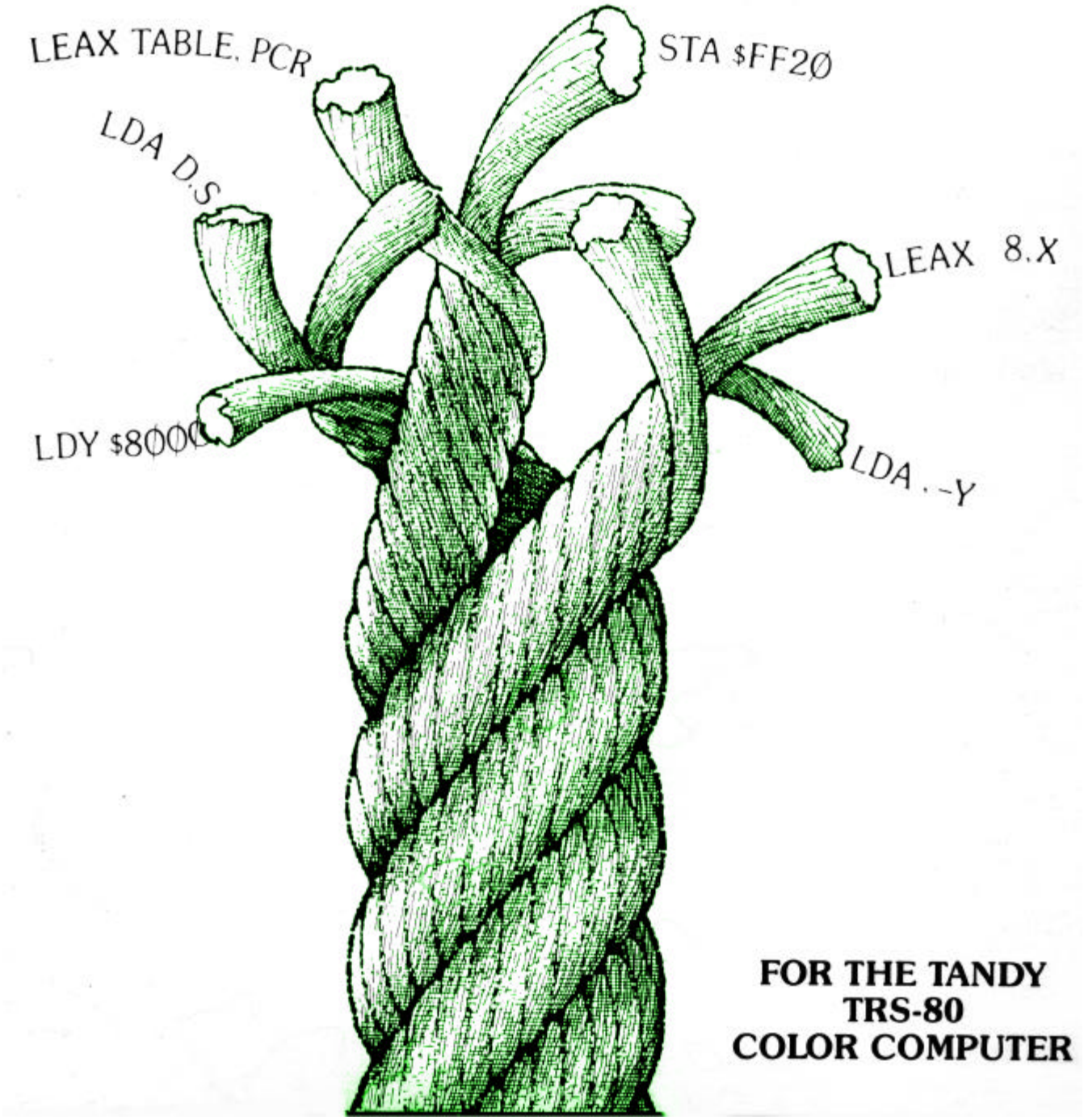
COLOR BASIC UNRAVELLED II



FOR THE TANDY TRS-80 COLOR COMPUTER

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FOREWORD

Due to the many requests for the Unravelled Series produced by Spectral Associates, and the fact that these books are rare and no longer in production, I have taken it upon myself to reproduce them in electronic .PDF (Adobe Acrobat®) format.

I have re-disassembled the ROMs listed in this book, and added all the comments from the Original Extended Basic Unravelled Book. Some changes were made to make the book a little easier to read.

1. The comments have been cleaned up some. In cases where a comments continued onto the next line, a * is placed in the Labels column, as well as a * at the beginning of each line of the comment. In cases where the previous comment used this format, a = was used. This was done in the original, but not all comments stuck to this format.
2. I have renumbered all the line numbers. Each Appendix (with code) starts at Line 0001.
3. Some spell checking, and context checking was done to verify accuracy.
4. I used the Letter Gothic MT Bold Font. This allows for display of Slashed Zeros. I thought it important to be able to distinguish between 0 and O.
5. All the Hex code now shows the Opcodes.

There were other minor changes that were made to make viewing a little better. If any discrepancies arise, please let me know so that I may correct the errors. I can be contacted at: mailto:wzydhek@internetcds.com

Special Thanks to Jean-François Morin for pointing out those Oops to me. I d like to also thank those who have either given me, or loaned me their copy of the original Unravelled Series.

About Me

My name is Walter K. Zydhek. I ve been a Computer Hobbyist since 1984 when I received my 1st Tandy Color Computer 2 for Christmas. It had 32K of ram, Cassette, and one Cartridge. I quickly learned to program in Basic and then moved into Assembly.

Over the next few years, I saved to purchase the Multi-Pak Interface, Disk Drives, Modem, OS-9, and various Odds and Ends.

I moved to Tampa Florida and in the move, My CoCo was damaged. I then replaced it with the CoCo 3. WOW what a difference. I added the 512K Ram Upgrade, A CM-8 color monitor, and joined the Carolwood CoCo Club. (Thanks Jean-François for reminding me of the name.)

I had a couple of close friends that helped me explore the world of CoCo and by this time, I knew that my CoCo would be my friend forever. I give special thanks to Steve Cohn, who helped me get started with ADOS. Two other people whose names I can t remember were very beneficial to my mastering of the CoCo.

Shortly after getting my CoCo 3, I started BBS ing. Wow, a whole new world. My knowledge just kept growing.

A few years later, I moved to Oregon, then to Phoenix, Arizona to attend school. I studied Electronics Technology at Phoenix Institute of Technology. In the second year, we studied Micro-processor Theory. For our labs, we just happen to use the Tandy Color Computer 3 (for studying 68Ø9 Processors). I had it made. In this class I added an EPROM programmer/reader to my list of hardware. My favorite instructor, Gary Angle & I spent many hours sharing information on the CoCo. At one time, we shared a joint project to disassemble ROMs from industrial machinery, which used the 68Ø9 Processor. Using the CoCo to read the ROMs to work with.

I even had a BBS running under OS-9 at one time. RiBBS I think it was. Very similar to QuickBBS and RemoteAccess BBS for the PC.

In 1991, I finally converted over to PC, but never forgetting my CoCo. About 5 years ago, My CoCo and all related material was stolen from me. And the CoCo world was just a memory.

In the last 2 Years, my love for the CoCo has re-kindled. I have been partially content to use a CoCo Emulator for my PC. I tried the CoCo 2 Emulator by Jeff Vavasour. This was OK, but a lot was left out. I then purchased the CoCo 3 Emulator. Much better, but would not use Double Sided Disks . Although it did have a Virtual Hard Drive for use in OS-9.

I then wanted to better the CoCo Emulator, add use of PC hardware, Add Double Sided Disk functionality, and even make it Windows Native, instead of a Dos Box. Unfortunately I could not get the source code for the CoCo 3 Emulator.

I then turned to Paul Burgin s Dragon 2/Coco 2 Emulator. This had source code available and with a small $2Ø.ØØ donation, was able to get the source code to additional portions of his program. I have tinkered with it, but came to understand that I needed more info on the CoCo. I have looked all over the net and found quite a lot of useful information, but what I really needed was the Unravelled Series.

I was able to find someone that had Extended Basic Unravelled and Disk Basic Unravelled (He sent them to me for free). And a friend of mine had Super Extended Basic Unravelled (A copy I gave him years ago). Unfortunately, the books are not in the best of shape, and the type is hard to read, and with so many people looking for the books, I decided to re-do them in Electronic format.

I ask everyone that obtains copies of this electronic document to PLEASE give freely. These books are for educational/informational use only. These books are no longer in publication and Spectral Associates no longer in business. Do not use these books for financial gain, as that would most certainly abuse the Copyright Laws that I have already bruised by re-producing them.

Other than that, enjoy the books!! I ll add more information to them as I get it. I plan on adding more Memory Map information, as well as hardware info in the coming months. But for now, take advantage of this fine resource.

Walter K. Zydhek

INTRODUCTION

BASIC Unravelled is a book that has specifically been written in order to provide the Color Computer user with a detailed, commented source listing of Color BASIC. Many entry points and useful routines for doing functions, which are required in machine language, have been detailed. Information contained in the book is extremely valuable and useful for anyone attempting to use BASIC integrated with machine language routines of their own. If there are some functions or facets of BASIC, which are too slow or awkward for the user, he needs to have a good idea as to what is going on in Color BASIC in order to be able to merge his routine with the routines, which are in color BASIC. There are many times when a person wants to know exactly what is going on in BASIC for a certain function such as clearing the screen or outputting a character to the screen. The information provided in BASIC Unravelled will allow the user to determine exactly what BASIC is doing under these circumstances. He will get an extremely good, in depth, basic knowledge of BASIC and be able to use that in any application he has in mind.

This book will not explain how to make the BASIC interpreter or give a detailed in depth knowledge of how a BASIC interpreter works. It assumes that the user is an experienced machine language programmer, understands 68Ø9 assembly language inside and out, and will understand the nuances and programming terminology which is used in the comments included with each BASIC program line. Do not attempt to use BASIC Unravelled as a textbook in order to teach yourself how to write a BASIC interpreter. If you are a very good programmer you will be able to write your own BASIC interpreter following the in depth reading of the assembly listings and the comments included in this book, but it should not be taken as a text on how to write a BASIC interpreter. The book is primarily designed to explain Color BASIC so that somebody who has a fair knowledge of how an interpreter works will be able to determine exactly how Color BASIC works. BASIC Unravelled will explain major operating formats of the most useful routines in BASIC and will identify the tricks, which Microsoft has used in programming Color BASIC. If the reader has any questions concerning the hardware of the Color computer, he's referred to the FACTS book, published by Spectral Associates. This book contains detailed descriptions of the hardware of the Color Computer and how one uses software in order to enable or disable the various hardware functions of the computer.

BASIC Unravelled will deal specifically with Color BASIC version 1.2 which is the version of Color BASIC released by Radio Shock, as of October 1983. The two earlier versions, version 1.Ø and version 1.1, have only minor differences in relation to version 1.2. These differences are described in detail in the appendices, and if the reader has any questions in regard to version 1.1 and version 1.Ø is referred to those appendices. Extended BASIC and Disk BASIC are covered in the two final books of the BASIC Unravelled sequence published by Spectral Associates. Any questions that regard explicitly to Extended BASIC and Disk BASIC will be covered in those books.

COLOR BASIC – An Interpreter

Color BASIC is a computer program, which is written in machine language, is very complex, and is extremely difficult to understand without some kind of helpful information. The idea behind writing a program, such as BASIC, is that BASIC is very easy to understand for the beginning user. Machine language, unfortunately, is very difficult to use and takes considerable amount of practice in order to get familiar with it. Therefore, BASIC is the language, which is provided with most computers when they are sold to the general public. As the user gets more and more familiar with BASIC, more and more questions generally arise as to how BASIC functions. That is one of the main purposes of the book -- to explain to the user exactly how Color BASIC, the Interpreter, works.

It is assumed that the reader is familiar with the manner in which the Interpreter functions. He at least knows the basic overall method of how an interpreter works in that the lines must be numbered, the interpreter executes these lines one after the other, and transfers control with GOTO, GOSUB and other similar statements. BASIC is an interpretive language related to the direct commands we are executing. BASIC executes a command by taking the last line typed to it and analyzing the line working from left to right looking for keywords and expressions, which it recognizes. Every time it encounters a keyword such as PRINT (or ? which is the abbreviation for PRINT), it interprets this word into a command, which means something to BASIC. Command words are stored in memory with bit 8 set to tell BASIC that it is a command word, or keyword (token). As a program line is entered into RAM memory through the use of the enter key, BASIC takes the line number and searches through memory, until it finds the same number, or the number just greater. If it is the same line number, then the entire line in memory is deleted and a new line is inserted into memory. In the preinterpreted state all the keywords are replaced with the single character token of the keyword. This allows the interpreter to store commands in the most memory efficient form. The only data stored is the data typed in by the programmer such as strings, pointers to the variables, and the keywords. PRINT, even though it takes five characters to type, only takes one character in memory.

BASIC is called an interpreter because the actual execution of the instructions is done by analyzing the keyword that needs to be executed in the program line, then executing that keyword under the control of a series of subroutines. This is a trade-off, which results in very memory-efficient storage programs but longer execution times that would be true of a machine language program. Because Color BASIC uses tokens in memory and stores them on I/O devices whenever a program is loaded and saved, the actual coding of data on tape or in memory is not transferable to other Machines. It is generally not possible to use BASIC instructions typed in from other machines. It is not assumed that the reader is very familiar with all the weaknesses and strengths of the BASIC interpreter as opposed to a compiled language. No effort will be made to explain the differences between compilation and interpretation except to make note of the fact that many of the weaknesses of the BASIC interpreter stem from the fact that it is not compiled; that is, that the program is not converted into machine language and executed in one pass after it is converted into machine language. Each time a statement has to be interpreted with the BASIC interpreter, the interpreter must look up the functions that need to be interpreted, find out what they are, calculate any numerical results that are necessary as a result of the interpretation, print

things to the screen and so forth, and then continue to the next statement. This is one of the main weaknesses of an interpreter-it is slow. Every time a statement has to be interpreted the some slow process has to take place. A perfect example of this is the determination of the value of a variable. BASIC stores its variables in a large table directly after the BASIC program. These tables have the variable tagged by its name, that is the one or two character ASCII sequence which is defined in the program such as: AA, A1, X, Y, etc. These variables are listed one after the other in the variable table and every time the BASIC program makes reference to a variable, BASIC must start at the beginning of the variable table and search through the entire length of table until it determines where that variable is. If a program were compiled, the program would know exactly where the variable is and wouldn't have to go searching through the table in order to find it. Obviously if the variable was located near the end of a very long variable table, a substantial amount of time will be consumed every time the BASIC program makes reference to this variable. This is one reason why it s convenient to put the variables, which are the most often used in a BASIC program, at the very beginning of the program. Another example of the slowness of an interpreter is every time you make program control transfers such as GOTO or GOSUB, the program has to search through the entire length of the BASIC program in order to find where the destination line number is. If the line number happens to be just before the point where the BASIC program starts searching, the entire program will have to be searched through in order to determine where the program line is and then transfer control there. As you can see, this will waste a lot of time.

Why then, you would ask, do we use BASIC programs in the first place? The primary reason is because of the fact that BASIC is user friendly. It is simple to learn and it is simple to program. And even if it s slow, it still provides a very powerful tool for the user. It is very easy to develop and test programs and takes only a fraction of the time involved in what it would take to develop a comparable length machine language program. The penalty, of course, is the speed and the size of the final program.

INTERPRETER MECHANICS

The Interpreter has various statements, commands, and functions, which are used in order to process, manipulate or otherwise use data. The overall goal of any computer program is the manipulation and movement of data in the memory of the computer and the transference of that data to an input/output device such as the screen, a disk file, or a cassette tape. Commands will tell the Color Computer to do something with the program. Sample commands would be LIST, RUN, STOP, and CONTINUE. Statements are used to operate on the data or program, which is in the Color Computer at the time. Examples of statements are CLEAR, DATA, DIM, END, GOSUB, INPUT, and so forth. Functions provide another manner that BASIC statements can be used to control the Color Computer. Intrinsic functions provided by BASIC are used to operate on string or numeric data and produce a result, which will be useful. Many of these functions are mathematical functions or string manipulation functions which will form substrings based upon certain subsets of the string in question. The arguments of these functions are always enclosed in parentheses. The argument of any function is the value which is being manipulated by the function and sometimes there may be more than one argument in any particular function, such as MID$, which may have three arguments. Often arguments may be left out and BASIC will supply default values. These default values can be found by looking at the routine in BASIC which controls that particular function and you can see whether or not a default value is allowed for. Sometimes a default value is not allowed, and if a value is not given BASIC will generate an error. Some examples of functions are ABS, ASC, SIN, COS, RIGHT$, LEFT$, etc.

The commands and functions of BASIC must be identified to the computer in a way that they can be understandable by the machine. The machine cannot understand PRINT, LIST, and RUN, it can only understand numbers. Therefore, there must be some way of identifying the commands and functions to the computer so that it knows that these are commands and functions. The method that most BASIC interpreters use in order to identify commands and functions is to identify them with a number from 128 to 255. The user will notice that these numbers are the equivalent of an 8-bit byte with bit 7 set. This is a very convenient way of identifying and abbreviating the commands and functions, because the numbers from Ø to 127 are the normal ASCII symbols used by BASIC. The numbers from 128 to 255 represent graphic symbols, which are rarely used in ASCII strings. These abbreviations for the BASIC commands and functions are called tokens. You will find in the BASIC listing a table of tokens and the respective addresses where command of BASIC is transferred when a certain token is encountered in an interpreted line. These are referred to as the dictionary of commands and the dictionary of dispatch jump addresses. Color BASIC created a problem when BASIC was written because of the fact that so many commands were required because of the graphics routines and the disk routines that 128 different commands would not suffice. Therefore, a novel method of expanding the number of tokens available by using the token $FF as a special pre-token marker. There are two sets of tokens in Color BASIC, primary and secondary tokens. Primary tokens will have a value from 128 ($8Ø) to 254 ($FE). If an $FF token is encountered in an input line it signifies that the byte immediately following the $FF is the secondary token in question. This can be confusing if you are not careful so you must be aware of the fact that secondary tokens require two bytes, an $FF to identify it as a secondary token and then a number from 128 to 254 immediately after it which identifies the actual token number. Secondary tokens are

used to keep track of the intrinsic functions, whereas the primary tokens are used to keep track of commands and statements.

When you type LIST, the computer lists your program; you see the words PRINT, LIST, NEW, LEFT, etc., spelled out on the screen for you. When the program statements are stored in the computer's memory these words are not spelled out. The tokenized value of these words is what is stored in the memory of the computer. There are two routines in BASIC called crunch and uncrunch which will tokenize or detokenize the BASIC input line. When you list the line to the screen, uncrunch is called and the tokens are detokenized and converted into ASCII strings which are representations of the tokens. When you type a program line into the computer from the keyboard and then hit ENTER to store it into the computer's memory, crunch is called and it tokenizes the line. PRINT, LIST, etc., are crunched down from ASCII representations of those words into tokens. This explains why when you use a monitor to look at an actual BASIC program which is stored in the memory of the computer you will see ASCII strings and PRINT literals or the prompts for input statements spelled out as ASCII words, but you will see graphics blocks interlaced throughout your program. These graphics blocks are the tokens, which have been crunched by BASIC and stored in the computer. Later on you will see in the disk or in the cassette versions of input/output routines either crunched methods of saving the program or ASCII saves. The crunched method of saving the program is the normal method where the BASIC program is merely taken directly from the memory of the computer and stored onto the tape or disk. The ASCII save is where the program is taken from the memory of the computer, uncrunched and then saved on the tape. Generally, when you want to transfer BASIC programs from different computers, i.e., Radio Shack to an Apple, Atari or vice versa, you will have to move the files back and forth in ASCII format because all of the tokens for the different machines will have different values, not to mention different functions.

BASIC program lines are stored in RAM according to the following rules:

1. Start of text is a zero byte.
2. Each program line is preceded by a two-byte RAM link containing the address of the first byte of the next line and a two-byte line number.
3. The compressed (crunched) text is followed by a zero byte.
4. End of text is stored as two zero link bytes.

Now its time to investigate the process, which is used by BASIC in order to interpret the program line. There is a main program loop in BASIC, which is referred to as the command interpretation loop. In this loop commands and statements are evaluated. The token is decoded to determine where the routine is which must be jumped to in order to perform the particular function that needs to be evaluated. The input into the command interpretation loop is taken from console in. Therefore, a clever machine language programmer would be able to have the input to BASIC taken not from the memory of the machine but potentially from a disk file or a cassette file or some other input device, if desired. One of the benefits, if you want to look at it that way, of Color BASIC is that various modules can be added on to BASIC very easily. That is why it is possible to buy extended BASIC, plug it into the computer, turn it on and have it work with no hardware modification. Disk BASIC may be added and provision has even been given for a user add-on. The primary and secondary tokens have a dictionary table, which is the ASCII representation of the various commands and functions spelled out in the memory of the computer. The last byte of the command or function, such as PRINT or

LIST, has bit 7 set. This is done so that BASIC can look through the lists of commands and functions and know when a particular command or function spelling is done. In this way an input command in a BASIC program is matched against the command, which is stored in the computer's memory. The computer knows if Extended BASIC, Disk BASIC or a user command table has been implemented. Therefore, it will search through the list of BASIC commands and if it does not find the command that you have typed in the list of BASIC commands, it will then go to Extended BASIC's command table. If it doesn't find it there, it will go to Disk BASIC's command table. If it doesn't find it there it will go to the User Supplied Command Table, if one has been given. When a command is found, there is an associated address in the dispatch table, which tells BASIC where control has to be transferred in order to perform the various functions, which have been called from the BASIC program. These linkable command tables are explained in the memory map of the computer and are located at $12Ø (COMVEC). When the first byte of a command table is equal to zero, it is an indication to BASIC that there are no further valid command tables following.

BASIC determines where it is at any one particular time in RAM through the use of the BASIC input pointer. This is an address maintained in the direct page at address $A5. When BASIC wants to get another character from a BASIC input line in order to determine what function or command needs to be interpreted or to get data or anything else from a BASIC program, it gets this data from the BASIC input pointer. This is done by executing the statement JSR $9F. This is a small routine which is moved into the direct page from ROM when BASIC is initialized, and when you call this routine it will increment the BASIC input pointer by one, fetch a character from the address pointed to by the BASIC input pointer, load it into accumulator A and then jump back into the main BASIC ROM. The point at which it jumps back into the main BASIC ROM will determine whether the character, which has been fetched from the BASIC program, is numeric. If the character is numeric, the carry flag will be set. Most people are familiar with the Extended BASIC PCLEAR bug, which was caused when a program was written which would PCLEAR memory during the execution of the program. The PCLEAR statement will cause the BASIC program to be moved up or down in RAM if more or fewer pages of graphic RAM are PCLEARED as a result of the statement. Unfortunately, the BASIC program was moved up or down in RAM, but the BASIC input pointer was never moved, therefore the program would be moved to a new place, but the BASIC input pointer would not be moved a corresponding amount. Therefore, BASIC would begin interpreting new program lines from garbage and you would usually get syntax errors.

The stack is used primarily for normal 68Ø9 functions in the Color Computer It does, however, have several auxiliary functions, which it must provide in order to support Color BASIC. For example, when you use a FOR/NEXT loop, 18 bytes of data are stored on the stack so that you can keep track of the index pointer, step value, the initial value that you started the loop at, and the terminal value at which the FOR/NEXT loop will be stopped. All GOSUB return addresses, which are comprised of 5 bytes, are stored on the stack. The expression evaluation routine uses the stack to store many different bytes and floating point numbers on it during the course of the evaluation of an expression. There are several routines in this BASIC and Extended BASIC such as PAINT, BACKUP, COPY, etc., which also use the stack for temporary storage. The experienced machine language programmer will realize that there can be problems with using the stack for temporary storage and variables. If stack storage is used in recursive loops and there are no controls

placed upon the limit of the recursive loops, the stack can grow in an uncontrolled manner and will eventually crash into your program and destroy it. For this reason there is a special routine provided in BASIC, which determines if there is enough free RAM to store the amount of data, which you want to store on the stack. This is required so that if you keep storing data on the stack YOU can merely check to verify that there is enough free RAM left in the machine in order to store the data on the stack. If there is not enough free RAM, an OM error results and you exit from the program in a controlled manner. There are, at this time, at least two bugs known to the author, which will create problems during the execution of a program. Both of these bugs are in the Extended BASIC ROM and neither one has been fixed by version 1.1 of Extended BASIC. The first bug is in the PAINT routine, which uses 6 bytes of stack to remember to paint a particular weird angle, which has been left in an odd shaped paint figure. The paint routine only checks to see if there are 4 bytes of free RAM each time it stores 6 bytes of data on the stack. As such, problems can occur in some very weird shaped paint pictures and the stack could actually creep down and either destroy some variables or parts of the BASIC program and the user would never know what hit him. The second bug is in the PCOPY statement, which will allow the user to PCOPY from page one to page five if only four pages have been PCLEARED. This is interesting and causes a really good explosion that may completely destroy the BASIC program.

VARIABLES

Variables are used by BASIC to keep track of quantities that may take on different values or change during the course of the execution of the program. COLOR BASIC uses only one type of numeric variable, SINGLE PRECISION. Many other BASICs use different types of variables including integer type and double precision. When COLOR BASIC was first developed, the decision was made not to allow double precision or integer type variables because it would take up too much room in the ROM in order to support these variables types. As a result, we have a smaller and more compact ROM but you lose the efficiency and power that is afforded the use of double precision and integer variable types. No matter which type of variable you have, either single precision or string variable, five bytes are allocated for the storage of this variable in the memory of the computer. A two-character ASCII string identifies all variables, which is the variable name. Variables may have more than two characters in their name but the characters following the second character will always be ignored. This may lead to some confusion when you're writing a BASIC program, but limiting the number of the characters in the variable name to two makes it much more compact and simple to store the variable 'in the memory of the computer. Any useful program has to deal with alphanumeric data. BASIC has a set of functions to deal with these data. Also, all alphanumeric data may be expressed as a continuous connection of characters, which is viewed by BASIC as the value of a single variable.

Color BASIC has a $ notation which is used to express variables which are strings of alphanumeric data. All of the rules, which apply to normal variables, apply to the string variable.

The limitation on the number of characters that can be stored in a string is 255. The accumulation of characters from an I/O device and the construction of data are accomplished by the concatenation of strings. The operator that is used is +.

Space is allocated for variables only as they are encountered. It is not possible to allocate an array on the basis of 2 single elements; hence, the reason to execute DIM statement before array references. Seven bytes are allocated for each simple variable whether it is a string, number, or user defined function. Each string variable is defined by a five-byte descriptor. This descriptor has five bytes only so that it may be the same length as the single precision floating point variable. Only three of the bytes in the descriptor are actually used to define a string. The other two bytes are wasted but are necessary in order to maintain the some length of descriptor as the floating-point descriptor. Byte zero represents the length of the string and may be any number from Ø to 255. If the length of the string is equal to Ø, it indicates a null string. Bytes two and three of the string descriptor are a pointer to the absolute RAM address of the start of the string. When one uses the instruction in BASIC, the access which is returned is the address of the descriptor and this is how you address the string, The absolute RAM address of the string may be anywhere in RAM so that the string may be located in the BASIC program itself, in the string space, or it may even be located in the random buffer file if you have a disk system. If you've been using BASIC for any length of time you may have become familiar with the time delays that occur whenever the BASIC program does what is called housekeeping or garbage collection. What the computer does is to sort all of string space and throws away all of the null strings. This can very often be a long, time-consuming process, which causes the computer to sit

and do what appears to be nothing or to be in a hung up state for an extended period of time.

Variables are stored in the variable table, which is immediately following the BASIC program in the memory of the computer. Each variable requires seven bytes to hold its space in the variable table. The first two bytes are the variable name, the next five bytes are the actual value of the variable if it's a floating point number or it's the five byte descriptor if it's a string variable. The variable names as described above contain two ASCII characters. The method that is used to determine whether the number is a floating point variable or a string variable is the condition of the first variable letter. If this first letter has bit seven set, the variable is a string. If bit seven of the first letter of the variable name is not set, that variable is a floating point variable. This is how BASIC determines the type of variable as it searches for a variable in the variable tables. This searching method should be kept in mind when writing BASIC programs so that you can get maximum efficiency and speed out of your program. Variables that are used most often should be located near the top of the table since BASIC starts at the top and works its way to the bottom when it's searching for a variable name. Looking in the BASIC disassembly of expression evaluation, you will find the method that is used in order to find a variable name (LB357). BASIC gets the variable name, which is found by stripping it off of the BASIC line. It then points itself to the beginning of the table and looks all the way through the variable table until it finds a match. If no match is found, then it inserts a variable in the variable table and a value of Ø or a null string if its a string variable is assigned to it. As you can see, this method can be very slow and cumbersome if you have variables that are very often used and are located at the bottom of a very large variable table. Therefore, if at all possible, define the variables, which are to be used most often at the beginning of your program, and this will cause an increase in speed of your BASIC program.

Floating Point Numbers. Single precision variables are stored in the computer as floating point numbers, which are comprised of an exponent, a four-byte mantissa and the sign of the mantissa. In this way, numbers in the approximate range 1E-39 < X < 1E+39 may be saved. A fifth mantissa byte, the sub byte, (FPSBYT), is used in calculations to achieve 9 significant digits of accuracy.

Floating point numbers are always stored with the mantissa "normalized", that is the mantissa is shifted to the left until a "1" is in the high order bit (7) of the most significant byte. When the mantissa sign in not placed into the high order bit of the most significant mantissa byte, the number is "unpacked".

The exponent is computed such that the mantissa Ø = 1 x 1. It is stored as a signed 8 bit binary plus a bias of $8Ø. Negative exponents are not stored 2's complement. Maximum exponent is $1Ø^{38}$ and minimum exponent is $1Ø^{-39}$, which is stored as $ØØ. A zero exponent is used to flag the number as zero.

Exponent	Approximate Value
FF	$1Ø^{38}$
A2	$1Ø^{1Ø}$
7F	$1Ø^{-1}$
Ø2	$1Ø^{-36}$
ØØ	$1Ø^{-39}$

Since the exponent is really a power of 2, it should best be described as the number of left shifts (EXP > $80) or right shifts (EXP < = $80) to be performed on the normalized mantissa to create the actual binary representation of the value.

Example of Floating Point Numbers

Exponent		MS	MANTISSA		LS	Sign
1E38	FF	96	76	99	52	ØØ
4EIØ	A4	95	Ø2	F9	ØØ	ØØ
2EIØ	A3	95	Ø2	F9	ØØ	ØØ
1EIØ	A2	95	Ø2	F9	ØØ	ØØ
1	81	8Ø	ØØ	ØØ	ØØ	ØØ
.5	8Ø	8Ø	ØØ	ØØ	ØØ	ØØ
.25	7F	8Ø	ØØ	ØØ	ØØ	ØØ
1E-4	73	D1	B7	59	59	ØØ
1E-37	Ø6	88	1C	14	14	ØØ
1E-38	Ø2	D9	C7	EE	EE	ØØ
1E-39	ØØ	AØ	ØØ	ØØ	ØØ	ØØ
Ø	ØØ	ØØ	ØØ	ØØ	ØØ	XX
-1	81	8Ø	ØØ	ØØ	ØØ	FF
-IØ	84	AØ	ØØ	ØØ	ØØ	FF

Actual floating point BASIC variables are stored in 5 bytes, rather than 6 bytes as in the floating accumulator. Upon examination, one will note that the most significant byte of the mantissa is always set. If we always assure the number will be in this format, we can use that bit to indicate the sign of the mantissa -- thus, freeing the byte used for sign. This is referred to as "packed" format.

The contents of the floating accumulator may be converted to a double byte integer by calling a subroutine (INTCNV), which is located at $B3ED The integer is returned in ACCD. An integer can be converted back to floating by loading the two most significant bytes ACCD then calling GIVABF at $B4F4.

Array Variables. Array variables need not be declared with a DIM statement if they have only one dimension and contain fewer than 1Ø elements. Each element in an array requires 5 bytes of storage and the format of the 5-byte block is the same as simple variables. Arrays are stored in the array table and each array is preceded by a header block of 5+2*N bytes where N = number of dimensions in the array. The first two bytes contain the name of the array, the next two bytes contain the total length of array items and header block, the fifth byte contains the number of dimensions and, finally, 2 bytes per each dimension contain the length of the dimension.

If large arrays are defined and initialized first before simple variables are assigned, much execution time can be lost moving the arrays each time a simple variable is defined. The best strategy to follow in this case is to assign a value to all known simple variables before assigning arrays. This will optimize execution speed.

CONSOLE INPUT/OUTPUT

Console input and console output are the data channels that are used when transferring information into and out of the computer. There are various different methods that are used by different computer manufacturers in order to control the transmission or the flow of data into and out of the computer. It has become useful in most of the jargon to refer to the process of transferring data into or out of the computer as console input or console output. By using a method such as this, one can merely call the console input function if one wants to get a character in Accumulator A, for instance, and then call the console output device and that character will be placed in the appropriate output device, be it cassette, disk, printer or even the screen. Obviously, something else has to be defined when using console in or console out, such as where we are going to send the character to, or from where we will get the character. The Color computer uses the concept of a device number (DEVNUM) in order to define from where the character is coming or where it is going.

The Color Computer has five different device types associated with it: device number Ø is the screen; -1 is the cassette; -2 is the Line Printer; -3 is the DLOAD (RS232 Download) option and device numbers 1 through 15 represent Disk files. Device number 16 is not accessible to the user because it is used by the system as a temporary scratch disk input/output file. The typical method that one uses to access the console in or console out function is to initially define the device number and then jump to the console input or console output and either get the character back into Accumulator A if you are using console in or to transmit the character to the appropriate output device in Accumulator A if using console out.

CONSOLE INPUT - Get a character from an input buffer, which has been defined somewhere in the computer by the routine, which is being used. Generally speaking, one has to OPEN an input channel with the open command. This is not necessary if one is using the screen because the input from the screen comes from the keyboard, which is always an open channel, and it is not necessary to either open or close it. However, if one is trying to use a cassette file, when the cassette file is open for input, there is a buffer established in the memory of the computer which will allow a block of data to be read from the cassette tape. When the user wants a byte of data out of that buffer, he simply calls console in and the byte is returned from the buffer. In this method the buffer is systematically emptied until, when the last character is taken from the buffer, the computer automatically attempts to read another block of data from the cassette file. If further blocks of data are available, then the buffer is refilled and console in can get more data. If there is no longer any further data in the cassette file, then the EOF flag is set and the user is told that there is no longer any data to be gotten from that device. The same type of method is used with DLOAD and, of course, can't be used from the Line Printer, because the Line Printer is only an output device. The method used to transfer data into and out of Disk files will be explained in the Disk BASIC Unravelled.

CONSOLE OUTPUT - Used to transmit data from the computer to an output device. All of the output devices as defined above may be used for outputting data. The method is very similar to the method used for inputting data from files. For example, if one is using a cassette file, an output buffer is established in the computer's memory. Characters are continuously placed in this output buffer until

the buffer is filled with 255 characters. At that time the buffer is flushed, that is, the contents of the buffer are written to tape and further input to the buffer is prohibited until the data block is written to the selected device. Upon completion of the data block transfer, the character buffer is reset to a Ø value, meaning it is empty, and further data may be input into the buffer. This is the same method that is used by Disk and that method of outputting data to a disk file will be explained in Disk BASIC Unravelled.

It should also be noted that you can not open a DLOAD file for output. That feature has not been implemented in the Color Computer -- DLOAD, can only be used to input data.

```
0001       8000      EXBAS     EQU   $8000
0002       A000      BASIC     EQU   $A000
0003       C000      ROMPAK    EQU   $C000
0004
0005       0008      BS        EQU   8               BACKSPACE
0006       000D      CR        EQU   $D              ENTER KEY
0007       001B      ESC       EQU   $1B             ESCAPE CODE
0008       000A      LF        EQU   $A              LINE FEED
0009       000C      FORMF     EQU   $C              FORM FEED
0010       0020      SPACE     EQU   $20             SPACE (BLANK)
0011
0012       003A      STKBUF    EQU   58              STACK BUFFER ROOM
0013       045E      DEBDEL    EQU   $45E            DEBOUNCE DELAY
0014       00FA      LBUFMX    EQU   250             MAX NUMBER OF CHARS IN A BASIC LINE
0015       00FA      MAXLIN    EQU   $FA             MAXIMUM MS BYTE OF LINE NUMBER
0016
0017       2600      DOSBUF    EQU   $2600          RAM LOAD LOCATION FOR THE DOS COMMAND
0018       0020      DIRLEN    EQU   32              NUMBER OF BYTES IN DIRECTORY ENTRY
0019       0100      SECLEN    EQU   256             LENGTH OF SECTOR IN BYTES
0020       0012      SECMAX    EQU   18              MAXIMUM NUMBER OF SECTORS PER TRACK
0021       1200      TRKLEN    EQU   SECMAX*SECLEN   LENGTH OF TRACK IN BYTES
0022       0023      TRKMAX    EQU   35              MAX NUMBER OF TRACKS
0023       004A      FATLEN    EQU   6+(TRKMAX-1)*2  FILE ALLOCATION TABLE LENGTH
0024       0044      GRANMX    EQU   (TRKMAX-1)*2    MAXIMUM NUMBER OF GRANULES
0025       0119      FCBLEN    EQU   SECLEN+25       FILE CONTROL BLOCK LENGTH
0026       0010      INPFIL    EQU   $10             INPUT FILE TYPE
0027       0020      OUTFIL    EQU   $20             OUTPUT FILE TYPE
0028       0040      RANFIL    EQU   $40             RANDOM/DIRECT FILE TYPE
0029
0030                 * PSEUDO PSEUDO OPS
0031       0021      SKP1      EQU   $21             OP CODE OF BRN   SKIP ONE BYTE
0032       008C      SKP2      EQU   $8C             OP CODE OF CMPX # - SKIP TWO BYTES
0033       0086      SKP1LD    EQU   $86             OP CODE OF LDA # - SKIP THE NEXT BYTE
0034                 *                              AND LOAD THE VALUE OF THAT BYTE INTO ACCA   THIS
0035                 *                              IS USUALLY USED TO LOAD ACCA WITH A NON ZERO VALUE
0036
0037                 * REGISTER ADDRESSES
0038       FF00      PIA0      EQU   $FF00           PERIPHERAL INPUT ADAPTER #0
0039       FF20      PIA1      EQU   $FF20           PERIPHERAL INPUT ADAPTER #1
0040       FF20      DA        EQU   PIA1+0          DIGITAL/ANALOG CONVERTER
0041       FF40      DSKREG    EQU   $FF40           DISK CONTROL REGISTER
0042       FF48      FDCREG    EQU   $FF48           1793 CONTROL REGISTER
0043       FFC0      SAMREG    EQU   $FFC0           SAM CONTROL REGISTER
0044
0045 0000                      ORG   0
0046       0000                SETDP 0
0047
0048 0000            ENDFLG    RMB   1              STOP/END FLAG: POSITIVE=STOP, NEG=END
0049 0001            CHARAC    RMB   1              TERMINATOR FLAG 1
0050 0002            ENDCUR    RMB   1              TERMINATOR FLAG 2
0051 0003            TMPLOC    RMB   1              SCRATCH VARIABLE
0052 0004            IFCTR     RMB   1              IF COUNTER - HOW MANY IF STATEMENTS IN A LINE
0053 0005            DIMFLG    RMB   1              *DV* ARRAY FLAG 0=EVALUATE, 1=DIMENSIONING
0054 0006            VALTYP    RMB   1              *DV* *PV TYPE FLAG: 0=NUMERIC, $FF=STRING
0055 0007            GARBFL    RMB   1              *TV STRING SPACE HOUSEKEEPING FLAG
0056 0008            ARYDIS    RMB   1              DISABLE ARRAY SEARCH: 00=ALLOW SEARCH
0057 0009            INPFLG    RMB   1              *TV INPUT FLAG: READ=0, INPUT<>0
0058 000A            RELFLG    RMB   1              *TV RELATIONAL OPERATOR FLAG
0059 000B            TEMPPT    RMB   2              *PV TEMPORARY STRING STACK POINTER
0060 000D            LASTPT    RMB   2              *PV ADDR OF LAST USED STRING STACK ADDRESS
0061 000F            TEMPTR    RMB   2              TEMPORARY POINTER
0062 0011            TMPTR1    RMB   2              TEMPORARY DESCRIPTOR STORAGE (STACK SEARCH)
0063                 ** FLOATING POINT ACCUMULATOR #2 (MANTISSA ONLY)
0064 0013            FPA2      RMB   4              FLOATING POINT ACCUMULATOR #2 MANTISSA
0065 0017            BOTSTK    RMB   2              BOTTOM OF STACK AT LAST CHECK
0066 0019            TXTTAB    RMB   2              *PV BEGINNING OF BASIC PROGRAM
0067 001B            VARTAB    RMB   2              *PV START OF VARIABLES
0068 001D            ARYTAB    RMB   2              *PV START OF ARRAYS
0069 001F            ARYEND    RMB   2              *PV END OF ARRAYS (+1)
0070 0021            FRETOP    RMB   2              *PV START OF STRING STORAGE (TOP OF FREE RAM)
0071 0023            STRTAB    RMB   2              *PV START OF STRING VARIABLES
0072 0025            FRESPC    RMB   2              UTILITY STRING POINTER
0073 0027            MEMSIZ    RMB   2              *PV TOP OF STRING SPACE
0074 0029            OLDTXT    RMB   2              SAVED LINE NUMBER DURING A "STOP"
```

```
0075 002B           BINVAL     RMB   2              BINARY VALUE OF A CONVERTED LINE NUMBER
0076 002D           OLDPTR     RMB   2              SAVED INPUT PTR DURING A "STOP"
0077 002F           TINPTR     RMB   2              TEMPORARY INPUT POINTER STORAGE
0078 0031           DATTXT     RMB   2              *PV 'DATA' STATEMENT LINE NUMBER POINTER
0079 0033           DATPTR     RMB   2              *PV 'DATA' STATEMENT ADDRESS POINTER
0080 0035           DATTMP     RMB   2              DATA POINTER FOR 'INPUT' & 'READ'
0081 0037           VARNAM     RMB   2              *TV TEMP STORAGE FOR A VARIABLE NAME
0082 0039           VARPTR     RMB   2              *TV POINTER TO A VARIABLE DESCRIPTOR
0083 003B           VARDES     RMB   2              TEMP POINTER TO A VARIABLE DESCRIPTOR
0084 003D           RELPTR     RMB   2              POINTER TO RELATIONAL OPERATOR PROCESSING ROUTINE
0085 003F           TRELFL     RMB   1              TEMPORARY RELATIONAL OPERATOR FLAG BYTE
0086
0087                * FLOATING POINT ACCUMULATORS #3,4 & 5 ARE MOSTLY
0088                * USED AS SCRATCH PAD VARIABLES.
0089                ** FLOATING POINT ACCUMULATOR #3 :PACKED: ($40-$44)
0090 0040           V40        RMB   1
0091 0041           V41        RMB   1
0092 0042           V42        RMB   1
0093 0043           V43        RMB   1
0094 0044           V44        RMB   1
0095                ** FLOATING POINT ACCUMULATOR #4 :PACKED: ($45-$49)
0096 0045           V45        RMB   1
0097 0046           V46        RMB   1
0098 0047           V47        RMB   1
0099 0048           V48        RMB   2
0100                ** FLOATING POINT ACCUMULATOR #5 :PACKED: ($4A $4E)
0101 004A           V4A        RMB   1
0102 004B           V4B        RMB   2
0103 004D           V4D        RMB   2
0104                ** FLOATING POINT ACCUMULATOR #0
0105 004F           FP0EXP     RMB   1              *PV FLOATING POINT ACCUMULATOR #0 EXPONENT
0106 0050           FPA0       RMB   4              *PV FLOATING POINT ACCUMULATOR #0 MANTISSA
0107 0054           FP0SGN     RMB   1              *PV FLOATING POINT ACCUMULATOR #0 SIGN
0108 0055           COEFCT     RMB   1              POLYNOMIAL COEFFICIENT COUNTER
0109 0056           STRDES     RMB   5              TEMPORARY STRING DESCRIPTOR
0110 005B           FPCARY     RMB   1              FLOATING POINT CARRY BYTE
0111                ** FLOATING POINT ACCUMULATOR #1
0112 005C           FP1EXP     RMB   1              *PV FLOATING POINT ACCUMULATOR #1 EXPONENT
0113 005D           FPA1       RMB   4              *PV FLOATING POINT ACCUMULATOR #1 MANTISSA
0114 0061           FP1SGN     RMB   1              *PV FLOATING POINT ACCUMULATOR #1 SIGN
0115
0116 0062           RESSGN     RMB   1              SIGN OF RESULT OF FLOATING POINT OPERATION
0117 0063           FPSBYT     RMB   1              FLOATING POINT SUB BYTE (FIFTH BYTE)
0118 0064           COEFPT     RMB   2              POLYNOMIAL COEFFICIENT POINTER
0119 0066           LSTTXT     RMB   2              CURRENT LINE POINTER DURING LIST
0120 0068           CURLIN     RMB   2              *PV CURRENT LINE # OF BASIC PROGRAM, $FFFF = DIRECT
0121 006A           DEVCFW     RMB   1              *TV TAB FIELD WIDTH
0122 006B           DEVLCF     RMB   1              *TV TAB ZONE
0123 006C           DEVPOS     RMB   1              *TV PRINT POSITION
0124 006D           DEVWID     RMB   1              *TV PRINT WIDTH
0125 006E           PRTDEV     RMB   1              *TV PRINT DEVICE: 0=NOT CASSETTE, -1=CASSETTE
0126 006F           DEVNUM     RMB   1              *PV DEVICE NUMBER: -3=DLOAD, -2=PRINTER,
0127                *                                                  -1=CASSETTE, 0=SCREEN, 1-15=DISK
0128 0070           CINBFL     RMB   1              *PV CONSOLE IN BUFFER FLAG: 00=NOT EMPTY, $FF=EMPTY
0129 0071           RSTFLG     RMB   1              *PV WARM START FLAG: $55=WARM, OTHER=COLD
0130 0072           RSTVEC     RMB   2              *PV WARM START VECTOR - JUMP ADDRESS FOR WARM START
0131 0074           TOPRAM     RMB   2              *PV TOP OF RAM
0132 0076                      RMB   2              SPARE: UNUSED VARIABLES
0133 0078           FILSTA     RMB   1              *PV FILE STATUS FLAG: 0=CLOSED, 1=INPUT, 2=OUTPUT
0134 0079           CINCTR     RMB   1              *PV CONSOLE IN BUFFER CHAR COUNTER
0135 007A           CINPTR     RMB   2              *PV CONSOLE IN BUFFER POINTER
0136 007C           BLKTYP     RMB   1              *TV CASS BLOCK TYPE: 0=HEADER, 1=DATA, $FF=EOF
0137 007D           BLKLEN     RMB   1              *TV CASSETTE BYTE COUNT
0138 007E           CBUFAD     RMB   2              *TV CASSETTE LOAD BUFFER POINTER
0139 0080           CCKSUM     RMB   1              *TV CASSETTE CHECKSUM BYTE
0140 0081           CSRERR     RMB   1              *TV ERROR FLAG/CHARACTER COUNT
0141 0082           CPULWD     RMB   1              *TV PULSE WIDTH COUNT
0142 0083           CPERTM     RMB   1              *TV BIT COUNTER
0143 0084           CBTPHA     RMB   1              *TV BIT PHASE FLAG
0144 0085           CLSTSN     RMB   1              *TV LAST SINE TABLE ENTRY
0145 0086           GRBLOK     RMB   1              *TV GRAPHIC BLOCK VALUE FOR SET, RESET AND POINT
0146 0087           IKEYIM     RMB   1              *TV INKEY$ RAM IMAGE
0147 0088           CURPOS     RMB   2              *PV CURSOR LOCATION
0148 008A           ZERO       RMB   2              *PV DUMMY - THESE TWO BYTES ARE ALWAYS ZERO
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0149 008C           SNDTON     RMB   1              *TV TONE VALUE FOR SOUND COMMAND
0150 008D           SNDDUR     RMB   2              *TV DURATION VALUE FOR SOUND COMMAND
0151
0152                ** THESE BYTES ARE MOVED DOWN FROM ROM
0153                ***                            INIT   DESCRIPTION
0154                *                              VALUE
0155 008F           CMPMID     RMB   1              18     *PV 1200/2400 HERTZ PARTITION
0156 0090           CMP0       RMB   1              24     *PV UPPER LIMIT OF 1200 HERTZ PERIOD
0157 0091           CMP1       RMB   1              10     *PV UPPER LIMIT OF 2400 HERTZ PERIOD
0158 0092           SYNCLN     RMB   2              128    *PV NUMBER OF $55'S TO CASSETTE LEADER
0159 0094           BLKCNT     RMB   1              11     *PV CURSOR BLINK DELAY
0160 0095           LPTBTD     RMB   2              88     *PV BAUD RATE CONSTANT (600)
0161 0097           LPTLND     RMB   2              1      *PV PRINTER CARRIAGE RETURN DELAY
0162 0099           LPTCFW     RMB   1              16     *PV TAB FIELD WIDTH
0163 009A           LPTLCF     RMB   1              112    *PV LAST TAB ZONE
0164 009B           LPTWID     RMB   1              132    *PV PRINTER WIDTH
0165 009C           LPTPOS     RMB   1              0      *PV LINE PRINTER POSITION
0166 009D           EXECJP     RMB   2              LB4AA  *PV JUMP ADDRESS FOR EXEC COMMAND
0167
0168                ** THIS ROUTINE PICKS UP THE NEXT INPUT CHARACTER FROM
0169                ** BASIC. THE ADDRESS OF THE NEXT BASIC BYTE TO BE
0170                ** INTERPRETED IS STORED AT CHARAD.
0171
0172 009F 0C A7     GETNCH     INC   <CHARAD+1      *PV INCREMENT LS BYTE OF INPUT POINTER
0173 00A1 26 02                BNE   GETCCH         *PV BRANCH IF NOT ZERO (NO CARRY)
0174 00A3 0C A6                INC   <CHARAD        *PV INCREMENT MS BYTE OF INPUT POINTER
0175 00A5 B6        GETCCH     FCB   $B6            *PV OP CODE OF LDA EXTENDED
0176 00A6           CHARAD           2              *PV THESE 2 BYTES CONTAIN ADDRESS OF THE CURRENT
0177                *                                  CHARACTER WHICH THE BASIC INTERPRETER IS
0178                *                                  PROCESSING
0179 00A8 7E AA 1A             JMP   BROMHK         JUMP BACK INTO THE BASIC RUM
0180
0181 00AB           VAB        RMB   1              = LOW ORDER FOUR BYTES OF THE PRODUCT
0182 00AC           VAC        RMB   1              = OF A FLOATING POINT MULTIPLICATION
0183 00AD           VAD        RMB   1              = THESE BYTES ARE USE AS RANDOM DATA
0184 00AE           VAE        RMB   1              = BY THE RND STATEMENT
0185
0186                * EXTENDED BASIC VARIABLES
0187 00AF           TRCFLG     RMB   1              *PV TRACE FLAG 0=OFF ELSE=ON
0188 00B0           USRADR     RMB   2              *PV ADDRESS OF THE START OF USR VECTORS
0189 00B2           FORCOL     RMB   1              *PV FOREGROUND COLOR
0190 00B3           BAKCOL     RMB   1              *PV BACKGROUND COLOR
0191 00B4           WCOLOR     RMB   1              *TV WORKING COLOR BEING USED BY EX BASIC
0192 00B5           ALLCOL     RMB   1              *TV ALL PIXELS IN THIS BYTE SET TO COLOR OF VB3
0193 00B6           PMODE      RMB   1              *PV PMODE'S MODE ARGUMENT
0194 00B7           ENDGRP     RMB   2              *PV END OF CURRENT GRAPHIC PAGE
0195 00B9           HORBYT     RMB   1              *PV NUMBER OF BYTES/HORIZONTAL GRAPHIC LINE
0196 00BA           BEGGRP     RMB   2              *PV START OF CURRENT GRAPHIC PAGE
0197 00BC           GRPRAM     RMB   1              *PV START OF GRAPHIC RAM (MS BYTE)
0198 00BD           HORBEG     RMB   2              *DV* *PV HORIZ COORD - START POINT
0199 00BF           VERBEG     RMB   2              *DV* *PV VERT COORD - START POINT
0200 00C1           CSSYAL     RMB   1              *PV SCREEN'S COLOR SET ARGUMENT
0201 00C2           SETFLG     RMB   1              *PV PRESET/PSET FLAG: 0=PRESET, 1=PSET
0202 00C3           HOREND     RMB   2              *DV* *PV HORIZ COORD - ENDING POINT
0203 00C5           VEREND     RMB   2              *DV* *PV VERT COORD - ENDING POINT
0204 00C7           HORDEF     RMB   2              *PV HORIZ COORD - DEFAULT COORD
0205 00C9           VERDEF     RMB   2              *PV VERT COORD - DEFAULT COORD
0206
0207                * EXTENDED BASIC SCRATCH PAD VARIABLES
0208 00CB           VCB        RMB   2
0209 00CD           VCD        RMB   2
0210 00CF           VCF        RMB   2
0211 00D1           VD1        RMB   2
0212 00D3           VD3        RMB   1
0213 00D4           VD4        RMB   1
0214 00D5           VD5        RMB   1
0215 00D6           VD6        RMB   1
0216 00D7           VD7        RMB   1
0217 00D8           VD8        RMB   1
0218 00D9           VD9        RMB   1
0219 00DA           VDA        RMB   1
0220
0221 00DB           CHGFLG     RMB   1              *TV FLAG TO INDICATE IF GRAPHIC DATA HAS BEEN CHANGED
0222 00DC           TMPSTK     RMB   2              *TV STACK POINTER STORAGE DURING PAINT
```

