Enigma for Windows Version 3.2 Help Index

■ Click the underlined topic which you want to know about. You can also use the TAB key to mark the topic and then press the RETURN key. In order to learn how to use HELP press the **F1** key.

The index contains a list of all topics covered in the help file of Enigma. To get general information how to use the Windows help system press the F1 key or choose the menu entry "Using Help"!

What is Enigma for Windows?

Enigma for Windows is a powerful program for encrypting and decrypting files of any type. Besides being able to conceal the contents of files it can be used as an electronic paper shredder. This program is named after the legendary encoding machine **Enigma 4** that was used by the Germans in the Second World War.

Everyone has files that should not be seen by others. Be it a patent or something as important as a love letter. Everyday many employees handle data that isn't meant for the eyes of others, for example company statistics, personnel records, payrolls and others. This type of data is only safe after it has been locked away with a lock and key.

In this day and age of massive computer use by banks, doctors, officials and a multitude of other offices it has become necessary to find alternatives to the traditional methods of securing data. Computer networks and the free exchange of data across these networks have added a whole new dimension to this problem.

Even though it is a good idea to lock away diskettes which contain sensitive data, encoding the data on those diskettes and using your own personal password as the key gives you a higher level of security. You should always encrypt sensitive or secret documents that you have received or transmit so they can under no circumstances be read without your permission. Encrypted files cannot be read or decrypted by any other users. The only way to make the file readable and usable again is to decrypt it with the same password that was used to encrypt it.

The ability to keep your data safe from unauthorised access depends on the encryption method that you use. Two methods have gained widespread acceptance; the RSA-Encryption method and the Data Encryption Standard (DES). The DES is used by many US. Government agencies and is a de facto standard. This method was also implemented in ***Enigma for Windows*** because of its safety and proven workability in everyday use. One can be sure that data encrypted with (Triple) DES cannot be decrypted in a reasonable amount of time with the help of today´s technology.

Many offices and government agencies use paper shredders to destroy their sensitive documents. The function **Wipe** is the electronic equivalent of this. Many computer users don't t know that files deleted with the DOS command ***del*** can often be recovered from their hard disks without much trouble even after a longer period of time. After using the **Wipe** function on a file you can be sure that no trace of it can be found on your hard disk any more.

Encryption

The function of classical cryptography is to make documents and intelligence unreadable for unauthorised persons. The transformation of real text into secret code is called encryption.

RSA

An encoding algorithm developed in 1978 at the MIT by Ronald **R**ivest, Adi **S**hamir and Leonard **A**delman. It uses two keys (passwords) one public and one private. The former can be found in published listings which are accessible to all users. The text is ciphered with the public and private password of the receiver. The receiver decodes the text by entering his private password. The algorithm encodes text by factoring large numbers into their primes with the (unproved) hope that the factorisation cannot be reversed with toadys technology.

History of Enigma for Windows

Version 1.0 - 09/01/1992
- Initial release.

Version 2.0 - 05/01/1993
- A comfortable installation program added.
- Context sensitive help by pressing the **F1** key.
- Encrypting, decrypting and deleting of several files or whole directories in one step.
- Dialog controlled choice of the target directory.
- Stopping the encryption process.
- 15% performance gain for DES based operations.
- Command line interface added.
- English version is now available.
- Enhanced setup.
- The option of compressing a file before it is encrypted was removed.
- Files created with Version 1.x are incompatible with Version 2.0. This was necessary in order to permit the simultaneous handling of several files. The product of this work is a modern directory structure on which future versions will be oriented.

Version 3.0 12/01/1994
- New double and triple DES algorithms added.
- DES routines have been isolated in a separate DLL to support their implementation in third party DES applications.
- Triple DES developer kit added.
- Screen distortion error by use of custom fonts fixed.
- Support of a default user specific password for each algorithm.
- Screen locking feature added.

Version 3.1 06/01/1995
- Runs in protected mode only (386+ required).
- Error in decrypting big files fixed.
- Professional key input dialog added.
- More than 300% performance gain for DES based operations.

Version 3.2 09/01/1995
- Some minor bugfixes.
- Output to self-extracting EXE files added.
- Professional search criteria in file selection dialog added.
- Enigma compatible DOS utility added

Enigma for Windows Installation

Enigma for Windows Version 3.2 is distributed with a comfortable setup program that carries out the following tasks:

- Copies the ***Enigma for Windows*** program files into the directory of your choice (default ***C:\ EFW32U***). ***Enigma for Windows*** Version 3.2 uses approximately 2500 KB disk space.

