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IBM Systems Reference Library

IBM 1410/7010 Operating System (1410-PR-155) COBOL

This publication is designed to be used by programmers in conjunction with the publication, *IBM General Information Manual, COBOL,* Form F28-8053, and contains additional specifications required to write COBOL programs to be processed under the 1410/7010 Operating System.

The similarity between COBOL and ordinary business English provides programmers with a convenient method for writing source programs. Source program statements are translated directly into machine language by the COBOL compiler (1410-CB-969), which takes full advantage of the capabilities of the IBM 1410 and 7010 Data Processing Systems.

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IBM 1410/7010 Operating System; COBOL, Form C28-0327,
with its associated Technical Newsletter (N28-1080).

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Contents

Purpose of this Publication

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Purpose of the Language

The similarity between COBOL and ordinary business English provides programmers with a convenient method for writing source programs. Source program statements are translated directly into machine language by the COBOL compiler, which takes full advantage of the capabilities of the IBM 1410 and 7010 Data Processing Systems.

Prerequisite and Related Information

A basic knowledge of COBOL and the IBM 1410/7010 Operating System is required, and a knowledge of the IBM 1410 or 7010 Data Processing System is recommended in order to fully understand the information presented in this publication.

Anyone without this prior knowledge is requested to read the following publications:

IBM General Information Manual, COBOL, Form F28-8053

IBM 1410/7010 Operating System; Basic Concepts, Form C28-0318

IBM 1410 Principles of Operation, Form A22-0576 or

IBM 7010 Principles of Operation, Form A22-6726

The following IBM 1410/7010 Operating System publications are mentioned in this manual and should be available for reference purposes:

System Monitor, Form C28-0319

System Generation, Form C28-0352

Basic Input/Output Control System, Form C28-0322

Operator's Guide, Form C28-0351

In order to make full use of the 1410/7010 COBOL language, and to run COBOL programs within the framework of the Operating System, the reader must be familiar with the contents of the publication, *System Monitor.*

Machine Requirements

The minimum machine requirements for compiling programs using the COBOL compiler are included in the publication, *System Generation,* Form C28-0352. However, machine requirements for running an object program depend upon the nature of the program.

Acknowledgment

In accordance with the requirements of the official government manual, *COBOL-1961-Extended,* Form number 1962-0668996, describing COBOL (obtained by sending a purchase order and $1.25 to: Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.), the following extract from that manual is presented for the information and guidance of the user:

"This publication is based on the COBOL System developed in 1959 by a committee composed of government users and computer manufacturers. The organizations participating in the original development were:

Air Materiel Command, United States Air Force
Bureau of Standards, United States Department of Commerce
Burroughs Corporation
David Taylor Model Basin, Bureau of Ships, United States Navy
Electronic Data Processing Division, Minneapolis-Honeywell Regulator Company
International Business Machines Corporation
Radio Corporation of America
Sylvania Electric Products, Inc.
UNIVAC Division of Sperry Rand Corporation

"In addition to the organizations listed above, the following other organizations participated in the work of the Maintenance Group:

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COBOL Language Forms and Notations

Throughout this publication, all the basic forms are prescribed for the various verbs, clauses, entries, and other essential elements of the 1410/7010 COBOL language. These are generalized forms intended to guide the programmer in writing his own statements. If statements are written in formats other than those presented in this manual, the compilation will result in error.

The following rules of notation have been followed in the presentation of these forms:

1. All words printed entirely in capital letters are COBOL words; i.e., words that have preassigned meanings in the COBOL system.

2. All underlined words are required unless the portion of the format containing them is itself optional; i.e., enclosed in square brackets. These are key words and if any such word is missing or is incorrectly spelled, it is an error in the program.

3. All COBOL words not underlined may be included or omitted at the option of the programmer. These words are optional and are used only for the sake of readability. Misspelling, however, constitutes an error.

4. All italicized words represent information that must be supplied by the programmer. The nature of the information required is indicated in each case. In most instances, the programmer will be required to provide an appropriate data-name, procedure-name, literal, etc.

5. Material enclosed in square brackets [ ] may be used or omitted as required by the programmer.

6. When material is enclosed in braces { }, only one of the enclosed items is required; the others are to be omitted. The choice is to be made by the programmer.

7. Punctuation, where shown, is essential. Other punctuation may be inserted by the programmer in accordance with the rules specified in the General Information Manual.

8. In certain cases, a succession of operands or other elements may be used in the same statement. In such a case, this possibility is indicated by the use of three dots following the item affected. The dots apply to the last complete element preceding them; thus, if a group of operands and key words are enclosed within brackets, and three dots precede the closing bracket, the entire group must be repeated if any repetition is required, not merely the last operand.

The information specified in the Identification Division of the source program allows the programmer to identify or label his program, and provide other pertinent information concerning the program. This division must precede the other divisions when the source program is presented to the compiler. The over-all structure of the Identification Division is:

IDENTIFICATION DIVISION.
PROGRAM-ID. *program-name.*
[AUTHOR. *author-name.*]
[INSTALLATION. *any sentence or group of sentences.*]
[DATE-WRITTEN. *any sentence or group of sentences.*]
[DATE-COMPILED. *any sentence or group of sentences.*]
[SECURITY. *any sentence or group of sentences.*]
[REMARKS. *any sentence or group of sentences.*]

Usage of the IDENT* portion of the PROGRAM-ID source statement is explained in the section, "1410/7010 COBOL Compiler Requirements."

For additional details concerning the Identification Division, see the General Information Manual.

*Columns 73-80 of the *COBOL Program Sheet* (Reference Format)

Environment Division

In this part of the COBOL source program, the programmer describes to the compiler the physical characteristics of the IBM 1410 or 7010 System that will be used to compile the source program, and the system that will be used to execute the object program. This division must immediately follow the Identification Division when the source program is submitted to the compiler.

Structure of the Environment Division

The over-all structure of the Environment Division for a source program is given below for reference purposes:

```
ENVIRONMENT DIVISION.
CONFIGURATION SECTION.
SOURCE-COMPUTER. — — — .
OBJECT-COMPUTER. — — — .
SPECIAL-NAMES. — — — .
INPUT-OUTPUT SECTION.
FILE-CONTROL. — — — .
I-O-CONTROL. — — — .
```

Each of the subdivisions of the Environment Division is discussed in the following pages. This discussion is in terms of the IBM 1410/7010 COBOL compiler, and therefore includes specifications not contained in the General Information Manual.

Configuration Section

The three paragraphs of the Configuration Section specify, respectively, the computer on which the COBOL compiler is to be run, the computer on which the object program is to be run, and the names of the machine devices and switch conditions referred to by the programmer in the Procedure Division of his source program.

SOURCE-COMPUTER Paragraph

The purpose of this paragraph is to specify the computer on which the COBOL compiler is to run to compile the source program. The general form of this paragraph for the 1410/7010 COBOL compiler is:

SOURCE-COMPUTER. $\left\{\begin{matrix}\underline{\text{IBM-1410}}\\ \underline{\text{IBM-7010}}\end{matrix}\right\}$.

Additional information regarding the source computer (e.g., actual core-storage size, core storage available, etc.) is contained in the Resident Monitor's Communication Region; therefore, no additional entries are permitted in this paragraph. (See *System Monitor.*)

OBJECT-COMPUTER Paragraph

The purpose of this paragraph is to specify the computer on which the object program is to be executed. The general form of this paragraph is:

OBJECT-COMPUTER. $\left\{\begin{matrix}\underline{\text{IBM-1410}}\\ \underline{\text{IBM-7010}}\end{matrix}\right\}$.

SPECIAL-NAMES Paragraph

This optional paragraph equates mnemonic-names with device-names representing certain system units or the console printer, and equates condition-names with the status of the system's Standard Input Unit end-of-file switch and/or a switch in the Resident Monitor's Communication Region. The general form of this paragraph is:

SPECIAL-NAMES. [*device-name-1* IS *mnemonic-name-1*
[*device-name-2* IS *mnemonic-name-2* . . .]].

[MONITOR-SWITCH
[*literal-1* STATUS IS *condition-name-1*]
[*literal-2* STATUS IS *condition-name-2* . . .]]

[I-O-SWITCH EOF-SIU
[ON STATUS IS *condition-name-3*]
[OFF STATUS IS *condition-name-4*]].

DEVICE-NAMES

The device-names of the SPECIAL-NAMES paragraph must be chosen from the following list:

DEVICE-NAME	DESCRIPTION
CONSOLE-PRINTER	the console printer
SYSTEM-OUTPUT-PUNCH	the Standard Punch Unit
SYSTEM-OUTPUT-PRINTER	the Standard Print Unit

System units are discussed in the publication, *System Monitor.*

MONITOR-SWITCH

The MONITOR-SWITCH is used to represent a single-character switch position within the Resident Monitor's Communication Region, which is set by the operator with the $3x console inquiry. This switch can be referred to in the Procedure Division by means of a con-

dition-name associated with a status of the switch. Literal-1 can be any valid, single-character, non-numeric literal. For details concerning this switch see "$3x Console Inquiry," in the publication, *System Monitor.*

I-O-SWITCH EOF-SIU

The I-O-SWITCH EOF-SIU is a programmed switch that indicates the end-of-file status of the Standard Input Unit. This switch can be referred to in the Procedure Division by means of a condition-name associated with the ON or OFF status of this switch.

Figure 1 illustrates a sample SPECIAL-NAMES paragraph.

Input-Output Section

The Input-Output Section of the Environment Division consists of the FILE-CONTROL paragraph and the I-O-CONTROL paragraph.

FILE-CONTROL Paragraph

This paragraph is used to name each file of the source program, identify its medium (i.e., magnetic tape or unit-record equipment) and assign each file to a symbolic unit. Methods of assigning files to magnetic tape and unit-record devices are discussed in that order.

TAPE FILES

The form of the FILE-CONTROL paragraph for files assigned to tape is:

FILE-CONTROL. SELECT *file-name-1*
[RENAMING *file-name-2*]
ASSIGN TO *device-name*
[RESERVE { *integer-1* / NO } ALTERNATE AREA[S]].
[SELECT ...].

SELECT Clause: Each file to be processed by the object program must be named in a SELECT clause. Each file-name must be unique within the source program, and each file must be described by a File Description entry in the Data Division.

RENAMING Option: The RENAMING option allows the programmer to use the File Description of *file-name-2* in the Data Division for *file-name-1.* This option enables two files to share the same File Description; it does *not* allow the two names to be used interchangeably in the program.

NOTE: "File-name-2" must precede "file-name-1" in the FILE-CONTROL paragraph. If both input and output files are involved, the output file must be selected first, and must have an associated File Description. Only one output file may be associated with a given RENAMING clause.

ASSIGN Clause: Each file must be assigned to a symbolic unit. The device-name in the ASSIGN clause must have the following form for files assigned to tape units:

TAPE-UNIT xxx

TAPE-UNIT is the device name itself and represents a symbolic assignment to magnetic tape. "xxx" is the name of a symbolic unit (e.g., MR1). (The COBOL programmer may reference symbolic units as either xxx or /xxx/. For details concerning symbolic units see the publication, *System Monitor.*)

RESERVE Option: This option allows the programmer to specify alternate input or output areas for the implementation of overlap processing. One to five alternate areas per file may be specified (integer-1). If NO ALTERNATE AREA is specified or if the RESERVE option is omitted, overlap processing will not take place.

UNIT-RECORD FILES

The form of the FILE-CONTROL paragraph for files assigned to unit-record equipment is:

FILE-CONTROL. SELECT *file-name-1*
[RENAMING *file-name-2*]
ASSIGN TO *device-name*
[RESERVE { *integer-1* / NO } ALTERNATE AREA[S]].
[SELECT ...].

```
SERIAL  CONT.  A       B
4   6   7      8       12   16   20   24   28   32   36   40   44   48   52   56   60   64   68   72
       SPECIAL-NAMES.
           SYSTEM-OUTPUT-PUNCH IS PUNCH.
           MONITOR-SWITCH 1 STATUS IS MONITORING-RUN
                          2 STATUS IS WEEKLY-RUN
           I-O-SWITCH EOF-SIU ON STATUS IS LAST-CARD.
```

Figure 1. Special-Names Paragraph

The SELECT clause, the RENAMING option, and the RESERVE option are used as described for tape files. The device-name of the ASSIGN clause must be chosen from the following list:

DEVICE-NAME	DESCRIPTION
CARD-READER xxx	is the standard device-name for the card reader of the 1402 Card Read Punch, or the 1442 Card Reader. "xxx" is the name of a symbolic unit (e.g., MR1).*
CARD-PUNCH xxx	is the standard device-name for the card punch of the 1402 Card Read Punch. "xxx" is the name of a symbolic unit (e.g., MR2).*
PRINTER xxx	is the standard device-name for the 1403 Printer with 132 print positions. "xxx" is the name of a symbolic unit (e.g., MR3).*

NOTE: The above device-names cannot be used for units assigned as the Standard Input Unit, Standard Punch Unit, and Standard Print Unit for the Operating System.

Figure 2 illustrates a sample FILE-CONTROL paragraph.

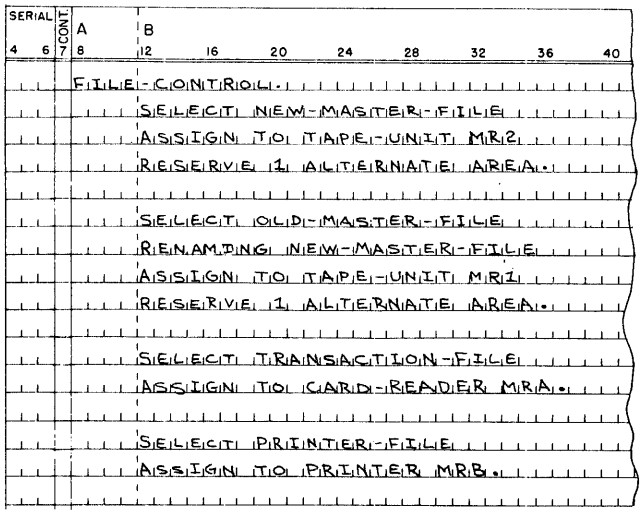


Figure 2. File-Control Paragraph

I-O-CONTROL Paragraph

The optional I-O-CONTROL paragraph allows the programmer to specify padding of short-length blocks of blocked, fixed-length output records; to control rewinding of tape files; and to establish rerun points.

*The COBOL programmer may reference symbolic units as either xxx or /xxx/. For details concerning symbolic units see the publication, *System Monitor.*

The form of this paragraph is:

I-O-CONTROL.[APPLY *literal-1* PADDING ON *file-name*]
[APPLY ...]
[APPLY OPEN-WITHOUT-REWIND ON *file-name-2*]
[APPLY ...]
[RERUN EVERY BEGINNING OF REEL OF
{ ALL FILES / *file-name-1* [*file-name-2* ...] }].

APPLY Option 1:

APPLY *literal-1* PADDING ON *file-name*

This option is used to specify padding of short-length blocks of a fixed-length, blocked tape-output file. Literal-1 can be any valid, single-character, non-numeric literal except ≠, ≠, *, ≠ and ≠. If this APPLY option is not specified, the compiler provides padding with spaces where required.

Note that spaces or nines should be used for padding characters if the file is to be sorted using the 1410/7010 Generalized Tape Sorting Program.

APPLY Option 2:

APPLY OPEN-WITHOUT-REWIND ON *file-name*

This option of the APPLY clause can be used to facilitate the processing of multi-file tape reels. This option only applies to the first reel in which the file is contained; subsequent reels will be rewound.

NOTE: Both APPLY options can be used for a given file.

RERUN Option: This option allows the programmer to specify rerun points (checkpoints) at every beginning of reel of all files, or of selected files. The tape upon which the rerun records are recorded is the optional Core Image file. (Information concerning checkpoints is contained in the publication, *IBM 1410/7010 Operating System; Basic Input/Output Control System,* Form C28-0322. Information concerning restarting a program from a checkpoint is contained in the publication, *IBM 1410/7010 Operating System; Operator's Guide,* Form C28-0351.)

The Data Division of a COBOL source program defines the nature and characteristics of the data to be processed by the object program. It begins with the header DATA DIVISION. Each of the three sections of the Data Division also begins with a header, and is followed by the word SECTION as shown below:

```
DATA DIVISION.
FILE SECTION.
   File Description Entries
   Record Description Entries
WORKING-STORAGE SECTION.
   Record Description Entries
CONSTANT SECTION.
   Record Description Entries
```

The File Section describes the input/output files with respect to content and organization. It has two types of entries: the File Description entry, which specifies the physical characteristics and organization of a file; and the Record Description entry, which describes the individual items contained in the data records of the file.

The Working-Storage Section describes the areas of core storage where intermediate results and other items are stored temporarily at object-program execution time.

The Constant Section describes fixed items of data which remain unchanged during the running of the object program.

Any section not required in the program being written should be omitted.

IBM 1410/7010 Files and Records

The programmer should understand how files and records are handled by the IBM 1410/7010 Operating System in order to use the COBOL language effectively in writing the Data Division entries for his source program. Information concerning files and records is therefore given below, prior to discussion of the COBOL language specifications for the Data Division.

Recording Modes

Information in a data processing system may be recorded in various forms and modes. The following discussion pertains to the file-recording modes of the IBM 1410 and 7010 Data Processing Systems. For additional details, see the publication, *IBM 1410 Principles of Operation,* Form A22-0526 or *IBM 7010 Principles of Operation,* Form A22-6726.

EVEN AND ODD PARITY MODES

The IBM 1410 and 7010 can record information on magnetic tape and read information from magnetic tape in either even-parity mode or odd-parity mode.

