Administrator's Guide and Reference

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About This Book

HCL Z and I Emulator for Windows reference books are comprised of this Administrator's Guide and Reference and an Emulator User's Reference. These volumes provide information for using HCL Z and I Emulator for Windows operating systems (hereafter called PC400).

Note:

1. *PC/3270* refers to the 3270 portion of the combined package.
2. *Workstation* refers to all supported personal computers.
3. *Windows*® refers to Windows® 8, Windows® 8.1, Windows® 10, Windows® 10 x64 and Windows® Server 2008. When information is applies only to a specific operating systems, this is indicated in the text.

Who Should Read This Book

This book is intended for administrators of Z and I Emulator for Windows.

How to Use This Book

This book contains reference information that you might need to refer to when installing or operating Z and I Emulator for Windows.

Z and I Emulator for Windows is designed to use various communication adapters and to work with other workstation and host system software. Refer to the appropriate documentation for the products you use.

Command Syntax Symbols

Parentheses, brackets, ellipses, and slashes have the following meanings or uses:

( )

Parentheses enclose operands that govern the action of certain command options.

[ ]

Brackets indicate an optional command argument. If you do not use the optional item, the program selects a default.

...

Ellipsis after an argument indicates that you can repeat the preceding item any number of times.

/

For 3270, a slash must precede the Time Sharing Option Extensions (TSO/E) password. A slash must also precede parameters of DOS commands entered from the command line. For 5250, a slash must precede parameters of IBM® DOS commands entered from the command line.

\

A backslash is included as part of any directory name. An initial backslash indicates the first-level directory, and an additional backslash is inserted in the directory name to indicate another level.

All directives, operands, and other syntax can be typed in either uppercase or lowercase, unless otherwise indicated.

Where to Find More Information

The following sections discuss getting help when you are installing, configuring, or using Z and I Emulator for Windows.

Product Documentation

You can find documentation and links to other resources at the Z and I Emulator for Windows Product Documentation, at the following address:

https://help.hcl-software.com/zie/ziewin/16.0/index.html

The Product Documentation contains reference material that is not found in this book, such as keyboard layouts and host code page tables. The Japanese Product Documentation also contains FAQs and troubleshooting tips.

The Z and I Emulator for Windows Product Documentation provides information in English and Japanese.

Online Help

The help facility describes how to install, configure, and use Z and I Emulator for Windows. Online help is very extensive and includes information about every aspect of configuring and using Z and I Emulator for Windows.

Use help to obtain the following information:

- Menu choices
- Operation procedures
- Operations in windows
- Meanings of the terms displayed in windows
- Causes of errors and the corresponding actions to take
- Mouse-based operations
- Operation without a mouse
- Detailed explanations of specific terms
- Further technical information about Z and I Emulator for Windows
- Detailed explanations of operator information area (OIA) messages

To display online help, select choices from the **Help** menu or press **F1**.

You can use Z and I Emulator for Windows online help just as you use the online help for Windows®.

Messages and Alerts

Online messages are displayed by Z and I Emulator for Windows, but a message does not always mean an error occurred. For example, a message might tell you that an operation is in progress or has been completed. A message can also prompt you to wait for the completion of an operation.

Messages That Appear in Pop-Up Windows

While using Z and I Emulator for Windows, you may see messages appear in popup windows, but not necessarily as a direct result of your actions. These messages can appear for a number of reasons, outlined in the following sections.

System-Fault Messages

If a message does appear in a pop-up window, you can paste its contents into the Windows® clipboard. To do this:

1. Click **Details** on the pop-up window.
2. Mark the text that you want to copy.
3. Click the marked text with the right mouse button and then click **Copy**.
4. Start an editor, such as Notepad, and click **Paste** from the **Edit** menu.
5. Save the file in case an IBM® Service Representative needs this information to diagnose your problem.

Security-Related Messages

Z and I Emulator for Windows optionally utilizes Secure Sockets Layer (SSL) or Transport Layer Security (TLS) to establish sessions with servers; this may require input from you (for example, a password). See Configuring and Using Security for Z and I Emulator for Windows on page 64 for details.

System-Policy-Related Messages

Your Z and I Emulator for Windows workstation configuration can be controlled centrally using facilities for managing system policies. See System Policy Support on page 55 for details.

OIA Messages

Z and I Emulator for Windows displays messages in the operator information area (OIA) or in a pop-up window. Messages from Z and I Emulator for Windows are displayed in the message window; messages from the host system regarding the condition of the session are displayed in the OIA of the session window.

The OIA is the bottom line of the session window. An OIA message indicates the status of Z and I Emulator for Windows as well as information about the workstation, host system, and attachment method.

All of the OIA indicators, reminders, and messages are described in the online help. To view this information:

1. Click **Index** from the **Help** menu.
2. Select **The operator information area messages**.

   To look up a specific OIA message, select **Search**. When the Search window appears, type the letters that appear in the OIA. For example, `MACH` or `PROG`. If a lightning bolt appears, type `COMM`.
3. Double-click the index entry that matches your search.
4. Scroll through the window until you find the number that appears in your OIA.

Alerts

Alerts may be generated which correspond to specific Z and I Emulator for Windows messages. See Alerts on page 302 for more information.

Z and I Emulator for Windows Library

The Z and I Emulator for Windows library includes the following publications:

- *CD-ROM Guide to Installation*
- *Quick Beginnings*
- *Emulator User's Reference*
- *Administrator's Guide and Reference*
- *Emulator Programming*
- *Host Access Class Library*
- *Client/Server Communications Programming*
- *System Management Programming*
- *Configuration File Reference*

These books are also available (except in DBCS versions) in PDF format and are optionally installed or viewed from the Installation Image.

In addition to the printed books, there are HTML documents provided with Z and I Emulator for Windows:

Host Access Class Library for Java

This HTML document describes how to write an ActiveX/OLE 2.0–compliant application to use Z and I Emulator for Windows as an embedded object.

Part I. General Information

Chapter 1. Z and I Emulator for Windows Highlights

Z and I Emulator for Windows brings the power of personal networking to your workstation by providing a variety of connectivity options supporting local area network (LAN) and wide area network (WAN) environments. Whether you need host terminal emulation, client/server applications, or connectivity, Z and I Emulator for Windows offers a robust set of communications, networking, and administrative features.

Z and I Emulator for Windows is a full-function emulator package with an easy-to-use graphical interface, which includes many useful features such as file transfer and dynamic configuration, and emulator APIs including the IBM® Host Access Class Library.

Z and I Emulator for Windows also provides a variety of SNA-based client application programming interfaces (APIs). You can create applications that use the peer-to-peer client APIs, which are based on LU 6.2 (and provided by Z and I Emulator for Windows). Using these APIs you can simultaneously access and process information on peer workstations.

With Z and I Emulator for Windows, you can participate in Advanced Peer-to-Peer Networking® (APPN®) as an end node, and use the advanced network features, high-performance routing (HPR), and dependent LU requester (DLUR).

Z and I Emulator for Windows provides the following functions:

- **zSeries Connections**

  LAN

  LAN via IEEE 802.2

  Communications Server for Windows®

  Telnet3270

  3270 via iSeries™

  APPC 3270 via LAN

  Microsoft® SNA client over FMI

  Dependent Logical Unit Requester (DLUR)

  VT-over-Telnet (TCP/IP)

  3174 Peer Communication

  SNA/IP

  LU 0, 1, 2, 3

  APPC 3270

  LU 0, 1, 2, 3 via DLUR

IBM-EEDLC

LU (0, 1, 2, 3) via DLUR

APPC 3270

OEM

LU (0, 1, 2, 3)

3270 via iSeries™ (passthru)

APPC 3270

Dependent LU Requester (DLUR)

- **iSeries™ Connections**

LAN

LAN via IEEE 802.2

Telnet5250 over TCP/IP

VT over Telnet

Telnet5250 over IPX/SPX

COM port

SNA-over-Async

Hayes AutoSync

SNA-over-Async (Console)

VT over Async

VT over Telnet

Telnet 5250

X.25 Hayes AutoSync

SDLC

Synchronous Data Link Control

SNA/IP

5250

IBM® ISA/MCA WAC

Synchronous Data Link Control (WAC)

X.25 Qualified Logical Link Control

IBM-EEDLC

5250

OEM

APPC 5250

- **ASCII Emulator Connections**

LAN

VT over Telnet

COM port

VT-over-Async

VT over Telnet

- **Client/Server Connections**

LAN

LAN via IEEE 802.2

COM port

SNA-over-Async

Hayes AutoSync

X.25

SDLC

Synchronous Data Link Control

AnyNet® SNA over TCP/IP

APPC

Enterprise Extender

HPR over IP

- **Configuration of SNA Node (APPN) Sessions**
  - Emulator
  - Client/server applications
- **SNA Node Operations**
  - Starting and stopping resources
  - Deleting resources
  - Displaying resource information
  - Changing session limits
  - Initiation of path switches
- **Log Viewer**

    - View Message Log, Trace Log, and Merged Log files
    - Summary and Detail views
    - Set default Message Log size and location
    - Filter and search Log files
    - Message Log entries Help
- **Trace Capability**
    - 3270/5250 emulator data
    - APPN® and APPC API data
    - Connectivity data, such as LAN or SDLC
    - User services data, such as node initialization
- **APPC Applets**
    - Display SNA sense data (GETSENSE)
    - Check connection (APING)
- **Sample Programs**
    - Located in \ZIE for Windows\samples subdirectory
- **Installation and Configuration**
    - Partial installation option
    - Program sharing on a network server
    - Automatic detection of installed communication adapters
    - Dynamic change of communication configurations
    - Automatic Dial Facility (Async (IGN), SDLC, Home3270, SNA-A)
    - Silent Installation
    - ASCII SNA-node configuration
    - Verification of ASCII configuration
- **OEM Adaptor Cards**

  An open API enables vendors and other equipment manufacturers (OEMs) to provide adapter cards that allow for additional connectivity options, for example, additional X.25, ISDN, or SDLC support.

- **Host Session Function**
    - Up to 52 sessions
    - Variable screen size and automatic font scaling
    - Function settings (of the host code page, for example) for each session
- **Host Graphics Support**
    - Built-in vector graphics support for GDDM® and other graphics applications
- **File Transfer Function**
    - Easy operation through graphical user interface (GUI) windows
    - Batch transfer of multiple files
    - Concurrent file transfer through multiple sessions
    - Background file transfer
    - File transfer invocation by macro
    - OfficeVision/MVS™ Import/Export functions
    - VT File Transfer (XModem and YModem)

- **Edit (Cut and Paste) Function**

  You can use the clipboard to cut, copy, and paste a selected areaIn addition, you can paste data in other applications, such as spreadsheet programs, that support the PasteLink function.
  - Support of spreadsheet data format (Sylk, Biff3, Wk3 formats)
  - Copy Append
  - Paste Next
  - Paste to Trim Rectangle
  - Paste Stop at Protected Line
- **Graphical User Interface (GUI)**
  - Customizable 3D iconic tool bar
  - 3D-button hotspots
  - Pop-up keypad
  - Macro function, including record and play
  - VBScripts, including record and play
  - Keyboard-function setup and remapping
  - Mouse-button-function setup and remapping
  - Display setup (cursor type, graphics, sound, colors, for example)
  - Automatic font size adjustment or fixed font size
  - Window-appearance setup
  - Menu-bar customization
  - 3270 Light Pen emulation by using a mouse
  - Status bar with history
  - Page Setup
  - Revised Configuration Dialog
  - Online help
- **Print Function**
  - Printer session (for PC/3270: SCS, LU 3, or non-SNA)
  - Graphics local print
  - Printing with the Windows printer drivers
  - Print function by printer definition table (PDT)
  - Multiple host-print functions in multiple sessions
  - Print-job control by SNA bracket timeout
  - PDF-to-PDT conversion tool
  - PC400 print function by OS/400® and i5/OS® Host Print Transform (HPT)
  - PC400 printing supported by the iSeries™, eServer™ i5, and System i5® Advanced Print Support Utility
  - ZipPrint
- **Programming Interfaces**
  - 16/32-bit Emulator High-Level Language Application Programming Interface (EHLLAPI)
  - 16/32-bit Dynamic Data Exchange (DDE)
  - 32-bit Node Operations Facility (NOF)
  - 16/32-bit Z and I Emulator for Windows API (PCSAPI)

- 32-bit Advanced Program-to-Program Communication (APPC)
- 32-bit Common Programming Interface for Communications (CPI-C)
- 32-bit Automation Object API
- 32-bit ActiveX/OLE 2.0
- ActiveX® Controls

- **PC400 Client Function**
  - Data transfer
  - PC Organizer
  - Text Assist
  - Enhanced Programmable Terminal User Interface (ENPTUI)

Chapter 2. Problem Analysis

This chapter describes the information that will help you analyze problems with Z and I Emulator for Windows, and ways to report a problem to HCL. For detailed information about contacting HCL, refer to *Quick Beginnings*.

For information about Z and I Emulator for Windows and support, refer to the following Web sites:

- The HCL Software home page provides access to general product information, and download services. To view this page, go to the following Internet address:

  http://www.ibm.com/software/network/pcomm

  https://www.hcltech.com/software

- The HCL Z and I Emulator for Windows support page provides links to code fixes, tips, newsgroups, support options, and services. To view this page or to submit a software defect report, go to the following Internet address:

  http://www.ibm.com/software/network/pcomm/support

  https://hclpnpsupport.hcltech.com/csm

Z and I Emulator for Windows provides several utilities to help you with problem analysis. They can be invoked by selecting their icons from the **Programs → HCL Z and I Emulator for Windows → Administrative and PD Aids** subfolder on the Windows® **Start** menu.

The following sections describe these utilities and how to use them.

Log Viewer

The Z and I Emulator for Windows log viewer utility enables you to view, merge, sort, search, and filter information contained in message and trace logs. Use the log viewer during problem analysis to work with message and trace log entries. The default name of the message log output file is PCSMSG.MLG; its file extension must be .mlg. The file extension for trace logs must be .tlg.

To view message or trace logs:

1. From the **Administrative and PD Aids** subfolder, click **Log Viewer**; or, from an active session, click **Launch → Log Viewer** from the **Actions** menu.
2. From the list of logged messages, double-click a message to display the message text.

Note: Only one message log is created per machine. In simultaneous user environments such as WTS, all user messages are logged into that single instance of the log file. See Using Windows Terminal Services on page 94 for more information about terminal services.

For more information about log viewer functions, see Log Viewer Functions on page 110.

Trace Facility

The Z and I Emulator for Windows trace facility enables you to log trace information for certain Z and I Emulator for Windows functions.

To start a trace, perform the following steps:

1. From the **Administrative and PD Aids** folder, click **Trace Facility**; or, from an active session, select **Launch → Trace Facility** from the **Actions** menu. The trace status on the title bar displays the current state:

   Active

   Trace data is being collected by the trace facility.

   Inactive

   No trace data is being collected.

2. From the main dialog box, click **Set Up** to set the desired trace system parameters.
3. Click **OK** to return to the main trace dialog box.
4. From the main trace dialog box, select the type of data you want to trace from the **Function Name**, **Component Name**, and **Trace Option** list boxes.

   Function Name

   A specific set of Z and I Emulator for Windows features, such as 3270/5250 Emulator or User Services.

   Component Name

   The name of a specific part of a function, such as API data (for the 3270/5250 Emulator function) or Node Initialization (for the User Services function).

   Trace Options

   The options associated with a particular component, such as EHLLAPI (for the API component) or API trace (for the Node Initialization component).

5. Start tracing data by clicking **Start**, or apply changes to the trace options by clicking **Apply**.
6. Run the operation that you want to trace.
7. Optionally, stop the trace by clicking **Stop**.
8. Save the trace data to your hard disk by clicking **Save**.
9. Click **Format** to specify a formatted trace file name and to format the trace data. The Information Bundler utility should be used immediately after the trace is complete to ensure that the correct information is gathered.

   Note: If you have changed the default path setting for the formatted trace file, the Information Bundler will not find the trace information. Copy the trace files to the system-class application data directory.

10. Click **OK**.

11. Click **Clear** to clear the trace buffer where you saved a trace.
12. Use the log viewer to view the formatted trace log.

Note: Trace facility can capture only the application level (Ring 3) tracing, when logged on WTS environment, where the conso session ID is non-zero. If you want to trace the kernel level tracing (Ring 0), use the command line tracing options.

Information Bundler

The Z and I Emulator for Windows Information Bundler utility gathers system files, trace and log files, and registry information into a .ZIP file. This file can be sent to support personnel, using the Internet Service utility. The Information Bundler should be executed immediately after the trace is complete to ensure that the correct information is gathered.

Start Information Bundler using one of the following methods:

- Click **Administrative and PD Aids → Information Bundler** from the Z and I Emulator for Windows program menu.
- In an active emulator session, click **Actions → Launch → Information Bundler** from the menu bar.

The X12345.ZIP file is created in the Z and I Emulator for Windows system-class application data directory. This file contains system and Z and I Emulator for Windows information. Refer to the installation documentation for the location of the system-class application data directory for each Windows® operating system.

NOTE : Information Bundler utility requires dotnet version 4.6.1 to work.

Internet Service

The Internet Service utility enables you to send the diagnostic data output file generated by the Information Bundler to an FTP server. This utility will not work unless TCP/IP is configured and you have a direct connection to the internet. To use Internet Service, do the following:

1. Double-click the **Internet Service** icon located in the Z and I Emulator for Windows program group; or, from an active session, click **Actions → Launch → Internet Service**.

   The Internet Service window contains four data fields that must have valid values before you can submit your problem report.

2. If IBM Service directs you to add an FTP address, type it in the **FTP Address** field. The default server is indicated by the `(Default)` prefix.
3. Type your e-mail address in the field provided.
4. In the **Problem Determination Filename** field, type the file name and path of the Information Bundler output file. This file is usually located in the Z and I Emulator for Windows application data directory specified during installation. You can also browse to the file by clicking the **...** button.

5. In the **PMR Number** field, type the data file name, including the PMR number that you received from IBM Service. The format of the data file name is *xxxxx.bbb.ccc.yyy.yyy*, where the variables are as follows:
    - *xxxxx* is the PMR number
    - *bbb* is the Branch Office (if known)
    - *ccc* is the IBM Country Code
    - *yyy.yyy* is a short description for the file type, such as `exe`, `exe.Z`, `zip`, `tar.Z`, or `restore.Z`

    Refer to the following file name examples:

    99999.999.000.exe
    88888.777.764.zip
    11111.222.760.tar.Z
6. Click **Transmit** to submit your problem determination information.

Checking for APARs and Manufacturing Refreshes

Service updates (Manufacturing Refreshes and Fix Packs) can be found for Z and I Emulator for Windows on Fixcentral at http://www.ibm.com/support/fixcentral/.

Fix Packs

A fix pack is a cumulative APAR package containing all currently available APAR fixes. Fix packs are tested to ensure that the included APARs function well together. You can obtain fix packs using the APAR commit option in the Product Update Tool or by downloading the .msp file.

When you check for APARs, any available fix packs are also displayed. The corresponding .msp file is located in the same application data directory as APARs, with the specific fix pack name. You might be prompted to reboot the system.

To download fix pack files, go to the manufacturing refresh site—you will find a link to the latest fix pack, a list of included APARs, and installation instructions.

Refer to *CD-ROM Guide to Installation* for information about applying fix packs to administrative installation images and local client installations.

Manufacturing Refreshes (MRs)

Manufacturing refreshes are packages containing a bundle of APARs and possibly new product options and improvements. For Z and I Emulator for Windows, new manufacturing refreshes are cumulative. To check for manufacturing refreshes, click **Check for MRs** in the Product Update Tool.

Installing a manufacturing refresh is similar to a reinstallation of the product (removing old product files and installing new files); therefore, there is no test and commit process available for manufacturing refreshes. To remove a manufacturing refresh, your only option is to uninstall the current Z and I Emulator for Windows product level, then reinstall the prior level.

You can obtain manufacturing refreshes only if you have purchased a full version of the product. This is validated by entering a service key, which is included in the original package of Z and I Emulator for Windows. When you check for manufacturing refreshes, your Internet browser opens to the manufacturing refresh site, where you are prompted to enter your registration data and service key. When registration is complete and the service key is entered, you can select the product, version, and language for which you need the manufacturing refresh update.

Note: A manufacturing refresh file is usually larger than 100 MB.

Part II. Advanced Configuration, Management, and Operations

Chapter 3. Advanced Configuration

This chapter describes facilities useful for deploying Z and I Emulator for Windows in large networks. Some of these facilities are handled by features of Z and I Emulator for Windows itself, while others are provided by external products, augmented with facilities provided by Z and I Emulator for Windows.

Configuration Files

The following sections describe the advanced configurations that you can make with the built-in files of Z and I Emulator for Windows. Advanced configurations enable you to easily configure and distribute common keywords and parameters to your client base, and include the following:

- Initial Configuration Definitions
- Configuration with Template and Update Files

Initial Configuration Definitions

Z and I Emulator for Windows enables network administrators to create an initial configuration definitions file that contains common configuration definitions for their clients. By using an initial configurations file, the administrator can distribute preconfigured definitions and have them automatically preloaded whenever a new configuration is created on a client.

The first step is to create a configuration using SNA node configuration, Start or Configure Sessions, or an ASCII editor. For detailed information on configuring sessions, refer to *Quick Beginnings*.

After you create the configurations file, rename the file to the appropriate reserved name. For SNA node configuration files (*.ACG), the file name is PCSINIT.AC$. For workstation profiles (*.WS), the file name is PCSINIT.WS$. For emulator configurations using SNA communication, you should use both a PCSINIT.WS$ and a PCSINIT.AC$ file.

After you rename the files, they can be distributed to client workstations. Put the files in the configuration files directory. The definitions in the files will be preloaded whenever a user creates a new configuration.

Note: The initial configuration file does not override parameter defaults for new definitions in new configurations, but preloads complete definitions into new configurations. Users can modify these definitions to get custom parameter values; however, the original initial configuration file remains unchanged.

Configuration File and Emulator Profile Directories

The default directory for configuration files is specified during installation. Configuration files can be used for all users or a specific user. Refer to *CD-ROM Guide to Installation* for details on specifying the initial default directory.

By default, Z and I Emulator for Windows searches for emulator profiles in the configuration files directory. You can use the **User Preference Manager** utility to indicate a different location for profiles.

Using Template and Update Files

When creating configurations for a large number of clients to implement, you can create a template configuration file that represents the common configuration elements for all clients. Using an update file with only those changes necessary for each client, you can distribute the template and update file and merge the two to create the target configuration.

The Z and I Emulator for Windows Server template and update files enable you to create or modify a configuration using an ASCII editor. You can configure all of the Z and I Emulator for Windows configuration keywords and parameters with update files. Both the template and update files have the same format as Z and I Emulator for Windows configuration (.ACG) files.

Template files can ease the mass distribution of configurations to remote clients. A template file can specify the keywords which are common to several clients. For example, if you have multiple clients to configure as SNA clients, many of the keywords will be identical. You can create a template configuration file that reflects those common keywords.

You can use update files to add, modify, or delete keywords in a template file. The original template configuration file is left unchanged. An update file is merged into a template file by specifying the INCLUDE keyword at the end of the template file. For example, if an update file is named myconfig.chg, the last line of the template file that will use the update file is `INCLUDE=myconfig.chg`. When the template file and the update file are merged, you can give the resulting configuration file a name with the .ACG extension that distinguishes it from other .ACG files.

When you create configurations using template and update files, the verification utility searches directories in the following order:

1. The local directory where the verification utility is being invoked
2. The system-class application data directory

To ensure that the verification utility can locate the template and update files, you should store them in the system-class application data directory, which is also where the configuration (.ACG) files are stored.

Key Fields

The key field is the parameter in a keyword that names the keyword and uniquely identifies it from other keywords of the same type.

Some keywords do not have key fields because they can only be specified once in a configuration file. An example of a keyword that can only be specified once is the NODE keyword.

Adding Keywords to a Template File

When using an update file to add a new keyword definition, you must provide the entire keyword. The key field must be provided along with a unique value. If any subfields are omitted from the keyword, the defaults for those fields are used. For example, to add a MODE keyword to the configuration, the update file might contain the following keyword:

```
MODE=(
     MODE_NAME=MYMODE
     COS_NAME=#INTER
     CRYPTOGRAPHY=NONE
     DEFAULT_RU_SIZE=1
     MAX_NEGOTIABLE_SESSION_LIMIT=128
     MAX_RU_SIZE_UPPER_BOUND=4096
     MIN_CONWINNERS_SOURCE=15
)
```

The content of the update file assumes that a MODE keyword with the parameter of MODE_NAME=MYMODE does not exist in the template. If it does, the parameters will be updated with the values provided in the update file.

If the MODE_NAME parameter is omitted from the update file, an error will occur during the configuration verification because the MODE_NAME parameter cannot be uniquely identified. Not all parameters available for the MODE keyword are specified in the update file. The remaining parameters use the defaults as specified in *Configuration File Reference*. The resulting addition to the configuration will look like this:

```
MODE=(
     MODE_NAME=MYMODE
     AUTO_ACT=0
     COMPRESSION=PROHIBITED
     COS_NAME=#INTER
     CRYPTOGRAPHY=NONE
     DEFAULT_RU_SIZE=1
     MAX_NEGOTIABLE_SESSION_LIMIT=128
     MAX_RU_SIZE_UPPER_BOUND=4096
     MIN_CONWINNERS_SOURCE=15
     PLU_MODE_SESSION_LIMIT=32
     RECEIVE_PACING_WINDOW=1
)
```

Modifying a Keyword in a Template File

When using the update file to modify an existing keyword definition, the original keyword should exist in the template file. If it does not exist in the template file, the update file adds an entry to the new configuration. You must specify the key parameter in the update file to identify the target keyword. Only those parameters specified in the update file keyword are updated in the template file's keyword. Parameters not specified in the update file are left unchanged. For example, if the following MODE keyword is in the template file:

```
MODE=(
     MODE_NAME=#INTER
     AUTO_ACT=0
     COMPRESSION=PROHIBITED
     COS_NAME=#INTER
     CRYPTOGRAPHY=NONE
     DEFAULT_RU_SIZE=1
     MAX_NEGOTIABLE_SESSION_LIMIT=256
     MAX_RU_SIZE_UPPER_BOUND=4096
     MIN_CONWINNERS_SOURCE=128
     PLU_MODE_SESSION_LIMIT=256
     RECEIVE_PACING_WINDOW=20
)
```

and the following keyword is specified in the update file:

```
MODE=(
     MODE_NAME=#INTER
     AUTO_ACT=10
)
```

the resulting configuration would have the following MODE keyword definition:

```
MODE=(
     MODE_NAME=#INTER
     AUTO_ACT=10
     COMPRESSION=PROHIBITED
     COS_NAME=#INTER
     CRYPTOGRAPHY=NONE
     DEFAULT_RU_SIZE=1
     MAX_NEGOTIABLE_SESSION_LIMIT=256
     MAX_RU_SIZE_UPPER_BOUND=4096
     MIN_CONWINNERS_SOURCE=128
     PLU_MODE_SESSION_LIMIT=256
     RECEIVE_PACING_WINDOW=20
)
```

Deleting a Keyword from a Template File

When using the update file to delete a keyword from the template, you must specify the key parameter and value that identify the keyword, along with the keyword DELETE. For example, if the template file specifies the following keyword:

```
MODE=(
     MODE_NAME=#INTER
     AUTO_ACT=0
     COMPRESSION=PROHIBITED
     COS_NAME=#INTER
     CRYPTOGRAPHY=NONE
     DEFAULT_RU_SIZE=1
     MAX_NEGOTIABLE_SESSION_LIMIT=256
     MAX_RU_SIZE_UPPER_BOUND=4096
     MIN_CONWINNERS_SOURCE=128
     PLU_MODE_SESSION_LIMIT=256
     RECEIVE_PACING_WINDOW=20
)
```

and the response file contains the following keyword:

```
MODE=(
     MODE_NAME=#INTER
     DELETE
)
```

the resulting configuration does not contain the #INTER mode definition.

The DELETE keyword can appear after a *parameter=value* specification or on a line by itself, either preceding or following the parameter. For example, the following uses of the DELETE keyword are valid:

```
MODE=(
     MODE_NAME=#INTER
     DELETE
```

```
)
MODE=(
     DELETE
     MODE_NAME=#INTER
)
```

The DELETE keyword cannot appear in front of a *parameter=value* specification on the same line. For example, the following uses of the DELETE keyword are not valid:

```
MODE=(
     DELETE MODE_NAME=#INTER
)

MODE=(
     MODE_NAME=#INTER DELETE
)
```

To delete all keywords of a particular type, or to delete one keyword that does not have a key field, only the keyword and the DELETE keyword are necessary. For example,

```
MODE=(
     DELETE
)
```

Note: Not all keywords can be deleted; only those which are not listed as required can be deleted—refer to *Configuration File Reference* for details.

Applying Updates to Configuration Files

To update or change an existing SNA configuration file using an update file, do the following:

1. Using a text editor, create an update file that contains keywords to be added, deleted, or changed in an existing SNA node configuration file.
2. Add an include statement at the bottom of the existing SNA node configuration or template indicating the name of the update file.
3. Invoke the SNA Configuration Verification utility by typing the following on the command line:

   ```
   vacgcon config.acg newconfig.chg
   ```

   config.acg

   The existing configuration file

   newconfig.chg

   The new configuration file

   You must remove the include statement to reuse your template as a configuration file.

Note: When an update file does not contain a complete, usable configuration, it is recommended that you use an extension other than .ACG.

Configuring Multiple Links

Many customers must attach to multiple iSeries™, eServer™ i5, System i5™, or zSeries™ mainframe systems. Z and I Emulator for Windows allows this type of configuration. The following sections explain how to do this.

Note: You do not need to read this section if you want to create multiple sessions on the same host.

Configuring a Second 3270 Emulation Link

Recommendation

If you want a second SNA connection (link) to run concurrently, we strongly recommend that you configure it in the same .ACG file as the first one; this will avoid any possible conflict of settings.

Perform the following steps to configure a second 3270 emulation link. You can make the configuration even if the first link is active.

1. Double-click the **Start or Configure Sessions** icon to start a new session; or click **Configure** from the **Communication** menu.
2. Choose the host, interface, and attachment type, as usual.
3. Configure the session parameters, then click **Configure Link**.
4. In the Configure Local System panel, check that the default .ACG file is the one in which you saved the configuration for the first link. If not, click **Existing** and choose the correct file from the list.
5. Check that the settings for the PC Location Name are correct. Click **Next**.
6. The LAN Device Connection panel appears. Under Device Selection, be sure that the device used for the first link is displayed. Under Connection Selection, select **New Connection**. Notice that the connection name has changed to show a new link name. Click **Next**.
7. The Configure LAN Connection panel is displayed. The Destination Address field will show 400000000000. Enter the Destination Address for the second link, and change the additional parameters if needed.
8. Click **Advanced**.
9. The Advanced dialog panel shows the default values for block ID and PU ID. Change them as necessary to the values for the second link. Click **OK.**
10. Click **Next**, then **Finish**, and save the .ACG file (replace the existing file). Then click **OK** until you return to the session window. If you have done everything correctly, and if the gateway or controller is running, you should get a connection.

You can add further 3270 links in the same way.

Configuring a Second 5250 Emulation Link

The steps you should follow to configure a second 5250 emulation link are almost the same as for 3270. You can make the configuration even if the first link is active.

1. Double-click the **Start or Configure Sessions** icon to start a new session; or click **Configure** from the **Communication** menu.
2. Choose the host, interface, and attachment type, as usual.
3. Configure the session parameters, then click **Configure Link.**
4. In the Configure Local System panel, check that the default .ACG file is the one in which you saved the configuration for the first link. If not, click **Existing** and choose the correct file from the list.
5. Check that the settings for the first link are correct. Click **Next.**
6. The Configure Logical Connection panel appears, showing the settings for the first link. If you are going to connect to a different iSeries™, eServer™ i5, or System i5™, change the System Location Name. Click **Next.**
7. The Configure LAN Connection panel appears. If the Link Station Name has not changed, change it.
8. Change the Destination Address (and the other parameters if necessary). If you want to change the Local SAP number or the Receive Buffer Count, (which is unlikely), click **Advanced.** If not, click **Next**, then **Finish**, and save the .ACG file (replace the existing file), then click **OK** until you return to the session window.

You can add further 5250 links in the same way.

Configuring a Second Link of a Different Kind

The procedure for configuring other links is similar to those for the configurations for 3270 and 5250 link configurations. This procedure applies whether you are going to configure two (or more) links that use the same connection type, or links that use different connection types. In this example, assume that you have already configured a 3270 connection and now want to add a 5250 connection. As before, you can make the configuration even if the first link is active.

1. Double-click the **Start or Configure Sessions** icon to start a new session; or click **Configure** from the **Communication** menu.
2. Choose iSeries™, the LAN interface and the IEEE 802.2 attachment type.
3. Configure the session parameters, then click **Configure Link.**
4. In the Configure Local System panel, check that the default .ACG file is the one in which you saved the configuration for the 3270 link. If not, click **Existing** and choose the correct file from the list. Notice that the PC Location Name is already there. Click **Next.**
5. The Configure Logical Connection panel appears. Enter the System Location Name and click **Next**.
6. Notice that the Link Station Name has changed. Enter the Destination Address of the iSeries™, eServer™ i5, or System i5™. Click **Next**, then **Finish**, and save the .ACG file (replace the existing file); then click **OK** until you return to the session window.

Configuring to Perform 3270 and 5250 Emulation to Multiple Hosts

To configure Z and I Emulator for Windows to perform 3270 and 5250 emulation to multiple hosts, use the following procedure:

1. Click **Actions → Launch → SNA Node Configuration** of your active session; or click **SNA Node Configuration** from the **Program → HCL Z and I Emulator for Windows** folder on the Windows® Start menu.
2. Configure the node information, as follows:
    a. Click **Configure Node** from the list of **Configuration** options.
    b. Click **New**.
    c. In the **Fully qualified CP name** field, enter the Network ID and CP name that is defined for you on the iSeries™, eServer™ i5, or System i5™ (APPN.TEST, for example).

    Note: If the iSeries™, eServer™ i5, or System i5™ is performing automatic configuration, the value you enter here is ignored. However, it is still necessary to enter a value in the field to close the panel.

    d. Click **OK**.
3. Configure the device information, as follows:
    a. Click **Configure Devices** from the list of **Configuration** options.

    Note: The dialog displays the device adapters that are installed and indicates whether each adapter is enabled or disabled.

    b. Click **LAN** from the list of available DLCs.

    Note: These instructions are based on the LAN DLC; the field names and tabs might be slightly different if you are configuring another type of DLC.

    c. Click **New**.
    d. Specify the adapter number for the connection.
    e. Click **OK**.
4. Configure the connection information, as follows:
    a. Click **Configure Connections** from the list of **Configuration** options.
    b. Click **LAN** from the list of available **DLC**s.
    c. Click **New**.
    d. Enter the Link station name (default is LINK0000) and click the LAN device (for example, LANX_04) that you selected from the list of available DLCs. This link will be defined for the 5250 session to the iSeries™, eServer™ i5, or System i5™.
    e. Enter the LAN destination address of the iSeries™, eServer™ i5, or System i5™.
    f. Click the **Advanced** tab.

g. Verify that **Activate at startup** is selected
h. Verify that **APPN support** is selected.
i. If you plan to use 3270 passthrough on this connection, click **Solicit SSCP sessions**.
j. Click **OK** to save the information.

5. Configure the second link for the 3270 session, using the following procedure:
   a. Click **New**.
   b. Enter the Link station name (default is LINK0001) and select the same device you used to define the 5250 session (for example, LANX_04). This link will be defined for the 3270 session to the host.
   c. Enter the LAN destination address of the host.
   d. Click the **Advanced** tab.
   e. Verify that **Activate at startup** is selected.
   f. Verify that **APPN support** is selected.
   g. Click **Solicit SSCP sessions**.
   h. In the **Local Node ID** field, enter the Block ID and Physical Unit ID that identifies the device.
   i. Click the **Adjacent Node** tab.
   j. Click **HOST-XID3** from the list of **Adjacent CP** types.
   k. Click **OK**.
6. Configure the Partner LU 6.2 information, as follows:
   a. Click **New**.
   b. Enter the Partner LU name, such as APPN.S101010. This is the name of the iSeries™, eServer™ i5, or System i5™; this information can be obtained by running a DSPNETA on the iSeries™, eServer™ i5, or System i5™.
   c. Click **OK**.
7. Save the configuration information, as follows:
   a. On the SNA Node Configuration window, click **Save As** from the **File** menu.
   b. Enter a file name with a .ACG file extension, such as TEST.ACG. Click **Yes** to make this configuration the default.
   c. Click **Exit** on the **File** menu.
8. Start the 5250 emulator session, using the following procedure:
   a. Click **Program → HCL Z and I Emulator for Windows → Start or Configure Sessions** from the Windows® **Start** menu.
   b. Click the **iSeries** host, the **LAN interface**, and the **IEEE 802.2 attachment**.
   c. Click **Configure**.
   d. Click **Configure Link**.
   e. Click **Existing**.
   f. Click the configuration you saved in step 7 from the list and click **Open**.
   g. Click **Next**.
   h. Verify that the System location name matches the name you specified in step 6. Click **Next**.
   i. In the **Device name** field, select the device name you defined in step 3. Click **Next**.
   j. In the **Link station** name field, select the name you defined in step 4, such as LINK0000. Click **Next**.
   k. Click **Finish**.

l. Click **Save** and then click **Yes** to overwrite the existing file.
m. Click **OK** to close the Customize Communication - 5250 Host window and then click **OK** to close the Customize Communication window and start the 5250 session.

9. Save the workstation profile for the 5250 session, as follows:
    a. Click **Save As** from the **File** menu on the emulator window.
    b. Enter a file name with a .WS extension and click **OK**.
    c. If you want the ability to start this session separately, click **Yes** to create an icon; otherwise, click **No**.
    d. Click **OK**.
10. Start the 3270 emulator session, using the following procedure:
    a. Click **Program → HCL Z and I Emulator for Windows → Start or Configure Sessions** from the Windows® **Start** menu.
    b. Click the **zSeries™** host, the **LAN interface**, and the **IEEE 802.2 attachment**.
    c. Click **Configure**.
    d. Click **Configure Link**.
    e. Click **Existing**.
    f. Select the configuration you saved in step 7 from the list and click **Open**.
    g. Click **Next**.
    h. In the **Device name** field, select the device name you defined in step 3. Click **Next**.
    i. In the **Link station name** field, select the name you defined in step 5, such as LINK0001.
    j. Click **Advanced**.
    k. Clear **APPN support** and click **OK**.
    l. Click **Next**.
    m. Click **Finish**.
    n. Click **Save** and then click **Yes** to overwrite the existing file.
    o. Click **OK** to close the Customize Communication - 3270 Host window and then click **OK** to close the Customize Communication window and start the 3270 session.
11. Save the workstation profile for the 3270 session, as follows:
    a. Click **Save As** from the **File** menu on the emulator window.
    b. Enter a file name with a .WS extension and click **OK**.
    c. If you want to start this session separately, click **Yes** to create an icon; otherwise, click **No**.
    d. Click **OK**.
12. Create a batch file to start both the 5250 session and the 3270 session at the same time, using the following procedure:
    a. Close both running emulator sessions.
    b. Click **Utilities → Multiple Sessions** from the Z and I Emulator for Windows program menu.
    c. From the list of workstation profile files, select the .WS file for the 5250 session (step 9). Click **Add**.
    d. From the list of workstation profile files, select the .WS file for the 3270 session (step 11). Click **Add**.
    e. Click **Save As** from the **File** menu and enter a file name with a .BCH extension to save the batch file. Click **OK**.
    f. Click **Yes**. Verify that the folder is the `DESKTOP` and select both check boxes. Click **OK**.
    g. Click **Exit** from the **File** menu.
13. To start the 5250 and 3270 emulator sessions together, double-click the **Batch File** icon on your Desktop.

Automatic Device Name Generation (5250 Only)

The Telnet 5250 client function can generate a new and non-arbitrary DEVice NAME (DEVNAME) for a session without requiring per-session profile (.WS) customization or a user exit.

You can use keywords and special characters in the WorkStationID (WID) field (in the [5250] stanza of the Workstation profile) to cause some or all of the following information to be substituted into the DEVice NAME value that is sent to the TN5250 server:

- Computer name or user name
- Short session ID
- Session type ID
- Collision avoidance ID

When specified, the Collision Avoidance ID enables the generation of a new DEVice NAME if the Telnet server rejects a submitted name (which can occur when the old name is already in use on the iSeries™, eServer™ i5, or System i5™). The ability to have a variety of names generated allows multiple sessions to the same iSeries™, eServer™ i5, or System i5™ from one or more clients using just one WorkStation Profile (.WS) file. The definition of the existing .WS file parameter WorkStationID in the [5250] stanza is extended to accomplish this.

Substitution Characters

You can use special substitution characters in the WID field to control the placement of the generated information into the DEVNAME field. One substitution character is used in the WID for each generated character. This reserves space in the DEVNAME for each generated character and indicates where each generated character is to be placed. The three special substitution characters are:

Short Session ID

(value range: A-Z or a-z) The special character signifying this in the WID is the asterisk (*).

Example:

If the WorkstationID is configured as `123*` and the short ID of the first session is A, then the device names generated for the first three sessions will be `123A`, `123B`, and `123C`.

Session Type ID

(possible values: S for diSplay or P for Printer) The special character signifying this in the WID is the percent sign (%).

Example: If the Workstation ID is configured as `%123*` and the session type is Printer, then the first three device names generated would be `P123A`, `P123B`, and `P123C`.

Collision Avoidance ID

(value range: 1-9, A-Z or a-z) The Collision Avoidance ID (CAID) is used by the device name collision (DNC) function (see Device Name Collision Processing on page 35) to generate a new DEVice NAME when the old name is rejected by the Telnet server as already being in use. The special character signifying this in the WID is the equals sign (=).

Example: If the Workstation ID is configured as `%ABC=`, the session type is Display, and the device name `SABC1` is already in use on the iSeries™, eServer™ i5, or System i5™, then the first generated device name (SABC1) will be rejected by the server, but the second name (SABC2) will be accepted.

Client Naming Function

If you specify a Client Naming (CN) substitution keyword in the Workstation ID (WID) field, then an external name is retrieved and used when generating the DEVice NAME.

The CN keywords are prefixed with the ampersand character (&), followed by a five character identifier. Two keywords are supported:

&COMPN

Windows® COMPuter Name for the client

&USERN

USER Name specified during logon to the Windows® computer where the emulator executes

A name whose length exceeds the space remaining in the 10 character long DEVNAME field will have that excess trimmed from the left side by default. Excess characters can alternatively be trimmed from the right side by prefixing the CN keyword with a plus sign (+) character (for example, `+&COMPN`).

Note:

1. If the specified name cannot be obtained, then the message `Unable to get the local "x" name` (where "x" is COMPN or USERN) is displayed in the status bar.
2. If a client naming keyword is specified in the WID, then characters other than those defined for this feature are ignored.
3. A numeric character in the first position of a DEVNAME is invalid, and may be converted by the iSeries™, eServer™ i5, or System i5™ to the pound (or number) character (#).

Example A: If the Workstation ID is `&COMPN*` and the name of the local computer is `clientaccess1`, then the device names generated for the first three sessions would be `ntaccess1A`, `ntaccess1B`, and `ntaccess1C`.

Example B: If the Workstation ID is `+&COMPN*%` and the name of the USER logon for the local computer is `clientaccess1`, then the device names generated for the first three sessions would be `clientaccA`, `clientaccB`, and `clientaccC`.

Device Name Collision Processing

Device name collision occurs when a Telnet client sends the Telnet server a virtual device name, but that device name is already in use on the server. When this occurs, the Telnet server sends a request to the client asking it to send a different DEVNAME.

Device name collision (DNC) processing handles requests from the server for a different DEVNAME. If the collision avoidance ID (CAID) substitution character is present in the WID, the CAID is incremented and sent as part of the new DEVNAME to the server.

If the server requests a different DEVNAME and the CAID is not present in the WID, then the error message `Device Name "x" is invalid or already in use on the server` is displayed on the status bar and the session is disconnected.

Commands for Emulator Functions

Z and I Emulator for Windows provides the following commands for managing Z and I Emulator for Windows sessions:

PCOMSTRT

Start a Z and I Emulator for Windows session

PCOMSTOP

Stop a Z and I Emulator for Windows session

PCOMQRY

Query Z and I Emulator for Windows sessions

Returns: DOS Error level is set for use when this command is invoked by a program. When the command is directly entered, a message is displayed indicating the session is stopping.

Configure OneDrive

OneDrive is a Microsoft Cloud service that provides access to all your Z and I Emulator for Windows configuration files from anywhere. It also stores and protects your files and allows you to share them with other users. When a user uses a different account with OneDrive, all the configured files get synced with the OneDrive user account.

User can also configure OneDrive with Z and I Emulator for Windows profile directory, Macro directory and Tool Bar icons directory. For more details, refer to below sections.

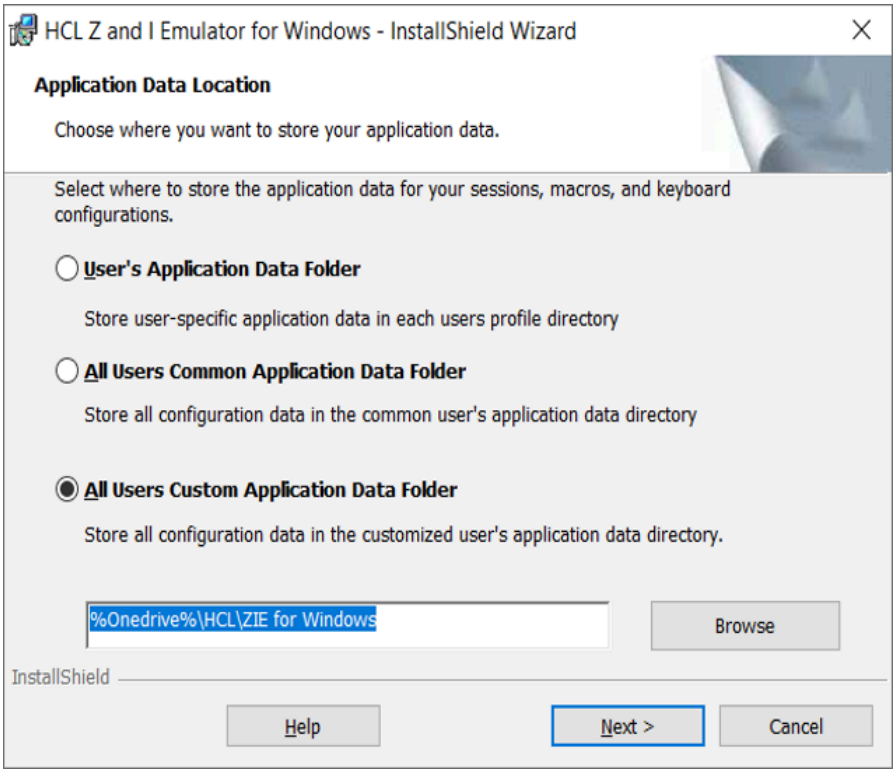
Configure Profile Directory with OneDrive

A user can configure profile directory with OneDrive either during Z and I Emulator for Windows installation using %OneDrive% variable or after installation through Preference Utility.

Execute the following steps to configure OneDrive while installing Z and I Emulator for Windows:

Note: Make sure that the user is configured with OneDrive and able to access %OneDrive% configured path.

1. Set %OneDrive% as profile directory during installation.
2. Select all users **"Custom Application Data Folder"** option and give the variable path.

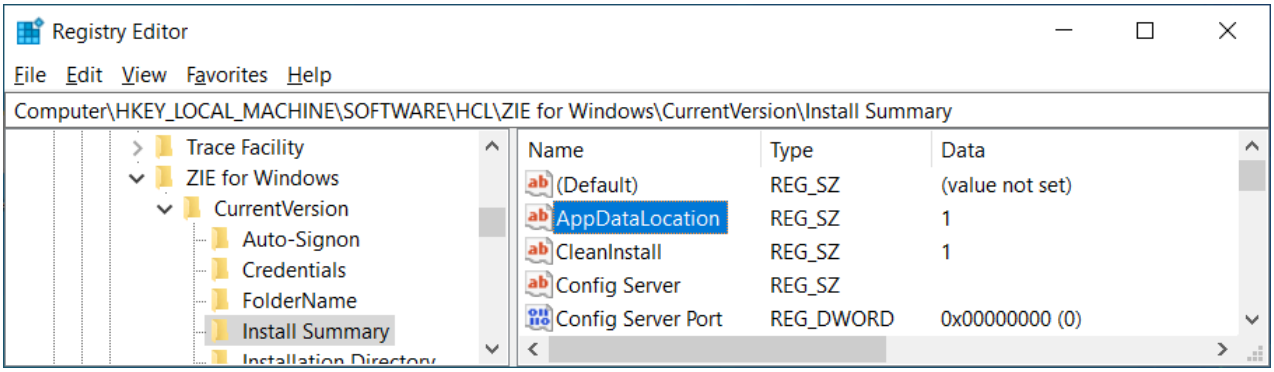


3. After successful configuration, a user can load all session files from OneDrive.

Execute the following steps to migrate the files to OneDrive after installing Z and I Emulator for Windows:

Note: Make sure that **AppDataLocation** registry is set to 1.

Registry path: *Computer\HKEY_LOCAL_MACHINE\SOFTWARE\HCL\ZIE for Windows\CurrentVersion\Install Summary*

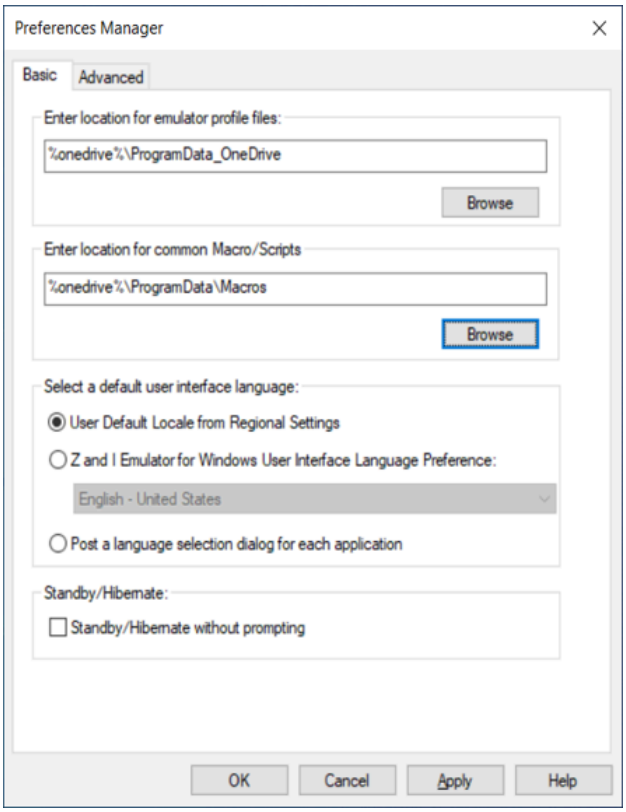


1. Open the Preference Utility.
2. Enter the **%OneDrive%** variable path under **Enter location for emulator profile files** field and click **OK**.
3. After successful configuration, a user can load all session files from OneDrive.

Configure Z and I Emulator for Windows Tool bar icons Directory with OneDrive

User can configure the “preferences” and load the customize icon/bitmap from “OneDrive”. Set the Keyword which needs be added under pcswin.ini as follows:

1. Open the **pcswin.ini** file.
2. Under the **[ToolBar]** section, set the **IconPath** to OneDrive path.



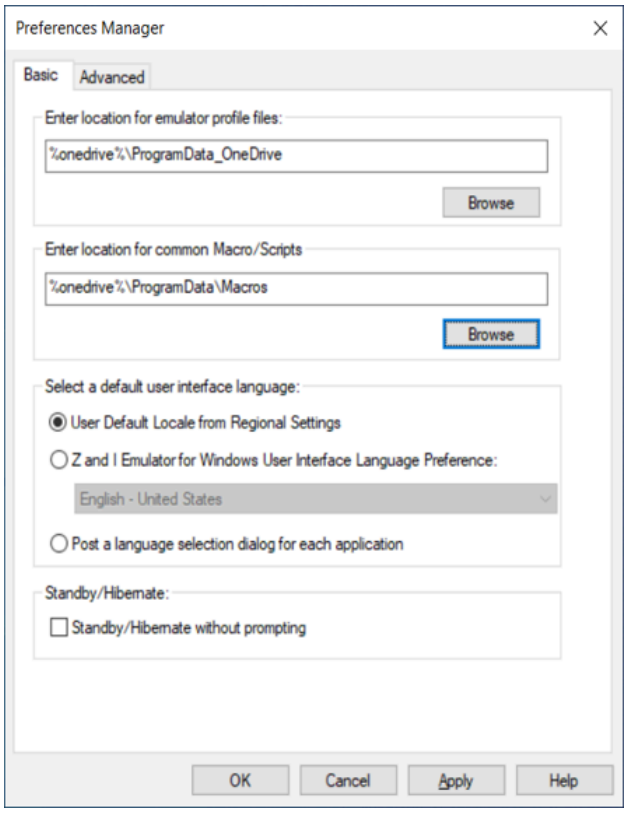
Once user configures the above keyword in pcswin.in, the tool bar files (*.bar) use the OneDrive path to load all the custom icons ignoring the local custom tool bar icon file path. The icon files are looked up in “IconPath” location with its name. If the file is not found, the user is informed with a message box and loads the default icon.

Configure Macro Directory with OneDrive

User can configure the preference and load the macros from “OneDrive”. Set the Keyword which needs be added under pcswin.ini as follows:

1. Open the **pcswin.ini** file.
2. Under the **[Macro]** section, set the **DIR** to OneDrive path.

Note: User can configure the same under “Enter location for common Macro/scripts” through **Preference Utility**.



Configure OneDrive Single Sign-On

1. Open the Preference Utility Manager (userpm).
2. Select the **OneDrive** checkbox.

   Note:

   - If the user is **not signed in** to OneDrive, a **OneDrive sign-in dialog** will appear.
   - If already signed in to OneDrive, the path `%onedrive%` is automatically set in the **Profile Directory** edit box.

3. Click the **Apply** button.

   Note:

- This action will store the `%onedrive%` path in the registry under the **profile directory key**.
- A registry key for **Onedrive Enabled** is also created or updated with the value **"T"** indicating that OneDrive is enabled.

Configure UI Synchronization for Session Files

1. Ensure the Profile Directory path is set to a OneDrive location.
2. Open the Session Manager (pcsfe) dialog box.
3. In the **Details** tab, a new **Status** column is visible if session files are loaded from OneDrive.

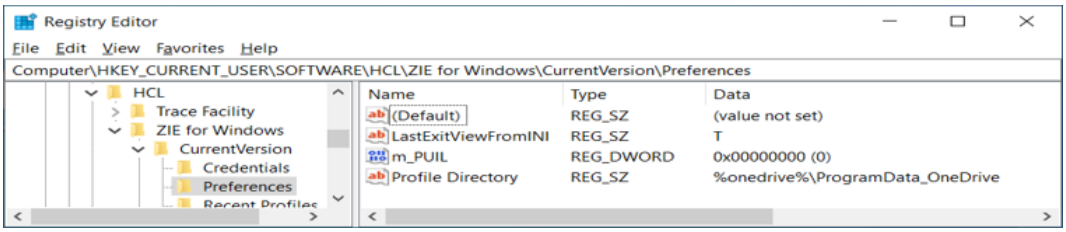
Note:

- If the Profile Directory is **not OneDrive**, the Status column is hidden.
- You can view the sync status in both **Large Icon View** and **Small Icon View**:
  - **Synced Sessions:** A green indicator appears at the **top-left corner** of the session icon.
  - **Not Synced Sessions:** The icon remains unchanged (no additional indicator is shown).

Limitations:

1. The given %onedrive% variable path will be expanded to full path in **Preferences** for a user**.** The variable path is stored in the following directory.

   Computer\HKEY_CURRENT_USER\SOFTWARE\HCL\ZIE for Windows\CurrentVersion\Preferences



2. All configuration files associated with session files can use the variable path, any change in session will rewrite the session file with full path.

Start a Z and I Emulator for Windows Session

The command PCOMSTRT has the following parameters:

/p

Name of workstation profile to start (required). The syntax is /p=*workstation-profile*. You can specify the workstation profile as either the path (drive, directory, and file name) or just the file name, in which case the location of the workstation profile file is the user-class application data directory.

Note: If multiple `/p` parameters are given, PCOMSTRT only uses the last one to start a profile (.WS file).

/s

Session letter of the session to start. The syntax is /s=*session-letter*. This is optional. If omitted, the first available session letter is used.

/w

Session window startup state. The syntax is /w={0|1|2|3}.

0

Hidden

1

Normal (default)

2

Minimized

3

Maximized

/q

Quiet mode. In quiet mode, PCOMSTRT does not write any messages to stdout.

/nowait

Do not wait for session to start. The /nowait option tells PCOMSTRT to complete execution without waiting until the emulator session is started. There is no /wait option; the default is to wait until the session is started.

/?

Displays help information.

Returns: DOS Error level is set for use when this command is invoked by a program. When the command is directly entered, a message indicating the session is starting is displayed.

Stop a Z and I Emulator for Windows Session

The command PCOMSTOP has the following parameters:

/s

Session letter of session to stop. The syntax is /s=*session-letter*. This is optional. If omitted, the first available session letter is used.

/all

Stops all sessions

/NCE

Stops all or specific session without confirmation, even if the confirmation on exit or exit all option are set.

/q

Quiet mode. In quiet mode, PCOMSTOP does not write any messages to stdout.

/?

Displays help information.

Query Z and I Emulator for Windows Sessions

The command PCOMQRY has the following parameters:

/s

Session letter of session to query, The syntax is /s=*session-letter*. This is optional. If omitted, the first available session letter is used.

/all

Queries all sessions.

/q

Quiet mode. In quiet mode, PCOMQRY does not write any messages to stdout.

/nowait

Do not wait for session to query. The /nowait option tells PCOMQRY to complete execution without waiting until the emulator session is queried. There is no /wait option; the default is to wait until the session is queried.

/?

Displays help information.

Chapter 4. Attachment Considerations and Adapter Setup Information

This chapter describes factors you should consider when configuring Z and I Emulator for Windows for the following attachment types:

- IBM-EEDLC on page 43
- TCP/IP Connection on page 44
- SDLC MPA Attachment on page 46
- IBM Global Network - SNA over Async Attachment on page 47
- IBM Global Network Connection Attachment on page 48
- Home3270 Attachment on page 48
- 3270 Attachment via the iSeries System on page 50
- IBM PC720 Modem Initialization (Japan only) on page 50
- 5250 Asynchronous Console on page 51

This chapter also contains information about setting up communications adapters (for example, MPA, SDLC). See the following topics:

- Creating and Updating Devices in Windows 8, Windows 8.1, or Windows 10 on page 51
- MPA Adapters on page 51
- OEM Adapters on page 54

Attachment Information

IBM-EEDLC

This section provides information, considerations, and restrictions for the Z and I Emulator for Windows IBM-EEDLC attachment.

TCP/IP Protocol Driver

You must set up your Windows® environment for the TCP/IP network. To verify that the TCP/IP protocol is installed on your workstation, view the properties for your network connection. Confirm that `TCP/IP` appears in the list of components for the connection. You can modify the TCP/IP properties, such as the IP address.

Concurrent IPv4 and IPv6 connections

For EEDLC, you can configure the link either by IP address or host name and run IPv4 and IPv6 connections concurrently.

1. For Enterprise Extender (HPR/IP), the ports at both ends of a link must use the same addressing format (IPv4 or IPv6).
2. If Communications Server for Windows® uses IPv4, it can connect only to remote systems that are configured to support IPv4.
3. If Communications Server for Windows® uses IPv6, you can configure it to use either IPv4 or IPv6, provided you have configured the respective Enterprise Extender port on the server. The option you choose must match the configuration at the remote system.
4. All links on the same Enterprise Extender port must use the same addressing format (IPv4 or IPv6).
5. If you need to support links with different addressing formats, you must use separate ports. Similarly, all Enterprise Extender ports on the same connection network must use the same addressing format.

TCP/IP Connection

This section provides information, considerations, and restrictions for Z and I Emulator for Windows TCP/IP connections.

TCP/IP Protocol Driver

You must set up your Windows® environment for the TCP/IP network. To verify that the TCP/IP protocol is installed on your workstation, double-click **Network** in your Control Panel and see if `TCP/IP` appears in the list of network components. Double-click **TCP/IP** to specify your IP address and other TCP/IP properties. You have to install IPv6 protocol to make use of IBM-EEDLC (IPv6) feature.

Screen Size

The following screen sizes are supported for TN3270:

24x80
32x80
43x80
27x132

The following two screen sizes are supported for TN5250:

24x80
27x132

Screen sizes 48x80, 62x160, and 24x132 are supported if your server/host supports the TN3270E protocol.

Terminal Type to Be Negotiated with TN3270

The terminal type to be negotiated is set to IBM-3278-2-E, IBM-3278-3-E, IBM-3278-4-E, or IBM3278-5-E according to the screen size that is specified on the **Customize Communication** 3270 Host panel. If you need to specify

IBM-3279-2-E or IBM-3279-3-E (for graphics), add the following line to the [Telnet3270] section in the workstation profile (.WS):

```
TerminalType=3279
```

Note: The following error message might be logged by z/OS console when the HCL Z and I Emulator for Windows version 6.0.2 with a 62x160 screen size is used:

```
"IEE936I CONSOLE HHSP0141 INITIALIZATION ERROR - RC:01 - 3277-2 IS ASSUMED"
```

z/OS console connection is made through the OSA-ICC telnet server. This server does not support the Terminal Type of IBM-DYNAMIC. To resolve the problem, take the following steps:

1. Edit the WS session profile.
2. Add the following statements under the Telnet3270 stanza to force HCL Z and I Emulator for Windows to use the original default string:

```
[Telnet3270]
TerminalTypeString=IBM-3278-2-E
```

TN3287 and TN3270E Connection

TN3287 (defined in RFC 1646) and TN3270E (defined in RFC 1647) were tested with following Telnet servers:

- Communications Server for Windows®
- Communications Server for OS/2®
- TN3287 Brixton PU2.1 V3.0
    - SNA Client Access™ for AIX® Version 1 Release 2
    - IBM® Communications Server for OS/2® Warp
- TN3270E Brixton PU2.1 V3.0
    - SNA Client Access™ for AIX® Version 1 Release 2
    - IBM® Communications Server for OS/2® Warp
- Microsoft® SNA Server

Other TCP/IP Functions

Backup Server/Host with LU Name and Port Number

Z and I Emulator for Windows enables you to specify up to two backup host or server names to connect to. This provides easier connections when the primary host or server cannot be reached. You can also specify a specific LU name or port number unique to that server or host.

Service Location Protocol

Z and I Emulator for Windows enables connection to SLP servers that are RFC 2165 compliant. This function eliminates the need for users to know the name of a network host supporting a specific service. SLP implementation for a Z and I Emulator for Windows client allows load balancing and dynamic location of a specific LU or LU pool across a group of servers. IBM® Communications Server for Windows® V6.1.x and V6.4 currently supports SLP. This support can be used in conjunction with SSL support.

SDLC MPA Attachment

This section describes factors you should consider when configuring Z and I Emulator for Windows with an SDLC attachment.

Line Speed

For the SDLC attachment, a line speed up to 28.8 Kbps is supported. However, actual line speed will vary depending on the carrier speed the modem supports.

V.25bis Autodial

Z and I Emulator for Windows only supports the bit-oriented protocol for V.25bis call control messages. Modems must support an ASCII-coded character set consisting of 7-bit coded ASCII characters with odd parity.

Z and I Emulator for Windows supports the following adapters:

- Multiprotocol (MPA) interface compatible adapters, for example:
  - IBM® Multiprotocol Communications Adapter (73G7099)
  - IBM® Multiprotocol Adapter/A (645114 or later)
  - IBM® SDLC/Async Communications Adapter (ASCA) (42H4332)
- IBM® SDLC PCMCIA adapter (Japan only)
- IBM® SDLC PCMCIA modem (Japan only)
- IBM® PCI Multiprotocol Adapter (12J2981)

Performance Considerations

If you use multiple sessions in a high-speed and high-load configuration with an SDLC attachment, the connection to the host might fail. In this case, set the host's timeout value to be greater than that of Z and I Emulator for Windows.

- To change the host timeout value, modify the following NCP parameters:

  REPLYTO

  The maximum duration in seconds that the host waits for a reply from the terminal. The default is 1 second.

RETRIES=(m,t,n)

The number of recovery attempts for errors occurring during transmission over the link. Repetitive retries are called a retry sequence. The maximum number of retries is specified as m, which can be from 0 to 128. NCP pause (the time between the retry sequences) is specified as *t* and can be from 1 to 255 seconds. The maximum number of retry sequences is specified by *n* and can be from 1 to 127. For example:

```
REPLYTO=1, RETRIES=(3,4,5)
(( 1(seconds) x 3(times) + 4(seconds)) x 5(times)
= 35 (seconds)
```

Note: In this example, the host waits 35 seconds for the terminal to reply.

For more details, ask your system personnel.

- To change the Z and I Emulator for Windows timeout value, type a new value in the Inactivity timer field on the Performance page of the Connections property sheet in SNA Node Configuration.

  The value is in seconds and can be from 40 to 160. The default is 80.

PIU Size

This value is negotiated between your workstation and the host system, unless `XID=No` is defined on the PU, or the Adjacent CP type has been changed to `Host - XID0` in SNA Node Configuration. If this value is not negotiated, the `Maximum PIU Size` must match the `MAXDATA` value defined on the host system.

Receive Window Count

This value is negotiated between your workstation and the host system, unless `XID=No` is defined on the PU, or the Adjacent CP type has been changed to `Host - XID0` in SNA Node Configuration. If this value is not negotiated, the `Receive Window Count` must match the `MAXOUT` value defined on the host system.

IBM Global Network® - SNA over Async Attachment

IBM Global Network® - SNA over Async is supported using 8-bit no parity; SNA session-level compression and decompression is not supported.

Line Speed

Line speeds up to 115.2 Kbps are supported. However, the maximum usable line speed depends on the speed of the processor or communication port. If communication stops or becomes exceedingly slow, reduce the line speed.

Updating Phone List

To update the phone number list for IBM Global Network® SNA over Async, do the following:

1. Click the **Use Phone Book** button on the **Define a Com Port Connection** panel.
2. Click the **Download Phone Numbers** button.

   Z and I Emulator for Windows FTPs to the IGN server and downloads the phone number file and converts it to the correct format.

   Note: A Proxy must be configured in order for this procedure to work.

IBM Global Network Connection Attachment

Note: This attachment type is not available in Japan.

IBM Global Network Connection supports only a single communication port.

Line Speed

IBM Global Network Connection supports up to 115.2 kbps as the line speed. However, the maximum usable line speed depends on the speed of the processor or communication port. If communication stops or becomes exceedingly slow, reduce the line speed.

Updating Phone List

To update the phone number list for IBM Global Network® SNA over Async, click the **Download Phone Numbers** button from the **Configuration** panel. When this button is selected, Z and I Emulator for Windows FTPs to the IGN server and downloads the phone number file and converts it to the correct format.

Note: A Proxy must be configured in order for this procedure to work.

Restrictions

You cannot use the following functions:

- Import/Export
- Host graphics
- Host print
- Server-Requester Programming Interface (SRPI)
- Concurrent multiple file transfers

Home3270 Attachment

Because Home3270 supports only a single COM port, only one session is available for use at a time.

Setting the Screen Colors in a Home3270 Session

Because protocol converters translate the 3270 (EBCDIC) data stream into an ASCII data stream, the original information about the 3270 fields is lost, and all the field attributes of the 3270 screen are treated as extended attributes. Because of this, you must select the **Extended Color** category in order to change the colors of characters on the screen. Changing base colors will have no effect.