- It modifies the Windows initialization file ***WIN.INI*** by adding the following line ***EN3=C:\EFW32U\ EFW32.EXE ^.EN3***.

- Creates the MS-Windows Program Manager group ***Enigma for Windows***.

- Creates the file ***EFW32U.INI*** in the Windows directory.

For installation follow the instructions listed below:

- Start MS-Windows !

- Start the Program Manager !

- Click the **Run** command in the **File** menu in the Program Manager !

- Type in ***A:\INSTALL*** or ***B:\INSTALL*** depending on which drive you are installing from !

- A dialog box will appear and the recommended directory for the installation of ***Enigma for Windows*** will be shown. Choose the directory in which you want to install the program. If the chosen directory doesn't exist it will be created. Click the button **OK** to start the installation.! If you want to install the program in a network environment make sure that you have the necessary write permissions.

- The installation program will now begin to copy the ***Enigma for Windows*** files to the target directory.

The versions 1.1 and 3.2 are not compatible. It is therefor necessary to decrypt the data with the version that it was encrypted with. Files encrypted with version 2.x can be decrypted by the current version.

System Requirements

The minimum requirements for running ***Enigma for Windows*** Version 3.2 are:

Software:

- ***MS Windows 3.1+*** or ***MS Windows NT 3.1+*** or ***MS Windows 95+***

Note: If you use on-line compressors such as ***Stacker*** or ***DoubleSpace*** we **cannot** guarantee that data which has been deleted with **Wipe** cannot be recovered again.

Hardware:

- 386+, VGA, 2,5 MB of free harddisk space

Enigma for Windows does not require any special hardware to other than the computers ability to run one of the above mentioned operating systems.

Note: Even though ***Enigma for Windows*** uses very fast algorithms their complexity (mainly the DES modes) make encrypting and decrypting data a time-consuming operation. It is therefor recommended that you use an i486 or a Pentium based PC.

Starting Enigma for Windows

Enigma for Windows can be started form Windows or from the MS-DOS Prompt.

Starting from the Windows Program Manager

1. Open or activate the Program Manager window !
2. Open the group window which contains ***Enigma for Windows*** !
3. Double-click the ***Enigma for Windows*** symbol or use the cursor and press **Enter** !

Starting from the Windows Program Managers File menu

1. Open the **File** menu in the Program Managers menu bar !
2. Click **Run** !

- If the program is in your path enter ***EFW32*** !
- If the program is not in your path enter the complete path to where it is located, for example ***C:\EFW32U\EFW32.EXE*** !

3. Click **OK** !

Starting from the MS-DOS-Prompt

1. At the DOS-Prompt enter the command ***WIN EFW32*** !
2...Press **Enter** !

Note: If you receive a message that the file could not be found this means that the directory containing ***Enigma for Windows*** is not in the path. Change to the directory which contains ***EFW32.EXE*** and try to start it again.

