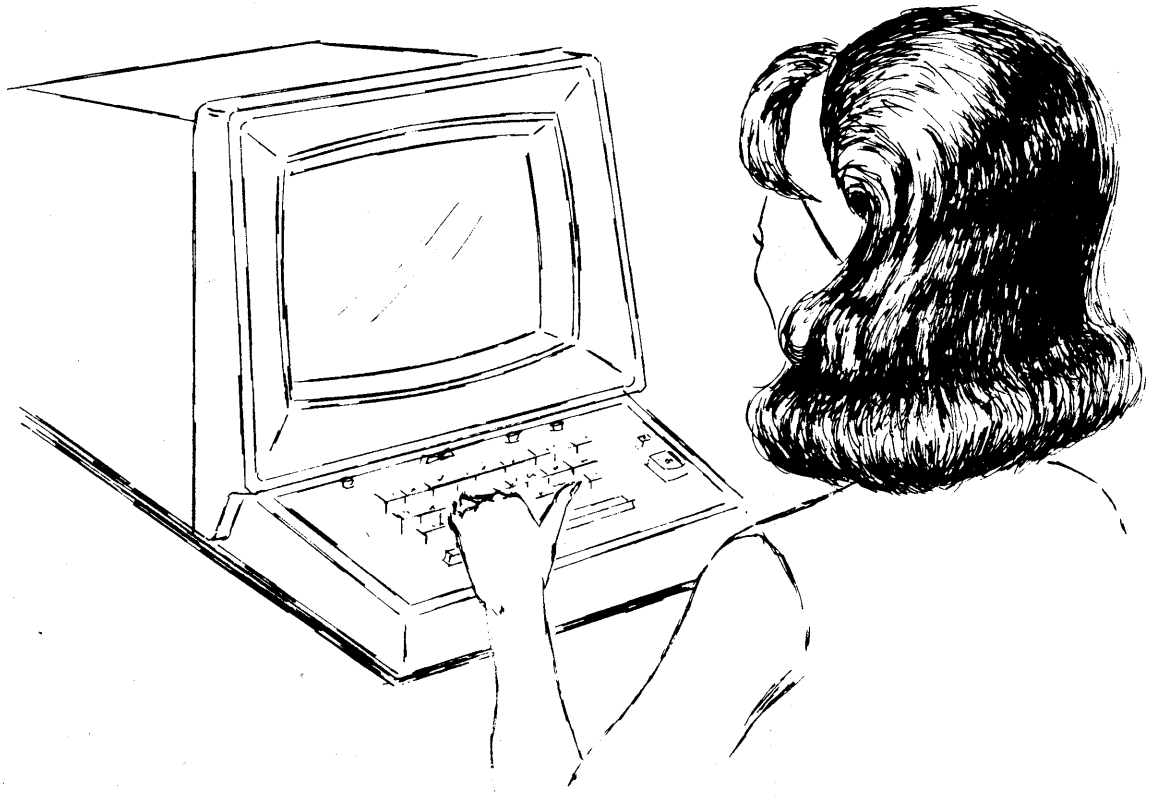
CONTROL DATA®

3290-4 (NON-EDIT)
MULTISTATION TERMINAL



CONTROL DATA
CORPORATION

OPERATING AND PROGRAMMING GUIDE

3290-4 (NON-EDIT) MULTISTATION TERMINAL
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FOREWORD

This manual discusses some of the major aspects of a Multi-station Terminal. The primary prupose is to provide the reader with a reasonably complete understanding of operating and programming priciples for this terminal.

The discussion is arranged in four basic sections and an appendix. The first explains the characteristics of the terminal from operational and functional viewpoints. Controls available to the operator along with basic operating procedures are covered in the second section. In the third section, attention focuses on programming including flow charts and communication sequences. The reader should pay considerable attention to Section IV, Programming Aids. Here, some of the less obvious features are discussed. An appendix is used to highlight all equipments used in the configuration. Specifications are given for each equipment, as well as a listing of available documentation.

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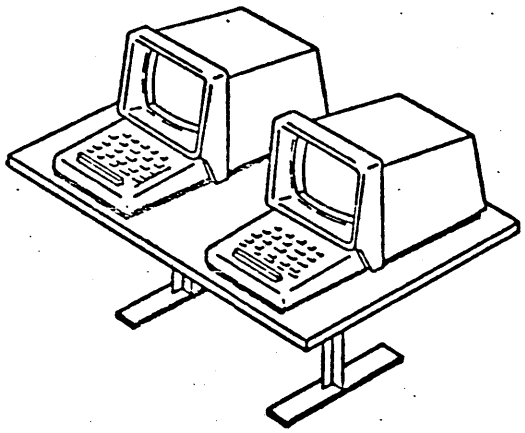
SECTION I

GENERAL DESCRIPTION

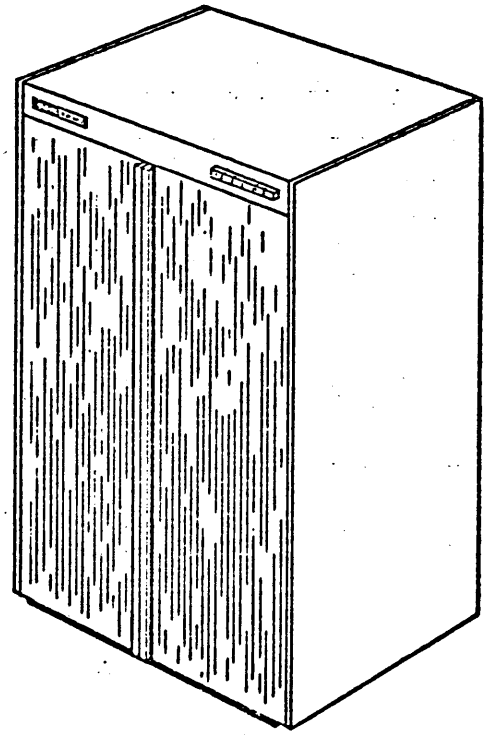
A terminal consists of a variety of data entry and retrieval devices communicating through a processor. The 3290-4 terminal discussed is capable of communicating with the processor over data cables at a distance of 200 feet. This terminal features data output in the form of cathode-ray tube displays. Data entry is achieved by entry keyboards associated with the displays. Figure 1-1 shows a typical terminal.

All processing for the terminal is handled by the Equipment Controller. This device is connected to the processor by data cables. All input/output devices are attached to the controller by means of cables.

The crt display unit is termed a Display Station. When a keyboard is added, it becomes a Display/Entry Station.



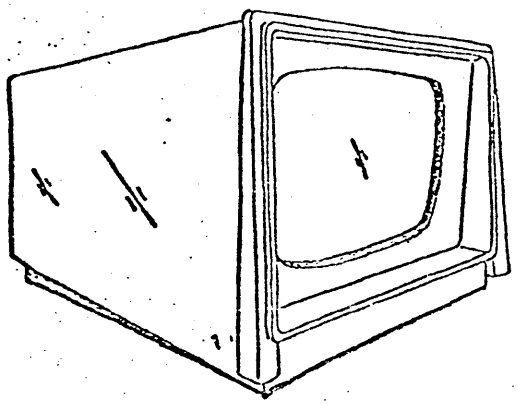
Display/Entry Stations



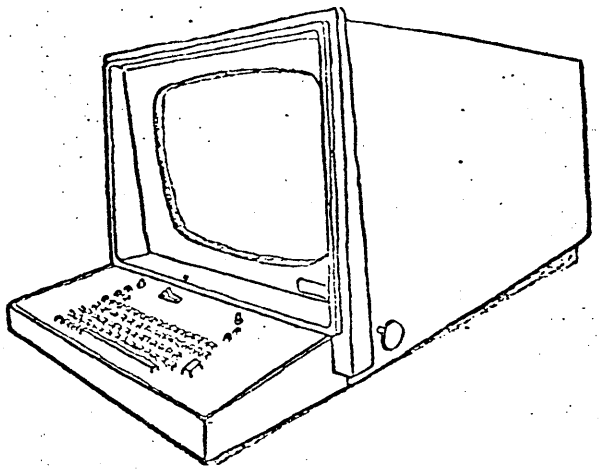
Equipment Controller

Figure 1-1. Typical Terminal

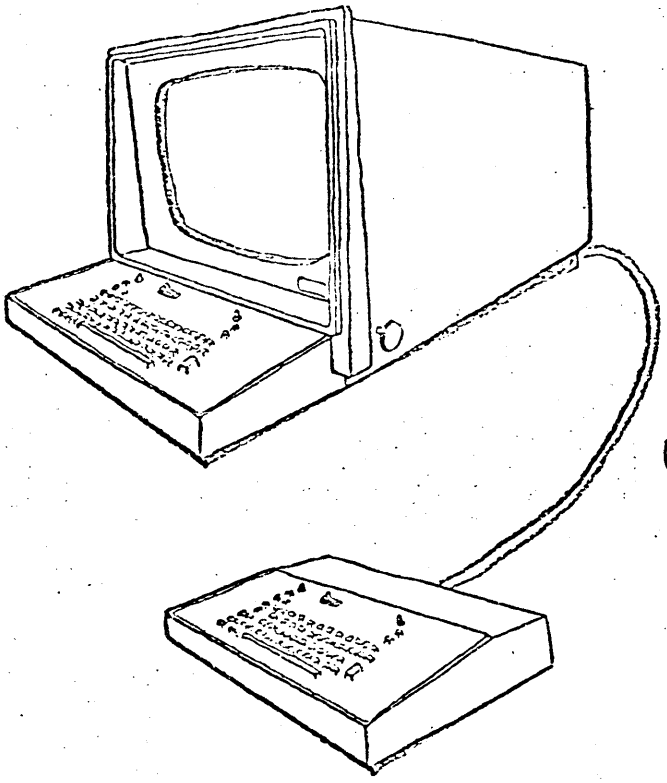
When one keyboard is used with a Display Station, it may be attached or detached. Detached keyboards can be located up to twenty cable feet from the display. When two keyboards are used with a station, one may be attached and one detached or both may be detached. Figure 1-2 illustrates the various configurations.



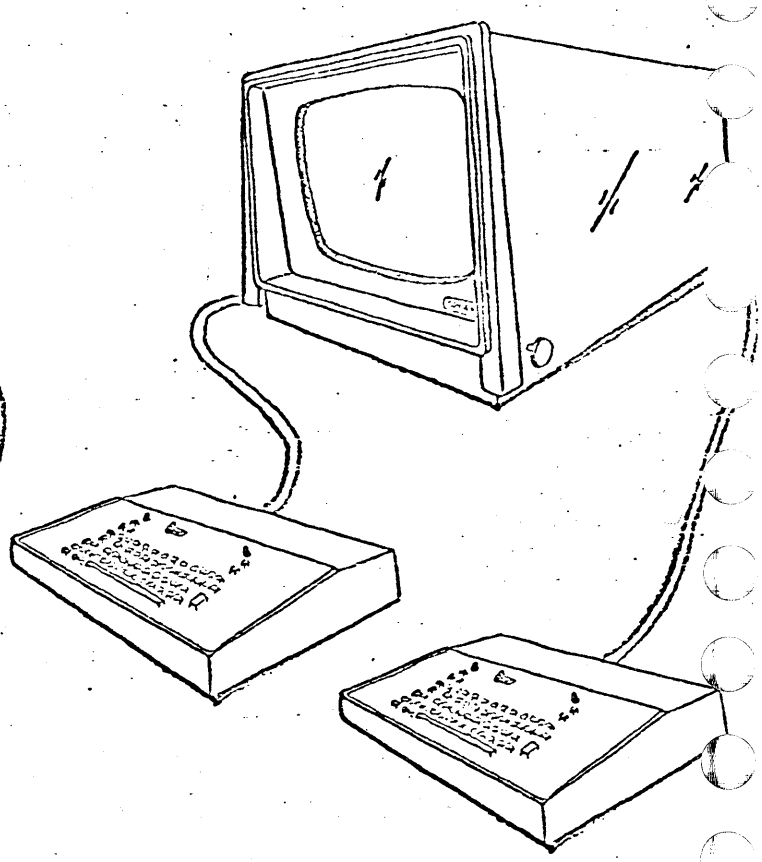
DISPLAY STATION
(NO ENTRY KEYBOARDS)



DISPLAY/ENTRY STATION
(1 ATTACHED ENTRY KEYBOARD)



DISPLAY/ENTRY STATION
(1 ATTACHED AND 1 DETACHED ENTRY KEYBOARD)



DISPLAY/ENTRY STATION
(2 DETACHED ENTRY KEYBOARDS)

Figure 1-2. Display/Entry Station Configurations

DATA PRESENTATION.

A Display Station features a 14-inch rectangular crt. Symbols display within a nominal 6 by 8 inch area on the crt screen. Standard display format is 20 lines of 50 symbols. An optional format is 13 lines of 80 symbols. Each symbol position is nominally 1/4 inch high by 1/8 inch wide and consists of a 5 by 7 dot matrix. A symbol is formed by brightening certain dots within the matrix. Figure 1-5 shows a typical formation, using the letter A. Symbols include the alphabet in uppercase, arabic numerals, punctuation marks, and several special symbols. Figure 1-6 shows an actual crt display.

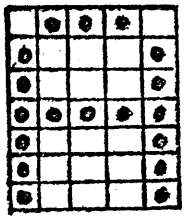


Figure 1-3. Symbol Formation.

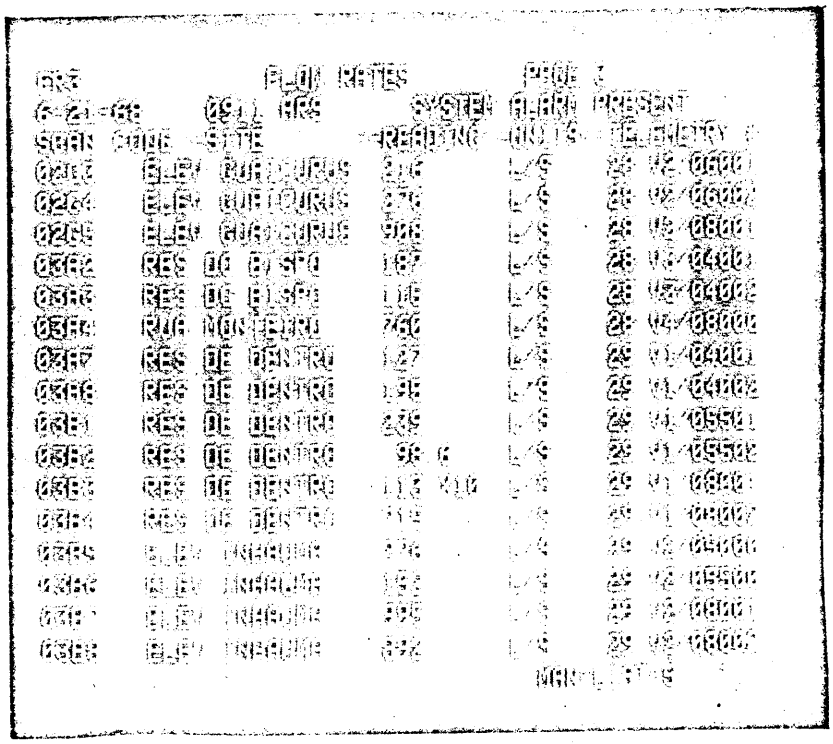
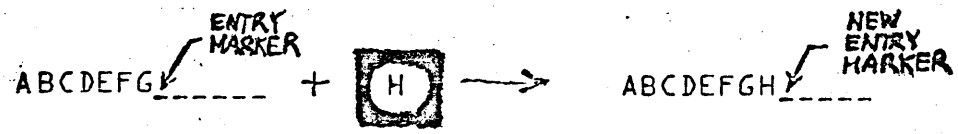


Figure 1-4. Display Presentation.

OPERATIONAL DESCRIPTION.

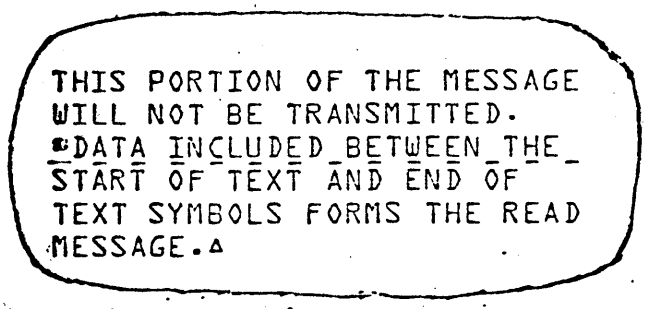
In a typical operation, the operator composes an inquiry message using the alphanumeric entry keyboard. As the message is composed, it is displayed on the crt. A chain of markers (underlines of symbol positions) indicate to the operator where the next symbol will be displayed. Initially, the markers extend from the left to the right edge in the top line of the raster. In this case, the marker in the upper left corner is called the entry marker.

Depressing a symbol key enters a symbol at this position and erases the marker. The next marker to the right now becomes the entry marker. After reaching the end of the line, the marker chain is automatically displayed in the next lower line. When the end of the last line is reached, the chain is re-displayed in the first line, with the marker in the upper left corner becoming the entry marker again.

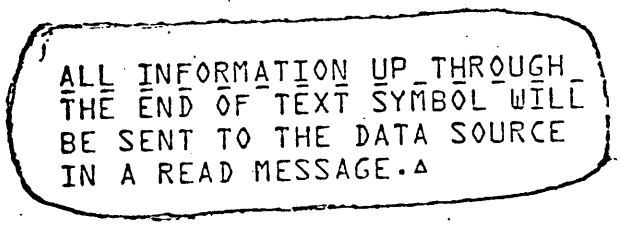


Either complete or partial message transmission is possible at the discretion of the user. A start of text indicator (■) may be inserted anywhere on the display page to indicate the starting point of transmission. Another indicator (Δ) is used to define the end of message. In this case, only data between the two symbols is transferred. If the start of text symbol is not used, the upper left corner of the raster becomes the starting position. The end of message symbol (Δ),

additionally, identifies the enclosed data as a READ message for transmission to the data source.



Partial Message



Complete Message

SECTION II

OPERATION

Operator action governs most of the communications network. This section describes in a general manner the operations necessary to begin communications. For more detail, refer to the applicable Reference/Customer Engineering Manuals.

Main power is applied via the control panel in the upper right corner of the Equipment Controller cabinet. Figure 2-1 shows the panel. Table 2-1 explains the function of each indicator and switch.

