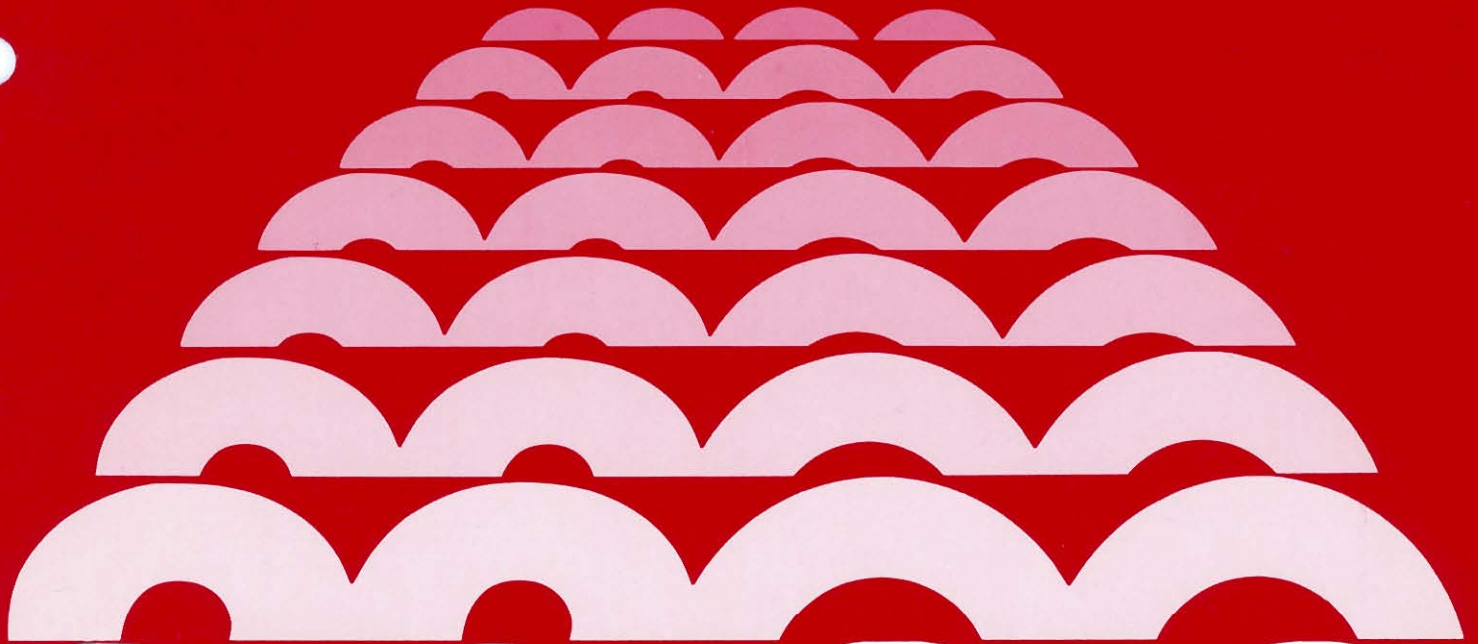


WANG

**Work Station
Introductory
Manual**



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Work Station Introductory Manual

4th Edition — January, 1981
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CHAPTER 1 INTRODUCTION

The 2200 Work Station brings independent remote processing power to your Wang system, along with full access to your disk data base. It is a powerful, compact, complete computer designed specifically to complement a 2200 disk system.

Up to three 2200 Work Stations can be multiplexed to any Wang 2200 equipped with a fixed/removable disk and 2230 MXA-1 disk multiplexer. Work Stations can concurrently carry out different processing tasks while sharing a common disk data base. Simplicity of operation, modularity of design, and true multiprocessing power highlight the Work Station.

The standard Work Station contains its own interactive 8K byte Random Access Memory (RAM), a separate 42.5K byte BASIC Interpreter on Read Only Memory (ROM), an upper/lowercase alphanumeric/BASIC Keyword Keyboard, an easy-to-read 12-inch cathode ray tube (CRT) display, and a disk multiplexer connector -- all contained in one desktop unit. The Work Station's BASIC Interpreter provides the complete 2200 BASIC language, and all the 2200 features that make programming a simple, straightforward operation.

