STEP PLAN

UNIVAC® SOLID-STATE SYSTEMS

OPERATING

Simple Transition to Electronic Processing

OPERATING

Simple Transition to Electronic Processing

Contents

1. Introduction

Each unit of the UNIVAC Solid-State Computer with the STEP System contains a control panel of plainly labeled indicators and control buttons. The control panel of the Central Processor contains the controls necessary for manual regulation of the system when debugging, instituting different modes of operation, starting the system and so on, and affords the operator a general view of the operation of the system. The control panels on the other units indicate conditions within the particular unit and provide controls for that unit.

When an indication of a general condition for a unit appears on the Central Processor panel, the operator should investigate the panel on the unit to arrive at the specific condition. The operator should always return to the Central Processor control panel to start or control the system after investigation of a condition at an individual unit as the entire system may be visualized only from the Processor panel.

Because of the modular construction of the system, the number of options available, and the possible combinations of the options, each unit in the system contains all the buttons and indicators that would be utilized in a full system. Whenever a button or indicator refers to an option not incorporated in the particular combination chosen, it will not be wired. If an option, such as stacker select, is not included, conditions referring to the option will not be pertinent.

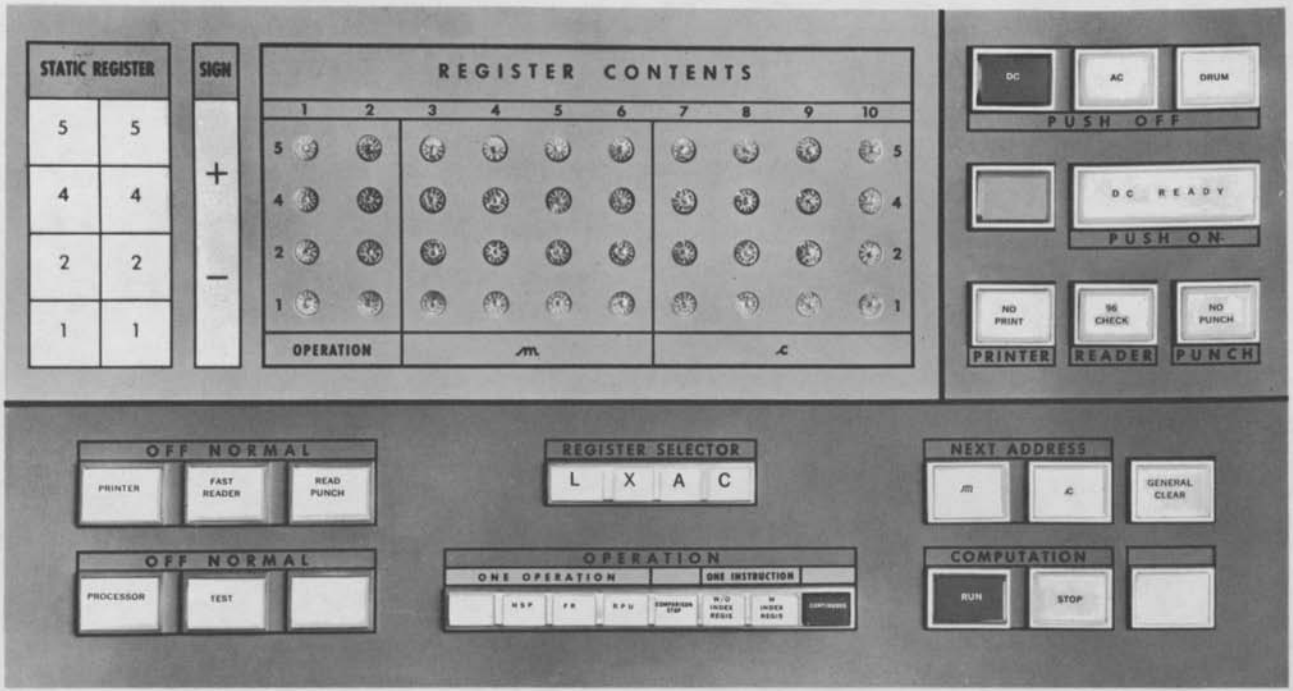

Figure 2-1. Central Processor Control Panel

2. Control Panels

CENTRAL PROCESSOR CONTROL PANEL

Register Lights

These adjacent panel lights enable the operator to see the contents of the registers, their sign, and the instruction being executed. By bringing the contents of a storage location to a register and then selecting that register for display, the operator may also learn the contents of any storage location. The contents of the register selected for display continually change during processing, reflecting the changes in the register from instruction to instruction.

Static Register Lights

This grouping of two rows of four lights displays the contents of the static register in computer code. The numbers indicate the magnitude of the bits (5, 4, 2, 1). The digits lit represent the operation code of the instruction currently being executed. For example, if the staticized instruction were a subtract command–which has the operation code 75–the 5 and 2 lights in the first vertical row would be lit, as would the 5 light in the second row.

