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**INFORMATION FOR OPERATORS**

**2111**

**DATA MANAGEMENT STATION**

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# Foreword

This manual is designed to teach an operator to use a System 21 Data Management Station. The introductory section describes the basic procedures for preparing to operate a System 21 Data Management Station and includes also a brief functional description of the components of System 21. Section II contains instructions for operating System 21 in a manual mode and explains the basic input/output capabilities of the Data Management Station. Section III describes the use of automatic input and output options with accompanying operator exercises. Section IV expands upon the operating instructions to include program control functions or the automatic mode of operation with System 21. Section V describes additional capabilities of the 2111 Microprocessor — automatic tape search, record reformatting, and key verification. Section VI is a summary of all keys, switches, and indicators and their use or interpretation. Optional exercises are provided throughout the manual as an aid to understanding and using new information as it is presented.

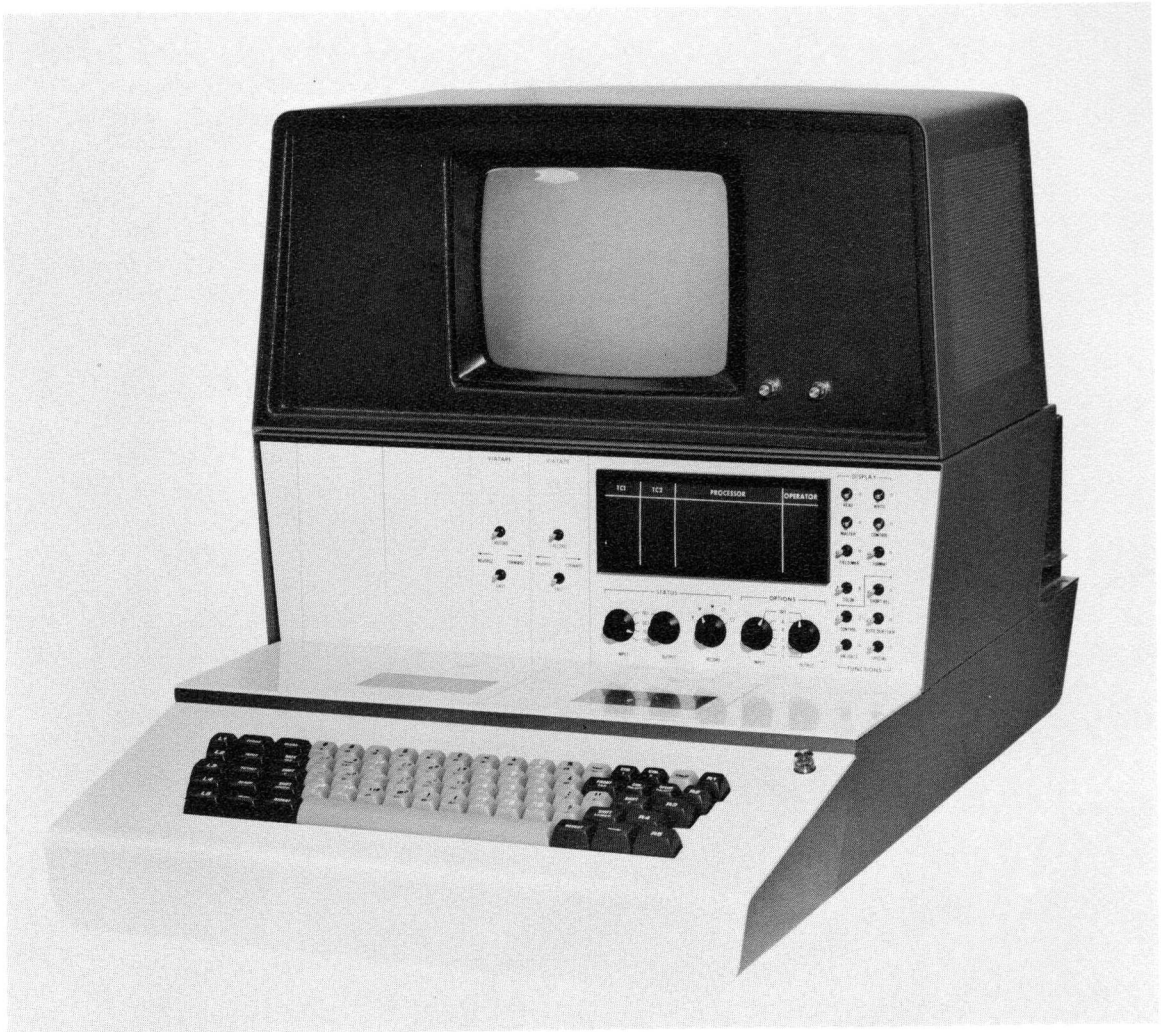


Figure 1-1. The Basic 2111 Data Management Station.

# **Section I Introduction**

## **SYSTEM 21 DATA MANAGEMENT STATION**

VIATRON'S System 21 is a family of data processing devices designed for data management, including data entry, control, display, communication, storage and retrieval. With its modular structure, System 21 can be configured to perform a wide variety of data processing operations.

A typical System 21 configuration includes a Microprocessor, two Tape Channels, a Keyboard, two Data Channels, and a Video Display. Central to the System 21 structure is the Microprocessor which contains hard-wired microprograms that perform a fixed set of logical operations. The hard-wired microprograms in the Microprocessor accomplish the same functions as a general-purpose computer operating system or assembler. Because the microprograms are hard-wired, however, there is no need for extensive programming.

There are two modes of system operation—manual control and program control. In the manual mode of operation, the operator initiates all Microprocessor functions. Under program control the Microprocessor performs certain functions automatically through the use of a control program.

The Microprocessor has four input/output channels, two Tape Channels and two Data Channels. The Tape Channels are devoted to either VIATAPE Recorders or Computer Tape Recorders, one recorder per channel. The two Data Channels can communicate with optional input/output devices. They can be connected, for example, to a Model 6001 Card Reader/Punch Adapter for reading and punching cards, or to a Model 6002 Printing Robot for providing hard copy. The Data Channels can also be interfaced with a Model 6003, 6004, or 6005 Communication Adapter for providing a link with another System 21 Data Management Station, a computer, or virtually any other device capable of USASCII interface. The Keyboard has its own Channel dedicated to providing data input and control to the Microprocessor.

The Microprocessor Video Display Subsystem, Model 3001, permits the attachment of several types of video displays to a System 21 Data Management Station. One or two Black and White Video Displays, Feature Code 301, or a Color Video Display, Feature Code 304, may be attached directly to the system. Using VIATRON's Black and White RF Modulators, Feature Code 305, up to 32 VIATRON Displays or commercial television sets can be connected to the same Microprocessor.

## **THE ROLE OF THE MICROPROCESSOR**

The 2111 Microprocessor contains the logic for performing all of the Data Management Station operations. Switches on the control panel, in conjunction with the keyboard, are used to control the operation of the Microprocessor.

Three basic capabilities of the Data Management Station are *data input*, *keyboard data entry*, and *data output*. These operations are always performed in relation to the Microprocessor. *Input* is defined as sending data into the Microprocessor from one of the four input/output channels. *Keyboard data entry* is used to describe an input to the Microprocessor from the keyboard. *Output*, then, is defined as sending data out of the Microprocessor to an input/output channel. The Video Display allows the operator to see any data stored in the Microprocessor. Figure 1-2 provides an illustration of the relation of the Microprocessor to the other elements of System 21.

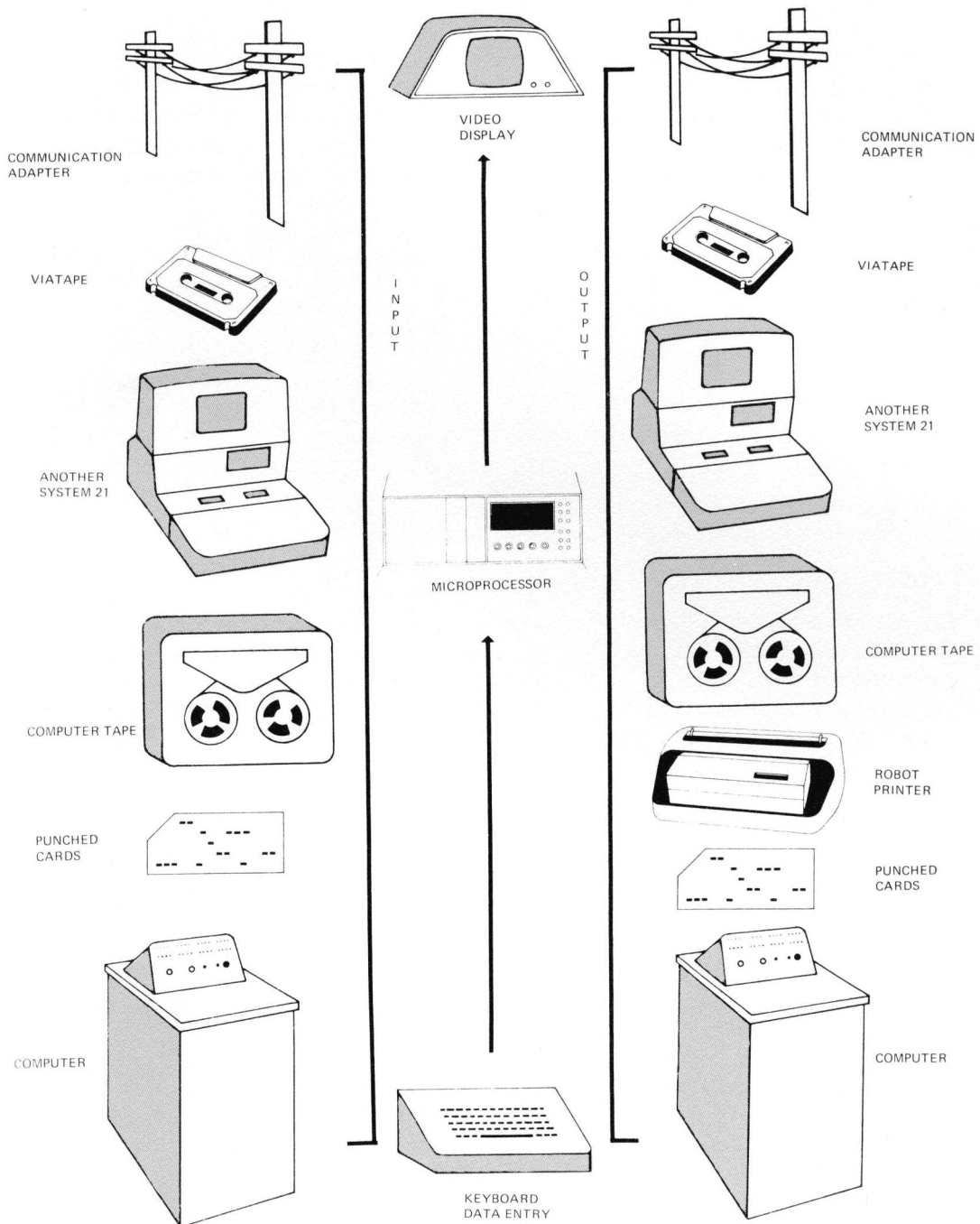


Figure 1-2. The Role of the Microprocessor in System 21.



## **THE ROLE OF THE VIDEO DISPLAY**

The 2111 Microprocessor has a main memory capacity of 400 characters. This 400-character memory is divided into five separate 80-character storage areas, designated as the READ record, the WRITE record, the MASTER record, CONTROL 1 record, and CONTROL 2 record.

### **Display Records**

The Video Display is divided into sections that correspond to the Microprocessor storage areas. Each section can display a record of 80 characters in four 20-character lines. Up to 320 characters of data can be displayed at a single time. The top four lines on the Display are devoted to displaying the contents of the READ record, the second four lines to the WRITE record, the third four lines to the MASTER record and the bottom four lines to either of the two CONTROL records. Although two CONTROL records can be stored in the Microprocessor, only one can be displayed at a time.

Whenever power is turned off, any data in the Microprocessor is erased from the 400-character memory. Therefore, whenever power is first turned on, there will be no stored data to be displayed.

### **WRITE RECORD**

The WRITE record is the normal composition record, the area on the display (and in Microprocessor memory) where data is entered from the Keyboard and where inputs from and outputs to the Tape and Data Channels are made.

### **READ RECORD**

When data in the WRITE record is output to a Tape or Data Channel, the data is automatically transferred from the WRITE record to the READ record. The READ record, then, generally contains the last output from the WRITE record. Data in the READ record can be duplicated into the record in which the operator is entering data.

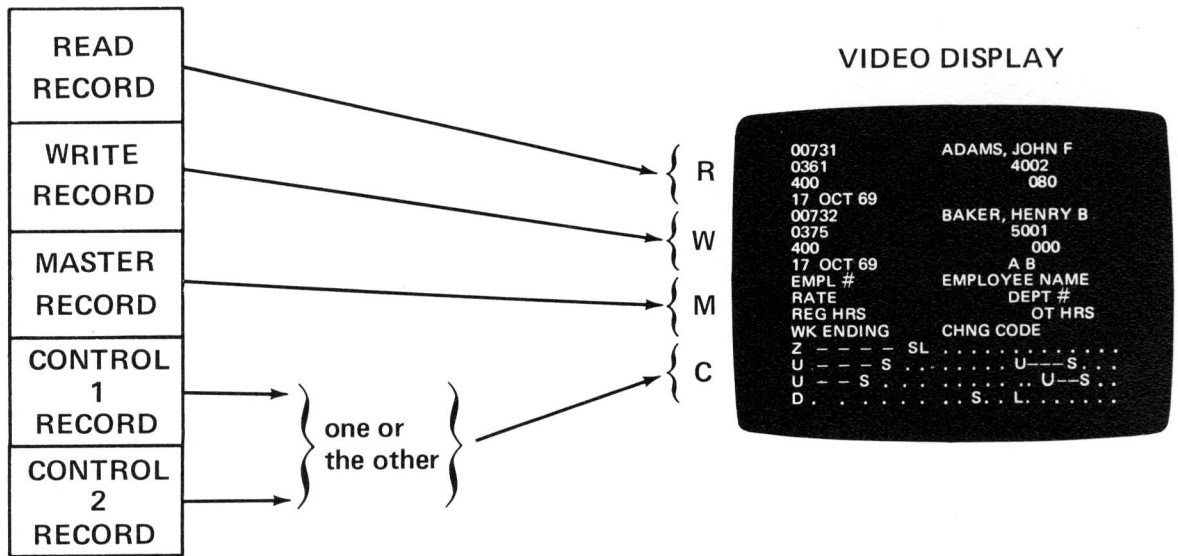
### **MASTER RECORD**

The MASTER record usually contains fixed information—the headings which the operator can use as a guide when entering data into the WRITE record. Data in the MASTER record can also be duplicated into the record in which the operator is entering data.

### **CONTROL RECORD**

Microprocessor CONTROL 1 and 2 records usually contain instructions for performing certain operations automatically. These instructions, called control programs, are used when the Data Management Station is being operated under program control. The CONTROL record display area can show either one of the two programs stored in the Microprocessor.

Figure 1-3 shows the relation between the Microprocessor records and the Video Display records. Each of the displayed records contains typical data.



**MICROPROCESSOR  
RECORDS**

Figure 1-3. Relation of Microprocessor Records and Video Display Records.

**Display Controls**

The data in each of the records can be displayed or suppressed at the option of the operator. Display and suppression of data is controlled by four switches on the DISPLAY section of the Microprocessor control panel. The four switches, labelled READ, WRITE, MASTER, and CONTROL, correspond to the records on the DISPLAY. When a switch is positioned to the right, in the direction of the dot, data in that record is displayed. Similarly, when a switch is positioned to the left, away from the dot, data in the record is suppressed. The switches are shown in Figure 1-4.

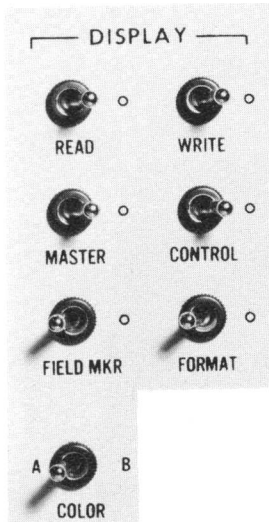


Figure 1-4. Display Switches.

The three remaining switches shown in Figure 1-4 are FIELD MKR, FORMAT, and COLOR A/B. The FIELD MKR switch is used when operating under program control, and the COLOR A/B switch is functional when the Data Management Station is equipped with a Color Video Display.

