

MISCELLANEOUS CONTROLS

POWERUP RESET: [ESC]P.

QUIT & CLEAR: [ESC]Q.

RESERVE MEMORY: [ESC]R x p s.

SPECIAL CHARACTERS REDEFINE:

[ESC]S a c s p r n f.

INITIAL VALUE	SPECIAL CHARACTER USAGE
a ESC	ATTENTION CONTROL (IMMEDIATE)
c !	NON SPEECH CONTROL (DEFERRED)
s @	SPEECH CONTROL (DEFERRED)
p ~	PHONEME STRING START
r CR	RUN EXECUTION BUFFER
n DC1	XON: RESUME SERIAL SENDING
f DC3	XOFF: HALT SERIAL SENDING

The last two are SENT TO THE USER when software handshaking is used.

LOAD MEMORY:

IL X DATA. Load exception table

MODE SET: [ESC]M c d s p.

- c = Clock chime (0=off, 1=on, 2=voice)
- d = Delay to auto run (0=off, 1-F sec)
- s = Serial length
- p = Parallel length

USER ROUTINE EXECUTE. !U vars.

WHAT VERSION: [ESC]V.

NOTES: [ESC] denotes the escape code in ASCII (decimal 27) NOT brackets and the letters E,S,C.

The information on this card is believed to be accurate at the date of its publication. However, the Votrax PS System User's manual should be consulted for the current version of this information.

Votrax Personal Speech System

PHONEME & NOTE TABLES

TABLE 1: PHONEME CHARACTERS

ASC	PHO	ASC	PHO	ASC	PHO	ASC	PHO
@	EH3	P	CH	"	A	0	AW2
A	EH2	Q	SH	!	AY	1	UH2
B	EH1	R	Z	"	Y1	2	UH1
C	PA0	S	AW1	#	UH3	3	UH
D	DT	T	NG	\$	AH	4	O2
E	A2	U	AH1	%	P	5	O1
F	A1	V	001	&	O	6	IU
G	ZH	W	00	'	I	7	U1
H	AH2	X	L	(	U	8	THV
I	I3	Y	K	)	Y	9	TH
J	I2	Z	J	*	T	:	ER
K	I1	[	H	+	R	:	EH
L	M	\	G	.	E	<	E1
M	N	]	F	-	W	=	AW
N	B	^	D	.	AE	>	PA1
O	V	_	S	/	AE1	?	END

ALTERNATE ASCII CHARACTERS WITH THE SAME LOWER 6 BITS AS THE ABOVE MAY BE USED.

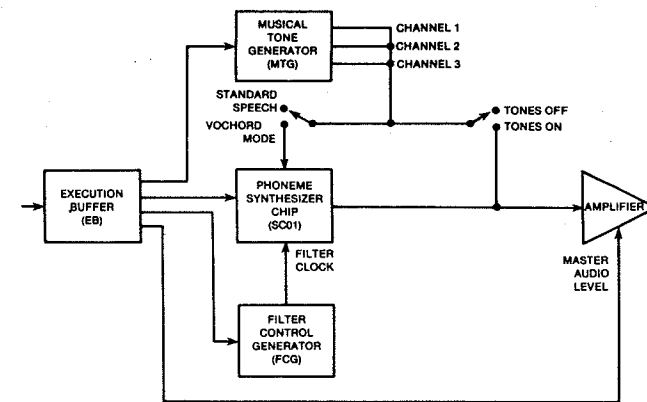
TABLE 2: MUSICAL NOTES 00 = REST

nn	Note	nn	Note	nn	Note	nn	Note
01	C 1	25	C 3	49	C 5	73	C 7
02	C#1	26	C#3	50	C#5	74	C#7
03	D 1	27	D 3	51	D 5	75	D 7
04	D#1	28	D#3	52	D#5	76	D#7
05	E 1	29	E 3	53	E 5	77	E 7
06	F 1	30	F 3	54	F 5	78	F 7
07	F#1	31	F#3	55	F#5	79	F#7
08	G 1	32	G 3	56	G 5	80	G 7
09	G#1	33	G#3	57	G#5	81	G#7
10	A 1	34	A 3	58	A 5	82	A 7
11	A#1	35	A#3	59	A#5	83	A#7
12	B 1	36	B 3	60	B 5	84	B 7
13	C 2	37	C 4	61	C 6	85	C 8
14	C#2	38	C#4	62	C#6	86	C#8
15	D 2	39	D 4	63	D 6	87	D 8
16	D#2	40	D#4	64	D#6	88	D#8
17	E 2	41	E 4	65	E 6	89	E 8
18	F 2	42	F 4	66	F 6	90	F 8
19	F#2	43	F#4	67	F#6	91	F#8
20	G 2	44	G 4	68	G 6	92	G 8
21	G#2	45	G#4	69	G#6	93	G#8
22	A 2	46	A 4	70	A 6	94	A 8
23	A#2	47	A#4	71	A#6	95	A#8
24	B 2	48	B 4	72	B 6	96	B 8

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PERSONAL SPEECH SYSTEM Quick Reference Card



AUDIO CENTER DIAGRAM

Votrax Incorporated
1358 Rankin
Troy, Michigan 48083 USA
1-800-521-1350
OR YOUR LOCAL VOTRAX DEALER

Dealer:

*** PRELIMINARY VERSION ***
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SPEECH & SPEECH CONTROL

TEXT TO BE SPOKEN:

Any string of PRINTABLE ASCII CHARACTERS below that does not begin with a control code will be processed into speech. (! is a control code. Also see REDEFINE.)

ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 = *
abcdefghijklmnopqrstuvwxyz !.?,;: +\$#%-

PHONEMES STRINGS FOR SPEECH OUTPUT:

A string of phoneme characters preceded by the phoneme control code "~" and terminated by a "?" will be sent to the speech chip directly. SEE TABLE 1.

ex. ~[BX&7? speaks "hello"

AMPLITUDE FADE: @Aar

a = master audio level (0-F)
r = fade rate (0-F)

TEXT CONVERSION MODE: @Cm

m = 0 basic translation
1 exceptions on
2 single numbers

SPEECH RATE: @Rr r = 0-F

VOICE MODE: @Vm

m = 0 standard SC01 (default)
2 VOCHORD (tm) mode (tones off)
4 VOCHORD (tm) mode (tones on)

INFLECTION: @i i = 0-7

REAL TIME CLOCK & ALARMS

TIME SET: [ESC]Thmmss.
SPEAK TIME: [ESC]T.

ALARM SET:

!A # hhmm TEXT. Set alarm 0-7
!A C. CLEAR ALARMS

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MUSIC & SOUND EFFECTS

MUSICAL TONE CONTROL:

lc nn d. Short form
lc nn d r a g. Complete form
c = channel (1,2,3)
nn = note (00=rest, 1-96 SEE TABLE 2)
d = duration (0-F tempo units)
r = hold (0-F tempo units)
a = amplitude (0= envelope, 1-F)
g = glide (0=off, 1-F)

ENVELOPE SHAPE: !E c a d s r w.

c = channel (1,2,3)
a = Attack rate (0-F)
d = Decay rate (0-F)
s = Sustain level (0-F)
r = Release rate (0-F)
w = attack Wait (0-F Ticks)

FILTER SETTING: !F bb tt r.

bb = base value (00-FF)
tt = target value (00-FF)
r = rate of movement (0-F)

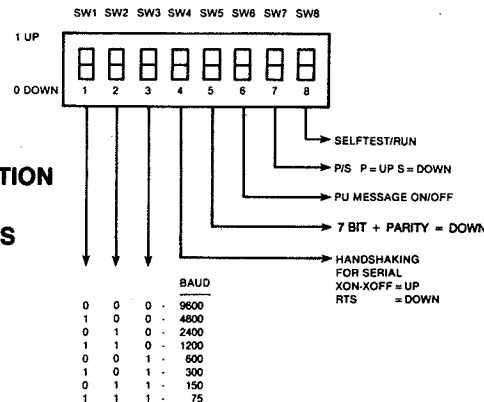
NOISE: !N c v r.

c = channel (0=off,1,2,3)
v = value (A-Z=noise period value)
r = rate of movement (0-F)

TEMPO: !T tt. 1 Tick = 8.192 ms

tt = Tempo unit (00-FF ticks) (ms = milliseconds)

CONFIGURATION SETUP SWITCHES



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INPUT / OUTPUT CONTROL

BAUD SELECT: !B b h.

b = 7 75 bps 3 1200 bps
6 150 bps 2 2400 bps
5 300 bps 1 4800 bps
4 600 bps 0 9600 bps
h = handshake 0=RTS 1=XON/XOFF

CONNECT INPUT TO: [ESC]C SerIN ParIN.

SerIN, ParIN OPTIONS:

0 = OFF OFFLINE
1 = EB EXECUTION BUFFER
2 = SOUT SERIAL OUTPUT BUFFER
4 = POUT PARALLEL OUTPUT BUFFER

PROMPT:

!P #. Audio prompt 0-9
!P S string. Send string (serial)
!P P string. Send string (parallel)

WAIT FOR:

!W d. Wait d seconds 1-F
!W Sc. Wait for character c (serial)
!W Pc. Wait for character c (parallel)

SPEECH POWER-UP SETTINGS

Amplitude @ AF1
Conversion Mode @ C0
Speech Rate @ R4
Voice Mode @ V0
Inflection @ 1

ERROR CODE DEFINITION

- 1 INVALID CONTROL TYPE
- 2 TERMINATOR MISSING
- 3 INVALID OPTION
- 4 INVALID NUMBER
- 5 MEMORY OVERFLOW
- 6 REQUEST NOT READY
- 7 SERIAL INPUT FAULT

Ref. Card \$1.00

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Phonetic Dictionary

INTRODUCTION

VOTRAX[®] Speech Synthesis Technology produces each of the 45 basic speech sounds, called phonemes. This handy dictionary gives you quick access to the VOTRAX[®] phoneme sequences used to create approximately 1400 words. Because VOTRAX[®] speech synthesis uses these basic phonetic sounds, you may program virtually any word in the English language by learning to use and combine the various phoneme codes.

This dictionary is intended for use with the SC-01 Speech Synthesizer. It can also serve as a guide for programming any product containing a VOTRAX[®] synthesizer.

GENERAL DESCRIPTION OF THE SC-01 CHIP

The SC-01 Speech Synthesizer is a completely self-contained solid state device. This single chip phonetically synthesizes continuous speech, of unlimited vocabulary, from low data rate inputs.

Speech is synthesized by combining phonemes (the building blocks of speech) in the appropriate sequence. The SC-01 Speech Synthesizer contains 64 different phonemes which are accessed by a 6-bit code. It is the proper sequential combination of these phoneme codes that creates continuous speech.

PHONEME DESCRIPTION

Table 1 lists the 64 phonemes produced by the SC-01. Each sound is represented by its VOTRAX[®] phoneme code and is accompanied by its phoneme symbol and an example. The underlined segments of the example word demonstrate the phoneme use, i.e., sound to be pronounced.

Table 2 provides the phoneme sequences used to produce vowels in the group called diphthongs, (2 vowel sounds in sequence, identified as a single sound, e.g., the

TABLE 1: PHONEME CHART

Phoneme Code	Phoneme Symbol	Duration (ms)	Example Word
ØØ	EH3	59	jack <u>e</u> t
Ø1	EH2	71	<u>e</u> nlist
Ø2	EH1	121	heav <u>y</u>
Ø3	PAØ	47	no sound
Ø4	DT	47	but <u>t</u> er
Ø5	A2	71	ma <u>d</u> e
Ø6	A1	103	ma <u>d</u> e
Ø7	ZH	90	azu <u>r</u> e
Ø8	AH2	71	h <u>o</u> n <u>e</u> st
Ø9	13	55	inhib <u>i</u> t
ØA	12	80	inhib <u>i</u> t
ØB	11	121	inhib <u>i</u> t
ØC	M	103	ma <u>t</u>
ØD	N	80	su <u>n</u>
ØE	B	71	ba <u>g</u>
ØF	V	71	va <u>n</u>
1Ø	CH*	71	ch <u>i</u> p
11	SH	121	sh <u>o</u> p
12	Z	71	z <u>o</u> o
13	AW1	146	law <u>f</u> ul
14	NG	121	th <u>i</u> ng
15	AH1	146	fa <u>t</u> her
16	001	103	loo <u>k</u> ing
17	00	185	bo <u>o</u> k
18	L	103	lan <u>d</u>
19	K	80	tr <u>i</u> ck
1A	J*	47	ju <u>d</u> ge
1B	H	71	he <u>l</u> lo
1C	G	71	g <u>e</u> t
1D	F	103	fa <u>s</u> t
1E	D	55	pa <u>i</u> d
1F	S	90	pa <u>s</u> s

/T/ must precede /CH/ to produce CH sound.

/D/ must precede /J/ to produce J sound.

TABLE 1: PHONEME CHART

Phoneme Code	Phoneme Symbol	Duration (ms)	Example Word
2∅	A	185	<u>day</u>
21	AY	65	<u>day</u>
22	Y1	80	<u>yard</u>
23	UH3	47	<u>mission</u>
24	AH	250	<u>mop</u>
25	P	103	<u>past</u>
26	O	185	<u>cold</u>
27	I	185	<u>pin</u>
28	U	185	<u>move</u>
29	Y	103	<u>any</u>
2A	T	71	<u>tap</u>
2B	R	90	<u>red</u>
2C	E	185	<u>meet</u>
2D	W	80	<u>win</u>
2E	AE	185	<u>dad</u>
2F	AE1	103	<u>after</u>
30	AW2	90	<u>salty</u>
31	UH2	71	<u>about</u>
32	UH1	103	<u>uncle</u>
33	UH	185	<u>cup</u>
34	O2	80	<u>for</u>
35	O1	121	<u>aboard</u>
36	IU	59	<u>you</u>
37	U1	90	<u>you</u>
38	THV	80	<u>the</u>
39	TH	71	<u>thin</u>
3A	ER	146	<u>bird</u>
3B	EH	185	<u>get</u>
3C	E1	121	<u>be</u>
3D	AW	253	<u>call</u>
3E	PA1	185	no sound
3F	STOP	47	no sound

TABLE 2: DIPHTHONG CHART

Phoneme Combination	Key Words
A1-AY-Y	<u>fate</u> , <u>maid</u>
AH1-EH3-Y	<u>find</u> , <u>wide</u>
UH3-AH2-Y	<u>fight</u> , <u>white</u>
AH1-I3-UH3-L	<u>file</u> , <u>smile</u>
O1-UH3-Y	<u>foy</u> , <u>boy</u>
O1-I3-UH3-L	<u>foil</u> , <u>spoil</u>
AH1-O2-U1	<u>found</u> , <u>cow</u>
UH3-AH2-U1	<u>foust</u> , <u>house</u>
O1-U1	<u>float</u> , <u>note</u>
Y1-IU-U1	<u>few</u> , <u>you</u> , <u>music</u>
AY-I1	<u>fear</u> , <u>beer</u>

Phonetic Programs

A A1, AY, Y
a-2 UH2, UH3
able A1, Y, B, UH3, L
abort UH1, B, O2, O2, R, T
about UH1, B, UH2, AH2, U1, T
above UH1, B, UH1, UH3, V
accept EH1, K, PAO, S, EH1, EH3, P, T
access AE1, EH3, K, PAO, S, EH1, EH3, S
account UH1, K, AH1, UH3, W, N, T
acid AE1, EH3, S, I1 D
act AE1, EH3, K, T
active AE1, EH3, K, T, I1, V
actual AE1, EH3, K, T, CH, U1, UH3, L
add AE1, EH3, D
address AE1, EH3, D, R, EH1, EH3, S
ade (use "aid" program)
adjust UH1, D, J, UH1, UH3, S, T
adjacent UH1, D, J, A1, AY, S, EH3, N, T
advance AE1, EH3, D, V, AE1, EH3, N, T, S
advise AE1, EH3, D, V, AH1, EH3, Y, Z
affect UH1, F, EH1, EH3, K, T
after AE1, EH3, F, T, ER
again UH1, G, A2, EH1, N
age A1, AY, Y, D, J
agent A1, Y, D, J, EH3, N, T
ahead UH1, H, EH1, EH3, D
aid A1, AY, Y, D
air EH2, EH2, R
alarm UH1, L, AH1, R, M
alert UH1, L, ER, R, T
all AW, L
allocate AE1, UH3, L, UH2, K, A1, Y, T
allow UH1, L, AH1, UH3, U1
alpha AE1, AW2, L, F, UH1
already AW, L, R, EH1, EH3, D, Y
also AW, L, S, O1, U1
altitude AE1, UH3, L, T, I2, T, IU, U1, U1, D
aluminum UH1, L, IU, U1, M, I3, N, UH1, M
am AE1, EH3, M

america UH1, M, EH1, R, I3, K, UH2, UH3
amount UH1, M, AH1, UH3, W, N, T
amp AE1, EH3, M, P
amplify AE1, EH3, M, P, L, I3, F, AH1, EH3, AY
an AE1, EH3, N
and AE1, EH3, N, D
angle AE1, EH3, NG, G, UH3, L
another UH1, N, UH1, UH3, THV, ER
answer AE1, EH3, N, S, ER
any EH2, EH2, N, Y
apostrophe UH1, P, AH1, UH3, S, T, R, UH3, F, Y
approach UH1, P, R, O1, U1, T, CH
approve UH1, P, R, IU, U1, U1, V
approximate UH1, P, R, AH1, K, PAO, S, EH3, M, I3, T
approximate-2 UH1, P, R, AH1, K, PAO, S, EH3, M, A2, Y, T
april A1, Y, P, R, UH2, L
architect AH1, R, K, UH2, T, EH3, EH2, K, T
are (see "R" program)
area EH1, EH3, R, Y, UH1
arrive UH1, R, AH1, EH3, Y, V
arrow EH1, EH3, R, O1, U1
article AH1, R, T, EH3, K, UH3, L
as AE1, EH3, Z
ASCII AE1, EH3, S, K, Y
ask AE1, EH3, S, K
assemble UH1, S, EH1, EH3, M, B, UH3, L
asset AE1, EH3, S, EH1, T
assign UH1, S, AH1, EH3, Y, N
assist UH1, S, I1, I3, S, T
associate UH1, S, O1, SH, Y, A1, Y, T
associate-2 UH1, S, O1, SH, Y, I2, T
assume UH1, S, IU, U1, M
at AE1, EH3, T
ate (see "eight" program)
attach UH1, T, AE1, EH3, T, CH
attempt UH1, T, EH1, EH3, M, P, T

august AW2, AW2, G, EH2, S, T
 authorize AW2, AW2, TH, ER, AH1, Y, Z
 automatic AW2, AW2, DT, UH3, M, AE1,
 EH3, DT, I3, K
 available UH1, V, A1, Y, L, UH3, B,
 UH3, L
 average AE1, EH3, V, R, I1, D, J
 avoid UH1, V, O1, UH3, I3, AY, D

B B, E1, Y
 back B, AE1, AE1, K
 bad B, AE1, AE1, D
 badge B, AE1, AE1, D, J
 bag B, AE1, AE1, G
 balance B, AE1, AH2, L, I3, N, DT, S
 ball B, AW2, AW1, L
 band B, AE1, EH3, N, D
 bank B, AE1, I3, NG, K
 bar B, AH1, UH3, R
 base B, A1, AY, Y, S
 basic B, A1, Y, S, I2, K
 bat B, AE1, EH3, T
 batch B, AE1, EH3, T, CH
 bath B, AE1, AE1, EH3, TH
 battery B, AE1, EH3, T, ER, Y
 be (use "B" program)
 bed B, EH1, EH3, D
 been B, EH1, EH3, N
 beep B, E1, Y, P
 before B, Y, F, O2, O2, R
 begin B, Y, G, I1, I3, N
 bell B, EH1, UH3, L
 below B, Y, L, UH3, O2, U1
 bend B, EH1, EH3, N, D
 best B, EH1, EH3, S, T
 beta B, A2, A2, AY, T, UH2
 better B, EH1, EH3, T, ER
 between B, Y, T, W, E1, Y, N
 bid B, I1, I3, D
 big B, I1, I3, G
 bill B, I1, I3, L
 billion B, I1, I3, L, Y, UH3, N
 bin B, I1, I3, N

birthday B, ER, R, TH, D, A1, I3, Y
 bit B, I1, I3, T
 bite B, UH3, AH2, Y, T
 black B, L, AE1, EH3, K
 blank B, L, AE1, EH3, NG, K
 blew (use "blue" program)
 blind B, L, AH1, EH3, Y, N, D
 block B, L, AH1, UH3, K
 blown B, L, O1, U1, N
 blue B, L, IU, U1, U1
 blur B, L, ER, R
 board B, O1, O2, R, D
 bolt B, O2, O2, L, T
 bond B, AH1, UH3, N, D
 book B, OO1, OO1, K
 bored (use "board" program)
 boss B, AW1, AW2, S
 bother B, AH1, UH3, THV, ER
 bottom B, AH1, UH3, T, UH1, M
 bought B, AW1, AW2, T
 box B, AH1, UH3, K, PAO, S
 brace B, R, A1, Y, S
 brain B, R, A1, Y, N
 brake B, R, A1, Y, K
 branch B, R, AE1, EH3, N, T, CH
 bravo B, R, AH1, UH3, V, O1, U1
 break (use "brake" program)
 bridge B, R, I1, I3, D, J
 brief B, R, AY, Y, F
 bright B, R, UH3, AH2, Y, T
 bring B, R, I1, I3, NG
 broke B, R, O1, U1, K
 brought B, R, AW, T
 brown B, R, AH1, UH3, U1, N
 bubble B, UH1, UH2, B, UH3, L
 budget B, UH1, UH3, D, J, I2, T
 bug B, UH1, UH2, G
 build B, I2, I2, L, D
 bus B, UH1, UH2, S
 business B, I3, I3, Z, N, EH2, S
 busy B, I3, I2, Z, Y
 but B, UH1, UH2, T

by B, AH1, EH3, I3, Y
bye B, AH1, EH3, I3, Y
byte (use "bite" program)

