



TYPE 'N TALK
USER'S MANUAL



TYPE 'N TALK
TNT
Operator's Manual

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Because its applications are virtually unlimited, it is impossible to foresee all the uses to which Type 'N Talk 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 Type 'N Talk. Dangerous uses must be avoided.

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INTRODUCTION

TYPE 'N TALK (TNT) is a text-to-speech synthesizer. A revolutionary new voice output device, TNT is as easy to program as typing data or programs into a computer. TNT is a small, light weight unit that may be interfaced to computer, modem, or any RS-232 compatible serial device. It contains a VOTRAX SC01 phoneme synthesizer chip and a text-to-speech translation system. Functioning as a voice output device, TNT may be utilized in a variety of different applications from Computer Aided Instruction (CAI) to warning or prompting signals in any existing (or new) software program. One or more TNT units (up to 8) can be linked together (daisy chained) in order to provide multiple voice outputs from a single computer interface. TNT is a totally self-contained text-to-speech synthesizer; therefore, it will not slow down the throughput of the user's computer doing time consuming text translations. With this responsibility off-loaded to a TNT, the user's computer is free to perform other tasks while speech is in process.

The vocabulary spoken by TNT is of the user's unrestricted design. This is because a text-to-speech synthesizer creates speech from a set of rules describing English, rather than from a set of prestored utterances. In other words, text-to-speech has an unlimited vocabulary repertoire. This vocabulary can be inserted directly into the user's software programs similar to the way statements for activating a printer or CRT are written. This eliminates the need for any extra memory, RAM or ROM, usually required for prestored vocabulary techniques. Also, it is possible to use a standard high level computer language to directly drive a TNT unit. The versatility of use of the TNT is unlimited.

The text that follows is intended to describe TNT's functions and operations. Implementation of a particular TNT configuration is to be determined by the user.

PHYSICAL DESCRIPTION

The TYPE 'N TALK device is packaged in a small, light weight case no larger than a portable cassette recorder. Dimensionally, TNT requires no more than 7.7" x 5.2" x 3.1" (19.3 mm. x 12.3 mm. x 6.5 mm.) of space. It weighs approximately 2 lbs. (896 g.)



Figure 1. TYPE 'N TALK UNIT — FRONT VIEW

Two voice control knobs, VOLUME and FREQUENCY, are located on the left front panel of TNT (See Figure 2). Referring to Figure 3, all other operational switches, jacks, and connector ports are located on the back panel of the unit. Note that 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. An RS-232 SERIAL PORT is in the center of the back panel. To the right of this port is the BAUD SELECT switch and the SPEAKER jack respectively.

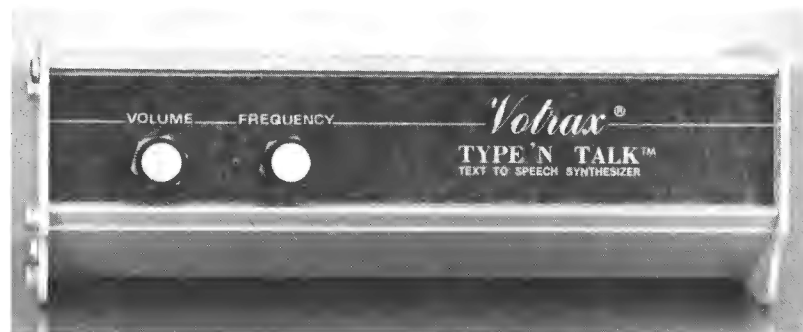


Figure 2. TNT FRONT PANEL



Figure 3. TNT BACK PANEL

INTERCONNECTIONS

POWER

A special TNT power connector is provided which attaches directly to the TNT unit. The power connector receptacle is located on the back panel. Note: 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.

AUDIO (Speaker)

Attach any 8 ohm speaker to the TNT unit for audio output. The SPEAKER jack is on the back panel of the unit.

