CENTRAL PROCESSOR CONSOLE OPERATING INSTRUCTIONS

1.0 C O N T E N T S

2.0 INTRODUCTION

The basic method of controling the UNIVAC 1050 Central Processor is through the central processor control console. Hardware lights and indicators, together with programmed stops and displays, inform the operator of the status of peripheral hardware and running programs. These lights and indicators are primarily on the lower half of the control panel. The operator may obtain more specific information, and may alter the contents of storage by using the switches located on the upper half of the console. It is the purpose of this manual to explain the use of the console in these two basic functions.

3.0 SWITCHES USED IN INITIAL SET UP AND PROGRAM MONITORING

SYSTEM ON

Glows green when the system is receiving full operating power; is extinguished when power is off. Depress the switch/indicator when extinguished to apply power to the system. Depressing this button when illuminated has no effect.

SYSTEM OFF

Glows red when power has been turned on to the system, but before full operating power is in effect; is extinguished when power is on and the SYSTEM ON button is illuminated. Depress when extinguished to remove power and turn off system.

CLEAR

Glows white when depressed; is extinguished when released. Depressing the CLEAR button sets all internal counters and indicators to their initial positions, clears all stored interrupts and initiates a console lamp test.

PROC ABNORMAL

Glows red when a second parity error is recognized and a previous parity error has not been cleared. Depressing this button when illuminated turns it off, but does not clear the parity error. May also be on due to maintenance operations.

PARITY

Indicator only. Glows yellow when a parity error is detected in a character read from storage. Parity errors cause an immediate processor halt.

CLASS III INHIBITED

Indicator only. Glows yellow every time a program instruction to inhibit I/O (Class III) interrupt is executed, and remains on until an instruction to release Class III interrupt inhibit occurs.

OVERFLOW INHIBITED

Indicator only. Same as the CLASS III INHIBITED indicator but applies to decimal overflow (Class II interrupt).

Note: Depressing any of the "indicator only" buttons has no effect. The lights behind them can be extinguished only by depressing the CLEAR button.

CHANNEL ABNORMAL 0 - 7

Each indicator applies to a particular input/output channel (See Section 5.0 for a list of standard channel assignments) and glows red when an error occurs in a unit on that channel. Once a channel abnormal light is illuminated it can be extinguished only by clearing the error at the peripheral unit and then depressing the illuminated button.

SENSE 1, 2, 3

Glow white when set; extinguished when reset. Use of the Sense switches is governed by operating instructions for each individual run.

OPERATOR REQUEST

Can be depressed when illuminated to stop program by causing a Class II interrupt. Depressing the OPERATOR REQUEST button when extinguished has no effect.

NEXT INSTRUCTION M

Glows white when program control is to be transferred to the address specified in M portion of current instruction. Depressing the M

button when illuminated has no effect; depressing the M button when extinguished illuminates it and extinguishes the CC button forcing transfer of control to the M address.

NEXT INSTRUCTION

CC — Glows white when program control is to continue with the address specified in control counter. Depressing the CC button when illuminated has no effect; depressing the CC button when extinguished illuminates it and extinguishes the M button. Either the M or the CC button will always be illuminated.

Note: During operation in the continuous mode, the Next Instruction switch/indicator will light according to the instruction sequence and depending on the result of programmed tests and comparisons. Consequently, these buttons should not be depressed during continuous operations. Doing so could force an incorrect instruction sequence.

PROGRAM START — Glows green when program instructions are being executed normally. Depressing the PROGRAM START button when extinguished initiates execution of program instructions under control of the Mode switches.

PROGRAM STOP — Glows red when program instructions are not being executed. Depressing this button when illuminated has no effect. Depressing it when extinguished stops the execution of program instructions and illuminates the indicator.

DISPLAY/ — Glows white when depressed; extinguishes when released. When depressed, causes the contents of the memory location represented in the M portion of the Display/Alter switches to be displayed in the lights in the C portion.

ALTER — Glows white when depressed, extinguishes when released. When depressed, causes the character represented by the setting of the C alter switches to be stored into the address specified in the M portion of the Display/Alter switches.

