Expert Sleepers

super disting EX plus α

Firmware v1.2
User Manual

Table of Contents

Introduction

Congratulations on your purchase of an Expert Sleepers 'super disting EX plus alpha' (hereafter 'disting EX'). Please read this user manual before operating your new module.

A note on videos

Throughout this user manual you will find links to videos, which illustrate the corresponding sections of the text. In general these have been shot at UHD (4k) resolution, which, as well as looking more awesome, has the practical benefit of making the module's display easier to read. You are advised to watch the videos in full resolution if possible. Be aware that some web browsers, notably Safari, do not support watching YouTube videos in 4k.

A note on navigating this manual

When one part of the manual refers to another, it may say something like "see Menus, below". In such cases the word 'below' (or 'above') is a hyperlink, and can be clicked on. Try it.

Installation
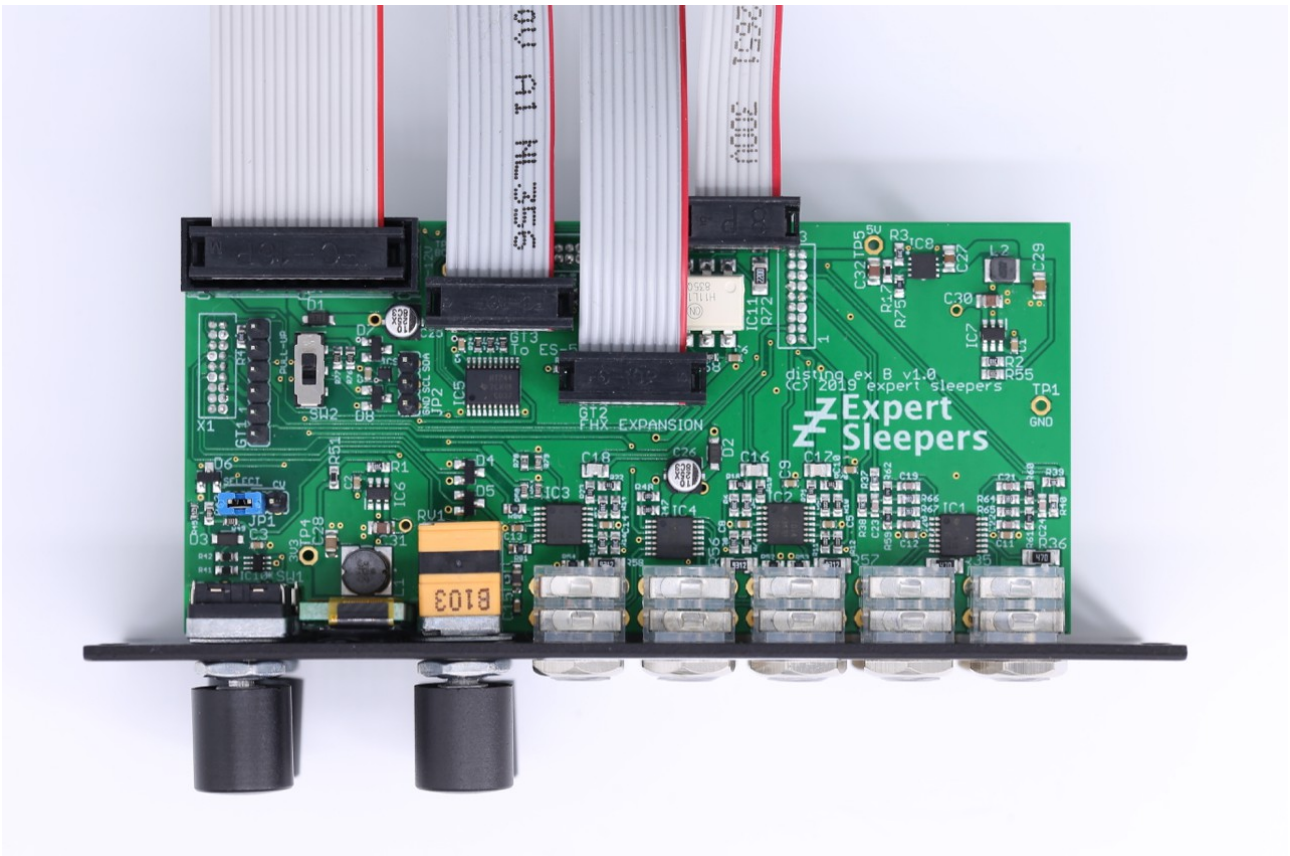
House the module in a Eurorack case of your choosing. The power connector is 16-pin Doepfer standard[1]. If using the power cable supplied with the module, the red edge of the cable is furthest from the top edge of the PCB, and carries -12V. ("-12V" is marked on the PCB itself next to this end of the connector.) Be sure to connect the other end of the power cable correctly, again so -12V corresponds to the red stripe on the cable.
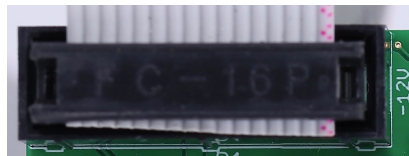
Power requirements

The disting EX draws up to 229mA on the +12V rail, and 50mA on the -12V rail.

It does not use the 5V rail.

Connecting expansion modules

Turn off the power before connecting or disconnecting expansion modules.

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1   http://www.doepfer.de/a100_man/a100t_e.htm

Connect an ES-5 module via the header on the back of the disting EX marked "GT3/To ES-5", using the 10-way cable provided. The red stripe should be oriented down on both modules, as shown in the photo above, and in the [ES-5 user manual](https://expert-sleepers.co.uk/es5usermanual.html)[2].
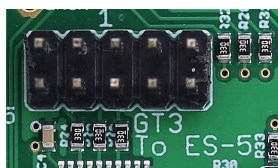
Connect an FHX-8GT or FHX-8CV module via the header on the back of the disting EX marked "GT2/FHX Expansion". The red stripe should be oriented down on both modules, as shown in the photo above.

Connect a MIDI breakout to the header on the back of the disting EX marked "GT4/MIDI". See the MIDI I/O section below.
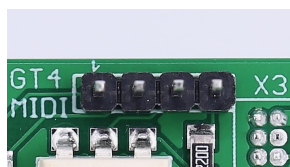
A device or module that communicates via I2C (e.g. the [16n Faderbank](https://16n-faderbank.github.io)[3]) can be connected via the header marked "JP2". See the I2C Connection section below.
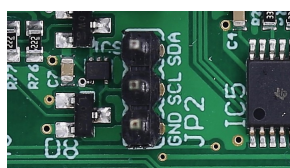
Jumpers

There is one jumper header on the disting EX marked "JP1", which sets whether the system CV bus line is used for pitch CV (the traditional use as implemented by Doepfer) or as the Select Bus. See below for more on the disting EX's Select Bus implementation.
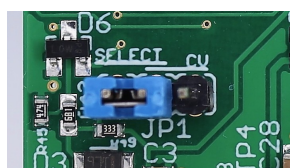
The photo above shows the jumper in the Select Bus position.

Regardless of this jumper position, the disting EX always connects to the system gate bus.

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2   https://expert-sleepers.co.uk/es5usermanual.html
3   https://16n-faderbank.github.io

Inputs and Outputs

The disting EX has six analogue inputs and four analogue outputs on 3.5mm TS jack sockets. These are designed to cope with any Eurorack signal (with a range of approximately ±10V), and are DC coupled, so can be used for CVs as well as audio.

The inputs are numbered on a white background; the four outputs are at the bottom of the module.

The disting mk4 labelling (Z/X/Y/A/B) is also printed on the panel, in orange.

The jack sockets are illuminated, lighting red for positive voltage and blue for negative voltage. (Audio appears purple, since it is a rapid alternation of positive and negative.)

Controls

The disting EX has two rotary encoders (labelled P & V, notionally for 'parameter' and 'value') and two rotary potentiometers (labelled L & R, for 'left' and 'right'). All four of these controls also have a push-button function.

A note on the pots

On the disting mk4, the Z pot and the Z input jack are permanently linked, and the LEDs of the Z jack display the combined signal from the pot and jack.

On the disting EX, this is still the case when in dual mode, but in single mode the pots are completely independent of the jacks, and the jack LEDs reflect only the incoming signal.

Menus

Video ▶

Many of the module's non-realtime functions are accessed via a menu. The menu is accessed by pressing 'P' (in single mode) or both 'P' & 'V' together (in dual mode).

While the menu is active, turning 'P' scrolls through menu items, and pressing 'P' chooses the current menu item (or descends to the next menu level, if the current menu item is a submenu). Pressing 'V' jumps back up one menu level. Holding down 'V' exits the menu completely.

SD Card slot

The disting EX has a MicroSD card slot, to the left of the display.

Inserting a MicroSD card

Video ▶

The exposed contacts of the card should face towards the display; the angled side of the card itself points up.

The slot is of the "push-push" type - to remove the card, push it in slightly and it will spring out.

Supported MicroSD cards

In theory any MicroSD card will work, but in practice there is a huge variety of cards on the market and we cannot possibly test them all. We recommend 32GB SDHC cards.

The MicroSD card must be formatted in FAT32 format, which is the as-sold state for many cards. If not, cards can easily be reformatted to FAT32 in Windows or macOS.

The card also needs to be partitioned using the 'Master Boot Record' (MBR) scheme. In macOS's Disk Utility, you may need to select View->Show All Devices to inspect the partitioning scheme. The Erase settings should look like this:
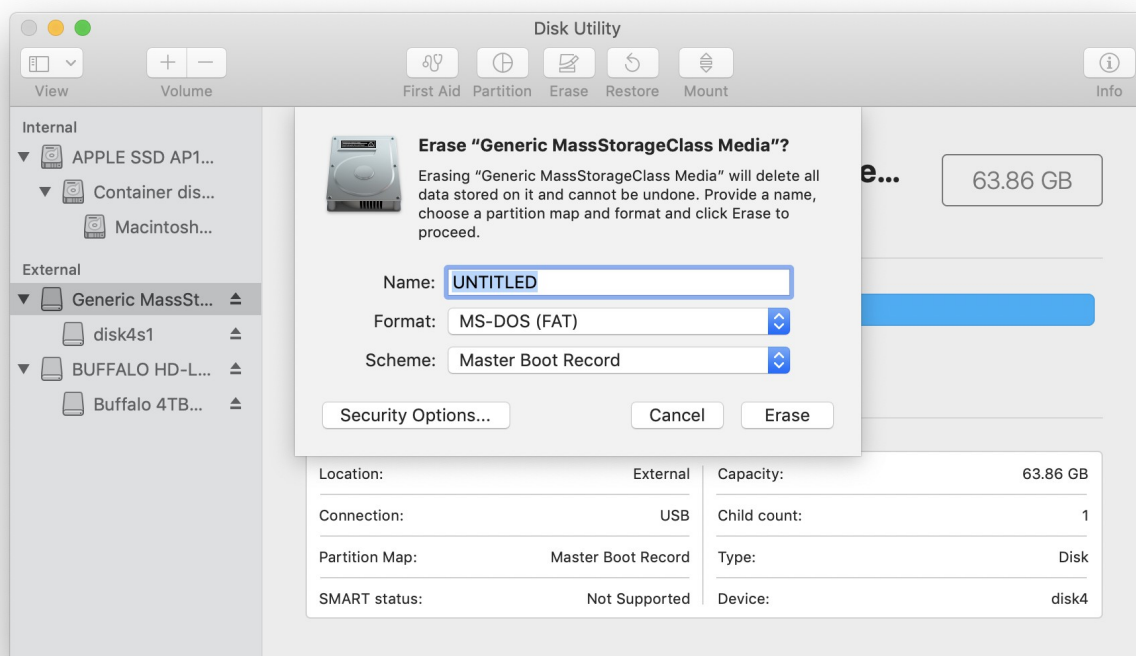
The speed of your SD card can be estimated using the 'Test SD speed' menu (under Misc->Tests).

