



Upgrading to Micro Focus Enterprise Developer 3.0 for Eclipse

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Contents

Upgrading to Enterprise Developer for Eclipse	4
Licensing Changes	4
Resolving conflicts between reserved keywords and data item names	4
Importing Existing COBOL Code into Enterprise Developer	5
Recompile all source code	6
Upgrading from Mainframe Express to Enterprise Developer	6
What is Enterprise Developer	6
Advantages to upgrading to Enterprise Developer	8
Approaches to upgrading your applications	9
Considerations when upgrading to Enterprise Developer	9
How to upgrade an application created with Mainframe Express to Enterprise Developer	10
Further Information and Assistance	13
Upgrading from Studio Enterprise Edition (Windows)	22
Upgrading from Server Express and Studio Enterprise Edition (UNIX)	22
Advantages of Upgrading to Enterprise Developer	23
Upgrading Your COBOL Application	23
Best Practice in Development Using Eclipse	28
Modernize Your Applications and Processes	29
Differences between Enterprise Developer and Net Express, Server Express and Mainframe Express	29
Summary of Differences	30
Backward Compatibility with Earlier Micro Focus Products	33
Compiling and Building Differences	40
Run-time System Differences	44
Restrictions and Unsupported Features	44
Run-Time Technology Differences	45
Editing and Debugging Differences	46
Tips: Eclipse IDE Equivalent to IDE Features in Earlier Products	47
Upgrading from ACUCOBOL-GT	50
Compatibility with ACUCOBOL-GT	50
Upgrading from RM/COBOL®	106
Compatibility with RM/COBOL	106
Procedural COBOL Compared with Managed COBOL	215
Customer Feedback	216
Copyright and Disclaimer	216

Upgrading to Enterprise Developer for Eclipse

This guide provides information on upgrading applications from earlier Micro Focus mainframe development environments to Enterprise Developer for Eclipse. It highlights the differences between the old and new products, and offers solutions on how to keep your application working in the same way as before. The guide also introduces the new concepts and features of the Integrated Development Environment.



Note:

- This documentation uses the name Enterprise Developer to refer to Enterprise Developer for Visual Studio and Enterprise Developer for Eclipse. The full product names are used only when it is necessary to differentiate between the two products.

Benefits of Upgrading

You get a number of important benefits by upgrading to Enterprise Developer from earlier Micro Focus development systems or other COBOL systems.

Enterprise Developer uses a proven industry Integrated Development Environment that supports thousands of clients for developing and deploying critical business applications. Enterprise Developer enables unified, collaborative, and cost-effective development through rich, industry-standard tooling and at the same time it helps minimize skills shortages, expands market reach and accelerates time-to-delivery to meet today's agile business requirements.

Licensing Changes

For a number of years Micro Focus used the Micro Focus License Management System on Windows and Micro Focus License System Administration on UNIX for Net Express and Server Express.

Micro Focus now uses a standard industry technology for license management, Sentinel RMS from SafeNet. New product releases use Sentinel RMS, as do updates to existing products.

For more on the Micro Focus License Administration tool, see *Managing Licenses* in the Enterprise Developer help.

Resolving conflicts between reserved keywords and data item names

Micro Focus continues to enhance the COBOL language, for example, by expanding the list of reserved COBOL words and adding new keywords to it as part of new levels of the COBOL language. Each Micro Focus release corresponds to a particular level. You can use the MFLEVEL Compiler directive to enable Micro Focus-specific reserved words in your code and change the behavior of certain features to be compatible with a specific level of the language.

If you use Enterprise Developer to compile applications created with an older Micro Focus product, and these applications use data names that are now reserved keywords in Enterprise Developer, you receive a COBOL syntax error COBCH0666 ("Reserved word used as data name or unknown data description qualifier"). To work around this issue and continue using some of the reserved words as data names in your source code, you can either:

- use the REMOVE Compiler directive to remove individual keywords from the reserved words list
- set the MFLEVEL Compiler directive to a lower level which corresponds to the level your applications are at (see the information about MFLEVEL of some Micro Focus products further down this section). This removes all reserved keywords which have been added for levels above that level from the reserved words list.

You can set both directives from the command line, in your source code, or in the **Additional Directives** field in the project's COBOL properties.

Setting directives from the command line

To use REMOVE from an Enterprise Developer command prompt, type the following:

```
cobol myprogram.cbl remove(title) ;
```

The command above removes TITLE as a keyword from the language so you can use it as an identifier in a COBOL program.

To use the set of reserved words that was used for Net Express v5.1 WrapPack 5, use this command line:

```
cobol myprogram.cbl mflevel"15" ;
```

Setting directives in the source code

To set either one of the directives in your source code, type the following starting with \$ in the indication area of your COBOL program:

```
$set remove "ReservedWord"
```

Or:

```
$set mflevel"nn"
```

Setting directives in the IDE

To set either one of the directives in the project's properties:

1. In the IDE, click **Project > Properties > Micro Focus > Project Settings > COBOL**.
2. Type MFLEVEL "nn" or REMOVE "ReservedWord" in the **Additional directives** field.
3. Click **Apply** and then **OK**.

Importing Existing COBOL Code into Enterprise Developer

You can open, edit, compile and debug individual COBOL files in Enterprise Developer or you can use the Net Express Project Import Wizard in Enterprise Developer that converts Net Express projects into Enterprise Developer projects and imports the COBOL source code into the IDE.

To load a file in the IDE

You can open your existing COBOL files in Enterprise Developer as standalone files and edit them without a project. Either double-click such a file in Windows Explorer or, in the IDE click **File > Open File** and browse to select the file and open it.

There is basic support in the IDE for editing, compiling and debugging of files that are not part of a project. To take advantage of all features that the IDE offers for compiling, editing and debugging, it is recommended to add the file to a project. The easiest way to add a standalone file to a project is to right-click in the editor, click **Create COBOL Project** and then specify your preferences for the new projects.

To import Net Express projects

The Net Express project format is not the same as the project format in Enterprise Developer for Eclipse so it is not possible to edit Net Express projects in Enterprise Developer directly.

You can use the Import and Convert Net Express Projects wizard to convert existing Net Express projects into Eclipse projects, and to import the COBOL source into the IDE. Click **File > Import > Micro Focus > Convert NetExpress Projects**. The wizard analyzes your Net Express project, converts it to the appropriate project type and sets Compiler directives as needed.

To import files into an existing project

In Eclipse, you import files into your project using **File > Import**. This automatically adds to the project all files from the project directory, the subdirectories and from any linked directories. To prevent a file from being compiled, right-click the file and click **Build Action > Ignore**.

To scan files and set Compiler directives

After importing your existing sources into a project in the new IDE, you need to set the required Compiler directives.

In Eclipse, to set Compiler directives on COBOL files, use the file properties, or the **Determine Directives** command from the context menu for the files in COBOL Explorer. This triggers file scanning and sets directives as specified in **Window > Preferences > Micro Focus > COBOL > Directives Determination**

Recompile all source code

Application executables that were compiled using earlier Micro Focus products must be recompiled from the sources using Enterprise Developer.

If you do not recompile, you may receive an error. The exact error depends on the operating system you are running. The error might be similar to this, on UNIX:

```
ld.so.1: rts32: fatal: libcobrts.so.2: open failed: No such file or directory
Killed
```

You can recompile from the IDE or the command line.

Upgrading from Mainframe Express to Enterprise Developer

What is Enterprise Developer

Micro Focus Enterprise Developer is specifically designed to upgrade the Micro Focus Mainframe Express product and provides a contemporary development environment for zEnterprise that enables you to modernize mainframe applications for deployment back on the mainframe or any of the z/Enterprise partitions. It provides for mainframe integration, workflow management and supports development and unit test environments.

Enterprise Developer is a powerful integrated development environment (IDE) that provides the ability to move development mainframe activities off the mainframe, providing agility, flexibility and direct access to new technologies and trends. It offers both Eclipse and Microsoft Visual Studio as standard IDEs, and in addition provides the development tools required to develop applications for deployment on platforms other than the mainframe.

Enterprise Developer supports COBOL, PL/I 1, IBM Assembler, CICS, IMS-TM, JCL, DB2, IMS-DB, z/OS file formats and the common batch utilities, including SORT. As a result of this compatibility, the day-to-day

analysis, edit, compile, and debug tasks - necessary to maintain and improve core online and batch applications -can all be undertaken on a Windows workstation. You can use a dedicated workstation or laptop for development and unit testing which means development and testing can be moved away from the mainframe.

Enterprise Developer is part of the Micro Focus Enterprise product set - a complete solution to help organizations through the mainframe modernization journey. It includes Enterprise Analyzer, Enterprise Test Server and Enterprise Server in addition to Enterprise Developer. Applications developed or updated using Enterprise Developer can then be fully tested under Enterprise Test Server before being deployed back to the mainframe.

Alternatively, Micro Focus Enterprise Server can be used to redistribute application workload by providing an alternative production platform off the mainframe.

Micro Focus Enterprise Developer revolutionizes the way mainframe development is performed.

Different versions of Enterprise Developer

The following Enterprise Developer options are available for either Visual Studio or Eclipse:

Micro Focus Enterprise Developer Connect	Enterprise Developer Connect is for customers looking to use modern and productive Eclipse-based tooling to develop mainframe applications directly on the mainframe. Close integration to mainframe configuration management systems and the ability to easily customize the Eclipse-based IDE to include mainframe-based tools and processes means developers can take full advantage of modern development tools without having to learn new development processes.
Micro Focus Enterprise Developer	Enterprise Developer is for customers looking to develop and modernize mainframe applications in a productive and modern Windows-based development environment, targeted for deployment onto an alternate server platform. Developers have the choice of either the Visual Studio or the Eclipse-based IDE and development and test tools are provided for all target environments currently supported by Micro Focus.
Micro Focus Enterprise Developer for z Systems	Enterprise Developer for z Systems gives customers the choice to develop directly on the mainframe or under Windows. Mainframe applications can be developed, maintained and modernized regardless of where they will be deployed, either back onto the mainframe or onto an alternative server environment. Support is provided for both the Visual Studio and Eclipse-based IDEs and for all the development and test tools for every target environment currently supported by Micro Focus - including z/Linux, AIX and x86 environments. Enterprise Developer for z Systems combines all the capabilities of Enterprise Developer Connect and Enterprise Developer. Full mainframe integration and the Application Workflow Manager are only available in the Eclipse-based IDE.

Enterprise Developer Connect

Enables you to develop mainframe applications directly on the mainframe. Close integration to mainframe configuration management systems and the ability to easily customize the Eclipse-based IDE to include mainframe-based tools and processes means developers can take full advantage of modern development tools without having to learn new development processes.

Enterprise Developer

Enables you to modernize mainframe applications and move them to an alternative platform. This option again uses either the Visual Studio or Eclipse-based IDE and supports development, local and remote debugging, and testing across all major supported open platforms.

Enterprise Developer for zEnterprise

Enables you to modernize applications for deployment anywhere on zEnterprise. It uses the Visual Studio or Eclipse-based IDE, mainframe integration and workflow management, and supports development and

testing on z/OS, z/Linux and AIX and x86 environments. Supports local and remote debugging, building and deploying applications across zEnterprise and includes the Application Workflow Modeling feature.

For more details about the product editions, see *Product Editions* at: <https://www.microfocus.com/products/enterprise/enterprise-developer.aspx>

Advantages to upgrading to Enterprise Developer

Micro Focus recognizes the investment that our mainframe clients have made in Mainframe Express - and the great working partnerships we have established as these products have evolved. It is these close working relationships that have formed the development and release of the new generation of mainframe development applications.

In Enterprise Developer we have created a product that represents the natural evolution of Mainframe Express: it's a seamless transition into the next generation of mainframe IDEs. It protects your existing investment and future-proofs your operation going forwards. Lapsed Mainframe Express users will quickly become converts - this is a feature-rich product with appeal right across the board.

Whatever your level of engagement with Mainframe Express, as an existing Micro Focus customer we developed Enterprise Developer to maximize the investment you have made in our technology and protect it moving forward.

Using the Enterprise Developer enhancements and modern IDEs have numerous advantages such as, among others:

Improved productivity

This is achieved through:

- Using the very latest IDE technology in a powerful integrated development environment
- Replicating mainframe environment on Windows; through easier sharing of development resources.
- Ready access to mainframe-based elements while removing unnecessary burden on the host.
- Fast and easy customization with major source control systems, integration with existing development lifecycle, and built-in extended IDE user interface for higher developer acceptance and productivity gains.
- Providing the tools to allow you to edit, compile, debug, execute and test applications on all supported Micro Focus UNIX and Linux environments including z/Linux, AIX, HP-UX etc. One development tool can now meet your development requirements today and in the future.
- Enabling cross-language application development which results in better quality and increased competitiveness.
- Full control of development activities directly on the mainframe through the Eclipse IDE to edit, execute, debug and unit test applications.
- Achieving faster time to market
- Using workstations to shorten the mainframe development and unit test cycles, and deliver new products and features faster.

Improved efficiency

Improve efficiency when performing day to day mainframe development activities on or off mainframe, enabling access to standard IDEs of choice, smart editor, instantaneous compilations, advanced test and debugging capabilities.

Address mainframe skills shortage

Using COBOL from within standard IDEs helps reduce the gap between the mainframe COBOL and Java or C# developers by providing a unifying, collaborative and dynamic development environment. Non-COBOL developers, can quickly and easily adapt to the COBOL language, and get up to speed in no time.

For a full list of the advantages of using Enterprise Developer, see [the Enterprise Developer data sheet and white papers on the Micro Focus Web site](#).

Approaches to upgrading your applications

There are different approaches to upgrading existing mainframe applications to Enterprise Developer in order to modernize them.

Starting over and rewriting your application in Enterprise Developer is not recommended as this means more costs, the need to do more testing and, potentially, incurs more risks.

You can keep the existing application intact and only create new front ends in Enterprise Developer that will interact with the application.

Or, and this might be the best approach and lower risk one in most situations, is to upgrade your applications and processes using incremental steps. In order to reduce the maintenance backlog and ensure that the applications have the flexibility and agility that the business needs. Using this approach:

- You upgrade your application one small step at a time, testing the change and planning for the next one on each phase.
- Start by only moving a small subset of the files in Enterprise Developer. This could mean only a small number of the people on your teams are involved with making the changes.
- Maintain the application using both Enterprise Developer and Mainframe Express.

Considerations when upgrading to Enterprise Developer

The following describes how you can move existing files and data from Mainframe Express to Enterprise Developer:

Sources

You copy the COBOL programs and copybooks in the Enterprise Developer project directory or, alternatively, from the Enterprise Developer you link to them in the original location where they are used by Mainframe Express.

Data

- Data files - you can reuse the .dat files in Enterprise Developer. There is a Data File Tools utility for editing data files.
- DB2
- IMS files - you can reuse the existing .dbd, .psb, and .mfs files after recompiling them in Enterprise Developer.
- XDB

Metadata

- Data catalog - you need to create a new catalog in Enterprise Developer.
- CICS resource definition files (dfhdrdat.*) - you can copy the existing files and use them in Enterprise Developer after performing a caspcupg to upgrade them.

Configuration

1. Regions - now available as instances of Enterprise Server which you need to create and configure.

Accessing the Mainframe

Enterprise Developer uses its own version of Mainframe Access OS/390 and z/OS Server that provides access to host resources for environments. A single installation of Mainframe Access can support all of these products, providing connectivity to any number of DB2, IMS, and CICS systems located anywhere in

an enterprise. It can also provide access to JES facilities, VSAM and non-VSAM data sets, and data controlled by external library management products such as Panvalet, Librarian and Endeavor. It includes the Drag and Drop utility, the Remote Job Step Execution (RJSE) facility for execution of one or more steps of a job on a remote z/OS host, Compare and Synchronization Monitor, and SourceConnect.

Enterprise Developer for Eclipse also provides a mainframe z/Server that provides the mainframe integration. You use the Remote Systems view to access the mainframe.

How to upgrade an application created with Mainframe Express to Enterprise Developer

The following provides an outline of the incremental approach to upgrading a Mainframe Express application to Enterprise Developer where you use both development products to maintain the application while gradually moving the sources to the new IDE.

1. Review your Mainframe Express application:

- Create an inventory of the sources it uses, the copybook dependencies, data files, SQL, JCL and IMS files, third party utilities, integrated preprocessors.
- Check what workgroups are used and what the workflow processes are, what repositories are used to store the sources, what the build scripts and command line parameters are, how the application accesses the mainframe.



Note: Use the MFECL command line utility of Mainframe Express to export the project details to an .xml file which will include all project details at a glance - files in use, workgroups, output and dependency folders, Compiler directives, project and file options. The command to use is:

```
mfecl /exportxml project-name.mvp [ xml-filename.xml ]
```

- Review the XML file to see what information it includes:

```
 2 <project name="bankdemo.MVP">
 3   <projectsettings>
83   <workgroups>
84     <level description="System">
94     <level description="Production">
101    <level description="Development">
118  </workgroups>
119  <component name="UDATECNV.MLC" type="source assembler">
125  <component name="UTWOSCMP.MLC" type="source assembler">
131  <component name="MBANK10.BMS" type="source bms">
139  <component name="MBANK20.BMS" type="source bms">
147  <component name="MBANK30.BMS" type="source bms">
155  <component name="MBANK40.BMS" type="source bms">
156    <folder location=".\\BMS\\MBANK40.BMS" type="source bms" />
157  </settings>
```

The file provides details about the project and file settings, as well as of the workgroup levels. You are going to use this information when you are configuring the new projects in Enterprise Developer.

- Analyze the strengths and weaknesses of your application in the Mainframe Express environment and to what extent it meets the business requirements. The application might be a good candidate for being modernized by upgrading it to Enterprise Developer.
2. Define a small selection of the source files of your Mainframe Express application that you will move across to Enterprise Developer as a start – this could be the files responsible for a single operation of the application.

See *Considerations* for whether the files need to be recompiled in the new environment.

3. Prepare your original application:

- Replace any hard-coded paths in your Mainframe Express project with concatenated ones – to do this, in Mainframe Express, click **Project > Convert Paths to Relative**.
- Backup the sources.

4. Create mainframe subsystem projects in Enterprise Developer.

In Visual Studio:

- a. Click **File > New**.
- b. Under COBOL, click **Native > Mainframe Subsystem Application**.
- c. Click **OK**.

To emulate workgrouping behavior in Visual Studio, you can create different projects in your solution that will represent each individual level in the workgroup. For each project, you need to specify the copybook paths that are for the respective workgroup level.

In Eclipse:

- a. Click **File > New > Mainframe COBOL Project**.

To emulate workgrouping behavior in Eclipse, you can use copybook projects that will define the copybook paths for each level, and you can add these projects as dependency projects to the ones for the source files. See *Emulating workgroups in Eclipse* in this guide.

5. Configure the projects in Enterprise Developer.

In Visual Studio, first turn off the automatic directive determination as you will be setting the directives manually:

- a. Click **Tools > Options > Micro Focus > Directives > COBOL**.
- b. Disable **Determine directives of files** and click **OK**.

Configure the project properties:

- a. Click **Project > YourProject Properties** and click the individual tabs to specify folder for the generated files and any other COBOL, IMS, JCL and CICS properties.

You need to set exactly the same project properties as the ones set for the MFE project as taken from the *xml-filename.xml* file.

In Eclipse, to specify project properties:

- Navigate to the project properties, expand Micro Focus and set the project properties as taken from the *xml-filename.xml* file.

6. Import the source files and establish a product baseline – use linking to add the files to the new projects in order to store the files in their original location:

In Visual Studio:

- a. Right-click your project in Solution Explorer, and click **Add > Existing Item**.
- b. Browse to the directory which stores the sources of your Mainframe Express application.
- c. Select the files to add, and click **Add As Link**.

This links the files to the project from within the original location and does not create copies of the files in the Enterprise Developer project directory.

In Eclipse:

- a. Right-click the project, and click **New > Folder** if you wish to add an entire folder, or **New > File**.
- b. Click **Advanced**, and click **Link to alternate location (Linked Folder)** or, respectively **Link to File in the file system**.
- c. Browse to the folder in your Mainframe Express project that includes the files you wish to add, select the folder or the file to add, and click **Finish**.

7. Set individual file properties:

- In Solution Explorer in Visual Studio, or in Eclipse, in COBOL Explorer, right-click a file in your project, and click **Properties**.
- Set individual file properties as taken from the `xml-filename.xml` file.

8. Compile the sources in Enterprise Developer.

In Visual Studio:

- Click **Build > Build Solution**. Check the **Output** window for the progress and the result of the build.

In Eclipse:

- By default, Eclipse performs a build automatically as you are adding the source files. Check the **Console** view to see if there are any errors.

9. Create and configure an enterprise server instance for the projects.

Check the `xml-filename.xml` file to see what regions the original application uses, and what its settings are.

10. Run the application.

- Run JCL applications by submitting the JCL file – right-click the JCL file in your project, and click **Submit JCL** (in Visual Studio) or **Submit to Enterprise Server** (Eclipse).

Use the Micro Focus Rumba emulator supplied with Enterprise Developer to connect to the enterprise server instance you have created. Run the application in Rumba.

11. Debug and perform thorough testing.

12. Configure MFA and the **Mainframe Explorer** window or the **Remote Systems** view.

13. Plan for rolling out Enterprise Developer project and servers to your development and QA teams. Also, organize relevant training for them.

- a. As a first step, ensure your project is configured as desired and that it builds successfully.
- b. Distribute the project:

With Visual Studio:

You can use Visual Studio to create customized templates with the desired set of options and the required source programs, and share these within your organization. Then, each user would be able to import the templates from a shared network location into their Visual Studio environments. See the Visual Studio help for more information on how to create, configure and distribute custom project templates.

With Eclipse:

In your workspace, copy the project folder with all the files. You can store this on a shared network location. Users need to import the existing project and sources locally in their workspaces.

Enterprise Server templates:

Create your own templates using the following command at an Enterprise Developer command prompt:

```
mfds -x [repository type] [repository address] [server name] <options>
<user id> <password>
```

Distribute the server .xml files across your development teams. The file should be saved in the `%ProgramFiles(x86)%\Micro Focus\Enterprise Developer\etc\ServerTemplates` subfolder in the local Enterprise Developer installation folders.

Further Information and Assistance

Tutorials

To get up-to-speed with using Enterprise Developer to edit and maintain your mainframe applications, check the Getting Started book in the help and, more specifically, the Mainframe tutorials. Start with the tutorial "Getting Started with Enterprise Developer" which provides basic understanding of how the product operates. Move on to the other tutorials which provide details about developing CICS, JCL and IMS applications.

Assistance

If you consider upgrading your development environment to Enterprise Developer, you can contact Micro Focus' Technical Services for assistance.

In addition, please note:

Functionality That Works Differently in Enterprise Developer

Some features of Mainframe Express work differently in Enterprise Developer or are superseded by features provided by the new IDE. The following list shows some of these differences:

Feature in Mainframe Express	Feature in Enterprise Developer
Analysis Option	Enterprise Developer offers integrated code analysis functionality.
AppMaster Builder (AMB) and Structured COBOL (S-COBOL) source code	AppMaster Builder is integrated into Enterprise Developer for Eclipse. The functionality is available when you install the Micro Focus AppMaster Builder AddPack. <i>See AppMaster Builder in Eclipse IDE vs. AppMaster Builder in Mainframe Express IDE.</i>
Automatic Catalog Import	Available through the MFA Drag and Drop interface as well as the option to catalog from the command line. Data connect functionality is being checked.
CICS resource definitions	You can reuse any existing CICS resource definitions in Enterprise Developer after performing a caspcupp operation. The cut-down resource definition (PCT, FCT, PPT) are not supported.
Command line utility (MFECL)	The equivalent to MFECL is not available in Enterprise Developer although command line options for much of the tooling is available. In addition you can use the standard facilities of the IDE. For example, in Visual Studio, you can use the MSBUILD utility to compile your sources, and PowerShell to manage solutions and projects. In Eclipse you can use Ant scripts to compile the code.
Easytrieve	Easytrieve is now available. Contact your Micro Focus SupportLine representative for more details.
Mainframe Express provided integrated support for Easytrieve through an add-on option which allowed Easytrieve applications to be edited, compiled and tested within the Mainframe Express IDE.	
Editor Autofix	The editor in Enterprise Developer includes an AutoCorrect feature. Other editor features that can help increase your productivity in writing code are Content Assist proposals and code templates.

Feature in Mainframe Express	Feature in Enterprise Developer
Interactive AMS	Not available.
IMS TM	<p>Enterprise Developer does not support the following IMS TM and communication features:</p> <ul style="list-style-type: none"> • The IMS Message exit • The IMS MFS Display exit • The Mainframe Express IMS to CICS LU6.2 Bridge. • IMS86ALT
<p>MAS SDK</p> <p>a collection of utilities to automatically compile downloaded source and provide reports on the outcome. These are part of Mainframe Express and Studio 6.0 (Net Express) and were developed for Windows.</p>	Not available.
MFA Server	A newer version of MFA Server is available with Enterprise Developer.
MFENTMAP, the Entry Point Mapping facility	Run-time system support for MFENTMAP is available and any existing configuration files will work.
Outline View	<p>Enterprise Developer for Visual Studio displays the copybook dependencies of projects within Solution Explorer.</p> <p>Enterprise Developer for Eclipse includes an Outline view that shows the program structure. Copybook dependencies are shown in the COBOL Explorer as well as in the Copybook Dependency view.</p>
PL/I	<p>PL/I application development is a fully supported within Enterprise Developer and PL/I applications are supported using CICS, IMS or JCL.</p> <p>The PL/I language (Micro Focus Open PL/I) is fully integrated into Eclipse and Visual Studio.</p>
Regions	Enterprise Developer provides support for full multi-tasking enterprise servers.
<p>Source code control systems</p> <p>Mainframe Express used the Microsoft Common Source Code Control (SCC) Interface to enable you to use the functions of a SCC-compliant source control manager with your IDE.</p>	<p>Enterprise Developer comes with an industry-standard integrated development environment (either Eclipse or Visual Studio) that provides access to any SCC tooling with the appropriate plug-in. For example:</p> <ul style="list-style-type: none"> • Enterprise Developer provides integration with <i>Micro Focus Enterprise Sync</i>, a change management system for mainframe development. • Enterprise Developer provides integration with Endeavor, a full function change control system for the mainframe with signout controls and extensive user customization. • In Visual Studio you can use the Visual Studio Team Foundation Server (TFS) plug-in or install VisualSVN in order to access sources from SVN. • A number of plugins are available for Eclipse that integrate the IDE with the version control system you are using - for example, subclipse for connecting to SVN, or eGIT for connecting to git.

Feature in Mainframe Express	Feature in Enterprise Developer
<p>Template projects</p>	<p>In Enterprise Developer you can create templates from both projects and regions and distribute them to your developers.</p> <p>With Enterprise Developer for Visual Studio, you can use the Visual Studio functionality to create custom project templates for COBOL applications. For more information, see the Visual Studio help.</p> <p>To distribute projects created with Enterprise Developer for Eclipse, you need to copy the project folder in the workspace with all of the contents. The users that are going to use that project need to import it in their workspace.</p> <p>Export and import commands for regions are available from Server Explorer inside the IDE.</p>
<p>Third party preprocessors</p>	<p>You can embed Third Party preprocessors in Enterprise Developer. The process involves creating registry entries similarly to how this was done in Mainframe Express.</p> <p>You can then enable the third party preprocessors in your projects's properties (on the Preprocessors tab in the properties of Visual Studio projects and in Micro Focus > Project Settings > COBOL > Additional Preprocessors for Eclipse projects). If a preprocessor is installed, select it from the drop-down list. Otherwise, check Use additional preprocessor and directives and use the PREPROCESS Compiler directive to refer to the preprocessor.</p> <p>Syntax checking is supported for ECMs and for COBSQL.</p>
<p>Time-Sharing Option (TSO)</p> <p>Mainframe Express supported the use of TSO commands, CLISTs and REXX execs, which could be run in TSO interactive (or foreground) sessions or in TSO batch (or background) sessions, using the IDAEFT01 (IKJEFF01) utility.</p>	<p>Enterprise Developer supports TSO batch (IKJEFTxx).</p> <p>You can emulate TSO interactive in Enterprise Developer for Eclipse. To do this, you need to use AWM to model an action calling a tool from the ISPF function package. This action would accept a REXX procedure or some CLIST plus parameters and execute them as a TSO batch job or online in the server.</p>
<p>WinRunner</p> <p>A screencapture utility that was supplied with some versions of Mainframe Express.</p>	<p>You can now use the products from the Micro Focus Silk portfolio.</p>
<p>Workgrouping</p>	<p>Workgrouping behavior can be emulated in Enterprise Developer for Eclipse through the use of dependency folders configuration and configuring the loadlib paths for Enterprise Server. See <i>Emulating workgroups in Eclipse</i>.</p>
<p>XDB tooling</p>	<p>The XDB tools are available from the Start menu group for Enterprise Developer or from the start screen (on some Windows versions).</p> <p>In Visual Studio, access the XDB tools from Tools > Options > SQL Option for DB2.</p> <p>In Eclipse, to access the XDB tools, click Run > Tools > SQL Option for DB2.</p> <p>To use XDB in your projects, set XDB as the precompiler in the projects' properties in order to view a list of the available XDB directives.</p>

Emulating workgroups in Eclipse

The following is an example of how you can set workgroup levels Enterprise Developer. There are numerous other ways in which the projects can be configured to work in this type of system. You can add a larger number of additional directories to each copybook project (either as relative paths to the workspace variable or as variables in their own right) which would allow for even more configurability.

Introduction

Enterprise Developer does not provide the Mainframe Express workgrouping mechanism out-of-the-box. It can be emulated, though.

There are a number of features in the Eclipse framework, many of them relating to how projects are created and operate together, which can help in creating a workgroup environment.

Using COBCPY

The Micro Focus Compiler uses the COBCPY environment variable to find all of the copybooks used in a program compilation. Setting up a workgrouping environment by setting COBCPY so that the IDE can inherit the settings has a few disadvantages.

- The IDE is not aware of any of the copybook locations used in the application which can lead to undefined behavior.
- The COBCPY path is typically of such a length that some of the tools cannot handle, which could lead to unexpected behavior.
- Each paths defined in COBCPY will always be searched during a when a compilation is performed. With Eclipse using a background parse to provide a number of key features, this can cause excessive delays in everyday operation. Though background parse can be switched off, this means you are not going to receive the instant feedback in the editor.

Using copybook projects

Another approach you can take to include copybooks is to use *copybook projects* to store your copybook directories. You can then add these projects as dependent projects to any other source projects which allows the IDE to identify the copybooks for build operations.

As you can add multiple paths to each copybook project, each one of these projects can then represent a "level" in the workgroup hierarchy. Multiple copybook projects can then be used to represent the set of levels in a potential workgrouping environment. There are many ways in which the final organisation can be arranged; the important thing is that the IDE 'knows' about the files to be used for compilation.

The following sections show how you can recreate the various workgroup levels and use copybook projects to manage the levels.

Creating folders for the workgroup levels

In your workspace, create folders that will represent your workgroup levels. For example:

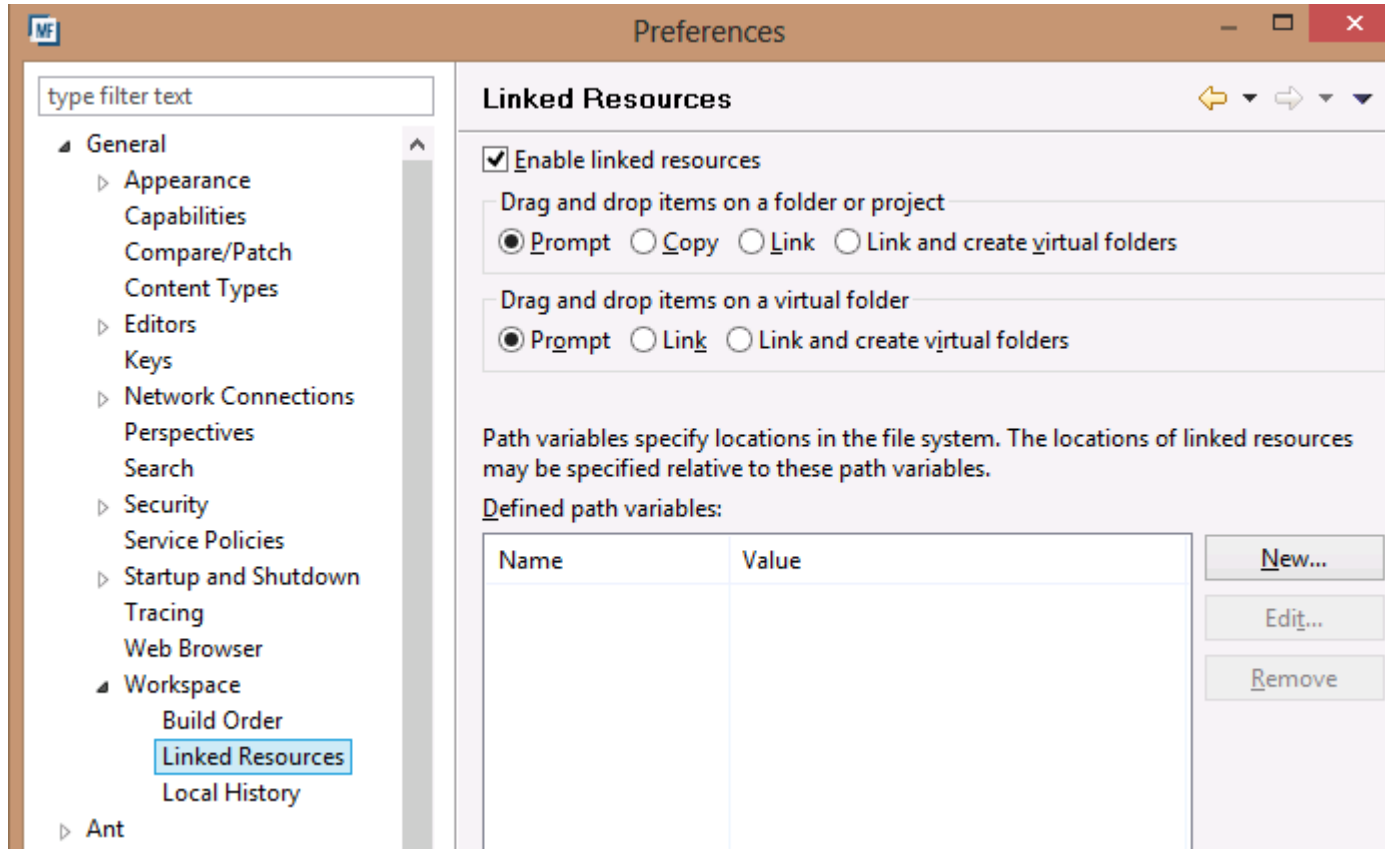
- `<workspace_dir>\PROD`
- `<workspace_dir>\TEST`
- `<workspace_dir>\DEV`

Set up the project variables

To avoid having to set too many hardcoded paths, you can use the workspace local variables (visible to all projects) to locate the root directories of the code.

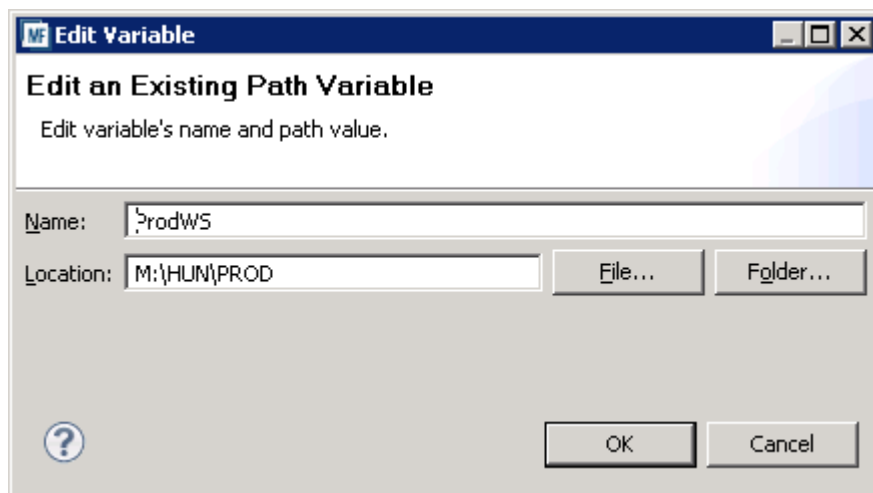
1. In the IDE, click the **Windows > Preferences**.
2. Expand **General > Workspace**, and click **Linked Resources**.

This opens the **Linked Resource** configuration page:

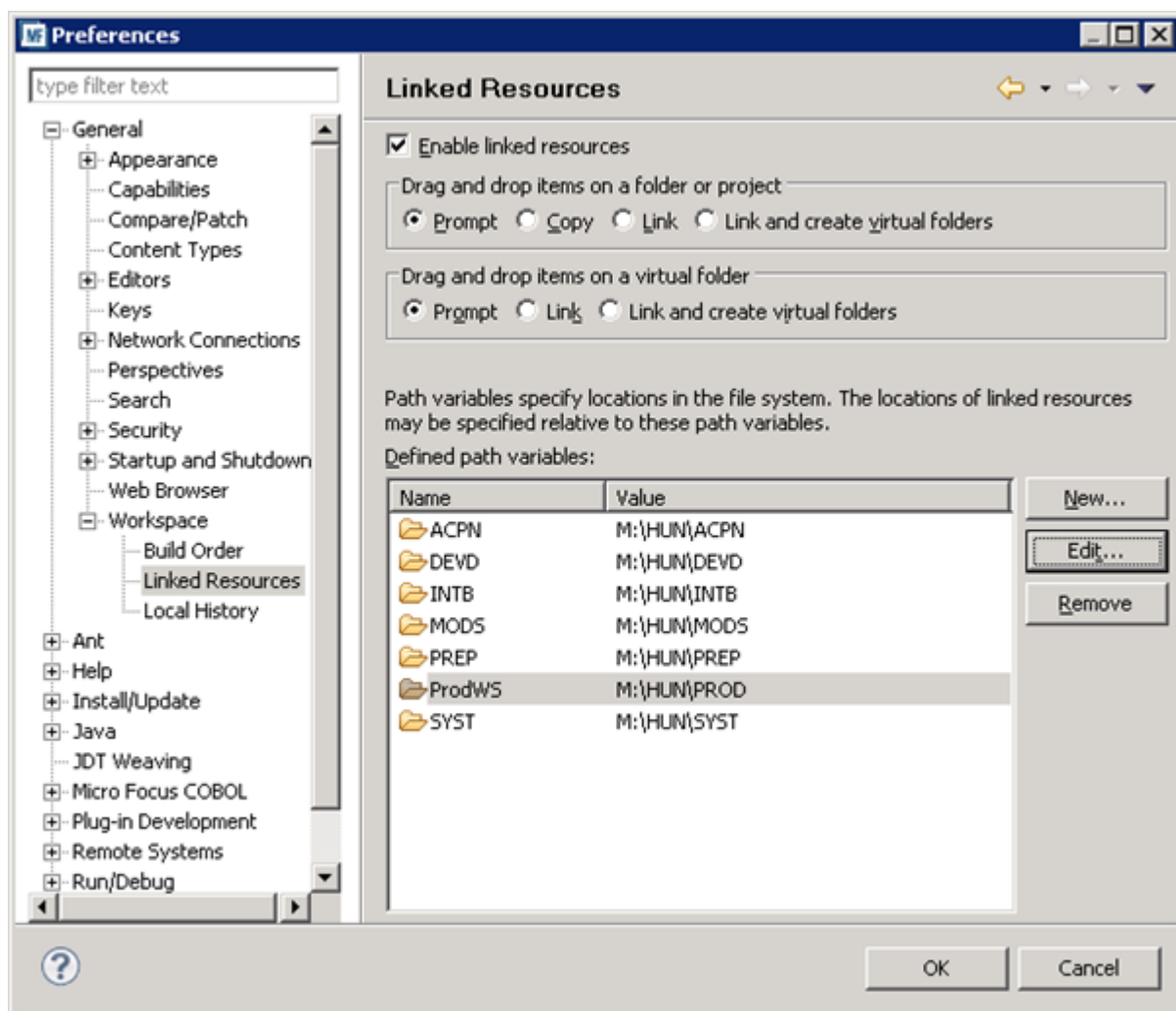


3. Click **New** to create a variable pointing to the root level of the workgroup level you want to use.

You can use a mapped drive letter, UNC name or a predefined location (such as `c:\source\prod`) which then allows the projects to be shared among multiple users without having to make any changes:



4. Repeat for each level that you need to set:



5. Click **OK**.

Remember that workspace variables are each defined on a per workspace basis - in a multi-user environment, each user needs to perform this step themselves for each workspace they need when developing their application.

Create the copybook projects

For each level in the workgroup, you need to create a copybook project. To do this, use the COBOL Copybook Project type and, for each project, give a name which reflects the name of the workgroup level you want it to represent (for example, PROD, INT, DEV).

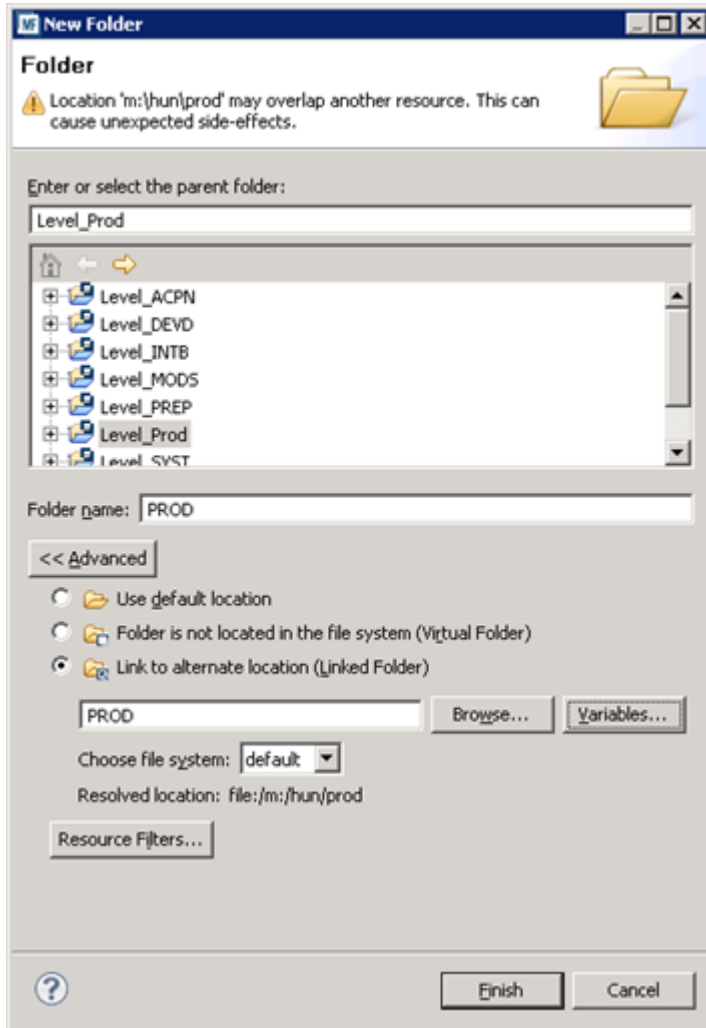
If you check the properties of a copybook project, you can notice there are no Builders set for it. This means no compilation operation will take place if source code is found in the project location.

Adding files to the copybook projects

The quickest way to do this is by adding a single linked directory item which points to the physical location of the root of the copy file location on disk. If you have never encountered *linked resources* in Eclipse before, they work in a similar manner to a UNIX/Linux symbolic link.

1. Click **File >New > Folder**.
2. Click **Advanced** and click **Link to alternate location (Linked Folder)**.
3. Click **Variables**.

4. Select the workspace variable that you created earlier which matches up with the root directory of your workgroup level. In this case, our variable was called PROD. Click **OK** and it should populate the folder dialog as shown below:



5. Click **Finish**.

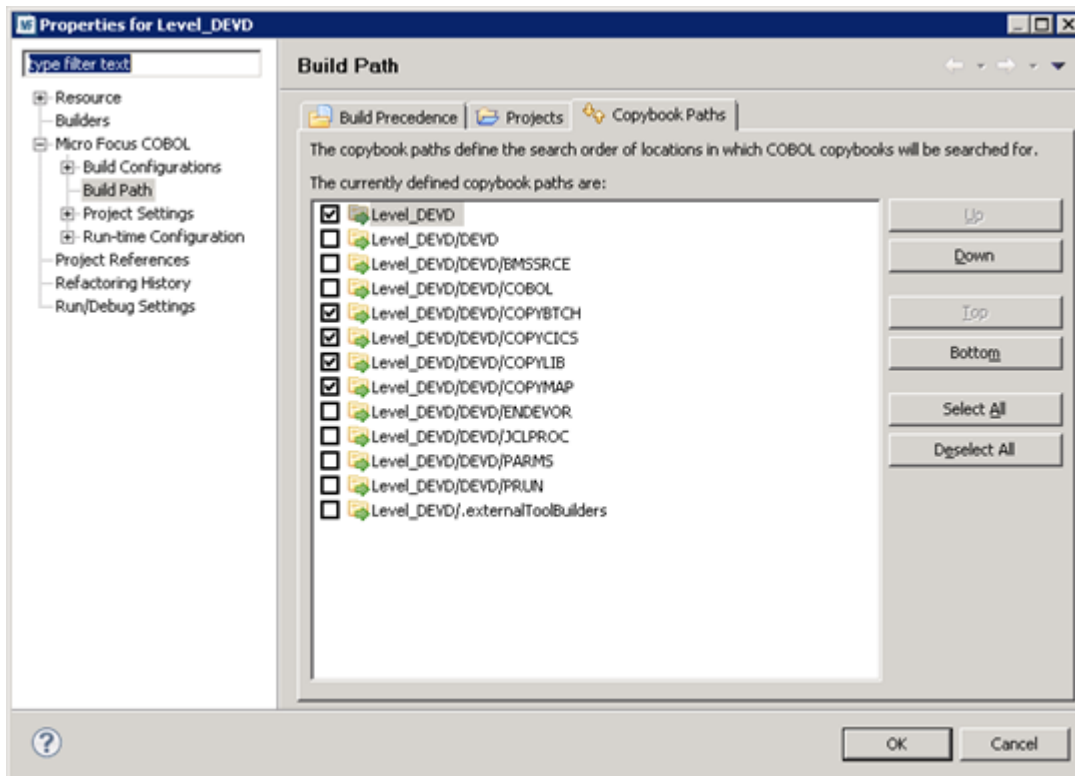
The IDE inspects the directory hierarchy for recognised COBOL types so they can be identified at a later time when working with your source code.

This project can be treated as a normal COBOL project and can have any directories it contains added to the copy path as well as the ordering of any such directories altered.

1. Open the project properties dialog, expand **Micro Focus > Build Path**, and then click the **Dependency Paths** tab.
2. Set **Path type** to **COBOL Copybook Paths** tab item

The set of paths that will be added to the copybook path is shown. If necessary, you can reorder the paths as well as enable or disable directories.

The default is not to include any paths so some paths almost certainly have to be switched on. Here is a typical entry for the copybook paths:



You have now created one level of your workgroup. You have created a single project with a workspace variable pointing to the top level of the physical location of the code for your level in the workgroup. You have also filtered out the COBOL source code items and have defined the copybook directory ordering for this level.

Repeat the same process for each level of your workgroup that you wish to use. In this particular example, there are seven levels defined.

Add the copybook projects as a dependency to a COBOL project

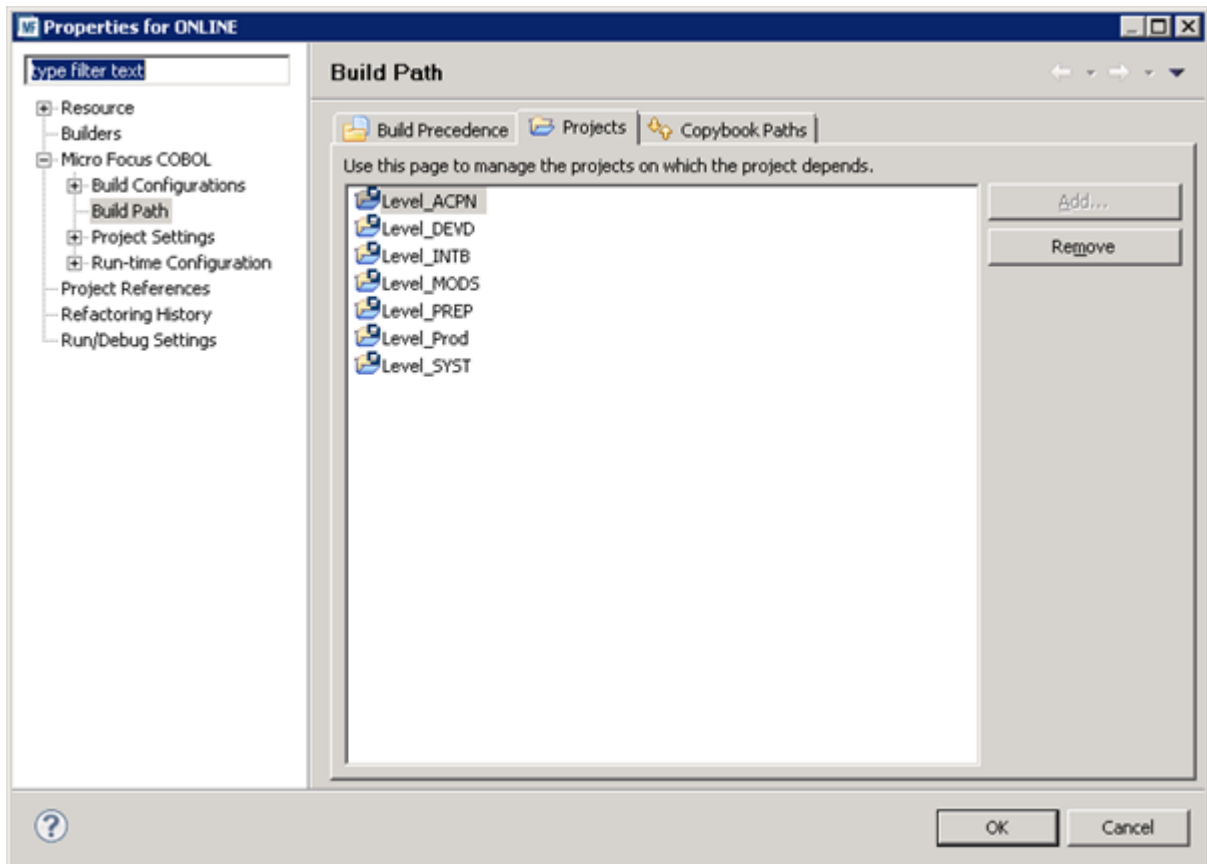
Once you have defined all your copybook projects, you can add them as dependent project to a COBOL project for the source files:

1. Create a COBOL project to hold your source files.
2. Add the source code items which you are going to working with.

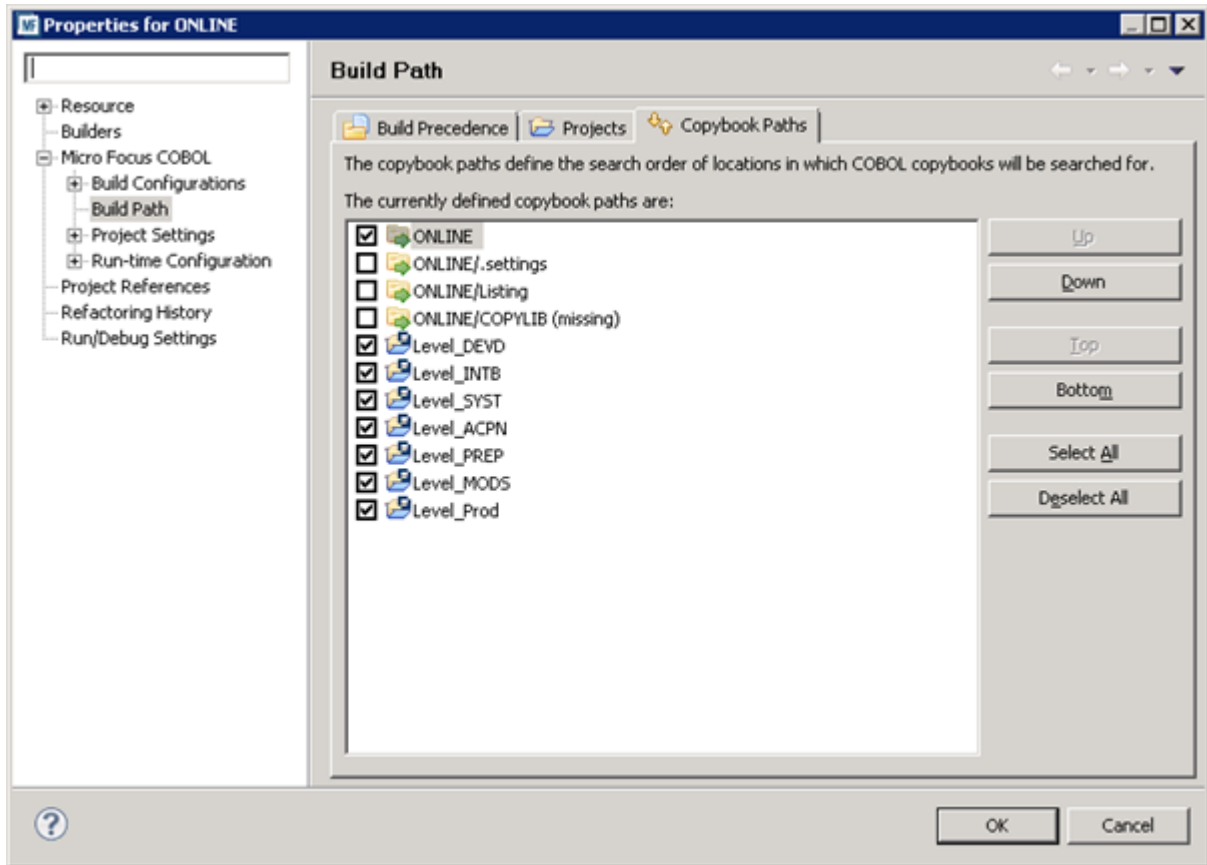
You do not need to add every item in the entire application - just the one with which you are likely to be changing and/or debugging.

3. In the project properties, expand **Micro Focus**, and click **Build Paths**.
4. Click the **Projects** tab, and then click **Add**.

This enables you to select the projects on which this one depends. The following example shows seven levels have been added:



5. Click the **Dependency Paths** tab and ensure **Path type** is set to **COBOL Copybook Paths**.
6. You can alter the order of the copybook projects as well as turn levels on and off according to what workgroup levels you may be working with. This provides a highly configurable and user friendly way in which to alter the copybook paths:



Distributing the copybook projects to multiple users

Once created, you can use the copybook projects as any other projects. Due to the way in which they utilize workspace variables, if all users in a multi-user environment are using the same locations for the source code on their local machines (or similarly named mapped drives) then the projects can be easily shared.

If a user imports the copybook projects into their own workspace (provided that they have also defined the workspace variables), then it should be a quick task to configure a workgroup hierarchy for all of your teams. The copybook projects can be committed to SVN (or any other SCCS) and should not have to be changed once created.

Upgrading from Studio Enterprise Edition (Windows)

Studio Enterprise Edition (Windows) used Visual Studio 2008. You upgrade projects created with it to Enterprise Developer for Visual Studio.

For more details on how to upgrade see the standalone guide on *Upgrading to Micro Focus Enterprise Developer for Visual Studio* available from the *Product Documentation* section of the [Micro Focus SupportLine Web site](#).


Upgrading from Server Express and Studio Enterprise Edition (UNIX)

You upgrade existing distributed applications created with Server Express to Visual COBOL for Eclipse.

Similarly, you upgrade mainframe applications created with Studio Enterprise Edition (UNIX) to Enterprise Developer.

The Enterprise Developer suite includes the following two independent products that are designed to be used together for maximizing the developers' productivity:

- Micro Focus Enterprise Developer UNIX Components is the counterpart of Server Express and must be installed on the machine that has your application sources.
- Enterprise Developer for Eclipse provides a rich and highly effective integrated development environment that can be connected to Micro Focus Enterprise Developer UNIX Components to enable you to edit, build and debug the applications' sources directly on the remote machine.

 **Note:** The process of upgrading Server Express and Studio Enterprise Edition (UNIX) is very similar. Therefore, references to Visual COBOL for Eclipse and Visual COBOL Development Hub apply equally to Enterprise Developer for Eclipse and Enterprise Developer UNIX Components, respectively.

The following sections provide information on how to upgrade.

Advantages of Upgrading to Enterprise Developer

Enterprise Developer offers numerous enhancements and a modern IDE that offers advantages such as:

Improved productivity

This is achieved through:

- Using the very latest technology of integrated development environments (IDEs) in a powerful IDE.
- Fast and easy customization with major source control systems, simplifying integration with existing development lifecycle leading to higher developer acceptance and productivity gains.
- Providing the tools to allow you to edit, compile, debug, execute and test COBOL applications on all supported Micro Focus UNIX and Linux environments. One development tool can now meet your development requirements today and in the future.
- Enabling cross-language application development which results in better quality and increased competitiveness.
- Full control of the development activities directly on the mainframe through the Eclipse IDE to edit, execute, debug and unit test applications.
- Achieving faster time to market.

Improved efficiency


Improve efficiency when performing day-to-day development activities, enabling access to Eclipse, smart editor, instantaneous compilations, advanced test and debugging capabilities.

Addressing of the COBOL skills shortage

Using COBOL from within a standard IDE helps reduce the gap between the COBOL and Java or C# developers by providing a unifying, collaborative and dynamic development environment. Non-COBOL developers can quickly and easily adapt to the COBOL language, and get up to speed in no time.

For a full list of the advantages of using Enterprise Developer, see [the Enterprise Developer data sheet and white papers on the Micro Focus Web site](#).

Upgrading Your COBOL Application

 **Note:** Upgrading your existing applications might be a complex task, therefore we recommend you contact Micro Focus Professional Services for assistance with this process.

If you've never used Eclipse before, Micro Focus recommends that you read the chapter *Introduction to Eclipse* in the product help of Enterprise Developer for Eclipse to get familiar with the IDE before you start upgrading your applications.

Prerequisites

In most situations when you are upgrading to Enterprise Developer, you will:

- Keep your source code on the UNIX machine. You need to install Micro Focus Enterprise Developer UNIX Components on this machine.
- Install Enterprise Developer for Eclipse on the your local Windows machine. You need to create a connection in Enterprise Developer to the remote UNIX machine and then create remote projects for the application's source files.

Upgrading your applications

The following outline shows an example approach to upgrading an application to Enterprise Developer:

1. Assess your existing processes for building and testing your applications.

Discover any similarities and differences between your existing applications and what programming issues they resolve. Determine what project types and scenarios you need to handle in Enterprise Developer for Eclipse.

Review the Compiler directives that are used to build the applications. Review these to ensure they are still valid.



Note: You can use Micro Focus COBOL Analyzer to check your existing applications and assess what might need to be changed or what functionality is no longer supported.

2. Compile your existing sources at the command line:

- a. Ensure Micro Focus Enterprise Developer UNIX Components is installed on the machine that stores your sources.
- b. From a terminal window, set the environment for Micro Focus Enterprise Developer UNIX Components and build the existing application. Resolve any compilation issues and ensure that the application behaves as it did previously.

3. Create a Enterprise Developer project to handle your source code:

- a. Install Enterprise Developer for Eclipse on a local Windows machine.
- b. In Eclipse, create a connection to the machine that includes your sources and create a remote project.
- c. Add the application sources to the new project and set the following Compiler directives on the project:

```
SOURCETABSTOP"8"  
COPYEXT",CBL,CPY"
```

- d. Add the Compiler directives that were used to compile the original project and are still valid to the new project.
- e. Build and debug the application using Eclipse.

Ensure you get the same results using Eclipse as you did when you used Micro Focus Enterprise Developer UNIX Components on the remote machine (see step 2b).