MODE BUTTONS

LOAD CARD — With this button depressed and illuminated, depressing the PROGRAM START button causes one card to be read from the reader into octal location 400. Depressing PROGRAM START again, with the CONTinuous mode button depressed, causes control to be transferred to octal location 400, when UNIVAC standard code cards are used.

LOAD TAPE — With this button depressed and illuminated, depressing PROGRAM START will cause one block of tape to be read from logical tape unit 0 into storage starting at octal location 400. Changing to the continuous mode and depressing PROGRAM START immediately after, will transfer control to this location.

ONE CYCLE — With this button depressed and illuminated, depressing PROGRAM START will cause instructions to be executed one instruction cycle at a time. This mode is generally used by Field Engineering personnel only.

ONE INSTR — With this button depressed and illuminated, depressing the PROGRAM START button will cause one instruction to be executed and the next instruction accessed.

CONT — Depressing the PROGRAM START button while this button is depressed and illuminated causes instructions to be executed in the continuous mode.

Note: One of these buttons must be depressed at all times. The CONT button is used for normal operation.

4.0 PROGRAM DEBUGGING AND TESTING

4.1 STORAGE DISPLAY AND ALTERATION BUTTONS

In order to display or alter the contents of storage the Display/Alter Selection buttons are used in conjunction with the display lights and alter switches. The functions of the Display/Alter Selection buttons are as follows:

Q1
Q2 — When set, these buttons display internal registers and indicators on the control console. They are primarily for engineering use.

CC — When set, the contents of the control counter is displayed in the M portion of the display lights.

INST — When set, the contents of the instruction register (the next instruction to be executed) is displayed in the 30 display lights.

OP/CH — When set, the entire instruction register is displayed, but only the operation code and channel (index register) designation portions of the instruction register are alterable.

M — When set, the entire instruction register is displayed, but only the operand address (M portion) of the instruction register is alterable.

C — When set, the entire instruction register is displayed, but only the C portion (detail field) of the instruction register is alterable.

MEM — When set, this button causes the contents of the storage location specified by the setting of the M alter switches to be displayed when the display switch is depressed, and altered when the ALTER switch is depressed.

SEQ — When set, it is used in conjunction with the DISPLAY or ALTER switch to display or alter the contents of sequential memory locations.

4.2 USE OF DISPLAY LIGHTS AND SWITCHES

The 30 display lights and corresponding toggle switches at the top of the console are a primary means of communication between the operator and a running program. These lights and switches must be read as octal numbers. To do this they are interpreted in groups of three binary digits. A binary digit, or bit, can have a value of either 0 or 1; in this case, an illuminated (on) display light represents a 1, while an extinguished (off) display light represents a 0. Similarly, an octal digit can have a value from 0 to 7, and any octal digit can be represented by three binary bits. The bit patterns, or groups of display lights, representing all the octal digits are as follows:

Octal Number	Bit Pattern
0	000
1	001
2	010
3	011
4	100
5	101
6	110
7	111

By interpreting the 30 display lights as 10 groups of three each, any display can be read as 10 octal digits.

The setting of the Display/Alter Select buttons at the middle of the console determines what will be displayed in the 30 lights. Normally, the INST Display/Alter Select button remains depressed so an entire 30-bit instruction will be displayed. Various portions of the instruction are delimited by the labels on the console between the display lights and their corresponding switches. The first five bits on the left comprise the operation code;* the next three bits are the channel number or index register used, if any; the next sixteen bits specify the storage address referred to, and the final six bits on the right comprise the detail field of the instruction.

When the computer comes to a programmed display stop, the instruction OP code will always be 30, and the detail field will always be 60 or 20; when the detail is 20 a blank is displayed. The configuration displayed in the M portion of the instruction is the"message"for that stop, and should be explained in the operating instructions for the run being executed. Display stops are usually defined only in terms of this M portion; the OP code of 30 and detail of 60 being understood. Consequently, a stop of 3007000160 would probably be written as stop 070001.

4.2.1 Display Contents of a Storage Location

1. Set the address of the location to be displayed in the M portion of the alter switches.
2. Depress the MEM Display/Alter Selection button.
3. Depress the DISPLAY button.
4. The contents of the selected storage location will be displayed in the six rightmost display lights (above the C notation on the console), and the address + 1 of the location displayed will appear in the M display lights.

