Systems

IBM 3250 Graphics Display System
Custom Feature Summary

IBM

Systems

IBM 3250 Graphics Display System
Custom Feature Summary

IBM

Preface

This publication summarizes the custom features that are available with the IBM 3250 Graphics Display System. Custom features are made available as a Request for Price Quotation (RPQ) items. An RPQ may include one or more custom features. The inclusion of specific custom features in this publication must not be construed as a commitment by IBM to make the custom feature available. Your IBM representative will advise you of the custom features that are available and of their relevance to specific applications.

The following custom features are described in this publication:

- Additional Workstation

- Continuous Refresh

- Data Communications Facility

- Engineering Symbols

- Increased Capacity

- Plotter Attachment

- Cursor Control Tablet Attachment

- Numeric Keypad Alphanumeric Keyboard.

For further information about the 3250 Graphics Display System, refer to the following publications:

- *An Introduction to the IBM 3250 Graphics Display System*, GA33-3035.

- *IBM 3250 Graphics Display System: Installation Manual - Physical Planning*, GA33-3036.

- *IBM 3250 Graphics Display System: Component Description*, GA33-3037.

- *IBM 3250 Graphics Display System: Data Communications Facility (RPQs SU0090, SU0091, 7J0005, and 7J0014.) Custom Feature User's Guide*, GA33-3055.

- *IBM 3250 Graphics Display System: Continuous Refresh (RPQs 7J0024 and 7J0025.) Custom Feature User's Guide*, GA33-3085.

- *IBM 3250 Graphics Display System: Attachments for Cursor Control Tablet and for Plotter (RPQs 7J0070, 7J0071, 7J0072, 7J0073.) Custom Feature Description. (For Systems with IBM 3255 Display Control Unit Model 1)*, GA33-3120.

- *IBM 3250 Graphics Display System: Attachment for Cursor Control Tablet and for Plotter (RPQs 7J0070, 7J0071, 7J0072, and 7J0073.) Custom Feature Description. (For Systems with IBM 3255 Display Control Unit Model 2),* GA33-3146.

A short description of the above publications is given in the bibliography.

Contents

Figures

Chapter 1. Introduction

The IBM 3250 Graphics Display System is a buffer-refreshed, directed-beam system that displays graphic and alphanumeric information on a cathode-ray tube. The system has optional alphanumeric and program function keyboards and a light pen for interaction with the displayed image and stored data.

The system attaches to the following host processors: IBM System/370 processing unit, IBM 303X-series Processor, IBM 308X-series Processor Unit, and IBM 4300-series Processor.

The IBM 3250 system contains the following units:

- IBM 3258 Channel Control Unit

- IBM 3255 Display Control Unit Model 1 or Model 2

- IBM 3251 Display Station Model 1.

An overview of the system is contained in *An Introduction to the IBM 3250 Graphics Display System*, GA33-3035.

Custom Features for the 3250 System

Custom features enhance the performance or extend the configuration of the 3250 system graphic applications. The features are available as requests for price quotation (RPQs). Their availability depends on the model of display control unit installed in the 3250 system (Figure 1).

Custom Feature	Available for:	
	3255 Model 1	3255 Model 2
Additional Workstation	x	See note
Continuous Refresh	x	x
Data Communications Facility	x	x
Engineering symbols	x	See note
Increased Capacity	x	See note
Plotter	x	x
Cursor Control Tablet	x	x
Numeric Keypad Alphanumeric Keyboard	x	See note

Note: The functions provided by these custom features are available
as standard on the 3255 Model 2.

Figure 1. Custom Feature Availability

Brief Description of the Custom Features

The custom features that enhance or extend the 3250 system are:

- **Additional Workstation**: The 3255 Display Control Unit Model 1 is designed to control a maximum of two 3251 Display Stations. The Additional Workstation custom feature allows three 3251s to be attached to each 3255. The maximum configuration of sixteen 3251s attached, through 3255s, to a single 3258 Channel Control Unit is not changed. Chapter 2 gives details of this custom feature. The Additional Workstation custom feature is available as standard with a 3255 Display Control Unit Model 2.

- **Continuous Refresh**: The image displayed at a 3251 Display Station is the result of a buffer program executed in the 3255 Display Control Unit Model 1 or 2; when the 3255 communicates with the host system, the buffer program terminates and image regeneration is interrupted. The Continuous Refresh custom feature modifies the 3255 to allow image regeneration to continue while the 3255 is communicating with the host system. Chapter 3 gives details of this custom feature. The Continuous Refresh custom feature is available as standard with a 3255 Display Control Unit Model 2.

