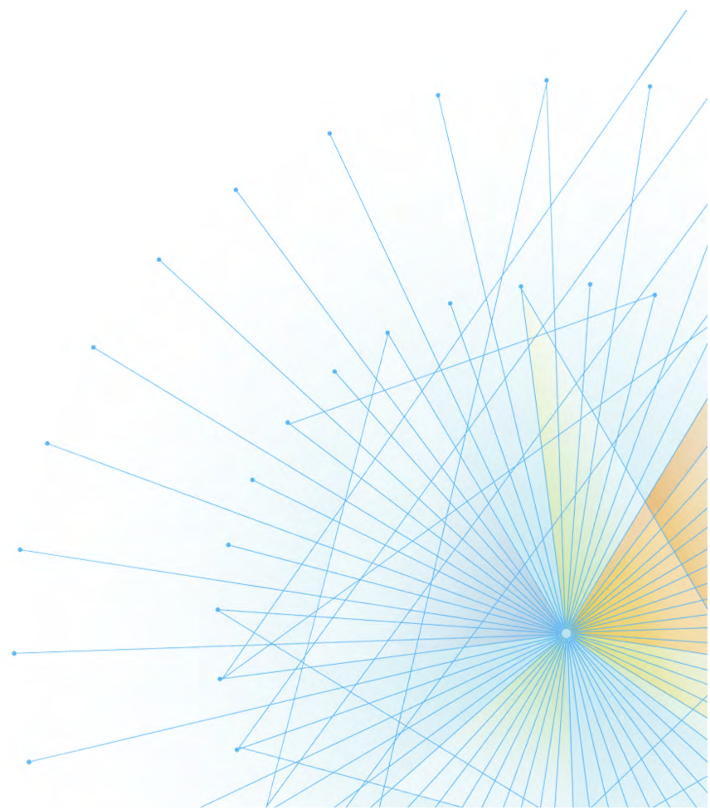
The Mainframe Software Partner For The Next 50 Years

Hiperstation Scripting Reference

Release 17.02



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Introduction

Compuware is committed to providing user-friendly documentation in a variety of electronic formats. This section describes the available formats and how to access them, provides an overview of this manual, describes the conventions used within and the resources available to help you.

Accessing Hiperstation Documentation

The Hiperstation documentation is available on the Compuware Support Center website at **http://go.compuware.com**. *Release Notes* are provided in HTML format and manuals in Portable Document Format (PDF):

- *Release Notes* — Provides recent information for the Hiperstation product. In this file, you can quickly access technical notes, customer support contact information, and a list of the new features available in the release. The *Release Notes* may be updated throughout the life cycle of a release with the most current version located on the Compuware Support Center for easy access to the latest product information.
- *Hiperstation Installation and Configuration Guide* — Provides installation and configuration procedures.
- *Hiperstation Advanced Configuration Guide* — Supplements the *Hiperstation Installation and Configuration Guide*, providing further customization instructions and reference information.
- *Hiperstation for VTAM User Guide* — Explains how to use Hiperstation for VTAM to test 3270 and LU0 applications.
- *Hiperstation for WebSphere MQ User Guide*— Explains how to use Hiperstation for WebSphere MQ to test WebSphere MQ applications.
- *Hiperstation for Mainframe Servers User Guide* — Explains how to use Hiperstation for Mainframe Servers to test APPC and TCP/IP applications.
- *Hiperstation Auditor User Guide* — Explains how to use the Hiperstation Archive Function.
- *Hiperstation Automated Testing Vehicle (ATV) Manager User Guide* — Explains how to use the Hiperstation ATV Manager to manage your testing environment and test cases.
- *Hiperstation Messages and Codes* — Explains the messages and codes that Hiperstation produces.
- *Hiperstation Scripting Reference* — Introduces advanced script editing concepts and provides reference information for technical users.
- *Hiperstation Reference Summary* — Summarizes the commands used in Hiperstation for VTAM's Domain Traveler and Session Demo features.

View and print PDF files with Adobe Reader. Download a free copy of the latest version of the reader from Adobe's web site: **http://www.adobe.com**.

With a few minor exceptions, PDF files comply with the requirements of section 508 of the Rehabilitation Act of 1973. Refer to the Accessibility preface in any of the user guides for information.

For your convenience, Compuware also provides the Hiperstation manuals in Hypertext Markup Language (HTML) format.

Access these formats on Compuware's Support Center website at **http://go.compuware.com**.

1. Log-in.
2. Select the desired product.
3. Click the Documentation link on the left selection bar.
4. Select the desired release. The Compuware Support Center presents a documentation list containing links to each of the product's manuals in all of the available formats.

HTML Files

View HTML files with any standard Web browser. Simply click the HTML link on the selected Compuware Support Center documentation page.

Using this Manual

This section describes the:

- contents of this manual
- notation conventions used throughout the manual
- command syntax and syntax diagrams.

Manual Contents

This reference provides script manipulation information for advanced testing concepts, such as data-driven testing. It includes the following sections:

- **"Hiperstation Script Language"**: How to use REXX to modify your scripts for specific jobs.
- **"Common Programming Interface"**: How to use programs written in REXX to manage communications within your system.
- **"3270 Repository Filtering and Copy Utility"**: How to filter messages or sessions from a large repository for more manageable review or script creation.
- **"Guidelines for Successful Stress Testing"**: How to plan, set up, and execute application stress testing, and how to use the results of your tests.

Notation Conventions

This document uses the following notations to describe Hiperstation screens and the information you enter on those screens:

- Technical revisions made to this document are indicated by revision bars in the left margin, as shown here.
- Sample screens generally show only the information appropriate to the accompanying text, for example:

```
ZOOM:PF23 --------------------- Hiperstation ------------------ LINE 1 OF 24
 COMMAND ===> record                                            SCROLL ===> HALF
 Record OFF  Play OFF  Journal OFF  Compare Log OFF  autoDoc OFF
 ***USR2312   WELCOME TO CICS/MVS  *** 10:11:42
```

- Blank lines or standard footings, as shown below, are usually omitted from screen illustrations.

```
Press ENTER to begin recording,  Use END to cancel setup.
```

- Information you enter is printed in **boldface**.
- Words defined within paragraphs are *italicized*.
- The phrase "select an option" refers to typing a slash next to one of the presented options and pressing Enter.

Command Syntax

Hiperstation uses statements and commands that you will learn about later. This section describes text conventions used in statement and command descriptions. It also explains how to read syntax diagrams.

- Keywords are shown in UPPERCASE letters. Enter keywords and special characters as shown. If a command or statement name can be abbreviated, the description shows only the abbreviation in uppercase letters.

  ```
  Find string [NEXT|PREV|ALL]
  ```

  The uppercase F in the command FIND means that you can enter the FIND command either as FIND or F.

- Variables and generic descriptions of parameter values are shown in lowercase letters.
- Vertical bars (|) are separators between mutually exclusive options.
- Brackets ([ ]) indicate optional parameters. All parameters not enclosed in brackets are required.
- Ellipses (…) indicate that the value can be repeated.

Reading Syntax Diagrams

Syntax diagrams define primary command syntax.

A **parameter** is either a keyword or a variable.

All KEYWORDs are shown in uppercase characters and must be spelled exactly as shown. You cannot substitute another value. If any part of a KEYWORD is shown in lowercase characters, that part is optional.

Variables are user-specified values and are printed in lowercase italics. For example, *dataset-name* indicates you are to substitute a value.

The syntax for commands is described in diagrams that help you visualize parameter use. The following example shows a command and a parameter:

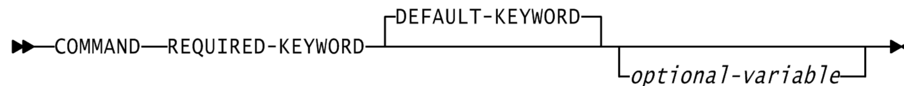
```
▶▶─COMMAND──parameter───▶◀
```

Read the diagrams from left to right and from top to bottom. These symbols help you follow the path of the syntax:

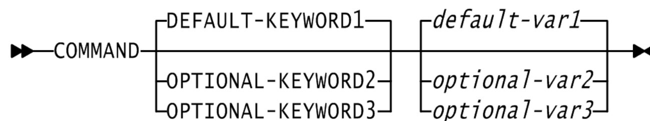
▶▶─ indicates the beginning of a statement.

- —► indicates the statement is continued on the next line.
- ►— indicates the statement is continued from the previous line.
- —►◄ indicates the end of a statement.

Required parameters appear on the horizontal line (the main path). Optional parameters appear below the main path. Default parameters appear above the main path and are optional. The command executes the same regardless of whether the default parameter is included.

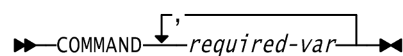


Vertically stacked parameters are mutually exclusive. If you must choose a parameter, one item of the stack appears on the main path. If the parameters are optional, the entire stack appears below the main path. If a parameter in a stack is the default, it appears above the main path.



If the same parameters are used with several commands, their syntax may be documented in a separate diagram. In the command syntax, these common parameters are indicated with separators before and after the parameter name.

An arrow returning to the left indicates a repeatable item. If the arrow contains a comma, separate the repeated items with a comma.



Accessibility

In accordance with section 508 of the Rehabilitation Act of 1973, Compuware has committed to making its products and services easier to use for everyone including people with disabilities.

Hiperstation is a mainframe application that runs on IBM’s z/OS operating systems. It has an ISPF interface that is accessed with IBM 327x-type terminals or with 3270 terminal emulator software. Since the mainframe environment offers few accessibility features, Compuware has focused its attention, with regard to accessibility, on 3270 terminal emulator software running on personal computers (PCs) with Microsoft Windows 2000 or more current. Hiperstation supports, with a few

exceptions, Microsoft Windows accessibility features and Window-based Assistive Technology (AT) software and devices, such as Braille devices, screen readers, magnifiers, etc.

Hiperstation is intended for use by mainframe software developers, programmers, and testers. Much of the input and output used or produced by Hiperstation, such as Job Control Language (JCL) and hexadecimal contents or dumps of memory, are not easily understood by the general public. Unfortunately, as in the case of hexadecimal dumps, data in these formats can be confusing to screen readers and therefore confusing to the people who use them. Effective use of this application requires the specialized knowledge of a mainframe systems software developer or programmer.

Hiperstation accessibility was evaluated using:

- Freedom Scientifics' JAWS screen reader
- Attachmate Corporation's myExtra Presentation Services tn3270 emulator
- Microsoft's Windows accessibility features
- Adobe Reader using the "Read Out Loud" function.

This evaluation not only identified accessibility exceptions, but revealed emulator and screen reader compatibility issues that in some cases can be remedied through appropriate configuration.

Installing Windows Accessibility Features

Microsoft Windows operating systems offer several accessibility features to aid individuals who have difficulty typing or using a mouse, who are blind or have low vision, or who are deaf or are hard-of-hearing. Install these features during setup or later using the Windows installation disks. Refer to the "accessibility" topics in the Windows Help system for information on installing and using these features. Visit the Microsoft Web site, **http://www.microsoft.com/enable**, for additional information and tutorials.

Selecting Font and Font Size

Microsoft Windows and emulator software packages offer font and font size settings to accommodate users with low vision. The emulator software's tool bars and dialog boxes typically use the font specified in the operating system, while the terminal presentation uses the font and font size specified in the emulator. To change the font or font size:

- Presented on the toolbars and dialog boxes, refer to the Windows Help system.
- Presented in the terminal window, refer to the emulator's documentation or Help.

Some screen readers recommend certain fonts and font sizes for compatibility. For example, Freedom Scientifics recommends setting the font to a common or "plain" font such as Lucida, Courier, or Times New Roman, and setting the font size to 10 points or smaller. Refer to the screen reader's documentation or Help for these recommendations.

Changing Color and Contrast

Color and contrast settings can assist users with low vision. ISPF and most emulator software packages offer color and contrast settings. If you are accessing Hiperstation with a terminal, use ISPF settings. Otherwise, adjust the color and contrast in the emulator software. Refer to ISPF Help or the emulator's documentation or Help.

Setting Cursor Blink Rate

The blink rate of the cursor can affect users with photosensitive epilepsy. Additionally, some screen readers require a specific blink rate. Some readers automatically adjust the blink rate while others expect you to adjust the rate. Refer to:

- The Microsoft Windows Help to find out how to set the cursor blink rate.
- The screen reader's documentation or Help to find out the recommended blink rate.

Using Keyboard Shortcuts

Keyboard access to application functions support users who cannot use a mouse.

Microsoft Windows provides keyboard access to all functions within the operating system, such as:

- Displaying or hiding the Windows Start Menu
- Showing the Desktop
- Minimizing all windows
- Searching for files
- Accessing the help system
- Controlling the behavior of the Windows accessibility features, for example, toggling the listening status to the microphone, or cycling focus backward and forward.

Most Windows-based applications also provide keyboard access to their functions. The combination of keys required to execute a given function is called a keyboard shortcut. Refer to the "Keyboard Shortcuts" topics in the Windows Help system for a complete list of Windows shortcuts. For a list of the shortcuts that are available in the emulator software or any third-party accessibility tool, such as the JAWS screen reader, refer to the software's documentation or Help.

Accessibility Exceptions Work Arounds

During Hiperstation accessibility evaluation, some exceptions were encountered where some accessibility features or AT were not fully supported. The causes of and solutions for these exceptions are currently under investigation by Compuware Corporation.

Known Exceptions

Accessibility exceptions include:

- Function Key (F Key) information at the bottom of the screen is not read by the screen reader on some screens. This is believed to be caused by an external interface. See Solutions for a viable work-around.
- Some system error and warning messages are not read by the screen reader when issued. Believed to be caused by an external interface. See Solutions for a viable work-around.
- Some pop-up dialog boxes or windows do not capture exclusive focus and are not read correctly by the screen reader. This is believed to be caused by an external interface. No known solution is currently available.
- System error and warning messages do not capture visual focus for the screen magnifier. This is believed to be caused by an external interface. No known solution is currently available.
- Some entry and display fields lack individual labels. When entry fields are accessed using the Tab key, the entire individual line is read.

- Current Web-based reports are not easily navigated using the keyboard and lack table element coordinate tags. Additionally, some of these reports contain color-coded elements — for example, the color of some elements conveys meaning.

Solutions

When the screen reader fails to read the F Key information upon entry to a new screen, do one of the following:

- Use the arrow keys to move the cursor down to the lines with the F Key information. The screen reader reads each line as the cursor is placed on it.

- Press the Page Up key for the screen reader to reread the entire screen.

When the screen reader fails to read an error or warning message, an audio alert occurs if this feature is enabled on your system. Press the Up key to place the cursor on the line containing the error message, usually on the top or title line. The screen reader reads the line and its error message individually.

Getting Help

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Visit Compuware on the web at **http://www.compuware.com** for additional product information.

Hiperstation Script Language

Hiperstation implements IBM's REXX as its script language. The script language utility significantly extends the capabilities of Hiperstation's playback function in both ISPF and unattended processing.

In addition to the REXX environment provided with MVS TSO/Extensions, Hiperstation offers a set of variables that allows information to be retrieved about the Hiperstation environment and data to be retrieved from the current and expected messages. Among the solutions that a script language offers are:

- Multiple ports that require unique input field values during batch execution.
- Scripts that require unique input field values each time they are played.
- Actions taken based on comparison of system output.
- The ability to call and share common scripts.

Statement of Compliance

The implementation of the Hiperstation script language makes every reasonable attempt to function as described in the appropriate IBM TSO/E REXX Reference. Many, but not all, features and functions of the REXX language implemented in the MVS environment are available with Hiperstation.

The Hiperstation script language facilities are the same as REXX in the non-TSO/E environment. This means that all language statements provided by REXX are available with Hiperstation. The only unavailable facilities are functions that are part of the TSO/E function package such as LISTDSI, OUTTRAP, and SYSDSN.

Hiperstation's REXX implementation is limited to the functions in the MVS environment. The MVS, LINK, and ATTACH host command environments are available in the Hiperstation script language.

Installation Requirements

Use of the Hiperstation script language requires the installation of IBM's TSO/E Version 2 or more current.

Capabilities of the Language

In stress testing, where multiple terminal sessions are involved, systems often require unique data for each session. This data is usually a user ID and a password. Hiperstation's table processing and variable substitution allows a table of users to be *read in* and substituted based on criteria such as the terminal ID or the *port number* of the session.

In load testing, you may need to provide a unique input (for example, policy number or social security number) for each iteration or *cycle* of the script's execution. Hiperstation's external file access and variable CYCLE easily facilitate such a requirement.

You may need to perform a *fix-up* script based on the output of a particular transaction. For example, if a batch job tries to close a database, and users are still attached, you can issue a message and reschedule the job. Hiperstation's conditional logic and CALL capability easily answer this requirement.

Some installations may need to create *special operator* scripts that perform operations that normally require terminal operators. For example, CICS installations might need to run the CEMT transaction

to OPEN and CLOSE databases during nightly backups or reorganizations. Hiperstation addresses this requirement.

Features that the REXX language provides include:

- Variable substitution on simulated user-entered input parameters (<Inn>, <I(xx,xx)>, or <I CURSOR> level only)
- Variable assignment using simple and complex expressions
- Conditional logic and flow control: IF-THEN-ELSE, DO-WHILE, DO-UNTIL, controlled repetitive DO, and branching
- Inclusion of data from external datasets to be used as terminal input
- Random number generation
- Ability to call other Hiperstation scripts, REXX EXECs, or other programs from an executing Hiperstation script
- Ability to introduce user-generated messages in the Hiperstation log
- Internal and external function calls
- Integer, decimal, and floating point arithmetic
- Debugging and trace options.

Hiperstation Additions to REXX

Hiperstation adds predefined variables to the REXX language. This gives REXX access to the screen data and other environmental data such as the name of the current domain destination or the port number in unattended mode processing.

Hiperstation also adds additional commands not found in the non-TSO/E environment. Use these commands through the HSCMDS environment. For more information, see Hiperstation HSCMDS Command Environment on page 48.

Statements

A 3270 script recorded by Hiperstation for VTAM is a series of input and output groups. The input group represents the actions taken at the terminal by the user. It records the data entered in each of the input fields and the PF key that was pressed to transmit the data. The output group records the output from the transaction. This data includes the output screen images and the response time of the transaction.

The recorded types are further described in this chapter. The combination appears as follows:

```
<INPUT>
…
</INPUT>
<OUTPUT>
…
</OUTPUT>
<INPUT>
```

The ellipses (...) indicate that there are input or output records in the group. The record type format, which is delimited with angle brackets (< >) complies with the format used by the SAA Dialog Tag Language (DTL).

Hiperstation script language execution units consist of one or more REXX statements. The statements can be placed by themselves in a dataset member or in a dataset member that is combined with a recorded script. When placed in a script, the statements must follow an output group and precede an input group. The output group terminates with an </OUTPUT> record, and the input group begins with an <INPUT> record.

The following example shows the proper placement of script language statements:

```
</OUTPUT>
…
IF POS('LOGON IN PROGRESS',SCREEN) = 0
   SAY 'USERID' userid,index.1 'ALREADY IN USE, RETRYING'
   USERINDEX = USERINDEX + 1
   IF USERINDEX > MAXUSERIDS
     EXIT
   ELSE
     CALL RETRYLOG
<INPUT>
…
```

Script language statements can also be placed at the beginning of a script before the first input group. Typically, script language statements that initialize variables and tables are placed at the beginning of a script.

Iterative Statements and Multiple Transactions

Iterative statements (such as DO WHILE or DO UNTIL) can span several transactions. For example, consider a set of transactions recorded in a Hiperstation script:

```
<INPUT>
…
</INPUT>
<OUTPUT>
…
</OUTPUT>
<INPUT>
…
</INPUT>
<OUTPUT>
…
</OUTPUT>
```

The ellipses (…) represent one or more recorded statements.

The iterative statements can surround this entire group. For example, to repeat a series of transactions five times, you can add the following two statements — a DO and an END — at the beginning and end of the transactions:

```
DO I = 1 TO 5
   <INPUT>
   …
   </INPUT>
   <OUTPUT>
   …
   </OUTPUT>
   <INPUT>
   …
   </INPUT>
   <OUTPUT>
   …
   </OUTPUT>
END
```

Conditional Statements

Conditional execution can be put in a script using any of the following REXX constructs: IF…THEN…ELSE. The DO statement provides iterative looping. The forms of the DO instruction are:

```
DO I=1 TO 5
…
END
DO WHILE I<10 /*While checked at the beginning of the loop*/
…
END
DO UNTIL I>10 /* Until checked at the end of the loop     */
…
END
```

In addition, REXX includes statements that provide *elegant* exits from DO loops. The ITERATE statement transfers control to the top of the loop, and the LEAVE statement transfers control to the statement following the DO loop.

The REXX SELECT statement is used to conditionally run one of several alternative instructions. The SELECT statement is similar to the CASE statement of C.

