2212 /322

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# DOCUMENT TRANSMITTAL

CONTROL DOC.

SYSTEM B1800/B1700

PL FILE NO. _____

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# PRODUCT SPECIFICATION

| REV LTR | REVISION ISSUE DATE | APPROVED BY | REVISIONS |
|---------|---------------------|-------------|-----------|
| A | 8/1/75 | J Nale | ORIGINAL ISSUE |
| B | 2/3/78 | Nale | Updated to 7.0 Version |

| Page | Change |
|------|--------|
| All | Updated to VII.0 level and restructured organizationally. B1700 changed to B1800/B1700. Tables numbered. |
| 2-1 | SYSTEM/PATCH information added to Pass 1 output. |
| 2-2 to 2-3 | ENVIRONMENT subsection reordered. Card reader and printer become optional hardware, no longer required. S-memory requirement changed from 16,000 to 12,600. Disk requirement changed from 52,000 to 127,000. Table 2-1 clarified. |
| 3-1 to 3-6 | BCD, BIND, CODE, CONTROL, DATAMAP, DOUBLE, END, INITIAL, INTERPACK, INTERPRETERPACK, INTRINPACK, INTRINSICPACK, LIBRARY, LIBRARYPACK, LIST, MAP, MERGE, NEW, NO, PAGE, RANGE, SEQ, SEQERR, SINGLE, TRUNCATE.NAMES, VOID and XREF options added. ERRORTRACE, SEPARATE, SYMBOLTABLE, TRACEC, BINDER.MONITOR and BSELECTIVEDEBUG deleted or superseded. HARDWARE.MONITOR and TRACE moved to Table 3-1 from Table 3-2. NO CPA warning added to Table 3-2. INTRINSICS amplified to Table 3-2. Two paragraphs added after tables. |
| 4-1 to 4-5 | All new from FORTRAN/INTMAKER generates... paragraph to end of section. |

# TABLE OF CONTENTS

## GENERAL DESCRIPTION

The Fortran compiler accepts Burroughs Standard (minimum level)
Fortran source language as input and generates an executable
Fortran S-language file as output.

The compiler itself is a three-pass program written in SDL that
produces, according to the options set, either an intermediate
code module (ICM) for each subprogram or a final code file for
the group of subprograms being compiled.

This product specification describes the environment and
operation of the compiler, defines the current exceptions to
Burroughs Standard Fortran and discusses the Fortran intrinsics
and FORTRAN/INTMAKER. Further information about Fortran and the
Fortran S-language is in the related documentation listed below.

## RELATED DOCUMENTATION

| NAME | NUMBER |
| --- | --- |
| B1800/B1700 Fortran S-Language | P. S. 2201 6737 |
| B1800/B1700 Fortran Reference Manual | |
| B1800/B1700 Fortran Manual | 1081882 |
| Burroughs Standard Fortran | |

## STANDARDS

The Fortran language implemented on the B1800/B1700 is based on
the minimum-level language specified by the Burroughs Standard
Fortran Manual. In general, the Burroughs Standard is compatible
with 1966 ANSI Fortran and has Fortran IV extensions.

## FUNCTIONAL DESCRIPTION

## THREE PASSES

### PASS 1

The first pass accepts Fortran source and compiler control cards and produces an ICM (Intermediate Code Module) for each subprogram of the group of subprograms being compiled.

Source language input media may be punched cards, magnetic tape or disk. The source presented to the compiler must be in EBCDIC or optionally BCD code. The compiler can merge symbolic sources on the basis of sequence numbers.

As output, the first pass produces (optionally):

1.  An updated EBCDIC symbolic file on tape, disk or punched cards.

2.  One or more of the following printed items:

    a.  Input source with SYSTEM/PATCH information and an indication of merged records.

    b.  Diagnostic messages indicating sources of errors, warnings and possible errors.

    c.  Generated code instructions.

3.  Nonexecutable ICM files of the group of subprograms being compiled.

When separate ICMs are produced for each subprogram compiled, the code in each ICM is in final form except for data addresses and calls on subprograms. The compilation procedure may stop at the end of the first pass and start again with Pass 1 or Pass 2 on

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subsequent executions of the compiler.

### PASS 2

The second pass is used to collect the various subprograms of a program into a final code file. As subprogram ICMs are added to the final code file, subprogram calls are given their final code dictionary number. COMMON blocks are processed by determining how much total data space each block requires. Code for referenced intrinsics is also added from a file consisting of ICMs for the intrinsics.

### PASS 3

The third pass assigns final dictionary entries to COMMON and local data segments. It then goes through the code of any subprograms not already having final data addresses and places the appropriate data dictionary number in data addresses.

