Language Manual

German

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1 Maj 2006

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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 Quality voices Sarah and Klaus.

2 Letters in orthographic text

Characters from **A–Z, a–z,** äÄ , ëË , ïÏ , öÖ , üÜ , éÉ , èÈ and ß may constitute a word. Certain other characters are also considered as letters, notably those used as letters in other European languages, i.e. “ñ, õ, å, ç”. These letters are not pronounced as in their native languages though, they are pronounced as regular “n, o, a, c” when occurring in a word.

Characters outside of these ranges, i.e. numbers, punctuation characters and other non-alphanumeric characters are not considered as letters.

3 Punctuation characters

Punctuation marks appearing in a text affect both rhythm and intonation of a sentence. The following punctuation characters are permitted in the normal input text string:
, : ; “ ” . ? ! ( ) { } [ ] '

3.1 Comma, colon and semicolon

Comma < **,** >, colon < **:** > and semicolon < **;** > cause a brief pause to occur in a sentence, accompanied by a small rising intonation pattern just prior to the character.

3.2 Quotation marks

Quotes < **“ ”** > appearing around a single word or a group of words cause a brief pause before and after the quoted text.

3.3 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. A full stop may also be used as a decimal marker in a number (see chapter 5) and in abbreviations (see chapter 8).

3.4 Question mark

A question mark <?> ends a sentence and causes question-intonation, first rising and then falling.

3.5 Exclamation mark

The exclamation mark <!> behaves in a similar manner to the full stop, causing a falling intonation pattern followed by a pause.

3.6 Parentheses, brackets and braces

Parenthesis < **( )** >, brackets < **[ ]** > and braces < **{ }** > appearing around a single word or a group of words cause a brief pause before and after the bracketed text.

4 Other non-alphanumeric characters

4.1 Non-punctuation characters

The characters listed below are processed as non-letter, non-punctuation characters. Some are pronounced at all times and others are only pronounced in certain contexts, which are described in the following sections of this chapter.

Symbol	Reading
/	Schrägstrich
+	Plus
$	Dollar
£	Pfund
€	Euro
¥	Yen
<	Kleiner-als
>	Größer-als
%	Prozent
^	Zirkumflex
³	hoch drei
~	Tilde
@	Klammeraffe
=	Gleich
²	hoch zwei
*	Stern

Table 1 Non-punctuation characters

4.2 The ² and ³ signs

The reading of expressions with ² and ³ is listed below. The space between the number and abbreviation is not mandatory, i.e. “1mm²” and “1 mm²” are treated the same.

Example	Reading
1 mm²	ein Quadratmillimeter
1 cm²	ein Quadratzentimeter
1 m²	ein Quadratmeter
1 km²	ein Quadratkilometer
1 mm³	ein Kubikmillimeter
1 cm³	ein Kubikzentimeter
1 m³	ein Kubikmeter
1 km³	ein Kubikkilometer

4.3 Symbols whose pronunciation varies depending on the context

4.3.1 Hyphen

A hyphen < **-** > is pronounced “minus“ if followed by a digit, and in between two numbers if they are followed by a < = > or if the hyphen is surrounded by spaces; if not surrounded by spaces, the hyphen is pronounced “Gedankenstrich“. In certain date formats, in between years or dates that are followed by a month, the hyphen is pronounced “bis”. In other cases, i.e. between two words or in “full“ date formats, the hyphen is not pronounced.

Example	**Reading**
-2	minus zwei
2-2=	zwei minus zwei gleich
2 – 2	zwei minus zwei
44-3	vierundvierzig Gedankenstrich drei
15-18 Oktober	fünfzehnter bis achtzehnter Oktober
6-10 Nov	sechster bis zehnter November
1998-2004	neunzehnhundertachtundneunzig bis zweitausendvier
02-02-2002	zweiter Februar zweitausendzwei
Adolf-Menge	Adolf Menge

4.3.2 Asterisk

Asterisk < ***** > is pronounced “mal” if enclosed by digits that are followed by < = >. In other cases it is pronounced “Stern”.

