Language Manual

HQ and CO Japanese

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Acknowledgement

Acapela Japanese TTS system is using the Unidic Japanese lexicon, under license by the Unidic consortium to train part of its internal modules.

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1 General

This document discusses certain aspects of text-to-speech processing for the Japanese 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 (HQ) and Colibri (CO) Japanese voices.

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 (both readings in Japanese characters and in Latin alphabet[1]) is written in *italics*.
- Keyboard entities are written within angle brackets < >.
- Phonetic transcriptions are written within slashes / /.

[1] The Latin alphabet readings show the pronunciation of the output in Japanese characters. We adopt the Hepburn Romanization. Vowels with the symbol <^> are long vowels.

2 Letters in orthographic text

Japanese characters (hiragana, katakana and kanji) and characters from **A-Z** and **a-z** may constitute a word. The apostrophe character < ' > is not considered to be a letter.

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 are treated as a new word.

3 Non-Japanese and non-alphanumeric characters

The processing of non-Japanese and non-alphanumeric characters varies, depending on the context in which the character is found and its function within that context. These are the types of non-Japanese and non-alphanumeric characters that are handled by the system:

- Characters normally processed as punctuation, and having a direct effect on the intonation.
- Non-punctuation characters that are always pronounced, with no effect on the intonation or pausing.
- Characters treated as special symbols.
- Characters whose pronunciation varies depending on the context.
- Control characters.

Below the characters are grouped by type, and for each character, the pronunciation is given in the three basic reading modes.

3.1 Punctuation characters

3.1.1 Comma, colon and semicolon

Comma <、> and < **,** >, colon < **:** > and semicolon < **;** > cause a brief pause to occur in a sentence.

3.1.2 Quotation marks

Quotation marks < **“** > , opening and closing quotation marks < **«** >,<「>, <『> and < **»** >, <」>, <』> may be used around a single word or a group of words in a sentence. They cause a brief pause before and after the quoted text.

3.1.3 Full stop

A full stop <。> and < **.** > 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 <.> may also be used as a decimal marker in a number (see chapter *Number processing*).

3.1.4 Question mark

A question mark <**?**> ends a sentence and causes question-intonation followed by a pause.

3.1.5 Exclamation mark

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

3.1.6 Parentheses, brackets and braces

Parentheses < **( )** > appearing around a single word or a group of words cause a brief pause before and after the bracketed text.

3.2 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 and chapters.

Table: Non-punctuation characters

Character	Reading (kana)	Reading (Latin alphabet)
@	アットマーク	attoma^ku
/	スラッシュ	surasshu
%	パーセント	pa^sento
=	イコール *(see section 4.7.)*	iko^ru
_	アンダーバー	anda^ba^
*	アスタリスク *(see section 3.3.2)*	asutarisuku
¥	えん	en
$	ドル	doru
£	ポンド	pondo
€	ユーロ	yu^ro
°	ど *(see 7)*	do
²	へいほう *(see section 7)*	heiho^
³	りっぽう *(see section 7)*	rippo^
#	ナンバー	namba^
≤	しょうなりイコール	sho^nariiko^ru
≥	だいなりイコール	dainariikoru
≈	ニアリーイコール	niari^iko^ru
≠	ノットイコール	nottoiko^ru
<	しょうなり	sho^nari
>	だいなり	dainari
÷	わる	waru
×	かける	kakeru
‰	パーミル	pa^miru

3.3 Symbols whose pronunciation varies depending on the context

3.3.1 Hyphen

Hyphen <-> is read according to the following principles:

- If surrounded by digits, it is pronounced の *(no)*.
- If followed by a digit and an equals sign '=', it is pronounced ひく *(hiku)*

- In certain date formats, in between days and years, the hyphen is pronounced *から (kara)*.

Table: Hyphen

Expression	Reading (kana)	Reading (Latin alphabet)
555-4758	*ごひゃくごじゅうご の よんせんななひゃくごじゅうはち*	*gohyaku goju^ go no yonsen nanahyaku goju^ hachi*
44-3=41	*よんじゅうよんひくさん は よんじゅういち*	*yonju^ jon hiku san ha yonju^ ichi*
15-20日	*じゅうごにちからはつか*	*ju^go nichi kara hatsuka*

3.3.2 Asterisk

Asterisk < ***** > is pronounced *かける(kakeru)* if a digit immediately precedes and follows it; it is pronounced *アスタリスク(asutarisuku)* in all other cases.