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0223 00DE           OCTAVE     RMB   1              *PV OCTAVE VALUE (PLAY)
0224 00DF           VOLHI      RMB   1              *DV* *PV VOLUME HIGH VALUE (PLAY)
0225 00E0           VOLLOW     RMB   1              *DV* *PV VOLUME LOW VALUE (PLAY)
0226 00E1           NOTELN     RMB   1              *PV NOTE LENGTH (PLAY)
0227 00E2           TEMPO      RMB   1              *PV TEMPO VALUE (PLAY)
0228 00E3           PLYTMR     RMB   2              *TV TIMER FOR THE PLAY COMMAND
0229 00E5           DOTYAL     RMB   1              *TV DOTTED NOTE TIMER SCALE FACTOR
0230 00E6           DLBAUD     RMB   1              *DV* *PV DLOAD BAUD RATE CONSTANT $B0=300, $2C=1200
0231 00E7           TIMOUT     RMB   1              *DV* *PV DLOAD TIMEOUT CONSTANT
0232 00E8           ANGLE      RMB   1              *DV* *PV ANGLE VALUE (DRAW)
0233 00E9           SCALE      RMB   1              *DV* *PV SCALE VALUE (DRAW)
0234
0235                * DSKCON VARIABLES
0236 00EA           DCOPC      RMB   1              *PV DSKCON OPERATION CODE 0-3
0237 00EB           DCDRV      RMB   1              *PV DSKCON DRIVE NUMBER 0 3
0238 00EC           DCTRK      RMB   1              *PV DSKCON TRACK NUMBER 0 34
0239 00ED           DSEC       RMB   1              *PV DSKCON SECTOR NUMBER 1-18
0240 00EE           DCBPT      RMB   2              *PV DSKCON DATA POINTER
0241 00F0           DCSTA      RMB   1              *PV DSKCON STATUS BYTE
0242
0243 00F1           FCBTMP     RMB   2              TEMPORARY FCB POINTER
0244
0245 00F3                      RMB   13             SPARE: UNUSED VARIABLES
0246
0247
0248                *                               BASIC  EXBASI(DOSBASIC
0249
0250 0100           SW3VEC     RMB   3              $XXXX  $XXXX  $3B3B  SWI3 VECTOR
0251 0103           SW2VEC     RMB   3              $XXXX  $XXXX  $3B3B  SWI2 VECTOR
0252 0106           SWIVEC     RMB   3              $XXXX  $XXXX  $XXXX  SWI VECTOR
0253 0109           NMIVEC     RMB   3              $XXXX  $XXXX  $D7AE  NMI VECTOR
0254 010C           IRQVEC     RMB   3              $A9B3  $894C  $D7BC  IRQ VECTOR
0255 010F           FRQVEC     RMB   3              $A0F6  $A0F6  $A0F6  FIRQ VECTOR
0256
0257 0112           TIMVAL
0258 0112           USRJMP     RMB   3              JUMP ADDRESS FOR BASIC'S USR FUNCTION
0259                *          RMB   2              TIMER VALUE FOR EXBAS
0260                *          RMB   1              UNUSED BY EXBAS OR DISK BASIC
0261 0115           RVSEED     RMB   1              * FLOATING POINT RANDOM NUMBER SEED EXPONENT
0262 0116                      RMB   4              * MANTISSA: INITIALLY SET TO $804FC75259
0263 011A           CASFLG     RMB   1              UPPER CASE/LOWER CASE FLAG: $FF=UPPER, 0=LOWER
0264 011B           DEBVAL     RMB   2              KEYBOARD DEBOUNCE DELAY (SET TO $45E)
0265 011D           EXPJMP     RMB   3              JUMP ADDRESS FOR EXPONENTIATION
0266                **                              INITIALLY SET TO ERROR FOR BASIC, $8489 FOR EX BASIC
0267
0268                ***        COMMAND INTERPRETATION VECTOR TABLE
0269
0270                ** FOUR SETS OF 10 BYTE TABLES:
0271
0272
0273                ** THE LAST USED TABLE MUST BE FOLLOWED BY A ZERO BYTE
0274                * THE JUMP TABLE VECTORS (3,4 AND 8,9) POINT TO THE JUMP TABLE FOR
0275                * THE FIRST TABLE. FOR ALL OTHER TABLES, THESE VECTORS POINT TO A
0276                * ROUTINE WHICH WILL VECTOR YOU TO THE CORRECT JUMP TABLE.
0277                * SUPER ENHANCED BASIC HAS MODIFIED THIS SCHEME SO THAT THE USER
0278                * TABLE MAY NOT BE ACCESSED.  ANY ADDITIONAL TABLES WILL HAVE TO BE
0279                * ACCESSED FROM A NEW COMMAND HANDLER.
0280
0281                *          BYTE  DESCRIPTION
0282                *          0     NUMBER OF RESERVED WORDS
0283                *          1,2   LOOKUP TABLE OF RESERVED WORDS
0284                *          3,4   JUMP TABLE FOR COMMANDS (FIRST TABLE)
0285                *                VECTOR TO EXPANSION COMMAND HANDLERS (ALL BUT FIRST TABLE)
0286                *          5     NUMBER OF SECONDARY FUNCTIONS
0287                *          6,7   LOOKUP TABLE OF SECONDARY FUNCTIONS (FIRST TABLE)
0288                *                VECTOR TO EXPANSION SECONDARY COMMAND HANDLERS (ALL BUT
0289                *                FIRST TABLE)
0290                *          8,9   JUMP TABLE FOR SECONDARY FUNCTIONS
0291                *          10    0 BYTE - END OF TABLE FLAG (LAST TABLE ONLY)
0292
0293 0120           COMVEC     RMB   10             BASIC'S TABLE
0294 012A                      RMB   10             EX BASIC'S TABLE
0295 0134                      RMB   10             DISC BASIC'S TABLE (UNUSED BY EX BASIC)
0296
```

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0297                    **** USR FUNCTION VECTOR ADDRESSES (EX BASIC ONLY)
0298 013E                        RMB   2              USR Ø VECTOR
0299 0140                        RMB   2              USR 1
0300 0142                        RMB   2              USR 2
0301 0144                        RMB   2              USR 3
0302 0146                        RMB   2              USR 4
0303 0148                        RMB   2              USR 5
0304 014A                        RMB   2              USR 6
0305 014C                        RMB   2              USR 7
0306 014E                        RMB   2              USR 8
0307 0150                        RMB   2              USR 9
0308
0309                    *** THE ABOVE 20 BYTE USR ADDR VECTOR TABLE IS MOVED TO
0310                    *** $95F-$972 BY DISC BASIC. THE 20 BYTES FROM $13E-$151
0311                    *** ARE REDEFINED AS FOLLOWS:
0312
0313                    *         RMB   10             USER (SPARE) COMMAND INTERPRETATION TABLE SPACE
0314                    *         FCB   Ø              END OF COMM INTERP TABLE FLAG
0315                    *         RMB   9              UNUSED BY DISK BASIC
0316
0317                    *         COMMAND INTERPRETATION TABLE VALUES
0318                    *              BYTE            BASIC  EX BAS␣DISK BASIC
0319                    *              Ø               53                  BASIC TABLE
0320                    *              1,2             $AA66
0321                    *              3,4             $AB67
0322                    *              5               20
0323                    *              6,7             $AB1A
0324                    *              8,9             $AA29
0325
0326                    *              Ø                     25            EX BASIC TABLE
0327                    *              1,2                   $8183
0328                    *              3,4                   $813C  $CE2E  ($CFØA 2.1)
0329                    *              5                     14
0330                    *              6,7                   $821E
0331                    *              8,9                   $8168  $CE56  ($CF32 2.1)
0332
0333                    *              Ø                     19 (2Ø 2.1)   DISK BASIC TABLE
0334                    *              1,2                   $C17F
0335                    *              3,4                   $C2CØ
0336                    *              5                     6
0337                    *              6,7                   $C201
0338                    *              8,9                   $C236
0339
0340
0341 0152               KEYBUF   RMB   8              KEYBOARD MEMORY BUFFER
0342 015A               POTVAL   RMB   1              LEFT VERTICAL JOYSTICK DATA
0343 015B                        RMB   1              LEFT HORIZONTAL JOYSTICK DATA
0344 015C                        RMB   1              RIGHT VERTICAL JOYSTICK DATA
0345 015D                        RMB   1              RIGHT HORIZONTAL JOYSTICK DATA
0346
0347                    * BASIC'S RAM VECTORS - INITIALIZED TO RTS BY COLOR BASIC
0348                    * 25 SETS OF 3 BYTE INSTRUCTIONS WHICH ARE CALLED BY COLOR BASIC
0349                    * EXTENDED AND DISK BASIC. THEIR PURPOSE IS TO ALLOW ENHANCEMENTS (SUCH
0350                    * AS EX BASIC AND DOS BASIC) AS MORE ROMS ARE ADDED TO THE
0351                    * SYSTEM BY EFFECTIVELY ALLOWING MORE CODE TO BE ADDED TO THE
0352                    * ROUTINES IN EARLIER ROMS. THIS NEW CODE IS LOCATED IN THE NEW ROMS
0353                    * AND THE ADDRESS TO GET TO THE NEW CODE IS IN BYTES 1 & 2 OF THE
0354                    * RAM VECTOR. BYTE Ø WILL CONTAIN A $7E WHICH IS THE FIRST BYTE OF
0355                    * THE JMP INSTRUCTION.
0356                    * THE FIRST ADDRESS IN THIS TABLE IS THE ADDRESS IN BASIC WHICH
0357                    * CALLS THE RAM VECTOR, THE SECOND ADDRESS IS THE VALUE WHICH
0358                    * EX BASIC PUTS IN THE RAM VECTOR (IF ANY) AND THE THIRD ADDRESS
0359                    * IS THE VALUE WHICH DISK BASIC PUTS THERE (IF ANY)
0360
0361
0362                    *                              2.Ø    2.1    1.Ø    1.1
0363 015E               RVECØ    RMB   3              $A5F6         $C426  $C44B  OPEN COMMAND
0364 0161               RVEC1    RMB   3              $A5B9         $C838  $C888  DEVICE NUMBER VALIDITY CHECK
0365 0164               RVEC2    RMB   3              $A35F         $C843  $C893  SET PRINT PARAMETERS
0366 0167               RVEC3    RMB   3              $A282  $8273  $CB4A  $CC1C  CONSOLE OUT
0367 016A               RVEC4    RMB   3              $A176  $8CF1  $C58F  $C5BC  CONSOLE IN
0368 016D               RVEC5    RMB   3              $A3ED         $C818  $C848  INPUT DEVICE NUMBER CHECK
0369 0170               RVEC6    RMB   3              $A406         $C81B  $C84B  PRINT DEVICE NUMBER CHECK
0370 0173               RVEC7    RMB   3              $A426         $CA3B  $CAE9  CLOSE ALL FILES
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0371 0176          RVEC8     RMB   3              $A42D  $8286  $CA4B  $CAF9  CLOSE ONE FILE
0372 0179          RVEC9     RMB   3              $B918  $8E9Ø  $8E9Ø  $8E9Ø  PRINT
0373 017C          RVEC1Ø    RMB   3              $B061         $CC5B  $CD35  INPUT
0374 017F          RVEC11    RMB   3              $A549         $C859  $C8A9  BREAK CHECK
0375 0182          RVEC12    RMB   3              $A39Ø         $C6B7  $C6E4  INPUTTING A BASIC LINE
0376 0185          RVEC13    RMB   3              $A4BF         $CA36  $CAE4  TERMINATING BASIC LINE INPUT
0377 0188          RVEC14    RMB   3              $A5CE         $CA6Ø  $C9ØC  EOF COMMAND
0378 018B          RVEC15    RMB   3              $B223  $8846  $CDF6  $CED2  EVALUATE AN EXPRESSION
0379 018E          RVEC16    RMB   3              $AC46         $C6B7  $C6E4  RESERVED FOR ON ERROR GOTO CMD
0380 0191          RVEC17    RMB   3              $AC49  $88FØ  $C24D  $C265  ERROR DRIVER
0381 0194          RVEC18    RMB   3              $AE75  $829C  $C99Ø  $CA3E  RUN
0382 0197          RVEC19    RMB   3              $BD22  $87EF                ASCII TO FLOATING POINT CONV.
0383 019A          RVEC2Ø    RMB   3              $AD9E  $82B9         $C8BØ  BASIC'S COMMAND INTERP. LOOP
0384 019D          RVEC21    RMB   3              $A8C4                       RESET/SET/POINT COMMANDS
0385 01AØ          RVEC22    RMB   3              $A91Ø                       CLS
0386               *                              $8162                       EXBAS' SECONDARY TOKEN HANDLER
0387               *                              $8AFA                       EXBAS' RENUM TOKEN CHECK
0388               *                              $975C         $C29A  $C2B2  EXBAS' GET/PUT
0389 01A3          RVEC23    RMB   3              $B821  $8304                 CRUNCH BASIC LINE
0390 01A6          RVEC24    RMB   3              $B7C2                       UNCRUNCH BASIC LINE
0391
0392 01A9          STRSTK    RMB   8*5            STRING DESCRIPTOR STACK
0393 01D1          CFNBUF    RMB   9              CASSETTE FILE NAME BUFFER
0394 01DA          CASBUF    RMB   256            CASSETTE FILE DATA BUFFER
0395 02DA          LINHDR    RMB   2              LINE INPUT BUFFER HEADER
0396 02DC          LINBUF    RMB   LBUFMX+1       BASIC LINE INPUT BUFFER
0397 03D7          STRBUF    RMB   41             STRING BUFFER
0398
0399 0400          VIDRAM    RMB   2ØØ            VIDEO DISPLAY AREA
0400
0401               *START OF ADDITIONAL RAM VARIABLE STORAGE (DISK BASIC ONLY)
0402 0600          DBUFØ     RMB   SECLEN         I/O BUFFER #Ø
0403 0700          DBUF1     RMB   SECLEN         I/O BUFFER #1
0404 0800          FATBLØ    RMB   FATLEN         FILE ALLOCATION TABLE - DRIVE Ø
0405 084A          FATBL1    RMB   FATLEN         FILE ALLOCATION TABLE - DRIVE 1
0406 0894          FATBL2    RMB   FATLEN         FILE ALLOCATION TABLE - DRIVE 2
0407 08DE          FATBL3    RMB   FATLEN         FILE ALLOCATION TABLE - DRIVE 3
0408 0928          FCBV1     RMB   16*2           FILE BUFFER VECTORS (15 USER, 1 SYSTEM)
0409 0948          RNBFAD    RMB   2              START OF FREE RANDOM FILE BUFFER AREA
0410 094A          FCBADR    RMB   2              START OF FILE CONTROL BLOCKS
0411 094C          DNAMBF    RMB   8              DISK FILE NAME BUFFER
0412 0954          DEXTBF    RMB   3              DISK FILE EXTENSION NAME BUFFER
0413 0957          DFLTYP    RMB   1              *DV* DISK FILE TYPE: Ø=BASIC, 1=DATA, 2=MACHINE
0414               *                                   LANGUAGE, 3=TEXT EDITOR SOURCE FILE
0415 0958          DASCFL    RMB   1              *DV* ASCII FLAG: Ø=CRUNCHED OR BINARY, $FF=ASCII
0416 0959          DRUNFL    RMB   1              RUN FLAG: (IF BIT 1=1 THEN RUN, IF BIT Ø=1, THEN CLOSE
0417               *                              ALL FILES BEFORE RUNNING)
0418 095A          DEFDRV    RMB   1              DEFAULT DRIVE NUMBER
0419 095B          FCBACT    RMB   1              NUMBER OF FCBS ACTIVE
0420 095C          DRESFL    RMB   1              RESET FLAG: <>Ø WILL CAUSE A 'NEW' & SHUT DOWN ALL FCBS
0421 095D          DLOADFL   RMB   1              LOAD FLAG: CAUSE A 'NEW' FOLLOWING A LOAD ERROR
0422 095E          DMRGFL    RMB   1              MERGE FLAG: Ø=NØ MERGE, $FF=MERGE
0423 095F          DUSRVC    RMB   2Ø             DISK BASIC USR COMMAND VECTORS
0424               *** DISK FILE WORK AREA FOR DIRECTORY SEARCH
0425               *   EXISTING FILE
0426 0973          V973      RMB   1              SECTOR NUMBER
0427 0974          V974      RMB   2              RAM DIRECTORY IMAGE ADDRESS
0428 0976          V976      RMB   1              FIRST GRANULE NUMBER
0429               *   UNUSED FILE
0430 0977          V977      RMB   1              SECTOR NUMBER
0431 0978          V978      RMB   2              RAM DIRECTORY IMAGE ADDRESS
0432
0433 097A          WFATVL    RMB   2              WRITE FAT VALUE: NUM OF FREE GRANS WHICH MUST BE TAKEN
0434                                              FROM THE FAT TO TRIGGER A WRITE FAT TO DISK SEQUENCE
0435 097C          DFFLEN    RMB   2              DIRECT ACCESS FILE RECORD LENGTH
0436 097E          DRØTRK    RMB   4              CURRENT TRACK NUMBER, DRIVES Ø,1,2,3
0437 0982          NMIFLG    RMB   1              NMI FLAG: Ø=DON'T VECTOR <>Ø=YECTOR OUT
0438 0983          DNMIVC    RMB   2              NMI VECTOR: WHERE TO JUMP FOLLOWING AN NMI
0439               *                              INTERRUPT IF THE NMI FLAG IS SET
0440 0985          RDYTMR    RMB   1              MOTOR TURN OFF TIMER
0441 0986          DRGRAM    RMB   1              RAM IMAGE OF DSKREG ($FF4Ø)
0442 0987          DVERFL    RMB   1              VERIFY FLAG: Ø=OFF, $FF=ON
0443 0988          ATTCTR    RMB   1              READ/WRITE ATTEMPT COUNTER: NUMBER OF TIMES THE
0444               *                              DISK WILL ATTEMPT TO RETRIEVE OR WRITE DATA
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0445                *                               BEFORE IT GIVES UP AND ISSUES AN ERROR.
0446
0447 0989           DFLBUF     RMB   SECLEN         INITIALIZED TO SECLEN BY DISKBAS
0448
0449                *RANDOM FILE RESERVED AREA
0450
0451                *FILE CONTROL BLOCKS AND BUFFERS
0452
0453                *GRAPHIC PAGE RESERVED AREA
0454
0455                *BASIC PROGRAM
0456
0457                *VARIABLE STORAGE AREA
0458
0459                *ARRAY STORAGE AREA
0460
0461
0462                * FREE MEMORY
0463
0464
0465                *STACK
0466
0467                *STRING SPACE
0468
0469                *USER PROGRAM RESERVED AREA
0470
0471                *END OF RAM
0472
0473 8000           ORG        $8000
0474
0475 8000                      RMB   $2000          EXTENDED BASIC ROM
0476 A000                      RMB   $2000          COLOR BASIC ROM
0477 C000           ROMPAK     EQU   *
0478 C000           DOSBAS     RMB   $2000          DISK BASIC ROM/ENHANCED BASIC INIT CODE
0479 E000                      RMB   $1F00          ENHANCED BASIC
0480
0481
0482                * I/O AREA
0483
0484 FF00           PIA0       EQU   *              PERIPHERAL INTERFACE ADAPTER ONE
0485
0486 FF00           BIT0       KEYBOARD ROW 1 AND RIGHT JOYSTICK SWITCH 1
0487                BIT1       KEYBOARD ROW 2 AND LEFT JOYSTICK SWITCH 1
0488                BIT2       KEYBOARD ROW 3 AND RIGHT JOYSTICK SWITCH 2
0489                BIT3       KEYBOARD ROW 4 AND LEFT JOYSTICK SWITCH 2
0490                BIT4       KEYBOARD ROW 5
0491                BIT5       KEYBOARD ROW 6
0492                BIT6       KEYBOARD ROW 7
0493                BIT7       JOTSTICK COMPARISON IINPUT
0494
0495 FF01           BIT0       CONTROL OF HSYNC (63.5ps)   0 = IRQ* TO CPU DISABLED
0496                           INTERRUPT                   1 = IRQ* TO CPU ENABLED
0497                BIT1       CONTROL OF INTERRUPT        0 = FLAG SET ON FALLING EDGE OF HS
0498                           POLARITY                    1 = FLAG SET ON RISING EDGE OF HS
0499                BIT2       NORMALLY 1                  0 = CHANGES FF00 TO DATA DIRECTION
0500                BIT3       SEL 1                       LSB OF TWO ANALOG MUX SELECT LINES
0501                BIT4       ALWAYS 1
0502                BIT5       ALWAYS 1
0503                BIT6       NOT USED
0504                BIT7       HORIZONTAL SYNC INTERRUPT FLAG
0505
0506 FF02           BIT0       KEYBOARD COLUMN 1
0507                BIT1       KEYBOARD COLUMN 2
0508                BIT2       KEYBOARD COLUMN 3
0509                BIT3       KEYBOARD COLUMN 4
0510                BIT4       KEYBOARD COLUMN 5
0511                BIT5       KEYBOARD COLUMN 6
0512                BIT6       KEYBOARD COLUMN 7 / RAM SIZE OUTPUT
0513                BIT7       KEYBOARD COLUMN 8
0514
0515 FF03           BIT0       CONTROL OF VSYNC (16.667ms)  0 = IRQ* TO CPU DISABLED
0516                           INTERRUPT                    1 = IRQ* TO CPU ENABLED
0517                BIT1       CONTROL OF INTERRUPT         0 = FLAG SET ON FALLING EDGE OF FS
0518                           POLARITY                     1 = FLAG SET ON RISING EDGE OF FS
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0519                BIT2      NORMALLY 1                  Ø = CHANGES FFØ2 TO DATA DIRECTION
0520                BIT3      SEL 2                       MSB OF TWO ANALOG MUX SELECT LINES
0521                BIT4      ALWAYS 1
0522                BIT5      ALWAYS 1
0523                BIT6      NOT USED
0524                BIT7      FIELD SYNC INTERRUPT FLAG
0525
0526 FFØ4                     RMB   28             PIAØ IMAGES
0527 FF2Ø           DA
0528 FF2Ø           PIA1      EQU   *              PERIPHERAL INTERFACE ADAPTER TWO
0529
0530 FF2Ø           BITØ      CASSETTE DATA INPUT
0531                BIT1      RS-232C DATA OUTPUT
0532                BIT2      6 BIT D/A LSB
0533                BIT3      6 BIT D/A
0534                BIT4      6 BIT D/A
0535                BIT5      6 BIT D/A
0536                BIT6      6 BIT D/A
0537                BIT7      6 BIT D/A MSB
0538
0539 FF21           BITØ      CONTROL OF CD               Ø = FIRQ* TO CPU DISABLED
0540                          (RS-232C STATUS)            1 = FIRQ* TO CPU ENABLED
0541                BIT1      CONTROL OF INTERRUPT        Ø = FLAG SET ON FALLING EDGE OF CD
0542                          POLARITY                    1 = FLAG SET ON RISING EDGE OF CD
0543                BIT2      NORMALLY 1                  Ø = CHANGES FF2Ø TO DATA DIRECTION
0544                BIT3      CASSETTE MOTOR CONTROL      Ø = OFF       1 = ON
0545                BIT4      ALWAYS 1
0546                BIT5      ALWAYS 1
0547                BIT6      NOT USED
0548                BIT7      CD INTERRUPT FLAG
0549
0550 FF22           BITØ      RS-232C DATA INPUT
0551                BIT1      SINGLE BIT SOUND OUTPUT
0552                BIT2      RAM SIZE INPUT
0553                BIT3      RGB MONITOR SENSING INPUT   CSS
0554                BIT4      VDG CONTROL OUTPUT          GMØ & UPPER/LOWER CASE*
0555                BIT5      VDG CONTROL OUTPUT          GM1 & INVERT
0556                BIT6      VDG CONTROL OUTPUT          GM2
0557                BIT7      VDG CONTROL OUTPUT          A*/G
0558
0559 FF23           BITØ      CONTROL OF CARTRIDGE        Ø = FIRQ* TO CPU DISABLED
0560                          INTERRUPT                   1 = FIRQ* TO CPU ENABLED
0561                BIT1      CONTROL OF INTERRUPT        Ø = FLAG SET ON FALLING EDGE OF CART*
0562                          POLARITY                    1 = FLAG SET ON RISING EDGE OF CART*
0563                BIT2      NORMALLY 1                  Ø = CHANGES FF22 TO DATA DIRECTION
0564                BIT3      SOUND ENABLE
0565                BIT4      ALWAYS 1
0566                BIT5      ALWAYS 1
0567                BIT6      NOT USED
0568                BIT7      CARTRIDGE INTERRUPT FLAG
0569
0570 FF24                     RMB   28             PIA1 IMAGES
0571 FF4Ø           PIA2
0572 FF4Ø           DSKREG    RMB   1              DISK CONTROL REGISTER
0573
0574 FF4Ø           BITØ      DRIVE SELECT Ø
0575                BIT1      DRIVE SELECT 1
0576                BIT2      DRIVE SELECT 2
0577                BIT3      DRIVE MOTOR ENABLE          Ø = MOTORS OFF      1 = MOTORS ON
0578                BIT4      WRITE PRECOMPENSATION       Ø = NO PRECOMP      1 = PRECOMP
0579                BIT5      DENSITY FLAG                Ø = SINGLE          1 = DOUBLE
0580                BIT6      DRIVE SELECT 3
0581                BIT7      HALT FLAG                   Ø = DISABLED        1 = ENABLED
0582
0583 FF41                     RMB   7              DSKREG IMAGES
0584
0585                * FLOPPY DISK CONTROLLER INTERNAL REGISTERS
0586 FF48           FDCREG    RMB   1              STATUS/COMMAND REGISTER
0587
0588                COMMANDS  TYPE  COMMAND              CODE
0589                          I     RESTORE              $Ø3
0590                          I     SEEK                 $17
0591                          I     STEP                 $23
0592                          I     STEP IN              $43
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0593                          I     STEP OUT              $53
0594                          II    READ SECTOR           $8Ø
0595                          II    WRITE SECTOR          $AØ
0596                          III   READ ADDRESS          $CØ
0597                          III   READ TRACK            $E4
0598                          III   WRITE TRACK           $F4
0599                          IV    FORCE INTERRUPT       $DØ
0600
0601                STATUS    BIT   TYPE I          READ ADDRESS/SECTOR/TRACK   WRITE SECTOR/TRACK
0602                          SØ    BUSY            BUSY                        BUSY
0603                          S1    INDEX           DRQ                         DRQ
0604                          S2    TRACK Ø         LOST DATA                   LOST DATA
0605                          S3    CRC ERROR       CRC ERROR (EXCEPT TRACK)    CRC ERROR (EXCEPT TRACK)
0606                          S4    SEEK ERROR      RNF (EXCEPT TRACK)          RNF (EXCEPT TRACK)
0607                          S5    HEAD LOADED     RECORD TYPE (SECTOR ONLY)   WRITE FAULT
0608                          S6    WRITE PROTECT                               WRITE PROTECT
0609                          S7    NOT READY       NOT READY                   NOT READY
0610
0611 FF49                     RMB   1               TRACK REGISTER
0612 FF4A                     RMB   1               SECTOR REGISTER
0613 FF4B                     RMB   1               DATA REGISTER
0614 FF4C                     RMB   4               FDCREG IMAGES
0615
0616 FF5Ø                     RMB   16              UNUSED SPACE
0617 FF6Ø                     RMB   1               X COORDINATE FOR X-PAD
0618 FF61                     RMB   1               Y COORDINATE FOR X-PAD
0619 FF62                     RMB   1               STATUS REGISTER FOR X-PAD
0620 FF63                     RMB   5               UNUSED
0621                * RS-232 PROGRAM PAK
0622 FF68                     RMB   1               READ/WRITE DATA REGISTER
0623 FF69                     RMB   1               STATUS REGISTER
0624 FF6A                     RMB   1               COMMAND REGISTER
0625 FF6B                     RMB   1               CONTROL REGISTER
0626 FF6C                     RMB   4
0627 FF7Ø                     RMB   13
0628 FF7D                     RMB   1               SOUND/SPEECH CARTRIDGE RESET
0629 FF7E                     RMB   1               SOUND/SPEECH CARTRIDGE READ/WRITE
0630 FF7F                     RMB   1               MULTI-PAK PROGRAMMING REGISTER
0631
0632 FF8Ø                     RMB   64              RESERVED FOR FUTURE EXPANSION
0633
0634
0635 FFCØ           SAMREG    EQU   *               SAM CONTROL REGISTERS
0636
0637 FFCØ           VØCLR     RMB   1               CLEAR COCO GRAPHICS MODE VØ
0638 FFC1           VØSET     RMB   1               SET COCO GRAPHICS MODE VØ
0639 FFC2           V1CLR     RMB   1               CLEAR COCO GRAPHICS MODE V1
0640 FFC3           V1SET     RMB   1               SET COCO GRAPHICS MODE V1
0641 FFC4           V2CLR     RMB   1               CLEAR COCO GRAPHICS MODE V2
0642 FFC5           V2SET     RMB   1               SET COCO GRAPHICS MODE V2
0643 FFC6           FØCLR     RMB   1               CLEAR COCO GRAPHICS OFFSET FØ
0644 FFC7           FØSET     RMB   1               SET COCO GRAPHICS OFFSET FØ
0645 FFC8           F1CLR     RMB   1               CLEAR COCO GRAPHICS OFFSET F1
0646 FFC9           F1SET     RMB   1               SET COCO GRAPHICS OFFSET F1
0647 FFCA           F2CLR     RMB   1               CLEAR COCO GRAPHICS OFFSET F2
0648 FFCB           F2SET     RMB   1               SET COCO GRAPHICS OFFSET F2
0649 FFCC           F3CLR     RMB   1               CLEAR COCO GRAPHICS OFFSET F3
0650 FFCD           F3SET     RMB   1               SET COCO GRAPHICS OFFSET F3
0651 FFCE           F4CLR     RMB   1               CLEAR COCO GRAPHICS OFFSET F4
0652 FFCF           F4SET     RMB   1               SET COCO GRAPHICS OFFSET F4
0653 FFDØ           F5CLR     RMB   1               CLEAR COCO GRAPHICS OFFSET F5
0654 FFD1           F5SET     RMB   1               SET COCO GRAPHICS OFFSET F5
0655 FFD2           F6CLR     RMB   1               CLEAR COCO GRAPHICS OFFSET F6
0656 FFD3           F6SET     RMB   1               SET COCO GRAPHICS OFFSET F6
0657 FFD4                     RMB   4               RESERVED
0658 FFD8           R1CLR     RMB   1               CLEAR CPU RATE, (Ø.89 MHz)
0659 FFD9           R1SET     RMB   1               SET CPU RATE, (1.78 MHz)
0660 FFDA                     RMB   4               RESERVED
0661 FFDE           ROMCLR    RMB   1               ROM DISABLED
0662 FFDF           ROMSET    RMB   1               ROM ENABLED
0663
0664 FFEØ                     RMB   18              RESERVED FOR FUTURE MPU ENHANCEMENTS
0665                *         INTERRUPT VECTORS
0666 FFF2           SWI3      RMB   2
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0667 FFF4          SWI2      RMB   2
0668 FFF6          FIRQ      RMB   2
0669 FFF8          IRQ       RMB   2
0670 FFFA          SWI       RMB   2
0671 FFFC          NMI       RMB   2
0672 FFFE          RESETV    RMB   2
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0001   A000                     ORG   $A000
0002   A000 A1 CB          POLCAT FDB   KEYIN                GET A KEYSTROKE
0003   A002 A2 82          CHROUT FDB   PUTCHR               OUTPUT A CHARACTER
0004   A004 A7 7C          CSRDON FDB   CASON                TURN ON CASSETTE MOTOR, START READING
0005   A006 A7 0B          BLKIN  FDB   GETBLK               READ A BLOCK FROM CASSETTE
0006   A008 A7 F4          BLKOUT FDB   SNDBLK               WRITE A BLOCK TO CASSETTE
0007   A00A A9 DE          JOYIN  FDB   GETJOY               READ JOYSTICKS
0008   A00C A7 D8          WRTLDR FDB   WRLDR               TURN ON MOTOR AND WRITE $55 S TO CASSETTE
0009                       *
0010   A00E 10 CE 03 D7    LA00E  LDS   #LINBUF+LBUFMX+1    SET STACK TO TOP OF LINE INPUT BUFFER
0011   A012 86 37                 LDA   #$37                *
0012   A014 B7 FF 23              STA   PIA1+3              * ENABLE 63.5 MICROSECOND INTERRUPT
0013   A017 96 71                 LDA   RSTFLG              GET WARM START FLAG
0014   A019 81 55                 CMPA  #$55                IS IT A WARM START?
0015   A01B 26 57                 BNE   BACDST              NO - D0 A COLD START
0016   A01D 9E 72                 LDX   RSTVEC              WARM START VECTOR
0017   A01F A6 84                 LDA   ,X                  GET FIRST BYTE OF WARM START ADDR
0018   A021 81 12                 CMPA  #$12                IS IT NOP?
0019   A023 26 4F                 BNE   BACDST              NO - DO A COLD START
0020   A025 6E 84                 JMP   ,X                  YES, G0 THERE
0021
0022   A027 31 8C E4       RESVEC LEAY  LA00E,PC            POINT Y TO WARM START CHECK CODE
0023   A02A 8E FF 20       LA02A  LDX   #PIA1               POINT X TO PIA1
0024   A02D 6F 1D                 CLR   -3,X                CLEAR PIA0 CONTROL REGISTER A
0025   A02F 6F 1F                 CLR   -1,X                CLEAR PIA0 CONTROL REGISTER B
0026   A031 6F 1C                 CLR   -4,X                SET PIA0 SIDE A TO INPUT
0027   A033 CC FF 34              LDD   #$FF34              *
0028   A036 A7 1E                 STA   -2,X                * SET PIA0 SIDE B TO OUTPUT
0029   A038 E7 1D                 STB   -3,X                * ENABLE PIA0 PERIPHERAL REGISTERS, DISABLE PIA0
0030   A03A E7 1F                 STB   -1,X                * MPU INTERRUPTS, SET CA2, CA1 TO OUTPUTS
0031   A03C 6F 01                 CLR   1,X                 CLEAR CONTROL REGISTER A ON PIA1
0032   A03E 6F 03                 CLR   3,X                 CLEAR CONTROL REGISTER B ON PIA1
0033   A040 4A                    DECA                      A REG NOW HAS $FE
0034   A041 A7 84                 STA   ,X                  BITS 1-7 ARE OUTPUTS, BIT 0 IS INPUT ON PIA1 SIDE A
0035   A043 86 F8                 LDA   #$F8                =
0036   A045 A7 02                 STA   2,X                 = BITS 0-2 ARE INPUTS, BITS 3-7 ARE OUTPUTS ON B SIDE
0037   A047 E7 01                 STB   1,X                 * ENABLE PERIPHERAL REGISTERS, DISABLE PIA1 MPU
0038   A049 E7 03                 STB   3,X                 * INTERRUPTS AND SET CA2, CB2 AS OUTPUTS
0039   A04B 6F 02                 CLR   2,X                 SET 6847 MODE TO ALPHA-NUMERIC
0040   A04D C6 02                 LDB   #$02                *
0041   A04F E7 84                 STB   ,X                  * MAKE RS232 OUTPUT MARKING
0042   A051 CE FF C0              LDU   #SAMREG             SAM CONTROL REGISTER ADDR
0043   A054 C6 10                 LDB   #16                 16 SAM CONTROL REGISTER BITS
0044   A056 A7 C1          LA056  STA   ,U++                ZERO OUT SAM CONTROL REGISTER BIT
0045   A058 5A                    DECB                      * DECREMENT COUNTER AND
0046   A059 26 FB                 BNE   LA056               * BRANCH IF NOT DONE
0047   A05B B7 FF C9              STA   SAMREG+9            SET DISPLAY PAGE AT $400
0048   A05E 1F 9B                 TFR   B,DP                SET DIRECT PAGE TO ZERO
0049   A060 C6 04                 LDB   #$04                USE AS A MASK TO CHECK RAMSZ INPUT
0050   A062 A7 1E                 STA   -2,X                SET RAMSZ STROBE HIGH
0051   A064 E5 02                 BITB  2,X                 CHECK RAMSZ INPUT
0052   A066 27 0A                 BEQ   LA072               BRANCH IF JUMPER SET FOR 4K RAMS
0053   A068 6F 1E                 CLR   -2,X                SET RAMSZ STROBE LOW
0054   A06A E5 02                 BITB  2,X                 CHECK RAMSZ INPUT
0055   A06C 27 02                 BEQ   LA070               BRANCH IF JUMPER SET FOR 64K RAMS
0056   A06E 33 5E                 LEAU  -2,U                ADJUST POINTER TO SET SAM FOR 16K RAMS
0057   A070 A7 5D          LA070  STA   -3,U                PROGRAM SAM FOR 16K OR 64K RAMS
0058   A072 6E A4          LA072  JMP   ,Y                  GO DO A WARM OR COLD START
0059                       * COLD START ENTRY
0060   A074 8E 04 01       BACDST LDX   #VIDRAM+1           POINT X TO CLEAR 1ST 1K OF RAM
0061   A077 6F 83          LA077  CLR   ,--X                MOVE POINTER DOWN TWO-CLEAR BYTE
0062   A079 30 01                 LEAX  1,X                 ADVANCE POINTER ONE
0063   A07B 26 FA                 BNE   LA077               KEEP GOING IF NOT AT BOTTOM OF PAGE 0
0064   A07D BD A9 28              JSR   LA928               CLEAR SCREEN
0065   A080 6F 80                 CLR   ,X+                 CLEAR 1ST BYTE OF BASIC PROGRAM
0066   A082 9F 19                 STX   TXTTAB              BEGINNING OF BASIC PROGRAM
0067   A084 A6 02          LA084  LDA   2,X                 LOOK FOR END OF MEMORY
0068   A086 43                    COMA                      * COMPLEMENT IT AND PUT IT BACK
0069   A087 A7 02                 STA   2,X                 * INTO SYSTEM MEMORY
0070   A089 A1 02                 CMPA  2,X                 IS IT RAM?
0071   A08B 26 06                 BNE   LA093               BRANCH IF NOT (ROM, BAD RAM OR NO RAM)
0072   A08D 30 01                 LEAX  1,X                 MOVE POINTER UP ONE
0073   A08F 63 01                 COM   1,X                 RE-COMPLEMENT TO RESTORE BYTE
0074   A091 20 F1                 BRA   LA084               KEEP LOOKING FOR END OF RAM
0075   A093 9F 74          LA093  STX   TOPRAM              SAVE ABSOLUTE TOP OF RAM
0076   A095 9F 27                 STX   MEMSIZ              SAVE TOP OF STRING SPACE
0077   A097 9F 23                 STX   STRTAB              SAVE START OF STRING VARIABLES
0078   A099 30 89 FF 38           LEAX  -200,X              CLEAR 200 - DEFAULT STRING SPACE TO 200 BYTES
0079   A09D 9F 21                 STX   FRETOP              SAVE START OF STRING SPACE
0080   A09F 1F 14                 TFR   X,S                 PUT STACK THERE
0081   A0A1 8E A1 0D              LDX   #LA10D              POINT X TO ROM SOURCE DATA
0082   A0A4 CE 00 8F              LDU   #CMPMID             POINT U TO RAM DESTINATION
0083   A0A7 C6 1C                 LDB   #28                 MOVE 28 BYTES
0084   A0A9 BD A5 9A              JSR   LA59A               MOVE 28 BYTES FROM ROM TO RAM
0085   A0AC CE 01 0C              LDU   #IRQVEC             POINT U TO NEXT RAM DESTINATION
0086   A0AF C6 1E                 LDB   #30                 MOVE 30 MORE BYTES
0087   A0B1 BD A5 9A              JSR   LA59A               MOVE 30 BYTES FROM ROM TO RAM
0088   A0B4 AE 14                 LDX   -12,X               POINT X TO SYNTAX ERROR ADDRESS
0089   A0B6 AF 43          LA0B6  STX   3,U                 * SET EXBAS COMMAND INTERPRETATION
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0090   A0B8 AF 48                    STX   8,U                    * HANDLERS TO SYNTAX ERROR
0091   A0BA 8E 01 5E                 LDX   #RVEC0                 POINT X TO START OF RAM VECTORS
0092   A0BD CC 39 4B                 LDD   #$394B                 SET UP TO SAVE 75 RTS
0093   A0C0 A7 80           LA0C0    STA   ,X+                    FILL THE RAM VECTORS WITH RTS
0094   A0C2 5A                       DECB                         * DECREMENT COUNTER AND
0095   A0C3 26 FB                    BNE   LA0C0                  * BRANCH IF NOT DONE
0096   A0C5 B7 02 D9                 STA   LINHDR-1               PUT RTS IN LINHDR-1
0097   A0C8 BD AD 19                 JSR   LAD19                  G0 DO A  NEW
0098   A0CB 8E 45 58                 LDX   #$4558                 ASCII  EX  (FIRST TWO LETTERS OF  EXTENDED )
0099   A0CE BC 80 00                 CMPX  EXBAS                  SEE IF EXTENDED ROM IS THERE
0100   A0D1 10 27 DF 2D              LBEQ  EXBAS+2                IF IT IS, BRANCH TO IT
0101   A0D5 1C AF                    ANDCC #$AF                   ENABLE IRQ, FIRQ
0102   A0D7 8E A1 46                 LDX   #LA147-1               POINT X TO COLOR BASIC COPYRIGHT MESSAGE
0103   A0DA BD B9 9C                 JSR   LB99C                  PRINT  COLOR BASIC
0104   A0DD 8E A0 E8                 LDX   #BAWMST                WARM START ADDRESS
0105   A0E0 9F 72                    STX   RSTVEC                 SAVE IT
0106   A0E2 86 55                    LDA   #$55                   WARM START FLAG
0107   A0E4 97 71                    STA   RSTFLG                 SAVE IT
0108   A0E6 20 0B                    BRA   LA0F3                  GO TO BASIC S MAIN LOOP
0109   A0E8 12              BAWMST   NOP                          NOP REQ D FOR WARM START
0110   A0E9 0F 6F                    CLR   DEVNUM                 SET DEVICE NUMBER TO SCREEN
0111   A0EB BD AD 33                 JSR   LAD33                  DO PART OF A NEW
0112   A0EE 1C AF                    ANDCC #$AF                   ENABLE IRQ,FIRQ
0113   A0F0 BD A9 28                 JSR   LA928                  CLEAR SCREEN
0114   A0F3 7E AC 73          LA0F3  JMP   LAC73                  GO TO MAIN LOOP OF BASIC
0115                         *
0116                         * FIRQ SERVICE ROUTINE
0117   A0F6 7D FF 23          BFRQSV TST   PIA1+3                  CARTRIDGE INTERRUPT?
0118   A0F9 2B 01                    BMI   LA0FC                  YES
0119   A0FB 3B                       RTI
0120   A0FC BD A7 D1          LA0FC  JSR   LA7D1                   DELAY FOR A WHILE
0121   A0FF BD A7 D1                 JSR   LA7D1                  KEEP DELAYING
0122   A102 31 8C 03          LA102  LEAY  <LA108,PC              Y = ROM-PAK START UP VECTOR
0123   A105 7E A0 2A                 JMP   LA02A                  GO DO INITIALIZATION
0124   A108 0F 71             LA108  CLR   RSTFLG                 CLEAR WARM START FLAG
0125   A10A 7E C0 00                 JMP   ROMPAK                 JUMP TO EXTERNAL ROM PACK
0126                         *
0127                         * THESE BYTES ARE MOVED TO ADDRESSES $8F - $AA THE DIRECT PAGE
0128   A10D 12                LA10D  FCB   18                     MID BAND PARTITION OF 1200/2400 HERTZ PERIOD
0129   A10E 18                       FCB   24                     UPPER LIMIT OF 1200 HERTZ PERIOD
0130   A10F 0A                       FCB   10                     UPPER LIMIT OF 2400 HERTZ PERIOD
0131   A110 00 80                    FDB   128                    NUMBER OF 55 S TO CASSETTE LEADER
0132   A112 0B                       FCB   11                     CURSOR BLINK DELAY
0133   A113 00 58                    FDB   88                     CONSTANT FOR 600 BAUD VER 1.2 & UP
0134   A115 00 01                    FDB   1                      PRINTER CARRIAGE RETURN DELAY
0135   A117 10                       FCB   16                     TAB FIELD WIDTH
0136   A118 70                       FCB   112                    LAST TAB ZONE
0137   A119 84                       FCB   132                    PRINTER WIDTH
0138   A11A 00                       FCB   0                      LINE PRINTER POSITION
0139   A11B B4 4A                    FDB   LB44A                  ARGUMENT OF EXEC COMMAND - SET TO  FC  ERROR
0140                         * LINE INPUT ROUTINE
0141   A11D 0C A7                    INC   CHARAD+1
0142   A11F 26 02                    BNE   LA123
0143   A121 0C A6                    INC   CHARAD
0144   A123 B6 00 00          LA123  LDA   >0000
0145   A126 7E AA 1A                 JMP   BROMHK
0146                         *
0147                         * THESE BYTES ARE MOVED TO ADDRESSES $10C-$129
0148   A129 7E A9 B3                 JMP   BIRQSV                 IRQ SERVICE
0149 > A12C 7E A0 F6                 JMP   BFRQSV                 FIRQ SERVICE
0150   A12F 7E B4 4A                 JMP   LB44A                  USR ADDRESS FOR 8K BASIC (INITIALIZED TO  FC  ERROR)
0151   A132 80 4F                    FCB   $80                    *RANDOM SEED
0152   A133 4F C7                    FDB   $4FC7                  *RANDON SEED OF MANTISSA
0153   A135 52 59                    FCB   $5259                  *.811635157
0154   A137 FF                       FCB   $FF                    UPPER CASE/LOWER CASE FLAG (STARTS SET TO UPPER)
0155   A138 04 5E                    FDB   DEBDEL                 KEYBOARD DEBOUNCE DELAY
0156   A13A 7E B2 77                 JMP   LB277                  DISPATCH FOR EXPONENTIATION (INITIALIZED TO SYNTAX ERROR)
0157                         * BASIC COMMAND INTERPRETATION TABLE ROM IMAGE
0158   A13D 35                LA13D  FCB   53                     53 BASIC COMMANDS
0159   A13E AA 66             LA13E  FDB   LAA66                  POINTS TO RESERVED WORDS
0160   A140 AB 67             LA140  FDB   LAB67                  POINTS TO JUMP TABLE FOR COMMANDS
0161   A142 14                LA142  FCB   20                     20 BASIC SECONDARY COMMANDS
0162   A143 AB 1A             LA143  FDB   LAB1A                  POINTS TO SECONDARY FUNCTION RESERVED WORDS
0163   A145 AA 29             LA145  FDB   LAA29                  POINTS TO SECONDARY FUNCTION JUMP TABLE
0164                         * COPYRIGHT MESSAGES
0165   A147 43 4F 4C 4F 52 20 LA147  FCC   'COLOR BASIC 1.2'
0166   A14D 42 41 53 49 43 20
0167   A153 31 2E 32
0168   A156 0D                LA156  FCB   CR
0169   A157 28 43 29 20 31 39 LA157  FCC   '(C) 1982 TANDY'
0170   A15D 38 32 20 54 41 4E
0171   A163 44 59
0172   A165 00                LA165  FCB   $00
0173   A166 4D 49 43 52 4F 53 LA166  FCC   'MICROSOFT'
0174   A16C 4F 46 54
0175   A16F 0D 00             LA16F  FCB   CR,$00
0176
0177   A171 8D 03             LA171  BSR   LA176                  GET A CHARACTER FROM CONSOLE IN
0178   A173 84 7F                    ANDA  #$7F                   MASK OFF BIT 7
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0179   A175 39                        RTS
0180
0181                          * CONSOLE IN
0182   A176 BD 01 6A          LA176   JSR   RVEC4                   HOOK INTO RAM
0183   A179 0F 70                     CLR   CINBFL                  RESET CONSOLE IN BUFFER FLAG = FULL
0184   A17B 0D 6F             LA17B   TST   DEVNUM                  CHECK DEVICE NUMBER
0185   A17D 27 32                     BEQ   LA1B1                   G0 DO CURSOR AND GET A KEY IF SCREEN MODE
0186   A17F 0D 79                     TST   CINCTR                  TEST CHARACTER COUNTER
0187   A181 26 03                     BNE   LA186                   NOT EMPTY - READ IN SOME CASSETTE DATA
0188   A183 03 70                     COM   CINBFL                  SET TO $FF: CONSOLE IN BUFFER EMPTY
0189   A185 39                LA185   RTS
0190                          *
0191   A186 34 74             LA186   PSHS  U,Y,X,B                 SAVE REGISTERS
0192   A188 9E 7A                     LDX   CINPTR                  PICK UP BUFFER POINTER
0193   A18A A6 80                     LDA   ,X+                     GET NEXT CHAR
0194   A18C 34 02                     PSHS  A                       SAVE CHAR ON STACK
0195   A18E 9F 7A                     STX   CINPTR                  SAVE NEW BUFFER POINTER
0196   A190 0A 79             LA190   DEC   CINCTR                  DECR CHAR COUNT
0197   A192 26 03                     BNE   LA197                   RETURN IF BUFFER NOT EMPTY
0198   A194 BD A6 35                  JSR   LA635                   GO READ TAPE
0199   A197 35 F6             LA197   PULS  A,B,X,Y,U,PC            RESTORE REGISTERS
0200                          *
0201   A199 0A 94             LA199   DEC   BLKCNT                  CURSOR BLINK DELAY
0202   A19B 26 0E                     BNE   LA1AB                   NOT TIME FOR NEW COLOR
0203   A19D C6 0B                     LDB   #11                     *
0204   A19F D7 94                     STB   BLKCNT                  *RESET DELAY COUNTER
0205   A1A1 9E 88                     LDX   CURPOS                  GET CURSOR POSITION
0206   A1A3 A6 84                     LDA   ,X                      GET CURRENT CURSOR CHAR
0207   A1A5 8B 10                     ADDA  #$10                    BUMP TO NEXT COLOR
0208   A1A7 8A 8F                     ORA   #$8F                    MAKE SURE IT S A SOLID GRAPHICS BLOCK
0209   A1A9 A7 84                     STA   ,X                      STORE TO SCREEN
0210   A1AB 8E 04 5E          LA1AB   LDX   #DEBDEL                 CURSOR BLINK DELAY
0211   A1AE 7E A7 D3          LA1AE   JMP   LA7D3                   DELAY WHILE X DECREMENTS TO ZERO
0212
0213                          * BLINK CURSOR WHILE WAITING FOR A KEYSTROKE
0214   A1B1 34 14             LA1B1   PSHS  X,B                     SAVE REGISTERS
0215   A1B3 8D E4             LA1B3   BSR   LA199                   GO DO CURSOR
0216   A1B5 8D 14                     BSR   KEYIN                   GO CHECK KEYBOARD
0217   A1B7 27 FA                     BEQ   LA1B3                   LOOP IF NO KEY DOWN
0218   A1B9 C6 60                     LDB   #$60                    BLANK
0219   A1BB E7 9F 00 88               STB   [CURPOS]                BLANK CURRENT CURSOR CHAR ON SCREEN
0220   A1BF 35 94             LA1BF   PULS  B,X,PC
0221                          *
0222                          * THIS ROUTINE GETS A KEYSTROKE FROM THE KEYBOARD IF A KEY
0223                          * IS DOWN. IT RETURNS ZERO TRUE IF THERE WAS NO KEY DOWN.
0224                          *
0225   A1C1 7F FF 02          LA1C1   CLR   PIA0+2                  CLEAR COLUMN STROBE
0226   A1C4 B6 FF 00                  LDA   PIA0                    READ KEY ROWS
0227   A1C7 43                        COMA                          COMPLEMENT ROW DATA
0228   A1C8 48                        ASLA                          SHIFT OFF JOYSTICK DATA
0229   A1C9 27 79                     BEQ   LA244                   RETURN IF NO KEYS OR FIRE BUTTONS DOWN
0230   A1CB 34 54             KEYIN   PSHS  U,X,B                   SAVE REGISTERS
0231   A1CD CE FF 00                  LDU   #PIA0                   POINT U TO PIA0
0232   A1D0 8E 01 52                  LDX   #KEYBUF                 POINT X TO KEYBOARD MEMORY BUFFER
0233   A1D3 4F                        CLRA                          * CLEAR CARRY FLAG, SET COLUMN COUNTER (ACCA)
0234   A1D4 4A                        DECA                          * TO $FF
0235   A1D5 34 12                     PSHS  X,A                     SAVE COLUMN CTR & 2 BLANK (X REG) ON STACK
0236   A1D7 A7 42                     STA   2,U                     INITIALIZE COLUMN STROBE TO $FF
0237   A1D9 69 42             LA1D9   ROL   2,U                     * ROTATE COLUMN STROBE DATA LEFT 1 BIT, CARRY
0238   A1DB 24 43                     BCC   LA220                   * INTO BIT 0 - BRANCH IF 8 SHIFTS DONE
0239   A1DD 6C 60                     INC   ,S                      INCREMENT COLUMN COUNTER
0240   A1DF 8D 59                     BSR   LA23A                   READ KEYBOARD ROW DATA
0241   A1E1 A7 61                     STA   1,S                     TEMP STORE KEY DATA
0242   A1E3 A8 84                     EORA  ,X                      SET ANY BIT WHERE A KEY HAS MOVED
0243   A1E5 A4 84                     ANDA  ,X                      ACCA=0 IF NO NEW KEY DOWN, <70 IF KEY WAS RELEASED
0244   A1E7 E6 61                     LDB   1,S                     GET NEW KEY DATA
0245   A1E9 E7 80                     STB   ,X+                     STORE IT IN KEY MEMORY
0246   A1EB 4D                        TSTA                          WAS A NEW KEY DOWN?
0247   A1EC 27 EB                     BEQ   LA1D9                   NO-CHECK ANOTHER COLUMN
0248   A1EE E6 42                     LDB   2,U                     * GET COLUMN STROBE DATA AND
0249   A1F0 E7 62                     STB   2,S                     * TEMP STORE IT ON THE STACK
0250                          * THIS ROUTINE CONVERTS THE KEY DEPRESSION INTO A NUMBER
0251                          * FROM 0-50 IN ACCB CORRESPONDING TO THE KEY THAT WAS DOWN
0252   A1F2 C6 F8                     LDB   #$F8                    TO MAKE SURE ACCB=0 AFTER FIRST ADDB #8
0253   A1F4 CB 08             LA1F4   ADDB  #$08                    ADD 8 FOR EACH ROW OF KEYBOARD
0254   A1F6 44                        LSRA                          ACCA HAS THE ROW NUMBER OF THIS KEY - ADD 8 FOR EACH ROW
0255   A1F7 24 FB                     BCC   LA1F4                   GO ON UNTIL A ZERO APPEARS IN THE CARRY FLAG
0256   A1F9 EB 60                     ADDB  ,S                      ADD IN THE COLUMN NUMBER
0257                          * NOW CONVERT THE VALUE IN ACCB INTO ASCII
0258   A1FB 27 48                     BEQ   LA245                   THE  AT SIGN  KEY WAS DOWN
0259   A1FD C1 1A                     CMPB  #26                     WAS IT A LETTER?
0260   A1FF 22 46                     BHI   LA247                   NO
0261   A201 CA 40                     ORB   #$40                    YES, CONVERT TO UPPER CASE ASCII
0262   A203 8D 29                     BSR   LA22E                   CHECK FOR THE SHIFT KEY
0263   A205 BA 01 1A                  ORA   CASFLG                  *  OR  IN THE CASE FLAG & BRANCH IF IN UPPER
0264   A208 26 02                     BNE   LA20C                   * CASE MODE OR SHIFT KEY DOWN
0265   A20A CA 20                     ORB   #$20                    CONVERT TO LOWER CASE
0266   A20C E7 60             LA20C   STB   ,S                      TEMP STORE ASCII VALUE
0267   A20E BE 01 1B                  LDX   DEBVAL                  GET KEYBOARD DEBOUNCE
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0268   A211 8D 9B              BSR   LA1AE
0269   A213 C6 FF              LDB   #$FF                  SET COLUMN STROBE TO ALL ONES (NO
0270   A215 8D 21              BSR   LA238                 STROBE) AND READ KEYBOARD
0271   A217 4C                 INCA                        = INCR ROW DATA, ACCA NOW 0 IF NO JOYSTICK
0272   A218 26 06              BNE   LA220                 = BUTTON DOWN. BRANCH IF JOYSTICK BUTTON DOWN
0273   A21A E6 62        LA21A LDB   2,S                   GET COLUMN STROBE DATA
0274   A21C 8D 1A              BSR   LA238                 READ A KEY
0275   A21E A1 61              CMPA  1,S                   IS IT THE SAME KEY AS BEFORE DEBOUNCE?
0276   A220 35 12        LA220 PULS  A,X                   REMOVE TEMP SLOTS FROM THE STACK AND RECOVER
0277                     *                                 THE ASCII VALUE OF THE KEY
0278   A222 26 07              BNE   LA22B                 NOT THE SAME KEY OR JOYSTICK BUTTON
0279   A224 81 12              CMPA  #$12                  IS SHIFT ZERO DOWN?
0280   A226 26 04              BNE   LA22C                 NO
0281   A228 73 01 1A           COM   CASFLG                YES, TOGGLE UPPER CASE/LOWER CASE FLAG
0282   A22B 4F           LA22B CLRA                        SET ZERO FLAG TO INDICATE NO NEW KEY DOWN
0283   A22C 35 D4        LA22C PULS  B,X,U,PC              RESTORE REGISTERS
0284
0285                     * TEST FOR THE SHIFT KEY
0286   A22E 86 7F        LA22E LDA   #$7F                  COLUMN STROBE
0287   A230 A7 42              STA   2,U                   STORE TO P1A
0288   A232 A6 C4              LDA   ,U                    READ KEY DATA
0289   A234 43                 COMA                        *
0290   A235 84 40              ANDA  #$40                  * SET BIT 6 IF SHIFT KEY DOWN
0291   A237 39                 RTS                         RETURN
0292
0293                     * READ THE KEYBOARD
0294   A238 E7 42        LA238 STB   2,U                   SAVE NEW COLUMN STROBE VALUE
0295   A23A A6 C4        LA23A LDA   ,U                    READ PIA0, PORT A TO SEE IF KEY IS DOWN
0296                     *                                 A BIT WILL BE ZERO IF ONE IS
0297   A23C 8A 80              ORA   #$80                  MASK OFF THE JOYSTICK COMPARATOR INPUT
0298   A23E 6D 42              TST   $02,U                 ARE WE STROBING COLUMN 7?
0299   A240 2B 02              BMI   LA244                 NO
0300   A242 8A C0              ORA   #$C0                  YES, FORCE ROW 6 TO BE HIGH - THIS WILL CAUSE
0301                     *                                 THE SHIFT KEY TO BE IGNORED
0302   A244 39           LA244 RTS                         RETURN
0303
0304   A245 C6 33        LA245 LDB   #51                   CODE FOR  AT SIGN
0305   A247 8E A2 38     LA247 LDX   #CONTAB-$36           POINT X TO CONTROL CODE TABLE
0306   A24A C1 21              CMPB  #33                   KEY NUMBER <33?
0307   A24C 25 16              BLO   LA264                 YES (ARROW KEYS, SPACE BAR, ZERO)
0308   A24E 8E A2 1A           LDX   #CONTAB-$54           POINT X TO MIDDLE OF CONTROL TABLE
0309   A251 C1 30              CMPB  #48                   KEY NUMBER >48?
0310   A253 24 0F              BHS   LA264                 YES (ENTER,CLEAR,BREAK,AT SIGN)
0311   A255 8D D7              BSR   LA22E                 CHECK SHIFT KEY (ACCA WILL CONTAIN STATUS)
0312   A257 C1 2B              CMPB  #43                   IS KEY A NUMBER, COLON OR SEMICOLON?
0313   A259 23 02              BLS   LA25D                 YES
0314   A25B 88 40              EORA  #$40                  TOGGLE BIT 6 OF ACCA WHICH CONTAINS THE SHIFT DATA
0315                     *                                 ONLY FOR SLASH,HYPHEN,PERIOD,COMMA
0316   A25D 4D           LA25D TSTA                        SHIFT KEY DOWN?
0317   A25E 26 AC              BNE   LA20C                 YES
0318   A260 CB 10              ADDB  #$10                  NO, ADD IN ASCII OFFSET CORRECTION
0319   A262 20 A8              BRA   LA20C                 GO CHECK FOR DEBOUNCE
0320   A264 58           LA264 ASLB                        MULT ACCB BY 2 - THERE ARE 2 ENTRIES IN CONTROL
0321                     *                                 TABLE FOR EACH KEY - ONE SHIFTED, ONE NOT
0322   A265 8D C7              BSR   LA22E                 CHECK SHIFT KEY
0323   A267 27 01              BEQ   LA26A                 NOT DOWN
0324   A269 5C                 INCB                        ADD ONE TO GET THE SHIFTED VALUE
0325   A26A E6 85        LA26A LDB   B,X                   GET ASCII CODE FROM CONTROL TABLE
0326   A26C 20 9E              BRA   LA20C                 GO CHECK DEBOUNCE
0327                     *
0328                     *
0329                     * CONTROL TABLE   UNSHIFTED, SHIFTED VALUES
0330   A26E 5E 5F        CONTAB FCB    $5E,$5F             UP ARROW
0331   A270 0A 5B              FCB   $0A,$5B               DOWN ARROW
0332   A272 08 15              FCB   $08,$15               RIGHT ARROW
0333   A274 09 5D              FCB   $09,$5D               LEFT ARROW
0334   A276 20 20              FCB   $20,$20               SPACE BAR
0335   A278 30 12              FCB   $30,$12               ZERO
0336   A27A 0D 0D              FCB   $0D,$0D               ENTER
0337   A27C 0C 5C              FCB   $0C,$5C               CLEAR
0338   A27E 03 03              FCB   $03,$03               BREAK
0339   A280 40 13              FCB   $40,$13               AT SIGN
0340
0341                     * CONSOLE OUT
0342   A282 BD 01 67     PUTCHR JSR    RVEC3               HOOK INTO RAM
0343   A285 34 04              PSHS  B                     SAVE ACCB
0344   A287 D6 6F              LDB   DEVNUM                GET DEVICE NUMBER
0345   A289 5C                 INCB                        SET FLAGS
0346   A28A 35 04              PULS  B                     RESTORE ACCB
0347   A28C 2B 31              BMI   LA2BF                 SEND TO LINE PRINTER
0348   A28E 26 7A              BNE   LA30A                 SEND TO SCREEN
0349                     * SEND TO CASSETTE
0350   A290 34 16              PSHS  X,B,A                 RESTORE REGISTERS
0351   A292 D6 78              LDB   FILSTA                GET FILE STATUS
0352   A294 5A                 DECB                        INPUT FILE?
0353   A295 27 0F              BEQ   LA2A6                 YES
0354   A297 D6 79              LDB   CINCTR                TEMP CHAR CTR
0355   A299 5C                 INCB                        IS THE BUFFER FULL
0356   A29A 26 02              BNE   LA29E                 NO
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0357   A29C 8D 0A              BSR   LA2A8                  YES, WRITE DATA BLOCK TO TAPE
0358   A29E 9E 7A        LA29E LDX   CINPTR                 GET BUFFER POINTER
0359   A2A0 A7 80              STA   ,X+                    PUT CHAR IN CASSETTE BUFFER
0360   A2A2 9F 7A              STX   CINPTR                 STORE NEW BUFFER POINTER
0361   A2A4 0C 79              INC   CINCTR                 INCR BYTE COUNT
0362   A2A6 35 96        LA2A6 PULS  A,B,X,PC
0363
0364                     * WRITE A BLOCK OF DATA TO TAPE
0365   A2A8 C6 01        LA2A8 LDB   #1                     DATA BLOCK TYPE - NOT A HEADER BLOCK
0366   A2AA D7 7C        LA2AA STB   BLKTYP                 BLOCK NUMBER
0367   A2AC 8E 01 DA           LDX   #CASBUF                CASSETTE BUFFER
0368   A2AF 9F 7E              STX   CBUFAD                 STARTING ADDRESS
0369   A2B1 D6 79              LDB   CINCTR                 GET NUMBER OF BYTES
0370   A2B3 D7 7D              STB   BLKLEN                 BYTE COUNT
0371   A2B5 34 62              PSHS  U,Y,A                  SAVE REGISTERS
0372   A2B7 BD A7 E5           JSR   LA7E5                  WRITE A BLOCK ON TAPE
0373   A2BA 35 62              PULS  A,Y,U                  RESTORE REGISTERS
0374   A2BC 7E A6 50           JMP   LA650                  RESET BUFFER POINTERS
0375
0376                     * SOFTWARE UART TO L1NE PRINTER
0377   A2BF 34 17        LA2BF PSHS  X,B,A,CC               SAVE REGISTERS AND INTERRUPT STATUS
0378   A2C1 1A 50              ORCC  #$50                   DISABLE IRQ,FIRQ
0379   A2C3 F6 FF 22     LA2C3 LDB   PIA1+2                 GET RS 232 STATUS
0380   A2C6 54                 LSRB                         SHIFT RS 232 STATUS BIT INTO CARRY
0381   A2C7 25 FA              BCS   LA2C3                  LOOP UNTIL READY
0382   A2C9 8D 30              BSR   LA2FB                  SET OUTPUT TO MARKING
0383   A2CB 5F                 CLRB                         *
0384   A2CC 8D 2F              BSR   LA2FD                  * TRANSMIT ONE START BIT
0385   A2CE C6 08              LDB   #8                     SEND 8 BITS
0386   A2D0 34 04        LA2D0 PSHS  B                      SAVE BIT COUNTER
0387   A2D2 5F                 CLRB                         CLEAR DA IMAGE I ZEROES TO DA WHEN SENDING RS 232 DATA
0388   A2D3 44                 LSRA                         ROTATE NEXT BIT OF OUTPUT CHARACTER TO CARRY FLAG
0389   A2D4 59                 ROLB                         * ROTATE CARRY FLAG INTO BIT ONE
0390   A2D5 58                 ASLB                         * AND ALL OTHER BITS SET TO ZERO
0391   A2D6 8D 25              BSR   LA2FD                  TRANSMIT DATA BYTE
0392   A2D8 35 04              PULS  B                      GET BIT COUNTER
0393   A2DA 5A                 DECB                         SENT ALL 8 BITS?
0394   A2DB 26 F3              BNE   LA2D0                  NO
0395   A2DD 8D 1C              BSR   LA2FB                  SEND STOP BIT (ACCB:0)
0396   A2DF 35 03              PULS  CC,A                   RESTORE OUTPUT CHARACTER & INTERRUPT STATUS
0397   A2E1 81 0D              CMPA  #CR                    IS IT CARRIAGE RETURN?
0398   A2E3 27 08              BEQ   LA2ED                  YES
0399   A2E5 0C 9C              INC   LPTPOS                 INCREMENT CHARACTER COUNTER
0400   A2E7 D6 9C              LDB   LPTPOS                 CHECK FOR END OF LINE PRINTER LINE
0401   A2E9 D1 9B              CMPB  LPTWID                 AT END OF LINE PRINTER LINE?
0402   A2EB 25 06              BLO   LA2F3                  NO
0403   A2ED 0F 9C        LA2ED CLR   LPTPOS                 RESET CHARACTER COUNTER
0404   A2EF 8D 14              BSR   LA305                  *
0405   A2F1 8D 12              BSR   LA305                  * DELAY FOR CARRIAGE RETURN
0406   A2F3 F6 FF 22     LA2F3 LDB   PIA1+2                 WAIT FOR HANDSHAKE
0407   A2F6 54                 LSRB                         CHECK FOR R5232 STATUS?
0408   A2F7 25 FA              BCS   LA2F3                  NOT YET READY
0409   A2F9 35 94              PULS  B,X,PC                 RESTORE REGISTERS
0410   A2FB C6 02        LA2FB LDB   #2                     SET RS232 OUTPUT HIGH (MARKING)
0411   A2FD F7 FF 20     LA2FD STB   DA                     STORE TO THE D/A CONVERTER REGISTER
0412   A300 8D 00              BSR   LA302                  GO WAIT A WHILE
0413   A302 9E 95        LA302 LDX   LPTBTD                GET BAUD RATE
0414   A304 8C 9E 97           FCB   SKP2                   SKIP NEXT TWO BYTES
0415   A305 9E 97        LA305 LDX   LPTLND                PRINTER CARRIAGE RETURN DELAY
0416   A307 7E A7 D3           JMP   LA7D3                  DELAY ON DECREMENTING X
0417
0418                     * PUT A CHARACTER ON THE SCREEN
0419   A30A 34 16        LA30A PSHS  X,B,A                  SAVE REGISTERS
0420   A30C 9E 88              LDX   CURPOS                 POINT X TO CURRENT CHARACTER POSITION
0421   A30E 81 08              CMPA  #BS                    IS IT BACKSPACE?
0422   A310 26 0B              BNE   LA31D                  NO
0423   A312 8C 04 00           CMPX  #VIDRAM                AT TOP OF SCREEN?
0424   A315 27 46              BEQ   LA35D                  YES - DO NOT ALLOW BACKSPACE
0425   A317 86 60              LDA   #$60                   BLANK
0426   A319 A7 82              STA   ,-X                    PUT IN PREVIOUS POSITION
0427   A31B 20 27              BRA   LA344                  SAVE NEW CURPOS
0428   A31D 81 0D        LA31D CMPA  #CR                    ENTER KEY?
0429   A31F 26 0E              BNE   LA32F                  BRANCH IF NOT
0430   A321 9E 88              LDX   CURPOS                 GET CURRENT CHAR POSITION
0431   A323 86 60        LA323 LDA   #$60                   BLANK
0432   A325 A7 80              STA   ,X+                    PUT IT ON SCREEN
0433   A327 1F 10              TFR   X,D                    *
0434   A329 C5 1F              BITB  #$1F                   * TEST FOR BEGINNING OF NEW LINE
0435   A32B 26 F6              BNE   LA323                  PUT OUT BLANKS TILL NEW LINE
0436   A32D 20 15              BRA   LA344                  CHECK FOR SCROLLING
0437   A32F 81 20        LA32F CMPA  #SPACE                 *
0438   A331 25 2A              BCS   LA35D                  * BRANCH IF CONTROL CHARACTER
0439   A333 4D                 TSTA                         SET FLAGS
0440   A334 2B 0C              BMI   LA342                  IT IS GRAPHIC CHARACTER
0441   A336 81 40              CMPA  #$40                   *
0442   A338 25 06              BCS   LA340                  * BRANCH IF NUMBER OR SPECIAL CHARACTER
0443   A33A 81 60              CMPA  #$60                   UPPER/LOWER CASE?
0444   A33C 25 04              BCS   LA342                  BRANCH IF UPPER CASE ALPHA
0445   A33E 84 DF              ANDA  #$DF                   CLEAR BIT 5, FORCE ASCII LOWER CASE TO BE UPPER CASE
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0446   A340 88 40           LA340   EORA  #$40                   INVERT BIT 6, CHANGE UPPER CASE TO LOWER & VICE VERSA
0447   A342 A7 80           LA342   STA   ,X+                    STORE CHARACTER TO SCREEN
0448   A344 9F 88           LA344   STX   CURPOS                 SAVE CURRENT CHAR POSITION
0449   A346 8C 05 FF                CMPX  #VIDRAM+511            END OF SCREEN BUFFER?
0450   A349 23 12                   BLS   LA35D                  RETURN IF NO NEED TO SCROLL
0451   A34B 8E 04 00                LDX   #VIDRAM                TOP OF SCREEN
0452
0453                        * SCROLL THE SCREEN
0454   A34E EC 88 20        LA34E   LDD   32,X                   GET TWO BYTES
0455   A351 ED 81                   STD   ,X++                   MOVE THEM UP ONE ROW
0456   A353 8C 05 E0                CMPX  #VIDRAM+$1E0           AT THE LAST LINE?
0457   A356 25 F6                   BCS   LA34E                  NO
0458   A358 C6 60                   LDB   #$60                   BLANK
0459   A35A BD A9 2D                JSR   LA92D                  BLANK LAST LINE
0460   A35D 35 96           LA35D   PULS  A,B,X,PC               RESTORE REGISTERS
0461
0462                        * SET UP TAB FIELD WIDTH, TAB ZONE, CURRENT POSITION
0463                        * AND LINE WIDTH ACCORDING TO THE DEVICE SELECTED
0464   A35F BD 01 64        LA35F   JSR   RVEC2                  HOOK INTO RAM
0465   A362 34 16                   PSHS  X,B,A                  SAVE REGISTERS
0466   A364 0F 6E                   CLR   PRTDEV                 RESET PRINT DEVICE NUMBER
0467   A366 96 6F                   LDA   DEVNUM                 GET DEVICE NUMBER
0468   A368 27 09                   BEQ   LA373                  BRANCH IF SCREEN
0469   A36A 4C                      INCA                         CHECK FOR CASSETTE
0470   A36B 27 17                   BEQ   LA384                  BRANCH IF CASSETTE
0471                        * END UP HERE IF PRINTER
0472   A36D 9E 99                   LDX   LPTCFW                 TAB FIELD WIDTH AND TAB ZONE
0473   A36F DC 9B                   LDD   LPTWID                 PRINTER WIDTH AND POSITION
0474   A371 20 09                   BRA   LA37C                  SET PRINT PARAMETERS
0475                        * SCREEN DISPLAY VALUES
0476   A373 D6 89           LA373   LDB   CURPOS+1               GET CURSOR LOC LS BYTE
0477   A375 C4 1F                   ANDB  #$1F                   KEEP ONLY COLUMN POSITION
0478   A377 8E 10 10                LDX   #$1010                 TAB FIELD WIDTH AND LAST TAB ZONE
0479   A37A 86 20                   LDA   #32                    DISPLAY SCREEN LINE WIDTH
0480   A37C 9F 6A           LA37C   STX   DEVCFW                 SAVE TAB FIELD WIDTH AND ZONE
0481   A37E D7 6C                   STB   DEVPOS                 SAVE PRINT POSITION
0482   A380 97 6D                   STA   DEVWID                 SAVE PRINT WIDTH
0483   A382 35 96                   PULS  A,B,X,PC               RESTORE REGISTERS
0484   A384 03 6E           LA384   COM   PRTDEV                 SET TO $FF FOR CASSETTE
0485   A386 8E 01 00                LDX   #$0100                 * TAB FIELD WIDTH = 1; ALL OTHER
0486   A389 4F                      CLRA                         * PARAMETERS = 0
0487   A38A 5F                      CLRB                         *
0488   A38B 20 EF                   BRA   LA37C                  SET PRINT PARAMETERS
0489
0490                        * THIS IS THE ROUTINE THAT GETS AN INPUT LINE FOR BASIC
0491                        * EXIT WITH BREAK KEY: CARRY = 1
0492                        * EXIT WITH ENTER KEY: CARRY = 0
0493   A38D BD A9 28        LA38D   JSR   LA928                  CLEAR SCREEN
0494   A390 BD 01 82        LA390   JSR   RVEC12                 HOOK INTO RAM
0495   A393 0F 87                   CLR   IKEYIM                 RESET BREAK CHECK KEY TEMP KEY STORAGE
0496   A395 8E 02 DD                LDX   #LINBUF+1              INPUT LINE BUFFER
0497   A398 C6 01                   LDB   #1                     ACCB CHAR COUNTER: SET TO 1 TO ALLOW A
0498                        *                                    BACKSPACE AS FIRST CHARACTER
0499   A39A BD A1 71        LA39A   JSR   LA171                  GO GET A CHARACTER FROM CONSOLE IN
0500   A39D 0D 70                   TST   CINBFL                 GET CONSOLE IN BUFFER FLAG
0501   A39F 26 2B                   BNE   LA3CC                  BRANCH IF NO MORE CHARACTERS IN INPUT FILE
0502   A3A1 0D 6F                   TST   DEVNUM                 CHECK DEVICE NUMBER
0503   A3A3 26 23                   BNE   LA3C8                  BRANCH IF NOT SCREEN
0504   A3A5 81 0C                   CMPA  #FORMF                 FORM FEED
0505   A3A7 27 E4                   BEQ   LA38D                  YES - CLEAR SCREEN
0506   A3A9 81 08                   CMPA  #BS                    BACKSPACE
0507   A3AB 26 07                   BNE   LA3B4                  NO
0508   A3AD 5A                      DECB                         YES - DECREMENT CHAR COUNTER
0509   A3AE 27 E0                   BEQ   LA390                  BRANCH IF BACK AT START OF LINE AGAIN
0510   A3B0 30 1F                   LEAX  -1,X                   DECREMENT BUFFER POINTER
0511   A3B2 20 34                   BRA   LA3E8                  ECHO CHAR TO SCREEN
0512   A3B4 81 15           LA3B4   CMPA  #$15                   SHIFT RIGHT ARROW?
0513   A3B6 26 0A                   BNE   LA3C2                  NO
0514                        * YES, RESET BUFFER TO BEGINNING AND ERASE CURRENT LINE
0515   A3B8 5A              LA3B8   DECB                         DEC CHAR CTR
0516   A3B9 27 D5                   BEQ   LA390                  GO BACK TO START IF CHAR CTR = 0
0517   A3BB 86 08                   LDA   #BS                    BACKSPACE?
0518   A3BD BD A2 82                JSR   PUTCHR                 SEND TO CONSOLE OUT (SCREEN)
0519   A3C0 20 F6                   BRA   LA3B8                  KEEP GOING
0520   A3C2 81 03           LA3C2   CMPA  #3                     BREAK KEY?
0521   A3C4 1A 01                   ORCC  #1                     SET CARRY FLAG
0522   A3C6 27 05                   BEQ   LA3CD                  BRANCH IF BREAK KEY DOWN
0523   A3C8 81 0D           LA3C8   CMPA  #CR                    ENTER KEY?
0524   A3CA 26 0D                   BNE   LA3D9                  NO
0525   A3CC 4F              LA3CC   CLRA                         CLEAR CARRY FLAG IF ENTER KEY - END LINE ENTRY
0526   A3CD 34 01           LA3CD   PSHS  CC                     SAVE CARRY FLAG
0527   A3CF BD B9 58                JSR   LB958                  SEND CR TO SCREEN
0528   A3D2 6F 84                   CLR   ,X                     MAKE LAST BYTE IN INPUT BUFFER = 0
0529   A3D4 8E 02 DC                LDX   #LINBUF                RESET INPUT BUFFER POINTER
0530   A3D7 35 81                   PULS  CC,PC                  RESTORE CARRY FLAG
0531
0532                        * INSERT A CHARACTER INTO THE BASIC LINE INPUT BUFFER
0533   A3D9 81 20           LA3D9   CMPA  #$20                   IS IT CONTROL CHAR?
0534   A3DB 25 BD                   BLO   LA39A                  BRANCH IF CONTROL CHARACTER
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0535   A3DD 81 7B                    CMPA  #'z-1                  *
0536   A3DF 24 B9                    BCC   LA39A                  * IGNORE IF > LOWER CASE Z
0537   A3E1 C1 FA                    CMPB  #LBUFMX                HAVE 250 OR MORE CHARACTERS BEEN ENTERED?
0538   A3E3 24 B5                    BCC   LA39A                  YES, IGNORE ANY MORE
0539   A3E5 A7 80                    STA   ,X+                    PUT IT IN INPUT BUFFER
0540   A3E7 5C                       INCB                         INCREMENT CHARACTER COUNTER
0541   A3E8 BD A2 82          LA3E8  JSR   PUTCHR                 ECHO IT TO SCREEN
0542   A3EB 20 AD                    BRA   LA39A                  GO SET SOME MORE
0543
0544                          * INPUT DEVICE NUMBER CHECK
0545   A3ED BD 01 6D          LA3ED  JSR   RVEC5                  HOOK INTO RAM
0546   A3F0 96 6F                    LDA   DEVNUM                 DEVICE NUMBER
0547   A3F2 27 21                    BEQ   LA415                  RETURN IF SCREEN
0548   A3F4 4C                       INCA                         *
0549   A3F5 26 0C                    BNE   LA403                  * BRANCH IF NOT CASSETTE (BAD FILE MODE)
0550   A3F7 96 78                    LDA   FILSTA                 GET FILE STATUS
0551   A3F9 26 05                    BNE   LA400                  FILE IS OPEN
0552   A3FB C6 2C             LA3FB  LDB   #22*2                   FILE NOT OPEN  ERROR
0553   A3FD 7E AC 46                 JMP   LAC46                  JUMP TO ERROR SERVICING ROUTINE
0554   A400 4A                LA400  DECA                         *
0555   A401 27 12                    BEQ   LA415                  * FILE IS IN INPUT MODE, RETURN
0556   A403 7E A6 16          LA403  JMP   LA616                   BAD FILE MODE  ERROR
0557
0558                          * PRINT DEVICE NUMBER CHECK
0559   A406 BD 01 70          LA406  JSR   RVEC6                  HOOK INTO RAM
0560   A409 96 6F                    LDA   DEVNUM                 GET DEVICE NUMBER
0561   A40B 4C                       INCA                         *
0562   A40C 26 07                    BNE   LA415                  * RETURN IF NOT TAPE
0563   A40E 96 78                    LDA   FILSTA                 GET FILE STATUS
0564   A410 27 E9                    BEQ   LA3FB                   FILE NOT OPEN  ERROR
0565   A412 4A                       DECA                         *
0566   A413 27 EE                    BEQ   LA403                  *  BAD FILE MODE  - FILE IN INPUT MODE
0567   A415 39                LA415  RTS
0568
0569                          * CLOSE
0570   A416 27 0E             CLOSE  BEQ   LA426                  BRANCH IF NO NAME SPECIFIED
0571   A418 BD A5 A5                 JSR   LA5A5                  CHECK DEVICE NUMBER
0572   A41B 8D 10             LA41B  BSR   LA42D                  GO CLOSE A FILE
0573   A41D 9D A5                    JSR   GETCCH                 GET CURRENT BASIC CHARACTER
0574   A41F 27 2A                    BEQ   LA44B                  RETURN IF NO MORE FILES
0575   A421 BD A5 A2                 JSR   LA5A2                  CHECK SYNTAX AND DEVICE NUMBER
0576   A424 20 F5                    BRA   LA41B                  KEEP CLOSING FILES
0577
0578                          * CLOSE ALL FILES HANDLER
0579   A426 BD 01 73          LA426  JSR   RVEC7                  HOOK INTO RAM
0580   A429 86 FF                    LDA   #-1                    CASSETTE DEVICE NUMBER
0581   A42B 97 6F                    STA   DEVNUM                 SET DEVICE NUMBER
0582                          * CLOSE FILE HANDLER
0583   A42D BD 01 76          LA42D  JSR   RVEC8                  HOOK INTO RAM
0584   A430 96 6F                    LDA   DEVNUM                 GET DEVICE NUMBER
0585   A432 0F 6F                    CLR   DEVNUM                 SET TO SCREEN
0586   A434 4C                       INCA                         *
0587   A435 26 14                    BNE   LA44B                  * BRANCH IF WAS NOT CASSETTE
0588   A437 96 78                    LDA   FILSTA                 GET FILE STATUS
0589   A439 81 02                    CMPA  #2                     IS IT OUTPUT MODE
0590   A43B 26 0C                    BNE   LA449                  NO
0591   A43D 96 79                    LDA   CINCTR                 GET CHARACTER BUFFER CTR
0592   A43F 27 03                    BEQ   LA444                  WRITE END OF PROG BLOCK IF BUFFER EMPTY
0593   A441 BD A2 A8                 JSR   LA2A8                  WRITE A BLOCK TO TAPE
0594   A444 C6 FF             LA444  LDB   #$FF                   END OF FILE TYPE BLOCK NUMBER
0595   A446 BD A2 AA                 JSR   LA2AA                  WRITE END OF FILE TYPE BLOCK
0596   A449 0F 78             LA449  CLR   FILSTA                 CASSETTE FILE STATUS CLOSED
0597   A44B 39                LA44B  RTS
0598
0599                          * CSAVE
0600   A44C BD A5 78          CSAVE  JSR   LA578                  GO SCAN OFF NAME
0601   A44F 9D A5                    JSR   GETCCH                 GET CURRENT CHARACTER IN THE BASIC LINE
0602   A451 27 16                    BEQ   LA469                  BRANCH IF NONE
0603   A453 BD B2 6D                 JSR   LB26D                  SYNTAX ERROR IF NOT COMMA
0604   A456 C6 41                    LDB   #'A                    IS THIS AN ASCII SAVE?
0605   A458 BD B2 6F                 JSR   LB26F                  SYNTAX ERROR IF NOT  A
0606   A45B 26 EE                    BNE   LA44B                  RETURN IF NOT END OF LINE
0607   A45D 4F                       CLRA                         FILE TYPE = 0
0608   A45E BD A6 5C                 JSR   LA65C                  WRITE OUT HEADER BLOCK
0609   A461 86 FF                    LDA   #-1                    CASSETTE CODE
0610   A463 97 6F                    STA   DEVNUM                 SET DEVICE NUMBER TO CASSETTE
0611   A465 4F                       CLRA                         CLEAR CARRY - FORCE LIST TO BEGIN AT PROGRAM START
0612   A466 7E B7 64                 JMP   LIST                   GO DO A  LIST  TO CASSETTE
0613
0614                          * NON-ASCII CSAVE
0615   A469 4F                LA469  CLRA                         FILE TYPE = 0
0616   A46A 9E 8A                    LDX   ZERO                   ZERO OUT ASCII FLAG AND FILE MODE
0617   A46C BD A6 5F                 JSR   LA65F                  WRITE HEADER BLOCK
0618   A46F 0F 78                    CLR   FILSTA                 CLOSE FILES
0619   A471 0C 7C                    INC   BLKTYP                 INCREMENT BLOCK NUMBER
0620   A473 BD A7 D8                 JSR   WRLDR                  WRITE 55 S TO CASSETTE
0621   A476 9E 19                    LDX   TXTTAB                 ADDRESS OF PROGRAM START
0622   A478 9F 7E             LA478  STX   CBUFAD                 STORE CURRENT BLOCK START ADDR
0623   A47A 86 FF                    LDA   #255                   255 BYTE BLOCKS
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0624   A47C 97 7D                 STA   BLKLEN                  BLOCK SIZE
0625   A47E DC 1B                 LDD   VARTAB                  END OF PROGRAM
0626   A480 93 7E                 SUBD  CBUFAD                  CURRENT BLOCK STARTING ADDR
0627   A482 27 0D                 BEQ   LA491                   BRANCH IF IT CAME OUT EXACT
0628   A484 10 83 00 FF           CMPD  #255                    MORE THAN 255 BYTES LEFT?
0629   A488 24 02                 BHS   LA48C                   YES
0630   A48A D7 7D                 STB   BLKLEN                  USE ACTUAL BLOCK SIZE IF LESS THAN 255
0631   A48C BD A7 F4       LA48C  JSR   SNDBLK                  WRITE BLOCK TO CASSETTE
0632   A48F 20 E7                 BRA   LA478                   DO ANOTHER BLOCK
0633   A491 00 7C          LA491  NEG   BLKTYP                  MAKE BLOCK NUMBER NEGATIVE (EOF BLOCK)
0634   A493 0F 7D                 CLR   BLKLEN                  ZERO BLOCK SIZE
0635   A495 7E A7 E7              JMP   LA7E7                   WRITE A BLOCK, TURN OFF MOTOR
0636
0637                       * CLOAD
0638   A498 0F 78          CLOAD  CLR   FILSTA                  CLOSE FILES
0639   A49A 81 4D                 CMPA  #'M                     IS IT CLOADM?
0640   A49C 27 60                 BEQ   LA4FE                   BRANCH IF SO
0641   A49E 32 62                 LEAS  2,S                     GET RID OF THE RETURN
0642   A4A0 BD A5 C5              JSR   LA5C5                   GO GET FILE NAME
0643   A4A3 BD A6 48              JSR   LA648                   SEARCH FOR FILE
0644   A4A6 7D 01 E4              TST   CASBUF+10               GET FILE MODE (NON-ZERO=DATA OR ASCII)
0645   A4A9 27 1D                 BEQ   LA4C8                   ZERO = CRUNCHED BASIC OR MACHINE LANG
0646   A4AB B6 01 E3              LDA   CASBUF+9                GET ASCII FLAG
0647   A4AE 27 1D                 BEQ   LA4CD                    BAD FILE NODE  0 = CRUNCHED OR MACH LANG
0648   A4B0 BD AD 19              JSR   LAD19                   DO A  NEW
0649   A4B3 86 FF                 LDA   #-1                     TAPE DEVICE NUMBER
0650   A4B5 97 6F                 STA   DEVNUM                  SET DEVICE NUMBER TO TAPE
0651   A4B7 0C 78                 INC   FILSTA                  FILE TYPE = INPUT
0652   A4B9 BD A6 35              JSR   LA635                   GO LOAD ASCII RECORD
0653   A4BC 7E AC 7C              JMP   LAC7C                   GO LOAD AND CRUNCH INPUT
0654
0655                       * COME HERE FROM BASIC S DIRECT LOOP IF CONSOLE
0656                       * IN BUFFER EMPTY
0657   A4BF BD 01 85       LA4BF  JSR   RVEC13                  HOOK INTO RAM
0658   A4C2 BD A4 2D              JSR   LA42D                   CLOSE ACTIVE FILE
0659   A4C5 7E AC 73              JMP   LAC73                   GO TO BASIC S DIRECT LOOP
0660
0661                       * CLOAD A CRUNCHED BASIC
0662   A4C8 B6 01 E2       LA4C8  LDA   CASBUF+8                FILE TYPE
0663   A4CB 27 03                 BEQ   LA4D0                   ZERO IS CSAVE TYPE
0664   A4CD 7E A6 16       LA4CD  JMP   LA616                    BAD FILE MODE  IF NOT BASIC FILE
0665   A4D0 BD AD 19       LA4D0  JSR   LAD19                   DO A  NEW
0666   A4D3 BD A7 7C              JSR   CASON                   TURN ON TAPE, START READING
0667   A4D6 9E 19                 LDX   TXTTAB                  GET START OF PROGRAM ADDRESS
0668   A4D8 9F 7E          LA4D8  STX   CBUFAD                  STORE IT IN LOAD BUFFER
0669   A4DA DC 7E                 LDD   CBUFAD                  GET START ADDRESS TO D REG
0670   A4DC 4C                    INCA                          ADD 256 TO LOAD ADDRESS
0671   A4DD BD AC 37              JSR   LAC37                   SEE IF ROOM BELOW STACK FOR ONE BLOCK
0672   A4E0 BD A7 0B              JSR   GETBLK                  READ A BLOCK
0673   A4E3 26 13                 BNE   LA4F8                   GOT AN ERROR DURING READ
0674   A4E5 96 7C                 LDA   BLKTYP                  BLOCK NUMBER
0675   A4E7 27 0F                 BEQ   LA4F8                   I/O ERROR IF HEADER BLOCK TYPE
0676   A4E9 2A ED                 BPL   LA4D8                   REAR MORE IF BLOCK NUMBER POSITIVE
0677   A4EB 9F 1B                 STX   VARTAB                  SET END OF PROGRAM ADDRESS
0678   A4ED 8D 4C                 BSR   LA53B                   TURN OFF TAPE DECK
0679   A4EF 8E AB EC              LDX   #LABED-1                POINT TO  OK  MESSAGE
0680   A4F2 BD B9 9C              JSR   LB99C                   PRINT  OK  TO CONSOLE OUT
0681   A4F5 7E AC E9              JMP   LACE9                   RESET INPUT POINTER, CLEAR VARIABLES AND
0682                       *                                    RETURN TO MAIN LOOP OF BASIC
0683
0684   A4F8 BD AD 19       LA4F8  JSR   LAD19                   DO A  NEW
0685   A4FB 7E A6 19       LA4FB  JMP   LA619                    I/O ERROR
0686
0687                       * CLOADM
0688   A4FE 9D 9F          LA4FE  JSR   GETNCH                  GET NEXT CHARACTER IN BASIC LINE
0689   A500 8D 76                 BSR   LA578                   GO SCAN OFF NAME
0690   A502 BD A6 48              JSR   LA648                   SEARCH FOR FILE
0691   A505 9E 8A                 LDX   ZERO                    STORE ZERO TO X REG, DEFAULT OFFSET VALUE
0692   A507 9D A5                 JSR   GETCCH                  CHECK FOR AN OFFSET
0693   A509 27 06                 BEQ   LA511                   BRANCH IF NO OFFSET
0694   A50B BD B2 6D              JSR   LB26D                   SYNTAX CHECK FOR COMMA
0695   A50E BD B7 3D              JSR   LB73D                   EVALUATE OFFSET; RETURN VALUE IN X
0696   A511 B6 01 E2       LA511  LDA   CASBUF+8                CHECK FILE MODE
0697   A514 81 02                 CMPA  #2                      IS IT MACHINE LANGUAGE?
0698   A516 26 B5                 BNE   LA4CD                    BAD FILE MODE  ERROR IF NOT
0699   A518 FC 01 E5              LDD   CASBUF+11               GET TRANSFER ADDR FROM TAPE
0700   A51B 33 8B                 LEAU  D,X                     ADD OFFSET
0701   A51D DF 9D                 STU   EXECJP                  STORE TRANSFER ADDR IN EXEC ARGUMENT
0702   A51F 7D 01 E4              TST   CASBUF+10               CHECK FILE MODE
0703   A522 26 A9                 BNE   LA4CD                    BAD FILE MODE  ERROR
0704   A524 FC 01 E7              LDD   CASBUF+13               GET LOAD ADDR FROM TAPE
0705   A527 30 8B                 LEAX  D,X                     ADD OFFSET
0706   A529 9F 7E                 STX   CBUFAD                  STORE IN BUFFER START ADDRESS POINTER
0707   A52B BD A7 7C              JSR   CASON                   START UP TAPE
0708   A52E BD A7 0B       LA52E  JSR   GETBLK                  READ A BLOCK
0709   A531 26 C8                 BNE   LA4FB                   BRANCH IF I/O ERROR
0710   A533 9F 7E                 STX   CBUFAD                  STORE NEW START ADDR (ONE BLOCK HIGHER)
0711   A535 0D 7C                 TST   BLKTYP                  CHECK BLOCK NUMBER
0712   A537 27 C2                 BEQ   LA4FB                   BRANCH IF I/O ERROR (HEADER BLOCK)
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0713   A539 2A F3                 BPL   LA52E                 GO READ SOME MORE
0714   A53B 7E A7 E9       LA53B  JMP   LA7E9                 GO TURN OFF TAPE DECK
0715
0716                       * EXEC
0717   A53E 27 05          EXEC   BEQ   LA545                 BRANCH IF NO ARGUMENT
0718   A540 BD B7 3D              JSR   LB73D                 EVALUATE ARGUMENT - ARGUMENT RETURNED IN X
0719   A543 9F 9D                 STX   EXECJP                STORE X TO EXEC JUMP ADDRESS
0720   A545 6E 9F 00 9D    LA545  JMP   [EXECJP]              GO DO IT
0721
0722                       * BREAK CHECK
0723   A549 BD 01 7F       LA549  JSR   RVEC11                HOOK INTO RAM
0724   A54C 96 6F                 LDA   DEVNUM                GET DEVICE NUMBER
0725   A54E 4C                    INCA                        CHECK FOR TAPE
0726   A54F 27 50                 BEQ   LA5A1                 RETURN IF TAPE
0727   A551 7E AD EB              JMP   LADEB                 GO DO BREAK KEY CHECK
0728
0729                       * THIS ROUTINE EVALUATES AN ARGUMENT
0730                       * AND MAKES SURE IT IS WITHIN LIMITS OF VIDEO DISPLAY RAM
0731   A554 BD B3 E4       LA554  JSR   LB3E4                 EVALUATE EXPRESSION AND RETURN VALUE IN ACCD
0732   A557 83 01 FF              SUBD  #511                  ONLY 512 VIDEO DISPLAY LOCATIONS
0733   A55A 10 22 0E EC           LBHI  LB44A                 BRANCH IF > 511 TO  ILLEGAL FUNCTION CALL
0734   A55E C3 05 FF              ADDD  #VIDRAM+511           ADD BACK IN OFFSET + START OF VIDEO RAM
0735   A561 DD 88                 STD   CURPOS                PUT THE CURSOR THERE
0736   A563 39                    RTS
0737
0738                       * INKEY$
0739   A564 96 87          INKEY  LDA   IKEYIM                WAS A KEY DOWN IN THE BREAK CHECK?
0740   A566 26 03                 BNE   LA56B                 YES
0741   A568 BD A1 CB              JSR   KEYIN                 GO GET A KEY
0742   A56B 0F 87          LA56B  CLR   IKEYIM                CLEAR INKEY RAM IMAGE
0743   A56D 97 53                 STA   FPA0+3                STORE THE KEY IN FPA0
0744   A56F 10 26 11 1C           LBNE  LB68F                 CONVERT FPA0+3 TO A STRING
0745   A573 97 56                 STA   STRDES                SET LENGTH OF STRING = 0 IF NO KEY DOWN
0746   A575 7E B6 9B              JMP   LB69B                 PUT A NULL STRING ONTO THE STRING STACK
0747
0748                       * STRIP A FILENAME OFF OF THE BASIC INPUT LINE
0749   A578 8E 01 D1       LA578  LDX   #CFNBUF               POINT TO FILE NAME BUFFER
0750   A57B 6F 80                 CLR   ,X+                   CLEAR THE FIRST BYTE - IT WILL CONTAIN THE COUNT
0751                       *                                  OF THE NUMBER OF CHARACTERS IN THE NAME
0752   A57D 86 20                 LDA   #SPACE                SPACE
0753   A57F A7 80          LA57F  STA   ,X+                   BLANK FILL 8 CHARS
0754   A581 8C 01 DA              CMPX  #CASBUF               DONE?
0755   A584 26 F9                 BNE   LA57F                 NO
0756   A586 9D A5                 JSR   GETCCH                GET CURRENT INPUT CHAR
0757   A588 27 17                 BEQ   LA5A1                 RETURN IF NO NAME
0758   A58A BD B1 56              JSR   LB156                 GET THE FILE NAME - EVALUATE EXPRESSION
0759   A58D BD B6 54              JSR   LB654                 POINT X TO START OF NAME (TOP STRING ON STRING STACK)
0760   A590 CE 01 D1              LDU   #CFNBUF               CASSETTE FILE NAME BUFFER
0761   A593 E7 C0                 STB   ,U+                   STORE THE NUMBER OF BYTES IN THE NAME
0762   A595 27 0A                 BEQ   LA5A1                 NULL NAME (BLANK NAME)
0763   A597 8C                    FCB   SKP2                  SKIP THE NEXT TWO BYTES
0764   A598 C6 08          LA598  LDB   #8                    MOVE 8 BYTES
0765
0766                       * MOVE ACCB BYTES FROM (X) TO (U)
0767   A59A A6 80          LA59A  LDA   ,X+                   GET BYTE FROM X
0768   A59C A7 C0                 STA   ,U+                   STORE IT AT U
0769   A59E 5A                    DECB                        MOVED ALL BYTES?
0770   A59F 26 F9                 BNE   LA59A                 NO
0771   A5A1 39             LA5A1  RTS
0772
0773                       * GET DEVICE NUMBER FROM BASIC LINE - CHECK VALIDITY
0774   A5A2 BD B2 6D       LA5A2  JSR   LB26D                 CHECK FOR COMMA, SYNTAX ERROR IF NONE
0775   A5A5 81 23          LA5A5  CMPA  #'#                   IS NEXT CHARACTER A NUMBER?
0776   A5A7 26 02                 BNE   LA5AB                 NO
0777   A5A9 9D 9F                 JSR   GETNCH                GET NEXT BASIC INPUT CHARACTER
0778   A5AB BD B1 41       LA5AB  JSR   LB141                 EVALUATE EXPRESSION
0779   A5AE BD B3 ED       LA5AE  JSR   INTCNV                CONVERT FPA0 TO INTEGER, RETURN VALUE IN ACCD
0780   A5B1 59                    ROLB                        MSB OF ACCB TO CARRY
0781   A5B2 89 00                 ADCA  #0                    ADD MSB OF ACCB TO ACCA
0782   A5B4 26 69                 BNE   LA61F                  DEVICE # ERROR  IF ACCA<FF80 OR >007F
0783   A5B6 56                    RORB                        RESTORE ACCB
0784   A5B7 D7 6F                 STB   DEVNUM                STORE B IN DEVICE NUMBER
0785   A5B9 BD 01 61              JSR   RVEC1                 HOOK INTO RAM
0786   A5BC 27 06                 BEQ   LA5C4                 BRANCH IF DEVICE NUMBER SET TO SCREEN
0787   A5BE 2A 5F                 BPL   LA61F                  DEVICE NUMBER  ERROR IF POSITIVE DEVICE NUMBER
0788   A5C0 C1 FE                 CMPB  #-2                   LOWEST LEGAL DEVICE NUMBER
0789   A5C2 2D 5B                 BLT   LA61F                  DEVICE NUMBER ERROR
0790   A5C4 39             LA5C4  RTS
0791
0792                       ** THIS ROUTINE WILL SCAN OFF THE FILE NAME FROM A BASIC LINE
0793                       ** AND RETURN A SYNTAX ERROR IF THERE ARE ANY CHARACTERS
0794                       ** FOLLOWING THE END OF THE NAME
0795   A5C5 8D B1          LA5C5  BSR   LA578                 SCAN OFF NAME
0796   A5C7 9D A5                 JSR   GETCCH                GET CURRENT INPUT CHAR FROM BASIC LINE
0797   A5C9 27 F9          LA5C9  BEQ   LA5C4                 RETURN IF END OF LINE
0798   A5CB 7E B2 77              JMP   LB277                 SYNTAX ERROR IF ANY MORE CHARACTERS
0799
0800                       * EOF
0801   A5CE BD 01 88       EOF    JSR   RVEC14                HOOK INTO RAM
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0802   A5D1 96 6F                LDA   DEVNUM                  GET DEVICE NUMBER
0803   A5D3 34 02                PSHS  A                       SAVE IT
0804   A5D5 8D D7                BSR   LA5AE                   CHECK DEVICE NUMBER
0805   A5D7 BD A3 ED             JSR   LA3ED                   CHECK FOR PROPER FILE AND MODE
0806   A5DA 5F                   CLRB                          NOT EOF FLAG = 0
0807   A5DB 96 6F                LDA   DEVNUM                  TEST DEVICE NUMBER
0808   A5DD 27 05                BEQ   LA5E4                   BRANCH IF NOT SET TO DISPLAY
0809   A5DF 0D 79                TST   CINCTR                  ANY CHARACTERS LEFT TO SEND?
0810   A5E1 26 01                BNE   LA5E4                   YES
0811   A5E3 53                   COMB                          NO - EOF: SET FLAG = -1 ($FF)
0812   A5E4 35 02          LA5E4 PULS  A                       GET DEVICE NUMBER BACK AGAIN
0813   A5E6 97 6F                STA   DEVNUM                  RESTORE IT
0814   A5E8 1D             LA5E8 SEX                           CONVERT ACCB TO 2 DIGIT SIGNED INTEGER
0815   A5E9 7E B4 F4             JMP   GIVABF                  CONVERT ACCD TO FLOATING POINT
0816
0817                       * SKIPF
0818   A5EC 8D D7          SKIPF BSR   LA5C5                   SCAN OFF THE BASIC FILE NAME
0819   A5EE 8D 58                BSR   LA648                   LOOK FOR THAT FILE ON TAPE
0820   A5F0 BD A6 D1             JSR   LA6D1                   READ THE FILE
0821   A5F3 26 24                BNE   LA619                    I/O ERROR
0822   A5F5 39                   RTS
0823
0824                       * OPEN
0825   A5F6 BD 01 5E       OPEN  JSR   RVEC0                   HOOK INTO RAM
0826   A5F9 BD B1 56             JSR   LB156                   GET FILE STATUS (INPUT,OUTPUT)
0827   A5FC BD B6 A4             JSR   LB6A4                   GET FIRST BYTE OF STATUS STRING TO ACCB
0828   A5FF 34 04                PSHS  B                       SAVE IT ON STACK
0829   A601 8D 9F                BSR   LA5A2                   CHECK FOR SYNTAX AND GET DEVICE NUMBER
0830   A603 BD B2 6D             JSR   LB26D                   SYNTAX CHECK FOR COMMA, SYNTAX ERROR IF NOT
0831   A606 8D BD                BSR   LA5C5                   GET FILE NAME
0832   A608 96 6F                LDA   DEVNUM                  GET DEVICE NUMBER
0833   A60A 0F 6F                CLR   DEVNUM                  SET DEVICE NUMBER TO SCREEN
0834   A60C 35 04                PULS  B                       GET STATUS AGAIN
0835   A60E C1 49                CMPB  #'I                     IS IT INPUT MODE?
0836   A610 27 12                BEQ   LA624                   YES
0837   A612 C1 4F                CMPB  #'O                     IS IT OUTPUT MODE?
0838   A614 27 42                BEQ   LA658                   YES
0839
0840                       * IF IT ISN T INPUT OR OUTPUT, BAD FILE MODE
0841   A616 C6 2A          LA616 LDB   #21*2                   ERROR # 21  BAD FILE MODE
0842   A618 8C                   FCB   SKP2                    SKIP TWO BYTES
0843   A619 C6 28          LA619 LDB   #20*2                   ERROR # 20  I/O ERROR
0844   A61B 8C                   FCB   SPK2                    SKIP TWO BYTES
0845   A61C C6 24          LA61C LDB   #18*2                   ERROR # 18  FILE ALREADY OPEN
0846   A61E 8C                   FCB   SKP2                    SKIP TWO BYTES
0847   A61F C6 26          LA61F LDB   #19*2                   ERROR # 19  DEVICE NUMBER ERROR
0848   A621 7E AC 46             JMP   LAC46                   JUMP TO ERROR HANDLER
0849                       *
0850   A624 4C             LA624 INCA                          DEVICE NUMBER SET TO TAPE?
0851   A625 2B EF                BMI   LA616                    BAD FILE MODE  IF DEVNUM = NEG BUT NOT CASSETTE
0852   A627 26 2E                BNE   LA657                   RETURN IF DEVNUM WAS SET TO SCREEN OR DISK
0853                       * SET TO TAPE
0854   A629 8D 1D                BSR   LA648                   GET HEADER BLOCK
0855   A62B B6 01 E3             LDA   CASBUF+9                GET ASCII FLAG
0856   A62E B4 01 E4             ANDA  CASBUF+10                AND  IT WITH FILE MODE
0857   A631 27 E3                BEQ   LA616                    BAD FILE MODE  - CRUNCHED FILE OR MACH LANG
0858   A633 0C 78                INC   FILSTA                  OPEN FILE FOR INPUT
0859   A635 BD A7 01       LA635 JSR   LA701                   START TAPE, READ A BLOCK
0860   A638 26 DF                BNE   LA619                    I/O ERROR
0861   A63A 0D 7C                TST   BLKTYP                  CHECK BLOCK NUMBER
0862   A63C 27 DB                BEQ   LA619                    I/O ERROR  IF HEADER BLOCK
0863   A63E 2B 17                BMI   LA657                   BRANCH IF THIS IS THE LAST BLOCK
0864   A640 96 7D                LDA   BLKLEN                  CHAR COUNT
0865   A642 27 F1                BEQ   LA635                   READ ANOTHER BLOCK IF NULL BLOCK
0866   A644 97 79          LA644 STA   CINCTR                  STORE IN TEMP CHARACTER COUNTER
0867   A646 20 0A                BRA   LA652                   RESET BUFFER POINTER
0868
0869                       * SEARCH FOR FILE NAME IN CNMBUF
0870   A648 0D 78          LA648 TST   FILSTA                  IS THE FILE OPEN?
0871   A64A 26 D0                BNE   LA61C                   YES-  FILE ALREADY OPEN
0872   A64C 8D 33                BSR   LA681                   SEARCH FOR CORRECT FILE NAME
0873   A64E 26 C9                BNE   LA619                    I/O ERROR
0874   A650 0F 79          LA650 CLR   CINCTR                  CLEAR CHARACTER COUNTER
0875   A652 8E 01 DA       LA652 LDX   #CASBUF                 CASSETTE INPUT BUFFER ADDRESS
0876   A655 9F 7A                STX   CINPTR                  RESET IT
0877   A657 39             LA657 RTS
0878
0879                       * WRITE OUT THE HEADER BLOCK
0880
0881                       ** CASBUF                           FILE NAME
0882                       ** CASBUF+8                         FILE TYPE
0883                       ** CASBUF+9                         ASCII FLAG
0884                       ** CASBUF+10                        FILE MODE
0885                       ** CASBUF+11,12                     TRANSFER ADDRESS
0886                       ** CASBUF+13,14                     START ADDRESS
0887
0888                       * ENTER HERE FOR DATA FILES W/DEVICE NUMBER IN ACCA
0889   A658 4C             LA658 INCA                          CHECK FOR CASSETTE DEVICE NUMBER
0890   A659 26 FC                BNE   LA657                   RETURN IF DEVICE NUMBER WASN T TAPE
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0891   A65B 4C                        INCA                            MAKE FILE TYPE = 1
0892                                * ENTER HERE FOR ASCII FILES
0893   A65C 8E FF FF                LA65C   LDX   #$FFFF                SET ASCII FLAG AND MODE = $FF
0894   A65F 0D 78                   LA65F   TST   FILSTA                 IS FILE OPEN?
0895   A661 26 B9                           BNE   LA61C                   YES-  FILE ALREADY OPEN
0896   A663 CE 01 DA                        LDU   #CASBUF                 CASSETTE INPUT BUFFER
0897   A666 DF 7E                           STU   CBUFAD                  STORE IN STARTING ADDRESS
0898   A668 A7 48                           STA   8,U                     FILE TYPE IN CASBUF+8
0899   A66A AF 49                           STX   9,U                     ASCII FLAG & MODE IN CASBUF+9, CASBUF+10
0900                                *         CASBUF     +8      +9    +10
0901                                *                                      TYPE   ASCII   MODE
0902                                * BASIC CRUNCHED                 00      00     00
0903                                * BASIC ASCII                           00      FF     FF
0904                                * DATA                                    01      FF     FF
0905                                * MACHINE LANGUAGE        02      00     00
0906                                * MACHINE BLK LOAD         02      00     FF
0907
0908   A66C 8E 01 D2                        LDX   #CFNBUF+1               POINT X TO FILE NAME BUFFER
0909   A66F BD A5 98                        JSR   LA598                   MOVE 8 BYTES FROM (X) TO (U)
0910   A672 0F 7C                           CLR   BLKTYP                  ZERO BLOCK NUMBER
0911   A674 86 0F                           LDA   #15                     15 BYTES IN THE HEADER BLOCK
0912   A676 97 7D                           STA   BLKLEN                  CHAR COUNT
0913   A678 BD A7 E5                        JSR   LA7E5                   GO WRITE ONE BLOCK
0914   A67B 86 02                           LDA   #2                      OUTPUT FILE
0915   A67D 97 78                           STA   FILSTA                  STORE IN FILE MODE
0916   A67F 20 CF                           BRA   LA650                   RESET POINTERS
0917
0918                                * SEARCH FOR CORRECT CASSETTE FILE NAME
0919   A681 8E 01 DA                LA681   LDX   #CASBUF                 CASSETTE BUFFER
0920   A684 9F 7E                           STX   CBUFAD                  LOAD ADDRESS POINTER
0921   A686 96 68                   LA686   LDA   CURLIN                  GET CURRENT LINE NUMBER MSB (CURLIN)
0922   A688 4C                              INCA                          IN DIRECT MODE IF ACCA = $FF
0923   A689 26 0B                           BNE   LA696                   BRANCH IF NOT DIRECT MODE
0924   A68B BD A9 28                        JSR   LA928                   CLEAR SCREEN
0925   A68E 9E 88                           LDX   CURPOS                  CURRENT SCREEN CHAR POSITION
0926   A690 C6 53                           LDB   #'S                      S  MEANS SEARCHING
0927   A692 E7 81                           STB   ,X++                    PUT AN  S  ON THE SCREEN
0928   A694 9F 88                           STX   CURPOS                  STORE NEW CURSOR LOCATION
0929   A696 8D 69                   LA696   BSR   LA701                   READ ONE BLOCK FROM TAPE
0930   A698 DA 7C                           ORB   BLKTYP                   OR  ERROR FLAG WITH BLOCK NUMBER
0931   A69A 26 34                           BNE   LA6D0                   BRANCH IF NOT BLOCK ZERO OR ERROR
0932   A69C 8E 01 DA                        LDX   #CASBUF                 POINT TO CASSETTE BUFFER
0933   A69F CE 01 D2                        LDU   #CFNBUF+1               POINT TO DESIRED NAME
0934   A6A2 C6 08                           LDB   #8                      EIGHT CHARACTERS MAX IN NAME
0935   A6A4 6F E2                           CLR   ,-S                     ZERO A BYTE ON THE STACK
0936   A6A6 A6 80                   LA6A6   LDA   ,X+                     GET CHAR FROM CASSETTE BLOCK
0937   A6A8 10 9E 68                        LDY   CURLIN                  GET CURLIN
0938   A6AB 31 21                           LEAY  1,Y                     DIRECT MODE?
0939   A6AD 26 05                           BNE   LA6B4                   FALL THROUGH IF DIRECT MODE
0940   A6AF 0F 6F                           CLR   DEVNUM                  SET DEVICE NUMBER TO SCREEN
0941   A6B1 BD A2 82                        JSR   PUTCHR                  OUTPUT A CHAR
0942   A6B4 A0 C0                   LA6B4   SUBA  ,U+                     SUBTRACT A CHAR FROM DESIRED NAME
0943                                                                      NON-ZERO RESULT IF NO MATCH
0944   A6B6 AA E4                           ORA   ,S                       OR  WITH TOP OF STACK, RESULT WILL BE NON-ZERO IF MISMATCH
0945   A6B8 A7 E4                           STA   ,S                      SAVE IT
0946   A6BA 5A                              DECB                          DONE ALL 8 CHARACTERS?
0947   A6BB 26 E9                           BNE   LA6A6                   NO
0948   A6BD A6 E0                           LDA   ,S+                     SEE IF ALL CHARS WERE OK
0949   A6BF 27 0A                           BEQ   LA6CB                   BRANCH IF GOOD COMPARE
0950   A6C1 6D 57                           TST   -9,U                    CHECK THE NUMBER OF CHARACTERS IN THE CLOAD STATEMENT
0951   A6C3 27 06                           BEQ   LA6CB                   IF NO NAME SPECIFIED, ANY FILE IS OK
0952                                * DIDN'T FIND THE RIGHT FILE IF HERE
0953   A6C5 8D 0A                           BSR   LA6D1                   LOOK FOR FILE
0954   A6C7 26 07                           BNE   LA6D0                   RETURN IF ERROR
0955   A6C9 20 BB                           BRA   LA686                   GO LOOK SOME MORE
0956   A6CB 86 46                   LA6CB   LDA   #'F                     *
0957   A6CD 8D 29                           BSR   LA6F8                   * PUT  F  ON THE SCREEN IF DIRECT MODE
0958   A6CF 4F                              CLRA                          SET ZERO FLAG TO INDICATE NO ERRORS
0959   A6D0 39                      LA6D0   RTS
0960   A6D1 7D 01 E4                LA6D1   TST   CASBUF+10               CHECK FILE MODE
0961   A6D4 26 09                           BNE   LA6DF                   BRANCH IF ASCII OR DATA
0962   A6D6 BD A7 7C                        JSR   CASON                   TURN ON TAPE DECK
0963   A6D9 8D 30                   LA6D9   BSR   GETBLK                  LOAD A BLOCK FROM TAPE
0964   A6DB 8D 08                           BSR   LA6E5                   CHECK FOR ERROR OR LAST BLOCK
0965   A6DD 20 FA                           BRA   LA6D9                   KEEP GOING
0966   A6DF 8D 20                   LA6DF   BSR   LA701                   READ ONE BLOCK FROM TAPE
0967   A6E1 8D 02                           BSR   LA6E5                   CHECK FOR ERROR OR LAST BLOCK
0968   A6E3 20 FA                           BRA   LA6DF                   KEEP READING BLOCKS
0969   A6E5 26 06                   LA6E5   BNE   LA6ED                   GOT AN ERROR ON READING IN BLOCK
0970   A6E7 96 7C                           LDA   BLKTYP                  GET BLOCK NUMBER
0971   A6E9 40                              NEGA                          CHECK FOR LAST BLOCK
0972   A6EA 2B 14                           BMI   LA700                   RETURN IF NOT AN END OF PROGRAM BLOCK
0973   A6EC 4A                              DECA                          IF BLOCK NUMBER WAS $FF, ACCA IS NOW ZERO - THIS WILL
0974                                *                                      CAUSE CLOAD TO IGNORE ERRORS IN THE
0975                                *                                      BLOCKS WHICH IT IS SKIPPING WHILE
0976                                *                                      LOOKING FOR THE CORRECT FILE NAME.
0977   A6ED 97 81                   LA6ED   STA   CSRERR                  STORE ACCA TO ERROR FLAG
0978   A6EF 32 62                           LEAS  2,S                     REMOVE RETURN ADDRESS FROM STACK
0979   A6F1 20 12                           BRA   LA705                   TURN OFF MOTOR
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0980   A6F3 B6 04 00          LA6F3   LDA   VIDRAM                  GET FIRST CHAR ON SCREEN
0981   A6F6 88 40                     EORA  #$40                    REVERSE THE VIDEO
0982   A6F8 D6 68             LA6F8   LDB   CURLIN                  GET CURLIN MSB
0983   A6FA 5C                        INCB                          CHECK FOR DIRECT MODE
0984   A6FB 26 03                     BNE   LA700                   BRANCH IF NOT DIRECT MODE
0985   A6FD B7 04 00                  STA   VIDRAM                  PUT IT ON SCREEN
0986   A700 39                LA700   RTS
0987
0988                          * READ A BLOCK FROM CASSETTE
0989   A701 8D 79             LA701   BSR   CASON                   START TAPE, AND LOOK FOR A BUNCH OF $55 OR $AA BYTES
0990   A703 8D 06                     BSR   GETBLK                  READ A BLOCK
0991   A705 BD A7 E9          LA705   JSR   LA7E9                   TURN OFF MOTOR
0992   A708 D6 81                     LDB   CSRERR                  GET ERROR STATUS
0993   A70A 39                        RTS
0994   A70B 1A 50             GETBLK  ORCC  #$50                    DISABLE IRQ,FIRQ
0995   A70D 8D E4                     BSR   LA6F3                   REVERSE VIDEO UPPER LEFT CHAR IF DIRECT MODE
0996   A70F 9E 7E                     LDX   CBUFAD                  GET LOAD ADDRESS
0997   A711 4F                        CLRA                          RESET ACCA
0998   A712 8D 41             LA712   BSR   LA755                   READ A BIT FROM TAPE, RETURN IT IN CARRY FLAG
0999   A714 46                        RORA                          PUT BIT IN MSB OF ACCA
1000   A715 81 3C                     CMPA  #$3C                    GET SYNC ED ON $3C
1001   A717 26 F9                     BNE   LA712                   NOT SYNC ED YET
1002   A719 8D 2E                     BSR   LA749                   GET BLOCK NUMBER
1003   A71B 97 7C                     STA   BLKTYP                  SAVE IT
1004   A71D 8D 2A                     BSR   LA749                   GET CHAR COUNT
1005   A71F 97 7D                     STA   BLKLEN                  SAVE IT
1006   A721 9B 7C                     ADDA  BLKTYP                  ACCUMULATE CHECKSUM
1007   A723 97 80                     STA   CCKSUM                  SAVE IT
1008   A725 96 7D                     LDA   BLKLEN                  GET BACK CHAR COUNT
1009   A727 97 81                     STA   CSRERR                  TEMP SAVE
1010   A729 27 10                     BEQ   LA73B                   NULL SET OF CHARACTERS
1011   A72B 8D 1C             LA72B   BSR   LA749                   GET BYTE FROM TAPE
1012   A72D A7 84                     STA   ,X                      FILL MEMORY WITH TAPE DATA
1013   A72F A1 80                     CMPA  ,X+                     SEE IF WE READ BACK SAME THING
1014   A731 26 11                     BNE   LA744                   BRANCH IF NOT PUTTING IT IN RAM
1015   A733 9B 80                     ADDA  CCKSUM                  ACCUMULATE CHECKSUM
1016   A735 97 80                     STA   CCKSUM                  TEMP STORE CHECKSUM
1017   A737 0A 81                     DEC   CSRERR                  DECR TEMP CHAR COUNT
1018   A739 26 F0                     BNE   LA72B                   GET ANOTHER CHARACTER
1019   A73B 8D 0C             LA73B   BSR   LA749                   GET CHECKSUM FROM TAPE
1020   A73D 90 80                     SUBA  CCKSUM                  COMPARE TO CALCULATED CHECKSUM
1021   A73F 27 05                     BEQ   LA746                   BRANCH IF OK
1022   A741 86 01                     LDA   #1                      CHECKSUM ERROR FLAG
1023   A743 8C                        FCB   SKP2                    SKIP TWO BYTES
1024   A744 86 02             LA744   LDA   #2                      NON-RAM ERROR FLAG
1025   A746 97 81             LA746   STA   CSRERR                  1 IF CHECKSUM ERROR, 2 IF LOADING INTO NON-RAM
1026   A748 39                        RTS
1027
1028                          * GET A BYTE FROM TAPE
1029   A749 86 08             LA749   LDA   #8                      8 BITS/BYTE
1030   A74B 97 82                     STA   CPULWD                  TEMP COUNTER
1031   A74D 8D 06             LA74D   BSR   LA755                   READ A BIT FROM TAPE
1032   A74F 46                        RORA                          PUT IT INTO ACCA
1033   A750 0A 82                     DEC   CPULWD                  GOT ALL 8 BITS
1034   A752 26 F9                     BNE   LA74D                   NO
1035   A754 39                        RTS
1036
1037                          * READ A BIT FROM THE TAPE
1038   A755 8D 06             LA755   BSR   LA75D                   GET THE TIME BETWEEN TRANSITIONS
1039   A757 D6 83                     LDB   CPERTM                  * GET PERIOD TIMER
1040   A759 5A                        DECB                          *
1041   A75A D1 8F                     CMPB  CMPMID                  CMPMID CONTAINS 18 INITIALLY, AND IS USED TO DETERMINE
1042                          *                                     WHETHER THE BIT READ IS A ONE OR ZERO
1043                          *                                     IF THE PERIOD TIMER IS < 18, THE BIT
1044                          *                                     IS CONSIDERED TO BE A ONE, IF > 18, IT IS ZERO
1045   A75C 39                        RTS
1046
1047                          * MAIN TIMING LOOP
1048   A75D 0F 83             LA75D   CLR   CPERTM                  RESET PERIOD TIMER
1049   A75F 0D 84                     TST   CBTPHA                  CHECK TO SEE IF SYNC ED ON THE HI-LO TRANSITION OR LO-HI
1050   A761 26 10                     BNE   LA773                   BRANCH ON HI-LO TRANSITION
1051                          * LO - HI TRANSITION
1052   A763 8D 07             LA763   BSR   LA76C                   READ CASSETTE INPUT BIT
1053   A765 25 FC                     BCS   LA763                   LOOP UNTIL IT IS LO
1054   A767 8D 03             LA767   BSR   LA76C                   READ CASSETTE INPUT DATA
1055   A769 24 FC                     BCC   LA767                   WAIT UNTIL IT GOES HI
1056   A76B 39                        RTS
1057
1058                          * READ CASSETTE INPUT BIT OF THE PIA
1059   A76C 0C 83             LA76C   INC   CPERTM                  INCREMENT PERIOD TIMER
1060   A76E F6 FF 20                  LDB   PIA1                    GET CASSETTE INPUT BIT
1061   A771 56                        RORB                          PUT CASSETTE BIT INTO THE CARRY FLAG
1062   A772 39                        RTS
1063
1064                          * WAIT FOR HI - LO TRANSITION
1065   A773 8D F7             LA773   BSR   LA76C                   READ CASSETTE INPUT DATA
1066   A775 24 FC                     BCC   LA773                   LOOP UNTIL IT IS HI
1067   A777 8D F3             LA777   BSR   LA76C                   READ CASSETTE INPUT
1068   A779 25 FC                     BCS   LA777                   LOOP UNTIL IT IS LO
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1069   A77B 39                    RTS
1070
1071                      *** LOOK FOR THE SYNC BYTES - RETURN WITH ACCA = Ø IF SYNC ED
1072                      *** ON HI - LO TRANSITION, ACCA = $AØ IF SYNC ED ON THE
1073                      *** LO - HI TRANSITION OF THE INPUT SIGNAL FROM THE CASSETTE.
1074   A77C 1A 50         CASON   ORCC  #$50                 DISABLE IRQ,FIRQ
1075   A77E 8D 4A                 BSR   LA7CA                TURN ON TAPE DECK MOTOR
1076   A780 ØF 82                 CLR   CPULWD               RESET UP TO SPEED COUNTER
1077   A782 8D DF         LA782   BSR   LA763                WAIT FOR LO-HI TRANSITION
1078   A784 8D 27         LA784   BSR   LA7AD                WAIT FOR HI-LO TRANSITION
1079   A786 22 ØF                 BHI   LA797                CASSETTE SPEED IN RANGE FOR 12ØØ HZ
1080   A788 8D 1D         LA788   BSR   LA7A7                WAIT FOR LO-HI TRANSITION
1081   A78A 25 ØF                 BCS   LA79B                CASSETTE SPEED IN RANGE FOR 24ØØ HZ
1082   A78C ØA 82                 DEC   CPULWD               DECREMENT UP TO SPEED COUNTER IF SYNC ED ON LO-HI
1083   A78E 96 82                 LDA   CPULWD               GET IT
1084   A790 81 A0                 CMPA  #-96                 HAVE THERE BEEN 96 CONSECUTIVE 1-Ø-1-Ø PATTERNS
1085   A792 26 EE         LA792   BNE   LA782                NO
1086   A794 97 84                 STA   CBTPHA               SAVE WHICH TRANSITION (HI-LO OR LO-HI)
1087   A796 39                    RTS
1088   A797 8D ØE         LA797   BSR   LA7A7                WAIT FOR LO-HI TRANSITION
1089   A799 22 E9                 BHI   LA784                BRANCH IF TWO CONSECUTIVE 12ØØ HZ PULSES
1090   A79B 8D 10         LA79B   BSR   LA7AD                WAIT FOR HI-LO TRANSITION
1091   A79D 25 E9                 BCS   LA788                BRANCH IF TWO CONSECUTIVE 24ØØ HZ PULSES
1092   A79F ØC 82                 INC   CPULWD               INCREMENT UP TO SPEED COUNTER IF SYNC ED ON HI-LO
1093   A7A1 96 82                 LDA   CPULWD               GET IT
1094   A7A3 80 60                 SUBA  #96                  GOT ENOUGH SYNC PULSES? - ACCA WILL BE ZERO IF
1095                      *                                  THERE HAVE BEEN 96 CONSECUTIVE Ø-1-Ø-1 PATTERNS
1096   A7A5 20 EB                 BRA   LA792
1097   A7A7 ØF 83         LA7A7   CLR   CPERTM                RESET PERIOD TIMER
1098   A7A9 8D BC                 BSR   LA767                WAIT UNTIL CASSETTE INPUT GOES HI
1099   A7AB 20 04                 BRA   LA7B1
1100   A7AD ØF 83         LA7AD   CLR   CPERTM                RESET PERIOD TIMER
1101   A7AF 8D C6                 BSR   LA777                WAIT UNTIL CASSETTE GOES LO
1102   A7B1 D6 83         LA7B1   LDB   CPERTM                GET PERIOD TIMER
1103   A7B3 D1 90                 CMPB  CMPØ                 UPPER LIMIT OF 12ØØ HZ PERIOD
1104   A7B5 22 03                 BHI   LA7BA                BRANCH IF CASSETTE SPEED IS TOO SLOW OR DROPOUT
1105   A7B7 D1 91                 CMPB  CMP1                 UPPER LIMIT OF 24ØØ HZ PERIOD
1106   A7B9 39                    RTS
1107   A7BA ØF 82         LA7BA   CLR   CPULWD               RESET UP TO SPEED COUNTER
1108   A7BC 39                    RTS
1109
1110                      * MOTOR
1111   A7BD 1F 89         MOTOR   TFR   A,B                  SAVE CURRENT TOKEN IN ACCB
1112   A7BF 9D 9F                 JSR   GETNCH               GET NEXT INPUT CHARACTER FROM BASIC
1113   A7C1 C1 AA                 CMPB  #$AA                  OFF  TOKEN
1114   A7C3 27 24                 BEQ   LA7E9                YES
1115   A7C5 C1 88                 CMPB  #$88                  ON  TOKEN
1116   A7C7 BD A5 C9              JSR   LA5C9                SYNTAX ERROR IF IT WASN T  ON  OR  OFF
1117   A7CA B6 FF 21      LA7CA   LDA   PIA1+1               READ CRA OF U4
1118   A7CD 8A Ø8                 ORA   #$Ø8                 TURN ON BIT 3 WHICH ENABLES MOTOR DELAY
1119   A7CF 8D 1F                 BSR   LA7FØ                PUT IT BACK
1120   A7D1 9E 8A         LA7D1   LDX   ZERO                 GET READY TO WAIT A WHILE
1121
1122                      * DELAY WHILE DECREMENTING X TO ZERO
1123   A7D3 30 1F         LA7D3   LEAX  -1,X                 DECREMENT X
1124   A7D5 26 FC                 BNE   LA7D3                BRANCH IF NOT ZERO
1125   A7D7 39                    RTS
1126
1127                      * SEND SYNCLN $55 S TO TAPE
1128   A7D8 1A 50         WRLDR   ORCC  #$50                 DISABLE INTERRUPTS
1129   A7DA 8D EE                 BSR   LA7CA                TURN ON TAPE DECK MOTOR
1130   A7DC 9E 92                 LDX   SYNCLN               GET COUNT OF $55 S TO SEND
1131   A7DE 8D 48         LA7DE   BSR   LA828                SEND $55 TO TAPE
1132   A7E0 30 1F                 LEAX  -1,X                 ARE ALL $55 S SENT?
1133   A7E2 26 FA                 BNE   LA7DE                NO
1134   A7E4 39                    RTS
1135
1136                      * WRITE SYNC BYTES AND A BLOCK TO TAPE
1137   A7E5 8D F1         LA7E5   BSR   WRLDR                WRITE SYNC BYTES TO TAPE
1138   A7E7 8D ØB         LA7E7   BSR   SNDBLK               GO WRITE A BLOCK
1139
1140                      * TURN OFF TAPE DECK MOTOR
1141   A7E9 1C AF         LA7E9   ANDCC #$AF                 ENABLE IRQ,FIRQ
1142   A7EB B6 FF 21              LDA   PIA1+1               READ CRA OF U4
1143   A7EE 84 F7                 ANDA  #$F7                 TURN OFF BIT 3
1144   A7FØ B7 FF 21      LA7FØ   STA   PIA1+1               PUT IT BACK
1145   A7F3 39                    RTS
1146
1147                      * WRITE A BLOCK TO CASSETTE
1148                      * BUFFER SIZE IN BLKLEN
1149                      * STARTING ADDR IN CBUFAD
1150                      * BLOCK NUMBER IN BLKTYP
1151   A7F4 1A 50         SNDBLK  ORCC  #$50                 DISABLE IRQ,FIRQ
1152   A7F6 D6 7D                 LDB   BLKLEN               GET CHAR COUNT
1153   A7F8 D7 81                 STB   CSRERR               TEMP CHAR COUNT
1154   A7FA 96 7D                 LDA   BLKLEN               GET CHAR COUNT (INCLUDED IN CHECKSUM)
1155   A7FC 27 Ø7                 BEQ   LA8Ø5                BRANCH IF NO CHARACTERS - NULL
1156   A7FE 9E 7E                 LDX   CBUFAD               GET STARTING ADDRESS
1157   A8ØØ AB 8Ø         LA8ØØ   ADDA  ,X+                  CHECKSUM THE BUFFER
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1158   A802 5A                        DECB                          DONE ALL CHARACTERS?
1159   A803 26 FB                     BNE    LA800                  NO
1160   A805 9B 7C             LA805   ADDA   BLKTYP                 ADD IN THE BLOCK NUMBER
1161   A807 97 80                     STA    CCKSUM                 SAVE THE CHECKSUM
1162   A809 9E 7E                     LDX    CBUFAD                 GET STARTING ADDRESS
1163   A80B 8D 1B                     BSR    LA828                  SEND $55 TO TAPE
1164   A80D 86 3C                     LDA    #$3C                   SYNC CHAR
1165   A80F 8D 19                     BSR    LA82A                  SEND TO TAPE
1166   A811 96 7C                     LDA    BLKTYP                 GET BLOCK NUMBER
1167   A813 8D 15                     BSR    LA82A                  SEND BLOCK NUMBER TO TAPE
1168   A815 96 7D                     LDA    BLKLEN                 GET CHARACTER COUNT
1169   A817 8D 11                     BSR    LA82A                  SEND CHAR COUNT TO TAPE
1170   A819 4D                        TSTA                          SET FLAGS
1171   A81A 27 08                     BEQ    LA824                  BRANCH IF CHAR COUNT IS ZERO
1172   A81C A6 80             LA81C   LDA    ,X+                    GET BUFFER CHARACTER
1173   A81E 8D 0A                     BSR    LA82A                  SEND BUFFER TO TAPE
1174   A820 0A 81                     DEC    CSRERR                 DECR TEMP CHAR COUNT
1175   A822 26 F8                     BNE    LA81C                  NOT DONE YET
1176   A824 96 80             LA824   LDA    CCKSUM                 GET CHECKSUM
1177   A826 8D 02                     BSR    LA82A                  SEND CHECKSUM TO TAPE
1178   A828 86 55             LA828   LDA    #$55                   SEND A $55 TO TAPE
1179
1180                          * THIS ROUTINE SENDS THE A REG TO TAPE
1181   A82A 34 02             LA82A   PSHS   A                      SAVE OUTPUT CHARACTER
1182   A82C C6 01                     LDB    #1                     ACCB CONTAINS A MASK USED TO DETERMINE WHETHER A
1183                          *                                     BIT IN THE OUTPUT CHARACTER IS HI OR LO
1184   A82E 96 85             LA82E   LDA    CLSTSN                 GET THE ENDING VALUE OF THE LAST SINE CYCLE
1185   A830 B7 FF 20                  STA    DA                     STORE IN THE D/A CONVERTER
1186   A833 10 8E A8 5C               LDY    #LA85C                 SINE LOOK-UP TABLE FOR GENERATING FSK
1187   A837 E5 E4                     BITB   ,S                     IS THE CURRENT BIT A ONE OR A ZERO ?
1188   A839 26 0D                     BNE    LA848                  IF A 1, DO HIGH FREQ
1189                          * LOW FREQUENCY LOOK UP
1190   A83B A6 A0             LA83B   LDA    ,Y+                    USE EVERY BYTE IN TABLE IF LOW FREQUENCY
1191   A83D 10 8C A8 80               CMPY   #LA85C+36              END OF SINE TABLE?
1192   A841 27 12                     BEQ    LA855                  YES
1193   A843 B7 FF 20                  STA    DA                     SEND NEXT VALUE TO D/A CONVERTER
1194   A846 20 F3                     BRA    LA83B                  GET NEXT VALUE
1195                          * HIGH FREQUENCY LOOK UP
1196   A848 A6 A1             LA848   LDA    ,Y++                   USE EVERY OTHER BYTE IF HIGH FREQUENCY
1197   A84A 10 8C A8 80               CMPY   #LA85C+36              END OF SINE TABLE?
1198   A84E 27 05                     BEQ    LA855                  YES
1199   A850 B7 FF 20                  STA    DA                     SEND NEXT VALUE TO D/A CONVERTER
1200   A853 20 F3                     BRA    LA848                  GET NEXT VALUE
1201   A855 97 85             LA855   STA    CLSTSN                 SAVE THE LAST VALUE SENT TO THE D/A CONVERTER
1202   A857 58                        ASLB                          SHIFT MASK BIT LEFT
1203   A858 24 D4                     BCC    LA82E                  DONE WHEN MASK BIT IS SHIFTED INTO CARRY FLAG
1204   A85A 35 82                     PULS   A,PC                   RESTORE OUTPUT CHARACTER AND RETURN
1205
1206                          * THIS IS A LOOK-UP TABLE OF SINE VALUES FOR THE TAPE DECK FSK
1207                          * (BIT 1 IS USED TO KEEP THE SERIAL OUTPUT MARKING)
1208   A85C 82 92 AA BA CA DA LA85C   FCB    $82,$92,$AA,$BA,$CA,$DA
1209   A862 EA F2 FA FA FA F2         FCB    $EA,$F2,$FA,$FA,$FA,$F2
1210   A868 EA DA CA BA AA 92         FCB    $EA,$DA,$CA,$BA,$AA,$92
1211   A86E 7A 6A 52 42 32 22         FCB    $7A,$6A,$52,$42,$32,$22
1212   A874 12 0A 02 02 02 0A         FCB    $12,$0A,$02,$02,$02,$0A
1213   A87A 12 22 32 42 52 6A         FCB    $12,$22,$32,$42,$52,$6A
1214
1215                          * SET
1216   A880 8D 3F             SET     BSR    LA8C1                  6ET ABSOLUTE SCREEN POSITION OF GRAPHICS BLOCK
1217   A882 34 10                     PSHS   X                      SAVE CHARACTER LOCATION
1218   A884 BD B7 38                  JSR    LB738                  SYNTAX CHECK FOR COMMA - RETURN EXPR VALUE IN ACCB
1219   A887 35 10                     PULS   X                      REGET CHARACTER LOCATION
1220   A889 C1 08                     CMPB   #8                     NINE ALLOWABLE COLORS
1221   A88B 22 48                     BHI    LA8D5                  ILLEGAL COLOR -  ILLEGAL FUNCTION CALL
1222   A88D 5A                        DECB                          CHANGE COLOR NUMBERS FROM 0-8 TO (-1 TO 7)
1223   A88E 2B 05                     BMI    LA895                  BRANCH IF SET (X,Y,0)
1224   A890 86 10                     LDA    #$10                   $10 OFFSET BETWEEN DIFFERENT COLORS
1225   A892 3D                        MUL                           MULT BY COLOR FOR TOTAL OFFSET
1226   A893 20 08                     BRA    LA89D                  GO SAVE THE COLOR
1227   A895 E6 84             LA895   LDB    ,X                     GET CURRENT CHAR FROM SCREEN
1228   A897 2A 03                     BPL    LA89C                  BRANCH IF NOT GRAPHIC
1229   A899 C4 70                     ANDB   #$70                   SAVE ONLY THE COLOR INFO
1230   A89B 21                        FCB    SKP1                   SKIP THE NEXT BYTE
1231   A89C 5F                LA89C   CLRB                          RESET ASCII BLOCK TO ZERO COLOR
1232   A89D 34 04             LA89D   PSHS   B                      SAVE COLOR INFO
1233   A89F 8D 6C                     BSR    LA90D                  SYNTAX CHECK FOR  )
1234   A8A1 A6 84                     LDA    ,X                     GET CURRENT CHARACTER FROM SCREEN
1235   A8A3 2B 01                     BMI    LA8A6                  BRANCH IF GRAPHIC
1236   A8A5 4F                        CLRA                          RESET ASCII CHARACTER TO ALL PIXELS OFF
1237   A8A6 84 0F             LA8A6   ANDA   #$0F                   SAVE ONLY PIXEL ON/OFF INFO
1238   A8A8 9A 86                     ORA    GRBLOK                  OR  WITH WHICH PIXEL TO TURN ON
1239   A8AA AA E0                     ORA    ,S+                     OR  IN THE COLOR
1240   A8AC 8A 80             LA8AC   ORA    #$80                   FORCE GRAPHIC
1241   A8AE A7 84                     STA    ,X                     DISPLAY IT ON THE SCREEN
1242   A8B0 39                        RTS
1243
1244                          * RESET
1245   A8B1 8D 0E             RESET   BSR    LA8C1                  GET ABSOLUTE SCREEN ADDRESS OF THIS CHARACTER
1246   A8B3 8D 58                     BSR    LA90D                  SYNTAX CHECK FOR ")"
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A8B5 4F                     CLRA                        * ACCA=ZERO GRAPHIC BLOCK - FOR USE IN CASE YOU RE
                                                        * TRYING TO RESET A NON GRAPHIC BLOCK
A8B6 E6 84                  LDB   ,X                    GET CURRENT CHAR FROM SCREEN
A8B8 2A F2                  BPL   LA8AC                 BRANCH IF NON-GRAPHIC
A8BA 03 86                  COM   GRBLOK                INVERT PIXEL ON/OFF MASK
A8BC D4 86                  ANDB  GRBLOK                AND IT WITH CURRENT ON/OFF DATA
A8BE E7 84                  STB   ,X                    DISPLAY IT
A8C0 39                     RTS

                    *** THIS ROUTINE WILL CHECK SYNTAX AND CHECK FOR LEGAL VALUES
                    *** OF SET,RESET & POINT HORIZONTAL AND VERTICAL PARAMETERS
                    *** AND RETURN THEIR ABSOLUTE SCREEN ADDRESS IN THE X REGISTER
                    *** WHICH OF THE FOUR PIXELS OF THE GRAPHIC BLOCK SELECTED
                    *** IS RETURNED IN GRBLOK.
A8C1 BD B2 6A       LA8C1   JSR   LB26A                 SYNTAX CHECK FOR "("
A8C4 BD 01 9D       LA8C4   JSR   RVEC21                HOOK INTO RAM
A8C7 BD B7 0B               JSR   LB70B                 EVALUATE EXPRESSION - RETURN VALUE IN ACCB
A8CA C1 3F                  CMPB  #63                   ONLY 64 HORIZONTAL GRAPHIC BLOCKS
A8CC 22 07                  BHI   LA8D5                   ILLEGAL FUNCTION CALL
A8CE 34 04                  PSHS  B                     SAVE HOR COORD
A8D0 BD B7 38               JSR   LB738                 SYNTAX CHECK FOR COMMA AND EVALUATE EXPR
A8D3 C1 1F                  CMPB  #31                   ONLY 32 VERTICAL BLOCKS
A8D5 22 71          LA8D5   BHI   LA948                   ILLEGAL FUNCTION CALL
A8D7 34 04                  PSHS  B                     SAVE VERT COORD
A8D9 54                     LSRB                        DIVIDE BY TWO BECAUSE THERE ARE 2 GRAPHIC PIXELS/HOR
                    *                                   CHARACTER POSITION (BYTE)
A8DA 86 20                  LDA   #32                   32 BYTES/ROW
A8DC 3D                     MUL                         GET ROW OFFSET OF CHAR POSITION
A8DD 8E 04 00               LDX   #VIDRAM               SCREEN BUFFER ADDRESS
A8E0 30 8B                  LEAX  D,X                   ADD ROW OFFSET TO SCREEN BUFFER ADDRESS
A8E2 E6 61                  LDB   1,S                   GET HOR COORD
A8E4 54                     LSRB                        2 VERTICAL PIXELS/CHARACTER POSITION
A8E5 3A                     ABX                         ADD VERTICAL OFFSET TO CHARACTER ADDRESS
A8E6 35 06                  PULS  A,B                   GET VER COORD TO ACCA, HOR COORD TO ACCB
A8E8 84 01                  ANDA  #1                    KEEP ONLY LSB OF VER COORD
A8EA 56                     RORB                        LSB OF HOR COORD TO CARRY FLAG
A8EB 49                     ROLA                        LSB OF HOR TO BIT 0 OF ACCA
A8EC C6 10                  LDB   #$10                  MAKE A BIT MASK - TURN ON BIT 4
A8EE 54             LA8EE   LSRB                        SHIFT IT RIGHT ONCE
A8EF 4A                     DECA                        SHIFTED IT ENOUGH?
A8F0 2A FC                  BPL   LA8EE                 NO
A8F2 D7 86                  STB   GRBLOK                ACCB=8 FOR UPPER LEFT PIXEL, =4 FOR UPPER RIGHT
                    *                                   PIXEL =2 FOR LOWER LEFT, =1 FOR LOWER RIGHT
A8F4 39                     RTS

                    * POINT
A8F5 8D CD          POINT   BSR   LA8C4                 EVALUATE EXPRESSION
A8F7 C6 FF                  LDB   #$FF                  INITIAL VALUE OF ON/OFF FLAG = OFF (FALSE)
A8F9 A6 84                  LDA   ,X                    GET CURRENT GRAPHIC CHARACTER
A8FB 2A 0D                  BPL   LA90A                 BRANCH IF NON-GRAPHIC (ALWAYS FALSE)
A8FD 94 86                  ANDA  GRBLOK                 AND  CURR CHAR WITH THE PIXEL IN QUESTION
A8FF 27 08                  BEQ   LA909                 BRANCH IF THE ELEMENT IS OFF
A901 E6 84                  LDB   ,X                    GET CURRENT CHARACTER
A903 54                     LSRB                        * SHIFT RIGHT
A904 54                     LSRB                        * SHIFT RIGHT
A905 54                     LSRB                        * SHIFT RIGHT
A906 54                     LSRB                        * SHIFT RIGHT - NOW THE HIGH NIBBLE IS IN THE LOW NIBBLE
A907 C4 07                  ANDB  #7                    KEEP ONLY THE COLOR INFO
A909 5C             LA909   INCB                        ACCB=0 FOR NO COLOR, =1 T0 8 OTHERWISE
A90A BD A5 E8       LA90A   JSR   LA5E8                 CONVERT ACCB TO FLOATING POINT
A90D 7E B2 67       LA90D   JMP   LB267                 SYNTAX CHECK FOR  )

                    * CLS
A910 BD 01 A0       CLS     JSR   RVEC22                HOOK INTO RAM
A913 27 13                  BEQ   LA928                 BRANCH IF NO ARGUMENT
A915 BD B7 0B               JSR   LB70B                 CALCULATE ARGUMENT, RETURN VALUE IN ACCB
A918 C1 08                  CMPB  #8                    VALID ARGUMENT?
A91A 22 1B                  BHI   LA937                 IF ARGUMENT >8, GO PRINT  MICROSOFT
A91C 5D                     TSTB                        SET FLAGS
A91D 27 06                  BEQ   LA925                 COLOR 0
A91F 5A                     DECB                        ACCB NOW CONTAINS 0-7
A920 86 10                  LDA   #$10                  EACH GRAPHIC BLOCK SEPARATED BY $10 FROM ONE ANOTHER
A922 3D                     MUL                         ACCB CONTAINS ONE OF 8 OFFSETS
A923 CA 0F                  ORB   #$0F                  BITS 0-3 SET FOR SOLID COLOR GRAPHIC BLOCK
A925 CA 80          LA925   ORB   #$80                  BIT 7 SET FOR GRAPHICS
A927 8C                     FCB   SKP2                  SKIP TWO BYTES

                    * CLEAR SCREEN
A928 C6 60          LA928   LDB   #$60                  BLANK
A92A 8E 04 00               LDX   #VIDRAM               GET ADDR OF START OF SCREEN BUFFER
A92D 9F 88          LA92D   STX   CURPOS                SAVE IT IN CURPOS
A92F E7 80          LA92F   STB   ,X+                   FILL SCREEN WITH CONTENTS OF ACCB
A931 8C 05 FF               CMPX  #VIDRAM+511           END OF SCREEN?
A934 23 F9                  BLS   LA92F                 NO
A936 39                     RTS
A937 8D EF          LA937   BSR   LA928                 CLEAR SCREEN
A939 8E A1 65               LDX   #LA166-1              *
A93C 7E B9 9C               JMP   LB99C                 * PRINT  MICROSOFT
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1336   A93F BD B2 6D          LA93F   JSR   LB26D                   SYNTAX CHECK FOR A COMMA
1337   A942 BD B7 ØB          LA942   JSR   LB7ØB                   EVALUATE EXPRESSION, RETURN VALUE IN ACCB
1338   A945 5D                        TSTB                          SET FLAGS
1339   A946 26 3C                     BNE   LA984                   RETURN IF NON ZERO
134Ø   A948 7E B4 4A          LA948   JMP   LB44A                    ILLEGAL FUNCTION CALL  IF ZERO
1341
1342                          * SOUND
1343   A94B 8D F5             SOUND   BSR   LA942                   EVALUATE EXPRESSION (FREQUENCY)
1344   A94D D7 8C                     STB   SNDTON                  SAVE IT
1345   A94F 8D EE                     BSR   LA93F                   EVALUATE EXPRESSION (SOUND LENGTH)
1346   A951 86 Ø4                     LDA   #4                      CONSTANT FACTOR
1347   A953 3D                        MUL                           EXPAND LENGTH EXPRESSION
1348   A954 DD 8D                     STD   SNDDUR                  SAVE LENGTH OF SOUND
1349   A956 B6 FF Ø3                  LDA   PIAØ+3                  GET CONTROL REGISTER OF PIAØ, PORT B
135Ø   A959 8A Ø1                     ORA   #1                      *
1351   A95B B7 FF Ø3                  STA   PIAØ+3                  * ENABLE 6Ø HZ INTERRUPT (PIAØ IRQ)
1352   A95E ØF Ø8                     CLR   ARYDIS                  CLEAR THE ARRAY DISABLE FLAG - FOR NO APPARENT REASON
1353   A96Ø 8D 4Ø                     BSR   LA9A2                   CONNECT D/A SOUND INPUT TO OUTPUT OF SOUND MUX
1354   A962 8D 12                     BSR   LA976                   TURN ON AUDIO - ENABLE SOUND MUX
1355   A964 8D 1F             LA964   BSR   LA985                   STORE 2.5 VOLTS TO D/A AND WAIT
1356   A966 86 FE                     LDA   #$FE                    DATA TO MAKE D/A OUT = 5 VOLTS
1357   A968 8D 1D                     BSR   LA987                   STORE IT TO D/A AND WAIT
1358   A96A 8D 19                     BSR   LA985                   STORE 2.5 VOLTS TO D/A AND WAIT
1359   A96C 86 Ø2                     LDA   #2                      DATA TO MAKE D/A OUT = Ø VOLTS
136Ø   A96E 8D 17                     BSR   LA987                   STORE IT TO D/A AND WAIT
1361   A97Ø 9E 8D                     LDX   SNDDUR                  * IS SNDDUR = Ø? - THE IRQ INTERRUPT SERVICING
1362                          *                                     * ROUTINE WILL DECREMENT SNDDUR
1363   A972 26 FØ                     BNE   LA964                   NOT DONE YET
1364
1365                          * THESE ROUTINES WILL ENABLE/DISABLE THE ANALOG MUX
1366   A974 4F                LA974   CLRA                          BIT 3 OF ACCA = Ø, DISABLE ANALOG MUX
1367   A975 8C                        FCB   SKP2                    SKIP TWO BYTES
1368   A976 86 Ø8             LA976   LDA   #8                      BIT 3 OF ACCA = 1, ENABLE ANALOG MUX
1369   A978 A7 E2                     STA   ,-S                     SAVE ACCA ON STACK
137Ø   A97A B6 FF 23                  LDA   PIA1+3                  GET CONTROL REGISTER OF PIA1, PORT B
1371   A97D 84 F7                     ANDA  #$F7                    RESET BIT 3
1372   A97F AA E0                     ORA   ,S+                     OR IN BIT 3 OF ACCA (SAVED ON STACK)
1373   A981 B7 FF 23                  STA   PIA1+3                  SET/RESET CB2 OF U4
1374   A984 39                LA984   RTS
1375   A985 86 7E             LA985   LDA   #$7E                    DATA VALUE TO MAKE D/A OUTPUT = 2.5 VOLTS
1376   A987 B7 FF 2Ø          LA987   STA   DA                      STORE IT IN D/A
1377   A98A 96 8C                     LDA   SNDTON                  GET FREQUENCY
1378   A98C 4C                LA98C   INCA                          INCREMENT IT
1379   A98D 26 FD                     BNE   LA98C                   LOOP UNTIL DONE
138Ø   A98F 39                        RTS
1381
1382                          * AUDIO
1383   A99Ø 1F 89             AUDIO   TFR   A,B                      SAVE ON/OFF TOKEN IN ACCB
1384   A992 9D 9F                     JSR   GETNCH                  MOVE BASIC POINTER TO NEXT CHARACTER
1385   A994 C1 AA                     CMPB  #$AA                     OFF  TOKEN?
1386   A996 27 DC                     BEQ   LA974                   YES - TURN OFF ANALOG MUX
1387   A998 CØ 88                     SUBB  #$88                     ON  TOKEN
1388   A99A BD A5 C9                  JSR   LA5C9                   SYNTAX ERROR IF NOT  OFF  OR  ON
1389   A99D 5C                        INCB                          NOW ACCB = 1
139Ø   A99E 8D Ø2                     BSR   LA9A2                   ROUTE CASSETTE TO SOUND MULTIPLEXER
1391   A9AØ 2Ø D4                     BRA   LA976                   ENABLE SOUND MULTIPLEXER
1392
1393                          * THIS ROUTINE WILL TRANSFER BIT Ø OF ACCB TO SEL 1 OF
1394                          * THE ANALOG MULTIPLEXER AND BIT 1 OF ACCB TO SEL 2.
1395   A9A2 CE FF Ø1          LA9A2   LDU   #PIAØ+1                 POINT U TO PIAØ CONTROL REG
1396   A9A5 8D ØØ                     BSR   LA9A7                   PROGRAM 1ST CONTROL REGISTER
1397   A9A7 A6 C4             LA9A7   LDA   ,U                      GET PIA CONTROL REGISTER
1398   A9A9 84 F7                     ANDA  #$F7                    RESET CA2 (CB2) OUTPUT BIT
1399   A9AB 57                        ASRB                          SHIFT ACCB BIT Ø TO CARRY FLAG
14ØØ   A9AC 24 Ø2                     BCC   LA9BØ                   BRANCH IF CARRY = ZERO
14Ø1   A9AE 8A Ø8                     ORA   #$Ø8                    FORCE BIT 3=1; SET CA2(CB2)
14Ø2   A9BØ A7 C1             LA9BØ   STA   ,U++                    PUT IT BACK IN THE PIA CONTROL REGISTER
14Ø3   A9B2 39                        RTS
14Ø4
14Ø5                          * IRQ SERVICE
14Ø6   A9B3 B6 FF Ø3          BIRQSV  LDA   PIAØ+3                  CHECK FOR 6ØHZ INTERRUPT
14Ø7   A9B6 2A ØD                     BPL   LA9C5                   RETURN IF 63.5 MICROSECOND INTERRUPT
14Ø8   A9B8 B6 FF Ø2                  LDA   PIAØ+2                  RESET PIAØ, PORT B INTERRUPT FLAG
14Ø9   A9BB BE ØØ 8D                  LDX   >SNDDUR                 GET INTERRUPT TIMER (SOUND COMMAND)
141Ø   A9BE 27 Ø5                     BEQ   LA9C5                   RETURN IF TIMER = Ø
1411   A9CØ 3Ø 1F                     LEAX  -1,X                    DECREMENT TIMER IF NOT = Ø
1412   A9C2 BF ØØ 8D                  STX   >SNDDUR                 SAVE NEW TIMER VALUE
1413   A9C5 3B                LA9C5   RTI                           RETURN FROM INTERRUPT
1414
1415                          * JOYSTK
1416   A9C6 BD B7 ØE          JOYSTK  JSR   LB7ØE                   EVALUATE JOYSTICK ARGUMENT
1417   A9C9 C1 Ø3                     CMPB  #3                      TWO JOYSTICKS MAXIMUM (HOR & VER FOR EACH)
1418   A9CB 1Ø 22 ØA 7B               LBHI  LB44A                    ILLEGAL FUNCTION CALL  IF >3
1419   A9CF 5D                        TSTB                          SET FLAGS
142Ø   A9DØ 26 Ø2                     BNE   LA9D4                   GET NEW DATA ONLY IF JOYSTK(Ø)
1421   A9D2 8D ØA                     BSR   GETJOY                  GET NEW DATA FOR ALL JOYSTICKS
1422   A9D4 8E Ø1 5A          LA9D4   LDX   #POTVAL                 POINT X TO JOYSTICK DATA BUFFER
1423   A9D7 D6 53                     LDB   FPAØ+3                  WHICH JOYSTICK DID YOU WANT?
1424   A9D9 E6 85                     LDB   B,X                     PUT ITS DATA INTO ACCB
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A9DB 7E B4 F3            JMP   LB4F3                  CONVERT ACCB INTO FLOATING POINT NUMBER
                         *
                         * JOYSTK DATA AT:
                         *     $15A      $15B      $15C      $15D
                         *     LEFT      LEFT      RIGHT     RIGHT
                         *     VERT      HORIZ     VERT      HORIZ
                         
                         ** THIS IS A 6 BIT SOFTWARE A/D CONVERSION ROUTINE
A9DE 8D 94               GETJOY BSR   LA974                  TURN OFF AUDIO
A9E0 8E 01 5E                   LDX   #POTVAL+4             POINT X TO JOYSTICK DATA BUFFER
A9E3 C6 03                      LDB   #3                    GET FOUR SETS OF DATA (4 JOYSTICKS)
A9E5 86 0A               LA9E5  LDA   #10                   10 TRIES TO GET STABLE READING
A9E7 ED E3                      STD   ,--S                  STORE JOYSTICK NUMBER AND TRY NUMBER ON THE STACK
A9E9 8D B7                      BSR   LA9A2                 SET THE SELECT INPUTS ON ANALOG MULTIPLEXER
A9EB CC 40 80            LA9EB  LDD   #$4080                ACCA IS A SHIFT COUNTER OF HOW MANY BITS TO CONVERT
                         *                                  AND WIlL BE $40 (6 BITS) FOR THE COLOR
                         *                                  COMPUTER. ACCB CONTAINS A VALUE EQUAL TO 1/2
                         *                                  THE CURRENT TRIAL DIFFERENCE. INITIALLY =$80 (2.5 VOLTS).
A9EE A7 E2               LA9EE  STA   ,-S                   TEMP STORE SHIFT COUNTER ON STACK
A9F0 CA 02                      ORB   #2                    KEEP RS 232 SERIAL OUT MARKING
A9F2 F7 FF 20                   STB   DA                    STORE IN D/A CONVERTER
A9F5 C8 02                      EORB  #2                    PUT R5232 OUTPUT BIT BACK TO ZERO
A9F7 B6 FF 00                   LDA   PIA0                  HIGH BIT IS FROM COMPARATOR
A9FA 2B 03                      BMI   LA9FF                 BRANCH IF COMPARATOR OUTPUT IS HIGH
A9FC E0 E4                      SUBB  ,S                    SUBTRACT 1/2 THE CURRENT TRIAL DIFFERENCE
A9FE 8C                         FCB   SKP2                  SKIP NEXT TWO BYTES
A9FF EB E4               LA9FF  ADDB  ,S                    ADD 1/2 OF THE CURRENT TRIAL DIFFERENCE
AA01 A6 E0                      LDA   ,S+                   PULL SHIFT COUNTER OFF THE STACK
AA03 44                         LSRA                        SHIFT IT RIGHT ONCE
AA04 81 01                      CMPA  #1                    HAVE ALL THE SHIFTS BEEN DONE?
AA06 26 E6                      BNE   LA9EE                 NO
AA08 54                         LSRB                        YES - THE DATA IS IN THE TOP 6 BYTES OF ACCB
AA09 54                         LSRB                        PUT IT INTO THE BOTTOM SIX
AA0A E1 1F                      CMPB  -1,X                  IS THIS VALUE EQUAL TO THE LAST TRY?
AA0C 27 04                      BEQ   LAA12                 YES - GO SAVE THE VALUE
AA0E 6A E4                      DEC   ,S                    NO-DECREMENT TRIES COUNTER
AA10 26 D9                      BNE   LA9EB                 BRANCH IF YOU HAVEN T TRIED 10 TIMES
                         *                                  IF YOU FALL THROUGH HERE YOU HAVE TRIED TO GET THE SAME READING
                         *                                  10 TIMES AND NEVER GOTTEN A MATCH. AS A RESULT YOU JUST FALL
                         *                                  THROUGH AND USE THE LAST VALUE READ IN.
AA12 E7 82               LAA12  STB   ,-X                   SAVE THE DIGITIZED VALUE
AA14 EC E1                      LDD   ,S++                  GET THE NUMBER OF THE JOYSTICK JUST DONE
AA16 5A                         DECB                        DECR JOYSTK NUMBER
AA17 2A CC                      BPL   LA9E5                 BRANCH IF THE LAST ONE DONE WASN T NUMBER 0
AA19 39                         RTS
                         *
                         * SET CARRY IF NUMERIC - RETURN WITH
                         * ZERO FLAG SET IF ACCA = 0 OR 3A(:) - END
                         * OF BASIC LINE OR SUB LINE
AA1A 81 3A               BROMHK CMPA  #'9+1                 IS THIS CHARACTER >=(ASCII 9)+1?
AA1C 24 0A                      BHS   LAA28                 BRANCH IF > 9; Z SET IF = COLON
AA1E 81 20                      CMPA  #SPACE                SPACE?
AA20 26 02                      BNE   LAA24                 NO - SET CARRY IF NUMERIC
AA22 0E 9F                      JMP   GETNCH                IF SPACE, GET NECT CHAR (IGNORE SPACES)
AA24 80 30               LAA24  SUBA  #'0                   * SET CARRY IF
AA26 80 D0                      SUBA  #-'0                  * CHARACTER > ASCII 0
AA28 39                  LAA28  RTS
                         *
                         * DISPATCH TABLE FOR SECONDARY FUNCTIONS
                         * TOKENS ARE PRECEEDED BY $FF                TOKEN #
AA29 BC 7A               LAA29  FDB   SGN                   SGN     80
AA2B BC EE                      FDB   INT                   INT     81
