By John Alexander, G7GCK

148 Leicester Road, Groby,
Leicester LE6 0DP.

E-mail: jalex_uk@ntlworld.com

Enigma-E

A fully operational electronic

From left
The alpha-numerical displays of the electronic Enigma machine.

A close up of the plug board.

Two views of the lamp section.

On a recent trip to Bletchley Park I was introduced to Marc Simons and Paul Reuvers from Holland. They had with them a kit of parts that, with a little care and time, transforms into exactly what it says on the box - a fully operational electronic Enigma machine.

BACKGROUND TO THE ENIGMA

The German Enigma is perhaps the best known of many mechanical cipher systems developed during the 20th century. The Enigma was produced by Dr Arthur Scherbius's company Chiffriermaschinen Aktien Gesellschaft of Steglitzerstrasse 2, Berlin, in 1923 as a commercial machine. Commercial Enigma machines? Oh yes, the Enigma was originally intended as a cipher machine for commercial use by banks, insurance companies - for any company that needed security for its business messages.

Spain, Italy and Switzerland bought commercial Enigmas and Sweden decided to build its own machine. The UK and USA each bought examples to evaluate.

The rare Abwehr Enigma - like G312 that was stolen from Bletchley Park - is a version of the commercial Enigma. The version (K) used by the Swiss from 1935 is a particularly sought-after machine. From 1935 the British used a machine very similar to Enigma - the Type X or Typex. So similar is Enigma to Typex that Typex could be set up to decipher Enigma messages once the settings had been discovered. Apparently one German operator converted an incomplete captured Typex so that it operated as an Enigma - as a spare machine.

The Enigma, a glow-lamp machine, was based upon work carried out by several other people working on mechanisation of ciphers using rotors or enciphering wheels. It is called a 'glow-lamp' machine because pressing a key causes the rotor(s) to turn and allows a current to flow through the rotor wirings, through the reflector and back for a second time through the rotors before lighting up a bulb below to indicate an alphabet character.

Scherbius made little money from the system and was killed before it was taken up by the largest potential customer of all - the German military. Germany was restricted by the Treaty of Versailles and one thing they had to do was to stop their potential enemies from reading their mail - the Enigma appeared to be just the thing they needed.

The system was potentially a good one, and has been strongly defended at times, but it ultimately failed through:

- Poor operational instructions given to users - these could have been better thought out to reduce the chance of anyone 'breaking in'.
- A well-placed (and expensive) spy in the German cipher office. Hans Thilo Schmidt (codename Asche), who also had a high ranking brother in the German army.
- German operators making errors in they way they set up and used Enigma. These were often very basic mistakes and the Luftwaffe were thought particularly bad. That was later a blessing for Bletchley Park.
- The application of sheer genius - the Polish made amazing advances through the genius of Marian Rejewski, Jerzy Rozycki and Henryk Zygalski. This expertise was later gifted, along with Polish-made Enigma machines, to the British and French. The genius of others, like Alan Turing, also came into play.

By the way, those Polish Enigma copies were built by AVA of Warsaw, a company producing short-wave radio equipment for military and amateur use.

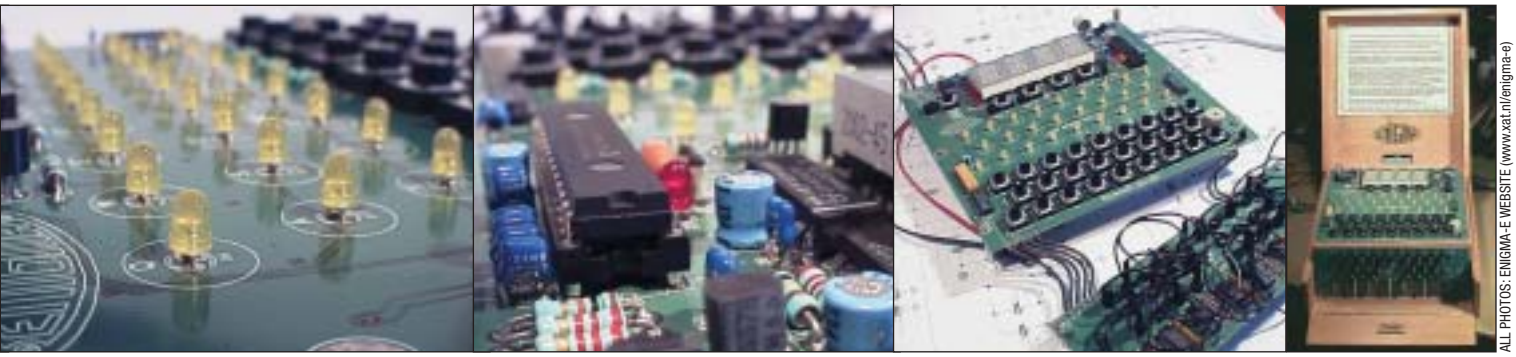
THE ELECTRONIC ENIGMA

Original Enigma machines, in good condition, are expensive to buy and an electronic version is a fine alternative - it illustrates the original working system and is more interesting (tactile) than a computer simulation.