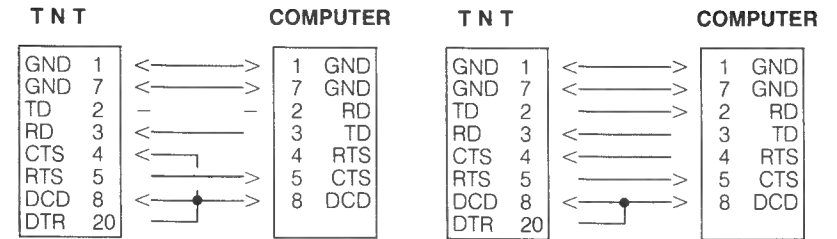
RS-232 (Interface)

TNT uses an RS-232C interface for receiving text and sending phonetic data from, and to, a user's computer. It is possible to configure a TNT with the user's equipment in several ways (See CONFIGURATIONS). To assure proper data transfer to TNT, the use of the RTS signal from the unit is required. This signal will tell the transmitting computer or device that TNT is not ready to accept data. Likewise, TNT will not transmit data if the CTS signal from a computer or device is not TRUE.

The DCD (Data Carrier Detect) signal is used with a modem to prevent TNT from speaking "gibberish" as a result of invalid data being received during carrier loss conditions. If a modem is not used then this input should be tied to +12 volts or the DTR (Data Terminal Ready) output on TNT. Similarly, if TNT is used in a receive-only mode, then its CTS (Clear To Send) input should also be tied to +12 volts or DTR.

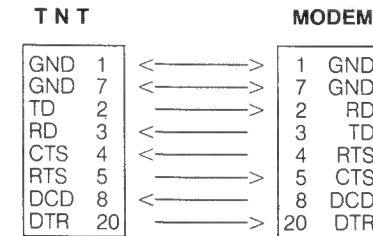
NOTE: Failure to connect DCD and CTS to the proper levels will prevent TNT from operating properly.

Figure 4. RS-232 CABLE CONFIGURATIONS



A. TNT RECEIVE ONLY

B. TNT SEND-RECEIVE

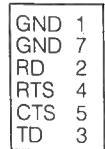


A. TNT WITH MODEM ONLY

GND = GROUND
 TD = TRANSMIT DATA
 RD = RECEIVE DATA

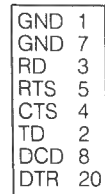
CTS = CLEAR TO SEND
 RTS = REQUEST TO SEND
 DCD = DATA CARRIER DETECT
 DTR = DATA TERMINAL READY

COMPUTER



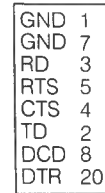
TYPE-'N-TALK

Unit #0 is placed after the computer and before additional peripherals

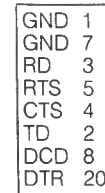


TYPE-'N-TALK

Units #1-7 can be placed in-between #0 and a terminal or line printer (if used)



TERMINAL OR LINE PRINTER



D. One or more TNT's daisy chained with a terminal or printer. Unit select codes allow independent or shared use of the data stream.

INSTALLATION

To interface the TNT unit to a computer, modem, or other RS-232 compatible serial device, a connector cable must be obtained (see RS-232 Interface section). Connect this cable in the SERIAL PORT on the back panel of the unit. This cable is then connected to the user's computer and to any additional equipment being used. Set the BAUD select switch on the back of TNT for the desired data rate (See TABLE 1). Only one switch may be closed at a time.

Connect the power transformer's DIN connector to the back of TNT, 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 RS-232 signals from the computer indicate that the computer is also ready. TNT may be powered-up without the computer being READY, but there will be no audio feedback from TNT to indicate that it is operational.

**Table 1
BAUD SELECTION SWITCHES**

BAUD	SWITCH	BAUD	SWITCH
75	1	1200	5
150	2	2400	6
300	3	4800	7
600	4	9600	8

Close (down position) only one switch at a time.

OPERATION

INPUTTING DATA

Data in the form of ASCII codes can be sent to TNT whenever the handshake line (RTS) indicates that it is not busy (logical 0). This data is classified in three ways: mode controls/commands, speech data, and null data. Mode controls and commands are discussed in their own sections below. Speech data is broken down into two classes: text and phonetic. All data types, with the exception of a Unit Select sequence, can only affect TNT when its input switch is ON (see UNIT SELECTION).