The maximum speed achievable with the disting EX is around 3 MB/s.

Technical note: the disting EX accesses the MicroSD card in SPI mode, and so can never achieve the rated speed of the card, which assumes full SD bus access. It can however use High Speed mode where available to double the throughput. Unfortunately whether a given card supports High Speed mode over SPI seems to be hard to gauge from the specs – we've tested a number of cards rated at UHS-I and above, some of which support High Speed mode and some of which don't. For the record, the Samsung EVO range do; the Sandisk Extreme range does not. A card which does not support High Speed mode will read around 1.8 MB/s on the disting EX's 'Test SD speed'.

A card that reads less than around 1.8 MB/s should be viewed with suspicion, and is probably not a good choice for card-intensive purposes such as playing or recording WAV files.

Overview

The disting EX is a multifunction module. Its various functions are referred to as **algorithms**. Types of algorithms include

- audio processing (audio in, audio out e.g. delays, reverbs)
- CV processing (CV in, CV out e.g. quantisers)
- CV generation (e.g. envelopes)
- audio generation (e.g. VCOs, WAV playback)

The disting EX builds on the rich legacy of the disting mk4, and can be used essentially as two disting mk4s with a shared display. This is known as **dual mode** as is described in more detail below.

The disting EX also includes its own unique algorithms, which take over the whole module in what we call **single mode**.
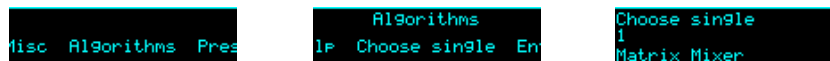
Because the disting mk4 has relatively few CV inputs, and because its small display makes accessing a large number of parameters awkward, it tends towards a proliferation of algorithms which are similar to one another but have, say, different means of CV control. In contrast the disting EX's single mode algorithms tend to be fewer but much more configurable.

Single Mode

Single mode concepts

<div align="center">

Video ▶

</div>

The disting EX runs one single mode algorithm at a time. Switching algorithms is done via the Algorithms menu (see above for basic information on using the menus).

There are two fundamental elements that define a single algorithm's operation, the **preset** and the **mapping**.
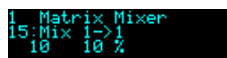
The **preset** is the state of the algorithm's parameters – a set of numerical values that control how the algorithm works. For example, the delay time of a delay effect, or the choice of samples files in a WAV playback algorithm.

The **mapping** defines how the parameters are controlled by a number of control sources – primarily, the module's own CV inputs, but also MIDI, I2C etc.

Changing algorithm resets the current preset and mappings to defaults.

Single mode display & controls

The display in single mode often varies with each algorithm, but is based around the common structure show below:

The first line simply shows the algorithm number and name.

The second line shows the current parameter number and name. Turning the 'P' knob scrolls through the parameters.

[Video](#) ▶

The third line shows the current parameter's value, and if appropriate, its unit (the unit in the screenshot above is "%"). You'll note that there are two values shown. The first (leftmost) is the parameter's **base value**. This is the one set by the preset, and is the one you edit when you turn the 'V' knob. The second value is the parameter's **effective value**. This is the value after control by CV inputs etc. has been taken into account, and is the actual value being used by the algorithm.

If a parameter is not under CV control, these two values will always be the same. When CV control is applied, this offsets the base value by an amount related to the CV.

If the 'R' knob has not been set up in the mapping, it defaults to changing the current parameter. Since 'R' is an absolute positional control (a pot, not an encoder) this can make it much easier to dial in values quickly, especially if the parameter has a large range.

Note that 'V' and 'R' are adjusting the same value, just in different ways.

If the 'R' button has not been set up in the mapping, it defaults to setting the current parameter to its default value when pushed.

Holding 'V' shows a key of the current input and knob functions, either as hardwired into the algorithm or set by the mapping.

Single mode common parameters

Every algorithm in single mode shares a number of parameters. These are:

	Name	Min	Max	Default	Unit	Description
1	Attenuverter 1	-200	200	100	%	Applies an attenuverter[4] to input 1. A negative value indicates that the CV will be inverted.
2	Attenuverter 2	-200	200	100	%	As above for input 2.
3	Attenuverter 3	-200	200	100	%	As above for input 3.
4	Attenuverter 4	-200	200	100	%	As above for input 4.
5	Attenuverter 5	-200	200	100	%	As above for input 5.
6	Attenuverter 6	-200	200	100	%	As above for input 6.

The attenuverters affect the incoming audio/CV signal just like an attenuator knob on an analogue module. Anything that uses the signal downstream (including parameter automation) uses the attenuated signal.

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4   An attenuverter is a Eurorack term for a combination of an attenuator and an inverter. These aren't strictly attenuators because the gain goes above 100%.

Single mode help

Each algorithm's user manual section can be accessed via the Algorithms menu.

Dual Mode

In dual mode, the disting EX essentially behaves like two souped-up [disting mk4](#)s[5].

Left disting mk4	**Right disting mk4**
S knob ⟶	⟵ S knob Turn to change parameter value. Hold & turn to choose parameter. Press to enter menu.
Z knob ⟶	⟵ Z knob
Input Z ⟶	⟵ Input Z
Input X ⟶	⟵ Input X
Input Y ⟶	⟵ Input Y
Output A ⟵	⟶ Output A
Output B ⟵	⟶ Output B
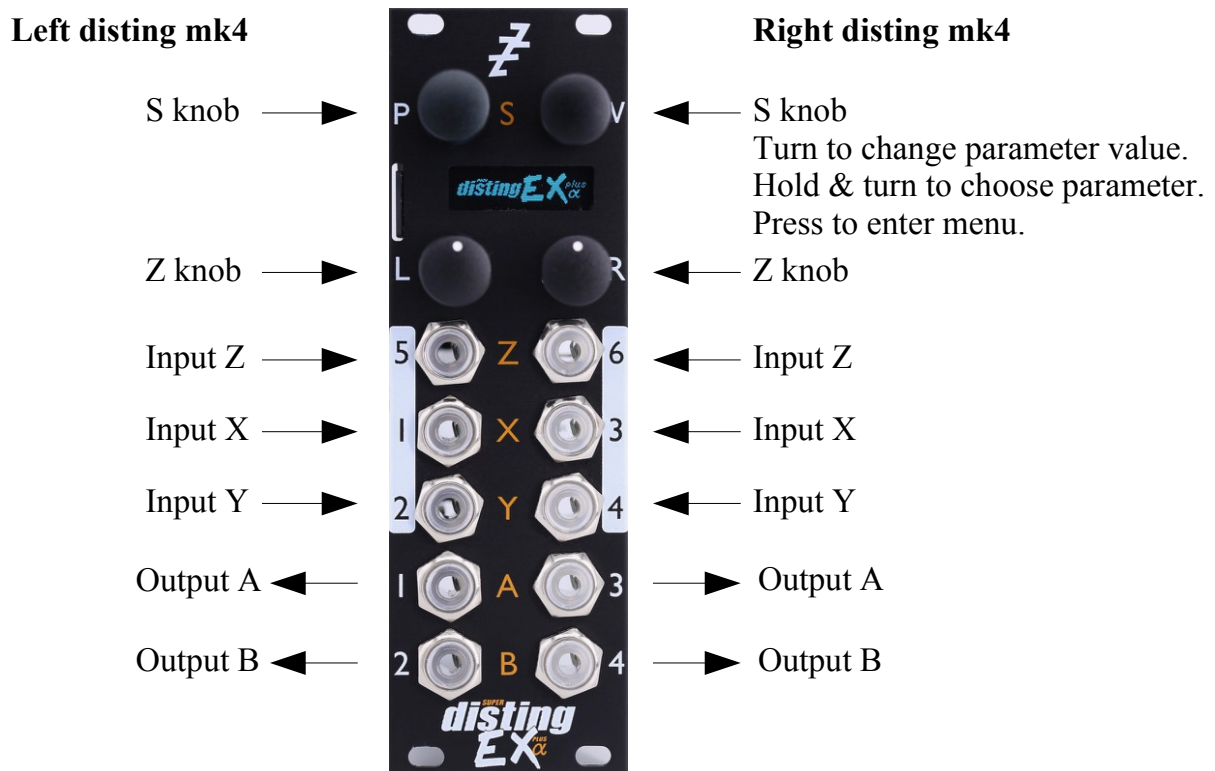
We do not propose to reproduce the entire disting mk4 [user manual](#)[6] here, which is itself a 109 page document. Instead, below is a list of ways in which the disting EX in dual mode differs from a disting mk4.

disting mk4 firmware version

This version of the disting EX firmware is synchronised with version 4.15 of the disting mk4 firmware. Please refer to that version of the disting mk4 user manual.

Sample rate

The disting mk4 runs at 75kHz in general, with some algorithms running lower for performance reasons. The disting EX runs at 96kHz.

Scala support

The 'logTables_16_20.bin' file is not required.

Favourites

Whereas on a disting mk4 these are set up with a text file on the MicroSD card, on the disting EX they are set via the Settings menu (see below).

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5   https://www.expert-sleepers.co.uk/disting.html
6   https://www.expert-sleepers.co.uk/distingfirmwareupdates.html

Help

The per-algorithm help is hardcoded into the firmware – it is not stored on the SD card. Also it displays the help a page at a time, rather than scrolling it a character at a time!

Z push functions & the Knob Recorder

On the disting mk4, the effect of pushing the Z knob is very algorithm-dependent – by default it advances to the next parameter, but an algorithm may override it to perform some other function e.g. 'freeze' on the reverbs, or the knob recorder.

The disting EX lets you choose this behaviour, via the dual-mode menu Options->Z function. The options are:

Function or Param	As on the disting mk4, pressing Z advances to the next parameter, unless the algorithm defines another function for it.
Function	Pressing Z always performs the algorithm-specific function, if any.
Parameter	Pressing Z always advances to the next parameter.
Knob Recorder	Pressing Z is used to activate the knob recorder.

This choice is stored as part of a preset.

Note that this means you have the option of using the knob recorder with any algorithm, not just those for which the disting mk4 implements it.

When the knob recorder is chosen, holding Z down while turning it causes the Z value changes to be recorded. As soon as the knob is released, the recording is played back in a loop. To end playback, turn the Z knob slightly to regain manual control.

disting mk4 algorithms not included

The following disting mk4 algorithms are not included in the disting EX:

- J-5 Audio Recorder & J-7 Mono Audio Recorder
  - You can use the disting EX's WAV Recorder mode instead.
- K-6 Clockable SD Delay, K-7 Stereo Clockable SD Delay, K-8 Stereo Clockable SD Delay (Z clock) & N-8 Clockable SD Ping Pong
  - On the disting EX, the equivalent non-SD versions have much longer delay times.

disting mk4 algorithms with improved specifications

- B-4 Clockable Delay/Echo
  - Operates at 96kHz and offers a maximum delay time of around 22 seconds.
- C-3 Clockable Ping Pong Delay (Z feedback) & C-4 Clockable Ping Pong Delay (Z input pan)
  - Operate at 96kHz and offer a maximum delay time of around 11 seconds.

- D-2 Tape Delay & M-6 Stereo Tape Delay
  - Maximum delay time is around 11 seconds (mono)/5.5 seconds (stereo). The algorithms have an extra 'Coarse' parameter to access the extra delay time available.
- K-1 Wavetable VCO, K-2 Clockable Wavetable LFO, K-3 Wavetable Waveshaper, K-4 Clockable Wavetable Envelope & N-5 Pulsar VCO
  - These algorithms support up to 1000 files in a wavetable folder, and up to 2 million total wave samples (100/29000 on the disting mk4).
- All Audio Playback algorithms
  - 24 bit WAV files are supported.
  - Triggering latency is down from 3ms to 700μs.
- L-1 Stereo Reverb, L-2 Mono-to-Stereo Reverb & L-3 Dual Reverb
  - The maximum reverb size parameter is 99 (rather than 32).