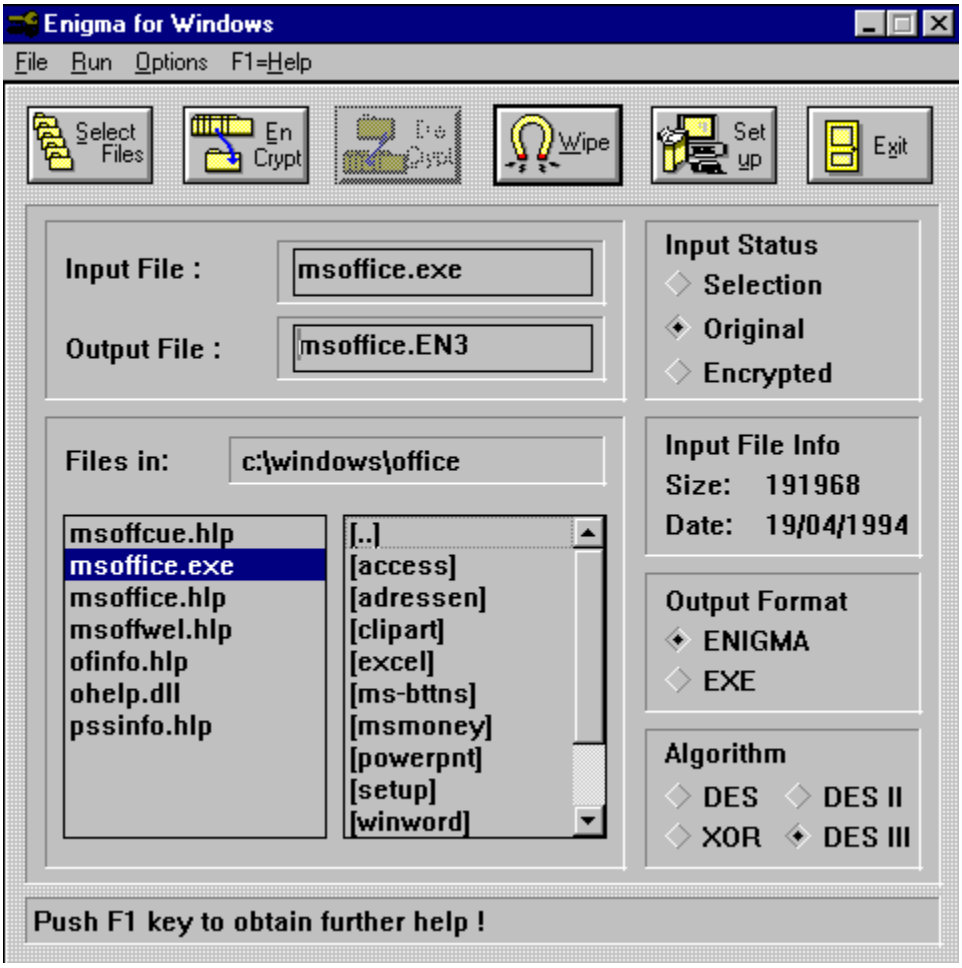
Starting from a MS-Windows command line interface

1. Once ***WinCLI***, ***WinCLI Pro***, ***4Win*** ...is running change the directory to where the program is located enter ***EFW32*** !.

Note: When you start ***Enigma for Windows*** for the first time you will see a dialog box which will ask you to identify yourself as a legal user of the program. Enter your serial number here. You will find it written on the label of your program diskette.

The User Interface

Move the mouse pointer over the screen. Whenever you see a hand you can get further information by pressing the left hand mouse button.



Commands in the File menu

Select Files...

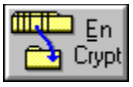
Opens a dialog in which a single file or whole directories can be selected.**[(ALT-S),(ALT-F,S)]** See section "Select File(s)" for further information.

Exit

Exits ***Enigma for Windows***. **[(ALT-X),(ALT-F,X),(ALT-F4)]**.

Commands in the Run menu

EnCrypt Files...



Encrypts the selected files. **[(ALT-E),(ALT-R,E)]** See section "EnCrypt File(s)". for further information.

DeCrypt File...

Decrypts the selected file. **[(ALT-C),(ALT-R,C)]**. See section "DeCrypt File(s)"D for further information.

Wipe Files...

Wipes out the selected files. **[(ALT-W),(ALT-R,W)]**.See section "Wipe File(s)" for further information.

Commands in the Options menu

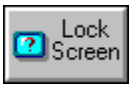
Setup...

Opens a dialog window in which various ***Enigma for Windows*** parameters can be changed **[(ALT-U), (ALT-O,U)]**.

Default User Passwords...

Opens a dialog window in which one can enter passwords which will be used for encrypting by default **[(ALT-O,D)]** See section Default User Passwords for further information.

Lock Screen...



By selecting this menu item you are been able to lock your current MS-Windows session. You computer will ignore any input by mouse or keyboard outside of this window. It is not possible to start an another program or to switch the session. You can unlock your screen by typing in your default DES I password in the text box. This feature protects your computer from attacks by unauthorized persons and little green men and women and vogons and klingons while you are absent from your desk.**[(ALT-O,L)]** . If you haven't a private DES-I password you can unlock the screen by typing "**12345678**".

Commands in the Help menu

Contens

Displays the help contents

Select Files

Displays the help for "Select File(s)"

EnCrypt Files

Displays the help for "EnCrypt File(s)"

DeCrypt File

Displays the help for "DeCrypt File(s)"

Wipe Files

Displays the help for "Wipe File(s)"

Using Help

Display the help for "Using Microsoft Help"

About...

Shows the environment, the copyright, and the version number.

Select File(s)

This dialog box contains three list boxes which are used to select and collect the files that are to be encrypted or deleted. With the help of various buttons you can select an individual file or whole directory trees. The selected files are listed in the bottom listbox. Marked files in the other two listboxes can be moved to the bottom listbox by clicking the **Update** button. After you are done selecting files confirm your selection by clicking the **OK** button.

