



ABSTRACT

"Data Output 4," program J3-03.0, is an RPC-4000 program which will print or punch the contents of groups of consecutive memory locations, assuming all numbers to be integers. The number of locations to be printed, the field width, the number of decimal places, and carriage returns, if desired, are specified by code words. The output word may consist of leading spaces, a decimal point, a sign, and a maximum of nine digits.

"Data Output 2" will continue to process and execute code words until an exit is encountered, whereupon it will transfer to the exit instruction specified by the source program.

STORAGE

MAIN MEMORY REQUIRED

191 sectors, including region assignment.

RECIRCULATING SECTORS USED

0, 1, 2, 3, and 4

INDEX REGISTER

Used in calling sequence and during execution. Contents prior to entry is not restored upon exit.

UPPER AND LOWER ACCUMULATORS

The Lower Accumulator contains the instruction to which "Data Output 2" will exit after completing the designated output.

The contents of the Upper Accumulator is immaterial.

The contents of either accumulator is not restored upon exit to the source program. The Lower Accumulator must be in One-Word Mode at time of entry to "Data Output 4," and will be left in this mode at exit.

DATA OUTPUT 4

INPUT

The input variables for "Data Output 4" are as follows:

1. The list of control codes.
2. The data to be output.

The control codes define the output format in the following manner:

- Bits 0-4 Order Portion of the Word - specifies the number of locations to be output under the control of a given code word. The number may range from 0 to 31.
- Bits 5-17 Data-Address Portion of the Word - contains the address of the first location to be printed.
- Bits 18-24 Next-Address Track - specifies the total field width including any leading spaces, digits, sign, and possible decimal point. The maximum field width is 63. The minimum width varies in accordance with the following rules:
- a. The minimum field for an integer print with no decimal point is 1 plus the number of digits to be printed. This allows for the sign position.
 - b. The minimum field for a number with a decimal point is 2 plus the number of digits to be printed.

It is assumed that at least one digit will be printed in all cases.

- Bits 25-30 Next-Address Sector - contains the number of decimal places desired, which may range from 00 to 09.
- Bit 31 Index Bit - the presence of an index bit will cause the subroutine to exit to the source program after output of the location(s) specified in the indexed code word. "Data Output 4" will continue to process sequential code words and execute output as specified until an indexed code word is encountered.

DATA OUTPUT 4

INPUT (Cont.)

Special Types of Code Words

- a. Carriage returns may be inserted when desired during output, without exiting from "Data Output 4." This may be accomplished by the use of a code word consisting of the configuration HEX*8000*0* (see "EXAMPLE"). This code word may not be indexed and is therefore unsuitable as an exit instruction.
- b. Code words which contain a zero in the Order portion of the word may be used. They will be examined and then skipped since they indicate no locations to be output. This feature enables the programmer to modify a set of code words in order to omit portions of the set without having to rearrange the code words in sequential order. Either the Order portion of the word or the entire location may be set to zero in order to skip the output it indicates. This type of code word may be indexed, however care must be taken not to "zero" the entire word if it is to signify an exit code.

When control is transferred to the subject program, the Index Register must contain the address of the first code word. The code word(s) may be anywhere in memory. If more than one is used, they must be in sequential locations. For example, the first control code, C_i , might be in 1300, then C_{i+1} would be in 1301, etc. The address 1300 would be in the Index Register.

CALLING SEQUENCE

<u>Location</u>	<u>Command</u>	<u>Data-Address</u>	<u>Next-Address</u>
A	LDX	C_i	B
B	RAL	EXIT]0141
EXIT	etc.		

In the calling sequence illustrated, C_i is the address of the first control code word, and EXIT is the location of the exit instruction to which "Data Output 4" will transfer when returning control to the source program. The entry location of "Data Output 4" is]0141.

CALLING SEQUENCE (Cont.)

It is not necessary for the calling sequence to be written in the form illustrated. Any sequence of operations may be used which places the address of the first control word in the Index Register and the exit instruction in the Lower Accumulator before transferring to the subject program.

OUTPUT

Output is exact. The specified locations will be output with leading zeros suppressed and will be followed by a sign position. A positive word is indicated by a trailing space, a negative word by a minus sign. A word equal to zero will be output with the integer portion suppressed, and with a trailing space to indicate a positive number.

