

On the Subject of The Ultimate Cycle

This cycle is exactly as bad as full password cycle...

This module consists of a screen, eight dials with red labels, and a QWERTY keyboard.

The labels on the dials, when decrypted and read from left to right, spell out an eight letter word.

The word has been encrypted through a series of ciphers, indicated by the direction each dial is pointing, from left to right.

To decipher it, decrypt the word from right to left instead.

Once deciphered, find the word in the table below, the word written below it is the word that should be entered.

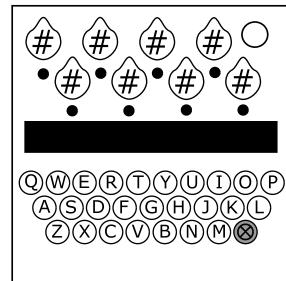
Apply the same sequence of encryptions to the response word, and type out the encrypted response word using the keys.

The word is automatically submitted when eight keys are pressed.

The red button can be pressed at any time before the eighth key is pressed to cancel the input.

Inputting any of the eight letters incorrectly will cause a strike to be issued and reset the module.

Note: Unless stated otherwise, any reference to a letter's alphabetic position starts at A = 1. Similarly, any reference to the position of a dial starts from the leftmost dial = 1.



O/N: Atbash Logic Cipher

If LED below the north pointing dial is lit, the process of encrypting is **Atbash > Logic**.

Otherwise, **Logic > Atbash**.

Logic component

Take the number of 45° rotation of the Nth position in the following order: 12 34 56 78 13 57 24 68; then replace the number to 1 if it's odd, otherwise replace it with 0.

Using the operator corresponding to the position of the north pointing dial (starting with AND = 1), find the truth values of each pair; the encrypted letter depends on whether each is true or false.

B_1	B_2	AND	OR	XOR	\Rightarrow	NAND	NOR	XNOR	\Leftarrow
0	0	F	F	F	T	F	F	T	T
1	0	F	T	T	F	T	F	F	T
0	1	F	T	T	T	T	F	F	F
1	1	T	T	F	T	T	T	T	T

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

Atbash component

Each letter in the word is swapped with the letter with the same alphabetic position in the reversed alphabet.

That is, a letter with alphabetic position X will become the letter with alphabetic position $27 - X$.

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

1/NE: Caesar Cipher

Each letter in the word has been shifted **right** through the alphabet by the number of 45° clockwise rotations, **of the individual dials**.

If the LED of NE dial is lit, each letter is then shifted **right** by the position of the dial corresponding to this cipher.

Otherwise, each letter is then shifted **left** by the position of the NE dial.

2/E: Playfair Cipher

The indexing of the lists start at zero.

- If the last dial is pointing east, use the word corresponding to the number of 45° rotations of the **first** dial.
Otherwise, use the word corresponding to the number of 45° rotations of the **next** dial.
- If there are less than three unique ports on the bomb, use the keyword from List A
Otherwise, use the keyword from List B.
- The keyword gives the first ten letters of the keysquare.
 - If the LED corresponding to this cipher is lit, the keyword is entered into the keysquare in **reverse reading order**.
 - Otherwise, the keyword is entered into the keysquare in reading order.
- The word is split into four pairs of letters.
- Each pair of letters is altered:
 - If both letters are the same, the encrypted pair is two of the letter diametrically opposite in the keysquare.
 - Otherwise, normal rules from [Playfair Cycle](https://ktane.timwi.de/HTML/Playfair%20Cycle.html) (<https://ktane.timwi.de/HTML/Playfair%20Cycle.html>) applies.

Important:

- If the pair of letters is **XX**, the pair is unchanged by the cipher.
 - If the pair of letters is either **X#** or **#X**, where # is not X, the X is changed to the other letter, forming a double letter pair, and enciphered normally.
- Then, the new letter is changed back to an X.

