



Interactive COBOL

Utilities

Manual

ICOBOL Revision 5.40

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PREFACE

Scope

This manual provides the information needed to use the utilities provided with the Interactive COBOL Runtime product on Linux[®] compatible systems and Windows[®].

The complete documentation for Interactive COBOL includes the following manuals:

Installing and Configuring Interactive COBOL on Linux[®] (011-00402)

Installing and Configuring Interactive COBOL on Windows[®] (011-00403)

Each manual provides the appropriate sections necessary to properly install and configure Interactive COBOL in the given environment.

Interactive COBOL Utilities Manual (011-00300)

Provides a simple guide to all the user visible utilities.

Interactive COBOL Language Reference & Developer's Guide (011-00100)

The complete COBOL syntax supported by Interactive COBOL. Provides how to use the development tools including the compiler and IDE. It also explains how the COBOL runtime works including its internal system calls, builtins, and how to program across the multiple environments supported by Interactive COBOL.

sp2 panel Editor

Provides how to develop and use the sp2 User Interface Development System.

COBOL FormPrint

How to use the FormPrint Editor to setup printers.

Terms

This document will use several terms which it will define as generic names to describe several individual products.

ICOBOL refers to any of the Interactive COBOL products unless otherwise stated.

ICOBOL/Windows refers to **ICOBOL** on a supported version of the Windows operating system.

Linux refers to all supported flavors of Linux unless specifically stated.

Windows will be used to refer collectively to various versions of the Windows operating system. As of ICOBOL 5.50 and this manual, the supported versions are Windows Server 2008 R2 through Windows Server 2022 and Windows 7 through Windows 11. How-to steps for Windows are based on Windows 10 and may be different for other versions of Windows.

PC refers to any style of personal computer based on the Intel x86 microcomputer architecture that runs Windows or a Linux-compatible operating system.

RDOS refers to the Data General operating system RDOS.

DG refers to Data General Corporation.

INTRODUCTION

A. Overview

This manual describes the various utilities (except ICCONFIG/ICEDCFW and ICEXEC) that are provided with the Interactive COBOL Runtime System.

Two sets of utilities will be discussed in this manual.

The first set of utilities are standard executables and can be run from any shell or command-processor. This set is composed of ICCHECK, ICCREATE, ICFIXUP, ICINFO, ICLIB, ICLINK, ICMAKEMS, ICNETD, ICPACK, ICPQUTIL, ICREORG, ICREV, ICREVW, ICSMVIEW, ICSORT, ICSTAT, and ICWHOHAS and will be referred to as command-line utilities. These are discussed starting on page [23](#).

The second set of utilities are available from within a COBOL program using the appropriate mechanism as documented in the Interactive COBOL Language Reference & Developer's Guide. This set is composed of Abort Terminal, Kill Terminal, Message Sending, Printer Control, System Information, Terminal Control, and Terminal Status. These are discussed starting on page [99](#).

B. How to Read this Manual

This manual should be used as a general reference for the Interactive COBOL utilities. As such, after reading this first chapter, the individual chapters that describe each utility should be read as needed using the Table of Contents or the page headers to find the specific utility.

C. Operating Environment

C.1. General Concepts

The Interactive COBOL system has been designed to provide an application operating environment that works as consistently as possible among several different operating system environments. This consistency is expressed in a few key concepts that have their roots in the UNIX operating systems. If you have used UNIX, the concepts may already be familiar to you.

The first concept is that programs communicate with their operating environment through three input/output streams or files: standard input (stdin), standard output (stdout), and standard error (stderr). Programs can read data to be processed from stdin, process it in some way, and write the results to stdout. They report errors to stderr. By default most systems connect stdin to the console keyboard and both stdout and stderr to the console display.

Many utilities, especially in the COBOL environment, must process complex data files that do not fit this simple model and so they do not often use stdin for the data to process. However, the stdout and stderr files are still very useful. They allow the utility to logically separate error reporting from reporting the results of processing. For example, the ICSTAT utility reports statistics about ICISAM files. It reports these statistics to stdout. If an error occurs, for example one of the command arguments does not exist, the error is reported to stderr.

The second concept is the ability to redirect i/o files from the default files to another file or device. The system provides a very simple way to redirect these standard files in the command processor by using the special characters '<' and '>'. When stdout is redirected to a file, it provides a simple mechanism to capture the output of a utility. See your operating system documentation for more on this concept. A variation of this concept is the ability to use the output of one program as the input to another program. This is called piping and uses the special character '|' between the two program names.

The third major concept is the ability to customize the operation of specific programs by setting information in items called Environment Variables. Environment variables have a name and a value like program variables or data items. The difference is that these variables are managed by the command processor and operating system. The utility programs can ask the operating system whether a particular environment variable is set or not, and what its value is. They are most often used to set default operating options, or the locations of important files. For example, all Interactive COBOL Windows executable programs look for the environment variable ICROOT as the base directory for finding the installation files. Customized system files can be found by using the ICCONFIGDIR environment entry. Each ICOBOL utility also looks for command-line options in an environment variable by its own name, e.g., ICREORG looks for an environment variable named ICREORG. Windows provides environment variables through its command processor.

During the Interactive COBOL installation, several pseudo-environment variables are configured into the Windows registry for use by Interactive COBOL programs if they do not find the environment variables maintained by the command processor. These entries include ICCODEPATH, ICROOT, and ICCONFIGDIR and they are set to point to the installation directory of Interactive COBOL.

Environment variables are maintained in the command processor. Environment variables are setup with a command like:

```
SET ICSMTPSERVER=192.168.0.1
    or
SET ICRUN=-ip
```

On Windows, common environment variables can be configured into the Registry. From the **Start** menu, choose **Settings** the use the Search field to search for Environment. Two options should pop up, one for system wide environment variables (which requires administrator privileges) and one the current user. Click on the one you want. Note that if it appears that nothing happened, the Environment Variables dialog may be hidden by the Settings dialog - either move it or close it.

C.2. Directory Structure

On Linux, the Interactive COBOL software is installed in a directory with the revision number in the name by default. For example, Interactive COBOL Revision 5.50 will be in a directory named "icobol.550". This directory is assumed by various scripts to be in /opt. The install script will set up a symbolic link named "icobol" that points to the version-specific directory. On Windows, Interactive COBOL will be installed in a directory named "icobol" in the "Program Files" directory by default. You will normally want to include this directory in your PATH.

The main directory contains all of the command-line programs, the readme file(s), and supplied COBOL executable programs. Additional subdirectories are provided as noted below. The help subdirectory contains help (.hf) files for all the command-line programs defined as <command>.hf. Interactive programs may have their own subdirectories under the help directory. Descriptions that start with (Dev) are part of the development system.

<u>Main Directory</u>	<u>Sub-Directories</u>	<u>Description</u>
icobol		Main executables and needed files
	docs	Readme, various documentation
	examples	Various examples
	help	Help files (.hf)
	icnet	server (surrogate) files
	install	installation files
	x86	(On a 64-bit install) these are the matching 32-bit executables

ICOBOL Directory Structure (Linux)

<u>Main Directory</u>	<u>Sub-Directories</u>	<u>Description</u>
icobol		Main executables and needed files
	docs	Readme, various documentation
	examples	Various examples
	help	Help files (.hf)
	icnet	server (surrogate)files
	install	installation files
	qpr	(Dev) Gui-printer development (Formprint) (ICQPRW)
	sentinel	Rainbow sentinel device files
	sp2	(Dev) Gui-screen development (ICSP2)
	uninstall	files needed for an uninstall
	x86	(On a 64-bit install) these are the matching 32-bit executables

ICOBOL Directory Structure (Windows)

Installs previous to 4.70 had a print sub-directory for printer translation (.pti) files and background .pdf files and a term sub-directory for terminal description (.tdi) files. The default versions of .pti and .tdi files are now built into the runtimes and any customized file(s) should be stored in a directory that is searched via the ICCONFIGDIR environment entry.

Command-line programs require the corresponding help file to be available in order to display their help text. If it is not available, an error message will be displayed that it could not find the help file. Help files are sought via the following steps:

```
$ICCONFIGDIR/help/<command>.hf
$ICROOT/help/<command>.hf
<curdir>/<command>.hf
```

C.3. ICEXEC

The Interactive COBOL system uses a control program called ICEXEC to coordinate multi-user access to system resources. Note that Linux does not provide an exclusive open capability and so this is provided by ICEXEC when it is running. The following executables **require** the shared area that ICEXEC manages:

icrun(w)	icrunrs	(ThinClient server started by icnetd)
icsmview	icios	(I/O server started by icnetd)
icwhoas	icsqls	(Remote ICSQL server if using ICODBCDR)

On Linux, when ICEXEC is NOT running, an exclusive open output is emulated by posting a write-lock on the whole file, and an exclusive open input is emulated by posting a read-lock on the whole file. All non-exclusive opens post a read-lock on byte 1 of the file. Thus an exclusive open output can detect if anyone else has the file open and all other opens can detect if an exclusive open output has the file open by using this method. Care should be used when starting ICEXEC if any programs using this method are running since new invocations of programs will use the ICEXEC-controlled scheme for sharing files which does not use operating system locks. More on ICEXEC can be found in the respective Installing manuals.

All other Interactive COBOL executables can operate with or without ICEXEC.

D. Conventions

Another aspect of providing a consistent system across multiple operating platforms, is in the command-line interface. The command-line programs use a common command-line syntax across all platforms, and they adhere to the following standard conventions:

- 1) all switches are composed of a single letter or digit preceded by a hyphen (-) (or optionally a forwardslash (/) on Windows);
- 2) the switches are order independent;
- 3) the switches ARE case sensitive;
- 4) lower-case switches imply an action or modification of an action, e.g., '-h' for help;
- 5) UPPER-CASE switches imply an action with a required argument that must follow with an intervening space, e.g., '-A audit.log' for setting up an auditfile called audit.log.
- 6) multiple lower-case switches can be combined with one hyphen, e.g., '-axz' for '-a -x -z'.

The following shows how the various conventions for defining syntax will be represented in the Interactive COBOL documentation:

- [] Brackets enclose optional portions of a format. One of the options contained within the brackets may be explicitly specified or that portion may be omitted.
- { } Braces enclosing a portion of a format means that one of the options contained within the braces must be specified.
- | Bar will be used to separate choices when multiple choices are allowed.
- ... Ellipsis indicates that the previous item can be repeated one or more times.

italic-lower-case Indicates a generic term representing a value that is defined as indicated.

Linux systems support case-sensitive filenames as opposed to Windows systems that are case-insensitive. All released Interactive COBOL on Linux files are lower-case which is in keeping with most Linux systems. By default, the Interactive COBOL on Linux runtime will convert all COBOL filenames, including program names, to lower-case before looking up that file in Linux. Although Interactive COBOL on Linux can support UPPER-CASE only or mixed-case, we recommend using only one case for filenames to ease portability to case-insensitive environments.

With this in mind, this document will still use upper-case names in the text for specific programs but will always use lower-case in examples and when showing what needs to be entered from the keyboard to run a program.

On Linux, all examples assume that the Bourne-compatible shell bash is being run.

E. Common Switches

E.1. Overall

There are several common switches that appear on all command-line programs except for ICINFO. These are described in detail in the following sections so that the descriptions for each program can be abbreviated. The command-line switch processor scans all the command-line switches, checking for errors. Any errors display an abbreviated startup banner (the program name and revision) to stdout before displaying the error message to stderr and then exiting with a non-zero exit code. If there are no errors to terminate processing prematurely, the common switches are processed. First, if the Help switch is given, an abbreviated startup banner and help text are displayed to stdout after which the program exits normally (i.e., no other switches or arguments are processed). Next, if the Audit switch is given, auditing is enabled. Finally, the Quiet switch, if given, is processed. The program then begins its specific processing by emitting a startup banner, consisting of the program name, revision level, system, and the copyright notice. When it finishes processing, it will emit a trailer message indicating that it is done.

E.2. Audit Switch

The Audit switch will be shown in the syntax as:

```
-a[:aflag] | -A file|dir[:aflag][:topt][:topt...]
```

Where *aflag* is a|b|d|p|t|u|da|db|pa|pb|ta|tb|ua|ub and modifies the behavior of the audit file selection.

- | | | |
|---|----------|---|
| a | Append | If the file exists, do Not truncate the file, just append. The Append flag can be used alone or with the Date, Pid, Time, or Username options. |
| b | Backup | If a previous log file (.lg) exists, rename it to *.lgb and then open a new .lg file. The Backup flag can be used alone or with the Date, Pid, Time, or Username options. <u>On Linux</u> , this will break hard links. |
| d | Date | Add date in the form of <u>YYYYMMDD</u> before the .lg extension. |
| p | PID | Add pid in the form of <u>NNNN</u> before the .lg extension. |
| t | Time | Add time in the form of <u>YYYYMMDDHHmmsshh</u> before the .lg extension. (YYYY-year, MM-month, DD-day of the month, HH-hour, mm-minute, ss-second, hh-hundredths of seconds.) |
| u | Username | Add username in the form <u>_name</u> before the .lg extension. |

NOTE:

- 1) On Windows, the option "-A c:a" will be treated as open file "c" in append mode in the current directory. Previously this would have been open file "a" in the current directory of drive C:. To get the old behavior, enter
"-A c:\a"

Where *topt* is a tracing option that enables low level tracing messages (first added in revision 4.41). Tracing options are usually only required when requested by the Envyr Support staff since their use generally creates very large log files. As the syntax indicates, if more than one option is specified, they are separated by commas. The help files generally show only the *aflag* syntax since this facility is not generally needed in production. The options are selected from the following:

- | | |
|---------|---|
| ALL | enables all sub-system enhanced tracing options listed below. |
| FILE | provides statistics and tracing for lower level file operations (this is very verbose and mostly only useful when requested by Support) |
| ICNETD | provides enhanced tracing for ICNETD |
| IND | provides Indexed i/o statistics and open/close tracing |
| MPX | provides enhanced tracing when using network multiplex i/o from the runtime, icrunrc, icodbcd |
| NET | provides for enhanced network tracing for any network traffic |
| PDF | provides enhanced tracing when using the PDF facility from the runtime |
| PGM | provides CALL/EXIT/CANCEL tracing, (including builtins) |
| REL | provides relative i/o statistics and open/close tracing |
| SEQ | provides sequential i/o statistics and open/close tracing |
| SP2 | provides enhanced tracing when using SP2 or QPR from the runtime or icrunrc |
| SQL | provides enhanced tracing when using ISQL from the runtime |
| SYSERRS | provides enhanced tracing for System errors |
| WEB | provides enhanced tracing when using any internet type facility like email from the runtime |

The audit flags (a,b,d,p,t,u) instruct the Audit processing to take a different action than the default for the audit file. The default action is the same as usual, truncate the file to zero on startup.

Note that:

- a Audit to the default file for this command.
- A *file* Audit to the specified file.
- A *dir* Audit to default file in the specified directory.

Audit files contain a copy of any output that was sent to either stdout or stderr, in the same order as it was emitted at execution time (i.e., it may be interspersed). The programs handle this internally, so stdout and stderr can still be redirected. The audit file can be specified to use the default name in the current directory (-a), a user specified name (-A *file*), or the default name in a specified directory (-A *dir*). An audit file is always created if it does not already exist. If it does exist, it is truncated to zero unless the Backup flag is set.

The default audit file name is <command>.lg.

E.3. Quiet Switch

The Quiet switch will be shown in the syntax as:

-q

The Quiet switch works by suppressing all output that is emitted to stdout. The most obvious effect is that it suppresses the usual banner and trailer messages that are emitted to stdout as the program starts and terminates. Because it is suppressing stdout, the Quiet switch may also suppress other parts of the usual output.

E.4. Help Switch

The Help switch will be shown in the syntax as:

-h|-?

The Help switch displays a summary of the command-line syntax, the switches and what they do, and the applicable environment variables.

F. Filename Extensions

Interactive COBOL requires that the extension for certain specific types of files to match those given in the following table except for those marked *defacto*. Those marked *defacto* are only the most common extensions used for these purposes and not required. All Interactive COBOL release files will conform to these *defacto* standards.

Those extensions marked as this sentence is marked are extensions in some older revision of Interactive COBOL or ICHOST but are handled in some special cases by current Interactive COBOL utilities.

Common extensions used by Interactive COBOL include:

.CD	old ICHOST COBOL program file
.CF	old Configuration file (pre-3.30)
.CFI	Configuration file (.ini format)
.CL	Library file
.CO	COBOL Source programs (card format) (<i>defacto</i>)
.COB	AOS/VS COBOL source text file
.CX	COBOL Program file
.ER	Error file (<i>defacto</i>)
.FA	File attribute file
.FP	Failsafe protection file
.GSY	Global symbol file for the IDE
.HF	Interactive COBOL help files
.ICP	Project files for the IDE
.LG	Audit / Log file (<i>defacto</i>)
.LGB	Backup Audit / Log file (<i>defacto</i>)

.LK	Link file
.LS	List file (<i>defacto</i>)
.MS	Message file
.DT,.NT	Pair of files, ICPACK data and index temporary files
.PD,.DD	Pair of files, older revision COBOL program file (program and data)
.PQ	Printer control file
.PT	old Printer translation file (pre-3.30)
.PTI	Printer translation file (.ini format)
.RP	old Remote protection file (MS-DOS only)
.SD	ICRUN Sort data file (temporary)
.SR	COBOL Source program (text format) (<i>defacto</i>)
.ST	ICRUN Sort tag file (temporary)
.SY	COBOL Symbol table file
.TD	old Terminal description file (pre-3.30)
.TDI	Terminal description file (.ini format)
.TMP	Temporary file (<i>defacto</i>)
.UDB	U/FOS database
.XD,.NX	Pair of files, COBOL ICISAM file (data and index portion)
.XCO	COBOL Source programs (extended card format) (<i>defacto</i>) (New in 5.40)
.XDB	ODBC database definition file (.ini format)
.XDT	ODBC table definition file (.ini format)
.XL	Log file (pre 5.40)
.XLG	Generation log file (pre-4.00)

On Linux, all Interactive COBOL utilities support mixed-case filenames. If a utility needs to add an extension, e.g., .PD/.DD, .XD/.NX, etc., it searches back from the end of the simple filename for the first alphabetic character. If it finds an upper-case alphabetic, it will use an upper-case extension, otherwise a lower-case extension is used. For example, "icheck DATABASE1" and "icheck 12345" would use the lower-case extensions '.xd' and '.nx' for the ICISAM file, while "icheck dataBASE52" would use the upper-case extensions '.XD' and '.NX'.

G. Exit Codes

All command-line programs return exit codes that provide an indication of the success or failure of the program. These are returned through the appropriate OS-specific mechanism (e.g., ERRORLEVEL on Windows and the exit code on Linux). In general, the following codes will be returned:

0	The program completed without errors.
1	The program ran, but some items it processed had errors.
2	The program was running, but was terminated by an operator interrupt or external abort.
3	The program was running, but was terminated by some fatal internal error. For example, the compiler was running but detected that its virtual memory manager had run out of memory unexpectedly.
4	There were command-line errors and so the program did not perform any of the requested function(s).
5	The user was not authorized to execute the program or perform a requested operation, so the program did not run.
6	The program experienced an error during its initialization phrase and could not execute. For example, it could not allocate sufficient memory to perform its function.
7	Help was requested.
8-9	Reserved for future 'common' errors.
10-	These codes are specific to each program and will be documented with each program.

All of the programs support exit codes 0 through 9 with the meaning described above.

H. Common Environment Variables

H.1. Overall

There are several common environment entries that most command-line programs use. These are described in detail in the following sections so as to not be duplicated under all program descriptions. Other environment variables that are more program specific will be described under each program.

All command-line utilities support an environment variable that is their own name, i.e., the environment variable ICHECK is read only by icheck, ICSTAT by icstat, etc.

H.2. ICROOT

ICROOT specifies the Interactive COBOL root directory. *ICROOT* is used to find the various directories (help, sp2, qpr, ...).

The syntax is:

```
ICROOT=dir
```

Where

dir

Specifies the directory where to find the various Interactive COBOL directories. Usually this should be set to the directory where the current revision is installed.

On Linux, if *ICROOT* is not set, the current directory is used. On Windows, if *ICROOT* is not set, then the registry is queried for the initial installation directory.

H.3. ICCONFIGDIR

(Added in 4.61)

ICCONFIGDIR specifies a directory for customized system files. *ICCONFIGDIR* is used to find customized system files like help, messages, print, and term entries that have been customized by the user.

The syntax is:

```
ICCONFIGDIR=dir
```

Where

dir

Specifies the directory where to find the customized system files (help, messages, print, and term).

If set, a particular help, message, term, or print file will first be sought using *ICCONFIGDIR*. If the particular file is not found, then *ICROOT* will be used.

If *ICCONFIGDIR* is not set, then *ICROOT* is used.

H.4. ICTMPDIR

ICTMPDIR specifies a directory to which programs may write any temporary files.

The syntax is:

```
ICTMPDIR=dir
```

Where

dir

Specifies a valid pathname for the directory in which any needed temporary files are to be written.

If *ICTMPDIR* is not set, the current directory is used.

Some of the programs that look for the *ICTMPDIR* environment variable are *ICRUN* and *ICSORT*.

On Windows, if running on a network drive, *ICTMPDIR* should be set to a local directory.

H.5. Executable Name

All command-line utilities support an environment variable of the same name as the utility in upper-case. For example, 'iccheck' will recognize the variable *ICCHECK*. The environment variable can contain command line options for the utility which will be processed prior to any options actually present on the command line. If such an environment variable is present, the utility will display the complete set of options at startup.

PART 1 - EXECUTABLES

I. ICCHECK

A. Introduction

The ICCHECK utility provides the ability to verify the integrity of ICISAM indexed and relative files. This utility should be run after all abnormal system terminations in the directories that contain ICISAM files. ICCHECK exclusively opens each ICISAM file, preventing any other process from using the files while ICCHECK is scanning them.

B. Syntax

The standard syntax is:

```
iccheck [-a[:aflag]|-A file|dir[:aflag]] [-e|-E file|dir] [-h|-?] [-i]
        [-N {s|w}...] [-p] [-q] [-s] [-u] [argument]...
```

Where

-a[:aflag]|-A file|dir[:aflag] (Audit)

Enables auditing (default iccheck.lg). Where *aflag* is a|b|d|p|t|u|d|a|d|b|p|a|p|b|t|a|t|b|u|a|u|b, defined as a-append, b-backup, d-date, p-pid, t-time, and u-username.

-e|-E file|dir (Error)

If an ICISAM file being processed has errors, this switch directs ICCHECK to create an error file or append to an error file that already exists. When the **-e** or **-E dir** switch is selected, the name of the error file is formed by adding a `.er` extension to the name of the ICISAM file being checked, and for **-E dir**, locating that file in the specified directory. The **-E file** switch creates a single error file with the specified name in which errors are recorded.

-h|-? (Help)

Displays help text.

-i (Info)

Displays information messages.

-N {s|w}... (No options)

Specifies a NO option. Valid NO options are:

s (No-scan) do not Scan the remainder of the file if the ICISAM reliability flags are not set and the `.XD/.NX` headers are valid. Use of the No-scan switch allows ICCHECK of many files to finish faster if the files are good.

w (No-warning) do not generate Warning messages.

-p (Progress)

A progress report is displayed as a key path is scanned. Progress is reported every 1%. This switch will substantially slow the processing of smaller files.

-q (Quiet)

Enables quiet operation.

-s (Sync Reporting)

Only report out-of-sync logging

-u (Unreliable)

Simply report the names of the files that do not pass the reliability tests (i.e. have their reliability bits set or have invalid file headers). No other checking of the integrity of any of the files will occur, so this option cannot be specified with the No-scan (**-N s**) or Error switches.

argument

Specifies any filename or template to be checked. If no argument is specified, all ICISAM files in the current directory are processed.

Environment variables:

ICCHECK Command line options

C. Description

If neither the No-scan switch (-N s) or Unreliable switch (-u) are given, full checking will be performed on the given files.

The reliability flags in an ICISAM file are set any time the integrity of the file may be compromised. They are set by the ICISAM system whenever a modification of the file is made and are normally cleared when the file is closed or otherwise updated to disk.

ICCHECK will set the ICISAM reliability flags if it detects any errors in the logical or physical structure of the file. If ICCHECK detects no errors and the reliability flags are set, ICCHECK will clear the flags, thus making the file accessible to Interactive COBOL processes without getting a File Status 9F.

ICCHECK first checks the .XD/.NX headers to make sure the headers contain valid information. Next, the header information is used to check that the files are consistent with the header information. If there are any errors at this point that ICCHECK can fix, it will correct the problem(s) to make the file consistent. Finally, unless the No-scan switch (-N s) is set, the index structure (.NX file) and sequential record path (.XD file) are scanned to check for valid records, keys, and consistent link structures. This check is done for each key declared in the file.

If ICCHECK detects any errors while processing a particular file, an error file is created according to the Error switch specification. All the same error messages as displayed on the console for that particular file are written to the error file.

If ICCHECK detects no errors on a file that previously had a .er file associated with it, the .er file is deleted.

The following information about an ICISAM file is given unless the No-scan switch was given:

- The ICISAM version of the file
- The default deletion type (logical or physical) is given along with the maximum file size (2GB or 4GB)
- The number of alternate keys for indexed files, record size, and number of records allocated
- The total number of record slots available for records before the .XD end-of-file
- For each key it reports:
 - Whether the key is the Primary or an Alternate along with seven possible attributes shown by the possible letters "dursaop" or "-----" if no attributes were given for the file. The possible attributes are shown below:
 - d duplicates are allowed,
 - u upper-case only,
 - r reverse (or DESCENDING) storage,
 - s suppress certain key values (the suppressed value is shown later),
 - a multiple scattered keys using ALSO clause,
 - o multiple tabular keys using OCCURS clause, and
 - p this key has suffixes using PLUS clause.
 - Finally the number of keys, records, and purged keys are shown.
 - If auditing, for each level in the index for that key the number of nodes, the number of keys in that node, and the average density of the nodes.
 - If auditing, the key length and offset in the record including suffixes (PLUS), OCCURS, scattered keys (ALSO), and any suppression value (SUPPRESS WHEN) shown as LOW-VALUE, HIGH-VALUE, SPACE, ZERO, or its octal value.

If ICCHECK detects only that the .NX file is corrupt, the ICFIXUP utility can be used to build a new .NX file. If problems are detected on the .XD file, either a backup copy should be installed, or the ICFIXUP utility should be run to rebuild both the .nx and .xd files.

An exit code of 10 will be returned if a corrupt file was encountered and no other error was detected.

II. ICCREATE

A. Introduction

The ICCREATE utility is used to create an empty ICISAM file from the command-line. It has switches to control all of the various parameters of an ICISAM file, including the main ICISAM version and special tuning items like logically or physically deleted records. It also will build a file attribute file which holds all the file information for a particular ICISAM file that can later be used to create another file with similar attributes or to fix a corrupt file.

After creating file attribute file(s) you should mark them read-only.

B. Syntax

The standard syntax is:

Create File attribute file for an existing file:

```
iccreate [-a[:aflag]|-A file|dir[:aflag]] [-h|-?] [-q] {-f|-F dir}
  { argument }...
```

Create Like another file:

```
iccreate [-a[:aflag]|-A file|dir[:aflag]] [-h|-?] [-q] [-f|-F dir] -L file
  [-D cnt|-R cnt] [-I cnt] { argument }...
```

Create Relative:

```
iccreate [-a[:aflag]|-A file|dir[:aflag]] [-C attr:on|off] [-h|-?] [-q]
  [-f|-F dir] -T r -S min[:max]] [-V version] { argument }...
```

Create Indexed:

```
iccreate [-a[:aflag]|-A file|dir[:aflag]] [-h|-?] [-q] [-f|-F dir]
  -T i -S min[:max] {-K <keyspecifier>}... [-C b|p:on|off] [-V version]
  { argument }...
```

Where

-a[:aflag]|-A file|dir[:aflag] (Audit)

Enables auditing (default iccreate.lg). Where *aflag* is a|b|d|p|t|u|da|db|pa|pb|ta|tb|ua|ub, defined as a-append, b-backup, d-date, p-pid, t-time, and u-username.

-C attr:on|off (Control attributes)

Set (on) or clear (off) the indicated file attribute(s). Available attributes are 'b' or 'p'. Control attribute can be specified multiple times to set each attribute.

b (Big File) Allows the maximum file size of the file to grow to 4GB. If not set, the maximum file size is 2GB. Only allowed for version 7 files.

p (Delete-is-physical) Sets the default type of record deletion on this file when neither LOGICAL nor PHYSICAL were specified in the delete operation. For logical deletes, the record is simply marked deleted so it can be undeleted; for physical deletes, the record area space is made available for new records to be written and no undelete can be done as the record is gone. The default is for the delete-is-physical attribute to be off. Only allowed for version 7 and 8 files.

-f|-F *dir* (File attribute file)

Create a file attribute file that contains all of the file creation parameters for the file, using the default name *argument.fa* in the current directory or the specified directory. This file can be used by the ICFIXUP utility to recover a corrupted file without having to enter all the parameters from the command-line. This switch can also be used to create an information file for an existing file by specifying just this switch and the name of an existing file as the argument.

-h|-? (Help)

Displays help text.

-K *pos:len[:d][:r][:u][:s[=val]][:p=*ppos:plen*]:...[:o=*cnt:span*]* (Key specification)

-K *pos:len[:d][:r][:u][:s[=val]][:a=*apos*]:...* (Key specification)

Specifies the keys for indexed files. A key specification must be supplied for each key in the file. At least one key must be specified for an indexed file creation. The number of keys will be determined by the number of key specifications. The first key specification will be for the primary key, all subsequent key specifications will be treated as alternate keys. All the alternate keys are sorted like the COBOL compiler sorts alternate keys allowing them to be specified in any order. Up to 17 key specifiers may be listed.

pos specifies a 1-based byte position in the record of the start of the key.

len specifies the length of the key in bytes.

:d specifies that the alternate key is to allow duplicate keys and is only allowed for alternate keys.