Language Constructs

This section introduces the REXX language and its relationship to Hiperstation scripts. It also provides several examples. An experienced REXX user will find portions of this material useful as a review of REXX capabilities and features. They are included here to initiate new REXX users and to assist those evaluating the Hiperstation program who do not have in-depth REXX knowledge.

Hiperstation script language statements are made up of a series of tokens. These tokens can be variable names, arithmetic operators, constants, and other language constructs. Following are examples of valid Hiperstation script language statements:

```
COLUMN = COLUMN + 1
IF COLUMN > 79
    COLUMN = 0
ROW = ROW + 1
IF ROW > 24
    SIGNAL ENDOFSCREEN
```

Variables

A variable is an object whose value can change during the execution of a Hiperstation script. The process of changing the value of a variable is called assignment. The value of Hiperstation variables can be either characters or integers.

Variable names can be from 1 to 32 characters long and can be entered in upper or lower case. Hiperstation always treats variables as though they are entered in upper case. This means that the following expressions all refer to the same variable:

```
MyVar ='Hello'
MYVAR = 123
myvar = -270
```

Constants

The language allows the introduction of constants in two different forms. Only constants that consist of numbers and an optional minus sign can be entered as a character string of 1 to 16 digits. Numeric constants can be optionally prefixed with a minus sign to indicate a negative value. The following are valid numeric constants:

```
1
1234987
-222
```

Other constants, non-numeric and numeric, can be enclosed in either single or double quotes. These constants are called literal strings. The following are valid literal strings: **‘Guacamole’** and **“The Great Gatsby”**.

Operators

Following are examples of valid operators in the Hiperstation script language:

Table 1 Hiperstation Script Language Operators

Operator	Description
+	Addition
-	Subtraction
*	Multiplication
/	Division
%	Integer division

All operators supported by REXX are supported in the Hiperstation environment. For more information on the available operators, refer to the *TSO/E REXX Reference Guide*.

Function Calls

Function calls can be included in an expression anywhere that a data term (either a variable name or a constant) is valid. The format of a function call is:

```
function_name (arg1, arg2, ...arg n)
```

The arguments can take the form of expressions. For example:

```
C_ROW = 10
C_COL = 32
MYVAR1=SUBSTR(SCREEN,C_ROW*80+C_COL,1+2*4)
```

The above call is equivalent to entering:

```
MYVAR1 = SUBSTR(SCREEN,832,9)
```

Expressions

The purpose of an expression is to compute a value. Expressions are composed of operands such as constants and variables, operators, and possibly function calls. The process of evaluation is to substitute values for the operands and perform the operations.

REXX expression evaluation is from left to right. This is modified by parentheses and operator precedence:

- When parentheses are encountered (other than those that mark function calls or array subscripts) the entire sub-expression between the parentheses is evaluated immediately when the term is required.
- When the sequence:

  ```
  term operator1 term operator2 term
  ```

is encountered, and operator2 has higher precedence than operator1, the expression (term operator2 term) is evaluated first, applying the same rule repeatedly as necessary.

Assignments

A variable is an object whose value can be changed during the execution of a Hiperstation script. The process of changing the value of a variable is called *assignment*. The value of a variable is a single character string, from 1 to 256 characters long, that can contain any characters.

Statements of the form: **variable_name=expression** are statements known as *assignments*. An *assignment* gives a variable a (new) value.

Retrieving Data from External Sources

The REXX EXECIO function allows data to be read from external sources. In a single statement, REXX can read an entire dataset and place the records in a set of variables with a common prefix, or stem, plus one variable per record.

The data can be parsed using one or many of the REXX parsing functions such as PARSE. The following example reads in a set of user IDs and passwords from the DD name DDUSERS and places the values in USER.n and PASSWORD.n. The user IDs and passwords are placed in a dataset in *free format*, with one user and password per record, separated by one or more spaces.

```
"EXECIO * DISKR DDUSERS (STEM INPUT. FINIS"
DO I=1 TO INPUT.0
   PARSE VAR INPUT.I USER.I PASSWORD.I
END
```

Retrieving Screen Data

Screen data can be retrieved from a screen using Hiperstation variables. The SCREEN variable contains a copy of the current screen image. Portions of the screen can be extracted using functions such as SUBSTR. The contents of the screen can be examined and searched using standard functions such as POS.

For example:

```
TITLE = SUBSTR(SCREEN,24,32)
```

retrieves 32 characters of screen data located in row 0, column 24, and places them in the TITLE variable.

Comments

A comment can be introduced in two ways:

- Text enclosed in **/* ... */** is considered to be a comment. To begin a comment, use the characters **/***. End the comment with the characters ***/**.
- A record that begins with the asterisk (*****) character in column 1 is considered to be a comment statement.

Examples:

```
/*statement            Meaningful comment              */
IF A=B THEN          /* Set 'a' to the value in 'b'   */
*         This entire line is regarded as a comment.
```

Using Language Statements

This section describes some of the common uses of REXX in Hiperstation scripts.

Terminal Input Substitution

Terminal input substitution allows constants and variables to be substituted or assigned to the user's entered input of a Hiperstation script. For example, a script may have an input field where the user entered **TSOHP00** in input field *number 1*. Hiperstation for VTAM records this in the script as: **<I01>"TSOHP00"**

A variable can be substituted in the place of the constant data by replacing the text with a variable name: **<I01>USER**

REXX variable substitution is sensitive to spaces. Any space between the closing angle bracket (>) and the REXX variable is included as part of the data. For example, if the variable USER contains **abcd**, then:

- **<I01>"abcd"** is the same as **<I01>USER**
- **<I01> USER** is the same as **<I01>** "**abcd**".

Assuming that you previously set the USER variable to a value using an assignment statement, Hiperstation for VTAM places the value in the input field on the screen image, and is later transferred to the domain destination. The rules of substitution are described in the *TSO/E REXX Reference Manual*.

String Concatenation Syntax

```
<Inn> varname
```

Example

Assume that the USERS variable is initialized from a dataset named by the DD statement INDD as follows:

```
"EXECIO * DISKR INDD (STEM USERS."
```

The following statements put a unique value in input field 1 for each port in unattended playback:

```
<I01>USERS.PORT
```

You can also assign values to variables and subsequently use them in input fields:

```
VARINPUT = 15*CYCLE    /*Assign variable VARINPUT */
<I15>"THIS IS TYPED AS: "VARINPUT
```

Assuming the value currently assigned to CYCLE is 2, the following is input field number 15:

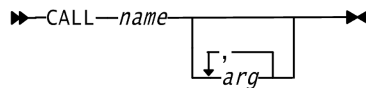
```
THIS IS TYPED AS: 30
```

Modular Scripts

The CALL statement invokes:

- Other scripts of the same protocol, for example, call a 3270 script from a 3270 script
- Additional script logic implemented as REXX internal procedures
- Programs written in REXX, Assembler, C, or other high-level languages.

Use this to create scripts that perform tasks and then return control to the original script.



You cannot use a valid TSO command as a script name when using CALL statements.

A subroutine that is called from within a script member must be accessible for the Unattended Compare to execute properly. It either needs to be in the Script dataset or in a dataset concatenated to the DD SYSLIB in the Unattended Compare JCL.

Examples

To call the CICSTERM script, code the following CALL statement:

```
CALL CICSTERM
```

To call the CUSTADD script, which expects two arguments (customer name and customer number), code the following CALL statement:

```
CUSTNUM='7234CB321'
CUSTNAME='John Smith'
CALL CUSTADD CUSTNAME,CUSTNUM
```

To accept the two arguments, the first non-comment line in the CUSTADD script is the REXX arg instruction. The ellipsis (...) represents one or more recorded statements.

```
arg name, number
<VERSION>6
<OUTPUT>. . .
```

Script Reports

The REXX SAY statement provides a mechanism to create reports from an executing script.

The result of the expression evaluation is written to the Hiperstation log. In unattended processing, this is the SYSPRINT dataset. With Hiperstation for VTAM's Domain Traveler, this is the log defined by the RLOG command. For example, the following statement places the string **Compuware Corporation** in the log:

```
SAY 'Compuware Corporation'
```

The following statement puts a blank line in the log:

```
SAY ' '
```

The following statement puts the text **SCRIPT CICSTEST WAS EXECUTED ON 03 Apr 2006 at 11:22:58** in the log:

```
SAY 'SCRIPT CICSTEST WAS EXECUTED ON' date() 'at' time()
```

Custom Return Codes

Create custom MVS job step return codes to provide more definitive playback results. For example, a playback job that ends successfully may result in a return code of 0, even if the application returned

an unexpected value. Add REXX logic to the script to evaluate message content and produce a specified return code value if the message content is incorrect.

To create a custom return code, add a REXX IF statement before the activity to be evaluated and include a RETURN or EXIT statement to specify the return code value. For example, the following logic returns a code of 108 and produces the message ‘Unable to continue script execution’ if ‘IKJ54621I’ appears anywhere on the input screen.

```
IF POS("IKJ56421I",SCREEN) > 0 THEN DO
  SAY "Unable to continue script execution"
  <INPUT>0000001
  <THINK>00.00.000 AT 00:00:00.000
  <KEY>PF3
  <CURSOR>01,01
  </INPUT>
  RETURN 108
END
```

On the RETURN or EXIT statement supply a numeric value between 0 and 4095. If you supply a non-numeric value or an out-of-range value, Hiperstation returns the decimal equivalent of the lower twelve bits. For example, if you specify 4100, Hiperstation returns 4. Additionally, be sure to select values that do not conflict with Hiperstation’s internal return codes. Refer to the:

- *Hiperstation for VTAM User Guide* for a complete list of 3270 return codes.
- *Hiperstation for Mainframe Servers User Guide* for a complete list of APPC and TCP/IP return codes.
- *Hiperstation for WebSphere MQ User Guide* for a complete list of MQ return codes.

Each of these manuals also contains a detailed explanation of return code processing.

Hiperstation REXX Variables

Hiperstation provides several predefined REXX variables that return playback information. Incorporate these variables into REXX logic that you add to your scripts for advanced testing. For example, use a variable that returns the replay iteration value to drive dynamic data replacement, or place a variable that returns the terminal ID into a SAY statement for troubleshooting purposes.

These variables are provided to the main script being played back, not to called scripts. This is due to the way TSO/E REXX separates and protects variables in external subroutines. Pass any required variables as arguments to called scripts.

Do not use variables set by Hiperstation on the left side of an assignment statement. Changing their values has no effect on Hiperstation, but can cause errors later in the script’s execution if the variables are inspected.

This section defines the variables available for each type of testing you can perform with the Hiperstation suite of products.

3270 REXX Variables

The following predefined REXX variables return information from 3270 playback jobs. Incorporate these variables into REXX logic that you add to your scripts. For example, the CYCLE variable returns a value that you can use to drive dynamic data replacement.

Understanding playback, especially the GROUP and SCRIPT statements, is integral to determining how to apply these variables. Refer to the *Hiperstation for VTAM User Guide* to learn more about these statements.

CMPRESULT

Indicates whether any miscompares occurred during the most recent screen comparison. It does not store a running count of miscompares. CMPRESULT returns a numeric value of 0 if there are no miscompares. If there are one or more miscompares, CMPRESULT returns a numeric value of 4. The following example shows how CMPRESULT might be used:

```
IF CMPRESULT > 0 THEN
   SAY 'Compare result is ' CMPRESULT
```

COLUMNS

Indicates how many columns are in each row of the terminal. For example, to set a loop counter for the number of columns in a screen:

```
C_COUNTER = COLUMNS
```

CYCLE

Returns the repeat value of the script. This value is set to one when a script begins execution.

The variable is incremented by one each time a REPEAT cycle occurs. You can enter REPEAT on the Play Setup screen in ISPF mode and by using the REPEAT keyword of the SCRIPT statement in unattended mode functions.

The CYCLE variable provides a unique value during each iteration of a script's execution.

The following example shows a list of policy numbers being read in using the EXECIO function. Then the variable POLICY is used in conjunction with CYCLE to provide a unique value during each iteration of the script.

```
"EXECIO * DISKR POLICIES (STEM POLICY."
. . .
<I01>POLICY.CYCLE
```

GRPCYCLE

Returns the repeat value of the group. This value is set to one when a group begins execution.

The variable is incremented by one each time a group finishes all of its scripts. You can use the REPEAT keyword on the GROUP statement in batch processing.

The GRPCYCLE variable provides a unique value during each iteration of a group's execution.

The following example shows a list of policy numbers being read in using the EXECIO function. Then the variable POLICY is used in conjunction with GRPCYCLE to provide a unique value during each iteration of the group.

```
"EXECIO * DISKR POLICIES (STEM POLICY."
. . .
<I01>POLICY.GRPCYCLE
```

LASTAID

Returns the 1-byte hex value of the AID key used in the previous input message. The AID key comes from the <KEY> script statement. The following example shows a message in the log if the CLEAR key was used:

```
IF LASTAID = '6D'X THEN
   SAY 'The CLEAR key was issued.'
```

LASTKEY

Returns a value listing the AID key used in the previous input message. The AID key comes from the <KEY> script statement. The following example shows the LASTKEY variable used to repeat the <KEY> that was last issued:

```
IF POS ('Processing...',screen) > 0 THEN
DO
   <INPUT>
   <EXECUTE>"<KEY>"||LASTKEY
   </INPUT>
END
```

LUNAME

Returns the terminal ID for the session. The following example places the LUNAME variable in the log using the SAY statement:

```
SAY 'We are signed on to ' LUNAME
```

OUTPUTNUM

Returns the sequence number of the <OUTPUT> tag when the screen comparison is made. The following example places the OUTPUTNUM variable in the log using the SAY statement:

```
SAY 'Expected output sequence number ' OUTPUTNUM
```

PORT

Returns a value listing the port (terminal). In ISPF mode, the port number is always 1. In unattended mode, the PORT number is always a unique, sequentially assigned identifier.

The following example shows a list of TSO user IDs being read in using the EXECIO function. Then the USER variable is used in conjunction with PORT to provide a unique user ID for each port (terminal) signing on.

```
"EXECIO * DISKR POLICIES (STEM USER."
. . .
<I01>USER.PORT
```

ROWS

Indicates how many lines are in the terminal. The following example sets a variable for a loop counter to indicate the number of rows in the screen:

```
ROWCOUNT=ROWS
```

SCREEN

Contains a copy of the current screen buffer. The following example extracts 32 characters from row 12, column 20 of the current screen:

```
SCREENOUTPUT=SUBSTR(SCREEN,(12-1)*80+20,32)
```

For details about extended attributes in the SCREEN variable, see SCREENXATR on page 26.

SCREENIN

Examines a screen image after inputs are applied. This data is made available after the next output from the application. It contains all screen information including user-entered data, which can be extracted and referenced later in the script.

The following example extracts 32 characters from row 12, column 20 of the current screen.

```
USERINPUT=SUBSTR(SCREENIN,(12-1)*80+20,32)
```

SCREENEXPECT

Contains a copy of the current screen expected buffer.

The following example extracts 32 characters from row 12, column 20 of the expected screen.

```
SCREENOUTPUT=SUBSTR(SCREENEXPECT,(12-1)*80+20,32)
```

SCREENEXPECT_SIZE

Contains the number of characters in the screen expected buffer. For a 24x80 screen, this variable is set to 1920.

The following statement assigns variable “BufferLength” to the size of the buffer for the expected screen.

```
BufferLength=SCREENEXPECT_SIZE
```

SCREENSIZE

Contains the number of characters in the screen buffer. For a 24 x 80 screen, this variable is set to 1920.

The following statement assigns variable “BufferLength” to the size of the buffer for the current screen.

```
BufferLength=SCREENSIZE
```

SCREENXATR

Contains the extended attributes referenced by the SCREEN variable.

The SCREEN variable contains the characters and attributes that represent the current screen image. To maintain a viewable SCREEN image, it is not possible to place the extended attributes in the SCREEN variable since the extended attribute may require up to nine bytes to represent a single byte on the screen. To accommodate this requirement, the SCREEN variable may contain a hexadecimal 22 to represent the existence of an extended attribute. The extended attribute can be found by taking the relative position of the extended attribute marker and multiplying it by the length of an extended attribute cell (nine bytes) and then adding one to reference the start of the cell. Following is the order of the nine attributes:

- byte 1: field attribute
- byte 2: outline mode
- byte 3: character set
- byte 4: shift in/shift out
- byte 5: foreground color
- byte 6: background color
- byte 7: highlighting
- byte 8: transparency
- byte 9: field validation.

Figure 1 shows a subroutine that extracts the extended attributes for the screen from the SCREENXATR variable. A hex 22 in the screen buffer indicates the existence of an extended attribute.

To find the extended attribute, compute its offset in the SCREENXATR variable. To do this, take the relative position of the hex 22 and multiply it by the length of an extended attribute cell, which is nine bytes, then add one to reference the start of cell.

Figure 1 Subroutine for Extracting Extended Attributes

```
x = pos('22'x,screen,1)
do while (x>0)
   attrs = substr(screenxatr, (((x-1)*9)+1),9)
   say 'ext attrs for screen position 'x
   say 'field attribute  = ' substr(attrs,1,1)
   say 'outline mode     = ' substr(attrs,2,1)
   say 'character set    = ' substr(attrs,3,1)
   say 'shift in/out     = ' substr(attrs,4,1)
   say 'foreground color = ' substr(attrs,5,1)
   say 'background color = ' substr(attrs,6,1)
   say 'highlighting     = ' substr(attrs,7,1)
   say 'transparency     = ' substr(attrs,8,1)
   say 'field validation = ' substr(attrs,9,1)
   say
   x = pos('22'x,screen,x+1)
end
```

TPFNAME

Contains the name of the domain destination for the Hiperstation session. The following example checks that you are signed on to the domain destination called 'CICSTEST':

```
IF TPFNAME = 'CICSTEST' THEN
   SAY "Logon to CICSTEST is successful"
```

APPC REXX Variables

Hiperstation provides several predefined REXX variables that return information during playback. Incorporate the variables into REXX logic that you can optionally add to your scripts. This section provides definitions for the APPC REXX variable types.

APPC Error Determination REXX Variables

The variables in Table 2 provide information pertaining to an error encountered during script processing. During playback, Hiperstation issues VTAM macros to perform operations indicated in the script. Return codes from these macros are placed in the following REXX variables.

Many of these variables provide data from the Request Parameter List (RPL). These values are the character representations of binary values.

Table 2 APPC Error Determination REXX Variables

REXX Variables	Description
CPICRC	Contains the equivalent CPIC return code for the error. If there is no error, the CPICRC is zero.
ERRMSGNO	Contains the Hiperstation error condition message number.
RPLFBK2	Contains the feedback code from the previous APPC operation. It is the register 0 value.
RPLRTNCD	Contains the return code from the previous APPC operation. It is the register 15 value.
RPL6CCST	Contains the conversation state from the VTAM RPL of the previous APPC operation.
RPL6RCPR	Contains the primary reason code from the VTAM RPL of the previous APPC operation.
RPL6RCSC	Contains the secondary reason code from the VTAM RPL of the previous APPC operation.
RPL6SNSI	Contains the sense data from the VTAM RPL of the previous APPC operation.
RPL6WHAT	Contains the “what received” value from the VTAM RPL of the previous APPC operation.

APPC Environment Data REXX Variables

The variables in Table 3 provide information pertaining to the APPC conversation. These variables cannot be used to set their corresponding conversation values. They are read only informational variables available for review while a script is running.

Table 3 APPC Environment Data REXX Variables

REXX Variables	Description
CONVCORR	Contains the conversation correlator.
LOGMODE	Contains the name of the logmode.
LUWINST	Contains the logical unit of work instance number for the conversation.
LUWNAME	Contains the logical unit of work name for the conversation.
LUWSEQ	Contains the logical unit of work sequence number for the conversation.
OPNRCDES	Contains the feedback code from the CNOS.
OPNRTNCD	Contains the return code from the CNOS.
RECEIVER	Contains the LU name receiving the ALLOCATE.
SECUSER	Contains the user ID used for security purposes.
SENDER	Contains the LU name sending the ALLOCATE.
TPNAME	Contains the transaction program name.

APPC Application Data REXX Variables

The variables described in this section provide values for both the expected and actual data received from an application during playback. The variables are read only and are set after normal or expedited data is received from the partner application. The values are usable only when they immediately follow <CONTENT> tags associated with the <SEND_DATA> or <SEND_EXPEDITED_DATA> verb.

The variables represent the data received from the partner application. They must be examined in the context of an <INBOUND> group of verbs in a Hiperstation-allocated conversation or in an <OUTBOUND> group of verbs in a Hiperstation-accepted conversation.

For example, an ALLOCATE statement in the conversation log runs the script shown in Figure 2. In this example, the first REXX SAY statement lists a null value (0 length string) because Hiperstation has not received data from the partner application. However, the four REXX SAY statements in the <INBOUND> group produces meaningful output.

