

# The flexisym package

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## User's guide

For now, the user's guide is in breqn.

## Implementation

### 1 flexisym

```
1 \*package
2 \ProvidesPackage{flexisym}[2007/12/19 v0.96]
3 \let\@xp\expandafter \let\@nx\noexpand
4 \edef\do{%
5   \@nx\AtEndOfPackage{%
6     \catcode\number'\=\number\catcode'\
7     \relax
8   }%
9 }
10 \do \let\do\relax
11 \catcode'\=12
12 \let\@sym\@gobble
13 \DeclareOption{robust}{%
14   \def\@sym#1{%
15     \ifx\protect\@typeset@protect \else\protect#1\@xp\@gobblefour\fi
16   }%
17 }
18 \def\mg@bin{2}% binary operators
19 \def\mg@rel{2}% relations
20 %%\def\mg@nre{B}% negated relations
21 \def\mg@del{3}% delimiters
22 %%\def\mg@arr{B}% arrows
23 \def\mg@acc{0}% accents
24 \def\mg@cop{3}% cumulative operators (sum, int)
25 \def\mg@latin{1}% (Latin) letters
26 \def\mg@greek{1}% (lowercase) Greek
27 \def\mg@Greek{0}% (capital) Greek
28 %%\def\mg@bflatin{4}% bold upright Latin letters ?
29 %%\def\mg@Bbb{B}% blackboard bold
```

```

30 \def\mg@cal{2}% script/calligraphic
31 %%\def\mg@frak{5}% Fraktur letters
32 \def\mg@digit{0}% decimal digits % 1 = oldstyle, 0 = capital
33 \expandafter\let\csname MathChar \endcsname\mathchar
34 \expandafter\let\csname Delimiter \endcsname\delimiter
35 \expandafter\let\csname Radical \endcsname\radical
36 \newcommand{\MathChar}{}
37 \edef\MathChar{\csname MathChar \endcsname\noexpand\string}
38 \newcommand{\Delimiter}{}
39 \edef\Delimiter{\csname Delimiter \endcsname\noexpand\string}
40 \newcommand{\Radical}{}
41 \edef\Radical{\csname Radical \endcsname\noexpand\string}
42 \let\sumlimits\displaylimits
43 \let\intlimits\nolimits
44 \let\name\limits\displaylimits
45 \edef\m@Ord#1#2#3{\csname MathChar \endcsname"0#1#2#3 }
46 \edef\m@Var#1#2#3{\csname MathChar \endcsname"7#1#2#3 }
47 \edef\m@Bin#1#2#3{\csname MathChar \endcsname"2#1#2#3 }
48 \edef\m@Rel#1#2#3{\csname MathChar \endcsname"3#1#2#3 }
49 \edef\m@Pun#1#2#3{\csname MathChar \endcsname"6#1#2#3 }
50 \edef\m@C0s#1#2#3{\csname MathChar \endcsname"1#1#2#3 \sumlimits}
51 \edef\m@C0i#1#2#3{\csname MathChar \endcsname"1#1#2#3 \intlimits}
52 \def\delim@a#1#2#3#4{\ifx\relax#1#2#3#4\else#1\fi #2#3#4}
53 \def\delim@b#1#2#3#4{\ifx\relax#1#2#3#4\else#1\fi }
54 \def\@tempa{%
55   \@nx\@xp\@nx\delim@a\@nx\csname sd@##1##2##3\@nx\endcsname ##1##2##3 }
56 \edef\m@DeL#1#2#3{\csname Delimiter \endcsname"4\@tempa}
57 \edef\m@DeR#1#2#3{\csname Delimiter \endcsname"5\@tempa}
58 \edef\m@DeB#1#2#3{\csname Delimiter \endcsname"0\@tempa}
59 \edef\m@DeA#1#2#3{\csname Delimiter \endcsname"3\@tempa}
60 \edef\m@Rad#1#2#3{\csname Radical \endcsname"\@tempa}
61 \def\do#1#2{\@xp\def\csname sd@#1\endcsname{#2}}
62 \do{300}{028}
63 \do{301}{029}
64 \do{302}{05B}
65 \do{303}{05D}
66 \do{304}{262}
67 \do{305}{263}
68 \do{306}{264}
69 \do{307}{265}
70 \do{308}{266}
71 \do{309}{267}
72 \do{30A}{268}
73 \do{30B}{269}
74 \do{30C}{26A}
75 \do{30D}{26B}
76 \do{30E}{13D}
77 \do{30F}{26E}
78 \do{340}{37A}
79 \do{341}{37B}
80 \do{33A}{33A}
81 \do{33B}{33B}
82 \do{33E}{33E}
83 \do{33C}{26A}

```

```

84 \do{33D}{26B}
85 \do{378}{222}
86 \do{379}{223}
87 \do{33F}{26C}
88 \do{37E}{22A}
89 \do{37F}{22B}
90 \do{377}{26D}
91 \do{30F}{26E}
92 \def\m@Acc#1#2#3#4{\mathaccent"#1#2#3{#4}}
93 \def\@symAcc{\@sym}
94 \let\@symtype\@firstofone
95 \def\@symOrd#1#2{\@symtype\mathord{\OrdSymbol{#2}}}
96 \def\@symVar{\@symOrd}
97 \def\@symBin#1#2{\@symtype\mathbin{\OrdSymbol{#2}}}
98 \def\@symRel#1#2{\@symtype\mathrel{\OrdSymbol{#2}}}
99 \def\@symPun#1#2{\@symtype\mathpunct{\OrdSymbol{#2}}}
100 \def\@symCoi#1#2{\@symtype\mathop{\OrdSymbol{#2}}\intlimits}}
101 \def\@symCoi#1#2{\@symtype\mathop{\OrdSymbol{#2}}\sumlimits}}
102 \def\@symOpe#1#2{\@symtype\mathopen{\OrdSymbol{#2}}}
103 \def\@symClo#1#2{\@symtype\mathclose{\OrdSymbol{#2}}}
104 \def\@symDeL#1#2{\@symtype\mathopen{\OrdSymbol{#2}}}
105 \def\@symDeR#1#2{\@symtype\mathclose{\OrdSymbol{#2}}}
106 \def\@symDeB#1#2{\@symtype\mathord{\OrdSymbol{#2}}}
107 \def\@symInn#1#2{\@symtype\mathinner{\OrdSymbol{#2}}}
108 \def\@xnce#1{\@xp\@nx\csname#1\endcsname}
109 \let\sym@global\global
110 \def\DeclareFlexSymbol#1#2#3#4{%
111   \begingroup
112   \edef\@tempb{\@nx\@sym\@nx#1\@xnce{m@#2}\@xnce{mg@#3}#4}%
113   \ifcat\@nx#1\relax
114     \sym@global\let#1\@tempb
115   \else
116     \sym@global\mathcode'#1="8000\relax
117     \lccode'\~='#1\relax
118     \lowercase{\sym@global\let~\@tempb}%
119   \fi
120   \endgroup
121 }
122 \def\DeclareFlexCompoundSymbol#1#2#3{%
123   \@xp\DeclareRobustCommand\@xp#1\@xp{\csname @sym#2\endcsname#1{#3}}%
124   \sym@global\let#1#1\relax
125 }
126 \DeclareRobustCommand\textchar{\text@char\textfont}
127 \DeclareRobustCommand\scriptchar{\text@char\scriptfont}%
128 \def\text@char@a{?}\endgroup}%
129 \def\text@char@sym#1#2#3{%
130   \begingroup
131   \let\@sym\relax % defense against infinite loops
132   \the\text@script@char#3%
133   \afterassignment\text@char@a
134   \chardef\~="#"%
135 }
136 \def\text@char#1#2{\begingroup\check@mathfonts
137   \let\text@script@char#1\let\@sym\text@char@sym

