

# X04BWFP

## NAG Parallel Library Routine Document

**Note:** before using this routine, please read the Users' Note for your implementation to check for implementation-dependent details. You are advised to enclose any calls to NAG Parallel Library routines between calls to Z01AAFP and Z01ABFP.

### 1 Description

X04BWFP outputs an  $m$  by  $n$  complex matrix  $A$  stored in a cyclic two-dimensional block distribution on a logical grid of processors to an external file (in its natural, non-distributed form).

This routine outputs matrices stored in the form required by some routines in Chapter F04.

### 2 Specification

```

SUBROUTINE X04BWFP(ICNTXT, NOUT, M, N, NB, A, LDA, FORMAT, WORK,
1                IFAIL)
COMPLEX*16      A(LDA,*), WORK(*)
INTEGER        ICNTXT, NOUT, M, N, NB, LDA, IFAIL
CHARACTER*(*)  FORMAT

```

### 3 Usage

#### 3.1 Definitions

The following definitions are used in describing the data distribution within this document:

- $m_p$  – the number of rows in the Library Grid.
- $n_p$  – the number of columns in the Library Grid.
- $p_r$  – the row grid coordinate of the calling processor.
- $p_c$  – the column grid coordinate of the calling processor.
- $N_b$  – the blocking factor for the distribution of the rows and columns of a matrix  $X$ .
- $\text{numroc}(\alpha, b_\ell, q, s, k)$  – a function which gives the **number of rows or columns** of a distributed matrix owned by the processor with the row or column coordinate  $q$  ( $p_r$  or  $p_c$ ), where  $\alpha$  is the total number of rows or columns of the matrix,  $b_\ell$  is the blocking factor used ( $N_b$ ),  $s$  is the row or column coordinate of the processor that possesses the first row or column of the distributed matrix and  $k$  is either  $n_p$  or  $m_p$ . The Library provides the function Z01CAFP (NUMROC) for the evaluation of this function.

#### 3.2 Global and Local Arguments

The following global **input** arguments must have the same value on entry to the routine on each processor and the global **output** arguments will have the same value on exit from the routine on each processor:

Global input arguments:        M, N, NB, IFAIL

Global output arguments:      IFAIL

**Note:** NOUT and FORMAT are only referenced on the root (or {0,0}) processor since it is only the root (or {0,0} processor) which performs output.

#### 3.3 Distribution Strategy

The matrix  $A$  should be partitioned into  $N_b$  by  $N_b$  square blocks and stored in an array  $A$  in a cyclic two-dimensional block distribution. This data distribution is described in more detail in the Essential Introduction of the NAG Parallel Library and in the F04 Chapter Introduction.

This routine assumes that the data has already been correctly distributed, and if this is not the case will fail to produce correct results.

## 4 Arguments

- 1:** ICNTXT — INTEGER *Local Input*  
*On entry:* the Library context, usually returned by a call to the Library Grid initialisation routine Z01AAFP.  
**Note:** the value of ICNTXT **must not** be changed.
- 2:** NOUT — INTEGER *Local Input*  
*On entry:* the unit number to which the output will be directed.  
*Constraint:*  $0 \leq \text{NOUT} \leq 99$ .
- 3:** M — INTEGER *Global Input*  
*On entry:*  $m$ , the number of rows of the matrix  $A$ .  
*Constraint:*  $M \geq 0$ .
- 4:** N — INTEGER *Global Input*  
*On entry:*  $n$ , the number of columns of the matrix  $A$ .  
*Constraint:*  $N \geq 0$ .
- 5:** NB — INTEGER *Global Input*  
*On entry:*  $N_b$ , the blocking factor for distributing the matrix  $A$ .  
*Constraint:*  $\text{NB} \geq 1$ .
- 6:** A(LDA,\*) — COMPLEX\*16 array *Local Input*  
**Note:** the size of the second dimension of the array  $A$  must be at least  $\max(1, \text{numroc}(N, \text{NB}, p_c, 0, n_p))$ .  
*On entry:* the local part of the matrix  $A$ , distributed in a cyclic two-dimensional block fashion.
- 7:** LDA — INTEGER *Local Input*  
*On entry:* the size of the first dimension of the array  $A$  as declared in the (sub)program from which X04BWFP is called.  
*Constraint:*  $\text{LDA} \geq \max(1, \text{numroc}(M, \text{NB}, p_r, 0, m_p))$
- 8:** FORMAT — CHARACTER\*(\*) *Local Input*  
*On entry:* the format which will be used for output of the elements of  $A$ .  
*Constraint:* any legal Fortran format for the output of floating-point numbers.  
**Note:** for reasons of compatibility with the equivalent real routine and of portability, FORMAT must now contain a valid Fortran format, not just a field descriptor for a floating point number.
- 9:** WORK(\*) — COMPLEX\*16 array *Local Workspace*  
**Note:** the dimension of the array WORK must be at least  $\max(1, N)$ .
- 10:** IFAIL — INTEGER *Global Input/Global Output*  
The NAG Parallel Library provides a mechanism, via the routine Z02EAFP, to reduce the amount of parameter validation performed by this routine. For a full description refer to the Z02 Chapter Introduction.  
*On entry:* IFAIL must be set to 0, -1 or 1. For users not familiar with this argument (described in the Essential Introduction) the recommended values are:  
    IFAIL = 0, if multigridding is **not** employed;  
    IFAIL = -1, if multigridding is employed.  
*On exit:* IFAIL = 0 (or -9999 if reduced error checking is enabled) unless the routine detects an error (see Section 5).

## 5 Errors and Warnings

If on entry  $IFAIL = 0$  or  $-1$ , explanatory error messages are output from the root processor (or processor  $\{0,0\}$  when the root processor is not available) on the current error message unit (as defined by X04AAF).

### 5.1 Full Error Checking Mode Only

$IFAIL = -2000$

The routine has been called with an invalid value of  $ICNTXT$  on one or more processors.

$IFAIL = -1000$

The logical processor grid and library mechanism (Library Grid) have not been correctly defined, see Z01AAFP.

$IFAIL = -i$

On entry, the  $i$ th argument was invalid. This error occurred either because a global argument did not have the same value on all logical processors, or because its value on one or more processors was incorrect. An explanatory message distinguishes between these two cases.

### 5.2 Any Error Checking Mode

$IFAIL = 1$

An error has occurred in writing to unit  $NOUT$ . The file may already have been opened for reading only or the user may have run out of disk space.

## 6 Further Comments

Output is performed by the root processor (or  $\{0,0\}$ ) processor if the root processor is not available. All other processors communicate their local portion of the matrix to the root (or  $\{0,0\}$ ) processor.

## 7 References

None.

## 8 Example

See Section 8 of the document for X04BVFP.

---