689	+	DEFB	088H	
0A61	50	2689	+	DEFB	050H	
0A62	50	2689	+	DEFB	050H	
0A63	20	2689	+	DEFB	020H	
0A64	20	2689	+	DEFB	020H	
0A65		2690		DEFCHR	088H, 088H, 088H, 0A8H, 0A8H, 0D8H, 088H ;	W
0A65	38	2690	+	DEFB	088H	
0A66	38	2690	+	DEFB	088H	
0A67	38	2690	+	DEFB	088H	
0A68	A8	2690	+	DEFB	0A8H	
0A69	A8	2690	+	DEFB	0A8H	
0A6A	D8	2690	+	DEFB	0D8H	
0A6B	38	2690	+	DEFB	088H	
0A6C		2691		DEFCHR	088H, 088H, 050H, 020H, 050H, 088H, 088H ;	X
0A6C	38	2691	+	DEFB	088H	
0A6D	38	2691	+	DEFB	088H	
0A6E	50	2691	+	DEFB	050H	
0A6F	20	2691	+	DEFB	020H	
0A70	50	2691	+	DEFB	050H	
0A71	38	2691	+	DEFB	088H	
0A72	38	2691	+	DEFB	088H	
0A73		2692		DEFCHR	088H, 088H, 050H, 020H, 020H, 020H ;	Y
0A73	38	2692	+	DEFB	088H	
0A74	38	2692	+	DEFB	088H	
0A75	50	2692	+	DEFB	050H	
0A76	20	2692	+	DEFB	020H	
0A77	20	2692	+	DEFB	020H	
0A78	20	2692	+	DEFB	020H	
0A79	20	2692	+	DEFB	020H	
0A7A		2693		DEFCHR	0F8H, 008H, 010H, 040H, 040H, 080H, 0F8H ;	Z
0A7A	F8	2693	+	DEFB	0F8H	
0A7B	08	2693	+	DEFB	008H	
0A7C	10	2693	+	DEFB	010H	
0A7D	20	2693	+	DEFB	020H	
0A7E	40	2693	+	DEFB	040H	
0A7F	80	2693	+	DEFB	080H	
0A80	F8	2693	+	DEFB	0F8H	
0A81		2694		DEFCHR	070H, 040H, 040H, 040H, 040H, 040H, 070H ;	[
0A81	70	2694	+	DEFB	070H	
0A82	40	2694	+	DEFB	040H	
0A83	40	2694	+	DEFB	040H	
0A84	40	2694	+	DEFB	040H	
0A85	40	2694	+	DEFB	040H	
0A86	40	2694	+	DEFB	040H	
0A87	70	2694	+	DEFB	070H	
0A88		2695		DEFCHR	000H, 080H, 040H, 020H, 010H, 008H, 000H ;	\
0A88	00	2695	+	DEFB	000H	
0A89	80	2695	+	DEFB	080H	
0A8A	40	2695	+	DEFB	040H	
0A8B	20	2695	+	DEFB	020H	

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0A8C	10	2695	+	DEFB	010H	
0A8D	08	2695	+	DEFB	008H	
0A8E	00	2695	+	DEFB	000H	
0A8F		2696		DEFCHR	070H, 010H, 010H, 010H, 010H, 010H, 070H ;	J
0A90	70	2696	+	DEFB	070H	
0A91	10	2696	+	DEFB	010H	
0A92	10	2696	+	DEFB	010H	
0A93	10	2696	+	DEFB	010H	
0A94	10	2696	+	DEFB	010H	
0A95	70	2696	+	DEFB	070H	
0A96		2697		DEFCHR	020H, 070H, 0A8H, 020H, 020H, 020H, 020H ;	^
0A97	20	2697	+	DEFB	020H	
0A98	70	2697	+	DEFB	070H	
0A99	A8	2697	+	DEFB	0A8H	
0A9A	20	2697	+	DEFB	020H	
0A9B	20	2697	+	DEFB	020H	
0A9C	20	2697	+	DEFB	020H	
0A9D		2698		DEFCHR	000H, 020H, 040H, 0F8H, 040H, 020H, 000H ;	+
0A9E	00	2698	+	DEFB	000H	
0A9F	20	2698	+	DEFB	020H	
0AA0	40	2698	+	DEFB	040H	
0AA1	F8	2698	+	DEFB	0F8H	
0AA2	40	2698	+	DEFB	040H	
0AA3	20	2698	+	DEFB	020H	
0AA4	00	2698	+	DEFB	000H	
0AA5		2699		DEFCHR	020H, 020H, 020H, 020H, 0A8H, 070H, 020H ;	DOWN
0AA6	20	2699	+	DEFB	020H	
0AA7	20	2699	+	DEFB	020H	
0AA8	20	2699	+	DEFB	020H	
0AA9	A8	2699	+	DEFB	0A8H	
0AAA	70	2699	+	DEFB	070H	
0AAB	20	2699	+	DEFB	020H	
0AAB		2700		DEFCHR	000H, 020H, 010H, 0F8H, 010H, 020H, 000H ;	RIGHT
0AAC	00	2700	+	DEFB	000H	
0AAC	20	2700	+	DEFB	020H	
0AAD	10	2700	+	DEFB	010H	
0AAE	F8	2700	+	DEFB	0F8H	
0AAF	10	2700	+	DEFB	010H	
0AB0	20	2700	+	DEFB	020H	
0AB1	00	2700	+	DEFB	000H	
0AB2		2701		DEFCHR	008H, 088H, 050H, 020H, 050H, 088H, 000H ;	MULTI
0AB3	00	2701	+	DEFB	000H	
0AB4	88	2701	+	DEFB	088H	
0AB5	50	2701	+	DEFB	050H	
0AB6	20	2701	+	DEFB	020H	
0AB7	50	2701	+	DEFB	050H	
0AB8	88	2701	+	DEFB	088H	
0AB9	00	2701	+	DEFB	000H	
0ABA	00	2702		DEFB	0	
0ABA	20	2703		DEFB	20H	
0ABB	00	2704		DEFB	0	
0ABC	F8	2705		DEFB	0F8H	
0ABD	00	2706		DEFB	0	
0ABE	20	2707		DEFB	20H	

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2708 ; ** LAST BYTE OF DIVIDE IS ZERO, WHICH HAPPENS TO BE FIR
2709 ;     BYTE OF ...
OABF 2710 ; SMALL CHARACTERS (4 X 6)
OABF 2711 SMLCHR
OABF 2712 DEF5 000H, 000H, 000H, 000H, 000H ; SPACE
OABF 00 2712 + DEF5 000H
OAC0 00 2712 + DEF5 000H
OAC1 00 2712 + DEF5 000H
OAC2 00 2712 + DEF5 000H
OAC3 00 2712 + DEF5 000H
  
```

```

OAC4 DDE1 2714 MMJUMP: POP IX
OAC6 E3 2715 EX (SP), HL
OAC7 DDE9 2716 JP (IX)
  
```

```

2718 ; NAME: CONVERT KEY CODE TO ASCII
2719 ; PURPOSE: SAME
2720 ; INPUT: A=KEY CODE
2721 ; OUTPUT: A=ASCII EQUIVALENT
2722 ; HOW: TABLE LOOKUP
OAC9 2723 MKCTAB:
OAC9 48 2724 LD C, B
OACA 0600 2725 LD B, 0
OACC 21D50A 2726 LD HL, KCATB
OACF 09 2727 ADD HL, BC
OAD0 7E 2728 LD A, (HL)
OAD1 FD7709 2729 QFF: LD (IY+CB), A
OAD4 C9 2730 RET
  
```

```

OADS 2732 KCTATB:
OADS 20 2733 DEF5 ' ' ; SPACE
OAD6 43 2734 DEF5 'C' ; BULLET
OAD7 5E 2735 DEF5 5EH ; UP ARROW
OADS 5C 2736 DEF5 5CH ; DOWN ARROW
OAD9 25 2737 DEF5 '%' ;
ODA 52 2738 DEF5 'R' ; RECALL
OADB 53 2739 DEF5 'S' ; STORE
OADC 3B 2740 DEF5 ';' ; PLUS/MINUS
OADD 2F 2741 DEF5 '/' ; DIVIDE
OADE 37 2742 DEF5 '7'
OADF 38 2743 DEF5 '8'
OAE0 39 2744 DEF5 '9'
OAE1 2A 2745 DEF5 '*' ; TIMES
OAE2 34 2746 DEF5 '4'
OAE3 35 2747 DEF5 '5'
OAE4 36 2748 DEF5 '6'
OAE5 2D 2749 DEF5 '-' ; MINUS
OAE6 31 2750 DEF5 '1'
OAE7 32 2751 DEF5 '2'
OAE8 33 2752 DEF5 '3'
OAE9 2B 2753 DEF5 '+' ; PLUS
OAEA 26 2754 DEF5 '&' ; CE
  
```

PROPRIETARY INFORMATION

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0AEB 30 2755 DEFB '0'
 0AEC 2E 2756 DEFB '1'
 0AED 3D 2757 DEFB '=' ; POINT
 ; EQUALS

2759 ; NAME: FILL AREA
 2760 ; PURPOSE: SET REGION OF SCREEN TO CONSTANT VALUE
 2761 ; INPUT: A = DATA TO FILL WITH
 2762 ; BC = NUMBER OF BYTES TO FILL
 2763 ; DE = STARTING ADDRESS OF REGION TO FILL

0AEE EB 2764 MFILL: EX DE, HL
 0AEF 77 2765 MFILL1: LD (HL), A ; STUFF BYTE
 0AF0 EDA1 2766 CPI ; BUMP HL, DEC BC
 0AF2 EAEFOA 2767 JP PE, MFILL1
 0AF3 C9 2768 RET

2770 ; NAME: RELATIVE TO ABSOLUTE
 2771 ; PURPOSE: COORDINATE CONVERSION
 2772 ; INPUT: E = X COORDINATE
 2773 ; D = Y COORDINATE
 2774 ; M = MAGIC REGISTER VALUE TO USE
 2775 ; OUTPUT: A = ABSOLUTE ADDRESS
 2776 ; P = MAGIC REGISTER TO USE

0AF6 CD080B 2778 MR0: LAB: CALL RELT
 0AF9 1805 2779 JR MREL1--\$
 2780 ; MAGIC ENTRY POINT
 0AFB CD4E0B 2781 MREL1: CALL RELT
 0AFE CBF2 2782 SET 6, D ; NOT MAGIC THE ADDRESS
 0B00 FD7304 2783 MREL2: LD (IY+0BE), E ; UPDATE CB DE
 0B03 FD7205 2784 LD (IY+0BD), D
 0B06 18C9 2785 MFROG: JR QFROG--\$
 2786 ; MAGIC ENTRY POINT
 0B08 CD4E0B 2787 RELT: CALL RELT
 0B0B D30C 2788 OUT (MAGIC), A
 0B0D C9 2789 RET
 0B0E 00 2790 CKSUM2: DEFB 0 ; *** CHECKSUM ***
 0B0F 2791 DEF5 0E0H, 0A0H, 0A0H, 0A0H, 0E0H ; 0
 0B0F E0 2791 + DEFB 0E0H
 0B10 A0 2791 + DEFB 0A0H
 0B11 A0 2791 + DEFB 0A0H
 0B12 A0 2791 + DEFB 0A0H
 0B13 E0 2791 + DEFB 0E0H
 0B14 2792 DEF5 040H, 040H, 040H, 040H, 040H ; 1
 0B14 40 2792 + DEFB 040H
 0B15 40 2792 + DEFB 040H
 0B16 40 2792 + DEFB 040H
 0B17 40 2792 + DEFB 040H
 0B18 40 2792 + DEFB 040H
 0B19 2793 DEF5 0E0H, 020H, 0E0H, 080H, 0E0H ; 2
 0B19 E0 2793 + DEFB 0E0H
 0B1A 20 2793 + DEFB 020H
 0B1B E0 2793 + DEFB 0E0H
 0B1C 80 2793 + DEFB 080H

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ADDR	OBJECT	STMT	LABEL	OPCODE	OPERAND	COMMENT
0B1D	EO	2793	+	DEFB	0E0H	
0B1E		2794		DEFB	0E0H, 020H, 060H, 020H, 0E0H ;	3
0B1E	EO	2794	+	DEFB	0E0H	
0B1F	20	2794	+	DEFB	020H	
0B20	60	2794	+	DEFB	060H	
0B21	20	2794	+	DEFB	020H	
0B22	EO	2794	+	DEFB	0E0H	
0B23		2795		DEFB	0A0H, 0A0H, 0E0H, 020H, 020H ;	4
0B23	AO	2795	+	DEFB	0A0H	
0B24	AO	2795	+	DEFB	0A0H	
0B25	EO	2795	+	DEFB	0E0H	
0B26	20	2795	+	DEFB	020H	
0B27	20	2795	+	DEFB	020H	
0B28		2796		DEFB	0E0H, 080H, 0E0H, 020H, 0E0H ;	5
0B28	EO	2796	+	DEFB	0E0H	
0B29	80	2796	+	DEFB	080H	
0B2A	EO	2796	+	DEFB	0E0H	
0B2B	20	2796	+	DEFB	020H	
0B2C	EO	2796	+	DEFB	0E0H	
0B2D		2797		DEFB	0E0H, 080H, 0E0H, 0A0H, 0E0H ;	6
0B2D	EO	2797	+	DEFB	0E0H	
0B2E	80	2797	+	DEFB	080H	
0B2F	EO	2797	+	DEFB	0E0H	
0B30	AO	2797	+	DEFB	0A0H	
0B31	EO	2797	+	DEFB	0E0H	
0B32		2798		DEFB	0E0H, 020H, 020H, 020H, 020H ;	7
0B32	EO	2798	+	DEFB	0E0H	
0B33	20	2798	+	DEFB	020H	
0B34	20	2798	+	DEFB	020H	
0B35	20	2798	+	DEFB	020H	
0B36	20	2798	+	DEFB	020H	
0B37		2799		DEFB	0E0H, 0A0H, 0E0H, 0A0H, 0E0H ;	8
0B37	EO	2799	+	DEFB	0E0H	
0B38	AO	2799	+	DEFB	0A0H	
0B39	EO	2799	+	DEFB	0E0H	
0B3A	AO	2799	+	DEFB	0A0H	
0B3B	EO	2799	+	DEFB	0E0H	
0B3C		2800		DEFB	0E0H, 0A0H, 0E0H, 020H, 0E0H ;	9
0B3C	EO	2800	+	DEFB	0E0H	
0B3D	AO	2800	+	DEFB	0A0H	
0B3E	EO	2800	+	DEFB	0E0H	
0B3F	20	2800	+	DEFB	020H	
0B40	EO	2800	+	DEFB	0E0H	
0B41		2801		DEFB	000H, 040H, 000H, 040H, 000H ;	
0B41	00	2801	+	DEFB	000H	
0B42	40	2801	+	DEFB	040H	
0B43	00	2801	+	DEFB	000H	
0B44	40	2801	+	DEFB	040H	
0B45	00	2801	+	DEFB	000H	
0B46		2802		DEFB	040H, 0E0H, 0E0H, 0E0H, 0E0H ;	BULLET
0B46	40	2802	+	DEFB	040H	
0B47	EO	2802	+	DEFB	0E0H	
0B48	EO	2802	+	DEFB	0E0H	
0B49	EO	2802	+	DEFB	0E0H	
0B4A	EO	2802	+	DEFB	0E0H	

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2804 ; MOVE ROUTINE
OB4B EDB0 2805 MMOVE: LDIR
OB4D C9 2806 RET

2808 ; SYSTEM ENTRY POINT FOR NONMAGIC ADDRESSES
OB4E E5 2809 RELTA1: PUSH HL
OB4F E6FC 2810 AND OFCH ; TOSS OUT SHIFT AMOUNT
OB51 6F 2811 LD L,A ; SAVE
OB52 7B 2812 LD A,E ; GET X
OB53 E603 2813 AND 03H ; ISOLATE SHIFT AMOUNT
OB55 B5 2814 OR L ; COMBINE WITH MR
OB56 F5 2815 RELTA2: PUSH AF
OB57 E640 2816 AND 040H ; IS FLOPPED BIT SET?
OB59 7B 2817 LD A,E
OB5A 2803 2818 JR Z,RELTA3-* ; JUMP IF NOT
OB5C 2F 2819 CPL ; YEP - UNFLOP THE COORDINATE
OB5D C6A0 2820 ADD A,160
OB5F 6A 2821 RELTA3: LD L,D ; HL = Y
OB60 2600 2822 LD H,0
OB62 29 2823 ADD HL,H ; SET HL = Y * 8
OB63 29 2824 ADD HL,H
OB64 29 2825 ADD HL,H
OB65 54 2826 LD D,H
OB66 5D 2827 LD E,L
OB67 29 2828 ADD HL,H ; SET HL = Y * 32
OB68 29 2829 ADD HL,H
OB69 19 2830 ADD HL,DE ; SET HL = Y * 40
OB6A CB3F 2831 SRL A ; A = Y / 4
OB6C CB3F 2832 SRL A
OB6E 5F 2833 LD E,A
OB6F 1600 2834 LD D,0
OB71 19 2835 ADD HL,DE ; HL = Y * 40 + X
2836 IF NWHDR=1
2837 ENDIF
OB72 EB 2838 EX DE,HL

2840 ; NAME: RETURN FROM MACRO SUBROUTINE
2841 ; PURPOSE: RETURN CONTROL TO CALLER
2842 ; THIS CODE WAS MOVED FROM RELABS SINCE
2843 ; IT DOES THE STACK CLEANUP THAT MRET DOES
OB73 F1 2844 MMR: POP AF
OB74 E1 2845 POP HL
OB75 C9 2846 RET

2848 ; ENTRY FOR USER
OB76 CD7B0B 2849 INXNIB: CALL XNIB
OB79 188B 2850 JR MFROG-*
  
```

PROPRIETARY INFORMATION

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	2852	; NAME:	INDEX NIBBLE	
	2853	; PURPOSE:	LOAD OF SPECIFIED NIBBLE RELATIVE TO BASE	
	2854	; INPUT:	C = NIBBLE NUMBER	
	2855	; OUTPUT:	HL = BASE ADDRESS	
	2856	; DESCRIPTION:	NIBBLE RETURNED RIGHT JUSTIFIED IN A.	
	2857	; BY AN EVEN NIBBLE NUMBER.	BYTE = NIBBLE# 2+BASE	
	2858	; THE LOW ORDER NIBBLE OF A GIVEN BYTE IS ADDRESSED		
0B7B	E5	2860	XNIB: PUSH HL	
0B7C	C5	2861	PUSH BC	
0B7D	0600	2862	LD B,0	
0B7F	CB39	2863	SRL C	
0B81	09	2864	ADD HL,BC	
0B82	7E	2865	LD A,(HL)	
0B83	C1	2866	POP BC	
0B84	CB41	2867	BIT 0,C	
0B86	2804	2868	JR Z,XNIB1-*	
0B88	0F	2869	RRCA	
0B89	0F	2870	RRCA	
0B8A	0F	2871	RRCA	
0B8B	0F	2872	RRCA	
0B8C	E60F	2873	XNIB1: AND 0FH	
0B8E	E1	2874	POP HL	
0B8F	C9	2875	RET	
	2877	; NAME:	STORE NIBBLE	
	2878	; PURPOSE:	NIBBLE STORING (!)	
	2879	; INPUT:	C = NIBBLE TO STORE	
	2880	; OUTPUT:	C = NIBBLE NUMBER (AS IN XNIB)	
	2881	; HL = BASE ADDRESS		
0B90	E5	2882	PLXNIB: PUSH HL	
0B91	C5	2883	PUSH BC	
0B92	0600	2884	LD B,0	
0B94	CB39	2885	SRL C	
0B96	09	2886	ADD HL,BC	
0B97	C1	2887	POP BC	
0B98	CB41	2888	BIT 0,C	
0B9A	2809	2889	JR Z,PLXNIB1-*	
0B9C	07	2890	; L.O. CASE - SHIFT IT	
0B9D	07	2891	RLCA	
0B9E	07	2892	RLCA	
0B9F	07	2893	RLCA	
0BA0	AE	2894	RLCA	
0BA1	E6F0	2895	XOR (HL)	
0BA3	1803	2896	AND 0FH	
0BA5	AE	2897	JR PUTNB2-*	
0BA6	E60F	2898	PUTNB1: XOR (HL)	; L.O. CASE
0BA8	AE	2899	AND 0FH	
0BA9	77	2900	PUTNB2: XOR (HL)	
0BAA	E1	2901	LD (HL),A	
0BAB	C9	2902	POP HL	
		2903	RET	

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2905 ; NAME : INDEX WORD TABLE (WORD INDEX)
2906 ; PURPOSE: TO INDEX AN ARRAY OF DEFW'S
2907 ; INPUTS: A=INDEX NUMBER (0-255)
2908 ; HL -> TABLE ENTRY 0
2909 ; OUTPUTS: DE = ENTRY LOOKED UP
2910 ; HL = POINTER TO ENTRY IN TABLE
OBAC 5F 2911 MINDW: LD E,A
OBAD 1600 2912 LD D,0
OBAF CB23 2913 SLA E
OBB1 CB12 2914 RL D ; DE*2
OBB3 19 2915 ADD HL,DE
OBB4 5E 2916 LD E,(HL)
OBB5 23 2917 INC HL
OBB6 56 2918 LD D,(HL)
OBB7 2B 2919 DEC HL
OBB8 CDF40C 2920 ST DE: CALL FINDL3
OBBB 1808 2921 JR MINDB1-$ ; JOIN STORE IN INDEX BYTE
  
```

```

2923 ; NAME: INDEX BYTE TABLE
2924 ; PURPOSE: TABLE LOOKUP
2925 ; INPUTS: A = INDEX NUMBER
2926 ; OUTPUT: A = VALUE OF BYTE
2927 ; HL = POINTER TO TABLE ENTRY
OBBD 5F 2928 MINDB: LD E,A
OBBE 1600 2929 LD D,0
OBC0 19 2930 ADD HL,D
OBC1 7E 2931 LD A,(HL)
OBC2 FD7709 2932 LD (IX+2BA),A
OBC5 FD740B 2933 MINDB1: LD (IY+2BH),H
OBC8 FD750A 2934 LD (IY+2BL),L
OBCB C9 2935 RET
  
```

```

2937 ; NAME: DISPLAY TIME
2938 ; PURPOSE: DISPLAY TIME ON SCREEN
2939 ; INPUTS: E = X COORD
2940 ; D = Y COORD
2941 ; C = SAME AS DISCHR OPTIONS EXCEPT BIT 7 = 1
2942 ; TO DISPLAY COLON AND SECONDS
2943 ; OUTPUTS: NONE
OBCC 2944 MINDTI:
OBCC DD210D02 2945 LD IX,SMLFNT
OBDO 0642 2946 LD B,42H
OBD2 21EE4F 2947 LD HL,GTMIN5
OBD5 C5 2948 PUSH BC
OBD6 FDCB06BE 2949 RES 7,(IY+CBC)
OBDA CDEB0B 2950 CALL BCDISP
OBDD C1 2951 POP BC
OBDE CB79 2952 BIT 7,C
OBE0 C8 2953 RET Z
OBE1 3EBA 2954 LD A,80H+3AH
  
```

PROPRIETARY INFORMATION

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OBE3 CDE107 2955          CALL DISPCH
OBE6 0642    2956          LD   B,42H
OBE8 21ED4F 2957          LD   HL,GTSECS
                2958 ; AND FALL INTO

                2960 ; NAME:          DISPLAY BCD NUMBER
                2961 ; INPUT:          B = NUMBER DISPLAY OPTIONS
                2962 ;                   C = CHARACTER DISPLAY OPTIONS
                2963 ;                   DE = Y, X COORDINATES
                2964 ;                   HL = NUMBER ADDRESS (POINTS AT LO BYTE)
                2965 ;                   IX = ALTERNATE FONT (IF USED)
                2966 ; OUTPUT:         DE UPDATED
                2967 ; DESCRIPTION: THIS ROUTINE CONVERTS EACH NIBBLE INTO
                2968 ; ASCII AND DISPLAYS IT. THE NORMALLY ILLEGAL BCD
                2969 ; VALUES ARE DISPLAYED AS CODES 2A THRU 2F RESPECTIVELY.
                2970 ; THE NUMBER DISPLAY OPTIONS BYTE IS FORMATED AS FOLLOWS:
                2971 ; BIT 7-6   SET IF LEADING ZERO SUPPRESSION WANTED
                2972 ; BIT 5-4   SET IF USE OF ALTERNATE FONT WANTED
                2973 ; BIT 3-0   NUMBER OF DIGITS TO DISPLAY (NOT NUMBER 0)

OBE8 79      2974 BCDISP: LD   A,B          ; GET OPTIONS
OBEC E63F    2975          AND   3FH          ; ISOLATE NUMBER OF DIGITS
OBEE 3D      2976 BCDOP: DEC  A          ;
OBEF F8      2977          RET  M          ; QUIT IF NULL OR NO MORE
OBF0 4F      2978          LD   C,A          ; SAVE
OBF1 CD7B0B 2979          CALL XNIB        ; GET NEXT DIGIT
OBF4 2007    2980          JR   NZ,BCDD1-$    ; JUMP IF NONZERO
OBF6 CB78    2981          BIT  7,B          ; IS ZERO SUPPRESS ON?
OBF8 2803    2982          JR   Z,BCDD2-$    ; JUMP IF NOT
OBF9 B1      2983          OR   C          ; LAST DIGIT?
OBF8 2014    2984          JR   NZ,BCDD4-$    ; JUMP IF NOT
OBF0 CBB8    2985 BCDOP: RES  7,B          ; CLEAR LEADING ZERO FLAG
OBF0 C606    2986          ADD  A,6          ;
OC01 E60F    2987          AND  0FH          ;
OC03 C62A    2988          ADD  A,2AH        ;
OC05 CB70    2989 BCDOP: BIT  6,B          ; ALTERNATE FONT?
OC07 2802    2990          JR   Z,BCDD3-$    ; JUMP IF NO
OC09 F680    2991          OR   80H          ; YEA - SET THE BIT
OC0B CDE107 2992 BCDOP: CALL DISPCH        ; DISPLAY THE CHAR
OC0E 79      2993          LD   A,C          ; GET TOP COUNTER IN A
OC0F 18DD    2994          JR   BCDD0-$    ; AND GO FOR NEXT
OC11 3E20    2995 BCDOP: LD   A,' '        ; LEADING ZERO - WRITE A SPACE
OC13 18F0    2996          JR   BCDDA

                2998 ; NAME:          INCREMENT SCORE
                2999 ; PURPOSE:    INCREMENT SCORE AND COMPARE TO END SCORE
3000 ; INPUTS:   HL -> PLAYER SCORE LOW ADDR OF 3 BYTES
3001 ; OUTPUTS:  GSBEND OF GAMSTB SET IF MAX SCORE REACHED

OC15 0603    3002 MINCSC: LD   B,3
OC17 E5      3003          PUSH HL
OC18 7E      3004 INCLOP: LD   A,(HL)
OC19 C601    3005          ADD  A,1
OC1B 27      3006          DAA
OC1C 77      3007          LD   (HL),A
  
```

PROPRIETARY INFORMATION

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OC1D 2003 3008 JR NZ, CMPIT-\$
OC1F 23 3009 INC HL
OC20 10F6 3010 DJNZ INCLOP-\$
OC22 E1 3011 CMPIT: POP HL
OC23 23 3012 INC HL
OC24 23 3013 INC HL
OC25 3AF84F 3014 LD A, (GAMSTB)
OC28 CB4F 3015 BIT GSBSCR, A
OC2A C8 3016 RET Z
OC2B 11F64F 3017 LD DE, ENDSCR+2
OC2E 0603 3018 LD B, 3
OC30 1A 3019 CMPLOP: LD A, (DE)
OC31 BE 3020 CP (HL)
OC32 2807 3021 JR Z, REPEAT-\$; ENDSCR = SCORE
OC34 D0 3022 RET NC ; ENDSCR > SCORE
OC35 21F84F 3023 SETEND: LD HL, GAMSTB ; ENDSCR < SCORE
OC38 CBFE 3024 SET GSBEND, (HL)
OC3A C9 3025 RET
OC3B 1B 3026 REPEAT: DEC DE
OC3C 2B 3027 DEC HL
OC3D 10F1 3028 DJNZ CMPLOP-\$
OC3F 18F4 3029 JR SETEND-\$

3031 ; NAME: QUIT
3032 ; PURPOSE: HOLD PRESENT GAME SCORE UNTIL KEY HIT OR
3033 ; SAY GAME OVER
OC41 3034 MQUIT: SYSSUK STRDIS
OC41 FF 3034 + RST 56
OC42 35 3034 + DEFB STRDIS+1
3034 + IF STRDIS.EQ. INTPC
3034 + ENDIF
OC43 30 3035 DEFB 48
OC44 18 3036 DEFB 24
OC45 4C 3037 DEFB 01001180B
OC46 570C 3038 DEFW GMOVR
OC48 3039 SYSTEM ACTINT ; ACTIVATE INTERRUPTS
OC48 FF 3039 + RST 56
OC49 0E 3039 + DEFB ACTINT
3039 + IF ACTINT.EQ. INTPC
3039 + ENDIF
OC4A 3040 MQUIT: SYSSUK SENTRY ; WAIT FOR SOMETHING TO HAPPEN
OC4A FF 3040 + RST 56
OC4B 43 3040 + DEFB SENTRY+1
3040 + IF SENTRY.EQ. INTPC
3040 + ENDIF
OC4C 1402 3041 DEFW AKEYS
OC4E FE14 3042 CP STO
OC50 2804 3043 JR Z, MQUIT2-\$; TRIGGER CHANGE?
OC52 FE13 3044 CP SKYD ; KEY HIT?
OC54 20F4 3045 JR NZ, MQUIT1-\$; NO - KEEP GOING
OC56 C7 3046 MQUIT2: RST 0 ; YES - RESET
OC57 47414D45 3047 GMOVR: DEFM 'GAME'
OC5B 06 3048 DEFB 6
OC5C 4F564552 3049 DEFM 'OVER'
OC60 00 3050 DEFB 0

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```

3052 ; *****
3053 ; * MENU ROUTINES *
3054 ; *****
>0060 3055 NOLINE EQU 96 ; NUMBER OF DISPLAYED LINES
>0000 3056 MNNL EQU 0 ; NEXT FIELD
>0001 3057 MNNH EQU 1
>0002 3058 MNSAL EQU 2 ; STRING ADDRESS
>0003 3059 MNSAH EQU 3
>0004 3060 MNGL EQU 4 ; GO TO ADDRESS
>0005 3061 MNGH EQU 5

3063 ; SYSTEM POWER UP ROUTINE
OC61 3A0020 3064 PWRUP LD A,(FIRSTC) ; GET FIRST CASSETTE LOCATION
OC64 FEC3 3065 CP OC3H ; IS IT A JUMP??
OC66 CA0020 3066 JP Z,FIRSTC ; JUMP TO IT IF SO
OC69 31CE4F 3067 LD SP,BEGRAM
OC6C 3068 SYSSUK F ; CLEAR SYSTEM RAM
OC6C FF 3068 + RST 56
OC6D 1B 3068 + DEFB FILL+
3068 + IF FILL EQ INTPC
3068 + ENDIF
OC6E CE4F 3069 DEFW BEGRAM
OC70 3200 3070 DEFW 50
OC72 00 3071 DEFB 0
OC73 32FF0F 3072 LD (WATCH),A ; CLEAR SHIFTER
OC76 3D 3073 DEC A
OC77 32EC4F 3074 LD (TIMEOUT),A ; CLEAR TIMEOUT WATCHDOG
OC7A 3075 SYSTEM INTPC
OC7A FF 3075 + RST 56
OC7B 00 3075 + DEFB INTPC
3075 + IF INTPC EQ INTPC
>0001 3075 +INTP DEFL 1
3075 + ENDIF
OC7C 3076 DO EMUSIO
OC7C 15 3076 + DEFB EMUSIO+1
OC7D 3077 DO SETQL
OC7D 17 3077 + DEFB SETQL+1
OC7E BF 3078 DEFB (NOLINE*2)-1
OC7F 29 3079 DEFB 41
OC80 08 3080 DEFB 8
OC81 3081 DO COLSET
OC81 19 3081 + DEFB COLSET+1
OC82 1300 3082 DEFW MENUCL
OC84 3083 DO ACTINT
OC84 0F 3083 + DEFB ACTINT+1
OC85 3084 EXIT
OC85 02 3084 + DEFB XINTC
>0000 3084 +INTPe DEFL 0
OC86 11F30D 3085 LD DE,GAMSTR ; 'SELECT GAME' AS TITLE
OC89 210020 3086 LD HL,FIRSTC ; ASSUME MENU STARTS IN CASSETT

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0C8C 7E      3087      LD  A, (HL)      ; GET FIRST CASSETTE BYTE
0C8D 23      3088      INC HL
0C8E FE55    3089      CP  55H          ; IS SENTINEL THERE?
0C90 2803    3090      JR  Z, PWRUP1-$  ; YEP - JUMP
0C92 211802  3091      LD  HL, GUNLNK   ; WRONG - USE ONBOARD ONLY
0C95        3092 PWRUP1: SYSTEM MENU ; DISPLAY THE MENU
0C95 FF      3092 +     RST 56
0C96 4A      3092 +     DEFB MENU
                3092 +     IF  MENU. EQ. INTPC
                3092 +     ENDF
  
```

```

3094 ; NAME:          DISPLAY MENU AND BRANCH ON CHOICE
3095 ; INPUT:         HL = MENU LIST
3096 ;               DE = MENU TITLE
3097 ; OUTPUT:        DE = TITLE OF SELECTION MADE
3098 ; DESCRIPTION:
3099 ; THE MENU LIST IS A LINKED LIST OF THE FOLLOWING F
3100 ; *****
3101 ; * NEXT ENTRY *
3102 ; * *
3103 ; *****
3104 ; * STRING ADDRESS *
3105 ; * *
3106 ; *****
3107 ; * BRANCH TO ADDRESS *
3108 ; * *
3109 ; *****
3110 ; THIS LIST IS TERMINATED BY A NEXT ENTRY FIELD OF ZEROS
3111 ; A MAXIMUM OF EIGHT ENTRIES MAY BE DISPLAYED.
0C97 E5      3112 MMEN  PUSH HL
0C98 E5      3113      PUSH HL
0C99 CD190D  3114      CALL MNCLR      ; CLEAR SCREEN AND THROWUP TITL
0C9C        3115      XYRELL DE, 12
0C9C 11100C  3115 +     LD  DE, RE (12). SHL. 8+(16)
0C9F 010901  3116      LD  BC, 10      ; INITIALIZE ENTRY # AND COLOR
0CA2 DDE1    3117 MMENH  POP  IX      ; FIRST ENTRY TO IX
0CA4 78      3118      LD  A, B        ; SELECTION NUMBER TO A
0CA5 C630    3119      ADD A, '0'      ; MAKE IT ASCII
0CA7        3120      SYSTEM CHRDIS ; AND SHOW IT
0CA7 FF      3120 +     RST 56
0CA8 32      3120 +     DEFB CHRDIS
                3120 +     IF  CHRDIS. EQ. INTPC
                3120 +     ENDF
0CA9 3E2D    3121      LD  A, '-'      ; DISPLAY DASH
0CAB        3122      SYSTEM CHRDIS
0CAB FF      3122 +     RST 56
0CAC 32      3122 +     DEFB CHRDIS
                3122 +     IF  CHRDIS. EQ. INTPC
                3122 +     ENDF
0CAD DD6603  3123      LD  H, (IX+MNSAH) ; HL = STRING ADDRESS
0CB0 DD6E02  3124      LD  L, (IX+MNSAL)
0CB3        3125      SYSTEM STRDIS ; DISPLAY SELECTION
0CB3 FF      3125 +     RST 56
0CB4 34      3125 +     DEFB STRDIS
                3125 +     IF  STRDIS. EQ. INTPC
  
```

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		3125 +	ENDIF		
OCB5	3E08	3126	LD	A, 8	
OCB7	92	3127	ADD	A, D	; TO NEXT LINE
OCB8	57	3128	LD	D, A	
OCB9	1E10	3129	LD	E, 16	
OCBB	04	3130	INC	B	; BUMP ENTRY #
OCBC	DD6601	3131	LD	H, (IX+MNNH)	; HL = NEXT ENTRY ADDR
OCBF	DD6E00	3132	LD	L, (IX+MNNL)	
OCC2	E5	3133	PUSH	HL	
OCC3	7C	3134	LD	A, H	
OCC4	B5	3135	OR	L	
OCC5	20DB	3136	JR	NZ, MMENU1-\$	; NO - JUMP BACK
		3137			; AT THIS POINT HL = 0, (SP) = 0
OCC7	39	3138	ADD	HL, SP	; HL = STACK POINTER
OCC8	C5	3139	MMENU3:	PUSH BC	
OCC9	010101	3140	LD	BC, 0101H	
OCCC		3141	XYRELL	DE, 16, 77	; FEEDBACK ADDRESS
OCCC	11104D	3141 +	LD	DE, RES. (77). SHL 8+(16)	
OCCF		3142	SYSTEM	GETNUM	; GET NUMBA
OCCF	FF	3142 +	RST	56	
OCDO	4E	3142 +	DEFB	GETNUM	
		3142 +	IF	GETNUM EQ. INTPC	
		3142 +	ENDIF		
OCD1	C1	3143	POP	BC	
OCD2	7E	3144	LD	A, (HL)	; HOW DOES SHE LOOK?
OCD3	A7	3145	AND	A	; ZERO ENTERED?
OCD4	2803	3146	JR	Z, MMENU5-\$	; JUMP IF SO
OCD6	B8	3147	CP	B	; IN RANGE?
OCD7	3806	3148	JR	C, MMENU6-\$	; JUMP IF SO
OCD9	3E3F	3149	LD	A, ?	; DUD ENTRY - SHOW ?
OCDB		3150	SYSTEM	CHRDIS	
OCDB	FF	3150 +	RST	56	
OCDC	32	3150 +	DEFB	CHRDIS	
		3150 +	IF	CHRDIS EQ. INTPC	
		3150 +	ENDIF		
OCDD	18E9	3151	JR	MMENU4-\$	; GO BACK FOR NEXT TRY
OCDF	E1	3152	MMENU4:	POP HL	; THROW OUT ENTRY AREA
OCE0	D1	3153	POP	DE	; RESTORE HEAD OF MENU LIST
OCE1	47	3154	LD	B, A	; NUMBER ENTERED TO B
OCE2	EB	3155	MMENU7:	EX DE, HL	; HL = ENTRY PTR
OCE3	5E	3156	LD	E, (HL)	; DE = NEXT
OCE4	23	3157	INC	HL	
OCE5	56	3158	LD	D, (HL)	
OCE6	10FA	3159	DJNZ	MMENU4-\$	; COUNT DOWN TO ENTRY
OCE8	23	3160	INC	HL	
OCE9	5E	3161	LD	E, (HL)	; STRING TO DE
OCEA	23	3162	INC	HL	
OCEB	56	3163	LD	D, (HL)	
OCEC	23	3164	INC	HL	
OCED	4E	3165	LD	C, (HL)	; GO TO ADDRESS TO BC
OCEE	23	3166	INC	HL	
OCEF	46	3167	LD	B, (HL)	
OCF0	E1	3168	POP	HL	; HL = RETURN TO PLACE
OCF1	F1	3169	POP	AF	; THROW OUT OLD PC
OCF2	C5	3170	PUSH	BC	; PUT NEW PC ON STACK
OCF3	E5	3171	PUSH	HL	; AND PUT BACK DUMMY RETURN
OCF4	FD7304	3172	FINDL3:	LD (IY+CBE), E	; PASS BACK TITLE ADDRESS

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```
OCF7 FD7205 3173 LD (IY+CB0),D
OCFA C9 3174 RET ; AND GO BACK
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3176 ; NAME: GET PARAMETER
3177 ; PURPOSE: INPUT OF PROGRAM OPTIONS
3178 ; INPUT: A = NUMBER OF DIGITS
3179 ; BC = PROMPT STRING ADDRESS
3180 ; DE = FRAME TITLE ADDRESS
3181 ; HL = PARAMETER ADDRESS
3182 ; DESCRIPTION:
3183 ; THIS ROUTINE ASKS THE USER TO ENTER A NUMBER
3184 ; FIRST A MENU FRAME IS CREATED, USING THE STRING
3185 ; POINTED AT BY DE AS A TITLE. THE STRING 'ENTER'
3186 ; IS DISPLAYED, FOLLOWED BY THE PROMPT STRING.
3187 ; GETNUM IS THEN CALLED TO INPUT THE NUMBER. FEEDBACK
3188 ; IS PROVIDED IN DOUBLE SIZED CHARACTERS.
3189 ; NOTE: ** THIS ROUTINE USES TWO SYSTEM LEVELS AND THE AL
OCFB F5 3190 MGET: PUSH AF ; SAVE NUMBER OF DIGITS
OCFC E5 3191 PUSH HL
OCFD C5 3192 PUSH BC
OCFE CD190D 3193 CALL MNCLR
OD01 3194 SYSSUK STRDIS ; DISPLAY 'ENTER'
OD01 FF 3194 + RST 56
OD02 35 3194 + DEFB STRDIS+1
3194 + IF STRDIS.EQ. INTPC
3194 + ENDIF
OD03 08 3195 DEFB 8
OD04 20 3196 DEFB 32
OD05 09 3197 DEFB 1001B
OD06 B70D 3198 DEFW ENTST
OD08 E1 3199 POP HL
OD09 3200 SYSTEM STRDIS ; DISPLAY WHAT TO ENTER
OD09 FF 3200 + RST 56
OD0A 34 3200 + DEFB STRDIS
3200 + IF STRDIS.EQ. INTPC
3200 + ENDIF
OD0B E1 3201 POP HL
OD0C F1 3202 POP AF
OD0D 47 3203 LD B,A
OD0E CBF1 3204 SET 6,C ; SET LARGE CHARS
OD10 3205 XYRELL DE,48 ; LOAD FEEDBACK ADDRESS
OD10 113030 3205 + LD DE,48.SHL:8+(48)
OD13 3206 SYSTEM GETNUM ; GET NUMBER
OD13 FF 3206 + RST 56
OD14 4E 3206 + DEFB GETNUM
3206 + IF GETNUM.EQ. INTPC
3206 + ENDIF
OD15 3207 SYSSUK PAWS ; LET USER READ IT
OD15 FF 3207 + RST 56
OD16 51 3207 + DEFB PAWS+1
3207 + IF PAWS.EQ. INTPC
3207 + ENDIF
OD17 0F 3208 DEFB 15
OD18 C9 3209 RET
3210 ; SUBROUTINE TO CLEAR SCREEN FOR MENU AND THROWUP TITLE
```

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OD19 D5      3211 MNCLR:  PUSH DE
OD1A         3212      SYSSUK FILL
OD1A FF      3212 +    RST 56
OD1B 1B      3212 +    DEFB FILL+1
              3212 +    IF FILL EQ. INTPC
              3212 +    ENDIF
OD1C 0040    3213      DEFW NORMEM
OD1E B01     3214      DEFW 11*BYTEPL
OD20 00      3215      DEFB 0
OD21         3216      SYSSUK FILL
OD21 FF      3216 +    RST 56
OD22 1B      3216 +    DEFB FILL+1
              3216 +    IF FILL EQ. INTPC
              3216 +    ENDIF
OD23 B841    3217      DEFW NORMEM+(11*BYTEPL)
OD25 480D    3218      DEFW (NOLINE-11)*BYTEPL
OD27 55      3219      DEFB 55H
OD28 E1      3220      POP HL
OD29         3221      XYRELL DE,24,0 ; TITLE
OD29 111800  3221 +    LD DE, RES.(0).SHL 8+(24)
OD2C 0E04    3222      LD C,0100B
OD2E         3223      SYSTEM STRDIS
OD2E FF      3223 +    RST 56
OD2F 34      3223 +    DEFB STRDIS
              3223 +    IF STRDIS EQ. INTPC
              3223 +    ENDIF
OD30 C9      3224      RET

