

Systems

**IBM 3270
Information Display System
Installation Manual –
Physical Planning**



Fifth Edition (December 1979)

This is a major revision of, and obsoletes, GA27-2787-3. Major technical changes have been made throughout, and this publication should be reviewed in its entirety. Significant changes or additions to the specifications contained in this publication will be reported in subsequent revisions or Technical Newsletters. Before using this publication in connection with the installation and operation of IBM equipment, refer to the *IBM System/360 Bibliography*, GC20-0360, and *IBM System/370 and 4300 Processors Bibliography*, GC20-0001, for editions that are applicable and current.

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Preface

This manual contains information that is intended to guide customers in planning the physical installation of terminals and control units of the IBM 3270 Information Display System. Included are scheduling information, floor-planning information, electrical and environmental requirements, and cabling information.

This manual is arranged in the following order:

Chapter 1. Introduction—Provides general information about the various units that make up the 3270 Information Display System. A preinstallation schedule and customer floor-planning guide are also discussed.

Chapter 2. Operator Work-Space Considerations—Contains information relating to work station design layouts and the environmental considerations to be observed when planning an installation.

Chapter 3. Site Preparation—Explains the requirements for site preparation, including electrical requirements, cabling, and the elimination of electrical/magnetic interference.

Chapter 4. System Configuration and Cabling—Contains cabling schematics for local and remote configurations as well as detailed information on cables required for each configuration.

Chapter 5. Machine Specifications—Contains detailed specifications of each unit in the 3270 Information Display System.

Chapter 6. Communication System Cabling—Contains information pertaining to coaxial cable installations, including specifications for cables and connectors that the customer may elect to fabricate.

This manual also includes the following appendices: Appendix A contains U.S. and Canada Power Cord Plug Types; Appendix B contains Power Cable Lengths; Appendix C contains WT Power Plug Requirements; Appendix D contains Power Cord Specifications; Appendix E contains the U.S. Lightning Damage Probability Map; Appendix F contains Connector Specifications for attaching Non-IBM Modems; Appendix G contains 3270 Specification Summary (Metric Units); Appendix H contains 3270 Specification Summary (English Units); Appendix J contains Cables and Connectors Attaching Non-IBM Devices; Appendix K contains a Wire Conversion Table; Appendix L contains an Inch-to-Centimetre Conversion Table; Appendix M contains Voltage Limitations; and Appendix N contains an Installation Checklist.

In planning the installation, the customer should make any arrangements deemed necessary for the services of professional consultants. The installation must meet local and national code requirements.

The following publications should be used in conjunction with this manual:

IBM 3270 Information Display System: Component Description, GA27-2749

IBM 3270 Information Display System: Planning and Setup Guide, GA27-2827

Assembly of Coaxial Cable and Accessories for Attachment to IBM Products, GA27-2805

IBM System/370 Installation Manual—Physical Planning, GC22-7004 (WT19-0004)

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Abbreviations and Definitions

ambient	environment	MHz	megahertz, one million cycles per second
A/FE	Americas/Far East	min	minimum or minute
avg	average	mm	millimetre
AWG	American Wire Gauge	modem	modulator-demodulator, device that modulates and demodulates signals transmitted over communication facilities
bps	bits per second		
BTU	British thermal unit		
C	Celsius	NEC	National Electrical Code
CCITT	Consultant Committee of International Telephone and Telegraph	NEMA	National Electrical Manufacturers' Association
cfm	cubic feet per minute	No.	number
cm	centimetre	NTT	Nippon Telephone and Telegraph
cont	continuous		
DAA	data-access arrangement	OD	outside diameter
db	decibel	ohm	the practical meter-kilogram-second unit of electric resistance equal to the resistance of a circuit in which a potential difference of 1 volt produces a current of 1 ampere
dielectric	nonconductor of direct electric current		
EAS	Extended Area Service		
EIA	Electronic Industry Association	pF	picofarad
E/ME/A	Europe/Middle East/Africa	PTT	Postal Telephone and Telegraph
EPO	Emergency Power Off	PVC	polyvinyl chloride
F	Fahrenheit/foot		
ft	feet	R	rear
H	height	REA	Rural Electrification Administration
Hz	hertz, unit of frequency equal to one cycle per second	Rel	relative
		rms	root-mean-square
		Rt	right
ID	identification		
IDS	Information Display System	S	side
in.	inch	secs	second
kcal/hr	kilocalories per hour	service clearance	minimum space required to allow working room for the machine operator and/or the customer engineer for servicing the unit
kg	kilogram		
kVA	kilovolt ampere	SF	special feature/specify feature
L	left		
lb	pound	UL	Underwriters Laboratory
lumens/m ²	lumens per square metre	U.S.	United States
		WE	Western Electric
m	metre		
max	maximum		
MES	Miscellaneous Equipment Specification		

Chapter 1. Introduction

The information presented in this manual is intended to assist management personnel, system planners, installation planners, and installation personnel in performing the physical planning and installation procedures required to install an IBM 3270 Information Display System at a customer's facility.

In general, the manual describes the site preparation activities that should be performed at a customer's facility prior to, during, and after delivery of a 3270 Information Display System to the customer. Further, the planning and installation data presented in this manual covers the whole spectrum of system configurations that are available to the customer: large clusters, small clusters, or a mixture of both types, operating in a local or remote environment.

Installation planning as described in this manual is divided into the following phases of activity: preinstallation planning, site preparation, work space and unit allocation, overall system design layout, cabling layout for local or remote system configurations, unit-to-unit cable routing, and installation of the cabling attaching all units.

3270 System Units

Listed below are the individual units that make up the 3270 Information Display System:

IBM 3271 Control Unit Models 1, 2, 11, and 12

IBM 3272 Control Unit Models 1 and 2

IBM 3274 Control Unit Models 1A, 1B, 1C, 1D, and 51C

IBM 3275 Display Station Models 1, 2, 11, and 12

IBM 3276 Control Unit Display Station Models 1, 2, 3, 4, 11, 12, 13, and 14

IBM 3277 Display Station Models 1 and 2

IBM 3278 Display Station Models 1, 2, 3, 4, and 5

IBM 3279 Color Display Station Models 2A, 2B, 3A, and 3B

IBM 3284 Printer Models 1, 2, and 3

IBM 3286 Printer Models 1 and 2

IBM 3287 Printer Models 1, 2, 1C, and 2C

IBM 3288 Line Printer Model 2

IBM 3289 Line Printer Models 1 and 2

Preinstallation Planning

The following general schedule is a guideline for customized planning at individual locations. Adherence to this schedule will ensure that the site is ready on the planned installation date.

Since the IBM 3274 Models 1C, 51C, 3276, 3278, 3279, 3287, and 3289 machines are designated Customer Setup (CSU) machines, additional information is provided to enable both the customer and the IBM Marketing Representative to develop a comprehensive plan for the setup of customer setup machines. This information is contained in the *IBM 3270 Information Display System: 3274 Control Unit Planning, Setup, and Customizing Guide*, GA27-2827, and the *IBM 3270 Information Display System: 3276 Control Unit Display Station Planning and Setup Guide*, GA18-2041. Delays in the installation may result if the information in these publications and the schedule in the following paragraphs are not used.

Schedule of Customer Responsibilities

Six Months before Delivery

- Review specifications for cables that the customer must supply and begin to gather procurement source information if cables are not to be ordered from IBM.
- Determine which cables to be obtained from IBM are available only in preassembled form and plan accordingly.
- Complete all structural, mechanical, and electrical design specifications.
- Verify that common carrier facilities can be installed and operational by the planned installation date.
- Obtain review by the IBM Marketing Representative for the final terminal installation plan.
- Submit invitations for bids to outside contractors as required.

Four Months before Delivery

- Have a source for cables and accessories that the customer must supply and ensure that they will be supplied on schedule.
- Submit order for cables to be obtained from IBM. (Remember that some cables are supplied with the unit and no order is required.)

Three Months before Delivery

- Begin alterations to building.

One Month to One Week before Delivery

- Review checklist provided in Appendix N to ensure adequate preparation.

At Time of Delivery

- Place units in proper locations.
- Place units in proper location before removing external packaging material, to prevent damage to the units. Some machines are shipped on pallets which are slightly larger than the machines. These units may not go through openings (doors) to the final machine location unless removed from such pallets. Should it be necessary to remove the pallet, be careful not to damage the legs or other supports of the machine while moving the machine to its proper location.
- Remove external packaging material.
- Check order; report any discrepancies to IBM.
- Install any units designated for customer setup.

Product and Environmental Safety

Safety is a major consideration in the design of IBM products. Environmental safety is the responsibility of the customer. The following safety factors should be considered:

Emergency disconnection of power to the branch circuits serving the equipment.

Clearances for both operating and service personnel (see the machine specification pages in Chapter 5 for recommended clearances); access clearance for each individual machine must also be considered (clearances in back of a unit are of little value if an access path is not provided).

Grounding of branch circuits as indicated under "Branch Circuits and Grounding" in Chapter 3 of this manual.

Lightning protection as indicated in Chapter 3 for power lines and in Chapter 6 for signal lines.

Customer Responsibility

The customer is responsible for all site preparation, including:

Following the "Schedule of Customer Responsibilities" cited above.

Doing floor planning, discussed below.

Obtaining, installing, and maintaining customer-supplied cables.

Providing on-site maintenance facilities when required.

Arranging to install any necessary communication facilities (common carrier, Postal Telephone and Telegraph, or private) and attaching IBM cabling to these facilities.

In addition, the customer must complete the setup installation, and checkout of all customer-setup 3270 units. For the customer setup units (3274 Model 1C, 51C, 3276, 3278, 3279, 3287, and 3289) the customer must follow the setup instructions in the *IBM 3270 Information Display System: 3274 Control Unit Planning, Setup, and Customizing Guide*, GA27-2827, and *IBM 3270 Information Display System: 3276 Control Unit Display Station Planning and Setup Guide*, GA18-2041. The procedures must be followed whenever a unit is delivered or relocated.

IBM's Marketing Representative will assist customer personnel in understanding the requirements in this manual and will assist with the physical installation plans.

Data Security

The transmission of data between units is subject to unauthorized access. The customer should take whatever precautions are necessary to protect vital information. Data encryption features or devices are available that can protect data from being understood if it is received accidentally or without authorization. These features or devices are effective, but only between the transmitting unit and the receiving unit. Because the encryption features or devices are associated with the 3276 Control Unit Display Station or the 3274 Control Unit, the transmission of information between the attached displays or printers and the control unit is unprotected and a possible source of unauthorized access.

Floor Planning

For each location, a detailed floor plan, showing terminal placement, should be prepared for efficient work flow, operator comfort and safety, and adequate service clearances.

When planning work-station display layouts, a review of Chapter 2, "Operator Work Space Considerations," is recommended.

The floor plan should be reviewed by customer management and, when required, by the IBM Installation Planning Representative before cabling is ordered.

The following items should be considered:

Service clearances as shown in planned views.

Operator clearances.

Functional clearances.

Access clearances.

The lengths of power cords and the location of the electrical outlets with proper phase, voltage, and ampacity.

The lengths of the cables that connect units of the system to the communication channel terminations; the common carrier or PTT representative must be consulted regarding the location of the communication channel termination and the type of connection proposed.

Where a device may interface with more than one control unit or vice versa, all cabling paths must be planned, that is, 3278 and 3279 display units with Feature Code 1720 permit switching operational control of that display unit between two different control units. Therefore, a separate coaxial cable run is necessary between the display unit and each control unit.

The path of the cables exiting from the unit:

- The protection of these cables
- The hazard these cables create by lying on the floor

The availability of telephones with outside lines near control units, to aid problem determination.

Electrostatic discharge (see “Electrostatic Discharge” in Chapter 3).

High electromagnetic field strength (see “Electromagnetic Compatibility” in Chapter 3).

Templates

To assist the customer's installation planning team in preparing a floor plan, IBM provides transparent templates of the units. The *IBM 3270 Information Display System Physical Planning Template*, GX27-2990, is in U.S. customary units and is drawn to a scale of 1/4 inch = 1 foot (1:48). The *IBM 3270 Information Display System Physical Planning Template*, GX27-2999, is in metric units and is drawn to a scale of 2 centimetres = 1 metre (1:50). The templates can be obtained from the IBM Marketing Representative.

Chapter 2. Operator Work Space Considerations

Work-station layout and environmental considerations have an effect on work efficiency and employee comfort. This is particularly true for tasks that require the operator to be at the terminal for extended periods. This chapter is not a complete work-environment design guide; it highlights factors that affect accommodation of a 3270 IDS terminal as part of a work station and performance of visual tasks.

Recommendations in this section are based on human body measurements and extensive observations. The recommended work-space dimensions are based on an adult female height of 162.5 cm (64.8 inches) and an adult male height of 178 cm (70.2 inches) and will accommodate the great majority of users of approximately these heights. Of course, some of these work-space dimensions are unsuitable in other geographical areas, because population body measurements differ significantly.

General Considerations

When an operator is at a work station more or less continuously, work-space dimensions, equipment orientation, and conveniences become important.

Where possible, allowances should be considered for individual differences, such as very tall or short operators, those with bifocals, the left-handed, and the handicapped. Adjustable chairs, keyboard wells, and footstools are some of the common ways of obtaining adjustments. Also, the operator should be able to customize the work station by re-orienting the keyboard and display positioning the source documents, reference items, and other job articles. Storage space for personal items should also be considered.

Putting more space or sound baffles or both between work stations is a common measure to control noise or voice interference. Where work stations are quite close, it may be desirable to reduce visual distractions with, for example, low dividers between stations.

One objective in work-station design is to be able to position the keyboard at a preferred height. Typically, the height should be such that forearms are (or are nearly) horizontal.

The choice of a work-station arrangement depends upon factors such as available space, facilities, traffic, and the intended application. Depending upon customer requirements, standard furniture may be used; some modifications to standard furniture may be warranted, or custom work stations may be designed.

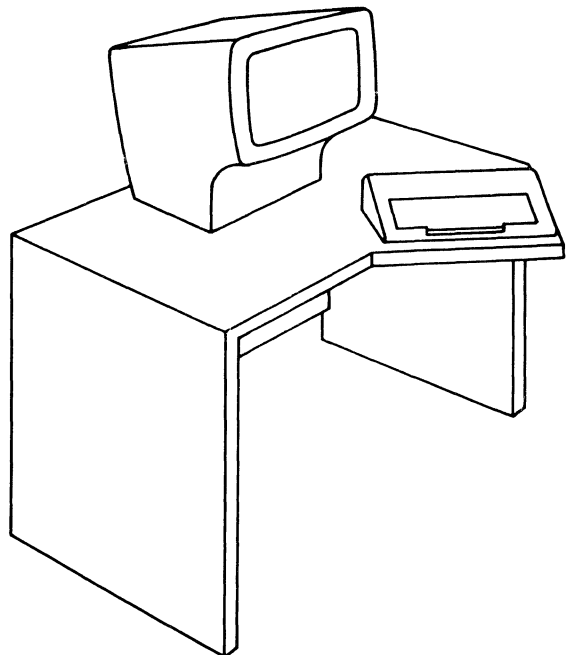
Two types of work stations commonly in use are discussed in the following paragraphs: data or text entry stations and interactive (inquiry/update) stations.

Data or Text Entry Work Stations

For data or text entry work stations, the major consideration is that the operator's primary task is to key in large amounts of data from source documents. The operator seldom needs to mark or alter the source documents. Usually they are assembled in batches, or pages in the case of text, and handled that way by the operator.

Visual attention is centered on the source document; the keyboard is operated by touch rather than guided visually. Typically, at the data entry work station the display is secondary in importance to either the source document or keyboard. Occasionally, the operator may look at the display to verify an item or to inspect status indicators. The same may apply to text entry.

A data or text entry work station is shown in Figure 2-1. Recommended dimensions are given in Figure 2-2. The work station shown is not provided by IBM. Some latitude is provided for adjustments in positioning the items.



Keyboard may be located on the left side if so desired. Provisions must be made for both signal and power cabling. See plan view of applicable unit.

Figure 2-1. Data or Text Entry Work Station

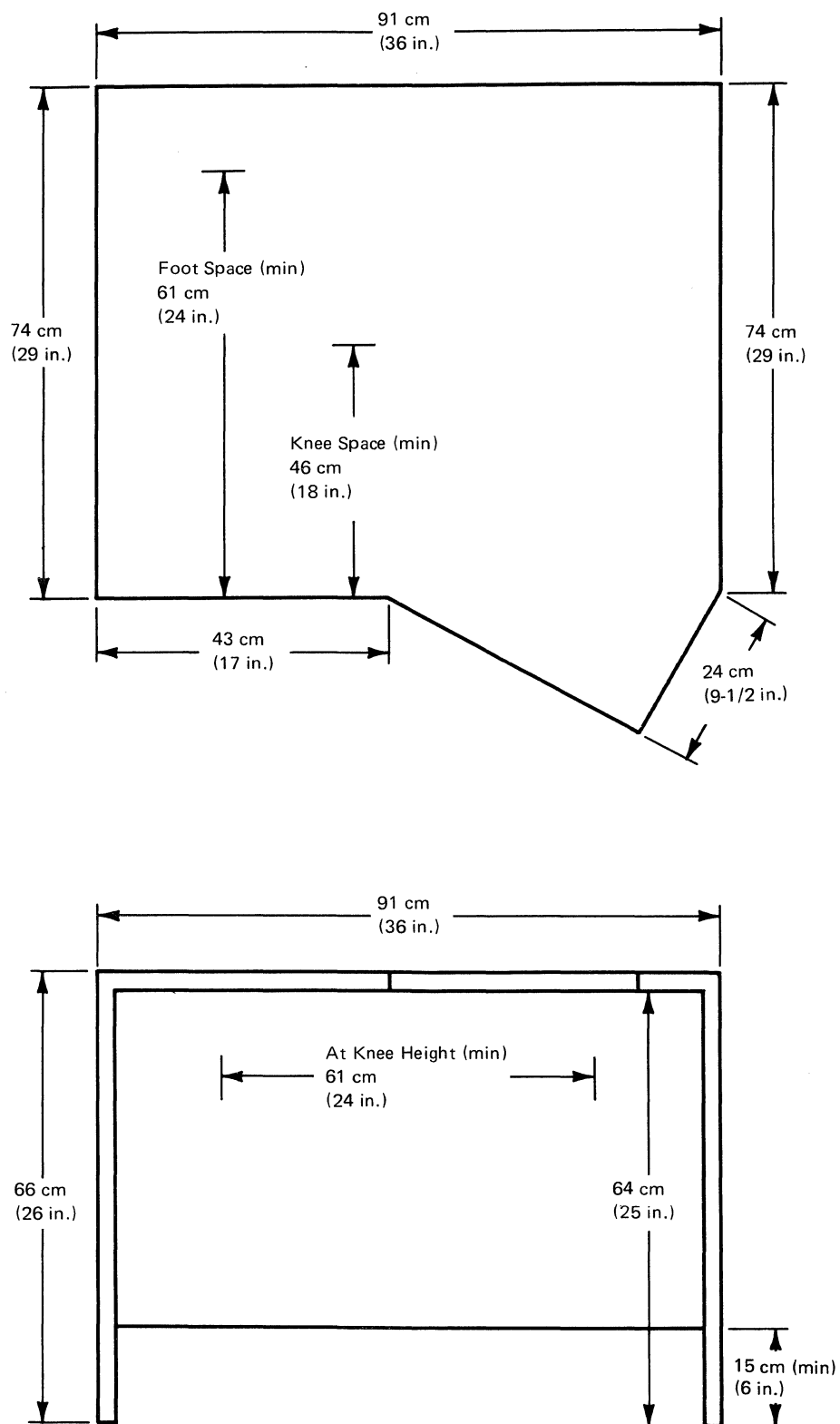


Figure 2-2. Dimensions of Data or Text Entry Work Station

Fan-folded paper panels, 38 cm X 28 cm (15 inches X 11 inches), a common computer printer size, will fit alongside the terminal when opened to 56 cm (22 inches). The interactive work station (shown in Figure 2-3) may also be used for data entry tasks, but it is not as efficient for this purpose as the data or text entry work station.

Interactive Work Stations

When a task primarily involves an interaction between the operator, display, and keyboard, the interactive station shown in Figure 2-3 is preferable. Recommended dimensions are given in Figure 2-4. In this class of applications, keying rates may be slow and are often visually guided. The operator, typically, is interested in information that is called up by a few key strokes. That information may be modified by a few more key strokes, orally transferred to a requesting party, or responded to by some decision-making process.

Other than width, the dimensions for this type of work station should not change much from those for data or text entry. At an interactive station, the minimum width depends on the amount of other equipment, reference material, forms, etc., required for performing a specific set

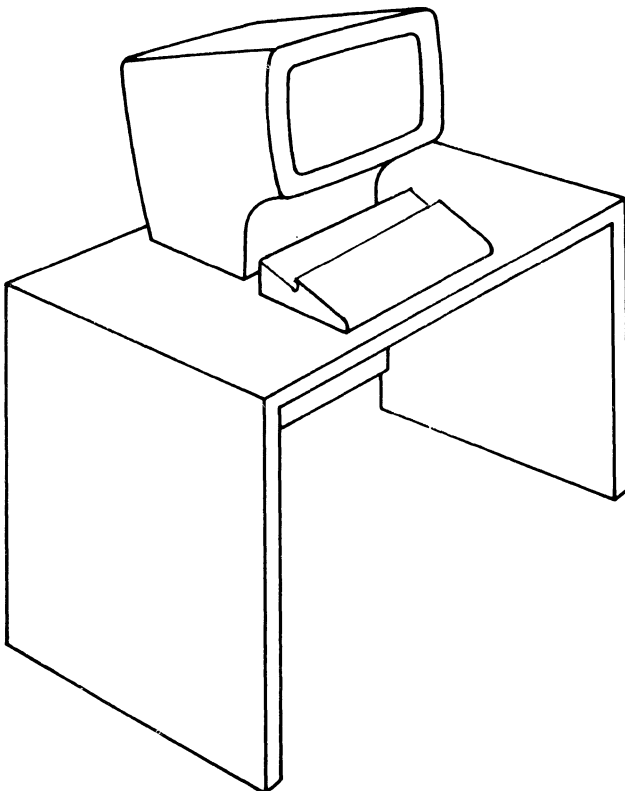


Figure 2-3. Interactive Work Station

of tasks. In any case, the width of this type of work station should not be less than 71 cm (28 inches), particularly if work stations are to be placed side by side. Fan-fold computer printer paper can be accommodated here too.

Multiple Work Stations

If the amount of floor space is particularly critical, structures that support more than one work station should be considered. Maximum compactness, with some loss of flexibility, may be obtained by designing a continuous structure that can support several individual work stations. No less than 71 cm (28 inches) of width should be allotted each work position. Figure 2-5 shows a dual work station arrangement on a 76-cm X 152-cm (30-inch X 60-inch) surface, a commonly available size.

Selected Dimensions

The following are recommended dimensions or positions for planning work station layouts.

Keyboard home row height from floor:

74 cm (29 inches) maximum for sustained professional keying

81 cm (32 inches) maximum for other keying (intermittent, hunt-and-peck)

Operator spacing:

71 cm (28 inches) minimum center-to-center between stations

122 cm to 152 cm (48 inches to 60 inches) preferred

Leg clearance, minimum:

Width: 61 cm (24 inches)

Depth: 46 cm (18 inches)

Height: 64 cm (25 inches)

Toe clearance for standing:

10 cm (4 inches) minimum

See-over height (top of display unit to floor):

Standing operator: 140 cm (55 inches) maximum

Seated operator: 112 cm (44 inches) maximum

Writing surface:

41 cm (16 inches) deep by 30 cm (12 inches) wide, minimum

Allow 2.5 cm (1 inch) spacing between multiple sets of documents

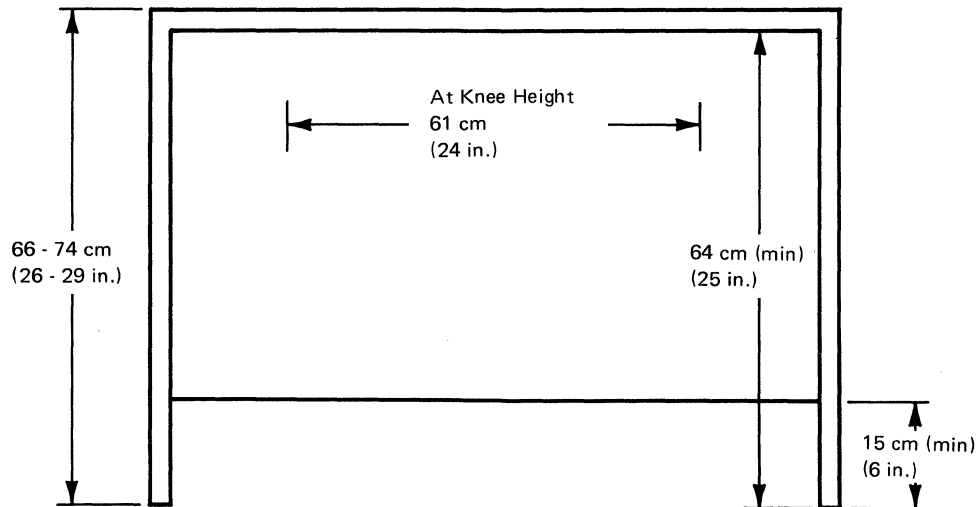
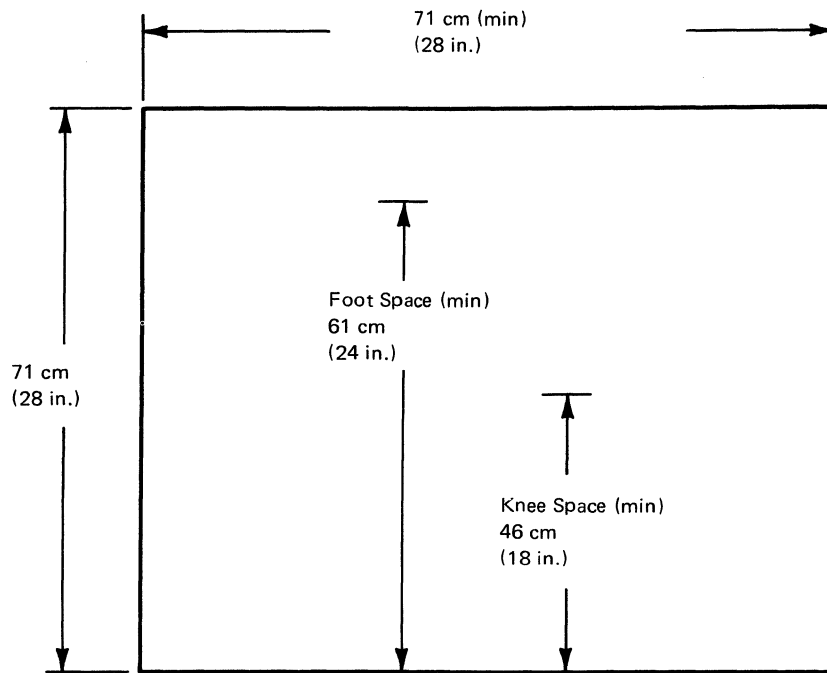


Figure 2-4. Dimensions of Interactive Work Station

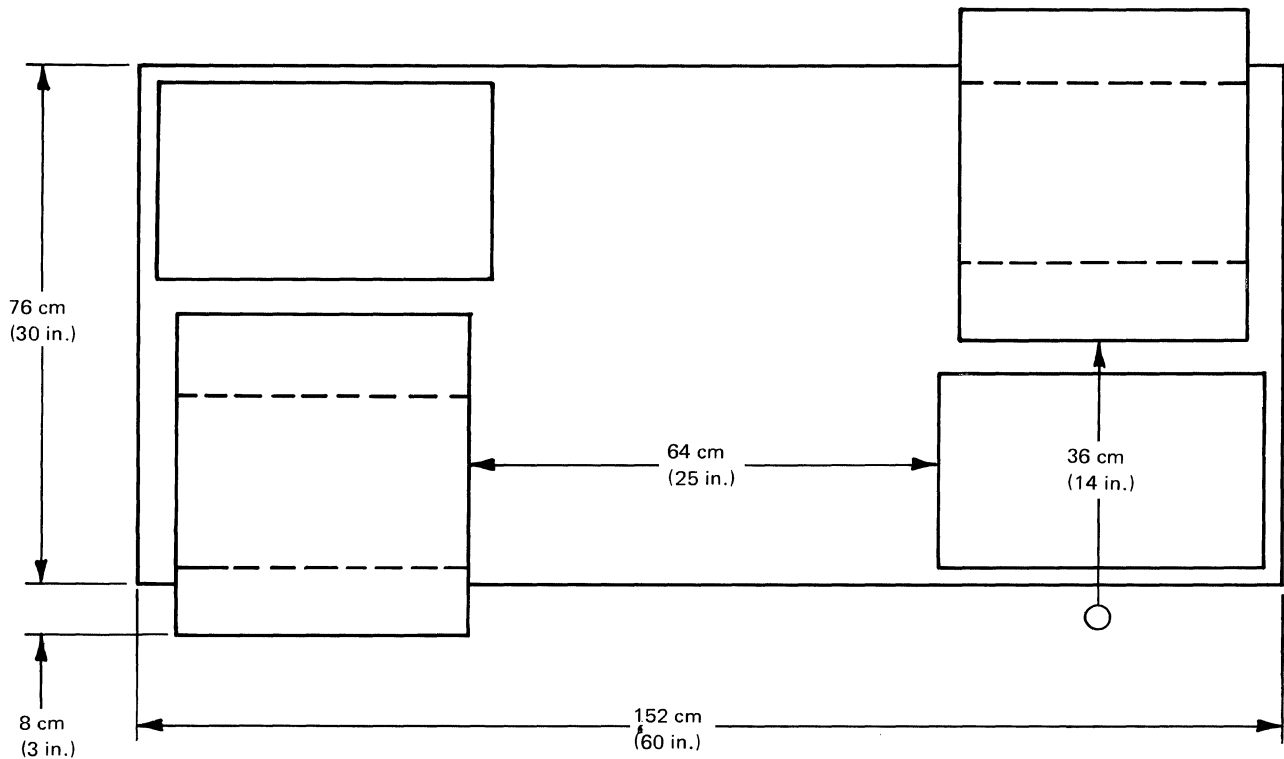


Figure 2-5. Dual Work Station Arrangement

Source and reference material:

To left of keyboard for data or text entry tasks

To right of keyboard for tasks that require writing

Telephone equipment to be left of keyboard, usually

Desk-to-desk, desk-to-wall: see Figure 2-6.