```

```

138 \let\@syntype\@secondoftwo \let\OrdSymbol\@firstofone
139 \let\ifmmode\iftrue \everymath{\$@gobble}%$
140 \def\mkern{\muskip\z@}\let\mskip\mkern
141 \ifcat\relax\noexpand#2#2%
142 \else
143 \lccode'\~=\expandafter'\string#2\relax
144 \lowercase{~}%
145 \fi
146 \endgroup
147 }
148 \providecommand\textprime{}
149 \DeclareRobustCommand\textprime{\leavevmode
150 \raise.8ex\hbox{\text@char\scriptfont\prime}%
151 }
152 \ifundefined{resetMathstrut@}{\{%
153 \def\resetMathstrut@{%
154 \setbox\z@\hbox{\textchar\vert}%
155 \ht\Mathstrutbox@ \ht\z@ \dp\Mathstrutbox@ \dp\z@
156 }%
157 }
158 \ifundefined{rightarrowfill@}{\{%
159 \def\rightarrowfill@#1{\m@th\setboxz@h{\$#1\relbar$}\ht\z@\z@
160 \$#1\copy\z@\mkern-6mu\cleaders
161 \hbox{\$#1\mkern-2mu\box\z@\mkern-2mu$}\hfill
162 \mkern-6mu\OrdSymbol{\rightarrow}$}
163 \def\leftarrowfill@#1{\m@th\setboxz@h{\$#1\relbar$}\ht\z@\z@
164 \$#1\OrdSymbol{\leftarrow}\mkern-6mu\cleaders
165 \hbox{\$#1\mkern-2mu\copy\z@\mkern-2mu$}\hfill
166 \mkern-6mu\box\z@$}
167 \def\leftrightarrowfill@#1{\m@th\setboxz@h{\$#1\relbar$}\ht\z@\z@
168 \$#1\OrdSymbol{\leftarrow}\mkern-6mu\cleaders
169 \hbox{\$#1\mkern-2mu\box\z@\mkern-2mu$}\hfill
170 \mkern-6mu\OrdSymbol{\rightarrow}$}
171 }
172 \def\binrel@sym#1#2#3#4#5{%
173 \xdef\binrel@##1{%
174 \ifx\m@Ord#2\@nx\@symOrd
175 \else\ifx\m@Var#2\@nx\@symVar
176 \else\ifx\m@COs#2\@nx\@symCOs
177 \else\ifx\m@COi#2\@nx\@symCOi
178 \else\ifx\m@Bin#2\@nx\@symBin
179 \else\ifx\m@Rel#2\@nx\@symRel
180 \else\ifx\m@Pun#2\@nx\@symPun
181 \else\@nx\@symErr \fi\fi\fi\fi\fi\fi\fi
182 ?{\@nx\OrdSymbol{##1}}}%
183 }
184 \def\binrel@a{%
185 \def\@symOrd##1#2{\gdef\binrel@#####1{\@symOrd##1{\OrdSymbol{#####1}}}%
186 \def\@symVar##1#2{\gdef\binrel@#####1{\@symVar##1{\OrdSymbol{#####1}}}%
187 \def\@symCOs##1#2{\gdef\binrel@#####1{\@symCOs##1{\OrdSymbol{#####1}}}%
188 \def\@symCOi##1#2{\gdef\binrel@#####1{\@symCOi##1{\OrdSymbol{#####1}}}%
189 \def\@symBin##1#2{\gdef\binrel@#####1{\@symBin##1{\OrdSymbol{#####1}}}%
190 \def\@symRel##1#2{\gdef\binrel@#####1{\@symRel##1{\OrdSymbol{#####1}}}%
191 \def\@symPun##1#2{\gdef\binrel@#####1{\@symPun##1{\OrdSymbol{#####1}}}%

```

```

192 }
193 \def\binrel@#1{%
194   \setbox\z@\hbox{${%
195     \let\mathchoice\@gobblethree
196     \let\@sym\binrel@sym \binrel@a
197     #1$}%
198 }
199 \def\@symextension{sym}
200 \newcommand\usesymbols[1]{%
201   \@for\@tempb:=#1\do{%
202     \xp\@onefilewithoptions\@xp{\@tempb}[] []\@symextension
203   }%
204 }
205 \newcommand\ProvidesSymbols[1]{\ProvidesFile{#1.sym}}
206 \DeclareRobustCommand{\not}[1]{\@symRel\not{\OrdSymbol{\notRel#1}}}
207 \DeclareRobustCommand{\OrdSymbol}[1]{%
208   \begingroup\mathchars@reset#1\endgroup
209 }
210 \def\mathchars@reset{\let\@sym\@sym@ord \let\@symtype\@symtype@ord
211   \let\OrdSymbol\relax}
212 \def\@symtype@ord#1#{}% a strange sort of \@gobble
213 \def\@sym@ord#1#2{\@xp\@sym@ord@a\string#2\@nil}%
214 \begingroup
215 \lccode'\.=' \@ \lowercase{\endgroup
216 \def\@sym@ord@a#1.#2#3\@nil#4#5#6{%
217   \csname MathChar \endcsname"0%
218   \if D#2\@xp\delim@b\csname sd@#4#5#6\endcsname#4#5#6
219   \else #4#5#6
220   \fi
221 }

```

Before declaring any math characters active, we have to take care of a small problem with `amsmath v2.x`, if it is loaded before `flexisym`. `\std@minus` and `\std@equal` are defined as

```

\mathchardef\std@minus\mathcode'\- \relax
\mathchardef\std@equal\mathcode'\= \relax

```

in `amsmath.sty` and again `\AtBeginDocument`. The latter is because

In case some alternative math fonts are loaded later. [`amsmath.dtx`]

The problem arises because `flexisym` sets the `mathcode` of all symbols to 32768 which is illegal for a `\mathchardef`.

We have to remove the assignments from the `\AtBeginDocument` hook as they will cause an error there.

```

222 \@ifpackageloaded{amsmath}{%
223   \begingroup

```

Split the contents of `\@begindocumenthook` by reading what we search for as a delimited argument and ensure these two assignments do not take place. It is questionable if anything reasonable can be done to them. In the case of a package such as `mathpazo` which defines

```

\DeclareMathSymbol{=}{\mathrel}{upright}{"3D}

```

the `\Relbar` will look wrong if we don't use the correct symbol. The way to solve this is define additional `.sym` files which contain the definition of `\relbar` and `\Relbar` needed. We need those additional files anyway for things like `\joinord`.

```

224 \long\def\next#1\mathchardef\std@minus\mathcode'\- \relax
225         \mathchardef\std@equal\mathcode'\= \relax#2\flexi@stop{%
226     \toks@{#1#2}%
227     \xdef\@begindocumenthook{\the\toks@}%
228 }%
229 \expandafter\next\@begindocumenthook\flexi@stop
230 \endgroup
231 \}{}

```

There is problem when using `\DeclareMathOperator` as the operators defined call a command `\newmcodes@` which relies on the mathcode of `-` being less than 32768. We delay the definition `\AtBeginDocument` in case `amssymb` hasn't been loaded yet.

```

232 \AtBeginDocument{%
233 \def\newmcodes@{%
234     \mathcode '\ '39\mathcode '\*42\mathcode '\."613A
235     \ifnum\mathcode'\-=45
236     \else

```

The extra check. Don't do anything if `-` is math active.

```

237     \ifnum\mathcode'\-=32768
238     \else
239         \mathchardef \std@minus \mathcode '\- \relax
240     \fi
241     \fi
242     \mathcode '\-45 \mathcode '\ /47\mathcode '\."603A\relax
243 }%
244 }