3226 ; MGETN1: GET NUMBER
3227 ; INPUT:  B = DISNUM OPTIONS
3228 ;        C = CHRDIS OPTIONS FOR FEEDBACK
3229 ;        DE = COORDINATES OF FEEDBACK AREA
3230 ;        HL = ADDRESS OF WHERE TO STASH NUMBER
3231 ; DESCRIPTION: THIS ROUTINE CAN INPUT A NUMBER FROM
3232 ; EITHER THE KEYBOARD OR THE HAND CONTROL. KEYBOARD
3233 ; ENTRY PROCEEDS CONVENTIONALLY. GETNUM EXITS
3234 ; WHEN THE EQUALS KEY IS PRESSED OR THE REQUIRED NU
3235 ; OF DIGITS IS ENTERED
3236 ;        PLAYER ONE HAND CONTROL MAY ALSO BE USED
3237 ; ENTER A NUMBER. TO USE THIS OPTION, PULL THE TRI
3238 ; THEN ROTATE THE POT UNTIL THE NUMBER YOU WISH TO
3239 ; ENTER IS SHOWN IN THE FEEDBACK AREA. PULL THE TR
3240 ; AGAIN TO REGISTER THE ENTRY. IF DURING THIS PROC
3241 ; THE KEYBOARD IS USED - KEYBOARD INPUT WILL OVERRI
3242 MGETN1:  EXX
OD31 D9      3242      CALL CLRNUM ; CLEAR THE NUMBER
OD32 CD990D  3243      LD C,A ; SET ZERO DIGITS IN - POT ENAB
OD35 4F      3244      LD A,(IY+CBB) ; ENTRY COMPLETE?
OD36 FD7E07  3245 MGETN1: XOR C
OD39 A9      3246      AND 3FH
OD3A E63F    3247      RET Z ; QUIT IF SO
OD3C C8      3248      LD HL,MGETN1
OD3D 21360D  3249      PUSH HL
OD40 E5      3250      SYSTEM RANGED ; RANDOMIZE WHILE WE WAIT
OD41         3251      RST 56
OD41 FF      3251 +
  
```

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OD42 76      3251 +      DEFB RANGED
              3251 +      IF RANGED. EQ. INTPC
              3251 +      ENDIF
OD43         3252      SYSSUK SENTRY
OD43 FF      3252 +      RST 56
OD44 43      3252 +      DEFB SENTRY+1
              3252 +      IF SENTRY. EQ. INTPC
              3252 +      ENDIF
OD45 0B00    3253      DEFW NUMBAS
OD47         3254      SYSSUK DOIT
OD47 FF      3254 +      RST 56
OD48 45      3254 +      DEFB DOIT+1
              3254 +      IF DOIT. EQ. INTPC
              3254 +      ENDIF
OD49 4C0D    3255      DEFW GNUMDO
OD4B C9      3256      RET ; NOTHIN - LOOP ON SENTRY
OD4C         3257 GNUMD JMP SKYD, MGETN6
OD4C 13      3257 +      DEFB SKYD
OD4D 7F0D    3257 +      DEFW MGETN6
              3257 +      IF 0
              3257 +      ENDIF
OD4F         3258      JMP STO, MGETN2
OD4F 14      3258 +      DEFB STO
OD50 550D    3258 +      DEFW MGETN2
              3258 +      IF 0
              3258 +      ENDIF
OD52         3259      JMP SPO, MGETN3
OD52 1C      3259 +      DEFB SPO
OD53 610D    3259 +      DEFW MGETN3
              3259 +      IF 0
              3259 +      ENDIF
              3260 ; TRIGGER ROUTINE
OD55 CB60    3261 MGETN2: BIT 4, B ; 0-1 PANS?
OD57 C8      3262      RET Z ; NO - IGNORE
OD58 79      3263      LD A, C
OD59 3C      3264      INC A ; ARE WE ALREADY IN POT MODE?
OD5A 283A    3265      JR Z, MGETN4-$ ; YEP - JUMP TO EXIT
OD5C CB79    3266      BIT 7, C ; POT LEGAL?
OD5E C0      3267      RET NZ ; NO - IGNORE
OD5F 0EFF    3268      LD C, OFFH ; SET BIT FLAG
              3269 ; POT ROUTINE
OD61 79      3270 MGETN3: LD A, C ; QUIT IF NOT IN POT MODE
OD62 3C      3271      INC A
OD63 C0      3272      RET NZ
              3273 ; HOW MANY DIGITS?
OD64 D9      3274      EXX ; TO NORMAL SET
OD65 78      3275      LD A, B ; SNATCH DIGITS
OD66 D9      3276      EXX
OD67 FE01    3277      CP 1 ; 1 PRAY TELL?
OD69 060A    3278      LD B, 10
OD6B 2802    3279      JR Z, MGETN4-$ ; JUMP IF GOOD GUESS
OD6D 0664    3280      LD B, 100 ; WRONG!
OD6F DB1C    3281 MGETN4: IN A, (POT0) ; GET CURRENT POT VALUE
OD71 57      3282      LD D, A ; RANGE IT
OD72 AF      3283      XOR A
OD73 5F      3284      LD E, A
OD74 67      3285      LD H, A
  
```

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0D75 19      3286 MGETN5: ADD HL, DE
0D76 CE00   3287      ADC A, 0      ; ADD EVERY CARRY TO AC
0D78 27     3288      DAA
0D79 10FA   3289      DJNZ MGETN5-*
0D7B D9     3290      EXX      ; BACK TO NORMAL SET
0D7C 77     3291      LD (HL), A
0D7D 1814   3292      JR MGETN8-*
          3293 ; KEYBOARD ROUTINE
0D7F 0C     3294 MGETN6: INC C      ; POT MODE?
0D80 2004   3295      JR NZ, MGETN7-* ; JUMP IF NOT
0D82 CD990D 3296      CALL CLRNUM
0D85 0C     3297      INC C      ; SET ONE DIGIT SO FAR
0D86 CBF9   3298 MGETN7: SET 7, C  ; SET POT LOCKOUT
0D88        3299      SYSTEM KCTASC
0D88 FF     3299 +      RST 56
0D89 40     3299 +      DEFB KCTASC
          3299 +      IF KCTASC, EQ, INTPC
          3299 +      ENDIF
0D8A FE3D   3300      CP '='      ; EQUALS TYPED?
0D8C 2808   3301      JR Z, MGETN9-* ; QUIT IF EQUALS
0D8E E60F   3302      AND 0FH
0D90 D9     3303      EXX
0D91        3304      SYSTEM SHIF TU ; SHIF DIGIT UP
0D91 FF     3304 +      RST 56
0D92 60     3304 +      DEFB SHIF
          3304 +      IF SHIF, EQ, INTPC
          3304 +      ENDIF
0D93 D5     3305 MGETN8: PUSH DE
0D94        3306      SYSTEM DISNUM
0D94 FF     3306 +      RST 56
0D95 36     3306 +      DEFB DISNUM
          3306 +      IF DISNUM, EQ, INTPC
          3306 +      ENDIF
          3307 ; ENTER HERE FOR EQUAL OR TRIGGER EXIT TO THROW OUT RETURN
0D96 D1     3308 MGETN9: POP DE
0D97 D9     3309      EXX      ; BACK TO NORMAL
0D98 C9     3310      RET

          3312 ; SUBROUTINE TO CLEAR NUMBER
0D99 C5     3313 CLRNUM: PUSH BC
0D9A D9     3314      EXX
0D9B E5     3315      PUSH HL ; TO NORMAL SET
0D9C 78     3316      LD A, B
0D9D 3C     3317      INC A
0D9E E63E   3318      AND 3EH
0DA0 1F     3319      RRA
0DA1 D9     3320      EXX      ; BACK TO ALTERNATE SET
0DA2 4F     3321      LD C, A
0DA3 AF     3322      XOR A
0DA4 47     3323      LD B, A
0DA5 D1     3324      POP DE
0DA6        3325      SYSTEM FILL
0DA6 FF     3325 +      RST 56
0DA7 1A     3325 +      DEFB FILL
          3325 +      IF FILL, EQ, INTPC
  
```

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3325 +      ENDIF
ODA8 C1    3326      POP BC
ODA9 C9    3327      RET

3329 ; NAME:      SHIFT UP
3330 ; INPUT:     A = DATA TO SHIFT UP
3331 ;           B = SIZE IN DIGITS
3332 ;           HL = AREA TO SHIFT ADDRESS

ODAA F5    3333 MSHFTU: PUSH AF
ODAB 78    3334      LD A, B
ODAC 3C    3335      INC A
ODAD E63E  3336      AND 3EH
ODAF 47    3337      LD B, A
ODB0 F1    3338      POP AF
ODB1 ED6F  3339 SHFTU:  RLD
ODB3 23    3340      INC HL
ODB4 10FB  3341      DJNZ SHFTU1-+
ODB6 C9    3342      RET
  
```

```

ODB7 454E5445 3344 ENT9:  DEFM 'ENTER'
ODBD 00        3345      DEFB 0
ODBE FA01     3346 CML:  DEFW CALCL
ODCO D30D     3347      DEFW PNCM
ODC2 2813     3348      DEFW CMSTRT ; CHECK RATE START
ODC4 0000     3349 SCBL:  DEFW 0
ODC6 E80D     3350      DEFW PNCBL
ODC8 190E     3351      DEFW SCBST
ODCA 47554E46 3352 PNGF:  DEFM 'GUNFIGHT'
ODD2 00        3353      DEFB 0
ODD3 43484543 3354 PNCM:  DEFM 'CHECK RATE'
ODDC 00        3355      DEFB 0
ODDD 43414C43 3356 PNCA:  DEFM 'CALCULATOR'
ODE7 00        3357      DEFB 0
ODE8 53435249 3358 PNSO:  DEFM 'SCRIBBLING'
ODF2 00        3359      DEFB 0
ODF3 53454C45 3360 GAMS:  DEFM 'SELECT GAME'
ODFE 67        3361      DEFB 67H
ODFF 08        3362      DEFB 8
OE00 58        3363      DEFB 88
OE01 0D        3364      DEFB 1101B
OE02 28432920 3365      DEFM '(C) BALLY MFG 1977'
OE14 00        3366      DEFB 0
OE15          3367      END
  
```

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TOTAL ASSEMBLER ERRORS =

CROSS REFERENCE

LABEL	VALUE	REFERENCE
A0	00E1	-509
A1	0070	-521
A2	0037	-533
A3	001B	-545
A4	000D	-557
A5	0006	-563
ACTINT	000E	-226 227 3040 3040 3084
AKEYS	0214	-1123 1075 3041
ALKEYS	0214	-50
AS0	00D4	-510
AS1	006A	-522
AS2	0034	-534
AS3	001A	-546
B0	00C8	-511
B1	0064	-523
B2	0031	-535
B3	0018	-547
BCDAD	0321	-1315 942
BCDADD	0062	-278 279
BCDCHS	006A	-282 283 1324 1374 1333 13
BCDCS	0364	-1391 946
BCDD0	0BEE	-2872 994
BCDD1	0BFD	-2881 980 2982
BCDD2	0C05	-2885 996
BCDD3	0C0B	-2888 2990
BCDD4	0C11	-2891 984
BCDDIV	0068	-231 282
BCDDV	0284	-1208 945
BCDISP	0BEB	-2870 920 2950
BCDML	02DE	-1268 944
BCDMUL	0066	-280 281
BCDNEG	006C	-283 284 1334 1384 1336 1336
BCDNG	0341	-1350 947
BCDNG1	034D	-1359 988
BCDSB	031F	-1316 943
BCDSUB	0064	-279 280
BEGRAM	4FCE	-595 640 3067 3069
BITSPL	00A0	-44
BLANK	002A	-244 245
BMUSIC	0012	-230 231
BYTEPL	0028	-43 506 2169 2248 2270 2280 2311 2348
		2377 611 3214 3217 3218
C1	00BD	-512
C2	005E	-524
C3	002E	-536
C4	0017	-548
C5	000B	-558
C6	0005	-564
C7	0002	-567
CALCL	01FA	-1099 3346
CALCST	1020	-652 1101
CBA	0009	-124 774 1080 1089 2129 2729 2932
CBB	0007	-122 842 1090 3245

PROPRIETARY INFORMATION

Dave Nutting Associates, Inc.

DO NOT REPRODUCE

CBC	0006	-121	843	1405	2032	2510	2557	2588	2949
CBD	0005	-120	775	2497	2499	2529	2784	3173	
CBE	0004	-119	776	2530	2606	2783	3172		
CBFLAG	0008	-123	1443	2028	2069				
CBH	000B	-126	768	1270	2933				
CBIXH	0003	-118	770	870					
CBIXL	0002	-117	771	867					
CBIYH	0001	-116							
CBIYL	0000	-115							
CBL	000A	-125	769	1271	2934				
CCT1	03E6	-1516	1537						
CCTLP	03DD	-1509	1538						
CHDOWN	0001	-112							
CHLEFT	0002	-111							
CHRDIS	0032	-249	250	3121	3121	3123	3123	3151	3151
CHRIGH	0003	-110							
CHTRIG	0004	-109							
CHUP	0000	-113							
CKSUM1	0033	-711							
CKSUM2	0B0E	-2698							
CLRNUM	0D99	-3147	3243	3296					
CML	0DBE	-3178	3129						
CMPIT	0C22	-2907	3008						
CMPLOP	0C30	-2915	3028						
CMSTRT	1328	-651	3348						
CNT	4FDD	-612	3547	1675	1677				
COLOL	0004	-169							
COLOR	0000	-165							
COL1L	0005	-170							
COL1R	0001	-166							
COL2L	0006	-171							
COL2R	0002	-167							
COL3L	0007	-172							
COL3R	0003	-168							
COLBX	000B	-173	1072	1084					
COLLST	4FE8	-623	3082	1083					
COLSET	0018	-235	236	3082					
CONC1	0264	-1169	1159						
CONC2	002B	-705	1171						
CONCM	0008	-190	1662						
CONCPL	0256	-1158	1144	1153					
CS1	00B2	-513							
CS2	0059	-525							
CS3	002C	-537							
CS4	0015	-549							
CS5	000A	-559							
CT0	4FD5	-603	1660						
CT1	4FD6	-604							
CT2	4FD7	-605							
CT3	4FD8	-606							
CT4	4FD9	-607							
CT5	4FDA	-608							
CT6	4FDB	-609							
CT7	4FDC	-610							
CTIMER	0203	-47							
CTLP	03D9	-1507	1549	1552					
D1	00A8	-514							

PROPRIETARY INFORMATION

Dave Nutting Associates, Inc.

DO NOT REPRODUCE

D2	0054	-526							
D3	0029	-538							
D4	0014	-550							
DABS	0072	-286	287	1257	1257	1259	1259		
DADD	006E	-284	285	1233	1233	1243	1243	1288	1288
		1338	1338						
DCLCT1	0849	-2494	2519						
DCLCTB	083E	-2486	2527	2586					
DECCTS	0010	-227	229						
DELOAD	0074	-775	1580	2587					
DISC1A	07F1	-2441	2470						
DISC1B	07FE	-2448	2464						
DISCH1	07ED	-2439	2461						
DISCH2	080A	-2453	2481						
DISCH3	080D	-2454	2479						
DISCH4	0821	-2466	2500						
DISCH5	0839	-2479	2471						
DISNUM	0036	-251	253	3307	3307				
DISPCH	07E1	-2438	918	2405	2955	2992			
DISTIM	0052	-26	269						
DIV1	029F	-122	1248						
DIV2	02A3	-123	1236						
DIV3	02B1	-123	1233						
DIV4	0315	-1307	1251						
DOIT	0044	-267	262	3255	3255				
DOITB	0046	-26	263						
DS1	009F	-51							
DS2	004F	-52							
DS3	0027	-53							
DS4	0013	-55							
DS5	0009	-56							
DS6	0004	-56							
DSMG	0070	-28	286						
DURAT	4FEA	-62	1691	1804	1911	1923			
E1	0096	-516							
E2	004A	-52							
E3	0025	-54							
E4	0012	-55							
EMUSIC	0014	-23	233	3077					
END	00C0	-38							
ENDSCR	4FF4	-63	3017						
ENTSTG	0DB7	-317	3198						
EPLOP	0410	-154	1560						
ETLP	0493	-164	1663	1666					
F1	008D	-51							
F2	0046	-52							
F3	0022	-54							
F4	0011	-55							
F5	0008	-56							
FILL	001A	-23	237	3069	3069	3213	3213	3217	3217
		332	3326						
FINDL3	0CF4	-3040	1076	2467	2502	2920			
FIRSTC	2000	-41	3064	3066	3086				
FNTSML	020D	-49							
FNTSYS	0206	-48							
FS1	0085	-518							
FS2	0042	-530							

PROPRIETARY INFORMATION

Dave Nutting Associates, Inc.

DO NOT REPRODUCE

FS3	0020	-542							
FS4	0010	-554							
FTBASE	0000	-94	2472						
FTBYTE	0003	-97	2476	2494	2546				
FTFSX	0001	-95	2531						
FTFSY	0002	-96	2537						
FTPPTH	0006	-100	2482						
FTPPTL	0005	-99	2483						
FTYSIZ	0004	-98	2477	2489					
G0	00FD	-507							
G1	007E	-519							
G2	003E	-531							
G3	001F	-543							
G4	000F	-555							
G5	0007	-562							
G6	0003	-566							
G7	0001	-568							
G8	0000	-569							
GAMSTB	4FF8	-635	752	3014	3023				
GAMSTR	0DF3	-3192	085						
GETNUM	004E	-266	267	3143	3143	3207	3207		
GETPAR	004C	-265	266						
GFSTRT	17DE	-650	131						
GMOVR	0C57	-2937	038						
GNACC	02C0	-1245	208	1280					
GNUMDO	0D4C	-3103	255						
GOUT	0502	-1732	715	1747	1751	1754			
GS0	00EE	-508							
GS1	0077	-520							
GS2	003B	-532							
GS3	001D	-544							
GS4	000E	-556							
GSBEND	0007	-63	755	3024					
GSBSCR	0001	-62	3015						
GSBTIM	0000	-61	1753						
GT01	04F4	-1724	1740						
GT02	04F9	-1728	1736						
GTIMER	04E0	-1708	1724						
GTMINS	4FEE	-629	947						
GTSECS	4FED	-628	957						
GUNLNK	0218	-1129	3091						
HANDLE	0453	-1590	1606						
HORAF	000F	-196							
HORCB	0009	-174	1515						
HUMANR	0040	-258	259						
INCLOP	0C18	-2900	3010						
INCSCR	0054	-269	271						
INDEXB	005C	-275	276						
INDEXN	0056	-272	273						
INDEXW	005A	-274	275						
INFBK	000D	-187	1045						
INLIN	000F	-189	1043						
INMOD	000E	-188	1519						
INTPC	0000	-217	218	1232	1233	1242	1243	1257	1259
		1288	1324	1333	1334	1336	1338	3035	3040
		3041	3069	3076	3076	3076	3093	3121	3123
		3126	3143	3151	3195	3201	3207	3208	3213

PROPRIETARY INFORMATION

Dave Nutting Associates, Inc.

DO NOT REPRODUCE

		3217	3224	3252	3253	3255	3300	3305	3307
		3326							
INTPE	004E	-754	844						
INTPE	0000	-2963	-2967						
INTST	0008	-194							
INXNIB	0B76	-2745	936						
ITAB	0034	-713	1040	1044					
JOYS	0471	-1610	1624						
KCTASC	0040	-259	260	3300	3300				
KCTATB	0AD5	-2640	2726						
KEY0	0014	-207							
KEY1	0015	-208							
KEY2	0016	-209							
KEY3	0017	-210	1582						
KEYSEX	4FE3	-618	1570	1719					
LRGCHR	08E4	-2610	1113						
M81	053A	-1791	1826						
M815	0540	-1794	1824						
M82	0547	-1798	1816						
M83	054B	-1801	1819	1821					
MACTIN	013B	-1034	713	900					
MAGIC	000C	-191	127	2556	2616	2788			
MATH	0056	-271	272						
MBLAN1	07A3	-2328	2358						
MBLAN2	07A4	-2329	2355						
MBLANK	079E	-2324	2314						
MCALL	0006	-220	221						
MCOLOR	01DB	-1083	905						
MDISTI	0BCC	-2840	934						
MDO1A	061C	-1935							
MDOIT	060C	-1923	927						
MDOIT0	060E	-1925	961						
MDOIT1	0616	-1931	952						
MDOIT2	0620	-1938	958						
MDOIT3	0621	-1939							
MDOITB	060B	-1922	928						
MENTRY	01AC	-1062	926						
MENU	004A	-264	265	3093	3093				
MENUCL	0013	-676	082						
MENUST	0218	-51							
MFILL	0AEE	-2672	906						
MFILL1	0AEF	-2673	2767						
MFROG	0B06	-2693	2350						
MGETN	0D31	-3094	932						
MGETN1	0D36	-3097	249						
MGETN2	0D55	-3101	259						
MGETN3	0D61	-3110	260						
MGETN4	0D6F	-3121	279						
MGETN5	0D75	-3126	289						
MGETN6	0D7F	-3134	258						
MGETN7	0D86	-3138	295						
MGETN8	0D93	-3141	3292						
MGETN9	0D96	-3142	3265	3301					
MGETP	0CFB	-3058	931						
MINCSC	0C15	-2898	935						
MINDB	0BBD	-2824	939						
MINDB1	0BC5	-2829	2921						

PROPRIETARY INFORMATION

Dave Nutting Associates, Inc.

DO NOT REPRODUCE

MINDW	OBAC	-2807	938	
MINTO	0084	-829	753	
MINT1	0095	-837	835	
MINT2	009A	-840	830	
MINTPC	007B	-814	893	
MJUMP	000A	-222	223	
MKCTAS	0AC9	-2631	925	
MMCALL	007D	-824	896	1968
MMENU	0C97	-2992	930	
MMENU1	0CA2	-2996	3136	
MMENU3	0CC8	-3012	3151	
MMENU5	0CD9	-3019	3146	
MMENU6	0CDF	-3020	3148	
MMENU7	0CE2	-3023	3159	
MMJUMP	0AC4	-2622	898	
MMOVE	0B4B	-2701	940	
MMRET	0B73	-2740	897	
MMTD	0240	-1144	956	
MMTD1	024E	-1152	150	
MMTD2	024F	-1153	147	
MNCLR	0D19	-3070	3114	3193
MNGH	0005	-2951		
MNGL	0004	-2950		
MNNH	0001	-2947	2131	
MNNL	0000	-2946	132	
MNSAH	0003	-2949	123	
MNSAL	0002	-2948	124	
M00	055B	-1809	1802	
M001	056B	-1818	1837	
M01	0574	-1823	1834	
M02	057D	-1828	1847	
M03	0587	-1834	1853	
M04	0594	-1841	1859	
M040	05A1	-1848	1865	
M041	05A5	-1850	1867	
M043	05B7	-1858	1876	
M044	05C0	-1865	1902	
M045	05C5	-1867	1857	
M05	05CC	-1870	1873	
M06	05DA	-1879	1895	
M061	05E6	-1884	1903	
MOVE	005E	-276	277	
MPAINT	06B2	-2099	907	
MPAUSE	001B	-687	733	
MPIZBK	01BA	-1068	929	1079
MPT1	06C5	-2112	2140	
MPT2	06CF	-2117	2137	
MPT3	06D5	-2122	2151	
MPT4	06DE	-2128	2147	
MQUIT	0C41	-2930	953	
MQUIT1	0C4A	-2932	1045	
MQUIT2	0C56	-2936	3043	
MRANGE	037F	-1425	952	
MRARGT	014B	-968	833	
MRCALL	0632	-1952	895	1970
MRELA1	0AFB	-2689	922	
MRELA2	0B00	-2691	2779	

PROPRIETARY INFORMATION

Dave Nutting Associates, Inc.

DO NOT REPRODUCE

MRELAB	0AF6	-2686	921	2231	
MREST	07AD	-2340	916		
MREST1	07B5	-2347	2381		
MRET	0008	-221	222		
MRFLOP	0006	-102	1146	2235	2330
MRLOCK	4FF7	-634			
MROR	0004	-104			
MRROT	0002	-106			
MRSHFT	0003	-107			
MRXOR	0005	-103			
MRXPND	0003	-105	2237	2276	
MSAVE	03B9	-1469	915		
MSAVE1	03C2	-1477	1509		
MSCRL1	026B	-1179	1189		
MSCROL	026A	-1178	917		
MSENK2	043B	-1570	1586	1596	
MSENKE	0446	-1579	1593		
MSETB	036C	-1398	954		
MSETUP	03CF	-1491	904		
MSETW	0023	-697	955		
MSHFTU	0DAA	-3165	941		
MSK1	042C	-1560	590		
MSKTD	007E	-292			
MSUCK	00A4	-857	899		
MSUCK1	00A8	-863	839	2412	
MSUCK2	00B6	-871	864		
MSUCK3	00BF	-879	886		
MSUCK5	00C6	-884	880		
MULT1	02CD	-1251	264		
MULT2	02E1	-1269	296		
MULT3	02E8	-1275	1291		
MULT4	02F0	-1279	295		
MULT5	0309	-1298	314		
MULT6	031B	-1308	1240	1322	1325
MULT7	0313	-1305	1316		
MUZ999	05F4	-1893	1932		
MUZAK	0012	-229	230		
MUZCP1	0517	-1774	768		
MUZCPU	0514	-1773	699		
MUZPC	4FCE	-597	797	1917	
MUZSET	0508	-1741	902		
MUZSP	4FD0	-598	766	1798	1918
MUZSTP	05FC	-1898	903	1767	1809
MVBLA1	079A	-2315	2331		
MVBLAN	077D	-2301	913		
MVCT1A	066F	-2047	2068		
MVECT	0633	-2004	924		
MVECT1	0665	-2040	2065		
MVECT2	0684	-2062	2080	2082	
MVECT3	06A4	-2082	2085		
MVECT6	06A6	-2084	2072		
MVECTC	0656	-2033	923	2039	
MVWRIT	06FE	-2174	908		
MWRIT	0719	-2207	911		
MWRITA	071C	-2211	912		
MWRITP	0715	-2200	910		
MWRITR	070B	-2184	909		

PROPRIETARY INFORMATION

Dave Nutting Associates, Inc.

DO NOT REPRODUCE

MWRT	0725	-2217	2252				
MWRTFL	0740	-2252	2236				
MWX	0735	-2231	2238				
MWX1	0736	-2232	2273				
MWX2	0739	-2235	2265				
MWXF	0766	-2272	2277				
MWXF1	0767	-2273	2314				
MWXF2	076A	-2276	2306				
MXINTC	0279	-1194	894				
MXSCR	021E	-52					
NEGT	0074	-287	288	1232	1232	1242	1242
NOGAME	0235	-54					
NOLINE	0060	-2945	3078	3218			
NOPLAY	0228	-53					
NORMEM	4000	-40	3213	3217			
NUMBAS	000B	-669	3253				
NUMPLY	4FF3	-632					
NWHDWR	0001	-37	2836				
NXTFR1	0858	-2507	2532				
NXTFR2	0863	-2513	2538				
NXTFR3	086A	-2517	2534				
NXTFRM	084E	-2503	2466	2487			
QA1	008F	-577					
QA2	0047	-578					
QA3	0023	-579					
QA4	0011	-580					
QA5	0008	-581					
QBO	00FE	-571					
QCO	00F1	-572					
QD1	00D6	-573					
QE1	00BF	-574					
QF1	00B4	-575					
QG1	00A0	-576					
QPLOOP	051E	-1775	1841	1846	1851	1864	
QPLP2	0592	-1940	1871	1881	1888	1893	1900
QPOT0	4FDF	-614					
QPOT1	4FE0	-615					
QPOT2	4FE1	-616					
QPOT3	4FE2	-617					
OSW0	4FE4	-619					
OSW1	4FE5	-620					
OSW2	4FE6	-621					
OSW3	4FE7	-622					
PAWS	0050	-267	268	3208	3208		
PBLP	01C7	-1075					
PFUG	0008	-649	1559				
PHOT	040B	-1538	1558				
PIZBRK	0048	-263	264				
PNCALC	0DDD	-3188	3100				
PNCM	0DD3	-3186	3347				
PNGF	0DCA	-3184	3130				
PNSCB	0DE8	-3190	3350				
POT0	001C	-202	1093	1553	3281		
POT1	001D	-203					
POT2	001E	-204					
POT3	001F	-205					
PRIOR	4FF9	-636	1685	1756	1904	1906	1924

PROPRIETARY INFORMATION

Dave Nutting Associates, Inc.

DO NOT REPRODUCE

PSWCY	0000	-59				
PSWPV	0002	-58				
PSWSGN	0007	-56				
PSWZRO	0006	-57	2028	2069		
PUSH1	005D	-763	761			
PUTNB1	0BA5	-2794	2889			
PUTNB2	0BA8	-2796	2897			
PUTNIB	0B90	-2778	937			
PVOLAB	4FD2	-599	1828	1861		
PVOLMC	4FD3	-600	1830			
PWRUP	0C61	-2954	663			
PWRUP1	0C95	-2974	3090			
QFROG	0AD1	-2637	1474	2785		
QUIT	0078	-289	290			
R1	03A2	-1445	1473			
R2	03A6	-1448	1470			
R3	03A9	-1450	1467			
RANGED	0076	-288	289	3252	3252	
RANSH	4FEF	-631	1450	1455	1456	1460
RCALL	0004	-219	220			
RECTAN	001C	-237	238			
RELAB1	003A	-254	255			
RELABS	0038	-253	254			
RELD	0068	-770	2413			
RELTA	0B08	-2695	2592	2778		
RELTA1	0B4E	-2705	1124	2781	2787	
RELTA2	0B56	-2711				
RELTA3	0B5F	-2717	2818			
RENTER	007C	-815	827			
REPEAT	0C3B	-2922	3021			
RESTOR	002E	-246	247			
RETN	027A	-1197	1751			
SAVE	002C	-245	246			
SCBL	0DC4	-3181	3099			
SCBST	0E19	-653	3351			
SCHEDR	000C	-225	226			
SCREEN	0000	-42				
SCROLL	0030	-247	249			
SCRSTR	0016	-233	234			
SCT0	0001	-129				
SCT1	0002	-130				
SCT2	0003	-131				
SCT3	0004	-132				
SCT4	0005	-133				
SCT5	0006	-134				
SCT6	0007	-135				
SCT7	0008	-136				
SDABS	0356	-1374	950			
SDADD	036E	-1408	948			
SDADD1	036F	-1409	949			
SDSMG	0329	-1323	949			
SDSMG1	0333	-1331	1360			
SEMI4S	4FDE	-613				
SENFLG	4FFA	-637	1062			
SENTRY	0042	-260	261	3041	3041	3253 3253
SETB	007A	-290	291			
SETEND	0C35	-2919	3029			

PROPRIETARY INFORMATION

Dave Nutting Associates, Inc.

DO NOT REPRODUCE

SETOUT	0016	-234	235	3078					
SETW	007C	-291	292						
SFO	0009	-137							
SF1	000A	-138							
SF2	000B	-139							
SF3	000C	-140							
SF4	000D	-141							
SF5	000E	-142							
SF6	000F	-143							
SF7	0010	-144							
SH1	03B1	-1455	1482						
SHFTU1	0DB1	-3171	3341						
SHIFTR	03AC	-1451	1451	1458					
SHIFTU	0060	-277	278	3305	3305				
SIXY	04CC	-1689	1694	1702	1706	1709			
SJO	0015	-153							
SJ1	0017	-155							
SJ2	0019	-157							
SJ3	001B	-159							
SKYD	0013	-146	091	1602	3044	3258			
SKYU	0012	-147	092						
SMLCHR	0ABF	-2620	120						
SMLFNT	020D	-1115	0945						
SNDBX	0018	-185	1806	1839	1905				
SNEGT	034C	-1358	0951						
SNUL	0000	-128							
SPO	001C	-148	0260						
SP1	001D	-149							
SP2	001E	-150							
SP3	001F	-151							
SSEC	0011	-145	1576						
ST0	0014	-152	042	3259					
ST1	0016	-154							
ST2	0018	-156							
ST3	001A	-158							
STAKO	04BE	-1679	1696						
STHLDE	0BB8	-2816	1155						
STIMER	0200	-46							
STOREN	0058	-273	0274						
STRD1	07CE	-2381	0402						
STRD2	07D4	-2384	0404						
STRDIS	0034	-250	0251	3035	3035	3126	3127	3195	3195
		3201	0201	3224	3224				
STRIPE	06E2	-2134	0139	2152					
STRNEW	07C4	-2375	0119	2407					
STRP1	06EB	-2139	02174						
SUCK	000C	-223	0225						
SW0	0010	-198	0314						
SW1	0011	-199							
SW2	0012	-200							
SW3	0013	-201							
SWHIT	0461	-1599	1618						
SWLOP	0456	-1591	1620						
SYSDPT	00CB	-893	756						
SYSFNT	0206	-1108	2462						
SYSRAM	4FCE	-640							
TIMEX	047B	-1625	1106						

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TIMEY	047E	-1635	901	1048		
TIMEZ	04A0	-1660	1046	1105		
TIMLP	0485	-1638	1674			
TIMOUT	4FEC	-627	1065	1096	3074	
TKEYS	0421	-1555	1573			
TMR60	4FEB	-626				
TONEA	0011	-178				
TONEB	0012	-179				
TONEC	0013	-180				
TONMO	0010	-177				
TPLOP	03FF	-1530	1568			
TRCHK	03EC	-1522	1088			
TSEX	0413	-1546	1546			
TTEST	01E5	-1088	1067	1077		
UMARGT	4FFB	-638	836			
UPISTR	0000	-216	217			
USERTB	4FFD	-639	762			
VBBLNK	0006	-88	2201	2325	2327	
VBCCHK	0004	-85	2071	2090	2093	2111
VBCH	0003	-84	2060	2088	2109	
VBCL	0002	-83	2061	2089	2108	
VBCLAT	0003	-92	2090	2111		
VBCLMT	0000	-90	2071			
VBCREV	0001	-91	2093			
VBDCH	0001	-82	2058	2104		
VBDCL	0000	-81	2059	2103		
VBDXH	0004	-69				
VBDXL	0003	-68	2037	2040		
VBDYH	0009	-74				
VBDYL	0008	-73	2040			
VBLANK	0028	-243	244			
VBMR	0000	-65	2198	2330		
VBOAH	000E	-79	2328			
VBOAL	000D	-78	2329			
VBSACT	0007	-87	2029			
VBSTAT	0001	-66	2029	2201	2325	2327
VBTIMB	0002	-67	2030	2031		
VBXCHK	0007	-72				
VBXH	0006	-71	200			
VBXL	0005	-70				
VBYCHK	000C	-77				
VBYH	000B	-76	2199			
VBYL	000A	-75				
VECT	003E	-256	258			
VECTC	003C	-255	256			
VERAF	000E	-195				
VERBL	000A	-175				
VIBRA	0014	-181				
VOICES	4FD4	-601	1765	1805	1850	
VOLAB	0016	-182	1071	1711	1829	1914
VOLC	0015	-183	1070	1712	1831	1915
VOLN	0017	-184				
VWRITR	001E	-238	239			
WASTE	0FFF	-586	587	2160	2161	3072
WASTER	0FFF	-587				
WRFL1	0751	-2255	2293			
WRFL2	0754	-2258	2285			

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WRIT	0024	-241	242	
WRITA	0026	-242	243	
WRITP	0022	-240	241	
WRITR	0020	-239	240	
WRTL1	088D	-2538	2584	
WRTL2	0898	-2546	2576	
WRTL3	08AC	-2562	2559	
WRTL4	08BF	-2570	2617	
WRTL5	08C4	-2575	2605	
WRTL6	08D4	-2586	2608	
WRTLIN	086C	-2522	2492	
XINTC	0002	-218	219	3085
XNIB	0B7B	-2756	2849	2979
XNIB1	0B8C	-2769	2868	
XPAND	0019	-192	2554	2589
XPNDON	0001	-36		

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641
642          LIST S,X,M,T
643 ; *****
644 ; * SKETCH *
645 ; *****
646 ;
647 ; THE OFFICIAL NAME OF THIS
648 ; PROGRAM IS SCRIBBLING
649 ;
650 ; SKETCH EQUATES
651 ; SKETCH PACKET DISPLACEMENTS:
>001E      652 SCPSIZ EQU 30          ; SIZE OF SKETCH PACKET
>0000      653 SCSAVA EQU 0          ; SAVE AREA START
>001A      654 SCXC EQU 26          ; X COORDINATE
>001B      655 SCYC EQU 27          ; Y COORDINATE
>001C      656 SCSADL EQU 28        ; SAVE ADDRESS LO AND HI
>001D      657 SCSADH EQU 29
658 ; OTHER GOODIES
>0004      659 MOVTR EQU 4          ; MOVE RATE
>0014      660 KSCSTEP EQU 20       ; COLOR STEPPING TIME
661          ORG 0E19H              ; ** START
0E19      662 BEGIN: SYSSUK GETPAR
0E19 FF    662 + RST 56
0E1A 4D    662 + DEFB GETPAR+1
662 + IF GETPAR.EQ. INTPC
662 + ENDIF
0E1B 2802  663 DEFW NOPLA
0E1D 01    664 DEFB 1
0E1E F34F  665 DEFW NUMPLY
0E20      666 SCSADL
0E20 31E84E 667 LD SP, SCSADL
0E23      668 SYSTEM INTFC
0E23 FF    668 + RST 56
0E24 00    668 + DEFB INTPC
668 + IF INTPC.EQ. INTPC
>0001      668 +INTFC DEFL 1
668 + ENDIF
0E25      669 DO FILL          ; CLEAR SCREEN
0E25 1B    669 + DEFB FILL+1
0E26 0040  670 DEFW NORMEM
0E28 600E  671 DEFW 92*BYTEPL
0E2A 00    672 DEFB 0
0E2B      673 DO FILL
0E2B 1B    673 + DEFB FILL+1
0E2C F04E  674 DEFW P1SCP
0E2E 7800  675 DEFW SCPSIZ*4
0E30 00    676 DEFB 0
0E31      677 DO SETOUT
0E31 17    677 + DEFB SETOUT+1
0E32 B8    678 DEFB 184
0E33 28    679 DEFB 40
0E34 08    680 DEFB 8
0E35      681 DO MOVE
0E35 5F    681 + DEFB MOVE+1
0E36 E84E  682 DEFW COLORS
0E38 0800  683 DEFW 8
0E3A 0C10  684 DEFW INICOL

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0E3C		685		DO	COLSET	
0E3C	19	685	+	DEFB	COLSET+1	
0E3D	E84E	686		DEFW	COLORS	
0E3F		687		DO	SETW	
0E3F	7D	687	+	DEFB	SETW+1	
0E40	46	688		DEFB	70	
0E41	24	689		DEFB	36	
0E42	0A4F	690		DEFW	P1SCP+SCXC	
0E44		691		DO	SETW	
0E44	7D	691	+	DEFB	SETW+1	
0E45	53	692		DEFB	83	
0E46	24	693		DEFB	36	
0E47	284F	694		DEFW	P2SCP+SCXC	
0E49		695		DO	SETW	
0E49	7D	695	+	DEFB	SETW+1	
0E4A	46	696		DEFB	70	
0E4B	30	697		DEFB	48	
0E4C	464F	698		DEFW	P3SCP+SCXC	
0E4E		699		DO	SETW	
0E4E	7D	699	+	DEFB	SETW+1	
0E4F	53	700		DEFB	83	
0E50	30	701		DEFB	48	
0E51	644F	702		DEFW	P4SCP+SCXC	
0E53		703		DO	SETB	
0E53	7B	703	+	DEFB	SETB+1	
0E54	04	704		DEFB	MOVTMP	
0E55	D54F	705		DEFW	CTO	
0E57		706		DONT	XINTC	
0E57	02	706	+	DEFB	XINTC	
0E58	21580E	707	MAIN	LD	HL, MAINP	
0E5B	E5	708		PUSH	HL	
0E5C		709		SYSSUK	SENTRY	
0E5C	FF	709	+	RST	56	
0E5D	43	709	+	DEFB	SENTRY	
		709	+	IF	SENTRY EQ. INTPC	
		709	+	ENDIF		
0E5E	650E	710		DEFW	KEYMES	
0E60		711		SYSSUK	DOIT	
0E60	FF	711	+	RST	56	
0E61	45	711	+	DEFB	DOIT+1	
		711	+	IF	DOIT EQ. INTPC	
		711	+	ENDIF		
0E62	A10E	712		DEFW	SCDOT	
0E64	C9	713		RET		
0E65	2F	714	KEYM	DEFB	2FH	
0E66	0F	715		DEFB	0FH	
0E67	0F	716		DEFB	0FH	
0E68	0F	717		DEFB	0FH	
		718			; KEYBOARD HANDLER	
0E69	05	719	KEYBO:	DEC	B	
0E6A	0E03	720		LD	C, 3	
0E6C	78	721		LD	A, B	
0E6D	FE14	722		CP	20	; CLEAR ENTRY DOWN?
0E6F	28AF	723		JR	Z, SCCLR-*	; JUMP TO CLEAR IF SO
0E71	0F	724		RRCA		
0E72	0F	725		RRCA		
0E73	A1	726		AND	C	

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0E74		727		SYSSUK INDEXB	
0E74	FF	727	+	RST 56	
0E75	5D	727	+	DEFB INDEXB+1	
		727	+	IF INDEXB. EQ. INTPC	
		727	+	ENDIF	
0E76	290F	728		DEFW CDELTB	
0E78	EB	729		EX DE, HL	
0E79	78	730		LD A, B	
0E7A	A1	731		AND C	
0E7B	67	732		LD H, A	
0E7C	79	733		LD A, C	
0E7D	94	734		SUB H	
0E7E		735		SYSSUK INDEXB	; POINT AT COLOR
0E7E	FF	735	+	RST 56	
0E7F	5D	735	+	DEFB INDEXB+1	
		735	+	IF INDEXB. EQ. INTPC	
		735	+	ENDIF	
0E80	E84E	736		DEFW COLORS	
0E82	1A	737		LD A, (DE)	
0E83	86	738		ADD A, (HL)	; ADD DELTA FACTOR
0E84	CB58	739		BIT 3, B	; WAS KEY FOR INTENSITY?
0E86	2804	740		JR Z, KEYB -*	
0E88	AE	741		XOR (HL)	
0E89	E607	742		AND 7	
0E8B	AE	743		XOR (HL)	
0E8C	77	744	KEYB1	LD (HL), A	
0E8D	23	745		INC HL	; CHANGE COLOR ON OTHER SIDE
0E8E	23	746		INC HL	
0E8F	23	747		INC HL	
0E90	23	748		INC HL	
0E91	77	749		LD (HL), A	
0E92		750		SYSSUK COLSET	
0E92	FF	750	+	RST 56	
0E93	19	750	+	DEFB COLSET+1	
		750	+	IF COLSET. EQ. INTPC	
		750	+	ENDIF	
0E94	E84E	751		DEFW COLORS	
0E96	3E14	752		LD A, KSCTR	; SET KEYSEX CLEAR TIMER
0E98	32D64F	753		LD (CT1), A	
0E9B	C9	754		RET	
		755		; ROUTINE TO CLEAR KEYSEX	
0E9C	AF	756	KLRKSX:	XOR A	
0E9D	32E34F	757		LD (KEYSEX), A	
0EA0	C9	758		RET	
0EA1		759	SCDCT1:	JMP SCT0, DOWRTS	
0EA1	01	759	+	DEFB SCT0	
0EA2	D30F	759	+	DEFW DOWRTS	
		759	+	IF 0	
		759	+	ENDIF	
0EA4		760		JMP SCT1, KLRKSX	
0EA4	02	760	+	DEFB SCT1	
0EA5	9COE	760	+	DEFW KLRKSX	
		760	+	IF 0	
		760	+	ENDIF	
0EA7		761		JMP SKYD, KEYBO	
0EA7	13	761	+	DEFB SKYD	
0EA8	690E	761	+	DEFW KEYBO	

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761 + IF 0
761 + ENDIF
762 ; ITERATE THROUGH ACTIVE PLAYERS SUBROUTINE
OEAA DD21F04E 763 ITER4: LD IX, P1SCP
OEAE 3AF34F 764 LD A, (NUMPLY)
OEB1 47 765 LD B, A
OEB2 4F 766 LD C, A
OEB3 C5 767 ITER41: PUSH BC
OEB4 E5 768 PUSH HL
OEB5 11BA0E 769 LD DE, ITRET
OEB8 D5 770 PUSH DE
OEB9 E9 771 JP (HL)
OEBA 111E00 772 ITRET: LD DE, SCPSIZ
OEBD DD19 773 ADD IX, DE
OEBF E1 774 POP HL
OEC0 C1 775 POP BC
OEC1 10F0 776 DJNZ ITER41-$
OEC3 C9 777 RET
778 ; UPDATE COORDINATES ROUTINE
OEC4 79 779 SCRUP1: LD A, C
OEC5 90 780 SUB B
OEC6 781 SYSSUK INDEB
OEC6 FF 781 + RST 56
OEC7 5D 781 + DEFB INDEB+1
781 + IF INDEB EQ. INTPC
781 + ENDIF
OEC8 E44F 782 DEFW OSWO
OECA E60F 783 AND OFH
OECB CD0110 784 CALL GETDL ; GET DELTAS
OECF DD7E1A 785 LD A, (IX+SCXC) ; UPDATE X
OED2 82 786 ADD A, D
OED3 FE98 787 CP 152 ; OUT OF BOUNDS?
OED5 3003 788 JR NC, SCRUP1-$
OED7 DD771A 789 LD (IX+SCYC), A
OEDA DD7E1B 790 SCRUP1: LD A, (IX+SCYC) ; SAME FOR Y
OEDD 84 791 ADD A, H
OEDE FE55 792 CP 85
OEE0 D0 793 RET NC
OEE1 DD771B 794 LD (IX+SCYC), A
OEE4 C9 795 RET
796 ; RESTORE
OEE5 DDE5 797 SCRUP1: PUSH IX
OEE7 D1 798 POP DE
OEE8 1A 799 LD A, (DE)
OEE9 A7 800 AND A
OEEA C8 801 RET Z
OEEB DD661D 802 LD H, (IX+SCSADH)
OEEE DD6E1C 803 LD L, (IX+SCSADL)
OEF1 804 SYSTEM RESTOR
OEF1 FF 804 + RST 56
OEF2 2E 804 + DEFB RESTOR
804 + IF RESTOR EQ. INTPC
804 + ENDIF
OEF3 AF 805 XOR A
OEF4 12 806 LD (DE), A
OEF5 C9 807 RET
808 ; WRITE ROUTINE

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0EF6 79      309  SCRWR1: LD  A,C
0EF7 90      310          SUB  B
0EF8        311          SYSSUK INDEXB
0EF8 FF      311 +    RST  56
0EF9 5D      311 +    DEFB INDEXB+1
              311 +    IF  INDEXB.EQ. INTPC
              311 +    ENDIF
0EFA E44F    312          DEFW OSWO
0EFC E610    313          AND  10H
0EFE C3      314          RET  Z
0EFF 2B      315  SCRWR1: DEC  HL          ; BACKUP TO POT
0F00 2B      316          DEC  HL
0F01 2B      317          DEC  HL
0F02 2B      318          DEC  HL
0F03 2B      319          DEC  HL
0F04 7E      320          LD  A,(HL)
0F05 07      321          RLCA
0F06 07      322          RLCA
0F07 4F      323          LD  C,A
0F08 E603    324          AND  3
0F0A        325          SYSSUK INDEXB          ; SET SIZES
0F0A FF      325 +    RST  56
0F0B 5D      325 +    DEFB INDEXB+1
              325 +    IF  INDEXB.EQ. INTPC
              325 +    ENDIF
0F0C 260F    326          DEFW SIZTBL
0F0E DD561B  327          LD  D,(IX+CYC)
0F11 DD5E1A  328          LD  E,(IX+CXC)
0F14 47      329          LD  B,A
0F15 79      330          LD  A,C
0F16 07      331          RLCA
0F17 07      332          RLCA
0F18 E603    333          AND  3
0F1A        334  SCRWR2: SYSSUK INDEXB
0F1A FF      334 +    RST  56
0F1B 5D      334 +    DEFB INDEXB+1
              334 +    IF  INDEXB.EQ. INTPC
              334 +    ENDIF
0F1C 220F    335          DEFW COLMS
0F1E 48      336          LD  C,B
0F1F        337          SYSTEM RECTAN
0F1F FF      337 +    RST  56
0F20 1C      337 +    DEFB RECTAN
              337 +    IF  RECTAN.EQ. INTPC
              337 +    ENDIF
0F21 C9      338          RET
0F22 00      339  COLM: DEFB 0
0F23 55      340          DEFB 01010101B
0F24 AA      341          DEFB 10101010B
0F25 FF      342          DEFB 11111111B
0F26 01      343  SIZTBL: DEFB 1
0F27 02      344          DEFB 2
0F28 04      345          DEFB 4
0F29 08      346  CDELTB: DEFB 8
0F2A F8      347          DEFB -8
0F2B 01      348          DEFB 1
0F2C FF      349          DEFB -1
  
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      850 ; SAVE ROUTINE
OF2D 78      851 SCRSAV: LD  A, B
OF2E         852      SYSSUK INDEXB
OF2E FF      852 +    RST  56
OF2F 5D      852 +    DEFB  INDEXB+1
              852 +    IF   INDEXB.EQ. INTPC
              852 +    ENDIF
OF30 E34F    853      DEFW  OSWO-1
OF32 E610    854      AND   10H
OF34 C0      855      RET   NZ
OF35 E5      856      PUSH HL
OF36 DD561B  857      LD   D, (IX+SCYC)
OF39 DD5E1A  858      LD   E, (IX+SCXC)
OF3C         859      SYSTEM RELAB1
OF3C FF      859 +    RST  56
OF3D 3A      859 +    DEFB  RELAB1
              859 +    IF   RELAB1.EQ. INTPC
              859 +    ENDIF
OF3E DD721D  860      LD   (IX+SCSADH), D
OF41 DD731C  861      LD   (IX+SCSADL), E
OF44 EB      862      EX   DE, HL
OF45 DDE5    863      PUSH IX
OF47 D1      864      POP  DE
OF48 010308  865      LD   BC, 0803H ; SAVE WORST CASE
OF4B         866      SYSTEM SAVE
OF4B FF      866 +    RST  56
OF4C 2C      866 +    DEFB  SAVE
              866 +    IF   SAVE.EQ. INTPC
              866 +    ENDIF
OF4D E1      867      POP  HL
OF4E 18AF    868      JR   SCRWAP$
              869 ; ZERO PLAYER GAME WRITE HANDLE
OF50 21F04E  870 ZEROPL: LD  HL, ZPSTMR ; LOAD PTR TO SIZE TIMER
OF53 11F34E  871      LD   DE, ZPSZ ; AND SIZE TRACKER
OF56 35      872      DEC  (HL) ; DECREMENT SIZE TIMER
OF57 F2690F  873      JP   P, ZPA ; JUMP IF NO COUNTDOWN
OF5A         874      SYSSUK RANGED ; GET NEW SIZE
OF5A FF      874 +    RST  56
OF5B 77      874 +    DEFB  RANGED+1
              874 +    IF   RANGED.EQ. INTPC
              874 +    ENDIF
OF5C 30      875      DEFB  48
OF5D FE08    876      CP   8 ; 8-47
OF5F 3802    877      JR   C, ZPO ; NO ZPO
OF61 E603    878      AND  3 ; YES HAVE MORE 1-4S
OF63 3C      879 ZPO: INC  A
OF64 12      880      LD   (DE), A ; SET NEW SIZE
OF65         881      SYSSUK RANGED ; GET NEW SIZE TIMER
OF65 FF      881 +    RST  56
OF66 77      881 +    DEFB  RANGED+1
              881 +    IF   RANGED.EQ. INTPC
              881 +    ENDIF
OF67 78      882      DEFB  120
OF68 77      883      LD   (HL), A
OF69 23      884 ZPA: INC  HL ; ADVANCE TO COLOR STUFF
OF6A 13      885      INC  DE
OF6B 35      886      DEC  (HL) ; AND DEC COLOR TIMER
  
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0F6C	F2770F	387		JP	P, ZPB	
0F6F		388		SYSSUK	RANGED	; GET NEW COLOR
0F6F	FF	388	+	RST	56	
0F70	77	388	+	DEFB	RANGED+1	
		388	+	IF	RANGED. EQ. INTPC	
		388	+	ENDIF		
0F71	04	389		DEFB	4	
0F72	12	390		LD	(DE), A	
0F73		391		SYSSUK	RANGED	; GET NEW COLOR TIMER
0F73	FF	391	+	RST	56	
0F74	77	391	+	DEFB	RANGED+1	
		391	+	IF	RANGED. EQ. INTPC	
		391	+	ENDIF		
0F75	78	392		DEFB	120	
0F76	77	393		LD	(HL), A	
0F77	23	394	ZPB:	INC	HL	; TO DIRECTION STUFF
0F78	13	395		INC	DE	
0F79	35	396		DEC	(HL)	; DECREMENT DIRECTION TIMER
0F7A	F2930F	397		JP	P, ZPD	
0F7D	11F54E	398	ZPC:	LD	DE, DIRVAL	; DE = DIRECTION TRACKER
0F80		399		SYSSUK	RANGED	; DRAW NEW DIRECTION
0F80	FF	399	+	RST	56	
0F81	77	399	+	DEFB	RANGED+1	
		399	+	IF	RANGED. EQ. INTPC	
		399	+	ENDIF		
0F82	0A	900		DEFB	10	
0F83	3C	901		INC	A	
0F84	FE03	902		CP	3	; REJECT ILLEGAL VALUES
0F86	28F5	903		JR	Z, ZPC	
0F88	FE07	904		CP	7	
0F8A	28F1	905		JR	Z, ZPC	
0F8C	12	906		LD	(DE), A	
0F8D		907		SYSSUK	RANGED	
0F8D	FF	907	+	RST	56	
0F8E	77	907	+	DEFB	RANGED	
		907	+	IF	RANGED. EQ. INTPC	
		907	+	ENDIF		
0F8F	28	908		DEFB	40	
0F90	32F24E	909		LD	(DIRTR), A	
0F93	1A	910	ZPD:	LD	A, (DE)	; GET DIRECTION VALUE
0F94	CD0110	911		CALL	GETDL	; GET DELTAS
0F97	010A4F	912		LD	BC, P13CP+SCXC	; POINT AT COORDINATES
0F9A	0A	913		LD	A, (BC)	
0F9B	82	914		ADD	A, D	
0F9C	FE50	915		CP	80	
0F9E	30DD	916		JR	NC, ZPC-\$	; GET NEW DIRECTION IF AT LMT
0FA0	02	917		LD	(BC), A	
0FA1	5F	918		LD	E, A	; SAVE X COORDINATE
0FA2	03	919		INC	BC	
0FA3	0A	920		LD	A, (BC)	
0FA4	84	921		ADD	A, H	
0FA5	FE2E	922		CP	46	
0FA7	30D4	923		JR	NC, ZPC-\$	
0FA9	02	924		LD	(BC), A	
0FAA	57	925		LD	D, A	; SET Y COORDINATE
0FAB	21F34E	926		LD	HL, ZPSIZ	; POINT AT SIZES AGAIN
0FAE	46	927		LD	B, (HL)	

PROPRIETARY INFORMATION
 Data Muling Associates, Inc.

