

## Ekmelily - Notation of Microtonal Music

Ekmelily is an extension for [LilyPond](#) that supports variable accidentals and key signatures for the notation of microtonal music in several equal-temperament tunings -- 12, 19, 24, 31, 36, 48, 53, 72-EDO -- and in 5-limit JI. For this purpose, it introduces [predefined](#) and [user-defined](#) notation styles. Each style describes a set of symbols for the alterations up to the five-quarters-tone, at most. Furthermore, Ekmelily defines own [note names](#) based on the names for semi- and quarter-tones given in LilyPond.

Ekmelily requires LilyPond version 2.19.22 or higher.

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## Contents

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Author and License . . . . .	3
Download and Installation . . . . .	4
Usage . . . . .	5
Fonts . . . . .	6
Tunings . . . . .	7
Languages and Note names . . . . .	8
Predefined Notation Styles . . . . .	9
User-defined Notation Styles . . . . .	12
Special Symbols . . . . .	13
Additional Commands . . . . .	14
Examples . . . . .	15

## Author and License

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## Download and Installation

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### Download

The folder `ly` contains the include files.

- Copy the file(s) for the desired [tuning\(s\)](#) as well as the main include file `ekmel-main.ily` into an appropriate folder, e.g. `LILYPOND/usr/share/lilypond/current/ly` with `LILYPOND` meaning the installation folder of LilyPond.
- Optionally install a [font](#) , e.g. [Ekmelos](#) .

**Note:** To make use of a newly installed font in LilyPond prior to 2.24, its font cache, i.e. the folder `~/.lilypond-fonts.cache-2` (on Windows `%HOMEPATH%\lilypond-fonts.cache-2`) must be emptied or completely deleted. So at the next execution of LilyPond this cache will be rebuilt from scratch including the new font.

## Usage

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Add the following lines near the top of your LilyPond input file. All commands are optional -- except for `\include` of the desired [tuning](#) -- but should be specified in this order.

```
ekmelicFont = FONTNAME
\include "ekmel..."
\language "LANGUAGE"
\ekmelicStyle STYLENAME
\ekmelicUserStyle USERSTYLENAME #'(
  (ALTERATION ELEMENT ...)
  ...
)
```

## Ekmelily + Esmuflily

To combine Ekmelily with [Esmuflily](#), add e.g. the following lines near the top of your LilyPond input file. This achieves LilyPond's standard behaviour, i.e. Dutch note names and Stein / Couper accidentals (`stc`) for quarter-tones (24-EDO). The first line can be omitted when using [Ekmelos](#).

```
ekmelicFont = FONTNAME
\include "ekmel-24.ily"
\include "esmufl.ily"
\language "nederlands"
\ekmelicStyle stc
```

## Fonts

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Ekmelily requires a font for accidentals defined by code point, character literal, or string. This applies to all accidentals in the [predefined notation styles](#). Each of them is a [SMuFL](#) Recommended character or [Ekmelos](#) specific Optional glyph.

Ekmelily uses [Ekmelos](#) by default. Another font can be selected, either with the variable

```
ekmelicFont = FONTNAME
```

before the include file, or with the command line option

```
-dekmelic-font=FONTNAME
```

Note: This option produces a warning 'no such internal option', which can be ignored. Warnings can be suppressed with the command line option `--loglevel=ERROR` or `--loglevel=NONE`.

The glyphs from LilyPond's Emmentaler font can be used with markup in a [user-defined notation style](#). See the [Example](#) `lilysingle`.

## Tunings

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Ekmelily supports different tunings available as separate include files. Each provides its own set of [languages](#) and [predefined notation styles](#). The first language and stylename specified in the following table is the default in the respective tuning. Some languages have alias names (in parentheses).

Tuning	Include file	Language	Stylename
12	ekmel-12.ily	nederlands english deutsch català (catalan) español (espanol) italiano français português (portugues) norsk suomi svenska vlaams	std sag msag
19	ekmel-19.ily	nederlands english deutsch català (catalan) español (espanol) italiano français português (portugues) norsk suomi svenska vlaams	std sag msag
24	ekmel-24.ily	nederlands english deutsch català (catalan) español (espanol) italiano français português (portugues) norsk suomi svenska vlaams	stc stz go stvt arrow sag msag arabic persian four haba
24	ekmel-arabic.ily	italiano	arabic
31	ekmel-31.ily	nederlands deutsch español (espanol) français italiano português (portugues)	std sag msag stz sth
36	ekmel-36.ily	nederlands english deutsch norsk suomi svenska	go arrow sag msag wys bos haba
48	ekmel-48.ily	nederlands english deutsch	sag msag gostz
53	ekmel-53.ily	makam thm ktm english number	aeu aeuek thm sag dia
72	ekmel.ily	nederlands english deutsch norsk suomi svenska	arrow rhm sims hesse sag msag wys gostz gostc bos fern haba
5Jl	ekmel-5ji.ily	nederlands	sag msag he

**Note:** `ekmel-arabic.ily` is a variant of `ekmel-24.ily` for Arabic scores, like LilyPond's `arabic.ly` but with the correct accidentals U+ED30 - U+ED38. It supports Arabic maqamat and defines only the Arabic notation and Italian note names, so the commands `\ekmelicStyle` and `\language` are not required.