For example, if you want to change the color of characters that appear in green on a black background, select **Extended Color - Green**, then click or drag-and-drop the color you want for the characters (and for the background if you wish). Do not change the appropriate **Base Color** because the change will have no effect.

Line Speed

Line speeds up to 115,200 bps are supported. However, characters might be lost on high-speed lines, depending on the processor speed. If communication stops or becomes exceedingly slow, reduce the line speed.

Unsupported Character Sequences

The following character sequences are valid for the Home3270 attachment. However, they perform no function.

- ESC P 1 (Block cursor command)
- ESC P 0 (Underline cursor command)
- DLE DC2 (Printer start command)
- DLE DC4 (Printer end command)

Conditions for Communication Check 50x

Home3270 requires both Data Set Ready (DSR) and Carrier Detect (CD) to determine the state of the attachment with the host system. If DSR is not recognized, communication check 501 appears in the operator information area. When DSR is recognized and CD is not recognized, communication check 504 appears in the operator information area.

When you select ROLMphone with DCM in the Home3270 configuration, communication check 504 does not appear.

Home3270 and OIA message COMM 504

If you run Home3270 sessions at a speed of 28.8 kbps or higher and the session disconnects with a COMM504 in the OIA, try lowering the port speed to equal the line speed of the Protocol Converter you are connecting to.

Note: DBCS is not available with this attachment.

Restrictions

The following functions are not available with this attachment:

- Host graphics
- Host print
- Server Requester Programming Interface

3270 Attachment via the iSeries System

This section provides information, considerations, and restrictions for PC/3270 connections through an iSeries™, eServer™ i5, or System i5™ system.

iSeries, eServer i5, or System i5 Setup

PC/3270 can connect to a host computer through one or more iSeries™, eServer™ i5, or System i5™ systems by using the passthrough function (usable with OS/400® Version 2.2.0 or later, or with i5/OS™).

To use this function, set the following communication configuration descriptions in the iSeries™, eServer™ i5, or System i5™ system to **on** (Vary On):

- Line description
- Controller description
- Printer description

Error Messages from the iSeries, eServer i5, or System i5

When the system is connected to a zSeries™ host system through an iSeries™, eServer™ i5, or System i5™, the following message might appear on the screen.

```
AS/400 CPI5xxx
```

The message might appear for the following reasons:

- Line error between the iSeries™, eServer™ i5, or System i5™ system and the host system
- Communication configuration description error in the iSeries™, eServer™ i5, or System i5™ system
- The communication configuration description in the iSeries™, eServer™ i5, or System i5™ system is set to off (Vary Off)

When this message appears, detailed error information is saved in the iSeries™, eServer™ i5, or System i5™ system operator message queue. Refer to the error message that corresponds to the number displayed on the screen and then correct the cause of the error.

IBM PC720 Modem Initialization (Japan only)

In the Japanese version of Z and I Emulator for Windows, if you use an IBM® PC720 and connect it via a dial connection, the error message "`COMDIA15 Unable to initialize modem`" may appear at startup. To correct this condition, increase the value of **Retries** in **Initialization** to more than 1 by using the **Modem Information** panel.

5250 Asynchronous Console

For the asynchronous console attachment, you must have a 2609 or 2612 adapter for the Multiple Function I/O Processor (MFIOP) on the iSeries™, eServer™ i5, or System i5™ system. This connection also requires a special cable. The part numbers for the cables are 46G0450 (6m) and 46G0479 (2.5m).

Note: The iSeries™ Advanced Portable Model P02 does not support the asynchronous console attachment.

An asynchronous console has the following restrictions:

- Multiple console sessions cannot be used.
- APIs are not supported
- The session type cannot be set to the **Printer**.
- The file transfer functions is not supported.
- The PC Organizer cannot be used.

Adapter Setup Information

The following sections provide additional information about configuring adapters, including PCMCIA and PCI cards.

Creating and Updating Devices in Windows 8, Windows 8.1, or Windows 10

In Windows® 8, Windows® 8.1, or Windows® 10 and later operating system, Z and I Emulator for Windows does not install drivers for communications adapters (MPA and SDLC). You have to install the drivers and create devices using the Windows® Hardware wizard or the Device Manager. You must use that process for both Plug-and-Play and non-Plug-and-Play adapters. The drivers and .INF files are located on the Z and I Emulator for Windows installation image in the `\admin\drivers` subdirectory.

If you are installing Z and I Emulator for Windows Version 1.0 on Windows® 8, Windows® 8.1, or Windows® 10 or later operating system over a previous release of Z and I Emulator for Windows, and you are using a communications adapter, you should update the existing driver using the Windows® Device Manager.

Not all communications adapters listed here are supported for Windows® 8, Windows® 8.1, or Windows® 10 and later operating system.

Note: For more information about driver installation, updating drivers, and adapter setup, refer to the *CD-ROM Guide to Installation*.

MPA Adapters

Preventing Conflicts with Non-PCI MPA Adapters

The multiprotocol adapters use system resources that, in some cases, cannot be shared. Therefore, you must make sure there are no conflicts with the following resources:

- DMA level
- I/O addresses (MPA0 uses X'380'–X'38F' and MPA1 uses X'3A0'–X'3AF')
- IRQ level (ISA bus only)

The IBM® Multiprotocol interface adapters use the following system resources:

- The ISA-bus SDLC adapters require the use of IRQ3 and DMA channel 1 and only the MPA0 communication port is supported.
- The MPA for ISA can be supported using mode 4 (IRQ3 and DMA1 channel 1) or mode A (IRQ4 and DMA channel 1). IRQ level send/receive of 3 or 4 is supported. The ASCA can be supported using mode 4 (IDQ3 or IRQ5 or IRQ4 or IRQ7 and DMA channel 1) or mode A (IRQ4 or IRQ7 and DMA channel 1). IRQ level send/receive or 3, 4, 5, or 7 is supported. The interrupt level setting on the configuration panel in Z and I Emulator for Windows must match the value on the adapter card.

  Note: When the MPA is configured for mode 4, the device is not allowed to use the other IRQ even though only one interrupt is claimed.

  Z and I Emulator for Windows supports the MPA0 or MPA1 communication ports. Some sound cards use an I/O address within the range X'380'–X'38F'. MPA1 should be used to avoid a conflict.
- The MPA/A for a microchannel-bus workstation uses IRQ3, and the DMA level can be configured. Both the MPA0 and MPA1 communication ports can be active at the same time and the interrupt is claimed as sharable.

IBM® SDLC PCMCIA Adapter and Modem (Japan Only)

Only one SDLC PCMCIA card can be used at a time. Because a common driver supports both SDLC PCMCIA and MPA interface cards, an MPA cannot be used concurrently with SDLC PCMCIA.

See Creating and Updating Devices in Windows 8, Windows 8.1, or Windows 10 on page 51.

IBM® SDLC PCMCIA Adapter

The IBM® SDLC PCMCIA adapter supports:

- Leased and switched connections
- Speeds up to 19.2 Kbps

- Switched and Constant Request To Send (RTS)
- NRZ and NRZI encoding schemes

The IRQ number on the device page's adapter property sheet is ignored.

IBM SDLC PCMCIA Modem

The IBM® SDLC PCMCIA modem supports:

- Switched V.26bis connections only
- Speeds up to 2400 baud
- Switched RTS only

The configured value on the constant RTS and IRQ level send/receive device page's adapter property sheet are ignored.

IBM PCI Multiprotocol Adapter

Two IBM® PCI Multiprotocol Adapters can operate concurrently. The configuration specifies one adapter with Communication Port MPA0 and the second adapter with Communication Port MPA1. When the link is activated, MPA0 is the first PCI Multiprotocol Adapter that the operating system finds and MPA1 is the second adapter found. If more than one PCI Multiprotocol adapter is installed on a machine and you are unsure which adapter the operating system will find first, you may want to perform an isolated test to determine which adapter is connected to which Communication Port. One suggestion is to disconnect the modems connected to the adapter from the telephone line and then try to start each link individually. By watching the modems, you should be able to determine which modem is connected to which Communication Port. Then the modems can be attached to the proper network. If a single PCI Multiprotocol Adapter is used, the configuration file must specify MPA0 as the Communication Port.

Note: If a Z and I Emulator for Windows configuration is using this adapter, and a PCI MPA adapter is added or removed from the system, Z and I Emulator for Windows may have to be reconfigured.

An ISA-bus MPA and IBM® PCI Multiprotocol Adapter can be used concurrently, as long as the ISA-bus MPA adapter is configured as MPA1.

The IBM® PCI Multiprotocol Adapter supports:

- Leased and switched connections
- Speeds up to 56 kbps
- Switched and Constant Request To Send (RTS)
- NRZ and NRZI encoding schemes

The IRQ number on the device page adapter property sheet is ignored.

OEM Adapters

Z and I Emulator for Windows has an open API that enables vendors and other equipment manufacturers (OEMs) to provide adapter cards that allow for additional connectivity options, for example, additional X.25, ISDN, or SDLC support. After installing the OEM adapter, you can begin to configure it in the usual manner described in *Quick Beginnings*. However, at some point in the configuration process you may need to provide information required by the manufacturer of the OEM adapter card.

Chapter 5. System Policy Support

System policies allow the user to control the actions that a user is permitted to perform.

Any application or component can define a policy. The policy appears in the administrator user interface; information that the user sets about the policy migrates to the local computer's registry. The application or component that defines a policy must check the registry to enforce its policy.

We provide support for both.*ADM* and.*ADMX* policy template files. These template files allow the users to enforce policy restrictions on various features—these files are package under the **Docs-Admin-Aids**.

Using ADM File Format:

1. Categories, policies, and parts are described in a policy template (*.ADM) file. The *Microsoft Resource Kit* includes three policy template files: WINNT.ADM, COMMON.ADM, and WINDOWS.ADM. Applications or components can also provide their own policy template files.

   Note: Z and I Emulator for Windows supplies a policy template for each language currently supported. For example, the policy template for the US English language is named ENUPOL.ADM and the policy template for the French language is named FRAPOL.ADM.

2. The user run the policy editor, which reads one or more policy templates and lists the available categories and policies. The user set up the desired policies, and the policy editor uses registry functions to save the work to a policy (*.POL) file. A group policy editor is provided with Windows®. Documentation about the use of Microsoft® policy editors is found at http://www.microsoft.com.
3. After the user logs on (and user profiles are reconciled if they are enabled), the policy downloader determines where to find the file on the network, opens the policy file, and merges the appropriate computer, user, and user group policies into the local registry.

Using ADMX File Format:

ADMX file is a Windows Group Policy settings XML-based file that serves as a replacement for the older ADM file type. ADMX files were introduced in Windows Vista and Windows Server 2008 and are referred to as “Administrative Template XML-Based files”.

Z and I Emulator for Windows provides a policy template files (***pol.ADMX and ***pol.ADML) for each language. The templates are on the **Docs-Admin-Aids** in the admin directory. The admin users configure the desired policies to enforce policy restrictions on various features.

ADMX files must be copied under the “**C:\Windows\PolicyDefinitions”.** To import Z and I Emulator for Windows policy ***pol.ADMX template files, copy them to the “**PolicyDefinitions”** folder.

Each ADMX has a corresponding language ADML policy template file and must be copied under the respective language folder under “**PolicyDefinitions”.**

For example: For US English language, please copy the enupol.ADML files under

"**en-US**" is the subfolder under "PolicyDefinitions".

Run the windows group policy editor which reads the imported ADMX/ADML file and a new entry of "HCL Z and I Emulator for Windows" is populated under the "Administrative Templates".

The users can navigate to the "HCL Z and I Emulator for Windows" policy categories and modify configuration settings. Find the following **Group Policy** options:

- **Not Configured**: This option does not enforce the policy restriction.
- **Enabled**: This option does not enforce the policy restriction.
- **Disabled**: This option enforces the policy restriction.

Note: When using the group policy editor provided with Windows 2000, the Not Configured setting allows the same permission or access to features as the Enabled setting. HCL Z and I Emulator for Windows provides its policy template file (PCSPOL.ADM).

It contains one category of type USER. Within the HCL Z and I Emulator for Windows category are the following policies:

- **Configuration**: Contains policy information related to configuration.
- **Execution**: Contains policy information related to the execution.
- **Installation**: Contains policy information related to removing HCL Z and I Emulator for Windows.
- **View**: Contains policy information related to changing the session window view.

Disable Licensing:

This policy controls the user's ability to disable the licensing.

The group policy editor has the following options to enforce ***"Disable Licensing"***:

- **Not Configured**: This option does not enforce the policy restriction for ***"Disable Licensing"***.
- **Enabled**: This option enforces the policy restriction for ***"Disable Licensing"***.
- **Disabled**: This option does not enforce the policy restriction for ***"Disable Licensing"***.

Note: If a user enforces the ***"Disable Licensing"*** through the group policy editor, it won't allow a user to enable ***"Disable Licensing"*** through Preference Manager.

Configuration Policy

This category contains policy information related to configuration.

Communication

This policy category controls the user's ability to change configuration information pertaining to communication. This includes both emulator configuration (modified by selecting the **Communication → Configure** menu) and the SNA node configuration utility (PCSCFG.EXE).

The "Not Configured" and "Disabled" options under the "Policy Editor" does not impose any policy restriction.

The Communication Configuration drop-down list contains the following options.

No Access

The user has no access to communication information. However, this does not prevent the user from changing the communication configuration information by manually editing the .WS file, the .ACG file, or both. This is the most restrictive level of control.

Write

The user can read preconfigured communication information, and can make temporary and permanent changes to the communication configuration information. This is the least restrictive, and is equivalent to the level of control in which users operate without policy support.

Menu

This policy controls the user's ability to read and change configuration information pertaining to the menu.

The "Not Configured" and "Disabled" options under the "Policy Editor" does not impose any policy restriction.

When the Menu Configuration policy is enabled, the drop-down list contains the following options.

No Access

The user has no access to menu configuration information; that is, the user cannot read preconfigured menu configuration information or change menu configuration information. This means that any menu configuration information contained in the .WS file (specifically, in the [Menu] stanza) or the PCSWIN.INI file (modified by selecting the **View → Show → Menu** menu) is ignored, and the user cannot execute the menu bar customization utility (pcscmenu.exe).

The difference between this item and the **Read** item is that this item ignores updates to the menu configuration information that the user may have made while manually editing the .WS file or PCSWIN.INI file. This means that the user can use only the product default menu configuration, and that

you cannot set up modified menu configurations to be used by users who have No Access. This is the most restrictive level of control.

Read

The user can only read preconfigured menu information. This means that menu configuration information contained in the .WS file (specifically, in the [Menu] stanza) and the PCSWIN.INI file (modified by selecting the**View → Show → Menu** menu) is *not* ignored, but the user cannot update the menu by selecting **View → Show → Menu** or the menu bar customization utility (pcscmenu.exe). The difference between this item and the **No Access** item is that this item does not prevent the user from updating the menu configuration information by hand editing the .WS file or the PCSWIN.INI file. However, unlike the **No Access** item, this item allows an administrator to set up modified menu configurations to be used by users who have *Read* access. This is less restrictive than **No Access**.

Write

The user can read preconfigured menu information, and can make permanent changes to the menu configuration information. This is the least restrictive item, and is equivalent to the level of control in which users operate without policy support.

Toolbar

This policy controls the user's ability to read and change configuration information pertaining to the toolbar.

The “Not Configured” and “Disabled” options under the “Policy Editor” does not impose any policy restriction.

When the Toolbar Configuration policy is enabled, the drop-down list contains the following options.

No Access

The user has no access to toolbar configuration information; that is, the user cannot read preconfigured toolbar configuration information or change (temporarily or permanently) toolbar configuration information. This means that any toolbar configuration information contained in the .WS file (specifically, in the [Toolbar] stanza) or the PCSWIN.INI file (modified by selecting the **View → Show → Tool Bar** menu) is ignored. The difference between this item and the **Read** item (described later) is that this item ignores updates to the toolbar configuration information that the user may have made while manually editing the .WS file or the PCSWIN.INI file. This means that the user can use only the product default toolbar configuration, and that you cannot set up modified toolbar configurations to be used by users who have **No Access**. This is the most restrictive level of control.

Read

The user can only read preconfigured toolbar information. This means that toolbar configuration information contained in the .WS file (specifically, in the [Toolbar] stanza) and the PCSWIN.INI file (the results of manipulating the **View → Show → Tool Bar** menu) is *not* ignored, but the user cannot change (temporarily or permanently) the toolbar configuration information. The difference between this item and the **No Access** item is that this item does not prevent the user from updating the toolbar configuration information by hand editing the .WS file or the PCSWIN.INI file. However, unlike the **No**

Access item, this item allows an administrator to set up modified toolbar configurations to be used by users who have **Read** access. This is less restrictive than **No Access**.

Write

The user read preconfigured toolbar information, and can make temporary or permanent changes to the toolbar configuration information. This is the least restrictive item, and is equivalent to the level of control in which users operate without policy support.

Multiple Sessions

This policy controls the user's ability to read, execute, and change configuration information pertaining to multiple sessions with the multiple sessions utility (PCSBAT.EXE).

The “Not Configured” and “Disabled” options under the “Policy Editor” does not impose any policy restriction.

When the Multiple Sessions policy is enabled, the drop-down list contains the following options.

No Access

The user has no access to multiple session configuration information; that is, the user cannot read or execute preconfigured multiple session configuration information or change multiple session configuration information. This means that the user cannot execute the multiple sessions utility (PCSBAT.EXE). This is the most restrictive level of control.

Read

The user can only read and execute preconfigured multiple session information. This means that the user can execute the multiple sessions utility (PCSBAT.EXE) to read multiple session configuration information, or execute the multiple sessions utility (PCSBAT.EXE) to execute preconfigured multiple session information. However, the user cannot save any changes made to the multiple session configuration information. This is less restrictive than **No Access**.

Write

The user can read and execute preconfigured multiple session information, and can make permanent changes to multiple session configuration information. This is the least restrictive item, and is equivalent to the level of control in which users operate without policy support. This setting allows the user access to the Modify function in the Session Manager window.

Keyboard

This policy controls the user's ability to read and change configuration information pertaining to the keyboard.

The “Not Configured” and “Disabled” options under the “Policy Editor” does not impose any policy restriction.

When the Keyboard Configuration policy is enabled, the drop-down list contains the following options.

No Access

The user has no access to “Keyboard Setup” dialog (“Settings” → “Keyboard…”) and change the configuration by editing the .WS file (specifically, in the [Keyboard] stanza) and the PCSWIN.INI file. This is the most restrictive level of control.

Read

The user can only read the preconfigured information under the “Keyboard Setup” dialog and can change the configuration by editing the.WS file (specifically, in the [Keyboard] stanza) and the PCSWIN.INI file. This is less restrictive than **No Access**.

Write

The user can read preconfigured keyboard information, and can make temporary or permanent changes to the keyboard configuration information. This is the least restrictive item, and is equivalent to the level of control in which users operate without policy support.

The default item for the keyboard configuration part is Write.

Mouse

This policy controls the user's ability to read and change configuration information pertaining to the mouse.

The “Not Configured” and “Disabled” options under the “Policy Editor” does not impose any policy restriction.

When the Mouse Configuration policy is enabled, the drop-down list contains the following options:

No Access

The user has no access to “Mouse Setup” dialog (“Settings” → “Mouse…”) and change the configuration by editing the .WS file (specifically, in the [Mouse] stanza) and the PCSWIN.INI file.

This is the most restrictive level of control.

Read

The user can only read the preconfigured information under the “Mouse Setup” dialog (“Settings” → “Mouse…”) and can change the configuration by editing the.WS file (specifically, in the [Mouse] stanza) and the PCSWIN.INI file. This is less restrictive than **No Access**.

Write

The user read preconfigured mouse information, and can make temporary or permanent changes to the mouse configuration information. This is the least restrictive item, and is equivalent to the level of control in which users operate without policy support. The default for the mouse configuration part is Write

Change Directory

This policy controls the user's ability to select sessions and batch files in directories other than the application data location, from the Session Manager window.

Import

This policy controls the user's ability to import .WS files from the Session Manager

Execution Policy

This category contains policy information related to execution.

Dynamic Menu Modification

This policy controls whether or not DDE applications executed by the user are permitted to dynamically add themselves to the menu of an active session.

Java™ Applet

This policy controls the user's ability to execute Java™ applets from the **Actions → Run Java™ Applet** menu.

Macro Play/Record

This policy controls the user's ability to play and record macros.

The “Not Configured” and “Disabled” options under the “Policy Editor” it does not impose any policy restriction.

The Macro Play/Record drop-down list has the following options:

No Access

The user has no access to macros; that is, the user cannot play or record macros. This is the most restrictive level of control.

Play

The user can play macros.

Record

The user can play and record macros.

Start Session

This policy controls the user's ability to minimize an emulator session window.

Minimize Session

This policy controls the user's ability to minimize an emulator session window.

Maximize Session

This policy controls the user's ability to maximize an emulator session window.

Close Session

This policy controls the user's ability to close an emulator session window.

Delete Session

This policy controls the user's ability to delete an emulator session from the Session Manager window.

Product Update

This policy controls the user's ability to start the Product Update Tool.

Detect and Repair

This policy controls the user's ability to utilize the Help Detect and Repair function.

File Transfer

This policy controls the user's ability to send or receive files from the host.

Installation Policy

This category contains policy information related to installing or removing Z and I Emulator for Windows.

Uninstall

This policy controls the user's ability to uninstall HCL Z and I Emulator for Windows.

View Policy

This category contains policy information related to changing the session window.

Menu Bar

This policy controls whether the user can view the menu bar.

Select Disable to hide the menu bar. The Not Configured or Enabled settings retain the menu bar in the session window.

Tool Bar

This policy controls whether the user can view the tool bar.

Select Disable to hide the tool bar. The Not Configured or Enabled settings retain the tool bar in the session window.

Status Bar

This policy controls whether the user can view the status bar.

Select Disable to hide the status bar. The Not Configured or Enabled settings retain the status bar in the session window.

Expanded OIA

This policy controls whether the user can view the expanded OIA.

Select Disable to hide the status bar. The Not Configured or Enabled settings retain the expanded OIA in the session window.

Quick Connect Bar

This policy controls whether the user can view the Quick Connect Bar. Select Disable to hide the Quick Connect Bar. The Not Configured or Enabled settings retain the Quick Connect Bar in the session window.

Chapter 6. Configuring and Using Security for Z and I Emulator for Windows

Z and I Emulator for Windows provides session security using IBM Global Security Kit (GSKit) and Microsoft CryptoAPI (MSCAPI). These packages enable use of the Transport Layer Security (TLS) security protocols.

The configuration information in this chapter usually applies to TLS. See Using Transport Layer Security on page 92 for more information.

You can display information about the security aspects of your session by clicking **Communication → Security Information** from the session menu bar. This provides details about the certificates exchanged during TLS negotiations between client and server.

A TLS session is established in the following sequence:

1. The client and the server exchange hello messages to negotiate the encryption algorithm and hashing function (for message integrity) to be used for the session.
2. The client requests an X.509 certificate from the server to verify the identity of the server. Optionally, the server can request a certificate from the client (known as *Client Authentication*).

   The digital signature of the certificate authority (CA) is authenticated using a published *root* certificate of the issuing CA. The client automatically decrypts certain information on the presented certificate using a *public* key on the CA's root certificate. This step is successful only when the presented certificate was encrypted using a well-guarded, unique, and corresponding *private* key, known only to the CA. This process can detect (and reject) intentional alterations (forgeries) and the rare garbling that can occur over data circuits. Z and I Emulator for Windows also allows users to use self-signed certificates for this purpose.
3. Once the certificate-issuer authentication step succeeds, the client and server negotiate for an encryption key to be used during the ensuing data exchange session. The client randomly generates a set of keys to be used for encryption. The keys are encrypted with the server's public key and are securely communicated to the server.

When a secure connection is established, a padlock icon is displayed in the Z and I Emulator for Windows status bar. Depending on the level of encryption, the icon is accompanied by a number (0, 40, 56, 128, 168, 256). If the session is not TLS-based, the icon shows as unlocked.

Certificates

Security is controlled by digital certificates that act as electronic ID cards. The purpose of a certificate is to assure a program or a user that it is safe to allow the proposed connection and (if encryption is involved) to provide the necessary encryption/decryption keys. They are usually issued by Certificate Authorities (CAs), which are organizations that are trusted by the industry as a whole and who are in the business of issuing of Internet certificates. A CA's certificate, which is also known as a root certificate, includes the CA's signature and a validity period, among other things.

Encryption and authentication are performed by means of a pair of keys, one public and one private. The public key is embedded in a certificate, known as a site or server certificate. The certificate contains several items of information, including the name of the Certificate Authority (CA) that issued the certificate, the name and public key of the server or client, the CA's signature, and the date and serial number of the certificate. The private key is created when you create a self-signed certificate or a CA certificate request and is used to decrypt messages from clients.

Certificate Migration

Z and I Emulator for Windows provides a utility for migrating personal or signer certificates from GSKit to MSCAPI. Click the **Certificate Migration** icon in the **HCL Z and I Emulator for Windows → Administrative and PD Aids** menu to start the utility. You will be required to enter the key database password.

The utility can be used to automatically migrate the selected certificate in the following paths:

- From GSKit Personal store to Windows Personal store
- From GSKit Signer store to Windows Trusted Root Certificate Authority store

You can also manually place certificates in each of the stores.

Managing Certificates in the Microsoft Certificate Stores

In order to connect secure sessions using the Microsoft CryptoAPI (MSCAPI) security package, the appropriate certificates must exist in the Microsoft Certificate Stores. To connect to a secure host, the root certificate of the host certificate's verification chain must be in the Trusted Root Certification Authorities store. To connect a secure client authentication session, the client certificate must be in the Personal store.

To add, remove, and view certificates in the Microsoft Certificate Stores, select **Internet Options** in the Windows Control Panel. On the **Content** tab, click **Certificates**. The tabs represent the different Microsoft Certificates Stores. Each tab shows the certificates that exist within each store.

To add a certificate to a store, click **Import**; the **Certificate Import** wizard helps you import certificates from a file. The Import wizard can import certificates from several types of certificate files, including the ARM, DER, and P12 formats that can be extracted or exported from the Certificate Management utility.

Configuring and Using Secure Sockets Layer

The purpose of basing communications on TLS is to provide privacy and integrity during communication over an unsecured TCP/IP connection between a client and a target server. This section briefly describes how to configure the Z and I Emulator for Windows client to use this mode.

Z and I Emulator for Windows provides two ways to manage certificates for use with the GSKit security package:

- Using Certificate Management on page 72
- Using the IKEYCMD Command-Line Interface on page 79

Preparation for TLS Communication

There is a division of labor for TLS configuration tasks. The configurations of the client and the server are coordinated to achieve the required compatibility. The following sections describe the preparation tasks required for client configuration and server configuration.

Server and Related Client Configuration

The administrator of a target server must have completed at least one of the following:

- **Equip the server with an appropriate class X.509 certificate from a well-known Certificate Authority (CA).** The administrator will have created a public/private key pair, submitted a request to the CA for a certificate, and received and activated that server certificate. By definition a *well-known CA* is one whose root certificates are already stored in the Z and I Emulator for Windows PCommClientKeyDb.kdb database file or Microsoft Certificate Store—see Connecting to a Server Using a Certificate from a Well-Known CA on page 73 for a list of these.

  Note: You must also equip the client with an X.509 personal certificate from the same certificate authority (CA) to enable client authentication.

- **Equip the server with an appropriate class X.509 certificate from an unknown CA.** The procedure is the same as the step above with the added necessity of obtaining the root certificate from the *unknown* CA. Usually the administrator of the target server will distribute the appropriate root certificate which must then be added to the PCommClientKeyDb.kdb database file.

  Note: You must also equip the client with an X.509 personal certificate from the same certificate authority (CA) to enable client authentication.

- **Equip the server with a self-signed X.509 certificate.** The administrator of the target server can do this as an interim measure while waiting for a CA's certificate. A copy of that certificate must be added to the client PCommClientKeyDb.kdb database file. The distribution must be done in a secure manner to guard the privacy and integrity offered by SSL.

  Note:

  1. You must also equip the client with an X.509 personal certificate from the same certificate authority (CA) to enable client authentication.
  2. You must also add a copy of this certificate to the server's key database.

Client Configuration

The following elements must be configured on the client side to enable TLS using the GSKit security package:

- **PCommClientKeyDb.kdb** is a certificate management database that is automatically created in the user-class application data directory when Z and I Emulator for Windows is installed. It is password protected. The default password is *pcomm* and is generated when PCommClientKeyDb.kdb is initially created by Z and I Emulator for Windows. To assure the continued integrity of PCommClientKeyDb.kdb, change the default password to a password or passphrase that is not easily guessed. See Changing the Password of a Client's Key Database on page 72 for instructions on changing the password. As installed, this database contains a list of well-known CAs and their root certificates that will be sufficient for the majority of TLS client users for server-side authentication. If the target server uses a certificate from one of those well-known CAs, the client user does not need to modify the PCommClientKeyDb.kdb other than to change the default password for server-side authentication. See the notes in Server and Related Client Configuration on page 66.
- **PCommClientKeyDb.sth** is a password stash file that is automatically created when Z and I Emulator for Windows is installed. By default, Z and I Emulator for Windows clients try to use the password stash file at runtime. The password or passphrase used to protect PCommClientKeyDb.kdb is encrypted and stored in this stash file for use by Z and I Emulator for Windows. Every time the password is changed on PCommClientKeyDb.kdb, this stash file must be regenerated. Otherwise, TLS mode will not operate. See Changing the Password of a Client's Key Database on page 72 for instructions on changing the password.

  Note: The use of a password stash file is strongly discouraged; the protection for these files is not strong.

  Z and I Emulator for Windows allows the option to not use the PCommClientKeyDb.sth password stash file. In order to operate without the stash file, erase the PCommClientKeyDb.sth file from the user-class application data directory; then, during TLS session configuration, select the **Prompt for Password Once** radio button in the **Security Setup → Advanced** dialog. This option is available only for GSKit security.
- Security must be enabled in order to operate in TLS mode. A client operating in TLS mode cannot establish a connection with a server that is operating in ordinary Telnet mode. Likewise, a client operating in ordinary Telnet mode cannot establish a connection with a server operating in TLS mode. See Configuring Z and I Emulator for Windows Session Security on page 68 for information about enabling security.
- Select **Send Personal Certificate to Server if Requested** on the **Security Setup** property page for client authentication. If this option is not selected, only server-side authentication is performed. If the server requests a client certificate and this option is not selected, there will be no active connection. See Opening a Key Database and Adding a Root Certificate on page 74 for details.

To add, remove, and view certificates in the Microsoft Certificate Stores, select **Internet Options** in the Windows Control Panel. On the **Content** tab, click **Certificates**. The tabs represent the different Microsoft Certificates Stores. Each tab shows the certificates that exist within each store.

Establishing a Secure Session

Upon establishing a preliminary connection with a target server, the Z and I Emulator for Windows client is presented a certificate by that server; if you have enabled client certificate authentication, your certificate is likewise presented to the server. The digital signature of the CA is authenticated using a published *root* certificate of the issuing CA.

The client automatically decrypts certain information on the presented certificate using a *public* key on the CA's root certificate. This step is successful only when the presented certificate was encrypted using a well-guarded, unique, and corresponding *private* key, known only to the CA. This process can detect (and reject) intentional alterations (forgeries) and the rare garbling that can occur over data circuits.

Z and I Emulator for Windows also allows users to use self-signed certificates for this purpose.

Note:

Once this certificate-issuer authentication step succeeds, the client and server negotiate to agree on an encryption key to be used during the ensuing data exchange session.

Configuring Z and I Emulator for Windows Session Security

Whether you are configuring a TN3270, TN5250, or VT session, the underlying protocol must be TCP/IP. Use the following procedure to enable security:

1. Start a workstation profile from the Session Manager; or, from an active session, click **Configure** from the **Communication** menu. When the dialog box opens, click **Configure**.
2. In the Customize Communication panel, choose the appropriate Type of Host, Interface, and Attachment values for the desired Telnet host.
3. Click **Link Parameters**.
4. On the **Host Definition** property page, do the following:
    a. Enter the **Host Name or IP Address**.
    b. Enter the **LU or Pool Name**.
    c. Enter the **Port Number**.
    d. To establish a secure connection on the port for a specific host, select the corresponding **Enable Security** checkbox.
    e. Click **OK** to save the settings.
5. For 3270 sessions, select the **Telnet-negotiated** option to have Z and I Emulator for Windows negotiate security with the Telnet 3270 server. See Negotiated Telnet Security on page 93 for details. If Enable Security is unchecked, the Telnet-negotiated option cannot be selected.
6. On the **Security Setup** property page, select the **IBM Global Security Kit (GSKit)** or **Microsoft CryptoAPI (MSCAPI)** security package.

    Note: To avoid the need of manually adding host certificate into the Microsoft Certificate Store, refer to **Pass Through Certificate Validation**.

7. For GSKit, you can click **Advanced** to control key ring access password options and Smart Card setup.

    In the **Key Ring Access** group box, you can choose whether or not to use the key database password stash file. Select **Use Password Stash (STH) File** to use key database stash file and not be prompted for the key database file password. You can use this option with or without the Client Authentication function.

Select **Cryptographic Support** to enable Smart Card use. Click **Setup** to enter module and token information.

8. Use the **Security Protocol** drop-down list to choose TLS protocol for negotiation of the secure session. The supported TLS protocols are TLS 1.2, TLS 1.1, and TLS 1.0.

   If the host does not support the selected TLS security protocol, Z and I Emulator for Windows will drop down to the next lower level of security protocol, and continue negotiations to establish a secure session. For example, if TLS1.2 is chosen from the Security Protocol drop-down box, and the host supports only up to TLS1.0, then the negotiation is carried out at TLS1.0.

9. To protect against security vulnerability in RC4 stream cipher, the FIPS (Federal Information Processing Standard) mode has been made mandatory.

   For GSKit, the following FIPS-approved cipher suites are available:
   - FIPS Allowed TLSV10 CipherSpecs:
     - TLS_RSA_WITH_AES_128_CBC_SHA
     - TLS_RSA_WITH_AES_256_CBC_SHA
     - TLS_RSA_WITH_3DES_EDE_CBC_SHA
   - FIPS Allowed TLSV11 CipherSpecs:
     - TLS_RSA_WITH_AES_128_CBC_SHA
     - TLS_RSA_WITH_AES_256_CBC_SHA
     - TLS_RSA_WITH_3DES_EDE_CBC_SHA
   - FIPS Allowed TLSV12 CipherSpecs:
     - TLS_RSA_WITH_AES_128_CBC_SHA
     - TLS_RSA_WITH_AES_256_CBC_SHA
     - TLS_RSA_WITH_3DES_EDE_CBC_SHA
     - TLS_RSA_WITH_AES_128_GCM_SHA256
     - TLS_RSA_WITH_AES_256_GCM_SHA384
     - TLS_RSA_WITH_AES_128_CBC_SHA256
     - TLS_RSA_WITH_AES_256_CBC_SHA256
     - TLS_ECDHE_RSA_WITH_3DES_EDE_CBC_SHA
     - TLS_ECDHE_RSA_WITH_AES_128_CBC_SHA
     - TLS_ECDHE_RSA_WITH_AES_256_CBC_SHA
     - TLS_ECDHE_ECDSA_WITH_AES_128_CBC_SHA256
     - TLS_ECDHE_ECDSA_WITH_AES_256_CBC_SHA384
     - TLS_ECDHE_RSA_WITH_AES_128_CBC_SHA256
     - TLS_ECDHE_RSA_WITH_AES_256_CBC_SHA384
     - TLS_ECDHE_ECDSA_WITH_AES_128_CBC_SHA
     - TLS_ECDHE_ECDSA_WITH_AES_256_CBC_SHA
     - TLS_ECDHE_ECDSA_WITH_AES_128_GCM_SHA256
     - TLS_ECDHE_ECDSA_WITH_AES_256_GCM_SHA384
     - TLS_ECDHE_RSA_WITH_AES_128_GCM_SHA256

- TLS_ECDHE_RSA_WITH_AES_256_GCM_SHA384
- TLS_ECDHE_ECDSA_WITH_3DES_EDE_CBC_SHA

For more details, you are suggested contacting HCL Technical Support.

For MSCAPI, refer to the vedor documentation for the latest information.

Note: Follow the below steps to enable AES support with MSCAPI on Windows® 8, Windows® 8.1, Windows® 10, Windows® Server 2008, and Windows® Server 2012.

a. From an administrator account, open **Group Policy Editor** (gpedit.msc).
b. Choose **Computer Configuration**->**Administrative Templates**->**Network**->**SSL Configuration Settings**.
c. Open **SSL Cipher Suite Order** and select **Enabled**.
d. Alter the cipher order as per you organization's needs, save the changes, and REBOOT the system for the above changes to apply.

It is important to note that the client can only present the server a prioritized cipher list. The host has the final say on what gets selected as the cipher for the session. When choosing an algorithm with a specific a bit length, one important consideration is to remember that encryption and decryption are CPU intensive operations which take time depending upon the key size. In almost all cases, a 128-bit key is more than sufficient to protect the information you are exchanging over your telnet connections.

10. Enable **Check for Server Name and Certificate Name Match** to have the session authenticate the server by matching the server name to the host or server certificate name. The server and certificate names must match exactly. For MSCAPI sessions, if the certificate name and server name do not match, an error is returned. For GSKit sessions, if the host certificate name does not match the name of the host to which are connecting, the session is terminated.
11. In the **Client Authentication** group box, you determine when and how the client certificate will be chosen for sending to the server.

    If you want to enable client authentication and have the personal client certificate from the key database file sent to the server when requested, check **Send Personal Certificate to Server if Requested**.

    Send Personal Certificate Trusted by Server

    Select this option if you do not want to be prompted to select a personal client certificate from a key database file. Z and I Emulator for Windows will send the personal client certificate trusted by the server.

    Send Personal Certificate based on Key Usage

    Use this option to select one or more key usages. Click **Key Usage** to select the defined Object ID (OID) key usages. Go to the **Extended Key Usage** panel to add a new OID and description to the list.

At authentication time, Z and I Emulator for Windows chooses certificates for client authentication, based on the key usage that you select. If a certificate's Enhanced Key Usage attribute contains one or more of the OIDs that you specify, the certificate is eligible for use.

If no eligible certificates are found, the authentication fails. If one eligible certificate is found, it is automatically used. If two or more eligible certificates are found, you will be prompted to select a personal client certificate.

Select or Prompt for Personal Client Certificate

Use this option if you want to choose the personal client certificate. You will be prompted to select a personal client certificate during session establishment, when the server requests the client certificate.

To preselect a personal client certificate during configuration, click **Select now** and choose the **Personal Certificate Label**.

Pass Through Host Certificate Validation

Use this option to disable the default certificate validation process during TLS handshake. Applicable only for Microsoft schannel provider.

Note: By default, schannel (MSCAPI) is responsible for validating the host certificate chain received during TLS handshake. Schannel runs several checks on the received certificate chain one of which is verifying that the signature affixed to the certificate valid, that is, the hash value computed on the certificate contents matches the value that results from decrypting the signature field using the public component of the issuer. In order to perform this operation, the user must possess the public component of the iss either through some integrity-assured channel, or by extracting it from another (validated) certificate. The default certificate valid process is exhaustive and runs several checks on the host certificate chain in order to successfully validate it. By enabling this option the user would effectively suppress the default validation done by schannel and the identity of the host is not verified. The use of this option is not recommended.

Pop-up Messages

During session establishment, your workstation may display pop-up messages in order to solicit from you:

- The password for accessing the PCommClientKeyDb.kdb database
- The location of the PCommClientKeyDb.kdb

If you chose to be prompted for personal client certificate information, the Select Client Personal Certificate Label Name screen is displayed at connection time, when the server requests the client personal certificate. The **Server**

Certificate Information list box displays the information about the certificate issued to the server, as well as the issuer. Information includes common name, organization, locality and e-mail. This is provided for information purpose only; none of the information can be selected. The **Server Trusted Root List** list box displays the information about the trusted root supported by the server. This is also provided for information purpose only; none of the information can be selected. Click the **Select Personal Certificate Label Name** drop-down list and select the personal certificate to be sent to the server for client authentication. Click **OK** after selection.

If you chose to be prompted once for the key database password, the Enter Key Database Password screen is displayed at connection time, when the server requests the client personal certificate. Enter the key database password and click **OK**.

Changing the Password of a Client's Key Database

The key database file created when Z and I Emulator for Windows is installed has a default set of root certificates that will handle a majority of server certificates without modification to the file. This initial file is accessible using certificate management. The default password *pcomm*.

Certificates can be managed using Certificate Manager or the IKEYCMD command-line interface.

Using Certificate Management

To change the password using Certificate Management, do the following:

1. From the **Start → Programs → HCL Z and I Emulator for Windows → Utilities** menu, select **Certificate Management**.
2. From the **Key Database File** menu, select **Open**.
3. Select the PCommClientKeyDb.kdb file from the user-class application data directory.
4. Click **Open**.
5. Type the current password for the file in the Password entry field.
6. From the **Key Database File** menu, select **Change Password**.

   Follow the guidelines issued by your network manager for selecting a password or passphrase that is not easily guessed.
7. Type the new password in the New Password entry field.
8. Type the new password again in the Confirm New Password entry field.
9. To set a password expiration time, click **Set expiration time** and enter the number of days until expiration.
10. Click **Stash the password** to *stash* the password of the current database encrypted.

    Note: Z and I Emulator for Windows cannot access the certificates in your file if this checkbox is not selected.

11. Click **OK**.

Connecting to a Server Using a Certificate from a Well-Known CA

The following CA signed root certificates are already stored in Personal Communication's key database and marked as trusted certificates:

Note: The updated list of CA certificates can be viewed by opening the default `PCommClientKeyDb.kdb` file.

- Entrust.net Certification Authority (2048)
- Entrust.net Client Certification Authority
- Entrust.net Global Client Certification Authority
- Entrust.net Global Secure Server Certification Authority
- Entrust.net Secure Server Certification Authority
- Thawte Personal Basic CA
- Thawte Personal Freemail CA
- Thawte Personal Premium CA
- Thawte Premium Server CA
- Thawte Server CA
- VeriSign Class 1 Public Primary Certification Authority
- VeriSign Class 1 Public Primary Certification Authority - G2
- VeriSign Class 1 Public Primary Certification Authority - G3
- VeriSign Class 2 Public Primary Certification Authority
- VeriSign Class 2 Public Primary Certification Authority - G2
- VeriSign Class 2 Public Primary Certification Authority - G3
- VeriSign Class 3 Public Primary Certification Authority
- VeriSign Class 3 Public Primary Certification Authority - G2
- VeriSign Class 3 Public Primary Certification Authority - G3
- VeriSign Class 3 Public Primary Certification Authority - G5
- VeriSign Class 4 Public Primary Certification Authority - G2
- VeriSign Class 4 Public Primary Certification Authority - G3

Following is a summary of the steps required for connecting to a server using a certificate issued by a well-known CA:

1. Confirm that the server you want to connect to has a certificate from a well-known CA.
2. Configure Z and I Emulator for Windows for TLS/SSL support. See Configuring Z and I Emulator for Windows Session Security on page 68 for details.

Connecting to a Server Using a Certificate from an Unknown CA

The procedures in this section explain how to configure security for connecting to a server using a certificate issued by an unknown CA; that is, a CA that is not already defined in the PCommClientKeyDb.kdb file.

Following is a summary of the steps required:

1. Confirm that the server you want to connect with has a certificate from an unknown CA.
2. Request the root certificate for the unknown CA from your server administrator.
3. Open the PCommClientKeyDb.kdb file and add the root certificate to it.
4. For client authentication, obtain a personal certificate from this unknown CA and add it to the PCommClientKeyDb.kdb file.

Opening a Key Database and Adding a Root Certificate

When you get the root certificate file from your server administrator, make sure that it is in one of the following formats, based on the normal file extensions:

.ARM

Base64-encoded ASCII data (armored 64 format)

.DER

Binary DER data

Only a certificate in one of these formats can be added to the keyring database.

Note: In many cases, instead of providing a root certificate file, the server administrator may create the key database file and password stash file at the server. After adding the root certificate, the server administrator can copy the files to each client. If you do this, it is important that the names and location match as follows:

- Key database file: PCommClientKeyDb.kdb
- Password stash file: PCommClientKeyDb.sth

These files are located in the user-class application data directory.

If the server administrator provided only a root certificate file, use the Certificate Management utility to open the key database file and add the root certificate.

Using Certificate Management

To use Certificate Management to open a key database and add a root certificate, do the following:

1. From the **Start → Programs → HCL Z and I Emulator for Windows → Utilities** menu, select **Certificate Management**.
2. From the **Key Database File** menu, click **Open**.
3. Select the PCommClientKeyDb.kdb file.
4. Click **Open**.
5. Type the password in the **Password** entry field and click **OK**.
6. Select **Signer Certificates** from the drop-down listbox.
7. Click **Add** to receive the certificate.

The Add CA's Certificate from a File panel appears.

8. Select the format dictated by your server administrator from the **Data Type** listbox.
9. Type the full path to the root certificate file in the **Certificate file name** entry field.
10. Click **Browse**, open the certificate file, and click **OK**.
11. Enter a label for the certificate and click **OK**.
12. Click **View/Edit**.
13. Activate the **Set the certificate as a trusted root**, and click **OK**.

Opening a Key Database and Adding a Personal Certificate

When you get the personal certificate file from your server administrator or a CA, make sure that it is in one of the following formats:

- PKCS#12 file
- CMS key database file
- Keyring file
- Base64-encoded ASCII data (armored 64 format)
- Binary DER data

A personal certificate can also be in a cryptographic device (such as a Smart Card or Fingerprint) or in a browser's keyring.

Using Certificate Management

To use Certificate Management to open a key database and add a personal certificate, do the following:

1. From the **Start → Programs → HCL Z and I Emulator for Windows → Utilities** menu, select **Certificate Management**.
2. From the **Key Database File** menu, click **Open**.
3. Select the PCommClientKeyDb.kdb file.
4. Click **Open**.
5. Type the password in the **Password** entry field and click **OK**.
6. Select **Personal Certificates** from the drop-down listbox.
7. Click **Import for KDB, DYR and P12 format files** to import the certificate.

   The Import Key panel appears.

8. Select the format dictated by your server administrator from the **Key file Type** listbox.
9. Type the full path to the root certificate file in the **Certificate file name** entry field.
10. Click **Browse**, open the certificate file, and click **OK**.
11. Enter the **Key Label**, or accept the default, and click **OK**.
12. Click **Receive for ARM and DER format files**.

The Add CA's Certificate from a File panel appears.

13. Select the format dictated by your server administrator from the **Data Type** listbox.
14. Type the full path to the root certificate file in the **Certificate file name** entry field.
15. Click **Browse**, open the certificate file, and click **OK**.
16. Enter a label for the certificate and click **OK**.

Obtaining a Personal ID Certificate from a Known Certificate Authority (CA)

A personal ID certificate uniquely identifies you, and can be obtained from known certificate authorities. One such certificate authority is Symantec. To obtain a Personal ID certificate from Symantec:

1. Open the Symantec web page at http://www.symantec.com/digital-id/
2. Follow the instructions to install a **Digital ID** (either *full-service* or *trial*) in your Web browser or on a cryptographic device, if the device has such capability.

After the certificate has been installed in your browser, you must store it in the key database. On Windows®, you can use the Certificate Management utility to open the Microsoft Certificate Store. For other supported Windows® operating systems, use the following procedure.

1. From the browser, export the certificate into a new key file.
2. Open the Z and I Emulator for Windows client key database file.
3. Click **Export/Import** to import the certificate. The **Export/Import Key** dialog appears.
4. Click the **Key** button.

Note: The key file type must be PKCS#12.

5. Enter the name of the file in the first field, the path to the file in the second field; click **OK**.
6. At the password prompt, enter your password and click **OK**.

Connecting to a Server Using a Self-Signed Certificate

Although using self-signed certificates is not recommended, a server administrator can use them while waiting for a purchased CA certificate. Once the CA certificate is available, the server and all clients should be reconfigured to switch from the self-signed certificate to the purchased one.

Following is a summary of the steps required:

1. Confirm that the server you want to connect with has a self-signed certificate.
2. Request from your server administrator the root certificate for the self-signed certificate.
3. Open the PCommClientKeyDb.kdb file and add the root certificate to it.

The steps required by a client in this scenario are the same as those for the Unknown CA scenario. See Opening a Key Database and Adding a Root Certificate on page 74 for the steps involved.

Problem Determination

Following is some information to help you avoid problems that might be related to TLS configuration.

- With server-side authentication, the common name in the sever's certificate is always compared to the name you type in the Host Name field on the client. These names must match exactly. You cannot:
  - Type the IP address in one place and the host name in the other
  - Type wrt05306 in one place and WTR5306 in the other
  - Type wtr05036 in one place and wtr05036.raleigh.ibm.com in the other

  Note: This information is available only from the target server administrator.
- Make sure that TLS is enabled on both the Z and I Emulator for Windows client and the TLS server.
- Makes sure that the port number in the Advanced configuration panel on the client matches the port number defined in the server.
- For each different server using a self-signed certificate, you must add a copy of each of the server certificates to your keyring.
- Be sure there is a root certificate of the proper class to correspond with the class and issuer of the certificate on the server.
- Make sure that the password to your key database has not expired.

Note: Notify your server administrator of any problems prior to contacting HCL Service.

Smart Card Support in GSKit

The GSKit security package includes Smart Card support. A Smart Card is a small electronic device that contains electronic memory and can be used to store a certificate. You can keep the certificate in a local or network accessed file, in Netscape PKCS#11 format. You can specify the location of the certificate in the session preferences, or prompt for the personal client certificate. You can control the timing of prompts for client certificates.

You need a Smart Card reader installed when working with certificates for Smart Card. Supported Smart Card Drivers displays the supported Smart Card drivers and their filenames.

Note: Drivers other than the ones listed below can be used by manually keying in the driver name and pressing TAB key to move to the next field.

Supported Smart Card Drivers on page 78 displays the supported Smart Card drivers and their filenames.

Table 1. Supported Netscape PKCS#11-compatible Smart Card Drivers

Smart Card Drivers	File names
IBM® SecureWay® Smartcard	w32pk2ig.dll
GemPlus/GemSoft Smartcard	w32pk2ig.dll
IBM® Netfinity® PSG Chip[1]	ibmpkcss.dll
Rainbow Ikey 1000	Cryptoki22.dll
Schlumberger Cryptoflex	acpkcs.dll *or* slbck.dll
SCW PKCS 3GI 3-G International	3gp11csp.dll
Data Key	Dkck232.dll
Fortezza Module	fort32.dll

[1]The system boards in some IBM® systems are preconfigured with a Promise of Value (POV) card, a 256-bit encrypted security chip daughtercard attached to the motherboard. If an attempt is made to remove the POV card from the board and install it into another system, the cryptographic key material will be erased, rendering it unusable. This security feature is by design and prevents the cryptographic key migration from one system to another. Therefore, moving this security chip from one board to another is not a supported option. If an attempt is made to move the POV card from one system to another, it may hang on boot and display an error message referring to an invalid machine type and serial number.

Enabling Smart Card Support in GSKit

Smart Card is only used for the personal certificate—it can only hold one personal certificate and does not hold the signer certificates. The signer certificate or the root and any intermediate certificate of the personal certificate on the Smart Card should be added in the PCommClientKeyDb.kdb file.

To enable Smart Card security using the Certificate Management utility, do the following.

1. From the **Select Key Database File** menu, select **Open**.
2. From the **Key database type** drop-down, menu, select **Cryptographic Token**
3. Locate the appropriate file or enter the file name and location.

To enable Smart Card support when configuring a session, do the following:

1. Select **Enable Security** in the Security Setup panel.
2. Select **Send Personal Certificate to Server if Requested**.
3. Select **Cryptographic Support (PKCS#11)**.
4. In the Cryptographic Support Setup panel, choose the Netscape Compatible PKCS#11 driver name from the drop-down list. If a driver software provider was not found by Z and I Emulator for Windows, you must enter a Smart Card driver name.
5. If the driver loaded successfully, the **Cryptographic Token Label** list is displayed. There may be a delay while the certificate labels are loaded.

6. Enter the Cryptographic Token Password for the selected Cryptographic Token Label; this provides access to the PKCS#11 Cryptographic device. You can then access the PKCS#11 Certificate Label Names from the drop-down list. If there is only one Certificate, it will automatically be used.

   If PKCS#11 Cryptographic support is enabled and a password for the PKCS#11 cryptographic module is not defined during configuration, you will be prompted for the password.

Using the IKEYCMD Command-Line Interface

IKEYCMD is a command-line tool that can be used to manage keys, certificates, and certificate requests. It is functionally similar to Certificate Management (IKEYMAN) and is intended to be run from the command line without a graphical interface.

Use IKEYCMD for configuration tasks related to public/private key creation and management. You can use IKEYCMD to create key database files for the same key database types that IKEYMAN currently supports. You can also create certificate requests, import CA signed certificates, and manage self-signed certificates.

You cannot use IKEYCMD for configuration options that update the server configuration file httpd.conf. To update the server configuration file, you must use the IBM® Administration Server.

Environment Setup for IKEYCMD Command-Line Interface

Use the following procedure to set the environment variables to use the IKEYCMD command-line interface.

1. Set or modify the PATH variable to include the location of the Java™ executables. This can be done by using the UI, modifying autoexec.bat, or typing the following in a command window:

   ```
   set PATH=c:\Program Files\IBM\Z and I Emulator for Windows\java\jre\bin;%PATH%;
   ```

   where `C:\Program Files\IBM\Z and I Emulator for Windows` is the directory where is Z and I Emulator for Windows installed.
2. Once completed, run IKEYCMD from any directory.

To run an IKEYCMD command, use the following syntax:

```
ikeycmd
```

IKEYCMD Syntax

The syntax of the IKEYCMD CLI is

```
ikeycmd <object> <action> [options]
```

where `object` is one of the following:

-keydb

Actions taken on the key database (either a CMS key database file, a WebDB keyring file, or SSLight class).

-cert

Indicates that the operation applies to a certificate.

-certreq

Actions taken on a certificate request.

-help

Display help for the IKEYCMD invocations.

-seckey

Actions taken on a secret key.

-version

Display version information for IKEYCMD.

Action is the specific action to be taken on the object, and *options* are the options (either required or optional) specified for the object and action pair. Some options may be required for certain object and action pairs.

Note: The object and action keywords are position-sensitive and must be in the order indicated in the example. However, options are not position-sensitive and can be typed in any order, provided that they are entered as an option and operand pair.

Object–Action Pairs

The following table describes each action that can be performed on a specified object.

Table 2. Object–Action Pairs for IKEYCMD

Object	Action	Description
`-keydb`	`-changepw`	Change the password for a key database.
	`-convert`	Convert the key database from one format to another.
	`-create`	Create a key database.
	`-delete`	Delete the key database.
	`-expiry`	Display password expiry
	`-list`	Currently supported types of key database.
	`-stashpw`	Stash the password of a key database into a file.
`-cert`	`-add`	Add a CA certificate from a file into a key database.
	`-create`	Create a self-signed certificate.
	`-delete`	Delete a CA certificate.
	`-details`	List the detailed information for a specific certificate.
	`-export`	Export a personal certificate and its associated private key from a key database into a PKCS#12 file, or to another key database.
	`-extract`	Extract a certificate from a key database.
	`-getdefault`	Get the default personal certificate.

Table 2. Object–Action Pairs for IKEYCMD (continued)

	`-import`	Import a certificate from a key database or PKCS#12 file.
	`-list`	List all certificates.
	`-listsigners`	List signer certificates delivered with ikeyman
	`-modify`	Modify a certificate. **Note:** Currently, the only field that can be modified is the Certificate Trust field
	`-populate`	Populate with included CA Certificates
	`-receive`	Receive a certificate from a file into a key database.
	`-rename`	Rename a certificate.
	`-setdefault`	Set the default personal certificate.
	`-sign`	Sign a certificate stored in a file with a certificate stored in a key database and store the resulting signed certificate in a file.
`-certreg`	`-create`	Create a certificate request.
	`-delete`	Delete a certificate request from a certificate request database.
	`-details`	List the detailed information of a specific certificate request.
	`-extract`	Extract a certificate request from a certificate request database into a file.
	`-list`	List all certificate requests in the certificate request database.
	`-recreate`	Recreate a certificate request.
`-seckey`	`-create`	Create a secret key.
	`-delete`	Delete a secret key.
	`-details`	Show the details of a specific secret key.
	`-export`	Export secret keys to a file.
	`-import`	Import secret keys from a file.
	`-list`	List all secret keys in a key database.
	`-rename`	Rename a secret key.
`-help`		Display this help text.
`-version`		Display iKeyman version information.

IKEYCMD Tasks for Z and I Emulator for Windows

IKEYCMD command-line interface tasks required for Z and I Emulator for Windows are summarized in the following sections.

- Creating a New Key Database on page 82
- Storing the Encrypted Database Password in a Stash File on page 83
- Creating a New Key Pair and Certificate Request on page 84
- Creating a Self-Signed Certificate on page 85

- Exporting Keys on page 85
- Importing Keys on page 86
- Listing CAs on page 86
- Storing the CA Certificate on page 86
- Showing the Default Key in a Key Database on page 88

See Summary of Command-Line Invocations on page 90 for a summary of command-line invocation syntax examples.

Creating a New Key Database

A key database is a file that the Z and I Emulator for Windows client uses to store one or more key pairs and certificates—this is required to enable secure connections between the Z and I Emulator for Windows client and the Telnet server. Before configuring TLS communication, you need to have the PCommClientKeyDb.kdb key database file in the Z and I Emulator for Windows application data directory. By default, this file is installed on your machine with Z and I Emulator for Windows and it has a default password of *pcomm*. It is recommended that you change this initial password the very first time you use Z and I Emulator for Windows. See Changing the Database Password on page 83 for instructions on how to change the key database password.

To create a key database using the IKEYCMD command-line interface, type the following command:

```
ikeycmd -keydb -create -db
```

```
PCommClientKeyDb.kdb -pw <password> -type cms -expire <days> -stash
```

where:

<password>

Password is required for each key database operation. The initial password for PCommClientKeyDb.kdb is *pcomm*.

-type

The PCommClientKeyDb.kdb used by the Z and I Emulator for Windows client is a CMS database type.

-expire

Number of days before password expires.

-stash

Stashes password for key database.

When the -stash option is specified during the key database creation, the password is stashed in the PCommClientKeyDb.sth file.

The PCommClientKeyDb.kdb key database file holds all the security information needed by the Z and I Emulator for Windows client. Any additions or changes are made to the existing PCommClientKeyDb.kdb key database file.

Setting the Database Password

When you create a new key database, specify a key database password. This password protects the private key. The private key is the only key that can sign documents or decrypt messages encrypted with the public key. Change the key database password frequently.

Use the following guidelines when specifying the password:

- The password must be from the U.S. English character set.
- The password should be at least six characters and contain at least two nonconsecutive numbers. Make sure the password does not consist of publicly obtainable information about you, such as the initials and birth date for you, your spouse, or children.
- Stash the password.

Note: Keep track of expiration dates for the password. If the password expires, a message is written to the error log. The server will start, but there will not be a secure network connection if the password has expired.

Changing the Database Password

To change the database password, type the following command:

```
 ikeycmd -keydb -changepw -db PCommClientKeyDb.kdb
-pw <password> -new_pw<new_password> -expire <days> -stash
```

where:

-new_pw

New key database password. This password must be different than the old password and cannot be a NULL string.

-expire

Number of days before the password expires.

-stash

Stashes password for key database.

Storing the Encrypted Database Password in a Stash File

For a secure network connection, store the encrypted database password in a stash file.

To store the password while a database is created, type the following command:

```
 java com.ibm.gsk.ikeyman.ikeycmd -keydb -create -db <path_to_db>/<db_name>.kdb
-pw <password> -type cms -expire <days> -stash
```

To store the password after a database has been created, type the following command:

```
 java com.ibm.gsk.ikeyman.ikeycmd -keydb -stashpw -db <db_name>.kdb -pw <password>
```

Registering a Key Database with the Server

The initial configuration setting for the default key database name is *key.kdb*. If you use key.kdb as your default key database name, you do not need to register the database with the server. The server uses the initial setting on the KeyFile directive in the configuration file. If you do not use key.kdb as your default key database name, or, if you create additional key databases, you must register those databases.

Creating a New Key Pair and Certificate Request

To create a public–private key pair and certificate request, do the following:

1. Type the following command:

```
java com.ibm.gsk.ikeyman.ikeycmd -certreq -create -db PCommClientKeyDb.kdb
-pw <password> -size <1024 | 512>
-dn<distinguished_name>-file <filename> -label <label>
```

   where:

   -size

   Key size of `512` or `1024`.

   -label

   Label attached to certificate or certificate request.

   -dn

   Enter an X.500 distinguished name.

   -file

   Name of file where the certificate request will be stored. By default, Z and I Emulator for Windows uses the name certreq.arm and it should be stored in the application data directory, where the PCommClientKeyDb.kdb key database is located.

2. Verify that the certificate was successfully created.
   a. View the contents of the certificate request file you created.
   b. Make sure the key database recorded the certificate request by typing the following command:

```
java com.ibm.gsk.ikeyman.ikeycmd -certreq -list -db PCommClientKeyDb.kdb
-pw <password>
```

   You should see the label that you just created in the list of certificates. Send the newly created file to a certificate authority.
3. Send the newly created file to a certificate authority.

Creating a Self-Signed Certificate

It usually takes two to three weeks to get a certificate from a well-known certificate authority (CA). While waiting for an issued certificate, use IKEYCMD to create a self-signed server certificate to enable TLS/SSL sessions between clients and the server. Use this procedure if you are acting as your own CA for a private Web network.

To create a self-signed certificate, type the following command:

```
 java com.ibm.gsk.ikeyman.ikeycmd -cert -create -db PCommClientKeyDb.kdb
-pw <password> -size <1024 | 512> -dn <distinguished name>
-label <label> -default_cert <yes or no>
```

where:

-size

Key size 512 or 1024.

-label

Enter a descriptive comment used to identify the key and certificate in the database.

-dn

Enter an X.500 distinguished name.

-default_cert

Type `yes` if you want this certificate to be the default certificate in the key database. Otherwise, type `no`.

Exporting Keys

To export keys to another key database or to export keys to a PKCS#12 file, type the following command:

```
java com.ibm.gsk.ikeyman.ikeycmd -cert -export -db PCommClientKeyDb.kdb -pw
<password> -label <label>-type <cms | sslight> -target <filename>
-target_pw <password> -target_type <cms | sslight | pkcs12>
-encryption <strong | weak>
```

where:

-label

Label attached to the certificate.

-target

Destination file or database.

-target_pw

Password for the target key database.

-target_type

Type of the database specified by `-target` operand.

-encryption

Strength of encryption. Default is strong.

Importing Keys

To import keys from another key database, type the following command:

```
java com.ibm.gsk.ikeyman.ikeycmd -cert -import -db <filename> -pw <password>
-label <label> -type <cms | sslight> -target <filename> -target_pw <password>
 -target_type <cms | sslight>
```

To import keys from a PKCS#12 file, type the following command:

```
 java com.ibm.gsk.ikeyman.ikeycmd -cert -import -file <filename> -pw <password>
 -type pkcs12 -target <filename> -target_pw <password> -target_type <cms | sslight>
```

where:

-label

Label attached to the certificate.

-target

Destination database.

-target_pw

Password for the key database if `-target` specifies a key database.

-target_type

Type of database specified by `-target` operand.

Listing CAs

To display a list of trusted CAs in the PCommClientKeyDb.kdb key database, type the following command:

```
java com.ibm.gsk.ikeyman.ikeycmd -cert -list CA -db PCommClientKeyDb.kdb
-pw <password>-type cms
```

Storing the CA Certificate

Receiving a CA-Signed Certificate

Use this procedure to receive an electronically mailed certificate from a certificate authority (CA), designated as a trusted CA on your server. By default, the following CA certificates are stored in the PCommClientKeyDb.kdb key database and marked as trusted CA certificates:

- IBM® World Registry™ CA
- Integrion CA Root (from IBM® World Registry™)
- VeriSign Class 1 Public Primary CA
- VeriSign Class 2 Public Primary CA

- VeriSign Class 3 Public Primary CA
- VeriSign Class 4 Public Primary C
- VeriSign Test CA
- RSA Secure Server CA (from VeriSign)
- Thawte Personal Basic CA
- Thawte Personal Freemail CA
- Thawte Personal Premium CA
- Thawte Premium Server CA
- Thawte Server CA

The CA may send more than one certificate. In addition to the certificate for your server, the CA may also send additional Signing certificates or Intermediate CA Certificates. For example, Verisign includes an Intermediate CA Certificate when sending a Global Server ID certificate. Before receiving the server certificate, you must receive any additional Intermediate CA certificates. See Storing a CA Certificate on page 88 for instructions on receiving Intermediate CA Certificates.

Note: If the CA who issues your CA-signed certificate is not a trusted CA in the key database, you must first store the CA certificate and designate the CA as a trusted CA. Then you can receive your CA-signed certificate into the database. You cannot receive a CA-signed certificate from a CA who is not a trusted CA. For instructions, see Storing a CA Certificate on page 88.

To receive the CA-signed certificate into a key database, type the following command:

```
 java com.ibm.gsk.ikeyman.ikeycmd -cert -receive -file <filename>
-db PCommClientKeyDb.kdb -pw <password> -format
<ascii | binary> -default_ cert <yes | no>
```

where:

-format

Certificate Authority might provide CA Certificate in either ASCII or binary format.

-label

Label attached to CA certificate.

-trust

Indicates whether this CA can be trusted. Use enable options when receiving a CA certificate.

-file

File containing the CA certificate.

-default_ cert

Type `yes` if you want to make this key your default key.

Storing a CA Certificate

To store a certificate from a CA who is not a trusted CA, type the following command:

```
java com.ibm.gsk.ikeyman.ikeycmd -cert -add -db PCommClientKeyDb.kdb
-pw <password>-label <label> -format <ascii> -trust <enable> -file <file>
```

where:

-label

Label attached to certificate or certificate request.

-format

Certificate Authorities might supply a binary ASCII file.

-trust

Indicate whether this CA can be trusted (should be `yes`).

Opening a Key Database

Explicit opening of a key database is not supported. For each command, database and password options are given—these options are sufficient to operate in a key database.

Showing the Default Key in a Key Database

To display the default key entry, type the following command:

```
java com.ibm.gsk.ikeyman.ikeycmd -cert -getdefault -db PCommClientKeyDb.kdb
-pw <password>
```

Managing a Digital Certificate on a Smart Card

You can manage digital certificates on a Smart Card (or, more generically, on a PKCS#11 cryptographic device). To do so, you must first use the following procedure to inform the IKEYMAN CLI of the name of the module for managing your Smart Card.

1. Edit the java.security file in your JDK environment with one of the following settings stored in the (JAVA_HOME)\jre\lib\security\ directory:
   - security.provider.1=sun.security.provider.Sun
   - security.provider.2=com.ibm.spi.IBMCMSProvider
   - security.provider.3=com.ibm.crypto.provider.IBMJCE
2. Edit the ikmcmd.properties file to set the DEFAULT_CRYPTOGRAPHIC_MODULE property to the name of the module for managing your smart card. For example,

   ```
   DEFAULT_CRYPTOGRAPHIC_MODULE=C:\\Winnt\\System32\\W32pk2ig.dll
   ```

   The module is normally installed on your system when you install the software for your Smart Card.
3. Save the ikmcmd.properties file.