List	Keyword	KW Reversed (lit)	Remaining letters
A0	ALGORITHMS	SMHTIROGLA	BCDEFJKNPQUVWXYZ
A1	AUTHORIZED	DEZIROHTUA	BCFGJKLMNPQSVWY
A2	BLUEPRINTS	STNIRPEULB	ACDFGHJKMNOQVWYZ
A3	DESPICABLY	YLBACIPSED	FGHJKMNOQRTUVWZ
A4	FORMIDABLE	ELBADIMROF	CGHJKNPQSTUVWXYZ
A5	HYPERBOLIC	CILOBREPYH	ADFGJKMNQSTUVWZ
A6	IMPORTANCE	ECNATROPMI	BDFGHJKLQSUVWXYZ
A7	LABYRINTHS	SHTNIRYBAL	CDEFGJKMOPQUVWXYZ
B0	WANDERLUST	TSULREDNAW	BCFGHIJKMOPQVYZ
B1	VANQUISHED	DEHSIUQNAV	BCFGJKLMOPRTWYZ
B2	ULTRASONIC	CINOSARTLU	BDEFGHJKMPQVWXYZ
B3	SCRAMBLING	GNILBMARCS	DEFHJKOPQTUVWXYZ
B4	PRECAUTION	NOITUACERP	BDFGHJKLMQSVWXYZ
B5	OSTRACIZED	DEZICARTSO	BFGHJKLMNPQUVWY
B6	METHODICAL	LACIDOHTEM	BFGJKNPQRSUVWXYZ
B7	MAGNITUDES	SEDUTINGAM	BCFHJKLOPQRVWXYZ

3/SE: Pigpen Cipher

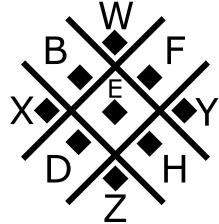
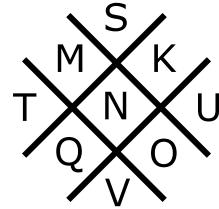
Normal rules from [Pigpen Cycle \(<https://ktane.timwi.de/HTML/Pigpen%20Cycle.html>\)](https://ktane.timwi.de/HTML/Pigpen%20Cycle.html) applies.

If the LED corresponding to this cipher is unlit, use cipher I.
Otherwise, use cipher II.

Cipher I

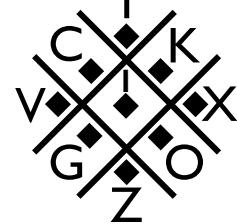
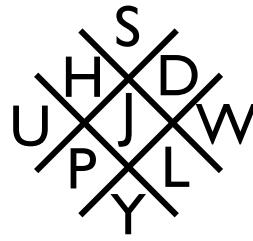
A	B	C
D	E	F
G	H	I

J	K	L
M	N	O
P	Q	R

**Cipher II**

A	C	E
G	I	K
M	O	Q

B	D	F
H	J	L
N	P	R



4/S: Two Square Bifid Cipher

The indexing of the lists start at 0. For this cipher, the leftmost dial has a position of 0.

- The two lists give the keywords for two 5x5 keysquares, the keyword from List A is used for the first keysquare and the keyword from List B is used for the second:
 - If the sum of serial number is more than 9,
A = Position of dial
B is given by the number of 45° rotations, of the previous dial.
 - Otherwise,
B = Position of dial
A is given by the number of 45° rotations, of the previous dial.
 - If the dial is first, the 'previous' dial is the last.
- For each letter, consider the status of the LED below the dial in its position:
 - If the status of the LED of the south dial is the same, find the coordinates of the letter in the first keysquare and write them in a column.
 - Otherwise, find the coordinates of the letter in the second keysquare and write them in a column.
- Obtain a new sequence of coordinates by reading off of the columns in reading order.
- For each new pair of coordinates, once again consider the status of the LED below the dial in its position:
 - If the status of the south dial is the same, the encrypted letter is given by the new coordinates in the second keysquare.
 - Otherwise, the encrypted letter is given by the new coordinates in the first keysquare.
- Note: The coordinate order are **ROW** first, then **COLUMN**, which is reversal of (x,y) coordinates.

Important:

- X is unchanged by the cipher and does not give any coordinates. Blank spaces in the columns are filled in with the coordinate from the previous column, wrapping around to the rightmost column if necessary.

