

**SDS PROGRAM LIBRARY
PROGRAM DESCRIPTION**

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Model No. 860798-11A00

IDENTIFICATION: North American Aviation Hybrid Executive.

AUTHOR: SDS

ACCEPTED: August 23, 1968

COMPUTER
CONFIGURATION: SDS 9300 and interface hardware for NAA
Hybrid System.

PURPOSE: The Hybrid Executive consists of a large number
of subroutines which provide the user control of
the hybrid system hardware. The executive
functions may be called by a Real-Time FORTRAN
IV program or made to respond to manual
commands.

PROGRAMMED
OPERATORS: None.

SUBROUTINES
REQUIRED: The Real-Time Monitor I/O Processor and the
Reentrant Monitor are required to be resident.

STORAGE: N/A

TIMING: N/A

SOURCE
LANGUAGE: Meta-Symbol.

LOADING
PROCEDURE: Called by FORTRAN IV call statements.

USE:

I. FORTRAN CALL AND FUNCTION LIBRARY

GENERAL

All of the routines in the Hybrid Executive Library can, on the basis of their intended use, be separated into two categories. The two groups are: Subroutines, and Functions.

FUNCTIONS

Functions are routines which return a number in the accumulator. The only values returned by functions in the Hybrid Executive Library are: minus one; plus one; and zero. The format, floating point or real, of the returned value is determined by the first letter in the name of the function according to standard FORTRAN conventions. Functions can be used in the following ways:

IF (FUNCTION (K + 2)) A, B, C

ALPHA = FUNCTION (4)

X = Y** FUNCTION (1, I, K (3))

ETC.

All of the functions included in the Hybrid Executive Library accept only integer arguments. The arguments may be supplied in any standard way within the program.

SUBROUTINES

A subroutine can do anything and may not even require an argument for operation. Subroutines are used by writing CALL SUBR (X, Y, ...) in which case subroutine SUBR is supplied with arguments X, Y, etc., and granted control of the computer.

When an arbitrary number of arguments or argument sets is indicated for a subroutine or

USE: (cont.)

SUBROUTINES Cont.

function, such as CALL SUBR (N_i , N_j , N_k ,
. . .), one or more arguments may be used.

A check for compatibility between arguments supplied and those acceptable to the subroutine or function using them is performed. If any argument type incompatibility is found, an error statement is output.

A. INTERRUPT STATEMENTS.

1. CALL ENABLE

All system interrupts are enabled.

2. CALL DISABLE

All system interrupts are disabled.

3. CALL ARM (I_i , I_j , I_k , . . .)

Interrupts I_i , I_j , I_k , etc., are armed.

Error messages:

- a. ERR ARM - Occurs when an interrupt number is outside the allowable range (0-31).

4. CALL DISARM (I_i , I_j , I_k , . . .)

Interrupts I_i , I_j , I_k , etc., are disarmed.

Error messages:

- a. ERR DRM - Occurs when an interrupt number is outside the allowable range (0-31).

USE: (cont.)

A. INTERRUPT STATEMENTS Cont..

5. CALL IDLE

The machine halts waiting for an interrupt. After any interrupt has occurred and been processed, the flow of control passes to the next statement.

- a. ERROR IDLE - Occurs when IDLE is called from a protected routine.

6. CALL NULL (I_i, I_j, I_k, \dots)

Interrupts I_i, I_j, I_k , etc., are tied to the briefest possible clear and return routine.

Error messages:

- a. ERR NUL - Occurs when an interrupt number is outside the allowable range, (0-31).

7. INTERRUPTS

This function routine returns a plus one if all system interrupts are disabled, and a minus one if they are enabled.

B. DIGITAL-ANALOG CONVERSION INSTRUCTIONS

1. CALL DAC ($L_i, V_i, L_j, V_j, \dots$)

The values of V_i, V_j , etc., are output as analog voltages on channels L_i, L_j , etc., of the digital-to-analog conversion system. The values V_i, V_j , etc., can be in either fixed or floating point format. If floating point format is used, the V's must lie in the range $1.0 > v \geq -1.0$ representing percentage of full scale. If fixed point format is used, the value is in two's complement integer form.

USE: (cont.)