Use the following command syntax for PKCS#11 operations:

```
-crypto <module_name> -tokenlabel <token_label> -pw <password>
```

For example, to display the certificate contained on your PKCS#11 cryptographic device, type the following:

```
java -Dikeycmd.properties=<properties_file> com.ibm.gsk.ikeyman.ikeycmd
-cert -list all -crypto <module_name> -tokenlabel <token_label> -pw <password>
```

where:

-cert

Indicates that the operation applies to a certificate.

-list all

Displays the certificate.

-crypto <module_name>

Specifies PKCS#11 cryptographic device usage, where `<module_name>` is the name of the module to manage your smart card. This parameter is optional if the module name is specified in the ikmcmd.properties file.

-tokenlabel <token_label>

The PKCS#11 cryptographic device token label.

-pw <password>

The password for the PKCS#11 cryptographic device.

Using Microsoft CryptoAPI

If you want to open a cryptographic hardware device using MS CryptoAPI, use the following procedure.

1. Edit the ikmcmd.properties file. Set the cryptographic service provider (CSP) name to the DEFAULT_CRYPTOGRAPHIC_MODULE property. For example,

   ```
   DEFAULT_CRYPTOGRAPHIC_MODULE=Schlumberger Cryptographic Service Provider
   ```

   The CSP is normally installed on your system when you install the software for your Smart Card.
2. Save the ikmcmd.properties file.

Use the following command syntax to display the certificate contained on your cryptographic device:

```
java -Dikeycmd.properties=<propertiesfile> com.ibm.gsk.ikeyman.ikeycmd -cert
-list all -crypto <CSP_module_name>
```

where:

-cert

Indicates that the operation applies to a certificate.

-list all

Displays the certificate.

-crypto <CSP_module_name>

Specifies the CSP name.

Managing the Microsoft Certificate Store

You can use the following command to manage the Microsoft Certificate Store:

```
-db MSCertificateStore
```

For example, to view the details of a certificate stored in Microsoft® Certificate Store, use the following command syntax:

```
java com.ibm.gsk.ikeyman.ikeycmd -cert -details -db MSCertificateStore
 -label <label>
```

where:

-cert

Indicates that the operation applies to a certificate.

-details

Specifies verbose mode when displaying information.

-db MSCertificateStore

Specifies Microsoft® Certificate Store.

-label <label>

The label of the certificate used in the operation.

The password parameter is not needed in `-db MSCertificateStore` operations.

Using GSK6CMD Batch File

The batch file gsk6cmd provides the same function as the `java com.ibm.gsk.ikeyman` command. For example, to store the password after a database has been created, you can also type the following command:

```
gsk6cmd -keydb -stashpw -db <db_name>.kdb -pw <password>
```

Summary of Command-Line Invocations

The following is a list of each of the command-line invocations, with the optional parameters specified in italics.

Note: The actual Java™ invocation `java com.ibm.gsk.ikeyman,iKeycmd` must precede each of the command examples.

```
-keydb -changepw -db <filename> -pw <password> -new_pw
<new_password> -stash -expire <days>
```

```
-keydb -convert -db <filename> -pw <password> -old_format
<cms | webdb> -new_format <cms>
```

```
-keydb -create -db <filename> -pw <password> -type <cms | sslight>
-expire <days> -stash
```

```
-keydb -delete -db <filename> -pw <password>
```

```
-keydb -stashpw -db <filename> -pw <password>
```

```
-cert -add -db <filename> -pw <password> -label <label> -file
<filename> -format <ascii |binary> -trust <enable | disable>
```

```
-cert -create -db <filename> -pw <password> -label <label> -dn
<distinguished_name> -size <1024 | 512> -x509version <3 | 1 | 2>
-default_cert <no |yes>
```

```
-cert -delete -db <filename> -pw <password> -label <label>
```

```
-cert -details -db <filename> -pw <password> -label <label>
```

```
-cert -export -db <filename> -pw <password> -label <label> -type
<cms | sslight> -target <filename> -target_pw <password>
-target_type <cms | sslight | pkcs12> -encryption <strong | weak>
```

```
-cert -extract -db <filename> -pw <password> -label <label> -target
<filename> -format <ascii | binary>
```

```
-cert -getdefault -db <filename> -pw <password>
```

```
-cert -import -db <filename> -pw <password> -label <label> -type
<cms | sslight> -target <filename> -target_pw <password>
-target_type <cms | sslight>
```

```
-cert -import -file <filename> -type <pkcs12> -target <filename>
-target_pw <password> -target_type <cms | sslight>
```

```
-cert -list <all | personal | CA |site> -db <filename> -pw
<password> -type <cms | sslight>
```

```
-cert -modify -db <filename> -pw <password> -label <label> -trust
<enable |disable>
```

```
-cert -receive -file <filename> -db <filename> -pw <password>
-format <ascii | binary> -default _cert <no | yes>
```

```
-cert -setdefault -db <filename> -pw <password> -label <label>
```

```
-cert -sign -file <filename> -db <filename> -pw <password> -label
<label> -target <filename> -format <ascii | binary> -expire
<days>
```

```
-certreq -create -db <filename> -pw <password> -label <label> -dn
<distinguished_name> -size <1024 | 512> -file <filename>
```

```
-certreq -delete -db <filename> -pw <password> -label <label>
```

```
-certreq -details -db <filename> -pw <password> -label <label>
```

```
-certreq -extract -db <filename> -pw <password> -label <label>
-target<filename>
```

```
-certreq -list -db <filename> -pw <password>
```

```
-certreq -recreate -db <filename> -pw <password> -label <label>
-target<filename>
```

```
-help
```

```
-version
```

Using Transport Layer Security

Z and I Emulator for Windows allows you to negotiate the Transport Layer Security 1.0 protocol. The TLS protocol is based on the SSL protocol. TLS differs from SSL mainly in the initial handshake protocol for establishing client/server authentication and encryption. TLS also allows you to use **FIPS** (Federal Information Processing Standard) mode. Although TLS and SSL do not operate with each other, TLS provides a mechanism by which a TLS 1.0 implementation can revert to SSLv3.

The TLS protocol uses public-key and symmetric-key cryptographic technology. Public-key cryptography uses a pair of keys, one public and one private. Information encrypted with one key can only be decrypted with the other key. For example, information encrypted with the public key can be decrypted only with the private key. Each server's public key is published, while the private key is confidential. To send a secure message to the server, the client encrypts the message by using the server's public key. When the server receives the message, it decrypts the message with its private key.

Symmetric-key cryptography uses the same key to encrypt and decrypt messages. The client randomly generates a symmetric key to be used for encrypting all session data. The key is then encrypted with the server's public key and sent to the server.

TLS provides three basic security services:

Message privacy

Achieved through a combination of public-key and symmetric-key encryption. All traffic between a client and a server is encrypted using a key and an encryption algorithm negotiated during session setup.

Message integrity

Ensures that session traffic does not change while in route to its final destination. TLS and SSL use a combination of public/private keys and hash functions to ensure message integrity.

Mutual authentication

Exchange of identification through public-key certificates. The client and server identities are encoded in public-key certificates, which contain the following components:

- Subject's distinguished name
- Issuer's distinguished name
- Subject's public key
- Issuer's signature

- Validity period
- Serial number

Configuring for TLS

When configuring a Telnet session, you can choose **TLS** or **SSL only** as your **Security Protocol**. If the configured host does not support TLS, the host does one of the following:

- Sends SSLv3 hello to Z and I Emulator for Windows

  In this case, Z and I Emulator for Windows will revert to SSLv3 and continue SSLv3 negotiations.
- Sends a fatal error

  In this case, Z and I Emulator for Windows does not continue negotiations with the host.

If you know that the host does not support TLS, you can select the **SSL only** option. In this case, Z and I Emulator for Windows starts with SSL negotiations to establish a secure connection, and does not attempt TLS negotiations. This option also enables SSLv2.

Negotiated Telnet Security

Typically, a secure channel is established before the Telnet 3270 server and client negotiate for a session. For Z and I Emulator for Windows 3270 sessions, you can use negotiated Telnet security. This option enables Z and I Emulator for Windows to establish security with the Telnet 3270 server during the Telnet negotiation. The security protocol used is TLS 1.0, TLS 1.1, and TLS 1.2.

If you select the **Telnet-negotiated** option on the Security Setup panel, the Telnet connection is established. Z and I Emulator for Windows then uses the *TLS-based Telnet Security* protocol (as defined by IETF) to negotiate the TLS security. If the connection is successful, a status message is returned.

This support is only applicable with a Telnet server which supports the *TLS-based Telnet Security* protocol. By default, this option is not enabled.

Chapter 7. Using Windows Terminal Services

Windows® Terminal Services (WTS) is a feature that allows more than one user to log onto a Windows machine. This functionality is also referred to as *simultaneous user environments* or *terminal services*.

Users can logon to the Windows® machine from the console (the screen attached to the Windows® machine) or from a remote desktop client.

On Windows® 8, Windows® 8.1, and Windows® 10, more than one user can logon at the console, although only one of the logged-on users will be able to see his desktop at any time. This terminal services function is called *fast user switching*.

Citrix MetaFrame allows administrators to configure their WTS servers to run individual applications, and to configure each user to run different applications on different servers. Thus, instead logging on to a WTS server, a user launches preconfigured applications from his Citrix environment running on their client machine. Citrix then logs onto the appropriate WTS server and runs the application. When the user closes the application, Citrix shuts down the application, waits for all processes that were started by the application to terminate, and then logs off from the WTS server.

Note:

1. A message file log is not maintained for each WTS logon session. Only one message log file is maintained for the WTS server.
2. When Z and I Emulator for Windows is used in a WTS environment, the maximum of 52 sessions (A-Z or a-z) applies to each WTS logon session. There is not a limit of 52sessions per WTS server.

Session IDs

In simultaneous user environments such as WTS, each time a user logs on, that specific logon session is assigned a session ID. When a user logs on at the console, that session is assigned the session ID **0** (zero)—this is also called the **server console** session. When a user logs on from a remote desktop, the assigned session IDs begin with session 1.

SNA Node Options

Z and I Emulator for Windows has a number of features that allow it to fully function in simultaneous user environments. In addition, you can use specific features to control the behavior of SNA nodes in such environments.

Note: You can only have one SNA node configuration file running for each WTS server. This means that each user cannot start an independent SNA node.

The following features are available in the SNA Node Configuration utility. Refer to the online help for specific information about option settings.

Configuration Preferences

The SNA Node Configuration **Edit → Preferences** dialog displays the following node options:

Auto Start

This option controls whether and when an SNA node is automatically started. The settings are as follows:

- **None**

  The SNA node is never automatically started.

- **On Boot**

  The SNA node is started when the workstation is booted up.

- **User**

  The SNA node is started when any user logs onto the workstation.

Auto Stop

This option controls whether and when an SNA node is automatically stopped. The settings are as follows:

- **None**

  The SNA node is automatically stopped only when the workstation is shut down or restarted.

- **TP User**

  The SNA node is stopped when the TP user logs off the workstation.

- **User**

  The SNA node is stopped when any user logs off the workstation.

- **Last User**

  The SNA node is stopped when the last logged-on user logs off the workstation.

TP Context

An SNA Node is responsible for starting Transaction Programs (TPs). This option controls whether a TP is allowed to access a user's desktop. The settings are as follows:

- **System**

  An SNA Node is responsible for starting Transaction Programs (TPs). The TP Context **System** value causes TPs to run with SYSTEM authority and the only workstation that can be accessed is the system console.

- **User**

  The TP Context **User** value allows a TP to access the TP User's desktop.

The *TP User* is defined as the user who starts the SNA node. If that user logs off the workstation, the TP User becomes the user who has been logged onto the system the longest. If the SNA node was started on boot then the TP User becomes the first user who logs on.

Note: The TP context is ignored when a user ID is specified in the Local LU definition in the active node configuration.

Default SNA Node Configuration

You can specify a default node configuration (.acg) file.

User ID (Local LU 6.2)

When you configure a Local LU 6.2, you can specify a user ID for this Local LU. When a Transaction Program is started on a Local LU that has this user ID defined, the SNA Node attempts to give the TP access to that user's desktop. If the user is logged on at the time, the TP context is the user ID entered in this Local LU 6.2 configuration panel.

This user ID field can also be the value **SYSTEM** (as in the TP Context configuration option). In that case, the TP is always started with a TP context value of **SYSTEM**.

Trace Facility

For simultaneous user environments such as WTS, the **APPN and APPC** and **Connectivity** functions are only available for users logged in as session 0.

Each user can run his own trace facility, which gives information from that user's specific WTS logon session. However, there are trace options that enable tracing from device drivers, which are not associated with any specific WTS logon session. Thus, those options only appear on the trace facility that is started in the WTS console session (session 0).

Chapter 8. Azure Virtual Desktop

Microsoft Azure, often referred to as Azure, is a cloud computing service operated by Microsoft for application management via Microsoft-managed data centres.

“Azure Virtual Desktop” (Windows Virtual Desktop) is a desktop and app virtualization service that runs on the cloud. Virtual machines (VMs) for multiple users and desktops get hosted on the Azure platform in an Azure Virtual Desktop environment. Organizations can use Azure Virtual Desktop service to deliver virtual applications and desktops to their employees via Azure’s cloud infrastructure.

Azure Virtual Desktop provides an application virtualization to any personal device with internet connection.

We can provide right access controls to the users and devices with Azure Active Directory Conditional access. On providing the access, users can launch any Azure Virtual Desktop client to connect to their published Windows applications.

Z and I Emulator for Windows supports the Windows Virtual Desktop. ZIEWin application can be published as a windows application using the WVD setup and we can access all the features of ZIEWin.

For more information on Azure Virtual Desktop : https://docs.microsoft.com/en-us/azure/virtual-desktop/overview.

Chapter 9. ODBC Drivers and Database Access Utility

This chapter contains information about ODBC drivers and the Database Access utility.

You can find additional information in the online help.

Overview of Open Database Connectivity (ODBC)

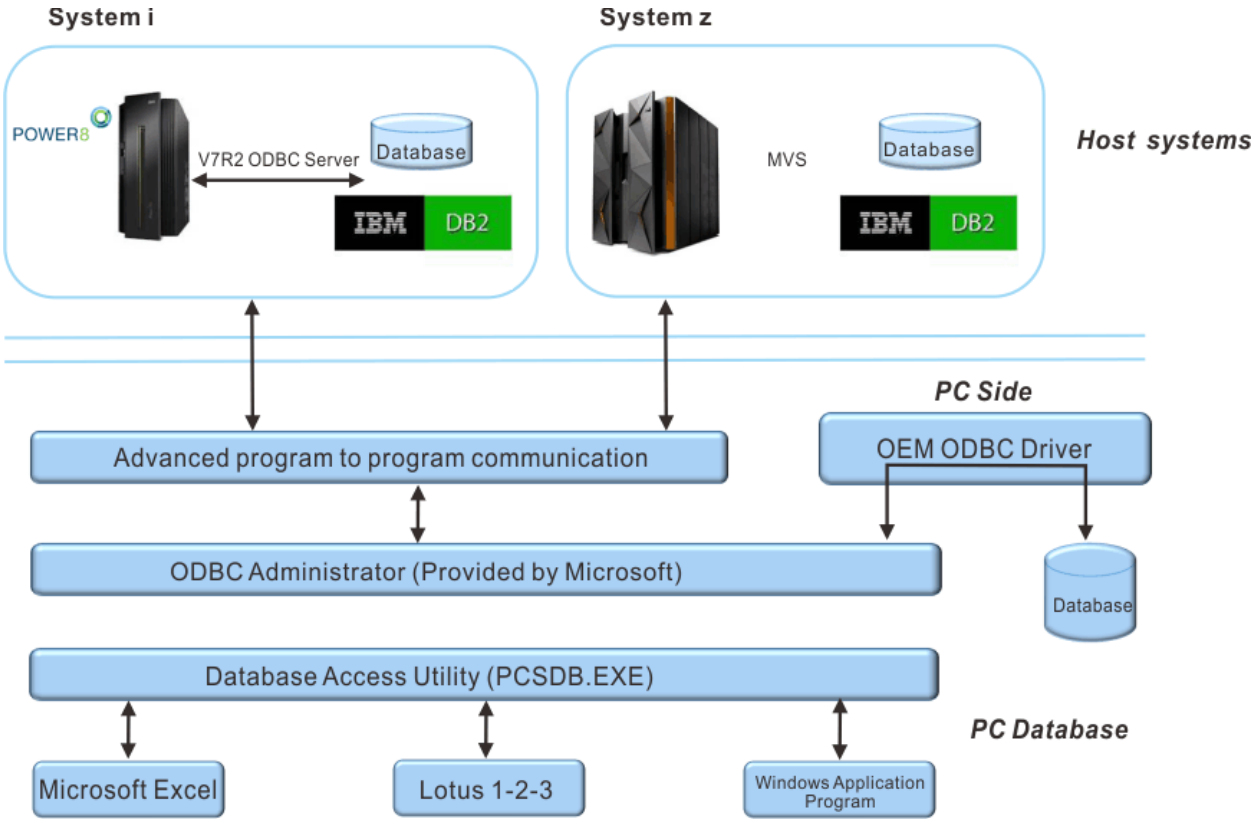
ODBC is an industry standard application program interface (API) that provides a solution to a common problem—how to write programs that access a Database Management System (DBMS) without making them dependent on specific DBMS designs. ODBC provides API access to SQL-accessible databases, allowing application programs to use SQL to access data from many kinds of sources. The independence of the access method from the original design of the database means that developers can design and produce a single version of an application that can work with, for example, Oracle or Sybase data, without requiring a separate version for each DBMS. Users simply add database drivers to link the application to their choice of DBMS.

ODBC is a component of the Windows® Open Services Architecture (WOSA). Z and I Emulator for Windows supports ODBC 2.0, for development of 32-bit applications for Windows® 8, Windows® 8.1, Windows® 10, and Windows® Server 2008.

An ODBC driver provides an application program with standard and uniform SQL access to a DBMS database. An ODBC driver allows the designers and users of the application program to ignore the SQL differences between various DBMS systems.

Figure 1: Database Access Overview on page 99 shows an overview of the Z and I Emulator for Windows Database Access utility and the ODBC DB2® drivers.

Figure 1. Database Access Overview



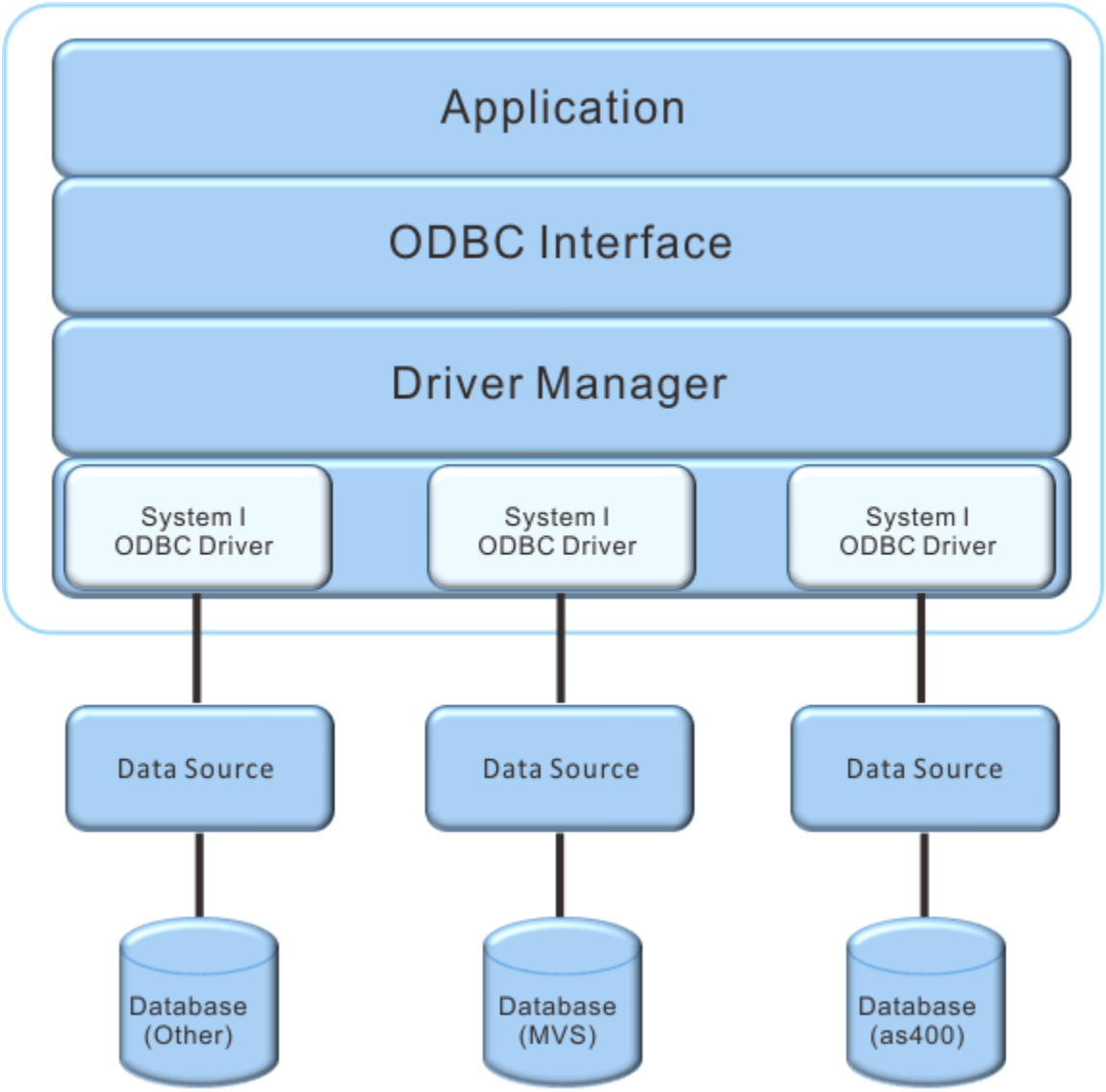
Components of ODBC

There are four components in the ODBC architecture:

- The **application** component defines and performs the work to be accomplished. It calls the ODBC API functions that submit SQL statements and retrieve results.
- The **driver manager** component loads drivers on behalf of an application.
- The **driver** component processes ODBC function calls, submits SQL requests to a specific data source, and passes results to the application. The driver transforms the application's SQL syntax into the syntax expected by the driver's associated DBMS.
- The **data source** component is the data to be accessed and the means for doing so, including the associated operating system, DBMS and network platform.

From the application program's perspective, the driver manager and the driver appear to be a single unit for processing ODBC function calls. Figure 2: ODBC Components on page 100 shows the relationship between the four components:

Figure 2. ODBC Components



Application Component

An application using ODBC performs the following tasks:

- Requests a session (connection) with a data source.
- Sends SQL requests to the data source.
- Defines storage areas and data formats for the results of the SQL requests.
- Requests the results of the defined query.
- Processes errors.
- Requests commit or rollback operations for transaction control.
- Terminates the session with the data source.

Any program that accesses a DBMS, such as a spreadsheet, a mail server, or a report generator, can be designed to use ODBC.

Driver Manager

The driver manager is a dynamic link library (DLL), the purpose of which is to load drivers. It also performs the following functions:

- Maps a data source name to a specific driver DLL.
- Processes ODBC initialization calls.
- Provides the entry points to the ODBC functions for each driver.
- Provides parameter and sequence validation for ODBC calls.

Driver

A driver is a DLL that implements ODBC function calls and interacts with a data source.

The driver manager loads a driver when the application calls the **SQLBrowseConnect**, **SQLConnect**, or **SQLDriverConnect** function.

A driver performs the following tasks in response to ODBC function calls from an application:

- Establishes a connection to a data source.
- Submits requests to the data source.
- Translates data to or from other formats, if requested by the application.
- Returns results to the application.
- Formats errors into standard error codes and returns them to the application.
- Declares and manipulates cursors if necessary. This operation is invisible to the application unless there is a request for access to a cursor name.
- Initiates transactions of the data source. This operation is invisible to the application.

Data Source

A data source is an instance of a DBMS product and any remote operating system and the protocol required to access it.

Database Access

Database Access lets you access host or PC databases and retrieve data, using ODBC drivers. If you specify the conditions for accessing data in each window, the desired query can be created automatically. See the online help for extensive information on using the Database Access utility with the Z and I Emulator for Windows ODBC drivers.

From Database Access, you can perform any of the following actions:

- You can see and modify the SQL statements that are created automatically.
- You can see available database table lists.
- You can copy spreadsheet data to the clipboard
- You can show data in the grid in the main window spreadsheet, send data to other applications (for example Lotus® 1-2-3® or Microsoft® Excel), or send data to a printer.
- If you want to know the meaning of items in the windows, you can see an explanation when you click on the item and then click help.

Accessing an ODBC Data Source

To access an ODBC data source, do one of the following:

- Click on the **Data Source** button on the toolbar.

- Select **Data Source** from the query pull-down menu.

The SQL Data Source window appears.

Select the data source you want to access; then click OK.

Note: Before using Database Access, you must install the 32-bit ODBC administrator and set up the ODBC data source you wish to use.

Selecting Database Tables

To select database tables, do one of the following:

- Click on the **Tables** button on the toolbar.

- Select **Tables** from the Query pull-down.

The Tables window appears.

Joining Conditions for Multiple Tables

To join conditions for multiple tables, do one of the following:

- Click on the **Join Conditions** button on the toolbar.

- Select **Join** from the Query pull-down menu.

The Join By window appears.

Selecting Database Columns

To select database columns, do one of the following:

- Click on the **Columns** button on the toolbar.

- Select **Columns** from the Query pull-down menu.

The Columns window appears.

Selecting Query Conditions

To select query conditions for the data, do one of the following:

- Click on the **Query Conditions** button on the toolbar.

- Select **Query Conditions** from the Query pull-down menu.

The Query Conditions window appears.

Selecting Sort Conditions

To select sort conditions for each column, do one of the following:

- Click on the **Order** button on the toolbar.

- Select **Order** from the Query pull-down menu.

The Order By window appears.

Viewing the Current SQL Statement

To view the current SQL statement, do one of the following:

- Click on the **SQL Statement** button on the toolbar.

- Select **SQL Statement** from the Query pull-down menu.
- Click the SQL button in any window selected from the Query pull-down menu.

The SQL Statement window appears.

Database Size Limit

When you use Database Access, the maximum number of each value that can be displayed in the spreadsheet is as follows:

Number of columns	400
Number of rows	16350
Column length	2048 bytes
Row length	2048 bytes
SQL statement's length	32766 bytes

Note: The values shown are standard, but your PC's available resources (such as memory) can result in other limits.

When you use another application (for example Lotus® 1-2-3®), refer to the manual for that application because the limit might be different.

Chapter 10. Express Logon

Bypass Signon Using Password Substitute (5250)

This option enables the user to bypass iSeries™ login screen by sending a SHA1 password substitute.

Note: This option works only when the `QPWDLVL` system value at the iSeries™ is either 2 or 3. A change to this system value takes effect at the next IPL. To see the current and pending password level values, use the **Display Security Attributes** (DSPSECA) command. The `QRMTSIGN` system value, which specifies how the system handles remote sign-on requests, als needs to be set to `*VERIFY`.

The credentials are encrypted and saved in the current user's registry hive on the local computer. The user is prompted for a password in case the password stored in the registry is no longer valid. The newly entered password shall be stored in the registry and used for subsequent bypass logins.

Users can update the existing password in the registry or add a new password by using **Update registry with bypass login credentials...** menu item present in the Actions menu. This option is used whenever an user changes the password on the host; for example, at the time of password expiry.

Starting from ZIEWin V12.0, If bypass login is enabled, ZIEWin prompts the user for a password in case the password stored in the registry is incorrect. The newly entered password is to be stored in the registry and used for subsequent bypass logins.

Also, there is a new menu option added to Actions menu called **Update registry with bypass login credentials...**, which allows users to update the existing password in the registry or add a new password corresponding to a particular hostname or IP address.

In case the password stored in the registry is expired and bypass login is enabled and the user logs in, the password change screen displays so that the user can set a new password.

When the user change the password successfully (registry still contains the old or expired password) , log out, disconnect, and try bypass login again, the old or expired password is still taken from the registry and used for the bypass login. Due to the invalidity of the old password from the registry, the login fails for the first time and ZIEWin prompts the user for new password. When the user enter the new password that has been created before reglogin, the correct password is to be stored in the registry and ZIEWin reconnects using the new password.

Kerberos Services Ticket Auto-Signon

For 5250 emulator sessions, the **Bypass signon using Kerberos principal** option enables Kerberos authentication.

- If the “Kerberos auto-signon” is disabled during the “Custom” installation, “Bypass signon using Kerberos principal” is disabled.
- If the “Kerberos auto-signon” is enabled during the “Custom” installation, “Bypass signon using Kerberos principal” is enabled.

A ticket is generated and passed to the iSeries™, eServer™ i5, or System i5™ host during TN5250 negotiation.

If the ticket is valid, authentication is completed and the user is logged onto the host. If authentication fails, a host login screen get displayed.

Note: The user must log into a Windows™ domain in order to use Kerberos authentication. Refer to the relevant Microsoft™ documentation for specific details.

For the Data Transfer utility, the user can set the **Use Kerberos principal, no prompting** option (from **Setup → Signon Options**).

- If the “Kerberos auto-signon” is disabled during the “Custom” installation, “Use Kerberos principal, no prompting” is not listed in the signon options of the Data Transfer utility.
- If the “Kerberos auto-signon” is enabled during the “Custom” installation, “Use Kerberos principal, no prompting” is listed in the signon options of the Data Transfer utility.

This function enables Kerberos authentication, using the ticket generated by the Windows™ user credentials.

Certificate Express Logon

Certificate Express Logon (formerly known as Express Logon Feature or ELF) enables a Z and I Emulator for Windows Telnet 3270 user to securely logon to a host application without sending the User ID and password. One advantage of using this function is that it reduces the time you spend maintaining host user IDs and passwords. It also reduces the number of user IDs and passwords that the users have to remember.

To use Certificate Express Logon, the host session must be configured for SSL and client authentication. This means the client must have a valid client certificate. The SSL connection must be made to one of the supported Telnet 3270 servers.

Using Certificate Express Logon

When starting a session using Certificate Express Logon, Z and I Emulator for Windows establishes an SSL client authentication session with the Telnet 3270 server. During the logon process, a macro with the Certificate Express Logon information is played. Once the session is established, Z and I Emulator for Windows sends the application ID for the application that the user is accessing to the Telnet 3270 server. This information is contained in the logon macro. The Telnet 3270 server uses certificate information from the SSL connection and the application ID received from Z and I Emulator for Windows, and requests the user ID and passticket (a temporary password) from the host access control program (such as RACF®).

Z and I Emulator for Windows uses the macro function to put predefined substitute strings in the user ID and password fields. The Telnet 3270 server substitutes the user ID and passticket in the appropriate place in the 3270 datastream. The logon is completed.

After a Certificate Express Logon macro is recorded, it can be distributed to multiple users for playback without further modification.

Preparing to Configure Certificate Express Logon

Before you configure an Certificate Express Logon macro, you need to have the following information.

- Host application name

  Name of the host application the user is logging onto. For example, the name entered on the USSMSG10 screen.

- Host access application ID

  This name must match the RACF® PTKTDATA (Passticket Data Profile) application name that is configured on the OS/390® (V2R10 or later) or z/OS™ host. This name could be the same as the application name that the user is logging onto (for example, the name on USSMSG10). When creating PTKTDATA profiles for applications such as TSO, the application name portion of the profile will most likely not be the same. For example, RACF® requires that the application ID portion of the profile name be TSO+SID. Refer to *OS/390 V2R10.0 SecureWay Security Server RACF Security Administrator's Guide* or *z/OS V1R1.0 SecureWay Security Server RACF Security Administrator's Guide* to determine the correct profile naming.

- User ID and password for the application that you are logging on to.

  During macro recording, the actual user ID and password are used. They are not recorded in the macro; only the predefined substitute strings are recorded in the macro. The Telnet 3270 server replaces the predefined substitute strings with the actual user ID and password during the logon process.

- Client Security Certificate

  The security certificate for the client must be stored in RACF® using the RACF® RACDCERT command.
  - For information about using digital certificates with RACF®, refer to the following books:
    - For OS/390®, refer to *OS/390 V2R10.0 SecureWay Security Server RACF Security Administrator's Guide* and *OS/390 V2R10.0 SecureWay Security Server RACF Command Language Reference*.
    - For z/OS™, refer to *z/OS V1R1.0 SecureWay Security Server RACF Security Administrator's Guide* and *z/OS V1R1.0 SecureWay Security Server RACF Command Language Reference*.
  - For information about configuring DCAS to use RACF® certificates, refer to the following books:
    - For OS/390®, refer to *OS/390 V2R10.0 IBM Communication Server IP Migration*.
    - For z/OS™, refer to *z/OS V1R1.0 IBM Communication Server IP Migration*.

Configuring Certificate Express Logon

Recording the Macro

You must record a macro for each host application that you want to access. You cannot log on to multiple applications with one macro. You do not have to configure SSL, and client authentication is not required on the telnet servers and OS/390® or z/OS™ before recording the logon macro, but you must do this before you can play the macro.

Manual Configuration of a Certificate Express Logon Macro

You can manually configure an existing Macro format file for Certificate Express Logon use. The procedure is as follows:

1. From the Action Bar, open the macro file containing the recorded keystrokes by selecting **Edit → Preferences → Macro/Script**.
2. Select the macro file you just recorded and then select **Customize**.
3. Replace the UserID recorded in the macro with two tags: the Certificate Express Logon Application ID and the UserID placeholder. The Application ID tag consists of three words, each separated by a blank character: `elf`, `applid`, and the identifier of the host application that will be logged onto. The UserID placeholder is `)USR.ID(`.

   For example, replace `"myUserID` with `")USR.ID(`.
4. Replace the Password recorded in the macro with the Certificate Express Logon Password placeholder tag `)PSS.WD(`.

   For example, replace `"myPassword` with `")PSS.WD(`.

Limitations of the Logon Macro

- Automatic insertion of the user ID and password placeholders into the recorded macro requires that the password be typed into the first non-display input field. The user ID is assumed to have been entered just prior to the password. The Modified Data Tag attribute of each formatted input field is assumed to be **ON** only when the field has been modified by the operator.
- There is a short delay while the Telnet 3270 server acquires the passticket from the host access control facility. The amount of time is probably less than the usual delay incurred when the user enters a user ID and password. However, the user can see the macro proceed through the screens during the logon process.
- Logon Express recording requires that the host program uses 3270 field attributes to define the password field on the screen.

Problem Determination

If the client logon fails and displays the messages `)USR.ID( NOT IN CP DIRECTORY`, `INVALID USERID, )USR.ID(`, `PASSWORD NOT AUTHORIZED` or any similar messages, check the Telnet 3270 server log for details.

Possible reasons for failures are:

- The application ID defined in the macro is not valid.
- The Telnet 3270 server could not connect to DCAS. The host might be down.
- The client certificate is not defined in RACF® or it is not valid.
- The passticket has expired and could not be used to log on.
- The Telnet 3270 server completed scanning of data stream without replacing the user ID or password.
- The Telnet 3270 server or the host does not support Certificate Express Logon.

Chapter 11. Log Viewer Functions

The Z and I Emulator for Windows log viewer utility enables you to view, merge, sort, search, and filter information contained in message and trace logs. You can use the viewer during problem determination to work with message and trace log entries. The default name of the message log output file is PCSMSG.MLG; its file extension must be .MLG. The file extension for trace logs must be .TLG. Note that the Help per Message Log Item functionality is available only for message logs.

Viewing Message and Trace Logs

To view message or trace logs:

1. From the **Administrative and PD Aids** folder, click **Log Viewer**; or, from an active session window, click **Actions → Launch → Log Viewer**.
2. From the list of logged messages, click on one of the details on the log entry in the bottom pane.

Note: If the logger device driver determines that the product kernel driver-generated log is full and cannot log a message, it will create an entry in the Windows® log. The information logged may include which log failed, as well as the location and reason for the failure.

Changing Message Log Size and Location

The Z and I Emulator for Windows log viewer utility allows you to modify the size and location of message log files, and change the name of the default message log file. The size of a log file is counted in kilobytes and can range from a minimum of 4Kb to a maximum limited only by available hard disk space.

To modify the location and size of the log:

1. From the **Log Viewer** main menu, click **Options** and then click **Configure Message Log Settings...** A Windows® common dialog box is displayed.
2. From the dialog box, browse the directory structure and choose the destination directory and file name for the message log.
3. Using the spin control counter field, use the up and down arrows to increase or decrease the log file size (in kilobytes).
4. Select **OK** to save settings and exit the window.

Merging Message and Trace Logs

The Z and I Emulator for Windows log viewer utility allows you to open and merge message and trace log entries in the same log viewer window. You can merge any combination of message and trace log files.

- .MLG into .TLG
- .TLG into .TLG

- .TLG into .MLG
- .MLG into .MLG

To merge message and trace log files:

1. From the Log Viewer window, select the message or trace log file window where the files will be merged.
2. Click the **File** menu, then click **Merge** and choose a file to be merged.

Sorting Message and Trace Logs

The Z and I Emulator for Windows log viewer utility allows you to sort message and log files in ascending and descending order. To sort files in ascending order, click the column header one time, or right mouse click the data. Click the column header, or right mouse click the data a second time to sort in descending order.

Message and logs can also be sorted by selecting the data to be sorted, and right mouse clicking to display the pop-up menu. Click **Sort**.

Searching Z and I Emulator for Windows Logs

To search the log files, click **Edit → Find** on the **Main** menu.

Type your search string in the provided box. You can refine your search by checking the **Match case** check box if your search is to be case-specific. If you want to limit your search to only complete words, select the **Match whole word only** check box.

Clicking **Find Next** takes you to the next instance where your search string appears highlighted in the log.

Clicking **Cancel** will stop the search.

Filtering Z and I Emulator for Windows Logs

Messages can be filtered by component only. Traces can be filtered by component, by process ID, and by thread ID.

To filter the message or trace record list, do the following:

1. Decide what you want to filter by. For example, in the message log, you may want to filter your view so that it contains only messages issued by a particular component. (Filtering by component is the default.)
2. Click the left mouse button to highlight the item that has the value that you want to filter by.
3. Right click in the appropriate column list area.
4. Click **Filter In**, **Filter Out** or **Sort**.

   Filter In allows only those items selected to be in the resulting view. **Filter Out** removes the selected items from the resulting view. **Sort** allows you to sort entries in ascending or descending order based upon the entry selected. This function works much like sorting by column header. Filters are cumulative, so you can filter the results of your first filter.

To restore your original view, click **View** and then **Refresh**, or you can press **F5**.

Part III. SNA and AnyNet Topics

Chapter 12. SNA Client/Server Concepts

Terminology

Advanced Program-to-Program Communication (APPC)

An implementation of the SNA LU 6.2 protocol that allows interconnected systems to communicate and share the processing of programs.

Advanced Peer-to-Peer Networking® (APPN®)

An enhancement for Systems Network Architecture (SNA) networks featuring:

- Dynamic exchange of network topology information that simplifies connections, route selection, network definition, and reconfiguration
- Automated resource registration and directory lookup
- Greater distributed network control that helps to isolate the effects of single points of failure

Common Programming Interface for Communications (CPI-C)

Z and I Emulator for Windows provides support for the Common Programming Interface for Communications (CPI-C) 2.0 industry standard interface from X/Open. The CPI-C interface enables greater application portability across different platforms. By using CPI-C 2.0, APPC programming is simplified, resulting in reduced cycle time, and enhanced client/server computing capability. This support provides the capability for distributed parts of an application to converse with one another. The implementation is consistent with the Conversational function described in the IBM® Open Blueprint®.

Logical Unit Address (LUA)

System software and interfaces that supply input/output (I/O) service routines to support communications that use LU types 0, 1, 2, and 3 SNA protocols. These protocols support user defined data streams, SNA character streams, and SNA 3270 data streams. LUA services include only those services that support data communications. LUA does not supply any device emulation facilities.

Node

An endpoint of a link, or a junction, common to two or more links in a network. Nodes can be linked to host processors, communication controllers, cluster controllers, terminals, or workstations.

End Node

Provides directory and routing services for a workstation on an APPN® network.

If the workstation will not be connecting from an end node to a network node server, you need to define an SNA connection.

APPC Concepts

Z and I Emulator for Windows provides Advanced Peer-to-Peer Networking® (APPN®) end node support for workstations, allowing them to communicate more flexibly with other systems in the network.

Z and I Emulator for Windows provides advanced program-to-program communications (APPC) to support communications between distributed processing programs, called *transaction programs* (TPs). APPN® extends this capability to a networking environment. The TPs can be located at any node in the network that provides APPC.

Introducing APPC and CPI-C

Advanced Program-to-Program Communication (APPC), also known as LU 6.2, is software that enables high-speed communications between programs on different computers, from portables and workstations to midrange and host computers. APPC software is available for many different IBM® and non-IBM operating systems, either as part of the operating system or as a separate software package.

APPC serves as an interface between application programs and the network. When the communications application on your workstation passes information to the APPC software, APPC takes the information and sends it on to a network interface, such as a token ring adapter card. The information travels across the network to another computer, where the APPC software receives the information from the network interface. APPC puts the information back into its original format and passes it to the corresponding communications application.

APPC provides a consistent set of functions for program-to-program communications across different platforms. But, the architecture did not specify a common application programming interface (API) for implementing these functions. As a result, each operating system that supports APPC developed its own API, a set of verbs that closely resemble the operating system itself. These differences do not pose a problem if you are writing programs for two computers that use the same operating system. Most client/server applications run on different types of computers, however, to take advantage of the strengths of each computer. So, if you are designing programs for different operating systems, you must learn how to use two or more different sets of verbs.

The Common Programming Interface for Communications (CPI-C) eliminates this problem. CPI-C provides one standard set of verbs, known as CPI-C calls, for all systems that support CPI-C. As a result, you learn only one set of calls to write client/server applications for different systems.

What Is a Transaction Program?

The part of the communications application that initiates or responds to APPC communications is called a transaction program. A transaction program is not an entire, stand-alone program. Instead, it is the part of the program that handles transactions (exchanges of data) with another program.

When people talk with each other, we say that they are having a conversation. Likewise, the communication between two transaction programs is called a conversation.

A conversation between two programs is similar to a conversation between two people. When you have a conversation with another person, you follow unwritten rules that govern how you begin and end the conversation, take turns speaking, and exchange information. Similarly, APPC is called a protocol because it provides the rules that govern how conversations between transaction programs start and stop, which program *"speaks"* first, and how data is exchanged. Computers need complete and rigid rules for conversations between programs. For that reason, APPC consists of a set of well-defined and thorough rules to cover all possible communications situations.

An APPC program may have several conversations active at one time, with the same transaction program or with different transaction programs.

Every transaction program needs a partner to communicate with. Thus, transaction programs are developed in pairs called partner transaction programs.

People use different parts of speech to communicate with each other. Transaction programs are more limited in their communications; they use only verbs to communicate with each other. The verbs are the programming language you use to start, stop, and control conversations.

A transaction program consists of APPC and CPI-C verbs such as:

ALLOCATE (CMALLC in CPI-C)

Starts a conversation with another transaction program

SEND_DATA (CMSEND in CPI-C)

Sends data to the partner transaction program

RECEIVE (CMRCV in CPI-C)

Receives data from the partner transaction program

DEALLOCATE (CMDEAL in CPI-C)

Ends a conversation with another transaction program.

The APPC verbs make up the application programming interface (API) for APPC and CPI-C. In other words, these verbs represent the interface between the transaction program and the APPC software.

What Is the Difference between APPC and APPN®?

APPC is a communications protocol that enables programs on different computers to *"talk to"* each other. APPC provides the interface between the programs and the networking hardware and software and defines the rules that programs use to exchange information.

Advanced Peer-to-Peer Networking® (APPN®) is the underlying networking protocol that routes APPC traffic through intermediate nodes in the network. For instance, when Program A uses APPC to talk to Program B, APPN® finds the node where Program B is located and directs the APPC traffic through the network.

APPN® includes several features that help reduce the amount of configuration required to set up and maintain a network. These features automate many tasks that are time-consuming, complicated, and error-prone. For example, if you're installing a new workstation that uses APPN®, you don't have to set up configuration information for every workstation you want to communicate with. You simply provide the name of the computer and the address of the intermediate node that handles your traffic. APPN® takes care of the rest of the information needed to route APPC traffic to and from your workstation.

If you connect to an APPN® network, you simplify your own configuration and make it easier for other computers in the network to find you.

Side Information Definitions

Before starting a conversation with a partner program, a CPI-C program requires the following information:

- The name of the partner program
- The name of the LU on the remote computer
- The type of session used by the program
- Security information

If the CPI-C partner program uses a blank symbolic destination name, a side information definition is not necessary.

Improving Productivity Using APPC

The advanced features of APPC help speed the development of robust client/server applications and keep development costs low.

Client/server applications often prove to be especially challenging to the programmer. It is not enough to understand the details about the computer and operating system that your application uses. If you're designing client/server applications, you have to deal with computers used by both sides of the application, as well as the intervening network. For instance, implementing effective security measures is more important and more complicated, since you must ensure security throughout the network. In addition, synchronization and error reporting are often problematic in a distributed environment, because both sides of the application must coordinate their work.

One reason that APPC has become so widely used in client/server applications is that it furnishes a complete set of useful functions like security, synchronization, and error reporting. If you use other protocols, you must build these functions in every application you write. For example, if you use NetBIOS, you must design and implement a strategy for security for each application. Not only does this approach require additional work, it may result in a number of incompatible security systems in your network. By contrast, APPC includes a common set of security services that are consistent across all APPC platforms.

Similarly, most protocols do not include synchronization functions. Synchronization is required by any program that cannot continue processing data until the data sent to the partner program has been received and processed. Rather than writing your own synchronization routine, APPC provides a Confirm call that you can use to handle synchronization between two programs.

Improving Productivity Using CPI-C

Because many client/server applications are distributed between mainframe systems and workstations, host programmers and workstation programmers must work together to develop partner applications. CPI-C bridges the gap between these programmers by providing a common language for designing the communications part of the applications. CPI-C also enables you to write the communications portion of an application without knowing the details of the operating system. After you write a CPI-C application, you can easily move the programs from one operating system to another with few changes. So, by using the CPI-C interface, you can port both your applications and your programming skills from one system to another, quickly and cost-effectively.

What Is a Logical Unit?

Every TP gains access to an SNA network through a *logical unit* (LU). An LU is SNA software that accepts verbs from your programs and acts on those verbs. A TP issues APPC verbs to its LU. These verbs cause commands and data to flow across the network to a partner LU. An LU also acts as an intermediary between the TPs and the network to manage the exchange of data between TPs. A single LU can provide services for multiple TPs. Multiple LUs can be active in the node simultaneously.

LU Types

Z and I Emulator for Windows supports LU types 0, 1, 2, 3, and 6.2. LU types 0, 1, 2, and 3 support communication between host application programs and different kinds of devices, such as terminals and printers.

LU 6.2 supports communications between two programs located at type 5 subarea nodes, type 2.1 peripheral nodes, or both, and between programs and devices. APPC is an implementation of the LU 6.2 architecture.

Communication occurs only between LUs of the same LU type. For example, an LU 2 communicates with another LU 2; it does not communicate with an LU 3.

When Z and I Emulator for Windows is configured, your local and partner LUs are defined once for each machine. When you design programs, you must understand the capabilities supported by the LU in the particular machines you plan to use.

Dependent and Independent LUs

A *dependent LU* depends on a system services control point (SSCP) to activate a session. A dependent LU needs an active SSCP-LU session, which the dependent LU uses to start an LU-LU session with an LU in a subarea node. A dependent LU can have only one session at a time with the subarea LU. For communications with a TP at a subarea node, each dependent LU can have only one conversation at a time, and each dependent LU can support communications for only one TP at a time.

An *independent LU* does not depend on an SSCP to activate a session. An independent LU supports multiple concurrent sessions with other LUs in a subarea node, so you can have multiple conversations and support multiple TPs for communications with subarea TPs. LUs between peripheral nodes also use this support.

The distinction between a dependent LU and an independent LU is meaningful only when discussing a session between an LU in a peripheral node and an LU in a subarea node. Otherwise, dependent and independent LUs both support multiple concurrent sessions and conversations when communicating between type 2.1 peripheral nodes, for example, between two Windows workstations. A Z and I Emulator for Windows LU can support a single session with a dependent LU or multiple sessions with an independent LU.

What Is a Session?

Before TPs can communicate with each other their LUs must be connected in a mutual relationship called a *session*. A session connects two LUs, so it is called an *LU-LU* session. Figure 3: A Session between Two LUs on page 119

illustrates this communication relationship. Multiple, concurrent sessions between the same two LUs are called *parallel* LU-LU sessions.

Figure 3. A Session between Two LUs

Sessions act as conduits that manage the movement of data between a pair of LUs in an SNA network. Specifically, sessions deal with things such as the quantity of data transmitted, data security, network routing, and traffic congestion.

Sessions are maintained by their LUs. Normally, your TPs do not deal with session characteristics. You define session characteristics when you:

- Configure your system
- Use the Session Services function in the Subsystem Management windows
- Use the management verbs

What Is a Conversation?

The communication between TPs is called a *conversation*. Conversations occur across LU-LU sessions. A conversation starts when a TP issues an APPC verb or CPI-C call that allocates a conversation. The conversation style associated with the conversation indicates the style of data transfer to be used, two-way alternate or two-way simultaneous. A conversation that specifies a two-way alternate style of data transfer is also known as a *half-duplex* conversation. A conversation that specifies a two-way simultaneous style of data transfer is referred to as a *full-duplex* conversation.

When a half-duplex conversation is allocated to a session, a send-receive relationship is established between the TPs connected to the conversation, and a two-way alternate data transfer occurs where information is transferred in both directions, one direction at a time. Like a telephone conversation, one TP calls the other, and they *"converse"*, one TP talking at a time, until a TP ends the conversation. One TP issues verbs to send data, and the other TP issues verbs to receive data. When it finishes sending data, the sending TP can transfer send control of the conversation to the receiving TP. One TP decides when to end the conversation and informs the other when it has ended.

When a full-duplex conversation is allocated to a session, both TPs connected to the conversation are started in send-and-receive state, and a two-way simultaneous data transfer occurs where information is transferred in both directions at the same time. Both TPs may issue verbs to send and receive data simultaneously with no transfer of send control required. The conversation ends when both TPs indicate they are ready to stop sending data, and each TP has received the data sent by the partner. If an error condition occurs, one TP may decide to end both sides of the conversation abruptly.

Conversations can exchange control information and data. The TP should select the conversation style best suited for its application.

A Conversation between Two TPs

Figure 4: A Conversation between Two TPs on page 120 shows a conversation between two TPs as it occurs over a session.

Figure 4. A Conversation between Two TPs

A session can support only one conversation at a time, but one session can support many conversations in sequence. Because multiple conversations can reuse sessions, a session is a long-lived connection compared to a conversation. When a program allocates a conversation and all applicable sessions are in use, the LU puts the incoming Attach (allocation request) on a queue. It completes the allocation when a session becomes available.

Two LUs can also establish parallel sessions with each other to support multiple concurrent conversations. A parallel session occurs when either TP allocates a conversation, and a session exists but is being used by a conversation. The LU can request a new session to satisfy the allocation.

Parallel Sessions between LUs

Figure 5: Parallel Sessions between LUs on page 120 shows three parallel sessions between two LUs; each session carries a conversation.

Figure 5. Parallel Sessions between LUs

SNA Communications

Z and I Emulator for Windows supports Systems Network Architecture (SNA) type 2.1 nodes (including SNA type 2.0 and SNA type 2.1 support for LUs other than SNA LU 6.2). This support lets you write programs to communicate with many other IBM® SNA products.

You can write programs without knowing the details of the underlying network. All you need to know is the name of the partner LU; you do not need to know its location. SNA determines the partner LU location and the best path for routing data. A change to the underlying network, such as a physical address change, the addition of a new adapter, or the relocation of a machine, does not affect APPC programs. A program might, however, need to establish link connections over switched SDLC connections.

When Z and I Emulator for Windows starts, it establishes local LU and logical link definitions, which are stored in a configuration file. The system management application programming interface (API) provides functions that control configuration definition and adapter and link activation.

SNA Node Operations

With SNA Node Operations, either a user or system administrator can display information or take action on node resources that are known to the active node.

The following tasks are supported:

- Starting and stopping resources
- Deleting resources
- Displaying resource information
- Changing session limits
- Initiating path switches

For more information about SNA node operations, see SNA Node Operations on page 150 or refer to the online help.

Chapter 13. AnyNet SNA over TCP/IP

This chapter describes the AnyNet® SNA over TCP/IP function of Z and I Emulator for Windows.

What Does AnyNet SNA over TCP/IP Do?

SNA over TCP/IP is one of the IBM® AnyNet® software offerings. AnyNet® software enables application programs to communicate over different transport networks and across interconnected networks. Using AnyNet®, you can reduce the number of transport networks and therefore reduce operational complexity. These benefits are gained without modification to your existing application programs or hardware.

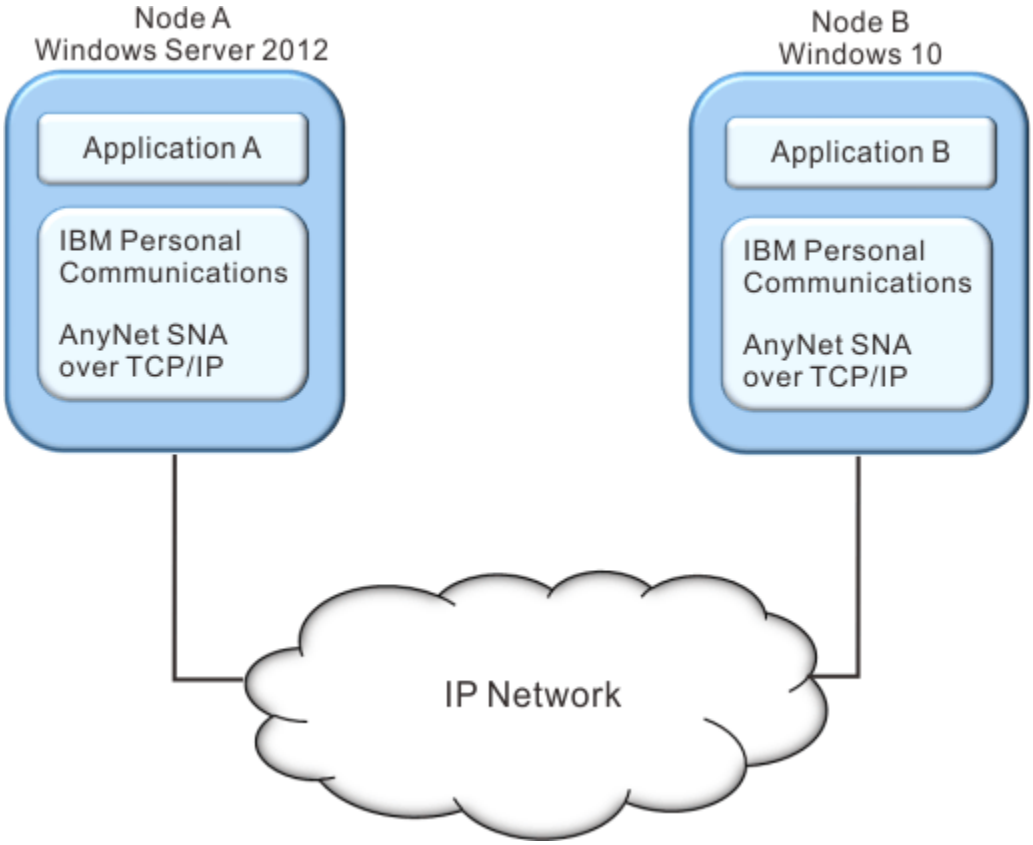
The AnyNet® function in Z and I Emulator for Windows enables SNA applications to communicate over an IP network. This includes the Z and I Emulator for Windows emulators, both 3270 and 5250, as well as APPC and CPI-C applications.

The following network configurations illustrate how SNA over TCP/IP access nodes and gateways can be used.

Running APPC or CPI-C Applications over a TCP/IP Network

Figure 6: Running APPC or CPI-C Applications over a TCP/IP Network on page 123 illustrates how you can use the AnyNet® SNA over TCP/IP function of Z and I Emulator for Windows to enable communication between SNA applications over an IP network. Configuration information for a similar configuration is provided in *Quick Beginnings*.

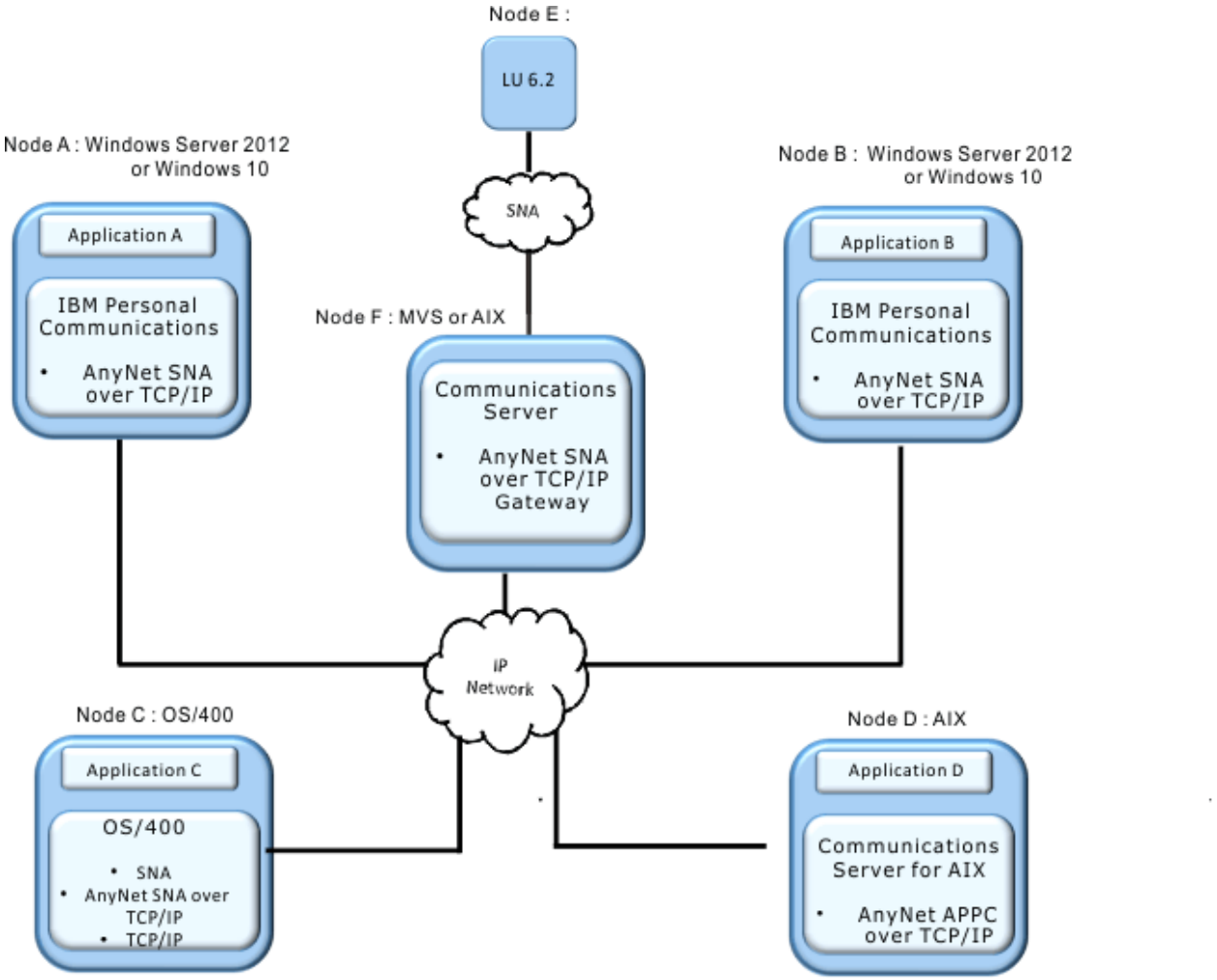
Figure 6. Running APPC or CPI-C Applications over a TCP/IP Network



Using AnyNet® to Connect SNA Applications on Different Platforms

Figure 7: Using AnyNet to Connect SNA Applications on Different Platforms on page 124 illustrates some of the many products with AnyNet® SNA over TCP/IP function. AnyNet® gateways (Node F) allow SNA applications to communicate across a combination of TCP/IP and SNA networks.

Figure 7. Using AnyNet® to Connect SNA Applications on Different Platforms

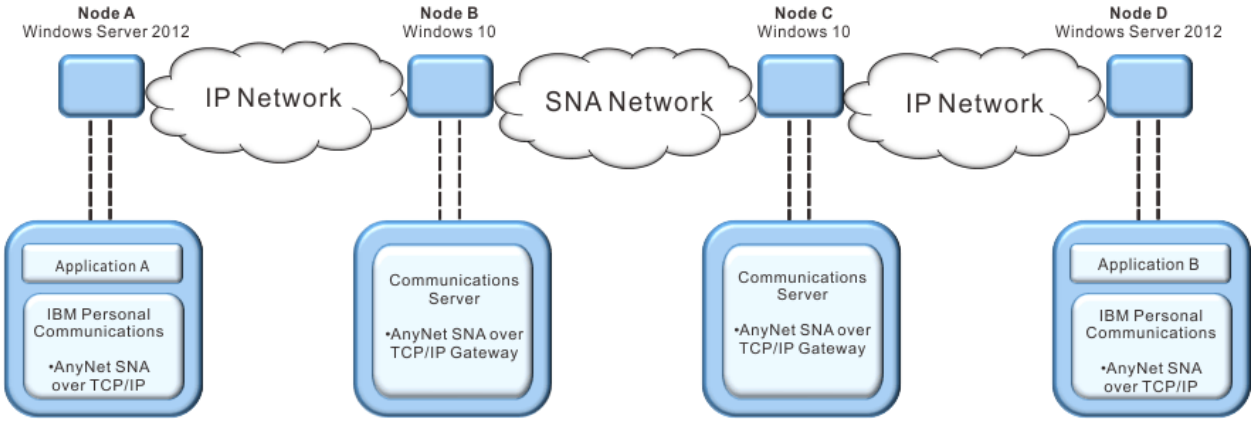


Chaining Gateways to Connect Multiple SNA and IP Networks

Chained gateways enable the SNA network to connect multiple IP networks.

Note: While Figure 8: Chaining Multiple Gateways to Connect Multiple IP Networks on page 125 shows three networks connected, the number of networks that can be concatenated is unlimited.

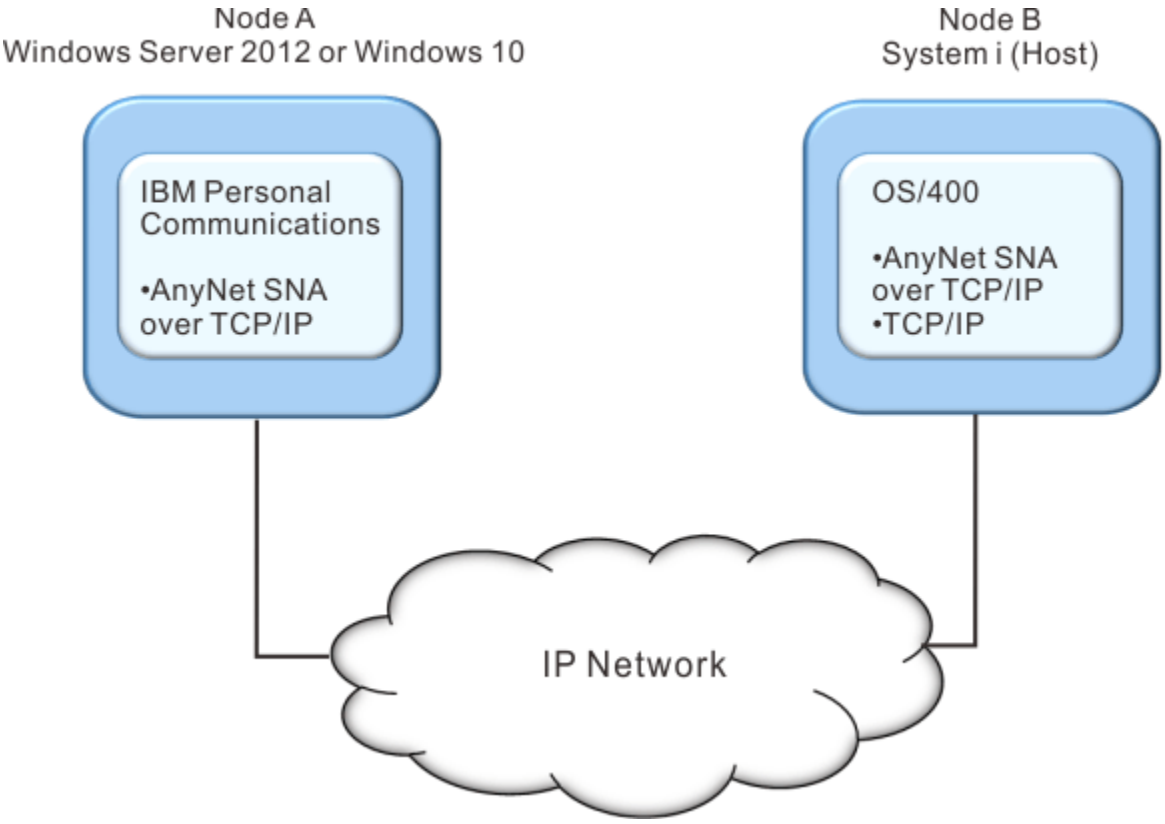
Figure 8. Chaining Multiple Gateways to Connect Multiple IP Networks



5250 Emulation over a TCP/IP Network

Figure 9: 5250 Emulation over a TCP/IP Network on page 125 illustrates how AnyNet® enables 5250 emulation over a TCP/IP network. Configuration instructions for this example are provided in *Quick Beginnings*.

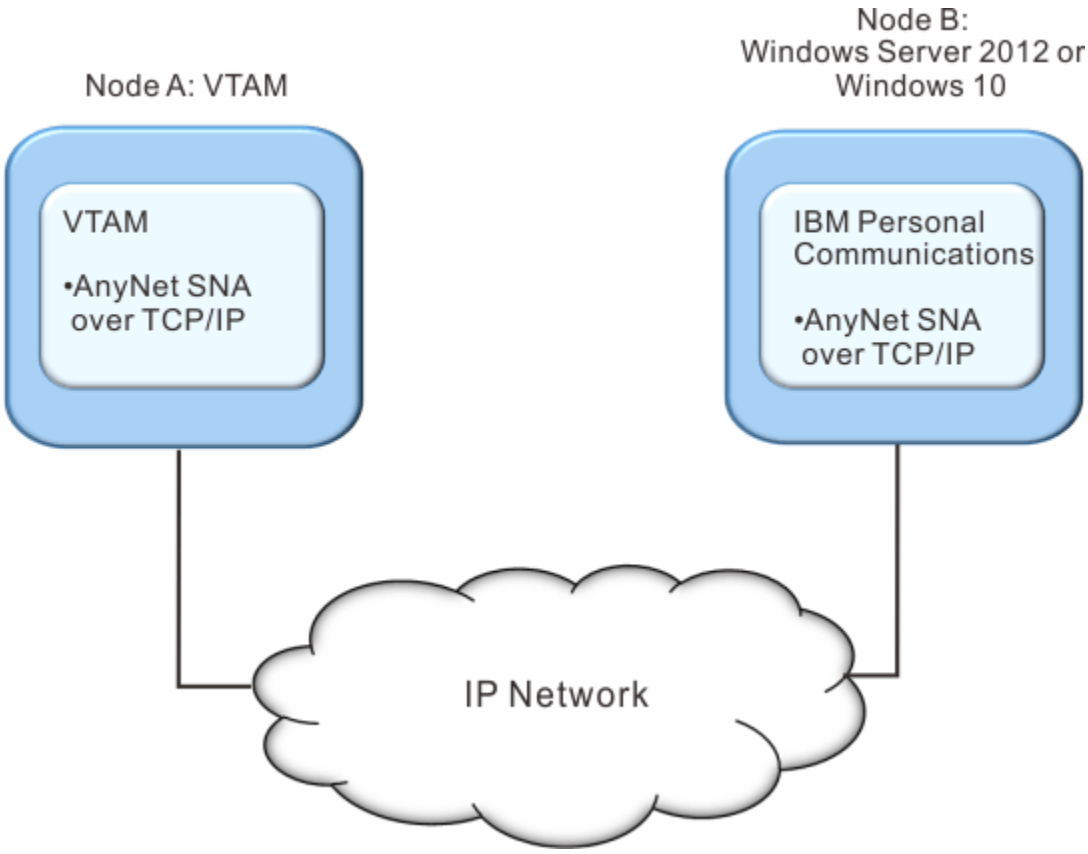
Figure 9. 5250 Emulation over a TCP/IP Network



APPC3270 Emulation over a TCP/IP Network

AnyNet® also enables APPC3270 emulation over a TCP/IP network. See Figure 10: APPC3270 Emulation over a TCP/IP Network on page 126. Configuration instructions for this example are given in *Quick Beginnings*.