C S, E1, Y
cable K, A1, Y, B, UH3, L
calendar K, AE1, UH3, L, I3, N, D, ER
calibrate K, AE1, UH3, L, UH3, B, R,
A1, Y, T

call K, AW2, AW1, L
came K, A1, AY, Y, M
can K, AE1, EH3, N
cancel K, AE1, EH3, N, S, UH3, L
capable K, A1, Y, P, UH3, B, UH3, L
capacitor K, UH2, P, AE1, EH3, S, EH3,
T, ER

capacity K, UH2, P, AE1, EH3, S, I3,
DT, Y

car K, AH1, UH3, R
card K, AH1, R, D
care K, EH3, EH3, ER
carpenter K, AH1, R, P, I3, N, D, ER
carriage K, EH2, EH3, R, I1, D, J
carry K, EH2, EH3, R, Y
carton K, AH1, R, T, I3, N
case K, A1, AY, Y, S
cash K, AE1, EH3, SH
cassette K, UH1, S, EH1, EH3, T
cassette-2 K, A2, AY, S, EH1, EH2, T
category K, AE1, EH3, DT, UH3, G, O1,
R, Y

catalog K, AE1, EH3, DT, UH3, L,
AW2, AW2, G

caution K, AW2, AW1, SH, UH3, N
cent S, EH1, EH3, N, T
center S, EH1, EH3, N, T, ER
centi S, EH1, EH3, N, T, I1, I3
centigrade S, EH1, N, T, I3, G, R, A1, Y, D
certify S, R, R, T, I3, F, AH1, Y
change T, CH, A1, AY, Y, N, D, J
character K, EH1, R, EH1, K, T, ER
charge T, CH, AH1, R, D, J
charlie T, CH, AH1, R, L, Y

check T, CH, EH1, EH3, K
cheer T, CH, AY, I2, R
chip T, CH, I1, I3, P
choice T, CH, O1, UH3, I3, AY, S
circle S, ER, R, K, UH3, L
circuit S, R, R, K, I2, T
city S, I1, T, Y
claim K, L, A1, AY, Y, M
class K, L, AE1, EH3, S
clean K, L, E1, AY, N
clear K, L, AY, I3, R
clerk K, L, ER, K
clip K, L, I1, I3, P
clock K, L, AH1, UH3, K
close K, L, UH3, O1, U1, Z
close-2 K, L, UH3, O2, U1, S
cloud K, L, AH1, UH3, W, D
coarse K, O1, O2, R, S
code K, O01, O2, U1, D
coin K, O1, UH3, I3, AY, N
collar K, AH1, UH3, L, ER
collect K, UH1, L, EH1, K, T
colon K, O01, O2, U1, L, I2, N
color K, UH2, UH2, L, ER
column K, AH1, UH3, L, UH3, M
combine K, UH2, M, B, AH1, EH3, Y, N
comma K, AH1, UH3, M, UH1
command K, UH2, M, AE, EH3, N, D
commerce K, AH1, UH3, M, ER, S
commercial K, UH1, UH3, M, ER, SH, UH3,
L

communicate K, UH2, M, Y1, IU, U1, N, I3, K,
A1, Y, T
company K, UH1, UH3, M, P, EH3, N, Y
compare K, UH1, UH3, M, P, EH3, EH3,
ER

compile K, UH1, UH3, M, P, AH1, EH3,
I3, UH3, L
complete K, UH1, UH3, M, P, L, AY, Y, T
comply K, UH1, UH3, M, P, L, AH1,
EH3, Y

component K, UH2, M, P, O2, O1, N, EH2,
N, T

conceal K, UH1, N, S, E1, AY, L
 condense K, UH1, N, D, EH1, EH3, N, S
 condition K, UH1, N, D, I1, I3, SH, UH3, M
 confirm K, UH1, N, F, ER, R, M
 confuse K, UH1, N, F, Y1, IU, U1, U1, Z
 confusion K, UH1, N, F, Y1, IU, U1, U1,
 ZH, UH3, N
 congratulations K, UH1, N, G, R, AE1, D, J,
 UH3, L, A1, AY, SH, UH3, N, Z
 connect K, UH1, N, EH1, EH3, K, T
 console K, AH1, UH3, N, S, O1, U1, L
 console-2 K, UH1, N, S, O1, O2, L
 consult K, UH1, N, S, UH1, UH2, L, T
 consume K, UH1, N, S, IU, U1, U1, M
 contain K, UH3, UH3, N, T, A1, AY, Y, N
 continue K, UH1, N, T, I1, I3, N, Y1, IU,
 U1
 contract K, AH1, UH3, N, T, R, AE1,
 EH3, K, T
 contrast K, AH1, UH3, N, T, R, AE1,
 EH3, S, T
 control K, UH1, N, T, R, O1, O2, L
 convenient K, UH2, N, V, E1, N, AY, EH3,
 N, T
 copper K, AH1, UH3, P, ER
 copy K, AH1, UH3, P, Y
 correct K, O2, O2, R, EH1, EH3, K, T
 correspond K, O1, R, I3, S, P, AH1, AH2,
 N, D
 cosine K, O1, U1, S, AH1, Y, N
 cost K, AW2, AW1, S, T
 could K, IU, IU, OO1, D
 count K, AH1, UH3, W, N, T
 country K, UH1, N, T, R, Y
 couple K, UH3, UH1, P, UH3, L
 courage K, ER, R, I3, D, J
 course K, O1, O2, R, S
 court K, O1, O2, R, T
 cover K, UH1, UH3, V, ER
 crane K, R, A1, AY, Y, N
 crash K, R, AE1, EH3, SH
 crease K, R, E1, Y, S
 create K, R, Y, A1, Y, T

credit K, R, EH1, EH3, D, I1, T
 crew K, R, IU, U1, U1
 critical K, R, I1, T, I3, K, UH3, L
 cross K, R, AW, S
 crowd K, R, AH1, UH3, U1, D
 cry K, R, AH1, EH3, I3, Y
 cue (use "Q" program)
 cup K, UH1, UH2, P
 curious K, Y, ER, Y, UH1, S
 current K, ER, R, EH3, N, T
 currency K, ER, R, I2, N, DT, S, Y
 curse K, ER, R, S
 curve K, ER, R, V
 customer K, UH1, UH2, S, T, UH1, M, ER
 cut K, UH1, UH2, T
 cycle S, UH3, AH2, Y, K, UH3, L

D D, E1, Y
 daily D, A1, AY, Y, L, Y
 damage D, AE1, EH3, M, I1, D, J
 danger D, A1, AY, Y, N, D, J, ER
 dark D, AH1, R, K
 dash D, AE1, EH3, SH
 data D, A1, Y, DT, UH1
 date D, A1, AY, Y, T
 day D, A1, I3, Y
 dead D, EH1, EH3, F
 dealer D, E1, AY, L, ER
 dear D, AY, I3, R
 debit D, EH1, EH3, B, I2, T
 debt D, EH1, EH3, T
 december D, Y, S, EH1, EH3, M, B, ER
 decide D, Y, S, AH1, EH3, Y, D
 decimal D, EH1, S, M, UH3, L
 decision D, Y, S, I1, ZH, UH3, N
 decline D, Y, K, L, AH1, EH3, Y, N
 decrease D, Y, K, R, E1, Y, S
 deduct D, Y, D, UH1, UH2, K, T
 deep D, E1, Y, P
 deer (use "dear" program)
 defeat D, Y, F, E1, AY, T
 defend D, Y, F, EH1, EH3, N, D

deficit D, EH1, F, I3, S, I1, T
degree D, Y, G, R, E1, Y
delay D, I1, L, EH3, A1, Y
delete D, E1, L, E1, Y, T
deliver D, Y, L, I1, V, ER
delta D, EH2, EH3, L, T, UH1
demand D, Y, M, AE1, EH3, N, D
demonstrate D, EH1, M, UH3, N, S, T, R,
A1, Y, T

deny D, Y, N, AH1, EH3, Y
destroy D, Y, S, T, R, O1, UH3, I3, AY
detail D, E, T, EH3, A1, I3, UH3, L
determine D, Y, T, ER, M, I1, N
device D, Y, V, UH3, AH2, Y, S
dew (use "do" program)
diagnostic D, AH1, AY, I3, G, N, AH1,
UH3, S, T, I3, K

dial D, AH1, EH3, I3, UH3, L
dictionary D, I1, I3, K, SH, UH3, N, EH3,
EH3, ER, Y

did D, I1, I3, D
die D, AH1, EH3, Y
diet D, AH1, EH3, AY, I2, T
differ D, I1, I3, F, ER
difference D, I1, F, R, EH3, N, DT, S
different D, I1, F, R, EH3, N, T
digit D, I1, D, J, I1, T
digital D, I1, D, J, I3, T, UH3, L
dime D, AH1, EH3, Y, M
diode D, AH1, EH3, AY, O1, U1, D
direct D, ER, EH1, EH3, K, T
directory D, ER, EH1, EH3, K, T, ER, Y
dirt D, ER, R, T
disagree D, I1, S, UH1, G, R, E1, Y
disappear D, I1, S, UH1, P, AY, I3, R
disconnect D, I1, S, K, UH1, N, EH1, EH3,
K, T

discuss D, I1, I3, S, K, UH1, UH2, S
disk D, I1, I3, S, K
display D, I1, I3, S, P, L, A1, I3, Y
distance D, I1, S, T, EH3, N, T, S
divide D, I1, V, AH1, EH3, Y, D
dividend D, I1, V, I1, D, EH1, EH3, N, D

do D, IU, U1, U1
dock D, AH1, UH3, K
doctor D, AH1, UH3, K, T, ER
document D, AH1, K, Y1, UH3, M, EH3,
N, T

does D, UH2, UH1, Z
dollar D, AH1, UH3, L, ER
done D, UH1, UH3, N
door D, O1, O2, R
double D, UH3, UH1, B, UH3, L
doubt D, UH3, AH2, U1, T
down D, AH1, UH3, U1, N
draft D, R, AE1, EH3, F, T
draw D, R, AW
drill D, R, I1, I3, L
drink D, R, I1, I3, NG, K
drive D, R, AH1, EH3, Y, V
drop D, R, AH1, UH3, P
drum D, R, UH1, UH2, M
dry D, R, AH1, EH3, I3, Y
due (use "do" program)
dump D, UH1, UH2, M, P
duration D, ER, R, A1, Y, SH, UH3, N
during D, ER, R, I1, NG
duty D, IU, U1, U1, T, Y
dwell D, W, EH1, EH3, L

E
each E1, Y
ear E1, AY, T, CH
early E1, I2, R
ER, R, L, Y
earn ER, R, N
east E1, AY, S, T
easy E1, AY, Z, Y
echo EH1, EH3, K, O1, U1
edge EH1, EH3, D, J
edit EH1, EH3, D, I2, T
educate EH1, D, J, U1, K, A1, Y, T
effect UH1, F, EH1, EH3, K, T
efficient E1, F, I1, SH, EH3, N, T
effort EH2, EH3, F, ER, T
eight A2 A2 Y T

eighty A2, A2, Y, T, Y
 either E1, Y, THV, ER
 electric EH3, L, EH1, K, T, R, I2, K
 electrician EH3, L, EH1, K, PAO, T, R, I1, SH, UH3, N
 electronic EH3, L, EH1, K, T, R, AH1, N, I2, K
 elevator EH1, L, UH3, V, A2, AY, D, ER
 eleven EH1, L, EH1, EH3, V, I2, N
 eligible EH1, L, UH3, D, J, EH3, B, UH3, L
 eliminate EH1, L, I1, M, I1, N, A1, Y, T
 else EH1, EH3, L, S
 emit Y, M, I1, I3, T
 employ EH1, EH3, M, P, L, O1, UH3, I3, AY
 empty EH1, EH3, M, P, T, Y
 enable EH1, N, A1, Y, B, UH3, L
 enclose EH1, EH3, N, K, L, O1, U1, Z
 end EH1, EH3, N, D
 engine EH1, EH3, N, D, J, I1, N
 engineer EH1, N, D, J, I2, N, AY, I1, R
 endorse EH1, EH3, N, D, O2, O2, R, S
 english I1, NG, G, L, I2, SH
 enter EH1, EH3, N, T, ER
 entry EH1, EH3, N, T, R, Y
 epsilon EH1, P, S, UH3, L, AH1, UH3, N
 equal Y, K, W, UH3, L
 equipment E1, K, W, IL, P, M, EH3, N, T
 erase E1, R, A1, Y, S
 error EH3, EH3, EH3, R, ER
 escape EH1, EH3, S, K, A1, AY, Y, P
 escrow EH1, EH3, S, K, R, O1, U1
 establish UH1, S, T, AE1, EH3, B, L, I2, SH
 estate EH1, EH3, S, T, A1, AY, Y, T
 estimate EH1, S, T, EH3, M, I3, T
 exact EH1, EH3, G, PAO, Z, AE1, EH3, K, T
 examine EH1, EH3, G, PAO, Z, AE1, EH3, M, I1, N
 exceed EH1, EH3, K, PAO, S, E1, Y, D
 exempt EH1, EH3, K, PAO, S, E1, Y, D

exchange EH1, EH3, K, PAO, S, T, CH, A1, AY, Y, N, D, J
 execute EH1, EH3, K, PAO, S, UH3, K, Y1, IU, U1, T
 exempt EH1, EH3, G, PAO, Z, EH1, EH3, M, P, T
 exit EH1, EH3, G, PAO, Z, I1, I3, T
 expect EH1, EH3, K, PAO, S, P, EH1, EH3, K, T
 expedite EH1, EH3, K, PAO, S, P, EH1, EH3, D, UH3, AH2, Y, T
 expend EH1, EH3, K, PAO, S, P, EH1, EH3, N, D
 experiment EH1, K, PAO, S, P, EH1, R, UH3, M, EH3, N, T
 exponent EH1, K, PAO, S, P, O2, O2, N, EH3, N, T
 express EH1, EH3, K, PAO, S, P, R, EH1, S
 extension EH1, EH3, K, PAO, S, T, EH1, EH3, N, SH, UH3, N

F EH1, EH2, F
 face F, A1, AY, Y, S
 facility F, UH2, S, I1, L, I3, T, Y
 fact F, AE1, EH3, K, T
 fahrenheit F, EH1, R, I2, N, H, UH3, AH2, Y, T
 fail F, A1, AY, I3, UH3, L
 fall F, AW, L
 false F, AW, L, S
 familiar F, UH1, M, I1, L, Y1, ER
 far F, AH1, UH3, R
 farad F, EH3, EH3, ER, AE1, EH3, D
 fast F, AE1, EH3, S, T
 fault F, AW, L, T
 feat (use "feet" program)
 feature F, E1, AY, T, CH, ER
 february F, EH1, B, Y1, IU, W, EH1, R, Y
 federal F, EH1, EH3, D, R, UH3, L
 fee F, E1, Y
 feed F, E1, Y, D

field F, E1, AY, UH3, L, D
 fifteen F, I1, I3, F, T, E1, Y, N
 fifth F, I1, I3, F, TH
 fifty F, I1, I3, F, T, Y
 file F, AH1, EH3, I3, UH3, L
 fill F, I1, I3, L
 final F, AH1, Y, N, UH3, L
 finance F, AH1, EH3, Y, N, AE1, EH3, N, S
 find F, AH1, EH3, Y, N, D
 finger F, I1, I3, NG, G, ER
 finish F, I1, N, I1, SH
 fire F, AH1, EH3, AY, R
 first F, ER, R, S, T
 fit F, I1, I3, T
 five F, AH1, EH3, Y, V
 fix F, I1, I3, K, PAO, S
 fixture F, I1, I3, K, PAO, S, T, CH, ER
 flash F, L, AE1, EH3, SH
 flat F, L, AE1, EH3, T
 flight F, L, UH3, AH2, Y, T
 flip F, L, I1, I3, P
 floor F, L, O1, O2, R
 flop F, L, AH1, UH3, P
 flow F, L, O1, U1
 fly F, L, AH1, EH3, Y
 fold F, O2, O2, L, L, D
 follow F, AH1, AW2, L, O1, U1
 food F, U1, U1, D
 foot F, OO1, OO1, T
 for (use "four" program)
 fore (use "four" program)
 force F, O2, O2, R, S
 foreman F, O2, O2, R, M, EH2, N
 forget F, O2, O2, R, G, EH1, EH3, T
 forgive F, O2, O2, R, G, I1, I3, V
 form F, O2, O2, R, M
 format F, O2, O2, R, M, AE1, EH3, T
 forty F, O2, O2, R, T, Y
 forward F, O2, O2, R, W, ER, D
 found F, AH1, UH3, W, N, D
 four F, O1, O2, R

fox trot F, AH1, UH3, K, PAO, S, T, R, AH1, UH3, T
 frame F, R, A1, AY, Y, M
 fraud F, R, AW, D
 free F, R, E1, Y
 french F, R, EH1, EH3, N, T, CH
 frequency F, R, E1, K, W, EH3, N, DT, S, Y
 frequent F, R, E1, K, W, EH3, N, T
 friday F, R, AH1, EH3, Y, D, A1, I3, Y
 fright F, R, UH3, AH2, Y, T
 from F, R, UH1, UH3, M
 front F, R, UH3, UH1, N, T
 fruit F, R, IU, U1, T
 fuel F, Y1, IU, U1, UH3, L
 full F, OO1, L
 function F, UH1, UH2, N, K, SH, UH3, N
 fund F, UH1, UH2, N, D
 furnace F, ER, R, N, EH3, S
 further F, ER, R, THV, ER
 future F, Y1, IU, U1, T, CH, ER
 G D, J, E1, Y
 gage (use "gauge" program)
 gain G, A1, AY, Y, N
 gait (use "gate" program)
 gallon G, AE1, AH2, L, UH3, N
 game G, A1, AY, Y, M
 gamma G, AE1, EH3, M, UH2, UH3
 gap G, AE1, EH3, P
 garage G, UH1, R, AH1, UH3, ZH
 gas G, AE1, EH3, S
 gate G, A1, AY, Y, T
 gauge G, A1, AY, Y, D, J
 general D, J, EH1, EH3, N, ER, UH3, L
 generate D, J, EH1, N, ER, A1, Y, T
 gentlemen D, J, EH1, EH3, N, T, L, M, I2, N
 german D, J, ER, R, M, EH2, N
 get G, EH1, EH3, T
 girl G, ER, R, L
 give G, I1, I3, V
 glass G, L, AE1, EH3, S
 glitch G, L, I1, I3, T, CH

golf G, AW2, AW2, UH3, L, F
good G, OO1, OO1, D
govern G, UH1, UH3, V, ER, N
grade G, R, A1, AY, Y, D
gram G, R, AE1, EH3, M
grand G, R, AE1, EH3, N, D
graph G, R, AE1, EH3, F
grate (use "great" program)
gray (use "grey" program)
great G, R, A1, Y, T
green G, R, E1, Y, N
greet G, R, E1, Y, T
grey G, R, A1, AY, Y
grind G, R, AH1, EH3, Y, N, D
grocery G, R, O1, U1, S, ER, Y
ground G, R, AH1, UH3, W, N, D
group G, R, U1, U1, P
grow G, R, O1, U1
guard G, AH1, R, D
guarantee G, EH1, R, I3, N, T, E1, Y
guess G, EH1, EH3, S

H A1, AY, Y, T, CH
had H, AE1, EH3, D
half H, AE1, EH3, F
halt H, AW, L, T
hammer H, AE1, EH3, M, ER
hand H, AE1, EH3, N, D
handle H, AE1, EH3, N, D, UH3, L
hang H, AE1, I3, NG
happy H, AE1, EH3, P, Y
hard H, AH1, R, D
has H, AE1, EH3, Z
have H, AE1, EH3, V
he H, E1, Y
head H, EH1, EH3, D
hear H, AY, I3, R
heart H, AH1, UH3, R, T
heat H, E1, AY, T
heavy H, EH1, V, Y
height H, UH3, AH2, Y, T
held H, EH1, UH3, L, D
hello H, EH1, UH3, L, UH3, O1, U1

henry H, EH1, EH3, N, R, Y
her H, ER
(use "hear" program)
here H, R, R, T, S
hertz H, EH1, EH3, K, PAO, S
hex H, AH1, EH3, Y
high H, I1, I3, Z
his H, O2, O2, L, L, D
hold H, O1, U1, L
hole H, O1, U1, M
home H, OO1, OO1, K
hook H, O1, U1, S, T
host H, AH1, UH3, T
hot H, O1, U1, T, EH2, EH2, L
hotel AH1, UH3, W, ER
hour H, UH3, AH2, U1, S
house H, AH1, O2, U1
how H, Y1, IU, U1, U1, M, EH2, N
human H, UH1, UH2, N, D, R, I3, D
hundred H, UH1, UH2, NG, G, R, Y
hungry

I AH1, EH3, I3, Y
idle AH1, Y, D, UH3, L
idol (use "idle" program)
if I1, I3, F
immediate I1, I3, M, E1, D, Y, EH3, T
important I1, I3, M, P, O2, O2, R, T, EH3, N, T
improper I1, I3, M, P, R, AH1, UH3, P, ER
improve I1, I3, M, P, R, IU, U1, U1, V
in I1, I3, N
inch I1, I3, N, T, CH
include I1, I3, N, K, L, IU, U1, U1, D
income I1, I3, N, K, UH1, UH3, M
independent I1, N, D, E1, P, EH2, EH3, N, D, EH3, N, T
index I1, I3, N, D, EH1, EH3, K, PAO, S
india I2, I3, N, D, Y, UH2
indicate I1, N, D, I3, K, A1, Y, T
industrial I1, I3, N, D, UH1, UH2, S, T, R, AY, UH3, L
inform I1, I3, N, F, O2, O2, R, M
initial I1, I3, N, I1, SH, UH2, I

input I1, I3, N, P, OO1, OO1, T
 inquire I1, I3, N, K, W, AH1, EH3, AY, R
 insert I1, N, S, R, R, T
 inspect I1, I3, N, S, P, EH1, EH3, K, T
 install I1, I3, N, S, T, AW, L
 instead I1, I3, N, S, T, EH1, EH3, D
 instruct I1, I3, N, S, T, R, UH1, UH2, K, T
 instrument I1, I3, N, S, T, R, UH1, M, EH1, EH3, N, T

 insufficient I1, N, S, UH2, F, I1, SH, EH3, N, T

 insurance I1, I3, N, SH, ER, R, EH3, N, T, S
 interest I1, N, T, R, EH1, S, T
 interface I1, I3, N, T, ER, F, A1, AY, Y, S
 interpret I1, I3, N, T, ER, P, R, EH3, T
 interrupt I1, N, T, ER, UH3, UH1, P, T
 intrude I1, I3, N, T, R, IU, U1, U1, D
 invalid I1, I3, N, V, AE1, AW2, L, I1, D
 invent I1, I3, N, V, EH1, EH3, N, T
 inventory I1, N, V, EH1, N, T, O1, R, Y
 invest I1, I3, N, V, EH1, EH3, S, T
 invoice I1, I3, N, V, O1, UH3, I3, AY, S
 irregular I1, R, EH1, G, Y1, UH3, L, ER
 is I1, I3, Z
 it I1, I3, T
 item AH2, UH3, Y, D, UH3, M

