Language Manual

German

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German
Gerhard and Helga
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1 General

This document discusses certain aspects of text-to-speech processing for the German text-to-speech system, in particular the different types of input characters and text that are allowed.

This version of the document corresponds to the High Density voices Helga and Gerhard.

1.1 Notational conventions

The following notational conventions are used in this manual:

- For linguistic entities in general, **boldface** is used.
- Input text is written in a `non proportional font`.
- Output text is written in *italics*.
- Keyboard entities are written within angle brackets < >.
- Phonetic transcriptions are written within slashes or hash marks depending on the phonetic alphabet used.

The following abbreviations are used in this manual:

LM	Letter mode
SM	Sentence mode

See the User's Guide for a description of the two different reading modes. Note that Sentence mode is sometimes referred to as Normal mode.

2 Letters in orthographic text

Characters from **A-Z** and **a-z** and the special German characters **A O U** and **a o u ß** may constitute a word. Certain other characters are also considered as letters, notably those used as letters in other European languages, i.e. "**n**, **c**, **e**", see section 2.1. The apostrophe character <'> can also occur among letters in words.

Characters outside of these ranges, i.e. digits and non-alphanumeric characters such as punctuation characters and currency markers etc, are not considered as letters. If such a non-letter is included within a word, the word is ended where the non-letter appears and the following letters considered belonging to a new word.

2.1 Characters treated as letters in other languages

In SM next to other letters, each special letter is read as a corresponding letter without the diacritic, i.e. **a** is read as an **a**, **e** is read as an **e** etc. In LM, the character of the diacritic will be indicated. See Table 1 below.

Character	SM	LM
ç, Ç	*ß*	*C cedille*
ñ, Ñ	*nj*	*N Tilde*
é	*e*	*E Akzent*
É	*E*	*E Akzent*
è	*e*	*E gravis Akzent*
î	*i*	*I circumflex Akzent*
ö	*ö*	*O Umlaut*
ë	*e*	*E Umlaut*
ã	*a, ang*	*A mit Tilde*
ë	*e*	*E Umlaut*
ÿ	*ü*	*Ypsilon Umlaut*
Ð, ð	*d*	*Edh (Icelandic character)*
Þ, þ	*t*	*Thorn (Icelandic character)*

Table 1 Non-German letters with diacritics

3 Non-alphanumeric characters

The processing of non-alphanumeric characters varies, depending on the reading mode, context of the character, and its function within that context. These are the types of non-alphanumeric characters to be distinguished:

- Characters always processed as punctuation, and having a direct effect on the intonation and pausing in SM.
- Non-punctuation characters that are always pronounced, with no effect on the intonation or pausing.
- Characters whose pronunciation varies according to context.
- Control characters

Below is a discussion of the characters grouped by type. For each character, the pronunciation is given in the three basic reading modes.

3.1 Punctuation characters

Table 2 lists punctuation characters permitted in the normal text input string and their readings. In SM they are all silent but they affect both rhythm and intonation as described in the sections below.

Character	LM	SM
.	*Punkt*	(silence)
!	*Ausrufezeichen*	(silence)
?	*Fragezeichen*	(silence)
,	*Komma*	(silence)
:	*Doppelpunkt*	(silence)
;	*Semikolon*	(silence)
"	*Anführungszeichen*	(silence)
(	*Klammer auf*	(silence, see 3.1.6)
)	*Klammer zu*	(silence, see 3.1.6)
'	*Apostroph*	(silence, see 3.1.7)

Table 2 Punctuation characters

3.1.1 Comma, colon and semicolon

Comma < **,** >, colon < **:** > and semicolon < **;** > occurring in a non-digit text string cause a brief pause to occur in a sentence, accompanied by a small rising intonation pattern just prior to the character. See chapter 4 for a description of the use of comma and colon in digit strings.

3.1.2 Quotation marks

Quotes < **“ ”** > may be used around a single word or a group of words in a sentence. Quotes are used in conjunction with digit strings to mark telephone numbers. See section 4.6 for a description of the appropriate formats.

3.1.3 Full stop

A full stop < **.** > is a sentence terminal punctuation mark which causes a falling end-of-sentence intonation pattern and is accompanied by a somewhat longer pause. Full stop has a special purpose when used in digit strings, see chapter 4.

3.1.4 Question mark

A question mark <**?**> causes two different intonation patterns:

- For Yes/No type questions there is a rising intonation contour.
- For W-questions (i.e. questions beginning with **wer**, **was**, **wo**, **wann**, **warum**, and **wie**), there is a falling intonation pattern.

Both are accompanied by a pause.

3.1.5 Exclamation mark

The exclamation mark <**!**> causes an emphatic intonation pattern to occur on the last word of the sentence, followed by a pause.

