

fonts-znam — fonts for Znamenny Notation

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version 1.1

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1 Introduction

This package provides OpenType-CFF PostScript fonts (.OTF fonts) for typesetting Znamenny Musical Notation encoded in Unicode. Znamenny Notation was proposed for inclusion in Unicode by the authors and has been accepted for encoding in a future version of the Unicode Standard. The latest versions of the fonts may be downloaded from the Slavonic Computing Initiative website. Before using the fonts, we suggest reading the Proposal to become familiar with the encoding methodology (see [1]).

Warning: The characters used to write the Znamenny Musical Notation have been accepted for encoding in a future version of the Unicode Standard, however the codepoints may still be subject to change. As such, these fonts should be considered BETA-stage software, and should be used for SOFTWARE-TESTING PURPOSES ONLY.

Color Data: The fonts provide information about the color of some glyphs (such as the cinnabar marks) via data in the COLR and CPAL tables. However, COLR / CPAL technology is presently not supported by some software. Color fonts are supported in modern browsers and advanced publishing software and partially supported in Microsoft Office 365. Color fonts are not supported in X_YT_EX or LuaT_EX, however the churchslavonic L^AT_EX package provides the `autocolormarks` option, which uses the `\cuKinovar` macro to automatically typeset the cinnabar marks in red. The latest version of the fonts also provides color data in SVG tables, which allows for automatically coloring cinnabar marks in software that supports OpenType-SVG fonts, such as Adobe Photoshop, InDesign and Illustrator.



Figure 1: Example of Type A Znamenny Notation

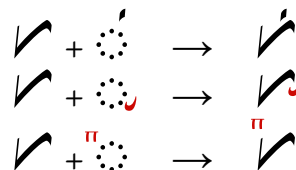
In other software that does not support color fonts, cinnabar marks will appear in black. Additionally, attempting to manually color the marks using formatting will generally break the OpenType glyph positioning rules, leading to improper mark positioning. You are encouraged to only use the fonts in software that supports color fonts. You can report your results in the issue tracker.

2 Mezenets Unicode

Mezenets Unicode is a font intended for typesetting Type A Znamenny Notation (notation that includes *priznaki*¹) and Type B Notation (notation without *priznaki*), as well as both old-style and new-style Put / Demestvenny (Kazan) Notation. An example of Znamenny Notation bearing *priznaki* is presented in Figure 1. The neumes are encoded at codepoints indicated in Table 1, and may be entered directly by codepoint, for example, from a Character Map utility (this is not recommended), or by using one of the entry methods provided.

2.1 Black and Red Modifier Marks

All modifying marks are entered following the base neume that they modify and are positioned by the rendering system in accordance with the anchor points provided in the font. This includes the cinnabar pitch marks, which are still entered following the base neume, even though they are generally positioned to the left of the neume that they modify.



Note: The font provides both left-attaching and right-attaching cinnabar pitch marks. The left-attaching pitch marks (which are standard) are encoded in Unicode at the codepoints U+1CF00 to U+1CF0B. The right-attaching pitch marks are rarely encountered in standard Znamenny Notation, but are commonly used in Put / Demestvenny Notation; they are encoded at the codepoints U+1CF0C to U+1CF17 (see Table 1).

¹The Church Slavonic term “priznaki” (sing. “priznak”) is pronounced with the stress on the second syllable, unlike its modern Russian paronym.

Table 1: Unicode Codepoints for Znamenny and Put / Demestvenny Notations

	1CF0	1CF1	1CF2	1CF3	1CF4	1CF5	1CF6	1CF7	1CF8	1CF9	1CFA	1CFB	1CFC
0													
1													
2													
3													
4													
5													
6													
7													
8													
9													
A													
B													
C													
D													
E													
F													

Key: Control Characters
 Characters Unique to Archaic Znamenny Notation
 Characters Unique to Put / Demestvenny Notation