### PERFORMANCE

The performance of the compiler is highly dependent upon the B1800/B1700 hardware available. Compilation speeds vary from a minimum of 25 to a maximum of more than 1000 cards per minute. These times do not include that required to bind the subprograms.

### ENVIRONMENT

SOFTWARE:        B1800/B1700 MCP released concurrently with the B1800/B1700 Fortran.

FIRMWARE:        B1800/B1700 Fortran and SDL interpreters released concurrently with the B1800/B1700 Fortran.

REQUIRED HARDWARE:

|  |  |
|---|---|
| S-MEMORY | 12,600 bytes plus MCP requirements. |
| DISK OR SYSTEM DISK | 127,000 bytes for the compiler, 50,000 bytes for the intrinsics, and additional increments of approximately 11,000 bytes per 1,000 source cards for code files. |

OPTIONAL HARDWARE:

|  |  |
|---|---|
| TAPE OR DISK | One tape for old symbolic input and one tape for new symbolic output or sufficient disk space for one or both purposes. |
| CARD READER | One for source language and control cards. |
| PRINTER | One for listing; 120 columns used. |

## COMPILER CONTROL CARDS ($ CARDS)

Compiler control cards ($ cards) may be optionally included in the source deck and, if used, contain specifications to the compiler governing symbolic input and output.

The dollar sign ("$"), which denotes a compiler control card, may appear in column 1 or 2; options, with blanks as delimiters, may follow immediately. If the dollar sign is placed in card column 2, the compiler control card image will be placed in the updated symbolic file (if such a file is generated). Control cards may not be continued. With the exceptions of ERRORTRACE and PROFILES, they may be placed at any point in the source deck.

The format of the compiler control card is given in Table 2-1.

| Card Columns | Contents |
| --- | --- |
| 1 or 2 | $ |
| 2 through 72 | Options in free-field format with blanks as delimiters |
| 73 through 80 | Sequence field or blanks |

Table 2-1:  Compiler Control Card Format

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## OPTIONS

### USER-ORIENTED OPTIONS

The B1800/B1700 set of options is a superset of those specified
in the standard.  Allowed user-oriented options are given in
Table 3-1.

| Option | Default | Function |
|--------|---------|----------|
| BCD | off | Considers all source input to be BCD instead of EBCDIC, from this point until otherwise specified. |
| BIND | on | Enables pass 2.  NO BIND is to perform pass 1 only. |
| CODE | off | Prints a listing of the generated code. |
| CONTROL | on | Enables printing of $ cards in file LINE. |
| DATAMAP | -- | (superseded by MAP) |
| DOUBLE | off | Effects double-spacing by writing a blank line to file LINE after each significant line.  DOUBLE is exactly equivalent to NO SINGLE. |
| DYNAMIC <no.> | -- | Specifies the number of words of dynamic space used.  If there are at least 10 pages, then the default is the sum of the 10 largest data pages; otherwise, it is the sum of all the pages. |
| END | -- | Imposes an immediate end-of-file on all input files.  Special caution should be taken when using END while NEW is in effect. |
| ERRORTRACE | off | (function superseded by TRACEF) |
| HARDWARE.MON-ITOR <number> | -- | Uses two-digit <number> to control hardware monitoring devices (see specifications for specific devices). |

| Option | Default | Function |
|---|---|---|
| INITIAL | on | Initializes all variables to zero, except those initialized by a DATA statement. NO INITIAL causes all variables to "undefined." |
| INTERPPACK <pack name> | -- | Gives pack where interpreter is to be found. The default pack is that containing the compiler. |
| INTERPRETERPACK-- <pack name> | | Same as INTERPPACK. |
| INTRINPACK <pack name> | -- | Gives pack where intrinsics are to be found. The default pack is that containing the compiler. |
| INTRINSICPACK <pack name> | -- | Same as INTRINPACK. |
| LIBRARY <file name> | -- | Inserts the specified file at this point. The <file name> does not include a pack name; the pack containing the compiler is assumed, unless LIBRARYPACK precedes LIBRARY. |
| LIBRARYPACK <pack name> | -- | Precedes the LIBRARY option to specify a pack name for it. |
| LIST | on | Controls listing of program on printer. NO LIST on the first card means file LINE will not be opened; on subsequent cards, it means nothing more will be written to LINE until LIST is specified. |
| MAP | off | Generates a map of the code (or data) addresses of the labels (or variables) used in the program. |
| MERGE | off | Merges file CARDS with file SOURCE, based on sequence numbers (columns 73-80). |
| NEW | off | Generates updated symbolic file NEWSOURCE. |