This button selects the starting directory for the encryption. When you are working with several files in different directories a defined starting point must be set in order to restore the directory structure when the files are decrypted. At first this button is grayed and the current directory is set as the starting directory. This button becomes available when you change to a directory which is higher up in the directory hierarchy **([..])** than the current starting directory or when you change to another drive. **[(ALT-T)]**

Tags all files in the left listbox. The listbox allows a so called multiple choice selection, this means that you can select files by simply holding down the left mouse button and pulling the mouse cursor downward. If you press the **CTRL** key at the same time you can also select files which don't immediately follow each other.**[(ALT-S)]**

Untags all files in the left listbox.**[(ALT-D)]**

Clicking this button causes the highlighted directory in the right listbox to be tagged. Clicking the **Update** button will copy all files in that directory or those of its sub directories into the bottom listbox in accordance with the file search criteria.**[(ALT-R)]**

This button causes all tagged files to be copied into the bottom listbox. It must activated again to copy each subsequently tagged file into the bottom listbox. **[(ALT-U)]**

Opens a new dialog in which you can declare the criteria by which the files will be selected. **[(ALT-X)]**

Removes marked files from the bottom listbox. **[(ALT-J)]**

Removes all files from the bottom listbox. **[(ALT-A)]**

Further information about a file can be obtained by double clicking it in the bottom listbox.

Expert Adjustments

In this dialog you can choose the search criteria to select the files which you want to encrypt. If you wish to regularly encrypt your latest files, you would enter a certain date here and all files newer than this date will be selected. Furthermore you can use regular expressions in the search mask to find files in a more professional manner. It is also possible to search for files with a certain size or file attributes. The chosen settings can be saved permanently by clicking the **Save** button. By default all files will be selected.

Regular Expression

In the **Expert** dialog a (limited) regular expression can be entered to create a file mask. The following characters have been implemented:

- ***** Matches any sequence of characters including a sequence of length zero.
- **?** Matches every single character
- **[...]** Character set, it matches any one of a group of characters that are enclosed in the square brackets
- **[^...]** Complemented character set, this matches any character which is not inside the brackets
- **-** Can be used inside brackets to define a range of numbers. For example, **sws[1-36**] matches **sws1**, **sws2**, **sws3** and **sws6**.
- **** This is used to suppress the special meaning of a character when matching. For example **]** matches the character **]** also **\[** and **\-** can be used anywhere inside a bracket and **\^** directly after the opening bracket.

- All other character match themselves

(Mr. Duden forgive me !)

EnCrypt File(s)

It is possible to either encrypt a single file or several files at once. If several files are to be encrypted they must be tagged in the dialog Select File(s). A permissible selection of files can be recognised by the status of the status element **Selection**. In this case the words **>> Selection List <<** will appear in the text field **Input File**, if only one file is selected this text field will contain the file name. Now you must the select the output file format. By default a self-extracting **EXE** file with the output name **ARCHIVxx.EXE** will be created. Use this format to send encrypted files to people who do not have a copy of Enigma. If you want to create an encrypted archive which can be decrypted again directly from Enigma click the **ENIGMA** status button. Then a file with an **EN3** extension will be created.

After selecting the input file(s), output file the encryption algorithm must be chosen. In order to do this click either the status element **XOR**, **DES**, **DES II** or **DES III**, then confirm the choice by clicking the switch **EnCrypt** or by choosing the command **EnCrypt File(s)...** in the **Run** menu. If you have selected several files a new dialog will appear which prompts you to confirm your selection. Use the 4 switches in the middle of the dialog box to move the files around between the listboxes. All files shown in the bottom listbox will be encrypted. When you are ready to encrypt click the **OK** button.

A dialog will appear in which you can chose in what directory the output file will be copied into. Compare the file size with the directory size in order to ensure that there is enough space to hold the output file.

Before the selected files are encrypted you must enter your personal password. No one can decrypt these encrypted file without knowledge of this password. See the section "Password for Encryption" for further information.

Now the encryption process can be started; a new window will appear which informs you about the encryption process and from here you can interrupt the encryption process at any time. After successful encryption of the tagged files, you can immediately wipe out these tagged files from your hard disk with **Wipe**.

Note: The status element **Original** must be marked if an encrypted files is to be encrypted again.