Entering dual mode

Video ▶

From the menu, choose 'Algorithms', then 'Enter dual mode'.

Accessing the main menu from dual mode

In dual mode, the two encoders enter the disting mk4-style menus of their respective halves. To access the main menu, press both encoders at the same time.

Presets in dual mode

Each half can save and load presets, as on the disting mk4, though there are more (256) slots available.

Also, from the main menu you can save & load a 'dual preset', which stores the parameters for both halves, and can be named. See Presets, below.

Dual display modes

Video ▶

The default display mode in dual mode presents the two halves side by side:

When a parameter is changed, or a menu is used, the display zooms to use the whole screen for the half being edited. A bar is drawn at the top of the screen showing whether the left or right half is being accessed:

The images above show a menu and a parameter being accessed for the left & right halves respectively.

In the main Settings menu (see below) you can choose alternative dual display modes. The options are 'Standard', 'Standard (no zoom)' and 'Retro'. The 'no zoom' option is as above but the display never zooms to use the entire screen for one half. The 'Retro' option recreates the actual disting mk4 display – a 5x7 LED matrix for each half:
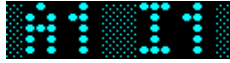
Presets

A preset on the disting EX stores the following information:

- The preset name.

- The current algorithm(s).

- The algorithm parameters.

- For dual algorithms:

  - The current parameter.

  - The chosen Z function.

- For single algorithms:

  - Any folder and/or file names used by the algorithm.

Presets can be stored in the module's flash memory and/or on the MicroSD card. There are 256 preset slots in flash memory. You can also save all 256 presets to/from MicroSD at once.

All preset functions are accessed via the top-level Presets menu.

Load preset
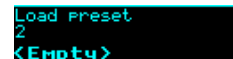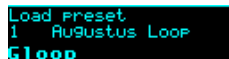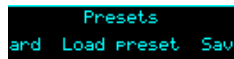
Loads a preset from flash memory. Use the 'P' knob to choose the preset slot. The preset name is shown at the bottom of the screen, or <Empty> if the slot is empty. The preset algorithm is also displayed.

Save preset
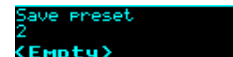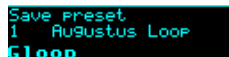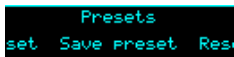
Saves the current module state to a preset in flash memory. Use the 'P' knob to choose the preset slot. If the slot is not empty, the preset name and algorithm are shown.

Reset preset
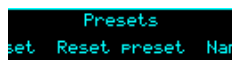
Resets the current state to defaults (for the current algorithm).

Name preset
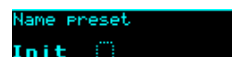
Allows you to edit the name of the current preset. Typically you would do this before saving it.

Use the 'P' knob to move the cursor, and the 'V' or 'R' knobs to edit the character under the cursor.

Load from SD card

Loads a preset from the MicroSD card.

Use the 'P' knob to choose the preset file to load.

Preset files may be located at the top level of the card, or inside folders. If a folder contains preset files, it is included in the names you can choose with 'P', and "(folder)" is displayed. Pressing 'P' will enter the folder and let you browse the preset files therein. Choosing the special item <..> steps back up to the parent folder.

Save to SD card

Saves the current module state to a preset file on the SD card. The file is placed in the root folder, and the filename is automatically constructed from the preset name.

Load all from SD card

Loads an 'all presets' file from the MicroSD card.

Take care – this function replaces all the presets saved in flash memory with those loaded from the card.

Use the 'P' knob to choose the preset file to load.

Save all to SD card

Saves all the presets in flash memory to a file on the MicroSD card. The file is placed in the root folder, and is named 'ALL<n>.dexpresets' where <n> is a number which increments to make the filename unique.

Mappings

A 'mapping' stores all the information about how an algorithm's parameters are controlled by CV, MIDI etc. It is dealt with separately from a preset on the rationale that you will change a mapping less often than a preset.

Mappings can be stored in the module's flash memory and/or on the MicroSD card. There are 64 mapping slots in flash memory. You can also save all 64 mappings to/from MicroSD at once.

All mapping functions are accessed via the top-level Mappings menu.
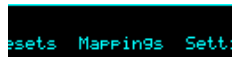
CV Mappings
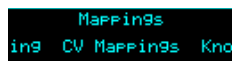
CV mappings let you control algorithm parameters from the module's six CV inputs. Every parameter can be assigned to a CV input simultaneously, and each parameter's response to that CV set independently.

The CV mappings offset the values set manually – the parameter value calculated from the CV voltage is added to the value set via the parameter/value knobs.

When you switch to a new algorithm, some CV mappings may be set up by default. Even for parameters which do not by default have an active CV mapping, the CV scalings are set appropriately so that simply enabling a CV input will control the parameter in a sensible way, usually mapping the range ±5V to the whole parameter range.

On the mapping editing screen, move the cursor (the dotted rectangle) with the 'P' knob. Turn the 'V' or 'R' knobs to adjust the value under the cursor. There are five cursor positions:

- The parameter number – choose which parameter's mapping you want to edit.

- The input – choose the CV input to use, or "-" for none.

- The CV polarity – choose "Bipolar" to use both positive and negative CV voltages, or "Unipolar" to use only positive voltages.

- Whether to treat the CV as a gate – choose "Norm" for a normal CV, or "Gate" for a gate. A gate-type mapping switches between the parameter's minimum and maximum when the input goes over 1V.

- The CV scaling – the relationship between incoming voltages and the parameter values. For example, in the screenshot above, Input 4 is controlling the Input Level with a scaling of 20.0%/V – that is, it will take a CV of 5V to change the input level by 100%.

Knob Mappings

Video ▶

```
           Mappings
gs  Knob Mappings  Bu
```
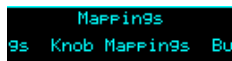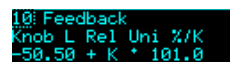
Knob mappings let you control algorithm parameters from the module's 'L' & 'R' knobs. Every parameter can be assigned to a knob simultaneously, and each parameter's response to that knob set independently.

The knob mappings can either offset the values set manually – the parameter value calculated from the knob is added to the value previously set – or they can directly set the parameter value.

When you switch to a new algorithm, some knob mappings may be set up by default. Even for parameters which do not by default have an active knob mapping, the knob scalings are set appropriately so that simply enabling a knob will control the parameter in a sensible way, usually mapping the knob to the whole parameter range.

```
1 Attenuverter 1          10 Feedback
Knob - Rel Bi  %/K        Knob L Rel Uni %/K
0.0 + K * 201.0           -50.50 + K * 101.0
```

On the mapping editing screen, move the cursor (the dotted rectangle) with the 'P' knob. Turn the 'V' or 'R' knobs to adjust the value under the cursor. There are six cursor positions:

- The parameter number – choose which parameter's mapping you want to edit.

- The knob – choose the knob to use, or "-" for none.

- Whether the knob offsets the parameter value ("Rel" or relative mode) or sets it directly ("Abs" or absolute mode).

- Whether the knob is considered Unipolar (range 0-1) or Bipolar (range ±1). This simply makes it easier to set the scale and offset values below.

- The knob offset, and

- The knob scale. These two values let you define the relationship between the knob position and the value set by the mapping. The value is Offset + K * Scale, where K is a value in the range [0,1] or [-1,1] (depending on the Uni/Bi setting).

Button Mappings

Video ▶

```
           Mappings
s  Button Mappings  M
```
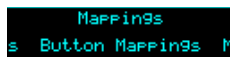
Button mappings let you control algorithm parameters from pushing the module's 'L' & 'R' knobs. Every parameter can be assigned to a button simultaneously, and each parameter's response to that button set independently.

The button mappings offset the values set manually – the parameter value from the button is added to the value set via the parameter/value knobs.

```
25 Stop tape
Button R
1
```

On the mapping editing screen, move the cursor (the dotted rectangle) with the 'P' knob. Turn the 'V' or 'R' knobs to adjust the value under the cursor. There are three cursor positions:

- The parameter number – choose which parameter's mapping you want to edit.

- The button – choose the button to use, or "-" for none.

- The offset – the value to be added to the parameter when you press the button.

MIDI Mappings

Video ▶
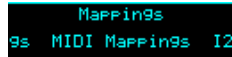
MIDI mappings let you control algorithm parameters via MIDI continuous controllers (CCs). Every parameter can be assigned to a CC simultaneously, and each parameter's response to that CC set independently.

The MIDI mappings set the base parameter values, exactly as if you had changed the value manually with the 'V' knob.

When you switch to a new algorithm, default MIDI mappings are applied, which is to control parameters 7 and up (i.e. everything except the common attenuverter parameters) from MIDI CCs 7 and up. The CC value range of 0-127 is mapped to the parameter's full value range.

On the mapping editing screen, move the cursor (the dotted rectangle) with the 'P' knob. Turn the 'V' or 'R' knobs to adjust the value under the cursor. There are six cursor positions:

- The parameter number – choose which parameter's mapping you want to edit.

- The CC number – choose which MIDI CC you want to control the parameter.

- The Enabled/Disabled setting.

- Whether the CC is treated as normal ("Norm") or symmetric ("Sym"). For a normal CC, the range 0-127 is mapped across the range set by the min & max settings below. For a symmetric CC, the value 64 is mapped to the mid point of the range, and values above and below that are scaled by half the total range. A symmetric mapping is appropriate for a parameter which has a bipolar range around zero (for example, a pan position), where you want to be sure that a MIDI value of 64 gives you exactly zero in the middle.

- The minimum ("Min") and

- the maximum ("Max") parameter values for the mapping.

I2C Mappings
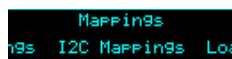
I2C mappings let you control algorithm parameters via the I2C bus (see below). Every parameter can be assigned an I2C controller simultaneously, and each parameter's response to that controller set independently.

The I2C mappings set the base parameter values, exactly as if you had changed the value manually with the 'V' knob.

When you switch to a new algorithm, default I2C mappings are applied, which is to control parameters 7 and up (i.e. everything except the common attenuverter parameters) from I2C

controllers 0 and up. The controller range of 0-16383 is mapped to the parameter's full value range.

```
10: Feedback
ID# 3   Enabled  Norm
Min 0 Max 100
```

On the mapping editing screen, move the cursor (the dotted rectangle) with the 'P' knob. Turn the 'V' or 'R' knobs to adjust the value under the cursor. There are six cursor positions:

- The parameter number – choose which parameter's mapping you want to edit.

- The controller number – choose which I2C controller you want to control the parameter.

- The Enabled/Disabled setting.

- Whether the CC is treated as normal ("Norm") or symmetric ("Sym"). For a normal CC, the range 0- 16383 is mapped across the range set by the min & max settings below. For a symmetric CC, the value 8192 is mapped to the mid point of the range, and values above and below that are scaled by half the total range. A symmetric mapping is appropriate for a parameter which has a bipolar range around zero (for example, a pan position), where you want to be sure that a controller value of 8192 gives you exactly zero in the middle.

- The minimum ("Min") and

- the maximum ("Max") parameter values for the mapping.

Load mapping

```
       Mappings              Load mapping            Load mapping
9s  Load mapping  Sav        1  (Augustus Loop)      2  (No algorithm)
                             Cait Sith              <Empty>
```

Loads a mapping from flash memory. Use the 'P' knob to choose the mapping slot. The mapping name is shown at the bottom of the screen, or <Empty> if the slot is empty. The algorithm for which the mapping was saved is also displayed.

Save mapping

```
       Mappings              Save mapping            Save mapping
ing  Save mapping  Res       1  (Augustus Loop)      2  (No algorithm)
                             Cait Sith              <Empty>
```

Saves the current module mapping state to a mapping in flash memory. Use the 'P' knob to choose the mapping slot. If the slot is not empty, the mapping name and algorithm are shown.

