

**Product:** Type-Ahead-Engine

**Manufacturer:** The Type-Ahead-Engine Company  
534 Rosal Avenue  
Oakland, California 94610

**Presenter:** Randy Medd  
Boettcher & Co.  
828 17th Street  
Denver, Colorado 80202

**Background:** Boettcher & Co. is an investment banking firm based in Denver, Colorado. Our system is a 1 megabyte HP-3000 Series III with 410MB of 792x disc, 42 interactive terminals and 2 line printers. Our applications range from interactive financial analysis, data-base inquiry and word processing to batch back-office accounting and reporting. We are currently involved in the conversion of an existing batch-oriented accounting system from a Honeywell 1250 to the HP-3000.

The Type-Ahead-Engine (TAE) is a micro-processor based terminal enhancement which has drastically improved our productivity in all phases of data entry, from word processing applications to program development and testing. The features of the TAE are listed below and will be discussed in detail later.

- 1). Type-Ahead;
- 2). 36 User Definable Soft Keys;
- 3). True, typewriter-like tabbing - e.g. no tab character conversion;
- 4). Automatic indentation;
- 5). Automatic carriage return past right margin;
- 6). Display functions, for non-HP264x terminals;
- 7). Ability to lock capital letters on terminals without caps lock;
- 8). Plugs directly into HP264x terminals, easy installation for other terminals.

1). Type-Ahead.

How often have you sat at your terminal waiting for the 3000 to get around to processing your last instruction, so you can enter your next instruction? Or, how much time have you spent waiting for the colon prompt to appear, after logging on as a user with a number of UDC files set?

These situations occur quite often on our system, for various reasons. The Type-Ahead feature of TAE allows the user to type data at the terminal without having to wait for the

system to provide a prompt. TAE acts as a buffer between the terminal and the computer, sending all user input directly to the computer in normal operation. When system response is slow, however, TAE saves user input, only releasing it to the system when the system is ready. You can type in a COBOL compile command, for example, and without waiting for the compile to finish, enter the :PREP command, a :SAVE command and the :RUN command. When the COBOL compile has completed and the 3000 has sent the colon prompt to the terminal, TAE will send the next line of user input to the computer. Since the TAE has a 512 character buffer, the only real limitation as to how much you can Type-Ahead is how sure you are that you're correctly anticipating and answering, in advance, all future questions from the computer.

Of course, if you feel, or know, that you've typed something incorrectly, TAE allows you to delete the current line, (Control-X), or all Typed-Ahead data.

(This feature is by far the most appealing of those available. In fact it is quite difficult, for those of us who have grown used to the TAE, to use a terminal without it.)

## 2). 36 User Definable Soft Keys.

TAE allows the terminal user to define up to 36 soft keys, letting you assign up to 25 characters to each alphabetic key and 50 characters to each numeric key. These soft keys are considerably more convenient than those available on an HP2645 because they are chainable. One soft key may invoke many other soft keys, much like subroutines. A soft key may also contain an imbedded 'call' to another soft key.

It is also possible to remotely 'trigger' a soft key. The TAE uses a user defined key-sequence to invoke each soft key. It is possible to send this key-sequence to a TAE equipped terminal via the :TELL command and cause the corresponding soft key's contents to be transmitted!

## 3). True, typewriter-like tabbing.

With TAE, you can define up to 138 tab stops. These tabs are true tabs, not tab characters which must be converted to tab locations, as with EDITOR/3000. When tab stops are defined and used, TAE issues as many space characters as needed to skip to the next tab location. Thus, it is a trivial matter to backspace through tab locations if you've tabbed too far. This can be done with either the backspace key, or by back-tabbing - skipping backwards to the last tab stop.

4). Automatic indentation.

TAE allows the user to specify that the cursor skip to the first tab stop automatically, after each carriage return.

5). Automatic carriage return past right margin.

The user can define a 'hot zone' on the terminal's screen which specifies the effective right margin for data entry. With the 'hot zone' defined at, say, column 70, when data is entered on the keyboard, TAE will generate an automatic carriage return at the first blank typed on or after column 70. In word processing applications, this means that data can be entered without ever having to glance at the screen to see if a line has been filled. TAE will prevent the user from entering single lines which are too long for the application. When coupled with the automatic indentation feature, this results in even more efficiency.

6). Display functions, for non-HP264x terminals.

The TAE gives the user the ability to display the non-printing characters on the terminal's screen. All of the non-printing characters involve the use of the Control key. RETURN is Control-M, ESCAPE is Control-[, Bell is Control-G, etc. With display functions turned on, TAE displays these as ^M, ^[, ^G, respectively.

