Part I

CM Fortran Utility Library

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Part I, consisting of Chapters 1 through 8, describes the CM Fortran utility library. The procedures are listed below by functional category.

System Inquiry Functions

```
ARCH = CMF_ARCHITECTURE ( )
NUM = CMF_NUMBER_OF_PROCESSORS ( )
BYTES = CMF_AVAILABLE_MEMORY ( )
```

Array Inquiry Subroutine

```
CMF_DESCRIBE_ARRAY ( ARRAY )
```

Random Number Subroutines

```
CMF_RANDOM ( DEST, LIMIT )
CMF_RANDOM_LONG_S_INTEGER ( DEST, LIMIT )
CMF_RANDOMIZE ( SEED )
```

Dynamic Array Allocation Subroutines

```
CMF_ALLOCATE_ARRAY
   ( ARRAY, EXTENTS, RANK, TYPE )
CMF_ALLOCATE_LAYOUT_ARRAY
   ( ARRAY, EXTENTS, RANK, TYPE, ORDERS, WEIGHTS )
CMF_ALLOCATE_DETAILED_ARRAY
   ( ARRAY, EXTENTS, RANK, TYPE, ORDERS, SUBGRIDS, PMASKS )
CMF_DEALLOCATE_ARRAY ( ARRAY )
```


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Array Aliasing Procedures

```
CMF_ALIAS_TYPE ( ALIAS, TYPE, ARRAY, RESIZE_MODE, ASTAT )
CMF_ALIAS_DETAILED ( ALIAS, RANK, EXTENTS, ORDERS,
   SUBGRIDS, PMASKS, OFFSETS, MASK_CHECK, ARRAY, ASTAT )

LOG = CMF_ARRAY_IS_ALIAS ( ARRAY, ASTAT )
CMF_SET_ALIAS_LOCATION ( ALIAS, LOCATION, ASTAT )
CMF_REMOVE_ALIAS ( ALIAS, ASTAT )
```

Array Descriptor Inquiries

```
INT = CMF_GET_GLOBAL_LOCATION ( ARRAY, OFFSETS, ASTAT )
INT = CMF_GET_PHYSICAL_LOCATION ( ARRAY, OFFSETS, ASTAT )
CMF_GET_AXIS_ORDERS ( ARRAY, ORDERS, RANK, ASTAT )
CMF_GET_LOCAL_EXTENTS ( ARRAY, EXTENTS, RANK, ASTAT )
CMF_GET_LOCAL_STRIDES ( ARRAY, STRIDES, RANK, ASTAT )
CMF_GET_PROCESSOR_MASKS ( ARRAY, MASKS, RANK, ASTAT )
```

Execution Environment (for Aliases)

```
INT = CMF_ARRAY_SIZE_QUANTUM (  )
CMF_SET_ALIAS_SAFETY_LEVEL ( SAFETY_LEVEL )
INT = CMF_GET_ALIAS_SAFETY_LEVEL (  )
```

Array Transfer Subroutines

```
CMF_FE_ARRAY_TO_CM ( DEST, SOURCE )
CMF_FE_ARRAY_FROM_CM ( DEST, SOURCE )
```

Scatter-with-Combining Subroutine

```
CMF_SEND_[ OVERWRITE | ADD | MAX | MIN | IOR | IAND | IEOR ]
   ( DEST, SEND_ADDRESS, SOURCE, MASK )
```

Array Address Construction Procedures

```
GEOMETRY = CMF_GET_GEOMETRY_ID ( ARRAY )
CMF_MAKE_SEND_ADDRESS ( ARRAY )
CMF_MY_SEND_ADDRESS ( ARRAY )
CMF_DEPOSIT_GRID_COORDINATE
   ( GEOMETRY, SEND_ADDRESS, AXIS, COORDINATE, MASK )
```


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Parallel Prefix Subroutine

```
CMF_SCAN_[ COPY | ADD | MAX | MIN | IOR | IAND | IEOR ]
   ( DEST, SOURCE, SEGMENT, AXIS, DIRECTION, INCLUSION,
     SEGMENT_MODE, MASK )
```

Sorting Subroutines

```
CMF_ORDER
   ( DEST, SOURCE, AXIS, MASK )
CMF_RANK
   ( DEST, SOURCE, SEGMENT, AXIS, DIRECTION,
     SEGMENT_MODE, MASK )
CMF_SORT
   ( DEST, SOURCE, SEGMENT, AXIS, DIRECTION,
     SEGMENT_MODE, MASK )
```

Table Lookup Procedures

```
TABLE = CMF_ALLOCATE_TABLE
   ( TYPE, ELEMENT_COUNT, INITIAL_VALUES )
CMF_LOOKUP_IN_TABLE ( DEST, TABLE, INDEX, MASK )
CMF_DEALLOCATE_TABLE ( TABLE )
```

Gathers/Scatters on Serial Axes (Subroutines)

```
CMF_AREF_1D ( DEST, ARRAY, INDEX, MASK )
CMF_ASET_1D ( ARRAY, SOURCE, INDEX, MASK )
```

CM File Operations Procedures

```
CMF_FILE_OPEN ( UNIT, PATH, IOSTAT )
CMF_FILE_OPEN_READONLY ( UNIT, PATH, IOSTAT )
CMF_FILE_CLOSE ( UNIT, IOSTAT )
CMF_FILE_UNLINK ( PATH, IOSTAT )

CMF_CM_ARRAY_TO_FILE ( UNIT, SOURCE, IOSTAT )
CMF_CM_ARRAY_FROM_FILE ( UNIT, DEST, IOSTAT )
CMF_CM_ARRAY_TO_FILE_FMS ( UNIT, SOURCE, IOSTAT )
CMF_CM_ARRAY_FROM_FILE_FMS ( UNIT, DEST, IOSTAT )
CMF_CM_ARRAY_TO_FILE_SO ( UNIT, SOURCE, IOSTAT )
CMF_CM_ARRAY_FROM_FILE_SO ( UNIT, DEST, IOSTAT )
```


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```
CMF_FILE_REWIND ( UNIT, IOSTAT )
CMF_FILE_LSEEK ( UNIT, OFFSET, IOSTAT )
CMF_FILE_LSEEK_FMS ( UNIT, OFFSET, IOSTAT )
CMF_FILE_LLSEEK ( UNIT, OFFSET, IOSTAT )
SIZEOF = CMF_SIZEOF_ARRAY_ELEMENT ( ARRAY )
CMF_FILE_TRUNCATE ( UNIT, LENGTH, IOSTAT )
CMF_FILE_LTRUNCATE ( UNIT, LENGTH, IOSTAT )
```

CM I/O via Sockets or Devices (Subroutines)

```
CMF_FILE_FDOPEN ( UNIT, CMFS_FD, IOSTAT )
CMF_FILE_GET_FD ( UNIT, CMFS_FD, IOSTAT )
```

Initialization Subroutine

```
CMF_INIT ( PADDING, AXISREORDER )
```


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