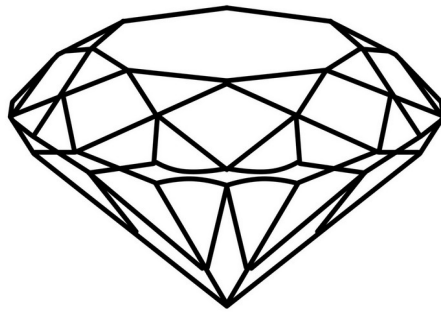


Texas Instruments
Extended BASIC 2.9
G.E.M.



by Harry Wilhelm
(based on Extended Basic v2.7 by Tony Knerr)

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Extended BASIC 2.9 Graphics Enhancement Module.

The original XB G.E.M.module was developed to see how much power could be packed into TI Extended BASIC using just the 5 XB groms and the standard XB roms. Three graphics utilities totaling about 18K of code were compressed and squeezed into about 12K of free space in the XB groms. There is virtually no room left in the standard size roms and groms, and further development within these limits is not feasible.

These limitations go away when you add additional bank switched ROM pages to the cartridge. This makes it possible to add many significant enhancements. Starting with Tony Knerr's XB 2.7, I added 18 – 8K pages of ROM memory and a number of new CALLs and other refinements to the XB 2.7 groms. The result is Extended BASIC v2.9 G.E.M.

NEW FEATURES IN XB 2.9

Some of the existing CALLs have been modified:

CALL CHAR can now define any of the characters from 30 to 159. A string up to 255 bytes long can be used as the pattern identifier. This lets you define up to 16 characters with a single CALL CHAR.

CALL CHARPAT can now return a character pattern for characters from 30 to 159.

CALL COLOR(ALL,foreground,background) changes the color of all characters from 30 to 143.

CALL COLOR can now define the color of all the character sets from 0 to 31. You cannot change the pattern of the characters below 30 and above 159, but if the foreground and background are the same color you get an 8x8 block of one solid color. Without sacrificing *any* of the definable characters from 30 to 159, you can have blocks of all 15 possible colors. Use HCHAR and VCHAR to place these blocks on the screen for borders and other graphics. See page 3 for more information.

With the changes to the limit checks, XB 2.9 G.E.M. can run TI BASIC programs using character sets 15 and 16, and usually with a considerable increase in speed.

CALL HCHAR, CALL VCHAR, CALL CHAR, and CALL CHARPAT are *much* faster.

HCHAR, VCHAR, and GCHAR can now retrieve multiple values in a single CALL.

CALL INIT – after loading the assembly support routines INIT also clears the interrupt hook at >83C4. Unlike standard XB, CALL INIT is performed at XB startup.

CALL LOAD(filename) now uses the fast assembly language loader from the minimemory cartridge. This is about 20x faster than the normal loader used by other Extended BASICs. You can now load compressed code, use REFs and most of the other features missing from the normal XB loader. ***Do not AORG code to memory from >2008 to >20F7.*** This ram is temporarily used by the loader. When the loader is finished these addresses are then reset to the normal values provided by CALL INIT. Error messages are the same as in XB: DATA ERROR is used for CHECKSUM ERROR, and UNRECOGNIZED CHARACTER is used for ILLEGAL TAG.

CALL HELP now displays a detailed help menu with brief descriptions of all the new calls in XB2.9. Use the space bar to advance to the next page of the help menu. The fourth page has tables showing color codes and character sets. Enter a font number between 1 and 60 to display that font. Press space bar and you can press any key to see the ASCII code for that key. Press space bar and you get a number converter. Enter a decimal, hexadecimal or binary number. Press space bar to exit.

CALL VERSION(X) returns 2.9+year+month+day. The latest version is 2.920250518

FONTS – 60 fonts are contained in the cartridge roms. A font can be loaded to the normal XB location with CALL FONT(number). The graphics packages have new CALL LINKs to load a font for use by screen 2 in XB256, the bit mapped screen of The Missing Link, the text mode screens in T40XB and T80XB, or the multicolor mode.

RND uses a modified version of the TI BASIC random number generator. This addresses some serious shortcomings in that version and is about 5x faster than the original XB random number generator. There is another very useful modification: normally a LOAD program will always produce the same random numbers when it autoruns at XB startup. This has been changed so that now a LOAD program will actually produce random numbers. (Note that if you use a random number seed (i.e. RANDOMIZE 99), the sequence of random numbers will be different from both TI BASIC and XB.)

There are changes to the 28 column editor to make programming easier. You can enter XB lines with up to 12 rows of code instead of the usual 5. The cursor repeat speed is faster. When editing a program line the cursor appears in the usual place, but you can go left to change the line number. The Fctn+E/S/D/X (Up/Left/Right/Down) keys function normally. Also you can use Ctrl+E/S/D/X to easily navigate a long program line. Ctrl+S(left) moves one column to the left. Ctrl+D (right) moves one column to the right. Ctrl+X(down) moves down one row or to the end of the line. Ctrl+E up) goes up one row or to the beginning of the line. Fctn 3(clear) erases the line from the cursor to the end of the line.

A powerful new full screen editor has been added that lets you program in the 40 or 80 column text mode. This is described on pages 5 and 6.

At startup or when a program breaks or ends, * Extended Basic 2.9 G.E.M. is displayed. Below that one of the following messages will be displayed.

* No additional message if you selected Extended BASIC v2.9.

* XB256 * when XB256 is loaded and active

* T40XB * when T40XB is loaded and active

* T80XB * when T80XB is loaded and active

* TML * when The Missing Link is loaded and active

* TMLGA * when TML Graphics Adventure is loaded and active.

* MULTICOLOR * when SteveB's Multicolor v1.1 utilities are loaded and active.

You would normally use CALL CAT(devicename) to get a disk catalog, but there is also an assembly language disk catalog program in XB256, T40XB, and T80XB. CALL LINK("CAT") will catalog a disk. Press any key to pause/resume the listing.