Reset mapping

```
       Mappings
ng  Reset mapping  Na
```
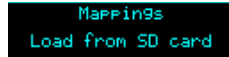
Resets the current mapping to defaults (for the current algorithm).

Name mapping

```
       Mappings              Name mapping
ing  Name mapping  CV        Cait Sith □
```
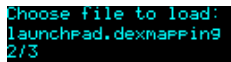
Allows you to edit the name of the current mapping. Typically you would do this before saving it.

Use the 'P' knob to move the cursor, and the 'V' or 'R' knobs to edit the character under the cursor.
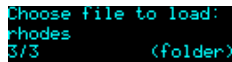
Load from SD card
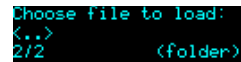
Loads a mapping from the MicroSD card.
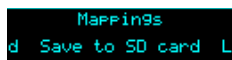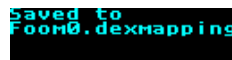
Use the 'P' knob to choose the mapping file to load.

Mapping files may be located at the top level of the card, or inside folders. If a folder contains mapping files, it is included in the names you can choose with 'P', and "(folder)" is displayed. Pressing 'P' will enter the folder and let you browse the mapping files therein. Choosing the special item <..> steps back up to the parent folder.
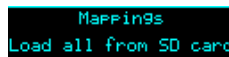
Save to SD card

Saves the current mapping to a file on the SD card. The file is placed in the root folder, and the filename is automatically constructed from the mapping name.
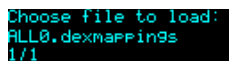
Load all from SD card

Loads an 'all mappings' file from the MicroSD card.
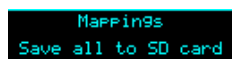
Take care – this function replaces all the mappings saved in flash memory with those loaded from the card.

Use the 'P' knob to choose the mapping file to load.

Save all to SD card

Saves all the mappings in flash memory to a file on the MicroSD card. The file is placed in the root folder, and is named 'ALL<n>.dexmappings' where <n> is a number which increments to make the filename unique.

Single Mode Algorithms

The following pages describe the disting EX's "single mode" algorithms.

1 – Matrix Mixer
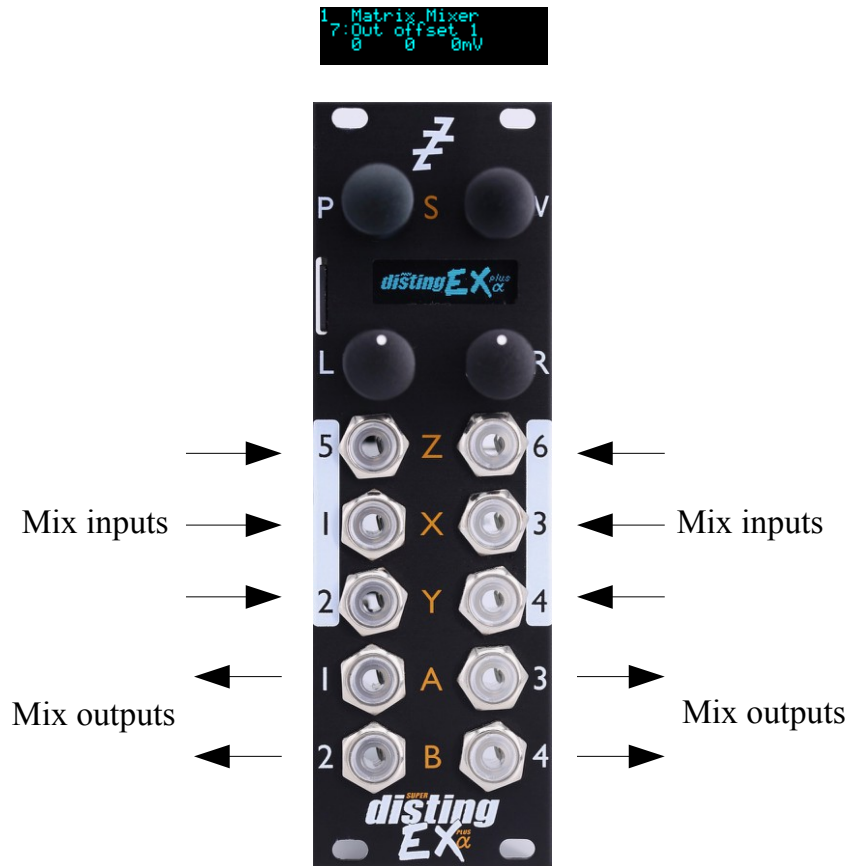
The Matrix Mixer is a flexible 6 into 4 mixer, mainly designed for CV processing, though it will happily handle audio as well. As well as a static mix, the algorithm is capable of complex dynamic mixes when CV mapping is used, and also of CV generation – for example, by automating the input and output offsets to generate four CVs which might control the rest of your patch in a 'macro' fashion.

Parameters

	Name	Min	Max	Default	Unit	Description
1-6	Attenuverter 1-6	-200	200	100	%	Applies an attenuverter to the corresponding input. A negative value indicates that the CV will be inverted.
7-10	Out offset 1-4	-10000	10000	0		Output offset for outputs 1-4. The unit of the offset depends on the corresponding 'Out offset type' parameter. The net offset in mV is shown to the right of the parameter value.
11-14	Out offset 1-4 type	0	2	0		Sets the unit for the corresponding 'Out offset' parameter. The options are V (Volts), mV (millivolts) and semitones (multiples of 83mV, corresponding to semitone steps of a 1V/octave pitch CV).

	Name	Min	Max	Default	Unit	Description
15-38	Mix N->M	-200	200	0	%	These 24 parameters set the mix matrix. E.g. 'Mix 5->2' sets the amount of input 5 that will be summed into output 2. A negative amount indicates that the signal will be inverted.
39-44	In offset 1-6	-10000	10000	0		Input offsets for inputs 1-6. The unit of the offset depends on the corresponding 'In offset type' parameter. The net offset in mV is shown to the right of the parameter value.
45-50	In offset 1-4 type	0	2	0		Sets the unit for the corresponding 'In offset' parameter. The options are the same as for 'Out offset type' above.
51-54	Out Quantize 1-4	0	2	0		Sets the quantization for outputs 1-4. The options are Off, V (whole Volts) and semitones (multiples of 83mV, corresponding to semitone steps of a 1V/octave pitch CV). The output quantization is applied after the output offset.
55-60	In Quantize 1-6	0	2	0		Sets the quantization for inputs 1-6. The options are the same as for 'Out Quantize' above. The input quantization is applied after the input offset.

2 – Augustus Loop

Feedback →	
Pitch CV →	← Clock
Left/mono input →	
Right input →	← Input level CV
Dry/delay mix left ←	→ Delay only left
Dry/delay mix right ←	→ Delay only right

Augustus Loop is a disting EX implementation of one of Expert Sleepers' oldest products, the VST plug-in of the same name[7]. Essentially, it's a tape-inspired stereo delay.

The delay time can be dialled in manually, or set by tap tempo or a clock input. The longest delay possible is around 44 seconds.

Being a tape delay, you can change the tape speed via CV. Patching an LFO into here is your route to all manner of subtle detuning or extreme mangling effects. You can also stop and reverse the tape.

Note that the 'Pitch CV' input changes the tape speed. It is labelled pitch rather than speed to emphasise the fact that it is scaled 1V/octave.

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7   https://expert-sleepers.co.uk/augustusloop.html

This diagram is reproduced from the VST plug-in user manual, and explains the signal flow graphically:
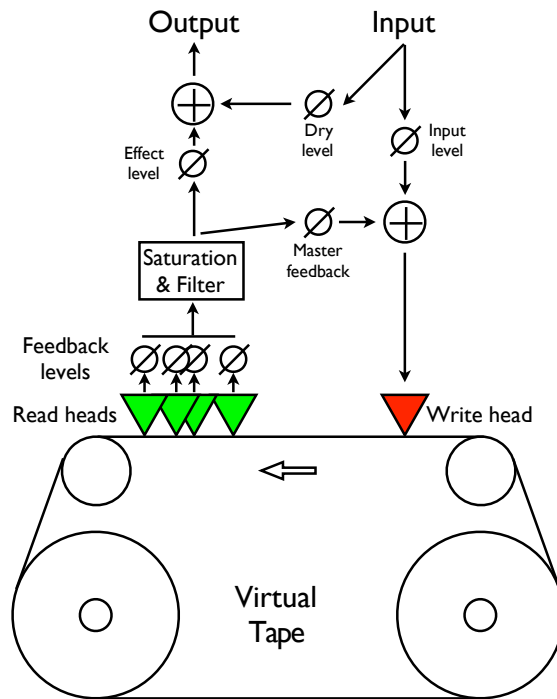
There are four 'tape read heads' with independent delay times and stereo positions, allowing for straight stereo delays, ping pong delays, or hybrid multi-tap style effects.

Algorithm-specific display
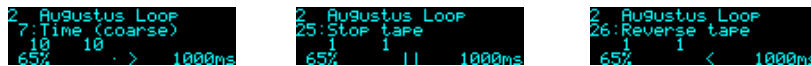
The bottom line of the display shows the current feedback, the tape direction, and the delay time.

Outputs

Outputs 1 & 2 are a mix of the dry and delay signals according to the 'Dry gain' and 'Effect gain' parameters.

Outputs 3 & 4 are the delay signal only.

Parameters

	Name	Min	Max	Default	Unit	Description
1-6	Attenuverter 1-6	-200	200	100	%	Applies an attenuverter to the corresponding input. A negative value indicates that the CV will be inverted.
7	Time (coarse)	0	437	10		Sets the delay time, in multiples of 100ms. The coarse and fine delay times are added to produce the actual delay time.

	Name	Min	Max	Default	Unit	Description
8	Time (fine)	-100	100	0	ms	Sets an adjustment to the delay time, in milliseconds. The coarse and fine delay times are added to produce the actual delay time.
9	Delay multiplier	0	23	15		A multiplier to apply to the delay time set by the parameters, the tap tempo, or the clock. See below for the available values.
10	Feedback	0	100	50	%	The master delay feedback amount.
11	Dry gain	-40	6	0	dB	The amount of the dry signal to mix into the outputs. At "-40" there is no dry signal at all i.e. it's actually $-\infty$dB.
12	Effect gain	-40	6	-3	dB	The amount of the effect (delay) signal to mix into the outputs. At "-40" there is no dry signal at all i.e. it's actually $-\infty$dB.
13	L-L Time	0	100	100	%	Scales the delay time of the left-to-left feedback path, as a percentage of the master delay time.
14	L-R Time	0	100	50	%	Scales the delay time of the left-to-right feedback path, as a percentage of the master delay time.
15	R-L Time	0	100	50	%	Scales the delay time of the right-to-left feedback path, as a percentage of the master delay time.
16	R-R Time	0	100	100	%	Scales the delay time of the right-to-right feedback path, as a percentage of the master delay time.
17	L-L Level	0	100	100	%	Scales the amount of the delayed left signal mixed into the left feedback path.
18	L-R Level	0	100	0	%	Scales the amount of the delayed left signal mixed into the right feedback path.
19	R-L Level	0	100	0	%	Scales the amount of the delayed right signal mixed into the left feedback path.
20	R-R Level	0	100	100	%	Scales the amount of the delayed right signal mixed into the right feedback path.
21	Mono-ize	0	100	0	%	Reduces the stereo width of the incoming signal. At zero the signal is reduced to mono, at a pan position set by the 'Initial pan' parameter.
22	Initial pan	-100	100	-100		Sets the pan position of the mono-ized signal. -100 is fully left; 100 is fully right.
23	Input level	0	100	100	%	Attenuates the input signal fed to the tape write head.