<i>Base Neumes</i>	<i>Control Characters</i>	<i>Black Pitch Marks</i>	<i>Black Modification Marks</i>	<i>Left-Attaching Pitch Marks</i>	<i>Red Modification Marks</i>	<i>Right-Attaching Pitch Marks</i>
						
<i>etc.</i>						

Table 2: Order of encoding (from left to right)

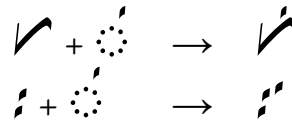
$$\begin{array}{c} \text{1CF57} \end{array} + \begin{array}{c} \text{1CF06} \end{array} + \begin{array}{c} \text{1CF10} \end{array} \rightarrow \begin{array}{c} \text{1CF57} \end{array}$$

Multiple modifying marks may be entered following any base neume. Generally speaking, the rendering system will position the marks correctly in accordance with the anchor points specified in the font for each mark. It is expected that the combining marks are encoded in the order given in Table 2. Note that the *prznak* control modifiers, if present, must be entered directly following the base neume (see below for more information).

Multiple combining pitch marks may be applied to a single neume, in which case the marks interact typographically and are stacked diagonally along the main beam of the neume:

$$\begin{array}{c} \text{1CF57} \end{array} + \begin{array}{c} \text{1CF06} \end{array} + \begin{array}{c} \text{1CF10} \end{array} \rightarrow \begin{array}{c} \text{1CF57} \end{array}$$

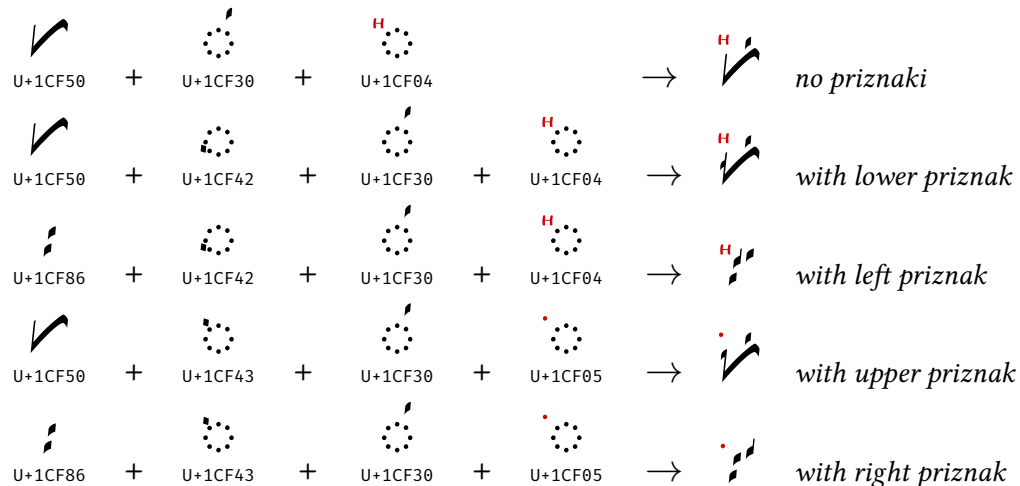
The Tonal Range marks encoded at U+1CF30 to U+1CF32 may form ligatures in certain instances:



2.2 Support for Priznaki

The priznaki are tiny markers (narrow slashes or dashes) that are added to the base neume to clarify its pitch within a Tonal Range (tetrachord). They are used only in later stages of Znamenny Notation (Type A Notation). For neumes pitched at the first scale degree of a Tonal Range (as indicated by a cinnabar mark ^r⦿, ^r⦿^m, or ^r⦿^m), no additional mark is added. For neumes pitched at the second scale degree (as indicated by a cinnabar mark ^h⦿, ^h⦿^m, or ^h⦿^m), a mark is placed on the left or lower part of the neume. For neumes pitched at the third scale degree (as indicated by a cinnabar mark ^u⦿, ^u⦿^m, or ^u⦿^m), a mark is placed on the right or upper part of the neume. For some neumes, the priznaki may attach to the tonal range markers placed above the neume rather than to the base neume itself.