CALL VPEEK, VPOKE and GPEEK have been renamed PEEKV, POKEV and PEEKG. This is consistent with the convention used in Editor/Assembler BASIC, MiniMemory BASIC and RXB.

When selecting an option from the main menu, you can hold down any key for about 2 seconds to defeat autoloading. This can be inverted so that when your finger is *off* a key XB *will not* autoload. See page 13 for information on how to customize XB 2.9 G.E.M.

You can temporarily change the edit mode colors and font with CALL LOAD(9456,colors,font) The color should be foreground*16+background-17. The font should be a number from 1-60. If you add 128 to the font number you can invert the autoload behavior so you have to hold down a key to RUN "DSK1.LOAD". If you add 64 to the font number you can run force command on BYE. See page 13 for information on how to customize XB 2.9 G.E.M.

Occasionally there was some erratic behavior while running the graphics modes in Classic99 using CPU overdrive. Changes have been made which hopefully will eliminate this problem.

NEW CALLS IN XB 2.9

(ALL OF THE NEW CALLS REQUIRE 32K AND USE ROUTINES IN CALL INIT)

CALL INITG

INITG does the CALL INIT routine, loads two additional support routines for GPLLNK and DSRLNK, then clears the interrupt hook at >83C4.

GPLLNK is at >24F4 and DSRLNK is at >253A.

CALL STCR(# bits,cruaddress,numeric-variable)

Reads 1 to 16 bits from the CRU into a variable. The bits are read starting at cru address. The first bit read will be stored in the least significant bit of the variable, The number of bits must be from 1 to 16, and the cruaddress must be from 0 to 4096.

CALL LDCR(# bits,cruaddress,numeric value)

Loads 1 to 16 bits contained in the numeric value into the CRU starting at cruaddress. The bits are sent starting with the least significant bit. The number of bits must be from 1 to 16, and the cru address must be from 0 to 4096.

CALL DM1000

Runs Disk Manager 1000 7.0. This is not useful for those who use emulators, but is very handy if you are running a real TI-99/4a.

FONTS

CALL FONT(Number)

FONT is used to load one of the 60 fonts contained in the XB 2.9 G.E.M. roms. Patterns are loaded for ASCII 30 to 127. The number must be from 1 to 60 and can be a constant or a variable.

CALL LFONT(Filename)

LFONT is used to load a font from disk. Patterns are loaded for ASCII 30 to 127.

CALL SFONT(Filename)

SFONT is used to save a font to disk. The cursor pattern is moved to ASCII 127 and then the characters from 32 to 127 are saved in memory image (binary) format.

SAVING/LOADING PROGRAMS

CALL SAVEIV("DSKn.PROGNAME")

Used to save a program to disk in IV254 format. This is the format used by XB when saving long programs to disk. CALL SAVEIV("DSK2.TEST3") will save the currently loaded XB program as TEST3 onto DSK2. If the program is very small, a line 1 is created to pad the program with a DATA statement, which lets you save even the shortest XB program as IV254. (Immediate mode)

LIST "DSKn.FILE"

Saves a program in DV80 format or .TXT format. It should only be used to save displayable ascii characters from 32 to 127. With Classic99 you can **LIST "DSKn.?W.FILE.TXT"** which saves the file as Windows text. There will be an extra carriage return at the end of each line, but this should cause no problems. Embedded assembly code can not be saved or loaded. (Immediate mode)

Unlike normal XB, you do not have to save the entire program.

LIST "DSK1.TEST":100-150

Saves lines 100 to 150 to disk 1 as the file "TEST"

LIST "DSK1.TEST1":200-

Saves lines 200 and above to disk 1 as the file "TEST1"

CALL DV2XB(filename)

Usually this would be used to merge a program previously saved in DV80 or .TXT format. If a program is already in memory, the lines of code are merged into that program. A line will replace an existing line if it has the same line number. Embedded code cannot be saved or loaded. It can also be used to send commands in a batch file to the XB line editor. DV2XB only sends characters when the line editor is active. It pauses when an XB program is running. Press Fctn 4 to abort. (Immediate mode)

CHAINING PROGRAMS

CALL RUN(Filename)

RUN is used to run another XB program from a running program. It does the same thing as RUN "DSK1.PROGRAM" but you can use a string variable which is not permitted in XB. This could be useful in a menu program or when chaining programs together.

CALL RUNL1(Filename)

RUNL1 is used to run another XB program from a running program. It is similar to CALL RUN but there is a major difference. After it loads the program it runs the first line in the program, *but without doing a prescan or resetting any of the variables of the calling program*. By chaining programs together with RUNL1 the 24K size limit disappears. You can divide a very long XB program into shorter sections and load the segments of program as needed, with instant start up of the chained programs.

More information on using RUN, RUNL1 and SAVEIV can be found in the section entitled AUTOLOADING AND CHAINING PROGRAMS, starting on page 15 below.

FORCE COMMAND

CALL FC

FC is used to start "Force Command". This will only work if you have TIPI. You will get the message I/O ERROR 00. if there is no TIPI. You can also change the default configuration of XB 2.9 G.E.M. so that BYE will start "Force Command". See page 13 for more information on how to customize XB 2.9 G.E.M.

TEXT MODE PROGRAMMING EDITOR

XB 2.9 G.E.M. now has the ability to edit an Extended BASIC program using the 40 column and the 80 column text mode. (80 columns requires the Classic99 emulator or an 80 column card for the TI expansion box.) The new text mode editor lets you edit a line anywhere on the screen, not just on the bottom row.

CALL EDIT32	selects the standard 32 (28) column editing mode. (default)
CALL EDIT40	lets you edit in the 40 column text mode.
CALL EDIT80	lets you edit in the 80 column text mode.

At startup, XB 2.9 G.E.M. tries to set the editing mode to EDIT32. But when a real TI99 is powered up, the memory is in an indeterminate state. This can cause some consoles to start in the EDIT40 mode. The EDIT32 and EDIT40 modes are retained after a “quit,” but the EDIT80 mode is reset to EDIT32.

