Getting Started
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Natural Construct™

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This document applies to Natural Construct Version 5.3 and to all subsequent releases. Specifications contained herein are subject to change and these changes will be reported in subsequent release notes or new editions.

Readers' comments are welcomed. Comments may be addressed to the Documentation Department at the following e-mail address: Documentation@softwareag.com.

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PREFACE

This preface explains the structure of the *Natural Construct Getting Started Guide*, as well as the document conventions used throughout the guide. It also contains information about other resources you can use to learn more about Natural Construct.

The following topics are covered:

- **Purpose and Structure of this Guide**, page 8
- **Document Conventions**, page 9
- **Other Resources**, page 10

Purpose and Structure of this Guide

This guide provides a quick overview of Natural Construct and its many features and capabilities. It covers the following topics:

Chapter	Title	Description
1	**Introduction to Natural Construct**, page 13	Describes the basic features and functions of the application generation environment. It includes step-by-step instructions to create a simple menu.
2	**Natural Construct for New Application Development**, page 33	Describes how to develop new applications for use in client/server environments. It contains information about creating business objects that encapsulate business rules and data access needs. It includes step-by-step instructions to create an object maintenance process.
3	**Natural Construct for the Natural Programmer**, page 55	Describes how you can speed up the development cycle and reduce errors. This chapter is intended for Natural programmers who are involved in maintenance programming or want to learn tips to increase productivity. It includes step-by-step instructions to create a multi-panel report supporting many user-requested features. Information in this chapter will benefit both new and experienced users.
4	**Troubleshooting and Debugging**, page 93	Provides troubleshooting and debugging information.
5	**Getting the Most From Natural Construct**, page 103	Describes some of the optional functions of Natural Construct, such as creating help for your applications and building custom models. It also describes the two JCL models and lists several add-on products you can use with Natural Construct.

Document Conventions

Throughout this guide, the following conventions apply:

Term	Description
Enter	Type a value in a field and press the Enter key.
Field	In general, any area on a screen where users can type information, select a value from a pop-up window, or indicate a preference by marking a box or circle.
Invoke	Activate or execute a program or menu.
Mark	Type a non-blank character in an input field (for example, an X) to select the corresponding option.
Panel	A full screen of information displayed by a program, etc.
Select	One of the following actions: • Move the cursor to a value and press the Enter key. • Scroll through a selection box and highlight a value. • Double-click on a value. • Type the name of a value in a key field and press the Enter key.
Specify	One of the following actions: • Type a value in a field. • Select a value from a selection window.
Window	A partial screen of information that overlays the current screen. A window is usually displayed with a border.

Other Resources

This section provides information about other resources you can use to learn more about Natural Construct. For information about the documents and courses, contact the nearest Software AG office or visit the website at www.softwareag.com to order documents or view course schedules and locations. You can also use the website to email questions to Customer Support.

Related Documentation

This section lists other documentation in the Natural Construct documentation set.

User Documentation

For information about using Natural Construct, see:

- *Natural Construct Generation*
  This documentation is intended for developers who create applications using the supplied models.
- *Natural Construct Help Text*
  This documentation is intended for developers who create and maintain help text for Natural Construct-generated applications, as well as for developers who create and maintain help text for user-written models.
- *Natural Construct Administration and Modeling*
  This documentation is intended for administrators who maintain the Natural Construct generation environment, as well as for developers who create new models.

Installation Documentation

For information about installing Natural Construct, see the installation guide for your platform.

Other Documentation

This section lists documents published by WH&O International, Wellesley, Mass., USA:

- *Natural Construct Tips & Techniques*
  This book provides a reference of tips and techniques for developing and supporting Natural Construct applications.
- *Natural Construct Application Development User's Guide*
  This guide describes the basics of generating Natural Construct modules using the supplied models.
- *Natural Construct Study Guide*
  This guide is intended for programmers who have never used Natural Construct.

Related Courses

In addition to the documentation, the following courses are available from Software AG:

- A self-study course on Natural Construct fundamentals
- An instructor-led course on building applications with Natural Construct
- An instructor-led course on modifying the existing Natural Construct models or creating your own models

INTRODUCTION TO NATURAL CONSTRUCT

This chapter is intended for programmers who have never used Natural Construct. It introduces new users to the basic features and functions of the generation environment, as well as how Natural Construct works.

To get acquainted with the generation environment, follow the step-by-step instructions to create a simple menu program for an order entry application. If you encounter problems, try one or more of the following suggestions:

- Display the online help as follows:
  - To view the help for a panel, press the help (PF1) key while the cursor is anywhere on the panel except an input field.
  - To view the help for an input field or select a parameter from a pop-up window, press PF1 or type "?" and press Enter when the cursor is in the field.

Note: If you do not specify a required parameter, or enter an incorrect one, Natural Construct will prompt you for the correct information.

- Check relevant sections of *Natural Construct Generation.*
- Visit our web site at www.softwareag.com to get timely product information, correspond with customer support representatives, or access related documents.

Although this guide deals mainly with the generation subsystem, Natural Construct contains two other subsystems. For information, see **Help Subsystem**, page 14, and **Administration Subsystem**, page 14.

The topics covered in this chapter are:

- **What is Natural Construct?**, page 14
- **How Does Natural Construct Work?**, page 16
- **Generate a Simple Program**, page 23
- **Creating Specification Documents**, page 31
- **Utilities Supplied with Natural Construct**, page 32

What is Natural Construct?

Natural Construct is a powerful, easy-to-use, model-based application generator that helps you create and implement high-quality, robust Natural applications. It can also generate JCL and Visual Basic code.

It is built around and uses existing Natural facilities, which means that Natural Construct-generated applications can be deployed on most platforms or distributed across multi-tiered environments.

To Natural's production-oriented development environment and portable execution environment, Natural Construct adds:

- a code generator (at a statement, as well as Natural object level)
- a help maintenance system
- a model maintenance system

These subsystems are described in the following sections.

Generation Subsystem

As a code generator, Natural Construct offers a wide range of reusable program structures, called models. These models allow even inexperienced programmers to generate fully functional applications using high-level, fill-in-the-blank specifications. And Natural Construct uses data defined in Predict, Software AG's data dictionary, to provide the default model specifications, such as local views and field prompts. You can also create your own verification or referential integrity rules in Predict for use with your Natural Construct-generated applications.

Help Subsystem

The help subsystem is designed for non-programmers. It separates the coding of an application from the creation of the online documentation. This separation allows business users or technical writers to write the online help information and programmers to concentrate on programming. In addition, the help subsystem supports multilingual help text. For information about this subsystem, see *Natural Construct Help Text*.

Administration Subsystem

The administration and modeling subsystem is used mainly by administrators. It allows them to modify the models supplied in the generation subsystem, create new models, and set security standards. For information about this subsystem, see *Natural Construct Administration and Modeling.*

Benefits of Using Natural Construct

There are many good reasons for using Natural Construct to create Natural applications. For example, you can:

- Reduce development efforts by 50% (as reported by many customers)
- Reduce training time and increase acceptance of new applications, as the generated programs have a consistent interface
- Decrease the development time for complex applications — and make fewer mistakes
- Reduce checking and testing requirements; you can concentrate on the customized code
- Reduce maintenance efforts by including business rules within the generated objects
- Easily regenerate applications as requirements change

How Does Natural Construct Work?

Natural Construct is based on the premise that most applications have common functional blocks of code. These blocks of code became object templates, called models, which ensure that the required and expected aspects of each object type are incorporated into the generated object in a standard way.

Rather than re-engineering redundant routines each time you create an object, you can use the Natural Construct models to produce functionality-rich business applications that incorporate state-of-the-art technology.

Natural Construct uses the following information to generate an object:

- The chosen model
- The model specifications supplied by the programmer
- Predict data, as required
- Data coded in the user exits (optional)

For more information about designing or implementing a Natural Construct application, see **Implementation Methodology** or **Design Methodology**, *Natural Construct Generation*.

Choosing a Model

Natural Construct supplies more than 100 models, which are available through the Generation main menu. These models generate various programs, subprograms, helproutines, data areas, maps, Natural statements, etc. You can also invoke the statement models from the Natural and User Exit editors.

For client/server environments, Natural Construct provides a series of object maintenance and browse models (Object-Maint and Object-Browse models). In addition, Natural Construct supplies user exit models to assist you in writing user exit code.

Which model you choose depends on what you are doing. For example:

For help:	Try:
Developing client/server applications	Object-Maint and Object-Browse models (for information, see **Generate a Business Object**, page 39).
Remembering Natural syntax	Statement models (for information, see **Writing Natural Statements**, page 87).
Testing Natural objects	Driver or Maint models (for information, see **Testing Subprograms and Helproutines**, page 58, or **Creating Test Data**, page 56).

For help:	Try:
Writing user exit code	User exit models (for information, see the Object-Browse Models chapter in *Natural Construct Generation*).
Developing conventional applications (character-based interfaces)	Maint model and/or models beginning with Browse or Browse-Select; also the Start, Menu, and Quit models.

Tip: The Browse and Browse-Select models are similar. Both models generate a browse (query) program that allows users to select and process a record, but the Browse-Select model provides more options. A generated browse program performs one pre-determined set of commands on a selected record (such as delete a record or modify a record); a generated browse-select program allows the user to specify which set of commands are performed.

Basically, the models can be grouped into four categories:

- conventional
- client/server
- statement
- user exit

Choose the model that provides the functionality you require. (For example, to create the sample menu program later in this chapter, you'll use the Menu model.) The following sections describe the most commonly used models in each category.

Conventional Models

These models generate non-distributed programs, subprograms, helproutines, data areas, and maps. The models in this category include:

Model	Generates
Startup	A startup program that initializes the application environment and invokes the menu and quit programs. It provides an easy way to set up initial global variables for an application.
Quit	A quit program that releases application resources. It provides a common exit point from anywhere in an application.

Model	Generates (continued)
Menu	A menu program that controls the flow of work modules in an application.
Browse/Browse-Select	A simple or complex browse program, subprogram, or helproutine that queries the database and allows users to browse through and select data for processing.
Maint	An online maintenance program that allows users to select a record from the database and then perform a maintenance function (delete, for example). The program controls all data access and user interface requirements.
Map	An external Natural map.
Batch	A program that runs in batch mode to create a report or update the database.
Driver	A driver program you can use to test and debug Natural subprograms and helproutines.
Shell	A skeleton program you can use as a template when developing Natural programs.

For more information about these models, see the applicable chapter in *Natural Construct Generation*. For an example of using the Menu model, see **Generate a Simple Program**, page 23.

Client/Server Models

The models in this category generate the components required for a client/server application. They include:

Model	Generates
Object-Maint-Subp	An object subprogram that accesses data, performs updates, and enforces data integrity.
Object-Maint-Dialog	An object dialog program that inputs the object map and invokes the object subprogram.
Object-Browse-Subp	An object browse subprogram and the associated object PDAs, key PDAs, and restricted PDAs.

Model	Generates (continued)
Object-Browse-Dialog	A character-based dialog that works with an object browse subprogram.
Object-Browse-Dialog-Driver	A driver program or helproutine that invokes an object browse dialog.

For more information about the client/server models, see the applicable chapter in *Natural Construct Generation*. For an example of creating an object maintenance process, see **Generate a Business Object**, page 39.

Statement Models

The statement models generate blocks of code containing one or more Natural statements, which you can use as building blocks when creating user exit code or specialized programs. Using the statement models assists you with the statement syntax and reduces the time required to write recurring code segments and test your code.

Typically, you invoke the statement models from the User Exit and Natural editors using a .g line command and the model name in brackets. For example, enter .g(view) to invoke the View statement model. Enter the .g commands in the same position as other line commands, such as the .i (insert) or .d (delete) command.

A few of the commonly used statement models are:

Model	Generates
Callnat	A Natural CALLNAT statement, which calls a subprogram for execution.
Decide-On	A Natural DECIDE-ON statement, which specifies multiple actions to be performed (depending on the contents of a variable).
Get	A Natural GET statement, which reads a record with a given Adabas ISN (internal sequence number) without initiating a processing loop.
View	The definition of a view, as derived from Predict.

Natural Construct supplies more than 40 statement models. For information about these models, see **Statement Models**, *Natural Construct Generation*. For an example of using statement models, see **Writing Natural Statements**, page 87.

User Exit Models

These models generate text member modules containing the field layout specifications for an object browse dialog. The models are invoked from the User Exit editor using the User-Exit statement model. The user exit models are:

Model	Generates
Input-Key	Layout specifications for input fields and prompts on the dialog.
Export-Data-Fields	Layout specifications for column headers and fields exported to an ASCII file on a PC.
Report-Data-Fields	Layout specifications for column headers and fields routed to a printer.
Write-Data-Fields	Layout specifications for column headers and fields displayed on a screen.

For more information, see **User Exit Models** and **User-Exit Statement Model**, *Natural Construct Generation*.

Defining the Model Specifications

Each model has at least one specification panel to collect specifications that are common to the code generated by that model. To help you fill in the parameters, most models supply default values for key fields. You need only specify any additional parameters the model requires to generate the appropriate code.

To create a menu program, for example, you must specify the following parameters:

- A menu heading
- The codes a user types to access options listed on the menu
- Descriptions of the options
- The name of the program executed to perform each option

Other parameters allow you to include optional features in your program.

Tip: When creating your specification documents, you can use the fields on the specification panels as a checklist to determine which parameters may be required.

Defining the Predict Data

Predict is a data dictionary system that centrally stores and manages all information about the metadata (data about data) for an organization. Natural Construct can use the metadata to accurately and consistently generate application code. Although a Natural Construct-generated application can be executed without Predict, the code generator relies on this metadata.

The main advantage of using Predict is that you can change the metadata and then regenerate the code to reflect the changes. For example, you can change a relationship between files in Predict, regenerate the code, and the new relationship is automatically incorporated.

Natural Construct uses the Predict metadata that describes:

- File relationships, such as restricted or cascade delete constraints
- File layouts
- Field attributes, such as maximum occurrences, redefinitions, edit masks, validation rules, and headings
- Field descriptions (for online help)

Note: The help subsystem and Natural Construct-generated applications can be implemented in an existing Natural environment without Predict. To do this, you add the standard helproutine (CDHELPR) to the Natural map for which help is required. For more information, see **Providing Online Help for Your Applications**, page 104.

Construct Spectrum, an add-on product, can use the Predict metadata to generate various GUI options, such as radio buttons or list boxes, based on the number of options available.

You can also create Predict metadata by documenting generated Natural objects. This option is available when you generate an object.

For more information about using Predict with Natural Construct, see **Use of Predict in Natural Construct** and **Defining Objects and Relationships**, *Natural Construct Generation*.

Defining User Exits

When specific customizations are required to fulfill your business needs, you can add additional code in a user exit. User exits are strategic points in the model outline, such as at the start of the program or after input. You choose which user exit you want based on the location of the exit within the code. If you are unsure of the location of a user exit, you can generate and edit the Natural object. The position of each user exit is shown in comments that begin with ** SAG Exit Point followed by the name of a user exit. For example:

```
** SAG Exit Point Change-History
```

These pointers indicate where the exit will be located in the generated code.

You enter user exit code in the User Exit editor, which you can access from the last specification panel for a model or when you enter U in the Function field on the Generation main menu. If you forget to choose an exit, you can display a list of available exits by entering “SAMPLE” on the command line in the editor.

You can place any Natural code within a user exit. The user exit code becomes part of the object’s source code. If you regenerate the object, changes to the user exit code are always preserved.

Many models supplied with Natural Construct have user exits available. When you’re creating an object, select the user exits you require and supply the appropriate code for each user exit. Natural Construct uses both the model specifications and the user exit code to create an object.

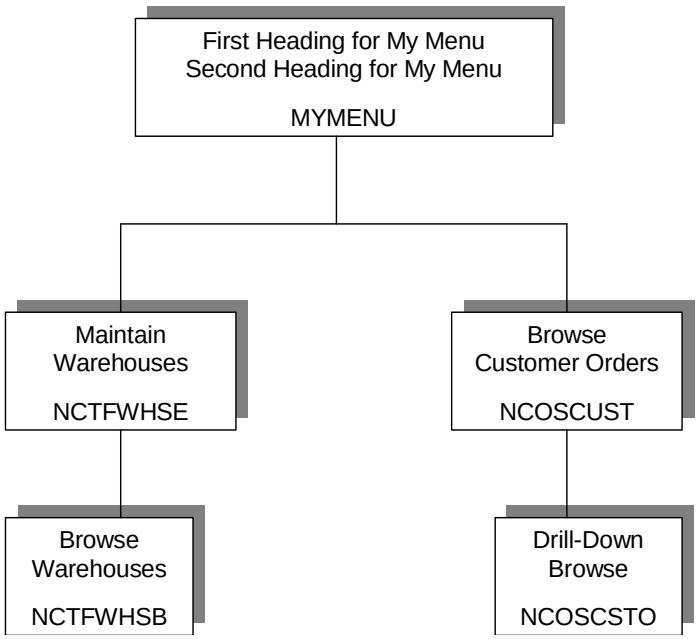
For more information, see **User Exits for the Generation Models**, *Natural Construct Generation*.

Generate a Simple Program

You're now ready to use Natural Construct to generate your first program — the main menu for an order entry system. A main menu provides users with a selection of functions available within a system, such as the Generation main menu.