	Name	Min	Max	Default	Unit	Description
24	Pitch inertia	0	125	64		Sets the amount of 'inertia' or slew on the pitch CV input. At zero, the tape speed follows the pitch input closely; at the maximum value, pitch changes are quite gradual.
25	Stop tape	0	1	0		When set to '1', the tape speed is set to zero. Note that the Pitch inertia affects how quickly the tape stops and starts.
26	Reverse tape	0	1	0		When set to '1', the tape is reversed. Note that the Pitch inertia affects how quickly the tape reverses.
27	Mono input	0	1	0		If '0', inputs 1 & 2 are used as a stereo input. If '1', only input 1 is used, as a mono input (leaving input 2 free for parameter mapping).
28	Sample rate	0	1	1		Controls the sample rate at which the algorithm runs. At the default '1' the algorithm runs at full speed (96kHz). At '0' the algorithm runs at 48kHz, which doubles the maximum delay time.
29	Bit depth	0	1	1		Controls the bit depth used in the delay memory (note, not the bit depth used in any other processing). Settings this to '0' (16 bit) doubles the maximum delay time.
30	Inertia free	0	1	0		Enables 'Inertia free' mode. See below.
31	Inertia fade time	1	1000	100	ms	The fade time to use when in Inertia free mode.
32	Pitch CV input	0	6	5		The CV input to use for pitch, or "0" for none.
33	Clock input	0	6	3		The CV input to use as the clock, or "0" for none. The delay time is set as the time between two rising clock edges.
34	Tap tempo	0	1	0		When this parameter transitions from 0 to 1, the algorithm acts on a tap tempo event. See tap tempo, below.

Default mappings

Input 4 is mapped to 'Input level'.

The 'L' knob is mapped to 'Feedback'.

The 'L' button is mapped to 'Tap tempo'.

'Pitch CV input' defaults to input 4.

'Clock input' defaults to input 3.

Delay time multipliers

Parameter value	Multiplier	Parameter value	Multiplier	Parameter value	Multiplier
0	1/64	8	3/16	16	x1.5
1	1/48	9	1/4	17	x2
2	1/32	10	5/16	18	x3
3	1/24	11	1/3	19	x4
4	1/16	12	3/8	20	x5
5	1/12	13	1/2	21	x6
6	1/8	14	3/4	22	x8
7	1/6	15	x1	23	x16

Tap tempo

The 'Tap tempo' parameter allows for a tap tempo function. Typically you would map this to a button push, or a MIDI event. By default it is mapped to the 'L' button.

Two taps are required to set the delay time. Taps more than 11 seconds apart are ignored. When the module is 'listening' for a second tap, a "!" is shown in the display, as in the screenshot above.

Inertia free mode

"Inertia free" mode relates to the algorithm's behaviour when the delay time is changed, either by changing the master delay time, the multiplier, or the four L-L, L-R, etc. times.[8]

When inertia free mode is not activated, the effect is as if the physical tape heads on a tape machine were slid along the tape to adjust the write/read head gap. This results in a characteristic and fairly drastic pitch slew sound.

When inertia free mode is activated, the algorithm crossfades between the old and new delay times, which is much more subtle effect. The length of the crossfade can be set with the 'Inertia fade time' parameter.

Activating inertia free mode forces the algorithm into 48kHz operation.

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8   Granted, the name of this parameter isn't particularly well chosen, but this is what it's called in the VST version, and we're sticking with it for the sake of consistency.

3 – SD Multisample

Video pt1 ▶️

Video pt2 ▶️
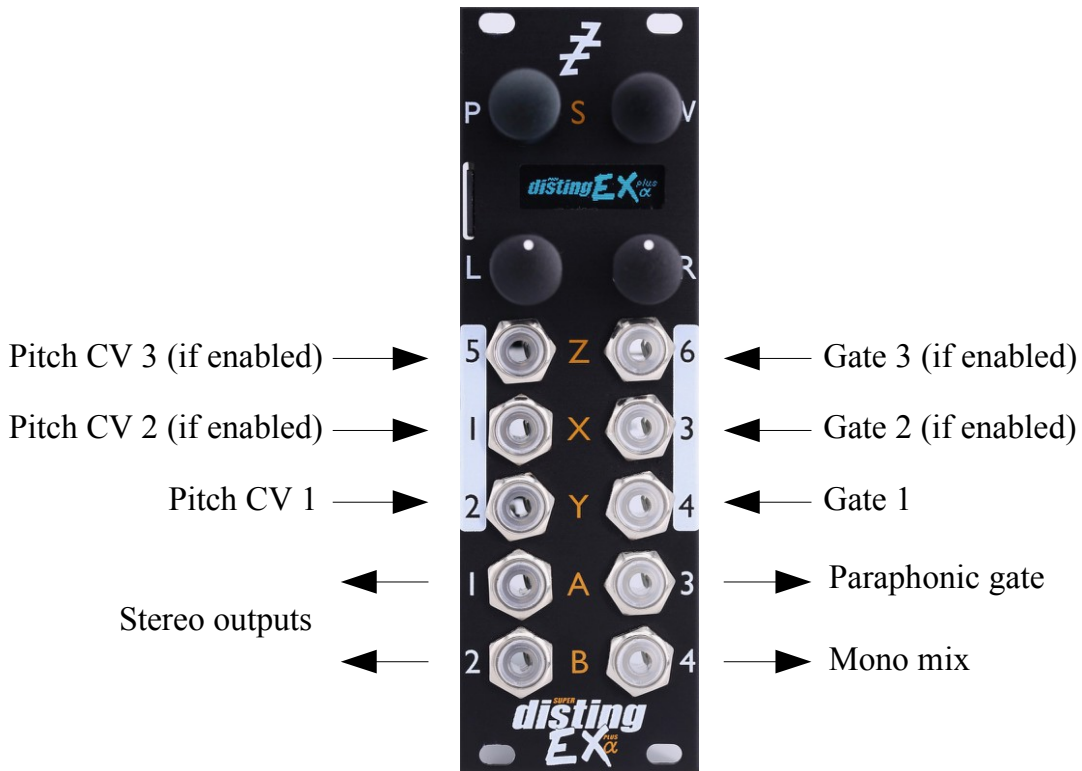
The SD Multisample algorithm is an 8 voice polyphonic sample playback instrument, playing WAV files from the MicroSD card. It can have up to 3 input CV/gate pairs, or can be played via MIDI. It supports both velocity switches and round robins per sample.

There is also a chord and arpeggio generator, based on those in the Expert Sleepers General CV[9] module.

The algorithm is based on the disting mk4's 'J-6 Multisample Audio Playback' algorithm but its capabilities go way beyond that.

The gate inputs are velocity sensitive – the voltage of the gate signal is used like the velocity of a MIDI note. 5V corresponds to maximum velocity.

Please see the section on WAV file naming conventions, below.

The algorithm supports microtonal tunings using Scala – see 'Scala support' below.

Algorithm-specific display

If the Folder parameter is current, the bottom line shows the folder name. Otherwise, it shows the

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9   https://expert-sleepers.co.uk/generalcv.html

file numbers being played by the 8 voices, or "--" if a voice is not playing. The top line shows information for the highest active voice: the file name, the file's natural pitch, and its switch setting.

Outputs

Outputs 1 & 2 are the main stereo outputs.

Output 4 is a mono mix of outputs 1 & 2.

Output 3 is a 'paraphonic gate' – it will be high while any voices are playing.

Parameters

	Name	Min	Max	Default	Unit	Description
1-6	Attenuverter 1-6	-200	200	100	%	Applies an attenuverter to the corresponding input. A negative value indicates that the CV will be inverted.
7	Folder	0	99	0		The folder on the MicroSD card to load the samples from.
8	Env Time	0	100	25		The (release) envelope time. The value 100 means "infinite" - the sample will play forever or until it stops, depending on whether it is looped or one-shot.
9	Input mode	1	3	1		Sets how many input CV/gate pairs the algorithm uses. "1" uses inputs 2/4; "2" adds inputs 1/3; "3" adds inputs 5/6.
10	Octave	-8	8	0		Transposes the whole instrument in octaves.
11	Transpose	-60	60	0		Transposes the whole instrument in semitones.
12	Fine tune	-100	100	0	cents	Tunes the whole instrument in cents.
13	Gain	-40	6	0	dB	Applies an output gain (before saturation, if enabled).
14	Saturation	0	1	1		Enables a soft saturation stage at the output. This will prevent harsh digital clipping, at the expense of some colouration of the sound when driven loud.
15	MIDI vel curve	0	3	0		Selects a velocity curve applied to incoming MIDI notes.
16	Sustain	0	1	0		Activates sustain (notes remain playing when the gate goes low).
17	Sustain mode	0	1	0		Sets the behaviour of the sustain function. The options are "Synth" (sustained notes cannot be retriggered) and "Piano" (sustained notes can be retriggered).
18	Max voices	1	8	8		Sets the maximum number of simultaneous voices.

	Name	Min	Max	Default	Unit	Description
19	Bend range	0	48	2		The pitch bend range, in semitones. Applies both to MIDI pitch bend, and to CV pitch bend, in which case a CV of ±5V maps to the chosen bend range.
20	Pitch bend input	0	6	0		The pitch bend input, or "0" for none.
21-28	Voice 1-8 detune	-100	100	0	cents	Sets a per-voice detune. This could be used for example to mimic an old polysynth with a badly tuned voice card.
29-36	Voice 1-8 bend input	0	6	0		The per-voice pitch bend input, or "0" for none.
37	Chord enable	0	1	0		Enables the chord generator function. (Note: the arpeggiator also requires this to be active.)
38	Chord key	-12	12	0		The key of the chord generator. "0" is C, "1" is C♯/D♭ etc.
39	Chord scale	0	6	0		The scale of the chord generator. See below for the options.
40	Chord shape	0	13	0		The shape of the chord generator. See below for the options.
41	Chord inversion	0	3	0		The chord inversion. For example the first inversion takes the first note of the chord and moves it an octave up, so the lowest note in the chord is now the second (e.g. C E G becomes E G C). See e.g. here[10] for a fuller explanation of inversions.
42-44	Arpeggio 1-3 mode	0	9	0		The arpeggiator mode for each CV/gate input pair. See below for the options.
45-47	Arpeggio 1-3 range	1	3	1		When set to 1, the arpeggio is simply the notes formed by the chord. When set to 2 or 3, a copy of the chord is appended to the pattern, one or two octaves higher, creating a longer pattern that spans multiple octaves.
48	Arp reset input	0	6	0		The input to use as the arpeggiator reset, or "0" for none. A trigger pulse into this input will reset the arpeggiator back to step 1.
49	Gate offset	0	496	0		Offsets (delays) the gate inputs relative to the pitch inputs. This is useful to allow pitch CVs to settle before they are sampled on the rising gate, and also to cope with modules which output both a pitch and gate but change their pitch first.[11]

10 https://en.wikipedia.org/wiki/Inversion_(music)#Inversions
11 For example, while making the demo movie for this algorithm, we discovered that a suitable value for the René mk2 is around 330.

	Name	Min	Max	Default	Unit	Description
50	Scala SCL	0	500	0		Sets the Scala scale file to use, or 0 for none.
51	Scala KBM	0	500	0		Sets the Scala keyboard map file to use, or 0 for none.

Default mappings

Input 1 is mapped to 'Env Time'.

Input 3 is mapped to 'Sustain'.

Chord scales

The available scales are as follows.

Name	Notes	Example (on C)
Major	1, 3, 5, 6, 8, 10, 12	C D E F G A B
Natural Minor	1, 3, 4, 6, 8, 9, 11	C D E♭ F G A♭ B♭
Dominant	1, 3, 5, 6, 8, 10, 11	C D E F G A B♭
Fully Diminished	1, 3, 4, 6, 7, 9, 10, 12	C D E♭ F F♯ A♭ A B
Dominant Dim	1, 2, 4, 5, 7, 8, 10, 11	C D♭ E♭ E F♯ G A B♭
Augmented	1, 4, 5, 8, 9, 12	C E♭ E G A♭ B
Whole Tone	1, 3, 5, 7, 9, 11	C D E F♯ G♯ A♯

Chord shapes

The available shapes are as follows.

