SAS/ACCESS® 9.4 Interface to ADABAS: Reference

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Contents

PART 1

SAS/ACCESS Interface to ADABAS: Usage

1

Overview of the SAS/ACCESS Interface to ADABAS

Introduction to the SAS/ACCESS Interface to ADABAS

This section introduces you to SAS/ACCESS software and briefly describes how to use the interface. This section also introduces the sample ADABAS data, SAS/ACCESS descriptor files, and SAS data files used in this document.

Note: Starting with SAS 9.4M8, SAS/ACCESS Interface to ADABAS is no longer available. If you have an existing instance of SAS/ACCESS Interface to ADABAS and plan to upgrade or migrate to SAS 9.4M8 or later, SAS recommends that you first unconfigure and uninstall this product. For more information, see Unconfiguring and Uninstalling Retired Products.

Purpose of the SAS/ACCESS Interface to ADABAS

SAS/ACCESS software provides an interface between SAS and the ADABAS database management system (DBMS). With the SAS/ACCESS interface, you can perform the following tasks:

- create SAS/ACCESS descriptor files using the ACCESS procedure
- directly access ADABAS data from within a SAS program using the SAS/ACCESS descriptor files created with the ACCESS procedure
- extract ADABAS data and place it in a SAS data file using the ACCESS procedure, the DATA step, or other SAS procedures
- update ADABAS data using the SQL procedure, SAS/FSP software, SAS/AF software, and the APPEND procedure.

The SAS/ACCESS interface consists of two parts:

- the ACCESS procedure, which you use to define the SAS/ACCESS descriptor files
- the interface view engine, which enables you to use ADABAS data in SAS programs in much the same way as you use SAS data files.

The ACCESS procedure enables you to describe ADABAS data to SAS. You store the description in SAS/ACCESS descriptor files, which you can use in SAS programs much as you would use SAS data files. You can print, plot, and chart the data described by the descriptor files, use it to create other SAS data sets, and so on. Several examples of using ADABAS data in SAS programs are presented in “Performance Considerations” on page 41. Using SAS/ACCESS descriptor files to update ADABAS data from within a SAS program is shown in “Performance Considerations” on page 41.

The interface view engine is an integral part of the SAS/ACCESS interface. However, the interface's design is embedded in the software, so you seldom have to deal directly with the engine. SAS automatically interacts with the engine (via the SAS/ACCESS descriptor files) when you use ADABAS data in your SAS programs. SAS and the interface view engine do much of the work automatically, so you can simply use ADABAS data in SAS programs in much the same way you use SAS data.

SAS/ACCESS Descriptor Files for ADABAS

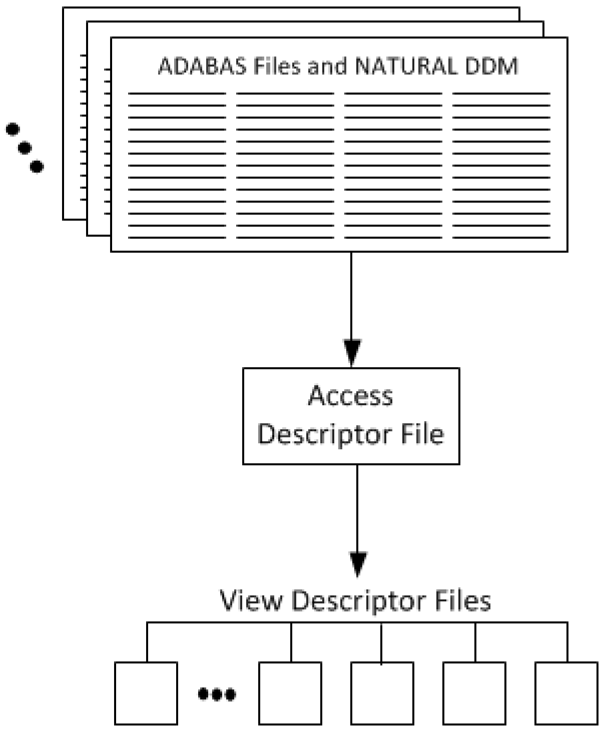
Using SAS/ACCESS Descriptor Files

SAS/ACCESS software uses SAS/ACCESS descriptor files to establish a connection between SAS and ADABAS. You create these files with the ACCESS procedure.

There are two types of SAS/ACCESS descriptor files: *access descriptors* and *view descriptors*.

The following figure illustrates the relationship among ADABAS data, an access descriptor, and view descriptors.

Figure 1.1 *Relationship among ADABAS Data, an Access Descriptor, and View Descriptors*



Access Descriptor Files

Access descriptor files are of member type ACCESS. Each access descriptor holds essential information about the ADABAS data that you want to access, such as the ADABAS file number or NATURAL Data Definition Module (DDM) name, the data field names, and their data types. It also contains corresponding information related to SAS, such as the SAS variable names, formats, and informats.

An access descriptor can describe only one ADABAS file or DDM. That is, you cannot join two ADABAS files or DDMs with a single access descriptor.