DO NOT REPRODUCE

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OFAF 23      928      INC HL
OFB0 7E      929      LD A, (HL)      ; GET COLOR TOO
OFB1 CD1A0F  930      CALL SCRWR2     ; DO FIRST WRITE
OFB4 67      931      LD H, A         ; SAVE COLOR
OFB5 D5      932      PUSH DE        ; AND X, Y
OFB6 3E5C    933      LD A, 92       ; REFLECT Y
OFB8 90      934      SUB B
OFB9 92      935      SUB D
OFBA 57      936      LD D, A
OFBB 7C      937      LD A, H
OFBC        938      SYSTEM RECTAN
OFBC FF      938 +    RST 56
OFBD 1C      938 +    DEFB RECTAN
          938 +    IF RECTAN. EQ. INTPC
          938 +    ENDIF
OFBE 3EA0    939      LD A, 160      ; REFLECT X
OFC0 91      940      SUB C
OFC1 93      941      SUB E
OFC2 5F      942      LD E, A
OFC3 7C      943      LD A, H
OFC4        944      SYSTEM RECTAN
OFC4 FF      944 +    RST 56
OFC5 1C      944 +    DEFB RECTAN
          944 +    IF RECTAN. EQ. INTPC
          944 +    ENDIF
OFC6 E1      945      POP HL         ; RESTORE X, Y
OFC7 54      946      LD D, H       ; RESTORE Y
OFC8        947      SYSTEM RECTAN
OFC8 FF      947 +    RST 56
OFC9 1C      947 +    DEFB RECTAN
          947 +    IF RECTAN. EQ. INTPC
          947 +    ENDIF
OFCA 3EFF    948      LD A, OFFH    ; RESET TIMEOUT
OFCC 32EC4F  949      LD (TIMOUT), A
OFCD 3E01    950      ZERO: LD A, 1      ; RESET COUNTER-TIMER
OFD1 182A    951      DOWNS: JR ZERO2
OFD3 3AF34F  952      LD A, (NUMR, Y)
OFD6 3D      953      DEC A
OFD7 FE04    954      CP 4
OFD9 D2500F  955      JP NC, ZEROPL
OFDC 21C40E  956      LD HL, SCRWD
OFDF CDAA0E  957      CALL ITER4
OFE2 21E50E  958      LD HL, SCRST
OFE5 CDAA0E  959      CALL ITER4
OFE8 21F60E  960      LD HL, SCRWR
OFEB CDAA0E  961      CALL ITER4
          962      ; NOT GOING BACKWARDS SAVE AND WRITE EVERYBODY WITH TRIGG
OFEF 41      963      LD B, C
OFEF 11E2FF  964      SCRB3: LD DE, -SCPSIZ
OFF2 DD19    965      ADD IX, DE
OFF4 C5      966      PUSH BC
OFF5 CD2D0F  967      CALL SCRSAV
OFF8 C1      968      POP BC
OFF9 10F4    969      DJNZ SCRB3-$
OFFB 3E04    970      LD A, MOVTMR
OFFD 32D54F  971      ZERO2: LD (CTO), A
1000 C9     972      RET      ; DONE
  
```

PROPRIETARY INFORMATION
 Dave Nutting Associates, Inc.

DO NOT REPRODUCE


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    973 ; SUBROUTINE TO SCARE UP DELTAS
1001 C5      974 GETDLT: PUSH BC
1002 47      975          LD  B, A
1003         976          SYSSUK MSKTD
1003 FF      976 +          RST  56
1004 7F      976 +          DEFB MSKTD+1
                976 +          IF  MSKTD. EQ. INTPC
                976 +          ENDIF
1005 0001    977          DEFW 100H
1007 00      978          DEFB 0
1008 0001    979          DEFW 100H
100A C1      980          POP  BC
100B C9      981          RET
                982 ; INITIAL COLORS:
100C 08      983 INICOL: DEFB 08H
100D 5B      984          DEFB 5BH
100E A5      985          DEFB 0A5H
100F 07      986          DEFB 007H
1010 08      987          DEFB 08H
1011 5B      988          DEFB 5BH
1012 A5      989          DEFB 0A5H
1013 07      990          DEFB 07H
                991          ORG 400003720
                992 ; SWITCH RAM:
4E38        993          DEFS 96
4EE8        994 SCPSK:
4EE8        995 COLS:  DEFS 8
>4EF0       996 ZPSTMR EQU  *
>4EF2       997 DIRTMR EQU ZPSTMR+2
>4EF3       998 ZPSMR EQU DIRTMR+1
>4EF5       999 DIRTBL EQU ZPSTMR+2
4EF0        1000 P13CP: DEFS SCPSK
4F0E        1001 P2SCP: DEFS SCPSK
4F2C        1002 P3SCP: DEFS SCPSK
4F4A        1003 P4SCP: DEFS SCPSK
4F68        1004          END
  
```

TOTAL ASSEMBLER ERRORS

PROPRIETARY INFORMATION

Dave Nutting Associates, Inc.

DO NOT REPRODUCE

CROSS REFERENCE

LABEL	VALUE	REFERENCE
A0	00E1	-508
A1	0070	-520
A2	0037	-532
A3	001B	-544
A4	000D	-556
A5	0006	-562
ACTINT	000E	-225
ALKEYS	0214	-49
AS0	00D4	-509
AS1	006A	-521
AS2	0034	-533
AS3	001A	-545
B0	00C8	-517
B1	0064	-529
B2	0031	-539
B3	0018	-547
BCDADD	0062	-271
BCDCHS	006A	-283
BCDDIV	0068	-295
BCDMUL	0066	-277
BCDNEG	006C	-289
BCDSUB	0064	-291
BEGIN	0E19	-61
BEGRAM	4FCE	-597
BITSPL	00A0	-1
BLANK	002A	-25
BMUSIC	0012	-21
BYTEPL	0028	-42
C1	00BD	-511
C2	005E	-523
C3	002E	-535
C4	0017	-547
C5	000B	-559
C6	0005	-561
C7	0002	-566
CBA	0009	-113
CBB	0007	-111
CBC	0006	-109
CBD	0005	-107
CBE	0004	-105
CBFLAG	0008	-103
CBH	000B	-101
CBIXH	0003	-115
CBIXL	0002	-113
CBIYH	0001	-111
CBIYL	0000	-114
CBL	000A	-124
CDELTB	0F29	-804
CHDOWN	0001	-111
CHLEFT	0002	-110
CHRDIS	0032	-248
CHRIGHT	0003	-109
CHTRIG	0004	-108

PROPRIETARY INFORMATION

671

728

Dave Nutting Associates, Inc.

DO NOT REPRODUCE

CHUP	0000	-112				
CNT	4FDD	-611				
COL0L	0004	-168				
COLOR	0000	-164				
COL1L	0005	-169				
COL1R	0001	-165				
COL2L	0006	-170				
COL2R	0002	-166				
COL3L	0007	-171				
COL3R	0003	-167				
COLBX	000B	-172				
COLLST	4FE8	-622				
COLMSK	0F22	-797	335			
COLORS	4EE8	-927	682	686	736	751
COLSET	0018	-234	686	751	751	
CONCM	0008	-189				
CS1	00B2	-512				
CS2	0059	-524				
CS3	002C	-536				
CS4	0015	-548				
CS5	000A	-558				
CT0	4FD5	-602	705	971		
CT1	4FD6	-603	753			
CT2	4FD7	-604				
CT3	4FD8	-605				
CT4	4FD9	-606				
CT5	4FDA	-607				
CT6	4FDB	-608				
CT7	4FDC	-609				
CTIMER	0203	-46				
D1	00A8	-513				
D2	0054	-525				
D3	0029	-537				
D4	0014	-549				
DABS	0072	-285				
DADD	006E	-283				
DECCTS	0010	-226				
DIRTMR	4EF2	-929	909	998		
DIRVAL	4EF5	-931	998			
DISNUM	0036	-250				
DISTIM	0052	-267				
DOIT	0044	-260	712	712		
DOITB	0046	-261				
DOWRTS	0FD3	-886	60			
DS1	009F	-514				
DS2	004F	-526				
DS3	0027	-538				
DS4	0013	-550				
DS5	0009	-559				
DS6	0004	-564				
DSMG	0070	-284				
DURAT	4FEA	-624				
E1	0096	-515				
E2	004A	-527				
E3	0025	-539				
E4	0012	-551				
EMUSIC	0014	-230				

PROPRIETARY INFORMATION

Dave Nutting Associates, Inc.

DO NOT REPRODUCE

END	00C0	-379							
ENDSCR	4FF4	-632							
F1	008D	-516							
F2	0046	-528							
F3	0022	-540							
F4	0011	-552							
F5	0008	-560							
FILL	001A	-235	670	674					
FIRSTC	2000	-40							
FNTSML	020D	-48							
FNTSYS	0206	-47							
FS1	0085	-517							
FS2	0042	-529							
FS3	0020	-541							
FS4	0010	-553							
FTBASE	0000	-93							
FTBYTE	0003	-96							
FTFSX	0001	-94							
FTFSY	0002	-95							
FTPTH	0006	-99							
FTPTL	0005	-98							
FTYSIZ	0004	-97							
G0	00FD	-506							
G1	007E	-518							
G2	003E	-530							
G3	001F	-542							
G4	000F	-554							
G5	0007	-561							
G6	0003	-565							
G7	0001	-567							
G8	0000	-568							
GAMSTB	4FF8	-634							
GETDLT	1001	-908	784	911					
GETNUM	004E	-265							
GETPAR	004C	-264	663	663					
GS0	00EE	-507							
GS1	0077	-519							
GS2	003B	-531							
GS3	001D	-543							
GS4	000E	-555							
GSBEND	0007	-62							
GSBSCR	0001	-61							
GSBTIM	0000	-60							
GTMIN3	4FEE	-628							
GTSECS	4FED	-627							
HORAF	000F	-195							
HORCB	0009	-173							
HUMANR	0040	-257							
INCSCR	0054	-268							
INDEXB	005C	-274	728	728	736	736	782	782	812
		812	826	826	835	835	853	853	
INDEXN	0056	-271							
INDEXW	005A	-273							
INFBK	000B	-186							
INICOL	100C	-915	664						
INLIN	000F	-188							
INMOD	000E	-187							

PROPRIETARY INFORMATION

Dave Nutting Associates, Inc.

DO NOT REPRODUCE

INTPC	0000	-216	663	669	669	669	710	712	729
		736	751	782	805	812	826	835	838
		853	860	867	875	882	889	892	900
		908	939	945	948	977			
INTP@	0001	-666							
INTST	0008	-193							
ITER4	0EAA	-733	957	959	961				
ITER41	0EB3	-737	776						
ITRET	0EBA	-742	769						
KCTASC	0040	-258							
KEY0	0014	-206							
KEY1	0015	-207							
KEY2	0016	-208							
KEY3	0017	-209							
KEYBO	0E69	-701	762						
KEYB1	0EBC	-722	740						
KEYMES	0E65	-696	710						
KEYSEX	4FE3	-617	757						
KLRKSX	0E9C	-732	761						
KSCTRV	0014	-660	752						
MAGIC	000C	-190							
MAINLP	0E38	-693	707						
MATH	0056	-270							
MCALL	0006	-219							
MENU	004A	-263							
MENUST	0218	-50							
MJUMP	000A	-221							
MOVE	005E	-275	682						
MOVTMR	0004	-659	704	970					
MRET	0008	-220							
MRFLOP	0006	-101							
MRLOCK	4FF7	-633							
MRDR	0004	-103							
MRROT	0002	-105							
MRSHT	0003	-106							
MRXOR	0005	-102							
MRXPND	0003	-104							
MSKTD	007E	-291	977	977					
MUZAK	0012	-228							
MUZPC	4FCE	-596							
MUZSP	4FD0	-597							
MXSCR	021E	-51							
NEGT	0074	-288							
NOGAME	0235	-53							
NOPLAY	0228	-52	663						
NORMEM	4000	-39	670						
NUMPLY	4FF3	-631	665	764	952				
NWHDWR	0001	-36							
OA1	008F	-576							
OA2	0047	-577							
OA3	0023	-578							
OA4	0011	-579							
OA5	0008	-580							
OBO	00FE	-570							
OCO	00F1	-571							
OD1	00D6	-572							
OE1	00BF	-573							

PROPRIETARY INFORMATION

Dave Nutting Associates, Inc.

DO NOT REPRODUCE

OF1	00B4	-574						
OG1	00A0	-575						
OPOT0	4FDF	-613						
OPOT1	4FE0	-614						
OPOT2	4FE1	-615						
OPOT3	4FE2	-616						
OSW0	4FE4	-618	782	812	853			
OSW1	4FE5	-619						
OSW2	4FE6	-620						
OSW3	4FE7	-621						
P1SCP	4EF0	-932	674	690	763	912		
P2SCP	4F0E	-933	694					
P3SCP	4F2C	-934	698					
P4SCP	4F4A	-935	702					
PAWS	0050	-266						
PIZBRK	0048	-262						
POT0	001C	-201						
POT1	001D	-202						
POT2	001E	-203						
POT3	001F	-204						
PRIOR	4FF9	-630						
PSWCY	0000	-577						
PSWPV	0002	-578						
PSWGN	0007	-583						
PSWZRO	0006	-584						
PVOLAB	4FD2	-590						
PVOLMC	4FD3	-591						
QUIT	0078	-268						
RANGED	0076	-267	875	875	882	882	889	892
		897	900	900	908	908		
RANSH	4FEF	-633						
RCALL	0004	-218						
RECTAN	001C	-234	838	838	939	939	945	948
		941						
RELAB1	003A	-253	860	860				
RELABS	0038	-252						
RESTOR	002E	-243	805	805				
SAVE	002C	-242	867	867				
SCCLR	0E20	-664	723					
SCDOTB	0EA1	-735	712					
SCHEDR	000C	-231						
SCPSIZ	001E	-652	675	772	964	1000	1002	1003
SCRBS	0FEF	-893	969					
SCREEN	0000	-4						
SCREST	0EE5	-745	958					
SCROLL	0030	-240						
SCRSAV	0F2D	-807	967					
SCRSTK	4EE8	-921	667					
SCRSTR	0016	-230						
SCRUP1	0EDA	-751	788					
SCRUPD	0EC4	-748	956					
SCRWR1	0EFF	-779	868					
SCRWR2	0F1A	-796	930					
SCRWRT	0EF6	-775	960					
SCSADH	001D	-657	802	860				
SCSADL	001C	-656	803	861				
SCSAVA	0000	-653						

PROPRIETARY INFORMATION

Dave Nutting Associates, Inc.

DO NOT REPRODUCE

SCT0	0001	-128	760						
SCT1	0002	-129	761						
SCT2	0003	-130							
SCT3	0004	-131							
SCT4	0005	-132							
SCT5	0006	-133							
SCT6	0007	-134							
SCT7	0008	-135							
SCXC	001A	-654	690	694	698	702	785	789	828
		858	912						
SCYC	001B	-655	790	794	827	857			
SEMI4S	4FDE	-612							
SENFLG	4FFA	-636							
SENTRY	0042	-259	710	710					
SETB	007A	-289	704						
SETOUT	0016	-233	678						
SETW	007C	-290	688	692	696	700			
SF0	0009	-136							
SF1	000A	-137							
SF2	000B	-138							
SF3	000C	-139							
SF4	000D	-140							
SF5	000E	-141							
SF6	000F	-142							
SF7	0010	-143							
SHIFTU	0060	-276							
SIZTBL	0F26	-801	826						
SJ0	0015	-152							
SJ1	0017	-154							
SJ2	0019	-156							
SJ3	001B	-158							
SKYD	0013	-145	762						
SKYU	0012	-146							
SNDBX	0018	-184							
SNUL	0000	-127							
SP0	001C	-147							
SP1	001D	-148							
SP2	001E	-149							
SP3	001F	-150							
SSEC	0011	-144							
ST0	0014	-151							
ST1	0016	-153							
ST2	0018	-155							
ST3	001A	-157							
STIMER	0200	-45							
STOREN	0058	-272							
STRDIS	0034	-249							
SUCK	000C	-222							
SW0	0010	-197							
SW1	0011	-198							
SW2	0012	-199							
SW3	0013	-200							
SYSRAM	4FCE	-639							
TIMOUT	4FEC	-626	949						
TMR60	4FEB	-625							
TONEA	0011	-177							
TONEB	0012	-178							

PROPRIETARY INFORMATION

Dave Nutting Associates, Inc.

DO NOT REPRODUCE

TONEC	0013	-179	
TONMO	0010	-176	
UMARGT	4FFB	-637	
UPISTR	0000	-215	
USERTB	4FFD	-638	
VBBLNK	0006	-87	
VBCCHK	0004	-84	
VBCH	0003	-83	
VBCL	0002	-82	
VBCLAT	0003	-91	
VBCLMT	0000	-89	
VBCREV	0001	-90	
VBDCH	0001	-81	
VBDCL	0000	-80	
VBDXH	0004	-68	
VBDXL	0003	-67	
VBDYH	0009	-73	
VBDYL	0008	-72	
VBLANK	0028	-242	
VBMR	0000	-64	
VBOAH	000E	-76	
VBOAL	000D	-77	
VBSACT	0007	-86	
VBSTAT	0001	-65	
VBTIMB	0002	-66	
VBXCHK	0007	-71	
VBXH	0006	-70	
VBXL	0005	-69	
VBYCHK	000C	-76	
VBYH	000B	-75	
VBYL	000A	-74	
VECT	003E	-255	
VECTC	003C	-254	
VERAF	000E	-194	
VERBL	000A	-174	
VIBRA	0014	-180	
VOICES	4FD4	-600	
VOLAB	0016	-181	
VOLC	0015	-182	
VOLN	0017	-183	
VWRITR	001E	-237	
WASTE	OFFF	-585	
WASTER	OFFF	-586	
WRIT	0024	-240	
WRITA	0026	-241	
WRITP	0022	-239	
WRITR	0020	-238	
XINTC	0002	-217	707
XPAND	0019	-191	
XPNDON	0001	-35	
ZER01	0FCF	-884	
ZER02	OFFD	-905	951
ZER0PL	0F50	-822	955
ZP0	0F63	-829	877
ZPA	0F69	-832	873
ZPB	0F77	-838	887
ZPC	0F7D	-842	903

PROPRIETARY INFORMATION

Dave Nutting Associates, Inc.

DO NOT REPRODUCE

ZPD
ZPSIZ
ZPSTMR

OF93
4EF3
4EFO

-850	897		
-930	871	926	999
-928	870	997	

PROPRIETARY INFORMATION

Dave Nutting Associates, Inc.

DO NOT REPRODUCE


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641
642 LIST S, X, M, T
643 ; *****
644 ; * CALCULATOR *
645 ; *****
646 ;
647 ; CALCULATOR EQUATES:
648 ; SCREEN PARAMETERS:
>005C 649 CALCLN EQU 92 ; LAST DISPLAY LINE USED
650 ; SCREEN MEMORY STACK PARAMETERS:
>005C 651 MAXSTK EQU CALCLN ; MAX NUMBER OF STACK ENTRIES
>4E58 652 STKBOT EQU MAXSTK*BYTEPL+4000H-8 ; ADDR OF STK BOTTOM
653 ; CALCULATOR MAJOR STATES:
>0000 654 ARG1MD EQU 0 ; ARG1 STATE
>0001 655 ARG2MD EQU 1 ; ARG2 STATE
>0002 656 SHOWMD EQU 2 ; SHOW STATE
657 ;
658 ORG 1020H ; ***
1020 31C04E 659 CLEAR: LD SP, CALSTK ; BUSHWACK THE STACK
1023 660 SYSTEM INTPC ; INTERPRET
1023 FF 660 + RST 56
1024 00 660 + DEFB INTPC
660 + IF INTPC EQ INTPC
>0001 660 +INTPC DEFL 1
660 + ENDF
1025 661 DO FILL
1025 1B 661 + DEFB FILL+1
1026 0040 662 DEFW 4000H
1028 600E 663 DEFW CALCLN*BYTEPL
102A 00 664 DEFB 0
102B 665 DO RECTA
102B 1D 665 + DEFB RECTA+1
102C 08 666 DEFB 8
102D 52 667 DEFB 82
102E 70 668 DEFB 112
102F 09 669 DEFB 9
1030 FF 670 DEFB 11111111B
1031 671 DO SETOU
1031 17 671 + DEFB SETOU+1
1032 B8 672 DEFB CALCLN*2
1033 1F 673 DEFB 31
1034 08 674 DEFB 8
1035 675 DO COLS
1035 19 675 + DEFB COLS+1
1036 1C13 676 DEFW COLORS
1038 677 DO FILL
1038 1B 677 + DEFB FILL+1
1039 C04E 678 DEFW CALRAM
103B 9400 679 DEFW ENDCR-CALRAM
103D 00 680 DEFB 0
103E 681 DO ACTINT
103E 0F 681 + DEFB ACTINT+1
103F 682 DO XINTC ; QUIT INTERPRETING
103F 03 682 + DEFB XINTC+1
1040 CD8&11 683 CALL DOCLRE ; SHOW A ZERO WHEN WE COME UP
684 ; GET NEXT KEY DEPRESSION
1043 214310 685 KEYGET: LD HL, KEYGET
  
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PROPRIETARY INFORMATION

Dave's Bitting Associates, Inc.

DO NOT REPRODUCE

1046	E5	686		PUSH HL	
1047		687		SYSSUK SENTRY	
1047	FF	687	+	RST 56	
1048	43	687	+	DEFB SENTRY+1	
		687	+	IF SENTRY.EQ.INTPC	
		687	+	ENDIF	
1049	1402	688		DEFW ALKEYS	
104B	FE13	689		CP SKYD	; KEY DOWN?
104D	C0	690		RET NZ	; NO - WAIT
104E	78	691		LD A,B	
104F		692		SYSSUK INDEXB	
104F	FF	692	+	RST 56	
1050	5D	692	+	DEFB INDEXB+1	
		692	+	IF INDEXB.EQ.INTPC	
		692	+	ENDIF	
1051	9F10	693		DEFW TOKETB-1	
1053	E60F	694		AND OFH	; ISOLATE 'TRANSLATE TO' FIELD
1055	4F	695		LD C,A	
1056	AE	696		XOR (HL)	; BRANCH ON TOKEN TYPE
1057	0F	697		RRCA	
1058	0F	698		RRCA	
1059	0F	699		RRCA	
105A	0F	700		RRCA	
105B	5F	701		LD E,A	
		702		; ARE WE WAITING FOR USER TO TYPE IN A MEMORY NUMBER?	
105C	21C24E	703		LD HL, MEMSTA	; POINT AT MEMORY STATE
105F	7E	704		LD A, (HL)	
1060	A7	705		AND A	
1061	2332	706		JR Z, KEYG1-*	; JUMP IF NOT IN THAT STATE
1063	7B	707		LD A, E	; WAS DIGIT TYPED?
1064	A7	708		AND A	
1065	C0	709		RET NZ	; NO - GO FOR NEXT ENTRY
1066	57	710		LD D, A	; ZERO OUT D
1067	79	711		LD A, C	
1068	FE0E	712		CP 0EH	; DID OPERATOR HIT A DECIMAL PO
106A	C8	713		RET Z	; YES - QUIT
		714		; SET MEMORY DIGIT FOR DISPLAY	
106B	23	715		INC HL	
106C	71	716		LD (HL),	
106D	34	717		INC (HL)	; ZERO DESIGNATES NOTHING
106E	5F	718		LD E, A	
106F	2B	719		DEC HL	
1070	7E	720		LD A, (HL)	; S-R STATUS TO A AGAIN
1071	0F	721		RRCA	; TEST STATUS
1072	3807	722		JR C, GMEM1-*	; JUMP IF RECALL
		723		; STATE PROCESSING	
1074	CDCA10	724		CALL XMEM	; DO POINTING AND SETUP
1077	EDB0	725		LDIR	; PERFORM STORE
1079	1809	726		JR SHONUM-*	
		727		; RECALL PROCESSING	
107B	CD0A12	728		GMEM1: CALL SHOWCK	; CHECK FOR SHOW MODE
107E	CDCA10	729		CALL XMEM	
1081	EB	730		EX DE, HL	
1082	EDB0	731		LDIR	; COPY MEM TO ARG2
1084	210000	732		SHONUM: LD HL, 0	
1087	22DA4E	733		LD (DIGITS), HL	; CLEAR DIGIT FLAGS
108A	21DD4E	734		LD HL, SHOWBF	

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108D E5      735      PUSH HL
108E CDC712  736      CALL CONVRT
1091 E1      737      POP HL
1092 C3DE11  738      JP ADIG7      ; JOIN DISPLAY SEQUENCE
1095         739      KEYGT1:
1095 7B      740      LD A,E
1096         741      SYSSUK INDEXW
1096 FF      741 +     RST 56
1097 5B      741 +     DEFB INDEXW+1
              741 +     IF INDEXW.EQ.INTPC
              741 +     ENDIF
1098 B810    742      DEFW TOKEJT
109A D5      743      PUSH DE
109B 21C14E  744      LD HL,STATEV
109E 7E      745      LD A,(HL)
109F C9      746      RET      ; CALL VIA RETURN
              747 ; TOKEN TYPE-TRANSLATE TABLE
              748 ; HIGH NIBBLE IS TYPE, LO NIBBLE IS WHAT TO TRANSLATE TO
10A0 80      749      DEFB 80H      ; 1 C
10A1 60      750      DEFB 60H      ; 2 UA
10A2 61      751      DEFB 61H      ; 3 DA
10A3 31      752      DEFB 31H      ; 4 %
10A4 51      753      DEFB 51H      ; 5 MF
10A5 52      754      DEFB 52H      ; 6 MS
10A6 40      755      DEFB 40H      ; 7 +
10A7 14      756      DEFB 14H      ; 8 DIVIDE
10A8 07      757      DEFB 07H      ; 9 7
10A9 08      758      DEFB 08H      ; 10 8
10AA 09      759      DEFB 09H      ; 11 9
10AB 13      760      DEFB 13H      ; 12 X
10AC 04      761      DEFB 04H      ; 13 4
10AD 05      762      DEFB 05H      ; 14 5
10AE 06      763      DEFB 06H      ; 15 6
10AF 12      764      DEFB 12H      ; 16
10B0 01      765      DEFB 01H      ; 17 1
10B1 02      766      DEFB 02H      ; 18 2
10B2 03      767      DEFB 03H      ; 19 3
10B3 11      768      DEFB 11H      ; 20 +
10B4 70      769      DEFB 70H      ; 21 7
10B5 00      770      DEFB 00H      ; 22 0
10B6 0E      771      DEFB 0EH      ; 23 E
10B7 20      772      DEFB 20H      ; 24 =
              773 ; TOKEN TYPE JUMP TABLE
10B8 8A11    774      DEFW ACTNUM      ; 0 NUMBER
10BA E810    775      DEFW OPROUT      ; 1 OPERATOR
10BC 1111    776      DEFW EQROUT      ; 2 EQUAL SIGN
10BE 2311    777      DEFW PERCEN      ; 3 PERCENT
10C0 DE10    778      DEFW CHGSGN      ; 4 CHANGE SIGN
10C2 D810    779      DEFW MEMFUN      ; 5 MEMORY
10C4 3812    780      DEFW SCRLKY      ; 6 SCROLL KEYS
10C6 AF11    781      DEFW CLRENT      ; 7 CLEAR ENTRY
10C8 2010    782      DEFW CLEAR      ; 8 CLEAR CALC
              783 ; SUBROUTINE TO POINT DE AT A MEMORY AND LOAD HL
              784 ; INPUT: D=0,E=DIGIT (0 TO 9 MEMORY #)
              785 ; OUTPUT: DE = POINTER TO MEM HL=ARG2 BC=12
10CA 21E64E  786      XMEM: LD HL,CMEMO
10CD 060B    787      LD B,11
  
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10CF 48      788      LD      C, B
10D0 19      789  XMEM1:  ADD    HL, DE
10D1 10FD    790      DJNZ  XMEM1-*
10D3 EB      791      EX     DE, HL
10D4 21CF4E  792      LD     HL, ARG2
10D7 C9      793      RET
          794 ; MEMORY KEY ROUTINE
10D8 21C24E  795  MEMFUN: LD     HL, MEMSTA ; SET MEMORY STATE
10DB 71      796      LD     (HL), C ; SET MEMORY STATE
10DC 1842    797      JR     EQRT1-*
          798 ; CHANGE SIGN ROUTINE
10DE CD0A12  799  CHGSGN: CALL  SHOWCK
10E1         800      SYSSUK BCDCHS
10E1 FF      800 +    RST   56
10E2 6B      800 +    DEFB  BCDCHS+1
          800 +    IF   BCDCHS.EQ. INTPC
          800 +    ENDIF
10E3 0B      801      DEFB  11
10E4 CF4E    802      DEFW  ARG2
10E6 1838    803      JR     EQRT1-*
          804 ; OPERATOR ROUTINE
10E8 FE02    805  OPR1:  CP     SHOWCK ; ARE WE IN SHOW STATE?
10EA 2004    806      JR     NZ, OP1-* ; JUMP IF NOT
10EC 3601    807      LD     (HL), ARG2MD ; GO TO ARG2 STATE
10EE 191B    808      JR     OP3-*
10F0 FE00    809  OP1:  CP     ARG1MD ; ARG1 MODE?
10F2 08      810      EX     AF, AF
10F3 79      811      LD     A, C
10F4 08      812      EX     AF, AF
10F5 200F    813      JR     NZ, OP2-* ; JUMP IF NOT
10F7 3601    814      LD     (HL), ARG2MD ; YEP, GO TO ARG2 STATE
10F9 CD1612  815      CALL  PUSHEN ; PUSH ARG1 DOWN
10FC         816      SYSSUK MOVE ; ARG2 ARG2
10FC FF      816 +    RST   56
10FD 5F      816 +    DEFB  MOVE+
          816 +    IF   MOVE.EQ. INTPC
          816 +    ENDIF
10FE C44E    817      DEFW  ARG1
1100 0B00    818      DEFW  11
1102 CF4E    819      DEFW  ARG2
1104 1803    820      JR     OP2A-*
1106 CD4611  821  OP2:  CALL  DOOR ; DO IT
1109 08      822  OP2A: EX     AF, A
110A 4F      823      LD     C, A
110B 79      824  OP3:  LD     A, C
110C 32C04E  825      LD     (OPCOD), A
110F 180F    826      JR     EQRT1-* ; JOIN EQUAL DISPLAY CALL
          827 ; EQUALS ROUTINE
1111 3D      828  EQROUT: DEC   A ; ARE WE IN ARG2MD?
1112 C0      829      RET   NZ
1113 3602    830      LD     (HL), SHOWMD ; ENTER SHOW STATE
1115 CD4611  831      CALL  DOOP
1118 3E05    832      LD     A, 5
111A 32C04E  833      LD     (OPCOD), A
111D CD1612  834      CALL  PUSHEN
1120 C38410  835  EQRT1: JP     SHONUM
1123 A9      836  PERCEN: XOR   C ; ARG2 MODE?

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1124 C0      837      RET NZ
1125        838      SYSSUK MOVE
1125 FF      838 +      RST 56
1126 5F      838 +      DEFB MOVE+1
              838 +      IF MOVE.EQ. INTPC
              838 +      ENDIF
1127 CF4E    839      DEFW ARG2
1129 0900    840      DEFW 9
112B D04E    841      DEFW ARG2+1
112D 32D84E  842      LD (ARG2+9),A
1130 21C44E  843      LD HL,ARG1
1133 060B    844      LD B,11
1135 3ACE4E  845      LD A,(ARG1+10) ; SAVE SIGN OF ARG1
1138        846      SYSTEM BCDMUL
1138 FF      846 +      RST 56
1139 66      846 +      DEFB BCDMUL
              846 +      IF BCDMUL.EQ. INTPC
              846 +      ENDIF
113A 32CE4E  847      LD (ARG1+10),A ; RESTORE SIGN OF ARG1
113D EB      848      EX DE,HL
113E 010B00  849      LD BC,11
1141 CD7511  850      CALL OVRCHK ; CHECK FOR OVERFLOW
1144 18DA    851      JR EQRT
              852 ; SUBROUTINE TO DO OPERATION
              853 ; NOTE THIS ROUTINE SETS BOTH ARG1 AND ARG2 EQUAL TO RESU
1146 CD1612  854 DOOP CALL PUSH
1149 3AC04E  855      LD A,(OPCODE)
114C        856      SYSSUK INDEW
114C FF      856 +      RST 56
114D 5B      856 +      DEFB INDEW+1
              856 +      IF INDEW.EQ. INTPC
              856 +      ENDIF
114E 5811    857      DEFW DOOPTB-2
1150 D5      858      PUSH DE
1151 21CF4E  859      LD HL,ARG1
1154 11C44E  860      LD DE,ARG2
1157 060B    861      LD B,11
1159 C9      862      RET ; JUMP USING RETURN
115A 6211    863 DOOPTB DEFW DOADD
115C 6511    864      DEFW DOSUB
115E 6811    865      DEFW DOMUL
1160 6B11    866      DEFW DODIV
1162        867 DOADD SYSTEM BCDADD
1162 FF      867 +      RST 56
1163 62      867 +      DEFB BCDADD
              867 +      IF BCDADD.EQ. INTPC
              867 +      ENDIF
1164 01      868      DEFB 01
1165        869 DOSUB SYSTEM BCDSUB
1165 FF      869 +      RST 56
1166 64      869 +      DEFB BCDSUB
              869 +      IF BCDSUB.EQ. INTPC
              869 +      ENDIF
1167 01      870      DEFB 01
1168        871 DOMUL: SYSTEM BCDMUL
1168 FF      871 +      RST 56
1169 66      871 +      DEFB BCDMUL
  
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      871 +      IF BCDMUL EQ. INTPC
      871 +      ENDIF
116A 01      872      DEFB 01
116B      873 DODIV:  SYSTEM BCDDIV
116B FF      873 +      RST 56
116C 68      873 +      DEFB BCDDIV
      873 +      IF BCDDIV. EQ. INTPC
      873 +      ENDIF
116D      874 NUMCHK: SYSSUK MOVE      ; ARG2 = ARG1
116D FF      874 +      RST 56
116E 5F      874 +      DEFB MOVE+1
      874 +      IF MOVE. EQ. INTPC
      874 +      ENDIF
116F CF4E    875      DEFW ARG2
1171 0B00    876      DEFW 11
1173 C44E    877      DEFW ARG1
1175 09      878 OVRCHK:  ADD HL, BC
1176 2B      879      DEC HL
1177 7E      880      LD A, (HL)
1178 E60F    881      AND 0FH      ; OVERFLOW SET?
117A C8      882      RET Z      ; QUIT IF NOT
117B 3E01    883      LD A, 1
117D 77      884      LD (HL), A
117E 3C      885      INC A      ; FOR SHOW MODE
117F 32C14E  886      LD (STATE), A
1182 CD1612  887      CALL PUSHED
1185 E1      888      POP HL      ; THROUGH OUT RETURN ADDRESS
1186 0E00    889 DODIE:  LD C, 0      ; FOR CLEAR ENTRY
1188 1825    890      JR CLREN
      891 ; SUBROUTINE TO ACCEPT A DIGIT
      892 ; ON A DIGIT
118A CD0A12  893 ACTNUM:  CALL SHOWC
118D 21DA4E  894      LD HL, DIGITS
1190 11CF4E  895      LD DE, ARG
1193 7E      896      LD A, (HL)      ; HOW MANY DIGITS SO FAR?
1194 FE0A    897      CP 10
1196 C8      898      RET Z      ; QUIT IF LIMIT ATTAINED
1197 23      899      INC HL      ; DECIMAL POINT ENTERED YET?
1198 7E      900      LD A, (HL)
1199 A7      901      AND A
119A 280F    902      JR Z, ADI01-4 ; JUMP IF NO
119C B9      903      CP C      ; IS INPUT A DECIMAL POINT?
      904      ; (FLAG = 0E IF SET!!)
119D C8      905      RET Z      ; QUIT IF EXTRA
119E 79      906      LD A, C
119F 23      907      INC HL
11A0 4E      908      LD C, (HL)      ; C = DECIMAL POINT POINTER
11A1 35      909      DEC (HL)
11A2 EB      910      EX DE, HL
11A3      911      SYSTEM STOREN ; STORE THE NIBBLE
11A3 FF      911 +      RST 56
11A4 58      911 +      DEFB STOREN
      911 +      IF STOREN. EQ. INTPC
      911 +      ENDIF
11A5 4F      912      LD C, A      ; GET DIGIT BACK IN C
11A6 EB      913      EX DE, HL
11A7 2B      914      DEC HL
  
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11A6 2B          915          DEC HL
11A9 182A       916          JR ADIG4-*      ; GO ADD TO SHOW BUFFER
                917 ; PRE DECIMAL POINT
11AB 2B         918 ADIG1: DEC HL      ; BACKUP TO DIGITS
11AC B6         919          OR (HL)        ; HOW MANY ENTRIES?
11AD 2012       920          JR NZ,ADIG2-*  ; ADIG2 IF NONZERO
11AF C0A12      921 CLRENT: CALL SHOWCK ; PUSH DOWN IF RESULT IS THERE
11B2 C5         922          PUSH BC       ; CLEAR ARG2, SHOWBUF AND VARS
11B3           923          SYSSUK FILL
11B3 FF         923 +        RST 56
11B4 1B         923 +        DEFB FILL+1
                923 +        IF FILL.EQ.INTPC
                923 +        ENDIF
11B5 CF4E       924          DEFW ARG2
11B7 1500       925          DEFW 21
11B9 00         926          DEFB 0
11BA 21DA4E     927          LD HL,DIGITS
11BD C1         928          POP BC
11BE B1         929          OR C          ; WAS DIGIT ZERO?
11BF 281C       930          JR Z,ADIG6-*   ; JUMP IF SO
                931 ; CODE FOR NONZERO PREVIOUS ENTRY OR NONZERO FIRST ENTRY
11C1 79         932 ADIG2: LD A,C
11C2 FE0E       933          CP OEH        ; WAS CHAR A DECIMAL PT
11C4 2007       934          JR NZ,ADIG3-* ; NO ADIG3
11C6 23         935          INC HL       ; TO DECIMAL FLAG
11C7 77         936          LD (HL)      ; SET IT
11C8 23         937          INC HL
11C9 3609       938          LD (HL)      ; SET DECIMAL POINT POINTER
11CB 1809       939          JR ADIG4-*   ; GO STUFF INTO SHOW BUFFER
11CD 13         940 ADIG5: INC DE  ; LEADING NUMERIC - STUFF IT
11CE 13         941          INC DE
11CF 13         942          INC DE
11D0 13         943          INC DE
11D1 13         944          INC DE
11D2 CD0F13     945          CALL ADDTB
11D5 34         946 ADIG7: INC (HL) ; BUMP DIGIT COUNTER
11D6 79         947 ADIG8: LD A,C   ; GET DIGIT BACK
11D7 11DD4E     948          LD DE,SHOWBF ; ADD DIGIT TO SHOW BUFFER
11DA CD0F13     949          CALL ADDTB
11DD EB         950 ADIG6: EX DE,HL
11DE           951 ADIG7: XYRELL DE,83
11DE 110853     951 +        LD DE,RES.(83).SHL.8+(8)
11E1 0E07       952          LD C,01B     ; DISPLAY ALWAYS POSITIVE
                953 ; DISPLAY RECALL OR STORE?
11E3 E5         954          PUSH HL
11E4 21C24E     955          LD HL,MEMSTA
11E7 7E         956          LD A,(HL)
11E8 A7         957          AND A
11E9 2802       958          JR Z,ADIG8-* ; ADIG8 IF NOT WANTED
11EB C631       959          ADD A,'R'-21H
11ED C620       960 ADIG8: ADD A,20H
11EF           961          SYSTEM CHRDIS
11EF FF         961 +        RST 56
11FO 32         961 +        DEFB CHRDIS
                961 +        IF CHRDIS.EQ.INTPC
                961 +        ENDIF
                962 ; SAME THING FOR STORE-RECALL DIGIT