```

And we then continue with the options.

```

245 \DeclareOption{mathstyleoff}{\PassOptionsToPackage{mathactivechars}{mathstyle}}
246 \DeclareOption{cmbase}{\usesymbols{cmbase}}
247 \DeclareOption{mathpazo}{\usesymbols{mathpazo}}
248 \DeclareOption{mathptmx}{\usesymbols{mathptmx}}
249 \ExecuteOptions{cmbase}
250 \ProcessOptions\relax
251 \renewcommand{\lnot}{\neg}
252 \renewcommand{\land}{\wedge}
253 \renewcommand{\lor}{\vee}
254 \renewcommand{\le}{\leq}
255 \renewcommand{\ge}{\geq}
256 \renewcommand{\ne}{\neq}
257 \renewcommand{\owns}{\ni}
258 \renewcommand{\gets}{\leftarrow}
259 \renewcommand{\to}{\rightarrow}
260 \renewcommand{\|}{\Vert}
261 \RequirePackage{mathstyle}
262 \endinput

```

## 2 cmbase, mathpazo, mathptmx

For each math font package we define a corresponding symbol file with extension `sym`. The Computer Modern base is called `cmbase` and `mathpazo` and `mathptmx` corresponds to the packages. The definitions are almost identical as they mostly concern the positions in the math font encodings. Look for differences in `\joinord`, `\relbar` and `\Relbar`. If you inspect the source code, you'll see that the support for `mathptmx` didn't require any work but I thought it better to create a `sym` file to maintain a uniform interface.

**Open question on ! and ?: maybe they should have type 'Pun' instead of 'DeR'. Need to search for uses in math in AMS archives. Or, maybe add a special 'Clo' type for them: non-extensible closing delimiter.**

Default mathgroup setup.

```

263 \*cmbase | mathpazo | mathptmx>
264 \cmbase\ProvidesSymbols{cmbase}[2007/12/19 v0.92]
265 \mathpazo\ProvidesSymbols{mathpazo}[2007/12/19 v0.2]
266 \mathptmx\ProvidesSymbols{mathptmx}[2007/12/19 v0.2]
267 \exp\edef\csname mg@OT1\endcsname{\hexnumber@\symoperators}
268 \exp\edef\csname mg@OML\endcsname{\hexnumber@\symletters}
269 \exp\edef\csname mg@OMS\endcsname{\hexnumber@\symsymbols}
270 \exp\edef\csname mg@OMX\endcsname{\hexnumber@\symlargesymbols}
271 \gdef\mg@bin{\mg@OMS}
272 \gdef\mg@del{\mg@OMX}
273 \xdef\mg@digit{\exp\nx\csname mg@OT1\endcsname}
274 \gdef\mg@latin{\mg@OML}
275 \global\let\mg@Latin\mg@latin
276 \global\let\mg@greek\mg@latin
277 \global\let\mg@greek\mg@digit
278 \global\let\mg@rel\mg@bin
279 \global\let\mg@ord\mg@bin
280 \global\let\mg@cop\mg@del

```

Symbols from the 128-character `cmr` encoding. Paren and square bracket delimiters from this encoding are covered by the definitions in the `cmex` section, however.

```

281 \DeclareFlexSymbol{!}      {Pun}{OT1}{21}
282 \DeclareFlexSymbol{+}      {Bin}{OT1}{2B}
283 \DeclareFlexSymbol{:}      {Rel}{OT1}{3A}
284 \DeclareFlexSymbol{\colon} {Pun}{OT1}{3A}
285 \DeclareFlexSymbol{;}      {Pun}{OT1}{3B}
286 \DeclareFlexSymbol{=}      {Rel}{OT1}{3D}
287 \DeclareFlexSymbol{?}      {Pun}{OT1}{3F}

```

$\mathcal{M}\mathcal{S}\mathcal{T}\mathcal{E}\mathcal{X}$ , and therefore the `amsmath` package, make the uppercase Greek letters class 0 (nonvariable) instead of 7 (variable), to eliminate the glaring inconsistency with lowercase Greek. (In plain  $\mathcal{T}\mathcal{E}\mathcal{X}$ , `\bf\Delta` works, while `\bf\delta` doesn't. ) Let us try to make them both variable (fonts permitting) instead of nonvariable.

```

288 \DeclareFlexSymbol{\Gamma} {Var}{Greek}{00}
289 \DeclareFlexSymbol{\Delta} {Var}{Greek}{01}

```

```

290 \DeclareFlexSymbol{\Theta} {Var}{Greek}{02}
291 \DeclareFlexSymbol{\Lambda} {Var}{Greek}{03}
292 \DeclareFlexSymbol{\Xi} {Var}{Greek}{04}
293 \DeclareFlexSymbol{\Pi} {Var}{Greek}{05}
294 \DeclareFlexSymbol{\Sigma} {Var}{Greek}{06}
295 \DeclareFlexSymbol{\Upsilon} {Var}{Greek}{07}
296 \DeclareFlexSymbol{\Phi} {Var}{Greek}{08}
297 \DeclareFlexSymbol{\Psi} {Var}{Greek}{09}
298 \DeclareFlexSymbol{\Omega} {Var}{Greek}{0A}

```

Decimal digits.

```

299 \DeclareFlexSymbol{0}{Var}{digit}{30}
300 \DeclareFlexSymbol{1}{Var}{digit}{31}
301 \DeclareFlexSymbol{2}{Var}{digit}{32}
302 \DeclareFlexSymbol{3}{Var}{digit}{33}
303 \DeclareFlexSymbol{4}{Var}{digit}{34}
304 \DeclareFlexSymbol{5}{Var}{digit}{35}
305 \DeclareFlexSymbol{6}{Var}{digit}{36}
306 \DeclareFlexSymbol{7}{Var}{digit}{37}
307 \DeclareFlexSymbol{8}{Var}{digit}{38}
308 \DeclareFlexSymbol{9}{Var}{digit}{39}

```

Symbols from the 128-character cmml encoding.

```

309 \DeclareFlexSymbol{,}{Pun}{OML}{3B}
310 \DeclareFlexSymbol{.}{Ord}{OML}{3A}
311 \DeclareFlexSymbol{/}{Ord}{OML}{3D}
312 \DeclareFlexSymbol{<}{Rel}{OML}{3C}
313 \DeclareFlexSymbol{>}{Rel}{OML}{3E}

```

To do: make the Var property of lc Greek work properly.

```

314 \DeclareFlexSymbol{\alpha}{Var}{greek}{0B}
315 \DeclareFlexSymbol{\beta}{Var}{greek}{0C}
316 \DeclareFlexSymbol{\gamma}{Var}{greek}{0D}
317 \DeclareFlexSymbol{\delta}{Var}{greek}{0E}
318 \DeclareFlexSymbol{\epsilon}{Var}{greek}{0F}
319 \DeclareFlexSymbol{\zeta}{Var}{greek}{10}
320 \DeclareFlexSymbol{\eta}{Var}{greek}{11}
321 \DeclareFlexSymbol{\theta}{Var}{greek}{12}
322 \DeclareFlexSymbol{\iota}{Var}{greek}{13}
323 \DeclareFlexSymbol{\kappa}{Var}{greek}{14}
324 \DeclareFlexSymbol{\lambda}{Var}{greek}{15}
325 \DeclareFlexSymbol{\mu}{Var}{greek}{16}
326 \DeclareFlexSymbol{\nu}{Var}{greek}{17}
327 \DeclareFlexSymbol{\xi}{Var}{greek}{18}
328 \DeclareFlexSymbol{\pi}{Var}{greek}{19}
329 \DeclareFlexSymbol{\rho}{Var}{greek}{1A}
330 \DeclareFlexSymbol{\sigma}{Var}{greek}{1B}
331 \DeclareFlexSymbol{\tau}{Var}{greek}{1C}
332 \DeclareFlexSymbol{\upsilon}{Var}{greek}{1D}
333 \DeclareFlexSymbol{\phi}{Var}{greek}{1E}
334 \DeclareFlexSymbol{\chi}{Var}{greek}{1F}
335 \DeclareFlexSymbol{\psi}{Var}{greek}{20}
336 \DeclareFlexSymbol{\omega}{Var}{greek}{21}
337 \DeclareFlexSymbol{\varepsilon}{Var}{greek}{22}
338 \DeclareFlexSymbol{\vartheta}{Var}{greek}{23}