:r specifies that this key is to be stored in reverse (DESCENDING) order.

:u specifies that this key is always stored and retrieved in upper-case-only.

:s[=val] specifies the value to suppress from key insertion and is only allowed on an alternate key. If *val* is not specified, LOW-VALUE is used.

*:p=*ppos:plen** specifies suffixed key values (PLUS) at the given position (*ppos*) and length (*plen*).

*:o=*cnt:span** and *:a=*apos** specify multiple key locations in the record for this key and is only allowed on an alternate key. The *:o* parameter (OCCURS) gives a tabular view with *cnt* times and how far apart each entry is in bytes (*span*). The *:a* parameter (ALSO) specifies scattered key values for this key at the indicated positions (*apos*).

-L *file* (Like file)

Create the current file to be like another indexed or relative file that already exists. That file is opened and all of the attributes are set to be like it. If this switch is used the other specification switches (-K, -C, -S, -V, and -T) cannot be specified. The *file* argument can also specify a file attribute (.FA) file.

-q (Quiet)

Enables quiet operation.

-S *min[:max]* (Size)

Defines the record size, in bytes. Required if the Like switch is not specified. If only *min* is specified all records are of that size. If *max* is specified, records can be between *min* and *max*.

-T *i|r* (Type)

Sets the file type to indexed ('i') or relative ('r'). If not specified, the default is indexed.

-V *version* (Version)

Create a file of a specific version. The *version* specifier must be an integer with the value 7 or 8. The default is 8.

argument

Specifies the filename to be created. If more than one filename is specified, all of the files will be created with the same parameters. The filename must not already exist, since this would conflict with the intention to create them. However, if the File attribute switch (-f|-F) is the only switch, ICCREATE will create a file attribute file from an existing file, so the argument ICISAM file must exist, but the .FA file may not.

Environment variables:

ICCREATE Command line options

C. Description

In a key specifier, the *:o* (OCCURS) and *:a* (ALSO) can not both be specified for a single key entry.

Alternate record keys are sorted based on the following criteria (just as in the compiler):

- a. ascending root segment position.

- b. ascending root segment length.
- c. absence of also keys and if present ascending number of also and ascending also position.
- d. absence of suffixes, and if present ascending number of suffixes, ascending suffix position, and ascending suffix length.
- e. absence of occurs, and if present ascending number of occurs and ascending occurs span.
- f. absence of duplicates allowed.
- g. absence of descending order.
- h. absence of uppercase conversion.
- i. absence of suppress when value, and if present ascending suppress when value.

D. Examples

The following will create an indexed file called test2 with 100 byte records and a 10 byte primary key starting at character 1 in the record. In addition, the file attribute file "test2.fa" will be created.

```
iccreate -T i -S 100 -f -K 1:10 test2
```

The following will create a version 7 indexed file called test7 with 100 byte records, a 10 byte primary key starting at character 1 in the record, a 10 byte alternate key starting at character 11 that is always stored in upper-case, and a 20 byte alternate starting at character position 21 that allows duplicates.

```
iccreate -T i -V 7 -S 100 -K 1:10 -K 11:10:u -K 21:20:d test7
```


III. ICFIXUP

A. Introduction

The ICFIXUP utility is used to recover corrupted ICISAM indexed and relative files. This is done in-place, thus preserving certain operating system level information such as Linux hard links. The purpose of this utility is to recover a corrupted file, not change it or optimize it in any way, thus there are no options for any type of reorganization operations during the recovery process.

B. Syntax

The standard syntax is:

```
icfixup [-a[:aflag]|-A file|dir[:aflag]] [-C b|p:on|off] [-f|-F dir]
        [-h|-?] [-K <keyspecifier>]... [-p] [-q] [-r] [-S min[:max]] [-T i|r]
        [-U d|i|di ] [-V version] { argument }...
```

Where

-a[:aflag]|-A file|dir[:aflag] (Audit)

Enables auditing (default icfixup.lg). Where *aflag* is a|b|d|p|t|u|d|a|d|b|p|a|p|b|t|a|t|b|u|a|u|b, defined as a-append, b-backup, d-date, p-pid, t-time, and u-username.

-C attr:on|off (Control file attribute)

Set (on) or clear (off) the indicated file attribute(s). Available attributes are `b` or `p`. Control attribute can be specified multiple times to set each attribute.

b (Big File) Allows the maximum file size of the file to grow to 4GB. If not set, the maximum file size is 2GB. Only allowed for version 7 files.

p (Delete-is-physical) Sets the default type of record deletion on this file when neither LOGICAL nor PHYSICAL were specified in the delete operation. For logical deletes, the record is simply marked deleted so it can be undeleted; for physical deletes, the record area space is made available for new records to be written and no undelete can be done as the record is gone. The default is for the delete-is-physical attribute to be off.

-f|-F dir (File attribute file)

Specifies the file attribute file. If -f, use the default file (*argument.fa*). If -F *dir*, use the default file in the specified directory.

-h|-? (Help)

Displays help text.

-K pos:len[:d][:r][:u][:s[=val]][:p=ppos:plen]...[:o=cnt:span] (Key specification)

-K pos:len[:d][:r][:u][:s[=val]][:a=apos]... (Key specification)

Specifies the keys for indexed files. A key specification must be supplied for each key in the file. At least one key must be specified for an indexed file creation. The number of keys will be determined by the number of key specifications. The first key specification will be for the primary key, all subsequent key specifications will be treated as alternate keys. All the alternate keys are sorted like the COBOL compiler sorts alternate keys allowing them to be specified in any order. Up to 17 key specifiers may be listed.

pos specifies a 1-based byte position in the record of the start of the key.

len specifies the length of the key in bytes.

:d specifies that the alternate key is to allow duplicate keys and is only allowed for alternate keys.

:r specifies that this key is to be stored in reverse (DESCENDING) order.

:u specifies that this key is always stored and retrieved in upper-case-only.

:s[=val] specifies the value to suppress from key insertion and is only allowed on an alternate key. If *val* is not specified, LOW-VALUE is used.

:p=ppos:plen specifies suffixed key values (PLUS) at the given position (*ppos*) and length (*plen*).

:o=cnt:span and *:a=apos* specify multiple key locations in the record for this key and is only allowed on an alternate key. The *:o* parameter (OCCURS) gives a tabular view with *cnt* times and how far apart each entry is in bytes (*span*). The *:a* parameter (ALSO) specifies scattered key values for this key at the indicated positions (*apos*).

-p (Progress)

There is an ongoing display of the processing, which typically runs much slower for smaller files. The reporting interval is for every 1% of the file processed.

- q (Quiet)
Enables quiet operation.
 - r (Rebuild)
Unconditionally rebuild the file, even if ICFIXUP detects no corruption.
 - S *min[:max]* (Record size)
Specify the record size, in bytes (not including any overhead added by the system). This switch is required if the headers are bad and the File attribute switch (-f|-F) is not used. If only *min* is specified all records are of that size. If *max* is specified, records can be between *min* and *max*.
 - T *i|r* (Type)
Set the file type to indexed ('i') or relative ('r'). The default is indexed.
 - U *d|i|di* (Unreliable portion)
Indicate that the specified portion(s) (d-data, i-index) of the file is corrupt and to ignore that portion of the file. Both d and i can be specified. For -d the utility will expect a specification for the type, version, record size, record count, and keys and the .NX header is not also marked corrupt (ICISAM files duplicate all this information in both headers). The file attribute switch could be used.
 - V *version* (Version)
Specify the file version number. The *version* specifier must be an integer with the value 7 or 8. The default is 8. This switch is required if the headers are bad and the File attribute switch (-f|-F) is not used.
- argument*
Specifies a filename or template. Using a template is only meaningful/useful if the corresponding file attribute files are used to specify the fixup parameters, otherwise the same set of explicitly specified parameters would be applied to all files.

Environment variables:

ICFIXUP Command line options

C. Description

The following information about an ICISAM file is given:

- The ICISAM version of the file
- The default deletion type (logical or physical) is given along with the maximum file size
- The number of alternate keys for indexed files, record size, and number of records allocated
- The total number of record slots available for records before the .XD end-of-file
- For each key it reports:
 - Whether the key is the Primary or an Alternate along with seven possible attributes shown by the possible letters "dursaop" or "-----" if no attributes were given for the file. The possible attributes are shown below:
 - d duplicates are allowed,
 - u upper-case only,
 - r reverse (or DESCENDING) storage,
 - s suppress certain key values (the suppressed value is shown later),
 - a multiple scattered keys using ALSO clause,
 - o multiple tabular keys using OCCURS clause, and
 - p this key has suffixes using PLUS clause.
 - Finally the number of keys, records, and purged keys are shown.
 - For each level in the index, for that key the number of nodes, the number of keys in that node, and the average density of the nodes.
 - The key length and offset in the record including suffixes (PLUS), OCCURS, scattered keys (ALSO), and any suppression value (SUPPRESS WHEN) shown as LOW-VALUE, HIGH-VALUE, SPACE, ZERO, or its octal value. Finally the maximum key entries per index node is given.
- The total number of indexed nodes.
- The number of logically deleted records in the file.

When rebuilding a file, purged records are removed from the file and records from the end of the file are moved to replace each purged record, thus logically shrinking the file.

If ICFIXUP detects an attempt to insert a duplicate key value into an index which does NOT allow duplicate key values, the offending record will be written to a separate collision file and eliminated from the ICISAM INDEXED or RELATIVE file. If the error is detected on the primary key, then the record space is collapsed from the file; otherwise, if the error is detected on an alternate key, then the record space is placed on the purged record list. The collision file is a simple fixed or varying length SEQUENTIAL file having the same name as the ICISAM file but with the ".fix" filename extension. ICREORG can be used to add these records back into the ISAM file as:

```
icreorg -I s:size filename.fix filename
```

Remember when using ICREORG in this fashion that Logically deleted records can cause a Duplicate Key error for alternate keys that do NOT allow duplicates. Remember, when using logical deletes with records with alternate keys that DO NOT ALLOW DUPLICATES, a Duplicate key error can be given for an alternate key that points to a deleted record. The record must be physically deleted to insert a new record with the same alternate key.

Alternate record keys are sorted based on the following criteria (just as in the compiler):

- a. ascending root segment position.
- b. ascending root segment length.
- c. absence of also keys and, if present, ascending number of also and ascending alsos position.
- d. absence of suffixes and, if present, ascending number of suffixes, ascending suffix position, and ascending suffix length.
- e. absence of occurs and, if present, ascending number of occurs and ascending occurs span.
- f. absence of duplicates allowed.
- g. absence of descending order.
- h. absence of uppercase conversion.
- i. absence of suppress when value and, if present, ascending suppress when value.

D. Recommendations

It is recommended that file attribute files (.FA) be built for all ICISAM files, ICCREATE can be used to do this function. Then allow ICFIXUP to use the file attribute file (-f | -F) to insure valid creation information for the ICISAM file and to keep from having to re-enter information about the file.

IV. ICINFO

A. Introduction

The ICINFO utility is a diagnostic tool to be used in detecting the particular state of a machine. Since much of the information depends on the operating system, ICINFO for Linux and Windows are very different from one another. Please consult the appropriate version in the following sections.

The ICINFO syntax does not follow any particular guidelines.

The latest version of icinfo can always be download from the web site (www.icobol.com) and can run without any revision specific .dlls/shared objects and so it can be run before ICOBOL is installed. It is the recommended mechanism to determine a computer's MAC address for licensing purposes.

The output of the ICINFO program should be included with any problem report. Run "icinfo -a" and send the contents of icinfo.lg.

B. Linux ICINFO

ICINFO tests some of the problem areas more frequently encountered by users and displays a report that should be submitted for all support requests.

Some of the information is intuitive while some only makes sense to Interactive COBOL's developers.

The syntax is:

```
icinfo [-a|-A file] [-h] [-n] [-t]
```

Where

- a|-A *file* (Audit)
Enables auditing (default icinfo.lg).
- h (Help)
Displays help message
- n (network only)
Only do Network scan
- t (Timing)
Enables timing tests

SCREEN 1 is a sample listing of the Linux ICINFO output.

```

icinfo Revision 5.40 (Linux for x86)
Started: ...
Current pid: 9868.
Parent pid: 26025.
Current directory: /home/ralph
ttyname(0): >>/dev/tty0<<   ttyname(1): >>/dev/tty0<<
Testing Ioctl.

fstat(0)          st_mode  st_ino   st_dev   st_rdev  st_nlink
fstat(00000000)  00002180 00001595 00000128 00001605 00000001
stat(ttyname)    00002180 00001595 00000128 00001605 00000001
fstat(1)         00002180 00001595 00000128 00001605 00000001
fstat(00000001) 00002180 00001595 00000128 00001605 00000001
stat(.)          000041FF 00000D4E 012A     00000000 00000002
stats of (/):f_bsize: 1024 f_blocks: 330378 f_bfree: 101722
stats of (.):f_bsize: 1024 f_blocks: 1000000 f_bfree: 51492
Login-name: >>ralph<<(long) >>ralph<<(short) User-id: 201 Group-id: 50
  User-id: 1002 Group-id: 1002
  Effective: User-id: 1002 Group-id: 1002
  Home dir: /home/test
  Supplementary groups (3) found:
    3, 4, 5
Max children (sysconf): 999
Memory: Page size: 4096 byets, Total Pages: 514476, Avail Pages: 292895
  Total: 997 MB, Avail: 62 MB.
Max open files/process(sysconf): 1024 (ulimit): 1024.
Max file size: 1073741824 bytes.
System name: Linux, Node name: intell,
  Release: 2.6.9-42.0.10.ELsmp,
  Version: #1 SMP Fri Feb 16 17:17:17 EST 2007
  Machine: i686.
Machinename: intell.
From /proc/cpuinfo.
  # of cpus: 1.
  Model name: xxxxx
From /proc/meminfo.
  ....
Some /proc/sys entries.
  kernel.shmmax: 200000000.
  vm.swappiness: 60
  net.ipv4.tcp_keepalive_time: 7200 (seconds).
  ...
Network Interface scan.
  Interface: `lo' IP address: 127.0.0.1
  Interface: `eth0' IP address: 192.168.2.2
  Interface: `eth0' MAC address: xx:xx:xx:xx:xx:xx
INFO: Created tmp$$01
Locking+++++++
Locks currently available are: 197 with Out of Locks errno=46.
(Ftime) Time in seconds past epoch: 824216551 millsec 230
Before: >>abcdefghijklmnopqrstuvwxy<< After: >>abcdefghijklmnopgh
Nosmear forward
Before: >>ABCDEFGHIJKLMNopqrstUVWXYz<< After: >>KLMNopqrstUVWXYzQR
Nosmear backward
Finished: ...
icinfo is finished.

```

SCREEN 1. Linux ICINFO

If ICINFO was started with a pipe (i.e., `icinfo | pg` etc.) then an error will be generated showing `ttyname1` because standard-out has been redirected and the `ttyname` call is not valid at that time. This does not indicate a problem.

The first line after the `icinfo` started message gives the current pid of the `icinfo` process.

Generally the lines `fstat(0)`, `fstat(00000000)`, `stat(ttyname)`, `fstat(1)`, and `fstat(00000001)` should show exactly the same values since standard-in and standard-out should be the same.

The last set of lines (from `Login-name` on) provide much of the easy to understand information. These are:

The `login-name` line shows both a long and short version of the current username. If these two names are different then Interactive COBOL and other user utilities that use username could become confused. You

should probably shorten your username. Next comes the user-id associated with the current username along with the current group setting and any supplemental groups that the user belongs.

The next line shows the maximum number of processes available.

The next line shows the maximum number of operating system file handles per process allowed by this kernel configuration. If it is not enough, rebuild the kernel with a larger value.

The next line shows the maximum file size allowed on this system.

The next two lines show the machine name and particular operating system information, including release and version number and machine architecture.

On some machines information from the /proc filesystem will be shown.

On some machines a “Network Interface scan” section will be shown. Here any network interfaces that can be detected and their IP and MAC address, if present, is shown.

The next two lines show how many record locks are available by actually trying to lock until it gets a lock error and what the lock error is. If it is not enough, rebuild the kernel with a larger value. If an error is received on the open then for some reason icinfo cannot create a file to test locking. If icinfo hangs at this point then for some reason locks are not allowed for this file (and/or the filesystem) that this file resides on. DO NOT use icrun to try to open files on this filesystem as the runtime will HANG!

If the Timing option was selected then:

The next two lines insure that the timer is working correctly.

Finally the CPUINDEX gives a very simplistic cpu benchmark of how this machine compares to others. This benchmark is only as accurate as the setting in which it was taken. To make this more accurate, insure that no other processes are running while this timing is in effect.

C. Windows ICINFO

The Windows ICINFO utility is provided to give detailed information about a particular system. It displays a report that should be submitted for all support requests.

The syntax for icinfo is:

```
icinfo [-a|-A file] [-h|-?] [-F exename | -G option...|-N option... ]
```

Where

- a|-A *file* (Audit)
Enables auditing. Default icinfo.lg.
- h|-? (Help)
Displays help text
- F *exename*
Display where the specified executable is 32 or 64 bit
- G *option* (Only option)
Specifies to only display that particular *option* (s)
- N *option* (No option)
Causes the specified *option* (s) to NOT be displayed by default

Valid *options* are:

- c Displays the CPU type and other cpu-related info. The serial number is shown if available.
- d Drive information

- f File version information (not default)
- h Check for hung semaphores
- i Displays install.txt (requires “r”)
- k Displays the keyboard type and other language information
- l Performs a lock test
- m Displays memory information
- n Displays network information including whether TCP/IP is loaded
- p Display printer information including the default printer and all installed printers
- r Displays registry information
- s Displays system name and startup information
- t Displays sleep and CPU timings (not default)
- v Displays verbose information, especially for CPU type
- z Display miscellaneous cpu flags. (not default)

SCREEN 2 is a sample listing of the Windows ICINFO output.

```

Audit log opened Feb-20-2020 21:19:33.00
Auditing icinfo 5.40 (Windows (64-bit)) with pid 7328 on WIN10X64VM
icinfo Revision 5.40 (Windows (64-bit))
Copyright (C) 1987-2020, Envyr Corporation. All rights reserved.
Started: Feb-20-2020 21:19:33.79
This is a 64-bit executable.
Current directory: C:\Users\test
Current pid: 7328
Parent pid: 8088
Current exe: C:\Program Files\icinfo.exe
Parent exe: C:\Windows\System32\cmd.exe
Started from cmd.exe
System is running Microsoft Windows 10 Professional Edition, 64-bit
  Version 10.0 Build 18362
  Suites Installed:
    SingleUserTS
    Running 64-bit under 64-bit Windows.
Systemname: WIN10X64VM
System was started with a normal boot
Remote Session detected
Startup Info:
  Console title: "C:\Program Files\icinfo -A w:\test\icinfo.lg"
  Station/desktop: Winsta0\Default
  WindowsDirectory: C:\WINDOWS
  SystemDirectory: C:\WINDOWS\system32
Number of monitors detected: 1
  Primary monitor size: 1920 x 1080
  Primary monitor size: full 1920 x 1017
  Primary monitor size: max 1936 x 1056
  Primary left-upper: 0, 0 and right-bottom: 1920, 1040
Drive information for the current drive. (C:\)
  Current directory: C:\Users\test\
  Volume Label:
  Filesystem: NTFS
  Total space: 67,659,132,928 bytes (63 GB).
  Free space: 37,205,336,064 bytes (34 GB).
Running on a Hypervisor
System has an Intel processor with CPUID (type=6)
  Cpu (brand string) is an Intel(R) Xeon(R) CPU E3-1230 V2 @ 3.30GHZ
Hardware information (from os)
  Processor Architecture: x64
  Number of processors: 2
  Page size: 4096
  Minimum application address: 10000
  Maximum application address: ffffffff
  Active processor mask: 3
System Memory (ex):
  Total Physical Memory: 2096628 Kbytes 2047 Mbytes 1.99 Gbytes
  Available Physical Memory: 215756 Kbytes 210 Mbytes 0.20 Gbytes
  Total PageFile Size: 2751988 Kbytes 2687 Mbytes 2.62 Gbytes
  Available Page Space: 720264 Kbytes 703 Mbytes 0.68 Gbytes
Keyboard type: 7 [Japanese] 12 Function keys
  Keyboard code: 00000409 Keyboard Layout: English (U.S.)
  Locale Language: English (U.S.)
  Code pages: (Console) 437, (Console Output) 437, (OEM) 437, (ANSI) 1252
Network detected.
  Systemname: WIN10X64VM
  Username: test.
  TCP/IP Installed.
SNMP information
  IP4 address: 127.0.0.1
  IP4 address: 192.168.0.72
GetAdaptersInfo information
  ComboIndex: 8
  Adapter Desc: Intel(R) 82574L Gigabit Network Connection
  MAC Address : 00-0C-29-7C-82-D5
  Index: 8
  Type: Ethernet
  IP4 Address: 192.168.0.72
  IP4 Mask: 255.255.255.0
  Gateway: 192.168.0.1
  DHCP Enabled: No
  Have Wins: No
Printer Information
  Default: HP-MFP225dw (HP LaserJet Pro MFP M225dw)
Local Printers:
  OneNote
  HP-MFP225dw (HP LaserJet Pro MFP M225dw)
  Send To OneNote 16
  Microsoft XPS Document Writer
  Microsoft Print to PDF
  Fax
No remote printers found.
Envyr 64-bit software lookup.
Envyr Corporation software found.
ICOBOL 5 software found.
  Default ICROOT: C:\Program Files\ICOBOL
  Default ICCODEPATH: C:\Program Files\ICOBOL\examples\programs
  Default ICPERMIT_MACHINE: mainoffice
ICOBOL 5 Setup Values:
  CurVersion: 5.40
  PrevVersion: 5.36
  InstallerType: Master
  AppFolder: C:\Program Files\ICOBOL
  Components: Runtime,BaseDev,ICIDE,FlexusDev,ICODEC
  WorkDir: C:\ICOBOL\
  RT Shortcut:
  IDE Shortcut:
  SourceFormat: free
icexec entries:
  AuditFile: C:\ProgramData\ICOBOL\
  AuditFlags: :da
  InfoOpt: false

```

SCREEN 2. WINDOWS ICINFO

From top to bottom:

The icinfo revision, operating environment, 32 or 64 bit.
Current process information including directory, pid, exe name.
The operating system, revision, and build information. (Always shown)
The *systemname* is the machine name known to the operating system, startup information, and the Windows directory and system directory. (Option s)
Monitor information including number and size.
Drive information for the current directory.
Whether on a hypervisor and the type of machine architecture and serial number for Pentium III type processors. (Option c)
The next several lines show physical and virtual memory status in Kbytes. (Option m)
The keyboard type and code, language, and code page selections are shown. (Option k)
Whether a network was detected or not and if so, the current username, whether TCP/IP is running, and the MAC address(s) if found of the network card(s). (Option n)
The default printer is shown along with the current list of available printers on this machine. (Option p)
The registry is checked for any ICOBOL software and its information is reported along with several system specific settings important to **ICOBOL** users . (Option r)
If the timing option was selected, several timing tests are performed. (Option t)
A semaphore check with ICEXEC.
Finally a lock test if a file can be created.

ICINFO will detect and show SMB Signing information from Workstation and Server parameter lists in the registry. These show up as "EnableSecuritySignature" and "RequireSecuritySignature". A setting of 0 is disabled and a setting of 1 is enabled.

If a Warning is shown relating to these settings, especially for "RequireSecuritySignature" AND you are having some "Access denied" problems or "The specified network name is no longer available" connecting over the network or you are receiving some "delayed write failures" over the network then you need to look into the possibility of disabling these settings.

For more information on these settings you can go to the Microsoft site and search for "SMB Signing", "EnableSecuritySignature", or "RequireSecuritySignature".

V. ICLIB

A. Introduction

The ICLIB utility allows the user to create and/or modify a library file. ICLIB allows for additions, replacements, extractions, listings, statistics, and deletions of files in the library.

The library file can be used by the runtime system to find COBOL programs (.CX files) by placing the library filename in ICCODEPATH as a separate entry.

The library file is provided for program files (.CX). Files in a library can not be processed by any command-line utility except for those that support a library switch (ICREV and ICREVSET) unless the files are first exported from the library file.

B. Syntax

The standard syntax is:

Help

```
iclib -h|-?
```

List Contents

```
iclib [-a[:aflag]|-A file|dir[:aflag]] [-q] -l libname [argument]...
```

Import

```
iclib [-a[:aflag]|-A file|dir[:aflag]] [-q] [-v] -i [-r|-n] libname
argument...
```

Export

```
iclib [-a[:aflag]|-A file|dir[:aflag]] [-q] [-v] -x [-r|-n] libname
argument...
```

Delete

```
iclib [-a[:aflag]|-A file|dir[:aflag]] [-q] -d libname argument...
```

Statistics

```
iclib [-a[:aflag]|-A file|dir[:aflag]] [-q] -s libname
```

Where

-a[:aflag]|-A file|dir[:aflag] (Audit)

Enables auditing (default iclib.lg). Where *aflag* is a|b|d|p|t|u|da|db|pa|pb|ta|tb|ua|ub, defined as a-append, b-backup, d-date, p-pid, t-time, and u-username.

-h|-? (Help)

Displays help text.

-q (Quiet)

Enables quiet operation.

-s (Statistics)

Displays the statistics for the library file including the number of files, the size of the library in KB, and the number of deleted entries.

-v (Verbose)

Enables verbose operation, causing messages to be displayed for every step it executes. By default, only errors and summary messages are emitted.

libname (Library filename)

Specifies the library filename to use and is required. Most of the utilities that look at a library file default to the name icobol.cl. If the '.cl' extension is not given, it is appended.

-l (List contents)

Displays a sorted list of files in the library including size and last modification. If no arguments are given, all files in the library are listed; otherwise, only the specified files are listed.

-i [-r|-n] (Import)

Works in combination with the Replace switch (-r) or Newer switch (-n) to import the files specified by the argument(s) into the library. Without the Replace switch or Newer switch, only files that are not already in the library are added. The Replace switch says to add new files and replace any files with the same name. The Newer switch says to add new files and replace ONLY IF the one in the library is older than the new file.

-x [-r|-n] (Export)

Works in combination with the Replace switch (-r) or Newer switch (-n) to export files specified by the argument(s) from the library. Templates for extraction can not have directory specifiers. Without the Replace switch or Newer switch, only files that do not already exist in the destination directory are exported from the library. The Replace switch says to extract files and to replace any existing files that have the same name. The Newer switch says to extract files and replace an existing file ONLY IF the one in the library is newer than the one in the destination directory.

-d (Delete)

Deletes the files specified by the given template(s) from the library file. At least one template or filename is required.

argument

Can be a filename or template. The Export (-x) and Delete (-d) switches require the names and templates to be simple names (i.e., they may not have a directory prefix).

Environment variables:

ICLIB Command line options

C. Description

The Statistics, List, Import, Delete, and Export library switches are mutually exclusive.

When using the Newer switch with Import and Export, the file system modification date is used for comparison of times.

From time to time, the statistics switch should be used to determine if there is a large amount of unused free space in the library. This can be caused by replacing files with ones that are slightly larger, causing ICLIB to allocate a new area for the file. When there is a lot of free space, the library can be compacted by extracting all the files, deleting the old library, and then constructing a new one. However, this will cause the "modified" time stamp to be changed for all of the files in the library.

ICLIB opens the library file with the exclusive option so it will fail if another Interactive COBOL process has the library open. Similarly, while ICLIB has the library file open no one else can use the library file.

If ICLIB deletes the last entry in a library, a warning is issued and the library is deleted.

On Linux, when performing the Delete, List, or Export operations with a template as an argument, it may be necessary to quote the template to prevent the template from being expanded by the shell.

Notes:

1. On Windows, all files will be loaded into the library as lower-case filenames to insure that they will be extracted as lower-case files on Linux.
2. On Linux, files will be loaded into the library in the case that the filename is presented to the utility. If the files are loaded on Linux and extracted on Linux their cases will be preserved provided Note 3 below is adhered to. Generally we recommend only lower-case files be stored in the library.
3. All files in a library are identified in a case-insensitive fashion. Thus no two filenames can have the same name in different cases, i.e., "A" and "a" represent the same file.
4. The library stores at most a 255-character name in the library file. Any file with a simple name longer than 255 characters will generate an error and will not be stored in the library.

VI. ICLINK

A. Introduction

The ICLINK utility allows the user to specify an alternate set of filenames for the files named in the COBOL programs executing under Interactive COBOL. It allows for a particular filename used in an OPEN, CALL, or CALL PROGRAM statement to be remapped (i.e., linked) to a new filename without changing the program. The linking can apply to entire pathnames. The utility also allows for exporting the contents of a link file.

The filename linking facility was specifically implemented to enhance the portability of existing Interactive COBOL programs.

Another important use for ICLINK is to use files on an ICNETD server (client/server). From the current working directory (usually on the local machine), certain files must be redirected to the server machine running ICNETD. ICLINK can be used to accomplish this without having to change the COBOL program(s).

The template characters “*” and “?” can be used to facilitate linking similar files.

ICLINK does NOT support linking files with embedded spaces to new filenames since space is used to delimit old names from new names in the ICLINK input file. New names can have embedded spaces on Linux and Windows.

B. Syntax

The standard syntax is:

Help
iclink -h|-?

Import
iclink [-a[:aflag]|-A file|dir[:aflag]] [-q] -i [-r] linkfile textfile

Export
iclink [-a[:aflag]|-A file|dir[:aflag]] [-q] -x [-r] linkfile textfile

Statistics
iclink [-a[:aflag]|-A file|dir[:aflag]] [-q] -s linkfile

Where

- a[:aflag]|-A file|dir[:aflag] (Audit)
Enables auditing (default iclink.lg). Where *aflag* is a|b|d|p|t|u|da|db|pa|pb|ta|tb|ua|ub, defined as a-append, b-backup, d-date, p-pid, t-time, and u-username.
- h|-? (Help)
Displays help text.
- q (Quiet)
Enables quiet operation.
- s (Statistics)
Displays statistics about the *linkfile*. These include the number of names, the size of the file (in KB), the average entry link, and the average lookup chain length.
- i (Import)
Read the line sequential file given by *textfile* and add the names to the specified *linkfile* based on whether the Replace switch was specified.
- x (Export)
Creates a line sequential file specified by *textfile* with the old-name, new-name pairs in it. This file is in a format suitable for importing into a new link file. If the file does not exist, it is created. If it does exist, and the -r switch is set, it is erased and the export list is written to it. If the -r switch is not set, the export list is appended to the file.

