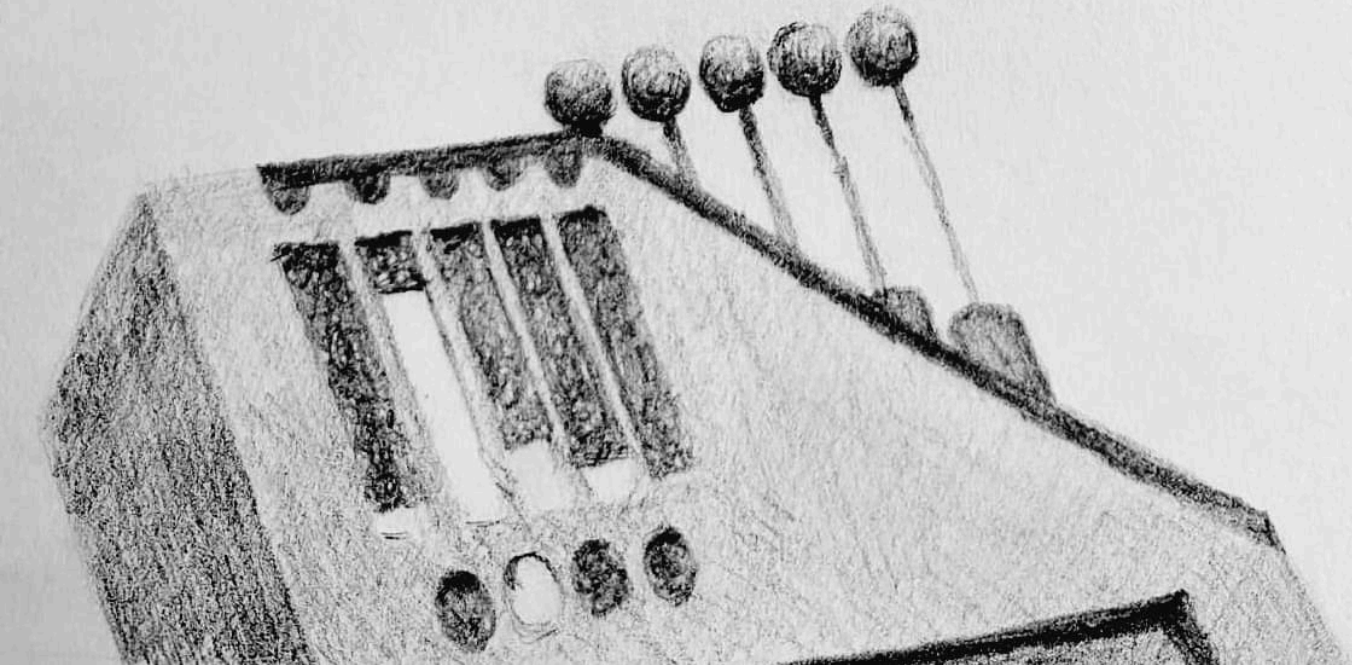
. The Stello-Matic & Decho-Matic

Manual



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1. Safety instructions

Before using the Stello-Matic and Decho-Matic, make sure to read all of the below safety instructions to ensure the prevention of injury or damage. Make sure to refer to this manual in case of doubt, and inform users of the manual when presenting them with the Stello-Matic or Decho-Matic.

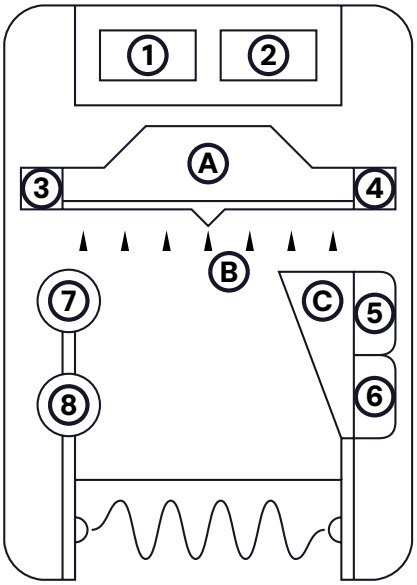
The creator of the Stello-Matic and Decho-Matic accepts no liability for damages incurred, whether the manual was followed or not, but will acknowledge it, and repent emotionally in a manner consistent with said damage.