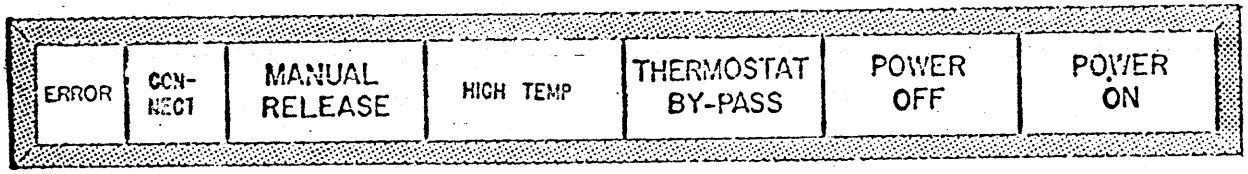


Figure 2-1. Control Panel

Table 2-1. Control Panel Functions

CONTROL	TYPE	FUNCTION
POWER ON	Push-button indicator-switch	When depressed, applies power to and clears all controller circuitry. Releasing the switch allows equipment operation to begin. Depressing the switch during operation master clears all controller circuitry. The switch lights whenever power is applied to the controller.
POWER OFF	Push-button switch	When depressed, removes power from the controller.
THERMOSTAT BY-PASS	Alternate-action push-button indicator-switch	If the indicator is not lit, depressing the switch lights the indicator and places the controller in the by-pass state. This state prevents an overtemperature condition from removing controller power. Depressing the switch again disables the by-pass state and turns off the indicator. In the by-pass state, the indicator remains lit if controller power is turned off.
HIGH TEMP	Indicator	Lights when controller temperature exceeds 110 degrees Fahrenheit. The indicator remains lit while an over temperature condition exists, even if controller power is off.
MANUAL RELEASE	Push-button switch	When depressed, resets the entry marker at each Display/Entry Station and clears all controller circuitry except data storage delay lines. Releasing the switch allows equipment operation to continue.
CONNECT	Indicator	Lights when a message is being received or transmitted by the controller.
ERROR	Indicator	Lights when an error is detected in an incoming message and turns off when the controller completes the error response message.

COMPOSING A MESSAGE FROM THE KEYBOARD.

The entry keyboard allows the operator to input data for communications with the data source. Assuming an initial power-off condition, use the foolowing steps to make the terminal operational.

(a) Depress POWER ON (figure 2-1).

(b) Rotate Display Station OFF/ON switch to ON position (figure 2-2).

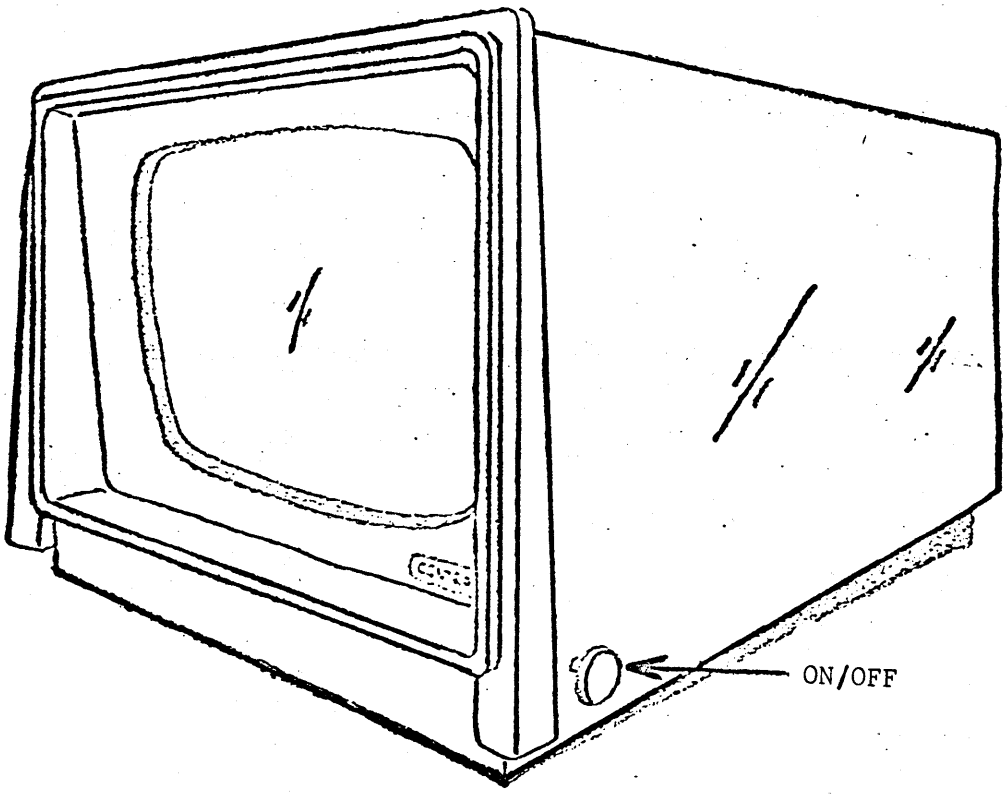


Figure 2-2. Display Station

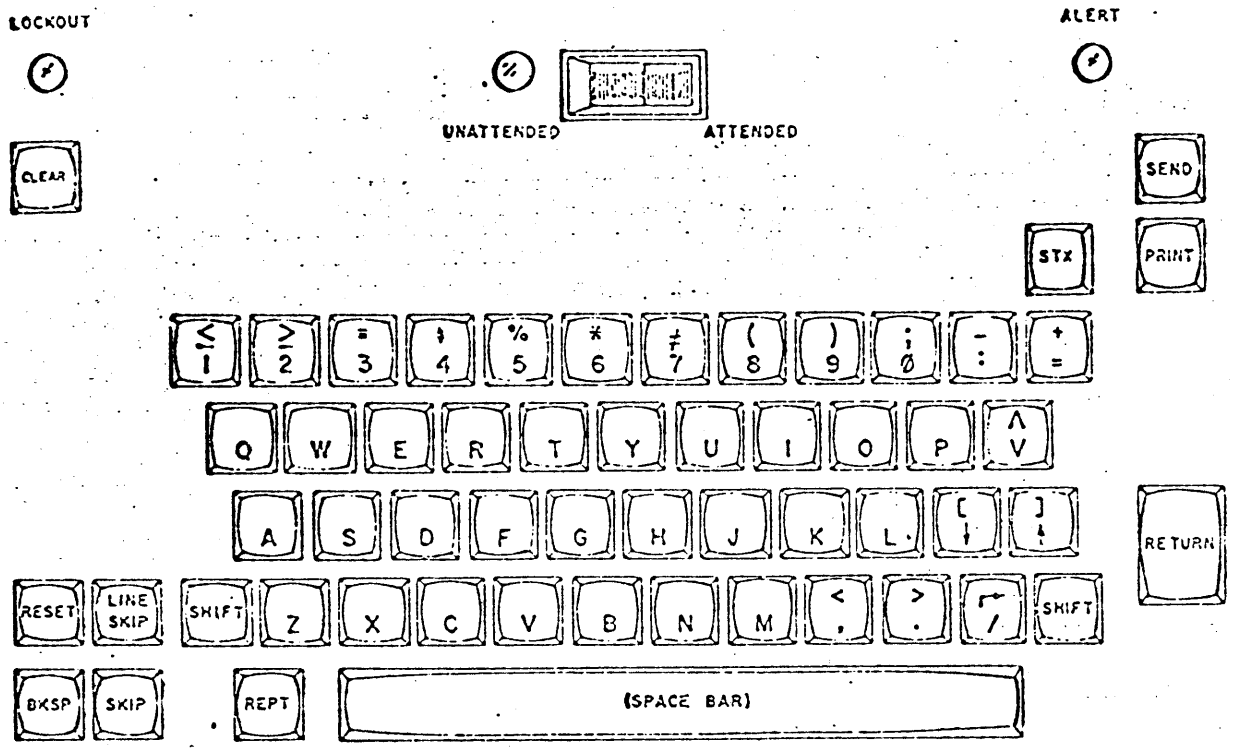


Figure 2-3. Keyboard

There are 44 alphanumeric keys on the keyboard. Depression of any key enables the corresponding symbol to be displayed at the current entry marker position and advances the marker one symbol position. The keyboard is electrically interlocked so the depression of two or more keys, simultaneously, results in display of only one of the selected symbols. The non-interlocking SHIFT keys are used to enable selection of the upper symbol on the two-symbol keys. They have no effect on single-symbol keys since the alphabet is in uppercase.

Should a symbol key be depressed when the entry marker references another symbol, the original symbol is replaced by the new

selection and the marker advances.

EDITING KEYS.

The following group of illustrations show the effect of the various editing keys on the display.

Skip.

The SKIP key advances the entry marker one symbol position without affecting data already displayed.

Backspace.

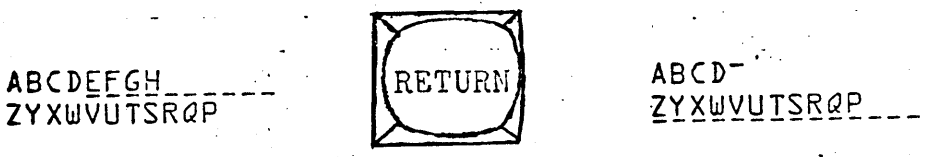
Depression of the BKSP key moves the marker one symbol position to the left without affecting displayed data.

Line Skip.

The marker chain is moved to the next lower line when the LINE SKIP key is used. Displayed data is unaffected.

Return.

The RETURN key inserts a carriage return symbol (¯) at the current entry marker position. All data to the right of this symbol is erased and the marker chain is moved to the next lower line.



Repeat.

Depression of the REPT key in conjunction with a second key performs a repeated action as designated by the second key. For example, depression of REPT and the "A" key causes repeated entry of the symbol "A" onto the display screen. The REPT key functions with all keys except the following:

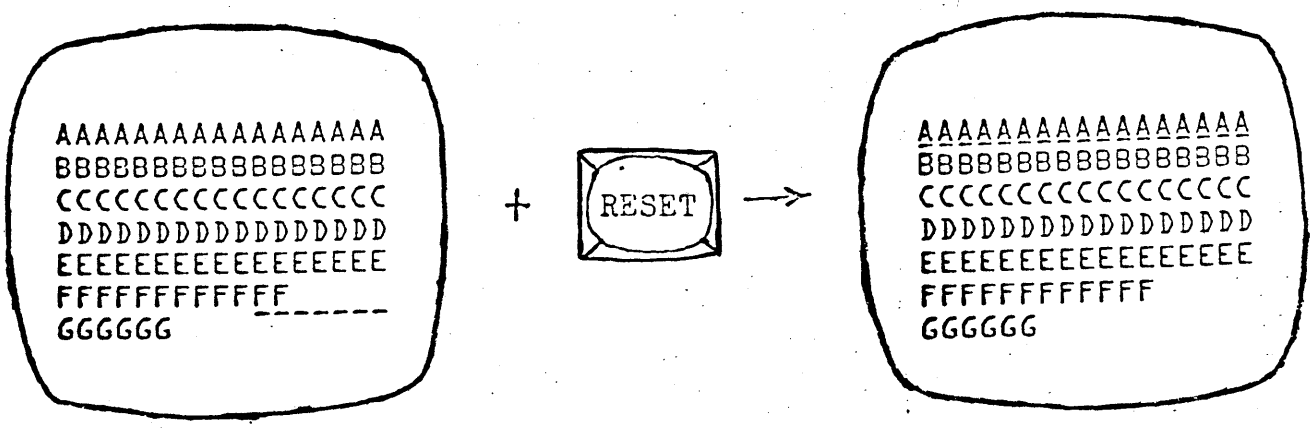
(a) PRINT

(b) SEND

(c) CLEAR.

Reset.

Depression of the RESET key moves the entire marker chain to the top line without affecting displayed data.



Clear.

The CLEAR dey erases all data from the raster and resets the marker chain to the top line.

TRANSMISSION CONTROL KEYS.

The remaining group of keys is classified as transmission control keys. They aid in determining output activity.

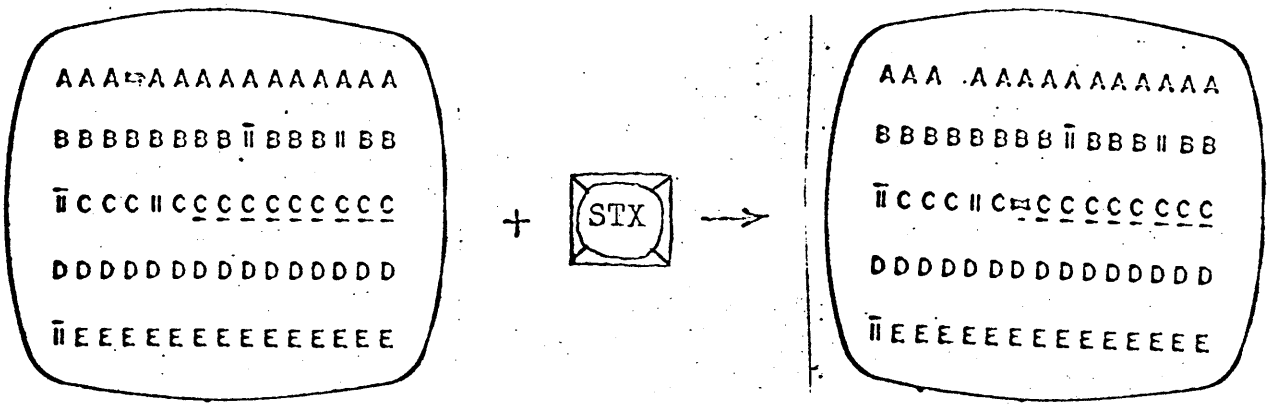
Transmission to Data Source.

At some point during the formation of a message, the operator should determine how much of the displayed message is to be transmitted. A start of text (STX) key permits the operator to maneuver the starting point. Use the following steps if a partial message is to be formed.

(a) Move the entry marker one symbol position to the left of the desired starting point.

(b) Depress the STX key. This inserts the associated symbol ( ) above the entry marker, and the marker is advanced. Any other STX symbol on the apge will be erased.

(c) The STX symbol will be the first symbol read by the computer, but will be read as a space.

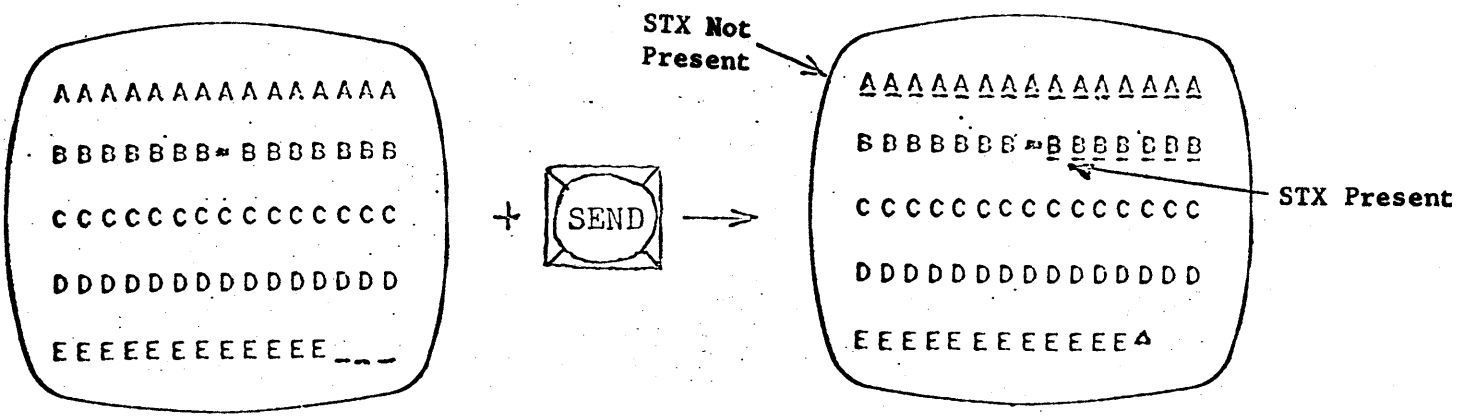


The SEND key is used to terminate the message and request the data source to read the displayed information. In addition, it locks out the keyboard (the LOCKOUT indicator will light); preventing any further key depressions until the message is read and a correct reply received. The MANUAL RELEASE button on the controller will release the keyboard without affecting the display.

(a) Move entry marker one symbol position to the right of the last symbol in the message.

(b) Depress SEND key. An end of message symbol ( ) will be displayed above the entry marker, and the marker chain will be reset. When reset, the entry marker will refer to the

STX symbol, if one exists, or the symbol in the upper left corner of the raster, if no STX symbol is present.



When the data source begins to read the displayed information, the CONNECT indicator on the controller lights. This indicator is illuminated whenever the terminal is transmitting or receiving information. As the read operation progresses, the entry marker continually advances. Upon completion of the read, it is displayed one symbol position to the right of the end of message symbol. The keyboard, however, remains locked out while the terminal awaits a reply from the data source.

Print Key.

Depressing the PRINT key will display the end of print symbol (') on the crt screen at the current entry marker position. However, since no printing equipment is available in the 3290-4 (Non-Edit) configuration, nothing further occurs.

Unattended/Attended and Alert Operation.

As long as the operator is present at the terminal, the UNATTENDED/ATTENDED switch should be in the ATTENDED position. Under normal circumstances, this means that the ALERT indicator and alarm will be activated when the data source wishes to send an alert function (the ALERT alarm can be turned off with the ALERT switch on the keyboard). This feature allows the operator to complete any message in progress and depress the SEND key. A depressed SEND key will prevent an incoming message from destroying the one composed locally, and turns off the light and alarm.

Whenever the site is to be vacated, but left operable, the UNATTENDED/ATTENDED switch should be placed in the UNATTENDED position. This allows the data source to gain access to the terminal for output purposes. Receipt of the first write message lights the UNATTENDED indicator and places the station in the unattended mode.

In the UNATTENDED mode, the ALERT light and alarm are disabled. Correct receipt of an alert function from the data source clears the display screen, displays an E1 symbol (Δ) in the upper left corner of the crt and resets the entry marker. This one character message is transmitted to the data source when the station is polled. The entire operation simulates SEND key depression. The ATTENDED mode can be re-established by placing the switch in the ATTENDED position.

Lockout Indicator.

The LOCKOUT indicator is illuminated whenever the keyboard is disabled. Under normal operating conditions, this situation occurs in the following circumstances:

(a) Depressing the SEND key lights the LOCKOUT indicator and disables the keyboard. The keyboard is released and the lockout light is extinguished 40 milliseconds after the READ message has been completed.

(b) When the Display Station with which the keyboard is associated begins to receive a write message from the data source modifying the display presentation. The keyboard is released and the LOCKOUT indicator goes out upon completion of the write message.

(c) When the data source reads the information stored in the Display Station delay line. The keyboard is released and and the LOCKOUT light extinguished 40 milliseconds after the READ message is completed.

(d) When the keyboard is in the UNATTENDED mode.

HINTS ON USE OF DISPLAY/ENTRY STATION.

Use RESET rather than CLEAR. Avoid retyping a command; instead update by using SKIP key.

Press SEND to enter end of message symbol (Δ) at entry

marker position, this transmits all data on display from upper left character or STX to Δ .

To send an entire screen, press RESET, BKSP, and SEND. This places the end of message symbol (Δ) in the lower right corner. Use this technique to save data on nonrecord commands.

Rapid movement of entry marker is accomplished by using REPT key with SKIP, SPACE bar, and LINE SKIP.

To move quickly to the end of a line, press LINE SKIP and BKSP.

Do not insert data to the right of a carriage return.

Avoid use of SPACE bar except in original input data. Use SKIP for editing.

SECTION III

PROGRAMMING

The 3290-4 (Non-Edit) Multistation Terminal is designed for operation with the 3000 series of computers and associated data channels. Communications between the terminal Equipment Controller and data channel is via data cable and data is passed in parallel.