- **Data Communications Facility**: Communication between the 3258 Channel Control Unit and the 3255 Display Control Unit Model 1 or 2 is by a customer-supplied coaxial cable. The distance between the 3258 and 3255 is limited by the characteristics of the machines and of the cable. The Data Communications Facility custom feature modifies the 3258 and the 3255 to

provide a CCITT[1] V.35 interface on each unit. This interface allows the units to communicate through a wideband data link. Chapter 4 gives details of this custom feature.

An additional custom feature (the Modem Interface Extension custom feature) modifies the 3255 to extend the wideband link to a second 3255.

• **Engineering Symbols:** This custom feature extends the character set supported by a 3250 system that has a 3255 Model 1 to include a range of nine symbols suitable for an engineering application. Chapter 5 gives details of the feature.

• **Increased Capacity:** This custom feature provides a second display buffer at a modified 3255 Display Control Unit Model 1. When only one buffer is available, applications that use large buffer programs may restrict the configuration to only one 3251 Display Station per 3255. The second buffer removes this restriction and allows the application programmer more freedom in constructing buffer programs.

Because this custom feature can be used to increase the amount of information displayed at the attached 3251s, the 3255 is modified to provide faster draw speeds. Chapter 6 gives details of the feature. The Increased Capacity custom feature is available as standard with a 3255 Display Control Unit Model 2.

• **Plotter Attachment:** This custom feature enables hard copy to be obtained at the display station work area. A general purpose EIA[2] RS-232-C or CCITT V.24 interface port and attachment cable are provided on the 3255 Display Control Unit Model 1 or 2 for attaching a plotter. Chapter 7 gives details of the feature.

• **Cursor Control Tablet Attachment:** This custom feature provides the facilities for attaching up to three cursor control tablets, via serial data interface ports, to each 3255 Display Control Unit model 1 or 2. Each tablet is permanently associated with one of the 3251 Display Stations to control the position of a cursor (in the form of a small square) on the 3251 screen. This feature has the same interactive capabilities as those provided by a light pen, with the added flexibility of an independent data source. Chapter 8 gives details of the feature.

• **Numeric Keypad Alphanumeric Keyboard:** This custom feature provides an 87-key English (U.S.) typewriter keyboard and the necessary modifications required for both the 3251 Display Station and the 3255 Display Control Unit Model 1. This feature also provides three engineering symbols in addition to the nine engineering provided by the Engineering Symbols custom feature. Chapter 9 gives details of the feature.

Each custom feature is described in this manual, either in a summary or in detail depending upon whether a separate user's guide exists for the RPQ. Available user's guides are listed in the preface.

---

[1]   The International Telegraph and Telephone Consultative Committee

[2]   EIA: Electronic Industries Association

An RPQ may apply to one feature, or to several features. When a custom feature requires modifications to more than one machine type, it has separate RPQs for each machine type. A custom feature may therefore have more than one RPQ number. In this publication, the relevant RPQs for each custom feature are listed in the appropriate chapter.

Some custom features depend for their operation on other custom features being present on the machine. Where prerequisites exist, they are listed with the installation information for each custom feature.

Similarly, some custom features may coexist whereas others may be incompatible. This publication does not address those combinations of custom features that may prove incompatible; your IBM representative will advise you as to whether or not the custom features selected for a particular configuration are compatible.

Chapter 2. Additional Workstation

The Additional Workstation custom feature is available as standard with a 3255 Display Control Unit Model 2, and as a request for price quotation (RPQ) for a 3255 Display Control Unit Model 1.

Description

The Additional Workstation custom feature modifies the 3255 Display Control Unit Model 1 so that a third 3251 Display Station can be attached. Only the 3255 requires modification for the additional workstation; the 3258 Channel Control Unit and the 3251 are not modified.

To protect data against accidental operation of the CANCEL key, the usage of this key is changed on all 3251s attached to a 3255 that has been modified for an additional workstation. Pressing CANCEL raises an input/output (I/O) interruption to the host system only if the CONTINUOUS key is held down when CANCEL is pressed.

Configuration

When this custom feature is installed, the 3250 system has the following configuration possibilities:

- A system based on a single 3258 Channel Control Unit may contain a mixture of modified and unmodified 3255s.

- A system based on a single 3258 Channel Control Unit may contain up to sixteen 3251s; this limit is not altered by the additional workstation custom feature.

- The third 3251-attachment position may be installed for future use; the modified 3255 can operate with one, two, or three 3251s.

Note: For information regarding the specification of devices to the operating system, see Chapter 6 "Increased Capacity."

Image Content

The 3250 system has a nominal regeneration rate of 46 cycles per second (cps). This rate allows 21.7 milliseconds in which to execute all the buffer programs for the 3251s that share a common 3255. Attaching three workstations and displaying complex images could reduce the regeneration rate. For details concerning the amount of data that can be displayed at the optimum regeneration rate, see Chapter 6.