Figure 2 Sample Script Using APPC Application Data REXX Variables

```
<VERSION>8
<ALLOCATE>
<OUTBOUND>
   <SEND_DATA>
   <CONTENT>....00000001This is outbound data
   say appc_actual          /* This is not meaningful, a null value is displayed. */
   <PREPARE_TO_RECEIVE>
   </OUTBOUND>
<INBOUND>
   <SEND_DATA>
   <CONTENT>....00000002This is inbound data
   say appc_actual          /* The actual data received (up to 2048 bytes).           */
   say appc_expected        /* The data we expect to receive (complete).              */
   say appc_actual_length   /* The length of the actual data (may be more than 2048). */
   say appc_expected_length /* The length of data we expect to receive (complete).    */
   <PREPARE_TO_RECEIVE>
   </INBOUND>
<OUTBOUND>
   <DEALLOCATE>
   </OUTBOUND>
```

APPC_ACTUAL

The APPC_ACTUAL variable contains the most recently received data from the partner application. This data can be either normal data from a <SEND_DATA> verb or expedited data from a <SEND_EXPEDITED_DATA> verb. If the application sends more than 2048 bytes of data, only the first 2048 bytes are available in this variable.

The variable contains a relevant value only when it immediately follows <CONTENT> tags associated with <SEND_DATA> or <SEND_EXPEDITED_DATA> verbs, and its value is reset when the next script tag is encountered. The variable generates useful data only when it is set following APPC verbs that represent data received by Hiperstation. As a result, using the variable in a section of the script where Hiperstation is sending data will not produce meaningful data.

Figure 3 shows the APPC_ACTUAL variable following a <CONTENT> tag associated with a <SEND_DATA> verb.

Figure 3 Sample Script Containing the APPC_ACTUAL Variable

```
<INBOUND>
   <SEND_DATA>
   <CONTENT>....00000002This is inbound data
   say appc_actual          /* The actual data received (up to 2048 bytes). */
   <PREPARE_TO_RECEIVE>
   say appc_actual          /* A 0 length string is displayed.              */
   </INBOUND>
```

APPC_EXPECTED

The APPC_EXPECTED variable contains the data that Hiperstation expects to receive from the partner application as a result of the most recently issued <SEND_DATA> or <SEND_EXPEDITED_DATA> verb. The value represents the data contained in the script or the associated detail file. The *complete* expected value is placed in the variable, even if it exceeds 2048 bytes (in contrast to the APPC_ACTUAL variable).

The variable contains a relevant value only when it immediately follows <CONTENT> tags associated with <SEND_DATA> or <SEND_EXPEDITED_DATA> verbs, and its value is reset when the next script tag is encountered. The variable generates useful data only when it is set following APPC verbs that represent data received by Hiperstation. As a result, using the variable in a section of the script where Hiperstation is sending data will not produce meaningful data.

Figure 4 shows the APPC_EXPECTED variable following a <CONTENT> tag associated with the <SEND_DATA> verb.

Figure 4 Sample Script Containing the APPC_EXPECTED Variable

```
<INBOUND>
   <SEND_DATA>
   <CONTENT>....00000002This is inbound data
   say appc_expected          /* Displays'This is inbound data'. */
   <PREPARE_TO_RECEIVE>
   say appc_expected          /* A 0 length string is displayed. */
   </INBOUND>
```

APPC_ACTUAL_LENGTH

The APPC_ACTUAL_LENGTH variable contains the length of the data most recently received from the partner application. This value can be obtained from normal data from a <SEND_DATA> verb or from expedited data from a <SEND_EXPEDITED_DATA> verb. This variable contains the ***exact*** length

of the data received from the partner, even if it exceeds 2048 bytes. Consequently, this value may be larger than the result of the REXX built-in: LENGTH(APPC_ACTUAL).

The APPC_ACTUAL_LENGTH variable contains a relevant value only when it immediately follows <CONTENT> tags associated with <SEND_DATA> or <SEND_EXPEDITED_DATA> verbs, and its value is reset when the next script tag is encountered. The variable generates useful data only when it is set following APPC verbs that represent data received by Hiperstation. As a result, using the variable in a section of the script where Hiperstation is sending data will not produce meaningful data.

Figure 5 shows the APPC_ACTUAL_LENGTH variable following a <CONTENT> tag associated with the <SEND_DATA> verb.

Figure 5 Sample Script Containing the APPC_ACTUAL_LENGTH Variable

```
<INBOUND>8
   <SEND_DATA>
   <CONTENT>....00000002This is inbound data
   say appc_actual_length  /* The length of the actual data (may be more than 2048). *
/
   <PREPARE_TO_RECEIVE>
   say appc_actual_length /* A 0 value is displayed.*/
```

APPC_EXPECTED_LENGTH

The APPC_EXPECTED_LENGTH variable contains the length of the data that Hiperstation expects to receive from the partner application. This can be normal data from a <SEND_DATA> verb or expedited data from a <SEND_EXPEDITED_DATA> verb. The value is the length of the data contained in the script or associated detail file. The length does not include any of the Hiperstation header information that appears on <CONTENT> tags (the first 12 bytes).

This variable contains a relevant value only when it immediately follows <CONTENT> tags associated with <SEND_DATA> or <SEND_EXPEDITED_DATA> verbs, and its value is reset when the next script tag is encountered. The variable generates useful data only when it is set after APPC verbs that represent data received by Hiperstation. As a result, using the variable in a section of the script where Hiperstation is sending data will not produce meaningful data.

Figure 6 shows the APPC_EXPECTED_LENGTH variable after a <CONTENT> tag associated with a <SEND_DATA> verb.

Figure 6 Sample Script Containing the ACCP_EXPECTED_LENGTH Variable

```
<INBOUND>8
   <SEND_DATA>
   <CONTENT>....00000002This is inbound data
   say appc_expected_length /* The length of data expected to receive (20 bytes). */
   <PREPARE_TO_RECEIVE>
   say appc_expected_length /* A 0 value is displayed.  */
   </INBOUND>
```

APPC General REXX Variables

The following variables return general playback information.

CYCLE

Returns the script repeat value. This value is set to one when a script begins execution.

GRPCYCLE

Returns the repeat value of the ALLOCATE or APPCGRP statement. This value is set to one when an ALLOCATE or APPCGRP statement begins execution.

The variable is increased by one each time an ALLOCATE or APPCGRP statement finishes all of its scripts. You can use the REPEAT keyword on the ALLOCATE or APPCGRP statement in batch processing.

The GRPCYCLE variable provides a unique value during each iteration of an ALLOCATE or APPCGRP statement's execution.

PORT

Returns a value listing the port assigned to each ALLOCATE or APPCGRP statement. The variable is increased by one for each ALLOCATE or APPCGRP statement. You can use the COUNT keyword on an ALLOCATE or APPCGRP statement in batch processing.

TCP/IP REXX Variables

The following predefined REXX variables return information from TCP/IP playback jobs. Incorporate these variables into REXX logic that you add to your scripts to control the way they play back. For example, the REPLAY_ID variable returns a value that you can use to drive dynamic data replacement.

Understanding playback, especially the SOCKETS and SCRIPT statements, is integral to determining how to apply these variables. Additionally, do not forget to set the SET_REXX_STREAM_VARIABLES playback control parameter to YES to enable the use of these variables during playback. Refer to the *Hiperstation for Mainframe Servers User Guide* for more information.

TCPIP_ACTUAL

Returns the content of the most recent message processed by Hiperstation. This variable's value is similar to the RequestBody or ResponseBody reporting fields, depending on whether the data came from the client or server.

TCPIP_EXPECTED

Returns the content of an inbound message that Hiperstation expects to receive. This is the server content from your script. This variable is similar to the ExpResponseBody reporting field.

TCPIP_ACTUAL_LENGTH

Returns the length of the most recent message processed by Hiperstation.

TCPIP_EXPECTED_LENGTH

Returns the length of an inbound message that Hiperstation expects to receive.

To use the TCPIP_ACTUAL, TCPIP_EXPECTED, TCPIP_ACTUAL_LENGTH, AND TCPIP_EXPECTED_LENGTH variables, place them after the last server script tag that you want to reference. If you place these variables before the last server script tag, only information prior to the variables is returned from the playback.

CONNECTION_NBR

Returns the current ID of the connection that is playing back. This value may be the same across multiple sockets since it is pulled from the script.

REPLAY_ID

Returns a sequential value for each instance of a SOCKETS replay. For example, a SOCKETS statement with COUNT(2) REPEAT(3), replays two instances of a script simultaneously, repeated three times, for a total of six unique replay IDs. Use REPLAY_ID in volume testing to provide a unique message for each connection to your application.

For example, to test 1000 simultaneous customer requests accessing your application, each with a different customer number and name:

1. Create an external file containing customer numbers and names with one customer per line.
2. Add data replacement logic to your script, for example:

```
/* Access external file and parse customer info */
"EXECIO * DISKR CUSTFILE (STEM cust.FINIS"
parse var cust.REPLAY_ID 1 cust_nbr 11 cust_name
/* Replace content in script with info from file */
<REPLACE FIELD =(0,cust_nbr) FIELD =(10,cust_name)>
/* Send the message    */
<CLIENT...
```

3. Set the count value in the SOCKETS statement to 1000, that is, **SOCKETS COUNT(1000)**. This generates 1000 unique customer requests by starting 1000 simultaneous sessions, all with unique REPLAY_IDs that correspond to the customer information from your external file.

SOCKETS_COUNT_NBR

Returns the COUNT value of the current SOCKETS replay. For example, if the SOCKETS statement specifies COUNT(3), the first instance returns COUNT = 1; the second, COUNT = 2; the third, COUNT = 3. This value is set when the SOCKETS replay begins.

Use this variable and SOCKETS_REPEAT_NBR to extend testing capability.

SOCKETS_REPEAT_NBR

Returns the REPEAT value of the given SOCKETS. This value is set when a socket begins execution. Use SOCKETS_COUNT_NBR and SOCKETS_REPEAT_NBR to replace script data on specific COUNTS and REPEATS. For example, to test three products (A, B, C) with two accounts (1, 2):

Iteration	All COUNTS execute simultaneously		
	COUNT 1	COUNT 2	COUNT 3
Repeat 1	Product A, Account 1	Product B, Account 1	Product C, Account 1
Repeat 2 (begins after Repeat 1 completes)	Product A, Account 2	Product B, Account 2	Product C, Account 2

1. Create an external file for each parameter you want to replace. Each file should contain one parameter value per line.
2. Add data replacement logic to your script, for example:

```
/* Access external files */
"EXECIO * DISKR PRODFILE (STEM product.FINIS"
"EXECIO * DISKR ACCTFILE (STEM account.FINIS"
product_nbr = product.MQGROUP_COUNT_NBR
account_nbr = account.MQGROUP_REPEAT_NBR
/* Replace content in script with info from file */
<REPLACE FIELD =(5,account_nbr) FIELD =(32,product_nbr)>
/* Send the message    */
<CLIENT...
```

3. Set the count and repeat values in the SOCKETS statement as follows: **SOCKETS COUNT(3),REPEAT(2)**. This generates six unique customer requests, each with a unique combination of product and account parameter values.

SCRIPT_REPEAT_NBR

Returns the REPEAT value of the current script playback. This value is set to one when the script begins execution and increments with every repeat.

ACTUAL_DB2_USERID

Returns the ID of the user associated with the DB2 transaction being played back. This value comes from the script and is sent to the server by playback.

ACTUAL_DB2_RDBNAM

Returns the name of the relational database associated with the DB2 transaction being played back. This value comes from the script and is sent to the server by playback.

ACTUAL_DB2_SQLSTMT

Returns the SQL Statement associated with the DB2 transaction being played back. This value comes from the script and is sent to the server by playback.

ACTUAL_DB2_SQLSTATE

Returns the value of the last SQL State returned by the application during playback. This is a live value that is received by playback from the server being tested.

ACTUAL_DB2_SQLCODE

Returns the value of the last SQL code returned by the application during playback. This is a live value that is received by playback from the server being tested.

ACTUAL_DB2_ANSWER_SET

Returns the server’s response to an SQL Query/Statement being played back. This is a live value that is received by playback from the server being tested.

ACTUAL_IMS_CLIENT

Returns the unique client identifier associated with the IMS transaction being played back. This value comes from the script and is sent to the server by playback.

ACTUAL_IMS_TRANS

Returns the IMS transaction code (target application) associated with the IMS transaction being played back. This value comes from the script and is sent to the server by playback.

ACTUAL_IMS_DSTORE

Returns the IMS Datastore associated with the IMS transaction being played back. This value comes from the script and is sent to the server by playback.

ACTUAL_IMS_USERID

Returns the ID of the user associated with the IMS transaction being played back. This value comes from the script and is sent to the server by playback.

ACTUAL_CTG_APPLID

Returns the APPLID of the VTAM application being accessed by the CTG transaction being played back. This value comes from the script and is sent to the server by playback.

ACTUAL_CTG_PROGID

Returns the name of the program being accessed by the CTG transaction being played back. This value comes from the script and is sent to the server by playback.

ACTUAL_ECI_USERID

Returns the ID of the user associated with the ECI call being played back. This value comes from the script and is sent to the server by playback.

ACTUAL_ECI_PROGID

Returns the name of the program invoked in CICS by the ECI call being played back. This value comes from the script and is sent to the server by playback.

MQ REXX Variables

The following predefined REXX variables return information from MQ playback jobs. Incorporate these variables into REXX logic that you add to your scripts to control the way they play back. For example, the REPLAY_ID variable returns a value that you can use to drive dynamic data replacement logic.

Understanding playback, especially the MQGROUP and SCRIPT statements, is integral to determining how to apply these variables. Additionally, do not forget to set the REXONN and SET_REXX_STREAM_VARIABLES playback control parameters to enable the use of these variables during playback. Refer to the *Hiperstation for WebSphere MQ User Guide* for more information.

ACTUAL_COMPCODE

Returns the completion code (COMPCODE) of an MQ_PUT, MQ_PUT1, or MQ_GET executed during playback. Place this variable after each script tag that executes a GET, PUT, or PUT1 of interest. For example, to report the completion code for a particular GET and PUT, incorporate this variable into REXX SAY statements placed after each of the applicable script tags. For example:

```
<MQ_GET,
CONNECTION_ID = 2,
OBJECT_ID = 1,
COMPCODE = 0,
REASON = 0,
MQMD_VERSION = 1,
...>

say 'Comp code of GET = 'ACTUAL_COMPCODE'

<MQ_PUT
...>

say ‘Comp code of PUT = 'ACTUAL_COMPCODE'
```

EXPECTED_COMPCODE

Returns the completion code (COMPCODE) that was recorded in the script for an MQ_PUT, MQ_PUT1, or MQ_GET executed during playback. Place this variable after each script tag that executes a GET, PUT, or PUT1 of interest. For example, to see the actual and expected completion

codes for a particular GET, insert the following REXX SAY statements after the MQ_GET tag that executes the call:

```
<MQ_GET,
...>

say 'Comp code of GET = 'ACTUAL_COMPCODE'
say 'Expected comp code of GET = 'EXPECTED_COMPCODE'
```

ACTUAL_CORRELID

Returns the correlation ID (MQMD_CORRELID), in character format, from an MQ_PUT, MQ_PUT1, or MQ_GET executed during playback. Place this variable after each script tag that executes a GET, PUT, or PUT1 of interest. If the transaction does not complete successfully, this variables returns 'NULL'. This variable is used in the example provided in Modify an MQ Script to Test the Requester on page 53.

EXPECTED_CORRELID

Returns the correlation ID (MQMD_CORRELID) from the script, in character format, for an MQ_PUT, MQ_PUT1, or MQ_GET executed during playback. Place this variable after each script tag that executes a GET, PUT, or PUT1 of interest.

ACTUAL_MSG

Returns the content of the most recent message processed by Hiperstation. This variable's value is similar to the MQMessageOutbound or MQMessageInbound reporting fields depending on whether an MQ_GET or MQ_PUT was processed. Refer to the *Hiperstation for WebSphere MQ User Guide* for detailed testing scenarios that illustrate the use of this variable.

EXPECTED_MSG

Returns the content of an inbound MQ message that Hiperstation is expecting to receive. Normally, this is the content of an MQ_GET from your script. However, if you reverse the direction of playback, it is the content from an MQ_PUT.

ACTUAL_MSGID

Returns the message ID (MQMD_MSGID) from the script, in character format, for an MQPUT, MQPUT1, or MQGET executed during playback. Place this variable after each script tag that executes a GET, PUT, or PUT1 of interest. If the transaction does not complete successfully, this variables returns 'NULL'.

EXPECTED_MSGID

Returns the message ID (MQMD_MSGID) from the script, in character format, for an MQPUT, MQPUT1, or MQGET executed during playback. Place this variable after each script tag that executes a GET, PUT, or PUT1 of interest.

ACTUAL_LENGTH

Returns the length of the most recent message processed by Hiperstation.

EXPECTED_LENGTH

Returns the length of an inbound MQ message that Hiperstation expects to receive.

ACTUAL_REASON

Returns the reason code (REASON) from an MQPUT, MQPUT1, or MQGET executed during playback. Place this variable after each script tag that executes a GET, PUT, or PUT1 of interest. This variable is used in the example provided in Modify an MQ Script to Test the Requester on page 53.

EXPECTED_REASON

Returns the reason code (REASON) from the script for an MQPUT, MQPUT1, or MQGET executed during playback. Place this variable after each script tag that executes a GET, PUT, or PUT1 of interest.

OBJECT_ID

Returns the current ID of the object (queue) associated with the activity that is playing back. This variable's value may be the same across multiple MQGROUPs since it is pulled from the script.

REPLAY_ID

Returns a sequential value for each instance of an MQGROUP replay. For example, an MQGROUP statement with COUNT(2) REPEAT(3), replays two instances of a script simultaneously, repeated three times, for a total of six unique replay IDs. Use REPLAY_ID in volume testing to provide a unique message for each connection to your application.

For example, to test 1000 simultaneous customer requests accessing your application, each with a different customer number and name:

1. Create an external file containing customer numbers and names with one customer per line.
2. Add data replacement logic to your script, for example:

```
/* Access external file and parse customer info */
"EXECIO * DISKR CUSTFILE (STEM cust.FINIS"
parse var cust.REPLAY_ID 1 cust_nbr 11 cust_name

/* Replace content in script with info from file */
<REPLACE FIELD =(0,cust_nbr) FIELD =(10,cust_name)>

/* Send the message    */
<MQ_PUT...
```

3. Set the count value in the MQGROUP statement to 1000, that is, **MQGROUP COUNT(1000)**. This generates 1000 unique customer requests by starting 1000 simultaneous sessions, all with unique REPLAY_IDs that correspond to the customer information from your external file.

PUT_QUEUE_NAME

Returns the name of the queue most recently used for an MQ_PUT.

GET_QUEUE_NAME

Returns the name of the queue most recently used for an MQ_GET.

MQGROUP_COUNT_NBR

Returns the COUNT value of the current MQGROUP replay. For example, if the MQGROUP statement specifies COUNT(3), the first instance returns COUNT = 1; the second, COUNT = 2; the third, COUNT = 3. This value is set when the MQGROUP begins execution.

Use this variable, and MQGROUP_REPEAT_NBR, to extend testing capability. Refer to the *Hiperstation for WebSphere MQ User Guide* for detailed testing scenarios that illustrate the use of this variable.

MQGROUP_REPEAT_NBR

Returns the REPEAT value of the MQGROUP replay. This value is set when a group begins execution. Use MQGROUP_COUNT_NBR and MQGROUP_REPEAT_NBR to replace script data on specific COUNTS and REPEATS. For example, to test three products (A, B, C) with two accounts (1, 2):

Value	All COUNTS execute simultaneously		
	COUNT 1	COUNT 2	COUNT 3
Repeat 1	Product A, Account 1	Product B, Account 1	Product C, Account 1
Repeat 2 (begins after Repeat 1 completes)	Product A, Account 2	Product B, Account 2	Product C, Account 2

1. Create an external file for each parameter you want to replace. Each file should contain one parameter value per line.
2. Add data replacement logic to your script, for example:

```
/* Access external files */
"EXECIO * DISKR PRODFILE (STEM product.FINIS"
"EXECIO * DISKR ACCTFILE (STEM account.FINIS"
product_nbr = product.MQGROUP_COUNT_NBR
account_nbr = account.MQGROUP_REPEAT_NBR
/* Replace content in script with info from file */
<REPLACE FIELD =(5,account_nbr) FIELD =(32,product_nbr)>
/* Send the message    */
<MQ_PUT...
```

3. Set the count and repeat values in the MQGROUP statement, for example, **MQGROUP COUNT(3),REPEAT(2)**. This generates six unique customer requests, each with a unique combination of product and account parameter values.

Refer to the *Hiperstation for WebSphere MQ User Guide* for detailed testing scenarios that illustrate the use of this variable.