SIGNAL LINES.

Communications between controller and data channel consists of three types of signals: command signals which are isued to the controller by the data source directing that certain operations be performed, control signals which are issued by either data source or controller to the other that indicate that certain conditions exist or that certain operations have been performed, and information signals which pass the actual data and the status of the terminal (figure 3-1).

COMMAND SIGNALS.

Command signals issued by the data source to the terminal are: the Connect signal, Function signal, Data signal, Read signal, Write signal, Suppress Assembly/Disassembly signal, Negate BCD Conversion signal, and the Master Clear signal.

Connect Signal.

The Equipment Controller receives a Connect signal when the data source wishes the terminal to interpret the code on the Data Lines as a Connect Word. The controller connects only if power is on, parity

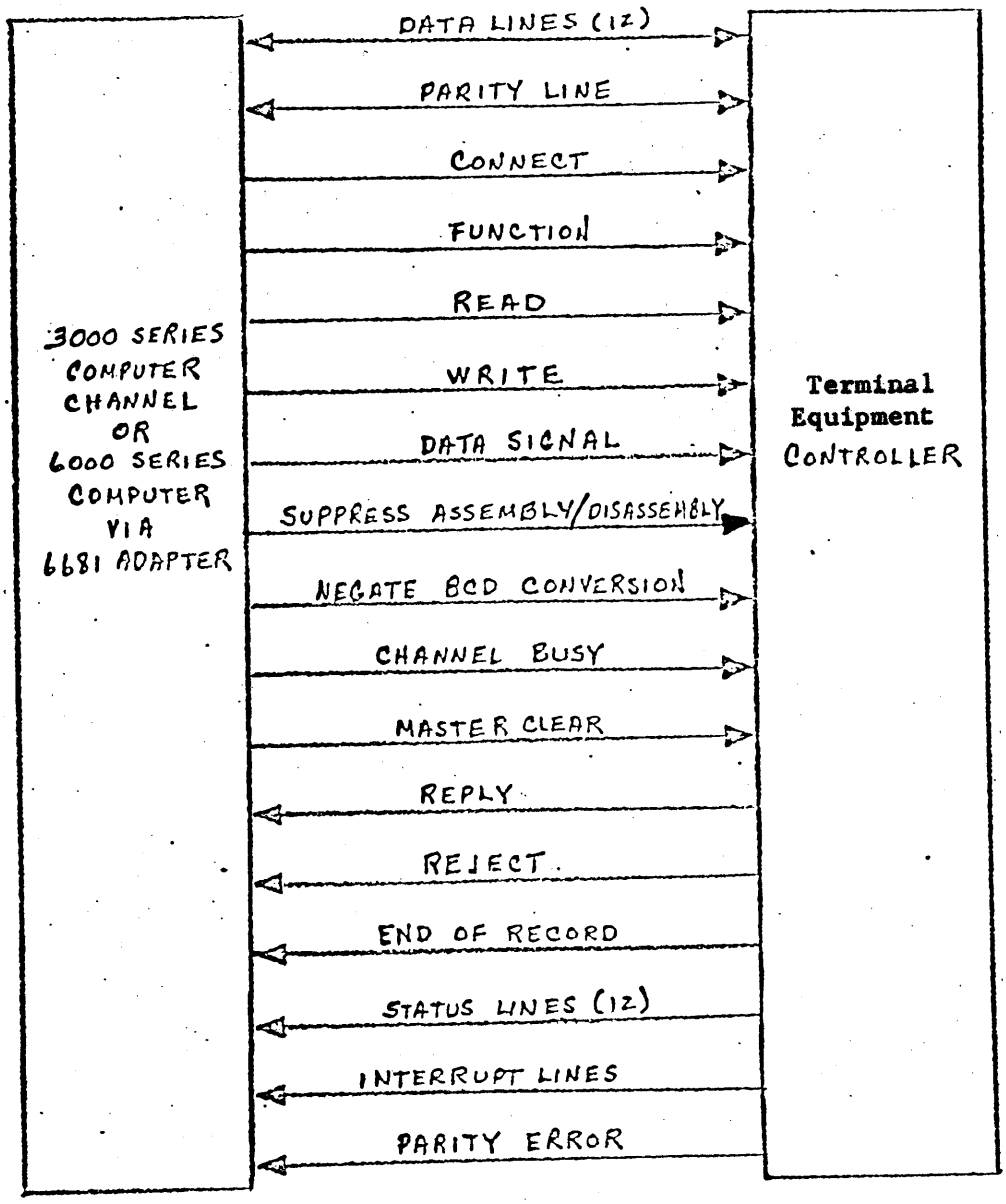


Figure 3-1. Communications Lines Between Data Channel and Terminal Equipment Controller.

is correct, and the most significant 3 bits (2^{11}, 2^{10}, and 2^{9}) of the connect word match the number setting of the EQUIP SELECT switch on the interface module. If a parity error exists on the connect word, the controller does not respond but the ERROR indicator on the controller external switch indicator panel lights on all Equipment Controllers

associated with that communications channel. After a delay of 100 microseconds, the data channel generates its own internal reject signal.

Once a controller connects to the computer, it remains connected until the data source initiates a disconnect. A connect code with the upper 3 bits not matching the controller Equipment Select code, a Master Clear signal, or a release function code performs a disconnect.

Function Signal.

The Function signal is a command by the data source for the controller to interpret the word on the Data Lines as a function code. If the controller is connected to the data channel and can execute the function at the time it receives the Function signal, it initiates the function and returns the Reply signal. If the controller cannot perform the function, it returns a Reject signal. The data source drops the function signal and the 12 bit function word upon receipt of the Reply or Reject signals. If a Reply or Reject signal return within a 100 microseconds, the computer generates its own internal reject. If parity error exists on the function code, the controller does not perform the function but returns a Parity Error signal and the ERROR indicator on the controller panel lights.

Once the controller accepts a function code, all other function codes are locked out until it acts on the first one. The controller does not stack up the function codes; it returns a Reply or Reject within 5 microseconds.

Read Signal.

The Equipment Controller interprets a Read Signal as a command to begin reading data from a station memory.

Write Signal.

The Equipment Controller interprets a Write signal as a command to begin writing data into a specified station memory.

Data Signal.

The computer sends a Data signal to the cotroller for each 12 bit data word during read or write operations. When the controller transmits a Reply (or End of Record) signal, the Data signal drops.

During a read operation, the Data signal indicates the computer is ready to accept a 12-bit data word from the controller. During a write operation, the Data signal indicates the computer has placed a 12-bit data word on the data lines.

Suppress Assembly/Disassembly Signal.

During a read operation, the Suppress Assembly/Disassembly signal forces the controller to assemble 0's in bits 6 through 11 of each 12-bit byte. In a write operation, bits 6 through 11 are not used when the Suppress Assembly/Disassembly signal is enabled. The signal has no effect on the address word during a read operation initiated by an interrupt.

Negate BCD Conversion Signal.

Information from the computer is in either internal or external binary coded decimal (BCD) form. When the data channel sends a Negate

BCD Conversion signal to the controller, communication takes place using external BCD codes. When the Negate BCD Conversion signal drops, communication takes place using internal BCD codes.

Master Clear Signal.

A Master Clear Signal sent from the computer returns the Equipment Controller to its initial condition and starts the polling operation if a poller is included in the system.

CONTROL SIGNALS.

Control signals used between data channel and controller are: Channel Busy, Reply, Reject, End of Record, Interrupt, and Parity Error.

Channel Busy Signal.

The Equipment Controller receives a Channel Busy signal when the computer communications channel is active during a read or write operation.

Reply Signal.

The controller transmits a Reply signal in response to the following:

(a) A connect code with no parity error when the equipment select code matches the number selected by the EQUIP SELECT switch, status is ready, and the controller is not busy. The station select code must reference an existing station except in response to an interrupt when the select code may be 0000.

(b) A function word with no parity error provided the controller can perform the specified function at the time it receives the Function signal.

(c) A write operation after the controller samples the data lines in response to a Data signal.

(d) A read operation when the controller has a word on the data lines in response to a Data signal. The End of Record is an exception to this condition.

The Reply signal drops when the Connect, Function, and Data signals drop.

Reject Signal.

The controller transmits a Reject signal in response to the following:

(a) A connect code (with no parity error) specifying a non-existent or busy station.

(b) A function code (with no parity error) specifying an illegal function.

(c) A function code (with no parity error) which cannot be performed within 5 microseconds after receipt of the Function signal.

(d) An Alert function to a poller that had its alert request status cleared.

End of Record Signal.

The Equipment Controller transmits an End of Record signal (instead of a Reply signal) in response to the next Data signal following transmission of an End of Message code or a local station status word. The End of Record signal drops when the Data signal drops. If the Read signal drops before the read operation completes, the controller does not transmit the End of Record signal.

Interrupt Signal.

Each Equipment Cintroller attached to a given data channel is assigned to one of eight separate interrupt lines selected by the equipment select switch. The Interrupt signal indicates to the computer that a predetermined condition has been reached. The interrupting condition can be determined by a program sampling the status lines following transmission of an Interrupt signal if the controller is connected. The interrupt drops upon receipt of a master clear, select function code, release function code, or clear function code for that particular interrupt.

Parity Error Signal.

The controller transmits a Parity Error signal when a parity error exists on a function code or a write operation. A Parity Error signal is not generated for a parity error occurring on a connect code or a read operation. During a write operation, a parity error on one word of a 12-bit byte results in display of both words as parity error symbols when the Suppress Assembly/Disassembly signal is disabled.

INFORMATION SIGNALS.

Information signals exchanged between computer and terminal are; data signals passed in parallel over twelve lines, the parity bit signal accompanying each data word, and the status signals, passed in parallel over 12 lines.

Data Lines.

During a read operation (input to the computer), the 12 data

lines carry data, 12 bits at a time, from the controller to the computer. During a write operation (output from the computer), the lines carry data from the computer to the controller. The data lines also transmit 12-bit connect and function codes associated with Connect and Function signals.

Parity Bit Signal.

A parity bit accompanies each 12 bits of data, connect code, and function code transmitted between the computer and the controller. Odd parity is used, i.e., the total number of 1's transmitted is always an odd number.

Status Signal Lines.

Following a connect operation, the controller places information on the status lines to indicate its operation conditions to the computer. Display subsystem status remains enabled to the computer until the controller is disconnected. The computer may sample the status lines at any time.

COMMAND AND CONTROL CODES.

Controller command and control codes include connect, function, and status codes. The connect code is used in addressing the display subsystem. Function codes, with the exception of reset, reset clear, alert, read station status and release, set up and remove interrupt conditions in the controller. Status codes indicate the conditions existing at the Equipment Controller. Following is a description of the connect code, function code, and status line assignments.

CONNECT CODE.

The computer transmits the connect code to the controller over the 12 data lines along with a connect signal. The controller interprets the connect code as follows:

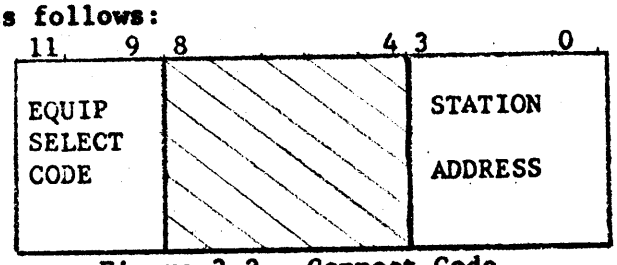


Figure 3-2. Connect Code.

Bits 9 through 11 designalte the number setting of the controller equipment selector switch. The station address portion of the connect code allows selection of any station in the controller.

FUNCTION CODES.

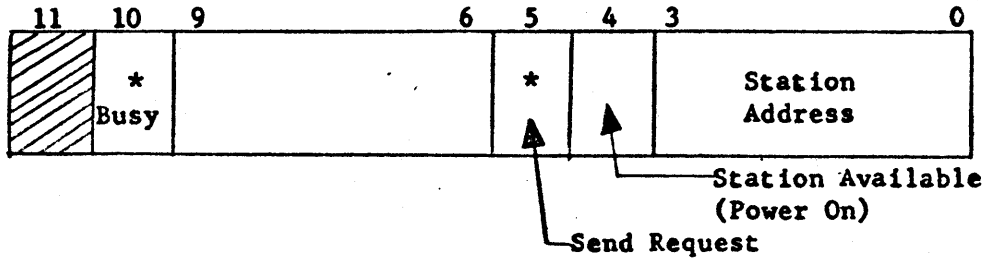
The data source transmits the 12-bit function code over the 12 data lines along with the Function signal on the function line. Table 3-1 lists and describes the controller function codes.

Table 3-1. Controller Function Codes.

CODE	TITLE	OPERATION
0000	Release	Disconnects the subsystem from the channel, clears all interrupt selections, and clears the Parity Error signal.
0010	Reset	Positions the entry marker on the selected Display Station to the first symbol position of the page. The Display Station indicates busy status for 20 to 40 milliseconds after receipt of the function.

Table 3-1. Controller Function Codes (Cont).

CODE	TITLE	OPERATION
0011	Reset-Clear	Positions the entry marker on the selected Display Station to the first symbol position of the page and clears the memory of the selected Display
		Station. The station indicates busy status for 20 to 40 milliseconds.
0012	Clear Send Request	Clears the send request causing the present station interrupt, but allows the station keyboard to remain locked out and the send request status to remain active until that station has been read by the computer.
0013		Reserved.
0014		Reserved.
0015	Read Station Status	Allows a one-word read (without resetting the selected station's entry marker) to check station status and the keyboard status switches. Response words to 0015 are in the following format. A release function or End of Record signal after the one-word read clears the 0015 function.



Display Station Response to Read Station Status

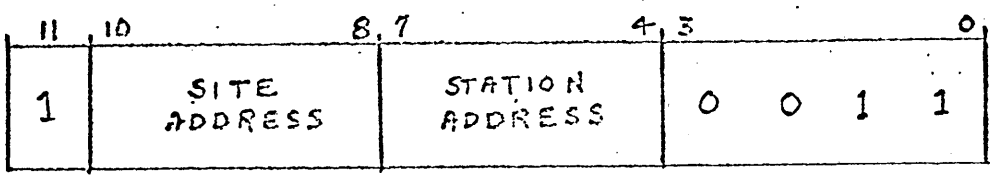
*** Indicated in controller status bits.**

Table 3-1. Controller Function Codes (Cont).

CODE	TITLE	OPERATION
0022	Enable Interrupt on End of Operation	Allows generation of an interrupt when a read, write, or a reset or reset-clear operation is complete by the selected station. Reselection removes the previous interrupt and enable.
0023	Clear Interrupt on End of Operation	Removes the 0022 interrupt and enable.
0024	Enable Alert Interrupt	Enables generation of an interrupt upon completion of an alert message by a poller. Reselection removes the previous interrupt and enable.
0025	Clear Alert Interrupt	Removes the 0024 interrupt and enable.
0026	Enable Station Interrupt	Enables generation of an interrupt if a SEND key at a local Display Station is depressed or a Typewriter Station has completed a computer-initiated printout. Reselection removes an interrupt resulting from a previous selection if a read or write operation was performed on the interrupting station prior to reselection. Function 0012 removes the interrupt condition on the selected station. Stacking of station interrupts is possible. If more than one station has a SEND key depressed, another interrupt occurs immediately after reselection.

Table 3-1. Controller Function Codes (Cont).

CODE	TITLE	OPERATION
0027	Clear Station Interrupt	Removes 0026 interrupt and enable.
1XXXXXXX0011 (Binary)	Alert	Sends an Alert signal to the connected station. If the connected station is a poller, bits 4 through 7 indicate the remote station and bits 8 through 10 indicate the remote site to be alerted. If not a poller, bits 4 through 10 are ignored.



Alert Code Format

STATUS CODES.

Twelve status lines indicate subsystem operating conditions to the computer. The computer may sample these lines at any time after being connected to the terminal. Table 3-2 identifies status conditions, lines, and octal code characteristics of the Equipment Controller. The computer may sample any single status line or group of lines.

All conditions listed in table 3-2 except send request are general status conditions, i.e., the computer connects only to the controller and any existing station before sampling status. Lines 0, 2, 3, 4, 5, and 10 are on a per station basis, i.e., a specific station must be addressed before sampling status.

Table 3-2. Controller Status Conditions.

STATUS LINE	OCTAL CODE	CONDITION	OPERATION
0	XXX1	Ready	Power on in the controller indicates ready status.
1	XXX2	Busy	The controller indicates busy status for the following conditions: 1) Channel Busy and Write signals are enabled. 2) Channel Busy and Read signals are enabled. 3) During a reset function. 4) During a reset-clear function. 5) When the connected station is busy.
2	XXX4	Send Request	Indicates the SEND key has been depressed at a Display Station.
3	XX1X	Print Request	**Not Used.**
4	XX2X	Poll Message Error	Indicates the connected poller has been unable to receive an expected response to a poll message in three tries.
5	XX4X	Alert Request	Indicates the connected poller is ready to process an alert function from the channel and that the previous alert has been processed.
6	X1XX	Station Interrupt	Indicates a station interrupt is present due to actuation of one or more SEND keys at Display Stations.
7	X2XX		**Not Used.**

Table 3-2. Controller Status Conditions (Cont).

STATUS LINE	OCTAL CODE	CONDITION	OPERATION
8	X4XX	End of Operation	Indicates generation of an interrupt by the end of a read or write operation or 1 millisecond before the end of the reset or reset-clear operation at any Display Station
9	1XXX	Alert Interrupt	Indicates generation of an interrupt by a poller on completion of an alert message.
10	2XXX	Poller Error	Indicates an error condition exists after three attempts to write to or alert a remote site are unsuccessful.
11			Not used (for multichannel equipment).

INTERRUPTS.

Interrupts permit the display subsystem to indicate to the computer certain preprogrammed conditions. The computer can selectively activate or deactivate these interrupt conditions. Three conditions generate an interrupt and three function codes enable these interrupts to the computer. Table 3-3 lists the interrupt conditions and the enabling and disabling functions. Refer to the specific enabling function code (table 3-1) for a complete description of the interrupt conditions.

Table 3-3. Controller Interrupts.

NAME	FUNCTION CODE	
	ENABLE	DISABLE
End of Operation Interrupt	0022	0023
Alert Interrupt	0024	0023
Station Interrupt	0026	0027

The computer must connect to a specific station before issuing any interrupt enable function codes. Normally, it checks controller status immediately following the connect. To perform a reset operation (function code 010) or a read or write operation and be informed when the operation is complete, the computer transmits function code 022 (interrupt on end of operation) prior to the operation.

The display subsystem sends the end of operation interrupt a maximum of 33 microseconds after the read or write line disables if the interrupt is selected previous to a read or write operation. Until the read or write operation is complete, the display subsystem is busy and status line 1 is enabled. Following a reset or reset-clear function, the subsystem is busy until the reset or reset-clear function is complete. When the function is complete, the subsystem becomes not busy. The Display Station sends the end of operation interrupt 1 millisecond before the reset or reset-clear is complete. If a read or write operation follows a reset operation, an additional 1 to 20 millisecond delay (after sending the end of operation interrupt) occurs before memory accepts the first word of data.