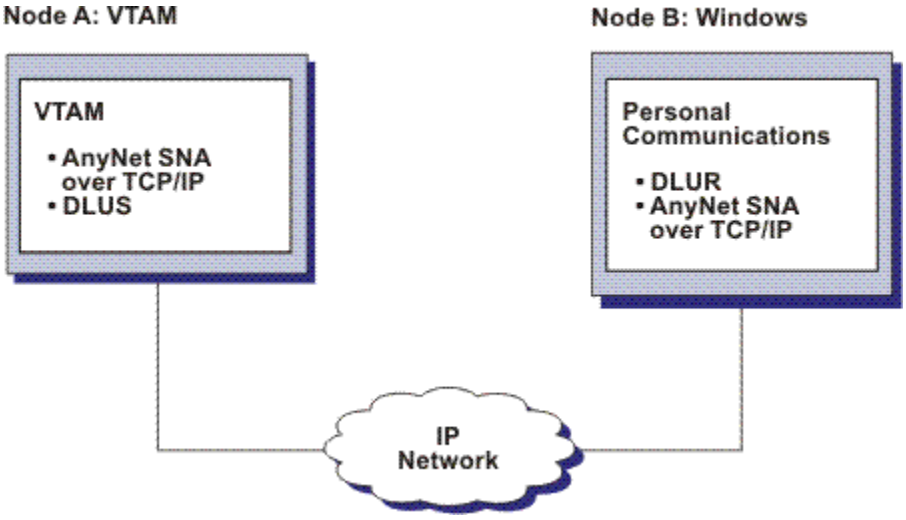
Figure 10. APPC3270 Emulation over a TCP/IP Network



3270 Emulation via DLUR over a TCP/IP Network

Figure 11: 3270 Emulation via DLUR over a TCP/IP Network on page 127 illustrates how you can use the AnyNet® SNA over TCP/IP function of Z and I Emulator for Windows to enable 3270 emulation over a TCP/IP network. Node B, an access node, is defined as a dependent LU requester (DLUR). Configuration instructions for this example are provided in *Quick Beginnings*.

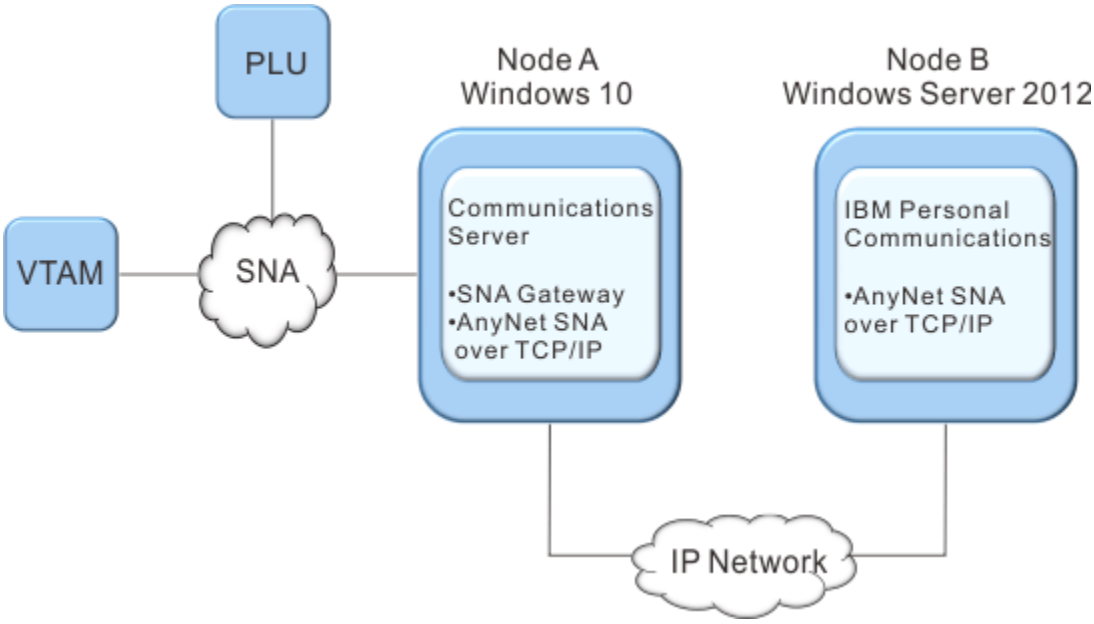
Figure 11. 3270 Emulation via DLUR over a TCP/IP Network



3270 Emulation over a TCP/IP Network via an SNA Gateway to a VTAM® Host on an SNA Network

Figure 12: 3270 Emulation over a TCP/IP Network via an SNA Gateway to a VTAM Host on an SNA Network on page 127 illustrates a configuration that supports dependent LU communications for downstream workstations to a subarea host. In this example, Node B is configured for dependent LU communication over AnyNet® to a zSeries™ host. Configuration instructions for this example are provided in *Quick Beginnings*.

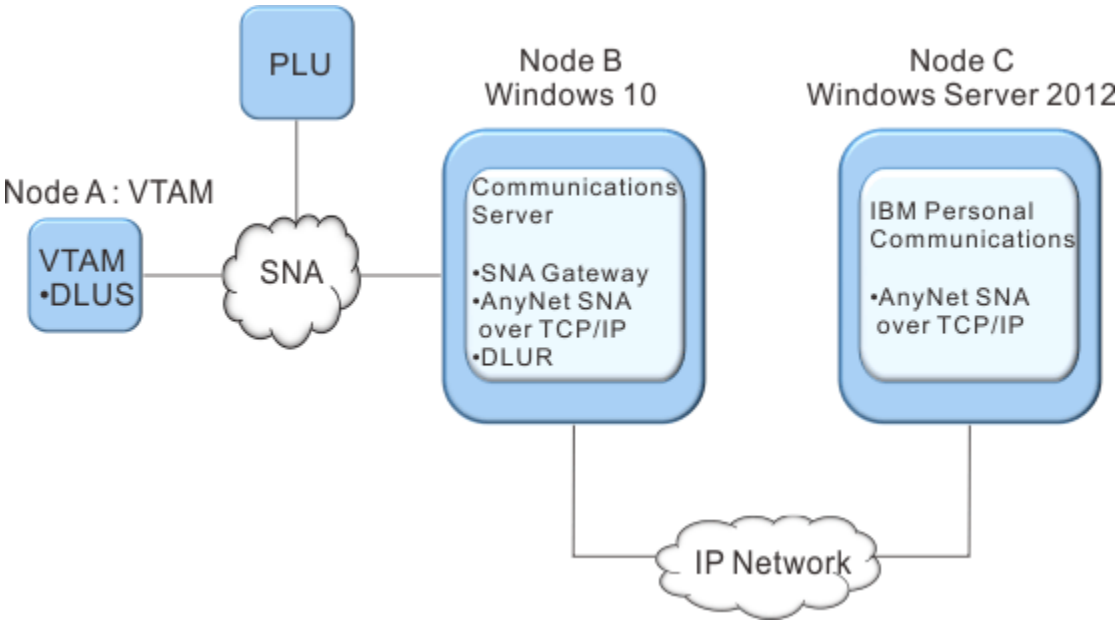
Figure 12. 3270 Emulation over a TCP/IP Network via an SNA Gateway to a VTAM® Host on an SNA Network



3270 Emulation over a TCP/IP Network via an SNA Gateway to a VTAM® Host on an APPN® Network

Figure 13: 3270 Emulation over a TCP/IP Network via an SNA Gateway to a VTAM Host on an APPN Network on page 128 illustrates a configuration that supports dependent LU communication for downstream workstations to an APPN® host. The configuration of Node C is the same as that of Node B in the previous example, but the VTAM® host and the OS/2® gateway are connected to an APPN® network.

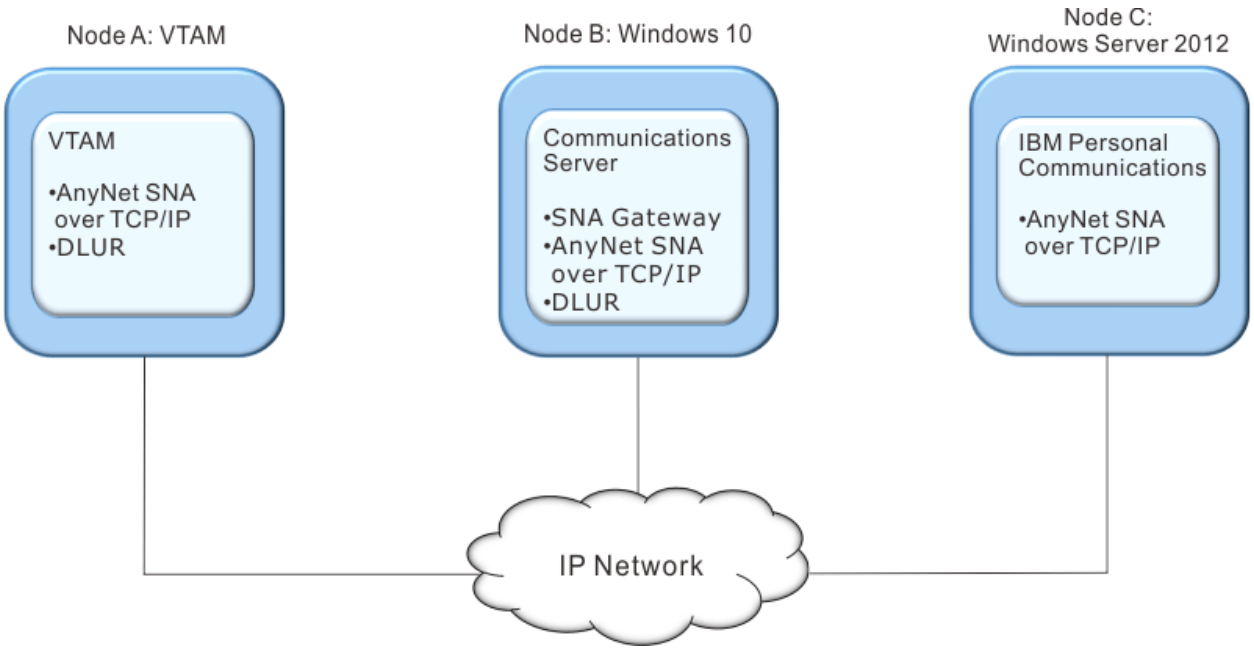
Figure 13. 3270 Emulation over a TCP/IP Network via an SNA Gateway to a VTAM® Host on an APPN® Network



3270 Emulation via an SNA Gateway over a TCP/IP Network

Figure 14: 3270 Emulation via an SNA Gateway over a TCP/IP Network on page 129 illustrates a configuration that supports dependent LU communication for downstream workstations over a single IP network. All three machines are running AnyNet® SNA over TCP/IP. As in the previous example, Node A is a dependent LU server (DLUS), and Node B is a dependent LU requester (DLUR). Configuration instructions for this example are given in *Quick Beginnings*.

Figure 14. 3270 Emulation via an SNA Gateway over a TCP/IP Network

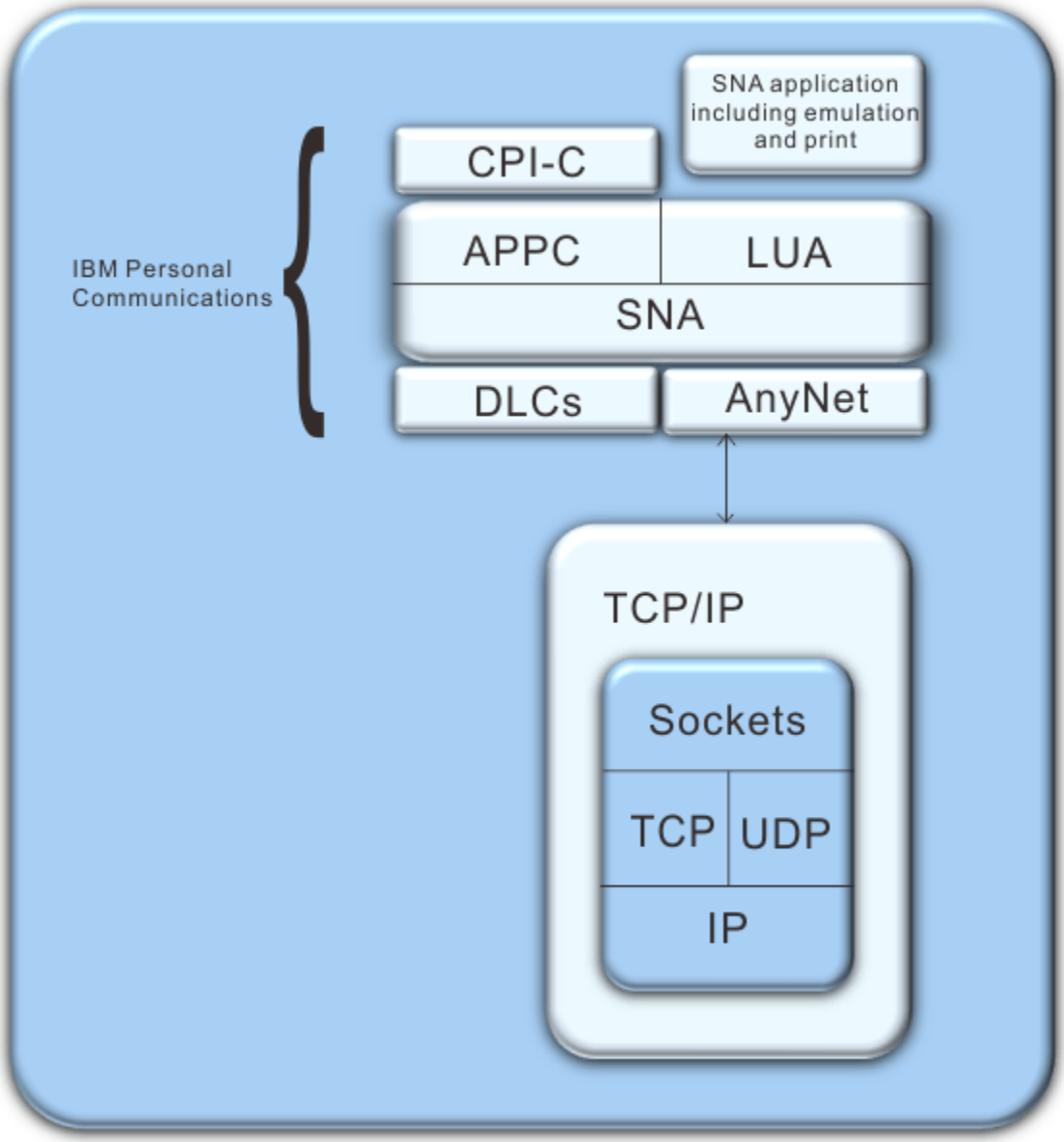


How Does SNA over TCP/IP Work?

SNA over TCP/IP uses protocols that bypass the lower transport layers of the SNA architecture. This process is transparent to the SNA application program. Using a supported API, an application program passes data to the presentation services of Z and I Emulator for Windows. This data, in turn, is passed through the SNA architectural layers and presented to SNA over TCP/IP at the data link control level. When Z and I Emulator for Windows initiates a session for an application program, SNA over TCP/IP translates the SNA routing information (network-qualified name) into IP routing information (IP address) and uses the IP address to create a TCP connection to the appropriate system.

Figure 15: Structure of SNA over TCP/IP for Z and I Emulator for Windows on page 130 illustrates how an SNA over TCP/IP access node enables SNA application programs to communicate over IP networks.

Figure 15. Structure of SNA over TCP/IP for Z and I Emulator for Windows



The configuration information you define enables SNA over TCP/IP to determine:

- Whether to route the data using SNA or to route the data using IP
- The IP address associated with the network-qualified LU name

SNA over TCP/IP uses both stream (TCP) and datagram (UDP) sockets that are bound to the well-known port (397). Any information received over this port is routed to AnyNet®.

Mapping SNA Resources to IP Addresses

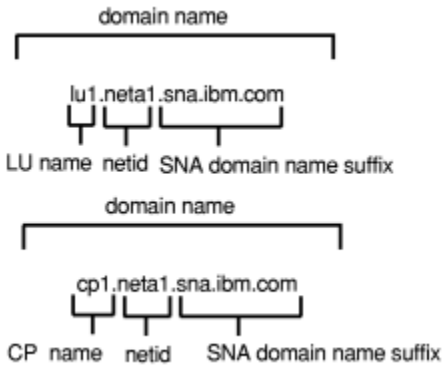
SNA over TCP/IP access nodes must determine the IP address of the partner before an SNA session can be established. The SNA identifier of the partner is mapped to an IP address using the following steps:

1. SNA over TCP/IP receives the SNA identifier from Z and I Emulator for Windows in one of the following formats:
   - For LU names, `netid.luname`
   - For CP names, `netid.cpname`
2. SNA over TCP/IP takes the identifier and generates a domain name:
   - For LU names, `luname.netid.snasuffix`
   - For CP names, `cpname.netid.snasuffix`

Note: The default value for `snasuffix` is **SNA.IBM.COM**. For additional information on the SNA domain name suffix, refer to the online help.

Figure 16: Formats of the Domain Names That SNA over TCP/IP Builds on page 131 shows examples of domain names generated by SNA over TCP/IP.

Figure 16. Formats of the Domain Names That SNA over TCP/IP Builds



3. SNA over TCP/IP requests that the domain name be translated into an IP address.
4. TCP/IP uses the HOSTS file or domain name server to translate the domain name into an IP address (for example, `9.67.192.28`).

When the IP network includes SNA over TCP/IP gateways, consider the following additional address mapping issue:

If the partner LU can be reached through a gateway, the domain name of the partner must be mapped to the IP address of the gateway. If there are parallel gateways, the domain name should be mapped to each gateway IP address.

Defining Domain Names and IP Addresses

This section describes the TCP/IP name resolution function, used by AnyNet® to map SNA resources to IP addresses. This function queries both the local HOSTS file and any domain name servers to convert a domain name (for example, `lu1.neta1.sna.ibm.com`) into an IP address (for example, 10.1.1.1).

HOSTS File

You can use TCP/IP HOSTS files to define domain names and IP addresses for your network. However, as your network becomes larger and maintaining the HOSTS file on each user workstation becomes too time-consuming, it is recommended that you use a domain name server.

The HOSTS file lists:

- IP address
- Domain name
- Other aliases for the domain name

For example, if your IP address is 10.1.1.1, network ID is NETA1, SNA resource name is LUA1, and SNA domain name suffix is the default (`sna.ibm.com`), enter the following in your HOSTS file:

```
10.1.1.1     lua1.neta1.sna.ibm.com
```

Domain Name Server

Domain names and IP addresses can also be defined in the domain name server database.

Each SNA identifier is mapped to a corresponding IP address by a domain name server. The location of these servers is configured in the Network section of the Control Panel.

For more information on HOSTS files and domain name servers, refer to your TCP/IP documentation. If your workstation is using the TCP/IP support in Windows® 8, Windows® 8.1, Windows® 10, and Windows® Server 2008, refer to the online TCP/IP documentation that is included with the Windows® products.

Defining Unique CP Names and Connection Network Names

For configurations that have two or more SNA over TCP/IP gateways connecting an SNA network with two or more IP networks, you must define a unique SNA control point (CP) name and a unique SNA connection network name for each IP network.

All LUs that reside on access nodes in the IP network appear to reside on a node with this CP name.

Use the reverse data file of the domain name server or the HOSTS file to define the CP name and the connection network name for a given IP network. Map the IP address 127.0.0.3 to the CP name and map the IP address 127.0.0.4 to the connection network name.

The following example shows entries in the reverse data file. For an IP network with SNA network ID NETA, CP name MYCPNAME, and connection network name MYCNET, you would define the following entries:

```
127.0.0.3       NETA.MYCPNAME.
127.0.0.4       NETA.MYCNET.
```

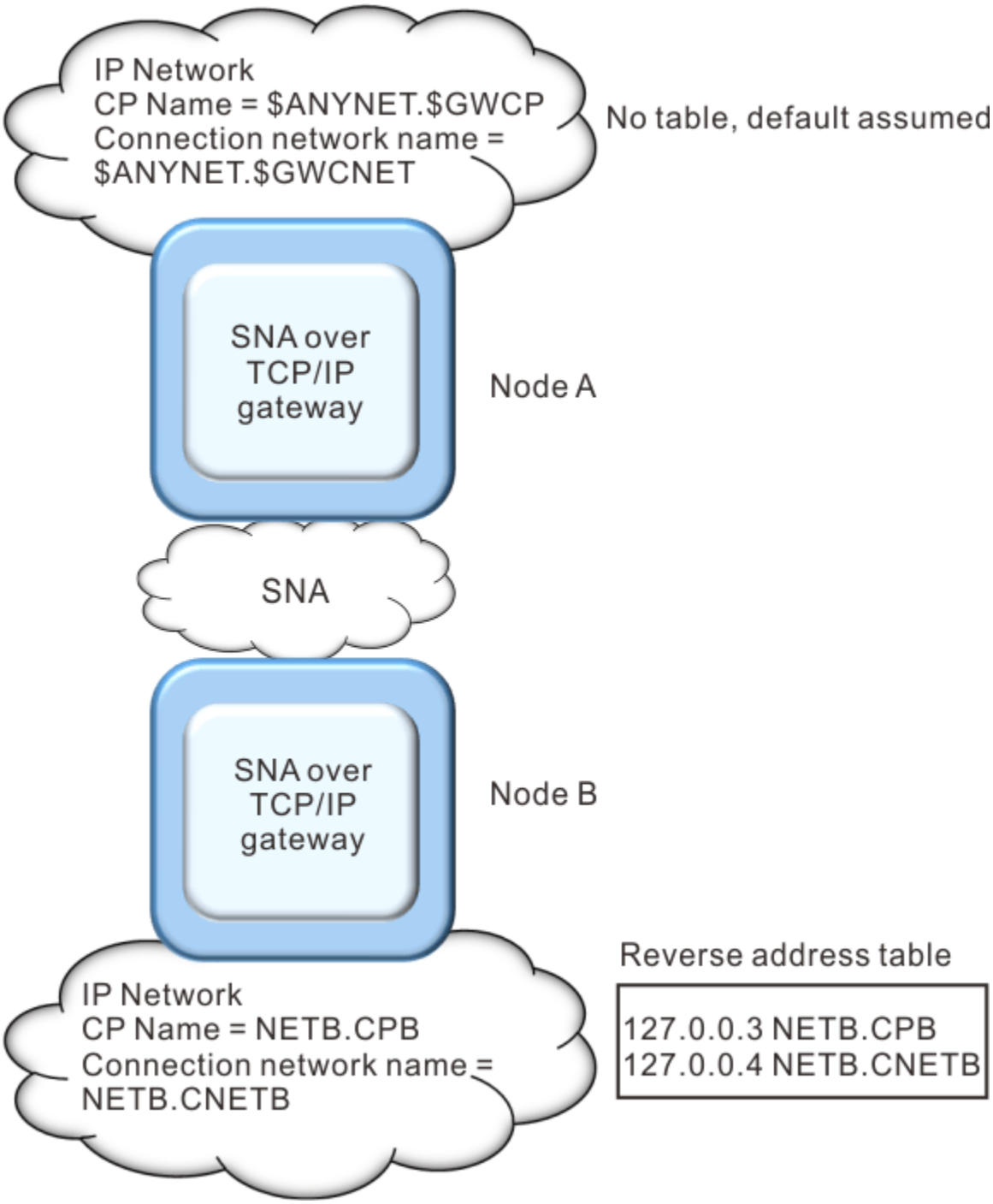
Note:

1. A period is required at the end of the name only if the definition is in the DNS reverse data file. No period is used in HOSTS file definitions.
2. Do not include the SNA domain name suffix.

The AnyNet® SNA over TCP/IP function of Z and I Emulator for Windows provides a default CP name ($ANYNET.$GWCP) and a default connection network name ($ANYNET.$GWCNET). In configurations with one IP network, you can use the default by not defining a CP name or a connection network name. In configurations with multiple gateways connecting multiple IP networks, one IP network can use the default. You must, however, define a unique CP name and connection network name for all other IP networks.

Figure 17: Defining a CP Name and a Connection Network Name on page 134 shows how to define the CP name and the connection network name for a configuration with two IP networks. An example is provided in *Quick Beginnings*.

Figure 17. Defining a CP Name and a Connection Network Name



Setting and Modifying the Routing Preference Protocol

When an SNA application initiates a session, Z and I Emulator for Windows must first determine which transport to use, either SNA, IP, or a combination of the two.

Z and I Emulator for Windows uses the default routing preference for the session unless there is a specific routing preference set for the partner LU. Z and I Emulator for Windows then sets up a session for the partner LU using the preferred transport.

If the partner is not available through the preferred transport, Z and I Emulator for Windows can reroute the session request over the other available transport, depending on the setting in the routing preference table. For example, if the setting in the routing preference table for the destination LU is nonnative first, Z and I Emulator for Windows will attempt to set up the session over TCP/IP. If the partner is not available through TCP/IP, Z and I Emulator for Windows will route the session over SNA. However, if the setting in the routing preference table for the destination LU is nonnative only, Z and I Emulator for Windows will attempt to set up the session over TCP/IP. If TCP/IP is not available, Z and I Emulator for Windows will not route the session over SNA, because the setting allows only Z and I Emulator for Windows to use nonnative transport.

The routing preference table is used only for new sessions. Previously existing sessions use the same transport; they are not brought down and rerouted if the routing preference table is changed.

You can set or modify the default routing preference to one of the following:

Native first

Requests are routed over SNA. If no SNA route is available, requests are routed over TCP/IP.

Nonnative first

Requests are routed over TCP/IP. If no TCP/IP route is available, requests are routed over SNA.

Native only

Requests are routed only over SNA. If no SNA route is available, the connection will fail.

Nonnative only

Requests are routed only over TCP/IP. If no TCP/IP route is available, the connection will fail.

Helpful Hints

This section contains helpful hints on tuning, TCP/IP connectivity via SLIP or PPP, and dynamic IP addresses.

Tuning

If you can access an LU through multiple SNA over TCP/IP gateways, and you have mapped that LU name to multiple IP addresses, increase the Connection retry duration and Connection wait time limit when configuring the AnyNet® base parameters. This ensures that TCP attempts to connect to all possible adapters and gateways. It can take as long as 90 seconds for a TCP connection to fail to an inactive IP address.

Connecting to iSeries, eServer i5, or System i5

If you are unable to connect to iSeries™, eServer™ i5, or System i5™ using SNA over TCP/IP, use the following procedure:

1. Make sure that the ANYNET support on the iSeries™, eServer™ i5, or System i5™ is activated. Issue the command **DSPNETA** on the iSeries™, eServer™ i5, or System i5™ and make sure the ANYNET status is yes.
2. Edit the HOSTS file on the PC, mapping the IP address to the CP name of the iSeries™, eServer™ i5, or System i5™.
3. Reboot the PC; the SNA over TCP/IP connection is then activated.

Dynamic IP Addresses

Generally, AnyNet® SNA over TCP/IP depends on SNA resources (for example, LU names, CP names, or idblk/num) being statically mapped to IP addresses. However, depending on your configuration and how your connections are initiated, you might be able to use AnyNet® SNA over TCP/IP in environments where IP addresses are dynamically assigned (for example, DHCP).

APPC or CPI-C Applications

An SNA over TCP/IP access node with a dynamically assigned IP address may always initiate sessions to another SNA over TCP/IP access node or gateway with a static IP address.

The only way an SNA over TCP/IP access node or gateway with a static IP address (node A) can initiate a session to a partner with a dynamic IP address (node B) is:

- Node B initiated a session to or through node A first.
- The session initiated in Step 1 is still active.

Dependent LU Applications

Note: The information in this section applies to LU 0, 1, 2, 3, or dependent 6.2 applications.

SNA over TCP/IP access nodes with dynamically assigned IP addresses can support dependent LU communications if the following criteria are met.

- Dependent LU communication is occurring through an SNA gateway either through:
  - Communications Manager/2: V5 or later
  - Communications Server for Windows®: 5.0 or later
- The SNA over TCP/IP access node with a dynamically assigned IP address initiates connections to an SNA gateway with a static IP address.

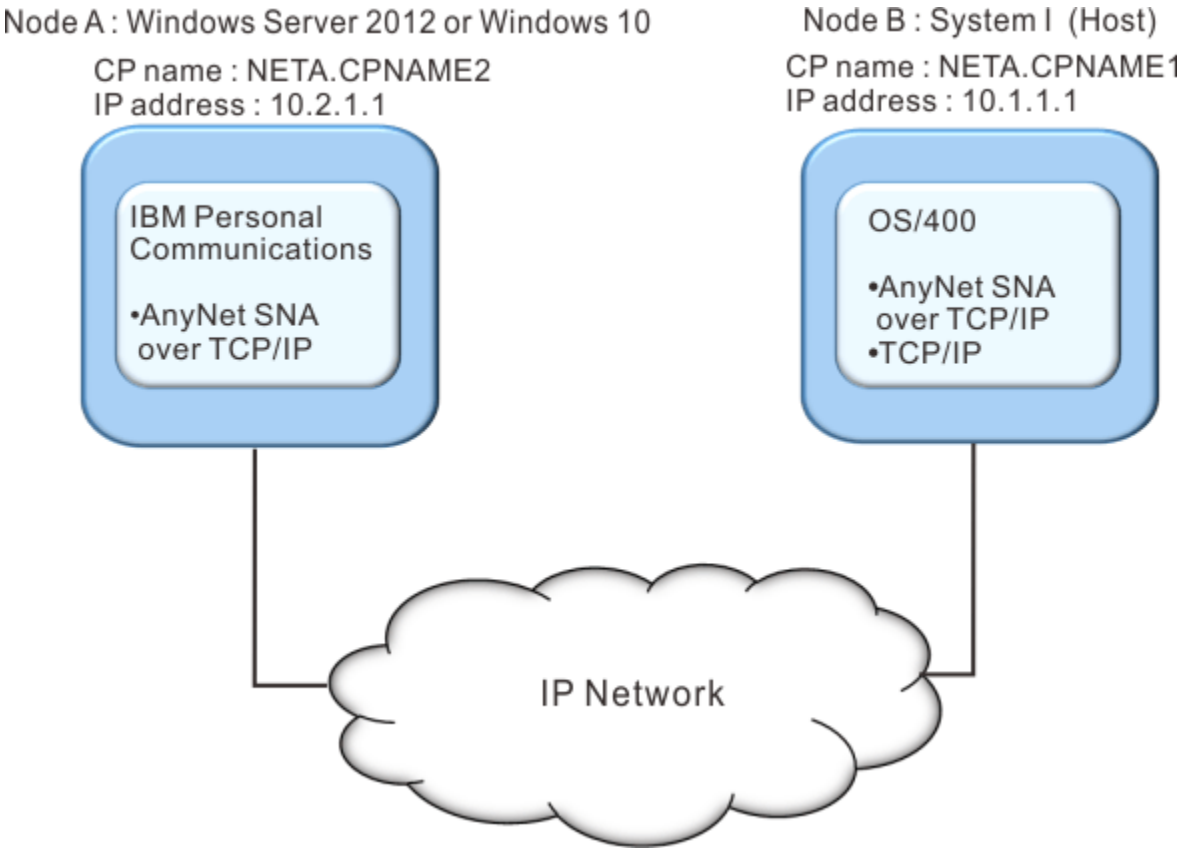
Dependent LU communication through DLUS/DLUR over AnyNet® SNA over TCP/IP is not supported if the DLUR node has a dynamically assigned IP address.

AnyNet® Configuration Examples

This section includes examples of AnyNet® running SNA over IP connections. In all examples, the SNA domain name suffix is SNA.IBM.COM.

Example 1. 5250 Emulation Over a TCP/IP Network

Figure 18. 5250 Emulation Over a TCP/IP Network



Follow these steps to establish communication between the Windows® 2008 workstation (Node A) and the iSeries™ host (Node B).

For Windows® 2008 Node A, do as follows:

1. Add the following entries to the local HOSTS file:

```
10.1.1.1 CPNAME1.NETA.SNA.IBM.COM
```

2. Create a workstation profile using the Z and I Emulator for Windows configuration tool:
    a. Click the **Start/Configure Session** icon; or click **Configure** from the **Communication** menu. The Customize Communication window is displayed.
    b. Select the following options:

- **Host: iSeries™**
- **Interface: AnyNet®**
- **Attachment: TCP/IP 5250**

c. Click **Configure**.

d. Click **Configure Link**.

e. On the Configure Local System window, enter:

PC Location Name: `NETA.CPNAME2`

On the Configure Logical Connection Windows®, enter:

System Location Name: `NETA.CPNAME1`

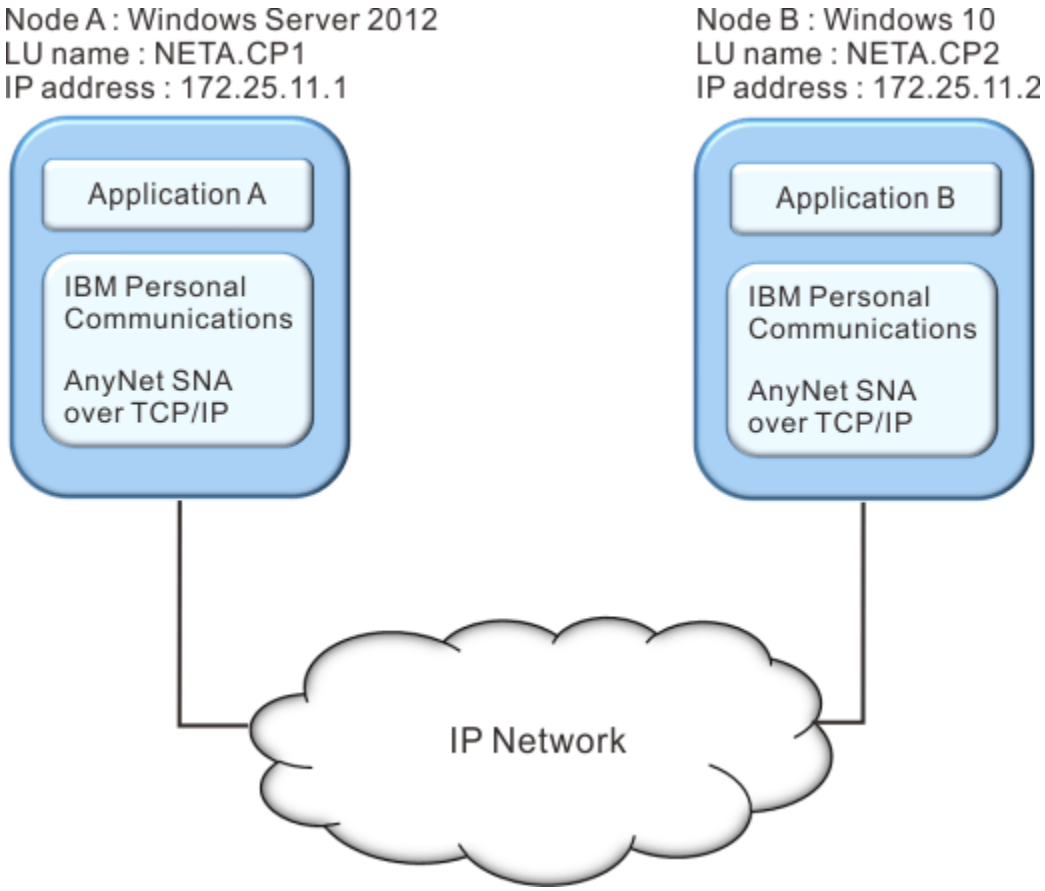
f. Save your workstation profile.

For iSeries™ Node B, add the following entry to the local HOSTS file:

```
10.2.1.1 CPNAME2.NETA.SNA.IBM.COM
```

Example 2. Running APPC or CPI-C Applications over a TCP/IP Network

Figure 19. Running APPC or CPI-C Applications over a TCP/IP Network



Follow these steps to establish communication between two Windows® nodes. Note that in this example, the CP names are used as LU names.

For Windows® Node A, do as follows:

1. Add the following entry to the local HOSTS file:

```
172.25.11.2  CP2.NETA.SNA.IBM.COM
```

2. Create a configuration using the Z and I Emulator for Windows configuration tool:
    a. Click the **SNA Node Configuration** icon; or click **Actions → Launch → SNA Node Configuration**. The Z and I Emulator for Windows SNA Node Configuration window is displayed.
    b. In the Configuration Options list, choose **Configure Node** and click **New**.
    c. On the Define the Node window on the Basic tab, enter:

    Fully qualified CP name: `NETA.CP1`

    Click **OK** to complete node configuration.

    d. Choose **Configure Devices**. In the **DLCs** list, choose **AnyNet® SNA/IP** and click **New**.
    e. On the Define an AnyNet® SNA over TCP/IP Device window on the Basic tab, enter:

    SNA domain name suffix: `SNA.IBM.COM`

    f. Click the **Routing Preferences** tab:

    Default Routing Preference: Nonnative only

    Click **OK** to complete configuration of the AnyNet® device.

    g. From the Z and I Emulator for Windows SNA Node Configuration window, click **File**. Click **Save as...** and enter the desired file name to save.

For Windows® Node B, do as follows:

1. Add the following entry to the local HOSTS file:

```
172.25.11.1  CP1.NETA.SNA.IBM.COM
```

2. Create a configuration using the Z and I Emulator for Windows configuration tool:
    a. Click the **SNA Node Configuration** icon; or click **Actions → Launch → SNA Node Configuration**. The Z and I Emulator for Windows SNA Node Configuration window is displayed.
    b. In the Configuration Options list, choose **Configure Node** and click **New**.
    c. On the Define the Node window on the Basic tab, enter:

    Fully qualified CP name: `NETA.CP2`

    Click **OK** to complete node configuration.

    d. Choose **Configure Devices**. In the DLCs list, choose **AnyNet® SNA/IP** and click **New**.
    e. On the Define an AnyNet® SNA over TCP/IP Device window on the Basic tab, enter:

SNA domain name suffix: `SNA.IBM.COM`

f. Click the **Routing Preferences** tab:

Default Routing Preference: Nonnative only

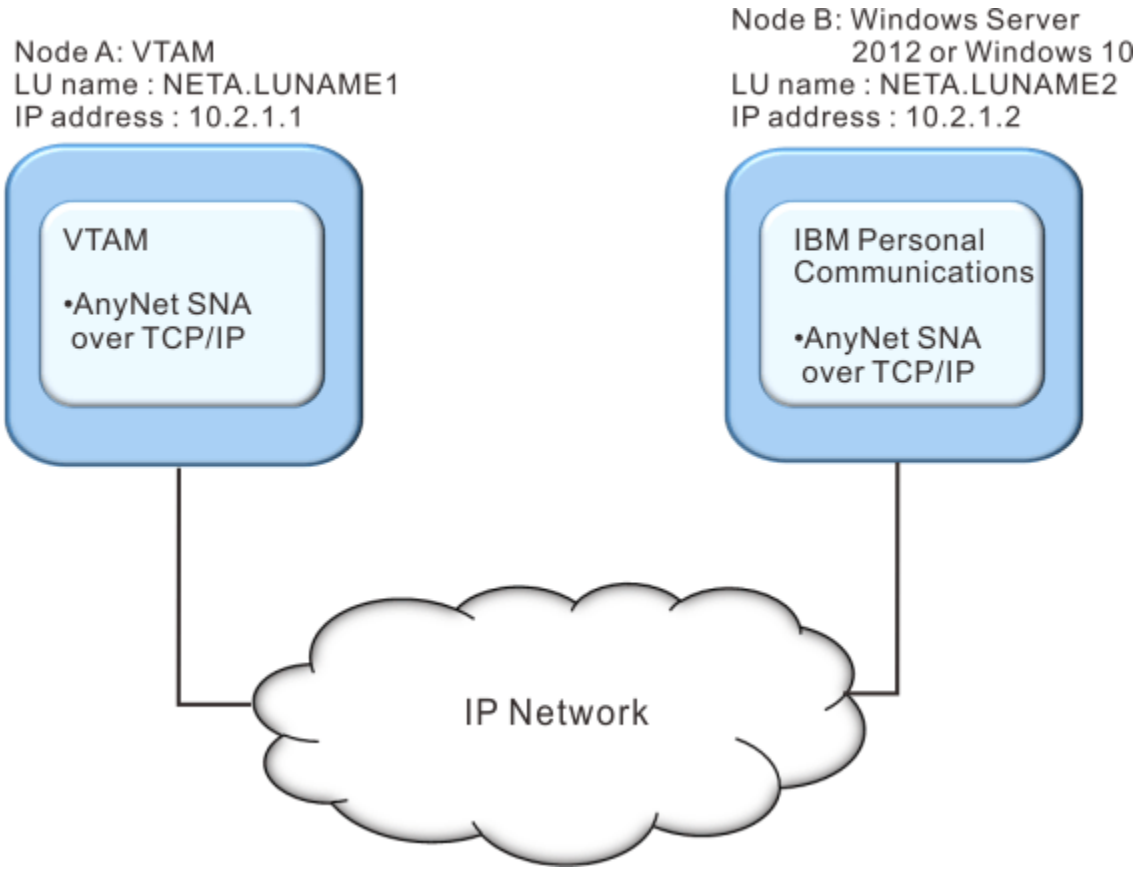
Click **OK** to complete configuration of the AnyNet® device.

g. From the Z and I Emulator for Windows SNA Node Configuration window, click **File**. Click **Save as...** and enter the desired file name to save.

3. Start Z and I Emulator for Windows on each machine.
4. Start your applications (for example APING).

Example 3. APPC3270 Emulation over a TCP/IP Network

Figure 20. APPC3270 Emulation over a TCP/IP Network



Follow these steps to establish communication between the VTAM® host (Node A) and the Windows® 2008 workstation (Node B).

For VTAM® Node A, add the following entry to the local HOSTS file:

```
10.2.1.2  LUNAME2.NETA.SNA.IBM.COM
```

For Windows® 2003 Node B, do as follows:

1. Add the following entry to the local HOSTS file:

```
10.1.1.1  LUNAME1.NETA.SNA.IBM.COM
```

2. Create a workstation profile using the Z and I Emulator for Windows configuration tool:
    a. Click the Start/Configure Session icon; or click **Configure** from the **Communication** menu. The Customize Communication window is displayed.
    b. Select the following options:
        - **Host: zSeries™**
        - **Interface: AnyNet®**
        - **Attachment: APPC3270**
    c. Click **Configure**.
    d. Click **Configure Link**.
    e. On the Configure Local System window, enter:

    PC Location Name: `NETA.LUNAME2`

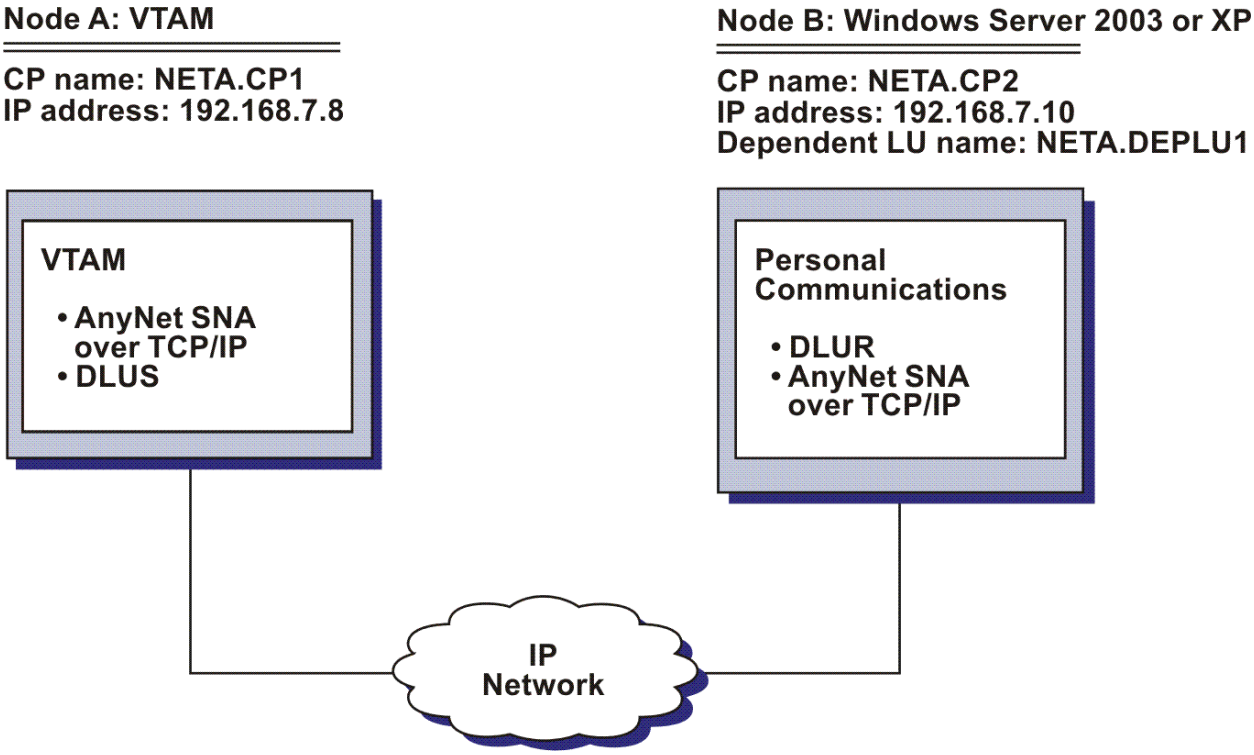
    f. On the Configure Logical Connection window, enter:
        - **System location name:** `NETA.LUNAME1`
        - **Routing Preference:** Nonnative only
    g. On the Configure AnyNet® Connection window, enter:

    SNA domain name suffix: `SNA.IBM.COM`

    h. Save your workstation profile.

Example 4. 3270 Emulation via DLUR over a TCP/IP Network

Figure 21. 3270 Emulation via DLUR over a TCP/IP Network



Follow these steps to establish communication between the VTAM® Host (Node A) and the Windows® 2008 workstation (Node B).

For VTAM® Node A, add the following entry to the HOSTS file:

```
        192.168.7.10  CP2.NETA.SNA.IBM.COM
        192.168.7.10  DEPLU1.NETA.SNA.IBM.COM
```

For Windows® 2008 Node B, do as follows:

1. Add the following entry to the local HOSTS file:

   ```
           192.168.7.8   CP1.NETA.SNA.IBM.COM
   ```

2. Create a workstation profile using the Z and I Emulator for Windows configuration tool:
   a. Click on the **Start/Configure Session** icon; or click **Configure** from the **Communication** menu. The Customize Communication window is displayed.
   b. Select the following options:
      - **Host: zSeries™**
      - **Interface: AnyNet®**
      - **Attachment: TCP/IP LU 0,1,2,3 via DLUR**
   c. Click **Configure**.
   d. Click **Configure Link**.

e. On the Configure Local System window, enter:

PC Location Name: `NETA.CP2`

f. On the Configure DLUR window, enter:

- **DLUS name:** `NETA.CP1`
- **Routing Preference:** Nonnative only

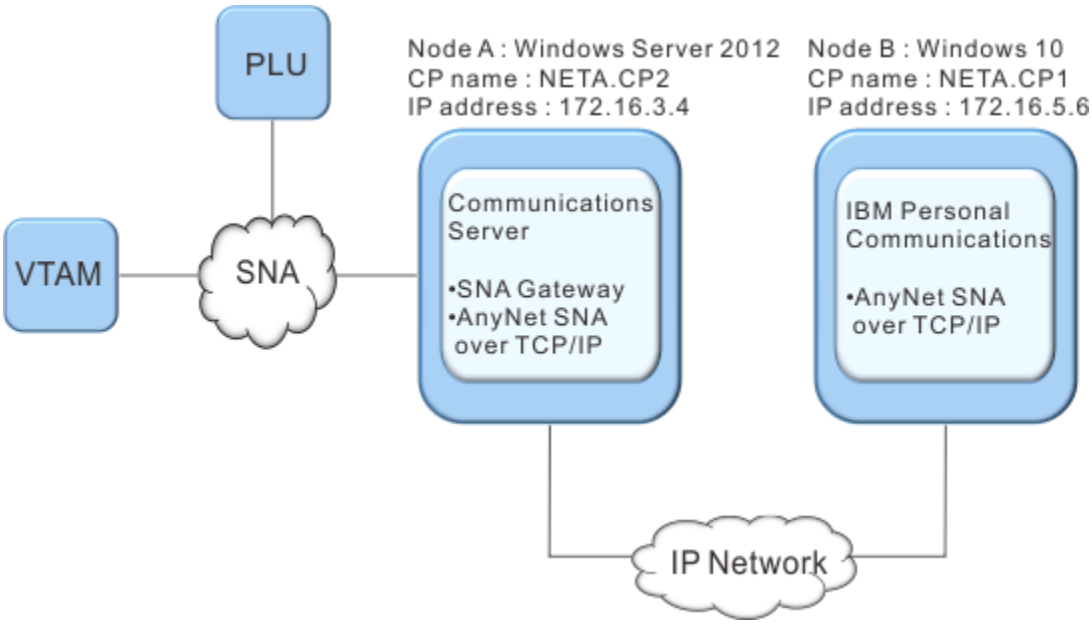
g. On the Configure AnyNet® Connection window, enter:

SNA domain name suffix: `SNA.IBM.COM`

h. Save your workstation profile.

Example 5. 3270 Emulation over a TCP/IP Network via a SNA Gateway to a VTAM Host on a SNA Network

Figure 22. 3270 Emulation over a TCP/IP Network via a SNA Gateway to a VTAM® Host on an SNA Network



For Windows® Server 2008 Node A, add the following entry to the HOSTS file:

```
        172.16.5.6  CP1.NETA.SNA.IBM.COM
```

Follow these steps to establish communication between the Windows® 8, Windows® 8.1, or Windows® 10 workstation (Node B) and the VTAM® host.

For Windows® 8, Windows® 8.1, or Windows® 10 Node B, do as follows:

1. Add the following entry to the local HOSTS file:

```
        172.16.3.4  CP2.NETA.SNA.IBM.COM
```

2. Create a workstation profile using the Z and I Emulator for Windows configuration tool:

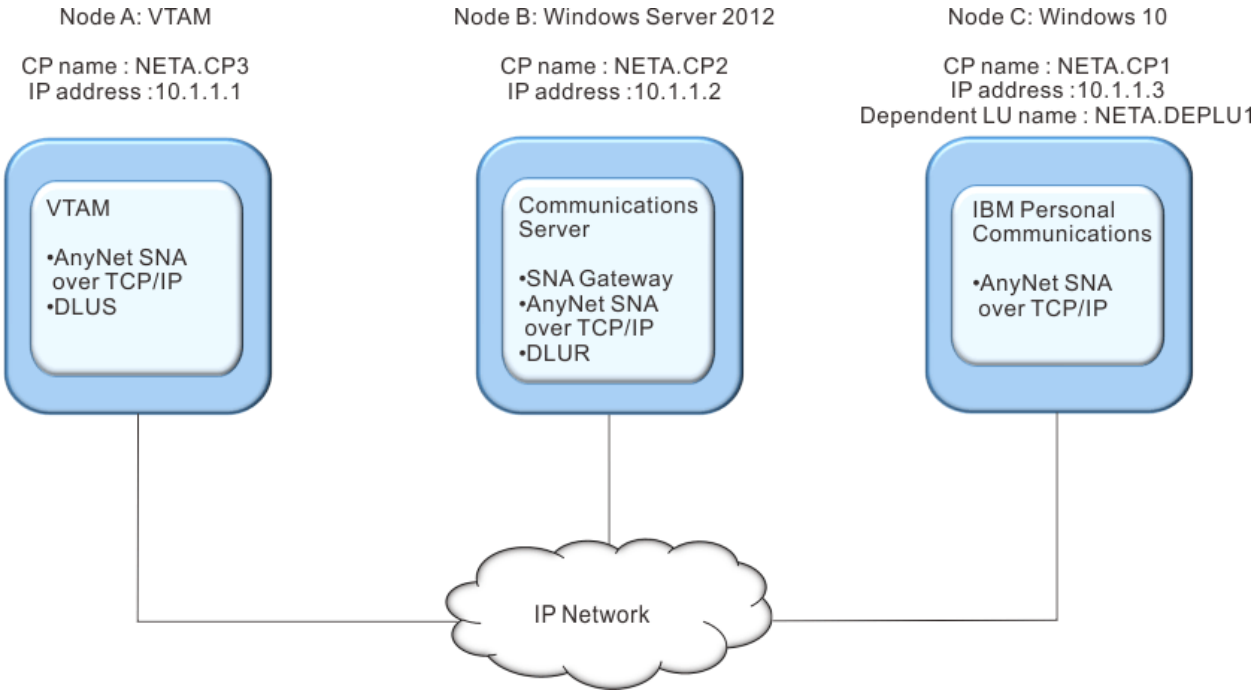
a. Click on the **Start/Configure Session** icon; or click **Configure** from the **Communication** menu. The Customize Communication window is displayed.
b. Select the following options:
   - **Host: zSeries™**
   - **Interface: AnyNet®**
   - **Attachment: TCP/IP LU 0,1,2,3**
c. Click **Configure**.
d. Click **Configure Link**.
e. On the Configure Local System window, enter:

   PC Location Name: `NETA.CP1`

f. On the Configure AnyNet® Connection window, enter:
   - **SNA domain name suffix:** `SNA.IBM.COM`
   - **Fully qualified CP name:** `NETA.CP2`
g. Save your workstation profile.

Example 6. 3270 Emulation via an SNA Gateway over a TCP/IP Network

Figure 23. 3270 Emulation via an SNA Gateway over a TCP/IP Network



Follow these steps to establish communication between the Windows® 8, Windows® 8.1, or Windows® 10 Workstation (Node C) and the VTAM® host (Node A).

For VTAM® Node A, add the following entry to the HOSTS file:

```
10.1.1.2    CP2.NETA.SNA.IBM.COM
10.1.1.2    DEPLU1.NETA.SNA.IBM.COM
```

For Windows® Server 2008 Node B, add the following entry to the HOSTS file:

```
10.1.1.3  CP1.NETA.SNA.IBM.COM
10.1.1.1  CP3.NETA.SNA.IBM.COM
```

For Windows® 8, Windows® 8.1, or Windows® 10 Node C, do as follows:

1. Add the following entry to the local HOSTS file:

   ```
   10.1.1.2    CP2.NETA.SNA.IBM.COM
   ```

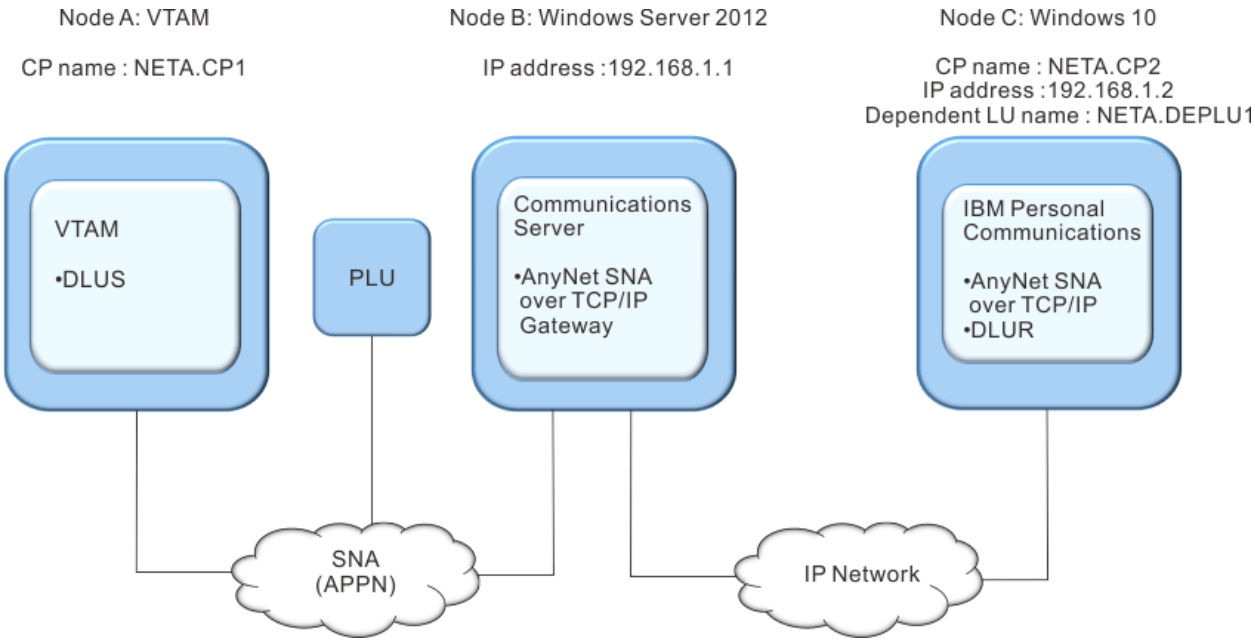
2. Create a workstation profile using the Z and I Emulator for Windows configuration tool:
   a. Click the **Start/Configure Session** icon; or click **Configure** from the **Communication** menu. The Customize Communication window is displayed.
   b. Select the following options:
      - **Host: zSeries™**
      - **Interface: AnyNet®**
      - **Attachment: TCP/IP LU 0,1,2,3**
   c. Click **Configure**.
   d. Click **Configure Link**.
   e. On the Configure Local System window, enter:

      PC Location Name: `NETA.CP1`

   f. On the Configure AnyNet® Connection window, enter:
      - **SNA domain name suffix:** `SNA.IBM.COM`
      - **Fully qualified CP name:** `NETA.CP2`
   g. Save your workstation profile.

Example 7. 3270 Emulation over a TCP/IP Network via an AnyNet SNA/IP Gateway to a VTAM Host on an APPN Network

Figure 24. 3270 Emulation over a TCP/IP Network via an AnyNet® SNA/IP Gateway to a VTAM® Host on an APPN® Network



Follow these steps to establish communication between the Windows® Server 2008 workstation (Node B) and the Windows® 2000 workstation (Node C).

For Windows® Server 2008 Node B, add the following entries to the HOSTS file:

```
192.168.1.2 CP2.NETA.SNA.IBM.COM
127.0.0.2   DEPLU1.NETA.SNA.IBM.COM
192.168.1.2 DEPLU1.NETA.SNA.IBM.COM
```

For Windows® 8, Windows® 8.1, or Windows® 10 Node C, do as follows:

1. Add the following entry to the local HOSTS file:

   ```
   192.168.1.1 CP1.NETA.SNA.IBM.COM
   ```

2. Create a workstation profile using the Z and I Emulator for Windows configuration tool:
   a. Click the **Start/Configure Session** icon; or click **Configure** from the **Communication** menu. The Customize Communication window is displayed.
   b. Select the following options:
      - **Host: zSeries™**
      - **Interface: AnyNet®**
      - **Attachment: TCP/IP LU 0,1,2,3 via DLUR**
   c. Click **Configure**.
   d. Click **Configure Link**.

e. On the Configure Local System window, enter:

PC Location Name: `NETA.CP2`

f. On the Configure DLUR window, enter:

- **DLUS name:** `NETA.CP1`
- **Routing Preference:** Nonnative only

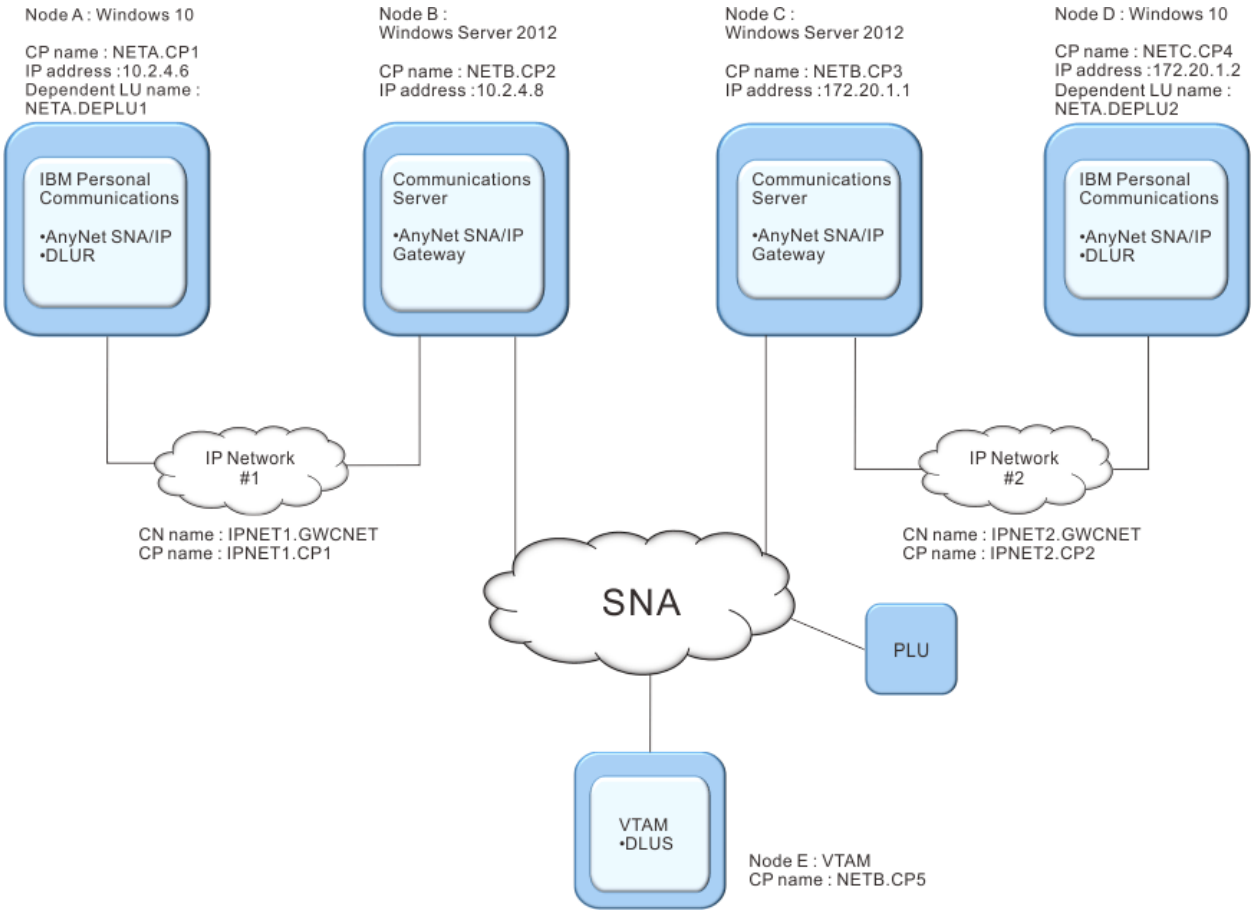
g. On the Configure AnyNet® Connection window, enter:

SNA domain name suffix: `SNA.IBM.COM`

h. Save your workstation profile.

Example 8. 3270 Emulation from a Windows 8, Windows 8.1, or Windows 10 Workstation on Different IP Networks

Figure 25. 3270 Emulation on Different IP Networks



Follow these steps to establish communication from the Windows® 8, Windows® 8.1, or Windows® 10 workstation (Node A), and from Windows® 8, Windows® 8.1, or Windows® 10 (Node D), to the VTAM® Host (Node E).

For Windows® 8, Windows® 8.1, or Windows® 10 Node A, do as follows:

1. Add the following entries to the local HOSTS file:

```
10.2.4.8    CP5.NETB.SNA.IBM.COM
127.0.0.4   IPNET1.GWCNET
127.0.0.3   IPNET1.CP1
```

2. Create a workstation profile using the Z and I Emulator for Windows configuration tool:
   a. Click on the **Start/Configure Session** icon; or click **Configure** from the **Communication** menu. The Customize Communication window is displayed.
   b. Select the following options:
      - **Host: zSeries™**
      - **Interface: AnyNet®**
      - **Attachment: TCP/IP LU 0,1,2,3 via DLUR**
   c. Click on **Configure**.
   d. Click on **Configure Link**.
   e. On the Configure Local System window, enter:

      PC Location Name: `NETA.CP1`

   f. On the Configure DLUR window, enter:
      - **DLUS name:** `NETB.CP5`
      - **Routing Preference:** Non-native only
   g. On the Configure AnyNet® Connection window, enter:

      SNA domain name suffix: `SNA.IBM.COM`

   h. Save your workstation profile.

For Windows® Server 2008 Node B, add the following entries to the HOSTS file:

```
10.2.4.6    CP1.NETA.SNA.IBM.COM
127.0.0.2   DEPLU1.NETA.SNA.IBM.COM
10.2.4.6    DEPLU1.NETA.SNA.IBM.COM
127.0.0.4   IPNET1.GWCNET
127.0.0.3   IPNET1.CP1
```

For Windows® Server 2008 Node C, add the following entries to the HOSTS file:

```
172.20.1.2  CP4.NETC.SNA.IBM.COM
127.0.0.2   DEPLU2.NETC.SNA.IBM.COM
172.20.1.2  DEPLU2.NETC.SNA.IBM.COM
127.0.0.4   IPNET2.GWCNET
127.0.0.3   IPNET2.CP2
```

For Windows® 8, Windows® 8.1, or Windows® 10 Node D, do as follows:

1. Add the following entry to the local HOSTS file:

```
172.20.1.1  CP5.NETB.SNA.IBM.COM
127.0.0.4   IPNET2.GWCNET
127.0.0.3   IPNET2.CP2
```

2. Create a workstation profile using the Z and I Emulator for Windows configuration tool:

a. Click the **Start/Configure Session** icon; or click **Configure** from the **Communication** menu. The Customize Communication window is displayed.
b. Select the following options:
    - **Host: zSeries™**
    - **Interface: AnyNet®**
    - **Attachment: TCP/IP LU 0,1,2,3 via DLUR**
c. Click **Configure**.
d. Click **Configure Link**.
e. On the Configure Local System window, enter:

   PC Location Name: `NETC.CP4`

f. On the Configure DLUR window, enter:
    - **DLUS name:** **`NETB.CP5`**
    - **Routing Preference:** Nonnative only
g. On the Configure AnyNet® Connection window, enter:

   SNA domain name suffix: **`SNA.IBM.COM`**

h. Save your workstation profile.

Chapter 14. SNA Node Operations

SNA Node Operations enable you to display information and manage the node for certain Z and I Emulator for Windows resources, which can be useful when operating the SNA node. The following tasks are supported:

- Starting and stopping resources
- Deleting resources
- Displaying resource information
- Changing session limits
- Initiating path switches

The configuration information for an SNA Node is stored in an ASCII file, with the extension .ACG. You can edit the file by launching SNA Node Configuration. To ensure that your new configuration is correct, use the Verification tool.