B. DIGITAL-ANALOG CONVERSION INSTRUCTIONS

1. Cont.

Error messages:

- a. ERR DAC - INSUFFICIENT DATA - Occurs if the number of arguments is odd.
- b. ERR DAC - INVALID CHAN NO. - Occurs if L is outside the allowable range, (0-47).
- c. ERR DAC - VALUE OUT OF LIMITS - Occurs if V is outside the allowable range.
- d. ERR DAC CALLED FROM A PROTECTED ROUTINE - Occurs if DAC is called from a protected routine.

2. CALL ADC ($L_i, V_j, L_j, V_j, \dots$)

Channels L_i, L_j , etc., of the analog-to-digital conversion system are read and the values assigned as fixed or floating point numbers to the variables V_i, V_j , etc.,. If floating point format is specified, the return arguments will lie in the range $1.0 > v \geq -1.0$ representing percentage of full scale. If fixed point format is specified, two's complement integer values will be returned.

Error messages:

- a. ERR ADC - INSUFFICIENT DATA - Occurs if the number of arguments is odd.
- b. ERR ADC - INVALID CHAN NO. - Occurs if L is outside the allowable range (0-79).

USE: (cont.)

B. DIGITAL-ANALOG CONVERSION INSTRUCTIONS

2. Cont.

- c. ERR ADC CALLED FROM A PROTECTED ROUTINE - Occurs if ADC is called from a protected routine.

C. ANALOG COMPUTER INSTRUCTIONS

1. CALL CONSOLE (N)

Analog Console N is selected. N must be fixed point integer.

Error messages:

- a. ERR CNS - Occurs if N is outside the allowable range (0-7).
- b. ERR CNS - CONSOLE NOT SELECTED - Occurs if console N cannot be selected within 100 ms.

2. CALL MODE (M_i, M_j, \dots)

Analog console N is placed in modes M_i, M_j, \dots). The M's must be fixed point integers.

Error messages:

- a. ERR MODE - Occurs if an M is outside the allowable range (0-10).
- b. ERR MODE - CONSOLE - MODE NOT SELECTED - Occurs if the console N or a mode M cannot be selected within 100 ms.

USE: (cont.)

C. DIGITAL-ANALOG CONVERSION INSTRUCTIONS

3. CALL SCAN ($M_i, V_i, M_j, V_j, \dots$)

The specified elements M_i, M_j , etc., of analog console N are read and the values assigned to the associated variables V_i, V_j , etc., in fixed or floating point format. If floating point format is specified, the return arguments will lie in the range of $1.0 > v > -1.0$ representing percentage of full scale. If fixed point format is specified, the return arguments will be two's complement integer values. In the argument list, M's are either three digit integers or three BCD characters made up of the category (first digit of integer or first character of BCD word from the following table) and a two-digit unit address.

<u>First BCD Character</u>	<u>First Integer Digit</u>	<u>Category</u>
R	0	Resolvers
M	1	Multipliers
F	2	Function Generators
C	3	Integrator Check Points
A	4	Amplifiers
T	5	Trunks
P	6	Potentiometers (First 100)
Q	7	Potentiometers (Second 100)

Error messages:

- a. ERR SCN - INSUFFICIENT DATA - Occurs if the number of arguments is odd.

USE: (cont.)

C. DIGITAL-ANALOG CONVERSION INSTRUCTIONS

3. Cont.

- b. ERR SCN - INVALID CATEGORY
XXXX - Occurs if category XXXX
is not from the above table.
- c. ERR SCN - INVALID UNIT
ADDRESS XXXX - Occurs if
the address is outside of the
allowable range (0-79).
- d. ERR SCN CALLED FROM A
PROTECTED ROUTINE -
Occurs if SCAN is called from
a protected routine.

4. CALL VALUETEST ($M_i, V_i, M_j, V_j, \dots$)

The specified elements M_i, M_j , etc., of analog console N are readⁱ and^j compared to the values V_i, V_j , etc.

In the argument list, the M's are specified as in CALL SCAN. The V's can be in either fixed or floating point format. If floating point format is used, the V's represent percentage of full scale and must lie in the range $1.0 > v > -1.0$. If fixed point format is used, the V's represent two's complement integer values.

Subroutine SCAN is called by VALUETEST to read the analog elements, therefore, error messages may occur from SCAN.

Error messages:

- a. ERR VTS - INSUFFICIENT
DATA - Occurs if the number of
arguments is odd.

USE: (cont.)