Visual Considerations

The system displays can be viewed comfortably by most persons over a range of distances, typically 33 cm to 51 cm (13 inches to 20 inches). The limits in any given case depend on the individual's eyesight, his visual environment, the work station layout, and features of the reference or source material. Viewing distances greater than 61 cm (24 inches) should not be used without careful consideration.

Ambient Lighting

Filters are provided for the 3270 IDS display screens to enhance contrast and to reduce reflections from ambient lighting. The 3277 display filter is a customer option at no cost; the 3276 Control Unit/Display Station, 3278, and 3279 displays have a built-in reflective filter.

Moderate lighting of only 540-810 lumens/metre² (50-75 footcandles) is indicated for most tasks requiring displays. It is usually helpful if lighting is reasonably balanced.

Although there are positive aspects to having windows in the display area, natural lighting may pose problems with almost any display because of its variability from less than "room ambient" to well over 100,000 lumens/metre² (10,000 footcandles). It is often helpful to orient the display screen at right angles to windows to avoid direct sunlight on the screen and to avoid sunlight in the operator's field of view when using the display.

Eye Fatigue

Eye discomfort has a number of causes which are often difficult to isolate. Discomfort may be symptomatic of bodily fatigue, a stressful visual environment, or a specific eye defect. Causes of eye discomfort and complaints are the same as in other clerical situations. Broadly speaking, the primary causes are found in attitudes, state of health, work organization factors, postural factors, the visual environment, and eye deficiencies. Often these factors interact. Those planning an installation of display terminals ought to be mindful of the common checkpoints for minimizing

visual fatigue where a display is used. Stated as qualitative rules, these points are:

Provide adequate illumination for any visual task.

Minimize differences in the viewing distances to the several objects, including the display, that are to be focused upon during the task.

Provide objects that are well defined (having minimum blur, good contrast, and medium, legible size and shape).

Minimize wide differences in brightness among work station areas; for example, desk top and walls or windows, documents, and desk tops.

Eliminate glare sources.

Reduce wide differences in brightness among objects; for example, document and display, documents used concurrently.

Keep display brightness as low as possible while providing good legibility.

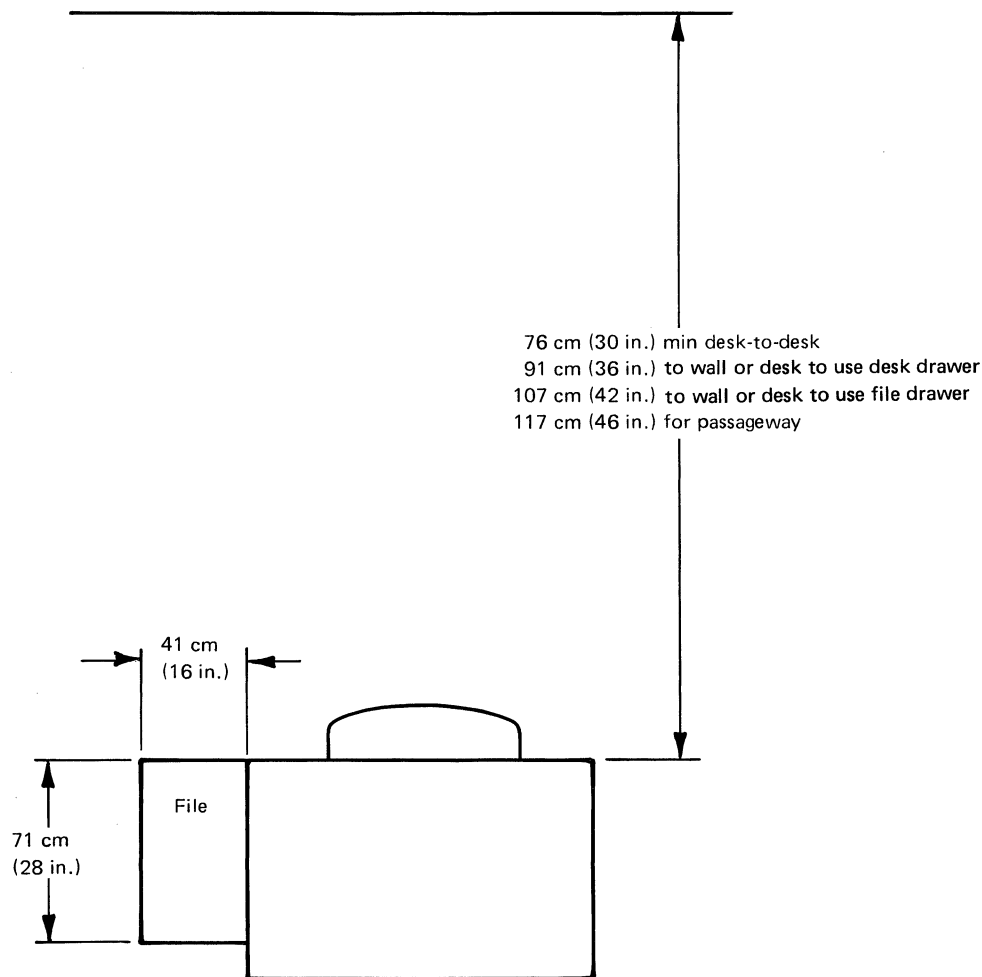


Figure 2-6. Clearances for Seated Operator

Chapter 3. Site Preparation

Temperature and Humidity

Hardware environmental requirements for temperature and humidity are as shown in Figure 3-1. Some individual units require special consideration and may have restrictive requirements. Refer to the machine specification pages in Chapter 5 for individual requirements. Humidity limits may not be the same for the machine as for various supply products such as forms and cards. The limits of the supplies should be known, because they are usually more restrictive. High or low humidity levels may cause improper feeding of paper. Before use, forms should be preconditioned not less than 48 hours in the environment of the printer. In some locations, airborne particles, vapors, or gases may subject units to contamination. If local conditions exist where contamination is suspected, contact the IBM Installation Planning Representative during the early planning stages, or before relocating units.

Environment Operating:	
Temperature	10.0° to 40.6°C* (50° to 105°F)
Rel Humidity	8% to 80%
Max Wet Bulb	26.7°C** (80°F)
Environment Non-Operating:	
Temperature	10.0° to 51.7°C* (50° to 125°F)
Rel Humidity	8% to 80%
Max Wet Bulb	26.7°C** (80°F)
Environment Storage:	
Temperature	0.6° to 60.0°C (33° to 140°F)
Rel Humidity	5% to 80%
Max Wet Bulb	29.4°C (85°F)
Environment Shipping:	
Temperature	-40.0° to 60.0°C (-40° to 140°F)
Rel Humidity	5% to 100% (including condensation, excluding rain)
Max Wet Bulb	29.4°C (85°F)

* The upper limit of air temperature should be derated 0.6°C (1°F) per 76 m (250 feet) of elevation above 914 m (3000 feet).

** The upper limit of wet bulb temperature should be derated 0.6°C (1°F) per 30.5 m (100 feet) of elevation above 305 m (1000 feet).

Figure 3-1. Temperature and Humidity Requirements

Electrical Requirements

Voltage and Frequency

The units of the 3270 Information Display System operate at 50 or 60 Hz. The allowable frequency variation is +0.5 Hz. The machine specification pages in Chapter 5 of this manual list the single-phase voltage at which the individual units operate. The allowable voltage variations are shown in Appendix M.

$$\text{Maximum Continuous Load} = \frac{\text{kVA} \times 1000}{\text{V}}$$

in Amperes

Power Cords and Receptacles

Each unit has a three-wire power cord that includes an equipment ground wire (green or green and yellow). For use in the U.S., Canada, and Japan, the power cords have plugs attached. Appendix A identifies the plugs supplied in the U.S. and Canada. Appendix C identifies the plugs supplied in Japan. For each E/ME/A or A/FE country, except Canada and Japan, units are shipped without power plugs except for the 3274, 3276, 3287, and 3289 units (customer setup units). The power cords for these units are supplied with a plug as indicated in Appendix C.

For each E/ME/A or A/FE country (except Canada) units are shipped without power plugs since plugs that are standard for each country are required. For IBM 3274, 3276, 3278, 3279, 3287, and 3289 units, the power cords are supplied with a plug as indicated in Appendix C.

Branch Circuits and Grounding

The individual branch circuits should have a suitable circuit protector properly derated in accordance with the manufacturer's specifications and with applicable codes. Each protector should be labeled to identify the branch circuit it is controlling.

The power cords are equipped with a green or green and yellow wire. This conductor must be carried back to earth or another suitable building ground. A dedicated insulated wire conductor is recommended for this purpose, however, a continuous metal conductor may be used provided that it has a permanent and continuous low impedance path to ground to ensure electrical continuity.

Lightning Protection

Power Lines

The customer should install lightning protection on his secondary power source when:

The utility company installs lightning protectors on the primary power source.

The area is subject to electrical storms or equivalent type power surges.

Communication Lines

It is also recommended that the customer ensure that lightning protection be provided on the common carrier lines.

Signal Lines

Refer to "Lightning Protection" in Chapter 6.

Selecting the lightning protector and installing it properly is a customer responsibility.

Electromagnetic Compatibility

In some instances, the site chosen for an installation may have ambient electromagnetic fields. These fields can result from nearby radio-frequency sources, such as transmitting antennas (AM, FM, television and two-way radios), radar installations, industrial equipment (radio-frequency induction heaters, arc welders, and insulation testers). Three-phase power distribution lines can generate magnetic fields that may cause display problems. As a precautionary measure, keep displays as far away as possible from such power distribution lines, preferably never closer than 1 m (3.3 feet), and from other sources of magnetic interference.

Other magnetic sources include transformers (including those installed within other units), distributions panel,

rotating machinery, and electric floor heating. To identify the location of such magnetic sources, a check with your building engineer should be made.

Before positioning units or cabling, an installation planning review may be appropriate to assess the environment and to determine whether any special installation or product considerations are required to assure normal system operation and maintenance. Consult with your IBM Installation Planning Representative.

Electrostatic Discharge

Electrostatic charges can be built up on people and furniture as a result of:

People, carts, or furniture in contact with floor covering

People in contact with furniture coverings, like seat covers

Discharge of these static charges to the metal of the unit or to the furniture on which it is situated may cause interference with the operation of the electronic equipment. It may also cause discomfort if discharged to other people.

Some major factors that contribute to this problem are:

High-resistance floor surface material

Carpeting without anti-static properties

Plastic seat covering

Very low humidity

Metal frame furniture

If any of the above factors apply, review the facility with your IBM Installation Planning Representative.

Chapter 4. System Configurations and Cabling

Local Attachment

Local (direct) attachment (Figure 4-1) of an IBM 3272 Control Unit or IBM 3274 Control Unit Model 1A, 1B, or 1D to a host system is through a selector, multiplexer, or block multiplexer channel; the control units attach via one of the eight control unit positions on the channel interface.

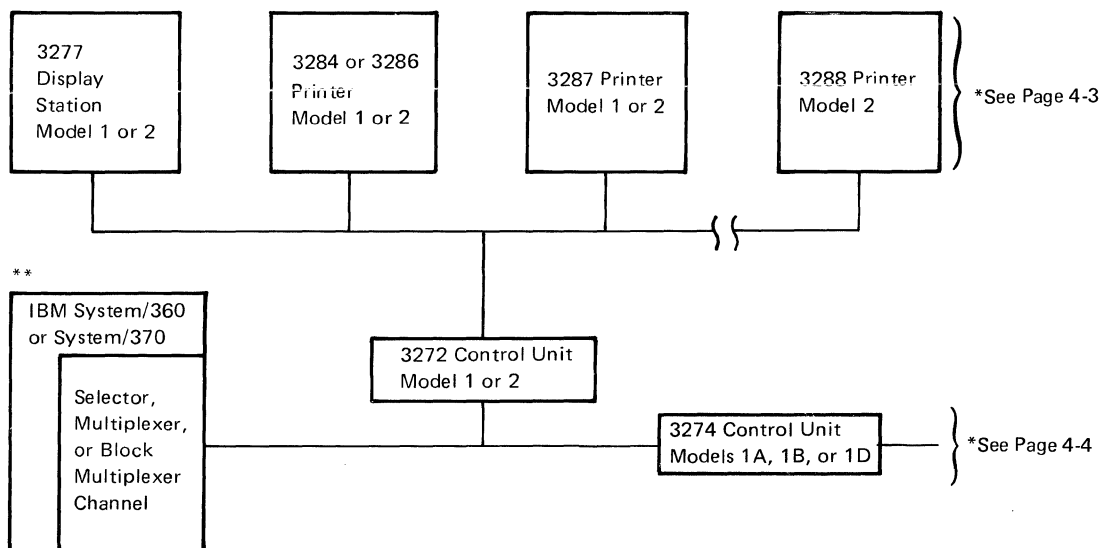
A 3272 can attach to IBM S/360 Models 25, 30, 40, 50, 65, 67 (in 65 mode), 75, 85, and 195 or IBM S/370 Models 115 through 195 or 3031, 3032, and 3033 Processors.

A 3274 Model 1A (SNA version) can attach to IBM S/370 Models 115 through 168MP and 3031, 3032, and 3033 Processors.

A 3274 Model 1B (3272 version) can attach to IBM S/360 Models 30, 40, 50, 65, 75, and 195 or IBM S/370 Models 115 through 195 or 3031, 3032, and 3033 Processors.

A 3274 Model 1D (3272 version) can only attach to IBM S/370 Models 115 through 195 or to 3031, 3032, and 3033 Processors.

At least one display station of the same model as the control unit with a keyboard special feature must be attached in each display system.



**Up to 32 devices can be attached to one control unit. A Model 1 control unit can only have these device models attached: 3284-1, 3286-1, 3277-1, 3287-1, and 3287-2. A Model 2 control unit can have any model device attached. However, the 3288-2 printer can only be attached to a Model 2 control unit.*

***Contact your IBM Sales Representative for possible systems that these control units can attach to.*

Figure 4-1. Locally Attached 3270 Information Display System

Host System Channel Priority

Input/Output Priority Sequence

Channel capabilities are affected by the sequence in which I/O devices are attached to the channel. This sequence is called priority. This is most pronounced on the byte multiplexer channel. For assigning priorities, the devices are divided into three groups:

- Class 1: Devices subject to overrun
- Class 2: Devices that require channel service in synchronization with their mechanical operations
- Class 3: Devices that do not require channel service to be in synchronization with their operations

The 3272 and 3274 control units do not require channel service in synchronization with their operation. Figure 4-2 shows the device priority considerations.

Device Wait (Critical) Time

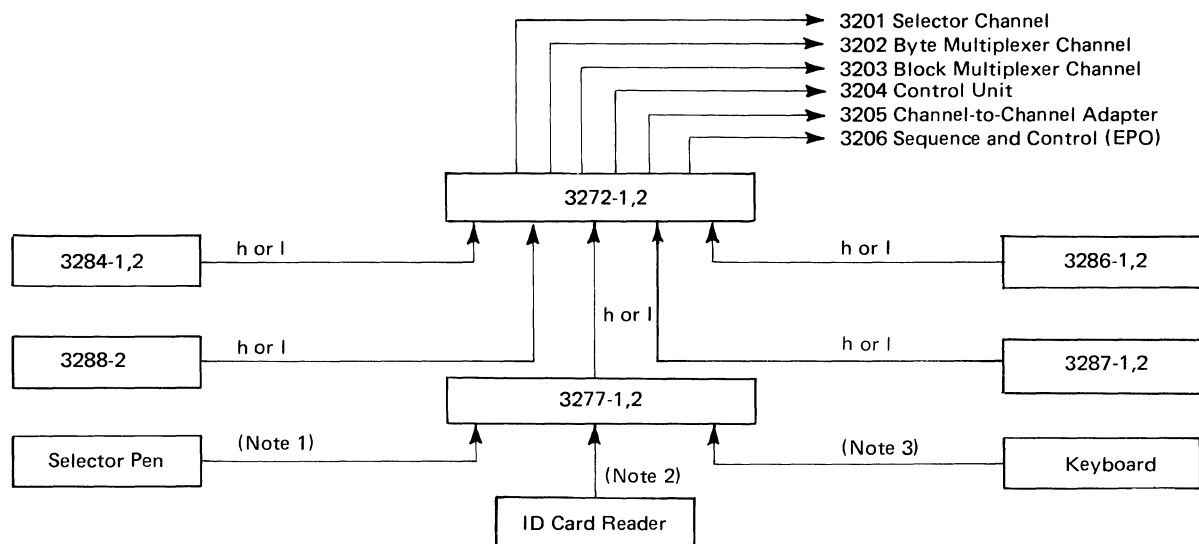
After a multiplex-mode device requests channel service, it has a fixed length of time that it can wait for service. If the channel provides service within this length of time, the device operates satisfactorily. If, however, the channel does not service the device within the device's wait time, one of two things happens: If the device is not subject to overrun, it continues waiting; if it is subject to overrun, it loses data and subsequently causes an I/O interruption condition. Neither unit (3272 or 3274) is subject to overrun; both continue to wait. However, the 3272 unit must have a response within 70 microseconds, or approximately 2 milliseconds of the data byte used in the read/write operation is lost. The time lost does not affect channel time out (32 microseconds), but it does have a major impact on data throughput.

Device	Class	Byte Multiplexer Channel Critical Time	Block Multiplexer and Selector Channel Burst Mode Data Rate (per second)
3272	3	70 microseconds	650,000 characters
3274-1A	3	No critical time	100,000 characters instantaneous
3274-1B	3	No critical time	400,000 characters instantaneous read
3274-1B	3	No critical time	650,000 characters instantaneous write

Figure 4-2. 3272 and 3274 Priority Considerations

3270 Information Display System Cabling Schematics (Local)

3272 Control Unit



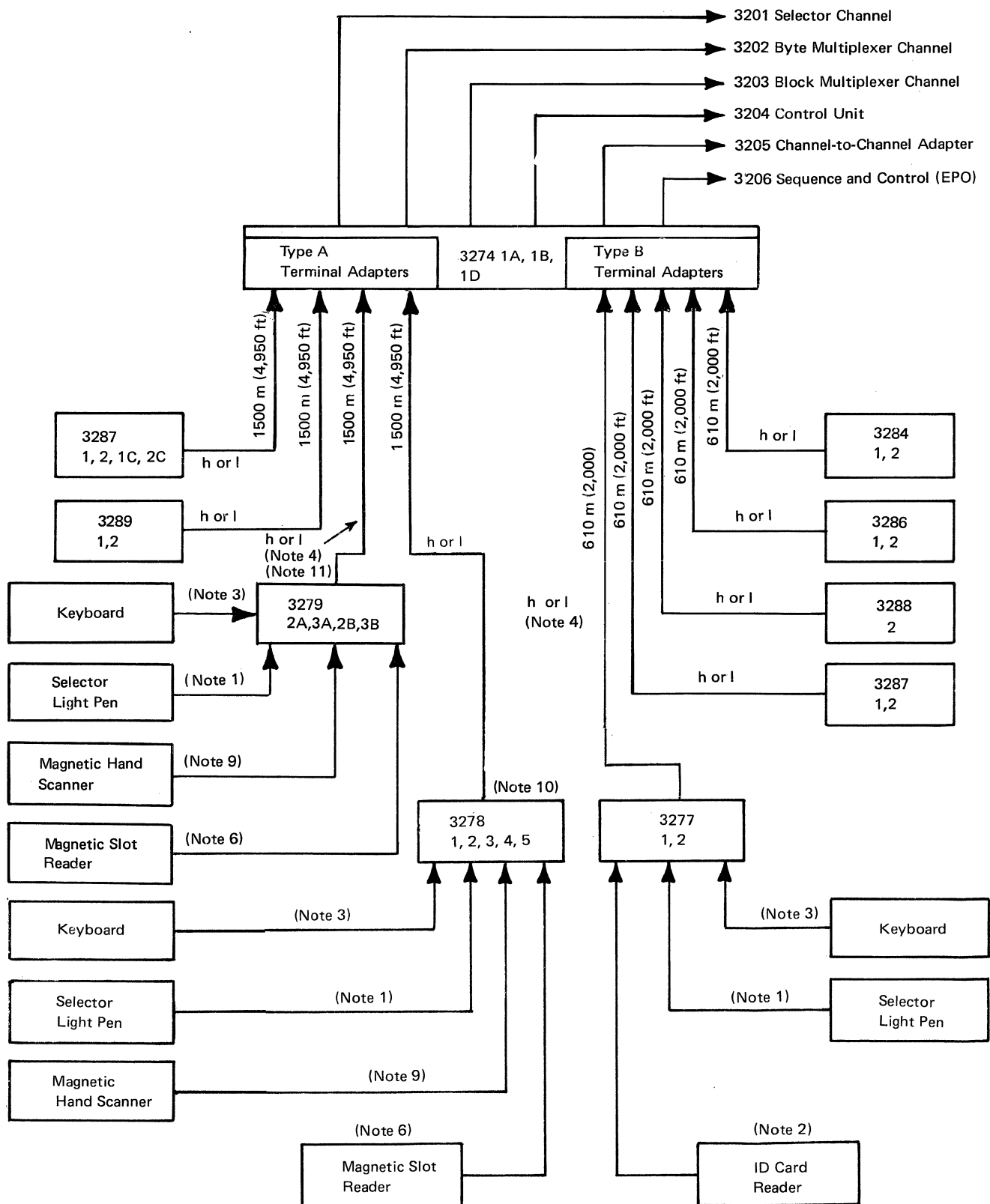
Cable Group No.	No. of Cables	From	To	Max Length m (ft.)	Notes
h or l	1	3277, 3284, 3286, 3287, 3288	3272	610 (2,000)	4
3201	2	3272	Selector Channel	-	5
3202	2	3272	Byte Multiplexer Channel	-	5
3203	2	3272	Block Multiplexer Channel	-	5
3204	2	3272	Control Unit	-	5
3205	2	3272	Channel-to-Channel Adapter	-	5, 7
3206	1	3272	Channel	46 (150)	6

Notes:

- Fixed cable length of 122 cm (4 feet) supplied with Selector Pen: 46 cm (1-1/2 feet) to holder; 76 cm (2-1/2 feet) from holder to Selector Pen
- Fixed cable length of 76 cm (2-1/2 feet) supplied with ID card reader
- Fixed cable length of 76 cm (2-1/2 feet) supplied with keyboard
- Customer-supplied, -installed, and -maintained; maximum length not to exceed 610 m (2,000 feet). See "Coaxial Cables" in Chapter 6 for ordering information and specifications.
- Total cable length of 61 m (200 feet) is available to attach all control units, unless modified by cabling schematics of individual processing units or control units. Refer to IBM System/370 Installation Manual—Physical Planning, GC22-7004, or IBM System/370 World Trade Installation Manual—Physical Planning, GC19-0004, for specific channel cabling information.
- Sequence and control (EPO).
- To channel-to-channel adapter

3274 Control Unit Models 1A, 1B, and 1D (Local)
Cabling Schematic

(Notes 5,7,8)



Cable Group No.	No. of Cables	From	To	Max Length m (ft)	Notes
h or l	1	3277, 3284, 3286, 3288, 3287 (Type B)	3274	610 (2000)	4
h or l	1	3278, 3279, 3287, 3289 (Type A)	3274	1500 (4920)	4
3201	2	3274	Selector Channel	61 (200)	5, 7
3202	2	3274	Byte Multiplexer Channel	61 (200)	5, 7
3203	2	3274	Block Multiplexer Channel	61 (200)	5, 7
3204	2	3274	Control Unit	61 (200)	5, 7
3205	2	3274	Channel-to-Channel Adapter	61 (200)	5, 7
3206	1	3274	Channel	46 (150)	8

Notes:

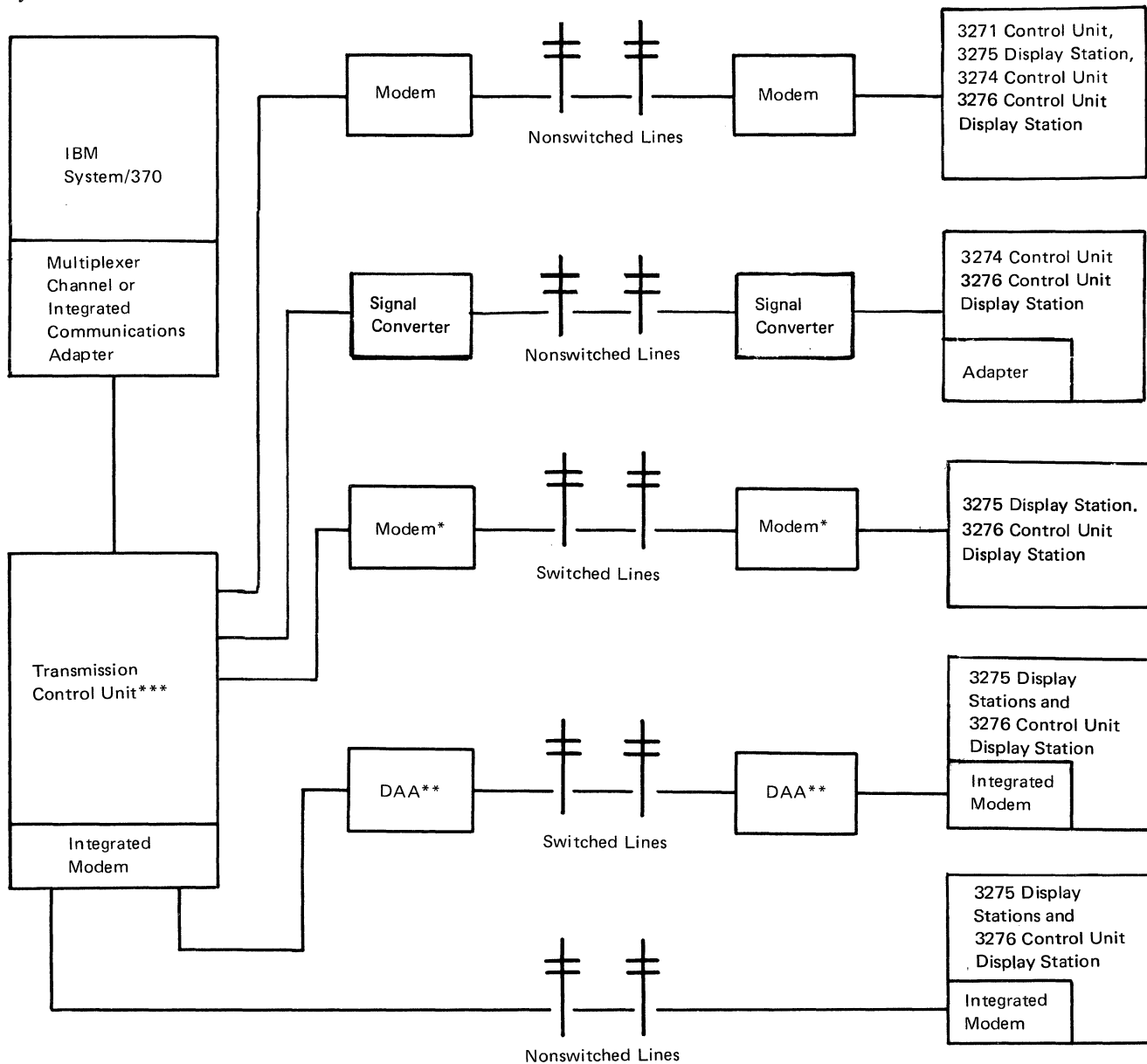
1. Fixed cable length of 122 cm (4 feet) supplied with selector light pen
2. Fixed cable length of 76 cm (2-1/2 feet) supplied with ID card reader
3. Fixed cable length of 91 cm (3 feet) supplied with keyboard; optional feature: 154 cm (5-1/2 feet)
4. Customer-supplied, -installed, and -maintained. See "Coaxial Cables" in Chapter 6 for ordering information and specifications.
5. Total cable length of 61 m (200 feet) is available to attach all control units, unless modified by cabling schematics of individual processing units or control units. Refer to IBM System/370 Installation Manual—Physical Planning, GC22-7004, or IBM System/370 World Trade Installation Manual—Physical Planning, GC19-0004, for specific channel cabling information.
6. A free-standing magnetic slot reader may be plugged into a 3278 or 3279 unit: The units are equipped with a 1.5 m (59 inches) cable for attachment to a stub cable in the 3278. To extend the distance at which the slot reader may be used, two extension cables may be ordered via MES. They are:
 - 6 m (19.7 feet) extension cable P/N 4832986
 - 12 m (39.4 feet) extension cable P/N 4832987

The maximum distance the slot reader may be extended is 13.5 m (44.3 feet); thus, both extension cables may not be used together. In addition, no cables other than those described above may be used.
7. The local attachment for the 3274 Control Unit must be ordered by cable order. The same cables used for the 3272 Control Unit are used for the 3274 Control Unit.
8. Sequence and Control
9. A magnetic hand scanner is available for use with a 3278 Display Station or a 3279 Color Display Station when they are attached to a 3274 Control Unit. The scanners are equipped with a 1.5 m (59 inches) cable for attachment to a stub cable in the 3278. To extend the distance at which the scanner may be used, two extension cables may be ordered via MES. They are:
 - 6 m (19.7 feet) extension cable P/N 4832986
 - 12 m (39.4 feet) extension cable P/N 4832987

The maximum distance the scanner may be extended is 13.5 m (44.3 feet); thus, both extension cables may not be used together. In addition, no cables other than those described above may be used.
10. A 3278 Model 5 attaches to a 3274 Model 1A or 1D.
11. The 3274 Model 1B does not support the 3279 Color Display Station Models 2B or 3B.