The FORMAT switch is used to interleave, or alternate, the WRITE and MASTER records. When the switch is to the left, or off, the four lines of the WRITE record are above the four lines of the MASTER record. When the switch is to the right, toward the dot, the four lines of the WRITE record are interleaved with the four lines of the MASTER record, the first line of the WRITE record followed by the first line of the MASTER record, and so on. Interleaving permits the operator to "fill-in-the-blanks" by entering data directly above the related heading in the MASTER record. Figure 1-5 shows the effects of both switch settings.

```

VIATRON CORPORATION
CUSTOMER NAME
ROUTE 62
ADDRESS
BEDFORD          MASS.
CITY             STATE
01730
ZIP

```

(a)

```

VIATRON CORPORATION
ROUTE 62
BEDFORD          MASS.
01730
CUSTOMER NAME
ADDRESS
CITY             STATE
ZIP

```

(b)

Figure 1-5. Effect of the FORMAT switch. FORMAT on (a), FORMAT off (b).

There are two controls located on the front of the Display case for adjusting brightness and contrast to suit the individual operator (Figure 1-6). The horizontal hold and vertical hold are located on the back of the Video Display.

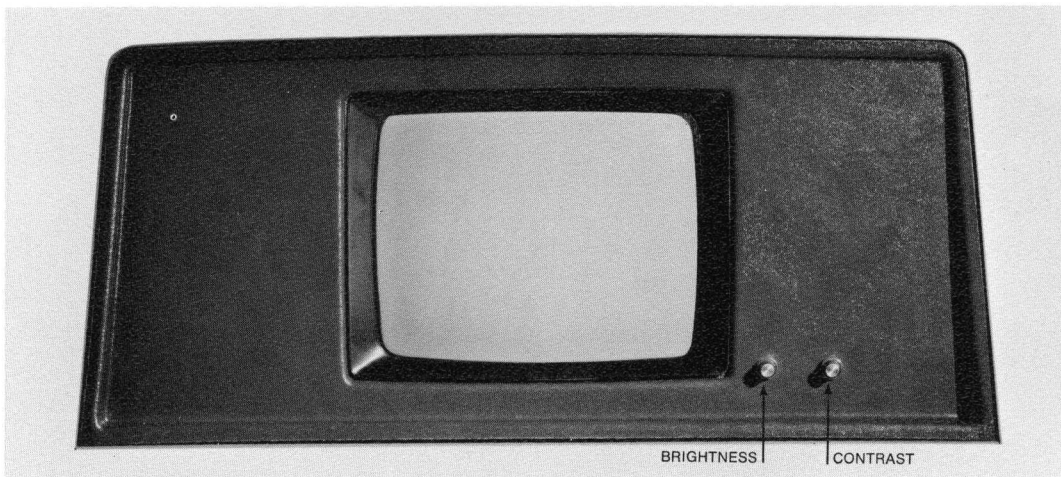


Figure 1-6. Brightness and Contrast Controls.

## PREPARING THE DATA MANAGEMENT STATION FOR OPERATION

The power ON/OFF switch is located at the back of the Microprocessor as shown in Figure 1-7. To turn the power on, push the switch in; pull the switch out to turn the power off.

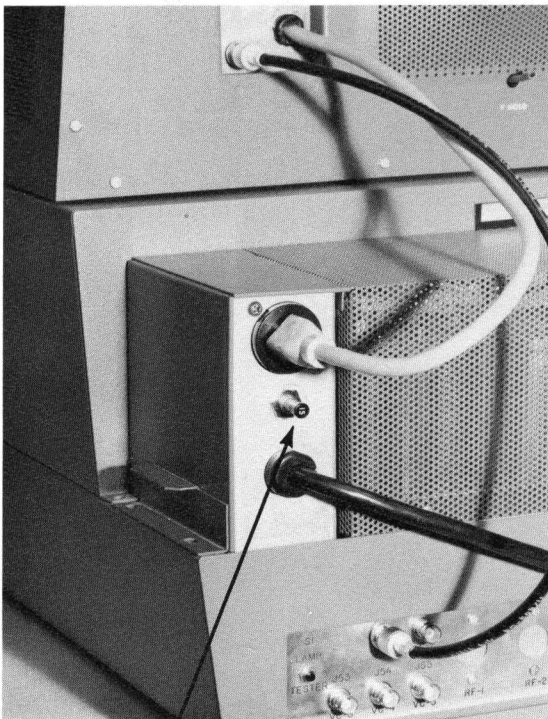


Figure 1-7. Power ON/OFF Switch.

When the power is turned on, the control panel indicators shown in Figure 1-8 illuminate.

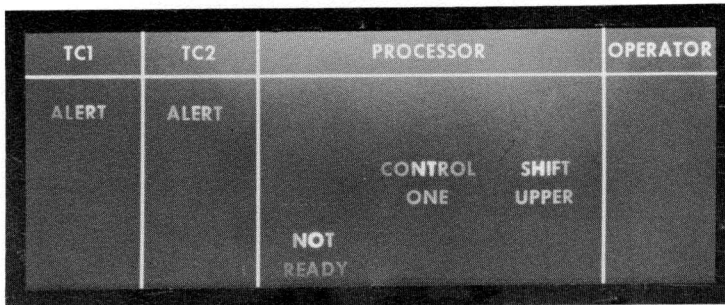


Figure 1-8. Indicators When Power Is First Turned On.

Next, set the control panel switches as shown in Figure 1-9.

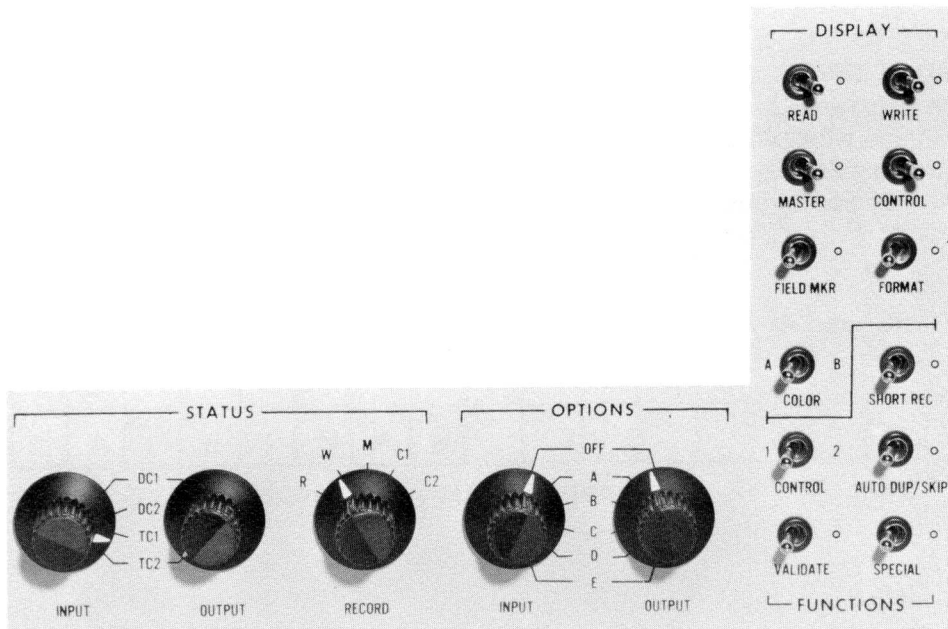


Figure 1-9. Control Panel Switch Settings for Beginning Exercises.

Finally, press the READY key and then the L5 (POSITION 1) key. The NOT READY and SHIFT UPPER indicators are turned off, the SHIFT LOWER indicator is turned on, and there is a line (the cursor) on the display.

## **STATUS RECORD Selector**

Although the operator will normally be working in the WRITE record, data may be entered in any of the five records. The function of the STATUS RECORD selector is to permit the operator to select the record in which operations are to be performed.

The STATUS RECORD selector has five settings, R, W, M, C1, and C2, corresponding to the READ, WRITE, MASTER, CONTROL 1, and CONTROL 2 records. In order to enter data in a particular record, the operator must position the STATUS RECORD selector to the setting for that record. For example, if the operator wants to enter data into the MASTER record, the STATUS RECORD selector must be set to M. Keyboard data entry always occurs in the record set on the STATUS RECORD selector.

## **NOT READY Indicator and READY Key**

Whenever power is first turned on, when the position of the STATUS RECORD selector is changed, or under other conditions which will be described below, the NOT READY indicator on the Microprocessor section of the control panel will go on. The NOT READY indicator signifies that certain switch settings have not been "read into" the Microprocessor. Operation is not possible when the NOT READY indicator is on. In order to turn off the NOT READY indicator and prepare the Data Management Station for operation, the operator must press the READY key.

## **CLEAR Key**

When the CLEAR key is pressed, all Microprocessor activity stops; the NOT READY, SHIFT UPPER, and CONTROL ONE indicators are turned on; and all other Microprocessor indicators are turned off. The yellow keyboard lock light also illuminates when CLEAR is pressed or when the NOT READY indicator is on. Data on the display and in memory is not affected by the use of CLEAR. To perform further operations, however, it is necessary to press the READY key.

## Section II Manual Operation

### THE KEYBOARD

The keyboard has three kinds of keys—alphanumeric, cursor movement, and function control. The alphanumeric keys, used to enter alphabetic characters, numbers, and special symbols into the Microprocessor, are arranged so that they will be familiar to both typists and keypunch operators. The alphabetic keys are in normal typewriter and keypunch positions. There are two sets of numerics—one in the normal typewriter position across the top row of keys and the other in the normal keypunch position on the right. (See Figure 2-1.)

Those alphanumeric keys having dots and circles in addition to their data characters identify keys that are used for entering color codes for color video displays.

The cursor movement keys are used to move the cursor, a line that appears on the display to indicate the next position where data will be entered. Data can be entered from the keyboard only when the cursor is on the display.

The last group of keys, the function control keys, are used to command the Microprocessor to perform operations, such as input, output, tab, erase, etc.



Figure 2-1. The Keyboard.

## **SHIFT Keys and Indicators**

Each key has two symbols inscribed on it; the characters on the bottom halves of the keys are lower shift characters and those on the top halves upper shift characters. The SHIFT LOWER and SHIFT UPPER indicators on the control panel tell the operator whether the lower or the upper shift character will be entered when an alphameric key is pressed. When the SHIFT LOWER indicator is on and an alphameric key is pressed, the character on the lower half of the key will be entered. One data character is entered each time an alphameric key is pressed.

*Exercise:* Press the “V” key five times.

*Result:* Five “V’s” have been entered on the display. Each time a “V” was entered, the cursor moved one position to the right.

The SHIFT LOWER and SHIFT UPPER keys are used to override the indicated shift state. When the SHIFT LOWER indicator is on, it is necessary to press the SHIFT UPPER key in conjunction with the alphameric key in order to enter a character on the upper half of a key. When overriding the shift state, it is necessary to hold down the appropriate shift key for each character that is being entered. There is no manual shift lock.

*Exercise:* While holding down the SHIFT UPPER key, press the “V” key several times.

*Result:* “=” has been entered as many times as the “V” key was pressed. Pressing the SHIFT UPPER key did not affect the control panel SHIFT LOWER indicator.

LOWER and UPPER SHIFT are always used to refer to the characters on the bottom and top halves of the keys, respectively. They are different, however, from the typewriter lower and upper shifts, which refer to the case of a single letter of the alphabet. All alphabetic characters appear on the display as upper case (or capital) letters.

The SHIFT X and SHIFT Y keys are special-purpose shift keys that are used with alphameric keys to generate communication control codes (SHIFT X) and color control and lower case codes (SHIFT Y). The use of these keys is explained in detail in the operator’s manuals for the Communication Adapters, the Printing Robot, and the Color Video Display.

## **REPEAT Keys**

There are two REPEAT keys on the Keyboard. When used in conjunction with another key, a REPEAT key will repeat the action of that other key.

*Exercise:* Press and hold down either of the REPEAT keys in conjunction with the “V” key for a few seconds. Then release both keys.

*Result:* “V’s” were entered until the keys were released.

## **Cursor Movement Keys**

The cursor is important because it indicates the next position in which data will be entered from the Keyboard. Each time a data character is entered, the cursor moves one position to the right.

There are eight keys that can be used to move the cursor. The use of FRONTSKIP (→), BACKSKIP (←), L5 (POSITION 1), R5 (POSITION 81), and L1 (POSITION SELECT) is described below. The remaining three cursor movement keys, BACK TAB, FRONT TAB, and L2 (FIELD SELECT), will be described in Section IV.



### **FRONTSKIP (→) and BACKSKIP (←) KEYS**

The FRONTSKIP (→) and BACKSKIP (←) keys move the cursor one position in the direction of the arrow.

*Exercise:* Press the FRONTSKIP (→) key once. Then press the BACKSKIP (←) key once.

*Result:* The cursor moved one position ahead when the FRONTSKIP (→) key was pressed and one position back when the BACKSKIP (←) key was pressed.

### **L5 (POSITION 1) KEY**

The L5 (POS 1) key moves the cursor to the first position of the selected record.

*Exercise:* Press the L5 (POS 1) key.

*Result:* The cursor moved to the first position of the WRITE record (the STATUS RECORD selector was set to W at the start of the exercises).

### **R5 (POSITION 81) KEY**

The R5 (POS 81) key moves the cursor off the display, to the 81st position.

*Exercise:* Press the R5 (POS 81) key. Then, to see that the cursor is, in fact, in the 81st position, press the BACKSKIP (←) key once.

*Result:* The cursor moved off the display when the R5 (POS 81) key was pressed and moved to the 80th position when the BACKSKIP (→) key was pressed.

### **ERROR CORRECTION USING THE CURSOR MOVEMENT KEYS**

The cursor movement keys are of particular significance when correcting errors and changing data that appears on the display. To correct errors or update data, the cursor must be moved to the desired location and the new data keyed in. The new data will replace the data at the cursor location.

*Exercise:* Press the L5 (POS 1) key. Then press and hold down the "A" and one of the REPEAT keys for a few seconds.

*Result:* The cursor moved to the first position of the WRITE record when the L5 (POS 1) key was pressed. When the "A" and one of the REPEAT keys were held down simultaneously, "A's" were entered until the keys were released, replacing the data that had been at the beginning of the WRITE record.

Using the FRONTSKIP, BACKSKIP, L5 (POS 1), and R5 (POS 81) keys, the operator can move the cursor to any location within the record to correct an error. The L1 (POS SEL) key permits the operator to move the cursor directly to any position within an 80-character record without having to count spaces or move the cursor one space at a time.

### **L1 (POSITION SELECT) Key**

Pressing the L1 (POS SEL) key and then entering a 2-digit number from 01 to 80 automatically moves the cursor to the position selected. The only numbers that can be used with the L1 (POS SEL) key are 01 through 80 because there are

only 80 positions in a record on the Video Display. Any other number will cause the Operator ERROR light to illuminate.

*Exercise:* a. Press the L1 (POS SEL) key.  
b. Key in "07" using the numeric keys across the top of the Keyboard.

*Result:* a. When L1 (POS SEL) was pressed the cursor moved to position 1 of the WRITE record.  
b. When "07" was keyed in, the cursor moved to position 7. The numbers "07" did not appear on the display. If an alphameric key were pressed now, that character would be entered in position 7.

In addition to rekeying data, the operator can correct an error by inserting or deleting data characters. The R3 (INSERT) and L3 (DELETE) keys permit the operator to enter and remove data. The Microprocessor automatically repositions the remaining data in the record.

### **R3 (INSERT) Key**

The R3 (INSERT) key permits the operator to insert a character at any location within a record. All data after the inserted character is automatically moved one position to the right.

*Exercise:* a. Press the L5 (POS 1) key.  
b. Key in EMLOYEE.  
c. Move the cursor back under the "L".  
d. Press the R3 (INSERT) key.  
e. Key in "P".

*Result:* a. When L5 (POS 1) was pressed, the cursor moved to position 1.  
b. EMLOYEE was entered in the WRITE record.  
c. When the cursor was moved under the "L" and the R3 (INSERT) key was pressed, the letters "LOYEE" moved one position to the right and a space was inserted at the cursor location.  
d. "P" was entered in the space and "EMPLOYEE" appeared spelled correctly.

The R3 (INSERT) key can be used anywhere within an 80-character record. If, however, there is data in position 80 of the record and the R3 (INSERT) key is pressed, the character that was in position 80 will be lost because of the shift to the right of all data after the inserted character.

### **L3 (DELETE) Key**

Operation of the L3 (DELETE) key is similar to that of the R3 (INSERT) key described above, except that a character is removed from the record instead of added to it. All data after the deleted character is automatically moved one position to the left. For example, if the word EMPLOYEE had been entered by mistake, the L3 (DELETE) key could be used to remove the extra "P".

*Exercise:* a. Press the L5 (POS 1) key.  
b. Key in EMPLOYEE.  
c. Move the cursor back under either "P".  
d. Press the L3 (DELETE) key.