7). Ability to lock capital letters.

The TAE can lock the keyboard so it only transmits Upper case characters. TAE performs an up-shift operation on any alphabetic character transmitted to it when operating in this mode.

8). Easy installation.

TAE resides on a printed circuit board identical to those contained in HP264x terminals. Its installation in these terminals is very straightforward. The TAE board is just plugged into any available slot inside the terminal. A short adapter is supplied with TAE which is used to connect the TAE with the computer cable. TAE draws its power from the 264x power supply.

For non-HP264x terminals, it is possible to rack mount the TAE boards externally. We have done this for HP2621 and LSI ADM3A terminals.

All of the above features of TAE are all implemented using a pre-defined set of key-sequences to communicate with TAE. A list of these commands is attached to this report. All of the above mentioned

features may be set either directly from the keyboard, or they may be downloaded from the 3000.

## TAE Command List

-----  
CC CC  
    transmit a single CC  
CC SC  
    transmit a single SC  
-----

CC C character  
    define CC to be character  
CC S character  
    define SC to be character  
-----

CC T C column1, column2, - , columnk.  
    clear tab stops from column1, column2, - , columnk  
CC T S column1, column2, - , columnk.  
    set tab stops in column1, column2, - , columnk

CC T L  
    set left margin in current column  
CC T R column.  
    set right margin in column  
CC T R.  
    disable right margin  
CC I  
    back tab to previous tab stop  
CC T A  
    enable automatic tabbing  
CC T N  
    disable automatic tabbing  
CC T Q  
    reset all tab variables  
-----

CC F label delimiter string delimiter  
    define transmit soft key identified by label  
CC L label delimiter string delimiter  
    define local soft key identified by label  
CC P label  
    print definition of soft key identified by label  
SC label  
    invoke soft key identified by label  
-----

CC Y  
    enable TAE display functions  
CC Z  
    disable TAE display functions

-----

CC X  
    delete all type-ahead

-----

CC :  
    enable TAE local echo  
CC ;  
    disable TAE local echo  
CC R  
    echo current line of type-ahead

-----

CC H  
    enable TAE half duplex echo  
CC D  
    disable TAE half duplex echo

-----

CC K  
    enable TAE caps lock  
CC U  
    disable TAE caps lock

-----

CC E  
    perform a hard reset  
CC G  
    perform a soft reset  
CC Q  
    perform a DC1 reset

## TAE Reference Manual

### Conventions

In the syntax descriptions of the TAE commands given below the following conventions will be followed:

- CC and SC, described below, are special characters
- all uppercase alphabetic characters represent actual characters to be typed by the user, upper or lowercase characters may be typed
- all words in lowercase describe the characters to be typed in that position of the command

### Command Sequences

Commands for the TAE are implemented with command sequences that begin with one of two special characters. The command character, referred to in this manual as CC, is the first character in all command sequences that are interpreted by the TAE. The soft key command character, referred to in this manual as SC, is the first character in all soft key invocation sequences. The actual character values of CC and SC are defined by the user; the initial values are control A and control Z, respectively. These initial values were chosen to avoid conflicts with the ASCII character escape (control []) which is interpreted by many terminals. The user may alter the values of CC and SC to suit the particular terminal with which the TAE is being used.

If you need to send the CC character itself to the computer, type two CCs. To send an SC to the computer, type CC SC. If you type a CC followed by a character that is not a TAE command, the CC and the character will be transmitted to the computer.

```
CC CC
    transmit a single CC
CC SC
    transmit a single SC
```

All command sequences defined for the TAE are recognized when received from the terminal or from the computer; thus command sequences defining tab stops and soft keys may be downloaded from the computer. If an attempt is made to enter command sequences from the terminal and computer simultaneously, the TAE will only interpret the command sequence that it recognized first. The other command sequence will be passed through uninterpreted.

If an attempt is made to assign an alphabetic to CC or SC, or an attempt is made to assign the same value to CC and SC, an error message is issued and the assignment is not performed. You should be

careful when choosing values for CC and SC to avoid conflicts with the normal usage of the characters chosen.

```
CC C character
    define CC to be character
CC S character
    define SC to be character
```

#### Tabs

The TAE provides a tab expansion facility that may be used with any terminal. Each tab character received from the terminal is replaced by the number of blanks required to make the current column maintained by the TAE equal to the column of the next tab stop to the right. If a tab is received and the current column is to the right of the last tab stop, a single blank replaces the tab. Tabs may be set in any column from 2 to 136, but the columns do not necessarily correspond to terminal screen or platen positions. Each line typed by the user is numbered from column one regardless of where the line is entered on the terminal. Thus, the column numbers specified for the TAE are the same as would be specified in the EDITOR; but it is not necessary to specify EDITOR tab stops since the TAE transmits blanks instead of tabs. Backspacing after tabbing is not a problem as you will backspace over blanks rather than tab characters.