The computer transmits function code 0026 (station interrupt enable) to receive data from a Display Station. Actuating the SEND key on this station, or any Display Station, transmits an interrupt.

Upon receiving an interrupt from the display subsystem, the computer normally connects to the Equipment Controller and samples status to determine what caused the interrupt. It can immediately perform a read operation following a connect word having a station address of 0000 if the interrupt is a station interrupt. A write operation requires connecting to a specific station before beginning the operation. After servicing the interrupt, reselcting or deselecting the same interrupt (except station interrupt) clears the interrupt line.

CONNECT SEQUENCE.

The connect word contains information which directs the controller to connect the data channel to the designated Display Station. Bits 9 through 11, the equipment select code, designate the equipment number which may be shosen on the EQUIP SELECT switch. Bits 0 through 3 (the station address code) select the specific Display Station with which the computer is to communicate. A station address of 0001 through 1100 binary designates one of the twelve correspondingly numbered Display Stations. A station address of 0000 binary indicates that the computer requests a check of status conditions or requests to communicate with the station causing an interrupt. Absence of an interrupt on a station address of 0000 prevents station connection.

Figure 3-3 shows the sequence of events upon receipt of a Connect signal. If the Equipment Controller is in a ready state, it checks parity on the Connect signal. A parity error at this time illuminates the ERROR indicator and the controller disconnects. Assuming parity is correct, the equipment select switch setting is compared to the equipment select code. If they are not equal, a disconnect is performed in about 1 microsecond. An exact comparison enables the status

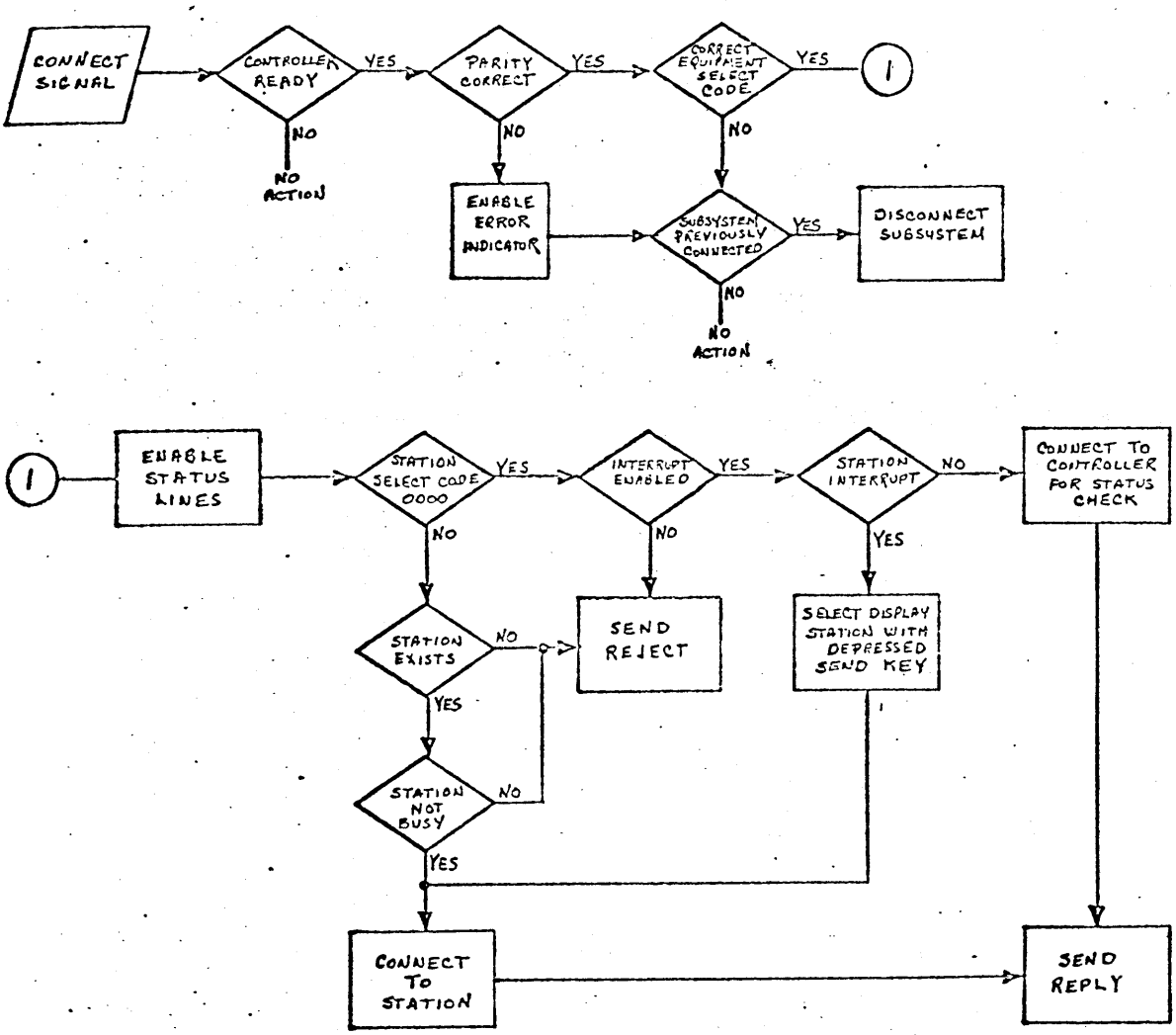


Figure 3-3. Connect Sequence.

lines. After comparing the equipment select code, the controller examines the station address code for the address of an existing Display Station. If the station is non-existent or busy, after 2 microseconds the controller sends a Reject signal to the computer. If the addressed Display Station exists and is not busy, the controller responds with a Reply signal in approximately 2 microseconds.

When the station address portion of the connect word contains all 0's and a station interrupt is not pending, the controller returns a Reject signal to the data source. If, however, a station interrupt does exist, the controller responds with a Reply signal and the interrupting station connects. The computer then reads at least the station word and normally continues reading all of the station's data. If an alert or end of operation interrupt exists, the computer connects to the Equipment Controller for reading status only; no read or write operation is performed.

FUNCTION SEQUENCE.

Once connected, the Equipment Controller is ready to perform any function requested by the computer in addition to read or write operations. Figure 3-4 shows the sequence of events upon receipt of a Function signal.

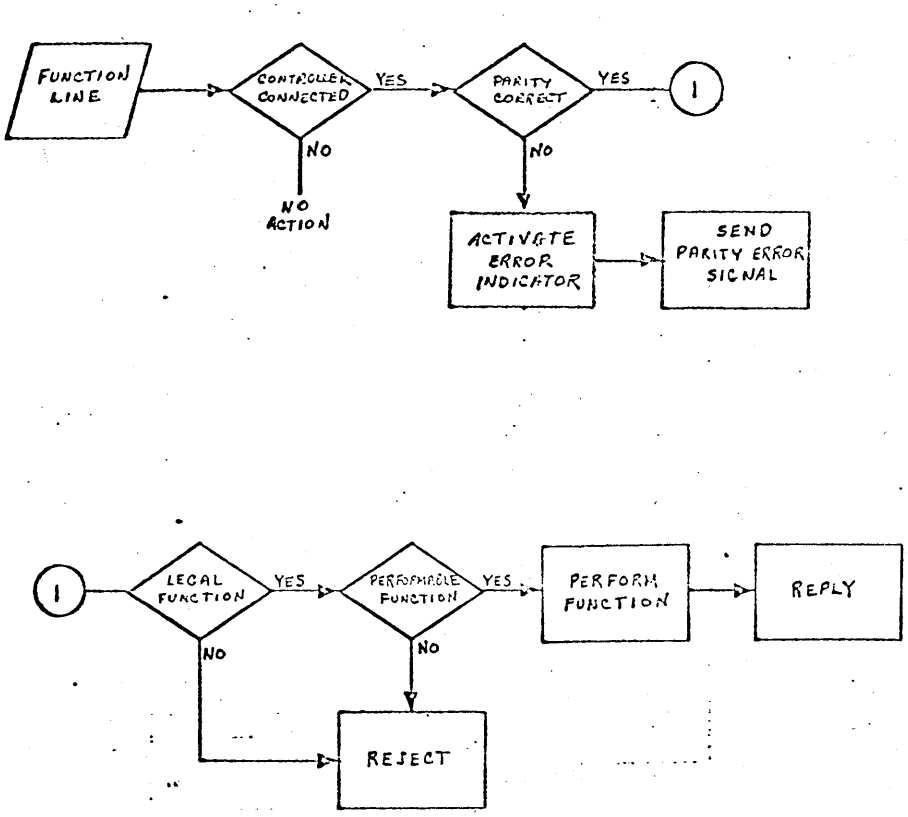


Figure 3-4. Function Sequence.

DATA TRANSFER.

The controller sends and receives data on the data lines in 12-bit bytes and 6-bit codes in the format shown in figure 3-8.

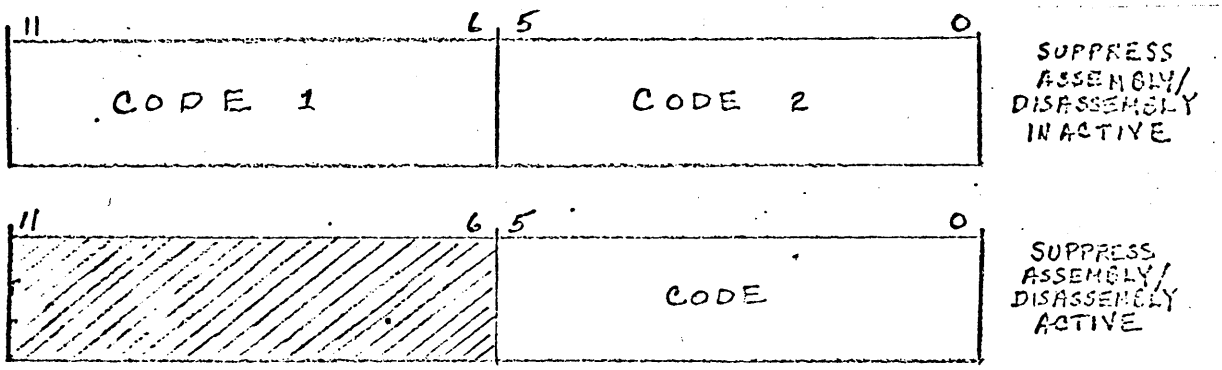


Figure 3-8. Data Word Format.

The input/output register in the controller handles packing and unpacking chores for read and write operations. The most significant 6 bits of the data are always filled or emptied first. This means that the upper register is always first to fill or empty. If the computer enables the Suppress Assembly/Disassembly line, the upper register is disabled or locked out of the operation for the duration of the signal. The lower register, which handles the least significant 6 bits, is unaffected by the Suppress Assembly/Disassembly signal; therefore, data transmission takes place in the form of one 6-bit word at a time.

Each 6 bits may contain one symbol code. Symbols display from left to right as they are received. Delay-line memory characteristics limit the data transfer rate to 25,000 12-bit words per second if the Suppress Assembly/Disaassembly signal is inactive or to 50,000 6-bit words per second if the Suppress Assembly/Disassembly signal is

active.

The time required for symbol transfer by the memory is 16.8 microseconds. Memory cycle time is 20 milliseconds. During a read or write operation, successive data bytes must follow within 33.6 microseconds if the Suppress Assembly/Disassembly signal is inactive or 16.8 microseconds if the Supress Assembly/Disassembly signal is active. If successive data bytes do not follow within the specified time, a 20 millisecond delay occurs between bytes due to delay-line latency characteristics.

READ/WRITE OPERATIONS.

Read or write operations from or to a local Display Station may be performed any time at computer discretion after checking status. The computer-initiated action takes priority over the operation. Initiation of a read or write operation during operator keyboard message composition locks out the keyboard and computer operation takes over.

Programmed instructions from the computer or SEND key actuation initiate read operations. Only the computer initiates write operations. A description of read and write operations follows.

Read Initiated by a Requesting Station.

Since the computer controls all data transmission to and from the terminal, a Display Station must request a Read Operation in order to pass information from the station memory to the data source. Figure 3-6 is a flow diagram of Read Operations. The requesting Display Station inserts the end of message symbol ( ) at the entry marker position and moves the entry marker to the upper left corner or to the STX symbol ( ). If the computer has enabled function code 026, it receives a station interrupt. The computer responds to the interrupt with a connect code containing a station address of 0000 binary. The controller then activates the status lines, and connects to the requesting station in scanning sequence.

The computer now has three options: it can go away and ignore the send request, it can read staion status with a function code 15, or it can enable the read line and receive the station word (figure 3-5).

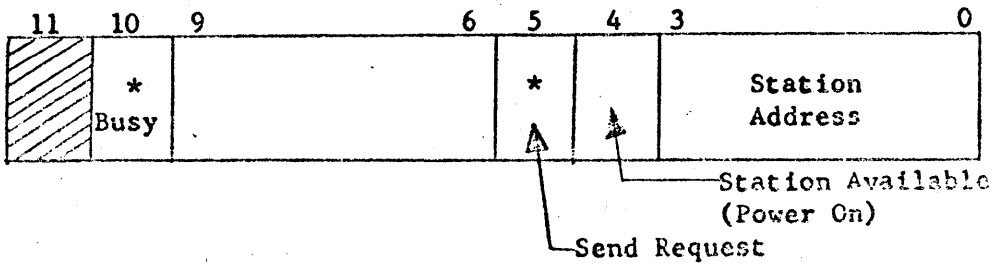
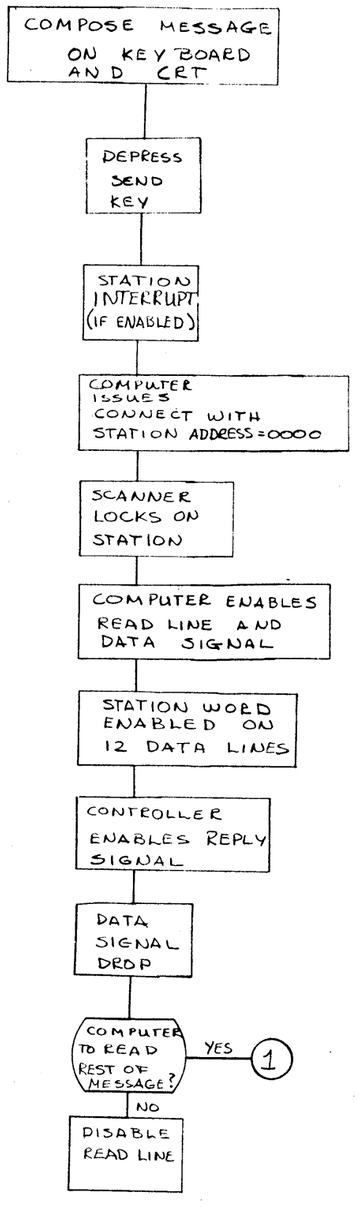


Figure 3-5. Station Word.

The computer must initiate the read operation to clear the send request status. If the computer does not perform a read operation, it receives the station interrupt again upon the next station interrupt enable.

The Equipment Controller sends the station word containing

STATION - INITIATED READ OPERATION



COMPUTER - INITIATED READ OPERATION

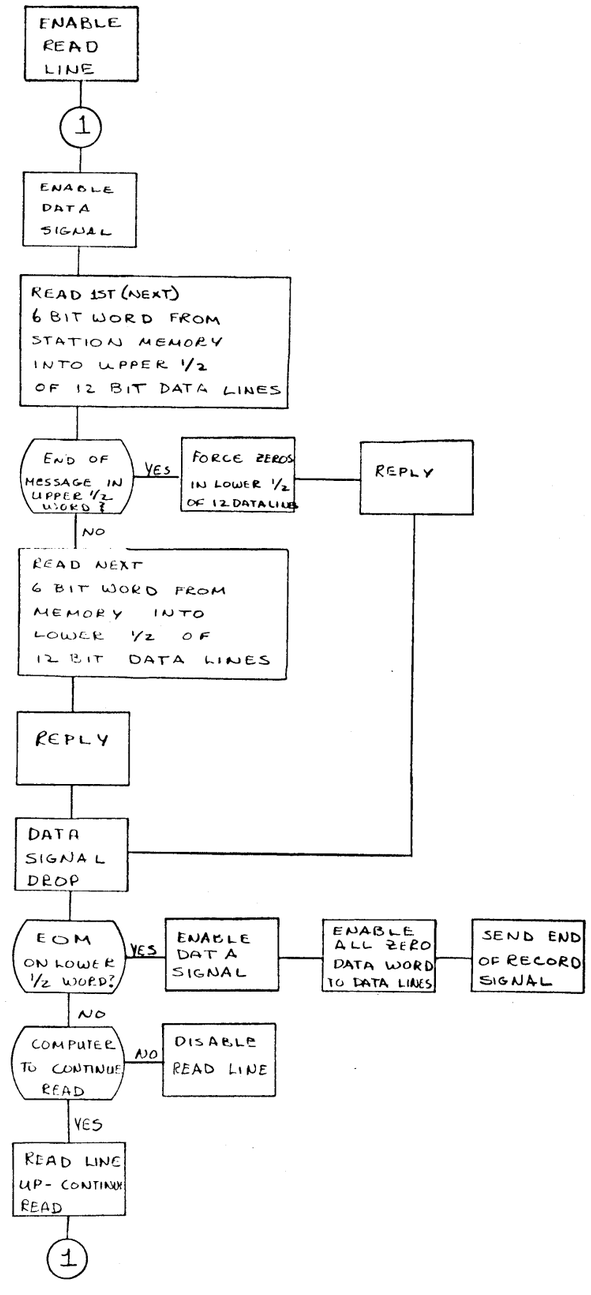


Figure 3-6. Read Operation Flow Diagram.

the number of the scanner selcted requesting station in response to the first Data signal during a station interrupt-initiated read operation. Succesive words after the station word contain data stored in the delay line starting at the entry marker position.

The computer receives the end of message code in a data word. If the end of message code is in the upper half of the 12-bit data word, the lower half of the word contains all zeros. In response to the next Data signal following an end of message code, the controller sends an End of Record signal accompanied by an all zero data word instead of the Reply signal. The read operation terminates when the Read signal disables for more than 2 nanoseconds. Data may be read, therefore, beyond the end of message code if the Read signal remains enabled.

Read Initiated by the Computer.

The computer may initiate a read operation at any time the connected local Display Station is not busy. Discretion is required in the use of this operation since it prevents entry od data by a Display Station operator. After connecting, the entry marker may be moved to the upper left corner by the reset function or may be left at its current position. In response to the Read and Data signals, the controller sends data words along with the Reply signal. The controller does not send the station word in response to a read operation after a connect to a specific station.

Write to a Display Station.

Data may be sent to a connected Display Station at any time

the station is not busy. After connecting and checking status, the computer sends data words to be written on the crt starting at the entry marker. A reset or reset-clear function may move the entry marker to the upper left corner before data writing begins. Sequential symbols in data words appear from left to right and from top to bottom on the crt. After the last symbol is written in the lower right corner, the entry marker moves to the upper left corner and data writing may con continue with the later data replacing data written earlier (figure 3-7).