If you have selected an Enigma compatible encrypted file as the output file all files will be appended to it which are not already contained in it. If files have been selected with the same name(s) as those already in the encrypted file the latter will be replaced. If you use a different password from that in the existing encrypted file you must ensure that you use the appropriate password for decrypting each encrypted file. We do NOT recommend this procedure ! Please be careful when wiping out the selected files. Make sure that your output file is not in this list, or else your data would be lost forever.

DeCrypt File

To decrypt a self-extracting EXE file, simply run it from the DOS command line, or pick **File/Run** in Program Manager, or double click it from File Manager. The program will prompt the user for the password and decrypt itself. To decrypt a file which was encrypted by Enigma to a Enigma compatible output format, tag this file in the left listbox in the main dialog. The status element **Encrypted** will automatically be marked. The file name will appear in the text field **Input File**. After the file has been selected click the switch **DeCrypt** or activate the **DeCrypt File** command in the **Run** menu.

After this a dialog will appear which shows what files are present in the input file. Here it is possible to select the files which should be decrypted. Confirm the selection by clicking **OK**.

Now a new dialog will appear in which you can select in which directory the decrypted files should be copied into. Afterwards a new dialog will prompt you for the password that was used to encrypt the file(s). The decryption process can now be started. Once started a new window will appear which informs you about the decryption process. Here the decryption process can be interrupted at any time.

After all the files in your input file have been decrypted make sure that your data has been decrypted correctly before you delete the input file. The program has no way of testing whether the correct password was used to encrypt the file(s) and there is no sure way of testing whether the result is meaningful. If you use the wrong password to decrypt the input file the output file will contain rubbish and you must decrypt the input file again with the correct password.

Wipe File(s)

It is possible to delete a single file or several files at once. If several files are to be deleted they must selected in the dialog Select Files. A permissible selection of files can be recognised by the status of the status element **Selection**. In this case the words **>> Selection List <<** will appear in the text field **Input File**, if only one file is selected this text field will contain the file name. After this is done you can click the **Wipe** button or activate the **Wipe File(s)...** command in the **Run** menu.

If you have selected several files a new dialog will appear which prompts you to confirm your selection. When you are ready to delete click the **OK** button and a new window will appear which informs you about the progress of the deleting operation and here it is possible to interrupt the operation at any time.

After this operation the data is lost for ever, so please be careful when selecting the files which you want to delete.

Default User Passwords

With the help of this dialog you can set a fixed private passwords for each algorithm which can be used for encryption. Enter your favourite passwords and your serial number into the corresponding text boxes. For the DES and XOR algorithm you should choose an eight character word - 16 byte and 24 byte length keys are essential for double DES and triple DES to work properly. To enter your keys in hexadecimal notation press the **H** button.You must click the **Save** button if you want use these keys in later sessions. To show your current passwords enter your serial number and click the **View** button !

Generating "good" keys

The security of an algorithm rests in the key. No one would try to break the algorithm if they knew that preferably you use the names of your children or your date of birth as your password. It doesn´t matter that the program uses DES encryption - it would be simple to decrypt your encrypted data.

If you want to encrypt your data for a short time period it is completely sufficient to encrypt your data with single DES and an alphanumeric key. A good key should be easy to remember, but difficult to guess. Never use parts of your name , dictionary words of common languages, words from databases, names of famous people and places etc. . Instead combine several word with special characters, for example "Hund&Katze", "Ja||Nein" or "You&me69". A better method is to use a string of letters which are the initials of a longer phrase, for example "Who is John Galt ?‘ generates the key "WhisJoGa" !

If you need to encrypt more valuable data or the data has to be encrypted for a longer time period you should use the double- or triple DES algorithm and correspondingly long keys. The program allows one to generate keys made up of the entire ASCII character set. It is worth the trouble to enter a full 24 byte key in hexadecimal notation. Finally you should write down this key and lock it in a safe.

Key in hexadecimal notation

By selecting this dialog you are been able to enter a key in hexadecimal notation and use characters in your password which can´t directly be entered with your keyboard

Using characters from the entire 8-bit ASCII character set increases the security of your encrypted data gigantically. Even at a key-length of 8 characters there are 20000 times more possible keys than if you are using only alphanumeric characters [A-Za-z0-9].

The Enigma for Windows Setup

This dialog box is opened by clicking the **Setup** Button in the Main Dialog Box or by pressing the key combination **(Alt-U)**. This chapter discusses the configuration of ***Enigma for Windows***.

- **Save the last directory as default working directory. (default: not marked) [(ALT-L)]**
  Mark this status element if you want to change into the last working directory by default. This can be helpful if you want to backup selected files regulary.