1. Avoid contact with the electric wave produced by the Stello-Matic. Keep hands, hair, clothing, and cursors away from the device to avoid the risk of disturbing the transmission, and to prevent injury to person and/or damage to the pointer device used.
2. The devices are not designed for commercial use.
3. Some persons may be sensitive to the sounds produced by the Stello-Matic. Please be considerate and use lower volumes and faster speeds whenever possible. If the disturbing of bystanders is unavoidable, do not employ the Stello-Matic.
4. The devices may be analyzed, deconstructed and reverse-engineered. Note that its internals are publicly available on [Codeberg](https://codeberg.org/vrugtehagel/vrugtehagel.nl/src/branch/main/src/transmit).
5. Transmission may not be 100% private if bystanders have access to their own Decho-Matic.
6. The devices are intended to transmit data through air molecules. Transmission may not work reliably or at all when used in other mediums such as water. Usage in other mediums may incur damages to the device, the host device, or the user.
7. The devices may be used by children of any age as long as they are supervised. The creator does not accept responsibility for any profanity sent and/or received using the Stello-Matic or Decho-Matic.

2. Device Controls

This section describes the accessible button labels for both the Stello-Matic and Decho-Matic. Numbers map to buttons, letters denote displays or other indicators.

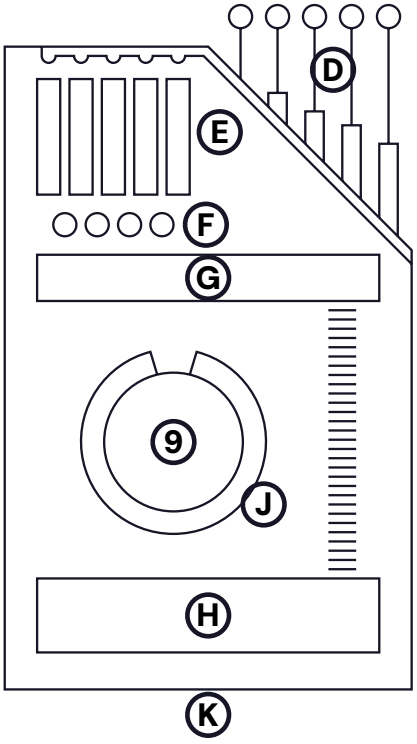
2.1. Stello-Matic Device Controls



1. TEXT: Insert a text message
2. FILE: Insert a file
3. FASTER: Increase transmission speed
4. SLOWER: Decrease transmission speed
5. VOLUME UP: Increase transmission volume
6. VOLUME DOWN: Decrease transmission volume
7. START: Start transmission
8. STOP: Stop transmission

A. ETA: estimated time remaining
B. Speed indicator
C. Volume indicator

2.2. Decho-Matic Device Controls



9. ON/OFF: toggle device power

D. Frequency-sensitive antennae
E. Frequency power indicators
F. Transformed double-bit indicator
G. Bit aggregation display
H. Main informative display
J. Progress indicator ring
K. Click&redeem ticket printer

3. Basic Usage

To ① use the Stello-Matic together with the Decho-Matic, load the virtual devices on two separate physical devices (such as a laptop or phone). The sending device must have a speaker, and the receiving device must possess a microphone. The Stello-Matic must be loaded on the sending device, and the Decho-Matic on the receiving one.

3.1. Preparing the Devices

3.1.1. Preparing the Stello-Matic

The Stello-Matic supports transmitting a text message, transmitting a file, or pinging the Decho-Matic without transmitting any data. In the first two cases, a cartridge must be slotted into the device, containing the data to transmit.

TEXT	Press the TEXT button ①, and enter the message onto the front of the cartridge. Once ready, click away from the cartridge to slot it into the device.
FILE	Press the FILE button ②. Choosing a file automatically inserts the appropriate cartridge.
PING	Insert nothing (skip insertion)

Once ready, the speed and volume may be adjusted to optimize for reliability using the respective buttons ③ ④ ⑤ ⑥. For noisier environments, a slower speed and/or higher volume is recommended. For quiet environments, like a home, faster speed and reasonably low volume is recommended, as the device may upset unsuspecting human listeners.

3.1.2. Preparing the Decho-Matic

The Decho-Matic automatically detects the start of a transmission. Therefore, it is of utmost importance that the device is turned on and listening before the Stello-Matic starts playing the transmission. To start the Decho-Matic, press the ON/OFF button ⑨ on the device. This may prompt the user for permission to access the microphone, which is necessary for the device to be able to “hear” the transmission. In some cases, browsers may reject this automatically. The Decho-Matic will display this on its main display Ⓗ with the message `no permission`. If

this is encountered, it is recommended to check the system settings for additional options, as this is not under the control of the Decho-Matic device.