- Result:*
- a. When L5 (POS 1) was pressed, the cursor moved to position 1.
  - b. EMPLOYEE appeared in the WRITE record.
  - c. When the cursor was positioned under the "P" and the L3 (DELETE) key was pressed, a "P" was removed from the word and the remaining letters all shifted left automatically one position to close up the space.
  - d. The word EMPLOYEE appears spelled correctly.

## **SPACE Bar**

The SPACE bar is used to enter the space character; it is not a cursor movement key. When the SPACE bar is pressed, the space character will replace the data at the cursor location.

*Exercise:* Using the BACKSKIP (←) key in conjunction with one of the REPEAT keys, move the cursor back until it is under data. Then press the SPACE bar twice.

*Result:* Each time the SPACE bar was pressed, a space was entered on the display, replacing the data that had been at the cursor location, and the cursor moved forward one position.

Each time the SPACE bar is pressed, a single space or blank is entered. When the SPACE bar is pressed in conjunction with a REPEAT key, spaces or blanks will be entered until the keys are released.

## **ERASE Key**

There is another key that can be used to fill an entire record with blanks—the ERASE key. Each time the ERASE key is pressed during a manual data entry operation, the selected record is erased, or filled with blanks, and the cursor is returned to the first position of that record.

*Exercise:* Press the ERASE key.

*Result:* The data in the WRITE record has been erased and the cursor is in the first position of the WRITE record.

## **ERROR Key and ERROR Indicator**

When an error is made in operating procedure, the ERROR indicator on the Operator section of the Microprocessor control panel is turned on. Whenever the ERROR indicator is on, the Microprocessor BUSY indicator will be on as well. No operations are possible when the ERROR and BUSY indicators are on. In order to turn off the indicators and resume operation, it is necessary to press the ERROR key.

One of the conditions which generates an operator error and lights the BUSY and ERROR indicators is attempting to enter data from the keyboard when the cursor is not visible on the display.

*Exercise:* Move the cursor off the display by pressing the R5 (POS 81) key. Then press one of the alphanumeric keys. Notice that the ERROR and BUSY lights have come on. Now press the ERROR key.

*Result:* The cursor was moved off the display when the R5 (POS 81) key was pressed. When the alphanumeric key was pressed, both the ERROR and the BUSY indicators were turned on. The indicators were turned off by pressing the ERROR key.

## R2 (READ DUPLICATION) Key

The R2 (R DUP) key can be used in a manual data entry operation to duplicate data from the READ record of the display into any other record. Each time the R2 (R DUP) key is pressed, one character is duplicated from the READ record into the selected record. If the REPEAT key and the R2 (R DUP) key are held down together, data will be duplicated continuously until the keys are released.

### Exercise

- a. Turn the STATUS RECORD selector to R.
- b. Press the READY key.
- c. Press the L5 (POS 1) key.
- d. Key in your name.
- e. Turn the STATUS RECORD selector to W.
- f. Press the READY key.
- g. Press the ERASE key.
- h. Press the R2 (R DUP) key.
- i. Hold down the R2 (R DUP) and REPEAT keys together until your name has been completely duplicated into the WRITE record.

### Result

- a. The NOT READY light was turned on.
- b. The NOT READY light was turned off.
- c. The cursor appeared in position 1 of the READ record.
- d. Your name was entered into the READ record.
- e. The NOT READY light was turned on.
- f. The NOT READY light was turned off.
- g. The contents of the WRITE record were erased from the display.
- h. The first character of your name was duplicated into the WRITE record.
- i. The remainder of your name was duplicated into the WRITE record.

## R1 (MASTER DUPLICATION) Key

The R1 (M DUP) key is used to duplicate data from the MASTER record of the display into any other record. Each time the R1 (M DUP) key is pressed in a manual data entry operation, one character is duplicated from the MASTER record into the selected record. By holding down the REPEAT key with the R1 (M DUP) key, data can be duplicated continuously until the keys are released.

### Exercise

- a. Turn the STATUS RECORD selector to M.
- b. Press the READY key.
- c. Press the L5 (POS 1) key.
- d. Key in: BOSTON, MASS.
- e. Turn the STATUS RECORD selector to W.
- f. Press the READY key.
- g. Press the ERASE key.
- h. Press the R1 (M DUP) key once.
- i. Hold down the R1 (M DUP) key and the REPEAT key.

### Result

- a. The NOT READY light was turned on.
- b. The NOT READY light was turned off.
- c. The cursor was moved to position 1 of the MASTER record.
- d. "BOSTON, MASS." was entered into the MASTER record.
- e. The NOT READY light was turned on.
- f. The NOT READY light was turned off.
- g. The contents of the WRITE record were erased from the display.
- h. "B" was duplicated from the MASTER record into the WRITE record.
- i. The remainder of "BOSTON, MASS." was duplicated into the WRITE record.

## R4 (LF/CR) Key

The R4 (LF/CR) key is a special-purpose communication control key that generates the ASCII character for carriage return in the LOWER SHIFT and the ASCII character for line feed in the UPPER SHIFT. The carriage return character is displayed as a hyphen (-), and the line feed character is displayed

as an asterisk (\*). These two characters are also used by the VIATRON Printing Robot to generate automatic carriage return and line feed operations. In addition, they can be used with the SHORT REC toggle switch (and the Short Record Feature, Feature Code 103 or 106) to permit input or output of records less than 80 characters long from a device attached to a Data Channel. (Refer to the operator's manuals for the Printing Robot and the Communications Adapters.)

## INPUT/OUTPUT OPERATIONS

Input and output operations can be performed manually or under program control. There are four input/output channels connected to the Microprocessor, two Tape Channels and two Data Channels. Any combination of peripheral devices can be attached to the Data Channels (e.g., a Card Reader/Punch Adapter, a Printing Robot, a Communications Adapter, or an Optical Character Reader), and either a VIATAPE Cartridge Recorder or a Computer Tape Recorder can be attached to each of the Tape Channels.

### STATUS INPUT and STATUS OUTPUT Selectors

Any of these four channels (DC1, DC2, TC1, or TC2) can be selected for input or output by means of the STATUS INPUT and STATUS OUTPUT selectors (Figure 2-2). For example, if a Card Reader/Punch Adapter were attached to DC1 and the operator wished to "read" a card, the STATUS INPUT selector would be set to DC1; or if the operator wished to record data on computer tape and the Computer Tape Recorder were attached to TC2, the STATUS OUTPUT selector would be set to TC2.

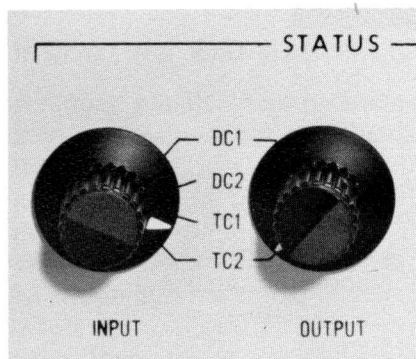


Figure 2-2. STATUS INPUT and STATUS OUTPUT Selectors.

### INPUT and OUTPUT Keys

The INPUT and OUTPUT keys on the Keyboard permit the operator to perform the input and output operations manually. Pressing the INPUT key commands the Microprocessor to input one record of data from the channel designated on the STATUS INPUT selector. Pressing the OUTPUT key commands the Microprocessor to output one record of data to the channel designated on the STATUS OUTPUT selector.

Sample input/output exercises are given below using the VIATAPE Cartridge Recorders.

## VIATAPE Cartridge Recorders

The two bidirectional Tape Channels attached to the 2111 Microprocessor are used for input of data or program information from VIATAPE or computer tape as well as output of information for storage or further processing. In other words, the operator can record information on tape and can read information previously stored on tape.

Figure 2-3 shows a VIATAPE Cartridge Recorder attached to each Tape Channel. When data is to be recorded directly on computer tape, a VIATRON Computer Tape Recorder will replace a VIATAPE Cartridge Recorder.

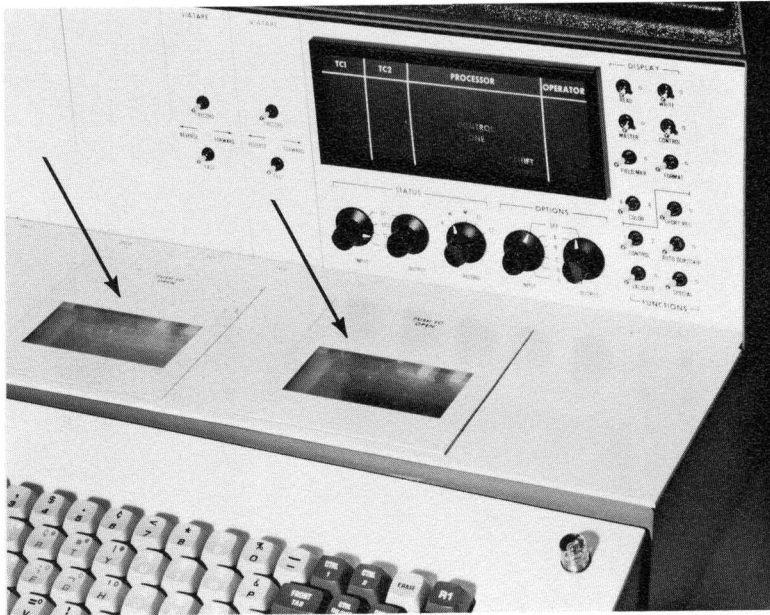


Figure 2-3. VIATAPE Cartridge Recorders.

The VIATAPE cartridge, used in the VIATAPE Cartridge Recorder and illustrated below, contains magnetic tape especially prepared for use in System 21. The cartridge contains two spools on which the tape is wound. The top of the cartridge has a clear plastic window through which the operator can see the amount of tape wound on each spool.

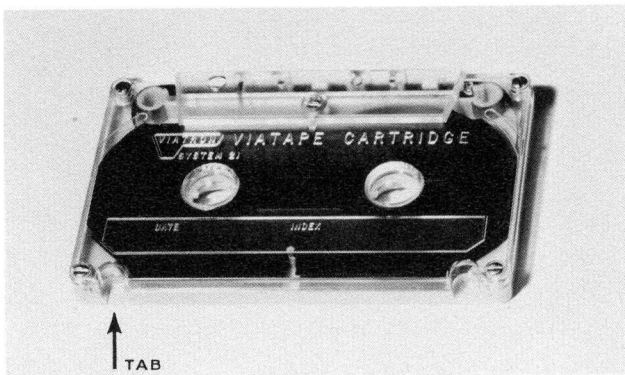


Figure 2-4. VIATAPE Cartridge.

Each cartridge has a label on which a title or description of its contents can be written. The cartridge should always be removed from the recorder before writing on or erasing the label.

The VIATAPE is divided into segments, each long enough to hold exactly 80 characters of data, or one record. Whenever data is input from (read from) or output to (recorded on) VIATAPE, the VIATAPE moves the length of one record and stops in position for performing the next operation.

Whenever data is recorded on VIATAPE it will replace any data previously recorded on that portion of the tape. When it is desirable to prevent data from being recorded over, the VIATAPE may be made a "read only" tape by breaking off the tab shown in Figure 2-4. When there is a tab on the VIATAPE cartridge, data can be either read from or recorded on the VIATAPE. A plastic write plug, shown in Figure 2-5, can be inserted in a "read only" VIATAPE to replace the tab that was broken off and permit the operator to record data on that VIATAPE again.

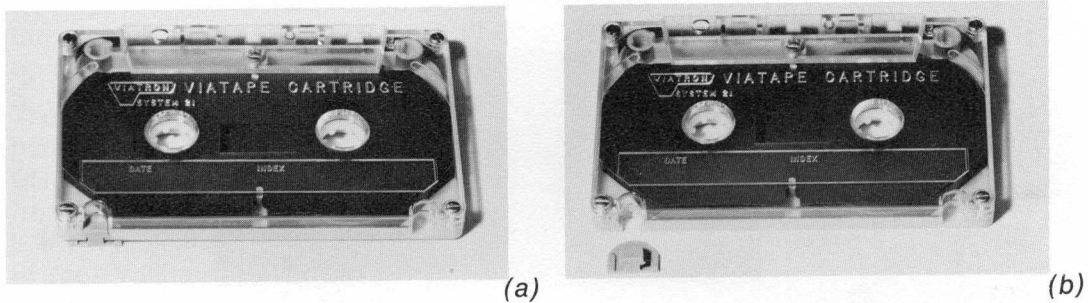


Figure 2-5. VIATAPE Cartridge with Write Plug On (a) and Off (b).

### INSTALLING AND REMOVING VIATAPE CARTRIDGES

A hinged plastic cover protects each VIATAPE Recorder. To remove or install a cartridge the cover must be raised by pressing down on the edge farthest from the Keyboard, as shown in Figure 2-6a. Then, it is necessary to press down on the latch to raise the track. To install a VIATAPE cartridge, hold the cartridge gently by the sides, as in Figure 2-6b, so that the label is right side up and can be read. Then slide it into the track as far as it will go. Do not use force when sliding the cartridge into the track.

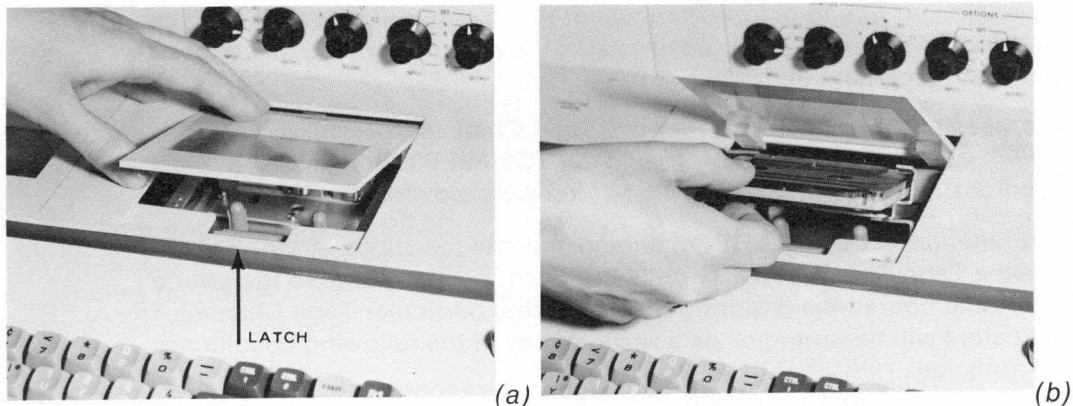


Figure 2-6a. Raising the Protective Cover. Figure 2-6b. Installing the Cartridge.

When the cartridge is in place, press down gently on the cartridge to return the track to its original position. Then close the cover.

To remove the cartridge from the recorder (1) raise the cover, (2) press the latch, and (3) slide the cartridge out of the transport. Then press the transport down gently so that it locks in position, and close the cover.

Always be careful when handling the VIATAPE cartridge and do not touch the tape itself with your fingers. Grease, water, or dust on the VIATAPE can affect its operation.

## VIATAPE CONTROLS AND INDICATORS

There is a set of controls for each VIATAPE Recorder located on the control panel, illustrated in Figure 2-7 below. The controls for TC1 and TC2 (Tape Channels 1 and 2) are used for the left- and right-hand VIATAPE Recorders, respectively. The switches are normally in the center (or off) position.

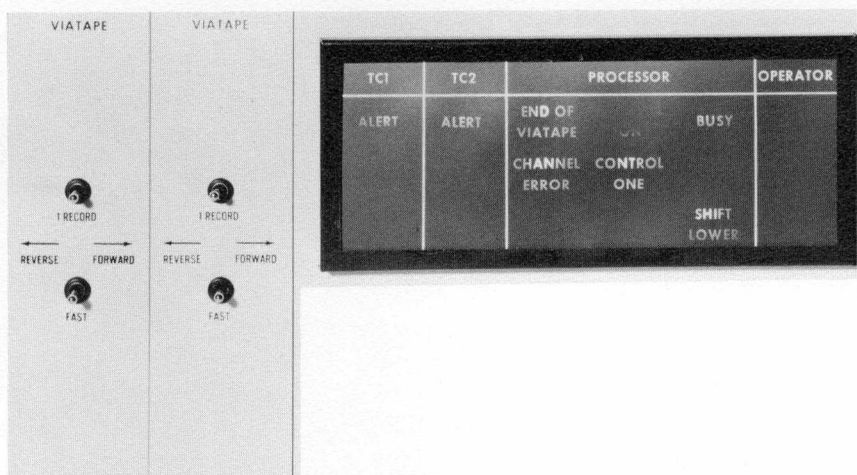


Figure 2-7. VIATAPE Controls and Indicators

When a switch is moved to the right, the tape moves FORWARD; when it is moved to the left, the tape moves in the REVERSE direction. The 1 RECORD switch moves the tape either forward or reverse the length of one record each time the switch is pressed. The FAST switch moves the tape until the switch is released or until the beginning or end of tape is reached. When either of the switches is released, tape movement stops at the beginning of the next record, in position for performing the next operation.