- **Remove files with a simple delete instead of using Wipe (default: not marked) [(ALT-R)]**
  The files will be simply deleted and can possibly be restored. Insecure but very fast.

- **Remove empty directories when deleting directory trees (default: marked) [(ALT-V)]**
  Removes empty directories when deleting whole directory trees with **Wipe**.

- **Create necessary directories while decrypting (default: marked) [(ALT-C)]**
  Creates the necessary directory structure while decrypting. If this button is not marked the filenames containing a path name will be written into the current directory. For example, ***tmp\dir1\file.txt*** will be decrypted and written into the current directory with the name ***file.txt***.

- **EnCrypt all selected files without further questions (default: not marked) [(ALT-E)]**
  If this status element is marked the selected files will be encrypted without further question, otherwise you would be able to modify your selection in a dialog box.

- **Wipe out all selected files without further questions (default: not marked) [(ALT-A)]**
  If this status element is marked the selected files will be wiped without further question, otherwise you would be able to modify your selection in a dialog box.

- **Higher multitasking ability activated (default: marked) [(ALT-M)]**
  If this status element is marked, MS-Windows has more time to process the internal message queue and it uses more CPU time for other applications which are running.

- **Hide password in decryption dialog (default: marked) [(ALT-I)]**
  If this status element is marked the password will not be showed in the decryption dialog, otherwise the entered password will be showed.

- **Automatic wipe after successful encryption (default: not marked) [(ALT-T)]**
  If this status element is marked your selected files will be wiped after a successful encryption. You should be very careful with this option.

- **Default Output Format EXE (default: marked) [(ALT-X)]**
  If status element is marked Enigma will produce a self-extracting executable file with an EXE extension. Use this format to send encrypted files to people who do not have a copy of Enigma.T

- **Default Output Format ENIGMA (default: not marked) [(ALT-N)]**
  If status element is marked Enigma will produce a Enigma compatible archiv file with an EN3 extension. You can decrypt this kind of files directly in Enigma.

- **ENIGMA extension [EN3] (default: marked) [(ALT-G)]**
  If you don't add an extension to the name of the Enigma output file, the program will automatically add the extension of the textbox. The use of a systematic extension can be helpful in relocating encrypted files.

- **Prompt before wiping a file (default: marked) [(ALT-W)]**

Asks for confirmation before deleting a file with **Wipe**.

- **Prompt before Overwriting a file (default: marked) [(ALT-O)]**
  Asks for confirmation before writing back a decrypted file. This option should always stay marked and you should always make sure that the file was decrypted with the right password otherwise rubbish might be written over the input file.

- **Default Algorithm (default: DES III)**

Mark here the algorithm with which you want to do most of your encryption.

Changes in this menu are only active for the current session. If you want to change the option's permanently you must click the button **Save Options [(ALT-S)]**. To restore the default values click the button **Default [(ALT-D)].**

National **B**ureau of **S**tandards

National **S**ecurity **A**gency

ununambiguous projection of an infinite set to itself

unit of the Information content of a message. 1 bit (binary digit) stands for a yes/no decision.

Daten**F**ern**Ü**bertragung

exclusive OR, y = 1, if x1 != x2

Data Encryption Standard (DES)

In 1972 the National Bureau of Standards (hereafter: NBS) made a public invitation to tender for the development of a program which would allow files (unclassified computer data) of any type to be encrypted. The low response prompted the NBS to ask the National Security Agency (NSA) for help. Here they had some experience in the development of simple encoding and encryption algorithms. After long discussions the NBS decided to use the Data Encryption Standard (short DES) as a standard. The DES had been developed at IBM.

The DES has its roots in an encoding method which was developed in Germany during WW I by an electrical engineer named Arthur Scherbius. In the second World War the Germans developed an electromechanical encoding device called **Enigma 4** which was based on the work of Arthur Scherbius. Like the **Enigma 4** the DES uses a series of permutations which for themselves are individually rather simple but when used in combination with themselves they are extremely complicated. In the **Enigma 4** encoding machine the permutations are generated by mechanical wheels while in the DES they are produced by program code or by hard wired chips.

DES in ECB mode handles data blocks of 64 bits at one time. DES is basically a bit permutation, substitution, and recombination function performed on blocks of 64 bits of data and 56 bits of key (eight 7-bit characters).