Sign Light

This indicator, to the left of the register display lights, contains a plus symbol and a minus symbol. When a register is being displayed, the symbol that corresponds to the sign of the register's contents is lighted.

Register Display Lights

This group of lights–ten across and four down – continually displays in computer code the contents of the register designated by the operator. Registers, *C*, *A*, *X*, or *L* may be so displayed. The contents of any storage location may be brought to these registers and then displayed.

Register Selector Buttons

These four buttons labeled *L*, *X*, *A*, and *C* are used to control which register will be displayed through the register display lights. The operator selects the register for display by pressing the appropriate button. The button lights when pressed, and only one button may be pressed at a time. The contents of registers are displayed when the operator is inserting an instruction as outlined under procedures. If none of the buttons is pressed, no register is selected.

Operation Buttons

This group of seven buttons, located at the bottom center of the panel, is used to control the system's mode of operation. Although the system normally operates on a continuous basis, these buttons provide a method of operating the system on a noncontinuous basis for such purposes as program-checking, keying-in information, comparison stops, memory print-outs, and so on. The buttons light when pressed, and only one button may be pressed at a time. To initiate the selected mode, the appropriate button and the run button must be pressed. The buttons may be pressed only when the Processor is stopped.

One Operation

Under the one-operation section of the operation panel are three buttons labeled HSP, FR, and RPU.

HSP–(One Line Print)

When this button is pressed, the Printer off-normal indicator is lit as the first instruction is executed after the start button is pressed. Then the Processor does not execute a print instruction (either 11 or 16) but transfers control to the $c + 1$ address. The $c + 1$ address should contain a routine capable of bringing the Processor to an orderly stop. When the operator is ready to return to the regular program, the print instruction must be keyed into register *C* and the Printer off-normal indicator cleared by depression of the general clear button.

FR–(One Card Read)

When this button is pressed, the High-Speed Reader off-normal indicator is lit as the first instruction is executed after the start button is pressed. Then the Processor does not execute a High-Speed Reader feed order (72) but transfers control to the $c + 1$ address. The $c + 1$ address should contain a routine capable of bringing the Processor to an orderly stop. When the operator is ready to return to the regular program, the High-Speed Reader feed instruction (72) must be keyed into register *C* and the High-Speed Reader off-normal indicator cleared by depression of the general clear button.

RPU–(One Card Read-Punch)

When this button is pressed, the Read-Punch off-normal indicator is lit as the first instruction is executed after the start button is depressed. Then the Processor does not execute a Read-Punch card-feed instruction (81) but transfers control to the $c + 1$ address. The $c + 1$ address should contain a routine capable of bringing the Processor to an orderly stop. When the operator is ready to return to the regular program, the Read-Punch card-feed instruction (81) must be keyed into register *C* and the Read-Punch off-normal indicator cleared by depression of the general clear button.

Comparison Stop

When this button is pressed, the Processor stops after a comparison has been made, but before searching for the next instruction. After depression, and before the program reaches a comparison instruction, normal execution of instructions continues. After the comparison is made, however, the compare instruction will be in register *C*, and the result of the comparison will be indicated by the next address button. To restart, one of the next address buttons must be pressed before pressing the run button. By pressing the appropriate button, the operator may override the address determined by the comparison.

One Instruction

These two operation buttons are used to permit the execution of a single instruction. The Processor executes the instruction in register *C*, places the next instruction in that register, and stops. If index registers are not included, the W/O Index button will effect one instruction when depressed.

1. *W/O Index Register*–When this button is pressed, the Processor executes the instruction in register *C*, bypassing index-register modification, and stops after the next instruction is staticized in register *C*.

2. *W Index Register*–When this button is pressed, index-register modification occurs when the instruction in register *C* is executed. If the instruction in register *C* is displayed, it will appear with the modified *m* address. The Processor stops after the next instruction is staticized in register *C*. It is effective only on Processors containing index registers.

Continuous

When this button is pressed, the Processor operates under the complete control of the internally stored program – the normal mode of operation. The Processor will operate until stopped by the program, until an error occurs, or until the operator presses the stop button. This button will light when pressed.

Next Address Button

After a comparison has been executed, the next address is the *m* or *c* portion of the word, depending on the outcome of the comparison. The next address button, labeled *m* and *c*, has the *m* or *c* lit to indicate the outcome of the comparison–the next instruction's location. By pressing one or the other of the buttons, the operator can determine where the next address will be found, and can thereby change the address determined by the comparison. The button when pressed will light, indicating the new address. If neither of the buttons is pressed, the next instruction will be found at the word portion determined by the compari-

son, when the run button is activated. These buttons should be pressed when the Processor is stopped. To restart, the run button must be pressed.

No-Print/No-Punch Buttons

When these two buttons are pressed, punching or printing is prevented, while the system operates normally in other respects, even when the program contains printing or punching instructions. Also, when pressed, the output interlace locations may be used for regular storage. They should be pressed only while the Processor is stopped.