Keys usable in EDIT32, EDIT40, and EDIT80:

Fctn S and Ctrl S	cursor left one column
Fctn D and Ctrl D	cursor right one column
Fctn E	edit previous line in program
Fctn X	edit next line in programming
Ctrl E	cursor up one row. If on the first row then to the beginning of the line
Ctrl X	cursor down one row. If on the last row then to the end of the line.
Fctn 1 (and Ctrl 1 text mode)	delete character at the cursor (same as normal XB)
Fctn 2 (and Ctrl 2 text mode)	set insert mode (same as normal XB)

The other editing keys such as Enter, Up, Down, Fctn 4 etc. work the same in all 3 modes.

Full screen editing using EDIT40 and EDIT80

When editing in the text mode you are no longer restricted to editing text on the bottom line of the screen. Any line marked with a > can be edited.

Keys used for full screen editing

Ctrl I	cursor up the screen to the beginning of the previous line marked by >.
Ctrl M	cursor down the screen to the beginning of the next line marked by >.
Ctrl J	cursor right to the next program statement after double colon, or the end of the line.
Ctrl K	cursor left to the previous program statement after double colon, or the start of the line.

Normally in XB, Fctn 8 is used to paste previously entered text on the screen. Because you can edit anywhere on the screen, this is not needed in the text mode editor, so the functions of Ctrl 3, Fctn 3, Ctrl 8, and Fctn 8 have been modified.

Ctrl 3	deletes the program statement the cursor is flashing on. AND copies to the edit/recall buffer. If necessary, the cursor goes left to the first character after a double colon or the first character after the line number. The deletion goes to the second colon in a double colon or the end of the line.
Fctn 3	deletes characters from cursor to end of program line. AND copies to the edit/recall buffer.
Ctrl 8	inserts contents of edit recall buffer after the double colon. If necessary, the cursor goes left to the first character after a double colon or the first character after the line number.
Fctn 8	inserts contents of the edit/recall buffer at the cursor.

When you paste using Ctrl 8 and Fctn 8, the characters are inserted at the cursor. They do not overwrite any text on the screen.

To copy/paste

Press Ctrl 3 or Fctn 3 to copy characters into the edit/recall buffer. This also erases those characters from the screen. Immediately press Ctrl 8 or Fctn 8 to restore the characters to the screen. The characters are still in the edit/recall buffer. Navigate to the desired location on the screen using the arrow keys. Then Ctrl 8 or Fctn 8 will paste the contents of the edit/recall buffer onto the screen. Repeat as desired.

After you have entered or changed a line, it will only be saved if you press Enter or the up/down arrow keys. If you make a mistake and want to “bail out”, Fctn 4 will do the trick.

The text mode editor uses a screen located in VDP ram at >1000. It communicates with XB by copying characters between the usual 28 column editing screen and the text mode screen. When it detects a cursor on the 28 column screen, XB goes to the text mode editor. From the text mode editor, the characters you type are copied to the normal XB editor when you press Enter/up/down. Once there, the characters are processed as if you had entered them using the 28 column editor. When the cursor reappears, control is again passed to the text mode editor. When you LIST a program, XB puts the lines on the normal 28 column screen. Once each line has been printed, XB 2.9 copies it to the text mode screen. Transferring characters between the two screens incurs a speed penalty, but it is only about 20%.

Almost everything will work properly from the text mode editor. But, it is important to know that the text mode screen is located in the middle of the VDP stack, and XB knows nothing about it. This can lead to some unexpected behavior. When you load a program of any significant length, garbage may appear on the text mode screen. It remains there until XB copies the program to the 32K memory, then the screen is cleared. You can RUN a program from the text mode editor, but CON has been blocked to avoid a possible memory clash between the VDP stack and the text mode editor screen. After a program breaks, you should be able to print numeric variables (which are kept in CPU ram), but printing a string variable may be incorrect.

After you press enter/up/down, control does not return to the text mode editor until the cursor reappears on the 28 column screen. This can lead to some pauses, sometimes lengthy. A line like this will work fine, but you cannot see the results until it has finished: `FOR I=1 TO 20::PRINT I;SQR(I)::NEXT I`

These limitations should not be a problem when entering and editing a program. But debugging may be easier if done using EDIT32. You can switch between the editors as desired at any time.

The Graphics Packages

The main purpose of XB 2.9 G.E.M. is to provide graphics packages that unshackle the crippling limits imposed by TI XB on the TMS9918A video display processor. All the graphics modes are accessed with easy to use assembly support routines. They can be selected from the main menu, or from CALLs in the XB editor or from a running XB program. All require the 32k memory expansion to run. If it is not detected, the message “32K NOT DETECTED” appears, and pressing any key will return to Extended BASIC 2.9.

The descriptions below briefly describe the routines and any differences from the disk based versions. Refer to their respective manuals in the documents folder for detailed information on how to use them.

XB256 – this is part of the XB game developers package. You can select from two independent screens. Screen1 is the screen normally used by Extended BASIC. It is accessed with the usual XB graphics statements. Screen2 lets you independently define 256 characters, more than twice the 112 normally available in XB. Along with these graphics you can have up to 28 double sized sprites using the patterns available in Screen1. You can toggle between the two screens as desired, preserving the graphics in each screen. Screen2 has assembly equivalents that replace CHAR, CHARPAT, COLOR, and CHARSET. Except for these subroutines, all screen access in Screen2 is by the usual Extended BASIC statements such as PRINT, SPRITE, ACCEPT, etc. You can scroll screen characters left, right, up, or down. By specifying a window area you can scroll just the characters in the window. Other routines let you scroll smoothly one pixel at a time to the left, right, up or down, or do a “text crawl” like the title scene of “Star Wars. You can highlight text, play sound lists, print text using 32 columns and much, much more.

The autoprompt feature is off by default. This is only useful to those who use the entire game developers package (XB256, compiler, loader, etc.) If desired it can be activated with CALL LINK(“XB256A”). The font used in screen 1 is whatever font used by the XB editor. Screen 2 uses font 1. The option to modify grom at >6000 is no longer needed and is disabled. The sound list compilers can be found in the disk based version of XB256.