 J D, J, EH3, A1, AY, Y
 jack D, J, AE1, EH3, K
 january D, J, AE1, EH3, N, Y1, UI, EH3, EH3, ER, Y

 job D, J, AH1, UH3, B
 join D, J, O1, UH3, I3, AY, N
 jolt D, J, O2, O2, L, T
 joy D, J, O1, UH3, I3, AY
 judge D, J, UH1, UH2, D, J
 juliet D, J, IU, U1, L, Y, EH2, EH3, T
 july D, J, UH1, L, AH1, EH3, Y
 jump D, J, UH1, UH2, M, P
 june D, J, IU, U1, U1, N

K K, EH3, A1, AY, Y
 keep K, E1, Y, R

keyboard K, AY, Y, B, O1, O2, R, D
 kill K, I1, I3, L
 kilo K, E1, AY, L, UH3, O2, U1
 knew (use "new" program)
 knot (use "not" program)
 know (use "no" program)
 knowledge N, AH1, UH3, L, I3, D, J

L
 lab EH1, EH3, UH3, L
 labor L, AE1, EH3, B
 language L, A1, Y, B, ER
 L, AE1, EH3, NG, G, W, I1, D, J

lapse L, AE1, EH3, P, S
 large L, AH1, R, D, J
 last L, AE1, EH3, S, T
 late L, A1, AY, Y, T
 law L, AW
 lead L, E1, Y, D
 led L, EH1, EH3, D
 left L, EH1, EH3, F, T
 leg L, EH1, EH3, G
 legal L, E1, G, UH3, L
 lend L, EH1, EH3, N, D
 length L, EH1, EH3, NG, TH
 less L, EH1, EH3, S
 let L, EH1, EH3, T
 letter L, EH1, EH3, T, ER
 level L, EH1, EH3, V, UH3, L
 life L, UH3, AH2, Y, F
 light L, UH3, AH2, Y, T
 like L, UH3, AH2, Y, K
 lima L, AY, Y, M, UH1
 limit L, I1, M I1, T
 line L, AH1, EH3, Y, N
 linear L, I2, I3, N, AY, Y, ER
 link L, I1, I3, NG, K
 lip L, I1, I3, P
 liquid L, I1, K, W, I1, D
 list L, I1, I3, S, T
 listen L, I1, I3, S, I2, N
 little L, I1, I3, T, UH3, L
 load L, UH3, O1, U1, D

local L, 02, 02, K, UH3, L
 lock L, AH1, UH3, K
 log L, AW, G
 long L, AW, NG
 look L, 001, 001, K
 loss L, AW, S
 lost L, AW, S, T
 lot L, AH1, UH3, T
 low L, 01, U1

 M EH1, EH2, M
 machine M, UH2, SH, E1, Y, N
 mail (use "male" program)
 maintenance M, A1, Y, N, T, EH2, N, EH3, N, DT, S

 make M, A1, AY, Y, K
 male M, A2, A2, AY UH3, L
 man M, AE1, EH3, N
 manage M, AE1, EH3, N, I1, D, J
 manual M, AE1, EH3, N, Y1, U1, UH3, L
 manufacture M, AE1, EH3, N, Y1, U1, F, AE1, EH3, K, T, CH, ER

 many M, EH2, EH2, N, Y
 map M, AE1, EH3, P
 march M, AH1, R, T, CH
 margin M, AH1, UH3, R, D, J, I2, N
 mark M, AH1, R, K
 market M, AH1, R, K, EH3, T
 match M, AE1, EH3, T, CH
 mature M, UH1, T, CH, IU, ER
 maximum M, AE1, EH3, K, PAO, S, EH3, M, UH2, M

 may M, A1, I3, Y
 me M, E1, Y
 measure M, EH3, EH1, ZH, ER
 meat M, E1, AY, T
 mechanical M, UH1, K, AE1, EH3, N, I3, K, UH3, L

 media M, E1, AY, D, Y, UH1
 medicine M, EH2, EH3, D, I3, S, I1, N
 medium M, E1, D, AY, UH1, M
 meet (use "meat" program)

memory M, EH1, EH3, M, ER, Y
 men M, EH1, EH3, N
 merchandise M, ER, T, CH, EH3, N, D, AH1, EH3, Y, Z

 merge M, ER, R, D, J
 message M, EH1, EH3, S, I2, D, J
 metal M, EH1, EH3, T, UH3, L
 meter M, E1, Y, T, ER
 micro M, UH3, AH2, AY, K, R, 01, U1
 middle M, I1, I3, D, UH3, L
 mike M, UH3, AH2, Y, K
 mile M, AH1, EH3, I3, UH3, L
 mill M, I1, I3, L
 milli M, I1, I3, L, UH3
 million M, I1, I3, L, Y, UH3, N
 mini M, I2, I2, N, Y
 minus M, AH1, Y, N, EH3, S
 minute M, I1, N, EH3, T
 miscellaneous M, I1, S, UH3, L, A1, AY, N, Y, UH3, S

 miss M, I1, I3, S
 mistake M, I1, I3, S, T, A1, AY, Y, K
 mode M, 01, U1, D
 model M, AH1, UH3, D, UH3, L
 module M, AH1, UH3, D, J, IU, U1, UH3, L

 monday M, UH3, UH1, N, D, A1, I3, Y
 money M, UH3, UH1, N, AY, Y
 month M, UH3, UH1, N, TH
 more M, 02, 02, R
 morning M, 02, 02, R, N, I1, I3, NG
 most M, 01, U1, S, T
 motor M, 01, U1, T, ER
 mount M, AH1, UH3, W, N, T
 move M, U1, U1, V
 Mr. M, I1, S, T, ER
 Mrs. M, I1, S, I2, Z
 Ms. M, I1, I3, Z
 much M, UH1, UH2, T, CH
 multi M, UH2, UH3, L, T, Y
 multiple M, UH1, L, T, EH3, P, UH3, L
 multiply M, UH1, L, T, I3, P, L, AH1, Y

N	EH1, EH2, N
name	N, A1, AY, Y, M
nano	N, AE1, EH3, N, O1, U1
national	N, AE1, EH3, SH, UH3, N, UH3, L
native	N, A1, Y, T, I1, V
near	N, AY, I1, R
neat	N, E1, AY, T
neck	N, EH1, EH3, K
need	N, E1, Y, D
negative	N, EH1, G, EH3, T, I1, V
net	N, EH1, EH3, T
neutral	N, IU, U1, T, R, UH2, L
new	N, IU, U1, U1
next	N, EH1, EH3, K, PAO, S, T
nice	N, UH3, AH2, Y, S
nickel	N, I1, I3, K, UH3, L
night	N, UH3, AH2, Y, T
nine	N, AH1, EH3, Y, N
ninety	N, AH1, EH3, Y, N, T, Y
nineth	N, AH1, Y, N, DT, TH
no	N, O01, O1, U1
noise	N, O1, UH3, I3, AY, Z
none	N, UH1, UH3, N
noon	N, IU, U1, U1, N
normal	N, O2, O2, R, M, UH3, L
north	N, O2, O2, R, TH
not	N, AH1, UH3, T
note	N, O1, U1, T
nothing	N, UH1, TH, I1, I3, NG
notice	N, O1, U1, T, I1, S
notify	N, O1, U1, T, I1, F, AH1, EH3, Y
november	N, O1, U1, V, EH1, EH3, M, B, ER
now	N, AH1, UH3, U1
number	N, UH1, UH2, M, B, ER
nurse	N, ER, R, S
nut	N, UH1, UH2, T
O	O2, O1, U1
oar	(use "or" program)
object	UH1, B, D, J, EH1, EH3, K, T

obligation	AH1, B, L, I3, G, A1, Y, SH, UH3, N
obsolete	AH1, UH3, B, S, UH3, L, AY, Y, T
october	AH1, UH3, K, T, O1, U1, B, ER
odd	AH1, UH3, D
of	UH1, UH3, V
off	AW, F
office	AW, F, I1, S
official	UH1, F, I1, SH, UH3, L
often	AW2, AW2, F, I3, N
ohm	O2, O2, U1, M
oil	O1, EH3, I3, UH3, L
old	O2, O2, L, L, D
omega	O1, U1, M, A1, Y, G, UH2
omit	O1, U1, M, I1, I3, T
on	AH1, UH3, N
once	W, UH1, N, T, S
one	W, UH1, UH2, N
only	O1, O2, N, L, Y
open	O1, P, I2, N
operable	AH1, UH3, P, ER, UH3, B, UH3, L
operate	AH1, UH3, P, ER, A1, Y, T
operator	AH1, UH3, P, ER, A1, Y, T, ER
option	AH1, UH3, P, SH, UH3, N
or	O2, O2, R
orange	O2, O2, R, I1, N, D, J
order	O2, O2, R, D, ER
ore	(use "or" program)
original	O2, R, I2, I3, D, J, I3, N, UH3, L
oscar	AH1, UH3, S, K, ER
other	UH1, UH3, THV, ER
ounce	AH1, UH3, W, N, S
out	UH3, AH2, U1, T
oven	UH1, V, I2, N
over	O1, O2, V, ER
oxygen	AH1, UH3, K, PAO, S, I3, D, J, I2, N
own	O1, U1, N
P	P, E1, Y
pack	P, AE1, EH3, K
package	P, AE1, EH3, K, I1, D, J

pain P, A1, AY, Y, N
(use "pain" program)
pane P, AE1, EH3, N, UH3, L
panel P, AH1, UH3, P, UH3, UH3
papa P, A1, Y, P, ER
paper P, AH1, R, S, UH3, L
parcel P, EH3, EH3, ER, I2, N
paren P, AH1, R, T
part P, AH1, R, SH, UH2, L
partial P, AE1, EH3, S
pass (use "past" program)
passed P, AE1, EH3, S, T
past P, AE1, EH3, T
pat P, AE1, EH3, T, ER, N
pattern P, AW, Z
pause P, A2, A2, AY, Y
pay (use "P" program)
pea (use "piece" program)
peace P, E1, AY, K
peak (use "peak" program)
peek P, ER, S, EH1, EH3, N, T
percent P, I1, R, Y, UH2, D
period P, ER, M, EH2, N, EH1, N, T
permanent P, ER, S, UH1, N
person P, ER, S, UH3, N, UH2, L
personal P, ER, S, UH3, N, AE1, UH3,
personality L, I3, T, Y

phase F, A1, AY, Y, Z
phone F, O1, U1, N
pick P, I1, I3, K
pico P, E1, Y, K, O2, U1
piece P, E1, Y, S
pint P, AH1, Y, N, T
pipe P, UH3, AH2, Y, P
place P, L, A1, AY, Y, S
plain (use "plane" program)
plan P, L, AE1, EH3, N
plane P, L, A1, AY, Y, N
plant P, L, AE1, EH3, N, T
play P, L, A1, I3, Y
please P, L, E1, Y, Z
plot P, L, AH1, UH3, T

pocket P, AH1, UH3, K, EH3, T
point P, O1, UH3, I3, AY, N, T
poke P, O1, U1, K
police P, UH1, L, AY, Y, S
plain (use "plane" program)
plan P, L, AE1, EH3, N
plane P, L, A1, AY, Y, N
plant P, L, AE1, EH3, N, T
play P, L, A1, I3, Y
please P, L, E1, Y, Z
plot P, L, AH1, UH3, T
plus P, L, UH1, UH2, S
pocket P, AH1, UH3, K, EH3, T
point P, O1, UH3, I3, AY, N, T
poke P, O1, U1, K
police P, UH1, L, AY, Y, S
policy P, AH1, UH3, L, I3, S, Y
poor (use "pour" program)
pop P, AH1, UH3, P
port P, O2, O2, R, T
position P, UH1, Z, I1, SH, UH3, N
positive P, AH1, UH3, Z, I1, T, I1, V
possible P, AH1, UH3, S, UH3, B, UH2, L
post P, O1, U1, S, T
potential P, O1, T, EH1, EH3, N, T, CH,
UH3, L

pound P, AH1, UH3, W, N, D
pour P, O1, O2, R
power P, AH1, UH3, W, ER
practice P, R, AE1, EH3, K, T, I1, S
premium P, R, AY, Y, M, Y, UH1, M
prepare P, R, E1, P, EH1, EH3, R
press P, R, EH1, EH3, S
pressure P, R, EH1, SH, ER
prevent P, R, Y, V, EH1, EH3, N, T
previous P, R, Y, V, Y, UH1, S
price P, R, UH3, AH2, Y, S
principal (use "principle" program)
principle P, R, I1, N, DT, S, UH3, P,
UH3, L

print P, R, I1, I3, N, T
prior P, R, AH1, Y, ER
priority P, R, AH1, Y, O1, R, I3, DT, Y

private P, R, AH1, EH3, Y, V, I3, T
probe P, R, 01, U1, B
problem P, R, AH1, UH3, B, L, UH3, M
procedure P, R, UH1, S, E1, D, J, ER
proceed P, R, 01, S, E1, Y, D
process P, R, AH1, UH3, S, EH1, EH3, S
produce P, R, UH1, D, IU, U1, U1, S
product P, R, AH1, UH3, D, UH1, UH2,
K, T

progress P, R, AH1, UH3, G, R, EH1, S
profession P, R, UH1, F, EH1, EH3, SH,
UH3, N

profit P, R, AH1, UH3, F, I1, T
program P, R, 01, G, R, AE1, EH3, M
project P, R, AH1, UH3, D, J, EH2,
EH2, K, T

PROM P, R, AH1, UH3, M
promote P, R, UH1, M, 01, U1, T
propose P, R, UH1, P, 01, U1, Z
protect P, R, UH1, T, EH1, EH3, K, T
public P, UH1, UH3, B, L, I3, K
pull P, 001, 001, L
pulse P, UH1, UH2, L, S
punch P, UH1, UH2, N, T, CH
purpose P, R, R, P, EH2, S
purchase P, R, R, DT, CH, I2, S
pure P, Y1, IU, ER
push P, 001, IU, SH
put P, 001, 001, T

Q K, Y1, IU, U1, U1
qualify K, W, AW1, L, I1, F, AH1, EH3, Y
quantity K, W, AH1, N, T, I3, T, Y
quart K, W, 01, R, T
quarter K, W, 01, R, T, ER
quebec K, W, I1, B, EH1, EH3, K
question K, W, EH1, EH3, S, T, CH,
UH3, N

quick K, W, I1, I3, K
quiet K, W, AH1, EH3, AY, I2, T
quit K, W, I1, I3, T
quiz K, W, I1, I3, Z
quota K, W, 01, 02, T, UH1

R AH1, UH2, ER
rail R, A1, AY, I3, UH3, L
rain R, A1, AY, Y, N
raise R, A1, AY, Y, Z
range R, A1, AY, Y, N, D, J
radio R, A1, Y, D, Y, 01, U1
rate R, A1, AY, Y, T
ratio R, A1, Y, SH, Y, 01, U1
reach R, E1, Y, T, CH
read R, E1, Y, D
ready R, EH1, EH3, D, Y
real R, E1, AY, L
reason R, E1, Y, Z, UH1, N
rebate R, E1, B, A1, Y, T
recall R, E1, K, AW2, AW1, L
receipt R, E1, S, AY, Y, T
receive R, E1, S, E1, Y, V
record R, E1, K, 02, 02, R, D
record-2 R, EH1, EH3, K, ER, D
red R, EH1, EH3, D
reel (use "real" program)
refer R, E1, F, UH1, UH2, N, D
refuse R, E1, F, Y1, IU, U1 U1, Z
register R, EH1, D, J, I1, S, T, ER
regular R, EH1, G, Y1, IU, L, ER
rein (use "rain" program)
reject R, E1, D, J, EH1, EH3, K, T
relay R, E1, L, A1, I3, Y
release R, E1, L, E1, AY, S
remain R, E1, M, A1, AY, Y, N
remove R, E1, M, U1, U1, V
repair R, E1, P, EH2, EH2, R
repeat R, E1, P, E1, AY, T
replace R, E1, P, L, A1, AY, Y, S
report R, E1, P, 02, 02, R, T
represent R, EH1, P, R, I2, Z, EH1, EH3,
N, T
request R, E1, K, W, EH1, EH3, S, T
require R, E1, K, W, AH1, EH3, AY, R
requisition R, EH1, K, W, I2, Z, I1, SH,
UH3, N
rescue R, EH1, EH3, S, K, Y1, IU, U1

resemble R, E1, Z, EH1, EH3, M, B,
 UH3, L
 reset R, E1, S, EH1, EH3, T
 resistor R, E1, Z, I1, S, T, ER
 respect R, E1, S, P, EH1, EH3, K, T
 respond R, E1, S, P, AH1, UH3, N, D
 responsible R, I2, S, P, AH1, UH3, N, DT,
 S, UH3, B, UH3, L
 rest R, EH1, EH3, S, T
 restrict R, E1, S, T, R, I1, I3, K, T
 result R, E1, Z, UH1, UH2, L, T
 resume R, E1, Z, IU, U1, U1, M
 retail R, AY, E1, T, EH3, A1, I3,
 UH3, L
 retain R, E1, T, A1, AY, Y, N
 return R, E1, T, ER, R, N
 revision R, E1, V, I1, ZH, UH3, N
 revolve R, E1, V, AH1, UH3, L, V
 ribbon R, I2, I3, B, UH3, N
 right R, UH3, AH2, Y, T
 romeo R, O1, U1, M, Y, O1, U1
 room R, U1, U1, M
 root R, U1, U1, T
 round R, AH1, UH3, W, N, D
 route R, UH2, AH2, U1, T
 row R, O1, U1
 run R, UH1, UH3, N
 rush R, UH1, UH2, SH

S EH1, EH2, S
 safe S, A1, AY, Y, F
 sail (use "sale" program)
 salary S, AE1, AH2, L, UH3, R, Y
 sale S, A1, A2, AY, UH3, L
 same S, A1, AY, Y, M
 saturday S, AE1, EH3, T, ER, D, A1, Y
 save S, A1, AY, Y, V
 say S, A1, I3, Y
 scan S, K, AE1, EH3, N
 scent (use "cent" program)
 schedule S, K, EH1, EH3, D, J, IU, U1, L
 school S, K, U1, U1, L

scrap S, K, R, AE1, EH3, P
 screw S, K, R, IU, U1, U1
 sea (use "C" program)
 seat S, E1, AY, T
 second S, EH1, EH3, K, UH1, N, D
 secret S, E1, K, R, I3, T
 section S, EH1, EH3, K, SH, UH3, N
 security S, EH1, EH3, K, Y, ER, I1, T, Y
 see (use "C" program)
 seize S, E1, Y, Z
 select S, UH1, L, EH1, EH2, K, T
 sell S, EH1, EH3, L
 semi S, EH1, M, AH1, Y
 semicolon S, EH1, M, AH1, Y, K, OO1,
 O1, L, I2, N
 send S, EH1, EH3, N, D
 sent (use "cent" program)
 sentence S, EH1, N, T, I2, N, DT, S
 separate S, EH1, EH3, P, UH1, R, A1,
 AY, T
 separate-2 S, EH1, EH3, P, R, I2, T
 september S, EH1, EH3, P, T, EH1, EH3,
 M, B, ER
 sequence S, E1, K, W, EH1, EH3, N, S
 serial S, I1, R, Y, UH3, L
 series S, I1, R, Y, Z
 service S, ER, V, I1, S
 set S, EH1, EH3, T
 seven S, EH1, EH3, V, I2, N
 seventh S, EH1, EH3, V, I2, N, DT, TH
 seventy S, EH1, V, I2, N, D, Y
 several S, EH1, V, ER, UH3, L
 sew (use "so" program)
 share SH, EH3, EH3, ER
 sharp SH, AH1, R, P
 shift SH, I1, I3, F, T
 ship SH, I1, I3, P
 shop SH, AH1, UH3, P
 short SH, O2, O2, R, T
 should SH, IU, IU, IU, D
 shunt SH, UH1, UH2, N, T
 shut SH, UH1, UH2, T
 side S, AH1, EH3, Y, D

signal
silver
single
six
sixth
sixty
size
skin
sky
slang
slash
slave
slip
slow
small
smell
smile
smoke
snow
so
soft
sold
solid
son
some
sorry
sort
sound
source
south
space
spark
speak
special
speed
speech
spell
spend
split
spoon
spring
square