Read-Punch No-Punch

When this button is pressed, punching is prevented. The 81 instruction (punch, sense, and move cards) is executed in every respect through the loading of the punch buffer, but the mechanical action of punching does not occur. However, if any punch-buffer errors occur (buffer parity, punch parity, and so on), the Processor will stop immediately.

Printer No-Print

When this button is pressed, printing is prevented. The print instruction is executed through the loading of the print buffer, but the mechanical action of advancing and printing does not occur. However, if any print errors occur (code-wheel parity, print-buffer parity, and so on), the Processor will transfer control to the $c + 1$ address of the print instruction in register *C*. When printing is unnecessary, depression of this button will enable the operator to run the regular program. If, in such a case, the Printer were turned off, the Processor would stall on the second print instruction, for the first would not have been executed.

Alert 96 Check

When this button is pressed, the Processor will be abruptly stopped if the High-Speed Reader buffer is not unloaded within the correct time span prior to the loading of the buffer by the next card. When pressed, this button will light as the 96 check condition occurs.

Off-Normal Lights (Processor)

This group is located in the lower left corner of the Processor control panel. When one is lit, it indicates that the related unit is not functioning normally.

Printer Off-Normal

This indicator lights when the Printer motors are shut off, when the no-print button is pressed, and whenever an abnormal condition occurs in the High-Speed Printer. A light on the High-Speed Printer panel will indicate the exact cause of the off-normal condition. If the condition has been caused by overheat or airflow, the Processor will come to an abrupt stop. If the High-Speed Printer motors are turned off, or the Printer no-print button is pressed, the Processor will continue to operate normally. If other off-normal conditions cause the Printer off-normal indicator to light, the Processor will proceed with the normal execution of instructions until a Printer instruction is encountered. Then, the Processor will transfer control to the $c + 1$ address. The $c + 1$ address should contain a routine capable of bringing the Processor to an orderly halt. Conditions which cause a $c + 1$ transfer are no ribbon, code-wheel parity, print-buffer parity, charge-check extinguish, paper-feed check, carriage out, and depression of the stop button.

Fast Reader Off-Normal

This indicator lights whenever the High-Speed Reader motor is off and whenever an abnormal condition occurs in the Reader. A light on the Reader control panel indicates the exact cause of the off-normal condition. If the condition has been caused by airflow or overheat, the Processor will come to an abrupt stop. If the Reader motors are shut off, the Processor will continue to operate normally. If the cause is another off-normal condition, the Processor proceeds with the normal execution of in-

structions until a High-Speed Reader card-cycle order is encountered. When this instruction is reached, the Processor transfers control to the $c + 1$ address. This address should contain a routine capable of bringing the Processor to an orderly halt. Conditions which cause a $c + 1$ transfer are empty magazine, read-one registration error, read-two registration error, full stacker, card jam, and depression of the stop button.

Read-Punch Off-Normal

This indicator lights when the Read-Punch motor is off, when the no-punch button is pressed and whenever an abnormal condition occurs in the Read-Punch Unit. A light on the Read-Punch control panel will indicate the exact cause of the off-normal condition. If the no-punch button has been pressed, the Processor will continue to operate normally. If the condition is caused by airflow or overheat, the Processor will be stopped abruptly. If it is caused by other abnormal conditions, the Processor proceeds with the normal execution of instructions until a Read-Punch card-cycle instruction is encountered. Then, control is transferred to the $c + 1$ address. This address should contain a routine capable of bringing the Processor to an orderly stop. Conditions which cause a $c + 1$ transfer are stop button depressed, empty magazine, empty read station one, empty read station two, full stacker, chip box full, and Read-Punch Unit door interlock.

Processor Off-Normal

This indicator lights when the Processor is stopped, when the Processor is in a non-continuous mode of operation, and whenever abnormal conditions occur in the Processor. These conditions—which cause the Processor to stop abruptly—are Processor door interlock, faulty airflow, overheat, cycling unit, memory parity, and time-selection parity.

Test

This indicator is lit when one or more of the test switches on the engineer's panel is in the test position. Maintenance personnel should be contacted to reset the switches.

General Clear

Depression of this button clears the Read-Punch abnormal indicator (the buffer-loaded indicators and stacker select indicators are unaffected), the High-Speed Reader abnormal and buffer-loaded indicators, the Printer abnormal and in-operation indicators and other control circuits within the Processor. This button ensures that all controls and abnormal indicators are cleared prior to computation. It should be pressed before depression of the run button, except between a card-cycling instruction and a buffer-unload instruction (in loading routines).

Computation Button-Lights

For the operator's convenience, these two button-lights are on the control panel of each of the four units of the system.

Run (Start) Button

When this button is pressed, the Processor begins processing by executing the instruction in register *C*. The button lights to indicate the Processor is operating.

Stop Button

When this button is pressed, the abnormal indicators of the Read-Punch Unit, the High-Speed Reader, and the High-Speed Printer are set. Then, when the Processor receives a print, read, or punch instruction, the Processor transfers control to the $c + 1$ address. This should contain an orderly stop routine. The button is lit when the Processor is not operating.