```



```

339 \DeclareFlexSymbol{\varpi}{Var}{greek}{24}
340 \DeclareFlexSymbol{\varrho}{Var}{greek}{25}
341 \DeclareFlexSymbol{\varsigma}{Var}{greek}{26}
342 \DeclareFlexSymbol{\varphi}{Var}{greek}{27}

```

Note that in plain T<sub>E</sub>X `\imath` and `\jmath` are not variable-font. But if a `j` changes font to, let's say, sans serif or calligraphic, a dotless `j` in the same context should change font in the same way.

```

343 \DeclareFlexSymbol{\imath}{Var}{OML}{7B}
344 \DeclareFlexSymbol{\jmath}{Var}{OML}{7C}
345 \DeclareFlexSymbol{\ell}{Ord}{OML}{60}
346 \DeclareFlexSymbol{\wp}{Ord}{OML}{7D}
347 \DeclareFlexSymbol{\partial}{Ord}{OML}{40}
348 \DeclareFlexSymbol{\flat}{Ord}{OML}{5B}
349 \DeclareFlexSymbol{\natural}{Ord}{OML}{5C}
350 \DeclareFlexSymbol{\sharp}{Ord}{OML}{5D}
351 \DeclareFlexSymbol{\triangleleft}{Bin}{OML}{2F}
352 \DeclareFlexSymbol{\triangleright}{Bin}{OML}{2E}
353 \DeclareFlexSymbol{\star}{Bin}{OML}{3F}
354 \DeclareFlexSymbol{\smile}{Rel}{OML}{5E}
355 \DeclareFlexSymbol{\frown}{Rel}{OML}{5F}
356 \DeclareFlexSymbol{\leftharpoonup}{Rel}{OML}{28}
357 \DeclareFlexSymbol{\leftharpoondown}{Rel}{OML}{29}
358 \DeclareFlexSymbol{\rightharpoonup}{Rel}{OML}{2A}
359 \DeclareFlexSymbol{\rightharpoondown}{Rel}{OML}{2B}
360 \DeclareFlexSymbol{a}{Var}{latin}{61}
361 \DeclareFlexSymbol{b}{Var}{latin}{62}
362 \DeclareFlexSymbol{c}{Var}{latin}{63}
363 \DeclareFlexSymbol{d}{Var}{latin}{64}
364 \DeclareFlexSymbol{e}{Var}{latin}{65}
365 \DeclareFlexSymbol{f}{Var}{latin}{66}
366 \DeclareFlexSymbol{g}{Var}{latin}{67}
367 \DeclareFlexSymbol{h}{Var}{latin}{68}
368 \DeclareFlexSymbol{i}{Var}{latin}{69}
369 \DeclareFlexSymbol{j}{Var}{latin}{6A}
370 \DeclareFlexSymbol{k}{Var}{latin}{6B}
371 \DeclareFlexSymbol{l}{Var}{latin}{6C}
372 \DeclareFlexSymbol{m}{Var}{latin}{6D}
373 \DeclareFlexSymbol{n}{Var}{latin}{6E}
374 \DeclareFlexSymbol{o}{Var}{latin}{6F}
375 \DeclareFlexSymbol{p}{Var}{latin}{70}
376 \DeclareFlexSymbol{q}{Var}{latin}{71}
377 \DeclareFlexSymbol{r}{Var}{latin}{72}
378 \DeclareFlexSymbol{s}{Var}{latin}{73}
379 \DeclareFlexSymbol{t}{Var}{latin}{74}
380 \DeclareFlexSymbol{u}{Var}{latin}{75}
381 \DeclareFlexSymbol{v}{Var}{latin}{76}
382 \DeclareFlexSymbol{w}{Var}{latin}{77}
383 \DeclareFlexSymbol{x}{Var}{latin}{78}
384 \DeclareFlexSymbol{y}{Var}{latin}{79}
385 \DeclareFlexSymbol{z}{Var}{latin}{7A}
386 \DeclareFlexSymbol{A}{Var}{Latin}{41}
387 \DeclareFlexSymbol{B}{Var}{Latin}{42}
388 \DeclareFlexSymbol{C}{Var}{Latin}{43}

```

```

389 \DeclareFlexSymbol{D}{Var}{Latin}{44}
390 \DeclareFlexSymbol{E}{Var}{Latin}{45}
391 \DeclareFlexSymbol{F}{Var}{Latin}{46}
392 \DeclareFlexSymbol{G}{Var}{Latin}{47}
393 \DeclareFlexSymbol{H}{Var}{Latin}{48}
394 \DeclareFlexSymbol{I}{Var}{Latin}{49}
395 \DeclareFlexSymbol{J}{Var}{Latin}{4A}
396 \DeclareFlexSymbol{K}{Var}{Latin}{4B}
397 \DeclareFlexSymbol{L}{Var}{Latin}{4C}
398 \DeclareFlexSymbol{M}{Var}{Latin}{4D}
399 \DeclareFlexSymbol{N}{Var}{Latin}{4E}
400 \DeclareFlexSymbol{O}{Var}{Latin}{4F}
401 \DeclareFlexSymbol{P}{Var}{Latin}{50}
402 \DeclareFlexSymbol{Q}{Var}{Latin}{51}
403 \DeclareFlexSymbol{R}{Var}{Latin}{52}
404 \DeclareFlexSymbol{S}{Var}{Latin}{53}
405 \DeclareFlexSymbol{T}{Var}{Latin}{54}
406 \DeclareFlexSymbol{U}{Var}{Latin}{55}
407 \DeclareFlexSymbol{V}{Var}{Latin}{56}
408 \DeclareFlexSymbol{W}{Var}{Latin}{57}
409 \DeclareFlexSymbol{X}{Var}{Latin}{58}
410 \DeclareFlexSymbol{Y}{Var}{Latin}{59}
411 \DeclareFlexSymbol{Z}{Var}{Latin}{5A}

```

The `\ldotPun` glyph is used in constructing the `\ldots` symbol. It is just a period with a different math symbol class. `\lhookRel` and `\rhookRel` are used in a similar way for building hooked arrow symbols.

```

412 \DeclareFlexSymbol{\ldotPun}{Pun}{OML}{3A}
413 \def\ldotp{\ldotPun}
414 \DeclareFlexSymbol{\lhookRel}{Rel}{OML}{2C}
415 \DeclareFlexSymbol{\rhookRel}{Rel}{OML}{2D}