Priznaki are supported by the use of control characters, marked in yellow in Table 1. Two control characters are available, U+1CF42 Znamenny Priznak Modifier Level 2 and U+1CF43 Znamenny Priznak Modifier Level 3, which are used to indicate the second and third scale degrees, respectively. The presence of a Priznak Modifier indicates that a priznak for the given scale degree should be turned on. The absence of a Priznak Modifier indicates either that a neume is pitched at the first scale degree of a tonal range (which is indicated by an absence of priznaki) or that Type B or Type C Notation is being encoded (where priznaki are not used at all). The priznak modifiers should be entered immediately following the base neume to which they apply, even if the actual priznak attaches to the tonal range marks.



The Mezents font also provides additional support for the more complex system of Priznaki used in [2]. For this purpose, the additional control character U+1CF44 Priznak Modifier Direction Flip may be entered, which modifies the direction of the priznak:



Note that the Zapyataya has additional priznakified forms that may be accessed by using the Priznak Modifier Direction Flip control character, as demonstrated in Figure 2.

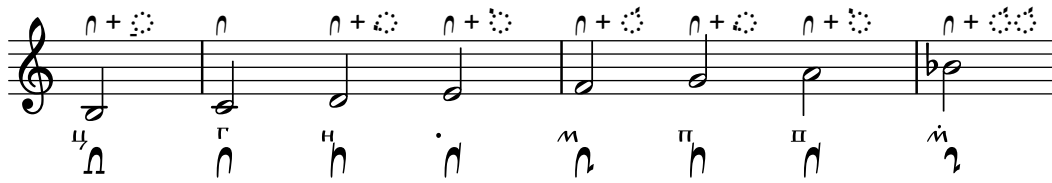


Figure 2: The Zapyataya with Different Priznaki in [2]

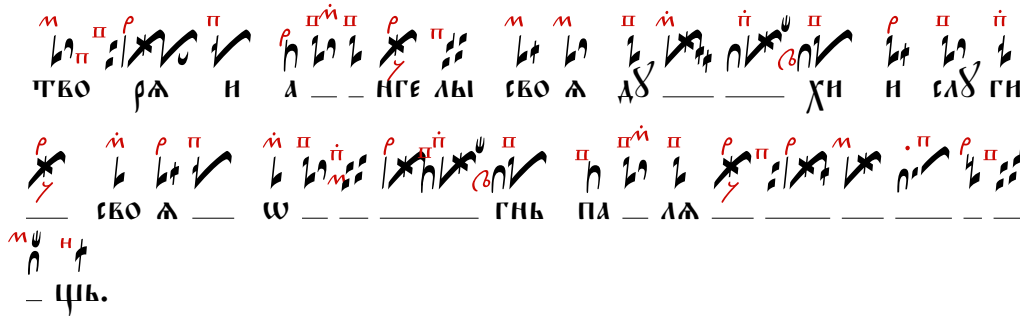
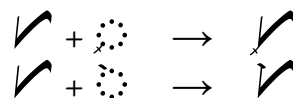


Figure 3: Example of Demestvenny Notation

Note Further: The precomposed priznakified glyphs are encoded in the Private Use Area (PUA) at codepoints U+EB60 to U+EBFF. They can be accessed directly in settings where relying on OpenType features is not possible or not desirable. See the section on PUA usage, below.

2.3 Demestvenny / Put Notation

The Mezenets Unicode font also provides the characters necessary for typesetting Demestvenny / Put (Kazan) Notations. An example of the new style of Demestvenny Notation is presented in Figure 3. The additional glyphs necessary for Demestvenny / Put (Kazan) Notations are labeled in green in Figure 1. In addition, the system of priznaki used in the older Put Notation is supported via the two additional control characters U+1CF45 Priznak Modifier Kryzh and U+1CF46 Priznak Modifier Rog (likewise marked in yellow in Figure 1):

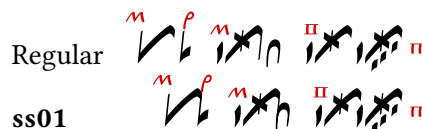


Note that support of ligatures used in Demestvenny Notation requires the use of one of the stylistic sets described below.