LOAD AND MOVE MODES

Another 1410/7010 file recording mode specifies how word marks and word separator characters are recorded during read and write operations.

Load Mode: The handling of word marks and word separator characters in the Load mode depends on the type of operation, as follows:

During *write* operations, each word mark is translated into a word separator character that immediately precedes the character with which the word mark was associated in core storage. Each word separator character in storage is translated into two word separator characters on tape.

During *read* operations, word marks already in the input area are cleared. Each word separator character on tape is translated into a word mark associated with the character it immediately preceded on tape, and pairs of word separator characters on tape are translated into single word separator characters without word marks in core storage.

Move Mode: When information is written in the Move mode, word marks have no effect on the data that is recorded on output media. Word marks in storage are undisturbed when information is read in this mode. Each word separator character is read into core storage and written out of core storage as a word separator character.

Standard Tape Labels

If STANDARD labels are specified in the File Description entry, certain items within the label are automatically processed by the COBOL compiler. The remaining items may be used by the programmer by using the BEGINNING-LABEL and/or the ENDING-LABEL options of the LABEL RECORDS clause in the File Description entry.

For details concerning the form of the standard tape labels, see the publication, *IBM 1410/7010 Operating System; Basic Input/Output Control System,* Form C28-0322.

Record Formats for Tape Files

The data record formats that can be handled by the 1410/7010 COBOL compiler for files assigned to tape are:

1a. Fixed-length, unblocked records with or without terminal record marks (Figure 3).

1b. Variable-length, unblocked records with terminal record marks and without length checking (Figure 4).

2. Fixed-length, blocked records with terminal record marks (Figure 5).

3. Variable-length, unblocked records containing a Record Character-Count field and with or without terminal record marks (Figure 6).

The Record Character-Count field is a four-position field at the beginning of each record. It contains a count of the total number of characters in that record, including itself and the terminal record mark, if present.

4. Variable-length, blocked records with a Block Character-Count field and containing Record Character-Count fields. Terminal record marks are required (Figure 7).

A four-character Block Character-Count (BCC) field at the beginning of each block contains a count of the total number of characters in the block (including the four-character Block Character-Count field itself).

This count is used to check and correct wrong-length-record conditions. The BCC field must have AB zone bits (12-punch) over the units position.

This field is not a part of a record and therefore is not defined in a Record Description entry.

A Record Character-Count (RCC) field of one to four characters in each record contains a count of the total number of characters in that record, including itself and the terminal record mark. This field must be in the same relative position in each record (the number of characters in each "C1" in Figure 7 is the same), and must be the same length in each record of a given file. The "C2" fields in Figure 7 are all equal in length.

Record Formats for Unit-Record Files

CARD READ PUNCH RECORDS

Records of files assigned to the card reader or card punch must be 80 characters in length, unblocked, and may or may not have record marks in the 80th character position. In addition, these files must be in Move mode and even parity.

Figure 3. Fixed-Length, Unblocked Records

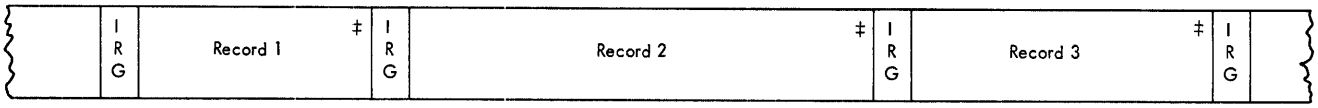


Figure 4. Variable-Length, Unblocked Records Without Length Checking

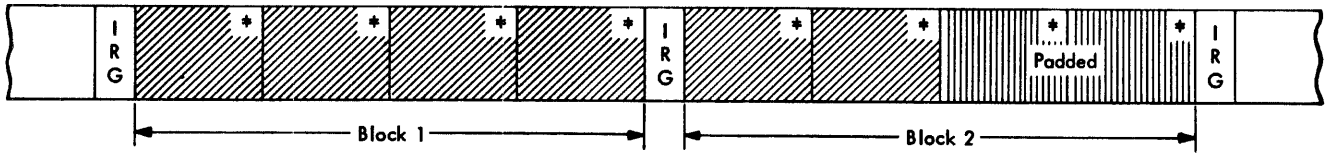


Figure 5. Fixed-Length, Blocked Records

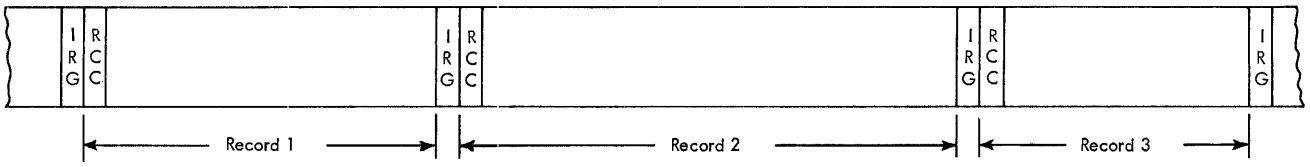


Figure 6. Variable-Length, Unblocked Records

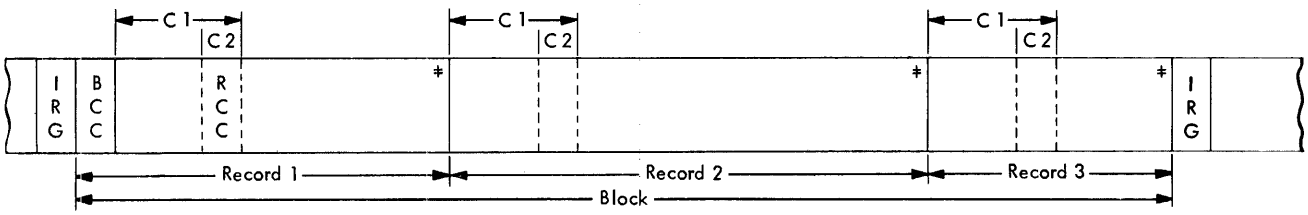


Figure 7. Variable-Length, Blocked Records

PRINTER RECORDS

Records of files assigned to the printer must be 132 characters, fixed-length, and unblocked. Files assigned to the printer must be in Move mode and even parity.

File Section

File Description Entry

A File Description entry must describe each file to be processed by the object program. It includes specifications for the mode in which the file is recorded, record and block size, label record information, and the names of the data records that make up the file.

The form of the File Description entry is:

```
FD file-name [ RECORDING MODE IS
                    { MOVE } MODE { EVEN } PARITY ]
                    { LOAD }      { ODD  }
    [ BLOCK CONTAINS integer-1 { RECORDS    } ]
                               { CHARACTERS }
RECORD CONTAINS [ integer-2 TO ]
                  integer-3 CHARACTERS
                [ DEPENDING ON data-name-1 ]
LABEL RECORD[S] { ARE }
                { IS  }
    { STANDARD      [ WITH integer-4 CHARACTERS ]
                    [ BEGINNING-LABEL ]
                    [ ENDING-LABEL ]
    { OMITTED
    { NON-STANDARD [ WITH integer-4 CHARACTERS ]
                    [ BEGINNING-LABEL ]
                    [ ENDING-LABEL ]
    [ VALUE OF FILE-IDENTIFICATION IS literal-1
                [ RETENTION-PERIOD IS integer-5 ] ]
DATA RECORD[S] { ARE } data-name-2 [ data-name-3 . . . ].
               { IS  }
```

Level Indicator: The level indicator FD identifies the beginning of the File Description entry and precedes the file-name assigned by the programmer (Figure 8).

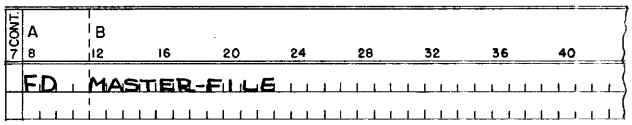


Figure 8. FD File-Name

RECORDING MODE Option: This option specifies the mode in which the file is recorded. (See the "Recording Modes" section of this publication.) If the RECORDING MODE option is omitted in the source program, the compiler assumes Move mode and even parity.

BLOCK CONTAINS Option: In addition to the details specified in the General Information Manual, the following information pertains to the BLOCK CONTAINS option.

If the file-name in the FD entry contains variable-length records, this entry must take the form:

BLOCK CONTAINS *integer-1* CHARACTERS

where integer-1 must be equal to or greater than the number of characters contained in the longest block of the file. This number includes the four-character Block Character-Count (BCC) field (see variable-length, blocked records in the section, "Record Formats for Tape Files").

RECORD CONTAINS Clause: This required clause is used to specify the size of a record in terms of the number of characters it contains and to indicate the record form. Integer-2 is used to specify the minimum number of characters in the smallest record of the file, whereas integer-3 indicates the maximum number of characters in the largest record. If all records in the file are exactly the same size, only integer-3 should be specified.

The DEPENDING ON data-name-1 option is required only when specifying variable-length records with Record Character-Count (RCC) fields. Data-name-1 is the name of the RCC field. The contents of this field indicate the number of characters in the record.

The following examples illustrate the use of the BLOCK CONTAINS option and the RECORD CONTAINS clause to specify each of the five record forms:

For fixed-length, unblocked records:

```
RECORD CONTAINS 80 CHARACTERS
```

For variable-length, unblocked records without length checking:

```
RECORD CONTAINS 100 TO 200 CHARACTERS
```

For fixed-length, blocked records:

```
BLOCK CONTAINS 5 RECORDS
RECORD CONTAINS 80 CHARACTERS
```

For variable-length, unblocked records:

```
RECORD CONTAINS 100 TO 200 CHARACTERS DE-
  PENDING ON RCC
```

For variable-length, blocked records:

```
BLOCK CONTAINS 504 CHARACTERS
RECORD CONTAINS 30 TO 50 CHARACTERS DE-
  PENDING ON RCC
```

LABEL RECORD Clause: This clause is required in every File Description entry. For unit-record files, this clause must specify that label records are OMITTED. If STANDARD labels are specified for tape files, the file identification, the reel sequence, and the retention period are automatically checked.

If either STANDARD or NON-STANDARD is specified and the WITH integer-4 CHARACTERS option is desired, integer-4 must be 80 or 120. This is required in order to conform with the 1410 80-character and IBM Standard 120-Character tape labels. (For details concerning these labels see the publication, *Basic Input/Output Control System.*) If this option is not used, the label record size is assumed to be 120 characters.

NOTE: Actual size of nonstandard labels need not be exactly 80 or 120 characters, but may not exceed 120.

When a file contains standard tape labels, and no processing beyond that supplied by the compiler is required, STANDARD must be specified.

If additional processing of the standard tape label is desired, the programmer must specify STANDARD with BEGINNING-LABEL and/or ENDING-LABEL in conjunction with the USE verb. If either or both of these options are used, a Record Description entry that defines the entire label must be provided.

Example:

```
.
.
.
LABEL RECORDS ARE STANDARD BEGINNING-LABEL
ENDING-LABEL
.
.
.
01 BEGINNING-LABEL.
    02...
    02...
01 ENDING-LABEL.
    02...
    02...
```

When a file contains nonstandard labels and label processing is not desired, NON-STANDARD must be specified. Use of NON-STANDARD without additional options will cause the nonstandard labels to be bypassed in the object program.

Special processing of nonstandard labels can be accomplished by defining the label format with the BEGINNING-LABEL and ENDING-LABEL options in conjunction with the USE verb. No automatic testing takes place if NON-STANDARD is specified.

VALUE Option: The function of the VALUE option in the File Description entry is to specify the contents of data items in the label record of the file. The following two forms of the VALUE option are permitted for standard tape labels;

Form 1.

```
VALUE OF FILE-IDENTIFICATION IS literal-1
```

This form applies to both input and output files and is required if standard tape labels are used. Literal-1 must be a ten-character non-numeric literal.

Form 2.

```
VALUE OF FILE-IDENTIFICATION IS literal-1
RETENTION-PERIOD IS integer-5
```

This form applies to output files only, and must be supplied for each output file if standard tape labels are used. Integer-5 must be an integer (up to four digits) indicating the number of days beyond the creation date the file is to be preserved. For files that are to be preserved indefinitely, the programmer inserts the digits "99" in the two high-order positions of the creation date (see "Standard Tape Labels").

DATA RECORD Clause: This clause is required in every File Description entry. Data-name-2, data-name-3, . . . etc., must each be the subject of a Record Description entry that has a level number of 01. The data-name order is not significant to the processor.

The appearance of more than one data-name in this clause means that the file contains a corresponding number of different types of data records. These records may be of different sizes and formats.

Figure 9 illustrates a sample File Description entry.

Record Description Entry

A Record Description entry specifies to the compiler the characteristics of each item of a data record. Every item given a separate name must be described in a

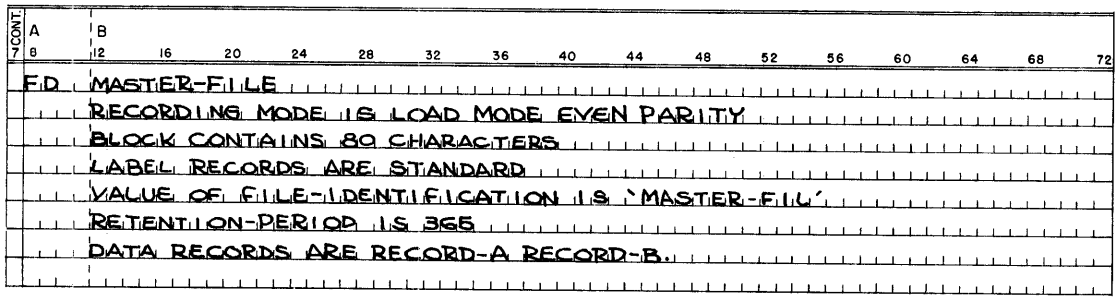


Figure 9. File Description Entry

separate entry in the same order in which it appears in the record. Each Record Description entry consists of a level-number, a data-name, and a series of independent clauses. The form of a Record Description is:

level-number {*data-name* / FILLER} [REDEFINES ...]
[SIZE ...] [CLASS ...] [USAGE ...]
[OCCURS ...] [POINT ...] [SIGNED ...]
[VALUE ...] [PICTURE ...] [BLANK WHEN ZERO]

Level-Number: The level-number shows the relationship between items in a record. Each level-number must be associated with a data-name or with the key word FILLER, as shown in the following general format:

level-number {*data-name* / FILLER}

A detailed description of level-numbers can be found in the General Information Manual.

REDEFINES Clause: The REDEFINES clause is fully implemented by the 1410/7010 COBOL compiler. The general form of this clause is:

level-number data-name-1 [REDEFINES *data-name-2*]

See the General Information Manual for details concerning the use of the REDEFINES clause. Additional information, pertinent to the use of REDEFINES in programs that are to be compiled on systems other than the 1410/7010 appears in the "Compatibility Considerations" section of this manual.

SIZE Clause: The general form of the SIZE clause is:

[SIZE IS *integer-1* [{CHARACTER[S] / DIGIT[S]}]]

See the General Information Manual for details concerning the use of this clause.

CLASS Clause: In addition to the details in the General Information Manual concerning the use of this clause, the reader should note that if a CLASS statement is omitted for a data-item and the USAGE clause specifies COMPUTATIONAL, numeric class is implied. In the absence of any CLASS specification or implication, alphanumeric class is assumed. Numeric class items must not exceed 18 digits. For report items, the number of numeric characters represented must not exceed 18.

The general form of the CLASS clause is:

[CLASS IS {ALPHABETIC / NUMERIC / ALPHANUMERIC / AN}]

USAGE Clause: The USAGE clause does not in any way affect the internal representation of data in the IBM 1410/7010 Data Processing Systems. All data is represented internally in BCD (binary-coded decimal) form and no distinction is made between COMPUTATIONAL and DISPLAY usage. If the USAGE clause for a data-item specifies COMPUTATIONAL and a CLASS statement is omitted, the class is assumed to be numeric. The general form of the USAGE clause is:

[USAGE IS {COMPUTATIONAL / DISPLAY}]

OCCURS Clause: The general form of the OCCURS clause is:

[OCCURS *integer-2* TIME[S]]

See the General Information Manual for details concerning the use of this clause.

POINT Clause: The general form of the POINT clause is:

[POINT LOCATION IS {LEFT / RIGHT} *integer-3* PLACE[S]]

See the General Information Manual for details concerning the use of this clause.

SIGNED Clause: A numeric data item will have an operational sign if this clause is used. An operational sign should be specified for the result field of any arithmetic statement where the sign is a consideration. Additional details concerning the use of the SIGNED clause are found in the General Information Manual.

The general form of this clause is:

[SIGNED]

VALUE Clause: The general form of the VALUE clause is:

[VALUE IS *literal*]

In addition to the details specified in the General Information Manual, the following information pertains to the use of this clause:

1. If the VALUE clause specifies a numeric literal with a preceding sign, the operational sign is created only if the programmer specifies the PICTURE symbol "S" or the SIGNED clause.

2. The VALUE clause can only be used to refer to elementary items.

3. The VALUE clause has no meaning for report items, and cannot be used to specify their initial values.

4. Neither a record mark (≡) nor a group mark (≡≡) can be used within the VALUE clause (see PICTURE symbols "J" and "K").

PICTURE Clause: The general form of the PICTURE clause is:

[PICTURE IS *any allowable combination of characters and symbols*]

The PICTURE clause can only be used to describe elementary items. It is recommended that, wherever possible, the programmer use this clause instead of the SIZE, POINT, CLASS, and BLANK clauses of a Record Description entry. The PICTURE clause specifies the characteristics of an elementary item in a more compact form, and can therefore be processed more efficiently.