You can display information or take action on resources if you start 3270, 5250, or any client/server sessions with one of the following attachment types:

zSeries Connections

LAN

LAN via IEEE 802.2

3270 via iSeries™

APPC 3270 via LAN

Dependent Logical Unit Requester (DLUR)

3174 Peer Communication

COM port

SNA-over-Async

IBM® Global network — SNA-over-Async

Dependent Logical Unit Requester (DLUR) via:

- SNA-over-Async
- Hayes AutoSync

APPC 3270 via:

- SNA-over-Async
- Hayes AutoSync
- X.25 Hayes AutoSync
- X.25 DLUR via Hayes AutoSync
- X.25 APPC 3270 via Hayes AutoSync

SDLC

Synchronous Data Link Control

3270 via iSeries™ (passthru)

APPC 3270 via SDLC

Dependent Logical Unit Requester (DLUR)

SNA/IP

LU 0, 1, 2, 3

APPC 3270

LU 0, 1, 2, 3 via DLUR

IBM-EEDLC

LU (0, 1, 2, 3) via DLUR)

APPC 3270

OEM

LU (0, 1, 2, 3)

3270 via iSeries™ (passthru)

APPC 3270

Dependent Logical Unit Requester (DLUR)

iSeries Connections

LAN

LAN via IEEE 802.2

COM port

SNA-over-Async

Hayes AutoSync

X.25 Hayes AutoSync

SDLC

Synchronous Data Link Control

SNA/IP

5250

IBM-EEDLC

5250

OEM

APPC 5250

Client/Server Connections

LAN

LAN via IEEE 802.2

COM port

SNA-over-Async

Hayes AutoSync

X.25

SDLC

Synchronous Data Link Control

AnyNet® SNA over TCP/IP

APPC

Enterprise Extender

HPR over IP

SNA resources that can be displayed or managed include the following:

Connection Networks

Allows APPN® nodes in a LAN to have direct links with each other without requiring logical link definitions at each node.

Connections

Link stations to the adjacent nodes.

CPI-C Side Information

Associate a set of parameters with a specified symbolic destination name.

Data Link Controls

How data is formatted for transmission on the physical connection.

Devices

Parts of the workstation hardware, such as adapters, that are used to transmit and receive data.

DLUR PUs

A dependent logical unit requester (DLUR) physical unit (PU) is a PU in an APPN® end node that owns dependent LUs, but requests that a dependent LU server provide the SSCP services for those dependent LUs.

Focal Points

A system that provides centralized network management services.

Local LU 0 to 3

A local logical unit (LU) type 0, 1, 2, or 3 is a dependent LU on the workstation that provides services for 3270 terminal and printer emulation applications.

Local LU 6.2

A local logical unit (LU) type 6.2 is an independent or dependent LU that provides APPC services.

LU 6.2 Sessions

Transports data between two partner LU 6.2s. Conversations between transaction programs use LU 6.2 sessions.

Mode

The name used by the initiator of a session to designate the characteristics desired for the session, such as traffic pacing values, message-length limits, sync point and cryptography options, and the class of service (COS) within the transport network.

Node

The control point that manages the node and its associated resources. The local node provides APPN® services.

Partner LU 6.2

A remote computer that communicates through an APPC session with local LU 6.2s.

RTP Connections

In high-performance routing (HPR), a rapid transport protocol (RTP) connection is the connection established between the endpoints of the route to transport session traffic.

Transaction Programs

A transaction program (TP) is a program that processes transactions in an SNA network. There are two kinds of TPs: application transaction programs and service transaction programs.

Starting Node Operations

To start Node Operations, click the **SNA Node Operations** icon in the Z and I Emulator for Windows folder; or, from an active session window, click **Actions → Launch → SNA Node Operations**.

Using the Menu Bar

From the menu bar of the SNA Node Operations utility, click one of the following:

Operations

To start or stop a SNA node.

To start a node, select the configuration file you want to use.

To change session limits (CNOS).

To apply a new configuration file, select the configuration file you want to use.

Launch

To launch to other Z and I Emulator for Windows programs, such as Log Viewer, Trace Facility, or SNA Node Configuration.

View

To modify the layout of your Z and I Emulator for Windows window (Tool bar or Status bar).

To select resource attributes, which allows you to customize the display of SNA resource attributes.

To view frequently used resources, such as:

- Node
- Connections
- Local LU 0 to 3
- Partner LUs
- LU 6.2 sessions

Window

To modify the layout of your Z and I Emulator for Windows window.

Help

To view the Z and I Emulator for Windows online help.

Displaying a Resource

To display a resource, select a resource from the pull-down list on the toolbar.

Starting a Resource

To start a resource:

1. Select a resource from the pull-down list on the toolbar.
2. Select the first column of the item, and right mouse click to display the pop-up menu.
3. Click **Start** to start the resource. A started (active) resource can be stopped, but not deleted.

Stopping a Resource

There are two ways of stopping a resource:

Normal Stop

Performs clean up and then stops the resource.

Abnormal Stop

Immediately stops the resource.

To stop a resource:

1. Select a resource from the pull-down list on the tool bar.
2. Select the first column of the item, and right mouse click to display the pop-up.
3. Select **Normal Stop** or **Abnormal Stop** to suspend the resource. If a resource is stopped (inactive), it can be deleted or redefined.

Deleting a Resource

To delete a resource:

1. Select a resource from the pull-down list on the tool bar.
2. Select the first column of the item, and right mouse click to display the pop-up.
3. Select **Delete** to delete the resource.

You should stop a resource (make it inactive) before redefining it. You do not need to delete the resource before redefining it.

Changing an HPR Path Switch

To perform a high performance routing (HPR) path switch:

1. Select **RTP connections** from the pull-down list on the tool bar.
2. Select the first column of the item, and right mouse click to display the pop-up.
3. Select **HPR path switch** to change the path for the data on this RTP connection.

Updating SNA Resources Dynamically

It is not necessary to delete an SNA resource before redefining it. A resource must be inactive, however, when you redefine it.

If a redefinition is rejected for a reason other than that the resource is active, a STATE_CHECK return code is returned as well as a specific secondary return code, as listed in the NOF specification. Most rejections are due to inconsistencies in the configuration, such as one of the following:

- Attempting to define an LS with the adjacent CP name set to the local CP name.
- Attempting to define two link stations on a non-switched port with the same destination address.

Such rejections occur regardless of whether you are defining a resource for the first time or redefining it.

Keep in mind the following when redefining resources:

- You cannot change the ls_role of a port that has link stations defined on it. The link stations must be deleted before the port role can be changed (because an LS may default to the port ls_role).
- You cannot change the type of a named DLC. The DLC definition must be deleted before the same name can be reused for a DLC of a different type.

Command-Line Utilities

Another way to perform SNA Node operations is to use the command line. Five command line programs are available to perform basic operations for the SNA Node.

CSSTART [-p | -q | -c | -a] [-m | -d] [cfgfile]

Use the CSSTART command to start the SNA Node with a specified configuration. The **-a** flag enables automatic start up after rebooting the machine. The **-d** flag sets the default SNA node configuration file. The **-m** flag stands for manual start which disables automatic start up after rebooting the machine. If the **-p** flag is used, all messages are shown in a message box pop-up. Messages are written to *stdout* by default. The **-q** flag suppresses all output. The **-h** flag summons the help data for this command. The **cfgfile** parameter is the name of the configuration file you want to use to start the product. If no **cfgfile** parameter is specified, the default configuration file is used. If no default configuration file has been set, an error is reported. If the node is successfully started, CSSTART returns zero, otherwise a nonzero value is returned.

CSSTOP [-p | -q | c][-h]

Use the CSSTOP command to stop the SNA Node. The flags have the same meaning as for CSSTART. If the node is successfully stopped then CSSTOP returns zero, otherwise a nonzero value is returned. The **-c** flag convert output to Windows® code page. This option is intended to use with the Tivoli-integration support for Z and I Emulator for Windows.

CSQUERY [-p | -q | c][-h]

Use the CSQUERY command to query the status of the SNA Node. The flags have the same meaning as for CSSTART. Along with the status, the default and active configuration file names are shown. If the node is running, then CSQUERY returns zero; otherwise a nonzero value is returned. The **-c** flag convert output to Windows® code page. This option is intended to use with the Tivoli-integration support for Z and I Emulator for Windows.

CSDSPY {resource [resource_id] [/D#]} [/C][-h]

Displays information about SNA node resources, where:

resource

One of the following:

AIL

AnyNet® IP to LU mapping

CNT

Connection networks

CON

Connections

CPS

CPI-C side information

DLC

Data link controls

DEV

Devices

DPU

DLUR PUs

FPT

Focal Points

LU0

Local LU 0 to 3

L62

Local LU 6.2

L6S

LU 6.2 sessions

MOD

Modes

NOD

Nodes

PLU

Partner LU 6.2

RTP

RTP connections

TRP

Transaction programs

object_id

Specifies a case-sensitive value (for example, LU001 or LINK001) to search for. Only objects whose first attribute matches this value are displayed. The object_id must be spelled correctly, including case (upper and lower). An incorrect object_id will result in nothing being displayed.

/D#

Specifies the level of detail to display. # has the value 1, 2, or 3, where 1 displays the least level of detail and 3 shows all information. 2 is the default.

The **-c** flag convert output to Windows® code page. This option is intended to use with the Tivoli-integration support for Z and I Emulator for Windows.

CSMODIFY {resource resource_id action} [/C][-h]

Enables you to control SNA node resources, where:

resource

Is one of the following:

CON

Connections. You can start, stop, or delete this resource.

CPS

CPI-C side information. You can delete this resource.

DLC

Data link controls. You can start, stop, or delete this resource.

DEV

Devices. You can start, stop, or delete this resource.

DPU

DLUR DPUs. You can start or stop this resource.

LU0

Local LU 0 to 3. You can delete this resource unless the LU is in use.

L62

Local LU 6.2. You can delete this resource.

RTP

RTP connections. You can switch the path of this resource.

object_id

Specifies a case-sensitive value (for example, LU001 or LINK001) to search for. Only objects whose first attribute matches this value are displayed. The object id must be spelled correctly, including case (upper and lower). An incorrect object id will result in an error being displayed.

action

One of the following:

SN

Normal stop

SI

Immediate stop

ST

Start

DL

Delete

PS

Path switch

[-h]

This switch is used to summon help data for this command.

The **-c** flag convert output to Windows® code page. This option is intended to use with the Tivoli-integration support for Z and I Emulator for Windows.

Chapter 15. SNA Cryptography Support

SNA session-level encryption (SLE) enables secure data transfer between nodes running SNA applications. The request units (RUs) for all the SNA traffic across the selected session are encrypted. Software encryption/decryption is implemented with the Application Manager for Data Security (AMDSEC) utility. AMDSEC is a software implementation of the Common Cryptographic Architecture verbs used by SNA Session Level Encryption (SLE). A subset of these verbs are implemented and they are the ones required to allow data confidentiality.

Because this is a complete software implementation, it will be slower than the conventional hardware-based encryption. SNA SLE is only supported for Windows Server 2008 and Windows 8, Windows 8.1, or Windows 10 platforms. Some of the supported environments are as follows:

- 3270 emulation
- APPC/CPI-C client-server applications
- APPC over TCP/IP

The key-encrypting keys can be added or accessed using the command-line utility amdsec.exe, which is available in the Z and I Emulator for Windows installation directory.

Enabling and Using Session-Level Encryption

Configuring Proper Key-Encrypting Keys

Enter the key-encrypting keys before performing any operation. KEKs are shared between the LUs that are going to be involved. KEKs reside in key storage (.kek file) and are used to protect data (session) keys when they are sent to the partner node or Logical Unit (LU).

The following commands are available to add or modify these keys:

amdsec clear

This command clears the AMDSEC key storage. All key-encrypting keys are discarded.

amdsec pass <new passphrase>

This command sets the AMDSEC passphrase. Using this passphrase, the key-encrypting keys are secured before they go to the storage file (by encryption). The default passphrase is **amdsec security**

amdsec addkey <label> <key value> <key form> <option>

`amdsec` adds a key-encrypted key to key storage.

- **<label>** is the key label for this KEK (up to 5 key label tokens of 8 bytes each). See Naming Labels for KEKs on page 161 for further details.
- **<key value>** is the KEK value. It must be 16 bytes in hexadecimal (32 hex digits), optionally separated by the **-** (hyphen) character.
- **<key form>** is the value **importer** or **exporter**.

- **<option>** is the value **translate**. Specify this option to have the translate attribute for this key.

  This parameter is optional. Data key translate is required only when you are running APPN encryption.

Example:

```
amdsec addkey cm@lu@im.netid.cpnam1.netid.lunam2
  8182-d4e7-836a-4d6f-8182-d4e7-830a-4d6f importer

amdsec addkey cm@lu@ex.netid.cpnam2.netid.lunam1
  8182-d4e7-836a-4d6f-8182-d4e7-830a-4d6f exporter
```

When entering KEKs, it is often easier to edit the commands in a batch (.bat) file and then execute the command to enter your keys in key storage.

amdsec repkey <label> <key value> <key form> <option>

`amdsec` replaces a key-encrypted key in key storage.

- **<label>** is the key label for this KEK (up to 5 key label tokens of 8 bytes each). See Naming Labels for KEKs on page 161 for further details.
- **<key value>** is the KEK value. It must be 16 bytes in hexadecimal (32 hex digits), optionally separated by the **-** (hyphen) character.
- **<key form>** is the value **importer** or **exporter**.
- **<option>** is the value **translate**. Specify this option to have the translate attribute for this key.

  This parameter is optional. Data key translate is required only when you are running APPN encryption.

Example:

```
amdsec repkey cm@lu@im.netid.cpnam1.netid.lunam2
  8182-d4e7-836a-4d6f-8182-d4e7-830a-4d6f importer

amdsec repkey cm@lu@ex.netid.cpnam2.netid.lunam1
  8182-d4e7-836a-4d6f-8182-d4e7-830a-4d6f exporter
```

amdsec list

`amdsec` lists your KEK labels in key storage.

Example:

```
amdsec list
```

Naming Labels for KEKs

Key Labels for Dependent LU Encryption

The key label when implementing session level encryption for dependent LU sessions uses the the following naming convention:

```
CM@LU@IM.mynet1.cpnamea.puname.locaddr
```

- **CM** is a constant prefix
- **@** is a constant delimiter
- **LU** identifies an LU key-encrypting key
- **IM** identifies an importer key-encrypting key
- **netid1.cpname1** is the fully qualified name of the local node where the key-encrypting key will be used
- **puname** is the PU name of the subarea or DLUR PU, as configured in Communications Server
- **locaddr** is the network addressable unit address or local address of the dependent LU. It has to be of the form **nnn** with possible values from 1 to 255 (for example, 001, 002, 003, . . ., 255)

Note: For encryption of dependent LU sessions you only need importer KEKs in the Communications Server node, because LUA sessions are always secondary.

Key Labels for APPC Encryption

The following key labels are used for the key-encrypting keys:

```
CM@LU@IM.netid1.cpname1.netid.luname

CM@LU@EX.netid1.cpname1.netid.luname
```

- **CM** is a constant prefix
- **@** is a constant delimiter
- **LU** identifies an LU key-encrypting key
- **IM** identifies an importer key-encrypting key
- **EX** identifies an exporter key-encrypting key
- **netid1.cpname1** is the fully qualified name of the local node where the key-encrypting key will be used
- **netid.luname** is the fully qualified name of the partner LU

Note: In APPC, an independent LU can initiate a session (primary LU) or it can be secondary when the partner LU initiates the LU 6.2 session. If the LU initiates a session, an exporter KEK is required in key storage. Otherwise, an importer KEK will be used.

Enabling Cryptography in SNA Node Configuration

Open the SNA Node Configuration utility (pcscfg.exe). In the **Connection Configuration** section of the LU you are planning to use, select the **Use Cryptography** option.

Note: For LU 6.2, a mode has to be defined with **Use Cryptography** enabled in the **Configure Modes → Advanced** panel. That mode has to be used while connecting to the peer LU

Part IV. National Language Support

Chapter 16. Multiple-Language Support

Z and I Emulator for Windows multiple-language support provides the capability to allow users to interact with more than a single language on their workstations. Prior versions allowed for different languages to be displayed in emulator sessions; now, the Windows® graphical user interface elements of the Z and I Emulator for Windows user interface can be tailored to the languages of users, allowing more flexibility in configuring and using Z and I Emulator for Windows.

This chapter provides a basic description of these facilities. Refer to *Quick Beginnings* for a description of the procedures for changing your configured user interface language. The particulars of installing the support are described in *Installation Guide*.

Overview

There are two system-related factors which govern the usage of multiple languages by Z and I Emulator for Windows users:

System Locale

This is set in the Windows Regional and Language Options under the control panel applet; it determines what system user interface languages can be viewed.

Language Groups

Each system locale is associated with a language group; some groups have only one language; others support several, allowing for simultaneous viewing of applications in more than one language.

System Locale

When you choose a language on the Regional Settings (or Options) screen, a system locale is established as the basis for interacting with the system; Windows® interactions of certain applications (such as Z and I Emulator for Windows) are governed by this setting.

Z and I Emulator for Windows uses the settings specified in **Regional and Language Options → Advanced → Language for non-Unicode programs**.

Note:

1. Windows® common dialogs, such as file open and print, may not change to match the system locale; they will be displayed in the language chosen when Windows® was installed.
2. The actions needed to switch system locales depend on the languages installed and the version of Windows®. Refer to your Windows® documentation for details.

Language Groups

The system locale set when Windows® is started determines which Windows/ANSI code page is used by applications; in turn, this code page determines which language group an application can use. The language groups and languages supported for Z and I Emulator for Windows user interface are:

Cyrillic

Russian

Japanese

Japanese

Latin 1

- Brazilian-Portuguese
- Danish
- Dutch
- English
- Finnish
- French
- German
- Italian
- Norwegian
- Portuguese
- Spanish
- Swedish

Latin 2

- Czech
- Hungarian
- Polish
- Slovenian

Turkish

Turkish

Note:

1. For Windows® 8, Windows® 8.1, or Windows® 10, most language groups are installed by default. You can specify supplemental language support.
2. English text can be displayed for any system locale without significant corruption. Therefore, English is an implicit member of each language group.
3. There are additional languages supported for host emulation sessions; these groups only concern user interface language.

Z and I Emulator for Windows User Interface Languages

It is important to understand how Z and I Emulator for Windows uses the capability for supporting multiple languages. Like other applications, Z and I Emulator for Windows can use any language within the language group for which the current system locale is set. As an administrator, you have the ability to change that locale, using the Windows® Regional Settings control panel applet.

There are several considerations to keep in mind:

- There is a default Z and I Emulator for Windows user interface language; this is set at installation, and applies to every user of the Windows® system.

  Note: This default is set to match the Windows® user default locale.

- The Z and I Emulator for Windows user interface language is a preference that is stored per user; thus, a shared workstation can support users of different languages.
- If a user does not have a user interface language preference defined, Z and I Emulator for Windows uses the Z and I Emulator for Windows default language for that machine.
- If the user's language preference cannot be displayed (because of a language group mismatch) the user interface is in the Z and I Emulator for Windows default language; a warning is displayed.
- If the Z and I Emulator for Windows default language is incompatible with the system language, English is used as the default.
- Each user in a client/server or Windows® Terminal Server (WTS) environments can have his own Z and I Emulator for Windows user interface language.

Multiple Sessions

It is possible to open multiple Z and I Emulator for Windows emulation sessions simultaneously; in previous versions of Z and I Emulator for Windows these sessions could interact with hosts of different languages.

It is also possible to have simultaneous sessions with different user interface languages; this is only possible for languages within a language group. In order to do this, you start a session in one language, then change the Z and

I Emulator for Windows configuration to another language; when you then start a new session, it will use the newly selected language.

Other Considerations

To prevent the generation of log files in several languages the Z and I Emulator for Windows log file is recorded in the default Z and I Emulator for Windows user interface language.

Some of the Z and I Emulator for Windows components (such as LLC2 drivers) do not require multiple-language support; they only use the default Z and I Emulator for Windows language.

Some Z and I Emulator for Windows components (the keyboard customizer, keypad, play/record, copy/paste and macro components, for example) record, store, and insert language-sensitive text into Z and I Emulator for Windows sessions. It should be noted that text created in one language group may be corrupted and meaningless when inserted in a session running under another language group. For instance, keyboard customizer text created on a Japanese Z and I Emulator for Windows configuration will not be readable on a French configuration.

Chapter 17. Country Codes and Character Sets

This chapter contains information useful in providing national language support for a network station or a gateway.

Table 3. Supported Keyboard Types

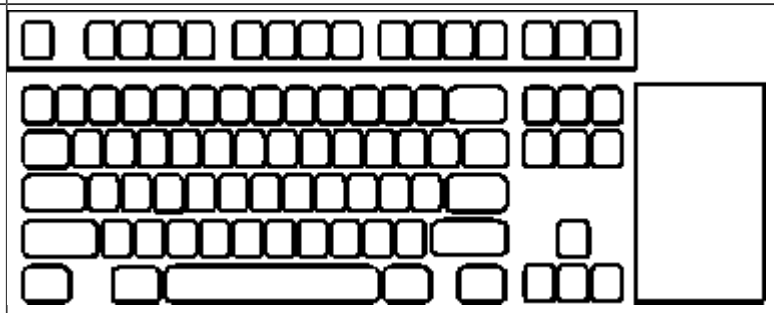
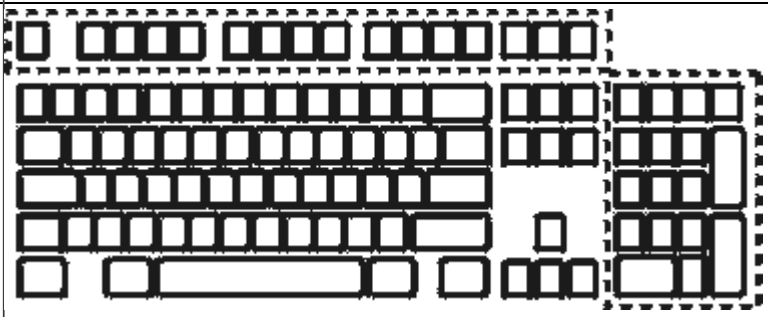
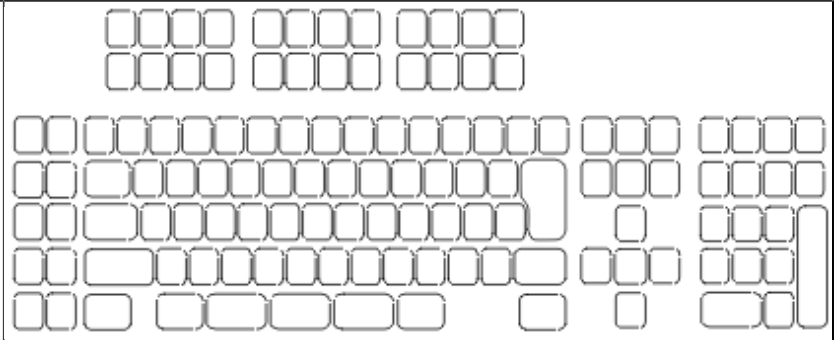
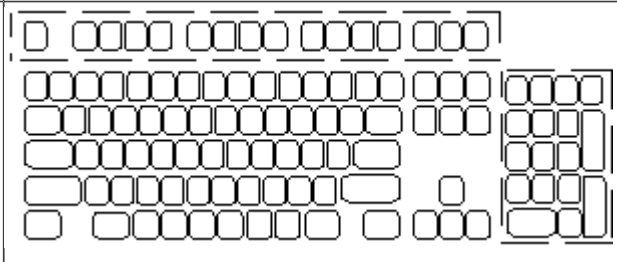
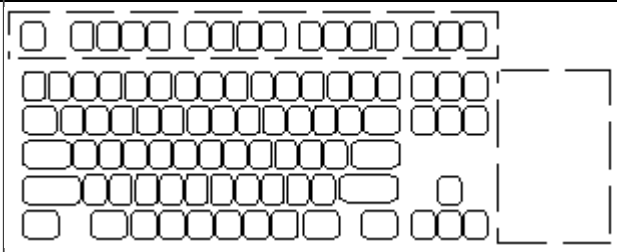
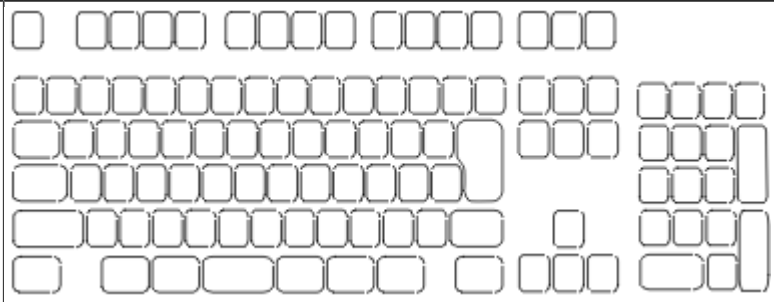
Keyboard Type (Characteristics)	Figure
Space Saving (single row of function keys; no numeric keypad)	
Enhanced and Microsoft® Natural (single row of function keys; numeric keyboard)	
5576-001 (Japanese keyboard with double row of function keys; numeric keypad)	
5576-002 (Japanese keyboard with single row of function keys; numeric keypad)	

Table 3. Supported Keyboard Types (continued)

Keyboard Type (Characteristics)	Figure
5576-003 (Japanese keyboard with single row of function keys; no numeric keypad)	
5576-A01 (Japanese keyboard with single row of function keys; numeric keypad)	

Keyboard Country ID and Shift Support

Table 4: Keyboard Country ID and Shift Support on page 169 shows the keyboard country ID and shift support for each country.

Table 4. Keyboard Country ID and Shift Support

Keyboard Country	Enhanced Keyboard ID	Enhanced Keyboard-Lock Mode
Arabic-speaking	238, 239, 240, 253, 254	C
Austria	129	S
Baltic		
Estonia	442	C
Latvia	463	C
Lithuania	449	C
Belgium	120	S
Brazil	275	C
Canada (Bilingual)	058	C
Canada (445)	445	C
Cyrillic		
Bulgaria	442	C

Table 4. Keyboard Country ID and Shift Support

(continued)

Keyboard Country	Enhanced Keyboard ID	Enhanced Keyboard-Lock Mode
Belarus	463	C
FYR Macedonia	449	C
Russia (441)	441	C
Russia (443)	443	C
Serbia / Montenegro	450	C
Ukraine	465	C
Denmark	159	C
Finland	153	C
France (120)	120	C
France (189)	189	S
Germany	129	S
Greece	319	C
Iceland	197	C
Israel	115	C
Italy (141)	141	C
Italy (142/293)	142	C
Japan	–	C
Laos	466	C
Latin America (Spanish)	171	C
Latin 1 (Open Systems)	1047	697
Latin 2		
Bosnia / Herzegovina (Latin)		C
Croatia	234	C
Czech Republic	234	C
Hungary	243	C
Poland	208	C
Romania (Moldavia)	457, 214	C
Slovakia	446	C
Slovenia	245	C
	234	C
Netherlands	143	C
Norway	155	C
Portugal	163	C
Spain	173	C

Table 4. Keyboard Country ID and Shift Support

(continued)

Keyboard Country	Enhanced Keyboard ID	Enhanced Keyboard-Lock Mode
Sweden	153	C
Switzerland (French)	150F	C
Switzerland (German)	150G	C
Turkey (179/402)	179	C
Turkey (440)	440	C
U.K. (166)	166	C
U.K. (168)	168	C
U.S. (English)	101G	C
Vietnam	461	C

Note:

–

Not selectable

S

Shift lock on key 30

C

Caps lock on key 30

IBM Japanese Character Set (2-Byte Codes)

The IBM® Japanese character set defines characters that consist of 2-byte codes.

Character Types

The following characters are included in this character set:

- Basic kanji set
- Basic non-kanji set: alphabet, numerals, Katakana, Hiragana, symbols, and space
- Extended kanji set
- New extended kanji set
- New extended non-kanji set
- Extended non-kanji set: Roman numerals, Greek alphabet, and Russian alphabet

In addition to these characters, you can define up to 1880 (6205 for extended Unicode subset) user-defined characters.

Character Size

A kanji character is displayed on the screen using the area of two SBCS characters; it is usually enclosed with the shift characters hex 0E and hex 0F. Similarly, when a kanji character is printed, it uses the area of two SBCS printed characters. This size is equivalent to double the area used by alphabetic, numeric, and Katakana characters when they are displayed or printed.

IBM Kanji Codes

The following tables show the relationship between kanji and IBM® kanji codes.

Table 5. IBM Japanese Character Set and IBM® Kanji Codes

1st byte (hex)		2nd byte (hex)	
	40	**41…**	**…FE**
40	space	Reserved area	
41		Extended non-kanji set	134 characters
42 ⋮ 44		Basic kanji set (includes space)	416 characters
45 ⋮ 55		Basic kanji set	3226 characters
56 ⋮ 68		Extended kanji set	3487 characters
69 ⋮ 7F		User-defined characters	1880 characters
80 ⋮ FE		Reserved area	

Table 6. IBM Japanese Character Set and IBM® Kanji Codes (Extended for Unicode Subset)

1st byte (hex)		2nd byte (hex)	
	40	**41…**	**…FE**
40	space	Reserved area	
41		Extended non-kanji set	134 characters
42 ⋮ 44		Basic kanji set (includes space)	416 characters
45 ⋮ 55		Basic kanji set	3226 characters
56 ⋮ 68		Extended kanji set	3478 characters
69 ⋮ B7		User-defined characters	6205 characters
B8⋮ A5		New extended kanji set	5522 characters
A6 ⋮ E9		New extended non-kanji set	2035 characters
EA ⋮ FE		Reserved area	

Note: These tables do not show that all characters have a kanji code assigned. Each kanji character has a kanji number is addition to the IBM® kanji code A kanji number is a decimal number up to five digits in length, which is used for entering a kanji-like symbol from keyboards that do not have *"YOMI"*.

Following is the relationship between IBM® kanji codes and kanji numbers:

```
kanji number = converted value of ((IBM kanji code) - x'4000')
```

All kanji characters can be entered using kanji numbers.

IBM® Traditional Chinese Character Set

Table 7. IBM Traditional Chinese Host Code

	Number of Characters	Code Range	Low-Byte Range
DBCS Space	1	X'4040'	
DBCS Symbols	1003	X'4141' - X'4959'	X'41' - X'FD', skipping X'7F'
Primary Chinese	5402	X'4C41' - X'68CB'	X'41' - X'FD', skipping X'7F'
Secondary Chinese	7654	X'6941' - X'91C7'	X'41' - X'FD', skipping X'7F'
User-Defined Area	6204	X'C241' - X'E2FD'	X'41' - X'FD', skipping X'7F'

IBM Simplified Chinese Character Set, GBK Code

Table 8. IBM Simplified Chinese Character Set, GBK Code

	Number of Characters	Host Code Range	PC Code Range
DBCS Space	1	X'4040'	X'A1A1'
GB 2312-80 Non-Chinese Character Set (GBK/1)		X'4141'-X'47FE' (737)	X'A1A1'-X'A9FE' (846)
GB 2312-80 Chinese Character Set (GBK/2)		X'4841'-X'6CFE' (6763)	X'B0A1'-X'F7FE' (6768)
ISO 10646-1 CJK unified ideographs (GBK/3)	6080	X'8141'-X'A0FE', X'A141'-X'A181'	X'8140'-X'A0FE' (Note 1)
ISO 10646-1 CJK unified ideographs ISO 10646-1 CJK compatibility	8160	X'A182'-X'A1FE', X'A241'-X'CCFE', X'CE41'-X'CEFE'	X'AA40'-X'FEA0' (Note 1)

Table 8. IBM Simplified Chinese Character Set, GBK Code

(continued)

	Number of Characters	Host Code Range	PC Code Range
(GBK/4)			
Big-5 Symbol Compatibility Ideographic Structure Symbols (GBK/5)		X'CD41'-X'CDFE' (148)	X'A840'-X'A9A0' (192) (Note 1)
User Definable Characters Area (UDC 1 to 3)	1894	X'7641'-X'80FE'	X'AAA1'-X'AFFE', X'F8A1'-X'FEFE', X'A140'-X'A7A0' (Note 1)
Note 1: X'7F' of second byte is excluded.			

IBM Hangeul Character Set

Table 9. IBM® Hangeul Host Code (833)

	Number of Characters	Code Range	Low-Byte Range
DBCS Space	1	X'4040'	
DBCS Symbols	939	X'4141' - X'4BFD'	X'41' - X'FD', skipping X'7F'
Hanja Set	5265	X'5041' - X'6C45'	X'41' - X'FD', skipping X'7F'
Hangeul and Jamo Set	2672	X'8441' - X'D3B7'	X'41' - X'FD', skipping X'7F'
User-Defined Area	1880	X'D441' - X'DDFD'	X'41' - X'FD', skipping X'7F'

Table 10. IBM Hangeul Host Code (1364)

	Number of Characters	Code Range	Low-Byte Range
DBCS Space	1	X'4040'	
Non-Hangeul/Hanja Set	1181	X'4141' - X'4E92'	X'41' - X'FE'
Hanja Set	5265	X'5041' - X'6C45'	X'41' - X'FE'
Hangeul and Jamo Set	11224	X'8441' - X'D3BD'	X'41' - X'FE'
User-Defined Area	1880	X'D441' - X'DDFD'	X'41' - X'FE'

Thai Language Support

Thai Display Mode Selection

Select **Appearance → Thai Compose Mode** on emulator session.

Switching Keyboard between Thai and Latin

Press either Alt+left Shift or Alt+right Shift to toggle the keyboard between Thai and Latin.

Language Shift Status

The status line of each emulator session shows a language shift indicator. If keyboard is in Thai language shift, an indicator **TH** will appear in the status line.

Thai Display Composed Mode

Mode 1: Non-compose mode

No character composition occurs in this mode.

Mode 2: Composed mode

Thai characters are auto-composed in this mode. No column realignment is performed.

Mode 3: Composed with space alignment

In this mode of composing, three consecutive spaces cause column realignment. The realignment occurs whenever composing routine finds three consecutive spaces. Thus if all fields have at least three trailing spaces, then all fields of all records will be properly aligned.

Mode 4: Composed with EOF alignment

In this mode of composing, the EOF character (Hexadecimal 'EA') also causes column realignment. Whenever the composing routine finds a single EOF, it deletes the EOF and performs column realignment. If two consecutive EOFs are found, no realignment occurs, one EOF is deleted, and one EOF is treated as data.

Mode 5: Composed with space and EOF alignment

This mode of composing performs the column realignment function of both mode 3 and mode 4.

Printer Space Adjustment

If your printer needs space adjustment for Thai printing, add the following statement to PCSWIN.INI, which resides in the user-class application data directory:

```
[Thai]
PrintAdjust=x
```

The value of `x` can be:

0

no adjustment (same as no PrintAdjust statement)

1

Perform adjustment when found three consecutive spaces

2

Perform adjustment when found EOF character

3

Perform adjustment when found three consecutive spaces or EOF character (combine 1 and 2)

Thai Scalable (Truetype) Font Support on Printers

Z and I Emulator for Windows provides a Thai Truetype font, ThaiPhuket. To print Thai characters, you can install a Thai scalable (Truetype) font as follows:

1. Open the **Control Panel** Folder.
    a. Click **Start** on the task bar.
    b. Move pointer to **Settings** and click **Control Panel**.
2. Open the **Fonts** Folder (Double-click the Fonts icon).
3. On the file menu, select **Install New Font**.
4. Click the drive and folder where Z and I Emulator for Windows is installed.
5. Double-click on **ThaiPhuket**.

Chapter 18. Bidirectional Language Support (Arabic and Hebrew)

Considerations for Printing

PDT printing mode requires the IBM® 864 code page font to be installed for Arabic printing, and the IBM® Hebrew 862 code page font for Hebrew printing.

Printing in Arabic

Using the Windows Printer Driver

To set up your printer to use a Windows® printer driver, do the following:

1. In the session window, click **File → Printer Setup**. The Printer Setup dialog lists the supported printers.
2. Select the desired printer driver from the **Printer** list. The default value is the Windows® default printer.
3. Confirm that the **Use PDT** option is clear and click **OK**.

Page Setup

For 5250 printer sessions, click the **Advanced Options** tab in the Page Setup dialog. Set the **Printer Font Code Page** to **1008**.

For 3270 sessions, click the **Text** tab in the Page Setup dialog. Set the **Font** to **Typing Arabic**.

Using Printer Definition Table (PDT) Files

To set up your printer to use a PDT file, do the following:

1. In the session window, click **File → Printer Setup**. The Printer Setup dialog lists the supported printers.
2. Select the desired port from the **Printer** list.
3. Select the **Use PDT** box and click **Select PDT**.
4. Select a PDT file to be used and click **OK**.

Page Setup

For 5250 printer sessions, click the **Advanced Options** tab in the Page Setup dialog. Set the **Printer Font Code Page** to **864**.

Creating an Arabic PDT file for an Arabic printer

If none of the predefined PDTs are acceptable, you can create a new one. To create a PDT, you must create a printer definition file (PDF) and then compile it to create a PDT.

You should understand a PDF's structure and the types of statements. See Building a Printer Definition Table (PDT) for PC400 on page 207 for information about building a PDT.

To customize an existing PDF file for Arabic, do the following:

1. In the macro definition dialog, define a macro containing a printer command that selects the Arabic printer font.

   Define the escape sequences of the fonts that you want to use. For example,

   ```
   /*   Naseem (  1  0  V  (  s  0  p  1  5  h  9  v  0  s  0  b  3  T     */
   NSM   EQU 1B 28 31 30 56 1B 28 73 30 70 31 35 68 39 76 30 73 30 62 33 54
   ```

   Note: You can get the font escape sequences by printing out the font names from the printer menus.

2. Add this macro to the START_JOB escape sequence in the Control Code section of the PDF. For example,

   ```
   START_JOB=CUL CBP NSM    /* Switch to Arabic Font   */
   ```

3. Save your new PDF file and copy it to the `pdfpdt` directory in the Z and I Emulator for Windows program directory.
4. In the **Printer Setup → Select PDT file** dialog, click **Convert PDF**.
5. Select the PDF file that you modified, and click **Convert**.
6. In the **Select PDT file** dialog, select the converted PDT file

Using Host Print Transform (5250 only)

When configuring an Arabic 5250 printer session, the Host Print Transform (HPT) mode can be selected. This mode requires that the 864 font be installed on the printer.

To use HPT, do the following:

1. Select **Printer** session type in the **Session Parameters – 5250 Host** panel. Click the **Advanced** tab.
2. Select the Host Print Transform=**Yes** option.

In the iSeries™, eServer™ i5, or System i5™ screen, do the following:

1. Specify that Host Print Transform will be used in the device description of a printer:

   ```
   Host print transform . . . . . TRANSFORM        (*YES)
   ```

2. Specify your printer type and model:

   ```
   Manufacturer type and model . . MFRTYPMDL (*__________)
   ```

3. Ensure that the character identifier parameter is capable of handling Arabic:

   ```
   Character identifier: CHRID
     Graphic character set . . . . 235
     Code page . . . . . .  420
   ```

Page Setup

Click the **Advanced Options** tab in the Page Setup dialog. Set the **Printer Font Code Page** to **864**.

DAT File for 5250 Arabic

For Arabic 5250 print sessions, selecting the 420 host code page prompts Z and I Emulator for Windows to load the PCSPDA.DAT file. This file ensures that the host-specified fonts map properly to the **Typing Arabic** print font.

If the 037 (U.S.) host code page is selected in a Win32 OS session, the PCSPD.SAM file is loaded automatically. This file replaces the Courier font with Courier New. For 5250 sessions in OS/2®, Z and I Emulator for Windows uses the original PCSPD.DAT file, since Euro support is implemented in Courier in OS/2®, not in Courier New (as in Windows®).

The user can specify the DAT file using the .ws parameter

```
DATFILE=xxxx
```

where xxxx is the name of the preferred DAT file.

Bidirectional Arabic Support

Limitations

The Bidirectional Text Assist Function is not supported in the Z and I Emulator for Windows iSeries™ component. As a result, the user cannot run Bidirectional OfficeVision/400™.

Installation Tips

To set up an Arabic workstation, do the following:

1. Select **420 Arabic Speaking** as the host code page in the **Customize Communication** panel.
2. Select **Arabic Speaking** as the keyboard layout.
3. In the **Select Display Font** panel, choose **ARB3270** at the Automatic Sizing list box or at the Fixed size font selection.
4. In the **API Settings** panel, select **1256** as the DDE/EHLLAPI PC code page.
5. Choose **Typing Arabic** as the font in the **Page Setup** panel.

To set up for Numeric Swapping or Symmetric Swapping:

1. Select **Display Setup** from the **Edit → Preferences → Appearance** pull-down list.
2. Select **Swapping** from the list box at the left, where the settings for numerics and symmetric characters is displayed. Changes are immediately reflected on the active session.

Note: Numeric Swapping is a 3270-only feature. This function will not be selectable if the session is an iSeries™ session.

The supported Arabic fonts are:

- ARB3270, which is found in the PCSANSIA.FON, or MFIANSIA.FON. To use the MFIANSIA.FON:
    1. Rename the file PCSANSIA.FON to PCSANSIA.ORG.
    2. Copy MFIANSIA.FON to PCSANSIA.FON.
- Typing Arabic, which is found in the file TYPEARB.TTF.

The Arabic font files are located on the installation image in the FONT subdirectory.

Bidirectional Keyboard Functions for 3270

The keys unique to Bidirectional 3270 are:

- **Language selection**: This function is activated by the key combination Alt+Shift and allows you to change the language layer. If the language layer is Latin, pressing the Alt+RightShift key combination changes the language layer to Arabic. If the language layer is Arabic, pressing the Alt+LeftShift key combination changes the language layer to Latin.
- **Screen Reverse**: This function is activated by the key combination Alt+NewLine and reverses the screen image. If the screen orientation is left-to-right, pressing this key combination reverses the screen image right-to-left. If the screen orientation is right-to-left, pressing this key combination reverses the screen image to left-to-right.

  Note that the operator information area is not reversed by this operation.

  When the screen orientation is changed, the language layer is changed to the default language of the new screen orientation. If the screen is reversed to right-to-left, then the language is changed to Arabic. If the screen is reversed to left-to-right, then the language is changed to one using Latin characters.

  If the swapping of symmetric characters is enabled, the inversion of the screen causes directional characters to be replaced by their counterparts.

  If the swapping of numeric characters is enabled, the inversion of the screen causes Hindi numerals to be replaced by their Arabic counterparts and the Arabic numerals to be replaced by their Hindi counterparts.
- **Field Reverse**: This function is activated by the key combination Alt+NumLock and toggles the field orientation to either opposite to or the same as the screen orientation. The text in the field is not inverted. The cursor orientation is set equal to the new field orientation and the language layer is selected accordingly.

If the cursor is in the first logical position of a field or line, when you select the field reverse function, the cursor skips to the other side of that field or line, which becomes the first logical position. If the cursor was not in the first position of the field or line, when selecting the field reverse function, the cursor remains in its position and allows natural and correct editing of existing text.

- **Auto Field Reverse**: This function is activated by the key combination Alt+NumPad5, which toggles the auto field reverse mode for the current screen orientation.

  Auto field reverse affects the automatic selection of the field orientation of unprotected fields:
  - When auto field reverse is disabled, upon initial entry to a field (whether numeric or alphanumeric), the field orientation is always set equal to the screen orientation.
  - When auto field reverse is enabled, upon initial entry to an alphanumeric field, the field orientation will be set to right-to-left (for both left-to-right and right-to-left screen orientations).
  - When auto field reverse is enabled, upon initial entry to a numeric field, the field orientation will be set to left-to-right (for both left-to-right and right-to-left screen orientations).
- **Push/End Push**: This function is activated by the key combination Shift+NumLock and allows the entering and editing of text whose direction is opposite from the field direction. When this function is activated, the cursor orientation is reversed, the language layer is changed accordingly, and a push segment is created.

  The PUSH function has two secondary modes:
  - Boundary mode: This mode is activated upon entering push mode. In this mode, the cursor remains in its position, and the typing of additional characters pushes the text in the direction opposite from the field direction. To indicate this boundary mode, the cursor has a block shape.
  - Edit mode: This mode is activated when the cursor is moved from its boundary position into the PUSH SEGMENT area. In this mode, you can edit the text within the PUSH segment, while typing in the field's natural direction.

  END PUSH, activated by the Shift+NumLock key sequence, terminates the push mode.

  Note: In Windows® mode, END PUSH is activated by the Shift+Numpad/ key sequence.

  The cursor jumps to the end of the PUSH segment, and its direction changes to the original direction. You can also perform END PUSH by pressing any field exit keys (for example, Cursor Up or Cursor Down) or an AID key (for example, Enter)
- **AutoPush**: This function is activated by the key combination Alt+NumPad/ and assists the terminal operator in typing mixed left-to-right and right-to-left text. When enabled, reversed segments are automatically initiated and terminated, according to the entered character or the selected language layer. This mode relieves the operator from manually pressing Push, as it is automatically invoked.
  - In right-to-left fields, typing a digit or a Latin letter causes the automatic initiation of Push, without language change. Further Latin letters or digits will continue the push mode; any other character automatically terminates push mode. This feature allows you to type Arabic text with imbedded numbers or Latin words without using Push/End Push.

- In left-to-right fields, typing an Arabic character or special character causes the automatic initiation of Push, without language change. Typing any digit or Latin character causes the automatic termination of the mode. This allows the user to type Latin text with imbedded Arabic words using language layer selection rather than Push/End Push.

Arabic Character Shape Selection Functions

There are five shape selection keys: one for Contextual Shape Determination (CSD), and 4 for Specific Shaping modes (Base/Isolated, Initial, Middle, Final). The default Shaping Mode is CSD.

The keys unique to Bidirectional 3270 are:

- **Contextual Shape Determination (CSD) key**: Pressing this key sets the shaping mode to Contextual Shape Determination (CSD), which is the default. Note that contextual shape determination is performed only for right-to-left text entered or modified by the operator. This key toggles between CSD and Base mode.

  Pressing any of the Specific shape selection keys disables CSD.

  The character Alef-Madda

  in the operator information area indicates that CSD is selected.

  This function is initiated by the key combination Alt+NumPad4.

- **Specific Shape Selection keys**:
  - Base/Isolated: initiated by the key combination Alt+NumPad2
  - Initial: initiated by the key combination Alt+NumPad1
  - Final: initiated by the key combination Alt+NumPad7
  - Middle: initiated by the key combination Alt+NumPad8

  Pressing one of the above keys disables CSD, and sets shaping mode to the selected value. Arabic letters typed from then on will have the selected shape.

  Note: Some Arabic characters do not have middle, initial, or final shapes. In this case, if the user enters one of those characters where the requested shape does not exist, then the closest shape is selected according to the following rules:
  - Instead of initial, isolated is selected.
  - Instead of final, isolated is selected.
  - Instead of middle, final (if it exists) or isolated is selected.

  The selected Shaping Mode is shown in the operator information area:

- Isolated GHEIN

  indicates Base/Isolated Shaping Mode
- Initial GHEIN

  indicates Initial Shaping Mode
- Middle GHEIN

  indicates Middle Shaping Mode
- Final GHEIN

  indicates Final Shaping Mode

- **Field Shape key**: Pressing the key combination Alt+NumPad+ causes the shaping of the Arabic data present in the current field or line. The cursor position remains unchanged.
- **Field De-Shape key**: The key combination Alt+NumPad Enter de-shapes the Arabic data present in the current field or line. All Arabic letters are converted to their Base/Isolated shapes.

Z and I Emulator for Windows iSeries

The keys unique to Bidirectional PC400 are:

- **Language selection**: This function is activated by the key combination Alt+Shift and allows the changing of the language layer. If the language layer is Latin, by pressing the Alt+RightShift key combination, the language layer will change to Arabic. If the language layer is Arabic, by pressing the Alt+LeftShift key combination, the language layer will change to Latin.
- **Screen Reverse**: This function is activated by the key combination Alt+NewLine and reverses the screen image. If the screen orientation is left-to-right, by pressing this key combination the screen image will be reversed to right-to-left. If the screen orientation is right-to-left, pressing this key combination reverses the screen image to left-to-right.

  Note that the operator information area is not reversed by this operation.

When the screen orientation is changed, the language layer is changed to the default language of the new screen orientation. If the screen is reversed to right-to-left, the language is changed to Arabic. If the screen is reversed to left-to-right, the language is changed to one using Latin characters.

The inversion of the screen causes directional characters to be replaced by their counterparts.

- **Field Reverse**: This function is activated by the key NumLock and toggles the field orientation to either left-to-right or right-to-left. The text in the field is not inverted. The cursor orientation is set equal to the new field orientation and the language layer is selected accordingly.

  If the cursor is in the first logical position of a field or line, when selecting field reverse function, the cursor skips to the other side of that field or line, which now becomes the first logical position. If the cursor was not in the first position of the field or line, when selecting field reverse function, the cursor remains in its position and allows natural and correct editing of existing text.

- **Close**: This function is activated by the key combination NumPad/ and is provided so that the data entered in one keying direction can be concatenated with the data that was previously entered in the opposite direction. It operates as follows:
  - All embedded nulls are removed from the current line.
  - Concatenated text is moved to the right boundary of the field (if the field direction is right-to-left) or to the left boundary (if the field direction is left-to-right).
  - The cursor direction is set to the field direction.
  - The language layer is set to the default for the field direction.
  - If the screen orientation is now left-to-right, the cursor is positioned at the first null to the right of the concatenated text.
  - If the screen orientation is now right-to-left, the cursor is positioned at the first null to the left of the concatenated text.
- **Base**: This function is activated by the key combination Ctrl+Home; it is a toggle key that activates or deactivates the Automatic Shape determination function for Arabic RTL text. It is valid only when processing RTL Arabic text. If it is pressed in an LTR field, an operator error 0027 results.

Bidirectional Hebrew Support

The Bidirectional Hebrew support in 3270 enables the program to emulate an English/Hebrew 3270 display terminal. Special Language and Bidirectional functions are added to the list of standard functions supported by the emulation program.

Bidirectional Functions for 3270

Table 11. Bidirectional Key-Combinations for 3270

Function	Combination
Hebrew Language	Alt+RightShift
English Language	Alt+LeftShift

Table 11. Bidirectional Key-Combinations for 3270 (continued)

Function	Combination
Screen Reverse	Alt+Enter
Field Reverse	Alt+NumLock
Auto Field Reverse	Alt+NumPad5
Push	Shift+NumLock
End Push	Shift+NumPad/
Autopush	Alt+NumPad/

The 3270 host system can run as a native Windows® application. The layout and user interface functions in the Windows-based product conform to the IBM® user interface standard (SAA/CUA®); they are similar to the layout and functions implemented in other IBM® products (for example, OS/2®).

- **Language Selection**: The key combination Alt+Shift allows you to change the language layer. If the language layer is Latin, pressing Alt+RightShift changes the language layer to Hebrew. If the language layer is Hebrew, pressing Alt+LeftShift changes the language layer to Latin.
- **Screen Reverse**: This function, activated by the Alt+Enter key sequence, reverses the screen image. If the screen direction is left-to-right, the screen image is inverted and displayed from right-to-left. Pressing this hotkey again returns the screen to its original direction, left-to-right. When the screen orientation is changed, the language layer is changed to the default language of the new screen orientation. If the screen is changed to right-to-left, the language changes to Hebrew. If the screen is changed to left-to-right, the language changes to Latin.

  Note that the status line (OIA) never reverses. It always displays from left to right.
- **Field Reverse**: In most cases, the field direction is the same as the general screen direction. However, sometimes it is necessary to have a field whose direction is the opposite of the screen direction. The Field Reverse function, activated by the Alt+NumLock key sequence, allows such transitions. When this function is activated, the typing direction is reversed, but the existing text in the field and the screen image does not change. This function creates a temporary change which stays in effect as long as the cursor remains within the field, or until Field Reverse is activated again.

  If the function is activated while the cursor is at the beginning of a line or field, the cursor jumps to the end of the line or field, so that the reversed field begins logically from that position. Otherwise, the cursor remains in its position and allows natural and correct editing of existing texts whose direction is the opposite of the screen direction.
- **Auto Field Reverse**: This function sets the field orientation for you, when you are entering data for mixed applications (Hebrew and English). This is done by automatically activating the Field Reverse function. The Auto Field Reverse mode is activated by the Alt+NumPad5 key sequence, and can be applied independently for each screen orientation, left-to-right or right-to-left.

- If the Auto Field Reverse option is activated on a right-to-left screen, the Field Reverse function is automatically activated every time the cursor moves to a numeric field. The cursor then jumps to the leftmost position of the numeric field, to allow left-to-right typing of numbers.
- If the Auto Field Reverse option is activated on a left-to-right screen, the Field Reverse function is automatically activated only when the cursor moves to an alphanumeric field. The cursor then jumps to the rightmost position of the field, to allow right-to-left typing of Hebrew.

Initially, the Auto Field Reverse option is enabled when the screen direction is right-to-left, and is not enabled when the screen direction is left-to-right. To terminate the Auto Field Reverse mode, press Alt+NumPad5 again.

- **Push** and **End Push**: These functions allow you to type or edit text whose direction is the opposite of the field direction. When this function is activated the cursor orientation is reversed, the language layer is changed accordingly, and a push segment is created.

  The Push function is activated by the Shift+NumLock key sequence. The Push function has two secondary modes:
  - Boundary Mode: This mode is activated upon entering the Push mode. In this mode, the cursor remains in its position, and the typing of additional characters pushes the text in the direction opposite to the field direction. To indicate this boundary mode, the cursor shape is changed.
  - Edit Mode: This mode is activated when the cursor is moved from its boundary position into the Push Segment area. In this mode, you can change the text within the Push segment, while typing in the text's natural direction.

  End Push, activated by the Shift+NumPad/ key sequence, terminates the temporary mode. The cursor jumps to the end of the Push segment, and its direction reverts to that of the field.
- **Autopush**: The Autopush mode makes work easier and more efficient when typing Hebrew and English mixed text. When this mode is enabled, reverse segments initiate and terminate automatically, according to the entered character or the selected language layer. It relieves the operator from manually selecting Push and End Push. Autopush is especially useful for typing digits in Hebrew fields (right-to-left fields). The Autopush mode is activated by the Alt+NumPad/ key sequence; it can be applied independently to fields whose direction is left-to-right or right-to-left. In this mode, the Push and End Push functions are automatically activated according to the language of the text being typed. There is no need to worry about activating and terminating the Push mode manually.
  - In right-to-left fields, typing a digit or a Latin letter causes the automatic initiation of Push, without language change. Additional Latin letters or digits will continue the push mode; any other character automatically terminates push mode. This feature allows you to type Hebrew text with imbedded numbers or Latin words without using Push/End Push.
  - In left-to-right fields, typing a Hebrew character causes the automatic initiation of Push. Typing any digit or Latin character causes the automatic termination of the mode. This allows the user to type Latin text with imbedded Hebrew words by using language layer selection rather than Push/End Push.

Keyboard Layout

Two Hebrew keyboard templates (Bulletin and Old Code) are supplied with the product. The Old-Code template is similar to the Bulletin template, with the following exceptions:

- Shift of "6" (s-6) produces the Greek Delta symbol (ASCII 235, hex EB), representing the old Israeli Lira, instead of the regular Cent symbol.
- Shift of "7" (s-7) does not produce anything (the Ampersand symbol is not available in Old Code).
- In English language mode, unshifted English letters produce uppercase letters (A-Z or a-z), rather than lower case letters (A-Z or a-z), whether Caps Lock is ON or OFF.

Configuration

To set up a Hebrew workstation, do the following:

1. Select **424 Hebrew (Bulletin Code)** or **803 Hebrew (Old Code)** as the host code page in the **Customize Communication** panel.
2. Select **Hebrew (Bulletin Code)** or **Hebrew (Old Code)** as the keyboard layout.
3. Select **Transfer** from the **Edit → Preferences** pull-down menu.
4. From the General tab, select **862**, **916**, or **1255** from the **PC Code-Page** list.
5. In the **API Settings** panel, select **862**, **916**, or **1255** as the DDE/EHLLAPI PC code page.
6. In the **Select Display Font** panel, choose **HEB3270** at the Automatic Sizing list box or at the Fixed size font selection.
7. Select **Page Setup** from the **File** pull-down menu.
8. In the **Text** tab, choose **(Courier Heb)** printer font.

Font

If you are accustomed to a traditional Display Station such as IBM® InfoWindow® 3472, you may not prefer the Z and I Emulator for Windows font. You can try an alternative font by changing the font files as follows:

1. Rename PCSANSIH.FON file to BASANSIH.FON
2. Copy ALTANSIH.FON to PCSANSIH.FON

In order to use the ALTANSIH.FON file, you must order the needed diskette separately.

File Transfer with 862 Code Page

PC code page 862 is the IBM® number for the Hebrew code page. Microsoft® Windows® (Hebrew) uses a code page based on (but not identical to) the ISO code page, and quite different from code page 862.

Apart from the differences in code points, Microsoft® Windows® for Hebrew works with logical text. This means that Windows® applications are expected to store text in logical order (that is, the same order as typed but not as displayed). Accordingly, the text that is displayed on the screen is different from the text that is processed by the application.

Therefore, when transferring files with translation to and from code page 862, there may be unexpected results (such as a different order of Hebrew text), in some cases. To overcome such problems, it is recommended after conversion of EBCDIC text to code page 862 to consider using the CONVERT program, provided as part of Microsoft® Windows®, which is capable of converting between logical text and visual text.

Bidirectional Functions for 5250

Table 12. Bidirectional Key-Combinations for 5250

Function	Combination
Hebrew Language	Alt+RightShift
English Language	Alt+LeftShift
Reverse	NumLock
Close	NumPad/
Screen Reverse	Alt+Enter

- **Hebrew Language**: same meaning as in Bidirectional Functions for 3270 on page 184
- **English Language**: same meaning as in Bidirectional Functions for 3270 on page 184
- **Reverse**: Pressing this key allows the operator to reverse the current cursor direction. It functions as follows:
  - The cursor is repositioned according to the current cursor direction. When right-to-left, the cursor is placed at the current left boundary location. When left-to-right, the cursor is placed at the current right boundary location.
  - The cursor direction is then reversed; the Keyboard Layer you get depends on the new cursor direction.
  - Insert mode is reset.
- **Close**: By pressing this key, data entered in one key direction is joined with data that was previously entered in the opposite direction:
  - All embedded null characters are removed from the current line (or field, if the field is contained on one line).
  - Joined text is moved to the right boundary of the field if the field direction is right-to-left, or to the left boundary if the field direction is left-to-right.
  - The remainder of the line (or the field, if contained on one line) is padded with null characters.
  - The cursor direction is set to the field direction.
  - If the cursor direction is now left-to-right, the cursor is positioned at the first null character to the right of the joined text. If the cursor direction is now right-to-left, the cursor is positioned at the first null character to the left of the joined text.
  - Insert mode is reset.
- **Screen Reverse**: same meaning as in Bidirectional Functions for 3270 on page 184

Bidirectional Support for VT

The bidirectional support in VT enables the program to emulate English/Arabic or English/Hebrew VT 340 7-bit, VT 340 8-bit, VT 100, VT 52, and VT ANSI display terminals. Special language and bidirectional functions are added to the list of standard functions supported by the emulation program.

Configuring VT Emulation for Arabic or Hebrew

To set up an Arabic or Hebrew workstation for VT emulation, do the following:

1. Click **Configure** from the **Communication** pull-down menu.
2. Select **ASCII** for the host type.
3. Click the **Session Parameters** button.
4. Select the **National** host code page type.
5. Select the host code page
    - If configuring for Arabic, choose Arabic ASMO 708 for 8-bit code page or Arabic ASMO 449 for 7-bit code page.
    - If configuring for Hebrew, choose Hebrew ISO or Hebrew NRCS.
6. Select the font by going to the **Edit** pull-down menu and selecting **Preferences → Appearance → Font**.
7. Select **Face Name**.
    - If configuring for Hebrew, select **HEB3270**.
    - If configuring for Arabic, select **AVT3270**.

File Transfer

Automatic code page conversion occurs during file transfer. However, this is only valid for 8-bit code pages.

For Arabic workstations, the conversion is from Arabic ASMO 708 to 1256 when sending. The code page conversion is reversed when receiving.

For Hebrew workstations, the conversion is from Hebrew ISO to 1255 when sending. The code page conversion is reversed when receiving.

Copy and Paste

Automatic code page conversion occurs during copy and paste operations. For Arabic, the conversion is from the current host code page to 1256, and vice versa. For Hebrew, the conversion is from the current host code page to 1255, and vice versa.

Print Screen

To print a screen in an Arabic or Hebrew session, do the following:

1. Click **Page Setup** from the **File** menu.
2. For an Arabic session, select the **Typing Arabic VT** font. For a Hebrew session, select the **Courier Heb** font.

Remapping BiDi Keys

You can customize the keyboard to map BiDi functions. The following functions are available for a VT BiDi session:

- Screen Reverse (for Logical sessions only)
- National Keyboard Layer
- Latin Keyboard Layer
- Set/reset right-to-left cursor direction (for Hebrew session and visual text type only)
- Toggle between 7-bit and 8-bit character set modes (for Hebrew session only)
- Adjust the column heading (for Arabic session only)

Bidirectional Functions for VT

Table 13. Bidirectional Key-Combinations for VT

Function	Combination
Language Selection (Hebrew or Arabic)	Alt+RightShift
English Language	Alt+LeftShift
Screen Reverse (Hebrew Logical Text Mode and Arabic only)	Alt+NewLine
Adjust Column Heading (Arabic only)	Alt+K
Toggle Cursor Direction (Visual Hebrew only)	Alt+D
Toggle 7–bit and 8–bit Character Set Modes (Hebrew only)	Alt+B

- **Language Selection**: Same meaning as in Bidirectional Functions for 3270 on page 184
- **English Language**: Same meaning as in Bidirectional Functions for 3270 on page 184
- **Screen Reverse**: Same meaning as in Bidirectional Functions for 3270 on page 184
- **Adjust Column Heading**: Column Heading mode causes blanks between columns of text to break insertions. Thus, the English titles for columns of data maintain their correct position.
- **Toggle Cursor Direction**: If current cursor direction is left-to-right, pressing Alt+D changes it to right-to-left, and back again. When the cursor direction is set to right-to-left, this does not affect cursor addressing , moving, inserting, and deleting characters, erasing in line or erasing in display.

  The following functions are affected by the right-to-left cursor direction setting:
  - Backspace (the cursor moves one position to the right)
  - Carriage return (the cursor moves to the rightmost position on the current line)

    - Line feed (the cursor moves to the rightmost position of the next line)
    - Typing in the auto wrap mode (current line is continued from rightmost position of the next line)
- **Toggle 7–bit and 8–bit Character Set Modes**: This function allows switching between 7-bit and 8-bit character sets. If the current character set is ISO Hebrew (8-bit), pressing Alt+B changes the character set to Hebrew NRCS (7-bit).

Arabic Support for ASMO 449 7-bit Code Page

The following Control Sequences are supported for ASMO 449 7-bit code page.

Table 14. Control Sequences for Arabic VT Support

Control Sequence	Description
Arabic Mode and State Controls	
DECSABM	• Arabization disabled • BiDi with Text Controls • BiDi without Text Controls
DDECSNL	Start new Arabic/Latin language
DECVTCM	• Invisible Text Controls • Visible Text Controls
DECSAPV	Numerals displayed in Arabic/Hindi, according to context
Arabic Imaging Controls	
DECBDOCPD	Set the direction of the screen (Document Presentation Direction)
Arabic Text Controls	
SLR	Start LTR direction
SRL	Start RTL direction
SDD	SDD start default direction

Chapter 19. Unicode Support

Z and I Emulator for Windows supports Unicode for Hindi and 1390/1399 Japanese code pages.

For a description of the procedure for configuring Z and I Emulator for Windows Hindi support, refer to *Quick Beginnings*. Installation information is described in *CD-ROM Guide to Installation*.

1390/1399 Code Pages

The following features are supported in Unicode for 1390/1399 Japanese character processing.

- Print Screen
- Record and play macros
- Data and file transfer
- Copy, Cut, and Paste
- EHLLAPI. Refer to *Emulator Programming* for information about 1390/1399 transfer APIs.
- Keyboard Customization

See the following list for more information about specific 1390/1399 support issues.

DBCS Translation Table

Z and I Emulator for Windows maps 1390/1399 code pages as follows:

- 1390-->UCS2
- UCS2-->1390
- 1399-->UCS2
- UCS2-->1399
- 1399-->943
- 943-->1390

Z and I Emulator for Windows loads a different translation table for display.

Z and I Emulator for Windows handles the Unicode printing both for GDI mode and PDT mode.

Data and File Transfer

File transfer uses the EBCDIC<-->UNICODE (or EBCDIC<-->ASCII) translation for Host to PC. The user can save as an ASCII file or as a Unicode file.

User Defined Area (UDA) Support

Z and I Emulator for Windows handles EBCDIC<-->UNICODE (UDC), which is different from EBCDIC <--> ASCII. The DBCS UDA mapping table editor handles UNICODE<--> EBCDIC UDA.

JIS2004 Support

JIS2004 support can be enabled by selecting host code page "1390 Japan Katakana Extended(JIS2004)" and "1399 Japan Latin Extended(JIS2004)". The 1390/1399 JIS2004 code pages

support all features as described above except for the following two features, that will not support surrogate characters:

- PDT mode printing
- Record and play macros

1388 China Unicode Code Page

The following features are supported in Unicode for 1388 China Unicode Simplified Chinese character processing.

- Rendering of new EBCDIC codes range(CF41 To FC99)
- Inputting chinese character through IME editor
- Print Screen

See the following list for more information about specific 1390/1399 support issues.

DBCS Translation Table

Z and I Emulator for Windows maps 1388 China Unicode code pages as follows:

- HCL CCSID 21868 to Unicode 6.0 UTF-32 (CCSID 25808)
- Unicode 6.0 (CCSID 25808) to CCSID 21868

Z and I Emulator for Windows loads a different translation table for display.

Hindi Support

The following features are supported in Unicode for Hindi.

- Print Screen
- Data transfer. File transfer is not supported.
- Copy, Copy Append, Cut, and Paste. Copy Link is not supported.
- EHLLAPI. Refer to *Emulator Programming* for information about Hindi data transfer APIs.
- Trace

See the following list for more information about specific Hindi support issues.

Code Page

The host code page for Hindi is 1137. The Unicode PC code page is 1200. Z and I Emulator for Windows uses a predefined translation table to map these code pages.

Record and Play Macros

Hindi enablement is limited to macro scripts only. Customization of the macro file is disabled in Hindi sessions. VB scripts are not supported.

Fonts

Only True Type Fonts are used for Hindi for display and printing. The TTF file is enumerated by Z and I Emulator for Windows and is displayed in the **Page Setup** pull-down menu. This font file has to be selected for printing the characters in Hindi. The Hindi font file is installed along with other font files.

Keyboard

The English keyboard layout is mapped to the Hindi layout. This is accomplished by loading the two key mapping tables corresponding to Hindi from the PCSKBD.DLL file. The first table maps the Windows® virtual key number to the IBM® key number. The second key mapping table maps the IBM® key number to the Unicode value of the corresponding character.

Keyboard Customization

When a key is selected in the **Keyboard Customization** dialog, the edit control window displays the corresponding Hindi character. The user can change the mapping by selecting a new character from the list box. If the user attempts to directly edit the edit control window, the characters from the current input character set appear.

Copy/Move/Swap and Find keys

The function of these keys is similar to that of the existing SBCS languages. The only difference is that the Hindi characters are stored as Unicode characters instead of single-byte characters.

Switching from Hindi to English

Hindi language support also includes toggling between Hindi and English using the ALT+left Shift key.

OIA Display

HI is displayed in the OIA when working in Hindi mode. There is no display when the user shifts from Hindi mode.