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11F1 23      963      INC  HL
11F2 7E      964      LD   A,(HL)
11F3 A7      965      AND  A
11F4 2807    966      JR   Z,ADIG9-$
11F6 C60F    967      ADD  A,'0'-21H
11F8 3600    968      LD   (HL),0      ; CLEAR DIGIT AND RECALL CODE
11FA 2B      969      DEC  HL
11FB 3600    970      LD   (HL),0
11FD C620    971      ADD  A,20H      ADIG9:
11FF        972      SYSTEM CHRDIS
11FF FF      972 +     RST  56
1200 32      972 +     DEFB CHRDIS
          972 +     IF   CHRDIS.EQ.INTPC
          972 +     ENDF
1201 E1      973      POP  HL
1202 3AC04E   974      LD   A,(OPCODE)
1205 0E03    975      LD   C,0011B
1207 C38A12   976      JP   NUMBA
          977 ; SUBROUTINE TO CHECK TO SEE IF WE ARE IN SHOW MODE
          978 ; IF SO - PUSH ARG2 AND GO INTO ARG1 MODE
120A 21C14E   979      SHOUCK: LD  HL,STATEV
120D 7E      980      LD   A,(HL)
120E FE02    981      CP   SHOWK
1210 C0      982      RET  NZ
1211 AF      983      XOR  A
1212 77      984      LD   (HL),A
1213 2B      985      DEC  HL
1214 77      986      LD   (HL),A      ; CLEAR OPERATOR
1215 C9      987      RET
          988 ; SUBROUTINE TO ADD AN ENTRY TO THE STACK
1216        989      PUSH: SYSSUK SCROLL      ; PUSH STACK UP
1216 FF      989 +     RST  56
1217 31      989 +     DEFB SCROLL+1
          989 +     IF   SCROLL.EQ.INTPC
          989 +     ENDF
1218 2800    990      DEFW BYTES
121A 08      991      DEFB 8
121B 5C      992      DEFB MAXSTK
121C 2040    993      DEFW 4020H      ; (FIRST LINE)
121E 21584E  994      LD   HL,STKBOT
1221 CDC712  995      CALL CONVRT      ; CONVERT AND ADD TO STACK
1224 21E44E  996      LD   HL,NLINES   ; HOW MANY ENTRIES?
1227 7E      997      LD   A,(HL)      ; ON THE STACK?
1228 FE5C    998      CP   MAXSTK     ; AT MAX?
122A 2901    999      JR   Z,PUSHE1-$ ; JUMP IF SO
122C 34      1000     INC  (HL)        ; BUMP ENTRY COUNT
          1001 ; ARE WE AT TOP OR BOTTOM OF STACK?
122D 23      1002     PUSH: INC HL      ; POINT AT SCROLL POINTER
122E 7E      1003     LD   A,(HL)
122F A7      1004     AND  A          ; JUMP IF AT BOTTOM
1230 2819    1005     JR   Z,SCRLU1-$
1232 FE52    1006     CP   MAXSTK-10 ; OR IF AT TOP
1234 2915    1007     JR   Z,SCRLU1-$
1236 34      1008     INC  (HL)      ; FIX SCROLL POINTER
1237 C9      1009     RET           ; AND QUIT
          1010 ; SCROLL KEY ENTRY
1238 AF      1011     SCRLKY: XOR A   ; CLEAR KEYSEX FOR SCROLL MOTOR
  
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1239 32E34F 1012 LD (KEYSEX),A
123C 21E44E 1013 LD HL,NLINES
123F 7E 1014 LD A,(HL) ; A = NUMBER OF LINES ON STK
1240 CB41 1015 BIT 0,C ; UP OR DOWN?
1242 201A 1016 JR NZ,SCRLDN-$ ; JUMP IF DOWN
1244 A7 1017 AND A ; QUIT IF ZERO LINES ON STACK
1245 C8 1018 RET Z
1246 23 1019 INC HL ; WHERE'S THE SCROLL POINTER?
1247 7E 1020 LD A,(HL)
1248 A7 1021 AND A ; QUIT IF AT BOTTOM
1249 C8 1022 RET Z
124A 35 1023 DEC (HL) ; ELSE DECREMENTETH
1024 ; PUSHEN JOINS HERE
124B 3E08 1025 SCRLU1: LD A,8 ; DOIT 8 TIMES
124D 1026 SCRLU2: SYSSUK SCROLL
124D FF 1026 + RST 56
124E 31 1026 + DEFB SCROLL+1
1026 + IF SCROLL.EQ.INTPC
1026 + ENDIF
124F 2800 1027 DEFW BYTEPL
1251 20 1028 DEFB 32
1252 4F 1029 DEFB 79
1253 2840 1030 DEFW 4028H
1255 3D 1031 DEC A
1256 20F5 1032 JR NZ,SCRLU2-$
1258 3C 1033 INC A
1259 1034 XYRELL DE,24,73
1259 111849 1034 + LD DE,RES.(73).SHL 8+(24)
125C 1818 1035 JR SCRLD1-$ ; JOIN SCRLDN DISPLAY CALL
1036 ; SCROLL DOWN ROUTINE
125E 23 1037 SCRLD1: INC HL ; ADVANCE TO SCROLLPTR
125F 96 1038 SUB (HL) ; SUBTRACT FROM LINES ON STACK
1260 FE0B 1039 CP 11 ; FAR ENOUGH APART?
1262 D8 1040 RET C ; QUIT IF NOT
1263 34 1041 INC (HL) ; YEAH - ADVANCE SCROLLPTR
1264 3E08 1042 LD A,8
1266 1043 SCRLD2: SYSSUK SCROLL
1266 FF 1043 + RST 56
1267 31 1043 + DEFB SCROLL+1
1043 + IF SCROLL.EQ.INTPC
1043 + ENDIF
1268 D8FF 1044 DEFW -BYTEPL
126A 20 1045 DEFB 32
126B 50 1046 DEFB 80
126C 804C 1047 DEFW 4000H+3200
126E 3D 1048 DEC A
126F 20F5 1049 JR NZ,SCRLD0-$
1271 3E0A 1050 LD A,10
1273 1051 XYRELL DE,24,1
1273 111801 1051 + LD DE,RES.(1).SHL 8+(24)
1276 21E54E 1052 SCRLD1: LD HL,SCRPTR
1279 86 1053 ADD A,(HL) ; ADD SCROLL PTR
127A 21904E 1054 LD HL,STKBOT+BYTEPL
127D 01D5FF 1055 LD BC,-BYTEPL
1280 09 1056 SCRLD2: ADD HL,BC
1281 3D 1057 DEC A
1282 20FC 1058 JR NZ,SCRLD2-$
  
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12C3 2D      1092      DEFB  '-'
12C4 62      1093      DEFB  62H
12C5 63      1094      DEFB  63H
12C6 3D      1095      DEFB  '='
12C7 11CF4E  1096  CONVRT: LD  DE, ARG2
12CA 3AC04E  1097      LD  A, (OPCOD)
12CD 0E0D    1098      LD  C, 13
12CF        1099      SYSTEM STOREN      ; STORE THAT NIBBLE
12CF FF      1099 +    RST  56
12D0 58      1099 +    DEFB  STOREN
1099 +    IF  STOREN.EQ. INTPC
1099 +    ENDIF
1100      ; TRANSFER SIGN
12D1 3AD94E  1101      LD  A, (ARG2+10)   ; GET SIGN BYTE
12D4 07      1102      RLCA                ; PUT SIGN IN LO BIT
12D5 0D      1103      DEC  C
12D6        1104      SYSTEM STOREN
12D6 FF      1104 +    RST  56
12D7 58      1104 +    DEFB  STOREN
1104 +    IF  STOREN.EQ. INTPC
1104 +    ENDIF
12D8 EB      1105  PACKED EX  DE, HL      ; DE = SAVE HL = ARG
12D9 010600  1106      LD  BC, 6          ; CLEAR SAVE
12DC AF      1107      XOR  A
12DD        1108      SYSTEM FILL
12DD FF      1108 +    RST  56
12DE 1A      1108 +    DEFB  FILL
1108 +    IF  FILL.EQ. INTPC
1108 +    ENDIF
12DF 0E13    1109      LD  C, 19
12E1        1110  CCVT: SYSTEM INDEXN      ; GET NIBBLE
12E1 FF      1110 +    RST  56
12E2 56      1110 +    DEFB  INDEXN
1110 +    IF  INDEXN.EQ. INTPC
1110 +    ENDIF
12E3 CDOF13  1111      CALL ADDTB          ; ADD INTO 'SAVE'
12E6 200D    1112      JR  NZ, CCVT1A-$   ; JUMP IF DONE
12E8 0D      1113      DEC  C              ; DECREMENT ARGPTR
12E9 79      1114      LD  A, C
12EA FE09    1115      CP   9              ; IS IT NOW 9?
12EC 20F3    1116      JR  NZ, CCVT1-$   ; NO - KEEP GOING
12EE 3E0E    1117      LD  A, 0EH         ; YEAH - PUT IN DECIMAL POINT
12F0 CDOF13  1118      CALL ADDTB
12F3 29EC    1119      JR  Z, CCVT1-$   ; JUMP BACK IF OK
1120      ; NOW REMOVE TRAILING ZEROS AND DECIMAL POINT
12F5 EB      1121  CCVT: EX  DE, HL      ; HL = SAVE
12F6 7E      1122  CCVT: LD  A, (HL)    ; GET LO NIBBLE
12F7 E60F    1123      AND  0FH           ; IS IT NONZERO?
12F9 2005    1124      JR  NZ, CCVT3-$   ; JUMP IF NOT ZERO
12FB CD0313  1125      CALL KILTRZ        ; REMOVE ONE TRAILING ZERO
12FE 18F6    1126      JR  CCVT2-$
1300 FE0E    1127  CCVT3: CP   0EH     ; DECIMAL POINT?
1302 C0      1128      RET  NZ            ; QUIT IF NOT
1303 010600  1129  KILTRZ: LD  BC, 6
1306 09      1130      ADD  HL, BC
1307 A7      1131      AND  A
1308 41      1132      LD  B, C
  
```

PROPRIETARY INFORMATION

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```

12C3 2D      1092      DEFB '-'
12C4 62      1093      DEFB 62H
12C5 63      1094      DEFB 63H
12C6 3D      1095      DEFB '='
12C7 11CF4E  1096  CONVRT: LD  DE, ARG2
12CA 3AC04E  1097      LD  A, (OPCOD)
12CD 0E0D    1098      LD  C, 13
12CF        1099      SYSTEM STOREN      ; STORE THAT NIBBLE
12CF FF      1099 +    RST  56
12D0 58      1099 +    DEFB STOREN
1099 +    IF  STOREN.EQ. INTPC
1099 +    ENDIF
1100      ; TRANSFER SIGN
12D1 3AD94E  1101      LD  A, (ARG2+10)    ; GET SIGN BYTE
12D4 07      1102      RLCA                ; PUT SIGN IN LO BIT
12D5 0D      1103      DEC  C
12D6        1104      SYSTEM STOREN
12D6 FF      1104 +    RST  56
12D7 58      1104 +    DEFB STOREN
1104 +    IF  STOREN.EQ. INTPC
1104 +    ENDIF
12D8 EB      1105  PACKED EX  DE, HL      ; DE = SAVE HL = ARG
12D9 010600  1106      LD  BC, 6          ; CLEAR SAVE
12DC AF      1107      XOR  A
12DD        1108      SYSTEM FILL
12DD FF      1108 +    RST  56
12DE 1A      1108 +    DEFB FILL
1108 +    IF  FILL.EQ. INTPC
1108 +    ENDIF
12DF 0E13    1109      LD  C, 19
12E1        1110  CCVT: SYSTEM INDEXN      ; GET NIBBLE
12E1 FF      1110 +    RST  56
12E2 56      1110 +    DEFB INDEXN
1110 +    IF  INDEXN.EQ. INTPC
1110 +    ENDIF
12E3 CD0F13  1111      CALL ADDTB          ; ADD INTO 'SAVE'
12E6 200D    1112      JR  NZ, CCVT1A-$   ; JUMP IF DONE
12E8 0D      1113      DEC  C              ; DECREMENT ARGPTR
12E9 79      1114      LD  A, C
12EA FE09    1115      CP   9              ; IS IT NOW 9?
12EC 20F3    1116      JR  NZ, CCVT1B-$   ; NO - KEEP GOING
12EE 3E0E    1117      LD  A, 0EH         ; YEAH - PUT IN DECIMAL POINT
12F0 CD0F13  1118      CALL ADDTB
12F3 28EC    1119      JR  Z, CCVT1C-$   ; JUMP BACK IF OK
1120      ; NOW REMOVE TRAILING ZEROS AND DECIMAL POINT
12F5 EB      1121  CCVT: EX  DE, HL      ; HL = SAVE
12F6 7E      1122  CCVT: LD  A, (HL)    ; GET LO NIBBLE
12F7 E60F    1123      AND  0FH           ; IS IT NONZERO?
12F9 2005    1124      JR  NZ, CCVT3-$   ; JUMP IF NOT ZERO
12FB CD0313  1125      CALL KILTRZ        ; REMOVE ONE TRAILING ZERO
12FE 18F6    1126      JR  CCVT2-$
1300 FE0E    1127  CCVT3: CP   0EH     ; DECIMAL POINT?
1302 C0      1128      RET  NZ            ; QUIT IF NOT
1303 010600  1129  KILTRZ: LD  BC, 6
1306 09      1130      ADD  HL, BC
1307 A7      1131      AND  A
1308 41      1132      LD  B, C
  