Name	Notes (within scale)	Example (in C major)
None	1	C
Octave	1-1(8ve)	C C(8ve)
Two Octaves	1-1(8ve)-1(15ma)	C C(8ve) C(15ma)
Root/Fifth	1-5	C G
Root/Fifth + 8ve	1-5-1(8ve)	C G C(8ve)
Triad	1-3-5	C E G
Triad + 8ve	1-3-5-1(8ve)	C E G C(8ve)
Sus4	1-4-5	C F G
Sus4 + 8ve	1-4-5-1(8ve)	C F G C(8ve)
Sixth	1-3-5-6	C E G A
Sixth + 8ve	1-3-5-6-1(8ve)	C E G A C(8ve)
Seventh	1-3-5-7	C E G B
Seventh + 8ve	1-3-5-7-1(8ve)	C E G B C(8ve)

Name	Notes (within scale)	Example (in C major)
Ninth	1-3-5-7-2(8ve)	C E G B D

Arpeggio modes

The 'Arpeggio 1-3 mode' parameters specify the way in which the notes from the chord are played to create an arpeggio. The options are as follows:

Name	Behaviour	Example (on C major triad)
Up	Notes are played from lowest to highest.	C E G C E G ...
Down	Notes are played from highest to lowest.	G E C G E C ...
Alt	Notes are played alternately up and down.	C E G E C E G ...
Alt2	Notes are played alternately up and down, repeating the top & bottom notes.	C E G G E C C E G ...
Up -8ve	See below.	
Down -8ve	See below.	
Alt -8ve	See below.	
Alt2 -8ve	See below.	
Random	Notes are played in a random order.	

The "-8ve" modes differ from the basic modes in how they treat the Range parameter (above), for shapes which end in "+8ve". As an example, consider the Triad+8ve shape in C major, which contains the notes:
C E G C(8ve)

If Range is set to 2, this pattern is repeated an octave higher, so modes Up/Down/Alt/Alt2 will arpeggiate the notes:
C E G C(8ve) C(8ve) E(8ve) G(8ve) C(15ma)

Note how C(8ve) is repeated. The "-8ve" modes skip this repeated note, so for example the Up-8ve mode will play:
C E G C(8ve) E(8ve) G(8ve) C(15ma) C E G ...

WAV file defaults

Loop setting: the default is for a file to be looping if it has loop markers defined in the file, or to be one-shot otherwise. This can be overridden in the playlist.

Scala support

Video ▶

You can apply microtonal tunings in this algorithm using files in Scala[12] format, placed on the MicroSD card. The files can be generated by the Scala application, any another tool that writes Scala-format files (for example, Scale Workshop[13]), or even written by hand.

Some example files are included on the MicroSD card that comes with the module. Scale files need

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12 http://huygens-fokker.org/scala/
13 https://sevish.com/scaleworkshop/

to go in the folder named 'scl', and keyboard map files need to go in the folder named 'kbm'.

Note that the 'playlist-scales.txt' file required by the dual mode algorithms is not used here. It suffices to simply put the .scl and .kbm files into the right folders.

Select the scale and keyboard mapping using the parameters. If either is 'None', no microtuning will be applied.

If there is a mismatch between the two files (for example, if the keyboard map refers to a scale degree not present in the scale), then this is indicated in the display, and no microtuning is applied.

When active, microtuning is applied both when playing the algorithm over MIDI and when playing using CV/gate.

SoundFont®s

Video ▶

SoundFont[14] is a file format (usually using the .sf2 extension) which rolls up multiple audio samples with data describing how they are to be combined into an instrument. Such samples are ideally matched for use in this algorithm. Sadly the way the data is arranged in the file format does not lend itself to an efficient implementation on the module, so we have not supported being able to directly load .sf2 files from the SD card. However, we have published an open source tool to extract the samples from .sf2 files and to create a folder of WAV files, named appropriately for this algorithm. The tool is here[15].

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14 https://en.wikipedia.org/wiki/SoundFont
15 https://github.com/expertsleepersltd/sf2_to_dex

4 – SD 6 Triggers
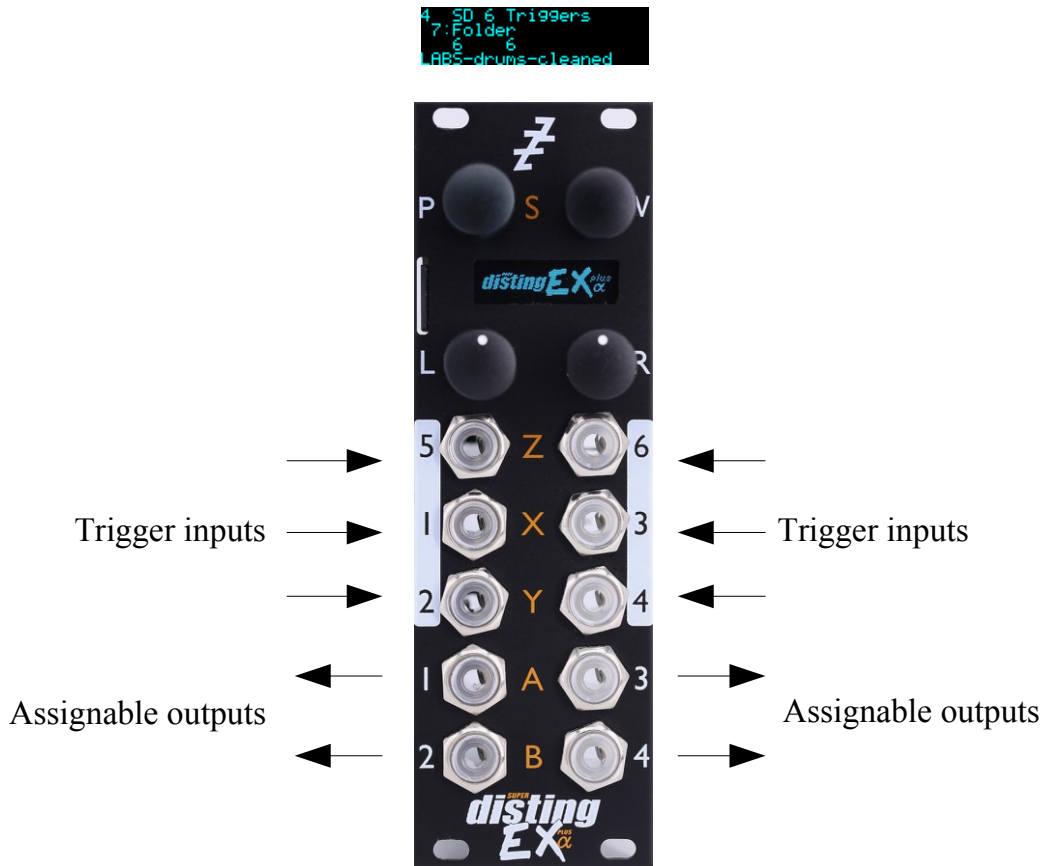
This algorithm, primarily designed for drum sample playback, offers 6 voices with independent triggers and sample selection.

It is somewhat like the disting mk4's 'I-8 Dual Audio Playback with Z Speed' but much more capable.

It supports both velocity switches and round robins per sample.

The gate inputs are velocity sensitive – the voltage of the gate signal is used like the velocity of a MIDI note. 5V corresponds to maximum velocity.

The trigger for each voice is the correspondingly numbered input i.e. input 1 triggers voice 1 etc.

Please see the section on WAV file naming conventions, below.

Algorithm-specific display

If the Folder parameter is current, the bottom line shows the folder name.

If one of the six Sample parameters is current, the bottom line shows the file name. If the voice is playing, the line above also shows the velocity, the velocity switch number and the round-robin number. If there are no round-robins or velocity switches, that number is replaced by ">".

Outputs

Outputs 1-4 are audio outputs. Each voice can be routed to one or a pair of these.

Parameters

	Name	Min	Max	Default	Unit	Description
1-6	Attenuverter 1-6	-200	200	100	%	Applies an attenuverter to the corresponding input. A negative value indicates that the CV will be inverted.
7	Folder	0	99	0		The folder on the MicroSD card to load the samples from.
8-13	Sample 1-6	-1	999	0-5		The sample chosen for the voice. The special value "-1" disables the voice.
14-19	Output 1-6	1	6	5		The output assignment for the voice. 1-4 indicate a single output; "5" indicates outputs 1/2 as a stereo pair; "6" indicates outputs 3/4 as a stereo pair.
20-25	Gain 1-6	-40	6	-6	dB	The gain for each voice.
26-31	Pan 1-6	-100	100	0		The pan position for each voice (if assigned to a stereo output).
32-37	Env Time 1-6	0	100	100		The (release) envelope time. The value 100 means "infinite" - the sample will play forever or until it stops, depending on whether it is looped or one-shot.
38-43	Transpose 1-6	-60	60	0		The transposition of each voice, in semitones.
44-49	Fine tune 1-6	-100	100	0	cents	The fine tuning of each voice, in cents.
50-55	Choke group 1-6	0	3	0		The voice's 'choke group', or "0" for off. When a voice in a choke group is triggered, it ends the playback of any other voices in the same choke group.
56-59	Out 1-4 Saturation	0	1	1		Enables soft saturation on each output. Saturation prevents harsh digital clipping, at the expense of some colouration of the sound when driven loud.

WAV file defaults

Loop setting: the default is for a file to be one-shot (not looping). This can be overridden in the playlist.

5 – WAV Recorder
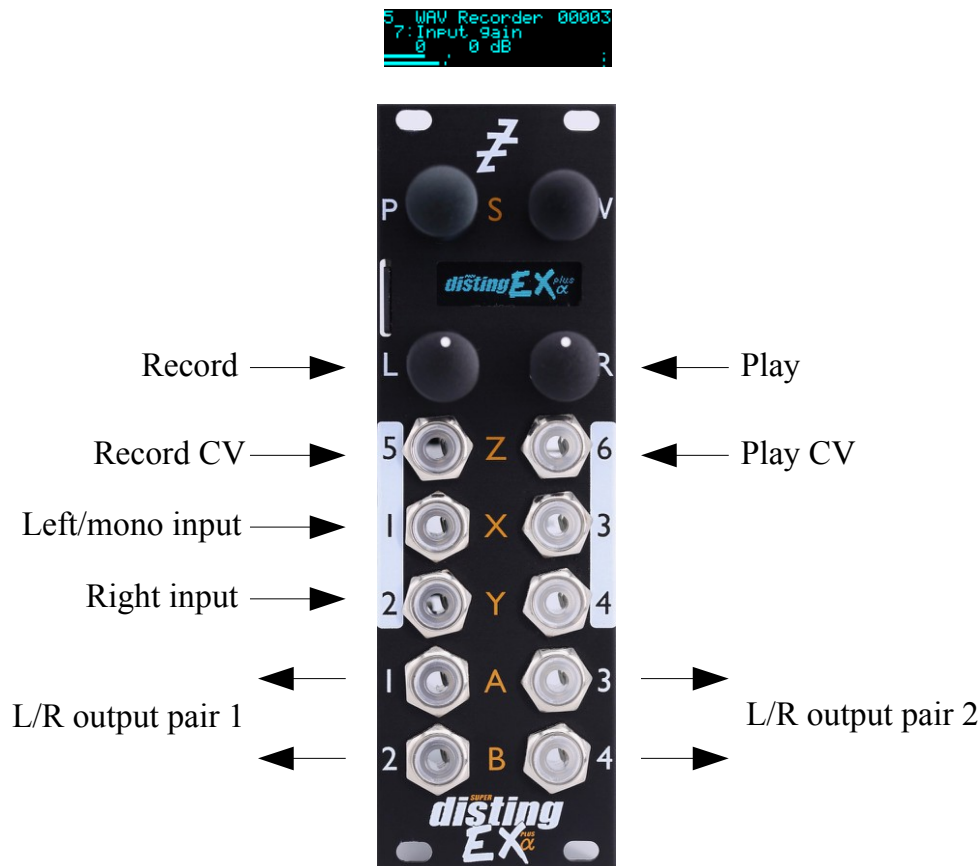
This algorithm records audio (or CV) to the MicroSD card as a WAV file. It can record up to six channels of audio at 48 or 96kHz, 16 or 24 bit. It can also play previous recordings, though the various WAV playing algorithms offer many more possibilities.