In addition to the rules given in the General Information Manual for forming a picture of a data item, the following information pertains to the use of the PICTURE clause:

1. The only way to define a record mark or group mark is by using a PICTURE symbol. The special PICTURE symbol "J" is used to indicate a one-character field containing a record mark (≡), and the special PICTURE symbol "K" is used to indicate a one-character field containing a group mark (≡≡). When used, the PICTURE symbol "J" or "K" must be the only character in the PICTURE.

2. The PICTURE symbol "S" is used to indicate an operational sign (see the SIGNED clause).

3. For report items, the maximum number of characters that can be represented by a PICTURE is 99.

4. The PICTURE symbol "V" to the right or left of PICTURE symbol "P" is redundant and constitutes an error.

5. PICTURE symbol "Z" may appear to the right of a decimal point in a PICTURE only if all numeric character positions are represented by "Z"s. This same rule applies to the replacement character "*".

BLANK WHEN ZERO Clause: The general form of the BLANK WHEN ZERO clause is:

[BLANK WHEN ZERO]

See the General Information Manual for details concerning the use of this clause.

Figure 10 illustrates a sample Record Description entry.

Working-Storage and Constant Sections

The Record Description entries described for the File Section apply also to the Working-Storage and Constant Sections. These sections begin with the header line "WORKING-STORAGE SECTION." or "CONSTANT SECTION." and are followed immediately by the Record Description entries.

In addition to the details specified in the General Information Manual, the following considerations pertain to the Working-Storage and Constant Sections.

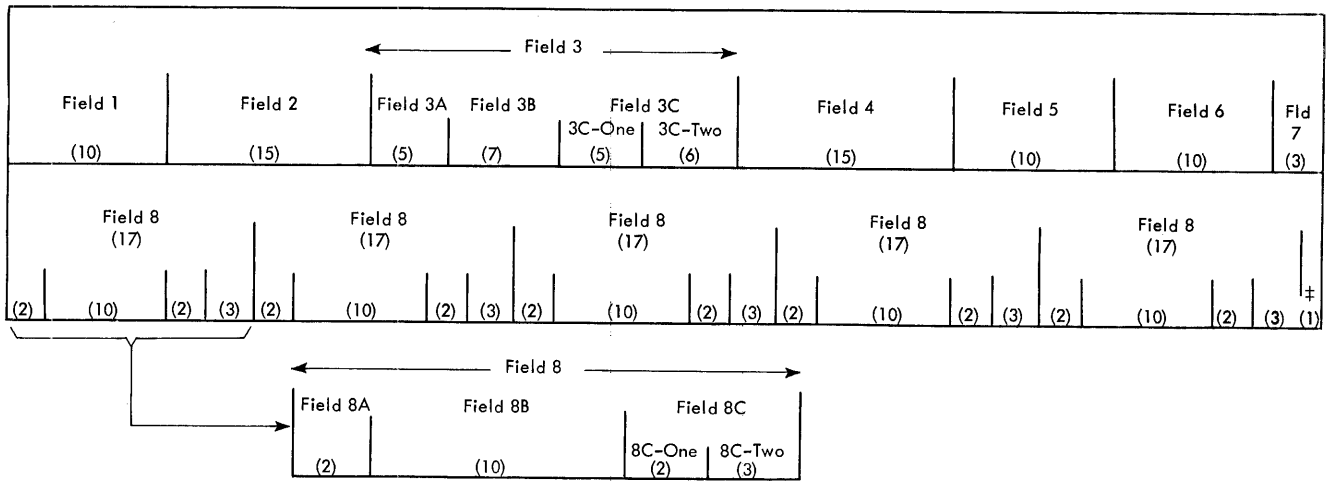
If the VALUE clause is not used to define the initial values of Working-Storage items, these values will be unpredictable.

Constant Section elementary items must include a VALUE clause or one of the PICTURE symbols "J" and "K", unless associated with a REDEFINES clause.

Added Features of the Data Division

An optional feature, not specified in the General Information Manual, but contained in the 1410/7010 COBOL language is:

The DEPENDING ON option of the RECORD CONTAINS clause.



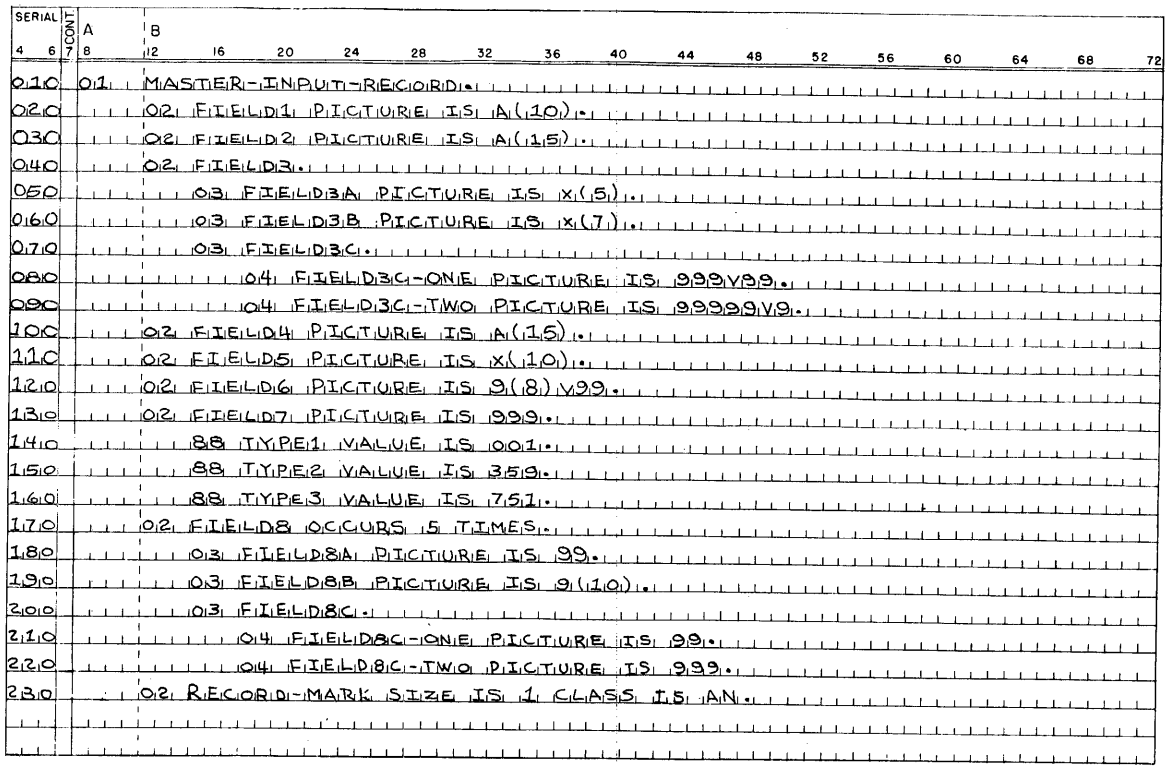


Figure 10. Record Description Entry

Once the computer and the data have been described, the programmer gives the COBOL compiler the instructions that specify the data processing steps the object program is to perform. Information that directs the compiler is also supplied by the programmer in the Procedure Division.

The COBOL verbs are the main elements in the Procedure Division and they are described in detail in the General Information Manual. However, for the convenience of the user, the general format of each COBOL verb is shown in this publication.

Information not included in the General Information Manual, but applicable to verbs which have additional meaning when used in a 1410/7010 COBOL source program, is supplied in later sections of this manual.

Compiler Directing Declaratives

Declaratives are compiler-directing statements that operate under the control of the "main body" of the Procedure Division or the Input/Output Control System. Declaratives consist of the USE verb and any associated procedures. If present, Declaratives

1. must be grouped at the beginning of the Procedure Division, and
2. must be preceded by the key word DECLARATIVES and followed by the key words END DECLARATIVES.

USE Verb

The USE verb is used to specify procedures for handling input/output errors and label processing (see "LABEL RECORD" clause) in addition to the procedures normally provided by the COBOL compiler. Each occurrence of the USE verb constitutes a complete section of the Procedure Division, and must therefore be preceded by a section-name. The remainder of the section consists of one or more paragraphs specifying the procedures to be used (Figure 11). A "USE" section must follow the rules for a section which is "performed" (see the PERFORM verb in the General Information Manual for details). For example, if the logic of a procedure requires a conditional exit prior to the final statement, the EXIT verb must be used. The section-name of a USE section must not be referenced by an ALTER, GO TO, or PERFORM statement since the USE entry is appended to this section header. The paragraph-name of the last paragraph in a USE section must not be referenced by an ALTER or PERFORM statement since the USE exit is appended to this paragraph.

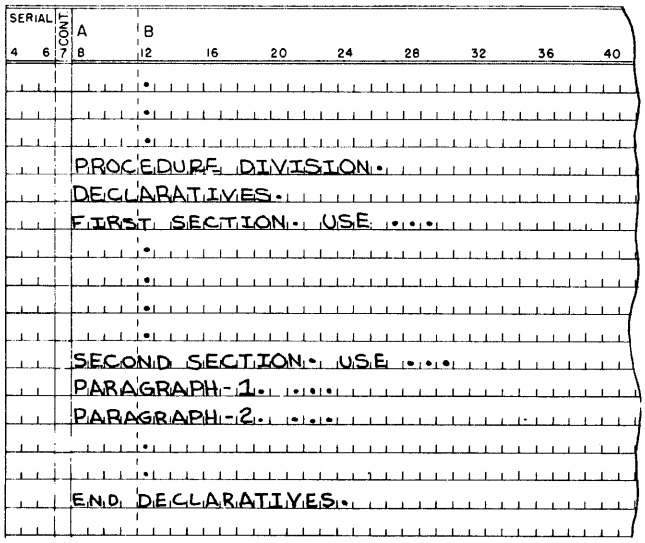


Figure 11. Declaratives

The following options of the USE verb are available.

Option 1

section-name SECTION. USE AFTER STANDARD ERROR PROCEDURE ON *file-name-1* [*file-name-2* . . .]. (*any COBOL statements including DISPLAY using the console printer but excluding all other input/output statements*)

This option allows the programmer to specify additional procedures if standard error-correction procedures do not suffice. Standard error procedures attempt to correct the error in accordance with 1410/7010 IOCS standards. If the error persists, the error condition is ignored and processing continues. Thus, the programmer has the following options: ignore the error condition and process the record, or by means of the USE verb perform special processing for error records (e.g., set a switch, display a console message, etc.).

Option 2

section-name SECTION. USE $\left\{\begin{matrix}\text{BEFORE}\\\text{AFTER}\end{matrix}\right\}$ STANDARD $\left[\left\{\begin{matrix}\text{BEGINNING}\\\text{ENDING}\end{matrix}\right\}\right]$ $\left[\left\{\begin{matrix}\text{REEL}\\\text{FILE}\end{matrix}\right\}\right]$

LABEL PROCEDURE ON *file-name*. (*any COBOL statements including DISPLAY using the console printer but excluding all other input/output statements*)

This option is used to:

1. Perform processing of standard tape labels beyond that supplied by the COBOL compiler.
2. Perform any desired processing of nonstandard labels.

If both BEGINNING and ENDING are omitted, the designated procedures will be executed for both beginning (header) and ending (trailer) labels.

If both REEL and FILE are omitted, the designated procedures will be executed upon detection of both end-of-reel and end-of-file conditions.

Input/Output Verbs

OPEN and CLOSE

The COBOL compiler provides the facility for opening an input or output file, processing it, closing it, and subsequently reopening it as an input or output file.

The OPEN verb is used to initiate the processing of one or more input and/or output files. The format of the OPEN verb is:

```
OPEN [ INPUT file-name-1 [ file-name-2 . . . ] ]
     [ OUTPUT file-name-3 [ file-name-4 . . . ] ]
```

The CLOSE verb is used to terminate processing of one or more input and/or output reels or files. Provision for optionally locking or not rewinding is also included. The format of the CLOSE verb is:

```
CLOSE file-name-1 [ REEL ] [ WITH { LOCK       } ]
                                  { NO REWIND }
                  [ file-name-2 . . . ]
```

See the General Information Manual for details concerning the OPEN and CLOSE verbs.

READ

The function of this verb is to make the next record from an input file available for processing. The general form of the READ verb is:

```
READ file-name RECORD [ INTO area-name ]
                AT END any imperative statement
```

In addition to the details specified in the General Information Manual, the following considerations pertain to the use of the READ verb:

1. An OPEN statement for the file must be executed prior to the execution of the first READ for that file.

2. When a READ is executed, the next record of the file becomes accessible in the input area defined by the associated Record Description entry in the File Section of the Data Division. The record remains available in the input area until the next READ (for that file) is executed. The named file must be defined by an FD entry in the Data Division of the program.

3. Every READ statement must include an AT END clause containing any imperative statements; i.e., any single verb with its operand(s), or a sequence of verbs with their operands terminated by a period and containing no explicit or implied conditional expressions. Once an AT END statement has been executed, any attempt to READ from the file will constitute an error unless a subsequent CLOSE and OPEN have been executed.

NOTE: When reading a file containing fixed-length, blocked records, the end-of-file condition does not necessarily occur following the last logical record. Therefore, the programmer must test for a record consisting of all padding characters, to ensure detection of the end of the logical file.

4. The INTO area-name option converts the READ into a READ and MOVE. The area-name specified must be the name of either a Working-Storage record area or an output record area. When this option is used, the current record becomes available in the input area, as well as in the area specified by area-name. If the format of the INTO area differs from that of the input record, the data will be moved in accordance with the rules for the MOVE verb without the CORRESPONDING option. It will be assumed that the area specified by area-name will be completely filled by information from the input record. If this is not the case, READ and MOVE should be used rather than READ INTO.

5. Each time an end-of-reel condition occurs in a reel other than the last, the READ verb causes the following operations to take place:

   a. If labels are present (as specified in the FD for that file) the standard end-of-reel label subroutine of the Input/Output Control System is executed.
   b. A tape alternation occurs, if appropriate.
   c. If labels are present, the standard beginning-of-reel label subroutine is executed.
   d. If RERUN has been specified for this file, a checkpoint record is written.
   e. The next record in the file is made available for processing.

WRITE

The purpose of the WRITE verb is to release a record for insertion in an output file. The format of a WRITE statement is:

```
WRITE record-name [ FROM area-name ]
```

In addition to the details specified in the General Information Manual, the following considerations pertain to the use of the WRITE verb:

1. If the user desires to write records which have been described by the RENAMING option (see the "FILE CONTROL" paragraph), the record-name must always be qualified by the file-name.

2. If the FROM option is used, information will be transmitted from area-name with or without word marks, depending upon the RECORDING MODE of the file associated with record-name. If the file is defined in the Load mode, word marks will be transmitted. If the file is defined in the Move mode, word marks will not be transmitted. Area-name must be the name of an input record or a Working-Storage or Constant Section record area.

DISPLAY

The format of the DISPLAY verb is:

DISPLAY { *data-name-1* / *literal-1* } [{ *data-name-2* / *literal-2* } ...]
[UPON *mnemonic-name*]

In addition to the details specified in the General Information Manual, the following information pertains to the use of the DISPLAY verb:

1. DISPLAY literals must be non-numeric.

2. The Operating System's Standard Punch Unit and Standard Print Unit may be equated with mnemonic-names in the SPECIAL-NAMES paragraph of the Environment Division. If the UPON option is omitted, the console printer will be used as the standard Display Device.

3. Depending on the 1403 printing chain or the console printer type head, certain characters will not be displayed. See the publication, *IBM 1410 Principles of Operation,* Form A22-0526 or *IBM 7010 Principles of Operation,* Form A22-6726, for further details.

4. If a printer is used, it will be assumed that the carriage tape has a channel-1 punch.

5. Information of any length can be displayed on any display device.

6. A standard set of error procedures is produced by the compiler for use in the execution of the DISPLAY verb.

Figure 12 shows a DISPLAY statement that will cause the contents of the field GRAND-TOTAL to be typed on the console printer when the object program is executed.

Figure 13 shows a DISPLAY statement that will cause the contents of the field GRAND-TOTAL to be displayed in 80-character records on the Standard Punch Unit

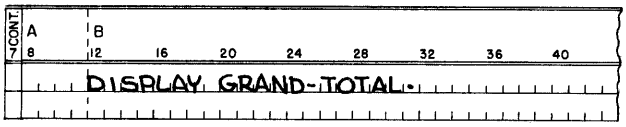


Figure 12. Standard Display Device

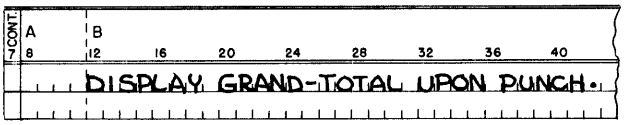


Figure 13. Punch Display

when the object program is executed, assuming that the mnemonic-name PUNCH has been equated with the SYSTEM-OUTPUT-PUNCH.

ACCEPT

The function of the ACCEPT verb is to obtain low-volume data from the Operating System's Standard Input Unit. The Standard Input Unit is the only device from which information can be accepted. The general form of the ACCEPT verb is:

ACCEPT *data-name*

Figure 14 shows an ACCEPT statement that will cause data to be read from the Standard Input Unit and moved into the area defined by the data-name CANCELLATIONS. If this area contains more than 80 characters, sufficient card images will be read to fill it.

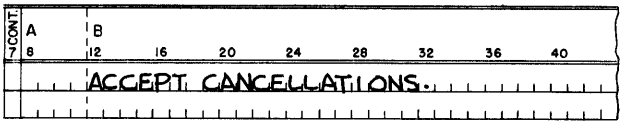


Figure 14. Accept

A standard set of error procedures is produced by the compiler for use in the execution of the ACCEPT verb.

