

# **Natural**

## **Introduction to XRef Evaluation**

Version 9.1.3 for Windows

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This document applies to Natural Version 9.1.3 for Windows and all subsequent releases.

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

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# 1 About this Documentation

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## Document Conventions

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

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# 2 Introduction to XRef Evaluation

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This section covers the following topics:

## About XRef Data

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XRef data is stored in the development server file.

XRef data documents objects of an application that have already been implemented. Data of this type mirrors the "real world" of the implementation, providing a comprehensive summary of information for all implemented members of an application.

Name references will be evaluated during cross reference analysis to reflect the functional structure in an environment you specify.

XRef data can be used to retrieve information on individual members or to retrieve comprehensive information about applications as a whole:

- its invocation structure
- the resources it uses
- its consistency, completeness and correctness.

For further details, please refer to the following sections:

- [Contents of XRef Data for Natural](#)
- [Benefits of XRef Data](#)
- [Creating XRef Data for Natural Members](#)

### Contents of XRef Data for Natural

The following information is stored for each Natural program cataloged:

- References to programs that are invoked, how they are invoked (for example `CALLNAT`, `FETCH`, `FETCH RETURN`, `PERFORM`, `RUN`, `STACK`, `SEND EVENT`, `SEND METHOD`) and the type of program (such as: main program, subroutine, subprogram, help routine, map or data area);
- References to data areas and variables, with additional information on usage of variables: use, modification or use for dynamic source code creation (described in the Natural Statements documentation in relation to the `RUN` statement). Additionally, library, `DBnr` and `Fnr` of the referenced data areas are stored.
- References to views and data area views, with additional information about their usage (for example definition in a data area, delete, read, or update);
- References to fields of views, with additional information about their usage: definition in a data area, count, read, search or update. For 3GL: precompiled by Adabas SQL Server, Adabas Native SQL;

- References to files used in the program and the type of file use (deleting, reading or updating);
- References to Natural copy code (source code), library, DBnr and Fnr of the copy codes used are stored.
- References to maps and help routines used in the program;
- References to SQL stored procedures via the Natural statement `CALLDBPROC`;
- References to Natural error numbers used in the program and the types of error messages (system-wide or application-specific);
- References to Natural printers;
- References to Natural workfiles used in the program and the type of use (whether read from, written to or close);
- References to Natural classes;
- References to Natural methods;
- References to Natural interfaces;
- References to External resources;
- References to external programs invoked from a program;
- References to entry points or functions defined in the program which can be invoked by other programs;
- References to retained sets used in the program and the type of use (build, use, or release a retained set);
- References to processing rules used in a map and their type of use (automatic, free, or inline processing rules);
- Reference to a DBRM (DB2 request module) for programs using static SQL;
- Use of EXPERT Models via the Natural statement `INVESTIGATE`;
- Use of the Natural command processor via the statement `PROCESS COMMAND`;
- Statistical information:
  - Date and time the program was cataloged/precompiled;
  - ID of the user who cataloged/precompiled the program;
  - ID of the terminal from which the program was cataloged/precompiled (in batch mode: the job name);
- Language.

## Benefits of XRef Data

The application development process can be advanced significantly at almost all phases by using XRef data:

Phase	Benefits of XRef Data
Design	Identifying programs of other applications that might possibly be used in the planned application.
Implementation	Finding resources that are not (or no longer) used. Finding errors and inconsistencies that cause errors at runtime, for example calls to non-existent subroutines. Supervising the implementation state of an application.
Testing	Detecting incomplete documentation. Detecting differences between design and implementation. Detecting programming errors.
Production	Reporting all information about the programs that are in production.
Maintenance	Estimating the impact of changes. Discovering the invocation structure of an application.