-r (Replace)

Specifies that during an import, any old-filename that already exists in the link file will automatically be replaced by a duplicate entry from the import file. Without this switch, such names are flagged with a warning and the replacement does not occur. For an export operation, the contents of the export file are erased and replaced by the new list, otherwise the list is appended to the file.

linkfile

Specifies the name of the linkfile to be used. If the .lk extension is not given, it is appended.

textfile

Specifies the name of a line sequential file containing the old- and new-filenames.

Environment variables:

ICLINK Command line options

The syntax of the textfile is:

```
old-filename space... new-filename <line-terminator>
.
.
```

Where

old-filename

Can be any set of characters except space and not longer than 255 characters. The template characters “*” and “?” can be used to match many or a single-character(s) respectively.

new-filename

Any string of characters beginning with the first non-blank character and going until a line-sensitive terminator (CR or NL) with any trailing spaces stripped. If template characters (“*” and/or “?”) were given in the *old-filename* then matching template characters must be given in *new-filename*.

Note that the template “*.?” does NOT match the file “joe000” since it contains no “.” character.

C. Description

A single source line cannot be longer than 255 characters.

To use ICLINK, first create a standard text file with each line containing the old-filename and the new-filename separated by at least one space. Then run ICLINK using that file as its textfile-argument and a link filename to create a linkfile.

If the ICRUNLK environment variable is set, this file is read by the Interactive COBOL runtime at startup time and used dynamically to replace occurrences of old-filenames with corresponding new-filenames. This replacement is done before the runtime adds the standard extensions to the names (.XD/.NX for ICISAM files or .CX for COBOL program files).

All old-filenames are stored and looked-up in a case-insensitive manner. Thus, attempting to import the old-filenames "ABC" and "abc" would cause an error unless the Replace switch (-r) was used, in which case the last one will replace the previous.

ICLINK opens the link file it is creating with the exclusive option so that no other Interactive COBOL process can access it while it is being constructed.

Upon invocation of the Interactive COBOL runtime, if the ICRUNLK entry is specified then the specified link file is activated, otherwise no filename linking is performed. The link file is opened for read-only access, read into memory, and then closed.

Link files are interchangeable from one machine to another and from one operating system to another.

Exact matches will be used before template matches. Template matches will be used in the order they appear in the source file.

The following is allowed to link "\$lpt" to "|>lp -ddest -ond"

```
$lpt <space>... |>lp -ddest -ond <line-terminator>
```

These new-filenames with embedded spaces and illegal characters are only useful on Linux in a sequential OPEN.

The link facility can also be used to open files using the ICNETD facility (client/server) by specifying ICNETD names as the new-filename. The template characters provide for whole groups of files to be mapped in this fashion. For example,

```
data\a* @\\machine6\data\a*
```

would link all files starting with "data\a" (including "data\a") over to machine6 using ICNETD.

Note: On Linux, it is possible when running in lower-case mode or upper-case mode to pass filenames of the other case through, by selecting a new-filename of the opposite case. For example, when running Interactive COBOL on Linux in lower-case mode the mapping "joe JOE" will allow the upper-case filename "JOE" to be opened.

VII. ICMAKEMS

A. Introduction

The ICMAKEMS utility is used to convert a text version of system message files into the internal format used by all of the Interactive COBOL programs (command-line utilities, compilers, and runtime). These files, *.ms, will be used to replace the default internal messages. These files can be changed to accommodate languages other than English by editing the released sample English message files and building the respective .ms file.

Any customized message file should use the ICCONFIGDIR mechanism to find the file.

B. Syntax

The standard syntax is:

```
icmakems [-a[:aflag]|-A file|dir[:aflag]] [-h|-?] [-q] [-O dir]
[argument]...
```

Where

- a[:aflag]|-A file|dir[:aflag] (Audit)
Enables auditing (default icmakems.lg). Where *aflag* is a|b|d|p|t|u|d|a|d|b|p|a|p|b|t|a|t|b|u|a|u|b, defined as a-append, b-backup, d-date, p-pid, t-time, and u-username.
- h|-? (Help)
Displays help text.
- q (Quiet)
Enables quiet operation.
- O *dir* (Output)
Place the output in the indicated directory *dir*. If the output file already exists, the new messages replace the old ones.
- argument*
Specifies a filename, a list of filenames, or a template.

Environment variables:

ICMAKEMS Command line options

C. Description

This utility is not required if the default set of messages are sufficient. The text files (coberrs-en.h, runerrs-en.h, and syserrs-en.h) in the messages directory show the default messages in English. Also found in the messages subdirectory is the file infostat.ms which is a special message file used by the IC_INFOS_STATUS_TEXT builtin. It is built from infostat.txt.

The content of the input files for ICMAKEMS are very simple .h files. Please see their descriptions within the samples provided.

syserrs	messages are the standard exception values provided by the runtime.
runerrs	messages are runtime and ICEXEC startup messages
coberrs	messages are compiler messages

The builtin IC_MSG_TEXT can be used to retrieve messages from within a COBOL program.

These files can be used to build a new message file (*.ms). For example:

```
icmakems syserrs-new.h
```

Will build a systerrs-new.ms file which can be renamed to syserrs.ms and it will be read at startup to replace the default entries.

Any customized message file should be placed in the directory specified by ICCONFIGDIR.

IX. ICPACK

A. Introduction

The ICPACK utility tailors the structure of the .NX portion of an ICISAM file to allow for optimized storage and access time. ICPACK works with the current .XD/.NX portions of a file to build a new .NX file to replace the current one.

ICPACK does not remove logically deleted records, use ICREORG. ICPACK does not reclaim space from physically deleted record slots, use ICREORG for that purpose.

B. Syntax

The standard syntax is:

```
icpack [-a[:aflag]]|-A file|dir[:aflag]] [-C density] [-h|-?]
        [-K key:density]... [-N i[:pct]] [-p] [-q] [argument]...
```

Where

-a[:aflag]|A file|dir[:aflag] (Audit)

Enables auditing (default icpack.lg). Where *aflag* is a|b|d|p|t|u|da|db|pa|pb|ta|tb|ua|ub, defined as a-append, b-backup, d-date, p-pid, t-time, and u-username.

-C *density* (Compaction Density)

Sets the default packing density for any unspecified key. If not set, the default is 99%.

-h|-? (Help)

Displays help text.

-K *key:density* (Individual key density)

Provides the density percentage values for each of the file's specified keys to be packed. If more than one density is the same, you can use the Compaction Density switch (-C) to set a default and then specify only those that are different. The *density* must be a number between 50 and 99, inclusive. The *key* value can be p for the primary, a1 for alternate key 1, a2 for alternate key 2, . . . up to a16 for alternate key 16. If a particular file has fewer keys than specified in the density-switches, the extra values are ignored. If density is not specified for a particular key, it defaults to the value given by the Compaction Density switch (-C).

-N i[:*pct*] (No-packing)

Do not pack the file. If the optional *pct* is added, the No-packing switch is conditioned on the percentage of space that would be freed: No-packing if less than *pct* amount of space is freed up. This switch is implemented based on calculations, not scans.

-p (Progress)

There is an ongoing display of the processing, which typically runs much slower for smaller files. The reporting interval is for every 1% of the file processed.

-q (Quiet)

Enables quiet operation.

argument

Specifies the filename or template for the files to be packed. If not given, all ICISAM files in the current directory are processed.

Environment variables:

ICPACK Command line options

C. Description

ICPACK requires temporary disk storage in which to build the new .NX file and only at the very end is the current .NX file deleted and replaced with the new .NX file. These temporary files have the '.nt' and '.dt' extensions for index and data respectively. This insures that if the machine crashes while ICPACK is running, the original file is not damaged in any way. On Linux, because ICPACK installs the new .NX file with a rename, all hard links to the .NX file will still point to the old version, i.e., when finished all hard links to the new .NX file will have been removed. Also the file attributes of the .nx file could be changed from the .xd if the *umask* is different.

ICPACK will not run on a file if either reliability flag is set (i.e., the file is corrupt). Run the ICCHECK utility on the file to make sure it is corrupt. If corrupt, the ICFIXUP utility can be used to build a new ICISAM file or a backup should be used if the .XD file is badly corrupted.

ICPACK will pack a particular key index structure from 50% to 99% full. The more dense the packing (i.e., the larger the percentage) the less storage the key structure takes and the faster a keyed access is performed. On the other hand, adding many new keys to a highly packed file will cause index node splitting to occur and may be slower.

ICPACK removes purged alternate keys.

ICPACK can reduce the size of the .NX file by up to 50% for files that have been randomly written and have not been packed.

ICPACK opens the file(s) with the exclusive option.

The following information about an ICISAM file is given:

- The ICISAM version of the file
- The default deletion type (logical or physical) is given along with the maximum file size
- The number of alternate keys for indexed files, record size, and number of records allocated
- For each key it reports:
 - Whether the key is the Primary or an Alternate along with seven possible attributes shown by the possible letters "dursaop" or "-----" if no attributes were given for the file. The possible attributes are shown below:
 - d - duplicates are allowed,
 - u - upper-case only,
 - r - reverse (or DESCENDING) storage,
 - s - suppress certain key values (the suppressed value is shown later),
 - a - multiple scattered keys using ALSO clause,
 - o - multiple tabular keys using OCCURS clause, and
 - p - this key has suffixes using PLUS clause.
 - Finally the number of keys and records are shown.
- The amount of space freed from packing.

X. ICPQUTIL

A. Introduction

The ICPQUTIL utility validates and optionally dumps printer control (.pq) files.

B. Syntax

The standard syntax is:

```
icpqutil [-a[:aflag]|-A file|dir[:aflag]] [-d] [-e] [-h|-?] [-N dhjz] [-q]
        [-u] argument
```

Where

-a[:aflag]|A file|dir[:aflag] (Audit)

Enables auditing (default icpqutil.lg). Where *aflag* is a|b|d|p|t|u|d|a|d|b|p|a|p|b|t|a|t|b|u|a|u|b, defined as a-append, b-backup, d-date, p-pid, t-time, and u-username.

-d (Dump)

Dump the contents of the .pq file.

-e (fix Errors)

Fix any fixable errors.

-h|-? (Help)

Displays help text.

-N dhjz (No options)

Do NOT dump the selected options: d-devices, h-header, j-jobs, z-items with zero status.

-q (Quiet)

Enables quiet operation.

-u (Update)

Update the .pq file if needed.

argument

Specifies the .pq filename to be viewed. If not given, system.pq is used.

The **-e** (fix Errors) and the **-u** (Update) switches require exclusive access to the .pq file such that the file can be updated.

When updating the file with **-u**, all jobs in the file are checked to insure that the file is still available. If the file is no longer available then the file is removed from the .pq file.

Environment variables:

ICPQUTIL Command line options

C. Description

ICPQUTIL can be used as a debugging tool to check and correct .pq files that go bad. The various dump options allow the file to be viewed in several ways differently than what is shown under the Printer Control Utility.

XI. ICREORG

A. Introduction

The ICREORG utility is a general file reorganization utility. It can convert files from one format to another among the supported Interactive COBOL file formats. In addition, the output records have a limited formatting capability that can be used to create reports. If the output file does not exist, it will be created. If it exists and is a sequential file, the new data will be appended. If it exists and is an indexed or relative file, the data will be merged according to the Merge switch (-m).

ICREORG assumes all indexed and relative input files are valid. It does not process corrupt files. ICFIXUP should be used to fix a corrupt indexed or relative file.

ICREORG can be used to remove logically deleted records from ISAM files. ICREORG can be used to remove physically deleted record slots.

ICREORG can read and write version 5 and 6 ISAM files.

B. Syntax

The standard syntax is:

```
icreorg [-a[:aflag]|-A file|dir[:aflag]] [-B num] [-C b|p:on|off] [-e]
        [-F pos:len|-F str:cnt]... [-h|-?] [-I type[:min[:max]]] [-k]
        [-K <keyspecifier>]... [-L file] [-m] [-N cnt] [-O type[:min[:max]]]
        [-p] [-q] [-R num] [-S key] [-u] [-V version] inputfile [outputfile]
```

Where

-a[:aflag]|-A file|dir[:aflag] (Audit)

Enables auditing (default icreorg.lg). Where *aflag* is a|b|d|p|t|u|da|db|pa|pb|ta|tb|ua|ub, defined as a-append, b-backup, d-date, p-pid, t-time, and u-username.

-B num (Beginning)

Specifies the beginning record number to use from the input file. It can be used with the Number (-N) switch to process just a portion of a file. The default is to begin with the first record. The record number is determined by numbering (counting) the records in the order they would be read according to the key order specified. Thus, the Nth record by the primary key will probably be different from the Nth record following an alternate key. The record number will also depend on the setting of the Undelete switch.

-C b|p:on|off (Control output file attribute)

Set (on) or clear (off) the indicated file attribute(s). Available attributes are 'b' or 'p'. Control attribute can be specified multiple times to set each attribute.

b (Big File) Allows the maximum file size of the file to grow to 4GB. If not set, the maximum file size is 2GB. Only allowed for version 7 files.

p (Delete-is-physical) Sets the default type of record deletion on this file when neither LOGICAL nor PHYSICAL were specified in the delete operation. For logical deletes, the record is simply marked deleted so it can be undeleted; for physical deletes, the record area space is made available for new records to be written and no undelete can be done as the record is gone. The default is for the delete-is-physical attribute to be off. Only allowed for version 7 and 8 files.

-e (Exclusive)

Open the input file exclusively.

-F *pos:len*|-F *str:cnt* (Field specifier)

Specifies the next field in the output record. The first format specifies that *len* characters starting at position *pos* in the input record are to be copied to the output record. The second format specifies that *cnt* instances of the character(s) *str* are to be copied to the output record. If the string starts with a quote it must be ended with the same quote, if not started with a quote it ends before the first ":". If the string starts with an integer, it must be enclosed in quotes. If the string includes a ":", it must be enclosed in quotes. The string may use the format *\nnn* to specify an arbitrary character in octal format. In order to include the quote character inside the string, the octal form must be used. If one Field specifier is used, the whole output record must be defined using one or more Field specifiers. Up to 33 field specifiers may be supplied.

-h|-? (Help)

Displays help text.

-I *type*[:*min*][:*max*] (Input type)

Used during file conversions to specify the type of the input file, and, optionally, the input file record length. *Type* is one of the following:

- i Indexed file
- l Line sequential file (delimited by <cr>, <nl>, <ff>, <nul>, or <cr><nl>), omit zero length records
- r Relative file
- s Fixed-length sequential file, length is required.
- v Variable-length sequential file
- z Line sequential file, keep zero length records.

If not specified, *type* defaults to i-indexed. The *min* field must be specified for fixed-length sequential files. If it is specified for other file types, the records are truncated or padded with null (or space for line-sequential) to the specified length.

-k (Keep)

Maintain logically deleted records from the input file as they are copied to the output file. By default, deleted records are ignored when reading the input file.

-K *pos:len*[:*d*][:*r*][:*u*][:*s*[:*val*]][:*p*=*ppos:plen*]...[:*o*=*cnt:span*] (Key specification)

-K *pos:len*[:*d*][:*r*][:*u*][:*s*[:*val*]][:*a*=*apos*]... (Key specification)

Specifies the keys for indexed files. A key specification must be supplied for each key in the file. At least one key must be specified for an indexed file creation. The number of keys will be determined by the number of key specifications. The first key specification will be for the primary key, all subsequent key specifications will be treated as alternate keys. All the alternate keys are sorted like the COBOL compiler sorts alternate keys allowing them to be specified in any order. Up to 17 key specifiers may be listed for version 7 and 8 files.

pos specifies a 1-based byte position in the record of the start of the key.

len specifies the length of the key in bytes.

:d specifies that the alternate key is to allow duplicate keys and is only allowed for alternate keys.

The following key specification options are only allowed for version 7 and 8 files.

:r specifies that this key is to be stored in reverse order.

:u specifies that this key is always stored and retrieved in upper-case-only.

:s[:*val*] specifies the value to suppress from key insertion and is only allowed on an alternate key. If *val* is not specified, LOW-VALUE is used.

:p=*ppos:plen* specifies suffixed key values (PLUS) at the given position (*ppos*) and length (*plen*).

:o=*cnt:span* and *:a*=*apos* specify multiple key locations in the record for this key and is only allowed on an alternate key. The *:o* parameter (OCCURS) gives a tabular view with *cnt* times and how far apart each entry is in bytes (*span*). The *:a* parameter (ALSO) specifies scattered key values for this key at the indicated positions (*apos*).

-L *file* (Like)

Used to create the file to be like an existing file when the output file is an indexed or relative file. If *file* does not include an extension (or if it is .NX or .XD), it is assumed to specify an indexed or relative file. If the .FA extension is used, the contents of the file attribute file are used.

-m (Merge)

If the output file is an indexed or relative file, directs the utility to merge new keyed records with existing records by deleting the existing record with this primary key and then writing the newer record. If this switch is not set, the existing record is retained, and the new record is ignored.

-N *cnt* (Number)

Process at most *cnt* records. It can be used to limit the processing to the first *cnt* records in a file. If this switch is not specified, the input file is processed until end of file is reached. It can be used with the -B switch to select a range of records.

-O *type[:min[:max]]* (Output type)

Used during file conversions to specify the type of the output file, and, optionally, the output file record length. *Type* is one of the following:

- i ICISAM Indexed file
- l Line sequential file (delimited by <cr><nl> on Windows and by <nl> on Linux)
- r ICISAM Relative file
- s Fixed-length sequential file
- v Variable-length sequential file

If not specified and *outputfile* is specified, *type* defaults to indexed. If not specified and *outputfile* is not specified, *type* defaults to line-sequential. If not specified, *min* defaults to the length used for the input file unless the relative or indexed output file already exists in which case its length is used, or a like file was specified.. If different from the input length, the records are truncated or padded with null (or space for line-sequential) to the specified length. If *max* is specified, then *min* and *max* represent the minimum and maximum record sizes allowed in the file.

-p (Progress)

There is an ongoing display of the processing, which typically runs much slower for smaller files. The reporting interval is for every 1% of the file processed.

-q (Quiet)

Enables quiet operation.

-R *num* (Relative start)

Used when the output file is a relative file, and it directs the utility to renumber the relative key values beginning with the value *num*. By default, reorganizing a relative file to a relative file leaves the numbering unchanged, and converting another file type to relative, numbers the records consecutively beginning with the value 1.

-S *key* (Sequence key)

Used when the input file is an indexed file with alternate keys to change the order in which the file is read. By default, the file is read in the order of the primary key. This changes it to be in the order of one of the alternate keys. The *key* field can have the value `a1' to `a16' for version 7 and 8 files.

-u (Undelete)

Undelete logically deleted records from the input file as they are being copied to the output file. By default, deleted records are ignored.

-V *version* (Version)

Sets the output file version number during conversions to an ICISAM indexed or relative file. The *version* may be 5, 6, 7, or 8 for an ICISAM file.

inputfile

Specifies the input file.

outputfile

Specifies the output file. If not specified, standard out is assumed and the Output type is set to line-sequential.

Environment variables:

ICREORG Command line options

C. Description

The default input type is indexed, with the key and record information derived from the file. If the outputfile name is given and the output file does not exist, the default type will be the same as the input file. If the outputfile is not given then standard out is used and the default output type is set to line-sequential.

The -k and -u switches are mutually exclusive.

In a key specifier, the :o (OCCURS) and :a (ALSO) can not both be specified for a single key entry.

On Linux, when using the Field specifier (-F) switch you must be careful about entering characters with the `\nnn` octal specification as the shell interprets a single `"\"` to mean take the next character literally when not within quotes and as an octal representation when within quotes. Thus, to use the `\nnn` specification you should enclose the string within quotes. When using quotes you must also understand that the shell strips the quotes after using them to delimit a single argument. I.E., a `"12HH"` will be passed to ICREORG as `12HH` which ICREORG will attempt to treat as a *pos* argument since it begins with a digit. (`12HH` is not legal as a *pos* argument and an error will be generated.) You must enter it as `"12HH"` to have the shell pass a `"12HH"` to ICREORG.

On Windows, when using the Field specifier switch (-F) with the string option, the double-quote (`"`) symbol must be escaped with a backslash (`\`) in order for ICREORG to see the double-quote. The close-quote (`'`) can also be used.

An item to note indexed files is that if an alternate key that does not allow duplicates is written to the file and there already is an alternate key with that value, then the record will not be written, it will be ignored. ICREORG will show the input record number for any duplicate key records. Just remember, when using logical deletes with records with alternate keys that **DO NOT ALLOW DUPLICATES**, a Duplicate key error can be given for an alternate key that points to a deleted record. The record must be physically deleted to insert a new record with the same alternate key.

Alternate record keys are sorted based on the following criteria (just as in the compiler):

- a. ascending root segment position.
- b. ascending root segment length.
- c. absence of also keys and if present ascending number of also and ascending alsos position.
- d. absence of suffixes, and if present ascending number of suffixes, ascending suffix position, and ascending suffix length.
- e. absence of occurs, and if present ascending number of occurs and ascending occurs span.
- f. absence of duplicates allowed.
- g. absence of descending order.
- h. absence of uppercase conversion.
- i. absence of suppress when value, and if present ascending suppress when value.

D. Examples

The following syntax reads the indexed file `test6` and builds a line sequential file `report1`, that has the first 10 bytes of the record, followed by two spaces, followed by bytes 20-29, and 50-69 in the output file.

```
icreorg -O 1 -F 1:10 -F "\040":2 -F 20:10 -F 50:20 test6 report1
```

The following syntax reads the line sequential file `inputdata`, starting at record 2, and builds the indexed file `outputdata` using a 100 byte record with a 20 byte primary key starting at character position 11, and a 10 byte alternate key with duplicates starting at position 26. The output record is composed of 10 bytes of spaces, followed by the first 20 characters from the input record, followed by 5 `"-"` characters, and then followed by the next 65 characters (characters 21 through 80) from the input record.

```
icreorg -I 1 -B 2 -O i:100 -K 11:20 -K 26:10:d -F "\040":10 -F 1:20  
-F "-":5 -F 21:65 inputdata outputdata
```

XII. ICREV

A. Introduction

The ICREV utility displays the file revision information for various types of Interactive COBOL files. The revision information includes the file format version, file creation information, file modification information, and the programmer supplied revision string that was set using ICREVSET or ICOBOL. ICREV can detect ICISAM version 5 and 6 files.

B. Syntax

The standard syntax is:

```
icrev [-a[:aflag]|-A file|dir[:aflag]] [-c] [-h|-?] [-L file] [-m] [-q]
      [-r] [-s] { argument }...
```

Where

- a[:*aflag*]|-A *file|dir[:aflag]* (Audit)
Enables auditing (default icrev.lg). Where *aflag* is a|b|d|p|t|u|da|db|pa|pb|ta|tb|ua|ub, defined as a-append, b-backup, d-date, p-pid, t-time, and u-username.
- c (Creation info)
Only the file creation information is displayed.
- h|-? (Help)
Displays help text.
- L *file* (Library)
Specifies a library file in which to find the specified file(s).
- m (Modification info)
Only the file modification information is displayed.
- q (Quiet)
Enables quiet operation.
- r (Revision info)
Only the file format revision information is displayed.
- s (Programmer info)
Only the programmer(supplier) revision string is displayed.
- argument*
Can be a filename or a template. The filenames or templates must specify an extension. Specifying a library file as an argument returns revision information about the library itself.

Environment variables:

ICREV Command line options

C. Description

The Library switch says use a library to look for the files specified by the argument list rather than looking in the host file system. On Linux, when using the library switch, template arguments may need to be quoted to prevent them from being expanded by the shell.

The creation and modification information includes the date and time, the utility responsible, and the system the utility ran on.

XIII. ICREVUP

A. Introduction

The ICREVUP utility provides the ability to up rev certain files when upgrading from one major revision to another. **ICOBOL 2** .cf, .pt, .td files can be converted to their .cfi, .pty, or .tdi forms and ICISAM version 5 and 6 files (.xd) can be converted to ICISAM version 7 or 8 files.

B. Syntax

The standard syntax is:

```
icrevup [-a[:aflag]|-A file|dir[:aflag]] [-h|-?] [-M cffile] [-N r] [-q]
        [-r] [-V 7|8] { argument }...
```

Where

-a[:aflag]|-A file|dir[:aflag] (Audit)

Enables auditing (default icrevup.lg). Where *aflag* is a|b|d|p|t|u|da|db|pa|pb|ta|tb|ua|ub, defined as a-append, b-backup, d-date, p-pid, t-time, and u-username.

-h|-? (Help)

Displays help text.

-M (Master console)

Use master console information from the given .cf file when processing .td files

-N r (No options)

Do not try to convert any rev5 files as RELATIVE files

-q (Quiet)

Enables quiet operation.

-r (Replace)

Always replace existing files.

-V 7|8 (Version)

Specify either ICISAM version 7 or 8 files when upgrading.

argument

Can be a filename or a template. The filenames or templates must specify an extension.

Environment variables:

ICREVUP Command line options

C. Description

When provided an argument with a .xd extension, icrevup will first look to see if the file is a rev 5 or 6 file, then rename the file with a .bu extension as name.bu.xd/.nx. Then the file will be converted to a rev7 or 8 file with the original name. Finally the .bu files will be renamed to .xd5/.nx5 or .xd6/.nx6.

Linux hard links will be broken.

Example:

```
icrevup -V 8 *.xd
```

would convert all rev5 and rev6 ICISAM files in the current directory to rev8 files and leave the old files with names as .xd5/.nx5 or .xd6/.nx6.

When provided an argument with a .cf, .pt, or .td extension, icrevup will convert the file to the appropriate .cfi, .pti, or .tdi file. ICREVUP will open the current file and output a corresponding file using the same PATH and base filename but with the new extension (e.g., .pt is output as .pti). These new files are used in the same places as the old files.

The -h option can be used to view all of icrevup's switches.

One note in particular, the pre-3.30 .cf file had Master Console information that now resides ONLY in the pcwindow.tdi file. This information must be transferred manually.

XIV. ICSHELLX (Only on Windows)

A. Introduction

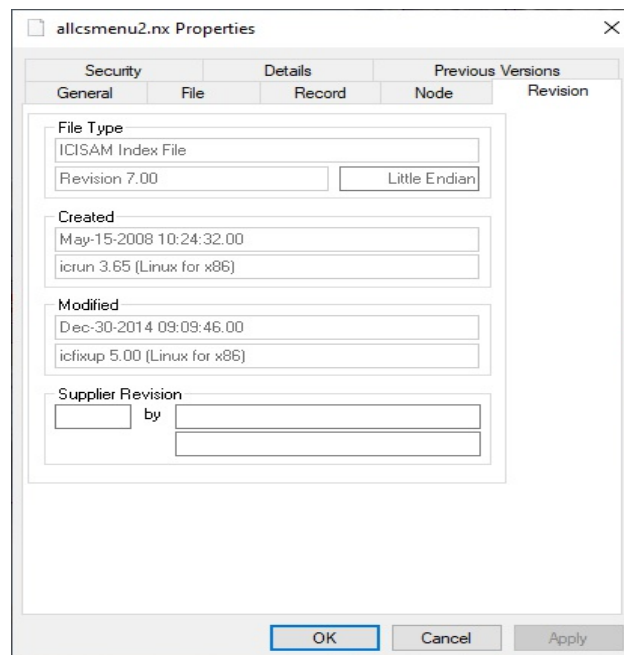
ICSHELLX is a utility program which extends the capabilities of Windows Explorer on systems with **ICOBOL** installed. This extended information includes revision information on all standard icobol file types and enhanced descriptions of the structure of ICISAM files. During **ICOBOL** installation the shell extensions module (ICSHELLX.DLL) is registered with the Windows operating system. Thereafter it becomes available as one or more tabs in the Properties window of a file selected in Windows Explorer.

B. Use

To use the extensions, select an **ICOBOL** file from within Windows Explorer. A single click of the left mouse button will accomplish this task. Next a single click of the right mouse button will bring up a context menu. Move the mouse so that the "Properties" menu entry is highlighted and select it using a single left click. The properties entry is normally the last entry on the context menu.

At this point a tabbed Properties window will appear. In addition to the standard tabs labeled "**General**" and "**Security**", when ICSHELLX is available a "**Revision**" tab will be shown. Other tabs may be available as well depending upon the type of file initially selected.

Select the "**Revision**" tab by a single left click. A screen similar to the following will be shown.



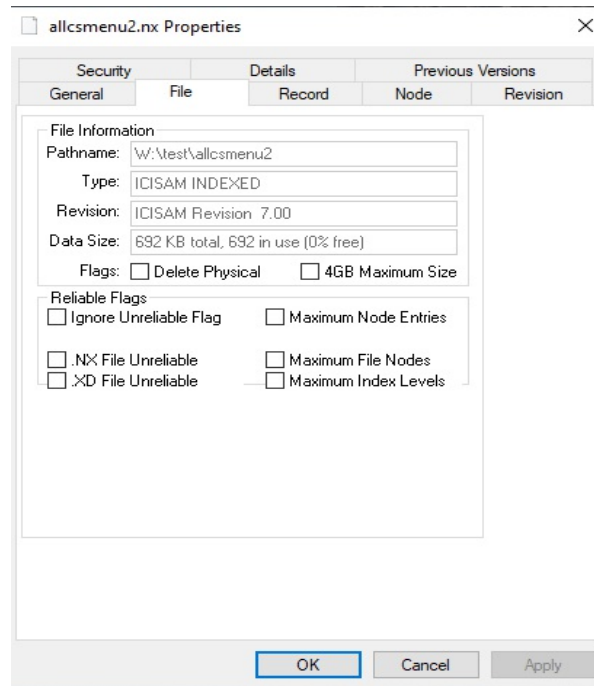
The "**Revision**" tab provides the following information:

- A description of the file including its file type, revision number and byte-ordering.
- The date and time that the file was created, and the process that created the file along with its revision number
- The date and time that the file was last modified, and the process that last modified the file along with its revision number
- The supplier (OEM) revision number and the process and its revision number that applied the supplier revision to the file, except for .ini type files (cfi, pti, and .tdi).