After generating the menu, you'll make a few changes to the specifications and regenerate the program.

The following diagram shows the modules used for the sample menu program:



Modules Used for the Sample Menu Program

Before You Begin

The sample menu, as well as other sample programs described in this guide, require access to several modules used in the Natural Construct demo system. The demo system is a fully functional order entry system that was generated using the Natural Construct models (see **Natural Construct Demo System**, *Natural Construct Generation)*. Natural Construct supplies the following demo systems:

- SYSCSTDE (Adabas)
- SYSCSTD2 (DB2)
- SYSCSTDV (VSAM)
- SYSCSTDS (SQL)

Note: Examples in this guide refer to the SYSCSTDE demo system.

Before beginning this procedure, use the Natural SYSMAIN utility to copy the following modules from the demo library into your user library:

Module	Description
MYMAP	Map used by the object maintenance dialog example (described in Chapter 2).
NCGDA	Global data area (GDA) containing global variables. NCGDA is a modified copy of CDGDA, the standard global data area for Natural Construct-generated applications.
NCOSCSTO	Drill-down browse subprogram invoked from NCOSCUST when the user selects an order.
NCOSCUST	Browse program for the Browse Customer Orders option.
NCOSODET	Subprogram used in the Callnat statement model example (described in Chapter 3).
NCTFWHS1	Map used by the browse subprogram.
NCTFWHSB	Browse subprogram invoked from NCTFWHSE when the user enters “B” in the Action field.
NCTFWHSE	Maintenance program for the Maintain Warehouses option.

Note: If you encounter problems trying to access the demo system or files (files beginning with NCST), your environment may not be set up. Contact your system administrator to set up the environment.

Generating the Menu Program

This section describes how to use the Menu model to generate a menu program.

Note: Before beginning the procedure, ensure that the required modules have been copied to the current library. For a list of modules, see **Before You Begin**, page 23.

➢ To generate the menu program:

1 At the Natural prompt, logon to your Natural Construct library.

2 Enter “ncstg”.
The Generation main menu is displayed:

```
CSGMAIN          N a t u r a l   C o n s t r u c t   4.4.1          CSGMNM0
Oct 22                     Generation Main Menu                     1 of 1

                  Functions
                  ----------------------------------------------
                  R  Read Specifications
                  M  Modify Specifications
                  U  User Exit Editor
                  G  Generate Source
                  T  Test Source
                  E  Edit Source
                  S  Save Source
                  W  Stow Source
                  L  List Modules
                  C  Clear Edit Buffer
                  ?  Help
                  .  Return
                  ----------------------------------------------
Function ......... _  Module ............. ________ Panel ...... __
Model ............ ____________________________ Type .......
Command .......... ____________________________ Library .... MYLIB
Enter-PF1---PF2---PF3---PF4---PF5---PF6---PF7---PF8---PF9---PF10--PF11--PF12---
      help        quit        optns                                  lang
```

Generation Main Menu

Tip: Typing “M” on the main menu is the equivalent of Create New.

For more information about the Generation main menu or the Generation subsystem, see **Using the Generation Subsystem**, *Natural Construct Generation*.

3 Specify the following:

M	Function field
MYMENU	Module field
Menu	Model field

Note: If you do not specify a model name, Natural Construct displays a selection window.

4 Press Enter.
The Standard Parameters panel for the Menu model is displayed. Notice that some of the fields are filled in for you, based on values you specified on the main menu:

```
CUMNMA                          MENU Program                          CU--MA0
Oct 22                      Standard Parameters                        1 of 2

 Module ............. MYMENU__
 System ............. MYLIB_____________________________
 Global data area ... CDGDA___
 With block ......... _____________________________

 Title ............... Menu ..._________________
 Description ........ This menu ..._____________________________________________
                      _____________________________________________________________
                      _____________________________________________________________
                      _____________________________________________________________

 First heading ...... _____________________________________________
 Second heading ..... _____________________________________________________

 Command ............ _
 Message numbers .... _
 Password ........... _

Enter-PF1---PF2---PF3---PF4---PF5---PF6---PF7---PF8---PF9---PF10--PF11--PF12---
right help  retrn quit                                          right main
```

Standard Parameters Panel for the Menu Model

5 Type “First Heading for My Menu” in the First header field.

Note: We aren’t using the remaining fields on this panel. If you’re curious about what these fields are used for, you can type “?” and press Enter to invoke Natural Construct’s online help or see **General Model Specifications**, *Natural Construct Generation*.

6 Press Enter.
The Additional Parameters panel is displayed:

```
CUMNMB                          MENU Program                          CUMNMB0
Oct 22                      Additional Parameters                      2 of 2

  Map layout ......... ________ *

     Code  Functions_____________________________________  Program Name
    ------ ---------------------------------------------- --------------
      __   ______________________________________________   ________ *
      __   ______________________________________________   ________ *
      __   ______________________________________________   ________ *
      __   ______________________________________________   ________ *
      __   ______________________________________________   ________ *
      __   ______________________________________________   ________ *
      __   ______________________________________________   ________ *
      __   ______________________________________________   ________ *
      __   ______________________________________________   ________ *
      __   ______________________________________________   ________ *
      __   ______________________________________________   ________ *
      __   ______________________________________________   ________ *
      __   ______________________________________________   ________ *
      __   ______________________________________________   ________ *

Enter-PF1---PF2---PF3---PF4---PF5---PF6---PF7---PF8---PF9---PF10--PF11--PF12---
      help  retrn quit        optns attr                     left  userX main
```

Additional Parameters Panel for the Menu Model

For this example, leave the Map layout field blank. This allows Natural Construct to create a default (internal) map layout. If you've created an external map layout tailored to your shop standards, you could type the name of that map in this field.

For more information about this panel, press PF1 (help) to invoke the online help or see **Additional Parameters Panel**, *Natural Construct Generation*.

7 Specify the following:

MW	1st Code field
Maintain Warehouses	On line to the right of the 1st Code field
NCTFWHSE	1st Program field
BC	2nd Code field
Browse Customer Orders	On line to the right of the 2nd Code field
NCOSCUST	2nd Program field

These parameters specify the codes the user enters to invoke the corresponding menu functions, the names of the functions, and the names of the programs invoked to perform the function.

8 Press Enter.
You are returned to the Generation main menu.

9 Enter “G” in the Function field.
A confirmation message is displayed, indicating that the generation was successful.

10 Enter “W” in the Function field.
A confirmation message is displayed. Your menu program is now generated and stowed.

Note: For more information about these functions, see **Generate Source Function** and **Stow Generated Source Function**, *Natural Construct Generation*.

To see the code generated by the Menu model, enter “E” in the Function field.

To see what the menu will look like to users, enter “T” in the Function field. The following menu is displayed:

```
MYMENU              ***** First Heading for My Menu *****
Oct 22                                                          5:18 PM

               Code Functions
               ---- -------------------------
                MW  Maintain Warehouses
                BC  Browse Customer Orders
                ?   Help
                .   Terminate
               ---- -------------------------
          Code: __




Enter-PF1---PF2---PF3---PF4---PF5---PF6---PF7---PF8---PF9---PF10--PF11--PF12---
      help  retrn quit        flip                                  main
```

Sample Menu Program

11 Press PF2 (retrn).
You are returned to the Generation main menu.

You’ve successfully created a sample menu program. Next, you’ll see how easy it is to change a few of the specifications and regenerate the menu program.

Note: If you have any problems creating the menu, see **Troubleshooting and Debugging**, page 93, for possible reasons.

Regenerating the Menu Program

This section describes how to change some of the specifications for the menu and then regenerate the program. The procedure begins at the Generation main menu.

➢ To change the specifications and regenerate the menu program:

1 Enter “M” in the Function field.

Note: “MYMENU” and “Menu” should be displayed in the Module and Model fields.

The Standard Parameters panel is displayed, showing the specifications you entered when you created the menu.

2 Enter “Second Heading for My Menu” in the Second header field.
The Additional Parameters panel is displayed.

3 Select the word “Functions” and type “Options”.
On the generated menu, Options will be displayed instead of Functions.

4 Enclose the words “Maintain” and “Browse” within angle brackets (for example, <Maintain>Warehouses and <Browse>Customer Orders).
Angle brackets are the default intensify characters for Natural Construct. They indicate that the enclosed text is highlighted on the generated menu screen.

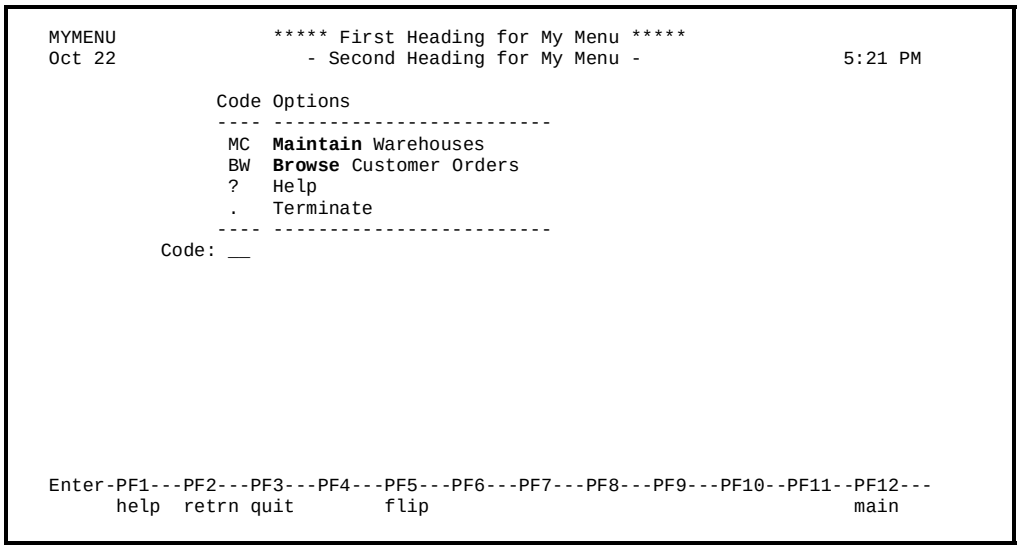
Tip: Notice that the intensify characters are placed in the space between words; they do not take up a physical space.

5 Press Enter.
You are returned to the Generation main menu.

6 Enter “G” in the Function field.
Natural Construct regenerates the menu program, incorporating your changes.

7 Enter “W” in the Function field.
Your menu is now regenerated and stowed.

8 Enter “T” in the Function field.
The following menu is displayed:



Sample Menu Program With Changes

You’ve successfully changed the specifications and regenerated the menu program. Now that you’re familiar with the generation subsystem, see **Natural Construct for New Application Development**, page 33, for information about creating a Natural Construct business object.

Creating Specification Documents

A common task an analyst performs is writing the specifications for a new program. Natural Construct can help create a list of questions you can use to create these documents.

- The first question is whether the program will be used in a client/server environment or as a stand-alone program. This answer restricts the range of models you should use.
- The next question is whether the program will query or maintain data, which further restricts the model selection.

  Once you've selected a model, you can use the fields on the model specification panels to determine what parameters may be required. For example, the following figure shows the first specification panel for the Menu model:

```
CUMNMA                          MENU Program                          CU--MA0
Oct 22                      Standard Parameters                        1 of 2

 Module ............. MYMENU__
 System ............. MYLIB_____________________________
 Global data area ... CDGDA___
 With block ......... _____________________________

 Title ............... Menu ..._________________
 Description ........ This menu ..._____________________________________________
                      _____________________________________________________________
                      _____________________________________________________________
                      _____________________________________________________________

 First heading ...... _____________________________________________________
 Second heading ..... _____________________________________________________

 Command ............ _
 Message numbers .... _
 Password ........... _

Enter-PF1---PF2---PF3---PF4---PF5---PF6---PF7---PF8---PF9---PF10--PF11--PF12---
right help  retrn quit                                             right main
```

Standard Parameters Panel for the Menu Model

Use the fields on this panel to determine what information is required to create the menu program. For example:

- What is the name of the menu program?
  This question is important if you must adhere to standardized naming conventions.
- What will it do?
- What is the first heading on the menu screen?
- What is the second heading?
- Will the menu allow users to access the Natural command line?
- Will the menu be implemented in different languages?
- Will the menu require security restrictions?

Press Enter to display the Additional Parameters panel and use the fields on that panel to determine other questions you need to answer. Once you have the answers to all these questions, you can easily write the specification document for the menu.

Utilities Supplied with Natural Construct

Natural Construct supplies many utilities to aid in the application development process. These utilities are described in different Natural Construct user documentation, depending on their function. The following table lists each document and some of the utilities it describes:

Document	Describes utilities to:
Natural Construct Administration and Modeling	• Transfer data across dissimilar platforms • Print a list of all code frames • Compare two source modules • Compare modules in two libraries • Convert Natural Construct components to uppercase For information, see the Utilities chapter.
Natural Construct Generation	• Transfer data across dissimilar platforms • Export models to a work file • Import models from a work file • Insert all INCLUDE statements into generated code (used for debugging) • Submit JCL • Convert the contents of the source buffer to uppercase • Regenerate multiple modules (either online or in batch) • Trace and debug Natural modules For information, see the Utilities chapter.
Natural Construct Help Text	• Print a copy of help text members • Unload members to a work file • Load members from a work or PC file to the help text file • Save the contents of the source buffer to the help text file For information, see the Utilities chapter.

NATURAL CONSTRUCT FOR NEW APPLICATION DEVELOPMENT

This chapter is intended for programmers who are creating new applications that require the benefits and functionality of object-oriented development for client/server applications. It describes a Natural Construct business object and how to define the business object in Predict. The last section in this chapter contains a step-by-step example of generating an object maintenance process.

The topics covered in this chapter are:

- **Natural Construct Business Object**, page 34
- **Add a Business Object**, page 36
- **Generate a Business Object**, page 39

Natural Construct Business Object

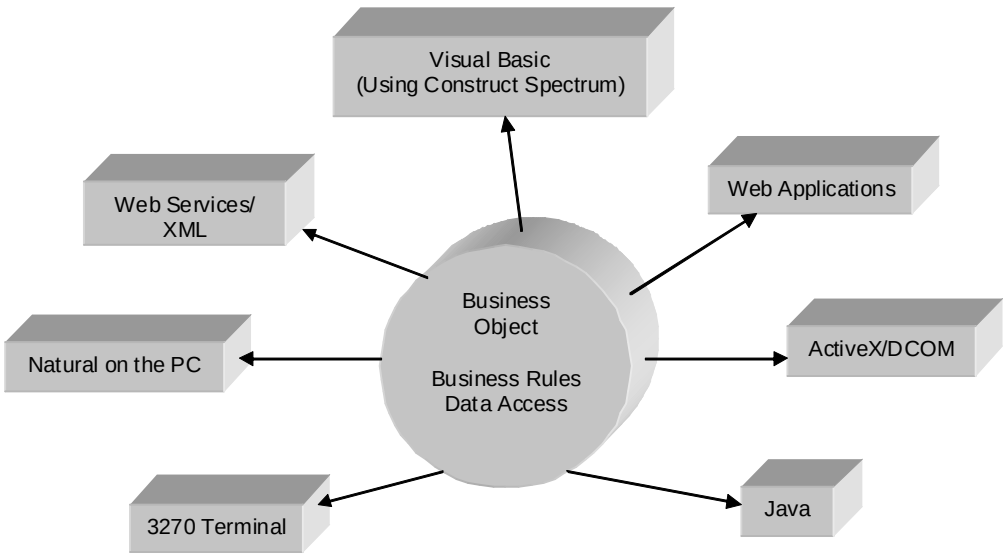
A business object is a group of entities that work together to process a single business function, such as adding an order. When you create a maintenance program using conventional design, the program contains the logic to access and validate data, as well as the user interface code. When you create the program using object-oriented design, the user interface is isolated from the rest of the program code.

The user interface component (dialog) invokes actions (methods) that are implemented by the data access component (data object). Because these components are separate, data is passed back and forth between the dialog and the data object via a communication component. The combination of these components produces a Natural Construct business object.

There are many advantages to separating data access from user interface, such as:

- Data, logic, and business rules are embedded in one central location.
- Data objects are reusable. For example, you can use the same data object with an Accounts Payable dialog and a Product Distribution dialog.
- The data object can be stored on a file server and the dialog can reside on another platform.

The following diagram shows how a Natural Construct business object encapsulates business rules and data access requirements for use with different interfaces:



Natural Construct Business Object

To create an object transaction, you must create the modules for the following data object and communication components:

Component	Module Required	Purpose
Data object		Builds the data access to a data structure.
	Object subprogram	Contains all the integrity checks, edit checks, and updates to the database.
Communication		Passes messages and data from the dialog to the data object.
	Parameter data area (object PDA)	Contains the database fields that comprise the data object.
	Restricted PDA	Contains variables for update logic that checks for intervening updates in the data object. It is passed with the object PDA.