View Descriptor Files

View descriptor files are sometimes called *views* because their member type is VIEW. This document uses the term *view descriptor* to distinguish them from views that are created by the SAS SQL procedure.

Each view descriptor can define all of the data or a particular subset of the data described by one access descriptor (and therefore one ADABAS file or DDM). For example, you might want to use only three or four possible data fields and only some of the logical records. The view descriptor enables you to select the data fields that you want and, by specifying selection criteria, to select only the specific data that you want. For example, your selection criteria might be that the date of transaction is July 3, 2007, and that customers' names begin with W.

Typically, for each access descriptor, you have several view descriptors, selecting different subsets of data.

You can join data from multiple ADABAS files or NATURAL DDMs with SAS SQL procedure. The SQL procedure can join data from SAS data files, PROC SQL views, and SAS/ACCESS view descriptors into one resulting file. In addition, SAS/ACCESS view descriptors can come from different database management systems. For examples that use the SQL procedure, see “Introduction to Using ADABAS Data in SAS Programs” on page 21 and “Performance Considerations” on page 41.

Example Data in the ADABAS Document

This document uses several NATURAL DDMs to show you how to use the SAS/ACCESS interface to ADABAS. The data was created for an international textile manufacturer. This company's product line includes some special fabrics that are made to precise specifications. The DDMs are named CUSTOMERS, EMPLOYEE, INVOICE, and ORDER. All the data is fictitious.

The ADABAS data is designed to show how the interface treats ADABAS data. It is not meant as an example for you to follow in designing ADABAS files or NATURAL DDMs for any purpose.

"Introduction to the ADABAS Example Data" on page 158 gives more information about the ADABAS data, SAS/ACCESS descriptor files, and SAS data files used in examples. The information about the ADABAS data includes the ADABAS statements that created each file, the data each ADABAS file contains, and a description of the NATURAL DDMs. The information about the SAS/ACCESS descriptor files includes their definitions and any selection criteria that were specified for them. The information about the SAS data files includes the SAS statements that created each data file and the data that each contains.

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ADABAS Essentials

Introduction to ADABAS Essentials

This section introduces SAS users to ADABAS, Software AG's database management system (DBMS). The section focuses on the following terms and concepts:

- the ADABAS DBMS and ADABAS databases
- ADABAS files, NATURAL Data Definition Modules, and ADABAS descriptors (indexes)
- ADABAS data fields and ADABAS and NATURAL data formats and lengths
- null (missing) values

- ADABAS Security and NATURAL SECURITY System options

If you want more information about an ADABAS concept or term than this section provides, see the ADABAS information about your system.

ADABAS DBMS

ADABAS is Software AG's database management system (DBMS). ADABAS organizes and accesses data according to relationships among *data fields*. The relationships among data fields are expressed by *ADABAS files*, which consist of *data fields* and *logical records*.

With the ADABAS DBMS, you can also use the high-level language NATURAL to operate on data that is managed by the DBMS. NATURAL is Software AG's fourth generation application development system that enables you to create, modify, read, and protect data that the DBMS manages. All ADABAS files and data fields referenced in a NATURAL program must be defined to NATURAL through a Data Definition Module (DDM).

ADABAS has single-user and multi-user execution environments, both of which are supported by the SAS/ACCESS interface to ADABAS.

ADABAS Databases

Definition of an ADABAS DBMS Database

An ADABAS database is a collection of data organized into ADABAS files. Each database has an associated *database identifier* and a *database name*. The database identifier is a numerical value in the range 1 to 65,535. The database name is a character value with a maximum of 16 characters. Each database can consist of up to 5,000 logical files.

An ADABAS database consists of three system files: Data Storage, Associator, and Work Storage.

- The *Data Storage system file* contains the actual data records for all ADABAS files in a database, in compressed form.
- The *Associator system file* contains internal storage information that manages the data for the entire database.
- The *Work Storage system file* contains temporary work files.

To use the SAS/ACCESS interface to ADABAS, you need to be familiar with three ADABAS components: ADABAS files, NATURAL DDMs, and ADABAS descriptors (which is an ADABAS data field that provides an index of its values). ADABAS files and NATURAL DDMs are the components from which you create SAS/ACCESS access descriptor and view descriptor files. Knowing about ADABAS descriptors can help you minimize the ADABAS processing time for your SAS/ACCESS view descriptors.

Note: To avoid confusion, keep in mind the two usages of the term *descriptor* throughout this document:

- An *ADABAS descriptor* is an ADABAS data field that provides an index of the data field's values.
- *SAS/ACCESS descriptor files*, on the other hand, are the files used to establish a connection between SAS and ADABAS.

The following sections describe ADABAS files, NATURAL DDMs, and ADABAS descriptors.

ADABAS Files

Definition of an ADABAS File

An ADABAS file is a collection of logically related data, organized by data fields and logical records. ADABAS permits maximums of 926 data fields and 4,294,967,294 logical records in each ADABAS file.

The following output illustrates four data fields and seven logical records from an ADABAS file containing data about customers. The data fields are the vertical columns of data. The logical records are the horizontal rows of data.