ICSHELLX provides a **Revision** tab for all standard **ICOBOL** files including ICSAM files (.nx, .xd), ICISAM file attribute files (.fa), program files (.cx), libraries (.cl), symbol table files (.sy), project files (.icp), printer control files (.pq), and link files (.lk). It will also provide information without the supplier (OEM) information for configuration files (.cfi), printer translation files (.pti), and terminal description files (.tdi).

If either the .xd or .nx of an ICISAM file is selected, ICSHELLX provides several additional tabs to the Properties window. These additional tabs are labeled as "**File**", "**Record**", and "**Node**" and may be selected with a single left click.

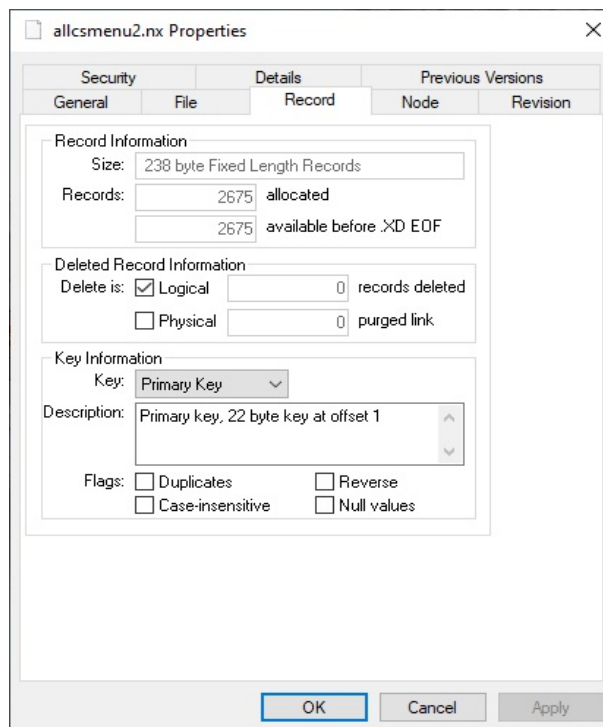
The "**File**" tab is shown below.



The "**File**" tab will show three sections.

- The "File Information" section includes the full pathname of the file, the file type and revision, the available data space in the file's .xd and the percentage of that space which is in use. Also shown are two check boxes which will be checked if physical deletes are the default (Delete Purges) and if large file support is enabled (4GB Maximum size).
- The "Reliable Flags" section contains a series of check boxes which when checked indicate the status of the file. The boxes include the state of the reliability bits for each portion of the file, the ignore reliability bits flag used internally, and the flags indicating that the maximum number node entries, nodes per file or index levels have been hit.

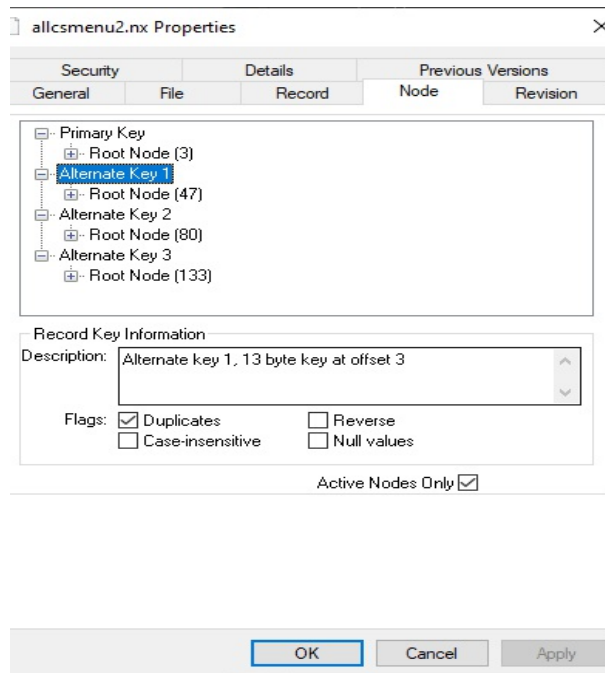
The "**Record**" tab is shown below.



The "**Record**" tab will again show three sections.

- The "Record Information" section shows the size of the records, how many have been allocated and how many are available before the end of file.
- The "Deleted/Purged Record Information" shows whether the default delete type is logical or physical, the logically deleted record count and the purged record link.
- The "Key Information" section shows information about a file's keys. The key to be described may be selected via a pull-down list. The information shown includes key size, record offset and composition of each of the keys as well as check boxes for whether the key's description contains the ALLOWS DUPLICATES clause (Duplicates), the ORDER BY ALPHABETIC-UPPER clause (Case-insensitive), the VALUES ARE DESCENDING clause (Reverse) or the SUPPRESS WHEN clause (Null values).

The "Node" tab is shown below.



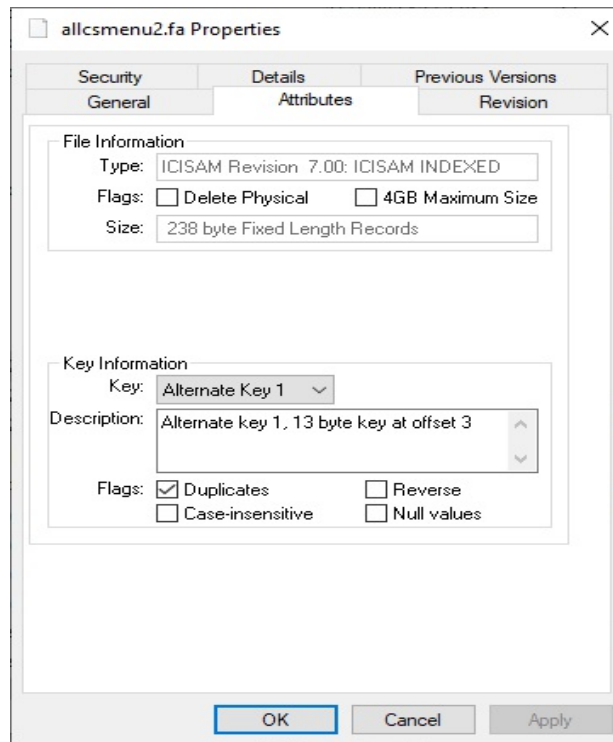
On the "Node" tab a tree view of the keys in the file will be shown. The mouse may be used to highlight entries in the tree and to expand or collapse branches of the tree. Under each key are entries for the index nodes starting with the root node (i.e., node 1), continuing through the various index levels, and at a leaf-node, the records offsets are displayed.

Selecting the check box "Active nodes Only" will partially limit the display to data relevant to the current contents of the file. When an entry is highlighted in the tree various pertinent information is displayed in the section below the tree view.

- For a key such as Primary Key you will see a display of information similar to that shown in the "Key Information" section of the "Record" tab.
- For a node various information from the node header is displayed including its node number, the key to which it belongs, its index level and the maximum entry count.
- For an active record entry you will see the key's position in the file, and the key value. The key value can be shown in either ASCII or Hex by selecting the appropriate check box.

If an ICISAM file attributes file (.fa) is selected, ICSHELLX provides an "Attributes" tab in addition to the "Revision" tab. The "Attributes" tab may be selected with a single left-click.

The "Attributes" tab for a file attributes file is shown below.



The "Attributes" tab will show two sections.

- The "File Information" section includes the file type and revision and the record size. Also shown are two check boxes which will be checked if physical deletes are the default (Delete Purges) and if large file support is enabled (4GB Maximum size).
- The "Key Information" section shows information about a file's keys. The key to be described may be selected via a pull-down list. The information shown includes key size, record offset and composition of each of the keys as well as check boxes for whether the key's description contains the ALLOWS DUPLICATES clause (Duplicates), the ORDER BY ALPHABETIC-UPPER clause (Case-insensitive), the VALUES ARE DESCENDING clause (Reverse) or the SUPPRESS WHEN clause (Null values).

C. Default File Associations

The following table shows the file associations that are set up by the ICOBOL installer. The “when” column indicators are R-runtime, D-Development, S-SP2 Development. These file associations can be edited by executing My Computer and choosing the View / Options / File Types menu selections.

When	Ext	File Description	
		Context Menu Options	Command line
R	.cfi	ICOBOL Configuration File (ini) Configure	icedcfw %1%
R	.cl	ICOBOL Library File	
D	.co	ICIDE Card-format Source Open Print	icide %1% icide /p %1%
R	.cx	ICOBOL Program File Run	icrun -a -C default %1%
D	.er	ICOBOL Error Listing Open Print If installed, icide is used in place of notepad.	notepad %1% notepad /p %1%
R	.fa	ICISAM File Attributes	
D	.gsy	ICIDE Global Symbols	
D	.icp	ICIDE Project	
always	.lg	ICOBOL Log File Open Print	notepad %1% notepad /p %1%
always	.lgb	ICOBOL Log File (backup) Open Print	notepad %1% notepad /p %1%
always	.lic	ICOBOL License File Open Print	notepad %1% notepad /p %1%
R,D	.lk	ICOBOL Filename Link File	
R,D	.ls	ICOBOL Program Listing File Open Print If installed, icide is used in place of notepad.	notepad %1% notepad /p %1%
R	.nx	ICISAM Index File Properties shows File, Record, Node, and Revision tabs	
S	.pan	ICOBOL sp2 Panel File Edit	icsp2 -a %1%
R	.pq	ICOBOL Printer Queue File	
R	.pti	ICOBOL Printer Translation File (ini) Configure	icedcfw -a %1%
D	.sr	ICIDE Free-format Source Open Print	icide %1% icide /p %1%
D	.sy	ICOBOL Symbol Table File	
R	.tdi	ICOBOL Terminal Description File (ini) Configure	icedcfw -a %1%
R	.xd	ICISAM Data File Properties shows File, Record, Node, and Revision tabs	
D	.xco	ICIDE Extended Card-format Source Open Print	icide %1% icide /p %1%
D	.xdb	ICODBC Database Definition File	

When	Ext	File Description
D	.xdt	Context Menu Options Command line ICODBC Table Definition File Edit notepad %1% Print notepad /p %1%

XV. ICSMVIEW

A. Introduction

The ICSMVIEW utility allows the shared area created by ICEXEC to be viewed. This utility is available on Linux and Windows and will only work when ICEXEC is running.

B. Syntax

The standard syntax is:

```
icsmview [-a[:aflag]|-A file|dir[:aflag]] [-b] [-B {b|h|l|p}...] [-F file]
          [-G {g|p|s|u}...] [-h|-?] [-I index] [-L {l|p}...]
          [-O {c|d|e|f|h|i|j|p|q|r|s|x|y}...] [-P pid] [-q] [-r] [-v|-V num]
```

Where

- a[:aflag]|A file|dir[:aflag] (Audit)
 - Enables auditing (default icsmview.lg). Where *aflag* is a|b|d|p|t|u|da|db|pa|pb|ta|tb|ua|ub, defined as a-append, b-backup, d-date, p-pid, t-time, and u-username.
- b (Bypass)
 - Bypass access conventions.
- B {b|h|l|p}... (Buffers)
 - Show Buffers: b-buffer descriptors, h-buffer hash descriptors, l-buffer LRU, p-buffers per file
- F file (File)
 - Show information about file.
- G {g|p|u|s}... (General)
 - Show the areas to dump. Options are::
 - g -global information
 - p -pid table
 - s -semaphores
 - u -UID table (Linux)
- h|-? (Help)
 - Displays help text.
- I index (Index)
 - Specify index number of item to process
- L {l|p}... (Locks)
 - Show Locks: l-record locks, p-record locks per file
- O {c|d|e|f|h|i|j|p|q|r|s|x}... (Objects)
 - Show the specified objects:
 - c-CON, d-device, e-SER, f-file, h-handle (obj ids), i-indexed, j-PCQ jobs, p-PRN, q-PCQ, r-relative, s-sequential, x-programs, y-pdf formats
- P pid (Pid)
 - Find the given *pid* in the shared area and display information about it.
- q (Quiet)
 - Enables quiet operation
- r (Reverse)
 - Reverse processing order
- v|-V num (Verbose)
 - Specify verbose mode. If -V num is specified, the greater the number the more verbosity will be generated. Num=0 is the same as -v.

Environment variables:

ICSMVIEW Command line options

If no actions are specified, the default is:

```
-B b -G gpu -L l -O cdefipqrsxy -bv
```

To get even more information use the above and add the `-V 2` to replace the `-v`.

C. Description

ICSMVIEW can be used as a debugging tool to check out information in the shared area maintained by ICEXEC. In particular the bypass option causes no semaphores to be used when accessing the shared area. In hang situations this is required. Versions prior to 5.40 would connect to the shared area and use an entry in the process table; however, that required the use of the LOGON semaphore and perturbed the shared area.

Some example output from `icsmview` is shown below along with the command that generates the output.

```
icsmview -P 234
```

```
Tracing PID (234)...
proc_num:      5   proc_pid:      234       icthins   sp2logon
```

```
icsmview -P 234 -v
```

```
Tracing PID (234)...
proc_num:      5   proc_pid:      234       icthins   sp2logon
      con_num    =      2040       username  = Ralph
```

```
Open Handles:
  han_obj_id [3].class = File
  han_obj_id [3].type  = File
  han_obj_id [3].index = 1
```

```
1 opened handles.
```

```
icsmview -G g
```

```
Global Information ...

Version number      = 1
Control pid        = 86
Shared area size   = 221620016 (bytes) 216425 (KB)   211 (MB)
  Buffer part       = 209715200 (bytes) 204800 (KB)   200 (MB)
Flags              = Ready, Active, Enabled
Handle/program information
  handle_count     = 128
```

```
icsmview -G p
```

```
Processing PID Table ...

Total processes      = 2048
Processed in use     = 8
Max processes used   = 8
```

icsmview -G p -v

Processing PID Table ...

Total processes = 2048
Processed in use = 8
Max processes used = 8

proc_num:	0	proc_pid:	86	(icexec)
proc_num:	1	proc_pid:	158	icrun logon
proc_num:	2	proc_pid:	214	icrunrs logon
proc_num:	3	proc_pid:	210	icrun logon
proc_num:	4	proc_pid:	230	icrunrs logon
proc_num:	5	proc_pid:	234	icrunrs sp2logon
proc_num:	6	proc_pid:	209	icrunrs sp2logon
proc_num:	7	proc_pid:	163	icrun mainmenu

Note: Versions of icsmview prior to 5.40 would appear in the process table.

XVI. ICSORT

A. Introduction

The ICSORT utility is a general purpose sort and merge utility with scripting capability. The sort operation takes up to ten(10) input files, sorts on from one(1) to twenty(20) keys, and produces a sequential output file. The merge operation takes up to ten(10) sorted sequential files of the same type and merges them into a single sequential output file.

ICSORT can produce a variety of different output files from a given input file. By selecting only certain portions of the input file, ICSORT can reformat the records for the output file. Thus, ICSORT can be used as a tool for generating tailored reports from a master file. Records can be sorted on any data type in ascending order, descending order, or according to a user-defined collating sequence. Translation between ASCII and EBCDIC and uppercase and lowercase are also supported. If sorting or translation is not part of the reporting process, ICREORG is more efficient in this process.

B. Syntax

The standard syntax is:

```
icsort [-a[:aflag]|-A file|dir[:aflag]] [-C file] [-d] [-D file] [-e]
      [-F pos:len|-F str:cnt]... [-K pos:len[:a|d[:dtype]]]... [-h|-?] [-m]
      [-M size] [-q] [-t] [-S sfile] {-I itype[:len] input-file}...
      {-O otype[:len] output-file}
```

Where

- a[:aflag]|-A file|dir[:aflag] (Audit)
Enables auditing (default icsort.lg). Where *aflag* is a|b|d|p|t|u|d|a|d|b|p|a|p|b|t|a|t|b|u|a|u|b, defined as a-append, b-backup, d-date, p-pid, t-time, and u-username.
- C file (Collating)
The collating sequence definition is in the specified file.
- d (Delete duplicates)
Delete duplicates from the output.
- D file (Write duplicate to file)
Writes duplicates to the indicated *file* (same format as output file)
- e (Exclusive)
Open input file(s) exclusively. This prevents the files from being changed while the sort is in progress and slightly increases performance.
- F pos:len|-F str:cnt (Field specifier)
Specifies the next field in the output record. The first format specifies that *len* characters starting at position *pos* in the input record are to be copied to the output record. The second format specifies that *cnt* instances of the character(s) *str* are to be copied to the output record. If the string starts with a quote it must be ended with the same quote, if not started with a quote it ends before the first ":". If the string starts with an integer, it must be enclosed in quotes. If the string includes a ":", it must be enclosed in quotes. The string may use the format *\nnn* to specify an arbitrary character in octal format. In order to include the quote character inside the string, the octal form must be used. If one Field specifier is used, the whole output record must be defined using one or more Field specifiers. Up to 33 field specifiers may be supplied.
- K pos:len[:a|d[:dtype]] (Key specification)
Specifies the key fields in the input records on which to sort. At least one key specifier must be listed unless the script option is used. Up to 20 key specifiers may be listed with no more than 1000 bytes total length. The keys are applied in the order they appear in the command-line, with the left-most being most significant in the sort. The first two fields, *pos* and *len*, are like *pos* and *len* in output field specifier. The next field is the sort order specifier, which is 'a' for ascending and 'd' for descending. If the sort order specifier is omitted, the default order is ascending. The final field is the data type (*dtype*) field from one of the following:

a	ASCII (8-bit) data (default)
b	binary/computational unsigned data
bs	binary/computational signed data
c5	unsigned COMP-5 data
c5s	signed COMP-5 data
n	numeric unsigned display data
nl	numeric signed display leading overpunch data
nls	numeric signed display leading separate data
nt	numeric signed display trailing overpunch data
nts	numeric signed display trailing separate data
p	packed-decimal unsigned data
ps	packed-decimal signed data

If no *dtype* argument is specified, the default is 'a' for ASCII data.

-h|-? (Help)

Displays help text.

-I *itype[:len]* *inputfile* (Input file)

Specifies the input file type, length (*len*), and name. The input file type (*itype*) is one of the following:

i	ICISAM Indexed file, length is not allowed
l	Line sequential file, length sets the maximum record size (delimited by <nl>, <cr>, <ff>, <nul>, or <cr><nl>), zero-length records are omitted. If not specified, 2047 is assumed.
r	ICISAM Relative file, length is not allowed
s	Fixed-length sequential file, length is required to set the record size
v, vb	Variable binary-length sequential file where the length is stored as a 2-byte binary value. (length is required to set the maximum record size)
va	Variable ASCII-length sequential file where the length is stored as a 4-byte ASCII value. (length is required to set the maximum record size)

-m (Merge)

Merge files instead of sorting. The input files are assumed to be sorted according to the keys specified.

-M *size* (Memory)

Specifies the amount of memory in MB to use for sorts. For memory rich systems, this option can be used to improve the performance for very large sorts. (1 - 1024). The default is 1MB. Care should be taken when using this option as it can dramatically slow performance when memory saturation is reached.

-O *otype[:len]* *outputfile* (Output file)

Specifies the output file type, length, and name of the output file. If field specifiers have been used to construct the output record, the record length must be at least that size; if larger, the record is padded with spaces. If length is not given, it defaults to the maximum input record size or to that specified by the Field specification. The output file type (*otype*) is one of the following letters:

l	Line sequential file (<cr><nl> delimiter on Windows, else <nl> delimiter)
s	Fixed-length sequential file
v, vb	Variable binary-length sequential file where the length is stored as a 2-byte binary value.
va	Variable ASCII-length sequential file where the length is stored as a 4-byte ASCII value.

-q (Quiet)

Enables quiet operation.

-S *sfile* (Script file)

Specifies a script file to control operations. If specified, none of the -C, -d, -D, -F, -I, -K, -m, -O, or -t options may be specified on the command line.

-t (Tag sort)

Perform a tag sort instead of a record sort. When disk space is tight (such that allowing ICSORT to use a record sort would result in an out-of-disk-space error) then a tag sort should be done. Only the key itself along with a pointer are stored in the temporary file(s) thus greatly decreasing the amount of temporary disk space required. Generally this tradeoff is with performance causing the sort to run slower. When using a tag sort, the input file(s) must be locked if the -e option was not specified to prevent changes to the file while the sort is in progress. This could cause other users to pend on updates to these file(s) until ICSORT is finished.

Environment variables:

ICSORT	Command line options
ICTMPDIR	Temporary files

On Windows, if running on a network drive, ICTMPDIR should be set to a local directory.

C. Description

A specific collating sequence can be defined by the user by creating a file that contains an alternate sequence and specifying this sequence's filename on the command line.

The input and output record counts are displayed at termination. Warnings are generated if records are truncated to fit in the specified output length of if input records contain no data.

ICSORT uses program-generated temporary work files of the form `icd<pid>.tmp` (data), `ick<pid>.tmp` (key), and `ict<pid>.tmp` (tag) for the sort operation.

The order in a sort is usually determined by straight ASCII (8-bit) sequence. The ASCII characters are represented by internal codes consisting of decimal integers from 0 through 255. When specified, the alternate collating sequence applies only to keys having the ASCII data type. The alternate collating sequence has no effect on keys having numeric or computational data types.

The alternate collating sequence file can be built by specifying up to 256 lines with the characters to be sorted. The default file is basically a file with 256 lines starting with `\000` on line 1, `\001` on line 2, ..., through `\377` on line 256. Each line is of the form `{chr}...` where *chr* can either be the ASCII character or the character as specified by the octal format `\nnn`. Any unspecified characters are assigned remaining collating positions in order.

On Linux, when using the Field specifier (-F) switch you must be careful about entering characters with the `\nnn` octal specification as the shell interprets a single `"\"` to mean take the next character literally when not within quotes and as an octal representation when within quotes. Thus, to use the `\nnn` specification you should enclose the string within quotes. When using quotes you must also understand that the shell strips the quotes after using them to delimit a single argument. I.E., a `"12HH"` will be passed to ICSORT as `12HH` which ICSORT will attempt to treat as a *pos* argument since it begins with a digit. (`12HH` is not legal as a *pos* argument and an error will be generated.) You must enter it as `"\12HH"` to have the shell pass a `"12HH"` to ICSORT.

D. Script Files

Script files are text files containing a series of commands that tell ICSORT how to process the data. These files may be created with any text editor. When using script files, no other ICSORT command-options that effect data may be entered on the command line. Scripting provides for all aspects of the sort/merge process from input and output descriptions, key descriptions, how to sort/merge/copy, and how to massage the file output including data translation.

The script file is composed of three different types of statements: Definition, When, and Imperative. The Definition and Imperative are required while the When statement(s) are optional and may be repeated. Comments are denoted by the standard COBOL comment character of `"*"` in the first position or `"*>"` for end-of-line comments.

A sort-merge script is structured as a definition section that is bracketed by `DEFINE` and `END-DEFINE`, followed by zero or more massage sections that are bracketed by `WHEN` and `END-WHEN`, and concluded with an imperative statement that gives the primary operation of the script.

Syntax of a script:

DEFINE

define-statement...

END-DEFINE

$$\left[\begin{array}{l} \text{WHEN } \left\{ \begin{array}{l} \text{READ [OF } \textit{file-identifier} \text{]} \\ \text{WRITE} \end{array} \right\} \\ \textit{message-statement...} \\ \text{END-WHEN} \end{array} \right] \dots$$

imperative-statement

A *define-statement* is one of the following:

INPUT FILE [*file-identifier*] IS *filename-string* [*records-clause*] [.]

OUTPUT FILE IS *filename-string* [*records-clause*] [.]

COLLATING SEQUENCE *collate-identifier* FROM *filename-string* [.]

TABLE *table-identifier* FROM *filename-string* [.]

The *records-clause* is defined as follows:

$$\text{RECORDS ARE } \left\{ \begin{array}{l} \text{DATA-SENSITIVE UP TO } \textit{integer} \text{ CHARACTERS} \\ \text{VARIABLE } \left[\begin{array}{l} \text{ASCII} \\ \text{BINARY} \end{array} \right] \text{ UP TO } \textit{integer} \text{ CHARACTERS} \\ \text{INDEXED} \\ \text{RELATIVE} \end{array} \right\} \left[\begin{array}{l} \text{DELIMITED BY } \textit{string...} \end{array} \right]$$

A *message-statement* is one of the following:

APPEND $\left\{ \begin{array}{l} \text{RECORD COUNT} \\ \textit{string} \end{array} \right\}$ [.]

CONVERT *location* [, *location*]... USING $\left\{ \begin{array}{l} \textit{table-identifier} \\ \text{ASCII} \\ \text{EBCDIC} \\ \text{LOWER} \\ \text{UPPER} \end{array} \right\}$ [.]

DELETE AREA *location* [.]

DELETE CHARACTERS [IN *location*] [MOVE REMAINDER $\left\{ \begin{array}{l} \text{LEFT} \\ \text{RIGHT} \end{array} \right\}$] [PAD WITH *string*] [.]

IF *condition* THEN
message-statement...

$\left[\begin{array}{l} \text{ELSE} \\ \textit{message-statement...} \end{array} \right]$

END-IF

$$\text{INSERT } \left\{ \begin{array}{l} \text{RECORD COUNT} \\ \text{string} \end{array} \right\} \text{ BEFORE integer [.]}$$

NEXT RECORD [.]

PAD TO integer CHARACTERS [WITH string] [.]

$$\text{REFORMAT } \left\{ \begin{array}{l} \text{location} \\ \text{string} \end{array} \right\} [, \left\{ \begin{array}{l} \text{location} \\ \text{string} \end{array} \right\}] \dots [.]$$

$$\text{REPLACE TAB CHARACTERS [IN location] [WITH string] \left[\begin{array}{l} \text{AT integer [, integer]...} \\ \text{EVERY integer} \end{array} \right] [.]$$

$$\text{REPLACE } \left[\begin{array}{l} \text{FIRST} \\ \text{ANY} \\ \text{ALL} \end{array} \right] \text{ string1 [IN location] WITH string2 [.]}$$

SEND RECORD TO filename-string [.]

STOP [.]

The *condition* in the IF statement has the following syntax:

$$[\text{NOT}] \left\{ \begin{array}{l} \text{BLANK} \\ \text{relation} \\ \text{(condition)} \end{array} \right\} \left[\left\{ \begin{array}{l} \text{AND} \\ \text{OR} \end{array} \right\} [\text{NOT}] \left\{ \begin{array}{l} \text{BLANK} \\ \text{relation} \\ \text{(condition)} \end{array} \right\} \right] \dots$$

where *relation* is:

$$\left\{ \begin{array}{l} \text{string} \\ \text{location} \\ \text{RECORD COUNT} \\ \text{RECORD LENGTH} \end{array} \right\} \left\{ \begin{array}{l} = \\ < > \\ < \\ < = \\ > \\ > = \\ :: \\ : < > : \end{array} \right\} \left\{ \begin{array}{l} \text{string} \\ \text{location} \\ \text{integer} \end{array} \right\}$$

The *imperative-statement* is one of the following:

COPY [.]

MERGE

$$\left[\left\{ \begin{array}{l} \text{DELETE DUPLICATES} \\ \text{WRITE DUPLICATES TO filename-string} \end{array} \right\} [.] \right]$$

$$\{ \text{KEY location [IS type-clause] } \left[\begin{array}{l} \text{ASCENDING} \\ \text{DESCENDING} \end{array} \right] [.] \dots$$

END-MERGE

```

SORT
  [ USE { KEYS ONLY } [.] ]
      { RECORDS } [.] ]
  [ { DELETE DUPLICATES
      WRITE DUPLICATES TO filename-string } [.] ]
  { KEY location [ IS type-clause ] [ ASCENDING
      DESCENDING ] [.] }...
END-SORT
    
```

In the MERGE and SORT statements, the *type-clause* is defined as follows:

$$\left\{ \begin{array}{l}
 \text{ALPHANUMERIC [COLLATING SEQUENCE IS } \left\{ \begin{array}{l} \text{identifier} \\ \text{ASCII} \\ \text{EBCDIC} \\ \text{LOWER} \\ \text{UPPER} \end{array} \right\}] \\
 \\
 \text{NUMERIC} \left[\begin{array}{l}
 \text{USAGE IS } \left\{ \begin{array}{l} \text{BINARY [WITH SIGN]} \\ \text{COMPUTATIONAL-5 [WITH SIGN]} \\ \text{PACKED-DECIMAL [WITH SIGN]} \\ \text{DISPLAY [SIGN IS } \left\{ \begin{array}{l} \text{LEADING} \\ \text{TRAILING} \end{array} \right\} [SEPARATE]]} \right. \\
 \\
 \left. \text{SIGN IS } \left\{ \begin{array}{l} \text{LEADING} \\ \text{TRAILING} \end{array} \right\} [SEPARATE] \right.
 \end{array} \right]
 \end{array} \right\}$$

As used in the formats above, a *string* is defined as:

$$\left\{ \begin{array}{l}
 \text{quoted-string} \\
 \text{CR} \\
 \text{ESC} \\
 \text{FF} \\
 \text{LF} \\
 \text{NUL} \\
 \text{SPACE}
 \end{array} \right\}$$

As used in the formats above, a *location* is defined as:

$$\left\{ \begin{array}{l}
 \text{start-integer} / \left\{ \begin{array}{l} \text{end-integer} \\ \text{LAST} \end{array} \right\} \\
 \text{start-integer} : \text{length-integer}
 \end{array} \right\}$$

A *filename-string* is a quoted string containing a valid operating-system pathname of the file.