```

Symbols from the 128-character cmsy encoding.

```

416 \DeclareFlexSymbol{*}{Bin}{bin}{03} % \ast
417 \DeclareFlexSymbol{-}{Bin}{bin}{00}
418 \DeclareFlexSymbol{|}{Ord}{OMS}{6A}
419 \DeclareFlexSymbol{\aleph}{Ord}{ord}{40}
420 \DeclareFlexSymbol{\Re}{Ord}{ord}{3C}
421 \DeclareFlexSymbol{\Im}{Ord}{ord}{3D}
422 \DeclareFlexSymbol{\infty}{Ord}{ord}{31}
423 \DeclareFlexSymbol{\prime}{Ord}{ord}{30}
424 \DeclareFlexSymbol{\emptyset}{Ord}{ord}{3B}
425 \DeclareFlexSymbol{\nabla}{Ord}{ord}{72}
426 \DeclareFlexSymbol{\top}{Ord}{ord}{3E}
427 \DeclareFlexSymbol{\bot}{Ord}{ord}{3F}
428 \DeclareFlexSymbol{\triangle}{Ord}{ord}{34}
429 \DeclareFlexSymbol{\forall}{Ord}{ord}{38}
430 \DeclareFlexSymbol{\exists}{Ord}{ord}{39}
431 \DeclareFlexSymbol{\neg}{Ord}{ord}{3A}
432 \DeclareFlexSymbol{\clubsuit}{Ord}{ord}{7C}
433 \DeclareFlexSymbol{\diamondsuit}{Ord}{ord}{7D}
434 \DeclareFlexSymbol{\heartsuit}{Ord}{ord}{7E}
435 \DeclareFlexSymbol{\spadesuit}{Ord}{ord}{7F}
436 \DeclareFlexSymbol{\smallint}{C0s}{OMS}{73}

```

Binary operators.

```

437 \DeclareFlexSymbol{\bigtriangleup}{Bin}{bin}{34}
438 \DeclareFlexSymbol{\bigtriangledown}{Bin}{bin}{35}
439 \DeclareFlexSymbol{\wedge}{Bin}{bin}{5E}
440 \DeclareFlexSymbol{\vee}{Bin}{bin}{5F}
441 \DeclareFlexSymbol{\cap}{Bin}{bin}{5C}
442 \DeclareFlexSymbol{\cup}{Bin}{bin}{5B}
443 \DeclareFlexSymbol{\ddagger}{Bin}{bin}{7A}
444 \DeclareFlexSymbol{\dagger}{Bin}{bin}{79}
445 \DeclareFlexSymbol{\sqcap}{Bin}{bin}{75}
446 \DeclareFlexSymbol{\sqcup}{Bin}{bin}{74}
447 \DeclareFlexSymbol{\uplus}{Bin}{bin}{5D}
448 \DeclareFlexSymbol{\amalg}{Bin}{bin}{71}
449 \DeclareFlexSymbol{\diamond}{Bin}{bin}{05}
450 \DeclareFlexSymbol{\bullet}{Bin}{bin}{0F}
451 \DeclareFlexSymbol{\wr}{Bin}{bin}{6F}
452 \DeclareFlexSymbol{\div}{Bin}{bin}{04}
453 \DeclareFlexSymbol{\odot}{Bin}{bin}{0C}
454 \DeclareFlexSymbol{\oslash}{Bin}{bin}{0B}
455 \DeclareFlexSymbol{\otimes}{Bin}{bin}{0A}
456 \DeclareFlexSymbol{\ominus}{Bin}{bin}{09}
457 \DeclareFlexSymbol{\oplus}{Bin}{bin}{08}
458 \DeclareFlexSymbol{\mp}{Bin}{bin}{07}
459 \DeclareFlexSymbol{\pm}{Bin}{bin}{06}
460 \DeclareFlexSymbol{\circ}{Bin}{bin}{0E}
461 \DeclareFlexSymbol{\bigcirc}{Bin}{bin}{0D}
462 \DeclareFlexSymbol{\setminus}{Bin}{bin}{6E}
463 \DeclareFlexSymbol{\cdot}{Bin}{bin}{01}
464 \DeclareFlexSymbol{\ast}{Bin}{bin}{03}
465 \DeclareFlexSymbol{\times}{Bin}{bin}{02}

```

Relation symbols.

```

466 \DeclareFlexSymbol{\propto}{Rel}{rel}{2F}
467 \DeclareFlexSymbol{\sqsubseteq}{Rel}{rel}{76}
468 \DeclareFlexSymbol{\sqsupseteq}{Rel}{rel}{77}
469 \DeclareFlexSymbol{\parallel}{Rel}{rel}{6B}
470 \DeclareFlexSymbol{\mid}{Rel}{rel}{6A}
471 \DeclareFlexSymbol{\dashv}{Rel}{rel}{61}
472 \DeclareFlexSymbol{\vdash}{Rel}{rel}{60}
473 \DeclareFlexSymbol{\nearrow}{Rel}{rel}{25}
474 \DeclareFlexSymbol{\searrow}{Rel}{rel}{26}
475 \DeclareFlexSymbol{\nwarrow}{Rel}{rel}{2D}
476 \DeclareFlexSymbol{\swarrow}{Rel}{rel}{2E}
477 \DeclareFlexSymbol{\Leftrightarrow}{Rel}{rel}{2C}
478 \DeclareFlexSymbol{\Leftarrow}{Rel}{rel}{28}
479 \DeclareFlexSymbol{\Rightarrow}{Rel}{rel}{29}
480 \DeclareFlexSymbol{\leq}{Rel}{rel}{14}
481 \DeclareFlexSymbol{\geq}{Rel}{rel}{15}
482 \DeclareFlexSymbol{\succ}{Rel}{rel}{1F}
483 \DeclareFlexSymbol{\prec}{Rel}{rel}{1E}
484 \DeclareFlexSymbol{\approx}{Rel}{rel}{19}
485 \DeclareFlexSymbol{\succeq}{Rel}{rel}{17}
486 \DeclareFlexSymbol{\preceq}{Rel}{rel}{16}
487 \DeclareFlexSymbol{\supseteq}{Rel}{rel}{1B}

```

```

488 \DeclareFlexSymbol{\subset}{Rel}{rel}{1A}
489 \DeclareFlexSymbol{\supseteq}{Rel}{rel}{13}
490 \DeclareFlexSymbol{\subseteq}{Rel}{rel}{12}
491 \DeclareFlexSymbol{\in}{Rel}{rel}{32}
492 \DeclareFlexSymbol{\ni}{Rel}{rel}{33}
493 \DeclareFlexSymbol{\gg}{Rel}{rel}{1D}
494 \DeclareFlexSymbol{\ll}{Rel}{rel}{1C}
495 \DeclareFlexSymbol{\leftrightharpoonup}{Rel}{rel}{24}
496 \DeclareFlexSymbol{\leftarrow}{Rel}{rel}{20}
497 \DeclareFlexSymbol{\rightarrow}{Rel}{rel}{21}
498 \DeclareFlexSymbol{\sim}{Rel}{rel}{18}
499 \DeclareFlexSymbol{\simeq}{Rel}{rel}{27}
500 \DeclareFlexSymbol{\perp}{Rel}{rel}{3F}
501 \DeclareFlexSymbol{\equiv}{Rel}{rel}{11}
502 \DeclareFlexSymbol{\asymp}{Rel}{rel}{10}

```

The `\notRel` glyph is a special zero-width glyph intended only for use in constructing negated symbols. `\mapstoRel` and `\cdotPun` have similar but more restricted applications.

```

503 \DeclareFlexSymbol{\notRel}{Rel}{rel}{36}
504 \DeclareFlexSymbol{\mapstoOrd}{Ord}{OMS}{37}
505 \DeclareFlexSymbol{\cdotOrd}{Ord}{OMS}{01}
506 \def\cdotp{\mathpunct{\cdotOrd}}