Example	**Reading**
2*3=	2 mal 3 gleich
2*3	2 Stern 3
*bc	Stern B C

5 Number processing

Strings of digits that are sent to the text-to-speech converter are processed in several different ways, depending on the format of the string of digits 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 recognised 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
Ordinal numbers
Arithmetic operators
Mixed digits and letters
Time of day
Year
Dates
Phone numbers
Roman numerals

5.1 Full number pronunciation

Full number pronunciation is given for the whole number part of the digit string.

Example	**Reading**
2425	zweitausendvierhundertfünfundzwanzig
2.425	zweitausendvierhundertfünfundzwanzig
2 425	zweitausendvierhundertfünfundzwanzig
24,25	vierundzwanzig Komma fünfundzwanzig

Numbers denoting thousands, millions and billions (numbers larger than 999) may be grouped using space or full stop. In order to achieve the right pronunciation the grouping must be done correctly.

The rules for grouping of numbers are the following:

- Numbers are grouped in groups of three starting at the end.
- The first group in a number may consist of one, two, or three digits.
- If a group, other than the first, does not contain exactly three digits, the sequence of digits is not interpreted as a full number.
- The highest cardinal number read is 999999999999 (12 digits). Larger numbers are read as separate digits.

Note: Numbers between 1100 and 1999 are interpreted as years and are always read as hundreds.

Example	**Reading**
2580	zweitausendfünfhundertachtzig
2 580	zweitausendfünfhundertachtzig
2.580	zweitausendfünfhundertachtzig
25800	fünfundzwanzigtausendachthundert
25 800	fünfundzwanzigtausendachthundert
25.800	fünfundzwanzigtausendachthundert
2580350	zwei Millionen fünfhundertachtzigtausenddreihundertfünfzig
2 580 350	zwei Millionen fünfhundertachtzigtausenddreihundertfünfzig
2.580.350	zwei Millionen fünfhundertachtzigtausenddreihundertfünfzig
1000000000	eine Milliarde
1234567890123	eins zwei drei vier fünf sechs sieben acht neun null eins zwei drei

5.2 Leading zero

Numbers that begin with 0 (zero) are read as full numbers preceded by a “null”.

Number	**Reading**
09253	null neuntausendzweihundertdreiundfünfzig
020	null zwanzig

5.3 Decimal numbers

Comma or full stop may be used when writing decimal numbers.

The full number part of the decimal number (the part before comma or full stop) is read according to the rules in 5.1. The decimals (the part after comma or full stop) are read as separate digits if there are more than 3 digits after the comma. Note: A number containing a full stop followed by exactly three digits is not read as a decimal number but as a full number, following the rules in 5.1.

Example	**Reading**
16,234	sechzehn Komma zweihundertvierunddreißig
3,1415	drei Komma eins vier eins fünf
1251,04	eintausendzweihunderteinundfünfzig Komma null vier
1.251,04	eintausendzweihunderteinundfünfzig Komma null vier
2.0	zwei Punkt null
2,00	zwei Komma null null
2.50	zwei Punkt fünfzig
2,50	zwei Komma fünfzig
3,141	drei Komma einhunderteinundvierzig

5.4 Currency amounts

The following principles are followed for currency amounts:

- Numbers with zero or two decimal places preceded or followed by the currency markers **£, $, ¥**, **€, DM, Sfr., or ös.** are read as monetary amounts.
- Numbers with zero or two decimal places followed by the words “Pfund”, “Dollar”, “Yen” and “Euro” (singular or plural) are read as monetary amounts.
- Accepted decimal markers are comma and full stop**.**
- No spaces are allowed in the number.
- The decimal part (consisting of two digits) in monetary amounts is read as “und nn Pence” and “und nn Cent”.
- If the decimal part is “00” it will not be read.