Remote Attachment

Remote attachment (Figure 4-3) of an IBM 3271, 3274, or 3276 Control Unit or 3275 Display Station to a host system is through communication lines and modems to a transmission control unit, an integrated communications adapter, or a communications controller cabled locally to a system channel.



Note: The 3270 IDS meets the voltage signal and impedance levels of EIA standard RS/232-C and CCITT V-28 and is designed to function with devices that comply with both standards.

*IBM modems on switched lines require data couplers or FCC-certified equivalents.

**DAA = Data-access arrangement. Data coupler type CDT or CBS, or FCC-certified equivalent required.

***Contact your IBM Sales Representative for other control units that may be applicable.

Figure 4-3. Remotely Attached 3270 Information Display System

Communication Facilities

Major Elements

The major elements of each data communication link between remotely located sites (see Figure 4-3) are as follows:

- A communication channel
- Modems or signal converters
- Interconnecting cables

The customer must arrange for installation of communication equipment and services. These facilities must be available at the time the IBM equipment is scheduled to be installed.

Communication Channel: A communication channel is usually supplied by a common carrier, or in World Trade countries by the Postal Telephone and Telegraph (PTT). A channel can consist of wire, radio waves, or both. At each site, the common carrier provides the connector that terminates the channel.

Modems and Signal Converters: A modem or signal converter is installed at each end of each communication channel, for example, at the transmission control unit and the 3270 system. The modem or signal converter is the interface between the communication channel and the data terminal equipment.

Modems: A modem modulates and demodulates the signals carried on the communication channel. At a transmitting

site, the modem modulates the communication channel signal with data bits. At a receiving site, the modem demodulates the transmitted signals back to data bits.

A modem can be a stand-alone (external) unit or it can be integrated. An integrated modem device is incorporated as a feature within a unit. In some countries, communication regulations mandate the use of PTT modems for certain types of communication services. In these cases, consult your IBM Sales Representative to determine which modems are compatible.

Signal Converters: A signal converter is similar to a modem in that it converts data bits to signals suitable for transmission over the communication channel. However, data is transmitted over the communication channel as digital signals. An adapter is required in the 3270 system for proper interface to the signal converter. The applicable networks for signal converters are:

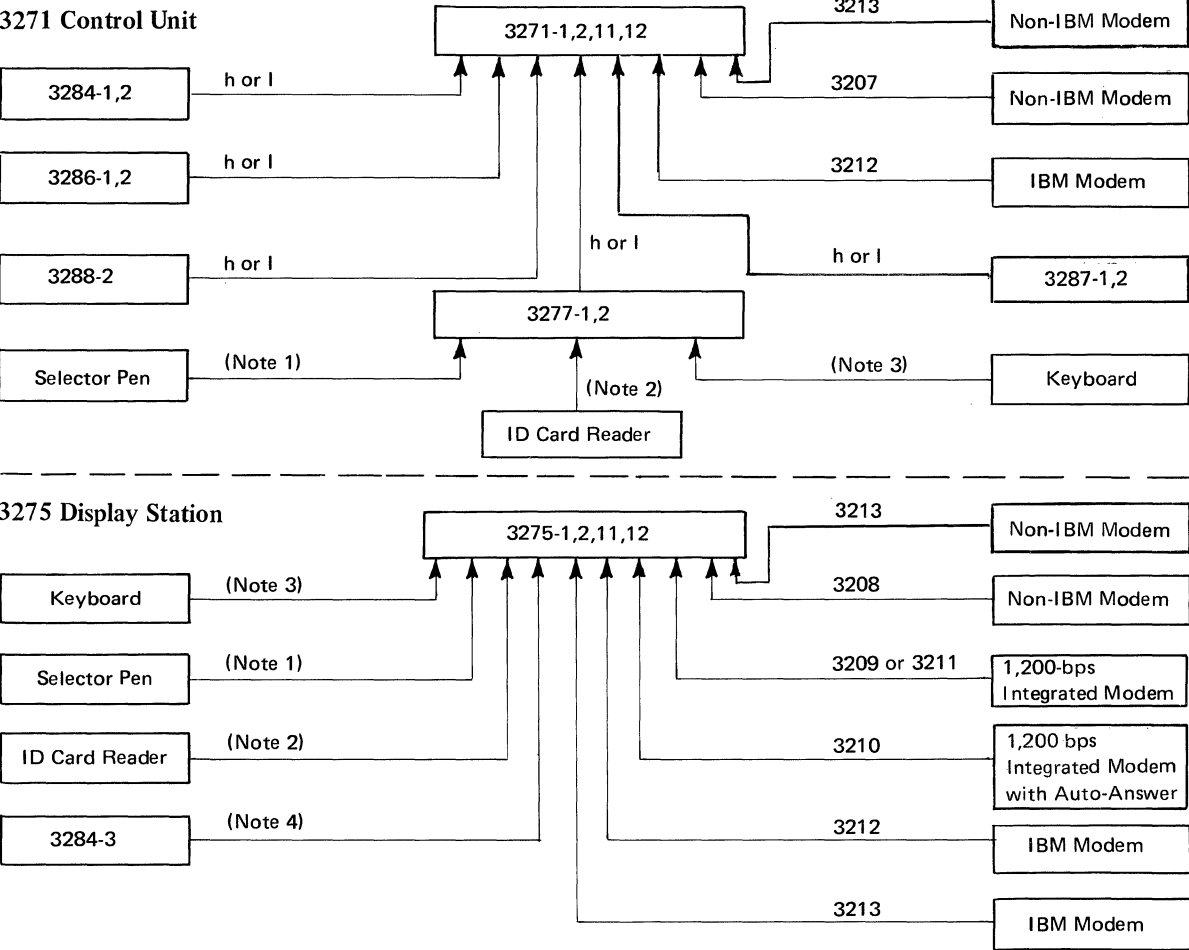
- AT&T non-switched Dataphone* digital data service network (US only)
- NTT DDC non-switched X.21 network (Japan only)

Cables: The cables are used to connect the following pieces of equipment:

- The system unit that interfaces with the communication channel
- The modem or signal converter
- The connector that terminates the communication channel

*Trademark of American Telephone & Telegraph Co.

3270 Information Display System Cabling Schematics (Remote)



Cable Group No.	No. of Cables	From	To	Max Length m (ft)	Notes
h or 1	1	3277, 3284, 3286, 3287, 3288	3271	610 (2,000)	5
3207	1	External Modem	3271	12 (40)	6, 7, 14
3208	1	External Modem	3275	12 (40)	6, 7, 14
3209	1	Nonswitched or Switched Lines	3275	12 (40)	6, 8, 9
3210	1	Switched Lines	3275	12 (40)	6, 10, 11
3211*	1	Switched or Nonswitched Lines	3275	12 (40)	6, 8
3212	1	External Modem	3271, 3275	12 (40)	12
3213	1	External Modem	3275	12 (40)	13, 15

Refer to Notes on the following page.

*World Trade countries only except Japan.

Notes:

1. Fixed cable length of 46 cm (1-1/2 feet) supplied with selector pen
2. Fixed cable length of 76 cm (2-1/2 feet) supplied with ID card reader
3. Fixed cable length of 76 cm (2-1/2 feet) supplied with keyboard
4. Fixed cable length of 3 m (10 feet) supplied with 3284
5. Customer-supplied, -installed, and -maintained; maximum length not to exceed 610 m (2,000 feet). See "Coaxial Cables" in Chapter 6 for ordering information and specifications.
6. See "Cables and Connectors for Attaching Non-IBM Devices" in Appendix J.
7. For switched or nonswitched lines
8. For switched lines without auto-answer or nonswitched lines (SF 5500)
9. Fixed cable length of 20 cm (8 inches) supplied with NTT-D1 service (Japan only)
10. For switched lines (SF 5501)
11. It is the customer's responsibility to have this cable connected to the communication facility.
12. One cable group number 3212 required for each IBM modem attached. The following chart shows attaching unit and modem types:

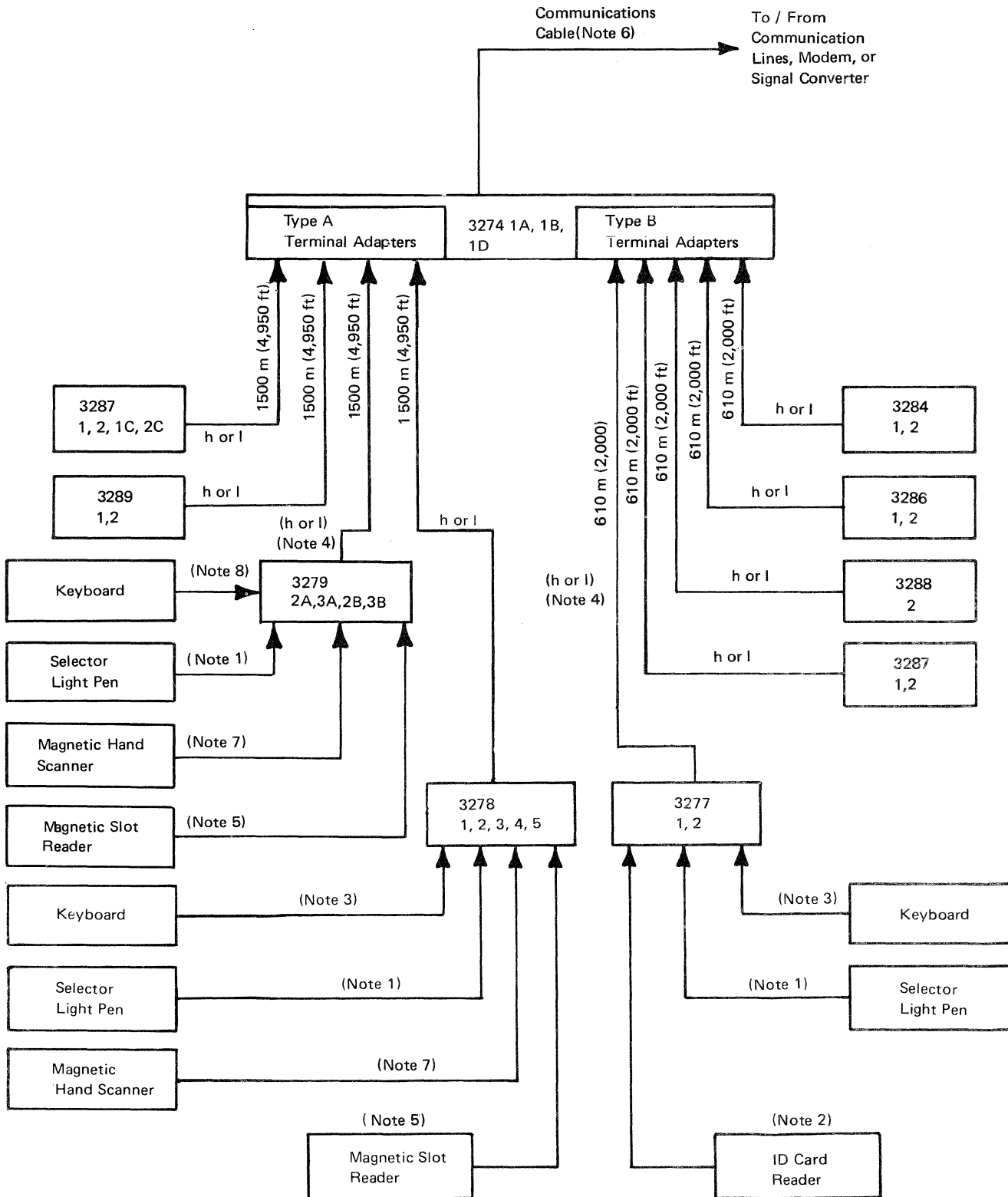
To Unit	Modem
3271	3872
	3874
	3875
	3976-3
	3977-3
	4872-1,3
3275	3976-3
	3977-2
	4872-1,3

13. One group number 3213 required to attach one IBM 3872, 3874, or 3875
14. For direct attachment to the host system, use cable group 3207 for the 3271 and cable group 3208 for the 3275. The cable will be attached to a cable from a unit in the host system. The maximum combined length of the two cables is 12.2 m (40 ft) unless the line set or adapter of the other unit permits a greater length; for example, a 3704/3705 with line set (FC 4716) permits a total combined length of 30.4 m (100 ft).
15. One cable group number 3213 required to attach one non-IBM modem in World Trade countries only, except Japan. Protective ground and signal ground are connected by this cable.

Cables for Non-IBM Modems

Appendix F contains specifications for connectors that attach non-IBM devices. Appendix J shows the cables and connectors that attach to non-IBM devices.

3274 Control Unit Model 1C (Remote)
Cabling Schematic



Refer to notes on following page.

Cable Group No.	No. of Cables	From	To	Max Length m (ft.)	Notes
h or l	1	3277, 3284, 3286, 3287, 3288	3274 (Type B)	610 (2000)	4
h or l	1	3278, 3287, 3289	3274 (Type A)	1500 (4920)	4
		3274	Modem / Signal Converter / Communication Line	12.2 (40)	6

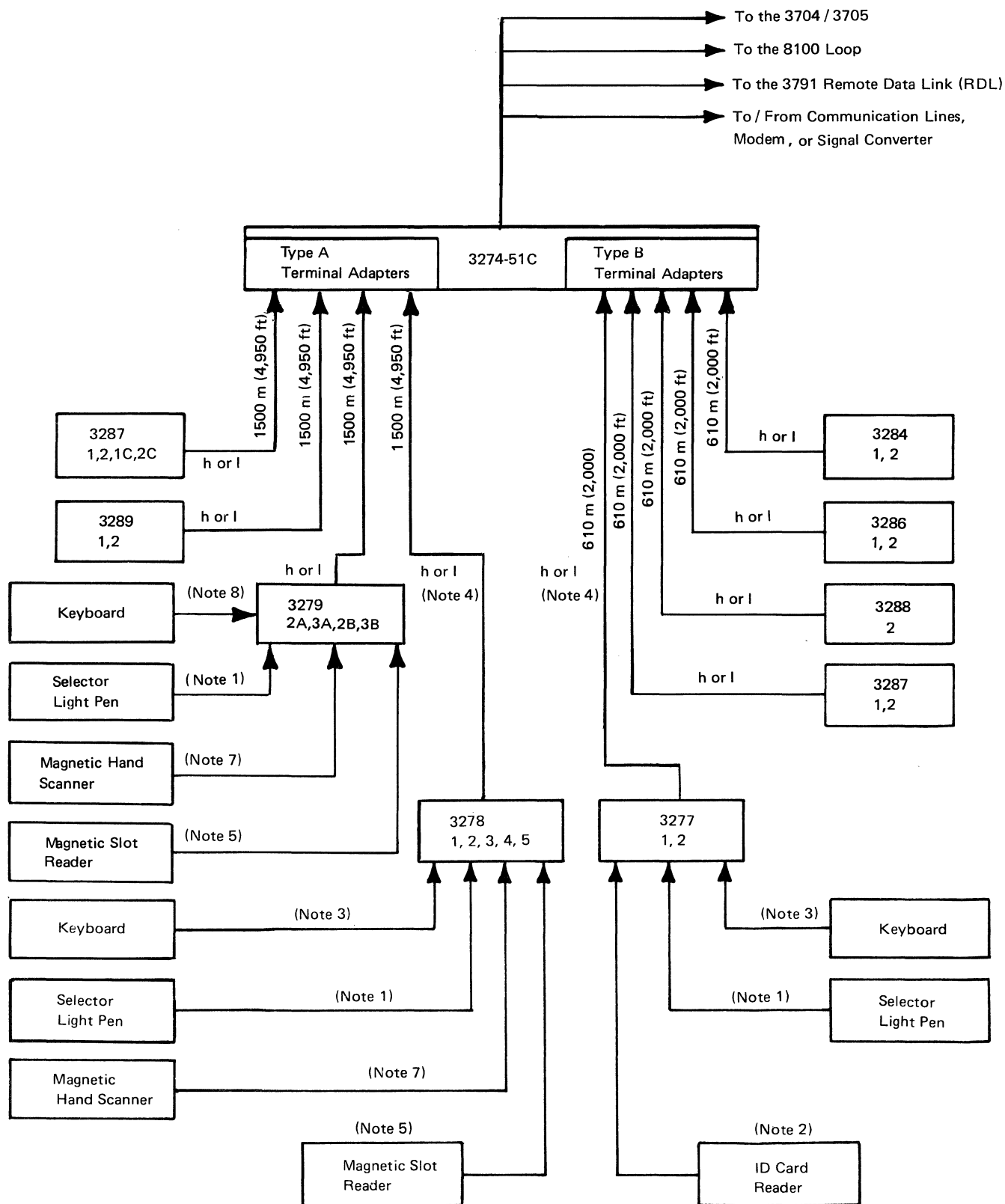
Notes:

- Fixed cable length of 122 cm (4 feet) supplied with selector light pen
- Fixed cable length of 76 cm (2-1/2 feet) supplied with ID card reader
- Fixed cable length of 76 cm (2-1/2 feet) supplied with keyboard; optional feature: 154 cm (5-1/2 feet)
- Customer-supplied, -installed, and -maintained. See "Coaxial Cables" in Chapter 6 for ordering information and specifications.
- A free-standing magnetic slot reader may be plugged into a 3278 or 3279 unit. This unit is equipped with a 1.5 m (59 inches) cable for attachment to a stub cable in the 3278/3279. To extend the distance at which the slot reader may be used, two extension cables may be ordered via MES. They are:
 - 6 m (19.7 feet) extension cable P/N 4832986
 - 12 m (39.4 feet) extension cable P/N 4832987

The maximum distance the slot reader may be extended is 13.5 m (44.3 feet); thus, both extension cables may not be used together. In addition, no cables other than those described above may be used.
- IBM supplies the cable that connects the 3274 Control Unit to the external modem, signal converter, or communication lines with the unit. This cable is customer installed. Unless a different length is specified, IBM supplies a 6.1 m (20 feet) cable. If a cable length other than 6.1 m (20 feet) is needed, a 3.05 m (10 feet), 9.1 m (30 feet), and 12.1 m (40 feet) may be specified. See Appendix J for cables and connectors attaching to Non-IBM devices. See the IBM Marketing Representative if further information is required.
- A magnetic hand scanner is available for use with a 3278/3279 Display Station attached to a 3274 Control Unit. The scanners are equipped with a 1.5 m (59 inches) cable for attachment to a stub cable in the 3278. To extend the distance at which the scanner may be used, two extension cables may be ordered via MES. They are:
 - 6 m (19.7 feet) extension cable P/N 4832986
 - 12 m (39.4 feet) extension cable P/N 4832987

The maximum distance the scanner may be extended is 13.5 m (44.3 feet); thus, both extension cables may not be used together. In addition, no cables other than those described above may be used.
- Fixed cable length of 91 cm (3 feet) supplied with keyboard.

3274 Control Unit Model 51C (Remote) Cabling Schematic



Refer to notes on the following page.

Cable Group No.	No. of Cables	From	To	Max Length m (ft.)	Notes
h or l	1	3277, 3284, 3286, 3287, 3288	3274 (Type B)	610 (2000)	4
h or l	1	3278, 3279, 3287, 3289	3274 (Type A)	1500 (4920)	4
		3274	Modem / Signal Converter/ Communication Line	12.2 (40)	6
h or l	1	3274-51C	Loop Attachment	12.2 (40)	6

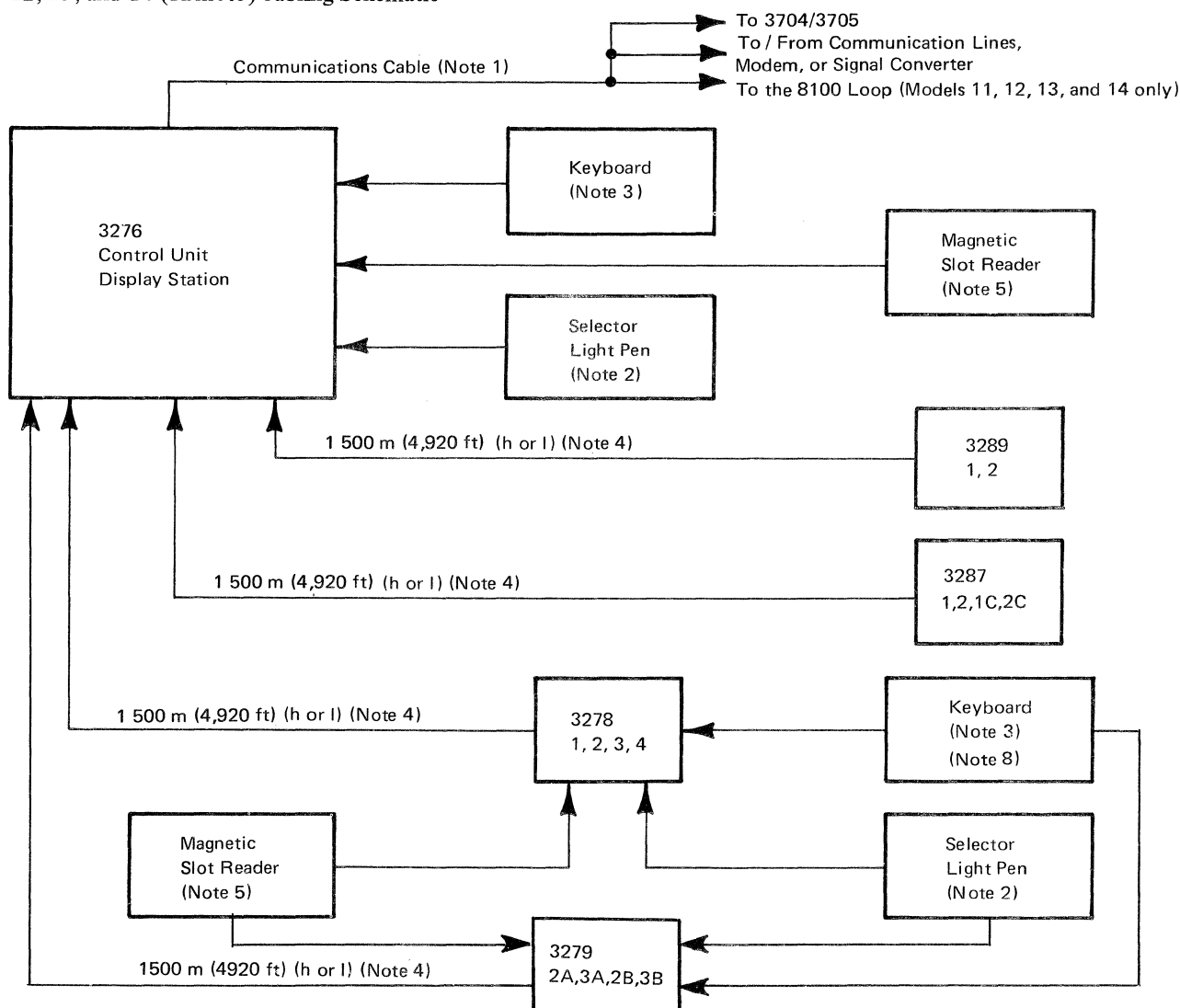
Notes:

1. Fixed cable length of 122 cm (4 feet) supplied with selector light pen
2. Fixed cable length of 76 cm (2-1/2 feet) supplied with ID card reader
3. Fixed cable length of 76 cm (2-1/2 feet) supplied with keyboard; optional feature: (3278 only).
4. Customer-supplied, -installed, and -maintained. See "Coaxial Cables" in Chapter 6 for ordering information and specifications.
5. A free-standing magnetic slot reader may be plugged into 3278 or 3279 units. This unit is equipped with a 1.5 m (59 inches) cable for attachment to a stub cable in the 3278. To extend the distance at which the slot reader may be used, two extension cables may be ordered via MES. They are:
 - 6 m (19.7 feet) extension cable P/N 4832986
 - 12 m (39.4 feet) extension cable P/N 4832987

The maximum distance the slot reader may be extended is 13.5 m (44.3 feet); thus, both extension cables may not be used together. In addition, no cables other than those described above may be used.
6. IBM supplies the cable that connects the 3274 Control Unit to the external modem, signal converter, or communication lines with the unit. This cable is customer installed. Unless a different length is specified, IBM supplies a 6.1 m (20 feet) cable. If a cable length other than 6.1 m (20 feet) is needed, a 3.05 m (10 feet), 9.1 m (30 feet), and 12.1 m (40 feet) may be specified. See Appendix J for cables and connectors attaching to Non-IBM devices. See the IBM Marketing Representative if further information is required.
7. A magnetic hand scanner is available for use with a 3278 Display Station or 3279 Color Display Station when they are attached to a 3274 Control Unit. The scanners are equipped with a 1.5 m (59 inches) cable for attachment to a stub cable in the 3278 or the 3279. To extend the distance at which the scanner may be used, two extension cables may be ordered via MES. They are:
 - 6 m (19.7 feet) extension cable P/N 4832986
 - 12 m (39.4 feet) extension cable P/N 4832987

The maximum distance the scanner may be extended is 13.5 m (44.3 feet); thus, both extension cables may not be used together. In addition, no cables other than those described above may be used.
8. Fixed cable length of 91 cm (3 feet) supplied with keyboard.

3276 Control Unit Display Station Models 1, 2, 3, 4, 11, 12, 13, and 14 (Remote) Cabling Schematic



Notes:

1. With the 3276 Control Unit Display Station, IBM supplies the cable that connects the 3276 unit to the modem, the signal converter, the Communication Lines, or to the 8100 Loop. The Specify feature will determine the type of cable supplied. See Appendix J for cable terminations. Unless a different cable is specified for attachment to communication lines or to modems, IBM supplies a 6.1 m (20 ft) cable; included with this cable is a 30.5-cm (15-in.) test cable. If a cable length other than 6.1 m (20 ft) is needed, 3.05 m (10 ft), 9.1 m (30 ft), and 12.1 m (40 ft) may be specified. See your IBM Marketing Representative. See the IBM 3270 Information Display System Planning, Setup, and Customizing Guide, GA27-2827, for details. This communication cable may attach directly to a cable from the 3704/3705. The total maximum length of both cables (3276 and 3704/3705 cables) should not exceed 30.5 m (100 ft). Unless a different cable is specified for attachment to the 8100 Loop, IBM supplies a 1.8-m (6-ft) cable. A 4.2-m (14-ft) cable may be specified.
2. With the Selector Light Pen, IBM supplies a 1.22 m (4 ft) cable that connects the pen to a 3276, 3278, or a 3279 unit. This cable is connected to the Selector Light Pen and the Display Station prior to delivery.
3. With each keyboard, IBM supplies a 0.76-m (2.5-ft) cable that is hardwired into the keyboard. When installing the keyboard, the customer plugs the other end of the cable into the 3276 or 3278 unit. An Optional Special Feature permits a 1.54-m (5-1/2-ft) cable.
4. The coaxial cable (h or l) is supplied, installed, and maintained by the customer. Cable h is for indoor use, and cable l is for both outdoor and indoor use.
5. A free-standing magnetic slot reader may be plugged into a 3276, 3278, or a 3279 unit. The MSR is equipped with a 1.5 m (59 in.) cable for attachment to a stub cable in all units.
6. 3276 Model 1 does not support 3279 Models 2A or 2B.
7. 3276 Models 1 and 2 do not support 3279 Models 3A or 3B.
8. Fixed cable length of 91 cm (3 feet) supplied with 3279 keyboard.

Chapter 5. Machine Specifications

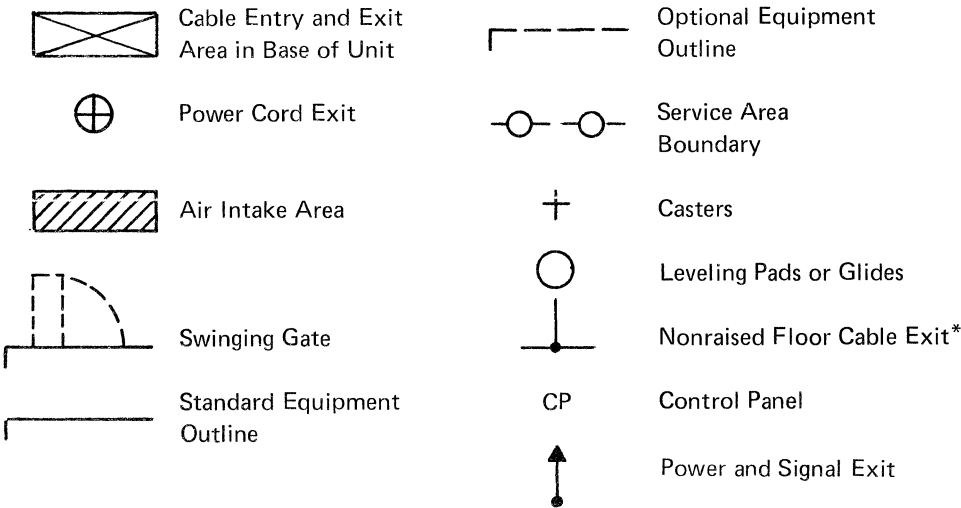
This chapter provides the machine specifications for each major component in the 3270 Information Display System.

Metric Conversions

In this manual, English units converted into metric units are rounded to the nearest whole number, or to the nearest decimal place, where decimals are used.

Symbols

Figure 5-1 shows the symbols that are used in the plan views.

