

Smalltalk 386 Beta Copy Installation Instructions

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Revised November 15, 1988

The purpose of this document is to aid beta site testers in the installation and use of Smalltalk 386. Consult existing Tektronix Smalltalk documentation for subjects not addressed here.

HARDWARE REQUIREMENTS

Smalltalk 386 requires an 80386 "PC/AT Clone" with a numeric co-processor (80287 or 80387), a minimum of four megabytes of extended memory, an EGA or VGA display ("super" types with higher resolution are preferred), a three button mouse (Mouse Systems or Logitech), and sufficient hard disk capacity (the distribution is about 4.5 megabytes).

SOFTWARE REQUIREMENTS

Because Smalltalk 386 runs in the 80386 protected mode, it will not run under any package using virtual 8086 mode. This includes DesqView 2.0, Windows 386, and any EMM simulators. It also has problems with some disk cache and ram disk programs which use the extended memory. The disk caching program SMARTDRV.SYS which comes with Windows 386 is known to work. Microsoft RAMDRIVE apparently works.

When using the Mouse Systems Mouse, install the MSMOUSE driver before running Smalltalk 386. For the Logitech mouse, install specifying Mouse Systems compatibility. Smalltalk 386 will not run with a two button Logitech Mouse or Microsoft Mouse.

The FILES parameter in the config.sys file should be set to at least 20 to run Smalltalk.

On systems having display resolution greater than 640x350, the extra resolution can usually be used by adding a HIRES entry to the environment. The following commands for various high resolution graphic adapter boards are known:

```
SET HIRES=73,73,c0000829,640,480
    for the PEP-301, 640x480 resolution
SET HIRES=79,79,c0000829,800,600
    for the PEP-301, 800x600 resolution
SET HIRES=70,00,c00004d8,640,480
    Everex MicroEnhancer Plus (Most of Ted Creedon's boxes)
    640x480 resolution
SET HIRES=50,00,c0001b0c,640,480
    Paradise card (ISL has these) 640x480 resolution
SET HIRES=70,02,c0000170,800,600
    Everex EVGA in 800x600 resolution
SET HIRES=73,73,c0000980,800,600
    Genoa SuperEga in 800x600 resolution
SET HIRES=12,00,00,640,480
    VGA, standard 640x480 resolution
SET HIRES=00,e00000,00,816,600
    ESL board 800x600 resolution
```

SET HIRES=6f05,62,c0001289,800,600
Video 7 VRAM VGA, 800x600 resolution

For other cards, the first argument is the hex value placed in AX when executing the BIOS "Set Video Mode" call, while the second argument is the value placed in BX. The third value is the four digit segment and four digit offset of the entry point of the EGA/VGA card. To find this value, boot the system without the mouse driver or any other TSR's present. Then run debug and look at location 0:40. The segment stored at that location should be C000, and the offset is card dependent. The fourth argument to HIRES is the display width, and the final argument is the display height. Note that a bug in the C compiler requires that each number be at least two digits long -- pad with a leading zero if necessary.

WARNING -- The wrong command arguments will probably cause a system crash.

For VGA cards, the color palette is limited to 64 colors, but the Smalltalk image can be readily extended to allow the complete selection. The display driver code only supports 4 plane (16 color) mode with 64k or less pixels.

SOFTWARE INSTALLATION

Smalltalk 386 comes on several disks. All files (except one) are packed in archive files (identified by the extension "ZOO"). An additional de-archiving program is provided. Run it with the command "looz archiveFileName", while in the destination directory. Just executing "looz" gives full instructions on its use.

The disks contain the following files:

1. **EXE.ZOO** contains the utility programs. Place these somewhere in your PATH. These files will be described later in this document.
2. **SOURCES.ZOO** contains the sources.std standard sources file. Place these anywhere.
3. **IMAGE.ZOO** contains **IMAGE.BAT**, **ST.EXE**, and **CHANGE.LOG** files. The **IMAGE.BAT** file is the image file which has been cleverly made executable. Always save images with the .BAT extension. Place **ST.EXE**, the Smalltalk interpreter, in your PATH.
4. **FONTS.ZOO** contains the font files. Place them as a group in a separate directory.
5. **DEMO.ZOO** contains the files necessary to make the demonstration image (the image file is not provided). Place them in a separate directory. The image must be built in this directory.
6. **FORMS.ZOO** contains the form files used by the demonstration image. Place them in a subdirectory called **FORMS** of the directory containing the demonstration image.
7. **FILEIN.ZOO** contains various utility programs provided with the standard Tek Smalltalk distribution. Place them in a subdirectory of the directory containing the demo directory in order to build the DEMO image.