On-Off

These four button-lights control the power to the system; they are used in turning the machine on and off. When all are lit, the computer is in operating condition. Depression of these buttons does not affect information recorded on the magnetic storage drum.

AC

Depressing this button cuts off both alternating and direct current. The AC, DC, and DC ready lights then go out. This AC indicator lights when alternating current is supplied to the system by depressing the DC ready button.

DC

Depressing this button causes direct current to be cut off without affecting the alternating current.

Drum

This indicator lights along with the AC indicator, when alternating current is supplied to the system by depressing the DC ready button. Depressing the latter cuts off all power and causes all four lights to be extinguished. To turn the machine off completely, it is necessary to press only the drum button.

DC Ready

This button is pressed to supply operating power to the Processor. It must be pressed three times; the second depression must not be made until 5 seconds after the first, and the third depression must not be made until the DC ready button lights.

Figure 2-2. Processor Keyboard

PROCESSOR KEYBOARD

The ten-key keyboard permits the operator to insert information manually into the Processor. Information can be entered only when the Processor is stopped and is placed in the one-instruction mode of operation.

Alert Button (A)

This is used to signal the Processor that information is forthcoming from the keyboard. When pressed, it erases the keyboard shift register, prepares input controls, and probes to determine if the Processor is in a position to receive information from the keyboard. It also enables the operator to erase keyed-in information and to begin again. The alert button is effective only when the Processor is in the one-instruction mode of operation.

Ready Lamp

This indicates whether or not the Processor is ready to receive information from the keyboard. When it is lit, the keying-in may be started.

0-9 Buttons

These are used singly to insert characters. In combination, they are used to insert nonnumeric bit patterns. If less than ten characters are keyed-in, they are placed in the least significant positions of the selected register with a zero fill on the left; if more than ten are keyed-in, they are superimposed on previously keyed characters. An alternative method to insert nonnumeric bit combinations is to type in more than ten consecutive digits. This causes the four-bit combinations of the last digits to be superimposed on the corresponding four-bit combinations of the first ten digits. If the digits of the word are properly chosen, the desired four-bit combination results in each digit position of the final word. Release of the button or buttons shifts all previous type-ins left one position. After ten key depressions, this shifting action has placed the first digit in the most significant digit position. If an error is made, the alert button should be pressed and keying-in begun again.

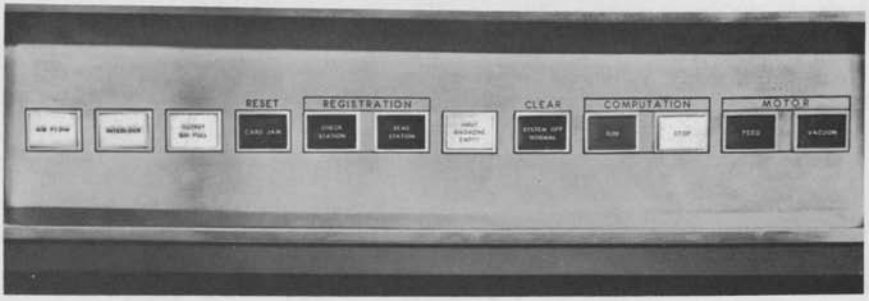

Figure 2-3. High-Speed Reader Panel

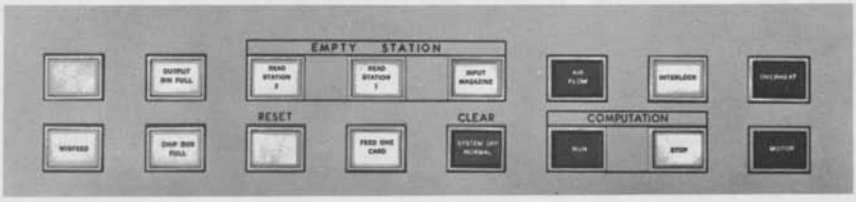

Figure 2-4. Read-Punch Unit Panel

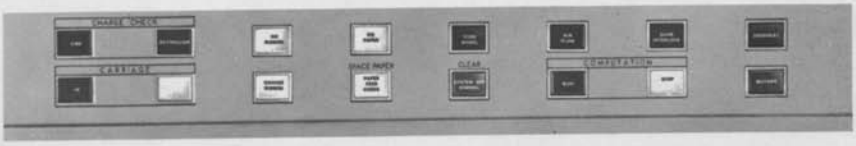

Figure 2-5. High-Speed Printer Panel

Word Release Buttons (+ and −)

These buttons are used to enter the proper sign, together with the ten characters previously keyed, into the register designated by the register selector button. Once the alert button has been depressed, one of the word release buttons must be depressed before restarting the Processor.