T40XB – T40XB lets you select from two independent screens. G32 is the default screen when a program starts running.. This is the 32 column graphics mode screen normally used by Extended BASIC. It is accessed using the usual XB graphics statements. T40 is the 40 column text screen which displays 24 rows of 40 columns.. You can toggle between the two screens as desired, and the graphics on each screen are preserved. When using the T40 screen there are assembly equivalents that replace PRINT, CLEAR, COLOR, INPUT, CHAR, HCHAR, VCHAR plus routines that will scroll the screen and invert text on the screen.

The font used in graphics mode (G32) is the font used by the XB editor. Text mode (T40) uses font 1. . The option to modify grom at >6000 is no longer needed and is disabled.

T80XB – This is virtually identical to T40XB except it uses the 80 column text mode provided by some display devices or Classic99

The Missing Link – allows easy and versatile access to bit mapped graphics. You can plot points, lines, circles and boxes. Turtle graphics can be used with none of the ink and color restrictions found in LOGO. Up to 32 moving sprites can be placed on the screen. Text can be input from or displayed to the screen. Word wrap is used when displaying text. The character size can be changed, permitting up to 32 rows by 60 columns on the screen. Different sized text can be displayed simultaneously on the same screen.

When you select The Missing Link from the main menu, a submenu lets you configure TML. You can choose 16 or 2 colors and 0-3 disk files open. The “Texas” cursor has been replaced with the standard rectangular cursor. The default font in bit-mapped mode is font 1. CALL LINK(“FONTA”,N) will load a font from the cartridge. CALL LINK(“LFONTA”,filename) or (”SFONTA”,filename) will load or save a font used by the bit mapped mode.

Since TML is loaded from the cartridge, it is possible to save programs to cassette. With 16 colors you can save a cassette program up to 2048 bytes long. With 2 colors the program can be up to 5724 bytes long. You can trick XB into saving or loading even longer cassette programs. (up to 10176 bytes in 16 color or up to 13928 bytes in 2 color.) First type:

CALL LOAD(-31888,63)

Now you can save or load the cassette program.

Then type CALL LOAD(-31888,31) when ready to run the program.

The Missing Link Graphic Adventure – This is version of TML was modified so that bit mapped graphics pictures can be added to text adventures. It can load pictures to the top third of the screen while having text on the lower third. The default font uses 5x7 characters for a 48 column screen. The lower third of the screen will scroll automatically as you input commands to the computer. The turtle graphics routines have been eliminated to make room for the new routines.

Multicolor mode – Multicolor library v1.1 was written by Stefan Bauch, who kindly gave his permission to include it in XB 2.9 G.E.M. The multicolor mode is a low resolution bit mapped mode providing 16 colors with a resolution of 64x48 pixels. For the first time, SteveB's routines make it easy for XB programmers to experiment with this rarely used graphics mode.

The manual for the multicolor mode is *Multicolor Library for XB.pdf*. In the manual, each assembly subroutine is described with two syntaxes. For example:

CALL PUTPIX(ROW,COL, COLOR)

CALL LINK(“PUTPIX”,ROW, COL, COLOR)

If you are using TiCodEd (also written by Stefan), you should use the first syntax.

If you are not using TiCodEd, then you should use the CALL LINK syntax.

The entire multicolor package is contained in the folder Mcolor, which has example programs and other information.

CHANGING GRAPHICS MODES

It is now possible to change graphics mode from the command line or from a running program. You have the option to perform the CALL FILES operation at the same time. If necessary, these will automatically move the stack to a new location. If the new graphics mode does not have enough stack space available you will get a memory full error.

All of the calls described below will open the specified graphics mode with the default 3 disk files. If desired, you may include a number from 0 and 9 to perform the CALL FILES(n) operation. Documentations for all these modes are included in the DOCS folder.

CALL XB or CALL XB(n)

Selects the normal Extended BASIC graphics mode.

CALL XXB or CALL XXB(n)

Selects the normal Extended BASIC graphics mode and loads XXB 1.5 by Barry Traver. This was part of XB 2.7. XXB is one of the more complete XB extension packages, providing many additions to XB.

CALL XB256 or CALL XB256(n)

Loads and activates the XB256 graphics extensions.

CALL T40XB or CALL T40XB(n)

Loads and activates the T40XB graphics extensions that provide access to the 40 column text mode.

CALL T80XB or CALL T80XB(n)

Loads and activates the T80XB graphics extensions that provide access to the 80 column text mode.

CALL TML or CALL TML(c,n)

Loads and activates The Missing Link graphics extensions that provide access to the bit mapped graphics mode. CALL TML starts with the default 16 color mode and 1 disk file. Two optional values can be passed. CALL TML(c,n) lets you select the color mode and also does CALL FILES(n). C is 1 for 16 colors or 2 for 2 colors; N must be a number from 0 to 3

CALL TMLGA or CALL TMLGA(c,n)

Loads and activates The Missing Link Graphics Adventure. These extensions are a customized version of The Missing Link configured for creating text and graphics adventures. CALL TMLGA starts with the default 16 color mode and 1 disk file. Two optional values can be passed. CALL TMLGA(c,n) lets you select the color mode and also does CALL FILES(n). C is 1 for 16 colors or 2 for 2 colors. N must be a number from 0 to 3

CALL MULTI or CALL MULTI(c,n)

Loads and activates multicolor mode utilities that provide access to the multicolor mode.

If a program requires a particular graphics mode you can select that mode in the first line of the program. For example, if your program requires XB256, you can add this line: 1 CALL XB256. This will ensure that XB256 is loaded when the program starts.

These calls make it possible to go between any of the special graphics modes (XB256, T40XB, T80XB, TML, and TMLGA) from within a running program. If you just want to toggle between one of these modes and the standard XB mode, XB256, T40XB, T80XB, TML can already toggle between the two modes *without losing the graphics screen*.