TEXT

Text is defined as any printable ASCII character that was not preceded by an ESCAPE code (see NULL DATA), or a phoneme delimiter. All text received is stored in the input buffer until it is spoken. Of all the printable characters, only a subset produces audible speech. This subset includes the characters:

```
"ABCDEFGHIJKLMNOPQRSTUVWXYZ"
"abcdefghijklmnopqrstuvwxyz0123456789."
```

The rest of the printable characters produce durations of silence or have no effect.

PHONETIC

Phonetic data is defined to be any printable character enclosed by phoneme delimiters (see APPENDIX B for Phoneme Table). The phoneme start and stop delimiters are the "~" and the "?" characters respectively. Phonetic data is stored in the input buffer along with text (they can be mixed). When data in the input buffer is being spoken, phonetic data is routed directly to the output queue, bypassing the text-to-speech translator (refer to FIGURE 5).

NULL DATA

Certain ASCII characters will have no effect on the operation of TNT; however, they will be ECHOed if this option is selected. The codes are as follows:

- 1) Any non-printable character that is not specified in the COMMANDS section with the exception of the ESCAPE code.
- 2) Any character preceded by an ESCAPE code that is not specified in the UNIT ASSIGNMENT/SELECTION and MODE CONTROLS sections.

SPECIAL CASE: The sequences ESCAPE, "Y" and ESCAPE, "=" cause the next two characters received to be ignored. These four characters are used for cursor addressing found on several commercially available video terminals.

UNIT ASSIGNMENT/SELECTION

Data can be selectively sent to a particular TNT unit in a daisy chain. This has value when the user desires to send different data to a TNT than to a printer/terminal, or other TNT units. All TNT's will have a unit number (UNIT-NUM) associated with it. Upon power-up all TNT units automatically assume the UNIT-NUM 0. This can be changed by the user to any number 0-7 via the codes shown below. An assignment or selection code must be preceded by the ESCAPE code in order to validate it.

Table 2.

UNIT ASSIGNMENT/SELECTION CODES

UNIT-NUM	ASSIGN CODE	SELECT CODE
0	8 = BS	0 = NUL
1	9 = HT	1 = SOH
2	10 = LF	2 = STX
3	11 = VT	3 = ETX
4	12 = FF	4 = EOT
5	13 = CR	5 = ENQ
6	14 = SO	6 = ACK
7	15 = SI	7 = BEL

When a TNT receives an assignment code it will store the corresponding UNIT-NUM as its own. It then adds one to the assignment code and transmits this downline. In essence, the TNT units are counting off. This allows multiple TNT units in a daisy chain to all be assigned with only one assignment code sent from the user's computer.

After an assignment has been made all units will be de-selected (switch 2 in FIGURE 5 is OFF). When a particular unit receives its UNIT-NUM, it will become selected (switch 2 is ON) and transmit UNIT-NUM 0 downline. Only the TNT unit corresponding to the last sent UNIT-NUM will be selected at any time!

MODE SELECTION

There are several optional modes of operation for a TNT that can be selected using control codes. These modes can be dynamically set in accordance with the user's application. TABLE 3 lists the various control codes along with a mnemonic descriptor of the feature. They will be discussed further below. To invoke a particular mode, an ESCAPE code (HEX 1B, DECIMAL 27) followed by the corresponding mode control code must be sent to a TNT while its input mode is ON.

