

# **Com-plete**

## **Com-plete HTTP Server**

Version 6.8.1

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This document applies to Complete Version 6.8.1 and all subsequent releases.

Specifications contained herein are subject to change and these changes will be reported in subsequent release notes or new editions.

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# Com-plete HTTP Server

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This documentation describes the HTTP server component of Com-plete. It includes the following documents:

## General Information

<a href="#">Introduction to the HTTP Server</a>	Introduces you to the HTTP Server, including the CGI programming concept.
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## Installation and Configuration

<a href="#">General Installation Information</a>	Describes the required environments for installing the HTTP server, the prerequisite software, the distribution media, and the general installation process.
<a href="#">Installation on z/OS</a>	Describes the installation procedure on z/OS systems.
<a href="#">Installation on z/VSE</a>	Describes the installation procedure on z/VSE systems.
<a href="#">Customizing and Using the HTTP Server</a>	Describes how to initialize, customize and use the HTTP Server.
<a href="#">Installing Natural CGI</a>	Describes the environment and installation procedures to enable Natural CGI processing,
<a href="#">The Com-plete 3270 Bridge</a>	Describes how 3270 terminal oriented applications can be called via the HTTP server.

## Reference and Maintenance

<a href="#">Security</a>	Discusses how to setup security for the HTTP server.
<a href="#">Programming CGI Requests</a>	Describes the CGI interface modules and how to call them.
<a href="#">Running CGI Programs under Com-plete</a>	Provides information about running application programs under Com-plete.
<a href="#">Support and Maintenance</a>	Describes the procedure for reporting problems and applying bugfixes.
<a href="#">The HTTP Server User Exit</a>	Describes the user exit interface.
<a href="#">Messages and Codes</a>	Explains messages and codes issued by the HTTP server, including remedial information.
<a href="#">Sample Members</a>	Lists the supplied sample jobs and tells you what they are used for.





# 1 About this Documentation

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## Document Conventions

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Convention	Description
<b>Bold</b>	Identifies elements on a screen.
Monospace font	Identifies service names and locations in the format <code>folder.subfolder.service</code> , APIs, Java classes, methods, properties.
<i>Italic</i>	Identifies:  Variables for which you must supply values specific to your own situation or environment. New terms the first time they occur in the text. References to other documentation sources.
Monospace font	Identifies:  Text you must type in. Messages displayed by the system. Program code.
{ }	Indicates a set of choices from which you must choose one. Type only the information inside the curly braces. Do not type the { } symbols.
	Separates two mutually exclusive choices in a syntax line. Type one of these choices. Do not type the   symbol.
[ ]	Indicates one or more options. Type only the information inside the square brackets. Do not type the [ ] symbols.
...	Indicates that you can type multiple options of the same type. Type only the information. Do not type the ellipsis (...).

## Online Information and Support

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### Software AG Documentation Website

You can find documentation on the Software AG Documentation website at <http://documentation.softwareag.com>. The site requires credentials for Software AG's Product Support site Empower. If you do not have Empower credentials, you must use the TECHcommunity website.

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- Use the online discussion forums, moderated by Software AG professionals, to ask questions, discuss best practices, and learn how other customers are using Software AG technology.
- Link to external websites that discuss open standards and web technology.

## **Data Protection**

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Software AG products provide functionality with respect to processing of personal data according to the EU General Data Protection Regulation (GDPR). Where applicable, appropriate steps are documented in the respective administration documentation.

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# 2 Introduction to the HTTP Server

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This section of the documentation tells you how the HTTP server works. It discusses the Complete implementation of the CGI interface for C programs; the Complete extensions to CGI for 3GL languages and Natural; and the Complete conversational CGI program concept.

## The HTTP Server

---

The HTTP server, based on the HTTP version 1.1 standard, is built on the capabilities of the Complete API and the Software AG Complete system. It can form the heart of a worldwide web site on the mainframe operating system and provides the vital link between the mainframe resident data and a company intranet or internet web site.

The HTTP server has the following highlights:

- Any form of data including static HTML pages, GIF files, JAVA classes can be delivered from the mainframe host to an HTTP user. Users of browsers on PCs or UNIX systems can access data on the mainframe.
- For text-based data, the HTTP server handles all EBCDIC/ASCII issues using configurable translation tables.
- Common Gateway Interface (CGI) support is fully integrated with the Complete API so that C CGI programs that comply with the CGI 'standard' can run.
- Extensions provided by the HTTP server make it possible for Natural , COBOL and PL/1 programs to operate as the target of CGI requests.
- When SAF security checking is active and the HTTP server is running under Complete, the HTTP server interfaces fully with three different modes of operation from running all users with the same SAF authorization to a situation where each and every user must provide a user ID and password to the HTTP server before any requests are serviced.
- When running in the Complete environment, one or more HTTP servers listening on different ports can be operational within the same Complete.
- Each HTTP server may operate with a different security mode.

## Complete Implementation of the Common Gateway Interface (CGI)

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**Note:** General information about the Common Gateway Interface (CGI) protocol is available on the Internet. You can use any search engine available on the Internet to find the CGI information.

## Com-plete CGI Input Processing

CGI input is processed according to the standard and depends on the HTTP request method used to invoke the CGI program:

- When the 'GET' HTTP request method is used, the input parameters are provided in the `QUERY_STRING` environment variable and any attempt to access stdin results in an 'end of file' condition being raised.
- When the 'POST' HTTP request method is used, the input parameters are provided as a stdin stream and may be read using any valid Com-plete function to read stdin input. The amount of input to be expected may be determined from the `CONTENT_LENGTH` environment variable.

## Input Translation

All data from the web browser is submitted in standard 7-bit ASCII codes. The HTTP server translates to EBCDIC and sets up headers in standard EBCDIC format as appropriate.

- When the input content type, as specified by the `CONTENT-TYPE` HTTP header, indicates that the input is type `TEXT`, the input is translated from ASCII to EBCDIC and is made available to the application program in EBCDIC format.
- When the input content type is `TEXT/X-WWW-URLENCODED`, any hex values in the data as specified by `%xx` where 'xx' is the ASCII hex code for the character being submitted to the CGI request, have the 'xx' translated to the appropriate EBCDIC hex representation of that character. The application may then safely convert this value to a character and be sure that it will be the desired EBCDIC equivalent of that character.

For example, the equals character '=' has an ASCII representation of `X'3D'` while it has an EBCDIC representation of `X'7E'`. In the `TEXT/X-WWW-URLENCODED` stream, it appears as `'%3D'`. The HTTP server processing converts this to `'%7E'` so that the user program sees the EBCDIC representation of the character.

## Com-plete CGI Output Processing

CGI output is sent to the stdout stream using any standard C functions normally used to send output to stdout.

## Header Processing

The application may provide all, some, or none of the HTTP headers, which provides the greatest flexibility in responding to requests. Two forms of output headers can be supplied:

- nonparsed header (NPH) output; and
- parsed header output.

### Nonparsed Header Output

Nonparsed header (NPH) output is supported. It is identified by the string 'HTTP' sent as the first four characters of output. The Com-plete CGI processing routines simply pass all data to the browser directly from the CGI application, so the CGI application can send any header it wishes and any data it likes. The CGI program is then completely responsible for accuracy.



**Note:** If a CGI application sends all HTTP headers itself, conversational processing is not supported for the HTTP server.

### Parsed Header Output

In most cases, a user CGI program provides a single HTTP header: the `CONTENT-TYPE`. This is sent as the first string in response to a CGI request and is followed by two `CRLF` sequences indicating that the data follows (headers are followed by only one `CRLF` sequence). Optionally, the application may include more than the `CONTENT-TYPE` header before sending the `CRLF``CRLF` sequence followed by data.

If Com-plete does not detect a `CONTENT-TYPE` header in the first output from the CGI program, it includes a `CONTENT-TYPE` header using the default content type for the HTTP server processing the request. Following the `CONTENT-TYPE` header, the user may submit zero or more HTTP headers.

Alternatively, the `LOCATION` header may be sent as the first (and only) header. No `CONTENT-TYPE` header is sent and the `LOCATION` header is handled according to the HTTP protocol.

### Providing No HTTP Headers

When a program sends no HTTP headers at all, which happens if an application was written to `stdout` in a number of environments, the HTTP server inserts a default `CONTENT-TYPE` header as specified in the `DFLCONT` configuration parameter. Software AG recommends that you set this parameter to `TEXT/PLAIN` to accommodate all programs. Other content types may cause confusing results.



## Output Translation Processing

All HTTP headers, whether generated by Com-plete or the CGI program, are expected in EBCDIC and are translated by the HTTP server to ASCII prior to being sent to the CGI requester. This ensures that application programs have readable headers included instead of setting up ASCII data streams using EBCDIC tools and editors.

Com-plete also monitors the data stream for the start of the content itself, which is signified by a CRLF CRLF sequence in the output data stream (headers are followed by only one CRLF sequence). Once the CRLF CRLF sequence is detected, all other data is treated as output content.

Com-plete translates output content from EBCDIC to ASCII only if the output type sent by the CGI program, or defaulted by the HTTP server, is of type TEXT/\* . This includes TEXT/PLAIN , TEXT/HTML but also occurs for any other user TEXT/x-application-\* type content headers.

Any other content types are sent through unchanged to the requester of the CGI program. This facilitates downloading binary data of any sort.

## Com-plete CGI Environment Variables

The following table summarizes the environment variables and their contents set up as a result of a CGI request processed by Com-plete:

Environment Variable	Contains ...
REQUEST_METHOD	a value indicating the HTTP request method used to generate the request. Normally this is GET or POST and indicates where the input data, if any, can be found.
SERVER_PROTOCOL	the version level of the HTTP protocol used to send the request to the server. Normally this has the form HTTP Vv.r where 'v' and 'r' indicate the level of HTTP being used.
SERVER_PORT	the HTTP port number being used to service requests by this HTTP server.
CONTENT_LENGTH	the length of the input data available on the stdin stream for processing CGI requests generated by the POST request method.
CONTENT_TYPE	the type of the input data available on the stdin stream for processing CGI requests generated by the POST request method.
QUERY_STRING	the parameters provided with a content type of TEXT/X-WWW-URLENCODED for CGI requests generated by the GET request method.
PATH_INFO	the piece of the URL used to invoke the CGI program following the CGI program name.
PATH_TRANSLATED	the physical path used to run the CGI program, which may differ on some systems from the URL path. The translated path is always the same as the URL path when running under the HTTP server.
SCRIPT_NAME	the piece of the URL up to the end of the CGI program name. SCRIPT_NAME and PATH_INFO together compose the URL.
REMOTE_USER	the remote user ID provided with the HTTP request.

In addition to the above, all HTTP headers are set up as environment variables by prefixing them with the string 'HTTP\_' and translating all '-' or dash characters in the HTTP header name to '\_' or underscore characters as per the CGI standard. For example, the header 'LOCATION' may be obtained by requesting 'HTTP\_LOCATION' if this header was provided on the request.



**Note:** All HTTP environment variable names are uppercase EBCDIC values.

## Com-plete CGI Termination Processing

When a CGI program terminates normally, it sends all output data to the stdout stream and returns control to the HTTP server. The HTTP server ensures that all data is sent to the web browser and then closes the connection.

When the HTTP client browser supports persistent sessions, the data is sent to the browser but instead of closing the connection, the HTTP server waits for another request over the same connection.

When a CGI program terminates abnormally either by ABENDING or not returning control to the HTTP server, the web browser may receive some or none of the data sent by the CGI program. In this case, the HTTP server's priority is to clean up the session by closing the connection and freeing all resources associated with that request, thus preventing resource 'leaks' that would otherwise impact the integrity of the HTTP server later in its cycle.

The HTTP server configuration parameter `SEND` determines the amount of data seen:

- If `SEND=IMMEDIATE` is set, the client browser sees all data written to stdout to the point where the program ABENDs. Software AG recommends that you set this option in a test environment.
- If `SEND=BUFFERED` is set, the client browser only sees data if the buffer was filled at least once prior to the ABEND. All data in the buffer at the time of the ABEND is lost. Software AG recommends that you set this option in a production environment for greater performance.

## Com-plete CGI Extensions

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Now that you understand how a CGI request is generated and processed by a CGI program, this section describes in general terms how languages use the Com-plete CGI extensions. The language-specific sections provide additional detail.

## Standard CGI Operation

CGI is essentially a remote procedure call (RPC) type request driven by an HTML page that results in a request being sent to the HTTP server to run a specific program. The request includes data from the browser filled in by the user of the HTML page that generated the request.

The HTTP server

- recognizes the CGI request;
- makes information from the submitted HTML page and information about the actual request available in the execution environment of the CGI application; and
- gives control to the program identified by the request.

Information is made available

- by using the C stdin stream for certain types of input; and
- by setting up well known environment variables that may be accessed using the getenv function.

By writing to the stdout stream, output is submitted back to the requester with the response.

## Non-C CGI Programs

The CGI standard was designed specifically for the C language; however, many installations need to leverage their current skills by providing CGI support in other languages.

Since most languages cannot take advantage of the 'stream' approach for accessing data used by the CGI interface, Com-plete provides extensions to the standard to enable languages other than C to access 'input' from a web CGI request and produce output in response to that input. The Com-plete extensions make it possible to write CGI routines in languages that are as powerful and productive as their C counterparts.

## Extensions for Other Languages

Languages such as Natural and COBOL are not suited to interpreting streams of data or parameters provided in strings. Implementation in PL/1 is clumsy while Assembler processing of this data is long-winded and time-consuming from a coding point of view.

Rather than adapt other languages to the C way of doing things, Com-plete provides CGI extensions for accessing data submitted in a CGI request and building the response to that request. The CGI extensions are implemented using a simple call mechanism that allows applications to be written in a more structured mode than normal CGI programs; a mode that suits languages like Natural , COBOL , and PL/1 .

Every piece of data submitted as part of a CGI request has a field name associated with it. Where data can be entered in a field, the user enters the field name and the data. As CGI programs are

designed to respond to the input from a given HTML page, or at a minimum, HTML pages with certain fields defined, there is no need for search strings.

The Com-plete primary user program request interface is called HAANUPR. This interface will be maintained and upgraded in the future.

For compatibility, previous interface modules continue to be supported so that existing applications can run unchanged, but they will not be enhanced.

These interface modules are documented in detail in the section *Programming CGI Requests* in this documentation.

## The Conversational CGI Program Concept

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Since the foundation of the worldwide web, all CGI programming has been non-conversational or "stateless". This means that when a request is issued, the CGI program processes the request, returns the response to the client, and forgets all about that client.

Some CGI applications store information away about the user's state and retrieve it when the user appears again; however, the state information must then be aged as the user may never come back. It also complicates the program in terms of transactional processing over more than one CGI request, identification of users, and so on.

### The HTTP Server Solution

The HTTP server conversational concept avoids these problems by enabling an application program to issue a CONVERSE call in the middle of a processing loop. This sends all data previously output by the CGI program to the client browser.

The HTTP server then suspends the application program until the next HTTP request is issued for that user.

When it is received, the appropriate session is restarted by the HTTP server after the call to CONVERSE with all the data from the client browser available to it as well as any data, switches, or database sessions that the CGI program had in local storage prior to the CONVERSE.

It is possible to set timeouts so that the session context is cancelled if a user doesn't respond within a specific period of time (for example, 30 minutes). When the user does respond, it receives a message to the effect that the conversation doesn't exist.

This mechanism has the following advantages:

- A conversational program can save valuable resources as it is only started once per user and remains active until the conversation ends. Normally, a CGI program must be started and terminated for every CGI request.

- Programs can be structured properly with standard loop and parameter gathering techniques.
- The application program can maintain database or any other connections over the duration of the conversation, avoiding the need to connect and disconnect for each CGI request.
- It gives a CGI application the ability to maintain a transaction over a conversation of two or more HTML pages, if necessary.
- It is a more natural way to program instead of having to collect all the context information which will be required the next time input appears from a given user.

### Conversational CGI Application Structure

Any CGI program may converse if the server where the CGI program will run is configured to allow conversational programs. This is controlled by the HTTP server CONV configuration parameter, which must be set to YES to allow conversational programs. Because the CGI program uses the ENABLE-CONVERSE, CONVERSE, and DISABLE-CONVERSE functions of the HAANUPR interface, this facility may be used from any programming language including Natural, COBOL, PL/1, and Assembler.

The following pseudo-code illustrates how such an application is structured. The member HO-ANCONV on the HTPvrs.SOURCE dataset is an example of a conversational COBOL CGI program. Comments in the following are enclosed using "/\*" to start the comment and "\*/" to terminate the comment.

```

BEGIN:
/*
  The following call tells the Com-plete HTTP server that you wish to have a
  conversation with the client browser. If conversations are not supported,
  this call will fail
*/
CALL 'HAANUPR' status 'ENABLE-CONVERSE'
/*
  In the following logic, the program fields would be filled out with the
  initial values to be presented to the client browser.
*/
Set initial values in output HTML page
/*
  The program will always loop indefinitely until the client at the browser
  indicates that it wants to terminate the conversation, or the program itself
  decides to terminate. The client may indicate this by entering a certain
  value in a field or by pressing a specific HTML button. The program may do
  this based on a transaction being completed.
*/
Do while not end of conversation
/*
  The HTML page is built using multiple calls to the HAANUPR interface to
  output the appropriate HTML to the client. This may be preceded by any
  other logic to get data from a database or build data based on time or

```

```
whatever.  
*/  
CALL 'HAANUPR' status 'PUT-TEXT' data length  
CALL 'HAANUPR' status 'PUT-TEXT' data length  
..  
/*  
    The only requirement in terms of output is that the CGI program must ensure  
    that it gets control back by using the appropriate URL on its SUBMIT  
    buttons. The easiest way is to use a relative URL like '/cgi/program/'  
    where 'program' is the name of the CGI program. The CGI program is then  
    redispached then next time the SUBMIT button is pressed. If the wrong URL  
    is used in this area, the conversational CGI program is never redispached.  
*/  
CALL 'HAANUPR' status 'PUT-TEXT' data length
```

```
/* ↵  
    The following request sends the output built above to the client and ↵  
    suspends the program at this point until the user presses one of the SUBMIT  
    buttons.  
*/  
CALL 'HAANUPR' status 'CONVERSE'  
/* ↵  
    At this point, all input or radio buttons from the input request can be  
    interrogated and appropriate action taken based on the input. No output ↵  
    requests should be issued between here and the bottom of the DO WHILE loop  
    in case the condition to terminate the conversation has been set.  
*/  
CALL 'HAANUPR' status 'GET-DATA' field length value  
CALL 'HAANUPR' status 'GET-DATA' field length value  
..  
CALL 'HAANUPR' status 'GET-DATA' field length value  
/*
```

The following is the end of the DO WHILE loop:

```
*/  
END  
/*
```

Once you arrive here, the conversation may be terminated:

```
*/  
CALL 'HAANUPR' status 'DISABLE-CONVERSE'  
/*  
    Write a final 'goodbye' message to the user  
*/  
CALL 'HAANUPR' status 'PUT-TEXT' data length  
END
```





# 3 General Installation Information

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This chapter describes the required environments for installing the Com-plete HTTP server, the prerequisite software, the distribution media, and the general installation process.

## Supported Operating Systems

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The Com-plete HTTP server runs in any operating system supported by Com-plete 6.7.

## Supported Environments

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The HTTP server uses the same infrastructure as the Com-plete tn3270 server. The same prerequisites apply. For details, please see the section *The tn3270 Server* in the *Com-plete System Programming* documentation.

The Com-plete HTTP server requires the SMARTS server to be active in Com-plete. Refer to the *Configuring the SMARTS Environment* documentation for information about installing the SMARTS server environment.

Com-plete can interface with any of the following TCP/IP stacks:

- IBM UNIX System Services for z/OS. .
- z/VSE using either the Connectivity Systems or the BSI Systems TCP/IP stack for z/VSE.

## Installation Media

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The HTTP server is currently only delivered as part of Com-plete.

All required installation files are contained on the Com-plete installation tape or cartridge.

## Installation Overview

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The installation comprises the following steps:

1	Create the mainframe installation datasets as required from the installation tape or cartridge.
2	Customize to achieve a running system. The customization required is minimal.
3	Verify the installation.

Software AG recommends that you follow the installation procedure step by step. Once the system is running, proper change control ensures that any subsequent changes that cause problems can be backed out smoothly and quickly.



# 4 Installation on z/OS

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Software AG recommends that you keep unmodified copies of all materials distributed or created as part of the installation process. This may assist with problem diagnosis later by providing an untouched sample of any given item.



**Note:** Additional installation steps for Natural CGI are documented in section [Installing Natural CGI](#).

- [The Installation Tape](#)
- [Step-by-Step Installation](#)
- [Where Next ?](#)
- [Troubleshooting](#)
- [Where Next?](#)

## The Installation Tape

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### Tape Contents

The following table lists the product datasets, what the dataset contains, and how it is created. While you are free to rename the datasets, the dataset names used in the table are used consistently throughout the product documentation to ensure clarity.

Dataset	Contains ...
HTPvrs.LOAD	all load modules required by Com-plete HTTP server
HTPvrs.SRCE	all sample source members and macros
HTPvrs.JOBS	all sample JCL required
HTPvrs.INPL	an INPL file for Natural modules and example programs (required only for Natural CGI)

### Copying Contents of the Tape to Disk

Copy the installation datasets to disk.

## Step-by-Step Installation

---

### ➤ Step 1: Modify the Com-plete Start-up Procedure or Job

- Include the following datasets in the COMPLIB dataset concatenation:

```
// DD DISP=SHR,DSN=HTPvrs.LOAD
```

You may optionally add the following DD statement in the JCL to direct output to a specific job class or dataset:

HTPTRCE	the HTTP server trace output when HTTP server tracing is active
---------	---

### ➤ Step 2: Configure the HTTP Server

- Copy member HAANCONF from HTPvrs.SRCE and use it as a pattern for setting up your configuration. For a basic installation, modify only the port number, leaving the fine-tuning for later.