3.1.6 Parentheses

Parentheses < **( )** > appearing around a single word or a group of words cause a brief pause before and after the bracketed text. Parentheses are pronounced *Klammer auf* and *Klammer zu* respectively in SM when part of a digit string which does not follow the Telephone Number format outlined in section 4.6. In SM this is restricted to cases that fulfil the following two conditions:

- The whole of what goes between the brackets must be a numerical expression.
- A digit string or numerical expression must immediately precede or follow the bracketed expression.

Non-matching brackets are not read out in SM.

Expression	**Reading**
`(10+4)`	*zehn plus vier*
`2*(10+4)`	*zwei mal Klammer auf zehn plus vier Klammer zu*
`2*(10+4a)`	*zwei mal zehn plus vier a*
`"(039)3378"`	*null drei neun* (pause) *drei drei* (pause) *sieben acht*

3.1.7 Apostrophe

< ' > is pronounced *Apostroph* in SM if it occurs in a digit string or between spaces. It is not pronounced if it occurs in a letter sequence.

3.2 Non-punctuation characters

The characters listed below in Table 3 are processed as non-letter, non-punctuation characters which are pronounced at all times in all reading modes.

Character	SM	LM
%	*Prozent*	*Prozent*
&	*und*	*und*
/	*Schrägstrich*	*Schrägstrich*
^	*Hochpfeil*	*Hochpfeil*
`	*Gravis*	*Gravis*
@	*Paragraph*	*Paragraph*
$	*Dollar*	*Dollar*
_	*Unterstrich*	*Unterstrich*
<	*Spitze Klammer auf*	*Spitze Klammer auf*
>	*Spitze Klammer zu*	*Spitze Klammer zu*
£	*Pfund*	*Pfund*
¢	*Cent*	*Cent*
€	*Euro*	*Euro*
¥	*Yen*	*Yen*
¿	*(silence)*	*Umgekehrtes Fragezeichen*
¡	*(silence)*	*Umgekehrtes Ausrufezeichen*
½	*ein Halb*	*ein Halb*
¼	*ein Viertel*	*ein Viertel*
¾	*drei Viertel*	*drei Viertel*
…	*Punkt Punkt Punkt*	*Punkt Punkt Punkt*
±	*plus minus*	*plus minus*
°	*Grad*	*Grad*
‰	*Promille*	*Promille*
¢	*Cent*	*Cent*
€	*Euro*	*Euro*
¥	*Yen*	*Yen*
ª	*hochgestellter A*	*hochgestellter A*
º	*hochgestellter O*	*hochgestellter O*
§	*Paragraph*	*Paragraph*
„ “ ” « »	*Anführungszeichen*	*Anführungszeichen*
²	*hoch zwei*	*hoch zwei*
³	*hoch drei*	*hoch drei*

Table 3 Non-punctuation characters

Special case

km², mm², cm² and **m²** are read as *Kvadratkilometer*, *Kvadratmillimeter* etc. (**km**, **mm** and **cm** are read as abbreviations, see chapter 8, but **m** on its own is read as the name of the letter; to have it read as e.g. *Meter* it is necessary to enter it in the user lexicon).

3.3 Characters whose pronunciation varies

The pronunciation of the characters listed below varies according to their context.

Character	LM	SM
-	*Bindestrich*	(see 3.4.1 and 3.4.5)
=	*Gleichheitszeichen*	(see 3.4.2)
+	*plus*	(see 3.4.5)
*	*Stern*	(see 3.4.3 and 3.4.5)
#	*Doppelkreuz*	(see 3.4.4 and 3.4.5)

Table 4 Characters with varying pronunciation

All examples below show the reading in SM.

3.3.1 Hyphen

Hyphen <-> is pronounced *minus* if a digit follows the hyphen. Hyphen is not pronounced if surrounded by spaces. When hyphen is used to mark compound words it is not pronounced. Hyphen is discarded at the end of a line, and causes the two parts of the hyphenated word to be joined into a single word.

In most other cases, hyphen is pronounced *Bindestrich*.

Expression	Reading
`-3`	*minus drei*
`11-88`	*elf minus acht und zwanzig*
`23 - 24`	*drei und zwanzig vier und zwanzig*
`nicht-komplementäre`	*nichtkomplementäre*
`Beide Län-` `der haben versucht.`	*Beide Länder haben versucht*
`--stptr`	*Bindestrich Bindestrich S T P T R*

3.3.2 The equal sign < = >

The equal sign < = > is pronounced *ist gleich* if a digit immediately follows it. It is pronounced *Gleichheitszeichen* in all other cases.

