

## Titan - Supplemental System

Titan - Supplemental is an extended version of the original Titan freeware. This version includes additional commands which summarize the time study elemental values and permit the application of performance rating, frequency of occurrence, and PF&D to each individual element. Results are output to the HP48 screen in both time per piece (unit) and pieces per hour.

**WARNING and DISCLAIMER:** Maynard Research Council does not recommend, nor endorse, the use of the Titan software in a manner which oversimplifies the work content of jobs. A complete, engineered work standard considers all work content, not simply the per-piece work elements. Experience indicates that many jobs include from 15 to 40 percent additional work content beyond the per-piece element time. While numerous examples of work standard development - those suggested by individuals offering themselves as experts; or textbooks, including handbooks and tutorials - propose that the sum of an operations per-piece elements is, in fact, an acceptable manner for creating a work standard, Maynard Research Council expressly cautions every Time Study Analyst that this method of work standard determination is incorrect.

However, the sum of per-piece elements is useful when a comparison of per-piece elemental time values is necessary. These cases generally arise during: work standard audits, work standard rate disputes, line balancing try-outs, old/new method comparisons, etc. Titan will provide useful for this work.

## Overall Description of Operation

Since the additional commands in the supplementary version extend the basic Titan Freeware, all operation features as described in the Titan Freeware manual remain the same. One exception is found at the completion of a time study. The original version concludes a time study session by displaying a brief message - Summarizing - during which data is saved to the variable TSfile. The supplementary version differs by continuing program execution and displaying the standard as the sum of the per-piece elements. The user has the option of changing the elemental rating, frequency of occurrence, and PF&D, for individual elements and re-calculating the standard time. Once the Titan program is exited, the data is retained, permitting an editing opportunity for the above mentioned values.

## Operation Instructions

NOTE: These instructions assume you have read the Titan Freeware Users Manual.

## Installing Titan - Supplemental

Your disc contains two separate files not bundled under Titan.exe. These files have the same names as the Titan Freeware files, but reside on the disc separately. Copy the Supplemental files - TITAN and Titan.lib - into the HP48 as described in the Freeware instructions, using the un-bundled files. The file names are identical in both versions to avoid the added task of re-coding the original Titan Freeware to accommodate either version.

## Set-up variables

Before using Titan - Supplemental, the first step to perform is to set the correct PF&D value and minutes per hour factor for your application. These figures are used as default values for standard calculations. During the program segment which allows elemental rating, you can enter a different value for PF&D for use in that specific calculation. This is explained a bit later, first you must save the proper value for the default.

## Saving the PF&D Default Value

Do not start the Titan program but move to the Titan directory. Press the NXT key on the keyboard - second row, right-most key. The menu label at the top of the screen should display a variable titled "PFD" and one titled "MINH". Type the delay percentage as a whole number, 15% is 15, 12.5% is 12.5. Press the ENTER key. Next, press the tick mark key, ' ', left-most on the third row. Press the menu label "PFD" and press ENTER. The screen should show:

```
4:
3:
2:          15  (Assuming 15% PF&D)
1:      'PFD'
```

Press the “STO” key - beside the tick mark key. The value is now saved as the default and displays automatically in subsequent calculations. You can change this value by repeating the previous instructions.

The next value to save is the conversion factor used to change time values expressed in (minutes per unit) into (units per hour). Using a factor of 60 minutes per hour is seldom correct. If this concept is not understood, please contact our offices for details. (PS: Many Unions know the reason and look for proper application values)

Type the correct value as a whole number or whole number plus decimal value ( 60, 58, 57.25, etc). Press ENTER. Press the tick mark key, press the menu label “MINH” and press ENTER. The display should appear as:

4:	
3:	
2:	58.25 (or your figure)
1:	‘minhr’

Press the STO key to save the value.

Note: You can change these values – PFD and/or minhr – whenever necessary. Each is recalled and used during calculations, but can change as needed.

## Instructions for Adjusting for Rating, Frequency, and PF&D

At the conclusion of a time study, a screen appears momentarily indicating:

Calculating .....

using 100% rating

This screen changes to one indicating the standard time value assuming the following:

100% rating

1:1 per-piece element occurrence

PF&D default value for delay percentage

Sum of per-piece elements is the standard

Sum in time units converted into pieces per hour.  
(Minutes and hours are automatically recognized .)

An option to edit the rating values is available by pressing the menu label "EDIT." Pressing "OK" exits the program.

## The Edit Matrix

The Titan Supplemental Program uses the built-in HP48 Matrix Editor™. This method of operation was selected to keep the programming effort to a minimum, permit the use of built-in HP48 features, and allow knowledgeable users to create their own custom features.

At the upper left corner of the matrix is a number pair. The first number is the number of elements, the second value is always the number three (3). On any row, the leftmost column is the performance rating, the middle column is the frequency of occurrence, and the rightmost column is the PF&D default value. You can change any value by moving the highlight bar (using the cursor positioning keys) to a specific cell and typing the desired value on the command line. Pressing the ENTER key stores that value into the highlighted cell. For example, to change the rating from 100% - which appears as 1.00 - to 115%, position the cursor, type 1.15 (note, ratings are decimal values) and press ENTER.

## Summary of Changing Rating

Highlight correct cell - element numbers are indicated at left

Type the proper value as a decimal 100% is 1.00; 125.5% is 1.255

Press ENTER

You can change a value back and forth until correct.