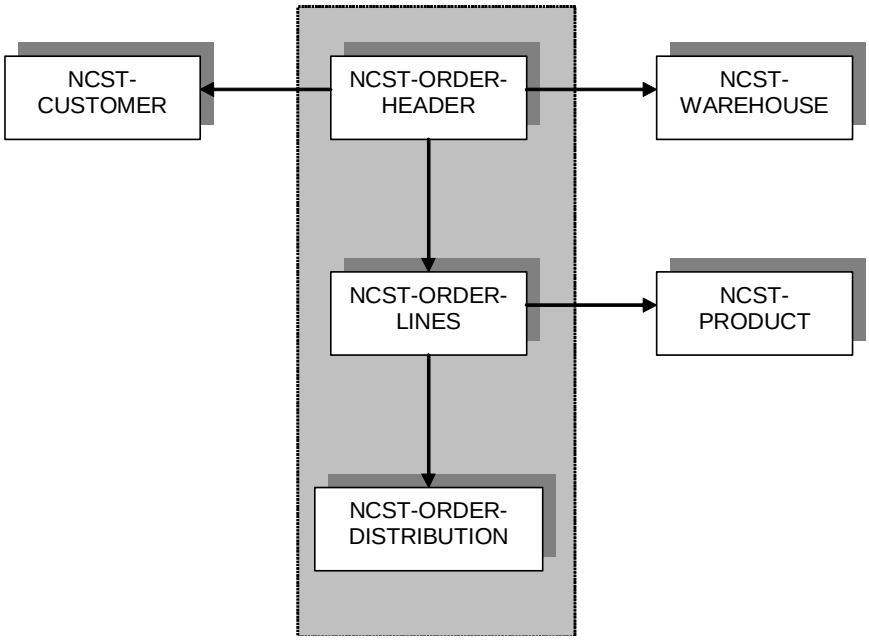
Natural Construct provides a series of models to generate the modules for an object transaction. The following table lists each module and which model to use:

Subcomponent	Model
PDA	Object-Maint-PDA
Restricted PDA	Object-Maint-PDA-R
Object subprogram	Object-Maint-Subp
Map	Map
Object maintenance dialog program	Object-Maint-Dialog
Object maintenance dialog subprogram	Object-Maint-Dialog-Subp

Note: In addition to the Object-Maint models, Natural Construct provides a series of Object-Browse models to generate an object query process. For information, see **Object-Browse Models**, *Natural Construct Generation*.

Add a Business Object

Once you decide to use a business object, the next step is to look at the relationships between the files. Certain relationships must exist before you can use the Object-Maint models effectively. The following diagram shows the files used for a maintenance function in the demo system supplied with Natural Construct:



Object Relationships

The files in the shaded area represent the business object, Order. These files have intra-object relationships. The NCST-CUSTOMER, NCST-WAREHOUSE, and NCST-PRODUCT files are not part of the Order object, but they do have inter-object relationships with the NCST-ORDER files.

The metadata stored in Predict provides Natural Construct with the information it needs to create data areas and generate a working program. When generating the components of an object transaction, Natural Construct not only uses the file information in Predict to build views, but it also builds referential integrity and verification rules based on the relationship metadata between the files.

When coding a maintenance program that maintains two or more files, you need to understand the file relationships and decide whether a modification of the business object (for example, the adding, deleting, or modifying of an order) will affect the secondary and/or tertiary files.

When you use the Object-Maint models to generate the program, you only specify the primary file; Natural Construct uses the Predict metadata to identify all other files that belong to the business object and all the maintenance logic required to access the data. To ensure data integrity, the primary file must contain a unique primary key field (either a descriptor or a superdescriptor) and a timestamp field.

For more information about the file views and relationships in Predict, see **Object-Maint Models**, *Natural Construct Generation.*

File Relationships Within Objects

To include files within a business object, you must verify that an intra-object relationship exists between the files and that it has been documented in Predict as type "N" (Natural Construct). Intra-object relationships relate the files within an object, since they define the object within the overall file structure.

Files have intra-object relationships if:

- They have an upper cardinality of (1:1) and a lower cardinality of (0 or 1:N).
- Always behave in a cascading delete fashion.
- Each contain a key that relates the parent file to the child file.

NCST-ORDER-HEADER and NCST-ORDER-LINES meet these requirements since:

- Every order header must have at least one order line.
- When an order is deleted, the order lines should also be deleted.
- NCST-ORDER-LINES has a key called ORDER-LINE-KEY that is made up of ORDER-NUMBER (a key field from NCST-ORDER-HEADER) and LINE-NUMBER (the suffix portion of the key).

Once you determine that intra-object relationships exist, define the relationship in Predict. All files used to define the relationships form a single object. From a Predict point of view, the object has already been created since Predict only describes the application's data needs and technical details required to implement the object.

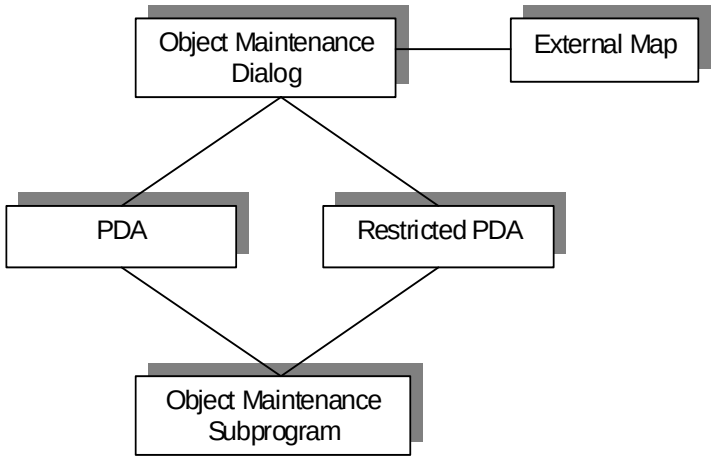
File Relationships Between Objects

The cardinality between files is identified by inter-object relationships. All inter-object relationships with a business object must have a restricted delete and update constraint type. For example, in the diagram shown on **page 36**, the NCST-CUSTOMER, NCST-WAREHOUSE, and NCST-PRODUCT files must have a restricted delete and update constraint type. You would not want actions (such as delete) to affect these files.

Application Design

After the files have been documented in Predict, you're ready to create the business object from a Natural Construct point of view. For the object maintenance process example, intra-object relationships exist between the NCST-ORDER-HEADER, NCST-ORDER-LINES, and NCST-ORDER-DISTRIBUTION files and inter-object relationships exist between the Order object and the NCST-CUSTOMER, NCST-WAREHOUSE, and NCST-PRODUCT files.

The following diagram shows the modules required to create an object maintenance process:



Modules Required for an Object Maintenance Process

Generate a Business Object

In this section, you'll generate a business object to maintain customer orders. It is assumed that the required demo modules and Predict relationships are installed.

Note: Before beginning the procedure, ensure that the required modules have been copied to the current library. For a list of modules, see **Before You Begin**, page 23.

➢ To create an object maintenance process:

1 Generate the object maintenance subprogram, which automatically generates the object PDA and restricted object PDA.

2 Generate the external map.

3 Generate the object maintenance dialog.

The components must be generated in this order as the specifications for the object maintenance dialog require the names of an existing map, object maintenance subprogram, object PDA, and restricted object PDA.

In the following sections, you'll generate the object maintenance subprogram and dialog for an order maintenance function. The external map is one of the demo system modules you copied into your library in Chapter 1 of this guide.

Generating the Object Maintenance Subprogram

➢ To generate the object maintenance subprogram:

1 Enter "ncstg" at the Natural prompt.
The Generation main menu is displayed.

2 Enter "C" in the Function field.
This clears the edit buffer.

3 Specify the following:

M	Function field
MYORDSUB	Module field

4 Press Enter.
Because you didn't specify a model name, Natural Construct displays the Select Model window.

5 Enter "O" in the Model field.
This repositions the list of models to model names beginning with "O".

6 Select "Object-Maint-Subp".

7 Press Enter.
The Standard Parameters panel is displayed:

```
CUOBMA                  OBJECT-MAINT-SUBP Subprogram                CUOBMA0
Oct 22                      Standard Parameters                      1 of 2

 Module ............. MYORDSUB
 System ............. MYLIB_____________________________

 Title .............. Object ...._______________
 Description ........ This subprogram is used to perform object maintenance__
                       for..._____________________________________________
                       _____________________________________________________
                       _____________________________________________________

 Message numbers .... _




Enter-PF1---PF2---PF3---PF4---PF5---PF6---PF7---PF8---PF9---PF10--PF11--PF12---
right help  retrn quit                                          right main
```

Standard Parameters Panel for the Object-Maint-Subp Model

8 Specify the following:

Order Maintenance Subprog	Title field
... the Order business object	Description field

9 Press Enter.
The Additional Parameters panel is displayed:

```
CUOBMB                  OBJECT-MAINT-SUBP Subprogram                  CUOBMB0
Oct 22                     Additional Parameters                       2 of 2

   Predict view ............. _____________________________________ *
   Primary key .............. _____________________________________ *
   Hold field ............... _____________________________________ *

   Object description ....... ____________________

                                        Generate   Source     Object
   Object PDA ............... MYORMSA_ *       X
   Restricted PDA ........... MYORMSR_ *       X
   Object name .............. MYORMSA_____________________________

   Next action prefix ....... _
   Log file suffix .......... ________
   Trace relationships ...... _



Enter-PF1---PF2---PF3---PF4---PF5---PF6---PF7---PF8---PF9---PF10--PF11--PF12---
main  help  retrn quit                                    left  userX main
```

Additional Parameters Panel for the Object-Maint-Subp Model

10 Specify the following:

NCST-ORDER-HEADER	Predict view field
ORDER-NUMBER	Primary key field
ORDER-TIMESTAMP	Hold field

Tip: As indicated by the asterisk (*), these fields have selection help available. To display the selection window, either type "?" and press Enter or press PF1 (help) when the cursor is in the field.

11 Type "Order" in the Object description field.
Application messages will be displayed as "Order has been added" or "Order has been updated".

Note: Because the object PDA and restricted PDA do not exist, Natural Construct will automatically name and generate these modules. It determines their names based on the object maintenance subprogram name. For information, see **Object-Maint Models**, *Natural Construct Generation*.

12 Type "Order" over "MYORMSA" displayed in the Object name field.

13 Press Enter.
You are returned to the Generation main menu.

14 Enter “G” in the Function field.
A confirmation message is displayed, indicating that the subprogram has been generated. For more information, see **Generate Source Function**, *Natural Construct Generation*.

15 Enter “W” in the Function field.
A confirmation message is displayed, indicating that the subprogram has been stowed. For more information, see **Stow Generated Source Function**, *Natural Construct Generation*.

Next, you’ll list the objects in your library to see how many modules have been created.

16 Enter “L” in the Function field.
The Select Module window is displayed:

```
CSGLIST                   Natural Construct                   CSGLIST0
Dec 03                      Select Module                       1 of 1

  Module               Model                         Title
---------- ------------------------------- ------------------------
MYORDSUB   OBJECT-MAINT-SUBP               Order Maintenance Subprog
MYORMSA    OBJECT-MAINT-PDA
MYORMSR    OBJECT-MAINT-PDA-R
SUPRDREW   VB-CLIENT-SERVER-SUPER-MODEL    Super Spec for...
VB-DREW    VB-CLIENT-SERVER-SUPER-MODEL    Super Spec for...
VEHLBCPV   VB-BROWSE-OBJECT                VB Browse Object ...
VEHLBSO    OBJECT-BROWSE-SUBP              Object Browse ...
VEHLBSP    SUBPROGRAM-PROXY                Subprogram proxy for...
VEHLMCDV   VB-MAINT-DIALOG                 Object Dialog...
VEHLMCPV   VB-MAINT-OBJECT                 Visual Basic Maint Object
VEHLMSA    OBJECT-MAINT-PDA
Module ... ________  Model .... ____________________________
Enter-PF1---PF2---PF3---PF4---PF5---PF6---PF7---PF8---PF9---PF10--PF11
      help  retrn                         bkwrd frwrd
```

Select Module Window

Notice that three modules were generated: the object maintenance subprogram, the object PDA and the restricted object PDA.

17 Press PF2 (retrn).
You are returned to the Generation main menu. Now, you’ll regenerate the subprogram and specify trace options.

18 Enter “M” in the Function field.
The Standard Parameters panel is displayed.

19 Press Enter.
The Additional Parameters panel is displayed:

```
CUOBMB                  OBJECT-MAINT-SUBP Subprogram                  CUOBMB0
Dec 03                     Additional Parameters                       2 of 2

   Predict view ............. NCST-ORDER-HEADER_______________ *
   Primary key .............. ORDER-NUMBER____________________ *
   Hold field ............... ORDER-TIMESTAMP_________________ *

   Object description ....... Order_______________

                                        Generate   Source     Object
   Object PDA ............... MYORMSA_ *       _      MYLIB      MYLIB
   Restricted PDA ........... MYORMSR_ *       _      MYLIB      MYLIB
   Object name .............. Order_____________________________

   Next action prefix ....... _
   Log file suffix .......... ________
   Trace relationships ...... _



Enter-PF1---PF2---PF3---PF4---PF5---PF6---PF7---PF8---PF9---PF10--PF11--PF12---
main  help  retrn quit                                    left  userX main
```

Additional Parameters Panel

Notice that the parameter data areas are not being generated by default.

20 Mark the Trace relationships field.

21 Press Enter.
You are returned to the Generation main menu.

22 Enter “G” in the Function field.
Because you marked the Trace relationships field, Natural Construct displays each Predict relationship and indicates whether it has been accepted as an intra- or inter-object relationship.

For example, Natural Construct displays the following message for the NCST-ORDER-HAS-LINES relationship between the NCST-ORDER-HEADER and NCST-ORDER-LINES files:

```
CUOBGPR4                    Natural Construct                    CUOPGPR0
Dec 03             NCST-ORDER-HEADER Relationship Trace            1 of 1

Relationship ....... NCST-ORDER-HAS-LINES
Type ............... N

Cardinality ........ 1  : CN

File 1                                      Minimum    Average    Maximum
File ..... NCST-ORDER-HEADER                  1        1.00         1
Field .... ORDER-NUMBER
File 2
File ..... NCST-ORDER-LINES                             5.00         30
Field .... ORDER-LINE-KEY
Constraint attribute
Update Type .. N
Delete Type .. C
Enter-PF1---PF2---PF3---PF4---PF5---PF6---PF7---PF8---PF9---PF10--PF11--PF1
      help  retrn
Relationship accepted as part of object MYORMSA
```

NCST-ORDER-HAS-LINES Relationship

This indicates an intra-object relationship between the files and the object is maintained.

23 Press Enter to display the next relationship.

24 Press Enter again.
The NCST-PRODUCT-ORDER-LINES relationship is displayed:

```
CUOBGPR4                    Natural Construct                    CUOPGPR0
Dec 03             NCST-ORDER-LINES Relationship Trace             1 of 1

Relationship ....... NCST-PRODUCT-ORDER-LINES
Type ............... N

Cardinality ........ 1  : CN

File 1                                    Minimum    Average    Maximum
File ..... NCST-PRODUCT                     1        1.00         1
Field .... PRODUCT-ID
File 2
File ..... NCST-ORDER-LINES                          100.00
Field .... ORDER-PRODUCT-ID
Constraint attribute
Update Type .. R
Delete Type .. R
Enter-PF1---PF2---PF3---PF4---PF5---PF6---PF7---PF8---PF9---PF10--PF11--PF1
      help  retrn
Accepted as object Update Type constraint against foreign file
```

NCST-PRODUCT-ORDER-LINES Relationship

This indicates an inter-object relationship between the files and Natural Construct will check to see if the product exists before adding an order line to the order.

25 Continue pressing Enter until all relationships have been displayed.
When generation is completed, a confirmation message is displayed.

26 Enter "W" in the Function field.
A confirmation message is displayed. Your object maintenance subprogram is now regenerated and stowed.

Tip: If your module will not stow, ensure that you changed the object name to Order on the Additional Parameters panel.

You've successfully created the object maintenance subprogram. To see the code generated by the Object-Maint-Subp model, enter "E" in the Function field.

Note: If you have any problems creating the subprogram, see **Troubleshooting and Debugging**, page 93, for possible reasons.

For more information about the Object-Maint-Subp model, see **Object-Maint-Subp Model**, *Natural Construct Generation*.

Supplied External Map

The external map is called "MYMAP" and is one of the modules copied into your library from from the demo library. This map was created using the Map model. (For more information, see **Map Model**, *Natural Construct Generation*.)

Natural Construct provides many variables you can use on your maps. For example, you can use the following variables to define scroll regions on a map:

Variable	Purpose
#LIN (P3)	Output field that identifies the array occurrences. The upper bounds value for this variable must match the upper bounds value for the largest array.
#NEXT-ARRAYn (P3)	Modifiable field that allows the user to specify which occurrence appears at the top of the display area.
#ARRAYn (N7)	Starting index for all the fields from the secondary file.

For a complete list of the variables you can use on a maintenance map, see **Variables You Can Use with Object-Maint-Dialog Model Maps**, *Natural Construct Generation*.

Generating the Object Maintenance Dialog

➢ To generate the object maintenance dialog:

1 Enter “C” in the Function field on the Generation main menu.
This clears the specifications from the previous generation.