Expression	Reading
`1+2=3`	*eine plus zwei ist gleich drei.*
`bc=10`	*B C ist gleich zehn*
`bc=dx`	*B C Gleichheitszeichen D X*
`--stptr`	*Bindestrich Bindestrich S T P T R*

3.3.3 Asterisk

Asterisk < ***** > is pronounced *mal* if a digit immediately precedes and follows it; it is pronounced *Stern* in all other cases.

Expression	Reading
`2*3`	*zwei mal drei*
`*bc`	*Stern b c*

3.3.4 Hash mark

The hash mark < **#** > is normally pronounced *Doppelkreuz* in all modes.

Expression	Reading
#123#	*Doppelkreuz eins zwei drei Doppelkreuz (LM)* *Doppelkreuz ein hundert drei und zwanzig Doppelkreuz (SM)*

3.3.5 Multiple occurrences of the same character

In SM, if more than three of the same character occur in sequence without a space separating the characters, only the first three occurrences will be pronounced. This is only valid for the following characters: < *** + - =** >.

Expression	Reading
*****	*Stern Stern Stern*
+++++	*plus plus plus*
-----	*Bindestrich Bindestrich Bindestrich*
=====	*Gleichheitszeichen Gleichheitszeichen Gleichheitszeichen*

3.4 Control characters

In LM (only) the control characters <RETURN> and <TAB> among others are read out in all systems according to Table 5. The reading out of the <BACKSPACE> character is not available on all systems. Most other control characters are read out, in most cases as *control* + the appropriate letter, e.g. ^T is read as *control T*.

Character	LM
^H <BACKSPACE>	*Rückwärtstaste*
^I <TAB>	*Tabulator*
^J <LINE FEED>	*Zeilenvorshub*
^M <RETURN>	*return*

Table 5 Control characters

3.5 Characters ignored by the system

All characters that are not described in chapter 2 and 3 and that are not phonetic symbols or digits, are ignored by the system. Normally, these characters are omitted but some of them may cause the sentence they appear in to be silent.

4 Number processing

Strings of digits that are sent to the text-to-speech converter are processed in several different ways, depending on the reading mode, format of the digit string, and the immediately surrounding punctuation or non-numeric characters. To familiarise the user with the various types of formatted and non-formatted strings of digits that are recognized by the system, we provide below a brief description of the basic number processing along with examples.

Number processing is subdivided into the following categories:

- Full number pronunciation
- Leading zero
- Decimal numbers
- Currency amounts
- Telephone numbers
- Time of day
- Arithmetic operators and other symbols
- Mixed digits and letters
- Ordinal numbers

4.1 Full number pronunciation

When LM is enabled, digit strings are read as single digits, and all punctuation marks are read.
In SM, full number pronunciation is given for the whole number part of the digit string.

Optional periods < **.** > may be used in the whole number portion to separate three-digit groups into hundreds, thousands, millions, and billions. Note that the grouping must be 'correct', i.e. the groups must consist of exactly three digits, except the first, which may contain one, two or three digits. A period < **.** > occurring between digits will be read as *Punkt* in all other cases.

The highest number read is 999999999999 (twelve digits). Numbers higher than this are read as separate digits, with pauses between groups of digits.

Number	**Reading**
2425	*zwei tausend vier hundert fünf und zwanzig*
2.425	*zwei tausend vier hundert fünf und zwanzig*
2.425.25	*zwei Punkt vierhundert fünf und zwanzig Punkt fünf und zwanzig*
1,000,000,000	*eine Milliarde*
1234567890123	*eins zwei drei* (pause) *vier fünf sechs* (pause) *sieben acht neun* (pause) *null eins* (pause) *zwei drei*

4.2 Exceptions to full number pronunciation

An exception is made for year pronunciation, which occurs in four-digit strings in the range of **1100** to **1999**. Digit strings ending in **00** within the same range are read as hundreds. Year pronunciation can be overridden by inserting a comma after the **1**.

Number	**Reading**
1088	*ein tausend acht und achtzig*
1900	*neunzehn hundert*
1988	*neunzehn hundert acht und achtzig*
1,988	*ein tausend neun hundert acht und achtzig*

4.3 Leading zero

Digit strings that begin with 0 (zero) are read digit by digit, with pauses between groups of digits if there are four or more digits.

Number	**Reading**
09253	*null neun zwei* (pause) *fünf drei*
020	*null zwei* (pause) *eins null*

4.4 Decimal numbers

In decimal numbers, the digits to the right of the decimal mark < **,** > are read as single digits, with pauses occurring between groups of digits if there are four or more digits. If exactly 2 digits follow the decimal mark, the decimal part is read as a full number.

Note 1: The character < **.** > is not processed as a decimal marker, but is read either as *Punkt* or discarded as described above, see section 4.1.

Note 2: Zeros at the end of a decimal number are ignored if they occur later than the second decimal position. If the decimal portion consists of precisely two zeros, this is read as *null null*; in other cases, if the decimal portion consists of only zeros, these are read as *null* (only once).

