



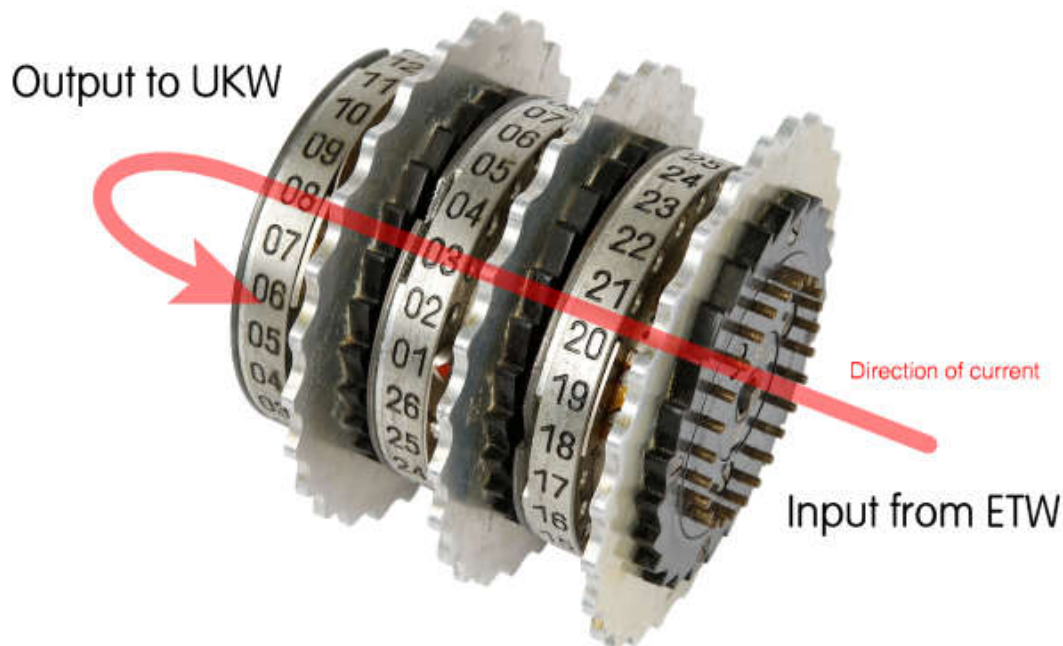
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Enigma Wiring

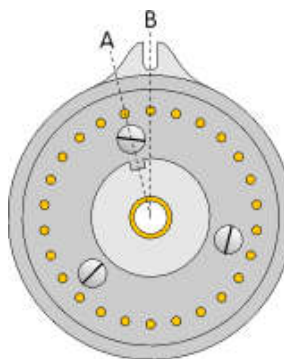
This page gives a complete overview of all known Enigma wirings. The wiring of the early machines (Enigma A, Enigma B and Enigma H) is currently unknown. In the tables below, the wiring is given for each cipher wheel, the entry disc (ETW) and the reflector (UKW). In the column **Notch** the position of the turnover notch on the circumference of the wheel is given, whilst the column **Turnover** shows which letter (or number) is visible in the window at that time.



Inside each wheel are 26 wires that connect the wires from the contacts one side to the other side, in a scrambled order. The wiring for the wheels is defined as a translation of the input (right) to the output (left). In other words: all wiring is given as seen from the entry disc (ETW), as illustrated in the diagram above. The A corresponds to contact 1, etc. Note that the Ringstellung (ring setting) has to be set to the letter 'A' or the number '01' before tracing the wiring.

01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
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

Please note that the wheels of the Service Enigma machines (Enigma I) have numbers (01-26) rather than letters (A-Z) around their circumference. As these are functionally identical (01=A, 02=B, etc.) we have only used letters in the tables below. Use the table above for conversion.



When measuring the reflector (UKW), please note that the first contact (A) is not at the top, but the one just before it. The contact at the top is 'B'. The diagram above shows the correct order of the pins on the UKW, when looking at the UKW from the right side of the machine (i.e. the side of the entry disc, or ETW). In other words: the UKW is rotated counter clockwise by one position.