2 Specify the following:

M	Function field
MYORDDIA	Module field
Object-Maint-Dialog	Model field

3 Press Enter.
The Standard Parameters panel is displayed:

```
CUOMMA                  OBJECT-MAINT-DIALOG Program                  CU--MA0
Oct 22                      Standard Parameters                       1 of 4

 Module ............. MYORDDIA
 System ............. MYLIB_____________________________
 Global data area ... CDGDA___
 With block ......... _____________________________

 Title ............. Object Dialog..._________
 Description ........ This program is used to maintain the..._________________
                      ____________________________________________________
                      ____________________________________________________
                      ____________________________________________________

 First heading ...... ____________________________________________
 Second heading ..... ____________________________________________________

 Command ............ _
 Message numbers .... _
 Password ........... _

 Enter-PF1---PF2---PF3---PF4---PF5---PF6---PF7---PF8---PF9---PF10--PF11--PF12---
 right help  retrn quit                                          right main
```

Standard Parameters Panel for the Object-Maint-Dialog Model

4 Specify the following:

NCGDA	Global data area field
Order Maintenance Dialog	Title field
... Order business object	Description field
Order Entry System	First header field
Maintain Customer Orders	Second header field

5 Press Enter.
The Additional Parameters panel is displayed:

```
CUOMMB                  OBJECT-MAINT-DIALOG Program                  CUOMMB0
Oct 22                     Additional Parameters                      2 of 4


   Object maint subprogram .. ________ *

   #ACTION field length ..... 1  Add ...... X  Browse ... ________ *
                                 Clear .... X  Display .. X
                                 Modify ... X  Next ..... X
                                 Purge .... X  Former ... _

   Window support ........... _
   Push-button support ...... _
   Mark cursor field ........ ____________________________________________


Enter-PF1---PF2---PF3---PF4---PF5---PF6---PF7---PF8---PF9---PF10--PF11--PF12---
      help  retrn quit        windw                         left  right main
```

Additional Parameters Panel for the Object-Maint-Dialog Model

6 Select “MYORDSUB” from the Object maint subprogram field.
This is the name of the object maintenance subprogram you created.

Note: By default, the Add, Clear, Display, Modify, Next, and Purge actions are selected. These are the actions the program will allow.

7 Type “2” over “1” displayed in the #ACTION field length field.
You change the length because the action field on MYMAP is two characters long.

8 Mark the Push-button support field.
This allows users to select actions by cursor on the generated screen.

9 Press Enter.
The Scroll Region Parameters panel is displayed:

```
CUOMMC                  OBJECT-MAINT-DIALOG Program                  CUOMMC0
Oct 22                    Scroll Region Parameters                    3 of 4


   Horizontal panels ................. 1

   >> 1 Input using map .............. ________ *

        Scrollable Regions              1        2        3        4
        Total occurrences .............  _____    _____    _____    _____
        Screen occurrences ............  ___      ___      ___      ___
        Starting from ................. #ARRAY1  #ARRAY2  #ARRAY3  #ARRAY4
        Scroll with panel .............   _        _        _        _

        Top left ...... Line .........  ___      ___      ___      ___
                        Column .......  ___      ___      ___      ___
        Bottom right .. Line .........  ___      ___      ___      ___
                        Column .......  ___      ___      ___      ___

        Depth occurrences ............. ___

Enter-PF1---PF2---PF3---PF4---PF5---PF6---PF7---PF8---PF9---PF10--PF11--PF12---
      help  retrn quit        deflt       bkwrd frwrd       left  right main
```

Scroll Region Parameters Panel for the Object-Maint-Dialog Model

10 Select “MYMAP” from the Input using map field.

11 Press PF5 (deflt).
Natural Construct reads the map and retrieves information about the arrays and scroll regions:

```
CUOMMC                  OBJECT-MAINT-DIALOG Program                  CUOMMC0
Oct 22                    Scroll Region Parameters                    3 of 4


   Horizontal panels ................. 1

   >> 1 Input using map .............. MYMAP *

        Scrollable Regions              1        2        3        4
        Total occurrences .............  30___    10___    20___    _____
        Screen occurrences ............  1__      4__      2__      ___
        Starting from ................. #ARRAY1  #ARRAY2  #ARRAY3  #ARRAY4
        Scroll with panel .............   _        _        _        _

        Top left ...... Line .........  10_      10_      16_      ___
                        Column .......  2__      45_      2__      ___
        Bottom right .. Line .........  15_      15_      18_      ___
                        Column .......  70_      70_      64_      ___

        Depth occurrences ............. ___

Enter-PF1---PF2---PF3---PF4---PF5---PF6---PF7---PF8---PF9---PF10--PF11--PF12---
      help  retrn quit        deflt       bkwrd frwrd       left  right main
Scroll parameters read from MYMAP map successfully
```

Scroll Region Parameters Panel — After Pressing PF5 (deflt)

12 Press Enter.
The Related File Parameters panel is displayed. As Natural Construct does not require access to other files, you don't need to specify information on this panel.

13 Press Enter again.
You are returned to the Generation main menu.

14 Enter "G" in the Function field.

15 Enter "W" in the Function field.
Your maintenance dialog is now generated and stowed.

To see the code generated by the Object-Maint-Dialog model, enter "E" in the Function field. To see what the panel will look like to users, enter "T" in the Function field:

```
 Add        Clear      Display    Modify     Next       Purge

MYORDDIA                ***** Order Entry System *****              MYMAP
Oct 25,01                - Maintain Customer Orders -             9:00 PM
 Action...........: __
 Order Number.....: ______   Invoice Number.....: ______
 Customer Number..: _____
 Warehouse ID.....: ___
 Order Date.......:          Order Amount:
 1_ ----- Product Information ------        1_ Distribution Information
  1 *Product....: ______             /\          Account     Amount
    Quantity...: _________                    1  _________ ____________ /\
    Cost/Unit..:                              2  _________ ____________
    Total......:                              3  _________ ____________
    Description:                      \/      4  _________ ____________ \/
 1_ Delivery Instructions (Scroll right for full screen)
  1                                                                  /\
  2                                                                  \/


Enter-PF1---PF2---PF3---PF4---PF5---PF6---PF7---PF8---PF9---PF10--PF11--PF12---
confm help  retrn quit        flip  pref  bkwrd frwrd                  main
```

Maintain Customer Orders Panel

16 Press PF2 (retrn).
You are returned to the Generation main menu.

You've successfully created the object maintenance dialog, but there are no business rules or validation edits. You can add this logic in the UPDATE-EDITS user exit for the object maintenance subprogram (the MYORDSUB module). The following section describes how to do this.

Note: If you have any problems creating the dialog, see **Troubleshooting and Debugging**, page 93, for possible reasons.

For more information, see **Object-Maint-Dialog Model**, *Natural Construct Generation*.

Adding Business Rules and Validation Edits

➢ To add business rules and validation edits:

1 Enter “C” in the Function field on the Generation main menu.

2 Specify the following:

R	Function field
MYORDSUB	Module field

3 Press Enter.
Natural Construct reads the object maintenance subprogram into the edit buffer.

4 Enter “U” in the Function field.
Because you marked the Trace relationships field when you created MYORDSUB, the relationship windows are displayed. Continue pressing Enter until all relationships have been shown and the User Exits panel is displayed:

```
CSGSAMPL                      NATURAL CONSTRUCT                        CSGSM0
Oct 22                            User Exits                           1 of 1

               User Exit              Exists    Sample   Required Conditional
    -------------------------------- -------- ---------- -------- ------------
  _  CHANGE-HISTORY                             Subprogram
  _  PARAMETER-DATA                              Example
  _  EXTENDED-RI-VIEWS
  _  LOCAL-DATA                                  Example
  _  START-OF-PROGRAM                            Example
  _  SELECT-STATEMENT                           Subprogram               X
  _  USER-DEFINED-FUNCTIONS                      Example
  _  BEFORE-ET-PROCESSING                        Example
  _  AFTER-ET-PROCESSING                         Example
  _  END-OF-PROGRAM                              Example
  _  AFTER-GET                                   Example
  _  AFTER-INIT                                  Example
  _  UPDATE-EDITS                               Subprogram
  _  DELETE-EDITS                               Subprogram
  _  AFTER-GET-EDITS                            Subprogram
  _  EXTENDED-RI-CHECKS                         Subprogram
Enter-PF1---PF2---PF3---PF4---PF5---PF6---PF7---PF8---PF9---PF10--PF11--PF12---
frwrd help  retrn quit                   bkwrd frwrd
```

User Exits Panel for the Object-Maint-Dialog Model

5 Mark the UPDATE-EDITS user exit.

6 Press Enter twice.
The UPDATE-EDITS Build Subroutine window is displayed:

```
CUOBGS                      Natural Construct                      CUOBGS0
Oct 22                UPDATE-EDITS Build Subroutine                 1 of 1

   File name
-----------------------------------
 _ NCST-ORDER-HEADER
 _ NCST-ORDER-LINES
 _ NCST-ORDER-DISTRIBUTION



Enter-PF1---PF2---PF3---PF4---PF5---PF6---PF7---PF8---PF9---PF10--PF11--PF
      help  retrn
```

UPDATE-EDITS Build Subroutine Window

Natural Construct provides validation subroutines that execute edit checks at different points during the processing of an entity.

7 Mark NCST-ORDER-HEADER.

8 Press Enter.
The default code is displayed in the User Exit editor:

```
0010 DEFINE EXIT UPDATE-EDITS
0020 *
0030 * Specify subroutines of the form V0-entity-name (or V1- or V2-) used
0040 * to validate or manipulate data before an UPDATE/STORE operation which
0050 * move data from the object to the entity-name record. Data manipulation
0060 * must be made against the record. If any reference to the object is
0070 * required because the relevant fields have different names on the
0080 * object and the file, appropriate indices (#L2),(#L2,#L3),(#L2,#L3,#L4)
0090 * should be used. The V2- routine is performed for an entity after all
0100 * of its children's processing while the V0-/V1- are invoked before
0110 * its children's, and before/after its PREDICT rules respectively.
0120 *
0130 ************************************************************************
0140 DEFINE SUBROUTINE V0-NCST-ORDER-HEADER
0150 ************************************************************************
0160 *
0170 * Insert code which is necessary to validate/manipulate the data from
0180 * NCST-ORDER-HEADER record before an update/store operation,
0190 * before its children's processing and before its PREDICT rules if any.
0200 *
0210 DECIDE FOR FIRST CONDITION
0220   WHEN NCST-ORDER-HEADER.ORDER-NUMBER EQ 0
0230     ASSIGN MSG-INFO.##MSG = ' :1: is required'
0240     ASSIGN MSG-INFO.##MSG-DATA(1) = 'Order Number'
0250     ASSIGN MSG-INFO.##ERROR-FIELD = 'ORDER-NUMBER'
0260   WHEN NCST-ORDER-HEADER.ORDER-AMOUNT EQ 0
0270     ASSIGN MSG-INFO.##MSG = ' :1: is required'
0280     ASSIGN MSG-INFO.##MSG-DATA(1) = 'Order Amount'
0290     ASSIGN MSG-INFO.##ERROR-FIELD = 'ORDER-AMOUNT'
0300   WHEN NCST-ORDER-HEADER.ORDER-DATE EQ 0
0310     ASSIGN MSG-INFO.##MSG = ' :1: is required'
0320     ASSIGN MSG-INFO.##MSG-DATA(1) = 'Order Date'
0330     ASSIGN MSG-INFO.##ERROR-FIELD = 'ORDER-DATE'
0340   WHEN NCST-ORDER-HEADER.ORDER-CUSTOMER-NUMBER EQ 0
0350     ASSIGN MSG-INFO.##MSG = ' :1: is required'
0360     ASSIGN MSG-INFO.##MSG-DATA(1) = 'Customer Number'
0370     ASSIGN MSG-INFO.##ERROR-FIELD = 'ORDER-CUSTOMER-NUMBER'
0380   WHEN NCST-ORDER-HEADER.ORDER-WAREHOUSE-ID EQ ' '
```

```
0390     ASSIGN MSG-INFO.##MSG = ' :1: is required'
0400     ASSIGN MSG-INFO.##MSG-DATA(1) = 'Warehouse ID'
0410     ASSIGN MSG-INFO.##ERROR-FIELD = 'ORDER-WAREHOUSE-ID'
0420   WHEN NCST-ORDER-HEADER.INVOICE-NUMBER EQ 0
0430     ASSIGN MSG-INFO.##MSG = ' :1: is required'
0440     ASSIGN MSG-INFO.##MSG-DATA(1) = 'Invoice Number'
0450     ASSIGN MSG-INFO.##ERROR-FIELD = 'INVOICE-NUMBER'
0460   WHEN NCST-ORDER-HEADER.DELIVERY-INSTRUCTIONS(*) EQ ' '
0470     ASSIGN MSG-INFO.##MSG = ' :1: is required'
0480     ASSIGN MSG-INFO.##MSG-DATA(1) = 'Delivery Instructions'
0490     ASSIGN MSG-INFO.##ERROR-FIELD = 'DELIVERY-INSTRUCTIONS'
0500     ASSIGN MSG-INFO.##ERROR-FIELD-INDEX1 = 1
0510   WHEN ANY
0520     ESCAPE ROUTINE
0530   WHEN NONE
0540     IGNORE
0550 END-DECIDE
0560 END-SUBROUTINE /* V0-NCST-ORDER-HEADER
0570 *
0580 ************************************************************************
0590 DEFINE SUBROUTINE V1-NCST-ORDER-HEADER
0600 ************************************************************************
0610 *
0620 * Insert code which is necessary to validate/manipulate the data from
0630 * NCST-ORDER-HEADER record before an update/store operation,
0640 * before its children's processing and after its PREDICT rules if any.
0650 *
0660   ESCAPE ROUTINE
0670 END-SUBROUTINE /* V1-NCST-ORDER-HEADER
0680 *
0690 ************************************************************************
0700 DEFINE SUBROUTINE V2-NCST-ORDER-HEADER
0710 ************************************************************************
0720 *
0730 * Insert code which is necessary to validate/manipulate the data from
0740 * NCST-ORDER-HEADER record before an update/store operation
0750 * after all of its children have been processed.
0760 *
0770   ESCAPE ROUTINE
0780 END-SUBROUTINE /* V2-NCST-ORDER-HEADER
0790 END-EXIT
```

For this example, you need only ensure that the order number and amount are not zero.

9 In the DEFINE SUBROUTINE V0-NCST-ORDER-HEADER section, delete the conditions for the order date, order customer number, order warehouse ID, invoice number, and delivery instructions (lines 300 to 500 of the default code).

10 Type “.” on the command line in the User Exit editor.

11 Press Enter.
You are returned to the Generation main menu.

12 Enter “G” in the Function field.

13 Enter “W” in the Function field.
Your object maintenance subprogram is now generated and stowed.

You’ve successfully added business rules and validation edits to your object maintenance subprogram. The following section describes how to execute the Maintain Customer Orders function you’ve created.

Executing the Program

Up to this point, you've executed programs using the Test Source function on the Generation main menu. You can also execute Natural Construct-generated programs as you do any Natural program — from the command line.

➢ To execute the Maintain Customer Orders function:

1 Type "MYORDDIA" on the Natural command line.

2 Press Enter.
The Maintain Customer Orders panel is displayed.

3 Move the cursor to Next.

4 Press Enter.
The order information for the first record is displayed:

```
 Add        Clear      Display    Modify     Next       Purge

MYORDDIA                ***** Order Entry System *****               MYMAP
Oct 25                   - Maintain Customer Orders -              9:25 PM
 Action...........: __
 Order Number.....: 122___   Invoice Number.....: 999___
 Customer Number..: 22266
 Warehouse ID.....: 544
 Order Date.......: 99/08/12 Order Amount: 10880.00
 1_ ----- Product Information ------        1_ Distribution Information
  1 *Product....: 187361             /\          Account     Amount
     Quantity...: 444_____                    1  _________ ____________ /\
     Cost/Unit..:      20.00                  2  _________ ____________
     Total......:      8880.00                3  _________ ____________
     Description: Fish Sticks        \/       4  _________ ____________ \/
 1_ Delivery Instructions (Scroll right for full screen)
  1                                                                    /\
  2                                                                    \/


Enter-PF1---PF2---PF3---PF4---PF5---PF6---PF7---PF8---PF9---PF10--PF11--PF12---
confm help  retrn quit        flip  pref  bkwrd frwrd                  main
```

Maintain Customer Orders Panel

You've successfully executed the Maintain Customer Orders function from the Natural command line. To test the edits, try adding an order with an order number or amount of zero and see if an error message is displayed.

Note: If you have any problems executing the program, see **Troubleshooting and Debugging**, page 93, for possible reasons.

NATURAL CONSTRUCT FOR THE NATURAL PROGRAMMER

This chapter contains information about using Natural Construct in the Natural development environment. It is intended for Natural programmers who are not familiar with the product and want to know how it can help them develop Natural applications. This chapter shows how to take advantage of Natural Construct as a development aid — without creating entire applications. The information is especially useful for maintenance programmers.

The topics covered in this chapter are:

- **Creating Test Data**, page 56
- **Testing Subprograms and Helproutines**, page 58
- **Comparing Natural Objects**, page 61
- **Creating Online Reports**, page 66
- **Writing Natural Statements**, page 87

Creating Test Data

When developing Natural programs, you often require data to test your programs. Did you know you can use the Maint model to generate a maintenance program for a file associated with your program? This allows you to quickly add data to test new Natural programs. For example, you can generate a maintenance program for the NCST-CUSTOMER file to supply data to test a new customer browse program.

For a more detailed description of the Maint model, see **Maint Model**, *Natural Construct Generation*.