   If sequential storage locations are to be displayed, the above procedure should be followed to display the first character. Then, to display subsequent locations:

   a. Depress the SEQ Display/Alter Selection button.
   b. Depress the DISPLAY button to display the next location.

   Every time the DISPLAY button is now depressed, the M address will be increased by one, and the contents of Location M-1 will be displayed in the C lights.

4.2.2 Altering the Contents of Storage

1. Depress the MEM Display/Alter Selection button.
2. Set the address of the memory location to be altered in the M alter switches.
3. Set the bit configuration of the character to be stored into this location in the six C alter switches.
4. Depress the ALTER button.

The procedure for altering sequential locations is analogous to that for displaying them:

1. Alter the first location as outlined above.
2. Depress the SEQ Display/Alter Selection button.
3. Set the new bit configuration to be stored in the next character location in the six C alter switches.
4. Depress the ALTER button.
5. Steps 3 and 4 should be repeated until all sequential character locations have been altered.

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*When reading the OP code a sixth least significant bit, which is always zero, is implied. As a result all octal OP codes are even numbers.

4.2.3 Altering the Next Instruction

To alter the instruction register (as displayed in the lights) the procedure is the same as that for altering the contents of storage except that the INST, OP/CH, M, or C Display/Alter Selection buttons may be used in place of the MEM and SEQ buttons.

4.2.4 Manual Instruction Execution

Although the CONTinuous Mode is the normal operating mode, during program testing it may occasionally be more desirable to execute one instruction at a time in order to follow the exact path taken in a particular phase of processing. This is accomplished by using the ONE INSTruction Mode button. When operating in this mode, the INST Display/Alter Select button usually remains depressed, but the CC button may also be used to display the contents of the control counter, thereby determining the location within the program of the instruction following the one about to be executed.

With the INST Display/Alter Select button depressed, operation in the one instruction mode will cause a single instruction to be executed each time the PROGRAM START button is depressed. The instruction displayed is always the next instruction to be executed; a subsequent push of the PROGRAM START button will execute this instruction and display the next one in the 30 display lights. If the CC Display/Alter Select button is depressed, the address of the next instruction in sequence, after the instruction displayed by pushing the INST button, will appear in the 16 lights of the M portion of the display lights. Note that the instruction specified by the address in the control counter is not always the next instruction to be executed. In the case of comparison instructions, in which the value of one field in storage is compared to another, different paths may be taken depending on the result of the comparison. Compare instructions in programs are almost always followed immediately by a Jump Conditional (JC) instruction. These instructions specify where program control is to be transferred if the condition tested for (which may be equal, unequal, greater, or smaller) is met. If the condition is not met, program control will simply pass to the next instruction in sequence.

4.2.5 Next Instruction Switches

Depression of the M button inserts binary zeros in the C portion of the instruction register. Depression of the CC button, when the processor is stopped, will force a Jump Conditional instruction into the instruction register. The following parts of the instruction word are affected:

1. The operation code is staticized to Jump Conditional.
2. The C portion is changed to a value that initiates the unconditional skip associated with the Jump Conditional operation code.

When the processor is restarted, the new instruction will be performed. In this manner, any instruction may be skipped.

If a Jump Conditional or Jump Return instruction is staticized, and the processor is stopped, depressing the M button will force the processor to take its next instruction from the address in the M portion. In this manner, any jump instruction may be forced to follow the M path.

Thus, if the M Next Instruction button is illuminated when a Jump Conditional instruction is being displayed, the condition tested for has been met. The next instruction to be executed is at the address specified in the M portion of the display lights. If the CC Next Instruction button is illuminated, the next instruction to be executed is the one following the jump instruction. Its address may be displayed by pushing the CC Display/Alter Select button.