AA2D BC 93                      FDB   ABS                   ABS     82
AA2F 01 12                      FDB   $0112                 USR     83
AA31 BF 1F                      FDB   RND                   RND     84
AA33 BF 78                      FDB   SIN                   SIN     85
AA35 B7 50                      FDB   PEEK                  PEEK    86
AA37 B6 81                      FDB   LEN                   LEN     87
AA39 B4 FD                      FDB   STR                   STR$    88
AA3B B7 16                      FDB   VAL                   VAL     89
AA3D B6 A0                      FDB   ASC                   ASC     8A
AA3F B6 8C                      FDB   CHR                   CHR$    8B
AA41 A5 CE                      FDB   EOF                   EOF     8C
AA43 A9 C6                      FDB   JOYSTK                JOYSTK  8D
AA45 B6 AB                      FDB   LEFT                  LEFT$   8E
AA47 B6 C8                      FDB   RIGHT                 RIGHT$  8F
AA49 B6 CF                      FDB   MID                   MID$    90
AA4B A8 F5                      FDB   POINT                 POINT   91
AA4D A5 64                      FDB   INKEY                 INKEY$  92
AA4F B4 EE                      FDB   MEM                   MEM     93
                         *
                         * THIS TABLE CONTAINS PRECEDENCES AND DISPATCH ADDRESSES FOR ARITHMETIC
                         * AND LOGICAL OPERATORS - THE NEGATION OPERATORS DO NOT ACT ON TWO OPERANDS
                         * S0 THEY ARE NOT LISTED IN THIS TABLE. THEY ARE TREATED SEPARATELY IN THE
                         * EXPRESSION EVALUATION ROUTINE. THEY ARE:
                         * UNARY NEGATION (-), PRECEDENCE &7D AND LOGICAL NEGATION (NOT), PRECEDENCE $5A
                         * THE RELATIONAL OPERATORS < > = ARE ALSO NOT LISTED, PRECEDENCE $64.
                         * A PRECEDENCE VALUE OF ZERO INDICATES END OF EXPRESSION OR PARENTHESES
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1514   AA51 79                LAA51   FCB   $79
1515   AA52 B9 C5                     FDB   LB9C5                  +
1516   AA54 79                        FCB   $79
1517   AA55 B9 BC                     FDB   LB9BC                  -
1518   AA57 7B                        FCB   $7B
1519   AA58 BA CC                     FDB   $BACC                  *
1520   AA5A 7B                        FCB   $7B
1521   AA5B BB 91                     FDB   $BB91                  /
1522   AA5D 7F                        FCB   $7F
1523   AA5E 01 1D                     FDB   $011D                  EXPONENTIATION
1524   AA60 50                        FCB   $50
1525   AA61 B2 D5                     FDB   $B2D5                  AND
1526   AA63 46                        FCB   $46
1527   AA64 B2 D4                     FDB   LB2D4                  OR
1528                          *
1529                          * THIS IS THE RESERVED WORD TABLE
1530                          *                                    TOKEN #
1531   AA66 46 4F D2          LAA66   FCC   'FO',$80+'R'           80
1532   AA69 47 CF                     FCC   'G',$80+'O'            81
1533   AA6B 52 45 CD                  FCC   'RE',$80+'M'           82
1534   AA6E A7                        FCB   '' + $80               83
1535   AA6F 45 4C 53 C5               FCC   'ELS',$80+'E'          84
1536   AA73 49 C6                     FCC   'I',$80+'F'            85
1537   AA75 44 41 54 C1               FCC   'DAT',$80+'A'          86
1538   AA79 50 52 49 4E D4            FCC   'PRIN',$80+'T'         87
1539   AA7E 4F CE                     FCC   'O',$80+'N'            88
1540   AA80 49 4E 50 55 D4            FCC   'INPU',$80+'T'         89
1541   AA85 45 4E C4                  FCC   'EN',$80+'D'           8A
1542   AA88 4E 45 58 D4               FCC   'NEX',$80+'T'          8B
1543   AA8C 44 49 CD                  FCC   'DI',$80+'M'           8C
1544   AA8F 52 45 41 C4               FCC   'REA',$80+'D'          8D
1545   AA93 52 55 CE                  FCC   'RU',$80+'N'           8E
1546   AA96 52 45 53 54 4F 52         FCC   'RESTOR',$80+'E'       8F
1547   AA9C C5
1548   AA9D 52 45 54 55 52 CE         FCC   'RETUR',$80+'N'        90
1549   AAA3 53 54 4F D0               FCC   'STO',$80+'P'          91
1550   AAA7 50 4F 4B C5               FCC   'POK',$80+'E'          92
1551   AAAB 43 4F 4E D4               FCC   'CON',$80+'T'          93
1552   AAAF 4C 49 53 D4               FCC   'LIS',$80+'T'          94
1553   AAB3 43 4C 45 41 D2            FCC   'CLEA',$80+'R'         95
1554   AAB8 4E 45 D7                  FCC   'NE',$80+'W'           96
1555   AABB 43 4C 4F 41 C4            FCC   'CLOA',$80+'D'         97
1556   AAC0 43 53 41 56 C5            FCC   'CSAV',$80+'E'         98
1557   AAC5 4F 50 45 CE               FCC   'OPE',$80+'N'          99
1558   AAC9 43 4C 4F 53 C5            FCC   'CLOS',$80+'E'         9A
1559   AACE 4C 4C 49 53 D4            FCC   'LLIS',$80+'T'         9B
1560   AAD3 53 45 D4                  FCC   'SE',$80+'T'           9C
1561   AAD6 52 45 53 45 D4            FCC   'RESE',$80+'T'         9D
1562   AADB 43 4C D3                  FCC   'CL',$80+'S'           9E
1563   AADE 4D 4F 54 4F D2            FCC   'MOTO',$80+'R'         9F
1564   AAE3 53 4F 55 4E C4            FCC   'SOUN',$80+'D'         A0
1565   AAE8 41 55 44 49 CF            FCC   'AUDI',$80+'O'         A1
1566   AAED 45 58 45 C3               FCC   'EXE',$80+'C'          A2
1567   AAF1 53 4B 49 50 C6            FCC   'SKIP',$80+'F'         A3
1568   AAF6 54 41 42 A8               FCC   'TAB',$80+'('          A4
1569   AAFA 54 CF                     FCC   'T',$80+'O'            A5
1570   AAFC 53 55 C2                  FCC   'SU',$80+'B'           A6
1571   AAFF 54 48 45 CE               FCC   'THE',$80+'N'          A7
1572   AB03 4E 4F D4                  FCC   'NO',$80+'T'           A8
1573   AB06 53 54 45 D0               FCC   'STE',$80+'P'          A9
1574   AB0A 4F 46 C6                  FCC   'OF',$80+'F'           AA
1575   AB0D AB                        FCC   '+' + $80              AB
1576   AB0E AD                        FCB   '-' + $80              AC
1577   AB0F AA                        FCB   '*' + $80              AD
1578   AB10 AF                        FCB   '/' + $80              AE
1579   AB11 DE                        FCB   '^' + $80              AF
1580   AB12 41 4E C4                  FCC   'AN',$80+'D'           B0
1581   AB15 4F D2                     FCC   'O',$80+'R'            B1
1582   AB17 BE                        FCB   '>' + $80              B2
1583   AB18 BD                        FCB   '=' + $80              B3
1584   AB19 BC                        FCB   '<' + $80              B4
1585                          *
1586                          * TOKENS FOR THE SECONDARY FUNCTIONS ARE PRECEEDED BY $FF
1587                          *                                    TOKEN #
1588   AB1A 53 47 CE          LAB1A   FCC   'SG',$80+'N'           80
1589   AB1D 49 4E D4                  FCC   'IN',$80+'T'           81
1590   AB20 41 42 D3                  FCC   'AB',$80+'S'           82
1591   AB23 55 53 D2                  FCC   'US',$80+'R'           83
1592   AB26 52 4E C4                  FCC   'RN',$80+'D'           84
1593   AB29 53 49 CE                  FCC   'SI',$80+'N'           85
1594   AB2C 50 45 45 CB               FCC   'PEE',$80+'K'          86
1595   AB30 4C 45 CE                  FCC   'LE',$80+'N'           87
1596   AB33 53 54 52 A4               FCC   'STR',$80+'$'          88
1597   AB37 56 41 CC                  FCC   'VA',$80+'L'           89
1598   AB3A 41 53 C3                  FCC   'AS',$80+'C'           8A
1599   AB3D 43 48 52 A4               FCC   'CHR',$80+'$'          8B
1600   AB41 45 4F C6                  FCC   'EO',$80+'F'           8C
1601   AB44 4A 4F 59 53 54 CB         FCC   'JOYST',$80+'K'        8D
1602   AB4A 4C 45 46 54 A4            FCC   'LEFT',$80+'$'         8E
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1603   AB4F 52 49 47 48 54 A4         FCC   'RIGHT',$80+'$'           8F
1604   AB55 4D 49 44 A4               FCC   'MID',$80+'$'             90
1605   AB59 50 4F 49 4E D4            FCC   'POIN',$80+'T'            91
1606   AB5E 49 4E 4B 45 59 A4         FCC   'INKEY',$80+'$'           92
1607   AB64 4D 45 CD                  FCC   'ME',$80+'M'              93
1608                          *
1609                          * DISPATCH TABLE FOR COMMANDS                TOKEN #
1610   AB67 AD 47             LAB67   FDB   FOR                       FOR     80
1611   AB69 AE 86                     FDB   GO                        GO      81
1612   AB6B AE E3                     FDB   REM                       REM     82
1613   AB6D AE E3                     FDB   REM                       REM     83
1614   AB6F AE E3                     FDB   REM                       ELSE    84
1615   AB71 AF 14                     FDB   IF                        IF      85
1616   AB73 AE E0                     FDB   DATA                      DATA    86
1617   AB75 B8 F7                     FDB   PRINT                     PRINT   87
1618   AB77 AF 42                     FDB   ON                        ON      88
1619   AB79 AF F5                     FDB   INPUT                     INPUT   89
1620   AB7B AE 02                     FDB   END                       END     8A
1621   AB7D B0 F8                     FDB   NEXT                      NEXT    8B
1622   AB7F B3 4E                     FDB   DIM                       DIM     8C
1623   AB81 B0 46                     FDB   READ                      READ    8D
1624   AB83 AE 75                     FDB   RUN                       RUN     8E
1625   AB85 AD E4                     FDB   RESTOR                    RESTORE 8F
1626   AB87 AE C0                     FDB   RETURN                    RETURN  90
1627   AB89 AE 09                     FDB   STOP                      STOP    91
1628   AB8B B7 57                     FDB   POKE                      POKE    92
1629   AB8D AE 30                     FDB   CONT                      CONTINUE93
1630   AB8F B7 64                     FDB   LIST                      LIST    94
1631   AB91 AE 41                     FDB   CLEAR                     CLEAR   95
1632   AB93 AD 17                     FDB   NEW                       NEW     96
1633   AB95 A4 98                     FDB   CLOAD                     CLOAD   97
1634   AB97 A4 4C                     FDB   CSAVE                     CSAVE   98
1635   AB99 A5 F6                     FDB   OPEN                      OPEN    99
1636   AB9B A4 16                     FDB   CLOSE                     CLOSE   9A
1637   AB9D B7 5E                     FDB   LLIST                     LLIST   9B
1638   AB9F A8 80                     FDB   SET                       SET     9C
1639   ABA1 A8 B1                     FDB   RESET                     RESET   9D
1640   ABA3 A9 10                     FDB   CLS                       CLS     9E
1641   ABA5 A7 BD                     FDB   MOTOR                     MOTOR   9F
1642   ABA7 A9 4B                     FDB   SOUND                     SOUND   A0
1643   ABA9 A9 90                     FDB   AUDIO                     AUDIO   A1
1644   ABAB A5 3E                     FDB   EXEC                      EXEC    A2
1645   ABAD A5 EC                     FDB   SKIPF                     SKIPF   A3
1646                          *
1647                          * ERROR MESSAGES AND THEIR NUMBERS AS USED INTERNALLY
1648   ABAF 4E 46             LABAF   FCC   'NF'                      0  NEXT WITHOUT FOR
1649   ABB1 53 4E                     FCC   'SN'                      1  SYNTAX ERROR
1650   ABB3 52 47                     FCC   'RG'                      2  RETURN WITHOUT GOSUB
1651   ABB5 4F 44                     FCC   'OD'                      3  OUT OF DATA
1652   ABB7 46 43                     FCC   'FC'                      4  ILLEGAL FUNCTION CALL
1653   ABB9 4F 56                     FCC   'OV'                      5  OVERFLOW
1654   ABBB 4F 4D                     FCC   'OM'                      6  OUT OF MEMORY
1655   ABBD 55 4C                     FCC   'UL'                      7  UNDEFINED LINE NUMBER
1656   ABBF 42 53                     FCC   'BS'                      8  BAD SUBSCRIPT
1657   ABC1 44 44                     FCC   'DD'                      9  REDIMENSIONED ARRAY
1658   ABC3 2F 30                     FCC   '/0'                      10 DIVISION BY ZERO
1659   ABC5 49 44                     FCC   'ID'                      11 ILLEGAL DIRECT STATEMENT
1660   ABC7 54 4D                     FCC   'TM'                      12 TYPE MISMATCH
1661   ABC9 4F 53                     FCC   'OS'                      13 OUT OF STRING SPACE
1662   ABCB 4C 53                     FCC   'LS'                      14 STRING TOO LONG
1663   ABCD 53 54                     FCC   'ST'                      15 STRING FORMULA TOO COMPLEX
1664   ABCF 43 4E                     FCC   'CN'                      16 CAN'T CONTINUE
1665   ABD1 46 44                     FCC   'FD'                      17 BAD FILE DATA
1666   ABD3 41 4F                     FCC   'AO'                      18 FILE ALREADY OPEN
1667   ABD5 44 4E                     FCC   'DN'                      19 DEVICE NUMBER ERROR
1668   ABD7 49 4F                     FCC   'IO'                      20 I/O ERROR
1669   ABD9 46 4D                     FCC   'FM'                      21 BAD FILE MODE
1670   ABDB 4E 4F                     FCC   'NO'                      22 FILE NOT OPEN
1671   ABDD 49 45                     FCC   'IE'                      23 INPUT PAST END OF FILE
1672   ABDF 44 53                     FCC   'DS'                      24 DIRECT STATEMENT IN FILE
1673
1674   ABE1 20 45 52 52 4F 52 LABE1   FCC   ' ERROR'
1675   ABE7 00                        FCB   $00
1676   ABE8 20 49 4E 20       LABE8   FCC   ' IN '
1677   ABEC 00                        FCB   $00
1678   ABED 0D                LABED   FCB   CR
1679   ABEE 4F 4B             LABEE   FCC   'OK'
1680   ABF0 0D 00                     FCB   CR,$00
1681   ABF2 0D                LABF2   FCB   CR
1682   ABF3 42 52 45 41 4B            FCC   'BREAK'
1683   ABF8 00                        FCB   $00
1684                          * SEARCH THE STACK FOR  GOSUB/RETURN  OR  FOR/NEXT  DATA.
1685                          * THE  FOR/NEXT  INDEX VARIABLE DESCRIPTOR ADDRESS BEING
1686                          * SOUGHT IS STORED IN VARDES. EACH BLOCK OF FOR/NEXT DATA IS 18
1687                          * BYTES WITH A $80 LEADER BYTE AND THE GOSUB/RETURN DATA IS 5 BYTES
1688                          * WITH AN $A6 LEADER BYTE.  THE FIRST NON "FOR/NEXT" DATA
1689                          * IS CONSIDERED  GOSUB/RETURN
1690   ABF9 30 64             LABF9   LEAX  4,S                       POINT X TO 3RD ADDRESS ON STACK - IGNORE THE
1691                          *                                       FIRST TWO RETURN ADDRESSES ON THE STACK
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1692   ABFB C6 12             LABFB   LDB   #18                    18 BYTES SAVED ON STACK FOR EACH  FOR  LOOP
1693   ABFD 9F 0F                     STX   TEMPTR                  SAVE POINTER
1694   ABFF A6 84                     LDA   ,X                      GET 1ST BYTE
1695   AC01 80 80                     SUBA  #$80                    * CHECK FOR TYPE OF STACK JUMP FOUND
1696   AC03 26 15                     BNE   LAC1A                   * BRANCH IF NOT  FOR/NEXT
1697   AC05 AE 01                     LDX   1,X                     = GET INDEX VARIABLE DESCRIPTOR
1698   AC07 9F 11                     STX   TMPTR1                  = POINTER AND SAVE IT IN TMPTR1
1699   AC09 9E 3B                     LDX   VARDES                  GET INDEX VARIABLE BEING SEARCHED FOR
1700   AC0B 27 09                     BEQ   LAC16                   BRANCH IF DEFAULT INDEX VARIABLE - USE THE
1701                         *                                     FIRST  FOR/NEXT  DATA FOUND ON STACK
1702                         *                                     IF NO INDEX VARIABLE AFTER  NEXT
1703   AC0D 9C 11                     CMPX  TMPTR1                  DOES THE STACK INDEX MATCH THE ONE
1704                         *                                     BEING SEARCHED FOR?
1705   AC0F 27 09                     BEQ   LAC1A                   YES
1706   AC11 9E 0F                     LDX   TEMPTR                  * RESTORE INITIAL POINTER, ADD
1707   AC13 3A                        ABX                           * 18 TO IT AND LOOK FOR
1708   AC14 20 E5                     BRA   LABFB                   * NEXT BLOCK OF DATA
1709   AC16 9E 11             LAC16   LDX   TMPTR1                  = GET 1ST INDEX VARIABLE FOUND AND
1710   AC18 9F 3B                     STX   VARDES                  = SAVE AS  NEXT  INDEX
1711   AC1A 9E 0F             LAC1A   LDX   TEMPTR                  POINT X TO START OF  FOR/NEXT  DATA
1712   AC1C 4D                        TSTA                          SET ZERO FLAG IF  FOR/NEXT  DATA
1713   AC1D 39                        RTS
1714                         * CHECK FOR MEMORY SPACE FOR NEW TOP OF
1715                         * ARRAYS AND MOVE ARRAYS TO NEW LOCATION
1716   AC1E 8D 17             LAC1E   BSR   LAC37                    ACCD = NEW BOTTOM OF FREE RAM - IS THERE
1717                         *                                     ROOM FOR THE STACK?
1718                         * MOVE BYTES FROM V43(X) TO V41(U) UNTIL (X) = V47 AND
1719                         * SAVE FINAL VALUE OF U IN V45
1720   AC20 DE 41             LAC20   LDU   V41                     POINT U TO DESTINATION ADDRESS (V41)
1721   AC22 33 41                     LEAU  1,U                     ADD ONE TO U - COMPENSATE FOR FIRST PSHU
1722   AC24 9E 43                     LDX   V43                     POINT X TO SOURCE ADDRESS (V43)
1723   AC26 30 01                     LEAX  1,X                     ADD ONE - COMPENSATE FOR FIRST LDA ,X
1724   AC28 A6 82             LAC28   LDA   ,-X                     GRAB A BYTE FROM SOURCE
1725   AC2A 36 02                     PSHU  A                       MOVE IT TO DESTINATION
1726   AC2C 9C 47                     CMPX  V47                     DONE?
1727   AC2E 26 F8                     BNE   LAC28                   NO - KEEP MOVING BYTES
1728   AC30 DF 45                     STU   V45                     SAVE FINAL DESTINATION ADDRESS
1729   AC32 39                LAC32   RTS
1730                         * CHECK TO SEE IF THERE IS ROOM TO STORE 2*ACCB
1731                         * BYTES IN FREE RAM - OM ERROR IF NOT
1732   AC33 4F                LAC33   CLRA                          * ACCD CONTAINS NUMBER OF EXTRA
1733   AC34 58                        ASLB                          * BYTES TO PUT ON STACK
1734   AC35 D3 1F                     ADDD  ARYEND                  END OF PROGRAM AND VARIABLES
1735   AC37 C3 00 3A          LAC37   ADDD  #STKBUF                 ADD STACK BUFFER - ROOM FOR STACK?
1736   AC3A 25 08                     BCS   LAC44                   BRANCH IF GREATER THAN $FFFF
1737   AC3C 10 DF 17                  STS   BOTSTK                  CURRENT NEW BOTTOM OF STACK STACK POINTER
1738   AC3F 10 93 17                  CMPD  BOTSTK                  ARE WE GOING TO BE BELOW STACK?
1739   AC42 25 EE                     BCS   LAC32                   YES - NO ERROR
1740   AC44 C6 0C             LAC44   LDB   #6*2                    OUT OF MEMORY ERROR
1741
1742                         * ERROR SERVICING ROUTINE
1743   AC46 BD 01 8E          LAC46   JSR   RVEC16                  HOOK INTO RAM
1744   AC49 BD 01 91                  JSR   RVEC17                  HOOK INTO RAM
1745   AC4C BD A7 E9                  JSR   LA7E9                   TURN OFF CASSETTE
1746   AC4F BD A9 74                  JSR   LA974                   DISABLE ANA MUX
1747   AC52 BD AD 33                  JSR   LAD33                   RESET STACK, STRING STACK, CONTINUE POINTER
1748   AC55 0F 6F                     CLR   DEVNUM                  SET DEVICE NUMBER TO SCREEN
1749   AC57 BD B9 5C                  JSR   LB95C                   SEND A CR TO SCREEN
1750   AC5A BD B9 AF                  JSR   LB9AF                   SEND A  ?  TO SCREEN
1751   AC5D 8E AB AF                  LDX   #LABAF                  POINT TO ERROR TABLE
1752   AC60 3A                        ABX                           ADD MESSAGE NUMBER OFFSET
1753   AC61 8D 3D                     BSR   LACA0                   * GET TWO CHARACTERS FROM X AND
1754   AC63 8D 3B                     BSR   LACA0                   * SEND TO CONSOLE OUT (SCREEN)
1755   AC65 8E AB E0                  LDX   #LABE1-1                POINT TO "ERROR" MESSAGE
1756   AC68 BD B9 9C          LAC68   JSR   LB99C                   PRINT MESSAGE POINTED TO BY X
1757   AC6B 96 68                     LDA   CURLIN                  GET CURRENT LINE NUMBER (CURL IN)
1758   AC6D 4C                        INCA                          TEST FOR DIRECT MODE
1759   AC6E 27 03                     BEQ   LAC73                   BRANCH IF DIRECT MODE
1760   AC70 BD BD C5                  JSR   LBDC5                   PRINT  IN ****
1761
1762                         * THIS IS THE MAIN LOOP OF BASIC WHEN IN DIRECT MODE
1763   AC73 BD B9 5C          LAC73   JSR   LB95C                   MOVE CURSOR TO START OF LINE
1764   AC76 8E AB ED                  LDX   #LABE1-1                POINT X TO  OK , CR MESSAGE
1765   AC79 BD B9 9C                  JSR   LB99C                   PRINT  OK , CR
1766   AC7C BD A3 90          LAC7C   JSR   LA390                   GO GET AN INPUT LINE
1767   AC7F CE FF FF                  LDU   #FFFF                   THE LINE NUMBER FOR DIRECT MODE IS $FFFF
1768   AC82 DF 68                     STU   CURLIN                  SAVE IT IN CURLIN
1769   AC84 25 F6                     BCS   LAC7C                   BRANCH IF LINE INPUT TERMINATED BY BREAK
1770   AC86 0D 70                     TST   CINBFL                  CHECK CONSOLE INPUT BUFFER STATUS
1771   AC88 10 26 F8 33               LBNE  LA4BF                   BRANCH IF BUFFER EMPTY - CLOSE FILE IF EMPTY
1772   AC8C 9F A6                     STX   CHARAD                  SAVE (X) AS CURRENT INPUT POINTER - THIS WILL
1773                         *                                     ENABLE THE  LIVE KEYBOARD  (DIRECT) MODE. THE
1774                         *                                     LINE JUST ENTERED WILL BE INTERPRETED
1775   AC8E 9D 9F                     JSR   GETNCH                  GET NEXT CHARACTER FROM BASIC
1776   AC90 27 EA                     BEQ   LAC7C                   NO LINE INPUT - GET ANOTHER LINE
1777   AC92 25 11                     BCS   LACA5                   BRANCH IF NUMER1C - THERE WAS A LINE NUMBER BEFORE
1778                         *                                     THE STATEMENT ENTERED, SO THIS STATEMENT
1779                         *                                     WILL BE MERGED INTO THE BASIC PROGRAM
1780   AC94 C6 30                     LDB   #2*24                    DIRECT STATEMENT IN FILE  ERROR
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1781   AC96 ØD 6F                TST   DEVNUM                  * CHECK DEVICE NUMBER AND
1782   AC98 26 AC                BNE   LAC46                   * ISSUE  DS  ERROR IF DEVNUM <> Ø
1783   AC9A BD B8 21             JSR   LB821                    GO CRUNCH LINE
1784   AC9D 7E AD CØ             JMP   LADCØ                    GO EXECUTE THE STATEMENT (LIVE KEYBOARD)
1785                            *
1786   ACAØ A6 8Ø                LACAØ LDA   ,X+                 GET A CHARACTER
1787   ACA2 7E B9 B1             JMP   LB9B1                    SEND TO CONSOLE OUT
1788                            * TAKE A LINE FROM THE LINE INPUT BUFFER
1789                            * AND INSERT IT INTO THE BASIC PROGRAM
1790   ACA5 BD AF 67             LACA5 JSR   LAF67              CONVERT LINE NUMBER TO BINARY
1791   ACA8 9E 2B                      LDX   BINVAL             GET CONVERTED LINE NUMBER
1792   ACAA BF Ø2 DA                   STX   LINHDR             STORE IT IN LINE INPUT HEADER
1793   ACAD BD B8 21                   JSR   LB821              GO CRUNCH THE LINE
1794   ACBØ D7 Ø3                      STB   TMPLOC             SAVE LINE LENGTH
1795   ACB2 8D 4D                      BSR   LADØ1              FIND OUT WHERE TO INSERT LINE
1796   ACB4 25 12                      BCS   LACC8              BRANCH IF LINE NUMBER DOES NOT ALREADY EXIST
1797   ACB6 DC 47                      LDD   V47                GET ABSOLUTE ADDRESS OF LINE NUMBER
1798   ACB8 A3 84                      SUBD  ,X                 SUBTRACT ADDRESS OF NEXT LINE NUMBER
1799   ACBA D3 1B                      ADDD  VARTAB             * ADD TO CURRENT END OF PROGRAM - THIS WILL REMOVE
1800   ACBC DD 1B                      STD   VARTAB             * THE LENGTH OF THIS LINE NUMBER FROM THE PROGRAM
1801   ACBE EE 84                      LDU   ,X                 POINT U TO ADDRESS OF NEXT LINE NUMBER
1802                            * DELETE OLD LINE FROM BASIC PROGRAM
1803   ACCØ 37 Ø2                LACCØ PULU  A                  GET A BYTE FROM WHAT S LEFT OF PROGRAM
1804   ACC2 A7 8Ø                      STA   ,X+                MOVE IT DOWN
1805   ACC4 9C 1B                      CMPX  VARTAB             COMPARE TO END OF BASIC PROGRAM
1806   ACC6 26 F8                      BNE   LACCØ              BRANCH IF NOT AT END
1807   ACC8 B6 Ø2 DC             LACC8 LDA   LINBUF             * CHECK TO SEE IF THERE IS A LINE IN
1808   ACCB 27 1C                      BEQ   LACE9              * THE BUFFER AND BRANCH IF NONE
1809   ACCD DC 1B                      LDD   VARTAB             = SAVE CURRENT END OF
1810   ACCF DD 43                      STD   V43                = PROGRAM IN V43
1811   ACD1 DB Ø3                      ADDB  TMPLOC             * ADD LENGTH OF CRUNCHED LINE,
1812   ACD3 89 ØØ                      ADCA  #Ø                 * PROPOGATE CARRY AND SAVE NEW END
1813   ACD5 DD 41                      STD   V41                * OF PROGRAM IN V41
1814   ACD7 BD AC 1E                   JSR   LAC1E              = MAKE SURE THERE S ENOUGH RAM FOR THIS
1815                            *                               = LINE & MAKE A HOLE IN BASIC FOR NEW LINE
1816   ACDA CE Ø2 D8                   LDU   #LINHDR-2          POINT U TO LINE TO BE INSERTED
1817   ACDD 37 Ø2                LACDD PULU  A                  GET A BYTE FROM NEW LINE
1818   ACDF A7 8Ø                      STA   ,X+                INSERT IT IN PROGRAM
1819   ACE1 9C 45                      CMPX  V45                * COMPARE TO ADDRESS OF END OF INSERTED
1820   ACE3 26 F8                      BNE   LACDD              * LINE AND BRANCH IF NOT DONE
1821   ACE5 9E 41                      LDX   V41                = GET AND SAVE
1822   ACE7 9F 1B                      STX   VARTAB             = END OF PROGRAM
1823   ACE9 8D 36                LACE9 BSR   LAD21              RESET INPUT POINTER, CLEAR VARIABLES, INITIALIZE
1824   ACEB 8D Ø2                      BSR   LACEF              ADJUST START OF NEXT LINE ADDRESSES
1825   ACED 2Ø 8D                      BRA   LAC7C              REENTER BASIC S INPUT LOOP
1826                            * COMPUTE THE START OF NEXT LINE ADDRESSES FOR THE BASIC PROGRAM
1827   ACEF 9E 19                LACEF LDX   TXTTAB             POINT X TO START OF PROGRAM
1828   ACF1 EC 84                LACF1 LDD   ,X                 GET ADDRESS OF NEXT LINE
1829   ACF3 27 21                      BEQ   LAD16              RETURN IF END OF PROGRAM
1830   ACF5 33 Ø4                      LEAU  4,X                POINT U TO START OF BASIC TEXT IN LINE
1831   ACF7 A6 CØ                LACF7 LDA   ,U+                * SKIP THROUGH THE LINE UNTIL A
1832   ACF9 26 FC                      BNE   LACF7              * ZERO (END OF LINE) IS FOUND
1833   ACFB EF 84                      STU   ,X                 SAVE THE NEW START OF NEXT LINE ADDRESS
1834   ACFD AE 84                      LDX   ,X                 POINT X TO START OF NEXT LINE
1835   ACFF 2Ø F0                      BRA   LACF1              KEEP GOING
1836                            *
1837                            * FIND A LINE NUMBER IN THE BASIC PROGRAM
1838                            * RETURN WITH CARRY SET IF NO MATCH FOUND
1839   ADØ1 DC 2B                LADØ1 LDD   BINVAL             GET THE LINE NUMBER TO FIND
1840   ADØ3 9E 19                      LDX   TXTTAB             BEGINNING OF PROGRAM
1841   ADØ5 EE 84                LADØ5 LDU   ,X                 GET ADDRESS OF NEXT LINE NUMBER
1842   ADØ7 27 Ø9                      BEQ   LAD12              BRANCH IF END OF PROG
1843   ADØ9 1Ø A3 Ø2                   CMPD  2,X                IS IT A MATCH?
1844   ADØC 23 Ø6                      BLS   LAD14              CARRY SET IF LOWER; CARRY CLEAR IF MATCH
1845   ADØE AE 84                      LDX   ,X                 X = ADDRESS OF NEXT LINE
1846   AD1Ø 2Ø F3                      BRA   LADØ5              KEEP LOOPING FOR LINE NUMBER
1847   AD12 1A Ø1                LAD12 ORCC  #1                 SET CARRY FLAG
1848   AD14 9F 47                LAD14 STX   V47                SAVE MATCH LINE NUMBER OR NUMBER OF LINE JUST AFTER
1849                                                           WHERE IT SHOULD HAVE BEEN
1850   AD16 39                   LAD16 RTS
1851
1852                            * NEW
1853   AD17 26 FB                NEW   BNE   LAD14              BRANCH IF ARGUMENT GIVEN
1854   AD19 9E 19                LAD19 LDX   TXTTAB             GET START OF BASIC
1855   AD1B 6F 8Ø                      CLR   ,X+                * PUT 2 ZERO BYTES THERE - ERASE
1856   AD1D 6F 8Ø                      CLR   ,X+                * THE BASIC PROGRAM
1857   AD1F 9F 1B                      STX   VARTAB             AND THE NEXT ADDRESS IS NOW THE END OF PROGRAM
1858   AD21 9E 19                LAD21 LDX   TXTTAB             GET START OF BASIC
1859   AD23 BD AE BB                   JSR   LAEBB              PUT INPUT POINTER ONE BEFORE START OF BASIC
1860                            * ERASE ALL VARIABLES
1861   AD26 9E 27                LAD26 LDX   MEMSIZ             * RESET START OF STRING VARIABLES
1862   AD28 9F 23                      STX   STRTAB             * TO TOP OF STRING SPACE
1863   AD2A BD AD E4                   JSR   RESTOR             RESET  DATA  POINTER TO START OF BASIC
1864   AD2D 9E 1B                      LDX   VARTAB             * GET START OF VARIABLES AND USE IT
1865   AD2F 9F 1D                      STX   ARYTAB             * TO RESET START OF ARRAYS
1866   AD31 9F 1F                      STX   ARYEND             RESET END OF ARRAYS
1867   AD33 8E Ø1 A9             LAD33 LDX   #STRSTK            * RESET STRING STACK POINTER TO
1868   AD36 9F ØB                      STX   TEMPPT             * BOTTOM OF STRING STACK
1869   AD38 AE E4                      LDX   ,S                 GET RETURN ADDRESS OFF STACK
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1870  AD3A 10 DE 21              LDS   FRETOP                  RESTORE STACK POINTER
1871  AD3D 6F E2                 CLR   ,-S                     PUT A ZERO BYTE ON STACK - TO CLEAR ANY RETURN OF
1872                       *                                   FOR/NEXT DATA FROM THE STACK
1873  AD3F 0F 2D                 CLR   OLDPTR                  RESET  CONT  ADDRESS SO YOU
1874  AD41 0F 2E                 CLR   OLDPTR+1                 CAN T CONTINUE
1875  AD43 0F 08                 CLR   ARYDIS                  CLEAR THE ARRAY DISABLE FLAG
1876  AD45 6E 84                 JMP   ,X                      RETURN TO CALLING ROUTINE - THIS IS NECESSARY
1877                       *                                   SINCE THE STACK WAS RESET
1878                       *
1879                       * FOR
1880                       *
1881                       * THE FOR COMMAND WILL STORE 18 BYTES ON THE STACK FOR
1882                       * EACH FOR-NEXT LOOP WHICH IS BEING PROCESSED. THESE
1883                       * BYTES ARE DEFINED AS FOLLOWS: 0- $80 (FOR FLAG);
1884                       *   1,2=INDEX VARIABLE DESCRIPTOR POINTER; 3-7=FP VALUE OF STEP;
1885                       *     8=STEP DIRECTION: $FF IF NEGATIVE; 0 IF ZERO; 1 IF POSITIVE;
1886                       *  9-13=FP VALUE OF  TO  PARAMETER;
1887                       * 14,15=CURRENT LINE NUMBER; 16,17=RAM ADDRESS OF THE END
1888                       *       OF THE LINE CONTAINING THE  FOR  STATEMENT
1889  AD47 86 80           FOR   LDA   #$80                    * SAVE THE DISABLE ARRAY FLAG IN VO8
1890  AD49 97 08                 STA   ARYDIS                  * DO NOT ALLOW THE INDEX VARIABLE TO BE AN ARRAY
1891  AD4B BD AF 89              JSR   LET                     SET INDEX VARIABLE TO INITIAL VALUE
1892  AD4E BD AB F9              JSR   LABF9                   SEARCH THE STACK FOR  FOR/NEXT  DATA
1893  AD51 32 62                 LEAS  2,S                     PURGE RETURN ADDRESS OFF OF THE STACK
1894  AD53 26 04                 BNE   LAD59                   BRANCH IF INDEX VARIABLE NOT ALREADY BEING USED
1895  AD55 9E 0F                 LDX   TEMPTR                  GET (ADDRESS + 18) OF MATCHED  FOR/NEXT  DATA
1896  AD57 32 85                 LEAS  B,X                     MOVE THE STACK POINTER TO THE BEGINNING OF THE
1897                       * MATCHED  FOR/NEXT  DATA SO THE NEW DATA WILL
1898                       * OVERLAY THE OLD DATA. THIS WILL ALSO DESTROY
1899                       * ALL OF THE  RETURN  AND  FOR/NEXT  DATA BELOW
1900                       * THIS POINT ON THE STACK
1901  AD59 C6 09           LAD59 LDB   #$09                    * CHECK FOR ROOM FOR 18 BYTES
1902  AD5B BD AC 33              JSR   LAC33                   * IN FREE RAM
1903  AD5E BD AE E8              JSR   LAEE8                   GET ADDR OF END OF SUBLINE IN X
1904  AD61 DC 68                 LDD   CURLIN                  GET CURRENT LINE NUMBER
1905  AD63 34 16                 PSHS  X,B,A                   SAVE LINE ADDR AND LINE NUMBER ON STACK
1906  AD65 C6 A5                 LDB   #$A5                    TOKEN FOR  TO
1907  AD67 BD B2 6F              JSR   LB26F                   SYNTAX CHECK FOR  TO
1908  AD6A BD B1 43              JSR   LB143                   TM  ERROR IF INDEX VARIABLE SET TO STRING
1909  AD6D BD B1 41              JSR   LB141                   EVALUATE EXPRESSION
1910                       *
1911  AD70 D6 54                 LDB   FP0SGN                  GET FPA0 MANTISSA SIGN
1912  AD72 CA 7F                 ORB   #$7F                    FORM A MASK TO SAVE DATA BITS OF HIGH ORDER MANTISSA
1913  AD74 D4 50                 ANDB  FPA0                    PUT THE MANTISSA SIGN IN BIT 7 OF HIGH ORDER MANTISSA
1914  AD76 D7 50                 STB   FPA0                    SAVE THE PACKED HIGH ORDER MANTISSA
1915  AD78 10 8E AD 7F           LDY   #LAD7F                  LOAD FOLLOWING ADDRESS INTO Y AS A RETURN
1916  AD7C 7E B1 EA              JMP   LB1EA                   ADDRESS - PUSH FPA0 ONTO THE STACK
1917  AD7F 8E BA C5        LAD7F LDX   #LBAC5                  POINT X TO FLOATING POINT NUMBER 1.0 (DEFAULT STEP VALUE)
1918  AD82 BD BC 14              JSR   LBC14                   MOVE (X) TO FPA0
1919  AD85 9D A5                 JSR   GETCCH                  GET CURRENT INPUT CHARACTER
1920  AD87 81 A9                 CMPA  #$A9                    STEP TOKEN
1921  AD89 26 05                 BNE   LAD90                   BRANCH IF NO  STEP  VALUE
1922  AD8B 9D 9F                 JSR   GETNCH                  GET A CHARACTER FROM BASIC
1923  AD8D BD B1 41              JSR   LB141                   EVALUATE NUMERIC EXPRESSION
1924  AD90 BD BC 6D        LAD90 JSR   LBC6D                   CHECK STATUS OF FPA0
1925  AD93 BD B1 E6              JSR   LB1E6                   SAVE STATUS AND FPA0 ON THE STACK
1926  AD96 DC 3B                 LDD   VARDES                  * GET DESCRIPTOR POINTER FOR THE  STEP
1927  AD98 34 06                 PSHS  B,A                     * VARIABLE AND SAVE IT ON THE STACK
1928  AD9A 86 80                 LDA   #$80                    = GET THE  FOR  FLAG AND
1929  AD9C 34 02                 PSHS  A                       = SAVE IT ON THE STACK
1930                       *
1931                       * MAIN COMMAND INTERPRETATION LOOP
1932  AD9E BD 01 9A        LAD9E JSR   RVEC20                  HOOK INTO RAM
1933  ADA1 1C AF                 ANDCC #$AF                    ENABLE IRQ,FIRQ
1934  ADA3 8D 46                 BSR   LADEB                   CHECK FOR KEYBOARD BREAK
1935  ADA5 9E A6                 LDX   CHARAD                  GET BASIC S INPUT POINTER
1936  ADA7 9F 2F                 STX   TINPTR                  SAVE IT
1937  ADA9 A6 80                 LDA   ,X+                     GET CURRENT INPUT CHAR & MOVE POINTER
1938  ADAB 27 07                 BEQ   LADB4                   BRANCH IF END OF LINE
1939  ADAD 81 3A                 CMPA  #':                     CHECK FOR LINE SEPARATOR
1940  ADAF 27 0F                 BEQ   LADC0                   BRANCH IF COLON
1941  ADB1 7E B2 77        LADB1 JMP   LB277                   SYNTAX ERROR -IF NOT LINE SEPARATOR
1942  ADB4 A6 81           LADB4 LDA   ,X++                    GET MS BYTE OF ADDRESS OF NEXT BASIC LINE
1943  ADB6 97 00                 STA   ENDFLG                  SAVE IN STOP/END FLAG - CAUSE A STOP IF
1944                       *                                   NEXT LINE ADDRESS IS < $8000; CAUSE
1945                       *                                   AN END IF ADDRESS > $8000
1946  ADB8 27 5B                 BEQ   LAE15                   BRANCH TO  STOP  - END OF PROGRAM
1947  ADBA EC 80                 LDD   ,X+                     GET CURRENT LINE NUMBER
1948  ADBC DD 68                 STD   CURLIN                  SAVE IN CURLIN
1949  ADBE 9F A6                 STX   CHARAD                  SAVE ADDRESS OF FIRST BYTE OF LINE
1950  ADC0 9D 9F           LADC0 JSR   GETNCH                  GET A CHARACTER FROM BASIC
1951  ADC2 8D 02                 BSR   LADC6                   GO PROCESS COMMAND
1952  ADC4 20 D8                 BRA   LAD9E                   GO BACK TO MAIN LOOP
1953  ADC6 27 78           LADC6 BEQ   LAE40                   RETURN IF END OF LINE
1954  ADC8 4D                    TSTA                          CHECK FOR TOKEN - BIT 7 SET (NEGATIVE)
1955  ADC9 10 2A 01 BC           LBPL  LET                     BRANCH IF NOT A TOKEN - GO DO A  LET  WHICH
1956                       *                                   IS THE  DEFAULT  TOKEN FOR MICROSOFT BASIC
1957  ADCD 81 A3                 CMPA  #$A3                    SKIPF TOKEN - HIGHEST EXECUTABLE COMMAND IN BASIC
1958  ADCF 22 0B                 BHI   LADDC                   BRANCH IF > A BASIC COMMAND
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1959   ADD1 BE Ø1 23              LDX   COMVEC+3                GET ADDRESS OF BASIC S COMMAND TABLE
196Ø   ADD4 48            LADD4   ASLA                          X2 (2 BYTE/JUMP ADDRESS) & DISCARD BIT 7
1961   ADD5 1F 89                 TFR   A,B                     SAVE COMMAND OFFSET IN ACCB
1962   ADD7 3A                    ABX                           NON X POINTS TO COMMAND JUMP ADDR
1963   ADD8 9D 9F                 JSR   GETNCH                  GET AN INPUT CHAR
1964                       *
1965                       * HERE IS WHERE WE BRANCH TO DO A  COMMAND
1966   ADDA 6E 94                 JMP   [,X]                    GO DO A COMMAND
1967   ADDC 81 B4          LADDC  CMPA  #$B4                    $B4 IS HIGHEST BASIC TOKEN
1968   ADDE 23 D1                 BLS   LADB1                    SYNTAX ERROR  IF NON-EXECUTABLE TOKEN
1969   ADEØ 6E 9F Ø1 2D           JMP   [COMVEC+13]             JUMP TO AN EX BAS COMMAND
197Ø                       *
1971                       * RESTORE
1972   ADE4 9E 19          RESTOR LDX   TXTTAB                  BEGINNING OF PROGRAM ADDRESS
1973   ADE6 3Ø 1F                 LEAX  -1,X                    MOVE TO ONE BYTE BEFORE PROGRAM
1974   ADE8 9F 33          LADE8  STX   DATPTR                   SAVE NEW DATA POINTER
1975   ADEA 39                    RTS
1976                       *
1977                       * BREAK CHECK
1978   ADEB BD A1 C1       LADEB  JSR   LA1C1                   GET A KEYSTROKE ENTRY
1979   ADEE 27 ØA                 BEQ   LADFA                   RETURN IF NO INPUT
198Ø   ADFØ 81 Ø3          LADFØ  CMPA  #3                      CONTROL C? (BREAK)
1981   ADF2 27 15                 BEQ   STOP                    YES
1982   ADF4 81 13                 CMPA  #$13                    CONTROL S? (PAUSE)
1983   ADF6 27 Ø3                 BEQ   LADFB                   YES
1984   ADF8 97 87                 STA   IKEYIM                  SAVE KEYSTROKE IN INKEY IMAGE
1985   ADFA 39             LADFA  RTS
1986   ADFB BD A1 CB       LADFB  JSR   KEYIN                   GET A KEY
1987   ADFE 27 FB                 BEQ   LADFB                   BRANCH IF NO KEY DOWN
1988   AEØØ 2Ø EE                 BRA   LADFØ                   CONTINUE - DO A BREAK CHECK
1989                       *
199Ø                       * END
1991   AEØ2 BD A4 26       END    JSR   LA426                   CLOSE FILES
1992   AEØ5 9D A5                 JSR   GETCCH                  GET CURRENT INPUT CHAR
1993   AEØ7 2Ø Ø2                 BRA   LAEØB
1994                       *
1995                       * STOP
1996   AEØ9 1A Ø1          STOP   ORCC  #$Ø1                    SET CARRY FLAG
1997   AEØB 26 33          LAEØB  BNE   LAE4Ø                   BRANCH IF ARGUMENT EXISTS
1998   AEØD 9E A6                 LDX   CHARAD                  * SAVE CURRENT POSITION OF
1999   AEØF 9F 2F                 STX   TINPTR                  * BASIC S INPUT POINTER
2ØØØ   AE11 Ø6 ØØ          LAE11  ROR   ENDFLG                  ROTATE CARRY INTO BIT 7 OF STOP/END FLAG
2ØØ1   AE13 32 62                 LEAS  2,S                     PURGE RETURN ADDRESS OFF STACK
2ØØ2   AE15 9E 68          LAE15  LDX   CURLIN                  GET CURRENT LINE NUMBER
2ØØ3   AE17 8C FF FF               CMPX  #$FFFF                  DIRECT MODE?
2ØØ4   AE1A 27 Ø6                 BEQ   LAE22                   YES
2ØØ5   AE1C 9F 29                 STX   OLDTXT                  SAVE CURRENT LINE NUMBER
2ØØ6   AE1E 9E 2F                 LDX   TINPTR                  * GET AND SAVE CURRENT POSITION
2ØØ7   AE2Ø 9F 2D                 STX   OLDPTR                  * OF BASIC S INPUT POINTER
2ØØ8   AE22 ØF 6F          LAE22  CLR   DEVNUM                  SET DEVICE NUMBER TO SCREEN
2ØØ9   AE24 8E AB F1               LDX   #LABF2-1                POINT TO CR,  BREAK  MESSAGE
2Ø1Ø   AE27 ØD ØØ                 TST   ENDFLG                  CHECK STOP/END FLAG
2Ø11   AE29 1Ø 2A FE 46            LBPL  LAC73                   BRANCH TO MAIN LOOP OF BASIC IF END
2Ø12   AE2D 7E AC 68               JMP   LAC68                   PRINT  BREAK AT ####  AND GO TO
2Ø13                       *                                    BASIC S MAIN LOOP IF  STOP
2Ø14
2Ø15                       * CONT
2Ø16   AE3Ø 26 ØE          CONT   BNE   LAE4Ø                   RETURN IF ARGUMENT GIVEN
2Ø17   AE32 C6 2Ø                 LDB   #2*16                    CAN T CONTINUE  ERROR
2Ø18   AE34 9E 2D                 LDX   OLDPTR                  GET CONTINUE ADDRESS (INPUT POINTER)
2Ø19   AE36 1Ø 27 FE ØC            LBEQ  LAC46                    CN  ERROR IF CONTINUE ADDRESS = Ø
2Ø2Ø   AE3A 9F A6                 STX   CHARAD                  RESET BASIC S INPUT POINTER
2Ø21   AE3C 9E 29                 LDX   OLDTXT                  GET LINE NUMBER
2Ø22   AE3E 9F 68                 STX   CURLIN                  RESET CURRENT LINE NUMBER
2Ø23   AE4Ø 39             LAE4Ø  RTS
2Ø24                       *
2Ø25                       * CLEAR
2Ø26   AE41 27 2C          CLEAR  BEQ   LAE6F                   BRANCH IF NO ARGUMENT
2Ø27   AE43 BD B3 E6               JSR   LB3E6                   EVALUATE ARGUMENT
2Ø28   AE46 34 Ø6                 PSHS  B,A                     SAVE AMOUNT OF STRING SPACE ON STACK
2Ø29   AE48 9E 27                 LDX   MEMSIZ                  GET CURRENT TOP OF CLEARED SPACE
2Ø3Ø   AE4A 9D A5                 JSR   GETCCH                  GET CURRENT INPUT CHARACTER
2Ø31   AE4C 27 ØC                 BEQ   LAE5A                   BRANCH IF NO NEW TOP OF CLEARED SPACE
2Ø32   AE4E BD B2 6D               JSR   LB26D                   SYNTAX CHECK FOR COMMA
2Ø33   AE51 BD B7 3D               JSR   LB73D                   EVALUATE EXPRESS1ON; RETURN VALUE IN X
2Ø34   AE54 3Ø 1F                 LEAX  -1,X                    X = TOP OF CLEARED SPACE
2Ø35   AE56 9C 74                 CMPX  TOPRAM                  COMPARE TO TOP OF RAM
2Ø36   AE58 22 18                 BHI   LAE72                    OM  ERROR IF > TOP OF RAM
2Ø37   AE5A 1F 1Ø          LAE5A  TFR   X,D                     ACCD = TOP OF CLEARED SPACE
2Ø38   AE5C A3 E1                 SUBD  ,S++                    SUBTRACT OUT AMOUNT OF CLEARED SPACE
2Ø39   AE5E 25 12                 BCS   LAE72                    OM  ERROR IF FREE MEM < Ø
2Ø4Ø   AE6Ø 1F Ø3                 TFR   D,U                     U = BOTTOM OF CLEARED SPACE
2Ø41   AE62 83 ØØ 3A               SUBD  #STKBUF                 SUBTRACT OUT STACK BUFFER
2Ø42   AE65 25 ØB                 BCS   LAE72                    OM  ERROR IF FREE MEM < Ø
2Ø43   AE67 93 1B                 SUBD  VARTAB                  SUBTRACT OUT START OF VARIABLES
2Ø44   AE69 25 Ø7                 BCS   LAE72                    OM  ERROR IF FREE MEM < Ø
2Ø45   AE6B DF 21                 STU   FRETOP                  SAVE NEW BOTTOM OF CLEARED SPACE
2Ø46   AE6D 9F 27                 STX   MEMSIZ                  SAVE NEW TOP OF CLEARED SPACE
2Ø47   AE6F 7E AD 26          LAE6F  JMP   LAD26                   ERASE ALL VARIABLES, INITIALIZE POINTERS, ETC
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2048   AE72 7E AC 44          LAE72   JMP    LAC44                     OM  ERROR
2049                          *
2050                          * RUN
2051   AE75 BD Ø1 94          RUN     JSR    RVEC18                    HOOK INTO RAM
2052   AE78 BD A4 26                  JSR    LA426                     CLOSE ANY OPEN FILES
2053   AE7B 9D A5                     JSR    GETCCH                    * GET CURRENT INPUT CHARACTER
2054   AE7D 1Ø 27 FE AØ               LBEQ   LAD21                     * IF NO LINE NUMBER
2055   AE81 BD AD 26                  JSR    LAD26                     ERASE ALL VARIABLES
2056   AE84 2Ø 19                     BRA    LAE9F                      GOTO  THE RUN ADDRESS
2057                          *
2058                          * GO
2059   AE86 1F 89             GO      TFR    A,B                       SAVE INPUT CHARACTER IN ACCB
2060   AE88 9D 9F             LAE88   JSR    GETNCH                    GET A CHARACTER FROM BASIC
2061   AE8A C1 A5                     CMPB   #$A5                       TO  TOKEN
2062   AE8C 27 16                     BEQ    LAEA4                     BRANCH IF GOTO
2063   AE8E C1 A6                     CMPB   #$A6                       SUB  TOKEN
2064   AE9Ø 26 45                     BNE    LAED7                      SYNTAX ERROR  IF NEITHER
2065   AE92 C6 Ø3                     LDB    #3                        =ROOM FOR 6
2066   AE94 BD AC 33                  JSR    LAC33                     =BYTES ON STACK?
2067   AE97 DE A6                     LDU    CHARAD                    * SAVE CURRENT BASIC INPUT POINTER, LINE
2068   AE99 9E 68                     LDX    CURLIN                    * NUMBER AND SUB TOKEN ON STACK
2069   AE9B 86 A6                     LDA    #$A6                      *
2070   AE9D 34 52                     PSHS   U,X,A                     *
2071   AE9F 8D Ø3             LAE9F   BSR    LAEA4                     GO DO A  GOTO
2072   AEA1 7E AD 9E                  JMP    LAD9E                     JUMP BACK TO BASIC S MAIN LOOP
2073                          * GOTO
2074   AEA4 9D A5             LAEA4   JSR    GETCCH                    GET CURRENT INPUT CHAR
2075   AEA6 BD AF 67                  JSR    LAF67                     GET LINE NUMBER TO BINARY IN BINVAL
2076   AEA9 8D 4Ø                     BSR    LAEEB                     ADVANCE BASIC S POINTER TO END OF LINE
2077   AEAB 3Ø Ø1                     LEAX   $Ø1,X                     POINT TO START OF NEXT LINE
2078   AEAD DC 2B                     LDD    BINVAL                    GET THE LINE NUMBER TO RUN
2079   AEAF 1Ø 93 68                  CMPD   CURLIN                    COMPARE TO CURRENT LINE NUMBER
2080   AEB2 22 Ø2                     BHI    LAEB6                     IF REO D LINE NUMBER IS > CURRENT LINE NUMBER,
2081                          *                                       DON T START LOOKING FROM
2082                          *                                       START OF PROGRAM
2083   AEB4 9E 19                     LDX    TXTTAB                    BEGINNING OF PROGRAM
2084   AEB6 BD AD Ø5          LAEB6   JSR    LAD Ø5                    GO FIND A LINE NUMBER
2085   AEB9 25 17                     BCS    LAED2                      UNDEFINED LINE NUMBER
2086   AEBB 3Ø 1F             LAEBB   LEAX   -1,X                      MOVE BACK TO JUST BEFORE START OF LINE
2087   AEBD 9F A6                     STX    CHARAD                    RESET BASIC S INPUT POINTER
2088   AEBF 39                LAEBF   RTS
2089                          *
2090                          * RETURN
2091   AEC Ø 26 FD            RETURN  BNE    LAEBF                     EXIT ROUTINE IF ARGUMENT GIVEN
2092   AEC2 86 FF                     LDA    #$FF                      * PUT AN ILLEGAL VARIABLE NAME IN FIRST BYTE OF
2093   AEC4 97 3B                     STA    VARDES                    * VARDES WHICH WILL CAUSE  FOR/NEXT  DATA ON THE
2094                          *                                       STACK TO BE IGNORED
2095   AEC6 BD AB F9                  JSR    LABF9                     CHECK FOR RETURN DATA ON THE STACK
2096   AEC9 1F 14                     TFR    X,S                       RESET STACK POINTER - PURGE TWO RETURN ADDRESSES
2097                          *                                       FROM THE STACK
2098   AECB 81 26                     CMPA   #$A6-$8Ø                  SUB TOKEN - $8Ø
2099   AECD 27 ØB                     BEQ    LAEDA                     BRANCH IF  RETURN  FROM SUBROUTINE
2100   AECF C6 Ø4                     LDB    #2*2                      ERROR #2  RETURN WITHOUT GOSUB
2101   AED1 8C                        FCB    SKP2                      SKIP TWO BYTES
2102   AED2 C6 ØE             LAED2   LDB    #7*2                      ERROR #7  UNDEFINED LINE NUMBER
2103   AED4 7E AC 46                  JMP    LAC46                     JUMP TO ERROR HANDLER
2104   AED7 7E B2 77          LAED7   JMP    LB277                      SYNTAX ERROR
2105   AEDA 35 52             LAEDA   PULS   A,X,U                     * RESTORE VALUES OF CURRENT LINE NUMBER AND
2106   AEDC 9F 68                     STX    CURLIN                    * BASIC S INPUT POINTER FOR THIS SUBROUTINE
2107   AEDE DF A6                     STU    CHARAD                    * AND LOAD ACCA WITH SUB TOKEN ($A6)
2108                          *
2109                          * DATA
2110   AEE Ø 8D Ø6            DATA    BSR    LAEE8                     MOVE INPUT POINTER TO END OF SUBLINE OR LINE
2111   AEE2 8C                        FCB    SKP2                      SKIP 2 BYTES
2112
2113                          * REM, ELSE
2114                          ELSE
2115   AEE3 8D Ø6             REM     BSR    LAEEB                     MOVE INPUT POINTER TO END OF LINE
2116   AEE5 9F A6                     STX    CHARAD                    RESET BASIC S INPUT POINTER
2117   AEE7 39                LAEE7   RTS
2118                          * ADVANCE INPUT POINTER TO END OF SUBLINE OR LINE
2119   AEE8 C6 3A             LAEE8   LDB    #':                       COLON = SUBLINE TERMINATOR CHARACTER
2120   AEEA 86                LAEEA   FCB    SKP1LD                    SKPILD SKIP ONE BYTE; LDA #$5F
2121                          * ADVANCE BASIC S INPUT POINTER TO END OF
2122                          * LINE - RETURN ADDRESS OF END OF LINE+1 IN X
2123   AEEB 5F                LAEEB   CLRB                             Ø = LINE TERMINATOR CHARACTER
2124   AEEC D7 Ø1                     STB    CHARAC                    TEMP STORE PRIMARY TERMINATOR CHARACTER
2125   AEEE 5F                        CLRB                             Ø (END OF LINE) = ALTERNATE TERM. CHAR.
2126   AEEF 9E A6                     LDX    CHARAD                    LOAD X W/BASIC S INPUT POINTER
2127   AEF1 1F 98             LAEF1   TFR    B,A                       * CHANGE TERMINATOR CHARACTER
2128   AEF3 D6 Ø1                     LDB    CHARAC                    * FROM ACCB TO CHARAC - SAVE OLD TERMINATOR
2129                          *                                       IN CHARAC
2130   AEF5 97 Ø1                     STA    CHARAC                    SWAP PRIMARY AND SECONDARY TERMINATORS
2131   AEF7 A6 84             LAEF7   LDA    ,X                        GET NEXT INPUT CHARACTER
2132   AEF9 27 EC                     BEQ    LAEE7                     RETURN IF Ø (END OF LINE)
2133   AEFB 34 Ø4                     PSHS   B                         SAVE TERMINATOR ON STACK
2134   AEFD A1 EØ                     CMPA   ,S+                       COMPARE TO INPUT CHARACTER
2135   AEFF 27 E6                     BEQ    LAEE7                     RETURN IF EQUAL
2136   AF Ø1 3Ø Ø1                    LEAX   1,X                       MOVE POINTER UP ONE
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2137   AF03 81 22                 CMPA  #'"                  CHECK FOR DOUBLE QUOTES
2138   AF05 27 EA                 BEQ   LAEF1                BRANCH IF " - TOGGLE TERMINATOR CHARACTERS
2139   AF07 4C                    INCA                       * CHECK FOR $FF AND BRANCH IF
2140   AF08 26 02                 BNE   LAF0C                * NOT SECONDARY TOKEN
2141   AF0A 30 01                 LEAX  1,X                  MOVE INPUT POINTER 1 MORE IF SECONDARY
2142   AF0C 81 86           LAF0C CMPA  #$85+1               TOKEN FOR IF?
2143   AF0E 26 E7                 BNE   LAEF7                NO - GET ANOTHER INPUT CHARACTER
2144   AF10 0C 04                 INC   IFCTR                INCREMENT IF COUNTER - KEEP TRACK OF HOW MANY
2145                       *                                  IF  STATEMENTS ARE NESTED IN ONE LINE
2146   AF12 20 E3                 BRA   LAEF7                GET ANOTHER INPUT CHARACTER
2147
2148                       * IF
2149   AF14 BD B1 41        IF    JSR   LB141                EVALUATE NUMERIC EXPRESSION
2150   AF17 9D A5                 JSR   GETCCH               GET CURRENT INPUT CHARACTER
2151   AF19 81 81                 CMPA  #$81                 TOKEN FOR GO
2152   AF1B 27 05                 BEQ   LAF22                TREAT  GO  THE SAME AS  THEN
2153   AF1D C6 A7                 LDB   #$A7                 TOKEN FOR THEN
2154   AF1F BD B2 6F              JSR   LB26F                DO A SYNTAX CHECK ON ACCB
2155   AF22 96 4F           LAF22 LDA   FP0EXP               CHECK FOR TRUE/FALSE - FALSE IF FPA0 EXPONENT = ZERO
2156   AF24 26 13                 BNE   LAF39                BRANCH IF CONDITION TRUE
2157   AF26 0F 04                 CLR   IFCTR                CLEAR FLAG - KEEP TRACK OF WHICH NESTED ELSE STATEMENT
2158                       *                                  TO SEARCH FOR IN NESTED  IF  LOOPS
2159   AF28 8D B6           LAF28 BSR   DATA                 MOVE BASIC S POINTER TO END OF SUBLINE
2160   AF2A 4D                    TSTA                       * CHECK TO SEE IF END OF LINE OR SUBLINE
2161   AF2B 27 BA                 BEQ   LAEE7                * AND RETURN IF END OF LINE
2162   AF2D 9D 9F                 JSR   GETNCH               GET AN INPUT CHARACTER FROM BASIC
2163   AF2F 81 84                 CMPA  #$84                 TOKEN FOR ELSE
2164   AF31 26 F5                 BNE   LAF28                IGNORE ALL DATA EXCEPT  ELSE  UNTIL
2165                       *                                  END OF LINE (ZERO BYTE)
2166   AF33 0A 04                 DEC   IFCTR                CHECK TO SEE IF YOU MUST SEARCH ANOTHER SUBLINE
2167   AF35 2A F1                 BPL   LAF28                BRANCH TO SEARCH ANOTHER SUBLINE FOR  ELSE
2168   AF37 9D 9F                 JSR   GETNCH               GET AN INPUT CHARACTER FROM BASIC
2169   AF39 9D A5           LAF39 JSR   GETCCH               GET CURRENT INPUT CHARACTER
2170   AF3B 10 25 FF 65           LBCS  LAEA4                BRANCH TO  GOTO  IF NUMERIC CHARACTER
2171   AF3F 7E AD C6              JMP   LADC6                RETURN TO MAIN INTERPRETATION LOOP
2172
2173                       * ON
2174   AF42 BD B7 0B        ON    JSR   LB70B                EVALUATE EXPRESSION
2175   AF45 C6 81                 LDB   #$81                 TOKEN FOR GO
2176   AF47 BD B2 6F              JSR   LB26F                SYNTAX CHECK FOR GO
2177   AF4A 34 02                 PSHS  A                    SAVE NEW TOKEN (TO,SUB)
2178   AF4C 81 A6                 CMPA  #$A6                 TOKEN FOR SUB?
2179   AF4E 27 04                 BEQ   LAF54                YES
2180   AF50 81 A5                 CMPA  #$A5                 TOKEN FOR TO?
2181   AF52 26 83           LAF52 BNE   LAED7                 SYNTAX  ERROR IF NOT  SUB  OR  TO
2182   AF54 0A 53           LAF54 DEC   FPA0+3               DECREMENT IS BYTE OF MANTISSA OF FPA0 - THIS
2183                       *                                  IS THE ARGUMENT OF THE  ON  STATEMENT
2184   AF56 26 05                 BNE   LAF5D                BRANCH IF NOT AT THE PROPER GOTO OR GOSUB LINE NUMBER
2185   AF58 35 04                 PULS  B                    GET BACK THE TOKEN FOLLOWING  GO
2186   AF5A 7E AE 88              JMP   LAE88                GO DO A  GOTO  OR  GOSUB
2187   AF5D 9D 9F           LAF5D JSR   GETNCH               GET A CHARACTER FROM BASIC
2188   AF5F 8D 06                 BSR   LAF67                CONVERT BASIC LINE NUMBER TO BINARY
2189   AF61 81 2C                 CMPA  #',                  IS CHARACTER FOLLOWING LINE NUMBER A COMMA?
2190   AF63 27 EF                 BEQ   LAF54                YES
2191   AF65 35 84                 PULS  B,PC                 IF NOT, FALL THROUGH TO NEXT COMMAND
2192   AF67 9E 8A           LAF67 LDX   ZERO                 DEFAULT LINE NUMBER OF ZERO
2193   AF69 9F 2B                 STX   BINVAL               SAVE IT IN BINVAL
2194                       *
2195                       * CONVERT LINE NUMBER TO BINARY - RETURN VALUE IN BINVAL
2196                       *
2197   AF6B 24 61           LAF6B BCC   LAFCE                RETURN IF NOT NUMERIC CHARACTER
2198   AF6D 80 30                 SUBA  #'0                  MASK OFF ASCII
2199   AF6F 97 01                 STA   CHARAC               SAVE DIGIT IN VO1
2200   AF71 DC 2B                 LDD   BINVAL               GET ACCUMULATED LINE NUMBER VALUE
2201   AF73 81 18                 CMPA  #24                  LARGEST LINE NUMBER IS $F9FF (63999) -
2202                       *                                  (24*256+255)*10+9
2203   AF75 22 DB                 BHI   LAF52                 SYNTAX  ERROR IF TOO BIG
2204                       * MULT ACCD X 10
2205   AF77 58                    ASLB                       *
2206   AF78 49                    ROLA                       * TIMES 2
2207   AF79 58                    ASLB                       =
2208   AF7A 49                    ROLA                       = TIMES 4
2209   AF7B D3 2B                 ADDD  BINVAL               ADD 1 = TIMES 5
2210   AF7D 58                    ASLB                       *
2211   AF7E 49                    ROLA                       * TIMES 10
2212   AF7F DB 01                 ADDB  CHARAC               ADD NEXT DIGIT
2213   AF81 89 00                 ADCA  #0                   PROPAGATE CARRY
2214   AF83 DD 2B                 STD   BINVAL               SAVE NEW ACCUMULATED LINE NUMBER
2215   AF85 9D 9F                 JSR   GETNCH               GET NEXT CHARACTER FROM BASIC
2216   AF87 20 E2                 BRA   LAF6B                LOOP- PROCESS NEXT DIGIT
2217                       *
2218                       * LET (EXBAS)
2219                       * EVALUATE A NON-TOKEN EXPRESSION
2220                       * TARGET = REPLACEMENT
2221   AF89 BD B3 57        LET   JSR   LB357                FIND TARGET VARIABLE DESCRIPTOR
2222   AF8C 9F 3B                 STX   VARDES               SAVE DESCRIPTOR ADDRESS OF 1ST EXPRESSION
2223   AF8E C6 B3                 LDB   #$B3                 TOKEN FOR "="
2224   AF90 BD B2 6F              JSR   LB26F                DO A SYNTAX CHECK FOR  =
2225   AF93 96 06                 LDA   VALTYP               * GET VARIABLE TYPE AND
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2226   AF95 34 02                 PSHS  A                    * SAVE ON THE STACK
2227   AF97 BD B1 56              JSR   LB156                EVALUATE EXPRESSION
2228   AF9A 35 02                 PULS  A                    * REGET VARIABLE TYPE OF 1ST EXPRESSION AND
2229   AF9C 46                    RORA                       * SET CARRY IF STRING
2230   AF9D BD B1 48              JSR   LB148                TYPE CHECK-TM ERROR IF VARIABLE TYPES ON
2231                         *                               BOTH SIDES OF EQUALS SIGN NOT THE SAME
2232   AFA0 10 27 0C 8F           LBEQ  LBC33                GO PUT FPA0 INTO VARIABLE DESCRIPTOR IF NUMERIC
2233                         * MOVE A STRING WHOSE DESCRIPTOR IS LOCATED AT
2234                         * FPA0+2 INTO THE STRING SPACE. TRANSFER THE
2235                         * DESCRIPTOR ADDRESS TO THE ADDRESS IN VARDES
2236                         * DON T MOVE THE STRING IF IT IS ALREADY IN THE
2237                         * STRING SPACE. REMOVE DESCRIPTOR FROM STRING
2238                         * STACK IF IT IS LAST ONE ON THE STACK
2239   AFA4 9E 52            LAFA4  LDX   FPA0+2                POINT X TO DESCRIPTOR OF REPLACEMENT STRING
2240   AFA6 DC 21                   LDD   FRETOP                LOAD ACCD WITH START OF STRING SPACE
2241   AFA8 10 A3 02                CMPD  2,X                   IS THE STRING IN STRING SPACE?
2242   AFAB 24 11                   BCC   LAFBE                 BRANCH IF IT S NOT IN THE STRING SPACE
2243   AFAD 9C 1B                   CMPX  VARTAB                COMPARE DESCRIPTOR ADDRESS TO START OF VARIABLES
2244   AFAF 25 0D                   BCS   LAFBE                 BRANCH IF DESCRIPTOR ADDRESS NOT IN VARIABLES
2245   AFB1 E6 84            LAFB1  LDB   ,X                    GET LENGTH OF REPLACEMENT STRING
2246   AFB3 BD B5 0D                JSR   LB50D                 RESERVE ACCB BYTES OF STRING SPACE
2247   AFB6 9E 4D                   LDX   V4D                   GET DESCRIPTOR ADDRESS BACK
2248   AFB8 BD B6 43                JSR   LB643                 MOVE STRING INTO STRING SPACE
2249   AFBB 8E 00 56                LDX   #STRDES               POINT X TO TEMP STRING DESCRIPTOR ADDRESS
2250   AFBE 9F 4D            LAFBE  STX   V4D                   SAVE STRING DESCRIPTOR ADDRESS IN V4D
2251   AFC0 BD B6 75                JSR   LB675                 REMOVE STRING DESCRIPTOR IF LAST ONE
2252                         *                                  ON STRING STACK
2253   AFC3 DE 4D                   LDU   V4D                   POINT U TO REPLACEMENT DESCRIPTOR ADDRESS
2254   AFC5 9E 3B                   LDX   VARDES                GET TARGET DESCRIPTOR ADDRESS
2255   AFC7 37 26                   PULU  A,B,Y                 GET LENGTH AND START OF REPLACEMENT STRING
2256   AFC9 A7 84                   STA   ,X                    * SAVE STRING LENGTH AND START IN
2257   AFCB 10 AF 02                STY   2,X                   * TARGET DESCRIPTOR LOCATION
2258   AFCE 39               LAFCE  RTS
2259
2260   AFCF 3F 52 45 44 4F   LAFCF  FCC   '?REDO'               ?REDO MESSAGE
2261   AFD4 0D 00                   FCB   CR,$00
2262
2263   AFD6 C6 22            LAFD6  LDB   #2*17                  BAD FILE DATA  ERROR
2264   AFD8 0D 6F                   TST   DEVNUM                CHECK DEVICE NUMBER AND BRANCH
2265   AFDA 27 03                   BEQ   LAFDF                 IF SET TO SCREEN
2266   AFDC 7E AC 46         LAFDC  JMP   LAC46                 JMP TO ERROR HANDLER
2267   AFDF 96 09            LAFDF  LDA   INPFLG                = GET THE INPUT FLAG AND BRANCH
2268   AFE1 27 07                   BEQ   LAFEA                 = IF  INPUT
2269   AFE3 9E 31                   LDX   DATTXT                * GET LINE NUMBER WHERE THE ERROR OCCURRED
2270   AFE5 9F 68                   STX   CURLIN                * AND USE IT AS THE CURRENT LINE NUMBER
2271   AFE7 7E B2 77                JMP   LB277                 SYNTAX ERROR
2272   AFEA 8E AF CE         LAFEA  LDX   #LAFCF-1              * POINT X TO  ?REDO  AND PRINT
2273   AFED BD B9 9C                JSR   LB99C                 * IT ON THE SCREEN
2274   AFF0 9E 2F                   LDX   TINPTR                = GET THE SAVED ABSOLUTE ADDRESS OF
2275   AFF2 9F A6                   STX   CHARAD                = INPUT POINTER AND RESTORE IT
2276   AFF4 39                      RTS
2277                         *
2278                         * INPUT
2279   AFF5 C6 16            INPUT  LDB   #11*2                 ID  ERROR
2280   AFF7 9E 68                   LDX   CURLIN                GET CURRENT LINE NUMBER
2281   AFF9 30 01                   LEAX  1,X                   ADD ONE
2282   AFFB 27 DF                   BEQ   LAFDC                 ID  ERROR BRANCH IF DIRECT MODE
2283   AFFD 8D 03                   BSR   LB002                 GET SOME INPUT DATA
2284   AFFF 0F 6F                   CLR   DEVNUM                SET DEVICE NUMBER TO SCREEN
2285   B001 39                      RTS
2286   B002 81 23            LB002  CMPA  #'#                   CHECK FOR DEVICE NUMBER
2287   B004 26 09                   BNE   LB00F                 NO DEVICE NUMBER GIVEN
2288   B006 BD A5 A5                JSR   LA5A5                 CHECK SYNTAX AND GET DEVICE NUMBER
2289   B009 BD A3 ED                JSR   LA3ED                 CHECK FOR VALID INPUT FILE
2290   B00C BD B2 6D                JSR   LB26D                 SYNTAX CHECK FOR COMMA
2291   B00F 81 22            LB00F  CMPA  #'"                   CHECK FOR PROMPT STRING DELIMITER
2292   B011 26 0B                   BNE   LB01E                 BRANCH IF NO PROMPT STRING
2293   B013 BD B2 44                JSR   LB244                 PUT PROMPT STRING ON STRING STACK
2294   B016 C6 3B                   LDB   #';                   *
2295   B018 BD B2 6F                JSR   LB26F                 * DO A SYNTAX CHECK FOR SEMICOLON
2296   B01B BD B9 9F                JSR   LB99F                 PRINT MESSAGE TO CONSOLE OUT
2297   B01E 8E 02 DC         LB01E  LDX   #LINBUF               POINT TO BASIC S LINE BUFFER
2298   B021 6F 84                   CLR   ,X                    CLEAR 1ST BYTE - FLAG TO INDICATE NO DATA
2299                         *                                  IN LINE BUFFER
2300   B023 0D 6F                   TST   DEVNUM                CHECK DEVICE NUMBER
2301   B025 26 22                   BNE   LB049                 BRANCH IF NOT SET TO SCREEN
2302   B027 8D 06                   BSR   LB02F                 INPUT A STRING TO LINE BUFFER
2303   B029 C6 2C                   LDB   #',                   * INSERT A COMMA AT THE END
2304   B02B E7 84                   STB   ,X                    * OF THE LINE INPUT BUFFER
2305   B02D 20 1A                   BRA   LB049
2306                         * FILL BASIC S LINE INPUT BUFFER CONSOLE IN
2307   B02F BD B9 AF         LB02F  JSR   LB9AF                 SEND A "?" TO CONSOLE OUT
2308   B032 BD B9 AC                JSR   LB9AC                 SEND A  SPACE  TO CONSOLE OUT
2309   B035 BD A3 90         LB035  JSR   LA390                 GO READ IN A BASIC LINE
2310   B038 24 05                   BCC   LB03F                 BRANCH IF ENTER KEY ENDED ENTRY
2311   B03A 32 64                   LEAS  4,S                   PURGE TWO RETURN ADDRESSES OFF THE STACK
2312   B03C 7E AE 11                JMP   LAE11                 GO DO A  STOP  IF BREAK KEY ENDED LINE ENTRY
2313   B03F C6 2E            LB03F  LDB   #2*23                  INPUT PAST END OF FILE  ERROR
2314   B041 0D 70                   TST   CINBFL                CHECK FOR MORE CHARACTERS IN CONSOLE IN BUFFER
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2315   B043 26 97                BNE   LAFDC                    IE  ERROR IF EMPTY
2316   B045 39                   RTS
2317                       *
2318                       * READ
2319   B046 9E 33          READ  LDX   DATPTR                   GET  READ  START ADDRESS
2320   B048 86                   FCB   SKP1LD                   SKIP ONE BYTE - LDA #*$4F
2321   B049 4F             LB049 CLRA                           INPUT  ENTRY POINT: INPUT FLAG = Ø
2322   B04A 97 Ø9                STA   INPFLG                   SET INPUT FLAG; Ø = INPUT: <> Ø = READ
2323   B04C 9F 35                STX   DATTMP                   SAVE  READ  START ADDRESS/ INPUT  BUFFER START
2324   B04E BD B3 57       LB04E JSR   LB357                    EVALUATE A VARIABLE
2325   B051 9F 3B                STX   VARDES                   SAVE DESCRIPTOR ADDRESS
2326   B053 9E A6                LDX   CHARAD                   * GET BASIC S INPUT POINTER
2327   B055 9F 2B                STX   BINVAL                   * AND SAVE IT
2328   B057 9E 35                LDX   DATTMP                   GET  READ  ADDRESS START/ INPUT  BUFFER POINTER
2329   B059 A6 84                LDA   ,X                       GET A CHARACTER FROM THE BASIC PROGRAM
2330   B05B 26 ØC                BNE   LBØ69                    BRANCH IF NOT END OF LINE
2331   B05D 96 Ø9                LDA   INPFLG                   * CHECK INPUT FLAG AND BRANCH
2332   B05F 26 58                BNE   LBØB9                    * IF LOOKING FOR DATA (READ)
2333                       * NO DATA IN  INPUT  LINE BUFFER AND/OR INPUT
2334                       * NOT COMING FROM SCREEN
2335   B061 BD Ø1 7C             JSR   RVEC1Ø                   HOOK INTO RAM IF  INPUT
2336   B064 BD B9 AF             JSR   LB9AF                    SEND A '?' TO CONSOLE OUT
2337   B067 8D C6                BSR   LBØ2F                    FILL INPUT BUFFER FROM CONSOLE IN
2338   B069 9F A6          LBØ69 STX   CHARAD                   RESET BASIC S INPUT POINTER
2339   B06B 9D 9F                JSR   GETNCH                   GET A CHARACTER FROM BASIC
2340   B06D D6 Ø6                LDB   VALTYP                   * CHECK VARIABLE TYPE AND
2341   B06F 27 27                BEQ   LBØ98                    * BRANCH IF NUMERIC
2342                       * READ/INPUT A STRING VARIABLE
2343   BØ71 9E A6                LDX   CHARAD                   LOAD X WITH CURRENT BASIC INPUT POINTER
2344   BØ73 97 Ø1                STA   CHARAC                   SAVE CURRENT INPUT CHARACTER
2345   BØ75 81 22                CMPA  #'"                      CHECK FOR STRING DELIMITER
2346   BØ77 27 12                BEQ   LBØ8B                    BRANCH IF STRING DELIMITER
2347   BØ79 3Ø 1F                LEAX  -1,X                     BACK UP POINTER
2348   BØ7B 4F                   CLRA                           * ZERO = END OF LINE CHARACTER
2349   BØ7C 97 Ø1                STA   CHARAC                   * SAVE AS TERMINATOR
2350   BØ7E BD A3 5F             JSR   LA35F                    SET UP PRINT PARAMETERS
2351   BØ81 ØD 6E                TST   PRTDEV                   CHECK PRINT DEVICE NUMBER
2352   BØ83 26 Ø6                BNE   LBØ8B                    BRANCH IF CASSETTE - USE TWO ZEROS AS TERMINATOR
2353                       *                                    CHARACTERS FOR CASSETTE
2354   BØ85 86 3A                LDA   #':                      END OF SUBLINE CHARACTER
2355   BØ87 97 Ø1                STA   CHARAC                   SAVE AS TERMINATOR I
2356   BØ89 86 2C                LDA   #',                      COMMA
2357   BØ8B 97 Ø2          LBØ8B STA   ENDCHR                   SAVE AS TERMINATOR 2
2358   BØ8D BD B5 1E             JSR   LB51E                    STRIP A STRING FROM THE INPUT BUFFER
2359   BØ9Ø BD B2 49             JSR   LB249                    MOVE INPUT POINTER TO END OF STRING
2360   BØ93 BD AF A4             JSR   LAFA4                    PUT A STRING INTO THE STRING SPACE IF NECESSARY
2361   BØ96 2Ø Ø6                BRA   LBØ9E                    CHECK FOR ANOTHER DATA ITEM
2362                       * SAVE A NUMERIC VALUE IN A READ OR INPUT DATA ITEM
2363   BØ98 BD BD 12       LBØ98 JSR   LBD12                    CONVERT AN ASCII STRING TO FP NUMBER
2364   BØ9B BD BC 33             JSR   LBC33                    PACK FPAØ AND STORE IT IN ADDRESS IN VARDES -
2365                       *                                    INPUT OR READ DATA ITEM
2366   BØ9E 9D A5          LBØ9E JSR   GETCCH                   GET CURRENT INPUT CHARACTER
2367   BØAØ 27 Ø6                BEQ   LBØA8                    BRANCH IF END OF LINE
2368   BØA2 81 2C                CMPA  #',                      CHECK FOR A COMMA
2369   BØA4 1Ø 26 FF 2E          LBNE  LAFD6                    'BAD FILE DATA' ERROR OR RETRY
2370   BØA8 9E A6          LBØA8 LDX   CHARAD                   * GET CURRENT INPUT
2371   BØAA 9F 35                STX   DATTMP                   * POINTER (USED AS A DATA POINTER) AND SAVE IT
2372   BØAC 9E 2B                LDX   BINVAL                   * RESET INPUT POINTER TO INPUT OR
2373   BØAE 9F A6                STX   CHARAD                   * READ STATEMENT
2374   BØBØ 9D A5                JSR   GETCCH                   GET CURRENT CHARACTER FROM BASIC
2375   BØB2 27 21                BEQ   LBØD5                    BRANCH IF END OF LINE - EXIT COMMAND
2376   BØB4 BD B2 6D             JSR   LB26D                    SYNTAX CHECK FOR COMMA
2377   BØB7 2Ø 95                BRA   LBØ4E                    GET ANOTHER INPUT OR READ ITEM
2378                       * SEARCH FROM ADDRESS IN X FOR
2379                       * 1ST OCCURENCE OF THE TOKEN FOR DATA
2380   BØB9 9F A6          LBØB9 STX   CHARAD                   RESET BASIC S INPUT POINTER
2381   BØBB BD AE E8             JSR   LAEE8                    SEARCH FOR END OF CURRENT LINE OR SUBLINE
2382   BØBE 3Ø Ø1                LEAX  1,X                      MOVE X ONE PAST END OF LINE
2383   BØCØ 4D                   TSTA                           CHECK FOR END OF LINE
2384   BØC1 26 ØA                BNE   LBØCD                    BRANCH IF END OF SUBLINE
2385   BØC3 C6 Ø6                LDB   #2*3                     OUT OF DATA  ERROR
2386   BØC5 EE 81                LDU   ,X++                     GET NEXT 2 CHARACTERS
2387   BØC7 27 41                BEQ   LB1ØA                    OD  ERROR IF END OF PROGRAM
2388   BØC9 EC 81                LDD   ,X++                     GET BASIC LINE NUMBER AND
2389   BØCB DD 31                STD   DATTXT                   SAVE IT IN DATTXT
2390   BØCD A6 84          LBØCD LDA   ,X                       GET AN INPUT CHARACTER
2391   BØCF 81 86                CMPA  #$86                     DATA TOKEN?
2392   BØD1 26 E6                BNE   LBØB9                    NO   KEEP LOOKING
2393   BØD3 2Ø 94                BRA   LBØ69                    YES
2394                       * EXIT READ AND INPUT COMMANDS
2395   BØD5 9E 35          LBØD5 LDX   DATTMP                   GET DATA POINTER
2396   BØD7 D6 Ø9                LDB   INPFLG                   * CHECK INPUT FLAG
2397   BØD9 1Ø 26 FD ØB          LBNE  LADE8                    * SAVE NEW DATA POINTER IF READ
2398   BØDD A6 84                LDA   ,X                       = CHECK NEXT CHARACTER IN  INPUT  BUFFER
2399   BØDF 27 Ø6                BEQ   LBØE7                    =  RETURN IF NO MORE DATA FOR INPUT
2400   BØE1 8E BØ E7             LDX   #LBØE8-1                 POINT X TO  ?EXTRA IGNORED
2401   BØE4 7E B9 9C             JMP   LB99C                    PRINT THE MESSAGE
2402   BØE7 39             LBØE7 RTS
2403
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2404   B0E8 3F 45 58 54 52 41 LB0E8   FCC   '?EXTRA IGNORED'          ?EXTRA IGNORED MESSAGE
2405   B0EE 20 49 47 4E 4F 52
2406   B0F4 45 44
2407   B0F6 0D 00                     FCB   CR,$00
2408
2409                          * NEXT
2410   B0F8 26 04             NEXT    BNE   LB0FE                    BRANCH IF ARGUMENT GIVEN
2411   B0FA 9E 8A                     LDX   ZERO                     X = 0: DEFAULT FOR NO ARGUMENT
2412   B0FC 20 03                     BRA   LB101
2413   B0FE BD B3 57          LB0FE   JSR   LB357                    EVALUATE AN ALPHA EXPRESSION
2414   B101 9F 3B             LB101   STX   VARDES                   SAVE VARIABLE DESCRIPTOR POINTER
2415   B103 BD AB F9                  JSR   LABF9                    GO SCAN FOR  FOR/NEXT  DATA ON STACK
2416   B106 27 04                     BEQ   LB10C                    BRANCH IF DATA FOUND
2417   B108 C6 00                     LDB   #0                        NEXT WITHOUT FOR  ERROR (SHOULD BE CLRB)
2418   B10A 20 47             LB10A   BRA   LB153                    PROCESS ERROR
2419   B10C 1F 14             LB10C   TFR   X,S                      POINT S TO START OF  FOR/NEXT  DATA
2420   B10E 30 03                     LEAX  3,X                      POINT X TO FP VALUE OF STEP
2421   B110 BD BC 14                  JSR   LBC14                    COPY A FP NUMBER FROM (X) TO FPA0
2422   B113 A6 68                     LDA   8,S                      GET THE DIRECTION OF STEP
2423   B115 97 54                     STA   FP0SGN                   SAVE IT AS THE SIGN OF FPA0
2424   B117 9E 3B                     LDX   VARDES                   POINT (X) TO INDEX VARIABLE DESCRIPTOR
2425   B119 BD B9 C2                  JSR   LB9C2                    ADD (X) TO FPA0 (STEP TO INDEX)
2426   B11C BD BC 33                  JSR   LBC33                    PACK FPA0 AND STORE IT IN ADDRESS
2427                          *                                      CONTAINED IN VARDES
2428   B11F 30 69                     LEAX  9,S                      POINT (X) TO TERMINAL VALUE OF INDEX
2429   B121 BD BC 96                  JSR   LBC96                    COMPARE CURRENT INDEX VALUE TO TERMINAL VALUE OF INDEX
2430   B124 E0 68                     SUBB  8,S                      ACCB = 0 IF TERMINAL VALUE=CURRENT VALUE AND STEP=0 OR IF
2431                          *                                      STEP IS POSITIVE AND CURRENT VALUE>TERMINAL VALUE OR
2432                          *                                      STEP IS NEGATIVE AND CURRENT VALUE<TERMINAL VALUE
2433   B126 27 0C                     BEQ   LB134                    BRANCH IF  FOR/NEXT  LOOP DONE
2434   B128 AE 6E                     LDX   14,S                     * GET LINE NUMBER AND
2435   B12A 9F 68                     STX   CURLIN                   * BASIC POINTER OF
2436   B12C AE E8 10                  LDX   16,S                     * STATEMENT FOLLOWING THE
2437   B12F 9F A6                     STX   CHARAD                   * PROPER FOR STATEMENT
2438   B131 7E AD 9E          LB131   JMP   LAD9E                    JUMP BACK TO COMMAND INTEPR. LOOP
2439   B134 32 E8 12          LB134   LEAS  18,S                     PULL THE  FOR-NEXT  DATA OFF THE STACK
2440   B137 9D A5                     JSR   GETCCH                   GET CURRENT INPUT CHARACTER
2441   B139 81 2C                     CMPA  #',                      CHECK FOR ANOTHER ARGUMENT
2442   B13B 26 F4                     BNE   LB131                    RETURN IF NONE
2443   B13D 9D 9F                     JSR   GETNCH                   GET NEXT CHARACTER FROM BASIC
2444   B13F 8D BD                     BSR   LB0FE                    BSR SIMULATES A CALL TO  NEXT  FROM COMMAND LOOP
2445
2446                          * EVALUATE A NUMERIC EXPRESSION
2447   B141 8D 13             LB141   BSR   LB156                    EVALUATE EXPRESSION AND DO A TYPE CHECK FOR NUMERIC
2448   B143 1C FE             LB143   ANDCC #$FE                     CLEAR CARRY FLAG
2449   B145 7D                LB145   FCB   $7D                      OP CODE OF TST $1A01 - SKIP TWO BYTES (DO
2450                          *                                      NOT CHANGE CARRY FLAG)
2451   B146 1A 01             LB146   ORCC  #1                       SET CARRY
2452
2453                          * STRING TYPE MODE CHECK - IF ENTERED AT LB146 THEN VALTYP PLUS IS 'TM' ERROR
2454                          * NUMERIC TYPE MODE CHECK - IF ENTERED AT LB143 THEN VALTYP MINUS IS 'TM' ERROR
2455                          * IF ENTERED AT LB148, A TYPE CHECK IS DONE ON VALTYP
2456                          * IF ENTERED WITH CARRY SET, THEN 'TM' ERROR IF NUMERIC
2457                          * IF ENTERED WITH CARRY CLEAR, THEN 'TM' ERROR IF STRING.
2458   B148 0D 06             LB148   TST   VALTYP                    TEST TYPE FLAG; DO NOT CHANGE CARRY
2459   B14A 25 03                     BCS   LB14F                    BRANCH IF STRING
2460   B14C 2A 99                     BPL   LB0E7                    RETURN ON PLUS
2461   B14E 8C                        FCB   SKP2                     SKIP 2 BYTES -  TM  ERROR
2462   B14F 2B 96             LB14F   BMI   LB0E7                    RETURN ON MINUS
2463   B151 C6 18                     LDB   #12*2                     TYPE M1SMATCH  ERROR
2464   B153 7E AC 46          LB153   JMP   LAC46                    PROCESS ERROR
2465                          * EVALUATE EXPRESSION
2466   B156 8D 6E             LB156   BSR   LB1C6                    BACK UP INPUT POINTER
2467   B158 4F                        CLRA                           END OF OPERATION PRECEDENCE FLAG
2468   B159 8C                        FCB   SKP2                     SKIP TWO BYTES
2469   B15A 34 04             LB15A   PSHS  B                        SAVE FLAG (RELATIONAL OPERATOR FLAG)
2470   B15C 34 02                     PSHS  A                        SAVE FLAG (PRECEDENCE FLAG)
2471   B15E C6 01                     LDB   #1                       *
2472   B160 BD AC 33                  JSR   LAC33                    * SEE IF ROOM IN FREE RAM FOR (B) WORDS
2473   B163 BD B2 23                  JSR   LB223                    GO EVALUATE AN EXPRESSION
2474   B166 0F 3F                     CLR   TRELFL                   RESET RELATIONAL OPERATOR FLAG
2475   B168 9D A5             LB168   JSR   GETCCH                   GET CURRENT INPUT CHARACTER
2476                          * CHECK FOR RELATIONAL OPERATORS
2477   B16A 80 B2             LB16A   SUBA  #$B2                     TOKEN FOR >
2478   B16C 25 13                     BCS   LB181                    BRANCH IF LESS THAN RELATIONAL OPERATORS
2479   B16E 81 03                     CMPA  #3                       *
2480   B170 24 0F                     BCC   LB181                    * BRANCH IF GREATER THAN RELATIONAL OPERATORS
2481   B172 81 01                     CMPA  #1                       SET CARRY IF  >
2482   B174 49                        ROLA                           CARRY TO BIT 0
2483   B175 98 3F                     EORA  TRELFL                   * CARRY SET IF
2484   B177 91 3F                     CMPA  TRELFL                   * TRELFL = ACCA
2485   B179 25 64                     BCS   LB1DF                    BRANCH IF SYNTAX ERROR : == << OR >>
2486   B17B 97 3F                     STA   TRELFL                   BIT 0: >, BIT 1 =, BIT 2: <  SAVE DESIRED RELATIONAL COMPARISON
2487   B17D 9D 9F                     JSR   GETNCH                   GET AN INPUT CHARACTER
2488   B17F 20 E9                     BRA   LB16A                    CHECK FOR ANOTHER RELATIONAL OPERATOR
2489                          *
2490   B181 D6 3F             LB181   LDB   TRELFL                   GET RELATIONAL OPERATOR FLAG
2491   B183 26 33                     BNE   LB1B8                    BRANCH IF RELATIONAL COMPARISON
2492   B185 10 24 00 6B               LBCC  LB1F4                    BRANCH IF > RELATIONAL OPERATOR
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2493   B189 8B Ø7                    ADDA  #7                      SEVEN ARITHMETIC/LOGICAL OPERATORS
2494   B18B 24 67                    BCC   LB1F4                   BRANCH IF NOT ARITHMETIC/LOGICAL OPERATOR
2495   B18D 99 Ø6                    ADCA  VALTYP                  ADD CARRY, NUMERIC FLAG AND MODIFIED TOKEN NUMBER
2496   B18F 1Ø 27 Ø4 7C              LBEQ  LB60F                   BRANCH IF VALTYP = FF, AND ACCA =  +  TOKEN -
2497                                                               CONCATENATE TWO STRINGS
2498   B193 89 FF                    ADCA  #-1                     RESTORE ARITHMETIC/LOGICAL OPERATOR NUMBER
2499   B195 34 Ø2                    PSHS  A                       * STORE OPERATOR NUMBER ON STACK; MULTIPLY IT BY 2
25ØØ   B197 48                       ASLA                        * THEN ADD THE STORED STACK DATA = MULTIPLY
25Ø1   B198 AB EØ                    ADDA  ,S+                     * X 3; 3 BYTE/TABLE ENTRY
25Ø2   B19A 8E AA 51                 LDX   #LAA51                  JUMP TABLE FOR ARITHMETIC & LOGICAL OPERATORS
25Ø3   B19D 3Ø 86                    LEAX  A,X                     POINT X TO PROPER TABLE
25Ø4   B19F 35 Ø2            LB19F   PULS  A                       GET PRECEDENCE FLAG FROM STACK
25Ø5   B1A1 A1 84                    CMPA  ,X                      COMPARE TO CURRENT OPERATOR
25Ø6   B1A3 24 55                    BCC   LB1FA                   BRANCH IF STACK OPERATOR > CURRENT OPERATOR
25Ø7   B1A5 8D 9C                    BSR   LB143                    TM  ERROR IF VARIABLE TYPE = STRING
25Ø8
25Ø9                         * OPERATION BEING PROCESSED IS OF HIGHER PRECEDENCE THAN THE PREVIOUS OPERATION.
2510   B1A7 34 Ø2            LB1A7   PSHS  A                       SAVE PRECEDENCE FLAG
2511   B1A9 8D 29                    BSR   LB1D4                   PUSH OPERATOR ROUTINE ADDRESS AND FPAØ ONTO STACK
2512   B1AB 9E 3D                    LDX   RELPTR                  GET POINTER TO ARITHMETIC/LOGICAL TABLE ENTRY FOR
2513                        *                                      LAST CALCULATED OPERATION
2514   B1AD 35 Ø2                    PULS  A                       GET PRECEDENCE FLAG OF PREVIOUS OPERATION
2515   B1AF 26 1D                    BNE   LB1CE                   BRANCH IF NOT END OF OPERATION
2516   B1B1 4D                       TSTA                        CHECK TYPE OF PRECEDENCE FLAG
2517 > B1B2 1Ø 27 ØØ 6A              LBEQ  LB22Ø                   BRANCH IF END OF EXPRESSION OR SUB-EXPRESSION
2518   B1B6 2Ø 4B                    BRA   LB2Ø3                   EVALUATE AN OPERATION
2519                         * DO A RELATIONAL COMPARISON HERE
2520   B1B8 Ø8 Ø6            LB1B8   ASL   VALTYP                  BIT 7 OF TYPE FLAG TO CARRY
2521   B1BA 59                       ROLB                        SHIFT RELATIONAL FLAG LEFT - VALTYP TO BIT Ø
2522   B1BB 8D Ø9                    BSR   LB1C6                   MOVE THE INPUT POINTER BACK ONE
2523   B1BD 8E B1 CB                 LDX   #LB1CB                  POINT X TO RELATIONAL COMPARISON JUMP TABLE
2524   B1CØ D7 3F                    STB   TRELFL                  SAVE RELATIONAL COMPARISON DATA
2525   B1C2 ØF Ø6                    CLR   VALTYP                  SET VARIABLE TYPE TO NUMERIC
2526   B1C4 2Ø D9                    BRA   LB19F                   PERFORM OPERATION OR SAVE ON STACK
2527
2528   B1C6 9E A6            LB1C6   LDX   CHARAD                  * GET BASIC S INPUT POINTER AND
2529   B1C8 7E AE BB                 JMP   LAEBB                   * MOVE IT BACK ONE
2530                         * RELATIONAL COMPARISON JUMP TABLE
2531   B1CB 64               LB1CB   FCB   $64                     RELATIONAL COMPARISON FLAG
2532   B1CC B2 F4            LB1CC   FDB   LB2F4                   JUMP ADDRESS
2533
2534   B1CE A1 84            LB1CE   CMPA  ,X                      COMPARE PRECEDENCE OF LAST DONE OPERATION TO
2535                        *                                      NEXT TO BE DONE OPERATION
2536   B1DØ 24 31                    BCC   LB2Ø3                   EVALUATE OPERATION IF LOWER PRECEDENCE
2537   B1D2 2Ø D3                    BRA   LB1A7                   PUSH OPERATION DATA ON STACK IF HIGHER PRECEDENCE
2538
2539                         * PUSH OPERATOR EVALUATION ADDRESS AND FPAØ ONTO STACK AND EVALUATE ANOTHER EXPR
2540   B1D4 EC Ø1            LB1D4   LDD   1,X                     GET ADDRESS OF OPERATOR ROUTINE
2541   B1D6 34 Ø6                    PSHS  B,A                     SAVE IT ON THE STACK
2542   B1D8 8D Ø8                    BSR   LB1E2                   PUSH FPAØ ONTO STACK
2543   B1DA D6 3F                    LDB   TRELFL                  GET BACK RELATIONAL OPERATOR FLAG
2544   B1DC 16 FF 7B                 LBRA  LB15A                   EVALUATE ANOTHER EXPRESSION
2545   B1DF 7E B2 77         LB1DF   JMP   LB277                    SYNTAX ERROR
2546                         * PUSH FPAØ ONTO THE STACK.  ,S = EXPONENT
2547                         * 1-2,S =HIGH ORDER MANTISSA  3-4,S = LOW ORDER MANTISSA
2548                         * 5,S = SIGN  RETURN WITH PRECEDENCE CODE IN ACCA
2549   B1E2 D6 54            LB1E2   LDB   FPØSGN                  GET SIGN OF FPAØ MANTISSA
2550   B1E4 A6 84                    LDA   ,X                      GET PRECEDENCE CODE TO ACCA
2551   B1E6 35 2Ø            LB1E6   PULS  Y                       GET RETURN ADDRESS FROM STACK & PUT IT IN Y
2552   B1E8 34 Ø4                    PSHS  B                       SAVE ACCB ON STACK
2553   B1EA D6 4F            LB1EA   LDB   FP0EXP                  * PUSH FPAØ ONTO THE STACK
2554   B1EC 9E 5Ø                    LDX   FPAØ                    *
2555   B1EE DE 52                    LDU   FPAØ+2                  *
2556   B1FØ 34 54                    PSHS  U,X,B                   *
2557   B1F2 6E A4                    JMP   ,Y                      JUMP TO ADDRESS IN Y
2558
2559                         * BRANCH HERE IF NON-OPERATOR CHARACTER FOUND - USUALLY  )  OR END OF LINE
2560   B1F4 9E 8A            LB1F4   LDX   ZERO                    POINT X TO DUMMY VALUE (ZERO)
2561   B1F6 A6 EØ                    LDA   ,S+                     GET PRECEDENCE FLAG FROM STACK
2562   B1F8 27 26                    BEQ   LB22Ø                   BRANCH IF END OF EXPRESSION
2563   B1FA 81 64            LB1FA   CMPA  #$64                    * CHECK FOR RELATIONAL COMPARISON FLAG
2564   B1FC 27 Ø3                    BEQ   LB2Ø1                   * AND BRANCH IF RELATIONAL COMPARISON
2565   B1FE BD B1 43                 JSR   LB143                    TM  ERROR IF VARIABLE TYPE = STRING
2566   B2Ø1 9F 3D            LB2Ø1   STX   RELPTR                  SAVE POINTER TO OPERATOR ROUTINE
2567   B2Ø3 35 Ø4            LB2Ø3   PULS  B                       GET RELATIONAL OPERATOR FLAG FROM STACK
2568   B2Ø5 81 5A                    CMPA  #$5A                    CHECK FOR  NOT  OPERATOR
2569   B2Ø7 27 19                    BEQ   LB222                   RETURN IF  NOT  - NO RELATIONAL COMPARISON
2570   B2Ø9 81 7D                    CMPA  #$7D                    CHECK FOR NEGATION (UNARY) FLAG
2571   B2ØB 27 15                    BEQ   LB222                   RETURN IF NEGATION - NO RELATIONAL COMPARISON
2572
2573                         * EVALUATE AN OPERATION. EIGHT BYTES WILL BE STORED ON STACK, FIRST SIX BYTES
2574                         * ARE A TEMPORARY FLOATING POINT RESULT THEN THE ADDRESS OF ROUTINE WHICH
2575                         * WILL EVALUATE THE OPERATION. THE RTS AT END OF ROUTINE WILL VECTOR
2576                         * TO EVALUATING ROUTINE.
2577   B2ØD 54                       LSRB                        = ROTATE VALTYP BIT INTO CARRY
2578   B2ØE D7 ØA                    STB   RELFLG                  = FLAG AND SAVE NEW RELFLG
2579   B21Ø 35 52                    PULS  A,X,U                   * PULL A FP VALUE OFF OF THE STACK
2580   B212 97 5C                    STA   FP1EXP                  * AND SAVE IT IN FPA1
2581   B214 9F 5D                    STX   FPA1                    *
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2582   B216 DF 5F                STU   FPA1+2                  *
2583   B218 35 Ø4                PULS  B                       = GET MANTISSA SIGN AND
2584   B21A D7 61                STB   FP1SGN                  = SAVE IT IN FPA1
2585   B21C D8 54                EORB  FPØSGN                  EOR IT WITH FPA1 MANTISSA SIGN
2586   B21E D7 62                STB   RESSGN                  SAVE IT IN RESULT SIGN BYTE
2587   B22Ø D6 4F          LB22Ø LDB   FPØEXP                  GET EXPONENT OF FPAØ
2588   B222 39             LB222 RTS
2589
2590   B223 BD Ø1 8B       LB223 JSR   RVEC15                  HOOK INTO RAM
2591   B226 ØF Ø6                CLR   VALTYP                  INITIALIZE TYPE FLAG TO NUMERIC
2592   B228 9D 9F                JSR   GETNCH                  GET AN INPUT CHAR
2593   B22A 24 Ø3                BCC   LB22F                   BRANCH IF NOT NUMERIC
2594   B22C 7E BD 12       LB22C JMP   LBD12                   CONVERT ASCII STRING TO FLOATING POINT -
2595                       *                                   RETURN RESULT IN FPAØ
2596                       * PROCESS A NON NUMERIC FIRST CHARACTER
2597   B22F BD B3 A2       LB22F JSR   LB3A2                   SET CARRY IF NOT ALPHA
2598   B232 24 5Ø                BCC   LB284                   BRANCH IF ALPHA CHARACTER
2599   B234 81 2E                CMPA  #'.                     IS IT  .  (DECIMAL POINT)?
2600   B236 27 F4                BEQ   LB22C                   CONVERT ASCII STRING TO FLOATING POINT
2601   B238 81 AC                CMPA  #$AC                    MINUS TOKEN
2602   B23A 27 4Ø                BEQ   LB27C                   YES - GO PROCESS THE MINUS OPERATOR
2603   B23C 81 AB                CMPA  #$AB                    PLUS TOKEN
2604   B23E 27 E3                BEQ   LB223                   YES - GET ANOTHER CHARACTER
2605   B24Ø 81 22                CMPA  #'"                     STRING DELIMITER?
2606   B242 26 ØA                BNE   LB24E                   NO
2607   B244 9E A6          LB244 LDX   CHARAD                  CURRENT BASIC POINTER TO X
2608   B246 BD B5 18             JSR   LB518                   SAVE STRING ON STRING STACK
2609   B249 9E 64          LB249 LDX   COEFPT                  * GET ADDRESS OF END OF STRING AND
2610   B24B 9F A6                STX   CHARAD                  * PUT BASIC S INPUT POINTER THERE
2611   B24D 39                   RTS
2612   B24E 81 A8          LB24E CMPA  #$A8                    NOT TOKEN?
2613   B25Ø 26 ØD                BNE   LB25F                   NO
2614                       * PROCESS THE NOT OPERATOR
2615   B252 86 5A                LDA   #$5A                     NOT  PRECEDENCE FLAG
2616   B254 BD B1 5A             JSR   LB15A                   PROCESS OPERATION FOLLOWING  NOT
2617   B257 BD B3 ED             JSR   INTCNV                  CONVERT FPAØ TO INTEGER IN ACCD
2618   B25A 43                   COMA                          *  NOT  THE INTEGER
2619   B25B 53                   COMB                          *
2620   B25C 7E B4 F4             JMP   GIVABF                  CONVERT ACCD TO FLOATING POINT (FPAØ)
2621   B25F 4C             LB25F INCA                          CHECK FOR TOKENS PRECEEDED BY 5FF
2622   B26Ø 27 2E                BEQ   LB29Ø                   IT WAS PRECEEDED BY 5FF
2623   B262 8D Ø6          LB262 BSR   LB26A                   SYNTAX CHECK FOR A  (
2624   B264 BD B1 56             JSR   LB156                   EVALUATE EXPRESSIONS WITHIN PARENTHESES AT
2625                       *                                   HIGHEST PRECEDENCE
2626   B267 C6 29          LB267 LDB   #')                     SYNTAX CHECK FOR  )
2627   B269 8C                   FCB   SKP2                    SKIP 2 BYTES
2628   B26A C6 28          LB26A LDB   #'(                     SYNTAX CHECK FOR  (
2629   B26C 8C                   FCB   SKP2                    SKIP 2 BYTES
2630   B26D C6 2C          LB26D LDB   #',                     SYNTAX CHECK FOR COMMA
2631   B26F E1 9F ØØ A6    LB26F CMPB  [CHARAD]                * COMPARE ACCB TO CURRENT INPUT
2632   B273 26 Ø2                BNE   LB277                   * CHARACTER - SYNTAX ERROR IF NO MATCH
2633   B275 ØE 9F                JMP   GETNCH                  GET A CHARACTER FROM BASIC
2634   B277 C6 Ø2          LB277 LDB   #2*1                    SYNTAX ERROR
2635   B279 7E AC 46             JMP   LAC46                   JUMP TO ERROR HANDLER
2636
2637                       * PROCESS THE MINUS (UNARY) OPERATOR
2638   B27C 86 7D          LB27C LDA   #$7D                    MINUS (UNARY) PRECEDENCE FLAG
2639   B27E BD B1 5A             JSR   LB15A                   PROCESS OPERATION FOLLOWING  UNARY  NEGATION
2640   B281 7E BE E9             JMP   LBEE9                   CHANGE SIGN OF FPAØ MANTISSA
2641
2642                       * EVALUATE ALPHA EXPRESSION
2643   B284 BD B3 57       LB284 JSR   LB357                   FIND THE DESCRIPTOR ADDRESS OF A VARIABLE
2644   B287 9F 52                STX   FPAØ+2                  SAVE DESCRIPTOR ADDRESS IN FPAØ
2645   B289 96 Ø6                LDA   VALTYP                  TEST VARIABLE TYPE
2646   B28B 26 95                BNE   LB222                   RETURN IF STRING
2647   B28D 7E BC 14             JMP   LBC14                   COPY A FP NUMBER FROM (X) TO FPAØ
2648
2649                       * EVALUATING A SECONDARY TOKEN
2650   B29Ø 9D 9F          LB29Ø JSR   GETNCH                  GET AN INPUT CHARACTER (SECONDARY TOKEN)
2651   B292 1F 89                TFR   A,B                     SAVE IT IN ACCB
2652   B294 58                   ASLB                          X2 & BET RID OF BIT 7
2653   B295 9D 9F                JSR   GETNCH                  GET ANOTHER INPUT CHARACTER
2654   B297 C1 26                CMPB  #2*19                   19 SECONDARY FUNCTIONS IN BASIC
2655   B299 23 Ø4                BLS   LB29F                   BRANCH IF COLOR BASIC TOKEN
2656   B29B 6E 9F Ø1 32          JMP   [COMVEC+18]             JUMP TO EXBAS SECONDARY TOKEN HANDLER
2657   B29F 34 Ø4          LB29F PSHS  B                       SAVE TOKEN OFFSET ON STACK
2658   B2A1 C1 1C                CMPB  #2*14                   CHECK FOR NUMERIC ARGUMENT TOKEN
2659   B2A3 25 22                BCS   LB2C7                   DO SECONDARIES $8D (JOYSTK) OR LESS
2660   B2A5 C1 24                CMPB  #2*18                   *
2661   B2A7 24 2Ø                BCC   LB2C9                   * DO SECONDARIES $92 (INKEY$) OR >
2662   B2A9 8D BF                BSR   LB26A                   SYNTAX CHECK FOR A  (
2663   B2AB A6 E4                LDA   ,S                      GET TOKEN NUMBER
2664   B2AD 81 22                CMPA  #2*17                   CHECK FOR  POINT  COMMAND
2665   B2AF 24 18                BCC   LB2C9                   DO POINT COMMAND ($91)
2666                       * DO SECONDARIES $8E, $8F, $9Ø (LEFT$, RIGHT$, MID$)
2667   B2B1 BD B1 56             JSR   LB156                   EVALUATE FIRST STRING IN ARGUMENT
2668   B2B4 8D B7                BSR   LB26D                   SYNTAX CHECK FOR A COMMA
2669   B2B6 BD B1 46             JSR   LB146                    TM  ERROR IF NUMERIC VARiABLE
2670   B2B9 35 Ø2                PULS  A                       GET TOKEN OFFSET FROM STACK
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2671   B2BB DE 52                    LDU   FPA0+2                  POINT U TO STRING DESCRIPTOR
2672   B2BD 34 42                    PSHS  U,A                     SAVE TOKEN OFFSET AND DESCRIPTOR ADDRESS
2673   B2BF BD B7 0B                 JSR   LB70B                   EVALUATE FIRST NUMERIC ARGUMENT
2674   B2C2 35 02                    PULS  A                       GET TOKEN OFFSET FROM STACK
2675   B2C4 34 06                    PSHS  B,A                     SAVE TOKEN OFFSET AND NUMERIC ARGUMENT
2676   B2C6 8E                       FCB   $8E                     OP CODE OF LDX# - SKIP 2 BYTES
2677   B2C7 8D 99            LB2C7   BSR   LB262                   SYNTAX CHECK FOR A  (
2678   B2C9 35 04            LB2C9   PULS  B                       GET TOKEN OFFSET
2679   B2CB BE 01 28                 LDX   COMVEC+8                GET SECONDARY FUNCTION JUMP TABLE ADDRESS
2680   B2CE 3A               LB2CE   ABX                           ADD IN COMMAND OFFSET
2681                         *
2682                         * HERE IS WHERE WE BRANCH TO A SECONDARY FUNCTION
2683   B2CF AD 94                    JSR   [,X]                    GO DO AN SECONDARY FUNCTION
2684   B2D1 7E B1 43                 JMP   LB143                    TM  ERROR IF VARIABLE TYPE = STRING
2685
2686                         * LOGICAL OPERATOR  OR  JUMPS HERE
2687   B2D4 86               LB2D4   FCB   SKP1LD                  SKIP ONE BYTE -  OR  FLAG = $4F
2688
2689                         * LOGICAL OPERATOR  AND  JUMPS HERE
2690   B2D5 4F               LB2D5   CLRA                          AND FLAG = 0
2691   B2D6 97 03                    STA   TMPLOC                  AND/OR FLAG
2692   B2D8 BD B3 ED                 JSR   INTCNV                  CONVERT FPA0 INTO AN INTEGER IN ACCD
2693   B2DB DD 01                    STD   CHARAC                  TEMP SAVE ACCD
2694   B2DD BD BC 4A                 JSR   LBC4A                   MOVE FPA1 TO FPA0
2695   B2E0 BD B3 ED                 JSR   INTCNV                  CONVERT FPA0 INTO AN INTEGER IN ACCD
2696   B2E3 0D 03                    TST   TMPLOC                  CHECK AND/OR FLAG
2697   B2E5 26 06                    BNE   LB2ED                   BRANCH IF OR
2698   B2E7 94 01                    ANDA  CHARAC                  *  AND  ACCD WITH FPA0 INTEGER
2699   B2E9 D4 02                    ANDB  ENDCHR                  * STORED IN ENDCHR
2700   B2EB 20 04                    BRA   LB2F1                   CONVERT TO FP
2701   B2ED 9A 01            LB2ED   ORA   CHARAC                  *  OR  ACCD WITH FPA0 INTEGER
2702   B2EF DA 02                    ORB   ENDCHR                  * STORED IN CHARAC
2703   B2F1 7E B4 F4         LB2F1   JMP   GIVABF                  CONVERT THE VALUE IN ACCD INTO A FP NUMBER
2704
2705                         * RELATIONAL COMPARISON PROCESS HANDLER
2706   B2F4 BD B1 48                 JSR   LB148                    TM  ERROR IF TYPE MISMATCH
2707   B2F7 26 10                    BNE   LB309                   BRANCH IF STRING VARIABLE
2708   B2F9 96 61                    LDA   FP1SGN                  *  PACK  THE MANTISSA
2709   B2FB 8A 7F                    ORA   #$7F                    * SIGN OF FPA1 INTO
2710   B2FD 94 5D                    ANDA  FPA1                    * BIT 7 OF THE
2711   B2FF 97 5D                    STA   FPA1                    * MANTISSA MS BYTE
2712   B301 8E 00 5C                 LDX   #FP1EXP                 POINT X TO FPA1
2713   B304 BD BC 96                 JSR   LBC96                   COMPARE FPA0 TO FPA1
2714   B307 20 36                    BRA   LB33F                   CHECK TRUTH OF RELATIONAL COMPARISON
2715
2716                         * RELATIONAL COMPARISON OF STRINGS
2717   B309 0F 06            LB309   CLR   VALTYP                  SET VARIABLE TYPE TO NUMERIC
2718   B30B 0A 3F                    DEC   TRELFL                  REMOVE STRING TYPE FLAG (BIT0=1 FOR STRINGS) FROM THE
2719                         *                                     DESIRED RELATIONAL COMPARISON DATA
2720   B30D BD B6 57                 JSR   LB657                   GET LENGTH AND ADDRESS OF STRING WHOSE
2721                         *                                     DESCRIPTOR ADDRESS IS IN THE BOTTOM OF FPA0
2722   B310 D7 56                    STB   STRDES                  * SAVE LENGTH AND ADDRESS IN TEMPORARY
2723   B312 9F 58                    STX   STRDES+2                * DESCRIPTOR (STRING B)
2724   B314 9E 5F                    LDX   FPA1+2                  = RETURN LENGTH AND ADDRESS OF STRING
2725   B316 BD B6 59                 JSR   LB659                   = WHOSE DESCRIPTOR ADDRESS IS STORED IN FPA1+2
2726   B319 96 56                    LDA   STRDES                  LOAD ACCA WITH LENGTH OF STRING B
2727   B31B 34 04                    PSHS  B                       SAVE LENGTH A ON STACK
2728   B31D A0 E0                    SUBA  ,S+                     SUBTRACT LENGTH A FROM LENGTH B
2729   B31F 27 07                    BEQ   LB328                   BRANCH IF STRINGS OF EQUAL LENGTH
2730   B321 86 01                    LDA   #1                      TRUE FLAG
2731   B323 24 03                    BCC   LB328                   TRUE IF LENGTH B > LENGTH A
2732   B325 D6 56                    LDB   STRDES                  LOAD ACCB WITH LENGTH B
2733   B327 40                       NEGA                          SET FLAG = FALSE (1FF)
2734   B328 97 54            LB328   STA   FP0SGN                  SAVE TRUE/FALSE FLAG
2735   B32A DE 58                    LDU   STRDES+2                POINT U TO START OF STRING
2736   B32C 5C                       INCB                          COMPENSATE FOR THE DECB BELOW
2737                         * ENTER WITH ACCB CONTAINING LENGTH OF SHORTER STRING
2738   B32D 5A               LB32D   DECB                          DECREMENT SHORTER STRING LENGTH
2739   B32E 26 04                    BNE   LB334                   BRANCH IF ALL OF STRING NOT COMPARED
2740   B330 D6 54                    LDB   FP0SGN                  GET TRUE/FALSE FLAB
2741   B332 20 0B                    BRA   LB33F                   CHECK TRUTH OF RELATIONAL COMPARISON
2742   B334 A6 80            LB334   LDA   ,X+                     GET A BYTE FROM STRING A
2743   B336 A1 C0                    CMPA  ,U+                     COMPARE TO STRING B
2744   B338 27 F3                    BEQ   LB32D                   CHECK ANOTHER CHARACTER IF =
2745   B33A C6 FF                    LDB   #$FF                    FALSE FLAG IF STRING A > B
2746   B33C 24 01                    BCC   LB33F                   BRANCH IF STRING A > STRING B
2747   B33E 50                       NEGB                          SET FLAG = TRUE
2748
2749                         * DETERMINE TRUTH OF COMPARISON - RETURN RESULT IN FPA0
2750   B33F CB 01            LB33F   ADDB  #1                      CONVERT $FF,0,1 TO 0,1,2
2751   B341 59                       ROLB                          NOW IT S 1,2,4 FOR > = <
2752   B342 D4 0A                    ANDB  RELFLG                   AND  THE ACTUAL COMPARISON WITH THE DESIRED -
2753                                                               COMPARISON
2754   B344 27 02                    BEQ   LB348                   BRANCH IF FALSE (NO MATCHING BITS)
2755   B346 C6 FF                    LDB   #$FF                    TRUE FLAG
2756   B348 7E BC 7C         LB348   JMP   LBC7C                   CONVERT ACCB INTO FP NUMBER IN FPA0
2757
2758                         * DIM
2759   B34B BD B2 6D         LB34B   JSR   LB26D                   SYNTAX CHECK FOR COMMA
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2760   B34E C6 01             DIM     LDB   #1                      DIMENSION FLAG
2761   B350 8D 08                     BSR   LB35A                   SAVE ARRAY SPACE FOR THIS VARIABLE
2762   B352 9D A5                     JSR   GETCCH                  GET CURRENT INPUT CHARACTER
2763   B354 26 F5                     BNE   LB34B                   KEEP DIMENSIONING IF NOT END OF LINE
2764   B356 39                        RTS
2765                          * EVALUATE A VARIABLE - RETURN X AND
2766                          * VARPTR POINTING TO VARIABLE DESCRIPTOR
2767                          * EACH VARIABLE REQUIRES 7 BYTES - THE FIRST TWO
2768                          * BYTES ARE THE VARIABLE NAME AND THE NEXT 5
2769                          * BYTES ARE THE DESCRIPTOR. IF BIT 7 OF THE
2770                          * FIRST BYTE OF VARIABLE NAME IS SET, THE
2771                          * VARIABLE IS A DEF FN VARIABLE. IF BIT 7 OF
2772                          * THE SECOND BYTE OF VARIABLE NAME IS SET, THE
2773                          * VARIABLE IS A STRING, OTHERWISE THE VARIABLE
2774                          * IS NUMERIC.
2775                          * IF THE VARIABLE IS NOT FOUND, A ZERO VARIABLE IS
2776                          * INSERTED INTO THE VARIABLE SPACE
2777   B357 5F                LB357   CLRB                          DIMENSION FLAG = 0; DO NOT SET UP AN ARRAY
2778   B358 9D A5                     JSR   GETCCH                  GET CURRENT INPUT CHARACTER
2779   B35A D7 05             LB35A   STB   DIMFLG                  SAVE ARRAY FLAG
2780   B35C 97 37                     STA   VARNAM                  SAVE INPUT CHARACTER
2781                          * ENTRY POINT FOR DEF FN VARIABLE SEARCH
2782   B35E 9D A5             LB35C   JSR   GETCCH                  GET CURRENT INPUT CHARACTER
2783   B360 8D 40                     BSR   LB3A2                   SET CARRY IF NOT ALPHA
2784   B362 10 25 FF 11               LBCS  LB277                   SYNTAX ERROR IF NOT ALPHA
2785   B366 5F                        CLRB                          DEFAULT 2ND VARIABLE CHARACTER TO ZERO
2786   B367 D7 06                     STB   VALTYP                  SET VARIABLE TYPE TO NUMERIC
2787   B369 9D 9F                     JSR   GETNCH                  GET ANOTHER CHARACTER FROM BASIC
2788   B36B 25 04                     BCS   LB371                   BRANCH IF NUMERIC (2ND CHARACTER IN
2789                          *                                     VARIABLE MAY BE NUMERIC)
2790   B36D 8D 33                     BSR   LB3A2                   SET CARRY IF NOT ALPHA
2791   B36F 25 0A                     BCS   LB37B                   BRANCH IF NOT ALPHA
2792   B371 1F 89             LB371   TFR   A,B                     SAVE 2ND CHARACTER IN ACCB
2793                          * READ INPUT CHARACTERS UNTIL A NON ALPHA OR
2794                          * NON NUMERIC IS FOUND - IGNORE ALL CHARACTERS
2795                          * IN VARIABLE NAME AFTER THE 1ST TWO
2796   B373 9D 9F             LB373   JSR   GETNCH                  GET AN INPUT CHARACTER
2797   B375 25 FC                     BCS   LB373                   BRANCH IF NUMERIC
2798   B377 8D 29                     BSR   LB3A2                   SET CARRY IF NOT ALPHA
2799   B379 24 F8                     BCC   LB373                   BRANCH IF ALPHA
2800   B37B 81 24             LB37B   CMPA  #'$                     CHECK FOR A STRING VARIABLE
2801   B37D 26 06                     BNE   LB385                   BRANCH IF IT IS NOT A STRING
2802   B37F 03 06                     COM   VALTYP                  SET VARIABLE TYPE TO STRING
2803   B381 CB 80                     ADDB  #$80                    SET BIT 7 OF 2ND CHARACTER (STRING)
2804   B383 9D 9F                     JSR   GETNCH                  GET AN INPUT CHARACTER
2805   B385 D7 38             LB385   STB   VARNAM+1                SAVE 2ND CHARACTER IN VARNAM+1
2806   B387 9A 08                     ORA   ARYDIS                  OR IN THE ARRAY DISABLE FLAG - IF = $80,
2807                          *                                     DON T SEARCH FOR VARIABLES IN THE ARRAYS
2808   B389 80 28                     SUBA  #'(                     IS THIS AN ARRAY VARIABLE?
2809 > B38B 10 27 00 75               LBEQ  LB404                   BRANCH IF IT IS
2810   B38F 0F 08                     CLR   ARYDIS                  RESET THE ARRAY DISABLE FLAG
2811   B391 9E 1B                     LDX   VARTAB                  POINT X TO THE START OF VARIABLES
2812   B393 DC 37                     LDD   VARNAM                  GET VARIABLE IN QUESTION
2813   B395 9C 1D             LB395   CMPX  ARYTAB                  COMPARE X TO THE END OF VARIABLES
2814   B397 27 12                     BEQ   LB3AB                   BRANCH IF END OF VARIABLES
2815   B399 10 A3 81                  CMPD  ,X++                    * COMPARE VARIABLE IN QUESTION TO CURRENT
2816   B39C 27 3E                     BEQ   LB3DC                   * VARIABLE AND BRANCH IF MATCH
2817   B39E 30 05                     LEAX  5,X                     = MOVE POINTER TO NEXT VARIABLE AND
2818   B3A0 20 F3                     BRA   LB395                   = KEEP LOOKING
2819
2820                          * SET CARRY IF NOT UPPER CASE ALPHA
2821   B3A2 81 41             LB3A2   CMPA  #'A                     * CARRY SET IF <  A
2822   B3A4 25 04                     BCS   LB3AA                   *
2823   B3A6 80 5B                     SUBA  #'Z+1                   =
2824   B3A8 80 A5                     SUBA  #-('Z+1)                = CARRY CLEAR IF <= 'Z'
2825   B3AA 39                LB3AA   RTS
2826                          * PUT A NEW VARIABLE IN TABLE OF VARIABLES
2827   B3AB 8E 00 8A          LB3AB   LDX   #ZERO                   POINT X TO ZERO LOCATION
2828   B3AE EE E4                     LDU   ,S                      GET CURRENT RETURN ADDRESS
2829   B3B0 11 83 B2 87               CMPU  #LB287                  DID WE COME FROM  EVALUATE ALPHA EXPR ?
2830   B3B4 27 28                     BEQ   LB3DE                   YES - RETURN A ZERO VALUE
2831   B3B6 DC 1F                     LDD   ARYEND                  * GET END OF ARRAYS ADDRESS AND
2832   B3B8 DD 43                     STD   V43                     * SAVE IT AT V43
2833   B3BA C3 00 07                  ADDD  #7                      = ADD 7 TO END OF ARRAYS (EACH
2834   B3BD DD 41                     STD   V41                     = VARIABLE = 7 BYTES) AND SAVE AT V41
2835   B3BF 9E 1D                     LDX   ARYTAB                  * GET END OF VARIABLES AND SAVE AT V47
2836   B3C1 9F 47                     STX   V47                     *
2837   B3C3 BD AC 1E                  JSR   LAC1E                   MAKE A SEVEN BYTE SLOT FOR NEW VARIABLE AT
2838                          *                                     TOP OF VARIABLES
2839   B3C6 9E 41                     LDX   V41                     = GET NEW END OF ARRAYS AND SAVE IT
2840   B3C8 9F 1F                     STX   ARYEND                  =
2841   B3CA 9E 45                     LDX   V45                     * GET NEW END OF VARIABLES AND SAVE IT
2842   B3CC 9F 1D                     STX   ARYTAB                  *
2843   B3CE 9E 47                     LDX   V47                     GET OLD END OF VARIABLES
2844   B3D0 DC 37                     LDD   VARNAM                  GET NEW VARIABLE NAME
2845   B3D2 ED 81                     STD   ,X++                    SAVE VARIABLE NAME
2846   B3D4 4F                        CLRA                          * ZERO OUT THE FP VALUE OF THE NUMERIC
2847   B3D5 5F                        CLRB                          * VARIABLE OR THE LENGTH AND ADDRESS
2848   B3D6 ED 84                     STD   ,X                      * OF A STRING VARIABLE
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2849   B3D8 ED Ø2                    STD   2,X                     *
2850   B3DA A7 Ø4                    STA   4,X                     *
2851   B3DC 9F 39           LB3DC    STX   VARPTR                  STORE ADDRESS OF VARIABLE VALUE
2852   B3DE 39              LB3DE    RTS
2853                        *
2854   B3DF 9Ø 8Ø ØØ ØØ ØØ  LB3DF    FCB   $9Ø,$8Ø,$ØØ,$ØØ,$ØØ     * FLOATING POINT -32768
2855                        *                                     SMALLEST SIGNED TWO BYTE INTEGER
2856                        *
2857   B3E4 9D 9F           LB3E4    JSR   GETNCH                  GET AN INPUT CHARACTER FROM BASIC
2858   B3E6 BD B1 41        LB3E6    JSR   LB141                   GO EVALUATE NUMERIC EXPRESSION
2859   B3E9 96 54           LB3E9    LDA   FPØSGN                  GET FPAØ MANTISSA SIGN
2860   B3EB 2B 5D                    BMI   LB44A                    FC  ERROR IF NEGATIVE NUMBER
2861
2862                        * CONVERT FPAØ TO A SIGNED TWO BYTE INTEGER; RETURN VALUE IN ACCD
2863   B3ED BD B1 43        INTCNV   JSR   LB143                    TM  ERROR IF STRING VARIABLE
2864   B3FØ 96 4F                    LDA   FPØEXP                  GET FPAØ EXPONENT
2865   B3F2 81 9Ø                    CMPA  #$9Ø                    * COMPARE TO 32768 - LARGEST INTEGER EXPONENT AND
2866   B3F4 25 Ø8                    BCS   LB3FE                   * BRANCH IF FPAØ < 32768
2867   B3F6 8E B3 DF                 LDX   #LB3DF                  POINT X TO FP VALUE OF -32768
2868   B3F9 BD BC 96                 JSR   LBC96                   COMPARE -32768 TO FPAØ
2869   B3FC 26 4C                    BNE   LB44A                    FC  ERROR IF NOT =
2870   B3FE BD BC C8        LB3FE    JSR   LBCC8                   CONVERT FPAØ TO A TWO BYTE INTEGER
2871   B4Ø1 DC 52                    LDD   FPA0+2                  GET THE INTEGER
2872   B4Ø3 39                       RTS
2873                        * EVALUATE AN ARRAY VARIABLE
2874   B4Ø4 DC Ø5           LB4Ø4    LDD   DIMFLG                  GET ARRAY FLAG AND VARIABLE TYPE
2875   B4Ø6 34 Ø6                    PSHS  B,A                     SAVE THEM ON STACK
2876   B4Ø8 12                       NOP                           DEAD SPACE CAUSED BY 1.2 REVISION
2877   B4Ø9 5F                       CLRB                          RESET DIMENSION COUNTER
2878   B4ØA 9E 37           LB4ØA    LDX   VARNAM                  GET VARIABLE NAME
2879   B4ØC 34 14                    PSHS  X,B                     SAVE VARIABLE NAME AND DIMENSION COUNTER
2880   B4ØE 8D D4                    BSR   LB3E4                   EVALUATE EXPRESSION (DIMENSION LENGTH)
2881   B41Ø 35 34                    PULS  B,X,Y                   PULL OFF VARIABLE NAME, DIMENSION COUNTER,
2882                        *                                     ARRAY FLAG
2883   B412 9F 37                    STX   VARNAM                  SAVE VARIABLE NAME AND VARIABLE TYPE
2884   B414 DE 52                    LDU   FPA0+2                  GET DIMENSION LENGTH
2885   B416 34 6Ø                    PSHS  U,Y                     SAVE DIMENSION LENGTH, ARRAY FLAG, VARIABLE TYPE
2886   B418 5C                       INCB                          INCREASE DIMENSION COUNTER
2887   B419 9D A5                    JSR   GETCCH                  GET CURRENT INPUT CHARACTER
2888   B41B 81 2C                    CMPA  #',                     CHECK FOR ANOTHER DIMENSION
2889   B41D 27 EB                    BEQ   LB4ØA                   BRANCH IF MORE
2890   B41F D7 Ø3                    STB   TMPLOC                  SAVE DIMENSION COUNTER
2891   B421 BD B2 67                 JSR   LB267                   SYNTAX CHECK FOR A  )
2892   B424 35 Ø6                    PULS  A,B                     * RESTORE VARIABLE TYPE AND ARRAY
2893   B426 DD Ø5                    STD   DIMFLG                  * FLAG - LEAVE DIMENSION LENGTH ON STACK
2894   B428 9E 1D                    LDX   ARYTAB                  GET START OF ARRAYS
2895   B42A 9C 1F           LB42A    CMPX  ARYEND                  COMPARE TO END OF ARRAYS
2896   B42C 27 21                    BEQ   LB44F                   BRANCH IF NO MATCH FOUND
2897   B42E DC 37                    LDD   VARNAM                  GET VARIABLE IN QUESTION
2898   B43Ø 1Ø A3 84                 CMPD  ,X                      COMPARE TO CURRENT VARIABLE
2899   B433 27 Ø6                    BEQ   LB43B                   BRANCH IF =
2900   B435 EC Ø2                    LDD   2,X                     GET OFFSET TO NEXT ARRAY VARIABLE
2901   B437 3Ø 8B                    LEAX  D,X                     ADD TO CURRENT POINTER
2902   B439 2Ø EF                    BRA   LB42A                   KEEP SEARCHING
2903   B43B C6 12           LB43B    LDB   #2*9                     REDIMENSIONED ARRAY  ERROR
2904   B43D 96 Ø5                    LDA   DIMFLG                  * TEST ARRAY FLAG - IF <>Ø YOU ARE TRYING
2905   B43F 26 ØB                    BNE   LB44C                   * TO REDIMENSION AN ARRAY
2906   B441 D6 Ø3                    LDB   TMPLOC                  GET NUMBER OF DIMENSIONS IN ARRAY
2907   B443 E1 Ø4                    CMPB  4,X                     COMPARE TO THIS ARRAYS DIMENSIONS
2908   B445 27 59                    BEQ   LB4AØ                   BRANCH IF =
2909   B447 C6 1Ø           LB447    LDB   #8*2                     BAD SUBSCRIPT
2910   B449 8C                       FCB   SKP2                    SKIP TWO BYTES
2911   B44A C6 Ø8           LB44A    LDB   #4*2                     ILLEGAL FUNCTION CALL
2912   B44C 7E AC 46        LB44C    JMP   LAC46                   JUMP TO ERROR SERVICING ROUTINE
2913
2914                        * INSERT A NEW ARRAY INTO ARRAY VARIABLES
2915                        * EACH SET OF ARRAY VARIABLES IS PRECEEDED BY A DE-
2916                        * SCRIPTOR BLOCK COMPOSED OF 5+2*N BYTES WHERE N IS THE
2917                        * NUMBER OF DIMENSIONS IN THE ARRAY. THE BLOCK IS DEFINED
2918                        * AS FOLLOWS: BYTES Ø,1:VARIABLE S NAME; 2,3:TOTAL LENGTH
2919                        * OF ARRAY ITEMS AND DESCRIPTOR BLOCK; 4:NUMBER OF DIMEN-
2920                        * ISIONS; 5,6:LENGTH OF DIMENSION 1; 7,8:LENGTH OF DIMEN-
2921                        * SION 2;  4+N,5+N:LENGTH OF DIMENSION N.
2922
2923   B44F CC ØØ Ø5        LB44F    LDD   #5                      * 5 BYTES/ARRAY ENTRY SAVE AT COEFPT
2924   B452 DD 64                     STD   COEFPT                  *
2925   B454 DC 37                     LDD   VARNAM                  = GET NAME OF ARRAY AND SAVE IN
2926   B456 ED 84                     STD   ,X                      = FIRST 2 BYTES OF DESCRIPTOR
2927   B458 D6 Ø3                     LDB   TMPLOC                  GET NUMBER OF DIMENSIONS AND SAVE IN
2928   B45A E7 Ø4                     STB   4,X                     * 5TH BYTE OF DESCRIPTOR
2929   B45C BD AC 33                  JSR   LAC33                   CHECK FOR ROOM FOR DESCRIPTOR IN FREE RAM
2930   B45F 9F 41                     STX   V41                     TEMPORARILY SAVE DESCRIPTOR ADDRESS
2931   B461 C6 ØB           LB461    LDB   #11                     * DEFAULT DIMENSION VALUE:X(1Ø)
2932   B463 4F                        CLRA                          *
2933   B464 ØD Ø5                     TST   DIMFLG                  = CHECK ARRAY FLAG AND BRANCH IF
2934   B466 27 Ø5                     BEQ   LB46D                   = NOT DIMENSIONING AN ARRAY
2935   B468 35 Ø6                     PULS  A,B                     GET DIMENSION LENGTH
2936   B46A C3 ØØ Ø1                  ADDD  #1                      ADD ONE (X(Ø) HAS A LENGTH OF ONE)
2937   B46D ED Ø5           LB46D    STD   5,X                     SAVE LENGTH OF ARRAY DIMENSION
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2938   B46F 8D 5D              BSR   LB4CE                   MULTIPLY ACCUM ARRAY SIZE NUMBER LENGTH
2939                         *                               OF NEW DIMENSION
2940   B471 DD 64              STD   COEFPT                  TEMP STORE NEW CURRENT ACCUMULATED ARRAY SIZE
2941   B473 30 02              LEAX  2,X                     BUMP POINTER UP TWO
2942   B475 0A 03              DEC   TMPLOC                  * DECREMENT DIMENSION COUNTER AND BRANCH IF
2943   B477 26 E8              BNE   LB461                   * NOT DONE WITH ALL DIMENSIONS
2944   B479 9F 0F              STX   TEMPTR                  SAVE ADDRESS OF (END OF ARRAY DESCRIPTOR - 5)
2945   B47B D3 0F              ADDD  TEMPTR                  ADD TOTAL SIZE OF NEW ARRAY
2946   B47D 10 25 F7 C3        LBCS  LAC44                    OM  ERROR IF > $FFFF
2947   B481 1F 01              TFR   D,X                     SAVE END OF ARRAY IN X
2948   B483 BD AC 37           JSR   LAC37                   MAKE SURE THERE IS ENOUGH FREE RAM FOR ARRAY
2949   B486 83 00 35           SUBD  #STKBUF-5               SUBTRACT OUT THE (STACK BUFFER - 5)
2950   B489 DD 1F              STD   ARYEND                  SAVE NEW END OF ARRAYS
2951   B48B 4F                 CLRA                          ZERO = TERMINATOR BYTE
2952   B48C 30 1F           LB48C  LEAX  -1,X                * STORE TWO TERMINATOR BYTES AT
2953   B48E A7 05              STA   5,X                     * THE END OF THE ARRAY DESCRIPTOR
2954   B490 9C 0F              CMPX  TEMPTR                  *
2955   B492 26 F8              BNE   LB48C                   *
2956   B494 9E 41              LDX   V41                     GET ADDRESS OF START OF DESCRIPTOR
2957   B496 96 1F              LDA   ARYEND                  GET MSB OF END OF ARRAYS; LSB ALREADY THERE
2958   B498 93 41              SUBD  V41                     SUBTRACT OUT ADDRESS OF START OF DESCRIPTOR
2959   B49A ED 02              STD   2,X                     SAVE LENGTH OF (ARRAY AND DESCRIPTOR)
2960   B49C 96 05              LDA   DIMFLG                  * GET ARRAY FLAG AND BRANCH
2961   B49E 26 2D              BNE   LB4CD                   * BACK IF DIMENSIONING
2962                         * CALCULATE POINTER TO CORRECT ELEMENT
2963   B4A0 E6 04           LB4A0  LDB   4,X                 GET THE NUMBER OF DIMENSIONS
2964   B4A2 D7 03              STB   TMPLOC                  TEMPORARILY SAVE
2965   B4A4 4F                 CLRA                          * INITIALIZE POINTER
2966   B4A5 5F                 CLRB                          * TO ZERO
2967   B4A6 DD 64           LB4A6  STD   COEFPT              SAVE ACCUMULATED POINTER
2968   B4A8 35 06              PULS  A,B                     * PULL DIMENSION ARGUMENT OFF THE
2969   B4AA DD 52              STD   FPA0+2                  * STACK AND SAVE IT
2970   B4AC 10 A3 05           CMPD  5,X                     COMPARE TO STORED  DIM  ARGUMENT
2971   B4AF 24 3A              BCC   LB4EB                    BS  ERROR IF > = "DIM" ARGUMENT
2972   B4B1 DE 64              LDU   COEFPT                  * GET ACCUMULATED POINTER AND
2973   B4B3 27 04              BEQ   LB4B9                   * BRANCH IF 1ST DIMENSION
2974   B4B5 8D 17              BSR   LB4CE                   = MULTIPLY ACCUMULATED POINTER AND DIMENSION
2975   B4B7 D3 52              ADDD  FPA0+2                  = LENGTH AND ADD TO CURRENT ARGUMENT
2976   B4B9 30 02           LB4B9  LEAX  2,X                 MOVE POINTER TO NEXT DIMENSION
2977   B4BB 0A 03              DEC   TMPLOC                  * DECREMENT DIMENSION COUNTER AND
2978   B4BD 26 E7              BNE   LB4A6                   * BRANCH IF ANY DIMENSIONS LEFT
2979                         * MULTIPLY ACCD BY 5 - 5 BYTES/ARRAY VALUE
2980   B4BF ED E3              STD   ,--S
2981   B4C1 58                 ASLB
2982   B4C2 49                 ROLA                          TIMES 2
2983   B4C3 58                 ASLB
2984   B4C4 49                 ROLA                          TIMES 4
2985   B4C5 E3 E1              ADDD  ,S++                    TIMES 5
2986   B4C7 30 8B              LEAX  D,X                     ADD OFFSET TO START OF ARRAY
2987   B4C9 30 05              LEAX  5,X                     ADJUST POINTER FOR SIZE OF DESCRIPTOR
2988   B4CB 9F 39              STX   VARPTR                  SAVE POINTER TO ARRAY VALUE
2989   B4CD 39              LB4CD  RTS
2990                         * MULTIPLY 2 BYTE NUMBER IN 5,X BY THE 2 BYTE NUMBER
2991                         IN COEFPT. RETURN RESULT IN ACCD, BS ERROR IF > $FFFF
2992   B4CE 86 10           LB4CE  LDA   #16                 16 SHIFTS TO DO A MULTIPLY
2993   B4D0 97 45              STA   V45                     SHIFT COUNTER
2994   B4D2 EC 05              LDD   5,X                     * GET SIZE OF DIMENSION
2995   B4D4 DD 17              STD   BOTSTK                  * AND SAVE IT
2996   B4D6 4F                 CLRA                          * ZERO
2997   B4D7 5F                 CLRB                          * ACCD
2998   B4D8 58              LB4D8  ASLB                      = SHIFT ACCB LEFT
2999   B4D9 49                 ROLA                          = ONE BIT
3000   B4DA 25 0F              BCS   LB4EB                   'BS' ERROR IF CARRY
3001   B4DC 08 65              ASL   COEFPT+1                * SHIFT MULTIPLICAND LEFT ONE
3002   B4DE 09 64              ROL   COEFPT                  * BIT - ADD MULTIPLIER TO ACCUMULATOR
3003   B4E0 24 04              BCC   LB4E6                   * IF CARRY <> 0
3004   B4E2 D3 17              ADDD  BOTSTK                  ADD MULTIPLIER TO ACCD
3005   B4E4 25 05              BCS   LB4EB                   'BS' ERROR IF CARRY (>$FFFF)
3006   B4E6 0A 45           LB4E6  DEC   V45                 * DECREMENT SHIFT COUNTER
3007   B4E8 26 EE              BNE   LB4D8                   * IF NOT DONE
3008   B4EA 39                 RTS
3009   B4EB 7E B4 47        LB4EB  JMP   LB447               'BS' ERROR
3010                         *
3011                         * MEM
3012                         * THIS IS NOT A TRUE INDICATOR OF FREE MEMORY BECAUSE
3013                         * BASIC REQUIRES A STKBUF SIZE BUFFER FOR THE STACK
3014                         * FOR WHICH MEM DOES NOT ALLOW.
3015                         *
3016   B4EE 1F 40            MEM     TFR   S,D                 PUT STACK POINTER INTO ACCD
3017   B4F0 93 1F              SUBD  ARYEND                  SUBTRACT END OF ARRAYS
3018   B4F2 21                 FCB   SKP1                    SKIP ONE BYTE
3019                         *CONVERT THE VALUE IN ACCB INTO A FP NUMBER IN FPA0
3020   B4F3 4F              LB4F3  CLRA                      CLEAR MS BYTE OF ACCD
3021                         * CONVERT THE VALUE IN ACCD INTO A FLOATING POINT NUMBER IN FPA0
3022   B4F4 0F 06           GIVABF CLR   VALTYP              SET VARIABLE TYPE TO NUMERIC
3023   B4F6 DD 50              STD   FPA0                    SAVE ACCD IN TOP OF FACA
3024   B4F8 C6 90              LDB   #$90                    EXPONENT REQUIRED IF THE TOP TWO BYTES
3025                         *                               OF FPA0 ARE TO BE TREATED AS AN INTEGER IN FPA0
3026   B4FA 7E BC 82           JMP   LBC82                   CONVERT THE REST OF FPA0 TO AN INTEGER
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3027
3028                          * STR$
3029   B4FD BD B1 43          STR     JSR   LB143                    'TM' ERROR IF STRING VARIABLE
3030   B500 CE 03 D9                  LDU   #STRBUF+2                *CONVERT FP NUMBER TO ASCII STRING IN
3031   B503 BD BD DC                  JSR   LBDDC                    *THE STRING BUFFER
3032   B506 32 62                     LEAS  2,S                      PURGE THE RETURN ADDRESS FROM THE STACK
3033   B508 8E 03 D8                  LDX   #STRBUF+1                *POINT X TO STRING BUFFER AND SAVE
3034   B50B 20 0B                     BRA   LB518                    *THE STRING IN THE STRING SPACE
3035                          * RESERVE ACCB BYTES OF STRING SPACE. RETURN START
3036                          * ADDRESS IN (X) AND FRESPC
3037   B50D 9F 4D             LB50D   STX   V4D                      SAVE X IN V4D
3038   B50F 8D 5C             LB50F   BSR   LB56D                    RESERVE ACCB BYTES IN STRING SPACE
3039   B511 9F 58             LB511   STX   STRDES+2                 SAVE NEW STRING ADDRESS
3040   B513 D7 56                     STB   STRDES                   SAVE LENGTH OF RESERVED BLOCK
3041   B515 39                        RTS
3042   B516 30 1F             LB516   LEAX  -1,X                     MOVE POINTER BACK ONE
3043                          * SCAN A LINE FROM (X) UNTIL AN END OF LINE FLAG (ZERO) OR
3044                          * EITHER OF THE TWO TERMINATORS STORED IN CHARAC OR ENDCHR IS MATCHED.
3045                          * THE RESULTING STRING IS STORED IN THE STRING SPACE
3046                          * ONLY IF THE START OF THE STRING IS <= STRBUF+2
3047   B518 86 22             LB518   LDA   #'"                      * INITIALIZE
3048   B51A 97 01                     STA   CHARAC                   * TERMINATORS
3049   B51C 97 02             LB51A   STA   ENDCHR                   * TO "
3050   B51E 30 01             LB51E   LEAX  1,X                      MOVE POINTER UP ONE
3051   B520 9F 62                     STX   RESSGN                   TEMPORARILY SAVE START OF STRING
3052   B522 9F 58                     STX   STRDES+2                 SAVE START OF STRING IN TEMP DESCRIPTOR
3053   B524 C6 FF                     LDB   #-1                      INITIALIZE CHARACTER COUNTER TO - 1
3054   B526 5C                LB526   INCB                           INCREMENT CHARACTER COUNTER
3055   B527 A6 80                     LDA   ,X+                      GET CHARACTER
3056   B529 27 0C                     BEQ   LB537                    BRANCH IF END OF LINE
3057   B52B 91 01                     CMPA  CHARAC                   * CHECK FOR TERMINATORS
3058   B52D 27 04                     BEQ   LB533                    * IN CHARAC AND ENDCHR
3059   B52F 91 02                     CMPA  ENDCHR                   * DON T MOVE POINTER BACK
3060   B531 26 F3                     BNE   LB526                    * ONE IF TERMINATOR IS "MATCHED"
3061   B533 81 22             LB533   CMPA  #'"                      = COMPARE CHARACTER TO STRING DELIMITER
3062   B535 27 02                     BEQ   LB539                    = & DON T MOVE POINTER BACK IF SO
3063   B537 30 1F             LB537   LEAX  -1,X                     MOVE POINTER BACK ONE
3064   B539 9F 64             LB539   STX   COEFPT                   SAVE END OF STRING ADDRESS
3065   B53B D7 56                     STB   STRDES                   SAVE STRING LENGTH IN TEMP DESCRIPTOR
3066   B53D DE 62                     LDU   RESSGN                   GET INITIAL STRING START
3067   B53F 11 83 03 D9               CMPU  #STRBUF+2                COMPARE TO START OF STRING BUFFER
3068   B543 22 07             LB543   BHI   LB54C                    BRANCH IF > START OF STRING BUFFER
3069   B545 8D C6                     BSR   LB50D                    GO RESERVE SPACE FOR THE STRING
3070   B547 9E 62                     LDX   RESSGN                   POINT X TO THE BEGINNING OF THE STRING
3071   B549 BD B6 45                  JSR   LB645                    MOVE (B) BYTES FROM (X) TO
3072                          *                                     [FRESPC] - MOVE STRING DATA
3073                          * PUT DIRECT PAGE STRING DESCRIPTOR BUFFER DATA
3074                          * ON THE STRING STACK. SET VARIABLE TYPE TO STRING
3075   B54C 9E 0B             LB54C   LDX   TEMPPT                   GET NEXT AVAILABLE STRING STACK DESCRIPTOR
3076   B54E 8C 01 D1                  CMPX  #CFNBUF                  COMPARE TO TOP OF STRING DESCRIPTOR STACK
3077   B551 26 05                     BNE   LB558                    FORMULA O.K.
3078   B553 C6 1E                     LDB   #15*2                    'STRING FORMULA TOO COMPLEX' ERROR
3079   B555 7E AC 46          LB555   JMP   LAC46                    JUMP TO ERROR SERVICING ROUTINE
3080   B558 96 56             LB558   LDA   STRDES                   * GET LENGTH OF STRING AND SAVE IT
3081   B55A A7 00                     STA   ,X                       * IN BYTE 0 OF DESCRIPTOR
3082   B55C DC 58                     LDD   STRDES+2                 = GET START ADDRESS OF ACTUAL STRING
3083   B55E ED 02                     STD   2,X                      = AND SAVE IN BYTES 2,3 OF DESCRIPTOR
3084   B560 86 FF                     LDA   #$FF                     * VARIABLE TYPE = STRING
3085   B562 97 06                     STA   VALTYP                   * SAVE IN VARIABLE TYPE FLAG
3086   B564 9F 0D                     STX   LASTPT                   = SAVE START OF DESCRIPTOR
3087   B566 9F 52                     STX   FPA0+2                   = ADDRESS IN LASTPT AND FPA0
3088   B568 30 05                     LEAX  5,X                      5 BYTES/STRING DESCRIPTOR
3089   B56A 9F 0B                     STX   TEMPPT                   NEXT AVAILABLE STRING VARIABLE DESCRIPTOR
3090   B56C 39                        RTS
3091                          * RESERVE ACCB BYTES IN STRING STORAGE SPACE
3092                          * RETURN WITH THE STARTING ADDRESS OF THE
3093                          * RESERVED STRING SPACE IN (X) AND FRESPC
3094   B56D 0F 07             LB56D   CLR   GARBFL                   CLEAR STRING REORGANIZATION FLAG
3095   B56F 4F                LB56F   CLRA                           * PUSH THE LENGTH OF THE
3096   B570 34 06                     PSHS  B,A                      * STRING ONTO THE STACK
3097   B572 DC 23                     LDD   STRTAB                   GET START OF STRING VARIABLES
3098   B574 A3 E0                     SUBD  ,S+                      SUBTRACT STRING LENGTH
3099   B576 10 93 21                  CMPD  FRETOP                   COMPARE TO START OF STRING STORAGE
3100   B579 25 0A                     BCS   LB585                    IF BELOW START, THEN REORGANIZE
3101   B57B DD 23                     STD   STRTAB                   SAVE NEW START OF STRING VARIABLES
3102   B57D 9E 23                     LDX   STRTAB                   GET START OF STRING VARIABLES
3103   B57F 30 01                     LEAX  1,X                      ADD ONE
3104   B581 9F 25                     STX   FRESPC                   SAVE START ADDRESS OF NEWLY RESERVED SPACE
3105   B583 35 84                     PULS  B,PC                     RESTORE NUMBER OF BYTES RESERVED AND RETURN
3106   B585 C6 1A             LB585   LDB   #2*13                    'OUT OF STRING SPACE' ERROR
3107   B587 03 07                     COM   GARBFL                   TOGGLE REORGANIZATION FLAG
3108   B589 27 CA                     BEQ   LB555                    ERROR IF FRESHLY REORGANIZED
3109   B58B 8D 04                     BSR   LB591                    GO REORGANIZE STRING SPACE
3110   B58D 35 04                     PULS  B                        GET BACK THE NUMBER OF BYTES TO RESERVE
3111   B58F 20 DE                     BRA   LB56F                    TRY TO RESERVE ACCB BYTES AGAIN
3112                          * REORGANIZE THE STRING SPACE
3113   B591 9E 27             LB591   LDX   MEMSIZ                   GET THE TOP OF STRING SPACE
3114   B593 9F 23             LB593   STX   STRTAB                   SAVE TOP OF UNORGANIZED STRING SPACE
3115   B595 4F                        CLRA                           * ZERO OUT ACCD
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3116   B596 5F                  CLRB                        * AND RESET VARIABLE
3117   B597 DD 4B               STD   V4B                   * POINTER TO Ø
3118   B599 9E 21               LDX   FRETOP                POINT X TO START OF STRING SPACE
3119   B59B 9F 47               STX   V47                   SAVE POINTER IN V47
3120   B59D 8E Ø1 A9            LDX   #STRSTK               POINT X TO START OF STRING DESCRIPTOR STACK
3121   B5AØ 9C ØB         LB5AØ CMPX  TEMPPT                COMPARE TO ADDRESS OF NEXT AVAILABLE DESCRIPTOR
3122   B5A2 27 Ø4               BEQ   LB5A8                 BRANCH IF TOP OF STRING STACK
3123   B5A4 8D 32               BSR   LB5D8                 CHECK FOR STRING IN UNORGANIZED STRING SPACE
3124   B5A6 2Ø F8               BRA   LB5AØ                 KEEP CHECKING
3125   B5A8 9E 1B         LB5A8 LDX   VARTAB                GET THE END OF BASIC PROGRAM
3126   B5AA 9C 1D         LB5AA CMPX  ARYTAB                COMPARE TO END OF VARIABLES
3127   B5AC 27 Ø4               BEQ   LB5B2                 BRANCH IF AT TOP OF VARIABLES
3128   B5AE 8D 22               BSR   LB5D2                 CHECK FOR STRING IN UNORGANIZED STRING SPACE
3129   B5BØ 2Ø F8               BRA   LB5AA                 KEEP CHECKING VARIABLES
3130   B5B2 9F 41         LB5B2 STX   V41                   SAVE ADDRESS OF THE END OF VARIABLES
3131   B5B4 9E 41         LB5B4 LDX   V41                   GET CURRENT ARRAY POINTER
3132   B5B6 9C 1F         LB5B6 CMPX  ARYEND                COMPARE TO THE END OF ARRAYS
3133   B5B8 27 35               BEQ   LB5EF                 BRANCH IF AT END OF ARRAYS
3134   B5BA EC Ø2               LDD   2,X                   GET LENGTH OF ARRAY AND DESCRIPTOR
3135   B5BC D3 41               ADDD  V41                   * ADD TO CURRENT ARRAY POINTER
3136   B5BE DD 41               STD   V41                   * AND SAVE IT
3137   B5CØ A6 Ø1               LDA   1,X                   GET 1ST CHARACTER OF VARIABLE NAME
3138   B5C2 2A FØ               BPL   LB5B4                 BRANCH IF NUMERIC ARRAY
3139   B5C4 E6 Ø4               LDB   4,X                   GET THE NUMBER OF DIMENSIONS IN THIS ARRAY
3140   B5C6 58                  ASLB                        MULTIPLY BY 2
3141   B5C7 CB Ø5               ADDB  #5                    ADD FIVE BYTES (VARIABLE NAME, ARRAY
3142                       *                                LENGTH, NUMBER DIMENSIONS)
3143   B5C9 3A                  ABX                         X NOW POINTS TO START OF ARRAY ELEMENTS
3144   B5CA 9C 41         LB5CA CMPX  V41                   AT END OF THIS ARRAY?
3145   B5CC 27 E8               BEQ   LB5B6                 YES - CHECK FOR ANOTHER
3146   B5CE 8D Ø8               BSR   LB5D8                 CHECK FOR STRING LOCATED IN
3147                       *                                UNORGANIZED STRING SPACE
3148   B5DØ 2Ø F8               BRA   LB5CA                 KEEP CHECKING ELEMENTS IN THIS ARRAY
3149   B5D2 A6 Ø1         LB5D2 LDA   1,X                   GET F1RST BYTE OF VARIABLE NAME
3150   B5D4 3Ø Ø2               LEAX  2,X                   MOVE POINTER TO DESCRIPTOR
3151   B5D6 2A 14               BPL   LB5EC                 BRANCH IF VARIABLE IS NUMERIC
3152                       * SEARCH FOR STRING - ENTER WITH X POINTING TO
3153                       * THE STRING DESCRIPTOR. IF STRING IS STORED
3154                       * BETWEEN V47 AND STRTAB, SAVE DESCRIPTOR POINTER
3155                       * IN V4B AND RESET V47 TO STRING ADDRESS
3156   B5D8 E6 84         LB5D8 LDB   ,X                    GET THE LENGTH OF THE STRING
3157   B5DA 27 1Ø               BEQ   LB5EC                 BRANCH IF NULL - NO STRING
3158   B5DC EC Ø2               LDD   2,X                   GET STARTING ADDRESS OF THE STRING
3159   B5DE 1Ø 93 23            CMPD  STRTAB                COMPARE TO THE START OF STRING VARIABLES
3160   B5E1 22 Ø9               BHI   LB5EC                 BRANCH IF THIS STRING IS STORED IN
3161                       *                                THE STRING VARIABLES
3162   B5E3 1Ø 93 47            CMPD  V47                   COMPARE TO START OF STRING SPACE
3163   B5E6 23 Ø4               BLS   LB5EC                 BRANCH IF NOT STORED IN THE STRING SPACE
3164   B5E8 9F 4B               STX   V4B                   SAVE VARIABLE POINTER IF STORED IN STRING SPACE
3165   B5EA DD 47               STD   V47                   SAVE STRING STARTING ADDRESS
3166   B5EC 3Ø Ø5         LB5EC LEAX  5,X                   MOVE TO NEXT VARIABLE DESCRIPTOR
3167   B5EE 39            LB5EE RTS
3168   B5EF 9E 4B         LB5EF LDX   V4B                   GET ADDRESS OF THE DESCRIPTOR FOR THE
3169                       *                                STRING WHICH IS STORED IN THE HIGHEST RAM ADDRESS IN
3170                       *                                THE UNORGANIZED STRING SPACE
3171   B5F1 27 FB               BEQ   LB5EE                 BRANCH IF NONE FOUND AND REORGANIZATION DONE
3172   B5F3 4F                  CLRA                        CLEAR MS BYTE OF LENGTH
3173   B5F4 E6 84               LDB   ,X                    GET LENGTH OF STRING
3174   B5F6 5A                  DECB                        SUBTRACT ONE
3175   B5F7 D3 47               ADDD  V47                   ADD LENGTH OF STRING TO ITS STARTING ADDRESS
3176   B5F9 DD 43               STD   V43                   SAVE AS MOVE STARTING ADDRESS
3177   B5FB 9E 23               LDX   STRTAB                POINT X TO THE START OF ORGANIZED STRING VARIABLES
3178   B5FD 9F 41               STX   V41                   SAVE AS MOVE ENDING ADDRESS
3179   B5FF BD AC 2Ø            JSR   LAC2Ø                 MOVE STRING FROM CURRENT POSITION TO THE
3180                       *                                TOP OF UNORGANIZED STRING SPACE
3181   B6Ø2 9E 4B               LDX   V4B                   POINT X TO STRING DESCRIPTOR
3182   B6Ø4 DC 45               LDD   V45                   * GET NEW STARTING ADDRESS OF STRING AND
3183   B6Ø6 ED Ø2               STD   2,X                   * SAVE IT IN DESCRIPTOR
3184   B6Ø8 9E 45               LDX   V45                   GET NEW TOP OF UNORGANIZED STRING SPACE
3185   B6ØA 3Ø 1F               LEAX  -1,X                  MOVE POINTER BACK ONE
3186 > B6ØC 7E B5 93            JMP   LB593                 JUMP BACK AND REORGANIZE SOME MORE
3187
3188                       * CONCATENATE TWO STRINGS
3189   B6ØF DC 52         LB6ØF LDD   FPAØ+2                * GET DESCRIPTOR ADDRESS OF STRING A
3190   B611 34 Ø6               PSHS  B,A                   * AND SAVE IT ON THE STACK
3191   B613 BD B2 23            JSR   LB223                 GET DESCRIPTOR ADDRESS OF STRING B
3192   B616 BD B1 46            JSR   LB146                 'TM' ERROR IF NUMERIC VARIABLE
3193   B619 35 1Ø               PULS  X                     * POINT X TO STRING A DESCRIPTOR
3194   B61B 9F 62               STX   RESSGN                * ADDRESS AND SAVE IT IN RESSGN
3195   B61D E6 84               LDB   ,X                    GET LENGTH OF STRING A
3196   B61F 9E 52               LDX   FPAØ+2                POINT X TO DESCRIPTOR OF STRING B
3197   B621 EB 84               ADDB  ,X                    ADD LENGTH OF STRING B TO STR1NG A
3198   B623 24 Ø5               BCC   LB62A                 BRANCH IF LENGTH < 256
3199   B625 C6 1C               LDB   #2*14                 'STRING TOO LONG' ERROR IF LENGTH > 255
3200   B627 7E AC 46            JMP   LAC46                 JUMP TO ERROR SERVICING ROUTINE
3201   B62A BD B5 ØD      LB62A JSR   LB5ØD                 RESERVE ROOM IN STRING SPACE FOR NEW STRING
3202   B62D 9E 62               LDX   RESSGN                GET DESCRIPTOR ADDRESS OF STRING A
3203   B62F E6 84               LDB   ,X                    GET LENGTH OF STRING A
3204   B631 8D 1Ø               BSR   LB643                 MOVE STRING A INTO RESERVED BUFFER IN STRING SPACE
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3205   B633 9E 4D                  LDX   V4D                    GET DESCRIPTOR ADDRESS OF STRING B
3206   B635 8D 22                  BSR   LB659                  GET LENGTH AND ADDRESS OF STRING B
3207   B637 8D 0C                  BSR   LB645                  MOVE STRING B INTO REST OF RESERVED BUFFER
3208   B639 9E 62                  LDX   RESSGN                 POINT X TO DESCRIPTOR OF STRING A
3209   B63B 8D 1C                  BSR   LB659                  DELETE STRING A IF LAST STRING ON STRING STACK
3210   B63D BD B5 4C               JSR   LB54C                  PUT STRING DESCRIPTOR ON THE STRING STACK
3211   B640 7E B1 68               JMP   LB168                  BRANCH BACK TO EXPRESSION EVALUATION
3212
3213                       * MOVE (B) BYTES FROM 2,X TO FRESPC
3214   B643 AE 02          LB643   LDX   2,X                    POINT X TO SOURCE ADDRESS
