

## NAG Library Function Document

### nag\_opt\_nlp\_revcomm\_option\_set\_file (e04udc)

#### 1 Purpose

To supply optional parameters to nag\_opt\_nlp\_revcomm (e04ufc) from an external file.

#### 2 Specification

```
#include <nag.h>
#include <nage04.h>

void nag_opt_nlp_revcomm_option_set_file (Nag_FileID fileid,
    Nag_Boolean lwsav[], Integer iwsav[], double rwsav[], NagError *fail)
```

#### 3 Description

nag\_opt\_nlp\_revcomm\_option\_set\_file (e04udc) may be used to supply values for optional parameters to nag\_opt\_nlp\_revcomm (e04ufc). nag\_opt\_nlp\_revcomm\_option\_set\_file (e04udc) reads an external file and each line of the file defines a single optional parameter. It is only necessary to supply values for those arguments whose values are to be different from their default values.

Each optional parameter is defined by a single character string, 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 value. Such numbers may be up to 40 contiguous characters which can be read using C's d or g 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
```

Optional parameter settings are preserved following a call to nag\_opt\_nlp\_revcomm (e04ufc) 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 nag\_opt\_nlp\_revcomm (e04ufc).

A complete list of optional parameters, their abbreviations, synonyms and default values is given in Section 12 in nag\_opt\_nlp\_revcomm (e04ufc).

#### 4 References

None.

## 5 Arguments

- 1: **fileid** – Nag\_FileID *Input*  
*On entry:* the ID of the option file to be read as returned by a call to nag\_open\_file (x04acc).
  - 2: **lwsav**[120] – Nag\_Boolean *Communication Array*
  - 3: **iwsav**[610] – Integer *Communication Array*
  - 4: **rwsav**[475] – double *Communication Array*
- The arrays **lwsav**, **iwsav** and **rwsav** MUST NOT be altered between calls to any of the functions nag\_opt\_nlp\_revcomm\_option\_set\_file (e04udc), nag\_opt\_nlp\_revcomm\_option\_set\_string (e04uec), nag\_opt\_nlp\_revcomm (e04ufc) or nag\_opt\_nlp\_revcomm\_init (e04wbc).
- 5: **fail** – NagError \* *Input/Output*  
The NAG error argument (see Section 2.7 in How to Use the NAG Library and its Documentation).

## 6 Error Indicators and Warnings

### NE\_ALLOC\_FAIL

Dynamic memory allocation failed.  
See Section 2.3.1.2 in How to Use the NAG Library and its Documentation for further information.

### NE\_BAD\_PARAM

On entry, argument *<value>* had an illegal value.

### NE\_INTERNAL\_ERROR

An internal error has occurred in this function. Check the function call and any array sizes. If the call is correct then please contact NAG for assistance.

An unexpected error has been triggered by this function. Please contact NAG.  
See Section 2.7.6 in How to Use the NAG Library and its Documentation for further information.

### NE\_INVALID\_OPTION

One or more lines of the options file is invalid.

### NE\_MISSING\_BEGIN

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

### NE\_MISSING\_END

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

### NE\_NO\_LICENCE

Your licence key may have expired or may not have been installed correctly.  
See Section 2.7.5 in How to Use the NAG Library and its Documentation for further information.

### NE\_NOT\_READ\_FILE

Could not open options file with **fileid** = *<value>*.

## 7 Accuracy

Not applicable.

## 8 Parallelism and Performance

`nag_opt_nlp_revcomm_option_set_file` (e04udc) is not threaded in any implementation.

## 9 Further Comments

`nag_opt_nlp_revcomm_option_set_string` (e04uec) may also be used to supply optional parameters to `nag_opt_nlp_revcomm` (e04ufc).

## 10 Example

This example solves the same problem as the example for `nag_opt_nlp_revcomm` (e04ufc), but in addition illustrates the use of `nag_opt_nlp_revcomm_option_set_file` (e04udc) and `nag_opt_nlp_revcomm_option_set_string` (e04uec) to set optional parameters for `nag_opt_nlp_revcomm` (e04ufc).

### 10.1 Program Text