Table 3. MODE CONTROL CODES

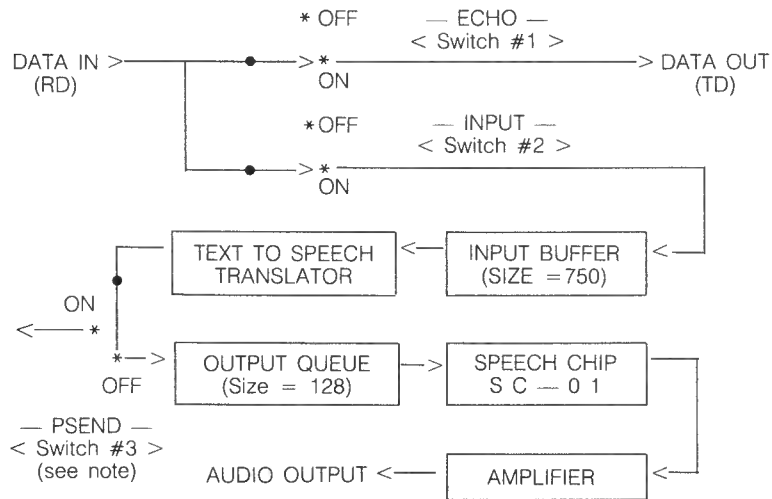
MODE	—CONTROL CODES—		
	HEX	DEC	ASCII
PSEND ON	11	17	DC1
*PSEND OFF	12	18	DC2
*ECHO ON	13	19	DC3
ECHO OFF	14	20	DC4
CAPS ON	15	21	NAK
*CAPS OFF	16	22	SYN
TIMER OFF	17	23	ETB
RESET	18	24	CAN

*Indicates automatic power-up selections

NOTE: If the TIMER is enabled then an ESCAPE code must be followed by any code within the timer interval (about 3-4 seconds) or TNT will lock-up and must be powered-down.

A block diagram showing data flow within a TNT is given in FIGURE 5. This figure will aid the reader in understanding the effect of the mode controls as they are described in detail below.

Figure 5. BLOCK DIAGRAM OF A TNT (with the software controlled switches at their power-up positions)



NOTE: When PSEND <Switch #3> is ON, the phoneme code stream from the text-to-speech translator is routed to DATA OUT (TD). This is not depicted in the above diagram.

The output queue allows the text-to-speech translator to accumulate up to 128 phonemes ahead of where the voice synthesizer is currently at (approximately 12 seconds of speech). This allows TNT to input subsequent messages while other ones are output pending.

The input buffer can hold more than 750 characters which is approximately one minute of speech. At 9600 baud this buffer takes less than one second to fill.

PSEND ON

When this mode is selected, all phoneme codes resulting from a translation of the input buffer are directed to the TD output of the TNT's RS-232 interface. This feature allows the user's computer to collect the phoneme codes corresponding to the text that's sent to the TNT, and to create a phonetic library or change the phonemes for different pronunciation.

PSEND OFF

This is the standard mode of operation where all phonemes generated from the input buffer are placed into the output queue where they can be removed by the speech synthesizer upon demand.

ECHO

This feature is used to selectively (ON/OFF) relay data received by a TNT unit to the next unit or peripheral in a daisy chain. Refer to Switch #1 in FIGURE 5 for a graphical description.

CAPS ON

In this mode capitalized letters are treated in two different manners. If only the first letter of a word is capitalized, such as a proper noun would be, then the word is translated by the text-to-speech algorithm. When two or more letters are capitalized at the beginning of a word, then the whole word is spelled out, letter by letter. This automatically separates acronyms, which are capitalized, from an English text string.

For example:

the words "TIN" and "BOB"
are pronounced "tee eye en" and "bee owe bee"

the words "Tin" and "Bob"
are pronounced "tin" and "bob"

CAPS OFF

This mode is useful for systems that can only use upper case characters. All upper case characters are folded into their lower case equivalent so all text is translated and not spelled out. Mixed upper and lower case text is treated as all lower case.

TIMER OFF

While text is being sent to TNT, if more than approximately 4 seconds elapses after the last character was received, the text in the input buffer is translated and spoken. This input timer is useful when ONLINE applications send a prompting message without being followed by a carriage return (this is the talk control character). If for any reason this timer feature is not desired it can be disabled with the TIMER OFF command.

RESET

This command resets all TNT modes and assignment number to their power-up settings.

COMMANDS

BACKSPACE (HEX 8): This command has the effect of deleting the last character in the input buffer.

TALK-CLR (HEX D): This command (carriage return=CR) will cause the data in the input buffer to be spoken, then cleared. There are two alternate ways that TALK-CLR can be executed without sending a CR. The first is the result of an input buffer full condition. The second is the result of the input timer expiring (see TIMER OFF). When text is being translated, data input will momentarily be halted by the RTS signal going TRUE.

STOP-TALK (BREAK = RD spacing for more than one data frame): This command (condition) causes all pending speech output to be cancelled.