There is an ALERT indicator for each Tape Channel: the TC1 ALERT indicator for the left-hand VIATAPE Recorder and the TC2 ALERT indicator for the right-hand Recorder. Both are located on the Microprocessor control panel.

The function of both ALERT lights is to indicate the status of the VIATAPE Recorder. When a Tape Channel ALERT indicator is on, it is not possible to perform additional operations requiring the use of that particular Tape Channel. The ALERT indicators will be turned on as a result of any of the following conditions:

1. There is no VIATAPE cartridge in the recorder.
2. The VIATAPE is in motion, as a result of either an input or an output operation or the use of the control panel switches.



3. The VIATAPE has been wound to the beginning or end.
4. The end of tape has been reached during operation. If an output is attempted, the ERROR indicator and keyboard lock light will be turned on as well.
5. An attempt has been made to output, or record, on a "read only" VIATAPE cartridge. This condition will also turn on the BUSY indicator and the keyboard lock light.
6. The VIATAPE has jammed, is broken, or is otherwise inoperative.

The END OF VIATAPE indicator on the Processor section of the control panel can apply to either Recorder. It is related to the END OF VIATAPE (EVT) character which is generated at the Keyboard by pressing the 9 key in conjunction with the SHIFT X key and is used to indicate the end of a sequence of related records stored on VIATAPE. During an input from or output to VIATAPE, upon detection of the EVT character in the 80th position of the record, the Microprocessor stops tape operation, and the END OF VIATAPE indicator and the BUSY indicator are turned on. In order to turn off the END OF VIATAPE indicator and continue operation with VIATAPE, the operator must press the CLEAR key.

The CHANNEL ERROR indicator on the Microprocessor section of the control panel is used for all input/output channels. The Microprocessor turns on the CHANNEL ERROR indicator when a data error has been detected during an input from a Tape or a Data Channel. System operation is not affected by the CHANNEL ERROR indicator, however, except during Tape Validation. A detailed description of Tape Validation is included later in this section.

## EXERCISES IN OPERATING WITH VIATAPE

### Output Exercises

The following exercises demonstrate recording on VIATAPE by using the OUTPUT key and the effect of the EVT character on operation.

Operator Action	Result
1. Insert a VIATAPE cartridge in either VIATAPE Recorder and hold the corresponding FAST toggle switch to the left until the tape movement stops. Then press CLEAR.	1. The tape ALERT indicator will be turned off when the cartridge is inserted, and it will be turned on again when the VIATAPE has been rewound to the beginning of tape. ALERT goes off when CLEAR is pressed.
2. Turn the STATUS RECORD selector to M and the STATUS OUTPUT selector to TC1 or TC2, depending upon which Recorder is used. Turn the READ, WRITE and MASTER display toggle switches on (to the right) and all other switches off (to the left).	2. The NOT READY indicator is turned on.
3. Press the READY key.	3. The NOT READY indicator is turned off and the cursor appears in position 1 of the MASTER record.

Operator Action	Result
<p>4. Key in:  EMPLOYEE NAME  COMPANY  CITY                      STATE  DATE</p>	<p>4. The sample MASTER record shown at the left is entered into the MASTER record of the Video Display.</p>
<p>To correct an error, move the cursor under the incorrect character and key in the correct character.</p>	
<p>5. Turn the FORMAT toggle switch on (to the right).</p>	<p>5. The four lines of the MASTER record just entered are alternated or interleaved with the four (blank) lines of the WRITE record. Two cursors now appear on the display, one in the WRITE record and the other in the corresponding position of the MASTER record.</p>
<p>6. Turn the STATUS RECORD selector to W and press the READY key.</p>	<p>6. The NOT READY indicator is turned on when the STATUS RECORD selection is changed. The NOT READY indicator is turned off when the READY key is pressed.</p>
<p>7. Press the L5 (POS 1) key.</p>	<p>7. The cursor is moved to position 1 of both the WRITE and the MASTER records.</p>
<p>8. Directly above the heading EMPLOYEE NAME key in your name. Then move the cursor ahead and enter your company name, city, state, and today's date directly above the headings.</p>	<p>8. The WRITE record now contains the data entered above the headings in the MASTER record.</p>
<p>9. Press the OUTPUT key once.</p>	<p>9. The VIATAPE moves and the ALERT indicator (for the selected Tape Channel) and the keyboard lock light illuminate during the output. The contents of the WRITE record are recorded on VIATAPE and are moved from the WRITE record of the Video Display to the READ record. Tape movement stopped when the output was completed, and the ALERT indicator and keyboard lock light were turned off. The cursor is repositioned to column 1 of the WRITE and MASTER records after the output is completed.</p>
<p>10. Key in another record using a different employee name. If you wish to duplicate the company name, city, state, and date, position the cursor at the beginning of the heading COMPANY NAME and then hold down both the REPEAT key and the R2 (R DUP) key until all desired data is duplicated. To change any data that</p>	<p>10. The WRITE record contains the new information keyed in and/or any data duplicated from the previous record (the READ record).</p>

Operator Action	Result
has been keyed in or duplicated, move the cursor to the desired location and key in the changes.	
11. Repeat Step 9.	11. Same as Step 9.
12. Repeat Step 10, using a different name, and enter in the 80th position of the record an EVT (END OF VIATAPE) character. To enter the EVT character move the cursor to column 80, then hold down the SHIFT X key while pressing the $\text{\textcircled{8}}$ key.	12. The WRITE record contains the data entered from the Keyboard and/or the data duplicated. The EVT character, displayed as <, is in column 80.
13. Press the OUTPUT key.	13. Output occurs as in Step 9. In addition, detection of the EVT character in position 80 of the record turns on the END OF VIATAPE and BUSY indicators and the keyboard lock light.
14. Press the CLEAR key.	14. The END OF VIATAPE and BUSY indicators are turned off, and the NOT READY indicator is turned on.
15. Press the READY key.	15. The NOT READY indicator and the keyboard lock light are turned off, and the cursor is returned to position 1 of the WRITE and MASTER records.
16. Key in two more sample records of data and output them to tape. If necessary, refer to Step 10 for entry procedure and to Step 9 for the output procedure.	

### Input Exercises

The following exercises require the use of the VIATAPE prepared above. They demonstrate reading from VIATAPE using the INPUT key and the use of the EVT character to halt system operation.

Operator Action	Result
1. Rewind the VIATAPE prepared above by pressing the related FAST toggle switch to the left until the tape stops moving. Then press CLEAR.	1. The Tape ALERT indicator is turned on while the tape is being rewound and stays on when the beginning of tape is reached. ALERT goes off when CLEAR is pressed.
2. Set the STATUS INPUT selector to TC1 or TC2, depending upon which Recorder is used, and then press the READY key.	2. The NOT READY indicator is turned on when the STATUS INPUT selector is turned. The NOT READY indicator is turned off when the READY key is pressed.
3. Press the INPUT key once.	3. The first record that was recorded on tape (your name, company, etc.) is input to the WRITE record. The cursor appears in position 1 of the WRITE and MASTER records after completion of the input.
4. Press the INPUT key again.	4. The second record that was recorded on tape is input to the WRITE record, replacing the record that was there. The cursor is then returned to position 1.

Operator Action	Result
5. Press the INPUT key again.	5. The third record on VIATAPE is read into the WRITE record. The EVT character (<) appears on the display in column 80. The END OF VIATAPE light, the BUSY light, and the keyboard lock light are all turned on, and operation has halted.
6. Press the CLEAR key and then the READY key.	6. The END OF VIATAPE and BUSY lights are turned off when CLEAR is pressed. The keyboard lock light and the NOT READY light are turned OFF when READY is pressed. The operator can now resume input of records from VIATAPE.
7. Press the INPUT key.	7. The next record of data is input from VIATAPE.
8. Repeat Step 7.	8. Same as Step 7.

When the STATUS INPUT selector is set to either TC1 or TC2, pressing the INPUT key causes the next VIATAPE record to be read in. If data has never been recorded on that portion of the VIATAPE, 80 question marks will appear on the display. The question marks are an indication of tape certification and do not affect operation. Once data is output to VIATAPE, the tape certification question marks are erased and valid data is stored.

### **CORRECTING ERRORS AFTER OUTPUT TO TAPE**

If a record containing an error has been written on tape (either VIATAPE or computer tape), the procedure for changing the information on tape is to record new data over the incorrect data. Assume that a record of data has been keyed into the WRITE record, output to tape, and is displayed in the READ record. The tape is now in position to accept the next output from the Microprocessor. As the operator glances at the Video Display, she detects an error in the data displayed in the READ record.

Before taking any steps to correct the error, the operator should always turn off the CONTROL ON and/or the OPTIONS ON indicators (if they are on). This is done by pressing the CTRL ON/OFF key and/or the OPTIONS ON/OFF key. The next step is to reposition the tape at the beginning of the incorrect record by pressing the appropriate Tape Channel 1 RECORD switch to the left (reverse).

The remaining procedures include entering the correct data into the Microprocessor and recording this information on tape over the incorrect record.

1. Press the L5 (POS 1) key.
2. Hold down the R2 (R DUP) key and the REPEAT key until all of the data in the READ record has been duplicated into the WRITE record.
3. Move the cursor to the error location and rekey, insert, or delete data as required to correct the record.
4. Press the OUTPUT key.

The corrected record has now been written on tape, over the incorrect data, and is also displayed in the READ record so that the operator can recheck it. The tape is also in position to accept the next output from the Microprocessor.

## **TAPE VALIDATION**

Tape validation is a means of checking for recording errors as data is being input from or output to VIATAPE or computer tape. When the VALIDATE switch is on, validation occurs automatically after each input from or output to tape. Upon detection of an error during either an input or an output operation, the tape that is being validated is automatically backed up one record length and re-read.

During an input operation, if no error is detected, the record is not re-read. As soon as an error is detected, the CHANNEL ERROR indicator will be turned on; it will stay on only for the duration of the input. The Microprocessor will then command the Recorder to back up one record and input the same record again. If the error is still detected during the re-reading of the record, CHANNEL ERROR will be turned on until the input is completed. The Operator ERROR indicator also will illuminate and operation will stop. In order to continue, the operator must press the ERROR key.

During an output operation, the validation procedure is used to ensure that the data recorded on tape is the same as the data that had been output from the Microprocessor. When the VALIDATE switch is on, each time data is output to tape, the following occurs automatically:

1. The data in the WRITE record is recorded on tape and transferred to the READ record;
2. The tape is backed up one record and the recorded data is read into the WRITE record;
3. The Microprocessor compares the data in the READ record with the data in the WRITE record.

If there are no errors, the data is erased from the WRITE record and operation can proceed.

If, however, an error is detected, the tape is backed up again one record length and the recorded data is read into the WRITE record again. If no error is detected during this second check, the normal output sequence occurs as above. When errors are found during this second check, the original data in the READ record is re-written on the tape, replacing the original output data. The re-written data is then compared as above by first being read into the WRITE record and then compared with the data in the READ record. If there are no errors in the re-written data, output occurs in the usual manner and the WRITE record is erased.

If an error is found on the third comparison, the Microprocessor enters question marks in the WRITE record from the position of the error to the end of the record. Then the WRITE record is output to tape. The contents of the READ record (i.e., the original data) are then transferred back to the WRITE record, and the Operator ERROR indicator illuminates halting further operation and signalling unsuccessful validation of the record. The operator must turn off Operator ERROR by pressing the ERROR key in order to perform any further operations. At the end of the validation operation, whether successful or unsuccessful, the Recorder is in position to receive the next output.

Once the operator has turned on the VALIDATE switch, the Microprocessor performs the validation automatically. The only time operator intervention is required is to turn off the Operator ERROR indicator. When validation is not required, the operator should turn the VALIDATE switch off.



# Section III Automatic Input and Output Options

## INTRODUCTION

Input and output options are used for performing the input and output operations automatically, eliminating the need for the operator to press the INPUT or OUTPUT key each time that operation is to be performed. In addition, when the Microprocessor is equipped with the AUTOMATIC MULTIPLE INPUT Feature, Feature Code 104, consecutive input of more than one record can be performed. When the Microprocessor is equipped with the AUTOMATIC MULTIPLE OUTPUT Feature, Feature Code 102, the Data Management Station can output the same record sequentially to up to three different output channels. The OPTIONS INPUT and OUTPUT selectors, located on the Microprocessor control panel and shown in Figure 3-1, are used for selecting the desired input and/or output options.

One automatic input option and one automatic output option are standard on the 2111 Microprocessor. The standard input option (A on the OPTIONS INPUT selector) provides for the automatic input of one record from the channel selected on the STATUS INPUT selector to the selected record. The standard output option (A on the OPTIONS OUTPUT selector) provides for automatic output of the selected record to the channel selected on the STATUS OUTPUT selector. Automatic input occurs after the output of a record. Automatic output occurs after keyboard entry of data into the 80th position of a record or when the cursor is moved off the display automatically under program control or manually by using the FRONT TAB key.

## OPTIONS SELECTORS AND INDICATORS

The control panel of the 2111 Microprocessor is equipped with two OPTIONS selectors, labelled INPUT and OUTPUT. When the desired selection(s) on the OPTIONS rotary switch(es) have been made, the selection is put into effect, or turned on, by pressing the OPTION ON/OFF key on the Keyboard. When the options are turned on, the OPTIONS ON indicator on the control panel is illuminated. To turn off OPTIONS (and the OPTION ON indicator), the operator should press the OPTION ON/OFF key again.

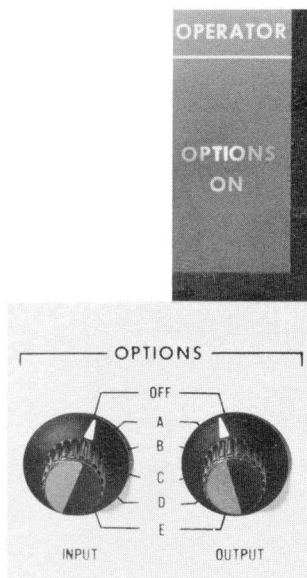


Figure 3-1. OPTIONS Selectors and Indicator.

There are five settings, A, B, C, D, and E, on the INPUT OPTIONS Selector and four, A, B, C, and D, on the OUTPUT OPTIONS selector. In addition, there is an OFF position on each selector. The operations performed with each setting are described below.

## **AUTOMATIC INPUT OPTIONS**

When an input option has been selected and the OPTIONS ON indicator is turned on, input occurs automatically each time an output is completed. With INPUT OPTIONS A, B, C and E, following each input, the cursor is returned to the first position in the selected record. If program control is on, the control character in the first position will be executed (see Section IV). The Microprocessor then waits until the operator takes some action. INPUT OPTION D is used to accomplish batch transfer of data. The automatic input operations performed for each selection are described in Table 3-1.

*Table 3-1. Automatic Input Options*

<b>OPTIONS INPUT SELECTION</b>	<b>OPERATION</b>
OFF	Input must be performed manually.
A	One record of data is input to the selected record from the channel designated on the STATUS INPUT selector.
B	Two records of data are input from Tape Channel 1, the first record into CONTROL 1 record and the second into the MASTER record. INPUT OPTION B overrides the settings of the STATUS INPUT and STATUS RECORD selectors.
C	Three sequential records of data are input from Tape Channel 1, the first into CONTROL 1 record, the second into CONTROL 2 record and the third into the MASTER record. INPUT OPTION C overrides the settings of the STATUS INPUT and STATUS RECORD selectors.
D	One record of data is input to the selected record from the channel designated on the STATUS INPUT selector and is immediately output to the channel designated on the STATUS OUTPUT selector. This process is known as batch transfer, that is the continuous movement of data through the Microprocessor. The only restriction upon the use of D is that the same Tape Channel may <i>not</i> be used for both input and output.
E	One record of data is input to the MASTER record from the channel selected on the STATUS INPUT selector. INPUT OPTION E overrides the setting of the STATUS RECORD selector.



## AUTOMATIC OUTPUT OPTIONS

When an automatic output option has been selected and the OPTIONS ON indicator is turned on, output occurs automatically under any of the following conditions:

1. Data has been keyed into the 80th position,
2. The cursor has been moved off the display automatically under program control (see Section IV),
3. The cursor has been moved off the display by pressing the FRONT TAB key, or
4. The input performed under INPUT OPTION D has been completed.

The operations performed with each selection are described in Table 3-2.