SCRIPT_REPEAT_NBR

Returns the REPEAT value of the current script playback. This value is set to one when the script begins execution, and increments with every repeat.

Using REXX Variables

Use REXX Variables as Input

One of the basic features of using REXX with Hiperstation is to replace recorded inputs with variable names to dynamically replace input data with unique values during playback.

When using REXX variables to substitute 3270 or APPC input data, the length of the REXX variable’s value cannot exceed 256 bytes.

The following example replaces the employee number field with a variable named employee_number. You can also add a loop to increment employee_number by 1 on each iteration of the loop.

Original

```
<INPUT>0000006
<THINK>00.07.907 AT 00:00:21.014
<KEY>ENTER
<CURSOR>01,07
<I01>"add"
<I02>"11111"
</INPUT>
```

Modified

```
<INPUT>0000006
<THINK>00.07.907 AT 00:00:21.014
<KEY>ENTER
<CURSOR>01,07
<I01>"add"
<I02>employee_number
</INPUT>
```

It is possible with unattended playback to run one script across multiple terminals. Using variable substitution, you can enter unique input data across the different terminals. For example, you can play back a single script that adds an employee number to the database, while simulating multiple terminals with each terminal entering a unique employee number to the application. To do this, insert a compound variable using PORT as the compound variable extension. In this example, the unattended playback controls are GROUP H01AC054 TERM(4) SUMMARY (*) SCRIPT (TEST1).

```
employee_number.1 = '11111'
employee_number.2 = '22222'
employee_number.3 = '33333'
employee_number.4 = '44444'
<INPUT>
<KEY>ENTER
<I01>employee_number.port
</INPUT>
```

Perform File I/O from a Script

Reading a file from a Hiperstation script is done the same way as reading a file in a stand-alone REXX program (see Retrieving Data from External Sources on page 20). Before you read or write to a file, the file must be allocated. ALLOCATE is a TSO command, so you cannot invoke it from REXX in a Hiperstation script. Hiperstation does provide its own ALLOCATE command. You can use it by invoking ADDRESS HSCMDS.

You must specify the fully qualified dataset name to be allocated, without using quotation marks, which is a slight difference from how you use TSO's ALLOCATE command.

Figure 7 External File Contents

```
File  Edit  Confirm  Menu  Utilities  Compilers  Test  Help
---------------------------------------------------------------------------

EDIT       USERID1.TRAINING.SCRIPT.INPUT                  Columns 00001 00072
Command ===>                                                 Scroll ===> CSR
****** ***************************** Top of Data ******************************

000100 18751 Covell Ryan 050.00 040.00
000200 23452 Woods Tiger 045.00 900.00
000300 56781 Couples Fred 020.00 840.00
000400 16531 Norman Greg 023.00 560.00
000500 86791 Watson Tom 042.00 480.00
****** **************************** Bottom of Data ****************************
```

Figure 8 Script Contents

```
<VERSION>7
<INPUT>0000002
<KEY>ENTER
</INPUT>
<INPUT>0000003
<KEY>ENTER
<I01>"userab0"
<N03>"n -Vbl"
</INPUT>
<INPUT>0000004
<KEY>CLEAR
</INPUT>

ADDRESS HSCMDS"ALLOC F(MYINDD) DA(USERAB0.TRAINING.SCRIPT.INPUT) SHR"
"EXECIO * DISKR MYINDD (STEM input_rec. FINIS "
ADDRESS HSCMDS"FREE F(MYINDD)"

DO ptr = 1 to input_rec.0
   PARSE VAR input_rec.ptr ,
             employee_number.ptr ,
             last_name.ptr ,
             first_name.ptr ,
             hours_worked.ptr ,
             hourly_rate.ptr
   employee_name.ptr = first_name.ptr||' '||last_name.ptr
   SAY employee_number.ptr
   SAY employee_name.ptr
   SAY hours_worked.ptr
   SAY hourly_rate.ptr
END

<INPUT>0000005
<KEY>ENTER
<I01>"plaf"
</INPUT>
DO x = 1 TO input_rec.0
     <INPUT>0000006
     <KEY>ENTER
     <I01>"add"
     <I02>employee_number.x
     </INPUT>
     <INPUT>0000007
     <KEY>ENTER
     <I01>employee_name.x
     <I02>hours_worked.x
     <I03>hourly_rate.x
     </INPUT>
     <INPUT>0000014
     <KEY>ENTER
     <I01>"del"
     <I02>employee_number.x
     </INPUT>
     <INPUT>0000015
     <KEY>ENTER
     </INPUT>
 END

<INPUT>0000016
<KEY>CLEAR
</INPUT>
<INPUT>0000017
<KEY>ENTER
<I01>"cesf logoff"
</INPUT>
```

Read Data from VSAM-GETVSAMR

The command,

```
ADDRESS HSCMDS “GETVSAMR”
```

retrieves a VSAM record. Four REXX variables are used for this command:

- HS_VSAM_DD
- HS_VSAM_KE
- HS_VSAM_RC

- HS_VSAM_REC

Before issuing this command, set HS_VSAM_DD with the allocated DD name of the VSAM dataset and HS_VSAM_KEY with the key. GETVSAMR sets HS_VSAM_RC as follows:

```
/*********************************/
/*HS_VSAM_RC :Notes */
/*0 :Successful */
/*4 :No record found */
/*8 :HS_VSAM_DD problem */
/*12 :HS_VSAM_KEY problem */
/*14 :HS_VSAM_REC problem */
/*16 :HS_VSAM_DD OPEN error */
/*24 :Not licensed */
/*********************************/
```

When HS_VSAM_RC is zero, HS_VSAM_REC will contain the VSAM record that matches the specified HS_VSAM_key.

Analyze Application Screens

You can code REXX in the script to interrogate screen contents. This information can then be used to make IF/THEN/ELSE decisions, to handle synchronization issues, and as input later in the script (as in data replacement).

Use commands such as POS and SUBSTR against the SCREEN variable to analyze data displayed on the screen. Figure 9 on page 41 shows an example of this analysis.

Use Logic to Control Script Flow

You can use REXX to control playback. Use conditional logic such as IF/THEN/ELSE structures, DO loops, and SELECT structures to do this.

You can wrap DO/END statements around portions of the script. Figure 8 shows a DO loop wrapped around the section of the script that adds and deletes the employee information to the application. See Figure 9 on page 41 for additional examples.

Use the REXX Log

The REXX log allows you to create custom reports to document what happens during script execution.

The REXX log creates a file that contains the results of any SAY statements executed from the script.

To create a REXX log during playback via Hiperstation for VTAM's Domain Traveler, enter the RLOG command on the command line. To create a REXX log during an unattended playback, specify RLOG(??) on the GROUP statement.

Figure 9 through Figure 14 shows a complete 3270 script containing REXX logic that:

- Sends the Enter command (up to 100 times) until the system returns a job complete return code

  and
- Reports the return code to the REXX log.

Figure 9 Examples of Analysis, Using Logic, and Using the REXX Log (1 of 6)

```
<VERSION>7

/* Let's check the tpf before starting with the script execution */
IF tpfname <> 'TSO' THEN
  DO
    SAY TIME() 'Oops. wrong tpf. Playback aborted'
    EXIT
  END

SAY TIME() 'The script execution has started'
<IMSUNLOK>N
<OUTPUT>0000001
<RESPONSE>01.27.709
<S01> IKJ56700A ENTER USERID -
<S02>
<S03>
<S04>
<S05>
<S06>
<S07>
<S08>
<S09>
<S10>
<S11>
<S12>
<S13>
<S14>
<S15>
<S16>
<S17>
<S18>
<S19>
<S20>
<S21>
<S22>
<S23>
<S24>
</OUTPUT>
<BASETIME>05/14/07 21:17:24.394
<INPUT>0000002
<THINK>00.04.985 AT 00:00:00.000
<KEY>ENTER
<CURSOR>01,07
<I02>"userab1"
</INPUT>
<OUTPUT>0000002
<RESPONSE>00.00.053
<S01> ------------------------------ TSO/E LOGON ---------------------
<S02>
<S03>
<S04>    Enter LOGON parameters below:                   RACF LOGON para
<S05>
<S06>    Userid    ===> USERAB1
<MSK>                                                   NNNNNNNNNNNNNNNN
<S07>
<S08>    Password  ===>                                  New Password ==
<MSK>                   NNNNNNNN
<S09>
<S10>    Procedure ===> AISPF41                          Group Ident  ==
<S11>
<S12>    Acct Nmbr ===> OVPBAS5.1.OMNT
<S13>
<S14>    Size      ===> 4096
<S15>
<S16>    Perform   ===>
<S17>
<S18>    Command   ===>
<S19>
<S20>    Enter an 'S' before each option desired below:
<S21>            -Nomail         -Nonotice      S -Reconnect        -OID
<S22>
<S23> PF1/PF13 ==> Help    PF3/PF15 ==> Logoff    PA1 ==> Attention    P
<S24> You may request specific help information by entering a '?' in any
</OUTPUT>
```

Figure 10 Examples of Analysis, Using Logic, and Using the REXX Log (2 of 6)

```
<INPUT>0000003
<THINK>00.03.102 AT 00:00:03.412
<KEY>ENTER
<CURSOR>07,25
<N01>"n -Vbl"
</INPUT>
<OUTPUT>0000010
<RESPONSE>00.07.775
<S01> ICH70001I USERAB1  LAST ACCESS AT 21:15:28 ON MONDAY, MAY 14, 2007
<S02> USERAB1 LOGON IN PROGRESS AT 21:17:28 ON MAY 14, 2007
<S03> NO BROADCAST MESSAGES
<S04> *****************************************************************
<S05> *                             Welcome to CW01
<S06> *   Compuware Mainframe System News (restricted to authorized user
<S07> *****************************************************************
<S08> *             This system is now running OS/390 V1R2M0
<S09> * Due to the nature of Server Pack operating system installation,
<S10> * many SYSRES/DLIB dataset names have changed. Please reference
<S11> * SYS2.SW.DOCLIB(NEWDSNS) for detailed information on OLD vs NEW D
<S12> * name changes. Please direct any questions to the help desk.
<S13> *****************************************************************
<S14> * Attention Boole CICS Manager Users:   Change all references of
<S15> * SYS2A.BOOLE.** to SYS2.BOOLE.** in your in your CICS region JCL
<S16> *****************************************************************
<S17> * Attention VSE Users:  VSE migration to the P/390 is scheduled fo
<S18> * May 24-25.  Reference SYS2.SW.DOCLIB(VSEMIGR) for details.
<S19> *****************************************************************
<S20> ***
<S21>
<S22>
<S23>
<S24>
</OUTPUT>
<INPUT>0000011
<THINK>00.01.328 AT 00:00:12.782
<KEY>ENTER
<CURSOR>19,05
</INPUT>
<OUTPUT>0000011
<RESPONSE>00.00.384
<S01>   Menu  Utilities  Compilers  Options  Status  Help
<S02> -----------------------------------------------------------------
<S03>                            ISPF Primary Option Menu
<S04> Option ===>
<S05>
<S06> 0  Settings      Terminal and user parameters            User ID .
<S07> 1  View          Display source data or listings         Time. . .
<S08> 2  Edit          Create or change source data            Terminal.
<S09> 3  Utilities     Perform utility functions               Screen. .
<S10> 4  Foreground    Interactive language processing         Language.
<S11> 5  Batch         Submit job for language processing      Appl ID .
<S12> 6  Command       Enter TSO or Workstation commands       TSO logon
<S13> 7  Dialog Test   Perform dialog testing                  TSO prefi
<S14> 8  LM Facility   Library administrator functions         System ID
<S15> 9  IBM Products  IBM program development products        MVS acct.
<S16> 10 SCLM          SW Configuration Library Manager        Release .
<S17> D  DB2 & QMF     DB2I/QMF access to DB2 subsystems
<S18> M  MIS           MIS Dialogs
<S19> P  Products      COMPUWARE Product Menu
<S20> S  SDSF          System Display and Search Facility
<S21> U  User          User Dialogs
<S22>
<S23>
<S24> Enter X to Terminate using log/list defaults
</OUTPUT>
```

Figure 11 Examples of Analysis, Using Logic, and Using the REXX Log (3 of 6)

```
<INPUT>0000012
<THINK>00.05.324 AT 00:00:18.760
<KEY>ENTER
<CURSOR>03,16
<I01>"3.4"
</INPUT>
<OUTPUT>0000012
<RESPONSE>00.00.430
<S01>   Menu  RefList  RefMode  Utilities  Help
<S02> ------------------------------------------------------------------
<S03>                             Data Set List Utility
<S04> Command ===>
<S05>
<S06>    blank Display data set list          P Print data set list
<S07>        V Display VTOC information      PV Print VTOC information
<S08>
<S09> Enter one or both of the parameters below:
<S10>    Dsname Level . . . USERAB1.LOGON.CLIST
<S11>    Volume serial  . .
<S12>
<S13> Data set list options:
<S14>    Initial View . . . 1  1. Volume           Enter "/" to select o
<S15>                          2. Space            /  Confirm Delete
<S16>                          3. Attrib
<S17>                          4. Total
<S18>
<S19> The following actions will be available when the list is displayed
<S20>    Enter a "/" on the data set list command field for command prom
<S21>    Enter TSO commands, CLIST, REXX execs, or "=" to execute previo
<S22>
<S23>
<S24>
</OUTPUT>
<INPUT>0000013
<THINK>00.05.105 AT 00:00:24.573
<KEY>ENTER
<CURSOR>09,44
<I02>"userab0.hiper.scripts"
</INPUT>
<OUTPUT>0000013
<RESPONSE>00.00.263
<S01>   Menu  Functions  Sort  Confirm  View  Utilities  Compilers  Help
<S02> ------------------------------------------------------------------
<S03> DSLIST - Data Sets Matching USERAB0.HIPER.SCRIPTS
<S04> Command ===>                                                  Scro
<S05>
<S06> Command - Enter "/" to select action                 Message
<S07> ------------------------------------------------------------------
<S08>          USERAB0.HIPER.SCRIPTS
<S09> ***************************** End of Data Set list ***************
<S10>
<S11>
<S12>
<S13>
<S14>
<S15>
<S16>
<S17>
<S18>
<S19>
<S20>
<S21>
<S22>
<S23>
<S24>
</OUTPUT>
```

Figure 12 Examples of Analysis, Using Logic, and Using the REXX Log (4 of 6)

```
<INPUT>0000014
<THINK>00.02.431 AT 00:00:27.527
<KEY>ENTER
<CURSOR>07,02
<I03>"e        USERAB0.HIPER.SCRIPTS                       "
</INPUT>
<OUTPUT>0000014
<RESPONSE>00.00.736
<S01>   Menu  Functions  Utilities  Help
<S02> -------------------------------------------------------------------
<S03> EDIT     USERAB0.HIPER.SCRIPTS                              Row 00
<S04> Command ===>                                                  Scro
<S05>    Name                 VV MM  Created     Changed     Size  Init
<S06> . ABC00000              00.00 07/04/22 07/04/22 15:58   319    10
<S07> . ASIAR                 01.01 06/03/13 06/03/13 17:42   168   168
<S08> . ASIA1                 00.00 06/03/13 06/03/13 17:16   307    10
<S09> . ASIA2                 00.00 06/03/13 06/03/13 18:05   472    15
<S10> . A1                    01.01 06/08/26 06/08/26 16:50  1089  1089
<S11> . BATCH                 01.97 05/03/10 07/05/12 21:16    16    16
<S12> . BATCHPB               01.00 07/05/12 07/05/12 21:17    16    16
<S13> . BATCH1                01.02 06/04/02 06/04/02 14:16    33    33
<S14> . BATCH2                01.81 04/07/14 06/03/26 10:23    21    16
<S15> . BATCH3                01.01 06/03/26 06/06/10 16:38    15    21
<S16> . BATCH4                01.00 06/03/26 06/03/26 10:21    21    21
<S17> . BBB                   00.10 06/08/08 06/08/15 10:13   160     9
<S18> . BBBIN                 01.01 06/08/08 06/08/14 17:03     4     4
<S19> . CALLER                01.10 06/07/25 06/07/25 10:50     4     4
<S20> . CHECK2                01.05 06/10/01 06/10/02 09:13    10    14
<S21> . CICSLIST              00.00 06/10/29 06/10/29 17:07   647    17
<S22> . CICSLST1              00.00 06/10/29 06/10/29 17:10   538    14
<S23> . CICSOFF               00.00 06/08/08 06/08/08 14:19   103     3
<S24> . CICSON                00.05 06/08/08 06/09/05 14:41   146     5
</OUTPUT>
<INPUT>0000015
<THINK>00.04.650 AT 00:00:33.172
<KEY>ENTER
<CURSOR>03,23
<I01>"s batchpb"
</INPUT>
<OUTPUT>0000015
<RESPONSE>00.00.370
<S01>   File  Edit  Confirm  Menu  Utilities  Compilers  Test  Help
<S02> -------------------------------------------------------------------
<S03> EDIT      USERAB0.HIPER.SCRIPTS(BATCHPB) - 01.00          Columns
<S04> Command ===>                                                  Scro
<S05> ****** ***************************** Top of Data *****************
<S06> ==MSG> -CAUTION- Profile changed to CAPS ON (from CAPS OFF) becaus
<S07> ==MSG>          data does not contain any lower case characters.
<S08> 000001 //USERAB0C JOB ('OVPBAS5.0.ODSP',P87,9,9),'RYAN COVELL',REG
<S09> 000002 //       NOTIFY=USERAB0,CLASS=2,MSGCLASS=R
<S10> 000003 //*******************************************************
<S11> 000004 //*
<S12> 000005 //*        SAMPLE JCL TO EXECUTE Hiperstation
<S13> 000006 //*                IN UNATTENDED MODE
<S14> 000007 //*
<S15> 000008 //*******************************************************
<S16> 000009 //HIPER2 EXEC PGM=EHSBATCH,REGION=4096K
<S17> 000010 //STEPLIB DD DISP=SHR,DSN=SYS2.HPER.V531.LOAD
<S18> 000011 //SYSLIB DD DSN=USERAB0.REVENUE.SCRIPTS,DISP=SHR
<S19> 000012 //SYSPRINT DD SYSOUT=*
<S20> 000013 //SYSUDUMP DD SYSOUT=*
<S21> 000014 //SYSIN DD *
<S22> 000015  GROUP H01AC054 TERM(5) SUMMARY(*) XLOG(*)
<S23> 000016    SCRIPT(TEST1)
<S24> ****** **************************** Bottom of Data ***************
</OUTPUT>
<INPUT>0000016
<THINK>00.16.845 AT 00:00:50.644
<KEY>ENTER
<CURSOR>03,17
<I01>"sub"
</INPUT>
```

Figure 13 Examples of Analysis, Using Logic, and Using the REXX Log (5 of 6)

```
<OUTPUT>0000019
<RESPONSE>00.01.182
<S01>   File  Edit  Confirm  Menu  Utilities  Compilers  Test  Help
<S02> -------------------------------------------------------------
<S03> EDIT       USERAB0.HIPER.SCRIPTS(BATCHPB) - 01.00          Column
<S04> Command ===> sub                                              Scr
<S05> ****** ***************************** Top of Data ****************
<S06> ==MSG> -CAUTION- Profile changed to CAPS ON (from CAPS OFF) becau
<S07> ==MSG>           data does not contain any lower case characters.
<S08> 000001 //USERAB1C JOB ('OVPBAS5.0.ODSP',P87,9,9),'RYAN COVELL',RE
<S09> 000002 //       NOTIFY=USERAB1,CLASS=2,MSGCLASS=R
<S10> 000003 //******************************************************
<S11> 000004 //*
<S12> 000005 //*        SAMPLE JCL TO EXECUTE Hiperstation
<S13> 000006 //*                IN UNATTENDED MODE
<S14> 000007 //*
<S15> 000008 //******************************************************
<S16> 000009 //HIPER2 EXEC PGM=EHSBATCH,REGION=4096K
<S17> 000010 //STEPLIB DD DISP=SHR,DSN=SYS2.HPER.V531.LOAD
<S18> 000011 //SYSLIB DD DSN=USERAB0.REVENUE.SCRIPTS,DISP=SHR
<S19> 000012 //SYSPRINT DD SYSOUT=*
<S20> 000013 //SYSUDUMP DD SYSOUT=*
<S21> JOB USERAB1C(JOB23067) SUBMITTED
<S22> ***
<S23>
<S24>
</OUTPUT>

/* Press enter until the 'JOB SUBMITTED' message is displayed */
DO loop_ctr = 1 TO 100
   x = POS('SUBMITTED',screen)
   IF x > 0 THEN
      LEAVE
   <INPUT>0000020
<KEY>ENTER
   </INPUT>
END
IF loop_ctr >= 100 THEN
  DO
    SAY TIME() 'Job did not successfully submit. Playback aborted.'
    EXIT
  END

/* Grab the JOBID off from the screen */
job_id = SUBSTR(screen,x - 7,5)

/* Display a message */
SAY TIME() 'Job sucessfully submitted. The JOBID is 'job_id

/* Now loop until the job completes */
DO loop_ctr = 1 TO 100
   IF POS('USERAB1C ENDED',screen) > 0 THEN
      LEAVE
   <WAIT>00,10
   <INPUT>0000020
   <KEY>ENTER
   </INPUT>
END
IF loop_ctr = 100 THEN
  DO
    SAY TIME() 'Job did not seem to end. Playback aborted.'
    EXIT
  END

/* Display the return code status */
return_code_position = POS('MAX COND',screen)
return_code_status = SUBSTR(screen,return_code_position,19)
SAY TIME() 'The batch job ended, status is 'return_code_status
```

Figure 14 Examples of Analysis, Using Logic, and Using the REXX Log (6 of 6)

```
<OUTPUT>0000028
<RESPONSE>00.00.024
<S01> 21.18.29 JOB23067 $HASP165 USERAB1C ENDED AT CW01 - MAX COND CODE
<S02>NAL)
<S03>
<S04>
<S05>
<S06>
<S07>
<S08>
<S09>
<S10>
<S11>
<S12>
<S13>
<S14>
<S15>
<S16>
<S17>
<S18>
<S19>
<S20>
<S21>
<S22>
<S23>
<S24>
</OUTPUT>

The above script actually continues to go the JES log to check the output messages.

The contents of the REXX log created by the above script is displayed below.

Menu  Utilities  Compilers  Help
 -------------------------------------------------------------------------------
 BROWSE    USERAB0.TRAINING.REXX.LOG                  Line 00000000 Col 001 080
 Command ===>                                                  Scroll ===> CSR
********************************* Top of Data **********************************
13:33:08 The script execution has started
13:33:31 Job sucessfully submitted. The JOBID is 27313
13:33:53 The batch job ended, status is MAX COND CODE 0000
13:34:15 The script execution has completed. Bye.
******************************** Bottom of Data ********************************
```

Building Hiperstation Script Statements Using <EXECUTE>

Hiperstation allows you to build script statements (<Inn>, <KEY>, <Snn>, <HEX>, etc.) for immediate execution using the <EXECUTE> statement. The data after the <EXECUTE> statement can contain a mixture of constants and variables as outlined under variable substitution.