3215   B645 DE 25          LB645   LDU   FRESPC                 POINT U TO DESTINATION ADDRESS
3216   B647 5C                     INCB                         COMPENSATION FOR THE DECB BELOW
3217   B648 20 04                  BRA   LB64E                  GO MOVE THE BYTES
3218                       * MOVE B BYTES FROM (X) TO (U)
3219   B64A A6 80          LB64A   LDA   ,X+                    * GET A SOURCE BYTE AND MOVE IT
3220   B64C A7 C0                  STA   ,U+                    * TO THE DESTINATION
3221   B64E 5A             LB64E   DECB                         DECREMENT BYTE COUNTER
3222   B64F 26 F9                  BNE   LB64A                  BRANCH IF ALL BYTES NOT MOVED
3223   B651 DF 25                  STU   FRESPC                 SAVE ENDING ADDRESS IN FRESPC
3224   B653 39                     RTS
3225                       * RETURN LENGTH (ACCB) AND ADDRESS (X) OF
3226                       * STRING WHOSE DESCRIPTOR IS IN FPA0+2
3227                       * DELETE THE STRING IF IT IS THE LAST ONE
3228                       * PUT ON THE STRING STACK. REMOVE STRING FROM STRING
3229                       * SPACE IF IT IS AT THE BOTTOM OF STRING VARIABLES.
3230   B654 BD B1 46       LB654   JSR   LB146                  'TM' ERROR IF VARIABLE TYPE = NUMERIC
3231   B657 9E 52          LB657   LDX   FPA0+2                 GET ADDRESS OF SELECTED STRING DESCRIPTOR
3232   B659 E6 84          LB659   LDB   ,X                     GET LENGTH OF STRING
3233   B65B 8D 18                  BSR   LB675                  * CHECK TO SEE IF THIS STRING DESCRIPTOR WAS
3234   B65D 26 13                  BNE   LB672                  * THE LAST ONE PUT ON THE STRING STACK AND
3235                       *                                    * BRANCH IF NOT
3236   B65F AE 07                  LDX   5+2,X                  GET START ADDRESS OF STRING JUST REMOVED
3237   B661 30 1F                  LEAX  -1,X                   MOVE POINTER DOWN ONE
3238   B663 9C 23                  CMPX  STRTAB                 COMPARE TO START OF STRING VARIABLES
3239   B665 26 08                  BNE   LB66F                  BRANCH IF THIS STRING IS NOT AT THE BOTTOM
3240                       *                                    OF STRING VARIABLES
3241   B667 34 04                  PSHS  B                      SAVE LENGTH; ACCA WAS CLEARED
3242   B669 D3 23                  ADDD  STRTAB                 * ADD THE LENGTH OF THE JUST REMOVED STRING
3243   B66B DD 23                  STD   STRTAB                 * TO THE START OF STRING VARIABLES - THIS WILL
3244                       *                                    * REMOVE THE STRING FROM THE STRING SPACE
3245   B66D 35 04                  PULS  B                      RESTORE LENGTH
3246   B66F 30 01          LB66F   LEAX  1,X                    ADD ONE TO POINTER
3247   B671 39                     RTS
3248   B672 AE 02          LB672   LDX   2,X                    *POINT X TO ADDRESS OF STRING NOT
3249   B674 39                     RTS                          *ON THE STRING STACK
3250                       * REMOVE STRING FROM STRING STACK. ENTER WITH X
3251                       * POINTING TO A STRING DESCRIPTOR - DELETE THE
3252                       * STRING FROM STACK IF IT IS ON TOP OF THE
3253                       * STACK. IF THE STRING IS DELETED, SET THE ZERO FLAG
3254   B675 9C 0D          LB675   CMPX  LASTPT                 *COMPARE TO LAST USED DESCRIPTOR ADDRESS
3255   B677 26 07                  BNE   LB680                  *ON THE STRING STACK, RETURN IF DESCRIPTOR
3256                       *                                    *ADDRESS NOT ON THE STRING STACK
3257   B679 9F 0B                  STX   TEMPPT                 SAVE LAST USED DESCRIPTOR AS NEXT AVAILABLE
3258   B67B 30 1B                  LEAX  -5,X                   * MOVE LAST USED DESCRIPTOR BACK 5 BYTES
3259   B67D 9F 0D                  STX   LASTPT                 * AND SAVE AS THE LAST USED DESCRIPTOR ADDR
3260   B67F 4F                     CLRA                         SET ZERO FLAG
3261   B680 39             LB680   RTS
3262
3263                       * LEN
3264   B681 8D 03          LEN     BSR   LB686                  POINT X TO PROPER STRING AND GET LENGTH
3265   B683 7E B4 F3       LB683   JMP   LB4F3                  CONVERT ACCB TO FP NUMBER IN FPA0
3266                       * POINT X TO STRING ADDRESS LOAD LENGTH INTO
3267                       * ACCB. ENTER WITH THE STRING DESCRIPTOR IN
3268                       * BOTTOM TWO BYTES OF FPA0
3269   B686 8D CC          LB686   BSR   LB654                  GET LENGTH AND ADDRESS OF STRING
3270   B688 0F 06                  CLR   VALTYP                 SET VARIABLE TYPE TO NUMERIC
3271   B68A 5D                     TSTB                         SET FLAGS ACCORDING TO LENGTH
3272   B68B 39                     RTS
3273
3274                       * CHR$
3275 > B68C BD B7 0E      CHR     JSR   LB70E                  CONVERT FPA0 TO AN INTEGER IN ACCD
3276   B68F C6 01          LB68F   LDB   #1                     * RESERVE ONE BYTE IN
3277   B691 BD B5 6D               JSR   LB56D                  * THE STRING SPACE
3278   B694 96 53                  LDA   FPA0+3                 GET ASCII STRING VALUE
3279   B696 BD B5 11               JSR   LB511                  SAVE RESERVED STRING DESCRIPTOR IN TEMP DESCRIPTOR
3280   B699 A7 84                  STA   ,X                     SAVE THE STRING (IT S ONLY ONE BYTE)
3281   B69B 32 62          LB69B   LEAS  2,X                    PURGE THE RETURN ADDRESS OFF OF THE STACK
3282   B69D 7E B5 4C       LB69D   JMP   LB54C                  PUT TEMP DESCRIPTOR DATA ONTO STRING STACK
3283
3284                       * ASC$
3285   B6A0 8D 02          ASC     BSR   LB6A4                  PUT 1ST CHARACTER OF STRING INTO ACCB
3286   B6A2 20 DF                  BRA   LB683                  CONVERT ACCB INTO FP NUMBER IN FPA0
3287   B6A4 8D E0          LB6A4   BSR   LB686                  POINT X TO STRING DESCRIPTOR
3288   B6A6 27 5E                  BEQ   LB706                  'FC' ERROR IF NULL STRING
3289   B6A8 E6 84                  LDB   ,X                     GET FIRST BYTE OF STRING
3290   B6AA 39                     RTS
3291
3292                       * LEFT$
3293   B6AB 8D 48          LEFT    BSR   LB6F5                  GET ARGUMENTS FROM STACK
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3294   B6AD 4F                  CLRA                        CLEAR STRING POINTER OFFSET - OFFSET = Ø FOR LEFT$
3295   B6AE E1 84        LB6AE  CMPB  ,X                    * COMPARE LENGTH PARAMETER TO LENGTH OF
3296   B6Ø 23 Ø3                BLS   LB6B5                 * STRING AND BRANCH IF LENGTH OF STRING
3297                     *                                  >= LENGTH PARAMETER
3298   B6B2 E6 84               LDB   ,X                    USE LENGTH OF STRING OTHERWISE
3299   B6B4 4F                  CLRA                        CLEAR STRING POINTER OFFSET (Ø FOR LEFT$)
33ØØ   B6B5 34 Ø6        LB6B5  PSHS  B,A                   PUSH PARAMETERS ONTO STACK
33Ø1   B6B7 BD B5 ØF             JSR   LB5ØF                 RESERVE ACCB BYTES IN THE STRING SPACE
33Ø2   B6BA 9E 4D                LDX   V4D                   POINT X TO STRING DESCRIPTOR
33Ø3   B6BC 8D 9B                BSR   LB659                 GET ADDRESS OF OLD STRING (X=ADDRESS)
33Ø4   B6BE 35 Ø4                PULS  B                     * PULL STRING POINTER OFFSET OFF OF THE STACK
33Ø5   B6CØ 3A                   ABX                         * AND ADD IT TO STRING ADDRESS
33Ø6   B6C1 35 Ø4                PULS  B                     PULL LENGTH PARAMETER OFF OF THE STACK
33Ø7   B6C3 BD B6 45             JSR   LB645                 MOVE ACCB BYTES FROM (X) TO [FRESPC]
33Ø8   B6C6 2Ø D5                BRA   LB69D                 PUT TEMP STRING DESCRIPTOR ONTO THE STRING STACK
33Ø9
3310                     * RIGHT$
3311   B6C8 8D 2B        RIGHT  BSR   LB6F5                 GET ARGUMENTS FROM STACK
3312   B6CA AØ 84               SUBA  ,X                    ACCA=LENGTH PARAMETER - LENGTH OF OLD STRING
3313   B6CC 4Ø                  NEGA                        NOW ACCA = LENGTH OF OLD STRING
3314   B6CD 2Ø DF               BRA   LB6AE                 PUT NEW STRING IN THE STRING SPACE
3315
3316                     * MID$
3317   B6CF C6 FF        MID    LDB   #$FF                  * GET DEFAULT VALUE OF LENGTH AND
3318   B6D1 D7 53               STB   FPAØ+3                * SAVE IT IN FPAØ
3319   B6D3 9D A5               JSR   GETCCH                GET CURRENT CHARACTER FROM BASIC
332Ø   B6D5 81 29               CMPA  #')                   ARGUMENT DELIMITER?
3321   B6D7 27 Ø5               BEQ   LB6DE                 YES - NO LENGTH PARAMETER GIVEN
3322   B6D9 BD B2 6D            JSR   LB26D                 SYNTAX CHECK FOR COMMA
3323   B6DC 8D 2D               BSR   LB7ØB                 EVALUATE NUMERIC EXPRESSION (LENGTH)
3324   B6DE 8D 15        LB6DE  BSR   LB6F5                 GET ARGUMENTS FROM STACK
3325   B6EØ 27 24               BEQ   LB7Ø6                 'FC' ERROR IF NULL STRING
3326   B6E2 5F                  CLRB                        CLEAR LENGTH COUNTER (DEFAULT VALUE)
3327   B6E3 4A                  DECA                        *SUOTRACT ONE FROM POSITION PARAMETER (THESE
3328   B6E4 A1 84               CMPA  ,X                    *ROUTINES EXPECT 1ST POSITION TO BE ZERO, NOT ONE)
3329                     *                                  *AND COMPARE IT TO LENGTH OF OLD STRING
333Ø   B6E6 24 CD               BCC   LB6B5                 IF POSITION > LENGTH OF OLD STRING, THEN NEW
3331                     *                                  STRING WILL BE A NULL STRING
3332   B6E8 1F 89               TFR   A,B                   SAVE ABSOLUTE POSITION PARAMETER IN ACCB
3333   B6EA E0 84               SUBB  ,X                    ACCB=POSITION-LENGTH OF OLD STRING
3334   B6EC 5Ø                  NEGB                        NOW ACCB=LENGTH OF OLDSTRING-POSITION
3335   B6ED D1 53               CMPB  FPAØ+3                *IF THE AMOUNT OF OLD STRING TO THE RIGHT OF
3336   B6EF 23 C4               BLS   LB6B5                 *POSITION IS <= THE LENGTH PARAMETER, BRANCH AND
3337                     *USE ALL OF THE STRING TO THE RIGHT OF THE POSITION
3338                     *INSTEAD OF THE LENGTH PARAMETER
3339   B6F1 D6 53               LDB   FPAØ+3                GET LENGTH OF NEW STRING
334Ø   B6F3 2Ø CØ               BRA   LB6B5                 PUT NEW STRING IN STRING SPACE
3341                     * DO A SYNTAX CHECK FOR ")", THEN PULL THE PREVIOUSLY CALCULATED NUMERIC
3342                     * ARGUMENT (ACCD) AND STRING ARGUMENT DESCRIPTOR ADDR OFF OF THE STACK
3343   B6F5 BD B2 67     LB6F5  JSR   LB267                 SYNTAX CHECK FOR A ")"
3344   B6F8 EE E4               LDU   ,S                    LOAD THE RETURN ADDRESS INTO U REGISTER
3345   B6FA AE 65               LDX   5,S                   * GET ADDRESS OF STRING AND
3346   B6FC 9F 4D               STX   V4D                   * SAVE IT IN V4D
3347   B6FE A6 64               LDA   4,S                   = PUT LENGTH OF STRING IN
3348   B7ØØ E6 64               LDB   4,S                   = BOTH ACCA AND ACCB
3349   B7Ø2 32 67               LEAS  7,S                   REMOVE DESCRIPTOR AND RETURN ADDRESS FROM STACK
335Ø   B7Ø4 1F 35               TFR   U,PC                  JUMP TO ADDRESS IN U REGISTER
3351   B7Ø6 7E B4 4A     LB7Ø6  JMP   LB44A                 'ILLEGAL FUNCTION CALL'
3352                     * EVALUATE AN EXPRESSION - RETURN AN INTEGER IN
3353                     * ACCB - 'FC' ERROR IF EXPRESSION > 255
3354   B7Ø9 9D 9F        LB7Ø9  JSR   GETNCH                 GET NEXT BASIC INPUT CHARACTER
3355   B7ØB BD B1 41     LB7ØB  JSR   LB141                 EVALUATE A NUMERIC EXPRESSION
3356   B7ØE BD B3 E9     LB7ØE  JSR   LB3E9                 CONVERT FPAØ TO INTEGER IN ACCD
3357   B711 4D                  TSTA                        TEST MS BYTE OF INTEGER
3358   B712 26 F2               BNE   LB7Ø6                 'FC' ERROR IF EXPRESSION > 255
3359   B714 ØE A5               JMP   GETCCH                GET CURRENT INPUT CHARACTER FROM BASIC
3360
3361                     * VAL
3362   B716 BD B6 86     VAL    JSR   LB686                 POINT X TO STRING ADDRESS
3363   B719 1Ø 27 Ø3 1C         LBEQ  LBA39                 IF NULL STRING SET FPAØ
3364   B71D DE A6               LDU   CHARAD                SAVE INPUT POINTER IN REGISTER U
3365   B71F 9F A6               STX   CHARAD                POINT INPUT POINTER TO ADDRESS OF STRING
3366   B721 3A                  ABX                         MOVE POINTER TO END OF STRING TERMINATOR
3367   B722 A6 84               LDA   ,X                    GET LAST BYTE OF STRING
3368   B724 34 52               PSHS  U,X,A                 SAVE INPUT POINTER, STRING TERMINATOR
3369                     *                                  ADDRESS AND CHARACTER
337Ø   B726 6F 84               CLR   ,X                    CLEAR STRING TERMINATOR : FOR ASCII - FP CONVERSION
3371   B728 9D A5               JSR   GETCCH                GET CURRENT CHARACTER FROM BASIC
3372   B72A BD BD 12            JSR   LBD12                 CONVERT AN ASCII STRING TO FLOATING POINT
3373   B72D 35 52               PULS  A,X,U                 RESTORE CHARACTERS AND POINTERS
3374   B72F A7 84               STA   ,X                    REPLACE STRING TERMINATOR
3375   B731 DF A6               STU   CHARAD                RESTORE INPUT CHARACTER
3376   B733 39                  RTS
3377
3378   B734 8D Ø7        LB734  BSR   LB73D                 * EVALUATE AN EXPRESSION, RETURN
3379   B736 9F 2B               STX   BINVAL                * THE VALUE IN X; STORE IT IN BINVAL
338Ø   B738 BD B2 6D     LB738  JSR   LB26D                 SYNTAX CHECK FOR A COMMA
3381   B73B 2Ø CE               BRA   LB7ØB                 EVALUATE EXPRESSION IN RANGE Ø <= X < 256
3382                     * EVALUATE EXPRESSION : RETURN INTEGER PORTION IN X - 'FC' ERROR IF
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3383                          * EXPRESSION IS NEGATIVE OR > 32767, I.E. NOT A LEGAL POSITIVE INTEGER.
3384   B73D BD B1 41          LB73D   JSR   LB141                    EVALUATE NUMERIC EXPRESSION
3385   B740 96 54             LB740   LDA   FP0SGN                   GET SIGN OF FPA0 MANTISSA
3386   B742 2B C2                     BMI   LB706                    'ILLEGAL FUNCTION CALL' IF NEGATIVE
3387   B744 96 4F                     LDA   FP0EXP                   GET EXPONENT OF FPA0
3388   B746 81 90                     CMPA  #$90                     COMPARE TO LARGEST POSITIVE INTEGER
3389   B748 22 BC                     BHI   LB706                    'ILLEGAL FUNCTION CALL' IF TOO LARGE
3390   B74A BD BC C8                  JSR   LBCC8                    SHIFT BINARY POINT TO EXTREME RIGHT OF FPA0
3391   B74D 9E 52                     LDX   FPA0+2                   LOAD X WITH LOWER TWO BYTES OF FPA0
3392   B74F 39                        RTS
3393
3394                          * PEEK
3395   B750 8D EE             PEEK    BSR   LB740                    CONVERT FPA0 TO INTEGER IN REGISTER X
3396   B752 E6 84                     LDB   ,X                       GET THE VALUE BEING 'PEEK'ED
3397   B754 7E B4 F3                  JMP   LB4F3                    CONVERT ACCB INTO A FP NUMBER
3398
3399                          * POKE
3400   B757 8D DB             POKE    BSR   LB734                    EVALUATE 2 EXPRESSIONS
3401   B759 9E 2B                     LDX   BINVAL                   GET THE ADDRESS TO BE 'POKE'ED
3402   B75B E7 84                     STB   ,X                       STORE THE DATA IN THAT ADDRESS
3403   B75D 39                        RTS
3404
3405                          * LLIST
3406   B75E C6 FE             LLIST   LDB   #-2                      * SET DEVICE NUMBER TO
3407   B760 D7 6F                     STB   DEVNUM                   * PRINTER
3408   B762 9D A5                     JSR   GETCCH                   GET CURRENT CHARACTER FROM BASIC
3409
3410                          * LIST
3411   B764 34 01             LIST    PSHS  CC                       SAVE ZERO FLAG ON STACK
3412   B766 BD AF 67                  JSR   LAF67                    CONVERT DECIMAL LINE NUMBER TO BINARY
3413   B769 BD AD 01                  JSR   LAD01                    * FIND RAM ADDRESS OF THAT LINE NUMBER AND
3414   B76C 9F 66                     STX   LSTTXT                   * SAVE IT IN LSTTXT
3415   B76E 35 01                     PULS  CC                       GET ZERO FLAG FROM STACK
3416   B770 27 12                     BEQ   LB784                    BRANCH IF END OF LINE
3417   B772 9D A5                     JSR   GETCCH                   GET CURRENT CHARACTER FROM BASIC
3418   B774 27 13                     BEQ   LB789                    BRANCH IF END OF LINE
3419   B776 81 AC                     CMPA  #$AC                     MINUS TOKEN (IS IT A RANGE OF LINE NUMBERS?)
3420   B778 26 09                     BNE   LB783                    NO - RETURN
3421   B77A 9D 9F                     JSR   GETNCH                   GET NEXT CHARACTER FROM BASIC
3422   B77C 27 06                     BEQ   LB784                    BRANCH IF END OF LINE
3423   B77E BD AF 67                  JSR   LAF67                    GET ENDING LINE NUMBER
3424   B781 27 06                     BEQ   LB789                    BRANCH IF LEGAL LINE NUMBER
3425   B783 39                LB783   RTS
3426                          * LIST THE ENTIRE PROGRAM
3427   B784 CE FF FF          LB784   LDU   #$FFFF                   * SET THE DEFAULT ENDING LINE NUMBER
3428   B787 DF 2B                     STU   BINVAL                   * TO $FFFF
3429   B789 32 62             LB789   LEAS  2,S                      PURGE RETURN ADDRESS FROM THE STACK
3430   B78B 9E 66                     LDX   LSTTXT                   POINT X TO STARTING LINE ADDRESS
3431   B78D BD B9 5C          LB78D   JSR   LB95C                    MOVE CURSOR TO START OF A NEW LINE
3432   B790 BD A5 49                  JSR   LA549                    CHECK FOR A BREAK OR PAUSE
3433   B793 EC 84                     LDD   ,X                       GET ADDRESS OF NEXT BASIC LINE
3434   B795 26 08                     BNE   LB79F                    BRANCH IF NOT END OF PROGRAM
3435   B797 BD A4 2D          LB797   JSR   LA42D                    CHECK CLOSE FILE HANDLER
3436   B79A 0F 6F                     CLR   DEVNUM                   SET DEVICE NUMBER TO SCREEN
3437   B79C 7E AC 73                  JMP   LAC73                    RETURN TO BASIC S MAIN INPUT LOOP
3438   B79F 9F 66             LB79F   STX   LSTTXT                   SAVE NEW STARTING LINE ADDRESS
3439   B7A1 EC 02                     LDD   2,X                      * GET THE LINE NUMBER OF THIS LINE AND
3440   B7A3 10 93 2B                  CMPD  BINVAL                   * COMPARE IT TO ENDING LINE NUMBER
3441   B7A6 22 EF                     BHI   LB797                    EXIT IF LINE NUMBER > ENDING LINE NUMBER
3442   B7A8 BD BD CC                  JSR   LBDCC                    PRINT THE NUMBER IN ACCD ON SCREEN IN DECIMAL
3443   B7AB BD B9 AC                  JSR   LB9AC                    SEND A SPACE TO CONSOLE OUT
3444   B7AE 9E 66                     LDX   LSTTXT                   GET RAM ADDRESS OF THIS LINE
3445   B7B0 8D 10                     BSR   LB7C2                    UNCRUNCH A LINE
3446   B7B2 AE 9F 00 66               LDX   [LSTTXT]                 POINT X TO START OF NEXT LINE
3447   B7B6 CE 02 DD                  LDU   #LINBUF+1                POINT U TO BUFFER FULL OF UNCRUNCHED LINE
3448   B7B9 A6 C0             LB7B9   LDA   ,U+                      GET A BYTE FROM THE BUFFER
3449   B7BB 27 D0                     BEQ   LB78D                    BRANCH IF END OF BUFFER
3450   B7BD BD B9 B1                  JSR   LB9B1                    SEND CHARACTER TO CONSOLE OUT
3451   B7C0 20 F7                     BRA   LB7B9                    GET ANOTHER CHARACTER
3452
3453                          * UNCRUNCH A LINE INTO BASIC S LINE INPUT BUFFER
3454   B7C2 BD 01 A6          LB7C2   JSR   RVEC24                   HOOK INTO RAM
3455   B7C5 30 04                     LEAX  4,X                      MOVE POINTER PAST ADDRESS OF NEXT LINE AND LINE NUMBER
3456   B7C7 10 8E 02 DD               LDY   #LINBUF+1                UNCRUNCH LINE INTO LINE INPUT BUFFER
3457   B7CB A6 80             LB7CB   LDA   ,X+                      GET A CHARACTER
3458   B7CD 27 51                     BEQ   LB820                    BRANCH IF END OF LINE
3459   B7CF 2B 15                     BMI   LB7E6                    BRANCH IF IT S A TOKEN
3460   B7D1 81 3A                     CMPA  #':                      CHECK FOR END OF SUB LINE
3461   B7D3 26 0D                     BNE   LB7E2                    BRNCH IF NOT END OF SUB LINE
3462   B7D5 E6 84                     LDB   ,X                       GET CHARACTER FOLLOWING COLON
3463   B7D7 C1 84                     CMPB  #$84                     TOKEN FOR ELSE?
3464   B7D9 27 F0                     BEQ   LB7CB                    YES - DON T PUT IT IN BUFFER
3465   B7DB C1 83                     CMPB  #$83                     TOKEN FOR REMARK?
3466   B7DD 27 EC                     BEQ   LB7CB                    YES - DON T PUT IT IN BUFFER
3467   B7DF 8C                        FCB   SKP2                     SKIP TWO BYTES
3468   B7E0 86 21             LB7E0   LDA   #'!                     EXCLAMATION POINT
3469   B7E2 8D 30             LB7E2   BSR   LB814                    PUT CHARACTER IN BUFFER
3470   B7E4 20 E5                     BRA   LB7CB                    GET ANOTHER CHARACTER
3471                          * UNCRUNCH A TOKEN
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3472   B7E6 CE Ø1 16          LB7E6   LDU   #COMVEC-1Ø               FIRST DO COMMANDS
3473   B7E9 81 FF                     CMPA  #$FF                     CHECK FOR SECONDARY TOKEN
3474   B7EB 26 Ø4                     BNE   LB7F1                    BRANCH IF NON SECONDARY TOKEN
3475   B7ED A6 8Ø                     LDA   ,X+                      GET SECONDARY TOKEN
3476   B7EF 33 45                     LEAU  5,U                      BUMP IT UP TO SECONDARY FUNCTIONS
3477   B7F1 84 7F             LB7F1   ANDA  #$7F                     MASK OFF BIT 7 OF TOKEN
3478   B7F3 33 4A             LB7F3   LEAU  1Ø,U                     MOVE TO NEXT COMMAND TABLE
3479   B7F5 6D C4                     TST   ,U                       IS THIS TABLE ENABLED?
348Ø   B7F7 27 E7                     BEQ   LB7EØ                    NO - ILLEGAL TOKEN
3481   B7F9 AØ C4                     SUBA  ,U                       SUBTRACT THE NUMBER OF TOKENS FROM THE CURRENT TOKEN NUMBER
3482   B7FB 2A F6                     BPL   LB7F3                    BRANCH IF TOKEN NOT IN THIS TABLE
3483   B7FD AB C4                     ADDA  ,U                       RESTORE TOKEN NUMBER RELATIVE TO THIS TABLE
3484   B7FF EE 41                     LDU   1,U                      POINT U TO COMMAND DICTIONARY TABLE
3485   B8Ø1 4A                LB8Ø1   DECA                           DECREMENT TOKEN NUMBER
3486   B8Ø2 2B Ø6                     BMI   LB8ØA                    BRANCH IF THIS IS THE CORRECT TOKEN
3487                          * SKIP THROUGH DICTIONARY TABLE TO START OF NEXT TOKEN
3488   B8Ø4 6D CØ             LB8Ø4   TST   ,U+                      GRAB A BYTE
3489   B8Ø6 2A FC                     BPL   LB8Ø4                    BRANCH IF BIT 7 NOT SET
349Ø   B8Ø8 2Ø F7                     BRA   LB8Ø1                    GO SEE IF THIS IS THE CORRECT TOKEN
3491   B8ØA A6 C4             LB8ØA   LDA   ,U                       GET A CHARACTER FROM DICTIONARY TABLE
3492   B8ØC 8D Ø6                     BSR   LB814                    PUT CHARACTER IN BUFFER
3493   B8ØE 6D CØ                     TST   ,U+                      CHECK FOR START OF NEXT TOKEN
3494   B81Ø 2A F8                     BPL   LB8ØA                    BRANCH IF NOT DONE WITH THIS TOKEN
3495   B812 2Ø B7                     BRA   LB7CB                    GO GET ANOTHER CHARACTER
3496   B814 1Ø 8C Ø3 D6       LB814   CMPY  #LINBUF+LBUFMX          TEST FOR END OF LINE INPUT BUFFER
3497   B818 24 Ø6                     BCC   LB82Ø                    BRANCH IF AT END OF BUFFER
3498   B81A 84 7F                     ANDA  #$7F                     MASK OFF BIT 7
3499   B81C A7 AØ                     STA   ,Y+                      * SAVE CHARACTER IN BUFFER AND
35ØØ   B81E 6F A4                     CLR   ,Y                       * CLEAR NEXT CHARACTER SLOT IN BUFFER
35Ø1   B82Ø 39                LB82Ø   RTS
35Ø2                          *
35Ø3                          * CRUNCH THE LINE THAT THE INPUT POINTER IS
35Ø4                          * POINTING TO INTO THE LINE INPUT BUFFER
35Ø5                          * RETURN LENGTH OF CRUNCHED LINE IN ACCD
35Ø6                          *
35Ø7   B821 BD Ø1 A3          LB821   JSR   RVEC23                   HOOK INTO RAM
35Ø8   B824 9E A6                     LDX   CHARAD                   GET BASIC'S INPUT POINTER ADDRESS
35Ø9   B826 CE Ø2 DC                  LDU   #LINBUF                  POINT X TO LINE INPUT BUFFER
351Ø   B829 ØF 43             LB829   CLR   V43                      CLEAR ILLEGAL TOKEN FLAG
3511   B82B ØF 44                     CLR   V44                      CLEAR DATA FLAG
3512   B82D A6 8Ø             LB82D   LDA   ,X+                      GET INPUT CHAR
3513   B82F 27 21                     BEQ   LB852                    BRANCH IF END OF LINE
3514   B831 ØD 43                     TST   V43                      * CHECK ILLEGAL TOKEN FLAG & BRANCH IF NOT
3515   B833 27 ØF                     BEQ   LB844                    * PROCESSING AN ILLEGAL TOKEN
3516   B835 BD B3 A2                  JSR   LB3A2                    SET CARRY IF NOT UPPER CASE ALPHA
3517   B838 24 18                     BCC   LB852                    BRANCH IF UPPER CASE ALPHA
3518   B83A 81 3Ø                     CMPA  #'Ø                      * DON T CRUNCH ASCII NUMERIC CHARACTERS
3519   B83C 25 Ø4                     BLO   LB842                    * BRANCH IF NOT NUMERIC
352Ø   B83E 81 39                     CMPA  #'9                      *
3521   B84Ø 23 1Ø                     BLS   LB852                    * BRANCH IF NUMERIC
3522                          * END UP HERE IF NOT UPPER CASE ALPHA OR NUMERIC
3523   B842 ØF 43             LB842   CLR   V43                      CLEAR ILLEGAL TOKEN FLAG
3524   B844 81 2Ø             LB844   CMPA  #SPACE                    SPACE?
3525   B846 27 ØA                     BEQ   LB852                    DO NOT REMOVE SPACES
3526   B848 97 42                     STA   V42                      SAVE INPUT CHARACTER AS SCAN DELIMITER
3527   B84A 81 22                     CMPA  #'"                      CHECK FOR STRING DELIMITER
3528   B84C 27 38                     BEQ   LB886                    BRANCH IF STRING
3529   B84E ØD 44                     TST   V44                      * CHECK DATA FLAG AND BRANCH IF CLEAR
353Ø   B85Ø 27 19                     BEQ   LB86B                    * DO NOT CRUNCH DATA
3531   B852 A7 CØ             LB852   STA   ,U+                      SAVE CHARACTER IN BUFFER
3532   B854 27 Ø6                     BEQ   LB85C                    BRANCH IF END OF LINE
3533   B856 81 3A                     CMPA  #':                      * CHECK FOR END OF SUBLINE
3534   B858 27 CF                     BEQ   LB829                    * AND RESET FLAGS IF END OF SUBLINE
3535   B85A 2Ø D1             LB85A   BRA   LB82D                    GO GET ANOTHER CHARACTER
3536   B85C 6F CØ             LB85C   CLR   ,U+                      * DOUBLE ZERO AT END OF LINE
3537   B85E 6F CØ                     CLR   ,U+                      *
3538   B86Ø 1F 3Ø                     TFR   U,D                      SAVE ADDRESS OF END OF LINE IN ACCD
3539   B862 83 Ø2 DA                  SUBD  #LINHDR                  LENGTH OF LINE IN ACCD
354Ø   B865 8E Ø2 DB                  LDX   #LINBUF-1                * SET THE INPUT POINTER TO ONE BEFORE
3541   B868 9F A6                     STX   CHARAD                   * THE START OF THE CRUNCHED LINE
3542   B86A 39                        RTS                            EXIT 'CRUNCH'
3543   B86B 81 3F             LB86B   CMPA  #'?                      CHECK FOR "?" - PRINT ABBREVIATION
3544   B86D 26 Ø4                     BNE   LB873                    BRANCH IF NOT PRINT ABBREVIATION
3545   B86F 86 87                     LDA   #$87                     * GET THE PRINT TOKEN AND SAVE IT
3546   B871 2Ø DF                     BRA   LB852                    * IN BUFFER
3547   B873 81 27             LB873   CMPA  #''                      APOSTROPHE IS SAME AS REM
3548   B875 26 13                     BNE   LB88A                    BRANCH IF NOT REMARK
3549   B877 CC 3A 83                  LDD   #$3A83                   COLON, REM TOKEN
355Ø   B87A ED C1                     STD   ,U++                     SAVE IN BUFFER
3551   B87C ØF 42             LB87C   CLR   V42                      SET DELIMITER = Ø (END OF LINE)
3552   B87E A6 8Ø             LB87E   LDA   ,X+                      SCAN TILL WE MATCH [V42]
3553   B88Ø 27 DØ                     BEQ   LB852                    BRANCH IF END OF LINE
3554   B882 91 42                     CMPA  V42                      DELIMITER?
3555   B884 27 CC                     BEQ   LB852                    BRANCH OUT IF SO
3556   B886 A7 CØ             LB886   STA   ,U+                      DON T CRUNCH REMARKS OR STRINGS
3557   B888 2Ø F4                     BRA   LB87E                    GO GET MORE STRING OR REMARK
3558   B88A 81 3Ø             LB88A   CMPA  #'Ø                      * LESS THAN ASCII ZERO?
3559   B88C 25 Ø4                     BCS   LB892                    * BRANCH IF SO
356Ø   B88E 81 3C                     CMPA  #';+1                    = CHECK FOR NUMERIC VALUE, COLON OR SEMICOLON
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3561   B89Ø 25 CØ              BCS   LB852              = AND INSERT IN BUFFER IF SO
3562   B892 3Ø 1F        LB892 LEAX  -1,X               MOVE INPUT POINTER BACK ONE
3563   B894 34 5Ø              PSHS  U,X                SAVE POINTERS TO INPUT STRING, OUTPUT STRING
3564   B896 ØF 41              CLR   V41                TOKEN FLAG Ø = COMMAND, FF = SECONDARY
3565   B898 CE Ø1 16           LDU   #COMVEC-1Ø         POINT U TO COMMAND INTERPRETATION
3566                     *                              TABLE FOR BASIC - 1Ø
3567   B89B ØF 42        LB89B CLR   V42                INITIALIZE V42 AS TOKEN COUNTER
3568   B89D 33 4A        LB89D LEAU  1Ø,U               MOVE TO NEXT COMMAND INTERPRETATION TABLE
3569   B89F A6 C4              LDA   ,U                 GET NUMBER OF COMMANDS
3570   B8A1 27 31              BEQ   LB8D4              GO DO SECONDARY FUNCTIONS IF NO COMMAND TABLE
3571   B8A3 1Ø AE 41           LDY   1,U                POINT Y TO COMMAND DICTIONARY TABLE
3572   B8A6 AE E4        LB8A6 LDX   ,S                 GET POINTER TO INPUT STRING
3573   B8A8 E6 A0        LB8A8 LDB   ,Y+                GET A BYTE FROM DICTIONARY TABLE
3574   B8AA E0 8Ø              SUBB  ,X+                SUBTRACT INPUT CHARACTER
3575   B8AC 27 FA              BEQ   LB8A8              LOOP IF SAME
3576   B8AE C1 8Ø              CMPB  #$8Ø               LAST CHAR IN RESERVED WORD TABLE HAD
3577                     *                              BIT 7 SET, SO IF WE HAVE $8Ø HERE
3578                     *                              THEN IT IS A GOOD COMPARE
3579   B8B0 26 38              BNE   LB8EA              BRANCH IF NO MATCH - CHECK ANOTHER COMMAND
3580   B8B2 32 62              LEAS  2,S                DELETE OLD INPUT POINTER FROM STACK
3581   B8B4 35 4Ø              PULS  U                  GET POINTER TO OUTPUT STRING
3582   B8B6 DA 42              ORB   V42                OR IN THE TABLE POSITION TO MAKE THE TOKEN
3583                     *                              - NOTE THAT B ALREADY HAD $8Ø IN IT -
3584   B8B8 96 41              LDA   V41                * CHECK TOKEN FLAG AND BRANCH
3585   B8BA 26 Ø6              BNE   LB8C2              * IF SECONDARY
3586   B8BC C1 84              CMPB  #$84               IS IT ELSE TOKEN?
3587   B8BE 26 Ø6              BNE   LB8C6              NO
3588   B8CØ 86 3A              LDA   #':                PUT A COLON (SUBLINE) BEFORE ELSE TOKEN
3589   B8C2 ED C1        LB8C2 STD   ,U++               SECONDARY TOKENS PRECEEDED BY $FF
3590   B8C4 2Ø 94              BRA   LB85A              GO PROCESS MORE INPUT CHARACTERS
3591   B8C6 E7 CØ        LB8C6 STB   ,U+                SAVE THIS TOKEN
3592   B8C8 C1 86              CMPB  #$86               DATA TOKEN?
3593   B8CA 26 Ø2              BNE   LB8CE              NO
3594   B8CC ØC 44              INC   V44                SET DATA FLAG
3595   B8CE C1 82        LB8CE CMPB  #$82               REM TOKEN?
3596   B8DØ 27 AA              BEQ   LB87C              YES
3597   B8D2 2Ø 86        LB8D2 BRA   LB85A              GO PROCESS MORE INPUT CHARACTERS
3598                     * CHECK FOR A SECONDARY TOKEN
3599   B8D4 CE Ø1 1B     LB8D4 LDU   #COMVEC-5          NOW DO SECONDARY FUNCTIONS
3600   B8D7 Ø3 41              COM   V41                TOGGLE THE TOKEN FLAG
3601   B8D9 26 CØ              BNE   LB89B              BRANCH IF NOW CHECKING SECONDARY COMMANDS
3602
3603                     * THIS CODE WILL PROCESS INPUT DATA WHICH CANNOT BE CRUNCHED AND SO
3604                     * IS ASSUMED TO BE ILLEGAL DATA OR AN ILLEGAL TOKEN
3605   B8DB 35 5Ø              PULS  X,U                RESTORE INPUT AND OUTPUT POINTERS
3606   B8DD A6 8Ø              LDA   ,X+                * MOVE THE FIRST CHARACTER OF AN
3607   B8DF A7 CØ              STA   ,U+                * ILLEGAL TOKEN
3608   B8E1 BD B3 A2           JSR   LB3A2              SET CARRY IF NOT ALPHA
3609   B8E4 25 EC              BCS   LB8D2              BRANCH IF NOT ALPHA
3610   B8E6 Ø3 43              COM   V43                SET ILLEGAL TOKEN FLAG IF UPPER CASE ALPHA
3611   B8E8 2Ø E8              BRA   LB8D2              PROCESS MORE INPUT CHARACTERS
3612   B8EA ØC 42        LB8EA INC   V42                INCREMENT TOKEN COUNTER
3613   B8EC 4A                 DECA                     DECR COMMAND COUNTER
3614   B8ED 27 AE              BEQ   LB89D              GET ANOTHER COMMAND TABLE IF DONE W/THIS ONE
3615   B8EF 31 3F              LEAY  -1,Y               MOVE POINTER BACK ONE
3616   B8F1 E6 A0        LB8F1 LDB   ,Y+                * GET TO NEXT
3617   B8F3 2A FC              BPL   LB8F1              * RESERVED WORD
3618   B8F5 2Ø AF              BRA   LB8A6              GO SEE IF THIS WORD IS A MATCH
3619
3620                     * PRINT
3621   B8F7 27 5F        PRINT BEQ   LB958              BRANCH IF NO ARGUMENT
3622   B8F9 8D Ø3              BSR   LB8FE              CHECK FOR ALL PRINT OPTIONS
3623   B8FB ØF 6F              CLR   DEVNUM             SET DEVICE NUMBER TO SCREEN
3624   B8FD 39                 RTS
3625   B8FE 81 4Ø        LB8FE CMPA  #'@                CHECK FOR PRINT @
3626   B9ØØ 26 Ø5              BNE   LB9Ø7              NOT PRINT @
3627   B9Ø2 BD A5 54           JSR   LA554              MOVE CURSOR TO PROPER PRINT LOCATION
3628   B9Ø5 2Ø ØA              BRA   LB911              GO PRINT THE DATA
3629   B9Ø7 81 23        LB9Ø7 CMPA  #'#                CHECK FOR PRINT NUMBER
3630   B9Ø9 26 ØD              BNE   LB918              NOT PRINT#
3631   B9ØB BD A5 A5           JSR   LA5A5              CHECK FOR A VALID DEVICE NUMBER
3632   B9ØE BD A4 Ø6           JSR   LA4Ø6              CHECK FOR A VALID OUTPUT FILE
3633   B911 9D A5        LB911 JSR   GETCCH            GET CURRENT INPUT CHARACTER
3634   B913 27 43              BEQ   LB958              BRANCH IF END OF LINE
3635   B915 BD B2 6D           JSR   LB26D              SYNTAX CHECK FOR COMMA
3636   B918 BD Ø1 79     LB918 JSR   RVEC9              HOOK INTO RAM
3637   B91B 27 48        LB91B BEQ   LB965              RETURN IF END OF LINE
3638   B91D 81 A4        LB91D CMPA  #$A4               TOKEN FOR TAB( ?
3639   B91F 27 5D              BEQ   LB97E              YES
3640   B921 81 2C              CMPA  #',                COMMA?
3641   B923 27 41              BEQ   LB966              YES - ADVANCE TO NEXT TAB FIELD
3642   B925 81 3B              CMPA  #';                SEMICOLON?
3643   B927 27 6E              BEQ   LB997              YES - DO NOT ADVANCE CURSOR
3644   B929 BD B1 56           JSR   LB156              EVALUATE EXPRESSION
3645   B92C 96 Ø6              LDA   VALTYP             * GET VARIABLE TYPE AND
3646   B92E 34 Ø2              PSHS  A                  * SAVE IT ON THE STACK
3647   B93Ø 26 Ø6              BNE   LB938              BRANCH IF STRING VARIABLE
3648   B932 BD BD D9           JSR   LBDD9              CONVERT FP NUMBER TO AN ASCII STRING
3649   B935 BD B5 16           JSR   LB516              PARSE A STRING FROM (X-1) AND PUT
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3650                            *                                       DESCRIPTOR ON STRING STACK
3651   B938 8D 65               LB938   BSR   LB99F                     PRINT STRING POINTED TO BY X
3652   B93A 35 04                       PULS  B                         GET VARIABLE TYPE BACK
3653   B93C BD A3 5F                    JSR   LA35F                     SET UP TAB WIDTH ZONE, ETC
3654   B93F 0D 6E                       TST   PRTDEV                    * CHECK THE PRINT DEVICE
3655   B941 27 06                       BEQ   LB949                     * AND BRANCH IF NOT CASSETTE
3656   B943 8D 13                       BSR   LB958                     SEND A CARRIAGE RETURN TO CONSOLE OUT
3657   B945 9D A5                       JSR   GETCCH                    GET CURRENT INPUT CHARACTER
3658   B947 20 D2                       BRA   LB91B                     CHECK FOR MORE PRINT DATA
3659   B949 5D                  LB949   TSTB                            CHECK CURRENT PRINT POSITION
3660   B94A 26 08                       BNE   LB954                     BRANCH IF NOT AT START OF LINE
3661   B94C 9D A5                       JSR   GETCCH                    GET CURRENT INPUT CHARACTER
3662   B94E 81 2C                       CMPA  #',                       COMMA?
3663   B950 27 14                       BEQ   LB966                     SKIP TO NEXT TAB FIELD
3664   B952 8D 58                       BSR   LB9AC                     SEND A SPACE TO CONSOLE OUT
3665   B954 9D A5               LB954   JSR   GETCCH                    GET CURRENT INPUT CHARACTER
3666   B956 26 C5                       BNE   LB91D                     BRANCH IF NOT END OF LINE
3667   B958 86 0D               LB958   LDA   #CR                       * SEND A CR TO
3668   B95A 20 55                       BRA   LB9B1                     * CONSOLE OUT
3669   B95C BD A3 5F            LB95C   JSR   LA35F                     SET UP TAB WIDTH, ZONE ETC
3670   B95F 27 F7                       BEQ   LB958                     BRANCH IF WIDTH = ZERO
3671   B961 96 6C                       LDA   DEVPOS                    GET PRINT POSITION
3672   B963 26 F3                       BNE   LB958                     BRANCH IF NOT AT START OF LINE
3673   B965 39                  LB965   RTS
3674                            * SKIP TO NEXT TAB FIELD
3675   B966 BD A3 5F            LB966   JSR   LA35F                     SET UP TAB WIDTH, ZONE ETC
3676   B969 27 0A                       BEQ   LB975                     BRANCH IF LINE WIDTH = 0 (CASSETTE)
3677   B96B D6 6C                       LDB   DEVPOS                    GET CURRENT POSITION
3678   B96D D1 6B                       CMPB  DEVLCF                    COMPARE TO LAST TAB ZONE
3679   B96F 25 06                       BCS   LB977                     BRANCH IF < LAST TAB ZONE
3680   B971 8D E5                       BSR   LB958                     SEND A CARRIAGE RETURN TO CONSOLE OUT
3681   B973 20 22                       BRA   LB997                     GET MORE DATA
3682   B975 D6 6C               LB975   LDB   DEVPOS                    *
3683   B977 D0 6A               LB977   SUBB  DEVCFW                    * SUBTRACT TAB FIELD WIDTH FROM CURRENT
3684   B979 24 FC                       BCC   LB977                     * POSITION UNTIL CARRY SET - NEGATING THE
3685   B97B 50                          NEGB                            * REMAINDER LEAVES THE NUMBER OF SPACES TO NEXT
3686                            *                                       * TAB ZONE IN ACCB
3687   B97C 20 10                       BRA   LB98E                     GO ADVANCE TO NEXT TAB ZONE
3688
3689                            * PRINT TAB(
3690   B97E BD B7 09            LB97E   JSR   LB709                     EVALUATE EXPRESSION - RETURN VALUE IN B
3691   B981 81 29                       CMPA  #')                       * 'SYNTAX' ERROR IF NOT ')'
3692   B983 10 26 F8 F0                 LBNE  LB277                     *
3693   B987 BD A3 5F                    JSR   LA35F                     SET UP TAB WIDTH, ZONE ETC
3694   B98A D0 6C                       SUBB  DEVPOS                    GET DIFFERENCE OF PRINT POSITION & TAB POSITION
3695   B98C 23 09                       BLS   LB997                     BRANCH IF TAB POSITION < CURRENT POSITION
3696   B98E 0D 6E               LB98E   TST   PRTDEV                    * GET PRINT DEVICE NUMBER AND
3697   B990 26 05                       BNE   LB997                     * BRANCH IF CASSETTE
3698   B992 8D 18               LB992   BSR   LB9AC                     SEND A SPACE TO CONSOLE OUT
3699   B994 5A                          DECB                            DECREMENT DIFFERENCE COUNT
3700   B995 26 FB                       BNE   LB992                     BRANCH UNTIL CURRENT POSITION = TAB POSITION
3701   B997 9D 9F               LB997   JSR   GETNCH                    GET NEXT CHARACTER FROM BASIC
3702   B999 7E B9 1B                    JMP   LB91B                     LOOK FOR MORE PRINT DATA
3703                            * COPY A STRING FROM (X) TO CONSOLE OUT
3704   B99C BD B5 18            LB99C   JSR   LB518                     PARSE A STRING FROM X AND PUT
3705                            *                                       DESCRIPTOR ON STRING STACK
3706   B99F BD B6 57            LB99F   JSR   LB657                     GET LENGTH OF STRING AND REMOVE
3707                            *                                       DESCRIPTOR FROM STRING STACK
3708   B9A2 5C                          INCB                            COMPENSATE FOR DECB BELOW
3709   B9A3 5A                  LB9A3   DECB                            DECREMENT COUNTER
3710   B9A4 27 BF                       BEQ   LB965                     EXIT ROUTINE
3711   B9A6 A6 80                       LDA   ,X+                       GET A CHARACTER FROM X
3712   B9A8 8D 07                       BSR   LB9B1                     SEND TO CONSOLE OUT
3713   B9AA 20 F7                       BRA   LB9A3                     KEEP LOOPING
3714   B9AC 86 20               LB9AC   LDA   #SPACE                    SPACE TO CONSOLE OUT
3715   B9AE 8C                          FCB   SKP2                      SKIP NEXT TWO BYTES
3716   B9AF 86 3F               LB9AF   LDA   #'?                       QUESTION MARK TO CONSOLE OUT
3717   B9B1 7E A2 82            LB9B1   JMP   PUTCHR                    JUMP TO CONSOLE OUT
3718
3719                            * FLOATING POINT MATH PACKAGE
3720
3721                            * ADD .5 TO FPA0
3722   B9B4 8E BE C0            LB9B4   LDX   #LBEC0                    FLOATING POINT CONSTANT (.5)
3723   B9B7 20 09                       BRA   LB9C2                     ADD .5 TO FPA0
3724                            * SUBTRACT FPA0 FROM FP NUMBER POINTED
3725                            * TO BY (X), LEAVE RESULT IN FPA0
3726   B9B9 BD BB 2F            LB9B9   JSR   LBB2F                     COPY PACKED FP DATA FROM (X) TO FPA1
3727
3728                            * ARITHMETIC OPERATION (-) JUMPS HERE - SUBTRACT FPA0 FROM FPA1 (ENTER
3729                            * WITH EXPONENT OF FPA0 IN ACCB AND EXPONENT OF FPA1 IN ACCA)
3730   B9BC 03 54               LB9BC   COM   FP0SGN                    CHANGE MANTISSA SIGN OF FPA0
3731   B9BE 03 62                       COM   RESSGN                    REVERSE RESULT SIGN FLAG
3732   B9C0 20 03                       BRA   LB9C5                     GO ADD FPA1 AND FPA0
3733                            * ADD FP NUMBER POINTED TO BY
3734                            * (X) TO FPA0 - LEAVE RESULT IN FPA0
3735   B9C2 BD BB 2F            LB9C2   JSR   LBB2F                     UNPACK PACKED FP DATA FROM (X) TO
3736                            *                                       FPA1; RETURN EXPONENT OF FPA1 IN ACCA
3737
3738                            * ARITHMETIC OPERATION (+) JUMPS HERE - ADD FPA0 TO
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3739                            * FPA1 (ENTER WITH EXPONENT OF FPAØ IN ACCB AND EXPONENT OF FPA1 IN ACCA
3740   B9C5 5D                  LB9C5   TSTB                            CHECK EXPONENT OF FPAØ
3741   B9C6 1Ø 27 Ø2 8Ø                 LBEQ   LBC4A                    COPY FPA1 TO FPAØ IF FPAØ =  Ø
3742   B9CA 8E ØØ 5C                    LDX    #FP1EXP                  POINT X TO FPA1
3743   B9CD 1F 89               LB9CD   TFR    A,B                      PUT EXPONENT OF FPA1 INTO ACCB
3744   B9CF 5D                          TSTB                            CHECK EXPONENT
3745   B9DØ 27 6C                       BEQ    LBA3E                    RETURN IF EXPONENT = Ø (ADDING Ø TO FPAØ)
3746   B9D2 DØ 4F                       SUBB   FPØEXP                   SUBTRACT EXPONENT OF FPAØ FROM EXPONENT OF FPA1
3747   B9D4 27 69                       BEQ    LBA3F                    BRANCH IF EXPONENTS ARE EQUAL
3748   B9D6 25 ØA                       BCS    LB9E2                    BRANCH IF EXPONENT FPAØ > FPA1
3749   B9D8 97 4F                       STA    FPØEXP                   REPLACE FPAØ EXPONENT WITH FPA1 EXPONENT
3750   B9DA 96 61                       LDA    FP1SGN                   * REPLACE FPAØ MANTISSA SIGN
3751   B9DC 97 54                       STA    FPØSGN                   * WITH FPA1 MANTISSA SIGN
3752   B9DE 8E ØØ 4F                    LDX    #FPØEXP                  POINT X TO FPAØ
3753   B9E1 5Ø                          NEGB                            NEGATE DIFFERENCE OF EXPONENTS
3754   B9E2 C1 F8               LB9E2   CMPB   #-8                      TEST DIFFERENCE OF EXPONENTS
3755   B9E4 2F 59                       BLE    LBA3F                    BRANCH IF DIFFERENCE OF EXPONENTS <= 8
3756   B9E6 4F                          CLRA                            CLEAR OVERFLOW BYTE
3757   B9E7 64 Ø1                       LSR    1,X                      SHIFT MS BYTE OF MANTISSA; BIT 7 = Ø
3758   B9E9 BD BA BA                    JSR    LBABA                    GO SHIFT MANTISSA OF (X) TO THE RIGHT (B) TIMES
3759   B9EC D6 62               LB9EC   LDB    RESSGN                   GET SIGN FLAG
3760   B9EE 2A ØB                       BPL    LB9FB                    BRANCH IF FPAØ AND FPA1 SIGNS ARE THE SAME
3761   B9FØ 63 Ø1                       COM    1,X                      * COMPLEMENT MANTISSA POINTED
3762   B9F2 63 Ø2                       COM    2,X                      * TO BY (X) THE
3763   B9F4 63 Ø3                       COM    3,X                      * ADCA BELOW WILL
3764   B9F6 63 Ø4                       COM    4,X                      * CONVERT THIS OPERATION
3765   B9F8 43                          COMA                            * INTO A NEG (MANTISSA)
3766   B9F9 89 ØØ                       ADCA   #Ø                       ADD ONE TO ACCA - COMA ALWAYS SETS THE CARRY FLAG
3767                           * THE PREVIOUS TWO BYTES MAY BE REPLACED BY A NEGA
3768                           *
3769                           * ADD MANTISSAS OF FPAØ AND FPA1, PUT RESULT IN FPAØ
3770   B9FB 97 63               LB9FB   STA    FPSBYT                   SAVE FPA SUB BYTE
3771   B9FD 96 53                       LDA    FPAØ+3                   * ADD LS BYTE
3772   B9FF 99 6Ø                       ADCA   FPA1+3                   * OF MANTISSA
3773   BAØ1 97 53                       STA    FPAØ+3                   SAVE IN FPAØ LSB
3774   BAØ3 96 52                       LDA    FPAØ+2                   * ADD NEXT BYTE
3775   BAØ5 99 5F                       ADCA   FPA1+2                   * OF MANTISSA
3776   BAØ7 97 52                       STA    FPAØ+2                   SAVE IN FPAØ
3777   BAØ9 96 51                       LDA    FPAØ+1                   * ADD NEXT BYTE
3778   BAØB 99 5E                       ADCA   FPA1+1                   * OF MANTISSA
3779   BAØD 97 51                       STA    FPAØ+1                   SAVE IN FPAØ
3780   BAØF 96 5Ø                       LDA    FPAØ                     * ADD MS BYTE
3781   BA11 99 5D                       ADCA   FPA1                     * OF MANTISSA
3782   BA13 97 5Ø                       STA    FPAØ                     SAVE IN FPAØ
3783   BA15 5D                          TSTB                            TEST SIGN FLAG
3784   BA16 2A 44                       BPL    LBA5C                    BRANCH IF FPAØ & FPA1 SIGNS WERE ALIKE
3785   BA18 25 Ø2               LBA18   BCS    LBA1C                    BRANCH IF POSITIVE MANTISSA
3786   BA1A 8D 5D                       BSR    LBA79                    NEGATE FPAØ MANTISSA
3787
3788                           * NORMALIZE FPAØ
3789   BA1C 5F                  LBA1C   CLRB                            CLEAR TEMPORARY EXPONENT ACCUMULATOR
3790   BA1D 96 5Ø               LBA1D   LDA    FPAØ                     TEST MSB OF MANTISSA
3791   BA1F 26 2E                       BNE    LBA4F                    BRANCH IF <> Ø
3792   BA21 96 51                       LDA    FPAØ+1                   * IF THE MSB IS
3793   BA23 97 5Ø                       STA    FPAØ                     * Ø, THEN SHIFT THE
3794   BA25 96 52                       LDA    FPAØ+2                   * MANTISSA A WHOLE BYTE
3795   BA27 97 51                       STA    FPAØ+1                   * AT A TIME. THIS
3796   BA29 96 53                       LDA    FPAØ+3                   * IS FASTER THAN ONE
3797   BA2B 97 52                       STA    FPAØ+2                   * BIT AT A TIME
3798   BA2D 96 63                       LDA    FPSBYT                   * BUT USES MORE MEMORY.
3799   BA2F 97 53                       STA    FPAØ+3                   * FPSBYT, THE CARRY IN
3800   BA31 ØF 63                       CLR    FPSBYT                   * BYTE, REPLACES THE MATISSA LSB.
3801   BA33 CB Ø8                       ADDB   #8                       SHIFTING ONE BYTE = 8 BIT SHIFTS; ADD 8 TO EXPONENT
3802   BA35 C1 28                       CMPB   #5*8                     CHECK FOR 5 SHIFTS
3803   BA37 2D E4                       BLT    LBA1D                    BRANCH IF < 5 SHIFTS, IF > 5, THEN MANTISSA = Ø
3804   BA39 4F                  LBA39   CLRA                            A ZERO EXPONENT = Ø FLOATING POINT
3805   BA3A 97 4F               LBA3A   STA    FPØEXP                   ZERO OUT THE EXPONENT
3806   BA3C 97 54                       STA    FPØSGN                   ZERO OUT THE MANTISSA SIGN
3807   BA3E 39                  LBA3E   RTS
3808   BA3F 8D 6D               LBA3F   BSR    LBAAE                    SHIFT FPAØ MANTISSA TO RIGHT
3809   BA41 5F                          CLRB                            CLEAR CARRY FLAG
3810   BA42 2Ø A8                       BRA    LB9EC
3811                           * SHIFT FPAØ LEFT ONE BIT UNTIL BIT 7
3812                           * OF MATISSA MS BYTE = 1
3813   BA44 5C                  LBA44   INCB                            ADD ONE TO EXPONENT ACCUMULATOR
3814   BA45 Ø8 63                       ASL    FPSBYT                   SHIFT SUB BYTE ONE LEFT
3815   BA47 Ø9 53                       ROL    FPAØ+3                   SHIFT LS BYTE
3816   BA49 Ø9 52                       ROL    FPAØ+2                   SHIFT NS BYTE
3817   BA4B Ø9 51                       ROL    FPAØ+1                   SHIFT NS BYTE
3818   BA4D Ø9 5Ø                       ROL    FPAØ                     SHIFT MS BYTE
3819   BA4F 2A F3               LBA4F   BPL    LBA44                    BRANCH IF NOT YET NORMALIZED
3820   BA51 96 4F                       LDA    FPØEXP                   GET CURRENT EXPONENT
3821   BA53 34 Ø4                       PSHS   B                        SAVE EXPONENT MODIFIER CAUSED BY NORMALIZATION
3822   BA55 AØ E0                       SUBA   ,S+                      SUBTRACT ACCUMULATED EXPONENT MODIFIER
3823   BA57 97 4F                       STA    FPØEXP                   SAVE AS NEW EXPONENT
3824   BA59 23 DE                       BLS    LBA39                    SET FPAØ = Ø IF THE NORMALIZATION CAUSED
3825                           *                                       MORE OR EQUAL NUMBER OF LEFT SHIFTS THAN THE
3826                           *                                       SIZE OF THE EXPONENT
3827   BA5B 8C                          FCB    SKP2                     SKIP 2 BYTES
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3828   BA5C 25 08          BA5C    BCS   LBA66                  BRANCH IF MANTISSA OVERFLOW
3829   BA5E 08 63                  ASL   FPSBYT                 SUB BYTE BIT 7 TO CARRY - USE AS ROUND-OFF
3830                       *                                    FLAG (TRUNCATE THE REST OF SUB BYTE)
3831   BA60 86 00                  LDA   #0                     CLRA, BUT DO NOT CHANGE CARRY FLAG
3832   BA62 97 63                  STA   FPSBYT                 CLEAR THE SUB BYTE
3833   BA64 20 0C                  BRA   LBA72                  GO ROUND-OFF RESULT
3834   BA66 0C 4F          LBA66   INC   FP0EXP                 INCREMENT EXPONENT - MULTIPLY BY 2
3835   BA68 27 28                  BEQ   LBA92                  OVERFLOW ERROR IF CARRY PAST $FF
3836   BA6A 06 50                  ROR   FPA0                   * SHIFT MANTISSA
3837   BA6C 06 51                  ROR   FPA0+1                 * ONE TO
3838   BA6E 06 52                  ROR   FPA0+2                 * THE RIGHT -
3839   BA70 06 53                  ROR   FPA0+3                 * DIVIDE BY TWO
3840   BA72 24 04          LBA72   BCC   LBA78                  BRANCH IF NO ROUND-OFF NEEDED
3841   BA74 8D 0D                  BSR   LBA83                  ADD ONE TO MANTISSA - ROUND OFF
3842   BA76 27 EE                  BEQ   LBA66                  BRANCH iF OVERFLOW - MANTISSA = 0
3843   BA78 39             LBA78   RTS
3844                       * NEGATE FPA0 MANTISSA
3845   BA79 03 54          LBA79   COM   FP0SGN                 TOGGLE SIGN OF MANTISSA
3846   BA7B 03 50          LBA7B   COM   FPA0                   * COMPLEMENT ALL 4 MANTISSA BYTES
3847   BA7D 03 51                  COM   FPA0+1                 *
3848   BA7F 03 52                  COM   FPA0+2                 *
3849   BA81 03 53                  COM   FPA0+3                 *
3850                       * ADD ONE TO FPA0 MANTISSA
3851   BA83 9E 52          LBA83   LDX   FPA0+2                 * GET BOTTOM 2 MANTISSA
3852   BA85 30 01                  LEAX  1,X                    * BYTES, ADD ONE TO
3853   BA87 9F 52                  STX   FPA0+2                 * THEM AND SAVE THEM
3854   BA89 26 06                  BNE   LBA91                  BRANCH IF NO OVERFLOW
3855   BA8B 9E 50                  LDX   FPA0                   * IF OVERFLOW ADD ONE
3856   BA8D 30 01                  LEAX  1,X                    * TO TOP 2 MANTISSA
3857   BA8F 9F 50                  STX   FPA0                   * BYTES AND SAVE THEM
3858   BA91 39             LBA91   RTS
3859   BA92 C6 0A          LBA92   LDB   #2*5                   'OV' OVERFLOW ERROR
3860   BA94 7E AC 46               JMP   LAC46                  PROCESS AN ERROR
3861   BA97 8E 00 12       LBA97   LDX   #FPA2-1                POINT X TO FPA2
3862                       * SHIFT FPA POINTED TO BY (X) TO
3863                       * THE RIGHT -(B) TIMES. EXIT WITH
3864                       * ACCA CONTAINING DATA SHIFTED OUT
3865                       * TO THE RIGHT (SUB BYTE) AND THE DATA
3866                       * SHIFTED IN FROM THE LEFT WILL COME FROM FPCARY
3867   BA9A A6 04          LBA9A   LDA   4,X                    GET LS BYTE OF MANTISSA (X)
3868   BA9C 97 63                  STA   FPSBYT                 SAVE IN FPA SUB BYTE
3869   BA9E A6 03                  LDA   3,X                    * SHIFT THE NEXT THREE BYTES OF THE
3870   BAA0 A7 04                  STA   4,X                    * MANTISSA RIGHT ONE COMPLETE BYTE.
3871   BAA2 A6 02                  LDA   2,X                    *
3872   BAA4 A7 03                  STA   3,X                    *
3873   BAA6 A6 01                  LDA   1,X                    *
3874   BAA8 A7 02                  STA   2,X                    *
3875   BAAA 96 5B                  LDA   FPCARY                 GET THE CARRY IN BYTE
3876   BAAC A7 01                  STA   1,X                    STORE AS THE MS MANTISSA BYTE OF (X)
3877   BAAE CB 08          LBAAE   ADDB  #8                     ADD 8 TO DIFFERENCE OF EXPONENTS
3878   BAB0 2F E8                  BLE   LBA9A                  BRANCH IF EXPONENT DIFFERENCE < -8
3879   BAB2 96 63                  LDA   FPSBYT                 GET FPA SUB BYTE
3880   BAB4 C0 08                  SUBB  #8                     CAST OUT THE 8 ADDED IN ABOVE
3881   BAB6 27 0C                  BEQ   LBAC4                  BRANCH IF EXPONENT DIFFERENCE = 0
3882                       * SHIFT MANTISSA POINTED TO BY (X) TO
3883                       $ THE RIGHT (B) TIMES. OVERFLOW RETAINED IN ACCA.
3884   BAB8 67 01          LBAB8   ASR   1,X                    * SHIFT MANTISSA AND SUB BYTE ONE BIT TO THE RIGHT
3885   BABA 66 02          LBABA   ROR   2,X                    *
3886   BABC 66 03                  ROR   3,X                    *
3887   BABE 66 04                  ROR   4,X                    *
3888   BAC0 46                     RORA                         *
3889   BAC1 5C                     INCB                         ADD ONE TO EXPONENT DIFFERENCE
3890   BAC2 26 F4                  BNE   LBAB8                  BRANCH IF EXPONENTS NOT =
3891   BAC4 39             LBAC4   RTS
3892   BAC5 81 00 00 00 00 LBAC5   FCB   $81,$00,$00,$00,$00     FLOATING POINT CONSTANT 1.0
3893
3894                       * ARITHMETIC OPERATION (*) JUMPS HERE - MULTIPLY
3895                       * FPA0 BY (X) - RETURN PRODUCT IN FPA0
3896   BACA 8D 63          LBACA   BSR   LBB2F                  MOVE PACKED FPA FROM (X) TO FPA1
3897   BACC 27 60                  BEQ   LBB2E                  BRANCH IF EXPONENT OF FPA0 = 0
3898   BACE 8D 78                  BSR   LBB48                  CALCULATE EXPONENT OF PRODUCT
3899                       * MULTIPLY FPA0 MANTISSA BY FPA1. NORMALIZE
3900                       * HIGH ORDER BYTES OF PRODUCT IN FPA0. THE
3901                       * LOW ORDER FOUR BYTES OF THE PRODUCT WILL
3902                       * BE STORED IN VAB-VAE.
3903   BAD0 86 00          LBAD0   LDA   #0                     * ZERO OUT MANTISSA OF FPA2
3904   BAD2 97 13                  STA   FPA2                   *
3905   BAD4 97 14                  STA   FPA2+1                 *
3906   BAD6 97 15                  STA   FPA2+2                 *
3907   BAD8 97 16                  STA   FPA2+3                 *
3908   BADA D6 53                  LDB   FPA0+3                 GET LS BYTE OF FPA0
3909   BADC 8D 22                  BSR   LBB00                  MULTIPLY BY FPA1
3910   BADE D6 63                  LDB   FPSBYT                 * TEMPORARILY SAVE SUB BYTE 4
3911   BAE0 D7 AE                  STB   VAE                    *
3912   BAE2 D6 52                  LDB   FPA0+2                 GET NUMBER 3 MANTISSA BYTE OF FPA0
3913   BAE4 8D 1A                  BSR   LBB00                  MULTIPLY BY FPA1
3914   BAE6 D6 63                  LDB   FPSBYT                 * TEMPORARILY SAVE SUB BYTE 3
3915   BAE8 D7 AD                  STB   VAD                    *
3916   BAEA D6 51                  LDB   FPA0+1                 GET NUMBER 2 MANTISSA BYTE OF FPA0
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3917   BAEC 8D 12                 BSR   LBB00                MULTIPLY BY FPA1
3918   BAEE D6 63                 LDB   FPSBYT               * TEMPORARILY SAVE SUB BYTE 2
3919   BAF0 D7 AC                 STB   VAC                  *
3920   BAF2 D6 50                 LDB   FPA0                 GET MS BYTE OF FPA0 MANTISSA
3921   BAF4 8D 0C                 BSR   LBB02                MULTIPLY BY FPA1
3922   BAF6 D6 63                 LDB   FPSBYT               * TEMPORARILY SAVE SUB BYTE 1
3923   BAF8 D7 AB                 STB   VAB                  *
3924   BAFA BD BC 0B              JSR   LBC0B                COPY MANTISSA FROM FPA2 TO FPA0
3925   BAFD 7E BA 1C              JMP   LBA1C                NORMALIZE FPA0
3926   BB00 27 95          LBB00  BEQ   LBA97                SHIFT FPA2 ONE BYTE TO RIGHT
3927   BB02 43             LBB02  COMA                       SET CARRY FLAG
3928                       * MULTIPLY FPA1 MANTISSA BY ACCB AND
3929                       * ADD PRODUCT TO FPA2 MANTISSA
3930   BB03 96 13          LBB03  LDA   FPA2                 GET FPA2 MS BYTE
3931   BB05 56                    RORB                       ROTATE CARRY FLAG INTO SHIFT COUNTER;
3932                       *                                 DATA BIT INTO CARRY
3933   BB06 27 26                 BEQ   LBB2E                BRANCH WHEN 8 SHIFTS DONE
3934   BB08 24 16                 BCC   LBB20                DO NOT ADD FPA1 IF DATA BIT = 0
3935   BB0A 96 16                 LDA   FPA2+3               * ADD MANTISSA LS BYTE
3936   BB0C 9B 60                 ADDA  FPA1+3               *
3937   BB0E 97 16                 STA   FPA2+3               *
3938   BB10 96 15                 LDA   FPA2+2               = ADD MANTISSA NUMBER 3 BYTE
3939   BB12 99 5F                 ADCA  FPA1+2               =
3940   BB14 97 15                 STA   FPA2+2               =
3941   BB16 96 14                 LDA   FPA2+1               * ADD MANTISSA NUMBER 2 BYTE
3942   BB18 99 5E                 ADCA  FPA1+1               *
3943   BB1A 97 14                 STA   FPA2+1               *
3944   BB1C 96 13                 LDA   FPA2                 = ADD MANTISSA MS BYTE
3945   BB1E 99 5D                 ADCA  FPA1                 =
3946   BB20 46             LBB20  RORA                       * ROTATE CARRY INTO MS BYTE
3947   BB21 97 13                 STA   FPA2                 *
3948   BB23 06 14                 ROR   FPA2+1               = ROTATE FPA2 ONE BIT TO THE RIGHT
3949   BB25 06 15                 ROR   FPA2+2               =
3950   BB27 06 16                 ROR   FPA2+3               =
3951   BB29 06 63                 ROR   FPSBYT               =
3952   BB2B 4F                    CLRA                       CLEAR CARRY FLAG
3953   BB2C 20 D5                 BRA   LBB03                KEEP LOOPING
3954   BB2E 39             LBB2E  RTS
3955                       * UNPACK A FP NUMBER FROM (X) TO FPA1
3956   BB2F EC 01          LBB2F  LDD   1,X                  GET TWO MSB BYTES OF MANTISSA FROM
3957                                                         FPA POINTED TO BY X
3958   BB31 97 61                 STA   FP1SGN               SAVE PACKED MANTISSA SIGN BYTE
3959   BB33 8A 80                 ORA   #$80                 FORCE BIT 7 OF MSB MANTISSA = 1
3960   BB35 DD 5D                 STD   FPA1                 SAVE 2 MSB BYTES IN FPA1
3961   BB37 D6 61                 LDB   FP1SGN               * GET PACKED MANTISSA SIGN BYTE. EOR W/FPA0
3962   BB39 D8 54                 EORB  FP0SGN               * SIGN - NEW SIGN POSITION IF BOTH OLD SIGNS ALIKE,
3963   BB3B D7 62                 STB   RESSGN               * NEG IF BOTH OLD SIGNS DIFF. SAVE ADJUSTED
3964                       *                                 * MANTISSA SIGN BYTE
3965   BB3D EC 03                 LDD   3,X                  = GET 2 LSB BYTES OF MANTISSA
3966   BB3F DD 5F                 STD   FPA1+2               = AND PUT IN FPA1
3967   BB41 A6 84                 LDA   ,X                   * GET EXPONENT FROM (X) AND
3968   BB43 97 5C                 STA   FP1EXP               * PUT IN EXPONENT OF FPA1
3969   BB45 D6 4F                 LDB   FP0EXP               GET EXPONENT OF FPA0
3970   BB47 39                    RTS
3971                       * CALCULATE EXPONENT FOR PRODUCT OF FPA0 & FPA1
3972                       * ENTER WITH EXPONENT OF FPA1 IN ACCA
3973   BB48 4D             LBB48  TSTA                       TEST EXPONENT OF FPA1
3974   BB49 27 16                 BEQ   LBB61                PURGE RETURN ADDRESS & SET FPA0 = 0
3975   BB4B 9B 4F                 ADDA  FP0EXP               ADD FPA1 EXPONENT TO FPA0 EXPONENT
3976   BB4D 46                    RORA                       ROTATE CARRY INTO BIT 7; BIT 0 INTO CARRY
3977   BB4E 49                    ROLA                       SET OVERFLOW FLAG
3978   BB4F 28 10                 BVC   LBB61                BRANCH IF EXPONENT TOO LARGE OR SMALL
3979   BB51 8B 80                 ADDA  #$80                 ADD $80 BIAS TO EXPONENT
3980   BB53 97 4F                 STA   FP0EXP               SAVE NEW EXPONENT
3981   BB55 27 0C                 BEQ   LBB63                SET FPA0
3982   BB57 96 62                 LDA   RESSGN               GET MANTISSA SIGN
3983   BB59 97 54                 STA   FP0SGN               SAVE AS MANTISSA SIGN OF FPA0
3984   BB5B 39                    RTS
3985                       * IF FPA0 = POSITIVE THEN 'OV' ERROR IF FPA0
3986                       * = IS NEGATIVE THEN FPA0 = 0
3987   BB5C 96 54          LBB5C  LDA   FP0SGN               GET MANTISSA SIGN OF FPA0
3988   BB5E 43                    COMA                       CHANGE SIGN OF FPA0 MANTISSA
3989   BB5F 20 02                 BRA   LBB63
3990   BB61 32 62          LBB61  LEAS  2,S                  PURGE RETURN ADDRESS FROM STACK
3991   BB63 10 2A FE D2    LBB63  LBPL  LBA39                ZERO FPA0 MANTISSA SIGN & EXPONENT
3992   BB67 7E BA 92       LBB67  JMP   LBA92                'OV' OVERFLOW ERROR
3993                       * FAST MULTIPLY BY 10 AND LEAVE RESULT IN FPA0
3994   BB6A BD BC 5F       LBB6A  JSR   LBC5F                TRANSFER FPA0 TO FPA1
3995   BB6D 27 0D                 BEQ   LBB7C                BRANCH IF EXPONENT = 0
3996   BB6F 8B 02                 ADDA  #2                   ADD 2 TO EXPONENT (TIMES 4)
3997   BB71 25 F4                 BCS   LBB67                'OV' ERROR IF EXPONENT > $FF
3998   BB73 0F 62                 CLR   RESSGN               CLEAR RESULT SIGN BYTE
3999   BB75 BD B9 CD              JSR   LB9CD                ADD FPA1 TO FPA0 (TIMES 5)
4000   BB78 0C 4F                 INC   FP0EXP               ADD ONE TO EXPONENT (TIMES 10)
4001   BB7A 27 EB                 BEQ   LBB67                'OV' ERROR IF EXPONENT > $FF
4002   BB7C 39             LBB7C  RTS
4003   BB7D 84 20 00 00 00 LBB7D  FCB   $84,$20,$00,$00,$00   FLOATING POINT CONSTANT 10
4004                       * DIVIDE FPA0 BY 10
4005   BB82 BD BC 5F       LBB82  JSR   LBC5F                MOVE FPA0 TO FPA1
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4006   BB85 8E BB 7D                LDX   #LBB7D                   POINT TO FLOATING POINT CONSTANT 1Ø
4007   BB88 5F                      CLRB                           ZERO MANTISSA SIGN BYTE
4008   BB89 D7 62            LBB89  STB   RESSGN                   STORE THE QUOTIENT MANTISSA SIGN BYTE
4009   BB8B BD BC 14                JSR   LBC14                    UNPACK AN FP NUMBER FROM (X) INTO FPAØ
4010   BB8E 8C                      FCB   SKP2                     SKIP TWO BYTES
4011                         * DIVIDE (X) BY FPAØ-LEAVE NORMALIZED QUOTIENT IN FPAØ
4012   BB8F 8D 9E            LBB8F  BSR   LBB2F                    GET FP NUMBER FROM (X) TO FPA1
4013
4014                         * ARITHMETIC OPERATION (/) JUMPS HERE. DIVIDE FPA1 BY FPAØ (ENTER WITH
4015                         * EXPONENT OF FPA1 IN ACCA AND FLAGS SET BY TSTA)
4016
4017                         * DIVIDE FPA1 BY FPAØ
4018   BB91 27 73            LBB91  BEQ   LBC06                    '/Ø' DIVIDE BY ZERO ERROR
4019   BB93 ØØ 4F                   NEG   FPØEXP                   GET EXPONENT OF RECIPROCAL OF DIVISOR
4020   BB95 8D B1                   BSR   LBB48                    CALCULATE EXPONENT OF QUOTIENT
4021   BB97 ØC 4F                   INC   FPØEXP                   INCREMENT EXPONENT
4022   BB99 27 CC                   BEQ   LBB67                    'OV' OVERFLOW ERROR
4023   BB9B 8E ØØ 13                LDX   #FPA2                    POINT X TO MANTISSA OF FPA2 - HOLD
4024                         *                                     TEMPORARY QUOTIENT IN FPA2
4025   BB9E C6 Ø4                   LDB   #4                       5 BYTE DIVIDE
4026   BBAØ D7 Ø3                   STB   TMPLOC                   SAVE BYTE COUNTER
4027   BBA2 C6 Ø1                   LDB   #1                       SHIFT COUNTER-AND TEMPORARY QUOTIENT BYTE
4028                         * COMPARE FPAØ MANTISSA TO FPA1 MANTISSA -
4029                         * SET CARRY FLAG IF FPA1 >= FPAØ
4030   BBA4 96 5Ø            LBBA4  LDA   FPAØ                     * COMPARE THE TWO MS BYTES
4031   BBA6 91 5D                   CMPA  FPA1                     * OF FPAØ AND FPA1 AND
4032   BBA8 26 13                   BNE   LBBBD                    * BRANCH IF <>
4033   BBAA 96 51                   LDA   FPAØ+1                   = COMPARE THE NUMBER 2
4034   BBAC 91 5E                   CMPA  FPA1+1                   = BYTES AND
4035   BBAE 26 ØD                   BNE   LBBBD                    = BRANCH IF <>
4036   BBBØ 96 52                   LDA   FPAØ+2                   * COMPARE THE NUMBER 3
4037   BBB2 91 5F                   CMPA  FPA1+2                   * BYTES AND
4038   BBB4 26 Ø7                   BNE   LBBBD                    * BRANCH IF <>
4039   BBB6 96 53                   LDA   FPAØ+3                   = COMPARE THE LS BYTES
4040   BBB8 91 6Ø                   CMPA  FPA1+3                   = AND BRANCH
4041   BBBA 26 Ø1                   BNE   LBBBD                    = IF <>
4042   BBBC 43                      COMA                           SET CARRY FLAG IF FPAØ = FPA1
4043   BBBD 1F A8            LBBBD  TFR   CC,A                     SAVE CARRY FLAG STATUS IN ACCA; CARRY
4044                         *                                     CLEAR IF FPAØ > FPA1
4045   BBBF 59                      ROLB                           ROTATE CARRY INTO TEMPORARY QUOTIENT BYTE
4046   BBCØ 24 ØA                   BCC   LBBCC                    CARRY WILL BE SET AFTER 8 SHIFTS
4047   BBC2 E7 8Ø                   STB   ,X+                      SAVE TEMPORARY QUOTIENT
4048   BBC4 ØA Ø3                   DEC   TMPLOC                   DECREMENT BYTE COUNTER
4049   BBC6 2B 34                   BMI   LBBFC                    BRANCH IF DONE
4050   BBC8 27 2E                   BEQ   LBBF8                    BRANCH IF LAST BYTE
4051   BBCA C6 Ø1                   LDB   #1                       RESET SHIFT COUNTER AND TEMPORARY QUOTIENT BYTE
4052   BBCC 1F 8A            LBBCC  TFR   A,CC                     RESTORE CARRY FLAG AND
4053   BBCE 25 ØE                   BCS   LBBDE                    BRANCH IF FPAØ =< FPA1
4054   BBDØ Ø8 6Ø            LBBDØ  ASL   FPA1+3                   * SHIFT FPA1 MANTISSA 1 BIT TO LEFT
4055   BBD2 Ø9 5F                   ROL   FPA1+2                   *
4056   BBD4 Ø9 5E                   ROL   FPA1+1                   *
4057   BBD6 Ø9 5D                   ROL   FPA1                     *
4058   BBD8 25 E3                   BCS   LBBBD                    BRANCH IF CARRY - ADD ONE TO PARTIAL QUOTIENT
4059   BBDA 2B C8                   BMI   LBBA4                    IF MSB OF HIGH ORDER MANTISSA BYTE IS
4060                         *                                     SET, CHECK THE MAGNITUDES OF FPAØ, FPA1
4061   BBDC 2Ø DF                   BRA   LBBBD                    CARRY IS CLEAR, CHECK ANOTHER BIT
4062                         * SUBTRACT FPAØ FROM FPA1 - LEAVE RESULT IN FPA1
4063   BBDE 96 6Ø            LBBDE  LDA   FPA1+3                   * SUBTRACT THE LS BYTES OF MANTISSA
4064   BBEØ 9Ø 53                   SUBA  FPAØ+3                   *
4065   BBE2 97 6Ø                   STA   FPA1+3                   *
4066   BBE4 96 5F                   LDA   FPA1+2                   = THEN THE NEXT BYTE
4067   BBE6 92 52                   SBCA  FPAØ+2                   =
4068   BBE8 97 5F                   STA   FPA1+2                   =
4069   BBEA 96 5E                   LDA   FPA1+1                   * AND THE NEXT
4070   BBEC 92 51                   SBCA  FPAØ+1                   *
4071   BBEE 97 5E                   STA   FPA1+1                   *
4072   BBFØ 96 5D                   LDA   FPA1                     = AND FINALLY, THE MS BYTE OF MANTISSA
4073   BBF2 92 5Ø                   SBCA  FPAØ                     =
4074   BBF4 97 5D                   STA   FPA1                     =
4075   BBF6 2Ø D8                   BRA   LBBDØ                    GO SHIFT FPA1
4076   BBF8 C6 4Ø            LBBF8  LDB   #$4Ø                     USE ONLY TWO BITS OF THE LAST BYTE (FIFTH)
4077   BBFA 2Ø DØ                   BRA   LBBCC                    GO SHIFT THE LAST BYTE
4078   BBFC 56               LBBFC  RORB                           * SHIFT CARRY (ALWAYS SET HERE) INTO
4079   BBFD 56                      RORB                           * BIT 5 AND MOVE
4080   BBFE 56                      RORB                           * BITS 1,Ø TO BITS 7,6
4081   BBFF D7 63                   STB   FPSBYT                   SAVE SUB BYTE
4082   BCØ1 8D Ø8                   BSR   LBCØB                    MOVE MANTISSA OF FPA2 TO FPAØ
4083   BCØ3 7E BA 1C                JMP   LBA1C                    NORMALIZE FPAØ
4084   BCØ6 C6 14            LBCØ6  LDB   #2*1Ø                    '/Ø' ERROR
4085   BCØ8 7E AC 46                JMP   LAC46                    PROCESS THE ERROR
4086                         * COPY MANTISSA FROM FPA2 TO FPAØ
4087   BCØB 9E 13            LBCØB  LDX   FPA2                     * MOVE TOP 2 BYTES
4088   BCØD 9F 5Ø                   STX   FPAØ                     *
4089   BCØF 9E 15                   LDX   FPA2+2                   = MOVE BOTTOM 2 BYTES
4090   BC11 9F 52                   STX   FPAØ+2                   =
4091   BC13 39                      RTS
4092                         * COPY A PACKED FP NUMBER FROM (X) TO FPAØ
4093   BC14 34 Ø2            LBC14  PSHS  A                        SAVE ACCA
4094   BC16 EC Ø1                   LDD   1,X                      GET TOP TWO MANTISSA BYTES
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4095   BC18 97 54                STA   FPØSGN                  SAVE MS BYTE OF MANTISSA AS MANTISSA SIGN
4096   BC1A 8A 80                ORA   #$80                    UNPACK MS BYTE
4097   BC1C DD 50                STD   FPA0                    SAVE UNPACKED TOP 2 MANTISSA BYTES
4098   BC1E 0F 63                CLR   FPSBYT                  CLEAR MANTISSA SUB BYTE
4099   BC20 E6 84                LDB   ,X                      GET EXPONENT TO ACCB
4100   BC22 AE 03                LDX   3,X                     * MOVE LAST 2
4101   BC24 9F 52                STX   FPA0+2                  * MANTISSA BYTES
4102   BC26 D7 4F                STB   FPØEXP                  SAVE EXPONENT
4103   BC28 35 82                PULS  A,PC                    RESTORE ACCA AND RETURN
4104
4105   BC2A 8E 00 45          LBC2A  LDX   #V45                  POINT X TO MANTISSA OF FPA4
4106   BC2D 20 06                BRA   LBC35                   MOVE FPA0 TO FPA4
4107   BC2F 8E 00 40          LBC2F  LDX   #V40                  POINT X TO MANTISSA OF FPA3
4108   BC32 8C                   FCB   SKP2                    SKIP TWO BYTES
4109   BC33 9E 3B             LBC33  LDX   VARDES                POINT X TO VARIABLE DESCRIPTOR IN VARDES
4110                          * PACK FPA0 AND MOVE IT TO ADDRESS IN X
4111   BC35 96 4F             LBC35  LDA   FPØEXP                * COPY EXPONENT
4112   BC37 A7 84                STA   ,X                      *
4113   BC39 96 54                LDA   FPØSGN                  GET MANTISSA SIGN BIT
4114   BC3B 8A 7F                ORA   #$7F                    MASK THE BOTTOM 7 BITS
4115   BC3D 94 50                ANDA  FPA0                    AND BIT 7 OF MANTISSA SIGN INTO BIT 7 OF MS BYTE
4116   BC3F A7 01                STA   1,X                     SAVE MS BYTE
4117   BC41 96 51                LDA   FPA0+1                  * MOVE 2ND MANTISSA BYTE
4118   BC43 A7 02                STA   2,X                     *
4119   BC45 DE 52                LDU   FPA0+2                  = MOVE BOTTOM 2 MANTISSA BYTES
4120   BC47 EF 03                STU   3,X                     =
4121   BC49 39                   RTS
4122                          * MOVE FPA1 TO FPA0 RETURN W/MANTISSA SIGN IN ACCA
4123   BC4A 96 61             LBC4A  LDA   FP1SGN                * COPY MANTISSA SIGN FROM
4124   BC4C 97 54             LBC4C  STA   FPØSGN                * FPA1 TO FPA0
4125   BC4E 9E 5C                LDX   FP1EXP                  = COPY EXPONENT + MS BYTE FROM
4126   BC50 9F 4F                STX   FPØEXP                  = FPA1 TO FPA0
4127   BC52 0F 63                CLR   FPSBYT                  CLEAR MANTISSA SUB BYTE
4128   BC54 96 5E                LDA   FPA1+1                  * COPY 2ND MANTISSA BYTE
4129   BC56 97 51                STA   FPA0+1                  * FROM FPA1 TO FPA0
4130   BC58 96 54                LDA   FPØSGN                  GET MANTISSA SIGN
4131   BC5A 9E 5F                LDX   FPA1+2                  * COPY 3RD AND 4TH MANTISSA BYTE
4132   BC5C 9F 52                STX   FPA0+2                  * FROM FPA1 TO FPA0
4133   BC5E 39                   RTS
4134                          * TRANSFER FPA0 TO FPA1
4135   BC5F DC 4F             LBC5F  LDD   FPØEXP                * TRANSFER EXPONENT & MS BYTE
4136   BC61 DD 5C                STD   FP1EXP                  *
4137   BC63 9E 51                LDX   FPA0+1                  = TRANSFER MIDDLE TWO BYTES
4138   BC65 9F 5E                STX   FPA1+1                  =
4139   BC67 9E 53                LDX   FPA0+3                  * TRANSFER BOTTOM TWO BYTES
4140   BC69 9F 60                STX   FPA1+3                  *
4141   BC6B 4D                   TSTA                          SET FLAGS ACCORDING TO EXPONENT
4142   BC6C 39                   RTS
4143                          * CHECK FPA0; RETURN ACCB = 0 IF FPA0 = 0,
4144                          * ACCB = $FF IF FPA0 = NEGATIVE, ACCB = 1 IF FPA0 = POSITIVE
4145   BC6D D6 4F             LBC6D  LDB   FPØEXP                GET EXPONENT
4146   BC6F 27 08                BEQ   LBC79                   BRANCH IF FPA0 = 0
4147   BC71 D6 54             LBC71  LDB   FPØSGN                GET SIGN OF MANTISSA
4148   BC73 59                LBC73  ROLB                        BIT 7 TO CARRY
4149   BC74 C6 FF                LDB   #$FF                    NEGATIVE FLAG
4150   BC76 25 01                BCS   LBC79                   BRANCH IF NEGATIVE MANTISSA
4151   BC78 50                   NEGB                          ACCB = 1 IF POSITIVE MANTISSA
4152   BC79 39                LBC79  RTS
4153
4154                          * SGN
4155   BC7A 8D F1             SGN    BSR   LBC6D                SET ACCB ACCORDING TO SIGN OF FPA0
4156                          * CONVERT A SIGNED NUMBER IN ACCB INTO A FLOATING POINT NUMBER
4157   BC7C D7 50             LBC7C  STB   FPA0                  SAVE ACCB IN FPA0
4158   BC7E 0F 51                CLR   FPA0+1                  CLEAR NUMBER 2 MANTISSA BYTE OF FPA0
4159   BC80 C6 88                LDB   #$88                    EXPONENT REQUIRED IF FPA0 IS TO BE AN INTEGER
4160   BC82 96 50             LBC82  LDA   FPA0                  GET MS BYTE OF MANTISSA
4161   BC84 80 80                SUBA  #$80                    SET CARRY IF POSITIVE MANTISSA
4162   BC86 D7 4F             LBC86  STB   FPØEXP                SAVE EXPONENT
4163   BC88 DC 8A                LDD   ZERO                    * ZERO OUT ACCD AND
4164   BC8A DD 52                STD   FPA0+2                  * BOTTOM HALF OF FPA0
4165   BC8C 97 63                STA   FPSBYT                  CLEAR SUB BYTE
4166   BC8E 97 54                STA   FPØSGN                  CLEAR SIGN OF FPA0 MANTISSA
4167   BC90 7E BA 18             JMP   LBA18                   GO NORMALIZE FPA0
4168
4169                          * ABS
4170   BC93 0F 54             ABS    CLR   FPØSGN               FORCE MANTISSA SIGN OF FPA0 POSITIVE
4171   BC95 39                   RTS
4172                          * COMPARE A PACKED FLOATING POINT NUMBER POINTED TO
4173                          * BY (X) TO AN UNPACKED FP NUMBER IN FPA0. RETURN
4174                          * ZERO FLAG SET AND ACCB = 0, IF EQUAL; ACCB = 1 IF
4175                          * FPA0 > (X); ACCB = $FF IF FPA0 < (X)
4176   BC96 E6 84             LBC96  LDB   ,X                    CHECK EXPONENT OF (X)
4177   BC98 27 D3                BEQ   LBC6D                   BRANCH IF FPA = 0
4178   BC9A E6 01                LDB   1,X                     GET MS BYTE OF MANTISSA OF (X)
4179   BC9C D8 54                EORB  FPØSGN                  EOR WITH SIGN OF FPA0
4180   BC9E 2B D1                BMI   LBC71                   BRANCH IF SIGNS NOT =
4181                          * COMPARE FPA0 WITH FP NUMBER POINTED TO BY (X).
4182                          * FPA0 IS NORMALIZED, (X) IS PACKED.
4183   BCA0 D6 4F             LBCA0  LDB   FPØEXP                * GET EXPONENT OF
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4184   BCA2 E1 84                    CMPB  ,X                     * FPAØ, COMPARE TO EXPONENT OF
4185   BCA4 26 1D                    BNE   LBCC3                   * (X) AND BRANCH IF <>.
4186   BCA6 E6 Ø1                    LDB   1,X                     * GET MS BYTE OF (X), KEEP ONLY
4187   BCA8 CA 7F                    ORB   #$7F                    * THE SIGN BIT - 'AND' THE BOTTOM 7
4188   BCAA D4 5Ø                    ANDB  FPAØ                    * BITS OF FPAØ INTO ACCB
4189   BCAC E1 Ø1                    CMPB  1,X                     = COMPARE THE BOTTOM 7 BITS OF THE MANTISSA
4190   BCAE 26 13                    BNE   LBCC3                   = MS BYTE AND BRANCH IF <>
4191   BCBØ D6 51                    LDB   FPAØ+1                  * COMPARE 2ND BYTE
4192   BCB2 E1 Ø2                    CMPB  2,X                     * OF MANTISSA,
4193   BCB4 26 ØD                    BNE   LBCC3                   * BRANCH IF <>
4194   BCB6 D6 52                    LDB   FPAØ+2                  = COMPARE 3RD BYTE
4195   BCB8 E1 Ø3                    CMPB  3,X                     = OF MANTISSA,
4196   BCBA 26 Ø7                    BNE   LBCC3                   = BRANCH IF <>
4197   BCBC D6 53                    LDB   FPAØ+3                  * SUBTRACT LS BYTE
4198   BCBE EØ Ø4                    SUBB  4,X                     * OF (X) FROM LS BYTE OF
4199   BCCØ 26 Ø1                    BNE   LBCC3                   * FPAØ, BRANCH IF <>
4200   BCC2 39                       RTS                             RETURN IF FP (X) = FPAØ
4201   BCC3 56               LBCC3   RORB                          SHIFT CARRY TO BIT 7; CARRY SET IF FPAØ < (X)
4202   BCC4 D8 54                    EORB  FPØSGN                  TOGGLE SIZE COMPARISON BIT IF FPAØ IS NEGATIVE
4203   BCC6 2Ø AB                    BRA   LBC73                   GO SET ACCB ACCORDING TO COMPARISON
4204                         * DE-NORMALIZE FPAØ : SHIFT THE MANTISSA UNTIL THE BINARY POINT IS TO THE RIGHT
4205                         * OF THE LEAST SIGNIFICANT BYTE OF THE MANTISSA
4206   BCC8 D6 4F            LBCC8   LDB   FPØEXP                  GET EXPONENT OF FPAØ
4207   BCCA 27 3D                    BEQ   LBD09                   ZERO MANTISSA IF FPAØ = Ø
4208   BCCC CØ A0                    SUBB  #$A0                    SUBTRACT $A0 FROM FPAØ EXPONENT T THIS WILL YIELD
4209                         *                                    THE NUMBER OF SHIFTS REQUIRED TO DENORMALIZE FPAØ. WHEN
4210                         *                                    THE EXPONENT OF FPAØ IS = ZERO, THEN THE BINARY POINT
4211                         *                                    WILL BE TO THE RIGHT OF THE MANTISSA
4212   BCCE 96 54                    LDA   FPØSGN                  TEST SIGN OF FPAØ MANTISSA
4213   BCDØ 2A Ø5                    BPL   LBCD7                   BRANCH IF POSITIVE
4214   BCD2 Ø3 5B                    COM   FPCARY                  COMPLEMENT CARRY IN BYTE
4215   BCD4 BD BA 7B                 JSR   LBA7B                   NEGATE MANTISSA OF FPAØ
4216   BCD7 8E ØØ 4F         LBCD7   LDX   #FPØEXP                 POINT X TO FPAØ
4217   BCDA C1 F8                    CMPB  #-8                     EXPONENT DIFFERENCE < -8?
4218   BCDC 2E Ø6                    BGT   LBCE4                   YES
4219   BCDE BD BA AE                 JSR   LBAAE                   SHIFT FPAØ RIGHT UNTIL FPAØ EXPONENT = $AØ
4220   BCE1 ØF 5B                    CLR   FPCARY                  CLEAR CARRY IN BYTE
4221   BCE3 39                       RTS
4222   BCE4 ØF 5B            LBCE4   CLR   FPCARY                  CLEAR CARRY IN BYTE
4223   BCE6 96 54                    LDA   FPØSGN                  * GET SIGN OF FPAØ MANTISSA
4224   BCE8 49                       ROLA                          * ROTATE IT INTO THE CARRY FLAG
4225   BCE9 Ø6 5Ø                    ROR   FPAØ                    ROTATE CARRY (MANTISSA SIGN) INTO BIT 7
4226                         *                                    OF LS BYTE OF MANTISSA
4227   BCEB 7E BA BA                 JMP   LBABA                   DE-NORMALIZE FPAØ
4228
4229                         * INT
4230                         * THE INT STATEMENT WILL "DENORMALIZE" FPAØ - THAT IS IT WILL SHIFT THE BINARY POINT
4231                         * TO THE EXTREME RIGHT OF THE MANTISSA TO FORCE ITS EXPONENT TO BE $AO. ONCE
4232                         * THIS IS DONE THE MANTISSA OF FPAØ WILL CONTAIN THE FOUR LEAST SIGNIFICANT
4233                         * BYTES OF THE INTEGER PORTION OF FPAØ. AT THE CONCLUSION OF THE DE-NORMALIZATION
4234                         * ONLY THE INTEGER PORTION OF FPAØ WILL REMAIN.
4235                         *
4236   BCEE D6 4F            INT     LDB   FPØEXP                  GET EXPONENT OF FPAØ
4237   BCFØ C1 A0                    CMPB  #$A0                    LARGEST POSSIBLE INTEGER EXPONENT
4238   BCF2 24 1D                    BCC   LBD11                   RETURN IF FPAØ >= 32768
4239   BCF4 8D D2                    BSR   LBCC8                   SHIFT THE BINARY POINT ONE TO THE RIGHT OF THE
4240                         *                                    LS BYTE OF THE FPAØ MANTISSA
4241   BCF6 D7 63                    STB   FPSBYT                  ACCB = Ø: ZERO OUT THE SUB BYTE
4242   BCF8 96 54                    LDA   FPØSGN                  GET MANTISSA SIGN
4243   BCFA D7 54                    STB   FPØSGN                  FORCE MANTISSA SIGN TO BE POSITIVE
4244   BCFC 8Ø 8Ø                    SUBA  #$8Ø                    SET CARRY IF MANTISSA
4245   BCFE 86 A0                    LDA   #$A0                    * GET DENORMALIZED EXPONENT AND
4246   BDØØ 97 4F                    STA   FPØEXP                  * SAVE IT IN FPAØ EXPONENT
4247   BDØ2 96 53                    LDA   FPAØ+3                  = GET LS BYTE OF FPAØ AND
4248   BDØ4 97 Ø1                    STA   CHARAC                  = SAVE IT IN CHARAC
4249   BDØ6 7E BA 18                 JMP   LBA18                   NORMALIZE FPAØ
4250
4251   BDØ9 D7 5Ø            LBDØ9   STB   FPAØ                    * LOAD MANTISSA OF FPAØ WITH CONTENTS OF ACCB
4252   BDØB D7 51                    STB   FPAØ+1                  *
4253   BDØD D7 52                    STB   FPAØ+2                  *
4254   BDØF D7 53                    STB   FPAØ+3                  *
4255   BD11 39               LBD11   RTS                           *
4256
4257                         * CONVERT ASCII STRING TO FLOATING POINT
4258   BD12 9E 8A            LBD12   LDX   ZERO                    (X) = Ø
4259   BD14 9F 54                    STX   FPØSGN                  * ZERO OUT FPAØ & THE SIGN FLAG (COEFCT)
4260   BD16 9F 4F                    STX   FPØEXP                  *
4261   BD18 9F 51                    STX   FPAØ+1                  *
4262   BD1A 9F 52                    STX   FPAØ+2                  *
4263   BD1C 9F 47                    STX   V47                     INITIALIZE EXPONENT & EXPONENT SIGN FLAG TO ZERO
4264   BD1E 9F 45                    STX   V45                     INITIALIZE RIGHT DECIMAL CTR & DECIMAL PT FLAG TO Ø
4265   BD2Ø 25 64                    BCS   LBD86                   IF CARRY SET (NUMERIC CHARACTER), ASSUME ACCA CONTAINS FIRST
4266                         *                                    NUMERIC CHAR, SIGN IS POSITIVE AND SKIP THE RAM HOOK
4267   BD22 BD Ø1 97                 JSR   RVEC19                  HOOK INTO RAM
4268   BD25 81 2D                    CMPA  #'-                     * CHECK FOR A LEADING MINUS SIGN AND BRANCH
4269   BD27 26 Ø4                    BNE   LBD2D                   * IF NO MINUS SIGN
4270   BD29 Ø3 55                    COM   COEFCT                  TOGGLE SIGN; Ø = +; FF = -
4271   BD2B 2Ø Ø4                    BRA   LBD31                   INTERPRET THE REST OF THE STRING
4272   BD2D 81 2B            LBD2D   CMPA  #'+                     * CHECK FOR LEADING PLUS SIGN AND BRANCH
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4273   BD2F 26 04              BNE   LBD35                 * IF NOT A PLUS SIGN
4274   BD31 9D 9F        LBD31 JSR   GETNCH                GET NEXT INPUT CHARACTER FROM BASIC
4275   BD33 25 51              BCS   LBD86                 BRANCH IF NUMERIC CHARACTER
4276   BD35 81 2E        LBD35 CMPA  #'.                   DECIMAL PO1NT?
4277   BD37 27 28              BEQ   LBD61                 YES
4278   BD39 81 45              CMPA  #'E                   "E" SHORTHAND FORM (SCIENTIFIC NOTATION)?
4279   BD3B 26 28              BNE   LBD65                 NO
4280                     * EVALUATE EXPONENT OF EXPONENTIAL FORMAT
4281   BD3D 9D 9F              JSR   GETNCH                GET NEXT INPUT CHARACTER FROM BASIC
4282   BD3F 25 64              BCS   LBDA5                 BRANCH IF NUMERIC
4283   BD41 81 AC              CMPA  #$AC                  MINUS TOKEN?
4284   BD43 27 0E              BEQ   LBD53                 YES
4285   BD45 81 2D              CMPA  #'-                   ASCII MINUS?
4286   BD47 27 0A              BEQ   LBD53                 YES
4287   BD49 81 AB              CMPA  #$AB                  PLUS TOKEN?
4288   BD4B 27 08              BEQ   LBD55                 YES
4289   BD4D 81 2B              CMPA  #'+                   ASCII PLUS?
4290   BD4F 27 04              BEQ   LBD55                 YES
4291   BD51 20 06              BRA   LBD59                 BRANCH IF NO SIGN FOUND
4292   BD53 03 48        LBD53 COM   V48                   SET EXPONENT SIGN FLAG TO NEGATIVE
4293                     * STRIP A DECIMAL NUMBER FROM BASIC LINE, CONVERT IT TO BINARY IN V47
4294   BD55 9D 9F        LBD55 JSR   GETNCH                GET NEXT INPUT CHARACTER FROM BASIC
4295   BD57 25 4C              BCS   LBDA5                 IF NUMERIC CHARACTER, CONVERT TO BINARY
4296   BD59 0D 48        LBD59 TST   V48                   * CHECK EXPONENT SIGN FLAG
4297   BD5B 27 08              BEQ   LBD65                 * AND BRANCH IF POSITIVE
4298   BD5D 00 47              NEG   V47                   NEGATE VALUE OF EXPONENT
4299   BD5F 20 04              BRA   LBD65
4300   BD61 03 46        LBD61 COM   V46                   *TOGGLE DECIMAL PT FLAG AND INTERPRET ANOTHER
4301   BD63 26 CC              BNE   LBD31                 *CHARACTER IF <> 0 - TERMINATE INTERPRETATION
4302                     *                                 IF SECOND DECIMAL POINT
4303                     * ADJUST FPA0 FOR THE DECIMAL EXPONENT IN V47
4304   BD65 96 47        LBD65 LDA   V47                   * GET EXPONENT, SUBTRACT THE NUMBER OF
4305   BD67 90 45              SUBA  V45                   * PLACES TO THE RIGHT OF DECIMAL POINT
4306   BD69 97 47              STA   V47                   * AND RESAVE IT.
4307   BD6B 27 12              BEQ   LBD7F                 EXIT ROUTINE IF ADJUSTED EXPONENT = ZERO
4308   BD6D 2A 09              BPL   LBD78                 BRANCH IF POSITIVE EXPONENT
4309   BD6F BD BB 82     LBD6F JSR   LBB82                 DIVIDE FPA0 BY 10
4310   BD72 0C 47              INC   V47                   INCREMENT EXPONENT COUNTER (MULTIPLY BY 10)
4311   BD74 26 F9              BNE   LBD6F                 KEEP MULTIPLYING
4312   BD76 20 07              BRA   LBD7F                 EXIT ROUTINE
4313   BD78 BD BB 6A     LBD78 JSR   LBB6A                 MULTIPLY FPA0 BY 10
4314   BD7B 0A 47              DEC   V47                   DECREMENT EXPONENT COUNTER (DIVIDE BY 10)
4315   BD7D 26 F9              BNE   LBD78                 KEEP MULTIPLYING
4316   BD7F 96 55        LBD7F LDA   COEFCT                GET THE SIGN FLAG
4317   BD81 2A 8E              BPL   LBD11                 RETURN IF POSITIVE
4318   BD83 7E BE E9           JMP   LBEE9                 TOGGLE MANTISSA SIGN OF FPA0, IF NEGATIVE
4319                     *MULTIPLY FPA0 BY TEN AND ADD ACCA TO THE RESULT
4320   BD86 D6 45        LBD86 LDB   V45                   *GET THE RIGHT DECIMAL COUNTER AND SUBTRACT
4321   BD88 D0 46              SUBB  V46                   *THE DECIMAL POINT FLAG FROM IT. IF DECIMAL POINT
4322   BD8A D7 45              STB   V45                   *FLAG=0, NOTHING HAPPENS. IF DECIMAL POINT FLAG IS
4323                     *                                 -1, THEN RIGHT DECIMAL COUNTER IS INCREMENTED BY ONE
4324   BD8C 34 02              PSHS  A                     SAVE NEW DIGIT ON STACK
4325   BD8E BD BB 6A           JSR   LBB6A                 MULTIPLY FPA0 BY 10
4326   BD91 35 04              PULS  B                     GET NEW DIGIT BACK
4327   BD93 C0 30              SUBB  #'0                   MASK OFF ASCII
4328   BD95 8D 02              BSR   LBD99                 ADD ACCB TO FPA0
4329   BD97 20 98              BRA   LBD31                 GET ANOTHER CHARACTER FROM BASIC
4330   BD99 BD BC 2F     LBD99 JSR   LBC2F                 PACK FPA0 AND SAVE IT IN FPA3
4331   BD9C BD BC 7C           JSR   LBC7C                 CONVERT ACCB TO FP NUMBER IN FPA0
4332   BD9F 8E 00 40           LDX   #V40                  * ADD FPA0 TO
4333   BDA2 7E B9 C2           JMP   LB9C2                 * FPA3
4334                     * MULTIPLY V47 BY 10 AND ADD TO ASCII NUMBER IN
4335                     * ACCA - SAVE BINARY RESULT IN V47
4336   BDA5 D6 47        LBDA5 LDB   V47
4337   BDA7 58                 ASLB                        TIMES 2
4338   BDA8 58                 ASLB                        TIMES 4
4339   BDA9 DB 47              ADDB  V47                   ADD 1 = TIMES 5
4340   BDAB 58                 ASLB                        TIMES 10
4341   BDAC 80 30              SUBA  #'0                   *MASK OFF ASCII FROM ACCA, PUSH
4342   BDAE 34 04              PSHS  B                     *RESULT ONTO THE STACK AND
4343   BDB0 AB E0              ADDA  ,S+                   ADD 1T TO ACCB
4344   BDB2 97 47              STA   V47                   SAVE IN V47
4345   BDB4 20 9F              BRA   LBD55                 INTERPRET ANOTHER CHARACTER
4346                     *
4347   BDB6 9B 3E BC 1F FD LBDB6 FCB   $9B,$3E,$BC,$1F,$FD  * 99999999.9
4348   BDBB 9E 6E 6B 27 FD LBDBB FCB   $9E,$6E,$6B,$27,$FD  * 999999999
4349   BDC0 9E 6E 6B 28 00 LBDC0 FCB   $9E,$6E,$6B,$28,$00  * 1E + 09
4350                     *
4351   BDC5 8E AB E7     LBDC5 LDX   #LABE8-1              POINT X TO " IN " MESSAGE
4352   BDC8 8D 0C              BSR   LBDD6                 COPY A STRING FROM (X) TO CONSOLE OUT
4353   BDCA DC 68              LDD   CURLIN                GET CURRENT BASIC LINE NUMBER TO ACCD
4354                     * CONVERT VALUE IN ACCD INTO A DECIMAL NUMBER
4355                     * AND PRINT IT TO CONSOLE OUT
4356   BDCC DD 50        LBDCC STD   FPA0                  SAVE ACCD IN TOP HALF OF FPA0
4357   BDCE C6 90              LDB   #$90                  REQ D EXPONENT IF TOP HALF OF ACCD = INTEGER
4358   BDD0 43                 COMA                        SET CARRY FLAG - FORCE POSITIVE MANTISSA
4359   BDD1 BD BC 86           JSR   LBC86                 ZERO BOTTOM HALF AND SIGN OF FPA0, THEN
4360                     *                                 SAVE EXPONENT AND NORMALIZE IT
4361   BDD4 8D 03              BSR   LBDD9                 CONVERT FP NUMBER TO ASCII STRING
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4362   BDD6 7E B9 9C          LBDD6   JMP   LB99C                    COPY A STRING FROM (X) TO CONSOLE OUT
4363
4364                          * CONVERT FP NUMBER TO ASCII STRING
4365   BDD9 CE Ø3 DA          LBDD9   LDU   #STRBUF+3                 POINT U TO BUFFER WHICH WILL NOT CAUSE
4366                          *                                       THE STRING TO BE STORED IN STRING SPACE
4367   BDDC 86 2Ø             LBDDC   LDA   #SPACE                    SPACE = DEFAULT SIGN FOR POSITIVE #
4368   BDDE D6 54                     LDB   FPØSGN                    GET SIGN OF FPAØ
4369   BDEØ 2A Ø2                     BPL   LBDE4                     BRANCH IF POSITIVE
4370   BDE2 86 2D                     LDA   #'-                       ASCII MINUS SIGN
4371   BDE4 A7 CØ             LBDE4   STA   ,U+                       STORE SIGN OF NUMBER
4372   BDE6 DF 64                     STU   COEFPT                    SAVE BUFFER POINTER
4373   BDE8 97 54                     STA   FPØSGN                    SAVE SIGN (IN ASCII)
4374   BDEA 86 3Ø                     LDA   #'Ø                       ASCII ZERO IF EXPONENT = Ø
4375   BDEC D6 4F                     LDB   FPØEXP                    GET FPAØ EXPONENT
4376   BDEE 1Ø 27 ØØ C6               LBEQ  LBEB8                     BRANCH IF FPAØ = Ø
4377   BDF2 4F                        CLRA                            BASE 1Ø EXPONENT=Ø FOR FP NUMBER > 1
4378   BDF3 C1 8Ø                     CMPB  #$8Ø                      CHECK EXPONENT
4379   BDF5 22 Ø8                     BHI   LBDFF                     BRANCH IF FP NUMBER > 1
4380                          * IF FPAØ < 1.Ø, MULTIPLY IT BY 1E+Ø9 TO SPEED UP THE CONVERSION PROCESS
4381   BDF7 8E BD CØ                  LDX   #LBDCØ                    POINT X TO FP 1E+Ø9
4382   BDFA BD BA CA                  JSR   LBACA                     MULTIPLY FPAØ BY (X)
4383   BDFD 86 F7                     LDA   #-9                       BASE 1Ø EXPONENT = -9
4384   BDFF 97 45             LBDFF   STA   V45                       BASE 1Ø EXPONENT
4385                          * PSEUDO - NORMALIZE THE FP NUMBER TO A VALUE IN THE RANGE
4386                          * OF 999,999,999 RO 99,999,999.9 - THIS IS THE LARGEST
4387                          * NUMBER RANGE IN WHICH ALL OF THE DIGITS ARE
4388                          * SIGNIFICANT WHICH CAN BE DISPLAYED WITHOUT USING
4389                          * SCIENTIFIC NOTATION
4390   BEØ1 8E BD BB          LBEØ1   LDX   #LBDBB                    POINT X TO FP 999,999,999
4391   BEØ4 BD BC AØ                  JSR   LBCAØ                     COMPARE FPAØ TO 999,999,999
4392   BEØ7 2E ØF                     BGT   LBE18                     BRANCH IF > 999,999,999
4393   BEØ9 8E BD B6          LBEØ9   LDX   #LBDB6                    POINT X TO FP 99,999,999.9
4394   BEØC BD BC AØ                  JSR   LBCAØ                     COMPARE FPAØ TO 99,999,999.9
4395   BEØF 2E ØE                     BGT   LBE1F                     BRANCH IF > 99,999,999.9 (IN RANGE)
4396   BE11 BD BB 6A                  JSR   LBB6A                     MULTIPLY FPAØ BY 1Ø
4397   BE14 ØA 45                     DEC   V45                       SUBTRACT ONE FROM DECIMAL OFFSET
4398   BE16 2Ø F1                     BRA   LBEØ9                     PSEUDO - NORMALIZE SOME MORE
4399   BE18 BD BB 82          LBE18   JSR   LBB82                     DIVIDE FPAØ BY 1Ø
4400   BE1B ØC 45                     INC   V45                       ADD ONE TO BASE 1Ø EXPONENT
4401   BE1D 2Ø E2                     BRA   LBEØ1                     PSEUDO - NORMALIZE SOME MORE
4402   BE1F BD B9 B4          LBE1F   JSR   LB9B4                     ADD .5 TO FPAØ (ROUND OFF)
4403   BE22 BD BC C8                  JSR   LBCC8                     CONVERT FPAØ TO AN INTEGER
4404   BE25 C6 Ø1                     LDB   #1                        DEFAULT DECIMAL POINT FLAG (FORCE IMMED DECIMAL PT)
4405   BE27 96 45                     LDA   V45                       * GET BASE 1Ø EXPONENT AND ADD TEN TO IT
4406   BE29 8B ØA                     ADDA  #9+1                      * (NUMBER  NORMALIZED  TO 9 PLACES & DECIMAL PT)
4407   BE2B 2B Ø9                     BMI   LBE36                     BRANCH IF NUMBER < 1.Ø
4408   BE2D 81 ØB                     CMPA  #9+2                      NINE PLACES MAY BE DISPLAYED WITHOUT
4409                          *                                       USING SCIENTIFIC NOTATION
4410   BE2F 24 Ø5                     BCC   LBE36                     BRANCH IF SCIENTIFIC NOTATION REQUIRED
4411   BE31 4A                        DECA                            * SUBTRACT 1 FROM MODIFIED BASE 1Ø EXPONENT CTR
4412   BE32 1F 89                     TFR   A,B                       * AND SAVE IT IN ACCB (DECiMAL POINT FLAG)
4413   BE34 86 Ø2                     LDA   #2                        FORCE EXPONENT = Ø - DON'T USE SCIENTIFIC NOTATION
4414   BE36 4A                LBE36   DECA                            * SUBTRACT TWO (WITHOUT AFFECTING CARRY)
4415   BE37 4A                        DECA                            * FROM BASE 1Ø EXPONENT
4416   BE38 97 47                     STA   V47                       SAVE EXPONENT - ZERO EXPONENT = DO NOT DISPLAY
4417                          *                                       IN SCIENTIFIC NOTATION
4418   BE3A D7 45                     STB   V45                       DECIMAL POINT FLAG - NUMBER OF PLACES TO
4419                          *                                       LEFT OF DECIMAL POINT
4420   BE3C 2E ØD                     BGT   LBE4B                     BRANCH IF >= 1
4421   BE3E DE 64                     LDU   COEFPT                    POINT U TO THE STRING BUFFER
4422   BE4Ø 86 2E                     LDA   #'.                       * STORE A PERIOD
4423   BE42 A7 CØ                     STA   ,U+                       * IN THE BUFFER
4424   BE44 5D                        TSTB                            CHECK DECIMAL POINT FLAG
4425   BE45 27 Ø4                     BEQ   LBE4B                     BRANCH IF NOTHING TO LEFT OF DECIMAL POINT
4426   BE47 86 3Ø                     LDA   #'Ø                       * STORE A ZERO
4427   BE49 A7 CØ                     STA   ,U+                       * IN THE BUFFER
4428
4429                          * CONVERT FPAØ INTO A STRING OF ASCII DIGITS
4430   BE4B 8E BE C5          LBE4B   LDX   #LBEC5                    POINT X TO FP POWER OF 1Ø MANTISSA
4431   BE4E C6 8Ø                     LDB   #Ø+$8Ø                    INITIALIZE DIGIT COUNTER TO Ø+$8Ø
4432                          * BIT 7 SET IS USED TO INDICATE THAT THE POWER OF 1Ø MANTISSA
4433                          * IS NEGATIVE. WHEN YOU 'ADD' A NEGATIVE MANTISSA, IT IS
4434                          * THE SAME AS SUBTRACTING A POSITIVE ONE AND BIT 7 OF ACCB IS HOW
4435                          * THE ROUTINE KNOWS THAT A 'SUBTRACTION' IS OCCURING.
4436   BE5Ø 96 53             LBE5Ø   LDA   FPAØ+3                    * ADD MANTISSA LS
4437   BE52 AB Ø3                     ADDA  3,X                       * BYTE OF FPAØ
4438   BE54 97 53                     STA   FPAØ+3                    * AND (X)
4439   BE56 96 52                     LDA   FPAØ+2                    = ADD MANTISSA
4440   BE58 A9 Ø2                     ADCA  2,X                       = NUMBER 3 BYTE OF
4441   BE5A 97 52                     STA   FPAØ+2                    = FPAØ AND (X)
4442   BE5C 96 51                     LDA   FPAØ+1                    * ADD MANTISSA
4443   BE5E A9 Ø1                     ADCA  1,X                       * NUMBER 2 BYTE OF
4444   BE6Ø 97 51                     STA   FPAØ+1                    * FPAØ AND (X)
4445   BE62 96 5Ø                     LDA   FPAØ                      = ADD MANTISSA
4446   BE64 A9 84                     ADCA  ,X                        = MS BYTE OF
4447   BE66 97 5Ø                     STA   FPAØ                      = FPAØ AND (X)
4448   BE68 5C                        INCB                            ADD ONE TO DIGIT COUNTER
4449   BE69 56                        RORB                            ROTATE CARRY INTO BIT 7
4450   BE6A 59                        ROLB                            *SET OVERFLOW FLAG AND BRANCH IF CARRY = 1 AND
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4451   BE6B 28 E3                 BVC   LBE5Ø                *POSITIVE MANTISSA OR CARRY = Ø AND NEG MANTISSA
4452   BE6D 24 Ø3                 BCC   LBE72                BRANCH IF NEGATIVE MANTISSA
4453   BE6F CØ ØB                 SUBB  #1Ø+1                * TAKE THE 9 S COMPLEMENT IF
4454   BE71 5Ø                    NEGB                       * ADDING MANTISSA
4455   BE72 CB 2F           LBE72 ADDB  #'Ø-1                ADD ASCII OFFSET TO DIGIT
4456   BE74 3Ø Ø4                 LEAX  4,X                  MOVE TO NEXT POWER OF 1Ø MANTISSA
4457   BE76 1F 98                 TFR   B,A                  SAVE DIGIT IN ACCA
4458   BE78 84 7F                 ANDA  #$7F                 MASK OFF BIT 7 (ADD/SUBTRACT FLAG)
4459   BE7A A7 CØ                 STA   ,U+                  STORE DIGIT IN STRING BUFFER
4460   BE7C ØA 45                 DEC   V45                  DECREMENT DECIMAL POINT FLAG
4461   BE7E 26 Ø4                 BNE   LBE84                BRANCH IF NOT TIME FOR DECIMAL POINT
4462   BE8Ø 86 2E                 LDA   #'.                  * STORE DECIMAL POINT IN
4463   BE82 A7 CØ                 STA   ,U+                  * STRING BUFFER
4464   BE84 53              LBE84 COMB                       TOGGLE BIT 7 (ADD/SUBTRACT FLAG)
4465   BE85 C4 8Ø                 ANDB  #$8Ø                 MASK OFF ALL BUT ADD/SUBTRACT FLAG
4466   BE87 8C BE E9              CMPX  #LBEC5+9*4           COMPARE X TO END OF MANTISSA TABLE
4467   BE8A 26 C4                 BNE   LBE5Ø                BRANCH IF NOT AT END OF TABLE
4468                       * BLANK TRAILING ZEROS AND STORE EXPONENT IF ANY
4469   BE8C A6 C2           LBE8C LDA   ,-U                  GET THE LAST CHARACTER; MOVE POINTER BACK
4470   BE8E 81 3Ø                 CMPA  #'Ø                  WAS IT A ZERO?
4471   BE9Ø 27 FA                 BEQ   LBE8C                IGNORE TRAILING ZEROS IF SO
4472   BE92 81 2E                 CMPA  #'.                  CHECK FOR DECIMAL POINT
4473   BE94 26 Ø2                 BNE   LBE98                BRANCH IF NOT DECIMAL POINT
4474   BE96 33 5F                 LEAU  -1,U                 STEP OVER THE DECIMAL POINT
4475   BE98 86 2B           LBE98 LDA   #'+                  ASCII PLUS SIGN
4476   BE9A D6 47                 LDB   V47                  GET SCIENTIFIC NOTATION EXPONENT
4477   BE9C 27 1C                 BEQ   LBEBA                BRANCH IF NOT SCIENTIFIC NOTATION
4478   BE9E 2A Ø3                 BPL   LBEA3                BRANCH IF POSITIVE EXPONENT
4479   BEAØ 86 2D                 LDA   #'-                  ASCII MINUS SIGN
4480   BEA2 5Ø                    NEGB                       NEGATE EXPONENT IF NEGATIVE
4481   BEA3 A7 42           LBEA3 STA   2,U                  STORE EXPONENT SIGN IN STRING
4482   BEA5 86 45                 LDA   #'E                  * GET ASCII  E  (SCIENTIFIC NOTATION
4483   BEA7 A7 41                 STA   1,U                  * FLAG) AND SAVE IT IN THE STRING
4484   BEA9 86 2F                 LDA   #'Ø-1                INITIALIZE ACCA TO ASCII ZERO
4485                       * CONVERT BINARY VALUE IN ACCB TO DECIMAL
4486                       * ASCII NUMBER (< 1ØØ) IN ACCD
4487   BEAB 4C              LBEAB INCA                       ADD ONE TO 1Ø S DIGIT OF EXPONENT
4488   BEAC CØ ØA                 SUBB  #1Ø                  SUBTRACT 1Ø FROM ACCB
4489   BEAE 24 FB                 BCC   LBEAB                ADD 1 TO 1Ø S DIGIT IF NO CARRY
4490   BEBØ CB 3A                 ADDB  #'9+1                CONVERT UNITS DIGIT TO ASCII
4491   BEB2 ED 43                 STD   3,U                  SAVE EXPONENT IN STRING
4492   BEB4 6F 45                 CLR   5,U                  CLEAR LAST BYTE (TERMINATOR)
4493   BEB6 2Ø Ø4                 BRA   LBEBC                GO RESET POINTER
4494   BEB8 A7 C4           LBEB8 STA   ,U                   STORE LAST CHARACTER
4495   BEBA 6F 41           LBEBA CLR   1,U                  CLEAR LAST BYTE (TERMINATOR - REQUIRED BY
4496                       *                                  PRINT SUBROUTINES)
4497   BEBC 8E Ø3 DA        LBEBC LDX   #STRBUF+3            RESET POINTER TO START OF BUFFER
4498   BEBF 39                    RTS
4499                       *
4500   BEC Ø 8Ø ØØ ØØ ØØ ØØ LBEC Ø FCB   $8Ø,$ØØ,$ØØ,$ØØ,$ØØ  FLOATING POINT .5
4501                       *
4502                       *** TABLE OF UNNORMALIZED POWERS OF 1Ø
4503   BEC5 FA ØA 1F ØØ     LBEC5 FCB   $FA,$ØA,$1F,$ØØ       -1ØØØØØØØ
4504   BEC9 ØØ 98 96 8Ø     LBEC9 FCB   $ØØ,$98,$96,$8Ø        1ØØØØØØ
4505   BECD FF FØ BD CØ     LBECD FCB   $FF,$FØ,$BD,$CØ       -1ØØØØØ
4506   BED1 ØØ Ø1 86 AØ     LBED1 FCB   $ØØ,$Ø1,$86,$AØ        1ØØØØ
4507   BED5 FF FF D8 FØ     LBED5 FCB   $FF,$FF,$D8,$FØ       -1ØØØ
4508   BED9 ØØ ØØ Ø3 E8     LBED9 FCB   $ØØ,$ØØ,$Ø3,$E8        1ØØØ
4509   BEDD FF FF FF 9C     LBEDD FCB   $FF,$FF,$FF,$9C       -1ØØ
4510   BEE1 ØØ ØØ ØØ ØA     LBEE1 FCB   $ØØ,$ØØ,$ØØ,$ØA        1Ø
4511   BEE5 FF FF FF FF     LBEE5 FCB   $FF,$FF,$FF,$FF       -1
4512                       *
4513                       *
4514   BEE9 96 4F           LBEE9 LDA   FPØEXP               GET EXPONENT OF FPAØ
4515   BEEB 27 Ø2                 BEQ   LBEEF                BRANCH IF FPAØ = Ø
4516   BEED Ø3 54                 COM   FPØSGN               TOGGLE MANTISSA SIGN OF FPAØ
4517   BEEF 39              LBEEF RTS
4518                       * EXPAND A POLYNOMIAL OF THE FORM
4519                       * AQ+BQ**3+CQ**5+DQ**7.... WHERE Q = FPAØ
4520                       * AND THE X REGISTER POINTS TO A TABLE OF
4521                       * COEFFICIENTS A,B,C,D....
4522   BEFØ 9F 64           LBEFØ STX   COEFPT               SAVE COEFFICIENT TABLE POINTER
4523   BEF2 BD BC 2F              JSR   LBC2F                MOVE FPAØ TO FPA3
4524   BEF5 8D Ø5                 BSR   LBEFC                MULTIPLY FPA3 BY FPAØ
4525   BEF7 8D Ø8                 BSR   LBF01                EXPAND POLYNOMIAL
4526   BEF9 8E ØØ 4Ø              LDX   #V4Ø                 POINT X TO FPA3
4527   BEFC 7E BA CA        LBEFC JMP   LBACA                MULTIPLY (X) BY FPAØ
4528
4529                       * CALCULATE THE VALUE OF AN EXPANDED POLYNOMIAL
4530                       * EXPRESSION. ENTER WITH (X) POINTING TO A TABLE
4531                       * OF COEFFICIENTS, THE FIRST BYTE OF WHICH IS THE
4532                       * NUMBER OF (COEFFICIENTS-1) FOLLOWED BY THAT NUMBER
4533                       * OF PACKED FLOATING POINT NUMBERS. THE
4534                       * POLYNOMIAL IS EVALUATED AS FOLLOWS: VALUE =
4535                       * (((FPAØ*YØ+Y1)*FPAØ+Y2)*FPAØ YN)
4536   BEFF 9F 64           LBEFF STX   COEFPT               SAVE COEFFICIENT TABLE POINTER
4537   BFØ1 BD BC 2A        LBF01 JSR   LBC2A                MOVE FPAØ TO FPA4
4538   BFØ4 9E 64                 LDX   COEFPT               GET THE COEFFICIENT POINTER
4539   BFØ6 E6 8Ø                 LDB   ,X+                  GET THE TOP OF COEFFICIENT TABLE TO
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4540   BF08 D7 55                STB   COEFCT                  * USE AND STORE IT IN TEMPORARY COUNTER
4541   BF0A 9F 64                STX   COEFPT                  SAVE NEW COEFFICIENT POINTER
4542   BF0C 8D EE          LBF0C BSR   LBEFC                   MULTIPLY (X) BY FPA0
4543   BF0E 9E 64                LDX   COEFPT                  *GET COEFFICIENT POINTER
4544   BF10 30 05                LEAX  5,X                     *MOVE TO NEXT FP NUMBER
4545   BF12 9F 64                STX   COEFPT                  *SAVE NEW COEFFICIENT POINTER
4546   BF14 BD B9 C2             JSR   LB9C2                   ADD (X) AND FPA0
4547   BF17 8E 00 45             LDX   #V45                    POINT (X) TO FPA4
4548   BF1A 0A 55                DEC   COEFCT                  DECREMENT TEMP COUNTER
4549   BF1C 26 EE                BNE   LBF0C                   BRANCH IF MORE COEFFICIENTS LEFT
4550   BF1E 39                   RTS
4551
4552                       * RND
4553   BF1F BD BC 6D       RND   JSR   LBC6D                   TEST FPA0
4554   BF22 2B 21                BMI   LBF45                   BRANCH IF FPA0 = NEGATIVE
4555   BF24 27 15                BEQ   LBF3B                   BRANCH IF FPA0 = 0
4556   BF26 8D 10                BSR   LBF38                   CONVERT FPA0 TO AN INTEGER
4557   BF28 BD BC 2F             JSR   LBC2F                   PACK FPA0 TO FPA3
4558   BF2B 8D 0E                BSR   LBF3B                   GET A RANDOM NUMBER: FPA0 < 1.0
4559   BF2D 8E 00 40             LDX   #V40                    POINT (X) TO FPA3
4560   BF30 8D CA                BSR   LBEFC                   MULTIPLY (X) BY FPA0
4561   BF32 8E BA C5             LDX   #LBAC5                  POINT (X) TO FP VALUE OF 1.0
4562   BF35 BD B9 C2             JSR   LB9C2                   ADD 1.0 TO FPA0
4563   BF38 7E BC EE       LBF38 JMP   INT                     CONVERT FPA0 TO AN INTEGER
4564                       * CALCULATE A RANDOM NUMBER IN THE RANGE 0.0 < X <= 1.0
4565   BF3B BE 01 16       LBF3B LDX   RVSEED+1                * MOVE VARIABLE
4566   BF3E 9F 50                STX   FPA0                    * RANDOM NUMBER
4567   BF40 BE 01 18             LDX   RVSEED+3                * SEED TO
4568   BF43 9F 52                STX   FPA0+2                  * FPA0
4569   BF45 BE BF 74       LBF45 LDX   RSEED                   = MOVE FIXED
4570   BF48 9F 5D                STX   FPA1                    = RANDOM NUMBER
4571   BF4A BE BF 76             LDX   RSEED+2                 = SEED TO
4572   BF4D 9F 5F                STX   FPA1+2                  = MANTISSA OF FPA0
4573   BF4F BD BA D0             JSR   LBAD0                   MULTIPLY FPA0 X FPA1
4574   BF52 DC AD                LDD   VAD                     GET THE TWO LOWEST ORDER PRODUCT BYTES
4575   BF54 C3 65 8B             ADDD  #$658B                  ADD A CONSTANT
4576   BF57 FD 01 18             STD   RVSEED+3                SAVE NEW LOW ORDER VARIABLE RANDOM # SEED
4577   BF5A DD 52                STD   FPA0+2                  SAVE NEW LOW ORDER BYTES OF FPA0 MANTISSA
4578   BF5C DC AB                LDD   VAB                     GET 2 MORE LOW ORDER PRODUCT BYTES
4579   BF5E C9 B0                ADCB  #$B0                    ADD A CONSTANT
4580   BF60 89 05                ADCA  #5                      ADD A CONSTANT
4581   BF62 FD 01 16             STD   RVSEED+1                SAVE NEW HIGH ORDER VARIABLE RANDOM # SEED
4582   BF65 DD 50                STD   FPA0                    SAVE NEW HIGH ORDER FPA0 MANTISSA
4583   BF67 0F 54                CLR   FP0SGN                  FORCE FPA0 MANTISSA = POSITIVE
4584   BF69 86 80                LDA   #$80                    * SET FPA0 BIASED EXPONENT
4585   BF6B 97 4F                STA   FP0EXP                  * TO 0 1 < FPA0 < 0
4586   BF6D 96 15                LDA   FPA2+2                  GET A BYTE FROM FPA2 (MORE RANDOMNESS)
4587   BF6F 97 63                STA   FPSBYT                  SAVE AS SUB BYTE
4588   BF71 7E BA 1C             JMP   LBA1C                   NORMALIZE FPA0
4589                       *
4590   BF74 40 E6          RSEED FDB   $40E6                   *CONSTANT RANDOM NUMBER GENERATOR SEED
4591   BF76 4D AB                FDB   $4DAB                   *
4592
4593                       * SIN
4594                       * THE SIN FUNCTION REQUIRES AN ARGUMENT IN RADIANS AND WILL REPEAT ITSELF EVERY
4595                       * 2*PI RADIANS. THE ARGUMENT IS DIVIDED BY 2*PI AND ONLY THE FRACTIONAL PART IS
4596                       * RETAINED. SINCE THE ARGUMENT WAS DIVIDED BY 2*P1, THE COEFFICIENTS MUST BE
4597                       * MULTIPLIED BY THE APPROPRIATE POWER OF 2*PI.
4598
4599                       * SIN IS EVALUATED USING THE TRIGONOMETRIC IDENTITIES BELOW:
4600                       * SIN(X)=SIN(PI-X) & -SIN(PI/2-X)=SIN((3*PI)/2+X)
4601   BF78 BD BC 5F       SIN   JSR   LBC5F                   COPY FPA0 TO FPA1
4602   BF7B 8E BF BD             LDX   #LBFBD                  POINT (X) TO 2*PI
4603   BF7E D6 61                LDB   FP1SGN                  *GET MANTISSA SIGN OF FPA1
4604   BF80 BD BB 89             JSR   LBB89                   *AND DIVIDE FPA0 BY 2*PI
4605   BF83 BD BC 5F             JSR   LBC5F                   COPY FPA0 TO FPA1
4606   BF86 8D B0                BSR   LBF38                   CONVERT FPA0 TO AN INTEGER
4607   BF88 0F 62                CLR   RESSGN                  SET RESULT SIGN = POSITIVE
4608   BF8A 96 5C                LDA   FP1EXP                  *GET EXPONENT OF FPA1
4609   BF8C D6 4F                LDB   FP0EXP                  *GET EXPONENT OF FPA0
4610   BF8E BD B9 BC             JSR   LB9BC                   *SUBTRACT FPA0 FROM FPA1
4611                       *NOW FPA0 CONTAINS ONLY THE FRACTIONAL PART OF ARGUMENT/2*PI
4612   BF91 8E BF C2             LDX   #LBFC2                  POINT X TO FP (.25)
4613   BF94 BD B9 B9             JSR   LB9B9                   SUBTRACT FPA0 FROM .25 (PI/2)
4614   BF97 96 54                LDA   FP0SGN                  GET MANTISSA SIGN OF FPA0
4615   BF99 34 02                PSHS  A                       SAVE IT ON STACK
4616   BF9B 2A 09                BPL   LBFA6                   BRANCH IF MANTISSA POSITIVE
4617   BF9D BD B9 B4             JSR   LB9B4                   ADD .5 (PI) TO FPA0
4618   BFA0 96 54                LDA   FP0SGN                  GET SIGN OF FPA0
4619   BFA2 2B 05                BMI   LBFA9                   BRANCH IF NEGATIVE
4620   BFA4 03 0A                COM   RELFLG                  COM IF +(3*PI)/2 >= ARGUMENT >+ PI/2 (QUADRANT FLAG)
4621   BFA6 BD BE E9       LBFA6 JSR   LBEE9                   TOGGLE MANTISSA SIGN OF FPA0
4622   BFA9 8E BF C2       LBFA9 LDX   #LBFC2                  POINT X TO FP (.25)
4623   BFAC BD B9 C2             JSR   LB9C2                   ADD .25 (PI/2) TO FPA0
4624   BFAF 35 02                PULS  A                       GET OLD MANTISSA SIGN
4625   BFB1 4D                   TSTA                          * BRANCH IF OLD
4626   BFB2 2A 03                BPL   LBFB7                   * SIGN WAS POSITIVE
4627   BFB4 BD BE E9             JSR   LBEE9                   TOGGLE MANTISSA SIGN
4628   BFB7 8E BF C7       LBFB7 LDX   #LBFC7                  POINT X TO TABLE OF COEFFICIENTS
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4629   BFBA 7E BE F0                  JMP   LBEF0                    GO CALCULATE POLYNOMIAL VALUE
4630
4631   BFBD 83 49 0F DA A2    LBFBD   FCB   $83,$49,$0F,$DA,$A2       6.28318531 (2*PI)
4632   BFC2 7F 00 00 00 00    LBFC2   FCB   $7F,$00,$00,$00,$00       .25
4633
4634                          * MODIFIED TAYLOR SERIES SIN COEFFICIENTS
4635   BFC7 05                LBFC7   FCB   6-1                       SIX COEFFICIENTS
4636   BFC8 84 E6 1A 2D 1B    LBFC8   FCB   $84,$E6,$1A,$2D,$1B       * -((2*PI)**11)/11!
4637   BFCD 86 28 07 FB F8    LBFC8   FCB   $86,$28,$07,$FB,$F8       *  ((2*PI)**9)/9!
4638   BFD2 87 99 68 89 01    LBFD2   FCB   $87,$99,$68,$89,$01       * -((2*PI)**7)/7!
4639   BFD7 87 23 35 DF E1    LBFD7   FCB   $87,$23,$35,$DF,$E1       *  ((2*PI)**5)/5!
4640   BFDC 86 A5 5D E7 28    LBFDC   FCB   $86,$A5,$5D,$E7,$28       * -((2*PI)**3)/3!
4641   BFE1 83 49 0F DA A2    LBFE1   FCB   $83,$49,$0F,$DA,$A2       *    2*PI
4642
4643   BFE6 A1 54 46 8F 13 8F LBFE6   FCB   $A1,$54,$46,$8F,$13       UNUSED GARBAGE BYTES
4644   BFEC 52 43 89 CD               FCB   $8F,$52,$43,$89,$CD       UNUSED GARBAGE BYTES
4645
4646                          * INTERRUPT VECTORS
4647   BFF0 A6 81             LBFF0   FDB   LA681                     RESERVED
4648   BFF2 01 00             LBFF2   FDB   SW3VEC                    SWI3
4649   BFF4 01 03             LBFF4   FDB   SW2VEC                    SWI2
4650   BFF6 01 0F             LBFF6   FDB   FRQVEC                    FIRQ
4651   BFF8 01 0C             LBFF8   FDB   IRQVEC                    IRQ
4652   BFFA 01 06             LBFFA   FDB   SWIVEC                    SWI
4653   BFFC 01 09             LBFFC   FDB   NMIVEC                    NMI
4654   BFFE A0 27             LBFFE   FDB   RESVEC                    RESET
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MODIFIED REGISTERS	ADDRESS	DESCRIPTION
ALL	RESVEC (AØ27)	RESET ENTRY POINT - set SAM, PIAs ram check - if RSTFLG = $55, then jump to RSTVEC; otherwise do a cold start.
ALL	BACDST (AØ74)	COLD START ENTRY POINT - clear 1st 1K of RAM, reset BASIC's pointers.
ALL	BAWMST (AØE8)	WARM START ENTRY POINT - reset some of BASIC's pointers.
A	A171	ASCII CONSOLE IN - read a character from CONSOLE IN. Mask off bit 7 and return character in ACCA.
A	A176	CONSOLE IN - read a character from active input device (DEVNUM). Return character in ACCA.
A,B,X	A199	CURSOR DRIVER - put a cursor block on the screen at the address in CURPOS.
A	A1B1	WAIT FOR A KEYSTROKE - blink the cursor while waiting for a keystroke. Return the ASCII value of the key in ACCA when a key is depressed.
A	KEYIN (A1CB)	SCAN THE KEYBOARD FOR A KEY DEPRESSION - Return zero flag = 1 if no new key down. Return the ASCII value of the key in ACCA if a new key is depressed.
NONE	PUTCHR (A282)	CONSOLE OUT - sends character in ACCA to output device. The output device is specified in DEVNUM.
NONE	A2BF	RS232 OUTPUT DRIVER - software UART specifically formatted to drive a line printer. The routine may be used to drive other devices, and has been modified by all revisions to BASIC. Version 1.2 will not begin transmitting data until the destination device is ready.
NONE	A30A	PUT A CHARACTER ON THE SCREEN - place a character on the screen (the screen starts at $4ØØ) at the location stored in CURPOS.
NONE	A35F	INITIALIZE PRINT PARAMETERS - set up tab field width, tab zone, current position and line width according to the device selected (DEVNUM). This routine will vector into RAM at RVEC2.
A,B,X	A38D	GET A BASIC INPUT LINE - this routine will allow the

		inputting of a BASIC input line from CONSOLE IN.
A	A3ED	INPUT DEVICE NUMBER CHECK - check for a valid input device number and file mode. This routine will vector into RAM at RVEC5.
A	A4Ø6	OUTPUT DEVICE NUMBER CHECK - check for a valid output device number and file mode. This routine will vector into RAM at RVEC6.
A	A42D	CLOSE A FILE - closes the file specified by DEVNUM. Vectors into RAM at RVEC8.
A	A549	BREAK CHECK - check to see if the break key or the pause (shift @) key is down. Vectors into RAM at RVEC11.
A,B,X	A7Ø1	START TAPE, READ A BLOCK - load a block of data from the cassette tape into RAM and return error status in ACCB.
A,B,X	GETBLK (A7ØB)	READ A BLOCK - load a block of data from the cassette tape into RAM.
A,B,X	CASON (A77C)	SYNC THE TAPE DECK - turn on the tape and wait for sync bytes.
X	A7D1	LONG DELAY - approximately 1/2 second delay. Loads X register with zero and counts it down to zero.
A,B,X,Y	WRLDR (A7D8)	WRITE LEADER - write a leader to the cassette tape.
A,B,X,Y	SNDBLK (A7F4)	WRITE BLOCK TO CASSETTE - take a block of RAM and write it to cassette.
A,B,X,Y	A82A	WRITE A BYTE TO TAPE - write ACCA to tape. This routine does the "dirty work" of actually writing a byte to tape.
B,X	A928	CLEAR SCREEN - store blanks ($6Ø) to the video display screen.
A	A974	DISABLE ANALOG MULTIPLEXER - disable the sound analog multiplexer. This will not allow any sound input to pass through to the analog multiplexer.
A	A976	ENABLE ANALOG MULTIPLEXER - enable the sound analog multiplexer. This will allow sound inputs to pass through the analog multiplexer.

A,U	A9A2	SET ANALOG MULTIPLEXER - set the control inputs to the analog multiplexer to allow one of the four inputs to pass through.
A,B,X,U	GETJOY (A9DE)	READ JOYSTICKS - software 6-bit analog to digital conversion routine used to read the joystick potentiometers.
A,B	AC33	FREE RAM CHECK - check to see if there is room to store 2*ACCB bytes in free RAM, OM error if not.
A,B,X,U	AD01	LINE NUMBER SEARCH - search the BASIC program for the line number stored in BINVAL. Set the carry flag if no match.
X	AD26	ERASE VARIABLES - erase BASIC's variables and reset pointers.
A,B,X	AF67	CONVERT LINE NUMBER TO BINARY - convert an ASCII line number in a BASIC program to binary and return the value in BINVAL.
A,B,X,Y	AFA4	PUT STRING IN STRING SPACE - move a string whose descriptor is located at FPA0+2 into the string space.
NONE	B143	NUMERIC TYPE MODE CHECK - test the contents of VALTYP and return if positive. TM error if negative.
NONE	B146	STRING TYPE MODE CHECK - test the contents of VALTYP and return if negative. TM error if positive.
ALL	B156	EVALUATE EXPRESSION - evaluate an expression in a BASIC statement. BASIC's input pointer must be pointed to the expression.
ALL	B357	EVALUATE VARIABLE - evaluate the variable to which BASIC's input pointer is pointing. Return with X and VARPTR pointing to the variable descriptor. If the variable is not stored in the variable table, that variable name with a value of zero is inserted into the variable table.
A	B3A2	SET CARRY IF NOT ALPHA - set the carry flag if ACCA is not and ASCII alpha character.
A,B,X	INTCNV (B3ED)	CONVERT FPA0 TO INTEGER. Convert FPA0 to a signed 2-byte integer; return the value in ACCD.
A,B,X	GIVABF (B4F4)	CONVERT INTEGER TO FLOATING POINT - convert the value in ACCD into a floating point number in FPA0.

A,B,X	B54C	PUT DESCRIPTOR ON STRING STACK - put the direct page descriptor buffer data (STRDES) onto the string stack. Set the variable type (VALTYP) to string type.
A,B,X	B56D	RESERVE ACCB BYTES IN STRING SPACE - reserve ACCB bytes in the string storage space. Return with the starting address of the reserved string space in X and FRESPC.
A,B,X	B74Ø	INTEGER SIZE CHECK - check FPAØ to make sure it is in the range -32768 <= FPAØ <= 32767. If it is, return the value of that integer in X.
ALL	B7C2	UNCRUNCH - uncrunch a basic line into BASIC's line input buffer. Vectors into RAM at RVEC24.
ALL	B821	CRUNCH - crunch the line that the input pointer is pointing to into the line input buffer and return the length of the crunched line in ACCD.
A,B,X,U	B99C	SEND STRING TO CONSOLE OUT - parse a string which is pointed to by X and send it to CONSOLE OUT.
A,B,X	BD12	CONVERT STRING TO FLOATING POINT - convert an ASCII string pointed to by BASIC's input pointer into a floating point value in FPAØ. Vectors into RAM at RVEC19.
A,B,X,U	BDCC	PRINT DECIMAL NUMBER TO CONSOLE OUT - convert the value in ACCD into a decimal number and send it to CONSOLE OUT.
A,B,X,U	BDD9	FLOATING POINT TO ASCII STRING - convert the floating point number in FPAØ into an ASCII string in the string buffer.
A,B,X	BEFF	EXPAND THE POLYNOMIAL - calculate the value of an expanded polynomial expression. Enter with X pointing to a table of coefficients the first byte of which is the number of (coefficients -1) followed by that number of packed floating point numbers. The polynomial is evaluated as follows: value = (((FPAØ*YØ+Y1)*FPAØ+Y2)* FPAØ +YN)

ADDRESS	DESCRIPTION
B9B4	ADD .5 TO FPAØ
B9B9	SUBTRACT FPAØ FROM FLOATING POINT NUMBER POINTED TO BY X, LEAVE RESULT IN FPAØ
B9BC	ARITHMETIC OPERATION (-) JUMPS HERE - SUBTRACT FPAØ FROM FPA1 (ENTER WITH EXPONENT OF FPAØ IN ACCB)
B9C2	ADD FLOATING POINT NUMBER POINTED TO BY X TO FPAØ - LEAVE RESULTS IN FPAØ
B9C5	ARITHMETIC OPERATION (+) JUMPS HERE - ADD FPAØ TO FPA1 (ENTER WITH EXPONENT OF FPAØ IN ACCB AND EXPONENT OF FPA1 IN ACCA)
BA1C	NORMALIZE FPAØ
BA79	NEGATE FPAØ MANTISSA
BA83	ADD ONE TO FPAØ MANTISSA
BACA	ARITHMETIC OPERATION (*) JUMPS HERE - MULTIPLY FPAØ BY X - RETURN PRODUCT IN FPAØ
BADØ	MULTIPLY FPAØ MANTISSA BY FPA1, NORMALIZE HIGH ORDER BYTES OF PRODUCT IN FPAØ. THE LOW ORDER FOUR BYTES OF THE PRODUCT WILL BE STORED IN VAB-VAE
BB2F	UNPACK A FLOATING POINT NUMBER FROM X INTO FPA1
BB6A	FAST MULTIPLY FPAØ BY 1Ø AND LEAVE RESULT IN FPAØ
BB82	DIVIDE FPAØ BY 1Ø
BB8F	DIVIDE X BY FPAØ - LEAVE NORMALIZED QUOTIENT IN FPAØ
BB91	DIVIDE FPA1 BY FPAØ. ENTER WITH EXPONENT OF FPA1 IN ACCA AND FLAGS SET BY TSTA
BBA4	COMPARE FPAØ MANTISSA TO FPA1 MANTISSA - SET CARRY FLAG IF FPA1 >= FPAØ
BCØB	COPY MANTISSA FROM FPA2 TO FPAØ
BC14	COPY A PACKED FLOATING POINT NUMBER FROM X TO FPAØ
BC2A	PACK FPAØ AND SAVE IT IN FPA4

BC2F	PACK FPAØ AND SAVE IT IN FPA3
BC33	PACK FPAØ AND SAVE IT IN ADDRESS STORED IN VARDES
BC35	PACK FPAØ AND SAVE IT IN ADDRESS POINTED TO BY X
BC4A	MOVE FPA1 TO FPAØ RETURN WITH MANTISSA SIGN IN ACCA
BC5F	TRANSFER FPAØ TO FPA1
BC6D	CHECK FPAØ; RETURN ACCB = Ø IF FPAØ = Ø, ACCB = $FF IF FPAØ = NEGATIVE, ACCB = 1 IF FPAØ = POSITIVE
BC7C	CONVERT A SIGNED NUMBER IN ACCB INTO A FLOTING POINT NUMBER
BC96	COMPARE A PACKED FLOATING POINT NUMBER POINTED TO BY X TO AN UNPACKED FLOATING POINT NUMBER IN FPAØ. RETURN ZERO FLAG SET AND ACCB=Ø IF EQUAL; ACCB = 1 IF FPAØ > (X); ACCB = $FF IF FPAØ < (X)
BDØ9	FILL MANTISSA OF FPAØ WITH CONTENTS OF ACCB

START	END	DESCRIPTION
A000	A00D	INDIRECT JUMP TABLE
A10D	A128	DIRECT PAGE ROM IMAGE
A129	A146	PAGE ONE ROM IMAGE
A147	A170	COPYRIGHT MESSAGES
A26E	A281	SPECIAL KEY LOOKUP TABLE
A85C	A87F	SINE WAVE LOOKUP TABLE
AA29	AA50	SECONDARY DISPATCH TABLE
AA51	AA65	OPERATOR PRECEDENCE TABLE
AA66	AB19	PRIMARY RESERVED WORD TABLE
AB1A	AB66	SECONDARY RESERVED WORD TABLE
AB67	ABAE	PRIMARY DISPATCH TABLE
ABAF	ABE0	ERROR MESSAGES
ABE1	ABEC	"ERROR IN" MESSAGE
ABED	ABF1	"OK" MESSAGE
ABF2	ABF8	"BREAK" MESSAGE
AFCF	AFD5	"?REDO" MESSAGE
B0E8	B0F7	"?EXTRA IGNORED" MESSAGE
B3DF	B3E3	FLOATING POINT NUMBER -32768
BAC5	BAC9	FLOATING POINT NUMBER 1.0
BB7D	BB81	FLOATING POINT NUMBER 10
BDB6	BDBA	FLOATING POINT NUMBER 99999999.9
BDBB	BDBF	FLOATING POINT NUMBER 999999999
BDC0	BDC4	FLOATING POINT NUMBER 1E+9
BEC0	BEC4	FLOATING POINT NUMBER .5

BEC5	BEE8	TABLE OF MANTISSAS OF UNNORMALIZED POWERS OF TEN
BF74	BF77	CONSTANT RANDOM NUMBER SEED
BFBD	BFC1	FLOATING POINT NUMBER 2*PI
BFC2	BFC6	FLOATING POINT NUMBER .25
BFC7	BFE5	MODIFIED TAYLOR SERIES SINE COEFFICIENTS
BFE6	BFEF	TWO GARBAGE FLOATING POINT NUMBERS
BFFØ	BFFF	INTERRUPT VECTORS

MEMORY MAP

One of the most important tools to have at your fingertips, if you are going to attempt to use any machine's built-in operating system, is a complete and accurate map of that system's memory structure. At the beginning of the BASIC disassembly listing you will find the most complete memory map available for the Color Computer outside of Microsoft s domain. It explains all of the variables in the direct page and what their functions are, defines all of the variables and buffers between the direct page and the video display RAM, and all of the variables that are used by Disk RAM. It identifies the areas in memory used by the variable tables, the array tables, the string space, cleared memory, and other important areas.

The direct page provides the most useful source of rapidly accessed variable space available in the 6809. When you become familiar with 6809 Machine Language programming you will notice that it is quicker byte wise and time wise to access variables which are located in the direct page. The Color Computer, of course, keeps the direct page in page 0, which makes it relatively compatible with 6502 programming. The direct page is also at the very bottom of RAM, where it is conveniently out of the way of any programs written by the user for whatever purpose he has in mind. If you look at the memory map at the beginning of Color BASIC Unravelled you will find that some of the variables will have asterisks designation in front of them. If that designation is PV, it defines a Permanent Variable. Permanent Variable has been chosen for lack of a better word; exactly what this means is that the variable has a defined function that is used by every command that BASIC has. Such a variable would be the beginning of BASIC, the top of free RAM, the beginning of array variables, the beginning of normal variables, the top of the string stock, the present pointer to the current value in the string stock and so forth. These variables will cause permanent harm to a BASIC program if they are modified during the course of your machine language program; therefore, you will have to be very careful how you use these variables. If you change the value, for instance, of the start of BASIC, you will cause BASIC to feel that there are fewer or more lines in the program than there actually are, which could easily result in an error or crash. Therefore, when you are making a program, which is designed to run and mesh with BASIC, you should not make any changes to a PV type variable, unless you are absolutely sure that you know what you are doing. Obviously, there can be some instances when you will want to change the start of BASIC. If there is some value you might want to change, you will have to make your decision based on what you're doing as to whether you want to change the variable or not, just be aware that PV variables are very tricky to change and changing them may blow up BASIC.

Other variables are designated TV, which is a temporary variable, and is a variable whose function should be uniform for all BASIC commands. A temporary variable has one specific use and one specific BASIC command. A perfect example would be the variable labeled DIMFLG This variable is used when defining a dimensioned array in order to specifically tell a certain routine in BASIC that the variable currently being defined is an array variable as opposed to a string variable or single precision variable. Once the variable is defined, obviously the value being stored in DIMFLG has no appropriate use for any other BASIC command. Therefore it may be modified if required for your own use, but you should be aware that the DIMFLG variable can be changed during the course of a BASIC program and

that if you use it for some specific value in your program you may not harm BASIC, but don't expect the value to be unmodified by BASIC in the course of the normal operation of BASIC.

The variables not labeled either TV nor PV will be used by many different routines in BASIC and are neither Temporary nor Permanent, because they are used by so many routines that it doesn't matter what happens to these variables. These variables have a particular function, such as a pointer, an address counter or normal counter. They have been given a specific label because they do have a particular function that remains common from BASIC command to BASIC command. There are also variables, which are referred to as Scratch Pad variables. These variables have the designation VXX, where the XX is the actual Hex address of that variable in RAM. These are different from the temporary variables, in that they may be used for any particular function by any particular BASIC command; therefore they could be pointers, counters or addresses or any other kind of temporary storage. These are the most useful to use as temporary storage for your own routines, since if you modify these routines between various BASIC commands (not in a BASIC command but between BASIC commands) it will not cause any harm whatsoever to the operation of a BASIC program.

Other variables may be identified with a DV designation, which may be in conjunction with a TV or PV or may be by itself. This particular designation is used to define a double variable; that is, there are places in BASIC where a variable is loaded into a 16-byte register even though the variable is an 8-byte quantity. As such, the variable and the variable immediately following the DV designation may not be separated from each other; they must be immediately adjacent to one another in the memory space of the computer. If for any reason these variables are separated from one another in the memory space of the computer, the instructions in BASIC, which grab data from the double variable, will not function properly. There are some variables in Extended BASIC, which are two 16-byte quantities, which must be kept next to each other, such as HORBEG or VERBEG. This is necessary because an index register is pointed at the first of these variables, then it is incremented to the appropriate variable.

AREA BETWEEN THE DIRECT PAGE AND VIDEO DISPLAY

The area between the direct page and the video display at $400 is used by several different routines to store pieces of useful information. There are some large buffers and some small 2 or 3 byte value storage blocks, which are used by some specific routines and some that are in general used by many different routines. The interrupt jump vectors are stored from address $100 to $111. These contain the addresses where the interrupt factors jump to IRQ, FIRQ, NMI, RESET, and Software Interrupt routines. Immediately following the interrupt vectors are several small variables, which are used by different routines. The first of these is the USRJMP variable. These are three bytes, which Color BASIC uses to store the jump address for the USR function. When Extended BASIC is in the machine, these locations are not used by the USR function any more. They are instead used to store the timer value (TIMVAL). Timer value is only two bytes and Extended or Disk BASIC does not use the third byte of this three-byte block of data. The next variable stored is RVSEED, a five-byte value for the variable Random Number Seed. Following that is CASFLG, the Case Flag, which determines whether the characters being put on the screen are in upper or lower case. If the value stored here is zero you are in

lower case. If it is $FF they are in upper case. Then comes DEBVAL, which is the keyboard debounce delay value, a two-byte quantity. Following that is EXPJMP, which is the address that the EXEC command uses to jump to. Next are the command interpretation tables. There are normally only as many interpretation tables as there are ROMs plugged into the computer. If extended BASIC and not disk BASIC is plugged in, in the area following COMVEC are the USR function jump vectors for Extended BASIC. If Disk BASIC is plugged in, the USR jump vectors are transferred to the disk RAM. After the command interpretation tables is the keyboard buffer. This is the memory that is used so that there can be rollover in the keyboard routine. Eight bytes are used to store the information on which keys have and have not been pressed. Following that are four bytes (POTVAL) to store the values of the joystick potentiometers. After POTVAL come BASIC's RAM vectors. An explanation of these vectors is provided in the memory map at the beginning of this book and the user should refer to that explanation in order to get a detailed description of how the RAM vectors function. Following the RAM hooks is a 40-byte block of data used to store string descriptors. This is the string stack, which is used in string manipulation functions. After the string stack comes the cassette file name buffer where the cassette file name is stored prior to searching for a cassette file. After that is a 256 byte block of data which is the cassette I/O buffer. Following that is a two-byte sub-block to the line input buffer, which is called the line input header. This is used to store the jump address of the next BASIC line. After line header comes LINBUF which is a 251-byte buffer to store BASIC input line as it is being typed in. This 251-byte area is also used for several different functions but primarily it is used as a line input buffer. The last block of data is a 41-byte block of data following LINBUF up to the video display RAM which is called STRBUF. This is a string buffer, which is used to hold temporary string information and temporary strings before they are moved into the string space. It is most commonly used in floating point to ASCII string and ASCII string to floating point data conversions. Then from $400 to $5FF is the 512-byte block of video display RAM. If you have a disk hooked up to your system, the area from $600 to $989 is used by the disk for its own special I/O buffers and disk variables.

INTERRUPTS

BASIC uses the 6809 interrupt structure to control those commands, which require precise timing intervals. The manner in which the interrupt signals are handled by the 6809 and 6821 (or 6822) in the Color Computer is described in the FACTS book and will not be covered in this book. Only the software aspects will be covered.

IRQ — The 6821 Peripheral Interface, Adapter (PIA) may be programmed to pass either a 16.67 ms (60HZ) or a 63.5 microsecond input to the 6809's IRQ interrupt pin. Color BASIC uses only the 60HZ interrupt; the 63.5 microsecond input is never enabled. The IRQ routine is used to increment or decrement the following parameters:

COMMAND	VARIABLE	IRQ FUNCTION
SOUND	SNDDUR	Decrement SNDDUR
PLAY	PLYTMR	Decrement VD5 from PLYTMR
TIMER	TIMVAL	Increment TIMVAL
(DOS BASIC)	RDYTMR	Decrement RDYTMR

The SOUND and PLAY commands will fall into an endless timing loop which will only be terminated by the IRQ routine's decrementing SNDDUR and/or PLYTMR to zero.

FIRQ — The PIAs may be programmed to pass either the RS 232 status input or the cartridge interrupt signal to the 6809's FIRQ interrupt pin. Color BASIC uses FIRQ to vector control to a ROM-PAK if pins 7 & 8 of the cartridge port are connected together by a cartridge.

NMI — The 6809's NMI pin is connected only to the cartridge port. The Disk Operating System (DOS) uses the NMI to vector out of data transfers between the 6809 and the 1793 Floppy Disk Controller.

SWI — Not used by Color BASIC

SWI2 — Not used by Color BASIC

SWI3 — The DOS command of Disk BASIC calls SWI3. The user must provide a SWI3 servicing routine Disk BASIC does not provide one.

EXPRESSIONS AND OPERATORS

Relational Operators		Arithmetic Operators	
=	Equal	+	Add
<	Less Than	-	Subtract
>	Greater Than	*	Multiply
<=	Less Than or Equal	/	Divide
>=	Greater Than or Equal	^	Exponentiation
<>	Not Equal	-	Negation

Boolean Operators	String Operators	
AND	+	Concatenation
OR		
NOT		

Rules for Evaluating Expressions

1. Operations of higher precedence are performed before operations of lower precedence. This means the multiplications and divisions are performed before additions and subtractions. As an example, 2+10/5 equals 4, not 2.4. When operations of equal precedence are found in a formula, the left-hand one is executed first: 6-3+5 = 8, not -2.
2. The order in which operations are performed can always be specified explicitly through the use of parentheses. For instance, to add 5 to 3 and then divide that by 4, we would use (5+3)/4, which equals 2. If, instead, we had used 5+3/4, we would get 5.75 as a result (5 plus 3/4).

The precedence of operators used in evaluating expressions is as follows, in order beginning with the highest precedence: (Note: Operators listed on the same line have the same precedence).

1)	FORMULAS ENCLOSED IN PARENTHESIS ARE ALWAYS EVALUATED FIRST.	
2)	^	EXPONENTATION
3)	NEGATION	-X WHERE X MAY BE A FORMULA
4)	*/	MULTIPLICATION AND DIVISION
5)	+-	ADDITION AND SUBTRACTION
6)	RELATIONAL OPERATORS (EQUAL PRECEDENCE FOR ALL SIX).	= EQUAL <> NOT EQUAL < LESS THAN > GREATER THAN <= LESS THAN OR EQUAL >= GREATER THAN OR EQUAL
7)	NOT	LOGICAL AND BITWISE NOT LIKE NEGATION, NOT TAKES ONLY THE FORMULA TO ITS RIGHT AS AN ARGUMENT
8)	AND	LOGICAL AND BITWISE AND
9)	OR	LOGICAL AND BITWISE OR

The ASCII table is defined in Appendix J. It contains the order in which characters within the Color Computer are represented when two strings are compared.

Characters within a set of strings are compared starting at the leftmost character to the end of the field specified.

Using the ASCII table, we can compare a string containing an "A" to one containing a "B" in the same position. The result is that the second string is greater than the first.

A string containing a blank is less than a "1", which is less than an "A", which is less than a "B". The string "A" is less than the string "ABC" or any string containing "A" as the first character. All characters are compared in sequence with the first unequal character defining the relationship between the strings. Thus, the same relational functions may be used for both strings and numbers.

Listed below are the differences between Color BASIC Version 1.0 and Version 1.2

CHANGE	ADDRESS	Version 1.0	Version 1.2
A	$A001	$C1	$CB
B	$A01B-$A0C7	SEE LISTING 1	
C	$A102-$A104	LDU #$A108	LEAY $A108,PCR
D	$A114	$57	$58
E	$A155	$30	$32
F	$A15E	$30	$32
G	$A1B5-$A26D	SEE LISTING 2	
H	$A2C3-$A2FA	SEE LISTING 3	
I	$A440	$08	$03
J	$A56A	$C1	$CB
K	$A6EB	$07	$14
L	$ADFD	$C1	$CB
M	$B23F	$E8	$E3
N	$B38E	$72	$75
P	$B3ED-$B427	SEE LISTING 4	
Q	$B9D6	$2B BMI	$25 BCS

Change A is a branch length change caused by the keyboard driver mod.

Change B (Listing 1) is a major rework of the warm and cold start initializations required to allow the computer to accept 64K dynamic RAMs.

Change C was required because change B changed the storage location of the RESET jump vector from the U register to the Y register.

Change D modified the line printer baud rate.

Change E is the version number.

Change F is the copyright year.

Change G is a major change (Listing 2) to the keyboard driver allowing a quick scan of the keyboard if no keys are down and filtering of joystick button depressions out of the keyboard scan.

Change H is also a major change (Listing 3) which allows the line printer driver to output an eight bit character and will not allow any transmission until the receiving device is ready.

Change I causes an end of program block to be written to a cassette file if the buffer is empty when the file is closed.

Change J speeds up the INKEY$ command by not entering the keyboard scan routine if no keys are depressed.

Change K is a minor change which causes the upper left hand corner of the screen to blink during cassette loading operations.

Change L speeds up the BREAK key check routine by not entering the

keyboard scan routine if no more keys are depressed.

Change M is a minor change which slightly speeds up the expression evaluation routine.

Change N is merely a different length branch caused by change P.

Change P (Listing 4) causes a numeric variable type check to be done before the INTCNV (FPAØ to integer) routine.

Change Q fixed a minor bug in the floating point addition routine.

*** LISTING 1