```

Symbols from the 128-character `cmex` encoding. `COs` stands for ‘cumulative operator (sum-like)’. `COi` stands for ‘cumulative operator (integral-like)’. These typically differ only in the default placement of limits. `cop` stands for ‘cumulative operator math group’.

```

507 \DeclareFlexSymbol{\coprod}{COs}{cop}{60}
508 \DeclareFlexSymbol{\bigvee}{COs}{cop}{57}
509 \DeclareFlexSymbol{\bigwedge}{COs}{cop}{56}
510 \DeclareFlexSymbol{\biguplus}{COs}{cop}{55}
511 \DeclareFlexSymbol{\bigcap}{COs}{cop}{54}
512 \DeclareFlexSymbol{\bigcup}{COs}{cop}{53}
513 \DeclareFlexSymbol{\int}{COi}{cop}{52}
514 \DeclareFlexSymbol{\prod}{COs}{cop}{51}
515 \DeclareFlexSymbol{\sum}{COs}{cop}{50}
516 \DeclareFlexSymbol{\bigotimes}{COs}{cop}{4E}
517 \DeclareFlexSymbol{\bigoplus}{COs}{cop}{4C}
518 \DeclareFlexSymbol{\bigodot}{COs}{cop}{4A}
519 \DeclareFlexSymbol{\oint}{COi}{cop}{48}
520 \DeclareFlexSymbol{\bigsqcup}{COs}{cop}{46}

```

Delimiter symbols. `DeL` stands for ‘delimiter (left)’. `DeR` stands for ‘delimiter (right)’. `DeB` stands for ‘delimiter (bidirectional)’. The principal encoding point for an extensible delimiter is the first link in the list of linked sizes as specified in the font metric information. For a math encoding such as OT1/OML/OMS/OMX where not all sizes of a given delimiter reside in a given font, the extra encoding point for the smallest delimiter must be supplied by defining

```
\sd@GXX
```

where `G` is the mathgroup and `XX` is the hexadecimal glyph position.

```
521 \DeclareFlexSymbol{\rangle}{DeR}{del}{0B}
```

```

522 \DeclareFlexSymbol{\langle}{DeL}{del}{0A}
523 \DeclareFlexSymbol{\rbrace}{DeR}{del}{09}
524 \DeclareFlexSymbol{\lbrace}{DeL}{del}{08}
525 \DeclareFlexSymbol{\rceil}{DeR}{del}{07}
526 \DeclareFlexSymbol{\lceil}{DeL}{del}{06}
527 \DeclareFlexSymbol{\rfloor}{DeR}{del}{05}
528 \DeclareFlexSymbol{\lfloor}{DeL}{del}{04}
529 \DeclareFlexSymbol{\l}{DeL}{del}{00}
530 \DeclareFlexSymbol{\r}{DeR}{del}{01}
531 \DeclareFlexSymbol{\lbracket}{DeL}{del}{02}
532 \DeclareFlexSymbol{\rbracket}{DeR}{del}{03}
533 \DeclareFlexSymbol{\lVert}{DeL}{del}{0D}
534 \DeclareFlexSymbol{\rVert}{DeR}{del}{0D}
535 \DeclareFlexSymbol{\lvert}{DeL}{del}{0C}
536 \DeclareFlexSymbol{\rvert}{DeR}{del}{0C}
537 \DeclareFlexSymbol{\Vert}{DeB}{del}{0D}
538 \DeclareFlexSymbol{\vert}{DeB}{del}{0C}

```

Maybe make the vert bars mathord instead of delimiter, to discourage poor usage.

```

539 \DeclareFlexSymbol{\l}{DeB}{del}{0C}
540 \DeclareFlexSymbol{\r}{DeB}{del}{0E}

```

These wacky delimiters need to be supported I guess for compabitility reasons.

The DeA delimiter type is a special case used only for these arrows.

```

541 \DeclareFlexSymbol{\lmoustache}{DeL}{del}{40}
542 \DeclareFlexSymbol{\rmoustache}{DeR}{del}{41}
543 \DeclareFlexSymbol{\lgroup}{DeL}{del}{3A}
544 \DeclareFlexSymbol{\rgroup}{DeR}{del}{3B}
545 \DeclareFlexSymbol{\bracevert}{DeB}{del}{3E}
546 \DeclareFlexSymbol{\arrowvert}{DeB}{del}{3C}
547 \DeclareFlexSymbol{\Arrowvert}{DeB}{del}{3D}
548 \DeclareFlexSymbol{\uparrow}{DeA}{del}{78}
549 \DeclareFlexSymbol{\downarrow}{DeA}{del}{79}
550 \DeclareFlexSymbol{\updownarrow}{DeA}{del}{3F}
551 \DeclareFlexSymbol{\Uparrow}{DeA}{del}{7E}
552 \DeclareFlexSymbol{\Downarrow}{DeA}{del}{7F}
553 \DeclareFlexSymbol{\Updownarrow}{DeA}{del}{77}
554 \DeclareFlexSymbol{\backslash}{DeB}{del}{0F}

```

### 3 Some compound symbols

The following symbols are not robust in standard L<sup>A</sup>T<sub>E</sub>X because they use # or \mathpalette (which is not robust and contains a # in its expansion): \angle, \cong, \notin, \rightleftharpoons.

In this definition of \hbar, the symbol is cobbled together from a math italic h and the cmr overbar accent glyph.

```

555 \DeclareFlexSymbol{\hbarOrd}{Ord}{OT1}{16}
556 \DeclareFlexCompoundSymbol{\hbar}{Ord}{\hbarOrd\mkern-9mu h}

```

For \surd, the interior symbol gets math class 1 (cumulative operator) to make the glyph vertically centered on the math axis, but the desired horizontal spacing is the spacing for a mathord. (Couldn't it just be class mathopen, though? )

```

557 \DeclareFlexSymbol{\surdOrd}{Ord}{OMS}{70}
558 \DeclareFlexCompoundSymbol{\surd}{Ord}{\mathop{\surdOrd}}

```

As shown in this definition of `\angle`, rule `dimens` are not allowed to use `math-` units, unfortunately.

```
559 \DeclareFlexCompoundSymbol{\angle}{Ord}{%
560   \vbox{\ialign{%
561     $\m@th\scriptstyle##$\crrc
562     \notRel\mathrel{\mkern14mu}\crrc
563     \noalign{\nointerlineskip}%
564     \mkern2.5mu\leaders\hrule \@height.34pt\hfill\mkern2.5mu\crrc
565   }}%
566 }
```

The `\not` function, which is defined in the `flexisym` package, requires a suitably defined `\notRel` symbol.

```
567 \DeclareFlexCompoundSymbol{\neq}{Rel}{\not{=}}
```

```
568 \DeclareFlexCompoundSymbol{\mapsto}{Rel}{\mapstoOrd\rightarrow}
```

The `\@vereq` function ends by centering the whole construction on the math axis, unlike `\buildrel` where the base symbol remains at its normal altitude. Furthermore, `\@vereq` leaves the math style of the top symbol as given instead of downsizing to `scriptstyle`.

```
569 \DeclareFlexCompoundSymbol{\cong}{Rel}{\mathpalette\@vereq\sim}
```