The default port numbers are 80 for HTTP and 443 for HTTPS. If the desired port number is not available on the default IP address of your machine, you must either specify some other port number in parameter PORT here, or a different IP address in Com-plete sysparm IPADDRESS. If in doubt, ask your TCP/IP administrator.

Store the configuration member into some parmlib, e.g. MY.PARMLIB(HAANCONF).

### ➤ Step 3: Modify the Com-plete Start-up Parameters

- Add a parameter

```
SERVER=(HTTP,HAENSERV,CONF=/my.parmlib/haanconf)
```

specifying the configuration member created in the previous step.

## Where Next ?

Restart Com-plete in order to pick up the changes made above.

From a web browser, enter

```
http://ip-addr:port
```

where

ip-addr	is the IP address of the TCP/IP subsystem where the HTTP server is running
port	is the port number specified in your HTTP server configuration

You should get the start page of the Com-plete web interface, or whatever resource you specified in the DFLTURL parameter in your HTTP server configuration.

## Troubleshooting

---

### Com-plete Initializes, but the HTTP Server Initialization Fails

The HTTP server configuration is probably invalid.

- Check for messages during the HTTP server initialization process that may identify the problem.
- Check in particular for socket errors that occur if the specified port is already in use by another application in your system.

### The HTTP Server Initializes, but Access Attempts Fail

The problem is probably in the request being issued or the port number being used. Ensure that

- the IP address or host name used to identify the target host actually identifies the TCP/IP stack with which Com-plete is communicating. More than one IP address is possible on a mainframe system: if you use the wrong one, your request will time out or be rejected.
- you can connect to the IP addresses by pinging that node. If the ping fails, you have no physical connection to that host.
- the port specified is the one the HTTP server is configured to work with.

## Where Next?

---

Familiarize yourself with the customization and configuration options available in the product. Following the customization sections are a number of sections detailing specific functionalities and their implementation.

For specific information about the programming interfaces and how to use them, refer to the section [Programming CGI Requests](#).



# 5 Installation on VSE

---

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- Step-by-Step Installation ..... 26
- Installation Verification ..... 27
- Troubleshooting ..... 27
- Where Next? ..... 28

Software AG recommends that you keep unmodified copies of all materials distributed or created as part of the installation process. This may assist with problem diagnosis later by providing an untouched sample of any given item.



**Note:** Additional installation steps for Natural CGI are documented in section [Installing Natural CGI](#).

- [The Installation Tape](#)
- [Step-by-Step Installation](#)
- [Installation Verification](#)
- [Troubleshooting](#)
- [Where Next?](#)

## The Installation Tape

---

### Tape Contents

The following table lists the product datasets, what the dataset contains, and how it is created. While you are free to rename the datasets, the dataset names used in the table are used consistently throughout the product documentation to ensure clarity.

Dataset	Contains ...
SAGLIB.HTPVrs	all components required by the Com-plete HTTP server
HTPVrs.INPL	an INPL file for Natural modules and example programs (required only for Natural CGI)

### Copying Contents of the Tape to Disk

#### > Step 1: Copy the installation datasets to disk

- Use the LIBR Restore function to copy the HTTP server components from the tape into the library or sublibrary of your choice. Software AG recommends that you use the library SAGLIB and the sublibrary HTPVrs.

## Step-by-Step Installation

---

#### > Step 1: Modify the Com-plete Start-up Job

- Add the HTTP server library and sublibrary to the LIBDEF concatenation.

#### > Step 2: Modify the Com-plete Start-up Parameters

- Add a parameter

```
SERVER=(HTTP,HAENSERV,CONF=/lib/parmlib/haanconf.j) ←
```

specifying the configuration member created in the previous step.

## Installation Verification

---

Restart Com-plete in order to pick up the changes made above.

From a web browser, enter

```
http://ip-addr:port
```

where

ip-addr	is the IP address of the TCP/IP subsystem where the HTTP server is running
port	is the port number specified in your HTTP server configuration

You should get the start page of the Com-plete web interface, or whatever resource you specified in the DFLTURL parameter in your HTTP server configuration.

## Troubleshooting

---

### Com-plete Initializes, but the HTTP Server Initialization Fails

The HTTP server configuration is probably invalid.

- Check for messages during the HTTP server initialization process that may identify the problem.
- Check in particular for socket errors that occur if the specified port is already in use by another application in your system.

### The HTTP Server Initializes, but Access Attempts Fail

The problem is probably in the request being issued or the port number being used. Ensure that

- the IP address or host name used to identify the target host actually identifies the TCP/IP stack with which Com-plete is communicating. More than one IP address is possible on a mainframe system: if you use the wrong one, your request will time out or be rejected.
- you can connect to the IP addresses by pinging that node. If the ping fails, you have no physical connection to that host.
- the port specified is the one the HTTP server is configured to work with.

## Where Next?

---

Familiarize yourself with the customization and configuration options available in the product. Following the customization sections are a number of sections detailing specific functionalities and their implementation.

For specific information about the programming interfaces and how to use them, refer to the section *Programming CGI Requests*.

# 6 Customizing and Using the HTTP Server

---

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This document describes the customizing and use of the HTTP Server.

## Initializing the HTTP Server

---

The HTTP server is normally initialized by specifying a SERVER statement:

```
SERVER=(HTTP,HAENSERV,CONF=<config>)
```

where

HTTP	is the name of the SERVER. The name of the server may be any name valid for the SERVER statement.
HAENSERV	is the name of the HTTP server module. The HTTP server module must always be specified as HAENSERV.
<config>	is the location, in /path/member notation, of the HTTP server configuration to be used..

### z/OS

Software AG strongly recommends to specify the following sysparm:

```
APPLYMOD=78
```

### z/VSE

The following sysparm must be specified:

```
RESIDENTPAGE=(TLSPLISN,$SOCKLST)
```

and for SSL, additionally

```
RESIDENTPAGE=IPCRYPTO
```

The modules \$SOCKLST and IPCRYPTO are located in library PRD1.BASE.

If inactive for any reason, the HTTP server may also be started using the operator command

```
SERV,INIT,HTTP,HAENSERV,CONF=<config>
```

where the meaning of the parameters is the same as previously outlined for the SERVER statement.



#### Notes:

1. It is possible to have more than one HTTP server active within the same Com-plete address space at the same time. Each server requires a different server name and a different configuration to ensure that it does not attempt to use the same port as one of the other servers.

2. The POSIX environment must be active before a HTTP server can be activated; otherwise, the HTTP server initialization fails. This can be achieved by placing any of the HTTP server SERVER statements after the POSIX SERVER statement in the Com-plete sysparms. When the servers are started using operator commands, the POSIX Server environment must be started first.

## Termination

---

The HTTP server is terminated automatically when the Com-plete address space is terminated. However, it is also possible to cycle the server without bringing the address space down by issuing the operator commands

```
SERV,TERM,HTTP
```

where HTTP is the name given to the server at startup.

## Configuration

---

The HTTP server is configured by a text file containing the HTTP server parameters as described below.

### Sample HAANCONF Member

The HTPvrs.SRCE library contains a sample HAANCONF member. This may be copied and/or modified to produce a number of different configuration options, if required. A configuration option can then be selected by an operator when the HTTP server is started.

## HTTP Server Parameters

---

The following parameters may be specified in the configuration file:

### 3270\_FILLER\_CHAR

Parameter	Use	Possible Values	Default
3270_FILLER_CHAR	Filler character to be removed from the end of all input fields upon output by the 3270 bridge.	1-byte string constant	none

Use this parameter to tell the 3270 bridge that your applications are using a filler character, so it can remove these characters when the 3270 output data stream is converted to XML.

Background: Some 3270 applications pad all input fields from end-of-text to end-of-field with a so-called filler character; usually characters like underscore ‘\_’ or period ‘.’ are used for this. This dates back to a time when on 3270 terminals protected and unprotected fields could not be distinguished by background color, so that the purpose of the filler character was to visualize the size of the input field. Filler characters are widely used, e.g., in Natural applications.

With respect to unprotected fields, 3270 terminals and emulations by default run in replace mode (as opposed to insert mode), and the filler characters are just overwritten when the user starts typing. Modern software like web browsers use insert mode by default, and there is no way from HTML to force replace mode, so the filler characters become an annoyance with the 3270 bridge.

#### Example

```
3270_FILLER_CHAR='.'
```

### CACHE

Parameter	Use	Possible Values	Default
CACHE	Allocate a server-side cache for files used in HTTP requests.	YES   NO   <i>n</i> [K M]	NO

Value	Description
NO	Only the HTTP server’s native files and those from an optional HOMEDIR are to be cached.
YES	All PDS(E) or VSE sublib members are to be cached.
<i>size</i>	Limit on the maximum size of the cache buffer pool, in Kilobytes or Megabytes (implies YES).

For more detailed information, refer to [Using a Cache](#).



## CGIPARM

Parameter	Use	Possible Values	Default
CGIPARM	A parameter string to be passed to every CGI program that is started.	1-256 byte parameter string	none

The string is passed in standard z/OS format where register 1 points to a pointer that points to a half word length followed by the data.

CGIPARM is used to pass parameters or set runtime options for language environment-enabled programs.

## CONTBUFL

Parameter	Use	Possible Values	Default
CONTBUFL	The size of a buffer allocated by the HTTP request processing program to hold information about the variables contained in a HTTP request, when the request is parsed by the HTTP server. 16 bytes per variable are required, so the default size of 1024 is sufficient for up to 64 variables. If the number of variables exceeds the value set in this parameter divided by 16, the request is rejected.	1-65545	1024



**Note:** Uploads to the M/F file system are written to the file directly from the receive buffer, without first reading all the data into a large buffer. If the request is to be handled by an installation-written CGI program, then all the data is written to a buffer which is allocated dynamically according to the size defined in the HTTP header "Content-length".

## DEFACEE

Parameter	Use	Possible Values	Default
DEFACEE	Indicates whether the server will build a default ACEE for the user specified in HTTPUSER during initialization and startup.	NO   YES	NO

Value	Description
YES	A default ACEE is built and associated with any user that does not log on to the system.
NO	Any user that does not log on to the system has the authority associated with the address space.

## DFLTCONT

Parameter	Use	Possible Values	Default
DFLTCONT	The default content type to be assigned to a URL if the content type cannot be determined through the dataset name or member type processing mechanism.	HTTP content type header	APPLICATION/OCTET-STREAM

The web browser uses the content type header to determine what to do with data. For example, for content type TEXT/HTML , the browser interprets the data as an HTML page. For content type IMAGE/GIF , the browser attempts to interpret the data as a GIF file.

The default value causes the web browser to download as binary data any URLs for which the content cannot be explicitly determined; that is, such URLs are downloaded as is without any translation.

## DFLTURL

Parameter	Use	Possible Values	Default
DFLTURL	The default URL to be returned to a user request connecting to the HTTP server with no URL information.	default URL for your installation	none

This circumstance occurs when the following URL is requested from a browser:

```
http://your.ip.address:port
```

Refer to the subsection later in this section relating to the specification of a default URL.

## EBCDIC\_CODEPAGE

Parameter	Use	Possible Values	Default
EBCDIC_CODEPAGE	The codepage number used to encode text data on the machine where the HTTP server runs.	37 United States 420 Arabic 500 International 870 Latin 2 1025 Cyrillic 1047 Open Systems 1141 Germany, Austria 1142 Denmark, Norway 1145 Spain 1147 France 1148 Belgium, Switzerland	500

This parameter determines what input (ASCII -> EBCDIC) and output (EBCDIC -> ASCII) translation tables are used by the HTTP server.

Translation does not apply to the HTTP server's native text files, as these are ASCII encoded.

Most EBCDIC codepages currently supported are translated to and from Latin 1 (ISO-8859-1), with the following exceptions:

- 420 (Arabic) - UTF-8
- 870 (Latin 2) - Windows-1250 or ISO-8859-2 depending on client
- 1025 (Cyrillic) - Windows-1251

The encoding is indicated to the HTTP client using the `charset=` property in the content-type HTTP header. If your machine uses an EBCDIC codepage that is not on the list, please, contact Software AG to have it added.

If in doubt what codepage is used on your machine, look at member `CODEPAGE.txt` at the link [Native HTML pages from the INDEX page](#), and proceed as described there.

## HOMEDIR

Parameter	Use	Possible Values	Default
HOMEDIR	Specifies the dataset name of the HTTP server's home directory.	The name, in path notation, of a PDS or PDSE text library. VSE: /lib/sublib/	none

In contrast to former versions, specification of a home directory is optional. All the native files required by the HTTP server itself are contained in the HTTP server's load library. The purpose of the home directory is only to hold files specific for your installation, like, e.g., your `favicon.ico`, `welcome.html`, or customized versions of some HTTP server files, for example if you prefer to remove certain functions from the menu in `index.html`. If specified, the home directory is logically concatenated before the HTTP server's internal directory.

### z/OS:

The home directory must be a PDS or PDSE, recommended data set attributes are VB/4096/4092. FB might work, but cannot be guaranteed. The HTTP server's internal directory can be accessed at the link [Native HTML pages from the Com-plete main menu](#). If you want to obtain the source of a file for customization, use the provided [Download links](#) rather than the links with the file names for HTML files, as this is the only way to avoid resolution of Server Side Includes contained in some of the HTML files.

### z/VSE:

Do not use the `HOMEDIR` parameter. The HTTP server's internal directory is the `HTPors` sublibrary. If you want to obtain the source of a HTML file for customization, use the `edit` link and then cut-

and-paste the contents from the text area. To replace a member, simply override it with your version in the HTTP sublibrary itself or put your version into a sublibrary concatenated in front of it in the LIBDEF SEARCH,PHASE... concatenation.

Text files in the home directory can be either in ASCII encoding (no characters x80-xFF), or in EBCDIC, matching the codepage specified in parameter EBCDIC\_CODEPAGE.

To reference a file in the home directory or in the HTTP server's internal directory in a URL, specify the file name without any path, e.g., http://my.server/index.html.



**Note:** This library is always accessed with the default user ID in effect (the one specified under HTTPUSER, or the one associated with the address space, depending on DEFACEE), as it contains files that are used for the log-in and log-out. Therefore, do not put any sensitive data into this library.

## HTTPUSER

Parameter	Use	Possible Values	Default
HTTPUSER	The user ID with which each HTTP request is identified if the HTTP request does not contain an authorization header.	1-8 character user ID	HTTPUSER

This is effectively the default user ID assigned initially to all requests.

## HTTPLIST

Parameter	Use	Possible Values	Default
HTTPLIST	The user ID assigned to the HTTP task that listens for requests.	1-8 character user ID	HTTPLIST

## HTTPHCD

Parameter	Use	Possible Values	Default
HTTPHCD	The hardcopy device name associated with any HTTP users.	1-8 character name	HTTPHCD

This output device name is used when the program attempts to write output to a SYSOUT/SYSLST type device. For example, when LE/370 is active and an abend occurs, LE/370 writes a dump to this hardcopy device name.

Output written to this device may be viewed and/or deleted using USPOOL or printed.

## LOGON

Parameter	Use	Possible Values	Default
LOGON	Determines the level of security that the HTTP server will enforce.	ALLOWED   DISALLOWED   REQUIRED	ALLOWED

The parameter must be used in association with the Complete SECSYS configuration parameter.

Refer to section [Security](#) for more information about this parameter.

## LOGON\_DOMAIN

Parameter	Use	Default
LOGON_DOMAIN	<p>Specifies the domain for which a user sign-in is valid. This can be used to organize single-point sign-in to multiple Complete HTTP servers running on the same machine or on different machines.</p> <p>To allow single-point sign-in to multiple Complete HTTP servers running on the same machine, specify LOGON_DOMAIN=HOST.</p> <p>To allow single-point sign-in to multiple Complete HTTP servers running on different machines in the same domain, specify the domain.</p> <p>The domain must be specified as per RFC 2965 - HTTP State Management Mechanism, i.e. in the form LOGON_DOMAIN=.mycompany.com.</p>	None. By default, each Complete requires a separate sign-in. Note that multiple HTTP servers running in the same Complete always share a single security environment.

## LOGON\_MESSAGE

Parameter	Use	Possible Values	Default
LOGON_MESSAGE	<p>Defines what method (HTML or basic) the HTTP server should use for requesting user authentication from the client. Any value other than "HTML" indicates basic authentication, and the value is treated as a message text given to the client for displaying it in the userID/password pop-up. In this case the server sends a HTTP response 401, a HTTP header WWW-Authenticate: Basic realm="message text", and the customizable page HHAN401.html . For "HTML", the server sends out the HTML form HHANLGON.html.</p>	HTML   message text	HTML

**Example:**

```
LOGON_MESSAGE='Welcome to the Complete web server!'
```



**Notes:**

1. With basic authentication, browsers remember the userID and password until the browser is closed. Even if the user terminates a session by clicking a "Log out" button, he will be logged in again automatically when he sends another request to the same server without closing the browser.
2. Basic authentication offers no possibility to provide the user with informational messages that might accompany a successful log-in, like for example "your password will expire in N days".

**MAXCONNECTIONS**

Parameter	Use	Possible Values	Default
MAXCONNECTIONS	The maximum number of parallel connections you want to allow this server to accept.	1-32767	No limit

**MAXCONTENTLENGTH**

Parameter	Use	Possible Values	Default
MAXCONTENTLENGTH	The maximum content length allowed for a HTTP request. Use this parameter for limiting the amount of data in a single transfer (upload). This limit does not apply to file uploads using the built-in upload program HAANUPLO, as these are written to the file directly.	0 - 1024M (number optionally followed by K or M)	1M (= 1MByte)



**Note:** A browser form submission results in a single HTTP request, no matter how many files are contained in it.

**MSGCASE**

Parameter	Use	Possible Values	Default
MSGCASE	The case in which messages are to be issued.	MIXED   UPPER	MIXED

## NATLIB


Parameter	Use	Possible Values	Default
NATLIB	Name of the default library where Natural CGI requests to the HTTP server are directed.	1-8 character name	NATCGI

If no library is provided on the CGI request, the program specified on the Natural CGI request to this server must be cataloged in this library.

## NATPARAM

Parameter	Use	Possible Values	Default
NATPARAM	Parameter string to be provided as override parameters to Natural for all Natural CGI requests.	1-256 byte parameter string	none

For more information see [Relationship to the HTTP Server Configuration](#) in *Installing Natural CGI*.

 **Note:** The contents of this field are not validated in any way and may cause problems if invalid. Any string should be thoroughly tested before being set in this parameter.

The 'STACK' override parameter is ignored if specified in this string.

It is also possible to supply Natural parameters dynamically in the CGI query string. If the keyword "natparm" is detected in the CGI query string, its value is appended to the value of the NATPARAM parameter dynamically, and the resulting string is passed to Natural.

## NATTHRD

Parameter	Use	Possible Values	Default
NATTHRD	The name of the Natural front-end driver module used to start Natural in Com-plete.	1-8 character name	NATCOM

See [Installing Natural CGI](#).

## PORT

Parameter	Use	Possible Values	Default
PORT	The sockets port on which the HTTP server server should listen for incoming HTTP requests.	1-32000	80

## RECVBUFL

Parameter	Use	Possible Values	Default
RECVBUFL	The length of the buffer used for receiving input data from the network.	1-65545	4096

When conversations are being supported, this buffer must be set to the highest incoming data size expected for one incoming conversational HTTP request; otherwise, data may be lost.

When conversations are not being supported, this buffer is reused to read the entire incoming data stream.

Changing this size affects the amount of local storage the request processing program needs to run.

## SEND

Parameter	Use	Possible Values	Default
SEND	Determines how HTTP sends data in response to a request.	IMMEDIATE   BUFFERED	IMMEDIATE

Value	Description
IMMEDIATE	Sends data as soon as it is available. This option may be useful where requests are failing: the web user receives whatever data has been created to the point of the failure. Should be used only temporarily in a test environment, as it is extremely slow.
BUFFERED	Buffers all data in the buffer created by the SENDBUFL parameter. If failures occur, the end user may see no response data at all as the data is being buffered; however, this is less resource and network intensive. Because the BUFFERED setting greatly increases the performance of the server, Software AG recommends that use it in a production environment.



**Note:** The SENDBUFL parameter must still be specified with SEND=IMMEDIATE as the data must be copied and translated in some instances prior to being sent.



**SENDBUFL**

Parameter	Use	Possible Values	Default
SENDBUFL	The length of the buffer used for sending output data to the network.	1-65545	4096

Changing this size affects the amount of local storage the request processing program needs in order to run.

**SERVNAME**

Parameter	Use	Possible Values	Default
SERVNAME	Name to identify the system.	1-8 character name	none

This name is included in all messages (except some start-up and termination messages) issued to the operator during the execution of the HTTP server.

The name must be unique within a machine.

**SERVPOOL**

Parameter	Use	Possible Values	Default
SERVPOOL	Indicates how many previously started HTTP server instances should be kept in a pool for reuse. If you specify 0, then server instances are not pooled, and a new server instance is started for each HTTP request and terminated after the request is completed.	0-32767 YES   NO	10

Value	Description
YES	YES is supported for compatibility with previous versions and treated as 10.
NO	NO is supported for compatibility with previous versions and treated as 0.