ROAR-DEPENDENT FEATURES

ROAR HEADER TAG REQUIRED

None. The program is preceded by the pseudo-instruction HED.

COMMUNICATION SYMBOLS

Symbol

]0141

Definition

Entry point and first instruction executed.]0141 is not the first instruction on the program tape and should be equated with the desired location.

REGIONS ASSIGNED

Symbol

A

Number of Sectors

9

OPERATING PROCEDURE

1. OPERATING TIME

Operating time depends upon and varies with the magnitude of the field width. Internally, one character is generated per drum revolution.

2. ACCURACY

Output is exact.

3. LOADING PROCEDURE

The program is assembled by ROAR III, program H2-01.2, and requires a nine sector region assignment for region A.

4. INPUT/OUTPUT DEVICES REQUIRED

No input device is needed during execution. The output device may be selected manually or by the source program.

5. SENSE SWITCH OPTIONS

None.

6. INFORMATION PRINTOUTS

None, except for error indications. (See "PROGRAM STOPS AND ERROR INDICATIONS.")

7. PROGRAM STOPS AND ERROR INDICATIONS

Two types of errors may occur during program execution:

- a. Incorrect code word. A printout and self-addressed halt will occur if a code word is entered which specifies too small a field width to accommodate the printing of the indicated digits. For example, if a field width of 10 spaces is indicated and the printing of 9 decimal places is called for, the code word violates the specification that, if a decimal point is to be output, the total field width must be at least 2 greater than the number of digits to be output. The printout for this error consists of the code word with the field width overtyped with slashes:

03 1452 1009

OPERATING PROCEDURE

7. PROGRAM STOPS AND ERROR INDICATIONS (Cont.)

- a. The ensuing halt is non-recoverable during execution. The error should be corrected and the program re-entered.
- b. Incorrect data word. If the number of digits in a data word exceeds the number permitted for the specified field width, the field width will be crossed out by x's, and the program will continue. This type of error would occur if, for example, a code word were input which specified a field width of 7 and no decimal places, and more than six digits were entered for printing, and might appear as:

06 4230 X00

Because of the nature of this error, the program will not halt.

8. ENTRANCE TO PROGRAM

This program is entered at symbolic location]0141 by coding a calling sequence in a source program.

9. OPERATION OF PROGRAM

One set of code words will be processed and the specified data will be output on the selected device each time the program is called. Termination of any set of code words is indicated by indexing the terminal word in the set.

10. EXIT FROM PROGRAM

An exit instruction must be provided in the calling sequence.

DATA OUTPUT 4

EXAMPLE

An example of the calling sequence and control codes may be as follows:

<u>Location</u>	<u>Command</u>	<u>Data-Address</u>	<u>Next-Address</u>
A	LDX	C_i	B
B	RAL	EXIT]0141
EXIT	Etc.		
⋮			
C_i	HEX	8000	0
C_{i+1}	03	3600	1200
C_{i+2}	HEX	8000	0
C_{i+3}	X06	5604	904

The instruction in location A stores the address C_i in the Index Register. The instruction in location B places the exit instruction in the Lower Accumulator and transfers control to "Data Output 4." C_i contains a code word which specifies a carriage return. C_{i+1} indicates that 3 sequentially-stored words will be output, beginning with the one in 3600, using a field width of 12 and having no decimal places. C_{i+2} specifies a carriage return. C_{i+3} indicates that 6 sequentially-stored words will be output, beginning with the one in location 5604, using a field width of 9 and having 4 decimal places. Because the instruction in location C_{i+3} is indexed, "Data Output 4" will transfer to EXIT after the word in location 5609 has been output.

COMMENTS

"Data Output 4" requires 2 tracks and 63 sectors of memory. One sector is left available for the printing of a stop code at the end of each output word, if desired. If the output data is to be used as input to any program, the printing of the stop code will render the output completely compatible with Data Input 3, program J2-03.0, for reading back into the RPC-4000. The following change should be made in the symbolic program to provide for the printing of a stop code:

Location STP should contain *PRD*899***. The original contents of location STP (*RAU*STR1***) should be the next instruction. This leaves the program undisturbed except for the changed location.