```
A01B                BNE   BACDST       NO - DO A COLD START
A01D                LDX   RSTVEC       WARM START VECTOR
A01F                LDA   ,X           GET FIRST BYTE OF WARM START ADDR
A021                CMPA  #$12         IS IT A NOP?
A023                BNE   BACDST       NO - DO A COLD START
A025                JMP   ,X           YES, GO THERE
                *
A027            RESVEC  LDU   #LA00E       BASIC WARM START ENTRY (RESET)
A02A            LA02A   CLRB               *
A02B                TFR   B,DP             * USE PAGE Ø AS DIRECT PAGE
                ********************
A02D                LDX   #PIA0        POINT X TO PIAØ
A030                CLR   1,X          CLEAR CONTROL REGISTER A ON PIAØ(U8)
A032                CLR   3,X          CLEAR CONTROL REGISTER B
A034                CLR   ,X           A SIDE IS INPUT
A036                LDD   #$FF34
A039                STA   2,X          B SIDE IS OUTPUT
A03B                STB   1,X          ENABLE PERIPHERAL REGISTERS
A03D                STB   3,X          AND CA2, CB2 AS OUTPUTS
                ********************
A03F                LDX   #PIA1        POINT X TO PIA1
A042                CLR   1,X          * CLEAR CONTROL REGISTER A ON PIA1(U4)
A044                CLR   3,X          * CLEAR CONTROL REGISTER B
A046                DECA               A - REG NOW HAS $FE
A047                STA   ,X           = BITS 1-7 ARE OUTPUTS, BIT Ø IS INPUT
                *                      = ON SIDE A
A049                LDA   #$F8         *
A04B                STA   2,X          * BITS Ø-2 ARE INPUTS, BITS 3-7 ARE
                *                      * OUTPUTS ON B SIDE
A04D                STB   1,X          ENABLE PERIPHERAL REGISTERS
A04F                STB   3,X          AND CA2, CB2 AS OUTPUTS
A051                CLR   2,X          ZEROS TO 6847
A053                LDA   #2           *
A055                STA   ,X           * MAKE SERIAL OUTPUT MARKING
A057                LDA   2,X          READ PORT B OF U4 (TO GET RAM SIZE)
A059                LDX   #SAMREG      SAM CONTROL REGISTER ADDR
A05C                LDB   #16          16 SAM CONTROL REGISTER BITS
A05E            LA05E   STA   ,X++         ZERO OUT SAM CONTROL REGISTER (CLEAR BITS)
A060                DECB               DECREMENT REGISTER COUNTER
A061                BNE   LA05E        BRANCH IF NOT DONE
A063                STA   SAMREG+9     SET DISPLAY PAGE AT $400
A066                ANDA  #4           MASK OFF ALL BUT RAM SIZE BIT
A068                BEQ   LA06C        BRANCH IF 4K RAM
A06A                STA   -5,X         SET FOR 16K DYNAMIC
```