Data Manipulation Verbs

MOVE

The MOVE verb can be used in either of two formats:

Option 1

MOVE { *data-name-1* / *literal* } TO *data-name-2* [*data-name-3* ...]

Option 2

MOVE CORRESPONDING *data-name-1* TO
data-name-2 [*data-name-3* ...]

In addition to the details specified in the General Information Manual, the following considerations pertain to the use of Options 1 and 2 of the MOVE verb:

1. The following moves are aligned by decimal point:
   a. Elementary numeric to elementary numeric
   b. Elementary numeric to elementary alphanumeric report
   c. Elementary non-numeric to elementary numeric (The elementary non-numeric item is assumed to be an integer.)
2. All other moves are left-justified.
3. When figurative constants are used as operands of the MOVE verb, the size of the receiving area determines the number of characters that are moved. For example, if the size of AREA-A in Figure 15 is five positions, its value after execution is five nines (99999).

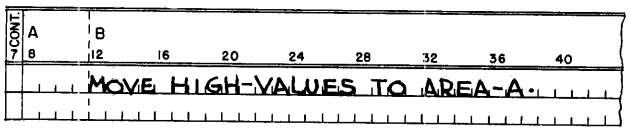


Figure 15. Move Verb

4. When using a MOVE CORRESPONDING, only the initial description of data-name-1 and data-name-2, etc., will be considered. That is, where a REDEFINES clause has been used within data-name-1 or data-name-2, the description of data contained within the REDEFINES clause is ignored. (See general suggestions given in the section, "Programming Techniques.")

EXAMINE

The general form of the EXAMINE verb is:

```
EXAMINE data-name

{ TALLYING { ALL     }                                  }
           { LEADING } literal-1                        }
           { UNTIL FIRST }                              }
                        [ REPLACING BY literal-2 ]      }
                                                        }
{ REPLACING { ALL     }                                 }
            { LEADING } literal-3 BY literal-4          }
            { UNTIL FIRST }                             }
```

See the General Information Manual for details concerning the EXAMINE verb.

Arithmetic Verbs

The following rules apply to the arithmetic verbs:

1. All data-names used in arithmetic statements must represent elementary numeric data items that are defined in the Data Division of the program. A data-name that is defined within the Constant Section cannot appear as the result field of an arithmetic statement.
2. All literals used in arithmetic statements must be numeric.
3. The maximum size of any operand (data-name or literal) is 18 digits. If the format for any operand specifies a size greater than 18 digits, the compiler will produce an error message when it encounters the discrepancy.
4. Intermediate result fields generated for the evaluation of arithmetic expressions (formulas) will always have a PICTURE of S9(10)V9(10). If greater precision is desired, the simple arithmetic verbs (i.e., ADD, SUBTRACT, MULTIPLY, and DIVIDE) must be used.
5. Decimal-point alignment is supplied automatically throughout computations.
6. The format of any data item involved in computations (e.g., addends, subtrahends, multipliers, etc.) cannot contain editing symbols. If this rule is violated, the compiler will indicate the error by an appropriate message. Operational signs and implied decimal points are not considered editing symbols. The data-name in the GIVING option and the result field in the COMPUTE verb format represent data items which must not enter into computations if they contain editing symbols.
7. The only figurative constant permitted in arithmetic statements is ZERO (or ZEROS and ZEROES).
8. For the simple arithmetic verbs the data characteristics of the receiving field control the precision of the operation; therefore, no high-order digit will be lost without creating the SIZE ERROR condition. All specified decimal positions will also be produced.
9. For use with the SIZE ERROR option "any imperative statement" is any single verb with its operand(s) or a sequence of verbs with their operands terminated by a period and containing no explicit or implied conditional expressions.
10. If exponentiation is used in a COMPUTE expression, the exponent must be an integer. Negative exponents are permitted.

ADD

The general form of the ADD verb is:

```
ADD { data-name-1 } [ { data-name-2 } ... ]
    { literal-1   }   { literal-2   }

[ { TO       }          ]  [ ROUNDED ]
[ { GIVING } data-name-n ]

[ ON SIZE ERROR any imperative statement ]
```

An ADD statement must name at least two addends. For additional details concerning the ADD verb, see the General Information Manual.

CORRESPONDING Option: The CORRESPONDING option of the ADD verb allows the programmer to specify the addition of corresponding items in one operation in a manner similar to MOVE CORRESPONDING.

The general form of ADD CORRESPONDING is:

ADD CORRESPONDING *data-name-1* TO *data-name-2*

[ROUNDED]

[ON SIZE ERROR *any imperative statement*]

Numeric elementary items within data-name-1 are added to numeric elementary items with matching names in data-name-2. Data-name-1 and data-name-2 must be nonelementary items. The rules stated for the simple ADD verb apply to each pair of items in the ADD CORRESPONDING option.

Only the initial description of data-name-1 and data-name-2 is considered in the implementation of the ADD CORRESPONDING option. That is, where a REDEFINES clause has been used for data-name-1 or data-name-2, the description of the data contained within the REDEFINES clause is ignored by ADD CORRESPONDING. (See general suggestions given in the section, "Programming Techniques.")

The ROUNDED option and the SIZE ERROR option of the ADD verb may also be used with ADD CORRESPONDING. For a detailed description of these two options, see the General Information Manual.

NOTE: When SIZE ERROR is used in conjunction with CORRESPONDING, the SIZE ERROR test is made only after the completion of all the add operations. If any of the additions produced a SIZE ERROR, the resultant field for that add remains unchanged, and the "any imperative statement" is executed.

To illustrate the use of the ADD CORRESPONDING option, assume that the programmer wishes to add items from a work area named RECEIPTS to corresponding items in an area designated STOCK-ON-HAND. He would write this statement:

```
ADD CORRESPONDING RECEIPTS TO STOCK-ON-
  HAND
```

Figure 16 shows what will result from this statement. Note that noncorresponding items in the STOCK-ON-HAND area are not affected.

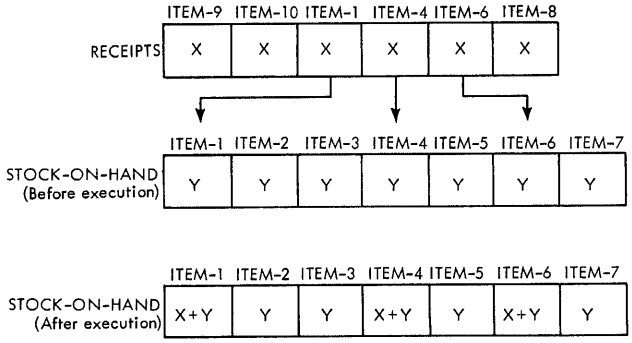


Figure 16. Add Corresponding

SUBTRACT

The general form of the SUBTRACT verb is:

SUBTRACT $\left\{\begin{matrix}\textit{data-name-1}\\ \textit{literal-1}\end{matrix}\right\}$ $\left[\left\{\begin{matrix}\textit{data-name-2}\\ \textit{literal-2}\end{matrix}\right\}\ldots\right]$

FROM $\left\{\begin{matrix}\textit{data-name-n}\\ \textit{literal-n}\end{matrix}\right\}$ [GIVING *data-name-m*]

[ROUNDED]

[ON SIZE ERROR *any imperative statement*]

A SUBTRACT statement must name at least one subtrahend and one minuend. For further details concerning the SUBTRACT verb, see the General Information Manual.

CORRESPONDING Option: The CORRESPONDING option of the SUBTRACT verb functions in the same way as the CORRESPONDING option of the ADD verb.

The general form of SUBTRACT CORRESPONDING is:

SUBTRACT CORRESPONDING *data-name-1*

FROM *data-name-2* [ROUNDED]

[ON SIZE ERROR *any imperative statement*]

MULTIPLY

The general form of the MULTIPLY verb is:

MULTIPLY $\left\{\begin{matrix}\textit{data-name-1}\\ \textit{literal-1}\end{matrix}\right\}$ BY $\left\{\begin{matrix}\textit{data-name-2}\\ \textit{literal-2}\end{matrix}\right\}$

[GIVING *data-name-3*] [ROUNDED]

[ON SIZE ERROR *any imperative statement*]

Additional details concerning the MULTIPLY verb are contained in the General Information Manual.

DIVIDE

The general form of the DIVIDE verb is:

DIVIDE $\left\{\begin{matrix}\textit{data-name-1}\\ \textit{literal-1}\end{matrix}\right\}$ INTO $\left\{\begin{matrix}\textit{data-name-2}\\ \textit{literal-2}\end{matrix}\right\}$

[GIVING *data-name-3*] [ROUNDED]

[ON SIZE ERROR *any imperative statement*]

Additional details concerning the DIVIDE verb are contained in the General Information Manual.

COMPUTE

The general form of the COMPUTE verb is:

```
COMPUTE data-name-1 [ROUNDED]
    = arithmetic expression
        [ON SIZE ERROR any imperative statement]
```

For details concerning the COMPUTE verb, see the General Information Manual.

Procedure Branching Verbs

GO TO

There are two formats in which the GO TO verb can be used:

Option 1

```
GO TO [procedure-name]
```

Option 2

```
GO TO procedure-name-1 procedure-name-2
    [procedure-name-3 . . .] DEPENDING ON data-name
```

For additional information concerning the GO TO verb, see the General Information Manual.

ALTER

The general form of the ALTER verb is:

```
ALTER procedure-name-1 TO PROCEED TO
                    procedure-name-2 [procedure-name-3 TO
                    PROCEED TO procedure-name-4 . . .]
```

A GO TO sentence that is to be altered must be:

1. An unconditional GO TO sentence
2. Written as a separate paragraph consisting solely of the GO TO sentence, preceded by a procedure-name

For additional information concerning the ALTER verb, see the General Information Manual.

PERFORM

There are five formats in which the PERFORM verb can be used. These are:

Option 1

```
PERFORM procedure-name-1 [THRU procedure-name-2]
```

Option 2

```
PERFORM procedure-name-1 [THRU procedure-name-2]
                    {integer-1   } TIME[S]
                    {data-name-1 }
```

Option 3

```
PERFORM procedure-name-1 [THRU procedure-name-2]
                    UNTIL condition-1
```

Option 4

```
PERFORM procedure-name-1 [THRU procedure-name-2]
                    VARYING data-name-1 FROM
                    {numeric-literal-1} BY {numeric-literal-2}
                    {data-name-2      }    {data-name-3      }
                    UNTIL condition-1
```

Option 5

```
PERFORM procedure-name-1 [THRU procedure-name-2]
                    VARYING subscript-name-1
                    FROM {integer-1   } BY {integer-2   }
                         {data-name-1 }    {data-name-2 }
                    UNTIL condition-1 [AFTER subscript-name-2
                    FROM {integer-3   } BY {integer-4   } UNTIL
                         {data-name-3 }    {data-name-4 }
                    condition-2 ] [AFTER subscript-name-3 FROM
                    {integer-5   } BY {integer-6   } UNTIL condition-3]
                    {data-name-5 }    {data-name-6 }
```

See the General Information Manual for further information concerning the PERFORM verb.

Compiler Directing Verbs

ENTER

The ENTER verb, used in conjunction with the CALL verb, allows the programmer to incorporate into his object program FORTRAN and/or Autocoder compiled subprograms. The incorporation of subprograms is performed at the time the object program is processed by the Linkage Loader. (See the publication, *System Monitor.*) Each ENTER statement must constitute a separate paragraph in the source program.

The form of the ENTER verb is:

```
ENTER {COMMUNICATION-MODE}.
      {COBOL             }
```

The entry ENTER COMMUNICATION-MODE precedes the calling of the subprogram(s). The CALL verb specifies the subprogram(s) to be included in the object program. The entry ENTER COBOL must terminate the list of subprograms. COMMUNICATION-MODE may be entered any number of times in a program.

CALL

The general form of the CALL verb is:

```
CALL subprogram-1 [USING {data-name-1} [{data-name-2} . . .]].
                         {literal-1   }  {literal-2   }      [CALL . . .].
```

Subprogram-1 is the name contained in the TITLE card of the subprogram. The CALL verb causes the COBOL compiler to generate an *imbedded* call for the named subprogram. When the imbedded call is processed by the Linkage Loader, it is converted into a branch to the first character of the called subprogram.

The USING option specifies the required parameters (data-names and/or literals) for the subprogram. These parameters reference data within the COBOL program and are the only means of communication between the main program and the subprogram. At object program run time, these parameters are represented by a sequence of five-character addresses of the appropriate data, with a word mark over the high-order position of each address. This list is followed by a terminal "No Operation" instruction. (The number of parameters is used by the called subprogram to determine the point at which control is to be returned to the main program.) Although any number of parameters may be specified, a maximum of two subscripted data-names may appear in a given USING option.

The CALL verb may be used only after the COMMUNICATION-MODE has been entered. No other verb may appear within the COMMUNICATION-MODE.

EXIT

The EXIT verb is used when it is necessary to provide an end point for a procedure that is to be executed by means of a PERFORM statement, or for procedures specified in the "USE" section. While EXIT is classified as a compiler-directing verb because it supplies the compiler with necessary information and does not produce any coding in the object program, it can also be thought of as a "dummy" program verb.

EXIT must appear in the source program as a one-word paragraph preceded by a paragraph-name. The form of the EXIT verb is:

EXIT.

Further discussion of the EXIT verb is contained in the General Information Manual.

NOTE

The form of the NOTE verb is:

NOTE *any comment.*

See the General Information Manual for any additional information concerning this verb.

Ending Verb

STOP

The general form of the STOP verb is:

STOP { *literal* / RUN }

In addition to the details specified in the General Information Manual, the following information pertains to the use of the STOP verb:

1. The statement:
   STOP *literal*

will cause the program to print the literal on the console printer and enter the Wait-Loop routine of the Resident Monitor. (For details, see the publication, *System Monitor.*)

2. The statement:
   STOP RUN

indicates the end of the program and generates the message "STOP RUN" on the console printer, followed by a return to the System Monitor.

Conditional Expressions

In addition to the details contained in the General Information Manual, the following rule applies to conditional expressions:

Within a relational expression the subject, relational operator, and object must all be at the same logical parenthetical level. Therefore, a left parenthesis preceding an object indicates that arithmetic follows.

Example:

VALID	INVALID
IF A = (B + C)	IF A = (B OR C)
IF A = (− B)	IF A = ((B + C) OR D)

As described in the General Information Manual, implied subjects and implied relational operators are permissible in conditional expressions. No other abbreviated usage is permitted.

Example:

VALID	INVALID
IF A = B OR C	IF A = B, C OR D

In a conditional expression the logical operator NOT is only permitted at one given parenthetical level.

Example:

VALID	INVALID
NOT (A OR B)	NOT (NOT A OR B)

Added Features of the Procedure Division

The following features, not contained in the General Information Manual, are included in the 1410/7010 COBOL language:

1. The USE Declarative
2. The CORRESPONDING option of the ADD verb
3. The CORRESPONDING option of the SUBTRACT verb

Programming Techniques

As mentioned in the General Information Manual, COBOL provides a convenient method of writing business-oriented programs. However, certain techniques can be used which may produce more efficient machine-language coding or increase compiling speed.

The following suggestions are included to aid the user in obtaining the most efficient machine-language coding from the 1410/7010 COBOL compiler:

1. For files which contain multiple records it may be more economical to define only one form and then transfer the record to an appropriate work area.

2. In an ADD or SUBTRACT operation where there are several operands (data-name or literal), the operands should be the same size. If this is not possible, the largest operand should appear first.

3. It is important to use signed rather than unsigned numeric fields wherever possible.

4. For elementary numeric items, the scaling variations should be minimized (use of PICTURE symbol "P").

5. Subscripting and REDEFINES clause usage may be less efficient than other approaches.

6. Whenever possible, simple statements referencing elementary items should be used, rather than complex statements or statements which reference group items.

The following suggestions are included to aid the user in increasing compilation speed:

1. Unnecessary paragraph-names should be avoided.

2. Certain EXEQ card options (see the section "1410/7010 COBOL Compiler Requirements") cause the compiler to produce additional output. When not essential, these options should not be elected.

3. It is recommended that, wherever possible, the programmer use the PICTURE clause instead of the SIZE, POINT, CLASS, and BLANK clauses of a Record Description entry. The PICTURE clause specifies the characteristics of an elementary item in a more compact form, and can therefore be processed more efficiently.

Some general suggestions, which may be beneficial to the programmer, are given below:

1. When desired precision of results of arithmetic expressions exceeds that represented by PICTURE S9(10)V9(10), it is suggested that the appropriate arithmetic verbs be used (i.e., ADD, SUBTRACT, MULTIPLY, and DIVIDE), rather than the COMPUTE verb.

2. The normal contents of the MONITOR-SWITCH, in the Resident Monitor's Communication Region, is a blank. Therefore, it is recommended that the user either: (a) not assign a blank value to a meaningful condition of this switch; or (b) let the blank value indicate that the switch has not been set.

3. Since Load mode deals with word marks, the user should remember the following, when reading or writing tape in Load mode:

   a. Reading a file in Load mode, processing it, and writing the file in Load mode should present no problems, if the files have been described properly.
   b. Writing in Load mode from information that has been read in other than Load mode, may cause unwanted word marks to appear in the output area. (See "WRITE FROM.")
   c. When a REDEFINES clause is associated with a Load mode input file, the input file must be created using a 1410/7010 COBOL object program. (Because of the REDEFINES technique, the redefined portion of the Load mode record does not carry word marks on tape.)

4. The READ verb with the INTO area-name option should not be used if the record is smaller in size than the area specified by area-name. In this case a simple READ followed by a MOVE should be used.

