

NAG Library Routine Document

E04DJF/E04DJA

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

To supply optional parameters to E04DGF/E04DGA from an external file. More precisely, E04DJF must be used to supply optional parameters to E04DGF and E04DJA must be used to supply optional parameters to E04DGA.

E04DJA is a version of E04DJF that has additional parameters in order to make it safe for use in multithreaded applications (see Section 5). The initialization routine E04WBF **must** have been called before calling E04DJA.

2 Specification

2.1 Specification for E04DJF

```
SUBROUTINE E04DJF(IOPTNS, INFORM)
  INTEGER          IOPTNS, INFORM
```

2.2 Specification for E04DJA

```
SUBROUTINE E04DJA(IOPTNS, LWSAV, IWSAV, RWSAV, INFORM)
  INTEGER          IOPTNS, IWSAV(610), INFORM
  double precision RWSAV(475)
  LOGICAL          LWSAV(120)
```

3 Description

E04DJF/E04DJA may be used to supply values for optional parameters to E04DGF/E04DGA. E04DJF/E04DJA reads an external file and each line of the file defines a single optional parameter. It is only necessary to supply values for those parameters whose values are to be different from their default values.

Each optional parameter is defined by a single character string, of up to 72 characters, consisting of one or more items. The items associated with a given option must be separated by spaces, or equals signs [=]. Alphabetic characters may be upper or lower case. The string

```
Print Level = 1
```

is an example of a string used to set an optional parameter. For each option the string contains one or more of the following items:

- a mandatory keyword;
- a phrase that qualifies the keyword;
- a number that specifies an INTEGER or **double precision** value. Such numbers may be up to 16 contiguous characters in Fortran's I, F, E or D formats, terminated by a space if this is not the last item on the line.

Blank strings and comments are ignored. A comment begins with an asterisk (*) and all subsequent characters in the string are regarded as part of the comment.

The file containing the options must start with Begin and must finish with End. An example of a valid options file is:

```
Begin * Example options file
  Print level = 5
End
```

For E04DJF each line of the file is normally printed as it is read, on the current advisory message unit (see X04ABF), but printing may be suppressed using the keyword Nolist. To suppress printing of Begin, Nolist must be the first option supplied as in the file:

```
Begin
  Nolist
  Print level = 5
End
```

Printing will automatically be turned on again after a call to E04DGF or E04DJF and may be turned on again at any time using the keyword List.

For E04DJA printing is turned off by default, but may be turned on at any time using the keyword List.

Optional parameter settings are preserved following a call to E04DGF/E04DGA and so the keyword Defaults is provided to allow you to reset all the optional parameters to their default values before a subsequent call to E04DGF/E04DGA.

A complete list of optional parameters, their abbreviations, synonyms and default values is given in Section 11 in E04DGF/E04DGA.

4 References

None.

5 Parameters

1: IOPTNS – INTEGER *Input*

On entry: the unit number of the options file to be read.

Constraint: $0 \leq \text{IOPTNS} \leq 99$.

2: INFORM – INTEGER *Output*

Note: for E04DJA, INFORM does not occur in this position in the parameter list. See the additional parameters described below.

On exit: contains zero if the options file has been successfully read and a value > 0 otherwise (see Section 6).

Note: the following are additional parameters for specific use with E04DJA. Users of E04DJF therefore need not read the remainder of this description.

2: LWSAV(120) – LOGICAL array *Communication Array*

3: IWSAV(610) – INTEGER array *Communication Array*

4: RWSAV(475) – **double precision** array *Communication Array*

The arrays LWSAV, IWSAV and RWSAV **must not** be altered between calls to any of the routines E04DJA, E04DGA, E04DKA and E04WBF.

5: INFORM – INTEGER *Output*

Note: see the parameter description for INFORM above.

6 Error Indicators and Warnings

Errors or warnings detected by the routine:

INFORM = 1

IOPTNS is not in the range $[0, 99]$.

INFORM = 2

Begin was found, but end-of-file was found before End was found.

INFORM = 3

end-of-file was found before Begin was found.

INFORM = 4

Not used.

INFORM = 5

One or more lines of the options file is invalid. Check that all keywords are neither ambiguous nor misspelt.

7 Accuracy

Not applicable.

8 Further Comments

E04DKF/E04DKA may also be used to supply optional parameters to E04DGF/E04DGA.

9 Example

This example solves the same problem as the example for E04DGF/E04DGA, but in addition illustrates the use of E04DJF/E04DJA and E04DKF/E04DKA to set optional parameters for E04DGF/E04DGA.

In this example the options file read by E04DJF/E04DJA is appended to the data file for the program (see Section 9.2). It would usually be more convenient in practice to keep the data file and the options file separate.