A likely configuration is:

\smalltal\ ---	image\ ---	sources.std	change.log	image.bat
	fonts\ ---	.fon	files	
	filein\ ---	.st	files in filein.arc	
	demo\ ---	files	in demo.arc	
		forms\ -----	.for	files

\bin\ ---- all .exe files

When the system is first started, you must configure it for your environment. Instructions for this are in a Smalltalk window. You may want to modify the image file in the image directory so that any new images made will start with a base that is already configured for your environment.

The default configuration of st.exe assures maximum memory will be available for DOS shell and executeUtility methods. For operation where maximum memory is desired for the Smalltalk image, use the cfg386 program to change the -MAXREAL option (described later).

There is a bug in the Phar Lap runtime environment (used by Smalltalk 386) that causes Smalltalk to quit with a "non-contiguous memory" error on systems with a high memory address limit of exactly 800000H - 1 (eight megabytes). To fix the problem, use cfg386: "cfg386 st.exe -EXTHIGH 7FFFF0".

Normally Smalltalk is executed by running the image file (which appears to DOS to be a batch file). The interpreter, st, can be executed directly. It takes a single argument, the name of the image file. If no argument is provided, the filename "image.bat" is used in the directory specified by the environment variable SMALLTALK, or the current directory if SMALLTALK is undefined. The specified directory name must end with a backslash character. This is convenient for running the unmodified Smalltalk image from any directory. Create a new change.log file, file in an application, and then save the modified image in the new directory.

THE SUPPLIED PROGRAMS

The following utility programs have been provided. These programs assist conversion between different file formats, and allow printing bit maps, forms, and text to an EPSON or equivalent printer.

CVTFONT converts a font file (extension .font on 68000 systems, .fon on MS/DOS) between 68000 and 80386 formats. Executing CVTFONT again converts back. The supplied font files have already been converted for 80386 use.

CVTFORM converts a form file (extension .for on 68000 systems, .for on MS/DOS) between 68000 and 80386 formats. Executing CVTFORM again converts back. The supplied form files have already been converted for 80386 use.

BPRINT prints a form (typical extension .for) or bitmap (typical extension .bm) file on the printer, PRN. The command line switches -p will suppress the banner, -e will formfeed after printing, and -s prints in single density.

PRINT prints a file generated with the "print out" selection in a browser. The switch -e forces a formfeed after printing, while -s interprets the escape sequences in the file. Always specify -e.

ADDCR adds carriage returns to files with lines delimited only by linefeeds. Use ADDCR to make .ST files viewable with standard MS/DOS editors, and printable on most printers. ADDCR can be used in three ways. As a filter, reading from standard input and writing to standard output, "addcr <foo.st | more" will allow paging through the file foo.st. If given a single file name as an argument, it will convert that file, giving the new file the same name as the original file. Given two file names, the first is the source file and the second is the new converted file.

REMOVECR removes all carriage returns from files. REMOVECR works analogously to ADDCR. Use REMOVECR to make standard ascii text files readable by Smalltalk.

CFIG386 is a utility program which configures st.exe. Its use is described in a separate section of this document.

IMPORTANT CONSIDERATIONS

Smalltalk 386 was implemented with the goal of making it compatible with the other 68000 based Tektronix implementations. Certain differences between the hardware keeps the systems from being completely compatible. You should keep the following differences from the 68000 Smalltalk in mind.

Display Differences. The physical display is smaller (fewer pixels) than existing Tektronix systems. The display is not capable of panning. The DisplayState is phoney.

Keyboard Differences. The sequence CTRL-ALT-DEL will cause the system to reboot. The Caps Lock key and the caps lock light work. The keyboard does not repeat (by Smalltalk convention). The Alt key is the left arrow when unshifted and up arrow when shifted. Of course, "_" and "^" can be used instead. The distributed image does not use the ScrollLock and SysReq keys, but their values are returned, so applications may use them.

PrintScreen will send Display printOnPrinter. The necessary methods to print the display (or any form) for an Epson FX series printer attached to parallel port 1 is in file filein\epson.st. The necessary methods to print the display in color to the Tektronix 4696 printer is in file filein\tek4696.st. These methods can be modified for other printers or ports. Printing occurs in a background process.

The numeric keypad acts as if NumLock is on, except the Del key (Rubout) is active and the period requires shifting. If the filein\joyswitch.st file is filed in then when numLock is off (or the shift key is held down) the numeric keypad is used to simulate the joyswitch.

Users of the 101 key keyboard have working F11 and F12 keys. All other new keys map directly onto the older multifunction keys. This means that the arrow keys will do their intended functions only if NumLock is off.