Abbreviations:

<u>ASC</u>	- <u>ASCENDING</u>
<u>CHAR</u>	- <u>CHARACTER</u>
<u>CHARS</u>	- <u>CHARACTERS</u>
<u>COMP-5</u>	- <u>COMPUTATIONAL-5</u>
<u>DESC</u>	- <u>DESCENDING</u>
<u>PACKED</u>	- <u>PACKED-DECIMAL</u>

The punctuation characters are period and comma. In general, they are optional.

The ASCII, EBCDIC, ASCII to EBCDIC, and EBCDIC to ASCII tables are provided in Appendices A thru D on pages [129](#), [131](#), [132](#), and [133](#) respectively. The lowercase to uppercase table has the characters “a” - “z” mapped to “A” - “Z” respectively, while the uppercase table has the characters “A” - “Z” mapped to “a” - “z” respectively. The lowercase sort table has the uppercase letters “A” - “Z” equivalent to the respective lowercase letters “a” - “z”. While the uppercase sort table is just the reverse.

E. Examples

Command-Line Usage

To specify an alternate collating sequence where the lower-case letters are equivalent to their upper-case counterparts, the file would be as follows. Lines 1 through 65 would contain the values \000 through \100. Line 66 would contain an "Aa", line 67 an "Bb", etc. through line 91 which would contain "Zz". Lines 92-97 would remain \133 through \140. Lines 98 through 122 would be deleted. The next line would start with \173 and continue line by line through \377.

To specify an alternate collating sequence where the upper-case letters are before the numeric digits, the file would be as follows. Lines 1 through 48 would contain the values \000 through \057. The next 26 lines (lines 49 through 75) would contain an "A" through "Z". Lines 76 and on would be the remaining values through \377.

Scripting Usage

Below is a sample script

```
* This is a test sort script

DEFINE
  INPUT FILE seq1 IS "seq1"
    RECORDS ARE 100 CHARACTERS.
  INPUT FILE seq2 IS "seq2"
    RECORDS ARE 100 CHARACTERS.

  OUTPUT FILE IS "joeout"
    RECORDS ARE VARIABLE ASCII UP TO 200 CHARACTERS.
    WORK RECORD UP TO 200 CHARACTERS.
END-DEFINE

WHEN READ OF seq1
  delete area 30/49.
  insert "seq1" Before 30.
END-WHEN

WHEN READ
  delete area 30/49.
  insert "seq2" before 30.
  append "*****"
*   replace all "bf" in 30/50 with "cdefb".
*   replace all "bffff" in 30/50 with "fb".
END-WHEN

SORT
  KEY      3/10 NUMERIC USAGE binary SIGN.
  KEY      30:4 IS ALPHANUMERIC DESC
END-SORT
```

end of sample script.

XVII. ICSTAT

A. Introduction

The ICSTAT utility analyzes ICISAM indexed and relative files, and reports useful information and statistics.

B. Syntax

The standard syntax is:

```
icstat [-a[:aflag]|-A file|dir[:aflag]] [-h|-?] [-N s] [-p] [-q]
      [argument]...
```

Where

-a[:aflag]|-A file|dir[:aflag] (Audit)

Enables auditing (default icstat.lg). Where *aflag* is a|b|d|p|t|u|da|db|pa|pb|ta|tb|ua|ub, defined as a-append, b-backup, d-date, p-pid, t-time, and u-username.

-h|-? (Help)

Displays help text.

-N s (No options)

Specifies NO options. Valid NO options are:

s (No-scan) Causes the file to NOT be scanned, only read the headers.

-p (Progress)

Displays an ongoing display of the processing, which typically runs much slower for smaller files. The reporting interval is 1% of the file processed.

-q (Quiet)

Enables quiet operation.

argument

Specifies any filename or template to be checked. If not given it defaults to all ICISAM files in the current directory.

Environment variables:

ICSTAT Command line options

C. Description

The following information about an ICISAM file is given:

- The ICISAM version of the file
- The default deletion type (logical or physical) is given along with the maximum file size
- The number of alternate keys for indexed files, record size, and number of records allocated
- The total number of record slots available for records before the .XD end-of-file
- For each key it reports:
 - Whether the key is the Primary or an Alternate along with seven possible attributes shown by the possible letters "dursaop" or "-----" if no attributes were given for the file. The possible attributes are shown below:
 - d duplicates are allowed,
 - u upper-case only,
 - r reverse (or DESCENDING) storage,
 - s suppress certain key values (the suppressed value is shown later),
 - a multiple scattered keys using ALSO clause,
 - o multiple tabular keys using OCCURS clause, and
 - p this key has suffixes using PLUS clause.
 - Finally the number of keys, records, and purged keys are shown. If the No-scan switch was given, these numbers will be zero.
 - For each level in the index for that key the number of nodes, the number of keys in that node, and the

- average density of the nodes if the No-scan switch was NOT given.
- The key length and offset in the record including suffixes (PLUS), OCCURS, scattered keys (ALSO), and any suppression value (SUPPRESS WHEN) shown as LOW-VALUE, HIGH-VALUE, SPACE, ZERO, or its octal value. Finally the maximum key entries per index node is given.
- The total number of indexed nodes if the No-scan switch was NOT given.
- The number of logically deleted records in the file if the No-scan switch was NOT given.

The total number of records allocated (written) and the total number of record slots available will be different in most cases due to the rounding of the data file to a 2048 byte boundary.

In the key description information, purged keys are keys that are no longer being used because a REWRITE changed a key value or for some reason a WRITE failed after the particular key was inserted and it was backed out. ICPACK will remove purged keys.

In the key attributes, no `d' means duplicates are not allowed, no `u' means that the key entry is used as given, no `r' means that the key is stored in ascending order, no `s' means there are no suppressed key values, no `a' or `o' means there are not multiple keys, and no `p' means there are no suffixes on the key.

An example of an ICSTAT output is shown in SCREEN 3 for a revision 7 and a revision 8 file.

```
Audit log opened Mar-05-2020 12:07:07.00
Auditing icstat 5.40 (Linux for x86 (ln7 64-bit)) with pid 17555 on ln7x64vm
icstat Revision 5.40 (Linux for x86 (ln7 64-bit))
Copyright (C) 1987-2020, Envyr Corporation. All rights reserved.
/ictests/artest/armaster7 processed on Mar-05-2020 12:07:07.30
  ICISAM Revision 7.10
  Default Delete is logical, Maximum file size is 4GB
  One Alternate Key          85 byte Records
  Primary ----- Key: 100001 Record: 100001
    Level: 1 Nodes:      794 Entries: 100002 Average Density: 99%
    Level: 2 Nodes:       7 Entries: 794 Average Density: 89%
    Level: 3 Nodes:       1 Entries: 7 Average Density: 6%
    11 byte key at offset 1.
    127 node entries maximum.
  Alternate 1d----- Key: 100001 Record: 100001
    Level: 1 Nodes:     1105 Entries: 100002 Average Density: 98%
    Level: 2 Nodes:     14 Entries: 1105 Average Density: 86%
    Level: 3 Nodes:     1 Entries: 14 Average Density: 15%
    14 byte key at offset 12.
    92 node entries maximum.
  Total number of index nodes: 1922
  Logically Deleted Records: 10000
  No Physically Deleted Records (purged)
  Deleted (logical and physical) record count: 10000
  1 files/arguments were processed, all are reliable.
  icstat is finished
  Audit log closed Mar-05-2020 12:07:07.00
```

```
Audit log opened Mar-05-2020 12:06:47.00
Auditing icstat 5.40 (Linux for x86 (ln7 64-bit)) with pid 17546 on ln7x64vm
icstat Revision 5.40 (Linux for x86 (ln7 64-bit))
Copyright (C) 1987-2020, Envyr Corporation. All rights reserved.
/ictests/artest/armaster processed on Mar-05-2020 12:06:47.68
  ICISAM Revision 8.00
  Default Delete is logical, Maximum file size is 64TB (xd) and 16TB (nx)
  One Alternate Key          85 byte Records
  100001 Records allocated (100,001)
  Primary ----- Key: 100001 Record: 100001
    Level: 1 Nodes:     458 Entries: 100002 Average Density: 86%
    Level: 2 Nodes:      2 Entries: 458 Average Density: 90%
    Level: 3 Nodes:      1 Entries: 2 Average Density: 1%
    11 byte key at offset 1.
    255 node entries maximum.
  Alternate 1d----- Key: 100001 Record: 100001
    Level: 1 Nodes:     636 Entries: 100002 Average Density: 85%
    Level: 2 Nodes:      4 Entries: 636 Average Density: 86%
    Level: 3 Nodes:      1 Entries: 4 Average Density: 2%
    14 byte key at offset 12.
    185 node entries maximum.
  Total number of index nodes: 1102
  Logically Deleted Records: 10000
  No Physically Deleted Records (purged)
  Deleted (logical and physical) record count: 10000
  1 files/arguments were processed, all are reliable.
  icstat is finished
  Audit log closed Mar-05-2020 12:06:48.00
```

SCREEN 3. ICSTAT

An example of an ICSTAT output using the No-scan switch is shown in SCREEN 4.

```
Audit log opened Mar-05-2020 12:21:37.00
Auditing icstat 5.40 (Linux for x86 (ln7 64-bit)) with pid 17709 on ln7x64vm
icstat Revision 5.40 (Linux for x86 (ln7 64-bit))
Copyright (C) 1987-2020, Envyr Corporation. All rights reserved.
/ictests/artest/armaster7 processed on Mar-05-2020 12:21:37.95
  ICISAM Revision 7.10
  Default Delete is logical, Maximum file size is 4GB
  One Alternate Key      85 byte Records
  Primary      ----- Key:      0 Record:      0
    11 byte key at offset 1.
    127 node entries maximum.
  Alternate 1d----- Key:      0 Record:      0
    14 byte key at offset 12.
    92 node entries maximum.
  Deleted (logical and physical) record count:      10000
  1 files/arguments were processed, all are reliable.
  icstat is finished
  Audit log closed Mar-05-2020 12:21:37.00
```

SCREEN 4. ICSTAT with No-Scan

XVIII. ICWEBMSG

A. Introduction

The ICWEBMSG utility facilitates the sending of an HTTP or HTTPS request and receiving the response via a command-line utility. The intention is that COBOL programs can use the CALL facility to execute this utility to implement various forms of web communication. The default is to send an XML request file and receive a response. ICWEBMSG acts as a very simple web client.

ICWEBMSG is a stand-alone utility. It does not require the shared area allocated by ICEXEC. Under Linux, it does not use any COBOL shared libraries. Under Windows, it uses the icsysxx.dll, icssleayxx.dll and iclibeyxx.dll, where xx is 32 or 64.

B. Syntax

The standard syntax is:

```
icwebmsg [-a[:aflag]|-A file|dir[:aflag]] [-C sec] [-F value] [-h|-?]
  [-I path] [-L value] [-M GET|POST|HEAD] [-P data] [-q] [-R sec]
  [-s|-S value] [-t | -T value] [-U value] [-v] [-V 1.0|1.1] target-url
  [output-file]
```

Where

- a[:aflag]|A file|dir[:aflag] (Audit)
Enables auditing (default icwebmsg.lg). Where *aflag* is a|b|d|p|t|u|d|a|db|pa|pb|ta|tb|ua|ub, defined as a-append, b-backup, d-date, p-pid, t-time, and u-username.
- B *username:password* provide Basic authorization
passes username and password as the basic authorization string.
- C *sec* (Connection timeout)
Connection wait timeout in seconds (default is to wait forever)
- E *filename* (External certificate)
Use the external client certificate specified by *filename*.
- F *value* (From value)
emit From: header with "value" (default: no From: header)
- h | -?
display Help text
- I *path* (Include)
Include content of "*path*", read and send it
- L *value* (Language header) (POST only)
emit content-Language: header with "value" (default: en-US)
- M GET|POST|HEAD (Mode)
request Mode for HTTP (default is POST)
- P *data*
Emit data as POST or GET data
- q (Quiet)
Quiet operation
- R *sec* (Response timeout)
Response wait timeout in seconds (default is to wait forever)
- s | -S *value* (POST only)
emit SOAPAction: header with no value or emit SOAPAction: header with "value"
- t | -T *value* (Type header) (POST only)
emit content-Type: header with emit "application/x-www-form-urlencoded", emit header with "value" or if not specified at all it defaults to "text/xml"
- U *value* (UserAgent header)
emit User-Agent: header value appended after %P/%r
- v (Verbose)

Verbose logging to the audit file
-V 1.0|1.1 (Version)
Version of HTTP to use (default is 1.0)
target-url (required)
specifies either a http or https web address.
output-file (optional)
specifies a file for any output, if not specified STDOUT is used

Notes:

-L, -s, -S, -t, -T only apply to the POST method
-t and -T are mutually exclusive
-P and -I are mutually exclusive, and at least one is required for a POST

Environment variables:

ICWEBMSG Command line options

C. Description

The first argument is required and is the target URL. The second argument is the path to the file that will receive the result, if not specified, it defaults to STDOUT. The URL must start with either HTTP or HTTPS. The Secure Sockets Layer (SSL) services are provided by the openssl project. The copyrights are included in the readme, and a snapshot of the sources used to build with are available upon request.

Several of the parameters control the various HTTP headers that are sent with the request. If the structure of an HTTP request is not familiar, there is a simple and helpful HTTP tutorial at:

<http://www.jmarshall.com/easy/http/>

-B *username:password* (Basic authorization)

Sends the username password as the Basic authorization for the SSL connection.

-C *seconds* (CONNECT WAIT TIMEOUT)

This parameter specifies the time in seconds that the utility will wait for a connection to the target-url. If no response is received within this timeframe a "Device Timeout" error will be given and the utility will terminate with an exit code of 1. Valid values are 0 to 6300. (I.E., 1 hr and 45 minutes). If not specified, ICWEBMSG will wait forever.

-E *filename* (External certificate)

Uses the external client certificate as part of the SSL connection. Specifies a .pem file.

-F *value* (FROM)

The From: header usually specifies the email address of the person or company responsible for sending the request. It is optional. This field is often transcribed into the web server logs. It may be helpful for debugging if the username or console number of the person making the request is supplied. This header is omitted by default.

-I *path* (INCLUDE)

When a POST request is sent, the data that the web server is to process must be supplied. This parameter specifies

the path to a file that will be sent. The file is sent, byte by byte to the web server as the "content". There is no translation of any sort. POST is the method used by XML servers, and the content is the xml file with the `<?xml version="1.0"?>` line as the first line.

For a GET request, this data is sent as part of the query. The file is sent, byte by byte to the web server as part of the query. There is no translation of any sort.

`-L value` (LANGUAGE)

The Language-Encoding header is supplied when POST is used and indicates to the web server the language being used by the content being sent. The value supplied here is simply passed on in the header line. en-US is supplied as the default.

`-M GET|POST|HEAD` (METHOD)

This parameter selects the basic request method being used. The default value is POST.

GET is the method used by a web browser when a URL is entered to get a page. The content that is returned is copied byte-by-byte into the output file. The returned headers are not copied.

HEAD only returns status headers and no content. Those headers are copied to the output file instead of content.

POST is the method that is often used by a browser to send the data that was filled out in a form. As previously mentioned, it is also often used by XML servers that communicate via HTTP.

`-P data` (PUT data)

Just like an include except that the data is specified on the command line.

`-R seconds` (RESPONSE WAIT TIMEOUT)

This parameter specifies the time in seconds that the utility will wait for an initial response to its request to the target-url. If no response is received within this timeframe a "Device Timeout" error will be given and the utility will terminate with an exit code of 1. Valid values are 0 to 6300. (I.E., 1 hr and 45 minutes). If not specified, ICWEBMSG will wait forever.

`-s | -S value` (SOAPACTION)

This parameter specifies that the SOAPAction header should be sent and the value to supply with that header. The `-s` option says to send the header, but the value is empty. The `-S` option passes whatever value specified. This header is required by some web/SOAP servers, but it is one that has been replaced by other fields in the SOAP content. If your system doesn't need it, don't set it.

`-t | -T value` (TYPE)

This parameter specifies the Content-Type header that is supplied when POST is used. If neither `-t` or `-T` is specified the default value is text/xml. For `-t` the value emitted is application/x-www-form-urlencoded. Supply whatever value is appropriate for the server and the type of request you are sending. It should be a valid MIME type or the web server may return an error.

`-U value` (USERAGENT)

One of the headers that is always sent is the User-Agent header. This header usually specifies the name and revision of the program that is sending the request, and it is usually logged in the web server logs. We always set it to `icwebmsg/3.xx`. If this parameter is specified, a space will be appended followed by the value specified. For example, if `-V CreditCheck/2.0` was specified, the header will look like:

```
User-Agent: icwebmsg/4.07 CreditCheck/2.0
```

If this is set to the name and revision of the COBOL program that calls ICWEBMSG, it will help as you debug your system.

`-v` (verbose)

This parameter indicates that ICWEBMSG is to perform verbose logging to the audit log. When this parameter is NOT set, only the data that would come out on the screen is sent to the audit log. When specified, the following additional information is logged:

- A copy of the headers that are sent
- Progress and size of any content that is sent
- Headers that are received as part of the response
- Progress and size of any content that is received
- Any trailers (possible with chunked data in HTTP/1.1) received

An item to note is the "Finished ... lines" provided by `icwebmsg` have a timestamp (HH:mm:ss.hh) at the end of each line. This timestamp can provide timing information in case the `Connect-wait` and/or `Response-wait` switches need to be given, or just to see the portions of time in the round-trip for each section.

General Format for verbose switch logging:

```
Secure:      No/Yes
Host:       xx
Port:       n
URL:        xx
Input:      xx                (for POST)
Output:     xx
SSL Connection information... (for Secure Sockets)
Finished connecting:          HH:mm:ss.hh
Writing Headers...
  method url HTTP/version
  Host: xx
  Connection: xx
  From: xx                    (optional)
  User-Agent: xx
  SOAPAction: xx              (optional)
  Content-Language: xx        (for POST)
  Content-Type: xx            (for POST)
  Content-Length: n           (for POST)
Finished writing headers:      HH:mm:ss.hh
Writing <n> bytes of content... (for POST)
Finished writing content:      HH:mm:ss.hh (for POST)
Reading Response...
  ...(actual response)
Finished reading response:     HH:mm:ss.hh
Reading headers...
  ...(actual header)
Finished reading headers:      HH:mm:ss.hh
Reading <n> bytes of content    (for GET and POST)
```

```

    or
    Reading content in chunks                (this section for chunk response)
    Reading chunk of <n> bytes                .
    End of chunks                            .
    Content size was <n> bytes                .
    Reading trailer...                        (optional)
    ... (actual trailer line(s))             (optional)
    or
    Reading content of unknown length
    Content size was <n> bytes
    Finished reading content:  HH:mm:ss.hh

```

`-V 1.0|1.1` (VERSION)

This parameter specifies the HTTP version that is set in the headers that are sent with the request be set. The default is 1.0, which should be recognized by virtually any web server. If version 1.1 is set, icwebmsg sends some additional headers needed (or desired) by the 1.1 protocol. The simple tutorial referenced above explains some of these.

Error Handling

Errors will be reported in the usual way - via stderr and into the audit file if one is specified - and they will result in a nonzero exit code. The exit code values follow the same conventions as other **ICOBOL** utilities.

We strongly suggest using an audit log - perhaps with a filename based on console number, and using the append option. That way you can see the entire set of transactions for a particular console. While you're getting the application up and running, use the `-v` switch to see everything going back and forth. It will let you track down most problems very quickly.

Besides errors from processing the command line, there can be errors for a failure to make a connection, i/o errors on the connection once it is made, filename processing errors, file open/create and i/o errors writing the data coming back, malformed responses or response headers, etc.

The other errors that can come back are HTTP errors, like 404 NOT Found. The utility inspects this value. Any value 300 or greater will be treated as an error. It will be reported and processing will stop after the header is read.

If there is an error and if nothing has been written yet to the output file, the output file will be deleted. If, however, some data was written, it is not deleted. Sometimes inspecting the partial result will help track down failures on the web-server side.

Some Web sites that may be helpful while debugging are:

```

    http://web-sniffer.net                    (provides an http viewer)
    http://www.rexswain.com/httpview.html    (another http viewer)

```

You can also manually experiment with HTTP by using telnet.

Using telnet, open an interactive socket to an HTTP server. Then manually enter a request, and see the response written to the screen. It's a great help when learning HTTP, to see exactly how a server responds to a particular request. It also helps when troubleshooting.

For example, to open a connection to an HTTP server would be something like:

```
telnet www.somehost.com 80
```

Then enter your request line by line, like:

```
GET / HTTP/1.0
[headers here, if any]
blank line here
```

You may have to send <cr><nl> to end each line (Ctrl-M, Ctrl-J) and you may also want to enable echoing in the telnet to see what you are typing. Also the blank line is REQUIRED to end the request.

After finishing your request with the blank line, you'll see the raw response from the server, including the status line, headers, and message body.

D. Examples

Note that all the samples use the -a and -v switches to specify auditing and verbosity.

Example 1 - GET

One very simple example is using the GET method to read a standard web page. To get the default icobol web page you could use:

```
icwebmsg -av -M GET http://www.icobol.com icobol.in.htm
```

This will get the default web page from the icobol.com site and store it in the file icobol.in.htm

Example 2 - POST

Another example using the POST method would be:

```
icwebmsg -av -I request.xml http://<server>/cgi-bin/HelloService.cgi
response.htm
```

Where the input file (request.xml) might be from the OpenSOAP project):

```
<?xml version="1.0"?>
<SOAP-ENV:Envelope
  xmlns:SOAP-ENV="http://schemas.xmlsoap.org/soap/envelope/">
  <SOAP-ENV:Body>
    <m:Hello xmlns:m="http://services.opensoap.jp/samples/Hello/">
      <MyName>foo</MyName>
    </m:Hello>
  </SOAP-ENV:Body>
</SOAP-ENV:Envelope>
```

The response (response.htm) received back looks like:

```
<?xml version="1.0" encoding="US-ASCII"?>
<SOAP-ENV:Envelope xmlns:SOAP-ENV="http://schemas.xmlsoap.org/soap/envelope/">
  <SOAP-ENV:Body>
    <m:HelloResponse xmlns:m="http://services.opensoap.jp/samples/Hello/">
      <Reply>Hello, foo!</Reply>
    </m:HelloResponse>
  </SOAP-ENV:Body>
</SOAP-ENV:Envelope>
```

From the OpenSoap project.

www.opensoap.jp

Example 3 - POST

Another example using the POST method that gets the current time from www.soapware.org

An example input file (called `gettime.xml`) would be (from www.soapware.org):

```
<?xml version="1.0"?>
<SOAP-ENV:Envelope
SOAP-ENV:encodingStyle="http://schemas.xmlsoap.org/soap/encoding/"
  xmlns:SOAP-ENC="http://schemas.xmlsoap.org/soap/encoding/"
  xmlns:SOAP-ENV="http://schemas.xmlsoap.org/soap/envelope/"
  xmlns:xsd="http://www.w3.org/1999/XMLSchema"
  xmlns:xsi="http://www.w3.org/1999/XMLSchema-instance">
<SOAP-ENV:Body>
<getCurrentTime></getCurrentTime>
</SOAP-ENV:Body>
</SOAP-ENV:Envelope>
```

The response (`gettime_res.htm`) received back looks like:

```
<?xml version="1.0"?>
<SOAP-ENV:Envelope
SOAP-ENV:encodingStyle="http://schemas.xmlsoap.org/soap/encoding/"
xmlns:SOAP-ENC="http://schemas.xmlsoap.org/soap/encoding/"
xmlns:SOAP-ENV="http://schemas.xmlsoap.org/soap/envelope/"
xmlns:xsd="http://www.w3.org/1999/XMLSchema"
xmlns:xsi="http://www.w3.org/1999/XMLSchema-instance">
  <SOAP-ENV:Body>
    <getCurrentTimeResponse>
      <Result xsi:type="xsd:dateTime">2004-07-15T07:01:38-04:00</Result>
    </getCurrentTimeResponse>
  </SOAP-ENV:Body>
</SOAP-ENV:Envelope>
```

The command line to implement this used the defaults and would be something like this:

```
icwebmsg -av -I gettime.xml -S \"/currentTime\" http://time.soapware.org
gettime_res.htm
```

NOTE:

The quote characters in the `-S` argument must be escaped such that the shell or command processor does not remove them as the entire string `"/currentTime"` (including the quotes) is required for the SOAPAction.

Another example is to perform a pipe-open in **ICOBOL** and read the input. For example using the sample logon program, select U for utilities, and then L for list. Enter `|<icwebmsg -q -M GET http://www.icobol.com`. This will list the html code returned from [icobol.com](http://www.icobol.com). The `-a` switch could have also been given to build an audit log.

More samples and SOAP information can be found at:

```
www.soapware.org
www.xmlrpc.com
```


XIX. ICWHOHAS

A. Introduction

The ICWHOHAS utility uses the shared area created by ICEXEC to show open file and/or lock information along with what process has the file opened or locked. This utility requires that ICEXEC be running.

B. Syntax

The standard syntax is:

```
icwhohas [-a[:aflag]|-A file|dir[:aflag]] [-C cols] [-F file] [-h|-?]
         [-L pos[:ext]] [-O {g|i|r|s}...] [-P pid] [-q] [-T term] [-W o|l]
```

Where

- a[:aflag]|A file|dir[:aflag] (Audit)
Enables auditing (default icwhoas.lg). Where *aflag* is a|b|d|p|t|u|da|db|pa|pb|ta|tb|ua|ub, defined as a-append, b-backup, d-date, p-pid, t-time, and u-username.
- C cols (Columns to show)
Valid columns selections (*cols*) are: c-COBOL program, e-extent of lock, f-file name, i-identifier of process, n-number of opens, o-open status, p-position of lock, r-run state of program, s-size of the file, t-terminals (@CON), u-username. No column selector can be picked more than once.
- F file (File)
Show information about the indicated *file*.
- h|-? (Help)
Displays help text.
- L pos[:ext] (Lock)
Show only a lock at the given byte position (*pos*) and optional extent (*ext*).
- O {g|i|r|s}... (file Organization)
Show only files of the selected file organization: g-generic, i-indexed, r-relative, and s-sequential.
- P pid (Pid)
Show only file/locks in use by process *pid*.
- q (Quiet)
Enables quiet operation
- T number (Terminal)
Show only files/locks in use by terminal (@CON) *number*.
- W o|l (What kind)
Show only o-open files or l-locks.

Environment variables:

ICWHOHAS Command line options

C. Description

ICWHOHAS can be used as a debugging tool to check out information in the shared area maintained by ICEXEC.

If no Column switch (-C) is given, the default is "tiupof" with no What switch (-W), the default is "tiuof" if -W o and the default is "tiupf" with -W l.

If no File switch (-F *file*) is given, all selected files are shown.

If no file Organization switch (-O) is given, all files are shown.

If no Process switch (-P *pid*) is given, all pids on the selected files are shown,

If no Terminal switch (-T *term*) is given, then all terminals using the selected files are shown.

If no What switch (-W o|l) is given, then all open files and all locked records are shown.

When using the Column switch (-C) with the filename column option, the file name should be the last column since file names can be a variable length..

If nothing is displayed, an exit code of 10 is returned.

Position of lock is the byte position in the file of the lock.

Extent of lock is the number of bytes locked at that point. For a record lock it should be 1. If no extent, then a "-----" will be shown.

Column Header descriptions:

- c COBOL program names are shown with a header of "Program.....". If the process is not a runtime then the process name itself will be give, for example an icios process will show as "(icios)".
- e Extent of a record lock is shown with a header of "...Extent".
- f File names are shown with a header of "File...".
- i process Identifiers (pids) are shown with the header ".....PID".
- o Open status is shown with a header of "Status" and then I for input, O for output, E for exclusive, B for buffered. M for file has been modified, L for file is locked, and S for a remote slave file.
- n Number of opens are shown with a header of " Opens".
- p Position of a record lock is shown with a header of ".Lposition". If no record lock then a "-----" will be shown.
- r The Run state of the program is shown with a header of " Runstate". If the run state cannot be determined an "Unknown" will be shown.
- s Size of the file is shown with a header of ".....Size".
- t Terminal numbers are shown with the header ".Term". An N/A is shown when no console number can be determined. This will usually imply the process is an icios process. The program name selection will show that case as "(icios)".
- u Usernames are shown with a header of "User.....".
- w lock pids are shown with a header of " ..Lock PID". If no lock a "None" is shown.

PART 2 - WITHIN COBOL

XX. Abort Terminal (COBOL)

A. Introduction

The Abort Terminal function is entered from a COBOL program with a call to the IC_ABORT_TERM builtin.

The Abort Terminal function allows active COBOL terminals to be aborted either to facilitate a system shutdown or for other reasons. Upon invocation, a terminal status window of all logged-on terminals will be displayed. You are then prompted as to which terminal you wish to abort. Once that terminal is aborted, you will see the confirmation in the status window. Aborting a terminal will not remove it from the terminal status window but will mark the terminal as 'Stopped' in the terminal status window.

This function uses the information in the shared area maintained by ICEXEC.

On Linux, the runtime requests ICEXEC to issue a Linux Signal of SIGUSR1 to the PID corresponding to the console number selected.

B. Use

Upon invocation a terminal status window of all logged on terminals is displayed. You are then prompted for the terminal number that you wish to abort.

```

                                Abort Terminal Utility Revision 5.40
T.S. Program      T.S. Program      T.S. Program      T.S. Program
0 I logon         2 R sample         4 R cs1s01         5 S csmenu
7 I logon         11 I logon

(S) tatus: (D) ebug, (L) ogin, (I) nactive, (P) ushed, (R) unning, (S) topped, (W) atching
Terminal number of job to abort.  _ ESC Exit

```

SCREEN 5. ABORT TERMINAL

XXI. Kill Terminal (COBOL)

A. Introduction

The Kill Terminal function is entered from a COBOL program with a call to the IC_KILL_TERM builtin.

The Kill Terminal function allows active COBOL terminals to be terminated either to facilitate a system shutdown or for other reasons. Upon invocation a terminal status window of all logged-on terminals will be displayed. You are then prompted as to which terminal you wish to terminate. Once that terminal is terminated you will see the confirmation in the status window. Killing a terminal will remove it from the terminal status window.