If the main display Ⓗ on the device reads `listening...` this means the Decho-Matic is ready to receive the transmission.

3.2. Transmitting

Once the Decho-Matic main display Ⓗ reads `listening...`, press the START button ⑦ on the Stello-Matic to begin the transmission. This will cause the Stello-Matic ETA Ⓐ to count down, displaying the time remaining for the transmission to complete.

The Decho-Matic's main display Ⓗ will read `(please wait)` once it has detected the transmission, and in the case of a text message, will show a preview of the tail of the received message during reception.

Note: if the Decho-Matic screen still reads `listening...` after the first 10 beeps, the device failed to recognize there is a transmission at all, and thus the transmission must be restarted.

To cancel the transmission at any point, press the STOP button ⑧ on the Stello-Matic. To restart the transmission, press the START button ⑦.

3.2.1. Errors

The Decho-Matic will display any errors with the transmission on its bottom screen. If it displays any of the errors below, the transmission has failed. The Stello-Matic may be stopped, and the transmission may be restarted. Note: the Decho-Matic turns itself off upon encountering an error. To restart the transmission, turn the Decho-Matic back on before pressing the START button ⑦ on the Stello-Matic.

The possible errors are as follows:

`signal lost`	This is displayed if the Decho-Matic does not detect any notable frequencies for a certain amount of time, failing the transmission. This is expected to happen if the Stello-Matic is turned off during transmission.

`! corrupted !`	This is displayed if the transmission has been found to be problematic, either because the format is invalid or because the transmission failed its final verification.

3.3. Redeeming the Transmission

Once a file or text transmission has completed and verified by the Decho-Matic, the Decho-Matic will display `received.` on its main display Ⓗ and print a one-time redeemable ticket from its printer Ⓚ. Taking the ticket redeems it immediately and should present you with the received file or text. This can then be downloaded or copied, respectively. Once the redeemed message is dismissed, it can no longer be retrieved.

4. The Stello-Decho Transmission Protocol

While currently no devices other than the Stello-Matic and Decho-Matic are known to be able to send or receive according to the Stello-Decho Transmission Protocol (SDTP), the necessities for a third-party implementation are fully available in the following technical descriptions. Other companies or persons are encouraged to build software and/or hardware supporting the SDTP communication protocol.

4.1. Predefined Values and Concepts

4.1.1. SDTP Frequencies

The SDTP protocol defines 5 specific frequencies: 941 Hz, 1209 Hz, 1394 Hz, 1540 Hz and 1704 Hz. These frequencies are based on dual-tone multi-frequency (DTMF) signaling, despite never playing two tones at the same time. This is because DTMF frequencies are chosen in a way that minimizes the chances of erroneous detection (and because the sounds are traditionally associated with old-school electronics).

4.1.2. SDTP Beep Durations

To improve reliability and accuracy, the SDTP protocol defines 7 fixed beep durations: 24ms, 32ms, 48ms, 72ms, 104ms, 160ms or 240ms per beep. There mustn't be any time between two subsequent beeps. The Decho-Matic corrects for slight misalignments while receiving transmissions, which is recommended for third-party implementations to improve transmission success rates.

4.1.3. Supported Compression Types

The SDTP protocol compresses payloads, when beneficial. The compression types are denoted with two bits, i.e. integers 0 through 3.

0	00	None	
1	01	GZIP	
2	10	DEFLATE	Note: without header and trailing checksum
3	11	Brotli	Note: not recommended, unsupported by Stello-Matic and Decho-Matic

Third-party software implementations are expressly discouraged from implementing Brotli compression as of 2026, as many environments do not provide the necessary capabilities to decompress Brotli. Since the selected compression method is not under the user's control, they may not be able to transmit certain content at all if the sending device supports Brotli (and selects it), and their receiving device is not capable of decompressing the payload.

4.1.4. Variable-Length Quantities (VLQ)

A variable-length quantity is a way of encoding numbers with as few bytes as possible. Small numbers fit in one byte, and large numbers will need more; there is no limit on size (although environments decoding them may impose a maximum).

To encode a number as variable-length quantity (VLQ), first prepend `0` bits until the number of bits is a multiple of 7. Then split the bitwise representation in groups of 7 bits each. Next, prepend a continuation bit of `1` to every group except the last one. Prepend a continuation bit of `0` to the last group, indicating it is the last one. This is the VLQ representation of the integer.