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Kits					
Shop	Wheel	ABCDEFGHIJKLMN O P Q R S T U V W X Y Z	Notch	Turnover	#
News	ETW	ABCDEFGHIJKLMN O P Q R S T U V W X Y Z			
Events	I	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	Y	Q	1
Wanted	II	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	M	E	1
Contact	III	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	D	V	1
About	IV	E S O V P Z J A Y Q U I R H X L N F T G K D C M W B	R	J	1
Links	V	V Z B R G I T Y U P S D N H L X A W M J Q O F E C K	H	Z	1
	UKW-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			
	UKW-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			
	UKW-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			

Norway Enigma

Postwar usage

In 1945, immediately after WWII, some captured [Enigma-I machines](#) were used by the the former Norwegian Police Security Service: *Overvåkingspolitiet*. They modified the wheel wiring and the wiring of the *Umkehrwalze* (UKW, reflector). The wiring of the *Eintrittswalze* (ETW, entry wheel) and the position of the turnover notches on the wheels were left unaltered. A machine that is modified in this way, is commonly known as a **Norway Enigma** or **Norenigma** as suggested by Frode Weierud in 2001 in order to discriminate between the standard and the modified wiring [\[2\]](#).

Wheel	ABCDEFGHIJKLMN O P Q R S T U V W X Y Z	Notch	Turnover	#
ETW	ABCDEFGHIJKLMN O P Q R S T U V W X Y Z			
I	W T O K A S U Y V R B X J H Q C P Z E F M D I N L G	Y	Q	1
II	G J L P U B S W E M C T Q V H X A O F Z D R K Y N I	M	E	1
III	J W F M H N B P U S D Y T I X V Z G R Q L A O E K C	D	V	1
IV	E S O V P Z J A Y Q U I R H X L N F T G K D C M W B	R	J	1
V	H E J X Q O T Z B V F D A S C I L W P G Y N M U R K	H	Z	1
UKW	M O W J Y P U X N D S R A I B F V L K Z G Q C H E T			

Sonder Enigma

Sondermaschine (special machine)

In the late 1980s, a strange Enigma machine was dicovered in the house of a former intelligence officer, who used to work for a *special unit*. Basically, this machine was a standard Enigma-I, of which the wiring of

the wheels and the UKW had been changed. For this reason, the machine and the wheels were were marked with the letter 'S', which probably means *Sondermaschine* (special machine). The wooden case is marked A1807S, whilst the machine is labelled 17401S/jla/43. The UKW is marked A19872S. The machine was re-discovered in 2017 by Gunter Hutter [9].

Wheel	ABCDEFGHIJKLMN O P Q R S T U V W X Y Z	Notch	Turnover	#
ETW	ABCDEFGHIJKLMN O P Q R S T U V W X Y Z			
I	VEOSIRZUJDQCKGWYPNXAFLTHMB	Y	Q	1
II	UEMOATQLSHPKCYFWJZBGVXINDR	M	E	1
III	TZHXMMBSIPNURJFDEQVCWGLAOY	D	V	1
UKW	CIAGSNDRBYTPZFULVHEKOQXWJM			

At the end of WWII, the Enigma with serial number **A17245 S** was confiscated by a TICOM team and transferred to the NSA. It has the same wiring of the UKW as the **A17401 S** mentioned above. As the wheel wiring of the former is known, we were able to complete the table above [10][11].

Enigma M3

German Navy (Kriegsmarine)

The [Enigma M1](#), [M2](#) and [M3](#) machines were used by the German Navy (Kriegsmarine). They are basically compatible with the [Enigma I](#). The wiring of the [Enigma M3](#) is given in the table below. Wheels I thru V are identical to those of the [Enigma I](#). The same is true for UKW B and C. The three additional wheels (VI, VII and VIII) were used exclusively by the *Kriegsmarine*. The machine is also compatible with the [Enigma M4](#) (when the 4th wheel of the M4 is set to position 'A').