(Table 3-1 is continued on next page)

| Option | Default | Function |
|--------|---------|----------|
| NO | -- | May precede any option, to disable it. Some options (those with "--" in the default column of this table) do not have on or off states and will simply ignore NO. NO is distributive over a card; e.g., $NO LIST CODE BIND is equivalent to $NO LIST NO CODE NO BIND. |
| PAGE | -- | Starts new page before continuing listing in file LINE. |
| PROFILES | off | Shows execution statistics of the subprogram and the statements within the subprogram, tc allow code optimization. If used, PROFILES must be placed before the first executable statement of a subprogram. Once set, it remains on for subsequent subprograms until removed by NO PROFILES, which may occur at any point in a program. PROFILES shows how often and for how long each subprogram was used, how often individual statements were used within a subprogram and the use of the different types of FORTRAN statements during program execution. |
| RANGE <base> <increment> | -- | Modifies parameters of a previously specified SEQ option. The <base> must be specified. The <increment> defaults to 100 if not specified. |
| SAVEICM | off | Causes the intermediate code files of a source program to remain on disk after binding. |
| SEPARATE | -- | (deleted) |
| SEQ <base> <increment> | -- | Resequences file from this point. If no parameters are specified, the first record is sequenced as 1000 and the increment is 1000. If only one parameter is specified, it is assumed to be the base and the increment is 1000. |

Option       Default                     Function


SEQERR        off     Checks for numbers in sequence field which
                      may be out of sequence.

SINGLE        on      Effects      single-spacing,      with      no
                      nonsignificant blank lines written to LINE.
                      SINGLE is exactly equivalent to NO DOUBLE.

STACKSIZE     --      Specifies the number of words to be used for
 <number>             the evaluation stack. The default is 100 and
                      maximum is 4095.

SUPPRESS      off     Suppresses printing of warning messages.

SYMBOLTABLE   --      (superseded by MAP)

TRACE <number> --     Prints S-machine-level trace information
                      during program execution. The <number> is a
                      three-bit mask as specified for SDL. This is
                      ineffective without the FORTRAN/TRACE
                      interpreter.

TRACEC        off     (deleted from user use)

TRACEF        off     Gives a high-level trace of FORTRAN statement
                      executions. Once set, it remains on for all
                      subsequent statements until removed by NO
                      TRACEF. Each TRACEF line contains the name
                      of the current subprogram, the
                      compiler-generated line number of the
                      current statement in the subprogram and an
                      identification of the statement.

TRUNCATE.NAMES off    Suppresses syntax error for variable
                      identifiers more than six characters long.
                      The compiler will still "see" only the first
                      six characters of an identifier, so caution
                      must be used in keeping names unique.

| Option | Default | Function |
|---|---|---|
| VOID <ending seq. no.> | -- | Voids cards in file SOURCE. VOID is valid only in file CARDS. The VOID control card must have a sequence number in columns 73-80. Beginning with the first card (after the VOID card) which has a sequence number equal to or greater than that on the VOID card, the compiler will void all cards until it finds one greater than the specified <ending sequence number>. If none is specified, it is assumed equal to the VOID card sequence number. |
| XREF | -- | Generates a full cross-reference table of all label and variable names in the whole compilation. |

Table 3-1: User-Oriented Options

## OPTIONS FOR INTRINSICS

In addition to the user-oriented options described above, the
options given in table 3-2 are used in developing intrinsics:

| Option | Default | Function |
|--------|---------|----------|
| BINDER.MONITOR | -- | (deleted from user use) |
| BSELEVTIVEDEBUG | -- | (deleted from user use) |
| CPA | on | Emits a compare parameter operator to check parameters at run time. NO CPA should be used only when compiling I/O intrinsics, and then with extreme caution. |
| INTRINSICS | off | Causes first pass of compiler to perform special processing for the subprogram, considering it an intrinsic rather than a normal subroutine. |
| NEWINTRINSIC | off | Causes first pass of binder to perform special processing for the subprogram, considering it an intrinsic rather than a normal subroutine. |

Table 3-2: Intrinsics-Oriented Options

When setting up intrinsic routines, the procedure is slightly
different for I/O intrinsics and for other intrinsics. In the
case of I/O intrinsics, the intrinsic name must begin with the
letter Q and NO CPA must be specified. For other intrinsics, the
name must begin with any non-Q letter and CPA must be on.

In either case, the next step is tc specify INTRINSICS,
NEWINTRINSIC and, optionally, SAVEICM. To bind the intrinsic
into the intrinsics file (as opposed to being bound into this
immediate code file only), FORTRAN/INTMAKER must be run on it
afterwards.