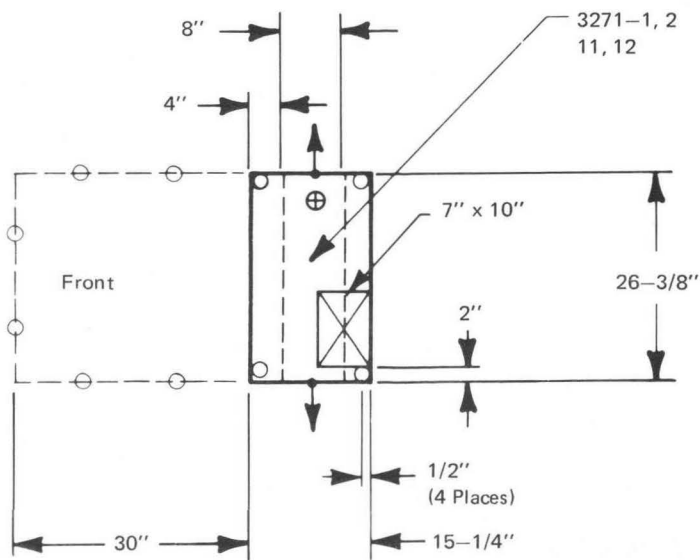


**For table- or counter-top terminals, the space between the bottom of the terminal and the table or counter surface permits signal cable and power cords to enter and exit from any direction. Thus, cutouts in table or counter are not necessary.*

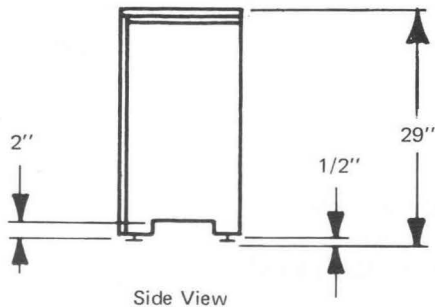
Figure 5-1. Symbols Used in Plan Views

3271 Control Unit Models 1, 2, 11, and 12

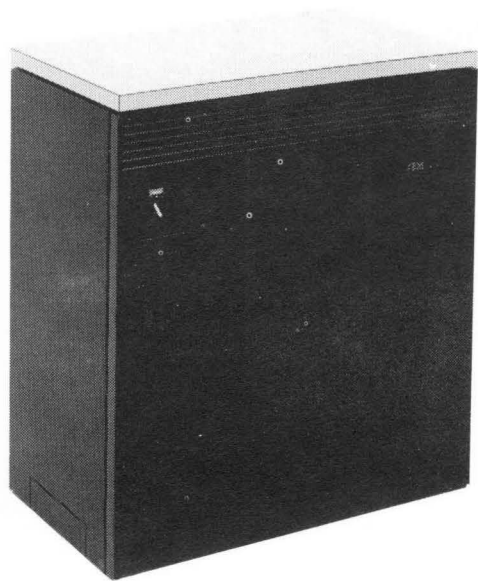
Plan View



Centimetres	(Inches)
1.3	(1/2)
5	(2)
10	(4)
18	(7)
20	(8)
25	(10)
39	(15-1/4)
66.4	(26-3/8)
74	(29)
76	(30)



Scale 1/2 inch = 1 foot



Specifications

Dimensions:

	F	S	H
cm	67	39	74
(Inches)	(26-3/8)	(15-1/4)	(29)

Service Clearances:

	F	R	Rt	L
cm	76	0	0	0
(Inches)	(30)	(0)	(0)	(0)

Weight: 44 kg (98 lb)

Models 1 and 2 Models 11 and 12

Heat Output:

Watts	176	186
(BTU/hr)	(595)	(630)

Airflow: *Models 1 and 2* Convection only *Models 11 and 12* Convection only

Power Requirements:

kVA	0.18	0.20
Phases	1	1
Ampacity	15	15

Power Cord Style: See Appendix D.

Power Cord Length: See Appendix B.

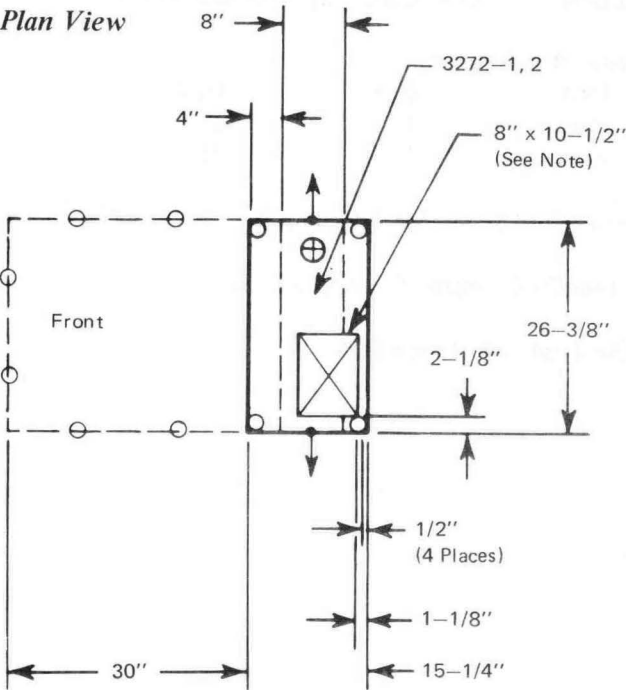
Plug Type: See Appendix A.

Voltages That Can Be Specified

	60 Hz					50 Hz					
	100	115/120	200	208	230	100	110	123.5	200	220	235
IBM (United States/Canada)		X		X	X						
IBM World Trade Americas/Far East	X	X	X			X	X	X	X		
IBM World Trade Europe/Middle East/Africa		X ¹								X	X

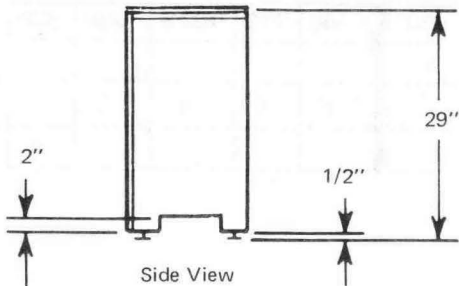
1. Saudi Arabia only.

3272 Control Unit Models 1 and 2

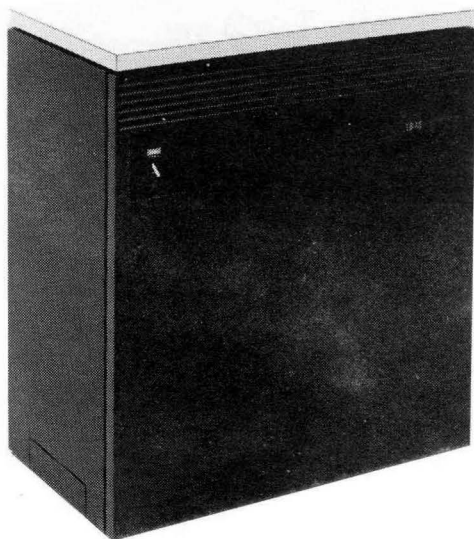


Centimetres	(Inches)
1.3	(1/2)
1.9	(3/4)
2.7	(1-1/8)
5.1	(2)
5.3	(2-1/8)
10.2	(4)
14.9	(5-3/4)
20	(8)
22	(8-1/2)
27	(10-1/2)
38.6	(15-1/4)
66.4	(26-3/8)
74	(29)
76.2	(30)

Note: Hole opening in the floor should not exceed 5-3/4" x 8-1/2" (15 cm x 22 cm). Maximum width for moulding is 3/4" (2 cm).



Scale 1/2 inch = 1 foot



Specifications

Dimensions:

	F	S	H
cm	67	39	74
(Inches)	(26-3/8)	(15-1/4)	(29)

Service Clearances:

	F	R	Rt	L
cm	76	0	0	0
(Inches)	(30)	(0)	(0)	(0)

Weight: 43 kg (95 lb)

Heat Output: 176 Watts (595 BTU/hr)

Airflow: Convection only

Power Requirements:

kVA	0.18
Phases	1
Ampacity	15

Power Cord Style: See Appendix D.

Power Cord Length: See Appendix B.

Plug Type: See Appendix A.

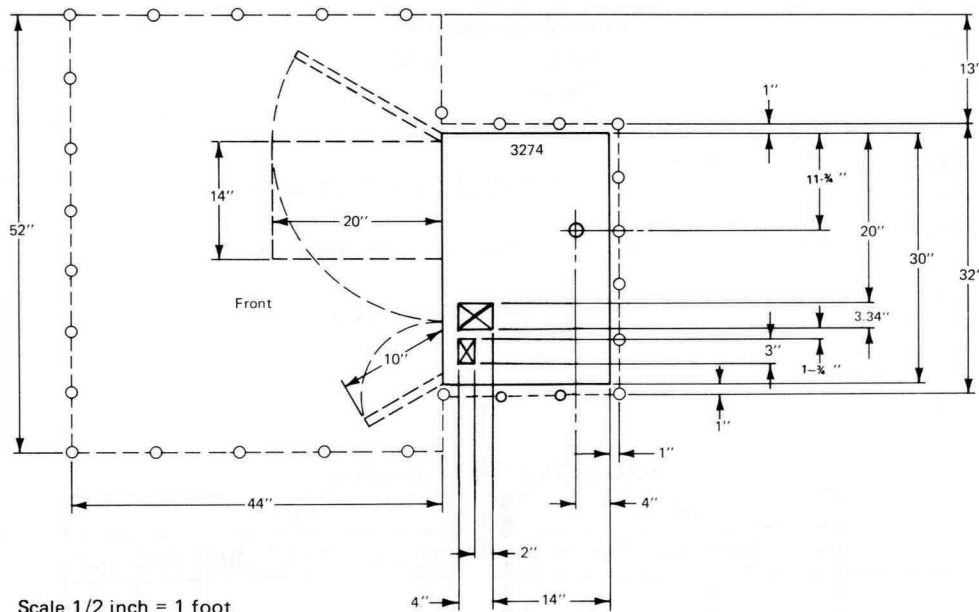
Voltages That Can Be Specified

	60 Hz					50 Hz					
	100	115/120	200	208	230	100	110	123.5	200	220	235
IBM (United States/Canada)				X	X						
IBM World Trade Americas/Far East	X	X	X			X	X	X	X		
IBM World Trade Europe/Middle East/Africa			X ¹							X	X

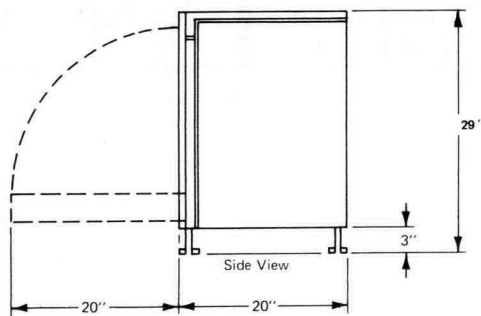
1. Saudi Arabia only.

3274 Control Unit Models 1A, 1B, 1C, and 1D (Model 1C Customer Setup Designated)

Plan View



Centimetres	(Inches)
2.54	(1)
3.33	(1- ³ / ₄)
5.08	(2)
7.62	(3)
8.48	(3- ³ / ₄)
10.16	(4)
25	(10)
30	(11- ³ / ₄)
32.39	(12- ³ / ₄)
33	(13)
35.56	(14)
50.80	(20)
68.8	(27)
73.50	(29)
76.20	(30)
81.28	(32)
111.7	(44)
132	(52)



3274 Control Unit Functional Clearances:

	cm	(Inches)	
Front	0	(0)	Dimensions are minimum requirements for functional operation of the machine. These dimensions allow sufficient air flow to provide cooling.
Rear	3	(1)	
Left	3	(1)	
Right	3	(1)	
Top	0	(0)	
Bottom	The feet provide space between the bottom of the unit and the supporting surface to allow airflow for cooling. Care should be taken that papers, books, etc., do not impede the air flow in this space.		

Note: If unit is installed with minimum clearance, service access must be provided.

Specifications

Dimensions:

	F	S	H
cm	76.2	50.8	73.5
(Inches)	(30)	(20)	(28.94)

Service Clearances:

	F	L	R	Rt	T
cm	111.8	2.54	2.54	2.54	0
(Inches)	(44)	(1)	(1)	(1)	(0)

Weight: 75 kg (165 lb)

Heat Output: 407 Watts (1382 BTU/hr)

Airflow: 2 m³/min (70 CFM) forced air

Power Requirements:

kVA	0.45
Phases	1
Ampacity	15

Power Cord Style: See Appendix D.

Power Cord Length: See Appendix B.

Plug Type: See Appendix A.

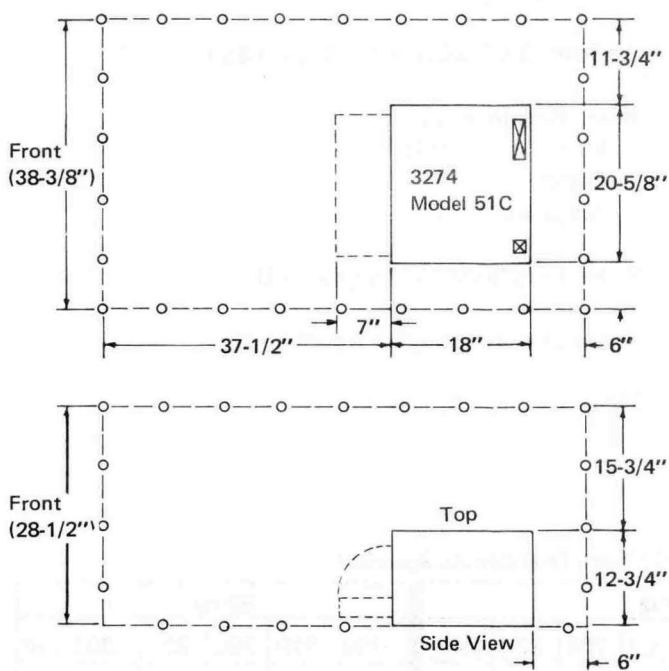
Voltages That Can Be Specified

	60 Hz								50 Hz					
	100	110	120	127	200	208	220	240	100	110	200	220	230	240
IBM (United States/Canada)			X ¹			X		X						
IBM World Trade Americas/Far East	X	X	X	X	X	X	X	X	X	X	X	X	X	X
IBM World Trade Europe/Middle East/Africa			X ²									X		X

1. Model 1C only.
2. Saudi Arabia only.

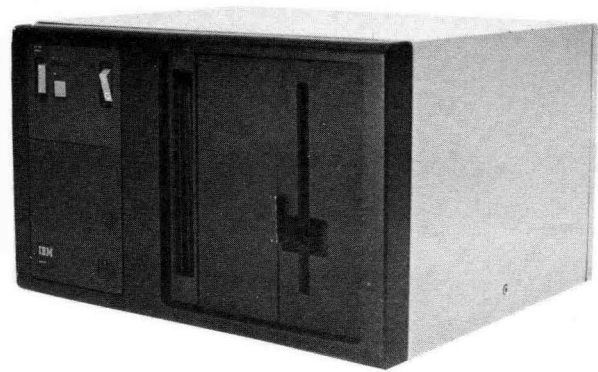
3274 Control Unit Model 51C (Customer Setup Designated)

Plan View



Centimetres	Inches
15	(6)
18.0	(7)
30	(11-3/4)
32.5	(12-3/4)
40	(15-3/4)
45.6	(18)
52.5	(20-5/8)
72.5	(28-1/2)
95	(37-1/2)
97.5	(38-3/8)

Scale: 1/2 inch = 1 foot



3274-51C Control Unit
Functional Clearances

	Centimetres	Inches	
Front	95	(37-1/2)	Dimensions are minimum requirements for functional operation of the machine. These dimensions allow sufficient air flow to provide cooling.
Rear	15	(6)	
Left	30	11-3/4)	
Right	15	(6)	
Top	40	(15-3/4)	

Note: If the unit is installed with minimum clearance, service access must be provided.

Specifications

Dimensions:

	F	S	H
cm	52.5	45.6	32.5
(Inches)	(20.7)	(18.0)	(12.8)

Service Clearances:

	F	L	R	Rt	T
cm	95	30	15	15	40
(Inches)	(37.4)	(11.8)	(5.9)	(5.9)	(15.75)

Weight: *29.6 – 40.9 kg* (65 – 90 lbs)

*Depends upon internal storage.

Heat Output: 362 Watts (1228 BTU/hr)

Airflow: 1.7 m³/min (60 CFM) forced air

Power Requirements:

kVA	0.47
Phases	1
Ampacity	3

Power Cord Style: See Appendix D.

Power Cord Length: See Appendix B.

Plug Type: See Appendix A.

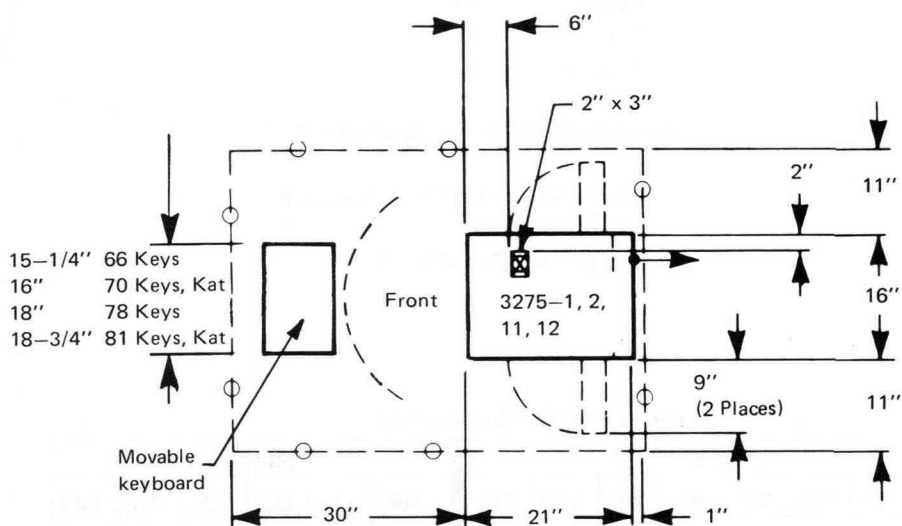
Voltages That Can Be Specified

	60 Hz								50 Hz					
	100	110	120	127	200	208	220	240	100	110	200	220	230	240
IBM (United States/Canada)			X											
IBM World Trade Americas/Far East	X	X	X	X	X	X	X	X	X	X	X	X	X	X
IBM World Trade Europe/Middle East/Africa			X ¹									X		X

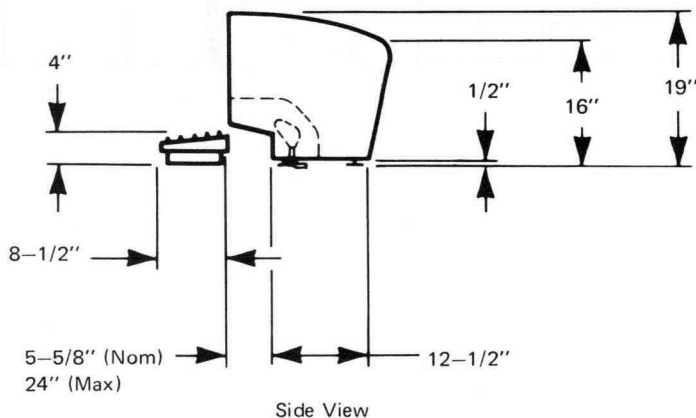
1. Saudi Arabia only.

3275 Display Station Models 1, 2, 11, and 12

Plan View



Centimetres	(Inches)
1.3	(1/2)
2.54	(1)
5.1	(2)
7.6	(3)
10	(4)
14.3	(5-5/8)
15.2	(6)
22	(8-1/2)
28	(11)
31.8	(12-1/2)
38.6	(15-1/4)
41	(16)
46	(18)
47.9	(18-3/4)
48	(19)
53.3	(21)
61	(24)
76	(30)



Scale 1/2 inch = 1 foot



Display Unit Functional Clearances

	cm	(Inches)	
Front	0	(0)	Dimensions are minimum requirements for functional operation of the machine. These dimensions allow sufficient airflow to provide convection cooling.
Rear	3	(1)	
Right	8	(3)	
Left	8	(3)	
Top	15	(6)	
Bottom	Unit should be installed in a manner which would guarantee adequate airflow into the underside of the unit to provide convection cooling.		

Note: If unit is installed with minimum clearance, service access must be provided.

Specifications

Dimensions:

	F	S (Note 1)	H
cm	41	53	48
(Inches)	(16)	(21)	(19)

Service Clearances:

	F (Note 2)	R	Rt	L
cm	76	3	28	28
(Inches)	(30)	(1)	(11)	(11)

Weight: 43 kg (95 lb) (Note 3)

	Models 1 and 2	Models 11 and 12
Heat Output:		
kcal/hr	207 Watts	236 Watts
(BTU/hr)	(700)	(800)

Airflow: Convection only Convection only

Models 1 and 2 Models 11 and 12

Power Requirements:

kVA	0.24	0.28
Phases	1	1
Ampacity	15	15

Notes:

The 3275 is installed on a customer-supplied desk or table. Recommended keyboard height (measured at home-row keys) is 72 cm (28-1/2 inches) from the floor. Lighting level should not exceed 75 footcandles (810 lumens/m²).

1. See also plan view.
2. Keyboard feature adds 22 cm (8-1/2 inches) to front of display and can be moved up to 61 cm (24 inches) away from lower front of display.
3. Keyboard feature adds about 5 kg (10 lb).

Power Cord Style: See Appendix D.

Power Cord Length: See Appendix B.

Plug Type: See Appendix A.

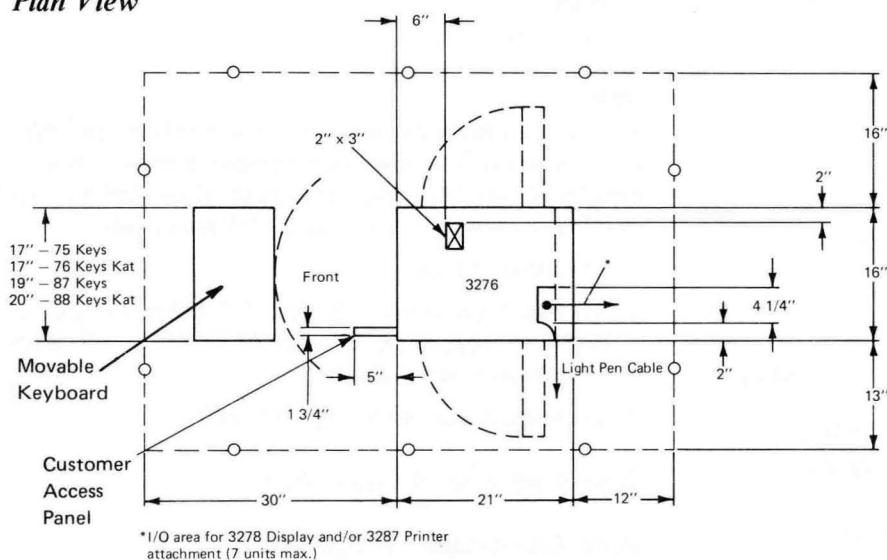
Voltages That Can Be Specified

	60 Hz					50 Hz					
	100	115/120	200	208	230	100	110	123.5	200	220	235
IBM (United States/Canada)		X									
IBM World Trade Americas/Far East	X	X				X	X	X			
IBM World Trade Europe/Middle East/Africa		X ¹								X	X

1. Saudi Arabia only.

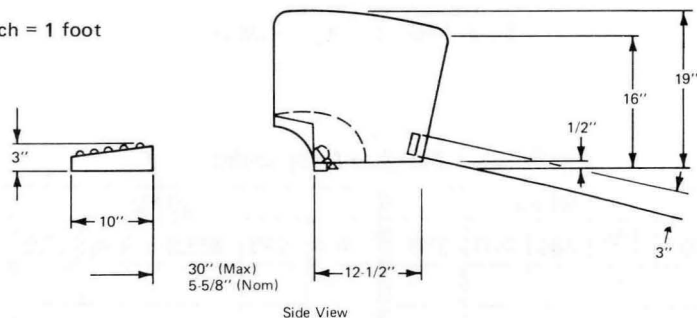
3276 Control Unit Display Station Models 1, 2, 3, 4, 11, 12, 13, and 14 (Customer Setup Designated)

Plan View



Centimetres	(Inches)
1.3	(1/2)
3.8	(1-1/2)
5.1	(2)
7.6	(3)
10.2	(4)
10.6	(4-1/4)
14.3	(5-5/8)
15.2	(6)
22.9	(9)
25.4	(10)
30.5	(12)
31.8	(12-1/2)
33	(13)
40.6	(16)
43.2	(17)
48.3	(19)
50.8	(20)
53.3	(21)
76.2	(30)

Scale 1/2 inch = 1 foot



Display Unit Functional Clearances

	cm	(Inches)	
Front	0	(0)	Dimensions are minimum
Rear	3	(1)	requirements for functional
Right	8	(3)	operation of the machine. These
Left	8	(3)	dimensions allow sufficient
Top	15	(6)	airflow to provide cooling.
Bottom	The feet provide space between the bottom of the unit and the supporting surface to allow airflow for cooling. Care should be taken that paper, books, etc., do not impede the airflow in this space.		

Note: If unit is installed with minimum clearance; service access must be provided.

Specifications

Dimensions:

	F	S (Note 1)	H (Note 2)
cm	40.6	53.3	48.3
(Inches)	(16)	(21)	(19)

Service Clearances:

	F (Note 3)	L	R	Rt	T
cm	76.2	40.6	30.5	33	15.2
(Inches)	(30)	(16)	(12)	(13)	(6)

Weight (Note 4): 45kg (100 lb)

Heat Output: 227 Watts (770 BTU/hr)

Airflow: 0.57 m³/min (20 CFM) forced air

Power Requirements:

kVA	0.260
Phase	1
Ampacity	15

Notes:

1. This dimension does not include keyboard. See plan view.
2. The 3276 is installed on a customer-supplied desk or table. Recommended keyboard height (measured from the floor to the bottom of the 3276 is 66.0 cm (26 inches).
3. Keyboard feature adds 25.4 cm (10 inches) to front of display and can be moved up to 76.2 cm (30 inches) away from lower front of display.
4. Keyboard feature adds about 6 kg (13 lb).

Power Cord Style: See Appendix D.

Power Cord Length: See Appendix B.

Plug Type: See Appendix A.

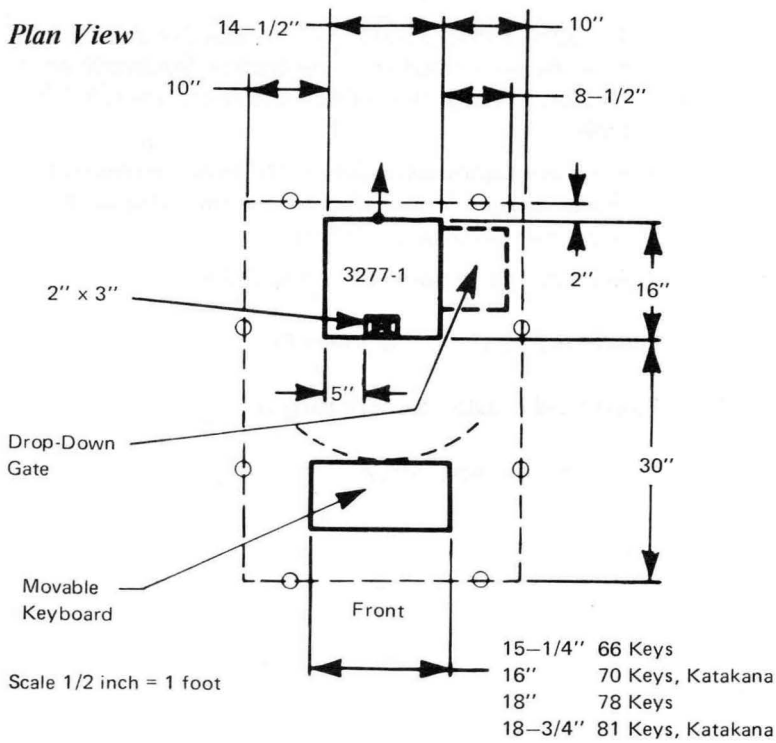
Voltages That Can Be Specified

	60 Hz				50 Hz					
	100	110	120	127	100	110	200	220	230	240
IBM (United States/Canada)			X							
IBM World Trade Americas/Far East	X	X	X	X	X	X	X	X	X	X
IBM World Trade Europe/Middle East/Africa			X ¹					X		X

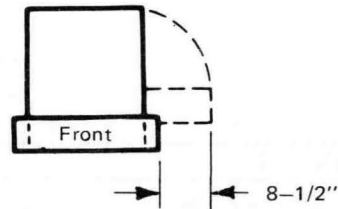
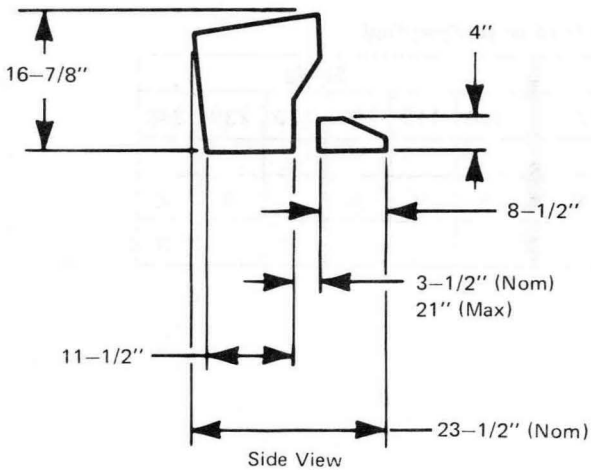
1. Saudi Arabia only.

3277 Display Station Model 1

Plan View



Centimetres	(Inches)
5	(2)
8	(3)
9	(3-1/2)
10	(4)
13	(5)
22	(8-1/2)
25	(10)
29	(11-1/2)
37	(14-1/2)
38.6	(15-1/4)
41	(16)
41.2	(16-7/8)
46	(18)
47.9	(18-3/4)
53	(21)
60	(23-1/2)
76	(30)



Display Unit Functional Clearances

	cm	(Inches)	
Front	0	(0)	Dimensions are minimum requirements for functional operation of the machine. These dimensions allow sufficient airflow to provide convection cooling.
Rear	3	(1)	
Right	8	(3)	
Left	8	(3)	
Top	15	(6)	
Bottom	Unit should be installed in a manner which would guarantee adequate airflow into the underside of the unit to provide convection cooling.		