## Creating XRef Data for Natural Members

XRef data for Natural is generated in the following cases:

- Natural writes XRef data for Natural programs and data areas when these are cataloged (provided that the `XREF` parameter has been set to either `ON` or `FORCE`, see below). This does not affect the performance of the program; only the cataloging time is insignificantly extended.
- Natural Security writes XRef data for programs that are used as Startup, Restart or Error-Transaction in an application or special link if the `XREF` parameter is set to `ON` or `FORCE` in the application's Natural Security definition and a user system file is defined for the application.
- The Natural Command Processor (NCP) writes XRef data for programs that are used as Startup, Restart or Error-Transaction in an application or special link if the `XREF` parameter is set to `ON` or `FORCE` in the application's NCP definition and a user system file is defined for the application.
- If Natural for DB2 is installed, the function `CREATE DBRM` of Natural for DB2 creates XRef data for Natural programs that use static SQL.

The Natural `XREF` parameter determines whether XRef data is created. Valid values:

ON	XRef data is created when a Natural object is cataloged.
OFF	XRef data is not created when a Natural object is cataloged.
FORCE	A Natural object can only be cataloged if a Predict documentation object exists for it. XRef data is then created when cataloging an object.
DOC	A Natural object can only be cataloged if a Predict documentation object exists for it. No XRef data is created.

There are different ways to set the Natural XREF parameter:

- In the Natural parameter module.
- As a dynamic parameter when starting a Natural session.
- In Natural Security. If Natural Security has been used to set the XREF parameter, the XREF command may only be used to enforce this setting (from ON to FORCE, from OFF to ON or FORCE).
- With the Natural XREF command. If Natural Security is not installed, the XREF parameter is usually set with the Natural XREF command. The Natural command XREF ? displays the current setting of the XREF parameter.

## What are Active and Passive Cross-References?

In general, there are two kinds of cross-references which you can display separately in the XRef Evaluation: active and passive cross-references (i.e. referencing and referenced).

Active cross-references will provide you with an answer to the question: "What does a certain object reference?"

Select passive cross-references if you want to know which other objects reference a certain object. For example, if you have a copycode you might want to know in which parts of your implementation it is included. There are some types of objects which by default only have passive cross-references, such as copycodes and DDMs.

## What is XRef Evaluation?

XRef Evaluation is available as an optional plug-in unit for Natural Studio. When the generation of cross-reference data is activated, the Natural compiler provides cross-reference (XRef) data created during CAT or STOW commands in the development server file.

XRef Evaluation evaluates this data with respect to your environmental settings, for example your logon library. It enables you to retrieve and display this essential development and maintenance information conveniently in Natural Studio. You can easily navigate through the analysis result output in tree views or list views.

For a detailed description of the XRef Evaluation functions, see the section [Using XRef Evaluation](#).

XRef Evaluation is automatically installed when you install the Natural development environment for Windows (see the [Natural for Windows installation documentation](#) for further information).

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This section covers the following topics:

## Before You Start

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XRef Evaluation is an optional plug-in unit for Natural Studio. Therefore, before any action can be taken, XRef Evaluation must be activated in your Plug-In Manager and the generation of cross-reference data must be enabled.

The following topics are covered below:

- [Enabling the Usage of Plug-ins](#)
- [Activating the XRef Evaluation Plug-in](#)
- [Activating the Generation of Cross-Reference Data](#)
- [Resulting Interface Changes](#)

### Enabling the Usage of Plug-ins

So that you can use the XRef Evaluation plug-in, you must first enable the usage of plug-ins in the **Options** dialog. Once enabled, the Plug-in Manager is automatically active each time you start Natural.

#### ➤ To enable the usage of plug-ins

- 1 From the **Tools** menu, choose **Options**.

The **Options** dialog box appears.

- 2 Make sure that the **Workspace** tab is shown.



**Note:** If you have previously disabled success and delete messages, the corresponding check boxes are not selected.

- 3 Make sure that the **Enable plug-ins** check box is selected.
- 4 Choose the **OK**.

The **Tools -> Configuration Tools -> Plug-in Manager** menu command and the corresponding toolbar button are now available. When the usage of plug-ins is not enabled, this menu command and toolbar button are not shown.