List	Keyword	Remaining letters	List	Keyword	Remaining letters
A0	AFTERSHOCK	BDGIJLMNPQUVWYZ	B0	DOWNSTREAM	BCFGHIJKLPUVYZ
A1	DESTROYING	ABCFHJKLMQPVWYZ	B1	EMORDNILAP	BCFGHJKQSTUVWYZ
A2	DUPPLICATES	BFGHJKLMNOQRVWYZ	B2	FLASHPOINT	BCDEGJKLMQRUVWYZ
A3	FARSIGHTED	BCJKLNMOPQUVWYZ	B3	INTRODUCES	ABFGHJKLMMPQVWYZ
A4	GRACIOUSLY	BDEFHJKLMNPQTVWZ	B4	PATHFINDER	BCGJKLMQSUWYZ
A5	INFAMOUSLY	BCDEGHJKLMNPQRTVWZ	B5	QUADRICEPS	BFGHJKLMNOTVWYZ
A6	NIGHTMARES	BCDFJKLMNPQUVWYZ	B6	TRAPEZOIDS	BCFGHJKLMNQUVWY
A7	PALINDROME	BCFGHJKLMQSTUVWYZ	B7	WAVERINGLY	BCDFHJKLMOPQSTUZ

5/SW: Monoalphabetic Substitution Cipher

The position of the dial corresponds to which of the eight words in the list below is the keyword for this cipher:

If the LED is unlit, the remaining thirteen letters of the alphabet are left in alphabetical order. Otherwise, the remaining thirteen letters are positioned in reverse alphabetical order.

- If there are an even number of batteries, **Keyword > Letters**.
- Otherwise, **Letters > Keyword**.

Each letter of the alphabet is mapped onto the letter of the cipher alphabet with the same alphabetic position.

The letters in the word change accordingly with these mappings.

To decrypt, find the letter in the sequence, determine the position of the letter in the sequence, then swap the letter corresponding to its alphabetic position.

Pos.	Keyword	Remaining letters (unlit)	Remaining Letters (lit)
1	DOCUMENTARILY	BFGHJKPQSVWXZ	ZXWVSQPKJHGFB
2	FLAMETHROWING	BCDJKPQSUVXYZ	ZYXVUSQPKJDJB
3	FLOWCHARTINGS	BDEJKMPQUVXYZ	ZYXVUQPMKJEDB
4	HYDROMAGNETIC	BFJKLPQSUVWXZ	ZXWVUSQPLKJFB
5	METALWORKINGS	BCDFHJPQUVXYZ	ZYXVUQPJHFDCB
6	MULTIBRANCHED	FGJKOPQSUVWXYZ	ZYXWVSQPOKJGF
7	TROUBLEMAKING	CDFHJPQSUVWXYZ	ZYXWVSQPJHFDC
8	UNPREDICTABLY	FGHJKMOPQSUVWXZ	ZXWVSQOMKJHGFB

6/W: Hill Cipher

Normal rules for [Hill Cycle \(<https://ktane.timwi.de/HTML/Hill%20Cycle.html>\)](https://ktane.timwi.de/HTML/Hill%20Cycle.html) applies.

If there are more lit than unlit indicators, use **List A**.

Otherwise, use **List B**.

The keyword used depends and the rotations of the dials adjacent to the one corresponding to this cipher:

The indexing of the lists start at zero.

- If the first dial is pointing west, use the keyword corresponding to six + number of 45° rotations, of the second dial.
- If the last dial is pointing west, use the keyword corresponding to six + number of 45° rotations, of the seventh dial.
- Otherwise, use the keyword corresponding to the sum of the numbers of 45° rotations of the two dials adjacent to this one.

If the LED corresponding to this cipher is lit, the matrix is then **transposed**, swapping its top-right and bottom-left entries.

List	Keyword	Key Matrix	List	Keyword	Key Matrix
A0	AEON	1-5-15-14	B0	BOMB	2-15-13-2
A1	COPY	3-15-16-25	B1	BUSY	2-21-19-15
A2	EACH	5-1-3-8	B2	DICE	4-9-3-5
A3	GOOD	7-15-15-4	B3	FAUX	6-1-21-24
A4	IOTA	9-15-20-1	B4	HUSK	8-21-19-11
A5	KILO	11-9-12-15	B5	JUKE	10-21-11-5
A6	MARK	13-1-18-11	B6	LIMA	12-9-13-1
A7	ONCE	15-14-3-5	B7	LOCI	12-15-3-9
A8	QUIT	17-21-9-20	B8	NAME	14-1-13-5
A9	RIOT	18-9-15-20	B9	PUSH	16-21-19-8
A10	SYNC	19-25-14-3	B10	RISE	18-9-19-5
A11	UNDO	21-14-4-15	B11	TASK	20-1-19-11
A12	WORK	23-15-18-11	B12	VOID	22-15-9-4
A13	YEAR	24-5-1-18	B13	XYST	24-25-19-20
A14	ZEAL	26-5-1-12	B14	ZOOM	26-15-15-13

7/NW: Bitshift Cipher

Find the 3 digit binary representations the numbers of rotations, starting from north, of each of the dials.