## INTRINSICS

### STANDARD FILE

The intrinsic file released as part of B1800/B1700 Fortran supplies mathematical functions and subroutines as specified by the standard. Also included in the file are subprograms used for format control of I/O. These are written in Standard Fortran, with some identifiers interpreted as special S-machine operators. The subprograms are compiled separately, then collected together as an intrinsic file by the FORTRAN/INTMAKER program.

### FORTRAN/INTMAKER

The FORTRAN/INTMAKER program is used to create and modify the intrinsic file released as part of the B1800/B1700 Fortran system.

The user may compile subprograms which are to be used by several programs and add them to the intrinsic file. This frees the user from having multiple copies of a subprogram when he wishes to use different pack and family names in naming his programs. Access to subprograms in the file is also faster than those existing as separate files.

Individual subprograms may be added, removed or replaced as desired.

FORTRAN/INTMAKER generates a new intrinsic file by creating a new file combining existing ICMs, by adding intrinsics to an existing file, or by replacing or removing them.

Before execution of FORTRAN/INTMAKER, all intrinsics to be placed in the intrinsic file should either already be in an existing intrinsic file or exist as individual ICMs (created by $SAVEICM at compile time) on a common pack and with a common multifile id.

Input files involved are given in Table 4-1. Output files involved are given in Table 4-2.

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| Input File | External File Name | Contents |
|---|---|---|
| OLD.INTRIN | FOR.INTRIN | Old intrinsic file to be updated; used in ADD, REMOVE and REPLACE mode. |
| ICM | (changed during execution) | Individual ICM files to be added to new file; created by Fortran compiler with $SAVEICM. |
| CARD | CARDS | Control specifications |

Table 4-1: INTMAKER Input Files

| Output File | External File Name | Contents |
|---|---|---|
| LINE | LINE | Output listing of actions taken. |
| NEW.INTRIN | NEW.INTRIN | Intrinsic file being created. |

Table 4-2: INTMAKER Output Files

To create a new intrinsic file, use the CARD deck given in Table
4-3a;    to modify an existing file, use the deck in Table 4-3b.
Semantics of these cards are explained in Table 4-3c.

```
?EX FORTRAN/INTMAKER
?DATA CARDS
$ICM.PACK.FAMILY   X/Y
$INTRIN.OUT        A/B/C
$CREATE
ICM#1
ICM#2
   .
   .
   .
ICM#N
?END
```

Table 4-3a: Deck to Create New Intrinsic File

```
?EX FORTRAN/INTMAKER
?DATA CARDS
$ICM.PACK.FAMILY       P/F
$INTRIN.IN             A/B/C
$INTRIN.OUT            X/Y/Z
$REPLACE (or $REMOVE or $ADD)
ICM#1
   .
   .
   .
ICM#N
$REPLACE (or $REMOVE or $ADD)
ICM#1
   .
   .
   .
ICM#M
   .
   .
   .
?END
```

Table 4-3b: Deck to Modify Intrinsic File

| Option | Function |
|--------|----------|
| ADD | The ICMs specified by the following cards will be added to the existing file. |
| CREATE | This card may not appear in the same input deck with any other $CREATE, $ADD, $REMOVE or $REPLACE cards.<br><br>When present, a new intrinsic file will be created, containing those ICMs specified by the following cards.<br><br>When not present, the existing intrinsic file is used as a template, from which ICMs may be replaced, removed, or to which ICMs may be added. |
| ICM#N | ICM#N is the name of an ICM (file-id only). Only one name may be specified per card. Each group of ICM-name cards must be preceded by either a $CREATE, $REPLACE, $REMOVE or $ADD card. |
| ICM.PACK.FAMILY | Must be present. Specifies pack and family id of all ICMs to be added. |
| INTRIN.IN | May be used to override the default name ("FOR.INTRIN") of the existing intrinsic file to be modified.<br><br>If $CREATE is to be specified, file OLD.INTRIN will not be opened. Therefore, this card is only effective when modifying an existing file. |
| INTRIN.OUT | May be used to override the default name ("NEW.INTRIN") of the file being created. |
| REPLACE | The ICMs specified by the following cards will be replaced from the existing file by new ICMs with the same names. |
| REMOVE | The ICMs specified by the following cards will be deleted from the existing file. |

Table 4-3c: Semantics of Controls in Tables 4-3a and 4-3b.

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Errors will be given if:

-- The total number of intrinsics in the existing file, plus the number of additions and removals, exceeds 256;

-- An attempt is made to add an existing ICM;

-- A misplaced card or an unrecognized $ card is seen;

-- More than one $ICM.PACK.FAMILY card is seen; or

-- A $CREATE card is intermixed with other options.

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