## Activating the XRef Evaluation Plug-in

The XRef Evaluation plug-in is not active by default.

When the Plug-in Manager has been enabled, you can activate the XRef Evaluation plug-in. Two types of activation mode are available:

- **Automatic**

XRef Evaluation is automatically activated each time Natural is started.

- **Manual**

XRef Evaluation must be activated manually on demand (default).

### ➤ To activate the XRef Evaluation plug-in

- 1 From the **Tools** menu, choose **Configuration Tools -> Plug-in Manager**.

Or:

Click the corresponding toolbar button.

The **Plug-in Manager** window appears.

- 2 Select the **XRef Evaluation** entry.
- 3 Click the right mouse button and from the resulting context menu, choose **Activation mode -> Automatic**.

This does not automatically activate XRef Evaluation for the current session. To activate it, you can either restart Natural or proceed as described with the next step.

- 4 Click the right mouse button while **XRef Evaluation** is still selected and from the resulting context menu, choose **Activate**. When activated, the XRef Evaluation toolbar is automatically provided.

For details, see the section [Invoking XRef Evaluation Commands](#).



**Note:** If you want to deactivate the XRef Evaluation toolbar, choose **Customize** from the **Tools** menu.

For detailed information, see the section *Plug-In Manager* in the Natural documentation.

## Activating the Generation of Cross-Reference Data

Whether the generation of cross-reference data is activated by default depends on the settings of the Natural parameter module and the environment you are currently connected to.

### ➤ To activate the generation of cross-reference data

- 1 From the **Tools** menu, choose **Configuration Tools -> XRef Generation**.

The **XREF - XRef Generation** dialog box appears.

- 2 Make sure that the **On** option is selected.
- 3 Choose the **OK** button.

A message appears indicating that XRef mode is now set to "On".

- 4 Choose the **OK** button.

Cross-reference data will from now on be generated when you catalog an object.

## Resulting Interface Changes

Once XRef Evaluation has been activated, your Natural Studio interface will be changed in the following way:

- the **Tools** menu will display the relevant XRef Evaluation commands,
- a toolbar will be available for the commands most frequently used in cross-reference analysis,
- context menu commands for cross-reference analysis will be available,
- the **XRef Evaluation** tab will be available in the **Options** dialog (**Tools -> Options**).

The command availability depends on your working context.

## General Information

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This section covers the following topics:

- [XRef Evaluation Options](#)
- [Analysis Result Output](#)
- [Using Filters](#)

- [Invoking XRef Evaluation Commands](#)

## XRef Evaluation Options

Choose the menu command **Tools -> Options** to display the **Options** dialog. In the dialog window which will be displayed, choose the **XRef Evaluation** tab and choose the settings you prefer. The following options can be specified:

- [Language](#)
- [Filter](#)
- [Expansion of Recursive Nodes](#)
- [Refresh](#)
- [Suppress Warnings](#)
- [Show Documentation Name](#)

### Language

You can specify which language setting will be used for your cross-reference analysis:

- Runtime language setting for your remote environment, or
- Natural Studio language setting



**Note:** You can change the Natural Studio language setting using the profile parameter `ULANG`.

### Filter

In order to always use filters during your cross-reference analysis, this option must be set to **On**. You can also switch the option on and off using the **Filter** button in the **XRef Evaluation** toolbar. For details about filtering, see the section [Using Filters](#).

### Expansion of Recursive Nodes

You can specify how recursive nodes in your XRef Evaluation output will be treated.

If you choose **Expandable**, all levels of recursion can be displayed when manually expanding a node.

If you choose **Not expandable**, only the first level below a recursive node can be displayed. Selecting and choosing the node will not expand it.



**Note:** The automatic **Expand All** function is deliberately not available for recursive nodes.

## Refresh

If **Refresh** is enabled, your XRef Evaluation output will be refreshed if changes were made to objects in the same environment. Enabling **Refresh** may result in a reduction of performance.