4. Add more projects, programs and copybooks as required.
5. Review the *Best Practice in Development Using Eclipse* information in this document to ensure you achieve maximum productivity.
6. Experiment with various debugging options to find those that best meet your requirements.
7. Compile for debug and for release and ensure that the application performs as expected.
8. Create one or more template projects and distribute those across the entire development team.

9. Examine ways in which Eclipse can help to modernize your applications and processes.

For more details about these steps see the following sections.

Compile Your Existing Programs without a Project

Enterprise Developer includes a lot of enhancements and changes and this is why applications that were compiled using earlier Micro Focus products must be recompiled from the sources using Enterprise Developer.

Micro Focus recommends you first compile without a project as you would have done in Server Express. This will help you focus on resolving any compilation issues following the changes in the environment. Then, you can look at creating a Enterprise Developer project in order to take advantage of all the benefits offered by the IDE.

To compile your existing programs from a terminal window directly on the UNIX machine:

1. Ensure that Micro Focus Enterprise Developer UNIX Components is installed on the remote machine where you store your existing COBOL programs.
2. Log onto the remote machine and from a terminal window, configure the environment and compile your programs using the `cob` command or the build scripts or makefiles used to build the application with Server Express.

Remember to review and reuse all Compiler directives that were previously used when compiling the application in Server Express.

Most programs created with Server Express should compile cleanly using your existing build scripts and makefiles without any changes to your code, as Enterprise Developer also provides the `cob` utility to create `.int`, `.gnt` or `.o` files.

Fixing compilation issues

Because Micro Focus continues to enhance the COBOL language, you might encounter some problems when compiling your existing Server Express applications in Enterprise Developer.

For example, the list of reserved COBOL words changes with each new level of the COBOL language, so an application created with an older Micro Focus product might use data names that are now reserved keywords in Enterprise Developer. If this happens, a COBOL syntax error COBCH0666 ("Reserved word used as data name or unknown data description qualifier") occurs. See *Reserved Words Table* in the product help of Enterprise Developer for a comprehensive list of reserved words and the levels at which they are supported.

Also, these Server Express Compiler directives are no longer supported:

01SHUFFLE	ENSUITE	REGPARAM
64KPARA	EXPANDDATA	SEGCROSS
64KSECT	FIXING	SEGSIZE
AUXOPT	FLAG-CHIP	SIGNCOMPARE
CHIP	MASM	SMALLDD
COBIDY	MODEL	TABLESEGCROSS
DATALIT	OPTSIZE	TRICKLECHECK
EANIM	OPTSPEED	WB2
EDITOR	PARAS	WB3
	PROTMODE	WB

and the pseudovariabes of the following Server Express environment variables are obsolete and can't be used.

BASENAME
FILENAME
PATH
TARGETDIR

You should consider using the following methods to solve such issues:

- Rewrite the source to avoid using these keywords in your code and directives files.
- Use the REMOVE Compiler directive to remove individual keywords from the reserved words list.
- Use the MF or MFLEVEL compiler directive to select an earlier version of Micro Focus COBOL that your code is compatible with. For example, setting MFLEVEL "12" ensures compatibility with Mainframe Express 3.0 and 3.1, Net Express 4.0, 5.0, and 5.1, and Server Expresss 4.0, 5.0, and 5.1. Refer to *Reserved Words Table* in the product help of Enterprise Developer for the value to use to ensure support for your existing reserved words.

Setting REMOVE and MFLEVEL Compiler directives at the command line

To use REMOVE from the terminal window (or later in the editor in Eclipse), type the following:

```
cobol myprogram.cbl remove(title) ;
```

The command above removes TITLE as a keyword from the language so you can use it as an identifier in a COBOL program.

To use the set of reserved words that was used for Server Express v5.1 WrapPack 5, use this command line:

```
cobol myprogram.cbl mflevel"15" ;
```

Setting REMOVE and MFLEVEL directives in the source code

To set either one of the directives in your source code, type the following starting with \$ in the indication area of your COBOL program:

```
$set remove "title"
```

Or:

```
$set mflevel"15"
```

Create a Project and Import Your Sources

Once you have ensured your programs compile cleanly in the Enterprise Developer environment, you can create a project for them so that you can take full advantage of all of the benefits offered by the Eclipse debugging environment. You need Enterprise Developer for Eclipse installed on your local Windows machine and you need to create a connection in it to the remote UNIX machine.

Connect Enterprise Developer to the remote machine

From your local installation of Enterprise Developer create a new remote connection to Micro Focus Enterprise Developer UNIX Components on the UNIX machine which has your existing COBOL programs. See *Creating connections to remote hosts* in the product help of Enterprise Developer.

Create a remote project

You need to create a project that will store the source files on the remote machine:

1. Start Enterprise Developer.

If this is the first time you have started Enterprise Developer you see the **Welcome** page in the IDE. You can also open the **Welcome** page by clicking **Help > Welcome**.

2. Click **Open COBOL perspective** in the **Welcome** page.

In this perspective, Eclipse offers you the views and commands that are best suited for COBOL development.

3. Click **File > New > Remote COBOL Project**.

Choose the remote connection to use and follow the instructions to create a remote native COBOL project in a directory on the remote machine.

Import the COBOL source files

Add the source files on the remote machine to your project as follows:

1. Right-click your project in the **COBOL Explorer** view and click **Import > Import**.
2. In the **Import** wizard, expand **General**, click **File System**, and then click **Next**.
3. Click **Browse**, navigate to the location of your source files on the remote machine, and click **OK** to confirm the path.
4. In the **Import** wizard, enable the check boxes for the files you want to import in your project, and click **Finish**.

This adds the files to your project and, if Eclipse uses the default settings, starts a build. You might need to set some Compiler directives to resolve any compilation issues, similarly to when you resolved any issues when compiling from a terminal window.

Configure your project

To configure your project and specify any Compiler directives:

1. Right-click your project in COBOL Explorer, and click **Micro Focus > Project Settings > COBOL**.
2. In the **Additional directives** field, specify any directives that you had to use to resolve any issues that occurred when you compiled without a project. These could be the Compiler directives that were used to compile the application in Server Express prior to the upgrade or new ones.
3. Also specify the following Compiler directives:

```
SOURCETABSTOP"8"  
COPYEXT",CBL,CPY"
```

If your source code contains tab stops, compilation might fail, because although a COBOL tab is eight characters long, the IDE's tab is four characters long, and lines of code might be starting in the sequence number and indicator areas section (columns one to seven) of the program instead of from column eight.

You can fix this problem using the `SOURCETABSTOP(n)` Compiler directive, where *n* is the number of space characters by which to expand tab characters during compilation.

4. Click **OK**.

Build the project

By default, Eclipse builds your source files each time you make a configuration change or add or edit the files. If you have changed this preference, to build the project click **Project > Build Project**.

Add copybooks

To add existing copybooks to your project, right-click the project and use the **Import > Import** command.

Copybooks are not compiled at build time and the files' **Build Action** property is automatically set to **None**. (You can also set this property for COBOL source files to keep a file in the project but not include a built version in any output.)

By default, Enterprise Developer identifies files as copybooks by their `.cpy` extension. You can specify other file extensions as copybooks in the IDE preferences - click **Window > Preferences > Content Types**, click **COBOL Copybook** and add any new file associations using this dialog box.

Best Practice in Development Using Eclipse

Here is a list of recommendations about how to make the most of using Eclipse in real-life scenarios.

Break down large projects

Projects that contain a large number of source files and build artefacts can be hard to navigate and slow to build. If you find this is the case with your application, Micro Focus recommends that you review the contents of large projects and split them into separate projects in which you group items that are logically related.

For example:

- If you have different versions of a product for different customers, keep common source in one project and have a separate project for each customer.
- If you have core code that is rarely changed or recompiled, keep that in one project and have separate projects for those areas that change regularly.

Reference common sources

Use the COBOL Copybook project type to store all your copybooks and add this project as a dependency to the projects that contain any source programs that reference the copybooks. Use this approach in preference to using linked resources.

Use linked folders to reference resources where it is not possible to restructure your projects (to use the COBOL Copybook project type) or use a remote project (to access any sources on remote machines).

Use existing Compiler directives files

To avoid repetition and reduce maintenance effort, consider keeping all your Compiler directive settings in a directives file. To reference this file in each project, specify the `USE "filename"` Compiler directive in the **Additional directives** field in each project's properties.

Use relative paths

Keep your sources relative to a base path and avoid specifying full paths in you projects. This ensures your code is portable and easy to use with source control systems.

Access sources on remote machines

- For optimal performance, create a remote project from the available project types to access any sources on remote machines.
- Use RSE or SSH in preference to Samba type remote connections. Only use the Samba type connection when it is not possible to use the other types of connections. This is because the Samba connection has the slowest performance.
- Avoid using network shares or drives to directly access any resources on remote machines from your local projects.

If for some reason, it is not possible to use local versions of the sources, you can use network shares as linked folders but the connection will be very slow. In such cases, you might be able to improve the performance by splitting the remote shared folder into smaller chunks then set the COBCPY environment variable before you start Enterprise Developer for Eclipse on your local machine.

Eclipse workspace

- To avoid performance issues, your Eclipse workspace must not be on a shared drive.
- Do not commit the Eclipse workspaces into a source control system, as they contain metadata which is updated frequently.

Configure Enterprise Developer

To boost your productivity, enable some additional views in Eclipse that are suitable for the programming tasks you're dealing with within the current active perspective. To do this click **Window > Show View** and either select a view from the ones that are displayed, or click **Other** to choose from all available ones.

For example, in the Debug perspective, enable the **Expressions** view that lists any data items you want to monitor. Or enable the **Remote Systems** view to see all remote systems that have a connection defined in Eclipse and to launch terminal sessions from within the IDE.

Modernize Your Applications and Processes

Following industry-standard development practices

Many source code control systems and Agile tools can be integrated into the Eclipse IDE.

You should also consider using continuous integration, which involves the automatic building and testing of an application after a change occurs to the source code. This method traps errors sooner in the development life cycle and can greatly improve efficiency and reduce costs.

Multi-user applications

Enterprise Developer includes a Run Unit API to enable multiple users to simultaneously use an application based on COBOL code that was designed originally for a single user.

Developing Web-based applications

You can use Enterprise Developer to migrate existing, core applications to a service-oriented architecture as Web services, and deploy them using Micro Focus COBOL Server and Enterprise Server, so that you can develop COBOL-based software components to be invoked across the Web.

Developing JVM applications

You can compile both new and existing COBOL as JVM COBOL managed code. This enables you to:

- Reuse existing COBOL business logic and data access in the Java Virtual Machine
- Access Java classes and features from COBOL applications
- Create and extend composite applications consisting of COBOL and Java code
- Reuse and extend Open ESQL applications

Both procedural and Object-Oriented (OO) COBOL are supported within the JVM. OO COBOL classes can inherit classes written in Java and vice versa.

The managed COBOL syntax includes many extensions to the COBOL language to support Java features; for example, the TRY ... CATCH syntax to enable exception handling in COBOL.

There are also certain directives that help integrate your managed COBOL with Java. For example, you can now expose the Linkage Section and entry points in your COBOL to other managed languages by compiling with the ILSMARTLINKAGE directive.

Differences between Enterprise Developer and Net Express, Server Express and Mainframe Express

You can upgrade COBOL applications that were developed in Net Express, Server Express to Visual COBOL or Studio Enterprise Edition and Mainframe Express to Enterprise Developer without the need to change their code.

All references to Net Express and Server Express in this guide relate to the variants of those products that provided Mainframe Subsystem Support as part of the Studio Enterprise Edition bundle.

This guide lists the differences between Net Express, Server Express, Mainframe Express and Enterprise Developer in the following areas:

Compiling and building	Having created a project in Enterprise Developer, you can either use the IDE or the command line to build.
Run-time systems	There are some differences between the run-time systems supplied with Enterprise Developer and those supplied with Net Express, Server Express and Mainframe Express. This, however, will not affect your existing applications and they will continue to run under Enterprise Developer - you only need to recompile the applications from the source code with Enterprise Developer.
Run-time system technologies	Some technologies behave differently and require some upgrade work.
Restrictions and unsupported features	Some features of Net Express, Server Express and Mainframe Express are not available in Enterprise Developer. However, there are alternative techniques for many of these features.
Editing and debugging	Much of the Net Express, Server Express and Mainframe Express functionality for editing and debugging is available in Enterprise Developer, but sometimes with a different name and with a slightly different behavior. In addition there are some new features such as background parsing, which highlights errors as you type and code completion techniques that provide easy access to language elements, enabling you to select and insert them simply.
Eclipse integration	Enterprise Developer is integrated with the Eclipse IDE. The development environment provides all the functionality to manage projects and debug applications. Applications previously built in Net Express, Server Express and Mainframe Express can be developed and run within the Eclipse IDE.

Summary of Differences

The majority of the applications created with Net Express, Mainframe Express or Server Express will continue to work in Enterprise Developer without any changes. However, there are some differences between these development systems you should consider when you upgrade to Enterprise Developer.

Compiling and Building Differences

There are several aspects of compiling and building applications that behave differently in Enterprise Developer. You might need to change the project properties and update some of the Compiler directives and settings that you previously used.

Output File Formats on page 41 Each project compiles into a single file (.dll, .so or .exe), or to multiple files of the same file type with one output file for each source file (.dll, .so, .exe, .int, or .gnt). As well as an .lbr file, which contains a collection of .int and .gnt files on Windows, you now can use a .dll as the container for application components.

Compiler directives on page 41 When you upgrade your source code to Enterprise Developer some Compiler directives that were specifically designed for 16-bit systems now produce an error on compilation because they are no longer relevant. You should remove them from your code and directives files before you compile.

Linking on page 42 The static run-time system and the single-threaded run-time system on Windows are no longer required and they are not shipped with Enterprise Developer. Applications built with Enterprise Developer are now linked to the shared or dynamic run-time systems. On UNIX, you can link to the single-threaded or multi-threaded shared or dynamic run-time system.

Called Programs and Dependencies on page 42	At run time, called programs are found in the same way as before. However, there are some new ways to set COBPATH and copy files into a common folder.
File Handler on page 43	The File Handler .obj files are not available in Enterprise Developer. Enterprise Developer uses the File handler packaged in the mffh.dll file instead.
Makefile Conversion on page 43	You cannot use existing makefiles from inside Enterprise Developer for Eclipse without changing some Eclipse defaults and adopting a modified build process. Where makefiles invoke commands supported by Enterprise Developer they will continue to work as before. Please contact Micro Focus for more information on using existing makefiles.
OpenESQL Assistant on page 43	The OpenESQL Assistant data source names (DSNs) in Enterprise Developer must be configured as ODBC or
SQL Compiler Directive Options on page 43	When you upgrade your to Enterprise Developer, some SQL applications could require additional SQL Compiler directive options to avoid compiler errors.
XML PARSE Statement on page 43	In Net Express, Server Express, the default setting for the XMLPARSE Compiler directive is COMPAT, which causes the XML PARSE statement to return information and events for IBM Enterprise COBOL Version 3. In Enterprise Developer, the default is XMLPARSE(XMLSS), which returns information and events for IBM Enterprise COBOL Version 4.

Run-Time System Differences

There are some differences between the run-time systems supplied with Enterprise Developer and those supplied with Net Express, Server Express and Mainframe Express. These, however, do not affect your existing applications if you recompile them from the source code in Enterprise Developer.

OpenESQL on page 44	Enterprise Developer sets the BEHAVIOR SQL Compiler directive option to MAINFRAME by default to provide optimal performance. To revert to the default behavior exhibited in Net Express, Server Express, set the BEHAVIOR directive to UNOPTIMIZED.
Single-Threaded Run-Time System on page 44	The single-threaded run-time system is not available in Enterprise Developer on Windows. Instead, both single-threaded and multi-threaded applications run using the multi-threaded run-time system. This has no effect on your existing applications. On UNIX, the single-threaded run-time system is available, so that applications can link with third-party code.
Static-Linked Run-Time System on page 44	The static-linked run-time system is not available in Enterprise Developer. Instead, you now link native code to the shared or dynamic run-time system. This has no effect on your existing applications.
Setting the environment on UNIX on page 44	You use the cobsetenv script to set your COBOL environment on UNIX.
Enterprise Developer Co-existing with Earlier Micro Focus Products on page 44	Some additional configuration is required to ensure Enterprise Developer and Studio Enterprise Edition work properly when installed on the same machine.

Restrictions and Unsupported Features

Some features in earlier Micro Focus products are not available in Enterprise Developer. However there are alternative techniques for many of these features.

CBL2XML Utility on page 44	The CBL2XML utility is currently available as a command line tool only.
---	---

DBMS Preprocessors on page 45	Earlier Micro Focus products supported DBMS preprocessor versions that are not supported in Enterprise Developer. For a list of currently supported DBMS preprocessors, see the <i>Database Access Support with Native COBOL</i> topic.
Dialog System on page 45	Dialog System applications are not supported in Eclipse but you can upgrade the non-GUI components of an application to Eclipse, and then recreate the GUI components using the GUI tools in Eclipse.
Form Designer on page 45	Form Designer is the Net Express tool for creating user interfaces for CGI-based Internet and intranet applications. Form Designer and the HTML page wizard are not available in Enterprise Developer.
GNT Analyzer on page 45	GNT Analyzer is not available in Enterprise Developer. It has been replaced by Test Coverage .
Host Compatibility Option (HCO) on page 45	Mainframe Express provided a user interface for the Host Compatibility Option (HCO) feature. This user interface is not available in Enterprise Developer; however the HCO Create Database, DDL Processor, DCLGEN, Export Data, and Import Data tools are available via batch command line invocation.
INTLEVEL Support on page 45	The INTLEVEL directive is rejected by the Compiler in Enterprise Developer.
NSAPI on page 45	There is no support for NSAPI in Enterprise Developer.
Online Help System on page 45	Net Express provided the Online Help System for creating online help from character-based applications, and displaying it on screen. It is not available in Enterprise Developer and the Online Help System information file type (.HNF) is not supported.
OpenESQL on page 45	In both Net Express and Studio Enterprise Edition, support is provided for Oracle OCI in OpenESQL. Enterprise Developer does not support Oracle OCI in OpenESQL.
SQL Option for DB2 on page 45	In the Mainframe Express and Net Express IDEs, you could invoke SQL Option for DB2 from the main menu within the IDE. For Enterprise Developer, SQL Option for DB2 is not available from the main menu in the IDE. Instead, all SQL Option for DB2 tools are available from Start > All Programs > Micro Focus Enterprise Developer > Data Tools > SQL Option for DB2 .

Run-Time Technology Differences

Some technologies behave differently in Enterprise Developer and this might affect how you upgrade existing applications.

File Handling on page 46	The way you integrate your own security modules into Fileshare has changed. Also, the FILEMAXSIZE setting is different for Enterprise Developer and for Net Express and Server Express .
Java and COBOL on page 46	The <code>cobs.je</code> script is not available in Enterprise Developer for Eclipse on UNIX. Enterprise Developer uses the COBOL run-time system to load JVM based on LIBPATH, LD_LIBRARY_PATH, JAVA_HOME etc...
Test Coverage on page 46	Test Coverage replaces GNT Analyzer, which was available in Server Express. Code coverage for native COBOL applications available from within the IDE in Enterprise Developer integrates the Test Coverage functionality.

Editing and Debugging Differences

Much of the edit and debug functionality in Net Express, Server Express and Mainframe Express is available in Enterprise Developer, but some of it has a different name or slightly different behavior. In addition there are some new features such as background parsing.

Interface Mapping Toolkit on page 46

The Interface Mapping Toolkit is available in Enterprise Developer for Eclipse; however it does not support CICS or IMS service interfaces.

Mixed Language Debugging on page 46

With Net Express you could debug mixed language applications. In Enterprise Developer, you can debug native COBOL and Java or native COBOL and C with some additional configuration.

Program Breakpoints on page 47

Program breakpoints are breakpoints that stop execution each time a specified program or entry point within the program is called. They are supported in Enterprise Developer, but by default their behavior is different from their behavior in Net Express

Remote Debugging on page 47

The Net Express animserv utility used for debugging programs remotely has been replaced by `cobdebugremote` (or `cobdebugremote64` when debugging 64-bit processes) in Enterprise Developer.

Source Pool View on page 47

The source pool view in Net Express showed all source files available in the project directory, regardless of whether or not they are used in the current build type. This view is not available in Enterprise Developer.

Backward Compatibility with Earlier Micro Focus Products

COBOL applications developed and built using previous Micro Focus products can be developed and built with Enterprise Developer. However, there are some differences in behavior and in terminology.

Executables requiring recompilation

If you are on the AIX platform, due to an internal change in version 2.0 of your product, you must recompile and/or relink your programs compiled prior to this version, to make them compatible with this run-time system.

Terminfo files

The following terminfo files have been removed:

- AT&T
 - att605
 - tty5420
- IBM
 - ibm3151
- Qume
 - qvt102
- Wyse
 - wy120
 - wy120-25
 - wy50
 - wy60
 - wy60-w

- wy75
- wy85

Diagnostic tools

The FaultFinder tool has been removed from the current version of Enterprise Developer. This includes the removal of the following tunables:

- faultfind_level
- faultfind_outfile
- faultfind_recsz
- faultfind_config
- faultfind_cache_enable

You should either remove these tunables from your application or set the tunable `cobconfig_error_report=false` in your configuration file.

You should also remove any calls to the library routine `CBL_FFND_REPORT`, as this now produces a COBRT107 Operation not implemented in this run-time system (fatal) error.

Backward Compatibility with Studio Enterprise Edition

File Control Description (FCD) The FCD format for file handling operations in 32-bit applications defaults to FCD3 in Enterprise Developer; in Studio Enterprise Edition, it defaulted to FCD2.

Copybook name changes A number of COBOL copybook files that were part of Studio Enterprise Edition had names in uppercase, whereas, in Enterprise Developer, most copybooks are provided with lowercase names.

This affects the following copybooks - DFHAFCD, IDADDSA, IDADTCA, IDAS99RB, IDAS99TU, IEESMCA, IEFJFCBN, IEFJSSIB, IEFTIOT1, IEZJSCB, IHAACEE, IHAASCB, IHAASVT, IHAASXB, IHACDE, IHAPSA, IKJTCB, MFJCTLBC, MFJDCUSR, MFJDSXIT, MFJDXIT, MVSFINDM, MVSGETCT, SPOOLHK.

If your code refers to any of these files in uppercase, and you are compiling with Enterprise Developer on UNIX, this may result in the code failing to compile, because it cannot locate the copybooks.

You can work around this issue in one of the following ways:

1. Change the names of the copybooks referred to from your code to lowercase.
2. Create copies of the copybooks, and save them with uppercase names.
3. Set up symbolic links to point the uppercase names to their lowercase equivalents as follows:
 - a. Create a script file, `copylink.sh`, which creates symbolic links for the above copybooks.
 - b. Paste the following contents into the file:

```
ln -s dfhafcd.cpy DFHAFCD.CPY
ln -s idaddsa.cpy IDADDSA.CPY
ln -s idadtca.cpy IDADTCA.CPY
ln -s idas99rb.cpy IDAS99RB.CPY
ln -s idas99tu.cpy IDAS99TU.CPY
ln -s ieesmca.cpy IEESMCA.CPY
ln -s iefjfcbn.cpy IEFJFCBN.CPY
ln -s iefjssib.cpy IEFJSSIB.CPY
ln -s ieftiot1.cpy IEFTIOT1.CPY
```

```

ln -s iezjscb.cpy      IEZJSCB.CPY
ln -s ihaacee.cpy     IHAACEE.CPY
ln -s ihaascb.cpy     IHAASCB.CPY
ln -s ihaasvt.cpy     IHAASVT.CPY
ln -s ihaasxb.cpy     IHAASXB.CPY
ln -s ihacde.cpy      IHACDE.CPY
ln -s ihapsa.cpy      IHAPSA.CPY
ln -s ikjtcbl.cpy     IKJTCLB.CPY
ln -s mfjctlbc.cpy    MFJCTLBC.CPY
ln -s mfjdcusr.cpy    MFJDCUSR.CPY
ln -s mfjdsxit.cpy    MFJDSXIT.CPY
ln -s mfjdxit.cpy     MFJDXIT.CPY
ln -s mvsfindm.cpy    MVSFINDM.CPY
ln -s mvsgctct.cpy    MVSGCTCT.CPY
ln -s spoolhk.cpy     SPOOLHK.CPY

```

- c. As superuser, execute the script in the folder which contains the copybooks (\$COBDIR/cpylib).

Backward Compatibility with Earlier Versions of Enterprise Developer

File Locking In versions prior to Enterprise Developer 2.3, the semantics of the sharing phrase specified in an OPEN statement or used within a call to CBL_OPEN_FILE were not correctly applied in some cases on UNIX and Linux platforms. From version 2.3 onwards, the sharing phrase is correctly honored when the tunable `strict_file_locking=true` is set, which is the default setting.

Example of potential changes in behavior:

- *Process-A* opens a file with read-only access and a sharing mode that denies other processes write access (SHARING WITH READ ONLY).
- *Process-B* then attempts to open the file with read-only access and a sharing mode that denies other processes read access (SHARING WITH NO OTHER).

With `strict_file_locking=true`, *Process-B* is unable to open the file, because *Process-A* has successfully opened the file allowing only read access.

With `strict_file_locking=false`, *Process-B* successfully opens the file.

If your application encounters unexpected OPEN conditions or fails to open files, it might be as a result of the new file locking behavior. In such circumstances, we recommend that you review the file locking and sharing requirements of your application and refactor your source code to work with the default setting. The original file locking and sharing behavior can be restored by setting `strict_file_locking=false`.

Updated run-time system

Enterprise Server now provides an execution environment capable of running applications that were each built using different development products. A consequence of this is that if your application has a main COBOL executable (.exe) that was built with a version of Enterprise Developer prior to version 2.3, you should ensure that the executable is rebuilt and packaged with the new run-time system. This does not affect mainframe subsystem projects deployed to Enterprise Server. You can rebuild from the IDE or the command line.

Other COBOL subprograms built with previous versions of Enterprise Developer are not required to be rebuilt.

JVM COBOL

Enterprise Developer for Eclipse now ships with Eclipse 4.4 (Luna). A consequence of this is that if your application contains JVM COBOL code that was built with a version of Enterprise Developer prior to version 2.3, those parts of your application must be rebuilt; otherwise you will experience errors at either compilation or run time.

Casspool recovery

Following the detection of an unrecoverable file status error on the casspool file, a message is displayed on the console and an ACCEPT statement is issued. This stops processing, allowing you to fix the underlying file problem, before continuing the job.

Casspool performance enhancement

As part of an enhancement to improve performance when browsing the spool queue of an Enterprise Server, you must update the casspool file for any Enterprise Server created before Enterprise Developer 2.2 Update 1 before you can submit jobs to it.

To update the casspool for each Enterprise Server, from a command prompt, run `fixcasspool.bat` (Windows) or `fixcasspool.sh` (UNIX), located in `%COBDIR%\bin` and `%COBDIR%\bin64` (Windows) or `$COBDIR/bin` (UNIX), using the following syntax:

```
fixcasspool.bat casspool.dat backup.dat
```

or

```
fixcasspool.sh casspool.dat backup.dat
```

where:

casspool.dat

is the spool file, located in the same directory as the Enterprise Server's system catalog, that will be updated.

backup.dat

is a file that will be created with a backup of the old `casspool.dat` file. If `backup.dat` already exists, the update is not run.

If you do not update casspool and attempt to start Enterprise Server, the following messages are displayed in the console:

```
JES000011E Batch Spool File Error; Status [39]
```

```
JES000130E Note JES000011 Error - New casspool indexes may need generating. See error description in product docs
```

ACUCOBOL-GT and RM/COBOL file handling under Enterprise Server

Two file handling configuration options have been introduced that enable or disable all types of file handling for ACUCOBOL-GT and RM/COBOL data files.

ACUFH has overall control, but is enabled by default, which means that there should be no change in behavior when handling files when not running under enterprise server. However, ESACUFH enables and disables file handling of these types under enterprise server, and is disabled by default. To continue handling ACUCOBOL-GT and RM/COBOL data files, ensure both options are enabled in your file handling configuration file.

Using parentheses in member reference

In managed COBOL syntax, you may only use parentheses when referencing methods. You can no longer specify parentheses when referencing fields or properties, as this will produce a syntax error.

For example:

```
set intLength to testString::Length()
```

must change to:

```
set intLength to testString::Length
```

Calling program search order

In previous versions of Enterprise Developer (and earlier Micro Focus products) you could use a run-time tunable to define a specific order in which the run-time system searches for called sub-programs. Due to changes in the run-time system, there is only one viable specific search order, and therefore the `program_search_order` tunable is no longer

available; remove the tunable from any configuration you have set. The default (and only) order used is:

- If the sub-program is already loaded, or is statically linked, it is located and the search ends.
- On UNIX platforms, if you are calling shared objects (`.so`), without a specific path, the `LD_LIBRARY_PATH` or `LIBPATH` environment variable is searched.
- If `COBPATH` is set, the list of paths in the variable are searched, in order; if `COBPATH` is not set, the current directory is searched.
- On Windows platforms, if you are calling shared objects (`.so`), without a specific path, the `LD_LIBRARY_PATH` or `LIBPATH` environment variable is searched.
- The path of the calling program is searched.

If the sub-program cannot be located using one of the above methods, a run-time error is produced.

Calling RM/COBOL compatible library routines Previously, to call an RM/COBOL compatible library routine, you had to set the `DIALECT"RM"` Compiler directive, which ensured the correct *call-convention* was used. To set this functionality now, you must explicitly use the correct *call-convention* in the `CALL` statement.

CALLFH If your code specifies the `ACUFH` parameter, it may now produce adverse effects when used. You should replace it with the methods described in *Configuring Access to Vision Data Files* or *Configuring Access to RM/COBOL Data Files*. Both of these methods offer a fuller-functioning solution to handling these types of data files.


DIALECT"ENTCOBOL" `DIALECT"ENTCOBOL"` now sets `NSYSMBOL"NATIONAL"`; previously, this set `NSYSMBOL"DBCS"`.

DIALECT"RM" `DIALECT"RM"` now sets `PERFORM-TYPE"RM"`. If you recompile an application that uses `DIALECT"RM"`, the behavior may change for nested `PERFORM` statements. If that is the case, explicitly set `PERFORM-TYPE"MF"` after `DIALECT"RM"` to continue with the previous behavior.

FLAGCD This Compiler directive is no longer available in Enterprise Developer. Remove it from your code, otherwise you receive a `COBCH0053 Directive invalid or not allowed here` error.

ILREF Previously, you could specify `.jar` files and other formats as a parameter when using this Compiler directive. Now, you can only specify `.class` files.

ILUSING If you set this Compiler directive using the `$set` command, the imported namespace is only applicable to programs, classes and referenced copybooks in that file. If you set the directive through the IDE or from the command line, the imported namespace is applicable to all programs and classes in the project or specified on the command line.

JVMDECIMAL  **Note:** This is applicable to JVM COBOL only.

This Compiler directive now controls how the following items are exposed in Java:

- Data items of type `DECIMAL`
- Non-integral data items exposed as the result of `ILSMARTLINKAGE`
- Non-integral data items exposed as the result of a `PROPERTY` keyword

Previously, these items would each be exposed as a `ScaledInteger`, which is still possible using `JVMDECIMAL`, but the directive's default is to expose each item as a `BigDecimal`.

**Compatible
ACUCOBOL-GT file
handling
environment
variables**

The following environment variables, introduced for ACUCOBOL-GT compatibility, have been replaced with other environment variables or configuration options that you add to your File Handler configuration file. No other ACUCOBOL-GT file handling environment variables are supported.

Redundant variable	Replaced with
FILE_CASE	FILECASE configuration option
FILE_PREFIX	COBDATA environment variable
FILE_SUFFIX	FILESUFFIX configuration option
APPLY_FILE_PATH	n/a
FILE_ALIAS_PREFIX	dd_ mapping

Setting these environment variables will have no effect.

**Open PL/I
Compiler**



Important: If you are installing this release as an upgrade to Enterprise Developer 2.2 Update 1, after the upgrade you must rebuild any applications that are compiled using the `-zp1` option.

The behavior of the `-zp1` option has been reverted to that of versions of Enterprise Developer earlier than 2.2 Update 1, with an additional correction relating to Char Varying data items.

The behavior has been restored to that in Enterprise Developer versions earlier than 2.2 where, when compiling with `-zp1`, all parameters are treated as unaligned. (In Enterprise Developer 2.2 Update 1, the behavior when compiling with `-zp1` was to not treat parameters as if unaligned).

When using the `-zp1` compiler option, all Character Varying data items are now treated as if unaligned. In previous versions of Open PL/I, for Character Varying data items, the `-zp1` unaligned requirement was applied only to structure members and parameters.

To illustrate the change, consider the following example:

```
zptest: proc options(main);  
  
    dcl 1 st1,  
        2 c char,  
        2 x(4) char(7) var init ('a', 'xx', 'yyy', 'zzzz');  
  
    dcl y(4) char(7) var init ('a', 'xx', 'yyy', 'zzzz');  
  
    dcl sub entry ((4) char(7) var);  
  
    call sub (x);  
  
    call sub (y);  
  
end;  
  
sub: proc (z);  
  
    dcl z(4) char(7) var;  
  
    dcl i fixed bin(31);  
  
    do i = 1 to hbound(z);  
        z(i) = 'x';  
    end;
```

```
end;
```

Where:

- For `x` and `z`, each `char (7) var` item is 7 plus 2 bytes which equals 9 and then multiplied by 4 equals 36.
- If `y` were aligned on half-word by default, each array element is half-word aligned and each equals 10 bytes (9 + 1 pad byte), and the total size equals 40 bytes.
- At `call sub (x)`, the calling argument and parameter are matched.
- At the `call sub (y)`, the `y` element size (10 bytes) is mismatched against the parameter `z` element size (9 bytes) due to `-zp1`. This is incorrect and causes unexpected program behavior.

Due to this correction of treating all Char Varying data items as if unaligned when using `-zp1`, the size of CHAR VARYING arrays now differs from previous versions of Open-PL/I. For example:

```
decl X(4) char(7) var;

Put skip list (size(X)) /* size is 36 bytes vs. 40 bytes in
previous versions of Open-PL1 */
```

Backward Compatibility with the Net Express and Mainframe Express IDE

The main differences between the Net Express, Mainframe Express and Eclipse IDEs are:

- Perspectives. The Team Developer perspective shows the views and menus relevant to COBOL and PL/I development, such as the Application Explorer view, Program Outline, Outline and Console views. There are other perspectives for Debugging, the Interface Mapper and CTF.
- **Project > Build automatically.** Whenever changes to a resource are saved, an incremental build starts, which rebuilds all the resources modified since the last build. You can force a rebuild by using **Project > Clean**.
- Build settings. These are available in three places:
 - **Project > Properties > Micro Focus > Project Settings.** You can specify any additional directives to be passed to the compiler at build time. These settings do not depend on the active build configuration and are always passed to the compiler.
 - **Project > Properties > Micro Focus > Build Configurations.** You can have multiple build configurations for different build scenarios and swap between them. You choose the configuration you want to use, by setting it as the current active configuration. This then overrides the project language settings.
 - **Properties** on the context menu for a single file. To set this, right-click the COBOL file in the Application Explorer view. The settings are specifically for this file and they override the currently active build configuration and the Project Language Settings.
- Debug and run configurations. You need one of these before you can debug or run a program. They are available from:
 - **Project > Properties > Micro Focus > Run-time Configuration.** These are the run-time settings for this project, such as run-time arguments, run-time tunables, COBOL switches and so on.
 - **Run > Debug Configurations.** Like build configurations, you can have multiple debug configurations and swap between them. These override the project run-time configuration.
 - **Run > Run Configurations.** These behave in the same way as debug configurations, but provide slightly different options.
- Cheat sheets. These are like tutorials and give step-by-step instructions on how to do a task, together with brief explanations. See **Help > Cheat Sheets > COBOL Development**. There are cheat sheets to:
 - Create a project to say "Hello COBOL World".

- Import existing COBOL files into Eclipse
- Debug a program

Changes in some options and files delivered with the product include:

ADIS In earlier Micro Focus products, the default location for the ADISCTRL file was `$(COBDIR)`. The default location of the file in Enterprise Developer is `$(COBDIR)/etc`.

Default working mode In Server Express and in versions of Visual COBOL R4 and earlier, the default working mode set by the COBMODE environment variable was 32-bit. With the current release of Visual COBOL and Enterprise Developer, it is 64-bit.

Format of the index files In Net Express and Server Express, the default setting of the IDXFORMAT option was 4. With the current release of Enterprise Developer, it is 8.

FILEMAXSIZE File Handler configuration option In Net Express and Server Express, the default setting for FILEMAXSIZE was 4. With the current release of Enterprise Developer, it is 8.

Coexisting with Earlier Micro Focus Products

Run-time system error due to COBCONFIG A run-time system error occurs if either the COBCONFIG or COBCONFIG_ environment variable is set when you run Enterprise Developer applications or when you use Enterprise Developer to edit or create projects and the configuration file it refers to contains entries that are not valid for Enterprise Developer.

For example, this might happen if you have Net Express or Studio Enterprise Edition installed and either COBCONFIG or COBCONFIG_ is set for it.

To work around this issue, ensure that Enterprise Developer is not running and then modify the configuration file by doing one of the following:

- If the invalid tunable is not needed by another application, remove it from the run-time configuration file.
- Add the following as the first line in the configuration file:

```
set cobconfig_error_report=false
```
- Unset COBCONFIG (or COBCONFIG_) or set it to another configuration file that does not contain the invalid tunable for the particular session you are running in.

Licensing error due to environment settings (applies to Windows environments only) The message "Micro Focus License Manager service is not running" can occur when you invoke a Net Express, Mainframe Express or Studio Enterprise Edition utility from Enterprise Developer. This happens when the tool is invoked with Enterprise Developer environment settings while it requires the Net Express or Studio Enterprise Edition ones.

This happens when you edit files such as `.dat` that have a file association with Net Express or Studio Enterprise Edition.

Compiling and Building Differences

There are several aspects of compiling and building applications that behave differently in Enterprise Developer. You might need to change the project properties and update some of the Compiler directives and settings that you previously used.

Output File Formats

Supported file formats - .exe and .dll

Each project compiles into a single file (.dll, .so or .exe), or to multiple files of the same file type with one output file for each source file (.dll, .so, .exe, .int, or .gnt). As well as an .lbr file, which contains a collection of .int and .gnt files on Windows, you now can use a .dll as the container for application components.

Building to multiple output files

Each project compiles into a single file (.dll, .so or .exe), or to multiple files of the same file type with one output file for each source file.

Instead of an .lbr file, which contained a collection of .int and .gnt files on Windows, you now use a .dll as the container for application components.

Your application can consist of multiple projects, each one building a single output file, with the projects linked together so that they can access each other. This is how you link to files outside of your project:

1. Click **File > New > Other**.
2. Expand **General** and click **File**.
3. Enter the name to use for the linked resource. You can enter an alias.
4. Click **Advanced**.
5. Select **Link to file in the file system** and browse to the file to link. You can also click **Variables** and define a path variable, so that you can link to files using a relative path.

Compiler directives

When you upgrade your source code to Enterprise Developer some Compiler directives that were specifically designed for 16-bit systems now produce an error on compilation because they are no longer relevant.

The following Compiler directives are no longer relevant and we recommend that you remove them from your code and directives files before you compile:

01SHUFFLE
64KPARA
64KSECT
AUXOPT
CHIP
DATALIT
EANIM
EXPANDDATA
FIXING
FLAG-CHIP
MASM
MODEL
OPTSIZE
OPTSPEED
PARAS
PROTMODE
REGPARM
SEGCROSS
SEGSIZE
SIGNCOMPARE

SMALLDD
TABLESEGCROSS
TRICKLECHECK

COBOL programs that interface with Assembler modules must be compiled with the AMODE directive. The AMODE directive was set by default in MSS; it is not set by default in Enterprise Developer.

Linking

The static run-time system and the single-threaded run-time system on Windows are no longer required and they are not shipped with Enterprise Developer. Applications built with Enterprise Developer are now linked to the shared or dynamic run-time systems. On UNIX, you can link to the single-threaded or multi-threaded shared or dynamic run-time system.

Linking from the command line

You can link applications from the Enterprise Developer command prompt with the `cbllink` or `cblnames` commands. For example, to produce an `.exe` file, use:

```
cbllink myprogram.cbl
```

To compile and link your code to produce a `.dll` file, use:

```
cbllink -d myprogram.cbl
```

With these commands, the single-threaded and static-linking options are automatically mapped onto the multi-threaded and shared run-time systems respectively.

Linking from the IDE

To specify what to link:

1. Click **Project > Properties**.
2. Expand **Micro Focus > Build Configurations**.
3. Click **Link** and specify your link settings.

Called Programs and Dependencies

At run time, called programs are found in the same way as before. However, there are some new ways to set COBPATH and copy files into a common folder.

To build the called programs

When you build the called programs into a `.dll` or `.so` file, you can set a property to output the built file into the same folder as the main application executable. To do this the called programs and the application main program must be in the same project. To set this:

1. Create a project that contains the programs that are called.
2. In the project properties, expand **Micro Focus > Build Configurations** and click **COBOL**.
3. In **Target Settings**, select **Single Native Library File**.
4. Set the **Output Path** to the subfolder where the main application executable is output.
5. If you want to debug the `.dll` file together with the application, expand **Override COBOL project settings**, check **Enable configuration specific settings**, and ensure **Compile for debugging** is checked.
6. Click **Apply** and then click **OK**.
7. Build the project.

To set the COBPATH environment variable

Add the COBPATH environment variable to the run-time configuration, as follows:

1. In the properties of the calling application project, expand **Micro Focus > Run-time Configuration > Environment Variables**.
2. Click **Add** to add the COBPATH variable and specify the full path to your called files.

File Handler

The File Handler .obj files are not available in Enterprise Developer. Enterprise Developer uses the File handler packaged in the `mffh.dll` file instead.

If the application you are upgrading from Net Express used the File Handler .obj files, when you link your application in Enterprise Developer the linker will emit a warning. The application will continue to operate as before provided that you supply the `mffh.dll` file with it.

Makefile Conversion

You cannot use existing makefiles from inside Enterprise Developer for Eclipse without changing some Eclipse defaults and adopting a modified build process. Where makefiles invoke commands supported by Enterprise Developer they will continue to work as before. Please contact Micro Focus for more information on using existing makefiles.

Enterprise Developer for Eclipse uses an ANT script, `.cobolBuild`, to build COBOL projects. This script is automatically generated from the `.cobolProj` project file. It is not possible to configure the IDE so that it uses existing external build scripts (such as makefiles, msbuild, shell scripts or others) for building COBOL applications.

You can still use existing build scripts to build COBOL applications outside of the IDE. You can set your own shell scripts as pre-build and post-build events and they will execute as part of the `.cobolBuild` ANT script before or after compiling.

1. Right-click on your project in the Navigator view and select **Properties**.
2. Expand **Micro Focus COBOL > Build Configurations** and click **Events** for the desired configuration.
3. Type the code of the script in the **Pre-build event command line field** or **Post-build event command line field**.
4. Click **Apply** and then **OK**.

To set pre-build and post-build events:

Please contact Micro Focus for more information on using existing makefiles.

OpenESQL Assistant

The OpenESQL Assistant data source names (DSNs) in Enterprise Developer must be configured as ODBC or XDB DSNs.

SQL Compiler Directive Options

If you get errors in Enterprise Developer when compiling an object application that was created in Net Express, Server Express or Studio Enterprise Edition, recompile specifying the GEN-CLASS-VAR SQL Compiler directive option in addition to other appropriate options.

XML PARSE Statement

In Net Express, Server Express, the default setting for the XMLPARSE Compiler directive is COMPAT, which causes the XML PARSE statement to return information and events for IBM Enterprise COBOL Version 3. In Enterprise Developer, the default is XMLPARSE(XMLSS), which returns information and events for IBM Enterprise COBOL Version 4.

To emulate the Net Express, Server Express behavior in Enterprise Developer, specify the XMLPARSE(COMPAT) Compiler directive option.

For a summary of the differences in event information between XMLPARSE(XMLSS) and XMLPARSE(COMPAT), see the *Special Registers* topic in your Enterprise Developer documentation.

Run-time System Differences

There are some differences between the run-time systems supplied with Enterprise Developer and those supplied with Net Express, Server Express and Mainframe Express. These, however, do not affect your existing applications if you recompile them from the source code in Enterprise Developer.

The changes in the run-time system are described in the following sections.

OpenESQL

Enterprise Developer sets the BEHAVIOR SQL Compiler directive option to MAINFRAME by default to provide optimal performance. To revert to the default behavior exhibited in Net Express, Server Express, set the BEHAVIOR directive to UNOPTIMIZED.

Single-Threaded Run-Time System

The single-threaded run-time system is not available in Enterprise Developer on Windows. Instead, both single-threaded and multi-threaded applications run using the multi-threaded run-time system. This has no effect on your existing applications. On UNIX, the single-threaded run-time system is available, so that applications can link with third-party code.

Static-Linked Run-Time System

The static-linked run-time system is not available in Enterprise Developer. Instead, you now link native code to the shared or dynamic run-time system. This has no effect on your existing applications.

See *Linking Native COBOL Code* in the product Help.

Setting the environment on UNIX

Before you start developing applications with Enterprise Developer for Eclipse on UNIX you need to set the environment. We recommend that you use the `cobsetenv` script to do this:

```
. /opt/microfocus/EnterpriseDeveloper/bin/cobsetenv
```

Note that `cobsetenv` is only compatible with POSIX-like shells, such as `bash`, `ksh`, or `XP4 sh`. It is not compatible with C-shell or pre-XP4 Bourne shell.

Enterprise Developer Co-existing with Earlier Micro Focus Products

If you have Enterprise Developer and Net Express or Studio Enterprise Edition installed on the same machine, you sometimes receive a run-time system error if either the `COBCONFIG` or `COBCONFIG_` environment variable is set when you run Enterprise Developer applications the configuration file it refers to contains entries that are not valid for Enterprise Developer.

To work around this issue, ensure that Enterprise Developer is not running and then modify the configuration file by doing one of the following:

- If the invalid tunable is not needed by another application, remove it from the run-time configuration file.
- Add the following as the first line in the configuration file:

```
set cobconfig_error_report=false
```

- Unset `COBCONFIG` (or `COBCONFIG_`) or set it to another configuration file that does not contain the invalid tunable for the particular session you are running in.

Restrictions and Unsupported Features

Some features in earlier Micro Focus products are not available in Enterprise Developer. However there are alternative techniques for many of these features.

CBL2XML Utility

The CBL2XML utility is currently available as a command line tool only.

DBMS Preprocessors

Earlier Micro Focus products supported DBMS preprocessor versions that are not supported in Enterprise Developer. For a list of currently supported DBMS preprocessors, see the *Database Access Support with Native COBOL* topic.

Dialog System

Dialog System applications are not supported in Eclipse but you can upgrade the non-GUI components of an application to Eclipse, and then recreate the GUI components using the GUI tools in Eclipse.

Form Designer

Form Designer is the Net Express tool for creating user interfaces for CGI-based Internet and intranet applications. Form Designer and the HTML page wizard are not available in Enterprise Developer.

In Enterprise Developer for Eclipse, you can install one of the available plug-ins to replicate these features.

GNT Analyzer

GNT Analyzer is not available in Enterprise Developer. It has been replaced by [Test Coverage](#).

Host Compatibility Option (HCO)

Mainframe Express provided a user interface for the Host Compatibility Option (HCO) feature. This user interface is not available in Enterprise Developer; however the HCO Create Database, DDL Processor, DCLGEN, Export Data, and Import Data tools are available via batch command line invocation.

INTLEVEL Support

The INTLEVEL directive is rejected by the Compiler in Enterprise Developer.

An INTLEVEL of 1, 2, or 3 is no longer supported and causes compilation errors. Other values are reserved for internal use and should not be used.

NSAPI

There is no support for NSAPI in Enterprise Developer.

Online Help System

Net Express provided the Online Help System for creating online help from character-based applications, and displaying it on screen. It is not available in Enterprise Developer and the Online Help System information file type (.HNF) is not supported.

OpenESQL

In both Net Express and Studio Enterprise Edition, support is provided for Oracle OCI in OpenESQL. Enterprise Developer does not support Oracle OCI in OpenESQL.

SQL Option for DB2

In the Mainframe Express and Net Express IDEs, you could invoke SQL Option for DB2 from the main menu within the IDE. For Enterprise Developer, SQL Option for DB2 is not available from the main menu in the IDE. Instead, all SQL Option for DB2 tools are available from **Start > All Programs > Micro Focus Enterprise Developer > Data Tools > SQL Option for DB2**.

Run-Time Technology Differences

Some technologies behave differently in Enterprise Developer and this might affect how you upgrade existing applications.

File Handling

The way you integrate your own security modules into Fileshare has changed. Also, the FILEMAXSIZE setting is different for Enterprise Developer and for Net Express and Server Express .

Using security modules

The way you integrate your own security modules (`fhrdrlngpwd`, `fhrdrpwd`, `fsseclog` and `fssecopn`) into Fileshare has changed.

In Enterprise Developer, you no longer relink Fileshare but you need to supply your own separate files, which are .dll files on Windows or shared objects on UNIX. For more information, see *Writing Your Own FHRdrLNgPwd Module*, *File Access Validation Module* and *Logon Validation Module* in the *File Handling* section of your product Help.

To use `fsseclog` and `fssecopn`, you need to link one or both of them into a `cobfssecurity.dll` or a shared object and place on the search path. Fileshare will issue a message indicating that it has loaded user security modules.

On UNIX, you no longer use `fsclose` to call Fileshare Manager. You need to use `cobfsclose` instead.

Sharing data files between applications built in Enterprise Developer and others built using Net Express or Server Express

If you have applications that access the same data files, all those applications should be built with the same FILEMAXSIZE setting otherwise file corruption may occur. However, you need to be aware that applications built with Enterprise Developer use a default setting of FILEMAXSIZE=8, while those built in Net Express or Server Express use FILEMAXSIZE=4.

Java and COBOL

The `cobsje` script is not available in Enterprise Developer for Eclipse on UNIX. Enterprise Developer uses the COBOL run-time system to load JVM based on LIBPATH, LD_LIBRARY_PATH, JAVA_HOME etc...

Test Coverage

Test Coverage replaces GNT Analyzer, which was available in Server Express. Code coverage for native COBOL applications available from within the IDE in Enterprise Developer integrates the Test Coverage functionality.

Test Coverage is also available from the command line.

Editing and Debugging Differences

Much of the edit and debug functionality in Net Express, Server Express and Mainframe Express is available in Enterprise Developer, but some of it has a different name or slightly different behavior. In addition there are some new features such as background parsing.

Interface Mapping Toolkit

The Interface Mapping Toolkit is available in Enterprise Developer for Eclipse; however it does not support CICS or IMS service interfaces.

Mixed Language Debugging

With Net Express you could debug mixed language applications. In Enterprise Developer, you can debug native COBOL and Java or native COBOL and C with some additional configuration.

To debug applications that contain programs in different languages, you need to debug the native COBOL and the non-COBOL code separately.

In Enterprise Developer for Eclipse, you can debug mixed native COBOL and Java using all COBOL target types.

You can debug native COBOL and C at the same time provided that the COBOL code has been compiled to .int code. In the COBOL Application debug configuration, you must uncheck the following option on the **General** tab and in the **Debug Options** section: **Allow debugging of all COBOL target types (and disable mixed language debugging)**.

Program Breakpoints

Program breakpoints are breakpoints that stop execution each time a specified program or entry point within the program is called. They are supported in Enterprise Developer, but by default their behavior is different from their behavior in Net Express

In Net Express, a program breakpoint caused execution to stop only when the Procedure Division entry point is called, while in Enterprise Developer, a program breakpoint causes execution to stop on any entry point to the program and on return to the program from a call.

Remote Debugging

The Net Express animserv utility used for debugging programs remotely has been replaced by `cobdebugremote` (or `cobdebugremote64` when debugging 64-bit processes) in Enterprise Developer.

To debug locally-developed programs on a remote machine you must start `cobdebugremote` (or `cobdebugremote64` when debugging 64-bit processes) before communication can be established. See the Enterprise Developer help for more information on `cobdebugremote`.

To debug remotely-developed programs on a remote machine:

- You use a local Enterprise Developer installation to develop remote projects on a remote UNIX machine that has Micro Focus Enterprise Developer UNIX Components installed.
- To debug a COBOL project, the project must be compiled for debugging and you need to create a debug configuration.

For more information, see the section on *Remote Debugging* in your Enterprise Developer for Eclipse product help.






Source Pool View













The source pool view in Net Express showed all source files available in the project directory, regardless of whether or not they are used in the current build type. This view is not available in Enterprise Developer.

Tips: Eclipse IDE Equivalents to IDE Features in Earlier Products

The following table shows Mainframe Express and Net Express IDE features and their corresponding equivalents and locations in Eclipse.

Functionality	In Mainframe Express	In Net Express	In Enterprise Developer for Eclipse
Project Control			
Project filename	* .MVP	* .APP	.cobolProj in Project directory
Add file to project	To create a new file from the supported types in the project directory, click File > New , specify the type of file to create, and click OK . Click Project > Add Files to add existing files to the project.	To create a new file from the supported types in the project directory, click File > New , specify the type of file to create, and click OK . Click Project > Add Files to Project to add existing files to the project.	All files in the project directory and its subdirectories are automatically part of the project. You can exclude programs or subdirectories from a build using the Build Action option on the context menu.

Functionality	In Mainframe Express	In Net Express	In Enterprise Developer for Eclipse
Copybook path	Via Workgrouping	Click Project > Properties , then click IDE and specify the COBCPY environment variable.	By default, all directories within a project and their subdirectories are included in the initial copybook path. To make changes, click Project > Project Properties > Micro Focus > Build Path and select the Dependency Paths tab.
Build settings for the project: <ul style="list-style-type: none"> • COBOL • CICS including BMS • Preprocessor • Additional directives 	ALT+F7 or click Project > Build Setting for Project and select the corresponding tabs.	ALT+F7 or click Project > Build Setting and select the corresponding tabs.	Right-click the project name and select Properties , (or click Project > Properties from the main menu).
Execution environment settings: <ul style="list-style-type: none"> • General • Assembler • COBOL • JCL 	Click Project > Project Settings and then click the Execution tab	The execution environment is Micro Focus Server.	The execution environment is Enterprise Server.
Debug settings: <ul style="list-style-type: none"> • DateWarp • Stored Procedures 	<ul style="list-style-type: none"> • Click Debug > DateWarp. • Click Debug > Debug Settings and check Enable Stored Procedures Debugging. 	<ul style="list-style-type: none"> • Click Debug > DateWarp. 	DateWarp is present in the debug launch configurations.
Editing			
Suggest Word/Content Assist	CTRL+G	CTRL+G	CTRL+Space
Locate	F12 (or context menu Locate)	F12 (or context menu Locate)	F3 (or context menu Goto Definition)
COBOL Find	CTRL+Shift+F12 (or context menu COBOL Find)	CTRL+Shift+F12 (or context menu COBOL Find)	CTRL+Shift+G (or context menu Find References)
Compress	Tool bar compress  (or context menu Compress)	Tool bar compress  (or context menu Compress)	Double-click on an item in the search result to jump to the line in the program.
Bookmark	CTRL+F2	CTRL+F2	Click Edit > Add Bookmark .
Compiling			
Single file Compile	CTRL+F7 (or click check mark )	CTRL+F7 (or click check mark )	Right-click a program name and select Single File Compile .  Note: This applies to native code only.

Functionality	In Mainframe Express	In Net Express	In Enterprise Developer for Eclipse
Build	F7 (or click build )	F7 (or click build )	By default, Eclipse automatically builds projects to keep them up to date. You can also build on request. To turn off the automatic build, click Project > Build Automatically .
Build All	ALT+B A	ALT+B A	Cleaning a project forces a rebuild. To access this, click Project > Clean .
Debugging			
Start Debugging	Alt+D A	Alt+D A	Choose Debug or F11 Before launching the session, create an appropriate debug launch configuration.
Stop Debugging	Shift+F5	Shift+F5	CTRL+F2 (or context menu Terminate) 
Restart Debugging	Ctrl+Shift+F5	Ctrl+Shift+F5	From the executable in the debug stack view, right-click and select Relaunch from the context menu.
Run	F5	F5	CTRL+F11
Step	F11 (or click step )	F11 (or click step )	F5
Step All	Ctrl+F5	Ctrl+F5	Click Resume  on the debug toolbar.
Run Thru	F10	F10	F6 (or Step Over )
Run Return	Shift+F11	Shift+F11	F7 (or Step Return )
Run to Cursor	Shift+F10 (or context menu)	Shift+F10 (or context menu)	CTRL+R (or context menu Run to Line )
Skip to Cursor	CTRL+Shift+F10	CTRL+Shift+F10	ALT+F12, R (or Reset Execution Point )
Skip Statement	ALT+D, I or click Debug > Skip Statement .	Click Debug > Skip Statement .	No equivalent. Use ALT+F12, R (or Reset Execution Point )
Skip Return	ALT+D, K or Click Debug > Skip Return	Click Debug > Skip Return .	No equivalent. Use ALT+F12, R (or Reset Execution Point )

Functionality	In Mainframe Express	In Net Express	In Enterprise Developer for Eclipse
Examine ' data item'	Shift+F9	Shift+F9	The Variables View automatically shows variable values on the current and previous lines.
Breakpoint set	F9	F9	Double click in the left margin to toggle a breakpoint.
Conditional Breakpoint	Click Debug > Breakpoint > Set Advanced.	Click Debug > Breakpoint > Set Advanced.	From the Breakpoints View, select a breakpoint and edit the properties.
Break on Data Change	Via list view	Via list view	To set a WatchPoint , double-click in the margin of line containing a WS item, or set it from the Outline View context menu.

Upgrading from ACUCOBOL-GT

There are conceptual and behavioral differences between Enterprise Developer and ACUCOBOL-GT, part of the Micro Focus extend® product family, and these differences can affect the way you upgrade existing applications to Enterprise Developer.

Refer to the *Compatibility with ACUCOBOL-GT* section for guidance and best practice on moving your applications to Enterprise Developer. It covers:

- Supported ACUCOBOL-GT features, including detailed information on support for compiler options and standard library routines.
- Syntactical differences between the two COBOL dialects, including workarounds or equivalent syntax where applicable.
- Detailed support of compatible ACUCOBOL Windowing syntax.
- Details on how to configure your applications to continue using your Vision data files.
- Details on converting your GUI projects using an import wizard (AddPack required).

Compatibility with ACUCOBOL-GT

The following sections describe supported ACUCOBOL-GT features and how to enable them.

Converting ACUCOBOL-GT Applications

With Enterprise Developer you can build, compile and debug ACUCOBOL-GT applications. Certain Compiler directives are provided to enable compatibility with some of ACUCOBOL-GT's language extensions, data files, and other behaviors.

After you have converted your application, you must run, license, and distribute your programs in the same manner as other Micro Focus programs. There is currently no clone of the ACUCOBOL-GT runtime known as `wrun32` (Windows) or `runcbl` (UNIX).

This section describes the ACUCOBOL-GT compatibility features, such as how they are enabled within Enterprise Developer, and also the potential problems you may encounter with some aspects of the converted source code.

Enabling ACUCOBOL-GT Compatibility

Compile your ACUCOBOL-GT source code with certain Compiler directives that enable support for ACUCOBOL-GT syntax, data types, and other behaviors. A number of traditional ACUCOBOL-GT compiler options are also available.

Compiler Directives for ACUCOBOL-GT Compatibility

There are a number of Compiler directives that provide compatibility with ACUCOBOL-GT. Use the `DIALECT"ACU"` directive to set all of these directives at once.

By setting `DIALECT"ACU"` you enable certain reserved words, data type storage behavior, and more. See *ACU DIALECT setting* for full details of the directives that are set.

You can set this directive in your source code directly, through the COBOL project options interface in your IDE or from the command line.

Compiler Option Support

You can use many of the ACUCOBOL-GT compiler options when compiling, by setting them with the `ACUOPT` Compiler directive. A list of the supported options is listed in this section.