S, I1, I3, G, N, UH3, L
S, I1, I3, L, V, ER
S, I1, I3, NG, G, UH3, L
S, I1, I3, K, PAO, S
S, I1, I3, K, PAO, S, TH
S, I1, I3, K, PAO, T, Y
S, AH1, EH3, Y, Z
S, K, I1, I3, N
S, K, AH1, EH3, I3, Y
S, L, AE1, EH3, NG
S, L, AE1, EH3, SH
S, L, A1, AY, Y, V
S, L, I1, I3, P
S, L, O1, U1
S, M, AW, L
S, M, EH1, EH3, L
S, M, AH1, EH3, I3, UH3, L
S, M, O1, U1, K
S, N, OO1, O2, U1
S, OO1, O2, U1
S, AW, F, T
S, O2, O2, L, L, D
S, AH1, UH3, L, I1, D
(use "sun" program)
(use "sum" program)
S, AW, R, Y
S, O2, O2, R, T
S, AH1, UH3, W, N, D
S, O1, O2, R, S
S, AH1, UH3, U1, TH
S, P, A1, AY, Y, S
S, P, AH1, R, K
S, P, E1, AY, K
S, P, EH1, EH3, SH, UH3, L
S, P, E1, Y, D
S, P, E1, Y, T, CH
S, P, EH1, EH3, L
S, P, EH1, EH3, N, D
S, P, L, I1, I3, T
S, P, U1, U1, N
S, P, R, I1, I3, NG
S, K, W, EH1, R

stand
standard
star
stare
start
state
station
status
steal
steel
step
stick
stock
stop
store
strait
straight
street
stress
string
structure
style
subject

substitute

subtract

sufficient
suggest

suit
suite
sum
summary
summer
sun
sunday
super
supply
surface
surge
surgery

S, T, AE1, EH3, N, D
S, T, AE1, EH3, N, D, ER, D
S, T, AH1, UH3, R
S, T, EH3, EH3, ER
S, T, AH1, R, T
S, T, A1, AY, Y, T
S, T, A1, Y, SH, UH3, N
S, T, AE1, EH3, T, I2, S
(use "steel" program)
S, T, E1, Y, L
S, T, EH1, EH3, P
S, T, I1, I3, K
S, T, AH1, UH3, K
S, T, AH1, UH3, P
S, T, O2, O2, R
(use "straight" program)
S, T, R, A1, AY, Y, T
S, T, R, E1, Y, T
S, T, R, EH1, EH3, S
S, T, R, I1, I3, NG
S, T, R, UH1, K, T, CH, ER
S, T, AH1, EH3, AY, UH3, L
S, UH1, UH2, B, D, J, EH1,
EH3, K, T
S, UH1, UH3, B, S, T, I3, T, IU,
U1, T
S, UH1, UH2, B, T, R, AE1,
EH3, K, T
S, UH1, F, I1, SH, EH3, N, T
S, UH1, UH2, G, D, J, EH1,
EH3, S, T
S, IU, U1, T
S, W, AY, Y, T
S, UH1, UH2, M
S, UH2, UH2, M, ER, Y
S, UH1, UH2, M, ER
S, UH1, UH2, N
S, UH1, UH2, N, D, A1, I3, Y
S, IU, U1, P, ER
S, UH2, P, L, AH1, Y
S, ER, F, I2, S
S, ER, R, D, J
S, ER, D, J, ER, Y

surgical S, ER, D, J, UH3, K, UH3, L
surplus S, ER, P, L, UH1, S
suspend S, UH1, S, P, EH1, EH3, N, D
sweep S, W, E1, Y, P
sweet (use "suite" program)
switch S, W, I1, I3, T, CH
syntax S, I1, N, T, AE1, EH3, K, PAO, S
system S, I1, S, T, UH3, M

T T, E1, AY, Y
table T, A1, Y, B, UH3, L
tail (use "tale" program)
tale T, A1, Y, UH3, L
talk T, AW, K
tangent T, AE1, EH3, N, D, J, EH3, N, T
target T, AH1, UH3, R, G, I2, T
tea (use "T" program)
team T, E1, Y, M
technical T, EH1, EH3, K, N, I3, K, UH3, L
tee (use "T" program)
temperature T, EH1, EH3, M, P, ER, UH1, T, CH, ER

ten T, EH1, EH3, N
terminal T, ER, M, EH3, N, UH2, L
test T, EH1, EH3, S, T
than THV, EH1, EH3, N
the THV, UH1, UH3
then (use "than" program)
theory TH, AY, I2, R, Y
thin TH, I1, I3, N
thing TH, I1, I3, NG
think TH, I1, I3, NG, K
third TH, ER, R, D
thirteen TH, ER, T, T, E1, Y, N
thirty TH, ER, R, D, Y
thousand TH, AH1, UH3, U1, Z, EH3, N, D
three TH, R, E1, Y
threw (use "through" program)
through TH, R, IU, U1
thursday TH, ER, R, Z, D, A1, I3, Y
ticket T, I1, I3, K, EH3, T
till T, I1, I3, L
" T, AH1, EH3, Y, M

tire T, AH1, EH3, AY, R
title T, UH3, AH2, Y, T, UH3, L
to (use "two" program)
today T, U1, D, A1, I3, Y
toilet T, O1, EH3, I3, L, I3, T
toll T, O2, O2, OO1, L
tomorrow T, U1, M, AH1, R, O1, U1
ton T, UH1, UH2, N, N
tone T, O1, U1, N
too (use "two" program)
tool T, U1, U1, L
total T, O1, U1, T, UH3, L
touch T, UH1, UH3, T, CH
towel T, AH1, W, UH3, L
trace T, R, A1, AY, Y, S
trade T, R, A1, AY, Y, D
train T, R, A1, AY, Y, N
transact T, R, AE1, EH3, N, S, AE1, EH3, K, T

transfer T, R, AE1, EH3, N, S, F, ER
transistor T, R, AE1, N, Z, I1, S, T, ER
transmit T, R, AE1, EH3, N, Z, M, I1, I3, T
transport T, R, AE1, EH3, N, S, P, O2, O2, R, T

transportation T, R, AE1, N, S, P, ER, T, A1, AY, SH, UH3, N

travel T, R, AE1, EH3, V, UH3, L
triangle T, R, AH1, I3, AE1, EH3, NG, G, UH3, L

trouble T, R, UH3, UH1, B, UH3, L
truck T, R, UH1, UH2, K
true T, R, IU, U1, U1
trust T, R, UH1, UH2, S, T
try T, R, AH1, EH3, I3, Y
tuesday T, IU, U1, U1, Z, D, A1, Y
tune T, IU, U1, U1, N
turn T, ER, R, N
twelve T, W, EH1, EH3, UH3, L, V
twenty T, W, EH1, EH3, N, T, Y
two T, IU, U1, U1
type T, UH3, AH2, Y, P

U
ultra UH3, UH2, L, T, R, UH1
under UH2, UH2, N, D, ER
uniform Y1, IU, U1, N, I3, F, O1, R, M
until UH2, UH2, N, T, I1, I3, L
up UH1, UH2, P
urgent R, R, D, J, I3, N, T
us UH1, UH2, S
use Y1, IU, U1, U1, Z
use-2 Y1, IU, U1, S

V
vacant V, E1, AY, Y
valid V, A1, Y, K, EH3, N, T
vary V, AE1, UH3, L, I1, D
(use "very" program)
value V, AE1, EH3, L, Y1, IU, U1
vendor V, EH1, EH3, N, D, ER
vent V, EH1, EH3, N, T
verify V, EH1, R, I3, F, AH1, EH3, Y
very V, EH1, R, Y
via V, E1, AY, UH2, UH3
victor V, I1, I3, K, T, ER
voice V, O1, UH3, I3, AY, S
void V, O1, UH3, I3, AY, D
volt V, O2, O2, L, T
volume V, AH1, UH3, L, Y1, IU, U1, M

W
wage D, UH1, B, UH3, L, Y1, IU, U1
wait W, A1, AY, Y, D, J
want W, A1, AY, Y, T
was W, AH1, UH3, N, T
wash W, UH1, UH3, Z
water W, AW, SH
water W, AH1, UH3, T, ER
watt W, AH1, UH3, T
wave W, A1, AY, Y, V
way (use "weigh" program)
we W, E1, Y
weak (use "week" program)
weapon W, EH2, EH2, P, UH1, N
wear (use "where" program)
wednesday W, EH1, N, Z, D, A1, I3, Y

weigh W, A2, A2, Y
weight (use "wait" program)
went W, EH1, EH3, N, T
west W, EH1, EH3, S, T
wet W, EH1, EH3, T
what W, UH3, UH1, T
wheel W, E1, Y, L
when W, EH1, EH3, N
where W, EH3, A2, EH3, R
which W, I1, I3, T, CH
while W, AH1, EH3, I1, UH3, L
whiskey W, I1, I3, S, K, AY, Y
white W, UH3, AH2, Y, T
who H, IU, U1, U1
whole (use "hole" program)
why (use "Y" program)
will W, I1, I3, L
window W, I1, N, D, O1, U1
winter W, I1, I3, N, T, ER
wire W, AH1, EH3, AY, R
with W, I1, I3, TH
withdraw W, I1, I3, TH, D, R, AW
without W, I1, I3, TH, UH2, AH2, U1, T
won (use "one" program)
word W, ER, R, D
work W, ER, R, K
write (use "right" program)
wrong R, AW, NG

X
x-ray EH1, EH2, K, PAO, S
EH1, EH2, K, PAO, S, R, A1,
I3, Y

Y
yankee W, AH1, EH3, I3, Y
yard Y1, AE1, EH3, NG, K, E1, Y
year Y1, AH1, R, D
year Y1, AY, I3, R
yellow Y1, EH1, EH3, L, O1, U1
yes Y1, EH3, EH1, S
yesterday Y1, EH3, EH1, S, T, ER, D, A1,
I3, Y

vet Y1, EH1, EH3, T

you	(use "U" program)
your	Y, O2, O2, R
you're	(use "your" program)

Z	Z, E1, Y
zap	Z, AE1, EH3, P
zero	Z, AY, I1, R, O1, U1
zone	Z, O1, U1, N
zulu	Z, IU, U1, L, IU, U1

Prefixes

con...	K, UH1, N
dis...	D, I1, S
en...	EH1, N
in...	I1, N
non...	N, AH1, UH3, N
pre...	P, R, E1
re...	R, E1
un...	UH1, N

Suffixes

...d	D
...ed	I2, D
...er	ER
...es	I2, Z
...ful	F, UH3, L
...ing	I2, NG
...less	L, EH2, S
...ly	L, Y
...ment	M, EH3, N, T
...ness	N, EH3, S
...s	S
...t (...ed)	T
...tion (...sion)	SH, UH3, N
...teen	T, E1, Y, N
...ward	W, ER, D
...y	Y
...z (...es)	Z





Personal Speech System

User Manual

VOTRAX®
PERSONAL SPEECH SYSTEM
Operator's Manual

The information contained herein has been carefully checked and is believed to be correct in all respects. Votrax, however, assumes no responsibility for inaccuracies or omissions. Furthermore, such information pertaining to the product described does not convey any license or rights to the purchaser under the copyright and patent rights of Votrax.

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Votrax reserves the right to change specifications at any time without notice.

Because its applications are virtually unlimited, it is impossible to foresee all the uses to which the Votrax Personal Speech System may be put. The user should carefully follow and double-check the instructions in this Manual and double-check any system or application using the Votrax Personal Speech System. Dangerous uses must be avoided.

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INTRODUCTION

A new generation of speech peripherals is emerging. The VOTRAX PERSONAL SPEECH (PS) SYSTEM, with its advanced text-to-speech processor, is the most articulate voice output unit of its kind on the market today.

Easy to operate, the Votrax PS System receives data directly from the users' software program. It performs its own translation and production functions, freeing the host computer for other operations. Standard features of the Votrax PS System include a built-in speaker, serial and parallel interfaces, and 3500 character buffer. Designed to accommodate the more advanced computer user, the PS System has a long list of user controlled features such as programmable speech rate, amplitude, and inflection. The master clock provides 255 programmable frequencies for unmatched control over speech and sound effects. The PS System also has a programmable "exception table," verbal error prompting, X-ON/X-OFF, RTS handshaking, and expandable ROM. With an SCO1 phoneme synthesizer chip on board, the PS System can be interfaced to any computer, modem, or RS-232 compatible or parallel device to produce speech.

The variety of applications in which a PS System might function are limited only by the creativity of the user. Now, virtually any computer can talk. This manual will describe in detail the functions and operations of the PS System. The user may then define a final configuration for implementing the Votrax Personal Speech System.

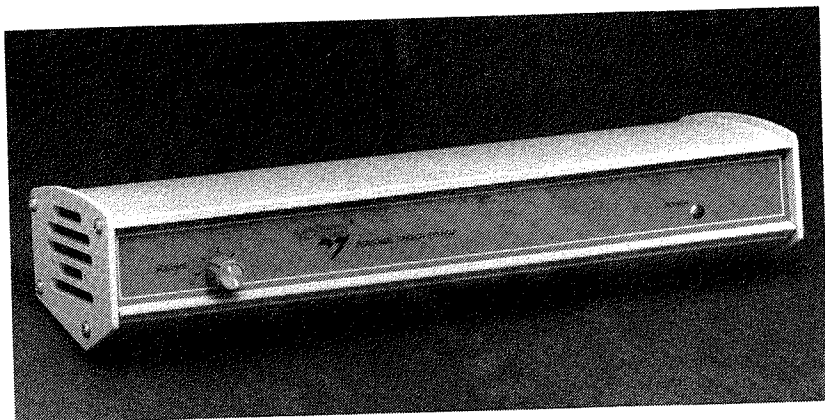
PHYSICAL DESCRIPTION

The Votrax Personal Speech (PS) System is packaged in a small, light weight case. Dimensionally, the Votrax PS System requires no more than 12.25" x 5.2" x 3.1" of space. It weighs approximately 2.6 lbs.

The Votrax PS System has one control knob for VOLUME located on the left front panel (See Figure 1). A POWER-ON Indicator (LED) is located on the right front panel. The unit is in the ON position when the LED is lit. All other operational switches, jacks, and connector ports are located on the back panel of the unit (SEE Figure 2). The ON/OFF push button switch is in the farthest left position on the back panel. The POWER jack, located to the right of the ON/OFF switch, will accept only a 5-pronged DIN connector, differentiating it from all other jacks. The PARALLEL PORT is located just left of center on the back panel and the RS-232C SERIAL PORT is just right of center. To the right of the serial port are the CONFIGURATION SETUP SWITCHES and the EXTERNAL SPEAKER jack.

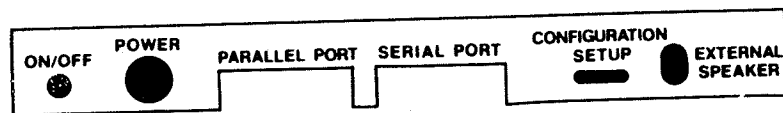
Figure 1 and Figure 2

Votrax PS System FRONT VIEW and BACK PANEL



Votrax Personal Speech System

Figure 2



Votrax Personal Speech System - Back Panel

INSTALLATION

CONNECTIONS

POWER

A special Votrax PS System power connector is provided which attaches directly to the unit. The power connector receptacle is located on the back panel. Note that the power receptacle will only accept the 5-pronged DIN connector provided. Any 110 volt AC outlet is appropriate for the transformer end of the connector.

EXTERNAL SPEAKER

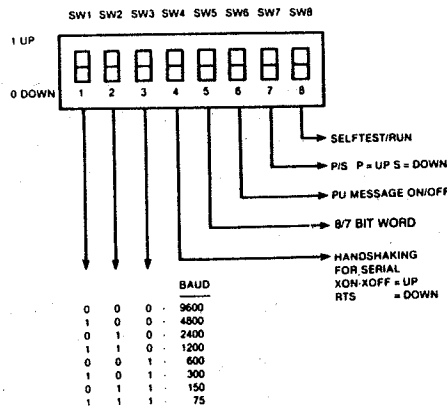
The Votrax PS System has an internal speaker for audio output. However, users may desire an external speaker of their own choosing. The external speaker jack is located on the back panel of the Votrax PS System. Any 8 ohm speaker equipped with a mini phone plug (1/8") may be attached to the unit via this jack. Once an external speaker is connected, the internal speaker is disabled.

RS-232C (SERIAL) INTERFACE

The Votrax PS System may use an RS-232C interface for receiving ASCII data from the host computer. A special cable is required for this purpose which may be purchased by the user or constructed according to the Configuration in APPENDIX G.

The Configuration Setup Switches on the back panel of the device must be set properly to ensure proper connection. Figure 3 below defines the switch functions in each position.

Figure 3



CONFIGURATION SETUP SWITCHES

SWITCH	POSITION	FUNCTION
1 to 3	_____	BAUD) selection as shown above
4	UP	XON/XOFF communication protocol utilized by serial port
	DOWN	RTS communication protocol utilized by serial port
5	UP	8 bit word
	DOWN	7 bit word + parity) Parity ignored. Down = Factory Preset Position
6	UP	MESSAGE ON) power-up message spoken
	DOWN	MESSAGE OFF) power-up message NOT spoken
7	UP	PARALLEL) parallel port used as the primary input port
	DOWN	SERIAL) serial port used as the primary input port
8	UP	SELF-TEST) continuously performs diagnostic tests — NO ACCESS to PS System in this mode
	DOWN	RUN) normal operating condition

Handshaking in some form is required to prevent memory overflow. Serial handshaking may be either XON/XOFF or RTS protocol.

XON/XOFF protocol (software): Whenever the input buffer comes within 30 bytes of being full, the XOFF character is output via the Serial port to inform the user of the space limitation. It is the user's responsibility to monitor the input stream for this character. Once received, the user should immediately cease transmitting to the PS System and refrain from doing so until the PS System transmits the XON character. The XON character will be output via the Serial port once the available space within the input buffer returns to a minimum of 50 bytes.

RTS protocol (hardware): RTS handshaking protocol functions in the same manner as the XON/XOFF protocol, but in hardware. The PS System de-asserts (lowers) the RTS line (pin 4 on the Serial connector) to signal that the buffer is nearly full instead of sending an XOFF character. Similarly, it asserts (raises) the RTS line when space is available instead of sending an XON character.

PARALLEL (Interface)

The Votrax PS System comes standard with a parallel interface. Like the Serial Interface, a special cable is required to connect the unit to the host. It may be purchased or it may be constructed following the diagram in APPENDIX G.

Only one mode of handshaking is available on the Parallel interface. When the BUSY line (Pin 14 on the Parallel connector) is asserted (high) the user may not transmit to the PS System via the Parallel interface. Once this line has been de-asserted (lowered) the user may resume transmission.

INSTALLATION PROCEDURES

Once the user has decided which interface to employ, the Votrax PS System may be installed. To interface the Votrax PS System to a computer, modem, or other P/S compatible device, attach the appropriate connector cable to the SERIAL or PARALLEL PORT on the back panel of the unit. This cable is then connected to the user's computer and/or to any additional equipment being used. Set the Configuration Setup Switches on the back of the Votrax PS System to the appropriate positions (See Figure 3).

Connect the power transformer's DIN connector to the back of the Votrax PS System, then plug the other end into a 110 volt AC outlet. Push the ON/OFF button to the ON position. The unit will say "SYSTEM READY" when the power switch is pushed to the ON position ONLY if the Power-Up message switch (SW6) is to the ON (up) position.

Self Test: In order to make a quick check of your PS System, first turn the power to the OFF position. Place the SELFTTEST/RUN Switch (SW8) to the self test position. Turn the power ON. You will hear a series of test phrases exercising various features of the unit. This will continuously cycle until the SW8 is in the run position at the end of a cycle. If the self test fails to occur within a few seconds of power up first check your power supply for proper connection. If this fails contact Votrax for details on repair information.

TEXT-TO SPEECH OVERVIEW

The Votrax Personal Speech System contains a Text-To-Speech processor. Its function is to translate standard English text (orthography) into the phonetic code required by the synthesizer in a manner appropriate for the articulate pronunciation of the text. Its purpose is to:

1. save time;
2. conserve memory; and
3. make speech output very easy to achieve.

With the Text-to-Speech processor, the need for extensive phonetic skills is eliminated from the programming task. Vocabulary is developed simply by typing the text to be spoken into your program without concern for the phonetic components. The speech chip may then be signalled to generate the sounds selected by the translator.

The processor uses pronunciation rules to facilitate text translation. With this memory efficient approach, the processor is able to make all basic phonetic decisions about constructing the words in the text. It is not limited to a prescribed number of words as a dictionary-type look up table approach would be. Thus, an unlimited vocabulary is possible. Although the translator provides the user with a more familiar medium (English text) in which to work, it is not equipped to assist with the semantic or syntactic design of the vocabulary.

The phonetic code used by the translator is very straightforward (see APPENDIX B) but the rules are not. With some self training, however, users may become proficient enough with phonetic programming so as to supplement the translator's capabilities. Text for translation may be mixed with phonetic programming to create special language effects.

OPERATION — BASIC PROCEDURES

Once the Votrax PS System has been installed, users are ready to MAKE THEIR PROGRAM TALK.

The Votrax PS System powers up ready to accept Standard English text as data for translation. To perform any other functions, the PS System must be instructed to change from its standard translation operation. This section describes the procedures to follow for entering data for translation as well as entering data to perform other functions. The information is presented according to the types of data that may be entered.

TYPES OF DATA

SPEECH DATA

TEXT
PHONETIC

NON-SPEECH DATA

NON-SPEECH FEATURE CONTROLS
MUSIC/SOUND EFFECTS
PROGRAMMABLE CLOCK
ALARMS

SPEECH FEATURE CONTROLS
INFLECTION CONTROL
RATE CONTROL
AMPLITUDE CONTROL

MAKE YOUR PROGRAM TALK, SUMMARY OF CONTROLS and data entry procedures follow. A QUICK REFERENCE CARD, summarizing command syntax, is enclosed with this manual.

MAKING YOUR PROGRAM TALK

Users must be familiar with the programming language of their computer to select the appropriate output statement to access the Votrax PS System. For example, if the language is BASIC, the output statement will more than likely be some form of a PRINT command such as PRINT #2. Incorporated into this output statement would be a literal or variable statement that represents a string of ASCII characters (see Appendix I).

OUTPUT STATEMENT = OUTPUT COMMAND + ASCII String
(for PS System)

Example: PRINT #2: "I CAN TALK"
PRINT #2: "HELLO ";NAME\$

The ASCII string will be interpreted by the PS System as speech, sound and other feature commands or controls (see SUMMARY OF CONTROLS). ASCII strings which represent speech or sound will not run until a RUN (CR) code is received by the Votrax PS System in the examples above.

