

# QUICK START GUIDE

## Forward Discrete Fourier Transform HP15c CE software pac

Pepin Torres, P.E.  
pepin(dot)torres{at}gmail(dot)com

### Introduction:

This software pac implements an N-point forward Discrete Fourier Transform for any real-valued matrix in row-vector form when stored in `Matrix A` (e.g.,  $\mathbb{R}^{1 \times 15}$ ).

See [https://en.wikipedia.org/wiki/Discrete\\_Fourier\\_transform](https://en.wikipedia.org/wiki/Discrete_Fourier_transform) for technical details of math involved.

### Who is this for?

This is for anyone who is ever in dire need of calculating the Forward DFT of a *real-valued* sequence with no computer or advanced calculator in sight. This software pac can run with the calculator in default mode or 15.2 mode (see *Size and Timing Considerations* section for details).

### Image File and Program Listings (with MD5):

```
27beb8cf8b65c5d61207ffc05ec9097 forward_dft.15c
22eb2f567b7b90c4c39262d5cb74b87a forward_dft.bin
839f1ba7ff1f67a3d516476ba8ac09d7 forward_dft.hex
046caad807d72e784e63f95a0e9b540d forward_dft.jrn
d4451572323c7664f9dcab7a6c8e916a forward_dft.k15
52dc1d030626ba1498dc65187b1947da forward_dft.tch
a1121ab1adcb7b8259271f90628b8012 forward_dft.txt
5e143e75241d8076a694dd8eb837aab forward_dft.xlsx
```

Excel file includes listing, comments, stack states, sanity check example, and timing table.

Note: Program is short enough that inputting by hand is not objectionable plus the added benefit of not having to blow away existing programs. The .bin file is provided for those who would rather not type it in.

### To calculate N-point Forward DFT:

#### Prerequisites:

Stack: N/A

Registers: None

Matrices: `Matrix A` of size  $[1 \times N]$  containing a real-valued sequence

where  $N = \{1 \dots 20\}$  for default mode (max N is assuming no other data in memory)  
 $N = \{1 \dots 52\}$  for 15.2 mode (max N is assuming no other data in memory)

#### Usage:

Press **GSB B** (state of stack does not matter)

#### Output:

`Matrix B` of size  $[N \times 2]$

where column 1 contains the real part of the result  
column 2 contains the imaginary part of the result

Registers used: R0, R1, R.0, R.1, R.2, R.4, R.5

**BONUS: To only calculate the  $k^{\text{th}}$ -point of the N-point Forward DFT:**

**Prerequisites:**

Stack:  $k$  in the x-register

where  $k = \{0 \dots N-1\}$

Registers: None

Matrices: Matrix  $A$  of size  $[1 \ N]$  containing a real-valued sequence

where  $N = \{1 \dots 20\}$  for default mode (max  $N$  is assuming no other data in memory)  
 $N = \{1 \dots 52\}$  for 15.2 mode (max  $N$  is assuming no other data in memory)

**Usage:**

Press **GSB A** (with  $k$  in x-register)

**Output:**

Value of Forward DFT at bin  $k$  is stored in  $R.4$  (real part) and  $R.5$  (imaginary part)

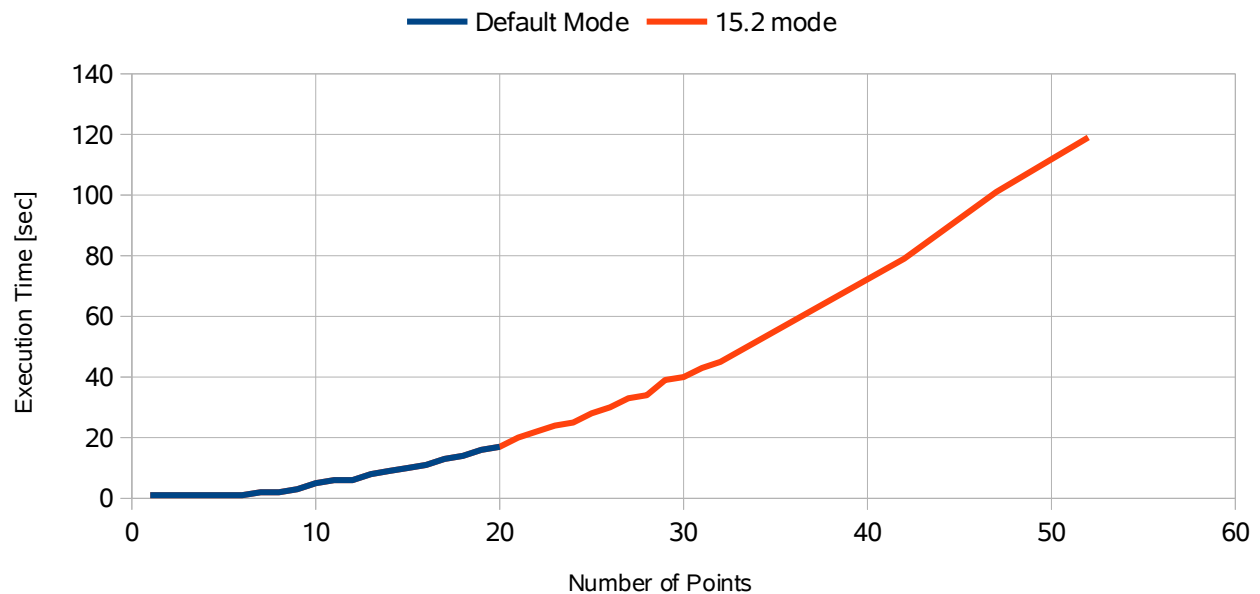
Registers used:  $R0, R1, R.0, R.1, R.2, R.4, R.5$

**Size and Timing Considerations:**

**Program size:** 74 instructions, 83 bytes

**Max DFT size:** 20 points in default mode, 52 points in 15.2 mode  
(assuming no other data or programs in memory.)

**Execution Time vs Number of Points**



NOTE: The .bin file puts the calculator state as if user had just ran the sanity check sample in the .xlsx file.