Part V. Building a Printer Definition Table (PDT)

Chapter 20. Building a Printer Definition Table (PDT) for PC/3270

This chapter, in combination with Building a Printer Definition Table (PDT) for PC400 on page 207, explains how to customize a printer definition table (PDT file) for PC/3270. Building a Printer Definition Table (PDT) for PC400 on page 207 contains basic information about creating and changing PDTs; this chapter contains specific information about creating PC/3270 PDTs. PDTs for PC/3270 and PC400 differ only slightly; if you use a common PDT (used for both PC/3270 and PC400), the additional statements for PC400 are ignored for PC/3270 processing. Similarly, statements unique to PC/3270 are ignored for PC400 processing.

ASCII_PASSTHRU? and EBCDIC_PASSTHRU?

The ASCII_PASSTHRU? and EBCDIC_PASSTHRU? PDF statements are new options available for PC/3270. See Transparent Print Capability on page 212 for details.

Supplemental Explanation of PDF Statements for PC/3270

The following PDF statements have functions that differ from those for PC400. All statements are listed in Field Names of Printer Definition Files on page 226.

MAXIMUM_PAGE_LENGTH

Printed lines per page. If you change this value, you must change the value in the SET_PAGE_LENGTH=SFL value statement (see Session parameters on page 210) to be the same.

MAXIMUM_PRINT_POSITION

Printed characters per line.

COMPRESS_LINE_SPACING?

Whether blank or null lines are to be printed if all characters on that line are nulls (for LU 3 only).

FORM_FEED_ANY_POSITION?

Whether a form feed is to be valid in any position. If NO, a form feed will be valid only in the following positions:

- First print-position of the buffer
- After a valid new line operation
- First print-position of a line

OVERRIDE_FORMATTED_PRINT?

Whether nulls are to be printed as blanks.

INTERV_REQ_TIMER

This statement is ignored.

INTERV_TIMER_ON_PE_ONLY?

This statement is ignored.

RESELECT_TIME_EXCPT_5204

This statement is ignored.

ESC/P_LINE_FEED?

If YES, the line feed (LF) function is emulated when the line feed command is received. This is useful when you do not want a line feed accompanied by a carriage return (CR) on a printer using the ESC/P printer language. If NO, the value defined in the LINE_FEED statement is sent to the printer.

IGNORE_FORM_FEED_AT_FIRST_POS?

If YES, the form feed (FF) function is ignored at the first position (for LU 2, LU 3, and non-SNA sessions) or at the beginning of the print job (for LU 1 sessions). Using this option eliminates extra blank pages at the beginning of each print job.

FORM_FEED_TAKES_POSITION?

If YES, the form feed (FF) function is effective if followed by data (LU 2, LU 3, and non-SNA sessions only).

KANJI_CODE?

If YES, kanji codes (JIS or SHIFT_JIS) have been used. This value cannot be changed.

ZENKAKU_SPACE

The size (adjustment unit) of a user-defined character and a HANKAKU character. This value cannot be changed.

SBCS_FONT_LOAD

Registration of a HANKAKU GAIJI. This value cannot be changed.

DBCS_FONT_LOAD

Registration of a ZENKAKU GAIJI. This value cannot be changed.

SET_LOCAL_FONT

Set a font set of user-defined characters. Remove it when user-defined characters are not loaded to a printer.

RESET_LOCAL_FONT

Reset a font set of user-defined characters. Remove it when user-defined characters are not loaded to a printer.

KANJI_ON

Set kanji mode.

KANJI_OFF

Reset kanji mode.

ATTRIBUTE_GRID_LINE

Set to grid-line print. This value cannot be changed.

START_DOUBLE_WIDTH_CHARACTER

Set a double-width character.

END_DOUBLE_WIDTH_CHARACTER

Reset a double-width character.

Note:

1. When using IBM5577.PDF, change FORM_FEED=EJC to FORM_FEED in the file when a continuous form job does not feed correctly.
2. When using ESC_P.PDF, DBCS (2-byte) characters are placed to the left of the character box, not in the center. To place DBCS characters in the center of the character box, change the IBM-supplied values in ESC_P.PDF:

```
P10 EQU 1B 50 1B 20 00 1C 53 00 0C 1C 54 00 00
P12 EQU 1B 4D 1B 20 00 1C 53 00 06 1C 54 00 00
P13 EQU 1B 67 1B 20 01 1C 53 00 03 1C 54 00 01
P15 EQU 1B 67 1B 20 00 1C 53 00 00 1C 54 00 00
```

to the following:

```
P10 EQU 1B 50 1B 20 00 1C 53 06 06 1C 54 00 00
P12 EQU 1B 4D 1B 20 00 1C 53 03 03 1C 54 00 00
P13 EQU 1B 67 1B 20 01 1C 53 02 01 1C 54 00 01
P15 EQU 1B 67 1B 20 00 1C 53 00 00 1C 54 00 00
```

SCS TAB Setting

A PC/3270 printer session LU type 1 can accept any number of tab positions, and the host printer session can send any number of tabs to the printer session. However, the workstation printer you are using might support fewer tab positions than the host application sets; for example, the IBM® Proprinter supports 27 tab positions.

If the number of tab positions that the host application sets exceeds the maximum number of positions that the printer supports, your printed output will not look as you expect it to. You can avoid this situation by modifying the PDF file and reconfiguring PC/3270 as follows:

1. Modify the SET_HORIZONTAL_TABS statement as follows:

   ```
   SET_HORIZONTAL_TABS=number
   ```

2. Save the file under a new name.
3. Convert the PDF file (with the procedure described in Building a Printer Definition Table (PDT) for PC400 on page 207).
4. Select the new PDT file created in Step 2 on page 198.

Printer Color Mixing

Some printers, such as the IBM® 5182, compose certain colors by mixing colors. Colors are mixed by printing the text in one color and then printing over the same text in another color on a second pass.

PC/3270 will compose a color if the color is not defined in the printer definition table of a color printer that is capable of mixing colors. Therefore, if you are using a printer that composes some colors by mixing two colors, leave the definition of the composed colors blank in the printer definition file. Only the composite colors defined in Table 15: Color Mixes on page 199 are created by double-printing the primary colors.

Table 15. Color Mixes

Composite Color	Primary Colors
Red	yellow, magenta
Green	yellow, cyan
Blue	magenta, cyan

For example, to create red, you must define yellow and magenta. The primary colors must be defined in the printer definition table.

Printer Session Data Stream Support

There are two types of host-directed print data streams supported by PC/3270: the 3270 data stream and the SNA character string (SCS) data stream.

3270 Data Stream

The 3270 data stream is a buffer-oriented data stream. The print data is formatted as if it were going to be displayed on a screen. The host system sends commands to format the presentation space. These commands can change the presentation space in any location at any time. Once the host system completes formatting the presentation space, it issues a START PRINT command and the presentation space is printed as accurately as the printer hardware allows.

The 3270 data stream can be sent to PC/3270 workstations over an SNA LU 3 session or a non-SNA DFT printer session.

Table 16: 3270 Data Stream Commands on page 199 lists the commands that can be sent in the 3270 data stream.

Table 16. 3270 Data Stream Commands

Command	Meaning
W	Write
EW	Erase/Write
EWA	Erase/Write Alternate

Table 16. 3270 Data Stream Commands (continued)

Command	Meaning
RB	Read Buffer
RM	Read Modified
RMA	Read Modified All
EAU	Erase All Unprotected
WSF	Write Structured Field

The RB, RM, and RMA commands cannot be used with an SNA attachment.

Table 17: 3270 Data Stream Orders on page 200 lists the orders that can be sent in the 3270 data stream.

Table 17. 3270 Data Stream Orders

Order	Meaning
SBA	Start Buffer Address
SF	Start Field
IC	Insert Cursor
PT	Program Tab
RA	Repeat to Address
EUA	Erase Unprotected to Address
SFE	Start Field Extended
SA	Set Attribute
MF	Modify Field

The last three orders in the preceding table manage the color, extended highlighting, and programmed symbols attributes for fields and individual characters. The programmed symbols attribute is not supported by PC/3270.

In addition to the commands and orders in the two preceding tables, there are special printer formatting control codes that can be included in the 3270 data stream.

The following table lists the control codes that can be sent in the 3270 data stream.

Table 18. 3270 Data Stream Format Control Codes

Code	Description
NL	New Line control code moves the print position to the left margin and down one line.
CR	Carriage Return control code moves the print position to the left margin.
EM	End of Message control code ends the print operation.

Table 18. 3270 Data Stream Format Control Codes (continued)

Code	Description
FF	Form Feed control code moves the print position to the left margin at the top of the next page.

Note: NL, CR, and EM are valid only if a line-length format specified by the WCC is not used. The FF code is valid in any buffer position.

PC/3270 printer support interprets each 3270 attribute and printer control code and translates them into a sequence of one or more workstation printer control codes. For more information about the 3270 data stream, refer to *IBM 3270 Information Display Data Stream Programmer's Reference*.

SCS Data Stream

The SCS data stream is a sequential data stream that is oriented toward line printers. The characters are translated according to the host system code page and printed according to the attributes and formatting specified by the control commands. The way in which SCS characters are printed depends only on the control codes that precede them. Therefore, it is not necessary to buffer the characters before they are printed. The SCS data stream flows across the SNA LU 1 session only.

The valid SCS control codes supported by PC/3270 are listed in Table 19: Supported SCS Control Codes on page 201.

Table 19. Supported SCS Control Codes

Code	Value	Command
NL	X'15'	New Line
LF	X'25'	Linefeed (Index)
CR	X'0D'	Carriage Return
FF	X'0C'	Form Feed
BS	X'16'	Backspace
BEL	X'2F'	Bell Function
IRS	X'1E'	Interchange-Record Separator
SA	X'28'	Set Attribute
TRN	X'35'	Transparent
NUL	X'00'	Null
HT	X'05'	Horizontal Tab
VT	X'0B'	Vertical Tab
SHF	X'2B C1'	Set Horizontal Format
SVF	X'2B C2'	Set Vertical Format
SLD	X'2BC 6'	Set Line Density

Table 19. Supported SCS Control Codes (continued)

Code	Value	Command
SPD	X'2BD2 xx29'	Set Print Density
VCS	X'04 xx'	Vertical Channel Select
ENP	X'14'	Enable Presentation
INP	X'24'	Inhibit Presentation
GE	X'08'	Graphic Escape
PPM	X'2BD2 xx48'	Page Presentation Media
SO	X'0E'	Shift Out
SI	X'0F'	Shift In
RNL	X'06'	Required New Line
RCR	X'06'	Required Carriage Return
SPS	X'09'	Superscript
WUS	X'23'	Word Underscore
IR	X'33'	Index Return
PP	X'34'	Presentation Position
EBS	X'36'	Expanded Backspace
NBS	X'36'	Numeric Backspace
SBS	X'38'	Subscript
IT	X'39'	Indent Tab
RFF	X'3A'	Required Form Feed
RPE	X'3A'	Required Page End
RSP	X'41'	Required Space
NSP	X'E1'	Numeric Space
ESP	X'E1'	Expandable Space
SH	X'CA'	Syllable Hyphen

Note: The ENP and INP commands are accepted, but are ignored, in an LU 1 session.

For more information about the SCS printer data stream, refer to *IBM Systems Network Architecture - Sessions Between Logical Units*.

Delimiting Print Jobs

Many print jobs can be sent over a single PC/3270 printer session. PC/3270 allows multiple sessions and applications to share a single workstation printer on a between-jobs basis. PC/3270 needs to know when each print job starts and ends so that printers can be shared properly and begin and end job strings can be sent at the appropriate times. The emulator recognizes a number of different methods of delimiting print jobs:

By Session

PC/3270 printer support assumes, by default, that all print jobs are delimited by sessions. That is, in the absence of all other indicators, PC/3270 assumes that a print job begins when a printer session is started and ends when it is reset.

Time-Out Interval

On non-SNA DFT sessions, print jobs can be delimited by a user-specified timeout interval. A print job on a non-SNA DFT printer session begins when the first host-outbound data for that job is received, and ends when no host-outbound data is received for a period of time exceeding the user-specified non-SNA DFT timeout interval. For PC/3270, this interval is specified during configuration.

By Brackets

On a SNA session with an LU 1 or LU 3 host application, PC/3270 can use bracket indicators to delimit print jobs. The emulator opens the printer when it receives the begin bracket, then it processes and prints data. The emulator closes the printer after it receives an end bracket.

When the emulator receives another begin bracket, it again opens a printer and begins processing a print job.

Structured Fields

The host can use structured fields to indicate to the device that a new file is beginning or that the current file is completed. PC/3270 delimits print jobs with Begin of File and End of File structured fields (SF) to perform host-directed printing. Structured fields are described in Structured Fields on page 203.

Structured Fields

The host uses Begin of File and End of File structured fields to indicate to a device that a file is beginning or ending.

Begin/End of File Query Reply

The Begin/End of File query reply indicates that a device supports Begin of File and End of File to delineate print jobs. The PC/3270 sends a query reply, as shown in Table 20: Begin/End of File Query Reply Format on page 203, to the host in response to a Read Partition General query.

Table 20. Begin/End of File Query Reply Format

Byte	Contents	Description
0–1	X'0005'	The length of this structure
2	X'81'	Query reply
3	QCODE X'9F'	Begin/End of File
4	FLAGS	Reserved; must be set to 0's

Begin/End of File Structured Fields

Begin/End of File structured fields are accepted on either LU 1 or LU 3 sessions. Table 21: Begin/End of File Structured Field Format on page 204 shows the format of the Begin/End of File structured fields.

Table 21. Begin/End of File Structured Field Format

Byte	Bit	Contents	Description
0–1		X'0007'	The length of this structure
2–3		X'0F85'	Begin/End of File
4		PID	Partition ID
5	0–1 2–7	FLAG1[1] B'00' B'01' B'10' B'11'	Reserved End of File is being sent Begin of File is being sent Reserved Reserved
6		FLAG2	Reserved; must be set to 0's.

:

[1]This byte indicates whether Begin of File or End of File is being sent

Processing Begin or End of File Structured Fields

When the Begin or End of File structured fields are used with brackets or non-SNA timeout intervals, the Begin or End of File SFs take precedence over the brackets or timeout intervals in determining when a print job begins or ends. See the following examples:

- Begin or End of File structured fields overriding brackets:

```
Begin Bracket, Begin of File Structured Field, ...Data...,
End Bracket
```

  The device will wait indefinitely until the End of File structured field is received before ending the print job.

- Begin or End of File structured fields overriding non-SNA timeout intervals:

```
Begin of File structured fields, ...Data..., pause > timeout value
```

  The device will wait indefinitely until the End of File structured fields is received before ending the print job.

- Inconsistent use of Begin or End of File structured fields and brackets:

```
Begin Bracket, ...Data1...,
Begin of File Structured Fields,...Data2..,
End of File Structured Fields, ...Data3...,
End Bracket
```

When you use the Begin of File and End of File structured fields inconsistently with brackets, the results are unpredictable. In the preceding example, the device might process Data1, Data2, and Data3 as separate jobs or combine two or more of them into one file.

For predictable results, each data block must be enclosed by a Begin of File structured field and an End of File structured field. The following example shows three print jobs all delimited by Begin or End of File structured fields:

```
Begin Bracket, Begin of File Structured Field, ...Data1...,
End of File Structured Field,(job1)
Begin of File Structured Field, ...Data2..., End of File Structured Field, (job2)
Begin of File Structured Field, ...Data3..., End of File Structured Field,
End Bracket(job3)
```

PC/3270 always keeps track of brackets and timeout intervals. After the emulator receives a Begin of File structured field, it takes no action on Begin Brackets, End Brackets, or timeout until it receives an End of File structured field. After a valid End of File SF is processed, the emulator defaults to delimiting jobs by brackets or timeout intervals until it receives the next Begin of File structured field.

Begin or End of File Structured Field Error Conditions

PC/3270 does not accept transmission of data belonging to two separate print jobs in the same chain. To be accepted by the emulator, Begin of File structured fields must be the first structured field of a chain and End of File structured fields must be the last structured field of a chain.

PC/3270 rejects transmission in the following instances:

- The emulator receives an End of File structured field without first receiving a Begin of File structured field.
- The emulator receives a second Begin of File structured field without receiving an intervening End of File structured field.
- The emulator receives a Begin of File structured field that is not the first structured field following a **write structured field** command (LU 2, LU 3, and non-SNA sessions) or a Function Management Header 1 (LU 1 sessions).
- The emulator receives an End of File structured field that is not the last structured field following a **write structured field** command (LU 2, LU 3, and non-SNA sessions) or a Function Management Header 1 (LU 1 sessions).

Processing SCS Data Streams

When processing an SCS data stream, PC/3270 treats Begin or End of File structured fields as follows:

- A Begin of File structured field indicates that all SCS data in the same transmission until an End of File structured field is received is part of a new print job.
- An End of File structured field indicates that any SCS data received in the same chain as the End of File structured field is the last data of the current print job.

Processing 3270 Data Streams

When processing a 3270 data stream, PC/3270 treats Begin or End of File structured fields as follows:

- A Begin of File structured field indicates that the next presentation space print (initiated by a **write type** command with the start print bit turned on in the write control character) is the first in a print job.
- An End of File structured field indicates that the last presentation space print was the last of the current print job. The emulator immediately sends a terminate string to the printer to close the printer session.

If PC/3270 receives a Begin of File structured field and an End of File structured field without at least one presentation space separating them, it ignores the structured fields.

Chapter 21. Building a Printer Definition Table (PDT) for PC400

This chapter explains how to create and change the printer definition table (PDT file) used for PC400. Building a Printer Definition Table (PDT) for PC/3270 on page 196 contains specific information about creating PC/3270 PDTs. PDTs for PC/3270 and PC400 differ only slightly; if you use a common PDT (used for both PC/3270 and PC400), the additional statements for PC400 are ignored for PC/3270 processing. Similarly, statements unique to PC/3270 are ignored for PC400 processing.

The PDT file is created by converting the printer definition file (PDF file). The PDF and PDT define the transmission of characters and control codes to the printer and the format of printer output. To change an existing PDF (the recommended method) or create a new one, use a text editor that can produce or update an ASCII file.

Using the Printer Definition Table (PDT) File

To use the PDT file:

1. Select **File** from the menu bar of the workstation window.
2. Select **Printer Setup** from the **File** menu.

   The Printer Setup window appears.
3. Select the **Use PDT file** check box and **Select PDT**.

   The Select PDT file window appears.

To build the PDT file (required only if the PDF has been changed or created):

1. Select **Convert PDF**. Select the PDF file to be converted from the list in the Convert PDF to PDT window; then select **Convert**. The PDF File Converter window appears. After the file has been converted, click on **Close**, then click **Close** in the Convert PDF to PDT window.
2. Click **OK** in the Select PDT file window.
3. Click **OK** on the Printer Setup window.

   After printer setup is complete, the Printer Setup window is closed.

Printer Definition File (PDF File) Format

A PDF contains 3 main sections:

- Macro definitions
- Formatting controls
- Character definitions using EBCDIC_xx keywords

Macro Definitions

This section of a PDF contains user-defined macros. A macro is a single mnemonic that stands for a control code or a sequence of control codes. A mnemonic simplifies defining control sequences for PC printers and makes it easier to read the information in the PDF.

The following table shows the structure of a macro definition statement. A macro definition is composed of four parts:

1	**2**	**3**	**4**
name	EQU	PC Printer Control Codes	Comments

For example:

```
   FFF    EQU   0C              /* Form Feed */
```

The first part is the user-defined mnemonic or macro name. This name must be exactly three characters long and must not begin with a number. It is helpful to define a meaningful mnemonic, such as P17 for 17.1 pitch.

The second part, EQU, stands for equate and must be coded as EQU.

The third part is the hexadecimal control code, which is specific to a PC printer. Each PC printer manufacturer can define different control codes for the same printer function. For example, the IBM® 4019 LaserPrinter uses control codes defined by the IBM® Personal Printer Data Stream (PPDS). Hewlett-Packard printers use control codes defined by the Hewlett-Packard Printer Control Language (PCL). These control codes are usually defined in the manual that comes with the printer.

Some PC printer manuals describe control sequences as a string of ASCII symbols, such as ESC J 1 K: others use hexadecimal numbers, such as 1B 57 01; while others use decimal values, such as 27 28 1. The printer definition table compiler accepts any of these formats.

The control codes in the macro definitions section can be any of the following:

- Single characters that are interpreted as their ASCII value
- Two-digit numbers that are interpreted as hexadecimal values
- Three-digit numbers that are interpreted as decimal values

If you leave the control code section blank or if you delete it, the character or control code is interpreted as a null string. If a character or control code is defined more than once in the file, the last definition is used.

The fourth part is the comment section. The symbols /* indicate the beginning of a comment and the symbols */ indicate the end of a comment. Comments can be coded at any point in the printer definition file and are ignored by the printer definition table compiler.

The following is an example macro definition statements that are specific to the IBM® 4019 LaserPrinter.

```
LFF EQU 0A                    /* Line Feed                */
VTB EQU 0B                    /* Vertical Tab              */
```

```
FFF EQU 0C                      /* Form Feed                  */
CRR EQU 0D                      /* Carriage Return            */
P05 EQU 1B 57 01                /* 5 Pitch-Characters/inch    */
P10 EQU 12                      /* 10 Pitch-Characters/inch   */
CDW EQU 1B 57 00                /* Cancel Double Wide contin. */
P17 EQU 12 0F                   /* 17.1 Pitch-Character/inch  */
LL8 EQU 1B 41 09 1B 32          /* Set line length 8 lines/inch*/
P12 EQU 1B 3A                   /* 12 Pitch-characters/inch   */
RES EQU 1B 5B 4B 07 00 05 31 01 A4 00 00 90
                                /* The above macro resets the */
                                /* printer using the factory  */
                                /* defaults.  See the IBM Laser*/
                                /* Printer Technical Reference */
                                /* manual.                    */
```

To illustrate how macros are coded, consider this example. To have the host print job printed in double-wide characters, you must know what control code turns on double-wide printing on your PC printer. On the IBM® 4019 LaserPrinter, the control code to turn on double-wide printing is X'1B5701'. This would be coded as:

```
BDW EQU 1B 57 01
```

where BDW stands for Begin Double Wide.

This alone would not cause 3270 host print to send this control to the printer. The mnemonic would have to be included in a control code statement, such as START_JOB which is described in the control codes section of the file.

Note: The IBM® 4019 LaserPrinter printer definition file that comes with HCL Z and I Emulator for Windows already has this control code defined as the P05 macro. See line 9 of the sample IBM® 4019 LaserPrinter Macro Definition Statements (IBM4019.PDF File Contents on page 214).

Macro Name Examples

The following are example mnemonics or macros. The control codes are for the IBM® 4019 LaserPrinter:

```
   LND      EQU 1B 26 6C 31 4F              /* LANDSCAPE    */
   POR      EQU 1B 26 6C 30 4F              /* PORTRAIT     */
   P12      EQU 1B 28 73 31 32 2E 30 30 48  /* PITCH_12.00  */
   T10      EQU 1B 28 73 31 30 2E 30 56     /* POINT_10.0   */
   LTR      EQU 1B 26 6C 32 41              /* LETT_PAPER   */
   G66      EQU 1B 26 6C 36 36 50           /* PG_LENGTH_66 */
```

Formatting Controls

The controls section of a PDF contains the following:

- Session parameters
- Control codes
- Color specifications
- Highlight specifications

Session parameters

MAXIMUM_PAGE_LENGTH, MAXIMUM_PRINT_POSITION, and SET_PAGE_LENGTH

The parameter to the left of the equal sign is a keyword and *must* be coded exactly as shown. The keyword is used to define a statement. The values to the right of the equal sign are macros or control codes. Because the values to the right of the equal sign can be both macros and control codes, they will sometimes be referred to as parameters.

The MAXIMUM_PAGE_LENGTH, MAXIMUM_PRINT_POSITION, and SET_PAGE_LENGTH parameters specify the dimensions of the output job. The number specified in the MAXIMUM_PAGE_LENGTH parameter is used in the SET_PAGE_LENGTH parameter and is substituted for the value keyword. In other words, if SET_PAGE_LENGTH and MAXIMUM_PAGE_LENGTH are coded as follows:

```
MAXIMUM_PAGE_LENGTH=066 /* Printed lines per page */
SET_PAGE_LENGTH=SFL 066
```

The results would be:

SET_PAGE_LENGTH=SFL 066

Because SFL is coded as X'1B 43' in the macro section, the actual control code that would be sent to the printer to set the maximum page length is:

X'1B 43 42'

where X'42' is decimal 66.

Note: Setting MPL=255 causes suppression of form feeds (FFs).

Control Codes

The control codes section of a PDF is used by the PDT function to determine what specific PC printer control code is to be sent to the PC printer when an SCS control code is received. Some of the statements used by Communications Manager are shown in the following example.

```
START_JOB=SEL CDW CDL CUL CDS CP8 CS2
END_JOB=CAT CDW CDL CUL CDS CP4 FFF
SET_PAGE_LENGTH=SFL value
SET_VARIABLE_LINE_DENSITY=ESC A value ESC 2
SET_10_CHARACTERS_PER_INCH=P10
```

Note: The above example lines come from the IBM® 4019 LaserPrinter PDF.

START_JOB and END_JOB

The control codes associated with START_JOB are sent at the start of each host print job. It is best to set all printer options to a known or desired state at the beginning of each host print job. The PC printer changes its state or

changes the options selected only when instructed to do so by control codes. Therefore, the previous PC application could have left the printer in portrait mode with a Courier font selected, and unless your job changed them, these would be the printer options used.

Even though the START_JOB and END_JOB control codes are the ones shipped with the IBM4019.PDF, many users change them to be more like the ones below:

```
START_JOB=RES P12 LL8
END_JOB=RES
```

In this example, the RES, P12 and LL8 macros are used on the START_JOB statement (these macros are defined in IBM4019.PDF File Contents on page 214). This translates into the following control codes being sent to the printer at the beginning of your print job:

X'1B 5B 4B 07 00 05 31 01 A4 00 00 90 1B 3A 1B 41 09 1B 32'

This sequence of control codes:

- Resets the printer to the IBM® PPDS factory default settings (RES)
- Begins printing in 12 pitch (P12)
- Begins printing at 8 lines per inch (LL8)

The END-JOB statement sends the following control code to the printer at the end of your job:

X'1B 5B 4B 07 00 05 31 01 A4 00 00 90'

This control code resets the printer to IBM® PPDS factory default settings (RES).

SET_VARIABLE_LINE_DENSITY

The SET_VARIABLE_LINE_DENSITY statement is used in combination with the panel where you can select the number of lines per inch (LPI), which can be either 6 or 8.

The PDT process uses whatever is selected in the lines per inch field, and substitutes this number for the value keyword in the SET_VARIABLE_LINE_DENSITY parameter. In other words, if lines per inch is set to 8, the SET_VARIABLE_LINE_DENSITY parameter is

```
SET_VARIABLE_LINE_DENSITY=ESC A 09 ESC 2
```

where the 09 comes from 72/8. The number of typographic points in 1 inch is 42; thus a value of 12 points would indicate six lines to an inch.

The control code that is sent to the printer to set the line density is:

```
X'1B 41 09 1B 32'
SET_10_CHARACTERS_PER_INCH
```

On most printers, the default pitch is 10 characters per inch. In most PDTs, Z and I Emulator for Windows uses this same convention and sends the control code found on the SET_10_CHARACTERS_PER_INCH statement. This is usually coded in the PDF as:

```
SET_10_CHARACTERS_PER_INCH=P10
```

where P10 is coded in the macro definition section as:

```
P10 EQU 12
```

Printing More than One Screen on a Page

If you want to print two or more screens per page, use the BEL command in the PDF to specify the number of blank lines to insert (instead of a Form Feed between two successive screens). You must coordinate this modification with the usage of the LPI and MPL parameters in the PDF (see Field Names of Printer Definition Files on page 226).

Note: This specific use of the BEL command is applicable only for printing screens using the **Print Screen Collection** function.

Setting the value `BEL=FF` will send a Form Feed, while the value `BEL=00` does not insert a Form Feed or a Line Feed.

Values between 00 and FF send that number of blank lines between successive screens. For example, `BEL=02` inserts two blank lines between two successive screens. Thus, more than one screen can be printed on a single page.

Transparent Print Capability

ASCII_PASSTHRU? Keyword Support

If you add the following line to your PDF, Z and I Emulator for Windows will send host data without any translation:

```
    ASCII_PASSTHRU? = YES
```

This option is for special host applications that generate PC printer control codes directly.

Even if ASCII_PASSTHRU? is set, control codes defined START_JOB and END_JOB are sent to the printer at the start and the end of a print job respectively. To remove those commands, you need to rebuild the PDT file after removing the PDF keyword definitions for START_JOB and END_JOB.

If ASCII_PASSTHRU? is set, all character definition lines, for example, EBCDIC_xx, are ignored.

If both ASCII_PASSTHRU? and EBCDIC_PASSTHRU? are set, ASCII_PASSTHRU? has priority.

EBCDIC_PASSTHRU? Keyword Support

If you add the following line to your PDF, Z and I Emulator for Windows will ignore all SCS commands and send data to the printer after EBCDIC-to-ASCII translation:

```
    EBCDIC_PASSTHRU? = YES
```

For example, the default EBCDIC-ASCII translation table used for U.S. English host code page 037 is as follows:

```
    Hex |  0 1  2 3  4 5  6 7  8 9  A B  C D  E F
   -----+-----------------------------------------
```

```
 0 | 2020 2020 2020 2020 2020 2020 2020 2020
10 | 2020 2020 2020 2020 2020 2020 2020 2020
20 | 2020 2020 2020 2020 2020 2020 2020 2020
30 | 2020 2020 2020 2020 2020 2020 2020 2020
40 | 20FF 8384 85A0 C686 87A4 BD2E 3C28 2B7C
50 | 2682 8889 8AA1 8C8B 8DE1 2124 2A29 3BAA
60 | 2D2F B68E B7B5 C78F 80A5 DD2C 255F 3E3F
70 | 9B90 D2D3 D4D6 D7D8 DE60 3A23 4027 3D22
80 | 9D61 6263 6465 6667 6869 AEAF D0EC E7F1
90 | F86A 6B6C 6D6E 6F70 7172 A6A7 91F7 92CF
A0 | E67E 7374 7576 7778 797A ADA8 D1ED E8A9
B0 | 5E9C BEFA B8F5 F4AC ABF3 5B5D EEF9 EF9E
C0 | 7B41 4243 4445 4647 4849 F093 9495 A2E4
D0 | 7D4A 4B4C 4D4E 4F50 5152 FB96 8197 A398
E0 | 5CF6 5354 5556 5758 595A FDE2 99E3 E0E5
F0 | 3031 3233 3435 3637 3839 FCEA 9AEB E9FF
```

You can modify this code page using EBCDIC_xx keywords. Note that the EBCDIC_PASSTHRU? line precedes any EBCDIC_xx lines in your PDF file because Z and I Emulator for Windows reinitializes the EBCDIC-to-ASCII translation table when it finds that EBCDIC_PASSTHRU? is set.

Even if EBCDIC_PASSTHRU? is set, control codes defined START_JOB and END_JOB are sent to the printer at the start and the end of a print job respectively. To remove those commands, you need to rebuild the PDT file after removing PDF keyword definitions for START_JOB and END_JOB.

EBCDIC_xx Keyword Support

EBCDIC_xx keywords are used to remap entries of EBCDIC-to-ASCII translation table for printer sessions that receive SNA character string (SCS) data streams. For example, if you want to print host space characters using ASCII X'1B', add the following line to your PDF file and recompile to update the PDT file:

```
EBCDIC_40 = 1B
```

You can specify two or more characters for one EBCDIC character. The following definition:

```
EBCDIC_F1 = 1 2 3
```

translates EBCDIC X'F1' into "123" in ASCII.

You can also remap EBCDIC code points (X'00'-X'3F') which are normally assigned to SCS control characters. The following line:

```
EBCDIC_15 = 0C
```

overrides the SCS new line function with X'0C', which normally works as a form feed function. If you remap a code point that is not used for a SCS command (for example, X'27') Z and I Emulator for Windows sends the defined code to the printer and does *not* send SNA sense data to the host. The following example

```
EBCDIC_27 = 1B
```

defines EBCDIC code point X'27' as ASCII X'1B', which is used as an escape character on most personal computer printers.

If you do not need to use any SCS command processing but still need EBCDIC-to-ASCII translation, the EBCDIC_PASSTHRU? is a better solution. If you do not need any SCS command processing or EBCDIC-to-ASCII translation, ASCII_PASSTHRU? is an easier solution.

Printer Definition Tables

Standard printer definition table file names are of the form **`IBM`**`nnnnn`**`.PDT`**, and PDT's ASCII-to-ASCII character definitions are of the form **`PRN`**`nnnnn`**`.PDT`**, where `nnnnn` is a machine type. See character definition descriptions for more details.

See the help panel or the specific 5250, 3270, or VT emulator user's reference for a list of the PDT files provided by Z and I Emulator for Windows.

The PDT files contained in the PC400 installation diskette can be used as is. However, you might want to do special formatting by changing the definitions of some fields. To do so, copy an existing PDF file, modify it, and then convert it to a new PDT file.

Example PDF files are shown in "Example Printer Definition Files". Do not attempt to change the statements in a field for which modification is specifically prohibited. If you use a PDT file created from a changed PDF file, the results of printing cannot be guaranteed.

Example Printer Definition Files

The following examples are annotated versions of printer definition files for the IBM® LaserPrinter 4019 (for SBCS sessions) and for the IBM® 5577 Printer (for DBCS sessions). These are examples only; the actual files may differ.

IBM4019.PDF File Contents

```
/*********************************************************************/
/*                                                                   */
/*    PRINTER SESSION DEFINITION FILE FOR: LaserPrinter 4019/4019-E   */
/*                                                                   */
/*********************************************************************/
/*********************************************************************/
/*                        Macro Definitions                          */
/* Define values here that will be used commonly throughout your     */
/* definitions.  Then use the left hand side of the equate as you    */
/* define your characters and control strings.  The printer compiler */
/* will substitute the right hand side of the equate for each        */
/* occurrence of the left hand side throughout the file.             */
/*                                                                   */
/* Macro names must be at least three characters long and may not    */
/* begin with a number.                                              */
/*                                                                   */
/* Format                                                            */
/* A Macro Name is associated with a value or string of values by the */
/* EQU statement.  The right hand side of an EQU statement must be a  */
/* string of zero or more two digit hexadecimal numbers.  If a macro  */
/* definition is more than one line long, you may extend it to the    */
/* next line by ending the first line with a comma.  In this manner   */
```

```
/* you may define a macro which is many lines long by terminating each*/
/* line except the last with a comma.  No macro names are allowed on  */
/* right hand side.                                                   */
/*********************************************************************/
BEGIN_MACROS
/* The following values are standard for most printers.  Check your   */
/* printer manual to verify that these are correct for your printer   */
NUL EQU 00             /* Nul character                               */
BEL EQU 07             /* Beeper                                      */
BAK EQU 08             /* Back Space                                  */
TAB EQU 09             /* Tab                                         */
LFF EQU 0A             /* Line Feed                                   */
VTB EQU 0B             /* Vertical Tab                                */
FFF EQU 0C             /* Form Feed                                   */
CRR EQU 0D             /* Carriage Return                             */
P05 EQU 1B 57 01       /* 5 Pitch-Characters/inch                     */
                       /* Same as Double Wide                         */
SEL EQU 11             /* Select Printer                              */
P10 EQU 12             /* 10 Pitch-Characters/inch                    */
CDW EQU 1B 57 00       /* Cancel Double Wide contin.                  */
CDL EQU 14             /* Cancel Double Wide line                     */
ESC EQU 1B             /* Escape                                      */
CAN EQU 18             /* Cancel Data                                 */
SPA EQU 20             /* Space                                       */
P17 EQU 12 0F          /* 17.1 Pitch-Characters/inch                  */
CS2 EQU 1B 36          /* Select Character Set 2                      */
CS1 EQU 1B 37          /* Select Character Set 1                      */
P12 EQU 1B 3A          /* 12 Pitch-characters/inch                    */
SVT EQU 1B 42          /* Set Vertical Tabs                           */
SFL EQU 1B 43 00       /* Set Form Length                             */
SHT EQU 1B 44          /* Set Horizontal Tabs                         */
SDS EQU 1B 47          /* Start Double Strike                         */
CDS EQU 1B 48          /* Cancel Double Strike                        */
SSP EQU 1B 4E          /* Set skip perforation                        */
CSP EQU 1B 4F          /* Cancel skip perforation                     */
CAT EQU 1B 52          /* Cancel all tabs Clears VT                   */
                       /* and sets HT every 8 position                */
CSS EQU 1B 54          /* Cancel Subscript or Superscript             */
SSO EQU 1B 53 00       /* Set Superscript over                        */
SSU EQU 1B 53 01       /* Set Subscript under                         */
SUL EQU 1B 2D 01       /* Start Underline                             */
CUL EQU 1B 2D 00       /* Cancel Underline                            */
SCP EQU 1B 5B 54 04 00 00 00 /* ESC T - select code page              */
CP8 EQU 1B 5B 54 04 00 00 00 03 52     /* select code page 850        */
CP4 EQU 1B 5B 54 04 00 00 00 01 B5     /* select code page 437        */
LL2 EQU 1B 41 24 1B 32 /* Setline length 2 lines/inch                 */
LL3 EQU 1B 41 18 1B 32 /* Setline length 3 lines/inch                 */
LL4 EQU 1B 41 12 1B 32 /* Setline length 4 lines/inch                 */
LL6 EQU 1B 41 0C 1B 32 /* Set line length 6 lines/inch                */
LL8 EQU 1B 41 09 1B 32 /* Set line length 8 lines/inch                */
LL0 EQU 1B 41 07 1B 32 /* Set line length 10 lines/inch               */
                       /* actually 7/72 inch                          */
SD1 EQU 1B 5B 46 05 00 00 01 01 00 00 /* Select Drawer 1              */
SD2 EQU 1B 5B 46 05 00 00 01 02 00 00 /* Select Drawer 2              */
ENV EQU 1B 5B 46 05 00 00 02 00 00 00 /* Select Envelope              */
FRM EQU 1B 64          /* Forward Relative Movement                   */
VLF EQU 1B 4A          /* Vertical Line Feed 1/216 inch units         */
SPO EQU 1B 6B          /* Set Portrait Orientation                    */
```

```
SLO EQU 1B 6C          /* Set Landscape Orientation                  */
SFG EQU 1B 5B 49 08 00 /* Set Font Global                            */
END_MACROS
/*                     Session Parameters                           */
/* These parameters determine the way in which output will be       */
/* formatted for your printer.                                      */
/* Numeric Parameters                                               */
/* These parameters should be defined with a two digit hex number   */
/* or a three digit decimal number.  The range of the number is zero  */
/* to 255 (decimal).                                                */
MAXIMUM_PAGE_LENGTH=066              /* Printed lines per page      */
MAXIMUM_PRINT_POSITION=080           /* Printed characters per line   */
INTERV_REQ_TIMER=001
RESELECT_TIME_EXCPT_5204=001
INTERV_TIMER_ON_PE_ONLY?=NO
HORIZONTAL_PEL=120
VERTICAL_PEL=216
LINE_SPACING_RATIO=072
PAGE_LENGTH_TYPE?=INCH               /* SET_PAGE_LENGTH "value" is    */
                                       /* values                    */
/* YES/NO Parameters                                                */
/* These parameters should be defined with either "YES" or "NO" on the*/
/* right hand side of the '='                                       */
COMPRESS_LINE_SPACING?=NO            /* Should blank or null lines    */
                                       /* be printed?               */
FORM_FEED_ANY_POSITION?=YES          /* Should the form feed be       */
                                       /* valid in any position?    */
OVERRIDE_FORMATTED_PRINT?=YES        /* Should nulls be printed as    */
                                       /* blanks?                   */
AUTO_NEWLINE_AT_MAX_POS?=NO
/*                         Control Codes                            */
/* These definitions tell the emulator what control strings to send to*/
/* your printer to issue control commands.                          */
/*                                                                  */
/* Format                                                           */
/* The name of the control command should always be at the beginning  */
/* of a line followed by a '=' and then a definition string.        */
/* A Definition String is any combination of macro names, hexadecimal */
/* numbers, and characters separated by blanks.  A macro must have    */
/* previously defined in the macro definitions section above. A       */
/* hexadecimal number must be two digits (0,..,F) long. and a         */
/* character must be preceded and followed by a blank.  If a          */
/* definition string will not fit on a line, it may be continued      */
/* as many lines as you wish by ending each line except the last with */
/* a comma;  ','.   You made add any comments you wish to by including*/
/* them between a slash*  and a *slash where slash is the symbol /.   */

/* START_JOB is the control string which will be sent to your printer */
/* at the beginning of each print job.                              */
START_JOB=SEL CDW CDL CUL CDS CP8 CS2
/* END_JOB is the string which will be sent to your printer at the end*/
/* of each print job.                                               */
END_JOB=CAT CDW CDL CUL CDS CP4 FFF
BACKSPACE=BAK
BEL=BEL
CARRIAGE_RETURN=CRR
NEW_LINE=CRR LFF
LINE_FEED=LFF
```

```
FORM_FEED=FFF
HORIZONTAL_TAB=TAB
VERTICAL_TAB=VTB
START_SUBSCRIPT=SSU
END_SUBSCRIPT=CSS
START_SUPERSCRIPT=SSO
END_SUPERSCRIPT=CSS
DUP=*
FIELD_MARK=;
/* The following commands specify control codes for which most PC     */
/* printers require command strings which contain a variable value    */
/* or values somewhere in the middle of the string.                   */
/* Place the word "value(s)" in the position of your definition       */
/* string where the Z and I Emulator for Windows 5250 should fill in       */
/* the hexadecimal value(s) indicated.                                */
/* For example, on the IBM Proprinter, the SET_HORIZONTAL_TABS        */
/* definition is:                                                     */
/* SET_HORIZONTAL_TABS=ESC D values NUL                               */
SET_HORIZONTAL_TABS=SHT values NUL   /* "values" are the tab stops    */
                                       /* in column numbers           */
SET_VERTICAL_TABS=SVT values NUL     /* "values" are the tab stops    */
                                       /* in line numbers             */
SET_HORIZONTAL_MARGINS=
SET_PAGE_LENGTH=SFL value            /* "value"=inch of the page      */
SET_AUTO_PERFORATION_SKIP=SSP value
                                       /* "value"=number of lines to  */
                                       /* skip over the perforation   */
                                       /* between pages.  Used to set */
                                       /* top and bottom margins.     */
SET_VARIABLE_LINE_DENSITY=ESC A value ESC 2
                                       /* "value"=number of points.   */
                                       /* A point is                  */
                                       /* 1/(LINE_SPACING_RATIO) inch.*/
SET_CHARACTER_SET=
/*SET_CHARACTER_SET=ESC I NULL  selects the normal font               */
/*SET_CHARACTER_SET=ESC I 02  selects the NLQ (near letter quality)   */
/*SET_CHARACTER_SET=ESC I 04  selects the normal downloaded font      */
/*SET_CHARACTER_SET=ESC I 06  selects the NLQ downloaded font         */
/*SET_CHARACTER_SET=CS1       selects the Character set 1             */
/*SET_CHARACTER_SET=CS2       selects the Character set 2             */

/* These control codes set the printer lines per inch and characters  */
/* per inch to fixed amounts.                                         */
/* If your printer does not support setting the line density in points*/
/* then you can enter control strings for the following commands.     */
/* When Z and I Emulator for Windows 5250 gets a command from the host to  */
/* set the lines per  inch, it will round it to the closest line per  */
/* inch setting that you provide.  Note that if you provide a command */
/* for the SET_VARIABLE_LINE_DENSITY command above that it will be    */
/* used and any control strings you provide for the set lines per inch*/
/* commands below will not be used.                                   */

SET_2_LINES_PER_INCH=LL2
SET_3_LINES_PER_INCH=LL3
SET_4_LINES_PER_INCH=LL4
SET_6_LINES_PER_INCH=LL6
SET_8_LINES_PER_INCH=LL8
SET_10_LINES_PER_INCH=LL0            /* 7/72 inch or 9/96 inch        */
```

```
SET_10_CHARACTERS_PER_INCH=P10
SET_12_CHARACTERS_PER_INCH=P12
SET_13_CHARACTERS_PER_INCH=          /*                              */
SET_15_CHARACTERS_PER_INCH=          /* The proprinter does not      */
                                       /* support 15 pitch except in  */
                                       /* graphic mode                */
SET_17_CHARACTERS_PER_INCH=P17       /* Condensed mode               */
SET_20_CHARACTERS_PER_INCH=
START_DOUBLE_WIDTH_CHARACTERS=P05
END_DOUBLE_WIDTH_CHARACTERS=CDW

/* These control codes are used to select the source drawer number    */
/* when your printer has the dual drawer sheetfeed option.            */
SELECT_DRAWER1=SD1
SELECT_DRAWER2=SD2
SELECT_DRAWER3=
SELECT_ENVELOPE=ENV                  /* Envelope                     */

/* These control codes select the print mode (quality of print).      */
SELECT_DRAFT_QUALITY=
SELECT_LETTER_QUALITY=
SELECT_ENHANCED_QUALITY=
SELECT_SETUP_QUALITY=

/* These control codes                                                */
SET_DUPLEX=
SET_DUPLEX_TUMBLE=
RESET_DUPLEX=

/* These control codes set page orientation                           */
SET_PORTRAIT_ORIENT=SPO
SET_LANDSCAPELEFT_ORIENT=SLO
SET_PORTRAITUPDWN_ORIENT=SPO
SET_LANDSCAPERGHT_ORIENT=SLO

/* These control codes move the print position (Horizontal/Vertical)  */
FORWARD_HORIZONTAL_SKIP=FRM word-value(LH)
FORWARD_VERTICAL_STEP_FEED=VLF byte-value

/* These control codes select the printer font via global font ID     */
SET_FONT_GLOBAL=
SET_GFID_0003=SFG 00 03 00 90 01 01 03 52 CDW   /* OCR-B.10           */
SET_GFID_0005=SFG 00 05 00 90 01 01 03 52 CDW   /* Orator.10          */
SET_GFID_0011=SFG 00 0B 00 90 01 01 03 52 CDW   /* Courier.10         */
SET_GFID_0012=SFG 00 0C 00 90 01 01 03 52 CDW   /* Prestige.10        */
SET_GFID_0013=SFG 00 0B 00 90 01 01 03 52 CDW   /* Artisan.10         */
SET_GFID_0018=SFG 00 12 00 90 01 01 03 52 CDW   /* Courier.Italic.10  */
SET_GFID_0019=SFG 00 13 00 90 01 01 03 52 CDW   /* OCR-A.10           */
SET_GFID_0020=SFG 00 14 00 90 01 01 03 52 CDW   /* Pica.10            */
SET_GFID_0030=SFG 00 1E 00 90 01 01 03 52 CDW   /* Math-Symbol.10     */
SET_GFID_0038=SFG 00 26 00 90 01 01 03 52 CDW   /* Orator.Bold.10     */
SET_GFID_0039=SFG 00 27 00 90 01 01 03 52 CDW   /* Gothic.Bold.10     */
SET_GFID_0040=SFG 00 28 00 90 01 01 03 52 CDW   /* Gothic-Text.10     */
SET_GFID_0041=SFG 00 29 00 90 01 01 03 52 CDW   /* Roman-text.10      */
SET_GFID_0042=SFG 00 2A 00 90 01 01 03 52 CDW   /* Serif-text.10      */
SET_GFID_0043=SFG 00 2B 00 90 01 01 03 52 CDW   /* Serif-text.Italic.10*/
SET_GFID_0044=SFG 00 2C 00 90 01 01 03 52 CDW   /* Katakana-gothic.10 */
SET_GFID_0045=SFG 00 2D 00 90 01 01 03 52 CDW   /* APL.10             */
```

```
SET_GFID_0046=SFG 00 2E 00 90 01 01 03 52 CDW   /* Courier.Bold.10    */
SET_GFID_0050=SFG 00 32 00 90 01 01 03 52 CDW   /* Shalom.10          */
SET_GFID_0066=SFG 00 42 00 78 01 01 03 52 CDW   /* Gothic-text.12     */
SET_GFID_0068=SFG 00 44 00 78 01 01 03 52 CDW   /* Gothic-text.Italic.12*/
SET_GFID_0069=SFG 00 45 00 78 01 01 03 52 CDW   /* Gothic.Bold.12     */
SET_GFID_0070=SFG 00 46 00 78 01 01 03 52 CDW   /* Serif-text.12      */
SET_GFID_0071=SFG 00 47 00 78 01 01 03 52 CDW   /* Serif-text.Italic.12*/
SET_GFID_0072=SFG 00 48 00 78 01 01 03 52 CDW   /* Serif.Bold.12      */
SET_GFID_0080=SFG 00 73 00 78 01 01 03 52 CDW   /* Math-Symbol.12     */
SET_GFID_0084=SFG 00 54 00 78 01 01 03 52 CDW   /* Script.12          */
SET_GFID_0085=SFG 00 55 00 78 01 01 03 52 CDW   /* Courier.12         */
SET_GFID_0086=SFG 00 56 00 78 01 01 03 52 CDW   /* Prestige.12        */
SET_GFID_0087=SFG 00 57 00 78 01 01 03 52 CDW   /* Letter-gothic.12   */
SET_GFID_0091=SFG 00 70 00 78 01 01 03 52 CDW   /* Light.Italic.12    */
SET_GFID_0107=SFG 00 55 00 78 01 01 03 52 CDW   /* Courier.12         */
SET_GFID_0110=SFG 00 6E 00 78 01 01 03 52 CDW   /* Letter-Gothic.Bold.12*/
SET_GFID_0111=SFG 00 6F 00 78 01 01 03 52 CDW   /* Prestige-Elite.Bold.12*/
SET_GFID_0112=SFG 00 70 00 78 01 01 03 52 CDW   /* Prestige.Italic.12 */
SET_GFID_0115=SFG 00 73 00 78 01 01 03 52 CDW   /* Math-Symbol.12     */
SET_GFID_0155=SFG 00 9B 00 78 02 01 03 52 CDW   /* Boldface.Italic.PSM*/
SET_GFID_0158=SFG 00 9E 00 78 02 01 03 52 CDW   /* Modern.PSM         */
SET_GFID_0159=SFG 00 9F 00 78 02 01 03 52 CDW   /* Document.PSM       */
SET_GFID_0160=SFG 00 A0 00 78 02 01 03 52 CDW   /* Essay.PSM          */
SET_GFID_0162=SFG 00 A2 00 78 02 01 03 52 CDW   /* Essay.Italic.PSM   */
SET_GFID_0163=SFG 00 A3 00 78 02 01 03 52 CDW   /* Essay.Bold.PSM     */
SET_GFID_0168=SFG 00 A8 00 78 02 01 03 52 CDW   /* Barak.PSM          */
SET_GFID_0173=SFG 00 AD 00 78 02 01 03 52 CDW   /* Essay.Light.PSM    */
SET_GFID_0175=SFG 00 AF 00 78 02 01 03 52 CDW   /* Document.PSM       */
SET_GFID_0176=SFG 00 B0 00 78 02 01 03 52 CDW   /* Boldface.PSM       */
SET_GFID_0177=SFG 00 9B 00 78 02 01 03 52 CDW   /* Boldface.Italic.PSM*/
SET_GFID_0193=SFG 00 73 00 78 01 01 03 52 CDW   /* Math-Symbol.12     */
SET_GFID_0198=SFG 00 1E 00 90 01 01 03 52 CDW   /* Math-Symbol.10     */
SET_GFID_0204=SFG 00 CC 00 6C 01 01 03 52 CDW   /* Gothic-text.13     */
SET_GFID_0221=SFG 00 DD 00 60 01 01 03 52 CDW   /* Prestige.15        */
SET_GFID_0222=SFG 00 E6 00 60 01 01 03 52 CDW   /* Gothic-text.15     */
SET_GFID_0223=SFG 00 DF 00 60 01 01 03 52 CDW   /* Courier.15         */
SET_GFID_0225=SFG 00 E1 00 60 01 01 03 52 CDW   /* Math-symbol.15     */
SET_GFID_0229=SFG 00 E5 00 60 01 01 03 52 CDW   /* Serif-text.15      */
SET_GFID_0230=SFG 00 E6 00 60 01 01 03 52 CDW   /* Gothic-text.15     */
SET_GFID_0245=SFG 00 2E 00 90 01 01 03 52 P05   /* Courier.Bold.5     */
SET_GFID_0252=SFG 00 FC 00 54 01 01 03 52 CDW   /* Courier.15         */
SET_GFID_0253=SFG 00 FD 00 54 01 01 03 52 CDW   /* Courier.Bold.17    */
SET_GFID_0254=SFG 00 FE 00 55 01 01 03 52 CDW   /* Courier.17         */
SET_GFID_0280=SFG 01 18 00 48 01 01 03 52 CDW   /* APL.20             */
SET_GFID_0281=SFG 01 19 00 48 01 01 03 52 CDW   /* Gothic-text.20     */
SET_GFID_0290=SFG 01 22 00 36 01 01 03 52 CDW   /* Gothic-text.27     */
SET_GFID_0751=SFG 11 37 00 A0 01 03 03 52 CDW   /* Sonoran-serif.8pt  */
SET_GFID_1051=SFG 11 37 00 C8 01 03 03 52 CDW   /* Sonoran-serif.10pt */
SET_GFID_1053=SFG 11 4B 00 C8 01 03 03 52 CDW   /* Sonoran-serif.bold.10pt*/
SET_GFID_1056=SFG 11 B7 00 C8 01 03 03 52 CDW   /* Sonoran-serif.italic.10pt*/
SET_GFID_1351=SFG 11 37 00 F0 01 03 03 52 CDW   /* Sonoran-serif.12pt  */
SET_GFID_1653=SFG 11 4B 01 40 01 03 03 52 CDW   /* Sonoran-serif.Bold.16pt*/
SET_GFID_2103=SFG 11 4B 01 E0 01 03 03 52 CDW   /* Sonoran-serif.Bold.24pt*/

/*                     Color Specifications                         */
START_COLOR_BLUE=
END_COLOR_BLUE=
START_COLOR_GREEN=
```

```
END_COLOR_GREEN=
START_COLOR_CYAN=
END_COLOR_CYAN=
START_COLOR_RED=
END_COLOR_RED=
START_COLOR_MAGENTA=
END_COLOR_MAGENTA=
START_COLOR_YELLOW=
END_COLOR_YELLOW=
START_COLOR_BLACK=
END_COLOR_BLACK=
START_COLOR_WHITE=
END_COLOR_WHITE=

/*                        Highlight Specifications                    */
/* These definitions will determine how things which are sent by the  */
/* host to be displayed or printed as underlined, reverse video, or   */
/* blinking will be highlighted on your printer.                      */

START_HIGHLIGHT_INTENSE=SDS           /* This is double strike        */
END_HIGHLIGHT_INTENSE=CDS
START_HIGHLIGHT_UNDERLINE=SUL
END_HIGHLIGHT_UNDERLINE=CUL
START_HIGHLIGHT_REVERSE_VIDEO=
END_HIGHLIGHT_REVERSE_VIDEO=
START_HIGHLIGHT_BLINK=
END_HIGHLIGHT_BLINK=

/*                      Character Definitions                         */
SPACE=SPA
EXCLAMATION_POINT=21
QUOTATION_MARKS=22
NUMBER_SIGN=23
DOLLAR_SIGN=24
PERCENT_SIGN=25
AMPERSAND=26
APOSTROPHE=27
LEFT_PARENTHESIS=28
RIGHT_PARENTHESIS=29
ASTERISK=2A
PLUS_SIGN=2B
COMMA=2C
HYPHEN=2D
PERIOD=2E
SLASH=2F
ZERO=0
ONE=1
TWO=2
THREE=3
FOUR=4
FIVE=5
SIX=6
SEVEN=7
EIGHT=8
NINE=9
COLON=3A
SEMICOLON=3B
LESS_THAN_SIGN=3C
```

```
EQUAL_SIGN=3D
GREATER_THAN_SIGN=3E
QUESTION_MARK=3F
AT_SIGN=40
A_CAPITAL=A
B_CAPITAL=B
C_CAPITAL=C
D_CAPITAL=D
E_CAPITAL=E
F_CAPITAL=F
G_CAPITAL=G
H_CAPITAL=H
I_CAPITAL=I
J_CAPITAL=J
K_CAPITAL=K
L_CAPITAL=L
M_CAPITAL=M
N_CAPITAL=N
O_CAPITAL=O
P_CAPITAL=P
Q_CAPITAL=Q
R_CAPITAL=R
S_CAPITAL=S
T_CAPITAL=T
U_CAPITAL=U
V_CAPITAL=V
W_CAPITAL=W
X_CAPITAL=X
Y_CAPITAL=Y
Z_CAPITAL=Z
LEFT_BRACKET=5B
BACKSLASH=5C
RIGHT_BRACKET=5D
CIRCUMFLEX_ACCENT=5E
UNDERLINE=5F
GRAVE_ACCENT=60
A_SMALL=a
B_SMALL=b
C_SMALL=c
D_SMALL=d
E_SMALL=e
F_SMALL=f
G_SMALL=g
H_SMALL=h
I_SMALL=i
J_SMALL=j
K_SMALL=k
L_SMALL=l
M_SMALL=m
N_SMALL=n
O_SMALL=o
P_SMALL=p
Q_SMALL=q
R_SMALL=r
S_SMALL=s
T_SMALL=t
U_SMALL=u
V_SMALL=v
```

```
W_SMALL=w
X_SMALL=x
Y_SMALL=y
Z_SMALL=z
LEFT_BRACE=7B
VERTICAL_BAR=7C
RIGHT_BRACE=7D
TILDE_ACCENT=7E
C_CEDILLA_CAPITAL=80
U_DIAERESIS_SMALL=81
E_ACUTE_SMALL=82
A_CIRCUMFLEX_SMALL=83
A_DIAERESIS_SMALL=84
A_GRAVE_SMALL=85
A_OVERCIRCLE_SMALL=86
C_CEDILLA_SMALL=87
E_CIRCUMFLEX_SMALL=88
E_DIAERESIS_SMALL=89
E_GRAVE_SMALL=8A
I_DIAERESIS_SMALL=8B
I_CIRCUMFLEX_SMALL=8C
I_GRAVE_SMALL=8D
A_DIAERESIS_CAPITAL=8E
A_OVERCIRCLE_CAPITAL=8F
E_ACUTE_CAPITAL=90
AE_DIPTHONG_SMALL=91
AE_DIPTHONG_CAPITAL=92
O_CIRCUMFLEX_SMALL=93
O_DIAERESIS_SMALL=94
O_GRAVE_SMALL=95
U_CIRCUMFLEX_SMALL=96
U_GRAVE_SMALL=97
Y_DIAERESIS_SMALL=98
O_DIAERESIS_CAPITAL=99
U_DIAERESIS_CAPITAL=9A
O_SLASH_SMALL=9B
POUND_SIGN=9C
O_SLASH_CAPITAL=9D
MULTIPLY_SIGN=9E
A_ACUTE_SMALL=A0
I_ACUTE_SMALL=A1
O_ACUTE_SMALL=A2
U_ACUTE_SMALL=A3
N_TILDE_SMALL=A4
N_TILDE_CAPITAL=A5
ORDINAL_INDICATOR_FEMININE=A6
ORDINAL_INDICATOR_MASCULINE=A7
QUESTION_MARK_INVERTED=A8
REGISTERED_TRADEMARK_SYMBOL=A9
LOGICAL_NOT=AA
ONE_HALF=AB
ONE_QUARTER=AC
EXCLAMATION_POINT_INVERTED=AD
LEFT_ANGLE_QUOTES=AE
RIGHT_ANGLE_QUOTES=AF
A_ACUTE_CAPITAL=B5
A_CIRCUMFLEX_CAPITAL=B6
A_GRAVE_CAPITAL=B7
```

```
COPYRIGHT_SYMBOL=B8
CENT_SIGN=BD
YEN_SIGN=BE
A_TILDE_SMALL=C6
A_TILDE_CAPITAL=C7
INTERNATIONAL_CURRENCY_SYMBOL=CF
ETH_ICELANDIC_SMALL=D0
ETH_ICELANDIC_CAPITAL=D1
E_CIRCUMFLEX_CAPITAL=D2
E_DIAERESIS_CAPITAL=D3
E_GRAVE_CAPITAL=D4
I_DOTLESS_SMALL=D5
I_ACUTE_CAPITAL=D6
I_CIRCUMFLEX_CAPITAL=D7
I_DIAERESIS_CAPITAL=D8
VERTICAL_LINE_BROKEN=DD
I_GRAVE_CAPITAL=DE
O_ACUTE_CAPITAL=E0
SHARP_S_SMALL=E1
O_CIRCUMFLEX_CAPITAL=E2
O_GRAVE_CAPITAL=E3
O_TILDE_SMALL=E4
O_TILDE_CAPITAL=E5
MICRO_SYMBOL=E6
THORN_ICELANDIC_SMALL=E7
THORN_ICELANDIC_CAPITAL=E8
U_ACUTE_CAPITAL=E9
U_CIRCUMFLEX_CAPITAL=EA
U_GRAVE_CAPITAL=EB
Y_ACUTE_SMALL=EC
Y_ACUTE_CAPITAL=ED
OVERLINE=EE
ACUTE_ACCENT=EF
SYLLABLE_HYPHEN=F0
PLUS_OR_MINUS_SIGN=F1
THREE_QUARTERS=F3
PARAGRAPH_SYMBOL=F4
SECTION_SYMBOL=F5
DIVIDE_SIGN=F6
CEDILLA=F7
DEGREE_SYMBOL=F8
DIAERESIS=F9
MIDDLE_DOT_ACCENT=FA
ONE_SUPERSCRIPT=FB
THREE_SUPERSCRIPT=FC
TWO_SUPERSCRIPT=FD
REQUIRED_SPACE=SPA
/*********************************************************************/
/*               PC5250 Internal Data Area.                          */
/* Do not change these statements.                                   */
/*********************************************************************/
TOP_MARGIN=
LEFT_MARGIN=
DYNAMIC_START_JOB=00 00 00 00 00 00 00 00 00 00 00
DYNAMIC_END_JOB=00 00
DYNAMIC_SET_PAGE_LENGTH=00 00 00
PRINTER_ID=40 19
/*                     End of Definition File                        */
```

IBM5577.PDF File Contents

```
/*********************************************************************/
/*    PDF FILE (PRINTER DEFINITION FILE) FOR: PS/55 Printer          */
/*********************************************************************/
BEGIN_MACROS
NUL EQU 00
BEL EQU 07
BAK EQU 08
TAB EQU 09
LFF EQU 0A
VTB EQU 0B
FFF EQU 0C
CRR EQU 0D
SEL EQU 11
DC3 EQU 13
ESC EQU 1B
CAN EQU 18
SPA EQU 20
P10 EQU 1B 7E 02 00 01 32
P12 EQU 1B 7E 02 00 01 3C
P13 EQU 1B 7E 02 00 01 43
P15 EQU 1B 7E 02 00 01 4B
SDW EQU 1B 7E 0E 00 01 09
EDW EQU 1B 7E 0E 00 01 0A
SVT EQU 1B 7E 19
SHT EQU 1B 7E 18
CSS EQU 1B 7E 0E 00 01 0F
SSO EQU 1B 7E 0E 00 01 0D
SSU EQU 1B 7E 0E 00 01 0E
SUL EQU 1B 7E 11 00 01 01
CUL EQU 1B 7E 11 00 01 00
LL2 EQU 1B 7E 03 00 01 14
LL3 EQU 1B 7E 03 00 01 1E
LL4 EQU 1B 7E 03 00 01 28
LL6 EQU 1B 7E 03 00 01 3C
LL7 EQU 1B 7E 03 00 01 4B
LL8 EQU 1B 7E 03 00 01 50
SPL EQU 1B 7E 04 00 03 00
INZ EQU 1B 7E 01 00 00
EJC EQU 1B 7E 0E 00 01 06
END_MACROS
/*********************************************************************/
/*                    Session Parameters                             */
/*********************************************************************/
MAXIMUM_PAGE_LENGTH=066
MAXIMUM_PRINT_POSITION=132
DEFAULT_CPI?=010
DEFAULT_LPI?=006
COMPRESS_LINE_SPACING?=NO
FORM_FEED_ANY_POSITION?=YES
OVERRIDE_FORMATTED_PRINT?=YES
HORIZONTAL_PEL=180
VERTICAL_PEL=120
UNITS_OF_DRAW_LINE=
KANJI_CODE?=SHIFT_JIS
ZENKAKU_SPACE=
```

```
PAGE_LENGTH_TYPE?=6INCH
/*********************************************************************/
/*                     Control Codes                                 */
/*********************************************************************/
START_JOB=INZ SEL LL6 P10
END_JOB=INZ
BACKSPACE=BAK
BEL=BEL
CARRIAGE_RETURN=CRR
NEW_LINE=CRR LFF
LINE_FEED=LFF
FORM_FEED=EJC
HORIZONTAL_TAB=TAB
VERTICAL_TAB=VTB
DESELECT=DC3
START_SUBSCRIPT=SSU
END_SUBSCRIPT=CSS
START_SUPERSCRIPT=SSO
END_SUPERSCRIPT=CSS
DUP=*
FIELD_MARK=;
SET_HORIZONTAL_TABS=SHT length(HL)-values
SET_VERTICAL_TABS=SVT length(HL)-values
SET_HORIZONTAL_MARGINS=
SET_PAGE_LENGTH=SPL word-value(HL)
SET_2_LINES_PER_INCH=LL2
SET_3_LINES_PER_INCH=LL3
SET_4_LINES_PER_INCH=LL4
SET_6_LINES_PER_INCH=LL6
SET_7.5_LINES_PER_INCH=LL7
SET_8_LINES_PER_INCH=LL8
SET_10_CHARACTERS_PER_INCH=P10
SET_12_CHARACTERS_PER_INCH=P12
SET_13.4_CHARACTERS_PER_INCH=P13
SET_15_CHARACTERS_PER_INCH=P15
START_DOUBLE_WIDTH_CHARACTERS=SDW
END_DOUBLE_WIDTH_CHARACTERS=EDW
IMAGE_TRANSMISSION=1B 25 31 length(HL)-images
FORWARD_HORIZONTAL_SKIP=1B 25 33 word-value(HL)
FORWARD_VERTICAL_STEP_FEED=1B 25 35 word-value(HL)
SET_FONT_SIZE=1B 7E 20 00 03 word-value(HL) 02
SET_TATEGAKI_MODE=1B 7E 0E 00 01 0B
RESET_TATEGAKI_MODE=1B 7E 0E 00 01 0C
SBCS_FONT_LOAD=1B 7E 81 00 28 F0 40 00 18 byte-values F0 40
DBCS_FONT_LOAD=1B 7E 81 00 4C F0 40 02 18 byte-values F0 40SELECT_DRAWER=
SET_LOCAL_FONT=
RESET_LOCAL_FONT=
ABS_HORIZONTAL_COLUMN_SKIP=1B 7E 1C 00 02 00 byte-value
REL_HOR_COLUMN_SKIP_TO_RIGHT=1B 7E 1C 00 02 01 byte-value
SET_SOLID_LINE_TYPE=
SET_DOTTED_LINE_TYPE=
SET_LINE_WIDTH_THIN=
SET_LINE_WIDTH_BOLD=
DRAW_LINE=
KANJI_ON=
KANJI_OFF=
ATTRIBUTE_GRID_LINE=1B 7E 16 length(HL)-values
/*********************************************************************/
```

```
/*                    Highlight Specifications                     */
/*****************************************************************/
START_HIGHLIGHT_INTENSE=ESC 7E 0E 00 01 17
END_HIGHLIGHT_INTENSE=ESC 7E 0E 00 01 18
START_HIGHLIGHT_UNDERLINE=1B 7E 11 00 01 01
END_HIGHLIGHT_UNDERLINE=1B 7E 11 00 01 00
/*****************************************************************/
/*                    Internal Data Area.                          */
/* Do not change these statement.                                  */
/*****************************************************************/
TOP_MARGIN=
LEFT_MARGIN=
DYNAMIC_START_JOB=00 00 00 00 00 00 00 00 00 00
DYNAMIC_END_JOB=00 00
DYNAMIC_SET_PAGE_LENGTH=00 00 00
PRINTER_ID=55 77
/*                     End of Definition File                      */
```