File Name Differences. A drive specification (such as "A:") is optional in directory names. The directory path separator is "\"; do not use "/". Case is insignificant in file names. Avoid non-alphanumeric characters in names. More than 8 characters in a name or 3 characters in an extension are ignored. When accessing a font file, the font name is compressed by removing all lower case characters and non-alphanumeric characters to create a file name that is 8 or fewer characters. The file out menu selection in the browser will truncate the desired file names to fit by first eliminating special characters, then eliminating vowels (from the right), and then truncating the file name (from the left).

File Directory Differences. The MS/DOS directories are not readable as a standard file. The class FileDirectory assumes they are. By adding three new methods to FileDirectory it works for everything in the image (such as file lists), but it would not work for any application which accesses the FileDirectory using normal stream methods.

Line Delimiter Differences. MS/DOS uses the pair of characters carriage return and line feed to delimit lines. Even though it was designed to handle it, the 68000 Smalltalk image does not work correctly with character pairs. At present, Smalltalk requires lines delimited with only the line feed character, and files it creates (the .st and change.log files) are delimited this way.

Word Ordering Differences. The difference in word ordering between the 68000 and 80386 affect any methods that make the assumption that increasing byte addresses decrease significance. Methods changed in the image are in the class Float, ExternalStream, and the unsignedMemory.. methods in class AbstractSystemCall.

Bit Ordering Differences. The bits in form bitmaps are ordered differently (the least significant bit is the left most in a bitmap). Convert Form and bitmap files with the `cvtform.exe` program. The Form methods `storeOn:`, `storeOn:base:`, `setExtent:fromCompactArray:setOffset:`, and `setExtend:fromArray:setOffset:` flip the bits so that source files which use the Form class `fromArray:` methods are portable. In other cases, use the methods `switchWordEndian` in classes `SequenceableCollection` and `Integer`, and the methods `switchByteEndian` in classes `String` and `Integer` to flip the bit ordering.

Operating System Interface. Use the new class `MSDOSSystemCall`, a subclass of `AbstractSystemCall`. There will never be multitasking -- the classes `OSFilter`, `Pipe..` and `Subtask` are removed. The mail server does not exist. The 68000 dependent classes `AimSystemCall`, and `UTek...` have been removed. The environment calls have been implemented, but the display calls are not (nor will they be).

Snapshot Files. While the Smalltalk interpreter will read 68000 images, the file system interface and some other parts of the image will need to be changed. The generated 80386 images should be given the extension `.BAT`. The start of the file is ascii characters which will invoke the Smalltalk interpreter using the batch file as the image.

Virtual Memory Differences. MSDOS does not support virtual memory so it is possible to run out. The original Smalltalk low memory notifier has been restored. The notifier will appear when the amount of remaining memory is less than 25% of that of the last notification or start of Smalltalk. Execute "Smalltalk coreLeft" to discover the remaining memory, and "Smalltalk core" to find the memory used.

MSDOS Interface

The global variable `OSEnvironmentVariables` is set to a Dictionary of the MSDOS environment variables. The image uses the following environment variables:

PATH	is used by the <code>executeUtility:... group of methods.</code>
COMSPEC	is used by the shell and <code>executeUtility: group of method to access command.com</code>
TEMP	is used by <code>tempDirectory</code> as a directory for temporary files. If absent then the current directory is used.
HOME	specifies the directory where the file <code>smalltal.pro</code> is to be found. If found, this file is filed in when Smalltalk starts.
SMALLTALK	is used by the interpreter to find the standard image file, as explained previously. The image does not use this, but it might in the future.

File descriptors are members of the class `MSDOSFileDescriptor` rather than being integers. This class has methods for creating new descriptors and descriptors for standard input, output, error, aux, and printer. It also has instance methods to access the handle number and name fields of the descriptor.

DOS programs (exe, com, and bat files) can be run. The amount of memory available depends on the setting of a switch inside the `st.exe` program. The `MAXREAL` switch specifies the amount of real mode memory in 16 byte paragraph units to save. If this value is set too high then the amount reserved is roughly the free space reported by `chkdsk.exe` less 160k bytes.

The following new or modified methods in `MSDOSSystemCall` deserve special mention:

shell

Leave the shell with the DOS command "exit". Smalltalk closes all open files before opening the DOS shell. The shell set the display to 80x25 color alphanumeric mode, with the Smalltalk screen restored upon return. The default drive and the current directory on the default drive are also restored.

executeUtility: aCommand withArguments: anOrderedCollection (1)

executeUtilityWithErrorMapping: aCommand withArguments: anOrderedCollection (2)

executeUtility: aCommand withArguments: anOrderedCollection from: inputStream to: outputStream (3)

shell: aCommand withArguments: anOrderedCollection (4)

If the program name, `aCommand`, contains a path, then it is considered to be the full name of the executable file. Otherwise the current directory on the default drive and the `PATH` environment variable are used to locate the executable file. If no filename extension is provided the search looks for exe, com, and bat files (in that order) in each directory checked. If the file is a batch file, or `aCommand` is one of `DIR COPY DEL ERASE ECHO BREAK DATE MKDIR MD REN RENAME RMDIR RD TIME TYPE VER VERIFY` or `VOL` then `command.com` is used to execute the command. The argument list, `anOrderedCollection`, is merged into a single string argument required by MSDOS. If the executed program changes the current directory or default drive, they will not be restored upon return.