VOCABULARY PROGRAMMING

To program vocabulary into the computer, the user must first be familiar with the computer language in which the programs are to be written. For the purpose of this manual, BASIC will be referenced throughout. It is assumed that the user is familiar enough with their own computer's language so as to be able to adapt the general information shown in this manual to the appropriate syntactical structure for their programming language.

Vocabulary may be entered into the user's computer the same way in which other data or programs are entered. The messages may be typed in as literal statements, using standard English text. This is exemplified in several one-line samples of hypothetical BASIC programs shown below:

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

e.g. 200 A\$="That is incorrect": PRINT #-2,A\$

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

The above examples would have TNT connected to a serial port that is accessed by the command PRINT #-2. In general, data transfer to TNT can occur via the same commands or device drivers used to send data to a CRT, a printer, or a tape drive.

Vocabulary programming is as simple as typing a sentence. The greater task is deciding where in the software program to put the vocabulary and, also, when to activate TNT. Once users have predefined their vocabulary in their software program, it can be sent to any 1 or more output systems simply by defining it within that same software. The user need only become familiar with the computer's command to write this directive. For example, if the voice output is to be used in an error-prompting scheme, the message might be written:

```
PRINT ' 'Warning. Disc drive not ready. ' '
```

The software may be programmed to send this message to TNT and/or a printer for output whenever an attempt is made to use the disc drive before it is ready.

If the computer is functioning as a Computer Aided Instruction (CAI) system, the software may be adjusted so that the messages intended for display on a CRT will, instead, be spoken by TNT. This will free the CRT for displaying other, more visually appropriate, material.

A TNT advantage is that it can speak messages independently of what is happening with other output devices. It can verbally draw attention to a specific piece of information that otherwise might be lost in a visual presentation. This could eliminate the errors made by a user who is searching a long, crowded listing for a single piece of data.

Below is a hypothetical example of a software program using TNT output:

```

100 RESTORE
110 FOR x = 1 to 3 : READ Q$,A$
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"

```

Because every application of a TNT unit is different, users must create a specific set of vocabulary to accommodate their individual voice output needs. The examples above are very brief agendas intended to inspire creative use of TNT by its new owner.

CORRECTING MISPRONOUNCED VOCABULARY

As you are undoubtedly already aware, the TNT translation system is the most compact system of its kind. In order to accommodate its unlimited vocabulary capabilities while maintaining its small size and low cost, the text-to-speech translator's design is extremely concentrated. A number of words may not be produced with the most acceptable pronunciations. However, the user may easily correct pronunciation errors by following one of several procedures: misspell the word, separate the word into smaller component parts, or phonetically program the word (create a sound sequence). The first two techniques are explained below. Phonetic Programming is handled in its own section immediately following.

Misspelling Words

The first and simplest procedure for correcting mispronounced words is to misspell them. For example, the first vowel sound in the word "english" is not accurately pronounced by TNT. To correct this, the user might misspell the word as "inglish." This letter sequence will produce an acceptable pronunciation of the sample word. The concept behind the misspelling process is that the user already has a command of the language and this knowledge will assist in determining which letter combinations will produce the desired sounds. In the example, the pronunciation of ". . .ing" is known from its use as a verb form ending. Since this letter sequence produces the sounds needed for "english," a quick substitution is made.

CONSONANTS: In most cases, the consonant sounds are easily identified by their letter symbols. The user, however, needs to be auditorially aware of those occasions when a consonant can be pronounced in two different ways. For example, the letter "c" is pronounced either like a "k" or an "s". When a pronunciation error involving the letter "c" occurs, simply substitute it with a "k" or an "s". The table below will identify several other letters with double pronunciations.

Table 4

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+W/ or /K/	quit technique
s	/S/ or /Z/	cats dogs
x	/K+S/ or /G+Z/	six example

VOWELS: Correcting the pronunciation of the vowels involves more substitution efforts than those used for the consonants. This is because there are only 5 vowel letters to represent 18 different vowel sounds. Spelling rules accommodate this situation by combining the vowel (and, occasionally, the consonants) letters in many different ways in order to achieve the specific sounds. There are 3 categories of vowel sounds defined within the American English spelling system: short vowel sounds, long vowel sounds, and diphthongs (2 vowel sounds in sequence spoken as a single unit). Some long vowels overlap with diphthongs but the user need only be concerned about what letter sequences are required to say the sounds they desire.