Field Names of Printer Definition Files

Table 22: Field Names of PDF Files on page 226 lists the field names of the printer definition files (PDF files) and their meanings:

Table 22. Field Names of PDF Files

Field Name	Meaning	Remarks
MAXIMUM_-PAGE_LENGTH	Default MPL	Default is 66
MAXIMUM_-PRINT_-POSITION	Default MPP	Default is 132
DEFAULT_CPI?	Default CPI	Default is 10
DEFAULT_LPI?	Default LPI	Default is 6
COMPRESS_-LINE_S-PACING?	Specifies whether to print a line containing only space characters or non-print characters.	
FORM_-FEED_ANY_-POSITION?	Specifies whether to validate the FF control code on the first line.	Do not change this field.
OVERRIDE_-FORMATTED_-PRINT?	Specifies whether to print NULL characters as blanks.	Do not change this field.
HORIZONTAL_-PEL	FORWARD_HORIZONTAL_SKIP length unit	
VERTICAL_PEL	FORWARD_VERTICAL_SKIP length unit	

Table 22. Field Names of PDF Files (continued)

Field Name	Meaning	Remarks
IMAGE_HORI-ZONTAL_PEL	IMAGE_TRANSMISSION horizontal length unit	
IMAGE_VERTI-CAL_PEL	IMAGE_TRANSMISSION vertical length unit	
LINE_S-PACING_RATIO	SET_VARIABLE_LINE_DENSITY length unit	
PAGE_-LENGTH_TYPE?	SET_PAGE _LENGTH page length parameter type	
FIRST_LEFT_-POSITION	Distance from left paper edge	
FIRST_TOP_-POSITION	Distance from top paper edge	
DRAWER1_-ORIENTATION	Default page orientation for drawer 1	Default is `COR`
DRAWER2_-ORIENTATION	Default page orientation for drawer 2	Default is `COR`
AUTOMATIC_-ORIENTATION	Specifies whether to calculate the page orientation.	
START_JOB	Printer control code sent to a printer to start printing	If the control code specifying LPI/CPI is defined, also change DEFAULT_CPI, DEFAULT_LPI.
END_JOB	Printer control code sent to a printer when printing ends	
BACKSPACE	Backspace control code	
BEL	Bell control code	Specifies the number of blank lines to send in Print Screen Collection mode
CARRIAGE_RE-TURN	Carriage return control code	
NEW_LINE	New line (CR/LF) control code	
LINE_FEED	New line control code	
FORM_FEED	Form feed (FF) control code	
HORIZONTAL_-TAB	Horizontal tab control code	
VERTICAL_TAB	Vertical tab control code	
DESELECT	Device control 3 control code	
START_-SUBSCRIPT	Subscript character specification	
END_-SUBSCRIPT	Subscript character specification release	

Table 22. Field Names of PDF Files (continued)

Field Name	Meaning	Remarks
START_SU-PERSCRIPT	Superscript character specification	
END_SU-PERSCRIPT	Superscript character specification release	
DUP	Character used for printing DUP codes	
FIELD_MARK	Character used for printing FIELD MARK characters	
SET_HORIZON-TAL_TABS	Horizontal tab setup	Do not change this field.
SET_VERTI-CAL_TABS	Vertical tab setup	Do not change this field.
SET_HORIZON-TAL_MARGINS	Right and left margin setup	Do not change this field.
SET_PAGE_-LENGTH	Page length setup	Assign the unit used for the defined control code page length to the PAGE_LENGTH_TYPE field. When single sheets are to be used, delete this field.
SET_-VARIABLE_-LINE_DENSITY	Line density setup	Assign the unit used for the control code length defined to LINE_SPACING_RATIO field.
SET_2_LINES_-PER_INCH	New line pitch (2LPI) setup	
SET_3_LINES_-PER_INCH	New line pitch (3LPI) setup	
SET_4_LINES_-PER_INCH	New line pitch (4LPI) setup	
SET_6_LINES_-PER_INCH	New line pitch (6LPI) setup	
SET_8_LINES_-PER_INCH	New line pitch (8LPI) setup	
SET_10_-LINES_PER_-INCH	New line pitch (10LPI) setup	
SET_10_CHAR-ACTERS_PER_-INCH	Character pitch (10CPI) setup	

Table 22. Field Names of PDF Files (continued)

Field Name	Meaning	Remarks
SET_12_CHAR-ACTERS_PER_-INCH	Character pitch (12CPI) setup	
SET_13_CHAR-ACTERS_PER_-INCH	Character pitch (13CPI) setup	
SET_15_CHAR-ACTERS_PER_-INCH	Character pitch (15CPI) setup	
SET_17_CHAR-ACTERS_PER_-INCH	Character pitch (17CPI) setup	
SET_20_CHAR-ACTERS_PER_-INCH	Character pitch (20CPI) setup	
IMAGE_-TRANSMISSION	Image data setup (vertical 24-dot image)	
SELECT_DRAW-ER1	Page tray (Primary) setup	
SELECT_DRAW-ER2	Page tray (Alternate) setup	
SELECT_ENVE-LOPE	Envelope tray setup	
SELECT_-DRAFT_QUALI-TY	Draft print quality setup	
SELECT_LET-TER_QUALITY	Letter print quality setup	
SELECT_EN-HANCED_-QUALITY	Enhanced print quality setup	
SET_DUPLEX	Duplex printing setup	
SET_DUPLEX_-TUMBLE	Duplex (tumble) printing setup	
RESET_DUPLEX	Duplex printing release	
SET_POR-TRAIT_ORIENT	Page orientation (Normal portrait (upright)) setup	

Table 22. Field Names of PDF Files (continued)

Field Name	Meaning	Remarks
SET_LANDS-CAPELEFT_-ORIENT	Page orientation (Landscape left (270 degree clockwise rotation of text)) setup	
SET_PORTRAI-TUPDWN_-ORIENT	Page orientation (Portrait upside down (180 degree clockwise rotation of text)) setup	
SET_LANDS-CAPERGHT_-ORIENT	Page orientation (Landscape right (90 degree clockwise rotation of text)) setup	
FORWARD_-HORIZONTAL_-SKIP	Variable skip (relative position/dot unit)	Assign the unit of the defined control code length to the HORI-ZONTAL_PEL field.
FORWARD_-VERTICAL_-STEP_FEED	Variable line feed (relative posi-tion/dot unit)	Assign the unit of the defined control code length to the VERTICAL_PEL field.
SET_FONT_-GLOBAL	Global font ID setup	Do not change this field.
SET_GFID_0003	GFID 3 (OCR-B) setup	
SET_GFID_0005	GFID 5 (Orator) setup	
SET_GFID_0011	GFID 11 (Courier 10) setup	
SET_GFID_0012	GFID 12 (Prestige Pica) setup	
SET_GFID_0013	GFID 13 (Artisan 10) setup	
SET_GFID_0018	GFID 18 (Courier Italic 10) setup	
SET_GFID_0019	GFID 19 (OCR-A) setup	
SET_GFID_0020	GFID 20 (Pica) setup	
SET_GFID_0030	GFID 30 (Math Symbol 10) setup	
SET_GFID_0038	GFID 38 (Orator Bold) setup	
SET_GFID_0039	GFID 39 (Gothic Bold 10) setup	
SET_GFID_0040	GFID 40 (Gothic Text 10) setup	
SET_GFID_0041	GFID 41 (Roman Text 10) setup	
SET_GFID_0042	GFID 42 (Serif Text 10) setup	
SET_GFID_0043	GFID 43 (Serif Italic 10) setup	
SET_GFID_0044	GFID 44 (Katakana 10) setup	
SET_GFID_0045	GFID 45 (APL 10) setup	
SET_GFID_0046	GFID 46 (Courier Bold 10) setup	
SET_GFID_0050	GFID 50 (Shalom 10) setup	
SET_GFID_0066	GFID 66 (Gothic Text 12) setup	
SET_GFID_0068	GFID 68 (Gothic Italic 12) setup	

Table 22. Field Names of PDF Files (continued)

Field Name	Meaning	Remarks
SET_GFID_0069	GFID 69 (Gothic Bold 12) setup	
SET_GFID_0070	GFID 70 (Serif Text 12) setup	
SET_GFID_0071	GFID 71 (Serif Italic 12) setup	
SET_GFID_0072	GFID 72 (Serif Bold 12) setup	
SET_GFID_0080	GFID 80 (Math Symbol 12) setup	
SET_GFID_0084	GFID 84 (Script 12) setup	
SET_GFID_0085	GFID 85 (Courier 12) setup	
SET_GFID_0086	GFID 86 (Prestige Elite) setup	
SET_GFID_0087	GFID 87 (Letter Gothic 12) setup	
SET_GFID_0091	GFID 91 (Light Italic 12) setup	
SET_GFID_0110	GFID 110 (Letter Gothic Bold 12) set-up	
SET_GFID_0111	GFID 111 (Prestige Elite Bold) setup	
SET_GFID_0112	GFID 112 (Prestige Elite Italic) setup	
SET_GFID_0115	GFID 115 (Math Symbol 12) setup	
SET_GFID_0155	GFID 155 (Boldface Italic) setup	
SET_GFID_0158	GFID 158 (Modern) setup	
SET_GFID_0159	GFID 159 (Boldface) setup	
SET_GFID_0160	GFID 160 (Essay) setup	
SET_GFID_0162	GFID 162 (Essay Italic) setup	
SET_GFID_0163	GFID 163 (Essay Bold) setup	
SET_GFID_0168	GFID 168 (Barak PSM) setup	
SET_GFID_0173	GFID 173 (Essay Light) setup	
SET_GFID_0175	GFID 175 (Document) setup	
SET_GFID_0176	GFID 176 (Boldface) setup	
SET_GFID_0177	GFID 177 (Boldface Italic) setup	
SET_GFID_0193	GFID 193 (Math Symbol 12) setup	
SET_GFID_0198	GFID 198 (Math Symbol 10) setup	
SET_GFID_0204	GFID 204 (Gothic Text 13) setup	
SET_GFID_0221	GFID 221 (Prestige 15) setup	
SET_GFID_0222	GFID 222 (Gothic Text 15) setup	
SET_GFID_0223	GFID 223 (Courier 15) setup	
SET_GFID_0225	GFID 225 (Math Symbol 15) setup	
SET_GFID_0229	GFID 229 (Serif Text 15) setup	
SET_GFID_0230	GFID 230 (Gothic Text 15) setup	
SET_GFID_0245	GFID 245 (Courier Bold 5) setup	
SET_GFID_0252	GFID 252 (Courier 17) setup	

Table 22. Field Names of PDF Files (continued)

Field Name	Meaning	Remarks
SET_GFID_0253	GFID 253 (Courier Bold 17) setup	
SET_GFID_0254	GFID 254 (Courier 17 (sub/super)) setup	
SET_GFID_0280	GFID 280 (APL 20) setup	
SET_GFID_0281	GFID 281 (Gothic Text 20) setup	
SET_GFID_0290	GFID 290 (Gothic Text 27) setup	
SET_GFID_0751	GFID 751 (Sonoran-Serif 8-pt Roman Medium) setup	
SET_GFID_1051	GFID 1051 (Sonoran-Serif 10-pt Roman Medium) setup	
SET_GFID_1053	GFID 1053 (Sonoran-Serif 10-pt Roman Bold) setup	
SET_GFID_1056	GFID 1056 (Sonoran-Serif 10-pt Italic Medium) setup	
SET_GFID_1351	GFID 1351 (Sonoran-Serif 12-pt Roman Medium) setup	
SET_GFID_1653	GFID 1653 (Sonoran-Serif 16-pt Roman Bold) setup	
SET_GFID_2103	GFID 2103 (Sonoran-Serif 24-pt Roman Bold) setup	
START_HIGHLIGHT_INTENSE	Highlight printing setup	
END_HIGHLIGHT_INTENSE	Highlight printing release	
START_HIGHLIGHT_UNDERLINE	Underline setup	
END_HIGHLIGHT_UNDERLINE	Underline release	
TOP_MARGIN	Default top margin	Do not change this field.
LEFT_MARGIN	Default left margin	Do not change this field.
DYNAMIC_START_JOB	Printer control code sent to a printer to start printing (internal use)	Do not change this field.
DYNAMIC_END_JOB	Printer control code sent to a printer to stop printing (internal use)	Do not change this field.

Table 22. Field Names of PDF Files (continued)

Field Name	Meaning	Remarks
DYNAMIC_-SET_PAGE_-LENGTH	Page length setup control code sent to a printer at the start of printing (internal use)	Do not change this field.
PRINTER_ID	Printer ID	Do not change this field.
KANJI_CODE?	Used kanji codes (JIS or SHIFT_JIS)	Do not change this field.
ZENKAKU_SPACE	The size (adjustment unit) of a user-defined character and a HANKAKU character	Do not change this field.
SBCS_FONT_-LOAD	Registration of a HANKAKU GAIJI	Do not change this field.
DBCS_FONT_-LOAD	Registration of a ZENKAKU GAIJI	Do not change this field.
SET_LOCAL_-FONT	Set a font set of user-defined characters	Remove this field when user-defined characters are not loaded to a printer.
RESET_LOCAL_FONT	Reset a font set of user-defined characters	Remove this field when user-defined characters are not loaded to a printer.
KANJI_ON	Set kanji mode	
KANJI_OFF	Reset kanji mode	
ATTRIBUTE_-GRID_LINE	Grid-line print	Do not change this field.
START_DOUBLE_WIDTH_-CHARACTER	Set a double-width character	
END_DOUBLE_-WIDTH_CHARACTER	Reset a double-width character	

Note:

1. When using IBM5577.PDF, change FORM_FEED=EJC to FORM_FEED in the file when a continuous form job does not feed correctly.
2. When using ESC_P.PDF, DBCS (2-byte) characters are placed to the left of the character box, not in the center. To place DBCS characters in the center of the character box, change the IBM-supplied values in ESC_P.PDF:

```
P10 EQU 1B 50 1B 20 00 1C 53 00 0C 1C 54 00 00
P12 EQU 1B 4D 1B 20 00 1C 53 00 06 1C 54 00 00
P13 EQU 1B 67 1B 20 01 1C 53 00 03 1C 54 00 01
P15 EQU 1B 67 1B 20 00 1C 53 00 00 1C 54 00 00
```

   to the following:

```
P10 EQU 1B 50 1B 20 00 1C 53 06 06 1C 54 00 00
P12 EQU 1B 4D 1B 20 00 1C 53 03 03 1C 54 00 00
P13 EQU 1B 67 1B 20 01 1C 53 02 01 1C 54 00 01
P15 EQU 1B 67 1B 20 00 1C 53 00 00 1C 54 00 00
```

The following table lists the session parameter field names and their effective values:

Table 23. Effective Values for PDF File Field Names

Field Name	Effective Value
MAXIMUM_PAGE_LENGTH	001 to 255
MAXIMUM_PRINT_POSITION	001 to 255
DEFAULT_CPI?	010/012/015
DEFAULT_LPI?	004/006/008
COMPRESS_LINE_SPACING?	YES/NO
FORM_FEED_ANY_POSITION?	YES/NO
OVERRIDE_FORMATTED_PRINT?	YES/NO
HORIZONTAL_PEL	FORWARD_HORIZONTAL_SKIP length unit
VERTICAL_PEL	FORWARD_VERTICAL_ STEP_FEED length unit
IMAGE_HORIZONTAL_PEL	IMAGE_TRANSMISSION horizontal unit
IMAGE_VERTICAL_PEL	IMAGE_TRANSMISSION vertical unit
LINE_SPACING_RATIO	SET_VARIABLE_LINE_DENSITY length unit
PAGE_LENGTH_TYPE?	LINE/INCH/6INCH*
FIRST_LEFT_POSITION	000 to 1440 in units of 1/1440 inch
FIRST_TOP_POSITION	000 to 1440 in units of 1/1440 inch
DRAWER1_ORIENTATION	LANDSCAPE/PORTRAIT/COR
DRAWER2_ORIENTATION	LANDSCAPE/PORTRAIT/COR
AUTOMATIC_ORIENTATION	YES/NO
* 6/INCH indicates that page length should be specified in units of 1/6 inch.	

Note:

1. If one of the desired CPI/LPI settings is not exactly supported by the printer, set the nearest value. The results of printing might not be as desired.
2. If the units used to specify the control code length defined in FORWARD_HORIZONTAL _SKIP and FORWARD_VERTICAL _STEP_FEED are not the same as the units used to specify the HORIZONTAL_PEL and VERTICAL_PEL, the desired output will not be obtained.

3. If the units used to specify the control code length defined in SET_VARIABLE_LINE_DENSITY are not the same as the units used to specify the LINE_SPACING_RATIO, the desired output will not be obtained.
4. When FIRST_LEFT_POSITION and FIRST_TOP_POSITION are specified, their values are regarded as specifying the unprintable area in the page of the printer. These values are included in the top margin and the left margin specified by the iSeries™, eServer™ i5, or System i5™ printer control code.

Symbols of Printer Definition Files

The following table lists the symbols that are defined for printer definition files.

Table 24. Printer Symbol Definitions

Field Name	Symbol
SPACE	
EXCLAMATION_POINT	!
QUOTATION_MARKS	"
NUMBER_SIGN	#
DOLLAR_SIGN	$
PERCENT_SIGN	%
AMPERSAND	&
APOSTROPHE	'
LEFT_PARENTHESIS	(
RIGHT_PARENTHESIS	)
ASTERISK	*
PLUS_SIGN	+
COMMA	,
HYPHEN	-
PERIOD	.
SLASH	/
ZERO	0
ONE	1
TWO	2
THREE	3
FOUR	4
FIVE	5
SIX	6
SEVEN	7
EIGHT	8

Table 24. Printer Symbol Definitions (continued)

Field Name	Symbol
NINE	9
COLON	:
SEMICOLON	;
LESS_THAN_SIGN	<
EQUAL_SIGN	=
GREATER_THAN_SIGN	>
QUESTION_MARK	?
AT_SIGN	@
A_CAPITAL	A
B_CAPITAL	B
C_CAPITAL	C
D_CAPITAL	D
E_CAPITAL	E
F_CAPITAL	F
G_CAPITAL	G
H_CAPITAL	H
I_CAPITAL	I
J_CAPITAL	J
K_CAPITAL	K
L_CAPITAL	L
M_CAPITAL	M
N_CAPITAL	N
O_CAPITAL	O
P_CAPITAL	P
Q_CAPITAL	Q
R_CAPITAL	R
S_CAPITAL	S
T_CAPITAL	T
U_CAPITAL	U
V_CAPITAL	V
W_CAPITAL	W
X_CAPITAL	X
Y_CAPITAL	Y
Z_CAPITAL	Z
LEFT_BRACKET	[
BACKSLASH	\

Table 24. Printer Symbol Definitions (continued)

Field Name	Symbol
RIGHT_BRACKET	]
CIRCUMFLEX_ACCENT	^
UNDERLINE	_
GRAVE_ACCENT	`
A_SMALL	a
B_SMALL	b
C_SMALL	c
D_SMALL	d
E_SMALL	e
F_SMALL	f
G_SMALL	g
H_SMALL	h
I_SMALL	i
J_SMALL	j
K_SMALL	k
L_SMALL	l
M_SMALL	m
N_SMALL	n
O_SMALL	o
P_SMALL	p
Q_SMALL	q
R_SMALL	r
S_SMALL	s
T_SMALL	t
U_SMALL	u
V_SMALL	v
W_SMALL	w
X_SMALL	x
Y_SMALL	y
Z_SMALL	z
LEFT_BRACE	{
VERTICAL_BAR	|
RIGHT_BRACE	}
TILDE_ACCENT	~
C_CEDILLA_CAPITAL	Ç
U_DIAERESIS_SMALL	ü

Table 24. Printer Symbol Definitions (continued)

Field Name	Symbol
E_ACUTE_SMALL	é
A_CIRCUMFLEX_SMALL	â
A_DIAERESIS_SMALL	ä
A_GRAVE_SMALL	à
A_OVERCIRCLE_SMALL	å
C_CEDILLA_SMALL	ç
E_CIRCUMFLEX_SMALL	ê
E_DIAERESIS_SMALL	ë
E_GRAVE_SMALL	è
I_DIAERESIS_SMALL	ï
I_CIRCUMFLEX_SMALL	î
I_GRAVE_SMALL	ì
A_DIAERESIS_CAPITAL	Ä
A_OVERCIRCLE_CAPITAL	Å
E_ACUTE_CAPITAL	É
AE_DIPTHONG_SMALL	æ
AE_DIPTHONG_CAPITAL	Æ
O_CIRCUMFLEX_SMALL	ô
O_DIAERESIS_SMALL	ö
O_GRAVE_SMALL	ò
U_CIRCUMFLEX_SMALL	û
U_GRAVE_SMALL	ù
Y_DIAERESIS_SMALL	ÿ
O_DIAERESIS_CAPITAL	Ö
U_DIAERESIS_CAPITAL	Ü
O_SLASH_SMALL	ø
POUND_SIGN	£
O_SLASH_CAPITAL	Ø
MULTIPLY_SIGN	×
A_ACUTE_SMALL	á
I_ACUTE_SMALL	í
O_ACUTE_SMALL	ó
U_ACUTE_SMALL	ú
N_TILDE_SMALL	ñ
N_TILDE_CAPITAL	Ñ
ORDINAL_INDICATOR_FEMININE	a

Table 24. Printer Symbol Definitions (continued)

Field Name	Symbol
ORDINAL_INDICATOR_MASCULINE	º
QUESTION_MARK_INVERTED	¿
REGISTERED_TRADEMARK_SYMBOL	®
LOGICAL_NOT	¬
ONE_HALF	½
ONE_QUARTER	¼
EXCLAMATION_POINT_INVERTED	¡
LEFT_ANGLE_QUOTES	«
RIGHT_ANGLE_QUOTES	»
A_ACUTE_CAPITAL	Á
A_CIRCUMFLEX_CAPITAL	Â
A_GRAVE_CAPITAL	À
COPYRIGHT_SYMBOL	©
CENT_SIGN	¢
YEN_SIGN	¥
A_TILDE_SMALL	ã
A_TILDE_CAPITAL	Ã
E_CIRCUMFLEX_CAPITAL	Ê
E_DIAERESIS_CAPITAL	Ë
I_ACUTE_CAPITAL	Í
I_CIRCUMFLEX_CAPITAL	Î
I_DIAERESIS_CAPITAL	Ï
VERTICAL_LINE_BROKEN	¦
I_GRAVE_CAPITAL	Ì
O_ACUTE_CAPITAL	Ó
O_CIRCUMFLEX_CAPITAL	Ô
O_GRAVE_CAPITAL	Ò
O_TILDE_SMALL	õ
O_TILDE_CAPITAL	Õ
MICRO_SYMBOL	µ
U_ACUTE_CAPITAL	Ú
U_CIRCUMFLEX_CAPITAL	Û
U_GRAVE_CAPITAL	Ù
ACUTE_ACCENT	´
SYLLABLE_HYPHEN	-

Table 24. Printer Symbol Definitions (continued)

Field Name	Symbol
PLUS_OR_MINUS_SIGN	±
THREE_QUARTERS	¾
PARAGRAPH_SYMBOL	¶
SECTION_SYMBOL	§
DIVIDE_SIGN	÷
DEGREE_SYMBOL	°
ONE_SUPERSCRIPT	¹
THREE_SUPERSCRIPT	³
TWO_SUPERSCRIPT	²
REQUIRED_SPACE	
INTERNATIONAL_CURRENCY_SYM-BOL	¤
ETH_ICELANDIC_SMALL	ð
ETH_ICELANDIC_CAPITAL	Ð
SHARP_S_SMALL	ß
THORN_ICELANDIC_SMALL	þ
THORN_ICELANDIC_CAPITAL	Þ
Y_ACUTE_SMALL	ý
Y_ACUTE_CAPITAL	Ý
OVERLINE	‾
CEDILLA	¸
DIAERESIS	..
MIDDLE_DOT_ACCENT	.

Using Printer Control Codes

This section explains the SNA Character String (SCS) control codes, or Final Form Text: Document Content Architecture (FFT DCA).

For details of iSeries™, eServer™ i5, or System i5™ printer control codes, refer to *AS/400 Guide to Programming for Printing*.

This table matches the iSeries™, eServer™ i5, or System i5™ table of fonts. PC400 builds a PC spool file with the selected font in it. The printer driver picks up the spool file and the font and sends it to the printer where the expected font is used. Refer to *Printer Device Programming* for additional information on other useful tables.

The following factors can produce unexpected results:

- Not all fonts are available on a PC or printer device.

  If the font that was selected from the table and incorporated into the spool file cannot be found on a PC or on a printer, the printer driver determines how to present the data on a printer. For example, HP printer drivers have the following order of considerations:

  - HP Font Priority Considerations:
    1. Symbol Set
    2. Spacing
    3. Pitch
    4. Height
    5. Style
    6. Stroke Weight
    7. Typeface Family
    8. Resolution
    9. Orientation
  - Location: printer ROM, SIMM module ROM, cartridge ROM, printer RAM

    Priority of locations:
    1. Soft font (lowest ID first)
    2. Cartridge Font
    3. SIMM Font
    4. Internal Font
  - 600 dpi has priority over 300 dpi

  To avoid this uncertainty, it is recommended that you update the table so that only the fonts that are available in the given environment are used.

- NLS

  The iSeries™, eServer™ i5, or System i5™ font has NLS characters in it, which are not part of a corresponding PC font. The IBM-supplied table does not support character sets other than ANSI, although it provides a field for them. In this case, PC400 builds a PC spool file with a font that doesn't recognize NLS.

  To fix the problem, it is recommended that you either change the font names in the table to the NLS enabled on a PC/printer, or if the font has the same name as the one in the table, update a Character Set value.

- After you decide to scale a printout which may be a result of CORig or BesFitting, you usually decrease the distance horizontally as well as vertically between characters. This can result in overlapping. PC400 attempts to adjust the given character size to a new one. A problem may occur when a font defined in the table is not a scalable font. Like GFID011, the most heavily used iSeries™, eServer™ i5, or System i5™ font is mapped to Courier. Courier is a non-scalable font which has only a limited number of character box sizes. To avoid possible problems it is recommended that you use Courier New instead, which is a scalable TTF font.

Printer Control Code Format

Some printer control codes perform single, specific functions by themselves, while others perform multiple functions according to the parameters specified after the control code.

A printer control code with parameters has the following format:

Control Code	Count	Para-meter 1	Parame-ter 2...
1 or 2 bytes	1 byte	1 or 2 bytes	1 or 2 bytes

A count consists of 1 byte, and indicates the length of the parameters (including the count) after the control code, in bytes. For example, a count and two 1-byte parameters is shown as X'03', because the count itself is included. Some control codes, such as the Printing Position (PP) control code, do not have counts.

A parameter can be 1 or 2 bytes in length. The number of bytes depends on the control codes. Not all control codes have parameters.

Note: In this manual, counts and parameters that are actually processed in binary are all expressed in hexadecimal (0–F) to improve readability.

Parameter Definition of Printer Control Codes

Some printer control codes require that parameters be specified. Pay particular attention when defining a parameter because how this is done depends on the parameter type. If the definition method for another type is used, the desired output will not be obtained.

The following table lists printer control code parameter types and their meanings:

Table 25. Printer Control Code Parameter Types

Parameter Type	Meaning
byte-value	One-byte parameter.
byte-values	Multibyte parameter. Used if operands are fixed.
word-value(HL)	One-word parameter (higher and lower bytes).
word-value(LH)	One-word parameter (lower and higher bytes).
length(HL)-values	Multibyte parameter requiring operands. An operand consists of a higher and lower byte. Used if operands are variable.

Table 25. Printer Control Code Parameter Types (continued)

Parameter Type	Meaning
length(LH)-values	Multibyte parameter requiring operands. An operand consists of a lower and higher byte. Used if operands are variable.
length(HL)-images	Image data requiring operands. An operand consists of a higher and lower byte.
length(LH)-images	Image data requiring operands. An operand consists of a lower and higher byte.
decimal-characters	Decimal characters parameter.

Supported Control Codes

Z and I Emulator for Windows supports all control codes for the 3812 printer.

Supported SCS Commands

Table 26. Supported SCS Commands

SCS Command	Abbreviation	Hexadecimal Code	Function
Character Attribute			
Set Font Size Scaling	SFSS	2BFDnn02xxyy	Specifies the font-size scaling for expansion.
Character Set Control			
Load Alternate Character (DBCS only)	LAC	2BFEnnmmee	Loads the alternate character font.
Set CGCS[1] Through Local ID	SCL	2BD1nn810B	Specifies the character set for each language.
Set Character Distance	SCD	2BD2nn29xxxx	Selects the pitch and font.
Set Font ID Through GFID[2]	SFG	2BD1nn05xxxxyyyyzz	Selects the font.
Set GCSGID[3] Through GCID[4]	SCG	2BD1nn01xxxxyyyy	Specifies the code page.
Set Presentation of Control Character	SPCC	2BFDnn03xxxx	Specifies the treatment of SO and SI.
Shift Out (DBCS only)	SO	0E	Start of DBCS field.
Shift In	SI	0F	End of DBCS field.

Table 26. Supported SCS Commands

(continued)

SCS Command	Abbreviation	Hexadecimal Code	Function
(DBCS only)			
Device Control			
Bell	BEL	2F	Ignored.
Null	NUL	00	Ignored.
Repeat	RPT	0A	Ignored.
Set Exception Action	SEA	2BD2nn85p1–pn	Specifies the explicit action.
Set Initial Conditions	SIC	2BD2nn45xx	Sets the environment of the EBCDIC transform.
Set Print Setup	SPSU	2BD2nn4Cp1–pn	Ignored.
Switch	SW	2A	Ignored.
Generation Control			
Begin Emphasis	BES	2BD1nn8Axx	Begins emphasis.
Begin Overstrike	BOS	2BD4nn72wwxxyyyyzzzz	Begins overstriking.
Begin Underscore	BUS	2BD4nn0Axxyy	Begins underscoring.
Enable Presentation	ENP	14	Ignored.
End Emphasis	EES	2BD1nn8Exx	Ends emphasis.
End Overstrike	EOS	2BD4nn76	Ends overstriking.
End Underscore	EUS	2BD4nn0E	Ends underscoring.
Inhibit Presentation	INP	24	Ignored.
Justify Text Field	JTF	2BD2nn03xxxxyy	Justifies the following text.
Set Graphic Error Action	SGEA	2BC8nnxxyy	Specifies how to process a received un-printable character font.
Set Justify Mode	SJM	2BD2nn0Dxxyy	Justifies each line of text between the left and right margins.
Subscript	SBS	38	Subscript.
Substitute	SUB	3F	Synonym for the graphic exception character.
Superscript	SPS	09	Superscript.
Word Underscore	WUS	23	Underscore the entire word immediately preceding the control.
Grid Control			
Define Grid Line	DGL	2BFDnn00 xxyyG1~Gn	Specifies and prints the grid line
Print Format Control			
Form Feed	FF	0C	Moves the printing position to the next page.

Table 26. Supported SCS Commands

(continued)

SCS Command	Abbreviation	Hexadecimal Code	Function
Page Presentation Media	PPM	2BD2nn48ssssuuvv wwxxyyzz	Specifies the forms setting, the source drawer, the quality, and the duplex function.
Required Form Feed	RFF	3A	Moves the printing position to the next page and restores the indent level to the left margin.
Set Horizontal Format	SHF	2BC1nnxxyyzzt1–tn	Specifies the maximum print position, the left and right margins, and the horizontal tab stops in units of 1 character.
Set Horizontal Margins	SHM	2BD2nn11xxxxyyyy	Sets the left and right margins in units of 1/1440 inch.
Set IGC Type	SIT	2BFDnn010000	Specifies the pitch of DBCS characters
Set Presentation Page Size	SPPS	2BD2nn40xxxxyyyy	Specifies the presentation surface width and depth.
Set Text Orientation	STO	2BD3nnF6xxxxyyyy	Specifies the page rotation.
Set Vertical Format	SVF	2BC2nnxxyyzzt1–tn	Specifies the maximum print line, the top and bottom margins, and the vertical tab stops in units of 1 character.
Set Vertical Margins	SVM	2BD2nn49xxxxyyyy	Sets the top and bottom margins in units of 1/1440 inch.
Printing Position Control			
Backspace	BS	16	Moves the printing position to the left one font width.
Carriage Return	CR	0D	Moves the printing position to the left margin.
Horizontal Tab	HT	05	Moves the printing position right to the next tab stop.
Indent Tab	IT	39	Moves the printing position right to the next tab stops and sets the indent level one tab stop further to the right.
Index Return	IRT	33	Synonym for “Required New Line.”
Interchange Record Separator	IRS	1E	Synonym for “New Line.”
Line Feed	LF	25	Moves the printing position one line vertically.
New Line	NL	15	Moves the printing position to the left margin of the next line.

Table 26. Supported SCS Commands

(continued)

SCS Command	Abbreviation	Hexadecimal Code	Function
Numeric Backspace	NBS	36	Synonym for “Backspace.”
Presentation Position	PP	34fpxx	Moves the printing position.
Release Left Margin	RLM	2BD2nn0B	Ignored.
Required New Line	RNL	06	Moves the printing position to the left margin of the next line and resets any pending indent level.
Set Horizontal Tab Stops	STAB	2BD2nn01xxt1–tn	Specifies the tab stops.
Set Indent Level	SIL	2BD2nn07xx	Sets the indent level to the specific tab stop.
Set Line Density	SLD	2BC6nnxx	Specifies the line pitch in units of 1/72 inch.
Set Line Spacing	SLS	2BD2nn09xx	Specifies the number of lines spaced by a new line control.
Set Single Line Distance	SSLD	2BD2nn15xxxx	Specifies the line pitch in units of 1/1440 inch.
Unit Backspace	UBS	1A	Moves the printing position 1/60 inch to the left.
Vertical Tab	VT	0B	Moves the printing position down to the next tab stop.
Transparent Control			
ASCII Transparent	ATRN	03	Allows printer commands and ASCII data to be passed to the printer.
Transparent	TRN	35nn	Allows printer commands and ASCII data to be passed to the printer.

Note:

1

Coded Graphic Character Set

2

Global Font ID

3

Graphic Character Set Global Identifier

Table 26. Supported SCS Commands

(continued)

SCS Command	Abbreviation	Hexadecimal Code	Function
4 Graphic Character set ID			
Legend: nn: Count fp: Function parameter ee, gg, hh, il–ix, mm, nn, p1–pn, ss, t1–tn, uu, vv, ww, xx, yy, zz: Numeric parameter			

Programming Notes

This section briefly explains how a printer reacts if a partial control code is received, or if an incomplete control code is sent.

If the transmission of a control code is interrupted, the printer waits for the remaining part of the code. If the data stream (the series of data units and control codes) sent after the interruption is consistent with the data stream sent before the interruption, (that is, if one complete printer control code is restored by chaining), the control code is processed as is.

If the two parts of the data stream are inconsistent, an error occurs. A negative response to an "Invalid Printer Parameter" is sent to the host system, or treated as a no-op (no operation; ignored because of a meaningless code). Detailed information is not sent to the host system if an error occurs in a control code. After programming, the data stream must be checked thoroughly by repeating the printing test.

Restrictions and Notes for iSeries, eServer i5, or System i5 Commands and Printer Setup

This section provides supplementary notes and explains restrictions for printing.

Printer Control Codes

Table 27. Printer Control Codes

Printer Control Code	If *Use PDT file* is Selected:	If a Windows® Printer Driver is Used:
SCD — Set the Character Density	Select the GFID for the valid character distance (CD) parameter as shown in Table 28: SCD Parameter Values on page 248.	
	If the specified font is not supported, a substitution is provided. For exam-	See How to Determine PC400 Font on page 249.

Table 27. Printer Control Codes

(continued)

Printer Control Code	If *Use PDT file* is Selected:	If a Windows® Printer Driver is Used:
	ple, when 15 CPI font is specified but the font is not supported, the supported 17 CPI font is substituted.	
SFG — Set Font ID through GFID	Recognizable GFIDs are restricted. (See Field Names of Printer Definition Files on page 226.) If the specified GFID is not supported and it is out of the range from 154 through 200, the closest font width from the fonts shown in Table 29: Commonly Used SFG GFID Values on page 249 is substituted. If the specified GFID is not supported and it is between 154 and 200, the following font is substituted: **Font name:** Document; **GFID value:**175.	
		See How to Determine PC400 Font on page 249.
BUS — Begin Underscore		The selected font might not support the underscore.
BES — Begin Emphasis		The selected font might not support the emphasis.
STO — Set Text Orientation		The page orientation can be changed to portrait or landscape. The direction, which is up, down, left, or right on the paper, depends on the Microsoft® Windows® printer driver. If the page orientation is changed, the current paper is ejected.
PPM — Page Presentation Media	The following parameters are supported for PDTs in DBCS mode: • Forms Control (FC) • Source Drawer (SD) • Duplex (DX) Other parameters are ignored.	

Table 28. SCD Parameter Values

CD Parameter	Character Pitch (normal)	GFID Value (COR)
000A	10 CPI	13 CPI 204
000B	Proportional	13 CPI 175
000C	12 CPI	15 CPI 86
000F	15 CPI	20 CPI 230

Table 28. SCD Parameter Values (continued)

CD Parameter	Character Pitch (normal)	GFID Value (COR)
00FF	10 CPI	13 CPI 204

The following table lists only the most commonly used GFIDs. See Table 30: iSeries, eServer i5, or System i5 Font Parameters on page 250 for the complete list.

Table 29. Commonly Used SFG GFID Values

Font Name	GFID value
Courier Bold 5	245
Courier 10	11
Prestige Elite 12	86
Gothic-text 13	204
Gothic-text 15	230
Courier 17	252
Gothic-text 20	281
Gothic-text 27	290

When you use the Windows® printer driver, the spooler must be on.

How to Determine PC400 Font

When a print job is created on iSeries™, eServer™ i5, or System i5™, a certain font, identified by font ID (GFID), is associated with it. Such a font can be specified by the following parameters:

- Font family
- Pitch and family
- Character set
- Width
- Height
- Weight
- Style

System fonts are available with all print drivers, and more flexible device fonts are unique to each printer and printer driver. These fonts are also more fixed as to CPI, weight, code pages, and other criteria that can preclude use of it when matching to the host specified needs.

There are problems associated with mapping an iSeries™, eServer™ i5, or System i5™ font to a PC font. When your PC has all of the fonts that you need, use the following table to determine the best font to use.

Table 30. iSeries, eServer i5, or System i5 Font Parameters

Entry ID	Font Family	GFID	Pitch & Family	Character Set	Width	Height	Weight	Style
GFID0003	OCR-B	3	49	0	144	240	400	0
GFID0005	Orator	5	49	0	144	240	400	0
GFID0011	Courier	11	49	0	144	240	400	0
GFID0012	Prestige	12	49	0	144	240	400	0
GFID0013	Artisan	13	49	0	144	240	400	0
GFID0018	Courier Italic	18	49	0	144	240	400	255
GFID0019	OCR-A	19	49	0	144	240	400	0
GFID0020	Pica	20	49	0	144	240	400	0
GFID0030	Symbol	30	49	2	144	240	400	0
GFID0038	Orator	38	49	0	144	240	400	0
GFID0039	Gothic	39	49	0	144	240	800	0
GFID0040	Gothic	40	49	0	144	240	800	0
GFID0041	Roman	41	49	0	144	240	400	0
GFID0042	Serif	42	49	0	144	240	400	0
GFID0043	Serif	43	49	0	144	240	400	255
GFID0044	Katakana	44	49	0	144	240	400	0
GFID0045	APL	45	49	0	144	240	400	0
GFID0046	Courier Bold	46	49	0	144	240	800	0
GFID0050	Shalom	50	49	0	144	240	400	0
GFID0066	Gothic	66	49	0	144	240	400	0
GFID0068	Gothic	68	49	0	120	240	400	255
GFID0069	Gothic	69	49	0	120	240	800	0
GFID0070	Serif	70	49	0	120	240	400	0
GFID0071	Serif	71	49	0	120	240	400	255
GFID0072	Serif	72	49	0	120	240	800	0
GFID0080	Symbol	80	49	2	120	240	400	0
GFID0084	Script	84	49	0	120	240	400	0
GFID0085	Courier	85	49	0	120	240	400	0
GFID0086	Prestige	86	49	0	120	240	400	0
GFID0087	Letter-Gothic	87	49	0	120	240	400	0
GFID0091	Light	91	49	0	120	240	400	255
GFID0107	Courier	107	49	0	120	240	400	0
GFID0110	Letter-Gothic	110	49	0	120	240	800	0

Table 30. iSeries, eServer i5, or System i5 Font Parameters

(continued)

Entry ID	Font Family	GFID	Pitch & Family	Character Set	Width	Height	Weight	Style
GFID0111	Prestige	111	49	0	120	240	800	0
GFID0112	Prestige	112	49	0	120	240	400	255
GFID0115	Symbol	115	49	2	120	240	400	0
GFID0155	Boldface	155	18	0	120	240	400	0
GFID0158	Document	158	18	0	120	240	400	0
GFID0159	Boldface	159	18	0	120	240	800	0
GFID0160	Essay	160	34	0	120	240	800	0
GFID0162	Essay	162	34	0	120	240	800	255
GFID0163	Essay	163	34	0	120	240	800	0
GFID0168	Barak	168	18	0	120	240	400	0
GFID0173	Essay	173	34	0	120	240	400	0
GFID0175	Document	175	18	0	120	240	400	0
GFID0176	Boldface	176	18	0	120	240	800	0
GFID0177	Boldface	177	18	0	120	240	800	255
GFID0193	Symbol	193	49	2	120	240	400	0
GFID0198	Symbol	198	49	2	144	240	400	0
GFID0204	Gothic	204	49	0	108	210	400	0
GFID0221	Prestige	221	49	0	96	210	400	0
GFID0222	Gothic	222	49	0	96	210	400	0
GFID0223	Courier	223	49	0	96	210	400	0
GFID0225	Symbol	225	49	2	96	240	400	0
GFID0229	Serif	229	49	0	96	210	400	0
GFID0230	Gothic	230	49	0	96	210	400	0
GFID0245	Courier Bold	245	49	0	288	240	800	0
GFID0252	Courier	252	49	0	84	240	400	0
GFID0253	Courier Bold	253	49	0	84	240	800	0
GFID0254	Courier	254	49	0	84	120	400	0
GFID0280	APL	280	49	0	72	120	400	0
GFID0281	Gothic	281	49	0	72	120	400	0
GFID0290	Gothic	290	49	0	54	120	400	0
GFID0751	Sono-ran-serif	751	18	0	54	162	400	0
GFID1051	Sono-ran-serif	1051	18	0	66	198	400	0

Table 30. iSeries, eServer i5, or System i5 Font Parameters

(continued)

Entry ID	Font Family	GFID	Pitch & Family	Character Set	Width	Height	Weight	Style
GFID1053	Sono-ran-serif	1053	18	0	66	198	800	0
GFID1056	Sono-ran-serif	1056	18	0	66	198	400	255
GFID1351	Sono-ran-serif	1351	18	0	84	240	400	0
GFID1653	Sono-ran-serif	1653	18	0	108	312	800	0
GFID2103	Sono-ran-serif	2103	18	0	162	480	800	0

Note:

1. Default GFID from host is 011, we use Courier 10 CPI.
2. A print driver will change the font to its default if you ask for a font name that it does not recognize. Some drivers recognize Gothic, but the DeskJet drivers do not.
3. Most print drivers default to Courier New, instead of Courier. So Courier switched to Courier New works, but Gothic switched to Courier New changes the font family. Preferably, you should explicitly select Courier New.
4. Special fonts like CourHEB and GRCOUR869 (for Greek) has required them to be added to PCSPD.DAT to work. Note if the operating system properly or fully supports a language, that font could be the default font instead of Courier New.

Avoiding iSeries System Dump

If you are running OS/400® Version 3 Release 1, and you attempt to perform a Telnet 5250 mode host print operation, you may experience an iSeries™ system dump under certain conditions. To prevent this from occurring you should apply PTF SF35327 on OS/400®.

PFT Migration Utility

The PFT migration utility converts the printer function table (PFT) for the PC Support/400 workstation feature to a printer definition file (PDF) for PC400.

This section describes the operator interface of the PFT migration utility.

For details about PFT, refer to *AS/400 PC Support: DOS and OS/2 Technical Reference*.

Using the PFT Migration Utility

The file name of the PFT Migration Utility program is PCSPFC.EXE. It is a Windows® application, and you can execute it by doing the following:

1. Double-click the program name using the Windows® Explorer utility.
2. Specify the program name (and parameters) in the Windows® Run utility as follows:

   ```
   PCSPFC [ [drive:] [path] PFT-file-name[.extension] ]
   ```

   If no parameter is specified, PCSPFC.EXE displays the Convert PFT to PDF dialog box.
   If you omit a drive name and a directory name, PCSPFC.EXE uses the current drive and the current directory. If you omit an extension, PCSPFC.EXE adds .PFT to the PFT file name.

3. When you execute the PFT Migration Utility, the Convert PFT to PDF dialog box appears. On the Convert PFT to PDF dialog box, select a PFT file from the list box or type a specific PFT file name, and click **OK**. The PFT Migration Utility starts the conversion and displays the PFT File Converter dialog box to show the conversion status.

After the conversion, if you click **Save List** on the PFT File Converter dialog box, conversion messages in the dialog box are saved into a list file. The list file is created in the same directory and with the same name as the PFT file, except the extension. The extension of the list file is .LS2.

If the conversion was completed successfully, you can click **Convert PDF to PDT** from the PFT File Converter dialog box to convert the PDF file to a PDT file. You can also create a PDT file by selecting **Printer Setup** from the File pull-down menu as explained in Using the Printer Definition Table (PDT) File on page 207.

Migration Considerations

When the base PDF file already exists, the converted PDF fields are appended to the end of the base PDF file. The name of the base PDF file is decided as follows:

Table 31. PDF File Name

PFT File Name	Base PDF File Name
xxxxxxxx.PFT	xxxxxxxx.PDF
xxxxx.MNL	MNLxxxxx.PDF
zzzxxxxx.MNL*	zzzxxxxx.PDF*

Table 31. PDF File Name

(continued)

PFT File Name	Base PDF File Name
: * “zzz” is not “IBM”.	

Even if the same fields are already defined in the PDF file, the appended fields are effective because the last definition is always effective in a PDF file.

If the base PDF file does not exist in the directory, the PFT Migration Utilitycreates a new PDF file that has only the converted fields from the PFT file. In this case, you should append this file to an appropriate base file manually, because the fields converted from the PFT file do not cover all of the necessary PDF fields.

Therefore, it is recommended that you prepare both the PFT file and its base PDF file in the same directory before the conversion.

Details of Migration

This section describes how the PFT Migration Utility migrates the printer function table (PFT) to the printer definition file (PDF).

Migration from the Printer Function Table

The following table shows the target fields of the PDF for the data in the PFT.

Table 32. Migration from the Printer Function Table to the Printer Definition File

PFT Field Name	PDF Field Name Description
INITIALIZATION AND RESET	
Initialization	
Initialization	START_JOB=
	When the data is defined in the Initialization field of PFT, the data is appended to the string START_JOB=.
Filename	
Filename	None
	This field is ignored.
Reset	
Reset	END_JOB=

Table 32. Migration from the Printer Function Table to the Printer Definition File

(continued)

PFT Field Name	PDF Field Name Description
	When the data is defined in the Reset field of PFT, the data is appended to the string END_JOB=.
VERTICAL LINE SPACING	
6 lines per inch	
6 lines per inch	SET_6_LINES_PER_INCH=
	When the data is defined in the 6 lines per inch field of PFT, the data is appended to the string SET_6_LINES_PER_INCH=.
8 lines per inch	
8 lines per inch	SET_8_LINES_PER_INCH=
	When the data is defined in the 8 lines per inch field of PFT, the data is appended to the string SET_8_LINES_PER_INCH=.
Variable line spacing	
Control Sequence	SET_VARIABLE_DENSITY=
	When the data is defined in the control sequence field of the PFT for the variable line spacing, the data is appended to the string SET_VARIABLE_DENSITY=. The parameter `n` in the control sequence is replaced with the PDF parameter type.
Maximum	None
	This field is ignored.
Offset	None
	This field is ignored.
X/Y	LINE_SPACING_RATIO=
	When the data is defined in the X/Y field of the PFT for the variable line spacing, the value Y/X is appended to the string LINE_SPACING_RATIO= as three-digit or four-digit numbers to indicate the decimal number. For example, when Y/X is 72, the `072` is appended to the string LINE_SPACING_RATIO= and `LINE_SPACING_RATIO=072` is written to the output file. When the value is greater than 255, the four-digit number is migrated. When the value is less than 255, the three-digit number is migrated.
Indexing Functions	
Begin Superscript	START_SUPERSCRIPT=
	When the data is defined in the Begin Superscript field and End Superscript field of the PFT for the indexing functions, the data is appended to the string START_SUPERSCRIPT=. If the data for the End Superscript is not defined, the data for the Begin Superscript is ignored.
End Superscript	END_SUPERSCRIPT=

Table 32. Migration from the Printer Function Table to the Printer Definition File

(continued)

PFT Field Name	PDF Field Name Description
	When the data is defined in the End Superscript field and Begin Superscript field of the PFT for the indexing functions, the data is appended to the string END_SUPERSCRIPT=. If the data for the Begin Superscript is not defined, the data for the End Superscript is ignored.
Begin Subscript	START_SUBSCRIPT=
	When the data is defined in the Begin Subscript field and End Subscript field of the PFT for the indexing functions, the data is appended to the string START_SUBSCRIPT=. If the data for the End Subscript is not defined, the data for the Begin Subscript is ignored.
End Subscript	END_SUBSCRIPT=
	When the data is defined in the End Subscript field and Begin Subscript field of the PFT for the indexing functions, the data is appended to the string END_SUBSCRIPT=. If the data for the Begin Subscript is not defined, the data for the End Subscript is ignored.
Reverse 1/2 Index	START_SUPERSCRIPT= END_SUBSCRIPT=
	The data is appended to the START_SUPERSCRIPT= for all of the following conditions: • When the data is not defined in the Begin Superscript field in the PFT or when the data is not defined in the End Superscript field in the PFT. • When the data is defined in the Reverse 1/2 index and Forward 1/2 index field in the PFT. The data is appended to END_SUBSCRIPT= for all of the following conditions: • When the data is not defined in the Begin Subscript field in the PFT or when the data is not defined in the End Subscript field in the PFT. • When the data is defined in the Reverse 1/2 index and Forward 1/2 index field in the PFT.
Forward 1/2 Index	END_SUPERSCRIPT= START_SUBSCRIPT=
	The data is appended to END_SUPERSCRIPT= for all of the following conditions: • When the data is not defined in Begin Superscript field in the PFT or when the data is not defined in End Superscript field in the PFT. • When the data is defined in the Reverse 1/2 index and Forward 1/2 index field in the PFT.

Table 32. Migration from the Printer Function Table to the Printer Definition File

(continued)

PFT Field Name	PDF Field Name Description
	The data is appended to START_SUBSCRIPT= for all of the following conditions: • When the data is not defined in the Begin Subscript field in the PFT or when the data is not defined in the End Subscript field in the PFT. • When the data is defined in the Reverse 1/2 index and Forward 1/2 index field in the PFT.
Reverse Index	None
	This field is ignored.
HORIZONTAL LINE SPACING	
5 pitch	
5 pitch	None
	This field is ignored.
8.55 pitch	
8.55 pitch	None
	This field is ignored.
10 pitch	
10 pitch	SET_10_CHARACTERS_PER_INCH=
	When the data is defined in the 10 pitch field of the PFT for the horizontal character spacing, the data is appended to the string SET_10_CHARACTERS_PER_INCH=.
12 pitch	
12 pitch	SET_12_CHARACTERS_PER_INCH=
	When the data is defined in the 12 pitch field of the PFT for the horizontal character spacing, the data is appended to the string SET_12_CHARACTERS_PER_INCH=.
15 pitch	
15 pitch	SET_15_CHARACTERS_PER_INCH=
	When the data is defined in the 15 pitch field of the PFT for the horizontal character spacing, the data is appended to the string SET_15_CHARACTERS_PER_INCH=.
17.1 pitch	
17.1 pitch	SET_17_CHARACTERS_PER_INCH=
	When the data is defined in the 17.1 pitch field of the PFT for the horizontal character spacing, the data is appended to the string SET_17_CHARACTERS_PER_INCH=.
Horizontal Motion Index	
Control Sequence	None
	This field is ignored.
Maximum	None

Table 32. Migration from the Printer Function Table to the Printer Definition File

(continued)

PFT Field Name	PDF Field Name Description
	This field is ignored.
Offset	None
	This field is ignored.
X/Y	None
	This field is ignored.
HORIZONTAL RELATIVE MOVEMENT	
Forward Relative Movement	
Control Sequence	FORWARD_HORIZONTAL_SKIP=
	When the data is defined in the Forward Relative Movement field of PFT, the data is appended to the string FORWARD_HORIZONTAL_SKIP=. The parameter `n` in the control sequence is replaced with the PDF parameter type.
Maximum	None
	This field is ignored.
Offset	None
	This field is ignored.
X/Y	HORIZONTAL_PEL=
	When the data is defined in the X/Y field of the PFT for the forward relative movement, the value Y/X is appended to the string HORIZONTAL_PEL= as three-digit or four-digit number to indicate the decimal number. For example, when Y/X is 120, **`120`** is appended to the string HORIZONTAL_PEL= and **`HORIZONTAL_PEL=120`** is written to the output file. When the value is greater than 255, the four-digit number is migrated. When the value is less than 255, the three-digit number is migrated.
Backward Relative Movement	
Control Sequence	None
	This field is ignored.
Maximum	None
	This field is ignored.
Offset	None
	This field is ignored.
X/Y	None
	This field is ignored.
HIGHLIGHTING	
Begin Emphasis	
Begin Emphasis	START_HIGHLIGHT_INTENSE=

Table 32. Migration from the Printer Function Table to the Printer Definition File

(continued)

PFT Field Name	PDF Field Name Description
	When the data is defined in the Begin Emphasis of PFT, the data is appended to the string START_HIGHLIGHT_INTENSE=.
End Emphasis	
End Emphasis	END_HIGHLIGHT_INTENSE=
	When the data is defined in the End Emphasis of PFT, the data is appended to the string END_HIGHLIGHT_INTENSE=.
Begin Underline	
Begin Underline	START_HIGHLIGHT_UNDERLINE=
	When the data is defined in the Begin Underline of PFT, the data is appended to the string START_HIGHLIGHT_UNDERLINE=.
End Underline	
End Underline	END_HIGHLIGHT_UNDERLINE=
	When the data is defined in the End Underline of PFT, the data is appended to the string END_HIGHLIGHT_UNDERLINE=.
Begin Quality Print	
Begin Quality Print	None
	This field is ignored.
End Quality Print	
End Quality Print	None
	This field is ignored.
PAPER HANDLING	
Bottom Tray Feed	
Bottom Tray Feed	SELECT_DRAWER2=
	If the data is defined in some fields for LANDSCAPE PAPER HANDLING, the PFT Migration Utility assumes that this control sequence includes the control of the portrait orientation. For this, the PFT Migration Utility divides this control sequence into two parts and migrates the control sequence for the drawer select and paper feed. The control sequence of the portrait orientation is migrated to SET_PORTRAIT_ORIENT=. If no data is defined in any fields for LANDSCAPE PAPER HANDLING, the PFT Migration Utility migrates this control sequence to the SELECT_DRAWER2=. (See Definition of PAPER HANDLING Migration on page 275.)
Top Tray Feed	
Top Tray Feed	SELECT_DRAWER1=
	If the data is defined in some fields for LANDSCAPE PAPER HANDLING, the PFT Migration Utility assumes that this control sequence includes the control of the portrait

Table 32. Migration from the Printer Function Table to the Printer Definition File

(continued)

PFT Field Name	PDF Field Name Description
	orientation. For this, the PFT Migration Utility divides this control sequence into two parts and migrates the control sequence for the drawer select and paper feed. The control sequence of the portrait orientation is migrated to SET_PORTRAIT_ORIENT=. If no data is defined in any fields for LANDSCAPE PAPER HANDLING, the PFT Migration Utility migrates this control sequence to SELECT_DRAWER1=. (See Definition of PAPER HANDLING Migration on page 275.)
Envelope Feed	
Envelope Feed	SELECT_ENVELOPE=
	If the data is defined in some fields for LANDSCAPE PAPER HANDLING, the PFT Migration Utility assumes that this control sequence includes the control of the portrait orientation. For this, the PFT Migration Utility divides this control sequence into two parts and migrates the control sequence for the drawer select and paper feed. The control sequence of the portrait orientation is migrated to SET_PORTRAIT_ORIENT=. If no data is defined in any fields for LANDSCAPE PAPER HANDLING, the PFT Migration Utility migrates this control sequence to SELECT_ENVELOPE=. (See Definition of PAPER HANDLING Migration on page 275.)
Manual Feed	
Manual Feed	SELECT_DRAWER3=
	If the data is defined in some fields for LANDSCAPE PAPER HANDLING, the PFT Migration Utility assumes that this control sequence includes the control of the portrait orientation. For this, the PFT Migration Utility divides this control sequence into two parts and migrates the control sequence for the drawer select and paper feed. The control sequence of the portrait orientation is migrated to SET_PORTRAIT_ORIENT=. If no data is defined in any fields for LANDSCAPE PAPER HANDLING, the PFT Migration Utility migrates this control sequence to SELECT_DRAWER3=. (See Definition of PAPER HANDLING Migration on page 275.)
Continuous Feed	
Continuous Feed	None
	This field is ignored.
Ignore Paper End Sensor	
Ignore Paper End Sensor	None
	This field is ignored.
Enable Paper End Sensor	
Enable Paper End Sensor	None
	This field is ignored.
Eject Automatic Cut Sheet	

Table 32. Migration from the Printer Function Table to the Printer Definition File

(continued)

PFT Field Name	PDF Field Name Description
Eject automatic Cut Sheet	None
	This field is ignored.
Eject Manual Cut Sheet	
Eject Manual Cut Sheet	None
	This field is ignored.
Collate	
Collate	None
	This field is ignored.
PAPER POSITIONING	
Continuous Forms	
Dist. from Top Paper Edge	None
	This field is ignored.
Dist. from Left Paper Edge	None
	This field is ignored.
Location of First Print Column	None
	This field is ignored.
Manual Feed	
Dist. from Top Paper Edge	None
	This field is ignored.
Dist. from Left Paper Edge	None
	This field is ignored.
Location of First Print Column	None
	This field is ignored.
Automatic Feed	
Dist. from Top Paper Edge	None
	This field is ignored.
Dist. from Left Paper Edge	None
	This field is ignored.
Location of First Print Column	None
	This field is ignored.
SET PAGE LENGTH (INCHES)	
Control Sequence	PAGE_LENGTH_TYPE?=INCH SET_PAGE_LENGTH=
	When the data is defined in the control sequence for SET PAGE LENGTH (INCHES) and if any of the data is not defined in the control sequence for SET PAGE LENGTH (LINES), this field is migrated.

Table 32. Migration from the Printer Function Table to the Printer Definition File

(continued)

PFT Field Name	PDF Field Name Description
Maximum	None
	This field is ignored.
Offset	None
	This field is ignored.
X/Y	None
	This field is ignored.
Top Margin Size	None
	This field is ignored.
Bottom Margin Size	None
	This field is ignored.
SET PAGE LENGTH (LINES)	
Control Sequence	PAGE_LENGTH_TYPE?=LINE SET_PAGE_LENGTH=
	When the length is defined in the control sequence for SET PAGE LENGTH (LINES), this field is migrated.
Maximum	None
	This field is ignored.
Offset	None
	This field is ignored.
X/Y	None
	This field is ignored.
Top Margin Size	None
	This field is ignored.
Bottom Margin Size	None
	This field is ignored.
SET LEFT MARGIN (INCHES)	
Control Sequence	None
	This field is ignored.
Maximum	None
	This field is ignored.
Offset	None
	This field is ignored.
X/Y	None
	This field is ignored.
SET LEFT MARGIN (COLUMNS)	
Control Sequence	SET_HORIZONTAL_MARGIN=

Table 32. Migration from the Printer Function Table to the Printer Definition File

(continued)

PFT Field Name	**PDF Field Name** **Description**
	When the data is defined in the control sequence field for SET LEFT MARGIN (COLUMNS), this field is migrated.
Maximum	None
	This field is ignored.
Offset	None
	This field is ignored.
CARRIER RETURN/LINE FEED	
Continuous Forms	
Carrier Return (Continuous Forms)	CARRIAGE_RETURN=
	This field is migrated for the following cases: • Case 1 ◦ The data is defined in the Carrier Return field for the Continuous Forms. ◦ Any of the data in the Carrier Return field is not defined for the Manual Feed and Automatic Feed. • Case 2 ◦ The data is defined in the Carrier Return field for the Continuous Forms. ◦ The same data is defined in the Carrier Return field for the Manual Feed. ◦ Any of the data in the Carrier Return field is not defined for the Automatic Feed. • Case 3 ◦ The data is defined in the Carrier Return field for the Continuous Forms. ◦ The same data is defined in the Carrier Return field for the Automatic Feed. ◦ Any of the data in the Carrier Return field is not defined for the Manual Feed. • Case 4 ◦ The data is defined in the Carrier Return field for the Continuous Forms. ◦ The same data is defined in the Carrier Return field for the Automatic Feed and Manual Feed.
Line Feed (Continuous Forms)	LINE_FEED=

Table 32. Migration from the Printer Function Table to the Printer Definition File

(continued)

PFT Field Name	PDF Field Name Description
	This field is migrated for the following cases: • Case 1 ◦ The data is defined in the Line Feed field for the Continuous Forms. ◦ Any of the data in the Line Feed Line field is not defined for the Manual Feed and Automatic Feed. • Case 2 ◦ The data is defined in the Line Feed field for the Continuous Forms. ◦ The same data is defined in the Line Feed field for the Manual Feed. ◦ Any data is not defined in the Line Feed field for the Automatic Feed. • Case 3 ◦ The data is defined in the Line Feed field for the Continuous Forms. ◦ The same data is defined in the Line Feed field for the Automatic Feed. ◦ Any data is not defined in the Line Feed field for the Manual Feed. • Case 4 ◦ The data is defined in the Line Feed field for the Continuous Forms. ◦ The same data is defined in the Line Feed field for the Automatic Feed and Manual Feed.
Manual Feed	
Carrier Return (Manual Feed)	CARRIAGE_RETURN=
	This field is migrated for the following cases: • Case 1 ◦ The data is defined in the Line Feed field for the Manual Feed. ◦ Any of the data in the Line Feed Line field is not defined for the Continuous Forms and Automatic Feed. • Case 2 ◦ The data is defined in the Line Feed field for the Manual Feed. ◦ The same data is defined in the Line Feed field for the Continuous Forms. ◦ Any data is not defined in the Line Feed field for the Automatic Feed. • Case 3

Table 32. Migration from the Printer Function Table to the Printer Definition File

(continued)

PFT Field Name	PDF Field Name Description
	◦ The data is defined in the Line Feed field for the Manual Feed. ◦ The same data is defined in the Line Feed field for the Automatic Feed. ◦ Any data is not defined in the Line Feed field for the Continuous Forms. • Case 4 ◦ The data is defined in the Line Feed field for the Manual Feed. ◦ The same data is defined in the Line Feed field for the Automatic Feed and Continuous Forms.
Line Feed (Manual Feed)	LINE_FEED=
	This field is migrated for the following cases: • Case 1 ◦ The data is defined in the Line Feed field for the Manual Feed. ◦ Any of the data in the Line Feed Line field is not defined for the Continuous Forms and Automatic Feed. • Case 2 ◦ The data is defined in the Line Feed field for the Manual Feed. ◦ The same data is defined in the Line Feed field for the Continuous Forms. ◦ Any data is not defined in the Line Feed field for the Automatic Feed. • Case 3 ◦ The data is defined in the Line Feed field for the Manual Feed. ◦ The same data is defined in the Line Feed field for the Automatic Feed. ◦ Any data is not defined in the Line Feed field for the Continuous Forms. • Case 4 ◦ The data is defined in the Line Feed field for the Manual Feed. ◦ The same data is defined in the Line Feed field for the Automatic Feed and Continuous Forms.
Automatic Feed	
Carrier Return (Automatic Feed)	CARRIAGE_RETURN=
	This field is migrated for the following cases:

Table 32. Migration from the Printer Function Table to the Printer Definition File

(continued)

PFT Field Name	PDF Field Name Description
	• Case 1 ◦ The data is defined in the Carrier Return field for the Automatic Feed. ◦ Any of the data in the Carrier Return field is not defined for the Continuous Feed and Manual Feed. • Case 2 ◦ The data is defined in the Carrier Return field for the Automatic Feed. ◦ The same data is defined in the Carrier Return field for the Continuous Forms. ◦ Any of the data in the Carrier Return field is not defined for the Manual Feed. • Case 3 ◦ The data is defined in the Carrier Return field for the Automatic Feed. ◦ The same data is defined in the Carrier Return field for the Manual Feed. ◦ Any of the data in the Carrier Return field is not defined for the Continuous Forms. • Case 4 ◦ The data is defined in the Carrier Return field for the Automatic Feed. ◦ The same data is defined in the Carrier Return field for the Manual Feed and Continuous Forms.
Line Feed (Automatic Feed)	LINE_FEED=
	This field is migrated for the following cases: • Case 1 ◦ The data is defined in the Line Feed field for the Automatic Feed. ◦ Any of the data in the Line Feed Line field is not defined for the Continuous Forms and Manual Feed. • Case 2 ◦ The data is defined in the Line Feed field for the Automatic Feed. ◦ The same data is defined in the Line Feed field for the Continuous Forms. ◦ Any data is not defined in the Line Feed field for the Manual Feed. • Case 3

Table 32. Migration from the Printer Function Table to the Printer Definition File

(continued)

PFT Field Name	PDF Field Name Description
	◦ The data is defined in the Line Feed field for the Automatic Feed. ◦ The same data is defined in the Line Feed field for the Manual Feed. ◦ Any data is not defined in the Line Feed field for the Continuous Forms. • Case 4 ◦ When the data is defined in the Line Feed field for the Automatic Feed. ◦ The same data is defined in the Line Feed field for the Manual Feed and Continuous Forms.
MULTIPLE COPIES	
Print without Clearing Page from	
Top Tray	None
	This field is ignored.
Bottom Tray	None
	This field is ignored.
Envelope Tray	None
	This field is ignored.
Manual Tray	None
	This field is ignored.
Clear Page Buffer	None
	This field is ignored.
Multiple Copies Variable Control	
Control Sequence	None
	This field is ignored.
Maximum	None
	This field is ignored.
Offset	None
	This field is ignored.
LANDSCAPE PAPER HANDLING	
Bottom Tray Feed	
Bottom Tray Feed	SET_LANDSCAPELEFT_ORIENT=
	If the data is defined in some fields for LANDSCAPE PAPER HANDLING, the PFT Migration Utility assumes that this control sequence includes the control sequence for the landscape orientation. For this, the PFT Migration Utility divides the control sequence into two parts. The control sequence for the drawer select and paper feed is ignored because this control sequence is migrated when the data for PAPER HAN-

Table 32. Migration from the Printer Function Table to the Printer Definition File

(continued)

PFT Field Name	PDF Field Name Description
	DLING is processed. The control sequence for landscape orientation is migrated to SET_LANDSCAPE_ORIENT=. (See Definition of PAPER HANDLING Migration on page 275.)
Top Tray Feed	
Top Tray Feed	SET_LANDSCAPELEFT_ORIENT=
	If the data is defined in some fields for LANDSCAPE PAPER HANDLING, the PFT Migration Utility assumes that this control sequence includes the control sequence for the landscape orientation. For this, the PFT Migration Utility divides the control sequence into two parts. The control sequence for the drawer select and paper feed is ignored because this control sequence is migrated when the data for PAPER HANDLING is processed. The control sequence for landscape orientation is migrated to SET_LANDSCAPE_ORIENT=. (See Definition of PAPER HANDLING Migration on page 275.)
Envelope Feed	
Envelope Feed	SET_LANDSCAPELEFT_ORIENT=
	If the data is defined in some fields for LANDSCAPE PAPER HANDLING, the PFT Migration Utility assumes that this control sequence includes the control sequence for the landscape orientation. For this, the PFT Migration Utility divides the control sequence into two parts. The control sequence for the drawer select and paper feed is ignored because this control sequence is migrated when the data for PAPER HANDLING is processed. The control sequence for landscape orientation is migrated to SET_LANDSCAPE_ORIENT=. (See Definition of PAPER HANDLING Migration on page 275.)
Manual Feed	
Manual Feed	SET_LANDSCAPELEFT_ORIENT=
	If the data is defined in some fields for LANDSCAPE PAPER HANDLING, the PFT Migration Utility assumes that this control sequence includes the control sequence for the landscape orientation. For this, the PFT Migration Utility divides the control sequence into two parts. The control sequence for the drawer select and paper feed is ignored because this control sequence is migrated when the data for PAPER HANDLING is processed. The control sequence for landscape orientation is migrated to SET_LANDSCAPE_ORIENT=. (See Definition of PAPER HANDLING Migration on page 275.)
TYPESTYLE DEFINITION	
Default Typestyle Definition	
PC Character Set	None

Table 32. Migration from the Printer Function Table to the Printer Definition File

(continued)

PFT Field Name	PDF Field Name Description
	This field is ignored.
Initial Control Sequence	None
	This field is ignored.
Ending Control Sequence	None
	This field is ignored.
Individual Typestyle Definition	
Typestyle number	SET_GFID_
	This number is appended as a four-digit number after the string SET_GFID_. For example, when the typestyle number `9` is defined, `0009` is appended after the string SET_GFID_ and SET_GFID_0009= is migrated. And the numbers supported by PC400 are migrated. The numbers not supported by PC400 are ignored.
PC Character Set	None
	This field is ignored.
Initial Control Sequence	SET_GFID_xxxx=
	This control sequence is appended after the string SET_GFID_xxxx=, where xxxx is the four-digit number defined in the typestyle number field.
Ending Control Sequence	None
	This field is ignored.
Characters	None
	This field is ignored.
Initial Control Sequence	None
	This field is ignored.
Ending Control Sequence	None
	This field is ignored.
Symbols	None
	This field is ignored.
Initial Control Sequence	None
	This field is ignored.
Ending Control Sequence	None
	This field is ignored.
Group Typestyle Definition	
Group Identifier	None
	This field is ignored.
Group Identifier Comment	None
	This field is ignored.