Wheel	ABCDEFGHIJKLMN O P Q R S T U V W X Y Z	Notch	Turnover	#
ETW	ABCDEFGHIJKLMN O P Q R S T U V W X Y Z			
I	EKMFLGDQVZNTOWYHXUSPAIBRCJ	Y	Q	1
II	AJDKSIRUXBLHWTMCQGZNPYFVOE	M	E	1
III	BDFHJLCPRTXVZNYEIWGAKMUSQO	D	V	1
IV	ESOVFPZJAYQUIRHXLNFTGKDCMWB	R	J	1
V	VZBRGITYUPSDNHLXAWMJQOFECK	H	Z	1
VI	JPGVOUMFYQBENHZRDKASXLICTW	HU	ZM	2
VII	NZJHGRCXMYSWBOUFAIVLPEKQDT	HU	ZM	2
VIII	FKQHTLXOCBJSPDZRAMEWNIUYGV	HU	ZM	2
UKW-B	YRUHQSLDPXNGOKMIEBFZCVWJAT			
UKW-C	FVPJIAOYEDRZXWGCTKUQSBNMHL			

Enigma M4

U-Boot Enigma

The [Enigma M4](#) was a further development of the [M3](#) and was used exclusively by the U-boat division of the German Navy (Kriegsmarine). It was introduced unexpectedly on 2 February 1942. Below is the wiring for each wheel, the ETW and all known UKWs. UKW-B was the standard reflector throughout the war and UKW-C was only temporarily used during the war. The wiring of the first 5 wheels (I-V) is identical to the wiring of the 5 wheels of the [Enigma I](#) used by the *Wehrmacht* and *Luftwaffe*. This allowed secure communication between the departments.

Wheel	ABCDEFGHIJKLMN O P Q R S T U V W X Y Z	Notch	Turnover	#
ETW	ABCDEFGHIJKLMN O P Q R S T U V W X Y Z			
I	EKMFLGDQVZNTOWYHXUSPAIBRCJ	Y	Q	1
II	AJDKSIRUXBLHWTMCQGZNPYFVOE	M	E	1
III	BDFHJLCPRTXVZNYEIWGAKMUSQO	D	V	1
IV	ESOVFPZJAYQUIRHXLNFTGKDCMWB	R	J	1
V	VZBRGITYUPSDNHLXAWMJQOFECK	H	Z	1
VI	JPGVOUMFYQBENHZRDKASXLICTW	HU	ZM	2
VII	NZJHGRCXMYSWBOUFAIVLPEKQDT	HU	ZM	2
VIII	FKQHTLXOCBJSPDZRAMEWNIUYGV	HU	ZM	2
Beta	LEYJVCNIXWPBQMDRTAKZGFUHS			
Gamma	FSOKANUERHMBTIYCWLPZXVQJD			

UKW-B	ENKQAUYWJICOPBLMDXZVFTHRGS
UKW-C	RDOBJNTKVEHMLFCWZAXGYIPSUQ

The three extra wheels (VI, VII and VIII) have two notches each, which causes a more frequent wheel turnover, but also introduces another weakness (more about the [Wheel turnover](#)).

Enigma G

Zählwerk Enigma A28 and G31

The [Zählwerk Enigma](#) was the first machine with a cog-wheel driven stepping mechanism. It is the predecessor of the [Enigma G](#). As the Zählwerk Enigma was built as a commercial machine, the initial wiring was identical to the wiring of the [Enigma D](#). The machine (and also the later [G31](#)) was also sold to the military (e.g. to the German secret service, the Abwehr) and to some foreign customers. Some of the latter changed the wiring of the cipher wheels, but in most cases the wiring of the UKW was left unaltered. Examples of individual Enigma G wiring are given below.