Example	**Reading**
$15,00.	fünfzehn Dollar
15,00£.	fünfzehn Pfund
€ 200,50	zweihundert Euro und fünfzig Cent
1.000.000 **DM**	eine Million D-Mark

There is also the possibility of writing large amounts, as follows:

Example	**Reading**
$ 1 Million	eine Million Dollar

5.5 Ordinal numbers

Numbers are read as ordinals in the following cases:

- If a number is followed by "." and a space.
- If a numbers is followed by the name of a month, an abbreviation of a month, or is in a "full" date format.
- A number followed by ":", and a space, is read as an enumeration, similar to an ordinal but always with the ending "-tens", ex: "1: " is read as "erstens".

Ordinal numbers in German are inflected depending on their number, gender and case. This system inflects ordinals depending on if they are preceded by certain articles and prepositions. Note: Certain articles may be used in more then one number or case, but the system will map such articles just to one number/case, see examples of "die" below. If an ordinal is not preceded by function words denoting its inflection it is read with the "strong inflection" in "masculine, nominative, singular", e.g. with the ending "-ter".

Example	**Reading**
2.	zweiter
3 Januar	dritter Januar
4. Mar.	vierter März
01.05.2005	erster Mai 2005
der 2. Spieler	der zweite Spieler
das 2. Bild	das zweite Bild
die 2. Frage	die zweite Frage
die 2. Fragen	die zweite Fragen
den 2. Oktober	den zweiten Oktober
dem 3. Bild	dem dritten Bild
des 10. Kapitels	des zehnten Kapitels
am 4. Juli	am vierten juli
am 01.05.2005	am ersten Mai 2005
im 3. Quartal	im dritten Quartal

5.6 Arithmetic operators

Numbers together with arithmetical operators are read according to the examples below. In certain cases a < = > is needed in order for an arithmetic operator to be read as such, i.e. "/", "*" and "-".

Example	**Reading**
-12	minus zwölf
2-2	zwei Gedankenstrich zwei
2-2=	zwei minus zwei gleich
+24	plus vierundzwanzig
2÷3	zwei geteilt durch drei
2×3	zwei mal drei
2*3	zwei Stern drei
2*3=	zwei mal drei gleich
6/3	sechs drittel
6/3=	sechs drittel gleich
6/3=2	sechs durch drei gleich zwei
25%	fünfundzwanzig Prozent
3.4%	drei Punkt vier Prozent

5.7 Mixed digits and letters

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.

Example	**Reading**
77B84Z3	siebenundsiebzig B vierundachtzig Z drei
0092B87-B	null null zweiundneunzig B siebenundachtzig B

5.8 Time of day

The colon is used to separate hours, minutes and seconds. Possible time formats are:

a) **hh:mm (or h:mm)**	ex 22:01
b) **hh:mm:ss (or h:mm:ss)**	ex 12:00:25
c) **hh:mm U**	ex 15:25 U
d) **hh.mm U**	ex 15.25 U

h = hour, **m** = minute, **s** = second.

If “mm” or “ss” is equal to “00” it will not be read. If they are read the reading is followed by “Minute/Minuten” and “Sekunde/Sekunden”. If “hh” is equal to “00” it will be read as “Mitternacht”. An “und” is inserted before the reading of “ss”, in b).

Example	**Reading**
2:53 U	zwei Uhr dreiundfünfzig
14.05Uhr	vierzehn Uhr fünf
12:25:00	zwölf Uhr fünfundzwanzig
2:01:00	zwei Uhr eine Minute
15:01:01	fünfzehn Uhr eine Minute und eine Sekunde
00:20:01	Mitternacht 20 Minuten und eine Sekunde
14:00:15	vierzehn Uhr und fünfzehn Sekunden

If “pm” precedes a time format, it is read following the time, similar to the reading of English time formats.

Example	**Reading**
pm 2:30	zwei Uhr dreißig pm

5.9 Years

Numbers between 1100 and 1999 are always read as hundreds (year reading) with the exception of numbers containing decimals.