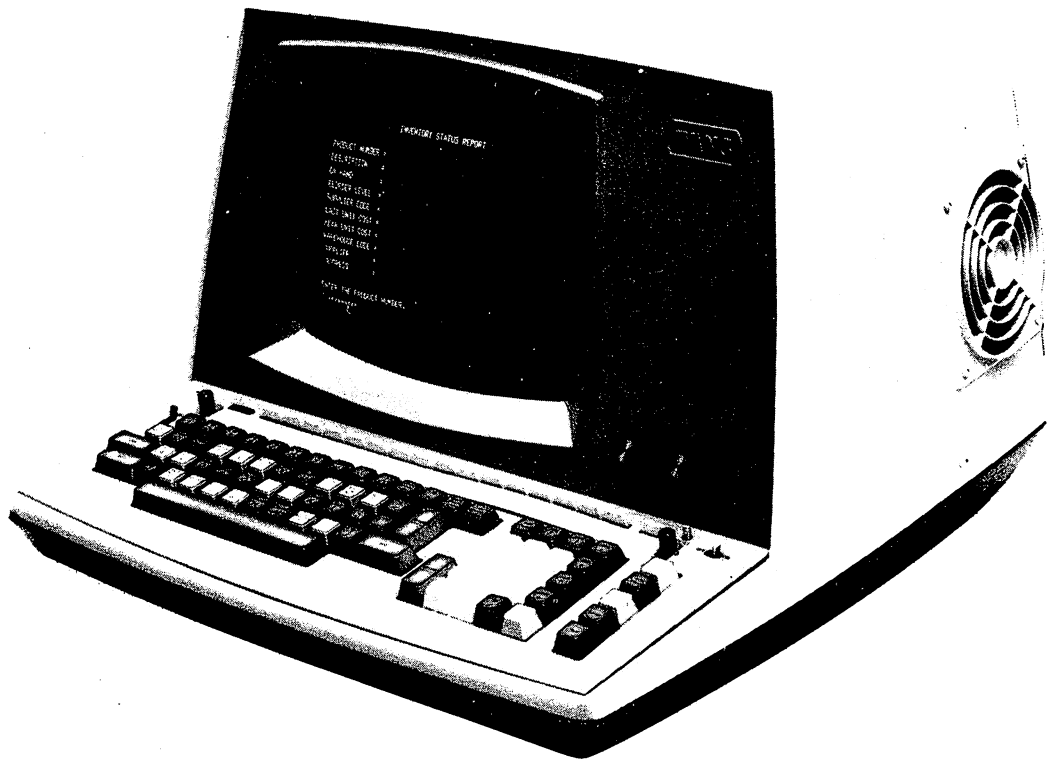


Figure 1-1. The 2200 Work Station

CHAPTER 2 INSTALLATION GUIDE

2.1 UNPACKING, INSPECTION, AND INSTALLATION

Your Work Station must be unpacked, inspected, and installed by a Wang Service Representative. Upon receipt of your Work Station, be sure to notify your Service Representative so that he may perform this service. Failure to follow this procedure will void your warranty.

Your Service Representative will ensure that the connectors for any peripherals are properly connected to the Work Station and locked in place and that power cords are properly plugged into a source of power. It is recommended that your Work Station be connected to a power line reserved exclusively for use with the Work Station; the line should not be shared by other office equipment such as water coolers, calculators, air-conditioners, typewriters, or copiers.

2.2 PLANNING YOUR INSTALLATION

Before summoning your Wang Service Representative to install your Work Station, you must decide on a location for it. There are several factors which must be considered in making such a decision.

Location Relative to Main 2200 and Other Work Stations

The Work Station is designed to be used with a main 2200 system that is equipped with a 2260BC disk drive and a Model 2230 MXA-1 Disk Multiplexer Master Controller board. The Work Station has a 2230 Slave Controller board built in. (The Model 2230 MXA-1 multiplexer controller system is described in detail in the System 2200 Disk Memory Reference Manual.) The 2230 MXA-1 Disk Multiplexer system permits up to three "slave" stations (such as the Work Station) to access the disk drive connected to the master station. These slave stations must be cable connected to the master station. When more than one Work Station is used, the stations must be connected serially via "T" connector cables.