Alternatively, you can compile using a clone of the ACUCOBOL-GT compiler known as `ccb1.exe` (Windows) or `ccb1` (UNIX). This executable is located in the `bin` directory found here:

`%ProgramFiles(x86)%\Micro Focus\Enterprise Developer.ccb1.exe` (Windows) or `ccb1` (UNIX) compiles to `.int` code unless you specify one of the `ccb1`'s native code options, in which case it produces `.gnt` code.

Setting Compiler Options

You can set the ACUCOBOL-GT compiler options by using the `ACUOPT` Compiler directive, or from a command line utility.

This COBOL system supports many of the compiler options available with the ACUCOBOL-GT (Acu) compiler. To specify these options use the `ACUOPT` Compiler directive along with the traditional ACU compiler option name.

For example:

```
ACUOPT(-option)
```

Or:

```
ACUOPT(--option)
```

`ACUOPT` automatically sets the `ACU` directive, which turns on overall ACUCOBOL-GT compatibility.

`NOACU` or `NOACUOPT` are not allowed.

Alternatively, you can compile using a clone of the ACUCOBOL-GT compiler known as `ccb1.exe` (Windows) or `ccb1` (UNIX). This executable is located in the `bin` directory found here:

`%ProgramFiles(x86)%\Micro Focus\Enterprise Developer.ccb1.exe` (Windows) or `ccb1` (UNIX) compiles to `.int` code unless you specify one of the `ccb1`'s native code options, in which case it produces `.gnt` code.

Supported ACUCOBOL-GT Compiler Options

There are a number of ACUCOBOL-GT Compiler options supported in Enterprise Developer, which you enable using the `ACUOPT` Compiler directive.

General Support Notes

Enterprise Developer supports the following ACUCOBOL-GT compiler functionality:

- Grouping of options

- CBLFLAGS environment variable
- Replacement of @ by the base name of the source file.

The following compiler options are available:

Standard Options

The standard options enable you to control certain compile time options, such as verbose output and renaming the object file.

The following compiler options are supported in Enterprise Developer when using `ccb1` (Windows) or `ccb132` and `ccb164` (UNIX) from the command line or the ACUOPT Compiler directive.

Option	Definition
-e	This option must be followed by a file name (as the next separate argument). When specified, this option causes the error listing to be written to the specified file instead of the screen. This file is removed if no errors are found.
-o	This option must be followed by a file name (as the next separate argument), which becomes the name of the object file instead of <code>source-name.int</code> . This file is removed if the compiler detects errors in the source.
-v	This option has multiple applications: <ul style="list-style-type: none"> • If it is the first and only option on the command line, then the compiler runs in "Version" mode. Using <code>-v</code>, you can display version information, the copyright notice, and other information. • Otherwise, if it is used in combination with other options, it causes the compiler to be verbose about its progress. <p>Because <code>-v</code> is the lead-in sequence for the video options, this option should be specified by itself.</p>
-w	This option causes warning messages to be suppressed (a warning condition is never a fatal compilation error). Suppressing warning messages can be helpful when you are converting programs from another COBOL dialect that uses slightly different syntaxes.
-x	This causes the CBLFLAGS environment variable to be ignored.

Native Object Code Options

The native object code option enables you to execute object files that contain native instructions for select families of processors.

The following compiler option is supported in Enterprise Developer when using `ccb1` (Windows) or `ccb132` and `ccb164` (UNIX) from the command line.

Option	Definition
-n	The Compiler produces native code specific to the bit arrangement and local machine. There is no support for cross-generation of native code.

Listing Options

The listing options enable you to control listing information generated with an object file.

The following compiler options are supported in Enterprise Developer when using `ccb1` (Windows) or `ccb132` and `ccb164` (UNIX) from the command line or the ACUOPT Compiler directive.



Note: The results of these options will differ from how they appear in ACUCOBOL-GT COBOL, as they map to listing Compiler directives in Enterprise Developer.

Option	Definition
-La	This option maps to the ERRLIST Compiler directive.
-Lc	This option maps to the XREF and RESEQ Compiler directives.
-Lf	This option maps to the COPYLIST Compiler directive.
-Li	This option maps to the ERRLIST Compiler directive.
-Ll	This option maps to the FORM Compiler directive.
-Lo	This option maps to the LIST Compiler directive.
-Ls	This option maps to the DATAMAP Compiler directive.
-Lw	This option maps to the LISTWIDTH Compiler directive.

Internal Table Options

The Internal Table options available in ACUCOBOL-GT are not required in Enterprise Developer. The following options are accepted by the compiler, but are ignored.

Option	Definition
-Td	Identifier and statement table — sets the maximum number of items in each statement. The default value is 4096.
-Te	Subscript statement table — sets the maximum size for OCCURS statements. The default value is 256.

Compatibility Options

The compatibility options enable you to control the compatibility with certain other COBOL systems.

The following compiler options are supported in Enterprise Developer when using `ccb1` (Windows) or `ccb132` and `ccb164` (UNIX) from the command line or the ACUOPT Compiler directive.

Option	Definition
-Ca	This option causes simple ACCEPT and DISPLAY statements to be treated in accordance with ANSI semantics. Specifying this option is the same as specifying FROM CONSOLE for all simple ACCEPT statements and UPON CONSOLE for all simple DISPLAY statements. You can control this behavior for individual ACCEPT or DISPLAY statements by specifying an explicit FROM/UPON phrase.
-Ci	This option sets the compiler to be compatible with ICOBOL for certain COBOL constructs.

Option	Definition
-Cr	This option sets the compiler to RM/COBOL compatibility mode.
-Cv	This option sets the compiler to IBM DOS/VS compatibility mode.

Source Options

The source options enable you to modify the way that the Compiler treats the physical source files.

The following compiler options are supported in Enterprise Developer when using `ccb1` (Windows) or `ccb132` and `ccb164` (UNIX) from the command line or the ACUOPT Compiler directive.

Option	Definition
-Sa	This causes the compiler to assume that the input source is in the standard ANSI source format.
-Sd	Setting this option causes debugging lines marked with D in the indicator area to be treated as normal source lines instead of comment lines. This is equivalent to supplying the phrase <code>WITH DEBUGGING MODE</code> in the <code>SOURCE-COMPUTER</code> paragraph.
-Sp	With this option you can specify a series of directories to be searched when the compiler is looking for COPY libraries. This option is followed (as the next separate argument) by the set of directories to search.
-St	This option forces the compiler to use the terminal source format.
-S1...-S9	Specifying a digit with -S uses alternate tab stops in source files. When this option is used, tabs will be set every # columns apart, where # is the number specified. For example, <code>-S4</code> will set tab stops at every fourth column. Tab stops always start in column 1.

Reserved Word Options

The reserved word options enable you to override the behavior of reserved words and synonyms.

The following compiler options are supported in Enterprise Developer when using `ccb1` (Windows) or `ccb132` and `ccb164` (UNIX) from the command line or the ACUOPT Compiler directive.

Option	Definition
-Rc	Allows you to change a reserved word. This option must be followed by two separate arguments: The first is the reserved word you want to change. The second is the word that you want to use instead. For example, <pre>-Rc TITLE NAME</pre> will allow you to use "TITLE" as a user-defined word and will cause the word NAME to be treated as the reserved word TITLE. You may not specify a word that is already reserved as the new reserved word. This option may be repeated to transform multiple reserved words.

Option	Definition
-Rn	<p>Allows you to make a reserved word a synonym for another reserved word. This option must be followed by two separate arguments: The first is the reserved word for which you want a synonym. The second is the word that functions as the synonym. For example,</p> <pre>-Rn COMP COMP-5</pre> <p>causes COMP-5 to be treated the same as the reserved word COMP. This option may be repeated to make multiple synonyms.</p>
-Rw	<p>This option allows you to suppress a particular reserved word. The option must be followed (as the next separate argument) by the reserved word you want to suppress. This option may be repeated to suppress multiple reserved words. This option also allows you to suppress some non-reserved words, such as control names (for example, <code>entry-field</code> and <code>label</code>) or property names (for example, <code>max-text</code> and <code>bitmap-number</code>).</p>

Data Storage Options

The data storage options control the behavior of certain data items and how they are stored.

The following compiler options are supported in Enterprise Developer when using `ccb1` (Windows) or `ccb132` and `ccb164` (UNIX) from the command line or the ACUOPT Compiler directive.

Option	Definition
-D1	<p>This option causes any data item whose underlying type is binary to be stored in one byte if that data item has only one or two digits. Normally, such a data item would be stored in two bytes.</p>
-D2	<p>This option causes COMPUTATIONAL data items to be treated as if they were declared as COMPUTATIONAL-2. This is the default when you are using RM/COBOL compatibility mode.</p>
-D5	<p>This option causes data items declared as BINARY to be treated as if they were declared as COMPUTATIONAL-5. This causes the values to be stored in the host machine's native byte-ordering instead of the machine-independent byte-ordering normally used. This option should be used with caution, because it can lead to programs that are not portable.</p>
-D6	<p>This option causes unsigned data items declared as PACKED-DECIMAL to be treated as if they were declared as COMPUTATIONAL-6. This saves one-half of a byte because the compiler will not generate any storage for the sign.</p>
-D7	<p>This option allows you to match one of the binary storage conventions used by Micro Focus COBOL. That convention is identical to the ACUCOBOL-GT <code>-Dm</code></p>

Option	Definition																						
	<p>convention, except that a PIC 9(7) data item (unsigned) is stored in 3 bytes instead of 4 and a PIC 9(12) data item (unsigned) is stored in 5 bytes instead of 6. When you use this option, the size of a binary item is determined as follows (the value in the table is the number of bytes occupied by the data item):</p> <table border="1" data-bbox="849 415 1468 1087"> <thead> <tr> <th data-bbox="849 415 1133 527">Number of Unsigned 9's in PIC Storage</th> <th data-bbox="1133 415 1468 527">Signed Storage</th> </tr> </thead> <tbody> <tr> <td data-bbox="849 527 1133 583">1 - 2 1</td> <td data-bbox="1133 527 1468 583">1</td> </tr> <tr> <td data-bbox="849 583 1133 640">3 - 4 2</td> <td data-bbox="1133 583 1468 640">2</td> </tr> <tr> <td data-bbox="849 640 1133 697">5 - 6 3</td> <td data-bbox="1133 640 1468 697">3</td> </tr> <tr> <td data-bbox="849 697 1133 753">7 3</td> <td data-bbox="1133 697 1468 753">4</td> </tr> <tr> <td data-bbox="849 753 1133 810">8 - 9 4</td> <td data-bbox="1133 753 1468 810">4</td> </tr> <tr> <td data-bbox="849 810 1133 867">10 - 11 5</td> <td data-bbox="1133 810 1468 867">5</td> </tr> <tr> <td data-bbox="849 867 1133 924">12 5</td> <td data-bbox="1133 867 1468 924">6</td> </tr> <tr> <td data-bbox="849 924 1133 980">13 - 14 6</td> <td data-bbox="1133 924 1468 980">6</td> </tr> <tr> <td data-bbox="849 980 1133 1037">15 - 16 7</td> <td data-bbox="1133 980 1468 1037">7</td> </tr> <tr> <td data-bbox="849 1037 1133 1087">17 - 18 8</td> <td data-bbox="1133 1037 1468 1087">8</td> </tr> </tbody> </table>	Number of Unsigned 9's in PIC Storage	Signed Storage	1 - 2 1	1	3 - 4 2	2	5 - 6 3	3	7 3	4	8 - 9 4	4	10 - 11 5	5	12 5	6	13 - 14 6	6	15 - 16 7	7	17 - 18 8	8
Number of Unsigned 9's in PIC Storage	Signed Storage																						
1 - 2 1	1																						
3 - 4 2	2																						
5 - 6 3	3																						
7 3	4																						
8 - 9 4	4																						
10 - 11 5	5																						
12 5	6																						
13 - 14 6	6																						
15 - 16 7	7																						
17 - 18 8	8																						
-Da	<p>This allows you to specify the data alignment modulus for level 01 and level 77 data items. Normally, level 01 and level 77 data items are aligned on a 4-byte boundary (modulus 4). This is optimal for 32-bit architectures. You can specify an alternate alignment boundary by following this option with the desired modulus. This should be specified as a single digit that immediately follows the -Da as part of the same argument. For example, -Da8 specifies that data should be aligned on 8-byte boundaries, which can provide improved performance on a 64-bit machine.</p>																						
-Db	<p>This causes COMPUTATIONAL data items to be treated as if they were declared as BINARY data items. This is the default when you are using VAX COBOL compatibility mode.</p>																						
-DCa	<p>This selects the ACUCOBOL-GT storage convention. It is the default setting. This convention is also compatible with data produced by RM/COBOL (not RM/COBOL-85) and previous versions of ACUCOBOL-GT. It also produces slightly faster code.</p>																						
-DCb	<p>This selects the MBP COBOL sign storage convention. Note that the MBP COBOL sign storage convention for USAGE DISPLAY directly conflicts with that used by IBM COBOL and some other COBOLs. As a</p>																						

Option	Definition
	<p>result, signed USAGE DISPLAY items in the MBP format are correctly understood only when the program is compiled with <code>-Dcb</code>. This is unlike the other sign conventions in which the runtime can usually extract the correct value even when a mismatched sign convention is specified at compile time.</p> <p>Also note that MBP COBOL does not have the COMP-2 storage type. The convention that ACUCOBOL-GT implements (Positive: X"0C"; Negative: X"0D") was chosen because MBP COBOL most closely matches the sign storage of other COBOLs that use that convention.</p>
-DCi	<p>This selects the IBM storage convention. It is compatible with IBM COBOL, as well as with several others including RM/COBOL-85. It is also compatible with the X/Open COBOL standard.</p>
-DCm	<p>This selects the Micro Focus storage convention. It is compatible with Micro Focus COBOL when the Micro Focus ASCII sign-storage option is used (this is the Micro Focus default).</p>
-DCn	<p>This causes a different numeric format to be used. The format is the same as the one used when the <code>-Dci</code> option is used, except that positive COMP-3 items use X"0B" as the positive sign value instead of X"0C". This option is compatible with NCR COBOL.</p>
-DCr	<p>This selects the Realia sign storage convention. Sign information for S9(n) variables is stored using the conventions for Realia COBOL, and their conversion to binary decimal is the same as that performed by the Realia compiler.</p>
-DCv	<p>This creates numeric sign formats that are compatible with VAX COBOL. These are identical to the IBM formats, except that unsigned COMP-3 fields place X"0C" in the sign position, instead of X"0F". The ANSI definition of COBOL does not state how signs should be stored in numeric fields (except for the case of SIGN IS SEPARATE). As a result, different COBOL vendors use different conventions. By using the options <code>-Dca</code>, <code>-Dci</code>, <code>-Dcm</code>, <code>-Dcn</code>, or <code>-Dcv</code>, you may select alternate sign-storage conventions. Doing so is useful in the following cases:</p> <ul style="list-style-type: none"> • If you need to export data to another COBOL system and need to match its sign-storage convention. • If you are importing data from another COBOL system, and that data contains key fields with signed data. Keys are treated alphanumerically, so if you use the incorrect sign-storage convention, ACUCOBOL-GT will not find a matching key when it is doing a READ.

Option	Definition						
-Dd31	<p>The storage-convention affects how data appears in USAGE DISPLAY, COMP-2, and COMP-3 data types.</p> <p>This option supports data items with up to 31-digits or 16 bytes. When this option is in effect, you may use as many as 31 X or 9 symbols in a PIC, instead of the usual 18. The maximum number of bytes in a COMP-X or COMP-N data item, whose picture contains only "X" symbols, is 16, instead of the usual 8. Intermediate results are calculated to 33 digits instead of the usual 20.</p>						
-Df	<p>This option changes the way the compiler treats data items declared as COMP-1 and COMP-2. Some compilers use COMP-1 and COMP-2 to specify single- and double-precision floating-point data items. ACUCOBOL-GT, however, assigns a different meaning to COMP-1 and COMP-2 and uses FLOAT and DOUBLE to specify floating-point data items. When the -Df option is used, the compiler treats data items declared as COMP-1 as if they were declared FLOAT and data items declared as COMP-2 as if they were declared DOUBLE. With the -Df option, you have the following correspondence:</p> <table border="1" data-bbox="849 905 1430 961"> <tr> <td>COMP-1</td> <td>FLOAT</td> <td>single precision</td> </tr> <tr> <td>COMP-2</td> <td>DOUBLE</td> <td>double precision</td> </tr> </table> <p>The -Df option makes it easier to compile code originally written for another compiler — one that used COMP-1 and COMP-2 to specify floating point data items. The -Df option lets you compile such code without having to change COMP-1 and COMP-2 to FLOAT and DOUBLE.</p>	COMP-1	FLOAT	single precision	COMP-2	DOUBLE	double precision
COMP-1	FLOAT	single precision					
COMP-2	DOUBLE	double precision					
-Di	<p>This option causes the compiler to initialize Working-Storage. Normally, the compiler will initialize all data items to spaces or the value specified with the -Dv option, except for those items given a VALUE clause. If this option is specified, data items are initialized according to their type:</p> <ul style="list-style-type: none"> • Alphabetic, alphanumeric, alphanumeric edited, and numeric edited items are initialized to spaces. • Numeric items are initialized to zero. • Pointer items are initialized to null. • Index items are initialized to 1. <p>Automatic initialization applies only to Working-Storage and does not apply to any item that (a) is given a VALUE clause, (b) is EXTERNAL, or (c) is subordinate to a REDEFINES phrase.</p>						
-D11/2/4/8	<p>This option allows you to limit the maximum alignment modulus that will be used for SYNCHRONIZED data items. Normally, a synchronized data item is aligned on a 2-, 4-, or 8-byte boundary depending on its type. This option allows you to specify an upper bound to the modulus used. This is specified as a single digit that</p>						

Option	Definition
	immediately follows the <code>-D1</code> as part of the same argument. For example, <code>-D14</code> specifies that the maximum synchronization boundary is a 4-byte boundary. If you want to make programs that are compliant with the 88/Open COBOL specification, you should specify <code>-D14</code> .
<code>-Dm</code>	This option causes any data item whose underlying type is binary to be stored in the minimum number of bytes needed to hold it. Normally, binary types are stored in two, four, or eight bytes. This option allows storage in any number of bytes ranging from one to eight.
<code>-Dq</code>	Causes the QUOTE literal to be treated as an apostrophe, or single quotation mark, rather than as a double quotation mark ("). One exception to this is the HP COBOL TRANSFORM verb, in which QUOTE is always treated as a double quotation mark.
<code>-Ds</code>	This causes USAGE DISPLAY numeric items with no SIGN clause to be treated as if they were described with the SIGN IS TRAILING SEPARATE clause. Several versions of RM/COBOL behave this way (all versions before 2.0, and some versions afterward).
<code>-Dv</code>	This option allows you to specify the default byte (initial value) used to initialize any data item not otherwise initialized when the program is loaded. The option must be followed by an equals sign (=) and the decimal value of the byte to use (for all current platforms, this is the ASCII value of the desired character). For example, to fill memory with the NULL character, use <code>-Dv=0</code> . To fill memory with the ASCII space character, use <code>-Dv=32</code> .
<code>-Dw32</code>	This option is checked for compatibility with the system's bit arrangement.
<code>-Dw64</code>	This option is checked for compatibility with the system's bit arrangement.

Truncation Options

The truncation options enable you to control the truncation of certain data items.

The following compiler options are supported in Enterprise Developer when using `ccb1` (Windows) or `ccb132` and `ccb164` (UNIX) from the command line or the ACUOPT Compiler directive.

Option	Definition
<code>-Dz</code>	All binary and packed-decimal data types ignore their PICTURE when determining the largest value they can hold. The PICTURE is not used when moving to a nonnumeric destination (the largest possible value determines the number of digits moved instead).
<code>-noTRUNC</code>	All binary data types ignore their PICTURE when determining the largest value they can hold. However, the PICTURE is used when moving data from a binary number to a nonnumeric data item. The name of this

Option	Definition
-truncANSI	<p>option is similar to the name used by some other COBOL systems that behave this way.</p> <p>Full ANSI COBOL rules are in place. Each numeric data item stores values up to its PICTURE in size. A small number of USAGE types provide exceptions (such as COMP-X and COMP-5). Values larger than allowed by the PICTURE are truncated using the standard size rules when the data item is the target of a MOVE statement; however, COMP-5 items do use their PICTURE when moving a value to a nonnumeric data item. The results of an arithmetic overflow (without the SIZE phrase) are undefined.</p>

Comments:

The -Dz truncation option is not supported in Managed COBOL.

Video Options

The video options enable you to control the behavior of certain items displayed to screen.

The following compiler options are supported in Enterprise Developer when using `ccb1` (Windows) or `ccb132` and `ccb164` (UNIX) from the command line or the ACUOPT Compiler directive.

Option	Definition
-Vc	This option causes any ACCEPT statement that contains a numeric or numeric edited receiving field to be treated as if the CONVERT phrase were also specified.
-Vd	<p>This option causes non-USAGE DISPLAY numeric items to be converted to USAGE DISPLAY before the screen display occurs.</p> <p>This option is always on.</p>

Warning and Error Options

The warning and error options enable you to set the error threshold before a object file will stop executing.

The following compiler options are supported in Enterprise Developer when using `ccb1` (Windows) or `ccb132` and `ccb164` (UNIX) from the command line or the ACUOPT Compiler directive.

Option	Definition
-a	This flag is now obsolete and should not be used.
-Qm	This option specifies the number of errors the compiler reports before it exits. The option must be followed by a positive numeric argument, which is the maximum number of errors the compiler reports before it exits. The default value is 100.

Debugging Options

The debugging options enable you to generate and execute object files suitable for debugging.

The following compiler options are supported in Enterprise Developer when using `ccb1` (Windows) or `ccb132` and `ccb164` (UNIX) from the command line or the ACUOPT Compiler directive.



Note: The results of these options may differ slightly from how they appear in ACUCOBOL-GT COBOL, as they map to the debugging Compiler directives in Enterprise Developer.

Option	Definition
-Ga, -Gd, -Gl, -Gs, -Gy	These options map to the ANIM Compiler directive setting.
-Gz	This option maps to the NOANIM Compiler directive setting.

Miscellaneous Options

The miscellaneous options enable you to control a number of aspects of the generated object files, such as bounds checking and optimization.

The following compiler options are supported in Enterprise Developer when using `ccb1` (Windows) or `ccb132` and `ccb164` (UNIX) from the command line or the ACUOPT Compiler directive.

Option	Definition
-Za	Causes the compiler to generate code to test array references at runtime. If an index is used which is out-of-bounds, the runtime system displays an error message showing the index value and the allowed bounds. (This causes some extra code to be generated and prevents certain table optimizations from occurring, so it should be turned off once a program is fully debugged.) With this option, the compiler does not re-use previously computed index values.
-Zc	This compact option optimizes for smaller code instead of faster code. This option is accepted by the compiler, but is ignored.
-Zd	Although still supported, this option has been replaced by the <code>-Gd</code> option. Both options produce the same results.
-Zg	Enables the use of segmentation (overlays) in the source. If this option is not used, section numbers will be ignored. This option is accepted by the compiler, but is ignored.
-Zi	Causes the program to be compiled as if it had the <code>IS INITIAL PROGRAM</code> phrase specified in its <code>PROGRAM-ID</code> paragraph.
-Zl	All data items may be larger than 64 KB. This option is obsolete.
-Zn	This turns off ACUCOBOL-GT's local optimizer. This is useful primarily to see if the optimizer is introducing errors in the generated object code. This option also prevents the compiler from re-using previously computed index values. This option is accepted by the compiler, but is ignored.
-Zs	Although still supported, this option has been replaced by the <code>-Gy</code> option. Both options produce the same results.

Option	Definition
-Zy	<p>This option lets you treat ACCEPT FROM DATE as ACCEPT FROM CENTURY-DATE, and ACCEPT FROM DAY as ACCEPT FROM CENTURY-DAY. If you use this option, the 4-digit year format will be used for ACCEPT FROM DATE providing that:</p> <ul style="list-style-type: none"> • The receiving field is numeric or numeric edited and contains eight or more integer digits; or • The receiving field is not numeric or numeric edited and contains eight or more character positions. <p>If neither of the above conditions applies, then ACCEPT FROM DATE will return its normal 6-digit format even if you use -Zy.</p>
-Zr0	<p>This option tells the compiler not to allow recursive PERFORMs. Event procedures require the ability to do recursive PERFORMs.</p>
-Zr1	<p>This option tells the compiler to allow recursive PERFORMs. Event procedures require the ability to do recursive PERFORMs.</p>

32- and 64-Bit Code Generation

When compiling with the DIALECT"ACU" directive, the Compiler generates intermediate code that is bit independent. By using `ccb1`, you can specify 32 or 64-bit intermediate code.

When compiling for generated code you must specify 32 or 64-bit. Enterprise Developer is bit-specific and does not support cross-bit generation.

For UNIX environments

`ccb1` is sensitive to the current COBMODE setting. There are also the `ccb132` and `ccb164` commands, which generate 32 or 64-bit code respectively. This is all analogous to `cob`.

For Windows environments

To produce bit-specific code, use `ccb1` from either a 32-bit or 64-bit command prompt.

ACUCOBOL-GT Conversion Issues

The syntax of most ACUCOBOL-GT source programs when submitted to run on this COBOL system will be accepted and run successfully. However, sometimes this COBOL system might reject some of the syntax in the original source program, or might cause your program to behave unexpectedly at run-time.

The following is not an exhaustive list of the restrictions of using ACUCOBOL-GT source code in Enterprise Developer. In most cases, if your code includes ACUCOBOL-GT features not supported by Enterprise Developer, you will receive a Compiler error.

Complementary ACUCOBOL-GT Technologies

In ACUCOBOL-GT, you can utilize a number of complementary technologies in your applications. In Enterprise Developer, there are a number of technologies that provide equivalent or similar functionality.

You should compile your source code with the DIALECT"ACU" Compiler directive to give the fullest ACUCOBOL-GT emulation in Enterprise Developer. If problems persist relating to any of the ACUCOBOL-GT technologies listed below, refer to the documentation for the corresponding Micro Focus technology to help remediate your code.

ACUCOBOL-GT technology	Corresponding technology	Notes
AcuConnect Thin Client	None	All syntax relating to this technology should be removed from your source.
AcuServer	Fileshare	You can connect to your Vision files through AcuServer, but the functionality is limited.
Acu4GL	Database Connectors	Full documentation is available from the <i>Product Documentation</i> section of the SupportLine website (http://supportline.microfocus.com).
AcuXDBC and AcuODBC	XDBC	Full documentation is available from the <i>Product Documentation</i> section of the SupportLine website (http://supportline.microfocus.com).
Xcentrinity for BIS	Xcentrinity for BIS	Full documentation is available from the <i>Product Documentation</i> section of the SupportLine website (http://supportline.microfocus.com).
XML Extensions	XML Extensions	Full documentation is available from the RM/COBOL product documentation set in the <i>Product Documentation</i> section of the SupportLine website (http://supportline.microfocus.com).
AcuSQL	OpenESQL preprocessor	Set the <i>DIALECT"ACU"</i> Compiler directive in your source to enable this preprocessor.
Graphical Technology (GT)	There are various JAVA toolkits (for example, Swing) that you can plug into the Eclipse IDE that provide GUI elements.	

Configuration Files and Configuration Variables

ACUCOBOL-GT configuration files and configuration variables are not supported in Enterprise Developer.

Enterprise Developer uses different configuration files and variables. You need to review your existing ACUCOBOL-GT configuration to determine which settings are relevant for use and which settings have Enterprise Developer equivalents.

For example, some configuration settings for handling Vision files can be set in the default File Handler in Enterprise Developer.

Some ACU configuration variables are not necessary or applicable in Micro Focus COBOL (for example, `PERFORM_STACK`), and the functionality of others is covered by the Micro Focus compile and run-time options (for example, `A_CHECKDIV`).

Multi-threading Implementation

The ACUCOBOL-GT multi-threading model differs from the multi-threading model implemented in Enterprise Developer.

The ACUCOBOL-GT model contains some additional syntax not supported in Enterprise Developer. Refer to *Multi-threaded Programming* for details of supported syntax and concepts in Enterprise Developer.

Screen Descriptions

Enterprise Developer and extend® differ in their support for some of the Screen Description phrases.

In Enterprise Developer, the following phrases of the Screen Description entry are not supported and should be removed from your programs:

AFTER
BEFORE
EXCEPTION

Truncation Options in Managed Code

The -Dz truncation option is not supported in Managed COBOL.

It is, however, supported in native COBOL, using the ACUOPT Compiler directive.

Unsupported Library Routines

The following ACUCOBOL-GT library routines are not (or will ever be) supported in Enterprise Developer and will produce a COBRT097 Acu library routine is and will remain unimplemented error. You should remove any calls to the following routines from your source code to avoid producing the error.



Note: This list may contain customer-specific routines that are not found in the ACUCOBOL-GT product documentation.

C\$ASYNCPOLL	C\$RESOURCE	W\$GETC
C\$ASYNCRUN	C\$SERVER-EXTENSION	W\$GETCHAR
C\$CHAIN	C\$SETERRORFILE	W\$GETCGI
C\$CHARTERR	C\$SETEVENTDATA	W\$GETURL
C\$CONFIG	C\$SETEVENTPARAM	W\$INPUTMODE
C\$EXCEPINFO	C\$SETVARIANT	W\$KEYBUF
C\$GETVARIANT	C\$TOJIS	W\$MENU
C\$GETEVENTDATA	KEISEN1	W\$MOUSE
C\$GETEVENTPARAM	KEISEN2	W\$PALETTE
C\$GETERRORFILE	KEISEN-SELECT	W\$POSTURL
C\$GETNETEVENTDATA	SYSID	W\$STATUS
C\$KEYMAP	W\$BROWSERINFO	\$HP-CURRENT-DATE
C\$PRODKEY	W\$FORGET	\$HP-TIME-OF-DAY

There is also another list of library routines that are not currently supported, but may be in the future. These also produce a run-time error COBRT098 The library routine is not available in Visual COBOL (routine-name) Please contact Micro Focus Customer Care for information and must be removed from your source code whilst they are not supported.

ASCII2HEX	C\$RCONVERT	REG_CREATE_KEY_EX
ASCII2OCTAL	C\$RECOVER	REG_DELETE_VALUE
HEX2ASCII	C\$REDIRECT	REG_ENUM_VALUE
KEISEN	C\$SOCKET	REG_QUERY_VALUE_EX
OCTAL2ASCII	C\$SYSLOG	REG_SET_VALUE_EX
C\$CODESET	R\$IO	S\$io
C\$DISCONNECT	REG_OPEN_KEY	\$WINHELP
C\$EXTINFO	REG_CLOSE_KEY	W\$BITMAP
C\$FILESYS	REG_CREATE_KEY	W\$FLUSH
C\$JAVA	REG_DELETE_KEY	W\$FONT

C\$KEYPROGRESS	REG_ENUM_KEY	W\$PROGRESSDIALOG
C\$LOCALPRINT	REG_QUERY_VALUE	W\$TEXTSIZE
C\$OPENSABEBOX	REG_SET_VALUE	WIN\$PLAYSOUND
C\$PARSEXFD	REG_OPEN_KEY_EX	WIN\$PRINTER
C\$PING		

For a list of currently supported library routines, refer to *ACUCOBOL-GT Library Routines*.

Using Pipes to Assign Filenames When Using the Vision File Handler

When assigning filenames, you cannot use certain pipes to assign a filename in the ASSIGN clause of the SELECT statement if you are using the Vision file handler.

The ACUCOBOL-GT syntax of assigning a file using the -P, -D, and -F syntax is not supported in Enterprise Developer; for example:

```
select test-file assign to "-P %TMP% cmd /c dir *.* > %TMP%"
```

```
select test-file assign to "-P ls *"
```

If your applications use this syntax, you should remove it from your SELECT statements.

For more information on the pipes that are supported, read *Programming > File Handling > File Handling Guide > Filenames > Setting Up Pipes*.

ACUCOBOL-GT File Handling

Enterprise Developer allows you to continue to use your existing ACUCOBOL-GT data files, including Vision indexed data files.

Those files can also continue to be used through AcuServer, with minimal changes to your code required.

Alternatively, you can convert your Vision files to Micro Focus format. There is no need to convert your sequential data files.

Configuring Access to Vision Files



Note: For these options to take effect, the ACUFH configuration option must be set ON; by default, this is ON. For these options to take effect under Enterprise Server, ESACUFH must also be set ON; by default, this is OFF.

To handle Vision files, you map a file to a compatible IDXFORMAT in the File Handler configuration file.

Within the configuration file, you can map an IDXFORMAT to all files in a particular folder, all files with a specific file extension, or a single file. See *Format of the Configuration File* for the tags that you can use for the mapping, and the order in which settings in these tags are applied.

The order that the mapping is applied is important, as conflicting settings can be overwritten; for example, the following excerpt of the configuration file sets all files in `c:\files\rmfiles` (Windows) or `usr/files/rmfiles` (UNIX) to IDXFORMAT 21 and all files with a `.DAT` extension to IDXFORMAT 17:

Windows:

```
[ FOLDER:C:\\files\\rmfiles ]
IDXFORMAT=21
```

```
[ *.DAT ]
IDXFORMAT=17
```

UNIX:

```
[ FOLDER:usr/files/rmfiles ]
IDXFORMAT=21
```

```
[ * .DAT ]
IDXFORMAT=17
```

If there is a .DAT file in `c:\files\rmfiles` (Windows) or `usr/files/rmfiles` (UNIX), the mappings are applied according to the type of tag. In the case above, mappings in the extension tag are applied after mappings in the FOLDER tag, and so the .DAT file in that directory has an IDXFORMAT of 17.

By default, the File Handler handles all sequential and relative data files, but if you want to handle them through the Vision file handler, use the INTEROP=ACU configuration option; however, in cases where the INTEROP and IDXFORMAT mappings conflict, the INTEROP setting will override IDXFORMAT for your Vision indexed data files.

File Limits

When using Vision files in Enterprise Developer, there are a number of file limits that affect file handling operations.

The following limits are in addition to the ones imposed in Enterprise Developer; see *Limits* in the *File Handling Reference* section.



Note: The limits listed on this page override any listed in the *File Handling Reference* section when handling Vision files.

Maximum record size:	64 MB (67,108,864)
Maximum number of indexed keys:	1 primary + 119 alternates
Maximum number of segments per key:	16
Maximum indexed key size:	250 bytes

Vision Related Utilities

Vision provides a series of utilities that enable you to manipulate Vision files from the command line.

Windows Platforms:

Each utility is available in a 32-bit and a 64-bit version, located in `%ProgramFiles(x86)%\Micro Focus\Enterprise Developer\bin` and `\bin64` respectively.

UNIX Platforms:

Each utility is available in a 32-bit and a 64-bit version, located in `$COBDIR/bin`. The version executed is determined by the COBMODE environment variable.

Commands

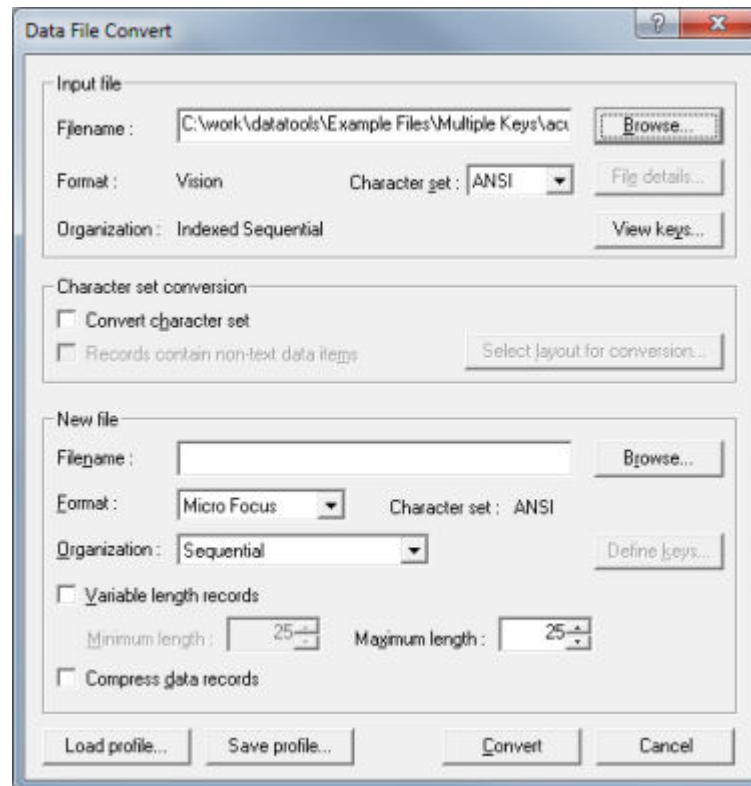
vuti132 (Windows) and mfvutil (UNIX)	Rebuilds a file that has become corrupt, or one that contains a large number of deleted records that you want to remove from the file.
vio32 (Windows) and mfvio (UNIX)	Enables you to collect a group of files together into archives, and allows you to extract some or all of these files from these archives.
loguti132 (Windows) and mflogutil (UNIX)	Enables you to examine and edit an ACUCOBOL-GT transaction log file.
acusort (Windows) and mfvisort (UNIX)	Enables you to sort or merge Vision files.

Converting Vision Files

You can access your Vision files using the File Handler, but if you prefer to convert them to Micro Focus format, as part of a migration, using one of the following:

Data File Converter

Use the Micro Focus Data File Converter to convert your Vision files to Micro Focus format.



DFCONV command line utility

Use DFCONV from the command line, specifying Vision as the input format for the file.



Note: For more information about the **Classic Data File Tools** utility, see *Converting Data Files*.

Configuring Access to Data Files Through AcuServer

Configure your converted applications to access data files through AcuServer.



Note: It is assumed that your environment and server is already configured correctly for using AcuServer.

Syntax:

To access a data file through AcuServer, the following syntax must be passed to the file handler:

Windows:

```
acurfap://servername:[port]:path\to\file
```

UNIX:

```
acurfap://servername:[port]:/path/to/file
```

acurfap://

The protocol to use for AcuServer. This does not change.

servername

The name of the AcuServer server.

port

The server port to use when connecting to AcuServer. This is optional, and if omitted, the default port number is used.

path/to/file

The path name to the file.

Specifying the file explicitly:

You can specify the full syntax in the SELECT statement. For example, the following statement connects to the server `asvr1`, on port 3011, then locates the file `idx1` at `C:\idx\` (Windows) or `/home/idx/` (UNIX).

Windows:

```
...
select acusvridx assign to acurfap://asvr1:3011:c:\idx\idx1.
...
```

UNIX:

```
...
select acusvridx assign to acurfap://asvr1:3011:/home/idx/idx1.
...
```

Specifying the file implicitly:

If you are not explicitly using the AcuServer syntax in your SELECT statement, for example:

```
...
select acusvridx assign to idx1.
...
```

you must specify it in the COBDATA environment variable using the syntax described above:

Windows:

```
set COBDATA=%COBDATA%; "acurfap://servername:port:path/to/file"
```

UNIX:

```
export COBDATA=$COBDATA: "acurfap://servername:port:path/to/file"
```

The following example connects to the server `asvr2`, on the default port, then locates the file in the SELECT statement at `c:\idx\` (Windows) or `/home/idx/` (UNIX).

Windows:

```
set COBDATA=%COBDATA%; "acurfap://asvr2::c:\idx"
```

UNIX:

```
export COBDATA=$COBDATA: "acurfap://asvr2::/home/idx"
```



Note: An additional set of quotation marks is required around the AcuServer syntax to preserve the original quotation marks. (UNIX only)

If a path name is specified in COBDATA, it is prepended to the file name before file name mapping takes effect.

You must also compile with FILETYPE=17 if you are using a sequential file, or if your file handling configuration file does not specify IDXFORMAT=17 for the Vision file.

File name mapping:

If you have used any ACUCOBOL file name mapping techniques to specify an AcuServer file, you will need to update the configuration to use Micro Focus file name mapping. Use the following table as a guide to some of the equivalents in this COBOL system.

ACUCOBOL variable	Replace with
FILE_CASE	FILECASE configuration option
FILE_PREFIX	COBDATA environment variable
FILE_SUFFIX	FILESUFFIX configuration option
APPLY_FILE_PATH	n/a
FILE_ALIAS_PREFIX	dd_mapping

Restrictions


The encryption and password protection features are not supported in Enterprise Developer.

ACUCOBOL-GT Library Routines

This COBOL development system provides a number of ACUCOBOL-GT library routines in native and managed code.

C\$CALLED BY

Returns the name of the caller of the currently running COBOL program or spaces if no caller exists or if the caller is unknown.

 **Note:** This ACUCOBOL-GT library routine is available in this COBOL version. Any compatibility issues in this COBOL system are in the Compatibility Issues section at the end of the topic.

Usage

```
CALL "C$CALLED BY"
    USING CALLING-PROGRAM
    GIVING CALL-STATUS
```

Parameters

CALLING-PROGRAM PIC X(n)	Contains the name of the calling program or spaces if no caller exists or if the caller is unknown. The runtime will use as much space for the name or spaces as the COBOL program allows. If the object being called is in an object library, the program returns the PROGRAM-ID. If the object is not in an object library, the disk name is returned.
CALL-STATUS PIC S99	This parameter receives one of the following values: 1 - Routine called by another COBOL program 0 - Routine is the main program; no caller exists -1 - Caller unknown; routine not called by a COBOL program

Compatibility Issues

None.

C\$CALLERR

Retrieves the reason why the last CALL statement failed. For accurate information, it must be called before any other CALL statement is executed.



Note: This ACUCOBOL-GT library routine is available in this COBOL version. Any compatibility issues in this COBOL system are in the Compatibility Issues section at the end of the topic.

Usage

```
CALL "C$CALLERR"
    USING ERR-CODE, ERR-MESSAGE
```

Parameters

ERR-CODE PIC X(2)

This parameter receives one of the following values:

01	Program file missing or inaccessible
02	Called file not a COBOL program
03	Corrupted program file
04	Inadequate memory available to load program
05	Unsupported object code version number
06	Recursive CALL of a program
07	Too many external segments
08	Large-model program not supported (returned only by runtimes that do not support large-model programs)
09	Exit Windows and run "share.exe" to run multiple copies of "wrun32.exe" (returned only by Windows runtimes)
14	Japanese objects are not supported (returned only by runtimes that do not support Japanese objects)

ERR-MESSAGE PIC X(n) (optional)

This routine may optionally be passed a second alphanumeric parameter. This parameter is filled in with a descriptive message about the error encountered.

Compatibility Issues

- Only ERR-CODE 01 is returned in this COBOL system.
- ERR-MESSAGE is always set to SPACES.

C\$CHDIR

Changes the current working directory.



Note: This ACUCOBOL-GT library routine is available in this COBOL version. Any compatibility issues in this COBOL system are in the Compatibility Issues section at the end of the topic.

Usage

```
CALL "C$CHDIR"
    USING DIR-NAME, ERR-NUM
```

Parameters

DIR-NAME PIC X(n)	Contains the name of the new directory, or spaces.
-------------------	--

ERR-NUM PIC 9(9) COMP-4 (optional)	<p>The "@[DISPLAY]:" for Thin Client support is allowed. For example:</p> <pre>C\$CHDIR "@[DISPLAY] : C : \path"</pre> <p>In Thin Client environments, to get the current default directory on the display host, DIR_NAME should contain "@[DISPLAY]:" followed by spaces.</p> <p>Holds the returned error number, or zero on success.</p>
------------------------------------	--

Comments

If a second USING parameter is passed, it must be described as PIC 9(9) COMP-4. This parameter will be set to ZERO if the directory change is successful. Otherwise, it will contain the operating system's error number.

If DIR-NAME contains spaces, then the current default directory is returned in it. In this case, ERR-NUM is not used. Otherwise, DIR-NAME should contain the name of a directory to make the new default directory. On Windows machines, this can include a drive letter. If you pass ERR-NUM, it will be set to zero if the change was successful. Otherwise, ERR-NUM will contain the error value returned by the operating system.

On some systems (such as VMS), it is legal to switch to a directory that does not exist, while other systems (Windows, UNIX) do not allow it.

The behavior of this routine is affected by the FILENAME_SPACES configuration variable. The value of FILENAME_SPACES determines whether spaces are allowed in a file name.

IMPORTANT

If you use C\$CHDIR, create a CODE_PREFIX configuration entry to locate your object files. Ensure that all of the search locations specified by the CODE-PREFIX are full path names. Do not use the current directory or any relative path names in the CODE_PREFIX. Without a full path name, the runtime system may be unable to find your object files if it needs to re-open them.

For example, the runtime system must occasionally re-open an object file when:

- you are using the source debugger
- the program contains segmentation (overlays)
- you are using object libraries

If the object file was initially found in the current directory or a directory specified relative to the current directory, and you then change the current directory with the C\$CHDIR routine, the runtime system will not be able to find the object file if it needs to re-open it. This will cause a fatal error and your program will halt.

If you use C\$CHDIR and you are running in debug mode, be sure to set CODE_PREFIX in the configuration file, not in the environment. You may set CODE_PREFIX in the environment when you are not in debug mode.

Compatibility Issues

- In JVM COBOL, this routine is not supported.
- "@[DISPLAY]" is not supported in this COBOL system.
- The FILENAME_SPACES configuration variable is not supported in this COBOL system. To use filenames that contain spaces, enclose them in quotation marks.
- The CODE_PREFIX configuration variable is not supported in this COBOL system.

C\$COPY

Creates a copy of an existing file.

Syntax:

```
CALL "C$COPY"  
    USING source-file, dest-file, [file-type,]  
    [GIVING status]
```

Parameters:**source-file**

PIC X(n)

dest-file

PIC X(n)

file-type

PIC X

status

Any numeric type

On Entry:**source-file**

The path name of the file to be copied

dest-file

The path name of the destination file

file-type

The file organization of the source file. It must be one of: S (for sequential), R (for relative) or I (for indexed).

This defaults to S if not specified.

On Exit:**copy-status**

Returns zero if the copy is successful, or non-zero if not.

Comments:

To obtain an extended file status code for this operation, define `status` as `comp xx comp-x` and follow the example in *Extended File Status Codes*.

C\$DELETE

Deletes a file.

Syntax:

```
CALL "C$DELETE"  
    USING file-name, [file-type,]  
    [GIVING status]
```

Parameters:**file-name**

PIC X(n)

file-type

PIC X

status

Any numeric type

On Entry:**file-name**

The pathname of the file to be deleted

file-type

The file organization of the filename. It must be one of: S (for sequential), R (for relative) or I (for indexed).

This defaults to S if not specified.

On Exit:**status**

Returns zero if the delete is successful, or non-zero if not.

Comments:

To obtain an extended file status code for this operation, define `status` as `comp xx comp-x` and follow the example in *Extended File Status Codes*.

C\$FILEINFO

Retrieves some operating system information about a given file.

Syntax:

```
CALL "C$FILEINFO"
    USING file-name, file-info
    GIVING status
```

Parameters:**file-name**

PIC X(n)

file-info

Define the following group

```
01 file-info
    03 file-size   pic x(8) comp-x.
    03 file-date   pic 9(8) comp-x.
    03 file-time   pic 9(8) comp-x.
```

status

Any numeric type

On Entry:**file-name**

The name of the file

On Exit:**file-info**

The group item to receive the file information

status

Returns zero if the delete is successful, or non-zero if not.

Comments:

To obtain an extended file status code for this operation, define `status` as `comp xx comp-x` and follow the example in *Extended File Status Codes*.

C\$GetLastFileOp

Retrieves the last COBOL I/O operation performed.

Use this library routine within a declarative procedure after an I/O error has occurred.

Syntax:

```
CALL "C$GetLastFileOp" USING operation
```

Parameters:

operation

PIC X(20)

On Exit:

operation The name of the last I/O operation performed. The valid operations returned are:

Close	ReadPreviousLock
Commit	ReadPreviousNoLock
Delete	Rewrite
DeleteFile	Rollback
Open	Start
ReadLock	StartTransaction
ReadNextLock	Unlock
ReadNextNoLock	UnlockAll
ReadNoLock	Write

Comments:

If the operation is longer than 20 characters, it is truncated to the right.

If the value SPACES is returned that indicates that no operation is available.

C\$JUSTIFY

C\$JUSTIFY performs left or right justification of data and centering of data.



Note: This ACUCOBOL-GT library routine is available in this COBOL version. Any compatibility issues in this COBOL system are in the Compatibility Issues section at the end of the topic.

Usage

```
CALL "C$JUSTIFY"  
USING DATA-ITEM, JUSTIFY-TYPE
```

Parameters

DATA-ITEM Any data item

This data item contains the data to be justified.

JUSTIFY-TYPE PIC X

This optional parameter contains one of three literal values:

L	indicates left justification
---	------------------------------

R	indicates right justification
C	indicates centering

If this parameter is omitted, then "R" is implied.

Description

This routine removes all leading and trailing spaces from DATA-ITEM and justifies the remaining data as indicated by JUSTIFY-TYPE. The resulting string is returned in DATA-ITEM. If centering is chosen, there will be one more space on the right than on the left if an odd number of spaces is used.

Compatibility Issues

None

C\$LIST-DIRECTORY

The C\$LIST-DIRECTORY routine lists the contents of a selected directory. Each operating system has a unique method for performing this task. C\$LIST-DIRECTORY provides a single method that will work for all operating systems.



Note: This ACUCOBOL-GT library routine is available in this COBOL version. Any compatibility issues in this COBOL system are in the Compatibility Issues section at the end of the topic.

Usage

```
CALL "C$LIST-DIRECTORY"
    USING OP-CODE, parameters
```

Parameters

OP-CODE PIC 99 COMP-X	Indicates which C\$LIST-DIRECTORY operation to perform. The operations are described below.
-----------------------	---

Parameters vary depending on the op-code chosen.

Parameters provide information and hold results for the op-code specified. These parameters are described below.

Description

C\$LIST-DIRECTORY allows you to get the names of files residing in a given directory. It accomplishes this through three distinct operations. The first operation opens the specified directory. The second operation returns the filenames in the list, one-at-a-time. The third operation closes the directory and deallocates all memory used by the routine. C\$LIST-DIRECTORY has the following operation codes (defined in `acucobol.def`):

LISTDIR-OPEN (VALUE 1)

Opens the specified directory. It has two parameters:

Directoryname PIC X(n)

Contains the name of the directory to open. This directory must exist, and you must have permissions to read the directory. You may use remote name syntax if AcuServer is installed on the remote machine. The "@[DISPLAY]:" for Thin Client support may be used.

For example:

```
C$LIST-DIRECTORY using listdir-open,
    "@[DISPLAY]:C:\path", pattern
```

Pattern PIC X(n)

Specifies the type of filename for which to search. This routine supports "wildcards," meaning that the character "*" will match any number of characters, and the character "?"

will match any single character. For example, you can search by file suffix (*.def) or by a common part of a file name (acu*).

If the call to LISTDIR-OPEN is successful, RETURN-CODE contains a handle to the list. The value in RETURN-CODE should be moved to a data item that is USAGE HANDLE. That data item should be passed as the directory handle to the other C\$LISTDIRECTORY operations. If the call to LISTDIR-OPEN fails (if the directory does not exist, contains no files, or you do not have permission to read the directory), RETURN-CODE is set to a NULL handle.

LISTDIR-NEXT (VALUE 2)

Reads each filename from the open directory. It has two parameters:

Handle USAGE HANDLE

The handle returned in the LISTDIR-OPEN operation.

Filename PIC X(n)

The location of the next filename to be returned. If the directory listing is finished, it is filled with spaces.

The call to LISTDIR-NEXT can include an additional argument, LISTDIR-FILE-INFORMATION (defined in "acucobol.def"), which receives information about the returned file name. This is an optional group item which returns information about the following data items:

LISTDIR-FILE-TYPE

The file type can be one of the following:

- B = block device
- C = character device
- D = directory
- F = regular file
- P = pipe (FIFO)
- S = socket
- U = unknown

LISTDIR-FILE-CREATION-TIME

The creation time is the date (and time) that the file was originally created.

LISTDIR-FILE-LAST-ACCESS-TIME

The last access time is the date (and time) that the file was last accessed by some application (usually when the file was queried in some way).

LISTDIR-FILE-LAST-MODIFICATION-TIME

The last modification time is the date (and time) the file was last written to.

LISTDIR-FILE-SIZE

The size of the file is given in bytes.

LISTDIR-CLOSE (VALUE 3)

Releases the resources used by the other operations. It must be called to avoid memory leaks. It has one parameter, handle, which is the same data item used by the LISTDIR-NEXT operation.

Handle USAGE HANDLE

The handle returned in the LISTDIR-OPEN operation.



Note: Because the supported file types vary by operating system, The data items in the above list have slightly different meanings depending on your operating system. Even on operating systems that support these values, some file systems may not. Some versions of the UNIX[®] operating system may change these values when permissions are changed. Refer to your operating system documentation for specific definitions.

Example

The following example lists the contents of a directory with repeated calls C\$LISTDIRECTORY:


```
WORKING-STORAGE SECTION.
copy "def/acucobol.def".
01 pattern          pic x(5) value "*.vbs".
01 directory        pic x(20) value "/virusscan".
01 filename         pic x(128).
01 mydir            usage handle.
PROCEDURE DIVISION.
MAIN.
* CALL LISTDIR-OPEN to get a directory handle.
  call "C$LIST-DIRECTORY"
    using listdir-open, directory, pattern.
  move return-code to mydir.
  if mydir = 0
    stop run
  end-if.
* CALL LISTDIR-NEXT to get the names of the files.
* Repeat this operation until a filename containing only
* spaces is returned. The filenames are not necessarily
* returned in any particular order. Filenames may be
* sorted on some machines and not on others.
  perform with test after until filename = spaces
    call "C$LIST-DIRECTORY"
      using listdir-next, mydir, filename
  end-perform.
* CALL LISTDIR-CLOSE to close the directory and deallocate
* memory. Omitting this call will result in memory leaks.
  call "C$LIST-DIRECTORY" using listdir-close, mydir.
  stop run.
```

Compatibility Issues

- You must compile with the DIALECT"ACU" Compiler directive when using this library routine.
- "@[DISPLAY]" is not supported in this COBOL system.
- Under the optional LISTDIR-FILE-INFORMATION group item, the fields LISTDIR-FILE-CREATION-TIME and LISTDIR-FILE-LAST-ACCESS-TIME only return zeroes.

C\$LOCKPID

This routine returns the Process ID (PID) of the process holding the lock responsible for the previous file lock or record locked condition encountered. This library routine works only with the Vision file system and the UNIX platform.

 **Note:** This ACUCOBOL-GT library routine is available in this COBOL version. Any compatibility issues in this COBOL system are in the Compatibility Issues section at the end of the topic.

Usage

```
CALL "C$LOCKPID"
  GIVING PROCESS-ID.
```

Parameter

PROCESS-ID PIC 9(n)

This contains a numeric data item large enough to hold a PID. On most platforms, PIC 9(5) is sufficient. On 64-bit systems, PIC 9(7) is recommended.

Comments

C\$LOCKPID returns a PROCESS-ID of 0 if you have not yet encountered a locked file or record, if the PID is otherwise not found, or if you've used this routine with a non-UNIX runtime.

Compatibility Issues

None

C\$MAKEDIR

Creates a new directory.



Note: This ACUCOBOL-GT library routine is available in this COBOL version. Any compatibility issues in this COBOL system are in the Compatibility Issues section at the end of the topic.

C\$MAKEDIR can make a directory only one level lower than an existing directory and cannot create more than one level at a time.

Usage

```
CALL "C$MAKEDIR"  
    USING DIR-NAME GIVING STATUS-CODE
```

Parameters

DIR-NAME PIC X(n)	Contains the name of the directory to be created. This should be either a full path name or a name relative to the current directory. You may use remote name syntax in combination with AcuServer to create a directory on a remote machine. The "@[DISPLAY]:" annotation for Thin Client support may also be specified. For example: <pre>C\$MAKEDIR "@[DISPLAY]:C:\path"</pre>
STATUS-CODE Numeric data item.	Receives the return status of the call to create a directory. A return status of zero indicates that the directory was successfully created; a status of one ("1") indicates otherwise. The behavior of this routine is affected by the FILENAME_SPACES configuration variable. The value of FILENAME_SPACES determines whether spaces are allowed in a file name.

Compatibility Issues

- "@[DISPLAY]" is not supported in this COBOL system.
- The FILENAME_SPACES configuration variable is not supported in this COBOL system. To use filenames that contain spaces, enclose them in quotation marks.

C\$MEMCPY (Dynamic Memory Routine)

Copies bytes between any two memory locations.



Note: This ACUCOBOL-GT library routine is available in this COBOL version. Any compatibility issues in this COBOL system are in the Compatibility Issues section at the end of the topic.

Usage

```
CALL "C$MEMCPY"  
    USING , BY VALUE , DEST-PTR , SRC-PTR , NUM-BYTES
```

Parameters

DEST-PTR USAGE POINTER or USING BY REFERENCE	Contains the address of the first byte of the destination.
SRC-PTR USAGE POINTER or USING BY REFERENCE	Contains the address of the first byte of the source.
NUM-BYTES USAGE UNSIGNED-INT or an unsigned numeric literal	Indicates the number of bytes to copy.

Description

This routine copies NUM-BYTES bytes of memory from the address contained in SRC-PTR to the address contained in DEST-PTR. This routine is functionally similar to the M\$COPY (Dynamic Memory Routine) routine except that parameters are passed by value instead of by reference. This routine can be used in cases where M\$PUT and M\$GET are not adequate. Note that this routine is relatively dangerous to use. It does not perform any error checking and can easily cause memory access violations if you pass it incorrect data. In other words, this routine is a very low-level routine and should be used cautiously.

You do not need to pass POINTER data items for SRC-PTR and DEST-PTR. If you prefer, either or both can be replaced by a data item passed BY REFERENCE. If you do this, then the address of the data item is passed to C\$MEMCPY. For example, you can copy 10 bytes to DEST-ITEM from the memory address contained in SRC-PTR with:


```
CALL "C$MEMCPY"  
    USING BY REFERENCE DEST-ITEM, BY VALUE SRC-PTR, 10
```

Compatibility Issues

None.

C\$MYFILE

Returns the filename of the disk file containing the currently executing program.

 **Note:** This ACUCOBOL-GT library routine is available in this COBOL version. Any compatibility issues in this COBOL system are in the Compatibility Issues section at the end of the topic.

This is especially useful if the disk file is an object library.

Usage

```
CALL "C$MYFILE"  
    USING PROGRAM-NAME  
    GIVING CALL-STATUS
```

Parameters

PROGRAM-NAME PIC X(n)	Indicates the name of the disk file containing the currently executing program, if known. The runtime will use as much space for the name of the file as the COBOL program allows. This parameter will contain the filename just as the runtime received it. For example, if an object library is loaded as <code>../ardir/myarlib.lib</code> , and a program in <code>myarlib.lib</code> calls this routine, PROGRAM-NAME will have a value of <code>../ardir/myarlib.lib</code> .
CALL-STATUS PIC S99.	This parameter receives one of the following values:

1 - PROGRAM-NAME was filled successfully

-1 - Program name unknown

Compatibility Issues

None.

C\$NARG

This routine returns the number of parameters passed to the current program.



Note: This ACUCOBOL-GT library routine is available in this COBOL version. Any compatibility issues in this COBOL system are in the Compatibility Issues section at the end of the topic.

Usage

```
CALL "C$NARG"  
    USING NUM-PARAM
```

Parameter

NUM-PARAM COMP-1

Description

This routine must be called with one USING parameter that must be a COMP-1 data item. This data item is filled in with the number of parameters. If the calling program is a subprogram, then this will be the number of USING items in the CALL statement that initiated the program. If the calling program is a main program, then this will be the number of CHAINING parameters passed from the runcbl command line or the CHAIN statement that initiated the program. C\$NARG works only when the program is a called subroutine. It does not work with the "CALL RUN" form of the CALL verb.

Compatibility Issues

- This routine is not supported in managed COBOL.
- Set the Compiler directive COMP1(BINARY) to set ACUCOBOL-GT behavior for COMP-1 data items.
- The "CALL RUN" statement is not supported in this COBOL system.
- In ACUCOBOL-GT COBOL, the number of parameters passed is calculated by the number of parameters specified in the USING phase of the CALL statement in the calling program. In this COBOL system, the number of parameters passed is calculated by the number of parameters the calling program actually receives.