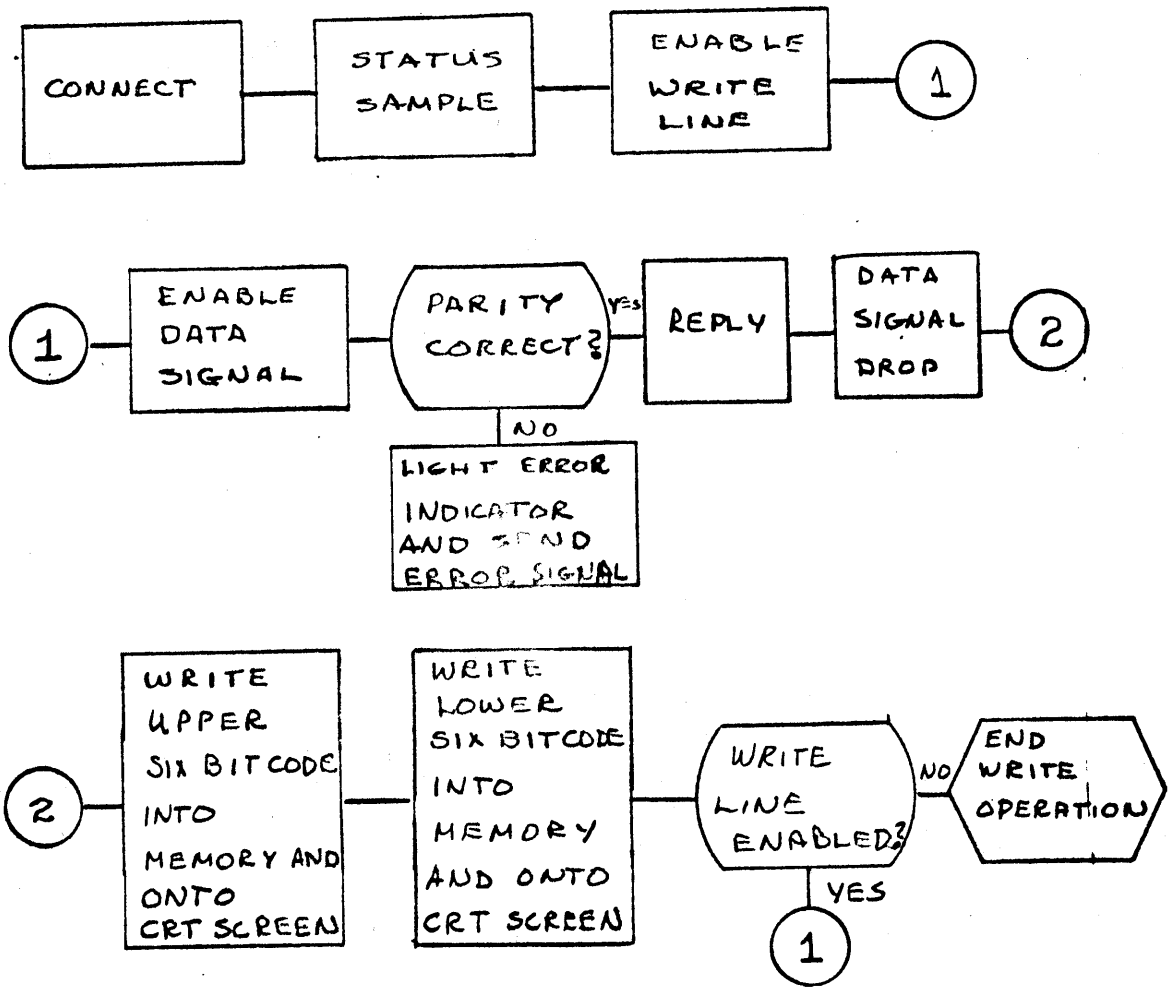


Figure 3-7. Write Operation Flow Diagram.

SYMBOL CODES.

Octal codes 00 through 77 enable the 63 symbols and space. Table 3-4 lists the external and internal BCD codes for the symbol repertoire. Although controller internal circuitry uses 7 bits, the 2^6 bit drops at the interface. Incoming and outgoing data, therefore, is in the form of 6-bit codes.

Table 3-4. Symbol Repertoire.

CODE		SYMBOL DISPLAYED OR PRINTED	CODE		SYMBOL DISPLAYED OR PRINTED
EXTERNAL	INTERNAL		EXTERNAL	INTERNAL	
00	12	: (colon)	40	40	- (minus)
01	01	1	41	41	J
02	02	2	42	42	K
03	03	3	43	43	L
04	04	4	44	44	M
05	05	5	45	45	N
06	06	6	46	46	O
07	07	7	47	47	P
10	10	8	50	50	Q
11	11	9	51	51	R
12	00	ø	52	52	V (logical OR)
13	13	= (equal)	53	53	$ (dollar sign)
14	14	≠ (not equal to)	54	54	* (asterisk)
15	15	≤ (less than or equal to)	55	55	↑
16	16	% (per cent)	56	56	↓
17	17	[(left bracket)	57	57	> (greater than)
20	60	SPACE	60	20	+ (plus sign)
21	61	/ (diagonal)	61	21	A
22	62	S	62	22	B
23	63	T	63	23	C
24	64	U	64	24	D
25	65	V	65	25	E
26	66	W	66	26	F
27	67	X	67	27	G
30	70	Y	70	30	H
31	71	Z	71	31	I
32	72	] (right bracket)	72	32	< (less than)
33	73	, (comma)	73	33	. (period)
34	74	((left parenthesis)	74	34	) (right parenthesis)
35	75	■ Parity Error	75	35	≥ (greater than or equal to)
36	76	' E2 Code (End of Print)	76	36	▪ (Carriage Return)
37	77	^ (logical AND)	77	37	Δ (End of Message)

SECTION IV

PROGRAMMING AIDS

This section summarizes the discussions presented throughout the text of this publication. In addition, a list and explanation of certain instructions plus a sample program are given. These are intended to aid the user in the operation and programming of the 3290-4 (Non-Edit) Terminal.

UNATTENDED OPERATION.

The UNATTENDED/ATTENDED seitch on the keyboard allows the data source to use the terminal's output facilities without the presence of the operator. To go UNATTENDED, the operator must:

(1) Place the UNATTENDED/ATTENDED switch in the UNATTENDED position.

(2) Compose a message, using the keyboard, informing the data source that the station will no longer be attended.

(3) Depress the SEND key.

This unattended message will be received as a response to the next poll. The data source should then send a write message. Once a correct write message is received by the terminal, the UNATTENDED indicator lights and the terminal is officially in the UNATTENDED mode.

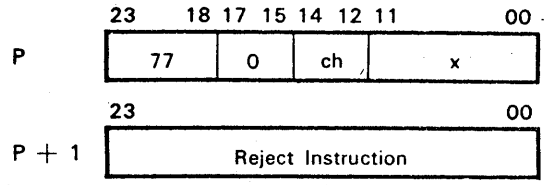
If the data source is in the habit of transmitting write messages only as responses to read messages, the sequence can continue. In the ATTENDED, mode, an alert message solicited an alarm. A read message response to a search could not be received until the SEND key

was depressed. The alert sequence still takes place in UNATTENDED operation, but the ALERT light and alarm are deactivated. The alert message produces a read request, so an automatic one word (E1) read message is available when the station again is polled.

INSTRUCTIONS TO THE COMPUTER.

When programming a 3000 series computer for use with the 3290-4 (Non-Edit) terminal, certain instructions are of interest. The following paragraphs give a brief description of each instruction. For a more complete description, see Control Data Corporation Publication 60043800, 3200 Computer System Reference Manual.

CON-Connect

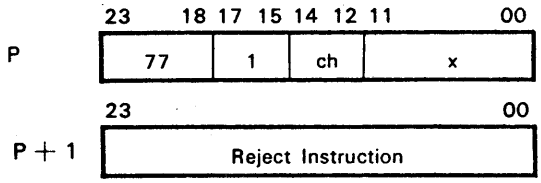


ch=I/O channel designator, 0-7

x = 12 bit Connect Code, see figure 3-2.

This instruction sends a 12-bit connect code along with a connect enable to the terminal equipment controller on the I/O data channel. If a Reply is received from the controller within 100 microseconds, the next instruction is read from address P+2. If a Reject is received or there is no response within 100 microseconds, a reject instruction is read from address P+1. If the I/O channel is busy, a reject instruction is read from address P+1.

SEL-Select Function



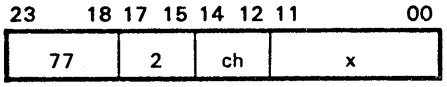
(Approximate execution time: indeterminate)

ch=I/O channel designator, 0-7

x =12-bit function code. See table 3-1 for a list of controller function codes.

This instruction sends a 12-bit function code along with a function enable to the terminal connected to the data channel. If a Reply is received from the terminal within 100 microseconds, the next instruction is read from P+2. If a Reject is received or there is no response within 100 microseconds, a reject instruction will be read from address P+1. If the I/O channel is busy, a reject instruction is read from address P+1.

EXS-Sense External Status



(Approximate execution time: 1.3-1.7 μsec.)

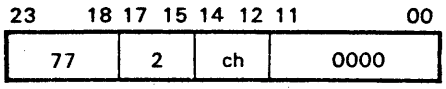
ch=I/O channel designator, 0-7

x =external status sensing mask code (see table 3-2).

When a terminal equipment controller is connected to a data channel by the CON instruction, the EXS instuction can sense conditions within that controller. Twelve status lines run between each controller and its data channel. Each line may monitor one condition within the cont-

roller (see table 3-2). To sense a specific conditon, a "1" is placed in the bit position of the status sensing mask that corresponds to the line number. When this instruction is recognized in a program, Read Next Instruction (RNI) at address P+1 if an external status line is active when its corresponding mask bits are "1". RNI at address P+2 if no selected line is active.

COPY-Copy External Status



(Approximate execution time: 1.3-1.7 μsec.)

ch=I/O channel designator, 0-7

This instruction performs the following functions:

(1) The external status code from the data channel is loaded into the lower 12 bits of A. See EXS instruction.

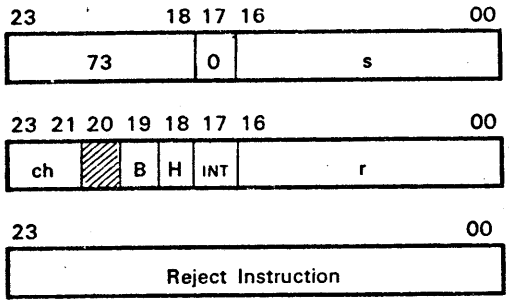
(2) The contents of the Interrupt Mask register are loaded into the upper bits of A. See table 4-1.

(3) RNI from address P+1.

Table 4-1. Interrupt Mask Register Bit Assignments.

Mask Bit Positions	Mask Codes (x)	Interrupt Conditions Represented
00	0001	External equipment interrupt line 0 active
01	0002	1
02	0004	2
03	0010	3
04	0020	4
05	0040	5
06	0100	6
07	0200	7
08	0400	Real-time clock
09	1000	Exponent overflow/underflow & BCD faults
10	2000	Arithmetic overflow & divide faults
11	4000	Search/Move completion

INPC-Character-Addressed Input to Storage



(Approximate execution time: 3.3 μsec.)

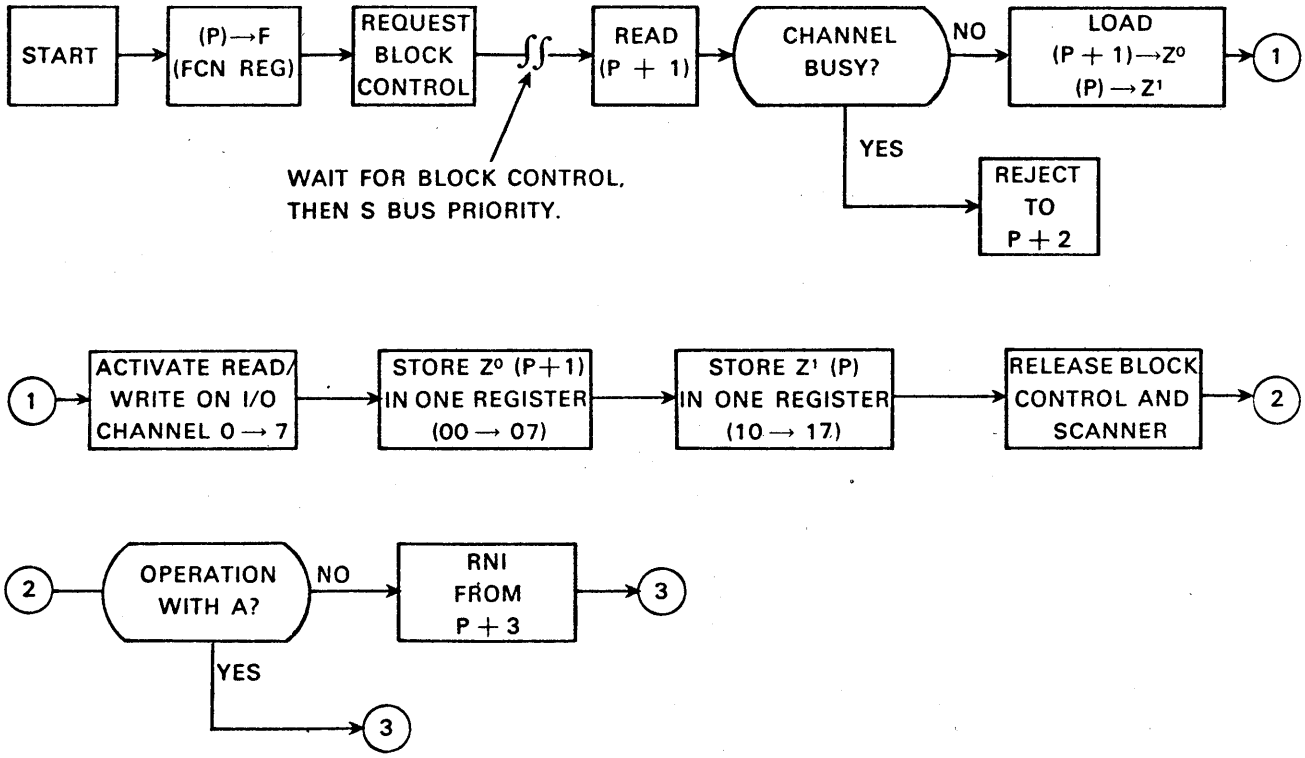
B = "1" for backward storage
ch = I/O channel designator, 0-7
H = "0" for 6- to 24-bit assembly
H = "1" for 12- to 24-bit assembly
INT = "1" for interrupt upon completion
r = first character address of I/O data block; becomes current address as I/O operation progresses
s = last character address of input data block, plus one (minus one, for backward storage)

This instruction transfers a character address block of data, consisting of 6-bit characters or 12-bit bytes, from the terminal controller to storage. This is known as the Read Operation from the terminal. During 12-to 24-bit assembly, the lowest bit of each character address is forced to remain a "0" in register OX. This ensures that assembled bytes are in either the upper or the lower half of the word being stored.

NOTE

If H=1, an even character count must be used. If the count is odd, the last character will be lost.

INSTRUCTION SEQUENCE



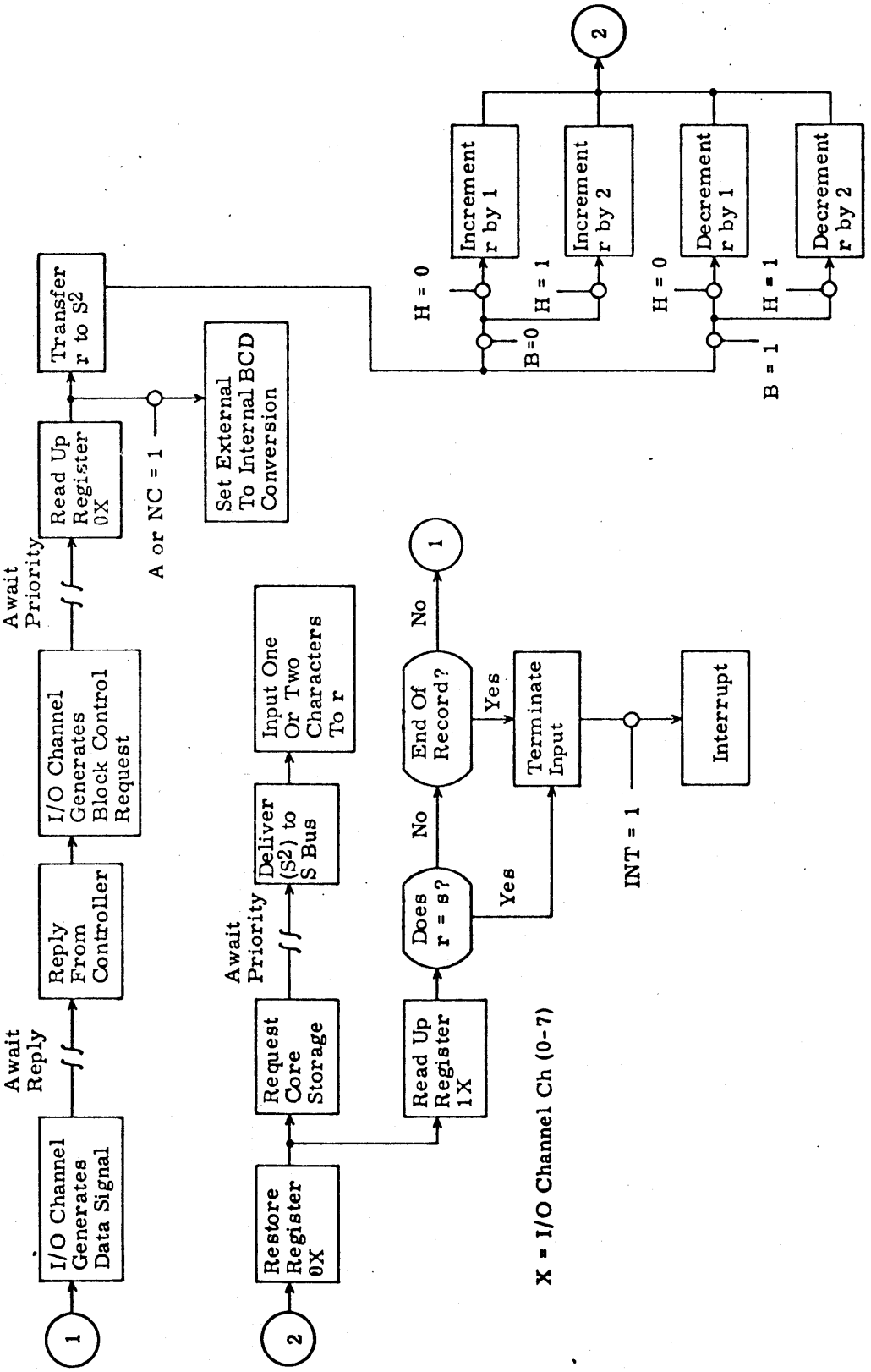
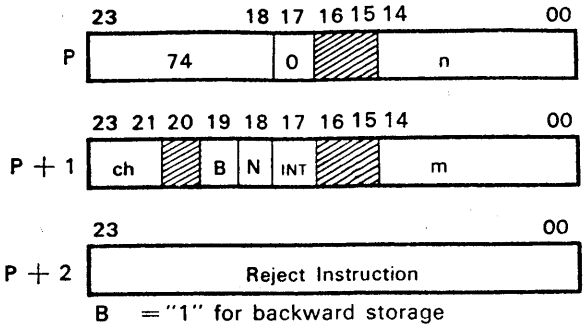


Figure 4-1. I/O Operation with Storage (Read Operation)

INPW-Word Addressed Input to Storage



(Approximate execution time: 3.3 μsec.)