Table: Asterisk

Expression	Reading	Reading (Latin alphabet)
2*3	*2かける3*	*ni kakeru san*
*bc	*アスタリスク B C*	*asutarisuku bi^ shi^*

4 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 recognized by the system, a brief description of the basic number processing is provided below, along with examples. Number processing is subdivided into the following categories:

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

4.1 Full number pronunciation

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

Numbers denoting thousands, millions and billions (numbers larger than 999) may be grouped using optional commas <,> . In order to achieve the right pronunciation the grouping must be done correctly. Period <.> may be used only to indicate a decimal amount (see section *Decimal numbers*).

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 number read is 999999999999 (twelve digits). Numbers higher than this are read as separate digits.

Table: Full number pronunciation

Number	Reading (kana)	Reading (Latin alphabet)
2425	にせんよんひゃくにじゅうご	nisen yonhyaku niju^ go
2.425	にてんよんにご	ni ten yon ni go
1,000,000,000	じゅうおく	ju^ oku

Number	Reading (kana)	Reading (Latin alphabet)
1 000 000 000	じゅうおく	ju^ oku
1234567890123	いちにさんよんごろくななはちきゅうぜろいちにさん	ichi ni san yon go roku nana hachi kyu^ zero ichi ni san

4.2 Leading zero

Numbers that begin with *0* (zero) are read as a zero followed by the number read as a whole.

Table: Leading zero

Number	Reading (kana)	Reading (Latin alphabet)
09253	れいきゅうせんにひゃくごじゅうさん	re^ kyu^sen nihyaku goju^ san
0210	れいにひゃくじゅう	re^ nihyaku ju^

4.3 Decimal numbers

The full number part of the decimal number (the part before full stop) is read according to the rules in the section *Full number pronunciation*. The decimals (the part after full stop) are read as separate digits.

Table: Decimal numbers

Number	Reading (kana)	Reading (Latin alphabet)
16.234	じゅうろくてんにさんよん	ju^roku ten ni san yon
3.1415	さんてんいちよんいちご	san ten ichi yon ichi go
1251.04	せんにひゃくごじゅういちてんぜろよん	sen nihyaku goju^ ichi ten zero yon
2.50	にてんごぜろ	ni ten go zero
2,50	に (pause) ごじゅう	ni (pause) goju^
.65	てんろくご	ten roku go

4.4 Currency amounts

The following principles are followed for currency amounts:

- Numbers with zero or two decimals preceded or followed by the currency markers *£*, *$*, *¥* or *€* are read as currency amounts.
- Accepted decimal markers are comma <,> and full stop <.>.
- The decimal part (consisting of two digits) in currency amounts is read as nn sento for *€* and *$*, nn pensu for *£*, and nn sen for *¥*.
- If the decimal part is *00* it will not be read.

Table: Monetary amounts

Expression	Reading (kana)	Reading (Latin alphabet)
$1988.45	*せんきゅうひゃくはちじゅうはちドルよんじゅうごセント*	*sen kyu^hyaku hachiju^ hachidoru yonju^ go sento*
€1,988.00	*せんきゅうひゃくはちじゅうはちユーロ*	*sen kyu^hyaku hachiju^ hachi yu^ro*
15.50£	*じゅうごポンドごじゅうペンス*	*ju^go pondo goju^ pensu*
1,000,000¥	*ひゃくまんえん*	*hyakuman en*
¥11000.70	*いちまんせんえんななじゅっせん*	*Ichiman sen en nanajussen*

4.5 Time of day

Time of day is read if one of the following formats is observed:

a. ***HH:MM*** **or** ***H:MM***

b. ***HH:MM:SS*** **or** ***H:MM:SS***

c. ***H*****時MM分 or** ***HH*****時*****MM*****分**

d. ***H*****時*****MM*****分SS秒 or** ***HH*****時*****MM*****分SS秒**

H represents the hours

M represents the minutes

S represents the seconds

If the *MM*-part or the *SS*-part is equal to *00*, this part will not be pronounced.

