

~~TOP SECRET FROTH~~

IV. ENIGMA WIRINGS

B. Steckered Enigmas

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ENIGMA WIRINGS

Page 163

Name of Machine: GERMAN SERVICE ENIGMA

Source: 25 (p. 1); 27 (p. 3, 4, 7); 33 (p. 2); 35 (p. 12, 14, 26, 29, 87); 43 (p. 1.1-1.3, 2.1, 7.1); 55 (p.4)

The Steckered or Plugboard Service Enigma was a three-wheel machine used by the German Army and Air Force and for a time, by the Navy. It was equipped with five wheels that could be used interchangeably in the fast, medium, or slow position of the machine, giving 60 wheel orders. As the Army used the machine, the wheel order selected for one day was rotated in cyclic order. These five wheels, called Sigma wheels, were given the numbers I through V. They had one notch each and were wired differently. The endplate was pluggable and the reflector plate, known as A or Anton, was fixed but unpluggable. The Army used six steckers and the Air Force used a varied number of steckers, usually more than six.

The Navy used the same basic machine with six steckers, but almost immediately instead of five wheels, there were eight from which to select three for the fast, medium, and slow positions: the five Sigma wheels (I-V) and three Delta wheels (VI-VIII). The Sigma wheels had one notch each; the Deltas, two.

The Poles had managed to get pictures of the keys for this machine for a period of three months during which time the wheel order had remained unchanged. As a result of this, they broke the first three Sigma wheels. The British took up where the Poles left off, starting to work on traffic of May 1937. During the summer of 1937 the A reflector had changed to the B reflector, and by April of 1940 ten steckers were in use. By August 1940 the British broke the No. VIII Delta wheel, the last new wheel to be introduced during the War.

In February 1942 the German Navy abandoned the old B reflector. A new B reflector plate and a No. IX additional wheel (Zusatzwalze), referred to as the Beta wheel, were introduced to occupy the space previously taken up by the old B reflector. Thus the machine was now a four-wheel Enigma. The first three positions, as before were occupied by any three of the five one-notched Sigma wheels and Delta wheels; the fourth position was occupied by the No. IX Beta wheel which was so wired that when set at the letter A its effect, combined with that of the new B reflector, would be equivalent to the old B reflector. This was done to permit intercommunication between holders of the three-wheel and four-wheel Enigmas.

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ENIGMA WIRINGS

GERMAN SERVICE ENIGMA (continued)

In July 1943 an alternate reflector, the C or Caesar, and an alternate Zusatzwalze, the No. X or Gamma wheel, were introduced. The Gamma wheel, when set at letter A and used with the C reflector, produced the effect of the old C reflector, broken in 1940 as a result of German error. The Caesar and Gamma wheels were broken in July 1943. Later it was discovered that these wheels had been captured in North Africa but had never been sent on to Bletchley Park.

The Zusatzwalzen differed from the other wheels in that they had 26 studs on each side. They were equipped with rings which were never actually used until near the end of the war. They were set by hand to any position and were not moved mechanically. The new B and C reflectors could be inserted only one way and remained fixed throughout the enciphering process.

The C reflector was never brought into use on Army or Air Force keys; their next reflector was the pluggable D or Dora, introduced near the end of the War by the Air Force. This reflector had a shell which could be removed, and an arrangement of plugs effecting a stecker of the contact connections.

The write-ups that follow discuss various versions of the German Service Enigma. The order of their appearance is: British version (one wiring), U.S. Navy version (five wirings), U.S. Army Signal Corps version (two wirings), the YELLOW Enigma (two wirings).

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ENIGMA WIRINGS

Name of Machine: GERMAN SERVICE ENIGMA

Source: 6m (p. 13-22, 37)

The five wirings given here, represent the U.S. Navy versions of the German Service Enigma. In the first (3-wheel) machine three wheels are selected from a set of five to fill the first three positions. In the second (3-wheel) machine three wheels are selected from a set of eight to fill the first three positions. Wheels VI, VII, and VIII are double-notch wheels. The old C reflector was issued for this machine at one time, but apparently was never used.

In the third (4-wheel) machine three wheels are selected from a set of eight to fill the first positions, and the No. IX (Beta) fills the fourth position. Wheels VI, VII, and VIII are double-notch wheels. The combination of the Beta wheel at letter A and the new B (Bruno) reflector gives the old B reflector.