Each Work Station has a connector on the rear panel labeled DISK. A 12-foot (3.7 meter) cable, supplied, plugs into this connector and links the Work Station to the next station down the chain, in the direction of the Master Station. If a slave station is to be used beyond a Work Station (in the direction away from the Master Station), then a 12-foot "T" connector cable must be used (part no. 120-4010, not supplied) in place of the standard 12-foot cable.

<u>Cable Length</u>	<u>Part #</u>
50 ft (15.5m)	120-2225-50
100 ft (31m)	120-2225-1
200 ft (61m)	120-2225-2

These cables are extension cables in a literal sense, since they serve as extensions for the standard connector cables; an extension cable cannot be used alone to connect two systems. Because the extension cable is always combined with the standard (or "T" connector) cable, the total length of the cable between two units is equal to the extension cable length plus 12 feet.

In special cases, it is possible to connect two or more extension cables together to create an extension longer than 200 feet. In every case, however, the maximum permissible distance between two systems is 512 feet, and the maximum distance between the first and last systems in the chain is 536 feet. The cable connecting the disk unit to the master CPU is approximately ten feet (3 meters) in length, and cannot be extended.

When planning the location of your Work Station you should trace the route that the multiplexer cables are to run, taking care to avoid exposing a cable to intense electric or magnetic fields, or sources of electronic noise, since these may interfere with data transmission over the cable. In general, you should try to keep the connector cable away from electrical trunk lines, fluorescent lights, and electrical office equipment (such as electric typewriters and tape recorders). If you have a specific question about routing a cable, contact your Wang Service Representative.

An extension cable can be routed through conduits or other tight spaces by removing one of its plugs. However, it is important that the plug be disconnected and reconnected by a qualified Wang Service Representative. Reconnection of the plug is a delicate job which, if done improperly, can hamper data transmission along the line.

Selecting a Work Station Site

The Work Station is extremely compact, and can fit comfortably on a large desk or any similar work surface. If a printer is to be used at the Work Station site, more space will be needed, the exact amount of needed space depends upon the printer model.

In selecting a Work Station site there are three important environmental factors to be considered: temperature, humidity and cleanliness.

The temperature is the most important factor to consider because it can vary greatly from day to day. The recommended operating temperature range is from 65°F to 75°F, but the allowable range is from 50°F to 90°F.

Low outside temperatures are usually not a problem because nearly all locations are heated. High temperatures can be a problem because many locations do not have air conditioning. If the system is used where temperatures exceed the maximum specified, component failure rates will drastically increase, resulting in costly downtime.

If an air conditioning unit is already installed, or if one is to be installed, it is imperative that a separate power line be used. If a separate power line is not used, system errors will occur when the air conditioner is in use.

While air conditioning is good for maintaining the proper temperature, it also removes moisture from the air, thereby lowering the humidity. If the system is installed in a carpeted room, the lower humidity plus the static generating capability of carpets and synthetic clothing impart static electrical charges to operating personnel. When an operator comes in contact with the system, the resultant static spark is uncomfortable, causes system malfunctions, and can even destroy recorded data.

If carpeting is to be installed, be sure it is a non-static variety. If carpeting already exists, and it is not a non-static carpet, it must be treated with an anti-static spray. Alternatively, an electrically conductive mat can be installed to prevent a static charge build-up. Carpets treated with an anti-static spray should be thoroughly cleaned before the first treatment, and retreated at least once every three months thereafter. If an electrically conductive mat is used, it should be installed under the system operating area and must be properly connected to an earth ground.

The recommended humidity range is from 35% to 65% Relative Humidity (R.H.), but 20% to 80% R.H. is allowable. (In cold weather, the humidity in heated buildings can be 10% or lower.) Humidifiers and dehumidifiers should be installed to increase or decrease the humidity as required.

Dirt and grease can accumulate rapidly on circuit boards and components, and can form a film that traps heat and provides a leakable path for signals. To prevent unnecessary failures due to dirt, all air conditioning, heating, and ventilating units should have air filters. These filters should be cleaned or replaced regularly. In areas where ordinary filters do not remove airborne dirt sufficiently, an electrostatic filter should be installed.

Electrical Environment

A 15 ampere, 115 VAC power line is adequate for the Work Station. This line must be regulated to within $\pm 10\%$ and must be noise free. It is recommended that the system have its own AC power line.