The `\m@th` in the `fontmath.ltx` definition of `\notin` is superfluous unless `\c@ncel` doesn't include it (which was perhaps true in an older version of `plain.tex`).

```
570 \providecommand*\joinord{}
571 \cmbase\mathptmx\renewcommand*\joinord{\mkern-3mu }
572 \mathpazo\renewcommand*\joinord{\mkern-3.45mu }
573 \DeclareFlexCompoundSymbol{\notin}{Rel}{\mathpalette\c@ncel\in}
574 \DeclareFlexCompoundSymbol{\rightleftharpoons}{Rel}{\mathpalette\rlh@{}}
575 \DeclareFlexCompoundSymbol{\doteq}{Rel}{\buildrel\textstyle.\over= }
576 \DeclareFlexCompoundSymbol{\hookrightarrow}{Rel}{\lhookRel\joinord\rightarrow}
577 \DeclareFlexCompoundSymbol{\hookleftarrow}{Rel}{\leftarrow\joinord\rhookRel}
578 \DeclareFlexCompoundSymbol{\bowtie}{Rel}{\triangleright\joinord\triangleleft}
579 \DeclareFlexCompoundSymbol{\models}{Rel}{\vert\joinord=}
580 \DeclareFlexCompoundSymbol{\Longrightarrow}{Rel}{\Relbar\joinord\rightarrow}
581 \DeclareFlexCompoundSymbol{\longrightarrow}{Rel}{\relbar\joinord\rightarrow}
582 \DeclareFlexCompoundSymbol{\Longleftarrow}{Rel}{\Leftarrow\joinord\Relbar}
583 \DeclareFlexCompoundSymbol{\longleftarrow}{Rel}{\leftarrow\joinord\relbar}
584 \DeclareFlexCompoundSymbol{\longmapsto}{Rel}{\mapstochar\longrightarrow}
585 \DeclareFlexCompoundSymbol{\longlefttrightarrow}{Rel}{\leftarrow\joinord\rightarrow}
586 \DeclareFlexCompoundSymbol{\Leftrightarrow}{Rel}{\Leftarrow\joinord\rightarrow}
```

Here is what you get from the old definition of `\iff`.

```
\glue 2.77771 plus 2.77771
\glue(\thickmuskip) 2.77771 plus 2.77771
\OMS/cmsy/m/n/10 (
\hbox(0.0+0.0)x-1.66663
.\kern -1.66663
\OMS/cmsy/m/n/10 )
\penalty 500
\glue 2.77771 plus 2.77771
\glue(\thickmuskip) 2.77771 plus 2.77771
```

Looks like it could be simplified slightly. But it's not so easy as it looks to do it without screwing up the line breaking possibilities.

```
587 \renewcommand*{\iff{%
588   \mskip\thickmuskip\Longleftarrow\mskip\thickmuskip
589 }
```

Some dotly symbols.

```
590 \DeclareFlexCompoundSymbol{\cdots}{Inn}{\cdotp\cdotp\cdotp}%
591 \DeclareFlexCompoundSymbol{\vdots}{Ord}{%
592   \vbox{\baselineskip4\p@ \lineskiplimit\z@
593     \kern6\p@\hbox{.}\hbox{.}\hbox{.}}}
594 \DeclareFlexCompoundSymbol{\ddots}{Inn}{%
595   \mkern1mu\raise7\p@
596   \vbox{\kern7\p@\hbox{.}}\mkern2mu%
597   \raise4\p@\hbox{.}\mkern2mu\raise\p@\hbox{.}\mkern1mu%
598 }
```

```
599 \def\relbar{\begingroup \def\smash@{tb}% in case amsmath is loaded
600   \mathpalette\mathsm@sh\mathchar"200 }\endgroup}
```

For `\Relbar` we take an equal sign of class 0 (Ord) from the operator family. For `cmr` and `mathptmx` we know this is family 0.

```
601 \cmbase | mathptmx \def\Relbar{\mathchar"3D }
```

For the `mathpazo` setup we need to use the equal sign from `cmr` and so must insert class 0 and use the symbol from the upright symbols.

```
602 \mathpazo \edef\Relbar{\mathchar\string\hexnumber@\symupright3D }
```

Done.

```
603 \cmbase | mathpazo | mathptmx
```

Various synonyms such as `\le` for `\leq` and `\to` for `\rightarrow` are defined in `flexisym` with `\def` instead of `\let`, for slower execution speed but smaller chance of synchronization problems.

```
604 \*msabm
605 \ProvidesSymbols{msabm}[2001/09/08 v0.91]
606 \RequirePackage{amsfonts}\relax
607 \exp\xdef\csname mg@MSA\endcsname{\hexnumber@\symAMSA}%
608 \exp\xdef\csname mg@MSB\endcsname{\hexnumber@\symAMSB}%
609 \DeclareFlexSymbol{\boxdot} {Bin}{MSA}{00}
610 \DeclareFlexSymbol{\boxplus} {Bin}{MSA}{01}
611 \DeclareFlexSymbol{\boxtimes} {Bin}{MSA}{02}
612 \DeclareFlexSymbol{\square} {Ord}{MSA}{03}
613 \DeclareFlexSymbol{\blacksquare} {Ord}{MSA}{04}
614 \DeclareFlexSymbol{\centerdot} {Bin}{MSA}{05}
615 \DeclareFlexSymbol{\lozenge} {Ord}{MSA}{06}
616 \DeclareFlexSymbol{\blacklozenge} {Ord}{MSA}{07}
617 \DeclareFlexSymbol{\circlearrowright} {Rel}{MSA}{08}
618 \DeclareFlexSymbol{\circlearrowleft} {Rel}{MSA}{09}
```

In `amsfonts.sty`:

```
619 %%\DeclareFlexSymbol{\rightleftharpoons}{Rel}{MSA}{0A}
620 \DeclareFlexSymbol{\leftrightharpoons} {Rel}{MSA}{0B}
```

```

621 \DeclareFlexSymbol{\boxminus}      {Bin}{MSA}{OC}
622 \DeclareFlexSymbol{\Vdash}         {Rel}{MSA}{OD}
623 \DeclareFlexSymbol{\Vvdash}        {Rel}{MSA}{OE}
624 \DeclareFlexSymbol{\vDash}         {Rel}{MSA}{OF}
625 \DeclareFlexSymbol{\twoheadrightarrow} {Rel}{MSA}{10}
626 \DeclareFlexSymbol{\twoheadleftarrow} {Rel}{MSA}{11}
627 \DeclareFlexSymbol{\leftleftarrows}  {Rel}{MSA}{12}
628 \DeclareFlexSymbol{\rightrightarrows} {Rel}{MSA}{13}
629 \DeclareFlexSymbol{\upuparrows}      {Rel}{MSA}{14}
630 \DeclareFlexSymbol{\downdownarrows}  {Rel}{MSA}{15}
631 \DeclareFlexSymbol{\upharpoonright}  {Rel}{MSA}{16}
632 \let\restriction\upharpoonright
633 \DeclareFlexSymbol{\downharpoonright} {Rel}{MSA}{17}
634 \DeclareFlexSymbol{\upharpoonleft}    {Rel}{MSA}{18}
635 \DeclareFlexSymbol{\downharpoonleft}  {Rel}{MSA}{19}
636 \DeclareFlexSymbol{\rightarrowtail}   {Rel}{MSA}{1A}
637 \DeclareFlexSymbol{\leftarrowtail}    {Rel}{MSA}{1B}
638 \DeclareFlexSymbol{\leftrightarrows}  {Rel}{MSA}{1C}
639 \DeclareFlexSymbol{\rightleftarrows}  {Rel}{MSA}{1D}
640 \DeclareFlexSymbol{\Lsh}              {Rel}{MSA}{1E}
641 \DeclareFlexSymbol{\Rsh}              {Rel}{MSA}{1F}
642 \DeclareFlexSymbol{\rightsquigarrow}   {Rel}{MSA}{20}
643 \DeclareFlexSymbol{\leftrightsquigarrow} {Rel}{MSA}{21}
644 \DeclareFlexSymbol{\looparrowleft}    {Rel}{MSA}{22}
645 \DeclareFlexSymbol{\looparrowright}   {Rel}{MSA}{23}
646 \DeclareFlexSymbol{\circeq}           {Rel}{MSA}{24}
647 \DeclareFlexSymbol{\succsim}          {Rel}{MSA}{25}
648 \DeclareFlexSymbol{\gtrsim}           {Rel}{MSA}{26}
649 \DeclareFlexSymbol{\gtrapprox}        {Rel}{MSA}{27}
650 \DeclareFlexSymbol{\multimap}         {Rel}{MSA}{28}
651 \DeclareFlexSymbol{\therefore}        {Rel}{MSA}{29}
652 \DeclareFlexSymbol{\because}          {Rel}{MSA}{2A}
653 \DeclareFlexSymbol{\doteqdot}         {Rel}{MSA}{2B}
654 \let\Doteq\doteqdot
655 \DeclareFlexSymbol{\triangleq}        {Rel}{MSA}{2C}
656 \DeclareFlexSymbol{\precsim}          {Rel}{MSA}{2D}
657 \DeclareFlexSymbol{\lessim}           {Rel}{MSA}{2E}
658 \DeclareFlexSymbol{\lessapprox}       {Rel}{MSA}{2F}
659 \DeclareFlexSymbol{\eqslantless}      {Rel}{MSA}{30}
660 \DeclareFlexSymbol{\eqslantgtr}       {Rel}{MSA}{31}
661 \DeclareFlexSymbol{\curlyeqprec}      {Rel}{MSA}{32}
662 \DeclareFlexSymbol{\curlyeqsucc}      {Rel}{MSA}{33}
663 \DeclareFlexSymbol{\preccurlyeq}      {Rel}{MSA}{34}
664 \DeclareFlexSymbol{\leqq}             {Rel}{MSA}{35}
665 \DeclareFlexSymbol{\leqslant}         {Rel}{MSA}{36}
666 \DeclareFlexSymbol{\lessgtr}          {Rel}{MSA}{37}
667 \DeclareFlexSymbol{\backprime}        {Ord}{MSA}{38}
668 \DeclareFlexSymbol{\risingdotseq}     {Rel}{MSA}{3A}
669 \DeclareFlexSymbol{\fallingdotseq}    {Rel}{MSA}{3B}
670 \DeclareFlexSymbol{\succcurlyeq}      {Rel}{MSA}{3C}
671 \DeclareFlexSymbol{\geqq}             {Rel}{MSA}{3D}
672 \DeclareFlexSymbol{\geqslant}         {Rel}{MSA}{3E}
673 \DeclareFlexSymbol{\gtrless}          {Rel}{MSA}{3F}