SUMMARY OF CONTROLS

SPEECH FEATURE

CONTROL CHARACTER — @ (Attention)

CONTROLLED FEATURES — @R rate
 @ (0-7) inflection
 @a A amplitude
 @c C conversion mode
 @v V voice mode

NON-SPEECH FEATURE

CONTROL CHARACTER — ! (Exclamation Point)

CONTROLLED FEATURES — !(1,2,3,) musical tone channel
 !A alarm set
 !B baud set
 !E envelope set
 !F filter set
 !L load
 !N noise set
 !P prompt
 !T tempo set
 !W wait

ATTENTION FEATURE

CONTROL CHARACTER — [ESC] (ESCAPE CODE)

CONTROLLED FEATURES — [ESC]C connect I/O
 [ESC]M mode set
 [ESC]P powerup
 [ESC]Q quit
 [ESC]R reserve memory
 [ESC]S special characters
 [ESC]T time set
 [ESC]V speak version

Additional parameters following each control are required. Instructions for using controls are detailed on the following pages.

SPEECH DATA

Definition: Data which represents a spoken word

Types: TEXT — Standard English text
 (alphabet characters Aa to Zz, number characters 0 to 9 plus other printable ASCII characters).

PHONETIC — ASCII characters representing phonemes
 (see APPENDIX B — PHONEME CONVERSION CHART for useable characters)

Entry: Refer to the TEXT and PHONETIC sections on the following pages for data entry procedures.

NOTE 1: Most other printable ASCII characters are treated as punctuation with the following spoken as indicated:

"number"
 \$ "dollars"
 % "percent"
 & "and"
 * "star"
 + "plus"
 / "slash"
 < "less than"
 > "greater than"

NOTE 2: The exclamation mark (!) is a control character. You may wish to review "SPECIAL CHARACTER REDEFINE."

NOTE 3: The Personal Speech System will only recognize printable ASCII characters.

TEXT

Purpose: generate speech from English spelling

Format: "(text)" (in BASIC)

Key: "... " = literal statement in BASIC
(text) = standard English

Procedure: Using Standard English, enter text to be spoken directly into the program. Use the appropriate output statement according to the language of your computer (see MAKING YOUR PROGRAM TALK on preceding page).

Examples: One-line, hypothetical BASIC programs

```
100 PRINT#-2, "Hello, my name is Votrax."

200 A$="That is correct.":PRINT#-2,A$

300 IF I$="blue"THEN PRINT#-2,I$;"is correct"ELSE
    PRINT#-2,"The color ";I$; "is wrong. Try again"
```

Example: Software Program with Speech Output

```
100 RESTORE
110 FOR X = 1to3: READQ$,A$
120 PRINT Q$ : PRINT#-2,Q$
130 INPUT R$ : IF R$(A$) THEN PRINT#-2,R$; "is wrong. Try
    again . . .": GOTO 120
140 PRINT "****CORRECT****"
150 PRINT#-2,R$;"is correct."
160 NEXT X : STOP
200 REM -----DATA TABLE-----
210 DATA "How many bits are in a byte?", "8"
220 DATA "How many bytes are in a K of memory?,""1024"
230 DATA "RAM stands for?","Random access memory"
```

Remarks: These examples would have the Votrax PS System connected to a serial or parallel port that is accessed by the command PRINT#-2.

NOTE: Do not terminate text with an exclamation point (!) unless it has been redefined.

PHONETIC

Purpose: generate speech from phoneme sequences

Format: ~ (insert ASCII equivalents of phonemes)?

Key: ~ = tilde character starts phoneme block
ASCII = characters representing phonemes from
APPENDIX B
? = question mark ends phoneme block

Procedure: Enter the tilde character "~" into the program to start a phoneme block. Next enter the ASCII characters that represent the phonemes for the word(s) being constructed (see APPENDIX B — PHONETIC CONVERSION CHART). Enter a "?" (question mark) to terminate the string.

Examples: ASCII Sequences producing words

```
~05*+/@Y_? (says "Votrax")
~_%(*P? (says "Speech")
```

Example: Combination entry — TEXT and PHONETIC

```
"This train will stop in Chicago and
~`IL5@)M? today." (says "Des Moines")
```

Remarks: A phoneme block may be created anywhere in the literal or variable statement that may or may not already contain other text. The block allows users to bypass the translator and access the speech synthesizer directly. Further discussion regarding phonetics and phonetic spelling may be found in the PHONETIC PROGRAMMING Section.

NOTE: If the tilde character "~" does not exist on the host computer, define another character in software to perform this function (See Special Characters).

NON-SPEECH DATA

Definition: Data which controls system features

Types: NON-SPEECH FEATURE CONTROLS —

MUSIC
SOUND EFFECTS
PROGRAMMABLE CLOCK
ALARMS

SPEECH FEATURE CONTROLS —

INFLECTION
RATE
AMPLITUDE

Entry: Refer to specific data type sections for entry procedures, which include controls and their usage.

NOTE: The OPERATION — ADVANCED PROCEDURES section discusses other types of non-speech data not listed here.

MUSIC

Purpose: generate musical tones

Format: !cnd.

Key: ! = non-speech control character
c = channel (1, 2, or 3)
nn = note (01 to 96, 00 = rest)
d = duration (0 to F)
. = sequence terminator

Procedure: Enter the control character "!" followed by the number of the Musical Tone Channel (1, 2, or 3). Next, enter the number representing the note (00 — 96 with 00 = rest). Refer to APPENDIX C — MUSICAL NOTES CHART for the list of notes and the numbers that represent them. Set the duration of the note by entering a hex number 0 (short) to F (long). Refer to Duration Code Chart below for values. Note that each duration code is associated with a number of tempo units (see Tempo section for procedures on assigning a length of time to a tempo unit). Enter a colon ":" between the data for two musical notes. Terminate the completed musical sequence with a "." (period). Enter a space before the next "!" is entered.

Example: for musical note A#2, channel 2

!2230.

Example: for musical sequence A#2 C3 G2, channel 1

!T08:1234:125:129:125:130.

Remarks: The second note is not executed until the first note is complete. Unspecified parameters assume the last value set. In the example above, duration 4 set on first note applies for subsequent notes until a new setting is specified. A musical note may be expanded further to include level selections for glide and hold conditions (see OPERATION — ADVANCED PROCEDURES).

DURATION CODE CHART

Duration Code	Tempo Units	Duration Code	Tempo Units	Duration Code	Tempo Units
0	1	5	6	A	11
1	2	6	7	B	12
2	3	7	8	C	13
3	4	8	9	D	14
4	5	9	10	E	15
				F	16

PROGRAMMABLE CLOCK

Purpose: set time

Format: [ESC]Thhmmss.

Key: [ESC] = attention control character
 T = time control character
 hh = hour
 mm = minutes
 ss = seconds
 . = sequence terminator

Procedure: Enter the characters [ESC]T and the current time in hours, minutes and seconds (time based on a 24 hour format). Terminate the sequence with a "." (period). [ESC] denotes the Escape code, NOT brackets and the letters E, S, and C.

Example: for PM, 8 hours, 25 minutes, 50 seconds

[ESC]T202550.

Remarks: Once the time data is entered, it is executed immediately. Time is set on a 24 hour format: e.g. 15:00 = 3 PM. Enter [ESC]T. for enunciation of the current time in AM/PM format: e.g. "The time is 3 PM.". Whenever time is accessed, system will revert to default positions.

NOTE 1: Time must be entered as a 6-digit number
 e.g.: 8:00 AM = 080000

NOTE 2: Automatic Time Annunciator chimes every 15 minutes with or without voice (see MODE SET).

NOTE 3: The Programmable Clock is software controlled and can not be externally accessed by the user.

ALARMS

Purpose: set alarm

Format: !A#hhmmText.

Key: ! = non-Speech Control character
 A = alarm control character
 # = alarm number (0 to 7)
 hh = hour
 mm = minutes
 Text = vocabulary to be spoken at time
 the alarm sounds (optional)
 . = sequence terminator

Procedure: Enter the sequence "!A" and the number of the alarm to be set. Choose one of eight available alarms (0 to 7). Next, enter the time in hours and minutes (based on a 24 hour format) that the alarm should sound. If a message is to be spoken at the time the alarm sounds, enter the text immediately following the time. The amount of text in the message is limited only by the available memory. Terminate the sequence with a "." (period). A space must precede the next "!" entered.

Example: for alarm 1, AM, 7 hours, 30 minutes

!A10730 Wake up, sleepy head.
 (says "The time is 7:30 AM. Wake up, sleepy head.")

Remarks: Users may set 1 or more of the 8 available alarms. To cancel all alarms, enter "!AC." To turn an alarm OFF, set it to the time 2500: e.g. !A12500. (cancels alarm 1).

NOTE 1: An alarm's time must be entered as a 4-digit number.
 e.g 8:30 AM. = 0830
 12:00 PM. = 1200
 12:00 AM. = 0000

NOTE 2: Once an alarm is set its contents can not be checked by the user.

INFLECTION

Purpose: set inflection level of speech data

Format: @i

Key: @ = speech control character
i = number of inflection (0-7)

Procedure: Enter the "@" character followed by a number 0 to 7. The number represents a level of inflection (pitch) from low (0 or 4) to high (3 or 7) which will be assigned to the speech data that follows it.

Examples: @3 Hello. @2 How are @3 you, @1 today.

Remarks: An inflection assignment precedes a word of text or a phoneme string and may be changed at any time according to the needs of the programmer. Assigned inflection will continue until reset. A "space" must precede the inflection control character. Inflection levels 0 to 3 reach their pitch targets at a slow rate while the targets for levels 4 to 7 are reached instantly.

INFLECTION LEVEL CHART

	Slow Movement	Instant Movement
Low	0	4
	1	5
	2	6
High	3	7

RATE

Purpose: assign rate level to speech data

Format: @Rr

Key: @ = speech control character
R = rate control character
r = number of rate level (0-F)

Procedure: Enter "@R" followed by the number of the rate level to be assigned to the speech data that follows it. Choose from level 1 (fastest) to F (slowest). Level 0 follows F and is the slowest. Assigned rate will continue until reset.

Example: @R4 Hello @R3 How are @R4 you?

Remarks: Like inflection, a rate assignment must precede the text or phoneme data it is to affect. Normal rate is around 4.

NOTE 1: Rates 1 and 2 are too fast to be used in normal speech, but may be used in special effects where the filter is set to the top of its range.

NOTE 2: When powered up, or clock is accessed, rate is reset to 4.

RATE CHART

1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	0
FAST										SLOW					

*See Note 2.

AMPLITUDE

Purpose: set loudness of speech data
set fade rate of loudness

Format: @Aar

Key: @ = speech control character
A = amplitude control character
a = number of amplitude level (0-F)
r = number of rate of amp fade (0 to F)

Procedure: Enter "@A" followed by the amplitude level to be assigned the speech data that follows. Choose a level from 0 (softest) to F (loudest). The rate of amplitude fade is set next by entering a number 0 (instantly) to F (slow).

Example: @AF0 @A07 Bye Bye Bye Bye Bye @AF1

Remarks: The first amplitude string at rate 0 instantaneously sets the amplitude to the designated level. The second string sets the amplitude fade at rate 7. The final amplitude string resets the volume for subsequent messages. The above example demonstrates a loud onset with speech fading to nothing. Amplitude is like inflection and rate. Assignments must precede the text or phonetic string they will affect and need only be used if the user wishes.

NOTE 1: Using the combinations of @AF8 to @AFF will lower the output to an inaudible level.

COMBINING CONTROLS

Many times the message you want to produce will require multiple controls to be called out back-to-back. Use the following formats for combining controls.

SPEECH CONTROLS

Speech controls may occur back-to-back with no special considerations. Remember that Speech controls must be completely specified.

eg. "@R4@AF0@3 THIS IS A SPEECH @2 DEMONSTRATION."

(Rate 4, Amplitude F & Amp fade 0, Inflection 3, THIS IS A SPEECH, Inflection 2, DEMONSTRATION)

NON-SPEECH CONTROL

Non-speech controls need not be fully specified and hence must be terminated. When more than one non-speech control occurs in a row, use a colon ":" to separate commands as follows:

eg. !T08:F80:E1088F0:1 12 4 1:1 24:1 36:1 48 6:1 60.

(Tempo 08, Filter 80, Envelope #1 0 8 8 F 0

Notes: B1 4 units, B2 4 units, B3 6 units, B4 6 units.)

NOTE 1: Unspecified parameters assume the last value.

NOTE 2: Spaces between parameter values are optional.

NOTE 3: IMMEDIATE Commands may NOT be combined.

NOTE 4: A space must precede the first @ of a sequence.

VOCABULARY PROGRAMMING

To enter text for translation by the PS System, refer to the OPERATIONS — BASIC PROCEDURES Section for procedures. The discussion in this section will be restricted to vocabulary programming: i.e. choosing a specific spelling of a word for entry as text to assure that the pronunciation output is the desired one.

Because every application of a Votrax PS System unit is different, users must create a specific set of vocabulary to accommodate their individual voice output needs. The text-to-speech processor will translate conversational English with approximately 95% accuracy. A small number of words, however, may not be produced with the pronunciation anticipated. If this occurs, the user may easily correct the pronunciation by following one of several procedures: adjust the spelling of the word, separate the word into smaller component parts, or phonetically spell the word (create a new sound sequence). The first two adjustment techniques are explained below. Phonetic Spelling is handled in the PHONETIC PROGRAMMING section immediately following.

ADJUSTED SPELLINGS

The first and simplest procedure for changing the pronunciation of a word is to adjust its spelling. Replace the letter(s) responsible for the pronunciation problem with another letter(s) that will elicit the desired pronunciation. Use English spelling rules/information to assist in selecting the letter substitutes. The first step is to determine what sounds the translator selects when presented with alphabet characters in varied environments. Tables 1, 2, 3, 4, and 5 in APPENDIX A may be used as a guide.

CONSONANTS

In most cases, the alphabet characters representing the consonants are translated into the appropriate consonant sounds. Users, however, need to be auditorially aware of occasions when the same alphabet character is used to represent two or more different sounds. The word "certificate", for example, has the letter "c" repeated twice. The first occurrence translates into the /S/ sound. The second occurrence should be translated into a /K/ sound. Because the pronunciation of the second occurrence is in error, adjust the spelling to correct for the translation. The adjustment might look like this:

e.g. certificate >> certifikit

Table 2 in APPENDIX A lists the consonants with more than one pronunciation. Most consonant inaccuracies may be adjusted with appropriate substitutions.

VOWELS

Spelling adjustments to change vowel pronunciations require more effort than those adjustments used for the consonants. This is because there are only 5 alphabet characters (not including "y") designated for representing the 18+ vowel sounds in American English. The language accommodates this situation by using different combinations of vowel (and consonant) alphabet characters to represent the vowel sounds. Our discussion of vowels will be made easier if we use a familiar vowel classification system to separate the vowel sounds into groups: long vowel sounds, short vowel sounds and diphthongs (2 vowel sounds spoken in rapid sequence but thought of as a single unit). Some long vowels overlap with diphthongs but the user need only be concerned with the letter sequences required to elicit the desired sound.

LONG VOWELS: The alphabet characters used to represent the vowels are: a, e, i, o, u. These characters, when written or spoken in isolation, are the pronunciation guides for the long vowel sounds. When these characters are found in English words, they will only produce long vowel sounds if they appear in a specific sequence of characters. Single syllable words often clearly exhibit long vowel patterns:

made	read	time	hole	rule
rain	seep	cry	boat	noon

Words with more than one syllable may not display the pattern but may require the sound. Using a double "e" sequence, for example, will usually elicit a long "e" sound:

e.g. placebo >> placeebo

Look to Table 3 in APPENDIX A for the letter patterns which most often elicit long vowel sounds.

SHORT VOWELS: To create a short vowel sound, users may have to manipulate the consonants that follow the vowel. For single syllable words with short vowel sounds, the Votrax PS System has a high degree of pronunciation accuracy. The words "tap", "red", "sit", "rob", and "saw" are produced correctly. To maintain the short vowel sounds when adding more syllables to these words, users already know from spelling rules to double the consonant before adding ".er", ".ing", or ".ed": "tapper", "sitting", "robbed", etc. The Votrax PS System also knows to do this. Without a double consonant following the vowel, the sound is automatically assumed a long vowel: "taper", "siting", "robed", etc. This same doubling principle can be used to adjust a word with more than one syllable. For example, the word "reconcile" is translated by the PS System with a long "e" vowel sound in the first syllable. By doubling the consonant that follows the "e", the letter will be translated into a short vowel sound:

e.g. reconcile)) reconcile

Refer to Table 5 in APPENDIX A for the letter sequences that may be used to elicit short vowel sounds. Note that several of the letter combinations listed are not usually found in English but can be used to direct the PS System toward a specific translation.

DIPHTHONGS: There are 6 vowel sounds in the diphthong group, referred to as such because they require 2 sounds to complete their pronunciation. They, however, are spoken in such rapid sequence that they are considered as a single unit. A sample of each diphthong used in a word would be: say, wide, coat, now, boy, and music. Note that 3 diphthongs are referred to as Long Vowels (see discussion above). The other 3, characteristically, may be created by sequencing 2 vowel letters: e.g. "oy" or "oi" or "ou" for diphthongs in "royal" or "poignant" or "cloud". Table 4 in APPENDIX A lists other letter sequences that may create diphthong sounds.

The user will quickly begin to learn many of the letter/sound sequences that may be useful for establishing desirable pronunciations. A list of words that present some adjustment problems may be found in Table 1 in APPENDIX A. Each word is listed along with its adjusted version. Other patterns for adjusting spellings may exist but are not listed. The user is not limited to only the adjustments listed. There may be more than one letter sequence that produces the sound sequence desired. The user is encouraged to experiment.

SEPARATING WORDS

Another technique used to change pronunciations is to separate words into 2 or more smaller segments. This procedure is used effectively for words with a structure like "timepiece" where the segments form words: e.g. "time piece." Examples of other words that may be adjusted with this technique are:

"Nonplus" — "non plus"
 "makeshift" — "make shift"
 "mishap" — "miss happ"

Spelling adjustment techniques have combined use. To change the word "scorpion," for example, separate it into two segments at an appropriate boundary: "scor pion." Adjust the spelling of the second segment to achieve the vowel pronunciation: "scor peeon."

As an experiment, enter the words listed in the left column below and listen to how they are pronounced by the PS System.

"forehand. fore hand"
 "interchangeable . . . interchange ible"
 "sociology sowsheyology"
 "budget budjet"
 "horseshoe horse shoe"
 "defamation. deaf amation"
 "reimburse. reeh imburse"
 "message messige"

Now enter the adjusted version listed in the right-hand column. Listen! Note how the pronunciation inaccuracies of the first set are changed in the second. Continue to follow this procedure for other words requiring adjustment.

PHONETIC PROGRAMMING

There are some instances where the pronunciations of words cannot be corrected utilizing the adjustment techniques described in the VOCABULARY PROGRAMMING Section. This situation may occur with vocabulary such as Proper Names or English words based in a foreign language. Users may wish to create their own phonetic versions of a word, accessing the phoneme synthesizer directly.

Refer to OPERATION — BASIC PROCEDURES for information on entering Phonetic Data. The information about Phonemes, Phonetic Symbols, and Phonetic Spelling, required before data may be entered, is presented in this section.

PHONEMES and PHONETIC SYMBOLS

There are a minimum of 45 phonemes, or speech sounds, used to create the pronunciations of words in American English. Every phoneme (speech sound) is represented by a symbol known as a Phonetic Symbol or Character. The set of symbols is referred to as a Phonetic Alphabet or System. Its purpose is to enable you to WRITE precisely the sound sequence (pronunciation) of a word. Writing words phonetically is often called Phonetic Spelling or Transcription.

There are hundreds of Phonetic Alphabets, each developed to accommodate a different language need. The Votrax PS Systems utilizes the symbols in the Votrax Phonetic Alphabet, designed for compatibility with the Votrax Phoneme Synthesizer.

There are 64 alphanumeric symbols in the Votrax System, each representing one of the 45 different sounds or one of their sound variations (allophones). The symbol /E/, for example, represents the long "e" vowel. The symbols /EH/ and /EH3/ both represent the short "e" vowel, with /EH3/ representing the shortest duration allophone of the /EH/ phoneme. Refer to APPENDIX B — PHONETIC CONVERSION CHART for a complete listing of the Votrax Phonetic Alphabet. Example words that define the pronunciation of the phonemes are also listed.

Words may now be phonetically represented. Phonetic symbols are enclosed in slash marks to differentiate them from standard alphabet characters when both occur in a sentence. As an example, the phonetic spelling of "symbol" is /S I1 M B UH3 L/. This format will be used throughout this section. An SC01 Pocket Dictionary is available as a phonetic spelling reference.

Users may now put this Phoneme and Phonetic Symbol information to work for them. The Votrax PS System was designed to accept only a single symbol for the entry of a single piece of phonetic data. In order to accommodate this situation, every symbol in the Votrax Phonetic Alphabet is equated with an ASCII character. When entering phonetic data, use only the ASCII character that represents the phoneme:

"symbol" = /S, I1, M, B, UH3, L/ = _KLNcX

The PHONETIC CONVERSION CHART in APPENDIX B includes the ASCII characters that represent the phonemes.

PHONETIC SPELLING

To create a word phonetically, first identify the number of sounds contained in the word by pronouncing it out loud very slowly. The word "ant", for example, has 3 sounds in it while the words "called" and "phones" have 4 sounds each. Secondly, determine the types of sounds in a word (consonant sound, long vowel sound, diphthong, etc.). In the example "ant," there is short vowel sound "a" and 2 consonants "n" and "t." "Called" has a different short "a" vowel and 3 consonants "k," "l" and "d." "Phones" has the long vowel "o" and 3 consonants "f," "n" and "z." Note that not every letter in a word is counted as a sound; only those that are pronounced may be counted. There will always be a minimum of 1 sound, a vowel, in every English word.