## Languages and Note names

---

Each [tuning](#) supports several languages for note names, which can be selected with the command

```
\language "LANGUAGE"
```

If LANGUAGE is not supported in the respective tuning, the default language is selected (usually `nederlands`). The note names are based on the names for semi- and quarter-tones given in LilyPond. See the [Tables](#) with all note names.

## Enharmonically equivalent note names

Some notation styles support two distinct, enharmonically equivalent accidentals, e.g. `arrow`, `hesse`, `rh`, and `sims` for the one-quarter-tone and the three-quarters-tone. Therefore, Ekmelily defines two note names each, e.g. `cqs` and `csaqf` (english) or `cih` and `ciseh` (deutsch). However, LilyPond does not support different accidentals for the same alteration. As a provisional solution, the combined note names like `csaqf` and `ciseh` have slightly differing alterations ( $+1/1024$ ) and therefore cause inaccurate MIDI output.

## NoteNames context

Ekmelily supports the `NoteNames` context and its properties. Note names can be drawn in any supported language by setting the `printNotesLanguage` property. Else, the language selected for music entry is used.

The format can be specified with the `printAccidentalNames` property (the first three values are equivalent to LilyPond's normal behaviour):

<code>#t</code>	Scale name and accidental (default)
<code>#f</code>	Scale name
<code>'lily</code>	Note name
<code>'all</code>	All alias note names stacked vertically
<code>'alteration</code>	Alteration name
<code>'fraction</code>	Scale name and fraction of alteration
<code>'accidental</code>	Accidental



## Predefined Notation Styles

Each [tuning](#) supports several predefined notation styles, which can be selected with the command

```
\ekmelicStyle STYLENAME
```

If STYLENAME is not supported in the respective tuning, the default notation style is selected. This can be overridden with the command line option

```
-dekmelic-style=STYLENAME
```

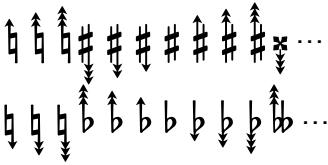

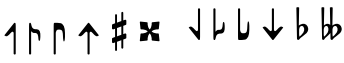
**Note:** This option produces a warning 'no such internal option', which can be ignored. Warnings can be suppressed with the command line option `--loglevel=ERROR` or `--loglevel=NONE`.

The following table shows all predefined notation styles. N indicates the default style in tuning N.

All accidentals in these styles require a [SMuFL compliant font](#). All optional glyphs are private supplements of [Ekmelos](#). See the [Tables](#) with alterations, the [Documentation](#), or [SMuFL](#) for details on the accidentals (code points, glyph names etc.)

Stylename		Tunings	Accidentals
std	Standard	<u>12</u> <u>19</u>	# x b bb
	Standard	<u>31</u>	↑ # x ↓ b bb
stc	Stein / Couper	<u>24</u>	# # # x d b db bb
stz	Stein / Zimmermann	24 31	# # # x d b db bb
stvt	Stein / Van Blankenburg / Tartini	24	# # # x l b lw bb
sth	Stein / Half flat Uses the optional glyphs U+F612 - U+F613 for the semi-flats.	31	# # # x l b lw bb
four	Digit 4	24	<sup>4</sup> # # x <sup>4</sup> b b bb
go	Gould	24 <u>36</u>	<sup>h</sup> # # <sup>h</sup> # x x <sup>h</sup> x <sup>h</sup> ↓ <sup>h</sup> b b <sup>h</sup> ↓ bb bb <sup>h</sup> ↓
arabic	Arabic See <code>ekmel-arabic.ily</code> for Arabic maqamat.	24	# # # x t b lb bb
persian	Persian See <a href="#">Persian music notation</a> for proper Persian microtonal alterations, note names, keys, etc.	24	‡ # x ‡ b bb