```
A06C            LA06C   JMP   ,U            GO DO A WARM START
A06E            BACDST  LDX   #Ø            POINT X TO TOP OF DIRECT PAGE
AØ71            LAØ71   CLR   ,X+           CLEAR FIRST 1K OF RAM
AØ73                    CMPX  #VIDRAM       COMPARE TO TOP OF DISPLAY (1K)
AØ76                    BNE   LAØ71         BRANCH IF NOT DONE
AØ78                    JSR   LA928         CLEAR SCREEN
AØ7B                    LDX   #LA1ØD        POINT X TO ROM IMAGE OF DIRECT PAGE VARS
AØ7E                    LDU   #CMPMID       POINT U TO RAM DESTINATION
AØ81                    LDB   #28           28 BYTES
AØ83                    JSR   LA59A         MOVE (B) BYTES FROM (X) TO (U)
AØ86                    LDU   #IRQVEC       POINT U TO NON-DIRECT PAGE VARIABLES
AØ89                    LDB   #3Ø           3Ø BYTES
AØ8B                    JSR   LA59A         MOVE (B) BYTES FROM (X) TO (U)
AØ8E                    LDX   #LB277        ADDR OF SYNTAX ERROR ROUTINE
AØ91                    STX   3,U           * SET EXBAS PRIMARY AND SECONDARY
                *                           * COMMAND INTERPRETATION TABLES TO
AØ93                    STX   8,U           * SYNTAX ERROR (U POINTS TO $12A AT
                *                           * THIS POINT)
AØ95                    LDX   #RVECØ        POINT X TO RAM VECTORS
AØ98                    LDA   #$39          OP CODE OF RTS
AØ9A            LAØ94   STA   ,X+           PUT RTS'S IN THE RAM VECTORS
AØ9C                    CMPX  #RVECØ+25*3   END OF RAM VECTORS?
AØ9F                    BNE   LAØ9A         NO KEEP INSERTING RTS
AØA1                    STA   LINHDR-1      PUT RTS IN $2D9
AØA4                    LDX   VIDRAM+$2ØØ   POINT TO COLOR BASIC'S START OF PROGRAM
AØA7                    CLR   ,X+           PUT A ZERO AT THE START OF BASIC
AØA9                    STX   TXTTAB        BEGINNING OF BASIC PROGRAM
AØAB            LAØAB   LDA   2,X           LOOK FOR END OF PROGRAM
AØAD                    COMA
AØAE                    STA   2,X           STORE IN RAM
AØBØ                    CMPA  2,X           IS VALUE IN MEMORY THE SAME AS WHAT WAS
                *                           JUST PUT THERE?
AØB2                    BNE   LAØBA         IF NOT, THEN IT IS NOT RAM OR THE RAM IS
                *                           BAD
AØB4                    LEAX  1,X           MOVE TO NEXT RAM LOCATION
AØB6            LAØB6   COM   1,X           RESTORE VALUE OF MEMORY JUST CHANGED
AØB8                    BRA   LAØAB         KEEP CHECKING RAM
AØBA            LAØBA   STX   TOPRAM        SET TOP OF RAM POINTER
AØBC                    STX   MEMSIZ        TOP OF STRING SPACE
AØBE                    STX   STRTAB        START OF STRING VARIABLES
AØCØ                    LEAX  -2ØØ,X        * CLEAR 2ØØ BYTES ON A COLD START -
AØC4                    STX   FRETOP        * SAVE NEW TOP OF FREE RAM
AØC6                    TFR   X,S           PUT STACK THERE (AT MEMEND-2ØØ)