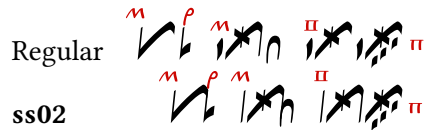
2.4 Advanced Font Features

The Mezenets Unicode font provides additional glyphs via the Stylistic Alternates and Stylistic Sets features. The following stylistic sets are available:

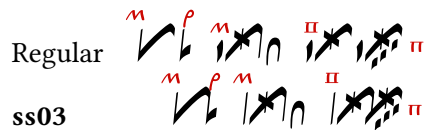
- **ss01** (Stylistic Set 1) – Old-style Demestvenny. This stylistic set turns on kerning rules that force adjoining neumes to make ligatures, as is customary in Demestvenny Notation. At the same time, the Zanozhkek, Mechik, and other neumes are typeset in the old style, commonly found in the manuscript tradition.



- **ss02** (Stylistic Set 2) – New-style Demestvenny. This stylistic set turns on kerning rules that force adjoining neumes to make ligatures, as is customary in Demestvenny Notation. The Zanozhek, Mechik, and other neumes are typeset in the new style, as used in [3].



- **ss03** (Stylistic Set 3) – New-style Contracted Demestvenny. This stylistic set turns on additional kerning rules that force some adjoining neumes to make contracted ligatures. The Zanozhek, Mechik, and other neumes are typeset in the new style, as used in [3].



- **ss04** (Stylistic Set 4) – Render cinnabar marks in black. This stylistic set turns off the coloring of cinnabar marks as specified by the COLR / CPAL or SVG tables and renders them in black. **NB:** turning on this feature will have a visible effect only in software that supports color fonts. In X₃TeX and LuaTeX use instead the churchslavonic package with the noautocolormarks option.



The Stylistic Alternates (*salt*) feature may be used to access alternate glyph forms, certain non-contextual variants and various non-standard glyphs, as demonstrated in Table 3. The codepoints of the glyphs are indicated in parentheses; for alternate glyph forms, these are codepoints in the Private Use Area (PUA). Accessing glyph alternates from the PUA directly by codepoint is not recommended, but may be necessary in certain instances where support for OpenType features is not available. See the section on the PUA, below.

In X₃TeX and LuaTeX, features may be turned on using methods provided in the fontspec package, for example:

```
\newfontfamily{\znamFont}[StylisticSet=1]{Mezenets Unicode}
```

Please consult the fontspec documentation for more information.

In LibreOffice, Stylistic Sets and other advanced OpenType features are available starting with version 4.1. However, there is no graphical interface that can be used to turn these features on and off. Instead, a special extended font name syntax has been developed: in order to activate an optional feature, its ID, followed by (optionally) an equals sign and the ID of the desired setting, are appended directly to the font name string. An ampersand is used to separate different feature/settings pairs. For example, setting the font to either of the following will enable Stylistic Set 1:

```
Mezenets Unicode:ss01
Mezenets Unicode:ss01=1
```

while setting the following will turn on both Stylistic Sets 1 and 4:

Table 3: Glyphs Accessible via Stylistic Alternates (*salt*)