Hiperstation allows you to use the <EXECUTE> tag to build script statements but not REXX statements. The REXX programming language includes the INTERPRET statement to provide the same capability for REXX commands, such as CALL, PARSE, DO, and ADDRESS.

The most common use of the <EXECUTE> statement is to vary the number of inputs entered on a screen. For example, an order entry application has a screen where as many as 25 items can be entered per order. The order numbers and item numbers are in an external file. Each statement has an order number and item number. On the screen, order number is input field 1, item numbers are input fields 2 through 26.

```
"EXECIO * DISKR ORDERS (STEM INPUT. FINIS"
DO K=1 TO INPUT.0
   PARSE VAR INPUT.K ORDER.K ITEM.K
END
DO J=1 TO INPUT.0
<INPUT>
<KEY>ENTER
<I01>ORDER.J
DO K=2 to INPUT.0
<EXECUTE>"<IO"||K||">"ITEM.K /*Builds <IOn>ITEM.K*/
END
</INPUT>
END
```

You can also use the <EXECUTE> tag to replace other Hiperstation script pieces with variables. For example, to use REXX to alter which key should be pressed on an input message, you can use the <EXECUTE> tag.

```
IF error = ‘YES’ THEN
   input_key = ‘PF3’
ELSE
   input_key = ‘ENTER’
<INPUT>
<EXECUTE>”<KEY>”||input_key
</INPUT>
```

You can also use <EXECUTE> to decide which input field number to use.

```
IF command_line_location = ‘AT THE TOP’ THEN
   field_number = ‘01’
ELSE
   field_number = ‘15’
<INPUT>
<KEY>ENTER
<EXECUTE>”<I”||field_number||’>”submit”’
</INPUT>
```

Altering Hiperstation Script Statements Using <ALTER> Tags

Hiperstation allows you to modify script statements during playback using the <ALTER> statement. Data after the <ALTER> statement can contain a mixture of constants and variables as discussed in Terminal Input Substitution on page 21. During playback, the resultant string (after variable substitution) completely replaces the script record that follows the <ALTER> statement.

The most common use of the <ALTER> statement is to alter a screen row. For example, an order entry application has a screen with a date field. During playback, a user wants to replace the date in the date field with a new date. Following is sample REXX code to do this:

```
IF y2k = ’Y’ THEN
  new_row = "<S02> Hire Date: 10/12/2000" ELSE
  new_row = "<S02> Hire Date: 10/12/1997"

<OUTPUT>
<S01>
<ALTER>new_row
<S02> Hire Date: 10/12/1997
<S03>
</OUTPUT>
```

Using the <ADDCALL> and <DELCALL> Tags

The <ADDCALL> tag adds a call to a REXX EXEC before each subsequent <INPUT> section. For example, to call a routine named CHECKER that takes an argument — SCREEN — use:

```
</OUTPUT>
<ADDCALL>CHECKER SCREEN.
<INPUT>
```

<ADDCALL> is powerful. You can use it to automatically invoke a routine that checks every screen for items such as error messages or if a compare mismatch occurred. The routine invoked can then take an action such as stopping playback.

There can be only one active EXEC at a time. If another <ADDCALL> is done before a <DELCALL>, the routine it specifies replaces the first <ADDCALL>.

The <DELCALL> tag removes a REXX EXEC added with <ADDCALL>. Basically, it turns off the <ADDCALL>.

Hiperstation HSCMDS Command Environment

Hiperstation has its own command environment for processing commands not found in the non-TSO/E REXX environment. These additional commands add to the functionality of the script language.

HSCMDS Commands

The commands available in the HSCMDS environment are:

- **ALLOC** — Allocates a dataset for use by the EXECIO statement.
- **FREE** — Frees an allocated dataset.
- **GETVSAMR** — Retrieves a VSAM record.

These commands are run using the REXX ADDRESS statement. The ADDRESS statement lists the environment to which the command is submitted and the command itself.

```
►►─ADDRESS──┬─HSCMDS──────┬─"command"─►◄
            └─environment─┘
```

environment

Indicates the name of the environment to which the command is submitted. For Hiperstation, this is always HSCMDS.

command

The command string. Enclose in double quotes except for those portions that contain REXX variables.

For example, run the Hiperstation FREE command to free a previously allocated file. The DD name of the file to free is in the REXX variable ddname.

```
ADDRESS HSCMDS "FREE F(ddname)"
```

ALLOC

```
                                                               ┌─OLD─┐
►►─ALLOC─┬──────────────────────┬─┬──────────────────────────┬─┴─SHR─┴─┬──────┬─►◄
         └─┬─FILE─┬─(ddname)────┘ └─DA─(dataset─┬──────────┬─)┘         └─REUS─┘
           └─F────┘                             └─(member)─┘
```

ddname

The DD name to which the dataset is allocated.

dataset

The fully qualified dataset name. You can enter a member name at the end of the dataset name by enclosing the member name in parentheses. Do not enclose the dataset name in quotes.

SHR|OLD

The disposition of the dataset. OLD is the default.

REUS

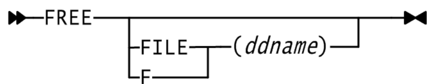
An existing allocation to the DD name is freed.

If the execution of the ALLOC command issues a -1 REXX return code (RC), the true return code can be found in variable HSCMDRC. The value in HSCMDRC is the return code from dynamic allocation. See HSCMDS ALLOC Return Codes on page 50 for information.

For example, member EMPNO in dataset USER1.RECORDS is to be allocated to DD name FILETEST. Allocate the dataset as shared and free any existing allocation.

```
ADDRESS HSCMDS "ALLOC F(FILETEST) DA(USER1.RECORDS(EMPNO)) SHR REUS"
```

Free



ddname

The DD name of the allocated dataset to be freed. For example:

```
ADDRESS HSCMDS "FREE F(FILETEST)"
```

GETVSAMR

```
►►─GETVSAMR──►◄
```

```
ADDRESS HSCMDS "GETVSAMR"
```

This command retrieves a VSAM record. Four REXX variables are used for this command:

- HS_VSAM_DD
- HS_VSAM_KEY
- HS_VSAM_RC
- HS_VSAM_REC

Before issuing this command, HS_VSAM_DD must be set with the allocated DD name of the VSAM dataset and HS_VSAM_KEY must be set with the key. GETVSAMR sets HS_VSAM_RC as follows.

```
/**********************************************/
/* HS_VSAM_RC : Notes                          */
/*      0     : Successful                     */
/*      4     : No record found                */
/*      8     : HS_VSAM_DD problem             */
/*     12     : HS_VSAM_KEY problem            */
/*     14     : HS_VSAM_REC problem            */
/*     16     : HS_VSAM_DD OPEN error          */
/*     24     : Not licensed                   */
/**********************************************/
```

When HS_VSAM_RC is zero, HS_VSAM_REC will contain the VSAM record that matches the one specified in HS_VSAM_KEY.

HSCMDS ALLOC Return Codes

REXX sets a special variable (RC) that contains the return code from the environment command processor. For the HSCMDS environment, the values for RC and their descriptions are as follows:

Table 4 HSCMDS ALLOC Return Codes

RC	Description
-3	The command was not found.
-2	The command contained an invalid parameter.
-1	Execution of the command was not successful.
0	Execution of the command was successful.

If RC is negative, then an ERROR condition can be trapped in the script or EXEC using the SIGNAL ON ERROR or CALL ON ERROR statements. For more information on these statements, see the *TSO/E REXX Reference Manual*.

Hiperstation sets two variables to aid in problem determination for HSCMDS commands. The variable, HSCMD, is set to the name of the last command entered; and the variable, HSCMDRC, is set to the value of the return code resulting from the command. When the REXX RC value is set to -1, check the value of HSCMDRC to determine the return code from the actual command.

You can add REXX code after the ADDRESS HSCMDS ALLOC statement to show the REXX error return code. Figure 15 shows an example of this code.

Figure 15 REXX Example to Display Error Return Code

```
ADDRESS HSCMDS "ALLOC F(LOGONFIL)DA(HIPER.DATA.CNTL(LOGON)) SHR REUS"
  IF RC /= 0 THEN
  DO
    IF RC = -1 THEN
      SAY 'ERROR: HSCMDS ALLOC SVC 99 RC IS: 'žžHSCMDRC
    ELSE
      SAY 'ERROR: HSCMDS ALLOC RETURN CODE IS: 'žžRC
  END
```

This example only shows how to view the return code. It takes no other action when an error occurs. If the return code was placed in HSCMDRC, it is an SVC 99 action code and is not explained in the Hiperstation manuals. Refer to IBM's *MVS AUTH Assembler Services Guide* for information.

Other Examples

This section provides script editing examples.

Modify APPC Script Data - Scenario 1

The following script uses the recommended method for modifying APPC script data — using the <REPLACE> tag inside the <OUTBOUND> section to replace <CMSEND> <CONTENT> data. <REPLACE> uses an offset method to indicate where to start replacing.

Both the offset count and the string of replacement data can be REXX variables (as they are in this example).

Figure 16 Script for Modifying Script Data Using the <REPLACE> Tag

```
<VERSION>8
<ADDCALL>COMPAPPC appc_expected, appc_actual, appc_expected_length,    appc_actual_length
target_domain = "H01AC079"
source_domain = "H01APPCP"
"EXECIO * DISKR MESSAGES (STEM msg_in. FINIS"
say "Message is:" msg_in.port "length:" length(msg_in.port)
<DETAIL COMBINED='*'>
<TIME>2006/11/02_11:22:12.380705
<PIU>
<CONTENT> ï00000001                ßÇ-
‡… l,Ã Ò ^^&úgiig¹         ³  ßH01AC079    #INTERÌ.§©iW¾ÌêUSCWXN01.H01AC079 ßH01AC074-”Áí
   øïhDUSCWXN01.CWXCDRM3USCWXN01.H01AC079ËÍß
<TIME>2006/11/02_11:22:12.385948
<PIU>
<CONTENT> i00000002                -ßÇ‡… ŽõÃ Ò ^^&ú ÃiiÃ ¹         ³       #INTERÌO.§©iW¾Ì    USCWXN01.H01AC074
   -”Áí   øïhDUSCWXN01.CWXCDRM
<TIME>2006/11/02_11:22:12.411075
<PIU>
<CONTENT> |00000003                ßÇ-  …næ   ü J  H3S ÓUSCWXN01.CW010001.§©dì« ê-   AA1 üRIGHT SAID FRED
<TIME>2006/11/02_11:22:12.411075
<CMALLC TPNAME=H3S SENDER=USCWXN01.³³source_domain,
RECEIVER=USCWXN01.³³target_domain,
LOGMODE=#INTER TYPE=MAPPED SYNCLVL=NONE SECURITY=NONE
STIME='2006/11/02_11:22:12.411075'
FTIME='2006/11/02_11:22:12.725288
CONVCORR='-AA1' LUWNAME=USCWXN01.CW010001 LUWINST=,
    '4B9B218446B8'X LUWSEQ='0001'X>
say "Receiver is:" receiver "sender is:" sender
send_data = "RIGHT SID CHRIS"
say "Port number is:" port
dat_len = X2C(length(msg_in.port))
dat_pos = 3
<OUTBOUND>
   <TIME>2006/11/02_11:22:12.411075
   <REPLACE FIELD=(dat_pos,msg_in.port) TYPE=ONE>
   <CMSEND DATATYPE=APPLDATA>
   <CONTENT> Ï 00000004RIGHT SID CHRIS
   <TIME>2006/11/02_11:22:12.411075
   <CMPTR TYPE=FLUSH>
   </OUTBOUND>
<INBOUND>
   <TIME>2006/11/02_11:22:12.725288
   <PIU>
   <CONTENT> Í00000005                -ßÇ  j üDERF DIAS THGIR
   <TIME>2006/11/02_11:22:12.725288
   <CMSEND DATATYPE=APPLDATA>
   <CONTENT> Ï 00000006DERF DIAS THGIR
   <TIME>2006/11/02_11:22:12.725288
   <CMDEAL TYPE=FLUSH LOGDATA=NO>
   </INBOUND>
```

Modify APPC Script Data - Scenario 2

This is an alternative method of modifying APPC script data.

Figure 17 Alternative Method for Modifying APPC Script Data

```
<VERSION>8
<ADDCALL>COMPAPPC appc_expected, appc_actual, appc_expected_length,    appc_actual_length
parse source op_sys how_called scr_name rest
address HSCMDS "ALLOC F(DETAILS) DA(USR2503.TSTEAM.DETAIL("scr_name")",
                " SHR REUS"
"EXECIO * DISKR DETAILS (STEM data_in. FINIS"
address HSCMDS "FREE F(DETAILS)"
parse var data_in.2 len_type "00000002" rest
"EXECIO * DISKR MESSAGES (STEM msg_in. FINIS"
say "Message is:" msg_in.port "length:" length(msg_in.port)
out_data = msg_in.port
data_in.2 = '00'X³³D2C(length(out_data)+12)³³substr(len_type,3,2)³³,
   "00000002"³³out_data
say "length:" C2D(substr(data_in.2,1,2))
new_mem = "H3C1NW"³³RIGHT(port,2,'0')
say "New Member:" new_mem
address HSCMDS "ALLOC F("new_mem") DA(USR2503.TSTEAM.DETAIL("new_mem")) OLD
   REUS"
"EXECIO" data_in.0 "DISKW" new_mem "(STEM data_in. FINIS"
address HSCMDS "FREE F("new_mem")"
detail_mem = "H3C10000"
<DETAIL COMBINED='DETAIL('³³new_mem³³')'>
<TIME>2006/11/02_11:25:54.424879
<PIU LABEL=00000001>
<TIME>2006/11/02_11:25:54.424879
<CMALLC TPNAME=H3S SENDER=USCWXN01.H01APPCP RECEIVER=USCWXN01.H01AC079
   LOGMODE=#INTER TYPE=MAPPED SYNCLVL=NONE SECURITY=NONE
STIME='2006/11/02_11:25:54.424879' FTIME='2006/11/02_11:25:54.435640'
   CONVCORR='-AA1' LUWNAME=USCWXN01.CW010001 LUWINST=,
   '4B9BBC105B62'X LUWSEQ='0001'X>
SAY "Receiver is:" RECEIVER "Sender is:" SENDER "Port:" PORT
<OUTBOUND>
   <TIME>2006/11/02_11:25:54.424879
   <CMSEND DATATYPE=APPLDATA LABEL=00000002>
   <TIME>2006/11/02_11:25:54.424879
   <CMPTR TYPE=FLUSH>
   </OUTBOUND>
<INBOUND>
   <TIME>2006/11/02_11:25:54.435640
   <PIU LABEL=00000003>
   <TIME>2006/11/02_11:25:54.435640
   <CMSEND DATATYPE=APPLDATA LABEL=00000004>
   <TIME>2006/11/02_11:25:54.435640
   <CMDEAL TYPE=FLUSH LOGDATA=NO>
   </INBOUND>
```

To explain the code, we will look at individual pieces.

1. Retrieve the user data from the associated DETAIL member:

```
parse source op_sys how_called scr_name rest
address HSCMDS “ALLOC F(DETAILS) DA(USR2503.TSTEAM.DETAIL(“scr_name”)”,
“SHR REUS”
“EXECIO * DISKR DETAILS (STEM data_in.FINIS”
address HSCMDS “FREE F(DETAILS)”
```

2. Determine which user <CONTENT> data record to modify using the attached LABEL and extract record type information:

```
parse var data_in.2 len_type “00000002” rest
```

3. Retrieve new data from the MESSAGE file and use the replay PORT number (provided by Hiperstation) to select the replacement record for this user:

```
“EXECIO * DISKR MESSAGES (STEM msg_in.FINIS”
out_data = msg_in.port
```

4. Build the replacement user <CONTENT> data record:

```
data_in.2 = ‘00’X||D2C(length(out_data)+12)||substr(len_type,3,2)||,
“00000002”||out_data
```

5. Build member name for replacement DETAIL member that contains the replacement user <CONTENT> record, again using the PORT number for uniqueness:

```
new_mem="H3C1NW"||RIGHT(port,2,'0')
```

6. Create new DETAIL member:

```
address HSCMDS "ALLOC(F("new_mem") DA(USR2503.TSTEAM.DETAIL("new_mem")) OLD
   REUS"
"EXECIO" data_in.0. "DISKW" new_mem "(STEM data_in. FINIS"
address HSCMDS "FREE F("new_mem")"
```

7. Modify <DETAIL COMBINED=...> tag to point to the replacement DETAIL member:

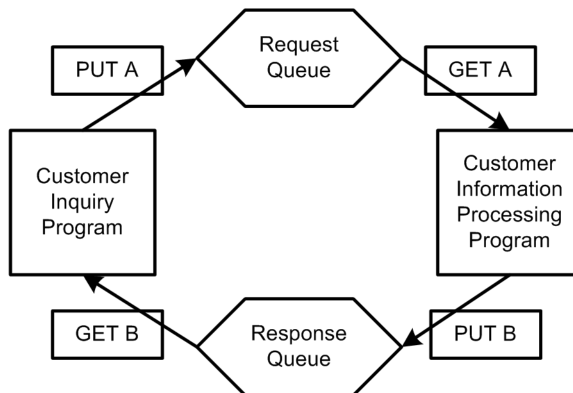
```
<DETAIL COMBINED='DETAIL('||new_mem||')>
```

Modify an MQ Script to Test the Requester

This section provides an example that shows how to modify an MQ script to test the requesting application. In this example, the application flow is as follows:

1. The Customer Inquiry Program PUTs an inquiry to the request queue (PUT A).
2. The Customer Information Processing Program GETs the request (GET A) and processes the inquiry.
3. The processing program PUTs the response on the response queue (PUT B).
4. The inquiry programs GETs the response from the response queue (GET B) and presents it to the user.

Figure 18 MQ Script Application Flow



The inquiry program assigns a unique correlation ID to the request message (PUT A). The correlation ID remains intact all of the way through processing. When the inquiry program retrieves the response (GET B), it uses the correlation ID to match the response with the request.

In this example, the user interface for the inquiry program must be tested to ensure that it is displaying information correctly, yet the processing program is unavailable.

To test the inquiry program, the player must act as the processing program. That is, it must execute GET A and PUT B. To do this, the request queue must contain a request that the player can GET (GET A). Input inquiries after playback starts to populate the queue. However, the correlation ID from the new requests will not match the correlation ID that was initially recorded. To make this scenario work, the player must replace the recorded correlation ID with the new correlation ID.