Installation

The following RPQs are required for the 3255 Display Control Unit Model 1:

Plant Installation: Not available.

Field Installation: RPQ 7J0043
Prerequisite: RPQ 7J0041 (Increased Capacity) if
                      7J0040 is not present.

Chapter 3. Continuous Refresh (3255 Models 1 and 2)

Description

A 3251 Display Station that is attached to a 3255 Display Control Unit Model 2, or a 3255 Display Control Unit Model 1 modified by the Continuous Refresh custom feature is able to work in continuous-refresh mode. This mode permits channel operations to write data into a program-defined area (batched write record receiver) in the display buffer and to read data from the display buffer without first terminating execution of the buffer program. Only the 3255 Model 1 requires modification for this custom feature; the 3258 Channel Control Unit and the 3251 Display Station are not modified.

Application programs designed for an unmodified 3250 system may be compatible with a modified system but will not use the additional functions. A separate publication, *IBM 3250 Graphics Display System: Continuous Refresh (RPQs 7J0024 and 7J0025) Custom Feature User's Guide*, GA33-3085, shows how to make full use of the feature.

Implementation

In addition to providing continuous-refresh mode, the Continuous Refresh custom feature includes enhancements to the 3255 that allow the application programmer to take full advantage of operating in continuous-refresh mode. The functional enhancements provided are:

- **Mode-Switching**: Continuous-refresh mode may be switched on and off dynamically for each 3251 attached to a modified 3255. The application program can set the most appropriate mode while the 3251 is being used without affecting other 3251s attached to the same 3255. A sense bit is defined that indicates whether or not the 3251 is operating in continuous refresh mode.

- **Buffer-Running Sense Bit**: Channel commands that write to, or read from, the display buffer are not accepted by the 3255 when the buffer-running bit is on for the addressed 3251. When a 3251 is operating in continuous refresh mode, a Set Buffer Address Register and Stop command resets the buffer-running sense bit without terminating the buffer program.

- **Batched Write Channel Command**: A Write Buffer command issued to a 3251 operating in continuous refresh mode is interpreted as a batched Write command. The application program can "batch" a number of small changes to the buffer program and issue a single Write Buffer command to transfer the batched changes to the display buffer.

- **Read Buffer Channel Commands**: Read Buffer commands issued to a 3251 operating in continuous refresh mode are valid channel commands, provided that the buffer-running sense bit is off when the command is received. In continuous refresh mode, the channel command and the buffer program contend for access to the display buffer.

- **Extended Start Regeneration Timer (GSRTE) Order:** The Start Regeneration Timer (GSRT) order is extended to contain additional controls and an optional address field. GSRTE supports all GSRT functions and, in addition, is able to:

  - Enable or disable input from the alphanumeric and program function keyboards

  - Test the status of the manual input register and cause a branch if the register is busy

  - Simulate manual input by setting an END, CANCEL, or program function (PF) key code into byte 0 of the manual input register for transmission to the application program.

  These extensions provide a means of transferring deferred light-pen detections to the application program as simulated manual input. This action avoids the automatic termination that occurs when the buffer program raises an I/O interruption to the host system on behalf of a light-pen detection.

- **Transfer on Count Order:** A Transfer on Count (GTCT) buffer order is added to the set of buffer orders. This order allows the application programmer to include simple loops in the buffer order program.

- **CANCEL Key Usage:** The usage of the alphanumeric CANCEL key is changed on all 3251s attached to a 3255 that has been modified with the Continuous Refresh custom feature. Regardless of the mode of operation, CANCEL is not accepted unless the CONTINUOUS key is held down when the CANCEL key is pressed. This change in usage decreases the possibility of I/O interruptions being raised by accidental operation of the CANCEL key.

Installation

The following RPQ is required for the 3255 Display Control Unit:

Plant Installation: Not available.

Field Installation: RPQ 7J0025
Prerequisite: None.

Chapter 4. Data Communications Facility (3255 Models 1 and 2)

Description

In a 3250 system, communication between the 3258 Channel Control Unit and the 3255 Display Control Unit Model 1 or 2 is via customer-supplied coaxial cables. This can restrict the configuration of the 3250 system by signal loss in the cable limiting the distance between the 3258 and its attached 3255s. The Data Communications Facility custom feature modifies the 3258 and 3255 to provide a CCITT V.35 interface. This interface allows the units to communicate through a customer-supplied wideband data link.

The four coaxial interfaces at the 3258 are replaced by a single V.35 interface. However, up to four modified 3255s can be attached to a point-to-point data link. The link is connected between the 3258 and the first 3255, and is then extended by modem interface extension (MIE) cables to the last (terminating) TP 3255.