C. DIGITAL-ANALOG CONVERSION INSTRUCTIONS

4. Cont.

- b. ELEMENT NO. XXXX = XXXXXXXXX
ERROR = XXXXXXXXX - Occurs if a difference of more than $\pm .0005$ is found between the values of M_i , and the value V_i .
- c. ERR VTS CALLED FROM A PROTECTED ROUTINE - Occurs if VALUETEST is called from a protected routine.

D. LINKAGE INSTRUCTIONS

1. TEST (L_i, L_j, L_k, \dots)

This function returns a minus one if any one of the sense lines L_i, L_j, L_k , has a true signal on it, and a plus one if not. The L's must be fixed point integers.

Error messages:

- a. ERR TST - Occurs when a line number is outside the allowable range (0-51).

2. CALL SETLINES ($L_i, M_i, L_j, M_j, \dots$)

Level output lines L_i, L_j , etc., are placed in the state determined by M_i, M_j , etc. The M's can be in either fixed or floating point format. The "on" state is represented by minus one, and the "off" state is represented by plus one. The L's must be fixed point integers.

Error messages:

- a. ERR STL - INSUFFICIENT DATA - Occurs if the number of arguments is odd.

USE: (cont.)

D. LINKAGE INSTRUCTIONS Cont..

2. Cont.

- b. ERR STL - INVALID LINE NO. -
Occurs when a line number is
outside the allowable range
(0-51).

E. MANUAL CONTROL INSTRUCTIONS

1. CALL MANUAL (N)

The manual intervention package is given control. Input will be from the CI device, where a return to the statement beyond CALL MANUAL can be accomplished by inputting rtn.

The integer N (maximum of four characters) will be printed upon entering the manual intervention package. This gives a method of identifying from what point in the main program the CALL statement was initiated.

II. MANUAL CONTROL LIBRARY

GENERAL

All individual manual control functions are selected by input of an associated three-character code followed by the necessary arguments. Only one control function is accepted in a record. A carriage return following a slash (/) terminates a typewriter input record and a card constitutes a record. Input requests cannot be preceded by spaces and the three characters in the selection code, followed by a space, must be the first four characters supplied as input after a legitimately terminated operation. A space, or comma, is used to terminate an argument field. If an error is detected in the input record, the message

USE: (cont.)

II. MANUAL CONTROL LIBRARY Cont..

"INPUT REQUEST NOT VALID", will be output through the CO device.

A. INTERRUPT INSTRUCTION

1. EIR (ENABLE)

Enable all system interrupts.
Responses: None.

2. DIR (DISABLE)

Disable all system interrupts.
Responses: None.

3. ARM I

Interrupt I is armed.
Responses: Error message from ARM.

4. DRM I

Interrupt I is disarmed.
Responses: Error message from DISARM.

5. NUL I

Interrupt I is tied to the briefest possible clear and return routine.
Responses: Error message from NULL.

B. DIGITAL-ANALOG CONVERSION

1. DAC L + xxxx

A voltage corresponding to $\frac{+ \text{xxxx}}{10000}$ of full scale if output on channel L of the digital-to-analog conversion system. The value, $\frac{+ \text{xxxx}}$, will be considered positive if $\frac{+ \text{xxxx}}$ is an integer which can consist of from one to four digits.

Responses: Error message from DAC.

USE: (cont.)

B. DIGITAL-ANALOG CONVERSION

2. ADC L

Channel L of the analog-to-digital conversion system is read and its value output. The value will correspond to + xxxx/10000 of full scale.

Responses: Error message from ADC.

C. ANALOG COMPUTER INSTRUCTIONS

1. CON N

Analog console N is selected.

Responses: Error messages from CONSOLE.

2. MOD M

Analog console N is placed in mode M.

Responses: Error messages from MODE.

3. SCN YYY

The value of element YYY on analog section N is read and output. The value will correspond to + ZZZZ/10000 of full scale. The analog element number YYY must be in BCD representation, as explained in CALL SCAN.

Responses: Error messages from CALL SCAN.

D. LINKAGE INSTRUCTIONS.

1. TST L

The state of sense line L is output.

USE: (cont.)

D. LINKAGE INSTRUCTIONS

1. Cont.

Responses: Error messages from TEST
("-1" for true, "1" for false).

2. STL L M

Level output line L is placed in the state
determined by M. The "on" state is
represented by minus one, and the "off"
state is represented by plus one.

Responses: Error messages from SET
LINES.