Example	**Reading**
1988	neunzehnhundertachtundachtzig
1939-45	neunzehnhundertneununddreißig bis fünfundvierzig
2088	zweitausendachtundachtzig
1988,0	eintausendachtundachtzig Komma null
1988,32	eintausendachtundachtzig Komma zweiunddreißig
September 1999	September neunzehnhundertneunundneunzig

5.10 Dates

The valid date formats are:

1.dd-mm-yyyy, dd.mm.yyyy, and dd/mm/yyyy
2.dd-mm-yy, dd.mm.yy, and dd/mm/yy

"**yyyy**" is a four-digit number, **"yy"** is a two-digit number, "**mm**" is a month number between 1 and 12 and "**dd**" a day number between 1 and 31. One or two digits may be used in the "mm" and "dd" in all formats, and numbers below 10 can be preceded by a zero. The "dd" is an ordinal number, it is inflected in some cases depending on what precedes the date.

Hyphen, full stop and slash may be used as delimiters.

Example			**Reading**
Type 1:			
10-02-2003	or	10-2-2003	zehnter Februar zweitausenddrei
10.02.2003	or	10.2.2003	zehnter Februar zweitausenddrei
10/02/2003	or	10/2/2003	zehnter Februar zweitausenddrei
Type 2:			
10-02-03	or	10-2-03	zehnter Februar zweitausenddrei
10.02.03	or	10.2.03	zehnter Februar zweitausenddrei
10/02/03	or	10/2/03	zehnter Februar zweitausenddrei

Ranges of days and years are also supported.

Example	**Reading**
1998-1999	neunzehnhundertachtundneunzig bis neunzehnhundertneunundneunzig
1939-45	neunzhenhundertneununddreißig bis fünfundvierzig
2002/3	zweitausendzwei bis drei
14-15 Januar	vierzehnter bis fünfzehnter Januar

Other possible date formats include using the written name of a month or day. The day can be followed by a comma or not. Listed below are the month and day abbreviations that are supported by the date processing, all abbreviations can also be followed by a full stop. The abbreviations for days are just resolved if followed by an optional comma, a date (one or two digits), and the name of a month. The month abbreviations are also resolved in other contexts then the formats described below.

Months: Jan, Feb, Mar, Apr, Jun, Jul, Aug, Sep, Okt, Nov, Dez
Days: Mon, Dien, Mit, Don, Fre, Sam, Son

Example	**Reading**
Montag, 15 Januar	Montag, fünfzehnter Januar
Mon. 1 Feb.	Montag erster Februar
30 April 1999	dreißigster April neunzehnhundertneunundneunzig
Januar 1953	Januar neunzehnhundertdreiundfünfzig
3 Jan	dritter Januar

5.11 Phone numbers

This section describes telephone number formats that are recognised by the system.

The digits of a phone numbers may be written together or grouped with spaces, "-", ".", and "/". Groups of numbers of 3 or less digits are read as cardinals. If a group of numbers contains more then 3 digits the numbers are divided by the system into groups of two and three digits, which then are read as cardinals. The division starts from the end of the group of numbers. Parenthesis can be used to define the area code.

Numbers that are not recognised as telephone numbers are numbers that can be defined as a cardinal number, e.g. "10.000" and "10.000.000". If such a number is preceded by an area code or a country code, it will be recognised as a phone number, e.g. "01/10 000" or "+49 10.000.000".

5.11.1 Ordinary phone numbers

Sequences of digits in the following formats are treated as phone numbers.

Format	**Example**
xx xx xx xx xx xx	07 01 96 45 60 00
(x xx xx) xx xx xx	(0 28 52) 50 77 97
(xx xx) xx xx xx	(03 11) 43 16 81
(xx xx) x xx xx x	(08 11) 9 49 63 0
(xx xx) x xx xx xx	(04 21) 4 80 29 42
x xx xx xx	4 07 88 45
x xx xx x	9 49 63 0
xx xx xx	83 63 65
xxx xxxx x	241 4133 0
xxxx xx xx xx	5121 49 28 24
xxx x xx xxxx	174 4 75 6359
xxx xxxxxxx	030 1234567
xxx xxxxx-xx	030 12345-67
xxxx x xxxxx	0190 8 12345
xxxx x xxxxxx	0900 5 123456
xxxx / xxx xx xx	0650 / 480 23 60
xxxx / xx xx xx xx	0699 / 11 32 59 83
xxxx / xxx xx	07221 / 634 39
xxx xxx xx xx	071 282 50 82
xx xxx xx xx	01 211 18 10
xxx-xxx xx xx	071-282 50 82
xx-xxx xx xx	01-211 18 10
xxx/xxx xx xx	071/282 50 82
xx/xxx xx xx	01/211 18 10

