

# NAG Library Routine Document

## G01FTF

**Note:** before using this routine, please read the Users' Note for your implementation to check the interpretation of *bold italicised* terms and other implementation-dependent details.

### 1 Purpose

G01FTF returns the value of the inverse  $\Phi^{-1}(x)$  of the Landau distribution function, via the routine name.

### 2 Specification

```
FUNCTION G01FTF (X, IFAIL)
REAL (KIND=nag_wp) G01FTF
INTEGER IFAIL
REAL (KIND=nag_wp) X
```

### 3 Description

G01FTF evaluates an approximation to the inverse  $\Phi^{-1}(x)$  of the Landau distribution function given by

$$\Psi(x) = \Phi^{-1}(x)$$

(where  $\Phi(\lambda)$  is described in G01ETF and G01MTF), using either linear or quadratic interpolation or rational approximations which mimic the asymptotic behaviour. Further details can be found in Kölbig and Schorr (1984).

It can also be used to generate Landau distributed random numbers in the range  $0 < x < 1$ .

### 4 References

Kölbig K S and Schorr B (1984) A program package for the Landau distribution *Comp. Phys. Comm.* **31** 97–111

### 5 Parameters

1: X – REAL (KIND=nag\_wp) *Input*  
*On entry:* the argument  $x$  of the function.  
*Constraint:*  $0.0 < X < 1.0$ .

2: IFAIL – INTEGER *Input/Output*  
*On entry:* IFAIL must be set to 0, –1 or 1. If you are unfamiliar with this parameter you should refer to Section 3.3 in the Essential Introduction for details.

For environments where it might be inappropriate to halt program execution when an error is detected, the value –1 or 1 is recommended. If the output of error messages is undesirable, then the value 1 is recommended. Otherwise, if you are not familiar with this parameter, the recommended value is 0. **When the value –1 or 1 is used it is essential to test the value of IFAIL on exit.**

*On exit:* IFAIL = 0 unless the routine detects an error or a warning has been flagged (see Section 6).

## 6 Error Indicators and Warnings

If on entry  $IFAIL = 0$  or  $-1$ , explanatory error messages are output on the current error message unit (as defined by  $X04AAF$ ).

Errors or warnings detected by the routine:

$IFAIL = 1$

On entry,  $X \leq 0.0$ ,  
or  $X \geq 1.0$ .

$IFAIL = -99$

An unexpected error has been triggered by this routine. Please contact NAG.  
See Section 3.8 in the Essential Introduction for further information.

$IFAIL = -399$

Your licence key may have expired or may not have been installed correctly.  
See Section 3.7 in the Essential Introduction for further information.

$IFAIL = -999$

Dynamic memory allocation failed.  
See Section 3.6 in the Essential Introduction for further information.

## 7 Accuracy

At least 5 – 6 significant digits are correct. Such accuracy is normally considered to be adequate for applications in large scale Monte–Carlo simulations.

## 8 Parallelism and Performance

Not applicable.

## 9 Further Comments

None.

## 10 Example

This example evaluates  $\Phi^{-1}(x)$  at  $x = 0.5$ , and prints the results.

### 10.1 Program Text

```

Program g01ftfe

!      G01FTF Example Program Text
!
!      Mark 25 Release. NAG Copyright 2014.
!
!      .. Use Statements ..
!      Use nag_library, Only: g01ftf, nag_wp
!      .. Implicit None Statement ..
!      Implicit None
!      .. Parameters ..
!      Integer, Parameter          :: nin = 5, nout = 6
!      .. Local Scalars ..
!      Real (Kind=nag_wp)         :: x, y
!      Integer                    :: ifail
!      .. Executable Statements ..

```

```

      Write (nout,*) 'G01FTF Example Program Results'
      Write (nout,*)

!      Skip heading in data file
      Read (nin,*)

!      Display titles
      Write (nout,*) ' X           Y           IFAIL'
      Write (nout,*)

d_lp: Do
      Read (nin,*,Iostat=ifail) x
      If (ifail/=0) Then
         Exit d_lp
      End If

!      Compute the value of the inverse of the Landau distribution function
      ifail = 0
      y = g01ftf(x,ifail)

!      Display results
      Write (nout,99999) x, y, ifail
End Do d_lp

99999 Format (1X,F4.1,3X,1P,E12.4,I6)
      End Program g01ftfe

```

## 10.2 Program Data

G01FTF Example Program Data  
 0.5 : Value of X

## 10.3 Program Results

G01FTF Example Program Results

X	Y	IFAIL
0.5	1.3558E+00	0

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