**SSL**

Parameter	Use	Possible Values	Default
SSL	Specifies whether this is a HTTP or HTTPS server. If you need servers for both protocols, you can set up two or more separate servers in the same address space using different port numbers. Using SSL requires specification of a key database or SAF key ring using the Com-plete SSL-KEYRING-* sysparms, and the IBM GSK load library SYS1.SIEALNKE must be present in either the system LINKLIST or Com-plete's COMPLIB chain.	YES   NO   CERT	NO

Value	Description
CERT	Implies YES. Specify CERT if you need the HTTPS server to require a client certificate from each client.



**Tip:** For an alternative to specifying SSL, you can use AT-TLS. To use it, set SSL=NO here. The location of the server certificate must be specified in the AT-TLS config; the Complete SSL-KEYRING-\* sysparms do not require specification. Complete's userID must have UPDATE permission to the resource IRR.DIGTCERT.LISTRING in CLASS(FACILITY) in this case.

Note that with AT-TLS the server will not be found if the URL specifies http:// and not https://; a native SSL server redirects the browser to the HTTPS URL when it receives a HTTP request.

## TRACE

Parameter	Use	Possible Values	Default
TRACE	Turns on tracing to the DD statement identified by the TRACEDD keyword.	REQUEST   HEADER   DATA	none

HEADER and DATA can be combined by specifying TRACE=(HEADER,DATA). REQUEST cannot be combined with any other options, but what is traced by REQUEST is also included in HEADER.

Value	Description
REQUEST	Writes one line per HTTP request, indicating: <ul style="list-style-type: none"> <li>■ timestamp in store-clock format,</li> <li>■ client IP address,</li> <li>■ sequence number of the request within a persistent connection,</li> <li>■ request URI (truncated when too long).</li> </ul>
HEADER	Dumps all HTTP headers and their associated data to the DD once they have all been read and processed.
DATA	Traces all HTTP input data as it is read and all data being sent in response to the request prior to it being sent. The data is printed in both character and hex formats. The hex represents what is actually sent in ASCII. The character output is translated to EBCDIC so that it can be read.

## TRACEDD

Parameter	Use	Possible Values	Default
TRACEDD	Name of the DD to which all HTTP trace data is written.	1-8 character name	HTPTRCE

If the DD/DLBL name is not specified in the Complete start-up procedure, it is automatically allocated as a SYSOUT/SYSLST dataset.

### z/VSE:

If you want to write the data to a sequential dataset, you must allocate it (e.g. using OBMAINT) before you start the HTTP server.

## TRANSLATE\_CONTENT

Parameter	Use
TRANSLATE_CONTENT	Specifies a list of content types to be treated as EBCDIC at output from the HTTP server, translating them to ASCII. Wildcards are not currently supported.

### Example:

```
TRANSLATE_CONTENT=(application/msword,
                   application/vnd.ms-excel,
                   application/pdf)
```



**Note:** By default, all content types starting with "text" are translated and cannot be eliminated from the list.

## UPLOAD

Parameter	Use	Possible Values	Default
UPLOAD	In order to avoid vulnerability when the administrator of a server is not aware of the presence of the upload functionality, this functionality is disabled by default. To activate it, set config parameter UPLOAD=YES. The scope of this parameter is the HTTP methods PUT and DELETE, and the CGI program haanuplo. Using the POST method with form elements "input type=file" to invoke other CGI programs is not affected by this parameter.	YES   NO	NO

## URLPBUFL

Parameter	Use	Possible Values	Default
URLPBUFL	Length of the buffer used for holding parameters passed on any given URL request (that is, any data following ? in the URL).	1-65545	1024

Depending on the nature of the requests in use, the length could be increased or decreased; however, if there is insufficient space in this buffer, the request is rejected.

Changing this size affects the amount of local storage the request processing program needs in order to run.

## Content Processing

---

One of the most important pieces of information that the HTTP server provides to the web browser in response to a HTTP request is the 'content type'. This is the HTTP header that the browser uses to interpret the data sent in response to the request. The HTTP server has a number of ways to determine what the content type is.

### Member Type Processing

When a member type is specified on a URL request, even though the mainframe operating system has no concept of types as such, the HTTP server uses this type to look up a user configuration table HAANTYPT to determine whether it can identify the content type of the URL.

The source for the table HAANTYPT is delivered in HTPvrs.SRCE and copied during installation to the HTPvrs.USER.SRCE datasets for modification by the user. The table is built using the HMANTYPT macro which has two parameters:

TYPE	1-8 character member type.
CONTENT	The content type to be returned to the browser when a member of this type is requested on a URL. The HTTP server does not validate content types: any type may be specified and new types are constantly being created. The sample HAANTYPT member contains examples of commonly used content types.



**Note:** The values specified for the above parameters are case-sensitive; for example, HTML and html are different 'TYPE's.

Once modified, the HAANTYPT table must be reassembled into a load library in the Com-plete COMPLIB concatenation.

Software AG recommends that you use the HTPvrs.USER.LOAD dataset for this. Member HJB-NTYPT in the HTPvrs.SRCE dataset contains sample JCL to assemble and link the HAANTYPT table.

If a match cannot be found for the type specified on the URL, or no type is specified on the URL, the HTTP server attempts to determine the content type from the last level of the URL provided.

### Dataset Name Processing

The HTTP server breaks down the URL provided by the user into

- a dataset name component; and
- optionally a member and member type component

```
/this/is/a/pds/member.type is THIS.IS.A.PDS(MEMBER)
```

or

```
/this/is/a/seq/file/ is THIS.IS.A.SEQFILE
```

On z/OS systems, the HTTP server assumes that the last level of the resulting dataset name indicates the sort of data contained in a given dataset. In the above examples, 'PDS ' and 'FILE ' are the last levels.

Once the last level is determined, the HTTP server checks a second user-configurable table HAANDSNT to determine if the last level can be used to map the URL to a content type. The HAANDSNT member is provided on the HTPvrs.SRCE dataset and copied by the installation to the HTPvrs.USER.SRCE for modification. HAANDSNT is built using the HMANDSNT macro which has the following parameters:

LASTDSNL	The last level of the dataset name resulting from the interpretation of the URL.
CONTENT	The content type to be returned to the browser when a member from this dataset (or the dataset itself, if sequential) is requested on a URL. The HTTP server does not validate these content types: any type may be specified and new types are being created daily. The sample HAANDSNT member contains examples of commonly used content types.



**Note:** The values specified for the above parameters are case-sensitive; for example, HTML and html are different 'LASTLEVL 's. At present, all LASTLEVL specifications should be in uppercase as there is no support for lowercase dataset names .

Once modified, the HAANDSNT table must be reassembled into a load library in the Complete COMPLIB concatenation.

Software AG recommends that you use the HTPvrs.USER.LOAD dataset for this. Member HJBNDSNT in the HTPvrs.USER.SRCE dataset contains sample JCL to assemble and link the HAANDSNT table.

If a match cannot be found in the HAANDSNT table, the HTTP server uses the default as specified by the DFLTCONT configuration parameter.

### CGI Request Output Processing

Any CGI program, whether it is written in Natural, C, COBOL, or PL/1, may write a CONTENT-TYPE header to the output stream to indicate the content it is going to send. If the HTTP server detects that no CONTENT-TYPE header is sent by the CGI program, it sends a CONTENT-TYPE header using the default content type for the system as specified by the DFLTCONT configuration parameter.

## Accessing HFS/zFS Files

---

In order to access HFS/zFS files via the Com-plete HTTP server, the respective directories must be mounted logically in the Com-plete/APS sysparms. The following definitions must be made:

```
CDI_DRIVER=( 'uss', PAAMFUSS )
```

The name of the protocol, which is 'uss' here, can be chosen freely, and must then be used for logically mounting one or more file systems.

You can mount an entire real file system (root), e.g.:

```
MOUNT_FS=( 'uss://', '/hfs/' )
```

Here this allows you to access for example */etc/profile* like *http://server/hfs/etc/profile*, or mount any existing (sub-) directories of any level, for example

```
MOUNT_FS=( 'uss://etc/', '/etc/' )
```

This allows you to access for example */etc/profiles* such as *http://server/etc/profile*.

The names of the mount points, which are '/hfs/' and '/etc/' here, can be any valid path names. The presence of these MOUNT\_FS parameters merely defines a mapping of path names; no access to the specified directories takes place until a mount point name is used in a real HTTP request.

Only those parts of a file system that are explicitly mounted in Com-plete can be accessed. Note that symbolic links in a mounted branch pointing to a non-mounted branch make the target branch accessible.

Normal UNIX file permissions apply (based on the userID).

## Using a Cache

The server-side cache has been added to avoid the overhead of reading files used in web pages (z/OS PDS(E) members, z/VSE library contents) multiple times. The storage is allocated as a buffer pool in a dataspace with a minimum size of 1MB and will expand as needed unless you specify a limit in the CACHE parameter.

With CACHE=NO set or on default, only the files in the home directory and in the HTTP server's internal directory are cached. Generally, sequential files are not cached, and PDS(E) members are only cached when referenced with a file name extension. This is in order to avoid caching of members when they are accessed from a directory listing, because otherwise users would be looking at stale versions when the contents of a member changes.

The following operator commands and utilities are available to administer the cache:

SERV <i>servername</i> ,CNEW	Deletes the current cache and allocates a new empty one.
	Return Codes:
	04   Cache in use (files are currently copied to and from it). 16   Cache never allocated
SERV <i>servername</i> ,CREFRESH	Removes unusable (incomplete) entries.

The contents of the cache can be displayed and cached files can be refreshed by using the link `Server cache` from the INDEX page.

Here you can also mark files as 'unusable', so that changed versions are read from disk. But keep always in mind that your browser has its own cache and might still use the original files. Each browser has options available to delete these temporary files too.

## Pooled Server Processing

The HTTP server implements pooled server processing dynamically.

When a request is received, the HTTP server checks the pooled server queue to determine if any pool servers are available. For the first request, no pool server is found so the system starts a server to process the request. When the request is processed, the server puts itself on the pooled server processing queue. When the next request arrives, the pooled server is found on the queue and is used to process the request.

## Advantages of Pooled Servers

- Using a pooled server rather than starting a new server saves the cost of starting and initializing a new thread of control and terminating the request processing logic. Significant resources are thus saved.
- The system creates pooled servers until a steady state is reached where a pooled server is always available to process an incoming request.
- If a pool server ABENDs for some reason, only the user being processed is affected. If insufficient pooled servers are available, the HTTP server attaches more users.
- Pooled servers are dormant while on the pooled server queue. They use no CPU. In Complete, pooled servers are eligible for rollout so they do not occupy a thread.

## Considerations when Using Pooled Servers

A pooled server can process any type of request. For example, the first request it services may be a static HTML deliver request, the second may be a COBOL program CGI request, the third may be a Natural program CGI request.

- The amount of storage available in the pooled server's thread must be carefully considered to ensure that sufficient unfragmented storage is available to run whatever request may arrive. To that end, it may be advisable to have a separate HTTP server processing Natural requests only.
- Because a pooled server instance never really terminates, CGI programs must clean up after processing to avoid a negative impact on following requests.

## Natural Considerations

When a Natural CGI request is issued and a new thread must be started, the Natural interface is started and, using an internal inverted call mechanism, Natural CGI programs are driven.

Using the inverted mechanism to call Natural means that the Natural environment is only started once per pooled server so that the next time a Natural CGI request is handled by the same pooled server, no Natural initialization/termination is required.

In this way, a significant savings is realized in both CPU and wall clock time required to process Natural CGI requests.



## Conversational Processing

---

Instead of maintaining a generic queue of active user threads, a more specific queue is maintained for conversational processing.

A conversation is maintained by sending a session-specific cookie to the browser with the output from the CGI program. The cookie is returned with the next request that enables the HTTP server to match the incoming request with the active request on the conversational request queue.

The incoming data is piped to the program in conversation and the conversational program is dispatched again to process the request from the user with whom it is in conversation.

If a conversational program terminates due to a timeout or an ABEND, the next time the user attempts to converse with the other user in the conversation, a message is issued to indicate that the conversation no longer exists.



# 7 Installing Natural CGI

---

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Com-plete supports the Natural runtime system as documented in the Natural documentation in the section for Com-plete.

Follow the steps for installing Natural under this environment as required.

The Natural installation should be complete and working in the environments where the HTTP server is to run before attempting to support the Natural CGI processing.

The Natural Web Interface is supported by Natural version 3.1 and above.

## Natural Tasks

---

A number of additional tasks are required to ensure that the Natural CGI processing operates successfully. Note that the HNANSHEL program delivered with the product is a Natural program itself and an integral part of the Natural CGI processing logic.

Follow the next steps carefully:

1. Ensure that the HTPvrs Natural library has been INPLed as part of the installation process.
2. Copy the Natural subprograms USR0050N, USR0330N, USR1025N and USR2013N from the SYSEXT Natural library to the SYSTEM library on FNAT.

As an alternative to this step, when Natural Security is installed, make SYSEXT a STEPLIB in the Natural environment.

3. If Natural Security is installed, copy the Natural Security Interface Subprogram NSCLI to the SYSTEM library on FUSER.

## Relationship to the HTTP Server Configuration

---

The following parameters specified in the HTTP server configuration are directly associated with the use of Natural CGI:

Parameter	Description
HTTPUSER	The default user ID for a user who is able to issue a Natural CGI request. The user ID is passed on to Natural and must therefore be defined, for example, if Natural Security is installed Note: Applies only when running under Com-plete.
LOGON	If the HTTP server is running with security, Natural is passed either the default user ID as specified by HTTPUSER or the user ID for which the user provided a valid user ID and password. Once again, there may be Natural Security or other implications. Note: Applies only when running under Com-plete.

Parameter	Description
NATLIB	Name of the Natural library where the HTTP server tells Natural to look for a Natural program specified on an HTTP request when no Natural library is specified.
NATPARM	Where appropriate or necessary, Natural parameters may be specified here to override parameters generated in the Natural parameters in the nucleus. The 'STACK' parameter is ignored if specified in this string.
NATTHRD	The name of the Natural front-end driver module used to start Natural in Com-plete.

A useful way to provide Natural parameters is to specify NATPARM='PROFILE=HTTP' (or any other profile name) and set all parameters in that profile in Natural.

RPC=(RPCSIZE=32)	Required.
OUTDEST=CONSOLE	When running as NATCGI, Natural is in "asynchronous" mode, i.e., without a terminal. OUTDEST=CONSOLE tells Natural to write error messages which would normally go to the terminal to the console and the Com-plete joblog.
SENDER=HTTPERR	Natural in asynchronous mode occasionally requires a destination for certain error output (even with OUTDEST=CONSOLE), otherwise it will complain "NAT1500 Open for print file HC failed (Invalid destination)". Specifying SENDER=HTTPERR causes Natural to send this output to the imaginary printer HTTPERR (or choose any other name). If you specify a name that is not a real printer, the error messages remain in the spool file and can be viewed using the Com-plete utility USPOOL or via the Com-plete web UI.
CM=OFF	When running as NATCGI, Natural must not attempt to read any commands.
MENU=OFF	When running as NATCGI, Natural must not use menu mode.
IMSG=ON,ITERM=ON	If Natural cannot start up cleanly, it should report the problems and terminate. Otherwise obscure subsequent errors might occur. Also, ITERM=ON terminates Natural when a program attempts reading terminal input, what would be illogical in this environment, and has even been observed to cause infinite loops flooding Com-plete's spool file.
AUTO=ON	Tells Natural to obtain the userID from Com-plete, i.e., either the user's userID if he logged in, otherwise the one set in HTTP server parm HTTPUSER.

## Invoking a Natural CGI Program

A Natural CGI program is invoked using the standard browser URL

```
http://ip-addr:port/natcgi/program
```

where 'program' is the Natural program you want to run, which exists in the Natural library specified in the NATLIB configuration parameter.

If you want to provide a Natural library name, use the URL

```
http://ip-addr:port/natcgi/library/program
```

where 'library' is the Natural library where 'program' resides.



**Note:** All programs to be run using Natural CGI must be cataloged; that is, they must be in object format.

## Installation Verification

---

To test the installation:

1. Invoke a program that does nothing.

Such a program is provided in the HTPvrs Natural INPL file delivered with Com-plete as HNANWTOP .

2. Stow the program HNANWTOP in your NATCGI library.
3. Try to invoke it from a web browser using the URL

```
http://ip-addr:port/natcgi/hnanwtop
```

You will receive no output at your browser; however, the message in the program should be written to the operator console.

4. If this is successful, test the sample Natural CGI program:

- Ensure that the HNANSAMP program is stowed or cataloged in the default CGI library specified by the NATLIB configuration parameter.
- Invoke the URL

```
http://ip-addr:port/htpvrs/srce/hhannatt.htm
```

When you enter your name, the HNANSAMP program should be invoked and echo your name back to the browser.

## Additional Notes

---

The following should also be taken into consideration when installing Natural CGI:

1. The Natural start-up program in all environments must be linked with AMODE=31 .
2. There must be no start-up errors from Natural as this will force Natural to try to write to the terminal or CMPRINT about the errors, which in turn can cause unpredictable results. This will also cause the Natural CGI request to fail.

## Using the Natural Web Interface



**Note:** This information is provided for compatibility reasons only. The recommended interface between Natural and the HTTP server is *CALL HAANUPR*.

### Required Tasks

The Natural CGI processing, as described above, must be installed and working correctly, before successful operation of the Natural Web Interface is ensured.

Also ensure that the Natural parameter `RPC=(size=32)` is present in the string specified for the 'NATPARM' HTTP server parameter.

The programs NWWAPS and W3APSENV INPLed to the SYSWEB library are an integral part of the Natural Web Interface processing.

### Invoking a Natural Web Interface Program

To invoke a Natural Web Interface program, use the standard browser URL

```
http://ip-addr:port/natcgi/sysweb/nwwaps/library/subprogram
```

where

library	is the Natural library where 'subprogram' resides
subprogram	is the Natural subprogram you want to run

If running with Natural Security, you can also call NWWAPS by defining SYSWEB as a steplib of the library named in the URL. For example:

```
http://ip-addr:port/natcgi/userlib/nwwaps/userlib/usercgi
```

If SYSWEB is defined in Natural Security as a steplib of USERLIB, then NWWAPS can be called. This is useful, as with Natural security installed, the NWWAPS program cannot call a subprogram from a different library (unless the subprogram is in a steplib of SYSWEB). That is, if the second library named in the URL is different to the first it will be ignored. It is possible to just specify the following:

```
http://<ip-addr>:<port>/natcgi/userlib/nwwaps/usercgi
```

Any NWI subprogram that resides in a steplib of USERLIB can also be called.



**Note:** All programs to be run using the Natural Web Interface must be cataloged; that is, they must be in object format.

## **Additional Notes**

For additional information about the Natural Web Interface, refer to the Natural documentation.



# 8 The Complete 3270 Bridge

---

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## Introduction – Invoking 3270 Terminal Oriented Applications from a Web Browser or an XML Client

---

Through a special CGI program which is part of the HTTP server, it is possible to invoke any 3270 terminal oriented applications that can run in Com-plete directly from an HTTP client. The 3270 output data stream from the application is converted to XHTML “on the fly”, without the need to make any changes to the existing application programs or terminal maps. User input data entered into the HTML form is send back to the server and converted into a 3270 input data stream as expected by the application program.

There are two major fields of application for this feature:

1. Access to terminal oriented applications from a standard web browser, without a terminal emulation. This makes it possible to integrate terminal oriented applications into web pages.
2. Access to and communication with terminal oriented transactions in Com-plete from any XML client program anywhere in the network. Instead of a 3270 screen, you get an XML document and can process it as such.

The look-and-feel of the presentation in the web browser is controlled using Cascading Style Sheets (CSS) and can be customized.

For applications using Com-plete terminal maps the output can be produced in XML format, using the original field names from the map. The XML data can be made visible in a web browser using a customizable XSLT style sheet, allowing for maximum flexibility in the presentation. For this kind of applications, it is also possible to add JavaScript code in the XSLT style sheet for client-side execution, e.g. for validation of user input, providing field-specific help texts, etc.

## Browser Requirements and Limitations

---

In general, the 3270 bridge works with the current versions of all major web browsers (Internet Explorer 6, Gecko-based browsers like Mozilla and Netscape 6, Opera 6, etc.). The basic requirements are:

- The browser must support DOM (Document Object Model).
- JavaScript and cookies must be enabled.

Recommended browser cache settings (“Temporary Internet files” in the Internet Explorer):

- Cache size: non-zero
- Check for new version of page: Automatically

If a style sheet changes, e.g., at a Com-plete version upgrade or because you customized it, then this setting should ensure that the browser finds out that it has changed, and loads the new version.

Avoid setting “Check for new version of page: at every visit”, because this would cause the browser to load style sheets and JavaScript files again and again with every 3270 transaction! The Com-plete 3270 bridge instructs the browser not to cache the actual transaction data, so it is guaranteed that the browser does submit the data to Com-plete when you press a key.

Note that not all features work equally well with all browsers. Known limitations are:

- XML / XSLT works only with Internet Explorer and Gecko-based browsers.
- Detecting the position of the caret (cursor) within a protected field (as opposed to input fields) works only with Internet Explorer and Gecko-based browsers.
- Many users prefer using the keyboard F1-F12 keys to emulate the mainframe PF1-PF12 keys. This requires the cancellation of keyboard events, a feature that is supported only by Internet Explorer.