Note: If unit is installed with minimum clearance, service access must be provided.



Specifications

Dimensions:

	F	S (Note 1)	H
cm	37	41	43
(Inches)	(14-1/2)	(16)	(16-7/8)

Service Clearances:

	F (Note 2)	R	Rt	L
cm	76	5	25	25
(Inches)	(30)	(2)	(10)	(10)

Weight: 27 kg (60 lb) (Note 3)

Heat Output: 155 Watts (525 BTU/hr)

Airflow: Convection only

Power Requirements:

kVA	0.17 (0.18 for 220V)
Phases	1
Ampacity	15

Notes:

The 3277 is installed on a customer-supplied desk or table. Recommended keyboard height (measured at home-row keys) is 72 cm (28-1/2 inches) from the floor. Lighting level should not exceed 75 footcandles (810 lumens/m²).

1. See also plan view.
2. Keyboard feature adds 22 cm (8-1/2 inches) to front of display and can be moved up to 53 cm (21 inches) away from lower front of display.
3. Keyboard feature adds about 5 kg (10 lb).

Power Cord Style: See Appendix D.

Power Cord Length: See Appendix B.

Plug Type: See Appendix A.

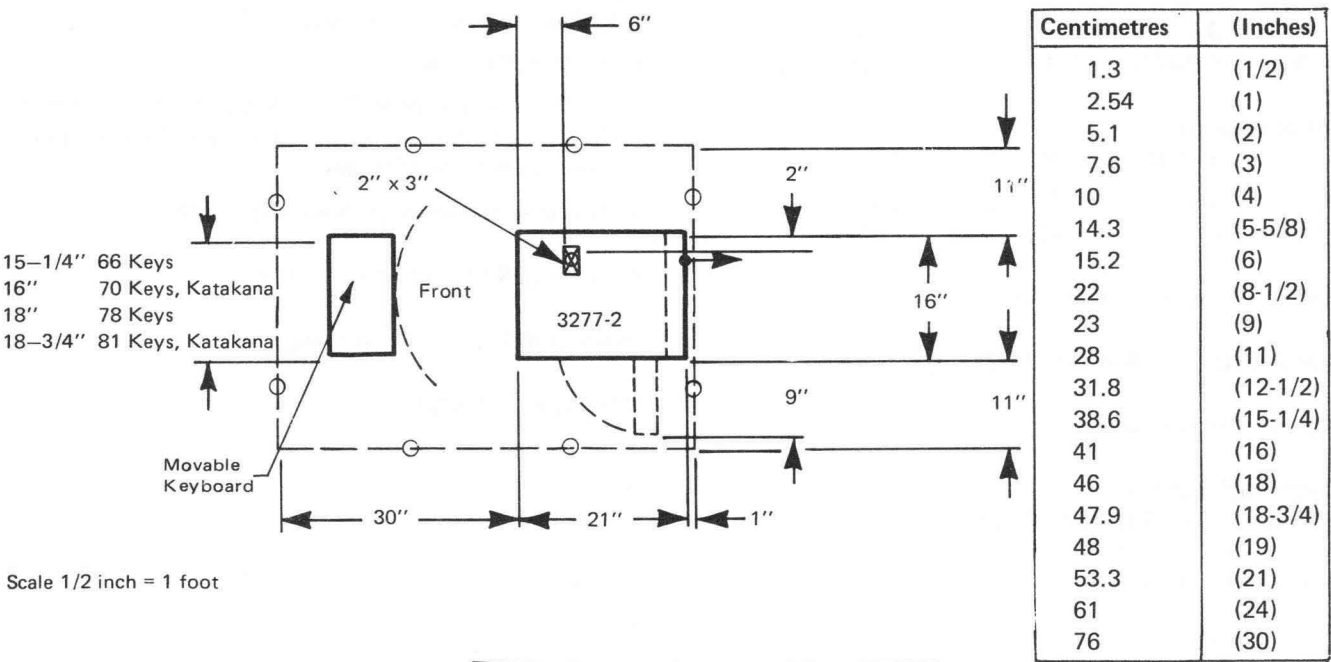
Voltages That Can Be Specified

	60 Hz					50 Hz					
	100	115/120	200	208	230	100	110	123.5	200	220	235
IBM (United States/Canada)		X									
IBM World Trade Americas/Far East	X	X				X	X	X			
IBM World Trade Europe/Middle East/Africa		X ¹								X	X

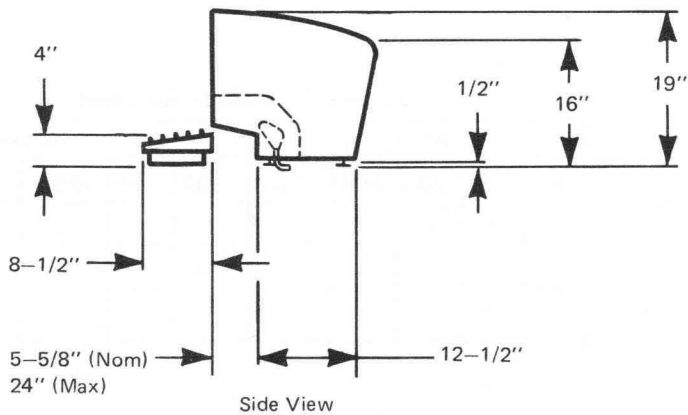
1. Saudi Arabia only.

3277 Display Station Model 2

Plan View



Scale 1/2 inch = 1 foot



Display Unit Functional Clearances

	cm	(Inches)	
Front	0	(0)	Dimensions are minimum requirements for functional operation of the machine. These dimensions allow sufficient air-flow to provide convection cooling.
Rear	3	(1)	
Right	8	(3)	
Left	8	(3)	
Top	15	(6)	
Bottom	Unit should be installed in a manner which would guarantee adequate airflow into the underside of the unit to provide convection cooling.		

Note: If unit is installed with minimum clearance, service access must be provided.



Specifications

Dimensions:

	F	S (Note 1)	H
cm	41	53	48
(Inches)	(16)	(21)	(19)

Service Clearances:

	F (Note 2)	R	Rt	L
cm	76	3	28	28
(Inches)	(30)	(1)	(11)	(11)

Weight: 39 kg (85 lb) (Note 3)

Heat Output: 155 Watts (525 BTU/hr)

Airflow: Convection only

Power Requirements:

kVA	0.17
Phases	1
Ampacity	15

Notes:

The 3277 is installed on a customer-supplied desk or table. Recommended keyboard height (measured at home-row keys) is 72 cm (28-1/2 inches) from the floor. Lighting level should not exceed 75 footcandles (810 lumens/m²).

1. See also plan view.
2. Keyboard feature adds 22 cm (8-1/2 inches) to front of display and can be moved up to 61 cm (24 inches) away from lower front of display.
3. Keyboard feature adds about 5 kg (10 lb).

Power Cord Style: See Appendix D.

Power Cord Length: See Appendix B.

Plug Type: See Appendix A.

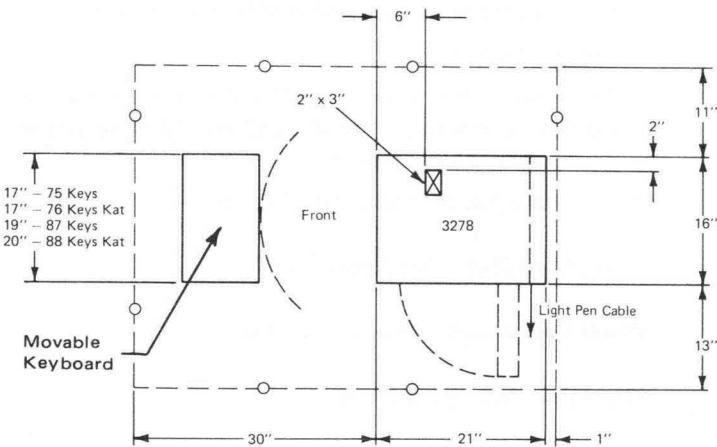
Voltages That Can Be Specified

	60 Hz					50 Hz					
	100	115/120	200	208	230	100	110	123.5	200	220	235
IBM (United States/Canada)		X									
IBM World Trade Americas/Far East	X	X				X	X	X			
IBM World Trade Europe/Middle East/Africa		X ¹								X	X

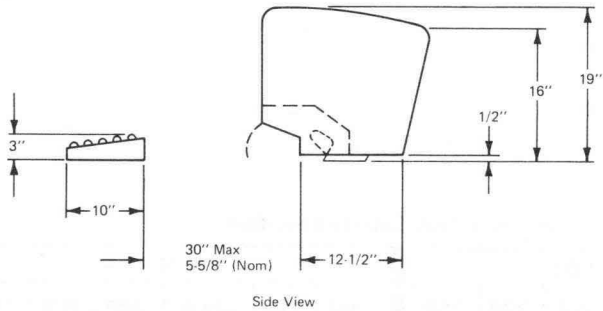
1. Saudi Arabia only.

3278 Display Station Models 1, 2, 3, 4, and 5 (Customer Setup Designated)

Plan View



Scale 1/2 inch = 1 foot



Centimetres	(Inches)
1.3	(1/2)
2.5	(1)
5.1	(2)
7.6	(3)
10.2	(4)
14.3	(5-5/8)
15.2	(6)
22.9	(9)
25.4	(10)
27.9	(11)
31.8	(12-1/2)
33	(13)
40.6	(16)
41.9	(16-1/2)
43.2	(17)
48.3	(19)
50.8	(20)
53.3	(21)
61.0	(24)
76.2	(30)

Display Unit Functional Clearances

	cm	(Inches)	
Front	0	(0)	Dimensions are minimum requirements for functional operation of the machine. These dimensions allow sufficient airflow to provide cooling.
Rear	3	(1)	
Right	8	(3)	
Left	8	(3)	
Top	15	(6)	
Bottom	The feet provide space between the bottom of the unit and the supporting surface to allow airflow for cooling. Care should be taken that paper, books, etc., do not impede the airflow in this space.		

Note: If unit is installed with minimum clearance, service access must be provided.



Specifications

Dimensions:

	F	S (Note 1)	H (Note 2)
cm	40.6	53.3	48.3
(Inches)	(16)	(21)	(19)

Service Clearances:

	F (Note 3)	L	R	Rt	T
cm	76.2	27.9	2.54	33	15.2
(Inches)	(30)	(11)	(1)	(13)	(6)

Weight (Note 4): 36.3kg (80 lb)

Heat Output: 125 Watts (420 BTU/hr)

Airflow: Natural convection

Power Requirements:

kVA	0.155
Phase	1
Ampacity	15

Notes:

1. This dimension does not include keyboard. See plan view.
2. The 3278 is installed on a customer-supplied desk or table. Recommended keyboard height (measured from the floor to the bottom of the 3278 is 66.0 cm (26 inches).
3. Keyboard feature adds 25.4 cm (10 inches) to front of display and can be moved up to 76.2 cm (30 inches) away from lower front of display.
4. Keyboard feature adds about 6 kg (13 lb).

Power Cord Style: See Appendix D.

Power Cord Length: See Appendix B.

Plug Type: See Appendix A.

Voltages That Can Be Specified

	60 Hz				50 Hz					
	100	110	120	127	100	110	200	220	230	240
IBM (United States/Canada)			X							
IBM World Trade Americas/Far East	X	X	X	X	X	X	X	X	X	X
IBM World Trade Europe/Middle East/Africa			X ¹					X		X

1. Saudi Arabia only.

Specifications

Dimensions:

	F	S (Note1)	H (Note 2)
cm	44.6	54.5	38
(Inches)	(17.5)	(21.5)	(15)

Service Clearances:

	F (Note 3)	L	R	Rt
cm	76.5	30.4	41	2.5
(Inches)	(30)	(12)	(16)	(1)

Weight (Note 4): 27 kg (58 lbs)

Heat Output: 243 Watts (825 BTU/hr)

Airflow: Natural convection

Power Requirements:

kVA	0.30
Phase	1
Ampacity	15

Notes:

1. This dimension does not include keyboard. See plan view.
2. The 3279 is installed on a customer-supplied desk or table. Recommended keyboard height (measured from the floor to the bottom of the 3279) is 66.0 cm (26 inches).
3. Keyboard feature adds 25.4 cm (10 inches) to front of display and can be moved up to 53.3 cm (21 inches) away from lower front of display.
4. Keyboard feature adds about:
 - 4.5 g (10 lbs) for 75/76 keyboard
 - 5.6 g (12.5 lbs) for 87 keyboard
 - 5.9 g (13 lbs) for 88 keyboard

Power Cord Style: See Appendix D.

Power Cord Length: See Appendix B.

Plug Type: See Appendix A.

Keyboards: Each 3279 unit must be equipped with a keyboard.

Nominal Operating Voltages

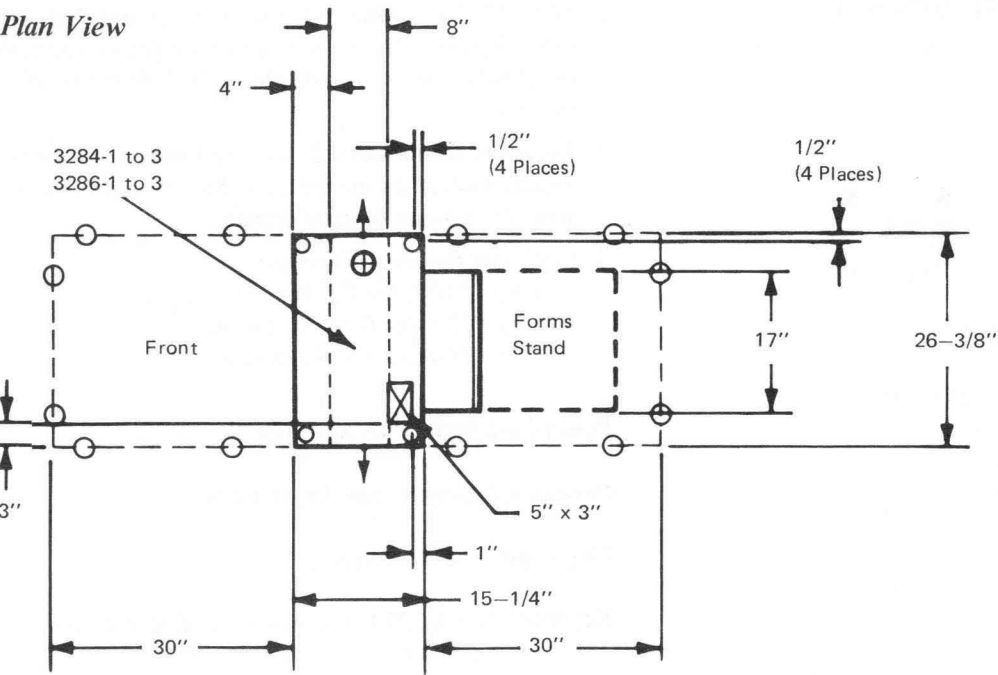
	100 V to 127 V 50 or 60 Hz	200 V to 240 V 50 or 60 Hz
IBM (United States/Canada)	X	
IBM World Trade Americas/Far East	X	X
IBM World Trade Europe/Middle East/Africa	X ¹	X

1. Saudi Arabia only.

3284 Printer Models 1, 2, and 3

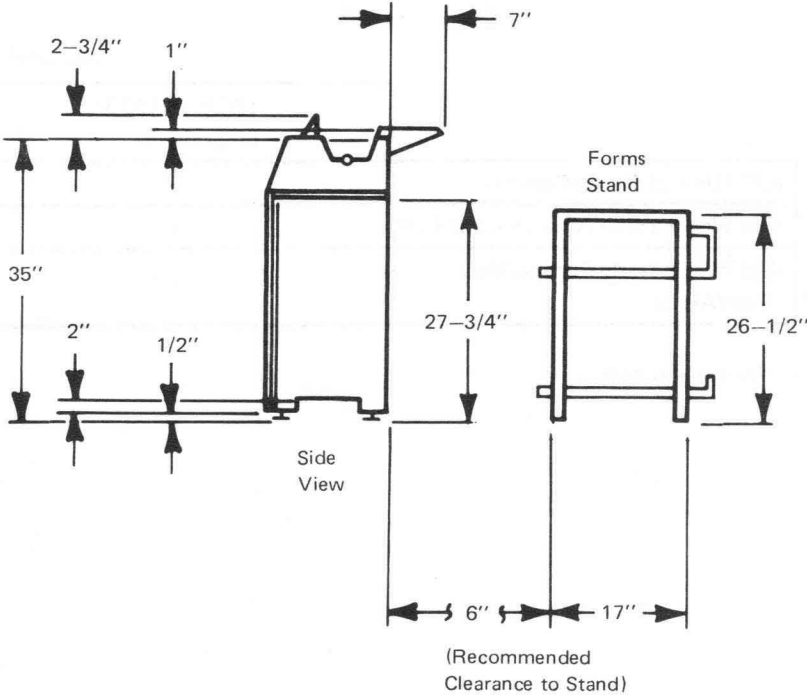
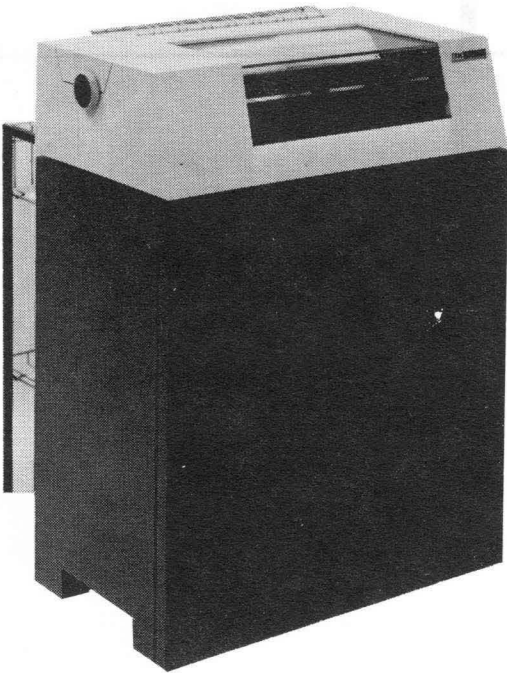
3286 Printer Models 1, 2, and 3

Plan View



Centimetres	(Inches)
1.27	(1/2)
2.54	(1)
5	(2)
6.9	(2-3/4)
8	(3)
10	(4)
13	(5)
18	(7)
20	(8)
38.6	(15-1/4)
41	(16)
43	(17)
66.4	(26-3/8)
67	(26-1/2)
70.9	(27-3/4)
76	(30)
89	(35)

Scale 1/2 inch = 1 foot



Specifications

Dimensions:

	F	S	H
cm	67	39	96
(Inches)	(26-3/8)	(15-1/4)	(37-3/4)

Service Clearances:

	F	R	Rt	L
cm	76	76	0	0
(Inches)	(30)	(30)	(0)	(0)

Weight: 61 kg (135 lb)

Heat Output: 227 Watts (770 BTU/hr))

Airflow: Convection only

Power Requirements:

kVA	0.26
Phases	1
Ampacity	15

Power Cord Style: See Appendix D.

Power Cord Length: See Appendix B.

Plug Type: See Appendix A.

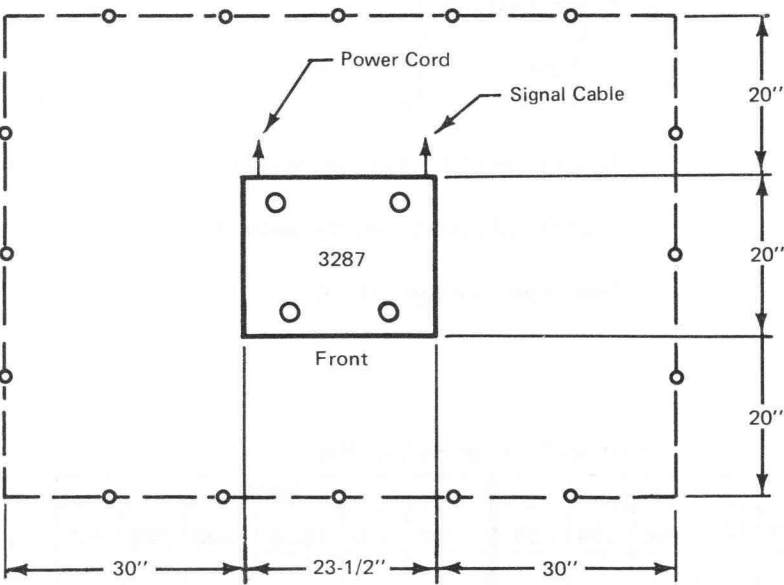
Voltages That Can Be Specified

	60 Hz					50 Hz					
	100	115/120	200	208	230	100	110	123.5	200	220	235
IBM (United States/Canada)		X									
IBM World Trade Americas/Far East	X	X				X	X	X			
IBM World Trade Europe/Middle East/Africa		X ¹								X	X

¹Saudi Arabia only.

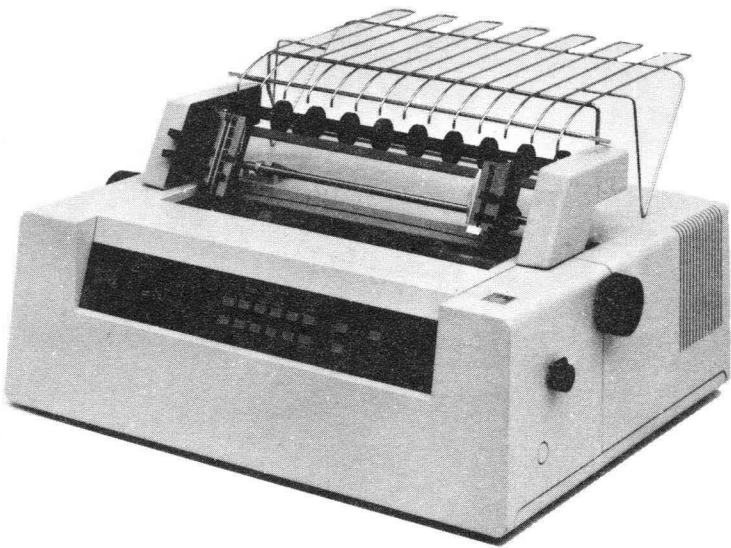
3287 Printer Models 1, 2, 1C, and 2C (Customer Setup Designated)

Plan View



Centimetres	(Inches)
50.8	(20)
60.	(23-1/2)
76.2	(30)

Scale 1/2 inch = 1 foot



Specifications

Dimensions:

	F	S	H (Note 1)
cm	60	51	25
(Inches)	(23 1/2)	(20)	(10)

Service Clearances (Note 2):

	F	L	R	Rt	T
cm	50.8	76.2	50.8	76.2	102
(Inches)	(20)	(30)	(20)	(30)	(40)

Weight: 39.5 kg (87 lbs)

Heat Output: 250 Watts (853 BTU/hr)

Airflow: 1.5m³/min (55 CFM) Standard
3m³/min (105 CFM) with
Blower Feature # 9030 when
operating above 32.2°C (90°F)

Power Requirements:

kVA	0.25
Phase	1
Ampacity	15

Notes:

1. Height is 35.6 cm (14 inches) with forms tractor.
2. Height is 27.4 cm (10.8 inches) with friction feed device.
3. Side is 58.4 cm (23 inches) with forms tractor; and 61 cm (24 inches) with friction feed device.
4. Width is 68.1 cm (26.8 inches) with platen (knob-to-knob).
5. 102 cm (40 inches) clearance above the table (measured from the table) is needed for logic gate which swings up from the top of the unit.
6. The 76.2 cm (30 inches) on each side are needed for:
Right – To adjust line space emitter timing.
Left – To service page length control switch and power transformer.
7. The minimum distance between the 3287 and the display terminals should be no less than 45.7 cm (18 inches).

Power Cord Style: See Appendix D.

Power Cord Length: See Appendix B.

Plug Type: Appendix A.

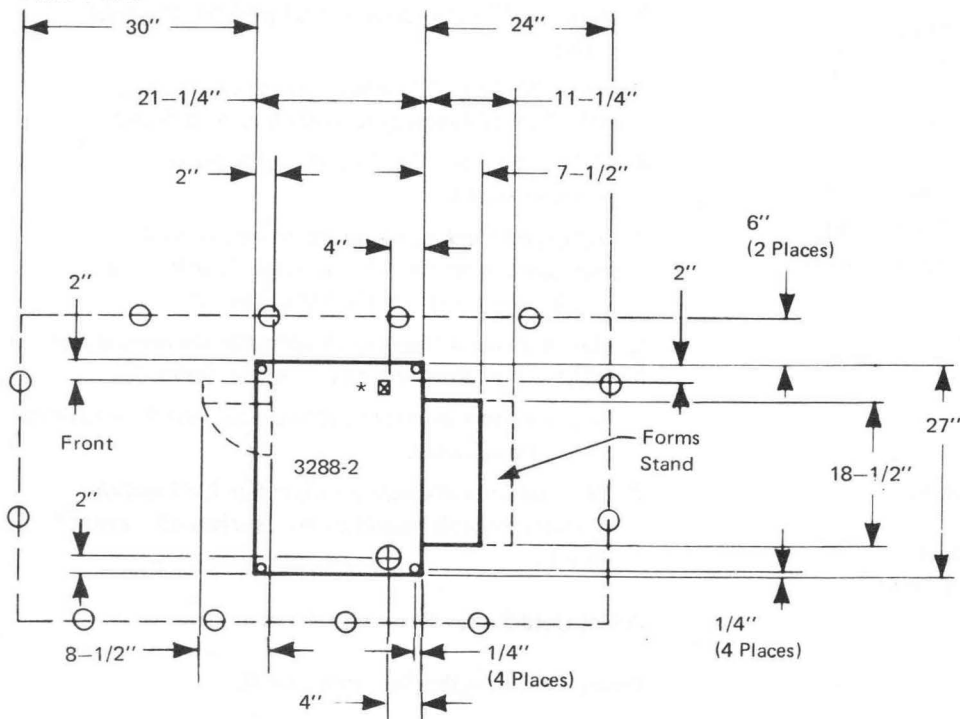
Voltages That Can Be Specified

	60 Hz				50 Hz					
	100	110	120	127	100	110	200	220	230	240
IBM (United States/Canada)			X							
IBM World Trade Americas/Far East	X	X	X	X	X	X	X	X	X	X
IBM World Trade Europe/Middle East/Africa			X ¹					X		X

¹ Saudi Arabia only.

3288 Line Printer Model 2

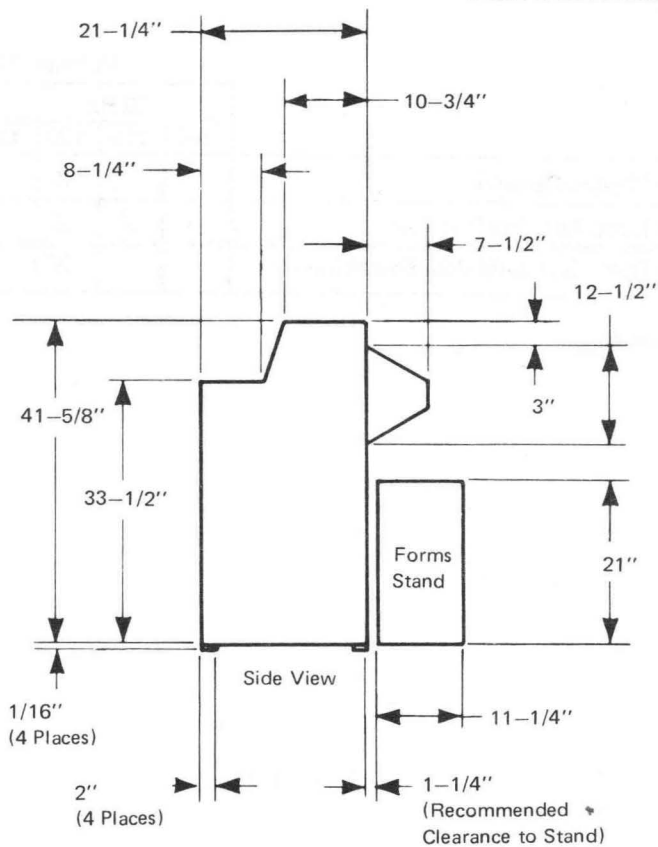
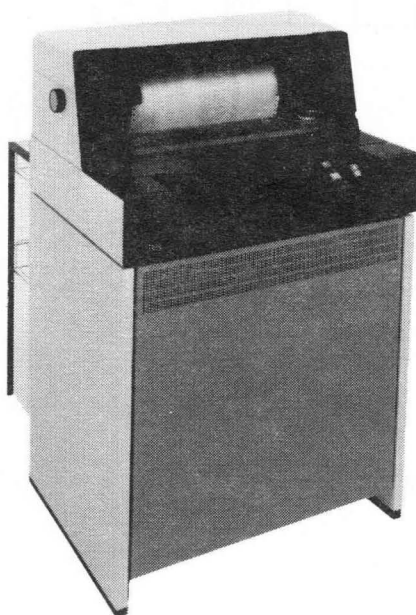
Plan View



* Cable entry/exit for coaxial cable.
Approximate dimensions 1/2" x 1/2".