EXTENDED BASIC VERSION 2.7

Documentation by Tony Knerr with modifications for XB 2.9 by Harry Wilhelm

There are several new commands in Extended Basic v2.7 which support floppy disk formatting from the command line of Extended Basic. It is only a limited implementation, as I have very few bytes of program space left in the gram banks. The new commands are: CALL SSSD, CALL DSSD, CALL DSDD, and CALL DSQD.

They have been tested with the TI, Corcomp, and Myarc Floppy disk controllers and the Myarc Hard and floppy disk controller. The disk is formatted as it would be using Disk Manager 1000 or Disk Utilities and choosing N(o) when prompted to verify. The only sectors checked are 0 and 1 as these sectors are written to at the end of the formatting process.

Extended Basic v2.7 is compatible with TI Extended Basic with the following differences:

The default colors in edit mode are the standard black on cyan, although this can be customized as described on page 13. Regardless of the colors in edit mode, when a program runs the colors revert to the standard black on cyan.

The default character set is one with true lower case. This can be customized as described on page 13.

The command CALL CHARSET has been modified to restore both upper and lower case characters to the original TI character set and also resets screen, foreground, and background colors to Black on Cyan.

The CALL INIT command executes a little faster and clears the interrupt hook at >83C4.

By holding down any key after selection of XB v2.7, the user can bypass the auto-search for DSK1.LOAD and go directly to edit mode. This can be inverted as described on page 13.

The following CALLs are resident in version 2.7 and 2.9:

CALL ALLSET in XB2.7 is replaced by CALL FONT(7). Used to reset the characters 32 through 126 to their original TI definitions. Works like CALL CHARSET but does not affect screen, foreground, or background colors.

CALL BYE resets to the title screen from a running program.

CALL BEEP sounds the familiar accept tone.

CALL CAT("pathname.") catalogs a device while in command mode. Has been tested with TI, Corcomp, and Myarc floppy controllers as well as the Myarc HFDC and Horizon Ramdisk. The pathname must end in a period. Directories on the HFDC of up to a total length of 11 characters are acceptable. Example – CALL CAT("WDS1.ABCDE.") is the longest pathname that will work.

CALL CHARA1 is replaced by CALL FONT(2). Restores the resident XB v2.7 character set if it has been redefined.

CALL CHIME generates a chime sound.

CALL CLSALL closes all open files.

CALL COLOR(ALL,foreground,background) replaces CALL COLR13, COLR15, COLR17, COLR18, COLR19, COLR1A, COLR1B, COLR1F, COLRF1, COLRF2, COLRF4, COLRF6, and COLRFC.

CALL DSDD formats a 1280 sector disk in drive 1 if you are using a Myarc floppy controller with a 40 track Eprom. A 1440 sector disk will be formatted if using a Corcomp floppy controller, a Myarc floppy controller with an 80 track Eprom, or a Myarc hard and floppy disk controller. You will be prompted to insert a disk in drive 1 and press enter to continue. Pressing any other key aborts the formatting process. Using this command with a TI controller will only be a waste of your time as the floppy controller will go through the whole formatting process only to give you an error at the end. Don't say I didn't warn you!

CALL DSQD formats a 2880 sector disk in drive 2 if you are using a Myarc floppy controller with an 80 track Eprom or a Myarc HFDC properly configured for 80 tracks. You will be prompted to insert a disk in drive 2 and press enter to continue. Pressing any other key aborts the formatting process. Using this command with a TI or /Corcomp controller will only be a waste of your time as the floppy controller will go through the whole formatting process only to give you an error at the end, and may damage your disk and/or drive. Don't say I didn't warn you!

CALL DSSD formats a 720 sector disk in drive 1. You will be prompted to insert a disk in drive 1 and press enter to continue. Pressing any other key aborts the formatting process.

CALL CRASH generates a crash sound.

CALL PEEKG(address, numeric variable list) – reads the contents of addresses in GROMS. The function is similar to CALL PEEK.(This was CALL GPEEK in XB2.7)

CALL HELP has been modified to display help screens showing the commands in XB 2.9. You can view a table of color codes, character sets, display any font, find ascii codes and convert numbers.

CALL HONK generates generate the familiar error tone.

CALL LRGCPs is replaced by CALL FONT(13). Loads the large capitals character set from the TI title screen.

CALL MLOAD("filename", mode) loads a program image file (E/A option 5) into memory and run it if MODE=1. Example - CALL MLOAD("DSK1.UTIL1",1) will load and run an E/A option 5 file named UTIL1 from floppy drive #1.

CALL MOVE(mode, start address, target address, # of bytes) moves a block of memory. The four modes available are: 1 - from VDP RAM to VDP RAM, 2 - from VDP RAM to CPU RAM, 3 - from CPU RAM to VDP RAM, 4 - from CPU RAM to CPU RAM

CALL MSAVE("filename", start address, # of bytes) saves a portion of memory in program image format.

CALL NEW is the same as the NEW command except that it can be used within a running program.

CALL NYANYA generates the NYANYA sound our children love to do so often.

CALL QUIT is the same as CALL BYE, that is, it will return to the title screen from a running program.

CALL QUITOF disables the function of the QUIT key (FCTN =).

CALL QUITON restores the function of the QUIT key (FCTN =) after a CALL QUITOF.

CALL RESTORE(numeric variable) is the same as the RESTORE statment except that a variable may be used. Example - 100 A=500 :: CALL RESTORE(A)

CALL SCREENOF turns off the screen.

CALL SCREENON turns on the screen again after a CALL SCREENOF.

CALL SPROF stops the motion of all sprites.

CALL SPRON restarts the motion of all sprites after a CALL SPROF.

CALL SSSD formats a 360 sector disk in drive 1. You will be prompted to insert a disk in drive 1 and press enter to continue. Pressing any other key aborts the formatting process.

CALL PEEKV(address, numeric variable list) – reads the contents of addresses in VDP RAM. The function is similar to CALL PEEK. (This was CALL VPEEK in XB2.7)

CALL POKEV(address, numeric variable list) – writes values to VDP RAM. The function is similar to CALL LOAD. (This was CALL VPoke in XB2.7)

CALL WAIT(duration) causes a delay. DURATION must be a value from 0 to 16382. A value of 60 equals one second of delay.