Table: Time of day

Time	Reading (kana)	Reading (Latin alphabet)
2:20	*にじにじゅっぷん*	*ni ji nijuppun*
12:00	*じゅうにじ*	*ju^ ni ji*
03:15:05	*さんじじゅうごふんごびょう*	*san ji ju^ go fun go byo^*
2:00:20	*にじにじゅうびょう*	*ni ji ni ju^ byo^*
23:00:00	*にじゅうさんじ*	*niju^ san ji*
一時二十分三十秒	*いちじにじゅっぷんさんじゅうびょう*	*ichiji nijuppun sanju^ byo^*
1時20分30秒	*いちじにじゅっぷんさんじゅうびょう*	*ichiji nijuppun sanju^ byo^*

4.6 Dates

The valid formats for dates are:

- **yyyy年mm月dd日**
- **yyyy-mm-dd**
- **yyyy.mm.dd**
- **yyyy/mm/dd**
- **yy年mm月dd日**
- **yy-mm-dd**
- **yy.mm.dd**
- **yy/mm/dd**

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. Hyphen, full stop, and slash may be used as delimiters. In all formats, one or two digits may be used in the **mm** and **dd** part. Zeros may be used in front of numbers below 10.

Table: Dates

Date	Reading (kana)	Reading (ro-ma ji)
2010年10月10日	*にせんじゅうねんじゅうがつとおか*	*nisen ju^nen ju^gatsu to^ka*
2010-10-10	*にせんじゅうねんじゅうがつとおか*	*nisen ju^nen ju^gatsu to^ka*

Date	Reading (kana)	Reading (ro-ma ji)
2010.10.10	にせんじゅうねんじゅうがつとおか	nisen ju^nen ju^gatsu to^ka
2010/10/10	にせんじゅうねんじゅうがつとおか	nisen ju^nen ju^gatsu to^ka
05年05月05日	ごねんごがついつか	gonen gogatsu itsuka
05-05-05	ごねんごがついつか	gonen gogatsu itsuka
05.05.05	ごねんごがついつか	gonen gogatsu itsuka
05/05/05	ごねんごがついつか	gonen gogatsu itsuka

4.7 Arithmetic operators and other symbols

Numbers together with arithmetical operators are read according to the examples below.

Table: Arithmetic operators and other symbols

Expression	Reading (kana)	Reading (ro-ma ji)
25%	にじゅうごぱーせんと	niju^ go pa^sento
3.4%	さんてんよんぱーせんと	san ten yon pa^sento
.05%	てんぜろごぱーせんと	ten zero go pa^sento
-12	まいなすじゅうに	mainasu ju^ni
2*3	にかけるさん	ni kakeru san
2*3=6	にかけるさんはろく	ni kakeru san ha roku
6/2=3	ろくわるにはさん	roku waru ni ha san

4.8 Mixed digits and letters

If a non-Japanese and non-alphabetic character 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.

Table: Mixed digits and letters

Expression	Reading (kana)	Reading (Latin alphabet)
208FR	にひゃくはちＦＲ	*nihyaku hachi efu a^ru*
77B84Z3	ななじゅうななＢはちじゅうよんＺさん	*nanaju- nana bi^ hachiju^ yon zetto san*

4.9 Phone numbers

In this section the patterns of digits that are recognised as phone numbers are described. In the pronunciation of phone numbers, each group of digits is read as a full number with *の (no)* between groups of numbers. Groups that contain more than three digits are read out digit by digit.

4.9.1 Ordinary phone numbers

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

The following sequences of digits can be separated by a space, a hyphen or a bracket:

- xx xxxx xxxx
- xxx xxx xxxx
- xxxx xx xxxx
- xxxxx x xxxx
- xx-xxxx-xxxx
- xxx-xxx-xxxx
- xxxx-xx-xxxx
- xxxxx-x-xxxx
- xx(xxxx)xxxx
- xxx(xxx)xxxx
- xxxx(xx)xxxx
- xxxxx(x)xxxx

4.9.2 International phone numbers

International phone numbers follow the pattern below:

International prefix + Country code + Regional number + Local number.