➢ To generate a maintenance program:

1 Enter “ncstg” at the Natural Next prompt.
The Generation main menu is displayed.

2 Specify the following:

M	Function field
MYMAINT	Module field
Maint	Model field

Note: If you do not specify a model name, Natural Construct displays a selection window.

3 Press Enter.
The Standard Parameters panel is displayed:

```
CUFMMA                          MAINT Program                          CU--MA0
Oct 23                       Standard Parameters                        1 of 3

 Module ............. MYMAINT_
 System ............. MYLIB_____________________________
 Global data area ... CDGDA___
 With block ......... _____________________________

 Title ............. Maintain..._______________
 Description ........ This program is used to maintain the...________________
                      ____________________________________________________________
                      ____________________________________________________________
                      ____________________________________________________________

 First heading ...... ____________________________________________________
 Second heading ..... ____________________________________________________

 Command ............ _
 Message numbers .... _
 Password ........... _

Enter-PF1---PF2---PF3---PF4---PF5---PF6---PF7---PF8---PF9---PF10--PF11--PF12---
right help  retrn quit                                            right main
```

Standard Parameters Panel for the Maint Model

4 Enter “Test Maintenance Program” in the First header field.
The Additional Parameters panel is displayed:

```
CUFMMB                          MAINT Program                          CUFMMB0
Oct 24                       Additional Parameters                      2 of 3

 Predict view ............. _____________________________ *
   Natural (DDM) .......... _____________________________
 Primary key .............. _____________________________ *
 Record description ....... _________________
 Log file name ............ _____________________________ *
   Natural (DDM) .......... _____________________________
 Input using map .......... ________ *
 Minimum key value ........ ____________________________________________________
 Maximum key value ........ ____________________________________________________
 Single prompt ............ _
 Multiple prompts ......... _
 Mark cursor field ........ ____________________________________________________

 #ACTION field length ..... 1  Add ...... X  Browse ... ________ *
                               Clear .... X  Display .. X
                               Modify ... X  Next ..... X
                               Purge .... X  Recall ... _  Former ... _
 Push-button support ...... _
Enter-PF1---PF2---PF3---PF4---PF5---PF6---PF7---PF8---PF9---PF10--PF11--PF12---
right help  retrn quit                                     left  right main
```

Additional Parameters Panel for the Maint Model

5 Select the following:
   – "NCST-CUSTOMER" from the Predict view field
   – "CUSTOMER-NUMBER" from the Primary key field
6 Press Enter.
   The Secondary File Parameters panel is displayed.
7 Press Enter again.
   You are returned to the Generation main menu.
8 Enter "G" in the Function field.
   When generation is completed, a confirmation message is displayed.

   Enter "W" in the Function field.
   Another confirmation message is displayed. You can now use the maintenance program to enter test data for the browse program.

Note: For more information, see **Generate Source Function** and **Stow Generated Source Function**, *Natural Construct Generation*.

To see the code generated by the Maint model, enter "E" in the Function field.

Testing Subprograms and Helproutines

To test Natural subprograms and helproutines, you require a program to call the modules. Use the Driver model to create a driver program to test and debug subprograms and helproutines.

The Driver model determines the parameters in a subprogram, defines the parameters in a simple driver program, and generates an input screen. This allows you to easily test the module without the complex logic of programs that typically call the subprogram. The Driver model also supplies headings and PF-keys in the language of your choice.

Tip: Using a driver program can eliminate the complexity of debugging a subprogram that runs in a GUI, client/server environment.

In the following example, you'll create a driver program to test the NCOSODET browse subprogram, which displays details about order lines.

Note: Before beginning the procedure, ensure that the required modules have been copied to the current library. For a list of modules, see **Before You Begin**, page 23.

➢ To generate a driver program:

1 Enter “ncstg” at the Natural Next prompt.
The Generation main menu is displayed.

2 Specify the following:

M	Function field
MYDRIVER	Module field
Driver	Model field

3 Press Enter.
The Driver Program window is displayed:

```
CUDRMA                          DRIVER Program                          CUDRMA0
Dec 04                       Standard Parameters                         1 of 1

  Module ............. MYDRIVER
  System ............. MYLIB_____________________________

  Title .............. Driver Program___________
  Description ........ Driver program for ...____________________________________
                       ________________________________________________________
                       ________________________________________________________
                       ________________________________________________________

                                       Source      Object
  Called Module ...... ________ *

Enter-PF1---PF2---PF3---PF4---PF5---PF6---PF7---PF8---PF9---PF10--PF11--PF12---
main  help  retrn quit                                            userX main
```

Driver Program Window

4 Select “NCOSODET” from the Called Module field.

5 Press Enter.
The names of the library containing the source and object code for the NCOSODET subprogram are displayed.

6 Press Enter again.
You are returned to the Generation main menu.

7 Enter “G” in the Function field.
A confirmation window is displayed, indicating that generation was successful.

8 Enter “W” in the Function field.
The driver program is stowed.

Note: You cannot regenerate a driver program.

9 Enter “T” in the Function field.
The Driver Program window is displayed:

```
MYDRIVER                  Natural Construct
Dec 04                      Driver Program                        1 of 1

Subprogram ......... NCOSODET

Input Parameters ... #PDA-KEY ______0 SELECTED-FUNCTION __________ ##COMMAN
_____________________________________________________________ ##MAIN _______
##QUIT _________ ##MSG
_____________________________________________________________________________
##MSG-NR ____0 ##MSG-DATA ____________________________________
_____________________________ ____________________________________ ##RETURN-
_ ##ERROR-FIELD ____________________________________ ##ERROR-FIELD-INDEX1 ___0
##ERROR-FIELD-INDEX2 ___0 ##ERROR-FIELD-INDEX3 ___0 ##USER _________
Enter-PF1---PF2---PF3---PF4---PF5---PF6---PF7---PF8---PF9---PF10--PF11--PF1
      help        quit                   bkwrd frwrd       right left
```

Driver Program Window

10 Enter “111” in the #PDA-KEY field.
The NCOSODET subprogram is processed for order number 111:

```
NCOSODET    ***** ORDER SUBSYSTEM *****
Dec  4,01         - ORDER DETAIL -         1 more >

Ln Prod Id Quantity  Unit Cost   Total Cost
-- ------- --------- ---------- ------------
 1 199210          5     100.00       500.00
 2 111111          2     555.00      1110.00
 3 745977          1       7.00         7.00
 4 777208         20      55.00      1100.00
             *** End of Data ***

Line Order Number: 000111 Line Number: __
Direct command...: _____________________________
Enter-PF1---PF2---PF3---PF4---PF5---PF6---PF7---PF8
      help  retrn quit        flip        bkwrd frw
```

Order Detail Window

Tip: When you enter “111” in the #PDA-KEY field, ensure that you remove the “0”.

For a description of the Driver model, see **Driver Model**, *Natural Construct Generation*.

Comparing Natural Objects

Natural Construct supplies various utilities to help you develop Natural applications. This section describes two of these utilities:

- CSGCMPL utility, which you can use to compare a range of Natural objects in one library to the same objects in another library
- CSGCMPS utility, which you can use to compare the code in two programs

Note: For information about other utilities, see **Utilities Supplied with Natural Construct**, page 32.

Comparing Objects in Different Libraries

➢ To compare the Natural objects in different libraries:

1 Enter “CSGCMPL” at the Next prompt.
The Source Range Compare Facility is displayed:

```
Source Range Compare Facility
                          Library  Database  File  Dominant
                          ======== ======== ====== ========
 Old library.............. ________  ___196  _____4     X
 New Library.............. ________  ___196  _____4     _
 Program range............ ________ thru ________
 Summary only............. _
 Only report if different.. _
 Ignore comment lines..... _
 Ignore trailing comments.. _
 Ignore leading spaces.... _
 Only compare object types  __________ (ACGHLMNPST)
```

Source Range Compare Facility Window

2 Specify the following:

MYLIB	Library field for the Old library
SYSCSTDE	Library field for the New library
A*	1st portion of the Program range field
Z*	2nd portion of the Program range field

The dominant library (MYLIB) identifies which objects are compared. Only objects that exist in the MYLIB and SYSCSTDE libraries are compared. Objects that only exist in the SYSCSTDE library are not included in the results.

Note: The “Old” and “New” designation is for identification purposes only; it does not indicate older or newer versions of the libraries.

Note: If desired, you can limit the comparison by specifying one or more options listed in this window. For more information, see **CSGCMPL Utility**, *Natural Construct Administration and Modeling*.

3 Press Enter.
The Library Compare Facility window is displayed:

```
 Library Compare Facility                 Page 1
Dec 04,01                                                      08:03 PM

Program                    Matching
 Name    lines    lines    lines    Comments
-------- -------- -------- -------- ----------------------
Input parameters...

                           Library  Database File Dominant
                           ======== ======== ==== ========
Old library.............. MYLIB         196        4     X
New Library.............. SYSCSTDE      196        4
Program range............ A*       thru Z*
Summary only.............
Only report if different..
Ignore comment lines......
Ignore trailing comments..
Ignore leading spaces.....
Compare all types
```

Library Compare Facility Window

4 Press Enter again.
The results of the comparison are displayed:

```
Library: MYLIB       **** N A T U R A L   C O N S T R U C T *****     CSGCMPS1
Object.: MYBROWSE            - SOURCE COMPARE FACILITY -              Dec 04,01
Page...: 1                                                            08:05 PM

    Line                       Source Text
    ---- ------------------------------------------------------------------------
 =  10   **SAG GENERATOR: BROWSE                          VERSION: 4.4.1
 -  20   **SAG TITLE: Summary browse Ords
 -  30   **SAG SYSTEM: SACADB
 -  40   **SAG GDA: NCGDA
 -  50   **SAG DESCS(1): This program is used to browse the ... Orders
 -  60   **SAG HEADER1: Order Entry System
 -  70   **SAG HEADER2: Order display by order number
 +  20   **SAG TITLE: Summary Browse for Orders
 +  30   **SAG SYSTEM: SYSCSTDE
 +  40   **SAG GDA: NCGDA
 +  50   **SAG DESCS(1): This program will display all the orders in order
 +  60   **SAG DESCS(2): number sequence.
 +  70   **SAG HEADER1: Order Entry System
 +  80   **SAG HEADER2: Order Display by Order Number
 =  80   **SAG DIRECT-COMMAND-PROCESS:
Enter-PF1---PF2---PF3---PF4---PF5---PF6---PF7---PF8---PF9---PF10--PF11--PF12---
           retrn quit  print       top
```

Source Compare Facility

Notice the signs displayed to the left of the line numbers. These signs indicate whether the corresponding line is the same in both libraries (=), contains less characters (–), or contains more characters (+).

5 Continue pressing Enter until the results for all modules have been displayed.
The following window is displayed:

```
 Library Compare Facility                Page 55
Dec 04,01                                                        08:07 PM

Program  MYLIB    SYSCSTDE Matching
 Name    lines    lines    lines    Comments
-------- -------- -------- -------- ----------------------
NCTFWHS1      89       89       89  Exact match
NYORDSUB     100        0        0
NYORMSA       39        0        0
NYORMSR       12        0        0
OFACTORY     100        0        0
SUPRDREW      25        0        0
VB-DREW       65        0        0
VEHLBCPV     100        0        0
VEHLBKEY      13        0        0
VEHLBPRI       8        0        0
VEHLBROW      17        0        0
VEHLBSO      100        0        0
VEHLBSP      100        0        0
VEHLMCDV     100        0        0
VEHLMCPV     100        0        0
```

Library Compare Facility Window

6 Press Enter.
The Source Range Compare Facility window is redisplayed:

```
Source Range Compare Facility
                          Library  Database  File  Dominant
                          ======== ======== ====== ========
Old library.............. MYLIB___  ___196  _____4     X
New Library.............. SYSCSTDE  ___196  _____4     _
Program range............ A*______ thru Z*______
Summary only............. _
Only report if different.. _
Ignore comment lines..... _
Ignore trailing comments.. _
Ignore leading spaces..... _
Only compare object types  __________ (ACGHLMNPST)
4 members match; 41 members don't match
```

The message at the bottom of the window indicates that 4 members match and 41 do not.

Comparing Two Natural Objects

➢ To compare the Natural objects in different libraries:

1 Enter “CSGCMPS” at the Next prompt.
The Compare Criteria window is displayed:

```
Compare Criteria
                 Library  Object   Database  File  or Source Area
                 ======== ======== ======== ======    ===========
 Old version ===> SYSCSTDE _________   __196  ____4          _
 New version ===> SYSCSTDE _________   __196  ____4          _

 Options...
    Ignore comment lines..... _
    Ignore trailing comments.. _
    Ignore leading spaces..... _
    Summary only............. _
 Enter-PF1---PF2---PF3---PF4---PF5---PF6---PF7---PF8---PF9---PF10-
                  quit
```

Compare Criteria Window

2 Specify the following:

MYLIB	Library field for the Old version
MYBROWSE	Object field for the Old version
MYBROWSE	Object field for the New version

Note: The “Old” and “New” designation is for identification purposes only; it does not indicate older or newer versions of the objects.

3 Press Enter.
The Source Compare Facility window is displayed:

```
Library: MYLIB       **** N A T U R A L   C O N S T R U C T *****     CSGCMPS1
Object.: MYBROWSE            - SOURCE COMPARE FACILITY -              Dec 04,01
Page...: 1                                                            08:16 PM

    Line                        Source Text
    ---- ------------------------------------------------------------------------
 =  10   **SAG GENERATOR: BROWSE                          VERSION: 4.4.1
 -  20   **SAG TITLE: Summary browse Ords
 -  30   **SAG SYSTEM: SACADB
 -  40   **SAG GDA: NCGDA
 -  50   **SAG DESCS(1): This program is used to browse the ... Orders
 -  60   **SAG HEADER1: Order Entry System
 -  70   **SAG HEADER2: Order display by order number
 +  20   **SAG TITLE: Summary Browse for Orders
 +  30   **SAG SYSTEM: SYSCSTDE
 +  40   **SAG GDA: NCGDA
 +  50   **SAG DESCS(1): This program will display all the orders in order
 +  60   **SAG DESCS(2): number sequence.
 +  70   **SAG HEADER1: Order Entry System
 +  80   **SAG HEADER2: Order Display by Order Number
 =  80   **SAG DIRECT-COMMAND-PROCESS:
Enter-PF1---PF2---PF3---PF4---PF5---PF6---PF7---PF8---PF9---PF10--PF11--PF12---
                 quit  print       top                    <     >
```

Source Compare Facility Window

The signs displayed to the left of the line numbers indicate whether the corresponding line is the same in both libraries (=), contains less characters (–), or contains more characters (+).

4 Continue pressing Enter until the last line is displayed.
The Comparison Results window is displayed:

```
Comparison Results
 Number of lines in lib MYLIB    ...:    775
 Number of lines in lib SYSCSTDE ...:    755
 Number of matching source lines ...:    724
```

Comparison Results Window

The results indicate that the MYBROWSE object in MYLIB has 20 more lines than the same object in the demo system, and that 724 source lines match in both objects.

For more information about the CSGCMPS utility, see **CSGCMPS Utility**, *Natural Construct Administration and Modeling*.

Creating Online Reports

Part of your job as a programmer is to create online reports. Did you know you can use the Browse model to quickly create multi-panel reports? Although you can easily write a browse program yourself, it's not always easy to include some of the functions users want, such as:

- Scrolling up and down through data, as well as left and right
- Printing the report
- Using wildcard characters to specify starting points, such as < or >
- Drilling down to display additional details

When you use the Browse model to create reports, you can provide all these functions. In addition, you can regenerate the report if the database changes (from DB2 to Adabas, for example) and the model will supply the appropriate database code.

Note: If the report produces large volumes of output, use the Batch model. For more information, see **Batch Model**, *Natural Construct Generation*.

To build fields for display, Natural Construct defaults the display value to the specified browse key. This functionality is ideal for generating quick browse routines to check the records in a file. For example, you can specify Customer-Name as the key field and the generated program will browse the Customer file by customer name.

If you want to display information about more than one field, you can use the WRITE-FIELDS user exit. The code in this exit defines additional logic to write information to each screen based on the contents of the #PANEL variable.

Another powerful feature of the Browse model is the PROCESS-SELECTED-RECORD user exit. You can use this exit to specify processing performed on a selected record based on the record's unique key. For more information about the user exits, see **WRITE-FIELDS** and **PROCESS-SELECTED-RECORD**, *Natural Construct Generation*.

The following sections describe how to use the Browse model to create different reports. For more detailed information about the Browse model, see **Browse Models**, *Natural Construct Generation*.

Creating a Report for a Key Field

Note: Before beginning the procedure, ensure that the required modules have been copied to the current library. For a list of modules, see **Before You Begin**, page 23.

➢ To create a report for a key field:

1 Enter “ncstg” at the Natural prompt.
The Generation main menu is displayed.

2 Specify the following:

M	Function field
MYBROWSE	Module field
Browse	Model field

3 Press Enter.
The Standard Parameters panel is displayed:

```
CUSCMA                          BROWSE Program                        CU--MA0
Oct 23                       Standard Parameters                       1 of 4

 Module ............. MYBROWSE
 System ............. MYLIB_____________________________
 Global data area ... CDGDA___
 With block ......... _____________________________

 Title ............. Browse ..._______________
 Description ........ This program is used to browse the ..._________________
                      ____________________________________________________
                      ____________________________________________________
                      ____________________________________________________

 First heading ...... ____________________________________________
 Second heading ..... ____________________________________________________

 Command ............ _
 Message numbers .... _
 Password ........... _

Enter-PF1---PF2---PF3---PF4---PF5---PF6---PF7---PF8---PF9---PF10--PF11--PF12---
right help  retrn quit                                          right main
```

Standard Parameters Panel for the Browse Model

4 Specify the following:

NCGDA	Global data area field
Summary Browse for Orders	Title field
This program will display all the orders in order number sequence	Description field
Order Entry System	First header field
Order Display by Order Number	Second header field

Note: For more information about this panel, see **General Model Specifications**, *Natural Construct Generation*.