If **Refresh** is disabled, your XRef Evaluation output will remain static, not reflecting changes that may have been made in the meantime.

## Suppress Warnings

This option enables or disables the display of XRef Evaluation warnings in message boxes and the result view.

By default the checkbox is empty, since typically users should be informed about all potentially harmful situations. However, if for some data a large amount of uniform warnings is issued, users may desire to suppress their display by checking the box **Suppress Warnings**.

All other XRef Evaluation messages except warnings are still displayed if this option is activated.

## Show Documentation Name

This option enables or disables the display of Predict documentation names.

If this option is enabled and a Predict documentation name has been assigned to a referenced or referencing object, then the Predict documentation name will be visible in the tree or list view when the object is displayed.

## Analysis Result Output

If you execute an XRef Evaluation command, the results will be displayed in a cross-reference view. A cross-reference view is an output window, either in the form of a tree or a list.

A "tree view" displays cross-reference information in hierarchical form. You can easily navigate between the objects and references of interest by collapsing or expanding the relevant nodes. At the top of each tree, a **Cross-reference Analysis Configuration** node is displayed, listing important parameters relevant for this analysis.

A "list view" displays additional information in non-hierarchical form. In list views, you can select more than one object for further processing.

For information on how to print the information displayed in a tree view or list view, refer to the section *Printing Views* in the *Natural for Windows* documentation.

The evaluation result displayed in a cross-reference view depends on the parameters you specified, for example the logon library, steplib settings and language code that are active when the analysis is started. For that reason, the results of the same XRef data retrieval can vary due to different environmental or user-specific settings.

For example, if you switch to a different logon library while XRef Evaluation processes an analysis, the presented result will always refer to the library that was active when you started your evaluation. This may lead to different results if you start the same analysis on the same object, but with a different logon library.

## Using Filters

Using filters, you can influence the scope of your cross-reference analysis. It may be useful to specify filter options, if you want to focus the result output on a particular range of interest.

If filtering is switched on and the filter functionality is available, whenever you perform the XRef Evaluation command **Active Cross-references** or **Passive Cross-references**, a dialog will be displayed before the command is executed. In this dialog, you can specify a variety of filtering conditions for the cross-reference analysis you want to perform.

If you select a particular object or set of objects as source object(s) for your cross-reference evaluation, the **Filter** dialog will offer only the choices for the target object.

If you select a library as source object for your cross-reference evaluation, the dialog will offer choices for both the source and the target object. The source object side of a **Filter** dialog might look as follows:

### » To specify filtering attributes

- 1 Place the cursor in the desired attribute line to select the attribute.  
The **Value** selection box above the table will be highlighted.
- 2 In the **Value** selection box, enter or select the value you want to use for filtering.  
Your entry will be displayed in the **Value** field in the attribute line.
- 3 Repeat this for as many attributes you want to specify, for both source object and target object.
- 4 On the target side select the **All Levels** check box, if you want to apply the filter criteria for more than one level in your analysis output.
- 5 Choose **OK**.

If an attribute was chosen which does not belong to the selected object type, the selection has no effect.

## Invoking XRef Evaluation Commands

### ➤ To invoke XRef Evaluation commands from the main menu

- 1 Select an application, a library or an object within a library.
- 2 From the main menu, choose **Tools -> Development Tools -> XRef Evaluation**.

The available commands are described in detail in the section [XRef Evaluation Functions](#).

### ➤ To invoke XRef Evaluation commands using toolbar buttons

- You can also use one of the following buttons:



to display active cross-references for selected objects.



to display passive cross-references for selected objects.



to enable or disable filtering.



to specify a library structure.

### ➤ To invoke XRef Evaluation commands using context menus

- 1 Select an application, a library or one or more objects within a library.
- 2 Right click on your selection to display the context menu.
- 3 Select the command you want to execute.

The context menus vary depending on the object of interest.