```

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```

1309 2B      1133 KILTR1: DEC HL
130A ED67   1134          RRD
130C 10FB   1135          DJNZ KILTR1-*
130E C9     1136          RET
           1137 ; SUBROUTINE TO ADD A DIGIT TO NUMBER POINTED AT BY DE
130F 0605   1138 ADDTB: LD B,5
1311 EB     1139 ADDTD: EX DE,HL
1312 E5     1140          PUSH HL
1313 ED6F   1141 ADDTB1: RLD
1315 23     1142          INC HL
1316 10FB   1143          DJNZ ADDTB1-*
1318 77     1144          LD (HL),A ; STUFF LAST
1319 E1     1145          POP HL
131A EB     1146          EX DE,HL
131B C9     1147          RET
           1148 ; COLORS FOR CALCULATOR
131C 76     1149 COLORS: DEFB 76H ; GREY
131D 5C     1150          DEFB 5CH ; RED
131E 00     1151          DEFB 00H ; WHITE
131F 07     1152          DEFB 07H ; BLACK
1320 0707   1153          DEFW 0707H
1322 0707   1154          DEFW 0707H
           1155 ; *****
           1156 ; * CALCULATOR RAM
           1157 ; *****
           1158          ORG 4000H
4000      1159          DEFS CALCLN, BYTEPL
4E60      1160          DEFS 96
4EC0      1161 CALSTK:
>4EC0     1162 CALR: EQU $
4EC0      1163 OPCODE: DEFS 1 ; OPERATION TO DO
4EC1      1164 STATE: DEFS 1 ; STATE VARIABLE
4EC2      1165 MEMSTA: DEFS 1 ; MEMORY STATE VARIABLE
4EC3      1166 MEMDIG: DEFS 1 ; MEMORY DIGIT VARIABLE
4EC4      1167 ARG1: DEFS 11
           1168 ; ** NOTE *** CODE EXPECTS ARG2 THRU SHOWBF TO BE IN ONE
4ECF      1169 ARG2: DEFS 11 ; ARGUMENT 2
4EDA      1170 DIGIT: DEFS 1 ; DIGIT COUNTER
4EDB      1171 DPOINT: DEFS 1 ; DECIMAL POINT ENTERED FLAG
4EDC      1172 POINTP: DEFS 1 ; DECIMAL POINT POINTER
4EDD      1173 SHOW: DEFS 7 ; ENTRY FEEDBACK BUFFER
4EE4      1174 NLIN: DEFS 1 ; NUMBER OF LINES ON SCROLL STA
4EE5      1175 SCRF: DEFS 1 ; CURRENT POS OF SCROLL SYSTEM
4EE6      1176 CMEM: DEFS 110 ; CALCULATOR MEMORYS
>4F34     1177 ENDC: EQU $
4F34      1178          END
  
```

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TOTAL ASSEMBLER ERRORS =

CROSS REFERENCE

LABEL	VALUE	REFERENCE							
A0	00E1	-508							
A1	0070	-520							
A2	0037	-532							
A3	001B	-544							
A4	000D	-556							
A5	0006	-562							
ACTINT	000E	-225	682						
ACTNUM	118A	-859	774						
ADDTB	130F	-1067	945	949	1111	1118			
ADDTB1	1313	-1070	1143						
ADDTD	1311	-1068							
ADIG1	11AB	-882	902						
ADIG2	11C1	-894	920						
ADIG3	11CD	-902	934						
ADIG4	11D5	-908	916						
ADIG5	11D6	-909	939						
ADIG6	11DD	-912	930						
ADIG7	11DE	-913	738						
ADIG8	11ED	-921	958						
ADIG9	11FD	-930	966						
ALKEYS	0214	-49	688						
ARG1	4EC4	-1096	817	843	5	847	877		
ARG1MD	0000	-654	809			839	842	859	
ARG2	4ECF	-1098	792	802	9	839	842	859	
		875	895	924	106	1101			
ARG2MD	0001	-655	807	814					
AS0	00D4	-509							
AS1	006A	-521							
AS2	0034	-533							
AS3	001A	-545							
B0	00C8	-510							
B1	0064	-522							
B2	0031	-534							
B3	0018	-546							
BCDADD	0062	-277	868	868					
BCDCHS	006A	-281	801	801					
BCDDIV	0068	-280	874	874					
BCDMUL	0066	-279	847	847	2	872			
BCDNEG	006C	-282							
BCDSUB	0064	-278	870	870					
BEGRAM	4FCE	-594							
BITSPL	00A0	-43							
BLANK	002A	-243							
BMUSIC	0012	-229							
BYTEPL	0028	-42	652	663	990	1027	1044	1054	1055
		1159							
C1	00BD	-511							
C2	005E	-523							
C3	002E	-535							
C4	0017	-547							
C5	000B	-557							
C6	0005	-563							
C7	0002	-566							

PROPRIETARY INFORMATION

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CALCLN	005C	-649	651	663	672	1159
CALRAM	4ECO	-1091	678	679		
CALSTK	4ECO	-1090	659			
CBA	0009	-123				
CBB	0007	-121				
CBC	0006	-120				
CBD	0005	-119				
CBE	0004	-118				
CBFLAG	0008	-122				
CBH	000B	-125				
CBIXH	0003	-117				
CBIXL	0002	-116				
CBIYH	0001	-115				
CBIYL	0000	-114				
CBL	000A	-124				
CCVT1	12E1	-1041	1116	1119		
CCVT1A	12F5	-1050	1112			
CCVT2	12F6	-1051	1126			
CCVT3	1300	-1056	1124			
CHDOWN	0001	-111				
CHGSGN	10DE	-785	778			
CHLEFT	0002	-110				
CHRDIS	0032	-248	962	962	973	1080
CHRHG	0003	-109				
CHTRIG	0004	-108				
CHUP	0000	-112				
CLEAR	1020	-659	782			
CLRENT	11AF	-885	781	890		
CMEMO	4EE6	-1105	786			
CNT	4FDD	-611				
COL0L	0004	-168				
COLOR	0000	-164				
COL1L	0005	-169				
COL1R	0001	-165				
COL2L	0006	-170				
COL2R	0002	-166				
COL3L	0007	-171				
COL3R	0003	-167				
COLBX	000B	-172				
COLLST	4FE8	-622				
COLORS	131C	-1078	676			
COLSET	0018	-234	676			
CONCM	0008	-189				
CONVRT	12C7	-1033	736	995		
CS1	00B2	-512				
CS2	0059	-524				
CS3	002C	-536				
CS4	0015	-548				
CS5	000A	-558				
CT0	4FD5	-602				
CT1	4FD6	-603				
CT2	4FD7	-604				
CT3	4FD8	-605				
CT4	4FD9	-606				
CT5	4FDA	-607				
CT6	4FDB	-608				
CT7	4FDC	-609				

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CTIMER	0203	-46			
D1	00A8	-513			
D2	0054	-525			
D3	0029	-537			
D4	0014	-549			
DABS	0072	-285			
DADD	006E	-283			
DECCTS	0010	-226			
DIGITS	4EDA	-1099	733	894	927
DISNUM	0036	-250	1076	1076	
DISTIM	0052	-267			
DCADD	1162	-843	863		
DOCLRE	1186	-855	683		
DODIV	116B	-843	866		
DOIT	0044	-260			
DOITB	0046	-261			
DOMUL	1168	-843	865		
DOOP	1146	-832	821	831	
DOOPTB	115A	-839	857		
DOSUB	1165	-843	864		
DPOINT	4EDB	-1100			
DS1	009F	-514			
DS2	004F	-526			
DS3	0027	-538			
DS4	0013	-550			
DS5	0009	-559			
DS6	0004	-564			
DSMG	0070	-284			
DURAT	4FEA	-624			
E1	0096	-515			
E2	004A	-527			
E3	0025	-539			
E4	0012	-551			
EMUSIC	0014	-230			
END	00C0	-379			
ENDCR	4F54	-1106	679		
ENDSCR	4FF4	-632			
EQR0UT	1111	-810	776		
EQRT1	1120	-817	797	803	
F1	008D	-516		856	851
F2	0046	-528			
F3	0022	-540			
F4	0011	-552			
F5	0008	-560			
FILL	001A	-235	662	678	
FIRSTC	2000	-40		924	1108 1109
FNTSML	020D	-48			
FNTSYS	0206	-47			
FS1	0085	-517			
FS2	0042	-529			
FS3	0020	-541			
FS4	0010	-553			
FTBASE	0000	-93			
FTBYTE	0003	-96			
FTFSX	0001	-94			
FTFSY	0002	-95			
FTPTH	0006	-99			

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MEMFUN	10D8	-781	779					
MEMSTA	4EC2	-1094	703	795	955			
MENU	004A	-263						
MENUST	0218	-50						
MJUMP	000A	-221						
MOVE	005E	-275	817	817	839	839	875	875
MRET	0008	-220						
MRFLOP	0006	-101						
MRLOCK	4FF7	-633						
MROR	0004	-103						
MRRGT	0002	-105						
MRSHFT	0003	-106						
MRXOR	0005	-102						
MRXPND	0003	-104						
MSKTD	007E	-291						
MUZAK	0012	-228						
MUZPC	4FCE	-596						
MUZSP	4FD0	-597						
MXSCR	021E	-51						
NEG	0074	-286						
NLINES	4EE4	-1103	996	1013				
NOGAME	0235	-53						
NOPLAY	0228	-52						
NORMEM	4000	-39						
NULKEY	12A9	-1019						
NUMBA	128A	-1009	976					
NUMBA1	129C	-1017	970					
NUMCHK	116D	-842						
NUMPLY	4FF3	-631						
NWHDWR	0001	-36						
OA1	008F	-576						
OA2	0047	-577						
OA3	0023	-578						
OA4	0011	-579						
OA5	0008	-580						
OBO	00FE	-570						
OCO	00F1	-571						
OD1	00D6	-572						
OE1	00BF	-573						
OF1	00B4	-574						
OG1	00A0	-575						
OP1	10F0	-793	806					
OP2	1106	-803	813					
OP2A	1109	-804	820					
OP3	110B	-806	808					
OPCOD	4EC0	-1092	825	833	955	974	109	
OPOTO	4FDF	-613						
OPOT1	4FE0	-614						
OPOT2	4FE1	-615						
OPOT3	4FE2	-616						
OPROUT	10E8	-799	775					
OPTBL	12C1	-1027	1078					
OSW0	4FE4	-618						
OSW1	4FE5	-619						
OSW2	4FE6	-620						
OSW3	4FE7	-621						
OVFERR	12AA	-1020	1067					

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OVFMSG	12B4	-1025	1084				
OVRCHK	1175	-844	850				
PACKER	12D8	-1038					
PAWS	0050	-266					
PERCEN	1123	-818	777				
PIZBRK	0048	-262					
POINTP	4EDC	-1101					
POTO	001C	-201					
POT1	001D	-202					
POT2	001E	-203					
POT3	001F	-204					
PRIOR	4FF9	-635					
PSWCY	0000	-58					
PSWPV	0002	-57					
PSWGN	0007	-55					
PSWZRO	0006	-56					
PUSHE1	122D	-957	999				
PUSHEN	1216	-946	815	834	854	887	
PVDLAB	4FD2	-598					
PVOLMC	4FD3	-599					
QUIT	0078	-288					
RANGED	0076	-287					
RANSHT	4FEF	-630					
RCALL	0004	-218					
RECTAN	001C	-236	666				
RELAB1	003A	-253					
RELABS	0038	-252					
RESTOR	002E	-245					
SAVE	002C	-244					
SCHEDR	000C	-224					
SCREEN	0000	-41					
SCRLD0	1266	-995	049				
SCRLD1	1276	-1001	035				
SCRLD2	1280	-1005	1058				
SCRLDN	125E	-989	1016				
SCRLKY	1238	-966	730				
SCRLU1	124B	-980	005	1007			
SCRLU2	124D	-981	032				
SCROLL	0030	-246	990	990	1027	1044	1044
SCRPTR	4EE5	-1104	1052				
SCRSTR	0016	-232					
SCT0	0001	-128					
SCT1	0002	-129					
SCT2	0003	-130					
SCT3	0004	-131					
SCT4	0005	-132					
SCT5	0006	-133					
SCT6	0007	-134					
SCT7	0008	-135					
SEMI4S	4FDE	-612					
SENFLG	4FFA	-636					
SENTRY	0042	-259	688	688			
SETB	007A	-289					
SETOUT	0016	-233	672				
SETW	007C	-290					
SFO	0009	-136					
SF1	000A	-137					

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SF2	000E	-138				
SF3	000C	-139				
SF4	000D	-140				
SF5	000E	-141				
SF6	000F	-142				
SF7	0010	-143				
SHIFTU	0060	-276				
SHONUM	1084	-720	726	835		
SHOWBF	4E1D	-1102	734	948		
SHOWCK	120A	-936	728	799	893	921
SHOWMD	0002	-656	805	830	981	
SJ0	0015	-152				
SJ1	0017	-154				
SJ2	0019	-156				
SJ3	001E	-158				
SKYD	0013	-145	689			
SKYU	0012	-146				
SNDBX	0018	-184				
SNUL	0000	-127				
SP0	001C	-147				
SP1	001D	-148				
SP2	001E	-149				
SP3	001F	-150				
SSEC	0011	-144				
ST0	0014	-151				
ST1	0016	-153				
ST2	0018	-155				
ST3	001A	-157				
STATEV	4EC1	-1093	44	886		
STIMER	0200	-45				
STKBOT	4E58	-652	994	1054		
STOREN	0058	-272	12	912		
STRDIS	0034	-249	886	1086	1100	1108 1105
SUCK	000C	-222				
SW0	0010	-197				
SW1	0011	-198				
SW2	0012	-199				
SW3	0013	-200				
SYSRAM	4FCE	-639				
TIMOUT	4FEC	-626				
TMR60	4FEB	-625				
TOKEJT	10B8	-760	742			
TOKETB	10A0	-735	893			
TONEA	0011	-177				
TONEB	0012	-178				
TONEC	0013	-179				
TONMO	0010	-176				
UMARGT	4FFB	-637				
UPISTR	0000	-215				
USERTB	4FFD	-638				
VBBLNK	0006	-87				
VBCCHK	0004	-84				
VBCH	0003	-83				
VBCL	0002	-82				
VBCLAT	0003	-91				
VBCLMT	0000	-89				
VBCREV	0001	-90				

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VBDCH	0001	-81
VBDCL	0000	-80
VBDXH	0004	-68
VBDXL	0003	-67
VBDYH	0009	-73
VBDYL	0008	-72
VBLANK	0028	-242
VBMR	0000	-64
VBOAH	000E	-78
VBOAL	000B	-77
VBSACT	0007	-86
VBSTAT	0001	-65
VBTIMB	0002	-66
VBXCHK	0007	-71
VBXH	0006	-70
VBXL	0005	-69
VBYCHK	000C	-76
VBYH	000B	-75
VBYL	000A	-74
VECT	003E	-253
VECTC	003C	-254
VERAF	000E	-194
VERBL	000A	-174
VIBRA	0014	-180
VOICES	4FD4	-600
VOLAB	0016	-181
VOLC	0015	-182
VOLN	0017	-183
VWRITR	001E	-237
WASTE	0FFF	-585
WASTER	0FFF	-586
WRIT	0024	-240
WRITA	0026	-241
WRITP	0022	-239
WRITR	0020	-238
XINTC	0002	-217
XMEM	10CA	-772
XMEM1	10D0	-775
XPAND	0019	-191
XPNDON	0001	-35

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641
642 LIST S, X, M, T
643 NLIST I
644 ; *****
645 ; * H V G C H E C K M A T E *
646 ; *****
647 ;
648 ;
649 ; M A C R O S
650 ;
651 DEF4X: MACR #A4X, #B4X, #C4X, #D4X
652 DEFB #A4X
653 DEFB #B4X
654 DEFB #C4X
655 DEFB #D4X
656 ENDM
657 WRECK MACR
658 DEFW 9, SHL 8+32
659 DEFB 0000B
660 ENDM
661 ;
662 ;
663 ; E Q U A L S
664 ;
>0000 665 OLDWAY EQU 1-NWHDWR ; 1=DO OLD WAY 0=DO NEW WAY
>0001 666 NEWWAY EQU 1-OLDWAY ; OPPOSITE OF OLDWAY
667 ; VARIOUS EQU'S
>000C 668 RLMOVE EQU 1100 ; RIGHT AND LEFT MOVES
>0003 669 UDMOVE EQU 0011 ; UP AND DOWN MOVES
>0002 670 NOSTRT EQU 2 ; # OF GAMES BIT
>0003 671 NPLT EQU 3 ; # PLAYERS BIT
>0003 672 ANIMAX EQU 3 ; MAX # TICKS PER ANIMATION FRAM
>009C 673 XMAX EQU (BYTEPL-1)*4 ; MAX X COORD
>0015 674 YLINES EQU 21 ; # VERT BLOCKS
>000B 675 LOWY EQU 11 ; LOWEST Y COORD
>005B 676 YMAX EQU ((YLINES-1)*4)+LOWY ; MAX Y COORD
>0000 677 LOWX EQU 0 ; LOWEST X COORD
>0008 678 AMOVE EQU 8H ; AN ARBITRARY MOVE
>0009 679 MLEVOL EQU 09H ; MUSIC VOLUME
>0024 680 TDOPT EQU 100100B ; TIME DISPLAY OPTIONS
>0044 681 COUPT EQU 01000100B ; COUNT DOWN OPT
>0010 682 WRITDR EQU 010000B ; WRIT WITH MAGIC OR
683 ; PLAYER PACKET OFFSETS
>0000 684 LASTSW EQU 0 ; LAST SWITCH SETTING
>0001 685 LASTMV EQU 1 ; LAST ACTUAL MOVE
>0002 686 CURSW EQU 2 ; CURRENT SWITCH SETTING
>0003 687 ARROT EQU 3 ; ARROW ROTATION AMOUNT
>0004 688 ARRX EQU 4 ; ARROW X COORD
>0005 689 ARRY EQU 5 ; ARROW Y COORD
>0006 690 PSTAT EQU 6 ; PLAYER STATUS
691 ; PLAYER STATUS MASKS
>0080 692 ACTIVE EQU 80H
>0040 693 HUMAN EQU 40H
>0007 694 ACTBIT EQU 7 ; 1=ACTIVE 0=DEAD
>0006 695 HUMBIT EQU 6 ; 1=HUMAN 0=COMPUTER
696 ; SCREEN TABS
>0028 697 XTAB1 EQU ((BYTEPL/4)*4)

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>0050      698 XTAB2 EQU XTAB1*2
>0078      699 XTAB3 EQU XTAB1*3
>0014      700 YTAB EQU (((YLINES-1)/4)*4)
>001F      701 YTAB1 EQU YTAB+LOWY
>0033      702 YTAB2 EQU (2*YTAB)+LOWY
>0047      703 YTAB3 EQU (3*YTAB)+LOWY
           704 ; OFFSETS FOR EACH PLAYERS ROM DATA
>0000      705 NOTE0 EQU 0 ; EACH DIRECTIONS NOTES
>0001      706 NOTE1 EQU 1
>0002      707 NOTE2 EQU 2
>0003      708 NOTE3 EQU 3
>0004      709 PPATL EQU 4 ; PLAYER PAT ADDR LOW
>0005      710 PPATH EQU 5 ; PLAYER PAT ADDR HIGH
>0006      711 PCDOP EQU 6 ; PLAYER CHAR DISP OPT
>0007      712 PSPOSX EQU 7 ; X COORD OF PLAYER SCORE
>0008      713 PSPOSY EQU 8 ; Y COORD OF PLAYER SCORE
>0009      714 PSDOP EQU 9 ; PLAYER SCORE DISP OPT
           715 ; MORE EQU'S
>00F6      716 FORCE EQU 0F6H ; VAL TO FORCE RANDOM MOVE
>0004      717 WIDTH EQU 4H ; # PIXELS WIDE OF PLAYER PAT
>0004      718 HEIGHT EQU 4H ; # PIXELS HIGH OF PLAYER PAT
>0020      719 ALLBY EQU (YLINES*4)*BYTEPL ; ALL BYTES ON A SCREEN
>41B3      720 START EQU (LOWY*BYTEPL)+NORM ; LOWEST ADDR OF PLAY FI
>0001      721 PATY EQU 1 ; #BYTES WIDE OF PLAYER PATTERN
>0004      722 PATX EQU 4 ; #BYTES HIGH OF PLAYER PATTERN
>0104      723 PATS EQU PATXS*GHLS OR PATYS*GHLS ; PATTERNS DIMENSIONS
>000F      724 JUS EQU 0FH ; ONLY JOY STICK BITS
>0008      725 CBLN EQU 8 ; COLOR BLOCK LENGTH
>0008      726 SBLN EQU 8 ; SOUND BLOCK LENGTH
>0000      727 WPN EQU 0
>0001      728 WPO EQU 1
>0002      729 WPPAL EQU 2
>0003      730 WPPAH EQU 3
>0005      731 WPXS EQU 5
>0004      732 WPYS EQU 4
           733 ;
           734 ;
           735 ;
           736 ORG NORMEM OF96H ; SHOULD BE EQUAL TO RSTART
           737 ; UNCLEARED RAM
4F96      738 UNCRAM
4F96      739 CURS DEFS 12 ; ALL CURRENT SCORES
           740 ; CLEARED
4FA2      741 CNOP DEFS 1 ; CURRENT # PLAYERS
4FA3      742 PLIX DEFS 1 ; WHO IS CURRENT PLAYER
4FA4      743 CNOH DEFS 1 ; CURRENT # HUMANS
4FA5      744 TARR DEFS 1 ; TEMP ARROW X COORD
4FA6      745 TARY DEFS 1 ; TEMP ARROW Y COORD
4FA7      746 RMASK DEFS 1 ; ROTATE MASK
           747 PPACKS ; START OF PLAYER PACKETS
4FA8      748 PLAY0: DEFS PSTAT+1
4FAF      749 PLAY1: DEFS PSTAT+1
4FB6      750 PLAY2: DEFS PSTAT+1
4FB0      751 PLAY3: DEFS PSTAT+1
4FC4      752 ENDRAM:
>4FA1      753 RSTART EQU BEGRAM-(ENDRAM-UNCRAM)+1 ; SHOULD BE RAM STA
           754 ORG 1328H

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1328          755 ONETIM:
          756 ; ONE TIME ONLY HOUSEKEEPING
1328 31964F   757 LD SP, UNCRAM
132B          758 SYSSUK GETPAR
132B FF      758 + RST 56
132C 4D      758 + DEFB GETPAR+1
          758 + IF GETPAR. EQ. INTPC
          758 + ENDIF
132D 3502    759 DEFW NOGAME
132F 82      760 DEFB 82H
1330 DC4F    761 DEFW CT7
1332          762 SYSSUK GETPAR
1332 FF      762 + RST 56
1333 4D      762 + DEFB GETPAR+1
          762 + IF GETPAR. EQ. INTPC
          762 + ENDIF
1334 2802    763 DEFW NOPLAY
1336 01      764 DEFB 1
1337 F34F    765 DEFW NUMPLY
1339          766 SYSSUK FILL
1339 FF      766 + RST 56
133A 1B      766 + DEFB FILL+1
          766 + IF FILL. EQ. INTPC
          766 + ENDIF
133B 964F    767 DEFW CURSCR
133D 0C00    768 DEFW 12
133F 00      769 DEFB 0
1340          770 FIRE
          771 ; RE-ENTRY POINT FROM END OF GAME
1340 F3      772 DI
1341 31964F   773 LD SP, UNCRAM
1344          774 SYSTEM INTPC
1344 FF      774 + RST 56
1345 00      774 + DEFB INTPC
          774 + IF INTPC. EQ. INTPC
>0001        774 +INTFB DEFL 1
          774 + ENDIF
          775 ; OUTPUT CONTROL BLOCK
1346          776 DO COLSET
1346 19      776 + DEFB COLSET+1
1347 AA17    777 DEFW CBLOCK
1349          778 DO EMUSIC
1349 15      778 + DEFB EMUSIC+1
          779 ; CLEAR JOYSTICKS
134A          780 DO FILL
134A 1B      780 + DEFB FILL+1
134B E44F    781 DEFW OSWO
134D 0400    782 DEFW 4
134F 00      783 DEFB 0
          784 ; CLEAR ALL RAM DATA
1350          785 DO FILL
1350 1B      785 + DEFB FILL+1
1351 A24F    786 DEFW CNOPL
1353 2200    787 DEFW . RES. (PLAY3+PSTAT)-CNOPL+1
1355 00      788 DEFB 0
1356          789 DO SETOUT
1356 17      789 + DEFB SETOUT+1
  
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1357 BE      790      DEFB . RES. ((Y LINES*4)+LOWY)*2 ; VER BLK
1358 40      791      DEFB 40H+0      ; HOR COL BND
1359 08      792      DEFB 08H        ; INTER MODE
              793      ; CLEAR SCORE BLOCKS
135A        794      DO RECTAN
135A 1D      794 +     DEFB RECTAN+1
135B 0000    795      DEFW 0
135D A00B    796      DEFW 11. SHL 9+160
135F 55      797      DEFB 01010101B
1360        798      DO RECTAN
1360 1D      798 +     DEFB RECTAN+1
1361 8000    799      DEFW 0. SHL 8+128
1363        800      WRECK
1363 2009    800 +     DEFW 9. SHL 8+32
1365 00      800 +     DEFB 0000B
1366        801      DO RECTAN
1366 1D      801 +     DEFB RECTAN+1
1367 5800    802      DEFW 0. SHL 8+88
1369        803      WRECK
1369 2009    803 +     DEFW 9. SHL 8+32
136B 00      803 +     DEFB 0000B
136C        804      DO RECTAN
136C 1D      804 +     DEFB RECTAN+1
136D 2900    805      DEFW 0. SHL 8+40
136F        806      WRECK
136F 2009    806 +     DEFW 9. SHL 8+32
1371 00      806 +     DEFB 0000B
1372        807      DO RECTAN
1372 1D      807 +     DEFB RECTAN+1
1373 0000    808      DEFW 0. SHL 8+0
1375        809      WRECK
1375 2009    809 +     DEFW 9. SHL 8+32
1377 00      809 +     DEFB 0000B
1378        810      DO ACTINT
1378 0F      810 +     DEFB ACTINT+1
1379        811      EXIT
1379 02      811 +     DEFB XINTC
>0000      811 +INTRC DEFL 0
              812      ; INITIALIZE STARTING ADDRESS OF ARROWS
137A 212833 813      LD HL, RES. (YTAB2. SHL 2)+XTAB1
137D 22AC4F 814      LD (PLAY0+ARRX), HL
1380 217933 815      LD HL, RES. (YTAB2. SHL 3)+XTAB3
1383 22B34F 816      LD (PLAY1+ARRX), HL
1386 21501F 817      LD HL, RES. (YTAB1. SHL 2)+XTAB2
1389 22BA4F 818      LD (PLAY2+ARRX), HL
138C 215047 819      LD HL, RES. (YTAB3. SHL 3)+XTAB2
138F 22C14F 820      LD (PLAY3+ARRX), HL
              821      ; CLEAR FIELD
1392 CDB414 822      CALL CLEARF
              823      ; DISPLAY # GAMES
1395 DD210D02 824      LD IX, FNTSML
1399        825      SYSSUK DISNUM
1399 FF      825 +     RST 56
139A 37      825 +     DEFB DISNUM+1
              825 +     IF DISNUM. EQ. INTPC
              825 +     ENDIF
139B 4C      826      DEFB 76
  
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139C 02      827      DEFB 2
139D 24      828      DEFB TDOPT
139E 42      829      DEFB 42H
139F DC4F    830      DEFW CT7
13A1        831      DONTD:
13A1 3AF34F  832      ; GET # HUMANS
13A4 FE05    833      LD A, (NUMPLY)
13A6 3802    834      CP 5
13A8 3E04    835      JR C, GOTNPL-$
13AA        836      LD A, 4
13AA 32A44F  837      GOTNPL:
13AA 32A44F  838      LD (CNOHUM), A
13AA 32A44F  839      ; GET # PLAYERS:
13AA 32A44F  840      ; IF HUMANS=1 OR 0 OR > 4 THEN PLAYERS=4 ELSE PLA
13AD FE02    841      CP 2
13AF 3804    842      JR C, FPLAY-$
13B1 FE05    843      CP 5
13B3 3802    844      JR C, ALLHUM-$
13B5 3E04    845      LD A, 4
13B7 32A24F  846      ALLHUM: LD (CNOPL), A
13B7 32A24F  847      ; INITIALIZE THE PLAYER PACKETS
13B7 32A24F  848      ; B=CURR. # HUMANS
13B7 32A24F  849      ; C=CURR. # PLAYERS
13B7 32A24F  850      ; D=THIS PLAYER #
13BA 3AA44F  851      INTPC: LD A, (CNOHUM)
13BD 47      852      LD B, A
13BE 3AA24F  853      LD A, (CNOPL)
13C1 4F      854      LD C, A
13C2 1600    855      LD D, 0
13C4 7A      856      GTIX: LD A, D
13C5 CD5C16  857      CALL LDPL
13C8 C5      858      PUSH BC
13C9 D5      859      PUSH DE
13CA 7A      860      LD A, D
13CB C631    861      ADD A, 31H ; SET UP ASCII LITERAL
13CD DD5E04  862      LD E, (I+ARRX)
13D0 DD5605  863      LD D, (I+ARRY)
13D3 1D      864      DEC E
13D4 1D      865      DEC E
13D5 FD4E06  866      LD C, (I+PCDOP)
13D8        867      SYSTEM CHRDIS ; DISPLAY PLAYER# ON FIELD
13D8 FF      867 + RST 56
13D9 32      867 + DEFB CHRDIS#
13D9 32      867 + IF CHRDIS. EQ. INTPC
13D9 32      867 + ENDIF
13DA FD5E07  868      LD E, (I+PSPOX)
13DD FD5608  869      LD D, (I+PSPOY)
13E0 D5      870      PUSH DE
13E1        871      SYSTEM CHRDIS ; DISPLAY# ON SCORE BLOCK
13E1 FF      871 + RST 56
13E2 32      871 + DEFB CHRDIS
13E2 32      871 + IF CHRDIS. EQ. INTPC
13E2 32      871 + ENDIF
13E3 D1      872      POP DE
13E4 7B      873      LD A, E
13E5 C606    874      ADD A, 6
13E7 5F      875      LD E, A
  
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13E8	14	876		INC	D	
13E9	14	877		INC	D	
13EA	010104	878		LD	BC, PATYSZ. SHL 8+PATXSZ	
13ED	FD6605	879		LD	H, (IY+PPATH)	
13F0	FD6E04	880		LD	L, (IY+PPATL)	
13F3	3E10	881		LD	A, 00010000B	
13F5		882		SYSTEM	WRIT	
13F5	FF	882	+	RST	56	; WRIT PLAYER PAT IN SCORE BLOCK
13F6	24	882	+	DEFB	WRIT	
		882	+	IF	WRIT. EQ. INTPC	
		882	+	ENDIF		
13F7	01	883		POP	DE	
13F8	05	884		PUSH	DE	
13F9	0DE3	885		PUSH	IX	
13FB	7A	886		LD	A, D	
13FC	0600	887		LD	B, 0	
13FE	4A	888		LD	C, D	
13FF	21964F	889		LD	HL, CURSCR	
1402	09	890		ADD	HL, BC	
1403	09	891		ADD	HL, BC	
1404	09	892		ADD	HL, BC	
1405	CDE313	893		CALL	DISPSCORE	; DISP SCORES
1408	DDE1	894		POP	IX	
140A	D1	895		POP	DE	
140B	C1	896		POP	BC	
140C	AF	897		XOR	A	
140D	B0	898		OR	B	
140E	28Q9	899		JR	Z, NOTNUM-\$	
1410	3ECO	900		LD	A, ACTIVE+HUMAN	
1412	DD7706	901		LD	(IX+PPATH), A	
1415	05	902		DEC	B	
1416	1806	903		JR	CKNOFF-\$	
1418	00	904	CKSUM3:	DEFB	0	
1419	3E80	905	NOTNUM:	LD	A, ACTIVE	
141B	DD7706	906		LD	(IX+PPATH), A	
141E	14	907	CKNOFF:	INC	D	
141F	0D	908		DEC	C	
1420	AF	909		XOR	A	
1421	B1	910		OR	C	
1422	20A0	911		JR	NZ, GTR LIX-\$	
1424	3E03	912		LD	A, 3	
1426		913	CDOPT:			
1426	F5	914		PUSH	AF	
1427		915		SYSSUK	PAWS	
1427	FF	915	+	RST	56	
1428	51	915	+	DEFB	PAWS+1	
		915	+	IF	PAWS. EQ. INTPC	
		915	+	ENDIF		
1429	05	916		DEFB	5	
142A	32A34F	917		LD	(PLIX), A	
142D	CD9114	918		CALL	UPMUZK	; MAKE SOUND FOR COUNT DOWN
1430	F1	919		POP	AF	
1431	F5	920		PUSH	AF	
1432	C630	921		ADD	A, 30H	
1434		922		XYRELL	DE, (XTAB2-4), . RES. (YTAB2-4)	
1434	00000000	922	+	LD	DE, . RES. (. RES. (YTAB2-4)). SHL 8+((XTAB2-4))	
1438	0E44	923		LD	C, CDOPT	

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143A          924          SYSTEM CHRDIS      ; DISPLAY COUNT DOWN #
143A FF      924 +      RST 56
143B 32      924 +      DEFB CHRDIS
                924 +      IF CHRDIS.EQ. INTPC
                924 +      ENDIF
143C          925          SYSSUK PAWS
143C FF      925 +      RST 56
143D 51      925 +      DEFB PAWS+1
                925 +      IF PAWS.EQ. INTPC
                925 +      ENDIF
143E 28      926          DEFB 40
143F          927          SYSTEM EMUSIC
143F FF      927 +      RST 56
1440 14      927 +      DEFB EMUSIC
                927 +      IF EMUSIC.EQ. INTPC
                927 +      ENDIF
1441 F1      928          POP AF
1442 3D      929          DEC A
1443 20E1    930          JR NZ, CDOWNL-*
1445 CDB414  931          CALL CLEARF
                932          ; INIT TICK COUNT
1448 CD4A16  933          CALL TICKIT
144B AF      934          XOR A
144C 32DD4F  935          LD (CNT), 0
144F          936 LOOP
144F          937          SYSSUK SENTRY
144F FF      937 +      RST 56
1450 43      937 +      DEFB SENTRY+1
                937 +      IF SENTRY.EQ. INTPC
                937 +      ENDIF
1451 1402    938          DEFW ALKE
1453          939          SYSSUK DOI
1453 FF      939 +      RST 56
1454 45      939 +      DEFB DOIT+1
                939 +      IF DOIT.EQ. INTPC
                939 +      ENDIF
1455 5914    940          DEFW THETB
1457 18F6    941          JR LOOP
1459          942 THE CT: RC SCTO, ACTION
1459 41      942 +      DEFB SCTO+40H
145A 6C14    942 +      DEFW ACTION
                942 +      IF 0
                942 +      ENDIF
145C          943          RC SJ0, MOVJOY
145C 55      943 +      DEFB SJ0+40H
145D 8414    943 +      DEFW MOVJOY
                943 +      IF 0
                943 +      ENDIF
145F          944          RC SJ1, MOVJOY
145F 57      944 +      DEFB SJ1+40H
1460 8414    944 +      DEFW MOVJOY
                944 +      IF 0
                944 +      ENDIF
1462          945          RC SJ2, MOVJOY
1462 59      945 +      DEFB SJ2+40H
1463 8414    945 +      DEFW MOVJOY
                945 +      IF 0
  
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    945 +      ENDIF
1465          946      RC      SJS,MOVJOY
1465 5B       946 +    DEFB   SJS+40H
1466 8414    946 +    DEFW  MOVJOY
            946 +    IF     0
            946 +    ENDIF
1468        947      RC      SKYD,CALPIZ,+END
1468 53      947 +    DEFB   SKYD+40H
1469 8B14    947 +    DEFW  CALPIZ
            947 +    IF     0+END
146B 00     947 +    DEFB   0+END
            947 +    ENDIF
146C        948  ACTION:
146C CD4A16 949      CALL  TICKIT
            950      ; INCREMENT THE CURRENT PLAYER INDEX BY 1 UNTIL
            951      ; AN ACTIVE PLAYER IS FOUND THEN UPDATE HIM
146F 3AA34F 952  INCR  LD     A,(PLIX)
1472 3C      953      INC     A
1473 E603    954      AND     03H
1475 32A34F 955      LD     (PLIX),A      ; CURR PLAYER IXC-CURR PL IX+1 M
1478 CD5C16 956      CALL  LDPLIX
147B DDCB067E 957     BIT  ACTBIT,(IX+PSTAT) ; TEST FOR ACTIVE PLAYER
147F 28EE    958      JR     Z,INCR-$
1481 C3BC14 959      JP     MOVEIT      ; THE MAJOR EVENT
1484        960  MOVJOY
1484 D615    961      SUB     SJO      ; TAKE OFF WHATEVER
1486 CB3F    962      SRL     A      ; DIV BY 2
1488 C31E16 963      JP     STALL
148B        964  CALPIZ:
148B CD4A16 965      CALL  TICKIT
148E        966      SYSTEM PIZBRK
148E FF      966 +    RST     56
148F 48      966 +    DEFB   PIZBRK
            966 +    IF     PIZBRK<=0 EQ INTPC
            966 +    ENDIF
1490 C9      967      RET
1491 3AA34F 968  UPMIN  LD     A,(PLIX)
1494 CD5C16 969      CALL  LDPLIX
1497 DD7E03 970      LD     A,(IX+AROT)
149A 0603    971      LD     B,3
149C        972  TSTB
149C 0F      973      RRCA
149D 3802    974      JR     C,GOTEST-$
149F 10FB    975      DJNZ  TSTB,$
14A1        976  GOTEST:
14A1 48      977      LD     C,B
14A2 0600    978      LD     B,0
14A4 FD09    979      ADD     IY,BC
14A6 FD7E00 980      LD     A,(IY+0)
14A9 D313    981      OUT    (TONEC),A
14AB 3E09    982      LD     A,MUSVOL
14AD D315    983      OUT    (VOLC),A
14AF 3E11    984      LD     A,0A4
14B1 D310    985      OUT    (TONMO),A
14B3 C9      986      RET
14B4        987  CLEARF:
            988      ; CLEAR FIELD
  
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14B4          989          SYSSUK FILL
14B4 FF      989 +        RST 56
14B5 1B      989 +        DEFB FILL+1
                989 +        IF FILL. EQ. INTPC
                989 +        ENDIF
14B6 B841    990          DEFW STARTS
14B8 200D    991          DEFW ALLBYT
14BA 00      992          DEFB 0
14BB C9      993          RET
14BC          994 MOVEIT:
                995          ; THIS ROUTINE UPDATES A PLAYER'S POSITION
                996          ; INPUT PARAS ARE: IX=POINTER TO PLAYERS PACKET
                997          ; DURING ROUTINE B=CURRENT SWITCH C=LAST SWITCH
14BC DD4E00  998          LD C, (IX+LASTSW)
14BF DD4602  999          LD B, (IX+CURSW)
14C2 DDCBQ676 1000         BIT HUMBIT, (IX+PSTAT)
14C6 2003    1001         JR NZ, NOCUR-$ ; IF NOT HUMAN
14C8 AF      1002 ZSW: XOR A ; CLEAR A
14C9 47      1003         LD B, A ; CLEAR CURRENT SWITCH
14CA 4F      1004         LD C, A ; CLEAR LAST SW ENDIF
14CB 78      1005 NOCL: LD A, B ; IF CURR SW = 0
14CC B7      1006         OR A
14CD 2001    1007         JR NZ, RANST-$
14CF 41      1008         LD B, C ; THEN CURR SW<-LAST SW ENDIF
14D0 DD7000  1009 RANT: LD (IX+LASTSW), B ; SAVE LAST SW
14D3 78      1010         LD A, B ; IF CURR SW=0
14D4 B7      1011         OR A
14D5 2005    1012         JR NZ, GOTM-$
14D7 0E00    1013         LD C, 0 ; LAST SW<-0
14D9 CD7F16  1014         CALL RANMOV ; GET RANDOM MOVE ENDIF
14DC          1015 GOTS:
14DC DD7E01  1016         LD A, (IX+LASTMV) ; GET LAST MOVE
14DF CDAC16  1017         CALL MOVST
14E2 2813    1018         JR Z, GOTM-$
                1019         ; ANY MOVE AND CURR SW
14E4 CDAA16  1020         CALL MOVANY
14E7 280E    1021         JR Z, GOTM-$
14E9 41      1022         LD B, C ; TRY LAST SWITCH
                1023         ; ANY MOVE
14EA CDAA16  1024         CALL MOVANY
14ED 2808    1025         JR Z, GOTM-$
14EF DD4601  1026         LD B, (IX+LASTMV) ; TRY LAST MOVE
                1027         ; ANY MOVE
14F2 CDAA16  1028         CALL MOVANY
14F5 203C    1029         JR NZ, CRASH-$
14F7          1030 GOTM:
                1031         ; A LEGIT MOVE HAS BEEN FOUND SO UPDATE THE GUY
14F7 DD7701  1032         LD (IX+LASTMV), A ; SAVE ACTUAL MOVE FOR LATER
14FA DD7703  1033         LD (IX+AROT), A ; ARROW ROTATION AMOUNT<-THE MOV
14FD DD5605  1034         LD D, (IX+ARRY)
1500 DD5E04  1035         LD E, (IX+ARRX)
1503 CD2515  1036         CALL ERASE
1506 FD6605  1037         LD H, (IY+PPATH)
1509 FD6E04  1038         LD L, (IY+PPATL)
150C 010104  1039         LD BC, PATYSZ. SHL 8+PATXSZ
150F 3E10    1040         LD A, WRITR
1511          1041         SYSTEM WRIT ; WRITE PLAYER PATTERN OVER ARRO

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1511 FF      1041 +      RST 56
1512 24      1041 +      DEFB WRIT
                1041 +      IF WRIT. EQ. INTPC
                1041 +      ENDIF
1513 3AA54F  1042      LD  A, (TARRX)
1516 DD7704  1043      LD  (IX+ARRX), A ; SAVE NEW ARROW X
1519 3AA64F  1044      LD  A, (TARRY)
151C DD7705  1045      LD  (IX+ARRY), A ; SAVE NEW ARROW Y
151F CD0016  1046      CALL ANIARR ; ANIMATE THE ARROW
1522 C39114  1047      JP  UPMUZZ
1525          1048      ERASE:
1525 D5      1049      PUSH DE
1526          1050      SYSSUK RELAB1
1526 FF      1050 +      RST 56
1527 3B      1050 +      DEFB RELAB1+1
                1050 +      IF RELAB1. EQ. INTPC
                1050 +      ENDIF
1528 00      1051      DEFB 0
1529 EB      1052      EX  DE, HL
152A 0600    1053      LD  B, 0
152C 110104  1054      LD  DE, PATXSZ. SHL 8+PATXSZ
152F          1055      SYSTEM BLANK
152F FF      1055 +      RST 56
1530 2A      1055 +      DEFB BLANK
                1055 +      IF BLANK. EQ. INTPC
                1055 +      ENDIF
1531 D1      1056      POP  DE
1532 C9      1057      RET
1533          1058      CRASH:
                1059      ; A PLAYER HAS CRASHED. DESTROY HIS ARROW AND ELIM
                1060      ; HIM FROM THE GAME.
1533 016D17  1061      LD  BC, EXPSTS
1536 118117  1062      LD  DE, EXCOLS ; DEK-EXPLODE COLOR TABLE ADDR
1539 3E05    1063      LD  A, 5
153B 21B217  1064      LD  HL, EXPNO
153E F5      1065      EXCHANGE:
153F C5      1066      EXCHANGE:
1540 D5      1067      EXCHANGE:
1541 E5      1068      EXCHANGE:
1542 1A      1069      LD  A, (DE) ; AK-EXPLODE COLOR
1543 D300    1070      OUT (COLOR), A
1545 C5      1071      PUSH BC
1546 DD5605  1072      LD  D, (IX+ARRY)
1549 DD5E04  1073      LD  E, (IX+ARRX)
154C CD2515  1074      CALL ERASE
154F E1      1075      POP  HL ; PAT ADDR
1550 3E10    1076      LD  A, WRITR
1552 010104  1077      LD  BC, PATYSZ. SHL 8+PATXSZ
1555          1078      SYSTEM WRIT ; WRIT EXPLOSION
1555 FF      1078 +      RST 56
1556 24      1078 +      DEFB WRIT
                1078 +      IF WRIT. EQ. INTPC
                1078 +      ENDIF
1557          1079      SYSSUK PAWS
1557 FF      1079 +      RST 56
1558 51      1079 +      DEFB PAWS+1
                1079 +      IF PAWS. EQ. INTPC

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1079 +      ENDIF
1559 07      1080      DEFB 7
155A E1      1081      POP HL ; GET EXPLODE SOUND ADDR
155B 011808 1082      LD BC, SBLN. SHL. 8+SNDBX
155E EDB3    1083      OTIR
1560 D1      1084      POP DE
1561 C1      1085      POP BC
1562 F1      1086      POP AF
1563 3D      1087      DEC A
1564 2807    1088      JR Z, EXPFIN-$ ; LOOP COUNT EXPIRED
1566 13      1089      INC DE ; INC TO NEXT COLOR
1567 03      1090      INC BC ; BUMP UP TO NEXT PAT ADDR
1568 03      1091      INC BC
1569 03      1092      INC BC
156A 03      1093      INC BC
156B 18D1    1094      JR EXLOOP-$
156D          1095      EXPFIN:
156D FD5605  1096      LD D, (IY+PPATH)
1570 FD5E04  1097      LD E, (IY+PPATL) ; DEC-PLAYER PAT ADDR
1573 FD210000 1098      LD IY, 0
1577 FD19    1099      ADD IY, DE ; IY<-PLAYER PAT ADDR
1579 110004  1100      LD DE, 4. SHL. 8+0 ; D<-LOOP COUNT
157C FD7E00  1101      ST A, (IY) ; A<-BYTE OF PLAYER PATTERN
157F 21B841  1102      LD HL, STPRTS
1582 01200D  1103      LD BC, ALLBYT
1585 EDB1    1104      STI: CPIR
1587 2005    1105      JR NZ, RESTOM-$
1589 03      1106      INC BC
158A 2B      1107      DEC HL
158B 73      1108      LD (HL), A
158C 18F7    1109      JR STLOG-$
158E FD23    1110      RESTOM: INC IY
1590 15      1111      DEC D
1591 20E9    1112      JR NZ, STIMP-$
1593 DDCB0676 1113      BIT HUMBIT, (IX+PSTAT) ;
1597 2804    1114      JR Z, KILLST-$ ; IF HUMAN
1599 21A44F  1115      LD HL, CHUM
159C 35      1116      DEC (HL) ; DEC CURRENT # HUMANS
159D DDCB06BE 1117      KILLST: RES ACTBIT, (IX+PSTAT) ; BILL STATUS
1118      ; INC ALL ACTIVE PLAYERS SCORES
15A1 0E04    1119      LD C, 4
15A3          1120      BUMPCK:
15A3 0D      1121      DEC C
15A4 79      1122      LD A, C
15A5 CD5C16  1123      CALL LDPLIX
15A8 DDCB067E 1124      BIT ACTBIT, (IX+PSTAT)
15AC 2818    1125      JR Z, BUMPCK-$
15AE 0600    1126      LD B, 0
15B0 C5      1127      PUSH BC
15B1 79      1128      LD A, C
15B2 21964F  1129      LD HL, CURSCR
15B5 09      1130      ADD HL, BC
15B6 09      1131      ADD HL, BC
15B7 09      1132      ADD HL, BC
15B8 37      1133      SCF
15B9 CDE315  1134      CALL DISPSC
15BC C1      1135      POP BC

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15BD          1136          SYSTEM INCSCR
15BD FF       1136 +      RST 56
15BE 54       1136 +      DEFB INCSCR
                  1136 +      IF INCSCR. EQ. INTPC
                  1136 +      ENDIF
15BF 79       1137          LD A, C
15C0 C5       1138          PUSH BC
15C1 B7       1139          OR A ; RESET CARRY
15C2 CDE315   1140          CALL DISPSC
15C5 C1       1141          POP BC
15C6          1142 BUMPCK:
15C6          1143          SYSSUK PAWS
15C6 FF       1143 +      RST 56
15C7 51       1143 +      DEFB PAWS+1
                  1143 +      IF PAWS. EQ. INTPC
                  1143 +      ENDIF
15C8 1E       1144          DEFB 30
15C9 79       1145          LD A, C
15CA B7       1146          OR A
15CB 20D6     1147          JR NZ, BUMPEM-$
                  1148          ; DEC CURR # PLAYERS
                  1149          ; IF CURR # PLAYERS LEQ 0 GO TO END GAME
15CD 21A24F   1150          LD HL, #PL
15D0 35       1151          DEC (HL)
15D1 35       1152          DEC (HL)
15D2 2802     1153          JR Z, ENCHK-$
15D4 34       1154          INC (HL)
15D5 C9       1155          RET
15D6          1156 ENCHK:
15D6 3ADC4F   1157          LD A, (C7)
15D9 3D       1158          DEC A
15DA 27       1159          DAA
15DB 32DC4F   1160          LD (C7), A
15DE C24013   1161          JP NZ, FEXIT
15E1          1162          SYSTEM QUIT
15E1 FF       1162 +      RST 56
15E2 78       1162 +      DEFB QUIT
                  1162 +      IF QUIT EQ. INTPC
                  1162 +      ENDIF
15E3          1163 DISPSC:
                  1164          ; DISPLAY SCORE
                  1165          ; A=PLAYER#
                  1166          ; HL->LAST BYTE OF SCORE
15E3 FD4E09   1167          LD C, (PSDOP)
15E6 3004     1168          JR NC, NOTXOR-$
15E8 CBA1     1169          RES MROR, C
15EA CBE9     1170          SET MRXOR, C
15EC          1171 NOCUR:
15EC FD5E07   1172          LD E, (IY+PSPOSX)
15EF FD5608   1173          LD D, (IY+PSPOSY)
15F2 3E0C     1174          LD A, 12
15F4 83       1175          ADD A, E
15F5 5F       1176          LD E, A
15F6 14       1177          INC D
15F7 0643     1178          LD B, 43H
15F9 DD210D02 1179          LD IX, FNTSML
15FD          1180          SYSTEM DISNUM
  
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PROPRIETARY INFORMATION
 Data Molding Associates, Inc.

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15FD FF      1180 +      RST  56
15FE 36      1180 +      DEFB  DISNUM
              1180 +      IF   DISNUM.EQ.INTPC
              1180 +      ENDIF
15FF C9      1181      RET
1600         1182 ANIARR:
              1183      ; ANIMATE THE ARROW
              1184      ; INPUT AND OUTPUT IS IX WHO STAYS THE SAME
              1185      ; DESTROYS ALL OTHER REGISTERS
1600 DDCB067E 1186      BIT  ACTBIT, (IX+PSTAT)
1604 C8      1187      RET  Z      ; EXIT IF NOT ACTIVE
1605 DD7E03  1188      LD   A, (IX+AROT)
1608 CD2F17  1189      CALL GETROT      ; HL<-ARROW PAT ADDR
160B DD5605  1190      LD   D, (IX+ARRY)
160E DD5E04  1191      LD   E, (IX+ARRX)
1611 E5      1192      PUSH HL
1612 CD2515  1193      CALL ERASE
1615 E1      1194      POP  HL
1616 010104  1195      LD   BC, PATYSZ.SHL.8+PATXSZ
1619 3E10     1196      LD   A, WRITOR
161B         1197      SYSTEM WRIT
161B FF      1197 +      RST  56
161C 24      1197 +      DEFB  WRIT
              1197 +      IF   WRIT.EQ.INTPC
              1197 +      ENDIF
161D C9      1198      RET
161E         1199 STA:
              1200      ; THIS ROUTINE TAKES CARE OF ARROW ANIMATION
              1201      ; AND SHOWING A PLAYER HIS CURRENT JOY STICK POSIT
              1202      ; A=WHICH PLAYER:
              1203      ; B=JOY STICK BITS
161E CD5C16  1204      CALL LDPLX      ; IX<-ADDR OF PLAYER PACKET
1621 AF      1205      XOR  A
1622 B0      1206      OR   B
1623 2003     1207      JR   NZ, STORIT-$
1625 DD7E02  1208      LD   A, (IX+CURSW)
1628 DD7702  1209      LD   (IX+CURSW), A
162B DDAE01  1210      XOR  (IX+LASTMV) ; AK-DIFFERENCE FROM LAST MOVE
162E 2812     1211      JR   Z, GETM-$   ; IF DIFFERENCE=0 USE LAST MOVE
1630 EEOC     1212      XOR  RLMOVE
1632 280E     1213      JR   Z, GETM-$
1634 EEOC     1214      XOR  RLMOVE
1636 EEO3     1215      XOR  UDMOVE
1638 2808     1216      JR   Z, GETM-$
163A EEO3     1217      XOR  UDMOVE
163C DDCB0676 1218      HUMB: BIT  HUMBIT, (IX+PSTAT)
1640 2003     1219      JR   NZ, GOTIT-$ ; IF HUMAN WE'VE GOT IT
1642 DD7E01  1220      GET: LD   A, (IX+LASTMV) ; GET LAST MOVE
1645 DD7703  1221      GOT: LD   (IX+AROT), A ; STORE ARROW ROTATION
1648 18B6     1222      JR   ANIARR-$
164A         1223 TICKIT:
              1224      ; TICK COUNT<-(8-CURR # PLAYERS)
164A 3AA44F  1225      LD   A, (CNOHUM)
164D B7      1226      OR   A
164E 3E02     1227      LD   A, 2
1650 2806     1228      JR   Z, STICK-$
1652 21A24F  1229      LD   HL, CNOPL

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PROPRIETARY INFORMATION

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1655 3E08      1230      LD      A,8
1657 96        1231      SUB     (HL)
1658 32D54F    1232  STICK: LD     (CT0),A
165B C9        1233      RET
165C          1234  LDPLIX:
165C          1235  LDPLIY:
                1236      ;LOAD IY WITH POINTER TO CURR PLAYER ROM DATA
                1237      ;LOAD IX WITH A POINTER TO CURRENT PLAYER PACKET
                1238      ;A=PLAYER# MUST BE GEQ 0 & LEQ 3
165C D5        1239      PUSH  DE
165D E5        1240      PUSH  HL
165E          1241      SYSSUK INDEXW
165E FF        1241 +     RST   56
165F 5B        1241 +     DEFB  INDEXW+1
                1241 +     IF    INDEXW.EQ.INTPC
                1241 +     ENDIF
1660 6F16     1242      DEFW  ROMTBL
1662 D5        1243      PUSH  DE
1663 FDE1     1244      POP   IY
1665          1245      SYSSUK INDEXW
1665 FF        1245 +     RST   56
1666 5B        1245 +     DEFB  INDEXW+1
                1245 +     IF    INDEXW.EQ.INTPC
                1245 +     ENDIF
1667 7716     1246      DEFW  RAMTBL
1669 D5        1247      PUSH  DE
166A DDE1     1248      POP   IX
166C E1        1249      POP   HL
166D D1        1250      POP   DE
166E C9        1251      RET
166F 4517     1252  ROMTBL: DEFW  PLR0M1
1671 4F17     1253      DEFW  PLR0M2
1673 5917     1254      DEFW  PLR0M3
1675 6317     1255      DEFW  PLR0M4
1677 A84F     1256  RAMTBL: DEFW  PLAY0
1679 AF4F     1257      DEFW  PLAY1
167B B64F     1258      DEFW  PLAY2
167D BD4F     1259      DEFW  PLAY3
167F          1260  RAMMOV:
                1261      ; GENERATE A RANDOM MOVE FOR THE PLAYER PACKET POI
                1262      ; INPUT AND OUTPUT:
                1263      ; B=CURRENT SWITCH C=LAST SWITCH
167F          1264      SYSSUK RANGED
167F FF        1264 +     RST   56
1680 77        1264 +     DEFB  RANGED+1
                1264 +     IF    RANGED.EQ.INTPC
                1264 +     ENDIF
1681 20        1265      DEFB  32
1682 B7        1266      OR    A      ; TIME TO CHANGE DIRECTION?
1683 2808     1267      JR    Z,NEWMOV-#
1685 DD4601   1268      LD    B,(IX+LASTMV) ; USE LAST MOVE
1688 78        1269      LD    A,B
1689 CDAC16   1270      CALL MOVST
168C C8        1271      RET  Z      ; LAST MOVE IS GOOD ENOUGH
168D          1272  NEWMOV: SYSSUK RANGED
168D FF        1272 +     RST   56
168E 77        1272 +     DEFB  RANGED+1

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PROPRIETARY INFORMATION

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1272 + IF RANGED. EQ. INTPC
1272 + ENDIF
168F 04 1273 DEFB 4
1690 47 1274 LD B, A
1691 04 1275 INC B
1692 3E80 1276 LD A, 80H
1694 07 1277 SHFTIT: RLCA
1695 10FD 1278 DJNZ SHFTIT-$
1697 47 1279 LD B, A
1698 3E08 1280 RANFIN: LD A, 08H
169A CDAC16 1281 CALL MOVTST
169D 2002 1282 JR NZ, ANYMOV-$
169F 47 1283 LD B, A
16A0 C9 1284 RET
16A1 060F 1285 ANYMOV: LD B, 0FH ; TRY ALL MOVES
16A3 3E08 1286 LD A, 08H
16A5 CDAC16 1287 CALL MOVTST
16A8 47 1288 LD B, A
16A9 C9 1289 RET
16AA 1290 MOVANY: LD A, AMOVE
16AA 3E08 1291 LD A, AMOVE
16AC 1292 MOVTEST:
1293 ; TEST THE NEW MOVE FOR VALIDITY
1294 ; THE INPUTS AND OUTPUTS
1295 ; B=A SET OF MOVES TO BE TESTED (IS UNCHANGED)
1296 ; C=UNCHANGED
1297 ; A=FIRST MOVE TO TEST, VALUE OF GOOD MOVE ON OUTPUT
1298 ; DE, HL=RETURNED UNCHANGED
1299 ; D=# ROTATES
1300 ; Z FLAG=Z IF GOOD MOVE FOUND(A CONTAINS FIRST GOOD
1301 ; Z FLAG=NZ IF NO GOOD MOVES FOUND(IN B)
16AC D5 1302 PUSH DE
16AD 1608 1303 LD D, 8 ; INIT ROTATES
16AF 0F 1304 ROTMSK: RRCA ; ROTATE TO NEXT MOVE
16B0 5F 1305 LD E, A
16B1 A0 1306 AND B
16B2 CDC016 1307 CALL CHKMO ; CHECK MOVE
16B5 7B 1308 LD A, E
16B6 2806 1309 JR Z, MOVEXT-$ ; FOUND ONE
16B8 15 1310 DEC D ; DEC ROTATES
16B9 20F4 1311 JR NZ, ROTMSK-$
16BB 37 1312 SCF ; NO GOOD MOVES
16BC CB12 1313 RL D ; SET Z FLAG=NZ
16BE D1 1314 MOVEXT: POP DE
16BF C9 1315 RET
16C0 1316 CHKMO:
1317 ; CHECK THE MOVE IN A FOR BEING UNOCCUPIED
1318 ; INPUT AND OUTPUT:
1319 ; A=UP, DOWN, RIGHT OR LEFT BIT (RETURNED UNCHANGED)
1320 ; Z FLAG=Z IF MOVE IN A IS TO AN EMPTY POSITION
1321 ; Z FLAG=NZ IF MOVE IN A IS BAD
1322 ; BC, DE, HL RETURNED UNTOUCHED
1323 ; IX=POINTER TO CURRENT PLAYER PACKET
1324 ; LOCAL TO THIS ROUTINE:
1325 ; D=TEMP X COORD OF ARROW
1326 ; E=TEMP Y COORD OF ARROW
16C0 C5 1327 PUSH BC
  
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16C1 D5      1328      PUSH DE
16C2 E5      1329      PUSH HL
16C3 F5      1330      PUSH AF
16C4 DD5604  1331      LD D, (IX+ARRX) ;GET X COORD OF ARROW
16C7 DD5E05  1332      LD E, (IX+ARRY) ;GET Y COORD OF ARROW
16CA CB57    1333      TLEFT:  BIT CHLEFT, A
16CC 280A    1334      JR Z, TRIGHT-$
16CE 7A      1335      LD A, D ;GOT A LEFT MOVE
16CF FE00    1336      CP LOWX
16D1 282F    1337      JR Z, BADMOV-$ ;ALREADY AT LOWEST X
16D3 D604    1338      SUB WIDTH ;DEC TEMP X BY 1 POSITION
16D5 57      1339      LD D, A
16D6 1830    1340      JR LOOKSQ-$
16D8 CB5F    1341      TRIGHT: BIT CHRIGH, A
16DA 280A    1342      JR Z, TUP-$
16DC 7A      1343      LD A, D ;GOT A RIGHT MOVE
16DD FE9C    1344      CP XMAX
16DF 3021    1345      JR NC, BADMOV-$ ;ALREADY GEQ MAX X
16E1 C604    1346      ADD A, WIDTH
16E3 57      1347      LD D, A
16E4 1822    1348      JR LOOKSQ-$
16E6 CB47    1349      TUP:   BIT CHUP, A
16E8 280A    1350      JR Z, TDOWN-$
16EA 7B      1351      LD A, E ;GOT AN UP MOVE
16EB FE0B    1352      CP LOWY
16ED 2813    1353      JR Z, BADMOV-$ ;ALREADY AT LOWEST Y
16EF D604    1354      SUB HEIGHT ;DEC TEMP Y BY 1 POSITION
16F1 5F      1355      LD E, A
16F2 1814    1356      JR LOOKSQ-$
16F4 CB4F    1357      TDOWN: BIT CHDOWN, A
16F6 280A    1358      JR Z, BADMOV-$
16F8 7B      1359      LD A, E ;GOT A DOWN MOVE
16F9 FE5B    1360      CP YMAX
16FB 2805    1361      JR Z, BADMOV-$ ;ALREADY AT HIGHEST Y
16FD C604    1362      ADD A, HEIGHT ;INC TEMP Y BY 1 POSITION
16FF 5F      1363      LD E, A
1700 1806    1364      JR LOOKSQ-$
1702 F1      1365      BADMOV: POP AF
1703 37      1366      SCF
1704 CB12    1367      RL D ;SET FLAG = NZ
1706 1823    1368      JR MOVED-$
1708          1369      LOOKSQ: ;SEE IF THE NEW SQUARE IS OCCUPIED
1708 D5      1371      PUSH DE
1709 D5      1372      PUSH DE
170A C1      1373      POP BC
170B 51      1374      LD D, C ;REVERSE X, Y FOR SYSTEM
170C 58      1375      LD E, B
170D          1376      SYSSUK RELAB1
170D FF      1376 +    RST 56
170E 3B      1376 +    DEFB RELAB1+1
170E          1376 +    IF RELAB1.EQ.INTPC
170E          1376 +    ENDIF
170F 00      1377      DEFB 0
1710 E1      1378      POP HL
1711 EB      1379      EX DE, HL
1712 7E      1380      LD A, (HL)
  
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PROPRIETARY INFORMATION

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1713 B7      1381      OR    A                ; TEST SQUARE
1714 20EC    1382      JR    NZ, BADMOV-$
1716 012800  1383      LD    BC, BYTEPL
1719 09      1384      ADD  HL, BC
171A 7E      1385      LD    A, (HL)
171B B7      1386      OR    A
171C 20E4    1387      JR    NZ, BADMOV-$
171E 7A      1388      LD    A, D
171F 32A54F  1389      LD    (TARRX), A      ; STORE TEMP ARROW X COORD
1722 7B      1390      LD    A, E
1723 32A64F  1391      LD    (TARRY), A     ; STORE TEMP ARROW Y COORD
1726 F1      1392      POP  AF
1727 1600    1393      LD    D, 0
1729 CB3A    1394      SRL  D                ; SET Z FLAG=Z
172B E1      1395      MOVEND: POP HL
172C D1      1396      POP  DE
172D C1      1397      POP  BC
172E C9      1398      RET
172F        1399      GETROT:
1400      ; HL←BASE ADDR OF ROTATED PATTERN
1401      ; AC←DIRECTION OF ROTATION
1402      ; IF A HAS MORE THAN 1 BIT SET THEN ONLY ONE IS US
172F 218A17  1403      LD    HL, 0
1732 CB47    1404      BIT  CHUP, A
1734 C0      1405      RET  NZ
1735 219217  1406      LD    HL, A DOWN
1738 CB4F    1407      BIT  CHDOWN, A
173A C0      1408      RET  NZ
173B 218E17  1409      LD    HL, A RIGHT
173E CB5F    1410      BIT  CHRIGH, A
1740 C0      1411      RET  NZ
1741 219617  1412      LD    HL, A LEFT
1744 C9      1413      RET
1414      ; START OF ROM DATA FOR EACH PLAYER.
1415      ; CONTAINS: 4 PLAYER NOTES, PLAYER PATTERN ADDR
1416      ; , PLAYER CHAR DISP OPT
1417      ; PLAYER SCORE DISP OPT
1418      ; AND PLAYER SCORE POSITION
1745        1419      PLDMMO:
1745        1420      PNOTE0: DEF4X GO, GSO, AO, ASO
1745 FD      1420 +      DEFB GO
1746 EE      1420 +      DEFB GSO
1747 E1      1420 +      DEFB AO
1748 D4      1420 +      DEFB ASO
1749 9A17    1421      PPAT0: DEFW PPAT0
174B 18      1422      PCOP0: DEFB 011000B
174C 04      1423      PSF0:  DEFB 4
174D 01      1424      DEFB 1
174E 18      1425      PSOP0: DEFB 011000B
174F        1426      PLRUM1:
174F        1427      PNOTE1: DEF4X B0, C1, CS1, D1
174F CS      1427 +      DEFB B0
1750 BD      1427 +      DEFB C1
1751 B2      1427 +      DEFB CS1
1752 A8      1427 +      DEFB D1
1753 9E17    1428      PPADR1: DEFW PPAT1
1755 1C      1429      PCOP1: DEFB 011100B

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PROPRIETARY INFORMATION

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Dave Sawyer

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1756 95      1430 PSPOS1:  DEFB 133
1757 01      1431          DEFB 1
1758 1C      1432 PSDOP1:  DEFB 011100B
1759          1433 PLROM2:
1759          1434 PNOTE2:  DEF4X DS1, E1, F1, FS1
1759 9F      1434 +      DEFB DS1
175A 96      1434 +      DEFB E1
175B 9D      1434 +      DEFB F1
175C 85      1434 +      DEFB FS1
175D A217    1435 PPADR2:  DEFW PPAT2
175F 1C      1436 PCDOP2:  DEFB 011100B
1760 2D01    1437 PSPOS2:  DEFW 45+1. SHL 8
1762 1C      1438 PSDOP2:  DEFB 011100B
1763          1439 PLROM3:
1763          1440 PNOTE3:  DEF4X G1, GS1, A1, AS1
1763 7E      1440 +      DEFB G1
1764 77      1440          DEFB GS1
1765 70      1440          DEFB A1
1766 6A      1440          DEFB AS1
1767 A617    1441 PPADR3:  DEFW PPAT3
1769 18      1442 PSDOP3:  DEFB 011100B
176A 5D01    1443 PSPOS3:  DEFW 93+1. SHL 8
176C 18      1444 PSDOP3:  DEFB 011100B
1445          ; EXPLOSION PATTERNS
176D          1446 XPATS:
176D          1447 XPAT1:  DEF4X 000010100B, 0000100B, 0
176D 00      1447          DEFB 0
176E 14      1447          DEFB 00010100B
176F 14      1447          DEFB 00010100B
1770 00      1447          DEFB 0
1771          1448 XPAT2:  DEF4X 01000101B, 0000001B, 0
1771 00      1448 +      DEFB 0
1772 45      1448 +      DEFB 01000101B
1773 51      1448          DEFB 01000101B
1774 00      1448          DEFB 0
1775          1449 XPAT3:  DEF4X 00000101B, 0100000B, 00000001B, 0101000B
1775 05      1449          DEFB 00000101B
1776 40      1449          DEFB 0000000B
1777 01      1449          DEFB 00000001B
1778 50      1449          DEFB 0101000B
1779          1450 XPAT4:  DEF4X 00010001B, 0100000B, 00000001B, 01000100B
1779 11      1450          DEFB 00010001B
177A 40      1450          DEFB 0000000B
177B 01      1450          DEFB 00000001B
177C 44      1450          DEFB 01000100B
177D          1451 XPAT5:  DEF4X 0, 0, 0, 0
177D 00      1451          DEFB 0
177E 00      1451          DEFB 0
177F 00      1451          DEFB 0
1780 00      1451 +      DEFB 0
1452          ; EXPLOSION COLORS
1781          1453 EXCOLS:
1781 07      1454          DEFB 7
1782 03      1455          DEFB 3
1783 07      1456          DEFB 7
1784 03      1457          DEFB 3
1785 77      1458          DEFB 077H
  
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1786 0400      1459      ;COUNT DOWN DISPLAY PACKET
1786 0400      1460 CDCOLR: DEFW 0100B+0.SHL.8
1786 0400      1461      ;TIMER DISPLAY PACKET
1788 0180      1462 TDPACK: DEFW 0001B+10000000B.SHL.8
1788 0180      1463      ;ARROW ANIMATION PATTERNS FOR EACH ROTATION
178A          1464 AUP:
178A          1465      DEF4X 00010100B,01010101B,01000001B,0
178A 14      1465 +      DEFB 00010100B
178B 55      1465 +      DEFB 01010101B
178C 41      1465 +      DEFB 01000001B
178D 00      1465 +      DEFB 0
178E          1466 ARIGHT:
178E          1467      DEF4X 00010100B,00000101B,00000101B,00010100B
178E 14      1467 +      DEFB 00010100B
178F 05      1467 +      DEFB 00000101B
1790 05      1467 +      DEFB 00000101B
1791 14      1467 +      DEFB 00010100B
1792          1468 ADOWN:
1792          1469      DEF4X 0,01000001B,01010101B,00010100B
1792 00      1469 +      DEFB 0
1793 41      1469 +      DEFB 01000001B
1794 55      1469 +      DEFB 01010101B
1795 14      1469 +      DEFB 00010100B
1796          1470 ALET:
1796          1471      DEF4X 00010100B,01010000B,01010000B,00010100B
1796 14      1471 +      DEFB 00010100B
1797 50      1471 +      DEFB 01010000B
1798 50      1471 +      DEFB 01010000B
1799 14      1471 +      DEFB 00010100B
1799          1472      ;PLAYER PATTERNS
179A          1473 PPA1: DEFW 00000000B,10101000B,00101010B,00100000B
179A 08      1473 +      DEFB 00000000B
179B A8      1473 +      DEFB 10101000B
179C 2A      1473 +      DEFB 00101010B
179D 20      1473 +      DEFB 00100000B
179E          1474 PPA2: DEFW 11111111B,11000011B,11000011B,11111111B
179E FF      1474 +      DEFB 11111111B
179F C3      1474 +      DEFB 11000011B
17A0 C3      1474 +      DEFB 11000011B
17A1 FF      1474 +      DEFB 11111111B
17A2          1475 PPA3: DEFW 00001000B,11111100B,00111111B,00110000B
17A2 0C      1475 +      DEFB 00001000B
17A3 FC      1475 +      DEFB 11111100B
17A4 3F      1475 +      DEFB 00111111B
17A5 30      1475 +      DEFB 00110000B
17A6          1476 PPA4: DEFW 10101010B,10000010B,10000010B,10101010B
17A6 AA      1476 +      DEFB 10101010B
17A7 82      1476 +      DEFB 10000010B
17A8 82      1476 +      DEFB 10000010B
17A9 AA      1476 +      DEFB 10101010B
17AA          1477      ;COLOR BLOCK
17AA          1478 CBLOCK:
17AA F8      1479      DEFB 0F8H
17AB F8      1480      DEFB 0F8H
17AC F8      1481      DEFB 0F8H
17AD F8      1482      DEFB 0F8H
17AE B5      1483      DEFB 0B5H
  
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PROPRIETARY INFORMATION

DO NOT REPRODUCE

17AF	52	1484		DEFB	052H	
17B0	F8	1485		DEFB	0F8H	
17B1	77	1486		DEFB	077H	
		1487				; EXPLOSION SOUNDS
17B2		1488	EXPSND:	DEFB	0EFH, 0FFH, 3FH, 0, 0FFH, 0FDH, 0F5H, 0F5H	
17B2	EF	1488	+	DEFB	0EFH	
17B3	FF	1488	+	DEFB	0FFH	
17B4	3F	1488	+	DEFB	3FH	
17B5	00	1488	+	DEFB	0	
17B6	FF	1488	+	DEFB	0FFH	
17B7	FD	1488	+	DEFB	0FDH	
17B8	F5	1488	+	DEFB	0F5H	
17B9	F5	1488	+	DEFB	0F5H	
17BA		1489		DEFB	08FH, 0EEH, 3EH, 0, 0FFH, 0FDH, 0F5H, 0F5H	
17BA	8F	1489	+	DEFB	08FH	
17BB	EE	1489	+	DEFB	0EEH	
17BC	3E	1489	+	DEFB	3EH	
17BD	00	1489	+	DEFB	0	
17BE	FF	1489	+	DEFB	0FFH	
17BF	FD	1489	+	DEFB	0FDH	
17C0	F5	1489	+	DEFB	0F5H	
17C1	F5	1489	+	DEFB	0F5H	
17C2		1490		DEFB	08FH, 08FH, 38H, 0, 0FFH, 0FDH, 0F5H, 0F5H	
17C2	4E	1490	+	DEFB	04EH	
17C3	88	1490	+	DEFB	088H	
17C4	38	1490	+	DEFB	38H	
17C5	00	1490	+	DEFB	0	
17C6	FF	1490	+	DEFB	0FFH	
17C7	FD	1490	+	DEFB	0FDH	
17C8	F5	1490	+	DEFB	0F5H	
17C9	F5	1490	+	DEFB	0F5H	
17CA		1491		DEFB	08FH, 044H, 34H, 0, 0FFH, 0FDH, 0F5H, 0F5H	
17CA	48	1491	+	DEFB	048H	
17CB	44	1491	+	DEFB	044H	
17CC	34	1491	+	DEFB	34H	
17CD	00	1491	+	DEFB	0	
17CE	FF	1491	+	DEFB	0FFH	
17CF	FD	1491	+	DEFB	0FDH	
17D0	F5	1491	+	DEFB	0F5H	
17D1	F5	1491	+	DEFB	0F5H	
17D2		1492		DEFB	0, 0, 0, 0, 0, 0, 0, 0	
17D2	00	1492	+	DEFB	0	
17D3	00	1492	+	DEFB	0	
17D4	00	1492	+	DEFB	0	
17D5	00	1492	+	DEFB	0	
17D6	00	1492	+	DEFB	0	
17D7	00	1492	+	DEFB	0	
17D8	00	1492	+	DEFB	0	
17D9	00	1492	+	DEFB	0	
17DA		1493		END		

PROPRIETARY INFORMATION
 Dave Darling
 Dave Darling

DO NOT REPRODUCE

TOTAL ASSEMBLER ERRORS =

CROSS REFERENCE

LABEL	VALUE	REFERENCE
A0	00E1	-508 1421
A1	0070	-520 1441
A2	0037	-532
A3	001B	-544
A4	000D	-556
A5	0006	-562
ACTBIT	0007	-694 957 1117 1124 1186
ACTINT	000E	-225 811
ACTION	146C	-893 943
ACTIVE	0080	-692 900 905
ADOWN	1792	-1368 1406
ALEFT	1796	-1369 1412
ALKEYS	0214	-49 938
ALLBYT	0D20	-719 991 1103
ALLHUM	13B7	-821 844
AMOVE	0008	-678 1291
ANIARR	1600	-1105 1046 1222
ANIMAX	0003	-672
ANYMOV	16A1	-1198 1282
ARIGHT	178E	-1367 1409
AROT	0003	-687 970 1033 1108 1221
ARRX	0004	-688 814 816 820 822 1035 1043
		1073 191 1331
ARRY	0005	-689 863 1034 1105 1072 1107 1332
AS0	00D4	-509 1421
AS1	006A	-521 1441
AS2	0034	-533
AS3	001A	-545
AUP	178A	-1366 1403
B0	00C8	-510 1428
B1	0064	-522
B2	0031	-534
B3	0018	-546
BADMOV	1702	-1278 1337 1345
BCDADD	0062	-277
BCDCHS	006A	-281
BCDDIV	0068	-280
BCDMUL	0066	-279
BCDNEG	006C	-282
BCDSUB	0064	-278
BEGRAM	4FCE	-594 753
BITSPL	00A0	-43
BLANK	002A	-243 1056 1056
BMUSIC	0012	-229
BUMPCK	15C6	-1071 1125
BUMPEM	15A3	-1051 1147
BYTEPL	0028	-42 673 697 719 720 1383
C1	00BD	-511 1428
C2	005E	-523
C3	002E	-535
C4	0017	-547
C5	000B	-557
C6	0005	-563

PROPRIETARY INFORMATION

Dave Nutting Associates Inc.

DO NOT REPRODUCE

C7	0002	-566							
CALPIZ	148B	-909	948						
CBA	0009	-123							
CBB	0007	-121							
CBC	0006	-120							
CBD	0005	-119							
CBE	0004	-118							
CBFLAG	0008	-122							
CBH	0008	-125							
CBIXH	0003	-117							
CBIXL	0002	-116							
CBiyH	0001	-115							
CBiyL	0000	-114							
CBL	000A	-124							
CBLen	0008	-725							
CBLOCK	17AA	-1372	777						
CDCOLR	1786	-1362							
CDOPT	0044	-681	923						
CDOWNL	1426	-1372	930						
CHDOWN	0001	-1372	1357	1407					
CHKMOV	16C0	-1372	1307						
CHLEFT	0002	-1333							
CHRDIS	0032	-648	868	868	872	872	925	925	
CHRIGH	0003	-109	1341	1410					
CHTRIG	0004	-109							
CHUP	0000	-1349	1349	1404					
CKNOPL	141E	-903	903						
CKSUM3	1418	-903							
CLEARF	14B4	-822	822	931					
CNOHUM	4FA4	-838	838	851	1115	1225			
CNOPL	4FA2	-786	786	787	846	853	1150	1229	
CNT	4FDD	-935	935						
COLOL	0004	-1070							
COLOR	0000	-1070	1070						
COL1L	0005	-169							
COL1R	0001	-165							
COL2L	0006	-170							
COL2R	0002	-166							
COL3L	0007	-171							
COL3R	0003	-177							
COLBX	0008	-172							
COLLST	4FE8	-672							
COLSET	0018	-174	777						
CONCM	0008	-179							
CRASH	1533	-1029	1029						
CS1	00B2	-1428	1428						
CS2	0059	-174							
CS3	002C	-176							
CS4	0015	-178							
CS5	000A	-158							
CT0	4FD5	-1232	1232						
CT1	4FD6	-603							
CT2	4FD7	-604							
CT3	4FD8	-605							
CT4	4FD9	-606							
CT5	4FDA	-607							
CT6	4FDB	-608							

PROPRIETARY INFORMATION

Dave Nutting Associates, Inc.

DO NOT REPRODUCE

CT7	4FDC	-609	761	830	1157	1160			
CTIMER	0203	-46							
CURSCR	4F96	-739	767	889	1129				
CURSW	0002	-686	999	1208	1209				
D1	00A8	-513	1428						
D2	0054	-525							
D3	0029	-537							
D4	0014	-549							
DABS	0072	-285							
DADD	006E	-283							
DECCTS	0010	-226							
DISNUM	0036	-250	826	826	1181	1181			
DISPSC	15E3	-1088	893	1134	1140				
DISTIM	0052	-267							
DOIT	0044	-260	940	940					
DOITB	0046	-261							
DONTD	13A1	-806							
DS1	009F	-514	1435						
DS2	004F	-527							
DS3	0027	-537							
DS4	0013	-557							
DS5	0009	-559							
DS6	0004	-564							
DSMG	0070	-284							
DURAT	4FEA	-624							
E1	0096	-517	1435						
E2	004A	-527							
E3	0025	-537							
E4	0012	-557							
EMUSIC	0014	-230	779	928	928				
END	00C0	-374	948	948					
ENDCHK	15D6	-1088	1153						
ENDRAM	4FC4	-757	753						
ENDSCR	4FF4	-632							
ERASE	1525	-987	1036	1074	93				
EXCOLS	1781	-1357	1062						
EXLOOP	153E	-1007	1094						
EXPAT1	176D	-1357							
EXPAT2	1771	-1357							
EXPAT3	1775	-1357							
EXPAT4	1779	-1357							
EXPAT5	177D	-1357							
EXPATS	176D	-1357	1061						
EXPFIN	156D	-1026	1088						
EXPSND	17B2	-1387	1064						
F1	008D	-517	1435						
F2	0046	-526							
F3	0022	-540							
F4	0011	-557							
F5	0008	-560							
FILL	001A	-235	767	767	781	786	990	990	
FIREIT	1340	-764	1161						
FIRSTC	2000	-40							
FNTSML	020D	-48	824	1179					
FNTSYS	0206	-47							
FORCEM	00F6	-716							
FPLAY	13B5	-820	842						

PROPRIETARY INFORMATION

Dave Nutting Associates, Inc.

DO NOT REPRODUCE

FS1	0085	-517	1435			
FS2	0042	-529				
FS3	0020	-541				
FS4	0010	-553				
FTBASE	0000	-93				
FTBYTE	0003	-96				
FTFSX	0001	-94				
FTFSY	0002	-95				
FTPTH	0006	-99				
FTPTL	0005	-98				
FTYSIZ	0004	-97				
G0	00FD	-506	1421			
G1	007E	-518	1441			
G2	003E	-530				
G3	001F	-542				
G4	000F	-554				
G5	0007	-561				
G6	0003	-565				
G7	0001	-567				
G8	0000	-568				
GAMSTB	4FF8	-570				
GETLM	1642	-111	1211	1213	1216	
GETNUM	004E	-165				
GETPAR	004C	-164	759	759	763	763
GETROT	172F	-119	1189			
GOTBIT	14A1	-118	974			
GOTIT	1645	-117	1219			
GOTMOV	14F7	-116	1018	1021	1025	
GOTNPL	13AA	-115	835			
GOTSW	14DC	-114	1012			
GSO	00EE	-113	1421			
GS1	0077	-112	1441			
GS2	003B	-111				
GS3	001D	-110				
GS4	000E	-109				
GSBEND	0007	-108				
GSBSCR	0001	-107				
GSBTIM	0000	-106				
GTMINS	4FEE	-105				
GTPLIX	13C4	-104	911			
GTSECS	4FED	-103				
HEIGHT	0004	-102	1354	1362		
HORAF	000F	-101				
HORCB	0009	-100				
HUMAN	0040	-99	900			
HUMANR	0040	-98				
HUMBIT	0006	-97	1000	1113	1218	
HUMCHK	163C	-96				
INCIX	146F	-95	958			
INCSCR	0054	-94	1137	1137		
INDEXB	005C	-93				
INDEXN	0056	-271				
INDEXW	005A	-273	1242	1242	1246	1246
INFBK	000D	-186				
INLIN	000F	-188				
INMOD	000E	-187				
INTIPP	13BA	-826				

PROPRIETARY INFORMATION

Dave Nutting Associates, Inc.

DO NOT REPRODUCE

INTPC	0000	-216	759	763	767	775	775	775	826
		868	872	883	916	925	926	928	938
		940	967	990	1042	1051	1056	1079	1080
		1137	1144	1163	1181	1198	1242	1246	1265
		1273	1377						
INTPE	0000	-768	-789						
INTST	0008	-193							
JUSJOY	000F	-724							
KCTASC	0040	-258							
KEY0	0014	-206							
KEY1	0015	-207							
KEY2	0016	-208							
KEY3	0017	-209							
KEYSEX	4FE3	-617							
KILLST	159D	-1048	1114						
LASTMV	0001	-685	1016	1026	1032	1210	1220	1268	
LASTSW	0000	-684	998	1009					
LDPLIX	165C	-1155	857	956	1123	1204			
LDPLIY	165C	-1156	969						
LOOKSQ	1708	-1282	1340	1348	1356	1364			
LOOPY	144F	-896	941						
LOWX	0000	-677	1336						
LOWY	000E	-675	1376	701	702	703	719	790	1352
MAGIC	000C	-190							
MATH	0056	-270							
MCALL	0006	-219							
MENU	004A	-263							
MENUST	0218	-50							
MJUMP	000A	-221							
MOVANY	16AA	-1203	1020	1024	1028				
MOVE	005E	-275							
MOVEIT	14BC	-935	959						
MOVEND	172B	-1306	1368						
MOVEXT	16BE	-1227	1309						
MOVJOY	1484	-905	944	945	946	947			
MOVTST	16AC	-1205	1017	1270	1271	1287			
MRET	0008	-220							
MRFLOP	0006	-101							
MRLOCK	4FF7	-633							
MROR	0004	-103	1169						
MRROT	0002	-105							
MRSHT	0003	-106							
MRXOR	0005	-102	1170						
MRXPND	0003	-104							
MSKTD	007E	-291							
MUSVOL	0009	-679	982						
MUZAK	0012	-228							
MUZPC	4FCE	-596							
MUZSP	4FD0	-597							
MXSCR	021E	-51							
NEGT	0074	-286							
NEWMOV	168D	-1187	1267						
NEWWAY	0001	-666							
NGBIT	0002	-670							
NOCUR	14CB	-946	1001						
NOGAME	0235	-53	759						
NOPLAY	0228	-52	763						

PROPRIETARY INFORMATION

Dave Nutting Associates, Inc.

DO NOT REPRODUCE

NORMEM	4000	-39	720	736								
NOTE0	0000	-703										
NOTE1	0001	-706										
NOTE2	0002	-707										
NOTE3	0003	-708										
NOTHUM	1419	-874	899									
NOTXOR	15EC	-1096	1168									
NPBIT	0003	-671										
NUMPLY	4FF3	-631	765	833								
NWHDWR	0001	-36	665									
QA1	008F	-576										
QA2	0047	-577										
QA3	0023	-578										
QA4	0011	-579	984									
QA5	0008	-580										
QBO	00FE	-570										
QCO	00F1	-571										
QD1	00D6	-572										
QE1	00BF	-573										
QF1	00B4	-574										
QG1	00A0	-575										
QLDWAY	0000		666									
QNETIM	1328	-755										
QPOT0	4FDF	-613										
QPOT1	4FE0	-614										
QPOT2	4FE1	-615										
QPOT3	4FE2	-616										
OSWO	4FE4	-617	781									
OSW1	4FE5	-618										
OSW2	4FE6	-619										
OSW3	4FE7	-620										
PATDIM	0104	-621										
PATXSZ	0001	-622	723	87	1039	1054	1077	1195				
PATYSZ	0004	-623	723	87	1039	1054	1077	1195				
PAWS	0050	-266	916	916	926	926	1080	1080	1144			
PCDOP	0006	-644										
PCDOP0	174B	-645	866									
PCDOP1	1755	-646										
PCDOP2	175F	-647										
PCDOP3	1769	-648										
PIZBRK	0048	-649	967	967								
PLAY0	4FA8	-650	814	1256								
PLAY1	4FAF	-651	816	1257								
PLAY2	4FB6	-652	818	1258								
PLAY3	4FBD	-653	787	829	1259							
PLIX	4FA3	-654	917	952	955	968						
PLROM0	1745	-655	1252									
PLROM1	174F	-656	1253									
PLROM2	1759	-657	1254									
PLROM3	1763	-658	1255									
PNOTE0	1745	-1331										
PNOTE1	174F	-1337										
PNOTE2	1759	-1343										
PNOTE3	1763	-1348										
POT0	001C	-201										
POT1	001D	-202										

PROPRIETARY INFORMATION

Pure Nutting Associates, Inc.

DO NOT REPRODUCE

POT2	001E	-203							
POT3	001F	-204							
PPACKS	4FA8	-747							
PPADRO	1749	-1331							
PPADR1	1753	-1337							
PPADR2	175D	-1343							
PPADR3	1767	-1348							
PPATO	179A	-1371	1421						
PPAT1	179E	-1371	1428						
PPAT2	17A2	-1371	1435						
PPAT3	17A6	-1371	1441						
PPATH	0005	-710	879	1037	1096				
PPATL	0004	-709	880	1038	1097				
PRIOR	4FF9	-635							
PSDOP	0009	-714	1167						
PSDOP0	174E	-1335							
PSDOP1	1758	-1341							
PSDOP2	1762	-1346							
PSDOP3	176C	-1351							
PSPOS0	174C	-1333							
PSPOS1	1756	-1333							
PSPOS2	1760	-1344							
PSPOS3	176A	-1350							
PSPOSX	0007	-712	868	1172					
PSPOSY	0008	-712	869	1173					
PSTAT	0006	-699	748	749	750	751		901	906
		951	1000	1113	1117	1124	1186	1218	
PSWCY	0000	-151							
PSWPV	0002	-151							
PSWSGN	0007	-151							
PSWZRO	0006	-151							
PVOLAB	4FD2	-595							
PVOLMC	4FD3	-595							
QUIT	0078	-282	1163	1163					
RAMTBL	1677	-1173	1246						
RANFIN	1698	-1193							
RANGED	0076	-282	1265	1265	1273	1273			
RANMOV	167F	-1173	1014						
RANSHT	4FEF	-630							
RANTST	14D0	-955	1007						
RCALL	0004	-215							
RECTAN	001C	-233	795	799	802	805			
RELAB1	003A	-253	1051	1051	1377	1377			
RELABS	0038	-253							
RESTOM	158E	-1040	1105						
RESTOR	002E	-24							
RLMOVE	000C	-661	1212	1214					
RMASK	4FA7	-746							
ROMTBL	166F	-1165	1242						
ROTMSK	16AF	-121	1311						
RSTART	4FA1	-758							
SAVE	002C	-244							
SBLN	0008	-726	1082						
SCHEDR	000C	-224							
SCREEN	0000	-41							
SCROLL	0030	-246							
SCRSTR	0016	-232							

PROPRIETARY INFORMATION

Dave Nutting Associates, Inc.

DO NOT REPRODUCE

SCT0	0001	-128	943	
SCT1	0002	-129		
SCT2	0003	-130		
SCT3	0004	-131		
SCT4	0005	-132		
SCT5	0006	-133		
SCT6	0007	-134		
SCT7	0008	-135		
SEMI4S	4FDE	-612		
SENFLG	4FFA	-636		
SENTRY	0042	-259	938	938
SETB	007A	-289		
SETOUT	0016	-233	790	
SETW	007C	-290		
SFO	0009	-136		
SF1	000A	-137		
SF2	000B	-138		
SF3	000C	-139		
SF4	000D	-140		
SF5	000E	-141		
SF6	000F	-142		
SF7	0010	-143		
SHFTIT	1694	-190	1278	
SHIFTU	0060	-276		
SJO	0015	-142	944	
SJ1	0017	-144	945	
SJ2	0019	-146	946	
SJ3	001B	-148	947	
SKYD	0013	-143	948	
SKYU	0012	-146		
SNDBX	0018	-184	1082	
SNUL	0000	-147		
SPO	001C	-147		
SP1	001D	-148		
SP2	001E	-149		
SP3	001F	-150		
SSEC	0011	-144		
ST0	0014	-151		
ST1	0016	-153		
ST2	0018	-155		
ST3	001A	-157		
STALL	161E	-120	963	
STARTS	41B8	-150	990	1102
STICK	1658	-153	1228	
STIMER	0200	-153		
STLOOP	1585	-155	1109	
STOMP	157C	-152	1112	
STOREN	0058	-152		
STORIT	1628	-150	1207	
STRDIS	0034	-159		
SUCK	000C	-152		
SW0	0010	-197		
SW1	0011	-198		
SW2	0012	-199		
SW3	0013	-200		
SYSRAM	4FCE	-639		
TARRX	4FA5	-744	1042	1389

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TARRY	4FA6	-745	1044	1391	
TDOFT	0024	-680	828		
TDOWN	16F4	-1270	1350		
TDFACK	1788	-1364			
THETBL	1459	-898	940		
TICKIT	164A	-1144	933	949	965
TIMOUT	4FEC	-626			
TLEFT	16CA	-1246			
TMR60	4FEB	-625			
TONEA	0011	-177			
TONEB	0012	-178			
TONEC	0013	-179	981		
TONMO	0010	-176	985		
TRIGHT	16D8	-1254	1334		
TSTBIT	149C	-915	975		
TUP	16E6	-1262	1342		
UDMOVE	0003	-669	1215	1217	
UMARGT	4FFB	-637			
UNCRAM	4F96	-738	753	757	773
UPISTR	0000	-215			
UPMUZK	1491	-911	918	1047	
USERTB	4FFD	-638			
VBBLNK	0006	-87			
VBCCHK	0004	-84			
VBCH	0003	-83			
VBCL	0002	-82			
VBCLAT	0003	-91			
VBCLMT	0000	-89			
VBCREV	0001	-90			
VBDCH	0001	-81			
VBDCL	0000	-80			
VBDXH	0004	-68			
VBDXL	0003	-67			
VB DYH	0009	-73			
VB DYL	0008	-72			
VBLANK	0028	-242			
VBMR	0000	-64			
VBOAH	000E	-78			
VBOAL	000D	-77			
VBSACT	0007	-86			
VBSTAT	0001	-65			
VBTIMB	0002	-66			
VBXCHK	0007	-71			
VBXH	0006	-70			
VBXL	0005	-69			
VBYCHK	000C	-76			
VBYH	000B	-75			
VBYL	000A	-74			
VECT	003E	-255			
VECTC	003C	-254			
VERAF	000E	-194			
VERBL	000A	-174			
VIBRA	0014	-180			
VOICES	4FD4	-600			
VOLAB	0016	-181			
VOLC	0015	-182	983		
VOLN	0017	-183			

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VWRITR	001E	-237							
WASTE	OFFF	-585							
WASTER	OFFF	-586							
WIDTH	0004	-717	1338	1346					
WPONOF	0000	-727							
WPOPT	0001	-728							
WPPAH	0003	-730							
WPPAL	0002	-729							
WPXSIZ	0005	-731							
WPYSIZ	0004	-732							
WRIT	0024	-240	883	883	1042	1042	1079	1079	1198
		1198							
WRITA	0026	-241							
WRITOR	0010	-682	1040	1076	1196				
WRITP	0022	-239							
WRITR	0020	-238							
XINTC	0002	-217	812						
XMAX	009C	-673	1344						
XPAND	0019	-191							
XPNDON	0001	-191							
XTAB1	0028	-191	698	699	813				
XTAB2	0050	-191	817	819					
XTAB3	0078	-191	815						
YLINE	0015	-191	676	700	719	790			
YMAX	005B	-191	1360						
YTAB	0014	-191	701	702	703				
YTAB1	001F	-191	817						
YTAB2	0033	-191	813	815					
YTAB3	0047	-191	819						
ZSW	14C8	-191							

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641
 642 LIST S.M.X.T
 643 ORG 17DEH
 17DE C3E819 644 JP INIT

646 ; *****
 647 ; * GUN FIGHT EQUATES *
 648 ; *****
 649 ; GUNFIGHT BACKGROUND JOB
 650 ; CONSISTING OF INITIALIZATION, PRE-ROUND DISPLAY,
 651 ; MONITORING OF CONTROLS AND VECTOR DELTA CHANGING
 652 ; DEATH, POST ROUND STUFF AND END GAME

654 ; EQUATES
 >0008 655 LNX EQU 8 ; LEFT NUMBER X
 >0002 656 BSY EQU 2 ; BANNER STRINGS Y
 >0088 657 RNX EQU 136 ; RIGHT NUMBER X
 >0020 658 LBULX EQU 32 ; LEFT BULLETS X
 >0068 659 RBULX EQU 104 ; RIGHT " "
 >004C 660 STIMER EQU 76 ; SUBTIMER X
 >002C 661 GRX EQU 44 ; GET READY X
 >0001 662 GRY EQU 1 ; "
 >0040 663 DRX EQU 64 ; DRAIN X
 >0014 664 TCACY EQU 20 ; TOP CACTUS Y
 >000F 665 TTREEY EQU TCACY-5
 >002A 666 MOCY EQU 42 ; MID CACTUS Y
 >0046 667 BCACY EQU 70 ; BOTTOM CACTUS Y
 >0041 668 BTREEY EQU BCACY-5
 >0040 669 LCACX EQU 64 ; LEFT CACTUS X
 >0058 670 RCACX EQU 88 ; RIGHT CACTUS X
 >004C 671 CCACX EQU 76 ; CENTER CACTUS X
 >0048 672 WAGX EQU 72 ; WAGON X
 >0060 673 COMX EQU RCAH+8 ; OTHER COWBOYS WINDOW X
 674 ;
 >000A 675 TLINE EQU 10 ; TOP LINE OF GUNSPACE
 >0009 676 ALINE EQU TLINE-1
 >005C 677 BLINE EQU 92 ; BOTTOM LINE OF "
 678 ;
 >0012 679 BULVSZ EQU 18 ; BULLET VECTOR SIZE
 >0017 680 GFCVZ EQU 23
 >0012 681 WAGVZ EQU 18 ; WAGON VECTOR SIZE
 682 ;
 >0032 683 WINBND EQU 50 ; TOP BOTTOM WINDOW BOUNDARY
 >006A 684 TOPLIN EQU 53*2 ; TOP WINDOW LINE
 >0000 685 BOTLIN EQU 00 ; BOTTOM WINDOW LINE
 >00C8 686 LFRLIN EQU 100*2 ; LOW PRIORITY FOREGROUND LINE
 687 ;
 >FFFF 688 NEXT EQU -1 ; NEXT LINK FOR QUEUES
 >000F 689 VBARM EQU VBOAH+1 ; ARM STATE
 >0010 690 VBOARM EQU VBARM+1 ; LAST ARM PATTERN WRITTEN
 >0011 691 VBLEGT EQU VBOARM+1 ; LEG TIMER
 >0012 692 VBLEG EQU VBLEGT+1 ; LEG LINK
 >0013 693 VBCOMP EQU VBLEG+1 ; TIMER FOR COMPUTER CONTROL

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694 ; BITS
>0000 695 VBSWAG EQU 0 ; WAGON BIT
>0003 696 VBSCHG EQU 3 ; CHANGE STATUS BIT
>0004 697 VBSNOM EQU 4 ; NOT MOVING STATUS
>0005 698 VBSINT EQU 5 ; INTERCEPTED/DEAD STATUS
  