Example	**Reading**
01/211.18.10	nulleins zweihundertelf achtzehn zehn
0900 5 123456	nullneun nullnull fünf zwölf vierunddreissig sechsundfünfzig
030 12345-67	nulldreissig einhundertdreiundzwanzig fünfundvierzig ziebenundsechzig

5.11.2 International phone numbers

International phone numbers are written with the prefix "+" or "00" and a country code, followed by telephone formats described in the section above.

Example	**Reading**
+49 4 07 88 45	plus neunundvierzig vier nullsieben achtundachtzig fünfundvierzig
00 49 4 07 88 45	nullnull neunundvierzig vier nullsieben achtundachtzig fünfundvierzig
+43(3116)8408	plus dreiundvierzig einunddreissig sechzehn vierundachtzig nullacht
+43/1/313 26	plus dreiundvierzig eins dreihundertdreizehn sechsundzwanzig
0043-1-52 36 316	nullnull dreiundvierzig eins zweiundfünfzig sechsunddreissig dreihundert…

+41 81 7202121	plus einundvierzig einundachzig siebenhundertzwanzig einundzwanzig…
0041-31-991 21 38	nullnull einundvierzig einunddreissig neunhunderteinundneunzig …

5.12 Roman Numerals

Certain letter combinations are interpreted as roman numerals, see the list below. Roman numerals are only recognised if they are written with capital letters.

Example	**Reading**
II	zwei
III	drei
IV	vier
VI	sechs
VII	sieben
VIII	acht
IX	neun
XI	elf
XII	zwölf
XIII	dreizehn
XIV	vierzehn
XV	fünfzehn
XVI	sechzehn
XVII	siebzehn
XVIII	achtzehn
XIX	neunzehn

6 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). In this lexicon, the user enters a phonetic transcription of the word (see chapter 7). Phonetic translations can also be entered directly in the text, using a PRN-tag (see User's guide).

7 German Phonetic Text

The German text-to-speech system uses the German subset of the SAMPA phonetic alphabet (Speech Assessment Methods Phonetic Alphabet).
The symbols are written with a space between each phoneme.

Only SAMPA may be used in phonetic transcriptions. Symbols not listed here are not valid in phonetic transcriptions and will be ignored if included in the user lexicon or in a PRN tag.

7.1 Consonants

7.1.1 Symbols for the German consonants

Symbol	Word	Phonetic text	Comment
p	ab	/ ? a1 p /	
b	Bier	/ b i:1 6 /	
t	Tier	/ t i:1 6 /	
d	dir	/ d i:1 6 /	
k	Kasse	/ k a1 s @ /	
g	Gasse	/ g a1 s @ /	
f	Vogel	/ f o:1 g l= /	
v	Wasser	/ v a1 s r= /	
s	Ast	/ ? a1 s t /	
S	spät	/ S p E:1 t /	
z	Sieb	/ z i:1 p /	
Z	Genie	/ Z E n i:1 /	
x	nach	/ n a:1 x /	
C	dich	/ d I1 C /	
h	Hut	/ h u:1 t /	
j	jetzt	/ j E1 ts t /	
pf	Pferd	/ pf e:1 6 t /	
ts	Zwei	/ ts v aI1/	
tS	Cello	/ tS E1 l o: /	
l	Liebe	/ l i:1 b @ /	
R	Riese	/ R i:1 z @ /	
6	Vier	/ f i:1 6 /	
m	Mut	/ m u:1 t /	
n	Nase	/ n a:1 z @ /	
N	bange	/ b a1 N @ /	
w	Web	/ w E1 p /	