## XRef Evaluation Functions

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The following XRef Evaluation commands are available:

- [Active Cross-References](#)
- [Passive Cross-References](#)
- [Unresolved Cross-References](#)
- [Error Numbers Without Text](#)
- [Referenced, but not linked](#)
- [Linked but not referenced](#)
- [Link to Application](#)
- [List Children](#)

- [Select Library Structure](#)

### Active Cross-References

If you select active cross-references of an object, XRef Evaluation generates a tree view with the referencing ("using") object (for example a program) below the configuration node in the tree view. Below this object, all objects which are referenced ("used") by the top level object are shown (for example other programs, subprograms or subroutines).

This command is available for selected objects in the **Tools** menu, in a context menu and using the relevant toolbar button.

### Passive Cross-References

If you select passive cross-references of an object, XRef Evaluation generates a tree view with the referenced ("used") object below the configuration node in the tree view. Below this object, all objects which reference ("use") the top level object are shown.

This command is available for selected objects in the **Tools** menu, in a context menu and using the relevant toolbar button.



**Note:** XRef Evaluation for DDMs in Windows or UNIX environments is only available, if the Natural parameter `FDDM` is specified.

### Unresolved Cross-References

This command is available for the selected library in the **Tools** menu and in a context menu.

When you execute Unresolved Cross-References, a passive cross-reference tree view displays the node **Unresolved references**. Expanding this node and all levels further down, you can display all objects in the current logon library which have unresolved references including their passive cross-references.

### Error Numbers Without Text

This command is available for the selected object(s) in the **Tools** menu and in a context menu.

The menu item **Not referenced** offers the following cascading menu options:

- [Objects Not Referenced](#)
- [Variables Not Referenced](#)

- [Error Numbers Not Referenced](#)

### **Objects Not Referenced**

When you execute **Objects not referenced**, a list view will display all objects in the current logon library which are not referenced by any other object in this library.

### **Variables Not Referenced**

When you execute **Variables not referenced**, a list view will display all variables specified in Data Areas in the current logon library which are not referenced by any object in this library.

### **Error Numbers Not Referenced**

When you execute **Error numbers not referenced**, a list view will display all error messages in the current logon library which are not referenced by any object in this library.

### **Referenced, but not linked**

This command is available for your selected object of type **Application** in the **Tools** menu and in a context menu.

When you execute **Referenced, but not linked**, a list view will display all objects which are referenced by the application for which you started the analysis, but not linked to the application. If you selected more than one application for the analysis, a separate list view is opened for each selected application.

### **Linked but not referenced**

This command is available for your selected **Application** in the **Tools** menu and in a context menu.

When you execute **Linked, but not referenced**, a list view will display all objects which are linked to the current application, but are not referenced by any objects linked to this application.

### **Link to Application**

This command is available in the **Tools** menu or in a context menu for objects selected in a cross-reference view. It is available only for objects in an application context, which are referenced by the object(s) for which you started the analysis, but not linked to the currently active application.

When you execute **Link to Application**, all objects which are referenced by the object(s) for which you started the analysis, but not linked to the currently active application will automatically be linked to the application.

For example, if you execute the command **Referenced, but not linked**, the result will be displayed in a cross-reference view. Using the command **Link Application** for one or more objects listed in



this view, you can easily link all objects to the application that are required for cataloging or runtime processing.

### **List Children**

This command is available in a context menu for nodes selected in a cross-reference view.

The result of the **List Children** command is a list view of the children of the selected node.

In contrast to the tree view, you can select more than just one object within the list view and perform an action such as **Catalog** or **Stow**. This is very helpful when performing mass updates is necessary.

### **Select Library Structure**

This command is available in the **Tools** menu and as a toolbar button.

The function **Select Library Structure** allows you to specify a library structure for your cross-reference analysis. In the **Select Library Structure** dialog you can select the name of the structure, then all libraries defined in the steplib structure will be displayed with their name, database ID and file number.