Table 3-2. Automatic Output Options

OPTIONS OUTPUT SELECTION	OPERATION
OFF	When INPUT OPTION D is selected, the Microprocessor interprets the off selection as OUTPUT OPTION A. Otherwise output must be performed manually.
A	One record of data is output from the selected record to the channel designated on the STATUS OUTPUT selector.
B	One record of data is output from the selected record first to Data Channel 1 and then to Tape Channel 2.
C	One record of data is output from the selected record first to Data Channel 1 and then to Data Channel 2.
D	One record of data is output from the selected record first to Data Channel 1, then to Data Channel 2, and finally to Tape Channel 2.
E	This selection is not functional. If selected, the 2111 Microprocessor interprets E as the OFF position.

At the completion of the output, the cursor is returned to the first position in the selected record. In addition, when the output is from the WRITE record, the data is erased from the WRITE record and appears in the READ record.

## EXERCISES USING INPUT AND OUTPUT OPTIONS

The exercises in this section demonstrate the use of the five input options (A through E) and one of the output options (A). The three remaining output options require the use of one or two Data Channel attachments. If the Data Management Station is equipped with one or two peripheral devices attached to the Data Channel(s), then the multiple automatic outputs can be performed.

## Output Option A

1. Insert a VIATAPE cartridge in TC1 or TC2. Rewind it to the beginning.
2. Set the INPUT OPTIONS selector to OFF and the OUTPUT OPTIONS selector to A.
3. Set the STATUS OUTPUT selector to the Tape Channel being used.
4. Set the STATUS RECORD selector to W. Press READY.
5. Press the OPTION ON/OFF key.
6. Simultaneously hold down “1” and one of the REPEAT keys, until the WRITE record is filled with “1’s”. When a “1” has been entered into the 80th position, the record will be output automatically to the selected Tape Channel.
7. Fill the WRITE record with “2’s” by simultaneously pressing “2” and one of the REPEAT keys. Output will occur automatically when a “2” is entered into the 80th position.
8. Fill the first 20 positions (first line) of the WRITE record with “3’s”. Then press the FRONT TAB key. The output occurs automatically when the cursor reaches the 81st position.
9. Press the OPTION ON/OFF key.

*Result:* The three automatic outputs were initiated by moving the cursor to the 81st position—by entering data in the 80th position in steps 6 and 7 and by using the FRONT TAB key in step 8. When operating under program control, automatic outputs can also be initiated when the cursor is moved off the display automatically. Pressing the R5 (POS 81) key, however, will *not* initiate an automatic output. The only function of the R5 (POS 81) key is to move the cursor to the 81st position.

## Input Option A

1. Rewind the VIATAPE cartridge prepared above. That cartridge will be used in the following exercises for input. Insert a VIATAPE in the other Tape Channel and rewind that tape to prepare it for receiving output data. If the Data Management Station is equipped with only one VIATAPE Recorder, select another output device.
2. Set the STATUS INPUT selector to the Tape Channel that contains the VIATAPE prepared above, in the Output Option A exercises.
3. Set the STATUS OUTPUT selector to the Tape or Data Channel of the output device to be used. Press READY.
4. Set the INPUT OPTIONS selector to A, the OUTPUT OPTIONS selector to OFF.
5. Press the OPTION ON/OFF key.
6. Key in today’s date and then press the OUTPUT key.
7. After the automatic input of the first record on the data tape, key in ORDER NO. 1. Then press the OUTPUT key.
8. After the automatic input of the second record on the data tape, key in ORDER NO. 2. Then press the OUTPUT key.

9. After the automatic input of the third record on the data tape, key in your name and press OUTPUT.
10. Press the OPTION ON/OFF key.

*Result:* Following the output of each data record, one record on the input VIATAPE was automatically read into the WRITE record and the cursor was returned to position 1 of the WRITE record.

This procedure is used in updating an original tape and creating a new one. In this exercise each output was manual, i.e., the OUTPUT key was pressed each time. In the exercises below, using both INPUT and OUTPUT OPTIONS, input as well as output will occur automatically.

### **Input Option A and Output Option A**

1. Rewind the original data tape to the beginning.
2. Set both the INPUT and the OUTPUT OPTIONS selectors to A.
3. STATUS INPUT, OUTPUT, and RECORD settings should remain as above.
4. Press the OPTION ON/OFF key.
5. Key data characters into the 79th and 80th positions.
6. Repeat Step 5 two more times.

*Result:* As soon as data was entered into the 80th position of the WRITE record, the record was output to the selected channel. Following the output, the next record was automatically input to the WRITE record from the original data tape.

### **Input Option B**

Input Option B, automatic programmed sequence load, results in the input of two records from Tape Channel 1—the first into CONTROL 1 record and the second into the MASTER record. Although the data records prepared above are used in this exercise, normally the operator would use Input Option B to bring in a CONTROL record and its related MASTER record.

1. Rewind the original VIATAPE and insert it in Tape Channel 1.
2. Set the INPUT OPTIONS selector to B and the OUTPUT OPTIONS selector to OFF.
3. The OPTIONS ON indicator should still be on; if it is not, press the OPTION ON/OFF key to turn it on.
4. Turn on the READ, WRITE, MASTER, and CONTROL Display switches.
5. Key in your name and press the OUTPUT key.

*Result:* After the output, the first two records on the original VIATAPE are input to the Microprocessor. The first record, containing “1’s” is input to the CONTROL 1 record. The second record, containing “2’s” is input to the MASTER record.

**NOTE:** If the application does not require a new CONTROL record and MASTER record after each output, the operator should turn options off or set the INPUT OPTIONS selector to OFF, after the input of the first set of CONTROL and MASTER records. If inputs are to be made from a source other than the Keyboard, following the use of INPUT OPTIONS B, the operator must press the READY key before continuing.

## Input Option C

1. Rewind the original VIATAPE to the beginning.
2. Erase all data on the display and return the STATUS RECORD selector to W.
3. Set the INPUT OPTIONS selector to C and the OUTPUT OPTIONS selector to OFF.
4. Check the control panel to see if the OPTIONS ON indicator is on. If not, press the OPTIONS ON/OFF key.
5. Key in your name and press the OUTPUT key.

*Result:* As soon as your name was output, three records from TC1 were input to the Microprocessor, the first record into CONTROL 1 record, the second into CONTROL 2 record, and the third into the MASTER record. This can be verified on the Video Display since the first three records on tape were numbered. Press the CONTROL 2 key to verify that the second record on VIATAPE entered C2. ✓

As described above under Input Option B, Input Option C should be turned OFF upon completion of the inputs, unless the input sequence is desired after each output. Also, following the use of Input Option C, the operator must press the READY key if an input from a source other than the Keyboard is to be made.

## Input Option D

This option provides for batch transfer of data through the Microprocessor from an input channel to an output channel. The OUTPUT OPTIONS setting used with D can be either A or OFF if the data is to be sent to only one output channel. If A or OFF is selected, the Microprocessor always sends the data to the output channel designated on the STATUS OUTPUT selector. The OUTPUT OPTIONS selector can be set to B, C, or D for multiple outputs, if desired.

1. Rewind the original VIATAPE in TC1 to the beginning of tape.
2. Set the INPUT OPTIONS selector to D and the OUTPUT OPTIONS selector to A or OFF.
3. Set the STATUS INPUT selector to TC1 and the STATUS OUTPUT selector to the desired output channel.
4. Check the control panel to see if the OPTIONS ON indicator is on. If not, press the OPTION ON/OFF key.
5. Press the INPUT key.

*Result:* After pressing the INPUT key, the first record from TC1 was input to the WRITE record. Following the input of the 80th character, the record was automatically output to the selected channel. Then the next record was input automatically from TC1 and output to the selected channel. This process will continue until the operator presses CLEAR or OPTIONS ON/OFF; an EVT character in position 80 of an input record will cause the batch transfer to stop after that record has been output.

## **Input Option E**

Input Option E, the automatic input of one record from TC1 into the MASTER record, is used primarily in the reformatting operation.

Refer to Section IV for an explanation of reformatting. The exercises below demonstrate the operation of Input Option E.

1. Rewind TC1 to the beginning.
2. Set the INPUT OPTIONS selector to E; turn the OUTPUT OPTIONS selector to OFF.
3. Make certain that the OPTIONS ON indicator is on. If not, press the OPTION ON/OFF key.
4. Make certain that the STATUS RECORD selector is set to W.
5. Hold down any data key and one of the REPEAT keys to fill the WRITE record with 80 characters. Then press the OUTPUT key.
6. After the first record on TC1 is input to the MASTER record, repeat Step 5.

*Result:* As soon as the contents of the WRITE record have been output, the first record on TC1 was input automatically to the MASTER record. The same occurred in Step 6.

**NOTE:** Input Option E may be used in conjunction with an automatic OUTPUT OPTION. At the completion of each automatic output, there will be an automatic input to the MASTER record. When entry is completed in the WRITE record, output will occur automatically, and so on, until the process is terminated by pressing the CLEAR or OPTION ON/OFF key, or by the detection of an EVT character in position 80.



# Section IV Program Control

## INTRODUCTION

Program control can be defined as the operation of a System 21 Data Management Station through the use of a CONTROL record so that certain operations are performed automatically by the Microprocessor. The operator can enter two CONTROL records, or programs, in the Microprocessor, thus providing a primary operating program and an alternate program. These two CONTROL records can be entered from the Keyboard, or if they have been previously prepared and stored on VIATAPE, they can be input from Tape Channel 1 using Input Option B or C.

When operating under program control, the Microprocessor can be programmed to change keyboard shift states automatically from lower to upper shift or vice versa; to duplicate data from the READ record into another record; to duplicate data from the MASTER record into any other record; to skip parts of a record; to perform left zero fill operations automatically; and to perform key verification, automatic tape search, and record reformatting.

## Fields

Records are subdivided into parts called fields. A field can contain from one to eighty characters, depending upon the size of the largest entry within that group. For example, a "name" field in a record should be set up in the CONTROL record to accommodate the largest name in the group. A "date" field could be set up as an 8-character field if the operator were always entering the date as eight characters, such as 10/23/69 or 01/31/70.

## CONTROL CHARACTERS

Control programs are made up of particular control characters of which there are two kinds — field begin characters and field continuation characters. The field begin characters indicate to the Microprocessor the beginning of an operation, and the field continuation characters instruct the Microprocessor to continue the operation initiated by the field begin character.

## Keyboard Data Entry Field Begin Characters

For normal keyboard data entry there are three field begin characters: L, U, and Z. See Table 4-1.

Table 4-1. Normal Data Entry Field Begin Characters

FIELD BEGIN CHARACTER	INTERPRETATION
L	Instructs the Microprocessor to set the Keyboard in lower shift for entry of alphabetics and typewriter numerics.
U	Instructs the Microprocessor to set the Keyboard in upper shift for entry of special characters and the upper shift, block numerics.
Z	Instructs the Microprocessor to perform a left zero fill operation.

## Field Continuation Characters

There are two field continuation characters: "." (period) and "-" (hyphen). The "." instructs the Microprocessor to continue in lower shift the operation indicated by the field begin character. The "-" instructs the Microprocessor to continue in upper shift the operation indicated by the field begin character. A lower shift field, beginning with an L, should be followed by as many "."s as there are character positions within the field. A field beginning with a U, an upper shift field, should be followed by as many "-"s as there are character positions in the field. The field continuation character for a left zero fill field (Z) will be "." if lower shift numerics are to be entered, and it will be "-" if the operator wishes to use the upper shift, block numerics.

## Duplicate and Skip Field Begin Characters

Table 4-2. Duplicate and Skip Field Begin Characters

FIELD BEGIN CHARACTER	INTERPRETATION
D	Instructs the Microprocessor to duplicate the data that appears in the <i>READ record</i> at the cursor location into the same location in the selected record.
M	Instructs the Microprocessor to duplicate the data that appears in the <i>MASTER record</i> at the cursor location into the same location in the selected record.
S	Instructs the Microprocessor to skip positions in the selected record.

For any of these three operations to occur automatically, the AUTO DUP/SKIP toggle switch must be in the "on" position.

The field continuation characters used with the D, M, and S field begin characters can be either "." or "-". Since the operator will not be entering data from the Keyboard into these fields, shift is not relevant.

## Input Field Begin Character

The field begin character "I" instructs the Microprocessor to input a record or records into memory from either the selected input channel or the device designated on the INPUT OPTIONS rotary switch. In other words, according to the input channel the operator has selected, and/or the input option chosen (refer to the INPUT OPTIONS discussion), one, two, or three records will be automatically input to the Microprocessor as soon as the "I" is detected in the CONTROL record. The Microprocessor interprets the "I" field begin character, essentially, as a command to press the INPUT key.



## Output Field Begin Character

The field begin character "O" instructs the Microprocessor to output the selected record as soon as the "O" is detected in the CONTROL record. The device or devices to which the record is output will be determined by the STATUS OUTPUT selection and/or the OUTPUT OPTIONS setting(s).

## Release Field Begin Character

An "R" field begin character instructs the Microprocessor to release or remove the cursor from the selected record. If the OPTIONS indicator is on and an output option has been selected, that output will occur. If the OPTIONS light is off, then no further action occurs after the cursor has been removed from the Video Display.

## Compare Field Begin Character

The field begin character "C" in the CONTROL record instructs the Microprocessor to compare the data in the MASTER record with the corresponding data in the WRITE record. The "C" character is used for either a tape search operation or for key verification. When using the "C" character in CONTROL 1 record, the operator must insert an L, U, I, O, or R character in the corresponding position of CONTROL 2 record depending on what operation is to be performed. Any other character in C2 will cause the Operator ERROR indicator to be turned on. Two examples of the use of the "C" field begin character for automatic tape search and key verification are described in detail in Section V.

## **Reformatting Control Characters**

The last group of control characters are used specifically for reformatting operations. These control characters are the digits 0 through 9. They are used to designate the location of data (any position from 01 to 80) within an existing record that is to be reformatted. (A detailed example of reformatting can be found in Section V.)

## **WRITING A CONTROL PROGRAM**

The following example shows how a control program could be written for a typical data entry operation. For purposes of the example, assume that several sales orders will be prepared using the MASTER record, shown in Figure 4-1, as a guide for entering the data.

1	C	2	U	3	S	4	T	5	O	6	M	7	E	8	R	9		10	N	11	A	12	M	13	E	14		15		16		17	O	18	R	19	D	20	#
21	M	22	O	23	D	24	E	25	L	26	#	27		28		29		30		31		32		33	Q	34	U	35	A	36	N	37	T	38	I	39	T	40	Y
41	U	42	N	43	I	44	T	45	\$	46		47		48		49		50		51		52		53	T	54	O	55	T	56	A	57	L	58	\$	59		60	
61	S	62	A	63	L	64	E	65	S	66	M	67	A	68	N	69		70		71		72		73	D	74	A	75	T	76	E	77		78		79		80	

Figure 4-1. Sample MASTER Record for Data Entry.

In this MASTER record, the first 16 positions are reserved for the "CUSTOMER NAME" field which will be entered in lower shift. Positions 17 through 20 are for a four-digit order number. If the upper shift numerics are to be used in entering the order number, the control program can contain instructions to set the Keyboard shift state to upper. "MODEL#" is also a numeric entry field, and again the Keyboard can be set to upper shift if the upper shift numerics will be used. Positions 27 through 32 will be blank and can be skipped automatically. Note that the number of positions being reserved for entry in each field is not necessarily equal to the length of the corresponding heading in the MASTER record.

"QUANTITY" is the next field in the MASTER record. Assuming that the quantity will not exceed five digits, it can be entered in positions 33 through 37. Numbers such as quantity can be entered so that units, tens, hundreds, etc., always line up. The quantity "1," in this example, must be entered as "00001" and "250" as "00250." To eliminate the need for entering the required number of zeros for each number entered, the control program contains a left zero fill field.

Since the QUANTITY field is to be left zero filled, the entire field will be filled automatically with zeros as soon as the cursor reaches the beginning of the field, and then the cursor will be moved to the right-most position in the field. Then as data is keyed into the field, it will appear in the right-most position at the cursor location, and each data character previously entered will shift one position to the left. The cursor will remain in the right-most position. The effect of the left zero operation is described in Table 4-3.

*Table 4-3. Entry of "250" in a 5-Position Left Zero Fill Field*

<b>Operator Actions (in sequence)</b>	<b>Displayed Results</b>
Cursor is moved forward to the beginning of the left zero fill field.	0000 <u>0</u>
"2" is entered	0000 <u>2</u>
"5" is entered	0002 <u>5</u>
"0" is entered	0025 <u>0</u>

The unit and total prices can also be entered with left zero fill and the upper shift numerics. Positions 46 through 52 will be skipped automatically. In the fourth line the salesman's name will be entered in lower shift. The date of the order will be the same for all sales orders. To avoid entering the same date in each record, the control program can automatically duplicate the date from the previous output, which will be in the READ record. The date will require six positions, 73-78. Positions 79 and 80 will be skipped.