Long Vowels: One spelling rule known by most is when a vowel letter is doubled, it will usually produce a long vowel sound. The word "keep," for example, has a long "e" vowel sound. Therefore, when TNT pronounces the word "read" like "red," the user may quickly replace the "ea" with "ee" ("reed") to achieve the appropriate pronunciation for the present tense form of this word. Examples of other letter sequences that produce long vowel and diphthong sounds may be found in the table below. The user may experiment with these sequences whenever the need exists.

Table 5

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	ye	type
i	i-e	line
i	y	my
o	o-e	home
o	oa	goat
o	ow	grow
o	a	war
u	oo	soon
u	ou	group
u	u-e	tune

Table 6

DIPHTHONG LETTER SEQUENCE

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

Short Vowels: To create a short vowel sound, the user may have to manipulate the consonants that follow the vowel. For single syllable words with short vowel sounds, TNT has a high degree of pronunciation accuracy. The words "bat," "spot," and "net" are produced correctly. To maintain the short vowel sounds when adding more syllables to these words, the user already knows to double the consonant before adding ". . . er," ". . . ing," or ". . . ed": "batter," "spotted" and "netting." Without the double consonant, the vowel sound is automatically assumed to be long. To misspell the word "definition" to get a short vowel pronunciation of "e," double the "f": "deffinition." Refer to the table below for other short vowel examples.

Table 7

LETTER SEQUENCES PRODUCING SHORT VOWEL SOUNDS

Short Vowel Sound	Letter Sequence	Example
a	a	hat
a (schwa)	a	about
a (schwa)	a	success
e	e	bet
e	ai	fair
e	er	merry
i	i	trip
i	y	symbol
i	ea	fear
o	o	mop
o	a	father
o	oll	doll
o	all	ball
o	ough	bought
o	au	August
o	ong	song
o	oo	book
o	ou	should
u	u	cup
u	io	nation
u	ou	double
er	er	verse
er	ir	bird
er	or	word
er	ur	turtle
er	ear	heard

Reiterating the spelling rules necessary to solve all the user's mispronunciation problems would require an enormous number of pages. However, the user will quickly begin to recall many other letter/sound sequences once the pronunciation tables have been reviewed. A list of words known to be mispronounced by TNT are presented in APPENDIX A. Each word has one misspelled version listed with it. From this list, patterns for correcting mispronounced words NOT listed may be elicited. The user should not be limited to just those versions listed. There may be more than one letter sequence which produces the same sound sequence. The APPENDIX will act as a guide for this purpose.

Separating Words

Another technique used to correct mispronounced words is to separate the words into 2 or more smaller segments. This procedure is used effectively for words with a structure like "baseball." To avoid the error in this example, type "baseball" as 2 words: "base ball." Other words with similar structures that may be adjusted with this technique are:

"typewriter" — "type writer"
 "output" — "out put"
 "everyone" — "every one"

As the user's vocabulary needs increase, it will become evident how both the misspelling and word separation techniques will have combined use. To correct "computer," for example, separate the word into two segments at an appropriate boundary: "com puter." Now, misspell the second segment: "com pewter."

As an experiment, enter each of the following words into the computer. Enter both the correctly spelled and incorrectly spelled versions of each. Listen for the pronunciation error in the first, and note the letter changes made in the second to produce the more acceptable pronunciation heard.

"definition deffinition"
 "country kuntry"
 "today tудay"
 "ware wayr"
 "shoes shoos"
 "replace reeplace"
 "capacity cuppacity"
 "baseball base ball"

PHONETIC PROGRAMMING

There are some instances where words cannot be corrected utilizing the forementioned techniques. This situation may occur with Proper Names and English words based in a foreign language. The user may then wish to access the phoneme synthesizer directly to create a phonetic version (sound sequence) of a word.