The next step in the phonetic spelling process is to match each of the identified sounds with the appropriate symbols from the Phoneme Conversion Chart (See APPENDIX B). The examples above would have the following phoneme sequences:

ant = /AE N T/
called = /K AW L D/
phones = /F O N Z/

Now match each phoneme symbol with its respective ASCII character.

ant = /AE N T/ >> .M*
called = /K AW L D/ >> Y=X
phones = /F O N Z/ >>]5MR

Once the ASCII characters have been identified, create a Phoneme Block in the literal or variable statement of the software program where text may or may not already be entered (see OPERATION — BASIC PROCEDURES, Phonetic Section, for entry format). Enter the selected ASCII characters into the Phoneme Block. When all characters have been inserted, type a "?" to end the Block. Following the procedure outlined above, phonetically program the name "Robert":

1. say the name "Robert"
2. # of vowel sound = 2 ("o" and "er")
3. # of consonant sounds = 3 ("r," "b," & "t")
4. match the sounds in 2. & 3, with characters in Conversion Chart (APPENDIX B)
5. phonetic characters = /R, AH, B, ER, T/
6. ASCII characters = +, \$, N, :, *
7. create Phoneme block (type "~")
8. enter ASCII character sequence (type +\$N:*)
9. end Phoneme Block (type "?")
10. "Robert" spoken when the phoneme block is output to the PS System

The same procedure may be used to create any word in the English language. The most familiar pronunciations are names. A good exercise for practicing phonetic spelling is to sequence the sounds necessary to pronounce one's own name, or other familiar names of people or places. Refer to APPENDIX B frequently to become familiar with the sounds available for programming and the characters that represent them. A Dictionary of words with Votrax Phonetic Spellings is included with this manual. The phonetic sequences presented in the dictionary are those used with the Votrax SC01 Phoneme Speech Synthesizer Chip present in the PS System. Convert the phonetic spellings into ASCII sequences before entering the word into the computer program.

Again, it should not be beyond the creativity of the user to substitute a word that is not acceptably pronounced with another word more suitable for the auditory environment. For assistance in determining what the phonetic spelling of a word might be, refer to any standard dictionary. Every word entry is phonetically represented. Each dictionary uses their own phonetic symbol system. Conversion charts for translating the dictionary symbols into sounds are usually located in the front section of the publications. The user must engage in a matching procedure to convert the dictionary's pronunciation suggestions into Votrax PS System symbology.

OPERATION — ADVANCED PROCEDURES

After reading the Basic Procedures section of this manual, the advanced user may wish to explore some of the more sophisticated features of the Personal Speech System. It is recommended that the THEORY OF OPERATION section be read for a more complete understanding of how this PS System functions.

DEFERRED COMMANDS

With the exception of the Programmable Clock, all of the commands explained so far are classified as deferred execution commands. They are executed only after a RUN code (carriage return) has been received. Most commands can be concatenated using a ":" separator. These are called command sequences. Command sequences are executed from left to right until a terminator is found or a requested resource is busy. In the latter case the command sequence is suspended until the resource is available. An example of this is the note sequence "!124:136:148:160:". Since all of the notes are on the same channel, each must wait for the preceding one to finish before it starts.

Only one command sequence is executed at a time. However, speech and one command sequence will be executed at the same time according to the rules below.

1. A command sequence following speech will wait for the speech to finish.
2. Speech following a command sequence will run simultaneously.
3. A command sequence following a command sequence will wait for the first to complete.

CONVERSION MODE

Purpose: Select text conversion options.

Format: @Cm

Key: @ = speech control character
 C = conversion mode indicator
 m = sum of mode numbers below
 0 = basic translation
 1 = exceptions on
 2 = single numbers

Procedure: Precede text to be affected with the desired conversion option.

TEXT Example: @C1 PARALLEL LINES NEVER TOUCH.

In this example @C1 instructs the text translator to check the user defined exception table for alternate pronunciations of words. In the above example the word "PARALLEL", which is mispronounced by the PSS, can be redefined in an exception table. SEE EXCEPTION TABLE USAGE.

NUMBER Example: @C2 I LIVE AT 12477 OAK STREET.
 @C0 MEET ME AT 11 A M PLEASE.

The first number is pronounced "one two four seven seven" due to the @C2 selection. The second number is pronounced "eleven". Conversion mode 2 is only used when numbers are not punctuated. Numbers which have a comma separating every three digits are considered punctuated. For example, the number 12,477 is pronounced accurately in mode 0 whereas 12477 is not.

MODES 1 AND 2 CAN BE COMBINED BY SELECTING MODE 3.

VOICE MODE

Purpose: Turn the VOCHORD mode ON/OFF.

Format: @Vm

Key: @ = speech control character
 V = voice mode indicator
 m = number of mode
 0 = standard SC01 (default)
 2 = VOCHORD Mode (tones off)
 4 = VOCHORD Mode (tones on)

Example: !12400A0. @V2 INTRUDER ALERT. !100. @V0

In this example channel 1 is used to feed note 24 (B2) to the SC01 speech synthesizer. Notice that a fixed amplitude (A) has been selected. Amplitude envelopes may alternatively be used. The "@V2" selects the VOCHORD mode for the message "INTRUDER ALERT". Channel 1 is placed in the REST state after speech completion. The "@V0" returns to the normal SC01 voice mode. SEE VOCHORD USAGE.

In mode 2 the audio tones pass only through the SC01. In mode 4 tones are also allowed to go to the audio amplifier at the same time. SEE THEORY OF OPERATION.

Remarks: The VOCHORD mode is intended for use in sound effects due to the variety of interesting textures that can be produced. The VOCHORD mode is not recommended for use in long speech sequences.

BAUD SET

Purpose: Change the baud selection under program control.

Format: !Bbh

Key: ! = non-speech control character
 B = baud set indicator
 b = baud select (0-7)
 h = handshake select (0,1)
 . = sequence terminator

Procedure: Enter "!" followed by the number representing the baud.
 Choose from numbers 0 to 7 according to the list below:

7 = 75 bps	3 = 1200 bps
6 = 150 bps	2 = 2400 bps
5 = 300 bps	1 = 4800 bps
4 = 600 bps	0 = 9600 bps

Next select the type of handshaking by entering the number 0 (RTS) or 1 (X-ON/X-OFF).

Example: !B20.

to select 2400 Baud and RTS handshaking.

ENVELOPE SET

Purpose: Set an amplitude envelope shape.

Format: !Ecadsw.

Key: ! = non-speech control character
 E = envelope set indicator
 c = channel (1,2,3)
 a = attack rate (0-F)
 d = decay rate (0-F)
 s = sustain level (0-F)
 r = release rate (0-F)
 w = attack wait (0-F Ticks)
 . = sequence terminator

Procedure: Enter "!" followed by the character that represents each of the 6 parameters that will make up the envelope shape.

Example: !E108840:E204840:E324880.

In the above example all 3 envelopes have been set to a different shape. This command by itself does not produce any sound. Only when a musical channel is used with the amplitude set to 0 will the envelopes have any effect.

There are 4 cycles in an envelope, ATTACK, DECAY, SUSTAIN, and RELEASE (ADSR). In the corresponding parameters shown above, ATTACK, DECAY, and RELEASE are rate settings. The SUSTAIN setting is a level. (SEE FIGURE 4.) Many interesting musical effects are created using envelopes. Different sounds can be created by merely changing the shape of the amplitude envelope. Experiment by changing one parameter at a time through all of its values until you understand how it affects sound in general.

Remarks: Each sound channel (1,2,3) has 16 possible amplitude levels. An envelope generator, once triggered, will go from amplitude 0 to F, full ON, in the selected attack time (see table below). Once hitting the peak it will start to decay toward amplitude 0 at the selected decay rate until hitting the sustain level. The sustain level is maintained until the note duration is complete or a hold release occurs. At this time the amplitude will go to 0 at the selected release rate.

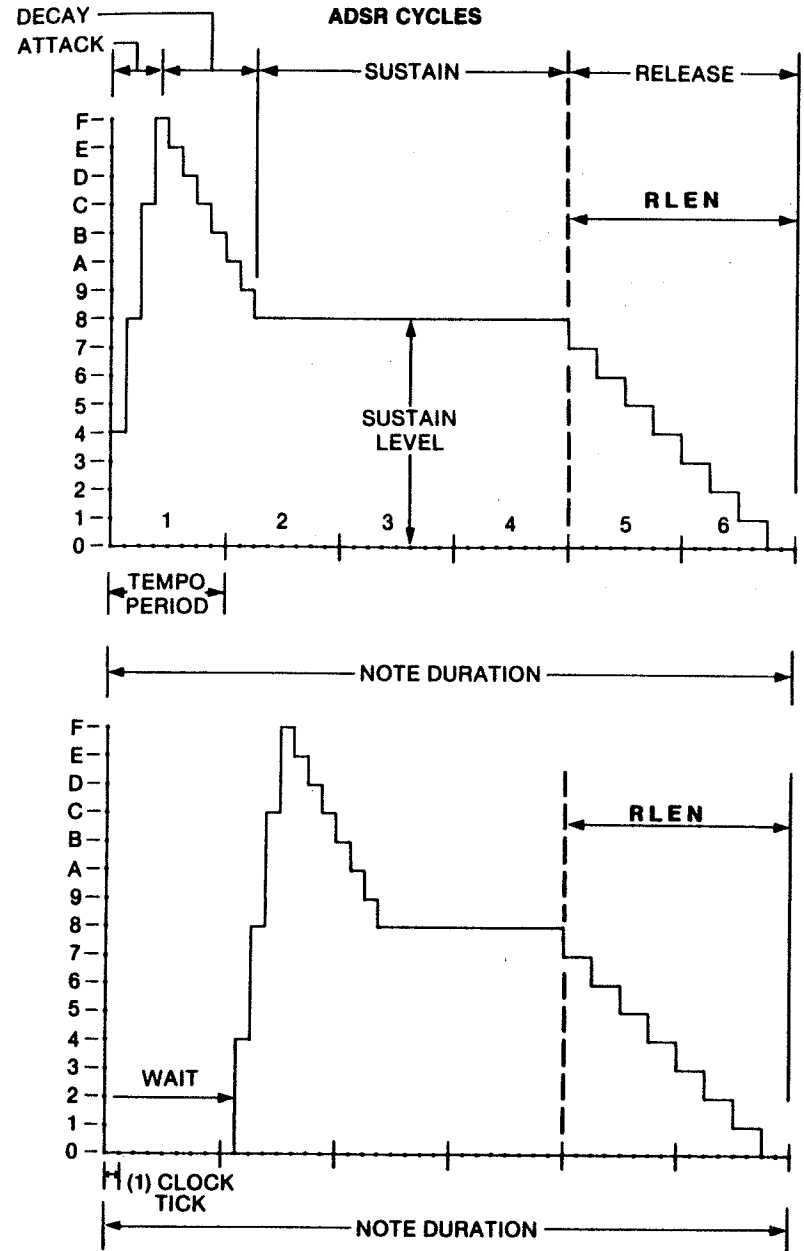
ENVELOPE TIMING CHART

VALUE	ATTACK	DECAY RELEASE	VALUE	ATTACK	DECAY RELEASE
0	0 ms	90 ms	8	319 ms	606 ms
1	24 ms	139 ms	9	401 ms	729 ms
2	57 ms	172 ms	A	483 ms	892 ms
3	90 ms	212 ms	B	606 ms	1138 ms
4	139 ms	262 ms	C	729 ms	1466 ms
5	172 ms	319 ms	D	892 ms	1875 ms
6	212 ms	401 ms	E	1138 ms	2285 ms
7	262 ms	483 ms	F	1466 ms	2940 ms

All times are stated in milliseconds and refer to the approximate time required to go from OFF (0) to full ON (F) or the reverse.

In the example shown in figure 4, the top envelope is set as "!E211840.". The lower envelope is identical except for the attack delay "!E211849.". The note triggering these envelopes would have the form !2xx520. This specifies a duration of 6 tempo units and the release begins 2 tempo units from the end.

Figure 4



FILTER SET

Purpose: Change the filter position for voice and sound effects.

Format: !Fbbvvr.

Key: ! = non-speech control character
 F = filter set indicator
 bb = base value (00-FF)
 vv = target value (00-FF)
 r = rate of movement (0=fast, F=slow)
 . = sequence terminator

Procedure: Precede text or sound sequences to be affected with a filter command. The base value can be used to adjust minor filter offset from unit to unit. The Target Value used in conjunction with the Rate of Movement setting can be used for voice and sound effects.

Example: !F20DF0. MY NAME IS ALVIN.

This example produces a very high resonance voice.

Remarks: In voice mode-0 speech will change in both pitch and resonance. When the VOCHORD mode is used, sound channels 1, 2 and 3 will be spectrally shaped by the SC01 speech synthesizer according to the filter setting and phoneme selection.

LOAD

Purpose: Load user exceptions

Formats: !LX Data.

Key: ! = non-speech control character
 L = load indicator
 X = user exception table
 Data = See Data Formats below
 . = sequence terminator

Procedure: Before loading exceptions memory space must be allocated by using the Reserve command (page 48).

Exception Data Format

The following conditions must be met when formatting the Exception Data:

1. Exceptions must be pre-sorted in alphabetical order.
2. An equal sign (=) must be used as a separator between the Exception and its Replacement.
3. Immediately after the equal sign, the type of Replacement must be specified ("T" for text, "P" for phoneme).
4. Each entry must be separated by a comma (,).

Example: !LX%1 = THELLO, %2 = TGOODBYE, DES MOINES = P'IL5(u)M.

Notice that the three entries are sorted (%1 < %2 < DES MOINES), that an equal sign (=) is used between each Exception and its Replacement, that each Replacement is identified as to type (the first two are text, the third is phoneme), and that each of the entries is separated by a comma (,).

Once an Exception Table is loaded and active, exceptions are treated as words. Consequently, they must be preceded and followed by spaces to distinguish them as such. The following examples utilize the Exception Table loaded above:

IN DES MOINES YESTERDAY The exception would be recognized.

IN DES MOINES, IOWA The exception would not be recognized.

If you wish to make additions to an existing Exception Table, the entire Exception Table (plus additions) must be reloaded.

The following method may be used to determine the number of bytes of memory to reserve for Exception table storage:

$$\# \text{ Bytes} = (\# \text{ of characters in the Data block}) - (\# \text{ of "=" signs in the Data block}) + 2$$

NOTE: 1 See the "Conversion Mode" command to enable an Exception Table for use (page 30).

NOTE: 2 See the "Exception Table Usage" section for further information (page 50).

NOISE SET

Purpose: Start noise for sound effects.

Format: !Ncvr.

Key: ! = non-speech control character
 N = noise set indicator
 c = channel (0=off,1,2,3)
 v = noise value (A,B,C,...,Z)
 r = rate of movement (0-F)
 . = sequence terminator

Procedure: Turn noise ON for a desired channel and use the amplitude controls of this channel to activate noise sound effects.

Example: !N2Z0 . BANG YOU'RE DEAD !E2048F0:297210 .

Remarks: This example uses an amplitude envelope from channel 2 to shape the noise. A special note selection is used for noise effects. Note 97 shuts off musical tones like a REST (00), but still allows an envelope to be triggered.

Noise is the basis of explosion type sound effects. Experiment with different envelope shapes to create many interesting sounds.

PROMPT

Purpose: Prompt user or host computer.

Formats: !P#. USER PROMPT
 !PS string. SERIAL COMPUTER PROMPT
 !PP string. PARALLEL COMPUTER PROMPT

Key: ! = non-speech control character
 P = prompt indicator
 # = number of audio prompt (0-8)
 S = serial output
 P = parallel output
 string = string to be sent via S or P
 . = sequence terminator

THIS MUST BE THE LAST COMMAND OF A SEQUENCE.

Procedure: Place a prompt command at the point in a sequence where it should occur.

User Prompt Example: !P6 . . . THAT ANSWER IS CORRECT

Remarks: The 9 audio prompts provide a programmer with some basic sounds for getting attention. Periods can be used before text to delay the voice until the prompt is complete.

AUDIO PROMPT NAMES

0 PING	5 INTERROGATIVE
1 ALARM	6 BLEEEP
2 BIG BEN	7 CHARGE!
3 ERROR	8 BANG
4 DING DONG	

Computer Prompt Example: SYSTEM READY !PSG01 .

After speaking the message "SYSTEM READY", the string "G01" is output via the serial port.

MUSIC

Format: !cnnhag. Complete Form

Key: ! = non-speech control character
 c = channel (1,2,3)
 nn = note (00-96)
 d = duration (0-F)
 r = RLEN (0-F)
 a = amplitude (0-F)
 g = glide (0=off, 1-F)
 . = sequence terminator

The short form of selecting a musical note was described earlier. The complete form shown above is an extension of the short form. The RLEN (Release Length) parameter defines how far from a note's end the release should begin. If envelopes are being used they will determine when the release will occur.

Amplitude envelopes give added appeal to music. Envelopes are selected by setting the amplitude to 0. Set your envelope shape with the Envelope Command.

The glide option is used to make notes glide in pitch from one to another. Specify a non-zero glide rate to enable this feature.

Once a parameter has been specified it is valid until it is redefined. Hence, it is not necessary to specify all parameters on every note if they don't change.

NOTE: Channel 1 is used for error prompting, clock chimes, and user prompts. Envelope shape and note parameters are changed when this happens. Use channel 2 or 3 when possible to avoid contention with channel 1.

TEMPO SET

Purpose: Set musical note tempo.

Format: !Tv.

Key: ! = non-speech control character
 T = tempo indicator
 v = tempo unit (01-FF)
 . = sequence terminator

Procedure: Set the tempo unit for the number of clock ticks (8.192 milliseconds) desired. For example tempo 08 = $8 \times 8.192 \text{ ms} = .065$ seconds per tempo unit.

Example: !T08:124:125:126:T20:124:125:126.

WAIT

Purpose: Wait for event to occur then continue.

Formats: !Wd. DELAY
!WSa. WAIT FOR SERIAL
!WPa. WAIT FOR PARALLEL

Key: ! = non-speech control character
W = wait indicator
d = number of seconds to wait (1-F)
S = serial select
P = parallel select
a = ASCII Character
. = sequence terminator

THIS MUST BE THE LAST COMMAND OF A SEQUENCE.

Procedure: Place the wait command at the point in a sequence where a delay should occur.

Example: INSERT YOUR DISK. !W8. NOW PUSH RETURN.

An 8 second delay is performed between the first and second messages.

Example: PUSH 7 WHEN READY. !WS7. THANK YOU.

After the first message is done all audio output is halted until the ASCII character "7" is received at the serial input port.

IMMEDIATE COMMANDS

Immediate commands begin with an [ESC] code and are terminated with a period. Upon being terminated, the selected command is immediately executed. The types of commands are explained below.

CONNECT INPUT TO

Purpose: Route the two inputs to an output device.

Format: [ESC]C SDev PDev.

Key: [ESC] = attention control character
C = connect indicator
SDev = device to connect Serial IN to.
PDev = device to connect Parallel IN to.
. = sequence terminator

THIS COMMAND MUST BE ISSUED VIA THE PRIMARY INPUT

Example: [ESC]C12.

In this example the serial input is fed into the Execution Buffer (EB) where it will be converted into audio output. The parallel input is redirected to the serial output buffer.

Remarks: You may redirect information flow from either input port to the four output devices below.

0 = OFF	OFFLINE
1 = EB	Execution Buffer
2 = SOUT	Serial OUTput buffer
4 = POUT	Parallel OUTput buffer

MODE SET

Purpose: Set miscellaneous mode parameters.

Format: [ESC]Mcdsp.

Key: [ESC] = attention control character
 M = mode set indicator
 c = clock chime (0-2)
 d = delay to auto run (0-F)
 s = serial output data length
 p = parallel output data length
 . = sequence terminator

CHIME MODE

- 0 Verbal time only upon request.
- 1 Chime every 1/4 hour.
- 2 Chime & verbal time every 1/4 hour.

DELAY TO AUTO RUN

The specified value, in seconds, is used for a count down timer. Whenever a character is received at the primary input port the counter is set to the specified value. If the count down reaches 0 before another character is received, all data in the EB will be processed. This mode is disabled when set to 0.

OUTPUT WORD LENGTH

- 0 8 Bits of data
- 1 7 Bits of data, 8th bit=0
- 2 7 Bits of data, 8th bit=1

POWER-UP

Purpose: Perform a power-up sequence.

Format: [ESC]P

Key: [ESC] = attention control character
 P = power-up/reset indicator
 . = sequence terminator

Example: [ESC]P.

Remarks: This command results in the same actions as if the power had been turned off and on again: i.e. RAM will be cleared and all variables initialized, power-up messages will be spoken. The purpose of this command is to quickly place the unit into a known state. (SEE APPENDIX L — POWER-UP SETTINGS.)

QUIT

Purpose: Terminate any speech and clear the EB.

Format: [ESC]Q.

Key: [ESC] = attention control character
 Q = quit & clear indicator
 . = sequence terminator

Remarks: This command will instantly stop speech and sound output. wait one second to accept any additional information still on the data lines, then clear the execution buffer.

RESERVE MEMORY

Purpose: Divide upper memory into sections for user needs.

Format: [ESC] = RØxps.

Key: [ESC] = attention control character
 R = reserve memory indicator
 Ø = default setting
 x = exception table size (O-F)
 p = parallel output buffer size (O-F)
 s = serial output buffer size (O-F)
 . = sequence terminator

This command allocates memory starting at the high end and works down. Memory is allocated in 256 byte blocks. The total number of reserved blocks cannot exceed 13 in the standard PSS unit.

Example: [ESC]RØ421.

Remarks: This example reserves 1024 bytes for an exception table, 512 bytes for a parallel output buffer, and 256 bytes for a serial output buffer.

SPECIAL CHARACTERS

Purpose: Redefine special character assignment.

Format: [ESC]Sacsprnf.

Key: [ESC] = attention control character
 S = redefine special characters
 a = attention character ([ESC])
 c = non-speech control character (!)
 s = speech control character (a)
 p = phoneme start character (~)
 r = run character ([CR])
 n = XON character ([DC1])
 f = XOFF character ([DC3])
 . = sequence terminator

Procedure: If some of the special character assignments at power-up are not to your liking, then you may redefine them. Select a unique ASCII character to replace each undesired one. Use this command to redefine characters.

Example: [ESC]S%&~[CR][DC1][DC3].

Remarks: This example redefines the special characters as follows.

%	attention	changed
~	non-speech control	changed
&	speech control	changed
~	phoneme start	same
[CR]	run	same
[DC1]	XON	same
[DC2]	XOFF	same

NOTE 1: The Personal Speech System will only recognize printable ASCII characters.

EXCEPTION TABLE USAGE

A powerful feature included in the PS System is the User Exception Table. This capability allows the user to define Text or Phoneme Strings as replacements for specified words. In this manner, the user can ensure that any words which the PS System might mispronounce (names, technical terms, etc.) will be automatically corrected. Alternatively, the user could define a unique set of symbols or alphabetic sequences for special-purpose pronunciations.