Wheel	ABCDEFGHIJKLMNOPQRSTUVWXYZ	Notch	Turnover	#
ETW	QWERTZUIOASDFGHJKPYXCVBNML			
I	LPGSZMHAEQKVXRFYBUTNICJDW	ACDEHIJKMNOQSTWXY	SUVWZABCEFGIKLOPQ	17
II	SLVGBTFXJQOHEWIRZYAMKPCNDU	ABDGHIKLNOPSUVY	STVYZACDFGHKMNQ	15
III	CJGDPSHKTURAWZXFMYNQOVLIE	CEFIMNPSUVZ	UWXAEFHKMNR	11
UKW	IMETCGFRAYSQBZXWLHKDVUPOJN			

Wiring of the G-312

G31 Abwehr Enigma

The table below shows the wiring of the G-312. Although the machine is believed to have been used by the German *Abwehr*, it is the only one every found with this wiring [3]. Different wirings were used for different sections of the Abwehr, and also for different radio nets. It is also possible that some machines were rewired a number of times during their lifetime.

Wheel	ABCDEFGHIJKLMNOPQRSTUVWXYZ	Notch	Turnover	#
ETW	QWERTZUIOASDFGHJKPYXCVBNML			
I	DMTWSILRUYQNKFEJCAZBPGXOHV	ACDEHIJKMNOQSTWXY	SUVWZABCEFGIKLOPQ	17
II	HQZGPJTMOBLNCIFDYAWVEUSRKX	ABDGHIKLNOPSUVY	STVYZACDFGHKMNQ	15
III	UQNTLSZFMREHDPXKIBVYGJCWOA	CEFIMNPSUVZ	UWXAEFHKMNR	11
UKW	RULQMZJSYGOCETKWDAHNBXPVIF			

Wiring of the G-260

G31 Abwehr Enigma

In March 1945, just before the end of WWII, the Argentine police arrested the German spy Johann Siegfried Becker. In his possession was an Enigma model G31 with serial number G-260. Two months later, they handed the machine over to the Americans [4]. As Becker was believed to work for the German Secret Service, the *Abwehr*, it is most likely that the G-260 was wired for Abwehr communication. The machine is now on public display at the NCM in Fort Meade (Maryland, US).

Wheel	ABCDEFGHIJKLMNOPQRSTUVWXYZ	Notch	Turnover	#
ETW	QWERTZUIOASDFGHJKPYXCVBNML			
I	RCSPBLKQAUMHWYTIFZVGOJNEXD	ACDEHIJKMNOQSTWXY	SUVWZABCEFGIKLOPQ	17
II	WCMIBVPJXAROSGNDLZKEYHUFQT	ABDGHIKLNOPSUVY	STVYZACDFGHKMNQ	15
III	FVDHZELSQMAXOKYIWPGCBUJTNR	CEFIMNPSUVZ	UWXAEFHKMNR	11
UKW	IMETCGFRAYSQBZXWLHKDVUPOJN			

Wiring of the G-111

G31 Hungarian Enigma

The [G-111](#) was a special version of the [Enigma G](#) (G31 model Ch.15b) [5] that was built for the Hungarian Army. It was supplied with five cipher discs. The table below shows the wiring of the wheels of the G-111, the **entry disc** (*Eintrittswalze*, ETW) and the **reflector** (*Umkehrwalze*, UKW). Note that only wheels **I**, **II** and **V** were found with this machine.

Wheel	ABCDEFGHIJKLMNPOQRSTUVWXYZ	Notch	Turnover	#
ETW	QWERTZUIOASDFGHJKPYXCVBNML	*1		
I	WLRHBQUNDKJCZSEXOTMAGYFPVI	ACDEHIJKMNOQSTWXY	SUVWZABCEFGIKLOPQ	17
II	TFJQAZWMHLCUIXRDYGOEVBN SKP	ABDGH I K L N O P S U V Y	STVYZACDFGHKMNQ	15
III	?	?	?	11
IV	?	?	?	?
V	QTPIXWVDFRMUSLJOHCANEZKYBG	AEHNPUY	SWZFHMQ	7
UKW	IMETCGFRAYSQBZXWLHKDVUPOJN	*2		

As we can learn from the above table, the number of notches as well as the turnover positions of wheels **I** and **II** are identical to those on the same wheels of other Zählwerk machines (17 and 15 notches respectively). This suggests that the notches of the G-machines were never changed.