CALL XB returns to the normal XB graphics mode. CALL XB(n) will return to XB with 0 to 9 disk files available. (modified for XB2.9 G.E.M.)

CALL XXB returns to the normal XB graphics mode and loads Barry Traver's XXB version 1.5 into low memory. All XB v2.7 and XXB v1.5 commands will then be available to the user, making for a very powerful Extended Basic environment. Docs for XXB v1.5 are included in the DOCS folder. CALL XXB(n) loads XXB with 0 to 9 disk files available. (modified for XB2.9 G.E.M.)

CUSTOMIZING XB 2.9 G.E.M.

TEMPORARILY CHANGE EDIT MODE COLORS AND FONT

The two bytes at cpu memory 9456 contain the colors and font used in the edit mode. At startup they are loaded with the default values 23,1. (>17,>01 for black on cyan and font 1) You can change these with CALL LOAD(9456,colors,font) The color should be foreground*16+background-17. (Neither color can be transparent and they cannot be the same.) The font should be a number from 1-60.

Normally when selecting an option from the main menu you can hold down a key for about 2 seconds to defeat autoloading of DSK1.LOAD. This can be inverted by adding 128 (>80) to the font number. Then if your finger is *off* a key XB *will not* autoload. If you do want to autoload you can hold a key down for about 2 seconds and XB will try to autoload DSK1.LOAD. TIPI users can add 64 (>40) to the font number. Then BYE will RUN “TIPI.FC.FCMDXB” and go directly to Force Command instead of going to the usual start screen.

Example: You want dark blue characters on a gray background, font 17 and autoload deactivated. Color is $5*16+15-17$ which is 78. Font = $17+128$ which is 145. From the immediate mode you can CALL LOAD(9456,78,145). Or you can make this a 1 line program saved as LOAD. When XB is chosen autoload is active, it loads your preferences for colors and font and inverts the autoload behavior.

PERMANENTLY CHANGE COLORS AND FONT USING HEX EDITOR

You can change the default colors and font permanently by changing the grom file XB28GEM_G.BIN. Use a hex editor such as *HxD hex editor* to change 6AF0 from 17 01 (black on cyan, font 1) to the desired colors and font. These values are the same as described above, only in hexadecimal. To get white letters on dark blue, font 3, suppress autoload and invoke force command on BYE, 6AF0 should be F4 C3. (The font number is >80 to suppress autoload +>40 to invoke force command on BYE +font number >3=>C3). Be sure to save the modified file.

Now that you can select any desired graphics mode directly from Extended BASIC, it is no longer essential to have the graphics modes at the start menu. You can unclutter the menu by removing entries 3 – 8. Use a hex editor to modify the file XB28GEM_G.BIN. Change 1C76 from 7C 5C to 6A 01. Be sure to save the modified file.

For XB256, T40XB, and T80XB, the default colors and fonts can be customized by using a hex editor to modify the rom file XB28GEM_8.BIN. A font from 1 to 60 may be used, but only a few will look good in the text mode. As usual, be sure to save the modified file.

For T40XB:

The default text mode color is at >1AED5 (default is >F4)
The default text mode font is at >1AC41 (default is >01)

For T80XB:

The default text mode color is at >1CF0F (default is >F4)
The default text mode font is at >1CC7B (default is >01)

For XB256:

The default screen 2 color is at >18D8B (default is >F4)
To change default screen 2 font >18A14 must contain a memory address having the desired font number. Default is >2C7C which contains >0001. For font 2 this can be >209A which contains >0002. Any address in ram from >0000 to >3FFF can be used if it contains the desired font number.

If you prefer to preload the colors for the unused characters, you can use a hex editor to change XB29GEM_G.bin. By changing the 15 bytes starting at >00001C88 to >11,>22,>33,>44,>55,>66,>77,>88,>99,>AA,>BB,>CC,>DD,>EE,>FF, you will get:

Set	Characters	Color	Set	Characters	Color
17	160-167	Black	25	224-231	light red
18	168-175	Medium green	26	232-239	dark yellow
19	176-183	light green	27	240-247	light yellow
20	184-191	dark blue	28	248-255	dark green
21	192-199	light blue	29	0-7	magenta
22	200-207	dark red	30	8-15	gray
23	208-215	cyan	31	16-23	white
24	216-223	medium red			

Using the REF directive in an assembly language program

The new assembly loader in XB 2.9 G.E.M. can process REF directives. Instead of VMBW EQU >2024, your code can simply REF VMBW. Below is a table showing the labels that will be recognized by REF. *If you want to use REF GPLLNK or REF XMLLNK, be sure to CALL INITG.* This does the normal CALL INIT, then loads the additional code for GPLLNK and XMLLNK.

UTLTAB	EQU >7020	VMBW	EQU >2024	SMUL	EQU >0E8C
PAD	EQU >8300	VSBR	EQU >2028	SDIV	EQU >0FF8
GPLWS	EQU >83E0	VMBR	EQU >202C	CSN	EQU >11AE
SOUND	EQU >8400	VWTR	EQU >2030	CFI	EQU >12B8
VDPRD	EQU >8800	DSRLNK	EQU >253A	FCOMP	EQU >0D3A
VDPSTA	EQU >8802	LOADER	EQU >25AE	NEXT	EQU >0070
VDPWD	EQU >8C00	GPLLNK	EQU >24F4	COMPCT	EQU >0000
VDPWA	EQU >8C02	NUMASG	EQU >2008	GETSTR	EQU >0002
SPCHRD	EQU >9000	NUMREF	EQU >200C	MEMCHK	EQU >0004
SPCHWT	EQU >9400	STRASG	EQU >2010	CNS	EQU >0006
GRMRD	EQU >9800	STRREF	EQU >2014	VPUSH	EQU >000E
GRMRA	EQU >9802	ERR	EQU >2034	VPOP	EQU >0010
GRMWD	EQU >9C00	FADD	EQU >0D80	ASSGNV	EQU >0018
GRMWA	EQU >9C02	FSUB	EQU >0D7C	CIF	EQU >0020
SCAN	EQU >000E	FMUL	EQU >0E88	SCROLL	EQU >0026
XMLLNK	EQU >2018	FDIV	EQU >0FF4	VGWITE	EQU >0034
KSCAN	EQU >201C	SADD	EQU >0D84	GVWITE	EQU >0036
VSBW	EQU >2020	SSUB	EQU >0D74		