The reading of decimal numbers in SM is exemplified below. In LM, all digits and punctuation marks are pronounced.

Number	**Reading**
3.1415	*drei Komma eins vier* (pause) *eins fünf*
234.65	*zwei hundert vier und dreißig Komma fünf und sechzig*
1251.42	*ein tausend zwei hundert ein und fünfzig Komma null vier zwei*
,65	*Komma fünf und sechzig*
1.65	*eins Punkt fünf und sechzig*
12.5	*zwölf Punkt fünf*
12,00120000	*zwölf komma null null* (pause) *eins zwei*
12,00	*zwölf komma null null*
12,000	*zwölf komma null*

4.5 Currency amounts

Several currency amounts are supported in this version of German: Euro, Deutsche Mark, Swiss francs, Austrian schillings, French francs and US dollars. For digit strings to be read as a currency amount in German, the following rules must be observed:

- The currency indicator, **€**, **DM**, **SFR**, **OS**, **FR** or **$**, must precede or follow the digit amount.
- If there is a decimal amount, a comma < **,** > must be used to separate the decimal amount from the rest of the string.
- Decimal amounts must be two digits. If there is no penny amount, one or two hyphens < **-** > may follow the comma, if used.

Expression	**Reading**
€1988,45	*ein tausend neun hundert acht und achtzig Euro fünf und vierzig*
0,50€	*fünfzig cent*
DM1988,45	*ein tausend neun hundert acht und achtzig Mark fünf und vierzig*
$200,-ÖS	*zwei hundert Schilling*
$4,99	*vier Dollar neun und neunzig*
10,45FR	*zehn Franken fünf und vierzig*

4.6 Telephone numbers

Telephone numbers are pronounced in SM if the number string is formatted in the following way, according to one German convention.

(A)S-E

A represents the Area Code;
S represents the Subscriber number;
E represents the Extension number.

The following rules must also be observed:

- The telephone number must be enclosed in double quotes < " " >, and may not contain any spaces.
- The Area Code A is optional, but if present, it must begin with 0 and be enclosed in parentheses. It may contain three to eight digits.
- The Subscriber number S may contain three to eight digits.
- The Extension number E is optional, but if present, it must begin with a dash < **-** > and may contain two to five digits.
-

Note: The digit <**2**> is pronounced *zwo* in telephone numbers in SM, but it is pronounced *zwei* in LM.

Telephone number	**Reading**
"(094)387543-12"	*null neun vier* (pause) *drei acht* (pause) *sieben fünf* (pause) *vier drei* (pause) *eins zwo*
"(039)740000"	*null drei neun* (pause) *sieben vier* (pause) *null null* (pause) *null null*
"641663"	*sechs vier* (pause) *eins sechs* (pause) *sechs drei*
"7631048-323"	*sieben* (pause) *sechs drei* (pause) *eins null* (pause) *vier acht* (pause) *drei zwo drei*

4.7 Time of day

Time of day is read in SM if the following format is observed:

H:M:S

H represents Hours;
M represents Minutes;
S represents Seconds.

Furthermore, the following rules must be observed:

- Each field must be separated by a colon < **:** >.
- The Hours field is required, and may contain one or two digits in the range **0**–**24**.
- The Minutes field is required and must contain exactly two digits in the range **00**–**59**.
- The Seconds field is optional. If present, it must contain exactly two digits in the range **00**–**59**.

Time	**Reading**
2:15:48	*zwei Uhr fünfzehn und acht und vierzig Sekunden*
08:45	*acht Uhr fünf und vierzig*
14:00:00	*vierzehn Uhr*

4.8 Arithmetic operators and other symbols

Digit strings with arithmetic operators and miscellaneous symbols are processed according to the examples below.

Note: The Time of Day notation has precedence over the use of the colon < **:** > as the division sign when the specified Time of Day format is used. Consequently, pairs of digits separated by a colon < **:** > that are a possible time expression are read as time.

Expression	**Reading**
25%	*fünf und zwanzig Prozent*
3,4%	*drei Komma vier Prozent*
,05%	*Komma null fünf Prozent*
-12	*minus zwölf*
+24	*plus vier und zwanzig*
2*3	*zwei mal drei*
1/2/88	*eins Schrägstrich zwei Schrägstrich acht und achtzig*
1-2-88	*eins minus zwei minus acht und achtzig*
6:3	*sechs durch drei*
23:11	*drei und zwanzig Uhr elf*
25:11	*fünf und zwanzig durch elf*

4.9 Mixed digits and letters

In SM, the only permissible alphabetic characters allowed in a digit string are the monetary abbreviations **DM**, **SFR**, **FR**, and **OS**. The occurrence of any other letter in a digit string will cause the digit string to be terminated and output according to the number processing described above.