In the fourth (4-wheel) machine three wheels are selected from a set of eight to fill the first three positions, and either the No. IX (Beta) or the No. X (Gamma) is used to fill the fourth position. This fourth position wheel is set by hand and does not advance mechanically. The reflector is chosen from a set of two (B and C) and is fixed. The combination of the Gamma wheel at letter A and a new C (Caesar) reflector gives the old C reflector. Wheels VI, VII, and VIII are double-notch wheels. There are $2 \times 2 \times 8 \times 7 \times 6$ or 1344 possible wheel orders. This machine can be reduced to a 3-wheel machine by proper selection and placement of the fourth wheel and reflector.

The last wiring presented here is a U.S. Navy version of wheel I of the German Service machine. No other data accompanied this wiring.

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ENIGMA WIRINGS

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Name of Machine: GERMAN SERVICE ENIGMA (First)

Endplate Sequence:

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z (Endplate)
(Keyboard)

Rotors: (3-wheel machine)

r. A B C D E F G H I J K L M N O P Q R S T U V W X Y Z
l. K F L N G M H E R W A O U P X Z I Y V T Q B J C S D

A B C D / E F G H I J K L M N O P Q R S T U V W X Y Z
F B K E L T J S V Y C M I X U N D R H A O Q Z G W P

A B C D E F G H I J K L M N O P Q R S T U V W X / Y Z
P C E G I K M D Q S U Y W A O Z F J X H B L N V T R

A B C D E F G H I J K L M N O P / Q R S T U V W X Y Z
Y D G U Q X R B L C A S W K T J Z N P H V I M F E O

A B C D E F G H I J K L M N O P Q R S T U / V W X Y Z
H F N Y C E U J L W B X S V G Q K O A D Z P M T R I

Reflector: A B C D E F G H I J K L M N O P Q R S T U V W X Y Z
"Old B" Y R U H Q S L D P X N G O K M I E B F Z C W V J A T

Notch patterns are indicated by /

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ENIGMA WIRINGS

Name of Machine: GERMAN SERVICE ENIGMA (Second)

Endplate Sequence:

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z (Endplate)
 (Keyboard)

Rotors: (3-wheel machine)

I. r. A B C D E F G H I J K L M N O P Q R S T U / V W X Y Z
 l. K F L N G M H E R W A O U P X Z I Y V T Q B J C S D

II. A B C D / E F G H I J K L M N O P Q R S T U V W X Y Z
 F B K E L T J S V Y C M I X U N D R H A O Q Z G W P

III. A B C D E F G H I J K L M N O P Q R S T U V W X / Y Z
 P C E G I K M D Q S U Y W A O Z F J X H B L N V T R

IV. A B C D E F G H I J K L M N O P / Q R S T U V W X Y Z
 Y D G U Q X R B L C A S W K T J Z N P H V I M F E O

V. A B C D E F G H I J K L M N O P Q R S T U / V W X Y Z
 H F N Y C E U J L W B X S V G Q K O A D Z P M T R I

VI. A B C D E F G H I J / K L M N O P Q R S T U V W / X Y Z
 X K Q H W P V N G Z R C F O I A S E L B T Y M J D U

VII. A B C D E F G H I J K / L M N O P Q R S T U / V W X Y Z
 U O A K I H S D Y N Z T X C P V G B J W M Q F L R E

VIII. A B C D E F G / H I J K L M N O P Q R S T U V W X Y / Z
 W G L R I U M Y P D C K T Q E A S B N F X O J V Z H

Reflector: A B C D E F G H I J K L M N O P Q R S T U V W X Y Z
 "Old B" Y R U H Q S L D P X N G O K M I E B F Z C W V J A T
 "Old C" F V P J I A O Y E D R Z X W G C T K U Q S B N M H L

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ENIGMA WIRINGS

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Name of Machine: GERMAN SERVICE ENIGMA (Third)

Endplate Sequence:

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z (Endplate)
(Keyboard)

Rotors: (4-wheel machine)