```
/* nag_opt_nlp_revcomm_option_set_file (e04udc) Example Program.
 *
 * NAGPRODCODE Version.
 *
 * Copyright 2016 Numerical Algorithms Group.
 *
 * Mark 26, 2016.
 */
#include <stdio.h>
#include <nag.h>
#include <nag_stdlib.h>
#include <nage04.h>

int main(void)
{
    const char *optionsfile = "e04udce.opt";

    /* Scalars */
    double objf, nctotal;
    Integer exit_status = 0, i, irevcm, iter, j, n, nclin, ncnln;
    Integer tda, tdcj, tdr, licomm, lrcomm;

    /* Arrays */
    double *a = 0, *bl = 0, *bu = 0, *c = 0, *cjac = 0, *clamda = 0, *objgrd = 0;
    double *r = 0, *rcomm = 0, rwsav[475], *x = 0;
    Integer *icomm = 0, *istate = 0, iwsav[610], *needc = 0;
    char cwsav[5 * 80];

    /* Nag Types */
    Nag_Boolean lwsav[120];
    NagError fail;
    Nag_FileID optfileid;

#define A(I,J) a[(I-1)*tda + J - 1]
#define CJAC(I,J) cjac[(I-1)*tdcj + J - 1]

    INIT_FAIL(fail);

    printf("nag_opt_nlp_revcomm_option_set_file (e04udc) "
           "Example Program Results\n");
    fflush(stdout);

    /* Skip heading in data file */
#ifdef _WIN32
    scanf_s("%*[^\\n] ");
#else
    scanf("%*[^\\n] ");
#endif
#endif
```

```

#ifdef _WIN32
    scanf_s("%" NAG_IFMT "%" NAG_IFMT "%" NAG_IFMT "%*[\n] ", &n, &nclin,
            &ncnln);
#else
    scanf("%" NAG_IFMT "%" NAG_IFMT "%" NAG_IFMT "%*[\n] ", &n, &nclin,
            &ncnln);
#endif

    if (n <= 0 || nclin < 0 || ncnln < 0) {
        printf("At least one of n, nclin, or ncnln is invalid\n");
        exit_status = 1;
    }
    else {
        tda = MAX(nclin, n);
        tdcj = MAX(ncnln, n);
        tdr = n;
        nctotal = n + nclin + ncnln;
        licomm = 3 * n + nclin + 2 * ncnln;
        lrcomm = 21 * n + 2;
        if (ncnln || nclin)
            lrcomm += 2 * n * n + 11 * nclin;
        if (ncnln)
            lrcomm += n * nclin + 2 * n * ncnln + 22 * ncnln - 1;

        /* Allocate memory */
        if (!(a = NAG_ALLOC(tda * MAX(1, nclin), double)) ||
            !(b1 = NAG_ALLOC(nctotal, double)) ||
            !(bu = NAG_ALLOC(nctotal, double)) ||
            !(istate = NAG_ALLOC(nctotal, Integer)) ||
            !(c = NAG_ALLOC(ncnln, double)) ||
            !(cjac = NAG_ALLOC(tdcj * MAX(1, ncnln), double)) ||
            !(clamda = NAG_ALLOC(nctotal, double)) ||
            !(objgrd = NAG_ALLOC(n, double)) ||
            !(r = NAG_ALLOC(tdr * n, double)) ||
            !(x = NAG_ALLOC(n, double)) ||
            !(needc = NAG_ALLOC(ncnln, Integer)) ||
            !(icomm = NAG_ALLOC(licomm, Integer)) ||
            !(rcomm = NAG_ALLOC(lrcomm, double)))
        {
            printf("Allocation failure\n");
            exit_status = -1;
        }
        else {
            /* Read A, BL, BU and X from data file */
            if (nclin > 0) {
                for (i = 1; i <= nclin; ++i)
                    for (j = 1; j <= n; ++j)
#ifdef _WIN32
                        scanf_s("%lf", &A(i, j));
#else
                        scanf("%lf", &A(i, j));
#endif
            }
#ifdef _WIN32
            scanf_s("%*[\n] ");
#else
            scanf("%*[\n] ");
#endif
        }

        for (i = 0; i < nctotal; ++i)
#ifdef _WIN32
            scanf_s("%lf", &b1[i]);
#else
            scanf("%lf", &b1[i]);
#endif