B = "1" for backward storage
ch = I/O channel designator, 0-7
INT = "1" for interrupt upon completion
N = "0" for 12- to 24-bit assembly
N = "1" for no assembly
m = first word address of I/O data block; becomes current address as I/O operation progresses
n = last word address of input data block, plus one (minus one, for backward storage)

Bits 15 and 16 at P and 15, 16 and 20 at P + 1 should be loaded with zeros.

This instruction transfers a word-addressed data block from the terminal to storage (Read Operation from Terminal). Transferring 12-bit bytes should be the method employed if the 3206 data channel is used.

During forward storage and 12-to 24-bit assembly, the first byte of a block of data is stored in the upper half of the memory location specified by the storage address. Conversely, during backward storage, the first byte is stored in the lower half of the memory location.

The instruction sequence for the word addressed input to storage is the same as the character addressed input and is found on page 4-6. The flow chart for the word addressed input to storage is shown in figure 4-2.

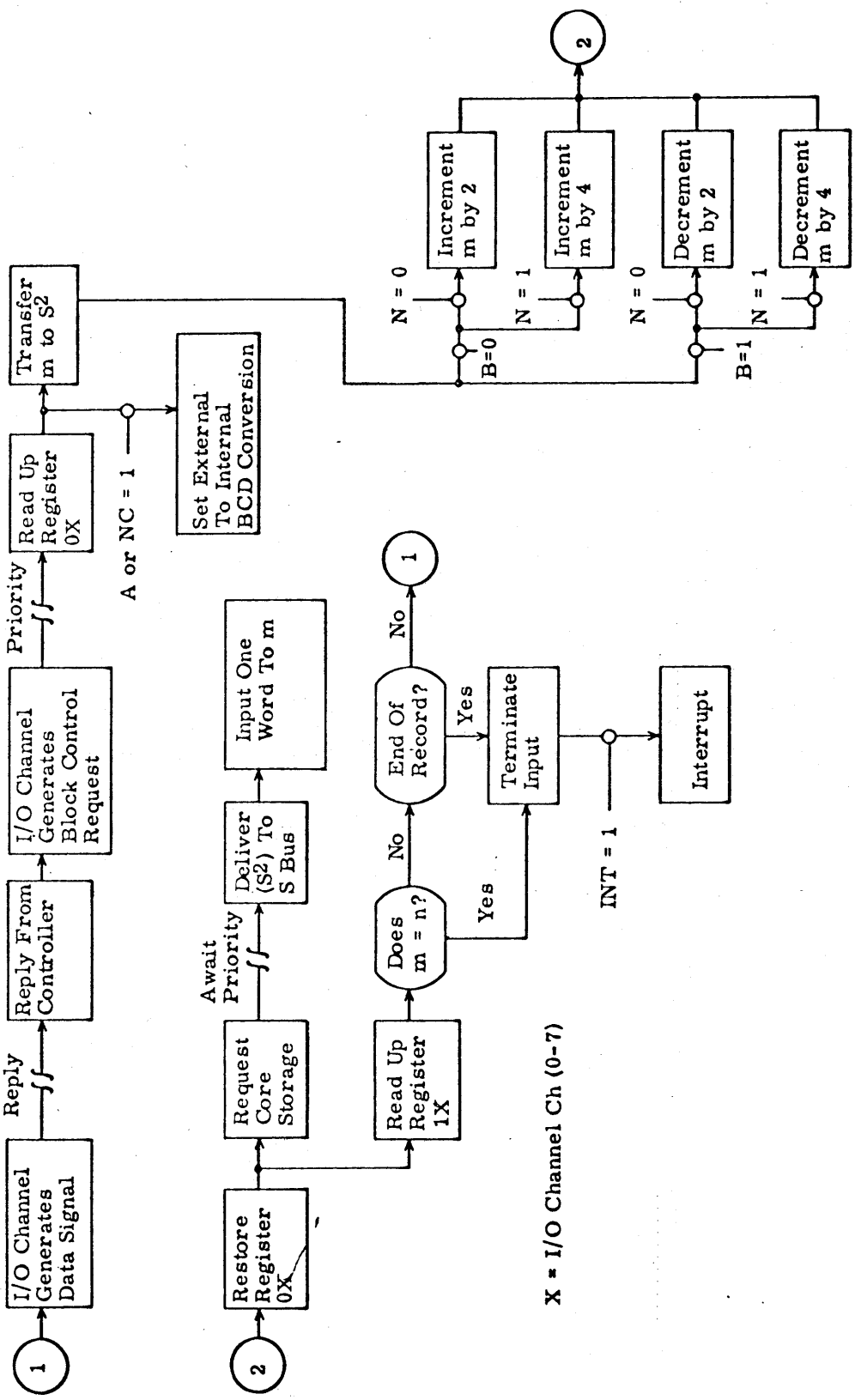
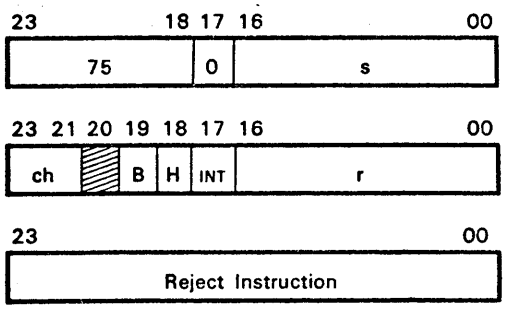


Figure 4-2. I/O Operation with Storage (Read Operation from Terminal).

OUTC-Character-Addressed Output from Storage (Write Operation to Terminal).



(Approximate execution time: 3.3 μsec.)

B = "1" for backward storage
ch = I/O channel designator, 0-7
H = "0" for 24- to 6-bit disassembly
H = "1" for 24- to 12-bit disassembly
INT = "1" for interrupt upon completion
r = first character address of I/O data block; becomes current address as I/O operation progresses
s = last character address of output data block, plus one (minus one, for backward output)

This instruction transfers a character-addressed block of data, consisting of 6-bit characters or 12-bit bytes, from storage to the terminal controller (Write Operation to Terminal).

NOTE

If H=1, an even character count must be used. If the count is odd, the last character will be lost.

The instruction sequence for OUTC is the same as that for INPC and is found on page 4-6. Figure 4-3 illustrates a flow chart for OUTC.

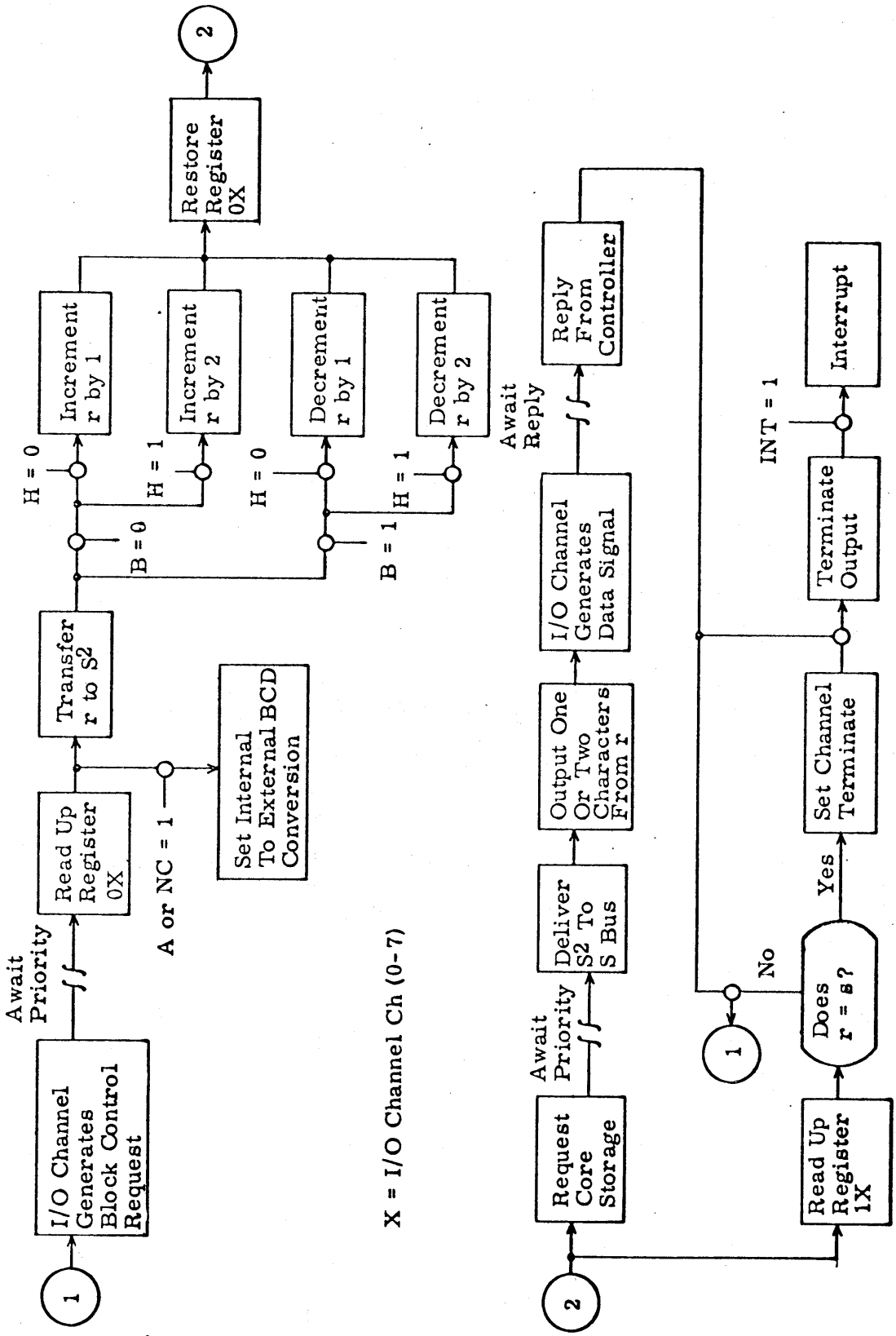
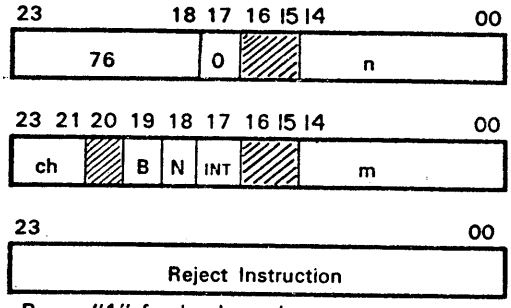


Figure 4-3. I/O Operation with Storage (Write Operation to Terminal).

OUTW-Word-Addressed Output from Storage (Write Operation to Terminal).



(Approximate execution time: 3.3 μsec)

B = "1" for backward storage
ch = I/O channel designator, 0-7
INT = "1" for interrupt upon completion
m = first word address of I/O data block; becomes current address as I/O operation progresses
N = "0" for 24- to 12-bit disassembly
N = "1" for straight 12- or 24-bit data transfer
n = last word address of output data block, plus one (minus one, for backward output)

This instruction transfers a word-addressed block of data consisting of 12-bit bytes or 24-bit words, from storage to the terminal. With no disassembly, 12 or 24-bit transfer capability depends upon whether a 3206 or 3207 data channel is used. If an attempt is made to send a 24-bit word over a 3206 data channel, the upper byte will be lost.

The instruction sequence for OUTW is the same as that for INPC and is found on page 4-6. Figure 4-4 illustrates a flow chart for OUTW.

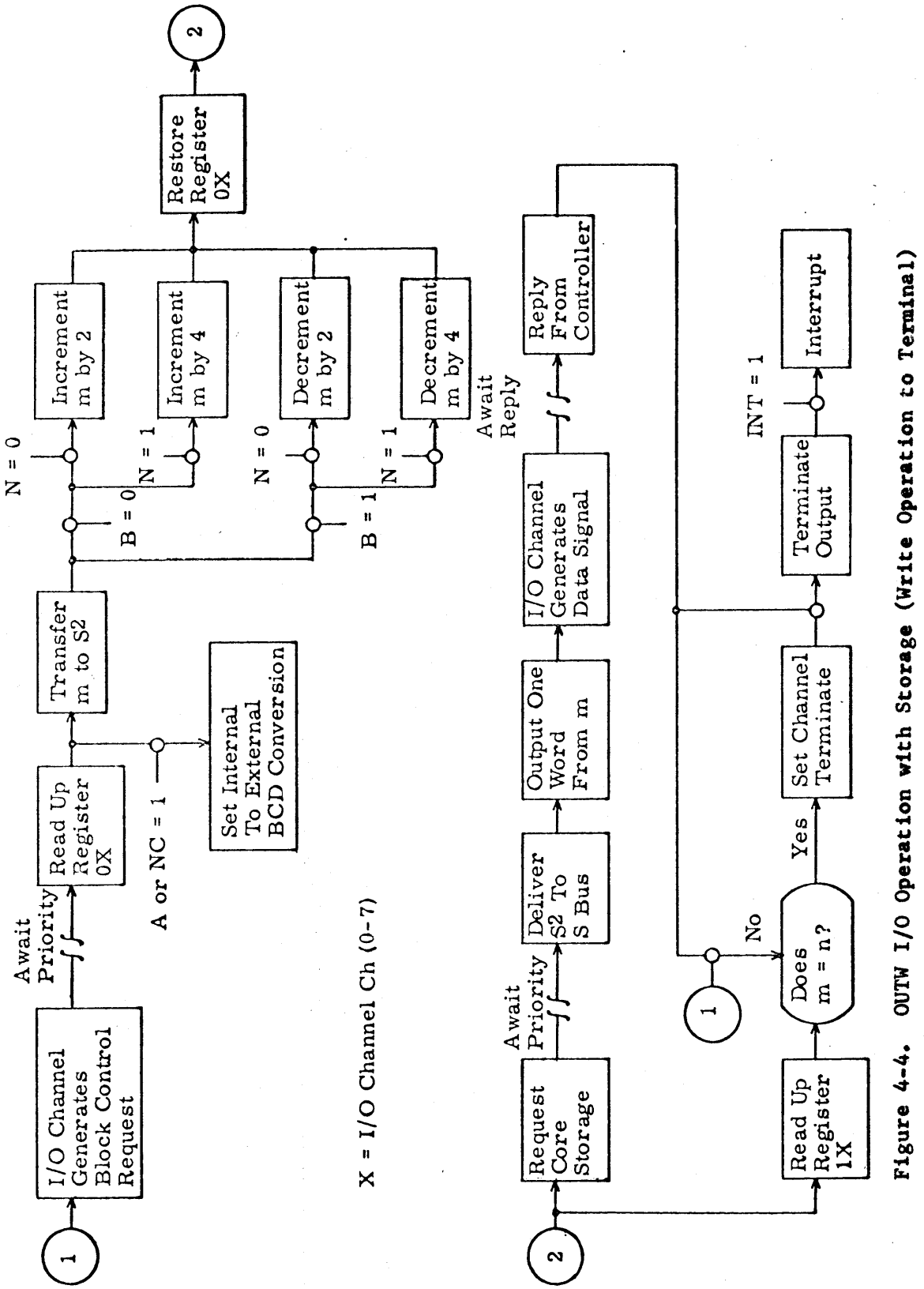


Figure 4-4. OUTW I/O Operation with Storage (Write Operation to Terminal)

SAMPLE PROGRAM.

A sample program containing a connect, select function (Reset), a write operation and a read operation is illustrated in this paragraph. The intent is to show the coding in 3200 machine language with comments added for explanation.

P (Instruction Sequence No.)	Code	Explanation
00100	77004003	Connect Equipment 4, Station 3 on Channel 0
00101	01000100	Reject Instruction
00102	77100010	Function Reset Entry Marker
00103	01000102	Reject Instruction
00104	77200002	Status Sense External Status
00105	01000104	Busy Status will be a '1' until Reset Complete.
00106	76000600	Output from P=00200 to P=00600
00107	00000200	Data Stream
00110	01000106	
00111	77100010	Function, Reset Entry Marker
00112	01000111	Loop until Reset complete
00113	77200002	Status, Sense External Status
00114	01000113	
00115	74001200	Input, from P=0601 to P=1200
00116	00000601	
00117	01000115	
00120	77770000	Halt

OUTPUT TIMING CONSIDERATIONS.

The 3000 series of computers is capable of processing data much faster than the terminal is capable of handling data. The time required for symbol transfer by the delay line memory of the display station is 16.8 microseconds. Memory cycle time is 20 milliseconds. During a read or write operation, successive data bytes must follow within 33.6 microseconds if the Suppress Assembly/Disassembly signal is inactive or 16.8 microseconds if the Suppress Assembly/Dissassembly signal is enabled. If successive data bytes do not follow within the specified times, a 20 millisecond delay occurs between bytes due to delay-line latency characteristics.

When an operator depresses the SEND key, a station interrupt will be generated, if enabled. When the computer responds with a connect code, station address=0000, the interface scanner will search for the station generating the interrupt. When that station is found, the scanner locks on the station and the station is connected. The time required for the search varies according to the address of the interrupting station. Thus the search for station 0001 (binary address) will take approximately 5 microseconds and a search for station 1100 (binary) the twelfth station, will take approximately 24 microseconds. Since a read operation should follow the connect, a delay will occur. The duration of this delay depends on the number of stations in the terminal. The connect instruction takes approximately 3 microseconds and a 1.6 microsecond delay must be allowed for each station in the terminal

during a search for an interrupting station. If there are twelve stations in the terminal, therefore, 24 microseconds must be allowed between the connect and the read instructions.