*** LISTING 2
A1B5                    BSR   KEYIN         GO CHECK KEYBOARD
A1B7                    BEQ   LA1B3         LOOP IF NO KEY DOWN
A1B9                    LDB   #$6Ø          BLANK
A1BB                    STB   [CURPOS]      BLANK CURRENT CURSOR CHAR ON SCREEN
A1BF            LA1BF   PULS  B,X,PC
                *
                * THIS ROUTINE GETS A KEYSTROKE FROM THE KEYBOARD IF A KEY
                * IS DOWN. IT RETURNS ZERO TRUE IF THERE WAS NO KEY DOWN.
                *
A1C1            KEYIN   PSHS  B,X           SAVE REGISTERS
A1C3                    BSR   LA1C8         GET KEYSTROKE
A1C5                    TSTA                SET FLAGS
```

```
A1C6                    PULS  B,X,PC       RESTORE REGISTERS
A1C8          LA1C8     LEAS  -3,S         ALLOCATE 3 STORAGE BYTES ON STACK
A1CA                    LDX   #KEYBUF      SET X TO KEYBOARD MEMORY BUFFER
A1CD                    CLR   ,S           RESET COLUMN COUNTER
A1CF                    LDB   #$FE         COLUMN STROBE DATA, CHECK BIT Ø FIRST
                  **                       A COLUMN IS BEING CHECKED IF THE
                  **                       CORRESPONDING BIT IN THE COLUMN STROBE
                  **                       REGISTER ($FFØ2) HAS A ZERO IN IT.
A1D1                    STB   PIAØ+2       STORE IN COLUMN STROBE REGISTER
A1D4          LA1D4     BSR   LA238        GET KEY DATA
A1D6                    STA   1,S          TEMP STORE KEY DATA
A1D8                    EORA  ,X           COMPARE WITH KEY MEMORY DATA
A1DA                    ANDA  ,X           ACCA=Ø IF THIS KEY WAS DOWN LAST TIME, TOO
A1DC                    LDB   1,S          GET NEW KEY DATA
A1DE                    STB   ,X+          STORE IT IN KEY MEMORY
A1EØ                    TSTA               WAS A NEW KEY DOWN?
A1E1                    BNE   LA1ED        YES
A1E3                    INC   ,S           NO, INCREMENT COLUMN COUNTER
A1E5                    COMB               SET CARRY FLAG
A1E6                    ROL   PIAØ+2       ROTATE COLUMN STROBE DATA LEFT ONE BIT
A1E9                    BCS   LA1D4        ALL COLUMNS CHECKED WHEN ZERO IN THE
                  *                        COLUMN STROBE DATA IS ROTATED INTO THE
                  *                        CARRY FLAG
A1EB                    PULS  B,X,PC       RESTORE REGISTERS