If the LED corresponding to a dial is lit, swap the 0s for 1s and the 1s for 0s in its binary representation.

Combine all of the binary representations together, from left to right.

Prepend a 0 and append a 1 to the combined binary representations to produce a 26 bit string.

Separate the alphabet into two sets, depending on whether each letter's alphabetic position in the string of bits is a 1 or a 0.

The letters in these sets remain in alphabetical order.

If the LED corresponding to the NW dial is lit, each letter in the word is shifted to the right by the position of the NW dial.

Otherwise, each letter is shifted to the left by the position of the NW dial.

Keyword Table

ADVANCED	ADVERTED	ADVOCATE	ADDITION	ALLOCATE	ALLOTYPE	ALLOTTED	ALTERING
PROGRESS	ZYGOTENE	QUARTICS	LINKAGES	QUICKEST	ORDERING	UNDOINGS	ZUGZWANG
BINARIES	BINORMAL	BINOMIAL	BILLIONS	BULKHEAD	BULLHORN	BULLETED	BULWARKS
YOKOZUNA	COMMANDO	GLOOMING	TRICKIER	GATEWAYS	INCOMING	ZYGMATA	FORMULAE
CIPHERED	CIRCUITS	CONNECTS	CONQUERS	COMMANDO	COMPILER	COMPUTER	CONTINUE
BULKHEAD	RELATION	LINKWORK	NANOTUBE	MONOTONE	YIELDING	ILLUMINE	KILOBYTE
DECRYPTS	DECEIVED	DECIMATE	DIVISION	DISCOVER	DISCRETE	DISPATCH	DISPOSAL
NANOBOTS	QUINTICS	ZIGZAGGY	MONOMIAL	ULTERIOR	KNUCKLED	UNDERWAY	ULTRARED
ENCIPHER	ENCRYPTS	ENCODING	ENTRANCE	EQUALISE	EQUATORS	EQUATION	EQUIPPED
JUNKYARD	QUADRANT	TRIANGLE	RELAYING	NANOGRAM	CONNECTS	INDICATE	BINORMAL
FINALISE	FINISHED	FINDINGS	FINNICKY	FORMULAE	FORTUNES	FORTRESS	FORWARDS
DISCRETE	JUNCTION	KILOWATT	ROTATION	POSITRON	DISPATCH	ENCIPHER	STANDOUT
GARRISON	GARNERED	GATEPOST	GATEWAYS	GAUNTLET	GAMBLING	GATHERED	GLOOMING
STOCKADE	FINDINGS	ADVANCED	JOURNEYS	STOPPING	LANDMARK	EQUATORS	VICELESS
HAZARDED	HAZINESS	HOTLINKS	HOTHEADS	HUNDREDS	HUNKERED	HUNTSMAN	HUNTRESS
DISCOVER	JUNCTURE	TOGETHER	GARRISON	WHATNOTS	DIVISION	TOGGLING	YEASAYER
INCOMING	INDICATE	INDIRECT	INDIGOES	ILLUDING	ILLUSION	ILLUSORY	ILLUMINE
VENOMOUS	FORTUNES	OBSERVED	QUITTERS	HUNKERED	HOTHEADS	TOMOGRAM	KNOWABLE
JIGSAWED	JIMMYING	JOURNEYS	JOUSTING	JUNCTION	JUNCTURE	JUNKYARD	JUDGMENT
YEARNING	TRIGONAL	VOLITION	DECRYPTS	LABELING	STARTING	OCTUPLES	ROTATORS
KILOWATT	KILOVOLT	KILOBYTE	KINETICS	KNOCKING	KNOCKOUT	KNOWABLE	KNUCKLED
POSITIVE	BILLIONS	WHATEVER	FINALISE	ENCRYPTS	OBSTACLE	ENCODING	ADVOCATE
LANGUAGE	LANDMARK	LIMITING	LINEARLY	LINGERED	LINKAGES	LINKWORK	LABELING
CONQUERS	EQUATION	GATEPOST	ILLUSION	QUIRKISH	NUMERATE	STANDARD	POSTSYNC
MONOGRAM	MONOLITH	MONOMIAL	MONOTONE	MULTITON	MULTIPLY	MULCTING	MULLIGAN
HUNTRESS	WINNABLE	ZYMOLOGY	ILLUSORY	VOLATILE	TOMAHAWK	OCTANGLE	ADVERTED