If the line is not sufficiently regulated to the limits indicated above, a constant voltage transformer should be installed. If the line is noisy, however, a detailed analysis of the problem must be performed to insure a correct solution.

Since computers and peripherals are extremely susceptible to Electromagnetic Interference (EMI), the source of the EMI must be determined before a solution is proposed. EMI can enter the system by conduction along wiring and cabling or by direct radiation. If sources of EMI, which include welders, are in close proximity to the Work Station, EMI will enter by direct radiation. The noise generating device should be moved, repaired, or filtered to prevent it from interfering with the system. If the source of the noise cannot be found, an EMI filter with a cut-off frequency near 10 KHz should be installed on the system's AC power line. In all cases, be sure the AC power line has been properly installed in a steel conduit, and that the conduit is properly connected to junction boxes. Also, insure that other devices, including fluorescent lighting, are not connected to the same AC power line. In extreme locations, such as those with nearby arc welders, it may be necessary to shield the peripheral cables.

CHAPTER 3 STANDARD WORK STATION EQUIPMENT

3.1 THE CRT DISPLAY

The standard CRT can display 16 lines, 64 characters wide, and includes a full upper- and lower-case character set. A steady cursor character (underscore) marks the location that will be occupied by the next received character.

The CRT screen should be cleaned periodically with a mild soap and water, using a soft cloth.

3.2 THE ALPHANUMERIC/BASIC-KEYWORD KEYBOARD

Modes of Operation

The Work Station Keyboard provides two modes of operation for entering data and programs into the Central Processor. The mode is selected by use of the toggle switch labeled "Keyword/A" and "A/a" at the upperleft corner of the keyboard.

The Keyword/A mode is specifically designed for use in program creation. It allows an entire BASIC language keyword to be entered by depressing SHIFT and just one other key. (The keywords are shown on the tops of the keys.) Any keyword can also be entered, character by character, in uppercase. When the keyboard is in Keyword/A mode, uppercase characters are entered without shifting. Keywords may not be entered in lowercase. Keyword/A mode is also useful for data entry operations in which all characters must be uppercase.

When the keyboard is in the A/a mode, it enters uppercase and lowercase characters the way a typewriter does (uppercase obtained only by depressing SHIFT together with the character key). Keywords cannot be entered with a single stroke.

There are three keys labeled RETURN(EXEC) on the Work Station keyboard. These keys may be used interchangeably; they appear in three keyboard locations for convenience only.

RESET and HALT/STEP

In the upper right corner of the keyboard is a button labeled RESET. RESET immediately interrupts instruction execution, clears the CRT, and displays the READY symbol. During program execution, RESET must not be used unless absolutely necessary. Since RESET immediately interrupts execution, depressing RESET during disk statement execution can leave half-written, unreadable data on a disk. By contrast, HALT/STEP can be used safely at any time. It interrupts execution after the currently executing statement is complete. It also permits execution to resume at the point of interruption, if CONTINUE(EXEC) is keyed.

3.3. THE WORK STATION PROCESSOR

The Work Station console contains a complete Central Processor. The processor includes 32K of Random Access Memory (RAM) along with a 42.5K BASIC Interpreter on Read Only Memory (ROM). The Work Station interpreter provides the full 2200 BASIC language instruction set as defined for the 2200T processor in the Wang BASIC Language Reference Manual. In broad groups, this includes:

- All general-purpose BASIC statements and commands
- All peripheral statements and commands
- The Edit mode commands
- The Matrix Statements
- The Sort Statements
- The General I/O Instruction Set

CHAPTER 4 MASTER INSTALLATION

4.1 POWER ON

An ON/OFF power switch is located at the top right corner of the Work Station keyboard. Approximately 15 seconds after turning on the Work Station, the display

READY

:_

should appear in the upper left corner of the CRT. This indicates that the Work Station is ready for use. If a printer or plotter is connected to the Work Station, it must be turned on by means of its own power switch.