C\$PARAMSIZE

This routine returns the number of bytes actually passed by the caller for a particular parameter.



Note: This ACUCOBOL-GT library routine is available in this COBOL version. Any compatibility issues in this COBOL system are in the Compatibility Issues section at the end of the topic.

Usage

```
CALL "C$PARAMSIZE"  
    USING PARAM-NUM,  
    GIVING PARAM-SIZE
```


Parameters

PARAM-NUM numeric parameter	This value is the ordinal position in the Procedure Division's USING phrase of the parameter whose size you want to know.
PARAM-SIZE any numeric data item	This item receives the number of bytes in the data item actually passed by the caller.

Description

This routine returns the actual size (in bytes) of a data item passed to the current program by its caller. You pass the number (starting with 1) of the data item in the Procedure Division's USING phrase, and C\$PARAMSIZE will return the size of the corresponding item that was actually passed. This can be useful for handling data items of unknown size.

For example, suppose that you wanted to write a routine that could convert any data item to upper-case, up to 10000 bytes in size. This routine could look like this:

```
IDENTIFICATION DIVISION.  
PROGRAM-ID. MAKE-UPPERCASE.  
  
DATA DIVISION.  
WORKING-STORAGE SECTION.  
77 PARAM-SIZE PIC 9(5).  
  
LINKAGE SECTION.  
77 PASSED-ITEM PIC X(10000).  
  
PROCEDURE DIVISION USING PASSED-ITEM.  
MAIN-LOGIC.  
    CALL "C$PARAMSIZE" USING 1, GIVING PARAM-SIZE  
    INSPECT PASSED-ITEM( 1 : PARAM-SIZE )  
        CONVERTING "abcdefghijklmnopqrstuvwxyz "  
        TO "ABCDEFGHIJKLMNOPQRSTUVWXYZ "  
    EXIT PROGRAM.
```

In this example, if you do not use C\$PARAMSIZE, you have to pass a full 10000 bytes to this routine or you get a memory usage error. By using C\$PARAMSIZE and reference modification, only the memory actually passed is referenced, and there is no error. C\$PARAMSIZE works only when the program is a called subroutine. It does not work with the "CALL RUN" form of the CALL verb.


If you pass a subitem of a linkage item in a CALL statement and the subprogram calls C\$PARAMSIZE with requesting the size of the parameter, it will get the size as described in the linkage section of the calling program, unless that subitem is the first item of the linkage item. In that case, the size returned will be the size of the original item.

Compatibility Issues

- This routine is not supported in managed COBOL.
- In this COBOL system, the size of the item as specified in the calling program is always returned.

C\$REGEXP

This routine allows you to search strings using regular expressions.

 **Note:** This ACUCOBOL-GT library routine is available in this COBOL version. Any compatibility issues in this COBOL system are in the Compatibility Issues section at the end of the topic.

Usage

```
CALL "C$REGEXP"  
    USING OP-CODE, parameters  
    GIVING return-value
```

Parameters

OP-CODE: Numeric data item.

Op-codes specify the operation to perform. Each operation is defined in `acucobol.def` and is described in detail below. Op-codes include:

Code	Operation
1	AREGEXP-GET-LEVEL
2	AREGEXP-COMPILE
3	AREGEXP-MATCH
4	AREGEXP-RELEASE-MATCH
5	AREGEXP-RELEASE
6	AREGEXP-NUMGROUPS
7	AREGEXP-GETMATCH
20	AREGEXP-LAST-ERROR

parameters: Type varies (defined in `acucobol.def`).

Parameters vary depending on the operation selected. They provide information and hold results.

return-value: Numeric data item.

Unless otherwise noted, each operation returns a value or a status in return-value. Its contents vary by operation and the result of the operation.

Description

This routine allows you to use a regular expression to search a text string.

A regular expression is a formula for matching strings that have a certain pattern. For a complete description of regular expressions, see the POSIX 1003.2 standard appropriate for your platform. Windows platforms use the `CAtlRegExp` library; UNIX platforms use the POSIX C routines native to the platform.

A simple use of `C$REGEXP` is outlined in the following steps.

1. Use the `AREGEXP-GET-LEVEL` op-code to validate that the host platform provides support for regular expressions.
2. Validate and compile your regular expression with op-code `AREGEXP-COMPILE`. Your program should include an error handling routine in the event that the compiler finds an error in the expression.
3. Use op-code `AREGEXP-MATCH` to apply a compiled regular expression to a string to search for a match. You may want to do this iteratively to find all matches in the string.
4. Use op-codes `AREGEXP-NUMGROUPS` and `AREGEXP-GETMATCH` to work with subexpression matches.
5. Manage the memory used by this routine with op-codes `AREGEXP-RELEASE-MATCH` and `AREGEXP-RELEASE`.

Op-codes and Parameters

`AREGEXP-GET-LEVEL` (op-code 1)

This operation indicates whether regular expression support is available on the host. Its usage is:

```
CALL "C$REGEXP" USING AREGEXP-GET-LEVEL GIVING return-value
```

The value of return-value can be one of the following (defined in `acucobol.def`):

AREGEXP-NONE	0	regular expression processing is not available
AREGEXP-WINDOWS	1	Windows regular expressions supported
AREGEXP-POSIX	2	POSIX regular expressions supported

AREGEXP-COMPILE (op-code 2)

This operation compiles a regular expression to ensure that it has a valid form, returning a handle to the compiled regular expression or NULL if there is an error. Its usage is:

```
CALL "C$REGEXP" USING AREGEXP-COMPILE, reg-expr, flags  
GIVING return-value
```

reg-expr

Must be a NULL-terminated regular expression. It must be NULL-terminated because trailing spaces are allowed in regular.

flags

(Optional) is the sum of one or more of the following values (defined in `acucobol.def`):

AREGEXP_COMPILE_IGNORECASE	1	Ignore case when matching patterns. (Windows or UNIX)
AREGEXP_COMPILE_BASIC	2	Change the type of regular expression from extended to basic. (UNIX only) (For an explanation of extended and basic, see the POSIX 1003.2 standard.)
AREGEXP_COMPILE_NO_SPECIAL	4	Treat all characters as ordinary characters with no special meaning. (UNIX only)
AREGEXP_COMPILE_NO_SUB	8	When matching, determine only if there is a match, without returning the offsets of the match. (UNIX only)
AREGEXP_COMPILE_NEWLINE	16	Treat newlines as special (end-of-line marker) characters. (UNIX only)
AREGEXP_COMPILE_NO_REGEXP	32	Treat <i>reg-expr</i> as text, not as a regular expression.

return-value contains a handle to the compiled expression, or NULL if an error occurred.

AREGEXP-MATCH (op-code 3)

This operation applies a regular expression to a string, and returns a handle. The match-start parameter must be initialized before AREGEXP-MATCH is attempted, as it specifies the start position in which matching should begin. To see if there is a match you need to check match-start; if it is 0, there is no match. Its usage is:

```
CALL "C$REGEXP" USING AREGEXP-MATCH,  
reg-expr-handle, string, length, match-start, match-end  
GIVING return-value
```

reg-expr-handle	is a handle to a regular expression returned by AREGEXP-COMPILE.
string	is the string to test for a match.
length	is the length of string. If length is zero, the size of string is used.
match-start	as an input parameter, match-start indicates where the matching should begin. As an output parameter, it returns the index of the start of the pattern that matched.
match-end	returns one byte beyond the pattern that matched. To test the string for additional matches, start a new AREGEXP-MATCH after setting match-start to match-end.
return-value	contains a handle to the match or zero if no match is found or an error occurred.

AREGEXP-RELEASE-MATCH (op-code 4)

This operation frees memory that is allocated when AREGEXP-MATCH is called. Return-value is not used. Its usage is:

```
CALL "C$REGEXP" USING AREGEXP-RELEASE-MATCH match-handle
```

match-handle	is a handle to a match returned by AREGEXP-MATCH.
--------------	---

AREGEXP-RELEASE (op-code 5)

This operation frees the memory allocated when AREGEXP-COMPILE is called. Return-value is not used. Its usage is:

```
CALL "C$REGEXP" USING AREGEXP-RELEASE reg-expr-handle
```

reg-expr-handle	is a handle to a regular expression returned by AREGEXP-COMPILE.
-----------------	--

AREGEXP-NUMGROUPS (op-code 6)

This operation returns the number of substrings that matched any subgroups in the regular expression. Its usage is:

```
CALL "C$REGEXP" USING AREGEXP-NUMGROUPS match-handle
GIVING return-value
```

match-handle	is a handle returned by AREGEXP-MATCH.
return-value	returns the number of matches.

Depending on the construction of a regular expression, it is possible for a subgroup of the regular expression to match multiple substrings. This operation reports the number of instances found in the last AREGEXP-MATCH operation. For more information, rules, and examples, see the POSIX 1003.2 documentation or one of the many books available on regular expressions.

AREGEXP-GETMATCH (op-code 7)

This operation returns a set of indices into a string passed to AREGEXP-MATCH that match the subexpression of the regular expression. Its usage is:

```
CALL "C$REGEXP"
USING AREGEXP-GETMATCH, match-handle, group,
idx-start, idx-end
GIVING return-value
```

The parameters are defined as follows:

match-handle	is a handle returned by AREGEXP-MATCH.
group	is a number between 1 and the value returned by AREGEXP-NUMGROUPS.
idx-start	returns an index into the beginning of the string that matches the subexpression of the regular expression.
idx-end	returns an index to the end of the string that matches the subexpression of the regular expression.
return-value	returns 1 if the operation succeeds, and zero if there is an error.

AREGEXP-LAST-ERROR (op-code 20)

This operation returns the last error code returned by a call to C\$REGEXP. Its usage is:

```
CALL "C$REGEXP" USING AREGEXP-LAST-ERROR GIVING return-value
```

The error value is returned in return-value. The possible error values (described in `acucobol.def`) have the following meanings:

AREGEXP-ERROR-NO-ERROR	0	No error
AREGEXP-ERROR-NO-MEMORY	1	Insufficient memory to handle the request
AREGEXP-ERROR-BRACE-EXPECTED	2	A closing brace is missing
AREGEXP-ERROR-PAREN-EXPECTED	3	A closing parenthesis is missing
AREGEXP-ERROR-BRACKET-EXPECTED	4	A closing bracket is missing
AREGEXP-ERROR-UNEXPECTED	5	An unknown error occurred
AREGEXP-ERROR-EMPTY-RANGE	6	An empty range was given
AREGEXP-ERROR-INVALID-GROUP	7	The group provided was invalid
AREGEXP-ERROR-INVALID-RANGE	8	An invalid range was given
AREGEXP-ERROR-EMPTY-REPEATOP	9	A repeat operator was given on an empty subexpression
AREGEXP-ERROR-INVALID-INPUT	10	The input was invalid
AREGEXP-ERROR-INVALID-HANDLE	11	The handle is not a regular expression handle or a match handle
AREGEXP-ERROR-INVALID-ARGUMENT	12	One of the arguments given is invalid
AREGEXP-ERROR-INVALID-CALL-SEQ	13	The order of C\$REGEXP operations is an invalid sequence.
AREGEXP-ERROR-NO-MATCH	14	The regular expression did not find a match in the given string.



Note: If the error code returned does not match a value in the list, it may be that the value is coming from the host's regular expression library. See the documentation for the host's regular expression library.

Compatibility Issues

None.

C\$RERR

Returns extended file status information for the last I/O statement.

Syntax:

```
CALL "C$RERR" USING extend-stat [text-message, status-type]
```

Parameters:

extend-stat

PIC X(5) or larger

text-message

PIC X(n)



Note: This optional parameter is ignored in this COBOL system.

status-type

PIC 9



Note: This optional parameter is ignored in this COBOL system.

On Exit:

extend-stat

Returns the extended file status caused by the last file I/O

Comments:

The statuses returned are listed in the file status table found in *Appendix E* of the ACUCOBOL-GT product documentation. If the file status (first two characters) is 30, the remainder of the information is the operating system's status code explaining what caused the error. On some systems, the operating system requires more than two digits for its status codes. That is why the C\$RERR routine may be passed a field that is larger than four characters.

Whenever an error 30 occurs, the operating system's status value is returned in this extended field. The number returned is a left-justified decimal value. If the receiving field is too small, the right-most digits are returned. If the receiving field is too large, the excess characters are filled with spaces.

C\$RERRNAME

Returns the name of the last file used in an I/O statement.

Use it in conjunction with C\$RERR to diagnose file errors.

Syntax:

```
CALL "C$RERRNAME" USING file-name
```

Parameters:

file-name

PIC X(n)

On Exit:

file-name

The name of the last file that was involved in an I/O statement.



Note: The filename is the one specified in the ASSIGN clause.

C\$RUN

ACUCOBOL-GT for Windows supports an alternate method for running other programs. This is through the library routine C\$RUN. This library routine works identically to the SYSTEM library routine, except that the calling program does not wait for the called program to finish. Instead, both programs run in parallel.



Note: This ACUCOBOL-GT library routine is available in this COBOL version. Any compatibility issues in this COBOL system are in the Compatibility Issues section at the end of the topic.

Usage

```
CALL "C$RUN"
    USING COMMAND-LINE ,
    GIVING STATUS-VAL
```

Parameters

COMMAND-LINE PIC X(n)	Contains the operating system command line to execute.
STATUS-VAL Any numeric data item	Returns 0 if successful or -1 if not.

Description

C\$RUN sets STATUS-VAL to -1 if the call fails or to 0 if it succeeds.

C\$RUN is implemented only under the Windows and Windows NT versions of ACUCOBOL-GT. On other systems, it always returns 1.

C\$RUN is supported in Thin Client environments. To execute a program on the display host in a thin client environment, add the prefix @[DISPLAY]: to the name of any program that resides on the client machine. For example:

```
C$RUN "@[DISPLAY]:C:\notepad myfile.txt
```

Compatibility Issues

"@[DISPLAY]" is not supported in this COBOL system.

C\$SLEEP

This routine causes the program to pause in a machine efficient fashion.



Note: This ACUCOBOL-GT library routine is available in this COBOL version. Any compatibility issues in this COBOL system are in the Compatibility Issues section at the end of the topic.

Usage

```
CALL "C$SLEEP"
    USING NUM-SEC
```

Parameter

NUM-SEC Numeric or alphanumeric parameter	The number of seconds to sleep. This parameter is a an unsigned fixed-point numeric parameter, or an alphanumeric data item containing an unsigned fixed-point number.
---	---

Description

This routine can be used to impose slight delays in loops. For example, you might want to introduce a delay in a loop that is waiting for a record to become unlocked. Calling C\$SLEEP will allow the machine to execute other programs while you wait.

The C\$SLEEP routine is passed one argument. This argument is the number of seconds you want to pause. For example, to pause the program for five and a half seconds, you could use either of the following:

```
CALL "C$SLEEP" USING 5.5  
CALL "C$SLEEP" USING "5.5"
```

The amount of time paused is only approximate. Depending on the granularity of the system clock and the current load on the machine, the time paused may actually be shorter or longer than the time requested. Typically, the time paused will be within one second or one-tenth of a second of the amount requested (unless the machine is excessively loaded).

If the sleep duration is zero, this function does nothing. If the sleep duration is signed, this function generates a runtime error.

Compatibility Issues

None

C\$TOUPPER and C\$TOLOWER

These routines translate text to upper- or lower-case.



Note: This ACUCOBOL-GT library routine is available in this COBOL version. Any compatibility issues in this COBOL system are in the Compatibility Issues section at the end of the topic.

Usage

```
CALL "C$TOUPPER"  
    USING TEXT-DATA, VALUE TEXT-LEN  
  
CALL "C$TOLOWER"  
    USING TEXT-DATA, VALUE TEXT-LEN
```

Parameters

TEXT-DATA PIC X(n)	Contains the data to translate to upper- or lower-case.
TEXT-LEN USAGE UNSIGNED-INT, or a numeric literal	Contains the number of characters to translate.

Description

C\$TOUPPER translates the first TEXT-LEN characters in TEXT-DATA to upper-case. C\$TOLOWER translates them to lower-case. No size checking is done on TEXT-DATA, so you must ensure that TEXT-LEN has a valid value. VALUE must be included in the calling statement. If it is omitted, the program will very likely encounter memory errors. These routines only translate characters with a numeric value of 0-128. Anything above that (such as é, with a value of 130) must be mapped to its associated upper- or lower-case character using the configuration variable UPPER-LOWER-MAP.

Compatibility Issues

- Calls to these routines immediately call the Micro Focus library routines CBL_TOUPPER and CBL_TOLOWER.

I\$IO

The I\$IO routine provides an interface to the file handler.



Note: This ACUCOBOL-GT library routine is available in this COBOL version. Any compatibility issues in this COBOL system are in the Compatibility Issues section at the end of the topic.

An operation code and some number of additional parameters (depending on the operation called) are passed to the routine. The return code is set automatically after the call. The external variable `F-ERRNO` is set according to any errors found. `F-ERRNO` may not be reset on entry to `I$IO`, and should be checked only if `I$IO` returns an error condition.

Usage

```
CALL "I$IO"
    USING OP-CODE, parameters
```

Parameters

- OP-CODE Numeric parameter

Specifies the file handling routine to be performed. This table shows which operation corresponds to each operation code. The operations are detailed in the description below:

Code	Operation
1	OPEN-FUNCTION
2	CLOSE-FUNCTION
3	MAKE-FUNCTION
4	INFO-FUNCTION
5	READ-FUNCTION
6	NEXT-FUNCTION
7	PREVIOUS-FUNCTION
8	START-FUNCTION
9	WRITE-FUNCTION
10	REWRITE-FUNCTION
11	DELETE-FUNCTION
12	UNLOCK-FUNCTION
13	REMOVE-FUNCTION
14	SYNC-FUNCTION
15	EXECUTE-FUNCTION
16	BEGIN-FUNCTION
17	COMMIT-FUNCTION
18	ROLLBACK-FUNCTION
19	RECOVER-FUNCTION
21	IN-TRANSACTION-FUNCTION

- parameters vary depending on the op-code chosen

The remaining parameters vary depending on the operation selected. They provide information and hold results for the operations specified. All parameters are passed by reference. Parameters may be omitted from those operations that do not require them.


Description

All parameters passed to I\$IO are passed by reference. This applies even to parameters that are integer values in the corresponding file handling routines. All numeric parameters should be passed to I\$IO as SIGNED-SHORT values. The I\$IO routine provides any necessary addressing conversions. Note that a parameter must be in the correct format for its type. Parameters that are PIC X must be terminated by a LOW-VALUES character.

Except for the MAKE function, I\$IO will automatically terminate any PIC X parameters with a LOW-VALUES byte for you. Also, you do not have to specify SYNC for level 01 or level 77 parameters because they are automatically synchronized by ACUCOBOL-GT.

The file `filesys.def` is a COBOL COPY file that contains many useful definitions for use with I\$IO. It contains definitions for the I\$IO codes along with the `F-ERRNO` error values and many useful pre-declared variables that are of the proper type and usage.

The behavior of this routine is affected by the `FILENAME_SPACES` configuration variable. The value of `FILENAME_SPACES` determines whether spaces are allowed in a file name.


 **Note:** The runtime configuration variable `FILE_PREFIX` is ignored by the I\$IO routine.

Compatibility Issues

- `filesys.def` is not supplied in this COBOL system.
- The `FILENAME_SPACES` configuration variable is not supported in this COBOL system.

M\$ALLOC (Dynamic Memory Routine)

Allocates a new area of dynamic memory.

 **Note:** This ACUCOBOL-GT library routine is available in this COBOL version. Any compatibility issues in this COBOL system are in the Compatibility Issues section at the end of the topic.

Usage

```
CALL "M$ALLOC"  
    USING ITEM-SIZE, MEM-ADDRESS
```

Parameters

ITEM-SIZE Numeric parameter	This indicates the number of bytes to allocate. This must be greater than zero.
MEM-ADDRESS USAGE POINTER	This holds the return value, either the address of the allocated memory or NULL if the allocation fails.

Comments

The maximum amount of memory you may allocate in one call depends on the host machine, but is at least 65260 bytes for all machines (providing that much memory is available). M\$ALLOC adds some overhead to each memory block allocated. This ranges between 4 and 16 bytes depending on the machine architecture. Also, each operating system will typically add its own overhead. The debugger's `U` command reports the amount of memory you have currently allocated via M\$ALLOC. The overhead added by M\$ALLOC is included in the total shown, but the operating system's overhead is not. Memory allocated by M\$ALLOC is initialized to binary zeros (LOW VALUES).

If you try to allocate more memory than the environment can give you, M\$ALLOC will return NULL, and no memory will be allocated.

Compatibility Issues

None.

M\$COPY (Dynamic Memory Routine)

Copies a region of memory from one location to another.



Note: This ACUCOBOL-GT library routine is available in this COBOL version. Any compatibility issues in this COBOL system are in the Compatibility Issues section at the end of the topic.

Usage

```
CALL "M$COPY"  
    USING DEST-PTR, SRC-PTR, NUM-BYTES
```

Parameters

DEST-PTR USAGE POINTER	Contains the address of the first byte of the destination region.
SRC-PTR USAGE POINTER	Contains the address of the first byte of the source region.
NUM-BYTES Numeric parameter	Indicates the size of the memory region to be copied.

Description

This routine copies NUM-BYTES from the address contained in SRC-PTR to the address contained in DEST-PTR. Note that this routine is relatively dangerous to use. No boundary checking is performed to ensure that the address range is valid, so memory access violations may result if you pass it incorrect data.

This routine is functionally similar to the C\$MEMCOPY routine except that parameters are passed by reference instead of by value. For example, you can copy 10 bytes to DEST-PTR from the memory address contained in SRC-PTR with:

```
CALL "M$COPY"  
    USING DEST-PTR, SRC-PTR, 10
```

Compatibility Issues

None.

M\$FILL (Dynamic Memory Routine)

Sets a region of memory to a constant value.



Note: This ACUCOBOL-GT library routine is available in this COBOL version. Any compatibility issues in this COBOL system are in the Compatibility Issues section at the end of the topic.

Usage

```
CALL "M$FILL"  
    USING DEST-PTR, BYTE-VALUE, NUM-BYTES
```

Parameters

DEST-PTR USAGE POINTER	Contains the address of the first byte of the region to be filled.
BYTE-VALUE Alpha-numeric parameter	Contains the value with which to fill the memory region.
NUM-BYTES Numeric parameter	Indicates the size of the memory region.

Description


This routine fills NUM-BYTES with BYTE-VALUE starting at address DEST-PTR. The parameters are passed BY REFERENCE. This routine does not do any boundary checking to make sure that the address range is valid.

Compatibility Issues

None.

M\$FREE (Dynamic Memory Routine)

Frees a previously allocated piece of memory.

 **Note:** This ACUCOBOL-GT library routine is available in this COBOL version. Any compatibility issues in this COBOL system are in the Compatibility Issues section at the end of the topic.

Usage

```
CALL "M$FREE"  
    USING MEM-ADDRESS
```

Parameter

MEM-ADDRESS USAGE POINTER	Must point to a memory area previously allocated by M\$ALLOC.
---------------------------	---

Comments

Use M\$FREE to release a memory block allocated by M\$ALLOC. This memory is returned to the pool of memory available for use by the runtime. On most operating systems, this memory is still associated with the runtime's process, so it cannot be used by any other processes. On a few systems, this memory may be made available to the operating system for re-use by other processes.


It is an error to attempt to use a block of memory once it has been freed. It is also an error to free a block of memory more than once or to free a memory address that has never been allocated. Any of these errors can lead to memory access violations. The runtime attempts to detect these errors and avoid them, but it cannot detect all such errors.

Compatibility Issues

None.

M\$GET (Dynamic Memory Routine)

Retrieves data from an allocated memory block.

 **Note:** This ACUCOBOL-GT library routine is available in this COBOL version. Any compatibility issues in this COBOL system are in the Compatibility Issues section at the end of the topic.

Usage

```
CALL "M$GET"  
    USING MEM-ADDRESS, DATA-ITEM, DATA-SIZE, DATA-OFFSET
```

Parameters

MEM-ADDRESS USAGE POINTER	Must point to a memory area previously allocated by M\$ALLOC.
DATA-ITEM Any data item	Data from the memory block will be stored in this item.
DATA-SIZE Numeric parameter (optional)	The number of bytes to move from the memory block. If omitted, then the number of bytes is set to the size of the memory block (excluding overhead bytes).

DATA-OFFSET Numeric parameter (optional)

The location within the memory block from which to start the move. The first location is position 1. If omitted, this value defaults to 1.

Description

This routine retrieves data from the memory block at MEM-ADDRESS and stores it in DATA-ITEM. Regardless of the value of DATA-SIZE, no bytes are copied from past the end of the memory block. Note that the size of DATA-ITEM is not checked.

Compatibility Issues

None.

M\$PUT (Dynamic Memory Routine)

Stores data in an allocated memory block.



Note: This ACUCOBOL-GT library routine is available in this COBOL version. Any compatibility issues in this COBOL system are in the Compatibility Issues section at the end of the topic.

Usage

```
CALL "M$PUT"  
    USING MEM-ADDRESS, DATA-ITEM, DATA-SIZE, DATA-OFFSET
```

Parameters

MEM-ADDRESS USAGE POINTER	Must point to a memory area previously allocated by M \$ALLOC.
DATA-ITEM Any data item	This is the data that will be stored in the memory block.
DATA-SIZE Numeric parameter (optional)	The number of bytes to move to the memory block. If omitted, then the number of bytes is set to the size of the memory block (excluding overhead bytes).
DATA-OFFSET PIC 9(n), USAGE DISPLAY or COMP-4 (optional)	The location within the memory block from which to start the move. The first location is position 1. If omitted, this value defaults to 1.

Description

This routine copies DATA-ITEM into the memory pointed to by MEM-ADDRESS for DATA-SIZE bytes. Regardless of the value of DATA-SIZE, no bytes are copied that exceed the size of the memory block at MEM-ADDRESS.

Compatibility Issues

None.

RENAME

Renames a file.

Syntax:

```
CALL "RENAME"  
    USING source-file, dest-file, [status,] [file-type]
```

Parameters:**source-file**

PIC X(n)

dest-file

PIC X(n)

status

Any numeric type

file-type

PIC X

On Entry:**source-file**

The path name of the file to be copied

dest-file

The path name of the destination file

file-type

The file organization of the source file. It must be one of: S (for sequential), R (for relative) or I (for indexed).

This defaults to S if not specified.

On Exit:**status**

Returns zero if the rename is successful, or non-zero if not.

Comments:

To obtain an extended file status code for this operation, define `status` as `comp xx comp-x` and follow the example in *Extended File Status Codes*.

WIN\$VERSION

Returns version information for Windows and Windows NT host platforms.



Note: This ACUCOBOL-GT library routine is available in this COBOL version. Any compatibility issues in this COBOL system are in the Compatibility Issues section at the end of the topic.

This routine provides more information about the system than is returned by the ACCEPT FROM SYSTEM-INFO statement.

Usage

```
CALL "WIN$VERSION"
    USING WINVERSION-DATA
```

Parameters

WINVERSION-DATA Group item as follows:

01	WINVERSION-DATA .	
03	WIN-MAJOR-VERSION	PIC X
COMP-X.		
03	WIN-MINOR-VERSION	PIC X
COMP-X.		
03	WIN-PLATFORM	PIC X
COMP-X.		
88	PLATFORM-WIN-31	VALUE

```

1.      88  PLATFORM-WIN-95      VALUE
2.      88  PLATFORM-WIN-9X     VALUE
2.      88  PLATFORM-WIN-NT     VALUE
3.      03  WIN-WORDSIZ        PIC X
COMP-X.      88  WIN-WORDSIZ-16  VALUE
1.      88  WIN-WORDSIZ-32     VALUE
2.      88  WIN-WORDSIZ-64     VALUE
3.      03  WIN-
BUILDNUMBER      PIC X(4)
COMP-X.      03  WIN-
CSDVERSION      PIC
X(128) .
03  WIN-SERVICEPACK-
MAJOR      PIC X COMP-X.
03  WIN-SERVICEPACK-
MINOR      PIC X COMP-X.
03  WIN-
SUITEMASK      PIC X(4)
COMP-X.
03  WIN-
PRODUCTTYPE      PIC X
COMP-X.
03  WIN-NT-
WORKSTATION      VALUE 1.
03  WIN-NT-DOMAIN-
CONTROLLER      VALUE 2.
03  WIN-NT-
SERVER      VALUE 3.

```

WINVERSION-DATA is found in the COPY library winvers.def.

Comments

Upon return from WIN\$VERSION, all of the data elements contained in WINVERSION-DATA are filled in. If you call WIN\$VERSION and the host machine is not a Windows or Windows NT system, the fields are set to zero.

The WINVERSION-DATA fields have the following meaning:

- WIN-MAJOR-VERSION - The major version number reported by Windows. See table below for possible values.
- WIN-MINOR-VERSION - The minor version number reported by Windows. See table below for possible values.

Windows Version	WIN-MAJOR-VERSION	WIN-MINOR-VERSION	Other
Windows XP	5	1	Not applicable.
Windows XP Professional x64 Edition	5	2	OSVERSIONINFOEX.wPro ductType == VER_NT_WORKSTATION) &&

Windows Version	WIN-MAJOR-VERSION	WIN-MINOR-VERSION	Other
			(SYSTEM_INFO.wProcessorArchitecture==PROCESSOR_ARCHITECTURE_AMD64
Windows Vista	6	0	OSVERSIONINFOEX.wProductType == VER_NT_WORKSTATION
Windows 7	6	1	OSVERSIONINFOEX.wProductType == VER_NT_WORKSTATION
Windows Server 2012	6	2	OSVERSIONINFOEX.wProductType == VER_NT_WORKSTATION
Windows Server 2008 R2	6	1	OSVERSIONINFOEX.wProductType != VER_NT_WORKSTATION
Windows Server 2008	6	0	OSVERSIONINFOEX.wProductType != VER_NT_WORKSTATION
Windows Server 2003 R2	5	2	GetSystemMetrics(SM_SERVERERR2) != 0
Windows Home Sever	5	2	OSVERSIONINFOEX.wSuiteMask & VER_SUITE_WH_SERVER
Windows Server 2003	5	2	GetSystemMetrics(SM_SERVERERR2) == 0

- WIN-PLATFORM - Provides a general description of the host system. If the host is Windows NT/Windows 2000, the value is set to PLATFORM-WIN-NT. If the host is Windows 98, the value is set to PLATFORM-WIN-9X.
- WIN-WORDSIZE - This item is set to WIN-WORDSIZE-32 for a 32-bit operating system, and WIN-WORDSIZE-64 for a 64-bit operating system.
- WIN-BUILDNUMBER - Identifies the build number of the operating system.
- WIN-CSDVERSION - Indicates the latest Service Pack installed on the system. If no Service Pack has been installed the string is empty.
- WIN-SERVICEPACK-MAJOR - Indicates the major version number of the latest Service Pack installed on the system. If no Service Pack has been installed the value is 0.
- WIN-SERVICEPACK-MINOR - Indicates the minor version number of the latest Service Pack installed on the system. If no Service Pack has been installed the value is 0.
- WIN-SUITEMASK - This is a bit mask that identifies the product suites available on the system. Refer to the operating system documentation for a list of possible values.
- WIN-PRODUCTTYPE - Identifies additional information about the system.

Compatibility Issues

The copybook `winvers.def` is not available in this COBOL system.

The following fields are not supported in this COBOL system:


- WIN-BUILDNUMBER

- WIN-CSDVERSION
- WIN-SERVICEPACK-MAJOR
- WIN-SERVICEPACK-MINOR
- WIN-SUITEMASK
- WIN-PRODUCTTYPE

These fields will return spaces or zeroes, as appropriate.

ACUCOBOL-GT Windowing Syntax

Your COBOL system provides some support for ACUCOBOL-GT windowing syntax that enables you to draw lines and boxes on the terminal screen, and create virtual terminal windows on a physical terminal. All ACCEPT and DISPLAY statements then act within the current window (except for ACCEPT format 1, 2, or 3 statements, DISPLAY format 1 statements, and DISPLAY WINDOW/LINE/BOX statements). The syntax also enables underlying displays to be kept and restored.

 **Note:** This functionality is supported in native COBOL only.

Windowing Syntax Summary

Your COBOL system includes the following syntax to support windowing:

- BEFORE TIME phrase in ACCEPT statement

Format 5 of the ACCEPT statement has the BEFORE TIME phrase, which enables you to specify a timeout period. If the user does not enter data during this period, the statement is terminated automatically.

- DISPLAY WINDOW

DISPLAY WINDOW creates a terminal window (a rectangular region of the screen) and makes it the current window. This is like a virtual terminal, in which screen positions used by subsequent ACCEPT/DISPLAY statements are relative to the top left corner of the window.

- DISPLAY LINE

DISPLAY LINE enables you to draw lines on the terminal (real or virtual). The best mode available on the terminal is used automatically. Used with the DISPLAY BOX statement, the DISPLAY LINE statement enables you to draw forms on the terminal.

- DISPLAY BOX

DISPLAY BOX enables you to draw boxes on the terminal. The best mode available on the terminal is used automatically. Used with the DISPLAY LINE statement, the DISPLAY BOX statement enables you to draw forms on the terminal.

- CLOSE WINDOW

CLOSE WINDOW removes a window. If you specify the window as being a POP-UP window, the underlying display can be restored.

Enabling Windowing Support

In order to use the windowing syntax, you must use the PREPROCESS"window1" Compiler directive.

You can specify this directive in one of two ways.

- In your source file, use the following line:

```
$SET preprocess"window1"
```

- From the command line, include the PREPROCESS"window1" directive:

Windows:

```
cobol prog.cbl preprocess"window1" color endp;
```

UNIX:

```
cob -C preprocess=window1 prog.cbl
```

The PREPROCESS "window1" directive must be the last Compiler directive apart from NOERRQ, AUTOCLOSE or COLOR. If an error is encountered, the Compiler asks if you wish to continue, and waits for your response. In order to disable this function, you must specify the NOERRQ directive after PREPROCESS"window1".

Windowing Support Syntax

The following sections give details of the windowing syntax enabled by the PREPROCESS"window1" directive.

The ACCEPT Statement

```
BEFORE TIME time-out
```

General Rules:

1. The BEFORE TIME phrase allows you to automatically terminate an ACCEPT statement after a certain amount of time has passed. The timeout value specifies the time to wait in hundredths of a second. For example, "BEFORE TIME 500" specifies a timer value of 5 seconds.
2. The user must enter data to the ACCEPT statement before the timer elapses. As soon as the user starts entering data, the timer is canceled and the user may take as much time as desired to complete the entry. If the user does not enter any data before the timer elapses, then the ACCEPT statement terminates.

The CLOSE WINDOW Statement

Format:

```
CLOSE WINDOW window-save-area
```

Syntax Rules:

1. *window-save-area* must be an elementary data item described with a PIC X(10) clause. It must have been the object of a POP-UP AREA phrase in a DISPLAY WINDOW statement.

General Rules:

1. The CLOSE WINDOW statement is used to remove popup windows created by the POP-UP AREA option of the DISPLAY WINDOW statement.
2. *window-save-area* must have been the object of a POP-UP phrase of a DISPLAY WINDOW statement that has been executed in this run unit. Furthermore, since that execution, it must not have been the object of a CLOSE WINDOW statement, nor can it have been modified by any other statement. Violation of these rules causes undefined results.
3. The CLOSE WINDOW statement restores the contents of the terminal screen that was in the active window when the corresponding DISPLAY WINDOW statement executed. In other words, the window that was created by that DISPLAY WINDOW statement is removed from the screen and replaced by the contents of the screen which were under that popup window.
4. The window that was active when the corresponding DISPLAY WINDOW statement executed becomes the active window, thereby becoming the top window and overlaying any other windows that might be present.

Comments:

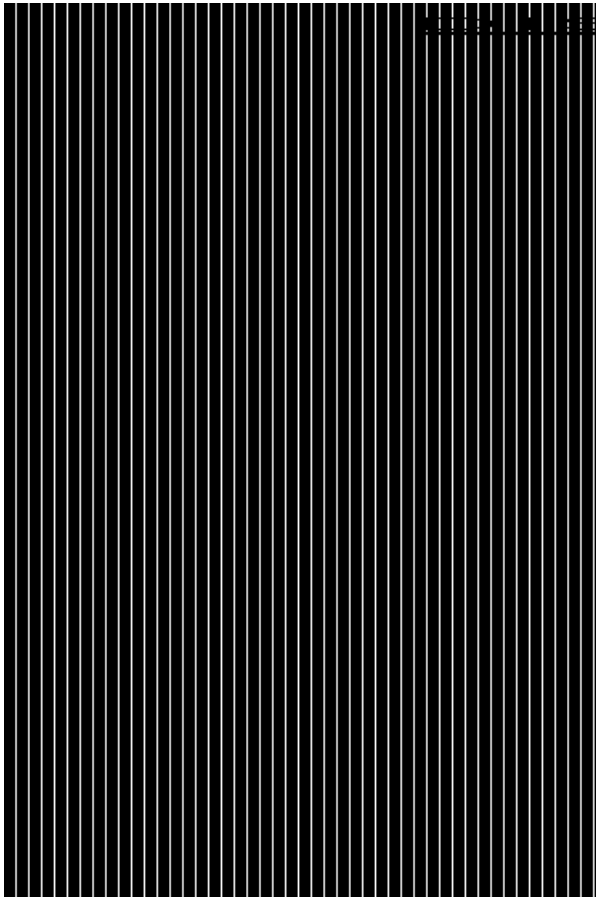
The current window is selected by closing windows identified by their respective *window-save-area* data items, as in the following example:

If five popup windows are created, *a*, *b*, *c*, *d* and *e* in that order:

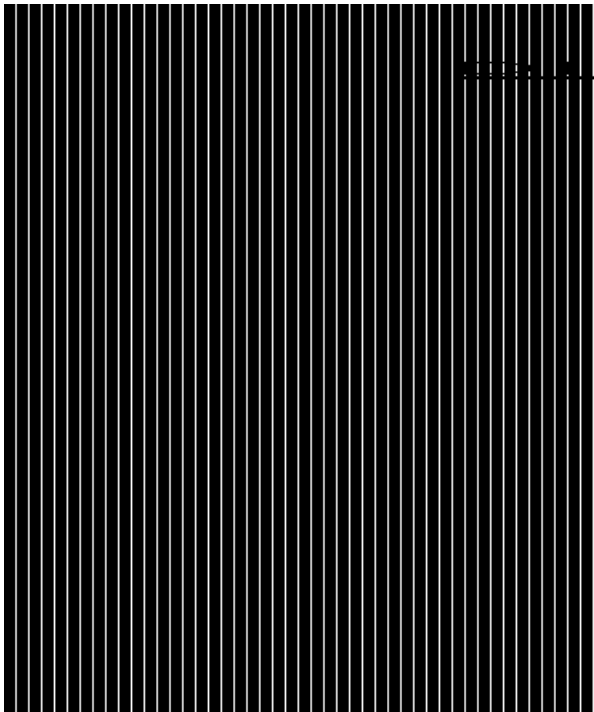
- If *d* is closed, *c* becomes current.
- If *b* is then closed, *a* becomes current.
- If *e* is subsequently closed, *c* becomes current again.

The DISPLAY Statement

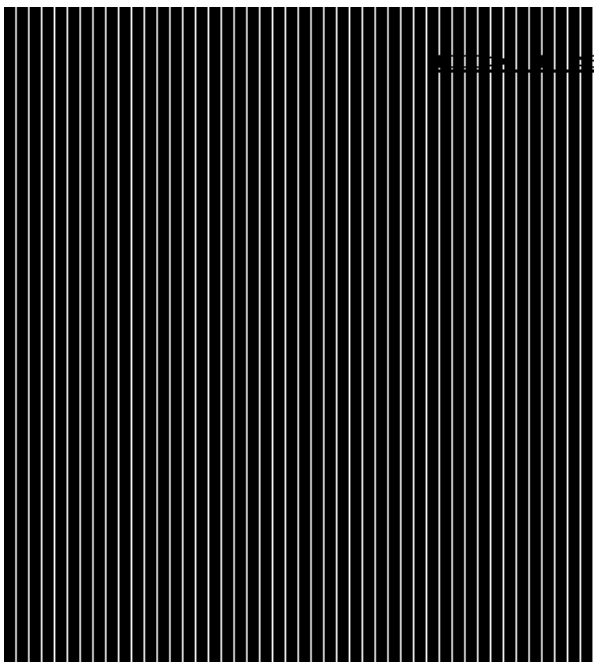
Format: for Format 1



Format: for Format 2



Format: for Format 3



Syntax Rules:


1. *line-num* is a numeric literal or data item that specifies the line position on the terminal screen. It must be a non-negative integer.
2. *col-num* is a numeric literal or data item that specifies the column position on the terminal screen. It must be a non-negative integer.

3. *length* is a numeric literal or data item that specifies the window-width, line-width or box-width in character positions. It must be a non-negative integer.
4. *height* is a numeric literal or data item that specifies the number of lines in the window, line or box. It must be a non-negative integer.
5. *title* is a non-numeric literal or alphanumeric data item.
6. *save-area* is an elementary data item described by a PIC X(10) clause.
7. COLUMN and COL are equivalent.
8. REVERSE and REVERSED and REVERSE-VIDEO are equivalent.
9. The COLOR phrase is supported only when the preprocessor directive COLOR is used. This adds support for existing non-Micro Focus syntax.
10. Exactly one of the SIZE or LINES phrases must be specified for a Format 2 DISPLAY statement.
11. *identifier-1*, *identifier-2*, *integer-1* and *integer-2* must take a value in the range 0 through 7 as follows:

0	black
1	blue
2	green
3	cyan
4	red
5	magenta
6	brown or yellow
7	white

12. *identifier-3* and *integer-3* must take a value which is obtained by adding together the appropriate values from the following:

Color	Foreground	Background
Black	1	32
Blue	2	64
Green	3	96
Cyan	4	128
Red	5	160
Magenta	6	192
Brown	7	224
White	8	25

 **Note:**
The foreground color values for use with the COLOR phrase are different from the standard Micro Focus color values for FOREGROUND-COLOR, BACKGROUND-COLOR and so on.

In addition you can specify the following video attributes with the following values:

Reverse video	1024
Low intensity	2048
High intensity	4096
Underline	8192

13. If a COLOR phrase is present at the same time as FOREGROUND-COLOR and/or BACKGROUND-COLOR, then the colors defined in the COLOR phrase are ignored, but any non-color attributes are actioned (where appropriate).

General Rules: for All Formats

1. The LINE and COLUMN phrases must specify a line or column on the physical screen.
2. On color systems, both the settings given in COLOR or FOREGROUND-COLOR and BACKGROUND-COLOR and other attribute settings (for example blink) are used. On monochrome systems, all color information supplied is ignored, and only other attribute settings used.
3. Not all combinations of attributes are supported on all systems. For example, on a standard DOS PC, set to monochrome mode, REVERSE and UNDERLINE are mutually exclusive - only one of these attributes is actioned.

General Rules: for DISPLAY WINDOW statement Format 1 (DISPLAY WINDOW)

1. The DISPLAY WINDOW statement creates and makes current a terminal window. The terminal window is a rectangular region of your screen. Any ACCEPT or DISPLAY statements (apart from another DISPLAY WINDOW/LINE/BOX or a Format 1, 2 or 3 ACCEPT or Format 1 DISPLAY as described in your Language Reference) affect only the current window. Furthermore, line and column numbers for all ACCEPT and DISPLAY statements (apart from another DISPLAY WINDOW/LINE/BOX or a Format 1, 2 or 3 ACCEPT or Format 1 DISPLAY as described in your Language Reference) are computed from the upper left-hand corner of the current window. That is, the current window defines a virtual terminal screen which occupies some area of your physical screen.
2. The initial window is set to the entire screen.
3. The only way to change the current window is with another DISPLAY WINDOW statement or with the CLOSE WINDOW statement.
4. The LINE NUMBER phrase sets the top line of the window. Line number one refers to the top line of the screen. Line numbers are relative to the screen, and not to the current window.
5. If the LINE NUMBER phrase is not specified, is specified as zero, or is off the physical screen, the top line of the screen is used.
6. The COLUMN NUMBER phrase sets the left-most column of the window. Column number one refers to the left side of the screen. Column numbers are relative to the screen, and not to the current window.
7. If the COLUMN NUMBER phrase is not specified, is specified as zero, or is off the physical screen, column number one is used.
8. The SIZE phrase sets the number of columns the window contains. If this causes the window to extend past the right edge of the screen, the window's width extends off the screen.
9. If the SIZE phrase is not specified or is specified as zero, the window extends to the right edge of the screen.
10. The LINES phrase sets the number of rows the window contains. If this causes the window to extend past the bottom of the screen, the window extends off the screen.
11. If the LINES phrase is not specified or is specified as zero, the window extends to the bottom edge of the screen.
12. When the ERASE phrase is specified, the window is cleared immediately after it is created. Otherwise the window's contents are not changed. Clearing a window sets it to spaces.
13. The BOXED phrase causes a box to be drawn around the new window. The box is drawn outside the window. Any portions of the box that lie off the screen are not drawn.
14. The terminal's line drawing set is used to draw the box. If the terminal does not have a line drawing set, equivalent ASCII characters are used. If the POP-UP phrase is also specified, the box overlays any other boxes on the screen. If this phrase is not specified, the box drawn is attached to any other boxes it intersects. When a boxed non-popup window intersects a boxed popup window, if the popup window is

created first, when it is closed the points where the two window boxes intersected is not redrawn. That is, intersection characters remain even though there is no longer an intersection.

15. The ERASE phrase is implied by the BOXED phrase.
16. The REVERSED phrase exchanges the window's foreground and background colors. This affects every ACCEPT and DISPLAY statement in the new window.
17. The REVERSED phrase implies the ERASE phrase. This usually causes the entire window to be set to reverse video spaces when it is initially created.
18. The SHADOW phrase causes the window to appear to float over the screen giving a three-dimensional effect.
19. If the color value for either foreground or background is set to 0 in the COLOR field, then the corresponding color of the default system attribute is used.
20. The TITLE phrase causes the title to be printed in the window's border. This has its effect only if the BOXED phrase is also specified.
21. Titles can be placed in one of six positions in the border region: top left, top center, top right, bottom left, bottom center and bottom right. If TOP or BOTTOM is not specified, TOP is used. If LEFT, CENTERED or RIGHT is not specified, CENTERED is used.
22. The NO SCROLL phrase is treated as documentary only; the Windows preprocessor displays a message confirming this.
23. The NO WRAP phrase is treated as documentary only; the Windows preprocessor displays a message confirming this.
24. The POP-UP AREA phrase causes your COBOL system to save system information prior to creating the new window. This information can be used by the CLOSE WINDOW statement to subsequently remove the new window and restore the underlying windows. This gives a popup window.
25. The *save-area* data item is filled in with system information. This data item must not be subsequently modified in any way or results are undefined. It can be referenced in a CLOSE WINDOW statement to restore an earlier window to the screen and re-establish that window as the current window.

General Rules: for DISPLAY LINE statement Format 2 (DISPLAY LINE)

1. The DISPLAY LINE statement enables you to draw vertical and horizontal lines in a machine- and terminal-independent manner. The lines are drawn using the best mode available on the display device. Used together with the DISPLAY BOX statement, this provides the ability to draw forms on your screen. The DISPLAY LINE statement does not affect the positioning of full screen ACCEPT and DISPLAY statements.
2. Lines are drawn so that when they intersect other lines on the screen, the appropriate intersection character is used. This is done so that when the end of a line intersects another line, the appropriate corner or three-way intersection is used.
3. If the SIZE phrase is specified, the line drawn is horizontal. The value of *length* gives the size of the line in screen columns. If the LINES phrase is used instead, the line drawn is a vertical line and *height* describes the number of screen rows to use.
4. Lines never wrap around or cause scrolling. If the LINES or SIZE phrase would cause the line to leave the current window, the line is truncated at the edge of the window. If LINES or SIZE is zero, no line is drawn.
5. The value of *line-num* gives the starting row of the line. The value of *col-num* gives the starting column. Lines are always drawn to the right or downward as appropriate. *line-num* and *col-num* must specify a position that is contained in the current window.
6. If the LINE NUMBER or COLUMN NUMBER phrases specify a point outside the physical screen, that is, *line-num* = 0 or 24 (or your screen's maximum), or *col-num* = 0 or > 80, no line is drawn.
7. The TITLE phrase has effect only when drawing horizontal lines. When specified, *title-string* is printed in part of the line.
8. The title can be printed near the right side, near the left side or in the center of the line depending on the RIGHT, LEFT or CENTERED phrase specified. If none is specified, CENTERED is used.

9. The REVERSE phrase exchanges the foreground and background color of the line.

General Rules: for DISPLAY BOX statement Format 3 (DISPLAY BOX)

1. The DISPLAY BOX statement enables you to draw a box in a machine- and terminal-independent manner. The boxes are drawn using the best mode available on the display device. If the lines used in drawing a box intersect other lines already present on the screen, the appropriate intersection characters are used. The DISPLAY BOX statement does not affect the positioning of full screen ACCEPT and DISPLAY statements.
2. The location of the box is specified by providing the location of the upper-left corner. The size of the box is specified by providing a height and a width.
3. If the LINE NUMBER or COLUMN NUMBER phrases specify a point outside the physical screen no box is drawn.
4. The SIZE phrase specifies the width of the box. The LINES phrase specifies its height. If the SIZE phrase is not specified, or zero, or such that the box would extend beyond the physical screen or the edge of the window, the box extends to the right edge of the current window. If the LINES phrase is not specified, or zero, or such that the box would extend beyond the physical screen, the box extends to the bottom of the current window.
5. The REVERSE phrase operates in the same manner as it does for a DISPLAY WINDOW statement.
6. The TITLE phrase operates in the same manner as it does for the DISPLAY WINDOW statement.

Windowing Restrictions

- This feature is not guaranteed to be intermediate code compatible, so you might need to recompile your source code between product releases.
- When using the ACCEPT or DISPLAY statements with this windowing syntax, you must include the AT LINE NUMBER syntax (see your Language Reference) or items do not appear in the windows.
- You should not use cobprintf() with these DISPLAY statements.
- You should not use COPY REPLACING or REPLACE statements.
- The windowing syntax is supported only for fixed format COBOL source.
- The following reserved words have been introduced by the windowing syntax, so you should avoid specifying them as user-defined words:

BOX BOXED CENTERED COLOR (if COLOR directive used) POP-UP SCROLLSHADOW WINDOW WRAP

- You should use only the ACCEPT and DISPLAY statements documented in your Language Reference with this windowing syntax.
- When using windowing syntax, the ANS85 Compiler directive is implied. You must not unset this directive either explicitly or implicitly.
- Alphanumeric literals must not be continued over the end of any line which includes a windowing statement.
- Some syntax errors, for example, spelling PROCEDURE DIVISION incorrectly, are flagged, but might result in spurious error messages for following source lines.
- Windowing syntax errors are serious errors, but are flagged in the form:

```
xnnn-p*****
```

- The -P cob flag should not be used with windowing syntax . You should instead use "-C list".
- Column 73 must not be used within source programs which use windowing syntax, as this column is always treated as being set to a space character.
- The Compiler asks if you wish to continue after any error occurs. You can disable this function by using the NOERRQ directive. You should not, however, use the NOERRQ directive when compiling from within the Development Environment.

If no error occurred, or if an error occurred but you replied "no" to the question "do you wish to continue", the Compiler returns a zero error return code.

- Each of the following statements must appear on a line by itself:
DISPLAY WINDOW DISPLAY BOX DISPLAY LINE CLOSE WINDOW EXIT PROGRAM
- The windowing subsystem is initialized automatically upon encountering the first windowing statement.
- If an application switches between using windowing syntax and other types of Accept/Display syntax, it must close down the windowing system completely before starting to use other types of Accept/Display syntax; otherwise the ACCEPT and DISPLAY statements may not have the desired effects.

You can create a subroutine to explicitly close the windowing system by compiling the following subprogram:

```
$set preprocess "window1" autoclose
procedure division
para-1.
exit program.
```

You then call this subprogram before switching to another type of Accept/Display syntax. The AUTOCLOSE preprocessor directive causes the EXIT PROGRAM statement to close down the windowing system before exiting the subprogram. The windowing subsystem is reinitialized upon encountering another windowing statement. Each time the windowing subsystem initializes, the background screen and contents are redisplayed.

- When a window is active, or has been active in the run unit, use of the DISPLAY SPACES UPON CRT statement clears the window to spaces but leaves attributes unchanged.

Windowing Error Messages

The following errors might be encountered during preprocessing.

Unexpected numeric literal

Unexpected alphanumeric literal

Unsupported keyword or noise word

Unrecognized clause to DISPLAY WINDOW

Unrecognized clause to DISPLAY LINE

Unrecognized clause to DISPLAY BOX

Unrecognized clause to ACCEPT FROM SCREEN

This keyword has already been used

This keyword conflicts with another

This reserved word is used incorrectly

Wrongly formed or ordered clause with keyword

Error during preprocessing - no further details

Unknown COPY file specified

WINDOW1 preprocessor cannot handle free format

SCROLL/WRAP clause processed as comment

The edit/compile/animate loop returns to an incorrect line within your source program after returning an error.

Windowing Supplementary Information

When the first windowing statement in your program is encountered the screen is redisplayed. This is expected behavior and does not affect your program in any way.

Upgrading from RM/COBOL®

There are a number of settings in Enterprise Developer that are designed specifically to ensure that your existing RM/COBOL source code can compile and run in Enterprise Developer.

Refer to the *Compatibility with RM/COBOL* section for guidance and best practice on moving your applications to Enterprise Developer. It covers:

- Supported RM/COBOL features, including detailed information on support for data types and subprograms.
- Syntactical differences between the two COBOL dialects, including workarounds or equivalent syntax where applicable.
- Details on how to configure your applications to continue using your RM/COBOL data files.

Compatibility with RM/COBOL

Enterprise Developer provides compatibility with the RM/COBOL programming language:

This enables you to migrate programs from this environment. You can:

- Convert applications written in RM/COBOL to the Micro Focus COBOL language, and enhance them using the advanced language and development features offered by Enterprise Developer.
- Retain the use of the selected COBOL on some machine environments while moving to Enterprise Developer on others. You might want to maintain a common set of source programs which are suitable for all environments.



Note: Any error messages and numbers that are returned when you compile your program in Enterprise Developer or when you execute the resulting code are different in the two environments. This should present no problems, but is something of which you should be aware.

Converting RM/COBOL Applications

By default, this COBOL system already supports much of the RM/COBOL syntax and behavior. Additional RM/COBOL-specific syntax that has been added for compatibility is documented in the section *RM/COBOL Syntax Support* in your *Language Reference*.

You can also enable additional RM/COBOL behavior using certain Compiler directives. Using these directives when you submit your RM/COBOL source programs to this COBOL system ensures that most of the programs are accepted the first time they are submitted. There are still certain compatibility issues between the two COBOL systems, which are detailed, with any possible workarounds, in the *RM/COBOL Conversion Issues* section.

Configuring Your Application for Eclipse

As an RM/COBOL user, you can modernize your applications for Enterprise Developer by using the `DIALECT"RM"` Compiler directive, which enables compilation and run-time behavior highly compatible with RM/COBOL.



Note: If your RM/COBOL source code uses RM/Panels syntax, refer to the *RM/Panels Conversion Example* for your IDE instead.

This tutorial demonstrates migrating your RM/COBOL source code to Enterprise Developer using the Eclipse IDE. It takes you through creating a new project, setting the Compiler directive, and then importing the RM/COBOL source into the project.

There are three additional files included in your Enterprise Developer installation that are intended for RM/COBOL modernizations: `ADISCTRL`, `cobkeymp`, and a `.dir` (directives) file. The first two files configure the Micro Focus enhanced ACCEPT/DISPLAY syntax run-time support module (Adis) for interactive programs. The directives file contains REMOVE directives, which un-reserves many Micro Focus COBOL

reserved words that may be used within your RM/COBOL programs. This tutorial also takes you through utilizing those in your application.

Create a Native Enterprise Developer Project

Create the project in which your RM/COBOL source code will be imported.

1. Launch Enterprise Developer. Specify a path for the Eclipse workspace when prompted.

If this is the first time you start Eclipse, the IDE displays the Eclipse **Welcome** page. Click **Open Team Developer Perspective** which is the default perspective in Enterprise Developer.

If the IDE does not start in the Team Developer perspective, to change to it, click **Window > Perspective > Open Perspective > Other**, click **Team Developer (default)**, and then click **OK**.

Perspectives are an Eclipse concept and they include the views, menus and options relevant to your activity. The Team Developer perspective shows the Application Explorer view, Outline and Console views, among others. The perspective is customizable, so you can choose your own views.

2. Select **File > New > Other**.

The **New** dialog box is displayed.

3. Expand **Micro Focus COBOL** folder, and then click **COBOL Project**.

4. Click **Next**.

The **New COBOL Project** dialog box is displayed.

5. In the **Project name** field, specify a name for the project.

6. Click **Finish**.

The project is created, and displayed in the Application Explorer view.

Set the DIALECT"RM" Compiler Directive for the Project

Set the DIALECT"RM" directive in the project's properties so that it applies to all programs within the project unless you explicitly override it at the program level.

1. Right-click your project in the COBOL Explorer view and select **Properties**.

The **Properties for <project-name>** dialog box appears.

2. Select **Micro Focus > Project Settings > COBOL**.

The COBOL settings appear in the right-hand pane.

3. In the **Language Dialect** field, select **RM/COBOL**.

4. Click **OK**.

The RM/COBOL dialect is applied to any program within the project, unless that program overrides it by setting the DIALECT directive explicitly within the source code.


Import your RM/COBOL Source Code


Import one or more of your source files into the project.



Note: You may use your own source code, but for this tutorial we are going to use the sample RM/COBOL program listed in *Appendix A - RM/COBOL source file*.

1. Open a plain-text editor, copy and paste the sample code in *Appendix A - RM/COBOL source file* into a new document.
2. Save the file with a `.cbl` extension.
- 3.

Drag the file into Eclipse, and drop it on the project name when the cursor changes to  (Windows)

or  (UNIX).

The **File Operation** dialog box appears.

4. Ensure **Copy Files** is selected (so that a copy of the original file is created in the project, and not simply a link to the original file inserted), then click **OK**. A copy of the file is added to the project, and if your environment is set to build automatically, the project is compiled.

Customizing the Reserved Words List


There are words that may be in your RM/COBOL source code that are reserved in Micro Focus COBOL; their presence will cause syntax errors unless you remove them from the reserved words list.

Use the directives file, `MigrateRM.dir`, that is supplied with your Enterprise Developer installation to remove any such words from the list. You can use this file with any RM/COBOL sources you are modernizing.

1. In your file system, browse to `%COBDIR%\etc\rm` (Windows) or `$COBDIR/etc/rm` (UNIX).

The directory containing `MigrateRM.dir` appears.

2.

Drag this file into Eclipse, and drop it on the project name when the cursor changes to  (Windows)

or  (UNIX).

The **File Operation** dialog box appears.

3. Ensure **Copy Files** is selected (so that a copy of the original file is created in the project, and not simply a link to the original file), then click **OK**.

A copy of the file is added to the project.

4. Right-click your project in the Application Explorer view and select **Properties**.

The **Properties for <project-name>** dialog box appears.

5. Select **Micro Focus > Project Settings > COBOL**.

The COBOL settings appear in the right-hand pane.

6. In the **Additional Directives** box, type `USE(MigrateRM.dir)`, then click **Apply**.

7. Click **OK** to save the project.

The directives in the `.dir` file are applied to your project.

The next task is to add Adis support to the project.

Add Adis Support to the Project


Add Adis support to your project to alter the default behavior of the enhanced ACCEPT and DISPLAY statements in Micro Focus COBOL.


Enterprise Developer ships with a version of Adis that contains a configuration intended for modernizing RM/COBOL applications.

1. In your file system, browse to `%COBDIR%\etc\rm` (Windows) or `$COBDIR/etc/rm` (UNIX).

The directory containing `ADISCTRL` appears.

2.