4.2.6 Altering Instruction Sequence

The sequence of program instructions may be altered by using the Next Instruction switch/indicators. If a programmed comparison has been made, and the M button light is lit along with the Jump Conditional instruction display, it may be desirable to see what would happen if the program would take the other path. This may be done by depressing the CC button to illuminate it, and depressing the PROGRAM START button to execute the next instruction (which is now the one specified by the control counter). This procedure does not in any way alter the contents of storage; the next time these instructions are executed, they will be unchanged. Any instruction (with the exception of Jump Loop, in which the control counter is only incremented by four instead of five) may be executed manually while the computer is in the one instruction mode. The following procedure must be followed:

1. Depress the CC Display/Alter Selection button to obtain the value of the control counter, if this value must be recorded for later use.
2. Depress the INST Display/Alter Select button.
3. Set the bit configuration of the instruction to be executed in the 30 alter switches.
4. Depress the ALTER button. The new instruction will be displayed.
5. Depress the PROGRAM START button.
6. The computer will execute the new instruction and stop, displaying the next instruction to be executed. The new contents of the control counter may be displayed by depressing the CC Display/Alter Selection button. Storage has not been altered; the next time this sequence of instructions is to be executed, the original instructions will be performed.

4.2.7 Tracing

Frequently during program execution, and especially during program testing, it is desirable to search (Trace) through the running program for a particular instruction, location or operation. This is accomplished through the Trace Mode buttons and Trace Address switches. The Trace Mode buttons are used to specify the type of trace being performed. The TRACE STOP button must be depressed in order to stop the computer if the traced value sought is found. However, whether or not the TRACE STOP button is depressed, a program-testable indicator is set when the trace conditions are met. If the trace is on a particular address, the value of that address must be set in the Trace Address toggle switches. These are three-position switches in which the down position indicates a 0, the up position indicates a 1, and the middle position can stand for either one. This latter feature enables tracing on several addresses at once. The five Trace Mode buttons and their uses are as follows:

OP — With this button and the TRACE STOP button depressed and illuminated, tracing will be done on the OP code value set in the five alter switches bracketed by OP on the console. The computer will stop when an instruction with this OP code is accessed.

CC — With this button and the TRACE STOP button set, tracing will be done on the address set in the Trace Address switches. The computer will stop when the setting of the control counter matches the Trace Address switch setting.

PROC — With this button and the TRACE STOP button set, the computer will stop when an operand address matches the setting of the Trace Address switches.

WRITE — With this button and the TRACE STOP button set, the computer will stop when a character has just been written into the address specified by the Trace Address switch setting.

I/O — With this button and the TRACE STOP button set, the computer will stop when an input/output control unit reference is made to the storage address specified by the Trace Address switch setting.

5.0 ERROR INDICATORS

There are two types of central processor errors that will cause an interrupt: a Class I interrupt, which is a parity error in a character read from storage, and a Class II interrupt (decimal overflow), caused by improper division or too great a carry in decimal addition.

A Class III interrupt is a normal interrupt of central processor operation that allows for the completion of input/output functions in the peripheral units. This class of interrupt, as well as Class II decimal overflow interrupt, may be permitted or inhibited by program instructions. If either type of interrupt is inhibited during a running program, the associated indicator will light. (During the operation of most programs, these lights may be seen flickering on and off.) All three classes of interrupt may be inhibited manually by setting the rotary switches at the botton of the console to I (inhibit), but this setting is not recommended to anyone except Field Engineering personnel.

Errors that occur in the peripheral units will be indicated by a red light on the appropriate Channel Abnormal switch/indicator. Each input/output device is assigned one of the central processor's eight I/O channels.

The following are the standard channel assignments:

Channel 0 - Printer
Channel 1 - Card Reader
Channel 2 - Card Punch
Channel 3 - Communications
Channel 4 - Tape Read
Channel 5 - Tape Write
Channel 6 - FASTRAND
Channel 7 - Unassigned