1. This machine contains the standard wiring of the ETW for a commercial machine.
2. The UKW is also wired in the standard fashion for a commercial machine.

Enigma D

Commercial Enigma A26

The [Enigma D](#) can be considered as the main commercial machine [6]. It was introduced in 1926 and was the basis for most of the later machines, including the [Enigma K](#), the [Enigma I](#) and the [Zählwerk Enigma](#). The wiring was identical for all commercial machines, including the later [Enigma K \(A27\)](#). Although the wiring of the wheels was changed by some customers, they often left the wiring of the UKW intact. As far as we know, the wiring of the ETW was never changed.

Wheel	ABCDEFGHIJKLMNPOQRSTUVWXYZ	Notch	Turnover	#
ETW	QWERTZUIOASDFGHJKPYXCVBNML			
I	LPGSZMHAEOQKVXRFYBUTNICJDW	G	Y	1
II	SLVGBTFXJQOHEWIRZYAMKPCNDU	M	E	1
III	CJGDPSHKTURAWZXFMYNQOBLVIE	V	N	1
UKW	IMETCGFRAYSQBZXWLHKDVUPOJN			

Enigma K

Commercial Enigma A27

The wiring of the wheels of the standard [Enigma K](#) was identical to the wiring of the [Enigma D](#). This suggests that the machine was initially intended for commercial customers. The standard commercial wiring is given in the table below [7].

Wheel	ABCDEFGHIJKLMNPOQRSTUVWXYZ	Notch	Turnover	#
ETW	QWERTZUIOASDFGHJKPYXCVBNML			
I	LPGSZMHAEOQKVXRFYBUTNICJDW	G	Y	1
II	SLVGBTFXJQOHEWIRZYAMKPCNDU	M	E	1
III	CJGDPSHKTURAWZXFMYNQOBLVIE	V	N	1
UKW	IMETCGFRAYSQBZXWLHKDVUPOJN			

Swiss-K

Swiss Enigma K variant

This was the [Swiss variant of the Enigma K](#). All Enigma K machines were delivered by the Germans with the standard commercial wheel wiring, also known from the [Enigma D](#) (see the table below). Immediately after reception, however, the Swiss changed the wiring of all cipher wheels [7].

Although the Swiss altered the wiring of the cipher wheels (I, II and III), the wiring of the UKW (reflector) was left unchanged. This is true for all three users of the Enigma K: the Swiss Army, the Air Force and the Foreign Ministry (diplomatic service). In the table below, the only known wiring of the wheels of the Swiss Air Force are given. The wiring of the other services are unknown to us.

Swiss Air Force

Enigma wiring				
Wheel	ABCDEFGHIJKLMN O P Q R S T U V W X Y Z	Notch	Turnover	#
ETW	QWERTZUIOASDFGHJKPYXCVBNML			
I	PEZUOHXSCVFMTBGLRINQJWAYDK	G	Y	1
II	ZOUESYDKFWPCIQXHMVB LGNJ RAT	M	E	1
III	EHRVXGAOBQUSIMZFLYNWKTPDJC	V	N	1
UKW	IMETCGFRAYSQBZXLHKDVUPOJN			

Enigma KD

Enigma K with UKW-D

The [Enigma KD](#) was a standard commercial [Enigma K](#) machine with a rewirable reflector ([UKW-D](#)). Below is the wiring if the first three wheels (I, II and III) of the Enigma KD that was found in the archives of the FRA in Sweden [\[8\]](#). This wiring might be identical to the first three wheels of the Enigma KD used by **Mil Amt** during WWII, but this is currently uncertain.