For details of this custom feature, see *IBM 3250 Graphics Display System: Data Communications Facility (RPQs SU0090, SU0091, 7J0005, and 7J0014) Custom Feature Description*, GA33-3055.

Installation

Installation of the data communications facility requires changes to the 3258 and to all attached 3255s whether Models 1 or 2.

A prerequisite RPQ provides an interface cable, 6 meters (20 feet) external length, that connects the V.35 interface to the data circuit terminating equipment (DCE) on the wideband communications link.

For the 3258 Channel Control Unit

Plant Installation: RPQ SU0090
Prerequisites: RPQ 7J0005 (interface cable); and data communications facility on the attached 3255(s).

Field Installation: RPQ 7J0018
Prerequisites: RPQ 7J0005 (interface cable); and data communications facility on the attached 3255(s).

For an Intermediate 3255 Display Control Unit (Model 1 or 2)

An intermediate 3255 uses the interface cable provided by RPQ 7J0005 on the terminating 3255. The cable connecting the intermediate 3255 and the terminating 3255 is included in the RPQ installed at the intermediate 3255.

Plant Installation: RPQ 7J0014 (Model 2 only)
Prerequisite: Data communications facility on the 3258
                      and on the terminating 3255.

Field Installation: Not available.

For the Terminating 3255 Display Control Unit (Model 1 or 2)

Plant Installation: RPQ SU0091
Prerequisites: RPQ 7J0005 (interface cable); and data
                      communications facility on the 3258 and
                      on any intermediate 3255.

Field Installation: RPQ 7J0017
Prerequisites: RPQ 7J0005 (interface cable); and data
                      communications facility on the host 3258
                      and any intermediate 3255.

Removal of the Data Communications Facility (3255 Models 1 and 2)

The data communications facility installed on 3258s and terminating 3255s can be removed to restore the coaxial interface. The RPQs needed for field restoration are as follows:

• For a 3258 Channel Control Unit: RPQ 7J0016

• For a terminating 3255 Display Control Unit: RPQ 7J0015.

Chapter 5. Engineering Symbol Sets (3255 Model 1 Only)

The Engineering Symbol Sets are no longer available as a custom feature with the 3255 Display Control Unit Model 1, but are available as standard with the 3255 Display Control Unit Model 2.

Refer also to Chapter 9 for a description of the Numeric Keypad Alphanumeric Keyboard.

Description

The engineering symbols custom feature modifies both the 3255 Display Control Unit Model 1 and the 3251 Display Station to allow certain engineering symbols to be entered from the alphanumeric keyboard. All 3251s attached to a modified 3255 must have this custom feature installed.

Nine symbols are provided:

Symbol	EBCDIC code	Description
₵	X'CD'	Center line
°	X'DB'	Degree
±	X'DC'	Plus or minus
φ	X'EB'	Diameter
≤	X'ED'	Less than or equal to
≥	X'EE'	Greater than or equal to
Ω	X'EF'	Omega
μ	X'FD'	Micro
·	X'FE'	Raised period

Notes:

1. The Engineering Symbols custom feature is restricted to the English (U.S.) keyboard.

2. When this feature is plant-installed on a 3251, the RPQ supplies an English (U.S.) keyboard; a keyboard feature code is not required.

3. No keyboard characters are lost when the engineering symbols are available; the symbol keys replace blank keys.

4. The symbol keys enter the specified symbol regardless of the keyboard shift (uppercase or lowercase).

Installation

Installation of the Engineering Symbols custom feature requires changes to the 3255 and to each attached 3251.

Notes:

1. This custom feature applies only to the 3255 Display Control Unit Model 1.

2. The 3255 Display Control Unit Model 2 supports an extended set of engineering symbols as standard.

For the 3255 Display Control Unit Model 1

Plant Installation: Not available.

Field Installation: RPQ 7J0012 (No longer available.)
Prerequisites: Character generator language - English (U.S.); and engineering symbols on all attached 3251s.

For the 3251 Display Station

Plant Installation: Not available.

Field Installation: RPQ 7J0009 (No longer available.)
Prerequisites: Alphanumeric keyboard;
keyboard language - English (U.S.);
character generator language - English (U.S.); and engineering symbols on the host 3255.

Chapter 6. Increased Capacity (3255 Model 1 Only)

Description

The increased capacity custom feature modifies the 3255 Display Control Unit Model 1 to provide an additional display buffer of 32 768 bytes (32K bytes). Only the 3255 requires modification. The 3258 Channel Control Unit and the 3251 Display Station are not modified.