Drag this file into Eclipse, and drop it on the project name when the cursor changes to  (Windows)

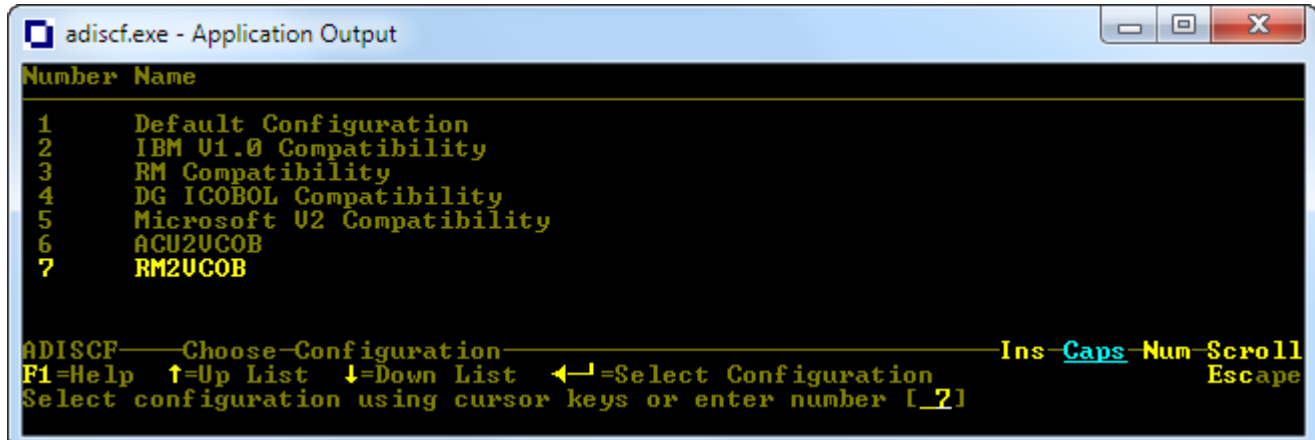
or  (UNIX).

The **File Operation** dialog box appears.

3. Ensure **Copy Files** is selected (so that a copy of the original file is created in the project, and not simply a link to the original file), then click **OK**.


A copy of the file is added to the project.

4. To verify that the correct Adis configuration is selected:
 - a) Using an Enterprise Developer command prompt, navigate to the project directory (that is, the directory containing ADISCTRL).
 - b) Type `adisconf`, then press **Enter**.
The **adisconf.exe** window appears.
 - c) Press **F6**, then ensure that the RM2VCOB configuration is selected.



See *Appendix B - ADISCTRL settings for RM2VCOB*, *Appendix C - Adis key mappings for RM2VCOB*, and *Appendix D - Adis key function mapping for RM2VCOB* for a full list of the settings.

- d) Press **Esc** twice to exit.

 **Note:** if you are prompted to exit without saving, press **N**, **F4**, then **Esc** twice again.


5. Right-click your project in the COBOL Explorer view and select **Properties**.

The **Properties for <project-name>** dialog box appears.

6. In the left-hand pane, select **Micro Focus > Build Configurations > Events**.

The Events appear in the right-hand pane.

7. In the Post-build event command line box, type `copy ${basedir}\ADISCTRL ${basedir}\New_Configuration.bin\ADISCTRL (Windows)`, or `cp ${basedir}/ADISCTRL ${basedir}/New_Configuration.bin/ADISCTRL (UNIX)`, then click **Apply**.


 **Note:** If your project builds to another location other than the default `New_Configuration.bin` directory, you will need to change the above command accordingly.

8. Click **OK**.

Add the RM/COBOL Keyboard Configuration

Add a keyboard configuration file to the project that sets the typical function key operations when executing ACCEPT statements in an RM/COBOL environment.



Enterprise Developer ships with a keyboard configuration intended for modernizing RM/COBOL applications.

 **Note:** On some UNIX platforms, the keyboard configuration file that is supplied may not be compatible with the local `termcap` file in use. You will be able to tell if this is the case when you run the application, and key-presses are not performing the required actions; in which case, you must use the Keyboard Configuration Utility (`keybcf`) to correct the supplied version of `cobkeymp`.

1. In your file system, browse to `%COBDIR%\etc\rm (Windows)` or `$COBDIR/etc/rm (UNIX)`.

The directory containing `cobkeymp` appears.

2.

Drag this file into Eclipse, and drop it on the project name when the cursor changes to  (Windows) or  (UNIX).

The **File Operation** dialog box appears.

3. Ensure **Copy Files** is selected (so that a copy of the original file is created in the project, and not simply a link to the original file), then click **OK**.

A copy of the file is added to the project.

4. Right-click your project in the COBOL Explorer view and select **Properties**.

The **Properties for <project-name>** dialog box appears.

5. Select **Micro Focus > Build Configurations > Events**.

The Events appear in the right-hand pane.

6. In the Post-build event command line box, on a new line, type `copy ${basedir}\cobkeymp ${basedir}\New_Configuration.bin\cobkeymp` (Windows), or `cp ${basedir}/cobkeymp ${basedir}/New_Configuration.bin/cobkeymp` (UNIX), then click **Apply**.



Note: If your project builds to another location other than the default `New_Configuration.bin` directory, you will need to change the above command accordingly.

If a prompt appears informing you that files already exist in the specified location, click **No**.

7. Click **OK**.

Build and Run the Project

By default, Eclipse is set to build projects automatically (see **Project** menu). If there are any problems, check the **Problems** window: errors for the project show the name of your imported `.cbl` source file in the Resource column. Double-click an entry to jump to the particular area of the code in error.

To run the application from Eclipse, you need to create a launch configuration.

1. Right-click your project in the COBOL Explorer view and select **Run As > Run Configurations**.

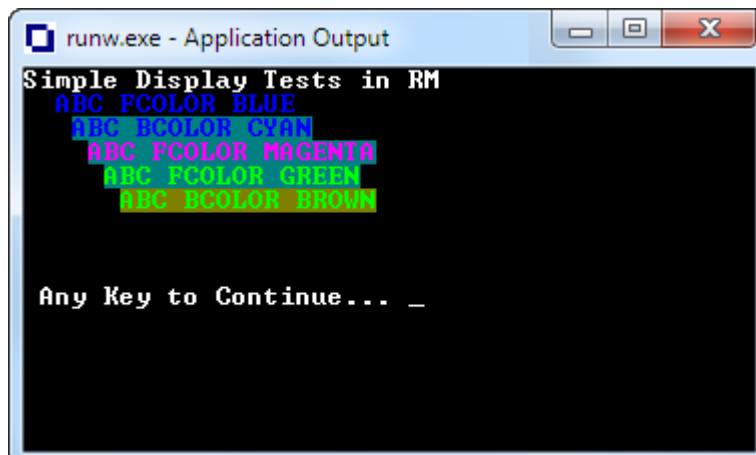
The **Run Configurations** dialog box appears.

2. Double-click **COBOL Application**.

Default launch configuration details for your project are displayed.

3. Click **Run**.

The following appears:



4. Press any key to end the application.

This concludes the tutorial in which we have created an Enterprise Developer project, configured it to be highly compatible with RM/COBOL source code, and then run a small RM/COBOL program.

Appendices

Appendix A - RM/COBOL Source File

If you do not want to test the conversion process using one of your RM/COBOL source files, you can use the source listed in this appendix.

```

identification division.
program-id. RmProgram1.

environment division.
configuration section.

data division.
  Working-Storage section.
  01 singleChar PIC X.

PROCEDURE DIVISION.

Main.

  DISPLAY "Simple Display Tests in RM" ERASE
  DISPLAY "ABC FCOLOR BLUE" AT 0203 CONTROL "FCOLOR=BLUE"
  DISPLAY "ABC BCOLOR CYAN" AT 0304
    CONTROL "BCOLOR=CYAN"
  DISPLAY "ABC FCOLOR MAGENTA" AT 0405
    CONTROL "FCOLOR=MAGENTA"
  DISPLAY "ABC FCOLOR GREEN" AT 0506
    CONTROL "FCOLOR=GREEN"
  DISPLAY "ABC BCOLOR BROWN" AT 0607
    CONTROL "BCOLOR=BROWN"
  DISPLAY "Any Key to Continue..." AT 1002
    CONTROL "BCOLOR=BLACK, FCOLOR=WHITE"

  ACCEPT singleChar at 1025.
  goback.
end program RmProgram1.

```

Appendix B - ADISCTRL Settings for RM2VCOB

This is a complete list of the Adis options and settings for the RM2VCOB configuration used in the tutorial. The settings in bold are the ones that differ from the default Adis configuration.

Setting no.	Description	Value
1	User function keys enable/disable - function keys are enabled.	2
2	Range of data keys accepted.	3
3	Prompt character.	[_] x'5F'
4	Prompt character used in PIC G fields.	[iQ] x'8151'
5	Pre-display of fields before an accept - enables the predisplay of numeric-edited fields with numeric editing when the cursor moves into them. No other predisplay occurs.	1
6	Accept in a SECURE field.	2
7	Auto-skip between fields.	2
8	Termination of an accept - keying or retyping a data character in the last available character position of an ACCEPT operation, provided auto-skip between fields is enabled.	3

Setting no.	Description	Value
9	Validation control if accept is terminated by a function key.	1
10	End of field effects - the cursor stays at the end of field, and overtyping is rejected.	2
11	Filed overflow buffers enable/disable - displaced data is not saved in an overflow buffer.	2
12	Auto-restore during backspace in replacement editing mode - RM backspace. Deleted characters are removed and characters to the right are shifted left, same as when in insertion editing mode.	3
13	Accepts into numeric edited fields - input is accepted as for alphanumeric fields and is normalized to remove illegal characters on exit from the field.	1
14	Accepts in non-edited numeric fields - all non-edited numeric fields are treated as alphanumeric fields.	3
15	Enable/disable auto-clear or pre-clear - pre-clear mode: the field is cleared to spaces or zeroes. Pressing the Undo key does not restore the original contents of the field.	4
16	Force field to be updated if it is not altered - the data item is always updated even if the field is not altered. This setting has effect only if the field is numeric or numeric-edited and the original data item did not contain any numeric data, or if the field is right justified and the original contents of the field were not.	2
17	Remembering where the end of field is - the enhanced ACCEPT/DISPLAY syntax notes the position of the last character entered into a field during an ACCEPT operation. This setting provides justification of RM-style numeric fields.	2
18	Rm style numeric data entry - the RM/COBOL 85 style of numeric and numeric-edited data entry is enabled.	3
19	Restricting maximum field size to one line.	1
20	Control of cursor positioning after an accept - the cursor is left at its current position.	2
21	Control of whether UPDATE clauses perform implicit CONVERTs - the CONVERT clause is implied.	2
22	Selection of the function key list to be used.	1
23	Select of the action for COLUMN + n clauses - a 'COLUMN + 1' clause leaves a one-character gap between the two fields.	2
24	Selection of the default action if no color specified.	1
25	Control of whether cursor left/right keys can exit a field - the keys cannot exit a field.	2
26	left justification of free-format edited numerics - the field is left-justified, provided RM-numeric handling is switched off. This is controlled by ACCEPT/DISPLAY option 18.	2
27	Validation control on FULL/REQUIRED fields.	1
28	Control of Adis keys defined as function keys.	2
29	Control of the read screen option for an accept.	1
30	Control of whether protected fields are skipped.	1
31	Control of special action for Kanji modifier characters.	1
32	Selection of the units used when calculating timeout.	1
33	Control of whether timeout is reset on each keystroke - the timer is reset each time a character is entered.	2
34	Control of line feed before first DISPLAY on a screen.	2

Appendix C - Adis Key Mappings for RM2VCOB

This is a complete list of the Adis key mappings for the RM2VCOB configuration used in the tutorial. The settings in bold are the ones that differ from the default Adis configuration.

No.	Function	Setting	No.	Function	Setting
0	Terminate accept	Enabled	14	Backspace character	Enabled
1	Terminate program	Enabled	15	Retype character	Disabled
2	Carriage Return	Enabled	16	Insert single character	Disabled
3	Cursor left	Enabled	17	Delete character	Enabled
4	Cursor right	Enabled	18	Restore character	Disabled
5	Cursor up	Enabled	19	Clear to end of field	Enabled
6	Cursor down	Enabled	20	Clear field	Enabled
7	Move to start of screen	Enabled	21	Clear to end of screen	Disabled
8	Move to next tab stop	Enabled	22	Clear screen	Disabled
9	Move to previous tab stop	Enabled	23	Set insert mode	Enabled
10	Move to end of screen	Enabled	24	Set replace mode	Enabled
11	Move to next field	Enabled	25	Reset field (Undo)	Disabled
12	Move to previous field	Enabled	26	Move to start of field	Function
13	Change case of character	Disabled	27	Move to mouse position	Disabled

Appendix D - Adis Key Function Mapping for RM2VCOB

This is a complete list of the Adis key function mappings for the RM2VCOB configuration used in the tutorial. The settings in bold are the ones that differ from the default Adis configuration.

Function				Mapped to	
Number	Name	Validate	Align	Number	Name
0	Terminate accept	-	-	255	Undefined
1	Terminate program	Y	N	1	Terminate program
2	Carriage Return	Y	N	0	Terminate accept
3	Cursor left	Y	N	3	Cursor left
4	Cursor right	Y	N	4	Cursor right
5	Cursor up	Y	N	12	Move to previous field
6	Cursor down	Y	N	11	Move to next field

Function				Mapped to	
Number	Name	Validate	Align	Number	Name
7	Move to start of screen	Y	N	7	Move to start of screen
8	Move to next tab stop	Y	N	11	Move to next field
9	Move to previous tab stop	Y	N	12	Move to previous field
10	Move to end of screen	Y	N	10	Move to end of screen
11	Move to next field	-	-	255	Undefined
12	Move to previous field	-	-	255	Undefined
13	Change case of character	Y	N	13	Change case of character
14	Backspace character	Y	N	14	Backspace character
15	Retype character	Y	N	15	Retype character
16	Insert single character	Y	N	16	Insert single character
17	Delete character	Y	N	17	Delete character
18	Restore character	Y	N	18	Restore character
19	Clear to end of field	Y	N	19	Clear to end of field
20	Clear field	Y	N	55	RM Clear Field
21	Clear to end of screen	Y	N	21	Clear to end of screen
22	Clear screen	Y	N	22	Clear screen
23	Set insert mode	Y	N	58	Insert toggle
24	Set replace mode	-	-	255	Undefined
25	Reset field (Undo)	Y	N	21	Reset field (Undo)
26	Move to start of field	Y	N	26	Move to start of field
27	Move to mouse position	Y	N	27	Move to mouse position

Compiler Directives for RM/COBOL Compatibility

You can set a number of Compiler directives in your RM/COBOL source programs that enable a program to emulate RM/COBOL behavior.

The main directive that sets the majority of RM/COBOL behavior is `DIALECT"RM"`. Setting this directive automatically sets additional Compiler directives; see the topic *RM Dialect Settings* for full details of the directives set.

Previously, compatibility was achieved by compiling with the RM Compiler directive. The newer DIALECT"RM" directive sets and extends the compatibility given by RM, and should be used for all new migrations from RM/COBOL, unless you normally set the ANSI switch when you submit your RM/COBOL source programs to the RM/COBOL system. If you do, set the RM"ANSI" directive when you compile your programs.

We also recommend that you set the NOMF directive when you submit your RM/COBOL source programs to this COBOL system. This ensures that only those words which are treated as reserved words under the ANSI '74 COBOL standard are regarded as reserved words by this COBOL system.


Setting the NORM directive disables the syntax enabled when the RM directive was set, and automatically resets the additional Compiler directives and syntax that RM originally set.

The final states of the additional directives set when you use the NORM directive are not necessarily the same as their initial default states.

Compiling RM/COBOL Programs Without DIALECT"RM"

The following issues may occur when compiling your RM/COBOL programs without the DIALECT"RM" Compiler directive:

- Directive settings will revert to Enterprise Developer defaults. Refer to the *MF Dialect setting* and *RM Dialect setting* sections of the DIALECT Compiler directive topic for the differences; you can explicitly set any of the directives to override the default set by the MF dialect. You can also use the SETTINGS directive to output a list of directive settings in effect.
- RM/COBOL reserved words that are not reserved in Enterprise Developer will not be treated as reserved words: this can cause errors such as "verb expected" or other such syntax errors. In some cases, you can use an ADDRSV directive to resolve this. In other cases, you must modify the syntax in the source to avoid the RM/COBOL reserved word; often there is an equivalent syntax in Enterprise Developer that uses a different reserved word.
- The CRT STATUS value for ACCEPT statements will not be converted to RM/COBOL numeric values. The CRT STATUS for an ACCEPT statement will be the Enterprise Developer three-byte value, where each byte has a different meaning - the second byte frequently contains the RM/COBOL numeric value.
- In the ASSIGN clause of a file control entry, the device types SORT-WORK, CARD-PUNCH, CARD-READER, CASSETTE and DISC will not be recognized as valid device types. You must modify the program to specify an equivalent device type supported by Enterprise Developer. Device types with a prefix of PRINTER and an additional character, for example, PRINTER1 or PRINTER?, will not be treated as printers; you must shorten the device type to just PRINTER.
- The ASSIGN clause of a file control entry will not assume DYNAMIC when the ASSIGN directive specifies "EXTERNAL". You must either override the ASSIGN"EXTERNAL" directive, or modify the program to specify DYNAMIC explicitly in the ASSIGN clause.
- Indexed file key-name references will not be implicitly qualified by the file-name in the file control entry or READ/START statements. Ambiguous reference errors may occur if the qualification is required for uniqueness of reference when the same key-name has been used for more than one file; in this case you must explicitly add the qualification OF file-name to the reference for Enterprise Developer.
- The CODE-SET clause is not allowed in the file control entry; it can be specified only in the file description entry. Move any CODE-SET clause specified in the file control entry to the file description entry.
- COLLATING SEQUENCE clauses may be repeated in the file control entry for an indexed file and the lexically last such clause specified takes precedence.
- Constant-expressions are fully supported for RM/COBOL syntax in Enterprise Developer, but Enterprise Developer computes a 64-bit result, as opposed to RM/COBOL's 32-bit result. This is only a problem if the expression or any sub-expression result exceeds 32 bits in the RM/COBOL program; in this case, Enterprise Developer will likely have a different result.
- Empty groups are not allowed. Modify the program to eliminate empty groups by including a subordinate data item in the group or by removing the group itself. A warning message COBCH0217 or COBCH0256 is produced for an empty group when DIALECT"RM" is set, but a severe error COBCH0217 or COBCH0256 is produced when DIALECT"RM" is not set.

- Byte-storage mode is used for binary data items, which can result in different length file records and redefinition issues. The IBMCOMP directive will restore word-storage mode, but will also cause length specifiers in data description entries to increase to the word size that is at least as large as the length specifier, which is different from RM/COBOL behavior. A better solution might be to provide length specifiers for all binary data item usage clauses.
 - RECORD DELIMITER IS LINE-SEQUENTIAL or BINARY-SEQUENTIAL does not set the record delimiting technique for the file. Specify the record delimiting technique in the ORGANIZATION clause or with the SEQUENTIAL directive.
 - VALUE OF LABEL data-name-1 is allowed, but treated as documentary. If data-name-1 is not defined in the program, it will not be defined implicitly. In this case, any references to data-name-1 will receive compilation errors, and you must change the program to remove the reference or define data-name-1 explicitly.
 - Records are not variable length unless records of different length are explicitly defined, even if there are OCCURS DEPENDING ON clauses in the record description entry, or the RECORD CONTAINS clause specifies a range of record sizes. You can use the RECMODE"RMCOBOL" directive to cause records to be variable length in the same manner as RM/COBOL.
 - Implicit data-name definition for forward references does not take place without the DIALECT"RM" directive, except for the external file-name data-name specified in the ASSIGN clause or the FILE-ID clause. Implicit definition relates to forward references in clauses such as CRT STATUS, CURSOR, FILE STATUS and others. The explicit definition must be added to the program to avoid compilation errors. Even with DIALECT"RM" set, an E-level error message, which can be ignored or suppressed, is generated; this error indicates that the implied definition might not be the desired definition.
 - The ERASE clause in a screen description entry cannot be specified without EOS or EOL. A simple ERASE clause must be changed to BLANK SCREEN. An ERASE LINE clause must be changed to ERASE EOL or BLANK LINE.
 - The SYNCHRONIZED clause follows Enterprise Developer specifications instead of RM/COBOL specifications. This may result in file record size differences or redefinition issues. It may be necessary to insert explicit definition of slack characters in record descriptions for groups that have an odd length, especially if the group or elementary items of odd length are subject to an OCCURS clause.
 - The USAGE COMP/COMPUTATIONAL clause in a data description entry does not produce the informational message COBCH1210 COMP processed as DISPLAY (future occurrences not indicated).
 - Procedure Division headers that specify a nonnumeric returning or giving data item are not permitted unless there is a prototype that specifies the RM call-convention (1024).
 - Procedure-names cannot be the same as data-names. When DIALECT"RM" is set, a procedure-name that is the same as a data-name produces an informational COBCH0305 message; when DIALECT"RM" is not set, a procedure-name that is the same as a data-name produces a serious COBCH0305 message and the two categories of names must be disjoint in the source program.
 - A comparison of a nonnumeric literal that contains only digits to a display unsigned numeric data item or literal does not preserve RM/COBOL behavior.
 - Character set handling for files does not preserve RM/COBOL behavior.
 - I/O statements that result in a serious error at run time do not terminate the program when there is no applicable declarative but a file status data item is declared. The file status data item must be checked after each I/O statement to see if a serious error has occurred.
 - I/O defaults to expect Enterprise Developer file formats. You need to set the FILETYPE"21" directive for I/O with existing RM/COBOL format files or convert those files to Micro Focus format files.
-  **Note:** Converting the file format does not convert the format of data items in the file. If the data items are not also converted, directives that define data format may be required, such as COMP"UNPACKED", COMP1"BINARY", COMP6"3", IBMCOMP and SIGN"EBCDIC".

If FILETYPE"21" is not specified, I/O status values will be different than in RM/COBOL.

- ACCEPT/DISPLAY syntax and behavior differs significantly, requiring revision of the source program to achieve behavior expected from the RM/COBOL program. Some of the revisions for behavior might not be necessary if the RM/COBOL ADISCTRL and COBKEYMAP files are used, but Enterprise Developer

does not send all the forms of ACCEPT/DISPLAY to ADIS; the CONSOLE IS CRT clause or the DISPLAY"CRT" directive might resolve this issue. Also:

- Pop-up windows are not available without setting DIALECT"RM".
- The TAB syntax for ACCEPT can be restored with an ADDRSV"TAB" directive.
- The reverse syntax for ACCEPT/DISPLAY can be restored with an ADDRSV"REVERSE" directive.
- The ACCEPT statement will not allow the ERASE phrase; a separate DISPLAY SPACE ERASE statement before the ACCEPT is required.
- The Enterprise Developer defaults will apply with respect to the MODE IS BLOCK, HIGH-LIGHT, BEEP and ECHO.
- The UNIT and ECHO phrases are not supported without setting DIALECT"RM".
- ACCEPT/DISPLAY statements with a group operand for the primary operand produce a COBCH1654 Should be elementary; MODE IS BLOCK assumed when certain phrases are used. When the error does not occur, the group operand will be treated similar to a screen ACCEPT/DISPLAY, with elementary items being the fields and FILLER items treated as empty space between fields on the screen. You must add the MODE IS BLOCK phrase to such ACCEPT/DISPLAY statements to obtain RM/COBOL behavior of treating the group as a single field.
- ACCEPT/DISPLAY statements position fields on the screen as explained for Enterprise Developer and not as they are for RM/COBOL. The program must be modified to make the positioning behave as desired.
- ACCEPT statements that specify the ON EXCEPTION identifier-1 syntax do not compile. The identifier-1 item in the ON EXCEPTION phrase must be removed. The data item referenced by the CRT status clause, which may need to be added, can be used to obtain the status of the ACCEPT statement, but be aware that its format is not the same as identifier-1 as specified in the ON EXCEPTION phrase. When DIALECT"RM" is set, the format of the CRT status data item is converted to match RM/COBOL's format if the ON EXCEPTION phrase is specified in the ACCEPT statement.
- ACCEPT statements that specify UPDATE or CONVERT revert to Enterprise Developer behavior for these phrases.
- ACCEPT statements cannot specify ERASE. The ERASE must be performed in a separate DISPLAY statement preceding the ACCEPT statement. This is also true of using the CONTROL phrase to specify ERASE in the control-string specified in the CONTROL phrase.
- ACCEPT statements do not beep by default. The RM"BEEP" directive can be specified to restore the RM/COBOL default beep, but that will also set old RM compatibility. Instead, you should modify the program to specify BEEP in ACCEPT statements where BEEP is desired.
- CALL statements cannot specify figurative constants or symbolic characters in the USING phrase.
- CALL statements with numeric literals as arguments might not preserve the original form of the literal as specified in the source for the actual argument value.
- CALL statements do not use an alignment of 1 for BY CONTENT temporaries, but instead align the temporary variable per the value of the ALIGN directive.
- CALL statements must have a numeric RETURNING/GIVING argument. The RM/COBOL feature of any type for RETURNING/GIVING arguments is not supported except when the 1024 call-convention is specified.
- CALL "SYSTEM" is not RM/COBOL compatible unless the call-convention is set to 1024, either by the DEFAULTCALLS"1024" directive, a prototype for SYSTEM that specifies the 1024 call-convention, or an explicit call-convention specified in the CALL statement.
- CANCEL of non-nested program behaves as if the program were nested in an IL program.
- CLOSE statements for a line sequential file cannot specify the NO REWIND phrase.
- DELETE FILE statements do not perform a USE procedure declared for the file when an error occurs.
- DISPLAY statements that specify a figurative constant with positioning information and do not specify the SIZE phrase are not converted to a single-byte literal.
- The WITH NO ADVANCING phrase for simple (ANSI) ACCEPT and DISPLAY statements is not handled in the same way as in RM/COBOL when the DISPLAY"CRT" directive is set and DIALECT"RM" is not.
- MOVE statements that move a nonnumeric literal, including a figurative constant, that contains non-digit characters to a numeric item, substitute 0 for the sending item and produce a COBCH1026 Source literal is nonnumeric - substituting zero error. The nonnumeric literal should be

changed to contain only digits or not be used as the sending item in a MOVE operation to a numeric data item.

- MOVE statements that move a nonnumeric data item to a display unsigned numeric item do not preserve RM/COBOL behavior.
- OPEN statements set retry lock unconditionally, which differs from RM/COBOL behavior, where this is conditional on there being a USE procedure and file status data item.

RM/COBOL Data Types

When you compile your programs with the DIALECT"RM" Compiler directive, all data types behave in the same way that they do in RM/COBOL.

If you do not compile with the DIALECT directive, you can still preserve RM/COBOL behavior for certain data types by using certain other Compiler directives: COMP, COMP1, COMP2, and COMP-6.

RM/COBOL Conversion Issues

The syntax of most RM/COBOL source programs when submitted to run on this COBOL system will be accepted and run successfully. However, sometimes this COBOL system might reject some of the syntax in your original RM/COBOL source program, or might cause your program to behave unexpectedly at run-time.

This section contains the known problems which you may encounter. Hints are also given on how you can either rectify the cause of such errors, or emulate the RM/COBOL type of behavior in this COBOL system.

Producing Executable Code

The following section covers the known issues when submitting RM/COBOL source programs to this COBOL system. Where possible, work-arounds and resolutions are also provided.

Perform Statements

PERFORM statements are not treated in the same way by both COBOL systems. This COBOL system uses a stack-based perform handling system, while the RM/COBOL system associates a return address with a specific procedure name.

As a result, under the RM/COBOL system, all end-points to PERFORM statements are always active until they are used. However, under this system, only the end-point of the last PERFORM statement is active at any one time.

You must set the PERFORM-TYPE directive with the RM parameter if this COBOL system is to emulate the behavior of RM/COBOL PERFORM statements.

ACCEPT FROM CENTURY-DATE and FROM CENTURY-DAY

In Enterprise Developer, to use the FROM CENTURY-DATE and FROM CENTURY-DAY phrases with the ACCEPT statement, set the RM Compiler directive.

Alternatively, use the following equivalent phrases with the ACCEPT statement:

- FROM DATE YYYYMMDD, which is the equivalent of FROM CENTURY-DATE.
- FROM DAY YYYYDDD, which is the equivalent of FROM CENTURY-DAY.

```
procedure division.  
ACCEPT data-name-1 FROM DATE YYYYMMDD.  
ACCEPT data-name-2 FROM DAY YYYYDDD.
```

CURSOR phrase not available in ACCEPT statement

The CURSOR phrase from RM/COBOL is not supported in Enterprise Developer. In Enterprise Developer, you must use the data item specified in the CURSOR clause in the special-names paragraph. To obtain the offset in the accepted field as returned by RM/COBOL for the CURSOR phrase of the ACCEPT statement, do the following:

1. Set the data item specified in the CURSOR clause to have the line and column where the ACCEPT statement begins. If the ACCEPT statement is not positioned and will start at the current cursor location, the CBL_GET_CRSR library routine can be used to get the current cursor position; note that CBL_GET_CRSR returns zero-relative position information, which must be adjusted to one-relative position information when setting the location in the data item specified by the CURSOR clause.
2. Save the start column in another data item.
3. Execute the ACCEPT statement (without a CURSOR phrase since it is not supported).
4. Subtract the original start column from the current column in the data item specified in the CURSOR clause and store this as the offset.

Nested COPY statements with REPLACING phrase

In Enterprise Developer, you cannot specify text replacement as part of a nested COPY statement when text replacement is already active as part of a COPY statement.

If you attempt to use COPY REPLACING in a file copied with a COPY REPLACING statement, an error code *COBCH0062 COPY replacement not supported* is displayed on compilation.

Duplicate Paragraph-names

In Enterprise Developer, if you have duplicate paragraph-names, in different sections, and then call a paragraph-name from outside its section, an error is produced unless you have explicitly referenced the paragraph-name and its section. In RM/COBOL, by just calling the paragraph-name, it assumes you are calling the next declaration of the paragraph-name found.

To ensure that references to duplicate paragraph-names are correctly resolved, you must qualify a reference to a duplicate paragraph-name by adding the section-name in which it is declared.

Example

If your source code contains the following:

```

....
perform para-2.
....
sect-1 section.
para-1.
....
para-2.
....
sect-2 section.
para-2.
....

```

RM/COBOL will resolve the reference to para-2 in the PERFORM statement by using the declaration of para-2 in the sect-1 SECTION. In Enterprise Developer, however, you must qualify the reference to the duplicate paragraph-name in your source code by using the PERFORM para-2 OF sect-1 statement.

Figurative Constants and the USING Phrase

In Enterprise Developer, to use figurative constants in the USING phrase of a CALL statement or as values of level 78 constants, set the DIALECT"RM" Compiler directive.

Alternatively, the figurative constant can be replaced by the equivalent non-numeric literal, such as " " for SPACE or "0" for ZERO.

File Not Found Errors

Enterprise Developer and RM/COBOL differ in the environment variables that they use to locate program and data files.

If your source code produces a file not found error, ensure the correct paths are set in the correct environment variables. In Enterprise Developer, set COBPATH to locate program files and COBDATA to

locate data files. The `RUNPATH` environment variable used in RM/COBOL, is not used in Enterprise Developer.

Indexed File Error on Open

Enterprise Developer and RM/COBOL differ in how they handle record length fields and some data fields when you open an RM/COBOL indexed file.

In Enterprise Developer, when you try to open an RM/COBOL indexed file, you may receive either a runtime error `COBRT161 Illegal intermediate code` or a file status code `39 A conflict has been detected between the fixed file attributes and the attributes specified for that file in the program.`

You must ensure that you read in the same size records that were created in RM/COBOL.

If the length of the file description does not match that which was processed in RM/COBOL, check the following:

- In RM/COBOL, you can set the `RECORD CONTAINS nn CHARACTERS` clause to be a different length than the actual length specified in the record description. If this clause is greater than the actual description, you must pad the record description with filler bytes to match the `RECORD CONTAINS` clause.
- If you have signed numeric display data in your file, Enterprise Developer will treat the sign as a separate byte if you are using the `RM` directive without "ANSI" specified. If these fields are stored as sign internal, you must use `RM"ANSI"` or do not use the `RM` directive at all.

LIKE Relational-operator Not Available

Enterprise Developer and RM/COBOL differ in the way that they allow you to use regular expressions.

RM/COBOL has a `LIKE` relational-operator. Enterprise Developer does not support the `LIKE` relational-operator. Instead, use the `C$REGEXP` library routine. `C$REGEXP` uses a call convention of zero, so when using it in a `DIALECT"RM"` program, where the default call convention is 1024, the call convention must be specified in the `CALL` statement for `C$REGEXP`.

The regular expressions supported by `C$REGEXP` differ somewhat from those used by the RM/COBOL `LIKE` relational-operator and between Windows and UNIX, so adjustments may be required in the regular expression syntax used.

Linkage Section in Main Program

In RM/COBOL, if the main program has a Linkage Section, it is initialized by the parameter passed on the command line. In Enterprise Developer, you must use the `command_line_linkage` Compiler directive to pass parameters from the command line to the Linkage Section.

Nested OCCURS DEPENDING Clauses

In Enterprise Developer, if you are using nested `OCCURS DEPENDING` clauses, you must set the `ODOSLIDE` Compiler directive.

Numbering of Segments

In Enterprise Developer, you can only specify segment numbers in the range 0 to 99 inclusive, which conforms to segment number limit specified in the ANS X3.23-1985 COBOL standard. In RM/COBOL, you can specify segment numbers greater than 99.

If your source code has segment numbers greater than 99, recode the program. Make sure that any new segment numbers you allocate do not clash with an already existing segment number. Segment numbers between 0 and 49 inclusive are used by Enterprise Developer to indicate fixed portions of your object program, while segment numbers 50 to 99 inclusive indicate independent segments.

For details on the use of segmentation and segment numbers in your source programs, see *COBOL Language Reference* in the product Help.

Program Identification and Data Names

In Enterprise Developer, you cannot use the same name for the Program-ID and a data item in the program; each name should be unique. RM/COBOL permits the name of the Program-ID paragraph and a data item to share the same name.

REMARKS Paragraph

In Enterprise Developer, if your program uses the REMARKS paragraph in the Identification Division, you must set the DIALECT"RM" Compiler directive.

Alternatively, mark the paragraph as comment lines.

Reserved Words

In Enterprise Developer, setting certain Compiler directives (such as RM and ANS85) activates certain reserved words that you cannot use as names for your data items.

If you attempt to use a reserved word, you receive a COBCH0666 ("Reserved word used as data name or unknown data description qualifier") COBOL syntax error.

To continue to use the reserved word as a data name, you can:

- Use the REMOVE Compiler directive, to unreserve that particular keyword.
- Set the MFLEVEL Compiler directive to an appropriate level, to unreserve all keywords above that level.

See *Compiler Directives* in the product Help.

Example

Your RM/COBOL source program may contain the following lines of code:

```
....
03 sort    pic 99.
....
move 1 to sort
```

If you submit this to Enterprise Developer, you will receive an error because the SORT verb is reserved. However, if you specify the REMOVE"SORT" Compiler directive when you submit this source program, you will not receive the error.

SAME AS Clause Not Available When Defining Data Structures

Enterprise Developer and RM/COBOL differ in the way that they allow you to reuse existing data structures.

In Enterprise Developer, use the TYPEDEF clause to define your base data structure, and then use the USAGE clause to create data structures of the same type.

```
data division.
working-storage section.
01 atype is typedef.
   03 var1 pic x(10) value "brown".
   03 var2 pic x(10) value "blue".
   03 var3 pic x(10) value SPACE.
01 a1 usage atype.
procedure division.
display var2 of a1.
```

The result of the display statement is blue.

The SAME AS clause used in RM/COBOL is not supported in Enterprise Developer.

Source Code in Columns 73 to 80

Enterprise Developer ignores any of the code in your source programs which lies within columns 73-80 inclusive.

Code in these columns could be the result of expanding TAB characters in your source program, instead of standard TAB stops. If your source program contains TAB stops, convert them to spaces.

If your RM/COBOL program used the `>>IMP MARGIN-R AFTER END OF RECORD` directive for long source records, remove that directive from the source and use the Enterprise Developer `SOURCEFORMAT"variable"` directive. Note that source lines longer than 256 bytes are not supported and will be truncated with a message at compile-time.

RM/COBOL implementor defined directives `>>IMP` for source format, `>>LISTING ON/OFF` and `>>PAGE` are not supported.

START WHILE LIKE Not Available

Enterprise Developer and RM/COBOL differ in the way that they allow you to select records from and indexed organization file.

RM/COBOL allows a WHILE LIKE filter in the START statement. The filter is passed to the file manager and only records that match the filter are returned to the COBOL program for processing. Enterprise Developer does not support such a filtering mechanism. The COBOL program must retrieve all the records and filter them in the program, which is less efficient, but at least emulates the RM/COBOL feature. The C \$REGEXP library routine can be used to apply a regular expression filter similar to what the WHILE LIKE phrase in RM/COBOL would apply in the file manager.

Undeclared Data Items in Clauses

In Enterprise Developer, you receive a COBCH0250 STATUS field data-name missing or illegal error if a data item used in the File Status clause is not declared in the Working-Storage section. In RM/COBOL, you do not have to declare the data item in Working Storage.

With the DIALECT"RM" directive, serious error COBCH0250 is no longer generated by Enterprise Developer for the undeclared items. Instead, a non-serious COBCH1787 is generated. This error can be suppressed or ignored. It indicates that a default definition has been provided. The default definition is the same as the one supplied by RM/COBOL, but it might not be the desired definition. If it is not the desired definition, modify your program to define the data item as desired.

User-names Longer than 127 Bytes are Truncated

In RM/COBOL, you can specify user-names (data-names, procedure-names, program-names, etc) up to 240 characters long. In this COBOL system, user-names longer than 127 bytes in length are truncated and a warning message is produced.

Solution:

Results may be affected if the truncated user-name is used with XML Extensions, to export or import XML documents; therefore, we recommend that you keep user-names to 127 bytes or less.

Using Relative Path Names

If your RM/COBOL application relies on the EXPANDED-PATH-SEARCH configuration option to locate files specified with a relative path name, you must set the COPYSEARCH"RM-EXPANDED" Compiler directive in Enterprise Developer for equivalent behavior.

When running your application under the DIALECT"RM" emulation, COPYSEARCH"RM" is set by default, which only emulates the standard RM/COBOL directory search sequence when trying to resolve relative path names. You must override this setting with the COPYSEARCH"RM-EXPANDED" Compiler directive on your individual programs or application.

Running the Code

Once you have successfully submitted your RM/COBOL source program to this COBOL system and produced executable code, you might encounter difficulties when you try to run this code under this system. Alternatively, the code might run but you might find that its behavior under this COBOL system is

not exactly the same as under the RM/COBOL system. The following sections detail known areas of difficulty you might encounter, and offer hints on how you can avoid them.

Table Bound Checking

If you try to run a program under this COBOL system which contains a subscript value greater than the size of the table to which it refers, the run-time system will produce an error indicating this. Under the RM/COBOL system, however, no such table bound checking is done.

Therefore, if you wish to disable table bound checking in this COBOL system, you must use the NOBOUND directive.

If you use the NOBOUND directive when running intermediate code, you will be able to access data beyond a table's bounds by using a subscript value greater than the table size. Use of the NOBOUND directive when you are producing intermediate code will also disable bound checking when running generated code. However, if you wish to access data beyond a table's bounds when running generated code, you must also use the directive NOBOUND OPT.

Note: When you use the NOBOUND OPT directive, performance will be impaired.

ACCEPT Fields at the Edge of the Screen

If your program contains an ACCEPT statement for a numeric data item at a position on the screen where the definition of the numeric data item would cause the ACCEPT field to go beyond the right-hand edge of the screen, both COBOL systems will truncate the input value. In RM/COBOL, the input value will be aligned into the ACCEPT field as an alphanumeric field, whereas in Enterprise Developer, the input value is aligned as a numeric field.

Change the definition of the relevant PICTURE clause from numeric to alphanumeric. Alternatively, change the PICTURE clause so that the field does not go beyond the edge of the screen.

Example

If your program contains the following statement:

```
ACCEPT data-item AT COLUMN NUMBER 75.
```

where *data-item* is a numeric data item defined as PIC 9(10), a value of 123456 entered into the ACCEPT field will be held under Enterprise Developer as "0000123456". However, in RM/COBOL, the value in the ACCEPT field would be held as "1234560000". To allow Enterprise Developer to emulate the RM/COBOL behavior, alter the definition of the data item in your program to PIC X(10) or PIC 9(6).

C\$CARG Not Supported

The RM/COBOL C\$CARG library routine is not supported.

Calls to C\$CARG must be changed to use C\$DARG, which is supported and provides equivalent functionality.

Display of Input Data in Concealed ACCEPT Fields

If you have specified OFF and ECHO clauses for the same ACCEPT statement in your program, RM/COBOL will conceal any data entered during input for that statement but on completion of input will display the data. Enterprise Developer will not display the data for this ACCEPT statement once input has been completed.

If you want to display the data input for an ACCEPT statement with the OFF and ECHO clauses specified, you must add a DISPLAY statement after the ACCEPT statement.

Embedded Control Sequences in DISPLAY Statements

In Enterprise Developer, you cannot embedded control sequences within data items that you want to be displayed.

Such characters are ignored at run time as they are hardware dependent.

Remove the control sequences from your source program and replace with the equivalent Micro Focus COBOL syntax; for example, use the syntax WITH UNDERLINE to replace <left-arrow>]4m.

End of File Notification

The first time you unsuccessfully try to READ a sequential file in either COBOL system because you have reached the end of the file, status key 1 in the FILE STATUS is set to 1 and status key 2 is set to 0. This indicates that there is no next logical record. If you try to READ the same file again, without it either having been previously closed and reopened, or it having been successfully started, Enterprise Developer continues to indicate that there is no next logical record. However, if you try to READ the same file again under RM/COBOL, status key 1 is set to 9 and status key 2 is set to 6.

A solution to the different file statuses returned for the circumstances given above will depend on the way in which your source program is coded. We suggest that you include tests for the values 1 and 0 in status key 1 and 2 of the file status, respectively, at the same time as you test for the values 9 and 6 in these status keys.

File Status Codes

If your program is set to return RM/COBOL file status codes, but does not use a file status, or does not have a Declaratives section acting upon your data file, file I/O errors are reported by the run-time system. The extended file status reported may initially seem incorrect, but due to differences in the file handling of the different COBOL systems, the second byte of the reported error code needs to be converted from binary to ASCII. For example, if an error of 9/051 is reported, convert 051 to its ASCII character equivalent, which is 3 (0x33 in hexadecimal); therefore, the true RM/COBOL file status is actually 93.

Field Wrap-Around

If, when using binary data items (that is, RM/COBOL COMPUTATIONAL-1 format items) an arithmetic operation gives a value which exceeds the capacity of the data item, and there is no ON SIZE ERROR clause, Enterprise Developer wraps-around the value of the item. However, in RM/COBOL, the data item is set to the limit of its capacity.

You should specify an ON SIZE ERROR clause to highlight such problems.

Example

In RM/COBOL, the following lines of code result in the value +32767 being stored in the data item, CALC-ITEM. However, Enterprise Developer sets CALC-ITEM to -32768:

```
01 calc-item          pic s9(4)  comp-1.

procedure division.
    ....
    move 32767 to calc-item.
    add 1 to calc-item.
```

File and Record Locking

Certain versions of RM/COBOL contain some software errors in the way in which locks for files and records are handled. These errors do not occur in Enterprise Developer.

The errors fixed when upgrading to Enterprise Developer are:

- Indexed files do not detect or acquire locks if they are opened for output. This is regardless of whether you specify the WITH LOCK phrase
- Relative and sequential files cannot be locked exclusively

- Files which are opened for input can detect record locks, although the RM/COBOL documentation states that they cannot. When the RM directive is set in Enterprise Developer, record locks can still be detected by files opened for input
- The first record in a sequential file opened for input-output is locked whenever any other record in that file is locked

Initialization of Working Storage

Enterprise Developer initializes all working storage items without VALUE clauses to SPACES. The RM/COBOL system initializes all working storage items to SPACES, unless you have placed numeric data items between data items with VALUE clauses.

If this feature causes you any problems, because your program relies on the initial value given to the system, add a VALUE clause with the appropriate value to your source program and resubmit it.

Example

The RM/COBOL system initializes the following group item to SPACES:

```
01 group-item.
   03 item-1      pic x.
   03 item-2      pic 99.
   03 item-3      pic x.
```

However, if item-1 and item-3 have value clauses associated with them, the RM/COBOL system initializes the second byte of item-2 to hexadecimal value 0 when item-2 is defined as USAGE COMP (signed or unsigned) or USAGE DISPLAY (unsigned only).

Numeric Fields Containing Illegal Characters When Using a DEPENDING ON Phrase of an OCCURS Clause

In Enterprise Developer, if you fail to initialize a numeric data item that is used in a DEPENDING ON phrase of an OCCURS clause appropriately, a COBRT163 *Illegal character in numeric field* error is displayed at run time, because the data item is initialized to SPACES if no value is specified. In RM/COBOL, the data item is initialized to ZERO, and therefore, the error does not occur.

ON SIZE ERROR Phrase

In Enterprise Developer, the ON SIZE ERROR condition exists when the value resulting from an arithmetic operation exceeds the capacity of the specified picture-string. In RM/COBOL, the ON SIZE ERROR condition exists when the value resulting from an arithmetic operation exceeds the capacity for the associated data item.

Ensure that the capacity of any data items in your source programs is specified by a picture-string; for example, COMPUTATIONAL-1 data items.

Open EXTEND of Nonexistent File

In Enterprise Developer, because setting the RM Compiler directive sets the NOOPTIONAL-FILE Compiler directive, if you try to open a non-existent file for I-O or EXTEND the run-time system will give an error message. For I-O, RM/COBOL does the same. However, for EXTEND, RM/COBOL creates the file and opens it as if you had specified OUTPUT.

The following options are available:

- Add the keyword OPTIONAL to the SELECT statement. This makes Enterprise Developer create the file and open it for OUTPUT
- Create the empty file before running your program
- Specify the OPTIONAL-FILE Compiler directive. This makes Enterprise Developer create the file and open it for OUTPUT. However, the behavior with files opened for I-O will now differ from RM/COBOL

Printer Output is Written to Disk

By default, Enterprise Developer writes all output intended for a printer to disk.

To send output to a physical printer, you must map the filename using the `dd_LPT1` environment variable or, if your system supports the `lp` printer spooler, you should use:

```
dd_LPT1=">lp";export dd_LPT1
```

With the `DIALECT"RM"` directive, the `ASSIGN-PRINTER""` directive is set. In this case, a file assigned to a printer without a file-name in the `ASSIGN` clause is given a file-name that matches the file-name specified in the `SELECT` clause. Thus, to redirect the output file, set an environment variable `dd_file-name` to the desired destination.

Screen Column Number Specification

Enterprise Developer permits you to specify screen column numbers up to and including 999, but RM/COBOL permits you to specify column numbers greater than 999. If you try to run an RM/COBOL source program containing a column number greater than 999 in Enterprise Developer, the column number is truncated so that only the last three digits are used. If truncation of the column number occurs for an item to be displayed on the screen, the position of that item on the screen in Enterprise Developer will differ from its position in RM/COBOL.

Trailing Blanks in Line Sequential Files

Enterprise Developer always removes trailing blanks from line sequential records before writing the record. RM/COBOL removes trailing blanks from such records only if the `FD` entry contains 01 level records of different sizes. This will not cause you any problems when you run your converted RM/COBOL programs in Enterprise Developer. However, you may receive errors at run time if any `REWRITE` operations on line sequential files change the length of the records.

Change the file organization to sequential, or move an alternative padding character (for example, `LOW-VALUES`) to the end of the record before it is written. This ensures that full-length records are written.

You also need to ensure that the `T` run-time switch is not set, as this might also change the size of the record. See *Run-time Switches* in the product Help.

Undefined Results of MOVE and Arithmetic Operations

Enterprise Developer and RM/COBOL differ in the results of `MOVE` statements, arithmetic operations, and comparisons that involve numeric and alphanumeric data items.

You can overcome most of these incompatibilities by redefining the data items involved, or by recoding the comparisons. If you submit a program in Enterprise Developer containing an alphanumeric to numeric data item `MOVE` statement, a warning message will be displayed indicating this.

Example

If you submit a source program containing the following data items and procedural statements, the specified test will fail at run time:

```
01 numeric-field          pic 9(5).
procedure division.
    move "abc" to numeric-field.
    if numeric-field = "00abc"
        ....
```

When the `RM` Compiler directive is set, Enterprise Developer partially emulates the behavior of RM/COBOL for alphanumeric to numeric `MOVE`s by treating the numeric item as an alphanumeric item which is right justified. However, the above example will still fail because RM/COBOL treats the literal `ABC` as numeric, and places `00ABC` in the numeric item. To make the statement run successfully in Enterprise Developer, amend the test in the source program to:

```
if numeric-field = " abc"
```

and resubmit the source program.

Using the Correct Calling Convention

We recommend that to use the RM/COBOL library routines provided in Enterprise Developer, you explicitly set the 1024 call-convention in the CALL statement.

```
program-id. Program1.  
Special-Names.  
call-convention 1024 is RM.  
...  
  
procedure division.  
  
call RM "SYSTEM" using "cmd.exe /c mkdir sys02".  
  
goback.  
end program Program1.
```

RM/COBOL Library Routines

The following RM/COBOL routines are available in this COBOL system.

C\$Century

Updates your COBOL programs to handle the year 2000 issue.



Note: When calling this routine, ensure you are using the 1024 calling convention.

This library routine retrieves the first two digits of the current year.

Syntax:

```
CALL "C$Century" USING value-buffer
```

Parameters:

value-buffer

A two-byte data item with a format of either unsigned numeric display (NSU) or alphanumeric display (ANS).

On Exit:

value-buffer The first two digits of the current year.

Comments:

You can achieve the same result using the standard COBOL command `ACCEPT data-name FROM DATE YYYYMMDD` and then referencing the data name.

C\$ConvertAnsiToOem

Converts a buffer containing ANSI characters to a buffer containing the corresponding OEM characters.

When calling this routine, ensure you are using the 1024 calling convention.

This is supported on Windows only.

Syntax:

```
CALL "C$ConvertAnsiToOem" USING ansi-buffer, oem-buffer  
[, char-count]
```

Parameters:**ansi-buffer**
PIC X(n)**oem-buffer**
PIC X(n)**char-count**
PIC 9(n)**On Entry:****ansi-buffer** The ANSI characters to be converted to OEM characters.**char-count** The number of characters to be converted.**Note:** If omitted or if the value is invalid, the actual size of the shorter of ansi-buffer and oem-buffer is used.**On Exit:****oem-buffer** The converted OEM characters.**C\$ConvertOemToAnsi**

Converts a buffer containing OEM characters to a buffer containing the corresponding ANSI characters.

**Note:** When calling this routine, ensure you are using the 1024 calling convention.**Syntax:**

```
CALL "C$ConvertOemToAnsi" USING oem-buffer, ansi-buffer
[, char-count]
```

Parameters:**oem-buffer**
PIC X(n)**ansi-buffer**
PIC X(n)**char-count**
PIC 9(n)**On Entry:****oem-buffer** The OEM characters to be converted to ANSI characters.**char-count** The number of characters to be converted.**Note:** If omitted or if the value is invalid, the actual size of the shorter of ansi-buffer and oem-buffer is used.**On Exit:****ansi-buffer** The converted ANSI characters.

C\$DARG

Returns information about a parameter passed in the USING or GIVING phrases of the CALL statement that called a subprogram.



Restriction: This routine is supported in native COBOL only.

When calling this routine, ensure you are using the 1024 calling convention.

This information identifies the type and length of the argument and, when the argument is numeric or numeric edited, the number of digits and scale factor for the argument.

Syntax:

```
CALL "C$DARG" USING argument-number, argument-description
```

Parameters:

argument-number

pic 9(n)

argument-description

```
01 ARGUMENT-DESCRIPTION.  
  02 ARGUMENT-TYPE PIC 9(2) BINARY(2).  
  02 ARGUMENT-LENGTH PIC 9(8) BINARY(4).  
  02 ARGUMENT-DIGIT-COUNT PIC 9(2) BINARY(2).  
  02 ARGUMENT-SCALE PIC S9(2) BINARY(2).  
  02 ARGUMENT-POINTER POINTER.  
  02 ARGUMENT-PICTURE POINTER.
```

On Entry:

argument-number

The ordinal position of the argument in the USING phrase of the CALL statement. The value zero returns the description of the GIVING phrase of the CALL statement.

On Exit:

argument-description

Details of the passed parameter. Those details include:

argument-type

The type of data item; see the table in the *Comments* section.

argument-length

The number of character positions of the data item.

argument-digit-count

The number of digits defined in the PICTURE character-string for an argument that is a numeric or numeric edited data item as indicated by the ARGUMENT-TYPE field value; otherwise, the value zero is returned for nonnumeric data items. The digit count for a numeric or numeric edited data item does not include any positions defined by the PICTURE symbol P, which represents a scaling position.

argument-scale

The power of 10 scale factor (that is, the position of the implied or actual decimal point) for an argument that is a numeric or numeric edited data item as indicated by the ARGUMENT-TYPE field value; otherwise, the value zero is returned for nonnumeric data items. If the PICTURE symbol P was used in the description of the data item, the absolute value of the ARGUMENTSCALE value will exceed the ARGUMENT-DIGIT-COUNT value; in this case, a positive scale value indicates an integer with P scaling positions on the right of the PICTURE character-string and a negative scale value indicates a

	fraction with P scaling positions on the left of the PICTURE character-string
argument-pointer	This parameter is not returned in this COBOL system.
argument-picture	This parameter is not returned in this COBOL system.


Comments:

Use the C\$NARG library routine to obtain the number of arguments passed in the CALL statement.

The actual number of arguments may exceed the number of formal arguments declared in the Procedure Division header of the program that calls C\$DARG. All of the actual arguments can be accessed using C \$DARG even though there is no formal argument name available for accessing the actual arguments beyond the number of formal arguments.


The following table is used to indicate the data type specified in the ARGUMENT TYPE field:

Type Number	RM/COBOL Data Type	Type Number	RM/COBOL Data Type
0	NSE	16	ANS
1	NSU	17	ANS (justified right)
2	NTS	18	ABS
3	NTC	19	ABS (justified right)
4	NLS	20	ANSE
5	NLC	21	ABSE
6	NCS	22	GRP (fixed length)
7	NCU	23	GRPV (variable length)
8	NPP	25	PTR
9	NPS	26	NBSN
10	NPU	27	NBUN
11	NBS	32	OMITTED
12	NBU		

 **Restriction:** Data type OMITTED (type number 32) is not supported in this COBOL system.

C\$Delay

Relinquishes the CPU for a length of time specified in seconds.

 **Note:** When calling this routine, ensure you are using the 1024 calling convention.

This library routine allows other programs to run while the current program waits.

Syntax:

```
CALL "C$Delay" USING seconds
```

Parameters:

seconds

PIC 9(n)v999, where n is a digit from 1 to 7

On Entry:

seconds The number of seconds.

Comments:

The amount of delay is not exact. It depends upon the particular machine configuration and the load on the machine.

C\$GetEnv

Returns the value of an environment variable.



Note: When calling this routine, ensure you are using the 1024 calling convention.

Syntax:

```
CALL "C$GetEnv" USING name, value [, return]
```

Parameters:**name**

PIC X(n)

value

PIC X (n)

return

PIC 9(n) BINARY, where n can be a digit from 1 to 9

On Entry:

name The name of the environment variable.

On Exit:

value The value of the environment variable, returned from the call.

return The result code returned from the call: zero for success and non-zero for failure.

Comments:

On UNIX, environment variable names are case-sensitive. On Windows, environment variable names are not case-sensitive.

C\$GetLastFileName

Retrieves the last filename used in a COBOL I/O statement (including OPEN and CLOSE).



Note: When calling this routine, ensure you are using the 1024 calling convention.

Syntax:

```
CALL "C$GetLastFileName" USING filename
```

Parameters:**filename**

PIC X(30)

On Exit:

filename The name of the filename used in the last I/O operation.

Comments:

For REWRITE and WRITE statements, the COBOL filename associated with the specified file record-name is provided.

If the filename is longer than 30 characters, it is truncated to the right.

C\$GetLastFileOp

Retrieves the last COBOL I/O operation performed.



Note: When calling this routine, ensure you are using the 1024 calling convention.

Use this library routine within a declarative procedure after an I/O error has occurred.

Syntax:

```
CALL "C$GetLastFileOp" USING operation
```

Parameters:**operation**

PIC X(20)

On Exit:

operation The name of the last I/O operation performed. The valid operations returned are:

Close	ReadRandom
CloseUnit	Rewrite
Delete	RewriteRandom
DeleteFile	Start
DeleteRandom	Unlock
Open	Write
ReadNext	WriteRandom
ReadPrevious	

Comments:

If the operation is longer than 20 characters, it is truncated to the right.

If the value SPACES is returned that indicates that no operation is available.

C\$GetNativeCharset

Retrieves information about the native character set in effect for the current run unit.



Note: When calling this routine, ensure you are using the 1024 calling convention.

The native character set specifies how non-numeric data is encoded in memory and on data files.

Syntax:

```
CALL "C$GetNativeCharset" USING charset-name [ , codepage-number ]
```

Parameters:**charset-name**

PIC X(n)

codepage-number

PIC 9(n)

On Exit:**charset-name** The name of the character set in use for the current run unit after the call.**Note:** For Windows, the name will have a value of "ANSI" or "OEM". On UNIX, the value will be "NONE".**codepage-number**

The codepage number of the character set in use for the current run unit after the call.

**Note:** For Windows, the codepage number will be the system ANSI codepage number if *charset-name* contains "ANSI" and will be the system OEM codepage number if *charset-name* contains "OEM". On UNIX, the value will be 0.**Comments:**

The native character set for a run unit on Windows can be either ANSI or OEM.

The native character set for a run unit on UNIX is determined by the locale settings for the system.

C\$LogicalAnd

Performs a bitwise logical AND operation on two or more non-numeric or numeric operands.

When calling this routine, ensure you are using the 1024 calling convention.

Syntax:

```
CALL "C$LogicalAnd"
[GIVING result]
USING operand1 {operand2} ...
```

Parameters:**result**

PIC 9(n)

operand1

A non-numeric or numeric operand

operand2, 3, etcA non-numeric or numeric operand that must be of the same data type as *operand1***Note:** If any non-numeric *operand2* is shorter than *operand1*, it is assumed to be padded on the right with binary zeroes.**On Entry:****operand1, 2, 3, etc** Non-numeric or numeric operands, which must be of the same data type as *operand1*.**On Exit:****result** The result of the operation or *operand1*.

Comments:

For non-numeric USING operands, the bitwise logical AND of all the operands replaces the value of *operand1*. The value of *result* is set to a non-zero value if any character of *operand1* is non-zero after the operation completes and zero otherwise.

For numeric USING operands, each operand is converted, if necessary, to a 32-bit binary integer. These 32-bit binary values are logically ANDed together. If the GIVING phrase is specified, the result of this operation is stored in *result* and the value of *operand1* is not modified. If the GIVING phrase is not specified, the result of this operation is stored in *operand1*.

C\$LogicalComplement

Performs a bitwise logical One's Complement operation on a non-numeric or numeric operand.

When calling this routine, ensure you are using the 1024 calling convention.

Syntax:

```
CALL "C$LogicalComplement "  
[GIVING result]  
USING operand
```

Parameters:

result

PIC 9(n)

operand

A non-numeric or numeric operand

On Entry:

operand A non-numeric or numeric operand.

On Exit:

result The result of the operation or *operand*.

Comments:

If *operand* refers to a non-numeric data item, the bitwise logical One's Complement of the value of *operand* replaces the value of *operand*. The value of *result* is set to a non-zero value if any character of *operand* is non-zero after the operation completes and zero otherwise.