4.2 MASTER INITIALIZATION

When the Work Station is turned off, all programs and data are cleared from its memory. When it is turned on, it quickly readies itself for operation via a process called Master Initialization. The READY display indicates that this process is complete. Master Initialization automatically selects default addresses for certain classes of I/O operations:

<u>I/O Class</u>	<u>Default Address</u>	<u>Normal Device</u>
Console Input	001	Keyboard
Console Output	005	CRT
Print	005	CRT
Input	001	Keyboard
Disk	310	Disk
Plot	413	Plotter

4.3 THE OTHER STATIONS IN THE SYSTEM

In order for a Work Station to carry on disk operations, the Master Station CPU and the multiplexed disk drive must be turned on. Other peripheral devices may be on or off, as needed. In the 2230 MXA-1 multiplexing system, power at the slave stations may be on or off without affecting operations at the other slave stations.

NOTE:

When several systems are multiplexed to the same disk with 2230MX Multiplexer, the master CPU (the CPU with the 2230MXA-1 master board) must be powered ON in order for any other system to access the disk. One or more of the slave CPU's (those with 2230MXB-1 slave boards) may be OFF without disturbing the operation of the other CPU's. However, slave stations cannot be powered on or off while the disk is in operation.

CHAPTER 5 DISK MULTIPLEXER OPERATIONS

5.1 INTRODUCTION

The Model 2230MXA disk multiplexer permits several independent systems to share a single disk unit. A maximum of four independent CPU's can be multiplexed to the same disk, allowing users to share a common disk-resident data base, or to maintain independent files on a commonly used disk.

The Model 2230MXA/B is a "daisy chain" multiplexer which consists of a 2230MXA-1 master controller board, and one or more slave controller boards. A slave controller board is contained in each Work Station (the connector on the rear panel is labeled "DISK"). The systems are connected by running cables from the master board to the slave board of the next consecutive CPU to form a chain. The disk connector cable plugs into the disk jack on the master board to complete the chain; only the system with the master board connects directly to the disk unit. When more than one Work Station (or PCS-IIA) is used, the stations must be connected via "T" connector cables as indicated below:

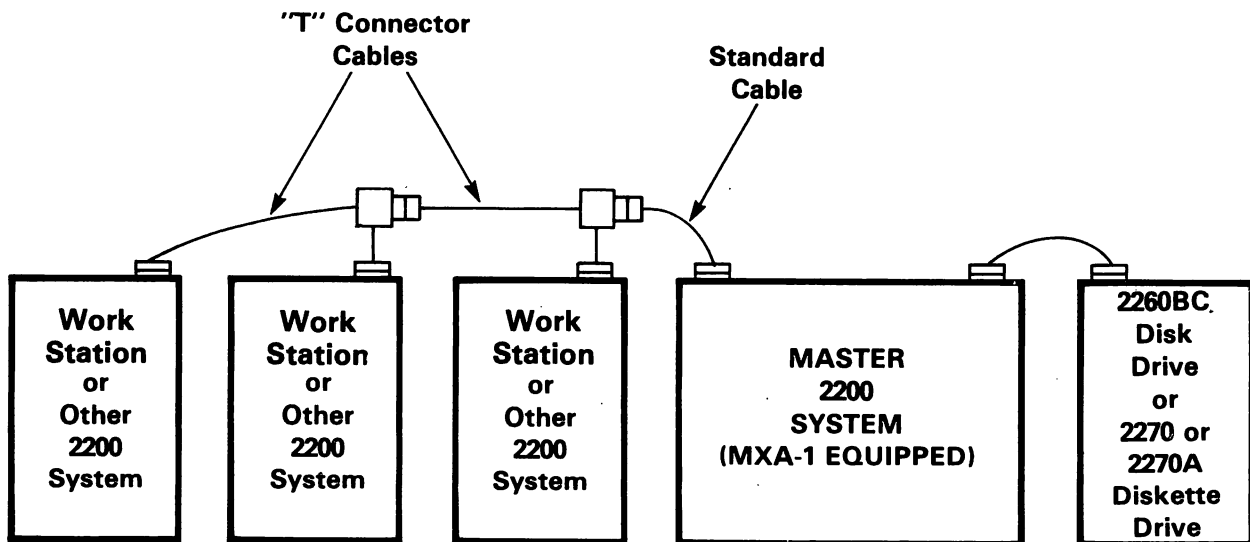


Figure 5-1. Serial Connection

In either case, the alpha variable is required to satisfy the general syntax of \$GIO statements. The alpha variable must be at least 10 bytes long, and independent of program execution. File numbers are values which are assigned, within programs, to disk device addresses. For example, SELECT #1 B10 assigns #1 to disk device address B10. Disk device addresses are not programmer selectable, but are preset within each disk controller board. For more information concerning disk device addresses, refer to the Wang BASIC Language Disk Reference Manual.