- I. r. A B C D E F G H I J K L M N O P Q R S T U V W X Y Z
1. K F L N G M H E R W A O U P X Z I Y V T Q B J C S D
- II. A B C D / E F G H I J K L M N O P Q R S T U V W X Y Z
F B K E L T J S V Y C M I X U N D R H A O Q Z G W P
- III. A B C D E F G H I J K L M N O P Q R S T U V W X / Y Z
P C E G I K M D Q S U Y W A O Z F J X H B L N V T R
- IV. A B C D E F G H I J K L M N O P Q R S T U V W X Y Z
Y D G U Q X R B L C A S W K T J / Z N P H V I M F E O
T M F Z K W D O J Y X Q C R N E S U B L A H G V I P (Beta 9)
- V. A B C D E F G H I J K L M N O P Q R S T U / V W X Y Z
H F N Y C E U J L W B X S V G Q K O A D Z P M T R I
- VI. A B C D E F G H I J / K L M N O P Q R S T U V W / X Y Z
X K Q H W P V N G Z R C F O I A S E L B T Y M J D U
- VII. A B C D E F G H I J K / L M N O P Q R S T U / V W X Y Z
U O A K I H S D Y N Z T X C P V G B J W M Q F L R E
- VIII. A B C D E F G / H I J K L M N O P Q R S T U V W X Y / Z
W G L R I U M Y P D C K T Q E A S B N F X O J V Z H
- IX. (See Beta 9 above, used in 4th position)

Reflector: A B C D E F G H I J K L M N O P Q R S T U V W X Y Z
(NewBruno) E N K Q A U Y W J I C O P B L M D X Z V F T H R G S

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ENIGMA WIRINGS

Name of Machine: GERMAN SERVICE ENIGMA (Fourth)

Endplate Sequence:

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z (Endplate)
 (Keyboard)

Rotors: (4-wheel machine)

- I. r. A B C D E F G H I J K L M N O P Q R S T U V W X Y Z
 l. K F L N G M H E R W A O U P X Z I Y V T Q B J C S D
- II. A B C D E F G H I J K L M N O P Q R S T U V W X Y Z
 F B K E L T J S V Y C M I X U N D R H A O Q Z G W P
- III. A B C D E F G H I J K L M N O P Q R S T U V W X Y Z
 P C E G I K M D Q S U Y W A O Z F J X H B L N V T R
- IV. A B C D E F G H I J K L M N O P Q R S T U V W X Y Z
 Y D G U Q X R B L C A S W K T J / Z N P H V I M F E O
 T M F Z K W D O J Y X Q C R N E S U B L A H G V I P (Beta 9)
 E G T P L B O V F S I N C U J Z D X M R Q A Y W H K (Gamma 10)
- V. A B C D E F G H I J K L M N O P Q R S T U V W X Y Z
 H F N Y C E U J L W B X S V G Q K O A D Z P M T R I
- VI. A B C D E F G H I J / K L M N O P Q R S T U V W X Y Z
 X K Q H W P V N G Z R C F O I A S E L B T Y M J D U
- VII. A B C D E F G H I J K / L M N O P Q R S T U V W X Y Z
 U O A K I H S D Y N Z T X C P V G B J W M Q F L R E
- VIII. A B C D E F G / H I J K L M N O P Q R S T U V W X Y Z
 W G L R I U M Y P D C K T Q E A S B N F X O J V Z H
- IX. (See Beta 9 above, used interchangeably with Gamma 10
 in 4th position)
- X. (See Gamma 10 above, used interchangeably with Beta 9
 in 4th position)

Reflector: A B C D E F G H I J K L M N O P Q R S T U V W X Y Z
 (New Caesar) R D O B J N T K V E H M L F C W Z A X G Y I P S U Q
 (New Bruno) E N K Q A U Y W J I C O P B L M D X Z V F T H R G S
 (used interchangeably)

Notch patterns are indicated by /

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ENIGMA WIRINGS

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Name of Machine: GERMAN SERVICE ENIGMA

Endplate Sequence:

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z (Endplate)
(Keyboard)

Rotors: (US Navy wiring)

I. r. A B C D E F G H I J K L M N O P Q R S T U V W X Y Z
1. K V X Z H B E G Q W A C F D L N U I Y T M S J O R P

II. A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

III. A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

Reflector: A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

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ENIGMA WIRINGS

Name of Machine: GERMAN SERVICE ENIGMA

Source: 6m

The U.S. Army Signal Corps wiring of the German Service Enigma is a relettering of the U.S. Navy wiring which was based on the British wiring. Assumedly the original German model had the letter A opposite the core dot. The British, in error, assumed the dot on the core was opposite Z, and constructed their machine accordingly. As a result, U.S. Navy and U.S. Army Signal Corps wirings differ in appearance. In the U.S. Army Signal Corps wiring, wheels I, II, III, VI, VII, and VIII are offset 1 from the U.S. Navy wirings; wheel IV, offset 2; and wheel V, offset 3. Only one wheel wiring was shown in the version that follows.