5. Care should be taken when using the CORRESPONDING option if data-name-1 or data-name-2 is associated with a REDEFINES clause at its own level, or if data-name-1 is one of multiple records defined in an input file. In either case, the description of data contained within subsequent entries where a REDEFINES clause has been used is *not* ignored and will affect the results of the statement.

Compatibility Considerations

Certain COBOL verbs and their associated language specifications cannot be defined in compatible terms between the 1410/7010 Systems and other systems. It is suggested that the user avoid the following when writing COBOL programs that are to be compiled on more than one system:

1. ACCEPT
2. UPON option of the DISPLAY verb
3. ENTER
4. USE

For reasons of compatibility, the use of the REDEFINES clause should be limited to one level of redefinition, with the exception that, if the REDEFINES is specified at the 01-level, one additional level of redefinition within the level 01 may be used.

Use of the COBOL Character Set (H2) for literals is suggested, when compatibility with other systems is a consideration.

The following clauses described in the General Information Manual are not implemented by the 1410/7010 COBOL compiler for reasons of compatibility:

1. The JUSTIFIED clause. Standard justification according to CLASS definition will always take place. If nonstandard data manipulation is required, the programmer can use other language specifications for this purpose (e.g., the REDEFINES clause).

2. The Editing clause. Editing functions can only be specified by use of the PICTURE clause.

Qualification of Names

Every name used in a COBOL source program must be unique within the source program, either because no other name has the identical spelling, or because the name exists within a hierarchy of names (so that the name can be made unique by mentioning one or more of the higher levels of the hierarchy). The higher levels are called qualifiers when used in this way, and the process is called qualification.

In addition to the information contained in the General Information Manual covering the qualification of names, the programmer should note the following:

1. Any name which requires qualification, but is not qualified, will refer to the first occurrence of that name in the program.

2. A name plus all its qualifiers cannot exceed a total of 300 characters. If it does, an error message is produced.

Literals

In addition to the rules for forming literals specified in the General Information Manual, the following rules apply to the 1410/7010 COBOL compiler:

For Forming Numeric Literals: A numeric literal must consist of at least one, and not more than 18 digits. It may also include a sign, preceding the first digit, and/or one decimal point.

For Forming Non-Numeric Literals: Any character in the character set, except the quotation mark, the record mark, and the group mark, can be used in a non-numeric (alphanumeric) literal. Blanks are treated as characters and may be included freely.

Character Sets

The IBM Character Set H2 must be used for COBOL source programs. This character set consists of the numerals 0 through 9, the 26 letters of the alphabet, and 12 special characters. The IBM 1410/7010 Character Set may be used only for alphanumeric literals, with the following exceptions: (1) the IBM 1410/7010 character "ß" (substitute blank) cannot be used with even-parity tape records; (2) the IBM 1410/7010 character "≁" (word separator character) cannot be loaded into the IBM 1410 or 7010 with a word mark.

The COBOL (Set H2) special characters are shown below with their equivalents in the IBM 1410/7010 Character Set:

CARD CODE	COBOL (SET H2)	1410/7010 (SET A2)	MEANING
blank			space
11	—	—	minus sign / hyphen
12	+	&	plus sign
0-1	/	/	division sign
11-4-8	*	*	multiplication sign / check protection symbol
12-4-8	)	□	right parenthesis
0-4-8	(	%	left parenthesis
0-3-8	,	,	comma
11-3-8	$	$	dollar sign
12-3-8	.	.	period / decimal point
3-8	=	#	equal sign
4-8	'	@	quotation mark

Figurative Constants

In addition to the details specified in the General Information Manual, the following information pertains to the figurative constants. All figurative constants are treated as belonging only to the ALPHANUMERIC class.

LOW-VALUE LOW-VALUES	The value of this figurative constant is the space, or blank, the lowest in the collating sequence.
HIGH-VALUE HIGH-VALUES	This figurative constant is defined as the character 9, the highest in the collating sequence.
ZERO ZEROS ZEROES	This figurative constant represents the value 0. It is the only figurative constant that can be treated as belonging to the NUMERIC class or the ALPHANUMERIC class.
SPACE SPACES	This figurative constant represents a blank, or space. It is the only figurative constant that can be treated as belonging to the ALPHABETIC class or the ALPHANUMERIC class.
QUOTE	This figurative constant represents the character '. Note that the use of the word QUOTE to represent the character ' is not equivalent to the use of symbol ' to bound a literal.
ALL "literal"	This figurative constant generates a sequence of characters specified by the single-character non-numeric literal.

TALLY

The word TALLY is the name of a data item whose PICTURE is S99999. It is used primarily to hold information produced by the EXAMINE verb; however, it may be referenced by the programmer in any statement where a signed numeric field is valid.

MONITOR-DATE

In addition to the figurative constants, the IBM 1410/7010 COBOL compiler provides the programmer with the special data-name constant MONITOR-DATE. This data-name constant is the name of a five-character data item (system symbol /DAT/) within the Communication Region of the Resident Monitor. MONITOR-DATE contains the current date established by the System Monitor, and may be used in label-checking routines. The form of the date is yyddd, where: yy is the year (00-99) and ddd is the day of the year (001-366). MONITOR-DATE can be used in the same way as any item described in the Constant Section.

Class Conditions

The General Information Manual specifies that the CLASS of a data item may be NUMERIC, ALPHABETIC or ALPHANUMERIC. It further specifies that the class condition is used to test an ALPHANUMERIC item at object time to determine whether it is wholly numeric or wholly alphabetic in content.

The source statement beginning:

IF FIELD-A IS NUMERIC . . .

results in a character-by-character check of the value of FIELD-A at object time. If an operational sign is present in the units position, the associated character will be interpreted as being numeric. Thus, −9 is interpreted as "minus 9," not as the letter "R."

The source statement beginning:

IF FIELD-B IS ALPHABETIC . . .

results in a character-by-character check of the value of FIELD-B at object time. If each character in FIELD-B is alphabetic, the item is considered alphabetic.

Examples: The following table shows how the class of an item is interpreted by the compiler depending on which of the class tests is specified:

CHARACTER	NUMERIC	ALPHABETIC
0-9	YES	NO
SPACE	NO	YES
A-R	YES (if units position)	YES
S-Z	NO	YES
? !	YES (if units position)	NO
Other Special Characters	NO	NO

It is assumed in the following material that the user is thoroughly familiar with the contents of the publication, *System Monitor.*

Requirements for Compilation

In order to process a COBOL source program under the IBM 1410/7010 Operating System, certain control cards are required to direct the operation of the Resident and Transitional Monitors and the Linkage Loader. The required Monitor control cards are:

```
MON$$   JOB
MON$$   MODE
MON$$   EXEQ
MON$$   ASGN
```

The required Linkage Loader control cards are:

```
PHASE
CALLN
CALL
```

These control cards are described in detail in the publication, *System Monitor.* However, certain COBOL options, which are available to the user, are discussed below.

EXEQ Card Operand Options

The user can control the output of the COBOL compiler by placing operands immediately after the comma which follows the third System Monitor option on the EXEQ card. These operands can appear in any order and must be separated by commas, with no intervening blanks. Any of the following operands may be used:

1. LIST—This operand produces a listing of source program names and corresponding object program relocatable storage assignments. A check for duplicate procedure-names is made if this option is elected. A warning message appears if duplicate names are present.

2. DIAGNOSTIC—This operand suppresses the creation of an object program. (DIAGNOSTIC cannot be requested on the same EXEQ card with TRACE or NOPCH.)

3. TRACE—This operand causes the generation of a self-tracing object program. When each paragraph or section of the main body of the Procedure Division is executed at object time, the paragraph or section-name is printed on the Standard Print Unit.

4. NOPCH—This option should be used only when a Go file is being created. The function of NOPCH is to suppress output on the Standard Punch Unit, thereby providing an object program on the Go file only.

In the event of an error in the use of any of these options on the EXEQ card, the compiler will ignore all options, and produce only the normal output (an object program on the Go file and/or the Standard Punch Unit).

Figure 17 shows an EXEQ card for COBOL compilation with the TRACE and LIST options.

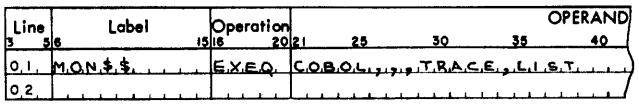


Figure 17. EXEQ Card for COBOL Compilation

Requirements for Execution

The object program produced by the COBOL compiler consists of several subprograms. In accordance with the requirements of the Linkage Loader, each subprogram is headed by a TITLE card.

The Subprogram TITLE Card

The COBOL compiler generates all necessary TITLE card information based on the source program.

The format of the TITLE card is:

Column	6	16	21	31	36	73
	yyddd	TITLE	*PROGRAM*	*nnnxxxxzzzzz*		*nnnsssss*

where

yyddd is the current date taken from the Resident Monitor's Communication Region.

PROGRAM is the first seven characters of the IDENT field of the PROGRAM-ID card in the source program.

nnn is the subprogram number, assigned serially by the compiler. This number is placed in columns 28-30 and columns 73-75.

xxxxx is the lowest relocatable storage address occupied by the subprogram.

zzzzz is the character count of common storage used by the subprogram.

sssss is the sequence-number field of the cards (or card images) in the subprogram. The sequence number of each TITLE card will always be 00001.

IDENT Field of the PROGRAM-ID Card

In order to comply with 1410/7010 Operating System requirements, the following restrictions pertain to completing the IDENT field:

1. It must always begin with an alphabetic character.

2. It cannot begin with the characters "IB".
3. It cannot contain the slash (/) or any blank characters.

If these requirements are not met, the compiler will replace the erroneous character with "A". For example, if the IDENT field contains IBPSD/b/, the TITLE cards will contain IAPSDAAnnn.

Multiple Subprogram COBOL Output

The following list shows the subprogram serial number and function in the normal output of a compilation:

SERIAL NO.	SUBPROGRAM FUNCTION
001	Storage allocation and value declarations for Identification, Environment, and Data Divisions
002	Storage allocation and value declarations for Procedure Division literals
003	Object code for Procedure Division
004	Overlay addresses

Control Card Requirements

The sequence of the appropriate Monitor and Linkage Loader control cards needed to compile and execute the program with the IDENT "PAYROLL1" using the TRACE option is shown in Figure 18.

The subprogram IBCOBOL is a required part of every object program. It must be requested with a CALLN card immediately after the PHASE card.

COBOL programs that have been compiled can be added to the System Library file. (For details, see the publication, *System Monitor.*) The CALL requirements for executing these programs from the System Library file are the same as those for the Go file.

Immediately following the CALLN card for IBCOBOL (Figure 18) is a CALL card for the first of the just-compiled subprograms. The name used in this card consists of the first seven characters of the IDENT field (PAYROLL) and the serial number, 001. The other three subprograms (PAYROLL002, PAYROLL003, and PAYROLL004) are processed by the Linkage Loader in response to *imbedded* calls that the compiler generates for each set of subprograms.

The Linkage Loader places the relocated program on the Job file, from which it is loaded by the Resident

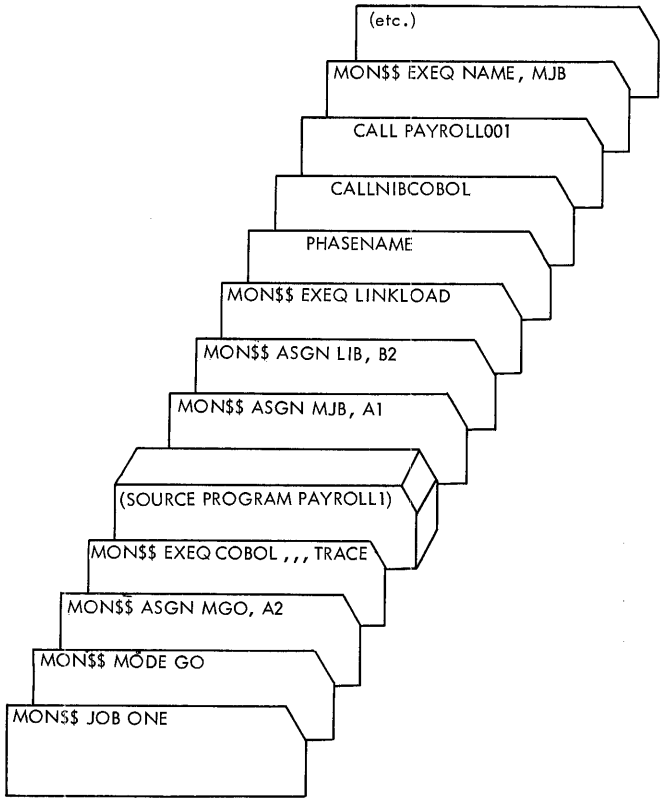


Figure 18. Sample Control Cards for a Compile-and-Go Operation

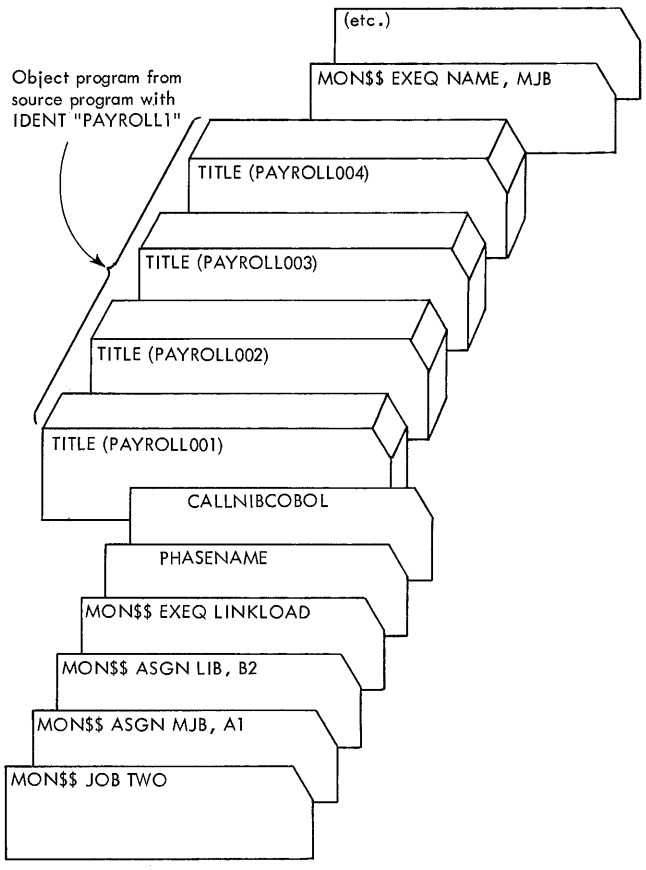


Figure 19. Sample Control Cards for Execution

Monitor (EXEQ NAME, MJB). Note that the name used in the EXEQ card for the program must be the same as that used in the PHASE card given the Linkage Loader, but need not be the same as that used in the IDENT field given the compiler.

The sequence of the appropriate Monitor and Linkage Loader control cards necessary to "execute" the program with the IDENT "PAYROLL1", compiled at a *prior* time is shown in Figure 19.

In Figure 19, the object program has been taken from the Standard Punch Unit and is submitted to the Linkage Loader from the Standard Input Unit (rather than from the Go file, as in Figure 18). The basic difference between the two examples (Figures 18 and 19) is that in Figure 19 a CALL card is not used for the subprogram PAYROLL001, because the TITLE card of a subprogram placed in the Standard Input Unit serves the call function.

Appendix A: COBOL Words

The words listed below constitute the complete IBM COBOL vocabulary. Words preceded by an asterisk (*) are not implemented by the 1410/7010 COBOL compiler but should be avoided when assigning names to data, etc., to avoid unnecessary difficulty in converting 1410/7010 COBOL programs to other IBM systems.

Programmers are cautioned that the words recognized by the 1410/7010 COBOL compiler can be used in a COBOL source program only as specified in this publication, or in the General Information Manual.