The control program to be used in performing these operations is shown in Figure 4-2.

1	L	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	U	—	—	—	
21	U	—	—	—	—	—	S	—	—	—	—	—	Z	—	—	—	—	S	—	—	
41	Z	—	—	—	—	—	S	—	—	—	—	—	Z	—	—	—	—	—	S	—	
61	L	.	.	.	.	.	.	.	.	.	.	.	.	D	—	—	—	—	—	S	—

Figure 4-2. CONTROL Record for Sample MASTER Record.

While the Microprocessor is under program control, it will perform the indicated operation every time the cursor moves to a position corresponding to that of a field begin character. The operation will continue until the next field begin character is detected. The position-by-position effect of the Figure 4-2 control program is detailed in Table 4-4.

Table 4-4. Effect of Sample Control Program when Operating Under Program Control.

POSITIONS	EFFECT OF SAMPLE CONTROL PROGRAM
1-16	Keyboard is in lower shift state.
17-20	Keyboard is in upper shift state.
21-26	Keyboard is in upper shift state.
27-32	These positions are skipped.
33-37	Zeros are entered by the Microprocessor and upper shift characters move from right to left as they are entered.
38-40	These positions are skipped.
41-45	Zeros are entered by the Microprocessor and upper shift characters move from right to left as they are entered.
46-52	These positions are skipped.
53-58	Zeros are entered by the Microprocessor and upper shift characters move from right to left as they are entered.
59-60	These positions are skipped.
61-72	Keyboard is in lower shift state.
73-78	Data is duplicated into these positions from the corresponding positions in the READ record.
79-80	These positions are skipped.

## CONTROL INDICATORS, KEYS, AND TOGGLE SWITCHES

### CTRL ON/OFF Key

Once a CONTROL record, or records, have been stored in the Microprocessor, the operator turns program control on, i.e., enables the control program to operate, by pressing the CTRL ON/OFF key. When this key is pressed, two lights on the control panel will illuminate. Both of these lights illuminate showing CONTROL ON. (See Figure 4-3).

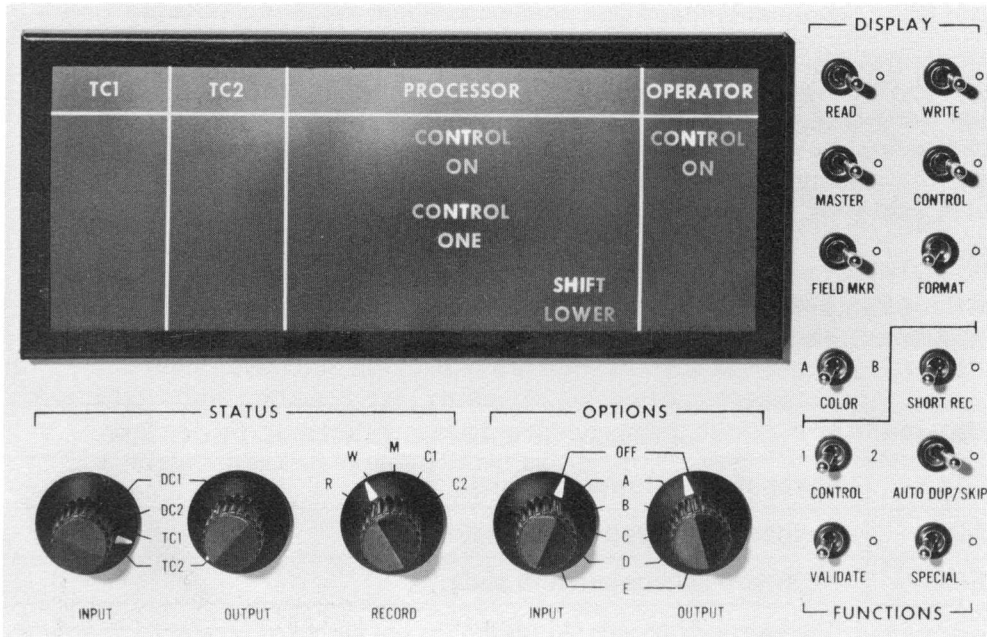


Figure 4-3. Controls and Indicators Used when Operating under Program Control.

### CONTROL ON Indicators

The CONTROL ON light in the Processor section of the control panel indicates that the Microprocessor has acknowledged the operator's action of turning control on, i.e., of pressing the CTRL ON/OFF key. The CONTROL ON light in the Operator section of the panel indicates that the operator has turned control on from the Keyboard. This latter CONTROL ON light stays on until the operator either turns control off with the CTRL ON/OFF key, with the CLEAR key, or with the power on/off switch. The processor CONTROL ON light, however, may occasionally be turned off automatically by the Microprocessor during operation, for example, during an output sequence, but it is also turned back on by the processor automatically.

### Control One, Control Two Lights; CTRL 1, CTRL 2 Keys

The CONTROL ONE and CONTROL TWO lights indicate to the operator which CONTROL record is being displayed on the screen and is also being executed. By pressing the CTRL 1 and CTRL 2 keys on the Keyboard the operator can switch control to the program she selects and display either control program on the Video Display.

## CONTROL 1/2 Toggle Switch

The CONTROL 1/2 toggle switch, shown in Figure 4-3, permits the operator to select the primary or main operating program. The operator can force display and execution of the alternate program, e.g., CONTROL 2 record, simply by pressing the CTRL 2 key; but as long as the toggle switch is set to CONTROL 1, the Microprocessor will always return control to CONTROL 1 record as soon as the record entered under CONTROL 2 record has been output. In other words, the CONTROL record selected on the toggle switch is the main or primary operating program, and the CONTROL record selected by one of the two control keys on the Keyboard is the alternate program. The CONTROL record selected by the key will be effective for only the one record entered after the key was pressed. Operation will always revert to the CONTROL record selected on the toggle switch after output of the record entered under the alternate program.

## Field Markers and FIELD MKR Switch

Field markers are small vertical lines that appear on the display at the beginning of each field when the Microprocessor is operated under program control. The FIELD MKR toggle switch on the control panel permits the operator to display or suppress the field markers. Whether displayed or suppressed, the field markers do not affect operation. They are provided for the ease of the operator. Field markers always appear in the record selected on the STATUS RECORD selector. A sample record containing field markers is shown in Figure 4-4.

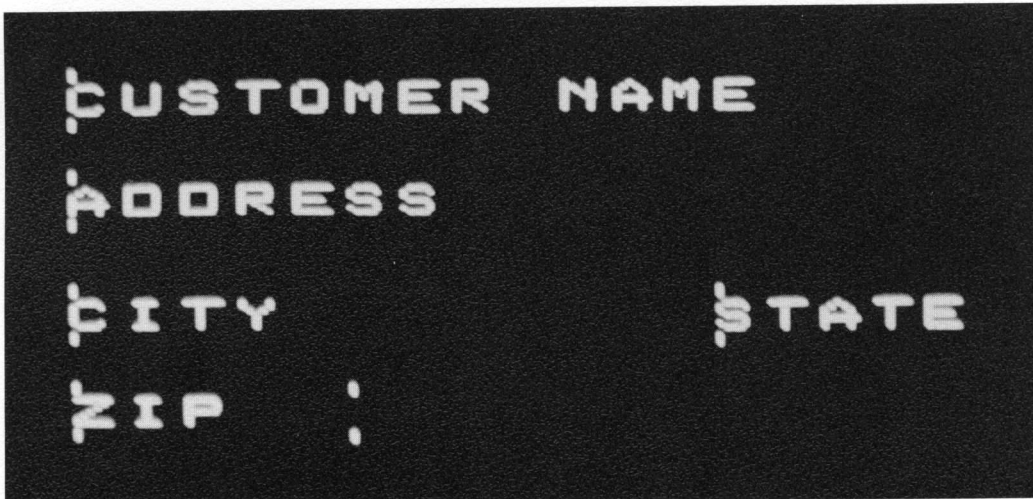


Figure 4-4. Sample Record Containing Field Markers.

## AUTO DUP/SKIP Toggle Switch

The AUTO DUP/SKIP toggle switch on the control panel must be on in order to have the Microprocessor interpret and execute the duplicate and skip field begin characters (D, S, and M) and the reformatting characters. When a duplicate character (D) is included in the program, the AUTO DUP/SKIP switch should be turned off so that the operator can key in the information that will be duplicated. After the first record is output, then the AUTO DUP/SKIP switch should be turned on so that the field will be duplicated automatically thereafter.

## **CURSOR MOVEMENT UNDER PROGRAM CONTROL**

The cursor movement keys used in manual data entry, FRONTSKIP (→), BACKSKIP (←), L5 (POS 1), R5 (POS 81), and L1 (POS SEL), may be used when operating under program control. They perform the same functions under program control as in the manual mode. When the Microprocessor is being operated under program control, there are three additional cursor movement keys which may be used: FRONT TAB, BACK TAB, and L2 (FIELD SELECT).

### **FRONT TAB Key**

Pressing the FRONT TAB key will move the cursor to the next field begin character; the field begin character at the new cursor location will be executed. The FRONT TAB key is the only cursor movement key which results in execution of the program at the new cursor location in any field. If the FRONT TAB key is pressed while the cursor is in the last field of the record, the cursor will move off the display. If an automatic output option has been selected and the OPTIONS ON indicator is turned on, the output will be executed. When the FRONT TAB key is used to move the cursor to a left zero fill field, the field will *always* be filled with zeros and the cursor moved to the right-most position in the field. Therefore, if there is data in a left zero field, cursor movement keys other than FRONT TAB should be used to move the cursor into a left zero fill field. The FRONT TAB key is also used to end the left zero operation when data entry has been completed in a left zero fill field.

### **BACK TAB Key**

Pressing the BACK TAB key will move the cursor to the previous field begin character. If the cursor is in the middle of a field and the BACK TAB key is pressed, the cursor will move to the beginning of the same field. If the cursor is already at the beginning of a field when the BACK TAB key is pressed, it will move to the beginning of the previous field. The field begin character at the new cursor location will not be executed.

### **L2 (FIELD SELECT) Key**

The L2 (FLD SEL) key is used to move the cursor to the beginning of one of the first nine fields in the selected record. When the operator presses the L2 (FLD SEL) key, the cursor moves automatically to position 1 in the selected record and the Keyboard shift state is automatically set to lower. Then, when a 1-digit number from "1" to "9" is keyed in, the cursor moves immediately to the field selected. For example, a "3" is keyed in and the cursor moves to the beginning of the third field. If the operator enters either a "0" or a number larger than the number of fields in the CONTROL record, the Operator ERROR indicator will be turned on. The field begin character at the new cursor location is never interpreted when the L2 (FLD SEL) key is used to move the cursor to that position.

## Control Character Execution with the L4 (GO) Key and the BACKSKIP (←) Key

The function of the L4 (GO) key is to instruct the Microprocessor to interpret and execute the control character at the cursor location. While not a cursor movement key itself, its use is related to the cursor movement keys. If the cursor is moved with any key other than FRONT TAB, it is necessary to press the L4 (GO) key in order to execute the control character at the new cursor location.

In order to command the Microprocessor to return to the left zero data entry mode once the cursor has been moved beyond the left zero field, it is necessary to use the BACKSKIP (←) key to move the cursor back into the left zero field.

### ERROR CORRECTION

Error correction procedures under program control are basically the same as in manual data entry. The cursor is moved to the error location and the correct data is keyed in replacing the incorrect data. Any of the keys described above in the section on cursor movement may be used to move the cursor.

Characters are also inserted and deleted under program control in essentially the same way as in manual data entry. The difference is, however, that in manual data entry, the entire record is affected when either of these keys is pressed. In the program control mode, the R3 (INSERT) and L3 (DELETE) keys operate only in the field in which the cursor is located.

If the R3 (INSERT) key is pressed, the data at the cursor location and any data to the right of it, but within the same field, is moved one position to the right. The cursor will not move, and a space will be inserted at the cursor location. The data in the right-most position of the field will be lost because of the shift to the right of all data after the inserted space. If an alphameric key is then pressed, the appropriate data character will be entered in the inserted space, at the cursor location, and the cursor will move one position to the right. In left zero fill fields, movement of the data is to the left instead of to the right, and any data in the left-most position of the field is lost. (See Table 4-5).

If the L3 (DELETE) key is pressed, the character at the cursor location is deleted. Again the cursor location does not change. The data to the right of the deleted character but within the same field will shift one position to the left. In left zero fill fields, the data to the left of the deleted character will shift one position to the right and a zero will be entered in the left-most position. (See Table 4-5).

Table 4-5. Example of the Effect of the R3 (INSERT) and L3 (DELETE) Keys in a Left Zero Fill Field.

Data in Left Zero Field	Effect of Key	
	R3 (INSERT)	L3 (DELETE)
123 <u>4</u> 5	23_45	01 <u>2</u> 45
1234 <u>5</u>	234_5	012 <u>3</u> 5
<u>1</u> 2345	_2345	<u>0</u> 2345

## ERASE Key

The ERASE key operates within one field at a time. When the ERASE key is pressed, the data in the field in which the cursor is located is erased and the cursor is placed in the left-most, or first position, of the field. The field begin character is not executed.

## R1 (M DUP) and R2 (R DUP) Keys

The R1 (M DUP) and R2 (R DUP) keys also operate only within the field in which the cursor is located. Each time the R1 (M DUP) key (or the R2 (R DUP) key) is pressed the data in the corresponding locations in the MASTER record (or the READ record) is duplicated into the selected record from the cursor location to the end of the field. If the R1 (M DUP) or the R2 (R DUP) key is pressed while the cursor is in an active left zero fill field, the duplication is performed for the entire field.

## EXERCISES IN OPERATING WITH PROGRAM CONTROL

### Writing a Control Program

In the exercise below, first a sample program will be constructed for names and addresses.

The MASTER record is set up with the names of the fields, or the headings, as in Figure 4-5.

1	L	2	A	3	S	4	T	5		6	N	7	A	8	M	9	E	10		11		12		13		14		15		16		17	I	18	N	19	I	20	T
21	S	22	T	23	R	24	E	25	E	26	T	27		28	A	29	N	30	D	31		32	N	33	U	34	M	35	B	36	E	37	R	38		39		40	
41	C	42	I	43	T	44	Y	45		46		47		48		49		50		51		52		53	S	54	T	55	A	56	T	57	E	58		59		60	
61	Z	62	I	63	P	64		65	C	66	O	67	D	68	E	69		70		71	P	72	H	73	O	74	N	75	E	76		77	N	78	O	79	.	80	

Figure 4-5. Sample MASTER Record.



**Exercise:**

1. Turn on the following display switches: READ, WRITE, MASTER, CONTROL, and FIELD MKR. Turn off the FORMAT switch.
2. Insert a VIATAPE cartridge in either VIATAPE Recorder and rewind it to the beginning. Set the STATUS OUTPUT selector to TC1 or TC2, depending upon which Tape Recorder is being used.
3. Set the STATUS RECORD selector to M. Press READY, then ERASE.
4. Key in the sample MASTER record.

There must be a control program corresponding to the MASTER record. (Refer to Figure 4-6). The first field, LAST NAME, is set up to contain 19 characters, allowing more than enough space for entering most last names. The INIT field, a 1-character field, begins in column 20. Both the LAST NAME and the INIT fields are programmed for lower shift (using the L and . control characters) since the operator will be keying in alphabetic characters.

1	L	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	L
21	U	—	—	—	—	L	.	.	.	.	.	.	.	.	.	.	.	.	.
41	L	.	.	.	.	.	.	.	.	.	.	L	.	.	.	.	.	.	.
61	U	—	—	—	—	—	—	—	—	Z	—	—	—	—	—	—	—	—	

Figure 4-6. Sample CONTROL Record.

The STREET and NUMBER fields are programmed for upper shift and lower shift; the number field will contain upper shift numerics and the street name alphabetic. The number field permits a maximum of five digits to be entered; it could have been set up for more or less positions. The street name will be keyed in beginning in position 26 where the L field begin character will automatically change the keyboard shift state from upper to lower shift. The next field begin character, in position 41, indicates the beginning of the CITY field. It extends for 12 positions, and the STATE field begins in position 53. The ZIP CODE field begins in column 61 and contains 10 positions even though only five will be used for the zip code. The extra five positions will contain spaces. (A skip field could have been entered in those five positions.) The last field, PHONE NUMBER, is a left zero fill field. As soon as the cursor reaches this field (column 71), it will automatically be positioned in the last position of the field, i.e., column 80, and as the operator keys in the numbers, they will enter the display from right to left. This numeric field is also programmed for upper shift, governed by the -'s; the operator could program it for lower shift using the .'s if she wished to use the typewriter numerics across the top of the keyboard.