Further, thorough testing requires displaying several customer records. Achieve this by replacing the customer information in the recorded response (PUT B) with information from an external file. Each

time you submit an inquiry, playback GETs the request and returns a response generated from the records in the external file. Add logic that terminates playback if the GET is unsuccessful or after all of the records have been used.

Start with a script that contains the processing program's activity, GET A and PUT B (Figure 19 and Figure 20). Then add REXX logic to:

- Initialize a Count Variable, page 56
- Read Data from an External File, page 57
- Loop Until an Unsuccessful GET or Last Record is Encountered, page 57
- Process the MQ_PUT Message, page 59.

Each of these sections explains the REXX logic required to achieve the example and indicates where in the script to add the logic. Each section presents the relevant portion of the script along with the additional logic in **bold** text. If you have trouble with context, compare the section with Figure 19 and Figure 20. They show the script as it was recorded.

Figure 19 Page 1 of Script Containing GET A and PUT B as Recorded

```
*
* SCRIPT STARTED ON 2007/02/13 AT 11:12:01
* DESC:
*
<VERSION>07.01.00
<DETAIL COMBINED='*'>

*
*  MQ_CONNECT    *
*
<TIME>2007/02/13_10:56:01.327075
<MQ_CONNECT,
   CONNECTION_ID = 2,
   COMPCODE = 0,
   REASON = 0,
   QMGR_NAME = 'QMGR',
   SYSTEM_NAME = 'SYS1',
   JOBNAME = 'JOB',
   STIME = '2007/02/13_10:56:01.327075'>1
*
* MQ_OPEN *
*
<TIME>2007/02/13_10:56:01.325201
<MQ_OPEN,
   CONNECTION_ID = 2,
   OBJECT_ID = 3,
   COMPCODE = 0,
   REASON   = 0,
   MQOO = (FAIL_IF_QUIESCING,SAVE_ALL_CONTEXT,INPUT_SHARED),
   MQOD_VERSION = 3,
   MQOD_OBJECTNAME_OUT = 'CLIENT.REQUEST.QUEUE',
   MQOD_OBJECTNAME_IN = 'CLIENT.REQUEST.QUEUE',
   MQOD_OBJECTQMGRNAME = '',
   MQOD_DYNAMICQNAME = 'CSQ.*'>2
*
* MQ_OPEN *
*
<TIME>2007/02/13_10:56:01.323695
<MQ_OPEN,
   CONNECTION_ID = 2,
   OBJECT_ID = 2,
   COMPCODE = 0,
   REASON   = 0,
   MQOO = (FAIL_IF_QUIESCING,PASS_ALL_CONTEXT,OUTPUT),
   MQOD_VERSION = 3,
   MQOD_OBJECTNAME_OUT = 'CUSTOMER.RESPONSE.QUEUE',
   MQOD_OBJECTNAME_IN = 'CUSTOMER.RESPONSE.QUEUE',
   MQOD_OBJECTQMGRNAME = '',
   MQOD_DYNAMICQNAME = 'CSQ.*'>3
*
* MQ_GET *
*
<TIME>2007/02/13_10:56:01.327075
<MQ_GET,
   CONNECTION_ID = 2,
   OBJECT_ID = 3,
   COMPCODE = 0,
   REASON   = 0,
   MQMD_EXPIRY = '00001387'X,
   MQMD_ENCODING = '00000222'X,
   MQMD_CODEDCHARSETID = 437,
   MQMD_FORMAT = 'MQSTR',
   MQMD_PRIORITY = '',
   MQMD_PERSISTENCE = NOT_PERSISTENT,
   MQMD_MSGID = '000000000000000000000000000000000000000000000000'X,
   MQMD_BACKOUTCOUNT = '',
   MQMD_REPLYTOQMGR = 'QMGR',
   MQMD_USERIDENTIFIER = 'ASPNET',
   MQMD_ACCOUNTINGTOKEN = '000000000000000000000000000000000000000000000000'X,
   MQMD_PUTAPPLTYPE = WINDOWS_NT,
   MQMD_PUTAPPLNAME = 'APPL',
   MQMD_PUTDATE = '20070213',
   MQMD_PUTTIME = '15560215',
   MQGMO_VERSION = 3,
```

Figure 20 Page 2 of Script Containing GET A and PUT B as Recorded

```
   MQGMO_OPTIONS = (CONVERT,NO_SYNCPOINT),
   MQGMO_RESOLVEDQNAME = 'CLIENT.REQUEST.QUEUE',
   CRNTLEN = 49,
   TRUELEN = 49,
   TRANSLATE=A2E>4
*
* MQ_PUT *
*
<TIME>2007/02/13_10:56:03.799357
<MQ_PUT,
   CONNECTION_ID = 2,
   OBJECT_ID = 2,
   COMPCODE = 0,
   REASON   = 0,
   MQMD_EXPIRY = '00001388'X,
   MQMD_FORMAT = 'MQSTR',
   MQMD_PERSISTENCE = NOT_PERSISTENT,
   MQMD_MSGID = '000000000000000000000000000000000000000000000000'X,
   MQMD_CORRELID = 'C3E2D840D7D4D8D44040404040404040BC70741C817B6021'X
   MQMD_BACKOUTCOUNT = '',
   MQMD_USERIDENTIFIER = 'ASPNET',
   MQMD_ACCOUNTINGTOKEN = '1A0FD4F5F2F0C3C8C9D5F3F9F8C2F7C3F3F000398B7C300000000'X,
   MQMD_PUTAPPLTYPE = WINDOWS_NT,
   MQMD_PUTAPPLNAME = '',
   MQMD_PUTDATE = '20070213',
   MQMD_PUTTIME = '15560215',
   MQPMO_OPTIONS = (FAIL_IF_QUIESCING,PASS_ALL_CONTEXT,NO_SYNCPOINT),
   MQPMO_RESOLVEDQNAME = 'CLIENT.RESPONSE.QUEUE',
   MQPMO_RESOLVEDQMGRNAME = 'QMGR',
   CRNTLEN = 1000,
   TRUELEN = 1000>6
   <CONTENT> þ 000000020000000000000000000000000000      000000000
*
* MQ_CLOSE *
*
<TIME>2007/02/13_10:56:03.802374
<MQ_CLOSE,
   CONNECTION_ID = 2,
   OBJECT_ID = 2,
   COMPCODE = 0,
   REASON   = 0,
   MQCO = (NONE)>8
*
* MQ_CLOSE *
*
<TIME>2007/02/13_10:56:03.801748
<MQ_CLOSE,
   CONNECTION_ID = 2,
   OBJECT_ID = 3,
   COMPCODE = 0,
   REASON   = 0,
   MQCO = (NONE)>7
*
* MQ_DISCONNECT *
*
<TIME>2007/02/13_10:56:03.823516
<MQ_DISCONNECT,
   CONNECTION_ID = 2,
   COMPCODE = 0,
   REASON   = 0>9
```

Initialize a Count Variable

The looping logic in this example requires a count variable. At the beginning of the script, after the <VERSION> tag, initialize the variable.

```
* SCRIPT STARTED ON 2007/02/13 AT 11:12:01
* DESC:
*
<VERSION>07.01.00
<DETAIL COMBINED='*'>

i= 0
```

Read Data from an External File

Reading data from the external file is the next required step. After variable initialization, before the connection is established, insert an EXECIO statement to read the records into a REXX stem variable, 'reply_message'. This results in a series of reply_message.*n* variables, where *n* indicates the record number. Include a FINIS parameter to close the file after all of the records have been read.

```
*
"EXECIO*DISKRINDATA(STEMreply_message.FINIS"

*
*  MQ_CONNECT    *
*
<TIME>2007/02/13_10:56:01.327075
<MQ_CONNECT,
   CONNECTION_ID = 2,
   COMPCODE = 0,
   REASON = 0,
   QMGR_NAME = 'QMGR',
   SYSTEM_NAME = 'SYS1',
   JOBNAME = 'JOB',
   STIME = '2007/02/13_10:56:01.327075'>1
*
* MQ_OPEN *
*
<TIME>2007/02/13_10:56:01.325201
<MQ_OPEN,
   CONNECTION_ID = 2,
   OBJECT_ID = 3,
   COMPCODE = 0,
   REASON   = 0,
   MQOO = (FAIL_IF_QUIESCING,SAVE_ALL_CONTEXT,INPUT_SHARED),
```

Loop Until an Unsuccessful GET or Last Record is Encountered

Because the script contains only a single transaction, looping logic must be added to the script to execute the GET and process the response message the correct number of times. If the GET is unsuccessful or there are no more records to process, the loop must terminate. To do this:

1. Before the MQ_GET tag that retrieves the request, insert a DO statement to execute the MQ_GET until all records have been processed (DO i=1 TO replay_message.0). 'reply_message.0' represents the total number of records.
2. Add a WAIT parameter to the MQGMO_OPTIONS to avoid executing multiple MQ_GETS on an empty queue.
3. After the MQ_GET tag, insert an IF statement that checks the reason code to ensure that the GET is successful. Use the Hiperstation for WebSphere MQ REXX variable ACTUAL_REASON to return the reason code. If the reason code equals zero, increment the count and set the length value (new_len) used for processing the response message to the length of the current record (reply_message.i).
4. After the MQ_PUT that delivers the response, insert an END statement that ends the current loop and returns to the beginning of the DO loop, providing the IF statement condition is met. That is, the MQ_GET is successful.
5. After the END statement, insert an ELSE statement that terminates the loop if the MQ_GET is unsuccessful. To terminate the loop, set the value of i to 'reply_message.0'.
6. After the ELSE statement, insert another END statement to terminate the DO loop when all records from the external file have been processed.

```
DO i= 1 TO reply_message.0
*
* MQ_GET *
*
<TIME>2007/02/13_10:56:01.327075
<MQ_GET,
   CONNECTION_ID = 2,
   OBJECT_ID = 3,
   COMPCODE = 0,
   REASON   = 0,
   MQMD_EXPIRY = '00001387'X,
   MQMD_ENCODING = '00000222'X,
   MQMD_CODEDCHARSETID = 437,
   MQMD_FORMAT = 'MQSTR',
   MQMD_PRIORITY = '',
   MQMD_PERSISTENCE = NOT_PERSISTENT,
   MQMD_MSGID = '000000000000000000000000000000000000000000000000'X,
   MQMD_BACKOUTCOUNT = '',
   MQMD_REPLYTOQMGR = 'QMGR',
   MQMD_USERIDENTIFIER = 'ASPNET',
   MQMD_ACCOUNTINGTOKEN = '00000000000000000000000000000000000000000000'X,
   MQMD_PUTAPPLTYPE = WINDOWS_NT,
   MQMD_PUTAPPLNAME = 'APPL',
   MQMD_PUTDATE = '20070213',
   MQMD_PUTTIME = '15560215',
   MQGMO_VERSION = 3,
   MQGMO_OPTIONS = (WAIT,CONVERT,NO_SYNCPOINT),
   MQGMO_RESOLVEDQNAME = 'CLIENT.REQUEST.QUEUE',
   CRNTLEN = 49,
   TRUELEN = 49,
   TRANSLATE=A2E>4
   IF ACTUAL_REASON = 0 THEN
      DO
         i = i + 1
         new_len = LENGTH(reply_message.i)
*
* MQ_PUT *
*
<TIME>2007/02/13_10:56:03.799357
<MQ_PUT,
   CONNECTION_ID = 2,
   OBJECT_ID = 2,
   COMPCODE = 0,
   REASON   = 0,
   MQMD_EXPIRY = '00001388'X,
   MQMD_FORMAT = 'MQSTR',
   MQMD_PERSISTENCE = NOT_PERSISTENT,
   MQMD_MSGID = '000000000000000000000000000000000000000000000000'X,
   MQMD_CORRELID = 'C3E2D840D7D4D8D44040404040404040BC70741C817B6021'X
   MQMD_BACKOUTCOUNT = '',
   MQMD_USERIDENTIFIER = 'ASPNET',
   MQMD_ACCOUNTINGTOKEN = '1A0FD4F5F2F0C3C8C9D5F3F9F8C2F7C3F3F000398B7C3'X,
   MQMD_PUTAPPLTYPE = WINDOWS_NT,
   MQMD_PUTAPPLNAME = '',
   MQMD_PUTDATE = '20070213',
   MQMD_PUTTIME = '15560215',
   MQPMO_OPTIONS = (FAIL_IF_QUIESCING,PASS_ALL_CONTEXT,NO_SYNCPOINT),
   MQPMO_RESOLVEDQNAME = 'CLIENT.RESPONSE.QUEUE',
   MQPMO_RESOLVEDQMGRNAME = 'QMGR',
   CRNTLEN = 1000,
   TRUELEN = 1000>6
   <CONTENT> þ 0000000200000000000000000000000000000      000000000
  END  ***Response is complete, return to MQ_GET Loop
 ELSE
    i=reply_message.0  ***GET failed, set value of i to terminate loop
END  ***End of external file, terminate loop
```

Process the MQ_PUT Message

The correlation ID that was recorded must be replaced with the correlation IDs from the live requests that are in the request queue. Additionally, the recorded response message must be replaced with the records from the external file.

1. Before the MQ_PUT tag that delivers the response and after the IF statement added in the last step, initialize a variable with the value of the current request's correlation ID. Use the Hiperstation REXX variable ACTUAL_CORRELID to return the actual correlation ID from the preceding MQ_GET. The correlation ID must be enclosed in single quotes and followed by the letter X to signify hexadecimal format. Therefore, the opening single quote, and the closing single quote and letter X, must be enclosed in double quotation marks.
2. Inside the MQ_PUT tag, replace the value of the MQMD_CORRELID parameter with the NEW_CORRELID variable.
3. Above the CONTENT tag associated with the MQ_PUT, insert the REPLACE tag to replace the recorded customer information with the current record from the external file (reply_message.i). The REPLACE tag requires a FIELD parameter that defines the offset and replacement value. It also supports an optional LENGTH parameter. Set the offset to 0 to begin replacing data with the first byte, set the replacement value to reply_message.i, which is the current record, and set the length value to new_len, which is the length of the current record.

```
NEW_CORRELID = " ' "ACTUAL_CORRELID " 'X"
*
* MQ_PUT *
*
<TIME>2007/02/13_10:56:03.799357
<MQ_PUT,
   CONNECTION_ID = 2,
   OBJECT_ID = 2,
   COMPCODE = 0,
   REASON   = 0,
   MQMD_EXPIRY = '00001388'X,
   MQMD_FORMAT = 'MQSTR',
   MQMD_PERSISTENCE = NOT_PERSISTENT,
   MQMD_MSGID = '000000000000000000000000000000000000000000000000'X,
   MQMD_CORRELID = NEW_CORRELID,
   MQMD_BACKOUTCOUNT = '',
   MQMD_USERIDENTIFIER = 'ASPNET',
   MQMD_ACCOUNTINGTOKEN = '1A0FD4F5F2F0C3C8C9D5F3F9F8C2F7C3F3F000398B7C3'X,
   MQMD_PUTAPPLTYPE = WINDOWS_NT,
   MQMD_PUTAPPLNAME = '',
   MQMD_PUTDATE = '20070213',
   MQMD_PUTTIME = '15560215',
   MQPMO_OPTIONS = (FAIL_IF_QUIESCING,PASS_ALL_CONTEXT,NO_SYNCPOINT),
   MQPMO_RESOLVEDQNAME = 'CLIENT.RESPONSE.QUEUE',
   MQPMO_RESOLVEDQMGRNAME = 'QMGR',
   CRNTLEN = 1000,
   TRUELEN = 1000>6
   <REPLACE FIELD(0,reply_message.i) LENGTH=new_len>
   <CONTENT> þ 00000002000000000000000000000000000000      000000000
  END  ***Response is complete, return to MQ_GET Loop
 ELSE
    i=reply_message.0  ***GET failed, set value of i to terminate loop
END  ***End of external file, terminate loop
*
* MQ_CLOSE *
*
<TIME>2007/02/13_10:56:03.802374
<MQ_CLOSE,
   CONNECTION_ID = 2,
   OBJECT_ID = 2,
   COMPCODE = 0,
   REASON   = 0,
   MQCO = (NONE)>8
*
```

```
* MQ_CLOSE *
*
<TIME>2007/02/13_10:56:03.801748
<MQ_CLOSE,
   CONNECTION_ID = 2,
   OBJECT_ID = 3,
   COMPCODE = 0,
   REASON   = 0,
   MQCO = (NONE)>7
*
* MQ_DISCONNECT *
*
<TIME>2007/02/13_10:56:03.823516
<MQ_DISCONNECT,
   CONNECTION_ID = 2,
   COMPCODE = 0,
   REASON   = 0>9
```

Common Programming Interface

The Hiperstation high-level language, common programming interface (HLL CPI) allows programs written in REXX to accomplish the following:

- Establish sessions with transaction processing facilities (such as CICS and IMS/DC) that use VTAM and 3270 communication protocol
- Simulate a terminal operator's typed input
- Send data to a transaction processing facility in either 3270 or field level formats
- Interrogate and examine the output terminal data
- Run Hiperstation scripts
- Terminate the session.

The terms *input* and *output* are used throughout this chapter. These terms are consistent with the CPU's point of view. Input is data flowing from the 3270 devices to the domain destination. Output is data coming from the domain destination and going to the virtual 3270.

Overview

The Common Programming Interface (CPI) is not related to embedding REXX code in a Hiperstation script and, therefore, does not deal with script language capability. Use the CPI to write a normal REXX program that can talk to an online application.

Perhaps, you want to write a REXX program that logs on to a CICS region, performs a sign-on, executes some online transactions, and logs off from the application. Rather than accomplishing this by playing back a script, use the CPI to take Hiperstation's automation capabilities to another level. If you wrote a REXX program that executed continuously all day as a started task, this program could periodically read from a transaction file, take that data, log onto IMS, and automatically enter that data into the online application. Or, it could periodically scan other areas (files and screens, for example) and automatically log on to the e-mail system and send a message to a system programmer if it discovers a problem. If you are running a web server system on your mainframe, you can create web pages that communicate to legacy applications. You do all this by writing a REXX CGI program that uses Hiperstation's REXX CPI to handle communication to the legacy online application.

By interfacing with Hiperstation, the REXX program "talks" to the online application through a Hiperstation virtual terminal. You do this by invoking a function called HSCPI, which is not a standard REXX function and is not documented in any REXX manual.

Before you can invoke the HSCPI function from a REXX program, you must define the HSCPI function to REXX (see "Define a Function Package Directory for REXX CPI" in the *Hiperstation Installation and Configuration Guide*).

Call Interface

The CPI operates as a REXX function. The function name is HSCPI. A typical call might look like:

```
HSCPI('LOGON','SESID', TSOVAR)
```

The first argument in the CALL parameter list identifies the action to be taken by the CPI. This argument is referred to as the verb.

The second argument always contains the name of a REXX variable to be used as a session identifier or session-ID. The session-ID is returned by the LOGON verb and is used in subsequent calls to identify the session on which the verb is to operate.

The HSCPI function call also returns a return code. The return code is placed in a REXX variable via an assignment statement:

```
RC = HSCPI('LOGON','SESID', TSOVAR)
```

Session IDs

Hiperstation uses a session ID to identify the session. The session is created during the successful execution of a LOGON verb, and the session ID is returned to the calling program as one of the parameters. Subsequent calls to the CPI pass the session-ID as a means of identifying the session to Hiperstation as in:

```
HSCPI('LOGON','SESID', tsovar)
```

Parameters

The CPI uses two types of parameters: (1) character strings of a variable length, and (2) integers.

All integers are of the full word type. In some calls, a variable amount of data may flow back and forth between the caller and called program.

Some of the parameters are mandatory. Others are optional. Optional parameters are shown in square brackets [ ]. In the following example, the verb and session-ID are required, and the key-ID is optional:

```
HSCPI('SEND','SESID',[key-ID])
```

DD Requirements

The CPI uses three DD statements:

- HPERIN DD
- HPERLIB DD
- HPEROUT DD.

The HPERIN DD contains the CONTROL statement that defines Hiperstation's execution environment.

The HPERLIB DD defines the datasets that contain any prerecorded scripts used by the EXECUTE verb. If the EXECUTE verb is not used, the HPERLIB DD is not required.

The HPEROUT DD defines the dataset containing Hiperstation status messages as well as any output from REXX that is generated via an executed script.

Verbs

The Hiperstation HLL CPI provides the following verbs for communication management:

- **LOGON:** Establishes a session with a domain destination.
- **LOGOFF:** Terminates a session created by LOGON.
- **EXECUTE:** Executes a prerecorded Hiperstation for VTAM script.

- **SEND:** Transmits data from the input buffer to the domain destination. Hiperstation waits for a response from the domain destination.
- **RECEIVE:** This verb is obsolete. Its function has been included in the SEND verb.
- **TYPE:** Places data in an input field.
- **RETRIEVE:** Copies data from the screen to variables in the caller's program.
- **COPY3270:** Copies the current screen in 3270 format to a variable in the user's program.
- **REPL3270:** Replaces the 3270 input data stream.