Output 2.1 *Sample ADABAS File*

```
CU           CI                ST        CO

14324742     San Jose          CA        USA
14569877     Memphis           TN        USA
14898029     Rockville         MD        USA
24589689     Belgrade                    Yugoslavia
26422096     La Rochelle                 France
38763919     Buenos Aires                Argentina
46783280     Singapore                   Singapore
```

ADABAS files are created with the ADABAS utility ADACMP. (To see the ADABAS data definition statements that created the ADABAS files used in this document, see "Introduction to the ADABAS Example Data" on page 158.)

ADABAS File Number

When you create an ADABAS file, you assign a file number using the FILE= statement of the ADACMP utility. Each database can consist of up to 5,000 logical files, depending on the device type.

Level Number

A data field *level number* is a one- or two-digit number, from 01 to 07, used in conjunction with data field grouping. (Grouping is discussed in “ADABAS Data Fields” on page 15.) Data fields with a level of 2 or greater are considered to be a part of the immediately preceding group, which has a lower level number.

Data Field Names

ADABAS data fields are identified by a two-character name. Each data field name in an ADABAS file must be unique. The first character must be alphabetic, and the second character can be either alphabetic or numeric. For example, AA and B4 are valid data field names.

Logical Record ISN

Each logical record within an ADABAS file is assigned an *internal sequence* number (ISN). An ISN is the logical identifier for each record. ISNs are unique within each ADABAS file.

Note: When you create SAS/ACCESS descriptor files for ADABAS data, the ACCESS procedure creates a SAS variable named ISN. This variable gives you access to the ISNs for all logical records stored in the ADABAS file.

Accessing ADABAS Files in NATURAL Programs

NATURAL Data Definition Modules

Accessing ADABAS Files in NATURAL Programs

To reference an ADABAS file and its data fields in NATURAL programs, you must create a NATURAL Data Definition Module (DDM) based on the ADABAS file. (Note that a DDM is often referred to as an ADABAS file, even though it is really only a *view* of an actual ADABAS file.) A DDM has an assigned name, which references the ADABAS file number on which the DDM is based. Also, more descriptive data field names can be assigned to a DDM. DDMs are stored in a system file, which is simply another ADABAS file.

DDM Filename

The filename for a NATURAL DDM can be a maximum of 32 characters.

Data Field Names

In a NATURAL DDM, data fields can be assigned a DDM external name of 3 to 32 characters. For example, in the CUSTOMERS DDM, the DDM data field name CUSTOMER corresponds to the ADABAS file two-character data field name CU.

ADABAS Descriptors

Using ADABAS Descriptors

If you plan to use a data field often in selection criteria, you can designate it as a key field. You designate a key field by specifying the descriptor option in the ADACMP utility data definition statement. When a data field is a descriptor field, ADABAS maintains and stores its values in an inverted list. An *inverted list* contains the different values of a descriptor data field, along with the count and the ISNs of the logical records that contain each value. ADABAS descriptors can also be defined so that inverted lists contain unique values only.

Specifying ADABAS descriptors speeds up the selection process considerably since ADABAS is able to access key values directly. Also, specifying descriptors controls read sequence when reading ADABAS data sequentially.

Several descriptor types can be specified for a data field. Each descriptor type is explained below.

Note: In order for you to use SAS variables corresponding to ADABAS data fields in a SAS BY statement, an SQL ORDER BY clause, or a view SORT clause, the data field must be designated as an ADABAS descriptor. Regarding a WHERE clause, there are conditions when you can use a nondescriptor data field and when you must use a descriptor data field. These conditions are explained in “Introduction to ACCESS Procedure Reference” on page 64.

Subdescriptor

A subdescriptor is an ADABAS descriptor that is derived from a portion of an elementary data field. For example, if ZIPCODE is a data field, a subdescriptor for it could be ZIPLAST2 defined for the last two digits of a ZIP code.

You can include a subdescriptor in SAS/ACCESS descriptor files for retrieval and selection criteria, but you cannot use subdescriptors in SAS updating procedures.

Superdescriptor

A superdescriptor is an ADABAS descriptor derived from more than one data field, portions of data fields, or combinations thereof. For example, a superdescriptor named STATE-ZIPLAST2 could be defined for the first two digits from the STATE data field and the last two digits from the ZIPCODE data field.

You can include a superdescriptor in SAS/ACCESS descriptor files for retrieval and selection criteria, but you cannot use superdescriptors in SAS updating procedures.

Phonetic Descriptor

A phonetic descriptor is an ADABAS descriptor defined to perform searches based on phonetic values, such as the retrieval by family name.

You can include a phonetic descriptor in SAS/ACCESS descriptor files for retrieval and selection criteria, but you cannot use phonetic descriptors in SAS updating procedures.

Note that if you use a phonetic descriptor in a SAS WHERE clause, the interface view engine must be able to process the entire SAS WHERE clause.

Note: The hyperdescriptor type is not described because hyperdescriptors are not supported by the SAS/ACCESS interface to ADABAS. Your ADABAS file can contain hyperdescriptors, but they are ignored.