If a letter appears within a sequence of digits, the groups of digits will be read as numbers according to the rules above. The letter marks the boundary between the numbers. The letter will also be read.

Expression	**Reading**
DM208	*zwei hundert acht Mark*
0092B87-B	*null null* (pause) *neun zwei B sieben und achtzig Strich B*

4.10 Ordinal numbers

A digit string is treated as an ordinal number if the string is terminated with a colon < **:** > followed by a space. In SM, the colon is then rendered by an inflected form of the ending (S)TE. If ordinal numbers are used outside sentences, e.g. to enumerate points, the digit string should be followed by colon and full stop < **:.** >. As the system cannot always predict the correct gender, case and number of a German noun, the inflection used will not always be correct. In general, a feminine ending (*-e*, *-en*) will be preferred if the system is unable to determine the correct ending.

Expression	**Reading**
`25: 10: 1989`	*fünfundzwanzigster zehnter neunzehnhundert-neunundachtzig*
`Kiel, den 25: Oktober`	*Kiel, den fünfundzwanzigsten oktober*
`3:.`	*drittens*
`1: Kapitel`	*erstes Kapitel*

5 German Phonetic Text

In the current version of the text-to-speech system, SAMPA (Speech Assessment Methods Phonetic Alphabet) is used when making lexicons or using phonetic strings within texts. In earlier versions, RULSYS was used. For the voices based on RULSYS, a conversion is made automatically from SAMPA to RULSYS inside the system.

We recommend new users to use only SAMPA since this is the notation that will be used in future development. Users who are already familiar with the RULSYS alphabet still have the possibility to use it when making user lexicons for all RULSYS-based voices (among them the German voices Helga and Gerhard). There will be a description of RULSYS in the next chapter.

For the sake of clarity, SAMPA transcriptions are written within slashes (/ /) and RULSYS transcriptions within hash marks (# #). Note that neither the slashes nor the hash marks are part of the actual transcription.

The German system uses a phonetic alphabet similar to the German subset of SAMPA. The phonetic alphabet is described below.

If the pronunciation is incorrect the user may write phonetic transcriptions in the text. Then, a PRN-tag is needed to switch to phonetic mode, see User's Guide. It is also possible to make user lexicons (see User's Guide), or change the orthography of a word (see chapter 7) in order to achieve the preferred pronunciation.

5.1 Consonants

The table below lists the phonetic symbols in SAMPA used for the German consonants along with example words (the letters corresponding to the consonant sound are in boldface) and their transcriptions.

Consonant symbol	Example	Transcription in SAMPA
b	**b**ei	/b aI1/
C	i**ch**	/I1 C/
d	**d**u	/d u:1/
f	**v**erfahren	/f @ R f a:1 R @ n/
g	**g**e**g**en	/g e:1 g @ n/
h	**H**err	/h E1 R/
j	**j**etzt	/j E1 t s t/
k	**K**arte	/k a1 R t @/
l	**L**icht	/l I1 C t/
m	**M**an	/m a1 n/
n	**n**eu**n**	/n OY1 n/
N	ju**ng**	/j U1 N/
p	**P**a**pp**e	/p a1 p @/
?	eis	/? aI1 s/ (see 5.1.1)
R	**R**auch	/R aU1 x/
s	Ma**ß**	/m a:1 s/
S	**s**tark	/S t a1 R k/
t	**T**orte	/t O1 R t @/
v	**w**em	/v e:1 m/
x	au**ch**	/aU1 x/
z	le**s**en	/l e:1 z @ n/
Z	Gara**g**e	/g a R a:1 Z @/
pf	**Pf**al	/pf a:1 l/
ts	**Z**ahl	/ts a:1 l/
tS	deu**tsch**	/d OY1 tS/
dZ	**Dsch**ungel	/dZ U1 N @ l/

Table 6 German consonant symbols

5.2 Vowels

The table below lists the phonetic symbols in SAMPA used for the German vowels along with example words and their transcriptions.

Vowel symbol	Example	Transcription in SAMPA
a:	K**ah**n	/k a1 n/
a	k**a**nn	/k a:1 n/
aU	**au**ch	/aU1 x/
e:	z**eh**n	/ts e:1 n/
E	s**e**chs	/s E1 k s/
@	les**e**n	/l e:1 z @ n/
aI	zw**ei**	/ts v aI1/
OY	n**eu**n	/n OY1 n/
i:	**ih**n	/i:1 N/
I	**i**n	/i1 N/
o:	v**o**r	/f o:1 R/
O	d**o**ch	/d O1 x/
u:	**Uh**r	/u:1 R
U	**u**m	/U1 m/
y:	**ü**ber	/y:1 b E R/
Y	M**ü**nchen	/m Y1 n C @ n/
E:	K**ä**se	/k E:1 z @/
_[E	M**ä**rz	/m _{ E1 R ts /
2:	**Ö**fen	/2:1 f @ n/
9	**ö**ffnen	/91 f n @ n/
E~	Bass**in**	/b a s E~1/ (French)
a~	ab**an**don	/a b a~ d o~1 / (French)
o~	all**o**nge	/a l o~1 Z/ (French)

Table 7 German vowel symbols

Note that /_{ E / is not a proper SAMPA symbol but it may still be used when making transcriptions. There is a corresponding symbol in RULSYS, see next chapter.

