DOCUMENT

JOHNNIAC OPERATOR'S CONSOLE

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D-3518

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Assigned to _____

This description explains the present function of each part of the JOHNNIAC operator's console shown in the diagram on page 13. Words and numbers in parentheses in the diagram are not actually seen on the console but are used for reference in this description.

The upper part of the console contains maintenance lights, an emergency switch, display windows, and two knobs controlling the 104 and 105 orders. The lower part of the console contains keys and buttons for manual control of a routine or for obtaining information about a routine.

In general, the lower part of the console has two types of keys: conditioning keys and action keys. All blue keys are conditioning keys; i.e. they set up some condition which can be acted upon. The action keys execute one or a series of operations. There are four colors of action keys. The yellow keys control the executing of one operation. The brown keys pertain to keyboard action. The green keys are used to start the machine executing a sequence of operations, and the red bar is for stopping a routine. The keyboard buttons in the center are conditioning buttons since they set up a number for the "enter" keys to act upon. Before each key is described individually, the section to which it belongs is described as a whole. In some cases a section consists of one key.

SELECTOR KEYS: These six blue keys are located at the left of the "operator's" console. They are selectors for the purpose of choosing the register to which the keyboard and display are to have access. They are interlocked so that only one may be chosen at a time. The display window above these keys, as well as a light inside the key, indicates the register chosen.

The A, I.R., N.R., and MQ registers are 13 octal plus one binary (sign) digit registers corresponding to a forty-bit JOHNNIAC word. The NIA register uses the 4 octal digits in the left address. The S register uses 4 octal digits in the left address to indicate the stop address and the sign position, a 0 or 1, to indicate a stop left or stop right, respectively.

A - The contents of the accumulator are displayed in the Central Display when this key is pressed. A number may be entered into the accumulator by pressing this A key, entering the number into the keyboard and pressing either of the two "enter" keys. Numbers are entered into any of the other 5 registers (I.R. through S) in the same way, using, of course, the proper selector key.

I.R. - This key is associated with the instruction register. The contents of this register may be displayed or changed as described above.

N.R. - The contents of the number register are displayed when this key is pressed. Since this register serves as a buffer between the store and the adder or input-output units, there is no reason for a programmer to enter any number into

it, although this may be done as with the other registers.

MQ - This key selects the multiplier quotient register for access by the Central Display or keyboard.

N.I.A. - This key selects the register containing the next instruction address (NIA). The NIA register contains the address from which the next instruction word will be fetched, unless the current instruction word contains an instruction which transfers control. The left address of the keyboard is used to enter an address into NIA.

S - This key is used to enter into the S register an address at which the routine is to stop. Depressing the Go to S key then starts the routine on its way to the S stop. The stop address is entered into the S register using the sign position and left address keys of the keyboard. The S register is never cleared while the JOHNNIAC is on.

P.R.: This is the yellow key below the six selector keys. When this "punch registers" key is pressed, the following information is punched in one binary card:

1. The contents of the six registers (A through S);

2. The condition of the conditioning switches and instruction keys; and

3. The type of "legal" stop as indicated in display unit 2.

The P.R. key is operative only while the machine is on MANUAL or when the machine is in a HANG-UP condition. A register selected becomes unselected at the time the P.R. key is used. Otherwise the machine condition or contents are not affected by the use of P.R.

KEYBOARD: This consists of 14 columns of brown and tan buttons corresponding to the 13-1/3 octal digits of a JOHNNIAC word. The Keyboard is located in the lower center of the console.

When the buttons are depressed, numbers are set up to be entered into the corresponding columns of the selected register. Blanks enter the S register as zeros and leave positions of the other registers unchanged. The bottom row of unmarked buttons is used to clear the corresponding keyboard columns.

KEYBOARD KEYS: These 3 brown keys are located just to the right of the keyboard.

Enter - This key is used to enter the contents of the keyboard into the selected register.

Clear K.B. - This key, when depressed, releases all columns of the keyboard.

Enter and Clear K.B. - This key performs in succession the functions of the Enter and Clear K.B. keys.