Methods (1) and (2) connect standard input to device `NUL`. Programs executed using these methods should not expect any input; if it does the program must exit on end of file indication. Programs that exit only upon command, such as most text editors, will cause Smalltalk to hang.

Methods (1), (2), and (3) communicate with the programs by redirecting standard output (and input in case 3) to files. When temporary files are needed, they are created in the

directory answered by tempDirectory and deleted upon completion. Smalltalk saves all its so the executed program gets its maximum allowable 15 handles. Two or three additional system file handles are used so it may be necessary to adjust the FILES parameter in the config.sys file upwards. Any programs which send their output directly to the display will cause that output to be lost -- Smalltalk restores the original display mode and contents upon return.

Method (1) answers a string which is the merged standard output and error streams. Method (2) answers an array of two strings, the first being the standard output, and the second being the standard error streams. In both cases, the strings have carriage return characters excised (line feed characters are intact).

Method (3) answers a string of the standard error stream with carriage returns excised. The argument inputStream is either a FileStream or a readable Stream (which gets sent to a temporary file) which is used as standard input for the program. The stream is read from its current position. If the stream is not a FileStream then it is left positioned at its end. The argument outputStream is either a writable FileStream or a writable Stream (which gets written from a temporary file). The output stream is written to at its current position.

Method (4) leaves standard input, output, and error connected to the keyboard and display, thus it is like the shell command but with Smalltalk specifying the desired program to run. This method closely approximates the functionality of the DOS Shell interface provided in Smalltalk V, but with much greater efficiency.

defaultDiskName

. Answers the default disk drive name, normally "C:".

changeDisk: aString

Sets the default drive based on the first character of the string, which should be alphabetic. Answers the number of existing logical devices.

switchCharacter

switchCharacter: aCharacter

Use to set and read the MSDOS switch character, an undocumented feature which allows using filenames with '/' as the path separator in DOS commands. Smalltalk will work with any switchCharacter setting, but pathnames must always be separated with '\'.
 '\'

Using CFIG386

The CFIG386 program is used to set many configuration options for the Smalltalk interpreter. The program is executed with the command:

cfig386 st.exe [-clear] switches

where st.exe is the name of the executable file being configured, -clear removes any previous switches (use this when changing existing switches), and switches are one or more of the following switches to add. Numeric values are in decimal, or hexadecimal if suffixed with an "h".

-A20

Disables A20 each time the 80386 changes to real mode. If selected, some ramdisk/diskcache/printerbuffer programs may work. The cost is slower execution.

-B0

Allows B0 mask 80386 chips to work with Smalltalk. Better solution is to get a newer processor chip.

-CEMM

Turns off Compaq CEMM or Quarterdeck QEMM so that Smalltalk will run.

-MINREAL n

Leave a minimum of "n" paragraphs of real mode memory free for DOS shell and executeUtility calls. Smalltalk will not run if insufficient memory is available. This should be left at its default "0".

-MAXREAL n

Leave a maximum of "n" paragraphs of real mode memory free for DOS shell and executeUtility calls. Defaults to 512 kbytes. For applications not desiring the use of the DOS shell or executeUtility methods, may be set to zero giving about 400k more memory for the Smalltalk image.

-MAXIBUF n

Allocate at most "n" K bytes ($1 \leq n \leq 64$) buffer for data on DOS and BIOS calls. Except for image loading and saving, there is no performance to be gained by having this value larger than the buffer size specified in the image (distributed as 2k). The default value has been set to 16.

-MINBUF n

Allocate a minimum of "n" K bytes for data on DOS and BIOS calls. Leave unset (1) or set to 2.

-NOMUL

Allows execution on systems having 80386 processors with the multiply bug.

-R287

Switch 80287, if present, to real mode on every 386 mode switch, to allow real mode code to use 287 while protected mode code is running. Not necessary for Smalltalk.

-NISTACK n

Allocate "n" buffers ($n \geq 4$) to be used for stack space when switching from protected to real mode. The default (4) seems fine.

-ISTKSIZE n

Set the size of each stack buffer to "n" K bytes ($1 \leq n \leq 64$). Again, the default (1) seems fine.

-EXTLOW addr

Only use extended memory above the specified page-aligned physical address. Used to reserve part of extended memory for some other use.

-EXTHIGH addr

Only use extended memory below the specified page-aligned physical address. Used to reserve part of extended memory for some other use.