ADABAS Data Fields

Data Field Types

Data Field Types

You can group logically related ADABAS data fields into one ADABAS file, which consequently can be accessed by one NATURAL DDM. Up to 926 data fields can be contained in a single logical record. Each data field has an assigned type, format, and length.

The SAS/ACCESS interface to ADABAS supports the ADABAS data fields as described below.

Elementary Field

An elementary field is limited to one value per record. For example, LASTNAME could be an elementary field.

Multiple-value Field

A multiple-value field can have 0 to 191 values per record. For example, JOBTITLE could be a multiple-value field because each employee at a company could have multiple job titles during their employment.

Group Field

A group field is several consecutive data fields combined into one for efficient access and ease of reference. Defining a group field enables you to reference a series of data fields by using a group name. For example, a group field named EDUCATION could consist of these data fields: COLLEGE, DEGREE, and YEAR.

A group field can also consist of other groups. In conjunction with grouping, you can assign level numbers 01 to 07 to define a group.

Periodic Group Field

A periodic group field is a group of data fields that repeat. A periodic group can be repeated up to 191 times and can contain one or more elementary fields and multiple-value fields. Groups can be nested, but periodic groups cannot. One periodic group cannot contain another. However, a record can have several periodic groups.

Subfield

A subfield is a data field defined from a portion of another data field. For example, a subfield named AREA-CODE could be defined for the first three digits from the PHONE data field.

You use subfields for Read operations only; they cannot be used for updating directly.

Superfield

A superfield is a data field composed of several data fields, portions of fields, or combinations thereof. For example, a superfield could be STATE-AREA-CODE accessing such values as TX512, NM505, and CA213.

You use superfields for Read operations only; they cannot be used for updating directly.

Mapping Data between SAS and ADABAS

When you access ADABAS data through the SAS/ACCESS interface, the interface view engine maps the ADABAS data into SAS observations. You need to be aware of how the interface view engine maps multiple-value fields and periodic groups. That is, *multiple-value field occurrences are mapped to multiple SAS variables, and periodic group occurrences are mapped to multiple SAS observations.*

For example, suppose an ADABAS file has the data fields and values shown in the following output. LASTNAME is an elementary field, JOBTITLE is a multiple-value field, and EDUCATION is a periodic group consisting of the data fields COLLEGE, DEGREE, and YEAR.

Output 2.2 *ADABAS Data*

```
 ____________________________________________________________
| LASTNAME  | JOBTITLE          | EDUCATION                 |
|___________|___________________|___________________________|
| Reid      | Systems Analyst   | Purdue    | BA    | 1973  |
|___________|-------------------|---------------------------|
            | DBA               | Harvard   | MBA   | 1975  |
            |___________________|___________________________|
```

The interface view engine would map the ADABAS data into two SAS observations, as shown in the following output.

Output 2.3 *ADABAS Data Mapped into SAS Observations*

```
LASTNAME   JOBTITL1         JOBTITL2   COLLEGE   DEGREE   YEAR
Reid       Systems Analyst  DBA        Purdue    BA       1973
Reid       Systems Analyst  DBA        Harvard   MBA      1975
```

If you were browsing the ADABAS data, such as with the FSVIEW procedure, the results would be similar to Output 2.3 on page 17, with LASTNAME, JOBTITL1, and JOBTITL2 repeated for each set of COLLEGE, DEGREE, and YEAR values. Actually though, the value Reid is stored in the ADABAS file only once. For retrievals, the results are straightforward. When updating, however, you need to keep in mind how the interface view engine maps multiple-value fields and periodic groups.

Suppose you want to change the spelling of a last name using the FSVIEW procedure. To change Reid to Reed, type REED over one of the REID values, and, with a single Update operation, the last names are all changed. On the other hand, suppose you want to delete an observation for Reid using the FSEDIT procedure. Each observation for his job titles and education data would display his last name. If you deleted an observation. For example, the one for Purdue, the deletion would not affect the last name or the job title data, but the Purdue observation would be gone. For more information and an example of deleting an observation from ADABAS data, see "Introduction to the ADABAS Example Data" on page 158.

Data Field Formats and Lengths

Data definition statements enable you to define data field formats and lengths for both ADABAS files and NATURAL DDMs. The standard format of a data field is specified with a one-character code shown next in the following table. The standard length of a data field is specified in bytes; the maximum length is also given.

Table 2.1 *ADABAS Standard Data Field Formats and Lengths*

Data Type	Standard Format	Standard Length	Description
Alphanumeric	A (ADABAS) A (DDM)	253–byte maximum	Left-justified. Trailing blanks are removed.
Binary	B (ADABAS) B (DDM)	126–byte maximum	Right-justified and unsigned. Leading zeros are removed.
Fixed Point	F (ADABAS) B (DDM)	Must be 4 bytes	Right-justified and signed. Uses twos complement notation.
Floating Point	G (ADABAS) F (DDM)	Must be 4 or 8 bytes	In normalized form and signed
Packed Decimal	P (ADABAS) P (DDM)	15–byte maximum	Right-justified and signed
Unpacked Decimal (Zoned)	U (ADABAS) N (DDM)	29–byte maximum	Right-justified and signed

If the standard length of a data field is specified as zero, the data field is a *variable length field*, which has no maximum or required length.