5.3 Extra symbols for phonetic details

In the current version of the German synthesis certain phonetic details can be specified in phonetic text. This can be exploited in case the user wishes to achieve an unusual pronunciation, or if the transcription automatically generated by the system is inaccurate.

5.3.1 Glottal stop

A glottal stop, represented by the phonetic symbol /**?**/, is the small interruption that occurs at the beginning of a word or syllable starting with a vowel. This sound is automatically inserted by the rules under the appropriate conditions.

Example **erarbeiten** /? E R ? a:1 R b aI t @ n/

5.3.2 Lexical stress

In words with more than one syllable, one (and normally only one) of the syllables is more prominent than the others. This is referred to as word stress, or lexical stress. Words of one syllable also have word stress when spoken in isolation, although many may lose the stress in certain contexts.

In German, lexical stress is often used to distinguish between two words that are spelled alike, but pronounced differently. It is therefore very important to include stress marks when writing transcriptions. For example, **modern** can be pronounced either **MOdern** (to moulder) or **moDERN** (modern).

There are two levels of stress available within a word. The strongest stress, primary stress, is represented by "**1**" placed after the vowel to receive the stress.

Example	**modern** (verb)	`/m o:1 d @ R n/`
	modern (adjective)	`/m O d E1 R n/`

The slightly weaker level of stress, secondary stress, is not possible to denote in SAMPA.

Generally there should only be one primary stress mark per word (except for emphatic expressions, e.g. **steinreich** `/S t aI1 n R aI1 C/`. If no stress marks appear in a sentence at all, the system may produce a monotone reading of the sentence.

Remember that only vowels are stressed, i.e., a stress mark must be preceded by a vowel written in phonetic characters.

5.3.3 Emphasis and reduction

It is also possible to emphasise or reduce the stress on a particular word in a phrase or sentence. In the input text string, this is done by placing < **_X** >, where **X** represents a single digit between **0** and **9**, within a PRN-tag (see User's Guide) immediately before the word whose prominence is to be altered. The emphasis mark can also be used in transcriptions in a user lexicon.

_2	normal stress for most words
_0	makes a word non-stressed
_1	gives stress to a normally unstressed word
_3 - **_9**	gives levels of emphatic stress

5.3.4 Punctuation marks

The punctuation marks < **. ! ? ,** > used in phonetic text have the same effect on intonation as when appearing in orthographic text. In SAMPA the punctuation marks are denoted as follows:

```
/_. _/
/_! _/
/_? _/
/_com _/
```

5.3.5 Hyphen

In phonetic text, hyphen (in SAMPA underscore + hyphen, < **_-** >) can be used to separate parts of a compound word. If the hyphen separating two parts of a word comes at the end of a line, the word is not read until the second part on the next line is typed. For a description of the use of the hyphen character in normal orthographic text, see section 3.3.1.

6 The RULSYS phonetic alphabet

Note that we recommend new users to use only SAMPA since this is the notation that will be used in future development. Note also that it is only possible to use RULSYS when making user lexicons, not in the input text string.

The following differentiates RULSYS from SAMPA in the German system:

- no spaces are used within words in transcriptions
- the lexical accent is placed before the vowel to be stressed, not after as in SAMPA
- it is possible to denote secondary stress

Note that the hash marks (# #) are used to indicate RULSYS transcriptions and to differentiate them from SAMPA transcriptions; the hash marks are not part of the actual transcriptions.

If the pronunciation is incorrect the user may write phonetic transcriptions in the text. Then, a PRN-tag is needed to switch to phonetic mode, see User's Guide. It is also possible to make user lexicons (see User's Guide), or change the orthography of a word (see chapter 7) in order to achieve the preferred pronunciation.

6.1 RULSYS Consonants

The table below lists the phonetic symbols in RULSYS used for the German consonants along with example words and their transcriptions.