As an example, let us take the proper name "MCDANIEL". The PS System's Text-to-Speech algorithm is going to mispronounce this name. (For one thing, how do you literally pronounce "MC"?). One method of correcting this problem is to misspell the name thusly; "MIC DAHNYUL". This approach is acceptable for a single occurrence, but becomes unwieldy if the name is utilized frequently or if the system is going to be used by other individuals who are unaware that the name requires misspelling.

To avoid these problems, we can inform the PS System that the name "MCDANIEL" is an exception to the Text-to-Speech algorithm, and specify either a text or Phoneme string replacement. We will examine both approaches.

To specify the text string replacement, the Exception table is loaded as follows:

```
!LXMCDANIEL = TMIC DAHNYUL.
```

where the "T" immediately to the right of the "=" identifies the replacement as a text string.

The above command loads the Exception table, but does not enable it for use. To accomplish this, the following Conversion Mode command must be issued (see page 30 for a detailed explanation of this command):

```
@C1
```

From this point on, whenever the PS System recognizes the text string "MCDANIEL", it will substitute the text string "MIC DAHNYUL" before passing it to the Text-to-Speech algorithm for translation and speech.

To specify the Phoneme string replacement, we must first translate "MIC DAHNYUL" to a sequence of phonemes (see Appendix B) as follows:

```
M I2 K D AE N Y1 UH2 L
```

These phonemes are represented by the following ASCII string:

```
L J Y ^ n M b q X
```

The Exception table is then loaded by entering:

```
!LXMCDANIEL = PLJY^ nMbqX.
```

where the "P" immediately to the right of the "=" identifies the replacement as a Phoneme string.

Once again, the Exception Table must be enabled by issuing the Conversion Mode command:

```
@C1
```

From this point on, whenever the PS System recognizes the text string "MCDANIEL", it will totally bypass the Text-to-Speech algorithm and send the specified Phoneme string directly to the SC-01 Speech Synthesizer chip.

NOTE 1: Before loading exception table. Memory space must be allocated by using the Reserve command (page 48).

NOTE 2: Before using exception table please read "Load Command" rules on page 37-38.

A second application of the Exception Table is the utilization of pre-stored speech. This allows you to utilize "tokens" within your program to call out complete words or sentences from the PS System.

For example, let us assume that you wish to use four tokens to represent the four words "VOTRAX PERSONAL SPEECH SYSTEM". These four tokens could be "%1, %2, %3, %4". (These are relatively unique strings that shouldn't be encountered during normal operation, and they do not begin with any of the PS System's Special Characters.)

Let us further assume that "VOTRAX" and "SPEECH" will be phoneme replacements, while "PERSONAL" and "SYSTEM" will be text replacements.

The Exception Table would be loaded as follows:

```
!LX%1 = P05* + /@Y., %2 = TPERSONAL, %3 = P_% < *P, %4 = TSYSTEM.
```

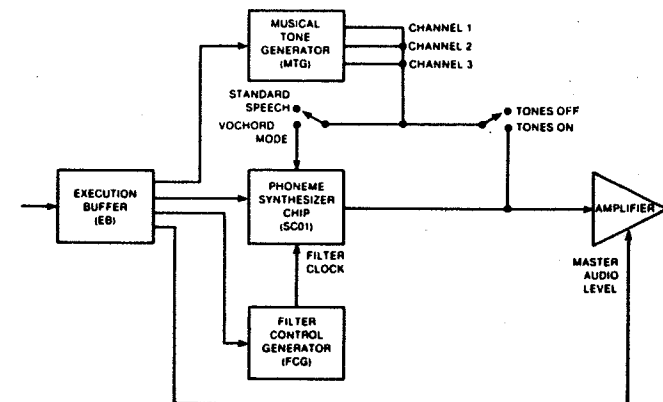
Note the use of commas (,) as separators between exceptions.

Once the Exception table is loaded and enabled, the PS System will utilize the appropriate replacement whenever it recognizes one of the specified tokens (%1, %2, %3, %4).

THEORY OF OPERATION

The Votrax Personal Speech System incorporates many of the elements found in a general purpose microcomputer. It is based on a Z-80 microprocessor, ROM, RAM, and has both parallel and serial I/O channels. In addition, the SC-01 phoneme synthesizer is included to perform voice functions. Unlike a general purpose computer, the PSS has a dedicated purpose. Most of its resources are dedicated to text-to-speech translation and sound functions. This frees a host computer from these time and resource consuming tasks.

Figure 5



PSS AUDIO CENTER DIAGRAM

AUDIO CENTER

As shown in Figure 5, there are four devices that affect audio output. They are the musical tone generator (MTG), the SC-01 phoneme synthesizer, a filter control generator, and an amplifier. These devices are controlled via the data and commands stored in the execution buffer. Only the SC-01 and the MTG are sources of audio frequencies. The SC-01 is fed directly into the amplifier. The MTG, however, is switched in or out of the amplifier using a deferred command. It can also be switched into the SC-01 for special voice and sound effects. When the VOCHORD mode is selected the MTG is automatically fed into the SC-01. The amplifier gain and the filter control generator are controlled using deferred commands.

SPEECH & DEFERRED COMMAND PROCESSING

As speech data and deferred commands are received they are stored in the Execution Buffer (EB — see Figure 5). When a RUN code (carriage return) is received all data in the EB is translated into phoneme codes and control sequences. Translation order is maintained as this new data is transferred to the SC-01, Sound Chip, Filter, Serial and Parallel output devices. The data flow is regulated by software generated timing.

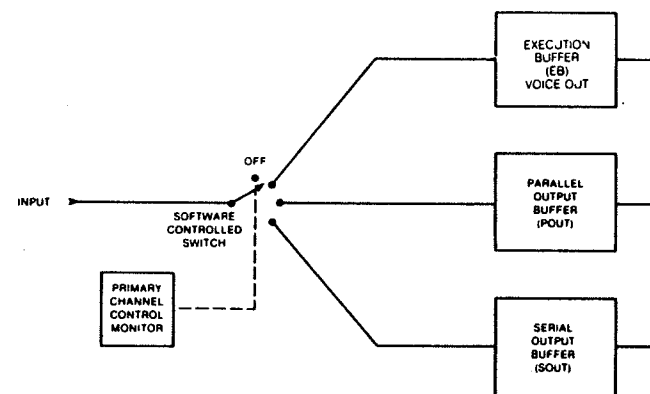
IMMEDIATE COMMAND PROCESSING

Commands which are preceded with an Attention code ([ESC]) are executed as soon as they are terminated. Only commands that don't require delayed or sequential execution are classified as immediate. An example of a useful immediate command is QUIT ([ESC]Q.). This provides a means of stopping a long speech sequence already in progress.

INPUT/OUTPUT

There are two types of external I/O channels available: parallel and serial. Using the connect command ([ESC]Csp) they can be used independently or interconnected. The two input devices, SerIN (serial) and ParIN (parallel), can be dynamically connected to one of four output devices (see figure 6).

Figure 6



INPUT CONNECT OPTIONS

When connected to device 0 (null) all data received at that input port is disregarded. Device 1 is the execution buffer for speech and deferred commands. Devices 2 and 4 are the serial and parallel output buffers respectively. They hold data for transmission outside of the PSS to another computer, printer, etc. These two output buffers are 64 bytes deep upon power-up. They can be increased in 256 byte increments using the Reserve memory command.

LIMITED WARRANTY

We warrant, for a period of sixty (60) days from the date of shipment to the original purchaser, that all Votrax products are free from defects in workmanship and materials under normal use and service, provided the equipment is used in accordance with the user's manual. This Warranty shall be void if the product case is opened or modified. If any failure to conform to this Warranty appears during the sixty (60) day period, we will correct the defect by either suitable repair or replacement, at our option and at our expense, if you return the product, transportation prepaid, to Votrax Incorporated, 1358 Rankin, Troy, Michigan 48083. We will pay the cost of returning the repaired or replaced equipment to you. Any product modification or repair other than that authorized by us in writing will void this Limited Warranty.

THE DURATION OF ANY IMPLIED WARRANTIES, INCLUDING ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS, IS LIMITED TO THE DURATION OF THE LIMITED WARRANTY. WE MAKE NO OTHER WARRANTIES, EXPRESSED OR IMPLIED. ALL WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE EXCEEDING THE DURATION OF THE LIMITED WARRANTY ARE DISCLAIMED. Some states do not allow limitations on how long an implied warranty lasts, so the above limitations may not apply to you.

WE WILL NOT BE LIABLE FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES ARISING FROM ANY PRODUCT DEFECT. Some states do not allow exclusion or the limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you.

This Warranty gives you specific legal rights and you may also have other rights which vary from state to state.

This Limited Warranty does not apply if the product is used for commercial purposes.

VOTRAX INCORPORATED

FEDERAL COMMUNICATIONS COMMISSION REGULATION STATEMENT

This unit generates radio frequency energy and if not installed and used properly — that is, in strict accordance with the manufacturer's instructions — it may cause interference to radio and television reception. It has been tested and found to comply with the limits for a Class B computing device in accordance with the specifications in Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference in a residential installation. However, there is no guarantee that interference will not occur in a particular installation. If this unit does cause interference to radio or television reception, which can be determined by turning the unit OFF and ON, the user is encouraged to try to correct the interference by following one or more of the following measures:

1. reorient the receiving antenna;
2. relocate the unit with respect to the receiver;
3. move the unit away from the receiver;
4. plug the unit into a different outlet so that the unit and receiver are on different branch circuits.

If necessary, the user should consult the dealer or an experienced radio/television technician for additional suggestions. The user may find the following booklet prepared by the Federal Communications Commission helpful: "How to Identify and Resolve Radio-TV Interference Problems." This booklet is available from the U.S. Government Printing Office, Washington, D.C. 20402, Stock #004-000-00345-4.

APPENDIX A VOCABULARY PROGRAMMING TABLES

Table 1

ADJUSTED SPELLING EXAMPLES

Word List	Adjustment	Word List	Adjustment
acquisition	aquisition	negative	negg ative
albums	al burns	official	uhficial
anonymity	anuhnimity	operate	operait
attorney	atterney	parallel	parallell
bitterly	bit erly	pasteurize	pasturize
brokerage	broker idge	petroleum	petrolium
business	buseness	placebo	pluhceebo
certificate	certifikit	political	puhlitical
completed	come pleted	presto	prestoe
composite	composit	previously	previously
contoured	kohn tourd	purchase	purchess
corporate	corper it	record	rehkerd
costume	kohstume	risen	rizzen
criticism	criticisum	routine	rooteen
defamation	deafamation	scorpion	scor peeon
denial	denile	senile	seenile
developed	developt	separately	seprety
electronic	electrohnic	seriously	seriously
exploratory	exploritory	softer	sawfen
fraternal	fruhternal	solder	sodder
image	imige	statute	stachute
influence	inflootence	stereo	stehrio
label	lable	symbol	symble
luxurious	lugjurious	synagogue	synagog
masque	mask	tiring	tireing
memory	memry	vacuum	vacume

Table 2
CONSONANTS WITH MORE THAN ONE PRONUNCIATION

Letter	Pronounced like ...	Examples
c	/K/ or /S/	corn city
d	/D/ or /T/	paid passed
g	/G/ or /J/	log page
q	/K/ or /K + W/	boutique quit
s	/S/ or /Z/	cats dogs
x	/K + S/ or /G + Z/	six exam

Table 3
LETTER SEQUENCES PRODUCING
LONG VOWEL SOUNDS

Long Vowel Sound	Letter Sequence	Example Word
a	ai	maid
a	ay	day
a	a-e	save
e	ee	keep
e	cei	receive
e	ie	retrieve
e	y	every
i	ey	eye
i	y-e	rhyme
i	y	my
i	i-e	line
o	o-e	home
o	oa	goat
o	ow	grow
o	a	war
o	ol	cold
o	or	nor
o	oe	toe
u	oo	soon
u	ou	group
u	u-e	tune

Table 4
DIPHTHONG
LETTER SEQUENCES

Diphthong Sequence	Example Word
ow	power
ou	house
oi	noise
oy	boy
you	you
u	music
ew	few

Table 5

LETTER SEQUENCES PRODUCING SHORT VOWEL SOUNDS

Short Vowel Sound	Letter Sequence	Example
Short a	a	hat
Schwa a	a	about
Schwa a	u	cup
Schwa a	tion	nation
Schwa a	ou	double
Schwa a	uh	
Short e	e	bet
Short e	ai	fair
Short e	err	merry
Short e	arr	carry
Short e	eh	
Short i	i	trip
Short i	y	symbol
Short i	ea	fear
Short o	o	mop
Short o	a	father
Short o	oh	
Short o	all	ball
Short o	oil	doll
Short o	aw	saw
Short o	ough	bought
Short o	au	August
Short o	ong	song
Short u	oo	book
Short u	ou	should
er	er	verse
er	ir	bird
er	or	word
er	ur	turtle
er	ear	heard

APPENDIX B

PHONEME CONVERSION CHART

Hex Code	ASCII Char.	Phoneme Symbol	Duration (ms)	Example Word
40	@	EH3	59	jackEt
41	A	EH2	71	Enlist
42	B	EH1	121	hEAvy
43	C	PAO	47	-PAUSE-
44	D	DT	47	buTTER
45	E	A2	71	enAble
46	F	A1	103	mAdE
47	G	ZH	90	meaSure
48	H	AH2	71	hOnest
49	I	I3	55	inhibIt
4A	J	I2	80	Inhibit
4B	K	I1	121	inhIbit
4C	L	M	103	Mat
4D	M	N	80	suN
4E	N	B	71	Bag
4F	O	V	71	Van
50	P	CH*	71	Chip
51	Q	SH*	121	SHop
52	R	Z	71	Zoo
53	S	AW1	146	AWful
54	T	NG	121	thiNG
55	U	AH1	146	fAther
56	V	OO1	103	lOOking
57	W	OO	185	bOOk
58	X	L	103	Land
59	Y	K	80	Kitten
5A	Z	J	47	JuDGe
5B	[	H	71	Hello
5C	\	G	71	Get
5D	]	F	103	Fast
5E	.	D	55	paiD
5F	-	S	90	paSS

PHONEME CONVERSION CHART

Hex Code	ASCII Char.	Phoneme Symbol	Duration (ms)	Example Word
60	'SP	A	185	mAld
61	a,!	AY	65	mAld
62	b,"	Y1	80	Yard
63	c,#	UH3	47	missiOn
64	d,\$	AH	250	gOt
65	e,%	P	103	Past
66	f,&	O	185	mOre
67	g,'	I	185	pln
68	h,(	U	185	tUne
69	i,)	Y	103	anY
6A	j,*	T	71	Tap
6B	k,+	R	90	Red
6C	l,.	E	185	mEEt
6D	m,-	W	80	Win
6E	n,.	AE	185	dAd
6F	o,/	AE1	103	After
70	p,0	AW2	90	sAlty
71	q,1	UH2	71	sUspect
72	r,2	UH1	103	About
73	s,3	UH	185	cUp
74	t,4	O2	80	fOr
75	u,5	O1	121	abOArD
76	v,6	IU	59	yOU
77	w,7	U1	90	yOU
78	x,8	THV	80	THe
79	y,9	TH	71	THing
7A	z,:	ER	146	blRd
7B	[,;	EH	185	gEt
7C	l,<	E1	121	bEfore
7D	],=	AW	250	cAll
7E	~,>	PA1	185	-PAUSE-
7F	DEL,?	STOP	47	-STOP-

NOTE: Where 2 ASCII characters appear, use 1st if lower case available, 2nd with upper case.

NOTE: Durations listed will vary depending on the FREQUENCY setting.

* /T/ must precede /CH/ to produce "ch" sound.

* /D/ must precede /J/ to produce "J" sound.

DIPHTHONG CHART

ASCII Combination	Phoneme Combinations	Example Words
Fai , F!)	A1-AY-Y	gAme, mAld, dAY
U@i , U@)	AH1-EH3-Y	tlme, skY, gUY
cHi , #H)	UH3-AH2-Y	fight, mice
Ucw , U#7	AH1-UH3-U1	cOW, cIOUd
cHw , #H7	UH3-AH2-U1	hOUse, abOUt
uw , 57	O1-U1	bOAt, nOte
uci , 5#)	O1-UH3-Y	tOY, nOise
bwv , "67	Y1-IU-U1	YOU, mUsic

APPENDIX C MUSICAL NOTES CHART

<u>nn Note</u>	<u>nn Note</u>	<u>nn Note</u>	<u>nn Note</u>
01 C 1	25 C 3	49 C 5	73 C 7
02 C#1	26 C#3	50 C#5	74 C#7
03 D 1	27 D 3	51 D 5	75 D 7
04 D#1	28 D#3	52 D#5	76 D#7
05 E 1	29 E 3	53 E 5	77 E 7
06 F 1	30 F 3	54 F 5	78 F 7
07 F#1	31 F#3	55 F#5	79 F#7
08 G 1	32 G 3	56 G 5	80 G 7
09 G#1	33 G#3	57 G#5	81 G#7
10 A 1	34 A 3	58 A 5	82 A 7
11 A#1	35 A#3	59 A#5	83 A#7
12 B 1	36 B 3	60 B 5	84 B 7
13 C 2	37 C 4	61 C 6	85 C 8
14 C#2	38 C#4	62 C#6	86 C#8
15 D 2	39 D 4	63 D 6	87 D 8
16 D#2	40 D#4	64 D#6	88 D#8
17 E 2	41 E 4	65 E 6	89 E 8
18 F 2	42 F 4	66 F 6	90 F 8
19 F#2	43 F#4	67 F#6	91 F#8
20 G 2	44 G 4	68 G 6	92 G 8
21 G#2	45 G#4	69 G#6	93 G#8
22 A 2	46 A 4	70 A 6	94 A 8
23 A#2	47 A#4	71 A#6	95 A#8
24 B 2	48 B 4	72 B 6	96 B 8

00 = REST

APPENDIX D SPECIFICATIONS

PHYSICAL

Width.....	12.25 inches
Depth.....	5.2 inches
Height.....	3.1 inches
Weight.....	2.6 lbs.

ENVIRONMENT

Temperature.....	Operating:	40 to 100 degrees F (4 to 38 degrees C)
	Storage:	-35 to 150 degrees F (-37 to 65 degrees C)
Humidity.....	Operating:	20% to 90%
	Storage:	5% to 95% (no condensation)

ELECTRICAL

Power.....	Input to transformer*	120 VAC, 60 Hz, 20 W
	Input to PS System*	pins 1-3, 19 VAC, 750 mA
		pin 2, 20 VDC, 150 mA
		pin 4 is 0 volt reference
Interface.....	RS-232C compatible, 75-9600 baud	Frame bits = 1 start, 8 data, 1 stop
		True Parallel compatible
Audio.....	1 watt into 8 ohm speaker,	AC coupled (OPTIONAL)

* USE ONLY VOTRAX APPROVED TRANSFORMER
PART #01p-1224B

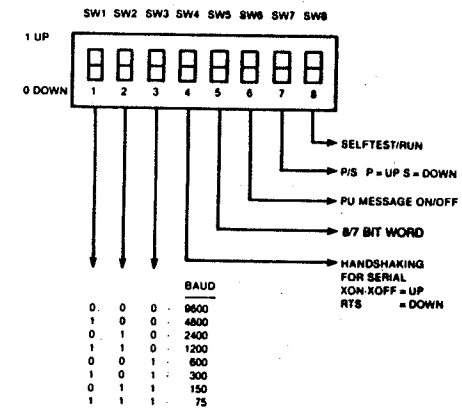
APPENDIX E ERROR CODE DEFINITION

VERBAL	DEFINITION
ERROR 1	INVALID CONTROL TYPE: The character following a control character has no command meaning.
ERROR 2	TERMINATOR MISSING: A period is needed to terminate a command string.
ERROR 3	INVALID OPTION: The requested command option is invalid.
ERROR 4	INVALID NUMBER: A non-numeric character was used in a numeric command option.
ERROR 5	MEMORY OVERFLOW: An attempt was made to use more memory than was available.
ERROR 6	REQUEST NOT READY: CURRENTLY NOT USED.
ERROR 7	SERIAL INPUT FAULT: The serial interface is set to the WRONG BAUD or improperly connected to your computer or is set to incorrect number of data bits (see p. 4). A BREAK condition will also generate error 7.

ERRORS ARE PROMPTED BY A TWO TONE WARNING AND A VERBAL ENUNCIATION OF THE ERROR NUMBER. WHEN AN ERROR IS DETECTED ALL AUDIO IS CANCELLED.

NOTE: The text translator is always ahead of the voice output. Error prompts 1-4 may not correspond to an error at the current audio output position because of this.