Note that when creating SAS/ACCESS descriptor files, you can specify SAS formats for ADABAS data to change how the data appears. For example, you can add decimal points. Also, you can specify a SAS date format in your SAS/ACCESS descriptor files to designate a date representation.

ADABAS Null Values

ADABAS has a special value called a *null* value, which means an absence of information. A null value is analogous to a missing value in SAS.

You can define data fields not to store null data by specifying the NU option in data definition statements. In normal data storage (that is, NU not specified), a null value is represented by two bytes (one for the value length and one for the null value). Suppressing null values results in a null value being represented by a one-byte empty field indicator. The null value itself is not stored.

Knowing whether a data field has null values assists you in writing selection criteria and in entering values to update ADABAS data. For example, if the NU option is specified for an ADABAS descriptor data field, null values for the data field are not stored in the inverted list. There are records that contain a null value for the data field. A search using this data field and a null value as the search value results in no records selected.

For more information about null values, see "Missing Values (Nulls)" on page 145.

ADABAS and NATURAL Security Options

Overview of Security Options

The ADABAS DBMS offers security options through both ADABAS and NATURAL. To protect your ADABAS data, you can use either form of security, or you can have both work together.

ADABAS Security Options

ADABAS provides a security facility to prevent unauthorized access to data stored in ADABAS files. Security is available through password protection and by maintaining data in enciphered form.

passwords
: provide protection at the ADABAS file level, data field level, and data value level. These security options are defined with the SECURITY utility ADASCR and are stored in the ADABAS Security system file.

  To access an ADABAS file protected by a password, you must provide the valid password. Each data field in an ADABAS file can be assigned up to fifteen levels of read and update security. A user password specifies the authority for the data field, and ADABAS automatically determines whether you are authorized to perform the requested operation. If the permission level of a password is equal to or greater than the permission level for the file that you are trying to access, access is granted. Any ADABAS file can be protected on individual data field values. In this case, the password specifies value restrictions on logical records to be selected, read, and updated.

cipher codes
: are simple numeric codes that you can assign using the ADACMP utility when creating an ADABAS file. Ciphering renders data records unreadable when they

are not displayed with an ADABAS program or utility. You must supply this cipher code in order to access the enciphered data.

Note: System information such as DDM and NATURAL SECURITY information is also stored in ADABAS files; they can also be password-protected or enciphered.

NATURAL Security Options

NATURAL provides an optional security system that controls the access and use of the NATURAL environment. You can restrict the use of whole application systems, individual programs and functions, and the access to DDMs.

Security is accomplished by defining objects and the relationships among these objects. There are three objects that you need to be familiar with when accessing data through NATURAL DDMs with the SAS/ACCESS interface: users, libraries, and files.

users
: can be people, computers, or groups of either, with assigned identifiers. The user identifier identifies you to NATURAL SECURITY and controls user activity during a NATURAL session. The identifier is unique to NATURAL and can be up to eight characters long. Each user identifier can have an associated eight-character password.

libraries
: contain sets of NATURAL source programs, object modules, or both that perform a particular function, with assigned identifiers. Stored in the library data are the ADABAS passwords or cipher codes to enable NATURAL programs to work with ADABAS Security. The library identifier identifies the library and the ADABAS file it is authorized to access to NATURAL SECURITY. The identifier is unique to NATURAL and can be up to eight characters long.

files
: are the NATURAL DDMs based on ADABAS files.

Relationships, called *Links*, are defined among these objects. These links define which users can use a library and which files in a library are accessible. The users, libraries, files, and links are all stored in the NATURAL Security system file. The NATURAL Security system file can also be protected with an ADABAS password or cipher code since it is an ADABAS file. For example, one user identifier and library might be able to access a DDM for read only. Another user identifier and library might be able to read and update the same DDM.

Note: Sites that do not have or choose not to use NATURAL SECURITY can rename load module NSCDDM, to prevent it from being called from the ADABAS engine. Routine ADBNSS dynamically loads NSCDDM before calling it. If NSCDDM is not found, it will not be dynamically loaded or executed. This is not an error condition.

3 ADABAS Data in SAS Programs

Introduction to Using ADABAS Data in SAS Programs

An advantage of the SAS/ACCESS interface to ADABAS is that it enables SAS to read and write ADABAS data directly using SAS programs. This section presents examples using ADABAS data accessed through view descriptors as input data for SAS programs.

Throughout the examples, the SAS terms *variable* and *observation* are used instead of comparable ADABAS terms because this section illustrates how to use SAS procedures and the DATA step. The examples demonstrate how to print and chart data, how to use the SQL procedure to combine data from various sources, and how to update a Version 6 SAS data file with ADABAS data. For more information about the SAS language and procedures used in the examples, see the documents listed at the end of each section.

"Performance Considerations" on page 41 presents some techniques for using view descriptors efficiently in SAS programs.