```

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700 ; *****
701 ; * SUBROUTINES *
702 ; *****
703 ; DISPLAY CLOCK AND UPDATE CT4
17E1 F3 704 DCLOCK DI
17E2 705 SYSSUK DECCTS
17E2 FF 705 + RST 56
17E3 11 705 + DEFB DECCTS+1
705 + IF DECCTS. EQ. INTPC
705 + ENDIF
17E4 80 706 DEFB 10000000B
17E5 DD210D02 707 LD IX, ENTSML
17E9 3ADC4F 708 LD A, (INT7)
17EC B7 709 OR A, (INT7)
17ED 2808 710 JR Z, DCOUT-*
17EF 711 SYSSUK DISNUM
17EF FF 711 + RST 56
17F0 37 711 + DEFB DISNUM+1
711 + IF DISNUM. EQ. INTPC
711 + ENDIF
17F1 4C 712 DEFB STRX
17F2 02 713 DEFB B
17F3 0B 714 DEFB TIME
17F4 42 715 DEFB 42H
17F5 DC4F 716 DEFW CT4
17F7 AF 717 DCOUT XOR A, (DCOUT)
17F8 D30C 718 OUT (MUSIC), A
17FA 32FF0F 719 LD (WRITE), A
17FD FB 720 EI
17FE C9 721 RET
722 FIRE BULLETS
723 LEFT COWBOY
17FF 724 SYSSUK SUCK
17FF FF 724 + RST 56
1800 0D 724 + DEFB SUCK+1
724 + IF SUCK. EQ. INTPC
724 + ENDIF
1801 DC 725 DEFB 11011100B
1802 614F 726 DEFW LCOWB
1804 DA4F 727 DEFW LBULS
1806 194F 728 DEFW BULV1+1
1808 1809 729 JR ZORE-*
180A 730 FIRE1 SYSSUK SUCK
180A FF 730 + RST 56
180B 0D 730 + DEFB SUCK+1
730 + IF SUCK. EQ. INTPC
730 + ENDIF
  
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180C DC      731      DEFB 11011100B
180D 734F    732      DEFW RCQWB
180F DB4F    733      DEFW RBULS
1811 3D4F    734      DEFW BULV3+1
1813 FD7E07  735  ZORE:    LD   A, (IY+CBB)
1816 B7      736      OR   A
1817 C8      737      RET  Z
1818 0A      738      LD   A, (BC)      ; GET BULLET COUNT
1819 B7      739      OR   A
181A C8      740      RET  Z
181B 7E      741      LD   A, (HL)      ; CHECK IF BULLET IS AVAILABLE
181C B7      742      OR   A
181D 2809    743      JR   Z, ZOK-$
181F 111200  744      LD   DE, BULVSZ   ; DELTA TO NEXT BULLET
1822 19      745      ADD  HL, DE
1823 7E      746      LD   A, (HL)
1824 B7      747      OR   A
1825 2801    748      JR   Z, ZOK-$
1827 C9      749      RET
          750 ; N HL->BULLET
          751 ; IX->COWBOY
          752 ; SUB 1 FROM BULLET COUNT
1828 0A      753  ZOK    LD   A, (BC)
1829 3D      754      DEC  A
182A 02      755      LD   (BC), A
          756 ; SUB TIMER IF OUT OF BULLETS
182B 200D    757      JR   NZ, BEBASE-$
182D 3ADC4F  758      LD   A, (C)
1830 B7      759      OR   A
1831 3E10    760      LD   A, 10
1833 2802    761      JR   Z, STDEC-$
1835 3E02    762      LD   A, 2
1837 32DC4F  763  STSET  LD   (CT7), A
          764  BEBASE  PUSH  HL
183A E5      765      PUSH IX
183B DDE5    766      LD   A, (B)
183D 0A      767      LD   L, A
183E 6F      768      LD   H, 0
183F 2600    769      ADD  HL, HL
1841 29      770      ADD  HL, HL      ; *4
1842 29      771      LD   DE, B*256+RBULX
1843 116802  772      BIT  MRFLP, (IX+VBMR)
1844 DDCB0076 773      LD   A, 40
          774      JR   Z, RITB-$      ; FLOOR MR
184E AF      775      XOR  A          ; NORMAL MR
          776 ; NOW POSITION AND ERASE
184F 19      777  RITB   ADD  HL, DE
1850 EB      778      EX   DE, HL
1851          779      SYSTEM RELAB1
1851 FF      779 +    RST  56
1852 3A      779 +    DEFB RELAB1
          779 +    IF  RELAB1.EQ.INTPC
          779 +    ENDIF
1853 EB      780      EX   DE, HL
1854 0605    781      LD   B, 5
1856 112800  782      LD   DE, 40      ; INC TO NEXT LINE
1859 36FF    783  BELP   LD   (HL), OFFH   ; ERASE A LINE
  
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185B 19          784          ADD HL, DE          ; GO DOWN A LINE
185C 10FB       785          DJNZ BELP-$
185E 1600       786          LD D, 0
1860 DD5E0F     787          LD E, (IX+VBARM)  ; GET CURRENT ARM POS
1863 62         788          LD H, D
1864 6B         789          LD L, E
1865 29         790          ADD HL, HL          ; *2
1866 19         791          ADD HL, DE          ; *3
1867 11931D    792          LD DE, BULTAB
186A 19         793          ADD HL, DE          ; -> BULTAB(ARM)
186B EB         794          EX DE, HL
186C C1         795          POP BC              ; BCC==IX
186D E1         796          POP HL              ; BUL [STAT]
186E E3         797          PUSH HL             ; SAVE FOR ACTIVATE
186F 23         798          INC HL              ; BUL [DEL TIME]
1870 3601      799          LD (HL), 1         ; MAKE BULIT JUMP OUT
1872 23         800          INC HL              ; BUL [DEL XLOW]
1873 03         801          INC BC              ; COW [STAT]
1874 03         802          INC BC              ; COW [DEL TIME]
1875 03         803          INC BC              ; COW [DX LO]
1876 CDD319    804          CALL PUTVEC
1879 03         805          INC BC              ; [EXCHK]
187A 03         806          INC BC              ; COW [DY LO]
187B 23         807          INC HL              ; [EXCHK]
187C 3601      808          LD (HL), 1         ; [INIT CHECK]
187E 23         809          INC HL              ; [DY LO]
187F CDD319    810          CALL PUTVEC
1882 E1         811          POP HL              ; [STAT]
1883 3680      812          LD (HL), 80H      ; [TIVE]
1885           813          SYSSUK MUSIC
1885 FF         813          RST 5
1886 13         813          DEFB BMUSIC+1
1886 13         813          IF BMUSIC.EQ.INTPC
1887 124F      814          ENDF
1887 124F      814          DEFW MSACK
1889 01         815          DEFB 0000001B    ; JUST NOISE
188A DB1F      816          DEFW GUNSHOT
188C C9         817          RET
188C C9         818          TAKE A COFFEE BREAK
188D           819          NBRK: DONT PI2BRK ; IF I CARE
188D 48         819          DEFB PI2BRK
188E           820          DO MRRT
188E 09         820          DEFB MRRT+1
188F DD21614F  821          CONVERT JOYSTICKS
188F DD21614F  822          JOY0 LD IX, LCOWB
1893 1804      823          JR PJOY-$
1895 DD21784F  824          JOY1 LD IX, RCOWB
1895 DD21784F  825          CONVERT JOYSTICKS
1899 DD4E00    826          JOY: LD C, (IX+VBMR)
189C 118000    827          LD DE, 128
189F 218000    828          LD HL, 128
18A2           829          SYSTEM MSKTD      ; COMPUTE DELTAS
18A2 FF         829          RST 56
18A3 7E         829          DEFB MSKTD
18A3 7E         829          IF MSKTD.EQ.INTPC
18A3 7E         829          ENDF
18A4 DD7409    830          STHN LD (IX+VBDYH), H

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18A7 DD7508 831 LD (IX+VBDYL),L
18AA DD7204 832 LD (IX+VBDXH),D
18AD DD7303 833 LD (IX+VBDXL),E
18B0 C9 834 RET
18B1 DD21784F 835 PFOT1: LD IX,RCOWB
18B5 78 836 LD A,B ; POT MUST BE FLOPPED BECAUSE
18B6 2F 837 CPL ; ARM IS FLOPPED
18B7 1805 838 JR PPOT-$
18B9 DD21614F 839 PPOTO: LD IX,LCOWB
18BD 78 840 LD A,B
841 ; CONVERT POT AND STORE
18BE E6E0 842 PPOT AND OEOH
18C0 0F 843 RRCA
18C1 0F 844 RRCA
18C2 0F 845 RRCA
18C3 0F 846 RRCA
18C4 FE0E 847 CP OEH
18C6 2002 848 JR NZ,KART-$
18C8 3E0C 849 LD A,OCH ; IF BOB=7 THEN SET TO 6
18CA DD770F 850 KART LD (IX+VBARM),A ; SET ARM POSITION
18CD C9 851 RET
852 ; CHECK IF BULLET HIT ANYTHING
18CE DD7E01 853 HITCHK: LD A,(IX+VBSTAT)
18D1 E660 854 AND 060H
18D3 FE20 855 CP 20H ; CHECK ONLY IF BLANKED
18D5 280F 856 JR Z,HIT-$
18D7 D0 857 RET NC ; RETURN IF NOT BLANKED YET
18D8 DDCB075E 858 BIT VBC1,A (IX+VBXCHK)
18DC C8 859 RET Z
18DD DD360100 860 LD (IX+VBSTAT),0 ; BULLET HIT WALL
18E1 DD360701 861 LD (IX+VBXCHK),1 ; SET LIMIT CHECK
18E5 C9 862 RET
18E6 DD7E06 863 HIT LD A,(IX+VBXH) ; CHECK WHAT PART OF SCR ITS IN
18E9 FE48 864 CP WAGX
18EB 300E 865 JR NC,HIT1-$
18ED DD360202 866 LD (IX+VBTIMB),2 ; MAKE IT JUMP OUT
18F1 DD360180 867 LD (IX+VBSTAT),80H ; REACTIVATE
18F5 218F1D 868 LD HL,BULLMT
18F8 869 SYSTEM VECT
18F8 FF 869 + RST 56
18F9 3E 869 + DEFB VECT
869 + IF VECT.EQ.INTPC
869 + ENDIF
18FA C9 870 RET
18FB DD360100 871 HIT LD (IX+VBSTAT),0 ; BULLET DIES FROM WAGON ON
18FF FE58 872 CP RCACX
1901 301D 873 JR NC,HIT2-$
1903 3A904F 874 LD A,(WAGON)
1906 B7 875 OR A ; IS IT A CACTII?
1907 C0 876 RET NZ ; NOPE ITS A WAGON
1908 1E4C 877 LD E,CCACX ; LOAD X
878 ; ERASE OBJECT BULLET HITS
190A DD560B 879 ERASE LD D,(IX+VBYH) ; LOAD Y
190D 15 880 DEC D
190E 881 SYSSUK RELAB1
190E FF 881 + RST 56
190F 3B 881 + DEFB RELAB1+1
  
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		881. +	IF	RELAB1. EQ. INTPC	
		881 +	ENDIF		
1910	00	882	DEFB	0	
1911	EB	883	EX	DE, HL	
1912	11D7FF	884	LD	DE, -41	
1915	0600	885	LD	B, 0	
1917	7E	886	LD	A, (HL)	
1918	70	887	LD	(HL), B	; ZERO THE SCREEN BYTE
1919	23	888	INC	HL	
191A	B6	889	OR	(HL)	
191B	70	890	LD	(HL), B	
191C	19	891	ADD	HL, DE	
191D	20FB	892	JR	NZ, ELOP-*	
191F	C9	893	RET		
1920	FE60	894	CP	RCACX+8	; GUNFTR SPACE
1922	300C	895	JR	NC, DIE-*	
1924	1E40	896	LD	E, LCACX	
1926	DDCB0076	897	BIT	MRFLOP, (IX+VBMR)	
192A	20DE	898	JR	NZ, ERASE-*	
192C	1E58	899	LD	E, RCACX	
192E	18DA	900	JR	ERASE-*	
1930	DDCB0076	901	BIT	MRFLOP, (IX+VBMR)	WHO DIED?
1934	280C	902	JR	LEFT-*	
1936		903	SYSSUK	SUCK	
1936	FF	903	RST	56	
1937	0D	903	DEFB	SUCK+1	
		903	IF	SUCK. EQ. INTPC	
		903	ENDIF		
1938	DD	904	DEFB	11011101B	
1939	614F	905	DEFW	LC0WB	
193B	08	906	DEFB	100	
193C	B11F	907	DEFW	TAPS	
193E	A64F	908	DEFW	RSCORE	
1940	180A	909	JR	DIE1-*	
1942		910	SYSSUK	SUCK	
1942	FF	910	RST	56	
1943	0D	910	DEFB	SUCK+1	
		910	IF	SUCK. EQ. INTPC	
		910	ENDIF		
1944	DD	911	DEFB	11011101B	
1945	784F	912	DEFW	RC0WB	
1947	64	913	DEFB	100	
1948	C11F	914	DEFW	FUNERL	
194A	A24F	915	DEFW	RSCORE	
194C	DD361106	916	LD	(IX+VBLEGT), 6	; GET FIRST CELL TIME
1950	DD361284	917	LD	(IX+VBLEG), KILL AND OFFH ; ??	
1954	DD360168	918	LD	(IX+VBSTAT), 068H ; KILL HIM	
1958	DD7E0B	919	LD	A, (IX+VBYH) ; WHERE TO WRITE GOT ME	
195B	D608	920	SUB	8	
195D	FE13	921	CP	TLINE+9	
195F	3002	922	JR	NC, DIE4-*	
1961	C620	923	ADD	A, 32	
1963	57	924	LD	D, A	; LOAD Y
1964		925	SYSTEM	INCSCR	
1964	FF	925 +	RST	56	
1965	54	925 +	DEFB	INCSCR	
		925 +	IF	INCSCR. EQ. INTPC	

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925 +      ENDIF
1966 2B    926      DEC HL
1967 7E    927      LD A, (HL)      ; FIELD
1968 FE05  928      CP 5            ; INC IF LESS THAN 5
196A CE00  929      ADC A, 0
196C 77    930      LD (HL), A
          931 ; PLAY DEATH SONG
196D 60    932      LD H, B
196E 69    933      LD L, C
196F DD21124F 934      LD IX, MSTACK
1973 3E00  935      LD A, 11000000B
1975      936      SYSTEM BMUSIC
1975 FF    936 +     RST 56
1976 12    936 +     DEFB BMUSIC
          936 +     IF BMUSIC.EQ. INTPC
          936 +     ENDIF
1977 0E0C  937      LD C, LARG2
1979 21061F 938      LD HL, GOTME
197C F3    939      DI
197D      940      SYSTEM STRDIS
197D FF    940 +     RST 56
197E 34    940 +     DEFB STRDIS
          940 +     IF STRDIS.EQ. INTPC
          940 +     ENDIF
197F      941      SYSSUK PAWS
197F FF    941 +     RST 56
1980 51    941 +     DEFB PAWS+1
          941 +     IF PAWS.EQ. INTPC
          941 +     ENDIF
1981 FA    942      DEFB 250
1982 3E01  943      LD A, 1
1984 32DE4F 944      LD (SEMI), A ; SET WAGON
1987 C9    945      RET
          946 ; FIELD PUTS UP THE SACTII APPROX TO SCORE
          947 ; A=SCORE OF OPP PLAYER UPTO 6
          948 ; B=ARRAY OF Y POSITIONS
1988 21F81E 949 FIELD LD HL, CACUS ; -> CACTUS PATTERN
198B F5    950      PUSH AF
198C 3E08  951      LD A, 1000B
198E D319  952      OUT (XPAND), A
1990 F1    953      POP AF
1991 FE01  954      CP 1
1993 D8    955      RET C
1994 FE04  956      CP 4
1996 3003  957      JR NC, TCAC-$
1998 CDC819 958      CALL CACW
199B 03    959 TCAC INC BC
199C FE02  960      CP 2
199E D8    961      RET C
199F FE05  962      CP 5
19A1 3003  963      JR NC, MCAC-$
19A3 CDC819 964      CALL CACW
19A6 FE03  965 MCAC CP 3
19A8 D8    966      RET C
19A9 03    967      INC BC
19AA 08    968      EX AF, AF'
19AB 3E81  969      LD A, 81H ; ACTIVATE WAGON
  
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19AD	32904F	970.		LD	(WAGON), A	
19B0	08	971		EX	AF, AF'	
19B1	CDC819	972		CALL	CACW	
19B4	FE04	973		CP	4	
19B6	D8	974		RET	C	
19B7	03	975		INC	BC	
19B8	21E91D	976		LD	HL, TREE	
19BB	F5	977		PUSH	AF	
19BC	3E0C	978		LD	A, 1100B	
19BE	D319	979		OUT	(XPAND), A	
19C0	F1	980		POP	AF	
19C1	CDC819	981		CALL	CACW	
19C4	FE05	982		CP	5	
19C6	D8	983		RET	C	
19C7	03	984		INC	BC	
19C8	F5	985	CACW:	PUSH	AF	
19C9	D5	986		PUSH	DE	
19CA	0A	987		LD	A, (BC)	
19CB	57	988		LD	D, A	
19CC	3E08	989		LD	A, 8	; EXPAND
19CE		990		SYSTEM	WRITP	
19CE	FF	990		RST	56	
19CF	22	990		DEFB	WRTP	
		990		IF	WRTP, EQ. INTPC	
		990		ENDIF		
19D0	D1	991		POP	DE	
19D1	F1	992		POP	AF	
19D2	C9	993		RET		
		994		PUT DEL X, Y	IN O BULLET VE	ARS
19D3	1A	995		LD	A, (DE)	; BULE [D LO]
19D4	77	996		LD	A, A	; [D LO]
19D5	13	997		INC	DE	; [D HI]
19D6	03	998		INC	BC	; [D HI]
19D7	23	999		INC	HL	; [D HI]
19D8	1A	1000		LD	A, (E)	
19D9	77	1001		LD	(L), A	
19DA	23	1002		INC	HL	; [LO]
19DB	13	1003		INC	DE	; [HI]
19DC	03	1004		INC	BC	; [LO]
19DD	3600	1005		LD	(HL), 0	
19DF	03	1006		INC	BC	; [HI]
19E0	23	1007		INC	HL	; BUL [HI]
19E1	0A	1008		LD	A, (BC)	
19E2	EB	1009		EX	DE, HL	
19E3	86	1010		ADD	A, (HL)	
19E4	EB	1011		EX	DE, HL	
19E5	77	1012		LD	(HL), A	; BUL [HI]=COW [HI]+TAB [HI]
19E6	13	1013		INC	DE	; TAB [D HI]
19E7	C9	1014		RET		

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1016 ; GUNFIGHT START UP ROUTINE (ONCE PER GAME)
19E8      1017 INIT: SYSSUK GETPAR
19E8 FF   1017 +   RST 56
19E9 4D   1017 +   DEFB GETPAR+1
          1017 +   IF GETPAR.EQ. INTPC
          1017 +   ENDIF
19EA 1E02 1018   DEFW MXSCR
19EC 84   1019   DEFB 84H
19ED F44F 1020   DEFW ENDSCR
19EF 31064F 1021  LD SP, STACK
19F2      1022   SYSTEM INTPC
19F2 FF   1022 +   RST 56
19F3 00   1022 +   DEFB INTPC
          1022 +   IF INTPC.EQ. INTPC
>0001     1022 +INTP@ DEFL 1
          1022 +   ENDIF
19F4      1023   DO FILL
19F4 1B   1023 +   DEFB FILL+1
19F5 064F 1024   DEFW STACK
19F7 D600 1025   DEFW CT7-STACK
19F9 00   1026   DEFB 0
19FA      1027   DO SETB
19FA 7B   1027 +   DEFB SETB+1
19FB 02   1028   DEFB 2**GSEBSCR
19FC F84F 1029   DEFW GAMSTB
19FE      1030   DO SETOUT ; SET UP GAME PORTS
19FE 17   1030 +   DEFB SETOUT+1
19FF B8   1031   DEFB BLINE* ; BOTTOM LINE - VERT BLK
1A00 D6   1032   DEFB RCACX/+COCH ; HORIZ SOUNDS
1A01 08   1033   DEFB 8 ; INMO
1A02      1034   DO COLSE
1A02 19   1034 +   DEFB COLSET+1
1A03 C71D 1035   DEFW GFCOLS
1A05      1036   DO BMUSIC ; PLAY STREETS OF LOREDO
1A05 13   1036 +   DEFB BMUSIC
1A06 124F 1037   DEFW MSTACK
1A08 C0   1038   DEFB 1100000B ; ON VOICE A
1A09 A31F 1039   DEFW HOME
1A0B      1040   EXIT
1A0B 02   1040 +   DEFB XINTC
>0000     1040 +INTP@ DEFL 0
          1041 ; ***
          1042 ; ONCE A ROUND START UP ROUTINE
          1043 ; ***
1A0C F3   1044 STRN DI
1A0D      1045   SYSTEM INTPC
1A0D FF   1045 +   RST 56
1A0E 00   1045 +   DEFB INTPC
          1045 +   IF INTPC.EQ. INTPC
>0001     1045 +INTP@ DEFL 1
          1045 +   ENDIF
          1046 ; INIT HANDLES, BULLETS, TIMERS
1A0F      1047   DO MOVE
1A0F 5F   1047 +   DEFB MOVE+1
1A10 DA4F 1048   DEFW CT5
1A12 0C00 1049   DEFW 12
  
```

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1A14 CF1D      1050.          DEFW SINIT
                1051 ; COLOR BANNER
1A16          1052          FILL? NORMEM, BYTEPL*ALINE, OFFH
1A16 1B       1052 +          DEFB FILL+1
1A17 0040    1052 +          DEFW NORMEM
1A19 6801    1052 +          DEFW BYTEPL*ALINE
1A1B FF      1052 +          DEFB OFFH
                1053 ; ERASE SCREEN
1A1C          1054          FILL? NORMEM+BYTEPL*ALINE, BYTEPL*(BLINE-ALINE), 0
1A1C 1B      1054 +          DEFB FILL+1
1A1D 6841    1054 +          DEFW NORMEM+BYTEPL*ALINE
1A1F F80C    1054 +          DEFW BYTEPL*(BLINE-ALINE)
1A21 00      1054 +          DEFB 0
                1055 ; RESET VECTORS
1A22          1056          FILL? STRRAM, ENDRAM-STRRAM, 0
1A22 1B      1056 +          DEFB FILL+1
1A23 124F    1056 +          DEFW STRRAM
1A25 8F00    1056 +          DEFW ENDRAM-STRRAM
1A27 00      1056 +          DEFB 0
                1057 ; SHOW SCORES
1A28          1058          DO SUCK
1A28 0D      1058 +          DEFB SUCK+1
1A29 10      1059          DEFB 00000000B
1A2A 0D02    1060          DEFW FNTSML
1A2C          1061          DO DISNUM
1A2C 37      1061 +          DEFB DISNUM+1
1A2D 08      1062          DEFB LNS
1A2E 02      1063          DEFB BS
1A2F 0B      1064          DEFB TIME
1A30 C4      1065          DEFB OCH
1A31 A24F    1066          DEFW LSORE ; Z80 SUPRS, SMALL
1A33          1067          DO DISNUM
1A33 37      1067 +          DEFB DISNUM+1
1A34 88      1068          DEFB RNS
1A35 02      1069          DEFB BS
1A36 0B      1070          DEFB TIME
1A37 C4      1071          DEFB OCH
1A38 A64F    1072          DEFW RSORE
                1073 ; CHECK FOR END GAME
1A3A          1074          DO RCALL
1A3A 05      1074 +          DEFB RCALL+1
1A3B 301B    1075          DEFW ENRGAM
1A3D          1076          TEXT GETRDY, GRX, GRY, LARGE
1A3D 35      1076 +          DEFB STDIS+1
1A3E 2C      1076 +          DEFB GRX
1A3F 01      1076 +          DEFB GRY
1A40 0B      1076 +          DEFB LARGE
1A41 7E1D    1076 +          DEFW GETRDY
1A43          1077          EXIT
1A43 02      1077 +          DEFB XINTC
>0000        1077 +INTP@ DEFL 0
1A44 AF      1078          XOR A ; SET UP WAGON
1A45 32904F  1079          LD (WAGON), A ; STOP WAGON
                1080 ; PUT UP PLAY FIELD:
1A48 3AA14F  1081          LD A, (RFIELD) ; NUMBER OF CACTII
1A4B 1E58    1082          LD E, RCACX ; RIGHT CAC COLUMN
1A4D 01C21D  1083          LD BC, RFTAB ; POSITIONS TABLE FOR CACTII

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1A50 CD8819 1084 CALL FIELD ; PUT THE CACTII UP
1A53 3AA54F 1085 LD A, (LFIELD)
1A56 1E40 1086 LD E, LCACX
1A58 01BD1D 1087 LD BC, LFTAB
1A5B CD8819 1088 CALL FIELD
1089 ; INITIALIZE Q POINTERS
1A5E 3E4F 1090 INITQ LD A, LCOWB. SHR. 8
1A60 32144F 1091 LD (WRITQ+2), A
1A63 32174F 1092 LD (VECG+2), A
1093 ; SET UP VECTORS SO COWBOYS WALK OUT
1A66 DD21614F 1094 LD IX, LCOWB ; LEFT COMBOY VECTOR
1A6A DD360010 1095 LD (IX+VBMR), 10H
1A6E 21154F 1096 LD HL, VECQ
1A71 CD341D 1097 CALL COWINT
1A74 DD21784F 1098 LD IX, RCOWB ; RIGHT COWBOY VECTOR
1A78 DD360050 1099 LD (IX+VBMR), 50H
1A7C CD341D 1100 CALL COWINT
1A7F 3A904F 1101 LD A, (WAGON) ; IF WAGON IS ON
1A82 B7 1102 OR A
1A83 281D 1103 JR Z, MIDC-$
1A85 DD218F4F 1104 LD IX, WAGVEC ; THEN ACTIVATE WAGON
1A89 DD360010 1105 LD (IX+VBMR), 10H
1A8D DD360C03 1106 LD (IX+VBXCHK), 3
1A91 DD360840 1107 LD (IX+VBDYL), 40H
1A95 DD360648 1108 LD (IX+VBXH), 72
1A99 DD360B0A 1109 LD (IX+VBYH), TLINE
1A9D CD541D 1110 CALL ADDT
1AA0 180B 1111 JR BORG$
1AA2 3E08 1112 LD A, 8
1AA4 D319 1113 OUT (XPAND), A
1AA6 1114 SYSSUK NR$TP ; EL PUT UP A CACTUS
1AA6 FF 1114 + RST 56
1AA7 23 1114 + DEFB WRITP+1
1114 + IF WRITP EQ. INTPC
1114 + ENDIF
1AA8 4C 1115 DEFB CCAC
1AA9 2A 1116 DEFB MCAC
1AAA 08 1117 DEFB 8 ; EXPAND
1AAB F81E 1118 DEFW CACTUS
1119 ; INITIALIZE BULLBT VECTORS
1AAD 111200 1120 BULL LD DE, BULLVSZ
1AB0 DD21184F 1121 LD IX, BULLV1
1AB4 012004 1122 LD BC, 256+20H
1AB7 3E02 1123 LD A, 2
1AB9 B8 1124 BULL CP B
1ABA 2002 1125 JR NZ, TIYU-$
1ABC 0E60 1126 LD C, 60H
1ABE DD7100 1127 TIYU LD (IX+VBMR), C
1AC1 DD360701 1128 LD (IX+VBXCHK), 1
1AC5 DD360C03 1129 LD (IX+VBYCHK), 3
1AC9 DD19 1130 ADD IX, DE
1ACB 10EC 1131 DJNZ BULLP-$
1132 ; FIRE UP INTERRUPTS
1ACD 3E1D 1133 LD A, INTTBL. SHR. 8
1ACF ED47 1134 LD I, A
1135 ; IM 2 ; DONE IN MENU
1AD1 3E78 1136 LD A, LFRVEC. AND. OFFH
  