There is an "auto-sampler" feature for automatically capturing multi-sampled instruments.

Recording

The files are placed in a folder called "!RECORD" (which will be created by the module if it does not exist). They are named e.g. "REC00001.WAV", where the number increases for each new recording. It can be controlled by pushing the module buttons, or by CV.

> Do not remove the card or power off the module while it is recording.
> Doing so may corrupt the card.

Inputs 1 & 2 are the stereo inputs (use input 1 for mono). When recording more than two channels, use inputs 3-6 as required.

Press 'L' to start and stop recording. Press 'R' to start and stop playback of the last recording. Both knobs can be 'locked' to prevent accidental activation. This is done by turning them anticlockwise. If the button is pressed while locked, the display indicates this:

Recording can also be controlled by a CV into input 5. Playback can be controlled by input 6. Note that when recording five or six channels, these inputs are used for audio. Be sure to switch to five or

six channels *before* connecting the audio signals to the inputs, or you risk attempting to start/stop recording & playback at audio rates, which will not end well.

Multi-channel audio

Recording of more than two channels at once places great demands on the MicroSD card. In our tests we have achieved reliable recording of six channels at 48kHz, 24 bit. You are unlikely to achieve 96kHz recordings of this many channels.

You are advised to thoroughly test your card before relying on it to make any critical recordings.

Currently, playback is only possible for mono or stereo files.

We have published a desktop tool to split multi-channel files into stereo & mono files, which is here[16].

Algorithm-specific display

The bottom of the screen shows a level meter. Each channel has a peak hold and a clip indicator. (The image above shows that the left channel has clipped.) The number at the top right is the number of the last recording – this will be incremented when recording starts.

While recording, the display looks like this:
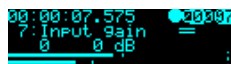
The top line changes to show the time since recording started, a circle to indicate recording, and a barber pole animation over the recording number.

Below the recording number are two horizontal lines, which will grow from left to right. The top line indicates how much data is being written into a memory buffer; the lower line indicates how this data is being transferred to the card. Ideally these will progress in lock-step. If the top line overtakes the lower line, this indicates that the module has been unable to write data to the card fast enough. Unless your recording is shorter than the module's RAM buffer, it is likely to be incomplete. In this case, use a faster card, or use a lower sample rate or bit depth.

While playing back a recording, the display looks like this:
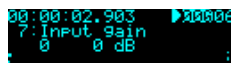
The top line shows the time within the recording, a triangle to indicate playback, and the recording number is superposed with a progress bar indicating the current position within the file.

Outputs

Outputs 1/2 and 3/4 are stereo pairs, whose exact function can be set with the 'Outputs' parameters.

Outputs 3/4 are also used as CV/gate outputs during auto-sampling.

---

16 https://github.com/expertsleepersltd/split_wav

Parameters

	Name	Min	Max	Default	Unit	Description
1-6	Attenuverter 1-6	-200	200	100	%	Applies an attenuverter to the corresponding input. A negative value indicates that the CV will be inverted.
7	Input gain	0	24	0	dB	The gain to apply to the inputs.
8	Sample rate	0	1	0		The sample rate of the recording. The options are 48kHz and 96kHz.
9	Bit depth	0	1	0		The bit depth of the recording. The options are 16 bit and 24 bit.
10	Channels	1	2	2		The number of channels to record.
11	Rec CV Mode	0	1	0		If "0", the record CV control (input 5) is a trigger; if "1", a gate.
12	Play CV Mode	0	1	0		If "0", the play CV control (input 6) is a trigger; if "1", a gate.
13	Play As Loop	0	1	0		Whether to play the recording as a one-shot or a loop.
14	Outputs 1/2	0	2	1		Controls what is output on outputs 1/2. See below for details.
15	Outputs 3/4	0	2	0		Controls what is output on outputs 3/4. See below for details.
16	AS Enable	0	1	0		Enables the auto-sampler.
17	AS Start Note	0	127	21		Auto-sampler start note. (MIDI note number; 48 is 0V for the CV output.)
18	AS End Note	0	127	108		Auto-sampler end note.
19	AS Note Step	1	127	1		Auto-sampler note step.
20	AS Vel Sw	1	9	1		Number of auto-sampler velocity switch layers.
21	AS RRobins	1	9	1		Number of auto-sampler round-robins.
22	AS Coarse	0	60	1	s	Auto-sampler note on time (coarse).
23	AS Fine	-1000	1000	0	ms	Auto-sampler note on time (fine).
24	AS Gap	1	600	1	x100 ms	Auto-sampler gap time (time between note-ons i.e. how long to keep recording after the note).
25	AS Latency	0	960	0		Auto-sampler latency adjustment.

Output options

The following options apply to the "Outputs 1/2" and "Outputs 3/4" parameters.

0	Thru	Output the input signals.
1	Thru/Play	Output the input signals, unless playback is active, in which case output the playback signals.
2	Play	Output the playback if active, else nothing.

Auto-sampler

Video ▶

Video ▶

The auto-sampler feature of this algorithm allows you to automatically create multi-sampled instruments in a format that can be immediately used by the SD Multisample algorithm, by triggering an external synth (by MIDI or CV/gate) and recording the resulting audio.

Use the parameters to set the range of notes to be sampled, and the step size (e.g. every note, every fourth note etc.). You can also choose to sample multiple velocity levels per note, and multiple round-robins of each note.

The selected sample rate, bit depth, and channel count parameters apply as usual.

To begin, set "AS Enable" to 1. Connect your MIDI synth via the breakout, or connect a synth via CV/gate to outputs 3 (CV) and 4 (gate).

Set the length of the note to be played using the "AS Coarse" and "AS Fine" parameters (these are simply added). Set the gap between notes (which should allow time for the release section of the note) with "AS Gap".

You can preview the note timings by pressing the 'R' knob.

This will generate a MIDI note and a gate of the set length, after which "Testing timing" will continue to be shown for the gap time.

This function also helps to set up the latency adjustment. This is unlikely to be necessary when using CV/gate but there will be some delay when triggering a MIDI synth, which if not accounted for will result in a short silence at the start of every sample. To the right of "Testing timing" will appear a number (6 in the screenshot above) which is the number of frames between the note on and the module receiving audio above a threshold (of 100mV). Set the "AS Latency" parameter to a little less than this value. Experiment for best results.

Press the 'L' knob to begin the auto-sampling process.

A new folder will be created on the card named e.g "AUTO0001" and the samples placed therein.

The current filename being recorded is shown on the display.

Pressing 'L' again during auto-sampling will cancel it (leaving any samples recorded so far in place).

WAV file naming conventions and playlists

The disting EX supports WAV file playlists exactly as documented for the disting mk4. However, it also supports naming conventions to set the most commonly used settings without requiring a playlist. Some of these naming conventions set features not available on the mk4 e.g. round robins. Look in the folders on the MicroSD card that is supplied with the module for some examples.

Key	Example	Playlist flag	Description
_<note name>	piano_A2.wav piano_C#5.wav	-natural	Sets the natural note pitch.
_SW<note number>	piano_A2_SW40.wav	-switch	Sets the sample's switch point when used in multisample algorithms. The 'note number' is the MIDI note number, in decimal.
_RR<number>	snare_RR1.wav snare_RR2.wav	N/A	Links files as round-robin variants of the same sample.
_V<number>	snare_V1.wav snare_V2.wav	N/A	Sets up a velocity switched sample. The lowest-numbered _V is used for the lowest velocity.
_CK<number>	amen_CK8.wav	-clocks	Sets the number of clocks per loop for the Clocked Audio Playback algorithm.
_TR<number>	funky_TR4.wav	-triggers	The number of triggers per loop.
_RP	loop_RP.wav	-ramp=1	Rising ramp.
_RN	loop_RN.wav	-ramp=-1	Falling ramp.

If round-robins and velocity switches are combined, the velocity switch comes first e.g.

> snare_V1_RR1.wav, snare_V1_RR2.wav

> snare_V2_RR1.wav, snare_V2_RR2.wav

In other words, each velocity layer can have round-robins.

Per-algorithm defaults

Note that unlike on the disting mk4, where all algorithms use the same default values for playlist settings, the disting EX algorithms may have different defaults. These are noted in the documentation of each algorithm.

Automatic '-natural' values

For the SD Multisample algorithm, if sample files are not assigned a natural pitch (for example, a folder of drum samples), they are assigned values from 48 upwards, so playing a keyboard chromatically from C3 will play a new sample on each semitone.

Automatic '-switch' calculation

If the -switch point for multisample files is not explicitly specified, the disting EX calculates sensible defaults, as follows.

If the gap between neighbouring samples is at most 3 semitones, the switch is set so that the higher

sample is pitched down within the gap.

For larger gaps, the lower sample is pitched up over half the remaining range.

For example:

Gap between samples (semitones)	Behaviour
1	Higher sample stretched down over 1
2	Higher sample stretched down over 2
3	Higher sample stretched down over 3
4	Higher sample stretched down over 3; lower sample stretched up over 1
5	Higher sample stretched down over 4; lower sample stretched up over 1
6	Higher sample stretched down over 4; lower sample stretched up over 2
	Etc.

Settings

The Settings menu provides access to some global settings which are not part of a preset. These settings are stored when changed and reapplied when the module powers up.

```
ings  Settings  Misc
```

General

```
        Settings
tings  General  MIDI/
```
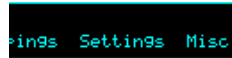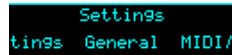
The Settings->General menu contains these settings:

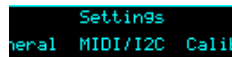| Setting	Value range	Default	Function
Contrast	0-255	127	Sets the display contrast/brightness.
Display blank	1-30	15	The time in minutes after which the display will be turned off, if idle, in order to extend the display's lifespan.
Display flip	0-1	0	Turns the display upside down.
Dual display mode	0-2	0	The display mode when in dual mode – see Error: Reference source not found.
Startup preset	0-256	0	The preset number to load at startup, or '0' for none.
Startup mapping	0-64	0	The mapping number to load at startup, or '0' for none.
Auto(-change) startup preset	0-1	0	If enabled, saving or loading a preset automatically changes the 'Startup preset' setting, so that the module will load the most recently saved/loaded preset when it next powers up.
Auto save (when) change alg(orithm)	0-1	0	If enabled, whenever you change algorithm (in single or dual mode), the preset will be saved to preset slot 1. If you also set the startup preset to 1, this means the module will power up with the most recently chosen algorithm(s).

MIDI/I2C

```
        Settings
eral  MIDI/I2C  Calib
```

This menu contains settings relating to MIDI or I2C communication.

Setting	Value range	Default	Function
Soft thru	0-1	0	If '1', enables a 'soft thru' function i.e. MIDI arriving at the module's MIDI in port will be immediately forwarded to its out port. Note that no attempt is made to correctly merge any MIDI that the module itself may generate.
RX channel (single)	1-16	1	The MIDI receive channel for single mode algorithms.

Setting	Value range	Default	Function
TX channel (single)	1-16	1	The MIDI transmit channel for single mode algorithms.
RX channel (dual L)	1-16	1	The MIDI receive channel for dual mode algorithms running on the left half.
TX channel (dual L)	1-16	1	The MIDI transmit channel for dual mode algorithms running on the left half.
RX channel (dual R)	1-16	2	The MIDI receive channel for dual mode algorithms running on the right half.
TX channel (dual R)	1-16	2	The MIDI transmit channel for dual mode algorithms running on the right half.
I2C address	0-127	49	The module's I2C address.
Select Bus function	0-3	3	The function of the Select Bus – see below.

