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Type-X Mark 22 Cipher Machine Manual -

1. Introduction

This manual describes the operation of the Type-X cipher machine. It is intended for all people who will handle the machine: cipher clerks and machine maintenance personnel.

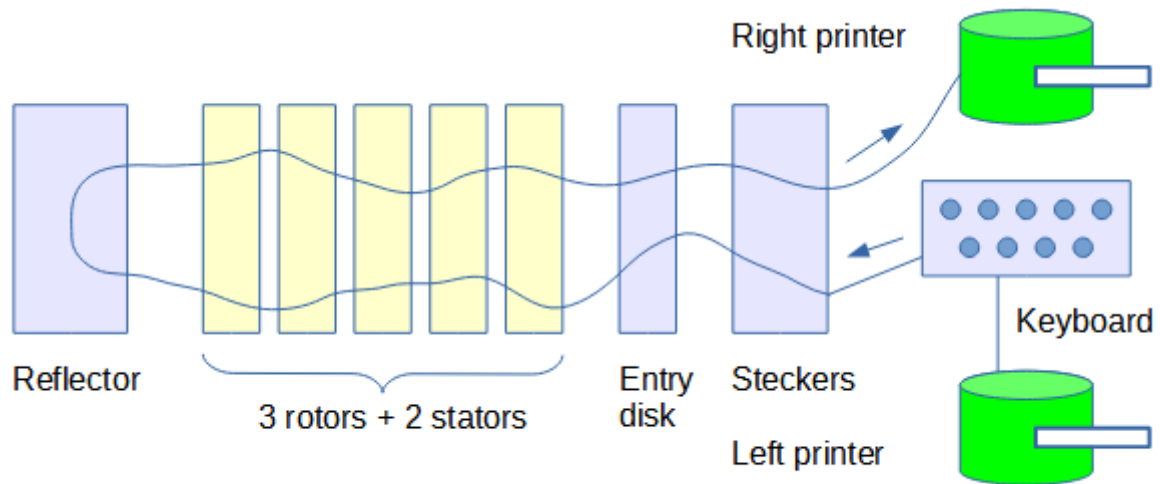
2. Description

The Typex machine is used to encrypt and decrypt a message. It has a keyboard and two printers, one which prints the input text (plain text or encrypted text), the other which prints the output text (plain text or encrypted text). Some models may use a panel with lamps instead of the output printer.

The cipher circuit includes the following:

- Five removable rotors. Each rotor has, around its perimeter, an alphabet (from A to Z) which identifies its position in the machine. The rotors belong to a set of 5 or more rotors. A set is identified by a number (eg 435) and each rotor in a set is identified by a letter or number (eg E or 5). For some sets of rotors, the core of the rotors can be reversed. Similarly, the rotors of certain games have a ring with associated notches acting on the advancement of the left rotor. The position of the ring can be changed for each rotor used.
- A reflector. It is a wiring that is equivalent to a fixed drum located to the left of the 5 rotors. This wiring is carried out by a drum internal to the machine or to an external circuit which can be easily rewired. The particularity of this equipment is that it acts as a mirror: Each letter in input corresponds to another letter in input. Thus, the 26 letters of the alphabet correspond to 13 pairs, for example (AK), (BZ), (CD), (EL), ... If the input current enters through the letter A, this gives the letter K in output and conversely if the letter in input is K, it gives the letter A in output.
- An input disc, whose wiring is fixed.
- Steckers: it is a plugboard. It is a wiring equivalent to a fixed rotor. This wiring is external and can easily be modified. We can remove it and then the letter A corresponds to the letter A, B to B, C to C, etc.

Note: Type-X model allows quick assembly with sockets. It is thus possible to very quickly change the reflector, the rotors in the five slots of the machine, to change (or remove) the plugboard.



The drawing (Fig. n°1) shows the electrical circuit which is activated when a key on the keyboard is pressed.



The photo (Fig. 2) shows a Type-X machine and its various components.

1: Reflector, 2: Cipher/Decipher switch and Letter/Figure button, 3: Keyboard, 4: Left printer (input text). Remark: at the base of printer, there is the on/off button. 5: Right Printer (output text), 6: Plugboard (Steckers). Remark: above the keyboard we can see five windows showing the actual position of the five rotors.

3. Keying

Tables of keys distributed each month, give the positions of the moving elements:

- The wiring of the reflector
- Plugboard wiring

- The set of rotors used and for each rotor: whether its core is inverted or not, the position of the ring.
- The 5 rotors used and in which slot each is positioned.

Note: According to the key tables, some items are changed, monthly, weekly or daily.

For each message, the cipher clerk indicates the time of sending (ex: H1730 for 5:30 PM), the indication of the encryption network (indicated at the top of the key table, for example: 76820) and finally a keyword making up the starting position of the rotors; for example the word SEVEN which on the key table corresponds to a random sequence, for example the starting key KNXVT. The message is followed by the number of letters of the message with the keywords included.

4. To enter and to print plain text and encrypted text

Before encrypting or decrypting a message, you must be sure to be in letter mode (using the buttons on the left and right of the keyboard). You also need to reset the counter. If you want to decrypt a message, you put the left lever in "Encryption" mode. Conversely, if you want to encrypt a message, you put the lever in "Decryption" mode. The machine is turned on (button on the left side of the machine).

When a message is decrypted and the machine is in the decryption mode, the decrypted text that is printed on the output printer includes not only letters but also special characters (numbers, period, comma, space, etc.).

Conversely, when a message is encrypted and the machine is in the encryption mode, the input text which is printed on the input text printer includes exactly the plain text, including special characters. On the other hand, the output printer only prints letters in groups of five letters (and therefore corresponds to the ciphertext). The text is printed on a strip of gummed paper which can then be pasted onto a form.

Each key on the keyboard has two meanings depending on the mode (Figures or Letters):

Figures :	1234567890	- / Z % X £ ()	V ' , .
Letters :	QWERTYUIOP	ASDFGHJKL	ZXCVBNM

Several keys on the keyboard have an important role:

- Space bar. If plain text is printed, a space is obtained.
- The key Fig. Switch to Figure mode
- The Let key. Switches to Letter mode.

On the other hand, when in encryption mode, the following keys are equivalent to the keys described above:

- The X key corresponds to the space bar.
- The Z key corresponds to the Fig key.
- The V key corresponds to the Let key.

When we are in decryption mode and in Figure mode, the following keys correspond to the following letters and symbols:

- The J key corresponds to the space bar.
- The D key corresponds to the letter Z.
- The C key corresponds to the letter V.
- The G key corresponds to letter X.