## Frequency of Elemental Occurrence

Frequency of occurrence is very flexible. After positioning the highlight to the middle column of the desired element, you can store a number directly as a decimal or whole number; or calculate the value as a fraction and allow the HP48 to store the correct decimal equivalent. Some examples:

1:1 is the default value, 1.00 - element is performed once per piece

2:1 is entered as 2.00 - element is performed twice per piece

1:4 - element is performed once per four pieces  
is entered as 0.25 or type one of the following

Method 1) 1 SPC 4 / ENTER

The SPC key is on the bottom row, the / is the divide key

The HP48 will store 0.25 in the middle frequency cell

Method 2)	'	tick mark key
	1/4	as an algebraic expression
	cursor right key	moves cursor outside of tick mark
	EVAL key	third row, third key from left
	ENTER	computes value and stores into cell

These latter two methods of entry are useful if the frequency of occurrence is mixed, such as 2 in 17, a decimal value of 0.1176

## Changing the PF&D

The rightmost column of the display matrix is the PF&D value. This value is supplied by the value stored in the default variable PFD (see instruction above). Changing this value in the matrix makes a temporary change to the value for the purpose of calculation but does not alter the value stored in PFD. A common example is where a machine controlled element is calculated at a value less than manually controlled elements. If five percent (5%) is used for that element and eight percent (8%) for others, highlight the element, rightmost column. Type 5 and press ENTER.

## Calculation of a Standard Including the Rating, Frequency, and Delay

Once the correct values are stored into the cells, press the ENTER key. (Note: pressing the ON key will exit without additional calculations). A screen appears briefly:

Calculating ...

Rated standard

The next screen indicates:

Engineered standard

Standard       ----- min

PCs/hr       -----

This screen remains visible until a key is pressed, returning to the Titan directory.

## Editing the Standard Further

From the Titan directory, press the menu label MAKE (which is the program MakeRate). The program re-sets the matrix to the default values (100% rating, 1:1 frequency, PFD default delay percentage). Repeat the corrections to the various adjustments (rating, frequency, delay) as described previously for a new computation. You can perform this as many times as you like. The standard is calculated using the values from the most recently created study, old studies are not saved within the system, so either save data using the Titan Output feature or record the results of your studies on paper.

## Advanced Topics: Appendix A

Five programs, written using the built-in programming features of the HP48, extend the basic Titan Freeware. The Titan Freeware itself is written using HP48 System Programming, a programming technique relying on HP48 system calls and assembly language, saved as a program library. These latter features are not part of the HP48 User Programming nor is there any need to modify these programs. Because the supplemental programs are User Programs, experienced or knowledgeable users can modify these programs as deemed fit. A description of the interface between the Titan Freeware and the User Programs making up the Supplement follows.

Titan Freeware saves the results of a time study in two separate objects: TSfile, a list holding the elemental descriptions, continuous-recorded elemental values, a sub-list of foreign recordings, and the individual elemental time values. A second matrix is created by the Titan Freeware, but created when the Output Results command is selected. This second matrix - the object Summary - contains the following data:

One column per element, seven data rows

Row 1: Total of elemental times	HP48 Command TOT
Row 2: Number of observations	
Row 3: Average	HP48 MEAN
Row 4: Standard Deviation	HP48 SDEV
Row 5: 0.0	Intended to record Mode
Row 6: Minimum value	HP48 MIN $\Sigma$
Row 7: Maximum value	HP48 MAX $\Sigma$

The Supplemental Version creates the object - Summary - at the completion of each time study. This was a minor change to the freeware code. Note: many Titan programs function in a particular – and sometimes peculiar – manner, because the original design considered the HP48G model, a version limited to 32K of memory.

The five User Programs - MakeRate, Summation, RtnValue, Adjust, Limit - extend the freeware to produce the standard time value, previous caveats and disclaimers noted. The engine behind the calculations is Summation, a mathematical expression. Summation does what you may expect, sums the elemental average time values.

The object Limit returns the number of elements to sum, ie, four elements returns 4, six elements returns 6, etc. RtnValue retrieves each element average value. RtnValue also calls the program object Adjust, which multiplies each element average by the values stored in the matrix object Adjustments. Confused? It simple by HP48 standards.

Summary	[[ Total of element 1, Total of elm 2, Total of 3 .....] [ Num of obs 1, Num of obs 2, Num of obs 3 ...] [ Average of 1 , Avg of 2 , Avg of 3 ..... ] [ Rest of data ..... ]]
Adjustments	[[ Rating of element 1, Frequency of element 1, PF&D of elm 1] [ Rating of element 1, Frequency of element 2, PF&D of elm 2] [ Same data for remaining elements .... ]]
RtnValue	<< Summary { 3, element number } GET (the value) Adjust >>
Adjust	<< Adjustments { element number, 1 } GET (the rating value and multiply) GET (the frequency and multiply) GET (the PF&D and multiply) >>
Summation	<p>Number of elements</p> $\sum_{N=1} \text{(Element value X rating X Freq X (1+(PF\&D/100)))}$

The program MakeRate creates a display screen and calls Summation to return the value of the standard. MakeRate also displays a menu label to continue calculations or exit.

### Editing the MakeRate Program

The MakeRate program is user modifiable, but unless you know what you are doing, DON'T! :

**CAUTION:** Do not change the values starting with # listed before SYSEVAL. Doing so may result in a loss of calculator memory. You will loose all data and need to re-install programs.

Please contact our offices for additional changes to the program. The Supplemental Features were created on a good will basis, thus may not function as seamlessly as the Titan Freeware but will operate correctly to its design.