This section describes the purpose of each verb, the operands associated with it, and its return codes.

Logon

The LOGON verb establishes a session with a domain destination. The domain destination name is set as one of the operands.

The session, or port-ID, is returned in the listed REXX variable following successful session establishment.

Logon Verb Operands

```
HSCPI(
'LOGON',
'session-ID',
domain-destination-data)
```

session-ID

The name of the REXX variable containing the returned session-ID. This identifier is required for further communication with the CPI.

domain-destination-data.

The name of the domain destination.

Return Codes

Table 5 Hiperstation Return Codes for the Logon CPI Verb

<table>
<tr><th>Code</th><th>Description</th></tr>
<tr><td>0</td><td>The session has been successfully connected.</td></tr>
<tr><td>8</td><td>Initialization error:
All virtual terminals busy.
Domain destination not active.
HPERIN not allocated.
Check the system log for messages EHSnnnn or ETnnnnnn for more detail.</td></tr>
<tr><td>16</td><td>Error: Invalid script statement found</td></tr>
<tr><td>20</td><td>Serious Error:
Port could not be started because LU2 application is not valid or not active.
Port started, but could not be initialized.
REXX EXEC/script not found.</td></tr>
<tr><td>24</td><td>Serious Error: The first port to start could not get started — the unattended mode process is terminated. If other ports started, unattended mode continues.</td></tr>
<tr><td>28</td><td>SEVERE ERROR: Port subtask could not be started.
SYSPRINT could not be opened or error processing SYSPRINT.
SYSIN could not be opened or error processing SYSIN.
SYSCNTL could not be opened or error processing SYSCNTL.
User failed security authorization.
Either LU2 or LU6.2 pool names could not be built from the provided prefix and suffix values.
Product is not licensed for LU6.2 (APPC) unattended mode processing.
LU6.2 is not supported for LU6.2 scripts.
Trace could not be initialized.
No terminals found to be played back.
VTAM initialization error.
A syntax error exists on the JOURNAL, LOG, XLOG, RLOG, AUTODOC, SUMMARY, or TRACE keywords on the CONTROL, GROUP, ALLOCATE, or COMPARE statements.</td></tr>
<tr><td>32</td><td>SERIOUS ERROR: A print file is full or could not be processed. The print files are the JOURNAL, LOG, XLOG, RLOG, AUTODOC, SUMMARY, and TRACE files.</td></tr>
<tr><td>40</td><td>SEVERE ERROR: Hiperstation is about to expire or has expired. Contact Hiperstation Customer Support for a date extension and new release availability information.</td></tr>
</table>

Logoff

LOGOFF terminates the session with the domain destination and frees all resources acquired during the session.

Logoff Verb Operands

```
HSCPI(
'LOGOFF',
'session-ID')
```

session-ID

The name of the REXX variable that contains the session-ID returned by the LOGON verb.

Return Codes

Table 6 Return Codes for Logoff CPI Verb

Code	Description
0	The session has been terminated.
64	Session-ID was invalid.

Execute

The EXECUTE verb executes a Hiperstation script.

Execute Verb Operands

```
HSCPI(
'EXECUTE',
'session-ID',
scriptname)
```

session-ID

The name of the REXX variable that contains the session-ID returned by the LOGON verb.

scriptname

The eight-byte name of a Hiperstation for VTAM script. The script must be in the HPERLIB DD statement.

Return Codes

Table 7 Return Codes for Execute CPI Verb

Code	Description
0	The script ran successfully.
4	The script was not found in the HPERLIB DD definition.
8	The HPERLIB DD statement was not defined.
64	Session-ID was invalid.

Send

Following a SEND operation, Hiperstation waits until either a response is received from the domain destination or until a timeout occurs. Available input data is sent to the domain destination. The SEND verb allows you to choose the PF or PA key to be transmitted.

Send Verb Operands

```
HSCPI(
'SEND',
'session-ID',
 [key-ID])
```

session-ID

The name of the REXX variable that contains the session-ID returned by the LOGON verb.

key-ID

The name of the attention identifier key used to transmit the data (for example, PF1, PA2, etc.). If this operand is omitted, transmit the data using the Enter key.

Return Codes

Table 8 Return Codes for Send CPI Verb

Code	Description
0	The data was sent.
4	Invalid AID key.
64	Session-ID was invalid.

Receive

This verb is obsolete. Its function has been included in the SEND verb. It appears here for downward compatibility.

Receive Verb Operands

```
HSCPI(
'RECEIVE',
'session-ID')
```

session-ID

The name of the REXX variable that contains the session-ID returned by the LOGON verb.

Return Codes

Table 9 Return Codes for Receive CPI Verb

Code	Description
0	The data has been received.
64	Session-ID was invalid.

Type

The TYPE verb places data in an input field in the 3270 screen image. You can enter the data at screen locations by row and column coordinates or by 3270 field number.

Type Verb Operands

```
HSCPI(
'TYPE',
'session-ID',
[row],
[column],
[field-number],
data)
```

session-ID

The name of the REXX variable that contains the session-ID returned by the LOGON verb.

row

Designates the row number of the input field. This number is relative to one.

column

Designates the column number of the input field. This number is relative to one.

field-number

Indicates the input field number to place the data in. This number is relative to one.

data

Data to be placed in the input field.

Return Codes

Table 10 Return Codes for the Type CPI Verb

Code	Description
0	The data has been placed in the input field.
4	The field number does not exist.
8	No input field at the entered row and column.
12	The data was truncated.
64	Session-ID was invalid.

Retrieve

Retrieve obtains data from the screen buffer and places it in the caller's variables.

The data can be retrieved by row and column coordinates or by a 3270 field number. You can obtain the entire screen image by omitting both the row/column and field numbers.

When the entire screen image is returned, the attributes are translated into pseudo-attributes to distinguish them from the textual data.

Retrieve Verb Operands

```
HSCPI(
'RETRIEVE',
'session-ID',
[row],
[column],
[field-number],
'data',
max-data-length,
['returned-data-length'])
```

session-ID

The name of the REXX variable that contains the session-ID returned by the LOGON verb.

row

Designates the row number of a field. This number is relative to one.

column

Designates the column number of a field. This number is relative to one.

field-number

Indicates the field number from which to retrieve data. This number is relative to one.

data

The name of the REXX variable containing the returned data.

max-data-length

Maximum length of the data that can be returned.

returned-data-length

The name of the REXX variable containing the actual length of the returned data.

Return Codes

Table 11 Return Codes for Retrieve CPI Verb

Code	Description
0	The data has been retrieved.
4	The field number does not exist.
8	The row and column exceed the screen dimensions.
12	The requested data was truncated because it exceeded the max-data-length.
64	Session-ID was invalid.

Copy3270

This verb copies the 3270 output screen buffer to the applications buffer. The screen is built as a 3270 data stream. The returned buffer contains both the write command and the WCC.

Copy3270 Verb Operands

```
HSCPI(
'COPY3270',
'session-ID',
'buffer',
max-buffer-length,
['returned-buffer-length'])
```

session-ID

The session-ID returned by the LOGON verb.

buffer

The name of a REXX variable containing the returned buffer.

max-buffer-length

The largest size data stream that the application can accept. The buffer should be approximately 4096 bytes long.

returned-buffer-length

The name of a REXX variable containing the actual length of the returned data.

Return Codes

Table 12 Return Codes for Copy3270 CPI Verb

Code	Description
0	Buffer successfully built.
12	The requested buffer was truncated because it exceeded the max-buffer-length.
64	Session-ID was invalid.

REPL3270

REPL3270 Replaces the 3270 input buffer. The data replaced is in 3270 format. The data must be in 3270 short read format, and it must be preceded by a 3270 AID definition (the row and column of the cursor followed by the screen data).

REPL3270 Verb Operands

```
HSCPI(
'REPL3270',
'session-ID',
buffer)
```

session-ID

The session-ID returned by the LOGON verb.

buffer

A buffer in 3270 input format.

Return Codes

Table 13 Return Codes for REPL3270 CPI Verb

Code	Description
0	The data was successfully stored in the buffer.
64	Session-ID was invalid.

Sample REXX EXEC

Figure 21 on page 70 is a sample REXX EXEC to log a user onto TSO, issue **=x** at the ISPF Primary Option Menu, and issue logoff at the TSO READY prompt to terminate the session. Calls to the “display” subroutine are made after each type and send request to show the current screen contents. This EXEC can be found in member CPIREXX of INSTALL.

Figure 21 Sample REXX EXEC

```
 PURPOSE: DEMONSTRATE THE USE OF HSCPI  Before you can use this REXX example, you
need to do the following:
 1. Follow the Install Instructions for the HSCPI (refer to "Define a Function
Package Directory for REXX CPI" in the Hiperstation Installation Guide.
 2. Allocate the HPERIN and HPEROUT DDs to your TSO session. See “DD Requirements”
on page 3-2 for more information.
 3. Allocate the HPERLIB DD if you want to be able to run Hiperstation scripts
within REXX.

"ALLOC F(HPERIN) DSNAME('USERAB0.REXX.EXEC(CONTROL)') SHR REUSE"
"ALLOC F(HPEROUT) DSNAME('USERAB0.REXX.EXEC(HIPROUT2)') SHR REUSE"
 /* REXX */
 y = 'TSO'                          /* data can be in a variable */
 x = hscpi('logon','SESID',y)
 say 'session ID is:' SESID         /* what is our session ID? */
 say 'return from logon:' x         /* a little trace */

 x = hscpi('type','SESID',2,2,,'TSOHP22')     /* type in userID */
 say 'return from type:' x
 call display SESID

 x = hscpi('send','SESID','enter')            /*  send data with enter key */
 say 'return from send:' x
 call display SESID

 x = hscpi('type','SESID',8,21,,'BLUE')       /* type in password */
 say 'return from type:' x
 call display SESID

 z = 'enter'
 x = hscpi('send','SESID',z)                  /*  send data with enter key */
 call display SESID

 x = hscpi('send','SESID','enter')            /* get rID of *** */
 call display SESID

 x = hscpi('type','SESID',2,15,,'=X')         /* put =x on ispf main menu */
 say 'return from type:' x
 call display SESID

 x = hscpi('send','SESID','enter')
 call display SESID

 x = hscpi('type','SESID',2,2,,'logoff')      /* logoff at ready prompt */
say 'return from type:' x
call display SESID

x = hscpi('send','SESID','enter')
call display SESID

x = hscpi('logoff','SESID')
say 'return from logoff:' x
exit

 display: procedure                 /*  display current screen image */
 arg SESID
 x = hscpi('retrieve','SESID',0,0,0,'DATA',1920)
 DATA = translate(DATA, '          ','01 02 03 04 05 06 07 08 09'x)
 do x = 24 to 1 by -1          /*  remove attribute at start of each line *1
    z = ((x-1)*80)+1
    DATA = delstr(DATA,z,1)
 end
 say 'session ID is:' SESID
 say DATA
 return
 "FREE F(HPERIN)"
 "FREE F(HPEROUT)"
```

3270 Repository Filtering and Copy Utility

Use the 3270 Repository Filtering and Copy Utility (EHS3COPY) to create subset repositories containing specific activity. Filter by any of the following criteria:

- Terminal LU
- VTAM APPLID
- User ID
- Session date-timestamps
- Message date-timestamps.

Write the filtered activity to a repository dataset or pass it to an exit program for further processing. For example, you need to audit the activity that transpired on a specific day relevant to a specific vehicle, but the repository contains several days worth of activity. To create a repository containing only the activity of interest:

1. Write an exit-program that scans the repository for information specific to the vehicle, such as Vehicle Identification Number (VIN).
2. Run the EHS3COPY utility with session date-time criteria and specify the exit-program to receive the filtered activity.

EHS3COPY is a batch utility that requires control statements. Plug the control statements into the JCL used to run the utility. Hiperstation provides a series of samples to help you write exit-programs and build JCL.

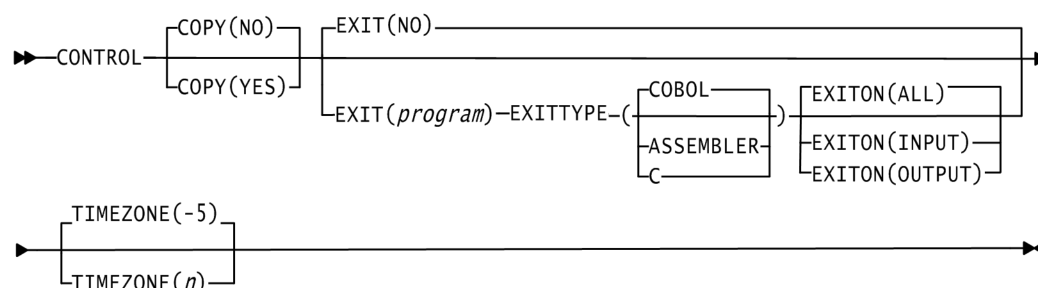
Creating EHS3COPY Control Statements

EHS3COPY is a batch utility that requires the following control statements:

- CONTROL Statement on page 71
- COPY Statement on page 72.

Place these statements in the JCL used to run the utility. Save time by starting with one of the JCL samples that Hiperstation provides. See Preparing the JCL on page 76 for more information.

CONTROL Statement



COPY(NO|YES)

Specifies whether to create an output repository. Default is NO (no output). YES creates an output repository containing all 3270 sessions that satisfy established filters.

If you use the sample JCL to run EHS3COPY, and you pass the data to an exit program modeled on one of the provided samples, do not supply the COPY parameter. The sample exit programs generate CONTROL and COPY statements into the CONTROL DD. CONTROL DD is used as the SYSIN for the second invocation of EHS3COPY, the copy step.

EXIT(NO|program)

Specifies whether an exit program is called with each terminal input and output. Only 3270 data is passed. Default is NO (no exit program is called). Entering a program name specifies an exit program to call. Program must be in COBOL II, Assembler, or C. If you specify an exit program, you must specify the EXITON() parameter.

Any non-zero return code from EXIT terminates the copy function.

EXITTYPE(COBOL|ASSEMBLER|C)

The language of the exit program specified on the EXIT parameter, if any.

EXITON(ALL|INPUT|OUTPUT)

Specifies when an exit program is to be called based on type of message. If you use this parameter, you must specify an exit program using EXIT(*program*).

ALL calls a user-exit program for all messages. **INPUT** calls a user-exit program for input messages only. **OUTPUT** calls a user-exit program for output messages only.

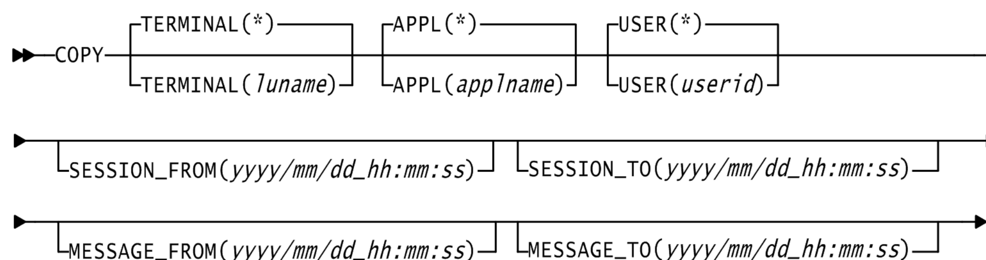
TIMEZONE(-5|n)

Time difference in your area from Greenwich Mean Time (GMT). Default is -5 (Eastern Standard time).

COPY Statement

The COPY statement provides filtering criteria. Place the COPY statement after the CONTROL statement in the JCL.

The COPY statement is optional. However, if you omit a COPY statement, but specify COPY(YES) on the CONTROL statement, all 3270 repository records are copied to the output repository. If COPY statements are added, there is a limit of 1,000 per execution.



TERMINAL(*|luname)

The LU name of the terminal associated with the sessions you need to copy. If filtering by terminal ID is unnecessary, omit this parameter. Otherwise, supply:

– A specific LU name.

– A range of LU names — An LU name prefix followed by an asterisk (*) wildcard character.

APPL(*|applname)

The APPLID associated with the sessions you need to copy. If filtering by application name is unnecessary, omit this parameter. Otherwise, supply:

– A specific APPLID.
– A range of APPLIDs — An APPLID prefix followed by an asterisk (*) wildcard character.

USER(*|userid)

The user ID associated with the sessions you need to copy. If filtering by user ID is unnecessary, omit this parameter. Otherwise, supply:

– A specific user ID.
– A range of user IDs — A user ID prefix followed by an asterisk (*) wildcard character.

SESSION_FROM(yyyy/mm/dd_hh:mm:ss)

If specified, a session time greater than or equal to the specified time is copied.

SESSION_TO(yyyy/mm/dd_hh:mm:ss)

If specified, a session time lesser than or equal to the specified time is copied.

MESSAGE_FROM(yyyy/mm/dd_hh:mm:ss)

If specified, a message time greater than or equal to the specified time is copied.

MESSAGE_TO(yyyy/mm/dd_hh:mm:ss)

If specified, a message time lesser than or equal to the specified time is copied.

Writing Exit Programs

User-written exit programs can be written in Assembler, COBOL, and C. The Hiperstation install library (INSTALL) contains sample programs including source code, exit data area, compile JCL, and run JCL.

Data passed to the user-exit program includes (from COBOL example in EHS3XDCB):

```
*01  EHS3COPY-EXIT-DATA.
   10  EXIT-ID            PIC X(8).
     88  EXIT-DATA-ID     VALUE 'EXITDATA'.
   10  EXIT-DATA-LENGTH   PIC S9(8)  COMP SYNC.
   10  FUNC               PIC S9(8)  COMP SYNC.
     88  EHS3COPY-EXIT-INIT   VALUE 1.
     88  EHS3COPY-EXIT-VSBE   VALUE 2.
     88  EHS3COPY-EXIT-TERM   VALUE 3.
     88  EHS3COPY-EXIT-ABEND  VALUE 4.
   10  RC                 PIC S9(8)  COMP SYNC.
   10  TERM               PIC X(8).
   10  APPL               PIC X(8).
   10  USER               PIC X(8).
   10  VSSSMSTR           PIC X(8).
   10  SESSION-START-TIME.
*        YYYY/MM/DD_HH:MM:SS.MMMMMM FORMAT
     20  EHS3YEAR         PIC X(4).
     20  S1               PIC X.
     20  EHS3MNTH         PIC X(2).
     20  S2               PIC X.
     20  EHS3DAY          PIC X(2).
     20  U                PIC X.
     20  EHS3HOUR         PIC X(2).
     20  C1               PIC X.
     20  EHS3MIN          PIC X(2).
```

```
         20  C2                PIC X.
         20  EHS3SEC           PIC X(2).
         20  D                 PIC X.
         20  EHS3MCRS          PIC X(6).
       10  MESSAGE-TIME.
      *        YYYY/MM/DD_HH:MM:SS.MMMMMM FORMAT
         20  EHS3YEAR          PIC X(4).
         20  S1                PIC X.
         20  EHS3MNTH          PIC X(2).
         20  S2                PIC X.
         20  EHS3DAY           PIC X(2).
         20  U                 PIC X.
         20  EHS3HOUR          PIC X(2).
         20  C1                PIC X.
         20  EHS3MIN           PIC X(2).
         20  C2                PIC X.
         20  EHS3SEC           PIC X(2).
         20  D                 PIC X.
         20  EHS3MCRS          PIC X(6).
       10  VSBE.
         20  VSBEID            PIC X(4).
           88  VSBE-DATA-ID    VALUE 'VSBE'.
         20  VSBELEN           PIC S9(8)  COMP SYNC.
         20  VSBEDIR           PIC X.
           88  VSBEIN          VALUE X'02'.
           88  VSBEOUT         VALUE X'01'.
         20  VSBEFLAG          PIC X.
         20  VSBETIME          PIC X(8).
         20  VSBETH.
             30  FID           PIC X.
             30  FILLER        PIC X(23).
             30  FID4DCF       PIC S9(4)  COMP SYNC.
      *        THE SIZE OF TIOA = FID4DCF - 3.
         20  VSBEDATA.
             30 VSBERH        PIC X(3).
             30  VSBE-DATA     PIC X(16297).
             30  TIOA     REDEFINES VSBE-DATA.
                40  FILLER     PIC X(16297).
```

Tips for Writing Exit Programs

1. The user-exit program is loaded once and called at each message. Initialize at INIT call (for example, reading search strings) once for performance, and write the result at the TERM call. The call type is passed in the FUNC area with the following level 88 values:

```
10  FUNC                PIC S9(8)  COMP SYNC.
  88  EHS3COPY-EXIT-INIT   VALUE 1.
  88  EHS3COPY-EXIT-VSBE   VALUE 2.
  88  EHS3COPY-EXIT-TERM   VALUE 3.
  88  EHS3COPY-EXIT-ABEND  VALUE 4.
```

2. The VSBEDIR field contains the following values:

```
20  VSBEDIR           PIC X.
  88  VSBEIN          VALUE X'02'.
  88  VSBEOUT         VALUE X'01'.
```

   VSBEIN is 3270 input. VSBEOUT is 3270 output.