Base Form	Alternate Forms	
	salt=1	salt=2
(U+007C)	⌈ (U+EA1B)	
- (U+002D)	— (U+EA1D)	
∅ (U+044D)	∅̂ (U+EA1C)	
⊙ ^x (U+1CF00)	⊙ ^{ΓH} (U+EA00)	
⊙ ^H (U+1CF01)	⊙ ^x (U+EA02)	
⊙ ^Γ (U+1CF03)	⊙ ^{ΓH} (U+EA01)	
⊙ ^H (U+1CF04)	⊙ ^H (U+EA03)	
⊙ [.] (U+1CF05)	⊙ ^c (U+EA04)	
⊙ ^m (U+1CF09)	⊙ ^ı (U+EA08)	
⊙ ^p (U+1CF22)	⊙ ^ı (U+EA10)	
⊙ ⁺ (U+1CF23)	⊙ ^ı (U+EA11)	
⊙ ^b (U+1CF24)	⊙ ^B (U+EA12)	
⊙ ^{no} (U+1CF27)	⊙ ^δ (U+EA13)	
⊙ ^x (U+1CF2D)	⊙ ^x (U+EA15)	
⊙ ^ı (U+1CF33)	⊙ ^[ı] (U+EA16)	
⊙ ^ı (U+1CF35)	⊙ ^[ı] (U+EA17)	
⌚ (U+1CF5F)	⌚ (U+EAA1)	
⌚ (U+1CF7D)	⌚ (U+EAE3)	⌚ (U+EAE7)
⌚ (U+1CF7E)	⌚ (U+EAE6)	⌚ (U+EAF1)
⌚ (U+1CF7F)	⌚ (U+EC21)	
⌚ (U+1CF82)	⌚ (U+EAF4)	
⌚ (U+1CF84)	⌚ (U+EAF6)	
⌚ (U+1CF85)	⌚ (U+EAF8)	
⌚ (U+1CF91)	⌚ (U+EB0B)	
⌚ (U+1CF98)	⌚ (U+EB20)	
⌚ (U+1CF99)	⌚ (U+EB22)	
⌚ (U+1CFC0)	⌚ (U+EB4E)	
⌚ (U+1CFC1)	⌚ (U+EA55)	
⌚ (U+1CFC2)	⌚ (U+EA56)	

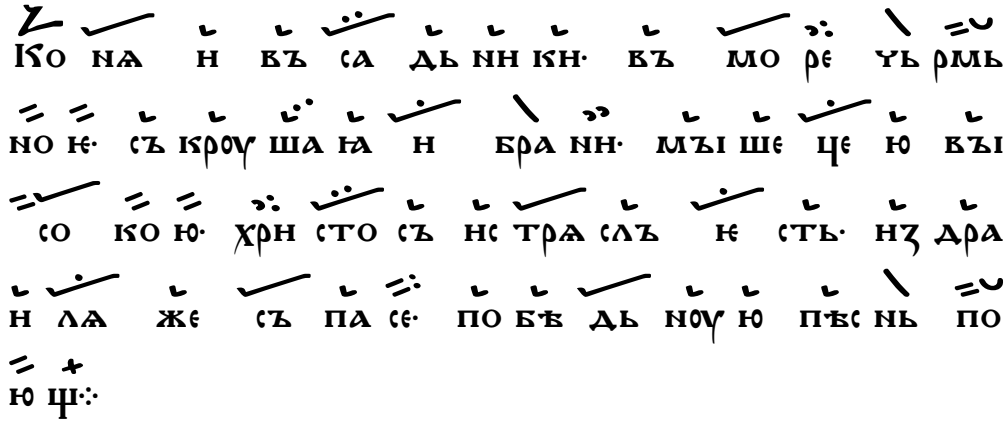


Figure 4: Example of Archaic Znamenny Notation (Hirmologion of Grigorovich)

Mezenets Unicode:ss01&ss04

In HTML, Stylistic Sets and other advanced features may be turned on using the `font-feature-settings` CSS property, for example:

```
.class {
  font-family: 'Mezenets Unicode';
  font-feature-settings: 'ss04';
}
```

3 Shaidur Unicode

This font is still under development.

4 Smolensky

Smolensky is a font intended for the typesetting of archaic Znamenny Notation as found in musical manuscripts of the 12th–15th centuries. The font is named after the renowned Russian musicologist, choir director and composer Stepan Smolensky. The glyphs were traced on the basis of photographs of the following manuscripts:

- Novgorod Sticherarion (NLR Sof. 384) – 12th century
- St. Petersburg Sticherarion (RASL 34.7.6) – 12th century
- Hirmologion of Grigorovich (Chilandar Slav. 308, RSL Grig. 37, NLR Q.п.I.75) – 13th century

The font provides additional characters needed for the archaic Znamenny Notation (in particular, the *kryukovye strely* – “hook-based arrows”), which are colored in light blue in Table 1.