Marc and Paul demonstrated their finished machine and I knew immediately I would have to have one. On my next visit to Bletchley Park I saw the kit on sale and paid out my own hard-earned cash. I walked away with it feeling just a little apprehensive. After all, how long had it been since I last touched a soldering iron?

I'm a certain age now and, through accumulated experience, I chose to spend some time reading the comprehensive manual and locating all parts. That was to help make the construction easy and straight-forward. Oh, and I first brushed up

Enigma machine



ALL PHOTOS: ENIGMA-E WEBSITE (www.xat.nl/enigma-e)

on those soldering skills too - soldered a few old parts to scrap circuit boards.

Over two afternoons, with breaks for tea and biscuits, I built the finished article. The instructions were carefully read, followed closely and the board checked for bad soldering before any power was applied.

It's a great feeling when a new project works perfectly first time - as mine did. Immediately I e-mailed a friend or two to see how they got on with theirs. One had a problem that turned out to be due to a poor solder joint. Once fixed, his worked perfectly too. Paul and Mark do provide a help service too if needed.

The manual is well laid out - that helped me enormously. The contents include an introduction, component recognition section, building instructions, a section on using the Enigma, excellent circuit layouts, plans for a suitable box, a history of the Enigma and some real messages (genuine intercepts) to work on.

USING THE ENIGMA-E

The Electronic Enigma beautifully emulates the German M4 (four rotor) Naval Enigma and the three-rotor version used by the Luftwaffe and Heeres (Army).

All settings can be made as for the real Enigma machine. Rotors and rotor order can be selected, 'crowns' and other initial settings made by pressing 'up' and 'down' buttons on the board. You can even store several settings in memory. That helps to switch ultra (pun intended) fast between predefined settings. There's no reason why you could not use the Electronic Enigma with the real thing and send messages between them.

There is a fully functional plugboard too - this had the effect of swapping pairs of letters. By 'Steckering' letters 'A' and 'T' for example, whenever an 'A' should appear, a 'T' will be produced instead - and *vice versa*. The plug board was an addition for military machines and did not appear on the commercially-sold Enigma machines.

There are some important additions to the kit version. The kit can be connected to a PC via a standard serial port or configured to send Morse automatically. If you wish, you can enter plain text and send cipher text to a simple text editor - and vice versa. Paste your enciphered text into an e-mail and you have a degree of security although it might be best not to send your most important secrets this way.

For portability, power is selectable, flicking a switch changes from battery (9V) to external power supply. I have included both options into my box - it makes it so simple to carry out and show off. I just need to finish the letter screen now - that helps you to read the plain text and cipher text character by character as you tap out messages on the keyboard.

The kit contains all necessary parts to build a working Enigma. Tools required to build it include a decent soldering iron, a wire stripper, side-cutters and a small screwdriver-that's about it. Just basic soldering kit.

Above
The Enigma-E machine completed.

Right
The completed electronic Enigma machine in a home-made wooden case.

THE BOX

A good box really sets this Enigma off so I spent some time looking for a suitable box to convert or build from scratch. My woodworking skills are even worse than my soldering and so I took the conversion route.

In an art shop I found a wooden box, designed to carry paint, brushes, and canvas, and converted that to my needs. Plenty of room for the power brick, a battery pack, spare leads and the (yet to be added) serial port connector. This kit can go anywhere.

Since then I have found an old rosewood box that I fancy converting so I may yet move it, or build another kit up. For the purists, the box design provided in the manual will give a much more realistic look and feel to the system.

CONCLUSION

As a collector of code and cipher systems from 1936 up to the 1970s, this kit was a 'must have' for me and comes highly recommended. Strangely, perhaps, it does not look out of place beside an original Enigma.

The Enigma-E costs £119.99 and is available from the Bletchley Park shop or from their website (see 'Websearch' below). ♦

WEB SEARCH

Bletchley Park museum and shop	www.bletchleypark.org.uk
Enigma-E	www.xat.nl/enigma-e
'Enigma Variations'	http://frode.home.cern.ch/frode/crypto/CSG