This function uses the information in the shared area maintained by ICEXEC.

On Linux, the runtime requests ICEXEC to issue a Linux Signal of SIGTERM to the PID corresponding to the console number selected.

B. Use

Upon invocation, a terminal status window of all logged on terminals is displayed. You are then prompted for the terminal number that you wish to kill.

```

                Terminate COBOL Process Utility Revision 5.40
T.S.Program    T.S.Program    T.S.Program    T.S.Program
0 I logon      2 R sample      4 R cs1s01     5 S
7 I logon      11 I logon

(S) tatus: (D) ebug, (L) ogin, (I) nactive, (P) ushed, (R) unning, (S) topped, (W) atching
Terminal number of process to terminate. _____

                ESC Exit
```

SCREEN 6. KILL TERMINAL

XXII. Message Sending (COBOL)

A. Introduction

The Message Sending function is entered from a COBOL program with a call to the IC_SEND_MSG builtin.

The Message Sending function allows the user to send a message to one, several, or all logged-on Interactive COBOL users, either active or inactive on the **same** machine.

This function uses the information in the shared area maintained by ICEXEC.

B. Use

Upon invocation, a terminal status window of all logged on terminals is displayed. You are then prompted for the message that you wish to send. You are then prompted for the terminal number to send the message to. If none, the message is sent to all logged-on users.

```

                Message Sending Utility Revision 5.00
T.S.Program    T.S.Program    T.S.Program    T.S.Program
0 I logon      2 R sample      4 R cs1s01     5 S
7 I logon      11 I logon

(S) tatus: (D) ebug, (L) ogin, (I) nactive, (P) ushed, (R) unning, (S) topped, (W) atching
Message: _____
Terminal Number: _____
                ESC Exit
    
```

SCREEN 7. MESSAGE SENDING

XXIII. Printer Control (COBOL)

A. Introduction

The Printer Control utility is entered from a COBOL program with a call to the IC_PRINT_STAT builtin.

The Printer Control utility enables the user to view and change the current status of the print spooling system including the files in the system, the files currently queued to a print queue or printing, and the files that have been printed.

The Printer Control utility provides for the spooling and separate printing of files. The Printer Control utility uses the printer control file to hold the filenames that are currently in the printer control queue. The printer control file can handle up to 1024 files based on what ICCONFIG has allowed. Once that maximum is reached an OPEN of a file that would have been placed in the printer control file will fail with a File Status 99 (Exception Status 44).

The Printer Control utility can be configured to automatically print a file once it has been entered or to allow each file to be queued separately to a printer by a user.

The printer control file is managed by the ICEXEC process. When the printer control file is initially read at startup, all entries are checked to see if the file still exists at its specified location. If a "File not Found" error is detected then the entry is removed from the printer control file. Any other error, along with a good return, causes the entry to remain in the printer control file.

B. Use

B.1. Overview

SCREENS 8, 9, and 10 show the screens that will be displayed for the Printer Control utility. SCREENS 8 and 9 are composed of three(3) different windows. These are from top to bottom 1) the file list window, 2) the file status window, and 3) the command window. These windows can be seen below alongside a partial printer control screen.

1) file list window . . .		
2) file status window	a) b) c) d) e) f) g)	<pre> Printer Contro Filename...Status File . . . Filename: <fullpath> Size: 87654 Status: Not yet printed Owned by: PCQ: 1 Priority: 127 <options>... Delete, Keep, or Remove Command: (Delete, Lo Cursor Keys to </pre>
3) command window		

```

Printer Control Utility Revision 5.40
Filename.....Status..  Filename.....Status..  Filename.....Status..
artable      N000-201  repl019      P000-205  test         N000-201
payroll      Q001-001  holdtab      *001-216  joelist      N000-210
ven          P000-090

Filename: /usr/ralph/artable
Size: 65432      Last modified: Jan-03-2020 08:23
Status: Not yet printed.  Last printed:
Owned by: ralph (201)  Printed by: ralph (201)
PCQ: 0 Priority: 127 Copies: 1 Notify: N
Nobanner: Y
Delete, Keep, or Remove: K All Pages: Y
Command: _ (Delete, pdF print, Local Print, Modify options, Print, Remove, View)
CursorKeys Position, TAB Devices, Ctrl-F Filters, F1 Compress, F2 PDF, ESC exit.

```

SCREEN 8. Linux PRINTER CONTROL

```

Printer Control Utility Revision 5.40
Filename.....Status..  Filename.....Status..  Filename.....Status..
artable      N000-201  repl019      P000-205  test         N000-201
payroll      Q001-001  holdtab      *001-216  joelist      N000-210
ven          P000-090

Filename: c:\test200\artable
Size: 65432      Last modified: Jan-03-2020 08:23
Status: Not yet printed.  Last printed:
Owned by: ralph (201)  Printed by: ralph (201)
PCQ: 0 Priority: 127 Copies: 1
FF at Begin: N FF per Copy: Y FF at End: N
Delete, Keep, or Remove: K All Pages: Y
Command: _ (Delete, pdF print, Local Print, Modify options, Print, Remove, View)
CursorKeys Position, TAB Devices, Ctrl-F Filters, F1 Compress, F2 PDF, ESC exit.

```

SCREEN 9. WINDOWS PRINTER CONTROL

The *file list window* is composed of at least 12 lines of 3 files apiece that show the simple filename (up to 14 characters) for the print file stored in the printer scheduler and a short-status indicator. If your ICLINES setting is greater than 24 then this window will be larger. The short-status indicator is defined as:

- **qqq-ooo* (blinking *) file is currently being modified by a COBOL program
- Aqqq-ooo* file has already been printed and/or submitted to be printed
- Eqqq-ooo* file had been printing but was terminated before it finished
- Hqqq-*jjj** queued file that has been held
- Nqqq-ooo* new file (not yet printed/submitted)
- Pqqq-*ppp** (blinking) actively printing file
- Qqqq-*jjj** queued file

Where

jjj

Is the queue entry number for that printer control queue. 1 implies it is the next file to be printed after the current one is finished, 2 is the second file, etc.

ooo

Is the user-id (On Linux) or terminal number (On Windows) of the last user to modify the file, i.e., the owner

ppp

Is the user-id (On Linux) or terminal number (On Windows) of the last user to have printed the file

qqq

Is the printer control queue number for the file (0-127)

The *file status window* is the next seven lines (1-7). This window shows detailed status information for the file currently highlighted in the file list window. This detailed information includes:

- a) the full pathname of the file (up to 70 characters).
- b) the size of the file in bytes, and when the file was last modified.
- c) status information on the file such as;
 - i) whether it has been printed and if so when,
 - ii) while printing it shows the percentage of the file printed for each copy,
 - iii) if an error occurs while printing the error is shown here;
 - iv) whether the file is being updated.
- d) On Linux, the username and user-id of the person that last modified the file (Owned by), along with the same information of the person that last printed the file (Printed by).
- d) On Windows, the username and the terminal number of the person that last modified the file (Owned by), along with the same information of the person that last printed the file (Printed by).
- e-g) the current print options.

Files can be highlighted (in reverse video) in the file list window by using the arrow keys along with HOME and END to move around.

A single HOME will move to the first entry currently displayed in the file list window, while a single END will move to the last entry currently displayed in the file list window. A HOME HOME (a HOME followed by another HOME) will move to the very first entry in the printer control queue, while an END END will move to the very last entry in the printer control queue. Most keyboard configuration files default to Ctrl-A being an END and Ctrl-P being a HOME.

The *command window* consists of the final two lines and shows the current valid commands that can be executed for the highlighted file. The first line of the command window shows Commands as described in the next section. The second line indicates that the cursor keys can be used to position to an entry, switch to the device screen, switch to the filter screen, switch to compressed mode, switch to pdf formats screen, and finally exit.

While in the main Printer Control screen the Printer Control Status screen can be shown by entering a TAB. SCREENS 10 - 13 show examples of a printer control status screens.

```

Printer Control Utility Revision 5.40 (Linux)
Unit Device..... Status..... Translation....
0 LPT1 Available
1 LPT2 Available
3 COM1 Not available
4 IOP7 Printing

ENTER Update immediately, ESC Exit.
```

SCREEN 10. PRINTER CONTROL STATUS (Linux)

```

Printer Control Utility Revision 5.40 (Windows)
Unit Device..... Status..... Translation....
0 LPT1 Available
1 LPT2 Available
3 COM1 Not available
4 IOP7 Printing

ENTER Update immediately, ESC Exit, TAB Toggle display.
    
```

SCREEN 11. PRINTER CONTROL STATUS (Windows)

```

Printer Control Utility Revision 5.40 (Windows)
Unit Device..... Status..... Location.....
0 LPT1 Available
1 LPT2 Available
3 COM1 Not available
4 IOP7 Printing

ENTER Update immediately, ESC Exit, TAB Toggle display.
    
```

SCREEN 12. PRINTER CONTROL STATUS (Windows)

```

Printer Control Utility Revision 5.40 (Windows)
Unit Device..... Status..... Comment.....
0 LPT1 Available
1 LPT2 Available
3 COM1 Not available
4 IOP7 Printing

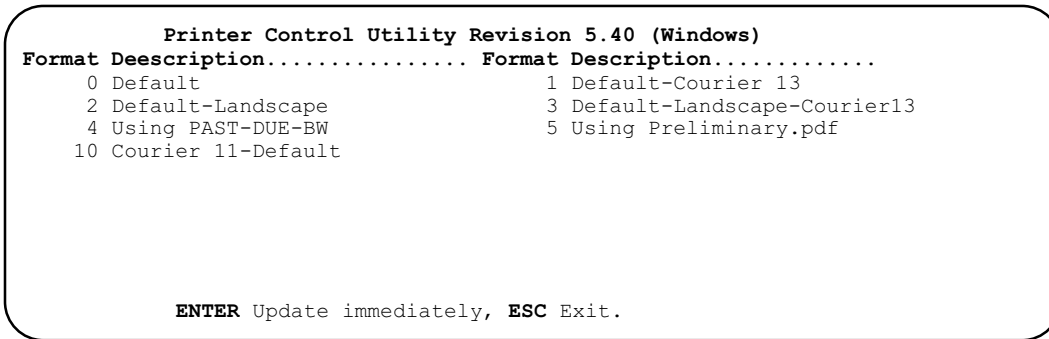
ENTER Update immediately, ESC Exit, TAB Toggle display.
    
```

SCREEN 13. PRINTER CONTROL STATUS (Windows)

The printer control status screen shows all enabled printer control queues along with its specified device and a status of "Not available", "Available", or "Printing". "Not available" says that at this time this queue cannot be accessed by Interactive COBOL. "Available" says that this queue is idle and available for printing. "Printing" says that this queue is currently printing a job and is available to queue more files for printing. The Translation column shows any translation files being used for a printer. On Windows, a TAB can be used to toggle the last column among Windows Location and Windows Comment in addition to the Translation column entries for each printer device.

On Windows, the status can also be "Paused", "Offline", or "Needs attention". Also a "*" will be shown in front of the Device name for the default Windows printer. (I.E., configured to blank in the configuration file.)

While in the main Printer Control screen the PDF Formats that are available can be shown by entering a F2. The . Screen below shows an example.



SCREEN 14. PDF FORMATS STATUS

B.2. Printer Control Commands

Available commands within the Printer Control utility are defined in TABLE 1. Each command works on the currently selected print file although not all are allowed for every file. Only the valid commands for the selected file are shown in the command window. To execute a command, type the highlighted first letter.

To actually use a particular command it must be displayed as a valid command option and the particular user must have the appropriate access to the print job entry and possibly the associated file.

To start a file printing from the Printer Control utility, the user must issue the Print command.

Command	Printer Control Function
C ancel	Cancel the file from the print queue
D elete	Delete the file from disk storage and remove its name from the print control list
p df print	Generate a PDF file from this entry, the pdf format is requested
H old	Hold the file in the print queue and keep it from printing
L ocal print	Print the file to the locally attached printer
M odify options	Change the current print options for PCQ; Priority; Number of copies; Notify; Disposition options of Delete, Keep, or Remove the file after printing; print All pages or the Starting and Ending pages. (On Windows) form-feed options of at Beginning, per Copy, and at End; or (On Linux) Nobanner;
P rint	Print the file with its current options
R emove	Remove the filename from the print control list
T erminate	Interrupts the printing file
U nhold	Unhold the file in the print queue
V iew	View the file on the screen

TABLE 1. PRINTER CONTROL COMMANDS

On Windows, any user with printer control management privilege can perform any operation to a file provided he has access to that file from the operating system. If a username has been stored into the printer control file for either owner or printer then it is used when matching on owner or printer, otherwise the owner's and printer's terminal number is used. The username convention will allow a given username to operate on files from different terminals on the system.

On Linux, super user or any user with printer control management privilege can perform any operation to a file that

he has the appropriate access to. Other conditions will be specified with each commands description below. When a file is placed into printer control, the current user-id and group-id are stored as the owner-user-id and owner-group-id. When an entry is printed, the current user-id and group-id are stored as the printed-by-id and printed-by-group-id.

Cancel removes a file from the print queue to keep it from printing. You cannot Cancel the file currently printing; instead, it must be terminated to stop further printing. On Linux, a user must be the owner or in the owner's group.

pdf print provides the ability to generate a .PDF file using a particular PDF Format that is requested.

Delete removes the file from the printer control file and deletes the file from storage. The user will be prompted with a confirmation message before the delete is done. If the file no longer exists, Delete gives an error and the Remove command must be used to remove the entry. On Linux, a user must be the owner, or in the owner's group and have delete permission (i.e., write access to the directory that the file is in) on the file.

Hold will temporarily keep a file from printing but keep it queued and unavailable for anyone to modify. A user can Hold those files printed by him or owned by him, and on Linux in the same group as the owner or the one who printed it.

Local print sends the file to the printer attached to the current console using printer-pass-thru. It uses the current settings for Start and End pages set with the Modify options. A console interrupt can be used to terminate a local print. Files that are printed locally will not be shown as Already printed.

Modify options is used to change any of the print options for a particular file. When the Modify options command is selected you are positioned to the Options section of the file status window. You can then fill in the form to define how you wish to print this particular file. Up-arrow and down-arrow can be used to move back and forth in the options form. On Linux, only the owner, or the owner's group can change the Delete or Remove part of the options, the other options can be changed if you have read access to the file.

The modifiable options are:

PCQ can be any available PCQ from 0 - 2047. The default is the value that was placed in the printer control file when the entry was created.

Priority can be a number from 0 (the highest) to 39 (the lowest) on Linux, or 1 (the highest) to 99 (the lowest) on Windows. The default is 127 and no priority respectively. On Linux, Interactive COBOL uses the '-q' to set the priority to the Linux spooler if a priority is given.

Copies can be a number from 1 to 9999 for the number of copies to print. The default is 1.

Notify can be either Yes or No to specify whether the printer control utility should send a message to the user who printed the file when the file has successfully printed. The default is N.

On Windows, *FF at Beginning* can be either Yes or No and instructs the printer control utility to generate an initial Form-Feed before printing the file. The default is that specified in ICCONFIG for this particular printer control queue.

On Windows, *FF per Copy* can be either Yes or No and instructs the printer control utility to generate a Form-Feed at the end of each copy. The default is that specified in ICCONFIG for this particular printer control queue.

On Windows, *FF at End* can be either Yes or No and instructs the printer control utility to generate a final Form-Feed after printing the file. The default is that specified in ICCONFIG for this particular printer control queue.

On Linux, *Nobanner* can be either Yes or No to specify whether the nobanner option should be specified to the Linux spooler. The default is that specified in ICCONFIG for this particular printer control queue.

Disposition of *Delete*, *Keep*, or *Remove* can be D, K, or R to specify whether to Delete the entry and remove it from the printer control file, Keep the file and the printer control file entry, or Remove the printer control file entry upon a successful completion of printing the file. The default is that specified in ICCONFIG for that particular printer control queue.

All pages can be either Yes or No on whether to print the entire file. If no is given then the utility prompts for *Start page* and *End page*.

If a user is changing a file's options, no other user will have access to that file. That second user will get the message "The item is currently in use" indicating another user has it.

Print will queue the file for printing with the currently displayed options. To print with a different set of options, the Modify options command must first be used. On a Print, the Printer Control utility opens the file and verifies that it is available and there is a valid start page. If there is an error in Print, an error message is displayed in the status section for that particular file entry. A Print of a file with zero length will generate an error saying the start page could not be found. A user must have read access to the file to print it.

Remove removes the file from the printer control file. Remove can be used to remove a non-existent file from the printer control file. On Linux, only the owner, or anyone in the owner's group can Remove it.

Terminate will terminate the currently printing file. Until the terminate is complete, the status for that particular printer will show that a Termination is being done. A user can only Terminate files that he owns or printed. On Linux, a user must be super user, the owner, or in the owner's group.

Unhold releases a held job and allows it to print. A user can Unhold a file if he is the owner, the one who printed it, or (On Linux) in the same group as the owner or the one who printed it.

View allows for a file to be viewed on the screen. A user can View a file if he has read access to the file. The View command uses the file list window to show portions of the selected file. The user will be prompted at the bottom to continue with selected options. Generally the options are *newline* for next screen, *l* for next line, *h* for next half screen, *e* for the end screen, and *q* to quit viewing the file. On a page break (i.e., a form-feed), the message will change to ask whether you wish to see the next page.

B.3. Printer Control Utility Display Filtering

The set of files displayed in the Printer Control Utility may be filtered to display only a subset of all files available. The display may be temporarily altered by using the filter menu of the Printer Control Utility. This menu is accessed by pressing the Word Forward Key (usually Ctrl-F) on the main Printer Control Menu. Changes made at this menu apply only during the current session of the Printer Control Utility and do not persist after the utility has exited. If a default filter is already applicable (either from the ICPCQFILTER environment variable or because the utility was entered with one from the IC_PRINT_STAT builtin function), its values are pre-loaded into the filter screen.

The filter menu screens are shown in the following screens:

```

Printer Control Utility Revision 5.40

Filter          Enable  Values
PCQ number      N      Min: ____ Max: ____
Owner name      N      Username: _____
Owner user-id   N      Min: ____ Max: ____
Printed-by name N      Username: _____
Printed-by user-id N     Min: ____ Max: ____
Simple filename N      Filename: _____
File size       N      Min: ____ Max: ____
Read access     N
Directory name  N      Dir: _____
Status         N      Status: _

Status codes:  Not yet printed  Update in progress  Printing
               Already printed  Queued to print     Retrying
               Error occurred   Holding in queue    Terminating

The filter values have changed.  Apply the new filter? _

ESC Exit.
```

SCREEN 15. Linux FILTER MENU

```

Printer Control Utility Revision 5.40

Filter      Enable  Values
PCQ number      N      Min: ____      Max: ____
Owner name      N      Username: _____
Owner user-id   N      Min: ____      Max: ____
Printed-by name N      Username: _____
Printed-by user-id N      Min: ____      Max: ____
Simple filename N      Filename: _____
File size       N      Min: ____      Max: ____
Read access     N
Directory name  N      Dir: _____
Status          N      Status: _

Status codes:  Not yet printed  Update in progress  Printing
               Already printed  Queued to print     Retrying
               Error occurred   Holding in queue    Terminating

The filter values have changed.  Apply the new filter? _

ESC Exit.

```

SCREEN 16. WINDOWS FILTER MENU

The following items are available for controlling the filters. If any is specified then only those files which meet the specified criterion will be displayed. If more than one of these items is specified, then only files which meet ALL of the specified criteria will be displayed:

- (a) a range of printer control queues (PCQs) from 0 to the maximum configured PCQ;
- (b) the username of the job owner;
- (c) a range of owner values (console numbers on Windows and user-id numbers on Linux);
- (d) the username of the last user who printed the file;
- (e) a range of printed-by values (console numbers on Windows, user-id numbers on Linux);
- (f) the simple filename of the print job;
- (g) a range of file sizes;
- (h) whether or not the user of the printer control utility has read access to the file. (This option may make the Printer Control Utility appear somewhat sluggish when there are a large number of files in the queue as each file must be queried as to its read status.);
- (i) the current status of the job;
- (j) a directory holding the print job or a subdirectory that holds the print job.

To exit the filter menu, press the ESC key. If no changes have been made to the filter, the main screen of the Printer Control Utility will be displayed. If any changes have been made, the following prompt will appear:

The filter values have changed. Apply the new filter?

Answer yes (Y) to activate the new values and return to the main screen of the Printer Control Utility. Answer no (N) to ignore the new values and return to the main screen of the Printer Control Utility. Pressing ESC at this prompt will return to the enable column of the PCQ number line.

B.4. Notes

The Printer Control utility allows multiple files to be queued to a printer at a time. Each file is scheduled to print in the order in which it was queued with the print command unless its priority is set to a lower value (i.e., higher priority) than a preceding job. In that case the file is moved in front of jobs with a higher number. As soon as the print file ahead of it is finished, it will start printing.

Entering a space or a newline while at the command prompt will refresh the screen with updated information, otherwise the screen is refreshed every ten seconds.

To keep a file from printing that is already queued, you can either Hold it, which will keep the file from printing but keep it in the queue and unavailable for modification; or Cancel it, in which case the file is no longer queued and returns to the status that it had before it was queued to the printer.

Remember, the printer control file can only hold the number of files set in ICCONFIG's System Parameters before subsequent OPEN's will fail with a File Status 99. Thus it would be wise to frequently check to see that print files have been either removed or deleted from the queues.

If the Printer Control utility gets a printer error, the appropriate entry is marked in error and anyone checking the Printer control utility will see the error and be able to correct it. The Printer Control utility will continue to retry on printer errors until the error condition is removed or the print job is terminated.

On Linux, the user-id for a particular user can be determined by looking in the file /etc/passwd for the user-name. The default group-id for a user is also given in the /etc/passwd file. For a particular group-id, its name can be determined by looking in the file /etc/group along with the users who are allowed access to the group. In addition the Linux groups command can be used.

XXIV. System Information (COBOL)

A. Introduction

The System Information function is entered with a call to the IC_SYS_INFO builtin.

The System Information function provides system information for the entire Interactive COBOL system that includes current values, maximum values encountered since invocation, and the maximum value configured for many tunable configuration parameters.

This function uses the information in the shared area maintained by ICEXEC.

B. Use

For System Information, Interactive COBOL provides a screen of statistical information about various Interactive COBOL parameters. For the named resource, three numbers are displayed. These are:

```
In Use           is the number currently in use
MaxUsed         is the most this has ever been, for this invocation
Max             is the maximum number configured
```

The MaxUsed values can be used to either raise or lower individual System Parameters in ICCONFIG, or in the Linux Kernel ([On Linux](#)) to provide a better tuned system.

System Information Display Utility Revision 5.40			
Resource	In Use	MaxUsed	Max
Process Count:	1	1	156
Terminal Count:	1	1	132
Run Program Terminals:	1	1	132
Detached/CGI Terminals:	0	0	3
SEQUENTIAL Files:	1	1	200
INDEXED Files:	1	1	100
RELATIVE Files:	1	1	8
Record locks:	0	3	1024
Unique Linux files:	2	3	1040
@PRN devices:	0	1	14
@PCQ devices:	0	2	9
@SER devices:	0	1	9
@CON devices:	1	1	132
Buffers (KB) assigned:	32	560	5000
Buffers (KB) accessed:	32	48	5000
Unique Linux devices:	1	1	467

ENTER Update immediately, **ESC** Exit.

SCREEN 17. Linux SYSTEM INFORMATION

System Information Display Utility Revision 5.40

Resource	In Use	MaxUsed	Max
Process Count:	1	1	156
Terminal Count:	1	1	132
Run Program Terminals:	1	1	132
Detached/CGI Terminals:	0	0	3
SEQUENTIAL Files:	1	1	200
INDEXED Files:	1	1	100
RELATIVE Files:	1	1	8
Record locks:	0	3	1024
Unique WINDOWS files:	2	3	1040
@PRN devices:	0	1	14
@PCQ devices:	0	2	9
@SER devices:	0	1	9
@CON devices:	1	1	132
Buffers (KB) assigned:	32	560	5000
Buffers (KB) accessed:	32	48	5000

ENTER Update immediately, **ESC** Exit.

SCREEN 18. WINDOWS SYSTEM INFORMATION

XXV. Terminal Control (COBOL)

A. INTRODUCTION

The Terminal Control function is entered with a call to the IC_TERM_CTRL builtin function.

This function allows the user to view the status of all Interactive Cobol runtime users on the system. The display includes detailed information on the highlighted terminal, including the terminal number, user name, program name, process-id, internal id, and program status. The privilege settings for the terminal are also displayed.

With the appropriate privileges, the user can perform the following actions on individual terminals:

- * goto a particular terminal
- * abort a terminal
- * kill a terminal
- * send a message to one or more terminals
- * control a terminal (takes over the terminal's keyboard and watches the screen)
- * watch a terminal's screen

This function uses the information in the shared area maintained by ICEXEC.

B. USE

The Terminal Control Function displays information in two windows called the terminal status window and the terminal details window. The user enters commands through a third window called the command window.

The terminal status window contains a display for each logged-in terminal. The display contains the terminal number, a status indicator, and either the program name or the PID and the username. An asterisk is printed if the terminal is being watched. The program or PID/username views can be toggled between with the TAB key. The terminals are displayed in ascending order by terminal number. Initially the terminal displayed at the upper left corner is highlighted in reverse video indicating that is the selected terminal. Terminals can be highlighted by using the Goto command to specify the terminal number or by using the arrow keys along with HOME and END to move around. Up to 3 terminals are displayed per line. If more terminals are logged on than can be shown in one screen, then indicators show whether more terminals are found before and/or after the currently displayed group. The size of the screen is used to display the most possible status lines.

Pressing the HOME key highlights the terminal displayed at the upper left corner of the current terminal status window. Pressing the HOME key two times in a row (HOME HOME) causes the lowest-numbered logged-on terminal to be displayed in the upperleft corner.

Similarly, pressing the END key highlights the terminal displayed at the lower-right corner of the current terminal status window. Pressing the END key two times in a row (END END) causes the highest-numbered logged-on terminal to be displayed in the lower-right corner.

The terminal details window shows details for the highlighted terminal including terminal number, status, complete program name, user name, process- id, privilege settings, and whether the terminal is watching another terminal or is being watched. The privileges are shown with letters indicating the current privileges available as:

- | | |
|-------------------------------------|---|
| A - Abort terminal privilege, | I - System information privilege, |
| M - Message sending privilege, | T - Terminal status privilege, |
| P - Printer control privilege, | C - printer Control management privilege, |
| S - System Shutdown privilege, | O - Detach/Host programs privilege, |
| B - console interrupt privilege, | D - Program debugging privilege, and |
| W - Watch other terminals privilege | X - eXclude this terminal from being watched. |

If the highlighted terminal is involved in a watch relationship, the other terminal's number is displayed. The details

window also displays the number of terminals currently logged on.

The terminal running the function is indicated in bold. When this terminal is the highlighted terminal, the additional note "This is your terminal" is displayed in the terminal details window.

The display updates approximately every 10 seconds. Pressing the Enter or Newline key causes an immediate update. The program is exited by pressing ESC.

The command window displays a menu of available commands, depending on the privileges of the user running the program. A command is chosen by typing the 1st letter of its name (case does not matter). The possible commands are:

- * Goto - always available. Prompts for a terminal number, and makes it the highlighted terminal. If the terminal is not visible on the current screen and its terminal number is lower than any displayed terminal, the screen is painted with the selected terminal highlighted in the upperleft corner. If the terminal number is higher than any displayed terminal, the screen is repainted with the selected terminal highlighted in the bottom right corner.
- * Abort - available to users with the Abort terminal privilege. Allows the user to abort the highlighted terminal. The user is prompted with the highlighted terminal's number and asked to confirm that it is to be aborted. If the user responds by typing a Y, an Abort is sent to the highlighted terminal. Note that it is possible to abort your own terminal.
- * Kill - available to users with the Abort terminal privilege. Allows the user to kill the highlighted terminal. The user is prompted with the highlighted terminal's number and asked to confirm that it is to be terminated. If the user responds by typing a Y, a Stop is sent to the highlighted terminal. Note that it is possible to kill your own terminal.
- * Message - available to users with the Message sending privilege. This command puts the user in message mode. The user is prompted to enter a brief (55 byte) message and a terminal number to be sent the message; the default is the highlighted terminal. To send the message to a different terminal, type in the terminal's number. To send to all terminals, type spaces over the default terminal number.

After the message is sent, the user can enter another terminal number to receive the same message or can press ESC once to return to the message prompt. Pressing ESC there exits message mode. If another message is entered, the highlighted terminal is again the default.

- * Control - Allows the highlighted terminal to be controlled. The user's display is repainted with the highlighted terminal's screen. All subsequent output displayed on the highlighted terminal's screen is displayed on the user's screen as well. Anything the user types at his terminal is typed on the highlighted terminal. The keyboard becomes inactive on the highlighted terminal.

Intr and Quit are NOT sent to the highlighted terminal, but act on the current user. The refresh key (usually Ctrl-U) also is not sent to the highlighted terminal but acts locally to repaint the screen.

- * Watch - Allows the user to view the highlighted terminal's screen. The user's display is repainted with the highlighted terminal's screen. All subsequent output displayed on the highlighted terminal's screen is displayed on the user's screen as well. In this mode the user cannot enter data to the highlighted terminal.
- * Status bar - Allows the user to place the Watch/Control status indicator. Valid selections are none, left, or right. Left is the default. If visible, the status indicator is shown in reverse on the top of the user's screen.

The Watch facility (Control, Watch, and Statusbar) are only available if the following conditions are met:

- The Watch other terminals privilege is enabled for this user

- Console Interrupts are enabled for this user

Watch and Control cannot be used on the current console. I.E., you cannot watch yourself.

Watch and Control cannot be used on another Watcher.

Control requires that ICLINES and ICCOLUMNS on the current terminal be at least that of the terminal to be controlled. When Watching, if the ICLINES and/or ICCOLUMNS are smaller then some data will not be shown.