Note: This font does not provide any glyphs for the cinnabar marks, for neumes used in Demestvenny / Put Notation, or any support for priznaki, as these are entirely anachronistic to the notation of the period that the font reproduces. The font is primarily of interest to Slavic musicologists studying early Slavic musical manuscripts. An example of text typeset in this font is presented in Figure 4.

5 Input Methods

The authors of the font also offer a keyboard layout for entering Znamenny Notation symbols via the keyboard. The keyboard layout is distributed separately from the fonts (see below for installation instructions). It is a four-level layout. The first level provides access to the left-side combining cinnabar pitch marks and various neumes, as demonstrated in Figure 5. The second level may be turned on by pressing the **Shift** key, and provides access to the right-side combining cinnabar pitch marks and various other neumes, as demonstrated in Figure 6. A third level, which provides access to additional neumes (see Figure 7), is turned on by pressing the **AltGr** key. On Windows systems, this is usually the right **Alt** key; on GNU / Linux this may be either **Alt** key. A final level is turned on by pressing both the **AltGr** and **Shift** keys simultaneously; it provides the neumes demonstrated in Figure 8.

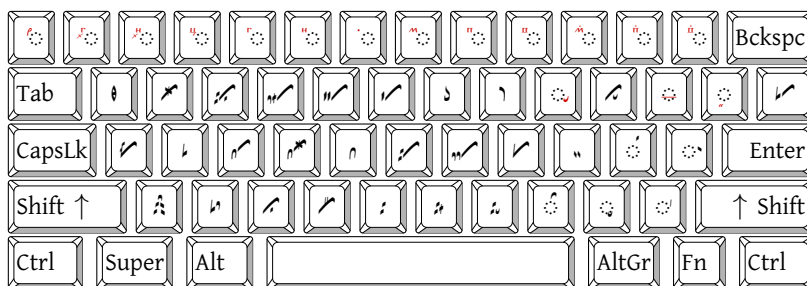


Figure 5: Znamenny Keyboard Mappings (no modifier keys depressed)

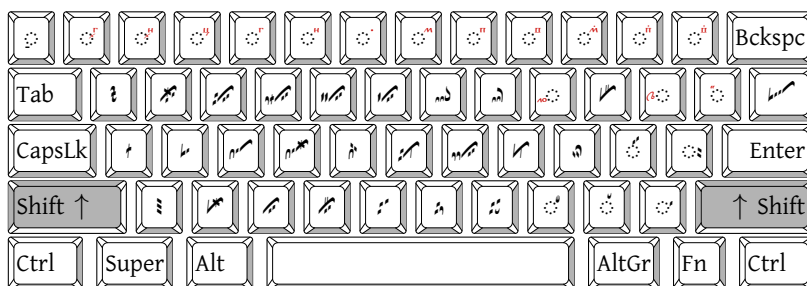


Figure 6: Znamenny Keyboard Mappings (with Shift key depressed)



Figure 7: Znamenny Keyboard Mappings (with AltGr key depressed)

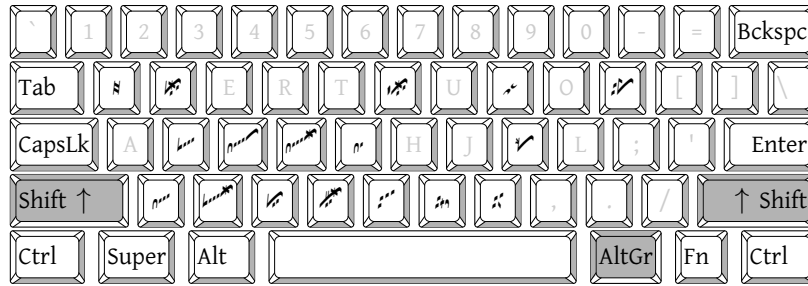


Figure 8: Znamenny Keyboard Mappings (with AltGr and Shift keys depressed)