A back tabbing facility is provided that will send backspaces (control H) to the HP-3000 as required to make the current column equal to the column of the next tab stop to the left. If a back tab is performed to the left of the first tab stop, sufficient backspaces are sent to set the current column to one. A back tab does not stop at the left margin except when the margin coincides with a tab stop or when no tab stop are defined.

```
CC I
    back tab  to previous tab stop
```

Tabs may be used in any context where multiple spaces are desired. e.g. the modify command in the EDITOR and the redo command in MPE. If the transmission of actual tab characters to the computer is desired, the TAE may be commanded not to substitute blanks for tabs.

Tabs may be set and cleared individually or in lists. The desired column numbers are entered, separated by commas and terminated with a period. When entered from the terminal, the columns entered are echoed for verification; the characters are not transmitted to the computer. No editing of the column lists is allowed as it is entered, if an incorrect column is specified it must be corrected with a subsequent command. If an invalid character or column number is entered, an error message is issued and the command is terminated.

```
CC T C column1,column2, -,columnk.
    clear tab stops from column1, column2 - , columnk
CC T S column1,column2, -,columnk
    Set tab stops in column1, column2, - , columnk
```



The user may specify a left margin to reduce the number of tabs required to reach a desired column. When a left margin has been set, the first tab character received in a line is replaced with the number of blanks required to move the current column to the left margin column. If the first tab received is at or to the right of the left margin, normal tab expansion takes place. Setting a left margin does not clear the tab stops to its left, it temporarily disables them making the left margin the first tab stop on the line. It is not necessary to have any tabs stops set in order to set the left margin; the left margin does not have to coincide with a tab stop.

The left margin is set by moving to the desired column and executing the TAE left margin command. Moving the left margin to the right of its current position is accomplished by tabbing to the left margin, the tabbing or spacing to the new position and executing the left margin command. Moving the left margin to the left of its current position is accomplished by spacing to the new location, or by tabbing to the left margin and backspacing or back tabbing to the desired location and executing the left margin command. Normally, the left margin is set while entering a line, of text, there is no requirement to execute the command on a line by itself.

If you need to move the margin frequently, it may be convenient to set up soft keys to perform the changes. Even though the left margin command can be executed from the computer, the desired effect may be hard to achieve since a column counter is maintained only for the characters entered from the terminal and it would be hard for the computer to determine this value.

An error message is issued if you attempt to set the left margin to the right of the right margin.

CC T L

set left margin in current column

A problem that exists with EDITOR/3000 is that of entering lines that extend beyond the allowed line length. The TAE provides a right margin that helps prevent excessively long lines from being entered in the EDITOR. When a right margin has been set in the TAE, the first blank that falls in or to the right of the right margin is replaced by a carriage return. The TAE does not split or move words, it only replaces blanks with carriage returns; thus it is still possible to overextend the EDITOR line with a long word that continues through the right margin. The right margin should be set enough below the maximum line length to minimize the chance of this happening. For example, if the EDITOR line length is set to 72, a reasonable value for the right margin might be 60.

The right margin is most useful when typing text where the position of words on the line is not important. The right margin might not be useful when entering source programs because it is desirable to utilize all positions in the line. In this case, you

might want to set the right margin one greater than the EDITOR line length to provide protection against overextended source lines. It is important to note that you may still type a carriage return whenever desired, it is not necessary to type all the way to the right margin. The right margin is specified by entering the right margin command followed by the desired column and a period. The right margin may be disabled by omitting the column and entering only the period following the command. An error message is issued if you attempt to set the right margin to the left of the left margin or to the right of column 136. In these cases, the right margin will be unchanged.

- CC T R column.  
set right margin in column
- CC T R .  
disable right margin

When a large amount of text is to be indented, it is possible to have the TAE automatically provide a tab at the beginning of each line of text; this tab will cause indentation to the left margin if it is set. Thus, each time you type a carriage return, or when the TAE sends one for you at the right margin, a tab will automatically be sent following the carriage return. This feature is enabled/disabled by command, but it is also required that a left margin be set to the right of column one for an automatic tab to be generated. If this latter requirement were not included, it would be impossible to type in column one whenever the automatic tabbing feature was enabled.