The additional buffer allows more flexibility when planning a 3250 system for complex applications. Two 3251s may be attached to a single 3255, with each retaining the use of a 32K-byte buffer.

This increased capacity is a prerequisite for the Additional Workstation custom feature, see Chapter 2. If three workstations are installed, one has the exclusive use of a 32K-byte buffer and the other two share a common buffer.

Implementation

This custom feature has the following characteristics:

- The two display buffers are separate entities. A buffer program contained in one buffer cannot branch to, or access data in, the second buffer.

- The allocation of buffers to particular 3251s is determined by the number of attached 3251s and their device addresses:

  - **One 3251**: The additional buffer is not used. (It may be installed, however, to allow for additional 3251s as required).

  - **Two 3251s**: The 3251 with the low address uses the basic buffer and the high-address 3251 uses the additional buffer.

  - **Three 3251s**: The 3251s with the low and medium addresses share the basic buffer; the high-address 3251 has exclusive use of the additional buffer.

  Note: Bit 0 of the the first byte of the address word is reserved, and should be set to zero.

- To protect data against accidental operation of the CANCEL key, the usage of this key is changed on all 3251s attached to a 3255 that has been modified for increased capacity. Pressing CANCEL raises an I/O interruption to the host system only if the CONTINUOUS key is held down when CANCEL is pressed.

Operating System Considerations

The basic and additional buffers are seen, by the operating system, as separate buffers. It is necessary to define them as such to the operating system.

VS1 and MVS

When running under Operating System/Virtual Storage 1 (VS1) or Operating System/Virtual Storage 2 - Multiple Virtual Storage (MVS), graphics applications are supported by the *IBM Graphic Programming Services* (GPS) component of the operating system. In this instance each buffer is seen as a separate physical control unit (PCU). In order to use the additional buffer, the IODEVICE macro instructions that describe the devices for system generation must specify different PCU operands for the devices that use the basic buffer and those that use the additional buffer.

VM/CMS

When running under IBM Virtual Machine/System Product (VM/SP) with Conversational Monitor System (CMS), graphics applications are supported by the *IBM Graphic Access Method/System Product*(GAM/SP). To obtain support for the two buffers, the GABDEV macros that define the devices should be associated with different GABBUF macros.

Image Content

Included in the Increased Capacity custom feature are improved execution times for graphic-mode data. See "Buffer Order Timing" later in this chapter. This enhancement reduces the time required to draw a series of vectors or points (vector or point-plotting with the beam unblanked). Figure 2 shows the maximum amount of data that can be displayed at each attached 3251 without reducing the regeneration rate of the displayed image.

Short Vectors, Incremental Addressing

| | Number of 3251s Connected to a 3255 | | |
	One	Two	Three
Vector Length	Number of Vectors and Total Length	Number of Vectors and Total Length	Number of Vectors and Total Length
15 mm	8616 (129 meters)	4095 (61 meters)	2588 (38 meters)
19 mm	7659 (145 meters)	3640 (69 meters)	2301 (43 meters)

Short Vectors, Absolute Addressing

| | Number of 3251s Connected to a 3255 | | |
	One	Two	Three
Vector Length	Number of Vectors and Total Length	Number of Vectors and Total Length	Number of Vectors and Total Length
15 mm	8616 (129 meters)	4095 (61 meters)	2588 (38 meters)
25 mm	6893 (172 meters)	3276 (81 meters)	2071 (51 meters)
75 mm	2997 (224 meters)	1427 (107 meters)	900 (67 meters)
150 mm	1628 (244 meters)	799 (119 meters)	505 (75 meters)
300 mm	872 (261 meters)	414 (124 meters)	262 (78 meters)

Alphanumeric Characters

| | Number of 3251s Connected to a 3255 | | |
Character Size	One No. Chars.	Two No. Chars.	Three No. Chars.
Small	5409	2575	1629
Basic	4586	2180	1379
Medium	3971	1887	1196
Large	3521	1673	1059

Figure 2. Maximum Amount of Displayable Data (Regeneration Rate of 46 cps)

Buffer Order Timing (3255 Model 1 Only)

Except for the draw speed (graphic-mode data, unblanked) and the Start Regeneration Timer order (GSRT), the time taken to execute each buffer order is as specified in *IBM 3250 Graphics Display System: Component Description*, GA33-3037.