CENTRAL DISPLAY: This is the 13-1/3 octal digit display situated just above the keyboard. It displays the contents of the register selected by the selector keys. The Central Display is dark while the machine is running, unless a 104 display instruction is given, or the S register is selected. On a 104 instruction the Central Display indicates the contents of the selected register. The length of time the register is displayed is determined by the knob to the left of the central display windows. This time increases from .5 seconds, with the knob at 0, to an indefinite time as the knob is turned to 9. If a new 104 operation

is given before the time of a previous one has been completed, the new operation is treated as a 000 operation and takes 12 microseconds for completion. When the machine halts, the display clears and shows the contents of the register selected. Also the display clears when the Enter key is pressed, after which the contents of the selected register after the "enter" operation are shown.

At the far right of the Central Display is the knob controlling the volume of the hoot speaker. This knob and the one mentioned above may be turned at any time.

INSTRUCTION KEYS: These are 4 yellow keys at the right of the Enter and Clear K.B. key. These keys are operative only while the machine is on MANUAL. When the machine is on MANUAL, a light under the Left Instruction, Right Instruction, or Fetch key indicates which of these three instruction types is next to be done in the machine sequence.

${\text{Left} \atop \text{Right}}$ Instr. - When this key is pressed the ${\text{left} \atop \text{right}}$ instruction standing in the instruction register is executed, regardless of the instruction key that is lit, and the sequencer is set accordingly. This key treats input-output operations as 000 operations.

Fetch - This key produces a fetch from the next storage position (as indicated by NIA) into the IR. Thus to display successive cells in storage, starting with cell 0100, say, do the following:

1. Select I.R.

2. Enter 010 0100 000 0000

3. Hit <u>Left Instr.</u> key

4. Hit <u>Fetch</u>, hit <u>Fetch</u>, ...

Step 3 puts cell 100 into the I.R. which is being displayed.
Each Fetch executed in step 4 places a successive word into
the I.R. The machine must be on **MANUAL** to execute this display.
Executing the following four steps will also result in the
display of successive cells:

1. Select N.I.A.

2. Enter 000 0100 000 0000

3. Select I.R.

4. Hit <u>Fetch</u>, hit <u>Fetch</u>, ...

<u>One Instr.</u> - This key causes the machine to perform the
next instruction or fetch in the automatic sequence. Therefore,
it can be used to step through a **routine**. Input-output opera-
tions are treated as OOO operations. 13X halt orders require
two depressions of this key for complete execution. When
stepping through a routine with the <u>One Instruction</u> key there
is no indicated stop after an "unexpected" overflow (described
under <u>O'flo Ign.</u>).

<u>CONDITIONING KEYS:</u>   These eleven blue keys are to the right
of the <u>Enter</u> key. An internal light indicates that the switch
is on. Any combination of these keys may be on.

<u>Clear Cond. Keys</u> - This key will turn all of the other ten
conditioning keys to the off position.

O'flo Ign. - When this key is on, the machine will ignore "unexpected" overflows, i.e. the machine will proceed even though an "unexpected" overflow has occurred. An overflow is "unexpected" if it is not followed by an 003 or 007 instruction. If the O'flo Ignore key is off, the machine will halt after executing the instruction following the occurrence of the overflow unless that instruction was an 003 or 007 order. When this key is changed from on to off, the overflow toggle is reset.

D_0, D_1, D_2 - When the $\underline{D_1}$ light switch is on, writing on position i of the drum is inhibited. If writing is attempted, the machine will stop and indicate DRUM in display unit 2 and HANG UP in unit 1. The routine can be continued by turning the $\underline{D_1}$ light off if it is desired to go ahead and write on that position. Reading from the drum is unaffected by these switches.

T_1, T_2, T_3 - These three switches control the conditional transfer instructions in the 01X class.

H_1, H_2, H_3 - These three switches control the conditional halt instructions in the 13X class. Two depressions of the One Instruction key, if stepping through manually, are needed to get by a 13X halt -- one to halt and the second to transfer. To continue after a 13X halt, hit either the One Instruction key or the Go key, not the Left or Right Instruction key. After a 13X halt, NIA contains the present address plus one.

LOAD AND GO KEYS: These three green keys are located to the right of the instruction keys.