```

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1AD3 D30D      1137      OUT (INFBK),A
              1138      ; ***
              1139      ; LET COWBOYS WALK OUT
              1140      ; ***
1AD5           1141      WALK: SYSSUK PAWS
1AD5 FF        1141      + RST 56
1AD6 51        1141      + DEFB PAWS+1
              1141      + IF PAWS.EQ.INTPC
              1141      + ENDIF
1AD7 64        1142      DEFB 100
1AD8 F3        1143      DI
1AD9 DD210D02 1144      LD IX,FNTSML
1ADD           1145      SYSTEM INTPC
1ADD FF        1145      + RST 56
1ADE 00        1145      + DEFB INTPC
              1145      + IF INTPC.EQ.INTPC
>0001          1145      + INTPC DEFL 1
              1145      + ENDIF
              1146      + ERASE GET READY
1ADF           1147      DO BLANK
1ADF 2B        1147      + DEFB BLANK+1
1AE0 12        1148      DEFB 18
1AE1 08        1149      DEFB 8
1AE2 FF        1150      DEFB OFFH
1AE3 00000000 1151      XYDEFW (GRX/4)+4000H,GRY
1AE7           1152      TEXT DRW,DRX,GRY,LARGE
1AE7 35        1152      + DEFB STADIS+1
1AE8 40        1152      + DEFB DRW
1AE9 01        1152      + DEFB GRW
1AEA 0B        1152      + DEFB LARGE
1AEB 8B1D      1152      + DEFW DRW
1AED           1153      DO CHRDIS
1AED 33        1153      + DEFB CHRDIS+1
1AEE 20        1154      DEFB LBW X
1AEF 02        1155      DEFB BSW
1AF0 0B        1156      DEFB BSW
1AF1 BB        1157      DEFB BSW
1AF2           1158      DO MCALL
1AF2 07        1158      DEFB MCALL+1
1AF3 571B      1159      DEFW BULRIT
1AF5           1160      DO SUX
1AF5 0D        1160      + DEFB SUX+1
1AF6 01        1161      DEFB 0000001B
1AF7 68        1162      DEFB RBLX
1AF8           1163      DONT CHRDIS ; DO THE RIGHT ONES
1AF8 32        1163      + DEFB CHRDIS ; DISPLAY FIRST ONE
1AF9           1164      DO MCALL ; DISP THE OTHER 5
1AF9 07        1164      DEFB MCALL+1
1AFA 571B      1165      DEFW BULRIT
1AFC           1166      DO PAWS
1AFC 51        1166      + DEFB PAWS+1
1AFD 3C        1167      DEFB 60
1AFE           1168      DO BLANK
1AFE 2B        1168      + DEFB BLANK+1
1AFF 08        1169      DEFB 8
1B00 08        1170      DEFB 8
1B01 FF        1171      DEFB OFFH
  
```

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1B02	00000000	1172		XYDEFW (DRX/4)+4000H, GRY	
1B06		1173		EXIT	
1B06	02	1173	+	DEFB XINTC	
>0000		1173	+INTPe	DEFL 0	

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1175 ; *****
1176 ; MAIN LOOP DURING ROUND
1177 ; GETS HANDLES, SETS VECTORS AND CHECKS BULLETS
1B07 1178 LOOP: SYSTEM INTPC
1B07 FF 1178 + RST 56
1B08 00 1178 + DEFB INTPC
1178 + IF INTPC.EQ. INTPC
>0001 1178 +INTPe DEFL 1
1178 + ENDIF
1B09 1179 DO SENTRY
1B09 43 1179 + DEFB SENTRY+1
1B0A 1402 1180 DEFW ALKEYS
1B0C 1181 DO DOIT
1B0C 45 1181 + DEFB DOIT+1
1B0D 381B 1182 DEFW DTAB
1B0F 1183 EXIT
1B0F 02 1183 DEFB XINTC
>0000 1183 INTPe DEFL 0

1195 CHECK FOR DEATHS
1B10 DD21184F 1186 DEATH LD IX,BULV1
1B14 111200 1187 LD IX,BULVSZ
1B17 0604 1188 LD B,
1B19 C5 1189 PP2 PUSH BC
1B1A D5 1190 PUSH DE
1B1B CDCE18 1191 CALL HI,CHK
1B1E D1 1192 POP DE
1B1F C1 1193 POP BC
1B20 DD19 1194 ADD IX,DE
1B22 3ADE4F 1195 LD IX,SEMI4S) ; CHECK IF DEATH MODE
1B25 3D 1196 DEC IX
1B26 28DF 1197 JR Z,LOOP-$
1B28 10EF 1198 DJNZ LOOP2-$
1B2A 18DB 1199 JR LOOP-$
1200
1B2C 1201 ENDRND EXIT
1B2C 02 1201 + DEFB XINTC
>0000 1201 INTPe DEFL 0
1B2D C30C1A 1202 JP STRND
1203
1B30 3AF84F 1204 ENDGAM: LD A,GAMSTB)
1B33 CB7F 1205 BIT A,END,A
1B35 C3 1206 RET
1B36 1207 SYSTEM QUIT
1B36 FF 1207 RST 56
1B37 78 1207 DEFB QUIT
1207 IF QUIT.EQ. INTPC
1207 ENDIF

1B38 1209 DTAB: JMP SCT7, ENDRND
  
```

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1B38 08	1209 +	DEFB SCT7
1B39 2C1B	1209 +	DEFW ENDRND
	1209 +	IF 0
	1209 +	ENDIF
1B3B	1210	JMP SFO, ENDRND
1B3B 09	1210 +	DEFB SFO
1B3C 2C1B	1210 +	DEFW ENDRND
	1210 +	IF 0
	1210 +	ENDIF
1B3E	1211	RC SPO, PPOTO
1B3E 5C	1211 +	DEFB SPO+40H
1B3F B918	1211 +	DEFW PPOTO
	1211 +	IF 0
	1211 +	ENDIF
1B41	1212	RC SP1, PPOT1
1B41 5D	1212 +	DEFB SP1+40H
1B42 B118	1212 +	DEFW PPOT1
	1212 +	IF 0
	1212 +	ENDIF
1B44	1213	RC SJO, JOY0
1B44 55	1213 +	DEFB SJO+40H
1B45 8F18	1213 +	DEFW JOY0
	1213 +	IF 0
	1213 +	ENDIF
1B47	1214	RC SJ1, JOY1
1B47 57	1214 +	DEFB SJ1+40H
1B48 9518	1214 +	DEFW JOY1
	1214 +	IF 0
	1214 +	ENDIF
1B4A	1215	MC SKY, NBRK
1B4A 93	1215 +	DEFB SKY+80H
1B4B 8D18	1215 +	DEFW NBRK
	1215 +	IF 0
	1215 +	ENDIF
1B4D	1216	RC STO, FIRE0
1B4D 54	1216 +	DEFB STO+40H
1B4E FF17	1216 +	DEFW FIRE0
	1216 +	IF 0
	1216 +	ENDIF
1B50	1217	RC ST1, FIRE1
1B50 56	1217 +	DEFB ST1+40H
1B51 0A18	1217 +	DEFW FIRE1
	1217 +	IF 0
	1217 +	ENDIF
1B53	1218	RC SSEC, DCLOCK, +END
1B53 51	1218 +	DEFB SSEC+40H
1B54 E117	1218 +	DEFW DCLOCK
	1218 +	IF 0+END
1B56 C0	1218 +	DEFB 0+END
	1218 +	ENDIF

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1B57	1220	BULRIT	DONT CHRDIS
1B57 32	1220 +		DEFB CHRDIS

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1B58          1221.          DONT CHRDIS
1B58 32       1221 +        DEFB CHRDIS
1B59          1222          DONT CHRDIS
1B59 32       1222 +        DEFB CHRDIS
1B5A          1223          DONT CHRDIS
1B5A 32       1223 +        DEFB CHRDIS
1B5B          1224          DONT CHRDIS
1B5B 32       1224 +        DEFB CHRDIS
1B5C          1225          DONT MRET
1B5C 08       1225 +        DEFB MRET
  
```