```



in amsfonts.sty

```

674 %% \DeclareFlexSymbol{\sqsubset}      {Rel}{MSA}{40}
675 %% \DeclareFlexSymbol{\sqsupset}      {Rel}{MSA}{41}
676 \DeclareFlexSymbol{\vartriangleright}{Rel}{MSA}{42}
677 \DeclareFlexSymbol{\vartriangleleft} {Rel}{MSA}{43}
678 \DeclareFlexSymbol{\trianglerighteq} {Rel}{MSA}{44}
679 \DeclareFlexSymbol{\trianglelefteq} {Rel}{MSA}{45}
680 \DeclareFlexSymbol{\bigstar}         {Ord}{MSA}{46}
681 \DeclareFlexSymbol{\between}         {Rel}{MSA}{47}
682 \DeclareFlexSymbol{\blacktriangledown}{Ord}{MSA}{48}
683 \DeclareFlexSymbol{\blacktriangleright}{Rel}{MSA}{49}
684 \DeclareFlexSymbol{\blacktriangleleft}{Rel}{MSA}{4A}
685 \DeclareFlexSymbol{\vartriangle}      {Rel}{MSA}{4D}
686 \DeclareFlexSymbol{\blacktriangle}    {Ord}{MSA}{4E}
687 \DeclareFlexSymbol{\triangledown}     {Ord}{MSA}{4F}
688 \DeclareFlexSymbol{\eqcirc}           {Rel}{MSA}{50}
689 \DeclareFlexSymbol{\lesseqgtr}        {Rel}{MSA}{51}
690 \DeclareFlexSymbol{\gtreqless}        {Rel}{MSA}{52}
691 \DeclareFlexSymbol{\lesseqqgtr}       {Rel}{MSA}{53}
692 \DeclareFlexSymbol{\gtreqqless}       {Rel}{MSA}{54}
693 \DeclareFlexSymbol{\Rrightarrow}      {Rel}{MSA}{56}
694 \DeclareFlexSymbol{\Lleftarrow}       {Rel}{MSA}{57}
695 \DeclareFlexSymbol{\veebar}           {Bin}{MSA}{59}
696 \DeclareFlexSymbol{\barwedge}         {Bin}{MSA}{5A}
697 \DeclareFlexSymbol{\doublebarwedge}   {Bin}{MSA}{5B}

```

In amsfonts.sty

```

698 %%\DeclareFlexSymbol{\angle}           {Ord}{MSA}{5C}
699 \DeclareFlexSymbol{\measuredangle}     {Ord}{MSA}{5D}
700 \DeclareFlexSymbol{\sphericalangle}    {Ord}{MSA}{5E}
701 \DeclareFlexSymbol{\varpropto}         {Rel}{MSA}{5F}
702 \DeclareFlexSymbol{\smallsmile}        {Rel}{MSA}{60}
703 \DeclareFlexSymbol{\smallfrown}        {Rel}{MSA}{61}
704 \DeclareFlexSymbol{\Subset}            {Rel}{MSA}{62}
705 \DeclareFlexSymbol{\Supset}            {Rel}{MSA}{63}
706 \DeclareFlexSymbol{\Cup}               {Bin}{MSA}{64}
707 \let\doublecup\Cup
708 \DeclareFlexSymbol{\Cap}               {Bin}{MSA}{65}
709 \let\doublecap\Cap
710 \DeclareFlexSymbol{\curlywedge}        {Bin}{MSA}{66}
711 \DeclareFlexSymbol{\curlyvee}          {Bin}{MSA}{67}
712 \DeclareFlexSymbol{\leftthreetimes}    {Bin}{MSA}{68}
713 \DeclareFlexSymbol{\rightthreetimes}   {Bin}{MSA}{69}
714 \DeclareFlexSymbol{\subseteqq}         {Rel}{MSA}{6A}
715 \DeclareFlexSymbol{\supseteqq}         {Rel}{MSA}{6B}
716 \DeclareFlexSymbol{\bumpeq}           {Rel}{MSA}{6C}
717 \DeclareFlexSymbol{\Bumpeq}           {Rel}{MSA}{6D}
718 \DeclareFlexSymbol{\lll}              {Rel}{MSA}{6E}
719 \let\llless\lll
720 \DeclareFlexSymbol{\ggg}              {Rel}{MSA}{6F}
721 \let\gggtr\ggg
722 \DeclareFlexSymbol{\circledS}          {Ord}{MSA}{73}
723 \DeclareFlexSymbol{\pitchfork}         {Rel}{MSA}{74}
724 \DeclareFlexSymbol{\dotplus}          {Bin}{MSA}{75}

```





















|                           |               |          |                          |                                  |  |
|---------------------------|---------------|----------|--------------------------|----------------------------------|--|
| <code>\vert</code> .....  | 154, 538, 579 |          |                          | <b>X</b>                         |  |
| <code>\Vdash</code> ..... | 623           |          | <code>\xdef</code> ..    | 173, 227, 267–270, 273, 607, 608 |  |
|                           |               |          | <code>\Xi</code> .....   | 292                              |  |
|                           |               |          | <code>\xi</code> .....   | 327                              |  |
|                           |               | <b>W</b> |                          |                                  |  |
| <code>\wedge</code> ..... | 252, 439      |          |                          | <b>Z</b>                         |  |
| <code>\wp</code> .....    | 346           |          | <code>\z@</code> .....   | 140, 154, 155, 159–              |  |
| <code>\wr</code> .....    | 451           |          |                          | 161, 163, 165–167, 169, 194, 592 |  |
|                           |               |          | <code>\zeta</code> ..... | 319                              |  |