## Parameters for Invoking the 3270 Bridge

The Com-plete 3270 bridge has been implemented as a CGI program named haen3270, hence all the rules for invoking CGI programs apply. In general, the URL for invoking a 3270 program via haen3270 looks like this:

```
http://ip-addr:port/cgi/haen3270?command=command&format=format&model=model&window=window
```

### Parameters

Keyword	Value
command	Any valid Com-plete terminal command of the format “program parmstring”. The value (the Com-plete command) must be URL-encoded, meaning spaces replaced by “+” signs, and special characters replaced by their %-notation. Default: If no command is supplied, the 3270 bridge sends to the browser a HTML form (“the command prompt”) that allows the user to type a command and select the other parameters.
format	HTML (or just H) XML (or just X) Default: HTML
model	The 3270 terminal model number: 2, 3, 4, or 5. Default: 2
window	The name of the browser window if (and only if) the conversation is being opened in a new browser window. The window name is used to close all 3270 bridge windows when the user logs out. Default: none

## Examples

```
http://complete/cgi/haen3270?command=ucrtl+cm  
http://complete/cgi/haen3270?command=nat31+du%3Dforce&model=5&window=screen2
```

Hint: In order to see the URL for a specific command, type it at the command prompt, and uncheck “open conversation in new window”. When you get the first screen (not on subsequent screens!), the address bar displays the full URL. Alternatively, at the first screen in a new window, select View -> Toolbars -> Address\_Bar from the browser menu.

Note that you do not have to have end users invoke applications from the command prompt. Instead, you can use hyperlinks from anywhere directly to the desired application, specifying the URL as described above.

## Customizations

---

Generally, the following characteristics of the Com-plete 3270 bridge can be customized.

### The Command Prompt Page

The command prompt page is a HTML file named *hhanprmt.html* that resides in the HTTP server home directory. You can edit or replace this file. For example, if you do not wish to allow users to type in commands, you can simply replace it with a warning page, or redirect users to any other URL.

### Fonts and Colors

All fonts and colors used for the presentation of 3270 screens in the browser are controlled using the Cascading Style Sheet *styl3270.css* in the HTTP server home directory. You can edit this file in order to change the default look and feel. Some browsers support individual style sheets, allowing each user to set his own preferences.

The Com-plete 3270 bridge maps the extended 3270 color attributes to CSS classes as per the following table:

oB	ordinary blue
oR	ordinary red
oP	ordinary pink
oG	ordinary green
oT	ordinary turquoise
oY	ordinary yellow
b	bold

bB	bold blue
bR	bold red
bP	bold pink
bG	bold green
bT	bold turquoise
bY	bold yellow
r	reverse video (3270 extended highlighting attribute, used, e.g., by Natural pop-up frames)

You can change all colors by using color names or #RGB values.

If you prefer a black background, there are a few obvious dependencies:

- Add "color:white" where you set background-color:black
- Invert color and background-color for class "r".
- Chose a brighter blue for classes "oB", "bB", and "b".

## XML Processing of HTML Output

The output data of an application invoked via the Com-plete 3270 bridge is presented in HTML by default, and the XML option (see below) does not work, e.g., for Natural applications, as these do not use Com-plete terminal maps. However, the HTML version used here is in fact XHTML, an XML compliant dialect of HTML. This makes it possible to process the output using any XML software.

Each field of the 3270 screen is represented by a tag with a unique ID. The ID consists of the letter "C" followed by a five-digit decimal number representing the position (screen offset) of the field, e.g., C00000 or C01082.

Each protected (non-input) field is represented by a <span> tag, with the field value located between the <span> and the </span> tags.

Each unprotected (input) field is represented by an <input> tag of the following structure: <input id="Cnnnnn" value="..." ... /> with the field value specified in the "value" attribute.

## Advanced Features with the XML Option

---

For applications that use Com-plete terminal maps (and only for these applications), the Com-plete 3270 bridge provides some advanced features. In order to make use of these, specify the `haen3270` parameter `format=XML`.

### Better Performance, Less Network Traffic

The XML data is generated directly from the terminal map and the application program data area, saving the CPU-consuming intermediate step of building the 3270 data stream and then converting it to HTML in Com-plete. The conversion from XML to HTML is done at the client, which is the more appropriate place for it. All information related to the format of the HTML page is contained in the XSLT style sheet, which is transferred only once, provided that the browser cache settings have been set properly. This allows then at each transaction to transfer only the actual transaction related data.

### Using the Original Field Names from the Map

The output can be produced in XML format, using the original field names from the map. This makes it easier to write XML processing applications that are independent from the layout of the 3270 terminal map. Even if the map changes, moving fields to different locations on the screen, this does not affect the XML application. Or if you have multiple maps with common field naming conventions, then this can be used for processing them using a single XML application.

### Extented Formatting and Control

With the XML option, you can do virtually anything with the 3270 output data, as you have full control over the generated HTML. On a per-map basis, you can specify your own XSLT style sheet using an environment variable:

```
SAG_COM_MAPXSL_mapname=/path/file.xml
```

where `mapname` is the load module name of the map, and `path/file` is the location (library and member name) of the XSLT style sheet in URL notation. This style sheet will then be used for the appropriate maps instead of the standard 3270 bridge style sheet `mapxslt.xml`.

Using these XSLT style sheets, you can easily present the 3270 data in any way you like, and it doesn't have to resemble a 3270 screen at all.

Once you control the XSLT style sheet, you can also imbed CSS style elements and JavaScript code in it. This can be used, for example, for client-side validation of user input, providing field-specific help texts, etc..

# 9 Security

---

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Security on the Internet is a major concern of installations publishing IBM mainframe data.

Com-plete is fully integrated with the Security Authorization Facility (SAF ) on z/OS systems and can thus work with CA-ACF/2 , RACF or CA-Top Secret . This integration involves

- verifying with the security system any provided user ID and password; and
- building an ACEE for each user that logs on to the system.

Com-plete then ensures that when the user issues a request to access any resource, the ACEE associated with that request is the one built for the user logging on. In this way, the security system can control access from multiple users with different security profiles from the same address space.

## The Default User

---

When the HTTP server initially starts processing a request, it knows nothing about the user until it reads various HTTP header areas. Even then, there may be no information about the user.

For this reason, each request is assigned a 'default' user ID using the HTTPUSER configuration parameter. Com-plete sees the 'default' user ID for the duration of the request unless the user has provided some authorization information in the HTTP headers.

When security is active, the 'default' user ID receives the CA-ACF/2 , RACF or CA-Top Secret authorization of the Com-plete address space.

To better identify the default user, Software AG recommends that you specify DEFACEE=YES in the configuration parameters. The HTTP server then builds a default ACEE for the user ID specified by HTTPUSER and ensures that each user running with the default user ID runs with an ACEE built for that default user. Note that when DEFACEE is specified, the user ID specified in HTTPUSER must be defined to the security system; otherwise, the HTTP server initialization fails.

## HTTP Server Security Integration

---

The HTTP server integrates with the Com-plete security facilities fully by passing on to the security system for verification any user ID and password information provided with a HTTP request. If the user ID and password is verified, from that moment on, any request initiated on behalf of that HTTP request is verified based on the user ID provided.

However, because different HTTP servers have different security requirements, it is possible to run the HTTP server in a number of modes as defined by the LOGON configuration parameter.



**Note:** SAF security processing must be active in the underlying Com-plete system before the HTTP server security processing functions correctly.



**Logon Allowed (LOGON=ALLOWED)**

This is the default mode in which the HTTP server runs. In this mode, all HTTP requests are accepted and dispatched without any logon requirements from the user. They are dispatched with the authorization of the default user as discussed earlier.

If the HTTP request attempts to access a resource to which the default user does not have access, a response is sent to the browser requesting that the user provide authorization information; i.e., a user ID and password. When this is submitted, it is verified with the underlying system and the request may then be repeated using the user's security profile. If the access attempt also fails for security reasons, the user's request is rejected.

This mode is intended for servers where unsecured and secured resources are available. Secured resources are only available to users that provide a valid user ID and password that has access to the secured data. Unsecured resources are available to all users that can connect to the server.

**Logon Required (LOGON=REQUIRED)**

When this mode is specified, the HTTP server requires a user to provide valid authorization criteria (that is, a valid user ID and password) with each request to the HTTP server. The first time a user attempts an access without authorization information, the HTTP server requests this information from the browser, which in turn requests it from the client.

This information is verified with the underlying security system: access to the server is only permitted if the user ID and password are successfully validated. From that point on, anything that the user does within the server is checked against the security profile for the user ID provided. If a resource is requested to which the user has no access, the request is simply rejected as the user already provided authorization criteria.

This mode is intended for servers where only secure resources are available or servers that should only be used by authorized personnel (that is, by people defined to the security system).

**Logon Disallowed (LOGON=DISALLOWED)**

When this mode is specified, the HTTP server ignores any authorization information provided as part of the HTTP request. All users connecting to the server run with the authority of the default user. In this way, the default user is only allowed access to that data that should be publicly available on the Internet.

This mode is intended for servers that are available publicly and where the installation does not want user IDs and passwords to be submitted over the net to the server.

## HTTP User ID and Password Encryption

When authorization information is provided to an HTTP request, it is encrypted using a simple and publicly available encryption mechanism. It is more secure than TELNET and FTP, which submit passwords in clear text over the net.

The HTTP server security logic fully secures an installation where the network itself is a "trusted" network. Generally, only Intranets may be considered trusted.

Where a server is available publicly on the Internet, a number of additional measures can be used to improve the security offered by this mechanism:

- Force people to change user IDs and passwords on a regular basis.
- Use conversational CGIs. Once the user ID and password are provided on the first CGI request of a conversation, it is no longer necessary to send them again until the conversation terminates.
- Allocate only user IDs and passwords for short periods of time to allow access to the system over a restricted time frame.

The encryption mechanism may also be useful for controlling access to resources that a server provides. While the data may not be sensitive, perhaps only users who have paid for a given service should be able to access the data. The encryption mechanism can ensure that only those who have been supplied with a valid user ID and password can access the system.

## Natural Security Considerations

---

When Natural acquires control with AUTO=ON, the user ID that is active in Complete is supplied to Natural Security. Where no logon has occurred, this is the user ID defined using the HTTPUSER configuration parameter. If a user provides configuration information and this is accepted and verified by the HTTP server, the user ID provided for the logon is passed to Natural Security.

Once again, Natural Security could be set up to restrict the public HTTPUSER user ID while allowing increased access based on a user ID for which a valid security system user ID and password is supplied.

## Implementing SAF Security

---

Security must first be implemented in the Com-plete system by specifying the configuration parameter SECSYS . This parameter is used to inform Com-plete whether RACF , CA-ACF2 or CA-Top Secret is in place.

CGI program execution permissions can be controlled per CGI program and per user. See section Controlling Program Execution in the *Com-plete System Programming* documentation for more information.

Once the security system is active, you must determine the appropriate level of access for each HTTP server and set the required LOGON configuration parameter in the server's configuration.

## Log-in / Session Considerations

---

Generally, a user requesting resources through the HTTP server does not go through the same log-in process as a Com-plete terminal user does. Merely a security system log-in is performed when the user supplies user ID and password. A HTTP server user does *not* have a fixed TIB control block associated with him for the duration of the session, and user exit ULOGX1 is not being invoked for HTTP server users.

The only exception to this is the Com-plete 3270 bridge. When a user invokes an application through the 3270 bridge for the first time, Com-plete builds an environment for him similar to the environment for a terminal session. Program ULOG is invoked implicitly, and so is user exit ULOGX1. However, a number of limitations applies to ULOGX1 for HTTP server users, see section ULOGX1 - ULOG Security Exit in the *Com-plete System Programming* documentation for details.



# 10 Programming CGI Requests

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This document explains the programming of CGI requests.

## Using REXX

---

A REXX script can be invoked by means of the URL pattern `/cgi/-execname?parms`, using the hyphen in front of the name to distinguish it from a load module.

REXX is the most convenient language for writing CGI scripts for the Com-plete HTTP server, because in this case no special calls are required for interaction with the HTTP server.

When a REXX script is executed in the HTTP server, the output from the SAY instruction is directly used as HTTP server output, and HTTP server variables and variables from the HTTP request are automatically available as REXX variables to the script. In all other languages (except the Natural Web Interface) calls to HAANUPR must be used, as described further down in this part of the documentation.

### Example 1:

```
/* REXX *** */
Say "Content-type: text/plain" || "0d 15 0d 15"x
Say "Hello world!"
```

### Example 2:

```
/* REXX *** */
If name == "NAME" Then name = "world"
Say "Content-type: text/html" || "0d 15 0d 15"x
Say "<html><body>Hello " || name,
  || ", your IP address is" REMOTE_ADDR "</body></html>"
```

If this script is invoked using `/cgi/-sample?name=Joe`, then it will show 'Hello Joe!' in the browser. If the NAME parameter is missing, it will show 'Hello world!'.

## Enabling REXX in Com-plete

For more detailed information please refer to section *REXX* in *Software Interfaces* in the *System Programming* documentation.



### Notes:

1. VSE: If you want to use REXX with the HTTP server on VSE, make sure PAENSTRT is catalogued in ULIB with at least 248K.
2. z/OS: REXX requires a buffer the size of the SYSEXEC library blocksize for some reason below the line, which in Complete is allocated from thread memory. Therefore, make sure the region size specified in ULIB for PAENSTRT is at least as large as the blocksize of your SYSEXEC library.

## Using Traditional REXX Execs with the HTTP Server

In order to support existing REXX scripts written for use from a terminal, the HTTP server provides the following features:

- If the first output line of a REXX script executed by the HTTP server does not start with a Content-type header, then the HTTP server assumes that the output is plain text and wraps it in some basic HTML.
- When a REXX script uses PULL to read input from the terminal, the HTTP server generates a text box and finalizes the HTML page, thus enabling the user to enter input for the PULL.
- If a REXX script expects arguments, these can be provided using a parameter with a name starting "ARG" (case-insensitive), e.g., `/cgi-someexec?arguments=parm1+parm2+parm3`.

## HAANUPR: The HTTP Server User Program Request Module

All current and future user program requests are serviced using the HAANUPR module. The basic call to the module is documented here.

Each call has the format

```
HAANUPR status function parm1 parm2 <..> parmn
```

where

status	returns the status of the request in the form of a two-byte return code and two-byte reason code in contiguous storage.
function	the name of the function to be invoked. The name must be in character format as described in the following subsections, left aligned in the 16-byte field and padded to the right with blanks.
parm1, parm2, ...	a set of parameters specific to the function named and described in the subsection devoted to that function.

Each available function is described in the following section along with its parameters and a list of return and reason codes and their meanings:

- [Standard Return and Reason Codes](#)
- [The CLEANUP-CONVERSE Function](#)
- [The CONVERSE Function](#)
- [The DISABLE-CONVERSE Function](#)
- [The ENABLE-CONVERSE Function](#)
- [The GET-DATA Function](#)
- [The GET-FILE-INFO Function](#)
- [The LIST-DATA Function](#)

- [The PUT-BINARY Function](#)
- [The PUT-TEXT Function](#)
- [The SET-VARIABLE Function](#)

### Standard Return and Reason Codes

The following reason and associated return codes may be returned on any request to HAANUPR:

Reason Code	Return Code	Meaning
4	8	Request failed due to insufficient storage. HAANUPR attempts to acquire a save and work area of about 90 bytes from local storage. If it fails, this status is returned.
40	12	Not an HTTP request. The HAANUPR request was issued from a program that was not running as an HTTP server request.
52	12	Unrecognized request. The 16-character function area provided as the second parameter to HAANUPR contained a function request that HAANUPR did not recognize. This may occur for the following reasons: <ul style="list-style-type: none"><li>▪ the character string in the field is either misspelled or not a valid function name.</li><li>▪ the string contains lowercase characters. All function identifiers must be in uppercase.</li><li>▪ the field length was not 16 characters. The function name must be left-aligned and padded to the right with blanks (not nulls).</li></ul>

### The CLEANUP-CONVERSE Function

If a CGI application has started more than one simultaneous conversation, it should terminate those before terminating itself. This can be accomplished using the CLEANUP-CONVERSE function.

This function is invoked as follows:

```
HAANUPR status 'CLEANUP-CONVERSE'
```

### CLEANUP-CONVERSE Parameters

The CLEANUP-CONVERSE function has no additional parameters.



## CLEANUP-CONVERSE Return and Reason Codes

The CLEANUP-CONVERSE function always returns 0

## The CONVERSE Function

The CONVERSE function is used by conversational CGI programs that wish to maintain a connection with the client browser. Refer to the section in this documentation that discusses conversational CGI programs for more information. This function may only be issued after an ENABLE-CONVERSE has been successfully issued and some data has been written to stdout. If the CONVERSE is successful, when the program is next dispatched, the user response to the data sent by the CONVERSE will be available to the application program.

This function is invoked as follows:

```
HAANUPR status 'CONVERSE'
```

## CONVERSE Parameters

The CONVERSE function has no additional parameters.

## CONVERSE Return and Reason Codes

Reason Code	Return Code	Meaning
52	12	Invalid request.
56	8	Conversational sequence error. The CONVERSE request may only be issued after some data has been written in response to an HTTP request. It is not possible to converse if the user has not received a mechanism with which to respond; i.e., an HTML form.
60	8	Conversation error. A request was received to converse, however, no ENABLE-CONVERSE was previously issued. The CGI program must first indicate that it wishes to establish a conversation by issuing an ENABLE-CONVERSE function call.

## The DISABLE-CONVERSE Function

The DISABLE-CONVERSE function indicates that the user program no longer wishes to converse with the client browser. This function may only be issued after an ENABLE-CONVERSE has been successfully issued at some time previously. It must also be issued prior to any output data being sent to the client browser for a given conversation. In other words, after a program has been redispached after a CONVERSE call, if the conversation is to be terminated, the DISABLE-CONVERSE must be issued before any final output is written to the client browser.

This function is invoked as follows:

```
HAANUPR status 'DISABLE-CONVERSE'
```

### DISABLE-CONVERSE Parameters

The DISABLE-CONVERSE function has no additional parameters.

### DISABLE-CONVERSE Return and Reason Codes

Reason Code	Return Code	Meaning
52	12	Invalid request.
56	8	Conversational sequence error. The DISABLE-CONVERSE request may only be issued before any data has been written in response to the current HTTP request. The HTTP server must know before the response is written that this is the last output for the conversation.
64	8	Conversations not supported. This indicates that the HTTP server CONV configuration parameter for the server is set to NO indicating that the server is not supporting conversations.

### The ENABLE-CONVERSE Function

The ENABLE-CONVERSE function indicates that a CGI program wishes to start a conversation with the client browser. It must be issued before any output whatsoever is issued in response to a request otherwise, the request will fail. Once this request has been issued, the session will remain in conversation with the client browser until a DISABLE-CONVERSE is issued or the program terminates.

This function is invoked as follows:

```
HAANUPR status 'ENABLE-CONVERSE'
```

### ENABLE-CONVERSE Parameters

The ENABLE-CONVERSE function has no additional parameters.

## ENABLE-CONVERSE Return and Reason Codes

Reason Code	Return Code	Meaning
52	12	Invalid request.
56	8	Conversational sequence error. The ENABLE-CONVERSE request may only be issued before any data has been written in response to the current HTTP request. The HTTP server must know before the response is written that the CGI program wishes to converse.
64	8	Conversations not supported. This indicates that the HTTP server CONV configuration parameter for the server is set to NO indicating that the server is not supporting conversations.

## The GET-DATA Function

The GET-DATA function may be used to get the value of a field name submitted as part of a CGI request. It may also be used to test for the existence of certain fields on the screen which may be used when lists are presented in HTML format to a user. These lists result in a field name with no value being submitted as part of a CGI request when they are selected.

The interface module will search either the input parameter area as provided when using the GET HTTP method, or the content area as provided when using the POST HTTP method. If the variable requested is not found in the input from the HTML page, or if it has not been specified that only the HTML page must be searched, the interface module will check for a server defined variable (i.e. a defined environment variable) of this name. The caller of this interface module does not have to worry about the type of HTTP method that generated the CGI request as this is handled by the interface module.


This function is invoked as follows:

```
HAANUPR status 'GET-DATA' field value length type start
```

## GET-DATA Parameters

field	is the name of the field from the HTML page for which this request is being issued. This field name must be terminated with a blank in order for the interface routine to correctly determine the length of the field name for which it is searching. Note: The longest variable name that can currently be handled by this interface is 255 bytes excluding the blank.
value	is a field with a minimum length of the binary value specified in the length field. If this area is smaller than the length specified in the 'length' parameter, overwrites will occur and the results will be unpredictable. When the field name specified in the 'field' parameter is found in the CGI input and has a value associated with it, the value submitted for the field is copied to this area for a maximum length of the length specified in the length parameter. The value is truncated if longer than this and a return and reason code set to indicate this event. If the value is shorter than the length set in the 'length' parameter, the actual length of the value will be set in the 'length' parameter.

length	is a 2-byte (GET-DATA) or 4-byte (GET-LONG-DATA) binary field containing the length of the area provided for the value to be returned in the 'value' parameter. This is set to the length of the returned value if the field name is found and has a value associated with it.
type	is a one-byte alpha indicating the type of variable which is to be returned and may be used to restrict the search as follows: 'S' Request server defined variable. 'P' Request variable defined on the HTML page. ' ' First found will satisfy request. When the request is completed and the variable requested is found, this field is modified to contain an 'S' or a 'P' depending on where the variable was found.
start	is a 2-byte (GET-DATA) or 4-byte (GET-LONG-DATA) binary field that may be specified to indicate the offset from which the requested variable is to be returned. Its purpose is to enable a program to obtain the contents of a long text field in chunks. When this field is not specified, the default is to start at position 0 of the input field which is the start of the field.

 **Note:** Where a field name appears twice on a HTML page, only the first is accessible using this mechanism. For this reason, HTML pages designed to work with this mechanism should use unique names although it is perfectly legal in HTML terms to have the same field names specified many times. To process multiple fields with the same name, the LIST-DATA function must be used.