A bug was found in Assm994a:

REF GPLWS

DATA GPLWS is fine, but

LWPI GPLWS does not assemble and load properly. It must be LWPI >83E0

Batch files

Besides simply entering lines into an Extended BASIC program, CALL DV2XB can be used to process batch files, where a single DV80 or .TXT file can feed commands or keystrokes to the TI99. The characters are fed to XB whenever a cursor is flashing, Press Fctn 4 to abort the process.

As a simple example, let's suppose you wanted to automate the following.

CALL INIT

CALL LOAD("DSK1.SUPPORT.OBJ")

RUN DSK1.PROGRAM

First you would create these lines in a text editor, then save it as a DV80 or .TXT file.

Let's say we saved it as DSK1.BATCH.TXT

From the XB command line, type CALL DV2XB("DSK1.BATCH.TXT").

The keystrokes in the file will be sent to the computer just as if you had typed them in.

This is a very simple example. With some creative thinking, long, convoluted batch files are possible, but I will leave it to the user to find them.

LIST in a batch file will crash the computer, but that is not something that would normally be used.

AUTOLOADING AND CHAINING PROGRAMS

Let's say you have written a complex program that needs to be in two or more parts. You have put all the character definitions, into the first program and then want that program to run a second program while preserving the characters you just defined. Simple enough, just add RUN "DSKn.PARTTWO to the first program and it will load and run PARTTWO, or you can use CALL RUN(A\$) if the disk name is a string variable. If you are using one of the graphics packages in XB 2.9 G.E.M. and want to preserve sound tables, the screen2 or text mode definitions and colors then PARTTWO **must** be in IV254 format.

Internal, Variable 254 is the format used by Extended BASIC when saving or loading large programs that are longer than the available stack space. If the program is large enough it will be saved in this format automatically. If you don't know what format the program has been saved in, you can CALL CAT("pathname.") to catalog the disk and this will display the file types.

CALL SAVEIV("DSKn.PROGNAME")

XB 2.9 G.E.M. has a subprogram that will force XB to save a program of any length in IV254 format. With your program loaded, in the immediate mode type:CALL SAVEIV("DSKn.PROGNAME") The program will be saved in IV254 format. If the program is very short a line 1 will automatically be added. This is a DATA statement that does nothing other than adding enough bytes to permit saving even the shortest programs in IV254 format. This will not happen if the program is larger than 256 bytes. This should be compatible with a CF7 device, but has not been tested.

CALL RUN(A\$)

RUN is used to run an XB program from a running XB program. The normal way to do this is with RUN "DSK1.PROGRAM", which normally works fine. The only reason for using CALL RUN would be to run a file name contained in a string variable:

```
10 D$="DSK1.PROGRAM"  
20 CALL RUN(D$)          (XB cannot do this)
```

As long as there is no break in the programs you can chain programs together this way and when the new program runs the screen, colors, character definitions, sprites, etc. will be preserved. But variables are *not* preserved. When the new program runs, prescan resets all numeric variables to zero and string variables to a null string. If you want to pass variables from one program to the next you have to store them with CALL LOAD and retrieve them with CALL PEEK, or save them to disk and then read them back with the new program. Wouldn't it be nice if there was a way to preserve the variables and automatically pass them along to the new program? Well, there is.

CALL RUNL1(A\$)

RUNL1 is used to run an XB program from a running program. It is similar to CALL RUN but with a major difference. After it loads the program it runs the first line, *but does not do a prescan or reset any of the variables of the calling program*. By chaining programs together with RUNL1 you can create a very long XB256 program, and the neat thing is that bypassing the prescan means super fast start up time and that all the variables are automatically carried over into the newly loaded program. You don't have to save them before exiting one program and retrieve them in the next program.

RUNL1 takes some liberties with the XB interpreter and to use it successfully, there are six rules that must be followed:

1 – The XB program that is first in the chain must be the longest. If RUNL1 tries to load a program that is longer than the first program, a "Memory Full" error will be issued. SIZE tells how many bytes are free and with that you can determine if the first program is the longest. If necessary, you can pad the first program with remarks to make it the longest program.

2 – Any program being loaded with RUNL1 must be in IV254 format. You can save a program of any length in this format by using CALL SAVEIV(filename). An I/O ERROR will be issued if RUNL1 tries to load a program that was saved in program format. If the first program in the chain is in IV254 format you can use RUNL1 to go back to it.

3 – All variables must all be contained in the first program. Prescan is only performed for the first program in the chain, which means that new variables cannot be introduced in a chained program. If the second program uses HCHAR and the variables X,Y,Z and A\$, but they are not used in the first, the first program should include them this way:

```
10 GOTO 100::X,Y,Z,A$::CALL HCHAR
```

This forces prescan to reserve space for the four variables and HCHAR. This line doesn't give a syntax error because XB never gets to the second part of the line. When you get an unexpected "SYNTAX ERROR IN #", be sure any variables in that line were included in the first program.

4 – If the chained programs use DATA statements, you must use RESTORE or RESTORE line-number. Otherwise the program cannot find the data and you will get a DATA ERROR message.

5 – SUB, SUBEND, SUBEXIT, and DEF can be used, subject to three rules: They must be included in all the programs. They must be the first lines entered into each program. They must be exactly the same in all the programs. Once they are included in the program you can merge program lines, paste XB in Classic99, enter lines of code from the keyboard, and even resequence. **But do not make any changes to the SUBs or DEFs.** as this will change their physical location in the program. This is described in greater detail below.