APPENDIX F CONFIGURATION SETUP SWITCHES

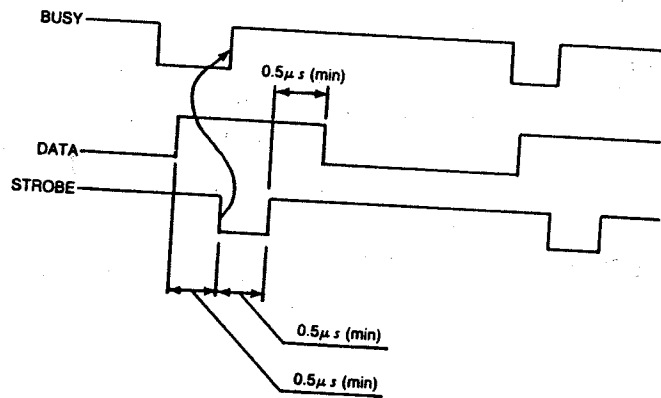
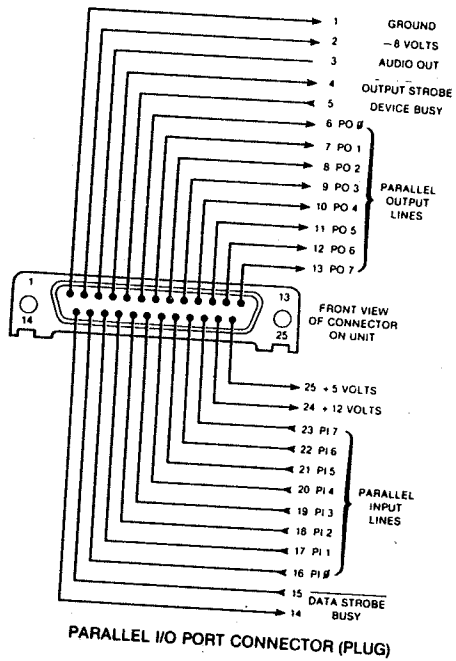


CONFIGURATION SWITCHES

SWITCH	POSITION	FUNCTION
1 to 3	_____	BAUD) selection as shown above
4	UP	XON/XOFF communication protocol utilized by serial port
	DOWN	RTS communication protocol utilized by serial port
5	UP	8 bit word
	DOWN	7 bit word + parity) Parity ignored. Down = Factory Preset Position
6	UP	MESSAGE ON) power-up message spoken
	DOWN	MESSAGE OFF) power-up message NOT spoken
7	UP	PARALLEL) parallel port used as the primary input port
	DOWN	SERIAL) serial port used as the primary input port
8	UP	SELF-TEST) continuously performs diagnostic tests — NO ACCESS to PS System in this mode
	DOWN	RUN) normal operating condition

APPENDIX G INTERFACE DIAGRAMS

PARALLEL INTERFACE

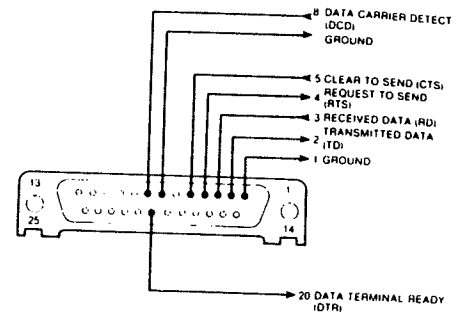


PARALLEL INTERFACE TIMING

G-1

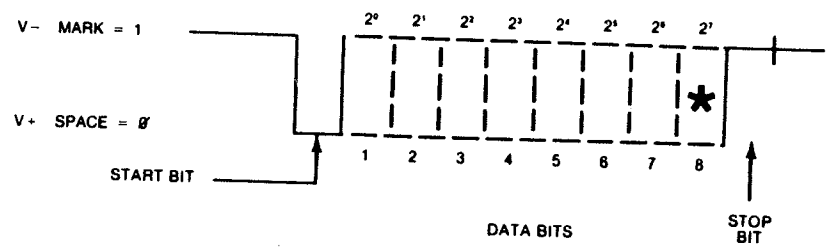
Copyright 1982 by VOTRAX

SERIAL INTERFACE



SERIAL I/O PORT CONNECTOR (SOCKET)

SERIAL DATA INPUT (PSS PIN 3)



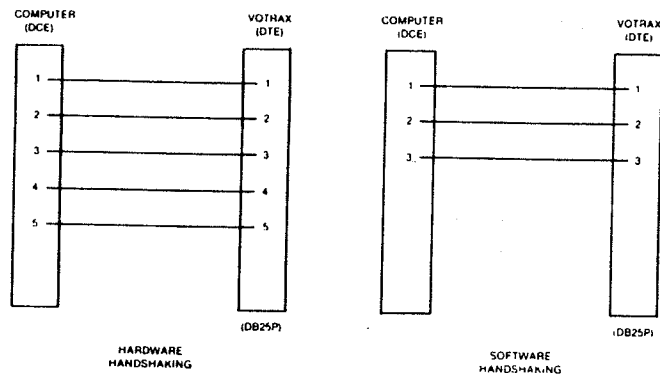
* BIT 8 CAN BE DATA (SW5 = UP)
OR PARITY (SW5 = DOWN)

NOTE: If SW5 is down, parity should be set to zero to none.

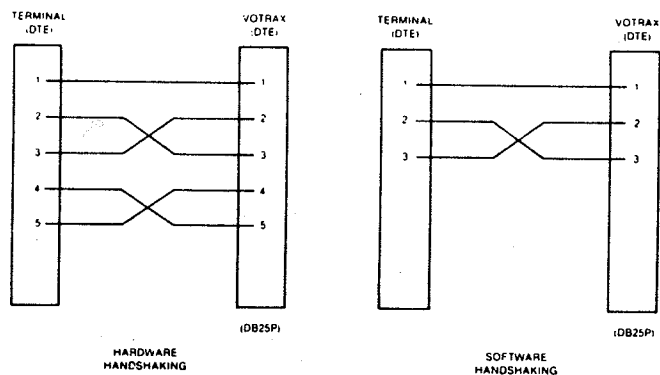
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G-2

SERIAL INTERFACE CABLE DIAGRAMS



COMPUTER (DCE) TO VOTRAX (DTE)

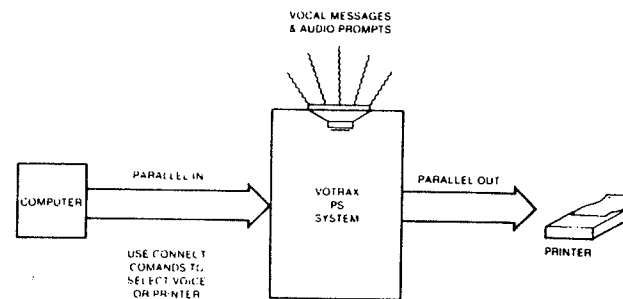


TERMINAL (DTE) TO VOTRAX (DTE)

NOTE 1: The above diagrams depict standard RS-232C protocol. Refer to your owner's manual for differences that may exist.

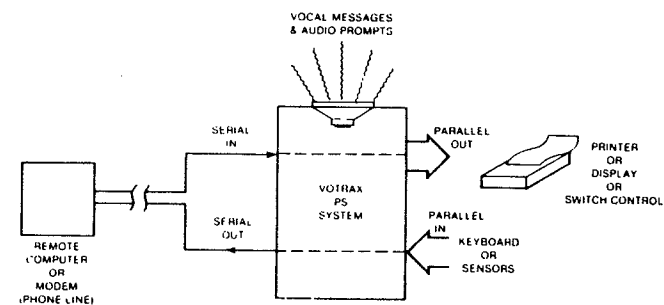
APPENDIX H

TANDEM PRINTER CONFIGURATION



(Saves adding an extra interface to a Computer)

REMOTE COMMUNICATION STATION



APPENDIX I

BASIC PROGRAMMING EXAMPLES

The Personal Speech System is programmed in the same fashion as a printer. Text to be spoken is sent to the PS System followed by a CR (carriage return). Speech output will occur only after the CR is sent. BASIC program examples for several personal computers are shown below to help get you started. Make sure you are using the same interface (parallel or serial) as the example indicates.

APPLE][— SERIAL OR PARALLEL

The Apple][has several slots inside (numbered 0-7) for adding interface cards. Using the BASIC command "PR#" any slot can be designated to receive subsequent text from a PRINT statement.

10 INPUT A\$	Input A\$ from keyboard
20 PR#1	Select slot #1 for output
30 PRINT A\$	Output A\$ to PSS
40 PR#0	Allow input to show on screen
50 GOTO 10	Continue this loop forever

VOTRAX HAS CABLES AVAILABLE FOR MANY PERSONAL COMPUTERS. IN ADDITION, A TANDEM PARALLEL ADAPTOR CABLE IS AVAILABLE. CONSULT YOUR DEALER FOR SPECIFIC INFORMATION.

ATARI 400/800 — PARALLEL

The Atari 850 interface module has both parallel and serial interfaces onboard. In this example the PS System is connected to the Parallel (printer) port.

10 DIM A\$(255)	Allow A\$ to hold 255 char
20 INPUT A\$	Read A\$ from keyboard
30 LPRINT A\$	Send A\$ to PS System
40 GOTO 20	Perform in/out loop forever

ATARI 400/800 — TANDEM PARALLEL PRINTER

If a parallel printer is being used, it can be connected in tandem with the PS System using the V200-PAC1 adaptor cable.

10 DIM A\$(255)	Allow A\$ to hold 255 char
20 DIM ESC\$(1)	Allow ESC\$
30 ESC\$ = CHR\$(27)	Define ESCAPE code
40 INPUT A\$	Read A\$ from keyboard
50 LPR. ESC\$;"C11.";A\$	Send A\$ to voice (connect)
60 LPR. ESC\$;"C04.";A\$	Relay A\$ to printer
70 GOTO 30	Perform in/out loop forever

ATARI 400/800 — SERIAL

Connect the PSS to port #1 on the 850 interface.

10 DIM A\$(255)	Allow A\$ to hold 255 char
20 OPEN #2,8,0,"R1:"	Open port 1 for output
30 XIO36,#2,12,0,"R1:"	Set baud to 2400
40 XIO34,#2,48,0,"R1:"	Set RTS line high
50 INPUT A\$	Read A\$ from keyboard
60 PRINT #2;A\$	Send A\$ to PSS
70 GOTO 50	Perform in/out loop forever

IBM-PC — PARALLEL

```

10 INPUT A$           Read A$ from keyboard
20 LPRINT A$         Output A$ via printer port
30 GOTO 10           Perform in/out loop forever

```

IBM-PC — SERIAL

```

10 OPEN "COM1:9600,N,8,1" AS #1 Set up RS232 9600 Baud
20 LINE INPUT "ENTER PHRASE:",A$ Input A$
30 PRINT #1,A$       Output A$ to PSS
40 GOTO 20           Perform loop forever

```

TRS-80 Model I, III — PARALLEL/SERIAL*

```

10 INPUT A$           Read A$ from keyboard
20 LPRINT A$         Output A$ via printer port
30 GOTO 10           Perform in/out loop forever

```

*TRS-80 Model (See Personal Computer Notes #2 & #3)

TRS-80 COLOR COMPUTER — SERIAL

```

10 INPUT A$           Read A$ from keyboard
20 PRINT #2,A$       Output A$ via RS-232
30 GOTO 10           Perform in/out loop forever

```

VIC-20/COMMODORE 64 — SERIAL

The VIC-20 requires a special cable in order to accommodate the electrical requirements of the RS-232 interface (serial) on the PS System.

```

10 OPEN 1,2,0,CHR$(6) Open file for output (300 baud)
20 INPUT A$           Read A$ from keyboard
30 PRINT #1,A$       Output A$ via serial
40 GOTO 20           Perform in/out loop forever

```

PERSONAL COMPUTER NOTES

1. Some personal computers may not have a labeled "escape" key (e.g.: VIC 20) or this key may not be usable by a peripheral device (e.g.: Apple II). There are alternatives. Most BASIC languages will allow sending the ASCII in its decimal form (CHR\$(x) where x is the decimal number of the ASCII character). To send the [ESC] escape code to the peripheral device (Personal Speech System), the following form can be used:

```

10 B$ = CHR$(27)      : REM escape code
20 PR #1              : REM (for Apple) open slot #
30 PRINT B$;"T."     : REM speak time
40 PR #0              :
50 END

```

or in a simpler form just:

```

10 PR #1
20 PRINT CHR$(27);"T." REM: speak time
30 PR #0
40 END

```

If your computer makes it difficult to utilize the Escape key, you may wish to redefine the Attention Character of the PS System. (see manual: "Special Characters", redefine).

```

10 B$ = CHR$(27)      : REM escape code
20 PR #1              : REM (for Apple) open slot #
30 PRINT B$;"S%."    : REM escape now %
40 PRINT "%T."       : REM speak time
50 PR #0              : REM (for Apple) return to screen

```

After execution of the above example, the PS System will recognize the "%" character as its Attention Character, and process it accordingly. This situation will remain in effect until:

- 1) the PS System is turned OFF, then back ON;
- 2) a "Power-up Reset" command is executed; or
- 3) the Attention Character is redefined again.

2. The TRS-80 Model I requires an RS232 board in the expansion interface and the loading of a software driver as found in TRS-80, RS-232C INTERFACE MANUAL page 29 and 30.

3. The TRS80 Model III serial output requires a driver routine. Consult your manual.

4. The Personal Speech System can be interfaced to virtually any computer or data terminal device which provides RS232C serial data or Centronics type parallel data.

Apple II is a trademark of Apple Computer, Inc.

Atari is a trademark of Atari, Inc.

TRS-80 is a trademark of Radio Shack, Inc.

VIC-20 is a trademark of Commodore Business Machines, Inc.

Commodore 64 is a trademark of Commodore Business Machines, Inc.

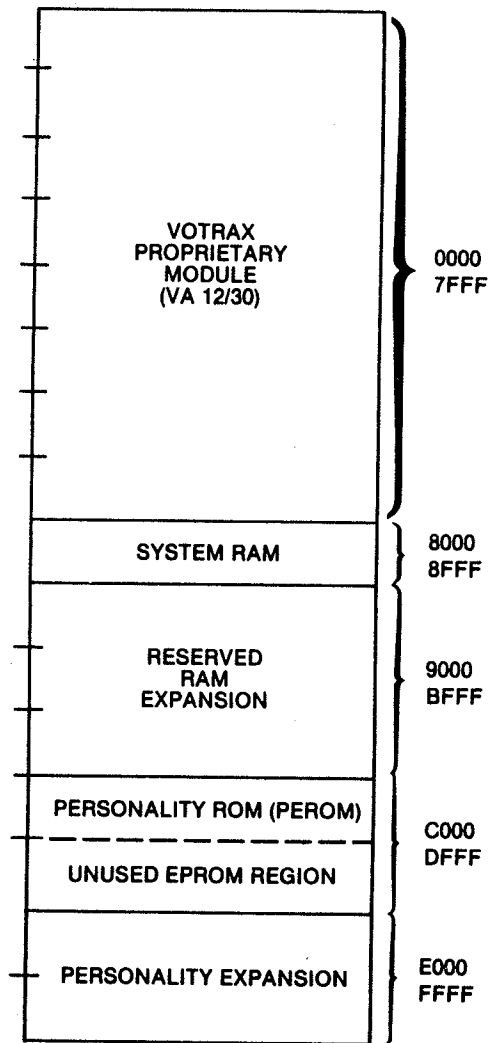
I.B.M. PC is a trademark of International Business Machines

Centronics is a trademark of Centronics Data Corp.

ASCII CHARACTER CODES

Decimal	Character	Decimal	Character	Decimal	Character
000	NUL	043	+	086	V
001	SOH	044	,	087	W
002	STX	045	-	088	X
003	ETX	046	.	089	Y
004	EOT	047	/	090	Z
005	ENQ	048	0	091	[
006	ACK	049	1	092	\
007	BEL	050	2	093]
008	BS	051	3	094	⬆
009	HT	052	4	095	⬇
010	LF	053	5	096	.
011	VT	054	6	097	a
012	FF	055	7	098	b
013	CR	056	8	099	c
014	SO	057	9	100	d
015	SI	058	:	101	e
016	DLE	059	:	102	f
017	DC1	060	<	103	g
018	DC2	061	=	104	h
019	DC3	062	>	105	i
020	DC4	063	?	106	j
021	NAK	064	@	107	k
022	SYN	065	A	108	l
023	ETB	066	B	109	m
024	CAN	067	C	110	n
025	EM	068	D	111	o
026	SUB	069	E	112	p
027	ESCAPE	070	F	113	q
028	FS	071	G	114	r
029	GS	072	H	115	s
030	RS	073	I	116	t
031	US	074	J	117	u
032	SPACE	075	K	118	v
033	!	076	L	119	w
034	"	077	M	120	x
035	#	078	N	121	y
036	\$	079	O	122	z
037	%	080	P	123	{
038	&	081	Q	124	|
039	'	082	R	125	}
040	(	083	S	126	~
041	)	084	T	127	DEL
042	*	085	U		

APPENDIX J



Z-80 MEMORY MAP FOR THE VOTRAX PERSONAL SPEECH SYSTEM

APPENDIX J

I/O MAP

- 00-03 8255 Parallel Peripheral Interface
- 40-41 8251A Serial I/O
- 80-83 8253 Timer
- C0-C3 AY-3-8910 Sound Chip

APPENDIX K

HEX to DECIMAL NUMBER CONVERSION TABLE

Hex	Dec	Hex	Dec	Hex	Dec	Hex	Dec
00	0	20	32	40	64	60	96
01	1	21	33	41	65	61	97
02	2	22	34	42	66	62	98
03	3	23	35	43	67	63	99
04	4	24	36	44	68	64	100
05	5	25	37	45	69	65	101
06	6	26	38	46	70	66	102
07	7	27	39	47	71	67	103
08	8	28	40	48	72	68	104
09	9	29	41	49	73	69	105
0A	10	2A	42	4A	74	6A	106
0B	11	2B	43	4B	75	6B	107
0C	12	2C	44	4C	76	6C	108
0D	13	2D	45	4D	77	6D	109
0E	14	2E	46	4E	78	6E	110
0F	15	2F	47	4F	79	6F	111
10	16	30	48	50	80	70	112
11	17	31	49	51	81	71	113
12	18	32	50	52	82	72	114
13	19	33	51	53	83	73	115
14	20	34	52	54	84	74	116
15	21	35	53	55	85	75	117
16	22	36	54	56	86	76	118
17	23	37	55	57	87	77	119
18	24	38	56	58	88	78	120
19	25	39	57	59	89	79	121
1A	26	3A	58	5A	90	7A	122
1B	27	3B	59	5B	91	7B	123
1C	28	3C	60	5C	92	7C	124
1D	29	3D	61	5D	93	7D	125
1E	30	3E	62	5E	94	7E	126
1F	31	3F	63	5F	95	7F	127

HEX to DECIMAL NUMBER CONVERSION TABLE

Hex	Dec	Hex	Dec	Hex	Dec	Hex	Dec
80	128	A0	160	C0	192	E0	224
81	129	A1	161	C1	193	E1	225
82	130	A2	162	C2	194	E2	226
83	131	A3	163	C3	195	E3	227
84	132	A4	164	C4	196	E4	228
85	133	A5	165	C5	197	E5	229
86	134	A6	166	C6	198	E6	230
87	135	A7	167	C7	199	E7	231
88	136	A8	168	C8	200	E8	232
89	137	A9	169	C9	201	E9	233
8A	138	AA	170	CA	202	EA	234
8B	139	AB	171	CB	203	EB	235
8C	140	AC	172	CC	204	EC	236
8D	141	AD	173	CD	205	ED	237
8E	142	AE	174	CE	206	EE	238
8F	143	AF	175	CF	207	EF	239
90	144	B0	176	D0	208	F0	240
91	145	B1	177	D1	209	F1	241
92	146	B2	178	D2	210	F2	242
93	147	B3	179	D3	211	F3	243
94	148	B4	180	D4	212	F4	244
95	149	B5	181	D5	213	F5	245
96	150	B6	182	D6	214	F6	246
97	151	B7	183	D7	215	F7	247
98	152	B8	184	D8	216	F8	248
99	153	B9	185	D9	217	F9	249
9A	154	BA	186	DA	218	FA	250
9B	155	BB	187	DB	219	FB	251
9C	156	BC	188	DC	220	FC	252
9D	157	BD	189	DD	221	FD	253
9E	158	BE	190	DE	222	FE	254
9F	159	BF	191	DF	223	FF	255

APPENDIX L SELF TEST LIST

1. Turn power to PSS OFF.
2. Place SW8 in the UP position.
3. Turn power to PSS ON.

The PSS will respond saying:

"VOTRAX PERSONAL SPEECH SYSTEM SELF TEST VERSION (#)."

The version # will vary with the product evolution.

The tests below will be executed.

TEST #	PURPOSE
1	Variable Speech rate ("Hi"—spoken faster & faster)
2	Amplitude Fade ("Bye-Bye"—quieter & quieter)
3	VOCHORD Test ("1,234,567"—with "Alien" voice)
4	Filter Sweep ("Filter Sweep"—low to high voice)
5	Sound Chip test
6	Scale
7	Prompts

THIS SEQUENCE WILL REPEAT UNTIL SW8 IS DOWN AND THE POWER IS RESET.

POWER-UP SETTINGS

Amplitude	@ AF1
Conversion Mode	@ C0
Speech Rate	@ R4
Voice mode	@ V0
Inflection	@ 1

ALARMS OFF

Envelope 1	! E100880.
Envelope 2	! E200880.
Envelope 3	! E300880.
Filter	! F20200.
Tempo	! T04.

Reserve Memory	[ESC]R0000.
Connect Input	[ESC]C11.
Mode Set:	
Clock Chime	0-0ff
Auto Run Delay	0-0ff

APPENDIX M**MUSIC, VOCHORD & SOUND EXAMPLES****MUSIC — ODE TO JOY**

!T10:E10B4B0:1363100:1371:139:139:137:
136:134:132:132:134:136:1362:1340:1343.

VOCHORD — DAISY

V2!T08:E20B4B0:229B100:!.DAY!226:!.Z!222:!.
DAY!217:!.Z!219:!.GIVE!221:!.ME!222:!.YOUR!219B:!.
ANS!222:!.ER!217B:!.DO

NOTE: "!" is used to stop the speech from going ahead of the notes.

SOUND EFFECTS — PROMPTS & MISC.

0 - !E10B4B0:T08:1888400.
1 - !E10B4B0:T10:1608400:1:1:1.
2 - !E10B4B0:T08:1488400:144:146:139.
3 - !E10B4B0:T08:1188400:112.
4 - !E10B4B0:T08:1608400:156F4
5 - !E10B4B0:T08:1304200:134:136:140.
6 - !E100800:T02:1124200:124:136:148:160:172:184:196.
7 - !E123440:T04:1302000:134:135:1374:1342:137.
8 - !E10B8B0:T08:N1Z0:197F20:100:NO.
!T05:2001000:3121010:280FOA1:396EOA1:200:300.
!T08:E300810:397100:N3A0:397:N3K0:397:N3Z0:300:NOA0.
!T06:E200000:E300042:2480001:372000:260:384:248:372.

WARNING

The Personal Speech System's (PSS) DB 25 pin parallel port supports Centronics-type interface signals. It is not, however, designed for direct connection to other DB25 pin parallel ports which are used on the IBM and compatible products. Direct connection of these two ports will severely damage your computer.

Votrax, Inc.