Phonetic Programming — Operation

To access the phoneme synthesizer, bypassing the TNT translator, the user must type the "~" character. This creates a Phoneme Block into which ASCII characters (representing phoneme characters) may be inserted. If the "~" character does not exist on the user's computer, another character may be defined in software to take over this function. The "~" character acts as a prompt for the computer to send all the data that follows the "~" directly to the synthesizer. Once all the ASCII (Phoneme) characters desired have been inserted, a "?" must be typed to end the string. This, again, is the computer's prompt to return to the mode of sending data through the translator. A Phoneme Block may be created anywhere in the literal statement that contains the vocabulary program.

Phonetic Alphabet

Every speech sound (phoneme) in English is represented by an alphanumeric symbol known as a Phonetic Character or Symbol, TNT utilizes the VOTRAX Phonetic Symbols. One symbol could be a single letter character: /E/ = long "e" vowel sound. Another symbol could be an alphanumeric symbol: /EH3/ = short "e" unstressed vowel sound. Note that phonetic characters are enclosed in slash marks to differentiate them from the standard alphabet characters when both occur in running text. In order to make the phonetic symbol system compatible with a computer, every phoneme symbol is represented by a single ASCII character. The user types into the computer only the ASCII character that represents the phoneme when programming phonetically. A Phoneme Conversion Chart is provided in APPENDIX B. Each Phonetic Symbol is listed along with its associated ASCII character. Example words to define the pronunciations are also listed.

Phonetic Programming — Procedure & Example

When all other techniques are unsuitable for correcting pronunciations, the user may create a word phonetically. First, identify the number and type of sounds contained in the word. There will be at least one vowel sound in every English word. However, a vowel is usually combined with one or more consonant sounds. It may help the user to speak the word aloud in order to identify the sounds. Next, match each of the sounds identified with the appropriate symbol from the Phoneme Conversion Chart. Now create a Phoneme Block in the vocabulary program (see Phonetic Programming — Operation for creating Phoneme Blocks). Insert the selected ASCII characters into the Phoneme Block in the appropriate order. Once the sequence has been completely 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 sounds = 2 ("o" and "er")
3. # of consonant sounds = 3 ("r," "b," & "t")
4. match the sounds in 2, & 3, with characters in Phonetic Conversion Chart (APPENDIX B)
5. phonetic characters = /R, AH, B, ER, T/
6. ASCII characters = K, d, N, z, j
7. create Phoneme Block (type "~")
8. insert ASCII character sequence (type KdNzj)
9. end Phoneme Block (type " ? ")
10. activate speak command ("Robert" spoken)

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 programming 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.

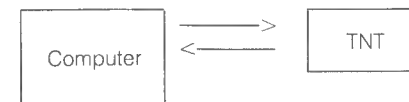
Again, it should not be beyond the creativity of the user to substitute a word that is not acceptably pronounced with another word more suitable for the auditory environment.

Additional assistance may be provided by a standard dictionary, where 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 TNT characters.

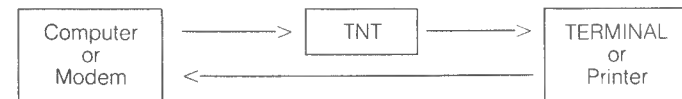
CONFIGURATIONS

TNT may be configured in 3 different ways: FIGURE 6 graphically represents these configurations.

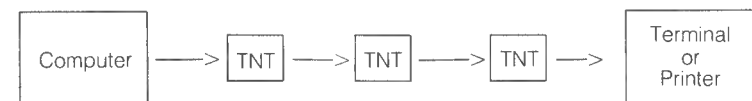
Figure 6. TNT CONFIGURATIONS



**A. Single TNT Unit — Dedicated Channel
— SDC —**



**B. Single TNT Unit — Shared Channel
— SSC —**



**C. Multiple TNT Unit — Shared Channel
— MSC —**

In a dedicated channel configuration (SDC), a single TNT unit may be interfaced to either a computer or a modem. This configuration is best used when no other TNT or serial peripherals are attached to the user's computer.

With the shared channel configurations (SSC and MSC), multiple serial devices may share a single RS-232C serial data channel. This saves the cost of adding additional RS-232C interfaces to the user's computer if one already exists.