5 Press Enter.
The Additional Parameters panel is displayed:

```
CUSCMB                          BROWSE Program                          CUSCMB0
Oct 23                      Additional Parameters                        2 of 4

  Predict view ............. _____________________________________ *
    Natural (DDM) .......... _____________________________________
    Program view ........... _____________________________________
  Primary key .............. _____________________________________ *

  Horizontal panels ........ 1_
  Backward scroll pages .... 10

  Input using map .......... ________ *
  Reserved input lines ..... _
  Minimum key value ........ ____________________________________________________
  Maximum key value ........ ____________________________________________________
  Single prompt ............ _
  Multiple prompts ......... _

  Wildcard support ......... _        Export data support ...... _
  Hardcopy support ......... _        Window support ........... _

Enter-PF1---PF2---PF3---PF4---PF5---PF6---PF7---PF8---PF9---PF10--PF11--PF12---
      help  retrn quit        windw                          left  right main
```

Additional Parameters Panel for the Browse Model

6 Select the following:

– "NCST-ORDER-HEADER" from the Predict view field

– "ORDER-NUMBER" from the Primary key field

The report will browse the NCST-ORDER-HEADER file by order number.

7 Mark the following:

- Wildcard support field
  Marking this field enables wildcard processing in the generated program. Users can enter wildcard characters, such as < or *, to limit the query.
- Window support field
  This enables the output to be displayed in a window, instead of on a full screen.

8 Press Enter.
The Window Parameters window is displayed:

```
CU--DWM           Natural Construct           CU--DWM0
Oct 23            Window Parameters             1 of 1

          Size .........  Height ....... ___
                          Width ........ ___

          Position .....  Line ......... ___
                          Column ....... ___

          Frame OFF .... _
Enter-PF1---PF2---PF3---PF4---PF5---PF6---PF7---PF8---
      help  retrn quit  test
```

Window Parameters Window

Note: You can also display this window by pressing PF5 (windw).

9 Specify the following:

24	Height field
65	Width field
10	Line field
10	Column field

10 Press Enter twice.
The Additional INPUT Parameters panel is displayed.

11 Press Enter.
The Restriction Parameters panel is displayed.

Note: For more information about these panels, see **Additional INPUT Parameters Panel** and **Restriction Parameters Panel**, *Natural Construct Generation.*

12 Press Enter.
You are returned to the Generation main menu.

13 Enter “G” in the Function field.

14 Enter “W” in the Function field.
Your browse program is now generated and stowed.

To see the code generated by the Browse model, enter “E” in the Function field.

Tip: To browse the orders by customer number, you can select Customer-Number as the primary key.

To see what the window will look like to users, enter “T” in the Function field. The following window is displayed:

```
MYBROWSE       ***** Order Entry System *****
Oct 25        - Order Display by Order Number -      9:47 PM

Order Number
------------









Order Number: ______
Enter-PF1---PF2---PF3---PF4---PF5---PF6---PF7---PF8---PF9---
      help  retrn quit        flip        bkwrd frwrd
```

Browse Customer Orders Panel

To display the order numbers, press Enter or PF8 (frwrd).

15 Press PF2 (retrn).
You are returned to the Generation main menu.

You’ve successfully created a report, but it only displays details about one field. To add the logic to display details about additional fields, you must select and define the WRITE-FIELDS user exit. The following section describes how to do this.

Creating a Report for Multiple Fields

You can create a report for more than one field by selecting and defining the WRITE-FIELDS user exit. This user exit helps you create the WRITE or DISPLAY statements required to display the additional fields on the report.

If you regenerate the report, the user exit code is not touched. You must select and define the user exit again and re-create the user exit code.

Tip: Because this user exit is invoked after each record in the primary file is read, you can also include the code to perform calculations if desired.

➢ To create a report for more than one field:

1 Enter “U” in the Function field.
The first User Exit panel is displayed:

```
CSGSAMPL                     NATURAL CONSTRUCT                        CSGSM0
Oct 23                           User Exits                           1 of 1

               User Exit              Exists    Sample   Required Conditional
    ------------------------------- -------- ---------- -------- ------------
 _  CHANGE-HISTORY                             Subprogram
 _  PARAMETER-DATA                              Example                X
 _  HE-PARAMETER-INDEXES                        Example                X
 _  BUILD-REPORT-LOCAL-VARS
 _  LOCAL-DATA                                 Subprogram
 _  START-OF-PROGRAM                            Example
 _  SELECT-STATEMENT                           Subprogram             X
 _  AFTER-READ                                  Example
 _  REJECT-AFTER-MAX-KEY-CHECK
 _  EXPORT-DATA                                Subprogram             X
 _  WRITE-FIELDS                               Subprogram
 _  TOP-OF-PAGE                                 Example
 _  BEFORE-INPUT                                Example
 _  BEFORE-STANDARD-KEY-CHECK                   Example
 _  AFTER-INPUT                                 Example
 _  HARDCOPY-EDITS                              Example                X
Enter-PF1---PF2---PF3---PF4---PF5---PF6---PF7---PF8---PF9---PF10--PF11--PF12---
frwrd help  retrn quit                    bkwrd frwrd
```

User Exits Panel for the Browse Model

Tip: If this panel is not displayed, enter “SAMPLE” on the command line.

---

2 Mark the WRITE-FIELDS user exit.

3 Press Enter twice.
The WRITE-FIELDS Data Parameters window is displayed:

```
CSUSELFV                  NATURAL CONSTRUCT                    CSUSELF0
Oct 23               WRITE-FIELDS Data Parameters                1 of 1

Label       Type        PREDICT Views or Data Areas      Select  All
-------- ---------- ------------------------------------ ------ ------
   1     View       NCST-ORDER-HEADER_________________ *      _      _
   2                _____________________________________ *      _      _
   3                _____________________________________ *      _      _
   4                _____________________________________ *      _      _
   5                _____________________________________ *      _      _
   6                _____________________________________ *      _      _
Enter-PF1---PF2---PF3---PF4---PF5---PF6---PF7---PF8---PF9---PF10--PF11
      help  retrn
```

WRITE-FIELDS Data Parameters Window

This panel determines whether you want to use all the fields in the file or only a subset. Based on your previous specifications, Natural Construct supplies the name of the file you're using. NCST-ORDER-HEADER is displayed in the first Predict Views or Data Areas field.

4 Mark the Select field following NCST-ORDER-HEADER.
This indicates that you want to select the fields.

5 Press Enter.
The Select NCST-ORDER-HEADER Field window is displayed:

```
CSGSELFD                  Natural Construct                    CSGSELF0
Oct 23               Select NCST-ORDER-HEADER Field              1 of 1

   Type  Level             Field name             Format Length  Desc
  ------ ------ ------------------------------- ------ ------ ------
           1    _ ORDER-NUMBER                      N      6.0    D
           1    _ ORDER-AMOUNT                      P     13.2
           1    _ ORDER-DATE                        N      8.0
           1    _ ORDER-CUSTOMER-NUMBER             N      5.0    D
           1    _ ORDER-WAREHOUSE-ID                A      3.0    D
           1    _ INVOICE-NUMBER                    N      6.0
           1    _ ORDER-TIMESTAMP                   T
    MC     1    _ DELIVERY-INSTRUCTIONS             A     60.0    N




Enter-PF1---PF2---PF3---PF4---PF5---PF6---PF7---PF8---PF9---PF10--PF11--
      help  retrn
```

Select NCST-ORDER-HEADER Field Window

This window shows the fields in the NCST-ORDER-HEADER file.

6 Mark the following fields:
- ORDER-NUMBER
- ORDER-AMOUNT
- ORDER-DATE
- ORDER-CUSTOMER-NUMBER
- ORDER-WAREHOUSE-ID
- INVOICE-NUMBER

7 Press Enter.
The first BROWSE Program Build Report panel is displayed:

```
CSUBLDRP                      Natural Construct                        CSUBLD10
Oct 23                   BROWSE Program Build Report                     1 of 2

  1_ Panel(*)  Order    Label    Field name                      Format   AL=
  >> ------- -------- -------- ------------------------------ ---------- -----
  1    __       ___      1 *    ORDER-NUMBER___________________  N 6.0__   _____
  2    __       ___      1 *    ORDER-AMOUNT___________________  P 13.2_   _____
  3    __       ___      1 *    ORDER-DATE_____________________  N 8.0__   _____
  4    __       ___      1 *    ORDER-CUSTOMER-NUMBER__________  N 5.0__   _____
  5    __       ___      1 *    ORDER-WAREHOUSE-ID_____________  A 3.0__   _____
  6    __       ___      1 *    INVOICE-NUMBER_________________  N 6.0__   _____
  7    __       ___      _ *    _______________________________  _ _____   _____
  8    __       ___      _ *    _______________________________  _ _____   _____
  9    __       ___      _ *    _______________________________  _ _____   _____
  10   __       ___      _ *    _______________________________  _ _____   _____
  11   __       ___      _ *    _______________________________  _ _____   _____
  12   __       ___      _ *    _______________________________  _ _____   _____
  13   __       ___      _ *    _______________________________  _ _____   _____
  14   __       ___      _ *    _______________________________  _ _____   _____


Enter-PF1---PF2---PF3---PF4---PF5---PF6---PF7---PF8---PF9---PF10--PF11--PF12---
      help  retrn deflt test  gen   selfd frwrd bkwrd reord       right proto
```

BROWSE Program Build Report Panel 1

This panel displays the fields selected for the report and allows you to define where and how the fields are displayed. The second panel (displayed when you press PF11) allows you to change the default values for the selected fields, such as the field prompt name or the field length and format.

Note: For more information, see the online help or **Build Report Panel 1** and **Build Report Panel 2**, *Natural Construct Generation.*

8 Press PF12 (proto).
Natural Construct fills in a panel number and order (sequence) for each field:

```
CSUBLDRP                      Natural Construct                        CSUBLD10
Oct 25                   BROWSE Program Build Report                     1 of 2

  1_ Panel(*)  Order    Label    Field name                    Format   AL=
  >> ------- -------- -------- ------------------------------ ---------- -----
  1    01       010      1 *    ORDER-NUMBER_____________________  N 6.0__   _____
  2    01       020      1 *    ORDER-AMOUNT_____________________  P 13.2_   _____
  3    01       030      1 *    ORDER-DATE_______________________  N 8.0__   _____
  4    01       040      1 *    ORDER-CUSTOMER-NUMBER____________  N 5.0__   _____
  5    01       050      1 *    ORDER-WAREHOUSE-ID_______________  A 3.0__   _____
  6    02       010      1 *    INVOICE-NUMBER___________________  N 6.0__   _____
  7    __       ___      _ *    _________________________________  _ _____   _____
  8    __       ___      _ *    _________________________________  _ _____   _____
  9    __       ___      _ *    _________________________________  _ _____   _____
  10   __       ___      _ *    _________________________________  _ _____   _____
  11   __       ___      _ *    _________________________________  _ _____   _____
  12   __       ___      _ *    _________________________________  _ _____   _____
  13   __       ___      _ *    _________________________________  _ _____   _____
  14   __       ___      _ *    _________________________________  _ _____   _____


Enter-PF1---PF2---PF3---PF4---PF5---PF6---PF7---PF8---PF9---PF10--PF11--PF12---
      help  retrn deflt test  gen   selfd frwrd bkwrd reord       right proto
```

BROWSE Program Build Report Panel 1 — After Pressing PF12

Note: When ordering fields on the reports, Natural Construct uses 10, 20, 30, etc., instead of 1, 2, 3, etc. This allows you to easily insert fields later if necessary. For example, to insert a new field in the second position, you can type 15.

9 Press PF4 (test).
The Test Display window is displayed:

```
CSGBLDTE                        BROWSE Program
Oct 25                           Test Display

Panel .. 01 ------------------------------------------------
Order                                Customer Warehouse
Number   Order Amount   Order Date  Number     ID
------ ---------------- ---------- -------- ---------

999999 9999999999999999  99999999   99999      XXX


Panel .. 02 ------------------------------------------------

Invoice Number
--------------

    999999




Enter-PF1---PF2---PF3---PF4---PF5---PF6---PF7---PF8---PF9---
      test  test  test  test  test  test  test  test  test
```

Test Display Window

Notice that the Invoice Number field is displayed on the second panel by itself. This will make it difficult for a user to determine what order the invoice is associated with. Also, the first panel appears to be crowded so you may want to remove one of the fields from the first panel and place it on the second panel.

10 Press Enter.
You are returned to the Build Report panel.

11 Specify the following:

* (asterisk)	Panel field preceding ORDER-NUMBER
2	Panel field preceding ORDER-WAREHOUSE-ID
30	Order field for ORDER-WAREHOUSE-ID

The order number will appear as the first field on all panels of the report and the warehouse ID will now appear as the third field on the second panel.

12 Press PF9 (reord).
Natural Construct reorders the fields on the panels.

13 Press PF4 (test) again.
The Test Display window is displayed:

```
CSGBLDTE                        BROWSE Program
Oct 25                           Test Display

Panel .. 01 ------------------------------------------------
Order                                 Customer
Number   Order Amount   Order Date  Number
------ ---------------- ---------- --------

999999 9999999999999999  99999999   99999

Panel .. 02 ------------------------------------------------
Order                 Warehouse
Number Invoice Number    ID
------ -------------- ---------

999999     999999        XXX



Enter-PF1---PF2---PF3---PF4---PF5---PF6---PF7---PF8---PF9---
      test  test  test  test  test  test  test  test  test
```

Test Display Window — After Modifying the Display

14 Press Enter.
You are returned to the Build Report panel.

15 Press PF5 (gen).
The code is generated into the User Exit editor:

```
0010 DEFINE EXIT WRITE-FIELDS
0020 DECIDE ON FIRST VALUE #PANEL
0030   VALUE 01
0040     WRITE(0)
0050       NCST-ORDER-HEADER.ORDER-NUMBER
0060       NCST-ORDER-HEADER.ORDER-AMOUNT
0070       2X NCST-ORDER-HEADER.ORDER-DATE
0080       3X NCST-ORDER-HEADER.ORDER-CUSTOMER-NUMBER
0090   VALUE 02
0100     WRITE(0)
0110       NCST-ORDER-HEADER.ORDER-NUMBER
0120       5X NCST-ORDER-HEADER.INVOICE-NUMBER
0130       8X NCST-ORDER-HEADER.ORDER-WAREHOUSE-ID
0140   NONE
0150     WRITE(0) 23X 'No fields to display on this panel'
0160 END-DECIDE
0170 END-EXIT
0180 DEFINE EXIT TOP-OF-PAGE
0190 **
0200 DECIDE ON FIRST VALUE #PANEL
0210   VALUE 01
0220     WRITE(0)
0230       'Order' (I)
0240       30X 'Customer' (I)
0250     WRITE(0)
0260       'Number' (I)
0270       3X 'Order' (I)
0280       1X 'Amount' (I)
0290       3X 'Order' (I)
0300       1X 'Date' (I)
```

```
0310       2X 'Number' (I)
0320     WRITE(0)
0330       '------' (I)
0340       1X '----------------' (I)
0350       1X '----------' (I)
0360       1X '--------' (I)
0370   VALUE 02
0380     WRITE(0)
0390       'Order' (I)
0400       17X 'Warehouse' (I)
0410     WRITE(0)
0420       'Number' (I)
0430       1X 'Invoice' (I)
0440       1X 'Number' (I)
0450       4X 'ID' (I)
0460     WRITE(0)
0470       '------' (I)
0480       1X '--------------' (I)
0490       1X '---------' (I)
0500   NONE
0510     WRITE(0) 23X 'No fields to display on this panel'
0520 END-DECIDE
0530 SKIP(0) 1
0540 END-EXIT
```

If there's more than one panel, Natural Construct automatically generates the required WRITE statements and provides default column headings in the TOP-OF-PAGE user exit (see the example above).

Note: If there is only one panel, Natural Construct generates a DISPLAY statement.

16 Enter "." on the command line.
You are returned to the Generation main menu.

17 Enter "G" in the Function field.

18 Enter "W" in the Function field.
Your browse program is now generated and stowed.

19 Enter “T” in the Function field.
The following panel is displayed:

```
MYBROWSE       ***** Order Entry System *****
Oct 25        - Order Display by Order Number -     1 more >

Order                                Customer
Number   Order Amount   Order Date  Number
------ ---------------- ---------- --------









Order Number: ______
Enter-PF1---PF2---PF3---PF4---PF5---PF6---PF7---PF8---PF9---
      help  retrn quit        flip        bkwrd frwrd
```

First Panel of Sample Report — With Additional Fields

20 Press Enter.
The order data is displayed. Use the PF-keys to scroll left and right, up and down.

21 Press PF11 (right).
The next panel of the report is displayed:

```
MYBROWSE       ***** Order Entry System *****
< 1 more      - Order Display by Order Number -     10:00 PM

Order                 Warehouse
Number Invoice Number    ID
------ -------------- ---------

323232     332323        222
323456        123        544
332222      10294        111
333333     231201        111
422222     190123        111
               *** End of Data ***




Order Number: ______
Enter-PF1---PF2---PF3---PF4---PF5---PF6---PF7---PF8---PF9---
      help  retrn quit        flip        bkwrd frwrd
```

Second Panel of Sample Report — With Additional Fields

22 Press PF2 (retrn).
You are returned to the Generation main menu.

You've successfully created an online report with additional fields. If desired, you can also create a drill-down report to display details about a selected record. See the following section, **Creating a Drill-Down Report**, for information.