ACCEPT
ADD
*ADDRESS
*ADDRESSES
AFTER
ALL
ALPHABETIC
ALPHANUMERIC
ALTER
ALTERNATE
AN
AND
APPLY
ARE
AREA
AREAS
ASSIGN
AT
AUTHOR
AUTHORS

*BCD
BEFORE
BEGINNING
BEGINNING-LABEL
*BEGINNING-REEL
*BINARY
BLANK
BLOCK
*BLOCKS
BY

CALL
CARD-PUNCH
CARD-READER
CHARACTER
CHARACTERS
*CHECKPOINT-UNIT
CLASS
CLOSE
COBOL
*COLLATE-MACHINE-SEQUENCE
COMMUNICATION-MODE
COMPUTATIONAL
*COMPUTATIONAL-1
*COMPUTATIONAL-2
COMPUTE
CONFIGURATION
CONSOLE-PRINTER
*CONSOLE-SWITCH
CONSTANT
*CONTAIN
CONTAINS
*CONTROLS
*COPY
CORRESPONDING
*CREATION-DATE
*CREATION-DAY
*CREATION-YEAR

DATA
DATE-COMPILED
DATE-WRITTEN
DECLARATIVES
*DENSITY
DEPENDING
DIGIT
DIGITS
DISPLAY
DIVIDE
DIVISION

*ELECTRONIC-SWITCH
*ELIMINATION
ELSE
END
ENDING
*ENDING-FILE
ENDING-LABEL
ENDING-REEL
ENTER
ENVIRONMENT
EOF-SIU
EQUAL
ERROR
EVEN
EVERY
EXAMINE
EXIT

FD
FILE
FILES
FILE-CONTROL
FILE-IDENTIFICATION
FILLER
FIRST
FOR
FROM

GIVING
GO
GREATER

*HEADER-LABEL
*HIGH
HIGH-VALUE
HIGH-VALUES
*HYPERTAPE-UNIT
*HYPERTAPE-UNITS

IBM-1410
IBM-7010
IDENTIFICATION
IF
IN
INPUT
INPUT-OUTPUT
INSTALLATION
INTO
I-O-CONTROL
*IOCS
*IOHSK
I-O-SWITCH
IS

LABEL
LEADING
LEFT
LESS
*LIBRARY
LOAD
LOCATION
LOCK
*LONG-LENGTH-RECORD
*LOW
LOW-VALUE
LOW-VALUES

*MEMORY
MODE
MONITOR-DATE
MONITOR-SWITCH
MOVE
*MULTIPLE
MULTIPLY

NEGATIVE
NEXT
NO
*NO-LENGTH-CHECK
*NONE
NON-STANDARD
*NO-OVERLAP
*NO-PRINT-STORAGE
*NO-RELEASE
NOT
*NO-TAPE-MARK
NOTE
NUMERIC

OBJECT-COMPUTER
*OBJECT-PROGRAM
OCCURS
ODD
OF

OFF
OMITTED
ON
OPEN
OPEN-WITHOUT-REWIND
*OPTIONAL-USAGE
OR
OTHERWISE
OUTPUT

PADDING
PARITY
PERFORM
PICTURE
PLACE
PLACES
POINT
POSITIVE
*PREASSEMBLED
PRINTER
*PRIORITY
PROCEDURE
PROCEED
PROGRAM-ID
*PROGRAM-START

QUOTE
QUOTES

READ
RECORD
RECORDING
*RECORD-MARK
RECORDS
REDEFINES
REEL
*REELS
*REEL-SEQUENCE-NUMBER
*REFERENCE
REMARKS
RENAMING
REPLACING
RERUN
RESERVE
RETENTION-PERIOD
REWIND
RIGHT
ROUNDED
RUN

SECTION
SECURITY
SELECT
SENTENCE
*SHORT-ALPHA-WORD
*SHORT-LENGTH-RECORD
SIGNED
SIZE
SOURCE-COMPUTER
SPACE
SPACES
SPECIAL-NAMES
STANDARD
STATUS
STOP
SUBTRACT
*SUPERVISOR
SYNCHRONIZED
*SYSTEM-INPUT-UNIT
SYSTEM-OUTPUT-PRINTER
SYSTEM-OUTPUT-PUNCH

TALLY
TALLYING
TAPE-UNIT
*TAPE-UNITS
THAN
THEN
THROUGH
THRU
TIME
TIMES
TO
*TRAILER-LABEL
*TYPEWRITER

*UNIT-RECORD-I-O-RECORD
UNTIL
UPON
USAGE
USE
USING

VALUE
VARYING

WHEN
WITH
*WITH-LABELS
*WITHOUT-LABELS
*WORDS
WORKING-STORAGE
WRITE

ZERO
ZEROES
ZEROS

Appendix B: Organization of Source Program

Some items which may appear in a source program are required, while others are optional. Whether an item is required or optional may be determined by reading the discussion of each individual COBOL word in this publication. The order of appearance of the divisions is mandatory and all divisions must be present. Certain sections within the divisions must also appear as specified, while others have no rigid rules. The items which may appear in a source program are the following:

```
IDENTIFICATION DIVISION.
PROGRAM-ID. program-name.
AUTHOR. author-name.
INSTALLATION. ...
DATE-WRITTEN. ...
DATE-COMPILED. ...
SECURITY. ...
REMARKS. ...

ENVIRONMENT DIVISION.
CONFIGURATION SECTION.
SOURCE-COMPUTER. ...
OBJECT-COMPUTER. ...
SPECIAL-NAMES. ...
INPUT-OUTPUT SECTION.
FILE-CONTROL. SELECT ...
I-O-CONTROL. APPLY ...

DATA DIVISION.
FILE SECTION.
FD file-name-1 ...
    01 data-name-1 ...
        02 data-name ...
            03 data-name ...
            88 condition-name ...
                .
                .
                .
        02 data-name ...
                .
                .
                .
    01 data-name ...
            .
            .
            .
FD file-name-2 ...
        .
        .
        .
FD file-name-n ...

WORKING-STORAGE SECTION.
77 data-name ...
    88 condition-name ...
            .
            .
            .
77 data-name ...
        .
        .
        .
01 data-name ...
    02 data-name ...
            .
            .
            .
```

```
01 data-name ...
   02 data-name ...
      03 data-name ...
      88 condition-name ...
            .
            .
            .
   02 data-name ...
         .
         .
         .
01 data-name ...
      .
      .
      .

CONSTANT SECTION.
77 data-name ...
      .
      .
      .
77 data-name ...
01 data-name ...
   02 data-name ...
         .
         .
         .
01 data-name ...
   02 data-name ...
      03 data-name ...
            .
            .
            .
   02 data-name ...
         .
         .
         .
01 data-name ...
      .
      .
      .

PROCEDURE DIVISION.
DECLARATIVES.
section-name SECTION. USE ...
paragraph-name. ...
END DECLARATIVES.
paragraph-name. ...
      .
      .
      .
section-name-1 SECTION.
paragraph-name-1. ...
      .
      .
      .
paragraph-name-2. ...
      .
      .
      .
paragraph-name-n. ...
      .
      .
      .
section-name-2 SECTION.
      .
      .
      .
section-name-n SECTION.
paragraph-name-1. ...
      .
      .
      .
paragraph-name-2. ...
      .
      .
      .
paragraph-name-n. ...
      .
      .
      .
```

Appendix C: Object Time Error Analysis and Messages

The following object time conditions will cause immediate job termination. The messages will appear on the Standard Print Unit and control will be transferred to the Resident Monitor's Unusual End of Program. (For details see the *System Monitor* publication.)

INVALID EXPONENTIATION

An attempt to raise zero to the zero power has been detected.

SUBSCRIPTING ERROR

A subscript that is zero, negative, or out of range (of the array), has been detected.

INVALID COMPLEX PERFORM

Object program has failed to follow COBOL rules for PERFORM. To locate this error it is suggested that the program be recompiled and executed using the TRACE option.

ZERO DIVISOR

An attempt to divide by zero has been detected.

UNALTERED STATEMENT nnnnn

A GO TO statement which required ALTERing was executed prior to being ALTERed.

If the program being run was compiled in the TRACE mode, the name of the paragraph in which this error occurred appears as the last paragraph-name on the Standard Print Unit.

If the program being run was *not* compiled in the TRACE mode, nnnnn is the relocated address of the unaltered GO TO statement.

Appendix D: Diagnostic Messages

This appendix includes all the diagnostic messages produced by the 1410/7010 COBOL compiler, and their meanings. The messages are listed by division, with a "general" section for messages which can occur in more than one division.

Normally, when a diagnostic message appears on the source program listing, an incomplete object program will be produced. The compiler will continue to examine the entire source program for further errors but terminates object program output. However, some messages are merely warnings to the programmer, and do not necessarily affect the compilation of the source program. A "W" preceding a message in this appendix indicates a warning-type message. Also indicated (for warning-type messages) are any assumptions the compiler may make about the intent of the statement in question.

Source Program Listing

The following information is included to assist the programmer to better understand the source program listing:

1. An "S" appearing to the left of a statement, or group of statements, indicates that the programmer-supplied sequence numbers are out of sequence. (This is a warning and does not affect compilation.)

2. The four-digit number appearing on the extreme left of the source program Procedure Division listing is a card reference number assigned by the compiler.

3. Source statements and diagnostic messages for the Identification, Environment, and Data Divisions appear interspersed in the source program listing.

4. Diagnostic messages for the Procedure Division appear in one section of the source program listing.

5. A message will appear indicating the storage allocated to the main program. This allocation does not include any optional subprograms called by the user or by the compiler.

6. One of the following messages appears on the Standard Print Unit if compilation of the source program has been prevented:

a. SHORT LENGTH WORK FILE (I/O operation)

Appears if one of the work files (MW1, MW2, or MW3) assigned for the COBOL compiler is not of sufficient length. Compilation is terminated and control passes to the Resident Monitor's Special-End-of-Program routine. (See the publication, *System Monitor,* for details.)

b. ****** OBJECT PROGRAM INCOMPLETE ******

Appears if there are errors in the source program which cannot be corrected by the COBOL compiler. It is the terminating message of a COBOL compilation in which a source error prevented the generation of a complete object program, unless DIAGNOSTIC has been specified on the EXEQ card. (See 7, below.) If this is a compile-and-go operation, the Go file is cancelled.

c. UNCORRECTABLE I/O ERROR IN (phase name)

Appears if there is some uncorrectable input or output error. Compilation is terminated and control passes to the Resident Monitor's Special-End-of-Program routine. (See the publication, *System Monitor,* for details.)

d. ****** SOURCE PROGRAM INCOMPLETE ******

Appears if the four COBOL Divisions are not found in the source program. Compilation is terminated and control passes to the Resident Monitor's Special-End-of-Program routine. (See the publication, *System Monitor,* for details.) If this is a compile-and-go operation, the Go file is cancelled.

In conjunction with messages a, b, and c, the following messages appear on the console printer:

10980 SHORT LENGTH WORK FILE (I/O operation)
10990 OUTPUT INCOMPLETE—SOURCE ERROR
10999 OUTPUT INCOMPLETE—I/O ERROR
(phase name)

7. The following message appears on the Standard Print Unit, and is the terminating message for a COBOL "DIAGNOSTIC" run.

****** END OF DIAGNOSTIC RUN ******

General

The messages appearing below can occur in more than one division.

W DUPLICATE CLAUSE KEYWORD
A clause keyword has appeared more than once in an entry.

W INVALID CONTINUATION CARD
Blank continuation card. It is ignored.

W INVALID LITERAL SYNTAX
Record mark or group mark found in a VALUE clause or a non-numeric literal format error.

W KEYWORD DIVISION MISSING
Presence of the word DIVISION is assumed.

W REFERENCE FORMAT ERROR
One of the format rules has been broken but is ignored by the compiler. (See the General Information Manual.)

W SYNTAX CHECK DISCONTINUED WITH "X"
The syntactical form of the input statements does not conform to COBOL syntax. "X" is the word initiating the erroneous source data.

W SYNTAX CHECK RESUMED WITH "X"
A valid syntactical form is recognized after the occurrence of the above message. "X" is the word with which checking is resumed.

Identification Division

W INVALID IDENTIFICATION ASSIGN IDENTIFICATION "X"
Columns 73-80 invalid. Value of "X" is assigned by the compiler.

W SEARCH FOR IDENTIFICATION
The keyword IDENTIFICATION has not been discovered in its proper position.

W SEARCH FOR PROGRAM-ID
The keyword PROGRAM-ID has not been discovered in its proper position.

Environment Division

W ASSIGN CLAUSE MISSING
Self-explanatory.

W CONFIGURATION SECTION MISSING
Self-explanatory.

W CONFIGURATION SECTION OUT-OF-ORDER
Self-explanatory.

W DUAL OBJECT-COMPUTER SPECIFICATION
IBM 1410 and IBM 7010 specified.

W DUAL SOURCE-COMPUTER SPECIFICATION
IBM 1410 and IBM 7010 specified.

W FILE-CONTROL PARAGRAPH MISSING
Self-explanatory.

W INPUT-OUTPUT SECTION MISSING
Self-explanatory.

W INVALID APPLY CLAUSE SYNTAX
The clause is ignored.

W INVALID APPLY LITERAL
More than one padding character, or invalid padding character.

W INVALID ASSIGN CLAUSE SYNTAX
The clause is ignored.

W INVALID DEVICE-NAMES CLAUSE SYNTAX
The clause is ignored.

W INVALID LABEL RECORD SIZE
Beginning-Label or Ending-Label record is greater than 120 characters.

W INVALID RENAMING CLAUSE SYNTAX
The clause is ignored.

W INVALID RERUN CLAUSE SYNTAX
The clause is ignored.

W INVALID RESERVE CLAUSE SYNTAX
The compiler assumes there are NO ALTERNATE AREAS.

W INVALID SELECT SYNTAX
SELECT not followed by ASSIGN, RESERVE, or RENAMING.

W INVALID SPECIAL-NAMES PARAGRAPH SYNTAX
The paragraph is ignored.

W INVALID SWITCH-NAMES CLAUSE SYNTAX
The clause is ignored.

W KEYWORD SECTION MISSING
Self-explanatory.

W MISSING PERIOD
Self-explanatory.

W NO I-O-CONTROL PARAGRAPH
Self-explanatory.

W NO SECTION HEADING
Self-explanatory.

W OBJECT-COMPUTER PARAGRAPH MISSING
Self-explanatory.

W PARAGRAPH INVALID IN THIS SECTION
Processing will take place as if SECTION were correct.

W PARAGRAPH OUT-OF-ORDER
Self-explanatory.

W SOURCE-COMPUTER PARAGRAPH MISSING
Self-explanatory.

W UNDEFINED APPLY FILE-NAME
File used in APPLY clause not defined.

W UNDEFINED RENAMING FILE-NAME
File used in RENAMING clause not defined.

W UNDEFINED RERUN FILE-NAME
File used in RERUN clause not defined.

Data Division

W 77-LEVEL OUT-OF-ORDER
Self-explanatory.

W 88-LEVEL INVALID AT GROUP LEVEL
Self-explanatory.

W 88-LEVEL INVALID IN THIS SECTION
An 88-level appears in the CONSTANT SECTION. This entry is ignored.

W CLAUSE MISSING IN THIS FD
LABEL RECORDS clause is missing and is asasumed to be omitted; or DATA RECORDS clause is missing and is ignored.

W ENTRY EXCEEDS MAXIMUM CLASS SIZE
Indicates a numeric item with a size greater than 18 digits. Class is assumed to be alphanumeric.

W FD ENTRY RECORD MISSING
An FD entry has no associated Record Description items. File is ignored.

W FD OUT-OF-ORDER
FD has been detected in other than File Section. Compiler will handle this condition.

W FILE SECTION OUT-OF-ORDER
Will be processed as if in proper order.

W INCOMPATIBLE BLOCK RECORD CLAUSE
Combination of BLOCK CONTAINS and RECORD CONTAINS clause does not agree with one of the five allowable formats.

W INCOMPATIBLE BLOCK RECORD SIZE
The record size is too large. Record size will be used.

W INCOMPATIBLE CLASS PICTURE CLAUSE
Classes as specified by the CLASS and PICTURE clauses in a given item do not agree. CLASS clause is ignored.

W INCOMPATIBLE LITERAL
CLASS or PICTURE does not agree with VALUE literal. The compiler ignores this condition and allocates storage for the literal.

W INCOMPATIBLE PICTURE POINT CLAUSE
The assumed decimal point in the POINT clause does not agree with the PICTURE. POINT clause is ignored.

W INCOMPATIBLE POINT CLASS CLAUSE
The POINT clause is not associated with a numeric item. POINT clause is ignored.

W INCOMPATIBLE RECORD SIZE
The record size as derived from the Record Description does not agree with the size as stated in the RECORD CONTAINS clause. The computed record size will be used.

W INCOMPATIBLE REDEFINES ENTRY
The size associated with the redefinition is not equal to the size of the original area. The size of the original is used if the redefined area is greater.

W INCOMPATIBLE SIGNED PICTURE CLASS CLAUSE
The existence of a sign, specified by the SIGNED clause, does not agree with the PICTURE, which is non-numeric. The SIGNED clause is ignored.

W INCOMPATIBLE SIZE CLAUSE AT GROUP LEVEL
SIZE as specified at group level does not agree with the size as calculated from the contained elementary items. Group SIZE is made to conform.

W INCOMPATIBLE SIZE PICTURE CLAUSE
Size as specified in a SIZE clause does not agree with the size given by the PICTURE clause. SIZE clause is ignored.

W INCOMPATIBLE WITH HIGHER LEVEL CLASS
Class specified for this item does not agree with class specified for the group. Group CLASS is ignored.

W INVALID 88-LEVEL
88-level occurs without a preceding condition variable (valid level-number). It is ignored.

W INVALID BLOCK CLAUSE SYNTAX
The compiler will infer block size from record size.

W INVALID CLASS SYNTAX
CLASS clause is ignored.

W INVALID DATA RECORD CLAUSE SYNTAX
The clause is ignored.

W INVALID DEPENDING ON ENTRY
The DEPENDING ON data name within a given RECORD CONTAINS clause either does not occur in a subsequent file record, or does not have consistent specifications in a multi-record file.

W INVALID EDITING CLAUSE SYNTAX
Invalid BLANK WHEN ZERO clause.

W INVALID LABEL RECORD CLAUSE SYNTAX
Compiler assumes OMITTED.

W INVALID LEVEL-NUMBER
The level-number of the first item following an FD is not 01. This item is assumed to be a 01-level.

W INVALID LEVEL-NUMBER SYNTAX
Invalid level-number sequence. Will be treated as if valid; therefore, hierarchical relationships may be affected.

W INVALID LITERAL
File Identification value is improper. If more than 10 characters the value is truncated.

W INVALID LITERAL IS THIS CONTINUATION CARD
Continuation indicator, but first non-blank character, not the quote sign. Continuation ignored-literal is terminated by end of first card.

W INVALID OCCURS CLAUSE
OCCURS clause generates a fourth or higher dimension array. The clause is ignored.

W INVALID OCCURS CLAUSE SYNTAX
The clause is ignored.

W INVALID PERIOD
Self-explanatory.

W INVALID PICTURE SYNTAX
The clause is ignored.

W INVALID POINT CLAUSE SYNTAX
The clause is ignored.