First, the 64 bit input block is subjected to a fixed initial permutation **IP** and split into two 32 bit blocks **L0** and **R0**. Then each block is scrambled up in 16 iterations. The resulting 32 bit blocks **L16** and **R16** are then permuted back to a 64 bit block by a permutation table **IP'** which is the inverse of **IP**. The resulting 64 bit encrypted block is then written to the output block.

In each iteration Ii the block **L*i*-1** is coupled with the 32 bit output of the function f**(R*i*-1,k*i*)** by a XOR operation. The iteration **I16** is an exception, here the blocks are swapped. The function **f(R*i*-1,k*i*)** receives the block **R*i*-1** and the 48 bit output of the function **K(*i*)** as its arguments. **f()** permutes the 32 bits of **R*i*-1** into 48 bits by using the permutation table **E**. The result is exclusive ORed with the 48 bit output from the function **K(*i*)**. The 48 bit result is then split into eight 6 bit values. Then the function **S** realizes a 4 bit value for each 6 bit value by a non-linear substitution. The eight 4 bit values are then combined to a 32 bit value, which is then coupled with the permutation table **P**. The resulting 32 bit is the output of the **f()**. The function **S** composed of eight substitution modules **s1,s2,...,s8** (the mysterious S-boxes) which are used on the eight 6 bit values from above. In this 16x4 matrix each of the 64 elements has a value between 0 and 15, a 4 bit value which substitutes a 6 bit value. The matrix co-ordinates of a 6 bit value are obtained in the following manner: bits 1 and 6 as binary give column 0..3, with bits 2 through 5 the row 0..15 is calculated. The function **S** returns the 4 bit value of the so addressed matrix element. The function **K(*i*)** returns the 48 bit value **k*i*** based on the key. There are two further permutation tables for the key. In the first iteration **I1** the key is permuted with the first table and then split into two halves. Each of these halves is shifted to the left once (***i* = 1,2,9,16**) or twice depending on the iteration number ***i***. Each subsequent iteration **I*i*** after the first uses the shifted value of the preceding iteration as input, shifts the value again and finally permutes it with the second permutation table. The decryption process uses the same algorithm, except that the decryption reverses the half exchanges during the iterations and uses the permuted key values returned by **K(*i*)** in the reverse order. In double and triple DES mode the key (16 byte or 24 byte) is split into 8 byte subkeys. Then the described algorithm is executed 2 or 3 times consecutively, each time with an another subkey.

Security of DES

>> ***The best that can be expected is that the degree of security be great enough to delay solution by the enemy for such a length of time that when the solution is finally reached, the information thus obtained has lost all its value.*** << William F. Friedman

It is best to trust algorithms because professional cryptographers have scrutinized them for years without cracking them, not because the algorithm´s designer makes grandiose claims about its security. In the last 20 years hundreds of experts tried to find an efficient attack to break DES.

In the process it turned out that after a few iteration steps each bit in the output block is dependent upon every bit of the input block and the key. A minimal change in the input block or in the key causes more than half of the bits in the output block to change, this is the so-called avalanche effect. To date there is no better way known to break DES other than to try every possible key; this is called a brute-force attack. This means that theoretically 72 quadrillion (2^56) keys have to be tried.

On a Sun SparcStation-2 , a key can be tested in 0.00005 seconds, an average of 20000 keys per second - results in a time of maximal 114168 years to find a key for a given encrypted text. With the help of a custom chip which is able to test a million keys a second it would take about 2284 years to try all possible combinations. 10000 of these chips in a parallel array would get the same result in about 80 days. A test for the plausibility of the decrypted text which has to be done after each test is not included in these calculations.

In August 1993 the Canadian Michael J. Wiener described how to build an exhaustive DES key search machine for $ 1 million that can find a key in 3.5 hours in average. Each of the used key search frames has the equivalent power of 14 million Sun workstations.

To greatly improve the security of DES the double- and triple DES algorithms have been implemented. With triple DES encryption, each input block is processed three times using independent keys to produce the encrypted block. Almost all attacks concentrate on exhaustive or brute force methods as well as Wiener's approach. In the age of colossally increased computer power and parallel systems these methods have become alarmingly practical - certainly with an unreasonable expenditure for private persons. A fairly painless way to improve security dramatically is to switch to triple-DES - which for the next decades is a sure-fire method to protect against these attacks.

Industry estimates suggest that by 1996 there will be 200M computers in use worldwide. If every one of those computers worked together on a brute-force attack, and each computer performed a million encryptions per second, it would still take a million times the age of the universe to recover a 24 byte triple DES key.