If *operand* refers to a numeric data item, the operand is converted, if necessary, to a 32-bit binary integer. The 32-bit binary value is logically One's Complemented. If the GIVING phrase is specified, the result of this operation is stored in *result* and the value of *operand* is not modified. If the GIVING phrase is not specified, the result of this operation is stored in *operand*.

C\$LogicalOr

Performs a bitwise logical OR operation on two or more non-numeric or numeric operands.

When calling this routine, ensure you are using the 1024 calling convention.

Syntax:

```
CALL "C$LogicalOr"  
  [GIVING result]  
  USING operand1 {operand2} ...
```

Parameters:**result**

PIC 9(n)

operand1

A non-numeric or numeric operand

operand2, 3, etcA non-numeric or numeric operand that must be of the same data type as *operand1***Note:** If any non-numeric *operand2* is shorter than *operand1*, it is assumed to be padded on the right with binary zeroes.**On Entry:****operand1, 2, 3, etc** Non-numeric or numeric operands, which must be of the same data type as *operand1*.**On Exit:****result** The result of the operation or *operand1*.**Comments:**

For non-numeric USING operands, the bitwise logical inclusive OR of all the operands replaces the value of *operand1*. The value of *result* is set to a non-zero value if any character of *operand1* is non-zero after the operation completes and zero otherwise.

For numeric USING operands, each operand is converted, if necessary, to a 32-bit binary integer. These 32-bit binary values are logically inclusive OR'd together. If the GIVING phrase is specified, the result of this operation is stored in *result* and the value of *operand1* is not modified. If the GIVING phrase is not specified, the result of this operation is stored in *operand1*.

C\$LogicalXor

Performs a bitwise logical exclusive OR operation on two or more non-numeric or numeric operands.

When calling this routine, ensure you are using the 1024 calling convention.

Syntax:

```
CALL "C$LogicalXor"
    [GIVING result]
    USING operand1 {operand2} ...
```

Parameters:**result**

PIC 9(n)

operand1

A non-numeric or numeric operand

operand2, 3, etcA non-numeric or numeric operand that must be of the same data type as *operand1***Note:** If any non-numeric *operand2* is shorter than *operand1*, it is assumed to be padded on the right with binary zeroes.

On Entry:

operand1, 2, 3, etc Non-numeric or numeric operands, which must be of the same data type as *operand1*.

On Exit:

result The result of the operation or *operand1*.

Comments:

For non-numeric USING operands, the bitwise logical exclusive OR of all the operands replaces the value of *operand1*. The value of *result* is set to a non-zero value if any character of *operand1* is non-zero after the operation completes and zero otherwise.

For numeric USING operands, each operand is converted, if necessary, to a 32-bit binary integer. These 32-bit binary values are logically exclusive OR'd together. If the GIVING phrase is specified, the result of this operation is stored in *result* and the value of *operand1* is not modified. If the GIVING phrase is not specified, the result of this operation is stored in *operand1*.

C\$LogicalShiftLeft

Performs a logical shift left operation on a non-numeric or numeric operand.

When calling this routine, ensure you are using the 1024 calling convention.

Syntax:

```
CALL "C$LogicalShiftLeft"
[GIVING result]
USING operand [shiftcount]
```

Parameters:**result**

PIC 9(n)

operand

A non-numeric or numeric operand

shiftcount

PIC 9(n)

On Entry:

operand A non-numeric or numeric operand.

shiftcount The number of positions to shift during the operation.

On Exit:

result The result of the operation.

Comments:

If *operand* refers to a non-numeric data item, the value of the data item is shifted left by the number of bit positions specified by *shiftcount*. Any bits shifted off the left end are lost and zero-valued bits are shifted into the right end. The value of *result* is set to a non-zero value if any character of *operand* is non-zero after the operation completes and zero otherwise.

If *operand* refers to a numeric data item, the operand is converted, if necessary, to a 32-bit binary integer. The 32-bit binary value is logically shifted left by the number of bit positions specified by *shiftcount*. If the

GIVING phrase is specified, the result of this operation is stored in *result* and the value of *operand* is not modified. If the GIVING phrase is not specified, the result of this operation is stored in *operand*.

C\$LogicalShiftRight

Performs a logical shift right operation on a non-numeric or numeric operand.

When calling this routine, ensure you are using the 1024 calling convention.

Syntax:

```
CALL "C$LogicalShiftRight"  
[GIVING result]  
USING operand [shiftcount]
```

Parameters:

result

PIC 9(n)

operand

A non-numeric or numeric operand

shiftcount

PIC 9(n)

On Entry:

operand A non-numeric or numeric operand.
shiftcount The number of positions to shift during the operation.

On Exit:

result The result of the operation.

Comments:

If *operand* refers to a non-numeric data item, the value of the data item is shifted right by the number of bit positions specified by *shiftcount*. Any bits shifted off the right end are lost and zero-valued bits are shifted into the left end. The value of Result is set to a non-zero value if any character of *operand* is non-zero after the operation completes and zero otherwise.

If *operand* refers to a numeric data item, the operand is converted, if necessary, to a 32-bit binary integer. The 32-bit binary value is logically shifted right by the number of bit positions specified by *shiftcount*. If the GIVING phrase is specified, the result of this operation is stored in *result* and the value of *operand* is not modified. If the GIVING phrase is not specified, the result of this operation is stored in *operand*.

C\$NARG

Returns the number of parameters passed in the USING phrase of a CALL statement to the subprogram that contains the call to C\$NARG.

Arguments specified explicitly as OMITTED in the USING list of the CALL statement are included in the count. The GIVING argument is not included in the count.



Note: When calling this routine, ensure you are using the 1024 calling convention.

Syntax:

```
CALL "C$NARG" USING parameter-count
```

Parameters:**parameter-count**

PIC 9(3) BINARY, COMP-4 or COMP-1

On Exit:**parameter-count**

The number of parameters passed.

C\$OSLockInfo

Returns the process ID of the process that has the record locked when a lock request fails. This routine should be called immediately after a lock request has failed.



Note: When calling this routine, ensure you are using the 1024 calling convention.



Note: This routine is supported on UNIX only.

Syntax:

```
CALL "C$OSLockInfo" USING processid
```

Parameters:**processid**

A four-byte, unsigned COMP-4 numeric item.

On Exit:**processid**

The ID of the process that has the record locked.

Comments:

This routine will return a zero if run on Windows.

C\$SecureHash

Produces a 20-byte message digest from an input text string using the secure hash algorithm (SHA-1).



Note: When calling this routine, ensure you compile using DIALECT"RM".

Syntax:

```
CALL "C$SecureHash" USING message-text [message-length]
GIVING message-digest
```

Parameters:**message-text**

PIC X(n)

message-length

PIC 9(n)

message-digest

PIC X(n)

On Entry:

message-text

Its value is the input text string to the secure hash algorithm. While the secure hash algorithm supports messages of length 2^{64} or less bits (2^{61} or less bytes), this implementation is limited to messages of length 2^{32} or less bits (2^{29} or less bytes).

message-length

Its value specifies the number of bytes of *message-text* to be considered when producing the message digest. Thus, the value must be less than or equal to the length of data item referenced by *message-text*. If *message-length* is omitted, the entire value of the data item referenced by *message-text* is used, as if `LENGTH OF message-text` had been specified for *message-length*.

On Exit:

message-digest

It must be an identifier that references a nonnumeric data item of exactly 20 bytes in length. The message digest result from the secure hash algorithm is returned in the referenced data item. The message digest value is stored in the form most significant byte at lowest address to least significant byte at highest address regardless of the memory architecture of the machine on which `C$SecureHash` is called.

When there is insufficient memory for `C$SecureHash` to do its work, the contents of *message-digest* are set to all binary zeroes. This only occurs when a memory area slightly larger than the size of the message text cannot be allocated. The secure hash algorithm used by `C$SecureHash`, other than the length limitation, is the one defined as the secure hash standard by Federal Information Processing Standard (FIPS) Publication 180-1, which is often referred to as SHA-1.

Comments:

One example of the usefulness of a message digest is storing a password in a secure form. Since *message-digest* is produced using a one-way hash of the password, it is computationally infeasible to recover the password from the *message-digest* value. (However, if the password is easy to guess or find in a dictionary, a computer program can be used to search for a password that hashes to a given *message-digest* value.)



Note: The input text string "abc" (length = 3 bytes) produces the hash value:

```
x"A9993E364706816ABA3E25717850C26C9CD0D89D"
```

Since this is a well-known test result for the secure hash algorithm (documented in FIPS Pub 180-1), "abc" is not recommended as a password value. Message digests are also often used to verify that a message has not been changed from its original value. This involves computing the *message-digest* of the original *message-text* and transmitting it in a secure manner, either on a separate secure channel or by using encryption of *message-digest* to guarantee that it is not modified during transmission. The receiver of the message can then compute the message digest from the received *message-text* and verify that the resulting *message-digest* matches the one supplied. If they match, it is extremely unlikely that the message text has been modified during transmission.

C\$SetEnv

Sets or clears the value of an environment variable.



Note: When calling this routine, ensure you are using the 1024 calling convention.

Setting the value of an environment variable with `C$SetEnv` updates the corresponding environment variable immediately in the process space of the current run unit. Thus, when the RM/COBOL runtime system uses environment variables for such actions as file access name resolution, the call to `C$SetEnv` will have an immediate effect on that run unit.

Syntax:

```
CALL "C$SetEnv" USING name, value [, return]
```

Parameters:**name**

PIC X(n)

value

PIC X(n)

return

PIC 9(n) BINARY, where n can be a digit from 1 to 9

On Entry:

name The name of the environment variable to set or clear.

value The value to which the environment variable is set. A value of SPACES indicates that the environment variable should be deleted.

On Exit:

return The result code returned from the call: zero for success and non-zero for failure.

Comments:

On UNIX, environment variable names are case-sensitive. On Windows, environment variable names are not case-sensitive.

C\$RERR

Returns the expanded I/O completion status, based on an error code received at run-time.

This routine returns either a four-character or an eleven-character extended status code, depending upon the length of the data item specified in the USING phrase. This status is for the last attempted I/O operation. The value returned conforms to ANSI COBOL 1985.

Syntax:

```
CALL "C$RERR" USING extended-status
```

Parameters:**extended-status**

PIC X(4) or PIC X(11)

On Exit:

extended-status The data item into which the expanded I/O completion status is stored in ASCII characters.

Comments:

If *extended-status* is four characters in length, the first two character positions contain the same digits as would the file status data item on completion of the I/O operation. The last two character positions provide additional information about the file status. In cases where only two digits for a status are shown, the last two character positions will contain ASCII zeroes. Although most statuses contain only the decimal digits 0 to 9, note that the hexadecimal digits A to F are possible in some character positions. Refer to *Appendix A: Runtime Messages* of the *RM/COBOL User's Guide* for a full list of status codes.

If *extended-status* is eleven characters in length, the first two character positions (positions one and two) contain the same digits as would the file status data item on completion of the I/O operation. In cases where Appendix A shows only two digits for a status, the remaining nine character positions contain ASCII blanks. In cases where Appendix A shows four digits for a status, character position three contains an ASCII comma, character positions four and five contain the last two digits of the status, and the remaining six character positions contain ASCII blanks. For permanent errors, that is, when the first two digits are 30, character position three contains an ASCII comma, character positions four and five contain a two-digit OS code (see the table below), character position six contains an ASCII comma, and character positions seven through eleven contain a five-digit, OS-specific error code. Refer to the *Input/Output Errors* section of the *RM/COBOL User's Guide*.

Table 1: The two-digit OS codes

Code	Description
00	Unknown OS error
01	File Manager Detected error
04	UNIX error
06	Btrieve error
10	Open File Manager error
11	C Library error
12	MS-Windows error
15	RM/InfoExpress Server error
16	RM/InfoExpress Client error
21	RM/InfoExpress WinSock error

DELETE

Deletes a file.



Note: When calling this routine, ensure you are using the 1024 calling convention.

Syntax:

```
CALL "DELETE" USING file-name [exit-code]
```

Parameters:

file-name

PIC X(n)

exit-code

PIC S9(4) BINARY

On Entry:

file-name The full or relative pathname of the file to be deleted.

On Exit:

exit-code The exit code of the command upon return from the operating system: zero for success and non-zero for failure.

Comments:

The values for the old-name parameter may be quoted with double quotes (") or single quotes ('). When the name is quoted, the quotes are removed, but the name is not otherwise modified. If the name is not quoted, the first control character terminates the name on Windows and the first white space character terminates the name on UNIX. On Windows, trailing spaces are removed from unquoted names.

The old-name data item must be less than 1024 characters in length.

RENAME

Renames a file.



Note: When calling this routine, ensure you are using the 1024 calling convention.

Syntax:

```
CALL "RENAME" USING old-name new-name [exit-code]
```

Parameters:

old-name

PIC X(n)

new-name

PIC X(n)

exit-code

PIC S9(4) BINARY

On Entry:

old-name	The source filename.
new-name	The target filename.

On Exit:

exit-code The exit code of the command upon return from the operating system: zero for success and non-zero for failure.

Comments:

The values for the old-name and new-name parameters may be quoted with double quotes (") or single quotes ('). When the name is quoted, the quotes are removed, but the name is not otherwise modified. If the name is not quoted, the first control character terminates the name on Windows and the first white space character terminates the name on UNIX. On Windows, trailing spaces are removed from unquoted names.

The old- and new-name data item must be less than 1024 characters in length.

SYSTEM

Executes an arbitrary operating system command.



Restriction: This routine is supported in native COBOL only.

When calling this routine, ensure you are using the 1024 calling convention.

Syntax:

```
CALL "SYSTEM" USING command-line [repaint-screen] [exit-code]
```

Parameters:**command-line**

PIC X(n)

repaint-screen

PIC X

exit-code

PIC S9(4) BINARY

On Entry:

command-line An alphanumeric data item that contains the command line to be passed to the operating system. The command is the contents of command-line with trailing white spaces suppressed. The command does not need to be null-terminated.

repaint-screen This parameter is ignored in this COBOL system.

On Exit:

exit-code The exit code for the command, returned from the operating system. The value returned is dependent on the underlying operating system. A value of 0, however, indicates success and a non-zero value indicates an error.

Comments:

The implementation of this library routine is identical to the existing Micro Focus version of SYSTEM.

This version of the SYSTEM command is used when the calling convention is 1024. This may be specified explicitly in the CALL, by using the DEFAULTCALLS Compiler directive, or by specifying the DIALECT"RM" Compiler directive.

RM/COBOL File Handling

When you migrate your RM/COBOL applications to Enterprise Developer, you can continue to use the same data files.

Configuring Access to RM/COBOL Indexed Data Files

Note: For these options to take effect, the ACUFH configuration option must be set ON; by default, this is ON. For these options to take effect under Enterprise Server, ESACUFH must also be set ON; by default, this is OFF.

To handle RM/COBOL indexed data files, you map a file to IDXFORMAT=21 in the File Handler configuration file.

Within the configuration file, you can apply IDXFORMAT 21 to all files in a particular folder, all files with a specific file extension, or a single file. See *Format of the Configuration File* for the tags that you can use for the mapping, and the order in which settings in these tags are applied.

The order that the mapping is applied is important, as conflicting settings can be overwritten; for example, the following excerpt of the configuration file sets all files in `c:\files\rmfiles` (Windows) or `usr/files/rmfiles` (UNIX) to IDXFORMAT 21 and all files with a `.DAT` extension to IDXFORMAT 17:

Windows:

```
[ FOLDER:C:\\files\\rmfiles ]
IDXFORMAT=21

[ *.DAT ]
IDXFORMAT=17
```

UNIX:

```
[ FOLDER:usr/files/rmfiles ]
IDXFORMAT=21

[ * .DAT ]
IDXFORMAT=17
```


If there is a .DAT file in `c:\files\rmfiles` (Windows) or `usr/files/rmfiles` (UNIX), the mappings are applied according to the type of tag. In the case above, mappings in the extension tag are applied after mappings in the FOLDER tag, and so the .DAT file in that directory has an IDXFORMAT of 17.

By default, the File Handler handles all sequential and relative data files, but if you want to handle them through the RM/COBOL file handler, use the INTEROP=RM configuration option; however, in cases where the INTEROP and IDXFORMAT mappings conflict, the INTEROP setting will override IDXFORMAT for your RM/COBOL indexed data files.

File Limits

When using RM/COBOL indexed files in Enterprise Developer, there are a number of file limits that affect file handling operations.

The following limits are in addition to the ones imposed in Enterprise Developer; see *Limits* in the *File Handling Reference* section.

 **Note:** The limits listed on this page override any listed in the *File Handling Reference* section when handling RM/COBOL indexed files.

Maximum record size:	64 MB (67,108,864)
Maximum number of indexed keys:	1 primary + 119 alternates
Maximum number of segments per key:	16
Maximum indexed key size:	250 bytes

RM/COBOL File Status Codes

RM/COBOL file status codes take a 2-digit form in the file status data item (by combining the values of the Status Key 1 and Status Key 2 columns), or a 4-character or 11-character extended file status code that can be retrieved using the C\$RERR standard library routine.

RM/COBOL file status codes are always returned when the FILETYPE=21 Compiler directive is in effect. If you set the DIALECT"RM" Compiler directive, this automatically sets FILETYPE=21, thus producing RM/COBOL file status codes.

If you are running under a different dialect or FILETYPE setting, but want to continue to return RM/COBOL file status codes, do the following:

- Set environment variable COBFSTATCONV to the RM/COBOL setting:

```
set COBFSTATCONV=rmstat
```
- Set the COBFSTATCONV Compiler directive.

If your program is set to return RM/COBOL file status codes, but does not use a file status, or does not have a Declaratives section acting upon your data file, file I/O errors are reported by the run-time system. The extended file status reported may initially seem incorrect, but due to differences in the file handling of the different COBOL systems, the second byte of the reported error code needs to be converted from binary to ASCII. For example, if an error of 9/051 is reported, convert 051 to its ASCII character equivalent, which is 3 (0x33 in hexadecimal); therefore, the true RM/COBOL file status is actually 93.

Status Key 1	Status Key 2	Extended File Status Code	Description
3	5	9/013	File not found.
3	5	9/188	Filename too large.
3	7	9/035	Incorrect access permission.
3	7	9/037	File access denied.
3	8	9/138	File is closed with lock - cannot open.
3	8	9/210	File is closed with lock.
4	1	9/141	File already open - cannot be opened.
4	2	9/142	File not open - cannot be closed.
4	3	9/143	REWRITE/DELETE not after successful READ
4	6	9/146	No current record defined for sequential read.
4	7	9/147	Wrong open or access mode for READ/ START.
4	8	9/148	Wrong open or access mode for WRITE.
4	9	9/149	Wrong open or access mode for REWRITE/ DELETE.
9	3	9/065	File locked.
9	8	9/071	Bad indexed file format.
9	8	9/139	Record length or key inconsistent.
9	9	9/068	Record is locked.

Debugging JVM COBOL Using RM/COBOL Indexed Files

When you debug a JVM COBOL application, there is a danger that an RM/COBOL indexed file will become corrupted when debugging ends, as the file is not closed correctly by default.

To ensure the file is closed correctly when debugging ends, you must set the RMFM_PRETEND_FORCE_CLOSED environment variable.

1. Click **Run > Debug Configurations**.
2. In the COBOL JVM Application section, select the application's main executable.
3. Select the **Environment** tab.
4. Click **New**.
5. In the **New Environment Variable** dialog box, enter the following, then click **OK**.
 - Name: **RMFM_PRETEND_FORCE_CLOSED**
 - Value: **YES**
6. Click **Apply**, then click **Debug** to rebuild and debug your project.

Enabling CTF to Trace RM/COBOL Data Files

Enable the Micro Focus Consolidated Tracing Facility (CTF) to trace activity with your RM/COBOL data files.

To enable CTF:

- Set the following environment variables:

```
set MFTRACE_CONFIG=ctf.cfg
set MFTRACE_LOGS=pathname    *> if not set, logs are stored in the current
folder.
```

- In `ctf.cfg`, set the following:

```
mftrace.dest                = textfile
mftrace.level.mf.rts        = info
mftrace.comp.mf.rts#eprintf = true
```

- Set the following environment variable:

```
set A_CONFIG=rmfm.cfg      *> rmfm is your RMFM configuration file
```

- In `rmfm.cfg`, set the following:

```
DEFAULT_FILESYSTEM RMFM
FILE_TRACE 3        *> values 0-9 set amount of activity traced.
```

When you run your program, a log-file is produced that includes the activity with the RM/COBOL data files.

For more information on CTF, see *Introduction to the Consolidated Tracing Facility*.

Data File Utilities

The following utilities are available to use with your RM/COBOL data files:

Indexed File Recovery (recover1) utility

The `recover1` utility recovers data stored in an RM/COBOL indexed file . It is a standalone program; that is, it does not require use of the Runtime Command to be executed.



Note:

- Unless specifically stated otherwise, the name `recover1` refers to both the UNIX (`recover1`) and Windows (`recover1.exe`) versions of the `recover1` program.
- If the output window of the Windows version of the `recover1` program disappears upon successful completion and you want that window to remain visible, set the `Persistent` property to `True` for the `recover1` program.
- The `recover1` utility does not use the environment variable `RUNPATH` to locate files. It is best to specify the full pathname of the indexed file to be recovered or to run `recover1` from the current directory in which the indexed file resides.

Recovery command

The Indexed File Recovery (`recover1`) utility is executed by issuing the following command:

```
recover1 indexed-file drop-file [options] ...
```

indexed-file


The filename of the indexed file to be recovered. The name is not resolved through any environment variables.

drop-file

The name of the file where `recover1` places any unrecoverable records found in the indexed file, as discussed in *Recovery process description*. If `drop-file` specifies an environment variable name, the environment variable value will be resolved before opening the dropped record file.

options

Zero or more command line options, as described in *Recovery command options*. Options are specified with letters that must be preceded with a hyphen (-) or a slash (/). Option letters may be specified in uppercase or lowercase. Certain option letters allow an optional pathname as part of the option format. The presence or absence of the pathname is determined by whether or not the next non-white space character following the option letter is a hyphen or slash, whichever one was used preceding the option letter.

 **Note:** The option introducer character slash is supported for Windows compatibility and should not be used on UNIX, where it can be confused with an absolute pathname; that is, a pathname that begins with a slash. Nevertheless, either the hyphen or the slash may be used to introduce option letters on Windows and UNIX. In the option formats given, only the hyphen is shown, but the hyphen may be replaced with a slash.

Recovery command options

Recovery command options can be specified in either of the following two ways:


- Depending on the operating system, they can be placed into the Windows registry or the UNIX resource file:
 - In the Windows registry, the Command Line Options property provides command line options for the Indexed File Recovery utility when Recovery is selected on the Select File tab of the RM/COBOL Properties dialog box.
 - In the UNIX resource file, the Options keyword, described in Command Line Options, provides command line options for the Indexed File Recovery utility in the global resource file `/etc/default/recover1rc` and the local resource file `~/.recover1rc`.
- They can be specified in the Recovery Command itself.

The following options may be specified to modify the behavior of the Indexed File Recovery (`recover1`) utility.

- I** Use the I option to cause `recover1` to test only the file integrity and then stop. The file will not be modified in any way. Specifying the I option causes both the T and Z options to be ignored. If no problems are discovered, the exit code is set to 0. If a problem is discovered, the exit code is set to 1. The I option has the following format:

```
-I
```

The default is for `recover1` to do a complete recovery of the indexed file if the file is marked as needing recovery. See the Y and Z options in this topic for additional options that modify the behavior of the Indexed File Recovery utility.

 **Note:** The integrity scan is a quick test of the file and is not comprehensive. Some problems, such as records with invalid duplicate keys, will not be detected. Indexed files with no errors detected by the integrity scan may still receive “98” errors or other I/O errors.

- K** Use the K option to indicate that the Key Information Block (KIB) should be assumed to be invalid and, optionally, to specify a template file for recovering the KIB. The K option has the following format:

```
-K [template-file]
```

If no `template-file` is specified, the user will be prompted either for a template file or for enough information to rebuild the KIB. If `template-file` is specified, it should be the name of a valid indexed file with the same format as the file being recovered. This file will be used as a template. The required KIB information is read from the KIB of the template file. The template file can be a backup copy of the file being recovered, if the backup occurred before the file was damaged, or, it can be a file created by performing an OPEN OUTPUT in a COBOL program with the proper file control entry and file description entry for the file being recovered. An OPEN OUTPUT must have been performed on the template file, but it need not contain any records. A template file must be specified if the KIB is corrupt and the file uses either an enumerated code set or an enumerated collating sequence. The default is to check the KIB for validity and, if it is found to be invalid, prompt for either a template file or

information to rebuild the KIB. The name of the template file is not resolved through any environment variables.



Warning: A template file with the wrong block size can cause the loss of a large percentage of the recoverable records in your file.

- L** Use the L option to write information about errors encountered while recovering the file to a log file. The L option has the following format:

```
-L [log-file]
```

Only the first 100 errors will be logged. In addition to errors, a number of informational lines about the indexed file and its recovery are written to the log file, including information about sort memory (see the M option regarding sort memory). If log-file specifies an environment variable name, the environment variable value will be resolved before opening the log file; this allows the use of the name PRINTER to send the log information to the print device. If log-file is omitted in the L option, the default value of log-file is PRINTER. If the L option is not specified, the default is not to write a log file.



Note: Environment variables can be set using synonyms set in the Windows registry or the UNIX resource file.

- M** Use the M option to specify the number of megabytes of memory to allocate to the sort algorithm used in phase 4, build node blocks. The M option has the following format:

```
-M [MB-of-memory]
```

where MB-of memory is a number in the range 0 to 2000. Allocating more memory generally results in faster execution of recover1 and causes fewer node blocks to be built. If this option is not specified, a suitable number will be computed; in this case, sort memory is limited to no more than 40 million bytes. When a log file is written (see the L option), a line is written into the log file to show the maximum effective sort-memory size. If the M option is specified without a number of megabytes, the default value of 50 is used.



Note: Specifying a number for MB-of-memory that is too large for your system may result in very poor system performance.

- Q** Use the Q option to cause recover1 to perform its work without displaying information or asking the operator questions. The Q option has the following format:

```
-Q
```

If the file is marked as needing recovery, or has a non-zero Open For Modify Count, then it will be recovered. Otherwise, no action occurs. This behavior can be modified by using the Y option. The default is to display information and ask questions, which must be answered by the operator.

- T** Use the T option to indicate that unused space should be truncated and returned

to the operating system. The T option has the following format:

```
-T
```

Specifying the T option will result in a minimal size indexed file, but may reduce performance if records are subsequently added to the indexed file. The default is not to truncate the file. When the file is not truncated, any empty blocks remain part of the file and are available for use in adding new records to the file.



Note: Some versions of UNIX do not support the operating system call required to truncate a file.

- Y** Use the Y option to cause recover1 to assume that the operator wants to answer “y” to all possible questions and therefore not stop to wait for a response. The Y option has the following format:

```
-Y
```

Using the Y option will cause a file to be recovered even if it is not marked for recovery, including the case of when the Q option is also specified. The default is to wait for a response from the operator after a question is displayed.

- Z** Use the Z option to reset the Open For Modify Count to zero, without performing a full recovery. The Z option has the following format:

```
-Z
```

If the file is marked as needing recovery, the Z option is ignored. The default is to treat a non-zero Open For Modify Count as indicating that the file needs recovery.



Note: Use the Z option with caution. Resetting the Open For Modify Count to zero without performing a full recovery may leave the file in a corrupted state.

Recovery process description

If the recover1 program is successful, the exit code is set to 0. If the recover1 program is canceled by the operator, the exit code is set to 2. Otherwise, the exit code is set to 1.

You may produce a list of the support modules loaded by the recover1 program by defining the environment variable RM_DYNAMIC_LIBRARY_TRACE. The listing will indicate which Terminal Interface support module is used, only the terminfo module is included with Visual COBOL. The Automatic Configuration File module is not included with Visual COBOL. This information is most helpful when attempting to diagnose a problem with support modules.



Note: The information will be visible only if you enter the recover1 command without any parameters. In this case, recover1 will show the proper form for the command and the list of support modules.

The recover1 program attempts to recover the indexed file in place; that is, the program rebuilds the internal file structure in the actual file being recovered. If necessary, the Key Information Block (KIB) is rebuilt and any corrupted data blocks are repaired. Corrupt data blocks may result in loss of some data records. Because of this feature, it is strongly recommended that you either backup the file or copy the indexed file to be recovered to some other directory or pathname as additional security. Any records that cannot be successfully reindexed into the file due to invalid duplicate key values, or invalid record sizes, are decompressed (if compression is selected for the file), converted to the native code set, and then written to drop-file. recover1 should be able to handle most kinds of indexed file corruption problems, but some fatal errors may still cause the recovery to fail. Any fatal error is displayed and causes the program to terminate. Broken hardware should be suspected in many of these cases.

drop-file can be in fixed- or variable-length format; this is set by recover1 based on whether indexed-file is fixed- or variable-length format. Records placed in *drop-file* were those undergoing change at the time of the system failure that required recovery or have invalid record sizes. Investigate any records appearing in *drop-file* and make the appropriate corrections to indexed-file.

The four phases of processing

The recover1 program's processing consists of up to four separate phases, which are run in the following order:

- 1. Integrity Scan.** If the Q option or Y option is specified, the Integrity Scan phase is disregarded unless it is forced to occur by the specification of the I option or L option. This phase reads the entire file in a forward direction checking for simple errors, and produces a summary report showing the state of the file and an estimate of the number of records recover1 can recover. The indexed file is not modified during this phase.
- 2. Repair Blocks.** The Repair Blocks phase, which is always run, reads and writes the file in a backward direction repairing corrupt data blocks, converting non-data blocks to empty blocks, and rebuilding some internal file structures.
- 3. Move Data Blocks.** The Move Data Blocks phase is run only when the truncate file

option (T) is specified. This phase reads and writes parts of the file moving highnumbered data blocks (near the end of the file) to lower-numbered available blocks to maximize the amount of space at the end of the file that can be truncated and returned to the operating system when recover1 finishes.

4. Build Node Blocks. The Build Node Blocks phase, which is always run, reads data blocks and writes node blocks in the file in a forward direction, rebuilding the entire node structure for each key of the file.



Note:

- After the Integrity Scan phase, if the Estimated Recoverable records value is zero or very low, and the number of corrupt data blocks is very close to the total number of data blocks found, the number of keys that allow duplicates may be incorrect, either because the KIB is corrupt or the user provided incorrect key information to recover1.
- After the Integrity Scan phase, if most of the blocks are invalid, the Disk Block Size or the Disk Block Increment may have been incorrectly specified or the KIB may be corrupt.
- During the Repair Blocks phase, a count of blocks that could be read but not written may be displayed. This count may indicate the presence of a hardware problem with your disk.

Recovery support module version errors

During initialization, the recovery utility locates and loads various support modules, and, on UNIX, the terminfo Terminal Interface support module. Also, at initialization, the recovery utility verifies that each support module is the correct version for the recovery utility. If a support module is not the correct version, the following message is displayed:

```
RM/COBOL: module-name version mismatch, expected 12.0n.nn, found n.nn.nn.
```

When the previous message is displayed, the recovery utility terminates with the following message:

```
Recover1: Error invoking mismatched recover1 and support module.
```

Recovery example

An example run through the Indexed File Recovery utility is described in Figure 44 through Figure 47. The recovery session is started in this example by the following command:

```
recover1 master.inx dropout1
```

Figure 44 shows information about the file master.inx.

Under the name of the file to be recovered, a description of the state of the file is displayed. Any of the following messages may appear:

- This file has not been marked as needing recovery!
- The Open For Modify Count for this file is not zero: count
- File has been marked as corrupted due to a previous error.
- KIB is corrupt. Using template file: template-file
- KIB is corrupt. Enter a template filename (press Enter for manual entry).

If the KIB is corrupt, and a template filename is not entered, recover1 will prompt the user for the required KIB information before continuing.

If more keys exist than can appear on this screen, as many as possible appear, after which you are asked if you want to see the remaining key descriptors. This continues until all keys are shown. You are then asked to verify that this is the file you want to recover. Entering N terminates the program. Entering Y continues the program.

Figure 44: Indexed File Recovery Utility: File Recovery Verification

```
Indexed File Recovery Utility
Recover1 for Visual COBOL
Indexed File: master.inx

This file has not been marked as needing recovery!
```

```

Disk Block Size:      1024   Minimum Record Length:  80
Disk Block Increment: 1024   Maximum Record Length:  80
Number of Index Blocks: 170   Number of Records:      150

```

```

Key   Position Size Remarks
PRIME    1     8
    1     9     8
    2    17     8  duplicates allowed

```

Is this the file you wish to recover (y/n)?

Figure 45 shows a summary of the information that is gathered during the file integrity scan.

You are then asked if you would like to proceed with the recovery process. Entering N terminates the program. Entering Y continues the program. The “Average record length” is computed by adding the length of all the records in the file and dividing by the number of records. The “Average data size” is computed by adding the size that the record actually occupies in the file and dividing by the number of records. This size allows you to determine how much your data can be compressed.

Figure 45: Indexed File Recovery Utility: recover1 Summary

```

                          Indexed File Recovery Utility
                          Recover1 for Visual COBOL
Indexed File: master.inx

Drop File: dropout1

This file has not been marked as needing recovery!

Disk Block Size:      1024 Minimum Record Length:  80
Disk Block Increment: 1024 Maximum Record Length:  80
Number of Index Blocks: 170 Number of Records:      150
Phase: Integrity Scan      Estimated Recoverable: 150

```

Block Type	Total Found	Total Corrupt	First Corrupt	Last Corrupt
KIB	1	0		
Data	102	0		
Node	61	0		
Empty	6	0		
Invalid	0	0		
Unreadable	0	0		

```

Average data size: 14, Average record length: 80
Do you wish to proceed with recovery (y/n)?

```

Figure 46 shows the information that is displayed while recover1 is rebuilding the node blocks for the prime key.

Figure 46: Indexed File Recovery Utility: recover1 Statistics

```

                          Indexed File Recovery Utility
                          Recover1 for Visual COBOL
Indexed File: master.inx

Drop File: dropout1

This file has not been marked as needing recovery!

Disk Block Size:      1024 Minimum Record Length:  80
Disk Block Increment: 1024 Maximum Record Length:  80
Number of Index Blocks: 170 Number of Records:      150
Phase: Build Node Blocks      Estimated Recoverable: 150

Key being processed:                                PRIME

```

```

Records recovered:                100
Records written to drop file:
Block being processed:            13
Number of data blocks moved (for truncate):  5

```

Figure 47 shows the information that is displayed after recover1 terminates successfully. The two lines regarding truncation are shown only when the T option is specified.

Figure 47: Indexed File Recovery Utility: recover1 Finished Successfully

```

                Indexed File Recovery Utility
                Recover1 for Visual COBOL
Indexed File: master.inx

Drop File: dropped

This file has not been marked as needing recovery!

Disk Block Size:          1024 Minimum Record Length: 126
Disk Block Increment:    1024 Maximum Record Length: 126
Number of Index Blocks:  120 Number of Records:      100
Phase: Build Node Blocks      Estimated Recoverable: 100

Key being processed:          PRIME
Records recovered:           100
Records written to drop file:
Block being processed:       120
Truncate option specified - number of data blocks moved:  4
Truncate action successful - new Number of Index Blocks: 112

Recovery successful.

```

In the example shown in Figure 48, the KIB of the file has been corrupted, and key information must be entered for the file to be recovered. This example shows manual entry of KIB information, however, it is recommended that a template file be used with the -K option to recover the KIB information. Underlined characters have been entered by the user.

The recovery session is started by the following command:

```
recover1 master.inx dropout1 -k
```



Note: Entering incorrect information about how many keys, or which keys, can have duplicate values may cause unpredictable results.

Figure 48: Indexed File Recovery Utility: Entering Key Information

```

                Indexed File Recovery Utility
                Recover1 for Visual COBOL
Indexed File: master.inx

Last error was 98,38 at 9:29 on 03-21-2008

Are any of the keys in this file segmented (split) (y/n)? y
Key #: PRIME Segment #: 2 Starting Position? 10 Length? 5
                Another Segment (y/n)? n
                Total Key Length = 13 Duplicates Permitted (y/n)? n
Another Key (y/n)? n

```

Figure 49 shows an example of entering the remainder of the KIB information. Underlined characters have been entered by the user.

Figure 49: Indexed File Recovery Utility: Entering KIB Information

```

                Indexed File Recovery Utility
                Recover1 for Visual COBOL
Indexed File: master.inx

```



```
Last error was 98,38 at 9:29 on 03-21-2008
```

```
Minimum Record Length (in bytes)? 80
Maximum Record Length (in bytes)? 80
Disk Block Size (in bytes)? 1024
User Block Size (1=none/2=in bytes/3=in records)? 1
Data Compression (y/n)? y      Space Character Value? 32      Zero Character
Value? 48
Key Compression (y/n)? y      Space Character Value? 32
File Version Number (0/2/3/4)? 4      Atomic I/O Enabled (y/n) y
File Lock Limit (in GB)? 2
Disk Block Increment (in bytes)? 1024
Allocation Increment (in blocks)? 8
Force Write Data Blocks (y/n)? n      Force Write Index Blocks (y/n)? n
Force to Disk (y/n)? n      Force File Closed (y/n)? n
Code Set (1=none/2=ASCII/3=EBCDIC)? 1
Collating Sequence (1=none/2=ASCII/3=EBCDIC)? 1

Is this information correct (proceed with recovery) (y/n)? y
```

After the key and KIB information has been successfully entered, the recovery process proceeds the same as before, beginning with Figure 44. If a template file had been specified on the command line or a template filename had been entered when prompted, the screens prompting for the key and KIB information would not have been displayed. A template file must be specified if the KIB is corrupt and the file uses either an enumerated code set or an enumerated collating sequence.

Recovery program error messages

Error status initializing file manager

recover1 was unable to initialize the RM/COBOL file management system for the reason indicated by status. The usual cause for this error is that a buffer pool has been configured that is too large to be allocated. See the BUFFER-POOL-SIZE keyword of the RUN-FILES-ATTR configuration record for instructions on changing the buffer pool size.

Truncate option not supported

recover1 detected that the truncated function was not supported on the system when the user requested file truncation. Truncation of the file is not possible.

recovery terminating - no records recoverable!

recover1 detected corruption in the indexed file and no records could be recovered. In this case, recover1 terminates at the end of the integrity scan to protect the user from erroneously deleting all the records from the file. This error may indicate that the block size, the block size increment, or the number of keys that allow duplicates has been incorrectly specified, or the KIB may be corrupt.

Error status on template file

recover1 was unable to initialize the RM/COBOL file management system for the reason indicated by status. The usual cause for this error is that a buffer pool has been configured that is too large to be allocated. See the BUFFER-POOL-SIZE keyword of the RUN-FILES-ATTR configuration record for instructions on changing the buffer pool size. recover 1 detected an error in the KIB of the template file specified by the user. The user may enter another template file, may enter the KIB information manually, or may enter a Ctrl- C to terminate recover 1.

Cannot write near end of file - check "ulimit"

recover1 detected that blocks near the end of the file can be read but not written, but other blocks of the file may be both read and written. This error may indicate that the operating system file size limit (ulimit) may

be smaller than the size of the file. Set the file size limit correctly or use an account with sufficient privileges and run `recover1` again.

RM/Panels

RM/COBOL's RM/Panels is a graphical user interface that uses panels (screens) and controls defined in a Panel Library file. The RM/Panels application interacts with the panels and controls through a RM/COBOL program `runpan2.cob`. The `runpan2` application has been converted to be compatible with Micro Focus COBOL, so that RM/COBOL applications that use RM/Panels can be converted to run in Enterprise Developer, when compiled with the Dialect"RM" Compiler directive.

An RM/Panels application has the following:

- **Panel Library:** The panel library file is a binary file. It is loaded at run time by the `runpan2` program. Each panel definition within the file includes information on sizes, background text, attributes, and controls. The name of the library file is passed to `runpan2` by setting the value of `RMP-LIBRARY`. The RM/COBOL library file is used without any modifications because `runpan2` expects the file format to be in RM/COBOL format. Refer to your *RM/Panels Reference Manual* for information on the RM/Panels Designer and the creation and editing of the Panel Library.
- **Working Storage definition for each panel:** Generally, each panel will have a `<panelname>.ws` file associated with it. The fields in the file represent the data for the controls defined on the panel. This file should not be edited manually; the fields are generated by the RM/Panels Designer.
- **Procedural code for each panel:** Each panel will also have procedural code in a `<panelname>.prc` file that defines the functions for interacting with the panel. This file can be edited manually, if necessary.
- **rmpanels.ws:** This copybook contains the fields for controlling the panels and controls, such as the current and next field values. This file also specifies the name of the program that loads the library file. The `RMP--RUNTIME` field value should be set to either:
 - `runpan2.dll` on Windows; or
 - `cobrunpan2` (32-bit), or `cobrunpan264` (64-bit) on UNIX

In addition to these elements taken from the original RM/COBOL application, the following additional elements are required for the application to run correctly in Enterprise Developer:

- **ADISCTRL:** This file specifies a number of settings that control how ADIS handles ACCEPT and DISPLAY commands. The instance of the file in the application's path needs to have the **RM-Panels** configuration selected.
- **The Dialect"RM" Compiler directive:** This directive will most likely already be set as part of the conversion process from RM/COBOL. If this is not set, some features of ADIS and `runpan2` may not behave as expected.

For more details on the actual conversion process, see *Conversion Example*.

Restrictions and Limitations

The following restrictions apply when using applications that contain RM/Panels

No Panel Editor in Enterprise Developer	The RM/Panels product includes both a runtime and a designer/editor of the panels. The RM/Panels Designer, the application that enables you to create or modify RM/Panels library files, is not available in Enterprise Developer. However, the RM/COBOL version can still be used to modify the library files.
No End-User Panel Editor	In RM/COBOL, you can enable an option to bring up the Panel Editor at run-time. This is not supported in the Enterprise Developer version of RM/Panels.
Character-based controls only	On Windows, controls are always character-based. In some versions of RM/COBOL, certain controls could be converted on-the-fly to Windows controls.

	This is not supported in the Enterprise Developer version of RM/Panels. (UNIX versions have never had this feature.)
Mouse support	On UNIX platforms, there is no mouse support for RM/Panels applications.
RM/Panels applications not interchangeable between platforms	RM/Panels applications designed for Windows are not compatible on UNIX platforms and vice versa. This is because of the difference in line terminators and line draw characters between the two platforms.
Modeless operation not supported (Windows platforms)	The utility function (RMP--U-SMD), which initiates modeless operation, has no effect.
Panels 2.0 support only	There were significant changes to the Panels library file between versions 1.0 and 2.0. The <code>runpan2</code> program will support the Panels 2.0 library file only. Refer to the <i>RM/Panels Reference Manual</i> for instruction on converting from version 1.0 to 2.0.

Converting RM/Panels Applications

Converting an existing RM/COBOL program to run in Enterprise Developer can be simple or complex, depending on the portability of the syntax and data types used in the program. Generally, the Dialect"RM" Compiler directive is sufficient to allow an RM/COBOL program to compile in Enterprise Developer.

See the section *Converting RM/COBOL Applications* for details about converting the application to run under Enterprise Developer.

The additional steps you need to take for applications that include RM/Panels are:

- ADISCTRL** The `ADISCTRL` configuration file controls how the Micro Focus Adis routine handles `ACCEPT` and `DISPLAY` statements. It contains a configuration required for applications using RM/Panels syntax.
- The default location for this file is `%ProgramFiles(x86)%\Micro Focus\Enterprise Developer\etc (Windows)`, or `/opt/microfocus/EnterpriseDeveloper/etc (UNIX)`. If this location is not writable, copy the file to another location, and edit and use that copy in your application.
- The first `ADISCTRL` file in the executable path should be set to the predefined configuration **RM-Panels** in order for the display and keyboard behaviour to function correctly. This is done by running the `adiscf.exe` utility while in the directory of the `ADISCTRL` file you plan to use.



Note: `ADISCTRL` also contains a general **RM2VCOB** configuration for modernizing RM/COBOL applications, but it is the **RM-Panels** configuration that you must use if your application contains RM/Panels syntax.

- RMP--RUNTIME** This is a field declared in the `rmpanels.ws` copybook that specifies the `runpan2` library. You need to edit this value in the copybook from your RM/COBOL application and ship it with the other converted files for the application.
- RMP--RUNTIME** is set to `runpan2` in the original RM/COBOL `rmpanels.ws` copybook. In Enterprise Developer, the value needs to identify the library that contains the `runpan2` entry point. On Windows, that is `runpan2.dll` (the `.dll` extension is required to locate the library file); on UNIX, that is `cobrunpan2` (32-bit) or `cobrunpan264` (64-bit) (do not include the `.so` suffix of the library file).

Conversion Example: Using Eclipse

The following is an example conversion from RM/COBOL to Enterprise Developer using Eclipse as the IDE.

The application in this example is called **qdemo**, and has two panels: **custinfo** and **message**.

The following files are from the original RM/COBOL application:

- `qdemo.cbl`: Main COBOL program file
- `custinfo.prc`: Procedural code for the **custinfo** panel
- `cusinfo.ws`: Data for the **custinfo** panel
- `message.prc`: Procedural code for the **message** panel
- `message.ws`: Data for the **message** panel
- `rmpanels.ws`: Control data for RM/Panels
- `qdemo.lib`: RM/Panels library file

The following files are available from Enterprise Developer:

- `ADISCTRL`: The ADIS configuration file for ACCEPT/DISPLAY statements.

Creating an Eclipse Project for the RM/Panels Application

The first task is to create a project.

1. Launch Enterprise Developer. Specify a path for the Eclipse workspace when prompted.

If this is the first time you start Eclipse, the IDE displays the Eclipse **Welcome** page. Click **Open Team Developer Perspective** which is the default perspective in Enterprise Developer.

If the IDE does not start in the Team Developer perspective, to change to it, click **Window > Perspective > Open Perspective > Other**, click **Team Developer (default)**, and then click **OK**.

Perspectives are an Eclipse concept and they include the views, menus and options relevant to your activity. The Team Developer perspective shows the Application Explorer view, Outline and Console views, among others. The perspective is customizable, so you can choose your own views.

2. Select **File > New > Other**.

The **New** dialog box is displayed.

3. Expand **Micro Focus COBOL** folder, and then click **COBOL Project**.

4. Click **Next**.

The **New COBOL Project** dialog box is displayed.

5. In the **Project name** field, type `vc_qdemo`.

6. Click **Finish**.

The project is created, and displayed in the Application Explorer view.

Set the Dialect"RM" Directive for the Project

Set the `DIALECT"RM"` directive in the project's properties so that it applies to all programs within the project unless you explicitly override it at the program level.



Note: The `qdemo.cbl` supplied with the demo files sets the directive explicitly in the source code already, so these steps are not essential; although, they are good practice if you were adding further source files to your project, as you would not have to then explicitly set the directive in the new source files each time.

1. Right-click your project in the COBOL Explorer view and select **Properties**.

The **Properties for <project-name>** dialog box appears.

2. Select **Micro Focus > Project Settings > COBOL**.


The COBOL settings appear in the right-hand pane.

3. In the **Language Dialect** field, select **RM/COBOL**.
4. Click **OK**.

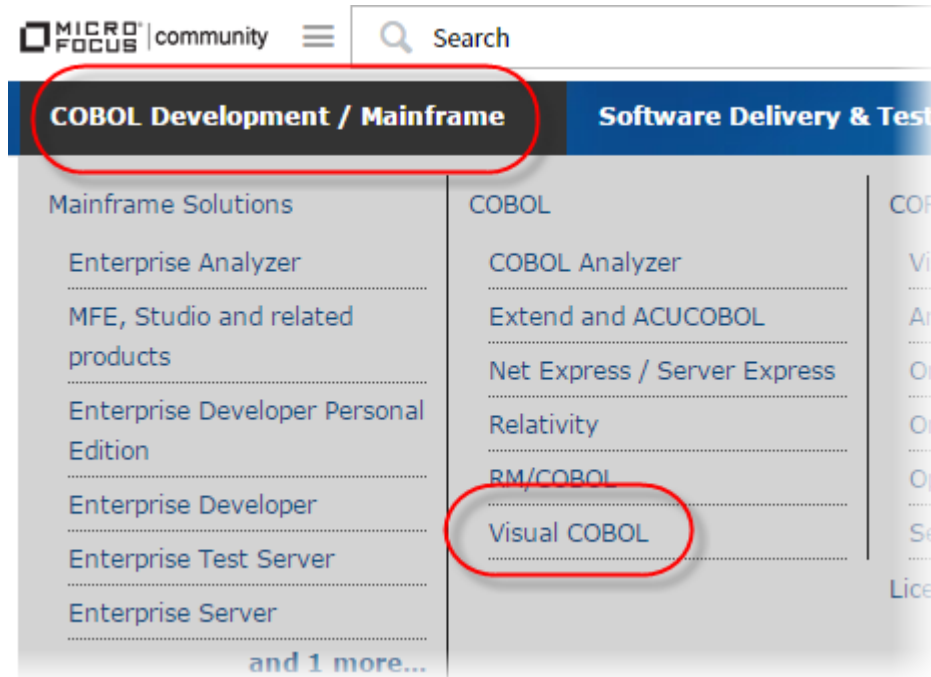
The RM/COBOL dialect is applied to any program within the project, unless that program overrides it by setting the DIALECT directive explicitly within the source code.

Download the Tutorial Files

The source files required to run the tutorial are available from the Micro Focus Community web site.

 **Note:** To download the files, you do not need to be a registered user of the Community web site, but to post comments or questions about the tutorial, on the forum, you will need to register and join the **Visual COBOL** group.

1. Visit the [Micro Focus Community web site](#).
2. Point to **Micro Focus**, then choose **Visual COBOL**.





The Visual COBOL group appears.

3. Click the **Files** tab.



The Visual COBOL - Media Gallery appears.

4. Click the appropriate **Visual COBOL RM/Panels Conversion** entry for your platform.

 **Note:** Click  to the right of the Media Gallery title to display the available files as a detailed list; this will enable you to easier locate the required file(s).

5. Under the **Options** group on the right side, click **Download file**.
6. When prompted, extract the contents of the `.zip` file to a directory that is not the project directory.

Import the RM/Panels Source Code

1. Ensure that the Navigator pane is selected, then drag the following files (downloaded in the previous step) into Eclipse, and drop them on the project name when the cursor changes to  (Windows) or  (UNIX).

- `qdemo.cbl`: Main COBOL program file
- `custinfo.prc`: Procedural code for the **custinfo** panel

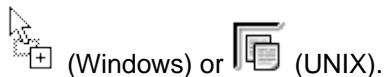
- `cusinfo.ws`: Data for the **custinfo** panel
- `message.prc`: Procedural code for the **message** panel
- `message.ws`: Data for the **message** panel
- `rmpanels.ws`: Control data for RM/Panels

The **File Operation** dialog box appears.

2. Ensure **Copy Files** is selected (so that a copy of the original file is created in the project, and not simply a link to the original file inserted), then click **OK**.

A copy of the files are added to the project, and if your environment is set to build automatically, the project is built. If the project does not build automatically, on the Project menu, select **Build Automatically**.

3. Again, ensure that the Navigator pane is selected, then drag the following files into Eclipse, and drop them on the directory that contains the executable that has just been built, when the cursor changes to



- `ADISCTRL`
- `qdemo.lib`



Note: The default directory is `New_Configuration.bin`, unless another directory is specified in the default Run configuration.

The **File Operation** dialog box appears.

4. Ensure **Copy Files** is selected again, then click **OK**.

A copy of the files are added to the project's output directory.

Configure Adis Support for RM/Panels

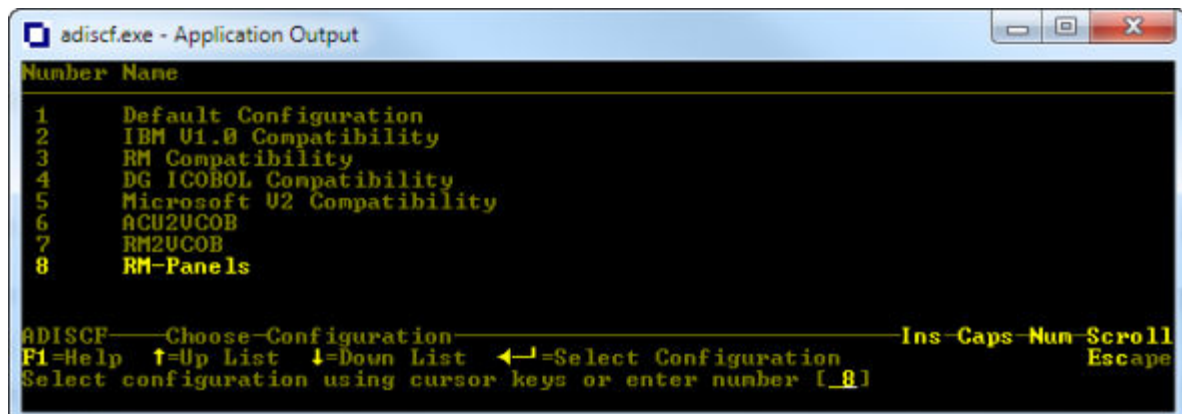
After importing the Adis configuration file, you must configure it to handle the enhanced ACCEPT and DISPLAY statements in a way that RM/Panels is expecting it to.

Enterprise Developer ships with a version of Adis that contains a configuration intended for applications that include RM/Panels syntax.

1. Using an Enterprise Developer command or shell prompt, navigate to the project output directory (that is, the directory containing `ADISCTRL`).
2. Enter `ADISCF`.

The `adiscf.exe` window appears.

3. Press **F6**, then ensure that the **RM-Panels** configuration is selected.



4. Press **Esc** twice to exit.



Note: if you are prompted to exit without saving, press **N**, **F4**, then **Esc** twice again.

Configure the Supported Copybook Extensions

Configure Eclipse to recognize the appropriate RM/COBOL file extensions as copybooks in Enterprise Developer.

1. On the **Window** menu, select **Preferences**.

The Preferences dialog box appears.

2. In the left-hand pane, select **General > Appearance > Content Types**.

The Content Types pane appears in the right-hand pane.

3. Select **Text > Micro Focus Project Types > COBOL Copybook**. In the bottom pane, a list of file associations for COBOL copybooks appears.
4. Click **Add**, then in the Add Content Type Association dialog box, type `*.prc` and click **OK**.
5. Repeat the previous step, entering `*.ws` this time.
6. Click **OK**.

The Preferences dialog box is closed. Files with the extension `.prc` or `.ws` are now recognized as copybooks for all projects in Eclipse.



Note: If the COPY statements in your source code reference any of these files without specifying the extension, you should also set the `COPYEXT"prc,ws"` Compiler directive in your project.

Configure the Library File for Run Time

This demo can run on Windows or UNIX. To change it to run from one to the other platform, you must edit a data item to point to the correct run-time system.

The downloaded library file should already be configured correctly for your platform; if it is not, you must update it and recompile your application.

1. In COBOL Explorer, select `rmppanels.ws`.

The copybook appears in the editor.



Note: Files with RM/COBOL-specific file extensions (such as `.ws` and `.prc`) may only show in a plain text editor; to display them in the COBOL editor, you may have to set the file associations on the **Run** menu, by selecting **Preferences**, then **General > Editors > File Associations**.

2. Locate the `RMP--RUNTIME` data item, and update the value accordingly:

- `runpan2.dll` (Windows)
- `cobrunpan2` (32-bit UNIX)
- `cobrunpan264` (64-bit UNIX)

```

01 RMP--PARAMETERS.
03 RMP--INTERNAL-VALUES.
05 RMP--VERSION          PIC 9(4) VALUE 220.
03 RMP--CONFIGURATION-PARAMETERS.
05 RMP--RUNTIME          PIC X(80) VALUE "runpan2.dll".
05 RMP--TEMP-FILE-NAME   PIC X(12) VALUE SPACE.
05 RMP--TEMP-FILE-DIRECTORY PIC X(80) VALUE SPACE.
05 RMP--DEBUG-SW        PIC X VALUE "N".
08 RMP--DEBUG           VALUE "Y" WHEN FALSE "N".
05 RMP--PROT-CHAR-SW    PIC X VALUE "N".
08 RMP--PROT-ALLOW-CHAR VALUE "Y".
08 RMP--PROT-PREVENT-CHAR VALUE "N".
  
```

3. Save the copybook.

Build and Run the Application

By default, Eclipse is set to build projects automatically (see **Project** menu). If there are any problems, check the **Problems** window: errors for the project show the name of your imported `.cbl` source file in the Resource column. Double-click an entry to jump to the particular area of the code in error.

To run the application from Eclipse, you need to create a launch configuration.

1. Right-click your project in the COBOL Explorer view and select **Run As > Run Configurations**.

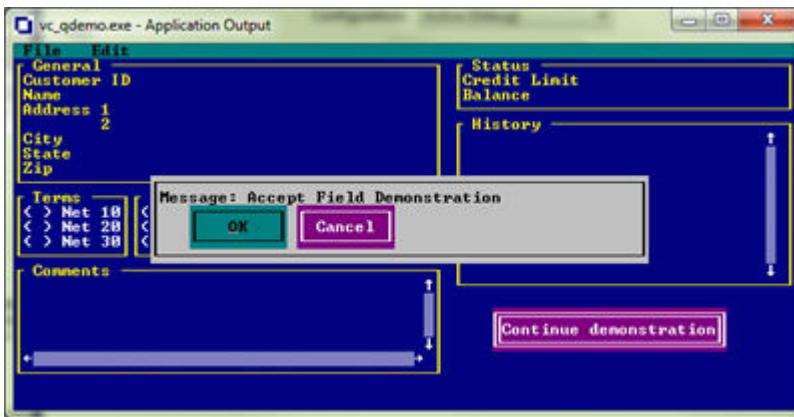
The **Run Configurations** dialog box appears.

2. Double-click **COBOL Application**.

Default launch configuration details for your project are displayed.

3. Click **Run**.

The following appears:



4. When you have finished viewing the demonstration, click the **Close** button in the top right-hand corner.

This concludes the tutorial in which we have created a project in Enterprise Developer, configured it to accept RM/Panels syntax, and then run a small program that demonstrates that.

Writing Programs

RM/Panels provides a powerful set of standard runtime functions for writing application programs. To use RM/Panels effectively, you must understand the general approach to using these standard runtime functions and have some familiarity with the specific usage of each one. Utility functions, which allow you to control the overall behavior of the RM/Panels runtime system, rather than manipulate individual panels, are also described.

This section discusses the basic processes of activating a panel library, setting parameters, executing standard runtime functions, including required copy files, error detection, and the appropriate screen handling strategy, followed by a detailed description of each RM/Panels standard runtime and utility function.

Standard Runtime Function Basics

Activating a Panel Library

Before your application can use or access individual panels, it must activate the library in which they are contained. The panel library remains active until a different library is activated. Related panels should be grouped into libraries so that RM/Panels does not have to repeatedly change from one library to another.

A library is activated by moving the filename of the library into the variable `RMP--LIBRARY`. The library becomes active the next time an RM/Panels standard runtime function is used.

Example:

```
MOVE "libraryname.LIB" TO RMP--LIBRARY.
```

Setting Runtime Parameters

Parameters are variables that are set to control the execution of RM/Panels. Two types of parameters are used with RM/Panels standard runtime functions:

- **Required**, which are those parameters that must be set to valid values in order for a standard runtime function to execute correctly.
- **Optional**, which are those parameters that can be set to override the default behavior specified for the panel. Optional parameters are always reset to their default values by the RM/Panels runtime system after the function is executed. This prevents later executions of the standard runtime function from inheriting the overridden behavior.

Some optional parameters are controlled by SET statements. The following example sets an optional parameter for the DISPLAY PANEL standard runtime function that displays field/control values along with panel text.

Example

```
SET RMP--SHOW-FIELDS TO TRUE.
```

Other optional parameters are controlled by MOVE statements. The following example sets a required parameter for the DISABLE FIELD FOR INPUT standard runtime function. This parameter identifies which field/control to disable.

Example

```
MOVE "CUSTOMER-NUMBER" TO RMP--FIELD-NAME.
```

All the parameters for RM/Panels standard runtime functions are listed in *Appendix B, Standard, Utility, and Extended Runtime Functions and Parameters*, and are contained in the master copy file, `RMPANELS.WS`; see *Appendix A, Master Copy File RMPANELS.WS* for a description of `RMPANELS.WS`.