HIGH-SPEED READER PANEL

System Off-Normal

This button lights whenever an abnormal condition exists in one of the four units. At the same time, one of the four off-normal lights on the Processor goes on to indicate which of the units is not functioning properly. Depression of this button duplicates the function of the general clear button, which resets all off-normal indicators. Before pressing this button, the operator should check the card jam button to see if it is lit, because this action extinguishes all jam indication lights.

Door Interlock

This light indicates that a door on the High-Speed Reader where the light is located is not properly closed and that power is off for that unit.

Airflow

This light indicates that the air blowers are not supplying enough air to the High-Speed Reader and that power is off for the unit. These conditions—door interlock, and airflow—set the proper abnormal indicator and light the appropriate off-normal indicator on the Processor plus the system off-normal lights on the three input-output units.

Feed

This button is used to supply power to the unit.

Computation Buttons— (Run/Stop)

These two buttons have the same function as the computation buttons on the Processor panel. They enable the operator to start or stop the Processor from the panels of the input-output units.

Input Magazine Empty

This light indicates that the input magazine of the High-Speed Reader has run out of cards. The condition also causes the Reader off-normal light on the Processor and the system off-normal lights of the three input-output units to light, and sets the High-Speed Reader abnormal indicator.

Registration Lights

These two lights indicate that the card passing through the respective station failed to pass the registration check; that is, the card is not moving through the stations at the proper speed. Failure to pass the registration check results in the following: read station and check station relays are opened; the High-Speed Reader abnormal indicator is set; the Reader off-normal button on the Processor lights and the system off-normal buttons on all these input-output units light; and alternating current to the drive motor is turned off.

Read Station

This light indicates that the card failed the registration check at the first set of sensing brushes.

Check Station

This light indicates that the card failed the registration check at the second set of sensing brushes.

Full Stacker

This light indicates that one of the three output stackers has reached its capacity. Upon reaching stacker capacity, the High-Speed Reader abnormal indicator is set, and the Reader off-normal button on the three input-output units lights.

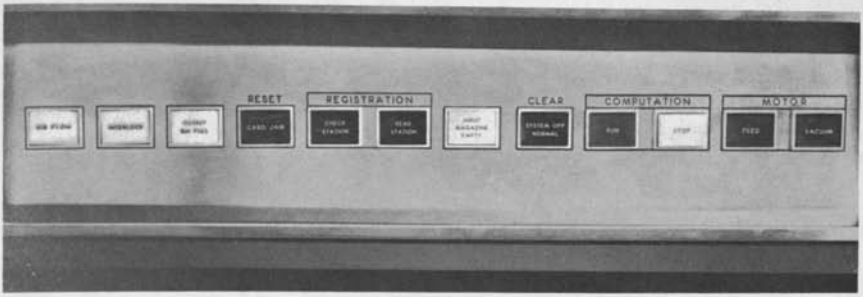

Figure 2-3. High-Speed Reader Panel

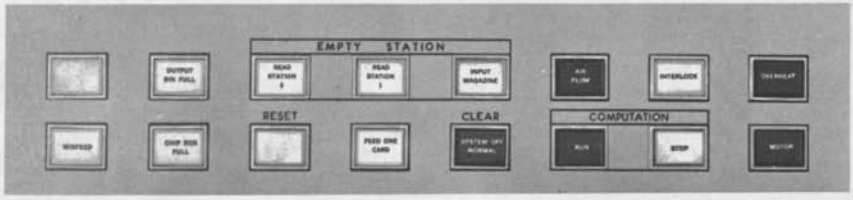

Figure 2-4. Read-Punch Unit Panel

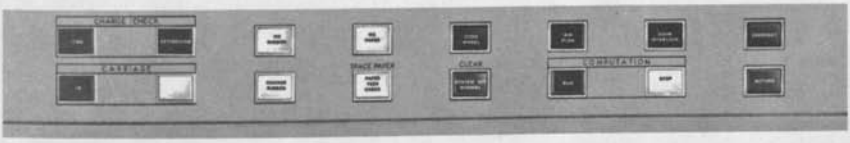

Figure 2-5. High-Speed Printer Panel

Card Jam

This light indicates that a card jam has occurred within the last four sets of rollers in the feed of the High-Speed Reader. The card-feed mechanism is disengaged immediately. Depression of this button re-engages the feeding mechanism of the Reader by closing the relays for the latter part of the feed.

This button must be pressed after any High-Speed Reader jams. (Jams must first be repaired manually.) The abnormal indicator is set. Alternating current is cut off, and the Reader off-normal button on the Processor, together with the system off-normal light on the three input-output units, lights.

READ-PUNCH UNIT PANEL

System Off-Normal

This button lights whenever an abnormal condition exists in one of the four units. At the same time, one of the four off-normal lights on the Processor goes on to indicate which of the units is not functioning properly. Depression of this button duplicates the function of the general clear button, which resets all off-normal indicators. Before pressing this button, the operator should check the card jam button to see if it is lit, because this action extinguishes all jam indication lights.

Door Interlock

This light indicates that a door on the Read-Punch Unit is not properly closed and that power is off for the unit.