A1ED          LA1ED     LDB   PIAØ+2       GET COLUMN STROBE DATA

                  ************************************************************
                  ** THIS ROUTINE CONVERTS THE KEY DEPRESSION INTO A NUMBER
                  ** FROM Ø-5Ø IN ACCB CORRESPONDING TO THE KEY THAT WAS DOWN
A1FØ                    STB   2,S          TEMP STORE IT
A1F2                    LDB   #$F8         TO MAKE SURE ACCB=Ø AFTER FIRST ADDB #8
A1F4          LA1F4     ADDB  #8           ADD 8 FOR EACH ROW OF KEYBOARD
A1F6                    LSRA               ACCA CONTAINS THE ROW NUMBER OF THIS KEY
                  *                        ADD 8 FOR EACH ROW
A1F7                    BCC   LA1F4        GO ON UNTIL A ZERO APPEARS IN THE CARRY
A1F9                    ADDB  ,S           ADD IN THE COLUMN NUMBER
                  ************************************************************
                  ** NOW CONVERT THE VALUE IN ACCB INTO ASCII
A1FB                    BEQ   LA245        THE 'AT SIGN' KEY WAS DOWN
A1FD                    CMPB  #26          WAS IT A LETTER?
A1FF                    BHI   LA247        NO
A2Ø1                    ORB   #$4Ø         YES, CONVERT TO UPPER CASE ASCII
A2Ø3                    BSR   LA22D        CHECK FOR THE SHIFT KEY
A2Ø5                    BEQ   LA2ØE        IT WAS DOWN
A2Ø7                    LDA   CASFLG       NOT DOWN, CHECK THE UPPER/LOWER CASE FLAG
A2ØA                    BNE   LA2ØE        UPPER CASE
A2ØC                    ORB   #$2Ø         CONVERT TO LOWER CASE
A2ØE          LA2ØE     STB   ,S           TEMP STORE ASCII VALUE
A21Ø                    LDX   DEBVAL       GET KEYBOARD DEBOUNCE
A213                    JSR   LA7D3        GO WAIT A WHILE
A216                    LDB   2,S          GET COLUMN STROBE DATA
A218                    STB   PIAØ+2       STORE IT
A21B                    BSR   LA238        READ A KEY
A21D                    CMPA  1,S          IS IT THE SAME KEY AS BEFORE DEBOUNCE?
A21F                    PULS  A            PUT THE ASCII VALUE OF KEY BACK IN ACCA
A221                    BNE   LA22A        NOT THE SAME KEY
```

```
A223                CMPA  #$12         IS SHIFT ZERO DOWN?
A225                BNE   LA22B        NO
A227                COM   CASFLG       YES, TOGGLE UPPER/LOWER CASE FLAG
A22A          LA22A CLRA              SET ZERO FLAG TO INDICATE NO NEW KEY DOWN
A22B          LA22B PULS  X,PC        RESTORE REGISTERS

              *** TEST FOR THE SHIFT KEY
A22D          LA22D LDA   #$7F        COLUMN STROBE
A22F                STA   PIA0+2      STORE TO PIA
A232                LDA   PIA0        READ KEY DATA
A235                ANDA  #$40        CHECK FOR SHIFT KEY, SET ZERO FLAG IF DOWN
A237                RTS               RETURN

              *** READ THE KEYBOARD
A238          LA238 LDA   PIA0        READ PIA0, PORT A TO SEE IF KEY IS DOWN
              **                      A BIT WILL BE ZERO IF ONE IS
A23B                ORA   #$80        MASK OFF THE JOYSTICK COMPARATOR INPUT
A23D                TST   PIA0+2      ARE WE STROBING COLUMN 7?
A240                BMI   LA244       NO
A242                ORA   #$C0        YES, FORCE ROW 6 TO BE HIGH -THIS WILL
              **                      CAUSE THE SHIFT KEY TO BE IGNORED
A244          LA244 RTS               RETURN

A245          LA245 LDB   #51         CODE FOR 'AT SIGN'
A247          LA247 LDX   #CONTAB-$36 POINT X TO CONTROL CODE TABLE
A24A                CMPB  #33         KEY NUMBER <33?
A24C                BLO   LA264       YES (ARROW KEYS, SPACE BAR, ZERO)
A24E                LDX   #CONTAB-$54 POINT X TO MIDDLE OF CONTROL TABLE
A251                CMPB  #48         KEY NUMBER > 48?
A253                BHS   LA264       YES (ENTER, CLEAR, BREAK, AT SIGN)
A255                BSR   LA22D       CHECK SHIFT KEY (ACCA WILL CONTAIN STATUS)
A257                CMPB  #43         IS KEY A NUMBER, COLON OR SEMICOLON?
A259                BLS   LA25D       YES
A25B                EORA  #$40        TOGGLE BIT 6 OF ACCA WHICH CONTAINS THE
              **                      SHIFT DATA ONLY FOR SLASH, HYPHEN, PERIOD,
              **                      COMMA
A25D          LA25D TSTA              SHIFT KEY DOWN?
A25E                BEQ   LA20E       YES
A260                ADDB  #$10        NO, ADD IN ASCII OFFSET CORRECTION
A262                BRA   LA20E       GO CHECK FOR DEBOUNCE

A264          LA264 ASLB              MULT ACCB BY 2 - THERE ARE 2 ENTRIES IN
              **                      CONTROL TABLE FOR EACH KEY - ONE SHIFTED,
              **                      ONE NOT
A265                BSR   LA22D       CHECK SHIFT KEY
A267                BNE   LA26A       NOT DOWN
A269                INCB              ADD ONE TO GET THE SHIFTED VALUE
A26A          LA26A LDB   B,X         GET ASCII CODE FROM CONTROL TABLE
A26C                BRA   LA20E       GO CHECK DEBOUNCE

*** LISTING 3
A2C3                BSR   LA2FB       SET OUTPUT TO MARKING
A2C5                ASLA              SEND 7 BITS AND ONE STOP BIT (BIT 7=0)
A2C6                LDB   #8          SEND 8 BITS
A2C8          LA2C8 PSHS  B           SAVE BIT COUNTER
A2CA                CLRB              CLEAR DA IMAGE 1 ZEROS TO DA WHEN SENDING
              *                       RS-232 DATA
```

```
A2CB                LSRA            ROTATE NEXT BIT OF OUTPUT CHARACTER TO
                    *                       CARRY FLAG
A2CC                ROLB            * ROTATE CARRY FLAG INTO BIT ONE
A2CD                ROLB            * AND ALL OTHER BITS SET TO ZERO
A2CE                STB   DA        STORE IT TO DA CONVERTER
A2D1                BSR   LA3Ø2     GO WAIT A WHILE
A2D3                NOP
A2D4                NOP
A2D5                NOP
A2D6                BSR   LA3Ø2     GO WAIT SOME MORE
A2D8                PULS  B         GET BIT COUNTER
A2DA                DECB            SENT ALL 8 BITS?
A2DB                BNE   LA2C8     NO
A2DD                BSR   LA2FB     SEND STOP BIT (ACCB=Ø)
A2DF                PULS  CC,A      RESTORE OUTPUT CHARACTER & INTERRUPT STATS
A2E1                CMPA  #CR       IS IT A CARRIAGE RETURN?
A2E3                BEQ   LA2ED     YES
A2E5                INC   LPTPOS    INCREMENT CHARACTER COUNTER
A2E7                LDB   LPTPOS    CHECK FOR END OF LINE PRINTER LINE
A2E9                CMPB  LPTWID    AT END OF LINE PRINTER LINE?
A2EB                BLO   LA2F3     NO
A2ED          LA2ED CLR   LPTPOS    RESET CHARACTER COUNTER
A2EF                BSR   LA3Ø5     *
A2F1                BSR   LA3Ø5     * DELAY FOR CARRIAGE RETURN
A2F3          LA2F3 LDB   PIA1+2    WAIT FOR HANDSHAKE
A2F6                LSRB            CHECK FOR RS232 STATUS
A2F7                BCS   LA2F3     NOT YET READY
A2F9                PULS  B,X,PC    RESTORE REGISTERS

*** LISTING 4
B3ED          INTCNV LDA  FPØEXP    GET FPAØ EXPONENT
B3EF                CMPA  #$9Ø      * COMPARE TO 32768 - LARGEST INTEGER
B3F1                BCS   LB3FB     * EXPONENT AND BRANCH IF FPAØ < 32768
B3F3                LDX   #LB3DF    POINT X TO FP VALUE OF -32768
B3F6                JSR   LBC96     COMPARE -32768 TO FPAØ
B3F9                BNE   LB44A     'FC' ERROR IF NOT =
B3FB          LB3FB JSR   LBCC8     CONVERT FPAØ TO A TWO BYTE INTEGER
B3FE                LDD   FPAØ+3    GET THE INTEGER
B4ØØ                RTS
                    * EVALUATE AN ARRAY VARIABLE
B4Ø1          LB4Ø1 LDB   DIMFLG    GET ARRAY FLAG
B4Ø3                LDA   VALTYP    GET VARIABLE TYPE
B4Ø5                PSHS  A,B       SAVE THEM ON THE STACK
B4Ø7                CLRB            RESET DIMENSION COUNTER
B4Ø8          LB4Ø8 LDX   VARNAM    GET VARIABLE NAME
B4ØA                PSHS  B,X       SAVE VARIABLE NAME AND DIMENSION COUNTER
B4ØC                BSR   LB3E4     EVALUATE EXPRESSION (DIMENSION LENGTH)
B4ØE                PULS  B,X,Y     PULL OFF VARIABLE NAME, DIMENSION COUNTER
                    *                       ARRAY FLAG
B41Ø                STX   VARNAM    SAVE VARIABLE NAME AND VARIABLE TYPE
B412                LDU   FPAØ+2    GET DIMENSION LENGTH
B414                PSHS  Y,U       SAVE DIMENSION LENGTH, ARRAY FLAG,
                                    VARIABLE TYPE
B416                INCB            INCREASE DIMENSION COUNTER
B417                JSR   GETCCH    GET CURRENT INPUT CHARACTER
B419                CMPA  #',       CHECK FOR ANOTHER DIMENSION
B41B                BEQ   LB4Ø8     BRANCH IF MORE
```

```
B41D                    STB   TMPLOC      SAVE DIMENSION COUNTER
B41F                    JSR   LB267       SYNTAX CHECK FOR A ")"
B422                    PULS  A,B         * RESTORE VARIABLE TYPE AND ARRAY
B424                    STA   VALTYP      * FLAG - LEAVE DIMENSION LENGTH ON STACK
B426                    STB   DIMFLG      *
```

Listed below are the differences between Color BASIC Version 1.1 and Version 1.2

CHANGE	ADDRESS	Version 1.1	Version 1.2
A	$A001	$C1	$CB
B	$A114	$57	$58
C	$A155	$31	$32
D	$A15E	$30	$32
E	$A1B5-$A26D	SEE LISTING 5	
F	$A2C3-$A2FA	SEE LISTING 6	
G	$A56A	$C1	$CB
H	$ADFD	$C1	$CB
J	$B23F	$E8	$E3
K	$B38E	$72	$75
L	$B3ED-$B427	SEE LISTING 7	
M	$B9D6	$2B BMI	$25 BCS

Change A is a branch length change caused by the keyboard driver mod.

Change B modified the line printer baud rate.

Change C is the version number.

Change D is the copyright year.

Change E is a major change (Listing 5) to the keyboard driver allowing a quick scan of the keyboard if no keys are down.

Change F is also a major change to the line printer driver which will not allow any transmission until the receiving device is ready (Listing 6).

Change G speeds up the INKEY$ command by not entering the keyboard scan routine if no keys are depressed.

Change H speeds up the BREAK key check routine by not entering the keyboard scan routine if no keys are depressed.

Change J is a minor change which slightly speeds up the expression evaluation routine.

Change K is merely a different length branch caused by change L.

Change L (Listing 7) causes a numeric variable type check to be done before the INTCNV (FPA0 to integer) routine.

Change M fixed a minor bug in the floating point addition routine.

*** LISTING 5

```
A1B5                BSR   KEYIN        GO CHECK KEYBOARD
A1B7                BEQ   LA1B3        LOOP IF NO KEY DOWN
A1B9                LDB   #$60         BLANK
A1BB                STB   [CURPOS]     BLANK CURRENT CURSOR CHAR ON SCREEN
A1BF          LA1BF PULS  B,X,PC
```

```
                    *
                    * THIS ROUTINE GETS A KEYSTROKE FROM THE KEYBOARD IF A KEY
                    * IS DOWN. IT RETURNS ZERO TRUE IF THERE WAS NO KEY DOWN.
                    *
A1C1                KEYIN   PSHS  B,X,U       SAVE REGISTERS
A1C3                        BSR   LA1C8       GET KEYSTROKE
A1C5                        TSTA              SET FLAGS
A1C6                        PULS  B,X,U,PC    RESTORE REGISTERS
A1C8                LA1C8   LDU   #PIAØ       POINT TO PIAØ
A1CB                        LDX   #KEYBUF     KEYBOARD MEMORY BUFFER
A1CE                        CLRA              * CLEAR CARRY FLAG, SET COLUMN COUNTER
A1CF                        DECA              * (ACCA) TO $FF
A1DØ                        PSHS  X,A         SAVE COLUMN CTR & 2 BLANK (X REG) ON STACK
A1D2                        STA   2,U         INITIALIZE COLUMN STROBE TO $FF
A1D4                        FCB   SKP1        SKIP ONE BYTE
A1D5                LA1D5   COMB              SET CARRY FLAG
A1D6                        ROL   2,U         * ROTATE COLUMN STROBE DATA LEFT 1 BIT,
A1D8                        BCC   LA1BF       * CARRY INTO BIT Ø-RETURN IF 8 BITS DONE
A1DA                        INC   ,S          INCREMENT COLUMN POINTER
A1DC                        BSR   LA239       READ KEYBOARD DATA ROW
A1DE                        STA   1,S         TEMP STORE KEY DATA
A1EØ                        EORA  ,X          SET ANY BIT WHERE A KEY HAS MOVED
A1E2                        ANDA  ,X          ACCA=Ø IF NO NEW KEY DOWN, <7Ø IF KEY WAS
                    *                         RELEASED
A1E4                        LDB   1,S         GET NEW KEY DATA
A1E6                        STB   ,X+         STORE IT IN KEY MEMORY
A1E8                        TSTA              WAS A NEW KEY DOWN?
A1E9                        BEQ   LA1D5       NO-CHECK ANOTHER COLUMN
A1EB                        LDB   2,U         * GET COLUMN STROBE DATA AND
A1ED                        STB   2,S         * TEMP STORE IT ON THE STACK
                    ************************************************************
                    ** THIS ROUTINE CONVERTS THE KEY DEPRESSION INTO A NUMBER
                    ** FROM Ø-5Ø IN ACCB CORRESPONDING TO THE KEY THAT WAS DOWN
A1EF                        LDB   #$F8        TO MAKE SURE ACCB=Ø AFTER FIRST ADDB #8
A1F1                LA1F1   ADDB  #8          ADD 8 FOR EACH ROW OF KEYBOARD
A1F3                        LSRA              ACCA CONTAINS THE ROW NUMBER OF THIS KEY
                    *                         ADD 8 FOR EACH ROW
A1F4                        BCC   LA1F1       GO ON UNTIL A ZERO APPEARS IN THE CARRY
A1F6                        ADDB  ,S          ADD IN THE COLUMN NUMBER
                    ************************************************************
                    ** NOW CONVERT THE VALUE IN ACCB INTO ASCII
A1F8                        BEQ   LA244       THE 'AT SIGN' KEY WAS DOWN
A1FA                        CMPB  #26         WAS IT A LETTER?
A1FC                        BHI   LA246       NO
A1FE                        ORB   #$4Ø        YES, CONVERT TO UPPER CASE ASCII
A2ØØ                        BSR   LA22E       CHECK FOR THE SHIFT KEY
A2Ø2                        BEQ   LA2ØB       IT WAS DOWN
A2Ø4                        LDA   CASFLG      NOT DOWN, CHECK THE UPPER/LOWER CASE FLAG
A2Ø7                        BNE   LA2ØB       UPPER CASE
A2Ø9                        ORB   #$2Ø        CONVERT TO LOWER CASE
A2ØB                LA2ØB   STB   ,S          TEMP STORE ASCII VALUE
A2ØD                        LDX   DEBVAL      GET KEYBOARD DEBOUNCE
A21Ø                        JSR   LA7D3       GO WAIT A WHILE
A213                        LDB   #$FF        * SET COLUMN STROBE TO ALL ONES (NO
A215                        BSR   LA237       * STROBE) AND READ KEYBOARD
A217                        INCA              = INCR ROW DATA, ACCA NOW Ø IF NO JOYSTK
A218                        BNE   LA22Ø       = BUTTON DOWN. BRANCH IF JOYSTK BUTTON DN
```

```
A21A            LA21A   LDB   2,S          GET COLUMN STROBE DATA
A21C                    BSR   LA237        READ A KEY
A21E                    CMPA  1,S          IS IT THE SAME KEY AS BEFORE DEBOUNCE?
A220            LA220   PULS  A            PUT THE ASCII VALUE OF KEY BACK IN ACCA
A222                    BNE   LA22B        NOT THE SAME KEY
A224                    CMPA  #$12         IS SHIFT ZERO DOWN?
A226                    BNE   LA22C        NO
A228                    COM   CASFLG       YES, TOGGLE UPPER/LOWER CASE FLAG
A22B            LA22B   CLRA               SET ZERO FLAG TO INDICATE NO NEW KEY DOWN
A22C            LA22C   PULS  X,PC         REMOVE TEMP STORAGE SLOTS FROM STACK

                *** TEST FOR THE SHIFT KEY
A22E            LA22E   LDA   #$7F         COLUMN STROBE
A230                    STA   2,U          STORE TO PIA
A232                    LDA   ,U           READ KEY DATA
A234                    ANDA  #$40         CHECK FOR SHIFT KEY, SET ZERO FLAG IF DOWN
A236                    RTS                RETURN

                *** READ THE KEYBOARD
A237            LA237   STB   2,U          SAVE NEW COLUMN STROBE VALUE
A239            LA239   LDA   ,U           READ PIA0, PORT A TO SEE IF KEY IS DOWN
                **                         A BIT WILL BE ZERO IF ONE IS
A23B                    ORA   #$80         MASK OFF THE JOYSTICK COMPARATOR INPUT
A23D                    TST   2,U          ARE WE STROBING COLUMN 7?
A23F                    BMI   LA243        NO
A241                    ORA   #$C0         YES, FORCE ROW 6 TO BE HIGH -THIS WILL
                **                         CAUSE THE SHIFT KEY TO BE IGNORED
A243            LA243   RTS                RETURN

A244            LA244   LDB   #51          CODE FOR 'AT SIGN'
A246            LA246   LDX   #CONTAB-$36  POINT X TO CONTROL CODE TABLE
A249                    CMPB  #33          KEY NUMBER <33?
A24B                    BLO   LA263        YES (ARROW KEYS, SPACE BAR, ZERO)
A24D                    LDX   #CONTAB-$54  POINT X TO MIDDLE OF CONTROL TABLE
A250                    CMPB  #48          KEY NUMBER > 48?
A252                    BHS   LA263        YES (ENTER, CLEAR, BREAK, AT SIGN)
A254                    BSR   LA22E        CHECK SHIFT KEY (ACCA WILL CONTAIN STATUS)
A256                    CMPB  #43          IS KEY A NUMBER, COLON OR SEMICOLON?
A258                    BLS   LA25C        YES
A25A                    EORA  #$40         TOGGLE BIT 6 OF ACCA WHICH CONTAINS THE
                **                         SHIFT DATA ONLY FOR SLASH, HYPHEN, PERIOD,
                **                         COMMA
A25C            LA25C   TSTA               SHIFT KEY DOWN?
A25D                    BEQ   LA20B        YES
A25F                    ADDB  #$10         NO, ADD IN ASCII OFFSET CORRECTION
A261                    BRA   LA20B        GO CHECK FOR DEBOUNCE

A263            LA263   ASLB               MULT ACCB BY 2 - THERE ARE 2 ENTRIES IN
                **                         CONTROL TABLE FOR EACH KEY - ONE SHIFTED,
                **                         ONE NOT
A264                    BSR   LA22E        CHECK SHIFT KEY
A266                    BNE   LA269        NOT DOWN
A268                    INCB               ADD ONE TO GET THE SHIFTED VALUE
A269            LA269   LDB   B,X          GET ASCII CODE FROM CONTROL TABLE
A26B                    BRA   LA20B        GO CHECK DEBOUNCE
A26D                    FCB   0            WASTED SPACE IN VERSION 1.1
```

```
*** LISTING 6
A2C3                BSR   LA2FB       SET OUTPUT TO MARKING
A2C5                CLRB              *
A2C6                BSR   LA2FD       * TRANSMIT ONE START BIT
A2C8                LDB   #8          SEND 8 BITS
A2CA          LA2CA PSHS  B           SAVE BIT COUNTER
A2CC                CLRB              CLEAR DA IMAGE 1 ZEROS TO DA WHEN SENDING
              *                       RS-232 DATA
A2CD                LSRA              ROTATE NEXT BIT OF OUTPUT CHARACTER TO
              *                       CARRY FLAG
A2CE                ROLB              * ROTATE CARRY FLAG INTO BIT ONE
A2CF                ASLB              * AND ALL OTHER BITS SET TO ZERO
A2D0                BSR   LA2FD       TRANSMIT DATA BYTE
A2D2                PULS  B           GET BIT COUNTER
A2D4                DECB              SENT ALL 8 BITS?
A2D5                BNE   LA2CA       NO
A2D7                BSR   LA2FB       SEND STOP BIT (ACCB=0)
A2D9                PULS  CC,A        RESTORE OUTPUT CHARACTER & INTERRUPT STATS
A2DB                CMPA  #CR         IS IT A CARRIAGE RETURN?
A2DD                BEQ   LA2E7       YES
A2DF                INC   LPTPOS      INCREMENT CHARACTER COUNTER
A2E1                LDB   LPTPOS      CHECK FOR END OF LINE PRINTER LINE
A2E3                CMPB  LPTWID      AT END OF LINE PRINTER LINE?
A2E5                BLO   LA2ED       NO
A2E7          LA2E7 CLR   LPTPOS      RESET CHARACTER COUNTER
A2E9                BSR   LA305       *
A2EB                BSR   LA305       * DELAY FOR CARRIAGE RETURN
A2ED          LA2ED LDB   PIA1+2      WAIT FOR HANDSHAKE
A2F0                LSRB              CHECK FOR RS232 STATUS
A2F1                BCS   LA2ED       NOT YET READY
A2F3                PULS  B,X,PC      RESTORE REGISTERS
A2F5                FDB   0,0,0       WASTED SPACE IN VERSION 1.1

*** LISTING 7
B3ED          INTCNV LDA  FP0EXP      GET FPA0 EXPONENT
B3EF                CMPA  #$90        * COMPARE TO 32768 - LARGEST INTEGER
B3F1                BCS   LB3FB       * EXPONENT AND BRANCH IF FPA0 < 32768
B3F3                LDX   #LB3DF      POINT X TO FP VALUE OF -32768
B3F6                JSR   LBC96       COMPARE -32768 TO FPA0
B3F9                BNE   LB44A       'FC' ERROR IF NOT =
B3FB          LB3FB JSR   LBCC8       CONVERT FPA0 TO A TWO BYTE INTEGER
B3FE                LDD   FPA0+2      GET THE INTEGER
B400                RTS
              * EVALUATE AN ARRAY VARIABLE
B401          LB401 LDB   DIMFLG      GET ARRAY FLAG
B403                LDA   VALTYP      GET VARIABLE TYPE
B405                PSHS  A,B         SAVE THEM ON THE STACK
B407                CLRB              RESET DIMENSION COUNTER
B408          LB408 LDX   VARNAM      GET VARIABLE NAME
B40A                PSHS  B,X         SAVE VARIABLE NAME AND DIMENSION COUNTER
B40C                BSR   LB3E4       EVALUATE EXPRESSION (DIMENSION LENGTH)
B40E                PULS  B,X,Y       PULL OFF VARIABLE NAME, DIMENSION COUNTER
              *                       ARRAY FLAG
B410                STX   VARNAM      SAVE VARIABLE NAME AND VARIABLE TYPE
B412                LDU   FPA0+2      GET DIMENSION LENGTH
B414                PSHS  Y,U         SAVE DIMENSION LENGTH, ARRAY FLAG,
                                      VARIABLE TYPE
```

```
B416                    INCB              INCREASE DIMENSION COUNTER
B417                    JSR   GETCCH       GET CURRENT INPUT CHARACTER
B419                    CMPA  #',         CHECK FOR ANOTHER DIMENSION
B41B                    BEQ   LB4Ø8       BRANCH IF MORE
B41D                    STB   TMPLOC      SAVE DIMENSION COUNTER
B41F                    JSR   LB267       SYNTAX CHECK FOR A ")"
B422                    PULS  A,B         * RESTORE VARIABLE TYPE AND ARRAY
B424                    STA   VALTYP      * FLAG - LEAVE DIMENSION LENGTH ON STACK
B426                    STB   DIMFLG      *
```

DISPLAY CHARACTER SET

HEX VALUE		CHARACTER	HEX VALUE		CHARACTER	HEX VALUE		CHARACTER
Non-Inverted	Inverted		Non-Inverted	Inverted		Non-Inverted	Inverted	
ØØ	4Ø	@	18	58	X	3Ø	4Ø	Ø
Ø1	41	A	19	59	Y	31	41	1
Ø2	42	B	1A	5A	Z	32	42	2
Ø3	43	C	1B	5B	[	33	43	3
Ø4	44	D	1C	5C	\	34	44	4
Ø5	45	E	1D	5D	]	35	45	5
Ø6	46	F	1E	5E	↑	36	46	6
Ø7	47	G	1F	5F	←	37	47	7
Ø8	48	H	2Ø	6Ø		38	48	8
Ø9	49	I	21	61	!	39	49	9
ØA	4A	J	22	62	"	3A	4A	:
ØB	4B	K	23	63	#	3B	4B	;
ØC	4C	L	24	64	$	3C	4C	<
ØD	4D	M	25	65	%	3D	4D	=
ØE	4E	N	26	66	&	3E	4E	>
ØF	4F	O	27	67	'	3F	4F	?
1Ø	5Ø	P	28	68	(			
11	51	Q	29	69	)			
12	52	R	2A	6A	*			
13	53	S	2B	6B	+			
14	54	T	2C	6C	,			
15	55	U	2D	6D	-			
16	56	V	2E	6E	.			
17	57	W	2F	6F	/			