Keyword Table cont.

NANOBOTS	NANOGRAM	NANOWATT	NANOTUBE	NUMBERED	NUMEROUS	NUMERALS	NUMERATE
ZIPPERED	STOCCATA	VENDETTA	LINGERED	FINNICKY	JUDGMENT	HUNDREDS	ILLUDING
OCTANGLE	OCTUPLES	ORDERING	ORDINALS	OBSERVED	OBSCURED	OBSTRUCT	OBSTACLE
KNOCKING	WINGDING	UNDERLIE	LINEARLY	TRIGGERS	PROJECTS	ALLOTYPE	YIELDERS
PROGRESS	PROJECTS	PROPHASE	PROPHECY	POSTSYNC	POSSIBLE	POSITRON	POSITIVE
JIGSAWED	KILOVOLT	ALLOTTED	RELATIVE	PROPHASE	COMPILER	LIMITING	NANOWATT
QUADRANT	QUADRICS	QUARTILE	QUARTICS	QUICKEST	QUIRKISH	QUINTICS	QUITTERS
YELLOWED	MULCTING	GATHERED	WEAKENED	WHATNESS	HAZINESS	REVOLVED	ENTRANCE
REVERSED	REVOLVED	REVEALED	ROTATION	ROTATORS	RELATION	RELATIVE	RELAYING
FORTRESS	WHATSITS	BULLHORN	GARNERED	INDIGOES	LANGUAGE	CIRCUITS	VOLTAGES
STARTING	STANDARD	STANDOUT	STANZAIC	STOCCATA	STOCKADE	STOPPING	STOPWORD
REVERSED	JIMMYING	DECEIVED	QUARTILE	GAUNTLET	HAZARDED	MULTIPLY	ZYMOGRAM
TRICKIER	TRIGONAL	TRIGGERS	TRIANGLE	TOMOGRAM	TOMAHAWK	TOGLLING	TOGETHER
MULLIGAN	ZIGGURAT	ALLOCATE	NUMERALS	BULWARKS	BINARIES	INDIRECT	REVEALED
UNDERRUN	UNDERWAY	UNDERLIE	UNDOINGS	ULTERIOR	ULTIMATE	ULTRARED	ULTRAHOT
JOUSTING	VICINITY	QUADRICS	MONOLITH	ORDINALS	KNOCKOUT	NUMEROUS	STOPWORD
VENOMOUS	VENDETTA	VICINITY	VICELESS	VOLITION	VOLTAGES	VOLATILE	VOLUMING
UNDERRUN	DISPOSAL	WEAPONED	HUNTSMAN	BULLETED	ALTERING	MONOGRAM	POSSIBLE
WEAKENED	WEAPONED	WINGDING	WINNABLE	WHATEVER	WHATNESS	WHATNOTS	WHATSITS
EQUALISE	OBSTRUCT	COMPUTER	STANZAIC	DECIMATE	EQUIPPED	BINOMIAL	YEARLONG
YELLOWED	YEARLONG	YEARNING	YEASAYER	YIELDING	YIELDERS	YOKOZUNA	YOURSELF
CIPHERED	CONTINUE	KINETICS	FORWARDS	ADDITION	FINISHED	GAMBLING	MULTITON
ZIPPERED	ZIGGURAT	ZIGZAGGY	ZUGZWANG	ZYGMATA	ZYGOTENE	ZYMOLOGY	ZYMOGRAM
VOLUMING	ULTIMATE	HOTLINKS	NUMBERED	PROPHECY	YOURSELF	ULTRAHOT	OBSCURED