To quit the Watch command or Control command the Intr key (or Quit) should be pressed. The Watcher immediately returns to the Terminal Control main menu and the Watchee stops sending screen data to the Watcher. In addition, for the Control command the keyboard is switched back to the Controlee.

Data inside a Printer Pass Thru-ON - Printer Pass Thru-Off sequence is not sent to the Watcher/Controller.

If the Watchee/Controlee program pushes to another executable, the Watcher will pend until that executable returns to the runtime. A message will be displayed on the Watcher's screen indicating that the Watchee has pushed off. This message is cleared when the Watchee returns from the pushed program. For a Control command, the keyboard has been switched back to the Controlee while in the pushed program. The keyboard is re-switched back to the Controller when the Controlee returns from the pushed program.

If the Watchee/Controlee terminates in some fashion such that the runtime shuts down, a message will be displayed on the Watcher's screen indicating that the Watchee has terminated and showing the last information sent to the screen. A newline will then return the Watcher to the main menu of Terminal Control.

If the Watchee program is using drawlines characters, those characters do not get translated by the Watcher. Funny characters may be displayed on the Watcher screen.

When a Watcher connects to a Watchee, if ICEXEC has logging enabled an Info message is written to the log.

When Watching a ThinClient and gui mode is in use, that information is NOT watched.

Sample screens:

SCREEN 19 would be seen by a user who has the Terminal status privilege and Message sending privilege, but not the Abort terminal privilege or Watch other terminals privilege:

```

Terminal Control Utility Revision 5.40
T.S. Program          T.S. Program          T.S. Program
0 R termctrl         1 R cycle0             2 R cycle0
 3 R subpgm1           4 R subpgm1           5 R subpgm1
 6 R cycle0            7 R subpgm1           8 R cycle1
 9 R cycle2           10 R cycle3           11 R cycle2
12 R cycle3           13 R cycle2           14 R cycle3
15 R subpgm2          16 R cycle2           17 R subpgm1
18 R subpgm1          19 R subpgm1          20 R cycle5
21 R cycle4           22 R cycle5           23 R cycle5
24 R subpgm2          25 R subpgm2          26 R cycle6
27 R subpgm2          28 R cycle6           29 R subpgm2
30 R cycle6           31 R cycle7           >>>>> MORE >>>>>
Terminal: 0          Username: carl
Program: termctrl
Status: Running
Privileges: _IM_PC_OBD_
Command: _ (Goto, Message)
Cursor Keys Position, TAB Toggle display, ESC Exit.
Process id: 20284
Active Terminals: 40

```

SCREEN 19. TERMINAL CONTROL (Programs)

SCREEN 20 is just like SCREEN 19 above but shows the other view of the screen that is available with the TAB key:

```

Terminal Control Utility Revision 5.40
T.S...PID.Username      T.S...PID.Username      T.S...PID.Username
0 R 20284 carl           1 R 17855 ralph          2 R 18212 mike
3 R 17865 jeremy         4 R 25999 mikeb          5 R 25669 ralph
6 R 28123 quint          7 R 24768 alice          8 R 25668 dan
9 R 15000 isaac          10 R 20112 ted           11 R 17875 mary
12 R 17882 brooks        13 R 17884 freddy        14 R 17886 fred
15 R 17888 jan           16 R 17889 butch         17 R 17890 lou
18 R 17892 coleman       19 R 17894 becky         20 R 17896 gerry
21 R 17898 rowland       22 R 20997 carl          23 R 17900 john
24 R 17904 test1         25 R 17906 jim           26 R 17910 ed
27 R 17920 root          28 R 17922 carl          29 R 25666 barbara
30 R 18100 bill          31 R 18102 cathy         >>>> MORE >>>>
Terminal:      0          Username:   carl
Program:      termctrl
Status:       Running
Privileges:   _IM_PC_OBD_
Command:      (Goto, Message)
Cursor Keys  Position, TAB Toggle display, ESC Exit.
Process id: 20284
Active Terminals: 40

```

SCREEN 20. TERMINAL CONTROL (Username)

SCREEN 21 would be seen by a user who has the Terminal status privilege, Message sending privilege and Abort terminal privilege, but not the Watch other terminals privilege:

```

Terminal Control Utility Revision 5.40
T.S.Program           T.S.Program           T.S.Program
0 R termctrl          1 R cycle0             2 R cycle0
3 R subpgm1           4 R subpgm1            5 R subpgm1
6 R cycle0            7 R subpgm1            8 R cycle1
9 R cycle2            10 R cycle3            11 R cycle2
12 R cycle3           13 R cycle2            14 R cycle3
15 R subpgm2          16 R cycle2            17 R subpgm1
18 R subpgm1          19 R subpgm1           20 R cycle5
21 R cycle4           22 R cycle5            23 R cycle5
24 R subpgm2          25 R subpgm2           26 R cycle6
27 R subpgm2          28 R cycle6            29 R subpgm2
30 R cycle6           31 R cycle7            >>>> MORE >>>>
Terminal:      0          Username:   carl
Program:      termctrl
Status:       Running
Privileges:   AIM_PC_OBD_
Command:      (Goto, Abort, Kill, Message)
Cursor Keys  Position, TAB to toggle display, ESC to Exit.
Process id: 20284
Active Terminals: 40

```

SCREEN 21. TERMINAL CONTROL

SCREEN 22 would be seen by a user who has the Terminal status privilege, Message sending privilege, Abort terminal privilege, and Watch other terminals privilege. Notice the setting for Watch is now available.

```

Terminal Control Utility Revision 5.40
T.S.Program      T.S.Program      T.S.Program
0 R termctrl     1 R cycle0       2 R cycle0
3 R subpgm1     4 R subpgm1     5 R subpgm1
6 R cycle0      7 R subpgm1     8 R cycle1
9 R cycle2     10 R cycle3     11 R cycle2
12 R cycle3    13 R cycle2     14 R cycle3
15 R subpgm2   16 R cycle2     17 R subpgm1
18 R subpgm1   19 R subpgm1    20 R cycle5
21 R cycle4    22 R cycle5     23 R cycle5
24 R subpgm2   25 R subpgm2    26 R cycle6
27 R subpgm2   28 R cycle6     29 R subpgm2
30 R cycle6    31 R cycle7     >>>> MORE >>>>
Terminal:      0      Username:  carl
Program:  termctrl      Process id: 20284
Status:  Running
Privileges: AIMTPC_OB_W      Active Terminals: 40
Command:  (Goto, Abort, Kill, Message, Control, Watch, Status bar:L)
Cursor Keys Position, TAB Toggle display, ESC Exit.

```

SCREEN 22. TERMINAL CONTROL

SCREEN 23 shows the user with terminal 11 is watching another terminal, and terminal 22 is being watched.

```

Terminal Control Utility Revision 5.40
T.S.Program      T.S.Program      T.S.Program
0 R termctrl     1 R cycle0       2 R cycle0
3 R subpgm1     4 R subpgm1     5 R subpgm1
6 R cycle0      7 R subpgm1     8 R cycle1
9 R cycle2     10 R cycle3     11 W termctrl
12 R cycle3    13 R cycle2     14 R cycle3
15 R subpgm2   16 R cycle2     17 R subpgm1
18 R subpgm1   19 R subpgm1    20 R cycle5
21 R cycle4    22 R*cycle5     23 R cycle5
22 R*glupd01   25 R subpgm2    26 R cycle6
27 R subpgm2   28 R cycle6     29 R subpgm2
30 R cycle6    31 R cycle7     >>>> MORE >>>>
Terminal:      22      Username:  carl
Program:  cycle5      Process id: 20997
Status:  Running      Watched by terminal 11
Privileges: _IM_PC_OBD_      Active Terminals: 40
Command:  _ (Goto, Message)
Cursor Keys Position, TAB Toggle display, ESC Exit.

```

SCREEN 23. TERMINAL CONTROL

Watch Facility:

The Watch Facility provides the ability to either just view the screen of a particular runtime user or to take over control of the keyboard, as well as that user for any terminal currently running the runtime. This includes direct attached as well as pseudo-ttys. The Watch Facility works with dissimilar terminal types by mapping the needed control codes to the appropriate one's for each terminal type including both input and output. The Watch Facility uses a special privilege that allows only selected users to use the facility.

The Watch Facility is useful as a debugging tool when building COBOL programs that run in a detached (no terminal) state.

The Watch Facility is accessed through the Terminal Control Utility which is the builtin IC_TERM_CTRL. For a user to use the Watch Facility a new privilege has been added to the Program Environments in ICCONFIG. The Watch other terminals privilege allows the indicated user to Watch and Control another user's terminal. Console 0 defaults to enabled for new configurations while all other consoles default to not enabled.

When the user starts to Watch another terminal either with the Watch command or Control command, the current terminal becomes the "Watcher" and the indicated terminal becomes the "Watchee". The Watchee immediately sends the Watcher its current screen image which the Watcher reformats and displays on its screen using its terminal type settings. As characters are displayed to the Watchee they are transmitted to the Watcher to be displayed.

To quit the Watch command or Control command the Intr key (or Quit) should be pressed. The Watcher immediately returns to the main menu of Terminal Control and the Watchee stops sending screen data to the Watcher. In addition, for the Control command the keyboard is switched back to the Watchee.

While in the Watch command, the Watcher can not interact with the program in progress on the Watchee. The Watcher is an observer.

While in the Control command, the Watcher has control of the keyboard for the program in progress on the Watchee. The Watchee is an observer. Anything the Watcher types (except for Intr or Quit) is sent to the program as if it came from the Watchee's keyboard. If the Watchee types on his keyboard no action is performed (the keystrokes are ignored).

Because of the ability to Watch dissimilar terminal types, the Watcher must be aware that his screen may not totally match the Watchee because of different ICLINES/ICOLUMNS or attribute settings. The Watch Facility relays the attribute commands from the Watchee to the Watcher but it does not know how each terminal will actually interpret each command.

Data inside a Printer Pass Thru-ON - Printer Pass Thru-Off sequence is not sent to the Watcher.

If the Watchee program pushes to another executable the Watcher will pend until that executable returns to the runtime. A message will be displayed on the Watcher's screen indicating that the Watchee has pushed off. This message is cleared when the Watchee returns from the pushed program. For a Control command the keyboard has been switched back to the Watchee while in the pushed program. The keyboard is re-switched back to the Watcher when the Watchee returns from the pushed program.

If the Watchee program terminates in some fashion such that the runtime shuts down, a message will be displayed on the Watcher's screen indicating that the Watchee has terminated and showing the last information sent to the screen. A newline will then return the Watcher to the main menu of Terminal Control.

XXVI. Terminal Status (COBOL)

A. Introduction

The Terminal Status function is entered with a call to the IC_TERM_STAT builtin.

The Terminal Status function allows the user to view the status of all Interactive COBOL runtime users on the machine as well as current system information.

This function uses the information in the shared area maintained by ICEXEC.

B. Use

The status of each logged-on terminal is displayed in the status window as the terminal number, status, and program name. SCREEN 24 shows a sample terminal status screen. On the header line T is for terminal, S for status, and Program for the Program name. Up to 4 terminals will be displayed per line for up to 17 lines, allowing a total of 68 terminals per screen to be shown. If more than 68 jobs are active, then multiple passes of the terminal status screen will be shown by pressing an enter to move to the next screen full of terminals or waiting 10 seconds for the screen to cycle to the next screen.

```

Terminal and Resource Status Utility Revision 5.40
T.S.Program      T.S.Program      T.S.Program      T.S.Program
0 I logon        2 R sample       4 R cs1s01       5 S usnews
7 I logon        11 I logon

(S)tatus: (D)ebug, (L)ogin, (I)nactive, (P)ushed, (R)unning, (S)topped, (W)atching
3 of 32 INDEXED files. 8 of 32 SEQUENTIAL files. 8 of 8 RELATIVE
6 of 9 Terminals. 14 of 48 Record locks. 0 of 3856KB buffers
ENTER Update immediately. ESC Exit.

```

SCREEN 24. TERMINAL STATUS

Terminal numbers (T) are 0 through the highest supported under this system depending on how the logical consoles are configured. The terminal number will only show the lower three digits if the terminal number is greater than 999.

The status (S) position will be set to the following:

- D while actually in the debugger,
- I while inactive (i.e., those in the LOGON program via IC_LOGON or after a STOP RUN and a newline was entered),
- L while in the process of bringing up Interactive COBOL or a utility,
- P while the process is executing an O/S executable,
- R while running or active,
- S while stopped, (i.e., programs that have been aborted or otherwise terminated), and
- W while watching another terminal.

Program is the name of the currently executing COBOL program which may be stopped.

At the bottom of the terminal status display some system information is given. This includes the number of indexed, sequential, and relative files in use and available, the number of ICISAM record locks in use and available, the number of terminals in use and available, and the amount of buffer memory in use and available.

The current revision of Interactive COBOL is displayed on the top line.

The number of terminals available is determined at invocation and is the smaller of the maximum number of processes and the maximum number of enabled consoles with the run program option enabled.

While in Terminal Status, pressing a newline will immediately refresh the screen with updated information, otherwise, every ten seconds the screen will be updated. When more than 68 Interactive COBOL processes are active, newline will move to the next screen of terminals.

To exit from Terminal Status hit ESC.

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APPENDIX A. ASCII CODES

Dec	Oct	Hex	DG Function	Ctrl-code	PC Function/Character
0	000	00	Null	Ctrl @	NUL space
1	001	01	Print Screen Form	Ctrl A	SOH ☉
2	002	02	Reverse off	Ctrl B	STX Ⓢ
3	003	03		Ctrl C	ETX ♥
4	004	04		Ctrl D	EOT ♦
5	005	05	Read cursor address	Ctrl E	ENQ ♣
6	006	06		Ctrl F	Ack ♠
7	007	07	Bell	Ctrl G	Bell ●
8	010	08	Cursor Home	Ctrl H	Backspace ▣
9	011	09		Ctrl I	HTab ○
10	012	0A	Newline	Ctrl J	Linefeed ◼
11	013	0B	Erase EOL	Ctrl K	VTab ♂
12	014	0C	Erase Screen	Ctrl L	Form-feed ♀
13	015	0D	Carriage Return	Ctrl M	Carriage Return ♪
14	016	0E	Blink ON	Ctrl N	SO 🎵
15	017	0F	Blink off	Ctrl O	SI ⚙
16	020	10	Write cursor addr(c,r)	Ctrl P	DLE ▶
17	021	11	Print Screen	Ctrl Q	DC1 (XON) ◀
18	022	12	Roll Enable	Ctrl R	DC2 ↑
19	023	13	Roll Disable	Ctrl S	DC3 (XOFF) !!
20	024	14	Underscore ON	Ctrl T	DC4 ¶
21	025	15	Underscore OFF	Ctrl U	NAK \$
22	026	16	Reverse On	Ctrl V	SYN ■
23	027	17	Cursor Up	Ctrl W	ETB †
24	030	18	Cursor Right	Ctrl X	CAN †
25	031	19	Cursor Left	Ctrl Y	EM †
26	032	1A	Cursor Down	Ctrl Z	SUB →
27	033	1B	Escape	Ctrl [	ESC ←
28	034	1C	Dim ON	Ctrl \	FS L
29	035	1D	Dim OFF	Ctrl]	GS ..
30	036	1E	Command Header	Ctrl ^	RS ▲
31	037	1F		Ctrl _	US ▼

Dec	Oct	Hex	DG	PC	Dec	Oct	Hex	DG	PC	Dec	Oct	Hex	DG	PC
32	040	20	space	space	64	100	40	@	@	96	140	60	'	'
33	041	21	!	!	65	101	41	A	A	97	141	61	a	a
34	042	22	"	"	66	102	42	B	B	98	142	62	b	b
35	043	23	#	#	67	103	43	C	C	99	143	63	c	c
36	044	24	\$	\$	68	104	44	D	D	100	144	64	d	d
37	045	25	%	%	69	105	45	E	E	101	145	65	e	e
38	046	26	&	&	70	106	46	F	F	102	146	66	f	f
39	047	27	'	'	71	107	47	G	G	103	147	67	g	g
40	050	28	(	(	72	110	48	H	H	104	150	68	h	h
41	051	29	)	)	73	111	49	I	I	105	151	69	i	i
42	052	2A	*	*	74	112	4A	J	J	106	152	6A	j	j
43	053	2B	+	+	75	113	4B	K	K	107	153	6B	k	k
44	054	2C	,	(comma),	76	114	4C	L	L	108	154	6C	l	l
45	055	2D	-	-	77	115	4D	M	M	109	155	6D	m	m
46	056	2E	.	.	78	116	4E	N	N	110	156	6E	n	n
47	057	2F	/	/	79	117	4F	O	O	111	157	6F	o	o
48	060	30	0	0	80	120	50	P	P	112	160	70	p	p
49	061	31	1	1	81	121	51	Q	Q	113	161	71	q	q
50	062	32	2	2	82	122	52	R	R	114	162	72	r	r
51	063	33	3	3	83	123	53	S	S	115	163	73	s	s
52	064	34	4	4	84	124	54	T	T	116	164	74	t	t
53	065	35	5	5	85	125	55	U	U	117	165	75	u	u
54	066	36	6	6	86	126	56	V	V	118	166	76	v	v
55	067	37	7	7	87	127	57	W	W	119	167	77	w	w
56	070	38	8	8	88	130	58	X	X	120	170	78	x	x
57	071	39	9	9	89	131	59	Y	Y	121	171	79	y	y
58	072	3A	:	:	90	132	5A	Z	Z	122	172	7A	z	z
59	073	3B	;	;	91	133	5B	[	[	123	173	7B	{	{
60	074	3C	<	<	92	134	5C	\	\	124	174	7C	|	|
61	075	3D	=	=	93	135	5D]]	125	175	7D	}	}
62	076	3E	>	>	94	136	5E	^	^	126	176	7E	~	~
63	077	3F	?	?	95	137	5F	_	_	127	177	7F	DEL	␣

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Dec	Oct	Hex	DGI	PC	Dec	Oct	Hex	DGI	PC
128	200	80		Ç	192	300	C0	À	┌
129	201	81		ü	193	301	C1	Á	└
130	202	82		é	194	302	C2	Â	┌
131	203	83		â	195	303	C3	Ã	└
132	204	84		à	196	304	C4	Ä	┌
133	205	85		á	197	305	C5	Å	└
134	206	86		ã	198	306	C6	Æ	┌
135	207	87		ç	199	307	C7	Ç	└
136	210	88		ê	200	310	C8	É	┌
137	211	89		è	201	311	C9	È	└
138	212	8A		è	202	312	CA	Ê	┌
139	213	8B		ì	203	313	CB	Ë	└
140	214	8C		î	204	314	CC	Í	┌
141	215	8D		ì	205	315	CD	Î	└
142	216	8E		Ä	206	316	CE	Ï	┌
143	217	8F		Å	207	317	CF	Ï	└
144	220	90		É	208	320	D0	Ñ	┌
145	221	91		æ	209	321	D1	Ó	└
146	222	92		Æ	210	322	D2	Ò	┌
147	223	93		ô	211	323	D3	Û	└
148	224	94		ö	212	324	D4	Ö	┌
149	225	95		ò	213	325	D5	Õ	└
150	226	96		û	214	326	D6	Ø	┌
151	227	97		ù	215	327	D7	Œ	└
152	230	98		ÿ	216	330	D8	Ú	┌
153	231	99		Û	217	331	D9	Û	└
154	232	9A		Ü	218	332	DA	Ü	┌
155	233	9B		ç	219	333	DB	Û	└
156	234	9C		£	220	334	DC	space	█
157	235	9D		¥	221	335	DD	Ý	█
158	236	9E		ƒ	222	336	DE	space	█
159	237	9F		f	223	337	DF	space	█

160	240	A0	space	á	224	340	E0	á	α
161	241	A1	→	í	225	341	E1	à	β
162	242	A2	½	ó	226	342	E2	â	Γ
163	243	A3	μ	ú	227	343	E3	ä	π
164	244	A4	²	ñ	228	344	E4	ã	Σ
165	245	A5	³	Ñ	229	345	E5	å	σ
166	246	A6	α	ª	230	346	E6	æ	μ
167	247	A7	¢	º	231	347	E7	ç	τ
168	250	A8	£	ˆ	232	350	E8	é	Φ
169	251	A9	ª	ˆ	233	351	E9	è	θ
170	252	AA	º	ˆ	234	352	EA	ê	Ω
171	253	AB	ı	½	235	353	EB	ë	δ
172	254	AC	ˆ	¼	236	354	EC	í	∞
173	255	AD	©	ı	237	355	ED	ì	φ
174	256	AE	®	«	238	356	EE	î	ε
175	257	AF	†	»	239	357	EF	ï	∩
176	260	B0	»	⋮	240	360	F0	ñ	≡
177	261	B1	«	⋮	241	361	F1	ó	±
178	262	B2	¶	⋮	242	362	F2	ò	≥
179	263	B3	™	|	243	363	F3	ô	≤
180	264	B4	f	┌	244	364	F4	ö	┌
181	265	B5	¥	└	245	365	F5	ø	└
182	266	B6	±	┌	246	366	F6	œ	÷
183	267	B7	≤	└	247	367	F7	œ	≈
184	270	B8	≥	┌	248	370	F8	ú	°
185	271	B9	·	└	249	371	F9	ù	·
186	272	BA	(grave)	┌	250	372	FA	û	·
187	273	BB	§	└	251	373	FB	ü	√
188	274	BC	° (degree)	┌	252	374	FC	β	n
189	275	BD	¨ (umlaut)	└	253	375	FD	ÿ	²
190	276	BE	´ (acute)	┌	254	376	FE	space	█
191	277	BF	†	└	255	377	FF	space	space

► **Notes:**

1. Decimal codes 128 - 159 for DGI are the same as their 7-bit counterparts by default.
2. DGI is as defined by a D216E+/D217/D413/D463 terminal.

APPENDIX B. EBCDIC CODES

<u>Dec</u>	<u>Oct</u>	<u>Hex</u>	<u>Char</u>	<u>Dec</u>	<u>Oct</u>	<u>Hex</u>	<u>Char</u>	<u>Dec</u>	<u>Oct</u>	<u>Hex</u>	<u>Char</u>	<u>Dec</u>	<u>Oct</u>	<u>Hex</u>	<u>Char</u>
0	000	00	NUL	32	040	20	DS	64	100	40	space	96	140	60	-
1	001	01	SOH	33	041	21	SOS	65	101	41		97	141	61	/
2	002	02	STX	34	042	22	FS	66	102	42		98	142	62	
3	003	03	ETX	35	043	23		67	103	43		99	143	63	
4	004	04	PF	36	044	24	BYP	68	104	44		100	144	64	
5	005	05	HT	37	045	25	LF	69	105	45		101	145	65	
6	006	06	LC	38	046	26	ETB	70	106	46		102	146	66	
7	007	07	DEL	39	047	27	ESC	71	107	47		103	147	67	
8	010	08		40	050	28		72	110	48		104	150	68	
9	011	09		41	051	29		73	111	49		105	151	69	
10	012	0A	SMM	42	052	2A	SM	74	112	4A		106	152	6A	|
11	013	0B	VT	43	053	2B	CU2	75	113	4B	.	107	153	6B	|,
12	014	0C	FF	44	054	2C	DC4	76	114	4C	<	108	154	6C	|,%
13	015	0D	CR	45	055	2D	ENQ	77	115	4D	(	109	155	6D	|,
14	016	0E	SO	46	056	2E	ACK	78	116	4E	+	110	156	6E	|,
15	017	0F	SI	47	057	2F	BEL	79	117	4F	|	111	157	6F	|,
16	020	10	DLE	48	060	30		80	120	50	&	112	160	70	?
17	021	11	DC1 (XON)	49	061	31		81	121	51		113	161	71	
18	022	12	DC2	50	062	32	SYN	82	122	52		114	162	72	
19	023	13	DC3 (XOFF)	51	063	33		83	123	53		115	163	73	
20	024	14	RES	52	064	34	PN	84	124	54		116	164	74	
21	025	15	NL	53	065	35	RS	85	125	55		117	165	75	
22	026	16	BS	54	066	36	UC	86	126	56		118	166	76	
23	027	17	IL	55	067	37	EOT	87	127	57		119	167	77	
24	030	18	CAN	56	070	38		88	130	58		120	170	78	
25	031	19	EM	57	071	39		89	131	59		121	171	79	`
26	032	1A	CC	58	072	3A		90	132	5A	!	122	172	7A	:
27	033	1B	CU1	59	073	3B	CU3	91	133	5B	\$	123	173	7B	#
28	034	1C	FS	60	074	3C		92	134	5C	*	124	174	7C	@
29	035	1D	GS	61	075	3D	NAK	93	135	5D	)	125	175	7D	'
30	036	1E	RS	62	076	3E		94	136	5E	;	126	176	7E	=
31	037	1F	US	63	077	3F	SUB	95	137	5F	~	127	177	7F	"
<u>Dec</u>	<u>Oct</u>	<u>Hex</u>	<u>Char</u>	<u>Dec</u>	<u>Oct</u>	<u>Hex</u>	<u>Char</u>	<u>Dec</u>	<u>Oct</u>	<u>Hex</u>	<u>Char</u>	<u>Dec</u>	<u>Oct</u>	<u>Hex</u>	<u>Char</u>
128	200	80		160	240	A0		192	300	C0	{	224	340	E0	\
129	201	81	a	161	241	A1	~	193	301	C1	A	225	341	E1	
130	202	82	b	162	242	A2	s	194	302	C2	B	226	342	E2	S
131	203	83	c	163	243	A3	t	195	303	C3	C	227	343	E3	T
132	204	84	d	164	244	A4	u	196	304	C4	D	228	344	E4	U
133	205	85	e	165	245	A5	v	197	305	C5	E	229	345	E5	V
134	206	86	f	166	246	A6	w	198	306	C6	F	230	346	E6	W
135	207	87	g	167	247	A7	x	199	307	C7	G	231	347	E7	X
136	210	88	h	168	250	A8	y	200	310	C8	H	232	350	E8	Y
137	211	89	i	169	251	A9	z	201	311	C9	I	233	351	E9	Z
138	212	8A		170	252	AA		202	312	CA		234	352	EA	
139	213	8B		171	253	AB		203	313	CB		235	353	EB	
140	214	8C		172	254	AC		204	314	CC		236	354	EC	
141	215	8D		173	255	AD	[	205	315	CD		237	355	ED	
142	216	8E		174	256	AE		206	316	CE		238	356	EE	
143	217	8F		175	257	AF		207	317	CF		239	357	EF	
144	220	90		176	260	B0		208	320	D0	}	240	360	F0	0
145	221	91	j	177	261	B1		209	321	D1	J	241	361	F1	1
146	222	92	k	178	262	B2		210	322	D2	K	242	362	F2	2
147	223	93	l	179	263	B3		211	323	D3	L	243	363	F3	3
148	224	94	m	180	264	B4		212	324	D4	M	244	364	F4	4
149	225	95	n	181	265	B5		213	325	D5	N	245	365	F5	5
150	226	96	o	182	266	B6		214	326	D6	O	246	366	F6	6
151	227	97	p	183	267	B7		215	327	D7	P	247	367	F7	7
152	230	98	q	184	270	B8		216	330	D8	Q	248	370	F8	8
153	231	99	r	185	271	B9		217	331	D9	R	249	371	F9	9
154	232	9A	^	186	272	BA		218	332	DA		250	372	FA	
155	233	9B		187	273	BB		219	333	DB		251	373	FB	
156	234	9C		188	274	BC		220	334	DC		252	374	FC	
157	235	9D		189	275	BD	]	221	335	DD		253	375	FD	
158	236	9E		190	276	BE		222	336	DE		254	376	FE	
159	237	9F		191	277	BF		223	337	DF		255	377	FF	