## Exercise:

1. Turn the STATUS RECORD selector to C1. Press READY, then ERASE.
2. Key in the sample CONTROL record. (Make certain that all 80 positions are correctly filled. If not, the Microprocessor will indicate an Operator ERROR when it attempts to read a space or any other illegal control character in C1.)
3. Turn the STATUS RECORD selector to W. Press READY, then ERASE.
4. Press the CTRL ON/OFF key once. If *both* CONTROL ON indicators do not go on, press the CTRL ON/OFF key twice more. Field markers are in the WRITE record at the beginning of each field.
5. Turn the FIELD MKR switch off to see the effect of the switch. Leave it off if you wish to work without the field markers; otherwise, turn it back on.
6. Turn the FORMAT switch on. The MASTER record is now interleaved with the WRITE record and there are two cursors on the display — one in the WRITE record and the other in the corresponding position of the MASTER record.
7. Referring to the headings in the MASTER record, key your last name into the first field of the WRITE record. Then press the FRONT TAB key. The cursor is now at the INIT field. Key in your first initial.
8. The cursor has moved to position 21, at the beginning of the second line, and the Microprocessor has set the shift state to upper. (Look at the SHIFT UPPER indicator). Key in your street number using the upper shift numerics, then press FRONT TAB.
9. The cursor has moved to the street name field and the Microprocessor has interpreted the L field begin character and set the keyboard shift state to lower. Key in your street name. Then press FRONT TAB.
10. The cursor is in position 41, at the beginning of the CITY field. Key in your city, then press FRONT TAB.
11. The cursor is now in the STATE field. Key in your state. Use abbreviations. Press FRONT TAB.
12. The cursor is in the ZIP CODE field, position 61. Key in your zip code using the upper shift numerics. Press FRONT TAB.
13. After FRONT TAB was pressed, the cursor moved to the field begin character of the PHONE NUMBER field, the Z in position 71. As soon as the Microprocessor read the Z, the cursor was moved to the right-most position of that field, position 80, and the entire field was filled with zeroes. Now key in your area code and phone number. Notice that as you key in each number, the previously entered numbers move one position to the left. When the entire number has been entered, the phone number should appear in positions 71-80 and the cursor should still appear in position 80. If you enter another digit now, it will be entered in position 80, the number previously in position 80 and all those to the left of position 80 will shift left one location, and the first digit of the field will be lost.

## Error Correction in a Left Zero Field

To correct an error in a left zero field, the operator has several alternative methods. It is recommended that you try all of these in order to become familiar with the procedures.

Procedure	Result
<p>1. Press the BACK TAB key twice and then press FRONT TAB once. Enter the correct number.</p>	<p>This moves the cursor out of the left zero field to the previous field begin character (in position 61); pressing FRONT TAB then brings the cursor to position 71 where the Microprocessor reads the Z field begin character and fills the entire field with zeros. The entire field can then be rekeyed.</p>
<p>2. Instead of back tabbing and front tabbing, the entire field can be filled with zeros by simultaneously holding down "0" and one of the REPEAT keys.</p>	<p>This procedure is similar to the one above. The field is filled with zeros again and the cursor is in the right-most position, ready for the operator to rekey the entire number.</p>
<p>3. If only one incorrect digit in the phone number field had been entered, the cursor can be moved back under that digit using the ← key. Then the digit can be rekeyed.</p>	<p>With this method only one digit is changed. The ← key must be used, however, to move the cursor to the error location.</p>
<p>4. If a number had been left out of the field during the original entry, the ← key can be used to move the cursor to the position where the missing digit should be. Then press the R3 (INSERT) key. Next, key in the missing digit.</p>	<p>With this procedure the operator again keys in only the missing digit, and the remainder of the field — keyed in correctly the first time — is not erased. Again, ← must be used to move the cursor to the position of the missing digit. Then, when R3 is pressed, the numbers to the left of and above the cursor move 1 position to the left, a space is inserted at the cursor position, and the operator keys in just the missing digit.</p>
<p>5. If an extra number had been entered in the left zero field, it can be deleted by moving the cursor under that extra number (by using the ← key) and then pressing the L3 (DELETE) key.</p>	<p>With this method, the extra digit is located and the cursor is positioned under it; then when L3 (DELETE) is pressed, that extra digit is deleted from the field. The numbers to the left of the cursor are shifted one position to the right to close up the space and a zero is entered in the left-most position of the field.</p>

When the record keyed in is complete and all corrections have been made, it can be output to the Tape Channel containing the VIATAPE. During the output to tape, the CONTROL ON indicator in the Processor section of the control panel will be turned off. The indicator will be turned back on and the cursor will be located in position 1 of the WRITE and MASTER records after the output. Key in and output several records following the procedures above.

The control program used above contained only five different control characters, L, U, Z, -, and . . The exercise below demonstrates the use of three more control characters: D, S, and M. The AUTO DUP/SKIP toggle switch on the control panel must be on in order to have the Microprocessor interpret and execute these three control characters. For the first record that will be entered, the AUTO DUP/SKIP switch should be off. The reason for this is that when the switch is on, the Microprocessor will automatically perform a duplication as soon as it interprets the D (or M) and the Microprocessor will duplicate either blanks or whatever data was previously in the READ (or MASTER) record. When the AUTO DUP/SKIP switch is off, the operator can key data into the duplicate or skip fields, if desired. After the first record has been keyed in and output, AUTO DUP/SKIP should be turned on.

**Exercise:**

1. Press CLEAR and READY.
2. Turn AUTO DUP/SKIP off.
3. Set the STATUS RECORD selector to M, press READY, then ERASE.
4. Key in the sample MASTER record below.

1	E	2	M	3	P	4	L	5	O	6	Y	7	E	8	E	9		10	N	11	A	12	M	13	E	14		15		16		17		18		19		20
21	F	22	E	23	B	24	R	25	U	26	A	27	R	28	Y	29		30	1	31	5	32	,	33		34	1	35	9	36	7	37	0	38		39		40
41		42		43		44	D	45	E	46	P	47	T	48	.	49	#	50		51		52		53		54		55	C	56	O	57	D	58	E	59		60
61		62		63		64		65		66		67		68		69		70		71		72		73		74		75		76		77		78		79		80

Figure 4-7. Sample MASTER Record.

5. Set the STATUS RECORD selector to C1. Press READY, then ERASE.
6. Key in the sample CONTROL record below.

1	L	2	.	3	.	4	.	5	.	6	.	7	.	8	.	9	.	10	.	11	.	12	.	13	.	14	.	15	.	16	.	17	.	18	.	19	.	20	.
21	M	22	.	23	.	24	.	25	.	26	.	27	.	28	.	29	.	30	.	31	.	32	.	33	.	34	.	35	.	36	.	37	.	38	S	39	—	40	—
41	—	42	—	43	—	44	D	45	—	46	—	47	—	48	—	49	—	50	S	51	—	52	—	53	—	54	—	55	D	56	—	57	—	58	—	59	—	60	—
61	S	62	.	63	.	64	.	65	.	66	.	67	.	68	.	69	.	70	.	71	.	72	.	73	.	74	.	75	.	76	.	77	.	78	.	79	.	80	.

Figure 4-8. Sample CONTROL Record.

Observe the correlation between C1 and the MASTER record. Employee name will be entered in positions 1-20. The date, in positions 21 through 37 of the MASTER record, will be duplicated into the corresponding positions of the WRITE record. Positions 38 through 43 will be skipped. The department number in positions 44 - 49 will be duplicated into the WRITE record from the READ record. Positions 50 - 54 will be skipped; the code in columns 55 through 60 will also be duplicated from the READ record. The remainder of the record will be skipped. Either - or . can be used as field continuation characters after M, S, and D.

**Exercise:**

1. Set the STATUS RECORD selector to W. Press READY, then ERASE.
2. Press CTRL ON/OFF once.
3. Key in your name and press FRONT TAB.
4. Because the AUTO DUP/SKIP switch is off, the M in position 20 is not executed. Press the R1 (M DUP) key. The date is duplicated into the WRITE record from the MASTER record.
5. Press FRONT TAB. The cursor is in position 44. Key in a 6-digit number for the department number field. Observe the shift indicator on the panel.
6. Press FRONT TAB. The cursor is in position 55. Key in a 6-digit number for the CODE field using the UPPER shift numerics.
7. Press OUTPUT. The record is output to VIATAPE and the cursor is in position 1 of the WRITE record.
8. Now turn on the AUTO DUP/SKIP toggle switch, and key in another name. Then press FRONT TAB.
9. The remainder of the record is completed automatically, with the date being duplicated from the MASTER record. The department number and code are duplicated from the READ record, and the appropriate fields are skipped.
10. The cursor has been moved off the display. Press the OUTPUT key. The record is output to VIATAPE and the cursor is in position 1 ready for the operator to key in the next employee name.



# Section V Additional Capabilities of the 2111 Data Management Station

## AUTOMATIC TAPE SEARCH

The automatic tape search capability permits the operator to locate a particular record or records on VIATAPE or computer tape. Identifying information, unique to the records to be located, is keyed in and the Microprocessor will search the tape automatically for the record(s) containing the identifier. Once the desired records have been located, they can be modified and/or output to the Printing Robot or to VIATAPE, for example, in order to create a new file.

Automatic tape search requires the use of both CONTROL 1 and CONTROL 2 record, as well as the MASTER record. The MASTER record must contain the identifier in the same record positions in which that information appears in the record(s) to be located. CONTROL 1 record must contain instructions in the corresponding positions in order to compare data in the same positions of any record input from tape with the identifier in the MASTER record. It can also contain instructions for output of the located records. CONTROL 2 record must contain instructions to the Microprocessor for handling input records that do not match the MASTER record identifier. For example, assume that a printout is desired of all the orders for Part Number B5894. The orders have been recorded on a VIATAPE cartridge along with orders for other part numbers. The part number field is in columns 10 through 14 of the records on VIATAPE. Figure 5-1 shows the MASTER record and two CONTROL records that could be used to perform the operation. Table 5-1 describes the function of the entries in each of those three records.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80

MASTER Record

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80

CONTROL 1 Record

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80

CONTROL 2 Record

Figure 5-1. MASTER Record, CONTROL 1 Record and CONTROL 2 Record for Automatic Tape Search Operation Example.

Table 5-1. Effect of Figure 5-1 Records in an Automatic Tape Search Operation.

RECORD	POSITIONS	INSTRUCTION TO MICROPROCESSOR
MASTER	10 through 14	Identifier — to be compared with data in corresponding positions of each record input from Tape.
CONTROL 1	1 through 9	Skip.
	10 through 14	Compare the identifier with the data in the corresponding positions of the input record.
	15	If the data in the input record matches the data in the identifier, output the record.
	16 through 80	Skip.
CONTROL 2	10 through 14	If the data in the input record does not match the data in the identifier, input the next record from Tape.

The switch settings for the example would be as follows:

1. STATUS INPUT selector — TC1
2. STATUS OUTPUT selector — the Data Channel to which the Printing Robot is attached
3. STATUS RECORD selector — W
4. AUTO DUP/SKIP switch — on  
(For a multiple output of the selected records, OUTPUT OPTION B, C, or D can be used.)

The operator would first insert the order tape in the TC1 Recorder, rewind it to the beginning, and prepare the Printing Robot for operation. Then the automatic search operation would be begun by pressing the CONTROL ON/OFF key to bring in the first record from TC1. Immediately the Microprocessor would read CONTROL 1 record and begin the comparison, position by position. If the part number in the WRITE record matched the identifier in the MASTER record (i.e., B5894), then the Microprocessor would output the entire WRITE record to the Printing Robot and the next record would be input automatically from TC1. If the part numbers had not matched, the Microprocessor would have read the "I" instruction in C2 and then input the next record from TC1 without performing the output. This process would continue until terminated by pressing the CONTROL ON/OFF key or the CLEAR key, by Microprocessor detection of an EVT character in position 80 of an input record, or by reaching the physical end of VIATAPE.

If, instead, a printed listing of all records containing part numbers other than B5894 were to be created, the CONTROL records would have contained an "I" in position 15 of C1 instead of an "O", and five "O's" in positions 10 through 14 of C2 instead of the five "I's." With these CONTROL records, the Microprocessor would output a record when a mismatch occurs and, when a record containing part number B5894 was located, the Microprocessor would input another record from TC1 without performing an output. It is possible also to add data to records located by including data entry control characters in C1. In the above example, this could be accomplished by eliminating the output instruction, "O," from C1 and entering instead the control characters for data entry in lower or upper shift, left zero operation, duplication, etc., in the appropriate positions in C1.





Verification of the payroll tape would then proceed as follows.  
First the switches should be set:

1. STATUS RECORD selector to W,
2. STATUS INPUT selector to TC1,
3. STATUS OUTPUT selector to TC2,
4. INPUT OPTIONS selector to A,
5. AUTO DUP/SKIP switch on.

The rewind payroll VIATAPE should be inserted in TC1 and a rewind VIATAPE for receiving the output data should be inserted in TC2. The operator should then press READY, OPTION ON/OFF, CTRL ON/OFF, and INPUT, in sequence.

The first record to be verified will be input to the WRITE record from TC1. The Microprocessor will read the "C" field begin character in the first position of CONTROL1 record, read the "L" in the first position of CONTROL 2 record, insert a space in the first position of the MASTER record, and stop, waiting for the operator to enter the appropriate lower shift character — the first character of the name from the original source document. As the name is keyed into the MASTER record, the Microprocessor compares each character keyed in with the character in the corresponding position in the WRITE record.

When there is a discrepancy between the character in the WRITE record and the character in the MASTER record, the operator ERROR indicator illuminates and the operator must correct one or the other so that a "legal" match can occur. If the character in the WRITE record had been incorrectly entered the first time, the operator can correct that character by pressing ERROR, then READY, and keying in the correct character. (Pressing READY causes the next character keyed to be entered into the WRITE record.)

The comparison is executed and the cursor moves to the next location to permit entry in the MASTER record. If, however, the operator had entered the incorrect character into the MASTER record during her re-keying of the data, then she merely re-keys the correct character in the MASTER record after turning off the ERROR indicator. The comparison is then executed and the cursor moves ahead to the next position to be verified. The cursor will not advance unless a match occurs.

If a character has been omitted in the original record (visible in the WRITE record), the operator can use the R3 (INSERT) key to insert a space at the desired location. Since all the data to the right of the cursor will move one position to the right, the last character in the field will be lost. After the space has been entered, the operator must then enter the omitted character in the WRITE record. The Microprocessor will then enter a space in the corresponding position of the MASTER record and wait until the verification character has been entered.

When the L3 (DELETE) key is used during key verification, the character at the cursor location is deleted from the WRITE record, all characters to the right of the cursor are shifted left one position, and a space is entered in the last position of the field. A space is then inserted into the MASTER record at the cursor location, and the Microprocessor waits for the operator to enter the next character to be verified.

NOTE: During key verification the R1 (M DUP), R2 (R DUP), FRONTSKIP (→), BACKSKIP (←), and L1 (POS SEL) keys are not functional. The operator must key a character into each successive position in the field being verified.

## REFORMATTING

Reformatting is the automatic rearranging of data within an existing record to form a new record. For example, if an operator has recorded all the order information for one day on a VIATAPE cartridge and then wishes to create a new tape containing just the customers' names, order numbers, and the total price of each sale, the Microprocessor can be programmed to do so automatically. As an alternative to creating a new VIATAPE, reformatted data could be printed by the VIATRON Printing Robot, or the data could be output to cards or to another System 21 via communications lines. A variety of new files can be created from existing data using the reformatting feature in combination with a particular output option. Perhaps the most advantageous feature of the reformatting operation is that the Microprocessor performs the entire function automatically once the program has been entered and turned on.

The control characters for reformatting are the digits 0 through 9. They are used to define position locations of data within an existing record that is to be reformatted. Both C1 and C2 must be used in reformatting since every location is identified by a two-digit number from 01 to 80.

For example, if the operator wishes to reformat a field presently in positions 10-15 to positions 1-6 of the new record, a "1" is inserted in the first position of C1 and a "0" in the first position of C2 to indicate position 10; then a "1" in the second position of C1 and a "1" in the second position of C2 to indicate position 11, and so on. All 80 character positions in CONTROL 1 record must contain a legal control character. In CONTROL 2 record, however, only those positions being reformatted need contain control characters.

During reformatting the original data records will be input to the MASTER record of the display, and the Microprocessor will create the newly formatted records in the WRITE area of the display.