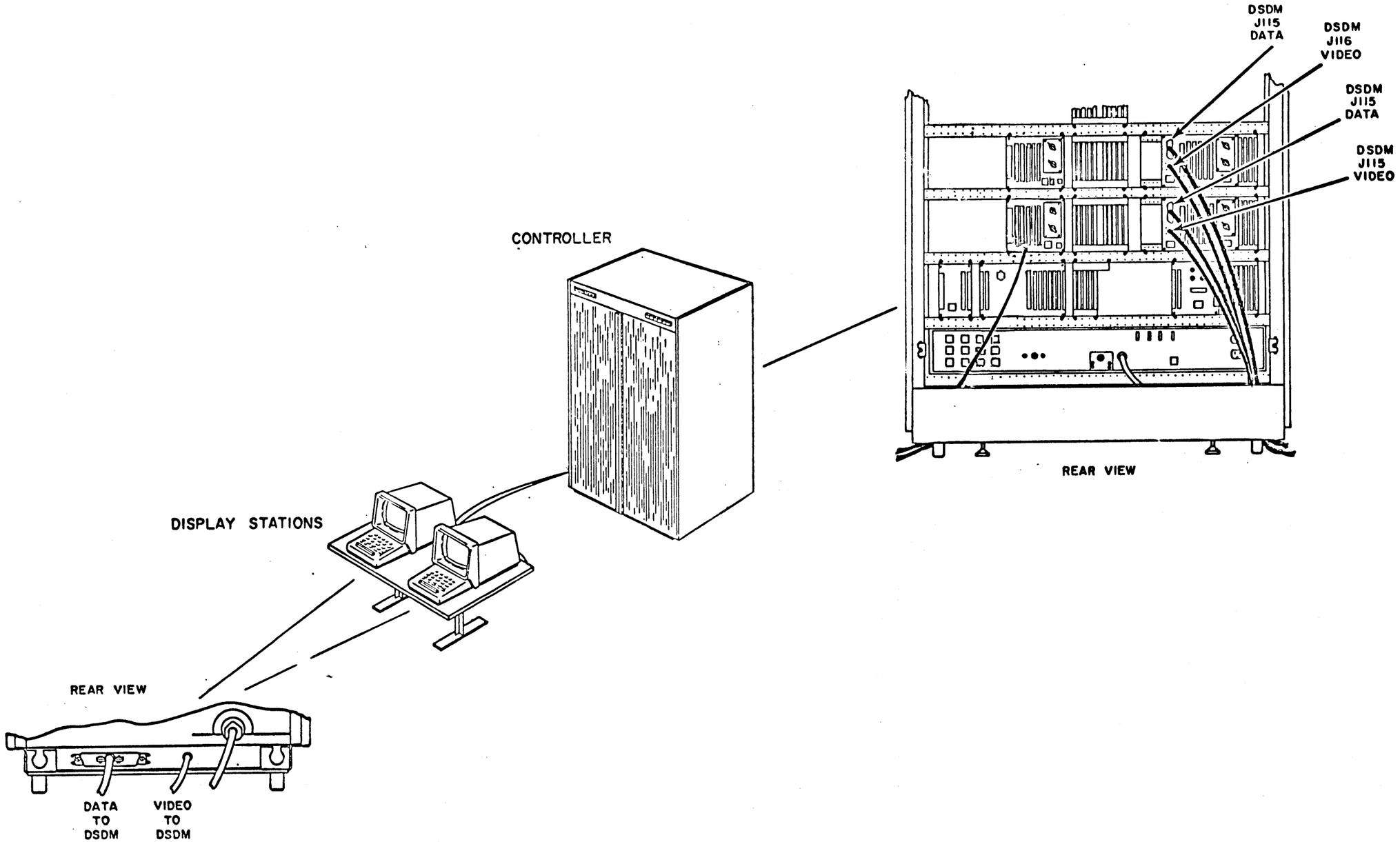
The proper delay can be introduced automatically into the program by using the EXS (77.2), Sense External Status instruction, and doing a loop until Send Request Status (Status bit 2-XXX4 octal) is a '1'. Thus the instructions would appear as follows:

```
P      77200004   Status, Sense External Status
P+1    01000P--   Loop until Send Request is a '1'
P+2    7400----   Input  (Enable Read Line).
```

APPENDIX

The characteristic feature of this terminal is its expandable data processing scope. Each member station adds it own unique feature to the overall performance. This appendix highlights specifications for each of the various euipments which may be used within a given configuration.

A Multistation Terminal consists of an Equipment Controller and up to twelve input/output stations. An adapter kit is required for each station added to the configuration. All adapters are housed in the controller cabinet, which provides the dc power and ventilation required. As aminimum, the cobinet should contain an interface module, main timing module, symbol generator module, and at least one station adapter kit.


CONTROLLER
DISPLAY STATIONS
REAR VIEW
DATA TO DSDM
VIDEO TO DSDM
DSDM J115 DATA
DSDM J116 VIDEO
DSDM J115 DATA
DSDM J115 VIDEO
REAR VIEW

CONTROLLER CABINET

The controller cabinet houses all adapter kits and logic required to link the data source with all input/output devices making up the terminal. It also provides all necessary dc power.

Equipment Number	Part Number
FC101-A	14036100

OPTIONS.

Equipment Number	Description	Part Number
GD601-A	50 Hz Power Conversion Kit	14038000

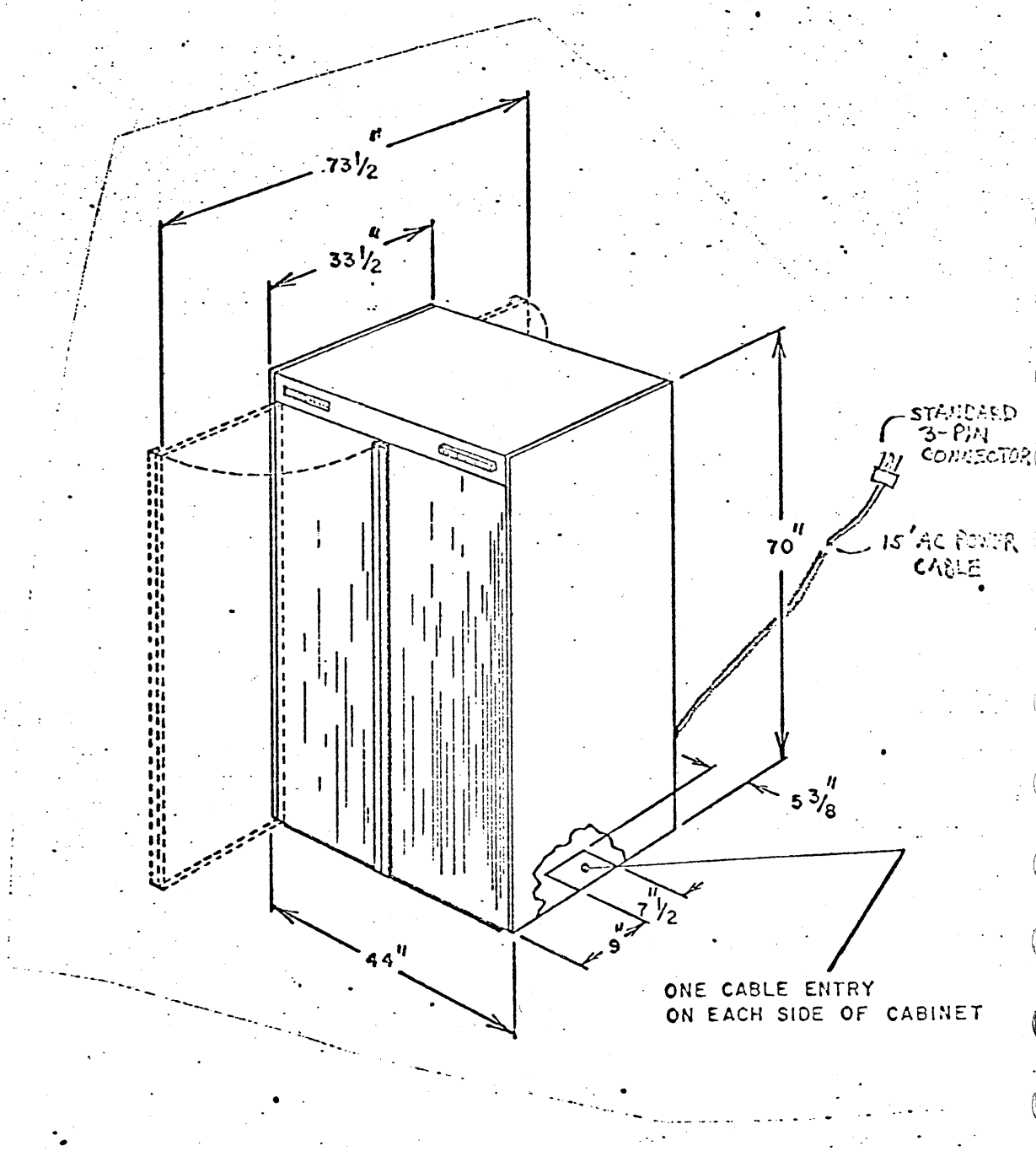
LITERATURE AVAILABLE.

Name	Publication No.
Basic Controller Cabinet Hardware Reference/Customer Engineering Manual	82140600

PHYSICAL CHARACTERISTICS.

WEIGHT: 732 Lbs
BTU'S/HOUR: 610*
INPUT POWER: 120 volts, 60 Hz, 1.52 amperes*
OUTLINE DIMENSIONS: See following illustrations

*Includes a blower and 2 basic power supplies. One add on power supply requires an additional 0.21 amperes and dissipates approximately 82 BTU's per hour. Cabinet service should be 20-ampere.


73 1/2"
33 1/2"
STANDARD 3-PIN CONNECTOR
15' AC POWER CABLE
70"
5 3/8"
7 1/2"
9"
44"
ONE CABLE ENTRY ON EACH SIDE OF CABINET

DISPLAY STATION

The Display Station provides cathode-ray-tube display capabilities for the parent sub-system. Symbol generator and display station adapter kits are required to govern output.

Equipment Number	Part Number
CC601-A	14031800
CC601-B	14031900

ADAPTER KITS REQUIRED.

Equipment Number	Description	Part Number
GK103-A	Symbol Generator Module	15503400
FV135-A*	Display Station Driver Module	15508600
FV136-A*	Display Station Driver Module	15508700

*Only one of these is required.

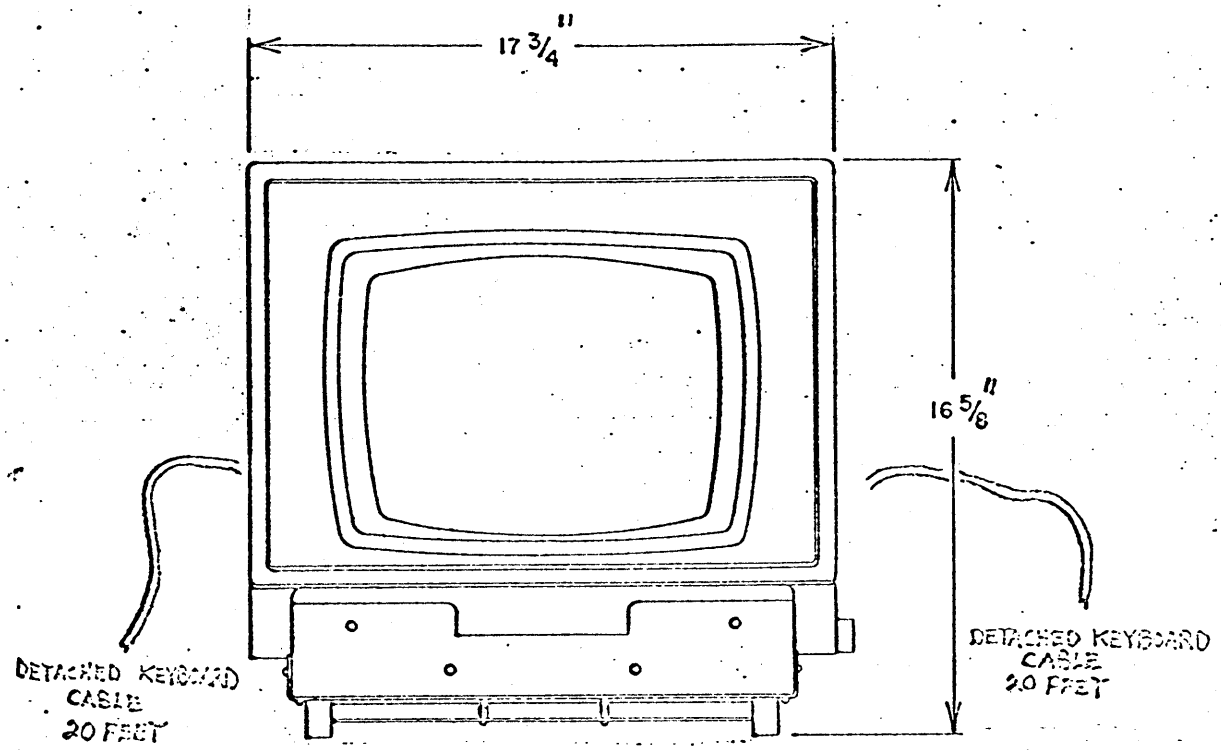
LITERATURE AVAILABLE.

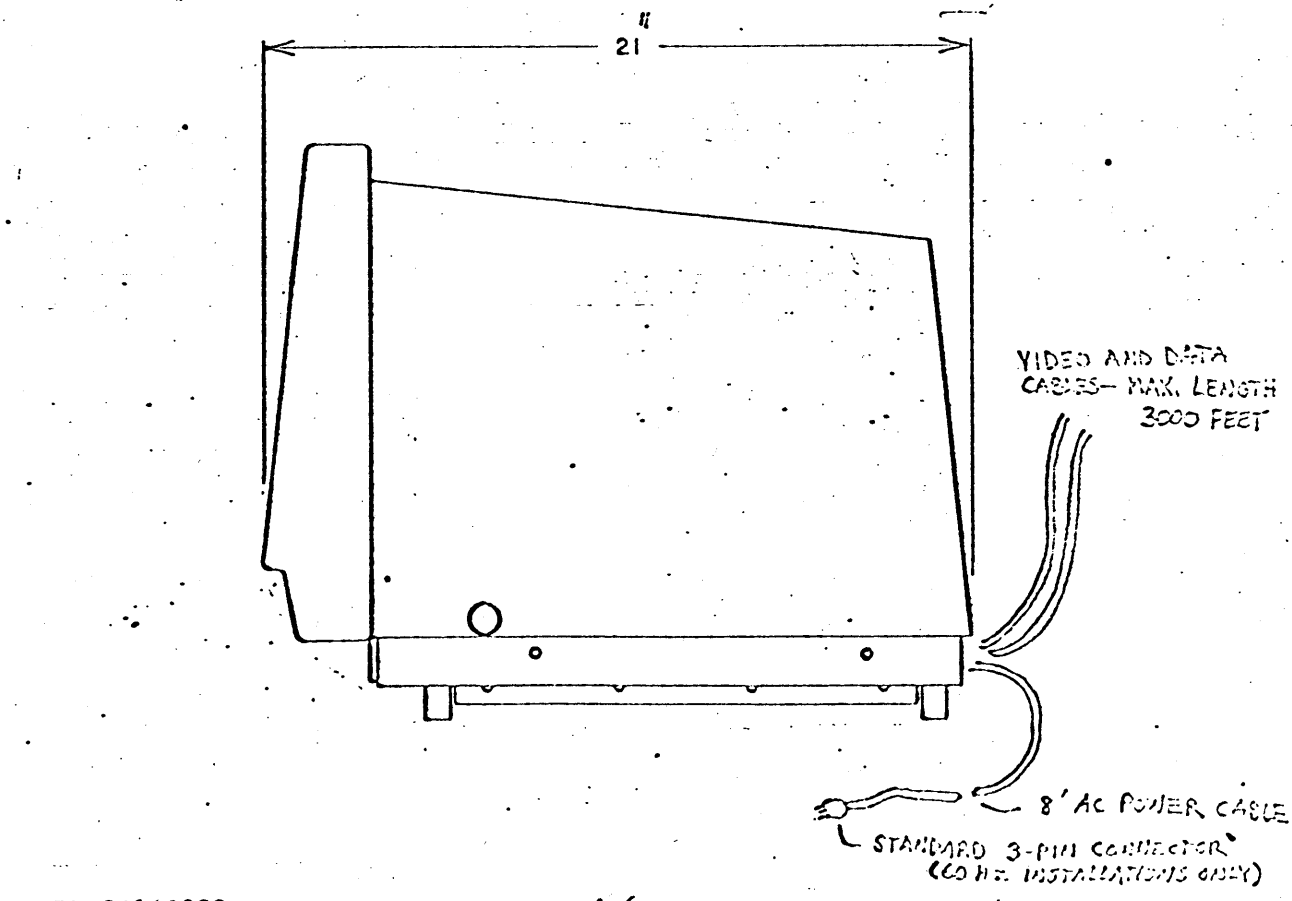
Name	Publication No.
Display Station Hardware Reference/Customer Engineering Manual	82134300

PHYSICAL CHARACTERISTICS.

WEIGHT: 60 Lbs
BTU'S/HOUR: 410
INPUT POWER: (CC601-A) 120 volts, 60Hz, 1 ampere
(CC601-B) 220 volts, 50Hz, 0.5 ampere
OUTLINE DIMENSIONS: See following illustrations

DISPLAY STATION (cont)





ENTRY KEYBOARDS

The Entry Keyboard provides the operator with a method for entering coded data into a communications terminal. It is linked to the terminal processor through a Display Station. The keyboards are 501 compatible. A display station driver module and main timing module are required for each or each pair of associated keyboards used.

Equipment Number	Part Number
CA 101-A (non-edit)	14032000

ADAPTER KITS REQUIRED.

Keyboard Option	Display Station Equipment No.	Driver Module* Part No.	Main Timing Equip. No.	Module** Part No.
Non-Edit	FV135-A	15508600	GA101-A	14036400
Non-Edit	FV136-A	15508700	GA102-A	14036500

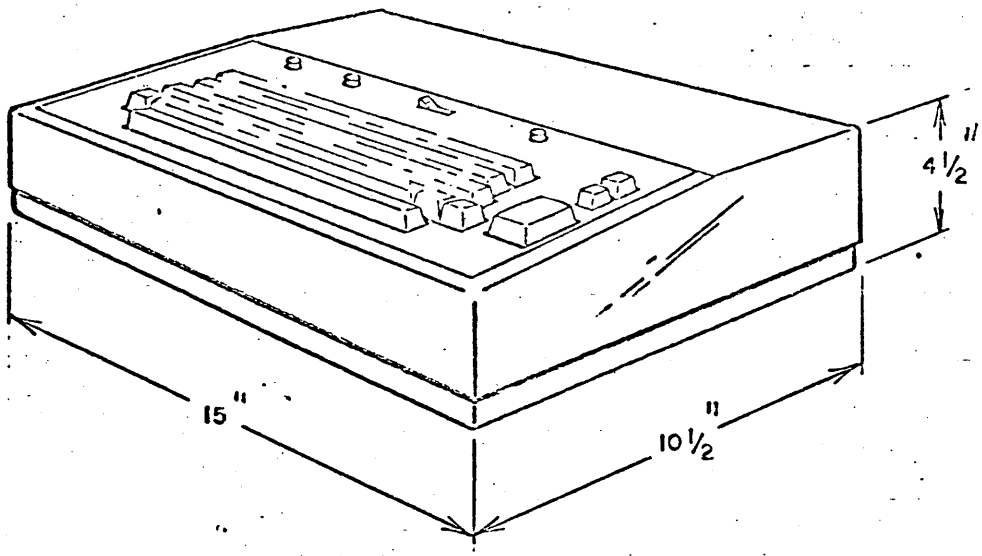
* Only one required per keyboard or pair of associated keyboards.
** Only one required per terminal.

LITERATURE AVAILABLE.

Name	Publication No.
Entry Keyboards Hardware Reference/ Customer Engineering Manual	82140400

PHYSICAL CHARACTERISTICS.

WEIGHT: 10 Lbs
INPUT POWER: Requires +12 and +16 volts from Display Station
OUTLINE DIMENSIONS: See following illustrations



MAIN TIMING ADAPTER KIT

The main timing module provides synchronous clock pulses for subscribing modules. Display format requirements necessitate two different modules, only one of which may be included in any given configuration.