3. In the exit program, TIOA size is calculated by this formula:

```
SIZE OF TIOA = FID4DCF-3
```

   Write the exit program so that it does not reference storage beyond the address of TIOA + TIOA length. Otherwise, the exit program may get storage protection errors (MVS abend 0C4).

   You need to know some 3270 datastream basics to write the exit program.

a. For output, the first byte in TIOA is 3270 command code.

```
Command
======================
(X'F1')Write
(X'F5')Erase/Write
(X'7E')Erase/Write Alternate
(X'F2')Read Buffer
(X'F6')Read Modified
(X'6E')Read Modified All
(X'6F')Erase all Unprotected
(X'F3')Write Structured Field
```

b. For input, the first byte in TIOA is 3270 AID (Attention IDentifier).

```
AID
========================
(X'60')No AID generated
(X'E8')No AID generated - printer only
(X'88')Structued Field
(X'61')Read Partition
(X'7F')Trigger Action
(X'F0')Test Req and Sys Req
(X'F1') to (X'F9') F1 to F9
(X'7A') to (X'7C') F10 to F12
(X'C1') to (X'C9') F13 to F21
(X'4A') to (X'4C') F22 to F24
(X'6C')PA1
(X'6E')PA2
(X'6B')PA3
(X'6D')Clear
(X'6A')Clear partition
(X'7D')Enter
(X'7E')Selector Pen
(X'E6')Magnetic Readers: Operator ID reader
(X'E7')Magnetic Readers: Mag Reader Number
```

4. One 3270 session can have multiple session control blocks. The first control block cannot contain the user ID because of the way Global Recording creates repository records.

   a. To select an entire session, use EHS3COPY with a user-exit (see ‘C’ sample in EHS3SXC) to create a control file to copy in step 4.c. Specify COPY(NO) in this step. Calling a user-exit program takes more processing time. Use the parameters in the COPY statement to reduce processing overhead by filtering records before the utility calls the user-exit program.

```
CONTROL COPY(NO) EXIT(EHS3SXC) EXITTYPE(C)
COPY TERMINAL(filter-information) APPL(filter-information) USER(filter-
information)
```

The COPY statement is optional. Also, in the //SCANINFO DD line, provide a “SCAN=*string*” (up to 75 bytes) card input or a “SELECT_ALL” to select every record. You can specify multiple scan strings.

For user ID selection, specify:

```
COPY USER(userid)
```

For an actual copy job with COPY(YES) parameter, the USER parameter should not be used in most cases.

Example of COPY Statement syntax:

```
//SYSIN DD *
CONTROL COPY(YES) EXIT(NO)
COPY USER(SJPHXA1) -
SESSION_FROM(2011/04/06_14:30:00) TERMINAL(DHPR*)
/*
```

Notice that there is a hyphen indicating a continuation of the COPY USER line. Also there is a space between the SESSION_FROM() and TERMINAL() parameters.

b. The output from the exit program (see 'C' sample in EHS3SXC) goes to the //REPORT DD //CONTROL DD file.

c. Run EHS3COPY with the control file created in step 4.a. If you want to modify the program, modify and compile the sample C program in INSTALL. The compile JCL is in INSTALL member EHS3CJC. The Hiperstation load library (SQQFLOAD) contains the EHS3SXC program.

Preparing the JCL

Hiperstation provides a series of samples to aid you in running the utility and writing your own exit programs (Table 14). Locate these samples in the Hiperstation install library (typically INSTALL). Member $EHS3IDX is an electronic index of these samples.

Table 14 Sample to Run EHS3COPY Utility and Aids for Authoring Exit Programs

Member	Description
EHS3CJA	JCL to assemble exit program written in Assembler
EHS3CJC	JCL to compile exit program written in C
EHS3CJCB	JCL to compile exit program written in COBOL
EHS3COPY	JCL to search and select/copy sessions
EHS3COP	JCL to copy sessions by terminal
EHS3RJA	JCL for using exit program written in Assembler
EHS3RJC	JCL for using exit program written in C
EHS3RJCB	JCL for using exit program written in COBOL
EHS3SCAN	JCL to search strings in a repository file
EHS3SXA	Source code for sample exit program written in Assembler
EHS3SXC	Source code for sample exit program written in C **Note:** This sample is ready for immediate use. It has been compiled and linked. Execute this program with sample member EHS3COPY. Within EHS3COPY, on the SCAN statement, specify the text to use for filtering. All matching activity is copied to the new repository.
EHS3SXCB	Source code for sample exit program written in COBOL
EHS3XDA	Layout of data passed to the exit program from EHS3COPY (Assembler)
EHS3XDC	Layout of data passed to the exit program from EHS3COPY (C)
EHS3XDCB	Layout of data passed to the exit program from EHS3COPY (COBOL)

JCL Examples

This section contains two examples of JCL that invokes EHS3COPY. The first is a simple scan and copy job. The second invokes a user-exit to scan the repository.

The following example invokes EHS3COPY to scan the repository and copies the activity from terminal VT15* through VT18* into a new repository. It also copies a user ID from the specified time

frame with the specified terminal. The COPY USER(USERA1) example line continues to the next line. The hyphen denotes the continuation. Also notice that there is a space between the SESSION_FROM() and TERMINAL() parameters.

```
//ST060 EXEC PGM=EHS3COPY,REGION=32M,PARM='POSIX(OFF)/'
//*
//STEPLIB DD DISP=SHR,DSN=COMPWARE.QQF160.SQQFLOAD
//REPOSIN DD DISP=SHR,DSN=CICSGOT.REPOSIT.ASOX01
//REPOSOUT DD DISP=SHR,DSN=CICSGOT.REPOSIT.ASOC04
//SYSPRINT DD SYSOUT=*
//SYSOUT DD SYSOUT=*
//CEEDUMP DD SYSOUT=*
//CONTROL  DD SYSOUT=*,DSORG=PS,RECFM=FB,LRECL=80
//SYSIN DD *
CONTROL COPY(YES) EXIT(NO)
COPY TERMINAL(VT15*)
COPY TERMINAL(VT16*)
COPY TERMINAL(VT17*)
COPY TERMINAL(VT18*)
COPY USER(USERA1) -
SESSION_FROM(2011/04/06_14:30:00) TERMINAL(DHPR*)
/*
```

The next example incorporates a user exit that scans the repository for sessions containing the text “green chev”, then copies those sessions to a new repository.

```
//*....... JOB ...PLACE YOUR INSTALLATION'S JOBCARD HERE...
//*
//* BEFORE YOU SUBMIT THE JOB, PERFORM THE FOLLOWINGS:
//* (1) ADD THE PROPER JOB CARD.
//* (2) CHANGE QALOAD= assignment with  your Hiperstation LOADLIB.
//* (3) CORRECT repository file names (REPOSIN and REPOSOUT)
//*
//*   START of PROC definition
//REPOCOPY PROC QALOAD='COMPUWARE.QQF160.SQQFLOAD',
//              REPOIN=,REPOOUT=
//DELETE EXEC PGM=IEFBR14
//DD1      DD DISP=(MOD,DELETE),DSN=&REPOOUT.,
//            SPACE=(CYL,(1,1),RLSE),
//            DSORG=PS,RECFM=VB,LRECL=32756,BLKSIZE=32760
//*
//SCAN   EXEC PGM=EHS3COPY,REGION=0M,PARM='POSIX(OFF)/'
//STEPLIB  DD DISP=SHR,DSN=&QALOAD.
//REPOSIN  DD DISP=SHR,DSN=&REPOIN.
//*SYSUDUMP DD SYSOUT=*
//SYSPRINT DD SYSOUT=*
//SYSOUT   DD SYSOUT=*
//CEEDUMP  DD SYSOUT=*
//CONTROL  DD DSN=&&CONTROL,DISP=(NEW,PASS),
//            SPACE=(CYL,(1,1)),
//            DSORG=PS,RECFM=FB,LRECL=80
//REPORT   DD DSN=&&REPORT,DISP=(NEW,PASS),
//            SPACE=(CYL,(1,1)),
//            DSORG=PS,RECFM=VB,LRECL=125
//*
//LISTRPT  EXEC PGM=IDCAMS,REGION=1024K,
//            COND=(4,LT,SCAN)
//INPUT    DD DSN=*.SCAN.REPORT,DISP=(OLD,PASS)
//OUTPUT   DD SYSOUT=*
//SYSPRINT DD DUMMY
//*
//LISTCNTL EXEC PGM=IDCAMS,REGION=1024K,
//            COND=(4,LT,SCAN)
//INPUT    DD DSN=*.SCAN.CONTROL,DISP=(OLD,PASS)
//OUTPUT   DD SYSOUT=*
//SYSPRINT DD DUMMY
//*
```

```
//COPY    EXEC PGM=EHS3COPY,REGION=0M,PARM='POSIX(OFF)/',
//             COND=(4,LT,SCAN)
//STEPLIB  DD DISP=SHR,DSN=&QALOAD.
//REPOSIN  DD DISP=SHR,DSN=&REPOIN.
//REPOSOUT DD DISP=(NEW,CATLG,DELETE),
//             DSN=&REPOOUT.,
//             SPACE=(CYL,(1,1),RLSE),
//             DSORG=PS,RECFM=VB,LRECL=32756,BLKSIZE=32760
//*SYSUDUMP DD  SYSOUT=*
//SYSPRINT DD SYSOUT=*
//SYSOUT   DD SYSOUT=*
//CEEDUMP  DD SYSOUT=*
//CONTROL  DD SYSOUT=*,DSORG=PS,RECFM=FB,LRECL=80
//SYSIN    DD DSN=*.SCAN.CONTROL,DISP=(OLD,PASS)
//         PEND
//*   END of PROC definition
//*
//SAMPLE   EXEC REPOCOPY,
//         REPOIN='REPOSITI',
//         REPOOUT='REPOSITO'
//*
//* THE 1ST EHS3COPY (SCAN) IS SCANNING MESSAGES
//* THE 2ND EHS3COPY (COPY) IS SELECT/COPY
//*
//SCAN.SYSIN    DD *
CONTROL COPY(NO) EXIT(EHS3SXC) EXITTYPE(C)
//*
//* SCANINFO file for user exit program EHS3SXC
//*  Search strings (max length of 75) are provided
//*  in this file prefixed by SCAN=
//*  examples:
//*    SCAN=USERAB
//*    SCAN=green chev
//*  SELECT_ALL in lieu of SCAN= will select all
//SCAN.SCANINFO DD *
SCAN=greenchev
//LISTRPT.SYSIN    DD *
REPRO INFILE(INPUT) OUTFILE(OUTPUT)
//LISTCNTL.SYSIN    DD *
REPRO INFILE(INPUT) OUTFILE(OUTPUT)
//
```

Guidelines for Successful Stress Testing

The last and perhaps most important step in a testing process is stress testing. Performing a stress test is a delicate and complex process that can consume people, system resources, and time. Through careful planning and using the proper tools, organizations can successfully perform consistent, repeatable stress testing to help ensure ongoing application and system quality.

Planning the Stress Test

Because of the extensive resources required to perform a stress test, comprehensive planning is crucial. Do not proceed with testing until you have a test plan in place that has been approved by everyone, and you have acquired all of the necessary resources.

Create a Test Plan

Solid planning up front helps you make the best use of your testing product. Be sure your test plan meets the following objectives:

- States your testing objectives.
- States the expected results.
- Specifies who is responsible for each phase of the test.
- Specifies what monitoring tools will be used.
- Specifies who will set up the testing environment.
- Specifies who will restore the testing environment after the test.
- Specifies the applications that will be used to perform the test.
- Specifies when the test is complete.
- Specifies who will analyze the test results.

Take into account that all components of the operating system, hardware, and application will be used in the test. To perform a DB2 stress test, for example, the application must be executed, the CICS or IMS regions must dispatch the work, and MVS must dispatch the CICS or IMS regions. Because any or all of these components could fail as a result of the test, include in your plan the appropriate technical specialists for these areas to help identify failures, any adverse effects on performance, and to resolve problems.

Stress tests can affect other applications executing in the environment. To ensure that results of the stress test can be measured while preserving the integrity of other applications, execute stress tests on evenings and weekends, or at other times when production activity is low.

Sample Stress Test Plan

State your testing objectives

A customer has decided to simulate 800 users to a single CICS region.

Test Description

The accounting database will be exercised to determine how much data can be processed before response time is affected. Account add programs ACCT1234 and ACCT1235 will be exercised. The database can handle the current production load of 500 adds per minute, so the stress test begins at this point. This baseline test establishes baseline measurements from which future test results can be

tracked. Each subsequent test increases the number of adds per minute by 50 until database response time diminishes to below the acceptable level of 1.0 seconds per transaction.

Number of Hiperstation Batch Jobs Involved

Prior tests indicate that each execution of the Hiperstation unattended batch (UAPB) job can drive 500 transactions per minute, which results in 300 accounting adds per minute. The test begins with two UAPB jobs until a rate of 600 accounting adds per minute has been achieved. At this point, a third UAPB job is added. These UAPB jobs execute on MVSPROD, which removes Hiperstation overhead from stress test statistics.

Number of Tests

The test begins with two UAPB jobs until a rate of 600 accounting adds per minute is achieved. At this point, a third UAPB job is added. These jobs execute on MVSPROD, which again removes Hiperstation overhead.

State the Expected Test Results

Test results are measured during each test execution. Measurements include:

- MVS paging rate
- CPU use
- CCS paging rate
- OSCORE use
- number of times a MAX and AMAX are reached
- transaction response time.

Database measurements include:

- response time
- number of deadlocks
- number of deadly embraces.

Channel busy and channel contention can also be measured.

Specify the applications that will be used to perform the test

The tests will execute in MVSTEST, CICS test region 1 using the ACCTADD database. CICS test region 1 should be configured to handle 1000 active transactions with a maximum of 1020. Storage size and OSCORE should reflect current production definition. Virtual terminal definitions for Hiperstation for VTAM should be added to VTAM and CICS test region 1. The ACCTADD database should be defined with enough threads to handle 600 concurrent users.

Specify who is responsible for each phase of the test

Each test begins at 8:00 p.m. and ends no later than 6:00 a.m. on Saturday and Sunday. One hour before and after the test is dedicated to setting up and restoring the testing environment.

Specify who will set up the testing environment and restore it after the test

The following staff is required to attend each test execution:

- MVS Specialist
- CICS Specialist
- VTAM Specialist
- Accounting Representative
- DBA Specialist
- Quality Assurance
- Test Manager.

Specify when the test is complete

Testing ends when response time drops below 1.0 seconds per transaction, or when 900 accounting adds per minute is achieved.

Set Up the Test

Establish the testing environment to alleviate bottlenecks and skewing of test results. Take CICS tasks and storage, database threads, and VTAM storage into consideration. Also, because Hiperstation for VTAM uses virtual terminals to execute multiple terminal activity, the definitions for these terminals are required in VTAM and in the CICS region. These definitions should reflect the terminal type normally used in production. A database or file restore from a baseline is also required.

To set up a WebSphere MQ test, clear the queues accessed by the CICS region, and ensure that they are not available to applications other than Hiperstation for WebSphere MQ.

Overhead

The main objective of stress testing is to load the system with enough data to simulate application performance requirements. Turn off Hiperstation parameters, such as comparing results and dubbing, that are not required during stress testing. This reduces overhead and frees Hiperstation to adequately stress system components.

Hiperstation for VTAM and Hiperstation for Mainframe Servers' APPC functions use the unattended playback batch job EHSBATCH to perform stress testing. Whenever possible, separate EHSBATCH from the environment being tested. This might involve executing EHSBATCH on a different CPU or LPAR. Removing the job from the environment removes any overhead that EHSBATCH incurs in terms of storage and CPU usage. It also allows a separate MVS to dispatch EHSBATCH tasks and manage the presentation of VTAM messages. The resulting analysis provides a true picture of environment performance.

If you are performing a WebSphere MQ test with Hiperstation for WebSphere MQ or TCP/IP tests with Hiperstation for Mainframe Servers, execute program TCPPBMN. This program normally runs on the same system as the CICS region or Web application being tested. You can run TCPPBMN on a different LPAR to reduce contention for resources.

Priority

MVS dispatches work processed by CPUs based on priority. In most data processing environments, batch jobs have the lowest priority of all work on the machine because they are long-running tasks and use large amounts of resources. Because Hiperstation performs stress testing using EHSBATCH, the systems programmer must ensure its dispatching priority is immediately below VTAM.

TCPPBMN needs to be included with EHSBATCH as a named program. Region size should be 0M.

Region Size

Set the region size for EHSBATCH to 0M. This allows MVS to give EHSBATCH as much storage as needed to perform the test.

Multiple EHSBATCH Jobs

If one EHSBATCH job does not simulate enough virtual terminals to stress the system enough, start more EHSBATCH jobs until the number of virtual terminal simulations is adequate.

Multiple TCPPBMN Jobs

Often an MQGROUP statement can be used to simulate a single WebSphere MQ user. If COUNT is used on the MQGROUP statement, then the value associated with COUNT indicates the number of

users that TCPPBMN will simulate. For example, COUNT(10) simulates ten users. The maximum number of MQGROUP statements that TCPPBMN can play is approximately 400.

Often a SOCKETS statement can be used to simulate a single TCP/IP user. If the COUNT statement appears on the SOCKETS statement, then the value associated with COUNT indicates the number of users that TCPPBMN will simulate. For example, COUNT(10) simulates ten users. The maximum number of SOCKETS that TCPPBMN can play is approximately 400.

If modifications to the test scripts are required, make the changes before you use the script in a stress test.

Execute the Test

When you run one huge stress test that includes all terminals, applications, queues, and databases, the large number of components makes it difficult to determine causes if the test fails. Not knowing the exact cause of the problem could lead to improper decisions based on the stress test results.

Start your stress test with a small number of virtual terminals within one EHSBATCH job. This determines if the test plan executes well and the test environment is set up properly.

Start your WebSphere MQ or TCP/IP stress test with a small number of messages within the TCPPBMN job. Confirm that the test environment is set up properly, and that a single script can be played multiple times. Often, in WebSphere MQ messages, one or more fields make that message unique (for example, the MsgID field in the message descriptor).

Work from Small to Large

As each test completes successfully, incrementally increase the number of virtual terminals/messages or TCP connections and retest. Change the number of simulated users by changing the TERM parameter (for 3270 playbacks) or the COUNT parameter (for WebSphere MQ and TCP/IP playbacks). You may need to start an additional job to obtain increased volume.

Journals

Do not invoke journals. When performing stress tests, the main objective is to lead the system according to requirements. Writing the results of the playback to external files could prevent Hiperstation from sending data quickly enough to stress a system component.

Caching

Turn caching on. Caching reduces storage and overhead used by Hiperstation and makes storage and CPU cycles available for stress testing.

Using the Stress Test Results

The VTAM Playback Summary Report lets you view the results of your stress test, such as number of transactions, response time, think time, and comparison checks. The success or failure of the test should tie back to the definition of the completed test as defined in the test plan. Results can be used in a number of ways:

- to determine performance levels
- to reveal unexpected results
- to make improvements.

For WebSphere MQ and TCP/IP playbacks, use one or more COLLECT statements to gather pertinent information. Normally these are transaction or message counts. The COLLECT statements direct TCPPBMN to create a file containing the statistics requested by the COLLECT statements. This file can be used to generate reports.

Determine Performance Levels

For example, a number of stress tests are performed on a DB2 database to identify the number of DB2 calls the database can handle before performance degrades.

The results of each test can be posted to a spreadsheet that monitors the number of DB2 calls, number of transactions, and transaction response times. This collective information can be used to perform multiple stress tests in which the number of calls is raised incrementally with each test until transaction performance begins to suffer. These results can then be included in the stress testing documentation as well as forwarded to management for review.

Reveal Unexpected Results

Because stress testing can exercise multiple components, it is important that you have a way to identify specific areas that fail as a result of the stress test. In the previous DB2 example, increasing the number of database calls requires that you increase the number of CICS transactions. This puts additional stress not only on the database, but also on CICS and MVS, which supports the CICS region. A situation could arise where the CICS region has problems handling the additional volume, which would prohibit the increased database calls from being presented to the database. Stress testing often yields unexpected results, and these results should be documented and presented as part of the overall stress testing results.

Make Improvements

Stress test results often indicate bottlenecks or areas that contributed to the failure of a stress test. This information can be used as the starting point for a plan of action for areas that need improvement. The plan might also indicate who owns these non-compliant areas, and who is responsible for correcting them. The results of the stress test and any action plans can be used to prepare for the next stress test and to compare test results to ensure there is no regression.