Table 32. Migration from the Printer Function Table to the Printer Definition File

(continued)

PFT Field Name	PDF Field Name Description
Typestyle number	SET_GFID_
	This number is appended as a four-digit number after the string SET_GFID_. For example, when the typestyle numbers 1, 2, 3, and 4 are defined, `0001`, `0002`, `0003`, and `0004` are appended after the string SET_GFID_ and SET_GFID_0001=, SET_GFID_0002=, SET_GFID_0003=, and SET_GFID_0004= are migrated because the PC400 does not have the group typestyle definition. The typestyle numbers that are not supported by the PC400 are not migrated.
PC Character Set	None
	This field is ignored.
Initial Control Sequence	SET_GFID_xxxx=
	This control sequence is appended after the string SET_GFID_xxxx=, where xxxx is the four-digit number defined in the typestyle number field.
Ending Control Sequence	None
	This field is ignored.
Characters	None
	This field is ignored.
Initial Control Sequence	None
	This field is ignored.
Ending Control Sequence	None
	This field is ignored.
Symbols	None
	This field is ignored.
Initial Control Sequence	None
	This field is ignored.
Ending Control Sequence	None
	This field is ignored.
Character Set Number	
Character Set Number	None
	This field is ignored.
SLOT SELECTION	
Slot 1 Sequence	
Slot 1 Sequence	None
	This field is ignored.
Slot 2 Sequence	
Slot 2 Sequence	None

Table 32. Migration from the Printer Function Table to the Printer Definition File

(continued)

PFT Field Name	**PDF Field Name** **Description**
	This field is ignored.
Slot 3 Sequence	
Slot 3 Sequence	None
	This field is ignored.
Stop Sequence	
Stop Sequence	None
	This field is ignored.
USER DEFINED CONTROL	
Parameters of SET ENVELOP SIZE Command	
Control Number: 984	None
	This field is ignored.
Control Sequence	None
	This field is ignored.
Control Sequence File Name	None
	This field is ignored.
ESC Sequence of SET ENVELOP SIZE Command	
Control Number: 985	None
	This field is ignored.
Control Sequence	None
	This field is ignored.
Control Sequence File Name	None
	This field is ignored.
Parameters of SET PAGE SIZE Command	
Control Number: 986	None
	This field is ignored.
Control Sequence	None
	This field is ignored.
Control Sequence File Name	None
	This field is ignored.
ESC Sequence of SET PAGE SIZE Command	
Control Number: 987	None
	This field is ignored.
Control Sequence	None
	This field is ignored.
Control Sequence File Name	None

Table 32. Migration from the Printer Function Table to the Printer Definition File

(continued)

PFT Field Name	PDF Field Name Description
	This field is ignored.
Printer Data Stream	
Control Number: 988	None
	This field is ignored.
Control Sequence	SET_FONT_GLOBAL=1B 5B 49 word-value(LH) word-value(HL) word-value(HL) byte-value word-value(HL)
	When `04` is defined in this field, SET_FONT_GLOBAL=1B 5B 49 … word-value(HL) is migrated. When the other value is defined, this field is ignored. `04` means IBM® Personal Printer Data Stream Level 2 or higher. When the migration is done for PAPER HANDLING, use this information. (See Definition of PAPER HANDLING Migration on page 275.)
Control Sequence File Name	None
	This field is ignored.
Duplex long edge	
Control Number: 989	None
	This field is ignored.
Control Sequence	SET_DUPLEX=
	When the data is defined in the control sequence for the duplex long edge, the data is appended to the string SET_DUPLEX=.
Control Sequence File Name	None
	This field is ignored.
Duplex short edge	
Control Number: 990	None
	This field is ignored.
Control Sequence	SET_DUPLEX_TUMBLE=
	When the data is defined in the control sequence for the duplex short edge, the data is appended to the string SET_DUPLEX_TUMBLE=.
Control Sequence File Name	None
	This field is ignored.
Simplex	
Control Number: 991	None
	This field is ignored.
Control Sequence	RESET_DUPLEX=
	When the data is defined in the control sequence for the simplex, the data is appended to the string RESET_DUPLEX=.

Table 32. Migration from the Printer Function Table to the Printer Definition File

(continued)

PFT Field Name	PDF Field Name Description
Control Sequence File Name	None
	This field is ignored.
Jog the output tray	
Control Number: 992	None
	This field is ignored.
Control Sequence	None
	This field is ignored.
Control Sequence File Name	None
	This field is ignored.
Normal portrait orientation	
Control Number: 993	None
	This field is ignored.
Control Sequence	SET_PORTRAIT_ORIENT=
	When the data is defined in the control field for the normal portrait orientation, the data is appended to the string SET_PORTRAIT_ORIENT=.
Control Sequence File Name	None
	This field is ignored.
Landscape left	
Control Number: 994	None
	This field is ignored.
Control Sequence	SET_LANDSCAPELEFT_ORIENT=
	When the data is defined in the control field for the landscape left, the data is appended to the string SET_LANDSCAPELEFT_ORIENT=.
Control Sequence File Name	None
	This field is ignored.
Portrait upside down orientation	
Control Number: 995	None
	This field is ignored.
Control Sequence	SET_PORTRAITUPDWN_ORIENT=
	When the data is defined in the control field for the portrait upside down orientation, the data is appended to the string SET_PORTRAITUPDWN_ORIENT=.
Control Sequence File Name	None
	This field is ignored.
Landscape right	
Control Number: 996	None

Table 32. Migration from the Printer Function Table to the Printer Definition File

(continued)

PFT Field Name	**PDF Field Name** **Description**
	This field is ignored.
Control Sequence	SET_LANDSCAPERGHT_ORIENT=
	When the data is defined in the control field for the landscape right, the data is appended to the string SET_LANDSCAPERGHT_ORIENT=.
Control Sequence File Name	None
	This field is ignored.
COR in 10 pitch	
Control Number: 997	None
	This field is ignored.
Control Sequence	None
	This field is ignored.
Control Sequence File Name	None
	This field is ignored.
COR in 12 pitch	
Control Number: 998	None
	This field is ignored.
Control Sequence	None
	This field is ignored.
Control Sequence File Name	None
	This field is ignored.
COR in 15 pitch	
Control Number: 999	None
	This field is ignored.
Control Sequence	None
	This field is ignored.
Control Sequence File Name	None
	This field is ignored.
FUNCTION SELECTION TEST RESPONSES	
Superscript /Subscript	None
	This data is ignored.
Underline	None
	This data is ignored.
Emphasis (Bold)	None
	This data is ignored.

Table 32. Migration from the Printer Function Table to the Printer Definition File

(continued)

PFT Field Name	PDF Field Name Description
Form Feed	None
	This data is ignored.
Back Space	BACKSPACE=
	This field is migrated when you type YES or NO in response to the prompt during the Backspace Function Selection Test.
Mid-line pitch change	None
	This data is ignored.
Horizontal Character spacing	None
	This data is ignored.
First character position	None
	This data is ignored.
PSM	None
	This data is ignored.
Cursor Draw	None
	This data is ignored.

Note: When you migrate IBM3812.PFT and IBM3812.MNL, the following fields are added to IBM3812.PDF:

- `FORWARD_VERTICAL_STEP_FEED=1B 5B 43 03 00 E3 word-value(LH)`
- `VERTICAL_PEL=240`

Definition of PAPER HANDLING Migration

The PFT Migration Utility migrates the data for PAPER HANDLING and LANDSCAPE PAPER HANDLING as follows:

1. The PFT Migration Utility checks whether the LANDSCAPE PAPER HANDLING controls are defined.
2. If the LANDSCAPE PAPER HANDLING controls are defined, the PFT Migration Utility assumes that the PAPER HANDLING control sequences include controls to set the page orientation to portrait. Each LANDSCAPE PAPER HANDLING control sequence has the controls to set the page orientation to landscape in addition to the tray select and feed controls.
3. If the LANDSCAPE PAPER HANDLING controls are not defined, the PAPER HANDLING controls do not have the controls to set the page orientation to portrait. If a personal printer supports normal portrait, landscape left, portrait upside down, and landscape right orientation, the page orientation controls are defined in the appropriate user-defined controls.

If the LANDSCAPE PAPER HANDLING controls are not defined

When the PAPER HANDLING controls are not defined, the controls are migrated as follows:

PFT Fields				PDF Fields
Bottom	Tray	Select & Feed	→	SELECT_DRAWER2=
Top	Tray	Select & Feed	→	SELECT_DRAWER1=
Envelope	Tray	Select & Feed	→	SELECT_ENVELOPE=
Manual		Select & Feed	→	SELECT_DRAWER3=

If the LANDSCAPE PAPER HANDLING controls are defined

When the PAPER HANDLING controls are defined, these controls have the controls to set the page orientation to portrait. The LANDSCAPE PAPER HANDLING controls have the controls to set the page orientation to landscape. The PFT Migration Utility migrates the controls as follows:

Length of the control in the corresponding field of LANDSCAPE PAPER HANDLING with PAPER HANDLING / Length of the control in the corresponding field of PAPER HANDLING with LANDSCAPE PAPER HANDLING	(Length1) ==0	(Length1) >0
(Length2) ==0	CASE 1	CASE 2
(Length2) > 0	CASE 3	Length1 != Length2 CASE 4 / Length1 == Length2 CASE 5

- **CASE 1**

  Since both of the fields are not defined, no data is migrated.

  Example: No data is migrated to SELECT_DRAWER2= under the following conditions. For this example, SELECT_DRAWER2= is not written in the output file.

- No data is defined in the bottom tray select and feed for PAPER HANDLING.
- No data is defined in the bottom tray select and feed for LANDSCAPE PAPER HANDLING.

- **CASE 2**

  Since no data is defined in the field for PAPER HANDLING, the PFT Migration Utility cannot compare the data in the corresponding field with the data for LANDSCAPE PAPER HANDLING. The data for LANDSCAPE PAPER HANDLING is migrated to the drawer selection field of PDF regardless, including control of the landscape orientation.

  Example: The control of the top tray select and feed for LANDSCAPE PAPER HANDLING is migrated to SELECT_DRAWER1= under the following conditions.
  - No data is defined in the top tray select and feed for PAPER HANDLING.
  - The control is defined in the top tray select and feed for LANDSCAPE PAPER HANDLING.

- **CASE 3**

  Since no data is defined in the field for LANDSCAPE PAPER HANDLING, the PFT Migration Utility cannot compare the data in the corresponding field with the data for PAPER HANDLING. The data for PAPER HANDLING is migrated to the drawer selection field of PDF regardless, including the control of the portrait orientation.

  Example: The control of the manual select and feed for PAPER HANDLING is migrated to SELECT_DRAWER3= under the following conditions.
  - The control is defined in the manual select and feed for PAPER HANDLING.
  - No data is defined in the top tray select and feed for LANDSCAPE PAPER HANDLING.

- **CASE 4**

  Since the length is different, no data is migrated.

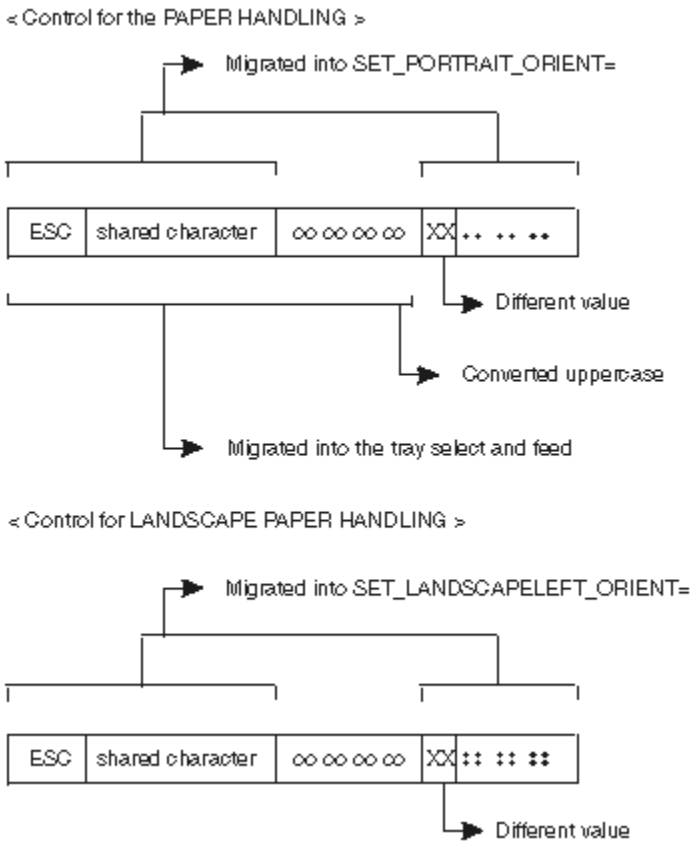
  Example: No data is migrated to SELECT_DRAWER2= under the following conditions. For this example, SELECT_DRAWER2= is not written in the output file.
  - The data is defined in the bottom tray select and feed for PAPER HANDLING and the length is 8.
  - The data is defined in the bottom tray select and feed for LANDSCAPE PAPER HANDLING and the length is 10.

- **CASE 5**

  The PFT Migration Utility compares the data for PAPER HANDLING with the data for LANDSCAPE PAPER HANDLING as follows:
  - If a different value is found in the data, search the control backward for the escape character X'1B'.
  - If the escape character is found in the middle of the control, divide the control into two parts. The PFT Migration Utility assumes that the first part is the control for the tray select and feed, and the second part is the control for the page orientation. The PFT Migration Utility migrates the first part of the PAPER HANDLING control into the tray select and feed, the second part of the PAPER HANDLING control into the SET_PORTRAIT_ORIENT=, and the second part of the LANDSCAPE PAPER HANDLING control into SET_LANDSCAPELEFT_ORIENT=.

- If the escape character is found at the top of the control and 03 (= HP PCL) is defined in the user-defined control 988, the PFT Migration Utility assumes that the controls are combined. For this, the control begins with the escape character and the two shared characters. For this, the PFT Migration Utility assumes that the last character of the first part is a lowercase letter and converts it to an uppercase letter to indicate that it is a terminating character.

  The PFT Migration Utility divides the controls into the two parts as follows:



- If the escape character is found, but the data stream is not HP PCL, the PFT Migration Utility displays the error message to indicate that the PFT Migration Utility cannot migrate the data.
- If the escape character is not found, the PFT Migration Utility displays the error message to indicate that the PFT Migration Utility cannot migrate the data.
- If a different value is not found, the same control is defined for PAPER HANDLING and LANDSCAPE PAPER HANDLING.

The PFT Migration Utility migrates the data in the following order:

1. Top Tray Select and Feed
2. Bottom Tray Select and Feed
3. Manual Select and Feed
4. Envelope Tray Select and Feed

The migration stops for the page orientation, SET_PORTRAIT_ORIENT= and SET_LANDSCAPELEFT_ORIENT=, when the controls for the page orientation are found. For example, the controls for the page orientation are found when the data is migrated for the Bottom Tray Select and Feed. The PFT Migration Utility does not care about the page orientation when migrating the data Manual Select and Feed, and Envelop Tray Select and Feed.

Chapter 22. Troubleshooting

There are a number of self-help information resources and tools to help you troubleshoot problems. When you have any problem when using the product, you can perform the following tasks:l

- Refer to the release information for your product for known issues, workarounds, and troubleshooting information.
- Check if a download or fix is available to resolve your problem.
- Search the available knowledge bases to see if the resolution to your problem is already documented.
- If you still need help, contact HCL Software Support and report your problem.

1. Z and I Emulator for Windows Database Access error when starting Microsoft Excel

Problem (Abstract)

Microsoft Excel startup via the Database Access utility might return PCSDB002 error. Modify system environment variable to correct the error.

Symptom

Error message PCSDB002. An error occurred when connecting with the application.

Environment

Microsoft Office 2007. Prior versions might also be affected.

Resolving the problem

Add the installation path of the Excel application (excel.exe) to the Windows Path environment variable.

2. Z and I Emulator for Windows Database Access utility limitations with Microsoft Office 2007

Problem (Abstract)

The .xlsx file format is not supported.

Resolving the problem

The following limitation applies when using Microsoft Office 2007 with Database Access:

- The Database Access utility does not support the .xlsx file format introduced in Microsoft Office 2007.
- A query result can be saved in a .xls file, which can then be edited with Microsoft Office Excel 2007.

3. Windows Firewall, provided as part of Windows XP Service Pack 2, blocks EEDLC packets

Problem (Abstract)

Windows® Firewall blocks EEDLC packets. You must add UDP ports to the firewall configuration.

Resolving the problem

Both IPv4 and IPv6 EEDLC packets are blocked by the Windows Firewall feature introduced in Microsoft® Windows XP SP2. This feature differs from the Internet Connection Firewall (ICF) in Windows XP releases prior to SP2. To enable the EEDLC connection, the EEDLC standard UDP ports (that is, 12000–12004) must be added to the Windows Firewall exception list. You can use any of the following methods to add the ports.

Windows Firewall configuration window:

1. Open Windows Firewall from the Windows Control Panel.
2. Click the Exceptions tab.
3. Click Add to add UDP ports 12000 to 12004.

Network Connections window:

1. Open the Network Connections dialog and click Properties > Advanced > Settings.
2. Click the Exceptions tab.
3. Click Add Port to add UDP ports 12000 to 12004.
4.

Command line:

1. Use the following commands to add each port:
    - netsh firewall set portopening UDP 12000 Udp_12000_EEDLC
    - netsh firewall set portopening UDP 12001 Udp_12001_EEDLC
    - netsh firewall set portopening UDP 12002 Udp_12002_EEDLC
    - netsh firewall set portopening UDP 12003 Udp_12003_EEDLC
    - netsh firewall set portopening UDP 12004 Udp_12004_EEDLC
2. After you add the ports, the Windows Firewall window exception dropdown list shows the new UDP port numbers.

For additional details about the Windows Firewall, refer to the Microsoft Developer Network database.

4. Disable firewall/filtering when using Z and I Emulator for Windows IPv6 functionality on Windows

Problem(Abstract)

The Windows® XP Internet Connection Firewall (filtering) blocks IPv6 packets by default. You must disable IPv6 filtering for all adapters for Z and I Emulator for Windows to operate properly. The behavior is different from Windows Firewall (introduced in Windows XP SP2).

Resolving the problem

If the Windows Internet Connection Firewall (ICF) is enabled, Z and I Emulator for Windows IPv6 features might not function properly. You must explicitly disable the ICF IPv6 firewall/filtering.

ICF is available on Windows XP releases prior to Service Pack 2; Microsoft™ introduced Windows Firewall with XP SP2.

To configure ICF, type netsh firewall show adapter at a command prompt to see a list of all network adapters with IPv6 configured. Each item indicates whether filtering is enabled for that adapter, as follows:

```
-------------------------------------------------
AdapterFriendlyName IPV6FilteringEnabled
-------------------------------------------------
Local Area Connection Yes
6to4 Tunneling Pseudo-Interface Yes
Automatic Tunneling Pseudo-Interface Yes
-------------------------------------------------
```

You could use the following commands to disable IPv6 filtering for the adapter interfaces shown in the previous example:

- netsh firewall set adapter "Local Area Connection" filtering=disable
- netsh firewall set adapter "6to4 Tunneling Pseudo-Interface" filtering=disable
- netsh firewall set adapter "Automatic Tunneling Pseudo-Interface" filtering=disable

After you disable filtering, type netsh firewall show adapter to show the firewall status. The display should be similar to the following:

```
-------------------------------------------------
AdapterFriendlyName IPV6FilteringEnabled
-------------------------------------------------
Local Area Connection No
6to4 Tunneling Pseudo-Interface No
Automatic Tunneling Pseudo-Interface No
-------------------------------------------------
```

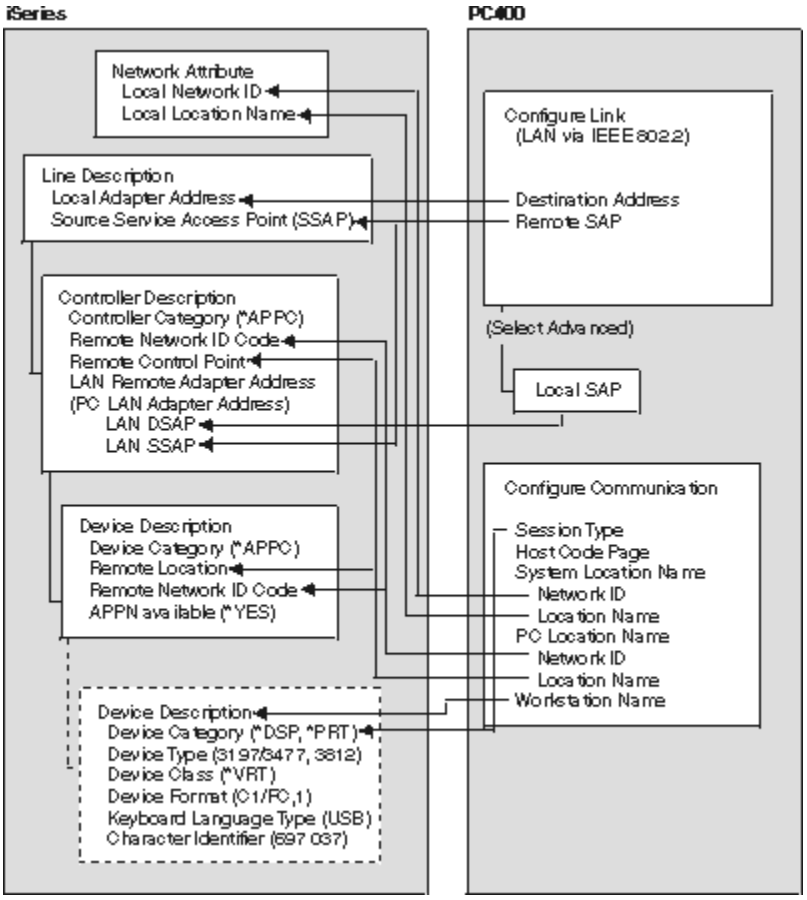
For additional details about configuring the IPv6 Internet Connection Firewall, refer to the Microsoft® TechNet database.

Appendix A. iSeries, eServer i5, or System i5 Configuration Examples

To connect to an iSeries™, eServer™ i5, or System i5™, you need to specify configuration information in the workstation profile that accurately corresponds to the information specified in the iSeries™, eServer™ i5, or System i5™ (referred to as the *device description*).

For example, the LAN attachment via IEEE 802.2 in the following figure shows how the configuration information specified in the workstation profile corresponds to the configuration information in the iSeries™, eServer™ i5, or System i5™.

Figure 26. LAN Attachment via IEEE 802.2



iSeries Device Description

To configure 5250 display or printer sessions, the following values must be set in the iSeries™ device description:

iSeries Device Description	Display Session		Printer Session
	24 x 80	27 x 132	
Device category	*DSP	*DSP	*PRT

iSeries Device Description	Display Session		Printer Session
	24 x 80	27 x 132	
Device class	*VRT	*VRT	*VRT
Device type	3197	3477	3812
Device model	C1	FC	1
Keyboard language type	USB+	USB+	-
Character identify code	697 037+	697 037+	-
+ For SBCS, depends on the host code page selection.			

The following table applies to DBCS only.

iSeries Device Description	Display Session		Printer Session
	Host Code Page 931	Host Code Page 939	
Device category	*DSP	*DSP	*PRT
Device class	*VRT	*VRT	*VRT
Device type	5555	5555	5553
Device model	C01	C01	B01
Keyboard language type	JUB	JPB	-
Character identify code	101 037	1172 1027	-
DBCS device feature	2424J0	2424J0	2424J0

5250 Sessions through One Link

If you want all your 5250 sessions to connect through one link to an iSeries™, eServer™ i5, or System i5™, use the same **PC Location Name** and the same **Link Parameters** for all the sessions.

For example, you can configure two display sessions and one printer session connected to an iSeries™, eServer™ i5, or System i5™ using APPN.PC5250 as the **Location Name**.

```
Session A   :  Session Type           :  Display
(Display)      System Location Name   :  APPN.S7801234
               PC Location Name       :  APPN.PC5250
               Workstation ID         :  (not specified)

Session B   :  Session Type           :  Display
(Display)      System Location Name   :  APPN.S7801234
               PC Location Name       :  APPN.PC5250
               Workstation ID         :  (not specified)

Session C   :  Session Type           :  Printer
(Printer)      System Location Name   :  APPN.S7801234
               PC Location Name       :  APPN.PC5250
               Workstation ID         :  PCLOCALP1
```

In this example, the iSeries™ network attributes are:

```
Local network ID : APPN
Local location   : S7801234
```

Tip

Enter **DSPNETA** from a 5250 session to display iSeries™, eServer™ i5, or System i5™ network attributes.

System i5, iSeries, eServer i5, or System Mode Description

PC400 initially uses mode description **QPCSUPP** on the iSeries™, eServer™ i5, or System i5™. If the PC Support/400 program or iSeries™ Access is installed on the iSeries™, eServer™ i5, or System i5™, QPCSUPP need not be created. If mode description QPCSUPP does not exist on the iSeries™, eServer™ i5, or System i5™, create the mode description:

1. Enter the following command on the command line of the main menu of the iSeries™, eServer™ i5, or System i5™:

   ```
   CRTMODD
   ```

   The Creating Mode Description panel appears.

   ```
                      Creating Mode Description (CRTMODD)

   Type the selected items, and push the Enter key.

   Mode Description.................              Name
   Maximum Session.................. 8             1-512
   Maximum number of interaction.... 8             1-512
   Number of Local Control Sessions. 4             0-512
   Number of Pre-joined Sessions.... 0             0-512
   Inbound Pacing Value............. 7             0-63
   Outbound Pacing Value............ 7             0-63
   Maximum Length of Request Unit... *CALC             241-16384, *CALC
   Text Description ................ *BLANK




                                                                        End
    F3=Exit    F4=Prompt         F5=Reshow    F10=Add parameter   F12= Cancel
    F13=How to use this panel                 F24=More key
   ```

2. Type the necessary values in each field, according to the following table.

Field Name	Input Value
Mode description	**QPCSUPP**
Maximum session	**64**
Maximum number of interactions	**64**
Number of local control sessions	**0**
Number of pre-joined sessions	**0**
Inbound pacing value	**7**
Outbound pacing value	**7**
Maximum length of request unit	***CALC**
Text description	This field is optional

3. After you type all the values, press the Enter key.

   This completes the creation of the mode description QPCSUPP.

iSeries, eServer i5, or System i5 Device Description for Twinaxial Attachments (APPC) Example

If you want to use a twinaxial (TDLC) attachment, the iSeries™, eServer™ i5, or System i5™ requires that you specify a device description. When the automatic device configuration indicator (QAUTOCFG) is set to ON in the iSeries™, eServer™ i5, or System i5™, the device description is created automatically. When the indicator is set to OFF, create the device description, as follows:

1. Enter the following command on the command line of the iSeries™, eServer™ i5, or System i5™ main menu:

   ```
   CRTDEVDSP
   ```

   The Creating Device Description (Display) panel appears.

   ```
                   Creating Device Description(Display)   (CRTDEVDSP)

   Type the selected item, and push Enter key.

   Device Description...    Name
   Device Class.........            *LCL, *RMT, *VRT, *SNPT
   Device Type..........            3101, 3151, 3161, 3162...
   Device Format........            0, 1, 2, 4, 11, 12, 23...

                                                                       End
    F3=Exit    F4=Prompt         F5=Reshow    F10=Add parameter   F12= Cancel
    F13=How to use this panel               F24=More key
   ```

2. Type the values in each field, according to the following table.

Field Name	**Input Value**
Device description	This is an optional field
Device class	***LCL**
Device type	**5150**
Device format	**2**

3. After you type all values, press the Enter key.

   The following screen appears:

```
                Creating Device Description(Display)   (CRTDEVDSP)

Type the selected item, and push Enter key.

Device Description.........>TWXP0A1 Name
Device Class...............>*LCL       *LCL, *RMT, *VRT, *SNPT
Device Type................>5150       3101, 3151, 3161, 3162...
Device Format..............>2       0, 1, 2, 4, 11, 12, 23...
Port Number.................. _          0-17
Switch Setting.............. _          0, 1, 2, 4, 5, 6
Online when IPL............>*YES       *YES,  *NO
Controller to be attached... _      Name
Keyboard Word Type.........>*SYSVAL     *SYSVAL,AGB,AGI,BLI...
Text Description...........>*BLANK




F3=Exit    F4=Prompt         F5=Reshow    F10=Add parameter   F12= Cancel
F13=How to use this panel                 F24=More key
```

4. Type the values for each field, according to the following table.

Field Name	Input Value
Port number	Number of the port to be attached
Switch setting	Device address
Controller to be attached	Descriptive name of the controller to be attached
Keyboard word type	**USB**[1]
[1] Depends on the host code page selection.	

5. After you enter all the values, press the Enter key.

   This completes the creation of the device description for the twinaxial attachment.

iSeries, eServer i5, or System i5 Device Description for Asynchronous Attachment Example

If you want to use an asynchronous dial attachment, the iSeries™, eServer™ i5, or System i5™ requires that you specify configuration parameters for the controller/line/devices to be used.

The following sample is a typical configuration on the iSeries™, eServer™ i5, or System i5™ for an asynchronous dialed connection through an ASCII Workstation Controller.

1. Enter the following command on the command line of the iSeries™, eServer™ i5, or System i5™ main menu:

   ```
   WRKCFGSTS *CTL CTL03
   ```

   where *CTL03* is the name of your controller.

   The Work with Configuration Status panel appears.

```
                    Work with Configuration Status


Position to . . . . . _____________  Starting characters

Type options, press Enter
  1=Vary on 2=Vary off 5=Work with job 8=Work with description
  9-Display mode status ...

Opt   Description         Status         -------------Job--------------
8_    CTL03               ACTIVE
__      ADLCTST           VARY ON PENDING
__      ASYNC             VARY ON PENDING
__      ASYNCD            VARY ON PENDING
__      EZASYNC           VARY ON PENDING
__      ASYNCP0           VARY ON PENDING
__      ASYNRTR           ACTIVE

                                                                        BOTTOM
Parameters or command
 ===>

F3=Exit F4=Prompt F12=Cancel F23=More options F24=More keys
```

2. Enter **8** in the **Opt** field to work with the controller description for CTL03.

   The Work with Controller Descriptions panel appears.

```
                    Work with Controller Descriptions


Position to . . . . . _____________  Starting characters

Type options, press Enter
   2=Change 3=Copy 4=Delete 5=Display 6=Print 7=Rename
   8=Work with status 9=Retrieve source 12=Print device addresses

Opt   Controller    Type  Text
2_    CTL03         6141  CREATED BY AUTO-CONFIGURATION









                                                                        BOTTOM
Parameters or command
 ===>
F3=Exit F4=Prompt F5=Refresh F6=Create F9=Retrieve F12=Cancel
F14=Work with status
```

3. Enter **2** in the **Opt** field to change the controller description for CTL03.

   The Change Controller Description panel appears.

```
                    Change Ctl Desc (local WS) (CHGCTLLWS)


Controller Description . . . . . . : CTL03
Option . . . . . . . . . . . . . . : *BASIC
Category of controller . . . . . . : *LWS

Controller type  . . . . . . . . . : 6141
Controller model . . . . . . . . . : 1
Resource name  . . . . . . . . . . : CTL03
TDLC line  . . . . . . . . . . . . : QTDL429000
Online at IPL  . . . . . . . . . . : *YES
Auto-configuration controller  . . : *YES
Text . . . . . . . . . . . . . . . : CREATED BY AUTO-CONFIGURATION
Device wait timer  . . . . . . . . : 10



Press Enter to continue.
 ===>                                                                  BOTTOM
F3=Exit  F4=Prompt  F5=Refresh  F12=Cancel  F13=How to use this display
F24=More keys
```

4. Type the values in each field, according to the following table.

Field Name	Input Value
Controller description	CTL03
Resource name	CTL03
Online at IPL	*YES
Device wait timer	10
Auto-configuration controller	*YES
Text description	This field is optional

The Work with Controller Descriptions panel appears.

```
                    Work with Controller Descriptions


Position to . . . . . _____________  Starting characters

Type options, press Enter
   2=Change 3=Copy 4=Delete 5=Display 6=Print 7=Rename
   8=Work with status 9=Retrieve source 12=Print device addresses

Opt   Controller    Type  Text
 8_   CTL03         6141  Created by auto-configuration









                                                                       BOTTOM
Parameters or command
 ===>
F3=Exit F4=Prompt F5=Refresh F6=Create F9=Retrieve F12=Cancel
F14=Work with status
```

5. Enter **8** in the **Opt** field to work with the configuration status.

The Work with Configuration Status panel appears.

```
                    Work with Configuration Status


Position to . . . . . _____________  Starting characters

Type options, press Enter
  1=Vary on 2=Vary off 5=Work with job 8=Work with description
  9-Display mode status ...

Opt   Description         Status         -------------Job--------------
__    CTL03               ACTIVE
__      ADLCTST           VARY ON PENDING
__      ASYNCPERTH        VARY ON PENDING
__      ASYNCD            VARY ON PENDING
__      EZASYNC           VARY ON PENDING
__      ASYNCP0           VARY ON PENDING
8_      ASYNRTR           ACTIVE

                                                                        BOTTOM
Parameters or command
 ===>

F3=Exit F4=Prompt F12=Cancel F23=More options F24=More keys
```

6. Enter **8** in the **Opt** field next to `ASYNRTR` to work with the display device description.

   The Work with Device Descriptions panel appears.

```
                    Work with Device Descriptions


Position to . . . . . _____________  Starting characters

Type options, press Enter
   2=Change 3=Copy 4=Delete 5=Display 6=Print 7=Rename
   8=Work with status 9=Retrieve source

Opt   Controller    Type  Text
 2_   ASYNRTR       5150  FOR PC400









                                                                        BOTTOM
Parameters or command
 ===>
F3=Exit F4=Prompt F5=Refresh F6=Create F9=Retrieve F12=Cancel
F14=Work with status
```

7. Enter **2** in the **Opt** field to change the device description.

   The Change Device Description panel appears.

```
                Change Device Desc (Display) (CHGDEVDSP)

 Type choices, press Enter.

 Device description . . . . . > ASYNRTR     Name
 Port number  . . . . . .   4           0-17, *SAME
 Switch setting . . . . . .   0           0-6, *SAME
 Online at IPL  . . . . . .   *YES        *SAME, *YES, *NO
 Keyboard language type . . . . . .   USI         *SAME, *SYSVAL, *NONE, AGB...

Character identifier:
   Graphic character set  . . . . .   *KBDTYPE    1-32767, *KBDTYPE, *SYSVAL...
   Code page  . . . . . .                         1-32767
 Allow blinking cursor  . . . . . .   *YES        *SAME, *YES, *NO
 Print device . . . . . .   *SYSVAL     Name, *SAME, *SYSVAL
 Output queue . . . . . .   *DEV        Name, *SAME, *DEV
   Library  . . . . . .                         Name, *LIBL, *CURLIB
 Printer file . . . . . .   QSYSPRT     Name, *SAME
   Library  . . . . . .     *LIBL     Name, *LIBL, *CURLIB
                                                                    More...
 Press Enter to continue.
  ===>
 F3=Exit  F4=Prompt  F5=Refresh  F10=Additional parameters  F12=Cancel
 F13=How to use this display     F24=More keys
```

This completes the creation of the controller and display device descriptions for an asynchronous dial attachment.

iSeries, eServer i5, or System i5 VT Asynchronous Attachment Example

The following sample is a typical configuration on the iSeries™, eServer™ i5, or System i5™ for a VT asynchronous dialed connection through an ASCII Workstation Controller. For more details on iSeries™, eServer™ i5, or System i5™ for VT asynchronous attachments, refer to *AS/400 ASCII Workstation Reference*.

1. Enter the following command on the command line of the iSeries™, eServer™ i5, or System i5™ main menu:

   ```
   CRTDEVDSP
   ```

   The Create Device Description panel appears, in a first and second screen, as shown for the configuration of a VT100 device in the following screens. When filling in the panel, make sure that the name of the attached controller (arbitrarily shown as CTL05 here) matches the name of the twinaxial controller configured on your iSeries™, eServer™ i5, or System i5™.

```
                    Create Device Desc (Display) (CRTDEVDSP)

Type choices, press Enter.

Device description . . . . . > VT100         Name
Device class . . . . . . . . . > *LCL        *LCL, *RMT, *VRT, *SNPT
Device type  . . . . . . . . . > V100        3101, 3151, 3161, 3162...
Device model . . . . . . . . . > *ASCII      0, 1, 2, 4, 5, 12, 23 ...
Emulated twinaxial device  . . > *TYPE       3196A2, 3197D2, *TYPE
Port number  . . . . . . . . . > 1           0-17
Emulating ASCII device . . . . > *NO         *NO, *YES
Physical attachment  . . . . . > *MODEM      *DIRECT, *PTT, *MODEM...
Online at IPL  . . . . . . . . > *YES        *YES, *NO
Attached controller  . . . . . > CTL05       Name
Keyboard language type . . . . > USB         *SYSVAL, AGB, AGI, ALI...
Inactivity timer . . . . . . . > *NOMAX      1-30, *ATTACH, *NOMAX...
Line speed . . . . . . . . . . > 19200       *TYPE, *CALC, 150, 300...
Word length  . . . . . . . . . > 8           *TYPE, *CALC, 7, 8
Type of parity . . . . . . . . > *NONE       *TYPE, *CALC, *EVEN, *ODD...
Stop bits  . . . . . . . . . . > 2           *TYPE, 1, 2
                                                                  More...
F3=Exit   F4=Prompt   F5=Refresh   F10=Additional parameters   F12=Cancel
F13=How to use this display        F24=More keys
```

```
                    Create Device Desc (Display) (CRTDEVDSP)

Type choices, press Enter.

Text 'description' . . . . . > 'dec vt100 device description test'


                          Additional Parameters
Character identifier:
  Graphic character set  . . . > *KBDTYPE      1-32767, *SYSVAL, *KBDTYPE
  Code page  . . . . . . . . .                 1-32767
Print device . . . . . . . . . > *SYSVAL       Name, *SYSVAL
Output queue . . . . . . . . . > *DEV          Name, *DEV
  Library  . . . . . . . . . .                 Name, *LIBL, *CURLIB
Printer file . . . . . . . . . > QSYSPRT       Name
  Library  . . . . . . . . . . >   *LIBL       Name, *LIBL, *CURLIB



                                                                 Bottom
F3=Exit   F4=Prompt   F5=Refresh   F10=Additional parameters   F12=Cancel
F13=How to use this display        F24=More keys
```

2. For a similar configuration for a VT220:

   Use the same command, CRTDEVDSP, on the command line of the iSeries™, eServer™ i5, or System i5™ main menu. Again, the same kind of panels appear. You must make sure that the name of the attached controller matches the name of the twinaxial controller configured on your iSeries™, eServer™ i5, or System i5™.

```
                    Create Device Desc (Display) (CRTDEVDSP)

Type choices, press Enter.

Device description . . . . . .   VT220          Name
Device class . . . . . . . . . > *LCL           *LCL, *RMT, *VRT, *SNPT
Device type  . . . . . . . . . > V220           3101, 3151, 3161, 3162...
Device model . . . . . . . . . > *ASCII         0, 1, 2, 4, 5, 12, 23
Emulated twinaxial device  . . > *TYPE          3196A2, 3197D2, *TYPE
Port number  . . . . . . . . . > 2              0-17
Emulating ASCII device . . . . > *NO            *NO, *YES
Physical attachment  . . . . . > *MODEM         *DIRECT, *PTT, *MODEM...
Online at IPL  . . . . . . . . > *YES           *YES, *NO
Attached controller  . . . . . > CTL05          Name
Keyboard language type . . . . > USB            *SYSVAL, AGB, AGI, ALI...
Inactivity timer . . . . . . . > *NOMAX         1-30, *ATTACH, *NOMAX...
Line speed . . . . . . . . . . > 19200          *TYPE, *CALC, 150, 300...
Word length  . . . . . . . . . > 8              *TYPE, *CALC, 7, 8
Type of parity . . . . . . . . > *NONE          *TYPE, *CALC, *EVEN, *ODD...
Stop bits  . . . . . . . . . . > 1              *TYPE, 1, 2
                                                                      More...
F3=Exit   F4=Prompt   F5=Refresh   F10=Additional parameters   F12=Cancel
F13=How to use this display        F24=More keys
```

```
                    Create Device Desc (Display) (CRTDEVDSP)

 Type choices, press Enter.

 Text 'description' . . . . . > 'dec vt220 device description test'


                           Additional Parameters

 Character identifier:
   Graphic character set  . . . . > *KBDTYPE      1-32767, *SYSVAL, *KBDTYPE
   Code page  . . . . . . . . . .                 1-32767
 Print device . . . . . . . . . . > *SYSVAL       Name, *SYSVAL
 Output queue . . . . . . . . . . > *DEV          Name, *DEV
   Library  . . . . . . . . . . .                 Name, *LIBL, *CURLIB
 Printer file . . . . . . . . . . > QSYSPRT       Name
   Library  . . . . . . . . . . . >   *LIBL       Name, *LIBL, *CURLIB



                                                                      Bottom
 F3=Exit   F4=Prompt   F5=Refresh   F10=Additional parameters   F12=Cancel
 F13=How to use this display        F24=More keys
```

iSeries, eServer i5, or System i5 Configuration for SDLC Example

The following examples refer to SDLC and Hayes AutoSync.

Network Attributes

To display the network attributes for the iSeries™, eServer™ i5, or System i5™ to which you are connecting, enter the command **dspneta** on the iSeries™, eServer™ i5, or System i5™ main menu.

```
MAIN                            iSeries Main Menu
                                                        System:   RALYAS4B
Select one of the following:

     1. User tasks
     2. Office tasks
     3. General system tasks
     4. Files, libraries, and folders
     5. Programming
     6. Communications
     7. Define or change the system
     8. Problem handling
     9. Display a menu
    10. Information Assistant options
    11. iSeries Access tasks

    90. Sign off

Selection or command
===> dspneta

F3=Exit   F4=Prompt   F9=Retrieve   F12=Cancel   F13=Information Assistant
F23=Set initial menu
```

Press **Enter**.

The Display Network Attributes screen is displayed.

```
                          Display Network Attributes

                                                       System:   RALYAS4B
 Current system name  . . . . . . . . . . . . . . :   RALYAS4B
   Pending system name  . . . . . . . . . . . . . :
 Local network ID . . . . . . . . . . . . . . . . :   USIBMRA
 Local control point name . . . . . . . . . . . . :   RALYAS4B
 Default local location . . . . . . . . . . . . . :   RALYAS4B
 Default mode . . . . . . . . . . . . . . . . . . :   BLANK
 APPN node type . . . . . . . . . . . . . . . . . :   *NETNODE
 Data compression . . . . . . . . . . . . . . . . :   *NONE
 Intermediate data compression  . . . . . . . . . :   *NONE
 Maximum number of intermediate sessions  . . . . :   200
 Route addition resistance  . . . . . . . . . . . :   128
 Server network ID/control point name . . . . . . :   *LCLNETID   *ANY




                                                                        More...
 Press Enter to continue.

 F3=Exit   F12=Cancel
```

The network attributes include the iSeries™, eServer™ i5, or System i5™ Network ID and CP name.

SDLC Leased Configuration

Several descriptions must be created on the iSeries™, eServer™ i5, or System i5™; examples are given in this section.

Creating an SDLC Line Description

To create an SDLC leased line description, enter the command **crtlinsdlc** on the iSeries™, eServer™ i5, or System i5™ main menu.

```
MAIN                            iSeries Main Menu
                                                        System:   RALYAS4B
Select one of the following:

     1. User tasks
     2. Office tasks
     3. General system tasks
     4. Files, libraries, and folders
     5. Programming
     6. Communications
     7. Define or change the system
     8. Problem handling
     9. Display a menu
    10. Information Assistant options
    11. iSeries Access tasks

    90. Sign off

Selection or command
===> crtlinsdlc

F3=Exit   F4=Prompt   F9=Retrieve   F12=Cancel   F13=Information Assistant
F23=Set initial menu
```

Press **F4** (Prompt).

The Create Line Description panel is displayed. Enter the values for each parameter on the panel.

```
                     Create Line Desc (SDLC) (CRTLINSDLC)

Type choices, press Enter.

Line description . . . . . > ZIEWinSDLCL    Name
Resource names . . . . . > LIN021        Name
             + for more values
Online at IPL  . . . . . .   *YES          *YES, *NO
Data link role . . . . . .   *NEG          *NEG, *PRI, *SEC
Physical interface . . . . . .   *RS232V24     *RS232V24, *V35, *X21, ...
Connection type  . . . . . .   *NONSWTPP     *NONSWTPP, *SWTPP, *MP, *SHM
Switched network backup  . . . .   *NO           *NO, *YES
Exchange identifier  . . . . . .   *SYSGEN       05600000-056FFFFF, *SYSGEN
NRZI data encoding . . . . . .   *YES          *YES, *NO
Line speed . . . . . .   9600          600, 1200, 2400, 4800...
Modem type supported . . . . . .   *NORMAL       *NORMAL, *V54, *IBMWRAP...
Maximum frame size . . . . . .   521           265, 521, 1033, 2057
Duplex . . . . . .   *HALF         *HALF, *FULL
Inactivity timer . . . . . .   300           *NOMAX, 150-4200 (0.1 sec)
Poll response delay  . . . . . .   0             0-2048 (0.0001 seconds)
                                                                    More...
F3=Exit   F4=Prompt   F5=Refresh   F12=Cancel   F13=How to use this display
F24=More keys
```

```
                     Create Line Desc (SDLC) (CRTLINSDLC)

Type choices, press Enter.

Nonproductive receive timer  . .   320           160-4200 (0.1 seconds)
Idle timer . . . . . .   30            5-300 (0.1 seconds)
Connect poll timer . . . . . .   30            2-300 (0.1 seconds)
Poll cycle pause . . . . . .   0             0-2048 (0.0001 seconds)
Frame retry  . . . . . .   7             0-64
Text 'description' . . . . . .    SDLC leased line


                          Additional Parameters

Attached nonswitched ctls  . . .                 Name
               + for more values
Modem data rate select . . . . .   *FULL         *FULL, *HALF
Error threshold level  . . . . .   *OFF          *OFF, *MIN, *MED, *MAX
Modulus  . . . . . .   8             8, 128
Maximum outstanding frames . . .   7             1-28
                                                                    More...
F3=Exit   F4=Prompt   F5=Refresh   F12=Cancel   F13=How to use this display
F24=More keys
```

Press **Enter** to save the line description `pcommsdlcl`.

SDLC Controller Description

To create the SDLC controller description for the line ZIEWinSDLCL, enter **crtctlappc** on the iSeries™, eServer™ i5, or System i5™ main menu.

```
MAIN                          iSeries Main Menu
                                                        System:   RALYAS4B
Select one of the following:

     1. User tasks
     2. Office tasks
     3. General system tasks
     4. Files, libraries, and folders
     5. Programming
     6. Communications
     7. Define or change the system
     8. Problem handling
     9. Display a menu
    10. Information Assistant options
    11. iSeries Access tasks

    90. Sign off

Selection or command
===> crtctlappc

F3=Exit   F4=Prompt   F9=Retrieve   F12=Cancel   F13=Information Assistant
F23=Set initial menu
```

Press **F4** (Prompt). The Create Controller Description panel is displayed. Enter values for each parameter on the following two panels.

```
                     Create Ctl Desc (APPC) (CRTCTLAPPC)

 Type choices, press Enter.

 Controller description . . . . . > ZIEWinSDLCL    Name
 Link type  . . . . . . . . . . . > *SDLC          *ANYNW, *FAX, *FR, *IDLC...
 Online at IPL  . . . . . . . . .   *YES           *YES, *NO
 Switched connection  . . . . . .   *NO            *NO, *YES
 Switched network backup  . . . .   *NO            *NO, *YES
 APPN-capable . . . . . . . . . .   *YES           *YES, *NO
 Attached nonswitched line  . . . > ZIEWinSDLCL    Name
 Maximum frame size . . . . . . .   *LINKTYPE      265-16393, 256, 265, 512...
 Remote network identifier  . . . > USIBMRA       Name, *NETATR, *NONE, *ANY
 Remote control point . . . . . . > ZIEWinCP      Name, *ANY
 Exchange identifier  . . . . . .                 00000000-FFFFFFFF
 Data link role . . . . . . . . .   *NEG           *NEG, *PRI, *SEC
 Station address  . . . . . . . .   C1            00-FE
 APPN CP session support  . . . .   *NO            *YES, *NO
 APPN node type . . . . . . . . .   *LENNODE       *ENDNODE, *LENNODE...
 APPN transmission group number     1             1-20, *CALC
                                                                    More...
 F3=Exit   F4=Prompt   F5=Refresh   F12=Cancel   F13=How to use this display
 F24=More keys
```

```
                     Create Ctl Desc (APPC) (CRTCTLAPPC)

Type choices, press Enter.

Autocreate device  . . . . . .   *ALL          *ALL, *NONE
Autodelete device  . . . . . .   1440          1-10000, *NO
User-defined 1 . . . . . . . .   *LIND         0-255, *LIND
User-defined 2 . . . . . . . .   *LIND         0-255, *LIND
User-defined 3 . . . . . . . .   *LIND         0-255, *LIND
Text 'description' . . . . . .   ZIEWin SDLC Leased


                          Additional Parameters

Attached devices . . . . . .                  Name
              + for more values
Character code . . . . . . . .   *EBCDIC       *EBCDIC, *ASCII
SSCP identifier  . . . . . . .                000000000001-FFFFFFFFFFFF
IDLC window size . . . . . . .   *LIND         1-31, *LIND
IDLC frame retry . . . . . . .   *LIND         0-100, *LIND
                                                                    More...
F3=Exit   F4=Prompt   F5=Refresh   F12=Cancel   F13=How to use this display
F24=More keys
```

Press **Enter**.

The APPC Device Description will create itself automatically.

SDLC Switched Configuration

The following examples contain information about the SDLC switched configuration on the iSeries™, eServer™ i5, or System i5™.

SDLC Line Description

To create an SDLC switched line definition on the iSeries™, eServer™ i5, or System i5™, enter the command **crtlinsdlc** on the iSeries™, eServer™ i5, or System i5™ main menu.

```
MAIN                          iSeries Main Menu
                                                        System:   RALYAS4B
Select one of the following:

     1. User tasks
     2. Office tasks
     3. General system tasks
     4. Files, libraries, and folders
     5. Programming
     6. Communications
     7. Define or change the system
     8. Problem handling
     9. Display a menu
    10. Information Assistant options
    11. iSeries Access tasks

    90. Sign off

Selection or command
===> crtlinsdlc

F3=Exit   F4=Prompt   F9=Retrieve   F12=Cancel   F13=Information Assistant
F23=Set initial menu
```

Press **F4** (Prompt).

The Create Line Description panel is displayed. Enter values for each parameter on the panel.

```
                    Create Line Desc (SDLC) (CRTLINSDLC)

Type choices, press Enter.

Line description . . . . . > PCOMSDLCSW    Name
Resource names . . . . . > LIN051        Name
             + for more values
Online at IPL  . . . . . .   *YES          *YES, *NO
Data link role . . . . . > *PRI          *NEG, *PRI, *SEC
Physical interface . . . . .   *RS232V24     *RS232V24, *V35, *X21, ...
Connection type  . . . . . > *SWTPP        *NONSWTPP, *SWTPP, *MP, *SHM
Vary on wait . . . . . .   *NOWAIT       *NOWAIT, 15-180 (1 second)
Autocall unit  . . . . . .   *NO           *NO, *YES
Exchange identifier  . . . . .   *SYSGEN       05600000-056FFFFF, *SYSGEN
NRZI data encoding . . . . . .   *YES          *YES, *NO
Line speed . . . . . .   9600         600, 1200, 2400, 4800...
Modem type supported . . . . .   *NORMAL       *NORMAL, *V54, *IBMWRAP...
Switched connection type . . .   *BOTH         *BOTH, *ANS, *DIAL
Autoanswer . . . . . .   *YES          *YES, *NO
Autodial . . . . . .   *NO           *NO, *YES
                                                                  More...
F3=Exit   F4=Prompt   F5=Refresh   F12=Cancel   F13=How to use this display
F24=More keys
```

```
                    Create Line Desc (SDLC) (CRTLINSDLC)

Type choices, press Enter.

Calling number . . . . . .   *NONE
Connect poll retry . . . . . .   7            0-64
Maximum frame size . . . . . .   521          265, 521, 1033, 2057
Duplex . . . . . .   *HALF         *HALF, *FULL
Nonproductive receive timer  . .   320          160-4200 (0.1 seconds)
Idle timer . . . . . .   30           5-300 (0.1 seconds)
Connect poll timer . . . . . .   30           2-300 (0.1 seconds)
Poll cycle pause . . . . . .   0            0-2048 (0.0001 seconds)
Frame retry  . . . . . .   7            0-64
Data Set Ready drop timer  . . .   6            3-60 (seconds)
Autoanswer type  . . . . . .   *DTR          *DTR, *CDSTL
Remote answer timer  . . . . . .   60           30, 35, 40, 45 (seconds)...
Text 'description' . . . . . .   ZIEWin SDLC switched line



                                                                  More...
F3=Exit   F4=Prompt   F5=Refresh   F12=Cancel   F13=How to use this display
F24=More keys
```

Press **Enter** to save the description `pcomsdlcsw`.

SDLC Controller Description

To create the controller description for the switched SDLC line, enter **crtctlappc** on the iSeries™, eServer™ i5, or System i5™ main menu.

```
MAIN                            iSeries Main Menu
                                                              System:   RALYAS4B
Select one of the following:

     1. User tasks
     2. Office tasks
     3. General system tasks
     4. Files, libraries, and folders
     5. Programming
     6. Communications
     7. Define or change the system
     8. Problem handling
     9. Display a menu
    10. Information Assistant options
    11. iSeries Access tasks

    90. Sign off

Selection or command
===> crtctlappc

F3=Exit   F4=Prompt   F9=Retrieve   F12=Cancel   F13=Information Assistant
F23=Set initial menu
```

Press **F4** (Prompt).

The Create Controller Description panel is displayed. Enter values for each parameter on the panel.

```
                      Create Ctl Desc (APPC) (CRTCTLAPPC)

 Type choices, press Enter.

 Controller description . . . . . > PCOMSDLCSW    Name
 Link type  . . . . . . . . . . . > *SDLC         *ANYNW, *FAX, *FR, *IDLC...
 Online at IPL  . . . . . . . . .   *YES          *YES, *NO
 Switched connection  . . . . . . > *YES          *NO, *YES
 Short hold mode  . . . . . . . .   *NO           *NO, *YES
 APPN-capable . . . . . . . . . .   *YES          *YES, *NO
 Switched line list . . . . . . . > PCOMSDLCSW    Name
               + for more values
 Maximum frame size . . . . . . .   *LINKTYPE     265-16393, 256, 265, 512...
 Remote network identifier  . . .   *NETATR       Name, *NETATR, *NONE, *ANY
 Remote control point . . . . . . > JO            Name, *ANY
 Exchange identifier  . . . . . . > 00000000      00000000-FFFFFFFF
 Initial connection . . . . . . . > *ANS          *DIAL, *ANS
 Connection number  . . . . . . . > 123
 Data link role . . . . . . . . . > *SEC          *NEG, *PRI, *SEC
 Station address  . . . . . . . .   01           00-FE
                                                                      More...
 F3=Exit   F4=Prompt   F5=Refresh   F12=Cancel   F13=How to use this display
 F24=More keys
```

```
                      Create Ctl Desc (APPC) (CRTCTLAPPC)

 Type choices, press Enter.

 APPN CP session support  . . . .   *NO           *YES, *NO
 APPN node type . . . . . . . . .   *LENNODE      *ENDNODE, *LENNODE...
 APPN transmission group number     1             1-20, *CALC
 APPN minimum switched status . .   *VRYONPND     *VRYONPND, *VRYON
 Autocreate device  . . . . . . .   *ALL          *ALL, *NONE
 Autodelete device  . . . . . . .   1440          1-10000, *NO
 User-defined 1 . . . . . . . . .   *LIND         0-255, *LIND
 User-defined 2 . . . . . . . . .   *LIND         0-255, *LIND
 User-defined 3 . . . . . . . . .   *LIND         0-255, *LIND
 Text 'description' . . . . . . .   PCOM SDLC switched line


                           Additional Parameters

 Attached devices . . . . . . . .                 Name
               + for more values
                                                                      More...
 F3=Exit   F4=Prompt   F5=Refresh   F12=Cancel   F13=How to use this display
 F24=More keys
```

Press **Enter** to save the controller description `pcomsdlcsw`.

The APPC Device Description will create itself automatically once Z and I Emulator for Windows attaches to the iSeries™, eServer™ i5, or System i5™ using the line and controller descriptions that were just created.

LAN Configuration Example

This example assumes that a line description (token-ring or Ethernet) is already in place. This is a shared configuration object—all connections on that adapter will use the same line description. In the configuration example shown, the line description name is TRN2619.

LAN Controller Description

The normal method would be to let the APPC controller create itself automatically. However, if preferred, the following command can be used to manually create the APPC controller.

To create a LAN controller description, enter **crtctlappc** on the iSeries™, eServer™ i5, or System i5™ main menu.

```
MAIN                          iSeries Main Menu
                                                        System:   RALYAS4B
Select one of the following:

     1. User tasks
     2. Office tasks
     3. General system tasks
     4. Files, libraries, and folders
     5. Programming
     6. Communications
     7. Define or change the system
     8. Problem handling
     9. Display a menu
    10. Information Assistant options
    11. iSeries Access tasks

    90. Sign off

Selection or command
===> crtctlappc

F3=Exit   F4=Prompt   F9=Retrieve   F12=Cancel   F13=Information Assistant
F23=Set initial menu
```

Press **F4** (Prompt). The Create Controller Description panel will be displayed.

Enter values for each parameter on the panel.

```
                     Create Ctl Desc (APPC) (CRTCTLAPPC)

Controller description . . . . . > ZIEWinLAN      Name
Link type  . . . . . . . . . . . > *LAN           *ANYNW, *FAX, *FR, *IDLC...
Online at IPL  . . . . . . . . .   *YES          *YES, *NO
APPN-capable . . . . . . . . . .   *YES          *YES, *NO
Switched line list . . . . . . . > TRN2619       Name
             + for more values
Maximum frame size . . . . . . .   *LINKTYPE     265-16393, 256, 265, 512...
Remote network identifier  . . .   *NETATR       Name, *NETATR, *NONE, *ANY
Remote control point . . . . . . > PEPE          Name, *ANY
Exchange identifier  . . . . . .                 00000000-FFFFFFFF
Initial connection . . . . . . .   *DIAL         *DIAL, *ANS
Dial initiation  . . . . . . . .   *LINKTYPE     *LINKTYPE, *IMMED, *DELAY
LAN remote adapter address . . .   400052005109  000000000001-FFFFFFFFFFFF
APPN CP session support  . . . .   *NO           *YES, *NO
APPN node type . . . . . . . . .   *LENNODE      *ENDNODE, *LENNODE...
APPN/HPR capable . . . . . . . .   *YES          *YES, *NO
                                                                    More...
F3=Exit   F4=Prompt   F5=Refresh   F12=Cancel   F13=How to use this display
F24=More keys
```

```
                     Create Ctl Desc (APPC) (CRTCTLAPPC)

Type choices, press Enter.

APPN transmission group number     1             1-20, *CALC
APPN minimum switched status . .   *VRYONPND     *VRYONPND, *VRYON
Autocreate device  . . . . . . .   *ALL          *ALL, *NONE
Autodelete device  . . . . . . .   1440          1-10000, *NO
User-defined 1 . . . . . . . . .   *LIND         0-255, *LIND
User-defined 2 . . . . . . . . .   *LIND         0-255, *LIND
User-defined 3 . . . . . . . . .   *LIND         0-255, *LIND
Model controller description . .   *NO           *NO, *YES
Text 'description' . . . . . . .   ZIEWin token-ring









                                                                    Bottom
F3=Exit   F4=Prompt   F5=Refresh   F10=Additional parameters   F12=Cancel
F13=How to use this display        F24=More keys
```

Press **Enter** to save the controller description `pcommlan`.

The APPC Device Description will create itself automatically. Z and I Emulator for Windows attaches to the iSeries™, eServer™ i5, or System i5™ using the controller description that was just created.

Appendix B. Alerts

Alerts are generated by components of Z and I Emulator for Windows; corresponding messages are logged in the message log and can be viewed with the Z and I Emulator for Windows log viewer utility. Refer to the information about log viewer functions in the User's Reference for the specific emulator type for more information.

Note that some alerts can be caused by different situations. Each situation may generate a different message. Other alerts are informational and do not generate specific messages in the log, although messages about problems relating to the situation that generated the alert may be logged.

Alert ID number	Messages logged
APPN	
X'034A6F0B'	PCS4066E
	PCS4068E
	PCS4093E
X'0DF28A14'	PCS4065E
	PCS4066E
	PCS4068E
	PCS4069E
	PCS4070E
X'170F7710'	No specific message
X'21745F28'	No specific message
X'2313A399'	PCS4364A
	PCS4365A
	PCS4379A
X'32CDF4E2'	PCS4073E
X'47302521'	No specific message
X'6D27D125'	PCS4066E
	PCS4068E
X'7599A7D8'	No specific message
X'769022F0'	PCS4504E
X'9DCD7CCA'	PCS4275E
	PCS4280E
	PCS4282E
	PCS4283A
	PCS4284E
	PCS4304E
	PCS4305E
	PCS4310A
	PCS4311E
	PCS4312E
X'9E452D9C'	PCS4593A
X'A89646AA'	PCS4275E
	PCS4280E
	PCS4282E
	PCS4283A
	PCS4284E
	PCS4304E
	PCS4305E
	PCS4310A
	PCS4311E
	PCS4312E
X'B558D310'	PCS4324E

```
                    PCS4342E
                    PCS4347E
  X'C781E91E'       No specific message
  X'EBAA3C4F'       PCS4593A
  X'EBEE390E'       PCS4063E
                    PCS4064E
                    PCS4066E
                    PCS4067E
                    PCS4068E
                    PCS4071A
                    PCS4091E
                    PCS4092E
                    PCS4094E
                    PCS4123E
                    PCS4124E
                    PCS4125E
  X'F52A0C01'       PCS4061E
                    PCS4062E
  X'FE1C42EB'       No specific message
LLC2 SAP

  X'016E5F4E'       PCS1066A
                    PCS1054A
  X'3BA03B6D'       PCS1066A
                    PCS1005E
  X'55BF3E1C'       PCS1066A
                    PCS1054A
  X'A676B230'       PCS1066A
                    PCS1005E
  X'CAF3C58A'       PCS1066A
                    PCS1054A
  X'D2E24978'       PCS1066A
                    PCS1005E
  X'D615A61E'       PCS1066A
                    PCS1054A
  X'EB1D6ABB'       PCS1066A
                    PCS1005E
  X'EB61E14F'       PCS1066A
                    PCS1005E

LLC2 Link Station

  X'216D1033'       PCS1065A
                    PCS1003E
  X'25AC0D84'       PCS1065A
                    PCS1004E
  X'28EF2B5D'       PCS1065A
                    PCS1001E
                    PCS1004E
                    PCS1006E
  X'5B8F5BA7'       PCS1065A
                    PCS1050A
  X'83D91642'       PCS1065A
                    PCS1000E
  X'87180BF5'       PCS1065A
                    PCS1000E
  X'8A5B2D2C'       PCS1065A
                    PCS1000E
```

```
  X'8E9A309B'         PCS1065A
                      PCS1000E
  X'E65B0B7F'         PCS1065A

pDLC

  Alert ID number     Messages logged      Alert type   Alert description

  X'0E499026'         PCS8607              01           3300
  X'0F935B3E'         PCS8603              01           3300
  X'21C346F0'         PCS8619              01           3300
  X'25025B47'         PCS8620              01           3300
  X'28417D9E'         PCS8617              01           3300
  X'2C806029'         PCS8618              01           3300
  X'4227687B'         PCS8610              01           3300
  X'6C6E2505'         PCS8604              01           8000
                      PCS8612
  X'7EA9C871'         PCS8608              01           3300
  X'8CEC6B74'         PCS8609              01           3300
  X'AB218ADF'         PCS8700              01           3300
  X'BB5C288E'         PCS8600              01           3300
  X'C16E9922'         PCS8615              01           3300
  X'C5AF8495'         PCS8616              01           3300
  X'C8ECA24C'         PCS8613              01           3300
  X'CC2DBFFB'         PCS8614              01           3300
  X'D3F9C6D8'         PCS8611              01           3300
  X'EBB67B65'         PCS8606              01           3300
```

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