Equipment No.	Keyboard	Display Format	Part No.
GA101-A	Non-Edit	20 Lines of 50 Symbols	14036400
GA102-A	Non-Edit	13 Lines of 80 Symbols	14036500

LITERATURE AVAILABLE.

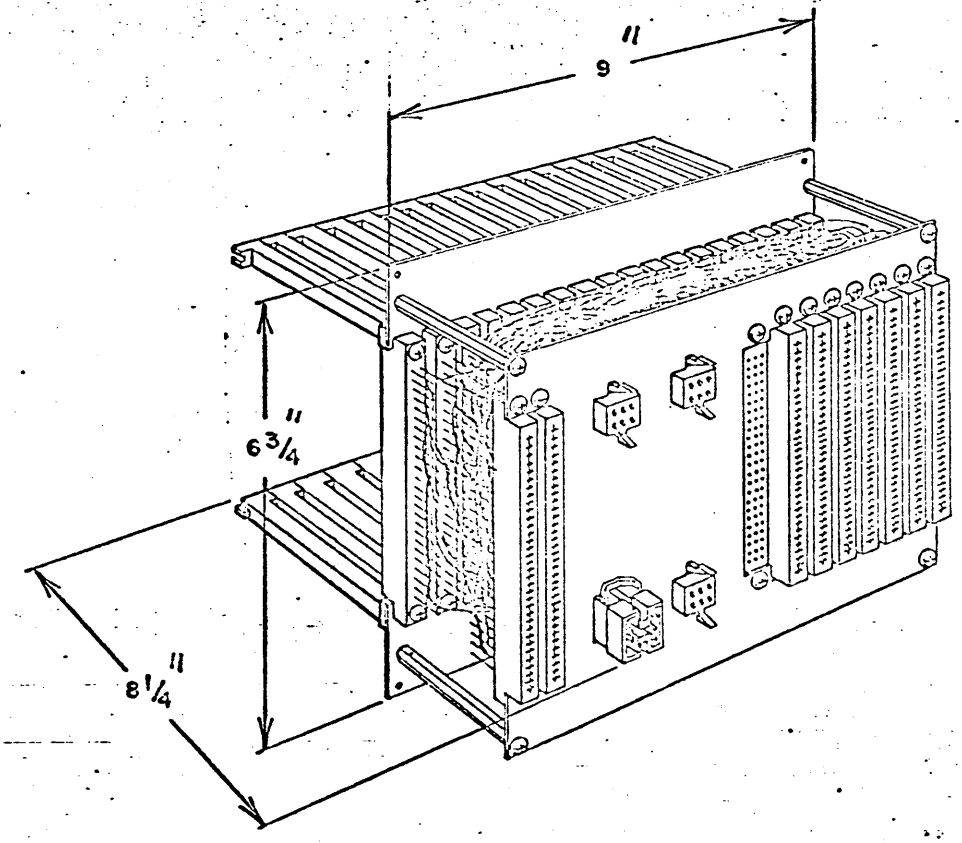
Name	Publication No.
Main Timing Adapter Kit Hardware Reference/ Customer Reference Manual	82139700

PHYSICAL CHARACTERISTICS.

WEIGHT:
BTU'S/HOUR: 264
INPUT POWER*: +5, +20, -20 volts dc required from cabinet.
EXTERNAL DIMENSIONS: See following illustrations

* Additional 0.66 ampere required on ac input to cabinet

MAIN TIMING ADAPTER KIT (cont)



SYMBOL GENERATOR ADAPTER KIT

Each Display Station within a subsystem receives pulse trains for character generation from a centralized symbol generator. Synchronous timing is provided by a main timing module, while power is obtained from the cabinet's regulated dc power supply.

Equipment Number	Part Number
GK103-A	15503400

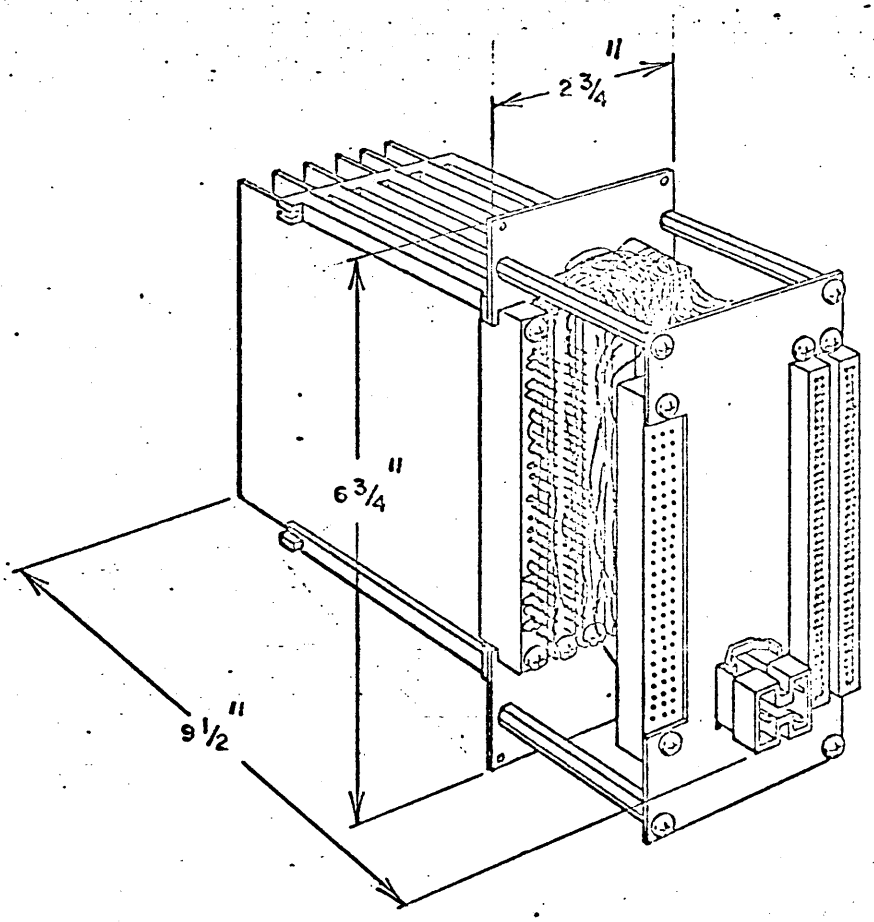
LITERATURE AVAILABLE.

Name	Publication No.
Symbol Generator Adapter Kit Hardware Reference/Customer Engineering Manual	82139900

PHYSICAL CHARACTERISTICS.

WEIGHT:
BTU'S/HOUR: 116
INPUT POWER*: +5, +20, -20 volts required from cabinet
OUTLINE DIMENSIONS: See following illustrations

*Additional 0.3 ampere required on ac input to cabinet


11
2 3/4
6 3/4 11
9 1/2 11

3000 INTERFACE ADAPTER KIT

The 3000 Interface Adapter Kit provides exchange of data with the 3000 series data channel. Translation circuitry transposes data words from the data channel into six-bit serial codes and transposes six-bit serial codes into data words acceptable to the data channel. The translator isselectively responsive to either external BCD or internal BCD coding for end-of-message, end-of-print, carriage return, and parity error. Data transfer is 25,000 twelve-bit words or 50,000 six-bit words per second.

Equipment Number	Part Number
DC117-A	15510000

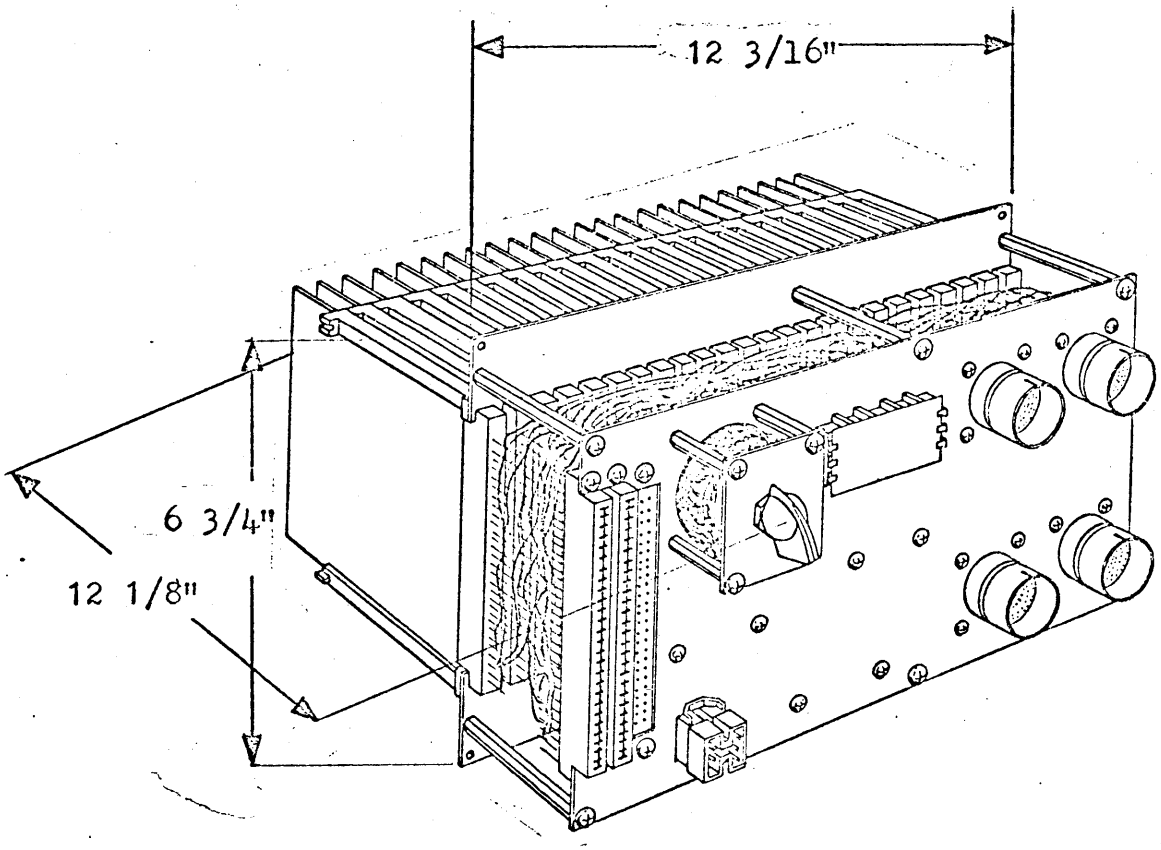
LITERATURE AVAILABLE.

Name	Publication No.
3000 Interface Adapter Kit Hardware Reference/Customer Engineering Manual	82141900

PHYSICAL CHARACTERISTICS.

WEIGHT:
BTU'S/HOUR: 160
INPUT POWER*: +5, +20, -20 volts dc required from cabinet.
EXTERNAL DIMENSIONS: See following illustration.'

*Additional 0.4 ampere required on ac input to cabinet.


12 3/16"
6 3/4"
12 1/8"

DISPLAY STATION ADAPTER KIT
(Display Station Driver Module)

The Display Station Adapter Kit provides control logic and memory for a Display Station and any associated entry keyboard(s). The two types of adapters cover display format.

Equipment Number	Keyboard	Display Format	Part No.
FV135-A	Non-Edit	20 Lines of 50 Symbols	15508600
FV136-A	Non-Edit	13 Lines of 80 Symbols	15508700

LITERATURE AVAILABLE.

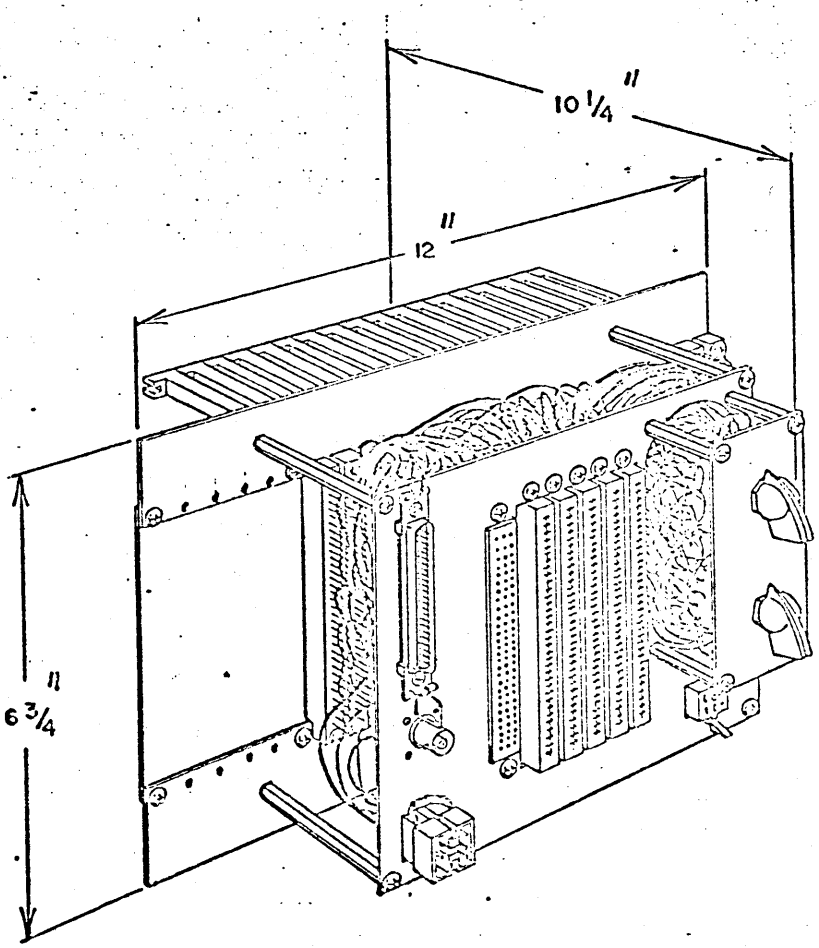
Name	Publication No.
Display Station Adapter Kit Hardware Reference/Customer Engineering Manual	82141700

PHYSICAL CHARACTERISTICS.

WEIGHT:
BTU'S/HOUR: 120
INPUT POWER*: +5, +20, -20 volts required from cabinet
OUTLINE DIMENSIONS: See following illustrations

*Additional 0.3 ampere required on ac input to cabinet

DISPLAY STATION ADAPTER KIT (cont)



POWER CONVERSION KIT

The FC101-A controller cabinet can operate from a 50 Hz power source when the power conversion kit is installed. Changes apply to the blower assembly, power distribution module, and two power supplies.

Equipment Number	Part Number
GD601-A	14038000

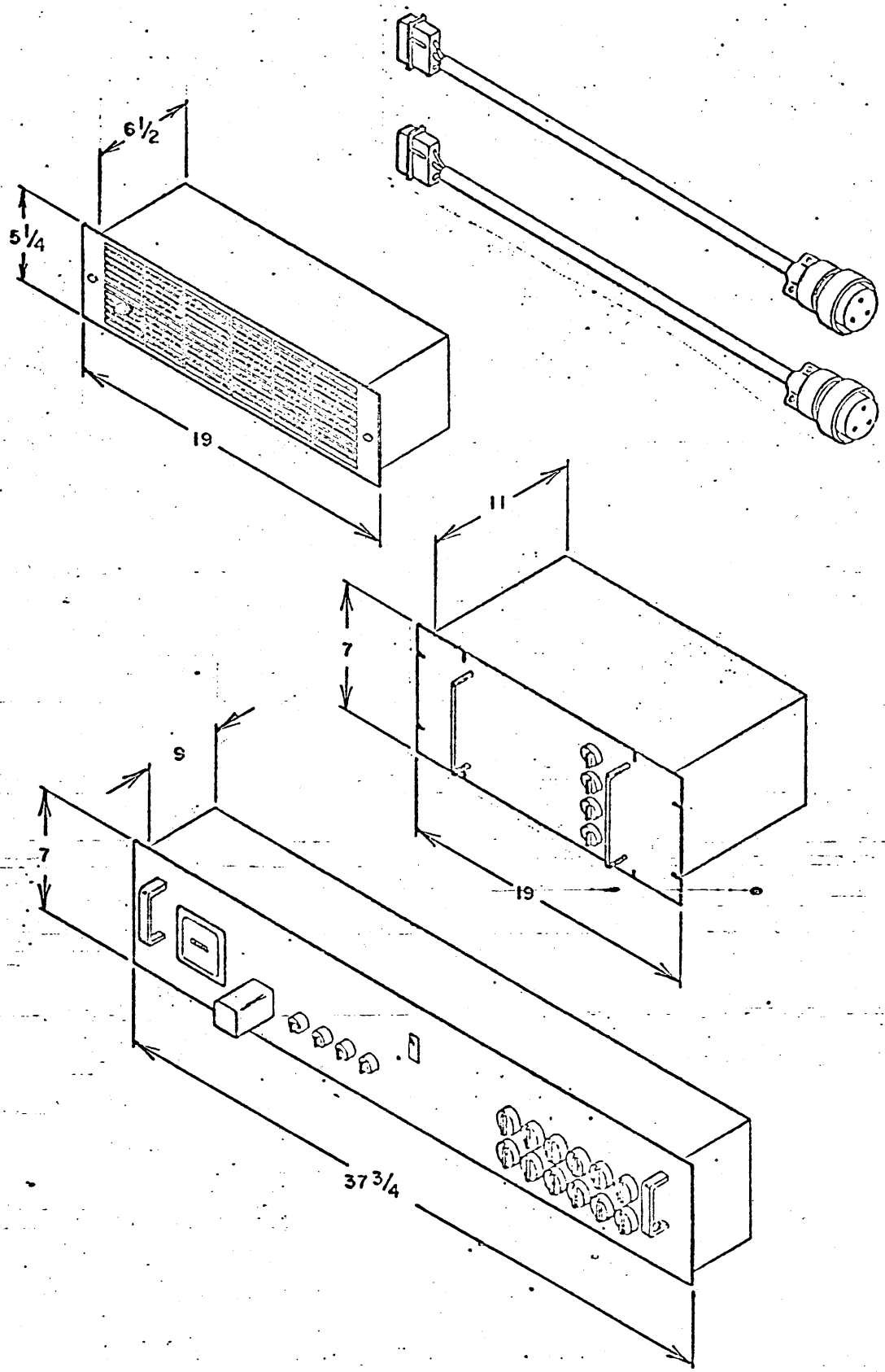
LITERATURE AVAILABLE.

Name	Publication No.
Power Conversion Kit Hardware Reference/Customer Engineering Manual	82140300

PHYSICAL CHARACTERISTICS.

WEIGHT:
BTU'S/HOUR: 610
INPUT POWER: 220 volts, 50 Hz, 1.2 amperes
OUTLINE DIMENSIONS: See following illustrations

POWER CONVERSION KIT (cont)



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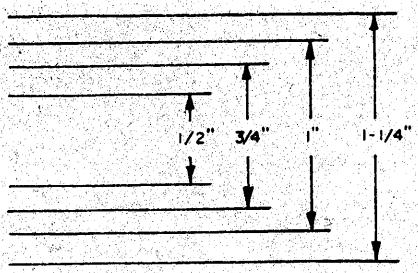

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