Typically, this feature is only enabled when you are actually entering text, otherwise each command line you type will also have blanks from the expanded tab at the front. Two soft keys could be used to help you control this situation; one key would enable the feature and issue an EDITOR add command; the other key would disable the feature, send a "//" and carriage return to terminate the add command.

- CC T A  
enable automatic tabbing
- CC T N  
disable automatic tabbing

When the tab reset command is given, all tab stops are cleared, the left margin is set to column one, and the right margin and automatic tabbing are disabled. When no tabs stops or a left margin are defined the TAE does not translate tab characters into spaces and back tabs are translated to a single backspace.

CC T Q  
reset all tab variables

#### Soft Keys

The TAE provides 36 soft keys (function keys) that will transmit user defined strings of characters from the TAE to the computer, or

transmit strings from the TAE to the terminal. Soft keys used to send characters to the computer are referred to as "transmit" soft keys; soft keys used to send characters from the TAE to the terminal are referred to as "local" soft keys. Ten soft keys, labelled 0 to 9, can contain up to 50 characters; twenty-six soft keys, labelled A to Z, can contain up to 25 characters. Soft keys can contain any sequence of characters, this includes control characters such as carriage return and TAE command sequences that define or invoke other soft keys.

Characters generated by invocation of a "transmit" soft key are interpreted by the TAE as normal input from the terminal, they are sent to the computer or buffered as appropriate. Characters generated by invocation of a "local" soft key are interpreted by the TAE as normal input from the computer. "Local" soft keys are not particularly useful in block mode as the soft key invocation command sequence is not transmitted by the terminal to the TAE until the block transfer is enabled.

Soft keys are defined by a command sequence that specifies the attribute, "transmit" or "local", the label, 0 to 9 or A to Z, and the characters that represent the key definition. The attribute is specified by an "F" for a "transmit" key and by an "L" for a "local" key. The label is the single desired alphanumeric character. A user chosen delimiter precedes and follows the definitional characters. The delimiter should be a character that does not appear in the definition.

When a soft key is being defined from the terminal the attribute, label, delimiter, and definition are echoed for verification. Display functions is turned on during this process to simplify verification of control characters. No editing of the definition is possible, if an incorrect character is entered the definition should be terminated and the entire command sequence should be repeated correctly. An error message is issued if an attempt is made to assign too many characters to a soft key. In this case the definition of the key consists of the characters entered up to the limit. Soft key sequences longer than allowed in one key are possible when soft keys are chained together; the last two characters of one key should invoke the next key. A bell is sounded two characters from the limit of a soft key definition to provide you the opportunity to insert a soft key invocation command to chain to the next key.

The attribute and definition of a soft key may be verified with the soft key print command. Printing is done with display functions on; the delimiter is always shown as "/".

```
CC F label delimiter definition delimiter
    define "transmit" soft key identified by label
CC L label delimiter definition delimiter
    define "local" soft key identified by label
CC P label
    print definition of soft key identified by label
```

Soft keys are invoked by an command sequence that specifies the label of the soft key desired. When invoked, "transmit" soft keys send, or buffer for transmission, the characters defining the key to the computer. When a "local" soft key is invoked, the TAE sends its defining characters to the terminal. If an undefined soft key is invoked the command sequence is transmitted. Soft keys may invoke other soft keys but the total number of nested invocations is ten. If this limit is exceeded, the extra invocations will be lost. This also limits the longest soft key sequence to 482 characters. If a soft key invocation fills the type-ahead queue, all characters from that point on will be lost. If TAE echoing is enabled, soft key invocations of greater than 128 characters will not be properly echoed. If a soft key invocation redefines a soft key currently being invoked, the soft key will correctly assume its new definition but the current invocation will reflect mixed portions of the old and new definitions.

SC label

invoke soft key identified by label

## Display Functions

Normally the TAE sends all characters received from the computer to the terminal unchanged. This includes control characters, which, when sent to the terminal may cause undesirable results. The TAE may be instructed to translate control characters into printable characters so that the terminal does not attempt to interpret the control characters. This mode of translation is called "display functions". When display functions is enabled each control character received from the computer by the TAE is translated into a two character "control" notation. The first character is an uparrow, "^", and the second is the printable character that is normally typed in conjunction with the control key. Some common control characters and their "control" notation are:

carriage return - control M - ^M

backspace - control H - ^H

tab - control I - ^I

escape - control [ - ^[

cancel - control X - ^X

linefeed - control J - ^J

When you are using an HP-264X terminal with term-type 10 or 11, MPE transmits an enquiry (ENQ) character to the terminal after every 80 characters to allow the terminal sufficient time to process the characters prior to the ENQ. No further characters will be transmitted by MPE until an acknowledge (ACK) is received from the terminal. Thus when the TAE display functions are enabled, the terminal will not receive any ENQ characters, (an ^E is received instead), and consequently no ACK will be sent back to the computer. In this case you must type the ACK character, control F, in response

to each ENQ. (Under MPE-III, if no ACK is received within a specific amount of time, output to the terminal will resume automatically.)