Example 5-1. Entering and Leaving Hog Mode Using \$GIO Hog

```

110    REM OPEN FILE IN NON-HOG MODE
120    SELECT #1 B20
130    DATA LOAD DC OPEN T#1, "DATAFILE"
.
.      (processing)
.
270    DBACKSPACE #1, BEG
280    DSKIP #1, N S:  REM SKIP N SECTORS
290    REM UPDATE RECORD IN HOG MODE
300    $GIO DISK HOG #1 (4480, A$): REM ENTER HOG MODE
310    DATA LOAD DC #1, A,B,C:  REM READ RECORD
320    DBACKSPACE #1, 1 S
330    DATA SAVE DC #1, A, B+K, C: REM UPDATE
340    $GIO DISK RELEASE #1 (4400, A$): REM LEAVE HOG MODE

```

This example illustrates a typical update routine in which hog mode is activated temporarily during the actual updating (from the time the record is read until its updated version is written). The file is opened with the disk drive in normal mode (line 130). Lines 270 and 280 locate the desired record, also while in normal mode. Hog mode is entered upon execution of line 300; this station maintains exclusive access to the entire disk drive until executing line 340, at which time hog mode is left.

Address Hog

The hog mode address for any multiplexed disk device can be calculated by adding HEX (80) to the normal address. Sample normal and hog mode address are:

<u>NORMAL ADDRESS</u>	<u>HOG MODE ADDRESS</u>
320	3A0
B20	BA0
B30	BB0

The hog mode addresses refer to the same disks as do the corresponding normal addresses.

Example 5-2. Entering and Leaving Hog Mode Using Address Hog

```
290     REM UPDATE RECORD IN HOG MODE
300     SELECT #1 BAO :REM HOG MODE ADDRESS
310     DATA LOAD DC #1, A, B, C :REM ENTER HOG MODE AND READ RECORD
320     DBACKSPACE #1, 1 S
330     SELECT #1 B20 :REM NON-HOG ADDRESS
340     DATA SAVE DC #1, A, B+K, C:REM UPDATE, THEN LEAVE HOG MODE
```

In the above example, line 300 substitutes the hog mode address (BAO), for the normal address (B20), in the device table. Hog mode is entered upon execution on line 310. A normal address is selected in line 330 in preparation for leaving hog mode. The disk is returned to normal mode upon execution of line 340.

The following points should be noted in regard to the operation of hog and non-hog modes:

1. When a multiplexed disk drive is hogged, the entire disk unit (all platters) is hogged.
2. Only the station which activates hog mode can deactivate it.
3. If a station attempts to execute a disk statement while another station is hogging the disk drive, the station simply waits, with the processing light on, until hog mode is released.
4. Hog mode is deactivated if RESET is keyed at the hogging station.

NOTE:

When several systems are multiplexed to the same disk with 2230MX Multiplexer, the master CPU (the CPU with the 2230MXA-1 master board) must be powered ON in order for any other system to access the disk. One or more of the slave CPU's (those with 2230MXB-1 slave boards) may be OFF without disturbing the operation of the other CPU's. However, slave stations cannot be powered on or off while the disk is in operation.