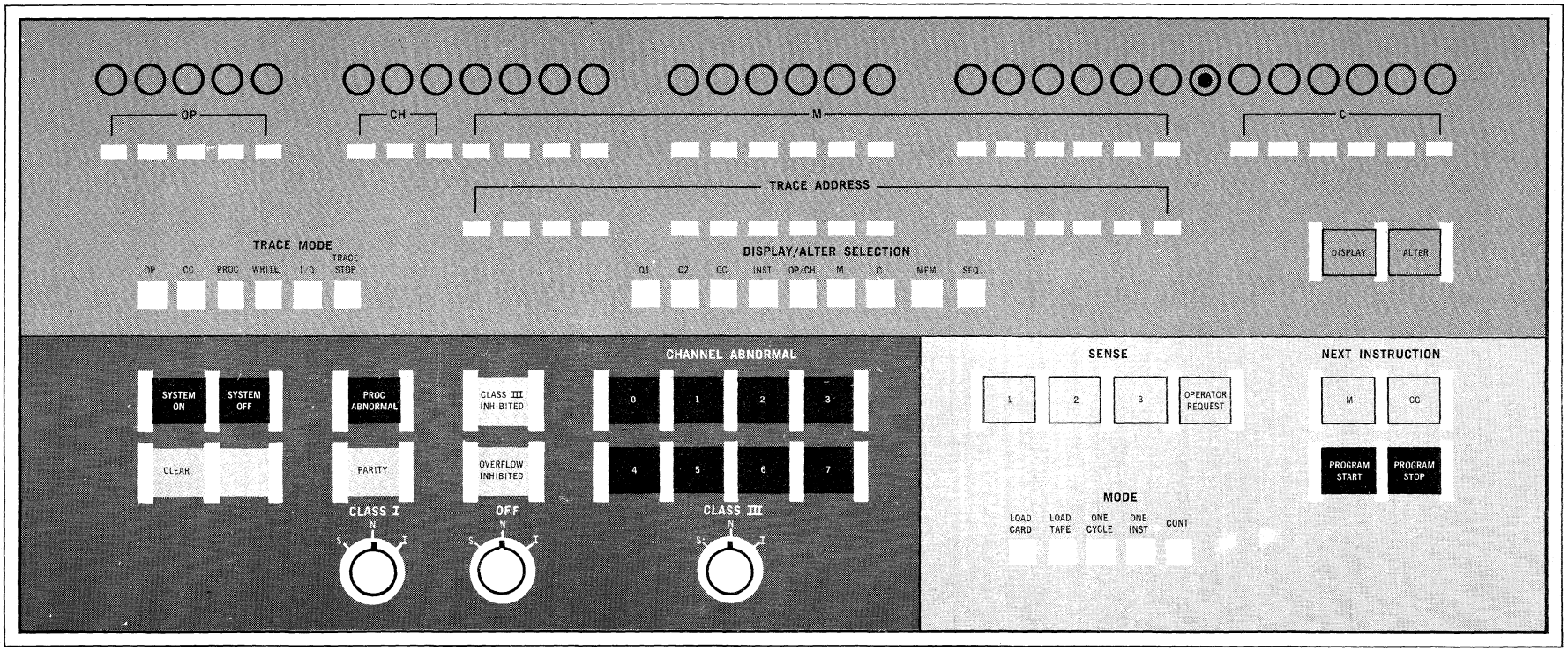
If a red Channel Abnormal light goes on, the operator should check the unit(s) associated with that channel for error conditions and clear them before attempting to continue the run. Clearing the error at the peripheral location will usually cause the error light on the console to go out, and program operation can be resumed.

All standard UNIVAC 1050 software routines have display stops in them which will occur simultaneously with a channel abnormal error stop to indicate the nature of the problem in the peripheral unit. (For detailed descriptions of these stops, refer to the software routine's operating instructions.)

6.0 SENSE SWITCHES AND OPERATOR REQUEST

Immediately above the five Mode buttons in the lower right-hand portion of the console is a row of four switch/indicators. The leftmost three are Sense switches, which may be used by programs to determine one among alternative courses of action (for example, to produce output in punched-card format rather than a printed listing). The use of Sense switches for any given program should be outlined in the operating instructions for that program. If no mention is made of Sense switches in the operating instructions, it is understood that they should all be off (light extinguished).

A running program may be interrupted at any time by depressing the OPERATOR REQUEST button when it is illuminated. Operator request is another form of Class II program interrupt. For tape systems running under the Executive Routine, depressing this button causes a unique display stop at which one of several courses of action may be selected. (For a detailed discussion of these alternatives, see the tape system software operating instructions.)



Central Processor Console