APPENDIX C. ASCII to EBCDIC

Dec	Oct	Hex	EBCDIC	Dec	Dec	Oct	Hex	EBCDIC	Dec	Dec	Oct	Hex	EBCDIC	Dec	Dec	Oct	Hex	EBCDIC	Dec	Dec	Oct	Hex	EBCDIC	Dec
0	000	00	-	32	040	20	64	64	100	40	124	96	140	60	121									
1	001	01	-	33	041	21	90	65	101	41	193	97	141	61	129									
2	002	02	-	34	042	22	127	66	102	42	194	98	142	62	130									
3	003	03	-	35	043	23	123	67	103	43	195	99	143	63	131									
4	004	04	55	36	044	24	91	68	104	44	196	100	144	64	132									
5	005	05	45	37	045	25	108	69	105	45	197	101	145	65	133									
6	006	06	46	38	046	26	80	70	106	46	198	102	146	66	134									
7	007	07	47	39	047	27	125	71	107	47	199	103	147	67	135									
8	010	08	22	40	050	28	77	72	110	48	200	104	150	68	136									
9	011	09	5	41	051	29	93	73	111	49	201	105	151	69	137									
10	012	0A	37	42	052	2A	92	74	112	4A	209	106	152	6A	145									
11	013	0B	-	43	053	2B	78	75	113	4B	210	107	153	6B	146									
12	014	0C	-	44	054	2C	107	76	114	4C	211	108	154	6C	147									
13	015	0D	-	45	055	2D	96	77	115	4D	212	109	155	6D	148									
14	016	0E	-	46	056	2E	75	78	116	4E	213	110	156	6E	149									
15	017	0F	-	47	057	2F	97	79	117	4F	214	111	157	6F	150									
16	020	10	-	48	060	30	240	80	120	50	215	112	160	70	151									
17	021	11	-	49	061	31	241	81	121	51	216	113	161	71	152									
18	022	12	-	50	062	32	242	82	122	52	217	114	162	72	153									
19	023	13	-	51	063	33	243	83	123	53	226	115	163	73	162									
20	024	14	60	52	064	34	244	84	124	54	227	116	164	74	163									
21	025	15	61	53	065	35	245	85	125	55	228	117	165	75	164									
22	026	16	50	54	066	36	246	86	126	56	229	118	166	76	165									
23	027	17	38	55	067	37	247	87	127	57	230	119	167	77	166									
24	030	18	-	56	070	38	248	88	130	58	231	120	170	78	167									
25	031	19	-	57	071	39	249	89	131	59	232	121	171	79	168									
26	032	1A	63	58	072	3A	122	90	132	5A	233	122	172	7A	169									
27	033	1B	39	59	073	3B	94	91	133	5B	173	123	173	7B	169									
28	034	1C	-	60	074	3C	76	92	134	5C	224	124	174	7C	106									
29	035	1D	-	61	075	3D	126	93	135	5D	189	125	175	7D	208									
30	036	1E	-	62	076	3E	110	94	136	5E	95	126	176	7E	161									
31	037	1F	-	63	077	3F	111	95	137	5F	109	127	177	7F	7									
128	200	80	32	160	240	A0	65	192	300	C0	118	224	340	E0	184									
129	201	81	33	161	241	A1	66	193	301	C1	119	225	341	E1	185									
130	202	82	34	162	242	A2	67	194	302	C2	120	226	342	E2	186									
131	203	83	35	163	243	A3	68	195	303	C3	128	227	343	E3	187									
132	204	84	36	164	244	A4	69	196	304	C4	138	228	344	E4	188									
133	205	85	21	165	245	A5	70	197	305	C5	139	229	345	E5	79									
134	206	86	6	166	246	A6	71	198	306	C6	140	230	346	E6	190									
135	207	87	23	167	247	A7	72	199	307	C7	141	231	347	E7	191									
136	210	88	40	168	250	A8	73	200	310	C8	142	232	350	E8	202									
137	211	89	41	169	251	A9	81	201	311	C9	143	233	351	E9	203									
138	212	8A	42	170	252	AA	82	202	312	CA	144	234	352	EA	204									
139	213	8B	43	171	253	AB	83	203	313	CB	154	235	353	EB	205									
140	214	8C	44	172	254	AC	84	204	314	CC	155	236	354	EC	206									
141	215	8D	9	173	255	AD	85	205	315	CD	156	237	355	ED	207									
142	216	8E	10	174	256	AE	86	206	316	CE	157	238	356	EE	218									
143	217	8F	27	175	257	AF	87	207	317	CF	158	239	357	EF	219									
144	220	90	48	176	260	B0	88	208	320	D0	159	240	360	F0	220									
145	221	91	49	177	261	B1	89	209	321	D1	160	241	361	F1	221									
146	222	92	26	178	262	B2	98	210	322	D2	170	242	362	F2	222									
147	223	93	51	179	263	B3	99	211	323	D3	171	243	363	F3	223									
148	224	94	52	180	264	B4	100	212	324	D4	172	244	364	F4	234									
149	225	95	53	181	265	B5	101	213	325	D5	74	245	365	F5	235									
150	226	96	54	182	266	B6	102	214	326	D6	174	246	366	F6	236									
151	227	97	8	183	267	B7	103	215	327	D7	175	247	367	F7	237									
152	230	98	56	184	270	B8	104	216	330	D8	176	248	370	F8	238									
153	231	99	59	185	271	B9	105	217	331	D9	177	249	371	F9	239									
154	232	9A	60	186	272	BA	112	218	332	DA	178	250	372	FA	-									
155	233	9B	61	187	273	BB	113	219	333	DB	179	251	373	FB	-									
156	234	9C	4	188	274	BC	114	220	334	DC	180	252	374	FC	-									
157	235	9D	20	189	275	BD	115	221	335	DD	181	253	375	FD	-									
158	236	9E	62	190	276	BE	116	222	336	DE	182	254	376	FE	-									
159	237	9F	225	191	277	BF	117	223	337	DF	183	255	377	FF	-									

► **Note:** - indicates straight-thru (same on both)

APPENDIX D. EBCDIC to ASCII

Dec	Oct	Hex	ASCII	Dec	Dec	Oct	Hex	ASCII	Dec	Dec	Oct	Hex	ASCII	Dec	Dec	Oct	Hex	ASCII	Dec	Dec	Oct	Hex	ASCII	Dec															
0	000	00	-	32	040	20	-	128	64	100	40	-	32	96	140	60	-	45	129	001	01	-	129	65	101	41	-	160	97	141	61	-	47						
1	001	01	-	33	041	21	-	129	66	102	42	-	161	98	142	62	-	178	130	002	02	-	130	67	103	43	-	162	99	143	63	-	179						
2	002	02	-	34	042	22	-	130	68	104	44	-	163	100	144	64	-	180	131	003	03	-	131	69	105	45	-	164	101	145	65	-	181						
3	003	03	-	35	043	23	-	131	70	106	46	-	165	102	146	66	-	182	132	004	04	156	36	044	24	-	132	71	107	47	-	166	103	147	67	-	183		
4	004	04	156	36	044	24	-	132	72	110	48	-	167	104	150	68	-	184	133	005	05	9	37	045	25	-	133	73	111	49	-	168	105	151	69	-	185		
5	005	05	9	37	045	25	-	133	74	112	4A	-	213	106	152	6A	-	124	134	006	06	134	38	046	26	-	134	75	113	4B	-	169	107	153	6B	-	186		
6	006	06	134	38	046	26	-	134	76	114	4C	-	60	108	154	6C	-	37	135	007	07	127	39	047	27	-	135	77	115	4D	-	170	109	155	6D	-	187		
7	007	07	127	39	047	27	-	135	78	116	4E	-	43	110	156	6E	-	62	136	008	08	151	40	050	28	-	136	79	117	4F	-	229	111	157	6F	-	188		
8	010	08	151	40	050	28	-	136	80	120	50	-	38	112	160	70	-	186	137	011	09	141	41	051	29	-	137	81	121	51	-	169	113	161	71	-	187		
9	011	09	141	41	051	29	-	137	82	122	52	-	170	114	162	72	-	188	138	012	0A	142	42	052	2A	-	138	83	123	53	-	171	115	163	73	-	189		
10	012	0A	142	42	052	2A	-	138	84	124	54	-	172	116	164	74	-	190	139	013	0B	-	43	053	2B	-	139	85	125	55	-	173	117	165	75	-	191		
11	013	0B	-	43	053	2B	-	139	86	126	56	-	174	118	166	76	-	192	140	014	0C	-	44	054	2C	-	140	87	127	57	-	175	119	167	77	-	193		
12	014	0C	-	44	054	2C	-	140	88	130	58	-	176	120	170	78	-	194	141	015	0D	-	45	055	2D	-	141	89	131	59	-	177	121	171	79	-	196		
13	015	0D	-	45	055	2D	-	141	90	132	5A	-	33	122	172	7A	-	58	142	016	0E	-	46	056	2E	-	142	91	133	5B	-	36	123	173	7B	-	35		
14	016	0E	-	46	056	2E	-	142	92	134	5C	-	42	124	174	7C	-	64	143	017	0F	-	47	057	2F	-	143	93	135	5D	-	41	125	175	7D	-	39		
15	017	0F	-	47	057	2F	-	143	94	136	5E	-	59	126	176	7E	-	61	144	020	10	-	48	060	30	-	144	95	137	5F	-	94	127	177	7F	-	34		
16	020	10	-	48	060	30	-	144	96	138	60	-	60	108	154	6C	-	37	145	021	11	-	49	061	31	-	145	97	139	61	-	95	129	179	-	-			
17	021	11	-	49	061	31	-	145	98	140	62	-	62	110	156	6E	-	62	146	022	12	-	50	062	32	-	146	99	141	63	-	96	130	180	-	-			
18	022	12	-	50	062	32	-	146	100	144	64	-	64	101	145	65	-	181	147	023	13	-	51	063	33	-	147	102	146	66	-	98	142	62	-	178			
19	023	13	-	51	063	33	-	147	103	147	67	-	66	103	147	67	-	183	148	024	14	157	52	064	34	-	148	104	148	68	-	99	143	63	-	179			
20	024	14	157	52	064	34	-	148	105	151	69	-	68	104	148	68	-	180	149	025	15	133	53	065	35	-	149	106	152	6A	-	124	106	152	6A	-	124		
21	025	15	133	53	065	35	-	149	107	153	6B	-	44	107	153	6B	-	44	150	026	16	8	54	066	36	-	150	108	154	6C	-	37	108	154	6C	-	37		
22	026	16	8	54	066	36	-	150	109	155	6D	-	95	109	155	6D	-	95	151	027	17	135	55	067	37	-	151	110	156	6E	-	62	110	156	6E	-	62		
23	027	17	135	55	067	37	-	151	111	157	6F	-	63	111	157	6F	-	63	152	031	19	-	56	070	38	-	152	112	160	70	-	186	112	160	70	-	186		
24	030	18	-	56	070	38	-	152	113	161	71	-	187	113	161	71	-	187	153	032	1A	146	57	071	39	-	153	114	162	72	-	188	114	162	72	-	188		
25	031	19	-	57	071	39	-	153	115	163	73	-	189	115	163	73	-	189	154	033	1B	143	58	072	3A	-	154	116	164	74	-	190	116	164	74	-	190		
26	032	1A	146	58	072	3A	-	154	117	165	75	-	191	117	165	75	-	191	155	034	1C	-	60	074	3C	-	155	118	166	76	-	192	118	166	76	-	192		
27	033	1B	143	59	073	3B	-	155	119	167	77	-	193	119	167	77	-	193	156	035	1D	-	61	075	3D	-	156	120	170	78	-	194	119	167	77	-	193		
28	034	1C	-	60	074	3C	-	156	121	171	79	-	96	121	171	79	-	96	157	036	1E	-	62	076	3E	-	157	122	172	7A	-	58	122	172	7A	-	58		
29	035	1D	-	61	075	3D	-	157	123	173	7B	-	35	123	173	7B	-	35	158	037	1F	-	63	077	3F	-	158	124	174	7C	-	64	124	174	7C	-	64		
30	036	1E	-	62	076	3E	-	158	125	175	7D	-	39	125	175	7D	-	39	159	037	1F	-	63	077	3F	-	159	126	176	7E	-	61	126	176	7E	-	61		
31	037	1F	-	63	077	3F	-	159	127	177	7F	-	34	127	177	7F	-	34																					
128	200	80	195	160	240	A0	-	209	192	300	C0	-	123	224	340	E0	-	92	129	201	81	97	161	241	A1	-	126	193	301	C1	-	65	225	341	E1	-	159		
129	201	81	97	161	241	A1	-	126	194	302	C2	-	66	226	342	E2	-	83	130	202	82	98	162	242	A2	-	115	195	303	C3	-	67	227	343	E3	-	84		
130	202	82	98	162	242	A2	-	115	196	304	C4	-	68	228	344	E4	-	85	131	203	83	99	163	243	A3	-	116	197	305	C5	-	69	229	345	E5	-	86		
131	203	83	99	163	243	A3	-	116	198	306	C6	-	70	230	346	E6	-	87	132	204	84	100	164	244	A4	-	117	199	307	C7	-	71	231	347	E7	-	88		
132	204	84	100	164	244	A4	-	117	200	310	C8	-	72	232	350	E8	-	89	133	205	85	101	165	245	A5	-	118	201	311	C9	-	73	233	351	E9	-	90		
133	205	85	101	165	245	A5	-	118	202	312	CA	-	232	234	352	EA	-	244	134	206	86	102	166	246	A6	-	119	203	313	CB	-	233	235	353	EB	-	245		
134	206	86	102	166	246	A6	-	119	204	314	CC	-	234	236	354	EC	-	246	135	207	87	103	167	247	A7	-	120	205	315	CD	-	235	237	355	ED	-	247		
135	207	87	103	167	247	A7	-	120	206	316	CE	-	236	238	356	EE	-	248	136	210	88	104	168	250	A8	-	121	207	317	CF	-	237	239	357	EF	-	249		
136	210	88	104	168	250	A8	-	121	208	320	D0	-	125	240	360	F0	-	48	137	211	89	105	169	251	A9	-	122	209	321	D1	-	74	241	361	F1	-	49		
137	211	89	105	169	251	A9	-	122	210	322	D2	-	75	242	362	F2	-	50	138	212	8A	196	170	252	AA	-	210	211	323	D3	-	76	243	363	F3	-	51		
138	212	8A	196	170	252	AA	-	210	212	324	D4	-	77	244	364	F4	-	52	139	213	8B	197	171	253	AB	-	211	213	325	D5	-	78	245	365	F5	-	53		
139	213	8B	197	171	253	AB	-	211	214	326	D6	-	79	246	366	F6	-	54	140	214	8C	198	172	254	AC	-	212	215	327	D7	-	80	247	367	F7	-	55		
140	214	8C	198	172	254	AC	-	212	216	330	D8	-	81	248	370	F8	-	56	141	215	8D	199	173	255	AD	-	213	217	331	D9	-	82	249	371					

APPENDIX E. EXCEPTION STATUS CODES

Following is a list of Exception Status codes along with the File Status that will be set, if appropriate. If two File Status values are given, the first is with ANSI COBOL 74 and the second is with ANSI COBOL 85; if only one is given, both return the same value.

On Windows, errors 1 - 31 map directly to Exception Status 1 - 31, while errors 32 - 92 map to Exception Status 288 - 347, i.e., add 256 to Microsoft errors greater than 31.

On Linux, errno maps to an Exception Status as documented in the second part of this table.

Exception Status	74 File Status	85 File Status	Message
1	30		Invalid operation
2	91	35	File not found
3	96		Path not found
4	91		No more handles available
5	92	37	Access denied
6	92		Invalid handle
7	30		Memory control blocks bad
8	30		Insufficient memory
9	30		Invalid memory control block address
10	30		Invalid environment
11	30		Invalid format
12	30		Invalid access code
13	30		Invalid data
14	30		Insufficient memory to complete this operation
15	96		Invalid drive specifier
16	92		Attempt to remove current directory
17	91		Not the same device
18	91		No more files
19	30	37	Write protected disk
20	30		Unknown hardware unit
21	30		Drive is not ready
22	30		Unknown hardware command
23	30		CRC error in data
24	30		Hardware drive request is bad
25	30		Disk seek error
26	30		Unknown disk media type
27	30		Sector not found
28	30		Printer out of paper
29	30		Write fault
30	30		Read fault
31	30		General failure
32	94		The file already exists
33	94		The file is exclusively opened
34	34		The filesize is too big
35	94	41	Attempt to exclusively open an open file
36	91		The filename is not valid
37	10		End of file
38	98	24	Invalid relative key
39	34		Out of (disk) space
40	91	34	Readline argument is too long
41	91	41	Attempt to open an open file
42	91	42	Attempt to close a closed file
43	92	38	Attempt to open a locked file
44	99		Printer control file is full
45	92		Invalid operation for open mode
46	92		Handle is not open
47	94		Attempt to delete an open file
48	92	34	Record area size too small for record
49	92	44	Record size mismatch on rewrite
50	9A	39	Record too long
51	9A	39	Too many keys requested
52	9A	39	Invalid key packet length
53	9A	39	Key is too long

APPENDIX E (Exception Status Codes)

Exception Status	74 File Status	85 File Status	Message
54	9A	39	Invalid key definition (not in record)
55	9A	39	Record size mismatch on open
56	9A	39	Number of keys mismatch on open
57	9A	39	Key size mismatch on open
58	9A	39	Key offset mismatch on open
59	9A		.NX file version is not valid
60	9A		.XD file version is not valid
61	9E		Out of record locks
62	94		Record is locked
63	23	46	Invalid current record pointer
64	23		Record is deleted
65	22		Record is not deleted
66	21		Not rewriting the current record
67	23		Key not found
68	22		Attempt to write a duplicate key
69	24		.NX file B-tree is full (node depth or full node)
70	21		Not writing in ascending order
71	9B		The .NX file is corrupt
72	9B		The .XD file is corrupt
73	9F		Reliability flag indicates .NX file is corrupt
74	9F		Reliability flag indicates .XD file is corrupt
75	94		Attempt to rename an open file
76	9T		Device timeout
77	30		Device I/O error
78	30		Printer is offline
79	30		Printer is out of paper
80	30		I/O operation aborted by console interrupt
81	91		Device is not available or does not exist
82	9B		The file format is not valid
83	9B		The file does not have the correct revision
84	9B		Record size is zero
85	9B		Record position is too small
86	9B		Record position is not aligned
87	9B		Record position is too big
88	9B		Record position is past EOF
89	9B		Node block number is not zero
90	9B		Node block number is zero
91	9B		Node block number is too big
92	9B		Duplicates are permitted
93	9B		Duplicates are not permitted
94	9B		Key size is zero
95	9B		Node block number is past EOF
96	9B		.XD file size is too small
97	9B		.NX file size is too small
98	9B		Key entry is deleted
99	9B		Record position does not match
100	9B		File version does not match
101	9B		Node block number is inconsistent
102	9B		Node entry count is zero
103	9B		Node entry count is too big
104	9B		Node entry count is the maximum
105	9B		Node level is inconsistent
106	9B		Node key number is inconsistent
107	9B		Node leaf indicator is inconsistent
108	9B		Position is not aligned on a node boundary
109	9B		Relative key value is inconsistent
110	9B		key value is inconsistent
111	00		Reliability flag(s) have been cleared
112	9B		Internal error - invalid use of buffer manager
113	9B		Attempt to release buffer not in use
114	9B		No buffers were available
115	9B		Attempt to destroy buffer still in use
116	9B		The object definition is in use (internal error)
117	97		No more files may be OPENED
118	97		No more OPEN resources are available
119	97		No more SEQUENTIAL files may be OPENed

Exception Status	74 File Status	85 File Status	Message
120	97		No more RELATIVE files may be OPENed
121	97		No more INDEXED files may be OPENed
122	30		Data Carrier Detect (DCD) has been lost
123	30		Requested object definition is not registered (internal error)
124	30		The path does not specify a directory
125	30		I/O aborted by WATCH interrupt
126	30		The terminal has too few lines to WATCH the selected terminal
127	30		The object does not match the expected object type (internal error)
128	30		Console interrupts are disabled
129	30		Aborted by DUMP interrupt
130	97		Object handle or indexd entry is NULL (internal error)
131	9B		No data is available
132	9A		Named item is the wrong type to perform this operation
133	91		The parameter string is not valid for this object
134	91		File's standard header information is bad (.ini)
135	97		Not enough resources to complete request
136	30		Internal system error
137	30		Invalid argument to system call
138	92		File or device must be on the same node or volume
139	02		A duplicate key value has been written
140	02		A duplicate key value has been read
141	30	9B	File standard header is not valid
142	30	9B	File standard header checksum is bad
143	30	9B	File type does not match required type
144	30	9B	File header length, offset, or checksum is bad
145	30	9B	File has wrong byte order
146	9A	39	Key with duplicates specification does not match
147	9A	39	ICISAM file format does not match
148	9A	39	ICISAM file version does not match
149	92	39	The .NX and .XD files are not properly paired
150	9A	39	Delete-is-physical mismatch on open
151	9A	39	Key null value suppression mismatch on open
152	9A	39	Key uppercase conversion specification does not match
153	00	05	File was created
154	00	05	The optional file was not available
155	92	47	Invalid operation for file without input access
156	92	48	Invalid operation for file without output access
157	92	49	Invalid operation for file without I-O access
158	92	43	DELETE or REWRITE not preceded by a successful READ
159	9B		The header information from the .XD and .NX file is not consistent
160	30		A Sort or Merge operation is already active
161	92	10	Optional file was unavailable for sequential READ
162	92	23	Optional file was unavailable for random READ or START
163	30	14	The relative key value exceeds the size of the relative key on READ
164	30	24	The relative key value exceeds the size of the relative key on WRITE
165	9B		Position is not aligned on a shared page boundary
166	22		Attempt to modify an unmodifiable key
167	94		Attempt to rewrite a record which has been modified since it was read
168	94		Attempt to perform an operation which would lead to a deadlock situation
169	9B		Invalid record length value in record header
170	9A	39	Too many key occurs requested
171	9A	39	Too many key suffixes requested
172	9A	39	Too many key also requested
173	9A	39	Key occurs/also specification does not match
174	9A	39	Key occurs/also count does not match
175	9A	39	Key occurs span specification does not match
176	9A	39	Key suffix count specification does not match
177	9A	39	Key reverse order specification does not match
178	30		The .XL and .XD files are not properly paired
179	30		The .XL operation is not in sequence
180	30		Invalid combination of network options
181	30		An invalid or corrupted network packet was received
182	30		Data value is not a valid data-type-vale
183	30		Data does not fit in the data area provided
184	9A	39	4GB maximum file size specification does not match
185	92	44	Record size specified exceeds the maximum or is less than the minimum

APPENDIX E (Exception Status Codes)

Exception Status	74 File Status	85 File Status	Message
186	30		*ERROR:
187	30		Conversion error (index register overflow)
188	30		An index is out of range
189	30		The perform count is too large
190	30		The perform stack has overflowed
191	30		Fatal I/O error
192	04		Length of record does not conform to that specified for the file
193	30		The program was terminated by a console interrupt
194	30		**stop run**
195	30		Fatal Runtime System Error
196	30		Fatal Runtime System Error: invalid operation code
197	30		The system is ready. Press Newline to begin LOGON
198	30		The system is currently unavailable
199	30		The program was terminated by another console
200	30		The program is too big
202	30		The program file is not valid
203	30		The program was not found
207	30		The program is already active
208	30		Attempt to call too many programs
209	30		Parameter mismatch in call
212			No more programs are available
213			The program file could not be loaded
215			The program had been disabled
216			I/O aborted by Wakeup Interrupt
219			Invalid task number
220			There are no more entries in the table
221			This operation is not permitted
222			The item is currently in use
223			The item was removed
224			The requested page is not in the file
225			The operation was cancelled by the user
228			The terminal is not logged on
229			The terminal is not configured into the system
230			The configuration file is not valid
231			Unsupported feature for the current terminal
233			The user has not been granted the requested logon type at this computer
234			The abort request was sent to terminal
235			The message was sent to terminal
236			The maximum number of users are already running
237			The option is not a valid option
238			Shared Library load error (no more information available)
239			Process initialization error
240			The option requires an argument
241			The argument is too long to process
242			There are no more options to process
243			Out of processes, system resources, or no data available
244			Shared memory initialization error
245			Shared area revision does not match
246			The shared area is not ready for use
247			Semaphore initialization error
248			No more processes can be run
249			Username:
250			ICEXEC is required
251			Process termination (Quit/Logoff)
252			Program not authorized
253			Process termination (Modem Hangup)
254			The process was terminated by a global timeout
255			Process Termination (Shutdown)
256			Super user privileges required

Exception Status	74 File Status	85 File Status	Message
257			Detaching from login session
258			Detached from login session
259			Icexec was abnormally terminated
260			The (.ini) file section was not found
261			Insufficient memory for Device Control Tables
262			Unable to initialize standard input file
263			Unable to initialize standard output file
264			Unable to initialize standard error file
265			Locking Open/Close
266			Unkown terminal type from terminfo
267			Terminal description keyboard table
268			Unsupported terminal types
269			Screen Control Area
270			Too many directories in path
271			Insufficient memory for pathlist
272			Too many libraries
273			The environment argument is not valid
274			The following environment argument was not provided
276			The PDF writing facility is not available
277			The requested PDF format descriptor is not configured or not enabled
278			The required network packet format revision is not supported
279			The required network command revision level is not supported
280			The required form for PDF writing had errors
281			The background form uses features that are not implemented yet
282			The background form reader encountered unexpected errors with the file format
283			The background form has attribute values that are not supported
284			The IC2X option is needed to run this program
285			The PDF writing facility cannot specify a remote filename
286			The path list only allows directories
287			The path list only allows directories and non-empty libraries
288	92		Sharing violation
289	94		Lock violation
290	30		Invalid disk change
291	30		FCB unavailable
292	30		Sharing buffer overflow
294	30		Out of Input
295	34		Insufficient disk space
306	30		Network request not supported
307	30		Remote computer not listed
308	30		Duplicate name on network
309	30		Network name not found
310	30		Network busy
311	30		Network device no longer exists
312	30		Net BIOS command limit exceeded
313	30		Network adapter hardware error
314	30		Incorrect response from network
315	30		Unexpected network error
316	30		Incompatible remote adapter
317	30		Print queue full
318	30		Not enough space for print file
319	30		Print file was deleted
320	30		Network name deleted
321	92	37	Access denied
322	30		Network device type incorrect
323	30		Network name not found
324	30		Network name limit exceeded
325	30		Net BIOS session limit exceeded
326	30		Temporarily paused
327	30		Network request not accepted
328	30		Print or disk redirection is paused
334	30		Not logged in or Network name not valid

APPENDIX E (Exception Status Codes)

Exception Status	74 File Status	85 File Status	Message
336	94		File exists
337	30		
338	30		Cannot make directory entry
339	30		Fail on INT 24
340	30		Too many redirections
341	30		Duplicate redirection
342	30		Invalid password
343	30		Invalid parameter
344	30		Network data fault
345	30		The system cannot start another process at this time
346	30		Required system component not installed
365	30		Connection broken
378	30		The data area passed to the system call is too small
416			Record manager initialization failed
417			Record Manager is inactive
418			Record Manager interface is invalid
419			Record Manager does not implement the required capability
420			Record Manager returned a reserved status code
421			Record Manager returned a generic status code
422			Record Manager returned an undefined status code
432			The terminal is already being WATCHed
433			Cannot watch a pushed terminal
434			Cannot watch a watching terminal
435			A watched terminal cannot watch another
436			Cannot interrupt the terminal to watch
437			Watched terminal has logged off
438			Watched terminal has pushed to CLI. Press Interrupt to discontinue watching
439			Invalid operation for your own terminal
440			Watched terminal terminated itself with an error
441			Watched terminal terminated by interrupt
442			The process is defunct
443			The watched terminals program process has terminated
444			Cannot watch an SP2 or CGI server process
445			Client/server protocol packet or parameter mismatch
448			Operation would block
449			Operation now in progress
450			Operation already in progress
451			Socket operation on non-socket
452			Destination address required
453			Message too long
454			Protocol wrong type for socket
455			Protocol not available
456			Protocol not supported
457			Socket type not supported
458			Operation not supported on socket
459			Protocol family not supported
460			Address family not supported
461			Address already in use
462			Cannot assign requested address
463			Network is down
464			Network is unreachable
465			Network dropped connection on reset
466			Software caused connection abort
467			Connection reset by peer
468			Out of stream resources
469			Socket is already connected
470			Socket not connected
471			Cannot send after socket shutdown
472			Too many connection, cannot splice
473			Connection timed out
474			Connection refused

Exception Status	74 File Status	85 File Status	Message
475			Too many symbolic links in path
476			Filename too long
477			Host is down
478			No route to host
479			Host not found
481			No more stream resources are available
482			The user account already exists
483			The password is too short or fails some other restriction
484			This beta release expired
485			This beta release will run until
486			Open/close semaphore could not be created
487			Open/close setup failed
488			Buffer semaphore could not be created
489			Buffer setup failed
490			Record lock semaphore could not be created
491			Record lock setup failed
492			Logon/logoff semaphore could not be created
493			Logon/logoff setup failed
494			Open semaphore could not be deleted
495			Buffer semaphore could not be deleted
496			Record lock semaphore could not be deleted
497			Logon/logoff semaphore could not be deleted
500			ExitCode 0: Processing completed successfully
501			ExitCode 1: Processing occurred, but had errors
502			ExitCode 2: Processing occurred, but was interrupted or aborted
503			ExitCode 3: Processing occurred, but was halted by a fatal internal error
504			ExitCode 4: Processing failed because of command-line errors
505			ExitCode 5: Processing failed because of an authorization failure
506			ExitCode 6: Processing failed because of program initialization
507			ExitCode 7: Processing did not occur because command-line help was requested
508			ExitCode 8: Processing did not occur because a command-line status request ran
509			ExitCode 9: reserver
510			Unimplemented operating system function
511			Unexpected operating system error

Following is a mapping of Linux errors (errno) to Exception Status codes.

E2BIG	241	EINVAL	137	ENOTCONN	470
EACCES	5	EIO	77	ENOTDIR	3
EADDRINUSE	461	EISCONN	469	ENOTSOCK	451
EADDRNOTAVAIL	462	EISDIR	5	ENOTTY	5
EADV	315	ELBIN	315	ENOTUNIQ	308
EAFNOSUPPORT	460	ELOOP	475	ENXIO	81
EAGAIN	243	EMFILE	4	EOPNOTSUPP	457
EALREADY	315	EMLINK	340	EOVERFLOW	136
EBADF	6	EMSGSIZE	453	EPERM	5
EBADFD	6	EMULTIHOP	340	EPFNOSUPPORT	459
EBADMSG	344	ENAMETOOLON	476	EPIPE	122
EBUSY	33	ENETDOWN	463	EPROTO	314
ECHILD	1	ENETRESET	465	EPROTONOSUPPORT	456
ECHRNG	6	ENETUNREACH	464	EPROTOTYPE	454
ECOMM	313	ENFILE	18	ERANGE	136
ECONNABORTED	466	ENOBUFS	468	EREMCHG	320
ECONNREFUSED	474	ENODATA	131	EREMOTE	138
ECONNRESET	467	ENODEV	81	EROFS	29
EDEADLK	168	ENOENT	2	ESHUTDOWN	471
EDEADLOCK	168	ENOEXEC	137	ESOCKTNOSUPPORT	457
EDESTADDRREQ	452	ENOLCK	61	ESPIPE	25
EDOM	137	ENOLINK	311	ESRCH	219
EDOTDOT	315	ENOMEM	8	ESRMNT	315
EDQUOT	295	ENOMSG	131	ETIME	76
EEXIST	32	ENONET	307	ETIMEDOUT	473
EFAULT	9	ENOPKG	346	ETOOMANYREFS	472
EFBIG	34	ENOPROTOPT	455	ETXTBSY	5
EHOSTDOWN	477	ENOSPC	39	EWOULDLOCK	448
EHOSTUNREACH	478	ENOSR	4	EXDEV	17
EIDRM	223	ENOSTR	5		
EINPROGRESS	315	ENOSYS	511		
EINTR	80	ENOTBLK	11		

any errno not listed generates a 511

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