Wheel	ABCDEFGHIJKLMN O P Q R S T U V W X Y Z	Notch	Turnover	#
ETW	QWERTZUIOASDFGHJKPYXCVBNML			
I	VEZIOJCXYDUNTWAPLQGBHSFMR	ACGIMPTVY	SUYAEHLNQ	9
II	HGRBSJZETDLVPMQYCAOKINFUW	ACGIMPTVY	SUYAEHLNQ	9
III	NWLHXGRBYOJSAZDVT PKFQMEUIC	ACGIMPTVY	SUYAEHLNQ	9
UKW	NSUOMKLIH ZFGEADVXWBYCPRQTJ			*1

1. Note that due to the nature of the (rewirable) UKW it does not have a fixed wiring. The table above shows the wiring of the UKW when the machine was discovered at the FRU. The actual wiring will have been changed frequently when the machine was used in an operational context.
2. Mil Amt changed the order of the wheels and the *Ringstellung* daily, whilst the *Grundstellung* (and probably also the wiring of UKW-D) was changed every three weeks [\[7\]](#).

Railway Enigma

Modified Enigma K

During WWII, the Germans used a special Enigma machine for the [German Railway \(Reichsbahn\)](#). It was basically a standard commercial [Enigma K](#) with rewired wheels and a rewired reflector (UKW). Furthermore, the position of the notches of wheels I and III were swapped [\[7\]](#). ➤ [More](#)

Wheel	ABCDEFGHIJKLMN O P Q R S T U V W X Y Z	Notch	Turnover	#
ETW	QWERTZUIOASDFGHJKPYXCVBNML			
I	JGDQOXUSCAMIFRVTPNEWKBLZYH	V	N	1
II	NTZPSFBOKMWRCJDIVLA EYUXHGQ	M	E	1
III	JVIUBHTCDYAKEQZPOSGXNRMWFL	G	Y	1
UKW	QYHOGNECVPUZTFDJAXWMKISRBL			

Enigma T

Japanese Enigma (Tirpitz)

The [Enigma T \(Tirpitz\)](#) was a special version of the [Enigma K](#) that was made for the Japanese Army during WWII. The wheels were wired differently and each had five turnover notches [\[7\]](#). The table below shows the wiring of the wheels, the entry disc (ETW) and the reflector (UKW).

Wheel	ABCDEFGHIJKLMN O P Q R S T U V W X Y Z	Notch	Turnover	#
ETW	KZROUQH Y AIGBLWSTDXFPNMCJE		*1	
I	KPTYUELOCVGRFQDANJMSWHZXI	EHMSY	WZEKQ	5
II	UPHZLWEQMTDJXCAKSOIGVBYFNR	EHNTZ	WZFLR	5
III	QUDLYRFEKONVZAXWHMGPJBSICT	EHMSY	WZEKQ	5
IV	CIWTBKXNRES PFLYDAGVHQOJZM	EHNTZ	WZFLR	5
V	UAXGISNJBVERDYLFZWTPCKOHMQ	GKNSZ	YCFKR	5
VI	XFUZGALVHCN YSEWQTDMRBKPIOJ	FMQUY	XEIMQ	5
VII	BJVFTXPLNAYOZIKWGDQERUCHSM	GKNSZ	YCFKR	5

-
1. Note that this is the only machine with a different wiring for the ETW. All other Enigma machines have an ETW that is wired either in the order of the alphabet (ABCDEF...) or the order of the keyboard (QWERZU...).

Glossary

ETW **Eintrittswalze**
Entry disc

UKW **Umkehrwalze**
Reflector (literally: Reversing wheel)

Contributors

The following people have contributed to the information on this page. For detailed copyright information please refer to the relevant page for each of the Enigma machines mentioned here.

- Neils Faurholt
- David Hamer
- Philip Marks
- Tom Perera
- Paul Reuvers
- Marc Simons
- Geoff Sullivan
- Frode Weierud
- Anders Wik
- Gütter Hütter

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Further information

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