International prefix:	00 or +
Country code:	1-3 digits
Regional number:	1-4 digits with or without parentheses (see below for exact formats)

Local number: 5-8 digits

Table: International phone numbers

Examples:	Reading (kana)	Reading (Latin alphabet)
0081 3 1234 5678	ぜろぜろはちいち の さん の いちにさんよん の ごろくななはち	zerozerohachiichi no san no ichinisanyon no gorokunanahachi
0081 23 456 7890	ぜろぜろはちいち の にさん の よんごろく の ななはちきゅうぜろ	zerozerohachiichi no nisan no yongoroku no nanahachikyu^zero
0081(234)56 7890	ぜろぜろはちいち の にさんよん の ごろく の ななはちきゅうぜろ	zerozerohachiichi no nisanyon no goroku no nanahachikyu^zero
0081-2345-67890	ぜろぜろはちいち の にさんよんご の ろく の ななはちきゅうぜろ	zerozerohachiichi no nisanyongo no roku no nanahachikyu^zero

5 Japanese phonetic text

The Japanese text-to-speech system uses a special phonetic alphabet which is described below.

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

5.1 Consonants

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

Table: Japanese consonants

Consonant symbol	Example	Reading (kana)	Reading (ro-ma ji)	transcription
k	柿	かき	***k***aki	/k a k' i/
k'	吸気	きゅうき	***Ky***u^***k***i	/k' u: k' i/
s	裾	すそ	***s***u***s***o	/s u s o/
S	写真	しゃしん	***sh***a***sh***in	/S a S i N:/
t	縦	たて	***t***a***t***e	/t a1 t e/
tS	地中海	ちちゅうかい	***ch***i***tyu***^kai	/tS_i tS u:1 k a i/
ts	釣り	つり	***ts***uri	/ts u r' i/
n	中庭	なかにわ	***n***akaniwa	/n a k a n' i w a/
n'	人気	にんき	***n***inki	/n' i G: k' i/
h	方法	ほうほう	***h***o^***h***o^	/h o: h o:/
C	日向	ひなた	***h***inata	/C i n a t a/
F	夫婦	ふうふ	***f***u^***f***u	/F u:1 F u/
m	メモ	めも	***m***e***m***o	/m e1 m o/
m'	茗荷	みょうが	***my***o^ga	/m' o: g a/
j	八百屋	やおや	***y***a***y***a	/j a o j a/

Consonant symbol	Example	Reading (kana)	Reading (ro-ma ji)	transcription
r	流浪	*るろう*	***r****u****r****o^*	/r u r o:/
r'	倫理	*りんり*	***r****in****r****i*	/r' i1 n: r' i/
w	私	*わたし*	***w****atashi*	/w a t a S i/
g	言語	*げんご*	***g****en****g****o*	/g e1 G: g o/
g'	行儀	*ぎょうぎ*	***gy****o^****g****i*	/g' o: g' i/
z	風	*かぜ*	*ka****z****e*	/k a z e/
dz	座禅	*ざぜん*	***z****azen*	/dz a z e N:/
Z	従事	*じゅうじ*	***j****u^****j****i*	/Z u:1 Z i/
dZ	人事	*じんじ*	***j****in****j****i*	/dZ i1 n: dZ i/
d	代打	*だいだ*	***d****ai****d****a*	/d a i d a/
b	バオバブ	*ばおばぶ*	***b****ao****b****a****b****u*	/b a o b a b u/
b'	美人	*びじん*	***b****ijin*	/b' i1 Z i N/
p	パリ	*ぱり*	***p****ari*	/p a1 r' i/
p'	ピザ	*ぴざ*	***p****iza*	/p' i1 z a/
G:	レンガ	*れんが*	*re****n****ga*	/r e1 G: g a/
n:	判断	*はんだん*	*ha****n****dan*	/h a1 n: d a N:/
n':	犯人	*はんにん*	*ha****n****nin*	/h a1 n': n' i N:/
m:	あんぱん	*あんぱん*	*a****m****pan*	/a m: p a N:/
N:	本	*ほん*	*ho****n***	/h o1 N:/
?	切符	*きっぷ*	*kippu*	/k' i ? p u/