It is believed that the Army obtained their wirings from a study of captured German wheels.

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ENIGMA WIRINGS

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Name of Machine: GERMAN SERVICE ENIGMA

Endplate Sequence:

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z (Endplate)
(Keyboard)

Rotors: (US Army Signal Corps wiring)

I. r. A B C D E F G H I J K L M N O P Q R S T U V W X Y Z
1. U W Y G A D F P V Z B E C K M T H X S L R I N Q O J

II. A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

III. A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

Reflector: A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

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ENIGMA WIRINGS

Name of Machine: GERMAN STECKERED ENIGMA

Source: 42 (p. 261 ff.)

On the following page is the wiring of the German Service Enigma as used by the German Army, Air Force, and Navy. This wiring (originally in digital form) refers to the British version of the machine, which, owing to misunderstanding at the time of the initial breaks, is not the same as the German version. On wheels I, II, III, VI, VII, and VIII the German ring setting is greater than the British by 1. On wheel IV the German ring setting is greater than the British by 3.

The diagonal of the machine, that is, the order of connection of the keys and lamps to the current entry plates, is A B C Z. The order is anti-clockwise, looking at the plates; terminal B is at the top, opposite the windows. (On the German version of the machine, the windows are opposite terminal A, that is, one position forward from the top.) This notation, continued paraxially through the machine, applies to the "rod" letters and also to the reflector.

The pins of the wheel are on the right-hand side, the plates on the left as the wheel is fixed in the machine. The clip is opposite terminal 1. Wheels Beta and Gamma have no turnovers.

A set of three captured wheels (I-III) were tested in NSA-18 and were found to have the same wiring as the first three wheels of this British version. Two others, a Beta and a No. VII, had a wiring corresponding to the like designated wheels shown here.

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ENIGMA WIRINGS

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Name of Machine: GERMAN STECKERED ENIGMA

Endplate Sequence:

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z (Endplate)
(Keyboard)

Rotors:

I. A B C D E F G H I J K L M N O P Q R S T U V W X Y Z
E K M F L G D Q V Z N T O W Y H X U S P A I B R C J

II. A B C D E / F G H I J K L M N O P Q R S T U V W X Y Z
A J D K S I R U X B L H W T M C Q G Z N P Y F V O E

III. A B C D E F G H I J K L M N O P Q R S T U V W X Y Z
B D F H J L C P R T X V Z N Y E I W G A K M U S Q O

IV. A B C D E F G H I J / K L M N O P Q R S T U V W X Y Z
C F T P W Q A K B Z R V J S I Y M O G U H L E D N X

V. A B C D E F G H I J K L M N O P Q R S T U V W X Y Z /
E M X B D T I K V A W R U F P J N Z C Y O L S Q H G

VI. A B C D E F G H I J K L M / N O P Q R S T U V W X Y Z /
J P G V O U M F Y Q B E N H Z R D K A S X L I C T W

VII. A B C D E F G H I J K L M / N O P Q R S T U V W X Y Z /
N Z J H G R C X M Y S W B O U F A I V L P E K Q D T

VIII. A B C D E F G H I J K L M / N O P Q R S T U V W X Y Z /
F K Q H T L X O C B J S P D Z R A M E W N I U Y G V

"Beta" A B C D E F G H I J K L M N O P Q R S T U V W X Y Z
L E Y J V C N I X W P B Q M D R T A K Z G F U H O S

"Gamma" A B C D E F G H I J K L M N O P Q R S T U V W X Y Z
F S O K A N U E R H M B T I Y C W L Q P Z X V G J D

Notch patterns are indicated by /; "Beta" and
"Gamma" wheels have no turnovers.