APPENDIX A WORK STATION OPTIONS

Output Peripherals

- Model 2221W Line Printer (132 columns) is a 10 pitch, 200 characters/second (60 to 300 lines/minute), 9 by 9 dot matrix printer. Its set of 96 characters include uppercase and lowercase characters, numerics, and special characters. The 2221W also produces highlighted print of double width characters under program control.
- Model 2231W-1 Line Printer (112 columns) is a 10 pitch, 120 characters/second (60 to 300 lines/minute), 9 by 7 dot matrix printer. Its ASCII set of 96 characters can be generated under program control in uppercase, lowercase and highlighted double width.
- Model 2231W-2 Line Printer (132 columns) is a 10 pitch, 120 characters/second (60 to 300 lines/minute), 9 by 7 dot matrix printer. Its ASCII set of 96 characters can be generated under program control in uppercase, lowercase and highlighted double width.
- Model 2231W-3 Line Printer (132 columns) is a 10 pitch, 120 characters/second (60 to 300 lines/minute), 7 by 8 dot matrix printer. The 2221W-3 is an accessory to the 2282 Graphic CRT only. When attached to the Graphic CRT, this printer provides an accurate hardcopy of the graphic information on the CRT.
- Model 2231W-6 Line Printer (132 columns) is a high density 20 by 12 dot matrix printer which produces typewriter-like quality output at the rate of approximately 70 character/second (45 to 250 lines/minute). Its set of 96 characters include uppercase and lowercase characters, numerics, and special characters.
- Model 2261W High Speed Printer (132 columns) is a 220 lines/minute, 11 by 8 dot matrix printer. The 2261W uses four bidirectional printing heads to print a full set of 96 ASCII characters with expanded print capability.

- . Model 2263-1 "chain-type" Line Printer prints 400 lines/minute, 6 lines/inch, 132 characters/line, using 64 uppercase or lowercase ASCII characters.
- . Model 2263-2 "chain-type" Line Printer prints 600 lines/minute, 6 lines/inch, 132 character/line using 64 uppercase or lowercase ASCII characters.
- . Model 2272-2 Triple Pen Drum Plotter offers point, continuous line, and alphanumeric plotting. Its 64 ASCII character set may be output in 15 selectable sizes. The plot may be positioned and repositioned with the four selectable coordinate axis settings. Metric versions are also available.
- . Model 2273 Band Printer is a microprocessor-controlled, solid character impact band printer. Available in two models, the Model 2273-1 prints 250 lines/minute; the Model 2273-2 prints 600 lines/minute. Both models offer the user a selection of character sets and print styles.
- . Model 2281W Plotting Daisy Output Writer is a daisy character wheel printer which functions as a digital plotter and an output writer. It bidirectionally prints an 86-character ASCII set containing uppercase and lowercase letters, numerics, and symbols at 30 characters/second. The 2281W can generate output in 10-pitch (132 characters/line) or 12-pitch (157 characters/line).
- . Model 2282 Graphic CRT provides CRT plotting and alphanumeric lettering. All plotting is displayed on the screen and can be modified by the operator. When used with the Model 2231W-3 Line Printer, the 2282 Graphic CRT provides an accurate reproduction of the graphics information displayed on the CRT.

Options

- . Option 66 provides a CRT that can display 24 lines of 80 characters each. The 24 x 80 CRT offers the same uppercase/lowercase character set as the standard 16 x 64 CRT, and is the same physical size.
- . Option 60 offers, as a package, the following Work Station enhancements.
 1. Keyboard Clicker: Installed in the keyboard, it emits an audible click when a key has been sufficiently depressed to enter a character.
 2. Auxiliary Display Connector: A read-panel connector which permits an auxiliary CRT display to be connected.
 3. Audio Alarm: A device which generates a brief audible tone when an ASCII bell code (HEX 07) is received at the CRT address.

APPENDIX B WORK STATION SPECIFICATIONS

Size
Height 13.50 in. (34.3 cm)
Depth 20.50 in. (52.1 cm)
Width 19.75 in. (50.2 cm)

Weight
54 lb (24.5 kg)