Stylename		Tunings	Accidentals
aeu	Arel-Ezgi-Uzdilek Uses the optional glyph U+F619 for the reversed slashed flat. See LilyPond's <code>turkish-makam.ly</code> for keys.	<u>53</u>	$\sharp \sharp \sharp \sharp \sharp \times \flat \flat \flat \flat \flat \flat$
aeuek	Arel-Ezgi-Uzdilek Equals <code>aeu</code> but does not use the reversed slashed flat, i.e. <code>eksik-bakiye</code> = <code>koma</code> .	53	$\sharp \sharp \sharp \sharp \sharp \times \flat \flat \flat \flat \flat \flat$
dia	Diatonic Uses the optional glyphs U+F61C - U+F61D for the quadruple sharp / flat.	53	$\sharp \times \times \sharp \times \times \flat \flat \flat \flat \flat \flat$
thm	Turkish folk music	53	$\sharp^1 \sharp^2 \sharp^3 \sharp^4 \sharp^5 \flat^1 \flat^2 \flat^3 \flat^4 \flat$
arrow	Arrow	24 36 <u>72</u>	$\uparrow \uparrow \uparrow \sharp \times \searrow \downarrow \downarrow \flat \flat$
bos	Bosanquet commatic	36 72	$\swarrow \sharp \times \searrow \flat \flat$
haba	Hába	24	$\flat \sharp \sharp \sharp \times \flat \flat \flat \flat \flat \flat$
	Hába Uses the optional glyphs U+F660 - U+F670.	36 72	$\flat \flat \flat \flat \flat \flat \flat \flat \flat \flat \flat \flat \times$ $\flat \flat \flat \flat \flat \flat \flat \flat \flat \flat \flat \flat$
wys	Wyschnegradsky	36 72	$\flat \flat \flat \flat \flat \sharp \sharp \sharp \sharp \sharp \times$ $\flat \flat \flat \flat \flat \flat \flat \flat \flat \flat \flat \flat \flat \flat \flat \flat$
fern	Ferneyhough	72	$\sharp \sharp \sharp \sharp \sharp \times \flat \flat \flat \flat \flat \flat$
gostc	Gould / Stein / Couper	72	$\sharp \sharp \sharp \sharp \sharp \sharp \times \times \times$ $\flat \flat \flat \flat \flat \flat \flat \flat \flat \flat \flat \flat$
gostz	Gould / Stein / Zimmermann	48 72	$\sharp \sharp \sharp \sharp \sharp \sharp \times \times \times$ $\flat \flat \flat \flat \flat \flat \flat \flat \flat \flat \flat \flat$
hesse	Hesse Uses the optional glyphs U+F606 - U+F60B for the degrees within the semitone.	72	$\uparrow \uparrow \uparrow \sharp \times \searrow \downarrow \downarrow \flat \flat$
rhm	Richter Herf / Maedel Uses the optional glyphs U+F600 - U+F605 for the degrees within the semitone.	72	$\sharp \sharp \sharp \sharp \sharp \times \searrow \downarrow \downarrow \flat \flat$
sims	Sims	72	$\uparrow \uparrow \uparrow \sharp \times \searrow \downarrow \downarrow \flat \flat$

Stylename		Tunings	Accidentals
he	Extended Helmholtz-Ellis	5JI	
sag	Sagittal	12 19 24 31 36 <u>48</u> 53 72 <u>5JI</u>	
msag	Mixed Sagittal Uses the large double sharp U+E47D. Hence it is different from std even for 12-EDO.	12 19 24 31 36 48 72 5JI	
void	No accidentals	all	

The universal notation style `void` defines no accidentals at all, except for the [special symbols](#) . As a consequence, the default accidental is drawn for each alteration. See the [Example](#) `numeric` which makes use of `void`.

## User-defined Notation Styles

---

A new notation style derived from the currently selected style can be created with the command

```
\ekmelicUserStyle USERSTYLENAME #'(
  (ALTERATION ELEMENT ...)
  ...
)
```

USERSTYLENAME is a freely chosen style name. If it is an empty string "", the name of the currently selected style extended with the suffix `-user` is taken.

ALTERATION is a rational number or the name of a [special symbol](#). For each specified alteration, a new symbol is defined which is the composition of the elements. For all other alterations where the previous symbol of ALTERATION appears likewise (usually combined with other symbols), this symbol is also replaced with the new one. Therefore, the order of alterations in the definition list can be significant, in particular, when a replaced symbol is again defined but for another alteration. See the [Example](#) `diaQuarter`.