Airflow

This light indicates that the air blowers are not supplying enough air to the particular unit and that power is off for that unit.

Overheat

This light indicates that the Read-Punch Unit is overheated and that power is off for the unit. These three conditions–door interlock, airflow, and overheat–set the proper abnormal indicator and light the appropriate off-normal indicator on the Processor plus the system off-normal lights on the three input-output units.

Control Button Motor

This button is used to supply power to the unit.

Computation Buttons — (Run/Stop)

These two buttons have the same function as the computation buttons on the Processor panel. They enable the operator to start or stop the Processor from the panels of the input-output units.

Output Bin Full Light

This indicates that one of the two output stackers has reached its card capacity.

Computation Buttons — (Run/Stop)

These two buttons have the same function as the computation buttons on the Processor. They enable the operator to start or stop the Processor from the Read-Punch panel.

*Chip Box Full Light

This, when lit, indicates that the chip box is full.

Empty Stations

These three lights, when lit, indicate that the respective card station in the Read-Punch Unit is empty. This condition disengages the Read-Punch clutch, and after the unit stops, the reset button must be pressed before the system is restarted.

**Read-Station One*

This light indicates that a card was not present in read-station 1 at the time it should have been.

**Read-Station Two*

This light, when lit, indicates that a card was not present in read-station 2 at the time it should have been.

**Input Magazine*

This light, when lit, indicates that the input magazine is empty.

**This condition sets the Read-Punch Unit abnormal indicator and lights the Read-Punch off-normal button on the Processor, as well as the system off-normal indicators on the three input-output units.*

***Misfeed**

This light indicates that a card jam has occurred in the feed of the Read-Punch Unit. The card-feeding mechanism is disengaged immediately.

Reset

This button re-engages the feeding mechanism of the Read-Punch Unit and resets the empty-station indicator. It must be pressed after all empty-station stops and after abnormal conditions, such as card jams, are cleared.

Feed One Card

This button is used to move cards in the Read-Punch card feed one station forward, without sensing or punching. The button can be used in loading and unloading the Read-Punch feed of cards. It is usually used to load the unit with cards before a program is run.

HIGH-SPEED PRINTER PANEL

System Off-Normal

This button lights whenever an abnormal condition exists in one of the four units. At the same time, one of the four off-normal lights on the Processor goes on to indicate which of the units is not functioning properly. Depression of this button duplicates the function of the general clear button, which resets all off-normal indicators. Before pressing this button, the operator should check the card jam button to see if it is lit, because this action extinguishes all jam indication lights.

Door Interlock

This light indicates that a door on the High-Speed Printer is not properly closed and that power is off for that unit.

Airflow

This light indicates that the air blowers are not supplying enough air to the High-Speed Printer and that power is off for the unit.

Overheat

This light indicates that the High-Speed Printer is overheated and that power is off for the unit.

These three conditions—door interlock, airflow, and overheat — set the proper abnormal indicator and light the appropriate off-normal indicator on the Processor plus the system off-normal lights on the three input-outputs units.

Control Button Motor

This button is used to supply power to the unit.

Computation Buttons — (Run/Stop)

These two buttons have the same function as the computation buttons on the Processor panel. They enable the operator to start or stop the Processor from the panels of the input-output units.

Computation Buttons (Start-Stop)

These two buttons have the same function as the computation buttons on the Processor panel. They enable the operator to start or stop the Processor from the Printer panel.

***Paper Feed Check Button-Light**

When lit, this indicates that the paper for the High-Speed Printer did not stop advancing after the time required for maximum paper advance (79 lines). Pressing this button will advance the paper one line.

Change Ribbon Button

When this is pressed, the ribbon will wind past the automatic ribbon-reverse position completely onto the take-up shaft. When wound to this position, the button will light and the ribbon may be changed.

**The Printer abnormal indicator is set, and the Printer off-normal button on the Processor, as well as the system off-normal button in the three input-output units, lights.*

3. Operating Procedures

STARTING PROCEDURE

When a process is begun, power must be supplied and the program must be entered in main storage.

PUSH IN AC + DRUM –

To Supply Power to the System

1. Press the DC ready button. Release after 5 to 10 seconds, when the drum-on indicator lights.
2. Press the DC ready button again to supply alternating current to the Processor. The AC button will light. Wait approximately 22 minutes until the DC ready button is lit.
3. Press the DC ready button for the third time to supply direct current to the Processor. The DC button and the push-off button will light.
4. When all four indicators – DC, AC, drum, and DC ready–are lit, the Processor is in operating condition.
5. Press the motor button on each of the input-output units to activate them. (On the High-Speed Reader, both the feed and the vacuum buttons must be pressed. Usually the feed one card button on the Read-Punch Unit panel is pressed three times to fill the three stations with blank cards before running a program.)

Now that the entire system is in operating condition, the operator will proceed as follows to begin an actual program.