Executing Standard Runtime

Use the PERFORM statement to execute RM/Panels standard runtime functions. The following example demonstrates the execution of the DISPLAY PANEL standard runtime function for a panel called MYPANEL.

Example

```
PERFORM RMP--DP-MYPANEL.
```

(The procedure `RMP--DP-MYPANEL` is contained in a panel-specific copy file, `MYPANEL.PRC`; see *Required Copy Files* for more information.)

The naming of RM/Panels standard runtime functions follows a strict pattern. The name is made up of three parts:

- The prefix, `RMP--`.
- An abbreviation for the desired RM/Panels standard runtime function. (See *Appendix B, Standard, Utility, and Extended Runtime Functions and Parameters* for a complete list of standard runtime function abbreviations.)

Examples are `DP` (DISPLAY PANEL) and `RP` (REMOVE PANEL).

- The panel name.

This naming convention makes it easy to use the RM/Panels standard runtime functions, even in programs using multiple panels.

Required Copy Files

Each application program that uses RM/Panels requires the master copy file `RMPANELS.WS`.

Note In some situations you may wish to use one of the other versions of `RMPANELS.WS` (`RMPANELS.LNK` and `RMPANELS.EXT`). See *Appendix A, Master Copy File RMPANELS.WS* for details on using these copy files.

`RMPANELS.WS` must be copied into the Working-Storage Section of the application program. The master copy file contains a parameter block used to pass parameters between the application program and the RM/Panels runtime system. Appendix A contains a complete description of `RMPANELS.WS`.

Each application program must also contain a pair of panel-specific copy files for each panel it uses. These two copy files are the interface between your application program and the RM/Panels runtime system. The Panel Editor automatically produces these copy files when you create a panel. The copy files are named with the first eight characters of the panel name, followed by the extensions, `.WS` and `.PRC`. For example, a program that used a panel named `MYPANEL` would require the copy files:

- `MYPANEL.WS`
- `MYPANEL.PRC`

These panel-specific copy files are described below, with `MYPANEL` representing the panel name variable.

MYPANEL.WS

`MYPANEL.WS` sets up a 100-byte work area for the panel that never needs to be directly modified or referenced by your application program. This work area exists solely for the use of RM/Panels.

`MYPANEL.WS` also contains declarations for each field/control on the panel. This area is called `MYPANEL-WS`. These fields are declared in the same manner as any other data item in the Working-Storage Section of a COBOL program. These field declarations are used both as the source of field/control values for RM/Panels displays and as the destination for RM/Panels accepts. The order of these fields/controls is dictated by the Panel Configuration and should not be changed manually. Values, however, can be moved in or out of the fields/controls at any time.

`MYPANEL.WS` must be copied into the Working-Storage Section of your application program.

Example of contents of `MYPANEL.WS`:

```
01MYPANEL-WS .
  03 FILLER          PIC X(100) VALUE "MYPANEL    0050" .
  03 CUST-CITY       PIC X(15) .
  03 CUST-NAME       PIC X(30) .
  03 CUST-NUMBER     PIC 9(5) .
```

MYPANEL.PRC

`MYPANEL.PRC` contains procedures that execute RM/Panels standard runtime functions, such as displaying or removing panels and entering panel fields/controls. `MYPANEL.PRC` must be copied into the Procedure Division of your application program.

Example of partial contents of `MYPANEL.PRC`:

```
RMP--AF-MYPANEL .
  CALL RMP--RUNTIME USING RMP--AF
  RMP--PARAMETERS MYPANEL-WS
RMP--EE-MYPANEL .
  CALL RMP--RUNTIME USING RMP--EE
  RMP--PARAMETERS MYPANEL-WS
```

Sample Program

The following sample program shows the minimum requirements for an RM/Panels program. This program, which displays a panel and then removes it, is called MINIMUM. It uses a panel called MYPANEL in the panel library called MYPANEL.LIB.

```
IDENTIFICATION DIVISION.  
PROGRAM-ID. MINIMUM.  
ENVIRONMENT DIVISION.  
DATA DIVISION.  
WORKING-STORAGE SECTION.  
    COPY "RMPANELS.WS" .  
    COPY "MYPANEL.WS" .  
PROCEDURE DIVISION.  
MAIN-PROCEDURE.  
    MOVE "MYPANEL.LIB" TO RMP--LIBRARY.  
    PERFORM RMP--DP-MYPANEL.  
    PERFORM RMP--RP-MYPANEL.  
    STOP RUN.  
  
COPY "MYPANEL.PRC" .
```

Error Detection

Every RM/Panels standard runtime function sets a status value. This value is contained in the variable RMP--STATUS in master copy file RMPANELS.WS. The possible status values and error conditions are as follows:

Status value	Description
0	The function executed successfully.
1	The field/control name is invalid.
2	The occurrence number is invalid.
3	The function number is invalid.
4	The attribute is invalid.
5	The panel is not in this library
6	The library does not exist.
7	The library configuration is invalid.
8	The panel does not contain any fields/controls.
9	The panel contains no input fields/controls.
10	The panel is not displayed.
11	The palette number is invalid.
12	Help message is not defined.
13	Error message is not defined.
14	A COBOL input/output error was encountered on the panel library during execution of this function. user's guide
15	The field/control is disabled.
16	A window error has occurred.
20	The menu command name is invalid.
22	There is no pulldown menu on this panel.
1001	API parameter is missing.

Status value	Description
1002	API message is not defined.
1003	API pulldown option is invalid.
1004	API pulldown option is uncheckable.

The following condition-names are declared in `RMPANELS.WS` to help in interpreting errors.

```

05 RMP--STATUS PIC 9(4).
   88 RMP--VALID-FUNCTION          VALUE 0.
   88 RMP--FIELD-INVALID           VALUE 1.
   88 RMP--OCCUR-INVALID           VALUE 2.
   88 RMP--FUNCTION-INVALID        VALUE 3.
   88 RMP--ATTRIBUTE-INVALID       VALUE 4.
   88 RMP--PANEL-INVALID           VALUE 5.
   88 RMP--LIBRARY-INVALID         VALUE 6.
   88 RMP--CONFIG-INVALID          VALUE 7.
   88 RMP--NO-FIELDS               VALUE 8.
   88 RMP--NO-INPUT-FIELDS         VALUE 9.
   88 RMP--PANEL-NOT-DISPLAYED     VALUE 10.
   88 RMP--PALETTE-INVALID         VALUE 11.
   88 RMP--NO-HELP-DEFINED         VALUE 12.
   88 RMP--NO-ERROR-DEFINED        VALUE 13.
   88 RMP--IO-ERROR                VALUE 14.
   88 RMP--CONTROL-DISABLED        VALUE 15.
   88 RMP--WINDOW-ERROR            VALUE 16.
   88 RMP--MENU-COMMAND-INVALID     VALUE 20.
   88 RMP--NO-PULLDOWN             VALUE 22.
   88 RMP--API-PARAM-MISSING        VALUE 1001.
   88 RMP--API-MSG-NOT-DEFINED      VALUE 1002.
   88 RMP--API-PD-OPTION-INVALID    VALUE 1003.
   88 RMP--API-UNCHECKABLE         VALUE 1004.

```

Screen Handling

RM/Panels supports three different methods of handling screens in COBOL application programs. In addition to the two common approaches of coding individual fields or accepting an entire screen definition, RM/Panels uses a third approach based on a programming technique called the event loop.

The event loop is common in programming graphical user interfaces. It frees you from having to direct all the activity of complex screens. The basic activities of the screen are performed automatically, but every event is reported to the application program to allow special processing when desired. RM/Panels applies this concept to COBOL screen handling to provide full-screen entry with field level control and a minimum of coding. The three methods are contrasted in the following sections.

In summary, remember the following steps when writing pop-up panels:

1. Create the pop-up panel as a window or set `RMP--WINDOW` to `TRUE` before displaying.
2. Reset the keyboard focus when returning to the main panel.
3. Do not let terminating condition(s) of the pop-up panel fall back to the main panel.

Individual Field Method

The individual field method of COBOL screen handling requires that you write or generate all the code needed to control each input field individually. This method requires a series of `ACCEPT` statements, as shown in the following example:

```

ACCEPT FIELD-1 LINE 10 POSITION 40.
ACCEPT FIELD-2 LINE 11 POSITION 40.
ACCEPT FIELD-3 LINE 12 POSITION 40.

```

This approach is usually embellished with code allowing the user to select or move between input fields. Help messages, prompts, validations, and special features may also be added. However, what begins as a simple series of ACCEPT statements soon grows into unmanageable code.

The benefit of building input logic in this method is that total control is possible at the field level. The disadvantage is that all screen handling responsibility is borne by the programmer, who must produce a cumbersome amount of code to add or modify the field level logic, add or delete fields, or move existing fields on the screen.

Entire Screen Method

The second common method of COBOL screen handling is to do an enhanced ACCEPT statement of an entire screen definition through the Screen Section or some other extension. This approach eliminates the need for extensive coding involved in controlling each individual field, but it also removes the ability to smoothly integrate field level logic and special features because the application program only gains control under a limited set of circumstances.

Event Loop Method

The event loop method enables sophisticated screen handling with tremendous flexibility and greatly reduced coding.

There are three components in an event loop:

- Loop control. This specifies the condition or conditions that terminates the loop.
- Execution of an event. One event occurs on each repetition of the loop, until the loop control conditions are met.
- Event testing. One or more checks by the application program to evaluate events. Rather than dictating each event, the application program responds to the current event.

Example of an RM/Panels Event Loop

```
PERFORM UNTIL F3-KEY-PRESSED      (Loop Control)
  PERFORM RMP--EE-PANELNAME      (Execution)
  EVALUATE RMP--LAST-FIELD
    WHEN "CUSTOMER-NUMBER"      (Event Test)
      PERFORM VALIDATE-CUSTOMER-NUMBER
    WHEN "CUSTOMER-STATE"      (Event Test)
      PERFORM VALIDATE-CUSTOMER-STATE
  END-EVALUATE
END-PERFORM.
```

The event is input to a field/control on the screen, which is performed by the procedure RMP--EE-PANELNAME. This procedure executes the RM/Panels EXECUTE EVENT standard runtime function. The EXECUTE EVENT standard runtime function accomplishes the following:

- Checks the parameters passed to it to see what event to perform
- Performs the event (field/control input)
- Sets parameters to indicate what event was executed and what event should be executed next
- Returns control to the application program

Each time the EXECUTE EVENT standard runtime function is performed, only one event is executed, thus the application program can always intercept control after any event. It then has the ability to perform special processing or force a particular event to occur.

There are many advantages to using the event loop method:

1. Writing tedious screen handling code is eliminated.
2. Adding special field/control level logic is made easier.
3. Field/control level logic is insulated from changes in field/control entry order and position.

4. Size of screen handling code is dependent upon the amount of special processing to be done, rather than the number of fields/controls on the screen.
5. Adding new fields/controls does not affect the event loop unless the fields/controls require special processing.
6. Event loops can be nested, which allows multiple panels to be used on the screen. The following section describes the use of multiple panels and special considerations in nesting event loops.

Using Multiple Panels

RM/Panels is designed to support windowed applications, where panels can be displayed (or “pop-up”) at different locations on the screen. While simple to produce, this type of application requires a few special considerations. The following describes the three steps to writing pop-up applications.

1. **Detect a request for a pop-up panel.** The first step in coding a windowed application is detecting the conditions that indicate the need to display the pop-up panel. This can be any condition, but is commonly a special keystroke, push button, or menu command. The detection is usually a test inside an event loop based on the EXECUTE EVENT standard runtime function. This is illustrated by the following code fragment:

```
DEMONSTRATE-FUNCTION.
  PERFORM RMP--EE-PANEL5.
  IF F3-KEY AND (RMP--LAST-FIELD = "CUST-SHIP-CODE")
    PERFORM SHIP-CODE-DETAILS
```

When the **F3** key is pressed during the entry of the CUST-SHIP-CODE field, the SHIP-CODE-DETAILS procedure, which controls the pop-up panel, is performed.

2. **Display, use, and remove the pop-up panel.** A pop-up panel is used like any other panel, but with one important difference. The “Make panel a window” parameter must be selected, or at runtime execution, RMP--WINDOW should be set to TRUE before the panel is displayed. Failure to do one of these will prevent the panel from being removed from the display properly.

The following code fragment shows how the pop-up panel is displayed, used, and removed:

```
SHIP-CODE-DETAILS.
  PERFORM RMP--DP-PANEL6.
  SET RMP--FIRST-FIELD TO TRUE.
  PERFORM RMP--EE-PANEL6
    WITH TEST AFTER UNTIL ESCAPE-KEY.
  PERFORM RMP--RP-PANEL6.
```

Since this panel was created with the windowing option selected, the code is no different from the usage of a normal panel. The panel is displayed, an event loop is used for user input, and then the panel is removed, restoring the screen contents.

3. Resume execution of the original event loop. The event loop is based on the ability of the EXECUTE EVENT standard runtime function to perform an input event and set up the next input event. Because the previous step includes an event loop that actually executes inside the original event loop, the internal variables determining which field/control should be entered next are set for the pop-up panel. One of these must be reset so that the keyboard focus moves to a field/control on the main panel. There are three ways to do this:

- a. Set RMP--REPEAT-EVENT to TRUE.

This returns keyboard focus to the last field/control that had it on the panel.

- b. Set RMP--FIRST-FIELD to TRUE.

This sets keyboard focus to the first enabled field/control on the panel.

- c. Move the name of a field to RMP--NEXT-FIELD.

This specifically moves keyboard focus to that field/control.

Also, care must also be taken not to allow the terminating condition from the inner loop to terminate the original loop. The following program prevents this problem by moving zero to RMP--EXCEPTION-

NUMBER, so that the Escape key condition is false upon resuming the original loop. The following code follows the sample shown in the first step.

```
SET RMP--REPEAT-EVENT TO TRUE
MOVE 0 TO RMP--EXCEPTION-NUMBER.
```

Standard Runtime Functions

The RM/Panels runtime system is an RM/COBOL-85 object program that must be available to and distributed with your application.



Note: In version 1.0 of RM/Panels, there was only one RM/Panels runtime system program, `runpanel.cob`. Version 1.1 introduced an additional runtime system program, `rmputil.cob`. Both of these programs must be distributed with applications written using RM/Panels version 1.1. In version 2.1 of RM/Panels, there is only one runtime system program, `runpan2.cob`.

The RM/Panels runtime system provides a powerful set of standard runtime functions that allows the application to manipulate panels. The following table gives the name and abbreviation of each RM/Panels standard runtime function.

Function	Abbreviation
ACCEPT FIELD	AF
CHANGE PANEL PALETTE	CPP
CHECK MENU OPTION	CMO
CLEAR ALL FIELDS	CAF
DISABLE ALL FIELDS	DA
DISABLE FIELD FOR INPUT	DFI
DISABLE MENU OPTION	DMO
DISPLAY ALL FIELDS	DAF
DISPLAY FIELD	DF
DISPLAY PANEL	DP
ENABLE ALL FIELDS	EA
ENABLE FIELD FOR INPUT	EFI
ENABLE MENU OPTION	EMO
EXECUTE EVENT	EE
INITIALIZE ALL FIELDS	IAF
INITIALIZE FIELD	IF
POPUP MENU	PUM
REMOVE PANEL	RP
SET FIELD ATTRIBUTE	SFA
SET SCROLL BAR RANGE	SSR
SHOW FIELD ERROR	SFE
SHOW FIELD HELP	SFH
SHOW PANEL ERROR	SPE

Function	Abbreviation
SHOW PANEL HELP	SPH
UNCHECK MENU OPTION	UMO
VALIDATE ALL FIELDS	VAF
VALIDATE FIELD	VF

Each standard runtime function is described in the following section. All parameters for RM/Panels standard runtime functions are defined in *Appendix B, Standard, Utility, and Extended Runtime Functions and Parameters*.

Configurable Keys

The RM/Panels runtime system takes special action on several keys. The field termination codes that RM/Panels recognizes as each key can be controlled by the application program. If the key values are set to zero, RM/Panels assumes the key is not to be used. The seven configurable keys and their interpretation by RM/Panels are as follows:

- Help** This key causes the automatic help facility to display help information for the field/control during the ACCEPT FIELD or EXECUTE EVENT standard runtime functions.
- Enter** This key is interpreted as the termination of normal input into a field/control. If a validation test fails, the user is forced to reenter the field/control, and an error message is displayed (if created). In the EXECUTE EVENT standard runtime function, preparations are made to enter the next field/control.
- Next Field** This key is interpreted as the termination of normal input into the current field/control and as a request to move to the next field/control. The default key is the **Down Arrow** key.
- Prev Field** This key is interpreted as the termination of normal input into the current field/control and as a request to move to the previous field/control. The default key used is the **Up Arrow** key.
- Next Group** This key is interpreted as the termination of normal input into the current field/control and as a request to move to the first field/control in the next group of fields/controls. The default key is the **Tab** key.
- Prev Group** This key is interpreted as the termination of normal input into the current field/control and as a request to move to the first field/control in the previous group of fields. The default key is the **Shift-Tab** key combination.
- Pulldown** This key is interpreted as a request to shift input focus to the pulldown menu, if present.

See *Appendix A, Master Copy File RM/PANELS.WS* for more information.


ACCEPT FIELD

Execution

```
PERFORM RMP--AF-PANELNAME
```

Description

This standard runtime function performs the entry of a single panel field/control by the user. It is similar to a standard COBOL ACCEPT statement, except that RM/Panels sets all the parameters and can perform many supporting activities automatically. Many characteristics of the field/control can then be modified through the Panel Editor, without requiring program changes or recompilation.

 **Note:** While much more powerful than an ACCEPT statement, this standard runtime function is not the preferred method of allowing user input in RM/Panels. Use the EXECUTE EVENT standard runtime function as the primary method to allow user input. Use ACCEPT FIELD when only one field/control is needed.

Required Parameters


The program must set the name of the field/control to be accepted in `RMP--FIELD-NAME`. If the field/control occurs more than once, the occurrence number must be specified in `RMP--FIELD-OCCUR`. The occurrence numbers are equivalent to COBOL subscripts and begin at 1.

Returned Values

The value entered by the user is stored in the appropriate field/control within `panelname.WS`. The field/control termination code indicating the ending key is returned in `RMP--EXCEPTION-NUMBER`.

Additional Usage Notes

- Before this standard runtime function can be executed, the panel must be displayed.
- User Input Errors. If validation is specified for the field/control and an error is detected, the behavior of RM/Panels depends on the way in which user input was terminated. If the input was terminated by the auto-exit property or by pressing the Enter key, the error message is displayed and the user is forced to reenter the field/control. If input was terminated in any other way, control is returned to the application program and `RMP--INVALID-INPUT` is TRUE. If you want the error message displayed under these circumstances, you must execute the SHOW FIELD ERROR standard runtime function. This approach differs somewhat from the handling of invalid input during the execution of the EXECUTE EVENT function. During the execution of the ACCEPT FIELD function, RM/Panels assumes that the auto-exit property and the Enter key indicate a normal termination of input. The user should not be allowed to proceed if the input is invalid. During the EXECUTE EVENT function, RM/Panels assumes that many other keys also indicate normal termination of input.

 **Note:** If accelerator values are used for any fields/controls, check both the exception value and `RMP--VALID-INPUT`. Accelerator keys can affect code logic.

- Disabled Fields/Controls. In the Panel Editor or at runtime execution, a field/control can be specified as not allowing entry. This characteristic does not apply to the ACCEPT FIELD standard runtime function. It only applies to standard runtime functions that allow input of more than one field/control. RM/Panels assumes that if a field/control is specifically identified for the ACCEPT FIELD standard runtime function, it should allow input regardless of the allow input characteristic. This can be quite useful. For example, ACCEPT FIELD might be used to allow input of a key field/control in a maintenance program, and then EXECUTE EVENT might be used to allow updating of the non-key fields/controls.

RMP--STATUS Values

Status value	Description
0	The function executed successfully.
1	The field/control name is invalid.
2	The occurrence number is invalid.
5	The panel is not in this library
6	The library does not exist.
10	The panel is not displayed.
14	A COBOL input/output error was encountered on the panel library during execution of this function. To

Status value	Description
	determine the exact nature of the I/O error, use the C \$RERR subprogram.

CHANGE PANEL PALETTE

Execution

```
PERFORM RMP--CPP-PANELNAME
```

Description

This standard runtime function redisplay a panel and all its fields/controls using a new palette.

Required Parameters

RMP--PALETTE must be set with the number of the palette to be used. You must have previously defined the palette number in the panel library with a value ranging from 1 to 99. A value of 0 causes the panel to display using the default palette for the panel.

Additional Usage Notes

Before this standard runtime function can be executed, the panel must be displayed. However, the default panel palette can be overridden at the time the panel is displayed.

RMP--STATUS Values

Status value	Description
0	The function executed successfully.
6	The library does not exist.
10	The panel is not displayed.
11	The palette number is invalid.
14	A COBOL input/output error was encountered on the panel library during execution of this function. To determine the exact nature of the I/O error, use the C \$RERR subprogram.

CHECK MENU OPTION

Execution

```
PERFORM RMP--CMO-PANELNAME
```

Description

This standard runtime function places a check next to a pulldown menu command when it is displayed.

Required Parameters

The application program must set the name of the menu command to be checked in RMP--COMMAND-NAME.

Returned Values

None.

Additional Usage Notes

This standard runtime function is valid only for pulldown menu commands that can be checked.
An inverse standard runtime function, UNCHECK MENU OPTION is also available.

RMP--STATUS Values

Status value	Description
0	The function executed successfully.
5	The panel is not in this library
6	The library does not exist.
14	A COBOL input/output error was encountered on the panel library during execution of this function. To determine the exact nature of the I/O error, use the C \$RERR subprogram.
20	The menu command name is invalid.

CLEAR ALL FIELDS

Execution

```
PERFORM RMP--CAF-PANELNAME
```

Description

This standard runtime function inserts spaces in all alphanumeric fields/controls and zeros in all numeric and date fields/controls on the panel. It is the equivalent of issuing an INITIALIZE statement to each field defined in *panelname*.WS.

Required Parameters

None.

Returned Values

The value for each field/control in the panel is stored within *panelname*.WS.

Additional Usage Notes

- The panel does not need to be displayed before clearing the fields/controls.
- This standard runtime function is similar to the INITIALIZE ALL FIELDS standard runtime function. However, the INITIALIZE ALL FIELDS standard runtime function sets all fields/controls to their default values, which may not be zero or spaces.
- This standard runtime function does not display the fields/controls on the screen.

RMP--STATUS Values

Status value	Description
0	The function executed successfully.
5	The panel is not in this library
6	The library does not exist.

Status value	Description
14	A COBOL input/output error was encountered on the panel library during execution of this function. To determine the exact nature of the I/O error, use the C \$RERR subprogram.

DISABLE ALL FIELDS

Execution

```
PERFORM RMP--DA-PANELNAME
```

Description

This standard runtime function causes all fields/controls on the panel to be disabled for input.

Required Parameters

None.

Additional Usage Notes

This function does not redisplay the fields/controls with their disabled attributes. Use the DISPLAY ALL FIELDS or DISPLAY PANEL standard runtime function after the DISABLE ALL FIELDS standard runtime function to show the change in their status.

RMP--STATUS Values

Status value	Description
0	The function executed successfully.
5	The panel is not in this library
6	The library does not exist.
14	A COBOL input/output error was encountered on the panel library during execution of this function. To determine the exact nature of the I/O error, use the C \$RERR subprogram.

DISABLE FIELD FOR INPUT

Execution

```
PERFORM RMP--DFI-PANELNAME
```

Description

This standard runtime function prevents input to a field/control that was specified as allowing input in the Panel Editor. Many times a certain field/control should be input, or not input, based on the value of another field/control. This standard runtime function allows a field/control to be disabled for input at runtime execution, rather than at panel creation time, increasing the flexibility of the EXECUTE EVENT standard runtime function.

Required Parameters

The program must set the name of the field/control to be disabled in RMP--FIELD-NAME. If the field/control occurs more than once, all occurrences of the field/control will be disabled.

Optional Parameters

RMP--SUPPRESS-EVENT-RESET can be set to TRUE to prevent RMP--NEXT-FIELD and RMP--NEXT-OCCUR from being reset.

Returned Values

The values of RMP--NEXT-FIELD and RMP--NEXT-OCCUR are reset, based upon the new input status of the fields/controls on the panel.

Additional Usage Notes

- This standard runtime function resets the next field/control to be entered because generally the standard runtime function is used within an event loop and the new input status of the field/control should take effect immediately.
- An inverse standard runtime function, ENABLE FIELD FOR INPUT, is also available.

RMP--STATUS Values

Status value	Description
0	The function executed successfully.
1	The field/control name is invalid.
5	The panel is not in this library
6	The library does not exist.
14	A COBOL input/output error was encountered on the panel library during execution of this function. To determine the exact nature of the I/O error, use the C \$RERR subprogram.

DISABLE MENU OPTION

Execution

```
PERFORM RMP--DMO-PANELNAME
```

Description

This standard runtime function disables a command on a pulldown menu. It does not apply to menu titles. The command appears on the menu with the disabled attribute, but the user is not able to select it.

Required Parameters

The application program must set the name of the menu item to be disabled in RMP--COMMAND-NAME.

Returned Values

None.

Additional Usage notes

An inverse standard runtime function, ENABLE MENU OPTION is also available.

RMP--STATUS Values

Status value	Description
0	The function executed successfully.
5	The panel is not in this library
6	The library does not exist.
14	A COBOL input/output error was encountered on the panel library during execution of this function. To determine the exact nature of the I/O error, use the C \$RERR subprogram.
20	The menu command name is invalid.

DISPLAY ALL FIELDS

Execution

```
PERFORM RMP--DAF-PANELNAME
```

Description

This standard runtime function displays the values of all fields/controls on the panel. It should be used as the primary method of displaying field/control values. Use a related standard runtime function, DISPLAY FIELD when only one field/control is to be displayed.

Required Parameters

None.

Additional Usage Notes

- This standard runtime function is intended primarily for displaying only field/control values. When you want to display both the panel text and graphics at the same time, you need to use the DISPLAY PANEL standard runtime function.
- Before this standard runtime function can be executed, the panel must be displayed.

RMP--STATUS Values

Status value	Description
0	The function executed successfully.
5	The panel is not in this library
6	The library does not exist.
10	The panel is not displayed.
14	A COBOL input/output error was encountered on the panel library during execution of this function. To determine the exact nature of the I/O error, use the C \$RERR subprogram.


DISPLAY FIELD

Execution

```
PERFORM RMP--DF-PANELNAME
```

Description

This standard runtime function displays the value of a single field/control on the panel. It is similar to a standard DISPLAY statement, except that RM/Panels sets all the parameters. Many characteristics of the field/control can then be modified solely through the Panel Editor, without requiring program changes or recompilation.

 **Note:** While much more powerful than a standard DISPLAY statement, this standard runtime function is not the preferred method of displaying field/control values in RM/Panels. Use the DISPLAY ALL FIELDS and DISPLAY PANEL standard runtime functions as the primary method of displaying field/control values. Use DISPLAY FIELD when only one field/control is to be displayed.

Required Parameters

The program must set the name of the field/control to be displayed in `RMP--FIELD-NAME`. If the field/control occurs more than once, the occurrence number must be specified in `RMP--FIELD-OCCUR`. The occurrence numbers are equivalent to COBOL subscripts and begin at 1.

Additional Usage Notes

- Before this standard runtime function can be executed, the panel must be displayed.
- Setting `RMP--FIELD-OCCUR` to 0 will display all occurrences of a repeating field/control.

RMP--STATUS Values

Status value	Description
0	The function executed successfully.
1	The field/control name is invalid.
2	The occurrence number is invalid.
5	The panel is not in this library
6	The library does not exist.
10	The panel is not displayed.
14	A COBOL input/output error was encountered on the panel library during execution of this function. To determine the exact nature of the I/O error, use the C \$RERR subprogram.

DISPLAY PANEL

Execution


```
PERFORM RMP--DP-PANELNAME
```

Description

This standard runtime function displays a panel on the screen.

Required Parameters

`RMP--LIBRARY` must be set to the name of the panel library which contains the panel.

 **Note:** Since this value is never changed by RM/Panels, it does not need to be set for each panel used in the same library.

Optional Parameters

RMP--BEEP can be set to TRUE to produce a beep when displaying the panel.

RMP--CLEAR can be set to TRUE to erase the entire video screen and set the color of the screen to the background color of the panel.

RMP--PALETTE can be set to select a specific palette other than the default for the panel.

RMP--PANEL-LINE can be set to 999 to center the panel vertically or it can be set to any non-zero value to display the panel on a specific starting line.

RMP--PANEL-POS can be set to 999 to center the panel horizontally or it can be set to any non-zero value to display the panel on a specific starting column position.

RMP--SHOW-FIELDS can be set to TRUE to display all field/control values with the panel.

RMP--WINDOW can be set to TRUE or FALSE to override the default windowing characteristic of the panel.

Additional Usage Notes

- If the value in RMP--PALETTE is 0 or invalid, the panel is displayed using the default palette for the panel.
- Displaying the field/control values with the panel is much faster than displaying the panel, then the fields/controls.

RMP--STATUS Values

Status value	Description
0	The function executed successfully.
5	The panel is not in this library
6	The library does not exist.
11	The palette number is invalid.
14	A COBOL input/output error was encountered on the panel library during execution of this function. To determine the exact nature of the I/O error, use the C \$RERR subprogram.

ENABLE ALL FIELDS

Execution

```
PERFORM RMP--EA-PANELNAME
```

Description

This standard runtime function causes all fields/controls on the panel to be enabled for input.

Required Parameters

None.

Additional Usage Notes

This standard runtime function does not redisplay the fields/controls with their enabled attributes. Use the DISPLAY ALL FIELDS or DISPLAY PANEL standard runtime function after the ENABLE ALL FIELDS standard runtime function to show the change in their status.

RMP--STATUS Values

Status value	Description
0	The function executed successfully.
5	The panel is not in this library
6	The library does not exist.
14	A COBOL input/output error was encountered on the panel library during execution of this function. To determine the exact nature of the I/O error, use the C \$RERR subprogram.

ENABLE FIELD FOR INPUT

Execution

```
PERFORM RMP--EFI-PANELNAME
```

Description

This standard runtime function allows input to a field/control that was specified as not allowing input in the Panel Editor. Many times a certain field/control should be input, or not input, based on the value of another field/control. This standard runtime function allows a field/control to be enabled for input at runtime execution, rather than at panel creation time, increasing the flexibility of the EXECUTE EVENT standard runtime function.

Required Parameters

The application program must set the name of the field/control to be enabled in `RMP--FIELD-NAME`. If the field/control occurs more than once, all occurrences of the field/control are enabled.

Optional Parameters

`RMP--SUPPRESS-EVENT-RESET` can be set to `TRUE` to prevent `RMP--NEXT-FIELD` and `RMP--NEXT-OCCUR` from being reset.

Returned Values

The values of `RMP--NEXT-FIELD` and `RMP--NEXT-OCCUR` are reset, based upon the new input status of the fields/controls on the panel.

Additional Usage Notes

- This standard runtime function resets the next field/control to be entered because generally the standard runtime function is used within an event loop and the new input status of the field/control should take effect immediately.
- An inverse standard runtime function, `DISABLE FIELD FOR INPUT`, is also available.
-

RMP--STATUS Values

Status value	Description
0	The function executed successfully.
1	The field/control name is invalid.

Status value	Description
5	The panel is not in this library
6	The library does not exist.
14	A COBOL input/output error was encountered on the panel library during execution of this function. To determine the exact nature of the I/O error, use the C \$RERR subprogram.

ENABLE MENU OPTION

Execution

```
PERFORM RMP--EMO-PANELNAME
```

Description

This standard runtime function enables a command on a pulldown menu. It does not apply to menu titles. The command appears with the normal attribute and the user is able to select it.

Required Parameters

The application program must be set to the name of the menu item to be enabled in `RMP--COMMAND-NAME`.

Returned Values

None.

Additional Usage Notes

- The next time the command is displayed, it is shown with the enabled attribute.
- An inverse standard runtime function, `DISABLE MENU OPTION`, is also available.

RMP--STATUS Values

Status value	Description
0	The function executed successfully.
5	The panel is not in this library
6	The library does not exist.
14	A COBOL input/output error was encountered on the panel library during execution of this function. To determine the exact nature of the I/O error, use the C \$RERR subprogram.
20	The menu command name is invalid.

EXECUTE EVENT

Execution

```
PERFORM RMP--EE-PANELNAME
```

Description

This standard runtime function performs the entry of a single panel field/control, but when placed in an event loop it allows entry of all fields/controls on the panel. Use the EXECUTE EVENT standard runtime function as the standard method of allowing user input with RM/Panels. It provides the power of multiple field entry with the flexibility of field-by-field control. Use a related standard runtime function, ACCEPT FIELD when only one field/control is to be entered.

Required Parameters

There are three ways to specify which field/control receives input focus on each execution of the EXECUTE EVENT standard runtime function:

1. If you want to begin entry on the first field/control of the panel, `RMP--FIRST-FIELD` must be set to `TRUE`.
2. If you want to specify the next input field/control, `RMP--NEXT-FIELD` must be set to the field/control name, and `RMP--NEXT-OCCUR` must be set to the field/control occurrence number. The RM/Panels runtime system resets these parameters after each execution of the EXECUTE EVENT standard runtime function, thereby preparing for the next execution.
3. If you want to resume entry on the last field/control of the panel that the user entered, `RMP--REPEAT-EVENT` must be set to `TRUE`. This is useful if multiple panels are in use and the user is returning to a previously accessed panel, or if invalid user input is detected.

Returned Values

The value entered for each field/control in the panel is stored within `panelname.WS`. The field termination code indicating the terminating key is returned in `RMP--EXCEPTION- NUMBER`.

The values of `RMP--LAST-FIELD`, `RMP--LAST-OCCUR`, `RMP--NEXT-FIELD`, and `RMP--NEXT-OCCUR` are also set to the appropriate values for the next event. Occurrence numbers are equivalent to COBOL subscripts and begin at 1.

Under modeless operation, the following parameters are also returned:

- `RMP--LAST-PANEL` contains the name of the panel for which the last EXECUTE EVENT standard runtime function was performed.
- `RMP--REQUESTED-PANEL` contains the name of the panel that the user requested for the next event. To support modeless behavior, the application program must be written so that the next EXECUTE EVENT standard runtime function is performed for the panel named by this parameter.

Additional Usage Notes

- Before this standard runtime function can be executed, the panel must be displayed.
- User Input Errors. If validation is specified for the field/control and an error is detected, the behavior of RM/Panels depends on the way in which user input was terminated. If the input was terminated by the auto-exit property or by pressing any of the keys defined in `RMPANELS.WS` as having a special function, the error message is displayed and the user is forced to reenter the field/control. If input was terminated in any other way, control is returned to the application program and `RMP--INVALID-INPUT` is `TRUE`. If you want the error message displayed under these circumstances, you must execute the SHOW FIELD ERROR standard runtime function. This approach differs somewhat from the handling of invalid input during the execution of the ACCEPT FIELD function. During the execution of the EXECUTE EVENT function, RM/Panels assumes that the auto-exit property and any of the keys defined in `RMPANELS.WS` indicate a normal termination of input. The user should not be allowed to proceed if the input is invalid. During the ACCEPT FIELD function, RM/Panels assumes that only the auto-exit property and the Enter key indicate normal termination of input.
- The simplest usage of this standard runtime function is as follows:

```
PERFORM RMP--EE-PANELNAME WITH TEST AFTER UNTIL F3-KEY.
```

This allows the user to operate all enabled panel fields/controls until the F3 key is pressed. The WITH TEST AFTER phrase ensures that the standard runtime function is executed at least once before testing the condition-name F3 KEY, in case the F3 key has just been pressed in another routine.

- The many parameters provided to interpret and control events make it possible to construct sophisticated input routines. The following sample demonstrates one such routine and is followed by an explanation of the numbered areas.

Example

```

1 SET RMP--FIRST-FIELD TO TRUE.
2 PERFORM WITH TEST AFTER UNTIL F3-KEY
3   PERFORM RMP--EE-PANELNAME
4     EVALUATE RMP--LAST-FIELD
5       WHEN "CUSTOMER-NUMBER "
6         PERFORM CUSTOMER-VALIDATION
7         IF CUST-NOT-VALID
8           SET RMP--REPEAT-EVENT TO TRUE
9         END-IF
10        WHEN "CUST-BAL "
11          IF CUST-BAL = 0
12            MOVE "SHIP-CODE" TO RMP--NEXT-FIELD
13          END-IF
14        WHEN "SHIP-CODE "
15          IF SHIP-CODE NOT = OLD-SHIP-CODE
16            PERFORM VALIDATE-SHIP-CODE
17            IF SHIP-CODE-NOT-VALID
18              SET RMP--REPEAT-EVENT TO TRUE
19            END-IF
20          END-IF
21        END-EVALUATE
22        EVALUATE RMP--NEXT-FIELD
23          WHEN "SHIP-CODE "
24            MOVE SHIP-CODE TO OLD-SHIP-CODE
25          END-EVALUATE
26        END-PERFORM.

```

1. Setting RMP--FIRST-FIELD to TRUE tells RM/Panels to begin user input with the first field/control on the panel.
2. This is the loop control, specifying the condition that terminates the event loop.
3. This is the execution of the event, the entry of a field/control. It is done with the EXECUTE EVENT standard runtime function.
4. This is the first of the event tests. The EVALUATE statement is used to determine the field/control on the panel that was just entered by the user.
5. This statement checks to see if the customer number was just entered. If it was entered, a validation routine contained in the application program is performed.
6. Setting RMP--REPEAT-EVENT to TRUE forces the customer number to be reentered as the next event, rather than moving on to the next field/control.
7. This statement checks to see if the customer balance was just entered.
8. Moving SHIP-CODE to RMP--NEXT-FIELD forces the next event to be the entry of the SHIP-CODE field/control, rather than the next field/control on the panel.
9. This statement checks to see whether the SHIP-CODE field/control was just entered. If so, the statement checks to see if the value changed and validates the new value.
10. Setting RMP--REPEAT-EVENT to TRUE forces reentry of the SHIP-CODE field/control.
11. This statement ends the evaluation of the last field/control entered.
12. This statement begins evaluation of the next field/control to be entered.
13. This statement checks to see whether the SHIP-CODE field/control is about to be entered. If so, it saves the current value allowing the operations, described previously in #9, to detect a change in the value.
14. This statement ends the evaluation of the next field/control to be entered.

15. This statement ends one iteration of the loop.

This type of flexibility provides limitless possibilities. For more conceptual information on event loops, see the discussion of *Event Loop Method*.

RMP--STATUS Values

Status value	Description
0	The function executed successfully.
1	The field/control name is invalid.
2	The occurrence number is invalid.
5	The panel is not in this library
6	The library does not exist.
8	The panel does not contain any fields/controls.
9	The panel contains no input fields/controls.
10	The panel is not displayed.
14	A COBOL input/output error was encountered on the panel library during execution of this function. To determine the exact nature of the I/O error, use the C \$RERR subprogram.

INITIALIZE ALL FIELDS

Execution

```
PERFORM RMP--IAF-PANELNAME
```

Description

This standard runtime function initializes all fields/controls to the default values specified in the panel. It is useful because the default value can be modified with the Panel Editor and does not require program changes or recompilation. Use the INITIALIZE ALL FIELDS standard runtime function as the primary method to initialize fields/controls.

Use a related standard runtime function, INITIALIZE FIELD when only one field/control is to be initialized.

Required Parameters

None.

Returned Values

The default value for each field/control in the panel is stored within *panelname*.WS.

Additional Usage Notes

- The panel does not need to be displayed before initializing all fields/controls.
- This standard runtime function is similar to the CLEAR ALL FIELDS standard runtime function which inserts spaces in all alphanumeric fields/controls and zeros in all numeric and date fields/controls on the panel.
- This standard runtime function does not display the fields/controls on the screen.

RMP--STATUS Values

Status value	Description
0	The function executed successfully.
5	The panel is not in this library
6	The library does not exist.
14	A COBOL input/output error was encountered on the panel library during execution of this function. To determine the exact nature of the I/O error, use the C \$RERR subprogram.

INITIALIZE FIELD

Execution

```
PERFORM RMP--IF-PANELNAME
```

Description

This standard runtime function initializes a single field/control or field/control occurrence to the default value specified in the panel. It is useful because the default value can be modified with the Panel Editor and does not require program changes or recompilation.

Note This standard runtime function is not the preferred method of initializing fields in RM/Panels. Use the INITIALIZE ALL FIELDS standard runtime function as the primary method to initialize fields/controls. Use INITIALIZE FIELD when only one field/control is to be initialized.

Required Parameters

The program must set the name of the field/control to be entered in `RMP--FIELD-NAME`. If the field/control occurs more than once, the occurrence number must be specified in `RMP--FIELD-OCCUR`. The occurrence numbers are equivalent to COBOL subscripts and begin at 1.

Returned Values

The default value for each field/control in the panel is stored within `panelname.WS`.

Additional Usage Notes

- The panel does not need to be displayed before initializing a field/control.
- This standard runtime function does not display the field/control on the screen.

RMP--STATUS Values

Status value	Description
0	The function executed successfully.
1	The field/control name is invalid.
2	The occurrence number is invalid.
5	The panel is not in this library
6	The library does not exist.
14	A COBOL input/output error was encountered on the panel library during execution of this function. To

Status value	Description
	determine the exact nature of the I/O error, use the C \$RERR subprogram.

POPUP MENU

Execution

```
PERFORM RMP--PUM-PANELNAME
```

Description

This standard runtime function displays or “pops up” one of the pulldown menus as an isolated menu, that is, without the menu bar. The popup menu looks and works just like the pulldown menu, including enabled, disabled, and checked options, accelerators, and mnemonics. Commands are chosen in the same way as from the pulldown menu.

The popup menu is modal. You must make a choice or cancel the menu with the pulldown menu Cancel button or by clicking the mouse outside the border of the menu. If a command is not selected, none of the event type conditions reported in `RMPANELS.WS` is set. The popup menu does not affect the setting of `RMP--LAST-FIELD`, `RMP--NEXT-FIELD`, or any of the other event parameters.

Required Parameters

`RMP--COMMAND-NAME` must be set to the name of one of the commands on the pulldown menu for this panel.

Optional Parameters

`RMP--PANEL-LINE` can be set as follows:

Value	Description
0	Display the pop-up menu on the same line on which it would be displayed if selected from the pulldown menu
999	Center the pop-up menu vertically on the screen

Any other value indicates a specific line on which the pop-up menu should be displayed.

`RMP--PANEL-POS` may be set as follows:

Value	Description
0	Display the pop-up menu on the same column on which it would be displayed if selected from the pulldown menu
999	Center the pop-up menu horizontally on the screen

Any other value indicates a specific column on which the pop-up menu should be displayed.

Additional Usage Notes

- This standard runtime function is only valid for panels that have a pulldown menu.
- The menu, which is to display or “pop up”, is identified by a command name rather than a menu title because the command name is language independent and the menu title is not.

RMP--STATUS Values

Status value	Description
0	The function executed successfully.
5	The panel is not in this library
6	The library does not exist.
10	The panel is not displayed.
14	A COBOL input/output error was encountered on the panel library during execution of this function. To determine the exact nature of the I/O error, use the C \$RERR subprogram.
16	A window error has occurred.
20	The menu command name is invalid.
22	There is no pulldown menu on this panel.

REMOVE PANEL

Execution

```
PERFORM RMP--RP-PANELNAME
```

Description

This standard runtime function removes a panel from the screen. If the panel was displayed with the default windowing option, the original contents of the screen are restored; otherwise, the area of the screen occupied by the panel is cleared and the color of that area is set to the attribute set represented by the A attribute code for the panel.

Required Parameters

None.

Optional Parameters

RMP--CLEAR can be set to TRUE to clear the entire screen and set the screen color to the attribute set represented by the A attribute code for the panel.

Additional Usage Notes

Before this standard runtime function can be executed, the panel must be displayed.

RMP--STATUS Values

Status value	Description
0	The function executed successfully.
6	The library does not exist.
10	The panel is not displayed.
14	A COBOL input/output error was encountered on the panel library during execution of this function. To determine the exact nature of the I/O error, use the C \$RERR subprogram.

SET FIELD ATTRIBUTE

Execution

```
PERFORM RMP--SFA-PANELNAME
```

Description

This standard runtime function alters the enabled attribute code assigned to a field/control through the Panel Editor. The attribute value remains altered until the panel is removed. This standard runtime function allows a field/control to be displayed with different attributes based on its value or other runtime system conditions.

Required Parameters

The program must set the name of the field/control to be changed in `RMP--FIELD-NAME`. If the field/control occurs more than once, the occurrence number must be specified in `RMP--FIELD-OCCUR`. The occurrence numbers are equivalent to COBOL subscripts and begin at 1.

`RMP--ATTRIBUTE` must be set to space or to a value in the range A through P to indicate the new attribute for the field/control. A value of space restores the default attribute value.

Additional Usage Notes

- Before this standard runtime function can be executed, the panel must be displayed.
- This standard runtime function displays the field/control with the new attribute. However, if it is a repeating field/control, it displays only the specified occurrence. Setting `RMP--FIELD-OCCUR` to 0 displays all occurrences of a repeating field/control.

RMP--STATUS Values

Status value	Description
0	The function executed successfully.
1	The field/control name is invalid.
2	The occurrence number is invalid.
4	The attribute is invalid.
5	The panel is not in this library
6	The library does not exist.
10	The panel is not displayed.
14	A COBOL input/output error was encountered on the panel library during execution of this function. To determine the exact nature of the I/O error, use the C \$RERR subprogram.

SET SCROLL BAR RANGE

Execution

```
PERFORM RMP--SSR-PANELNAME
```

Description

This standard runtime function changes the minimum, maximum, step, and page values for a scroll bar. In some instances, these values are unknown until the RM/Panels runtime system and this function can be used to reset them.

Required Parameters

The application program must set the name of the scroll bar in `RMP--FIELD-NAME`.

`RMP--SB-MIN` must be set to the new minimum value. `RMP--SB-MAX` must be set to the new maximum value.

Optional Parameters

`RMP--SB-STEP` may be set to the new step value or zero to keep the current value. `RMP--SB-PAGE` may be set to the new page value or zero to keep the current value.

Additional Usage Notes

- This standard runtime function always sets the minimum and maximum value for a scroll bar.
- If `RMP--SB-STEP` is set to 0, the step value is not changed. If `RMP--SB-STEP` is set to any non-zero value, that value becomes the new step value.
- If `RMP--SB-PAGE` is set to 0, the page value will not be changed. If `RMP--SB-PAGE` is set to any non-zero value, that value will become the new page value.
- The scroll bar thumb needs special consideration when resetting the scroll bar range. To avoid the possibility of having two scroll bar thumbs displayed simultaneously, always do the following before using this standard runtime function.
 - Set the scroll bar value to the minimum.
 - Display the scroll bar with the `DISPLAY FIELD` standard runtime function.

RMP--STATUS Values

Status value	Description
0	The function executed successfully.
1	The field/control name is invalid.
5	The panel is not in this library
6	The library does not exist.
14	A COBOL input/output error was encountered on the panel library during execution of this function. To determine the exact nature of the I/O error, use the C \$RERR subprogram.

SHOW FIELD ERROR

Execution

```
PERFORM RMP--SFE-PANELNAME
```

Description

This standard runtime function displays the error message, if any, that you have defined for a field/control. It complements the `ACCEPT FIELD`, `EXECUTE EVENT`, `VALIDATE ALL FIELDS`, and `VALIDATE FIELD` standard runtime functions by allowing the application program to display the error message under circumstances that prevent RM/Panels from displaying it automatically.

`SHOW FIELD ERROR` displays the message, waits for the user to press any key, erases the message, and then returns control to the application program.

Required Parameters

The application program must set the name of the field/control for which the error message is to be displayed in `RMP--FIELD-NAME`. No occurrence number is required, even for fields/controls with multiple occurrences, as the error message applies to each occurrence.

RMP--STATUS Values

Status value	Description
0	The function executed successfully.
1	The field/control name is invalid.
5	The panel is not in this library
6	The library does not exist.
14	A COBOL input/output error was encountered on the panel library during execution of this function. To determine the exact nature of the I/O error, use the C \$RERR subprogram.

SHOW FIELD HELP

Execution

```
PERFORM RMP--SFH-PANELNAME
```

Description

This standard runtime function displays the help message, if any, that you defined for a field/control. It allows you to display, rather than re-create, existing help messages in situations other than those involving user input. (Help messages are displayed automatically when the Help key is pressed during user input.)

SHOW FIELD HELP displays the message, waits for the operator to press any key, erases the message, and then returns control to the application program.

Required Parameters

The application program must set the name of the field/control for which the help message is to be displayed in `RMP--FIELD-NAME`. No occurrence number is required, even for fields/controls with multiple occurrences, as the help message applies to each occurrence.

RMP--STATUS Values

Status value	Description
0	The function executed successfully.
1	The field/control name is invalid.
5	The panel is not in this library
6	The library does not exist.
12	Help message is not defined.
14	A COBOL input/output error was encountered on the panel library during execution of this function. To determine the exact nature of the I/O error, use the C \$RERR subprogram.

SHOW PANEL ERROR

Execution

```
PERFORM RMP--SPE-PANELNAME
```

Description

This standard runtime function displays the error message, if any, that you defined for a panel. It complements the ACCEPT FIELD, EXECUTE EVENT, VALIDATE ALL FIELDS, and VALIDATE FIELD standard runtime functions by allowing the application program to display the existing error message in situations other than those involving user input. (RM/Panels automatically displays error messages during user input.)

SHOW PANEL ERROR displays the message, waits for the operator to press any key, erases the message, and then returns control to the application program.

Required Parameters

None.

RMP--STATUS Values

Status value	Description
0	The function executed successfully.
5	The panel is not in this library
6	The library does not exist.
13	Error message is not defined.
14	A COBOL input/output error was encountered on the panel library during execution of this function. To determine the exact nature of the I/O error, use the C \$RERR subprogram.

SHOW PANEL HELP

Execution

```
PERFORM RMP--SPH-PANELNAME
```

Description

This standard runtime function displays the help message, if any, that you defined for a panel. It allows you to display, rather than re-create, existing help messages in situations other than those involving user input. (Help messages are displayed automatically when the Help key is pressed during user input.)

SHOW PANEL HELP displays the message, waits for the operator to press any key, erases the message, and then returns control to the application program.

Required Parameters

None.

RMP--STATUS Values

Status value	Description
0	The function executed successfully.
5	The panel is not in this library
6	The library does not exist.
12	Help message is not defined.
14	A COBOL input/output error was encountered on the panel library during execution of this function. To determine the exact nature of the I/O error, use the C \$RERR subprogram.

UNCHECK MENU OPTION

Execution

```
PERFORM RMP--UMO-PANELNAME
```

Description

This standard runtime function removes a check from a pulldown menu command when it is displayed.

Required Parameters

The application program must be set to the name of the menu command to be unchecked in RMP--COMMAND-NAME.

Returned Values

None.

Additional Usage Notes

- This standard runtime function is valid only for pulldown menu commands that can be, and are currently, checked.
- An inverse standard runtime function, CHECK MENU OPTION, is also available.

RMP--STATUS Values

Status value	Description
0	The function executed successfully.
5	The panel is not in this library
6	The library does not exist.
14	A COBOL input/output error was encountered on the panel library during execution of this function. To determine the exact nature of the I/O error, use the C \$RERR subprogram.
20	The menu command name is invalid.

VALIDATE ALL FIELDS

Execution

```
PERFORM RMP--VAF-PANELNAME
```

Description

This standard runtime function validates values of all fields/controls on the panel. This is the same validation RM/Panels performs when a user enters a value into a field/control. VALIDATE ALL FIELDS provides a way to validate the values of fields/controls that the user has not yet entered or fields/controls that acquired values from some means other than user input.

VALIDATE ALL FIELDS validates each field/control in sequence of entry order until all fields/controls have been validated or an invalid field/control is found. If an invalid field/control is found, its name and occurrence number are reported to the application program. The application program determines what action to take next, either displaying an error message or reentering the field/control.

Required Parameters

None.

Returned Values

If no fields/controls are found to be invalid, RMP--VALID-INPUT is TRUE. If an invalid field/control is found, RMP--INVALID-INPUT is TRUE; RMP--FIELD-NAME is set to the name of the field/control; and RMP--FIELD-OCCUR is set to the field/control occurrence. Occurrence numbers are equivalent to COBOL subscripts and begin at 1.

Additional Usage Notes

This standard runtime function provides the ability to validate all panel fields/controls when the user has completed input. It is especially useful to detect required fields/controls that have not been entered.

RMP--STATUS Values

Status value	Description
0	The function executed successfully.
5	The panel is not in this library
6	The library does not exist.
14	A COBOL input/output error was encountered on the panel library during execution of this function. To determine the exact nature of the I/O error, use the C \$RERR subprogram.

VALIDATE FIELD

Execution

```
PERFORM RMP--VF-PANELNAME
```

Description

This standard runtime function performs any validations you defined for the named panel field/control. It does not display any error message for the field/control, but simply reports the validity of the field/control data to the application program through RMP--VALID-INPUT.

Note This standard runtime function is not the preferred method of validating fields/controls in RM/Panels. Use the VALIDATE ALL FIELDS standard runtime function as the primary method to validate fields/controls. Use VALIDATE FIELD when only one field/control is to be validated.

Required Parameters

The application program must set the name of the field/control to be validated in RMP-- FIELD-NAME. If the field/control occurs more than once, the occurrence number must be specified in RMP--FIELD-OCCUR. The occurrence numbers are equivalent to COBOL subscripts and begin at 1.

Returned Values

If the field/control data is valid, RMP--VALID-INPUT is TRUE; otherwise RMP--INVALID-INPUT is TRUE.

Additional Usage Notes

This standard runtime function is not commonly used since field/control validation is performed whenever a panel field/control is input.

RMP--STATUS Values

Status value	Description
0	The function executed successfully.
1	The field/control name is invalid.
2	The occurrence number is invalid.
5	The panel is not in this library
6	The library does not exist.
14	A COBOL input/output error was encountered on the panel library during execution of this function. To determine the exact nature of the I/O error, use the C \$RERR subprogram.

Utility Functions

The RM/Panels utility functions are provided to allow you to control the overall behavior of the RM/Panels runtime system, rather than manipulate individual panels. Unlike the RM/Panels standard runtime functions described previously, the utility functions are not related to individual panels, are not generated into the panelname.PRC files, and do not require a panel work area parameter. These functions are included in your program through CALL statements.

The following table gives the name and abbreviation of each RM/Panels utility function.

Function	Abbreviation
DELETE TEMPORARY FILE	DTF
END MODELESS OPERATION	EMD
END POLLING	EP
HIDE MOUSE CURSOR	HMC
SET COLOR	SCO
SET MONOCHROME	SMO
SHOW MOUSE CURSOR	SMC

Function	Abbreviation
START MODELESS OPERATION	SMD
START POLLING	SP

Each utility function is described in the following sections. All parameters for RM/Panels utility functions are defined in *Appendix B, Standard, Utility, and Extended Runtime Functions and Parameters*.

DELETE TEMPORARY FILE

Execution

```
CALL RMP--RUNTIME USING RMP--U-DTF RMP--PARAMETERS
```

Description

This utility function removes the temporary file that may have been created by the RM/Panels runtime system.

If dynamic changes are made to a panel during execution of an application, RM/Panels may create a temporary file to store the altered panel information. This file may also be created if modeless operation is used. The temporary file should be deleted before exiting from COBOL back to the operating system to prevent wasted disk space.

This utility function should not be performed when a CALLED program is exited, but when the COBOL run unit itself is about to be terminated.



Note: It is recommended to always perform this utility function before terminating a COBOL run unit that uses RM/Panels. If no temporary file has been created, the utility function does not perform any action.

END MODELESS OPERATION

Execution

```
CALL RMP--RUNTIME USING RMP--U-EMD RMP--PARAMETERS
```

Description

This utility function tells the RM/Panels runtime system to end modeless operation, which was started with the START MODELESS OPERATION utility function.

END POLLING

Execution

```
CALL RMP--RUNTIME USING RMP--U-EP RMP--PARAMETERS
```

Description

This utility function instructs the RM/Panels runtime system to end the polling process, which was started with the START POLLING utility function.

HIDE MOUSE CURSOR

Execution

```
CALL RMP--RUNTIME USING RMP--U-HMC RMP--PARAMETERS
```


Description

This utility function removes the mouse cursor from the monitor.

When RM/Panels opens a panel library, it checks for the presence of a mouse. If a mouse is found, the mouse cursor is displayed. The mouse cursor remains visible until you remove it. You may wish to hide the mouse cursor temporarily while performing some lengthy process, or you may wish to hide it while executing a portion of the application that does not support the mouse. While the mouse cursor is hidden, RM/Panels disregards any mouse events.

If your application does not wish to support the mouse at all, simply do not include `rmpmouse.exe` with your application. If this file is not present, RM/Panels does not recognize the mouse.

Before exiting from COBOL back to the operating system, you should perform this utility function to hide the mouse cursor. If you fail to do this, the mouse cursor is displayed at the operating system prompt.



Note: Mouse support is not available for UNIX systems. The HIDE MOUSE CURSOR has no effect under Windows.

SET COLOR

Execution

```
CALL RMP--RUNTIME USING RMP--U-SCO RMP--PARAMETERS
```

Description

This utility function instructs the RM/Panels runtime system to perform all subsequent screen output with color specifications.

This utility function does not automatically redisplay any information that is on the monitor. After executing this function, the application program should redisplay any information it wants to have redisplayed in color.

Use this utility function to cancel the effects of a previous SET MONOCHROME utility function or the setting of `RMP--FORCE-MONO` to TRUE in `RMPANELS.WS`. However, if `RMP--FORCE-MONO` remains TRUE, the runtime system reverts to monochrome output when a different panel library is opened, because `RMP--FORCE-MONO` is checked every time a library is opened. If the SET COLOR function is used to cancel the effects of `RMP--FORCE-MONO`, `RMP--FORCE-MONO` should be set to FALSE.

SET MONOCHROME

Execution

```
CALL RMP--RUNTIME USING RMP--U-SMO RMP--PARAMETERS
```

Description

This utility function instructs the RM/Panels runtime system to perform all subsequent screen output without color specifications.

`RMPANELS.WS` contains a parameter that can be set to force monochrome operation (`RMP--FORCE-MONO`), but this parameter is only checked when a panel library is opened. This utility function allows the application program to change to monochrome operation at any time.

This utility function does not automatically redisplay any information that is on the monitor. After executing this utility function, the application program should redisplay any information it wants to have redisplayed in monochrome.

SHOW MOUSE CURSOR

Execution


```
CALL RMP--RUNTIME USING RMP--U-SMC RMP--PARAMETERS
```

Description

This utility function makes the mouse cursor visible on the monitor.

When RM/Panels opens a panel library, it checks for the presence of a mouse. If a mouse is found, the mouse cursor is displayed. This mouse cursor remains visible until you remove it with the HIDE MOUSE CURSOR utility function. After hiding the mouse cursor, you can use the SHOW MOUSE CURSOR utility function to make the mouse cursor visible again.

When the RM/Panels runtime system opens a panel library, it automatically makes the mouse cursor visible if it recognizes the mouse. The SHOW MOUSE CURSOR utility function is only needed if you hide the mouse cursor and then want to restore it.

 **Note:** Mouse support is not available for UNIX systems. The SHOW MOUSE CURSOR function has no effect under Windows.

START MODELESS OPERATION

Execution

```
CALL RMP--RUNTIME USING RMP--U-SMD RMP--PARAMETERS
```

Description

This utility function instructs the RM/Panels runtime system to begin modeless operation. Modeless behavior differs from modal behavior, which is the default.

In modal operation, a panel is displayed, information is entered on that and only that panel, then the panel is removed or possibly overlaid by another panel. In modal operation, the topmost panel is the only panel that can be accessed.