6 – Always do a fresh reload of the program if you want to edit a program that was loaded by RUNL1. When RUNL1 loads a program it moves the line number table so the program is the same length as the first program. This causes some hidden bytes to be temporarily included in the program and you don't want to make these permanent. These go away when you reload the program. After reloading the program you can safely make any necessary changes, but remember: no changes to SUBs or DEFs.

Programs that do not use SUBs or DEFs can be entered normally normally, but be sure to observe the six rules above.

Programs that use SUBs or DEFs require more attention to detail. Below is a step by step description showing how to include them in chained programs. For this example we create two programs in the chain called RL1TESTA and RL1TESTB and save them on DSK9.

Start by placing the SUBs and DEFs in a program of their own:

```
10 DEF CUBE(X)=X*X*X
20 DEF FOURTH(X)=X*X*X*X
200 SUB SQUARE(X)
210 PRINT X*X
220 SUBEND
230 SUB ROOT(X)
240 PRINT SQR(X)
250 SUBEND
```

Now let's write the two programs RL1TESTA and RL1TESTB.

```
1 ! RL1TESTA - The initial program in chain
30 DIM SR(30)
40 CALL CLEAR :: CALL SCREEN(4)
42 PRINT "Now running RL1TESTA"
50 CALL CHAR(128,"0103070B0A1B2A2B2A2B4A4B4A7B0E0A0080C0A0A0B0A8A8A8A8A4A4A4BCE0A0")
60 CALL MAGNIFY(4):: CALL SPRITE(#1,128,5,100,120,-7,0)
62 X=11 :: PRINT :X :: CALL SQUARE(X):: CALL ROOT(X)
64 PRINT CUBE(X):: PRINT FOURTH(X)
66 Z=31 :: A=PI
70 FOR I=1 TO 30 :: SR(I)=SQR(I):: NEXT I
75 READ DT$ :: PRINT DT$
80 INPUT "ENTER A STRING: ":A$
90 CALL RUNL1("DSK9.RL1TESTB")
100 DATA "Data-line 100, 1st program"

1 ! RL1TESTB - 2nd part of demo
110 CALL CLEAR :: CALL SCREEN(12)
120 PRINT "Now running RL1TESTB"
122 FOR I=1 TO 30 :: PRINT SR(I),:: NEXT I :: PRINT
124 PRINT Z :: CALL SQUARE(Z):: CALL ROOT(Z)
126 PRINT CUBE(Z):: PRINT FOURTH(Z)
130 PRINT A$
140 RESTORE :: READ DT$ :: PRINT DT$;
150 GOTO 150
190 DATA "Data-line 190, 2nd program"
```

These two programs must be combined with the subs and defs. The easiest way is to use a text editor and Classic99 to paste into XB. (Edit>Paste XB) The order is important - the subs and defs **must** go first.

Start with NEW, then copy/paste the subs and defs into XB, then copy/paste RL1TESTA into XB, then CALL SAVEIV("DSK9.RL1TESTA").

Similarly, for the second program start with NEW, then copy/paste the subs and defs into XB, then copy/paste RL1TESTB into XB, then CALL SAVEIV("DSK9.RL1TESTB").

All done! Now you are ready to test. Enter RUN "DSK9.RL1TESTA"

(Some explanation of the program is in order so you know what is happening.)

(Description of RL1TESTA)

42 – prints "Now running RL1TESTA"

50,60 – creates a sprite and sets it in motion

62 sets X=11; prints X; CALL SQUARE(X); CALL ROOT(X)

(The two SUBs print X^2 , then SQR(x))

64 PRINT CUBE(X); PRINT FOURTH(X)

(uses DEFs to print x^3 and x^4)

66 Z=31 :: A=PI

(these values not used here, they will be used by the next program in chain)

70 fills the array SR(n) with square roots from 1 to 30

(used in next program in chain)

75 reads a string from a data statement and prints it

80 asks you to enter a string

(the string is used in next program in chain)

90 loads and runs the program RL1TESTB

When RL1TESTB is run in line 90, XB doesn't know that a completely new program has been loaded. It assumes it is continuing with the original program and so all the variables are retained automatically, as demonstrated by the second program in the chain.

(Description of RL1TESTB)

The sprite created in the first program continues to move across the screen.

120 – prints “Now running RL1TESTB”

122 – prints the 30 square roots that were created in line 70 of RL1TESTA (shows that variables can be passed)

124 – prints Z; CALL SQUARE(Z); CALL ROOT(Z) (shows that Z is passed and that SUBs work properly)

126 – PRINT CUBE(Z); PRINT FOURTH(Z) (shows that DEFs work in the chained program)

130 – PRINT A\$ (shows that string variables can be passed to the second program)

140 – RESTORE; read string from DATA statement; print it. (DATA can be used in the chained program)

150 – wait for Fctn 4 to be pressed

You can add lines to these programs freely, but be *very careful* not to edit any of the lines with SUBs or DEFs. Even though the listing is the same, the physical location of the code will be moved, and the only way to restore the proper order is to start over. Be sure to make frequent backups!

A few more steps are required when you use a real TI-99/4a.

1 – Enter the program segment containing the SUBs and DEFs. Save this program to disk.

SAVE DSK9.RL1TESTSD.

2 – Enter the listing for RL1TESTA. Save to disk in merge format:

SAVE DSK9.RL1TESTAM,MERGE

3 – Enter the listing for RL1TESTB. Save to disk in merge format:

SAVE DSK9.RL1TESTBM,MERGE

Now combine the subs and defs with the main programs.

4 – Combine and save the first program:

OLD DSK9.RL1TESTSD

MERGE DSK9.RL1TESTAM

CALL SAVEIV(“DSK9.RL1TESTA”)

5 – Combine and save the second program:

OLD DSK9.RL1TESTSD

MERGE DSK9.RL1TESTBM

CALL SAVEIV(“DSK9.RL1TESTB”)

Now the programs can be tested with RUN “DSK9.RL1TESTA”