ELEMENT is one of the following:

- a code point (integer), e.g. `#xE47B` for Wilson plus
- a character literal, e.g. `#\b` for flat
- a string, e.g. `"bb"` for double-flat
- markup, e.g. `, (markup #:semisharp)`

Two or more elements are juxtaposed with a padding of 0.12 staff units, but no extra space is inserted between the characters of a string. Note that in a [SMuFL compliant font](#), all accidental glyphs have a zero side-bearing. This also applies to the Basic Latin (ASCII) characters in the [Ekmelos](#) font, so that e.g. `"bb"` is drawn without a padding, contrary to `#\b #\b`. See the [Example](#) `hewm`.

## Special Symbols

---

Every notation style includes three special symbols. They can be **user-defined** like accidentals by specifying the respective name instead of an alteration.

```
\ekmelicUserStyle USERSTYLENAME #'(
  (leftparen ELEMENT ...)
  (rightparen ELEMENT ...)
  (default ELEMENT ...)
  ...
)
```

- `leftparen` : Left parenthesis for cautionary accidentals. Predefined is U+E26A.
- `rightparen` : Right parenthesis for cautionary accidentals. Predefined is U+E26B.
- `default` : Default accidental for alterations which are not defined in the selected notation style. This applies to the style `void` and to some styles in `ekmel-53.ily`, or it can occur with `\transpose`. Predefined is no symbol.

## Additional Commands

---

`\ekmelicOutputSuffix`

Set the name of the selected notation style as the output filename suffix for the current `\book` section.

`\ekmelic-style-name`

Draw the name of the selected notation style as markup.

`\ekmelic-font-name`

Draw the name of the selected font as markup.

`\ekmelic-char ALTERATION`

Draw the accidental of ALTERATION (a rational number) according to the selected notation style as markup.

Used property:

- `font-size (1)`

`\ekmelic-elem ELEMENT`

Draw ELEMENT with the selected font as markup. ELEMENT is a code point (integer), a character literal, a string, or markup. This command is intended to combine glyphs from the selected font with other markup in a [user-defined notation style](#).

`\ekmelic-fraction ALTERATION`

Draw ALTERATION (a rational number) as markup. If the denominator is 1, only the numerator is drawn.

`\ekmelic-fraction-small ALTERATION`

Draw ALTERATION (a rational number) as markup with a 3 steps smaller font size. If the denominator is 1, only the numerator is drawn, but with the current font size.

Used property:

- `font-size (0)`

`\ekm-fraction ARG1 ARG2`

Draw a fraction of ARG1 and ARG2 as markup. This command is a variant of LilyPond's `\fraction` with consistent vertical alignment. It is used by the above commands.

Used property:

- `font-size (0)`

`\ekmelic-table NATURAL COMPOSITE ORDER`

Draw a table of all accidentals in the selected notation style as markup, including the natural symbol if NATURAL is true, and all composite accidentals if COMPOSITE is true. [Enharmonically equivalent](#) accidentals and [special symbols](#) are always ignored. The accidentals are arranged in a row with the respective alteration placed beneath, and sorted by ascending or descending alteration if ORDER is 1 or -1, respectively, or by absolute alteration if ORDER is 2 or -2.

Used properties:

- `font-size (0)`
- `width (4)`: Horizontal extent for each accidental.
- `baseline-skip`: Distance between accidental and alteration.

## Examples

---

See also the file `styles/user-styles.ly` for further examples of user-defined styles.

```
ekmelicFont = "Bravura"
\include "ekmel.ily"
\language "english"
\ekmelicStyle sims
```

Sets the predefined Sims notation for 72-EDO, selects the English note names, and draws the accidentals with the Bravura font.

```
\include "ekmel-24.ily"
\ekmelicStyle stz
\ekmelicUserStyle myNotation #'(
  (-3/4 #xE327)
  (1 #xE262 #xE262))
```

Sets the predefined Stein / Zimmermann notation (`stz`) for quarter-tones (24-EDO) and modifies it into a user-defined notation with the Sagittal flat 11 medium diesis down symbol  $\Downarrow$  (U+E327) for three-quarter-tones flat, and two sharp symbols  $\sharp$  (U+E262) for double-sharp.

```
\include "ekmel-24.ily"
\ekmelicStyle stz
\ekmelicUserStyle myNotation #`(
  (,THREE-Q-FLAT #xE327)
  (,DOUBLE-SHARP #xE262 #xE262))
```

This is the same example as above but it makes use of the corresponding Scheme symbols.

```
\include "ekmel.ily"
\language "english"
\ekmelicUserStyle hewm #'(
  (1 #\x)
  (-1 #\b #\b)
  (1/2 #\#)
  (-1/2 #\b)
  (1/4 #\^ )
  (-1/4 #\v)
  (1/6 #\>)
  (-1/6 #\<)
  (1/12 #\+)
  (-1/12 #\-) )
```