Centimetres	(Inches)
0.16	(1/16)
0.64	(1/4)
1.3	(1/2)
3.2	(1-1/4)
5	(2)
6	(2-1/2)
8	(3)
10	(4)
15	(6)
19	(7-1/2)
20.6	(8-1/4)
22	(8-1/2)
26.9	(10-3/4)
28.6	(11-1/4)
47	(18-1/2)
53	(21)
53.6	(21-1/4)
61	(24)
69	(27)
76	(30)
83	(33-1/2)
105.6	(41-5/8)

Scale 1/2 inch = 1 foot



Specifications

Dimensions:

	F	S	H
cm	69	54	106
(Inches)	(27)	(21-1/4)	(41-5/8)

Service Clearances:

	F	R	Rt	L
cm	76	61	15	15
(Inches)	(30)	(24)	(6)	(6)

Weight: 127 kg (280 lb)

Heat Output: 566 Watts (1,926 BTU/hr)

Airflow: 39 cfm (1.1m³/min)

Power Requirements:

kVA	0.60
Phases	1
Ampacity	15

Power Cord Style: See Appendix D.

Power Cord Length: See Appendix B.

Plug Type: See Appendix A.

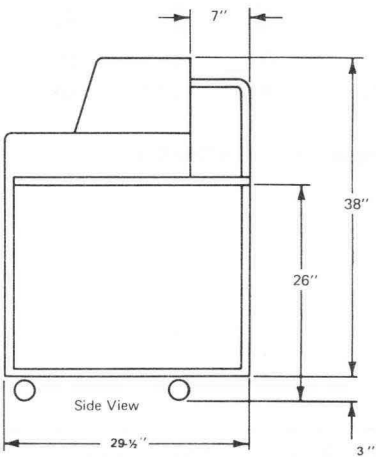
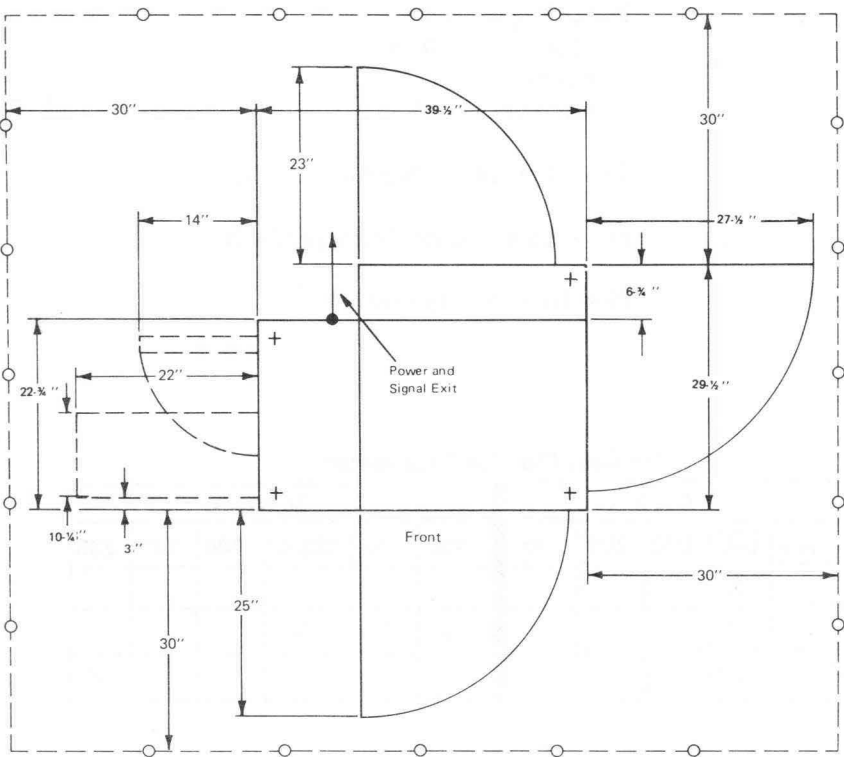
Voltages That Can Be Specified

	60 Hz					50 Hz					
	100	115/120	200	208	230	100	110	123.5	200	220	235
IBM (United States/Canada)		X									
IBM World Trade Americas/Far East	X	X				X	X	X			
IBM World Trade Europe/Middle East/Africa		X ¹									X

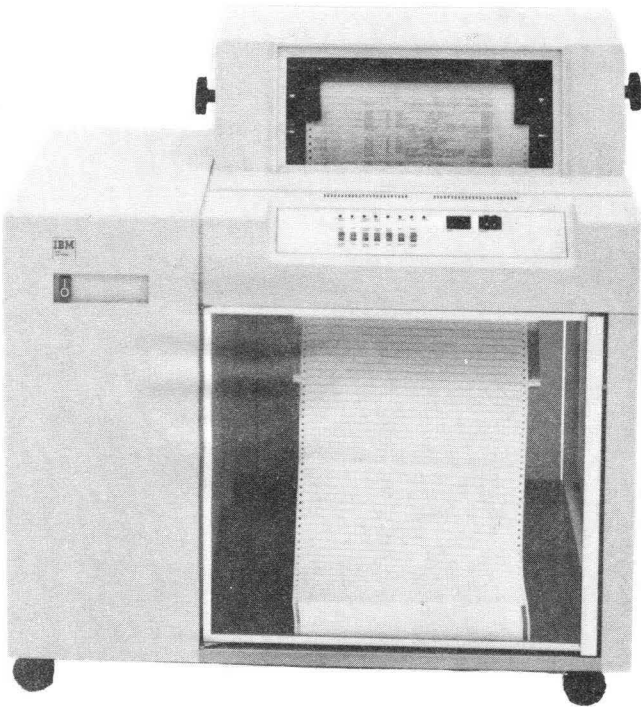
1. Saudi Arabia only.

3289 Line Printer Models 1 and 2 (Customer Setup Designated)

Plan View



Scale 1/2 inch = 1 foot



Centimetres	(Inches)
7.5	(3)
16.8	(6-3/4)
17	(6-3/4)
25.3	(10-1/4)
36	(14)
56	(22)
58	(22-3/4)
58	(23)
60	(23-1/2)
64	(25)
66	(26)
70	(27-1/2)
75	(29-1/2)
76	(30)
96.5	(38)
100	(39-1/2)

Specifications

Dimensions:

	F	S	H
cm	100	75	104
(Inches)	(39.5)	(29.5)	(40.95)

Service Clearances:

	F	R	L	Rt
cm	76	76	76	76
(Inches)	(30)	(30)	(30)	(30)

Environment

Note: For optimum paper stacking a temperature range of $15.6^{\circ}\text{--}37.8^{\circ}\text{C}$ ($60^{\circ}\text{--}100^{\circ}\text{F}$) and a relative humidity range of 26%–62% is recommended.

Weight: 200 kg (440 lb)

Heat Output: 412 Watts (1400 BTU/hr)

Airflow: Convection

Power Requirements:

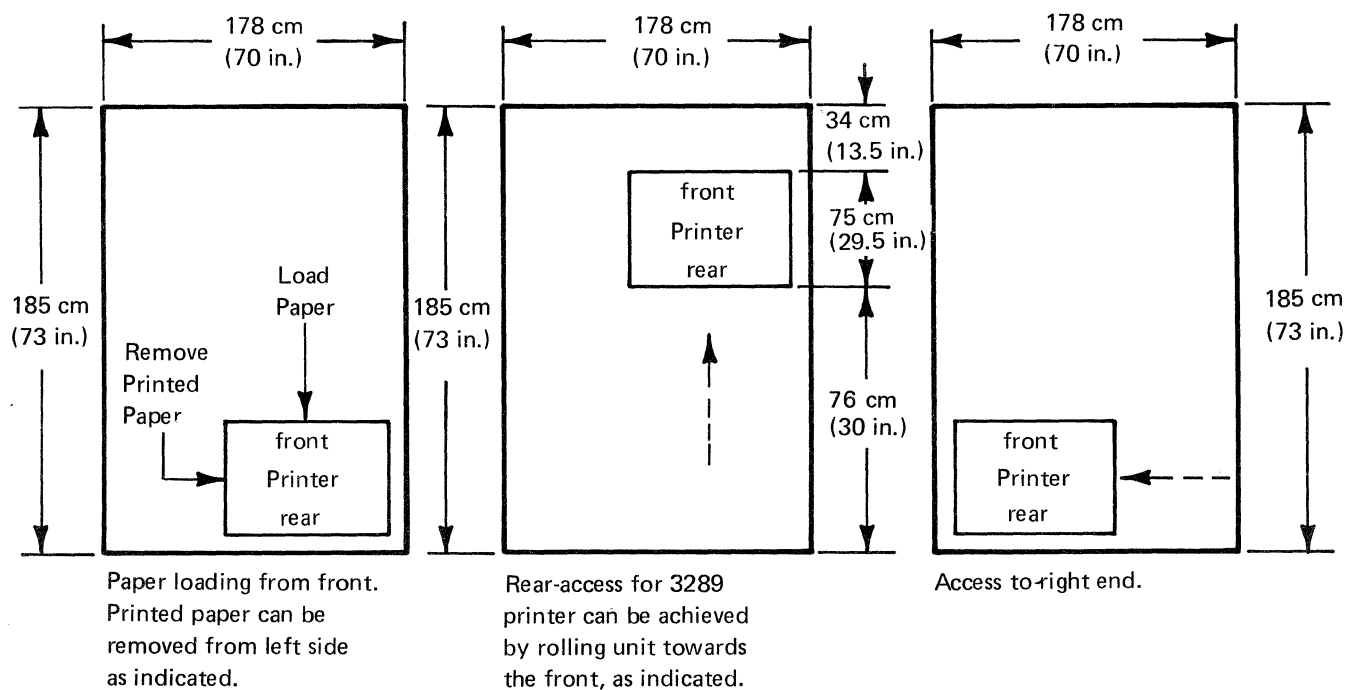
kVA	0.6
Phase	1
Ampacity	15

Voltages That Can Be Specified

	60 Hz				50 Hz					
	100	110	120	127	100	110	200	220	230	240
IBM (United States/Canada)			X							
IBM World Trade Americas/Far East	X	X	X	X	X	X	X	X	X	X
IBM World Trade Europe/Middle East/Africa			X ¹					X		X

1. Saudi Arabia only.

A space-saving technique for a congested environment is illustrated below. Casters on the 3289 Printer facilitate movement for access. Cable slack must be provided to achieve the results illustrated. Note that, in the center illustration, a 34-cm (13.5 in.) space is still available in front of the unit.



Chapter 6. Communication System Cabling

This chapter provides information about cabling for the IBM 3270 Information Display System. IBM-supplied cables (other than those automatically supplied with the unit) are cross-referenced between figures by cable group number; customer-supplied cables, by a letter designation. This section also provides information on coaxial cable installation, specifications for cables and connectors for the customer who elects to fabricate these cables, and IBM part numbers for the customer who elects to purchase the customer-supplied cables from IBM.

Conversion of 2260 Display Cables

If the customer has previously installed 2260 cables, they may be used for 3270 installations. For conversion of 2260 cables to single coaxial cables, refer to *Assembly of Coaxial Cable and Accessories for Attachment to IBM Products*, GA27-2805.

System Cabling

Cabling for the system includes communication cables, power cables, and signal cables (coaxial). Some of these cables are supplied by IBM; others must be supplied by the customer, who has the option of fabricating them or purchasing them, preassembled, from IBM. A preassembled cable is one that is cut to the specified length, with the connectors installed on it.

IBM-Supplied Cables

There are two types of IBM-supplied cables and two ways to order:

For cables automatically supplied with units, determine the type and length (if variable) at the time you order the unit, and include the cables in the unit order.

Identify cables that must be ordered separately by a cable group number and a variable length (within limits).

The IBM representative will order these cables by a cable order. The length must be specified on the cable order.

IBM-supplied cables are always equipped with the connectors necessary for attachment. Refer to Appendix F and Appendix J.

Customer-Supplied Cables

Customer-supplied cables are referred to by a letter designation, which appears in place of the cable group number used for IBM-supplied cables. The customer is responsible for obtaining, installing, and maintaining these

cables. IBM part numbers are provided in this manual so that these cables may be ordered from IBM using a miscellaneous equipment specification (MES) form. The lengths must be specified. These part numbers are for preassembled cables.

Optional Customer Fabrication of Cables

The customer may elect to fabricate customer-supplied cables. Specifications for bulk cable and descriptions of IBM-approved connectors are provided in this section.

Customers who choose to fabricate coaxial cables should order *Assembly of Coaxial Cable and Accessories for Attachment to IBM Products*, GA27-2805.

When ordering bulk cable from IBM or other source, the customer should indicate the continuous unit-to-unit cable lengths to the cable suppliers so that unplanned cutting may be avoided. If joining of coaxial cable ends is required, the adapter described under "Coaxial Cable Splicing" should be used.

Cable Installation—General

The following paragraphs provide general information about cable installation, labeling, and completion testing.

Cable Runs (Indoors)

Communication cabling and signal cables should be separated from normal electrical wiring (100/240 V - 50/60 Hz) in accordance with the *Coaxial Cable Separation Guide* (page 6-2). Unshielded high-power or high-energy sources may require a larger separation.

Some low-frequency pocket paging systems are sensitive to the low-level signals used in the 3270 IDS. To prevent interference, communication cables should not be routed in proximity to existing systems.

When an installation of a paging system is being planned in a facility with an IBM system already installed, review the plan with your IBM Installation Planning Representative to assure compatible operation of the paging system.

Cabling runs may be run in the same conduit as telephone lines without adverse effect.

The cable adapter terminating conductor or shield of the coaxial cable should not be grounded while the system is in operation.

Shield Commoning

Shields of different coaxial cable runs must not be commoned. This could result in ground loops in the shield which could cause erratic operation within the system. If more than one cable terminates in the same location and a panel board is desired to terminate the cable runs, the panel board must be of nonconductive material.

Identification and Labeling of Device Cabling (Coaxial)

Device coaxial cables are those cables that attach to a device at one end (printer or display unit) and to a control unit (3271, 3272, 3274, 3276) at the other.

Control Unit End

Label cables to indicate panel (where applicable) and port number of the control unit to which the cables will be attached. Since the output information emanates from a specific port, each device must be attached to its proper port. Labeling the cables as indicated should prevent the unit from being improperly connected, should the cables ever be removed from the unit.

Device End

No labeling is necessary if there is only one device at a specific location. If more than one device is present at the same location, each device and its assigned number should be indicated on the cable. Refer to the *IBM 3270 Information Display System Planning and Setup Guide* (GA27-2827) for details associated with the 3274/3276 units.

Cable Runs (Outdoors)

Conductors on poles should be located below the light and power conductors and shall not be attached to a cross arm carrying light or power conductors. The coaxial cable is not self-supporting and requires a messenger for support. In areas subject to sleet and snow, support may be needed more than every 3.05 m (10 ft). Proper lead-in clearances must be provided. Lead-in or aerial-drop cables from a pole or other support, including the point of initial contact with a building, shall be kept away from electric light or power circuits, so as to avoid the possibility of accidental contact.

Coaxial Cable Separation Guide

The following distances are a guide for voltages up to 440 volts; for voltages higher than 440 volts, contact your IBM Installation Planning Representative.

The minimum distance between coaxial cable and fluorescent, neon, or incandescent lighting fixtures is 12.7 cm (5 in.).

The minimum distance between coaxial cable and unshielded power lines or electrical equipment depends upon the power of the equipment:

- 2 kVA or below: 12.7 cm (5 in.)
- 2 - 5 kVA: 30.5 cm (12 in.)
- Over 5 kVA: 61.0 cm (24 in.)

The minimum distance between coaxial cable and unshielded power lines or electrical equipment with the coaxial cable enclosed in grounded metallic conduit:

- 2 kVA or below: 6.35 cm (2.5 in.)
- 2 - 5 kVA: 15.2 cm (6 in.)
- Over 5 kVA: 30.5 cm (12 in.)

The minimum distance between coaxial cable and power lines in grounded metallic conduit:

- 2 kVA or below: 6.35 cm (2.5 in.)
- 2 - 5 kVA: 15.2 cm (6 in.)
- Over 5 kVA: 30.5 cm (12 in.)

The minimum distance between coaxial cable enclosed in grounded metallic conduit and power lines enclosed in grounded metallic conduit:

- 2 kVA or below: 3.05 cm (1.2 in.)
- 2 - 5 kVA: 6.5 cm (3 in.)
- Over 5 kVA: 15.2 cm (6 in.)

Some governing factors that should be known before asking for guidance over 440 volts are:

Voltage and ampacity of the power lines and the unbalance of three-phase lines.

Shield, if any, and type of shielding.

Distance of power lines above ground (since coaxial cables should be below power lines), which determines if sufficient distance is available.

Type of power lines (for example, multigrounded neutral-balanced three-phase).

Length of parallel run of the two types of cable.

Cabling that is part of the system, even though it is a customer responsibility, may be purchased from IBM.

Completion Tests of Cabling

Contracts for installation of cabling should stipulate completion tests to ensure that there are no faults, high-resistance connections, or circuit imbalances. Tests for the following faults should be included:

Open circuits in individual conductors or shields. The combined resistance of the center conductor and the cable shield of the coaxial cable is approximately 47 ohms per 300 m (1000 ft) of cable (center conductor and shield shorted at remote end).

Short circuits between conductors of the same pair.

Grounds on individual conductors, either between a conductor and shield or between a conductor and a grounded object.

National Electrical Code Classification

The signal power on the coaxial cable, when the system is operating, is approximately 8 volts and 40 ma. This signal power is within the limits of Article 725 for Class 2 and 3 circuits of the National Electrical Code.

UL Listing

Signal cabling purchased from IBM is listed with the Underwriters Laboratory.

Coaxial Cable Installation

This section of the manual presents information relating to the installation of coaxial cables.

Indoors

Coaxial cable (IBM part 323921) is approved for indoor installation only. Because this cable is not self-supporting, it must be supported at least every 3 m (10 ft).

Outdoors

Coaxial cable bearing IBM part 5252750 is modified for outdoor use. This cable is suitable for both indoor and outdoor installation. It is also suitable for above-ground installation as well as direct burial (provided that adequate precautions are taken to protect the cable from damage in the trench and that it is buried well below the frost line to prevent upheaval). Since this cable is not self-supporting, it must be provided with some type of messenger when installed overhead.

Substitute Cabling

Substitute cabling for either indoor coaxial cable (IBM part 323921) or outdoor coaxial cable (IBM part 5252750) must meet both physical and electrical specifications. See Figures 6-10 and 6-11.

Lightning Protection

Because some areas are more susceptible than others to lightning activity, the precautions taken vary with each installation. The following is a list of suggested outdoor cable installation methods for areas with varying degrees of exposure to lightning. In all cases, station protectors are required at both ends of the cable as described under the heading "Station Lightning Protectors."

Appendix E contains the REA Lightning Damage Probability Map for the Continental United States, which can serve as a guide for "low," "medium," and "high" lightning areas. This map was developed by the U.S. Department of Agriculture Rural Electrification Administration, Washington, D.C. 20250. It is intended only as a *broad guideline* for determining the type of installation to be used. The map does not take into account terrain features and other local conditions that can affect exposure. Good engineering judgment and a knowledge of local conditions are essential.

Low Lightning Exposure Areas

Aerial Installation

Since the coaxial cable is not self-supporting, it must be attached to the messenger (support) wire a minimum distance of every 3.05 m (10 ft). Ground the messenger wire at both ends and in accordance with the instructions given under the heading "Station Lightning Protectors." See Figure 6-1.

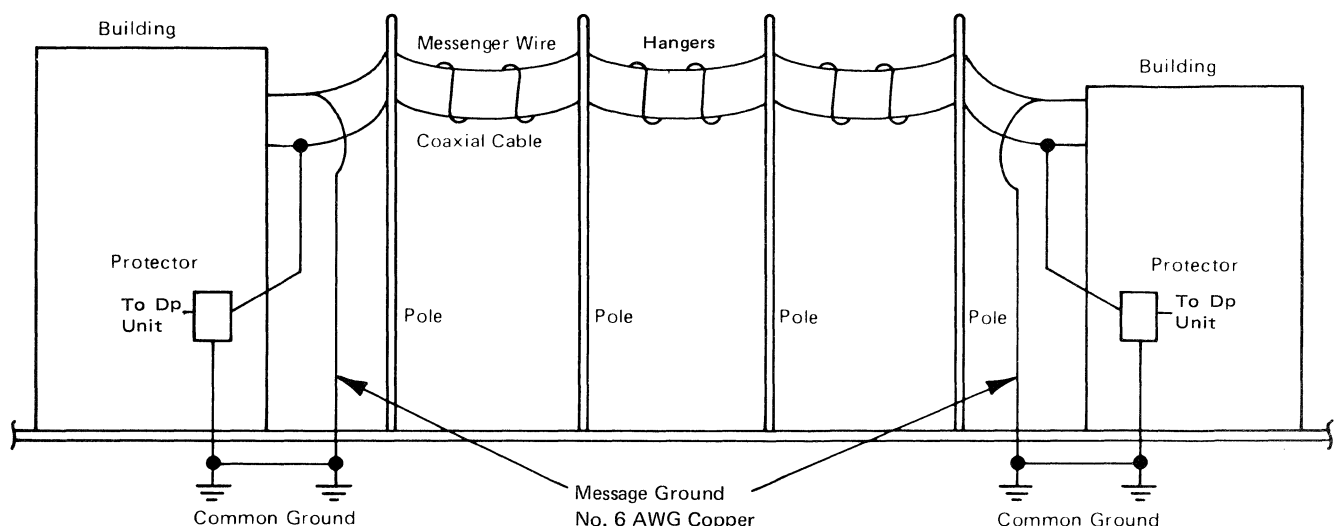


Figure 6-1. Low Lightning Exposure Area – Aerial Installation

Buried Installation

Bury the cable well below the frost line to prevent upheaval.

Medium Lightning Exposure Areas

Aerial Installation

Install the coaxial cable and supporting messenger wire at least 1 m (39 in.) below a shield* line. Both the shield line and the messenger wire must be grounded at each pole and at each end with No. 6 AWG copper wire. The ground resistance at each pole should not exceed 10 ohms if possible. A grounding rod driven into the earth a minimum of 2.7 m (9 ft) is the minimum requirement. Both ends of the messenger wire and shield line should be grounded in accordance with the instructions given under the heading "Station Lightning Protectors." See Figure 6-2.

Buried Installation

Provide the adequate protection and bury the cable with two shield wires installed above the coaxial cable. The horizontal spacing between the shield wires should be between 46 cm (18 in.) and 61 cm (24 in.). The two shield wires should be approximately 61 cm (2 ft) above the

cable and buried below the frost line. The shield wire should be No. 6 AWG (or larger) copper wire. The cable should be centered between the two shield wires as shown in Figure 6-3.

High Lightning Exposure Areas

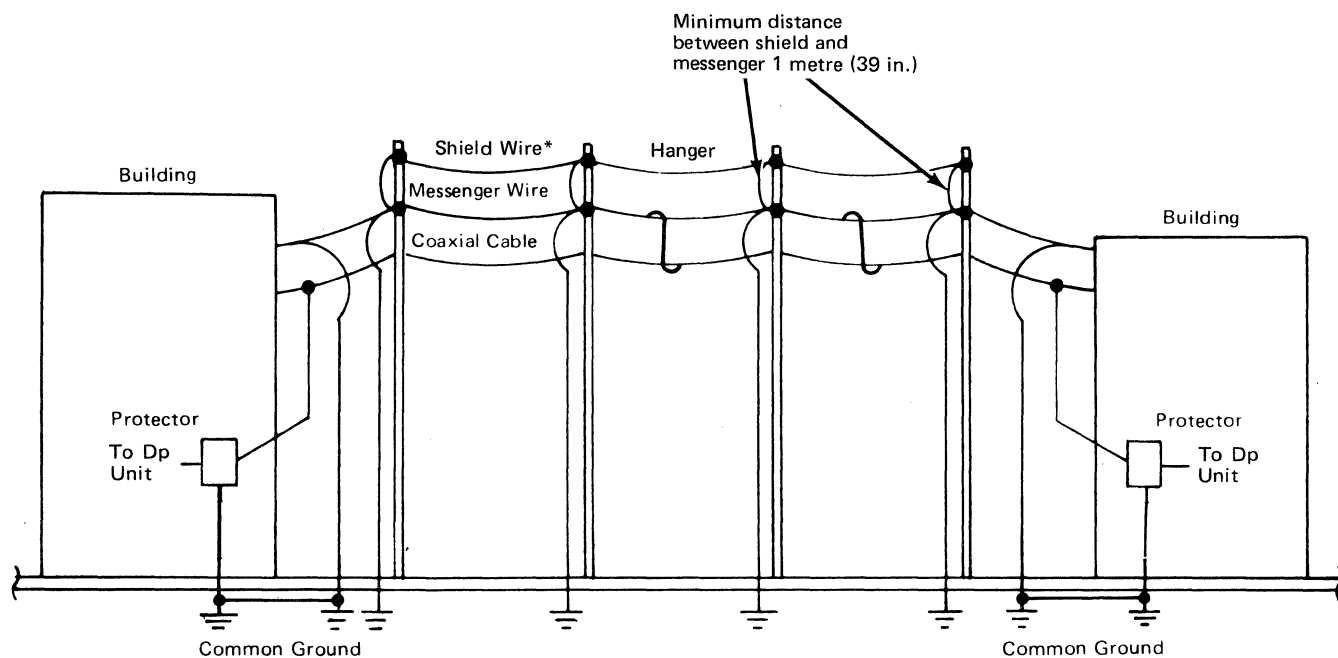
Aerial Installation

The recommendations for aerial installation in Medium Lightning Exposure areas also apply to High Lightning Exposure areas. When ground resistivity is high, run a parallel buried ground wire (counterpoise) below the frost line. In addition, provide pole protection wires on each nonmetallic pole. Fasten a No. 6 AWG (or larger) copper wire to the pole from top to bottom. This wire can also act as the grounding wire for the shield line and messenger wire. The counterpoise, if used, should have all pole grounds attached to it and be commoned to the grounding system used for the building. See Figure 6-4.

Buried Installation

Run the cable in a metal conduit buried below the frost line. Generally, routing buried or aerial cables through the highest points of the local terrain, which are subject to increased lightning activity, should be avoided.

*Power lines can provide shielding. When the cable is run jointly with the power line, the messenger wire should be bonded to the multiground neutral (MGN). The MGN can be used in lieu of an earth-driven grounding rod. Bond all ground points to the power company multiground neutral.



*Power lines can provide shielding. When the cable is run jointly with the power line, the messenger wire should be bonded to the multiground neutral (MGN). The MGN can be used in lieu of an earth-driven grounding rod. Bond all ground points to the power company multiground neutral.

Figure 6-2. Medium Lightning Exposure Area – Aerial Installation

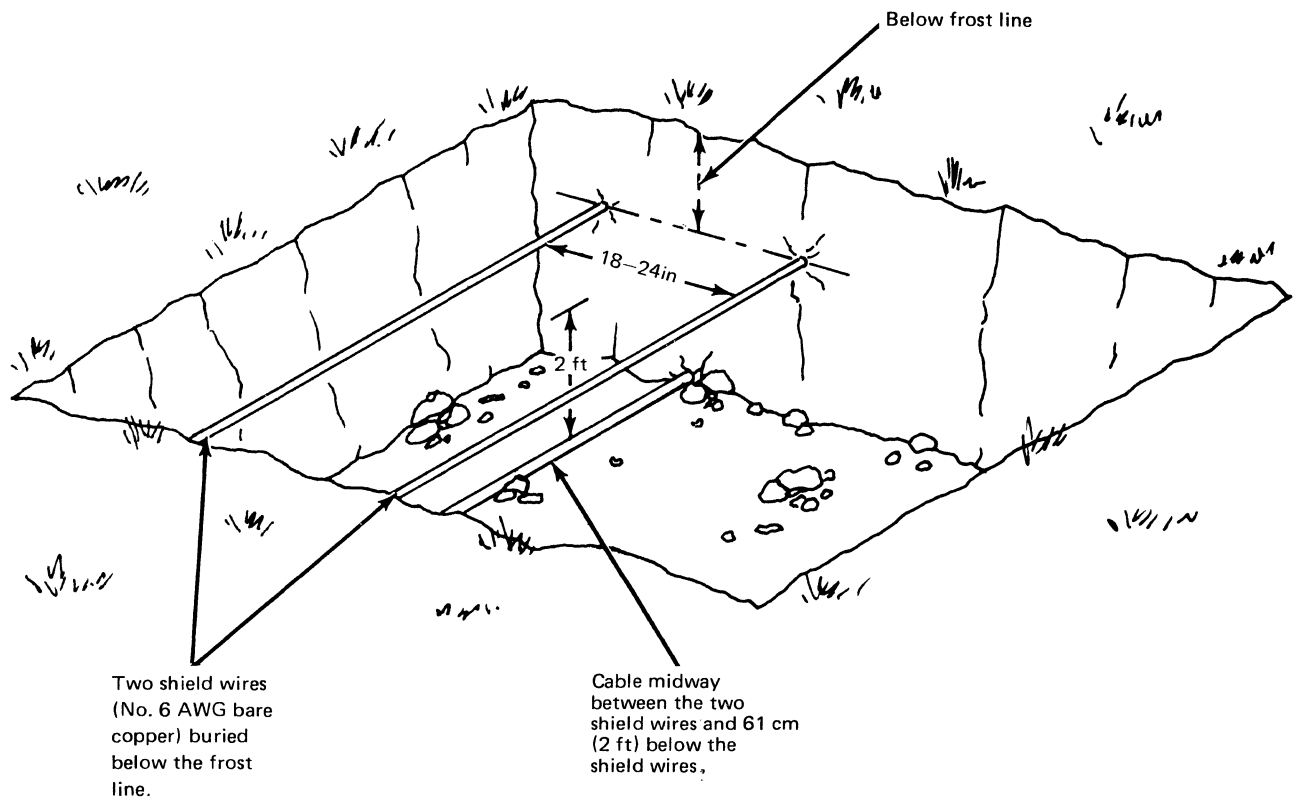
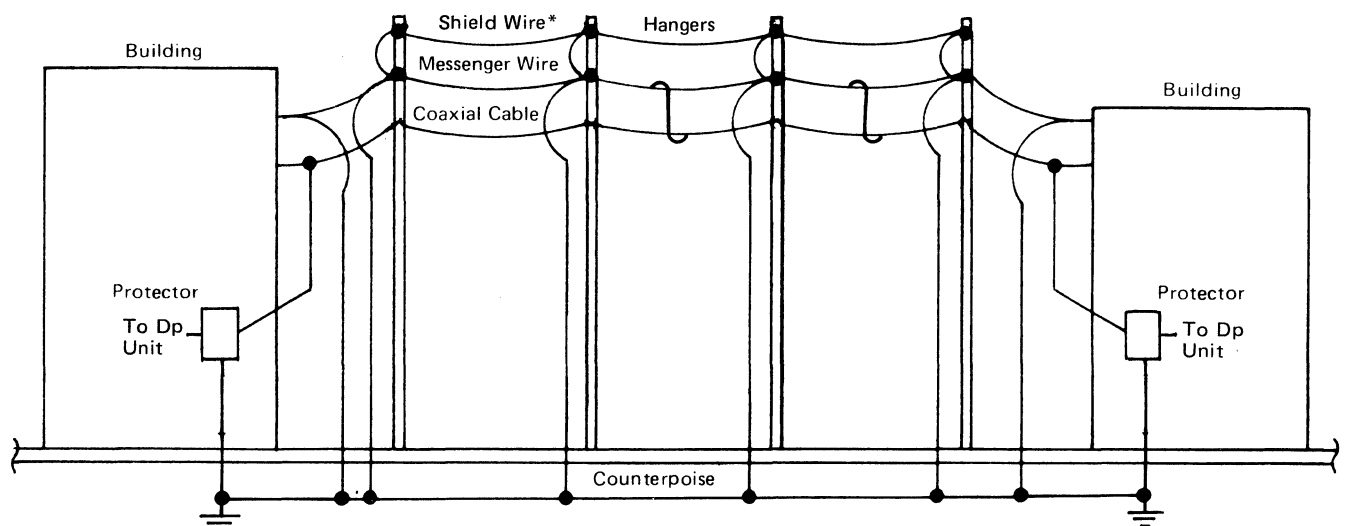


Figure 6-3. Medium Lightning Exposure Area – Buried Installation



*Power lines can provide shielding. When the cable is run jointly with the power line, the messenger wire should be bonded to the multiground neutral (MGN). The MGN can be used in lieu of an earth-driven grounding rod. Bond all ground points to the power company multiground neutral.