For definitions of all view descriptors referenced in this section, see "Introduction to Using ADABAS Data in SAS Programs" on page 21. This appendix also contains the ADABAS data and SAS data files used in this document.

Reviewing ADABAS Variables

If you want to use ADABAS data that is described by a view descriptor in your SAS program but cannot remember the variable names or formats and informats, you can use the CONTENTS or DATASETS procedures to display this information.

The following examples use the DATASETS procedure to give you information about the view descriptor Vlib.CusPhon, which references the NATURAL DDM named CUSTOMERS.

```
proc datasets library=vlib memtype=view;
   contents data=cusphon;
quit;
```

The following output shows the information for this example. The data that is described by Vlib.CusPhon, is shown in Output 3.9 on page 33.

Output 3.1 *Results of Using the DATASETS Procedure to Review a View Descriptor*

```
                              The SAS System

                            DATASETS PROCEDURE

Data Set Name: VLIB.CUSPHON                          Observations:         .
Member Type:   VIEW                                  Variables:           3
Engine:        SASIOADB                              Indexes:             0
Created:       14:09 Friday, October 5, 1990         Observation Length:  80
Last Modified: 14:33 Friday, October 5, 1990         Deleted Observations: 0
Data Set Type:                                       Compressed:          NO
Label:

                  -----Engine/Host Dependent Information-----


             -----Alphabetic List of Variables and Attributes-----

     #    Variable    Type    Len    Pos    Format    Informat    Label
     ----------------------------------------------------------------------
     1    CUSTNUM     Char      8      0    $8.       $8.         CUSTOMER
     3    NAME        Char     60     20    $60.      $60.        NAME
     2    PHONE       Char     12      8    $12.      $12.        TELEPHONE
```

Note the following points about this output:

- You cannot change a view descriptor's variable labels using the DATASETS procedure. The labels are generated to be the complete ADABAS data field name when the view descriptor is created and therefore cannot be overwritten.
- The `Created` date is the date the access descriptor for this view descriptor was created.
- The `Last Modified` date is the last time the view descriptor was updated.
- The `Observations` number field contains a null value.

For more information about the DATASETS procedure, see the *Base SAS Procedures Guide*.

Printing ADABAS Data

Printing ADABAS data that is described by a view descriptor is like printing any other SAS data set, as shown in the following examples.

The following example contains the code for printing the ADABAS data that is described by the view descriptor Vlib.Empinfo:

```
proc print data=vlib.empinfo;
   title "Brief Employee Information";
run;
```

Vlib.EmpInfo accesses data from the NATURAL DDM named EMPLOYEE. The following output shows the results for this example.

Output 3.2 *Results of Printing ADABAS Data*

```
                Brief Employee Information

        OBS      EMPID    DEPT      LASTNAME

          1     119012    CSR010    WOLF-PROVENZA
          2     120591    SHP002    HAMMERSTEIN
          3     123456              VARGAS
          4     127845    ACC024    MEDER
          5     129540    SHP002    CHOULAI
          6     135673    ACC013    HEMESLY
          7     212916    CSR010    WACHBERGER
          8     216382    SHP013    PURINTON
          9     234967    CSR004    SMITH
         10     237642    SHP013    BATTERSBY
         11     239185    ACC024    DOS REMEDIOS
         12     254896    CSR011    TAYLOR-HUNYADI
         13     321783    CSR011    GONZALES
         14     328140    ACC043    MEDINA-SIDONIA
         15     346917    SHP013    SHIEKELESLAM
         16     356134    ACC013    DUNNETT
         17     423286    ACC024    MIFUNE
         18     456910    CSR010    ARDIS
         19     456921    SHP002    KRAUSE
         20     457232    ACC013    LOVELL
         21     459287    SHP024    RODRIGUES
         22     677890    CSR010    NISHIMATSU-LYNCH
```

When you use the PRINT procedure, you might want to use the OBS= option, which enables you to specify the last observation to be processed. This is especially useful when the view descriptor describes large amounts of data or when you just want to see an example of the output. The following example uses the OBS= option to print the first five observations described by the view descriptor Vlib.CusOrdr.

```
proc print data=vlib.cusordr (obs=5);
   title "First Five Observations Described
          by VLIB.CUSORDR";
run;
```

Vlib.CusOrdr. accesses data from the NATURAL DDM named ORDER. The following output shows the result of this example.

Output 3.3 *Results of Using the OBS= Option*

```
              First Five Observations Described by VLIB.CUSORDR

                             OBS    STOCKNUM    SHIPTO

                               1      9870      19876078
                               2      1279      39045213
                               3      8934      18543489
                               4      3478      29834248
                               5      2567      19783482
```

In addition to the OBS= option, the FIRSTOBS= option also works with view descriptors. The FIRSTOBS= option does not improve performance significantly because each observation must still be read and its position calculated. The POINT= option in the SET statement is not currently supported by the SAS/ACCESS interface to ADABAS.

For more information about the PRINT procedure, see the *Base SAS Procedures Guide*. For more information about the OBS= and FIRSTOBS= options, see the *SAS Data Set Options: Reference*.