Favourites

This menu lets you set up the 'favourites' dual mode slots, numbered O-1 to P-8. These slots can be set up to point to any of the dual mode algorithms (A-1 to N-8), allowing convenient access to your most often used algorithms.

Calibration

This menu contains functions relating to the calibration of the module. Note that the module is calibrated in the factory and should not need further calibration by the user.

The 'Calibrate' menu item enters the calibration process – see below for details. If you enter this mode by accident, pressing 'L' cancels it.

'View raw calibration' shows the raw data that the calibration process captures. This is intended for debugging purposes only.

'View input voltages' shows the voltages that the module is reading on its six inputs, with the calibration applied.

Reset Settings

This menu item allows you to reset all settings to their factory defaults. Note that this includes the calibration – the module will need to be recalibrated if you do this.

Miscellaneous functions

Various functions that don't naturally fit anywhere else can be found under the 'Misc' menu.

Show firmware version

Does what it says on the tin.

Reboot

Reboots the module. Any changes to the current preset will be lost.

Show MIDI history

Shows the last four MIDI messages received by the module (most recent at the bottom). At the start of each line is 'R' if the message was received on the Select Bus or 'B' if the message was received via the MIDI breakout.

Show I2C history

Shows the last 16 bytes received on the I2C bus. The address byte is shown inverted.

Show stats

Shows a whole bunch of numbers. For internal developer use.

Tests

The 'Tests' menu provides a number of tests to exercise various parts of the module's hardware. They are mainly for factory use but are also useful to check if things are working correctly at any time.

The available tests are:

Test outputs	Outputs 1-4 output ±10V sine waves at 100Hz, 200Hz, 500Hz and 1kHz respectively.
Test inputs	The module's screen shows an oscilloscope-like view of the input signal of one input at time. It automatically switches to show the active input. Full range on the display corresponds to an input voltage of ±10V.
Test SRAM	Tests the module's SRAM for integrity and displays a pass or fail message.
Test ES-5	Tests an attached ES-5 expansion module. The 8 LEDs on the ES-5 should light in sequence.
Test FHX-8CV	Tests an attached FHX-8CV expansion module. All 8 outputs of the FHX-8CV should show a full range ramp. The FHX-8CV's jumpers should be set to

	'Expansion number 0' (no jumpers on).
Test FHX-8GT	Tests an attached FHX-8GT expansion module. The 8 LEDs on the FHX-8GT should light in sequence. The FHX-8GT's jumpers should be set to 'Expansion number 0' (no jumpers on).
Test MIDI out	Sends MIDI channel 1 CC #0 messages with a value ramping from 0 to 127 from the MIDI breakout's output.
Test select bus out	Sends MIDI channel 1 CC #1 messages with a value ramping from 0 to 127 on the Select Bus.
Test SD speed	Performs a large number of reads from the SD card and presents the resulting timing information.

5-pin DIN MIDI I/O

The disting EX has an expansion header on the PCB which can be used to add a pair of traditional 5-pin DIN MIDI ports to the module (one input/one output). This is compatible with the Expert Sleepers MIDI breakout[17].

Connections

The MIDI ports are exposed on a 4-pin expansion header (labelled GT4/MIDI) on the rear of the module. All of the necessary electronics are on the PCB; all that needs to be added is the actual sockets.

The header pin-out is as follows (pin 1 is closest to the 'GT4' text):

Pin	Function
1	OUT pin 4
2	OUT pin 5
3	IN pin 5
4	IN pin 4

Pin numbers refer to the 5-pin DIN socket as in the MIDI specification[18].

The header is a standard 0.1" pitch header compatible with e.g. typical IDC cable sockets.

When using the Expert Sleepers MIDI breakout, pin 1 of the breakout's header (GT1) corresponds to pin 1 of the disting EX's header (GT4). Orient the ribbon cable to match up these pins. The supplied ribbon cable has two rows of four contacts – use the same row of four at each end.

MIDI "Low-Voltage Signaling"

When MIDI was first conceived, standard logic circuits ran at 5V, and the initial hardware reference designs worked on this assumption. However, there is nothing in the MIDI standard that actually requires a specific voltage, since it operates as a current loop via an opto-isolator.

Nowadays it is much more common for logic to run at 3.3V or lower. The MIDI Manufacturers Association has now released a reference hardware design based on 3.3V, which they call the "Low-Voltage Signaling" standard, and it is this that the disting EX uses.

The disting EX is therefore fully compatible with any device that adheres strictly to the MIDI specification, but may not be with devices that play fast and loose with the spec and assume 5V.

Download the full MIDI electrical specification here[19].

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17 http://expert-sleepers.co.uk/dm4midibreakout.html
18 https://www.midi.org/specifications/item/midi-din-electrical-specification
19 https://www.midi.org/specifications/item/midi-din-electrical-specification

MIDI System Exclusive (SysEx)

The disting EX supports a variety of features via MIDI System Exclusive messages.

SysEx Header

All SysEx messages are prefixed with a manufacturer's ID, which is a unique series of hex bytes assigned by the MIDI Manufacturers Association. The Expert Sleepers ID is 00H 21H 27H, so all SysEx messages relating to Expert Sleepers hardware will begin

```
F0 00 21 27
```

Messages for the disting EX follow this with 5DH:

```
F0 00 21 27 5D
```

and then with a byte to identify the specific type of message e.g.

```
F0 00 21 27 5D 01
```

Received SysEx messages

01H – Take screenshot

```
F0 00 21 27 5D 01 F7
```

This causes the disting EX to respond with a SysEx message containing a screenshot of what is currently on the module's display, using the '33H – Screenshot' format, below.

02H – Display message

```
F0 00 21 27 5D 02 <NULL terminated ASCII string> F7
```

Displays the enclosed string on the disting EX's screen.

22H – Request version string

```
F0 00 21 27 5D 22 F7
```

This causes the disting EX to respond with a SysEx message containing the module's version string as text, using the '32H – Message' format, below.

Sent SysEx messages

32H – Message

```
F0 00 21 27 5D 32 <NULL terminated ASCII string> F7
```

This message is transmitted in response to any request for a string e.g the version string.

33H – Screenshot

```
F0 00 21 27 5D 33 00 00 <screenshot data> F7
```

This message is transmitted in response to a '01H – Take screenshot' message.

Select Bus

The disting EX is capable of both sending and receiving on the Select Bus. Note that the jumper needs to be set appropriately as shown below:

The Select Bus is a means of inter-module communication currently supported by a handful of modules from various manufacturers, including the Malekko Varigate 8+[20], Macro Machines Storage Strip[21] and the Make Noise Tempi[22] & René 2[23].

The disting EX currently only responds to save/recall messages, by saving or loading a preset. It does not initiate anything, in this firmware version.

The message 'Select save' or 'Select load' will appear on the display if the module responds to a Select Bus save/recall.

Any MIDI that arrives on the Select Bus that is not explicitly part of the Select Bus protocol can be used as if it arrived on the disting's regular MIDI input – see above. This is controlled by the 'Select Bus function' setting (see Settings, above). The options are:

| Setting value	Setting	Notes
0	Disabled	The Select Bus is completely disabled.
1	Only Select Bus	Only Select Bus protocol messages (save & recall) will be processed.
2	Only MIDI	All MIDI arriving on the Select Bus (including Program Change messages that would normally indicate a save or recall) is used as regular MIDI. The Select Bus essentially becomes an additional MIDI input port.
3	Select Bus & MIDI	Select Bus save & recall messages are used as such; any other MIDI is used as regular MIDI messages.

The default is 'Select Bus & MIDI'.

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20 https://malekkoheavyindustry.com/product/varigate-8/
21 http://macromachines.net/products/storage-strip/
22 http://www.makenoisemusic.com/modules/tempi
23 http://makenoisemusic.com/modules/rene

I2C Connection

The disting EX supports an [I2C](24) connection, via the header on the PCB marked "JP2". The GND, SCL & SDA lines are clearly marked on the PCB. Be sure to connect these to the corresponding lines on the other I2C device(s) in use.
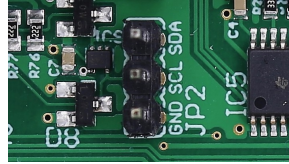
Make/remove I2C connections with the power off.

An I2C bus requires that somewhere on the bus are a pair of "pull up" resistors. The disting EX provides these on a switch labelled 'SW2':
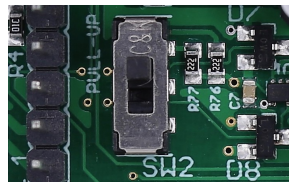
The pull up resistors are enabled if the switch is towards the power connector (as shown in the photo above), and disabled in the other position.

Devices on an I2C bus have an address, which a sending device uses to identify the intended recipient. The disting EX's address is set in the Settings (see above).

Currently the disting EX sends no messages on the I2C bus. It receives messages in the following format:

<address> 11H <controller number> <value MSB> <value LSB>

These messages are used via the Mappings (see above) to control algorithm parameters.

You may find the 'Show I2C history' menu item (above) helpful.

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24 https://en.wikipedia.org/wiki/I²C

Calibration

The calibration menu is accessed via the settings, as described above.

Calibration requires a 3V voltage reference. Any stable and accurate voltage source can be used. It's a good idea to let the whole system warm up for 5 minutes before calibrating to stabilise any temperature-dependent factors.

The process can be cancelled at any time by pressing the 'L' knob.

The procedure is as follows:

1. With the disting powered up and with nothing connected to it, use the menu to select 'Calibrate'.

2. Calibration will begin immediately.

3. Wait for the display to show 'Waiting: A->X B->Y'.

4. Using patch cables (as short as possible), connect the left output A to input X, and output B to input Y.

5. Press the 'P' encoder.

6. After a short delay, all four jack sockets should light up red. After another short delay, the display will show 'Waiting: 3V -> X'.

7. Remove the patch cables. Connect the 3V voltage reference to input X.

8. Repeat steps 6 & 7 for inputs Y & Z.

9. Remove the voltage reference, and repeat steps 3-8 for the right side.

All being well, the display will show 'Calibration complete', and the new calibration will be saved. If the calibration failed, the display will show 'Calibration failed' and the calibration stored in the settings will not be overwritten.

Firmware Updates

Video ▶

The disting EX's firmware can be updated using a MicroSD card. (See 'Supported MicroSD cards' above.) The process is as follows:

- Download the firmware from the Expert Sleepers website.

- Unzip the download.

- Copy the file (which will be named something like 'distingEX_1.0.0.hex') from the unzipped download to the root folder of a MicroSD card.

- Turn off the disting and insert the MicroSD card into the socket.

  - The exposed contacts of the card should face towards the display; the angled side of the card itself points up.

  - **You are advised to observe basic ESD (electrostatic discharge) precautions** - see for example here. Don't be wearing a nylon sweater in an air conditioned room.

- Turn on the disting EX with the P knob pressed. It will go through the first stage of its startup sequence, showing the bootloader version number.

- Hold P until the display changes. If the module finds firmware files on the card, it will show 'Choose firmware to install:' and then a filename.

- Turn the 'V' knob to select the firmware you want to install, then press 'V' to begin the installation.

- The module should show the message "Flashing..." and a progress indictor.

- Finally it should show "Success! Press left encoder to reboot" at which point you can press 'P' to reboot or simply turn off the power.

- Any other message indicates a problem.

Where to get help

Please see this page[25].

Acknowledgments

The disting EX logo and boot animation were designed by Andrew Beltran.

The font used in the disting mk4 (and so also in the disting EX's 'retro' mode) is an adapted version of 'Tom Thumb' by Robey Pointer. More on the font here[26].

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25 https://www.expert-sleepers.co.uk/contact.html
26 https://robey.lag.net/2010/01/23/tiny-monospace-font.html