(continued)

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ENIGMA WIRINGS

GERMAN STECKERED ENIGMA (continued)

Reflectors: A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

A.	E J M Z A L Y X V B W F C R Q U O N T S P I K H G D
B.	Y R U H Q S L D P X N G O K M I E B F Z C W V J A T
C.	F V P J I A O Y E D R Z X W G C T K U Q S B N M H L
D.	O
	(pluggable, but with fixed pairing 2/15)
"Bruno"	E N K Q A U Y W J I C O P B L M D X Z V F T H R G S
	("Bruno" plus wheel "Beta", in position 1, combine to give reflector B)
"Caesar"	R D O B J N T K V E H M L F C W Z A X G Y I P S U Q
	("Caesar" plus wheel "Gamma", in position 1, combine to give reflector C)

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ENIGMA WIRINGS

Name of Machine: YELLOW ENIGMA

Source: 7; 10 (p. 1-2, 4-5); 39

The YELLOW or Plugboard Stecker Enigma was used by the German Army and Air Force in the European and African theaters of operation. It was used for the encipherment of operational messages of a highly secret nature, dealing mainly with matters of supply, administration, and current military operations. The Germans were definitely aware that the Allied Armies had captured the machine, and they relied on the daily keys and the basic nature of the machine for security.

This Enigma is similar to the Commercial Enigma in many of its fundamental parts. There are five cipher wheels available to each holder of the machine. These are completely interchangeable and fit into positions A, B, and C. Each wheel has one notch on its left side similar to other Service wheels. The position of the notches for each wheel relative to the window settings are: I, Q/R; II, E/F; III, V/W; IV, J/K; V, Z/A. The wiring from the 26 contact points on the right side of each cipher wheel to the 26 contact points on the left side is random mixed. In the reflector plate, which is fixed, 13 random mixed wires connect the 26 contact points on its right into 13 reciprocal pairs.

In the two wirings that follow, a comparison of the positions underlined in each will reveal like difference values at these points for the same designated wheel of both machines. These differences are: wheel I, 65; wheel II, 18; wheel III, 71; wheel IV, 192; and wheel V, 1025. The second version, given originally in digital form, was simply named "Enigma Cipher Machine".

Two captured wheels were tested in NSA-18 and were found to have the same wiring as the Nos. IV and V wheels as presented in the first YELLOW Enigma wiring here.

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ENIGMA W1A1N33

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Name of Machine: YELLOW ENIGMA

Endplate Sequence:

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z (Endplate)
(Keyboard)

Rotors: (Yellow normal)

- I. 1. A B C D E F G H I J K L M N O P Q/R S T U V W X Y Z
r. U W Y G A D F P V Z B E C K M T H X S L R I N Q O J
- II. A B C D E / F G H I J K L M N O P Q R S T U V W X Y Z
A J P C Z W R L F B D K O T Y U Q G E N H X M I V S
- III. A B C D E F G H I J K L M N O P Q R S T U V / W X Y Z
T A G B P C S D Q E U F V N Z H Y I X J W L R K O M
- IV. A B C D E F G H I J / K L M N O P Q R S T U V W X Y Z
H Z W V A R T N L C U P X Q C E J M B S K D Y O I F
- V. A B C D E F G H I J K L M N O P Q R S T U V W X Y Z /
Q C Y L X W E N F T Z O S M V J U D K G I A R P H B

Reflector: A B C D E F G H I J K L M N O P Q R S T U V W X Y Z
Y R U H Q S L D P X N G O K M I E B F Z C W V J A T

Notch patterns are indicated by /

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ENIGMA WIRINGS

Name of Machine: ENIGMA

Endplate Sequence:

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z (Endplate)
 (Keyboard)

Rotors:

- I. A B C D E F G H I J K L M N O P Q R S T U V W X Y Z
 W E Y B D N T X Z C A I K R F V Q J P G L O M H S U
 ("o" point of wheel wiring is at 25)
- II. A B C D E F G H I J K L M N O P Q R S T U V W X Y Z
 Q M Z W E N T G D A V P J F H O S X C Y U K I R L B
 ("o" point of wheel wiring is at 5)
- III. A B C D E F G H I J K L M N O P Q R S T U V W X Y Z
 W J X N Y O G S A R B Q C P E K D H F M T Z U I V L
 ("o" point of wheel wiring is at 20)
- IV. A B C D E F G H I J K L M N O P Q R S T U V W X Y Z
 X L G O H T U A D S J B U P F Z W Y Q N M R I K E C
 ("o" point of wheel wiring is at 18)
- V. A B C D E F G H I J K L M N O P Q R S T U V W X Y Z
 T S A J B P V K O I R F Q Z G C E W N L D X M Y U H
 ("o" point of wheel wiring is at 23)

Reflector: A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

Notch patterns are indicated by /

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