The weakest link in DES are the users themselves whom exchange their passwords or keep their passwords insufficiently secure or choose a poor key.

msb - most significant bit

XOR

XOR uses a substitution algorithm, this means that every character of the text is coupled with a character in the password by a XOR operation to produce a character in the output file. This means that in contrast to other encoding algorithms where the characters of the password are coupled with the text characters one after another the XOR uses a procedure that randomly selects a character of the password to couple with a character of the text.

The randomising procedure is dependent upon the length of the password. By filling the output buffer with random numbers the degree of disorder is further increased.

You should thoroughly memorise your password. If a file is accidentally encrypted more than once it can be decrypted by entering the passwords in the opposite order. A text that has been encrypted twice with the same password does **not** yield the original text.

THERE IS NO REAL SECURITY HERE. THIS KIND OF ENCRYPTION IS TRIVIAL TO BREAK BY A CRYPTOANALYST, EVEN WITHOUT COMPUTERS. IT WILL ONLY TAKE A FEW MINUTES WITH A COMPUTER !

Password for encryption

Before the selected files are encrypted you must enter your personal password. No one can decrypt these encrypted file without knowledge of this password. The password is not shown on the screen when you enter it for protection against unwanted observers. For safety reasons it has to be entered twice (Fields Password: and Confirmation:). Suggestions for a "good" password are given in "Generating good keys".

Clicking the **Make Key** switch causes an algorithm specific password to generated by a random character generator, it can be seen in the field **Automatic:**. After clicking the **Hex** button a new dialog appears and you can enter or show your key in hexadecimal notation. You should write this password down before clicking **OK**. If you click the **Default** button your default user password can be used for encryption.

Password for decryption

Enter the password that was used to encrypt the file(s). In the default configuration the password is not shown. By clicking the **Hex** you are been able to enter or show your key in hexadecimal notation.

Specifications

The DES-Algorithm used in this program conforms to the following standards (as far as this is possible for a software implementation).

- FIPS PUB 46-1 - Data Encryption Standard (1988)
  Contains the specification for the Data Encryption Standard (DES) algorithm, which can be implemented hardware to protect sensitive unclassified information.

- FIPS PUB 74 - Guidelines for Implementing and Using the NBS DES (1981)
  Companion to FIPS PUB 46-1. Contains guidance for the use of cryptographic techniques.

- FIPS PUB 81 - DES Modes of Operation (1980)
  Companion to FIPS-PUB 46-1. Contains descriptions of the four modes of operation for the DES: Electronic Code book (ECB), Cipher Block Chaining (CBC), Cipher Feedback (CFB), and Output Feedback (OFB).

- ANSI X3.92 - Data Encryption Algorithm (DEA)
- ANSI X3.106 - DEA Modes of Operation

In 1986 the ISO published the "DEA-1" specification, where it is recommended that DES be used for encoding data.

- FIPS - Federal Information Processing Standards
- ANSI X3 - American National Standards Institute (Information Processing)
- ISO - International Standards Organisation

The Wipe algorithm conforms to specification CSC-STD-005-85 of the National Computer Security Center, it is described in the Department of Defense Magnetic Remanence Security Guideline, 15 Nov. 85, Section 5.3.1 .

Press this button to exit ***Enigma for Windows***

This text field shows the name of the input file. It is automatically filled by clicking a file in the left listbox

Text field for the name of the output file. You must manually enter the name of the output file here before encrypting

Shows the current directory

Shows the files which are in the current directory

Shows all directories and drives

A text box in which help texts are displayed dependent on the mouse cursor position

This status element is marked if a valid file selection has been generated in the corresponding dialog.

This status element is marked when the file in the text field **Input File** has been encrypted.

This status element is on if the file shown in the input file field has not yet been encrypted. If you want to encrypt a file that has already been encrypted you must click this element.

Shows the size of the selected input file

Gives the date on which the file was created

Status element shows that the DES algorithm is being used. It is automatically marked when a DES encrypted input file has been chosen for decrypting

Status element shows that the double DES algorithm is being used. It is automatically marked when a double DES encrypted input file has been chosen for decrypting.

Status element shows that the triple DES algorithm is being used. It is automatically marked when a triple DES encrypted input file has been chosen for decrypting.

Shows that the XOR algorithm is being used for encryption and decryption. It is set automatically when the input file has been encrypted with XOR

Shows that the ENIGMA compatible output format is being used.

Shows that the EXE output format is being used.