TO LOAD A PROGRAM

Generally, the routines provided by UNIVAC Program Library Services, for loading, reading, and so on, and the programs handled by the system have individual loading procedures related specifically to the particular routine. However, to initiate card-feeding in the High-Speed Reader, the procedures followed by the operator are the same. After placing the cards of the appropriate loading program in the input magazine of the Reader, the operator, at the Processor control panel, must

1. Press the one-instruction button to select this mode of operation. (This button-light will then go on.)
2. Press the register selector button *C* to select register *C*.
3. Press the alert button on the Processor keyboard to signal the Processor that information is forthcoming from the keyboard. (The ready lamp will light to indicate that the Processor is ready to receive information.)
4. On the Processor keyboard, key-in a 72 instruction (card cycle, High-Speed Reader) by pressing, one at a time, the 7, 2, 0, 0, 0, 0, 0, 0, 0, 0 buttons. (The *c* address as well as the *m* address of the 72 command is ignored here.) If an error is made during the keying-in operation, the alert button should be pressed. When the ready lamp lights, the keying-in may be started again.
5. After the ten characters have been keyed and register *C* selected, press the word release button (+) on the Processor keyboard to enter the instruction in register *C*.
6. Press the run button on the Processor control panel to have the 72 instruc-

tion in register *C* executed. Between steps 6 and 8, the operator should *not* press the general clear button.

7. Press the alert button (the ready lamp will light).

8. Key-in on the Processor keyboard a 96 instruction (High-Speed Reader buffer-to-storage transfer) by pressing the 9 and 6 keys, and then press the appropriate keys for the *m* address. (The program will be read by the 96 from the buffer into the band specified by *m*.) Press the appropriate keys for the *c* address, which should be *m* band plus the interlace factor for the *J* 20 image. (The first word, which must be in machine code, will be at that address. By making the address the *c* portion of the 96 instruction, the first instruction of the loading program will be executed as soon as the 96 is completed.)

9. After all ten digits of the 96 instruction have been keyed-in and register *C* selected, press the word release button (+).

10. Press the continuous mode button.

11. Press the run button. Operation from this point is directed by the program you have stored in the Processor.

TO DISPLAY THE CONTENTS OF REGISTERS A, L, X, C

If the operator wishes to examine the contents of registers *A*, *L*, *X*, or *C*, he must perform the following steps:

1. Press the stop button.

2. Press the appropriate *(A, L, X,* or *C)* register selector button.

3. The contents of the register selected (and the sign) will appear on the display lights labeled *sign* and *register contents.*

To Return to the Program in Continuous Mode

4. Press the continuous mode button.

5. Press the general clear button.

6. Press the run button.

TO DISPLAY THE CONTENTS OF A STORAGE LOCATION

At times the operator may want to know the contents of a particular storage location. To display the contents of any location, he must

1. Press the stop button to bring the Processor to an orderly stop.

2. Press the one-instruction mode of the operation button. Since one of the three arithmetic registers, *A*, *X*, or *L* will be used to display the contents of the storage location, the information now in the arithmetic register must be saved if it is meaningful.

3. Therefore, press the register selector button which corresponds to the arithmetic register to be used. The present contents and sign will then appear illuminated on the register contents display. The operator should make note of them for reference in step 12.

4. Press register selector button *C*. The present contents (current instruction) will then appear illuminated on the register contents display. The operator should make note of them for reference in step 16.

5. Press the alert button (the ready lamp will light).

6. On the keyboard, key-in an instruction which will transfer the word from its present location in storage to the register in which it is to be displayed. (If, for example, the register used is register *A*, the instruction will have an operation code 25. Likewise, the operation code to bring the word to reg-

ister X will be 05 and to register L, 30. The m address is the location of the word to be displayed. The c portion must represent the address of the next instruction to be executed.)*

7. Press the plus word release button.
8. Press the run button to cause the Processor to execute the instruction and stop.
9. Press the register selector button for the register containing the word to be displayed. The contents of the desired storage location, having been placed in this register, will now appear illuminated in the sign and register display section of the Processor panel.

To Restore the Initial Contents of the Arithmetic Register and Then to Return to the Original Program

10. Press the register selector button corresponding to the arithmetic register used.
11. Press the alert button (the ready lamp will light).
12. Key-in on the Processor keyboard the information which was noted in step 3.
13. Press the appropriate word release button.
14. Press the register C selector button.
15. Press the alert button (the ready lamp will light).
16. Key-in on the Processor keyboard the ten-digit word which earlier (step 4) had been read from register C.
17. Press either word release button to restore to register C the instruction word which was about to be executed when the program was interrupted.
18. Press the continuous mode button.
19. Press the general clear button.
20. Press the run button. The program will now resume at the interruption point and continue along its prescribed sequence automatically.