Note: If you have any problems creating the report, see **Troubleshooting and Debugging**, page 93, for possible reasons.

Creating a Drill-Down Report

You can create a drill-down report that displays additional details about a record by selecting and defining the PROCESS-SELECTED-RECORD user exit. The code in this exit calls a browse subprogram when a user selects a record displayed on a report.

➢ To create a drill-down report:

1 Enter "U" in the Function field.
The User Exit editor is displayed.

2 Enter "SAMPLE" on the command line.
The first User Exit panel for the Browse model is displayed.

3 Press Enter again.
The second User Exit panel is displayed:

```
CSGSAMPL                      NATURAL CONSTRUCT                        CSGSM0
Oct 25                            User Exits                           1 of 1

               User Exit              Exists    Sample   Required Conditional
   ------------------------------- -------- ---------- -------- ------------
 _  HARDCOPY-TERMINATING-PROCESS               Example                X
 _  PROCESS-SELECTED-RECORD                   Subprogram             X
 _  END-OF-PROGRAM                            Example
 _  ASSIGN-PREFIX-VALUE                       Subprogram             X
 _  SET-PF-KEYS                               Example
 _  MISCELLANEOUS-SUBROUTINES                 Example




Enter-PF1---PF2---PF3---PF4---PF5---PF6---PF7---PF8---PF9---PF10--PF11--PF12---
      help  retrn quit                   bkwrd frwrd
```

User Exits Panel for the Browse Model

4 Mark the PROCESS-SELECTED-RECORD user exit.

5 Press Enter.
The User Exit editor is displayed, showing the default code generated for the PROCESS-SELECTED-RECORD user exit:

```
Module ............. MYBROWSE
Title .............. Summary Browse for Orders
>                                          > + ABS: _ X-Y: _ S   69 L   52
  Bot  ....+....1....+....2....+....3....+....4....+....5....+....6....+....7..
  0520 END-DECIDE
  0530 SKIP(0) 1
  0540 END-EXIT
  0550 DEFINE EXIT PROCESS-SELECTED-RECORD
  0560 *
  0570 * Processing to be performed after a record has been selected.
  0580     IF *PF-KEY = 'ENTR' THEN
  0590       /*
  0600       /* Process #SELECTED-KEY record here.
  0610       IGNORE
  0620     ELSE
  0630       /* PF8 will just reposition the selected value to the top of
  0640       /* the screen OR you may wish to use PF8 to perform different
  0650       /* OR you may wish to use PF8 to perform
  0660       /* record processing.
  0670       IGNORE
  0680     END-IF
  0690 END-EXIT
```

User Exit Editor — Default Code for the PROCESS-SELECTED-RECORD User Exit

The Natural Construct-defined variable, #SELECTED-KEY, identifies the selected record. In this case, the order number is the selected key.

6 Change the default code as follows:

```
Module ............. MYBROWSE
Title .............. Summary Browse for Orders
>                                          > + ABS: _ X-Y: _ S   69 L   52
  Bot  ....+....1....+....2....+....3....+....4....+....5....+....6....+....7..
  0520 END-DECIDE
  0530 SKIP(0) 1
  0540 END-EXIT
  0550 DEFINE EXIT PROCESS-SELECTED-RECORD
  0560 *
  0570 * Processing to be performed after a record has been selected.
  0580     IF *PF-KEY = 'ENTR' THEN
  0590   CALLNAT 'NCOSODET'
  0600           #SELECTED-KEY
  0610           'select fun' /* Note NCOSODET has a 10-character parm
  0620                        /* field in case a function needs to be passed.
  0630                        /* In this example we don't need it, but we must
  0640                        /* pass something.
  0650           DIALOG-INFO
  0660           MSG-INFO
  0670           PASS
  0680     END-IF
  0690 END-EXIT
```

Code Defined for the PROCESS-SELECTED-RECORD User Exit

Notice that the syntax calls the NCOSODET module, which displays order lines for a selected order.

7 Enter "." on the command line.
You are returned to the Generation main menu.

8 Enter "G" in the Function field.

9 Enter "W" in the Function field.
Your browse program is now generated and stowed.

10 Enter “T” in the Function field.
The following panel is displayed:

```
MYBROWSE       ***** Order Entry System *****
Oct 25        - Order Display by Order Number -     1 more >

Order                                Customer
Number   Order Amount   Order Date  Number
------ ---------------- ---------- --------









Order Number: ______
Enter-PF1---PF2---PF3---PF4---PF5---PF6---PF7---PF8---PF9---
      help  retrn quit        flip        bkwrd frwrd
```

First Panel of Sample Drill-Down Report

11 Press Enter to display the orders.

12 Select an order.
The order lines for the selected order are displayed in a window:

```
NCOSODET    ***** ORDER SUBSYSTEM *****
Oct 25            - ORDER DETAIL -         1 more >

Ln Prod Id Quantity  Unit Cost   Total Cost
-- ------- --------- ---------- ------------
 1 654070         40     100.00      4000.00
 2 222222        100      50.00      5000.00
            *** End of Data ***



Line Order Number: 234234 Line Number: __
Direct command...: _____________________________
Enter-PF1---PF2---PF3---PF4---PF5---PF6---PF7---PF8
      help  retrn quit        flip        bkwrd frw
```

Drill-Down Window Showing Order Details

13 Press PF2 (retrn) twice.
You are returned to the Generation main menu.

You’ve successfully created a drill-down report.

The following section describes the NCOSODET subprogram used in this example.

Note: If you have any problems creating the report, see **Troubleshooting and Debugging**, page 93, for possible reasons.

NCOSODET Subprogram

NCOSODET is a subprogram that displays additional details about a selected record. To learn more about the module, look at the information specified on the specification panels and in the user exits.

➢ To see the specifications and user exits for NCOSODET:

1 Enter “ncstg” at the Natural Next prompt.
The Generation main menu is displayed.

2 Specify the following:

R	Function field
NCOSODET	Module field

3 Press Enter.
Natural Construct reads the module into the edit buffer and displays a confirmation message.

4 Enter “M” in the Function field.
The Standard Parameters panel is displayed:

```
CUSCMA                     BROWSE-SUBP Subprogram                    CU--MA0
Oct 23                      Standard Parameters                       1 of 5

 Module ............. NCOSODET
 System ............. MYLIB_____________________________
 Global data area ... ________
 With block ......... _____________________________

 Title ............... Order Header Detail______
 Description ........ This subprogram will display all the lines associated__
                      with the selected order entry._____________________
                      ____________________________________________________
                      ____________________________________________________

 First heading ...... ORDER SUBSYSTEM_____________________________
 Second heading ..... ORDER DETAIL_________________________________________

 Command ............ X
 Message numbers .... _
 Password ........... _

Enter-PF1---PF2---PF3---PF4---PF5---PF6---PF7---PF8---PF9---PF10--PF11--PF12---
right help  retrn quit                                          right main
```

Standard Parameters Panel for the NCOSODET Module

As indicated by the title, the NCOSODET module is a browse subprogram. Because it is a subprogram, and not a program, a GDA is not required.

5 Press Enter.
The Additional Parameters panel is displayed.

6 Press Enter again.
The Additional INPUT Parameters panel is displayed. These two panels are similar to the panels for a browse program.

7 Press Enter again.
The Specific Parameters panel for a browse subprogram is displayed:

```
CUSCMF                     BROWSE-SUBP Subprogram                    CUSCMF0
Oct 23                      Specific Parameters                       4 of 5

    Parameter Override
    Note: Format and Length defaults to ORDER-LINE-KEY key
    Field Name ......... #PDA-KEY
    Natural format ..... N 6.0__ *









Enter-PF1---PF2---PF3---PF4---PF5---PF6---PF7---PF8---PF9---PF10--PF11--PF12---
right help  retrn quit                                    left  right main
```

Specific Parameters Panel for the NCOSODET Module

When the key for the browse subprogram differs from the key for the calling program, you specify the format and length of the passed key (#SELECTED-KEY) on this panel. Since the format and length defaults to the ORDER-LINE-KEY key, which contains the order number and order line sequence number, the format and length has been changed to that of the ORDER-NUMBER key (N6).

Note: If the key for the browse subprogram is the same size as that of the calling program, you do not need to specify the format and length on this panel.

8 Press Enter.
The Restriction Parameters panel is displayed:

```
CUSCMG                     BROWSE-SUBP Subprogram                    CUSCMG0
Oct 23                     Restriction Parameters                     5 of 5

  Prefix Options
  Restrict browse with prefix .. X

  Number of characters (bytes) . 6__
  Number of components ......... __

  Protect prefix ............... X
  Suppress prefix .............. _

  Field Name ................ ____________________________________________


  Prefix Helproutine Specifications
     Component       Helproutine    Parameter Name
        1             ________ *    ________________________________
        2             ________ *    ________________________________


Enter-PF1---PF2---PF3---PF4---PF5---PF6---PF7---PF8---PF9---PF10--PF11--PF12---
main  help  retrn quit                                     left  userX main
```

Restriction Parameters Panel for the NCOSODET Module

Because the default key contains the order number and the line sequence number, the first 6 digits (which represent the order number) must be protected. This allows the calling program to determine which order is browsed; the user cannot change the order number.

9 Press Enter.
You are returned to the Generation main menu.

At this point, you can read the MYBROWSE module back into the editor and re-test your report. Drill down to the order lines and see if you can change the order number.

The following section describes how to create a drill-down report when the calling program and the subprogram use different keys.

Creating a Drill-Down Report Using Different Keys

This section describes the NCOSCSTO module, which browses the NCST-ORDER-HEADER file by customer date. When a user selects a customer, details about the customer's orders are displayed.

To see how this is done, read the NCOSCSTO module into the editor and display the user exits:

```
0010 DEFINE EXIT LOCAL-DATA
0020   LOCAL
0030   01 ORDER-DETAIL VIEW OF NCST-ORDER-HEADER
0040     02 ORDER-NUMBER
0050 END-EXIT /* LOCAL-DATA
0060 DEFINE EXIT WRITE-FIELDS
0070     DISPLAY
0080       1X 'Order Date'(I) NCST-ORDER-HEADER.ORDER-DATE
0090          (AD=I EM=9999/99/99)
0100       'Order No'(I) NCST-ORDER-HEADER.ORDER-NUMBER
0110         (LC=^)
0120       'Invoice No'(I) NCST-ORDER-HEADER.INVOICE-NUMBER
0130         (LC=^^)
0140       'WH ID'(I) NCST-ORDER-HEADER.ORDER-WAREHOUSE-ID
0150         (LC=^)
0160       'Order Amount'(I) NCST-ORDER-HEADER.ORDER-AMOUNT
0170 END-EXIT
0180 DEFINE EXIT BEFORE-INPUT
0190 *
0200 * Processing to be performed just before the input statement.
0210   /* Change standard message to indicate that selection can be done
0220   /* ONLY by positioning the cursor (not entering key value since
0230   /* input is protected.
0240   ASSIGN MSG-INFO.##MSG = 'Position cursor to select.'
0250 END-EXIT
0260 DEFINE EXIT PROCESS-SELECTED-RECORD
0270 *
0280 * Processing to be performed after a record has been selected.
0290 IF *PF-KEY = 'ENTR' THEN
0300   GET ORDER-DETAIL #SELECTED-ISN
0310   RESET MSG-INFO
0320   CALLNAT 'NCOSODET'
0330           ORDER-DETAIL.ORDER-NUMBER
0340           CDSELPDA.SELECTED-FUNCTION
0350           DIALOG-INFO
0360           MSG-INFO
0370           PASS
0380 END-IF
0390 END-EXIT /* PROCESS-SELECTED-RECORD
```

Notice that the LOCAL-DATA user exit has been defined. Because the NCOSCSTO module browses by customer date, the customer date is available in the #SELECTED-KEY variable.

When a user drills down to display additional details, the module must have access to the NCST-ORDER-HEADER file to display the order details. To do this with Adabas, you can use the #SELECTED-ISN variable to retrieve the order header file and find the order number.

Also notice the GET statement in the PROCESS-SELECTED-RECORD user exit. When a user selects a record, the order header file is retrieved and the order number is passed to the NCOSODET module.

Writing Natural Statements

Another way Natural Construct can save you time and effort is by using the statement models. These models generate individual Natural statements or functions (blocks of code). Some of the benefits of using the statement models are:

- Reduces your dependency on the Natural documentation to recall syntax
- Reduces the number of keystrokes required to code Natural statements, since keywords are generated automatically
- Produces statement code that:
  - has a consistent indentation scheme
  - programmatically performs tedious calculations
  - accesses your system files to retrieve Predict views, etc.

The following sections describe some of the ways you can use the statement models to save time and effort.

For more information, see **Statement Models**, *Natural Construct Generation*.

Note: Each statement model has a two-character alias you can use to invoke the model. For example, the alias for the View model is VW. The model alias is used in the statement model examples.

Note: Before beginning the procedures, ensure that the required modules have been copied to the current library. For a list of modules, see **Before You Begin**, page 23.

Generating a Predict View

You can use the View statement model to generate a Predict view. The following sample procedure generates a view for the NCST-CUSTOMER file.

➢ To generate a Predict view for the NCST-CUSTOMER file:

1 Enter “e p” at the Next prompt.
The Natural editor is displayed.

2 Press the Tab key twice.
The cursor should be in the first position of the first line in the editor. This is where you enter the .g line command.

3 Enter “.g”.
Because you didn’t specify a model name, the Select Model window is displayed:

```
CSGDLIST            Natural Construct             CSGDLST0
Oct 25                 Select Model                 1 of 1

           Model                            Type
         -------------------------------- ------------
         ADD                              Statement
         ARBITRARY-FIELD-PROCESSING       Statement
         AT-TOP-OF-PAGE                   Statement
         CALLNAT                          Statement
         CLOSE                            Statement
         COMPRESS                         Statement
         DECIDE-FOR                       Statement
         DECIDE-ON                        Statement
         DEFINE-PRINTER                   Statement
         DEFINE-SUBROUTINE                Statement
         DEFINE-VARIABLE                  Statement
Enter-PF1---PF2---PF3---PF4---PF5---PF6---PF7---PF8---PF9---
      help  retrn                         bkwrd frwrd
Model .. ____________________________ All models ... _
```

Select Model Window

4 Enter “V” in the Model field.
The list of models is repositioned to model names beginning with “V”.

5 Select the View model.
The VIEW Function window is displayed:

```
                      VIEW Function

 Predict view ............. ____________________________________ *
 Program view ............. ____________________________________

   C* variables ................... X
   Redefined components ........... X
   Superdescriptor fields ......... _
   Natural format specifications .. _
```

VIEW Function Window

6 Select “NCST-CUSTOMER” from the Predict view name field.

7 Press Enter.
The following view is generated:

```
0010 /*
0020 /*
0030 01 NCST-CUSTOMER VIEW OF NCST-CUSTOMER
0040   02 CUSTOMER-NUMBER
0050   02 BUSINESS-NAME
0060   02 PHONE-NUMBER
0070   02 MAILING-ADDRESS
0080     03 M-STREET
0090     03 M-CITY
0100     03 M-PROVINCE
0110     03 M-POSTAL-CODE
0120   02 SHIPPING-ADDRESS
0130     03 S-STREET
0140     03 S-CITY
0150     03 S-PROVINCE
0160     03 S-POSTAL-CODE
0170   02 CONTACT
0180   02 CREDIT-RATING
0190   02 CREDIT-LIMIT
0200   02 DISCOUNT-PERCENTAGE
0210   02 CUSTOMER-WAREHOUSE-ID
0220   02 CUSTOMER-TIMESTAMP
```

Generating a DECIDE-ON Statement

When you use the statement models to generate Natural statements, you don’t need to remember the statement syntax.

➢ To generate a DECIDE-ON statement:

1 Enter “.g(do)” at the beginning of a line in the Natural editor.
The following window is displayed:

```
 DECIDE ON FIRST X EVERY _  VALUE OF #NUMBER_____________________
>> 1 VALUE 1_____________________________________________________
      ASSIGN ...______________________________________________
      ________________________________________________________
      ________________________________________________________
      ________________________________________________________

    ANY VALUE
      ________________________________________________________
      ________________________________________________________
    ALL VALUE
      ________________________________________________________
      ________________________________________________________
    NONE VALUE
      IGNORE__________________________________________________
      ________________________________________________________
 END-DECIDE
```

DECIDE-ON Statement Window

2 Specify the following:

*PF-KEY	VALUE OF field
'PF1'	1 VALUE field
PERFORM ROUTINE-UPD	Over "ASSIGN"

3 Press Enter.
The following code is generated:

```
0010 /*
0020 /*
0030 DECIDE ON FIRST *PF-KEY
0040   VALUE 'PF1'
0050     PERFORM ROUTINE-UPD
0060   NONE
0070     IGNORE
0080 END-DECIDE
```

Generating a CALLNAT Statement

When using subprograms, you may want to generate a CALLNAT statement to supply the parameters. You can do this easily using the Callnat statement model. For example, you can generate a CALLNAT statement in the PROCESS-SELECTED-RECORD user exit to pass the selected key to an object PDA. This PDA then passes the data to an object maintenance subprogram for processing.