Sets the **HEWM** (Helmholtz / Ellis / Wolf / Monzo) notation for 72-EDO and selects the English note names. Note that double-flat is defined with `#\b` `#\b` which is drawn with a padding contrary to `"bb"` .

```
\include "ekmel-24.ily"
\language "nederlands"
\ekmelicStyle stz
\ekmelicUserStyle stockhausen #'(
  (1/4 #xED58)
  (-1/4 #xED59)
  (3/4 #xED5A)
  (-3/4 #xED59 #xE260))
```

Sets the notation after Karlheinz Stockhausen for 24-EDO with the fractional sharp symbols

♯ (U+ED58, U+ED5A), and the quarter-tone flat symbol ♭ (U+ED59), and selects the Dutch note names.

```
\include "ekmel.ily"
\ekmelicUserStyle smuflHesse #'(
  (1/4 #xE27A)
  (-1/4 #xE27B)
  (1/6 #xE2A4)
  (-1/6 #xE2A1)
  (1/12 #xE479)
  (-1/12 #xE47A))
```

Sets a variant of the Hesse notation for 72-EDO using SMuFL characters: Gould arrows

↑ ↓ (U+E27A, U+E27B), Sims half arrows ↗ ↘ (U+E2A4, U+E2A1), and Bosanquet commatic symbols ↗ ↘ (U+E479, U+E47A). It is very similar to the Arrow notation.

```
\include "ekmel-24.ily"
\ekmelicUserStyle diaQuarter #'(
  (1 #xF61C)
  (-1 #xF61D)
  (3/4 #xE265)
  (-3/4 #xE266)
  (1/2 #xE263)
  (-1/2 #xE264)
  (1/4 #xE262)
  (-1/4 #xE260)
  (5/4 #xF61C #xE262)
  (-5/4 #xF61D #xE260))
```

Sets the Standard sharp / flat symbols, single thru quintuple, like the predefined Diatonic notation (`dia`) but for quarter-tones (24-EDO). The quadruple symbols **xx** **||||** (U+F61C, U+F61D) are private supplements of the [Ekmelos](#) font. Note that here, the order of alterations is significant since the standard accidentals in the default notation (`stc`) are rearranged.



```

\include "ekmel-48.ily"
\ekmelicUserStyle lilysingle #`(
  (0      , (markup #:natural))
  (1/8    , (markup #:musicglyph "accidentals.natural.arrowup"))
  (-1/8   , (markup #:musicglyph "accidentals.natural.arrowdown"))
  (1/4    , (markup #:semisharp))
  (-1/4   , (markup #:semiflat))
  (3/8    , (markup #:musicglyph "accidentals.sharp.arrowdown"))
  (-3/8   , (markup #:musicglyph "accidentals.flat.arrowup"))
  (1/2    , (markup #:sharp))
  (-1/2   , (markup #:flat))
  (5/8    , (markup #:musicglyph "accidentals.sharp.arrowup"))
  (-5/8   , (markup #:musicglyph "accidentals.flat.arrowdown"))
  (3/4    , (markup #:sesquisharp))
  (-3/4   , (markup #:sesquiflat))
  (7/8    , (markup #:musicglyph "accidentals.sharp.slashslashslash.stemstem"))
  (-7/8   , (markup #:musicglyph "accidentals.flatflat.slash"))
  (1      , (markup #:doublesharp))
  (-1     , (markup #:doubleflat))
  (leftparen , (markup #:musicglyph "accidentals.leftparen"))
  (rightparen , (markup #:musicglyph "accidentals.rightparen")))

```

Sets the Standard sharp / flat symbols and other single glyphs for quarter- and eighth-tones (48-EDO), as well as for parentheses of cautionary accidentals, from LilyPond's Emmentaler font.  $\pm 9/8$  and  $\pm 5/4$  are omitted here since they are set automatically to combinations of  $\pm 1$  with  $\pm 1/8$  and  $\pm 1/4$ .

```

#(define-markup-command (numeric-accidental layout props)
  ()
  (let ((alt (ly:chain-assoc-get 'alteration props 0)))
    (interpret-markup layout
      (cons '((font-size . -3)) props)
      (markup #:vcenter #:ekmelic-fraction alt))))

\ekmelicStyle void
\ekmelicUserStyle numeric #`(
  (default , (markup #:numeric-accidental)))

```

Sets alteration values instead of accidental symbols drawn as fraction, or integer if the denominator is 1, with the command `\ekmelic-fraction` and a 3 steps smaller font size. It is applicable to all tunings. The `void` notation ensures that the default accidental is used for each alteration.