Draw Speed (3255 Model 1 Only)

The time needed to draw from the current beam position to the beam position defined by an x,y coordinate pair in a graphic-mode data list is reduced to equal the move speed. The reduced times are as follows:

Point Plotting, Light Pen Enabled:
$3.1 + (0.075 \times \text{distance [millimeters]})$ microseconds
(minimum = 4.5 microseconds per point)

Point Plotting, Light Pen Disabled:
$1.6 + (0.075 \times \text{distance [millimeters]})$ microseconds
(minimum = 3.0 microseconds per point)

Vector Plotting, Light Pen Enabled:
$2.0 + (0.075 \times \text{distance [millimeters]})$ microseconds
(minimum = 3.3 microseconds per vector)

Vector Plotting, Light Pen Disabled:
$1.1 + (0.075 \times \text{distance [millimeters]})$ microseconds
(minimum = 2.4 microseconds per vector)

Start Regeneration Timer (GSRT) (3255 Model 1 only)

Because of the additional controls required to switch from the basic display buffer to the additional display buffer, the execution time of the GSRT order may vary between 600 microseconds and 2.9 milliseconds. Where a 3255 has been modified for both the increased capacity and additional workstation custom features, the average execution time of the GSRT order is 1 millisecond.

Installation

The following RPQ is required for the 3255 Display Control Unit:

Plant Installation: Not available.

Field Installation: RPQ 7J0041
Prerequisite: None.

Chapter 7. Plotter Attachment

Description

The Plotter Attachment custom feature provides a general-purpose RS-232-C or V.24 communications port for connecting one plotter to a 3255 Display Control Unit Model 1 or 2.

The attached plotter is controlled by the host application program via a dedicated buffer program in the 3255. A subset of the 3255 buffer orders and channel commands are used, together with additional buffer orders, to provide the necessary control dialog. The plotter is known to the host program by the lowest device address available at the 3255. Each 3255 in a system may have one plotter attachment, provided that the maximum number of addressed devices (3251 Display Stations or plotters) attached to each 3258 Channel Control Unit does not exceed 16.

For a detailed description of the cursor control tablet and the plotter, refer to *IBM 3250 Graphics Display System: Attachments for Cursor Control Tablet and for Plotter (RPQs 7J0070, 7J0071, 7J0072, and 7J0073) Custom Feature Description, (IBM 3255 Display Control Unit Model 1)*, GA33-3120, or *IBM 3250 Graphics Display System: Attachments for Cursor Control Tablet and for Plotter (RPQs 7J0070, 7J0071, 7J0072, and 7J0073) Custom Feature Description. (For Systems with IBM 3255 Display Control Unit Model 2)*, GA33-3146.

Installation

Installation of the plotter attachment facilities requires changes to the host application program and additions to the buffer orders. Hardware changes to the 3255 are necessary to install the interface and cabling.

Plotter attachment facilities are provided by: RPQ 7J0071, Plotter Attachment (plant installation only.) This RPQ provides: attachment facilities for one plotter, including an attachment cable 9.14 meters (30 feet) long.

The RPQ is compatible with:

*   RPQ SU0091, RPQs 7J0005 7J0014, 7J0015, and 7J0017 (Data Communications Facility) and, RPQ 7J0070 (Cursor Control Tablet Attachment.)

The following RPQ is required for the 3255 Display Control Unit:

Plant Installation: RPQ 7J0071
Prerequisites: None.

Field Installation: Not available.

Chapter 8. Cursor Control Tablet Attachment (3255 Models 1 and 2)

Description

The Cursor Control Tablet Attachment custom feature provides similar facilities for detecting displayed graphic elements and interacting with the system as those provided by a light pen, but with the added flexibility of an independent data source.

A cursor control tablet is used to control the position of a cursor (in the form of a small square) on the screen of the associated 3251 Display Station. Coordinates indicated by the position of the stylus on the tablet surface, and the operation of the stylus tip-switch, are transmitted as a serial data stream from the tablet to the 3255 Display Control Unit. The cursor symbol may be used as a detection window for designating displayed graphic elements for further processing, or for injecting new coordinates into the 3250 system. Three new buffer orders are provided to support the feature.

Each tablet is connected to a 3255 via a port and serial data interface. Signal levels at the interface are TTL compatible, and +15 volts dc power is provided for the tablet via the attachment cable.

When the necessary RPQs are installed, up to three tablets may be connected to each 3255 in the system. The addition of the feature does not alter the configuration variations that are possible with the basic 3250 Graphics Display System.

For details of this custom feature, see *IBM 3250 Graphics Display System: Attachments for Cursor Control Tablet and for Plotter (RPQs 7J0070, 7J0071, 7J0072, and 7J0073) Custom Feature Description. (For Systems with IBM 3255 Display Control Unit Model 1)*, GA33-3120, or *IBM 3250 Graphics Display System: Attachments for Cursor Control Tablet and for Plotter (RPQs 7J0070, 7J0071, 7J0072, and 7J0073) Custom Feature Description. (For Systems with IBM 3255 Display Control Unit Model 2)*, GA33-3146.