9.1 Program Text

Note: *the following program illustrates the use of E04DJF. An equivalent program illustrating the use of E04DJA is available with the supplied Library and is also available from the NAG web site.*

```
*      E04DJF Example Program Text
*      Mark 16 Release. NAG Copyright 1993.
*      .. Parameters ..
      INTEGER          NMAX
      PARAMETER        (NMAX=10)
      INTEGER          NIN, NOUT
      PARAMETER        (NIN=5,NOUT=6)
*      .. Local Scalars ..
      DOUBLE PRECISION OBJF
      INTEGER          I, IFAIL, INFORM, ITER, N, OUTCHN
*      .. Local Arrays ..
      DOUBLE PRECISION OBJGRD(NMAX), RUSER(5*NMAX), WORK(13*NMAX),
+      X(NMAX)
      INTEGER          IUSER(NMAX), IWORK(NMAX+1)
*      .. External Subroutines ..
      EXTERNAL         E04DGF, E04DJF, E04DKF, OBJFN1, X04ABF
*      .. Executable Statements ..
      WRITE (NOUT,*) 'E04DJF Example Program Results'
      OUTCHN = NOUT
*      Skip heading in data file
      READ (NIN,*)
      READ (NIN,*) N
      IF (N.LE.NMAX) THEN
*
*          Read X from data file
*
          READ (NIN,*) (X(I),I=1,N)
*
*          Set two options using E04DKF
*
          CALL E04DKF(' Verify Level = -1 ')
```

```

*      CALL E04DKF(' Maximum Step Length = 100.0 ')
*
*      Set the unit number for advisory messages to OUTCHN
*
*      CALL X04ABF(1,OUTCHN)
*
*      Read the options file for the remaining options
*
*      CALL E04DJF(NIN,INFORM)
*
*      IF (INFORM.NE.0) THEN
+        WRITE (NOUT,99999) 'E04DJF terminated with INFORM = ',
+          INFORM
+        GO TO 20
*      END IF
*
*      Solve the problem
*
*      IFAIL = 1
*
*      CALL E04DGF(N,OBJFN1,ITER,OBJF,OBJGRD,X,IWORK,WORK,IUSER,RUSER,
+        IFAIL)
+      IF (IFAIL.NE.0) THEN
+        WRITE (NOUT,*)
+        WRITE (NOUT,99999) ' ** E04DGF returned with IFAIL = ',
+          IFAIL
+      END IF
*
*      END IF
20 CONTINUE
*
99999 FORMAT (1X,A,I5)
END
*
SUBROUTINE OBJFN1(MODE,N,X,OBJF,OBJGRD,NSTATE,IUSER,RUSER)
*  Routine to evaluate F(x) and approximate its 1st derivatives
*  .. Scalar Arguments ..
DOUBLE PRECISION OBJF
INTEGER          MODE, N, NSTATE
*  .. Array Arguments ..
DOUBLE PRECISION OBJGRD(N), RUSER(*), X(N)
INTEGER          IUSER(*)
*  .. Local Scalars ..
DOUBLE PRECISION EPSRF
INTEGER          I, IFAIL, IMODE, IWARN, LHES, MSGGLVL
*  .. Local Arrays ..
DOUBLE PRECISION USE(1)
INTEGER          IUSE(1)
*  .. External Subroutines ..
EXTERNAL          E04XAF, OBJFN2
*  .. Executable Statements ..
IF (MODE.EQ.0) THEN
*    Evaluate F(x) only
*    CALL OBJFN2(MODE,N,X,OBJF,OBJGRD,NSTATE,IUSE,USE)
*
*  ELSE IF (MODE.EQ.2) THEN
*    Evaluate F(x) and approximate its 1st derivatives
*    MSGGLVL = 0
*    EPSRF = 0.0D0
*    IMODE = 0
*    LHES = N
*    DO 20 I = 1, N
*      RUSER(I) = 0.0D0
*      RUSER(4*N+I) = X(I)
20    CONTINUE
*    IFAIL = 1
*
*    CALL E04XAF(MSGGLVL,N,EPSRF,RUSER(4*N+1),IMODE,OBJFN2,LHES,
+      RUSER(1),OBJF,OBJGRD,RUSER(N+1),RUSER(2*N+1),IWARN,
+      RUSER(3*N+1),IUSE,USE,IUSER,IFAIL)

```

```

*
      END IF
*
      RETURN
      END
      SUBROUTINE OBJFN2(MODE,N,X,OBJF,OBJGRD,NSTATE,IUSE,USE)
* Routine to evaluate F(x)
* .. Scalar Arguments ..
      DOUBLE PRECISION OBJF
      INTEGER           MODE, N, NSTATE
* .. Array Arguments ..
      DOUBLE PRECISION OBJGRD(N), USE(*), X(N)
      INTEGER           IUSE(*)
* .. Local Scalars ..
      DOUBLE PRECISION X1, X2
* .. Intrinsic Functions ..
      INTRINSIC         EXP
* .. Executable Statements ..
      X1 = X(1)
      X2 = X(2)
*
      OBJF = EXP(X1)*(4.0D0*X1**2+2.0D0*X2**2+4.0D0*X1*X2+2.0D0*X2+
+          1.0D0)
*
      RETURN
      END

```

9.2 Program Data

E04DJF Example Program Data

```

      2                               :Value of N
     -1.0  1.0                       :End of X
Begin   Example options file for   E04DJF
      Iteration Limit   =   25       * (Default = 50)
      Print Level       =    1       * (Default = 10)
End

```

9.3 Program Results

E04DJF Example Program Results

Calls to E04DKF

```

      Verify Level = -1
      Maximum Step Length = 100.0

```

OPTIONS file

```

      Begin   Example options file for   E04DJF
      Iteration Limit   =   25       * (Default = 50)
      Print Level       =    1       * (Default = 10)
      End

```

*** E04DGF

Parameters

```

Variables.....                2

Maximum step length....  1.00E+02   EPS (machine precision)  1.11E-16
Optimality tolerance...  3.26E-12   Linesearch tolerance...  9.00E-01

Est. opt. function val.      None    Function precision.....  4.37E-15
Verify level.....           -1

```

Iteration limit..... 25 Print level..... 1

Exit from E04DGF after 10 iterations.

Variable		Value	Gradient value
Varbl	1	0.500000	9.1E-07
Varbl	2	-1.00000	8.3E-07

Exit E04DGF - Optimal solution found.

Final objective value = 0.5271691E-13
