1 SUMMARY

To compute values of **Dawson's Integral**

$$F(x) = e^{-x^2} \int_0^x e^{t^2} \, dt$$

for x real.

The following approximations are used,

(a) $x^2 < 6$ a Taylor series expansion.

(b) $6 \le x^2 \le 36$ a series expansion in $(x^2 - x_0^2)$ where x_0 is a lower limit of one of eight subranges in $\{6,36\}$.

(c) $x^2 \ge 36$ an asymptotic series.

ATTRIBUTES — **Version:** 1.0.0. **Types:** `FC13A; FC13AD`. **Calls:** `PB01`. **Original date:** May 1966. **Origin:** A.R.Curtis, Harwell.

2 HOW TO USE THE PACKAGE

The single precision version (5 sig. fig.)

```
CALL FC13A(X,F)
```

The double precision version (13 sig. fig.)

```
CALL FC13AD(X,F)
```

`X` is a `REAL` (`DOUBLE PRECISION` in the D version) variable which must be set by the user to the value of the argument x.

`F` is a `REAL` (`DOUBLE PRECISION` in the D version) variable which is set by the subroutine to the computed value of the function $F(x)$.

3 GENERAL INFORMATION

Use of common: none.

Workspace: internal, 370 words.

Other subroutines: calls `PB01AS/AD`.

Input/Output: none.

Restrictions: none.

Accuracies:

5 figures using 4-byte arithmetic

13 figures using 8-byte arithmetic

4 METHOD

4.1 The approximations

For $x^2 < 6$, a Taylor series for the integral is used. In each of the ranges

$6 \le x^2 < 8$,

$8 \le x^2 < 11$,

$11 \le x^2 < 15$,

$15 \le x^2 < 19$,

$19 \le x^2 < 23$,

$23 \le x^2 < 27$,

$27 \le x^2 < 31$,

$31 \le x^2 < 36$,

a series expansion in $(x^2 - x_0^2)$ is used, where x_0 is the lower value of each range. For $x \ge 36$, an asymptotic series is used.

4.2 Accuracies

The method used to evaluate the function is designed to give approximately thirteen figures accuracy, but to do this a computer word length of at least fourteen to fifteen figures must be available. A word length longer than this will not necessarily give any more than thirteen figures. The single precision version uses the same method and therefore does not significantly reduce the calculation time.