5.2 Vowels

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

Table: Japanese vowels

Consonant symbol	Example	Reading (kana)	Reading (ro-ma ji)	transcription
a	朝	あさ	***a**s**a***	/a1 s a/
i	位置	いち	***i**ch**i***	/i1 tS i/
u	臼	うす	***u**s**u***	/u1 s u/
e	世間	せけん	*s**e**k**e**n*	/s e1 k e N/
o	斧	おの	***o**n**o***	/o1 n o/
a:	パーカー	ぱーかー	*p**a**^k**a**^*	/p a: k a:/
i:	BGM	びーじーえむ	*b**i**^j**i**^emu*	/b' i: Z i: e1 m u/
u:	琉球	りゅうきゅう	*ry**u**^ky**u**^*	/r' u: k' u/
e:	形成	けいせい	*k**e**^s**e**^*	/k e: s e:/
o:	東洋	とうよう	*t**o**^y**o**^*	/t o:1 j o:/
_i	四季	しき	*sh**i**ki*	/S_i1 k' i/
_u	机	つくえ	*ts**u**kue*	/ts_u k u e/

5.3 Accent

In Japanese, “accent” means the place where the pitch declines. A word can have an accent in several places depending on the word and the context of the word. For isolated words, there are generally as many possible accents as there are moras in a word, plus one.

Example:

A 3-mora word has 4 types of accent; no-accent, accent on the first vowel, on the second vowel and on the final vowel

In a sentence, there will be zero or one accent on a grammatical or semantic unit, called an “*accentual phrase*”. This “*accentual phrase*” often corresponds to a locution.

Accents are marked by <1>.

5.4 Pause

An underscore /_/ in a phonetic transcription generates a small pause.

6 How to change the pronunciation

Phonetic transcriptions can be entered directly in the text, using the PRN tag (see *User's guide*).

7 Abbreviations

In the Japanese text-to-speech system, the abbreviations in the table below are recognised in all contexts. These abbreviations are case-insensitive, and do not require a full stop in order to be processed as an abbreviation. If a full stop accompanies the abbreviation, the sentence ends at the full stop.

Table: Abbreviations in the Japanese system

Abbreviation	Reading (kana)	Reading (ro-ma ji)
mm	ミリメートル	*Miriritttoru*
cm	センチメートル	*senchime^toru*
km	キロメートル	*kirome^toru*
ml	ミリリットル	*miriritttoru*
cl	センチリットル	*senchiritttoru*
mm²	へいほうミリメートル	*heiho^mirime^toru*
cm²	へいほうセンチメートル	*heiho^senchime^toru*
m²	へいほうメートル	*heiho^me^toru*
km²	へいほうキロメートル	*heiho^kirome^toru*
mm³	りっぽうミリメートル	*rippo^mirime^toru*
cm³	りっぽうセンチメートル	*rippo^senchime^toru*
m³	りっぽうメートル	*rippo^me^toru*
km³	りっぽうキロメートル	*rippo^kirome^toru*
°C	どシー	*doshi^*
°F	どエフ	*doefu*

8 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 ドット*(dotto)*, hyphens '-' as ハイフン*(haifun)*, underscores '_' as アンダーバー*(anda^ba^)*, slashes '/' as スラッシュ *(surasshu).*
- jp, uk, fr and all the other abbreviations for countries are spelled out letter by letter.
- The @ is read as アットマーク*(attoma^ku)*.

Table: Web-addresses and email

Example	**Reading (kana)**	**Reading (ro-ma ji)**
http://www.acapela-group.com/	*h t t p コロン スラッシュスラッシュ w w w ドット a c a p e l a ハイフン g r o u p ドット c o m スラッシュ*	*h t t p koron surasshu surasshu w w w dotto a c a p e l a haifun g r o u p dotto Si^o^emu surasshu*
suzuki_taro@yahoo.co.jp	*s u z u k i アンダーバー t a r o ヤフー アットマーク ドット c o ドット j p*	*s u z u k i anda^ba^ t a r o attoma^ku yafu^ dotto c o dotto j p*