TO INSERT DATA INTO STORAGE

Upon occasion, the operator may want to insert information into a storage location by means of the keyboard. To do so, he must

1. Press the stop button.
2. Press the one-instruction mode of operation button-light (which lights).
3. Press register selector button A. If saving the contents of this register is desired, make note of them now as they are illuminated on the register display lights. (Registers X or L may be used instead.)
4. Press the alert button (the ready lamp will light).
5. When the ready lamp is lighted, key-in the desired ten-digit information on the Processor keyboard. (If less than ten characters are keyed-in, they will be placed in the least significant digit positions of the selected register. If more than ten characters are keyed-in, they will be superimposed on previously keyed characters. If an error occurs in the keying-in process, the operator should depress the alert button and start keying over again.)
6. Press the appropriate (plus or minus) word release button to have the information placed in register A.
7. Press register selector button C. Make note of the contents of register C.
8. Key-in the digits 60 m c. (The 60 will send the information from register A

**The c portion will vary, depending upon where the operator wishes the program to continue after the register display. If he wishes to resume the program at the point where he interrupted it, the c address of the instruction keyed here is irrelevant and should contain zeros to complete the necessary ten digits. If the program is to continue at the interruption point without first restoring the original contents of the arithmetic register used for the display, steps 10 through 13 may be omitted; otherwise, all of the following steps (beginning with step 7) must be performed. If, however, the program is to resume at a specified location, that address should be the c portion of the instruction keyed here. If the contents of the arithmetic register are to be restored before the program continues at the designated address, the operator may omit steps 14 through 17; if the program is to go directly to the known location without restoring the original contents of the register, steps 10 through 17 may be omitted.*

to the location specified by the four digits of m. The four digits of c will be the address of the next instruction to be executed. If the program is to resume at a known address, the four digits of c will specify this location. If the program is to pick up at the point where it was interrupted, the c portion of the 60 command will be irrelevant and should contain zeros to complete the necessary ten digits.)

9. Press either word release button.
10. Press the run button to execute the instruction which will send the inserted data from register A to the desired storage location. If the original contents of register A are to be restored, they must be keyed-in here.

If the Program Is to Resume at the Specified Address

11. Press the continuous mode of operation button.
12. Press the general clear button.
13. Press the run button.

If the Program Is to Resume at the Point of Interruption

11. Press register selector button C.
12. Press the alert button (the ready lamp will light).
13. Key-in on the Processor keyboard the ten-digit instruction word which has been read from register C after step 7.
14. Press the plus word release button.
15. Press the general clear button.
16. Press the continuous mode button.
17. Press the run button to resume operation at the point of interruption. The Processor will now automatically carry out the instructions in the internally stored program.

OFF-NORMAL CONDITIONS RECOVERY

Certain types of malfunctions may cause data in the Processor to be incorrect. These are divided into two classes by the methods used to signal the Processor that a malfunction exists.

Orderly Stop

There are abnormal conditions and malfunctions that stop the Processor while permitting the observer to know exactly at what point in the processing the condition occurred. Once known, the "point" may be used as the restart position when processing is resumed. For errors resulting from these types of malfunctions, the system is not immediately stopped. Instead, on a specific future instruction, the contents of register C are transferred automatically to register A, and the next instruction is taken from $c + 1$ (the location one greater than that specified by the c address of the instruction), rather than from the location specified by c. The specific future instruction is the next advance (16) or advance and print (11) instruction for Printer malfunctions, the next card cycle (72) instruction for High-Speed Reader malfunctions, and the next card cycle (81) instruction for Read-Punch Unit malfunctions. In all cases, the instruction referred to above is not executed, but is transferred from register C to register A. Thus, control may be transferred to a subroutine which may record and preserve all information from cards already committed, and then bring the system to a programmed stop. Other techniques may also be used at the discretion of the programmer.

Malfunctions of this type are

1. Printer
   a) Out of paper
   b) Full output stacker (any of three stackers)
   c) Carriage out
   d) Print-buffer parity error
   e) Code-wheel parity error
   f) Paper-feed check
   g) Printer power off
2. High-Speed Reader
   a) Empty input magazine
   b) Full output stacker (any of three stackers)
   c) First read station registration check
   d) Second read station registration check

e) High-Speed Reader power off
f) Card jam

3. Read-Punch Unit
   a) Empty input magazine
   b) Full output stacker (either of two stackers)
   c) Misfeed or card jam
   d) Full chip box
   e) Read-Punch power off
   f) Empty read station (1 or 2)

Abrupt Stop

The other types of malfunction stop the Processor immediately at the end of the current instruction cycle. Because these types could occur at any time, it would be impractical for the Processor to continue executing instructions. In order to correct errors resulting from these malfunctions, and to start the program properly again, the programmer must establish rerun points at appropriate intervals (for example, every 5,000 cards). The optimum frequency of rerun points should be established separately for each problem, but at each rerun point all information necessary to identify the point and completely reestablish the problem must be retained.

These malfunctions are

1. Main-storage parity error
2. Timing-band parity error
3. Cycling-unit error
4. Main computer power off

Remington Rand Univac
DIVISION OF SPERRY RAND CORPORATION

U 2423