Charting ADABAS Data

CHART procedure programs work with ADABAS data that is described by view descriptors just as they do with other SAS data sets. The following example uses the view descriptor Vlib.AllOrdr to create a vertical bar chart of the number of orders per product.

```
proc chart data=vlib.allordr;
   vbar stocknum;
   title "Data Described by VLIB.ALLORDR";
run;
```

Vlib.AllOrdr accesses data from the NATURAL DDM named ORDER. The following output shows the results for this example. STOCKNUM represents each product; the number of orders for each product is represented by the height of the bar.

Output 3.4 *Results of Charting ADABAS Data*

```
                          Data Described by VLIB.ALLORDR

Frequency

8 +      *****     *****                                   *****     *****
  |      *****     *****                                   *****     *****
  |      *****     *****                                   *****     *****
  |      *****     *****                                   *****     *****
  |      *****     *****                                   *****     *****
7 +      *****     *****                                   *****     *****
  |      *****     *****                                   *****     *****
  |      *****     *****                                   *****     *****
  |      *****     *****                                   *****     *****
  |      *****     *****                                   *****     *****
6 +      *****     *****     *****                         *****     *****
  |      *****     *****     *****                         *****     *****
  |      *****     *****     *****                         *****     *****
  |      *****     *****     *****                         *****     *****
  |      *****     *****     *****                         *****     *****
5 +      *****     *****     *****                         *****     *****
  |      *****     *****     *****                         *****     *****
  |      *****     *****     *****                         *****     *****
  |      *****     *****     *****                         *****     *****
  |      *****     *****     *****                         *****     *****
4 +      *****     *****     *****                         *****     *****
  |      *****     *****     *****                         *****     *****
  |      *****     *****     *****                         *****     *****
  |      *****     *****     *****                         *****     *****
  |      *****     *****     *****                         *****     *****
3 +      *****     *****     *****                         *****     *****
  |      *****     *****     *****                         *****     *****
  |      *****     *****     *****                         *****     *****
  |      *****     *****     *****                         *****     *****
  |      *****     *****     *****                         *****     *****
2 +      *****     *****     *****     *****               *****     *****
  |      *****     *****     *****     *****               *****     *****
  |      *****     *****     *****     *****               *****     *****
  |      *****     *****     *****     *****               *****     *****
  |      *****     *****     *****     *****               *****     *****
1 +      *****     *****     *****     *****               *****     *****
  |      *****     *****     *****     *****               *****     *****
  |      *****     *****     *****     *****               *****     *****
  |      *****     *****     *****     *****               *****     *****
  |      *****     *****     *****     *****               *****     *****
  ----------------------------------------------------------------------------
          750       2250      3750      5250      6750      8250      9750

                                   STOCKNUM
```

For more information about the CHART procedure, see the *Base SAS Procedures Guide*.

If you have SAS/GRAPH software, you can create colored block charts, plots, and other graphics based on ADABAS data. See the *SAS/GRAPH: Reference* for more information about the types of graphics that you can produce with SAS/GRAPH software.

Calculating Statistics with ADABAS Data

Using Statistical Procedures

You can use statistical procedures on ADABAS data that is described by view descriptors just as you would with SAS data files. This section shows simple examples using the FREQ, MEANS, and RANK procedures.

Calculating Statistics Using the FREQ Procedure

Suppose you want to find what percentage of your invoices went to each country so that you can decide where to increase your overseas marketing. The following example calculates the percentages of invoices for each country accessed by the NATURAL DDM named INVOICE, using the view descriptor Vlib.Inv.

```
proc freq data=vlib.inv;
   tables country;
   title "Data Described by VLIB.INV";
run;
```

The following output shows the one-way frequency table this example generates.

Output 3.5 *Results of Calculating Statistics Using the FREQ Procedure*

```
                   Data Described by VLIB.INV

                            COUNTRY

                                        Cumulative  Cumulative
COUNTRY            Frequency   Percent   Frequency    Percent
--------------------------------------------------------------
Argentina                 2      11.8           2       11.8
Australia                 1       5.9           3       17.6
Brazil                    4      23.5           7       41.2
USA                      10      58.8          17      100.0

                               Frequency Missing = 2
```

For more information about the FREQ procedure, see the *Base SAS Procedures Guide*.

Calculating Statistics Using the MEANS Procedure

In an analysis of recent orders, suppose you also want to determine some statistics for each of your USA customers. In the following SAS program, the view descriptor Vlib.UsaOrdr accesses data from the NATURAL DDM named ORDER, the SAS WHERE statement selects observations that have a SHIPTO value beginning with a 1, which indicates a USA customer, and the SAS BY statement sorts the data by order number. (Note that both ORDERNUM and SHIPTO are ADABAS descriptor data fields.)

The following example generates the mean and sum of the length of material ordered and the fabric charges for each USA customer. Also included are the number of observations (N) and the number of missing values (NMISS).

```
proc means data=vlib.usaordr mean sum n nmiss
     maxdec=0;
   where shipto like "1%";
   by ordernum;
   var length fabricch;
   title "Data Described by VLIB.USAORDR";
run;
```

The following output shows the results for this example.