Figure 6-4. High Lightning Exposure Area – Aerial Installation

Station Lightning Protectors

To help protect personnel and minimize damage to IBM equipment from sudden surges of lightning energy, a station protector must be attached to the shield at each end of each coaxial cable that is routed outdoors. This is true for both overhead and buried cable runs. The station protector procured from IBM must be installed indoors. (The protector is designed for inside installation only.) The protector should be installed at the point at which the cable enters or exits from the building and as close to suitable ground as practical. The protector must be grounded. The minimum recommended gauge of the grounding conductor is 12 AWG (2.05 mm, 0.08 in. in diameter). The grounding conductor should be routed to the grounding electrode in as straight a line as practical and should not exceed 3.05 m (10 feet) in length. Longer runs will require proportionally larger diameter ground wires.

The following are the various types of grounding electrodes in the preferred sequence:

1. Public metallic water pipe system (any metallic water pipe system will suffice, if at least 3.05 m (10 feet) is in moist earth).
2. Power service conduit, service-equipment enclosure or building steel (usually when a metallic water pipe system is not available, the grounding system used by the power utility is the best available ground).
3. Other grounding electrodes approved by local/national codes, that is, N.E.C. 800-31.
4. The grounding rod electrode, the least preferable, since rods driven in other than good, moist earth (in water table) have been known to have a resistance of several hundred ohms.

All grounds should be commoned at one location (National Fire Protection Code). Common grounding is recognized as the most effective method of preventing side flashes resulting from a lightning discharge. The conductors used for bonding and interconnecting these grounds should be at least No. 6 AWG, 4.1-mm copper wire (lightning protection code NFPA-78).

Lightning protectors should not be installed in areas where unauthorized personnel may come in contact with them. They should not be installed, have maintenance performed, be connected or disconnected, or be handled in any way during periods of lightning activity; neither should the coaxial cable that runs from the protector to the terminal. The protectors should be installed so that access for maintenance and replacement of the elements can be readily accomplished. The area of the building at which the cables enter or leave must neither contain combustible material nor be considered a hazardous area.

Surge protectors vary in initial cost, cost of maintenance, stability, useful life, and fail-safe protection. The customer should decide what type of protector best meets his needs. *Rural Electrification Administration Telephone Engineering and Construction Manual*, Section 823, Issue #2, dated January 1976, because of reliability and lower maintenance costs, recommends the use of gas type protectors in the following situations:

1. On all high-priority circuits of any type where continuity of service is important and only the minimum outage time can be tolerated (such as fire alarm circuits, interoffice of EAS trunk circuits, and data circuits).
2. On all carrier circuits where lightning incidence is significant.
3. For all subscriber station protectors in areas with a record of high station protection maintenance costs with carbon blocks or plant or equipment damage due to lightning surges or power fault current-induced surges.
4. For all main frame protectors in unattended central offices located in areas with a record of high protector maintenance or equipment failures caused by lightning or power fault current-induced surges.

At the present time, only the gas tube type protector is available from IBM for the above stated reasons.

The following protector and attachment kits (see Figure 6-5) may be ordered from IBM on a miscellaneous equipment specification (MES) form:

Protector Kit

IBM PN 1830818—Contains two gas element station protectors, one for each end of the cable run.

Attachment Kit

IBM PN 1833106—Contains the parts necessary for attaching a station protector to two coaxial cable ends. An attachment kit is needed for each coaxial cable.

Each station protector can handle two coaxial cables. Therefore, if two cables are routed between the same two points, only one station protector *kit* is required, but two attachment kits are necessary. Refer to *Assembly of Coaxial Cable and Accessories for Attachment to IBM Products*, GA27-2805, for details on method of attachment. Gas element IBM PN 5252899 (Reliable Electric #1304 FSR) can be used to replace former IBM PN 5252772 (Reliable Electric #1304) by simply unscrewing the carbon element and screwing in the gas element. Care should be taken not to spill the contents in the process.

IBM PN	Part Description	Quantity	Commercial Source
1830818 Includes the following: 5252895 5252899	Kit for gas element station protectors	1	IBM
	Station Protector	2	Reliable Electric Co.* R-123 FSR
	Gas Protector Unit (Replaceable item for the gas element station protector)	4	Reliable Electric Co.* 1304-FSR
1833106 Includes the following: 5252764 1833107	Kit for attaching the station protectors	1	IBM
	Adapter BNC Bulkhead UG-492A/U	2	Amphenol Corporation* 31-220
	Jumper Assembly The following parts make up 1833107:	2	IBM
	Ring Terminal 0.500" (12.7 mm) Stud-Wire Range 14–16	1	Electrical Supplier
	Ring Terminal #10 Stud Wire Range 14–16	1	Electrical Supplier
	Wire-Green/Yellow #14 AWG (2" 50.8 mm)	1	Electrical Supplier

**Or other equivalent customer-selected source.*

Note: *The Gas Protector Unit (P/N 5252899) can recover repeatedly from momentary transient voltages. Sustained high current will cause the arrester to permanently ground the circuit. When this occurs the Gas Protector Unit must be replaced.*

Figure 6-5. Station Protector Summary

Cable Specifications

This section provides bulk cable specifications and descriptions of IBM-approved connectors for the customer who elects to fabricate these cables. IBM part numbers are also provided for the customer who wishes to purchase bulk cable, connectors, or preassembled cables from IBM. See Figure 6-6 for a summary of IBM part numbers for cables and accessories.

Coaxial Cables (h and l)

These cables must be procured, installed and maintained by the customer. Cable h is for indoor installation only; cable l is for outdoor installation, although it is approved for indoor use as well.

Cable h (Indoor)

Refer to Figure 6-7 for bulk cable specifications for cable h (IBM part 323921). Cables may be purchased from IBM or from a customer-selected source. Bulk cables may be ordered from IBM by specifying IBM part 323921 and the length on a miscellaneous equipment specifications (MES) form. Preassembled cables may be purchased from IBM by specifying IBM part 2577672 and the length on the MES form.

For fabricating cables, two BNC-type connectors are needed: IBM part 1836444 or equivalent. These two connectors can be ordered in a kit from IBM by specifying "Connector Group (indoor type), IBM part 1836418" on the MES form. Instructions for assembling BNC-type connectors on bulk cable are given in *Assembly of Coaxial Cable and Accessories for Attachment to IBM Products*, GA27-2805.

Cable l (Outdoor)

Refer to Figure 6-8 for bulk cable specifications for Cable l (IBM part 5252750). This cable is suitable for indoor and

outdoor installation and for burial. The cable may be purchased from IBM or from a source selected by the customer.

Bulk cable may be ordered from IBM by specifying IBM part 5252750 and the length on a miscellaneous equipment specification (MES) form. Preassembled cables may be purchased from IBM by specifying IBM part 1833108 and the length on the MES form.

For fabricating cables, two BNC-type connectors are needed, IBM part 1836447 or equivalent outdoor type. These two connectors may be obtained in a kit from IBM by specifying "Connector Group (outdoor type); IBM part 1836419" in the MES form. Instructions for assembling BNC-type connectors on bulk cable are given in *Assembly of Coaxial Cable and Accessories for Attachment to IBM Products*, GA27-2805.

Coaxial Cable Splicing

Do not cut and splice cables; instead, use a quick-disconnect adapter, IBM part 5252643, or commercial adapter, Amphenol Corp. part UG-914/U. A maximum of 13 connections is allowed in any given cable run. The adapter and the attached cable connectors must be covered with 127 mm (5 inches) of shrink tubing, 19.05 mm (0.75 inch) expanded diameter, to prevent accidental grounding of splice (Figure 6-9). This adapter and connecting jacks should be waterproofed for applications requiring this type of installation.

3270 IDS Cabling Summary

Listed in Figure 6-10 is a summary of all the varied cable types that are required for unit installation in either a local or remote 3270 Information Display System configuration.

Units From To		Cable Group	Type	IBM Preassembled Cable Assembly	Bulk Cable No.	Connector Group ^{1, 2}	Length ⁴ (Metres)
3271 or 3272	3277	h l	indoor outdoor	2577672 1833108	323921 5252750	1836418 1836419	610 610
	3284	h l	indoor outdoor	2577672 1833108	323921 5252750	1836418 1836419	610 610
	3286	h l	indoor outdoor	2577672 1833108	323921 5252750	1836418 1836419	610 610
	3287	h l	indoor outdoor	2577672 1833108	323921 5252750	1836418 1836419	610 610
	3288	h l	indoor outdoor	2577672 1833108	323921 5252750	1836418 1836419	610 610
3276	3278	h l	indoor outdoor	2577672 1833108	323921 5252750	1836418 1836419	1500 1500
	3279	h	indoor outdoor	2577672 1833108	323921 5252750	1836419 1836419	1500 1500
	3287	h l	indoor outdoor	2577672 1833108	323921 5252750	1836418 1836419	1500 1500
3274	3277	h l	indoor outdoor	2577672 1833108	323921 5252750	1836418 1836419	610 610
	3278	h l	indoor outdoor	2577672 1833108	323921 5252750	1836418 1836419	1500 1500
	3279	h l	indoor outdoor	2577672 1833108	323921 5252750	1836418 1836419	1500 1500
	3284	h l	indoor outdoor	2577672 1833108	323921 5252750	1836418 1836419	610 610
	3286	h l	indoor outdoor	2577672 1833108	323921 5252750	1836418 1836419	610 610
	3287	h l	indoor outdoor	2577672 1833108	323921 5252750	1836418 1836419	610/1500 610/1500
	3288	h l	indoor outdoor	2577672 1833108	323921 5252750	1836418 1836419	610 610
	3289	h l	indoor outdoor	2577672 1833108	323921 5252750	1836418 1836419	1500 1500

Notes:

1. IBM connector kit 1836418 contains two BNC connectors (IBM 1836444).
2. IBM connector kit 1836419 contains two BNC connectors (IBM 1836447).
3. See Assembly of Coaxial Cable and Accessories for Attachment to IBM Products, GA27-2805, when assembling connectors to coaxial cables.
4. Devices attached to Type B Terminal Adapters may have a maximum cable length of 610 m (2000 feet); those attaching to Type A Terminal Adapters may have a maximum cable length of 1500 m (4920 feet). Refer back to pages 4-4 and 4-10.

Figure 6-6. Summary of IBM Part Numbers for Cables and Accessories

Specifications Note 2, Note 3		
Conductor	AWG Wire Size Stranding Material	22 Solid Copper Covered Steel 40% Conductivity
Shield	Material Type Coverage	Copper Braid AWG 34 Note 1
Jacket	Material Avg. Single Wall Thickness	PVC 0.79 mm (0.031 in.)
Rating	Ambient Temperature	60 ° C Max
Capacitance, Nominal		14.5 pF/ft
Impedance, Characteristic		93 ± 5 Ohms
Attenuation @ 400 MHz		8.0 dB/100 ft Max
Velocity of Propagation		80%
DC Resistance		44 Ohms/1000 ft Max

Notes:

1. Seven ends, 16 carriers, $8.2 \pm 10\%$ pick per inch, 90% minimum coverage.
2. Cable commercially designated RG 62 A/U or M17/030/RG 062 meeting the above specifications, is an approved substitute.
3. Cable OD 6.15 ± 0.18 mm ($0.242 \pm .007$ in.).

Figure 6-7. Bulk Cable Specifications for Indoor Coaxial Cable (h)

Specification Note 3, Note 4		
Conductor	AWG Wire Size Stranding Material	22 Solid Copper Covered Steel 40% Conductivity
Shield	Material Type Coverage	Copper Braid AWG 34 Note 1
Jacket	Material Avg. Single Wall Thickness	PVC Note 2 1.02 mm (0.040 in.) Min
Rating	Ambient Temperature	60° C Max
Capacitance, Nominal		14.5 pF/ft
Impedance, Characteristic		93 ± 5 Ohms
Attenuation @ 400 MHz		8.0 dB/100 ft Max
Velocity of Propagation		80%
DC Resistance		44 Ohms/1000 ft Max

Notes:

1. Seven ends, 16 carriers, 8.2 ± 10% pick per inch, 90% minimum coverage.
2. Jacket must meet the minimum requirements for underground feeder and branch circuit cable and must also be weatherproofed and sunlight resistant, per U.L. Subj. 493.
3. Cable commercially designated RG 62 A/U or M17/030/RG 602, which is modified for outdoor use (including vapor barrier and thicker cover) and which meets above specifications, is a suitable substitute.
4. Cable OD 6.6 ± 0.25 mm (0.260 ± 0.01 in.).

Figure 6-8. Bulk Cable Specifications for Outdoor Coaxial Cable (I)

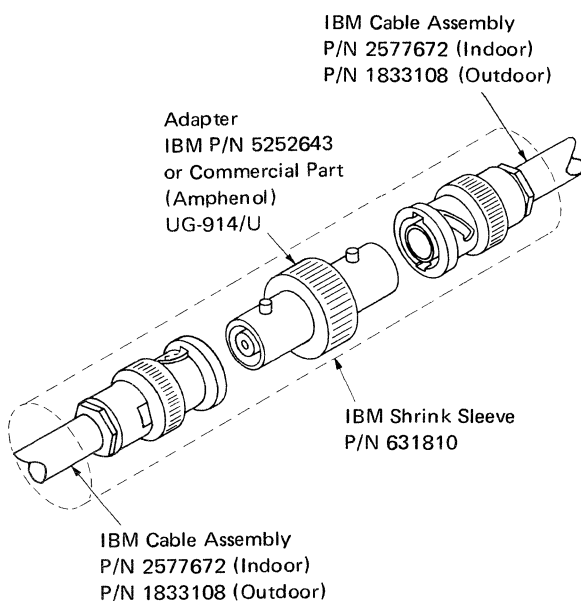


Figure 6-9. Cable Adapter for Joining Coaxial Cables

3270 Unit	Cable Type	Cable Group	Comment
3271	Teleprocessing	3207, 3208, 3209, 3210, 3211, 3212, 3213	Ordered by cable order. Installed by IBM.
	Signal (Coaxial)	h or l	Procured and installed by customer. Maximum length 610 m (2000 ft).
3272	Local Channel Attachment	3201, 3202, 3203, 3204, 3205	Ordered by cable order.
	Sequence and Control (EPO)	3206	Required with LCA cables. Ordered by cable order.
	Signal (Coaxial)	h or l	Procured and installed by customer. Maximum length 610 m (2000 ft).
3274	Local Channel Attachment	3201, 3202, 3203, 3204, 3205	Ordered by cable order. Installed by IBM.
	Sequence and Control (EPO)		
	Teleprocessing	Not applicable	Supplied with the unit. Installed by customer.
	Signal (Coaxial)	h or l	Procured and installed by customer. Maximum length to 3278, 3287, (Type A) 3289 is 1500 m (4920 ft). Maximum length to 3277, 3284, 3286. 3287 (Type B) 3288 is 610 m (2000 ft).
3275	Teleprocessing	3207, 3208, 3209, 3210, 3211, 3212, 3213	Ordered by cable order. Installed by IBM.
	Signal (Coaxial)	h or l	Provided and installed by customer.
3274-51C 3276	Teleprocessing	Not applicable	Supplied with unit. Installed by customer.
	Signal (Coaxial)	h or l	Procured and installed by customer. Maximum length to 3278, 3287 is 1500 m (4920 ft).
	Communication Cable	Not applicable	Supplied with unit Specify feature 4850
3277 3284* 3286 3288	Signal (Coaxial)	h or l	Procured and installed by customer. Maximum length is 610 m (2000 ft).
3278 3279	Signal (Coaxial)	h or l	Procured and installed by customer. Maximum length is 1500 m (4920 ft).
3287	Signal (Coaxial)	h or l	Procured and installed by customer. Maximum length to 3274/3276 Type A adapter is 1500 m (4920 ft). Maximum length to 3274 Type B adapter is 610 m (2000 ft).
3289	Signal (Coaxial)	h or l	Procured and installed by customer. Maximum length is 1500 m (4920 ft).

* Except Model 3 (see page 4-8)

Figure 6-10. 3270 IDS Cabling Summary

Appendix A. U.S. and Canada Power Cord Plug Types

IBM supplies power cords with attached plugs for the United States and Canada. See Figures A-1, A-2, and A-3. The customer must provide the corresponding power outlet receptacle. For the 3276, 3278, 3279, 3287, and 3289 units in the United States or Canada, the customer may specify one of the following power cords.

With Nonlocking Plug

NEMA 5-15P 125 Vac Rating Specify Code 9891

With Locking Plug

NEMA L5-L15P 125 Vac Rating Specify Code 9890

For other World Trade countries, IBM supplies the power cord with attached plug that corresponds to the power outlet receptacle that is most used in that country. Refer to Appendix C, Figures C-1 through C-11, for illustrations of the power cord plugs that are supplied and for the ampere/voltage rating of these plugs.

Plug Type	3271	3272	3274 1A, 1B 1D	3274 1C	3274 51C	3275	3276	3277	3278	3279	3284	3286	3287	3288	3289	Reference Figures
A		X*														A-2, A-3
A2			X*													A-2, A-3
H	X			X	X	X	X	X	X	X	X	X	X	X	X	A-2, A-3
J	X			X	X	X	X	X	X	X	X	X		X	X	A-2, A-3
K	X	X	X	X												A-2, A-3
L	X	X	X	X												A-2, A-3

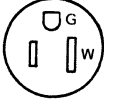

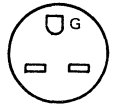

* A waterproof plug may be ordered for the 3272 by specifying RPO8K0295;
for the 3274 Models 1A, 1B and 1D by Feature Code 8801.

Figure A-1. Power Cord Plugs Supplied in the U.S. and Canada

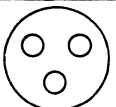



Provided by IBM					Provided by Customer					
Plug Type	Plug Cap Types			IBM Reference	Service Rating				Inline Connector	Receptacle
	Water- proof	Non- lock	Lock		Volts	Amps	Phase	Wires		
A	3720			Russell- Stoll	208/ 240	20	1	3	3913	3743
A2	3720 U-2			Russell- Stoll	208/ 240	15	1	3	3913 U-2	3743 U-2
H		5-15P		NEMA	120	15	1	3	5-15R	5-15R
J			L5-15P	NEMA	120	15	1	3	L5-15R	L5-15R
K		6-15P		NEMA	208/ 240	15	1	3	6-15R	6-15R
L			L6-15P	NEMA	208/ 240	15	1	3	L6-15R	L6-15R

Figure A-2. Descriptions of Plugs and Receptacles

Nonlocking Plugs and Receptacles

15 Amperes		
	Receptacle	Plug
Type	H	H
125V	 5-15R	 5-15P
Type	K	K
250V	 6-15R	 6-15P

Waterproof Plugs and Receptacles

20 Amperes		15 Amperes	
	Receptacle	Plug	
Type	A	A	
250V	 3913 / 3743	 3720	
Type	A2	A2	
250V	 3913 U-2 / 3743 U-2	 3720 U-2	

Locking Type Plugs and Receptacles

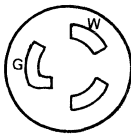

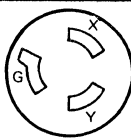
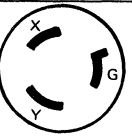
15 Amperes		
	Receptacle	Plug
Type	J	J
125V	 L5-15R	 L5-15P
Type	L	L
250V	 L6-15R	 L6-15P

Figure A-3. NEMA Configurations

Appendix B. Power Cable Lengths

Unit	Cable Length
3271	1.8 m (6 ft) 2.8 m (9 ft)*
3272	1.8 m (6 ft) 2.8 m (9 ft)*
3274	1.8 m (6 ft) 4.3 m (14 ft)*
3275	1.8 m (6 ft) 2.3 m (7.5 ft)*
3276	1.8 m (6 ft) 2.8 m (9 ft)* 3.7 m (12 ft) 4.5 m (15 ft)
3277	1.8 m (6 ft) 2.3 m (7.5 ft)*
3278	1.8 m (6 ft) 2.8 m (9 ft)* 3.7 m (12 ft) 4.5 m (15 ft)
3279	1.8 m (6 ft) 2.8 m (9 ft)* 4.5 m (15 ft)
3284	1.8 m (6 ft) 2.8 m (9 ft)*
3286	1.8 m (6 ft) 2.8 m (9 ft)*
3287	1.8 m (6 ft) 2.8 m (9 ft)* 3.7 m (12 ft) 4.5 m (15 ft)
3288	1.8 m (6 ft) 2.8 m (9 ft)*
3289	1.8 m (6 ft) 2.8 m (9 ft)* 3.7 m (12 ft) 4.5 m (15 ft)

*Standard Cable

Notes:

1. For the 3276, 3278, 3279, 3287, and 3289, only the 2.8 m (9 ft) and the 4.5 m (15 ft) cords are available in E/ME/A countries.
2. For the 3276, 3278, and 3279 only the 2.8 m (9 ft) and 4.5 m (15 ft) cords are available in A/FE countries except Canada.
3. For the 3279, the 1.8 m (6 ft) cord is available in the U.S. only.
4. For the 3274, only the 4.3 m (14 ft) cord is available in A/FE and E/ME/A countries.

Appendix C. WT Power Plug Requirements

World Trade Countries (Except Canada) Plugs — Customer Setup Units Only

Country	Figure	Country	Figure
Algeria	C-4	Israel	C-11
Argentina	C-6	Italy	C-10
Australia	C-6		
Austria	C-1	Jamaica	C-3
		Japan	C-3 & C9
Bahamas	C-3		
Barbados	C-3	Malaysia	C-5
Belgium	C-4	Mexico	C-3
Bermuda	C-3		
Bolivia	C-3	Netherlands	C-1
Brazil	C-3	Netherlands Antilles	C-3
Bulgaria	C-1	New Zealand	C-6
		Nicaragua	C-3
Chile	C-6	Norway	C-1
Colombia	C-6		
Costa Rica	C-3	Panama	C-3
		Paraguay	C-6
Denmark	C-8	Peru	C-3
Dominican Rep	C-3	Philippines	C-3
		Poland	C-1
Ecuador	C-3	Portugal	C-1
El Salvador	C-3		
		Rumania	C-1
Finland	C-1	Saudi Arabia	**
France	C-4	South Africa	C-7
		Spain	C-1
Germany	C-1	Sweden	C-1
Guatemala	C-3	Switzerland	C-2
Honduras	C-3	Taiwan	C-3
Hungary	C-4	Thailand	C-3
Iceland	C-1	United Kingdom	C-5
Indonesia	C-1	Uruguay	C-6
Iran	C-1		
Ireland	C-5	Venezuela	C-6
		Yugoslavia	C-1

Notes:

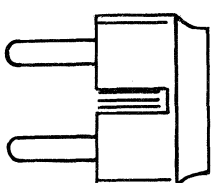
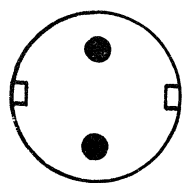
- World Trade E/ME/A countries not listed will receive power cords with attached plug as shown in Figure C-1.
- World Trade A/FE countries not listed will receive power cords with attached plugs as shown in Figure C-3 (for voltages under 200V) or as shown in Figure C-6 (for voltages of 200V and above).
- World Trade A/FE countries listed will receive power cords with attached plugs (for voltages under 200V) as shown in Figure C-3.
- World Trade A/FE countries listed in Figure C-3, and that specify voltages of 200V and above, will receive power cords without plugs.
- World Trade A/FE countries listed will receive power cords with attached plugs (for voltages of 200V and above) as shown in Figure C-6.
- World Trade A/FE countries listed above, but not listed in Figure C-3 that specify voltages under 200V will receive power cords without attached plugs.

Installation of a Power Plug

Because different plugs are used in different countries, it is difficult to cover all plug installations in one procedure. However, three things must be considered:

1. That the shield of the power cord always have a good electrical connection to the branch circuit ground.
2. That steps be taken to assure that the grounding wire and/or the drain (shield) wire cannot come in contact (touch) the other (hot) wires.
3. That the grounding wire (green-green/yellow) be properly attached to the grounding terminal in the plug.