With Natural, the following syntax is also supported in addition to the standard CALL:


```
CALL INTERFACE4 'HAANUPR' status 'GET-DATA' field value [length]
```

This syntax is intended for use with a dynamic value variable and in this case the variable is automatically resized to hold the full return value.

If the value variable is not dynamic, the returned string is truncated if longer.

The length parameter is optional; if present it must be of type I2 or I4.

The length parameter is only used to return the full length of the value string; its contents before the call is ignored.

 **Note:** CALL INTERFACE4 'HAANUPR' returns 12-24 (Parameter data format error) when used with any HAANUPR function other than GET-DATA.

**GET-DATA Return and Reason Codes**

Reason Code	Return Code	Meaning
8	12	Invalid length supplied in a length field to the interface function.
20	4	Variable length error. It was not possible to return the full length of a variable due to the fact that insufficient space was provided in the users' parameters to hold the value to be returned.
24	12	The format of the parameters provided was invalid.
28	8	Variable name requested was not found in the CGI data.

Reason Code	Return Code	Meaning
32	16	A logic error occurred due to the format of the content data provided with the CGI request.
36	8	Invalid variable name (longer than 256 characters).
40	12	Returned when these modules are called from a program which is not running as a result of an HTTP request and therefore does not have the data available to satisfy the request.
48	12	Invalid parameter list. This indicates that one or more parameters for a given request have not been provided or contain invalid data.
52	12	Invalid request.

### The GET-FILE-INFO Function

The GET-FILE-INFO function may be used to get additional information related to an uploaded file (INPUT TYPE="FILE" form field), namely size, original file name and MIME type (Content-Type).



**Note:** The format of the file name returned depends on the user agent (browser). In particular, it may or may not contain path information.

This function is invoked as follows:

```
HAANUPR status 'GET-FILE-INFO' file dataSizeTargetField
fileNameTargetField fileNameTargetFieldLength mimeTypeTargetField
mimeTypeTargetFieldLength
```

### GET-FILE-INFO Parameters

file	is the name of the INPUT TYPE="FILE" form field from the HTML page for which this request is being issued. This name must be terminated with a blank in order for the interface routine to correctly determine the length of the field name for which it is searching. Note: The longest variable name that can currently be handled by this interface is 255 bytes excluding the blank.
dataSizeTargetField	is a 4-byte field in which the file size shall be returned in binary.
fileNameTargetField	is the field in which the original file name shall be returned.
fileNameTargetFieldLength	is a 2-byte binary value containing the length of the fileNameTargetField. On return this is set to the length of the original file name. If the length specified on input is smaller than the length of the original file name, truncation occurs and is indicated by the return and reason code.
mimeTypeTargetField	is the field in which the MIME type shall be returned.
mimeTypeTargetFieldLength	is a 2-byte binary value containing the length of the mimeTypeTargetField. On return this is set to the length of the MIME type string. If the length

	specified on input is smaller than the length of the MIME type string, truncation occurs and is indicated by the return and reason code.
--	--

**GET-FILE-INFO Return and Reason Codes**

Reason Code	Return Code	Meaning
8	12	Invalid length supplied in a length field to the interface function.
20	4	Value length error. It was not possible to return the full length of a value due to the fact that it is longer than the respective field length specified.
28	8	Variable name requested was not found in the CGI data.
32	16	A logic error occurred due to the format of the content data provided with the CGI request.
36	8	Invalid variable name (longer than 256 characters).
48	12	Invalid parameter list. This indicates that one or more parameters for a given request have not been provided or contain invalid data.
52	12	Invalid request.

**The LIST-DATA Function**

The LIST-DATA function may be used to get a list of both the variable names from the HTML page and their values, and the server defined or environment variables defined at the server for the request. The interface allows that one or more of these variables may be returned at the same time and multiple requests may be made to return all defined variables to the application program.

The server defined or environment variables are returned first, while the variables found in the HTML page are returned once all environment variables have been returned. When issuing multiple requests, the same TOKEN parameter must be provided to the interface each and every time until the list is exhausted.

This function is invoked as follows:

```
HAANUPR status 'LIST-DATA' token entries name-length
  name1 value-length1 value1 type1
  name2 value-length2 value2 type2
  <..>
  namen
  value-lengthn
  valuen
  typen
```

**LIST-DATA Parameters**

token	is a 4-byte binary token used by the interface for multiple requests. When this is null, the listing of variables starts from the first one found. When all variables available cannot be found, this is set to an internal token value to allow the interface to continue the list at the next variable to be returned. The token is reset to null when all available values have been returned to the caller.
entries	is a 4-byte binary field containing the number of variable name and value entries which the application program may accept from the interface in one call. For each entry, a set of return variables (name, value-length, value and type) must be provided, otherwise the results will be unpredictable. When the call completes, this field contains the number of variable sets returned. This must be used in association with the return and reason codes to determine if all data has been returned or if any data has been returned (the last call may have exhausted the list but may not be obvious from the return, reason codes and entries value returned).
name-length	is a 4-byte binary field containing the maximum length of variable name that can be returned. This must be set based on the length of the name fields passed to the interface.

The following constitute a set which is required to return the information about a given variable to the application program. For each entry specified, a set of fields must be provided to contain the data to be returned. Failure to do this will result in unpredictable results.

name	is an alpha field in which the name of a server or HTML page variable is returned. Its maximum length is determined by the name-length variable. If any name to be returned to the application exceeds this length, the value is truncated.
value-length	is a 4-byte binary field containing the maximum length of the value for the variable that can be accepted for this variable instance. The following value field must have at least this amount of space allocated for it, otherwise, overwrites will occur. When a variable value is returned, this field is changed to reflect the true length of the value as determined from the data.
value	is an alpha field in which the value for the variable name associated with this value field is returned. It must be at least as long as the value specified in its associated value-length field, otherwise storage overwrites may occur. When a variable is found, its name is returned in the associated 'name' parameter and the value is returned in this field. The actual length of the value is set in the associated value-length field when the variable name is found. If the value is longer than the value-length specification, the value is truncated.
type	is a 1-byte alpha field that indicates where the variable with which it is associated was found. When the variable is an environment variable set in the server environment, this field contains a 'S'. When the variable was found on the HTML page returned from the client, this field contains 'P'.

### LIST-DATA Return and Reason Codes

Reason Code	Return Code	Meaning
8	12	Invalid length supplied in a length field to the interface function.
20	4	Variable length error. It was not possible to return the full length of a variable due to the fact that insufficient space was provided in the users' parameters to hold the value to be returned.
24	12	The format of the parameters provided was invalid.
32	16	A logic error occurred due to the format of the content data provided with the CGI request.
36	8	Invalid variable name (longer than 256 characters).
40	12	Returned when these modules are called from a program which is not running as a result of an HTTP request and therefore does not have the data available to satisfy the request.
44	4	End of data reached. This will be set for the LIST-DATA function when all data has been returned. The application program should check the 'entries' field as the number of entries returned may be '0' depending on the sequence of LIST-DATA function requests.
48	12	Invalid parameter list. One or more parameters for a given request have not been provided or contain invalid data.
52	12	Invalid request.

### The PUT-BINARY Function

The PUT-BINARY function enables a CGI application program to send output in response to the CGI request. This output is provided to the HTTP server in the same way as 'standard' CGI output is processed.

The PUT-BINARY function differs from the PUT-TEXT function only in terms of the way it processes the parameters passed to it. PUT-BINARY simply takes the data and length provided at face value and passes them directly to the HTTP output processing module. Refer to the section on PUT-TEXT for information about how it processes output.

This function is invoked as follows:

```
HAANUPR status 'PUT-BINARY' data length
```



## PUT-BINARY Parameters

data	is the data or the field containing the data to be output in response to the CGI request.
length	is a 2-byte binary value containing the length of the data area provided. The contents of the data area are output for exactly the length specified in this field. Alternatively the function PUT-LONG-BINARY can be used; it expects a 4-byte length field.

## PUT-BINARY Return and Reason Codes

Reason Code	Return Code	Meaning
8	4	Zero length supplied.
8	12	Invalid length supplied in a length field to the interface function.
12	4	Warning returned from the HTTP server output processing module.
16	8	Error returned from the HTTP server output processing module.
24	12	The format of the parameters provided was invalid.
32	16	A logic error occurred due to the format of the content data provided with the CGI request.
40	12	Returned when these modules are called from a program that is not running as a result of an HTTP request and therefore does not have the data available to satisfy the request.
48	12	Invalid parameter list. One or more parameters for a given request have not been provided or contain invalid data.
52	12	Invalid request.

## The PUT-TEXT Function

The PUT-TEXT function also enables a CGI application program to send output in response to the CGI request. This output is provided to the HTTP server in the same way as 'standard' CGI output is processed.

The PUT-TEXT function differs from the PUT-BINARY function only in terms of the way it processes the parameters passed to it. PUT-TEXT assumes text output and strips all trailing non-printable characters from the end of the provided data (as determined from the provided data and length) up to the first character that has a value greater than blank. The only exception to this is where a carriage return (X'0D') or a line feed (X'0A') is encountered. In either case, this will also be treated as valid data and treated as the last character in the output data. This is useful where a standard area and length are to be used as output text data as the program generating the output must include the CR or LF characters to format text correctly. Using the PUT-BINARY request, anything following the CR or LF is also treated as data and may cause output to 'skew'.

This function is invoked as follows:

```
HAANUPR status 'PUT-TEXT' data length
```



**Note:** Use of this function has no bearing on the way data is translated; only on the way the actual length of the data is calculated prior to output. After it has been output, translation occurs based on the criteria described earlier.

### PUT-TEXT Parameters

data	is the data or the field containing the data to be output in response to the CGI request.
length	is a 2-byte binary value containing the length of the data area provided. This must contain the maximum length of the data area. As stated previously, PUT-TEXT strips off all trailing non-printable characters in the data area. Alternatively the function PUT-LONG-TEXT can be used; it expects a 4-byte length field.

### PUT-TEXT Return and Reason Codes

Reason Code	Return Code	Meaning
8	4	Zero length supplied, or data contains no valid text characters.
8	12	Invalid length supplied in a length field to the interface function.
12	4	Warning returned from the HTTP server output processing module.
16	8	Error returned from the HTTP server output processing module.
24	12	The format of the parameters provided was invalid.
32	16	A logic error occurred due to the format of the content data provided with the CGI request.
40	12	Returned when these modules are called from a program which is not running as a result of an HTTP request and therefore does not have the data available to satisfy the request.
48	12	Invalid parameter list. This indicates that one or more parameters for a given request have not been provided or contain invalid data.
52	12	Invalid request.

### The SET-VARIABLE Function

The SET-VARIABLE function may be used to assign a text string to a variable, to be used in conjunction with Server Side Includes of the form `<!--#include file="/path/file" -->` and HTML files containing Server Side Includes of the form `<!--#echo var="VAR_NAME" -->`.

When the file is sent to the client, these constructs are replaced by the value of the respective variable (e.g., VAR\_NAME) if it exists.

This function is invoked as follows:

```
HAANUPR status 'SET-VARIABLE' name value value-length
```

### SET-VARIABLE Parameters

name	is the name of the variable, ending in a space or a hexadecimal zero. If a variable of the same name exists already, it is overridden.
value	is the data area containing the value (text) to be assigned to the variable.
value-length	is a 4-byte binary value containing the length of the above data area. Note that a hexadecimal zero at any position in the data area is treated as end of text.

### SET-VARIABLE Return and Reason Codes

Reason Code	Return Code	Meaning
36	8	Invalid variable name (longer than 256 characters).
48	8	Invalid parameter list. One or more parameters for a given request have not been provided or contain invalid data.
52	12	Invalid request.

### Example

#### Natural program:

```
DEFINE DATA LOCAL
01 CGI-STATUS (I4)
01 REDEFINE CGI-STATUS
  02 CGI-RC (I2)
  02 CGI-REASON (I2)
01 #DATA (A250) INIT<' '>
01 #DATALEN (I2) INIT<250>
01 #VARNAME (A10) INIT<'PGMVAR'>
01 #VAR (A20) INIT<'program variable'>
01 #VARLEN (I4) INIT<20>
01 #PUT-TEXT (A16) INIT<'PUT-TEXT'>
01 #SET-VAR (A16) INIT<'SET-VARIABLE'>
END-DEFINE
*
CALL 'HAANUPR' CGI-STATUS #SET-VAR #VARNAME #VAR #VARLEN
COMPRESS 'Content-type: text/html' H'0D150D15'
'<!--#include file="/test/html/echovars" -->' INTO #DATA LEAVING NO
CALL 'HAANUPR' CGI-STATUS #PUT-TEXT #DATA #DATALEN
END
```

### File TEST.HTML(ECHOVARS):

```
<html>
<head>
</head>
<body style="background-color: #B4CFEC; font-family: Verdana">
<p>Value of variable PGMVAR: <!--#echo var="PGMVAR" --></p>
<p>Value of variable REMOTE_ADDR: <!--#echo var="REMOTE_ADDR" --></p>
<p>Value of variable USER_AGENT: <!--#echo var="HTTP_USER_AGENT" --></p>
<p>Value of variable SCRIPT_NAME: <!--#echo var="SCRIPT_NAME" --></p>
<p>Value of variable QUERY_STRING: <!--#echo var="QUERY_STRING" --></p>
<p>Value of variable INPUT: <!--#echo var="INPUT" --></p>
</body>
</html>
```

### URI:

http://host:port/natcgi/test/testvar?input=just\_testing

### Browser Output:

```
Value of variable PGMVAR: program variable
Value of variable REMOTE_ADDR: 10.20.108.56
Value of variable USER_AGENT: Mozilla/4.0 (compatible; MSIE 6.0; Windows NT 5.1; SV1)
Value of variable SCRIPT_NAME: /natcgi/test/testvar
Value of variable QUERY_STRING: input=just_testing
Value of variable INPUT: just_testing
```

## HAANCGIG Interface Module

---



**Note:** This documentation is only provided for compatibility. All applications should use the HAANUPR GET-DATA function to achieve this functionality.

The HAANCGIG module obtains the value of a field name submitted as part of a CGI request.

It also determines the existence of fields selected from lists presented to the user in HTML format which result in a field name with no value being submitted as part of a CGI request.

The interface module ascertains the type of HTTP method used to generate the CGI request and searches

- the input parameter area as provided when using the GET HTTP method; or
- the content area as provided when using the POST HTTP method.

If the variable requested is not found in the input from the HTML page and if the search has not been restricted to the HTML page only, the interface module checks for a server-defined variable (that is, a defined environment variable) of this name.

It is not necessary to be concerned about the HTTP method that generated the CGI request when calling the interface module as this is handled by the interface module itself.

The HAANCGIG interface module must be invoked with the following parameter list:

```
HAANCGIG status field value length type start
```

where

status	returns the status of the request
field	names the field from the HTML page for which the request is being issued. The field name must be terminated with a blank in order for the interface routine to correctly determine the length of the field name for which it is searching. The longest variable name that can currently be handled by this interface is 255 bytes excluding the blank.
value	is a field with a minimum length of the binary value specified in the length field. If this area is smaller than the length specified in the 'length' parameter, overwrites occur and the results are unpredictable. When the field name specified in the 'field' parameter is found in the CGI input and has a value associated with it, the value submitted for the field is copied to this area for a maximum length specified in the length parameter. If the value is longer, it is truncated and a return and reason code are set. If the value is shorter, the actual length of the value is set in the 'length' parameter.
length	is a 2-byte binary value containing the length of the area provided for the value to be returned in the 'value' parameter. This is set to the length of the returned value if the field name is found and has a value associated with it.
type	is a one-byte alpha field indicating the type of variable to be returned. It may be used to restrict the search as follows: 'S' request server-defined variable. 'P' request variable defined on the HTML page ' ' first found satisfies request. When the request is completed and the requested variable is found, this field is modified to contain an 'S' or 'P' depending on where the variable was found.
start	is a two-byte binary field used to indicate the offset from which the requested variable is to be returned. This information makes it possible for a program to obtain the contents of a long text field in chunks. By default, the program starts at the beginning of the field, which is position 0 of the input field.



**Note:** If a field name appears twice on an HTML page, only the first occurrence is accessible using this mechanism. Thus HTML pages designed to work with this mechanism should use unique field names, although HTML itself allows the same field names to be specified multiple times.

## HAANCGIL Interface Module



**Note:** This documentation is provided only for compatibility. All applications should use the HAANUPR LIST-DATA function to achieve this functionality.

The HAANCGIL module is used to obtain a list of

- the variable names from the HTML page and their values; and
- the server-defined or environment variables defined at the server for the request.

The interface allows one or more of these variables to be returned at the same time and multiple requests may be made to return all defined variables to the application program.

The server-defined variables or environment variables are returned first, while the variables found in the HTML page are returned after all environment variables have been returned.

The HAANCGIL interface module must be invoked with the following parameter list:

```
HAANCGIL status token entries name-length
name1 value-length1 value1 type1
name2 value-length2 value2 type2
...
namen value-lengthn valuen typen
```

where

status	is used to return the status of the request as documented in the section <a href="#">Interface Module Status</a> .
token	is a 4-byte binary value used by the interface for multiple requests. When the token value is null, the listing of variables starts from the first one found. When all variables available cannot be found, "token" is set to an internal value to allow the interface to continue the list at the next variable to be returned. The token value is reset to null when all available values have been returned to the caller.
entries	is a 4-byte binary field containing the number of variable name and value entries which the application program may accept from the interface. For each entry, a set of return variables (name, value-length, value, and type) must be provided; otherwise, the results are unpredictable. When the call has completed, this field contains the number of variable sets returned. This number must be used in association with the return and reason codes to determine if all data has been returned or if any data has been returned (the last call may have exhausted the list but may not be obvious from the return/reason codes and entries value returned).
name-length	is a 4-byte binary field that specifies the maximum length of the variable 'name' that can be returned. This length must be set based on the length of the 'namen' fields passed to the interface.

For each entry specified, a set of fields must be provided to contain the data to be returned. Failure to provide these fields produces unpredictable results. The following fields comprise the set required to return the information about a given variable to the application program:	
name	is an alpha field in which the name of a server or HTML page variable is returned. The maximum length of the name is determined by the variable 'name-length'. Any name to be returned to the application that exceeds this length is truncated.
value-length	is a 4-byte binary field containing the maximum length of the variable 'value' that can be accepted for this variable instance. The following 'value' field must have at least this amount of space allocated for it; otherwise, storage overwrites occur. When a variable 'value' is returned, this field is changed to reflect the true length of the 'value' as determined from the data.
value	is an alpha field in which the value for the variable 'name' associated with this value field is returned. This field must be at least as long as the value specified in the associated 'value-length' field; otherwise, storage overwrites occur. When a variable is found, its name is returned in the associated 'name' parameter and the value is returned in this field. The actual length of the value is set in the associated 'value-length' field when the variable name is found. If the value is longer than the value-length specification, the value is truncated.
type	is a 1-byte alpha field that indicates where the associated variable was found. When the variable is an environment variable set in the server environment, this field contains 'S'. When the variable was found on the HTML page returned from the client, this field contains 'P'.

## HAANCGIP and HAANCGIT Interface Modules



**Note:** This documentation is provided only for compatibility. All applications should use the HAANUPR PUT-BINARY and PUT-TEXT functions to achieve this functionality.

The HAANCGIP and HAANCGIT modules enable a CGI application program to send output in response to the CGI request. This output is provided to the HTTP server in the same way as 'standard' CGI output is processed. See the section [Standard CGI Operation](#) for more information about the processing of this output.

The HAANCGIT interface module differs from the HAANCGIP interface module only in the way it processes the parameters passed to it:

- HAANCGIP accepts the data and length provided at face value and passes them directly to the HTTP output processing module.
- HAANCGIT assumes text output and strips all trailing, nonprintable characters from the end of the provided data (as determined from the provided data and length) up to the first character which has a value greater than blank.

HAANCGIT treats a carriage return (X'0D') or a line feed (X'0A') as valid data and as the last character in the output data. This is useful where a standard area and length are to be used

when outputting text data as the program generating the output must include the CR or LF characters to format text correctly. Using the HAANCGIP interface, anything following the CR or LF is also treated as data and may cause output to 'skew'.

The HAANCGIP/T interface modules must be invoked with the following parameter list:

```
HAANCGIP/T status data length
```

where

status	is used to return the status of the request as documented in the section <i>Interface Module Status</i> .
data	is the data or the field containing the data to be output in response to the CGI request.
length	is a 2-byte binary value containing the length of the data area provided. For the HAANCGIP interface, this is the exact length of the data to be sent. For the HAANCGIT interface, this is the maximum length of the data area. As stated previously, HAANCGIT strips off all trailing nonprintable characters in the data area.

## CGI Extension Interface Module Status

---

The status parameter passed to the CGI extension interface modules is a four-byte contiguous area comprising a two-byte return code followed by a two-byte reason code. Appropriate definitions are provided in the language-specific sections; however, the return and reason codes are documented in this section.

The language-related call to the interface modules must be successful before any return or reason codes are entered. The call fails if the interface module

- is not linked with the module produced by the language compiler; or
- could not be loaded at run time if this facility is available to the language.

### Interface Module Return Codes

The following codes may be returned by the CGI extension interface modules.

Return Code	The CGI extension interface request . . .
0	was processed successfully
4	was processed successfully but there is additional information related to the calling of the function in the reason code field
8	failed due to some environmental error. The reason code indicates what happened
12	was invalidated based on information the user provided or failed to provide. The reason code indicates what happened.



Return Code	The CGI extension interface request . . .
16	failed due to an internal processing error. The reason code indicates what happened.

### Interface Module Reason Codes



**Note:** This documentation is provided only for compatibility. All applications should use the HAANUPR interface functions to achieve this functionality.