#ifdef _WIN32
            scanf_s("%*[\n] ");
#else
            scanf("%*[\n] ");
#endif
    }
}

```

```

        for (i = 0; i < nctotal; ++i)
#ifdef _WIN32
            scanf_s("%lf", &bu[i]);
#else
            scanf("%lf", &bu[i]);
#endif

#ifdef _WIN32
            scanf_s("%*[\n] ");
#else
            scanf("%*[\n] ");
#endif
        for (i = 0; i < n; ++i)
#ifdef _WIN32
            scanf_s("%lf", &x[i]);
#else
            scanf("%lf", &x[i]);
#endif

        /* Set all constraint Jacobian elements to zero.
           Note that this will only work when 'Derivative Level = 3'
           (the default; see Section 11.2) */

        for (j = 1; j <= n; ++j)
            for (i = 1; i <= ncnln; ++i)
                CJAC(i, j) = 0.0;

        /* Initialize nag_opt_nlp_revcomm (e04ufc) and check for error
           exits */
        nag_opt_nlp_revcomm_init("e04ufc", cwsav, 5, lwsav, 120, iwsav, 610,
                                rwsav, 475, &fail);

        /* Set three options using
           nag_opt_nlp_revcomm_option_set_string (e04uec) */
        nag_opt_nlp_revcomm_option_set_string("Infinite Bound Size = 1.0d+25",
                                                lwsav, iwsav, rwsav, &fail);
        nag_opt_nlp_revcomm_option_set_string("Print Level = 1", lwsav, iwsav,
                                                rwsav, &fail);
        nag_opt_nlp_revcomm_option_set_string("Verify Level = 11", lwsav, iwsav,
                                                rwsav, &fail);

        /* Use nag_opt_sparse_nlp_option_set_file (e04vkc) to read some
           * options from the options file. Call nag_open_file (x04acc) to
           * set the options file optfileid */
        /* nag_open_file (x04acc), see above. */
        nag_open_file(optionsfile, 0, &optfileid, &fail);

        /* nag_opt_nlp_revcomm_option_set_file (e04udc).
           * Supply optional parameter values for
           * nag_opt_nlp_revcomm (e04ufc) from external file
           */
        nag_opt_nlp_revcomm_option_set_file(optfileid, lwsav, iwsav, rwsav,
                                             &fail);

        /* Solve the problem */
        irevcm = 0;

        do {
            nag_opt_nlp_revcomm(&irevcm, n, nclin, ncnln, tda, tdcj, tdr, a,
                                bl, bu, &iter, istate, c, cjac, clamda, &objf,
                                objgrd, r, x, needc, icomm, licomm, rcomm, lrcomm,
                                cwsav, lwsav, iwsav, rwsav, &fail);

            if (irevcm == 1 || irevcm == 3)
                /* Evaluate the objective function */
                objf = x[0] * x[3] * (x[0] + x[1] + x[2]) + x[2];

            if (irevcm == 2 || irevcm == 3) {
                /* Evaluate the objective gradient */
                objgrd[0] = x[3] * (2.0 * x[0] + x[1] + x[2]);
                objgrd[1] = x[0] * x[3];
            }
        } while (irevcm != 4);

```

```

    objgrd[2] = x[0] * x[3] + 1.0;
    objgrd[3] = x[0] * (x[0] + x[1] + x[2]);
}

if (irevcm == 4 || irevcm == 6) {
    /* Evaluate the nonlinear constraint functions */
    if (needc[0] > 0)
        c[0] = x[0] * x[0] + x[1] * x[1] + x[2] * x[2] + x[3] * x[3];
    if (needc[1] > 0)
        c[1] = x[0] * x[1] * x[2] * x[3];
}

if (irevcm == 5 || irevcm == 6) {
    /* Evaluate the constraint Jacobian */
    if (needc[0] > 0) {
        CJAC(1, 1) = 2.0 * x[0];
        CJAC(1, 2) = 2.0 * x[1];
        CJAC(1, 3) = 2.0 * x[2];
        CJAC(1, 4) = 2.0 * x[3];
    }

    if (needc[1] > 0) {
        CJAC(2, 1) = x[1] * x[2] * x[3];
        CJAC(2, 2) = x[0] * x[2] * x[3];
        CJAC(2, 3) = x[0] * x[1] * x[3];
        CJAC(2, 4) = x[0] * x[1] * x[2];
    }
}
} while (irevcm > 0);

if (fail.code != NE_NOERROR) {
    printf("e04ufc failed.\n%s\n", fail.message);
    exit_status = 1;
}
}