W INVALID PUNCTUATION OR SPECIAL CHARACTER
This is ignored.

W INVALID RECORD SYNTAX
Syntactical error in RECORD CONTAINS clause. The clause is ignored.

W INVALID RECORDING MODE CLAUSE SYNTAX
Compiler assumes Move mode and even parity.

W INVALID REDEFINES CLAUSE SYNTAX
The redefined data name is undefined or the entries redefining an area do not immediately follow the original definition of the area, or the redefined data-name level-number does not agree with the current-name level-number.

W INVALID SIZE CLAUSE SYNTAX
The clause is ignored.

W INVALID SYNCHRONIZED CLAUSE SYNTAX
The clause is ignored.

W INVALID U/R SPECIFICATION
Recording mode specified is invalid for unit record. Move mode and even parity is assumed.

W INVALID USAGE CLAUSE SYNTAX
The clause is ignored.

W INVALID VALUE CLAUSE
VALUE and REDEFINES clauses are in same item. VALUE and OCCURS clauses are in same item. VALUE in item subordinate to grouped REDE-

FINES item. VALUE in item subordinate to grouped OCCURS item. VALUE within a File Section Record Description; or VALUE with report item. The VALUE is ignored.

W KEYWORD SECTION MISSING
The word SECTION does not appear. The compiler assumes that it is present.

W LITERAL EXCEEDS MAXIMUM CHARACTER SIZE 120
Literal will be truncated.

W LITERAL TRUNCATION
VALUE exceeds SIZE. This message will also appear whenever a VALUE is given to a field whose PICTURE includes PICTURE symbol "P" on the left.

W NO CONTINUATION CARD INVALID LITERAL
No terminal quote sign on current card, or no continuation indicator on next one. Literal assumed terminated at end of first card.

W NO ENTRY CLASS
No CLASS or PICTURE for an elementary item. Low order character(s) of the literal will not fit in the field as specified.

W NO LITERAL WITH 88-LEVEL
88 is assigned a value of blanks.

W NO SIZE IN THIS ENTRY
Self-explanatory.

NUMBER OF ENTRIES WITHIN GROUP EXCEEDS TABLE SIZE—BREAK UP GROUP USING REDEFINES OPTION
Self-explanatory.

W OCCURS CLAUSE INVALID IN THIS ENTRY
OCCURS clause associated with a 01 or 77-level item. The clause is ignored.

W PICTURE CLAUSE INVALID AT GROUP LEVEL
PICTURE clause is describing a group item rather than an elementary item. The clause is ignored.

W POINT CLAUSE INVALID AT GROUP LEVEL
POINT clause is used to describe group rather than elementary item. The clause is ignored.

W PUNCTUATION INVALID IN THIS ENTRY
One of the punctuation rules has been broken. (See the General Information Manual.) Punctuation is ignored.

W RECORD CLAUSE MISSING
RECORD CONTAINS clause is missing.

RECORD OUT-OF-ORDER
A Record Description entry within the File Section has no associated FD. Item is processed as WORKING-STORAGE.

W REDEFINES CLAUSE OUT-OF-ORDER
REDEFINES clause is not the first clause in an item. The clause is accepted.

W REDUNDANT 88-LEVEL CLAUSE
A clause other than VALUE is associated with an 88-level item. This is ignored.

W SIGNED CLAUSE INVALID AT GROUP LEVEL
SIGNED clause is used to describe group item rather than elementary item. This is ignored.

W UNDEFINED DATA-RECORD
01 Record not defined in DATA RECORD clause.

W UNDEFINED ENTRY
Undefined name in REDEFINES clause or RECORD CONTAINS DEPENDING ON clause.

W UNDEFINED FILE
FD entry has no associated SELECT clause, or invalid SELECT clause.

W VALUE CLAUSE INVALID AT GROUP LEVEL
The clause is ignored.

W WORD EXCEEDS MAXIMUM CHARACTER SIZE 30
The word is truncated.

W WORKING STORAGE SECTION OUT-OF-ORDER
This is processed as if in proper order.

Procedure Division

(name) IS AN INVALID QUALIFIER IN (name)
Invalid qualifier is identified by the paragraph in which it is used.

(name) IS AN UNDEFINED NAME IN (name)
Undefined procedure-name is identified by the paragraph in which it is used.

(name) NOT A CONDITION-NAME
Self-explanatory.

(name) OVERSIZE PARAGRAPH
Paragraph should be broken down into more than one paragraph.

W CONDITIONAL CLASS CONTRADICTION
Data items of unlike class are being compared, or a non-numeric data item is being tested for a sign, or a sign test on an unsigned numeric data item.

W CORRESPONDING OPERATOR INVALID REPLACED WITH "X" OPERATOR
In MOVE, ADD, or SUBTRACT CORRESPONDING, TO or FROM was missing. "X" will be either "TO" or "FROM."

CORRESPONDING STATEMENT FORMAT ERROR
Self-explanatory.

W CORRESPONDING VERB IGNORED
CORRESPONDING used with other than MOVE, ADD, or SUBTRACT.

EXAMINE OPERAND ERROR
Attempt to EXAMINE a constant or a literal.

GO TO STATEMENT MISSING DEPENDING
Self-explanatory.

INCORRECT CONDITIONAL EXPRESSION
Self-explanatory.

W INCORRECT CONTINUATION
Continuation card error. Text starts prior to column 12 of continuation card. Unnecessary continuation indicator detected. This condition is ignored.

W INCORRECT END DECLARATIVES
The compiler will correct this error.

INCORRECT LITERAL
Invalid record mark or group mark.

INCORRECT LITERAL CONTINUATION
Non-numeric literal continuation error.

W INCORRECT PUNCTUATION
Incorrect punctuation will be ignored.

W INVALID ALTER STATEMENT
Something other than a Paragraph/Section-name follows ALTER; TO PROCEED TO is not specified properly; Paragraph/Section-name does not follow TO PROCEED TO; invalid format for compound ALTER statements or more than one level of qualification has been given for Paragraph/Section-name.

INVALID CALL STATEMENT
Self-explanatory.

INVALID CHARACTER
1410/7010 special character meaningless to COBOL will be ignored.

INVALID COMPUTE OPERAND
Self-explanatory.

INVALID COMPUTE OPERATOR
Self-explanatory.

INVALID CONDITIONAL OPERAND
Data-name is used incorrectly.

INVALID CONDITIONAL OPERATOR
Self-explanatory.

INVALID CORRESPONDING
CORRESPONDING option is used incorrectly.

INVALID DATA-NAME IN ACCEPT STATEMENT
Self-explanatory.

INVALID DECLARATIVES
Section-name does not follow DECLARATIVES. The compiler will skip to the next procedure-name or END DECLARATIVES.

INVALID DISPLAY DEVICE
Self-explanatory.

INVALID ENTER STATEMENT
Self-explanatory.

INVALID EXAMINE STATEMENT
Self-explanatory.

INVALID EXIT
Keyword EXIT appeared in other than a one-word paragraph.

INVALID OPERAND
Invalid operands, invalid qualification, or more than three levels of subscripting.

INVALID OPERAND AFTER GIVING CLAUSE
Multiple receiving fields invalid.

INVALID OPERAND USAGE IN CORRESPONDING
Multiple receiving field specified in ADD or SUBTRACT CORRESPONDING, or invalid data-name, such as literal or elementary item used, or a level 77 used.

INVALID PARENTHESIS
Self-explanatory.

INVALID PERFORM STATEMENT
Self-explanatory.

INVALID STATEMENT
Missing ENTER COBOL.

INVALID USE STATEMENT
Self-explanatory.

INVALID WORD AFTER OPEN VERB
Self-explanatory.

IS UNDEFINED
Undefined name. The name will appear on the preceding line.

W LITERAL EXCEEDS 120 CHARACTERS
Literal will be truncated.

MISSING AT END IN READ STATEMENT
Self-explanatory.

MISSING BY AFTER VARYING IN PERFORM STATEMENT
Self-explanatory.

MISSING DISPLAY OPERAND ONE
Self-explanatory.

MISSING ERROR AFTER SIZE
Self-explanatory.

MISSING FIRST MOVE OPERAND
Self-explanatory.

MISSING FROM AFTER VARYING IN PERFORM STATEMENT
Self-explanatory.

MISSING IF TO MATCH THIS NEXT SENTENCE CLAUSE
Self-explanatory.

MISSING LEFT PARENTHESIS IN CONDITIONAL
Self-explanatory.

MISSING LITERAL IN EXAMINE STATEMENT
Self-explanatory.

MISSING LITERAL TWO AFTER EXAMINE
Self-explanatory.

MISSING OPERAND ONE IN THIS STATEMENT
Self-explanatory.

W MISSING PERIOD BEFORE P/S NAME
Statement not properly terminated before new paragraph/section-name.

MISSING PERIOD OR SECTION AFTER PROCEDURE-NAME
Self-explanatory.

MISSING PROCEDURE IN USE STATEMENT
Self-explanatory.

MISSING PROCEDURE-NAME AFTER GO TO
Self-explanatory.

MISSING PROCEDURE-NAME IN PERFORM STATEMENT
Self-explanatory.

MISSING RECEIVING OPERAND
Self-explanatory.

MISSING REPLACING OR BY IN EXAMINE STATEMENT
Self-explanatory.

MISSING REWIND AFTER NO
Self-explanatory.

MISSING RIGHT PARENTHESIS IN CONDITIONAL
Self-explanatory.

MISSING RUN OR LITERAL AFTER STOP
Self-explanatory.

MISSING SECOND MOVE OPERAND
Self-explanatory.

MISSING SENTENCE AFTER NEXT
Self-explanatory.

MISSING STATEMENT 1 TO MATCH THIS OTHERWISE OR ELSE
The word ELSE or OTHERWISE is used without an associated IF statement.

MISSING TALLYING OR REPLACING IN EXAMINE STATEMENT
Self-explanatory.

MISSING TIMES IN PERFORM STATEMENT
Self-explanatory.

MISSING TO AFTER GO
Self-explanatory.

MISSING TO AFTER MOVE
Self-explanatory.

MISSING UNTIL AFTER VARYING IN PERFORM STATEMENT
Self-explanatory.

MISSING VALID EXPONENTIATE OPERAND
Self-explanatory.

MISSING VALID FILE-NAME AFTER CLOSE VERB
Self-explanatory.

MISSING VALID FILE-NAME AFTER OPEN INPUT
Self-explanatory.

MISSING VALID FILE-NAME AFTER OPEN OUTPUT
Self-explanatory.

MISSING VALID FILE-NAME IN READ STATEMENT
Self-explanatory.

MISSING VALID GO TO DEPENDING OPERAND
Data-name is missing or is not an integer.

MISSING VALID OPERAND AFTER BY OR INTO
Self-explanatory.

MISSING VALID OPERAND AFTER EXAMINE
Self-explanatory.

MISSING VALID OPERAND AFTER GIVING
Self-explanatory.

MISSING VALID OPERAND AFTER VARYING IN PERFORM
Self-explanatory.

MISSING VALID READ AREA-NAME
Self-explanatory.

MISSING VALID WRITE AREA-NAME
Self-explanatory.

MISSING VALID WRITE RECORD
Self-explanatory.

W MOVE CLASS CONTRADICTION
Self-explanatory.

MOVE OPERAND ERROR
The receiving field designated is a literal, constant, etc.

MOVE SUBSCRIPT FROM OPERAND
More than two subscripted data-names have appeared in the USING option of the CALL verb.

NO MATCH FOR CORRESPONDING
No match found for MOVE (one item elementary) or Arithmetic (both items elementary numeric). Improper qualifications exists for matching data items. Matching data items are in secondary redefined area, or qualified by same.

PARAGRAPH/SECTION INCOMPLETE IN (name)
This message occurs if a source error has prevented processing of part of a statement or paragraph; or a statement implies the existence of a clause or statement that is not present.

W POSSIBLE TRUNCATION
Sending or FROM data-name larger than receiving data-name, or storing of arithmetic results where digits might be lost. (This message may occur where the ROUNDING option is used, and should be ignored.)

P/S NAME FORMAT ERROR
Procedure-name not followed by SECTION or period.

QUALIFIED NAME EXCEEDS STORAGE ALLOCATION
Total number of characters has exceeded 300.

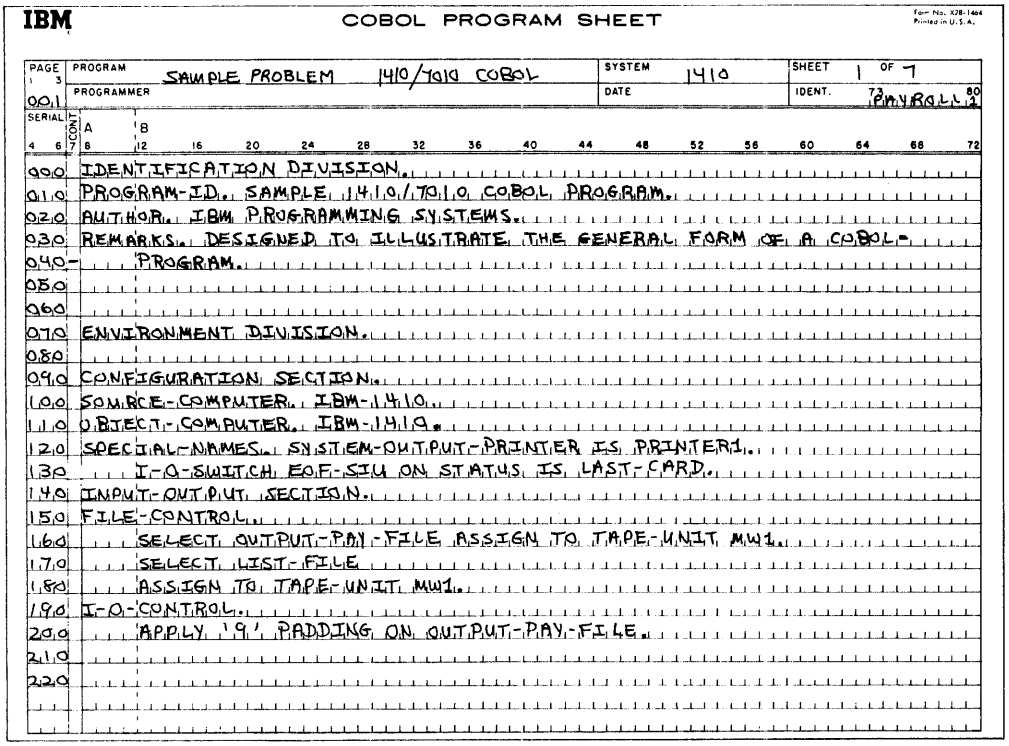
SUBSCRIPT ERROR
Subscripting used with a data-name not associated with an OCCURS clause, or the number of subscripts used does not agree with the associated data description.

USE VERB MISSING
In DECLARATIVES, first word after section-name SECTION must be USE. Compiler will skip to the next procedure-name or END DECLARATIVES.

W WARNING (name) IS A MULTIPLE DEFINED NAME
This message only appears if the LIST option is used and a duplicate name occurs.

W WORD EXCEEDS 30 CHARACTERS
Word is truncated.

Appendix E: Sample Problem



IBM COBOL PROGRAM SHEET

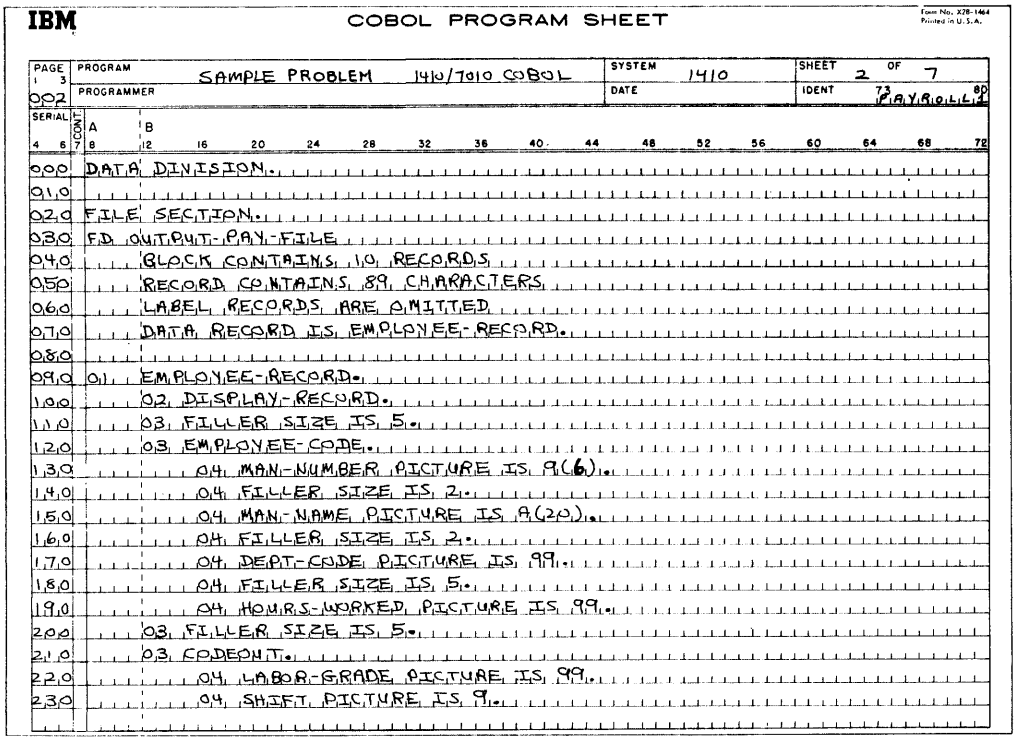
Form No. X28-1464 Printed in U.S.A.