An SSC configuration can be operated in two ways. The first way is to verbally repeat data being sent to a terminal/printer. This has use in systems where it is undesirable to modify existing software in order to add voice output. Another use is in ONLINE applications where information is interactively being accessed from a large data base and sent to a terminal.

The second way of using an SSC configuration is to send independent message packets to the TNT and terminal/printer. An example of this use is when a CRT is filled with information and the computer would like to prompt the user without destroying any portion of the screen. The CRT terminal can be de-selected while the TNT is speaking a prompting message (see ECHO OFF and UNIT SELECTION).

In an MSC configuration two to eight TNT units can be linked together (daisy chained) with a computer and a terminal. Independent message packets are sent to each TNT and terminal using unit select codes (see UNIT SELECTION).

SPECIFICATIONS

PHYSICAL

Width 7.7 inches (19.3 mm)
 Depth 5.2 inches (12.3 mm)
 Height 3.1 inches (6.5 mm)
 Weight 2 lbs. (0.896 Kg.)

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% (no condensation)
	Storage:	5% to 95% (no condensation)

ELECTRICAL

Power	Input to transformer*	120 VAC, 60 Hz, 20 W
	Input to TNT*	— pins 1-3, 26 VAC, 180 mA
(see note below)		— pin 2, 20 VDC, 50 mA
		— pin 4 is 0 volt reference

Interface RS-232C compatible, 75-9600 baud
 Frame bits = 1 start, 8 data, 1 stop

Audio..... 1 watt into 8 ohm speaker, AC coupled

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

APPENDIX A

VOCABULARY PROGRAMMING
Pronunciation Correction Guide

Word List	Correction	Word List	Correction
advertisement	advertise ment	everyone	every one
baseball	base ball	extensive	extensiv
beautiful	butiful	generator	generayter
break	brake	goto	go to
breakfast	brekfest	item	ightem
bringing	bring ing	machine	mosheen
calculation	cal culation	machinery	mosheenery
capacity	cuppacity	output	out put
cassette	case et	paste	payst
certain	certin	phoneme	phone eem
character	kereker	procedures	prowceejers
children	children	program	prowgram
circuit	cirkit	promise	promiss
clients	clyents	pronunciation	pronunsiation
clothes	cloze	radio	radeo
close	near by	replace	reeplace
color	cuhler	requirement	require ment
comfortable	comfterble	rodeo	rowdeo
customer	custummer	scissors	scizors
data	dayta	shoes	shooz
definition	deffinition	singer	sing er
delete	deleet	software	softwayr
easiest	easy est	specify	specifuy
english	inglish	today	tuday
equivalent	eequivalent	typewriter	type writer
error	airor	vocabulary	vowcabulary
error	mistake	ware	wair

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	hEAy
43	C	PA0	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	IOOking
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
60	`, SP	A	185	mAlD
61	a, !	AY	65	mAlD
62	b, "	Y1	80	Yard
63	c, #	UH3	47	miss!On
64	d, \$	AH	250	gOt
65	e, %	P	103	Past
66	f, &	o	185	mOre

Hex Code	ASCII Char.	Phoneme Symbol	Duration (ms)	Example Word
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	trAdition
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	, <	E1	121	bEfore
7D	}, =	AW	250	cAll
7E	~, >	PA1	185	-PAUSE-
7F	DEL, ?	STOP	47	-STOP-

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

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

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

DIPHTHONG CHART

ASCII Combination	Phoneme Combination	Example Words
Fai	A1-AY-Y	gAme, mAld, dAY
U @	AH1-EH3-Y	tlme, skY, gUY
cHi	UH3-AH2-Y	flght, mlce
Uvw	AH1-UH3-U1	cOW, IOUd
cHw	UH3-AH2-U1	hOUse, abOUt
uw	O1-U1	bOAt, nOte
uci	O1-UH3-Y	tOY, nOlse
bvW	Y1-IU-U1	YOU, mUsic

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.

LIMITED WARRANTY

We warrant, for a period of thirty (30) 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 thirty (30) 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 Division of Federal Screw Works, 500 Stephenson Highway, Troy, Michigan 48084. 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.

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FEDERAL SCREW WORKS