Load - When this key is pressed the registers and toggles, except for the S register, are cleared and the two instructions 100 0000, 101 0000, are executed. Then, with NIA cleared to 0000, the instruction in cell 0000 is fetched and placed in the I.R. for execution. The Load key is effective in any type of "legal" or "illegal" stop.

Go - When a 13X or Go to S stop has been reached, or after a CONSOLE (Stop bar) stop, the Go key can be pressed to continue the routine. On an "unexpected" overflow stop, the routine may be continued, if it is meaningful to continue, by turning on the O'flo Ignore key and pressing the Go key or Go to S key. This does not reset the overflow toggle. On a COPY stop the Go key can be hit the necessary number of times to get past the last copy instruction of the input or output cycle. The routine will then continue automatically on the first depression of Go after the last copy instruction. The Go key cannot be used to get by a HANG UP condition.

Go to S - This key is used with the S key described above to stop the routine at some point S. With the stop address set up in the S register by the S key, the Go to S key is depressed to start the routine on its way to the S stop. S need not be selected when Go to S is hit. When S is reached, the routine will stop (prior to the execution of the S instruction) and display Unit 2 will show AT-S. Any number of S stops may be carried out successively.

To Load and Go to S do the following:

  a. Enter the stop address in the S register.

  b. In turn, depress the Load key, depress the
      Go to S key, release the Load key, and release
      the Go to S key. Picturewise this is:

```
Load      _____        _____

                            |_____|


Go to S   _____        _____

                                      |_____|
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STOP: This long red bar is located to the right of the Clear
K.B. key. The routine will stop at the end of the instruction
being executed when the stop bar is depressed, except for
input-output cycles. In this case the stop is held up until
completion of the current cycle in order to prevent a late
copy. Only the Conditioning switches and Stop bar, of all the
buttons and keys on the console, affect a routine when they are
depressed while the routine is running.

DISPLAY UNITS: These five display windows are located to the
right of the Central Display. Over each window in the diagram
are written the different words that can be displayed in that
particular window. More than one unit can be on display at
one time and words in one display can be superimposed in some
cases.

    Unit 1 - This unit has associated with it the "illegal"
stops. A programmer might consider one of these stops as "legal"
in some special case. READER is displayed when the card reader

is selected. The display is visible only when the select instructions are given rapidly enough. If the reader is off or out of cards the routine will continue when the condition of the reader has been corrected. The PUNCH and PRINT displays perform the corresponding functions for the punch and printer respectively.

The machine will stop, and HANG UP will be displayed under either of two conditions. If, due to a program or machine error, an illegal operation is encountered by the machine, a HANG UP will occur. The Load key or Stop bar may be used to get out of this HANG UP. Second, a HANG UP will occur if Switch D_1 is lighted and position 1 of the drum is called on for writing. In this case, unit 2 will display DRUM also. If it is desired to go ahead and write on that position; turn the D_1 light off and the program will continue.