Installation

Installation of the Cursor Control Tablet attachment custom feature requires changes to the host application program and additions to the buffer orders.

The cursor control tablet attachment is available with:

- RPQ 7J0070, Cursor Control Tablet Attachment (plant installation only.) This RPQ provides attachment facilities for one cursor control tablet, including an attachment cable 15.24 meters (50 feet) long.

  Note: This RPQ can only be installed at the manufacturing plant. Plant installation, or subsequent field installation, of one additional cursor control tablet attachment is available through RPQ 7J0073, Additional Cursor Control Tablet; see below.

The RPQ is compatible with: RPQs SU0091, 7J0005, 7J0014, 7J0015, and 7J0017 (Data Communications Facility) and, RPQ 7J0071 (Plotter Attachment.)

- RPQ 7J0073, Additional Cursor Control Tablet (plant or field installation). This RPQ provides attachment facilities for one additional cursor control tablet if attached to a 3255 Display Control Unit Model 1, or a maximum of two extra cursor control tablets if attached to a 3255 Display Control Unit Model 2.

The following RPQ is required for the 3255 Display Control Unit:

Plant Installation: 7J0070
Prerequisites: None.

Field Installation: 7J0073
Prerequisites: None.

Chapter 9. Numeric Keypad Alphanumeric Keyboard

The Numeric Keypad Alphanumeric Keyboard custom feature is available as standard on a 3255 Display Control Unit Model 2, and as a request for price quotation (RPQ) with the 3255 Display Control Unit Model 1.

Description

The Numeric Keypad Alphanumeric Keyboard custom feature provides an 87-key English (U.S.) typewriter keyboard and the necessary modifications required for both the 3251 Display Station and the 3255 Display Control Unit Model 1. The keyboard has a 12-key numeric keypad on the right hand side, and twelve engineering symbols. These comprise the nine described in Chapter 5 under "Engineering Symbols Custom Feature (3255 Model 1 Only)", previously available as RPQ 7J0011, and three new symbols for countersink, counterbore, and depth. The layout of the central typewriter section of the keyboard is retained unchanged.

Keypad and Engineering Symbols

The keypad layout is as follows:

```
Top row   7  8  9

          4  5  6

          1  2  3

          0  .  +
```

Note: Codes for the keypad characters are the same as the basic keyboard chararacters.

The following 12 engineering symbols are provided:

Symbol	EBCDIC code	Description
℄	X'CD'	Center line
°	X'DB'	Degree
±	X'DC'	Plus or minus
⊔	X'DE'	Counterbore
⊤	X'DF'	Depth
φ	X'EB'	Diameter
≤	X'ED'	Less than or equal to
≥	X'EE'	Greater than or equal to
Ω	X'EF'	Omega
∨	X'FC'	Countersink
μ	X'FD'	Micro
·	X'FE'	Raised period

Note the following:

- All the engineering symbol characters are extra to the English (U.S.) typewriter keyboard, therefore no basic characters are lost or displaced by this custom feature.

- All the characters described are active in both uppercase and lowercase shift.

- The custom feature is restricted to the English (U.S.) keyboard.

- When this feature is installed in the plant on a 3251, the RPQ supplies an English (U.S.) keyboard; a keyboard feature code is not required.

  3255 Display Control Units with this feature installed will still support compatible 75-key English (U.S.) keyboards and RPQ 7J0010 (Engineering Symbols) on 3251.

Installation

Installation of the Numeric Keypad Alphanumeric Keyboard custom feature requires changes to the 3255 Model 1 and to each attached 3251 requiring the extra function. These changes are:

For the 3255 Display Control Unit (Model 1)

Plant Installation:	RPQ 7J0078 (No longer available.)
Prerequisites:	Character generator language - English (U.S.); and numeric keypad on all attached 3251s.

Field Installation:	RPQ 7J0079
Prerequisites:	Character generator language - English (U.S.); and numeric keypad on all attached 3251s.

For the 3251 Display Station

Plant Installation:	RPQ 7J0090 (No longer available.)
Prerequisites:	Alphanumeric keyboard; keyboard language - English (U.S.); character generator language - English (U.S.); and engineering symbols on the host 3255.

Field Installation:	RPQ 7J0091
Prerequisites:	Alphanumeric Keyboard; Keyboard Language - English (U.S.); Character Generator Language - English (U.S.); and Engineering Symbols on the host 3255.

Bibliography

Further information concerning the IBM 3250 Graphics Display System is contained in the following publications:

An Introduction to the IBM 3250 Graphics Display System, GA33-3035: This publication provides introductory information about the system, its attachment to a host system, and the available programming support.