The following reason codes may be returned by the CGI extension interface modules. Each reason code has an associated return code as documented in this table.

Reason Code	Associated Return Code	Meaning
4	8	Request failed due to insufficient storage.
8	12	Invalid length supplied to the interface function in a length field.
12	4	Warning returned from the HTTP server output processing module.
16	8	Error returned from the HTTP server output processing module.
20	4	Variable length error. The full length of a variable could not be returned due because insufficient space was provided in parameters supplied by the user to hold the value to be returned.
24	12	The format of the parameters provided was invalid.
28	8	The variable name requested was not found in the CGI data.
32	16	A logic error occurred due to the format of the content data provided with the CGI request.
36	8	Invalid variable name (longer than 256 characters).
40	12	The module is called from a program that is not running as a result of a HTTP request and therefore does not have the data available to satisfy the request.
44	4	End of data reached. This will be set for the HAANCGIL function when all data has been returned. The application program should check the 'entries' field as the number of entries returned may be '0' depending on the sequence of HAANCGIL interface requests.
48	12	Invalid parameter list. One or more parameters for a given request have not been provided or contain invalid data.
52	12	Invalid request.

## CGI Server Side Includes

---

Server Side Includes provide a convenient method for embedding dynamic contents in static HTML pages. When the HTML document passes through the HTTP server, Server Side Includes are simply replaced by the dynamic content they represent, e.g., the value of a variable, the contents of a file, or the result of a program execution.

The following Server Side Includes are currently supported by this HTTP server:

Server Side Include	Replaced by
<code>&lt;!--#echo var="VAR_NAME" --&gt;</code>	the value of variable VAR_NAME. <b>Note:</b> The variable name is case sensitive.
<code>&lt;!--#exec cgi="PROGRAM" --&gt;</code>	the output (using HAANUPR PUT-*) of the CGI program PROGRAM.
<code>&lt;!--#exec natcgi="LIB/PROGRAM" --&gt;</code>	the output (using HAANUPR PUT-*) of the Natural CGI program PROGRAM or a Natural web interface subprogram.
<code>&lt;!--#include file="/path/file" --&gt;</code>	the contents of the file.

### Restrictions:

1. The string `<!--#...-->` must not contain any line breaks. When created by a CGI program, it must be sent by a single HAANUPR PUT-\* call.
2. Natural CGI cannot be nested, i.e. if a Natural CGI program sends out a `<!--#exec natcgi=... -->` either directly using HAANUPR PUT-\* or recursively from an included file, this does not get replaced.
3. Conversations don't make sense and hence are not allowed in programs invoked from Server Side Includes (ENABLE-CONVERSE is rejected in this case).
4. SSI recursions are currently limited to three levels.

## Server Variables

---

The following server variables are defined and can be queried using the GET-DATA or LIST-DATA functions:

QUERY_STRING	The full query string from the HTTP GET or POST request (if any).
REMOTE_ADDR	The IP address of the client. Example: 10.20.30.140
REMOTE_USER	The user ID of the user, if logged in.
REQUEST_METHOD	GET or POST
REQUEST_CONTENT	For HTTP requests that are not the result of a HTML form submission (all except Content-type application/x-www-form-urlencoded or multipart/form-data), the request content.
SCRIPT_NAME	The name ( including the path) of the CGI program. Example: /natsgi/sysweb/nwwaps
SERVER_PORT	The port number of the server. Example: 1080
SERVER_PROTOCOL	HTTP/1.1
SERVER_SOFTWARE	SoftwareAG-ComPlete-HTTPserver/2.5.1

In addition, each received HTTP request header is available through a variable in the form HTTP\_HEADER, i.e. "HTTP\_" followed by the name of the HTTP header converted to upper case EBCDIC and "-" translated into "\_".

### Examples:

```
HTTP_CONTENT_LENGTH
HTTP_USER_AGENT
```

## HTTP Output Data Format

The Com-plete HTTP server sends all data using 'chunked transfer encoding' as described in RFC 2616; this is indicated by the HTTP header 'Transfer-Encoding: chunked'. HTTP clients wanting to communicate with this server must be able to handle this (all major browsers are).

RFC 2616 also includes information on trailers and other issues; however, this information is not relevant when the Com-plete HTTP server is used.

The Com-plete HTTP server splits the message body into chunks of the following format:

```
<hex length of data in chunk> CRLF
<chunk of data> CRLF
```

End of data is indicated by a zero chunk:

```
0 CRLFCRLF
```

This is more flexible than indicating the overall length of the message body in a Content-length HTTP header, because in that case the server would need to know the length of the data before it could start sending anything.

# 11 Running CGI Programs under Com-plete

---

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This section provides information about running application programs under Com-plete in the supported environments.

## The Com-plete Environment

---

Programs that comply with the HTTP server CGI requirements can use any of the mechanisms available under Com-plete to access data.

It is currently possible to access Adabas , DB2 , and VSAM data from this environment.

Refer to the appropriate Com-plete documentation for more information about accessing data from this environment.

This section provides information about running programs under Com-plete.

### Linking the Program for Com-plete

An application program may only be run under Com-plete if it is available to the Com-plete address space. To make an application program available to the Com-plete address space, link the program into a dataset in the COMPLIB concatenation under z/OS, or to one of the libraries in the z/VSE search chain. Always link a reentrant module with the 'RENT' option .

Sample jobs HJBNCOBC and HJBNPL1C are provided on the HTPvrs.JOBS dataset to do this once an object module has been created. Creation of the object modules is covered in the appropriate language-specific section of this section.



**Note:** Since high-level languages like Natural, COBOL, and PL/1 load the Com-plete-provided CGI extensions, COBOL and PL/1 programs must be linked into a dataset in the COMPLIB concatenation whereas no additional processing is required for Natural.

## Thread Storage Considerations

---

Depending on the programming language you plan to use for writing CGI programs, and a number of other factors, you must ensure that there is enough memory available in the threads where your programs will run. Unfortunately, some environments require considerable amounts of memory in the threads below the line, as listed in the following table:

Environment	Thread size required below 16MB
IBM LE with z/VSE	200 - 400 kByte, can be reduced using customized CEEUOPT/CEEROPT (see IBM Language Environment Considerations in section <i>Software Interfaces</i> in the <i>Com-plete System Programming</i> documentation)
IBM LE with z/OS 1.4 or above	8-32 kByte
Natural 3	4 kByte
Assembler, Natural 4	0

### General Rules for Saving Thread Storage

- Build your modules with the attributes RENT and RMODE=ANY.
- On z/OS, specify Com-plete sysparm APPLYMOD=78.

### The Thread Root Program PAENSTRT

By design of the HTTP server, the root program started in any thread used by the HTTP server is PAENSTRT. This module, in turn, loads the actual CGI programs into the same thread and executes them. Therefore, if your CGI programs require memory below the 16MB line, you must catalog PAENSTRT in ULIB, specifying the size as necessary. Also, make sure there is a thread group and subgroup available big enough to hold this size.

### Determining the Required Thread Size

If you get errors indicating that there is not enough memory available to the CGI programs, like abends U4093 with LE, proceed as follows:

- Ensure the thread size above the 16MB line is large enough. THSIZEABOVE=2048 should be sufficient in most cases.
- Start off with a thread size below the line of 400K (both THREAD-GROUP and PAENSTRT).
- Run your programs, and use UCTRL function TU to watch how much memory they really use.
- Reduce the sizes for THREAD-GROUP and PAENSTRT accordingly.

## COBOL Considerations

COBOL programs must be compiled and linked as if for the batch environment on the operating system where they will run. Once compiled and available to the Com-plete address space or partition, COBOL programs may simply be run as documented earlier in this documentation.

## Sample Programs and Jobs

The following table describes the various HTTP server COBOL samples that are provided on the HTTPvrs.SRCE dataset.

Member	This is a sample ...
HHANCOBT	HTML page that drives the HOANSAMP COBOL program using a form and the HTTP GET method. It may be referenced using the following URL. Refer to the installation verification procedure for more information about interpreting this URL. <i>http://your.ip.address:port/htpvr/srce/hhancobt.htm</i>
HJBNCOBC	JCL member to compile and link the sample COBOL CGI program HOANSAMP.
HOANCONV	COBOL program that uses the conversational features of the HTTP server to enable it to converse with a WWW browser over a series of HTML pages. It may be started using the following URL. Refer to the installation verification procedure for more information about interpreting this URL. <i>http://ip-addr:port/cgi/hoanconv</i>
HOANSAMP	COBOL CGI program that is driven by the HHANCOBT HTML page.

## COBOL and the Com-plete CGI Extensions

COBOL programs may use the Com-plete CGI extensions by issuing a call to the appropriate extension module as follows:

```
call 'HAANUPR' using HTPCGI-STATUS, function, parm1, parm2, <..>, parmn.
```

The HTPCGI-status must be defined as follows in COBOL:

```
01 HTPCGI-STATUS.
   03 HTPCGI-RETURN-CODE pic 9(4)COMP.
   03 HTPCGI-REASON-CODE pic 9(4)COMP.
```

The following describes the COBOL format required for the other parameters:

Name	COBOL Format	Description
field	pic x(<length>)	Must be an alpha field ending in a blank character
variable	pic x(<length>)	Must be an alpha field ending in a blank character
value	pic x(<length>)	Must be an alpha field of length 'length'
length	pic 9(4) COMP	Must be a two-byte binary field containing a length
data	no defined format	The start of an area (normally alpha) of length 'length'



## PL/1 Considerations

PL/1 programs must be compiled and linked as if for the batch environment on the operating system where they will be running. Once compiled and available to the Com-plete address space or partition, PL/1 programs may be run as documented earlier in this documentation.

### Sample Programs and Jobs

The following table describes the HTTP server PL/1 samples that are provided on the HTPvrs.SRCE dataset.

Member	This is a sample ...
HHANTPL1T	HTML page that drives the HPANSAMP PL/1 program using a form and the HTTP GET method. It may be referenced using the following URL. Refer to the installation verification procedure for more information about interpreting this URL. <i>http://ip-addr:port/htpvrs/srce/hhancget.htm</i>
HJBNPLIC	JCL to compile and link the sample PL/1 CGI program HPANSAMP.
HPANSAMP	PL/1 CGI program that is driven by the HHANPL1T HTML page.

### PL/1 and the Com-plete CGI Extensions

PL/1 programs may use the Com-plete CGI extensions by issuing a call to the appropriate extension module as follows:

```
CALL 'HAANUPR' using HTPCGI-status, function, parm1, parm2, <..>, parmn.
```

The parameters required by this interface is described in the section [Com-plete CGI Extensions](#).

The HTPCGI-status must be defined as follows in PL/1:

```
DCL 1 HTPCGI-STATUS,
      2 HTPCGI-RETURN-CODE FIXED BINARY(15),
      2 HTPCGI-REASON-CODE FIXED BINARY(15);
```

The following describes the PL/1 format required for the other parameters:

Name	PL/1 Format	Description
field	CHAR(<length>)	Must be an alpha field ending in a blank character
variable	CHAR(<length>)	Must be an alpha field ending in a blank character
value	CHAR(<length>)	Must be an alpha field of length 'length'
length	FIXED BINARY(15)	Must be a two-byte binary field containing a length
data	no defined format	The start of an area (normally alpha) of length 'length'

## S/390 Assembler Considerations

---

### Assembler and the Com-plete CGI Extensions

Software AG recommends that Assembler programs use the standard Com-plete API to handle CGI requests.

# 12 Support and Maintenance

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This document provides information on support and maintenance issues.

## Reporting Problems

---

Problems should be reported to your local technical support center. You will be asked to provide whatever information is required to solve the problem. Generally, you should have the following available when reporting a problem:

1. Version, revision, SM level and cumulative fix pack of the Com-plete HTTP server software where the problem occurred.
2. Type and level of operating system where Com-plete was running.
3. Version, revision, and SM level of other products associated with the problem (for example, Natural , Adabas ).
4. Message numbers where applicable.
5. System log for a period of time before the event.
6. Sequence of actions used to cause the problem, if reproducible.
7. Name and offset of the module where the problem occurred. Where an ABEND occurs within a Com-plete module, RC generally points to the start of the module where you will find a constant identifying the module. Subtract the PSW address from the address in RC to provide the offset into the module.
8. The register contents at the time of the ABEND.

With this information, it may be possible to identify a previous occurrence of the problem and a correction. If this is not the case, the following additional information is required:

1. The Com-plete online dump or Com-plete address space dump, as appropriate.
2. Output from the job where the failure occurred.
3. Other information that support personnel feel is relevant.

## Problem Resolution

---

A number of tools are available to diagnose HTTP server problems as follows.

## Thread Dump Diagnosis under Com-plete

When an application program ABENDs within Com-plete, a thread dump is written to the dump file. These dumps may be viewed from the HTTP UI [Dumps](#) link. Alternatively, dumps may be viewed using the UDUMP 3270 utility. Refer to the Com-plete *Utilities* documentation for more information.

## HTTP Server Trace Facilities

When HTTP requests are not being processed successfully, it can be useful to trace incoming and outgoing data. For incoming data, the HEADER trace will provide details of exactly how HTTP server has interpreted a given request while DATA tracing will show the exact format of data as it is received at the HTTP server side and what is actually sent back by the HTTP server request processing module (or the CGI program) to the web browser. HTTP server tracing may be activated using the HTTP server TRACE configuration parameter.

## Applying Maintenance

---

Bugfixes are provided in the form of cumulative fix packs, which are accumulated updates (replacement modules) to the various product libraries. Software AG recommends that you copy each update into your corresponding installation library, after having backed up the latter.

For urgent problems, hotfixes are provided.



# 13

## The HTTP Server User Exit

---

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The single HTTP server user exit is given control at strategic points in the processing of each HTTP request to enable an installation to control and manipulate the processing of HTTP requests.

## Installation

---

The HTTP server user exit must be a load module called HAANUXIT and must be available for loading by the HTTP server.

It is loaded when the HTTP server is initialized and becomes part of the HTTP server nucleus. It must be reentrant and may reside above the 16-megabyte line.

The member HAANUXIT on the HTPvrs.SRCE dataset is a sample user exit that implements each of the user exit points currently taken but simply returns normally to the user exit point. Thus, the user exit as delivered may be compiled and will not affect the normal operation of the HTTP server.

A message is issued during the server initialization process when the module is found and loaded. If this message is not issued, the exit is not operational.

## General Interface

---

The exit is called with the following registers:

Register	Contents
0	No relevant data
1	Pointer to a parameter list as described in this section
2-12	No relevant data
13	Pointer to an 18F savearea, which may be used by the exit
14	Address to which the exit returns. The exit must return using the following instruction to insure that the caller gets control back in the appropriate mode: BSM R0,R14
15	Pointer to the entry point of the module



## Exit Parameter List

On entry to the user exit, register 1 points to a parameter list that varies depending on the call.

The parameters passed to each exit point are documented in the appropriate section; however, the first parameter is always a pointer to the UXIT control block, which contains information about the HTTP server itself and the exit point for which the user exit has been called.

A DSECT to map this control block may be generated by the following statement in the Assembler program:

```
MYUXIT HMANUXIT DSECT=YES
```

The parameter list may be addressed using the following statements assuming R1 contains what it contained when the module was entered:

```
L      Rx,0(,R1)      Rx -> UXIT control block
USING  UXIT,Rx       Address UXIT area
```

The following table describes the field names and their contents, which are relevant for all exit points. The UXIT control block may also contain data relevant only to specific exit calls. Any fields of additional significance are documented in the description of the exit point itself.

Field Name	Description
UXITFUNC	Contains a function code indicating the exit point for which the exit has been called.
UXITSSNM	Names the HTTP server subsystem for which the exit is being called. Each HTTP server has a subsystem name assigned when the server is started. This field allows the exit to uniquely identify an HTTP server when more than one is running in the same Complete address space or partition.
UXITUSER	A field available to the user. This will be NULL on entry to the exit the first time and will be passed intact to the user for each subsequent call. This field is intended for use as an anchor point for the exit where storage areas are maintained from call to call. In particular, the exit must insure that any storage areas acquired during the exit processing and returned to any given exit point are freed during the termination call.

The HAANUXIT source member on the HTPVRS.SRCE dataset shows how the UXIT parameter list may be addressed and processed. It should be used as the basis for any exit written at an installation.

## Entry/Exit Processing

The HTTP server has been written using a standard entry/exit mechanism to provide consistent standards within the server and to centralize much of the common coding used during entry/exit processing.

Two macros are used:

- HMANENT for entry processing; and
- HMANEXIT for exit processing.

### HMANENT Macro for Entry Processing

The HMANENT macro takes a number of parameters; however, the important ones from the exit's point of view are the WRKL and WRKD parameters.

- WRKL specifies the length of the savearea and work area that should be allocated for the exit.
- WRKD specifies the name of the working storage DSECT that will be used to address the area.

When control is passed to the code following the HMANENT macro expansion, the following registers are set:

Register	Contents
0	As passed by the calling program (for HAANUXIT, contains no relevant data).
1	As passed by the calling program (for HAANUXIT, contains a pointer to the HAANUXIT parameter list).
2-11	As passed by the calling program (for HAANUXIT, contains no relevant data).
12	Set up as the program base register.
13	<p>Pointer to a newly allocated savearea and work area allocated based on the length specified on the WRKL parameter. The DSECT name provided on the WRKD parameter must have the following format:</p> <pre> WORK      DSECT WORKSAVE DS      18F            Exit work fields here  WORKL     EQU     *-WORK </pre> <p>Note that the field names are not important in this case once they are provided correctly on the HMANENT macro. The main point is that the area must start with an 18F savearea.</p>
14	Address to which the exit returns. While the exit returns using the HMANEXIT macro, this may be useful for determining the mode of the calling program. In the case of the HAANUXIT, it is always called from programs running AMODE=31.
15	Pointer to the entry point of the module.

## HMANEXIT Macro for Exit Processing

The HMANEXIT macro returns control to the calling program, optionally returning values in registers 15, 0, and 1. For HAANUXIT, the only relevant register in this case is 15, which is used as a return code.

Note that the HMANEXIT macro must get control with registers 12 and 13 containing the same values as were set up by the HMANENT macro.

## Exit Points

For each exit point, the following subsections will be documented:

Subsection	Documents . . .
Purpose	the purpose for which the exit point is intended.
Parameters	the parameters, if any, supplied at a given exit point in addition to the UXIT control block.
Return Codes / Return Values	the return codes that may be returned in register 15 and the processing that any given return code causes. In all cases when register 15 contains an invalid return code on return from the exit, processing continues as described for return code 0.

## Initialization

### Purpose

The initialization exit point is designed to provide an opportunity for the exit to initialize its own environment prior to any subsequent calls.

### Parameters

Parm	Description
1	Pointer to the UXIT control block

### Return Codes / Return Values

Return	Description
0	Continue processing normally

### Termination

#### Purpose

The termination entry point has been designed to provide the exit with a point at which it should clean up after any given request.

#### Parameters

Parm	Description
1	Pointer to the UXIT control block

### Return Codes / Return Values

Return	Description
0	Continue processing normally

### URL Processing

#### Purpose

The URL processing exit point is taken immediately before the URL as provided by the user is processed. The installation can then

- modify or replace the URL all together and cause the HTTP server to use a different URL to service the request. This may be useful when URL names change and a cut-over period is required to handle old and new requests.
- reject access to the URL, which causes the HTTP server to return a 'permission denied' response to the request.

## Parameters

Parm	Description
1	Pointer to the UXIT control block.
2	Pointer to the URL. This is a null1-terminated field. If this area is modified as it stands, the URL processed is the one returned in this area. If the pointer is replaced, this is not be used unless an appropriate return code is set on return from the exit.
3	Pointer to a fullword containing the length of the URL excluding the null-termination byte at the end. If the address in parameter 2 is replaced, this field must be updated to reflect the length of the URL in the area to which parameter 2 now points.

## Return Codes / Return Values

Return	Description
0	Continue processing normally. The URL is located and returned as provided to the exit or as modified in place by the exit.
4	The second parameter contains the address of a new storage location containing the URL to be used. The fullword pointed to by the third parameter has been updated to reflect the length of this new URL.
8	Access to the URL is denied. The request is rejected with a 'permission denied' response.

## Output Processing

### Purpose

The output processing exit point that is taken one or more times as output is built to be sent in response to the request. How often the exit is taken depends totally on what the URL represents and how large the output object is.

This exit point may be used to

- control translation of the output data if the basic facilities provided by the HTTP server are not adequate. This exit can effectively replace the HTTP server translation processing and do the translation itself.
- insert data into the output data stream. This is useful for inserting HTTP headers for any given request; however, users must be careful that the resulting output is still a valid HTTP request. The HTTP server does not control what is being sent in this case and therefore the user is responsible for ensuring that it is correct.
- prevent certain data from being sent.

**Parameters**

Parm	Description
1	Pointer to the UXIT control block Two additional flags are used in this control block as follows: UXITMHHS => HTTP header sent. UXITMCHS => Content-type header sent. UXITMCON => Now sending HTTP content
2	Pointer to output data. All data sent in response to a request is passed to this exit starting with the HTTP protocol headers and finishing with the content for the request, if any. If the data area pointed to by this pointer is modified in any way, the modified value is used for 'normal' processing. If this pointer is replaced, the data is only sent if an appropriate return code is returned from the exit.
3	Pointer to a fullword containing the length of the data pointed to by parameter 2. This must be modified if the length of data in the area pointed to by parameter 2 changes or the address is changed to point to a new area.
4	Pointer to the content type being sent. This reflects the content type as the HTTP server believes it to be. If the exit changes the content type in any way, it should be reflected here by the exit. When a CGI or Natural CGI request is being processing, this contains the value 'CGI' or 'NATCGI' until the content type being sent by the CGI program is established by the program itself sending a 'CONTENT-TYPE' header or a default header being sent by the HTTP server itself.