For a legible display, carriage returns are translated to "^M" followed by an actual carriage return and line feed.

CC Y  
enable TAE display functions  
CC Z  
disable TAE display functions

#### Caps Lock

The TAE provides a caps lock feature that improves the feature found on most terminals. When TAE caps lock is enabled all lowercase characters are translated to uppercase and all uppercase characters are translated to lowercase. The way to use this feature is to set the terminal in upper/lower case mode and TAE caps lock on. Thus as lowercase letters are typed they will be upshifted, to type the occasional lower case letter, press shift and the desired character. This feature can also be used on all uppercase terminals to generate lowercase.

CC K  
enable TAE caps lock  
CC U  
disable TAE caps lock

#### Type Ahead Deletion

When the TAE receives a control X from the terminal, it repeatedly deletes the last character in the type-ahead buffer until the buffer is emptied or a carriage return is found. If the buffer is emptied a control X is transmitted to the computer. If a carriage return is found it is not deleted and no control X is transmitted to the computer. Thus, a control X is transmitted only if characters from the current line have been transmitted to the computer. To force a control X to be transmitted, type any character followed by a control X.

All characters in the type-ahead buffer can be deleted with the TAE type-ahead delete command. No control X is sent in this case.

CC X  
delete all type-ahead

#### Local Echo

The HP-3000 normally echos each character as it is received from the terminal, thus you see each character as it is typed. But, as the TAE buffers all characters that are not enabled for transmission to the computer, these "typed ahead" characters are not echoed as they are typed. These characters will be echoed by the computer when they are ultimately received. Usually this presents no problem if the

number of characters typed ahead is small or if you are confident of what you are typing. If a large amount of type ahead is anticipated, the TAE can be instructed to echo characters as they are received from the terminal. Remember that these characters will still be echoed by the computer when they are received, thus each character will appear on the terminal twice. (Of course, the HP-3000 can be instructed not to echo received characters.) The TAE echoes characters after interpreting them, so soft key invocation sequences will be expanded and then echoed. As a convenience, carriage returns are echoed as a carriage return and line feed to produce a more legible display.

If it is not desired that the TAE echo all characters typed, it is still possible to see the current line of type ahead. The TAE line echo command can be issued before the final carriage return on a line to instruct the TAE to echo the current line of type ahead to the terminal. Once a line has been terminated by a carriage return, it is not possible to have the TAE echo the line.

```
CC :  
    enable TAE local echo  
CC ;  
    disable TAE local echo  
CC R  
    echo current line of type-ahead
```

#### Half Duplex Echo

For those situations where the TAE is at local site and is used to access a computer at a remote site, the TAE can perform echoing as it transmits characters and the HP-3000 can have its echoing disabled. This will result in decreased transmission activity. Note that the half duplex echo is different from the TAE local echo described above in that half duplex echo sends characters to the terminal as they are sent to the computer. TAE local echo sends characters to the terminal as they are received from the terminal.

```
- CC H  
    enable TAE half duplex echo  
- CC D  
    disable TAE half duplex echo
```

#### Reset

Occasionally it may be desirable to reset the TAE to its initial power on state. This is accomplished with the TAE hard reset command which performs the following functions:

- all type ahead is deleted
- all characters received from the computer but not yet sent to the terminal are deleted
- transmission to the computer is enabled
- the CC command character is set to control A
- the SC command character is set to control Z

- TAE local and half duplex echoing is disabled
- TAE display functions is disabled
- all soft keys are cleared
- all tab stops are cleared, the left margin is set to column one, the right margin and automatic tabbing are disabled

An alternative to the hard reset command is the soft reset which performs all of the hard reset functions except that the soft keys and tabs are unaffected.

An additional reset command, the DC1 reset, is provided to address a particular situation that arises when using the TAE. When a session is logged off the HP-30000, MPE waits for the next carriage return to initiate a new terminal session. No DC1 is sent to the terminal though. Thus the TAE will not send the next carriage return and MPE will not respond unless a carriage return is received. To resolve this deadlock, the DC1 reset command can be given to the TAE to force it to send the carriage return.

CC E  
perform a hard reset  
CC G  
perform a soft reset  
CC Q  
perform a DC1 reset