However, in modeless operation, the user can choose between a number of displayed panels. The chosen panel is displayed again on top of the other panels, and the user can work with that panel.

By default, RM/Panels works in a modal state. When an EXECUTE EVENT standard runtime function is performed, RM/Panels recognizes only events for the panel for which the function was performed. In a modeless state, RM/Panels recognizes a mouse click on any displayed panel as a request to access that panel, informs the application program which panel was chosen, and if the application program allows it, redisplay that panel on top of the others.

This process does not complicate RM/Panels programming nearly as much as you might think. It really just requires that a check be added to the event loop to see which panel was requested.

The following limitations apply to modeless behavior:

- This utility function should be executed before any panels that are to be modeless are displayed. Any panels already displayed when this utility function is performed will be ignored.
- DISPLAY statements should not be used to place information on panels that will be modeless. The RM/Panels runtime system will be automatically redisplaying these panels and you will not get an opportunity to display your information.
- There is a limit of 2000 bytes of data for each panel that will be used in modeless operation.

 **Note:** Modeless operation is not supported under Windows.

START POLLING

Execution

```
CALL RMP--RUNTIME USING RMP--U-SP RMP--PARAMETERS
```

Description

This utility function instructs the RM/Panels runtime system to begin a polling process, during which the EXECUTE EVENT standard runtime function will report a polling event to the application program whenever a specified amount of time has elapsed.

At first this might seem similar to the time-out event that is available for fields/controls, but the time-out interval is relative to the time at which the field/control gained keyboard focus. The polling interval is relative to actual clock time.

The polling event is reported only by the EXECUTE EVENT standard runtime function and is subject to limitations. Internal processes of the RM/Panels runtime system are not interrupted to report the event, therefore, the polling event is reported as soon as possible after the polling interval has passed. You should allow for some delay in receiving these events. It would be unwise to count polling intervals to determine total elapsed time, especially when a very short polling period is set, as some could be missed.

Required Parameters

RMP--POLLING-INTERVAL must be set to the polling interval in seconds. The value must be in the range 1-999999.

Appendix A: Master Copy File RMPANELS.WS

RMPANELS.WS is a master copy file that must be copied into the Working-Storage Section of each application program that uses RM/Panels. It contains a parameter block used to pass parameters between the program and the RM/Panels runtime system.

Appendix B lists the contents of RMPANELS.WS and describes each field contained in the file.



Note: The RM/Panels parameter block contained in RMPANELS.WS may also be passed to CALLED programs. This allows changes to the key configuration information to be made in a "high level" program and affect all the programs it calls.

To declare the parameter block in a called program, use RMPANELS.LNK instead of RMPANELS.WS. RMPANELS.WS is a copy of RMPANELS.WS with the value clauses removed (but the 88-level items not removed) so that it compiles cleanly in the Linkage Section. Never use RMPANELS.WS in the Working-Storage Section.

Another strategy can be used to make changes in the RM/Panels parameter block available to all programs. You can use a file called RMPANELS.EXT to declare the RMPANELS parameter block as an external variable in the Working-Storage Section of all programs. (RMPANELS.EXT is identical to RMPANELS.WS, but with a declaration of EXTERNAL.)

You must initialize certain variables when using RMPANELS.EXT before any program calls the RM/Panels runtime system. The initialization needs to be done only once by one program no matter how many programs are involved. The external declaration of the parameter block causes the values to be retained. The following statements initialize the necessary variables.

These statements must be included exactly as shown:

```
MOVE 200 TO RMP--VERSION.  
MOVE X"0102030405060708090A0B0C0D0E0F"  
    TO RMP--FUNCTION-CODES (1:15).  
MOVE X"101112131415161718191A1B1C1D"  
    TO RMP--FUNCTION-CODES (16:14).  
MOVE X"F1F2F3F4F5F6F7F8F9"  
    TO RMP--FUNCTION-CODES (30:9).
```

```

MOVE X"8081828384858687888898A8B8C8D8E8F"
  TO RMP--FUNCTION-CODES (39:16).
MOVE X"909192939495969798999A9B9C9D"
  TO RMP--FUNCTION-CODES (55:14).
MOVE X"A0A1A2A3"
  TO RMP--FUNCTION-CODES (69:4).
MOVE X"B0B1B3B4B7B8B9BA"
  TO RMP--FUNCTION-CODES (73:8).

```

These statements can be tailored to your preferences:

```

MOVE "runpan2" TO RMP--RUNTIME.
MOVE SPACE TO RMP--TEMP-FILE-NAME RMP--TEMP-FILE-DIRECTORY.
SET RMP--DEBUG RMP--PROT-PREVENT-CHAR TO TRUE.
SET RMP--GEN-HELP-SUP RMP--FORCE-MONO TO FALSE.
MOVE "0010000000000000" TO RMP--HELP-KEY-VALUES.
MOVE "0130000000000000" TO RMP--RETURN-KEY-VALUES.
MOVE "0530000000000000" TO RMP--NEXT-FIELD-KEY-VALUES.
MOVE "0520000000000000" TO RMP--PREV-FIELD-KEY-VALUES.
MOVE "0580000000000000" TO RMP--NEXT-GROUP-KEY-VALUES.
MOVE "0560000000000000" TO RMP--PREV-GROUP-KEY-VALUES.
MOVE "0270000000000000" TO RMP--PULLDOWN-KEY-VALUES.

```

Contents of RMPANELS WS

```

01 RMP--PARAMETERS.
  03 RMP--INTERNAL-VALUES.
    05 RMP--VERSION PIC 9(4) VALUE 200.
  03 RMP--CONFIGURATION-PARAMETERS.
    05 RMP--RUNTIME PIC X(80) VALUE "runpan2".
    05 RMP--TEMP-FILE-NAME PIC X(12) VALUE SPACE.
    05 RMP--TEMP-FILE-DIRECTORY PIC X(80) VALUE SPACE.
    05 RMP--DEBUG-SW PIC X VALUE "N".
      88 RMP--DEBUG VALUE "Y" WHEN FALSE "N".
    05 RMP--PROT-CHAR-SW PIC X VALUE "N".
      88 RMP--PROT-ALLOW-CHAR VALUE "Y".
      88 RMP--PROT-PREVENT-CHAR VALUE "N".
    05 RMP--FORCE-MONO-KEY PIC 9(3).
    05 RMP--USER-EDIT-KEY PIC 9(3).
    05 RMP--BACKSPACE-KEY PIC 9(3).
    05 RMP--GEN-HELP-SUP-SW PIC X VALUE "N".
      88 RMP--GEN-HELP-SUP VALUE "Y" WHEN FALSE "N".
    05 RMP--KEY-CONFIGURATION.
      07 RMP--HELP-KEY-VALUES PIC X(15)
        VALUE "0010000000000000".
      07 RMP--RETURN-KEY-VALUES PIC X(15)
        VALUE "0130000000000000".
      07 RMP--NEXT-FIELD-KEY-VALUES PIC X(15)
        VALUE "0530000000000000".
      07 RMP--PREV-FIELD-KEY-VALUES PIC X(15)
        VALUE "0520000000000000".
      07 RMP--NEXT-GROUP-KEY-VALUES PIC X(15)
        VALUE "0580000000000000".
      07 RMP--PREV-GROUP-KEY-VALUES PIC X(15)
        VALUE "0560000000000000".
      07 RMP--PULLDOWN-KEY-VALUES PIC X(15)
        VALUE "0270000000000000".
    03 RMP--GENERAL-FUNCTION-PARAMS.
      05 RMP--LIBRARY PIC X(80).
      05 RMP--FIELD-NAME PIC X(30).
      05 RMP--FIELD-OCCUR PIC 9(4).
      05 RMP--FIELD-SEQ PIC 9(3).
      05 RMP--ATTRIBUTE PIC X.
      05 RMP--PALETTE PIC 99.
      05 RMP--SUPPRESS-EVENT-RESET-SW PIC X VALUE "N".

```

```

    88 RMP--SUPPRESS-EVENT-RESET VALUE "Y" WHEN FALSE "N".
05 RMP--FORCE-MONO-SW PIC X VALUE "N".
    88 RMP--FORCE-MONO VALUE "Y" WHEN FALSE "N".
05 RMP--POLLING-INTERVAL PIC 9(6).
03 RMP--PANEL-DISPLAY-PARAMS.
05 RMP--SHOW-FIELDS-SW PIC X VALUE "N".
    88 RMP--SHOW-FIELDS VALUE "Y" WHEN FALSE "N".
05 RMP--CLEAR-SW PIC X VALUE "N".
    88 RMP--CLEAR VALUE "Y" WHEN FALSE "N".
05 RMP--WINDOW-SW PIC X VALUE SPACE.
    88 RMP--WINDOW VALUE "Y" WHEN FALSE "N".
05 RMP--PANEL-LINE PIC 9(3).
05 RMP--PANEL-POS PIC 9(3).
05 RMP--BEEP-SW PIC X VALUE "N".
    88 RMP--BEEP VALUE "Y" WHEN FALSE "N".
03 RMP--EXECUTE-EVENT-PARAMS.
05 RMP--EE-CONTROL-PARAMS.
    07 RMP--REPEAT-EVENT-SW PIC X VALUE "N".
        88 RMP--REPEAT-EVENT VALUE "Y" WHEN FALSE "N".
    07 RMP--FIRST-FIELD-SW PIC X VALUE "N".
        88 RMP--FIRST-FIELD VALUE "Y" WHEN FALSE "N".
    07 RMP--NEXT-FIELD PIC X(30).
    07 RMP--NEXT-OCCUR PIC 9(3).
    07 RMP--NEXT-CURSOR-POS PIC 9(4).
    07 RMP--NEXT-FIELD-SEQ PIC 9(3).
    07 RMP--SUPPRESS-SELECTION-SW PIC X VALUE "N".
        88 RMP--SUPPRESS-SELECTION VALUE "Y" WHEN FALSE "N".
05 RMP--EE-RETURNED-PARAMS.
    07 RMP--LAST-FIELD PIC X(30).
    07 RMP--LAST-OCCUR PIC 9(3).
    07 RMP--LAST-CURSOR-POS PIC 9(4).
    07 RMP--LAST-FIELD-SEQ PIC 9(3).
    07 RMP--EVENT-TYPE PIC X VALUE SPACE.
        88 RMP--BUTTON-PRESS VALUE "B".
        88 RMP--BOX-CHANGED VALUE "C".
        88 RMP--MENU-COMMAND VALUE "M".
        88 RMP--RADIO-BTN-PRESSED VALUE "R".
        88 RMP--LB-CHOICE-SELECTED VALUE "L".
        88 RMP--SB-MOVED VALUES ARE "S" "D" "d" "U" "u".
        88 RMP--SB-PAGE-UP VALUE "U".
        88 RMP--SB-PAGE-DOWN VALUE "D".
        88 RMP--SB-STEP-UP VALUE "u".
        88 RMP--SB-STEP-DOWN VALUE "d".
        88 RMP--SB-DRAG VALUE "S".
        88 RMP--TIME-OUT-OCCURRED VALUE "T".
        88 RMP--POLLING-OCCURRED VALUE "P".
        88 RMP--PANEL-MOVED VALUE "F".
    07 RMP--DATA-CHANGED-SW PIC X VALUE "N".
        88 RMP--DATA-CHANGED VALUE "Y" WHEN FALSE "N".
    07 RMP--PULLDOWN-PARAMETERS.
        09 RMP--COMMAND-NAME PIC X(30).
        09 RMP--COMMAND-TEXT PIC X(30).
    07 RMP--MOUSE-CLICK-TYPE PIC X VALUE SPACE.
        88 RMP--DOUBLE-CLICK VALUE "D".
        88 RMP--SINGLE-CLICK VALUE "S".
    07 RMP--LAST-PANEL PIC X(20).
    07 RMP--REQUESTED-PANEL PIC X(20).
    07 RMP--PROT-CHAR PIC X.
    07 FILLER PIC X(96).
03 RMP--RETURNED-VALUES.
05 RMP--EXCEPTION-NUMBER PIC 9(3).
    88 F10-KEY VALUE 10.
    88 ESCAPE-KEY VALUE 27.
05 RMP--MOUSE-PRESENT-SW PIC X VALUE SPACE.

```

```

88 RMP--MOUSE-PRESENT VALUE "Y" WHEN FALSE "N".
05 RMP--VALID-INPUT-SW PIC X VALUE SPACE.
88 RMP--VALID-INPUT VALUE "Y".
88 RMP--INVALID-INPUT VALUE "N".
05 RMP--STATUS PIC 9(4) VALUE 0.
88 RMP--VALID-FUNCTION VALUE 0.
88 RMP--FIELD-INVALID VALUE 1.
88 RMP--OCCUR-INVALID VALUE 2.
88 RMP--FUNCTION-INVALID VALUE 3.
88 RMP--ATTRIBUTE-INVALID VALUE 4.
88 RMP--PANEL-INVALID VALUE 5.
88 RMP--LIBRARY-INVALID VALUE 6.
88 RMP--CONFIG-INVALID VALUE 7.
88 RMP--NO-FIELDS VALUE 8.
88 RMP--NO-ENABLED-FIELDS VALUE 9.
88 RMP--PANEL-NOT-DISPLAYED VALUE 10.
88 RMP--PALETTE-INVALID VALUE 11.
88 RMP--NO-HELP-DEFINED VALUE 12.
88 RMP--NO-ERROR-DEFINED VALUE 13.
88 RMP--IO-ERROR VALUE 14.
88 RMP--FIELD-DISABLED VALUE 15.
88 RMP--WINDOW-ERROR VALUE 16.
88 RMP--MENU-COMMAND-INVALID VALUE 20.
88 RMP--MODELESS-DATA-OVERLOAD VALUE 21.
88 RMP--NO-PULLDOWN VALUE 22.
88 RMP--WRONG-FIELD-TYPE VALUE 23.
88 RMP--TOO-MANY-PANELS VALUE 40.
88 RMP--CANNOT-CREATE-TEMP VALUE 41.
88 RMP--CANNOT-OPEN-TEMP VALUE 42.
88 RMP--API-PARAM-MISSING VALUE 1001.
88 RMP--API-MSG-NOT-DEFINED VALUE 1002.
88 RMP--API-PD-OPTION-INVALID VALUE 1003.
88 RMP--API-UNCHECKABLE VALUE 1004.
03 RMP--FUNCTION-CODES.
05 RMP--CAF PIC X VALUE X"01".
05 RMP--CPP PIC X VALUE X"02".
05 RMP--DAF PIC X VALUE X"03".
05 RMP--DF PIC X VALUE X"04".
05 RMP--DFI PIC X VALUE X"05".
05 RMP--DP PIC X VALUE X"06".
05 RMP--EE PIC X VALUE X"07".
05 RMP--EFI PIC X VALUE X"08".
05 RMP--IAF PIC X VALUE X"09".
05 RMP--IF PIC X VALUE X"0A".
05 RMP--RP PIC X VALUE X"0B".
05 RMP--SFA PIC X VALUE X"0C".
05 RMP--SFE PIC X VALUE X"0D".
05 RMP--SFH PIC X VALUE X"0E".
05 RMP--SPE PIC X VALUE X"0F".
05 RMP--SPH PIC X VALUE X"10".
05 RMP--VAF PIC X VALUE X"11".
05 RMP--VF PIC X VALUE X"12".
05 RMP--SSR PIC X VALUE X"13".
05 RMP--EMO PIC X VALUE X"14".
05 RMP--DMO PIC X VALUE X"15".
05 RMP--CMO PIC X VALUE X"16".
05 RMP--UMO PIC X VALUE X"17".
05 RMP--EA PIC X VALUE X"18".
05 RMP--DA PIC X VALUE X"19".
05 RMP--AF PIC X VALUE X"1A".
05 RMP--PUM PIC X VALUE X"1B".
05 FILLER PIC X(2).
05 RMP--U-SMC PIC X VALUE X"F1".
05 RMP--U-HMC PIC X VALUE X"F2".

```

```

05 RMP--U-SMD PIC X VALUE X"F3" .
05 RMP--U-EMD PIC X VALUE X"F4" .
05 RMP--U-DTF PIC X VALUE X"F5" .
05 RMP--U-SMO PIC X VALUE X"F6" .
05 RMP--U-SCO PIC X VALUE X"F7" .
05 RMP--U-SP PIC X VALUE X"F8" .
05 RMP--U-EP PIC X VALUE X"F9" .
05 RMP--E-CL PIC X VALUE X"80" .
05 RMP--E-AL PIC X VALUE X"81" .
05 RMP--E-CP PIC X VALUE X"82" .
05 RMP--E-AP PIC X VALUE X"83" .
05 RMP--E-SPL PIC X VALUE X"84" .
05 RMP--E-GPL PIC X VALUE X"85" .
05 RMP--E-GPC PIC X VALUE X"86" .
05 RMP--E-SPC PIC X VALUE X"87" .
05 RMP--E-GFD PIC X VALUE X"88" .
05 RMP--E-AFD PIC X VALUE X"89" .
05 RMP--E-CFD PIC X VALUE X"8A" .
05 RMP--E-GFV PIC X VALUE X"8B" .
05 RMP--E-SFV PIC X VALUE X"8C" .
05 RMP--E-GPT PIC X VALUE X"8D" .
05 RMP--E-SPT PIC X VALUE X"8E" .
05 RMP--E-GPD PIC X VALUE X"8F" .
05 RMP--E-SPD PIC X VALUE X"90" .
05 RMP--E-GMS PIC X VALUE X"91" .
05 RMP--E-SMS PIC X VALUE X"92" .
05 RMP--E-SHM PIC X VALUE X"93" .
05 RMP--E-SPLT PIC X VALUE X"94" .
05 RMP--E-GPLT PIC X VALUE X"95" .
05 RMP--E-SLC PIC X VALUE X"96" .
05 RMP--E-GLC PIC X VALUE X"97" .
05 FILLER PIC X(6) .
05 RMP--E-GFN PIC X VALUE X"A0" .
05 FILLER PIC X(3) .
05 RMP--E-SP PIC X VALUE X"B0" .
05 RMP--E-DC PIC X VALUE X"B1" .
05 RMP--E-DFD PIC X VALUE X"B3" .
05 RMP--E-HDP PIC X VALUE X"B4" .
05 RMP--E-RMO PIC X VALUE X"B7" .
05 FILLER PIC X(2) .
05 RMP--E-UDP PIC X VALUE X"BA" .
03 RMP--SCROLL-BAR-WS .
    05 RMP--SB-MIN PIC 9(4) .
    05 RMP--SB-MAX PIC 9(4) .
    05 RMP--SB-STEP PIC 9(4) .
    05 RMP--SB-PAGE PIC 9(4) .
    05 RMP--SB-OPERATED PIC X(30) .
03 FILLER PIC X(50) .

```

RMPANELS WS Field Definitions

```
01 RMP--PARAMETERS .
```

This is the group-level name used to reference the entire parameter block.

```
03 RMP--INTERNAL-VALUES .
```

This area contains values that are used solely by RM/Panels.

```
05 RMP--VERSIONPIC 9(4) VALUE 210 .
```

This field allows future versions of the RM/Panels runtime system to provide backward compatibility with the current version.

```
03 RMP--CONFIGURATION-PARAMETERS .
```

This area contains values that configure the behavior of the RM/Panels runtime system.

```
05 RMP--RUNTIMEPIC X(80) VALUE "runpan2".
```

This area contains the name of the RM/Panels runtime system program. The value clause contains the default value. This default can be changed by individual programs at runtime execution, or can be modified in `RMPANELS.WS` before programs are compiled.

```
05 RMP--TEMP-FILE-NAMEPIC X(12) VALUE SPACE.
```

If dynamic changes are made to a panel, a temporary file may be created by the RM/Panels runtime system to store these changes. RM/Panels generates a filename if this field is blank, but if you supply a filename here it is used instead. Supplying a filename does not require you to supply a directory in `RMP--TEMP-FILE-DIRECTORY`.

```
05 RMP--TEMP-FILE-DIRECTORYPIC X(80) VALUE SPACE.
```

If dynamic changes are made to a panel, a temporary file may be created by the RM/Panels runtime system to store these changes. RM/Panels places this file in the current working directory if this field is blank, but if you supply a directory name here it is used instead. Supplying a directory name does not require you to supply a filename in `RMP--TEMP-FILE-NAME`.

```
05 RMP--DEBUG-SWPIC X VALUE "N".  
88 RMP--DEBUG VALUE "Y" WHEN FALSE "N".
```

This parameter can be used to enable the RM/Panels debugging mode. In this mode, extensive information is presented on the screen whenever an invalid standard runtime function request is made. The debugging mode should be used during program development. The parameter is set by the following statement:

```
SET RMP--DEBUG TO TRUE.  
05 RMP--PROT-CHAR-SWPIC X VALUE "N".  
88 RMP--PROT-ALLOW-CHAR VALUE "Y".  
88 RMP--PROT-PREVENT-CHAR VALUE "N".
```

This parameter is used to control the type of keyboard action that returns control to the application program when a protected field/control is being entered. If `RMP--PROT-ALLOW-CHAR` is `TRUE`, a normal character key returns control to the application program in addition to exception keys. If `RMP--PROT-PREVENT-CHAR` is `TRUE`, only exception keys return control to the application program when a protected field/control is being entered. The parameter is set by the following statement:

```
SET RMP--PROT-ALLOW-CHAR TO TRUE.  
05 RMP--FORCE-MONO-KEYPIC 9(3).
```

This parameter is used to indicate a field termination code that toggles between color and monochrome on the monitor, regardless of the type of video adapter or terminal being used. The parameter is set by the following statement:

```
MOVE 94 TO RMP--FORCE-MONO-KEY.
```

or by adding a value clause:

```
05 RMP--BACKSPACE-KEYPIC 9(3) VALUE 75.  
05 RMP--USER-EDIT-KEYPIC 9(3).
```

This parameter is used to indicate a field termination code that starts the End-User Panel Editor. The parameter is set by the following statement:

```
MOVE 95 TO RMP--USER-EDIT-KEY.
```

or by adding a value clause:

```
05 RMP--BACKSPACE-KEYPIC 9(3) VALUE 75.  
05 RMP--BACKSPACE-KEYPIC 9(3).
```

This parameter is used to indicate the field termination code that is generated by the Backspace key. The parameter is set by the following statement:

```
MOVE 75 TO RMP--BACKSPACE-KEY.
```


or by adding a value clause:

```
05 RMP--BACKSPACE-KEYPIC 9(3) VALUE 75 .
05 RMP--GEN-HELP-SUP-SWPIC X VALUE "N" .
   88 RMP--GEN-HELP-SUP VALUE "Y" WHEN FALSE "N" .
```

This parameter is used to suppress the ability to display the panel help message when a field/control-specific help message is displayed. This parameter is set by the following statement:

```
SET RMP--GEN-HELP-SUP TO TRUE .
05 RMP--KEY-CONFIGURATION .
```

This area contains values that identify specific keys to the RM/Panels runtime system. These keys control RM/Panels behavior, such as displaying help messages, or moving to the previous field/control. Default values are included, but these can be changed by individual programs at runtime execution, or modified in RMPANELS.WS before programs are compiled.

Each entry relates to a specific type of behavior and contains room for up to five keys that RM/Panels recognizes. The values assigned to the entry are three-digit RM/COBOL field termination codes.

The order of the values is not important. When modifying values, be careful to use three-digit values and do not add spaces. For example:

The help function in the default configuration is assigned to the F1 key.

The F1 key is field termination code 1, so the default configuration is:

```
07 RMP--HELP-KEY-VALUES PIC X(15) VALUE "001000000000000" .
```

If you want the F3 key (field termination code 3) and the F9 key (field termination code 9) to also function as help keys, you would change the help key configuration to the following:

```
07 RMP--HELP-KEY-VALUES PIC X(15) VALUE "001003009000000" .
07 RMP--HELP-KEY-VALUESPIC X(15) VALUE "001000000000000" .
```

This area specifies the field termination codes that initiate the automatic help messages provided by RM/Panels.

```
07 RMP--RETURN-KEY-VALUESPIC X(15) VALUE "013000000000000" .
```

This area specifies the field termination codes that should be interpreted by RM/Panels as the Enter key.

```
07 RMP--NEXT-FIELD-KEY-VALUES PIC X(15) VALUE "053000000000000" .
```

This area specifies the field termination codes that should be interpreted by RM/Panels as a request to move to the next field/control on the panel.

```
07 RMP--PREV-FIELD-KEY-VALUES PIC X(15) VALUE "052000000000000" .
```

This area specifies the field termination codes that should be interpreted by RM/Panels as a request to move to the previous field/control on the panel.

```
07 RMP--NEXT-GROUP-KEY-VALUES PIC X(15) VALUE "058000000000000" .
```

This area specifies the field termination codes that should be interpreted by RM/Panels as a request to move to the next group on the panel.

```
07 RMP--PREV-GROUP-KEY-VALUES PIC X(15) VALUE "056000000000000" .
```

This area specifies the field termination codes that should be interpreted by RM/Panels as a request to move to the previous group on the panel.

```
07 RMP--PULLDOWN-KEY-VALUESPIC X(15) VALUE "027000000000000" .
```

This area specifies the field termination codes that should be interpreted by RM/Panels as a request to activate a pulldown menu.

```
03 RMP--GENERAL-FUNCTION-PARAMS .
```

This area contains parameters that are used with a number of different standard runtime functions.

```
05 RMP--LIBRARYPIC X(80).
```

This parameter identifies the panel library that contains the panels to be used. It must be set before the first panel is used, and set again whenever a new panel library is needed.

```
05 RMP--FIELD-NAMEPIC X(30).
```

This parameter is used with many standard runtime functions to identify a specific panel field/control.

```
05 RMP--FIELD-OCCURPIC 9(4).
```

This parameter is used with many standard runtime functions to identify a specific occurrence of a panel field/control.

```
05 RMP--FIELD-SEQPIC 9(3).
```

This parameter is used with many standard runtime functions to identify a panel field/control by the order in which it is entered on the panel.

```
05 RMP--ATTRIBUTEPIC X.
```

This parameter is used to specify an attribute value for the SET FIELD ATTRIBUTE standard runtime function.

```
05 RMP--PALETTEPIC 99.
```

This parameter is used to select a palette for the DISPLAY PANEL and CHANGE PANEL PALETTE standard runtime functions.

```
05 RMP--SUPPRESS-EVENT-RESET-SW PIC X VALUE "N".  
88 RMP--SUPPRESS-EVENT-RESET VALUE "Y" WHEN FALSE "N".
```

This parameter is used with the ENABLE/DISABLE FIELD standard runtime function, but it is included here because it controls the EXECUTE EVENT standard runtime function. It prevents RM/Panels from resetting the values of RMP--NEXT-FIELD and RMP--NEXT-OCCUR when a field/control is enabled or disabled.

```
05 RMP--FORCE-MONO-SWPIC X VALUE "N".  
88 RMP--FORCE-MONO VALUE "Y" WHEN FALSE "N".
```

This parameter is used to tell the RM/Panels runtime system to operate in monochrome mode, suppressing all colors. Because this parameter is checked by the runtime system when a library is opened, it must be set before a library is open. Setting RMP--FORCE-MONO to TRUE after opening a library has no effect until a new library is opened. This parameter is set by the following statement:

```
SET RMP--FORCE-MONO TO TRUE.  
05 RMP--POLLING-INTERVALPIC 9(6).
```

This parameter is used by the utility function, START POLLING, to specify a polling interval in seconds.

```
03 RMP--PANEL-DISPLAY-PARAMS.
```

This area contains parameters for the DISPLAY PANEL standard runtime function. RMP--CLEAR-SW is also a parameter for the REMOVE PANEL standard runtime function.

```
05 RMP--SHOW-FIELDS-SWPIC X VALUE "N".  
88 RMP--SHOW-FIELDS VALUE "Y" WHEN FALSE "N".
```

This parameter is used to display the values of panel fields/controls at the same time the panel is displayed. The parameter is set by the following statement:

```
SET RMP--SHOW-FIELDS TO TRUE.  
05 RMP--CLEAR-SWPIC X VALUE "N".  
88 RMP--CLEAR VALUE "Y" WHEN FALSE "N".
```

This parameter is used to erase the entire screen before a panel is displayed, or when a panel is erased. The parameter is set by the following statement:

```
SET RMP--CLEAR TO TRUE.  
05 RMP--WINDOW-SWPIC X VALUE SPACE.  
88 RMP--WINDOW VALUE "Y" WHEN FALSE "N".
```

This parameter is used to override the default windowing characteristic of a panel. To force a panel to display as a window, set the parameter by the following statement:

```
SET RMP--WINDOW TO TRUE.
```

To force a panel to display without behaving as a window, set the parameter by the following statement:

```
SET RMP--WINDOW TO FALSE.  
05 RMP--PANEL-LINEPIC 9(3).
```

This parameter is used to control the screen line at which a panel is displayed. Leaving this value at 0 accepts the default. Setting this parameter to 999 centers the panel vertically. Setting any other value displays the panel at the specified line.

```
05 RMP--PANEL-POSPIC 9(3).
```

This parameter is used to control the screen column at which a panel is displayed. Leaving this value at 0 accepts the default. Setting this parameter to 999 centers the panel horizontally. Setting any other value displays the panel at the specified column.

```
05 RMP--BEEP-SWPIC X VALUE "N".  
88 RMP--BEEP VALUE "Y" WHEN FALSE "N".
```

This parameter is used to generate a beep when a panel is displayed. The parameter is set by the following statement:

```
SET RMP--BEEP TO TRUE.  
03 RMP--EXECUTE-EVENT-PARAMS.
```

These fields are parameters or returned values related to the EXECUTE EVENT standard runtime function.

```
05 RMP--EE-CONTROL-PARAMS.
```

These parameters are used to control the behavior of a single execution of the EXECUTE EVENT standard runtime function.

```
07 RMP--REPEAT-EVENT-SWPIC X VALUE "N".  
88 RMP--REPEAT-EVENT VALUE "Y" WHEN FALSE "N".
```

This parameter is used to force the RM/Panels runtime system to repeat the last event executed on this panel. It is set by the following statement:

```
SET RMP--REPEAT-EVENT TO TRUE.  
07 RMP--FIRST-FIELD-SWPIC X VALUE "N".  
88 RMP--FIRST-FIELD VALUE "Y" WHEN FALSE "N".
```

This parameter is used to force the RM/Panels runtime system to begin user input with the first field/control on the panel. The parameter is set by the following statement:

```
SET RMP--FIRST-FIELD TO TRUE.  
07 RMP--NEXT-FIELDPIC X(30).
```

This parameter is set by the RM/Panels runtime system to indicate the name of the field/control that will be entered next by the user. It may be modified by the application program to force input of a different field/control.

```
07 RMP--NEXT-OCCURPIC 9(3).
```

This parameter is set by the RM/Panels runtime system to indicate the occurrence of the field/control that will be entered next by the user. It may be modified by the application program to force input of a different occurrence.

```
07 RMP--NEXT-CURSOR-POSPIC 9(4).
```

This parameter is automatically set to zero by the RM/Panels runtime system and causes the cursor to move to the start of a field/control. By setting this parameter to a value other than zero, you can control the character position that the cursor initially moves to in a field/control.



Note: This value may be ignored under some graphical user interfaces.

```
07 RMP--NEXT-FIELD-SEQPIC 9(3).
```

This parameter is automatically set to zero by the RM/Panels runtime system and causes the cursor to move to the first enabled field/control. By setting this parameter to a value other than zero, you can control the field/control that is input next by entry order number.

```
07 RMP--SUPPRESS-SELECTION-SWPIC X VALUE "N".
88 RMP--SUPPRESS-SELECTIONVALUE "Y" WHEN FALSE "N".
```

Setting this parameter to TRUE prevents the field/control being input during the next EXECUTE EVENT standard runtime function from being displayed with the selected attribute, even though it has the keyboard focus.

```
05 RMP--EE-RETURNED-PARAMS.
```

The parameters in this area contain values returned by the RM/Panels EXECUTE EVENT standard runtime function.

```
07 RMP--LAST-FIELDPIC X(30).
```

This parameter is used by the RM/Panels runtime system to indicate the name of the field/control that was just entered by the user.

```
07 RMP--LAST-OCCURPIC 9(3).
```

This parameter is used by the RM/Panels runtime system to indicate the occurrence of the field/control that was just entered by the user.

```
07 RMP--LAST-CURSOR-POSPIC 9(4).
```

This parameter is set to the location of the keyboard cursor, relative to the start of the field/control, when input was terminated. It is set only for input type fields/controls.



Note: This value may not be reported under some graphical user interfaces.

```
07 RMP--LAST-FIELD-SEQPIC 9(3).
```

This parameter is set to the entry order number of the field/control that was just entered by the user.

```
07 RMP--EVENT-TYPEPIC X VALUE SPACE.
```

This parameter is set by the RM/Panels runtime system to describe the type of event that just occurred. If none of the following conditions occur, input is terminated “normally”, that is, by auto exit or by pressing a field termination key.

```
88 RMP--BUTTON-PRESS VALUE "B".
```

This condition indicates that a push button was pressed. The name of the push button is contained in RMP--NEXT-FIELD. The condition-name representing the button in *panelname*-WS is also set to TRUE.

```
88 RMP--BOX-CHANGED VALUE "C".
```

This condition indicates that a check box was toggled. The name of the check box is contained in RMP--NEXT-FIELD.

```
88 RMP--MENU-COMMAND VALUE "M".
```

This condition indicates that a pulldown menu command was selected. The name and text of the command are contained in RMP--COMMAND-NAME and RMP--COMMAND-TEXT, respectively.

```
88 RMP--RADIO-BTN-PRESSED VALUE "R".
```

This condition indicates that a radio button was pressed. The name of the radio button is contained in RMP--NEXT-FIELD.

```
88 RMP--LB-CHOICE-SELECTED VALUE "L" .
```

This condition indicates that a list box choice was selected. The name of the list box is contained in RMP--NEXT-FIELD.

```
88 RMP--SB-MOVED VALUES ARE "S" "D" "d" "U" "u" .
```

This condition indicates that a scroll bar's thumb position was changed. The name of the scroll bar is reported in RMP--SB- OPERATED because scroll bars, unlike other fields/controls, do not receive keyboard focus. The following conditions give more detail on how the scroll bar thumb was moved.

```
88 RMP--SB-PAGE-UP VALUE "U" .
```

This condition indicates that a scroll bar's thumb was moved up by clicking above the thumb.

```
88 RMP--SB-PAGE-DOWN VALUE "D" .
```

This condition indicates that a scroll bar's thumb was moved down by clicking below the thumb.

```
88 RMP--SB-STEP-UP VALUE "u" .
```

This condition indicates that a scroll bar's thumb was moved up by clicking on the up arrow.

```
88 RMP--SB-STEP-DOWN VALUE "d" .
```

This condition indicates that a scroll bar's thumb was moved down by clicking on the down arrow.

```
88 RMP--SB-DRAG VALUE "S" .
```

This condition indicates that a scroll bar's thumb was moved by dragging it.

```
88 RMP--TIME-OUT-OCCURRED VALUE "T" .
```

This condition indicates that a "time out" occurred.

```
88 RMP--POLLING-OCCURRED VALUE "P" .
```

This condition indicates that the polling interval established with the START POLLING utility function has elapsed.

```
88 RMP--PANEL-MOVED VALUE "F" .
```

This condition indicates that the user moved the panel and that RM/Panels has repainted the panel and its fields. If you used a DISPLAY statement to place information on the panel, you need to display it again.

```
07 RMP--DATA-CHANGED-SWPIC X VALUE "N" .  
88 RMP--DATA-CHANGED VALUE "Y" WHEN FALSE "N" .
```

This condition indicates that the value of a field/control was changed by the last event. There is no indication of the field/control that was changed, because it is possible to change two fields/controls with one event. When a user types input to an input field/control and then clicks on a check box, both fields/controls change. This parameter allows you to bypass validation routines when no data has been changed on the panel.

```
07 RMP--PULLDOWN-PARAMETERS .
```

These parameters report the name and text of a pull-down menu command when it is selected.

```
09 RMP--COMMAND-NAMEPIC X(30) .
```

This parameter reports the name of a pull-down menu command when it is selected. This name is an internal value that is not displayed to the user. Programs should check this value, rather than the text of the command, to maintain the logical, rather than physical, connection to the user interface.

```
09 RMP--COMMAND-TEXTPIC X(30) .
```

This parameter reports the text of a pulldown menu command when it is selected. Programs are discouraged from checking this value and should instead use RMP--COMMAND-NAME.

```
07 RMP--MOUSE-CLICK-TYPEPIC X VALUE SPACE.
```

This parameter reports the type of mouse click performed on a field/control.

```
88 RMP--DOUBLE-CLICK VALUE "D".
```

This condition indicates that the mouse was double clicked on the field/control. Fields/controls must be configured to allow a double click.

```
88 RMP--SINGLE-CLICK VALUE "S".
```

This condition indicates that the mouse was single clicked on the field/control. All enabled fields/controls allow a single click.

```
07 RMP--LAST-PANELPIC X(20).
```

This parameter reports the name of the panel that was most recently accessed and is useful when implementing modeless behavior.

```
07 RMP--REQUESTED-PANELPIC X(20).
```

This parameter reports the name of an underlying panel that was selected during modeless behavior. This tells the application program the panel that should be used for the next EXECUTE EVENT standard runtime function to allow the panel to be elevated to the top level on the monitor.

```
07 RMP--PROT-CHARPIC X.
```

If a character key is pressed during protected field/control entry and RMP--PROT-ALLOW-CHAR is TRUE, this parameter contains the character that was pressed and RMP--EXCEPTION-NUMBER is 0. If an exception key is pressed, RMP--EXCEPTION-NUMBER contains the field termination code and is set to SPACE.

```
07 FILLERPIC X(96).
```

This area is reserved for future use.

```
03 RMP--RETURNED VALUES.
```

This area contains values that are returned by the RM/Panels runtime system.

```
05 RMP--EXCEPTION-NUMBERPIC 9(3).  
88 F10-KEY VALUE 10.  
88 ESCAPE-KEY VALUE 27.
```

This parameter is used by the RM/Panels runtime system to indicate to the application the key that was used to terminate user input. The value returned is the same value that the ON EXCEPTION clause returns for the key.

Level 88 condition-names are added after this parameter to allow the application program to easily interpret the key pressed. RETURN-KEY and ESCAPE-KEY are just samples that can be renamed, deleted, or added to. The names and values in this area are not important to the standard runtime function of RM/Panels. They are solely for the use of the application program.

```
05 RMP--MOUSE-PRESENT-SWPIC X VALUE SPACE.  
88 RMP--MOUSE-PRESENT VALUE "Y" WHEN FALSE "N".
```

This parameter is set by the RM/Panels runtime system whenever a library is opened. It lets the application program know whether a mouse is present and accessible to RM/Panels.

```
05 RMP--VALID-INPUT-SW PIC X VALUE SPACE.  
88 RMP--VALID-INPUT VALUE "Y".  
88 RMP--INVALID-INPUT VALUE "N".
```

This parameter is used by the RM/Panels runtime system to indicate to the application program whether user input to a field/control satisfied validation rules specified for that field/control in the panel. If the input satisfied the

rules, the value is set to Y. If the input failed to satisfy the rules, the value is set to N.

```
05 RMP--STATUS PIC 9(4) VALUE 0.
   88 RMP--VALID-FUNCTION VALUE 0.
   88 RMP--FIELD-INVALID VALUE 1.
   .
   .
   .
   88 RMP--NO-ERROR-DEFINED VALUE 13.
   88 RMP--IO-ERROR VALUE 14.
   88 RMP--CONTROL-DISABLED VALUE 15.
   88 RMP--WINDOW-ERROR VALUE 16.
   88 RMP--NO-PULLDOWN VALUE 22.
   88 RMP--MENU-COMMAND-INVALID VALUE 20.
   88 RMP--MODELESS-DATA-OVERLOAD VALUE 21.
   88 RMP--NO-PULLDOWN VALUE 22.
   88 RMP--WRONG-FIELD-TYPE VALUE 23.
   88 RMP--TOO-MANY-PANELS VALUE 40.
   88 RMP--CANNOT-CREATE-TEMP VALUE 41.
   88 RMP--CANNOT-OPEN-TEMP VALUE 42.
   88 RMP--API-PARAM-MISSING VALUE 1001.
   88 RMP--API-MSG-NOT-DEFINED VALUE 1002.
   88 RMP--API-PD-OPTION-INVALID VALUE 1003.
   88 RMP--API-UNCHECKABLE VALUE 1004.
```

This parameter is used by the RM/Panels runtime system to report the outcome of the function request. If the function was performed successfully, a value of 0 is returned. If the function was unsuccessful, a non-zero value is returned indicating the reason. The condition-names are provided to make it easier for the application program to detect and interpret unsuccessful function requests.

```
03 RMP--FUNCTION-CODES.
```

These parameters contain the function codes used to identify standard, utility, and extended runtime functions to the RM/Panels runtime system. They should not be modified and the application program should never depend on the value or even the type of the data items. The calls to the RM/Panels runtime system use the data names. If direct calls are used in your application programs, they must always use the data-name and not the actual value.

```
03 RMP--SCROLL-BAR-WS.
```

These parameters contain values specific to scroll bars and their standard runtime functions.

```
05 RMP--SB-MINPIC 9(4).
```

This parameter is used to set a new minimum value for a scroll bar.

```
05 RMP--SB-MAXPIC 9(4).
```

This parameter is used to set a new maximum value for a scroll bar.

```
05 RMP--SB-STEPPIC 9(4).
```

This parameter is used to set a new step value for a scroll bar.

```
05 RMP--SB-PAGEPIC 9(4).
```

This parameter is used to set a new page value for a scroll bar.

```
05 RMP--SB-OPERATEDPIC X(30).
```

This parameter is used to report the name of a scroll bar when its thumb position is altered.

```
03 FILLERPIC X(50).
```

This area reserved for future use.

Appendix B Standard Utility, and Extended Runtime Functions and Parameters

The following types of parameters are used with RM/Panels standard, utility, and extended runtime functions:

- Required parameters
- Optional parameters

Required parameters are those that must be set to valid values in order for a standard, utility, or extended runtime function to execute correctly.

Optional parameters are those that can be set to override the default behavior specified for the panel. Optional parameters are always reset to their default values by the RM/Panels runtime system after the function is executed. This prevents later executions of the standard runtime function from inheriting the overridden behavior.

Extended runtime functions also use additional arguments on the CALL statement.

The following table lists the required and optional parameters for RM/Panels standard runtime functions.

Standard Runtime Function Name	Abbr.	Required Parameters	Optional Parameters
ACCEPT FIELD	AF	RMP--FIELD-NAME RMP--FIELD-OCCUR	NONE
CHANGE PANEL PALETTE	CPP	RMP--PALETTE	NONE
CHECK MENU OPTION	CMO	RMP--COMMAND-NAME	NONE
CLEAR ALL FIELDS	CAF	NONE	NONE
DISABLE ALL FIELDS	DA	NONE	NONE
DISABLE FIELD FOR INPUT	DFI	RMP--FIELD-NAME	RMP--SUPPRESS- EVENT- RESET
DISABLE MENU OPTION	DMO	RMP--COMMAND-NAME	NONE
DISPLAY ALL FIELDS	DAF	NONE	NONE
DISPLAY FIELD	DF	RMP--FIELD-NAME RMP--FIELD-OCCUR	NONE
DISPLAY PANEL	DP	RMP--LIBRARY	RMP--BEEP RMP--CLEAR RMP--PALETTE RMP--PANEL-LINE RMP--PANEL-POS RMP--SHOW-FIELDS RMP--WINDOW
ENABLE ALL FIELDS	EA	NONE	NONE
ENABLE FIELD FOR INPUT	EFI	RMP--FIELD-NAME	RMP--SUPPRESS- EVENT- RESET
ENABLE MENU OPTION	EMO	RMP--COMMAND-NAME	NONE
EXECUTE EVENT	EE	RMP--FIRST-FIELD1 RMP--NEXT-FIELD1 RMP--NEXT-OCCUR1 RMP--REPEAT-EVENT1 You may select one of these parameters to execute the standard runtime function.	NONE

Standard Runtime Function Name	Abbr.	Required Parameters	Optional Parameters
INITIALIZE ALL FIELDS	IAF	NONE	NONE
INITIALIZE FIELD	IF	RMP--FIELD-NAME RMP--FIELD-OCCUR	NONE
POPUP MENU	PUM	RMP--COMMAND-NAME	RMP--PANEL-LINE RMP--PANEL-POS
REMOVE PANEL	RP	NONE	RMP--CLEAR
SET FIELD ATTRIBUTE	SFA	RMP--ATTRIBUTE RMP--FIELD-NAME RMP--FIELD-OCCUR	NONE
SET SCROLL BAR RANGE	SSR	RMP--FIELD-NAME RMP--SB-MAX RMP--SB-MIN	RMP--SB-PAGE RMP--SB-STEP
SHOW FIELD ERROR	SFE	RMP--FIELD-NAME	NONE
SHOW FIELD HELP	SFH	RMP--FIELD-NAME	NONE
SHOW PANEL ERROR	SPE	NONE	NONE
SHOW PANEL HELP	SPH	NONE	NONE
UNCHECK MENU OPTION	UMO	RMP--COMMAND-NAME	NONE
VALIDATE ALL FIELDS	VAF	NONE	NONE
VALIDATE FIELD	VF	RMP--FIELD-NAME RMP--FIELD-OCCUR	NONE

The following table lists the required and optional parameters for RM/Panels utility functions.

Utility Function Name	Abbr.	Required Parameters	Optional Parameters
DELETE TEMPORARY FILE	DTF	NONE	NONE
END MODELESS OPERATION	EMD	NONE	NONE
END POLLING	EP	NONE	NONE
HIDE MOUSE CURSOR	HMC	NONE	NONE
SET COLOR	SCO	NONE	NONE
SET MONOCHROME	SMO	NONE	NONE
SHOW MOUSE CURSOR	SMC	NONE	NONE
START MODELESS OPERATION	SMD	NONE	NONE
START POLLING	SP	RMP--POLLING-INTERNAL	NONE

The following table lists the required parameters and additional arguments for RM/Panels extended runtime functions.

Extended Runtime Function Name	Abbr.	Required Parameters	Additional Arguments
ACTIVATE A LIBRARY	E-AL	NONE	libraryname

Extended Runtime Function Name	Abbr.	Required Parameters	Additional Arguments
ACTIVATE A PANEL	E-AP	NONE	panelname
ADD FIELD DESCRIPTION	E-AFD	NONE	FIELD-DESCRIPTION
CHANGE FIELD DESCRIPTION	E-CFD	RMP--FIELD-NAME	FIELD-DESCRIPTION
CREATE A LIBRARY	E-CL	NONE	libraryname
CREATE A PANEL	E-CP	NONE	panelname
DELETE FIELD DESCRIPTION	E-DFD	RMP--FIELD-NAME	NONE
DISCARD CHANGES	E-DC	NONE	NONE
GET FIELD DESCRIPTION	E-GFD	RMP--FIELD-NAME	FIELD-DESCRIPTION
BY NAME			
GET FIELD DESCRIPTION BY NUMBER	E-GFN	RMP--FIELD-SEQ	FIELD-DESCRIPTION
GET FIELD VALUE	E-GFV	RMP--FIELD-NAME	FIELD-VALUE-DESC
GET LIBRARY CONFIGURATION	E-GLC	NONE	LIBRARY-CONFIG-DESC
GET MESSAGE	E-GMS	NONE	MSG-DESC
GET PALETTE DESCRIPTION	E-GPLT	RMP--PALETTE	PALETTE-DESC
GET PANEL CONFIGURATION	E-GPC	NONE	PANEL-CONFIG-DESC
GET PANEL LINE	E-GPL	NONE	PANEL-LINE-DESC
GET PULLDOWN MENU PULLDOWN OPTIONS	E-GPD	NONE	PULLDOWN-PD-DESC
GET PULLDOWN MENU TOP LEVEL OPTIONS	E-GPT	NONE	PULLDOWN-TITLE-AREA
HIDE PANEL	E-HDP	NONE	NONE
REMOVE MENU OPTION	E-RMO	RMP--COMMAND-NAME	NONE
SAVE A PANEL	E-SP	NONE	NONE
SET FIELD VALUE	E-SFV	RMP--FIELD-NAME	FIELD-VALUE-DESC
SET LIBRARY CONFIGURATION	E-SLC	NONE	LIBRARY-CONFIG-DESC
SET MESSAGE	E-SMS	NONE	MSG-DESC
SET PALETTE DESCRIPTION	E-SPLT	RMP--PALETTE	PALETTE-DESC
SET PANEL CONFIGURATION	E-SPC	NONE	PANEL-CONFIG-DESC
SET PANEL LINE	E-SPL	NONE	PANEL-LINE-DESC
SET PULLDOWN MENU PULLDOWN OPTIONS	E-SPD	NONE	PULLDOWN-PD-DESC
SET PULLDOWN MENU TOP LEVEL OPTIONS	E-SPT	NONE	PULLDOWN-TITLE-AREA
SHOW MESSAGE	E-SHM	NONE	MSG-DESC
UPDATE PANEL	E-UDP		

Compatibility with XML Extensions

XML Extensions has many capabilities. The major features support the ability to import and export XML documents to and from COBOL working storage. Specifically, XML Extensions allows data to be imported from an XML document by converting data elements (as necessary) and storing the results into a matching COBOL data structure. Similarly, data is exported from a COBOL data structure by converting the COBOL data elements (as necessary) and storing the results in an XML document.

For more information about XML Extensions, refer to the *XML Extensions User's Guide*, available from the SupportLine section of the Micro Focus Web site.

For RM/COBOL users that utilize XML Extensions, here is a summary of compatibility issues that you need to be aware of when working in this COBOL system. Refer to this list and the *RM/COBOL Conversion Issues* list in the *Compatibility with RM/COBOL* section

Click a summary title for a fuller explanation and workaround, where possible.

Additional Parameter Required with XML Extensions Processing Statements

In statements that use a Document Pointer parameter, you are also required to pass an additional Document Length parameter.

When using XML Extensions processing statements, each Document Pointer parameter must be immediately followed by a Document Length parameter. This applies to the following statements:

- XML EXPORT TEXT
- XML IMPORT TEXT
- XML TEST WELLFORMED-TEXT
- XML VALIDATE TEXT
- XML GET TEXT
- XML PUT TEXT
- XML TRANSFORM TEXT



Note: XML FREE TEXT does not require that you use the Document Length parameter.

Solution:

Ensure that the Document Length parameter (MY-DOCUMENT-LENGTH) is specified immediately following the Document Pointer parameter (MY-DOCUMENT-POINTER) when calling an XML Extensions processing statement:

When the statement is outputting data, the statement will set MY-DOCUMENT-LENGTH:

```
XML EXPORT TEXT
  MY-DATA-ITEM
  MY-DOCUMENT-POINTER
  MY-DOCUMENT-LENGTH
  "MY-MODEL-FILE" .
IF NOT XML-OK GO TO Z.
```

When the statement is inputting data, you must set MY-DOCUMENT-LENGTH before the statement is processed:

```
XML IMPORT TEXT
  MY-DATA-ITEM
  MY-DOCUMENT-POINTER
  MY-DOCUMENT-LENGTH *> Item size MY-DOCUMENT-POINTER points to.
  "MY-MODEL-FILE" .
IF NOT XML-OK GO TO Z.
```

COBOL programs using BIS

Programs in this COBOL system that are used with the Xcentrity Business Information Server (BIS) must end with the GOBACK statement, not the STOP RUN statement. Also, messages for the BIS trace log must be generated by calling the B\$Trace library program, not the DISPLAY statement.

Programs that are used with the BIS must not use the STOP RUN statement, as this will terminate the MF run-time prematurely and the BIS will be unable to process any further web service requests.

In RM/COBOL, programs that are used with BIS capture the output of a DISPLAY statement and place it in the BIS trace log. In this COBOL system, to place messages in the BIS trace log, use the B\$Trace library routine.

Solutions:

To ensure that programs used with the BIS do not prematurely terminate the MF run-time, use the GOBACK statement in those programs.

To place messages in the BIS trace log, call the B\$Trace library program, using the same identifiers or literals, but not figurative constants, that you would use in a DISPLAY statement.



Note: Numeric data items can be of any data type and are converted to a numeric string by B\$Trace.

```
call "B$Trace" using "Log message: " MyMessage " " MyStatus.
```

Conflicts Between Model File-names and XML Data Files

In this COBOL system, model file-names, as created by the compiler, are of the form *program-name.xml*. You should ensure your XML data files do not share the same name as this, to avoid any conflicts.

In this COBOL system, if the ModelFileName#DataName parameter does not include a hash, it is always treated as a model data-name, and the model file-name is assumed to be *program-name.xml* for the program (or one of its callers) that executed an XML Extensions export or import statement. With this in mind, if you do not explicitly set a model file-name, you should ensure that your XML data files do not share the same name as your COBOL programs when performing import and export XML Extensions statements.

Solution:

To avoid conflicts between model file-names and XML data file-names, do one of the following:

- Ensure you set the DocumentName parameter in your import and export statements to a name other than your COBOL program name.
- If you want to keep your XML data file-names the same as the program-name, rename the model file-name after compilation and specify the new name in the value of the ModelFileDataName parameter before the hash, separating it from the ModelDataName.

When using the second technique, it is recommended that the compilation be done with a script that includes the renaming command, to avoid forgetting this step.

Notes:

In RM/COBOL, you can use the environment variable RM_MISSING_HASH to determine the meaning of the ModelFileDataName parameter when the hash is omitted. In this COBOL system, the environment variable is not supported.

Also, RM/COBOL v12 and later generally did not use model files because the model was embedded in the object program file; this COBOL system is more like RM/COBOL v11 and earlier, which always used model files. Thus, care must be taken to distribute model files with applications that use XML Extensions.

Creating an XML Model File

To create an XML model file for use with XML Extensions, compile your application with the XMLGEN Compiler directive.

For complete information on using the XMLGEN compiler directive, see *XMLGEN*.

See *Restricted data items with XML Extensions* for a workaround to include data descriptions from other Data Division sections of your source code.

Displaying the Status of XML Extensions Statements

In this COBOL system, use the XML-Status-Edited data item to display the status result of an XML Extensions statement execution.

In RM/COBOL, XML-Status, the data item used to display the status result of an XML Extensions statement execution, is defined as Display Usage. In this COBOL system, XML-Status is defined as:

```
03 XML-Status          PIC S9(4) COMP-5.
```

Therefore, an additional declaration is made in *lixmldef.cpy*, so that you can easily use the status result in your code:

```
03 XML-Status-Edited   PIC +9(4).
```

When an XML Extensions statement is executed, the value of XML-Status-Edited is not set, so you need move XML-Status to XML-Status-Edited before you can use the result.

Importing and Exporting Ambiguous Data-names

In RM/COBOL, if you attempt to export an ambiguous data-item to a model file, an error is produced. If you attempt to import to an ambiguous data-item, the data is placed in the first occurrence of the named data-item.

In this COBOL system, if you attempt to export an ambiguous data-item to a model file, a warning message is produced and the first occurrence of the named data-item is exported. Similarly, If you attempt to import to an ambiguous data-item, a warning message is displayed and the data is placed in the first occurrence of the named data-item.

Example:

```
01 Group01.
  02 GroupA.
    03 NumItem      PIC S9(5).
    03 StrItem      PIC X(5).
  02 GroupB.
    03 NumItem      PIC S9(5).
    03 StrItem      PIC X(5).

-----
<StrItem> ABCDE </StrItem>    *> this produces a warning and
updates StrItem in GroupA

<GroupB><StrItem> ABCDE </StrItem></GroupB>    *> this updates
StrItem in GroupB
```

Invalid Characters in Condition Names

In this COBOL system, if you use mark-up characters as values for condition names, this can produce invalid XML when exporting code using XML Extensions.

Mark-up characters, such as "<", ">" or "&" used in the values for condition names will produce invalid model files when using XML Extensions. The model files will cause parse errors when loaded by XML Extensions using the XML parser; XML Extensions will report the parse error and be unable to perform the requested export or import.

```
88 cond-name VALUE "<br/>".
```

Solution:

In this COBOL system, you must modify the COBOL source code, to eliminate mark-up characters in condition-name values.

Restricted data items with XML Extensions

In this COBOL system, you cannot use data items described in any section other than the File or Working Storage Sections, as model data names.

To export data items from or import XML data into this COBOL system, use the XMLGEN Compiler directive to create a model file, for use with XML Extensions.

The model data names specified in the model file are determined by XMLGEN:

- XMLGEN with no parameter specified produces model data names for data items/structures in the File Section only.
- XMLGEN(ws) produces model data names for data items/structures in the Working Storage Section only.



Important: Data items/structures described in the Linkage Section, Communication Section, Local-Storage Section and Thread-Local-Storage Section cannot be used as model data names in a model file.

Solution:

Using a copybook containing your data items, compile a dummy program that copies the descriptions into the Working Storage section, and then use the XMLGEN(ws) Compiler directive to create a model file containing the required data items.

Notes:

The data items used at runtime when the model file is used can be in any section of the data division.

Unable to Use Data Items Declared in Nested Programs

In this COBOL system, you cannot use data items declared in nested programs, as model data-names.

Solution:

Using a copybook containing your data items, compile a dummy program that copies the descriptions into the Working Storage section of your top-level program, and then use the XMLGEN(ws) Compiler directive to create a model file containing the required data items.

User-names Longer than 127 Bytes are Truncated

In RM/COBOL, you can specify user-names (data-names, procedure-names, program-names, etc) up to 240 characters long. In this COBOL system, user-names longer than 127 bytes in length are truncated and a warning message is produced.

Solution:

Results may be affected if the truncated user-name is used with XML Extensions, to export or import XML documents; therefore, we recommend that you keep user-names to 127 bytes or less.

Using the Correct Calling Convention

In this COBOL system, XML Extensions uses the standard COBOL calling convention. If your programs are also using the standard library routines implemented for RM/COBOL compatibility, you need to be aware that these are called using the 1024 calling convention.

Solution:

Generally, you should explicitly use the 1024 calling convention when calling your RM/COBOL standard library routines, but if you are using the DEFAULTCALLS Compiler directive to set this calling convention, you will need to override it when calling to XML Extensions.

Procedural COBOL Compared with Managed COBOL

Procedural COBOL is regular COBOL without any of the new syntax that has been added for .NET and JVM. This is the COBOL that will have been used to write Net Express, Server Express and Mainframe Express applications, and it is still actively supported today.

You can compile to native or (in most cases) managed code. The core COBOL syntax is supported in managed code. However, there are some features that are not supported (for example Panels V2, Dialog System and ACUCOBOL-GT). This means that you can take most existing COBOL applications and recompile to create managed applications.

Managed COBOL

Managed COBOL is the collective term for .NET COBOL and JVM COBOL.

Managed COBOL is COBOL with extensions to support the .NET and JVM frameworks. It offers OO syntax support and syntax to allow access to the available class libraries.

When you compile managed COBOL the compiler generates managed code: `.class` or `.jar` for JVM which will run on the Java Virtual Machine.

Managed Code and Native Code

You can compile your COBOL program to managed code using the `jvmgen` compiler directive. From within the IDE this happens automatically if you are using a managed COBOL COBOL JVM project.

The compiler has now created an intermediate language (JVM byte code `.class/.jar`).

COBOL and all other JVM languages (for example Java, JRuby and Jyphon) compile to this format, which makes mixed language applications easy to write.

You can also create native code applications. In Eclipse the default COBOL project compiles to native code.

The compiler generates `.exe/.dlls` as the result of a native compilation.

The native COBOL application has to call the appropriate management services available for the operating system, whereas a managed application can take advantage of the management services provided by the run time such as exception handling, garbage collection, and thread management.

Run Time

The JVM byte code (`.class/.jar` files) can be deployed to a JVM for execution.

The JVM's just-in-time (JIT) compiler compiles the byte code into code native to the operating system. The JVM provides additional services including memory management, exception handling, garbage collection and thread management.

Developing Native and Managed Applications

You use the IDE to develop, compile and debug both native and managed applications. You can write new COBOL code or you can recompile existing COBOL applications to managed or native code, potentially without any code changes.

You can deploy and further debug the application under the run-time system provided by Enterprise Server.

JVM COBOL applications are deployed to a Java Virtual Machine for execution.

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