**Return Codes / Return Values**

Return	Description
0	Continue processing normally. Normal processing means that the data in the area pointed to by parameter 2 for a length based on the fullword pointed to by parameter 3 is sent in response to the request. If headers are still being processed (that is, UXITMCNS is not on), these are always translated from EBCDIC to ASCII. If content is being processed (that is, UXITMCNS is on), the data is only translated from EBCDIC to ASCII if the CONTENT-TYPE header is of the form TEXT/* (where '*' is any value).
4	Do not translate the data. The data is sent exactly as is.
8	Do not send the data. The attempt to send the data is ignored.
12	Insert the data pointed to by a parameter 2 for a length specified by the fullword pointed to by parameter 3. The data is translated based on the rules for return code 0. The next call to the exit represents the same data as was presented on this call, thus enabling the exit to insert HTTP headers and/or content data if desired.
16	Same as return code 12; however, no HTTP server translation is performed on the data.

## Input Processing

### Purpose

Called when input is being processed for an incoming HTTP request, the input processing exit point may be used to

- translate incoming content in a way different from the basic translation services provided by the HTTP server.
- track or report identified HTTP headers or requests identified by certain requests.

### Parameters

Parm	Description
1	Pointer to the UXIT control block.
2	Pointer to the data relating to the header identified by parameter 4.
3	Length of the data pointed to by parameter 2.
4	Pointer to the name of the HTTP header in EBCDIC for which the data pointed to by parameter 2 has been provided. Two 'logical headers' are defined for this interface ('logical' because they do not exist in the HTTP protocol specification and are used only to identify the data): QUERY_STRING => the parameter string on the URL CONTENT => the actual request content
5	Pointer to a fullword containing the length of the HTTP header pointed to by parameter 4.
6	Points to the CONTENT-TYPE for the request when it is identified.
7	Points to a fullword containing the length of the content type as pointed to by parameter 6.

### Return Codes / Return Values

Return	Description
0	Continue processing normally. 'Normal processing' translates any HTTP header data from ASCII to EBCDIC unless it contains encoded data. Content is translated if the incoming content type is TEXT/* (where '*' represents any value).
4	Do not translate: use the data exactly as is in the buffer.

## Accept Processing

### Purpose

The accept processing exit point is taken immediately after a client has connected to the HTTP server. It may be used to control which IP addresses may connect with the HTTP server

### Parameters

Parm	Description
1	Pointer to the UXIT control block.
2	<p>Pointer to a fullword containing the address of the peer application which has connected to the server. This is in the form of an Internet address as follows:</p> <p>H =&gt; Address family: always '2' to indicate an Internet address</p> <p>H =&gt; Port number of the peer program</p> <p>F =&gt; IP address of the peer program</p> <p>This structure is set to nulls when the address of the peer application cannot be established.</p> <p><b>Note:</b> Where a proxy is in use, this is the IP address of the proxy and not of the originating client.</p>

### Return Codes / Return Values

Return	Description
0	Continue processing normally; that is, accept and process the request.
4	No current meaning.
8	Reject the request. The HTTP server immediately terminates the connection with the client.



# 14 Messages and Codes

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- ABEND codes Complete HTTP ABEND Codes ..... 115
- Messages Server COMHTTP HTTP Server Messages ( COMHTTP server message prefix COMHTTP Prefix) ..... 116

This section contains messages and codes issued by the HTTP server components of the Com-plete system.

The explanation of the messages is organized as follows:

### Message Format

Com-plete HTTP server messages have the following format:

```
COMHTPnnnn - message-id
```

where

HTP	identifies the HTTP subsystem as issuing the message.
nnnn	is a sequential message number identifying the message within the subsystem.
message-id	identifies the Com-plete address space issuing the message. This value is determined from the Com-plete configuration parameter MESSAGE-ID. It may be a single character in braces (e.g. (X)) or it may contain the installation ID as specified in the Com-plete configuration parameter INSTALLATION.

### Message Documentation

Messages are documented with the message identifier (excluding the constant 'COM' which is always present) in the heading followed by the message text.

The message text appears something like the following:

```
This is a test &1 with three (&2) replacement parms '&3'
```

When displayed or written to the console, the message contains the text as displayed; however, the placeholders identified by the '&n' construct are replaced by data relevant to the message.

If the data to be displayed is X, y, and AB, the message appears as follows:

```
This is a test X with three (y) replacement parms 'AB'
```

Each message includes the following subsections:

Description	explains why the message was issued.
Placeholders	describes what each of the placeholders (that is, the '&n' values) contains. If the message contains no placeholders, the expression 'Not applicable' is written.
Action	describes the actions to be taken when this message is issued. A number of actions may be listed, if appropriate. If no action is required, the expression 'Not applicable' is written.

Additional References	describes any other additional source(s) of information that may further explain the message. A number of references may be listed, if appropriate. If no additional references are available, the expression 'Not applicable' is written.
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## ABEND codes Com-plete HTTP ABEND Codes

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<b>ABEND U2000</b>	<b>Insufficient Storage</b>
<b>Explanation</b>	ABEND U2000 occurs when insufficient storage is available to obtain a primary control block within the Com-plete HTTP environment. It indicates a problem at a point where it is not possible to issue a Com-plete HTTP error message.
<b>Action</b>	Make sufficient storage available to the program running in the environment to enable the request to be satisfied.

<b>ABEND U2001</b>	<b>Logic Error in Com-plete HTTP Nucleus</b>
<b>Explanation</b>	ABEND U2001 indicates an unexpected condition within the nucleus for which a message could not be issued.
<b>Action</b>	It could occur due to storage overwrites in the Com-plete HTTP environment or as a result of earlier errors in the environment. If none of these appears to be the case, report the problem to your local support center.

<b>ABEND U2002</b>	<b>Invalid Com-plete local storage stack area</b>
<b>Explanation</b>	On freeing the Com-plete HTTP server request's local storage stack area, it was found to be corrupt.
<b>Action</b>	See below for storage corruption explanation.

<b>ABEND U2003</b>	<b>Storage Corrupted</b>
<b>Explanation</b>	While freeing storage within the Com-plete nucleus, a corruption failure was detected.
<b>Action</b>	When storage is allocated, Com-plete puts a storage accounting prefix at the start of the storage and an identical suffix at the end of the storage. If these do not match when the storage is freed, this ABEND occurs.

A mismatch indicates that either

- the user that allocated the storage requested "n" bytes but used more than "n" bytes thus overwriting the storage accounting area at the end; or
- a user of storage before the storage area being freed overwrote the prefix of the storage area.

In any event, register 7 will point to the prefix accounting area of the storage. The length of the storage is found at register 7 + 4 (if it hasn't been corrupted) while the storage area itself returned to the user can be found at register 7 + 8.

## Messages Server COMHTTP HTTP Server Messages ( COMHTTP server message prefix COMHTTP Prefix)

**HTP0001**                    **HTTP server already active**

**Explanation**                An attempt was made to issue an INIT command to an HTTP server; however, the HTTP server was already active.

**Placeholder**                Not applicable

**Action**                        Not applicable

**References**                  Not applicable

**HTP0002**                    **Insufficient storage for \$2 (\$1 bytes)**

**Explanation**                An attempt by the HTTP server to acquire storage failed due to insufficient storage either in a user program thread or in the Com-plete address space.

**Placeholders**

\$1	Number of bytes that the system tried to acquire. The number may be suffixed with a 'K' or an 'M' to denote KBYTES or MBYTES, respectively. '0' indicates that the HTTP server was not in a position to determine the amount of storage that could not be acquired. This could occur if a request to an underlying system failed due to a storage shortage without indicating how much was required.
\$2	A character string indicating what the storage was for and possibly a four-digit code in braces indicating which control block this storage was for, if applicable.

- Action**
- If the storage is thread-related, use the ULIB utility to increase the catalog size of the HTTP server application program that suffered the error. Note that the thread sizes in general may have to be increased in the Com-plete region depending on how much thread space the application requires.
  - If the storage is outside of the thread, there is a shortage of storage in the Com-plete region itself. Where possible, Com-plete will expand its storage areas so it is likely that such an expansion request failed thus resulting in this message. Check for other errors related to any attempted expansion for more details.
  - The following table identifies the storage areas by name, where they may be located and what they are used for:

Storage name	Location	Description
Master control block (HMCB)	Above	The main control block used by the HTTP server; acquired from the Com-plete environment general buffer pool.
Working storage	Above	The generic term used for storage acquired on a temporary basis. It will normally be allocated in the HTTP server application program thread.

Storage name	Location	Description
HTTP request areas (HPRQ and buffers)	Above	The main HTTP server request processing block and associated buffers acquired by the HTTP server request processing program HAANRQST from the application program thread.
HTTP request header (HPRH)	Above	The request header control block acquired per request header found in any given HTTP request. It is allocated from the HTTP server request processing program (HAANRQST) thread.
HTTP environment variable work area	Above	Area allocated from the HTTP server request program thread storage to issue 'putenv' requests to the Com-plete environment to build environment variables for CGI requests.

**HTP0003****Invalid parameter specified \$1****Explanation**

An invalid parameter was specified on the HTTP server startup. This may have been supplied in the Com-plete SERVER configuration parameter or operator command.

**Placeholders**

\$1	The string presented as a parameter to the HTTP server, which was not recognized.
-----	---

**Action**

- Correct the Com-plete configuration parameter SERVER to start the HTTP server.
- Reissue the Com-plete operator command SERVER INIT with a valid parameter value.

**HTP0004****Server initialization failed****Explanation**

An attempt to start an HTTP server failed. The reason for the failure is indicated in a previously issued message.

**Placeholders**

Not applicable

**Action**

Correct the problem that caused the HTTP initialization failure as specified in the preceding message.

**References**

Not applicable

**HTP0005****URL parameter data exceeds maximum (\$1 Bytes)****Explanation**

A user issued an HTTP request with a parameter on the URL that exceeded the length of the URL parameter area. The URL parameter is the data following the question mark, which in turn follows the actual URL itself. The URL parameter buffer is allocated based on the HTTP server configuration parameter URLPBUFL.

**Placeholders**

\$1	The maximum URL parameter length of data in bytes that is acceptable to the instance of the HTTP server on which the error occurred.
-----	--

**Action**              Determine if the request itself is valid and if so, increase the specification of the HTTP server configuration parameter URLPBUFL accordingly.

**References**         See section *Customizing and Using the HTTP Server*.

**HTP0006              Content length exceeds maximum (\$1 Bytes)**

**Explanation**        A user issued an HTTP request with content that exceeded the length of the allocated content area. The content of an HTTP request is the data that follows the last HTTP header provided for a request. The content buffer is allocated based on the specification of the HTTP server configuration parameter CONTBUFL.

**Placeholders**

\$1	The maximum length of content data in bytes which is acceptable to the instance of the HTTP server on which the error occurred.
-----	---

**Action**              Determine if the request itself is valid and, if so, increase the specification of the HTTP server configuration parameter CONTBUFL accordingly.

**References**         See section *Customizing and Using the HTTP Server*.

**HTP0007              Content length required for request**

**Explanation**        Where content is provided for an HTTP request, a 'CONTENT-LENGTH' header must be provided on the request to determine how much content to expect. This message is issued when the last HTTP header is received that is followed by content data; however, no content length header has been received.

**Placeholders**        Not applicable

**Action**              Determine which client is submitting the HTTP request and change it to either submit no content data or to submit a content length header indicating how much content data will follow.

**References**         The HTTP V1/1 Protocol specification

**HTP0008              Server is not active**

**Explanation**        An operator command has been issued to an HTTP server or an attempt has been made to terminate an HTTP server that is not active.

**Placeholders**        Not applicable

**Action**              Not applicable

**References**         Not applicable

<b>HTP0009</b>	<b>Content length '\$1' invalid for request</b>		
<b>Explanation</b>	Content data has been provided on a HTTP request. Content data has been detected and a content length header has been provided; however, the content data provided was less than or greater than the length specified in the content length header.		
<b>Placeholders</b>	<table border="1" data-bbox="492 354 1474 436"> <tr> <td>\$1</td> <td>The length of data expected based on the length provided in the content length HTTP header.</td> </tr> </table>	\$1	The length of data expected based on the length provided in the content length HTTP header.
\$1	The length of data expected based on the length provided in the content length HTTP header.		
<b>Action</b>	Determine which client issued the HTTP request and correct its content length processing.		
<b>References</b>	The HTTP V1/1 Protocol specification		
<b>HTP0010</b>	<b>URL '\$1' not found</b>		
<b>Explanation</b>	A client requested that the URL indicated in placeholder \$1 be returned; however, the URL does not exist.		
<b>Placeholders</b>	<table border="1" data-bbox="492 779 1065 827"> <tr> <td>\$1</td> <td>The URL as requested by the client program.</td> </tr> </table>	\$1	The URL as requested by the client program.
\$1	The URL as requested by the client program.		
<b>Action</b>	This generally occurs for a dataset or dataset and member request. The HTTP server translates a URL of the form /a/b/c/ to a sequential dataset name of the form a.b.c , or a URL of the form /x/y/z to a PDS member name of the form x.y(z). The sequential dataset or PDS member as translated from the URL by the HTTP server was not found on the system. This indicates that either it doesn't exist or it has not been cataloged.		
<b>References</b>	Not applicable		
<b>HTP0011</b>	<b>Unable to load CGI program '\$1'</b>		
<b>Explanation</b>	A request was issued that resulted in the URL being interpreted as a CGI request for the program identified by placeholder \$1. This program was not available to the Com-plete address space and therefore the CGI request could not be completed.		
<b>Placeholders</b>	<table border="1" data-bbox="492 1310 1474 1388"> <tr> <td>\$1</td> <td>Name of the program identified by the CGI request which could not be loaded in the Com-plete region where the request was received.</td> </tr> </table>	\$1	Name of the program identified by the CGI request which could not be loaded in the Com-plete region where the request was received.
\$1	Name of the program identified by the CGI request which could not be loaded in the Com-plete region where the request was received.		
<b>Action</b>	Determine if the request was valid and if it was, make the program available in the Com-plete region where the request should be processed.		
<b>References</b>	See section <a href="#">Running CGI Programs under SMARTS</a> .		
<b>HTP0012</b>	<b>Natural startup module '\$1' not found: '\$2' NATCGI request failed</b>		
<b>Explanation</b>	A request was received by the HTTP server that resulted in an attempt to execute the Natural CGI program identified by the \$2 placeholder. It was not possible to process this request as the Natural thread-resident portion identified by the \$1 placeholder could not be loaded in the Com-plete region where the request was received.		

<b>Placeholders</b>	\$1	Name of the thread-resident Natural portion that is identified on the HTTP server configuration parameter NATTHRD.
	\$2	Name of the Natural program that the Natural CGI request was attempting to execute.

**Action** Correct the specification of the HTTP configuration parameter NATTHRD to identify the correct Natural thread portion; or make the Natural thread portion named available to the Com-plete region where the request was received.

**References** See section *Installing Natural CGI*.

**HTP0013      **Module \$1 loaded****

**Explanation** The module identified by the \$1 placeholder was loaded by the nucleus. This message is issued in the following cases:

- When more than one version of a module exists, it indicates which version of the module was loaded.
- For exits that may not normally be part of the nucleus, this indicates when an exit has been loaded and is active in the system.

<b>Placeholders</b>	\$1	Name of the module that was loaded.
---------------------	-----	-------------------------------------

**Action** This is an informational message, no action is necessary.

**References** Not applicable

**HTP0014      **Server initialization in progress****

**Explanation** The HTTP server has commenced its initialization processing.

**Placeholders** Not applicable

**Action** Not applicable

**References** Not applicable

**HTP0015      **Read error '\$1' processing URL '\$2'****

**Explanation** A URL identifying a sequential dataset or PDS member has been received. This dataset or PDS member has been found; however, an error occurred while reading the data to transmit it to the user.

<b>Placeholders</b>	\$1	The error number returned by the Com-plete API function being used to read the dataset or PDS member. The HTTP server uses the 'gets' and 'read' functions to access data, so refer to the descriptions of these functions for details of the cause of the identified error number being returned.
	\$2	The URL as requested by the user.

**Action** Use the returned information to identify the problem and correct it.



- HTP0016**            **'putenv' failed processing environment variables errno=\$1**
- Explanation**        When a CGI request is identified, the HTTP server must make a number of specific environment variables available to the CGI program. This is done by using the Com-plete API 'putenv' function to set the environment variables before calling the CGI program. This indicates that the function request failed and therefore one or more environment variables will not be available to the CGI program called.
- Placeholders**

\$1	The error number as returned by the 'putenv' function.
-----	--
- Action**                Based on the information returned, determine why the 'putenv' function failed and correct the problem. Normally, 'putenv' only fails when insufficient storage is available in the thread where the CGI program runs. This is determined by the size at which the HTTP server request processing module (default name HAANRQST) is catalogued using the ULIB utility.
- 
- HTP0017**            **\$1 Sockets \$2 request error errno=\$3**
- Explanation**        The HTTP server uses the Com-plete API sockets functions to communicate with clients. This message indicates that the request indicated by the \$1 placeholder failed with the error number indicated.
- Placeholders**

\$1	Name of the sockets function request that failed
\$2	Error number
\$3	Error number
- Action**                Sockets errors generally occur when the peer program terminates the conversation, or a transport error occurs on the network.
- 
- HTP0018**            **Access to URL '\$1' forbidden**
- Explanation**        A user attempted to access the URL identified by \$1 but access to the resource was denied. This occurs depending on the specification of the HTTP server configuration parameter LOGON as follows:
- When LOGON=REQUIRED is specified, or LOGON=ALLOWED is specified and the user supplies authorization information (user ID and password) for the request, this error indicates that access to the resource based on the provided information was not granted.
  - When LOGON=DISALLOWED is specified and the 'public' user ID does not have access to the requested resource, the user is not permitted to provide authorization information so the request is refused.

**Placeholders**

\$1	The URL that the user attempted to access.
-----	--

**Action**              If the resource should be accessible to users of the HTTP server in question, grant the necessary access rights. If not, determine why users are attempting to access the resource in question.

**References**         The information on Security.

**HTP0020              Internal logic error in \$1+x\$2**

**Explanation**        Something unexpected has occurred in the HTTP server nucleus. Additional errors are likely to follow any occurrence of this error message.

**Placeholders**

\$1	Name of the HTTP server nucleus program in which the error was detected.
\$2	Hexadecimal offset in the program where the error was detected.

**Action**              Report the error message and the steps taken to produce the error to your local support center.

**References**         Not applicable

**HTP0021              Server is quiescing**

**Explanation**        The HTTP server is quiescing. In this state, current requests may continue to completion; however, no new requests are allowed.

**Placeholders**        Not applicable

**Action**              This is an informational message: no action is necessary.

**References**         Not applicable

**HTP0022              SAF Logon for default userid \$1 failed**

**Explanation**        The default user ID specified is not authorized.

**Placeholders**

\$1	Default user ID
-----	-----------------

**Action**              Check that the default user ID specified in the HMANCONF macro by the parameter HTTPUSER is valid.

**References**         The information on Security.

**HTP0023              Invalid URL '\$1'**

**Explanation**        The URL requested by a client is invalid.

<b>Placeholders</b>	<code>\$1</code> The URL as requested by the client
<b>Action</b>	Specify a URL that the HTTP Server can understand. Refer to the appropriate IETF standards for information on what constitutes a valid URL.
<b>References</b>	Not applicable
<b>HTP0024</b>	<b>Natural initialization failure, RC=\$1</b>
<b>Explanation</b>	A request was received by the HTTP server that resulted in an attempt to execute a Natural CGI program. The Natural thread-resident portion that is identified on the HTTP server configuration parameter NATTRD was loaded, but an error occurred at startup.
<b>Placeholders</b>	<code>\$1</code> The return code received from the Natural thread-resident portion.
<b>Action</b>	Determine from the Natural documentation why the return code is returned and correct the error.
<b>References</b>	<i>Natural Installation and Operations</i> documentation
<b>HTP0026</b>	<b>Conversation \$1 no longer exists</b>
<b>Explanation</b>	When a conversation is started with a WWW browser, it is assigned an internal identifier known only to the HTTP server and the browser with which it is conversing. This error indicates that when the browser eventually sent data in response to a request, the original conversation no longer existed. This could occur due to a timeout, a system ABEND, or even a stored URL being sent minutes, hours, days, or even weeks after the conversation was terminated normally by the user.
<b>Placeholders</b>	<code>\$1</code> Name of the conversational cookie.
<b>Action</b>	Restart the conversational application as appropriate.
<b>References</b>	Not applicable
<b>HTP0027</b>	<b>Input buffer space \$1 bytes exhausted</b>
<b>Explanation</b>	This error occurs if pooled sessions are in use and the entire request from the user must fit into the input buffer. The message is longer than the input buffer length specified in the configuration for the HTTP server.
<b>Placeholders</b>	<code>\$1</code> The length of the buffer used for receiving input data from the network.
<b>Action</b>	Increase the specification of the HTTP server configuration parameter RECVBUFL.
<b>References</b>	See section <a href="#">Customizing and Using the HTTP Server</a> .

**HTP0028 Server interface \$1 request failed rc=\$2**

**Explanation** A call to the environment independent server interface failed.

**Placeholders**

\$1	The server function requested: initialization, termination, command
\$2	Return code

**Action** One or more messages will be written to the console to indicate the nature of the error. Correct these problems and restart the server.

**References** Not applicable

**HTP0030 HTTP header '\$1' unrecognized**

**Explanation** A header was detected in an HTTP request that was not recognized by the HTTP server. The header is ignored and the request is processed normally, ignoring the specified header.