To decode a VLQ, read bytes as long as their most significant bit, the continuation bit, is a `1`. Once the continuation bit is `0`, stop reading. The VLQ can then be reconstructed by taking out the continuation bits and reading the resulting series of bits as a single integer.

4.2. SDTP Cartridge Format

Cartridges store their data as a series of bytes, which are later converted to beeps. The general fomat for this data encodes the connection signal in the first 18 bits, some important metadata in the next 6 bits, the length of the rest of the payload, the payload itself, and a Fletcher-16 checksum.

4.2.1. High-level Wrapper Format

While payload formats differ across transmission types, the higher level structure for data transmission is the same for both text messages as well as files.

18 bits	Start of transmission, always `000001101111100100`
2 bits	Transmission type (`00`: ping, `01`: text, `10`: file, `11`: reserved)

2 bits	Compression type
2 bits	Number of bytes in encoded length, zero-indexed
1-4 bytes	Length of (remaining) data
	Payload (compressed as per declared type)
2 bytes	Fletcher-16 checksum for payload

Pings are encoded (in hexadecimal notation) as `06 F9 00 00`, which follows the format above, with the exception that it is missing a checksum, as it does not have a payload by definition. However text transmission, even if empty, must include the checksum.

4.2.2. Payload Formats

Text transmissions don't send any metadata alongside the message itself; the payload is a UTF-8 representation of the message.

File payloads contain a file name, MIME type, and file body (in that order). The file name and MIME type are both UTF-8 encoded and preceded by their length, which is encoded as VLQ. The file body is not preceded by its length, as this is unnecessary. The payload consists of these three parts, back-to-back.

As an example, let us encode a simple text file `file.txt` containing the string `Hello world` (including a trailing newline). The file name's length is 8, whose VLQ encoding is (in hexadecimal notation) `08`. Similarly, its MIME type (`text/plain`) contains 10 characters, which encodes as `0A` in hexadecimal notation. The resulting payload is therefore represented as follows:

```
08 66 69 6C 65 2E 74 78 74              (8 bytes) file.txt
0A 74 65 78 74 2F 70 6C 61 69 6E        (10 bytes) text/plain
48 65 6C 6C 6F 20 77 6F 72 6C 64 0A     Hello world\n
```

This particular payload is shortest uncompressed. Its Fletcher-16 checksum is 39383, or `99 D7`. The transmission length is therefore 34 (payload 32 bytes, checksum 2 bytes), or `22` in hexadecimal notation. This means the corresponding cartridge's complete data is:

```
06 F9 20 22  08 66 69 6C
65 2E 74 78  74 0A 74 65
78 74 2F 70  6C 61 69 6E
48 65 6C 6C  6F 20 77 6F
72 6C 64 0A  99 D7
```

4.3. SDTP Broadcasting

In order to maximize resilience and reliability, the SDTP protocol is designed never to broadcast the same frequency twice in a row. Each beep encodes two bits, which represents an integer between 0 and 3. The associated frequency is then chosen by index, where the frequency of the previous beep is temporarily removed from the list. For example, if the previous beep was at a frequency of 1394 Hz, and the current two bits to broadcast are `10`, then the list of available frequencies are 941 Hz, 1209 Hz, 1540 Hz and 1704 Hz, and the the selected frequency is therefore 1540 Hz (the frequency at zero-based index `10`, which represents 2).

Since the first frequency in a transmission does not have a well-defined previous beep, it is assumed to be 1704 Hz. In practice, it is not relevant because the start of every transmission is a fixed `00000110111111100100`, which converts to playing each frequency in order, from lowest to highest, then back to lowest. This ensures each frequency can be correctly sent and received.

4.3.1. Receiving SDTP Broadcasts

A receiving device may choose any methodology to detect the Stello-Matic-emitted frequencies, though some approaches may prove more reliable than others. Using a Fast Fourier Transform (FFT) may prove difficult as its accuracy is notably worse than frequency-detecting algorithms such as Goertzel's Algorithm (deployed by the Decho-Matic).

The receiving device must, while powered on and not actively receiving a transmission, look for the starting signal, which walks through the frequencies, lowest to highest, then back to lowest (9 beeps in total) at the selected speed. The selected device must also infer the selected speed and may assume the speed to be consistent throughout the rest of the transmission. Note that volume is subject to change at any point.