5.1 Installation Instructions

5.1.1 On GNU / Linux

On Linux and other Unix-like systems Znamenny keyboard entry requires use of the Intelligent Input Bus (IBus) and the `m17n` library. The `m17n` library realizes multilingualization for GNU/Linux and other Unix-based applications. The Slavonic Computing Initiative maintains the package `m17n-cu`, which provides Church Slavonic data for the `m17n` library. The Znamenny keyboard layout is provided in this library together with the other Church Slavonic (Cyrillic and Glagolitic) and Russian Extended layouts.

For Debian-based systems such as Ubuntu and Linux Mint:

1. Add the SCI ppa to your sources: `sudo add-apt-repository ppa:aleksandr-andreev/sci`
2. Update your source tree: `sudo apt update`
3. Install the library: `sudo apt install m17n-cu`






On other systems, you may need to install the data manually:

1. Download the `m17n-cu` package and extract its contents to some directory in your home folder (for example, `/home/jblow/m17n-cu/`).
2. Check that the `m17n` database data (usually packaged as `m17n-db`) were properly installed in your `/usr/share/m17n/` directory. (You can run `m17n-db` to check). If the data are installed to some other location, you will need to edit `Makefile` and point it to the correct path for your `m17n` data. See the `INSTALL` file for details.
3. Now install the additional Church Slavonic `m17n` data. To do this, in the directory where you have downloaded the files of this package, run: `sudo make install DESTDIR=.` This command installs the keyboard data files into your `m17n` data directory.

Once you've installed the `m17n-cu` data, you need to configure IBus:

1. Install the `ibus-m17n` package for your distribution. This is probably provided by your package manager, alternatively, you may download the latest version of `ibus-m17n` from the IBus project website.
2. Run `im-config` and set IBus to be your default input method.
3. Load the Slavonic input method. From the Terminal shell, run `ibus-setup`.
 - On the Input Method tab, check `Customize active input methods`.
 - Click on `Select input method`.

- Click on Show all input methods.
- Scroll down and select Church Slavic; Old Slavonic; Old ..., then select the Znamenny keyboard (select the znamstd variant)
- Click Add
- Click Close

Installation should be complete at this point. By default, IBus can be turned off and on by pressing  and  on the keyboard. You can switch between input methods by pressing   . You can customize these keyboard shortcuts by running `ibus-setup` and changing the options on the General tab. To uninstall the keyboard layouts, the `m17n-cu` data, IBus or other components, follow the instructions in the `INSTALL` file that comes with `m17n-cu`.

While the authors do not provide technical support, community-based support for `m17n-cu` is available on the Slavonic Computing Initiative mailing list `sci-users`.

5.1.2 On Microsoft Windows

On Windows systems, download the Znamenny Keyboard Layout zip archive. Extract the archive and run `setup.exe`. Follow the on-screen instructions. Note that because Microsoft Corporation does not recognize Znamenny Notation as a valid writing system, the software installs as a Russian keyboard layout and will appear in your language bar as Russian (Znamenny Notation). Anecdotal evidence also suggests that Microsoft Windows is unable to recognize keyboard entry of characters outside of the Unicode 10.0 range. Please note that we do not provide any technical support for Microsoft products. Please do not write to the SCI-users mailing list with Windows-related issues.

References

- [1] Andreev A. and N. Simmons. “Proposal to Encode Znamenny Musical Notation in Unicode”. (L2/19-053). 2019. <https://www.ponomar.net/files/palaeoslavica.pdf>
- [2] Морозов, А. И. Круг церковного древнего знаменного пения. В шести частях. Изданием потомственного почетного гражданина Арсения Ивановича Морозова, St. Petersburg: Типография V. S. Balasheva, 1884–1885.
- [3] Kalashnikov, L. F. Азбука Демественного пения. Киев: Типография S. V. Kul’zhenko, 1911.