**** Same as 15A, 125V Locking Plug
used in U.S. and Canada (see
Figure A-3).**

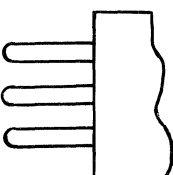


Austria
Bulgaria
Finland
Germany
Iceland
Indonesia

Iran
Netherlands
Norway
Poland
Portugal
Rumania

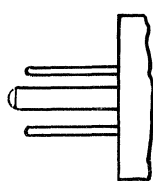
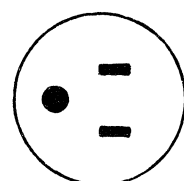
Spain
Sweden
Yugoslavia

Figure C-1. Plug with Side Earthing (Ground) Pin – 16A Max, 250V



Switzerland

Figure C-2. Plug with Earthing (Ground) Pin – 10A Max, 250V

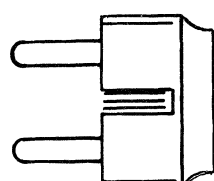
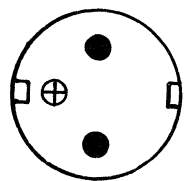


Bahamas
Barbados
Bermuda
Bolivia
Brazil
Costa Rica
Dominican Republic

Ecuador
El Salvador
Guatemala
Honduras
Jamaica
Japan
Mexico

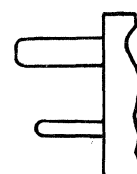
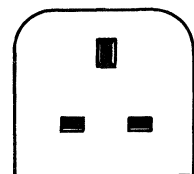
Netherlands Antilles
Nicaragua
Panama
Peru
Philippines
Taiwan
Thailand

Figure C-3. Plug with Earthing (Ground) Pin – Same plug as required for U.S. – 15A Max, 125V



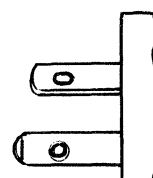
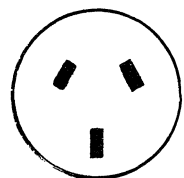
Algeria
Belgium
France
Hungary

Figure C-4. Plug with Contact Tube and Side Earthing (Ground) – 16A Max, 250V



Ireland
Malaysia
United Kingdom

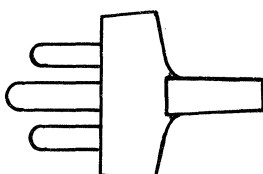
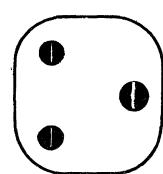
Figure C-5. Plug with Earthing (Ground) Pin – 13A Max, 250V



Argentina
Australia
Chile
Colombia
New Zealand

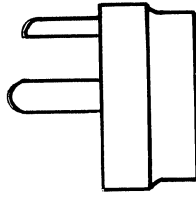
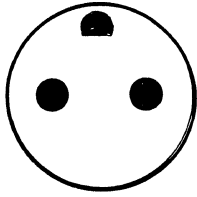
Paraguay
Uruguay
Venezuela

Figure C-6. Plug with Earthing (Ground) Pin – 10A Max, 250V



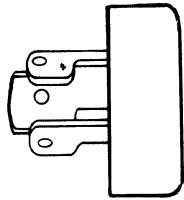
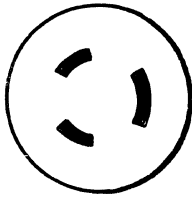
South Africa

Figure C-7. Plug with Earthing (Ground) Pin – 15A Max, 250V



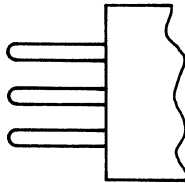
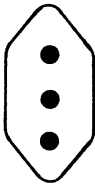
Denmark

Figure C-8. Plug with Earthing (Ground) Pin – 10A Max, 250V



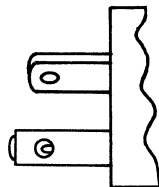
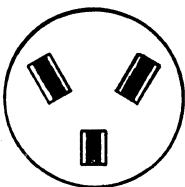
Japan

Figure C-9. Locking Plug with Earthing (Ground) Pin – 10A Max, 250V



Italy

Figure C-10. Plug with Earthing (Ground) Pin – 16A Max, 250V



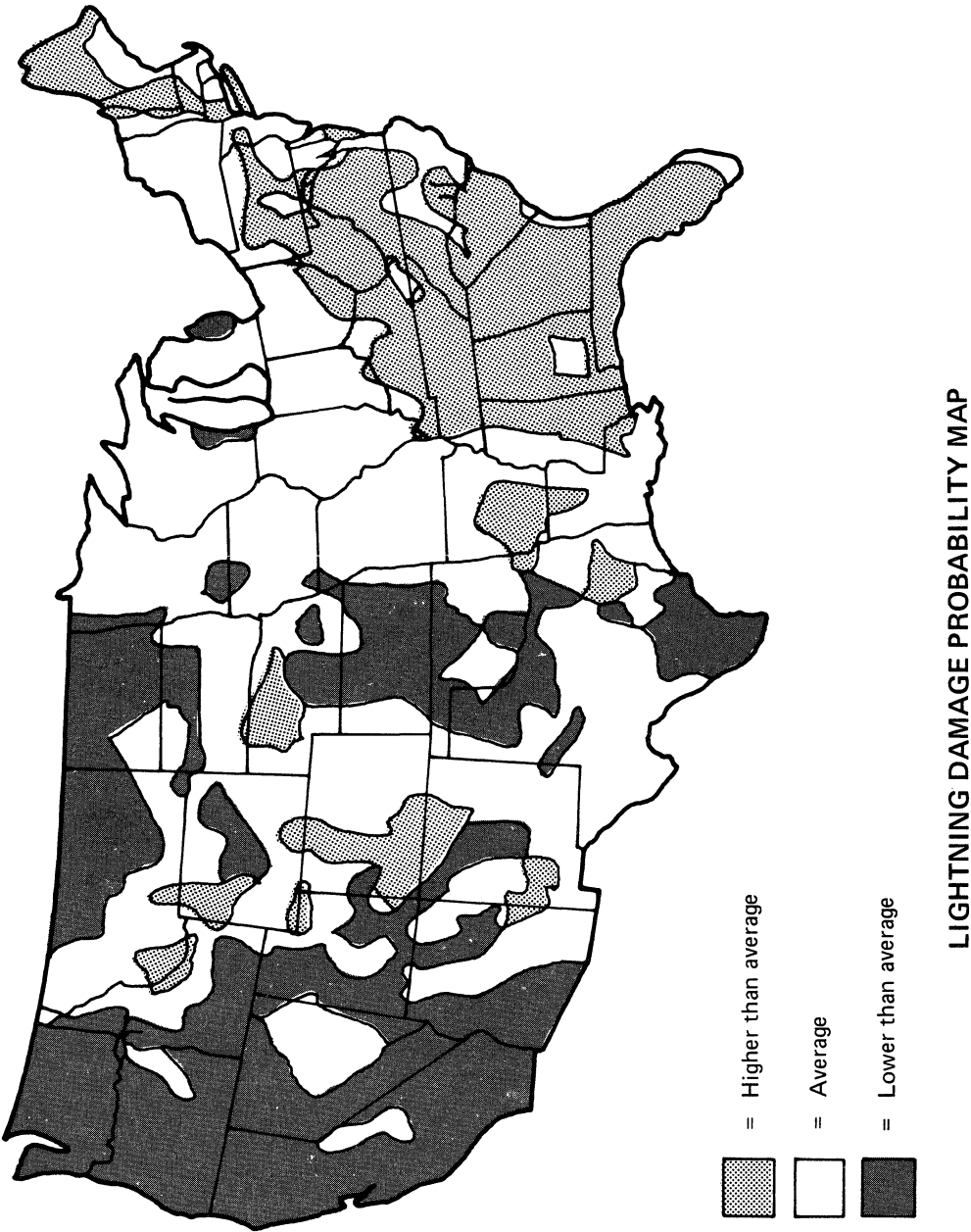
Israel

Figure C-11. Plug with Earthing (Ground) Pin – 10A Max, 250V

Appendix D. Power Cord Specifications

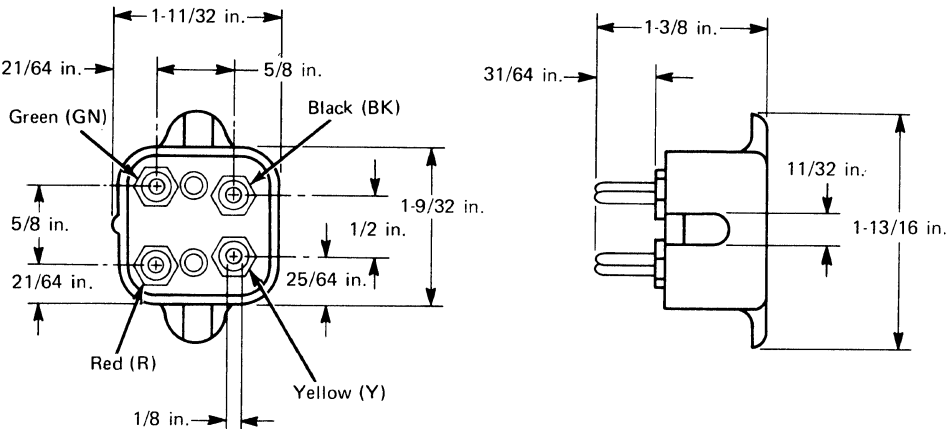
Cables				Conductors			
Unit	Nominal	O.D.	No. of Shields	Quantity	Nominal	O.D.	AWG No.
	Inches	mm			Inches	mm	
3271	0.350	9	1	3	0.048	1	18
3272	0.350	9	0	3	0.048	1	18
3274	0.350	9	1	3	0.048	1	18
3275	0.350	9	1	3	0.048	1	18
3276	0.350	9	1	3	0.048	1	18
3277	0.350	9	1	3	0.048	1	18
3278	0.350	9	1	3	0.048	1	18
3279	0.350	9	1	3	0.048	1	18
3284	0.350	9	0	3	0.048	1	18
3286	0.350	9	0	3	0.048	1	18
3287	0.350	9	1	3	0.048	1	18
3288	0.350	9	0	3	0.048	1	18
3289	0.380	9.7	1	3	0.857	1.4	16
3289	0.520	13	1	3	0.071	1.8	14

Appendix E. Continental U.S. Lightning Damage Probability Map



Appendix F. Connector Specifications for Attaching Non-IBM Modems

Type 283B Plug

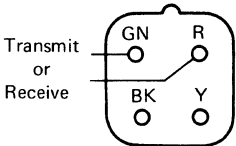


Metric Conversion Table

cm	Inches
0.32	1/8
0.83	21/64
0.87	11/32
0.99	25/64
1.23	31/64
1.27	1/2
1.59	5/8
3.25	1-9/32
3.41	1-11/32
3.49	1-3/8
4.60	1-13/16

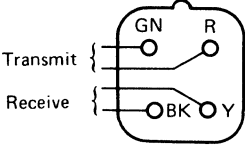
Line Termination Jacks

Common Carrier Provided
Type 404B or 549A Surface Mount, or
Type 493A Flush Mount (or Equivalent)
Jacks



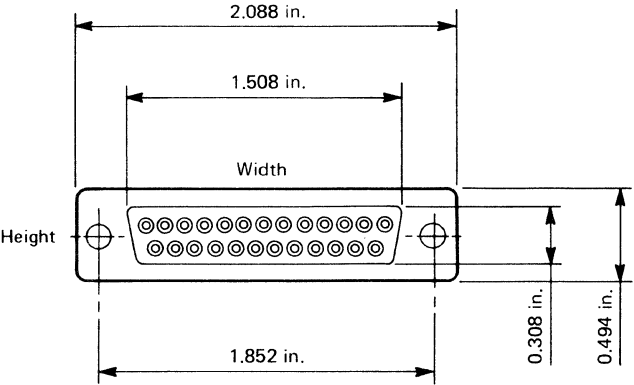
2-Wire Termination Jack

Common Carrier Provided
Type 404B or 549A Surface Mount, or
Type 493A Flush Mount (or Equivalent)
Jacks



4-Wire Termination Jack

25-Pin EIA/CCITT Female Connector

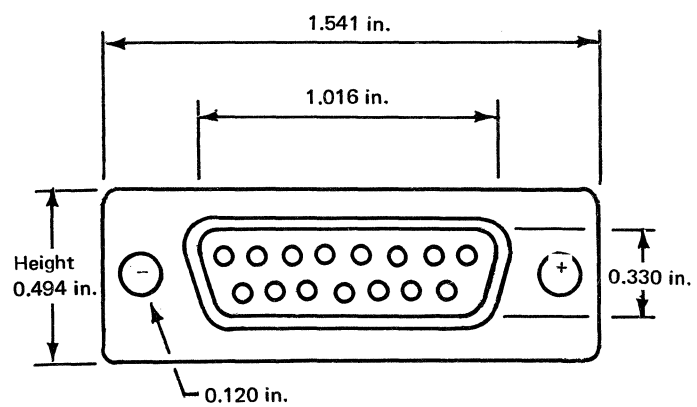


Metric Conversion Table

cm	Inches
0.782	0.308
1.254	0.494
1.981	0.780
3.830	1.508
4.704	1.852
5.303	2.088
5.588	2.200

Note: Cable connectors are protected by a hood and strain relief assembly, with the following overall dimensions: 2.2 inches wide by 0.78 inch high.

15-Pin DTE Connector



Metric Conversion Table

Centimeter	Width
3.04	0.120
8.41	0.330
12.55	0.494
25.810	1.016
39.140	1.541

Appendix G. 3270 Specification Summary (Metric Units)

Type	Model	Description	Electrical	Environmental		Weight (kg)	Dimensions (cm)			Service Clearances (cm)				Notes
			kVA	Watts	Cool- ing (Note 4)		Front	Side	Height	F	R	Rt	L	
3271	1, 2	Control Unit	0.18	176	—	44	67	39	74	76	0	0	0	1, 2, 3
3271	11, 12	Control Unit	0.20	186	—	44	67	39	74	76	0	0	0	1, 2, 3
3272	1, 2	Control Unit	0.18	176	—	43	67	39	74	76	0	0	0	1, 2, 3
3274	1A, 1B, 1C, 1D	Control Unit	0.45	407	•	75	76	51	74	112	3	3	3	1, 2, 3
3274	51C	Control Unit	0.47	362	—	29.6- 40.9	52.5	45.6	32.5	95	15	15	30	1, 2, 3
3275	1, 2	Display Station	0.24	287	—	43	41	53	48	76	3	28	28	1, 2, 3
3275	11, 12	Display Station	0.28	236	—	43	41	53	48	76	3	28	28	1, 2, 3
3276	All Models	Display Station	0.260	227	•	45	41	53	48	76	31	33	41	1, 2, 3
3277	1	Control Unit												
3277	2	Display Station	0.17	155	—	27	37	41	48	76	5	25	25	1, 2, 3
3277	2	Display Station	0.17	155	—	39	41	53	48	76	3	28	28	1, 2, 3
3278	1,2,3,4,5	Display Station	0.155	125	—	36	41	53	48	76	3	33	28	1, 2, 3
3279	2A, 2B 3A, 3B	Color Display Station	0.30	243	—	27	44.4	54	38	76	41	2.5	30.4	1, 2, 3
3284	1, 2, 3	Printer	0.26	227	—	61	67	39	96	76	97	0	0	1, 2, 3
3286	1, 2, 3	Printer	0.26	227	—	61	67	39	96	76	97	0	0	1, 2, 3
3287	1, 2	Printer	0.25	250	•	34	67	51	25	51	51	76	76	1, 2, 3
3288	2	Line Printer	0.60	566	•	127	69	54	106	76	76	15	15	1, 2, 3
3289	1, 2	Line Printer	0.60	412	—	200	100	75	104	76	76	76	76	1, 2, 3

Notes:

- Parameters not shown may be found in the machine specifications, Chapter 5.
- These units can withstand a transient-voltage condition of plus 15% or minus 18% of nominal, if the input voltage returns to within a steady-state tolerance of plus 10% or minus 8% of the normal rated voltage within 30 cycles.
- See Appendix A for receptacle identification. See Appendix D for power cord specifications.
- Type of cooling:
 - Convection
 - Forced Air

Appendix H. 3270 Specification Summary (English Units)

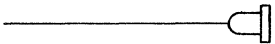


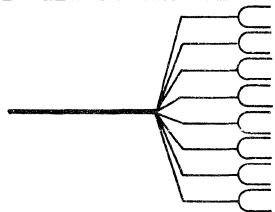
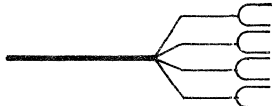
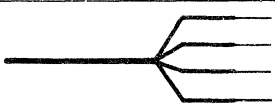
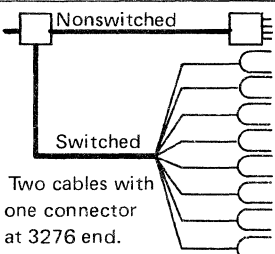
Type	Model	Description	Electrical	Environmental		Weight (lb)	Dimensions (inches)			Service Clearances (inches)				Notes
			kVA	BTU/hr	Cool- ing (Note 4)		Front	Side	Height	F	R	Rt	L	
3271	1, 2	Control Unit	0.18	595	—	98	26-3/8	15-1/4	29	30	0	0	0	1, 2, 3
3271	11, 12	Control Unit	0.20	630	—	98	26-3/8	15-1/4	29	30	0	0	0	1, 2, 3
3272	1, 2	Control Unit	0.18	595	—	95	26-3/8	15-1/4	29	30	0	0	0	1, 2, 3
3274	1A, 1B, 1C, 1D	Control Unit	0.45	1,382	•	165	30	20	28.9	40	1	1	1	1, 2, 3
3274	51C	Control Unit	0.47	1,228	—	65-90	20-5/8	18	12.8	37.4	5.9	5.9	11.8	1, 2, 3
3275	1, 2	Display Station	0.24	700	—	95	16	21	19	30	1	11	11	1, 2, 3
3275	11, 12	Display Station	0.28	800	—	95	16	21	19	30	1	11	11	1, 2, 3
3276	All Models	Display Station												
		Control Unit	0.26	770	•	100	16	21	19	30	12	13	16	1, 2, 3
3277	1	Display Station	0.17	525	—	60	14-1/2	16	16-7/8	30	2	10	10	1, 2, 3
3277	2	Display Station	0.17	525	—	85	16	21	19	30	1	11	11	1, 2, 3
3278	1,2,3,4,5	Display Station	0.155	420	—	80	16	21	19	30	1	13	11	1, 2, 3
3279	2A, 2B 3A, 3B	Color Display Station	0.30	825	—	58	17-1/2	21-1/2	15	30	16	1	12	1, 2, 3
3284	1, 2, 3	Printer	0.26	770	—	135	26-3/8	15-3/4	37-3/4	30	38	0	0	1, 2, 3
3286	1, 2, 3	Printer	0.26	770	—	135	26-3/8	15-1/4	37-3/4	30	38	0	0	1, 2, 3
3287	1, 2, 1C, 2C	Printer	0.25	853	•	87	23-1/2	20	10	20	20	30	30	1, 2, 3
3288	2	Line Printer	0.60	1,926	•	280	27	21-1/4	41-5/8	30	30	6	6	1, 2, 3
3289	1, 2	Line Printer	0.60	1,400	—	440	39-1/2	29-1/2	41	30	30	30	30	1, 2, 3

Notes:

- Parameters not shown may be found in the machine specifications, Chapter 5.
- These units can withstand a transient-voltage condition of plus 15% or minus 18% of nominal, if the input voltage returns to within a steady-state tolerance of plus 10% or minus 8% of the normal rated voltage within 30 cycles.
- See Appendix A for receptacle identification. See Appendix D for power cord specifications.
- Type of cooling:
 - Convection
 - Forced Air

Appendix J. Cables and Connectors for Attaching Non-IBM Devices

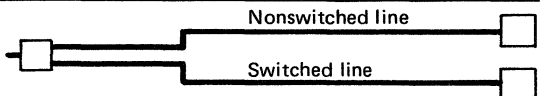
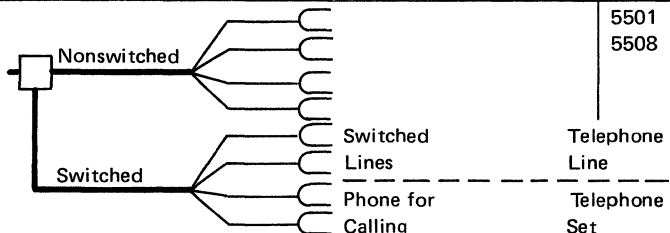
Cables to Non-IBM Devices

Cable Group	Machine	Non-IBM Termination	Feature Code	Notes
3207 3212 3208 3213 NA* NA*	3271 3271 3275 3275 3274** 3276**	 Short test cables required for certain countries between this cable and the modem will have the same connector.**	3701	One EIA RS 232C Connector or one CCITT Connector (25-pin). Standard termination. (All countries)
NA*	3274 1C 3274 51C 3276		5650 5651	15-pin connector for digital service attachment to AT&T channel service unit. (U.S. and Canada)
3209 NA*	3274 51C 3275 3276		5500 5502	WE-283B Plug: Customer provides 404B Surface Mount, 493A Flush Mount Jacks. Termination for: <ul style="list-style-type: none"> • DAA CDT (or equivalent) switched. • Non-switched for U.S., Canada, and Japan.
3210 NA*	3274 51C 3275 3276		5501	Four Pair No. 6 Spade Lugs. Standard termination for: <ul style="list-style-type: none"> • DAA CBS auto-answer switched network (U.S. and Canada)
3211	3275		5500	Four No. 8 Spade Lugs. Standard termination for World Trade (only) nonswitched.
NTT-D1 Service	All		2943	Skinned and tinned. (Japan only)
NA*	3274 51C 3276		5508	Termination for: <ul style="list-style-type: none"> • Nonswitched lines with SNBU auto-answer (U.S. and Canada)

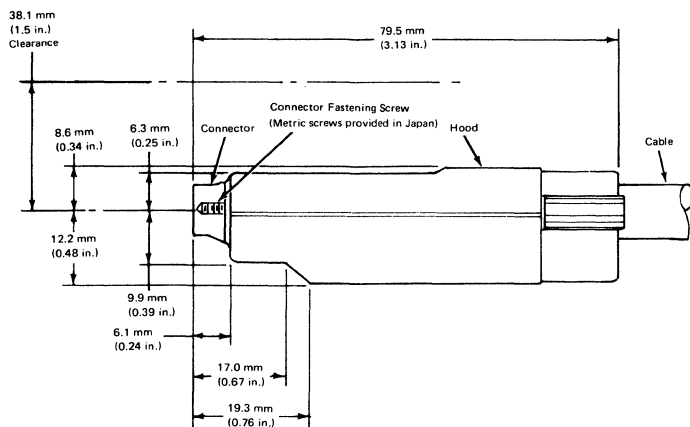
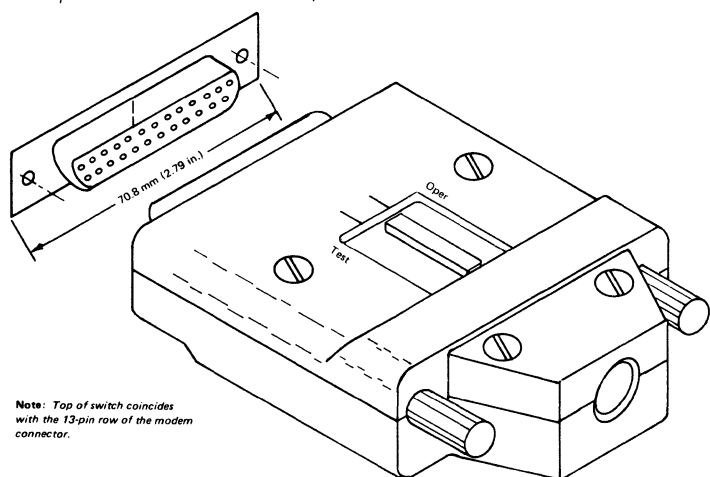
* Cable supplied with unit when feature code is ordered; therefore, no cable group number is required or assigned.

** This 3274/3276 EIA/CITT cable for attachment to a modem or direct attachment to a 3704, 3705, or 8100 Processor, incorporates a TEST/OPERATE wrap-test switch in the modem connector plug. A special adapter cable may be needed because of the space and access requirements of the TEST/OPERATE switch. An adapter cable is automatically shipped with the communications cable for U.K. Datel modems when Specify Code 2835 is ordered. In other cases where the adapter cable is needed, it can be obtained from an IBM field representative.

Note: When the 3274 or 3276 is directly attached (without modems) to a 3704, 3705, or 8100 Processor, the total combined communications cable length must not exceed 12.2 metres (40 feet).

NA*	3274 51C 3276	 <p>Two cables with a common connector.</p>	5507	Termination for: <ul style="list-style-type: none"> • Nonswitched lines with SNBU manual-answer (U.S. and Canada)
NA*	3274 51C 3276	 <p>Two cables with a common connector.</p>	5501 5508	Termination for: <ul style="list-style-type: none"> • Switched network auto-answer • Nonswitched lines — SNBU (World Trade except Canada)

EIA/CCITT Cable TEST/OPERATE Switch



*Cable supplied with unit when feature code is ordered; therefore, no cable group number is required or assigned.

**This 3274/3276 EIA/CCITT cable for attachment to a modem or direct connection to a 3704, 3705, or 8100 Processor, incorporates a TEST/OPERATE wrap-test switch in the modem connector plug. A special adapter cable may be needed because of the space and access requirements of the TEST/OPERATE switch. An adapter cable is automatically shipped with the communications cable for U.K. Datel modems when Specify Code 2835 is ordered. In other cases where the adapter cable is needed, it can be obtained from an IBM field representative.

Note: When the 3274 or 3276 is directly connected (without modems) to a 3704, 3705, or 8100 Processor, the total combined communications cable length must not exceed 12.2 metres (40 feet).

Appendix K. Wire Conversion Table

AWG No.	Nominal Diameter (inch)	Calculated Area (sq. in.)	Nominal Diameter (mm)	Calculated Area (mm ²)
12	0.0808	0.005128	2.052	3.307
13	0.0720	0.004072	1.829	2.627
14	0.0641	0.003227	1.628	2.082
15	0.0571	0.002561	1.450	1.651
16	0.0508	0.002027	1.290	1.307
17	0.0453	0.001612	1.151	1.040
18	0.0403	0.001276	1.024	0.824
19	0.0359	0.001012	0.912	0.653
20	0.0320	0.000804	0.813	0.519
21	0.0285	0.000638	0.724	0.412
22	0.0253	0.000503	0.643	0.325
23	0.0226	0.0004012	0.574	0.259
24	0.0201	0.0003173	0.511	0.205

Appendix L. Inch-to-Centimetre Conversion Table

in.	cm	in.	cm	in.	cm	in.	cm	in.	cm
1/16	0.1588	22	56	49	124	76	193	103	262
1/8	0.3175	22-1/2	57	49-1/2	126	76-1/2	194	103-1/2	263
3/16	0.4762	23	58	50	127	77	196	104	264
1/4	0.6350	23-1/2	60	50-1/2	128	77-1/2	197	104-1/2	265
5/16	0.7938	24	61	51	130	78	198	105	267
3/8	0.9525	24-1/2	62	51-1/2	131	78-1/2	199	105-1/2	268
7/16	1.1112	25	64	52	132	79	201	106	269
1/2	1.2700	25-1/2	65	52-1/2	133	79-1/2	202	106-1/2	271
9/16	1.4288	26	66	53	135	80	203	107	272
5/8	1.5875	26-1/2	67	53-1/2	136	80-1/2	204	107-1/2	273
3/4	1.9050	27	69	54	137	81	206	108	274
7/8	2.2225	27-1/2	70	54-1/2	138	81-1/2	207	108-1/2	276
1	2.54	28	71	55	140	82	208	109	277
1-1/2	3.81	28-1/2	72	55-1/2	141	82-1/2	210	109-1/2	278
2	5	29	74	56	142	83	211	110	279
2-1/2	6	29-1/2	75	56-1/2	144	83-1/2	212	110-1/2	281
3	8	30	76	57	145	84	213	111	282
3-1/2	9	30-1/2	77	57-1/2	146	84-1/2	215	111-1/2	283
4	10	31	79	58	147	85	216	112	284
4-1/2	11	31-1/2	80	58-1/2	149	85-1/2	217	112-1/2	286
5	13	32	81	59	150	86	218	113	287
5-1/2	14	32-1/2	83	59-1/2	151	86-1/2	220	113-1/2	288
6	15	33	84	60	152	87	221	114	290
6-1/2	17	33-1/2	85	60-1/2	154	87-1/2	222	114-1/2	291
7	18	34	86	61	155	88	224	115	292
7-1/2	19	34-1/2	88	61-1/2	156	88-1/2	225	115-1/2	293
8	20	35	89	62	157	89	226	116	295
8-1/2	22	35-1/2	90	62-1/2	159	89-1/2	227	116-1/2	296
9	23	36	91	63	160	90	229	117	297
9-1/2	24	36-1/2	93	63-1/2	161	90-1/2	230	117-1/2	298
10	25	37	94	64	163	91	231	118	300
10-1/2	27	37-1/2	95	64-1/2	164	91-1/2	232	118-1/2	301
11	28	38	97	65	165	92	234	119	302
11-1/2	29	38-1/2	98	65-1/2	166	92-1/2	235	119-1/2	304
12	30	39	99	66	168	93	236	120	305
12-1/2	32	39-1/2	100	66-1/2	169	93-1/2	237	120-1/2	306
13	33	40	102	67	170	94	239	121	307
13-1/2	34	40-1/2	103	67-1/2	171	94-1/2	240	121-1/2	309
14	36	41	104	68	173	95	241	122	310
14-1/2	37	41-1/2	105	68-1/2	174	95-1/2	243	122-1/2	311
15	38	42	107	69	175	96	244	123	312
15-1/2	39	42-1/2	108	69-1/2	177	96-1/2	245	123-1/2	314
16	41	43	109	70	178	97	246	124	315
16-1/2	42	43-1/2	110	70-1/2	179	97-1/2	248	124-1/2	316
17	43	44	112	71	180	98	249	125	318
17-1/2	44	44-1/2	113	71-1/2	182	98-1/2	250	125-1/2	319
18	46	45	114	72	183	99	251	126	320
18-1/2	47	45-1/2	116	72-1/2	184	99-1/2	253	126-1/2	321
19	48	46	117	73	185	100	254	127	323
19-1/2	50	46-1/2	118	73-1/2	187	100-1/2	255	127-1/2	324
20	51	47	119	74	188	101	257	128	325
20-1/2	52	47-1/2	121	74-1/2	189	101-1/2	258	128-1/2	326
21	53	48	122	75	191	102	259	129	328
21-1/2	55	48-1/2	123	75-1/2	192	102-1/2	260	129-1/2	329

Appendix M. Voltage Limitations

	Nom	Min	Max
A/FE 50 Hz	100	90	110
	110	96.5	119
	123.5	111	136
	200	180	220
	220	193	238
	230	202	249
	235	210	259
	240	210	259
A/FE 60 Hz	100	90	110
	110	96.5	119
	115	104	127
	120	104	127
	127	111	137
	200	180	220
	208	180	220
	220	193	238
	230	207	252
	240	208	254
E/ME/A 50 Hz	110	96.5	119
	120	104	127
	123.5	111	136
	220	193	238
	235	210	259
	240	210	259
U.S. & Canada 60 Hz	115	104	127
	120	104	127
	208	180	220
	230	207	252
	240	208	254

Appendix N. Installation Checklist

Following is a suggested checklist to be used by the customer one week to one month before delivery of system components.

Task	Done	Requires Attention
All building alterations completed		
Unit area large enough per plan view (adequate clearance, including height clearance)		
Adequate lighting in unit area (50-75 footcandles for displays)		
Good furniture design		
Operator work station considering:		
Height of counters		
Knee space		
Acoustics, etc.		
Electrostatic impact:		
Plastic seat covering		
Metal frame furniture		
Carpeting (anti-static)		
Floor resistance		
Raised floor cutouts (if applicable)		
Power Receptacles		
Within cord length of machine		
Proper configuration		
Adequately grounded		
Environment		
Electromagnetic (no problem from)		
Transmitting antennas		
Industrial equipment (induction heaters, arc welders, etc.)		
Three-phase power distribution lines		
Electrostatic (No Problem Anticipated)		
Humidity		
Floor surfaces		
Furniture		
Gaseous (noncontaminating)		
Particulate (noncontaminating)		
Storage space (forms, cards, tapes, etc.)		
Sufficient		
Proper		
Common carrier facilities		
Proper connections		
Wrap test hood acceptable		
Correct service		
Within length of the cable		
Neat and safe installation		
Lightning protection (provided by the common carrier)		
Device Considerations		
Proper cable (meets electrical and physical specifications)		
Cable is tested		
Properly labeled to assure proper attachment		
Neat and safe installation		
No stumbling hazards		
No potential of damage to cables from personnel or equipment traffic		
Lightning protection		
Installed in a safe place and according to codes		
Grounded per recommendations in this manual		
Accessible for maintenance		
Not readily accessible to other personnel		

Reader's Comment Form

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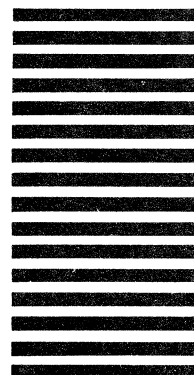
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Physical Planning

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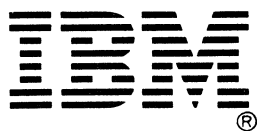
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