IBM 3250 Graphics Display System Component Description, GA33-3037: This publication provides reference information for users of the 3250 system. The information is primarily intended to assist the user who is writing application programs for execution in the 3250 system and includes (1) a description of the facilities available to the programmer; (2) a definition of the buffer orders used by the 3250 system; and (3) an example buffer program with a description of some programming techniques.

IBM 3250 Graphics Display System: Installation Manual - Physical Planning, GA33-3036. This describes the customer-planning requirements prior to the installation of a 3250 Graphics Display System.

OS/VS Graphic Programming Services (GPS) for the IBM 2250 Display Unit and the IBM 3250 Graphics Display System, GC27-6971: This publication describes macro instructions and routines for use with OS/VS to aid in writing assembler language programs that use the 3250. It also provides general programming information for the 3250. (See Note)

Note: The IBM 3250 Graphics Display System is compatible with the IBM 2250 Display Unit Model 3 apart from the differences described in Chapter 7 of *An Introduction to the IBM 3250 Graphics Display System*, GA33-3035. Any reference to the IBM 2250 Display Unit Model 3 in the above publications is pertinent also to the 3250 system.

IBM 3250 Graphics Display System: Data Communications Facility (RPQs SU0090, SU0091, 7J0005, and 7J0014.) Custom Feature User's Guide, GA33-3055. This describes the data communications facilities available as custom features on the 3250 Graphics Display System.

IBM 3250 Graphics Display System: Continuous Refresh (RPQs 7J0024 and 7J0025.) Custom Feature User's Guide, GA33-3085. This describes how to obtain maximum benefit from the enhancements offered by the Continuous Refresh custom feature.

*IBM 3250 Graphics Display System: Attachments for Cursor Control Tablet and for Plotter (RPQs 7J0070, 7J0071, 7J0072, 7J0073.) Custom Feature Description. (For Systems with IBM 3255 Display Control Units Model 1)*GA33-3120. This describes the attachment of plotters for hardcopy output, and cursor control tablets for digitized input, to a 3250 Graphics Display System with IBM 3255 Display Control Unit Model 1.

IBM 3250 Graphics Display System: Attachments for Cursor Control Tablet and for Plotter (RPQs 7J0070, 7J0071, 7J0072, and 7J0073.) Custom Feature Description. (For Systems with IBM 3255 Display Control Unit Model 2), GA33-3146. This describes the attachment of plotters for hardcopy output, and cursor control tablets for digitized input to a 3250 Graphics Display System with IBM 3255 Display Control Unit Model 2.

Index

S

U

IBM 3250 Graphics Display System:
Custom Feature Summary

Order No. GA33-3086-2

This manual is part of a library that serves as a reference source for systems analysts, programmers, and operators of IBM systems. You may use this form to communicate your comments about this publication, its organization, or subject matter, with the understanding that IBM may use or distribute whatever information you supply in any way it believes appropriate without incurring any obligation to you. Your comments will be sent to the author's department for whatever review and action, if any, are deemed appropriate.

Note: *Copies of IBM publications are not stocked at the location to which this form is addressed. Please direct any requests for copies of publications, or for assistance in using your IBM system, to your IBM representative or to the IBM branch office serving your locality.*

Number of your latest Technical Newsletter for this publication . . .

If you want a reply, please give your name and address below.

Name . . . .

Job Title . . . . Company . . . .

Address . . . .

. . . . Zip . . . .

Thank you for your cooperation. No postage stamp necessary if mailed in the U.S.A. (Elsewhere, an IBM office or representative will be happy to forward your comments or you may mail directly to either address in the Edition Notice on the back of the title page.)

*Note: Staples can cause problems with automated mail sorting equipment.
Please use pressure-sensitive or other gummed tape to seal this form.*

— — — Cut Along Dotted Line — — —

GA33-3086-2

Reader's Comment Form

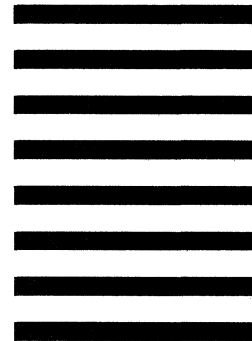Fold and Tape   Fold and Tape   Fold and Tape

No postage
necessary
if mailed
in the
United States

BUSINESS REPLY MAIL

FIRST CLASS   PERMIT 40   ARMONK, NEW YORK

Postage will be paid by addressee:

International Business Machines Corporation
Department 812H
1133 Westchester Avenue
White Plains, New York 10604

Fold and Tape   Fold and Tape   Fold and Tape

IBM®

IBM 3250 Graphics Display System: Custom Feature Summary   Printed in U.S.A.   GA33-3086-2

GA33-3086-2

IBM®