/* Deallocate any allocated arrays */
NAG_FREE(a);
NAG_FREE(bl);
NAG_FREE(bu);
NAG_FREE(istate);
NAG_FREE(c);
NAG_FREE(cjac);
NAG_FREE(clamda);
NAG_FREE(objgrd);
NAG_FREE(r);
NAG_FREE(x);
NAG_FREE(needc);
NAG_FREE(icommm);
NAG_FREE(rcomm);
}
return exit_status;
}

```

## 10.2 Program Data

Begin \* Example options file for e04ufc

Major Iteration Limit = 15 \* (Default = 50)

Minor Iteration Limit = 10 \* (Default = 50)

End

nag\_opt\_nlp\_revcomm\_option\_set\_file (e04udc) Example Program Data

4	1	2							:Values of n, nclin and ncnln
1.0	1.0	1.0	1.0						:End of matrix a
1.0	1.0	1.0	1.0	-1.0e+25	-1.0e+25	25.0			:End of bl
5.0	5.0	5.0	5.0	20.0	40.0	1.0e+25			:End of bu
1.0	5.0	5.0	1.0						:End of x

### 10.3 Program Results

nag\_opt\_nlp\_revcomm\_option\_set\_file (e04udc) Example Program Results

\*\*\* e04ufc

Parameters

-----

Linear constraints.....	1	Variables.....	4
Nonlinear constraints..	2		
Infinite bound size....	1.00E+25	COLD start.....	
Infinite step size....	1.00E+25	EPS (machine precision)	1.11E-16
Step limit.....	2.00E+00	Hessian.....	NO
Linear feasibility.....	1.05E-08	Crash tolerance.....	1.00E-02
Nonlinear feasibility..	1.05E-08	Optimality tolerance...	3.26E-12
Line search tolerance..	9.00E-01	Function precision.....	4.37E-15
Derivative level.....	3	Monitoring file.....	-1
Verify level.....	11		
Start obj chk at varble	1	Stop obj chk at varble.	4
Start con chk at varble	1	Stop con chk at varble.	4
Major iterations limit.	15	Major print level.....	1
Minor iterations limit.	10	Minor print level.....	0
Workspace provided is	IWORK( 17),	WORK( 192).	
To solve problem we need	IWORK( 17),	WORK( 192).	

Verification of the objective gradients.

-----

The objective gradients seem to be ok.

Directional derivative of the objective	8.15250000E-01
Difference approximation	8.15249734E-01

J	X(J)	DX(J)	G(J)	Difference approxn	Itns
1	1.00E+00	3.86E-07	1.20000000E+01	1.20000000E+01 OK	1
2	5.00E+00	7.94E-06	1.00000000E+00	1.00000000E+00 OK	3
3	5.00E+00	7.94E-06	2.00000000E+00	2.00000000E+00 OK	3
4	1.00E+00	2.65E-06	1.10000000E+01	1.10000000E+01 OK	3

4 Objective gradients out of the 4  
set in cols 1 through 4 seem to be ok.

The largest relative error was 5.54E-12 in element 1

Exit from NP problem after 5 major iterations,  
9 minor iterations.

Varbl	State	Value	Lower Bound	Upper Bound	Lagr Mult	Slack
V 1	LL	1.00000	1.00000	5.00000	1.088	.
V 2	FR	4.74300	1.00000	5.00000	.	0.2570
V 3	FR	3.82115	1.00000	5.00000	.	1.179
V 4	FR	1.37941	1.00000	5.00000	.	0.3794

L Con	State	Value	Lower Bound	Upper Bound	Lagr Mult	Slack
L 1	FR	10.9436	None	20.0000	.	9.056

N	Con	State	Value	Lower Bound	Upper Bound	Lagr Mult	Slack
N	1	UL	40.0000	None	40.0000	-0.1615	-3.5264E-11
N	2	LL	25.0000	25.0000	None	0.5523	-2.8791E-11

Exit e04ufc - Optimal solution found.

Final objective value = 17.01402

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