Assume that there is an order tape created with the following MASTER record:

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
N	A	M	E											O	R	D	E	R	#
21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
M	O	D	E	L	#							Q	U	A	N	T	I	T	Y
41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
U	N	I	T	\$							T	O	T	A	L	\$			
61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
S	A	L	E	S	M	A	N					D	A	T	E				

Figure 5-3. Sample Order Entry MASTER Record.

Each of the data records on the VIATAPE would resemble the one below:

1	J	2	O	3	H	4	N	5		6	D	7	O	8	E	9		10		11		12		13		14		15	B	16	4	17	7	18	6	19	9	20	4
21	M	22	O	23	D	24	E	25	L	26		27	2	28	1	29	0	30	1	31		32		33		34		35		36		37		38	5	39	0	40	0
41	\$	42	2	43	0	44	.	45	0	46	0	47		48		49		50		51		52	\$	53	1	54	0	55	0	56	0	57	0	58	.	59	0	60	0
61	J	62	.	63	J	64	O	65	N	66	E	67	S	68		69		70		71		72		73	0	74	1	75	/	76	1	77	4	78	/	79	7	80	0

Figure 5-4. Sample Order Entry WRITE Record.

When this information is reformatted, only the order number (located in positions 15-20), the name (located in positions 1-13), and the total price (located in positions 52-60) will appear in the records to be created. The three fields can be positioned as shown below in the sample record. Order number will be in positions 1-6, name in positions 8-20, and total price in positions 21-29 of the reformatted record.

1	O	2	R	3	D	4	E	5	R	6	#	7		8	N	9	A	10	M	11	E	12		13		14		15		16		17		18		19		20	
21	T	22	O	23	T	24	A	25	L	26	\$	27		28		29		30		31		32		33		34		35		36		37		38		39		40	
41		42		43		44		45		46		47		48		49		50		51		52		53		54		55		56		57		58		59		60	
61		62		63		64		65		66		67		68		69		70		71		72		73		74		75		76		77		78		79		80	

Figure 5-5. Sample Order Entry MASTER Record, Fields Rearranged.

As each record is input to the Microprocessor from the original order tape, it will be reformatted so that the new data record will appear as:

1	B	2	4	3	7	4	6	5	9	6	4	7		8	J	9	O	10	H	11	N	12		13	D	14	O	15	E	16		17		18		19		20	
21	\$	22	1	23	0	24	0	25	0	26	0	27	.	28	0	29	0	30		31		32		33		34		35		36		37		38		39		40	
41		42		43		44		45		46		47		48		49		50		51		52		53		54		55		56		57		58		59		60	
61		62		63		64		65		66		67		68		69		70		71		72		73		74		75		76		77		78		79		80	

Figure 5-6. Sample Order Entry WRITE Record Reformatted.

The two CONTROL records used to achieve this reformatting are:

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	1	1	1	1	2	S	0	0	0	0	0	0	0	0	0	1	1	1	1
21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
5	5	5	5	5	5	5	5	6	0	-	-	-	-	-	-	-	-	-	-
41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

CONTROL 1 Record

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
5	6	7	8	9	0	7	1	2	3	4	5	6	7	8	9	0	1	2	3
21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
2	3	4	5	6	7	8	9	0	-	-	-	-	-	-	-	-	-	-	-
41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

CONTROL 2 Record

Figure 5-7. CONTROL Records for Reformatting Example.

The two CONTROL records contain the position locations of the data that is to be reformatted. The 1 in the first position of CONTROL 1 record (C1) and the 5 in the first position of CONTROL 2 record (C2) instruct the Microprocessor to take the data from position 15 of the MASTER record and enter it in the first position of the WRITE record. The 1 in the second position of C1 and the 6 in the second position in C2 instruct the Microprocessor to take the data from position 16 of the MASTER record and enter it in the second position of the WRITE record, and so on, until the order number has been reformatted from character positions 15 through 20 of the original record to locations 1 through 6 in the reformatted record. The Microprocessor next skips one position in the WRITE record. The 0 in position 8 of C1 and the 1 in position 8 of C2 instruct the Microprocessor to take the data from position 1 of the MASTER record and enter it in the next position (8) of the WRITE record. So, too, for the data in positions 02 through 13 which will be re-entered in positions 9 through 20 of the reformatted record. The name field of the original record, originally in locations 1 through 13, has now been entered in positions 8 through 20 of the new record. The Microprocessor then reads the 5 in position 21 of C1 and then the 2 in position 21 of C2 and enters the data from position 52 of the MASTER record into position 21 of the WRITE record. The same action continues for entering the data in positions 53-60 of the MASTER record into positions 22-29 of the WRITE record. The Microprocessor now reads the "0" in column 30 of C1 and executes the Output instruction. This process will continue automatically for all the records on the original order tape until the new reformatted tape has been created.

Once the two CONTROL records have been entered, the procedure for performing a reformatting operation is as follows.

First the switches should be set:


1. STATUS INPUT selector to TC1,
2. STATUS OUTPUT selector to the desired output channel,
3. STATUS RECORD selector to W,
4. INPUT OPTIONS selector to E,
5. OUTPUT OPTIONS selector as required by the application,
6. AUTO DUP/SKIP on, and
7. CONTROL 1/2 to 1.

Next the following keys should be pressed in sequence: CLEAR, READY, ERASE, OPTION ON/OFF, CTRL ON/OFF, and INPUT.

The first record will be input from TC1 and the reformatting operation will begin. At the completion of the reformatting of each record, the reformatted record will be output automatically. The reformatting operation will continue until the CLEAR, OPTION ON/OFF, or CTRL ON/OFF keys are pressed, or until the Microprocessor detects an EVT character in position 80 of an input record, or the physical end of VIATAPE is reached.


## Section VI Summary of Function Keys, Switches, Selectors, and Indicators

KEY	MANUAL	CONTROL ON
L1 (POSITION SELECT)	Permits the operator to move the cursor to any position in the selected record. Cursor is reset to position 1 in the selected record, and the Microprocessor is conditioned to receive from the keyboard any legal 2-digit sequence from 01 to 80. As soon as the second digit is entered, the cursor moves to the designated position.	Same. In addition, the Microprocessor executes the shift state in the new cursor location.
L2 (FIELD SELECT)	Turns on the Operator ERROR light. Functional only with CONTROL ON.	Moves the cursor in the selected record to one of the first nine fields designated in the active CONTROL record. When the L2 key is pressed and a 1-digit number (1-9) is entered from the keyboard, the cursor moves to the first position of that field. The control character in that field is not executed.
L3 (DELETE)	Deletes the character above the cursor location and shifts the remaining characters in the record one position to the left.	Deletes the character above the cursor location and shifts the remaining characters of that field one position to the left. In a left zero field, the character above the cursor is deleted, the characters to the left of the cursor are moved one position to the right, and a 0 is entered in the first column of the left zero field.
L4 (GO)	No effect.	If the cursor is above a field begin character, the action specified is executed. If the cursor is above a field continuation character, the shift state is interpreted.
L5 (POSITION 1) ERROR	Moves the cursor to position 1 of the selected record.  Releases keyboard lockout resulting from an operator error condition. Turns off Operator ERROR light.	Same. In addition, the field begin character in position <sup>1</sup> is executed.  Same.

KEY	MANUAL	CONTROL ON
INPUT	Inputs one record from channel selected on STATUS INPUT selector to record selected on STATUS RECORD selector. Cursor returns to first position. If EVT character is detected, all Microprocessor activity stops and EVT, BUSY, and keyboard lock lights are turned on.	Same. In addition, the first field begin character in the active CONTROL record is executed.
OUTPUT	Outputs one record from record selected on STATUS RECORD selector to channel selected on STATUS OUTPUT selector. Cursor returns to first position. If EVT character is detected, all Microprocessor activity stops and EVT, BUSY, and keyboard lock lights are turned on.	Same. In addition, the first field begin character in the active CONTROL record is executed after completion of the output.
READY	Reads all STATUS switch settings into the Microprocessor; turns off the NOT READY light.	Same. In addition, the automatic operation at the cursor location is performed.
 (BACKSKIP)	Back spaces the cursor one position.	Same. In addition, if new cursor location is within a left zero field, the Microprocessor enters the left zero mode. Otherwise, the automatic operation at the new cursor location is not performed.
CLEAR	Resets the Microprocessor to initial conditions: 1. All Microprocessor activity stops. 2. OPTIONS ON light goes off. 3. NOT READY light goes on. 4. SHIFT UPPER light goes on. 5. ALERT lights go off, if VIATAPES are in recorders. 6. Tape movement stops. 7. EVT light goes off.	Same. In addition: 1. CONTROL ON lights go off. 2. CONTROL 1 light goes on.
BACK TAB	Resets the cursor to the first position of the selected record.	Resets the cursor to the previous field begin character. Automatic operation at the new cursor location is not performed. Only shift state is interpreted.
SHIFT X	When pressed in conjunction with an alphameric key, enters the ASCII communication control character associated with that key.	Same.



<b>KEY</b>	<b>MANUAL</b>	<b>CONTROL ON</b>
SHIFT UPPER	Changes the keyboard shift state to upper shift.	Changes the keyboard shift state to upper shift when the programmed shift state is lower.
REPEAT	When pressed in conjunction with any other key, repeats the action of that key.	Same.
CTRL 1 CTRL 2	Selects CONTROL 1 record (or 2) for display.	Selects CONTROL 1 record (or 2) as operating program for duration of current record. Control reverts to panel switch-selected CONTROL record at the completion of the record.
ERASE	Erases the contents of the selected record and returns the cursor to position 1.	Erases the contents of the field in the record in which the cursor is located and returns the cursor to the first position of the field. The automatic operation at the new cursor location is not performed.
R1 (MASTER DUPLICA- TION)	Duplicates data at the cursor location from the MASTER record into the record selected on the STATUS RECORD selector.	Duplicates from the MASTER record into the record selected on the STATUS RECORD selector all of a left zero field and in all other fields, duplicates from the cursor location to the end of field.
FRONT TAB	Moves the cursor off the display (81st position). Any OUTPUT OPTIONS selected are executed.	Moves the cursor to the beginning of the next field. The automatic operation at the new cursor location is performed.
CTRL ON/ OFF	Turns program control on and illuminates CONTROL ON indicators.	Turns off program control and CONTROL ON indicators.
OPTION ON/OFF	Turns selected INPUT/OUTPUT OPTIONS and OPTIONS ON light on or off.	Same.
R2 (DUPLICA- TION)	Duplicates data at the cursor location from the READ record into the record selected on the STATUS RECORD switch.	Duplicates from the READ record into the record selected all of a left zero field, and in all other fields, duplicates from the cursor location to the end of a field.
SHIFT Y	When pressed in conjunction with an alphabetic color coding key, enters the color code character associated with that key. When pressed in conjunction with any of the alphabetic keys, enters the code for printing that character in lower case.	Same.

KEY	MANUAL	CONTROL ON
R3 (INSERT)	Inserts a space at the cursor location and shifts the characters above and to the right of the cursor one position to the right.	Inserts a space at the cursor location and shifts the characters above and to the right of the cursor in that field one position to the right. In a left zero field, characters above and to the left of the cursor are shifted left one position and a space is inserted at the cursor location.
SHIFT LOWER	No effect.	Changes the keyboard shift state to lower shift when programmed shift is upper.
R4 (LF/CR)	Enters ASCII characters for carriage return (CR) in lower shift and line feed (LF) in upper shift.	Same.
 (FRONT- SKIP)	Moves the cursor to the right one position.	Same. In addition, the automatic operation at the new cursor location is not performed.

All switches are on when positioned to the right except COLOR and CONTROL. 14 2

SWITCH	EFFECT
<b>DISPLAY SWITCHES</b>	
READ WRITE MASTER CONTROL FIELD MKR FORMAT COLOR     A B	<p>When ON, displays the individual record; when OFF, suppresses the individual record.</p> <p>When ON, in a program control operation, displays vertical markers (i.e., field markers) at the beginning of each field in the record selected on the STATUS RECORD selector. No effect in manual operation.</p> <p>When ON, interleaves the four lines of the WRITE record with the four lines of the MASTER record, and causes cursors to appear in the WRITE and MASTER records, regardless of the setting of the STATUS RECORD selector.</p> <p>Allows selection of 8 color codes for data characters and 8 color codes for background in any combination.</p> <p>Permits use of four functional colors:            aqua for upper case printout,            green for lower case printout,            yellow for display of numbers and punctuation, and            red for ASCII communication characters.</p>
<b>FUNCTIONS SWITCHES</b>	
SHORT REC CONTROL 1 2 AUTO DUP/SKIP VALIDATE	<p>When ON, allows inputs to and outputs from DC1 or DC2 of records less than 80 characters long.</p> <p>Allows selection of CONTROL 1 record or CONTROL 2 record as the operating program.</p> <p>When ON, the control program instructions for duplication, master duplication, skipping, and reformatting will be performed automatically. Functional only with CONTROL on.</p> <p>When ON, causes a re-read of a record that is input from or output to a Tape Channel to check for recording errors.</p>

SWITCH	EFFECT
OPTIONS SELECTORS	
INPUT	<p>Input Options, when selected, are initiated automatically after output of the 80th character, or by execution of an INPUT control character in the active CONTROL record, or by pressing the INPUT key.</p> <p>A Inputs one record to the record selected on the STATUS RECORD selector from the channel selected on the STATUS INPUT selector.</p> <p>B Automatic PSL—inputs two records from Tape Channel 1, the first into CONTROL 1 record and the second into the MASTER record. Overrides the setting of the STATUS INPUT selector. Returns the cursor to the first position of the selected record. If control is on, the field begin character in position 1 of C1 is executed.</p> <p>C Inputs three records from Tape Channel 1; the first into CONTROL 1 record, the second into CONTROL 2 record, and the third into the MASTER record. Overrides the setting of the STATUS INPUT selector. Resets the cursor to position 1 of the selected record. If control is on, the field begin character in position 1 of C1 is executed.</p> <p>D Inputs one record from the channel selected on the STATUS INPUT selector. Following input completion, the record is output to a selected channel (or channels). Used for batch throughput.</p> <p>E Inputs one record from the selected channel to the MASTER record. Primarily used for reformatting operations.</p>
OUTPUT	<p>Output Options, when selected, are initiated automatically after the input or entry of the 80th character, or by execution of the OUTPUT control character in the active CONTROL record, or by pressing the OUTPUT key.</p> <p>A Outputs the selected record to the selected output channel. Output Options B, C, and D override the setting of the STATUS OUTPUT selector.</p> <p>B Outputs the selected record first to DC1, and then to TC2.</p> <p>C Outputs the selected record first to DC1, and then to DC2.</p> <p>D Outputs the selected record first to DC1, then to DC2, and then to TC2.</p> <p>E No effect.</p>

SWITCH		EFFECT
<b>STATUS SELECTORS</b>		
INPUT and OUTPUT	DC1 DC2 TC1 TC2	Allows selection of Data Channel 1, Data Channel 2, Tape Channel 1, or Tape Channel 2 as input and output channels.
RECORD	R W M C1 C2	Allows selection of READ, WRITE, MASTER, CONTROL 1, or CONTROL 2 record for input, keyboard data entry, or output.

### INDICATORS

INDICATOR	MEANING
TC1 and TC2 ALERT	VIATAPE is in motion, at end, jammed, not in the recorder, or otherwise not ready for use.
PROCESSOR END OF VIATAPE	Following an input or output, the Microprocessor detects an EVT character in the 80th position of the record.
CHANNEL ERROR	Error in input data from a Tape or Data Channel. (Each error character is displayed as a "?")
NOT READY	Current setting of the STATUS selectors has not been read into the Microprocessor.
CONTROL ON	Microprocessor is under program control.
CONTROL ONE CONTROL TWO	CONTROL 1 (or 2) is being displayed and, if CONTROL ON light is also on, the Microprocessor is under the control of the indicated program.
BUSY	Microprocessor is performing an operation.
SHIFT UPPER	Keyboard is in upper shift.
SHIFT LOWER	Keyboard is in lower shift.
OPERATOR CONTROL ON	Program control has been selected for operation.
OPTIONS ON	Selected automatic input and/or output options are in effect.
ERROR	Incorrect operator procedure.

### VIATAPE CONTROLS

TC1 and TC2 1 RECORD	Pressing the switch moves VIATAPE one record length in the direction indicated by the arrow.
FAST	VIATAPE moves rapidly in the direction indicated by the arrow until the switch is released or the beginning or end of VIATAPE is reached.



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**VIATRON**

COMPUTER  
SYSTEMS  
CORPORATION

Crosby Drive, Bedford, Massachusetts 01730 • (617) 275-6100

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