DATA OUTPUT 4

SUMMARY

ENTRY REQUIREMENTS

Upper Accumulator	Immaterial.
Lower Accumulator	Exit instruction.
Index Register	Address of first code word.

SYMBOLIC ENTRY

]0141	Entry point and location of first instruction to be executed.
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REGION ASSIGNMENT

A (9 sectors)

RECIRCULATING SECTORS USED

0, 1, 2, 3, and 4.

INDEX REGISTER USED BY PROGRAM

Yes

EXIT CONDITIONS

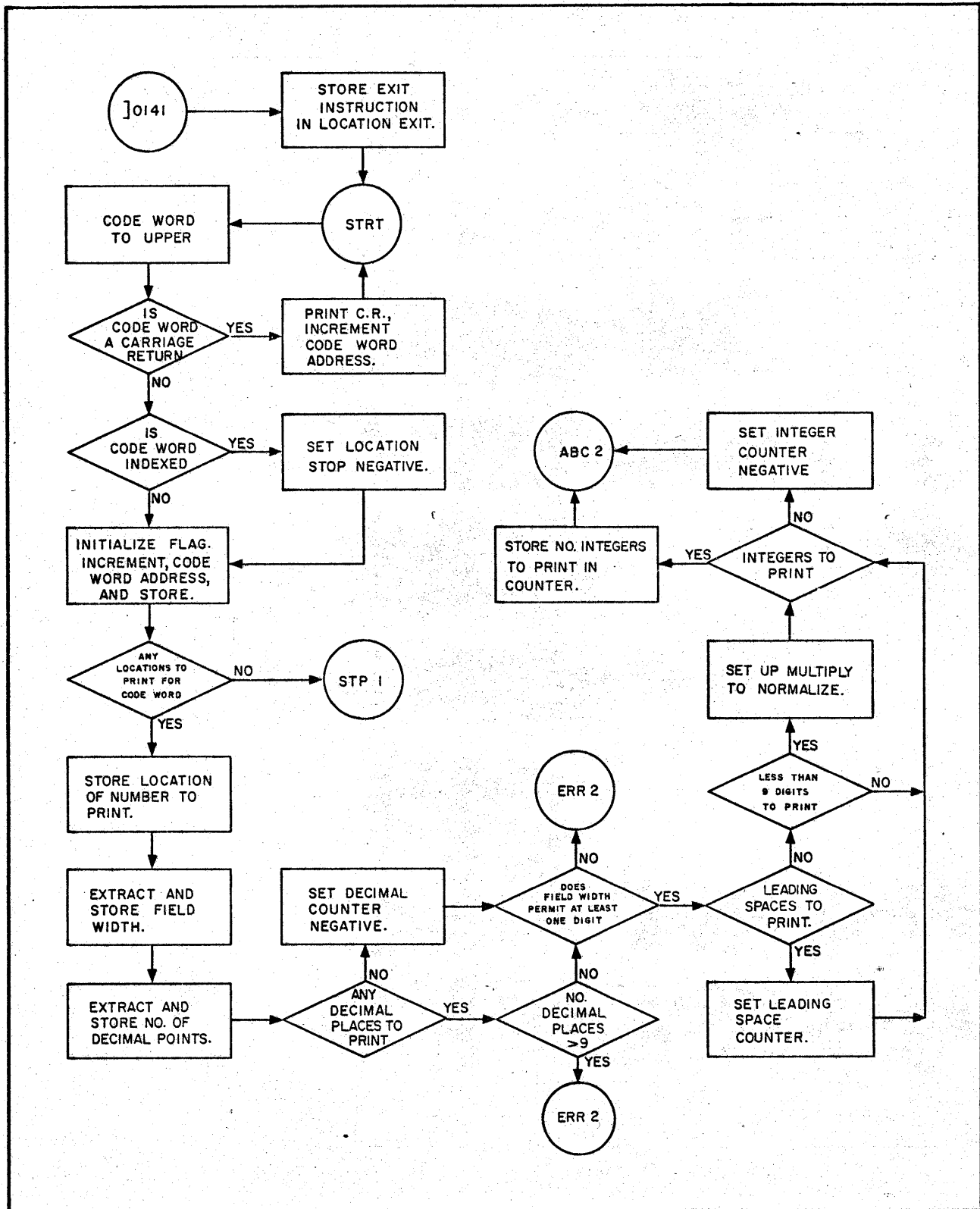
Upper Accumulator	Unpredictable.
Lower Accumulator	Unpredictable.
Index Register	Unpredictable.