The following example shows how to use the CALLNAT statement within the PROCESS-SELECTED-RECORD user exit to supply the parameters for MYORDSUB (described in **Generating the Object Maintenance Subprogram**, page 39).

Note: The source code for the specified subprogram must exist in the current library or steplib.

➢ To generate a CALLNAT statement for the MYORDSUB subprogram:

1 Enter ".g(cn)" at the beginning of a line in the Natural editor.
The following window is displayed:

```
CALLNAT _______ *
```

Callnat Statement Window

Note: For more information, see **Using the Callnat Statement Window**, *Natural Construct Generation*.

2 Select “MYORDSUB” from the Callnat field.

3 Press Enter.
The following code is generated:

```
0010 /*
0020 CALLNAT 'MYORDSUB'
0030            ORDER
0040            MYORMSA-ID
0050            MYORMSR
0060            CDAOBJ2
0070            MSG-INFO
```

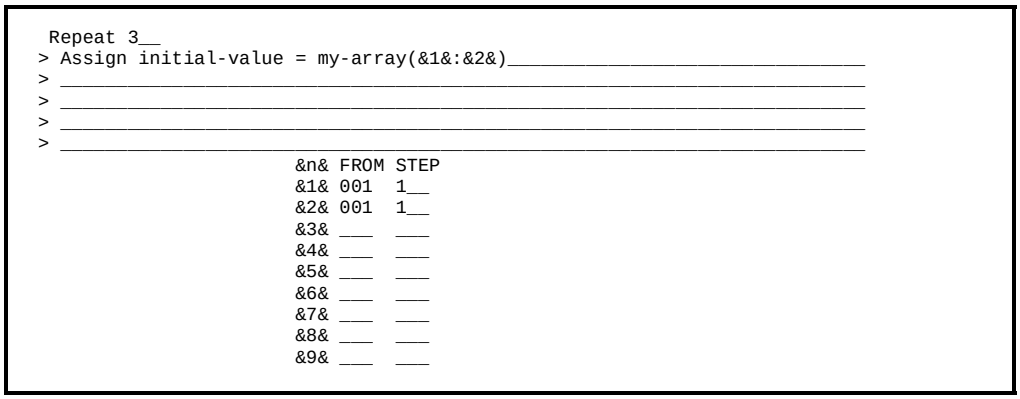
Notice that all the parameters from the subprogram are added to the CALLNAT statement. Although you may need to change the names to correspond with the program names, this list helps you determine which parameters are required.

Repeating a Sequence With Variations

Not all statement models generate Natural statements. The Sequence model generates a block of code that repeats a given line, with some variations, as many times as specified. The changes are applied to each variation.

➢ To generate a repeating sequence with variations:

1 Enter “.g(sq)” at the beginning of a line in the Natural editor.
The following window is displayed:



Sequence Statement Window

2 Specify the following:

7	Repeat field
WRITE ‘&1&’	Over “Assign initial-value ...”
002	FROM field for &1&
003	STEP field for &1&

3 Press Enter.
The following code is generated:

```
0010 /*
0020 /*
0030 WRITE 'LINE 2'
0040 WRITE 'LINE 5'
0050 WRITE 'LINE 8'
0060 WRITE 'LINE 11'
0070 WRITE 'LINE 14'
0080 WRITE 'LINE 17'
0090 WRITE 'LINE 20'
```

TROUBLESHOOTING AND DEBUGGING

If you encounter problems while using Natural Construct, there are a few things you can try before contacting your Natural Construct administrator. This chapter describes some of the methods you can use to troubleshoot and/or debug your applications.

Note: Many of these methods are applicable to any Natural program, not just Natural Construct-generated programs.

Natural Construct provides several utilities you can use to trace and debug Natural modules. For information about these and other utilities, see **Supplied Generation Utilities**, *Natural Construct Generation*.

The topics covered in this chapter are:

- **Specifying Parameters**, page 94
- **Generating Programs**, page 97
- **Working in the Editor**, page 99
- **Viewing Error Messages**, page 100
- **Using the Natural Debugging Tool**, page 102

Specifying Parameters

This section contains suggestions you can try if you encounter problems when specifying the model parameters.

Check the Online Help

Before contacting your administrator, check the online help available from each model specification panel. For example, many required fields have active help available. If you press the help PF-key when the cursor is in the field, a window is displayed listing valid entries for that field.

For more information about using the online help, see **Getting Online Help**, *Natural Construct Generation*.

Look at the Demo System

Another suggestion is to look at the demo system supplied with Natural Construct. The demo system is a fully functional order entry application generated using Natural Construct.

There are two ways you can use the demo system for troubleshooting your programs. You can:

- display the model specification panels to see what values were entered for a similar program in the demo system
- look at the generated code to see how a similar program is structured
- invoke the demo system to see how the programs run and interact

The following sections describe each of these options.

Display the Model Specification Panels

➢ To display the model specification panels for a program in the demo system:

1 Logon to the demo (SYSCSTDE, for example) library.

2 Enter “ncstg” at the Natural Next prompt.
The Generation main menu is displayed.

3 Enter “L” in the Function field.
The Select Module window is displayed:

```
CSGLIST                   Natural Construct                   CSGLIST0
Oct 22                      Select Module                       1 of 1

  Module               Model                          Title
---------- -------------------------------- ------------------------
CUSBRSUB   OBJECT-BROWSE-SUBP               Object Browse ...
CUSBR020   OBJECT-BROWSE-STATIC             Object Browse Static ...
CUSTN      OBJECT-MAINT-SUBP                Customer Maintenance
EMPLBR     OBJECT-BROWSE-SUBP               Employee Browse Object
MENU       STARTUP                          Demo System Startup Pgm
MYMENU     MENU                             Menu ...
MYORDSUB   OBJECT-MAINT-SUBP                Order Maintenance Subprog
MYORMSA    OBJECT-MAINT-PDA
MYORMSR    OBJECT-MAINT-PDA-R
NCCFCSTB   BROWSE-SUBP                      Browse Customer File
NCCFCUST   OBJECT-MAINT-DIALOG              Customer Maintenance
Module ... ________  Model .... ________________________________
Enter-PF1---PF2---PF3---PF4---PF5---PF6---PF7---PF8---PF9---PF10--PF11
      help  retrn                         bkwrd frwrd
Position cursor or enter screen value to select
```

Select Module Window

This window lists the modules contained in the demo library. It shows the module names, the type of model used to generate the modules, and a brief description of each module.

Note: For more information about this window, see **List Generated Modules Function**, *Natural Construct Generation*.

4 Move the cursor to the line containing the module for which you want to see specifications.

5 Press Enter.
You are returned to the Generation main menu.

The name of the module you selected is displayed in the Module field and the name of the model used to generate the module is displayed in the Model field.

6 Enter “M” in the Function field.
The first specification panel for the selected module is displayed. Continue pressing Enter to display all specification panels for the module. Press Enter again to return to the main menu.

7 Enter “U” in the Function field.
The user exits for the selected module are displayed.

Display the Generated Code

➢ To display the code generated for a program in the demo system:

1 Logon to the demo library (SYSCSTDE, for example).

2 Enter “ncstg” at the Natural Next prompt.
The Generation main menu is displayed.

3 Enter “L” in the Function field.
The Select Module window is displayed.

4 Move the cursor to the line containing the module for which you want to see generated code.

5 Press Enter.
You are returned to the Generation main menu.

6 Enter “E” in the Function field.
The code generated for the selected module is displayed.

Invoke the Demo System

➢ To display the model specification panels for a program in the demo system:

1 Logon to the demo library.

2 Enter “menu” at the Natural Next prompt.
The main menu for the demo system is displayed.

Generating Programs

This section contains troubleshooting suggestions you can try if you encounter problems when generating programs.

Display the Embedded Statements

When you generate a module from the Generation main menu, a status window is displayed showing the progress of the generation. If a problem occurs, you can optionally regenerate the module and display the embedded statements that perform the generation processing. You can then determine where in the problem occurred.

➢ To display the embedded statements:

1 Prior to generating the module, press PF5 (optns) on the Generation main menu. The Optional Parameters window is displayed:

```
CSGOPTS             Natural Construct             CSGOPTS0
Oct 25             Optional Parameters              1 of 1

  Status window ................. X
                  Step ....... _
                  Text ....... _
  Embedded statements .......... _
  Condition codes ............... _
  Post-generation modifications  _

  Specifications only .......... _
  Document in PREDICT .......... _
Enter-PF1---PF2---PF3---PF4---PF5---PF6---PF7---PF8---PF9-
      help  retrn quit
```

Optional Parameters Window

2 Mark the Embedded statements field.

3 Press Enter.

4 Enter “G” in the Function field.
The status window is displayed, showing the progress of generation.

When generation is complete, enter “E” in the Function field. The embedded statements are displayed in the generated code.

The following example shows the first 25 lines of code generated by the Object-Maint-Dialog model. An embedded statement is displayed on line 0040:

```
0010 **SAG GENERATOR: OBJECT-MAINT-DIALOG              VERSION: 4.4.1
0020 **SAG TITLE: Order Maintenance Dialog
0030 **SAG SYSTEM: MYLIB
0040 **> Trace ...... --> SAVE CUOMS
0050 **SAG GDA: CDGDA
0070 **SAG DESCS(1): This program is used to maintain the order business
0080 **SAG DESCS(2): object.
0090 **SAG HEADER1: Order Entry System
0100 **SAG HEADER2: Maintain Customer Orders
0110 **SAG DIRECT-COMMAND-PROCESS:
0140 **SAG OBJECT-NAME: MYORDSUB
0150 **SAG ACTIONS: 0101010101010000
0160 **SAG ACTION-LENGTH: 2
0190 **SAG ACTIONS-AS-PUSH-BUTTONS: X
0200 **SAG MAX-WINDOWS: 1
0210 **SAG MAP-NAME(1): MYMAP
0220 **SAG UPPER-BOUNDS(1,1): 00030
0230 **SAG UPPER-BOUNDS(1,2): 00010
0240 **SAG UPPER-BOUNDS(1,3): 00020
0250 **SAG SCREEN-OCCURS(1,1): 001
```

After determining where the error occurred, contact your system administrator.

Note: The problem may have occurred in a code frame, a block of code that performs a specific function. The Natural Construct models use code frames, as well as subprograms, in the generation process. For example, the C--BAN9 code frame supplies the standard banner that appears at the top of all generated modules.

Working in the Editor

This section contains troubleshooting suggestions you can try if you encounter problems while working in the Natural editor.

Determine the Last Command Issued

While working in the editor, you may not always remember which command was issued when an error occurred. If this happens, you can display the name of the last command by typing an asterisk (*) on the command line and pressing Enter.

To display a list of the last 10 (or less) commands issued, type “LAST *” and press Enter:

```
                LAST
_  NPC CSGMENU
_  NPC CSGMAIN
_  NPC      CSGMAIN
_  RENUMBER
_  STOW
_  NPC      CSGMAIN
_  RENUMBER
_  STOW
_  ? NAT0247
```

Last Commands Window

Note: This functionality is only available in the Natural editor (not the User Exit editor or Help Text editor).

Viewing Error Messages

This section contains information about viewing Natural error messages.

Determine The Last Error

Sometimes you require the number of the last Natural error that occurred. One method of determining the error number is to enter “TECH” at the Next prompt.

Note: You can also issue the TECH command on the command line in the Natural editor.

A series of three windows is displayed:

```
23:05:21                                        01-10-22

User ................. SACAPR
Library .............. MYLIB

Version / SM Level ... 2.3 / 0004
Startup Transaction ..
NATURAL SECURITY ..... Yes
Operating System ..... MVS/ESA
Oper. Sys. Version ... SP6.0.5
Machine Class ........ MAINFRAME
Hardware ............. 7060
TP Monitor ........... COMPLETE
Device Type .......... COLOR
Terminal ID .......... 1      3

Last Command ......... STOW
```

Window 1

This window shows information about the current settings, such as the user and library names, the operating system, and the terminal ID. It also lists the name of the last command issued. Press Enter to display the second window:

```
23:05:53                                        01-10-22

Last Error
  Error Number ....... 247

  Error Line ......... 1950
  Object ............. MYORDDIA
  Object Type ........ Program
  Level .............. 0
  Library ............
  DBID/FNR ...........

  Error Class ........ System
  Error Type ......... Syntax
  Error Time ......... 2001-10-22 23:05:01

  Error Transaction ..
```

Window 2

This window shows the number of the last error, as well as the error line, class, type, and time. In the example above, 82 is displayed in the Error Number field. Since error numbers consist of four digits, the actual error number is 0082.

Press Enter again to display the last window:

```
23:06:26                                        01-10-22

  Steplib   DBID  FNR       Object   Type Level
  --------  ----- -----     -------- ---- -----
  SYSTEM    196   4
  SYSTEM    196   3
```

Window 3

This window shows information about the steplib chain, database ID, and file number.

Note: The steplib chain indicates the order in which libraries are searched in the current library. The current library is searched first, then the first steplib, second steplib, etc., up to the eighth steplib (if present). The SYSTEM library is searched last.

Once you know the error number, you can use the method described in the following section to view the error message.

Display a Natural Error Message

Once you know the number of a Natural error, you can display the associated error message text.

➢ To display the message text:

1 Type "?" and the four-digit error number at the Next prompt (? 0247, for this example).

Note: You can also issue this command on the command line in the Natural editor.

2 Press Enter.
The following window is displayed:

```
23:08:00               ***** NATURAL HELP UTILITY *****               01-10-22
Library MYLIB         - NATURAL System Message NAT0247 -              Page 1

   Error in automatic parameter :1: for map.

Tx *** Short Text ***

   Error in automatic parameter ... for map.

Ex *** Explanation ***

   A parameter which is included for a constant input map or write map
   without explicit parameter specification is invalid or undefined.

Ac *** Recommended Action ***

   Correct error in program.
```

Error Message Text for NAT0247 Error

After reading the text, you can determine what to do next.

Using the Natural Debugging Tool

To help debug your Natural programs, you can also use the Natural Debugging tool. This tool allows you to place break points and watch points at strategic locations in your code.

The procedure to run this utility differs depending on the platform. For more information, see the Natural documentation for your platform.

GETTING THE MOST FROM NATURAL CONSTRUCT

This chapter discusses additional capabilities of Natural Construct, such as providing online help information for your applications, building new models, and creating JCL for DOS or OS environments. It also lists add-on products available for use with Natural Construct.

The topics covered in this chapter are:

- **Providing Online Help for Your Applications**, page 104
- **Building New Models**, page 105
- **Creating JCL**, page 106

Providing Online Help for Your Applications

You can provide either passive or active online help for all your applications — not just those generated using Natural Construct.

Note: For more information about providing help for your applications, see *Natural Construct Help Text*.

The following sections describe each type of online help.

Passive Online Help

Passive help displays a window containing text that describes what to do on a panel or which parameters are required for a field. Within this help window, you can also include hotlinks to other help text members. Hotlinks appear as bolded text within angle brackets; when the user places the cursor over this text and presses Enter, another help window is displayed.

You create passive help in the Help Text subsystem. For example, you can create a help text member that describes the options available on a panel (panel-level help) or lists valid values for a field (field-level help). Using the Help Text subsystem allows you to:

- Create multilingual help text for your applications
- Separate technical writing requirements from the programming

➢ To enable passive help:

1 Create the help text members in the Help Text subsystem.

2 Enter the following as the HE (help) parameter for the panel or field on the associated map:

```
'CD-HELPR',=
```

CD-HELPR is a subprogram supplied with Natural Construct. When a user invokes help on a panel or field, it locates and displays the help member based on the internal name of the panel or field.

Active Online Help

Active online help invokes a browse window listing valid values for a field and allows the user to select a value.

➢ To create the active online help:

1 Generate the browse helproutine module.

2 Enter the helproutine name as the HE (help) parameter for the field on the associated map.

Building New Models

In addition to the Help Text subsystem, Natural Construct provides the Administration subsystem. This subsystem helps you create your own models or modify the ones shipped with Natural Construct. You must have the appropriate security rights to access this subsystem. Typically, only Natural Construct administrators can access this subsystem.

Note: For more information about creating or modifying models, see *Natural Construct Administration and Modeling*. This document describes the external programs, subprograms, and helproutines used in the model creation process, the supplied utilities, and how to implement security and multilingual support.

Creating JCL

For DOS and OS mainframe environments, Natural Construct supplies models to create a JCL (job control language) member used to execute Natural in batch mode. The models generate the JCL stream into a Natural text object, which you can use as required.

The JCL models are:

Model	Purpose
JCL-DOS-Natbatch	Generates JCL for the DOS environment.
JCL-OS-Natbatch	Generates JCL for the OS environment.

As with all other Natural Construct models, the JCL models are available through the Generation main menu. For more information, see **JCL Models (Mainframe)**, *Natural Construct Generation*.