Table 2 German consonants

7.2 Vowels

7.2.1 Symbols for the German vowels

Symbol	Word	Phonetic text	Comment
aI	Eins	/ ? aI1 n s /	
OY	neu	/ n OY1 /	
aU	auf	/ ? aU1 f /	
@	sehen	/ z e:1 @ n /	
i:	bieten	/ b i:1 t n= /	
I	bitten	/ b I1 t n= /	
y:	übung	/ ? y:1 b U N /	
Y	Ypsilon	/ ? Y1 p s i: l O n /	
e:	Beten	/ b e:1 t n= /	
E	Betten	/ b E1 t n= /	
E:	ähnlich	/ ? E:1 n l I C /	
2:	öfen	/ ? 2:1 f n= /	
9	öffnen	/ ? 91 f n @ n /	
u:	Schule	/ S u:1 l @ /	
U	lustig	/ l U1 s t I C /	
o:	Ofen	/ ? o:1 f n= /	
O	offen	/ ? O1 f n= /	
a:	aber	/ ? a:1 b r= /	
a	Alarm	/ ? a l a1 R m /	
r=	Lager	/l a:1 g r= /	
m=	Graben	/g R a:1 b m= /	
n=	Retten	/R E1 t n= /	
l=	Vogel	/f o:1 g l= /	
E~	Bulletin	/ b Y l t E~1 /	French
a~	Pendant	/ p a~ d a~1 /	French
o~	nonchalant	/ n o~ S a l a~1 /	French

Table 3 German vowels

7.3 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. For the correct pronunciation of a word, it is important to include the symbol marking the word stress.

In the phonetic transcriptions the word stress is indicated by the symbol "1" placed directly after the stressed vowel (with no space between the vowel symbol and the stress symbol).

7.4 Glottal stop

A glottal stop, represented by the phonetic symbol /?/, is a small sound which is used to separate two words or two syllables when the second word or syllable starts with a vowel. In the phonetic transcriptions a /?/ is used before each word that starts with a vowel, also if such a word is part of a compound, such as “Ast” in “Baumast” / b aU1 m ? a s t/.

7.5 Pause

An underscore < **_** > in a phonetic transcription generates a pause.

8 Abbreviations

In the current version of the German text-to-speech system, the abbreviations in table 4 below are recognised in all contexts. These abbreviations are mostly case-insensitive and require no full stop in order to be recognised as an abbreviation.

As previously mentioned, there are also abbreviations for the days of the week and the months and for the most common units (mm, mm^2, cm^2, ...) .

Abbreviation	Reading
Dr.	Doktor
DM	D-Mark (just if preceded or followed by a number)
usw	und so weiter
°C	Grad Celsius
°F	Grad Farenheit
°K	Grad Kelvin
sin	Sinus
Cos	Cosinus
Bhf , Bf.	Bahnhof
GmbH	G M B H
Mme	Madame
Abs.	Absender
Abt.	Abteilung
Adr.	Adresse
Ank.	Ankunft
Art.	Artikel
Art.Nr.	Artikelnummer
Bz.	Bezirk
Co.	Company
Fa.	Firma
Frl.	Fräulein
Fr.	Frau
Frh.	Freiherr
Ges.	Gesellschaft
Inst.	Institut
Inh.	Inhalt

Table 3 Abbreviations

9 Web-addresses and email

Web-addresses and email-addresses are read as follows:

- "www" is read as three w's spelled letter by letter.
- Full stops are read as "Punkt", hyphens as "Gedankenstrich", underscore ("_") as "Unterstricht", slash ("/") as "slash".
- "us, uk, fr" and all the other abbreviations for countries are spelled out letter by letter.
- The "@" is read "Klammeraffe" .
- Words/strings (including "org", "com" and "edu") are pronounced according to the normal rules of pronunciation in the system and in accordance with the lexicon.

Example	**Reading**
www.babeltech.com	W W W Punkt babeltech Punkt com
http://www.babeltech.com	H T T P : / / W W W Punkt babeltech Punkt com
smith@yahoo.us	smith klammeraffe yahoo Punkt U S