MANDATORY ROAR INPUT CODES

None.

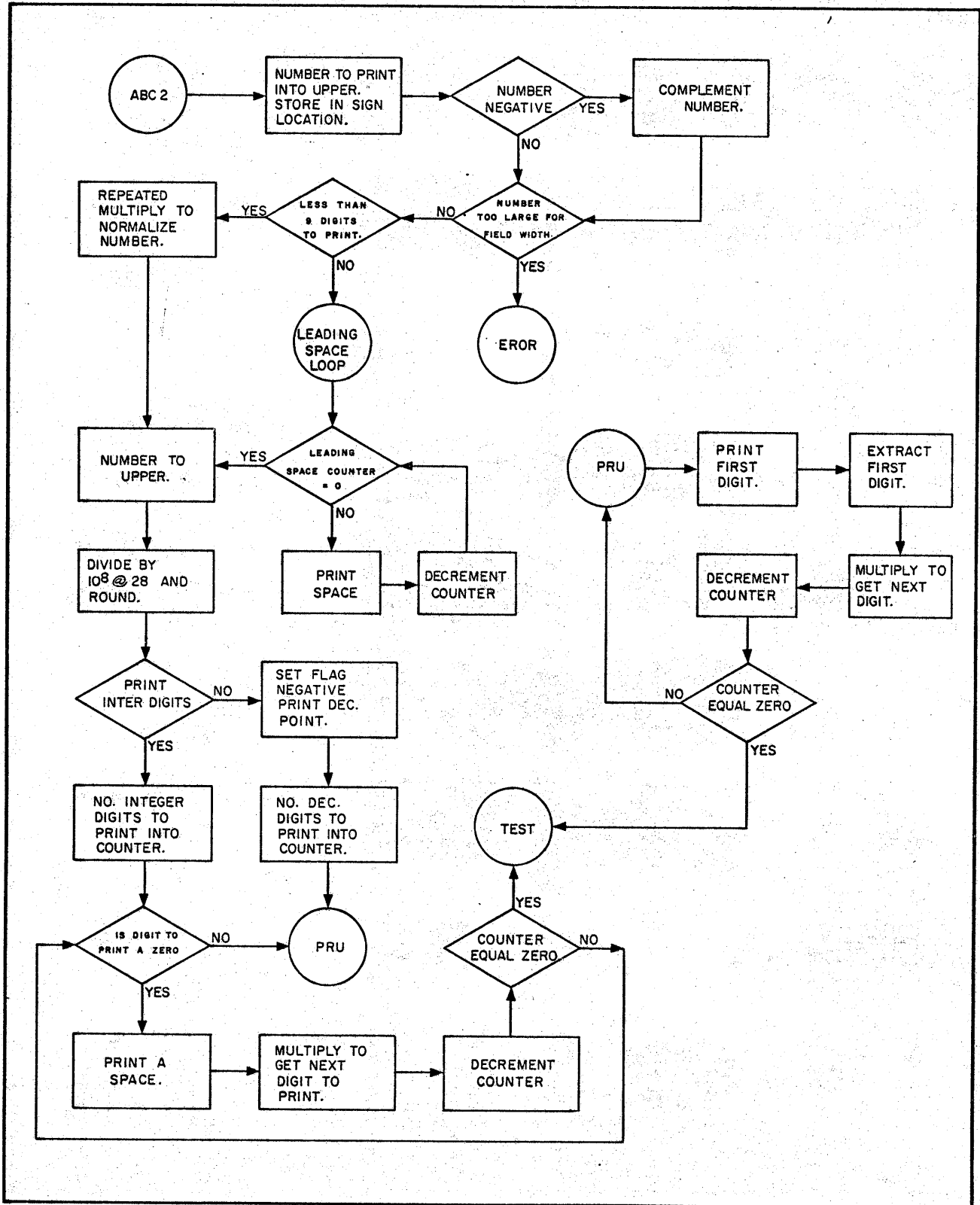
DATA OUTPUT 4

FLOW CHART



DATA OUTPUT 4

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