PAGE 1 3 | PROGRAM SAMPLE PROBLEM 1410/7010 COBOL | SYSTEM 1410 | SHEET 1 OF 7

PROGRAMMER | DATE | IDENT. 73 PAYROLL1 80

SERIAL 1 4 6 | CONT 7 | A 8 | B 12 16 20 24 28 32 36 40 44 48 52 56 60 64 68 72

```
000 IDENTIFICATION DIVISION.
010 PROGRAM-ID. SAMPLE 1410/7010 COBOL PROGRAM.
020 AUTHOR. IBM PROGRAMMING SYSTEMS.
030 REMARKS. DESIGNED TO ILLUSTRATE THE GENERAL FORM OF A COBOL-
040-    PROGRAM.
050
060
070 ENVIRONMENT DIVISION.
080
090 CONFIGURATION SECTION.
100 SOURCE-COMPUTER. IBM-1410.
110 OBJECT-COMPUTER. IBM-1410.
120 SPECIAL-NAMES. SYSTEM-OUTPUT-PRINTER IS PRINTER1.
130     I-O-SWITCH EOF-SIW ON STATUS IS LAST-CARD.
140 INPUT-OUTPUT SECTION.
150 FILE-CONTROL.
160     SELECT OUTPUT-PAY-FILE ASSIGN TO TAPE-UNIT MW1.
170     SELECT LIST-FILE
180     ASSIGN TO TAPE-UNIT MW1.
190 I-O-CONTROL.
200     APPLY '9' PADDING ON OUTPUT-PAY-FILE.
210
220
```



IBM COBOL PROGRAM SHEET

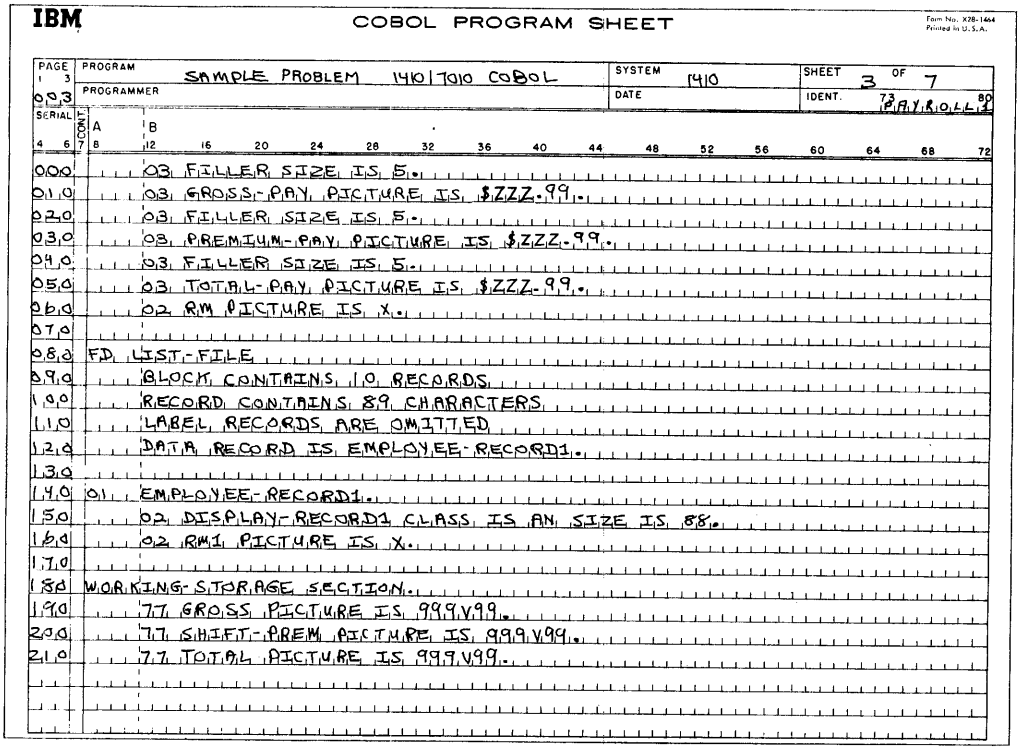
Form No. X28-1464 Printed in U.S.A.

PAGE 2 3 | PROGRAM SAMPLE PROBLEM 1410/7010 COBOL | SYSTEM 1410 | SHEET 2 OF 7

PROGRAMMER | DATE | IDENT 73 PAYROLL1 80

SERIAL 1 4 6 | CONT 7 | A 8 | B 12 16 20 24 28 32 36 40 44 48 52 56 60 64 68 72

```
000 DATA DIVISION.
010
020 FILE SECTION.
030 FD OUTPUT-PAY-FILE
040     BLOCK CONTAINS 10 RECORDS
050     RECORD CONTAINS 89 CHARACTERS
060     LABEL RECORDS ARE OMITTED
070     DATA RECORD IS EMPLOYEE-RECORD.
080
090 01  EMPLOYEE-RECORD.
100     02 DISPLAY-RECORD.
110     03 FILLER SIZE IS 5.
120     03 EMPLOYEE-CODE.
130         04 MAN-NUMBER PICTURE IS 9(6).
140         04 FILLER SIZE IS 2.
150         04 MAN-NAME PICTURE IS A(20).
160         04 FILLER SIZE IS 2.
170         04 DEPT-CODE PICTURE IS 99.
180         04 FILLER SIZE IS 5.
190         04 HOURS-WORKED PICTURE IS 99.
200     03 FILLER SIZE IS 5.
210     03 CODEONE.
220         04 LABOR-GRADE PICTURE IS 99.
230         04 SHIFT PICTURE IS 9.
```



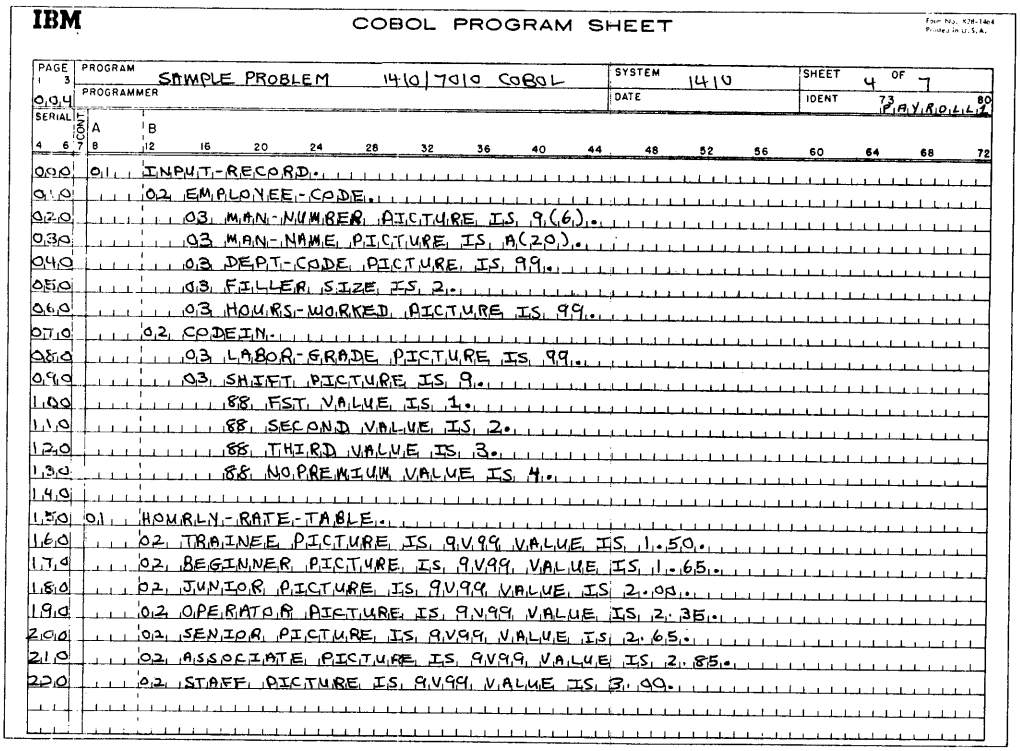
IBM COBOL PROGRAM SHEET

Form No. X28-1464 Printed in U.S.A.

PAGE 003 | PROGRAM: SAMPLE PROBLEM 1410/7010 COBOL | SYSTEM: 1410 | SHEET 3 OF 7 | PROGRAMMER: | DATE: | IDENT. 73 PAYROLL1 80

SERIAL 4 6 | CONT 7 | A 8 | B 12 16 20 24 28 32 36 40 44 48 52 56 60 64 68 72

```
000  03 FILLER SIZE IS 5.
010  03 GROSS-PAY PICTURE IS $ZZZ.99.
020  03 FILLER SIZE IS 5.
030  03 PREMIUM-PAY PICTURE IS $ZZZ.99.
040  03 FILLER SIZE IS 5.
050  03 TOTAL-PAY PICTURE IS $ZZZ.99.
060  02 RM PICTURE IS X.
070
080  FD LIST-FILE
090      BLOCK CONTAINS 10 RECORDS
100      RECORD CONTAINS 89 CHARACTERS
110      LABEL RECORDS ARE OMITTED
120      DATA RECORD IS EMPLOYEE-RECORD1.
130
140  01  EMPLOYEE-RECORD1.
150      02 DISPLAY-RECORD1 CLASS IS AN SIZE IS 88.
160      02 RM1 PICTURE IS X.
170
180  WORKING-STORAGE SECTION.
190      77 GROSS PICTURE IS 999V99.
200      77 SHIFT-PREM PICTURE IS 999V99.
210      77 TOTAL PICTURE IS 999V99.
```



IBM COBOL PROGRAM SHEET

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PAGE 004 | PROGRAM: SAMPLE PROBLEM 1410/7010 COBOL | SYSTEM: 1410 | SHEET 4 OF 7 | PROGRAMMER: | DATE: | IDENT 73 PAYROLL2 80

SERIAL 4 6 | CONT 7 | A 8 | B 12 16 20 24 28 32 36 40 44 48 52 56 60 64 68 72

```
000  01  INPUT-RECORD.
010      02 EMPLOYEE-CODE.
020          03 MAN-NUMBER PICTURE IS 9(6).
030          03 MAN-NAME PICTURE IS A(20).
040          03 DEPT-CODE PICTURE IS 99.
050          03 FILLER SIZE IS 2.
060          03 HOURS-WORKED PICTURE IS 99.
070      02 CODEIN.
080          03 LABOR-GRADE PICTURE IS 99.
090          03 SHIFT PICTURE IS 9.
100              88 FST VALUE IS 1.
110              88 SECOND VALUE IS 2.
120              88 THIRD VALUE IS 3.
130              88 NOPREMIUM VALUE IS 4.
140
150  01  HOURLY-RATE-TABLE.
160      02 TRAINEE PICTURE IS 9V999 VALUE IS 1.50.
170      02 BEGINNER PICTURE IS 9V999 VALUE IS 1.65.
180      02 JUNIOR PICTURE IS 9V999 VALUE IS 2.00.
190      02 OPERATOR PICTURE IS 9V999 VALUE IS 2.35.
200      02 SENIOR PICTURE IS 9V999 VALUE IS 2.65.
210      02 ASSOCIATE PICTURE IS 9V999 VALUE IS 2.85.
220      02 STAFF PICTURE IS 9V999 VALUE IS 3.00.
```

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COBOL PROGRAM SHEET

Form No. X28-1464 Printed in U.S.A.

PAGE 005 | PROGRAM: SAMPLE PROBLEM 1410/7010 COBOL | SYSTEM: 1410 | SHEET 5 OF 7
PROGRAMMER | DATE | IDENT 73 PAYROLL1 80

SERIAL 4 6 | CONT 7 | A 8 | B 12 16 20 24 28 32 36 40 44 48 52 56 60 64 68 72

```
000 01  RATE-REDEFINES-HOURLY-RATE-TABLE.
010     02 HRLY-RATE PICTURE IS 9V999 OCCURS 7 TIMES.
020
030 CONSTANT SECTION.
040     77 RMK PICTURE IS X.
050     77 FIRST-SHIFT PICTURE IS V99 VALUE IS .10.
060     77 SECOND-SHIFT PICTURE IS V99 VALUE IS .13.
070     77 THIRD-SHIFT PICTURE IS V99 VALUE IS .15.
080     77 ZERO-PREM PICTURE IS 999V99 VALUE IS 000.00.
090
100 01  HEADING-RECORD.
110     02 FILLER SIZE IS 5.
120     02 MNO PICTURE IS A(6) VALUE IS 'MAIN-NO'.
130     02 FILLER SIZE IS 5.
140     02 NM PICTURE IS A(4) VALUE IS 'NAME'.
150     02 FILLER SIZE IS 14.
160     02 DPT PICTURE IS A(4) VALUE IS 'DEPT'.
170     02 FILLER SIZE IS 3.
180     02 HRS PICTURE IS A(3) VALUE IS 'HRS'.
190     02 FILLER SIZE IS 4.
200     02 CD PICTURE IS A(4) VALUE IS 'CODE'.
210     02 FILLER SIZE IS 5.
220     02 GRSS PICTURE IS A(5) VALUE IS 'GROSS'.
```

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COBOL PROGRAM SHEET

Form No. X28-1464 Printed in U.S.A.

PAGE 006 | PROGRAM: SAMPLE PROBLEM 1410/7010 COBOL | SYSTEM: 1410 | SHEET 6 OF 7
PROGRAMMER | DATE | IDENT 73 PAYROLL1 80

SERIAL 4 6 | CONT 7 | A 8 | B 12 16 20 24 28 32 36 40 44 48 52 56 60 64 68 72

```
000     02 FILLER SIZE IS 4.
010     02 PREM PICTURE IS A(7) VALUE IS 'PREMIUM'.
020     02 FILLER SIZE IS 8.
030     02 TOTL PICTURE IS A(5) VALUE IS 'TOTAL'.
040
050 PROCEDURE DIVISION.
060
070 DECLARATIVES.
080 UNREADABLE SECTION. USE AFTER STANDARD ERROR PROCEDURE ON
090     LIST-FILE, DISPLAY, DISPLAY-RECORD1.
100 END DECLARATIVES.
110
120 INTRODUCTION. NOTE THAT THIS PROGRAM HAS BEEN DESIGNED
130     TO DEMONSTRATE TYPICAL COBOL FORMAT. NO ATTEMPT HAS BEEN
140     MADE TO CREATE A PROGRAM FOR ACTUAL CUSTOMER APPLICATION.
150
160 START. OPEN OUTPUT OUTPUT-PAY-FILE.
170 NEXT-EMPLOYEE. ACCEPT INPUT-RECORD IF LAST-CARD GO TO RWND.
180     MOVE CORRESPONDING EMPLOYEE-CODE IN INPUT-RECORD TO EMPLOYEE-
190-    CODE IN DISPLAY-RECORD. MOVE CODEIN TO CODEOUT. MULTIPLY
200     HOURS-WORKED IN INPUT-RECORD BY HRLY-RATE (LABOR-GRADE IN
210     CODEIN) GIVING GROSS. MOVE GROSS TO GROSS-PAY.
220
```

IBM COBOL PROGRAM SHEET

Form No. X28-1464 Printed in U.S.A.

PAGE 1 3 | PROGRAM SAMPLE PROBLEM 1410/7010 COBOL | SYSTEM 1410 | SHEET 7 OF 7

007 | PROGRAMMER | DATE | IDENT 73 PAY ROLL1 80

SERIAL 1 4 6 | CONT 7 | A 8 | B 12 16 20 24 28 32 36 40 44 48 52 56 60 64 68 72

```
000    IF NOPREMIUM GO TO NO-PREM-RTN ELSE GO TO PREM1, PREM2
010    PREM3, DEPENDING ON SHIFT IN CODEIN. STOP 'INVALID PREMIUM
020-   'CODE'.
030
040    NO-PREM-RTN. MOVE ZERO-PREM TO PREMIUM-PAY. MOVE GROSS TO TOTAL-P
050-   AY GO TO OUTPUT-ROUTINE.
060    PREM1. COMPUTE SHIFT-PREM ROUNDED = GROSS * FIRST-SHIFT. GO TO
070    TOTAL-RTN.
080    PREM2. MULTIPLY GROSS BY SECOND-SHIFT GIVING SHIFT-PREM ROUNDED.
090    GO TO TOTAL-RTN.
100    PREM3. COMPUTE SHIFT-PREM ROUNDED = GROSS * THIRD-SHIFT.
110
120    TOTAL-RTN. MOVE SHIFT-PREM TO PREMIUM-PAY. ADD SHIFT-PREM TO
130    GROSS GIVING TOTAL. MOVE TOTAL TO TOTAL-PAY.
140    OUTPUT-ROUTINE. MOVE RMK TO RM. WRITE EMPLOYEE-RECORD
150    GO TO NEXT-EMPLOYEE.
160    RWND. CLOSE OUTPUT-PAY-FILE OPEN INPUT LIST-FILE.
170    NOTE PRINT OUT OF RECORD CREATED ON TAPE.
180    DISPLAY HEADING-RECORD UPON PRINTER1.
190    PRINT-RECORD. READ LIST-FILE AT END GO TO CLOSE-RTN.
200    IF CODEOUT IS EQUAL TO '999' GO TO CLOSE-RTN. DISPLAY
210    DISPLAY-RECORD1 UPON PRINTER1 GO TO PRINT-RECORD.
220    CLOSE-RTN. CLOSE LIST-FILE WITH LOCK. DISPLAY 'END OF EXECUTION',
230    STOP RUN.
```

Index

Reader's Comments

IBM 1410/7010 Operating System (1410-PR-155)
COBOL

Form C28-0327-1

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