Consonant symbol	Example	Transcription in RULSYS
B	**b**ei	#B'EI#
CH	i**ch**	#'ICH#
D	**d**u	#D'U:#
F	ver**f**ahren	#FE0RF'A:RE0N#
G	**g**e**g**en	#G'E:GE0N#
H	**H**err	#H'ER#
J	**j**etzt	#J'ETST#
K	**K**arte	#K'ARTE0#
L	**L**icht	#L'ICHT#
M	**M**an	#M'AN#
N	**n**eu**n**	#N'EUN#
NG	ju**ng**	#J'UNG#
P	**P**a**pp**e	#P'APE0#
Q	eis	#Q'EIS# (see 6.3.1)
R	**R**auch	#R'AUX#
S	Ma**ß**	#M'A:S#
SH	**s**tark	#SHT'ARK#
T	**T**or**t**e	#T'ORTE0#
V	**w**em	#V'E:M#
X	au**ch**	#'AUX#
Z	le**s**en	#L'E:ZE0N#
ZH	Gara**g**e	#GAR'A:ZHE0#
PF	**Pf**ad	#PF'A:D#
TS	**Z**ug	#TS'U:K#
TSH	deu**tsch**	#D'EUTSH#
DZH	**Dsch**ungel	#DZH'UNGE0L#

Table 8 RULSYS consonants

6.2 RULSYS Vowels

The table below lists the phonetic symbols in RULSYS used for the German vowels along with example words and their transcriptions.

Vowel symbol	Example	Transcription in RULSYS
A:	K**ah**n	#K'A:N#
A	k**a**nn	#K'AN#
AU	**au**ch	#'AUX#
E:	z**eh**n	#TS'E:N#
E	s**e**chs	#Z'EKS#
E0	les**e**n	#L'E:ZE0N#
E0R	Mess**er**	#M'ESE0R#
EI	zw**ei**	#TSV'EI#
EU	n**eu**n	#N'EUN#
I:	**ih**n	#'I:N#
I	**i**n	#'IN#
O:	v**o**r	#F'O:R#
O	d**o**ch	#D'OX#
U:	**Uh**r	#'U:R#
U	**u**m	#'UM#
Y:	**ü**ber	#'Y:BER#
Y	M**ü**nchen	#M'YNCHE0N#
Ä: or [:	K**ä**se	#K'Ä:ZE0# or #K'[:ZE0#
Ä or [	M**ä**rz	#M'ÄRTS# or #M'[RTS#
Ö: or \:	**Ö**fen	#'Ö:FE0N# or #'\:FE0N#
Ö or \	**ö**ffnen	#'ÖFNE0N# or #'\FNE0N#

Table 9 RULSYS vowels

6.3 Extra symbols for phonetic details

In the current version of the German synthesis certain phonetic details can be specified in phonetic text. This can be exploited in case the user wishes to achieve an unusual pronunciation, or if the transcription automatically generated by the system is inaccurate.

6.3.1 Glottal stop

Glottal stop is represented by the phonetic symbol /**Q**/. See section 5.3.2 for a description of glottal stop.

Example **erarbeiten** #QERQ'A:RBEITE0N#

6.3.2 Lexical stress

For a description of lexical stress, see section 5.3.2.
In RULSYS, primary stress is represented by an apostrophe < ' > placed before the vowel to receive the stress.

Example	**modern** (verb)	`#M'O:DE0RN#`
	modern (adjective)	`#MOD'ERN#`

Secondary stress, is represented by a quote < " >. Vowels not preceded by either a primary stress mark < ' > or a secondary stress mark < " > receive no stress at all.

Example	**Brief**	`#BR'I:F#`
	Briefmarke	`#BR'I:FM"ARKE0#`

It is important to have stress marks in a sentence written in phonetic text. Generally there should only be one primary stress mark per word (except for emphatic expressions, for example ***steinreich*** `#SHT'EINR'EICH#)`. More than one secondary stress mark may occur in a word. If no stress marks appear in a sentence at all, the system may produce a monotone reading of the sentence.

Remember that only vowels are stressed, a stress mark must be followed by a vowel written in phonetic characters. Be sure, for example, that you do not leave a real apostrophe or real quotes in phonetic text.

6.3.3 Emphasis and reduction

It is also possible to emphasise or reduce the stress on a particular word in a phrase or sentence. In the input text string, this is done by placing < **_X** >, where **X** represents a single digit between **0** and **9**, within a PRN-tag (see User's Guide) immediately before the word whose prominence is to be altered. The emphasis mark can also be used in transcriptions in a user lexicon.

_2	normal stress for most words
_0	makes a word non-stressed
_1	gives stress to a normally unstressed word
_3 - **_9**	gives levels of emphatic stress

6.3.4 Hyphen

For a description of the use of hyphen in normal orthographic text, see section 3.4.1.
In phonetic text, hyphen can be used to separate parts of a compound word.

Example `#BR'I:F-M"ARKE0#`

If the hyphen separating two parts of a word comes at the end of a line, the word is not spoken until the second part on the next line is also read in.