**Placeholders**

\$1	Name of the header found in the HTTP request that was not recognized by the HTTP server.
-----	--

**Action** Report this to your technical support representative. While this is not an error as such, it is possible that the HTTP header should be recognized in a future release of the HTTP server.

**References** Not applicable

**HTP0031 Unsupported request data \$1/x\$2**

**Explanation** In the unformatted portion of an HTTP request, the HTTP server expects data as specified in the HTTP V1/1 protocol standard. If more information than normal is provided, or if the HTTP server makes an error interpreting the request, this message is issued. The request is processed normally; however, the data indicated in the message placeholders is be taken into account in the processing of the request.

**Placeholders**

\$1	The data provided on the request that the HTTP server ignored in character format.
\$2	The data provided on the request that the HTTP server ignored in hexadecimal format.

**Action** Report this to your technical support representative. While this is not an error as such, it is possible that the HTTP request data should be recognized in a future release of the HTTP server.

**References** Not applicable

<b>HTP0032</b>	<b>Header '\$1' data '\$2' ignored</b>						
<b>Explanation</b>	The HTTP server recognized the header identified by the \$1 placeholder, however, it had to ignore the data as identified by the \$2 placeholder. This generally occurs due to a shortage of working space in the HTTP server request processing areas. The request is processed, however, the ignored header data, as shown in this message, is not taken into account while processing the request.						
<b>Placeholders</b>	<table border="1"> <tr> <td>\$1</td> <td>Name of the HTTP header for which the data was ignored.</td> </tr> <tr> <td>\$2</td> <td>The data (or at least the start of the data) that was ignored for the header identified by \$1.</td> </tr> </table>	\$1	Name of the HTTP header for which the data was ignored.	\$2	The data (or at least the start of the data) that was ignored for the header identified by \$1.		
\$1	Name of the HTTP header for which the data was ignored.						
\$2	The data (or at least the start of the data) that was ignored for the header identified by \$1.						
<b>Action</b>	Report this to your technical support representative. While this is not an error as such, it indicates that certain values within the HTTP server request interpretation processing may need to be reviewed.						
<b>References</b>	Not applicable						
<b>HTP0033</b>	<b>Environment interface \$1 request failed rc=\$2</b>						
<b>Explanation</b>	A call to the environment dependent interface failed. Environmental components are called for initialization, termination and for initialization of the listening task.						
<b>Placeholders</b>	<table border="1"> <tr> <td>\$1</td> <td>The server function requested: ENVINIT, ENVTERM, or LISTINIT</td> </tr> <tr> <td>\$2</td> <td>Return code</td> </tr> </table>	\$1	The server function requested: ENVINIT, ENVTERM, or LISTINIT	\$2	Return code		
\$1	The server function requested: ENVINIT, ENVTERM, or LISTINIT						
\$2	Return code						
<b>Action</b>	Report the error to your local support center.						
<b>References</b>	Not applicable						
<b>HTP0034</b>	<b>\$1 Invalid data \$2/x\$3 for program</b>						
<b>Explanation</b>	One of the HTTP server thread processing programs HAANLIST or HAANRQST is started by a mechanism apart from the internal processing of the HTTP server. These programs expect specific parameters that can only be provided via the internal HTTP server mechanisms.						
<b>Placeholders</b>	<table border="1"> <tr> <td>\$1</td> <td>Name of the program that was started with the invalid data.</td> </tr> <tr> <td>\$2</td> <td>The invalid data provided to the program in character format.</td> </tr> <tr> <td>\$3</td> <td>The invalid data provided to the program in hexadecimal format.</td> </tr> </table>	\$1	Name of the program that was started with the invalid data.	\$2	The invalid data provided to the program in character format.	\$3	The invalid data provided to the program in hexadecimal format.
\$1	Name of the program that was started with the invalid data.						
\$2	The invalid data provided to the program in character format.						
\$3	The invalid data provided to the program in hexadecimal format.						
<b>Action</b>	Determine who or what is attempting to start these programs in an incorrect way and force them to stop.						
<b>References</b>	Not applicable						

- HTP0035**                    **Com-plete API \$1 Request failed rc=\$2/errno=\$3**
- Explanation**            An error occurred for a request made to the Com-plete environment.
- Placeholders**
- |     |                      |
|-----|----------------------|
| \$1 | Name of the request. |
| \$2 | Return code.         |
| \$3 | Error number.        |
- Action**                    Note that in many cases these "errors" may be normal due to general activity on the TCP/IP network, for example.
- 
- HTP0036**                    **Server waiting for \$1 user(s) to terminate**
- Explanation**            The server cannot terminate correctly until all users have terminated. The message indicates the number of users upon which the server is waiting.
- Placeholders**
- |     |                                   |
|-----|-----------------------------------|
| \$1 | The number of users still active. |
|-----|-----------------------------------|
- Action**                    Wait until all users have terminated and reissue the request to QUIESCE or TERMINATE the server. The server may be forced; however, this is not recommended due to the subsequent problems it can cause.
- References**                Not applicable
- 
- HTP0037**                    **Operator command \$1 issued successfully**
- Explanation**            The operator command identified in the message has been successfully issued to the server.
- Placeholders**
- |     |                                      |
|-----|--------------------------------------|
| \$1 | Name of the operator command issued. |
|-----|--------------------------------------|
- Action**                    This is an informational message: no action is necessary.
- References**                Not applicable
- 
- HTP0039**                    **HTTP server \$1 active on port \$2**
- Explanation**            The HTTP listening task attached for the server indicated by the \$1 placeholder has been started successfully and is now listening for incoming HTTP requests on the TCP/IP port identified by the \$2 placeholder.
- Placeholders**
- |     |   |
|-----|---|
| \$1 | Name of the HTTP server as specified on the Com-plete SERVER configuration parameter or operator command.                     |
| \$2 | The TCP/IP port number on which the HTTP server is listening. This is set using the HTTP server configuration parameter PORT. |
- Action**                    Not applicable
- References**                The HTTP Server installation ionformation.

**HTP0040            Module not found \$1****Explanation**

The module identified by the \$1 placeholder cannot be found. A request to the operating system to load the module has failed. Modules to be loaded by the HTTP server must be available either in

- the COMPLIB DD concatenation or system LNKST for z/OS and MSP systems; or
- a library identified in the search path for z/VSE.

If this message is issued during the initialization process, initialization fails if the module is required for the correct operation of the HTTP server. Otherwise, initialization continues.

If this message is issued during the termination process, termination continues; however, depending on the function of the module, the termination process may not complete successfully.

**Placeholders**

\$1	Name of the module that could not be found
-----	--

**Action**

If the module should be available during initialization and/or termination processing, determine why it cannot be found.

**References**

Not applicable

**HTP0041            Module \$1 load error rc=\$2/\$3****Explanation**

The module identified by the \$1 placeholder could not be loaded due to an error during LOAD processing. A request to the operating system to load the module failed for some reason other than the fact that the module could not be found.

If this message is issued during the initialization process, initialization fails if the module is required for the correct operation of the HTTP server. Otherwise, initialization continues.

If this message is issued during the termination process, termination continues; however, depending on the function of the module, the termination process may not complete successfully.

**Placeholders**

\$1	Name of the module for which the LOAD request failed.
\$2	Return code from the operating system LOAD request.
\$3	Reason code from the operating system LOAD request.

**Action**

Determine from the return and reason codes why the LOAD request failed and correct the error.

**References**

*z/OS Assembler Programmers Macro Reference Manual*  
*VSE/ESA Assembler Programmers Macro Reference Manual*

**HTP0042            Module \$1 issued return code \$2**

**Explanation**        A number of modules are called internally during HTTP server initialization and termination. These modules generally issue a 0 return code when they complete successfully. This message is issued when a module is called and its return code is not 0. When a non-zero return code is issued, the module responsible issues a message itself to indicate where the problem lies.

Initialization processing continues if the return code is less than 8 and terminates if the return code is 8 or greater.

Termination processing continues; however, if the return code is 8 or greater, there may be additional failures later in the termination process.

**Placeholders**

\$1	Name of the module that issued the return code
\$2	Return code issued by the module identified by \$1.

**Action**                Refer to preceding messages in the log to determine why the return code was issued. Correct the situation.

**References**            Not applicable

**HTP0043            Server \$1 initialization successful**

**Explanation**        Initialization processing for the HTTP server identified by the \$1 placeholder completed successfully.

**Placeholders**

\$1	Name of the HTTP server as specified on the Com-plete SERVER configuration parameter or operator command.
-----	---

**Action**                Not applicable

**References**            Not applicable

**HTP0044            Server \$1 terminating on port \$2**

**Explanation**        The HTTP server as identified in the \$1 placeholder is no longer listening for incoming HTTP requests on the port specified by placeholder \$2. This generally indicates that an error has occurred on the sockets 'listen' or 'accept' request, which in turn indicates that the TCP/IP connection has problems.

**Placeholders**

\$1	Name of the HTTP server as specified on the Com-plete SERVER configuration parameter or operator command.
\$2	The TCP/IP port number on which the HTTP server was listening.

**Action**                Not applicable



<b>HTP0047</b>	<b>Server \$1 terminated</b>						
<b>Explanation</b>	The HTTP server identified by the \$1 placeholder terminated successfully.						
<b>Placeholders</b>	<table border="1"> <tr> <td>\$1</td> <td>Name of the HTTP server as specified on the Com-plete SERVER configuration parameter or operator command.</td> </tr> </table>	\$1	Name of the HTTP server as specified on the Com-plete SERVER configuration parameter or operator command.				
\$1	Name of the HTTP server as specified on the Com-plete SERVER configuration parameter or operator command.						
<b>Action</b>	Not applicable						
<b>References</b>	Not applicable						
<b>HTP0048</b>	<b>Unrecognized operator command \$1</b>						
<b>Explanation</b>	An operator command was issued to the HTTP server using the Com-plete SERVER operator command; however, the operator command was not processed because it was not recognized by the HTTP server.						
<b>Placeholders</b>	<table border="1"> <tr> <td>\$1</td> <td>The operator command provided in the Com-plete SERVER operator command for the HTTP server that was not recognized by the HTTP server.</td> </tr> </table>	\$1	The operator command provided in the Com-plete SERVER operator command for the HTTP server that was not recognized by the HTTP server.				
\$1	The operator command provided in the Com-plete SERVER operator command for the HTTP server that was not recognized by the HTTP server.						
<b>Action</b>	Issue a valid operator command.						
<b>References</b>	See section <a href="#">Customizing and Using the HTTP Server</a> .						
<b>HTP0054</b>	<b>Server \$1 using \$2 configuration</b>						
<b>Explanation</b>	The HTTP server identified by the \$1 placeholder is initializing with the HTTP server configuration parameters specified by the \$2 placeholder.						
<b>Placeholders</b>	<table border="1"> <tr> <td>\$1</td> <td>Name of the HTTP server as specified on the Com-plete SERVER configuration parameter or operator command.</td> </tr> <tr> <td>\$2</td> <td>Name of the HTTP server configuration parameter module that will be used by this instance of the HTTP server for its configuration information.</td> </tr> </table>	\$1	Name of the HTTP server as specified on the Com-plete SERVER configuration parameter or operator command.	\$2	Name of the HTTP server configuration parameter module that will be used by this instance of the HTTP server for its configuration information.		
\$1	Name of the HTTP server as specified on the Com-plete SERVER configuration parameter or operator command.						
\$2	Name of the HTTP server configuration parameter module that will be used by this instance of the HTTP server for its configuration information.						
<b>Action</b>	Not applicable						
<b>References</b>	See section <a href="#">Customizing and Using the HTTP Server</a> .						
<b>HTP0055</b>	<b>Invalid configuration file \$1 data=\$2/x\$3</b>						
<b>Explanation</b>	The HTTP server configuration file identified by the \$1 placeholder starts with invalid data and thus cannot be used by the HTTP server for its configuration processing. The HTTP server initialization process terminates.						
<b>Placeholders</b>	<table border="1"> <tr> <td>\$1</td> <td>Name of the configuration file found to be invalid.</td> </tr> <tr> <td>\$2</td> <td>The data found at the start of the invalid module in character format.</td> </tr> <tr> <td>\$3</td> <td>The data found at the start of the invalid module in hexadecimal format.</td> </tr> </table>	\$1	Name of the configuration file found to be invalid.	\$2	The data found at the start of the invalid module in character format.	\$3	The data found at the start of the invalid module in hexadecimal format.
\$1	Name of the configuration file found to be invalid.						
\$2	The data found at the start of the invalid module in character format.						
\$3	The data found at the start of the invalid module in hexadecimal format.						
	<ul style="list-style-type: none"> <li>■ Ensure that the module was generated using the procedures and samples provided with Com-plete.</li> </ul>						

- Ensure that another module of the same name is not higher in the COMPLIB concatenation or z/VSE search path than the HTTP configuration module you wish to use.

**References** The information on installation, as well as customization and use of the HTTP Server.

**HTP0056 Server cannot initialize - SMARTS environment not active**

**Explanation** The SMARTS environment must be active before the HTTP server can be activated. During its initialization processing, the HTTP server determined that the SMARTS environment was not active.

**Placeholders** Not applicable

**Action** Ensure the POSIX SERVER statement appears before the HTTP SERVER statement(s) in the Com-plete sysparms.

**HTP0057 Module '\$1' attach failed rc=\$2**

**Explanation** The HTTP server uses internal Com-plete functions to start new processes in the Com-plete region. An attempt to attach the program identified by the \$1 placeholder failed.

If this program is HAANLIST, no task was available to listen on the appropriate port for a given instance of the HTTP server.

If the module name is HAANRQST (or an alternate name assigned by the user), that particular request itself fails; however, the HTTP server remains active and listening

**Placeholders**

\$1	Name of the program for which the attach request failed
\$2	Return code from the Com-plete request issued as follows:
4	Insufficient TIBs available in the system.
8	Program to be attached was not found.
12	Security error.
16	Invalid program name to be attached.
20	Insufficient space in the Com-plete general buffer pool.

**Action**

RC	Action
4	The number of TIBs available in the system is determined by the Com-plete configuration parameter TIBTAB.
8	The program cannot be found if the HTTP server configuration parameter HTTPRQST specifies a program name that is not available to the Com-plete system.
8, 16	Report these errors to your technical support representative.
20	Review the Com-plete storage configuration parameters.

**References** *Com-plete System Programming* documentation

**HTP9001 NATURAL PROGRAM '\$1' not found in library '\$2'**

**Explanation** A request was issued that resulted in the URL being interpreted as a NATCGI request for the Natural program \$1, in the Natural library \$2. This Natural program could not be located in the Natural library.

<b>Placeholders</b>	\$1	Name of the Natural program identified by the NATCGI request.
	\$2	Name of the Natural library in which the HTTP server is attempting to locate the Natural program. This could either have been supplied in the requesting URL or as a default in the configuration module.

**Action** Determine if the request is valid, and the Natural program is available in the requested library. If it is, then check, and correct if necessary, the HTTP server parameters NATLIB, NATPARM and NATTHRD.

**References** Section *Customizing and Using the HTTP Server* and section *Installing Natural CGI*.

**HTP9002 NATURAL Object '\$1' in library '\$2' not type 'Program' (is type '\$3')**

**Explanation** A request was issued that resulted in the URL being interpreted as a NATCGI request for the Natural program \$1, in the Natural library \$2. This Natural object was located in the Natural library, but it is not of type program.

<b>Placeholders</b>	\$1	Name of the Natural object identified by the NATCGI request.
	\$2	Name of the Natural library in which the HTTP server is attempting to locate the Natural program. This could either have been supplied in the requesting URL or as a default in the configuration module.
	\$3	The actual type of the Natural object:
		M is Map
		L is Local
		C is Global
		N is Subprogram
		S is Subroutine

**Action** Determine if the request is valid, and the Natural program is available in the requested library. If it is, then check, and correct if necessary, the HTTP server parameters NATLIB, NATPARM and NATTHRD.

**References** Section *Customizing and Using the HTTP Server* and section *Installing Natural CGI*.

**HTP9003**                    **HAANUPR REQUEST failed, RC=\$1 Reason=\$2**

**Explanation**            An internal error occurred during NATCGI processing. This message will usually be preceded by another error message.

**Placeholders**

\$1	Error return code.
\$2	Error reason code.

**Action**                    Check for a preceding error message and take action to correct that error. If no other error messages are available, report this error to your technical support representative.

**References**              Not applicable

**HTP9005**                    **'\$1'**

**Explanation**            A Natural error condition has occurred while trying to execute a NATCGI program. The module HNANERR has gained control and issues the error message based on the status code.

**Placeholders**

\$1	Error message text dependent on the error status code, as follows:	
	C	Command processing error
	L	Logon processing error
	O	Object time error
	S	Non-correctable syntax error

**Action**                    Check that the Natural CGI installation is correct. In the case of a 'Logon processing error' check the Natural Security settings. In particular, check that the default user ID (named in the HTTP server parameter HTTPUSER) has been correctly defined.

**References**              Section [Customizing and Using the HTTP Server](#) and section [Installing Natural CGI](#). See also the *Natural Programming* and the *Natural Security* documentation.

# A Sample Members

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- On the HTTP Load Library ..... 134
- On the HTTP Source Dataset ..... 134
- On the Complete HTTP JOBS Dataset ..... 135
- On the Natural Library HTPvrs ..... 135
- On the Natural INPL Update for SYSWEB ..... 136



**Note:** Refer to the installation verification procedure for more information about interpreting the URLs provided in the following tables.

## On the HTTP Load Library

The members in this library can be accessed as follows: z/OS: Use the link `Native HTML pages` from the Com-plete main menu. z/VSE: Navigate to the HTPvrs sublibrary using the “Libraries” link from the Com-plete main menu.

Member	Description
HHANCOBT.html	HTML page that drives the COBOL program HOANSAMP using a form and the HTTP GET method.
HHANNATT.html	HTML page that drives the Natural program HNANSAMP using a form and the HTTP GET method.
HHANNATA.html	Demo calling Natural CGI using Ajax (invokes HNANSAMA).
HHANNATS.html	Demo calling Natural CGI using Server Side Includes (invokes HNANSAMS).
HHANNATU.html	Demo uploading a file into a PDS member using Natural CALL INTRECE4 with a dynamic variable (invokes HNANSAMU).
HHANPL1T.html	HTML page that drives the PL/1 program HNANSAMP using a form and the HTTP GET method.
SAMPREXX.txt	Sample showing how to upload a file using REXX.

## On the HTTP Source Dataset

The following section lists the sample members on the source dataset and tells what they are used for.

Member	Description
HAANCONF	the HTTP server configuration member.
HAANDSNT	source used to map the dataset name to content type for the HTTP server.
HAANTYPT	source used to map the member type to content type for the HTTP server. Can be modified and reassembled to add, remove, or change entries in the table.
HAANUXIT	user exit to alter the processing of requests by the HTTP server.
HCANSAMP	C program to accept a simple CGI request and return some data to the user. When compiled and linked, it can be used in conjunction with the source members HHANCGET or HHANCPUT on the HTPvrs.SRCE dataset, which contain HTML. Note: The PJASCC and associated link jobs may be used to compile and link this sample, if required.

Member	Description
HHANCGET	HTML page that drives the C program HCANSAMP using a form and the HTTP GET method. The page may be referenced as: <i>http://ip-addr:port/htpvr/srce/hhancget.htm</i>
HHANCOBT	HTML page that drives the COBOL program HOANSAMP using a form and the HTTP GET method. The page may be referenced as: <i>http://your.ip.address:port/htpvr/srce/hhancobt.htm</i>
HHANCPUT	HTML page that drives the C program HCANSAMP using a form and the HTTP POST method. The page may be referenced as: <i>http://ip-addr:port/htpvr/srce/hhancput.htm</i>
HHANNATT	HTML page that drives the Natural program HNANSAMP using a form and the HTTP GET method. The page may be referenced as: <i>http://ip-addr:port/htpvr/srce/hhannatt.htm</i>
HHANPL1T	HTML page that drives the PL/1 program HNANSAMP using a form and the HTTP GET method. The page may be referenced as: <i>http://ip-addr:port/htpvr/srce/hhancget.htm</i>
HOANCONV	COBOL program that uses the HTTP server to converse with a web browser over a series of HTML pages. The program is started using <i>http://ip-addr:port/cgi/hoanconv</i>
HOANSAMP	COBOL CGI program driven by the HTML page HHANCOBT.
HPANSAMP	PL/1 CGI program driven by the HTML page HHANPL1T.

## On the Com-plete HTTP JOBS Dataset

The following section lists the sample members on the jobs dataset and tells what they are used for.

Member	Description
HJBNCOBC	job to compile and link the COBOL CGI program HOANSAMP.
HJBNSDNT	job to compile and link the HAANDSNT configuration table.
HJBNPLIC	job to compile and link the PL/1 CGI program HPANSAMP.
HJBNTYPT	job to compile and link the HAANTYPT configuration table
HJBNUXIT	job to compile and link the HAANUXIT user exit.

## On the Natural Library HTPvrs

Member	Description
HAANSAMP	Natural CGI program that is launched by HTML page HHANNATT.
HNANSHEL	Natural CGI interface shell program delivered in object format.
HNANWTOP	Natural program that writes to the operator and is used to verify that Natural CGI processing is operating correctly.

## On the Natural INPL Update for SYSWEB

---

Member	Description
NWWAPS	Natural Web Interface extension program delivered in object format
W3APSENV	Natural subroutine required by NWWAPS delivered in object format
D5*	27 Natural modules (subprogram/subroutine/copycode/parameter/text) delivered in source format, which make up the Natural Web Interface demo application



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