```

1227 ; *****
1228 ; * GUNFIGHT WRITE INTERRUPT ROUTINE *
1229 ; *****
1B5D 08       1230          RIT: EX  AF, AF'
1B5E D9       1231          EXX
1B5F DDE5     1232          PUSH IX
1B61 3E78     1233          RESINT: LD  A, DFRVEC.AND.OFFH ; ESTABLISH TICKS INT
1B63 D30D     1234          OUT  (LFBK), A
1B65 3EC8     1235          LD   A, LFRLIN
1B67 D30F     1236          OUT  (INLIN), A
1B69 21124F   1237          LD   HL, WRITQ ; FIRST WRITE Q ENTRY
1B6C CD6B1D   1238          CALL FIRST
1B6F CD291D   1239          CALL DEIS ; DROP FROM WRITE Q
1B72 AF       1240          XOR  A
1B73 32FF0F   1241          LD   (WASTE), A
1B76 DDCB0146 1242          BIT  VBSWAG, (IX+VBSTAT) ; WAGON?
1B7A 2028     1243          JR   NZ, GFWRT1-* ; JUMP IF YEP
1244 ; GUNFIGHTER - BLANKETH HIM
1B7C 110514   1245          LD   DE, 1405H ; LOAD BLANKING PARMS
1B7F          1246          SYSTEM BLANK ; CALL BLANKER
1B7F FF       1246          RST  56
1B80 28       1246          DEFB VBANK
1246 +        IF  VBANK.EQ.INTPC
1246 +        ENDIF
1B81 261E     1247          LD   H, LEGO.SHR.8 ; WRITE LEG PATTERN
1B83 DD6E12   1248          LD   L, (IX+VBLEG)
1B86 2C       1249          INC  L ; SKIP OVER LINK AND TIME
1B87 2C       1250          INC  L
1B88          1251          SYSTEM WRITR ; AND WRITE LEG
1B88 FF       1251          RST  58
1B89 1E       1251          DEFB VWRITR
1251 +        IF  VWRITR.EQ.INTPC
1251 +        ENDIF
1252 ; IS GUNFIGHTER DEAD?
1B8A DDCB016E 1253          BIT  VBSINT, (IX+VBSTAT)
1B8E 2030     1254          JR   NZ, GFWRT5-* ; JUMP IF 30
1B90 21DB1D   1255          LD   HL, ARMTBL ; LOOKUP ARM PATTERN
1B93 1600     1256          LD   D, 0
1B95 DD5E0F   1257          LD   E, (IX+VBARM)
1B98 19       1258          ADD  HL, DE
1B99 5E       1259          LD   E, (HL)
1B9A 23       1260          INC  HL
  
```

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1B9B 56      1261      LD   D,(HL)
1B9C EB      1262      EX   DE,HL
1B9D         1263      SYSTEM VWRITR      ; WRITE ARM PATTERN
1B9D FF      1263 +     RST  56
1B9E 1E      1263 +     DEFB VWRITR
                1263 +     IF   VWRITR.EQ.INTPC
                1263 +     ENDIF
1B9F 21101F  1264      LD   HL,GFBDY      ; LOAD BODY PATTERN
1BA2 1808    1265      JR   GFWRT2-$      ; JOIN WAGON WRITE
                1266      ; BLANK THE WAGON
1BA4 110416  1267      GFWRT1: LD  DE,1604H      ; LOAD WAGON SIZE
1BA7         1268      SYSTEM VBLANK
1BA7 FF      1268 +     RST  56
1BA8 28      1268 +     DEFB VBLANK
                1268 +     IF   VBLANK.EQ.INTPC
                1268 +     ENDIF
1BA9 21401F  1269      LD   HL,WAGPAT
1BAC         1270      GFWRT2: SYSTEM VWRITR      ; NOW WRITE
1BAC FF      1270 +     RST  56
1BAD 1E      1270 +     DEFB VWRITR
                1270 +     IF   VWRITR.EQ.INTPC
                1270 +     ENDIF
1BAE DD720E  1271      GFWRT3: LD   (IX+VBAH),D
1BB1 DD730D  1272      LD   (IX+VBAL),E
1BB4 21154F  1273      GFWRT4: LD   HL,VECT      ; ADD VECTOR TO VECTOR Q
1BB7 CD541D  1274      CALL ADDTQ
1BBA DDE1     1275      POP  IX
1BBC 08      1276      EX   AF,AF
1BBD D9      1277      EXX
1BBE FB      1278      EIRE
1BBF C9      1279      RET
1BC0 210C1F  1280      GFWRT5: LD   HL,NUCLAT
1BC3 18E7    1281      JR   GFWRT2-$
                1282      ; *****
                1283      ; * GUNFIGHT LOW FOREGROUND ROUTINE *
                1284      ; *****
1BC5 F5      1285      GFLFR: PUSH AF
1BC6 C5      1286      PUSH BC
1BC7 D5      1287      PUSH DE
1BC8 E5      1288      PUSH HL
1BC9 DDE5    1289      PUSH IX
                1290      ; BUMP TIME BASES ON ACTIVE OR INTERCEPTED VECTORS
1BCB 21194F  1291      LD   HL,BULV1+VBSTAT
1BCE 111100  1292      LD   DE,BULVSZ-1
1BD1 0604    1293      LD   B,4
1BD3 CD1E1D  1294      CALL TBUMP
1BD6 23      1295      INC  HL      ; SKIP LINK FIELD
1BD7 111600  1296      LD   DE,GFVSIZ-1
1BDA 0603    1297      LD   B,3
1BDC CD1E1D  1298      CALL TBUMP
                1299      ; LOOP TO UNWRITE, THEN WRITE ALL 4 BULLETS
                1300      ; BUT FIRST, A WORD TO OUR SHIFTER
1BDF AF      1301      XOR  A
1BE0 32FF0F  1302      LD   (WASTE),A
1BE3 0604    1303      LD   B,4
1BE5 DD21184F 1304      LD   IX,BULV1
                1305      ; UNWRITE THIS GUY?

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1BE9 DDCB0176 1306 WRBUL1: BIT VBBLNK, (IX+VBSTAT)
1BED 2911 1307 JR Z, WRBUL2-$ ; JUMP IF NOT
1BEF DD660E 1308 LD H, (IX+VBOAH)
1BF2 DD6E0D 1309 LD L, (IX+VBOAL)
1BF5 DD7E0F 1310 LD A, (IX+VBARM) ; GET LAST MR
1BF8 D30C 1311 OUT (MAGIC), A
1BFA 36C0 1312 LD (HL), OCOH ; UNWRITE BULLET
1BFC DDCB01B6 1313 RES VBBLNK, (IX+VBSTAT) ; CLEAR BLANK BIT
1314 ; SHALL WE WRITE THIS GUY?
1C00 DDCB017E 1315 WRBUL2: BIT VBSACT, (IX+VBSTAT)
1C04 292B 1316 JR Z, WRBUL4-$
1C06 DD560B 1317 LD D, (IX+VBYH)
1C09 DD5E06 1318 LD E, (IX+VBXH)
1C0C DD7E00 1319 LD A, (IX+VBMR)
1C0F 1320 SYSTEM RELABS
1C0F FF 1320 RST 56
1C10 38 1320 DEFB RELABS
1320 IF RELABS. EQ. INTPC
1320 ENDIF
1C11 DD720E 1321 LD (IX+VBOAH), D
1C14 DD730D 1322 LD (IX+VBOAL), E
1C17 DD770F 1323 LD (IX+VBARM), A
1C1A 210040 1324 LD N, NORMEM-SCREEN
1C1D 19 1325 ADD HL, DE
>4FFF 1326 EQU WASTE-SCREEN+NORMEM
1C1E 7E 1327 LD A, HL
1C1F EB 1328 EX DE, HL
1C20 36C0 1329 LD (HL), OCOH
1C22 B7 1330 OR A
1C23 2908 1331 JR Z, WRBUL3-$ ; JUMP IF NOT
1C25 DDCB01BE 1332 RES VBSACT, (IX+VBSTAT) ; KILL ACTIVE BIT
1C29 DDCB01EE 1333 SET VBSINT, (IX+VBSTAT) ; SET INTERCEPT BIT
1C2D DDCB01F6 1334 WRBUL3: SET VBBLNK, (IX+VBSTAT) ; SET BLANK BIT
1335 ; STEP TO NEXT BULLET VECTOR ; LOOP BACK IF NOT DONE
1C31 111200 1336 WRBUL4: LD DE, BULVSZ
1C34 DD19 1337 ADD IX, DE
1C36 10B1 1338 DJNZ WRBUL1-$
1339 GET NEXT PATTERN TO WRITE, AND SCHEDULE HIM
1C38 21124F 1340 LD HL, WRITQ
1C3B CD6B1D 1341 CALL FIRST
1C3E 2912 1342 JR Z, WRBL5A-$ ; JUMP IF EMPTY Q
1C40 3E7A 1343 LD A, WRTVEC. AND. OFFH ; SET FEEDBACK REG
1C42 D30D 1344 OUT (FBK), A
1C44 DD7E0B 1345 LD A, (IX+VBYH) ; WHICH WINDOW TO USE?
1C47 FE32 1346 CP WINEND ; COMPARE TO WINDOW BOUNDARY
1C49 3E00 1347 LD A, BOTLIN ; RESUME BOTTOM LINE
1C4B 3002 1348 JR NC, WRBUL5-$ ; JUMP IF GOOD GUESS
1C4D 3E6A 1349 LD A, TOPLIN ; WRONG - USE TOP
1C4F D30F 1350 WRBUL5: OUT (INLIN), A ; SET LINE REGISTER
1C51 FB 1351 EI
1352 ; LOOP THRU VECTORING THOSE BULLETS
1C52 DD21184F 1353 WRBL5A LD IX, BULV1
1C56 0604 1354 LD B, 4
1C58 219F1D 1355 LD HL, BULLMT ; HL = BULLET LIMITS TABLE
1C5B 111200 1356 LD DE, BULVSZ
1C5E DDCB017E 1357 WRBUL6: BIT VBSACT, (IX+VBSTAT) ; ACTIVE BULLET?
1C62 290C 1358 JR Z, WRBUL7-$

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1C64		1359		SYSTEM VECT	
1C64	FF	1359	+	RST 56	
1C65	3E	1359	+	DEFB VECT	
		1359	+	IF VECT. EQ. INTPC	
		1359	+	ENDIF	
1C66	DDCB075E	1360		BIT VBCLAT, (IX+VBXCHK) ; DID Y HIT EDGE?	
1C6A	2804	1361		JR Z, WRBUL7-\$; NOPE	
1C6C	DDCB01BE	1362		RES VBSACT, (IX+VBSTAT) ; DEACTIVATE BULLET	
1C70	DD19	1363		WRBUL7: ADD IX, DE	
1C72	10EA	1364		DJNZ WRBUL6-\$; LOOP BACK	
		1365		; NOW PUT SOMETHING ON THE WRITE Q	
1C74	0602	1366		LD B, 2 ; MAX 2 TIMES THRU	
1C76	21154F	1367		LD HL, VECQ	
1C79	CD6B1D	1368		GVECT: CALL FIRST ; GET VECTOR Q ENTRY	
1C7C	CAFC1C	1369		JP Z, GVECT4 ; JUMP IF Q EMPTY	
1C7F	CD291D	1370		CALL DELQ ; DROP FROM VECTOR Q	
1C82	FB	1371		EI	
		1372		; WAGON?	
1C83	DDCB0146	1373		BIT VBSWAG, (IX+VBSTAT)	
1C87	C2071D	1374		JP NZ, GVECT5 ; JUMP ON WAGON	
		1375		; DEAD?	
1C8A	DDCB016E	1376		BIT VBSNOM, (IX+VBSTAT)	
1C8E	2025	1377		JR NZ, GVECT1-\$; JUMP IF DEAD	
		1378		; ZERO VELOCITY?	
1C90	DD7E03	1379		LD A, (IX+VBDXL)	
1C93	DDB604	1380		OR (IX+VBDXH)	
1C96	DDB608	1381		OR (IX+VBDYL)	
1C99	DDB609	1382		OR (IX+VBDYH)	
1C9C	2017	1383		JR NZ, GVECT1-\$; GVECT1 IF NONZERO	
1C9E	DD7702	1384		LD (IX+VBTIMB), A ; ZERO TIME BASE	
1CA1	DDCB0166	1385		BIT VBSNOM, (IX+VBSTAT) ; ALREADY STATIONARY?	
1CA5	2036	1386		JR NZ, GVECT3-\$	
		1387		; SET STATIONARY LEGS	
1CA7	DD36124F	1388		LD (IX+VBLEG), LEGO. ; OFFH	
1CAB	DDCB01DE	1389		SET VBSCHG, (IX+VBSTAT) ; SET CHANGED	
1CAF	DDCB01E6	1390		SET VBSNOM, (IX+VBSTAT) ; AND STATIONARY	
1CB3	1828	1391		JR GVECT3-\$; JUMP TO ARM CHECK	
		1392		; MOVING GUNFIGHTER	
		1393		; VECTOR	
1CB5	21871D	1394		GVECT1: LD HL, GUNLMT ; LOAD GF LIMITS	
1CB8		1395		SYSTEM VECT	
1CB8	FF	1395	+	RST 56	
1CB9	3E	1395	+	DEFB VECT	
		1395	+	IF VECT. EQ. INTPC	
		1395	+	ENDIF	
1CBA	2808	1396		JR Z, GVECT2-\$; JUMP IF HE DIDN'T MOVE	
1CBC	DDCB01DE	1397		SET VBSCHG, (IX+VBSTAT) ; SET CHANGED BIT	
1CC0	DDCB01A6	1398		RES VBSNOM, (IX+VBSTAT) ; CLEAR NOT MOVING STATUS	
		1399		; NEED WE GO TO NEXT CELL IN ANIMATION SEQUENCE?	
1CC4	DD7E11	1400		GVECT2: LD A, (IX+VBLEGT) ; A = ANIMATION TIMER	
1CC7	91	1401		SUB C ; SUBTRACT TIME BASE	
1CC8	F2DA1C	1402		JP P, GVECT3 ; JUMP IF NOT COUNTED DOWN	
		1403		; GET NEXT CELL	
1CCB	DD5E12	1404		LD E, (IX+VBLEG) ; GET LINK	
1CCE	161E	1405		LD D, LEGO. SHR. 8 ; SET H. O. PART	
1CD0	1A	1406		LD A, (DE) ; A = NEXT	
1CD1	DD7712	1407		LD (IX+VBLEG), A	

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1CD4	13	1408		INC	DE	; STEP TO TIMER
1CD5	1A	1409		LD	A, (DE)	; GET NEW TIMER
1CD6	DDCB01DE	1410		SET	VBSCHG, (IX+VBSTAT)	; SET CHANGED BIT
1CDA	DD7711	1411		GVECT3:	LD (IX+VBLEGT), A	; STORE BACK TIMER
		1412				; DID ARM CHANGE?
1CDD	DD7E0F	1413		GVEC3A:	LD A, (IX+VBARM)	
1CE0	DDBE10	1414		CP	(IX+VBOARM)	; COMPARE TO OLD ARM
1CE3	2807	1415		JR	Z, GVEC3B-\$	; JUMP IF NO CHANGE
1CE5	DDCB01DE	1416		SET	VBSCHG, (IX+VBSTAT)	; SET CHANGED BIT
1CE9	DD7710	1417		LD	(IX+VBOARM), A	
		1418				; ADD ITEM TO WRITE Q?
1CEC	DDCB015E	1419		GVEC3B:	BIT VBSCHG, (IX+VBSTAT)	
1CF0	2020	1420		JR	NZ, GVECT6-\$	; YES GVECT6
		1421				; NO CHANGE - LINK TO VECTOR Q
1CF2	21154F	1422		LD	HL, VECQ	
1CF5	CD541D	1423		CALL	ADDTQ	
1CF8	05	1424		DEC	B	
1CF9	C2791C	1425		JP	NZ, GVECT	; SUB FOR DJNZ
1CFC	FB	1426		GVECT4:	EI	
1CFD	CD0002	1427		CALL	STIMER	
1D00	DDE1	1428		POP	IX	
1D02	E1	1429		POP	HL	
1D03	D1	1430		POP	DE	
1D04	C1	1431		POP	BC	
1D05	F1	1432		POP	AF	
1D06	C9	1433		RET		
		1434				; VECTOR AND Q WAGON
1D07	217C1D	1435		GVECT5:	LD HL, WAGLMT	
1DOA		1436			SYSTEM VECT	
1DOA	FF	1436		RST	56	
1DOB	3E	1436		DEFB	VE	
		1436		IF	VECT. EQ. INTPC	
		1436			ENDIF	
1DOC	21154F	1437		LD	HL, VECQ	
1DOF	CD291D	1438		CALL	DELQ	; REMOVE FROM VECTOR Q
1D12	DDCB019E	1439		GVECT6:	RES VBSCHG, (IX+VBSTAT)	
1D16	21124F	1440		LD	HL, WRITQ	
1D19	CD541D	1441		CALL	ADDTQ	
1D1C	18DE	1442		JR	GVECT4-\$	; JUMP BACK TO QUIT
		1443				; ROUTINE TO BUMP TIME BASES OF VECTORS
1D1E	7E	1444		GUMP:	LD A, (HL)	; GET STATUS
1D1F	23	1445		INC	HL	
1D20	E6A0	1446		AND	0A, HL	; ACTIVE OR INTERCEPTED?
1D22	2801	1447		JR	Z, TBUMP1-\$	; NO - TBUMP1
1D24	34	1448		INC	(HL)	; BUMP THE TIME BASE
1D25	19	1449		GUMP1:	ADD HL, DE	
1D26	10F6	1450		DJNZ	TBUMP-\$	
1D28	C9	1451		RET		
		1452				; SUBROUTINE TO DELETE ENTRY AT FRONT OF Q
		1453		; ENTRY:	HL = HEAD-TAIL, IX = OBJECT, A = CLOBBERE	
1D29	F3	1454		DELQ:	DI	
1D2A	DD7EFF	1455		LD	A, (IX+NEXT)	; HEAD = NEXT(OBJECT)
1D2D	77	1456		LD	(HL), A	
1D2E	A7	1457		AND	A	; IS HEAD NOW NIL?
1D2F	C0	1458		RET	NZ	; QUIT IF NOT
1D30	23	1459		INC	HL	; YES - SET TAIL = NIL TOO
1D31	77	1460		LD	(HL), A	

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1D32 2B      1461      DEC  HL
1D33 C9      1462      RET
1D34 DD360332 1463      COWINT LD  (IX+VBDXL),50 ; SLOW WALK OUT
1D38 DD360180 1464      LD  (IX+VBSTAT),80H ; ACTIVATE
1D3C DD360701 1465      LD  (IX+VBXCHK),1
1D40 DD360C01 1466      LD  (IX+VBYCHK),1
1D44 DD360604 1467      LD  (IX+VBXH),4
1D48 DD360B28 1468      LD  (IX+VBYH),40
1D4C DD360F06 1469      LD  (IX+VBARM),6 ; SET ARM STRAIGHT
1D50 DD36124F 1470      LD  (IX+VBLEG),LEGO.AND.OFFH
      1471      ; JP      ADDTQ
      1472      ; SUBROUTINE TO APPEND ENTRY TO END OF Q
      1473      ; ENTRY: HL = HEAD-TAIL BYTES, IX = OBJECT, A, DE C
1D54 DDE5    1474      ADDTQ: PUSH IX      ; DE = ENTRY
1D56 D1      1475      POP  DE
1D57 F3      1476      DI
1D58 DD36FF00 1477      LD  (IX+NEXT),0 ; NEXT(OBJ)=NIL
1D5C 23      1478      INC  HL
1D5D 7E      1479      LD  A,(HL)      ; A = OLD TAIL
1D5E 73      1480      LD  (HL),E      ; SET TAIL = .OBJ
1D5F A7      1481      AND  A          ; WAS OLD TAIL NIL?
1D60 2906    1482      JR   Z,ADDTQ1-$ ; JUMP IF SO
      1483      ; NNIL OLD TAIL SET NEXT(OLD TAIL)=OBJ
1D62 5F      1484      LD  E,A        ; DE = NEXT(OLD TAIL)
1D63 7E      1485      LD  A,(HL)     ; A = OBJ (FROM NEW TAIL)
1D64 2B      1486      DEC  HL
1D65 1B      1487      DEC  DE
1D66 12      1488      LD  (DE)
1D67 C9      1489      RET
      1490      ; OLD TAIL CASE
1D68 2B      1491      ADTQ1: DEC HL      ; BACKUP TO HEAD
1D69 73      1492      LD  (HL),E     ; HEAD = .OBJ
1D6A C9      1493      RET
      1494      ; SUBROUTINE TO PRINT IX AT FIRST ENTRY ON A Q
      1495      ; ENTRY: HL = Q HEAD-TAIL
      1496      ; EXIT: DE = OBJECT, A = L.O. BYTE OF OBJECT
      1497      ; NONZERO STATUS SET IF Q NOT EMPTY
1D6B F3      1498      PRINT: DI
1D6C 5E      1499      LD  E,(HL)
1D6D 23      1500      INC  HL
1D6E 23      1501      INC  HL
1D6F 56      1502      LD  D,(HL)     ; D = H.O. ADDR. BYTE
1D70 2B      1503      DEC  HL
1D71 2B      1504      DEC  HL
1D72 7B      1505      LD  A,E        ; E HEAD OF Q
1D73 A7      1506      AND  A
1D74 D5      1507      PUSH DE
1D75 DDE1    1508      POP  IX
1D77 C9      1509      RET
  
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1511 ; *****
1512 ; * GUNFIGHT CONSTANTS *
1513 ; *****
  
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		1514		ORG	(\$+1). AND. OFFFEH
1D78		1515	INTTBL:		
1D78	CS1B	1516	LFRVEC:	DEFW	GFLFR
1D7A	5D1B	1517	WRTVEC:	DEFW	GFWRIT
		1518	;	WAGON	LIMITS TABLE
1D7C	0A	1519	WAGLMT:	DEFB	TLINE
1D7D	44	1520		DEFB	BLINE-24
1D7E	47455420	1521	GETRDY:	DEFM	'GET READY'
		1522	;	GUNFIGHTER	LIMITS
1D87	00	1523	GUNLMT:	DEFB	0
1D88	2F	1524		DEFB	LCACX-17
1D89	0A	1525		DEFB	TLINE
1D8A	48	1526		DEFB	BLINE-20
1D8B	44524157	1527	DRAW:	DEFM	'DRAW'
		1528	;	BULLET	LIMITS
1D8F	00	1529	BULLMT	DEFB	0
1D90	9F	1530		DEFB	159
1D91	09	1531		DEFB	ALINE
1D92	5B	1532		DEFB	BLINE-1
		1533		MACR	#DX, #ARMX, #DY, #ARMY
		1534		DEFW	#DX
		1535		DEFW	#ARMX
		1536		DEFW	#ARMY
		1537		DEFB	#ARMY
		1538		ENDM	
1D93		1539	TAB	BN	768, 15, 768, 15
1D93	0003	1539	+	DEFW	768
1D95	0F	1539	+	DEFB	15
1D96	0003	1539	+	DEFW	768
1D98	0F	1539	+	DEFB	15
1D99		1540		BN	1024, 15, 512, 12
1D99	0004	1540	+	DEFW	1024
1D9B	0F	1540	+	DEFB	15
1D9C	0002	1540	+	DEFW	512
1D9E	0C	1540	+	DEFB	12
1D9F		1541		BN	1024, 15, 256, 11
1D9F	0004	1541	+	DEFW	1024
1DA1	0F	1541	+	DEFB	15
1DA2	0001	1541	+	DEFW	256
1DA4	0B	1541	+	DEFB	11
1DA5		1542		BN	1024, 15, 0, 8
1DA5	0004	1542	+	DEFW	1024
1DA7	0F	1542	+	DEFB	15
1DA8	0000	1542	+	DEFW	-256
1DAA	08	1542	+	DEFB	8
1DAB		1543		BN	1024, 15, -256, 6
1DAB	0004	1543	+	DEFW	1024
1DAD	0F	1543	+	DEFB	15
1DAE	00FF	1543	+	DEFW	-256
1DB0	06	1543	+	DEFB	6
1DB1		1544		BN	1024, 15, -512, 4
1DB1	0004	1544	+	DEFW	1024
1DB3	0F	1544	+	DEFB	15
1DB4	00FE	1544	+	DEFW	-512
1DB6	04	1544	+	DEFB	4
1DB7		1545		BN	768, 15, -768, 3
1DB7	0003	1545	+	DEFW	768

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1DB9	OF	1545	+		DEFB	15	
1DBA	00FD	1545	+		DEFW	-768	
1DBC	03	1545	+		DEFB	3	
1DBD		1546		LFTAB:	DEF5	72, 22, 44, 67, 14	
1DBD	48	1546	+		DEFB	72	
1DBE	16	1546	+		DEFB	22	
1DBF	2C	1546	+		DEFB	44	
1DC0	43	1546	+		DEFB	67	
1DC1	0E	1546	+		DEFB	14	
1DC2		1547		RFTAB:	DEF5	18, 68, 40, 13, 63	
1DC2	12	1547	+		DEFB	18	
1DC3	44	1547	+		DEFB	68	
1DC4	28	1547	+		DEFB	40	
1DC5	0D	1547	+		DEFB	13	
1DC6	3F	1547	+		DEFB	63	
1DC7	9D	1548		GFCOLS:	DEFB	9DH	
1DC8	76	1549			DEFB	76H	
1DC9	FC	1550			DEFB	0FCH	
1DCA	87	1551			DEFB	87H	
1DCB	9D	1552			DEFB	9DH	
1DCC	76	1553			DEFB	76H	
1DCD	6C	1554			DEFB	6CH	
1DCE	87	1555			DEFB	87H	
1DCF		1556		SINI	DEFB	6, 6, 0, 0, 0, 30H, 30H, 0	
1DCF	06	1556	+		DEFB	6	
1DD0	06	1556	+		DEFB	6	
1DD1	00	1556	+		DEFB	0	
1DD2	00	1556	+		DEFB	0	
1DD3	00	1556	+		DEFB	0	
1DD4	30	1556	+		DEFB	30H	
1DD5	30	1556	+		DEFB	30H	
1DD6	00	1556	+		DEFB	0	
1DD7		1557			DEF4	0, 80H, 0FH, 0FH	
1DD7	00	1557	+		DEFB	0	
1DD8	80	1557	+		DEFB	80H	
1DD9	0F	1557	+		DEFB	0FH	
1DDA	0F	1557	+		DEFB	0FH	
>0007		1558		NUMB:	EQU	0000011B	; COLOR MASK
>000B		1559		BUL:	EQU	00001011B	
>000B		1560		TIME:	EQU	00001011B	
>000B		1561		LARC:	EQU	00001011B	
>000C		1562		LARC:	EQU	00001100B	
1564							
1565							
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PATTERN TABLES:

ARMTBL:	DEFW	ARMO
	DEFW	ARM1
	DEFW	ARM2
	DEFW	ARM3
	DEFW	ARM4
	DEFW	ARM5
	DEFW	ARM6

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1576 ; PATTERN DEFINITION MACROS
1577 DEF02 MACR #A, #B
1578 DEF02 MACR #A, #B
1579 DEF02 MACR #A, #B
1580 DEF02 MACR #A, #B
1581 DEF03 MACR #A, #B, #C
1582 DEF03 MACR #A, #B, #C
1583 DEF03 MACR #A, #B, #C
1584 DEF03 MACR #A, #B, #C
1585 DEF03 MACR #A, #B, #C
1586 DEF04 MACR #A, #B, #C, #D
1587 DEF04 MACR #A, #B, #C, #D
1588 DEF04 MACR #A, #B, #C, #D
1589 DEF04 MACR #A, #B, #C, #D
1590 DEF04 MACR #A, #B, #C, #D
1591 DEF04 MACR #A, #B, #C, #D
1592 TREE DEF2 1, 17
1592 DEF2 1, 17
1592 DEF2 1, 17
1593 DEF2 1, 17
1594 DEF2 1, 17
1595 DEF2 1, 17
1596 DEF2 1, 17
1597 DEF2 1, 17
1598 DEF2 1, 17
1599 DEF2 1, 17
1600 DEF2 1, 17
1601 DEF2 1, 17
1602 DEF2 1, 17
1603 DEF2 1, 17
1604 DEF2 1, 17
1605 DEF2 1, 17
1606 DEF2 1, 17
1607 DEF2 1, 17
1608 DEF2 1, 17
1609 DEF2 1, 17
1610 ARM0: DEF04 0A, 0A, 2, 5
1610 DEF04 0A, 0A, 2, 5
1610 DEF04 0A, 0A, 2, 5
1610 DEF04 0A, 0A, 2, 5
1611 DEF02 0A, 00,
1611 DEF02 0A, 00,
1611 DEF02 0A, 00,
1612 DEF02 51, 00,
1612 DEF02 51, 00,
1612 DEF02 51, 00,
1613 DEF02 04, 00,
1613 DEF02 04, 00,
1613 DEF02 04, 00,
1614 DEF02 01, 00,
1614 DEF02 01, 00,
1614 DEF02 01, 00,
1615 DEF02 00, 40,
1615 DEF02 00, 40,
1615 DEF02 00, 40,
1616 ARM1: DEF04 0A, 0A, 2, 3
1616 DEF04 0A, 0A, 2, 3

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1E0A	0A	1616	+		DEFB 00AH
1E0B	0A	1616	+		DEFB 00AH
1E0C	02	1616	+		DEFB 02H
1E0D	03	1616	+		DEFB 03H
1E0E		1617			DEF02 50, 00,
1E0E	50	1617	+		DEFB 050H
1E0F	00	1617	+		DEFB 000H
1E10		1618			DEF02 14, 00,
1E10	14	1618	+		DEFB 014H
1E11	00	1618	+		DEFB 000H
1E12		1619			DEF02 01, 40,
1E12	01	1619	+		DEFB 001H
1E13	40	1619	+		DEFB 040H
1E14		1620		ARM2:	DEF04 0A, 0A, 2, 2
1E14	0A	1620	+		DEFB 00AH
1E15	0A	1620	+		DEFB 00AH
1E16	02	1620	+		DEFB 02H
1E17	02	1620	+		DEFB 02H
1E18		1621			DEF02 54, 00,
1E18	54	1621	+		DEFB 054H
1E19	00	1621	+		DEFB 000H
1E1A		1622			DEF02 55, 00,
1E1A	55	1622	+		DEFB 055H
1E1B	40	1622	+		DEFB 040H
1E1C		1623		ARM2:	DEF04 0A, 7, 2, 4
1E1C	0A	1623	+		DEFB 00AH
1E1D	07	1623	+		DEFB 07H
1E1E	02	1623	+		DEFB 02H
1E1F	04	1623	+		DEFB 04H
1E20		1624			DEF02 10, 00,
1E20	10	1624	+		DEFB 010H
1E21	00	1624	+		DEFB 000H
1E22		1625			DEF02 05, 40,
1E22	05	1625	+		DEFB 005H
1E23	40	1625	+		DEFB 040H
1E24		1626			DEF02 54, 00,
1E24	54	1626	+		DEFB 054H
1E25	00	1626	+		DEFB 000H
1E26		1627			DEF02 50, 00,
1E26	50	1627	+		DEFB 050H
1E27	00	1627	+		DEFB 000H
1E28		1628		ARM2:	DEF04 0A, 2, 5
1E28	0A	1628	+		DEFB 00AH
1E29	06	1628	+		DEFB 06H
1E2A	02	1628	+		DEFB 02H
1E2B	05	1628	+		DEFB 05H
1E2C		1629			DEF02 00, 40,
1E2C	00	1629	+		DEFB 000H
1E2D	40	1629	+		DEFB 040H
1E2E		1630			DEF02 45, 00,
1E2E	45	1630	+		DEFB 045H
1E2F	00	1630	+		DEFB 000H
1E30		1631			DEF02 10, 00,
1E30	10	1631	+		DEFB 010H
1E31	00	1631	+		DEFB 000H
1E32		1632			DEF02 50, 00,
1E32	50	1632	+		DEFB 050H

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1E33	00	1632	+	DEFB	000H
1E34		1633		DEF02	40, 00,
1E34	40	1633	+	DEFB	040H
1E35	00	1633	+	DEFB	000H
1E36		1634	ARMS:	DEF04	0A, 5, 2, 6
1E36	0A	1634	+	DEFB	00AH
1E37	05	1634	+	DEFB	05H
1E38	02	1634	+	DEFB	02H
1E39	06	1634	+	DEFB	06H
1E3A		1635		DEF02	00, 40,
1E3A	00	1635	+	DEFB	000H
1E3B	40	1635	+	DEFB	040H
1E3C		1636		DEF02	01, 00,
1E3C	01	1636	+	DEFB	001H
1E3D	00	1636	+	DEFB	000H
1E3E		1637		DEF02	05, 00,
1E3E	05	1637	+	DEFB	005H
1E3F	00	1637	+	DEFB	000H
1E40		1638		DEF02	14, 00,
1E40	14	1638	+	DEFB	014H
1E41	00	1638	+	DEFB	000H
1E42		1639		DEF02	5, 00,
1E42	54	1639	+	DEFB	05H
1E43	00	1639	+	DEFB	000H
1E44		1640		DEF02	50, 00,
1E44	50	1640	+	DEFB	050H
1E45	00	1640	+	DEFB	000H
1E46		1641	ARM:	DEF04	0, 5, 1, 5
1E46	0A	1641	+	DEFB	00AH
1E47	05	1641	+	DEFB	05H
1E48	01	1641	+	DEFB	01H
1E49	05	1641	+	DEFB	05H
1E4A	01	1642		DEFB	01H
1E4B	44	1643		DEFB	44H
1E4C	10	1644		DEFB	10H
1E4D	40	1645		DEFB	40H
1E4E	40	1646		DEFB	40H
		1647		**** NOTE ****	
		1648		THE FOLLOWING PATTERNS ARE CONSTRAINED TO EXIST ON THE	
		1649		PAGE. THE FOLLOWING ORG WILL DO IT FOR EXPERIMENTAL	
		1650		PATTERNS ARE: LEGO, LEG1, LEG2, KIL1, KIL2	
		1651		ORG (\$+255). AND. OFF00H	
1E4F	64	1652	GO:	DEFB	64H. AND. OFFH
1E50	04	1653		DEFB	04H
1E51		1654		DEF04	0, 0F, 3, 5
1E51	00	1654	+	DEFB	00H
1E52	0F	1654	+	DEFB	00FH
1E53	03	1654	+	DEFB	03H
1E54	05	1654	+	DEFB	05H
1E55		1655		DEF03	01, 55, 00,
1E55	01	1655	+	DEFB	001H
1E56	55	1655	+	DEFB	055H
1E57	00	1655	+	DEFB	000H
1E58		1656		DEF03	05, 45, 40,
1E58	05	1656	+	DEFB	005H
1E59	45	1656	+	DEFB	045H
1E5A	40	1656	+	DEFB	040H

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1E5B		1657		DEF03	15, 01, 40,
1E5B	15	1657	+	DEFB	015H
1E5C	01	1657	+	DEFB	001H
1E5D	40	1657	+	DEFB	040H
1E5E		1658		DEF03	50, 01, 40,
1E5E	50	1658	+	DEFB	050H
1E5F	01	1658	+	DEFB	001H
1E60	40	1658	+	DEFB	040H
1E61		1659		DEF03	15, 00, 54,
1E61	15	1659	+	DEFB	015H
1E62	00	1659	+	DEFB	000H
1E63	54	1659	+	DEFB	054H
1E64	74	1660	LEG1:	DEFB	LEG2. AND. OFFH
1E65	04	1661		DEFB	4
1E66		1662		DEF04	2, 0F, 2, 5
1E66	02	1662	+	DEFB	02H
1E67	0F	1662	+	DEFB	00FH
1E68	02	1662	+	DEFB	02H
1E69	05	1662	+	DEFB	05H
1E6A		1663		DEF02	15, 50,
1E6A	15	1663	+	DEFB	015H
1E6B	50	1663	+	DEFB	050H
1E6C		1664		DEF02	54, 5
1E6C	54	1664	+	DEFB	054H
1E6D	50	1664	+	DEFB	050H
1E6E		1665		DEF02	50, 5
1E6E	50	1665	+	DEFB	050H
1E6F	50	1665	+	DEFB	050H
1E70		1666		DEF02	50, 50
1E70	50	1666	+	DEFB	050H
1E71	50	1666	+	DEFB	050H
1E72		1667		DEF02	55, 1
1E72	55	1667	+	DEFB	055H
1E73	15	1667	+	DEFB	015H
1E74	4F	1668	LEG:	DEFB	LEG0. AND. OFFH
1E75	04	1669		DEFB	4
1E76		1670		DEF04	3, 0F, 2, 5
1E76	03	1670	+	DEFB	03H
1E77	0F	1670	+	DEFB	00FH
1E78	02	1670	+	DEFB	02H
1E79	05	1670	+	DEFB	05H
1E7A		1671		DEF02	55, 00
1E7A	55	1671	+	DEFB	055H
1E7B	00	1671	+	DEFB	000H
1E7C		1672		DEF02	15, 00,
1E7C	15	1672	+	DEFB	015H
1E7D	00	1672	+	DEFB	000H
1E7E		1673		DEF02	15, 00,
1E7E	15	1673	+	DEFB	015H
1E7F	00	1673	+	DEFB	000H
1E80		1674		DEF02	14, 00,
1E80	14	1674	+	DEFB	014H
1E81	00	1674	+	DEFB	000H
1E82		1675		DEF02	05, 40,
1E82	05	1675	+	DEFB	005H
1E83	40	1675	+	DEFB	040H
1E84	D6	1676	KIL1:	DEFB	KIL2. AND. OFFH

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1E85	14	1677		DEFB	20
1E86		1678		DEF04	0, 1, 4, 13
1E86	00	1678	+	DEFB	00H
1E87	01	1678	+	DEFB	01H
1E88	04	1678	+	DEFB	04H
1E89	13	1678	+	DEFB	013H
1E8A		1679		DEF04	01, 10, 00, 00,
1E8A	01	1679	+	DEFB	001H
1E8B	10	1679	+	DEFB	010H
1E8C	00	1679	+	DEFB	000H
1E8D	00	1679	+	DEFB	000H
1E8E		1680		DEF04	45, 54, 40, 00,
1E8E	45	1680	+	DEFB	045H
1E8F	54	1680	+	DEFB	054H
1E90	40	1680	+	DEFB	040H
1E91	00	1680	+	DEFB	000H
1E92		1681		DEF04	55, 55, 40, 00,
1E92	55	1681	+	DEFB	055H
1E93	55	1681	+	DEFB	055H
1E94	40	1681	+	DEFB	040H
1E95	00	1681	+	DEFB	000H
1E96		1682		DEF04	0A, A8, 00, 00,
1E96	0A	1682	+	DEFB	00AH
1E97	A8	1682	+	DEFB	0A8H
1E98	00	1682	+	DEFB	000H
1E99	00	1682	+	DEFB	000H
1E9A		1683		DEF04	0A, A2, 00, 01,
1E9A	0A	1683	+	DEFB	00AH
1E9B	A2	1683	+	DEFB	0A2H
1E9C	00	1683	+	DEFB	000H
1E9D	01	1683	+	DEFB	001H
1E9E		1684		DEF04	06, AA, 80, 14,
1E9E	0A	1684	+	DEFB	00AH
1E9F	AA	1684	+	DEFB	0AAH
1EA0	80	1684	+	DEFB	080H
1EA1	14	1684	+	DEFB	014H
1EA2		1685		DEF04	0A, AA, 00, 50,
1EA2	02	1685	+	DEFB	002H
1EA3	AA	1685	+	DEFB	0AAH
1EA4	00	1685	+	DEFB	000H
1EA5	50	1685	+	DEFB	050H
1EA6		1686		DEF04	0A, A8, 05, 40,
1EA6	00	1686	+	DEFB	000H
1EA7	A8	1686	+	DEFB	0A8H
1EA8	05	1686	+	DEFB	005H
1EA9	40	1686	+	DEFB	040H
1EAA		1687		DEF04	05, 55, 54, 00,
1EAA	05	1687	+	DEFB	005H
1EAB	55	1687	+	DEFB	055H
1EAC	54	1687	+	DEFB	054H
1EAD	00	1687	+	DEFB	000H
1EAE		1688		DEF04	15, 55, 50, 00,
1EAE	15	1688	+	DEFB	015H
1EAF	55	1688	+	DEFB	055H
1EB0	50	1688	+	DEFB	050H
1EB1	00	1688	+	DEFB	000H
1EB2		1689		DEF04	54, 55, 50, 00,

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ADDR	OBJECT	STMT	LABEL	OPCD	OPERAND	COMMENT
1EB2	54	1689	+	DEFB	054H	
1EB3	55	1689	+	DEFB	055H	
1EB4	50	1689	+	DEFB	050H	
1EB5	00	1689	+	DEFB	000H	
1EB6		1690		DEF04	50, 05, 54, 00,	
1EB6	50	1690	+	DEFB	050H	
1EB7	05	1690	+	DEFB	005H	
1EB8	54	1690	+	DEFB	054H	
1EB9	00	1690	+	DEFB	000H	
1EBA		1691		DEF04	50, 01, 55, 00,	
1EBA	50	1691	+	DEFB	050H	
1EBB	01	1691	+	DEFB	001H	
1EBC	55	1691	+	DEFB	055H	
1EBD	00	1691	+	DEFB	000H	
1EBE		1692		DEF04	10, 01, 55, 40,	
1EBE	10	1692	+	DEFB	010H	
1EBF	01	1692	+	DEFB	001H	
1EC0	55	1692	+	DEFB	055H	
1EC1	40	1692	+	DEFB	040H	
1EC2		1693		DEF04	10, 00, 05, 50,	
1EC2	10	1693	+	DEFB	010H	
1EC3	00	1693	+	DEFB	000H	
1EC4	05	1693	+	DEFB	005H	
1EC5	50	1693	+	DEFB	050H	
1EC6		1694		DEF04	00, 00, 01, 50,	
1EC6	00	1694	+	DEFB	000H	
1EC7	00	1694	+	DEFB	000H	
1EC8	01	1694	+	DEFB	001H	
1EC9	50	1694	+	DEFB	050H	
1ECA		1695		DEF04	00, 00, 00, 40,	
1ECA	00	1695	+	DEFB	000H	
1ECB	00	1695	+	DEFB	000H	
1ECC	00	1695	+	DEFB	000H	
1ECD	40	1695	+	DEFB	040H	
1ECE		1696		DEF04	00, 00, 01, 40,	
1ECE	00	1696	+	DEFB	000H	
1ECF	00	1696	+	DEFB	000H	
1ED0	01	1696	+	DEFB	001H	
1ED1	40	1696	+	DEFB	040H	
1ED2		1697		DEF04	00, 00, 00, 54,	
1ED2	00	1697	+	DEFB	000H	
1ED3	00	1697	+	DEFB	000H	
1ED4	00	1697	+	DEFB	000H	
1ED5	54	1697	+	DEFB	054H	
1ED6	D6	1698	KIL2	DEFB	KIL2. AND. OFFH	
1ED7	3C	1699		DEFB	60	
1ED8		1700		DEF04	0, D, 4, 7	
1ED8	00	1700	+	DEFB	00H	
1ED9	0D	1700	+	DEFB	0DH	
1EDA	04	1700	+	DEFB	04H	
1EDB	07	1700	+	DEFB	07H	
1EDC		1701		DEF04	01, 10, 00, 00,	
1EDC	01	1701	+	DEFB	001H	
1EDD	10	1701	+	DEFB	010H	
1EDE	00	1701	+	DEFB	000H	
1EDF	00	1701	+	DEFB	000H	
1EE0		1702		DEF04	45, 54, 40, 00,	

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1EE0	45	1702	+	DEFB	045H	
1EE1	54	1702	+	DEFB	054H	
1EE2	40	1702	+	DEFB	040H	
1EE3	00	1702	+	DEFB	000H	
1EE4		1703		DEF04	55, 55, 40, 00,	
1EE4	55	1703	+	DEFB	055H	
1EE5	55	1703	+	DEFB	055H	
1EE6	40	1703	+	DEFB	040H	
1EE7	00	1703	+	DEFB	000H	
1EE8		1704		DEF04	0A, A8, 00, 00,	
1EE8	0A	1704	+	DEFB	00AH	
1EE9	A8	1704	+	DEFB	0A8H	
1EEA	00	1704	+	DEFB	000H	
1EEB	00	1704	+	DEFB	000H	
1EEC		1705		DEF04	0A, 38, 15, 01,	
1EEC	0A	1705	+	DEFB	00AH	
1EED	38	1705	+	DEFB	038H	
1EEE	15	1705	+	DEFB	015H	
1EEF	01	1705	+	DEFB	001H	
1EF0		1706		DEF04	16, A5, 55, 41,	
1EF0	16	1706	+	DEFB	016H	
1EF1	A5	1706	+	DEFB	0A5H	
1EF2	55	1706	+	DEFB	055H	
1EF3	41	1706	+	DEFB	041H	
1EF4		1707		DEF04	15, 55, 55, 55,	
1EF4	15	1707	+	DEFB	015H	
1EF5	55	1707	+	DEFB	055H	
1EF6	55	1707	+	DEFB	055H	
1EF7	55	1707	+	DEFB	055H	
1EF8		1708		DEF2	1, 12, 12, 12,	
1EF8	01	1708	+	DEFB	1	
1EF9	0C	1708	+	DEFB	12	
1EFA	20	1709		DEFB	00100000B	
1EFB	30	1710		DEFB	00100000B	
1EFC	38	1711		DEFB	00100000B	
1EFD	30	1712		DEFB	00100000B	
1EFE	B2	1713		DEFB	1010010B	
1EFF	F2	1714		DEFB	1110010B	
1F00	F6	1715		DEFB	1110110B	
1F01	3C	1716		DEFB	00111100B	
1F02	3C	1717		DEFB	00111100B	
1F03	30	1718		DEFB	00100000B	
1F04	30	1719		DEFB	00100000B	
1F05	30	1720		DEFB	00100000B	
1F06	474F5420	1721		DEFM	'GOT ME'	
1FOC	00	1722		DEFB	0	
1F0D	00	1723		DEFB	0	
1F0E	01	1724		DEFB	1	
1F0F	01	1725		DEFB	1	
1F10		1726		DEF04	0, 0, 3, F	
1F10	00	1726	+	DEFB	00H	
1F11	00	1726	+	DEFB	00H	
1F12	03	1726	+	DEFB	03H	
1F13	0F	1726	+	DEFB	0FH	
1F14		1727		DEF03	00, 44, 00,	
1F14	00	1727	+	DEFB	000H	
1F15	44	1727	+	DEFB	044H	

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1F16	00	1727	+	DEFB	000H	
1F17		1728		DEF03	11, 55, 10,	
1F17	11	1728	+	DEFB	011H	
1F18	55	1728	+	DEFB	055H	
1F19	10	1728	+	DEFB	010H	
1F1A		1729		DEF03	15, 55, 50,	
1F1A	15	1729	+	DEFB	015H	
1F1B	55	1729	+	DEFB	055H	
1F1C	50	1729	+	DEFB	050H	
1F1D		1730		DEF03	02, AA, 00,	
1F1D	02	1730	+	DEFB	002H	
1F1E	AA	1730	+	DEFB	0AAH	
1F1F	00	1730	+	DEFB	000H	
1F20		1731		DEF03	02, A2, 00,	
1F20	02	1731	+	DEFB	002H	
1F21	A2	1731	+	DEFB	0A2H	
1F22	00	1731	+	DEFB	000H	
1F23		1732		DEF03	02, AA, 80,	
1F23	02	1732	+	DEFB	002H	
1F24	AA	1732	+	DEFB	0AAH	
1F25	80	1732	+	DEFB	080H	
1F26		1733		DEF03	00, 80, 00,	
1F26	00	1733	+	DEFB	000H	
1F27	AA	1733	+	DEFB	0AAH	
1F28	00	1733	+	DEFB	000H	
1F29		1734		DEF03	00, 80, 00,	
1F29	00	1734	+	DEFB	000H	
1F2A	A8	1734	+	DEFB	0A8H	
1F2B	00	1734	+	DEFB	000H	
1F2C		1735		DEF03	15, 80, 00,	
1F2C	15	1735	+	DEFB	015H	
1F2D	55	1735	+	DEFB	055H	
1F2E	00	1735	+	DEFB	000H	
1F2F		1736		DEF03	55, 80, 50,	
1F2F	55	1736	+	DEFB	055H	
1F30	55	1736	+	DEFB	055H	
1F31	50	1736	+	DEFB	050H	
1F32		1737		DEF03	51, 80, 50,	
1F32	51	1737	+	DEFB	051H	
1F33	55	1737	+	DEFB	055H	
1F34	50	1737	+	DEFB	050H	
1F35		1738		DEF03	41, 80, 00,	
1F35	41	1738	+	DEFB	041H	
1F36	55	1738	+	DEFB	055H	
1F37	00	1738	+	DEFB	000H	
1F38		1739		DEF03	41, 55, 00,	
1F38	41	1739	+	DEFB	041H	
1F39	55	1739	+	DEFB	055H	
1F3A	00	1739	+	DEFB	000H	
1F3B		1740		DEF03	45, 55, 00,	
1F3B	45	1740	+	DEFB	045H	
1F3C	55	1740	+	DEFB	055H	
1F3D	00	1740	+	DEFB	000H	
1F3E	01	1741		DEFB	01H	
1F3F	55	1742		DEFB	55H	
1F40		1743	WAGPAT:	DEF04	0, 0, 4, 16	
1F40	00	1743	+	DEFB	00H	

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ADDR	OBJECT	STMT	LABEL	OPCD	OPERAND	COMMENT
1F41	00	1743	+	DEFB	00H	
1F42	04	1743	+	DEFB	04H	
1F43	16	1743	+	DEFB	016H	
1F44		1744		DEF04	00, 05, 50, 00,	
1F44	00	1744	+	DEFB	000H	
1F45	05	1744	+	DEFB	005H	
1F46	50	1744	+	DEFB	050H	
1F47	00	1744	+	DEFB	000H	
1F48		1745		DEF04	00, 55, 55, 00,	
1F48	00	1745	+	DEFB	000H	
1F49	55	1745	+	DEFB	055H	
1F4A	55	1745	+	DEFB	055H	
1F4B	00	1745	+	DEFB	000H	
1F4C		1746		DEF04	01, 55, 55, 40,	
1F4C	01	1746	+	DEFB	001H	
1F4D	55	1746	+	DEFB	055H	
1F4E	55	1746	+	DEFB	055H	
1F4F	40	1746	+	DEFB	040H	
1F50		1747		DEF04	05, 55, 55, 50,	
1F50	05	1747	+	DEFB	005H	
1F51	55	1747	+	DEFB	055H	
1F52	55	1747	+	DEFB	055H	
1F53	50	1747	+	DEFB	050H	
1F54		1748		DEF04	15, 54, 15, 54,	
1F54	15	1748	+	DEFB	015H	
1F55	54	1748	+	DEFB	054H	
1F56	15	1748	+	DEFB	015H	
1F57	54	1748	+	DEFB	054H	
1F58		1749		DEF04	15, 50, 05, 54,	
1F58	15	1749	+	DEFB	015H	
1F59	50	1749	+	DEFB	050H	
1F5A	05	1749	+	DEFB	005H	
1F5B	54	1749	+	DEFB	054H	
1F5C		1750		DEF04	15, 40, 01, 54,	
1F5C	15	1750	+	DEFB	015H	
1F5D	40	1750	+	DEFB	040H	
1F5E	01	1750	+	DEFB	001H	
1F5F	54	1750	+	DEFB	054H	
1F60		1751		DEF04	15, 40, 01, 54,	
1F60	15	1751	+	DEFB	015H	
1F61	40	1751	+	DEFB	040H	
1F62	01	1751	+	DEFB	001H	
1F63	54	1751	+	DEFB	054H	
1F64		1752		DEF04	15, 50, 05, 54,	
1F64	15	1752	+	DEFB	015H	
1F65	50	1752	+	DEFB	050H	
1F66	05	1752	+	DEFB	005H	
1F67	54	1752	+	DEFB	054H	
1F68		1753		DEF04	05, 54, 15, 50,	
1F68	05	1753	+	DEFB	005H	
1F69	54	1753	+	DEFB	054H	
1F6A	15	1753	+	DEFB	015H	
1F6B	50	1753	+	DEFB	050H	
1F6C		1754		DEF04	01, 55, 55, 40,	
1F6C	01	1754	+	DEFB	001H	
1F6D	55	1754	+	DEFB	055H	
1F6E	55	1754	+	DEFB	055H	

PROPRIETARY INFORMATION

DO NOT REPRODUCE

ADDR	OBJECT	STMT	LABEL	OP/CD	OPERAND	COMMENT
1F6F	40	1754	+	DEFB	040H	
1F70		1755		DEF04	00, 55, 55, 00,	
1F70	00	1755	+	DEFB	000H	
1F71	55	1755	+	DEFB	055H	
1F72	55	1755	+	DEFB	055H	
1F73	00	1755	+	DEFB	000H	
1F74		1756		DEF04	00, 15, 54, 00,	
1F74	00	1756	+	DEFB	000H	
1F75	15	1756	+	DEFB	015H	
1F76	54	1756	+	DEFB	054H	
1F77	00	1756	+	DEFB	000H	
1F78		1757		DEF04	02, AA, AA, 80,	
1F78	02	1757	+	DEFB	002H	
1F79	AA	1757	+	DEFB	0AAH	
1F7A	AA	1757	+	DEFB	0AAH	
1F7B	80	1757	+	DEFB	080H	
1F7C		1758		DEF04	00, AA, AA, 00,	
1F7C	00	1758	+	DEFB	000H	
1F7D	AA	1758	+	DEFB	0AAH	
1F7E	AA	1758	+	DEFB	0AAH	
1F7F	00	1758	+	DEFB	000H	
1F80		1759		DEF04	12, AA, AA, 84,	
1F80	12	1759	+	DEFB	012H	
1F81	AA	1759	+	DEFB	0AAH	
1F82	AA	1759	+	DEFB	0AAH	
1F83	84	1759	+	DEFB	084H	
1F84		1760		DEF04	10, A8, 2A, 04,	
1F84	10	1760	+	DEFB	010H	
1F85	A8	1760	+	DEFB	0A8H	
1F86	2A	1760	+	DEFB	02AH	
1F87	04	1760	+	DEFB	004H	
1F88		1761		DEF04	10, 20, 08, 04,	
1F88	10	1761	+	DEFB	010H	
1F89	20	1761	+	DEFB	020H	
1F8A	08	1761	+	DEFB	008H	
1F8B	04	1761	+	DEFB	004H	
1F8C		1762		DEF04	52, AA, AA, 85,	
1F8C	52	1762	+	DEFB	052H	
1F8D	AA	1762	+	DEFB	0AAH	
1F8E	AA	1762	+	DEFB	0AAH	
1F8F	85	1762	+	DEFB	085H	
1F90		1763		DEF04	10, 20, 08, 04,	
1F90	10	1763	+	DEFB	010H	
1F91	20	1763	+	DEFB	020H	
1F92	08	1763	+	DEFB	008H	
1F93	04	1763	+	DEFB	004H	
1F94		1764		DEF04	10, 00, 00, 04,	
1F94	10	1764	+	DEFB	010H	
1F95	00	1764	+	DEFB	000H	
1F96	00	1764	+	DEFB	000H	
1F97	04	1764	+	DEFB	004H	
1F98		1765		DEF04	10, 00, 00, 04,	
1F98	10	1765	+	DEFB	010H	
1F99	00	1765	+	DEFB	000H	
1F9A	00	1765	+	DEFB	000H	
1F9B	04	1765	+	DEFB	004H	
		1766	;			

PROPRIETARY INFORMATION

Dave Nutting Associates, Inc.

DO NOT REPRODUCE

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1F9C 00      1767. FUDG4:  DEFB 0
              1768 ;
1F9D        1769 MSET  MASTER 0A4
1F9D 80      1769 +    DEFB 80H
1F9E 11      1769 +    DEFB 0A4
1F9F        1770      VOLUME 09H, 0H
1F9F B0      1770 +    DEFB 0B0H
1FA0 09      1770 +    DEFB 09H
1FA1 00      1770 +    DEFB 0H
1FA2 C9      1771      RET
              1772 ; HOME ON THE RANGE
1FA3 CD9D1F  1773 HOME  CALL MSET
1FA6        1774      NOTE1 36, G1
1FA6 24      1774 +    DEFB 36&7FH
1FA7 7E      1774 +    DEFB G1
1FA8        1775      NOTE1 12, F1
1FA8 0C      1775 +    DEFB 12&7FH
1FA9 8D      1775 +    DEFB F1
1FAA        1776      NOTE1 18, E1
1FAA 12      1776 +    DEFB 18&7FH
1FAB 96      1776 +    DEFB E1
1FAC        1777      NOTE1 6, D1
1FAC 06      1777 +    DEFB 6&7FH
1FAD A8      1777 +    DEFB D1
1FAE        1778      NOTE1 36, E1
1FAE 24      1778 +    DEFB 36&7FH
1FAF 96      1778 +    DEFB E1
1FB0        1779      QUIET
1FB0 F0      1779 +    DEFB 0F0H
              1780 TAPS
1FB1        1781 TAPS
1FB1 CD9D1F  1782      CALL MSET
1FB4        1783      NOTE1 18, C1
1FB4 12      1783 +    DEFB 18&7FH
1FB5 BD      1783 +    DEFB C1
1FB6        1784      NOTE1 6, C1
1FB6 06      1784 +    DEFB 6&7FH
1FB7 BD      1784 +    DEFB
1FB8        1785      NOTE1 36, F1
1FB8 24      1785 +    DEFB 36&7FH
1FB9 8D      1785 +    DEFB F1
1FBA        1786      NOTE1 18, C1
1FBA 12      1786 +    DEFB 18&7FH
1FBB BD      1786 +    DEFB
1FBC        1787      NOTE1 6, F1
1FBC 06      1787 +    DEFB 6&7FH
1FBD 8D      1787 +    DEFB F1
1FBE        1788      NOTE1 36, A1
1FBE 24      1788 +    DEFB 36&7FH
1FBF 70      1788 +    DEFB A1
1FC0        1789      QUIET
1FC0 F0      1789 +    DEFB 0F0H
              1790 ; FUNERAL
1FC1        1791 FUNERL
1FC1 CD9D1F  1792      CALL MSET
1FC4        1793      NOTE1 24, A0
1FC4 18      1793 +    DEFB 24&7FH
  
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PROPRIETARY INFORMATION

Dave Studing Associates, Inc.

DO NOT REPRODUCE

ADDR	OBJECT	STMT	LABEL	OPCODE	OPERAND	COMMENT
1FC5	E1	1793	+	DEFB	A0	
1FC6		1794		NOTE1	18, A0	
1FC6	12	1794	+	DEFB	18&7FH	
1FC7	E1	1794	+	DEFB	A0	
1FC8		1795		NOTE1	6, A0	
1FC8	06	1795	+	DEFB	6&7FH	
1FC9	E1	1795	+	DEFB	A0	
1FCA		1796		NOTE1	24, A0	
1FCA	18	1796	+	DEFB	24&7FH	
1FCB	E1	1796	+	DEFB	A0	
1FCC		1797		NOTE1	18, C1	
1FCC	12	1797	+	DEFB	18&7FH	
1FCD	BD	1797	+	DEFB	C1	
1FCE		1798		NOTE1	6, B0	
1FCE	06	1798	+	DEFB	6&7FH	
1FCF	C8	1798	+	DEFB	B0	
1FDO		1799		NOTE1	18, B0	
1FDO	12	1799	+	DEFB	18&7FH	
1FD1	C8	1799	+	DEFB	B0	
1FD2		1800		NOTE1	6, A0	
1FD2	06	1800	+	DEFB	6&7FH	
1FD3	E1	1800	+	DEFB	A0	
1FD4		1801		NOTE1	18, B0	
1FD4	12	1801	+	DEFB	18&7FH	
1FD5	E1	1801	+	DEFB	A0	
1FD6		1802		NOTE1	6, B0	
1FD6	06	1802	+	DEFB	6&7FH	
1FD7	EE	1802	+	DEFB	GS0	
1FD8		1803		NOTE1	18, B0	
1FD8	12	1803	+	DEFB	18&7FH	
1FD9	E1	1803	+	DEFB	A0	
1FDA		1804		QUIET		
1FDA	FO	1804	+	DEFB	OF0H	
1FDB		1805		GUNSHOT	OUTPUT 18H, OF0H, OF5H, OFAH, OFFH, O, 3FH, OFFH, OEFH	
		1805	+	IF	. NOT(18H=18H)	
		1805	+	ENDIF		
		1805	+	IF	18H=3H	
1FDB	88	1805	+	DEFB	88H	
1FDC		1805	+	DEFB	OEFH, OFFH, 3FH, O, OFAH, OFDH, OF5H, OF0H	
1FDC	EF	1805	+	DEFB	OEFH	
1FDD	FF	1805	+	DEFB	OFFH	
1FDE	3F	1805	+	DEFB	3FH	
1FDF	OQ	1805	+	DEFB	O	
1FE0	FF	1805	+	DEFB	OFFH	
1FE1	FD	1805	+	DEFB	OFDH	
1FE2	F5	1805	+	DEFB	OF5H	
1FE3	FO	1805	+	DEFB	OF0H	
		1805	+	ENDIF		
1FE4		1806		LEGSTA		
1FE4	E0	1806	+	DEFB	OE0H	
1FE5		1807		VOLUME	OFFH, O3FH	
1FE5	B0	1807	+	DEFB	OB0H	
1FE6	FF	1807	+	DEFB	OFFH	
1FE7	3F	1807	+	DEFB	O3FH	
1FE8		1808		REST	5	
1FE8	E1	1808	+	DEFB	OE1H	
1FE9	O5	1808	+	DEFB	5	

PROPRIETARY INFORMATION

Dave Nutting Associates, Inc.

DO NOT REPRODUCE

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1FEA          1809          NOTE1 5,8FH
1FEA 05       1809 +       DEFB 5&7FH
1FEB 8F       1809 +       DEFB 8FH
1FEC          1810          NOTE1 5,4CH
1FEC 05       1810 +       DEFB 5&7FH
1FED 4C       1810 +       DEFB 4CH
1FEE          1811          QUIET
1FEE FO       1811 +       DEFB 0FOH
>1FEF        1812 LASTB   EQU $
  
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1814 ; *****
1815 ; * RAM CELLS *
1816 ; *****
1817          1817          ORG  NORMEM+0E70H
4E70          1818          DEFS 150
>4F06         1819          EQU $
4F06          1820          DEFS 12
>4F12         1821          EQU $
>4F12         1822          EQU $
4F12          1823          DEFS 3
4F15          1824          DEFS 3
>4F18         1825          EQU $
4F18          1826          DEFS BULVSZ
4F2A          1827          DEFS BULVSZ
4F3C          1828          DEFS BULVSZ
4F4E          1829          DEFS BULVSZ
4F60          1830          DEFS 1
4F61          1831          DEFS GFVSIZ-1
4F77          1832          DEFS 1
4F78          1833          DEFS GFVSIZ-1
4F8E          1834          DEFS 1
4F8F          1835          DEFS WAGVSZ
>4F90         1836          EQU WAVEC+VBSTAT
>4FA1         1837          EQU $
>4FDA         1838          EQU $
>4FDB         1839          EQU $
4FA1          1840          DEFS 1
4FA2          1841          DEFS 3
4FA5          1842          DEFS 1
4FA6          1843          DEFS 1
>1FEF        1844          LIST
4FA9          1845          EQU LASTB
          1846          END
  
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PROPRIETARY INFORMATION
 Dave Halliday, Inc.

DO NOT REPRODUCE

TOTAL ASSEMBLER ERROR =

CROSS REFERENCE

LABEL	VALUE	REFERENCE							
A0	00E1	-508	1794	1795	1796	1797	1801	1802	1804
A1	0070	-520	1789						
A2	0037	-532							
A3	001B	-544							
A4	000D	-556							
A5	0006	-562							
ACTINT	000E	-225							
ADDTQ	1D54	-1355	1110	1274	1423	1441			
ADDTQ1	1D68	-1372	1482						
ALINE	0009	-676	1053	1055	1055	1531			
ALKEYS	0214	-49	1180						
ARM0	1DFC	-1479	1569						
ARM1	1E0A	-1479	1570						
ARM2	1E14	-1479	1571						
ARM3	1E1C	-1479	1572						
ARM4	1E28	-1479	1573						
ARM5	1E36	-1479	1574						
ARM6	1E46	-1479	1575						
ARMTBL	1DDB	-1439	1255						
AS0	00D4	-509							
AS1	006A	-521							
AS2	0034	-533							
AS3	001A	-545							
B0	00C8	-510	799	1800					
B1	0064	-521							
B2	0031	-534							
B3	0018	-546							
BCACY	0046	-667	668						
BCDADD	0062	-277							
BCDCHS	006A	-291							
BCDDIV	0068	-280							
BCDMUL	0066	-279							
BCDNEG	006C	-282							
BCDSUB	0064	-278							
BEGIN	1B61	-1132							
BEGRAM	4FCE	-594							
BELP	1859	-773	785						
BERASE	183A	-756	757						
BITSPL	00A0	-43							
BLANK	002A	-243	1148	1169					
BLINE	005C	-677	1031	1055	1520	1526	1531		
BMUSIC	0012	-229	814	814	937	937	1055		
BORG	1AAD	-1064	1111						
BOTLIN	0000	-685	1347						
BSY	0002	-656	713	771	1063	1069	1155		
BTREEY	0041	-668							
BULLMT	1D8F	-1410	868	1355					
BULLP	1AB9	-1068	1131						
BULRIT	1B57	-1125	1159	1165					
BULT	000B	-1429	1156						
BULTAB	1D93	-1420	792						
BULV1	4F18	-1541	728	1121	1186	1291	1304	1353	
BULV2	4F2A	-1542							

PROPRIETARY INFORMATION

Dave Nutting Associates, Inc.

DO NOT REPRODUCE

BULV3	4F3C	-1543	734						
BULV4	4F4E	-1544							
BULVSZ	0012	-679	744	1120	1187	1292	1336	1356	1826
		1827	1828	1829					
BYTEPL	0029	-42	1053	1055	1055				
C1	00BD	-511	1784	1785	1787	1798			
C2	005E	-523							
C3	002E	-535							
C4	0017	-547							
C5	000B	-557							
C6	0005	-563							
C7	0002	-566							
CACTUS	1EF8	-1499	949	1118					
CACW	19C8	-953	958	964	972	981			
CBA	0009	-123							
CBB	0007	-121	735						
CBC	0006	-120							
CBD	0005	-119							
CBE	0004	-118							
CBFLAG	0008	-117							
CBH	000B	-116							
CBIXH	0003	-115							
CBIXL	0002	-114							
CBiyH	0001	-113							
CBiyL	0000	-112							
CBL	000A	-111							
CCACX	004C	-110	877	1115					
CHDOWN	0001	-109							
CHLEFT	0002	-108							
CHRDIS	0032	-107	1154	1164	1221	1222	1223	1224	1225
CHRIGH	0003	-106							
CHTRIG	0004	-105							
CHUP	0000	-104							
CNT	4FDD	-103							
COL0L	0004	-102							
COL0R	0000	-101							
COL1L	0005	-100							
COL1R	0001	-99							
COL2L	0006	-98							
COL2R	0002	-97							
COL3L	0007	-96							
COL3R	0003	-95							
COLBX	000B	-94							
COLLST	4FEB	-93							
COLSET	0018	-92	1035						
CONCM	0008	-91							
COWINT	1D34	-90	1097	1100					
COWX	0060	-89							
CS1	00B2	-88							
CS2	0059	-87							
CS3	002C	-86							
CS4	0015	-85							
CS5	000A	-84							
CT0	4FD5	-83							
CT1	4FD6	-82							
CT2	4FD7	-81							
CT3	4FD8	-80							

PROPRIETARY INFORMATION

Dave Nutting Associates, Inc.

DO NOT REPRODUCE

CT4	4FD9	-606					
CT5	4FDA	-607	1048	1838			
CT6	4FDB	-608	1839				
CT7	4FDC	-609	708	716	758	763	1025
CTIMER	0203	-46					
D1	00A8	-513	1778				
D2	0054	-525					
D3	0029	-537					
D4	0014	-549					
DABS	0072	-285					
DADD	006E	-283					
DCLOCK	17E1	-704	1219				
DCOUT	17F7	-713	710				
DEATH	1B10	-1113					
DECCTS	0010	-226	706	706			
DELQ	1D29	-1335	1239	1370	1438		
DIE	1930	-881	895				
DIE1	194C	-892	909				
DIE4	1963	-900	922				
DIFER	4FFF	-121					
DISNUM	0036	-25	712	712	1062	1068	
DISTIM	0052	-267					
DLEFT	1942	-88	902				
DOIT	0044	-260	1182				
DOITB	0046	-26					
DRAW	1D8B	-1408	1153				
DRX	0040	-66	1153				
DS1	009F	-51					
DS2	004F	-52					
DS3	0027	-53					
DS4	0013	-55					
DS5	0009	-55					
DS6	0004	-56					
DSMG	0070	-28					
DTAB	1B38	-1133	1182				
DURAT	4FEA	-62					
E1	0096	-518	1777	1779			
E2	004A	-52					
E3	0025	-53					
E4	0012	-55					
EIRE	1BBE	-116					
ELOP	1917	-86	892				
EMUSIC	0014	-23					
END	00C0	-37	1219	1219			
ENDGAM	1B30	-113	1075				
ENDRAM	4FA1	-155	1057				
ENDRND	1B2C	-112	1210	1211			
ENDSCR	4FF4	-63	1020				
ERASE	190A	-86	898	900			
F1	008D	-51	1776	1786	1788		
F2	0046	-52					
F3	0022	-540					
F4	0011	-552					
F5	0008	-560					
FIELD	1988	-917	1084	1088			
FILL	001A	-235	1024	1053	1055	1057	
FIRE0	17FF	-720	1217				

PROPRIETARY INFORMATION

Dave Nutting Associates, Inc.

DO NOT REPRODUCE

FIRE1	180A	-724	1218		
FIRST	1D6B	-1379	1238	1341	1368
FIRSTC	2000	-40			
FNTSML	020D	-48	707	1060	1144
FNTSYS	0206	-47			
FS1	0085	-517			
FS2	0042	-529			
FS3	0020	-541			
FS4	0010	-553			
FTBASE	0000	-93			
FTBYTE	0003	-96			
FTFSX	0001	-94			
FTFSY	0002	-95			
FTPTH	0006	-99			
FTPTL	0005	-98			
FTYSIZ	0004	-97			
FUDG4	1F9C	-1519			
FUNERL	1FC1	-1528	914		
G0	00FD	-506			
G1	007E	-518	1775		
G2	003E	-530			
G3	001F	-542			
G4	000F	-554			
G5	0007	-566			
G6	0003	-568			
G7	0001	-567			
G8	0000	-568			
GAMSTB	4FF8	-634	1029	1204	
GETNUM	004E	-265			
GETPAR	004C	-264	1018	1018	
GETRDY	1D7E	-1402	1077		
GFBODY	1F10	-1516	1264		
GFCOLS	1DC7	-1420	1035		
GFLFR	1BC5	-1174	1516		
GFVSIZ	0017	-680	1296	1831	1833
GFWRIT	1B5D	-1129	1517		
GFWRT1	1BA4	-1160	1243		
GFWRT2	1BAC	-1161	1265	1281	
GFWRT3	1BB4	-1162			
GFWRT4	1BAE	-1160			
GFWRT5	1BC0	-1165	1254		
GOTME	1F06	-1511	938		
GRX	002C	-661	1077		
GRY	0001	-662	1077	1153	
GSO	00EE	-507	1803		
GS1	0077	-519			
GS2	003B	-531			
GS3	001D	-543			
GS4	000E	-555			
GSBEND	0007	-61	1205		
GSBSCR	0001	-61	1028		
GSBTIM	0000	-60			
GTMINS	4FEE	-628			
GTSECS	4FED	-627			
GUNLMT	1D87	-1404	1394		
GUNSHO	1FDB	-1530	816		
GVEC3A	1CDD	-1296	1386	1391	

PROPRIETARY INFORMATION

Dave Nutting Associates, Inc.

DO NOT REPRODUCE

LFIELD	4FA5	-1557	1085			
LFRLIN	00C8	-686	1235			
LFRVEC	1D78	-1397	1136	1233		
LFTAB	1DBD	-1420	1087			
LNK	0008	-655	1062			
LOOP	1B07	-1109	1197	1199		
LPPP2	1B19	-1116	1198			
LSCORE	4FA2	-1556	915	1066		
MAGIC	000C	-190	718	1311		
MATH	0056	-270				
MCAC	19A6	-933	963			
MCACY	002A	-666	1116			
MCALL	0006	-219	1159	1165		
MENU	004A	-263				
MENUST	0218	-50				
MIDC	1AA2	-1058	1103			
MJUMP	000A	-221				
MOVE	005E	-275	1048			
MRET	0008	-228	821	1226		
MRFLOP	0006	-10	772	897	901	
MRLOCK	4FF7	-63				
MROR	0004	-108				
MRROR	0002	-10				
MRSHT	0003	-10				
MRXOR	0005	-10				
MRXPND	0003	-10				
MSET	1F9D	-152	1773	1782	92	
MSKTD	007E	-29	830	830		
MSTACK	4F12	-153	314	934	37	
MUZAK	0012	-228				
MUZPC	4FCE	-59				
MUZSP	4FD0	-59				
MXSCR	021E	-5	1018			
NBRK	189D	-807	1216			
NEGT	0074	-286				
NEXT	FFFF	-62	1455	1477		
NOGAME	0235	-5				
NOPLAY	0228	-5				
NORMEM	4000	-3	1053	1055	824	1326
NULPAT	1F0C	-151	1280			
NUMB	0007	-1423				
NUMPLY	4FF3	-63				
NWHDWR	0001	-3				
OA1	008F	-57				
OA2	0047	-57				
OA3	0023	-57				
OA4	0011	-57	1770			
OA5	0008	-58				
OBO	00FE	-57				
OCO	00F1	-57				
OD1	00D6	-572				
OE1	00BF	-573				
OF1	00B4	-574				
OG1	00A0	-575				
OPOTO	4FDF	-613				
OPOT1	4FE0	-614				
OPOT2	4FE1	-615				

PROPRIETARY INFORMATION

Dave Nutting Associates, Inc.

DO NOT REPRODUCE

OPOT3	4FE2	-616					
OSW0	4FE4	-618					
OSW1	4FE5	-619					
OSW2	4FE6	-620					
OSW3	4FE7	-621					
PAWS	0050	-266	942	942	1142	1142	1167
PIZBRK	0048	-262	820				
PJOY	1899	-812	823				
POT0	001C	-201					
POT1	001D	-202					
POT2	001E	-203					
POT3	001F	-204					
PPOT	18BE	-826	838				
PPOT0	18B9	-823	1212				
PPOT1	18B1	-819	1213				
PRIOR	4FF9	-635					
PSWCY	0000	-58					
PSWPV	0002	-57					
PSWSGN	0007	-55					
PSWZRO	0006	-56					
PUTVEC	19D3	-961	804	810			
PVOLAB	4FD2	-598					
PVOLMC	4FD3	-599					
QUIT	0078	-288	1208	1208			
RANGED	0076	-287					
RANSHT	4FEF	-630					
RBULS	4FDB	-1554	733				
RBULX	0068	-659	771	1162			
RCACX	0058	-670	673	872			
RCALL	0004	-218	075				
RCOWB	4F78	-1548	732	824			
RECTAN	001C	-236					
RELAB1	003A	-253	780	780			
RELABS	0038	-252	1321	1321			
RESTOR	002E	-245					
RFIELD	4FA1	-1555	1081				
RFTAB	1DC2	-1420	1083				
RITB	184F	-769	774				
RNX	0088	-657	068				
RSCORE	4FA6	-1558	908	1072			
SAVE	002C	-244					
SCHEDR	000C	-224					
SCREEN	0000	-41	1324	1326			
SCROLL	0030	-246					
SCRSTR	0016	-232					
SCT0	0001	-128					
SCT1	0002	-129					
SCT2	0003	-130					
SCT3	0004	-131					
SCT4	0005	-132					
SCT5	0006	-133					
SCT6	0007	-134					
SCT7	0008	-135	1210				
SEMI4S	4FDE	-612	944	1195			
SENFLG	4FFA	-636					
SENTRY	0042	-259	1180				
SETB	007A	-289	1028				

PROPRIETARY INFORMATION

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DO NOT REPRODUCE

SETOUT	0016	-233	1031						
SETW	007C	-290							
SFO	0009	-136	1211						
SF1	000A	-137							
SF2	000B	-138							
SF3	000C	-139							
SF4	000D	-140							
SF5	000E	-141							
SF6	000F	-142							
SF7	0010	-143							
SHIFU	0060	-276							
SINIT	1DCF	-1428	1050						
SJO	0015	-152	1214						
SJ1	0017	-154	1215						
SJ2	0019	-156							
SJ3	0018	-158							
SKYD	0013	-145	1216						
SKYU	0012	-146							
SNDBX	0019	-184							
SNUL	0000	-127							
SPO	001C	-147	1212						
SP1	001D	-148	1213						
SP2	001E	-149							
SP3	001F	-150							
SSEC	0011	-14	1219						
ST0	0014	-151	1217						
ST1	0016	-152	1218						
ST2	0018	-153							
ST3	001A	-154							
STACK	4F06	-1534	1021	1024	1025				
STHN	18A4	-81							
STIMER	0200	-45	1427						
STMRX	004C	-660	712						
STOREN	0058	-272							
STRDIS	0034	-249	941	941	1077	1153			
STRND	1A0C	-1001	1202						
STRRAM	4F12	-153	1057	1057					
STSEC	1837	-755	761						
SUCK	000C	-222	725	725	731	731	904	904	911
		91	1059	1161					
SW0	0010	-197							
SW1	0011	-198							
SW2	0012	-199							
SW3	0013	-200							
SYSRAM	4FCE	-63							
TAPS	1FB1	-1525	907						
TBUMP	1D1E	-132	1294	1298	1450				
TBUMP1	1D25	-133	1447						
TCAC	199B	-92	957						
TCACY	0014	-66	665						
TIME	000B	-1430	714	1064	1070				
TIMOUT	4FEC	-626							
TIYU	1ABE	-1071	1125						
TLINE	000A	-675	676	921	1109	1519	1525		
TMR60	4FEB	-625							
TONEA	0011	-177							
TONEB	0012	-178							

PROPRIETARY INFORMATION

Dave Nutting Associates, Inc.

DO NOT REPRODUCE

TONEC	0013	-179								
TONMO	0010	-176								
TOPLIN	006A	-684	1349							
TREE	1DE9	-1462	976							
TTREEY	000F	-665								
UMARGT	4FFB	-637								
UPISTR	0000	-215								
USERTE	4FFD	-638								
VBARM	000F	-689	690	787	950	1257	1310	1323	1413	
		1469								
VBBLNK	0006	-87	1306	1313	1334					
VBCCHK	0004	-84								
VBCH	0003	-83								
VBCL	0002	-82								
VBCLAT	0003	-91	858	1360						
VBCLMT	0000	-89								
VBCOMP	0013	-693								
VBCREV	0001	-90								
VBDCH	0001	-81								
VBDCL	0000	-80								
VBDXH	0004	-68	832	1380						
VBDXL	0003	-67	833	1379	1463					
VBDYH	0009	-73	830	1382						
VBDYL	0008	-72	831	1107	1331					
VBLANK	0028	-242	247	1247	1269	1269				
VBLEG	0012	-692	693	917	1208	1388	1407	1470		
VBLEGT	0011	-691	692	916	1400	1411				
VBMR	0000	-64	772	826	901	1099	1105	1099	1105	
		1127	319							
VBOAH	000E	-78	689	1271	1321					
VBOAL	000D	-77	1272	1309						
VBOARM	0010	-690	691	1414						
VBSACT	0007	-86	315	1332	1362					
VBSCHG	0003	-696	1389	1397	1416	1439				
VBSINT	0005	-698	1253	1333	1376					
VBSNOM	0004	-697	1385	1390	1398					
VBSTAT	0001	-65	853	960	871	918	1242	1253		
		1291	1306	1313	1332	1333	1334	1357		
		1362	1373	1376	1389	1397	1397	1398		
		1410	1416	1419	1464	1839				
VBSWAG	0000	-695	242	1373						
VBTIME	0002	-66	866	1384						
VBXCHK	0007	-71	858	861	1128	1360	1465			
VBXH	0006	-70	863	1108	1128	1467				
VBXL	0005	-69								
VBYCHK	000C	-76	1106	1129	1109	1317	1396	1468		
VBYH	000B	-75	879	919						
VBYL	000A	-74								
VECG	4F15	-1539	1092	1096	1273	1367	1422	1437		
VECSTR	4F18	-1540								
VECT	003E	-255	870	870	1360	1360	1396	1396	1437	
		1437								
VECTC	003C	-254								
VERAF	000E	-194								
VERBL	000A	-174								
VIBRA	0014	-180								
VOICES	4FD4	-600								

PROPRIETARY INFORMATION
 Do Not Reproduce

DO NOT REPRODUCE

VOLAB	0016	-181						
VOLC	0015	-182						
VOLN	0017	-183						
VWRITR	001E	-237	1252	1252	1264	1264	1271	1271
WAGLMT	1D7C	-1400	1435					
WAGON.	4F90	-1551	874	970	1079	1101		
WAGPAT	1F40	-1518	1269					
WAGVEC	4F8F	-1550	1104	1836				
WAGVSZ	0012	-681	1835					
WAGX	0048	-672	864					
WALK	1AD5	-1085						
WASTE	0FFF	-585	719	1241	1302	1326		
WASTER	0FFF	-586						
WINBND	0032	-683	1346					
WRBL5A	1C52	-1240	1342					
WRBUL1	1BE9	-1195	1338					
WRBUL2	1C00	-1204	1307					
WRBUL3	1C2D	-1221	1331					
WRBUL4	1C31	-1223	1316					
WRBUL5	1C4F	-1237	1348					
WRBUL6	1C5E	-1244	1364					
WRBUL7	1C70	-1248	1358	1361				
WRIT	0024	-240						
WRITA	0026	-241						
WRITP	0022	-239	991	991	1115	1115		
WRITQ	4F12	-1538	1091	1237	1440	1440		
WRITR	0020	-238						
WRTVEC	1D7A	-1398	1343					
XINTC	0002	-217	1041	1078	1174	1184	1202	
XPAND	0019	-191	952	979	1113			
XPNDON	0001	-31						
ZOK	1828	-745	743	748				
ZORE	1813	-727	729					

PROPRIETARY INFORMATION

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DO NOT REPRODUCE