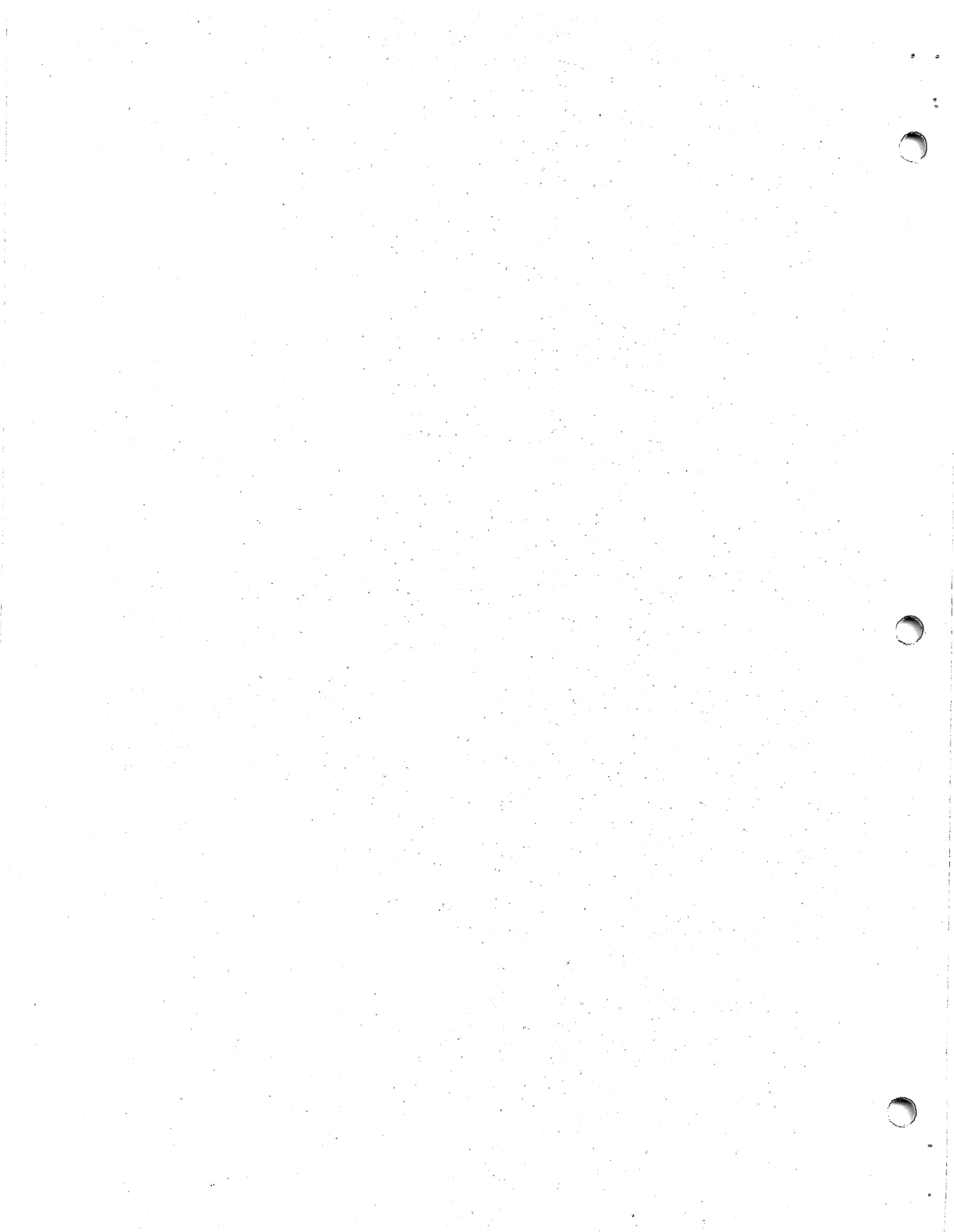
CRT
Display Size 12 in. (30.5 cm) diagonal measure
Capacity 16 lines, 64 characters/line
Character Size
Height 0.20 in. (0.51 cm)
Width 0.12 in. (0.30 cm)

Optional CRT
Display Size 12 in. (30.5 cm) diagonal measure
Capacity 24 lines, 80 characters/line
Character size
Height 0.16 in. (0.41 cm)
Width 0.09 in. (0.23 cm)

Power Requirements
115 or 230 VAC \pm 10%
50 or 60 Hz \pm 0.5 Hz
260 W

Fuses
2.5 amp @ 115 V/60 Hz
0.5 amp @ 230 V/50 Hz

Operating Environment
65°F to 75°F (18°C to 24°C) recommended
50°F to 90°F (10°C to 32°C) allowable
35% to 65% relative humidity recommended
20% to 80% relative humidity allowable



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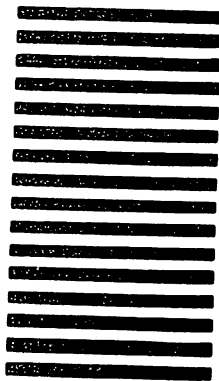


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