Unit 2 - This unit is associated with "legal" stops. When the stop bar is pressed CONSOLE is displayed.

13X is displayed when the machine has reached a 13X halt.

AT-S is displayed when the machine has stopped at an S stop.

COPY is displayed when a late copy has occurred. The routine can be continued from this point by hitting Go the necessary number of times to get by the copy instructions.

O'FLO is displayed when an "unexpected" overflow halt occurs.

DRUM is displayed when an 11X instruction is given. The display is visible only when 11X instructions are given rapidly enough. Also, DRUM is displayed if an 11X instruction is given and for some reason the drum is not ready to be used.

Unit 3 - This unit is controlled by the overflow toggle. When the overflow toggle is on, O'FLO is displayed. The overflow toggle can be turned off by giving an 003 or 007 command, by changing O'flo Ignore from on to off, or by the master clear on the Load key.

Unit 4 - When the machine is halted "legally", this unit indicates what instruction is to be done next. Thus it can read LEFT, RIGHT, or FETCH.

Unit 5 - A MANUAL display means that the machine is subject to manual control; that the keys are active. MANUAL is displayed when any "legal" stop occurs. These include O'FLO, 13X, AT-S, late COPY, or CONSOLE (Stop bar) stops. Hang ups do not cause MANUAL to be displayed.

When the machine is running, RUN is displayed.

During maintenance periods when certain switches inside the console are turned on, MEM'Y TEST is displayed.

MAINTENANCE LIGHTS: These four lights are located across the top of the console. When a light is on the word(s) displayed are in effect. No routine should be loaded into the machine with any of these four lights on. If any of the lights go on while a routine is running it is best to call a maintenance man and get the routine off the machine, although in some cases the routine may not be affected. The lights are explained left to right.

Maint. - This light indicates that some maintenance switch is in a non-normal position.

Refrig. Marginal - If the machine's refrigeration unit is below par, these words will be lighted. A routine can continue without being affected for up to 15 minutes after this light goes on. Then the machine will automatically turn off.

System Disabled - This light indicates serious trouble in the machine and that the machine is off the air.

Marginal Operation - With this light on, the machine is operating under marginal conditions. It may run under these conditions without error. However, the machine reliability is impaired and it is usually best to stop should this light go on while a routine is running.

PUSH FOR EMERGENCY POWER OFF: This red switch is located in the top center of the console. It should be pushed only in times of emergency.

MAINT.	REFRIG. MARGINAL	PUSH FOR EMERGENCY POWER OFF	SYSTEM DISABLED	MARGINAL OPERATION

ACC.
I.R
N.R
M.Q.
N.I.A
S

2
1

(CENTRAL DISPLAY)

CONSOLE
13.X
READER AT-S
PUNCH COPY
PRINT O'FLO
HANG UP DRUM

LEFT MEM'Y TEST
RIGHT RUN
FETCH MAN'L

(1) (2) (3) (4) (5)
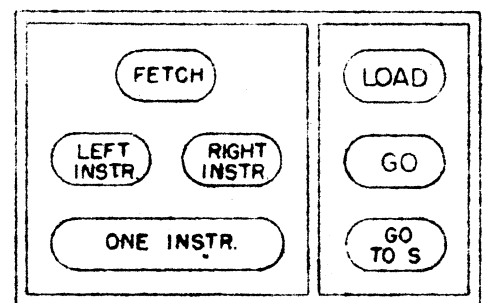
2
1
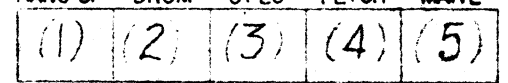
(DISPLAY UNITS)

A
I.R
N.R
M.Q.
N.I.A
S.
P.R.
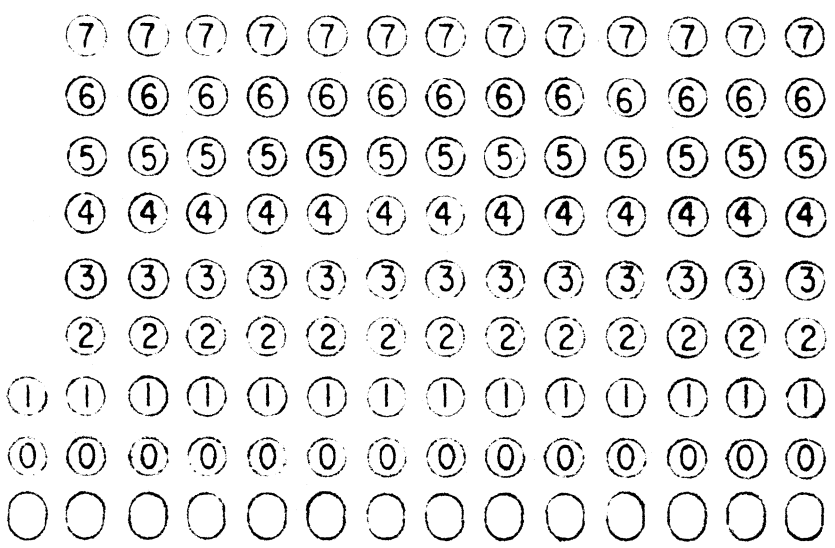
ENTER
CLR COND KEYS
O'FLO IGN
H₁ H₂ H₃
D₀ D₁ D₂ T₁ T₂ T₃

ENTR & CLR K.B.

FETCH
LEFT INSTR
RIGHT INSTR
ONE INSTR.

LOAD
GO
GO TO S

CLR K.B.

STOP