6.3.5 Punctuation marks

Punctuation marks are also permitted in phonetic text, and have the same effect as in normal text, affecting both the rhythm and intonation of the sentence. The following punctuation characters are permitted in phonetic text:

, . ? ! -

The characters < " > and < ' > have a completely different function when writing in phonetic text than in ordinary text, notably they are reserved characters used to mark primary and secondary stress in a word, see section 6.3.2. They cannot be used to quote text or mark elisions in phonetic text.

7 How to change pronunciation errors

Words that are not pronounced correctly by the text-to-speech converter can be entered in the user lexicon (see User's guide). There are two ways to do this: either, the user enters a phonetic transcription of the word (see chapter 6), or, the user rewrites the word orthographically.
Phonetic transcriptions can also be entered directly in the text, using a PRN-tag (see User's guide).

7.1 Change the orthography

7.1.1 Spelling incorrectly

It is possible to intentionally misspell a word by trying to spell a word in a more phonetic manner, i.e., choosing non-ambiguous letter combinations to represent difficult sounds. For example, the letters **eu** in **Friseur** might better be represented by the letter **o**, which are closer to the actual sound in the word.

Examples **Duisburg** can be misspelled **Dusburg**
Friseur can be misspelled **Frisor**

Another common way of misspelling is to double the consonant following the vowel. This can be used in order to change the pronunciation of a vowel from long to short. By inserting an **H** after the vowel the system can be made to pronounce this long.

Example **Furst** can be spelled **Furrst**
schult can be misspelled **schuhlt**

7.1.2 Use of hyphen

A hyphen character can be used within a word to separate two letters that might otherwise be incorrectly pronounced together.

Example **Lieblingschor** can be written **Lieblings-chor**
Tabakladen can be written **Tabak-laden**

7.1.3 Expanding acronyms

Very few acronyms are handled by the current German system (see chapter 8). Therefore, it may be very useful to expand them in the user dictionary. Since acronyms should be expanded to more than one word it may be difficult to enter a proper transcription. It is much easier to enter the words in question orthographically. The examples below show some acronyms and their expanded readings.

Examples	**DAG**	Deutsche Angestellten-Gewerkschaft
	EU	Europaische Union

7.2 Using phonetic text

When you are unable to correct a pronunciation error by misspelling the word, phonetic text should be used to produce the desired pronunciation. When phonetic text is used, the system bypasses the normal pronunciation rules, and pronounces each phonetic symbol "literally", according to the examples listed in Table 6 and Table 7.

7.2.1 Writing with phonetic text

A helpful way to transcribe in phonetic text is to work with a dictionary. Often, dictionaries give a pronunciation guide for each word. They also provide a pronunciation key to show how to pronounce the special symbols used in the pronunciation guide. Similarly, Table 6 and Table 7 in this document give the pronunciation key for the special phonetic symbols used in German for the text-to-speech converter.
To transcribe a word phonetically, "sound out" the word slowly. Working with Table 6 and Table 7, find the symbols that most closely correspond to each of the sounds in the word you want to transcribe. To

mark stress, decide which vowel is the most prominent, and place a primary stress mark < **1**> after the vowel.

Example

Suppose we want to transcribe the place name **Sydney**. We sound out the word, **S-I-D-N-I**, and decide that the primary stress should be on the first vowel since it is the most prominent, i.e., **SYDney**.
In Table 6 and Table 7, and section 5.3.2, we find the following corresponding symbols:

S (Ma**ß**), I (**i**n), D (**d**u), N (**n**eu**n**), ' (primary stress)

Now we can transcribe **Sydney** using the German phonetic symbols for the text-to-speech converter:

```
/s I1 d n I/
```

8 Abbreviations

In the current version of the German text-to-speech system, the following abbreviations are recognized in all contexts (in SM only) with the exception of the currency abbreviation FR. These abbreviations are all case-sensitive and require no full stop in order to be processed as abbreviations.

The user lexicon may be used to redefine any of these abbreviations, or to create your own.

Abbreviation	LM	SM
cm	*C M*	*Zentimeter*
dm	*D M*	*D Mark (but Mark when next to numbers)*
dr	*D R*	*Doktor*
fr	*F R*	*Frau (see 8.1)*
kg	*K G*	*Kilo*
km	*K M*	*Kilometer*
mm	*M M*	*Millimeter*
mr	*M R*	*Mister*
nr	*N R*	*Nummer*
sfr	*S F R*	*Schweizer Franken*
ös	*Ö S*	*Schilling*
usw	*U S W*	*und so weiter*

Table 10 Abbreviations in the German system

In SM, the abbreviation FR is pronounced as the currency unit *Franken* if preceded or followed by a digit string. See Currency Amounts, section 4.5.

Expression	Reading
50 FR	*fünfzig Franken*
Fr Hüber	*Frau Hüber*