Output 3.6 *Results of Calculating Statistics Using the MEANS Procedure*

```
                         Data Described by VLIB.USAORDR

--------------------------------- ORDERNUM=11269 -------------------------------


Variable  Label                           N         Nmiss           Mean            Sum
-------------------------------------------------------------------------------
LENGTH    LENGTH                          1             0            690            690
FABRICCH  FABRICCHARGES                   1             0              0              0
-------------------------------------------------------------------------------

--------------------------------- ORDERNUM=11271 -------------------------------


Variable  Label                           N         Nmiss           Mean            Sum
-------------------------------------------------------------------------------
LENGTH    LENGTH                          1             0            110            110
FABRICCH  FABRICCHARGES                   1             0       11063836       11063836
-------------------------------------------------------------------------------

--------------------------------- ORDERNUM=11273 -------------------------------


Variable  Label                           N         Nmiss           Mean            Sum
-------------------------------------------------------------------------------
LENGTH    LENGTH                          1             0            450            450
FABRICCH  FABRICCHARGES                   1             0         252149         252149
-------------------------------------------------------------------------------

--------------------------------- ORDERNUM=11274 -------------------------------


Variable  Label                           N         Nmiss           Mean            Sum
-------------------------------------------------------------------------------
LENGTH    LENGTH                          1             0           1000           1000
FABRICCH  FABRICCHARGES                   1             0              0              0
-------------------------------------------------------------------------------

--------------------------------- ORDERNUM=11276 -------------------------------


Variable  Label                           N         Nmiss           Mean            Sum
-------------------------------------------------------------------------------
LENGTH    LENGTH                          1             0           1500           1500
FABRICCH  FABRICCHARGES                   1             0        1934460        1934460
-------------------------------------------------------------------------------

--------------------------------- ORDERNUM=11278 -------------------------------


Variable  Label                           N         Nmiss           Mean            Sum
-------------------------------------------------------------------------------
LENGTH    LENGTH                          1             0           2500           2500
FABRICCH  FABRICCHARGES                   1             0        1400825        1400825
-------------------------------------------------------------------------------
```

For more information about the MEANS procedure, see the *Base SAS Procedures Guide*.

Calculating Statistics Using the RANK Procedure

You can use advanced statistics procedures on ADABAS data that is described by a view descriptor. The following example uses the RANK procedure to calculate the order of birthdays for a set of employees. This example creates a SAS data file MyData.RankEx from the view descriptor Vlib.Emps and assigns the name DATERANK to the new variable (in the data file) created by the procedure.

```
proc rank data=vlib.emps out=mydata.rankex;
   var birthdat;
   ranks daterank;
run;
proc print data=mydata.rankex;
   title "Order of Employee Birthdays";
run;
```

Vlib.Emps accesses data from the NATURAL DDM named EMPLOYEE. The following output shows the result of this example.

Output 3.7 *Results of Calculating Statistics Using the RANK Procedure*

```
                         Order of Employee Birthdays

   OBS      EMPID    JOBCODE    BIRTHDAT    LASTNAME              DATERANK

     1     456910       602     24SEP53     ARDIS                     5
     2     237642       602     13MAR54     BATTERSBY                 6
     3     239185       602     28AUG59     DOS REMEDIOS              7
     4     321783       602     03JUN35     GONZALES                  2
     5     120591       602     12FEB46     HAMMERSTEIN               4
     6     135673       602     21MAR61     HEMESLY                   8
     7     456921       602     12MAY62     KRAUSE                    9
     8     457232       602     15OCT63     LOVELL                   11
     9     423286       602     31OCT64     MIFUNE                   12
    10     216382       602     24JUL63     PURINTON                 10
    11     234967       602     21DEC67     SMITH                    13
    12     212916       602     29MAY28     WACHBERGER                1
    13     119012       602     05JAN46     WOLF-PROVENZA             3
```

For more information about the RANK procedure and other advanced statistics procedures, see the *Base SAS Procedures Guide*.

Selecting and Combining ADABAS Data

Methods for Selecting and Combining ADABAS Data

The great majority of SAS programs select and combine data from various sources. The method that you use depends on the configuration of the data. The next three examples show you how to select and combine data using two different methods. When choosing between these methods, you should consider the issues described in “Performance Considerations” on page 41.

Selecting and Combining Data Using the WHERE Statement

Suppose you have two view descriptors, Vlib.UsaInv and Vlib.ForInv, that list the invoices for USA and foreign customers, respectively. You can use the SET statement to concatenate these files into a SAS data file containing information about customers who have not paid their bills and whose bills amount to at least $300,000.

The following example contains the code to create the SAS data file containing the information that you want on the customers.

```
data notpaid(keep=invoicen billedto amtbille
     billedon paidon);
   set vlib.usainv vlib.forinv;
   where paidon is missing and
      amtbille>=300000;
run;
proc print;
   title "High Bills--Not Paid";
run;
```

In the SAS WHERE statement, you must use the SAS variable names, not the ADABAS data field names. Both Vlib.Usainv and Vlib.Forinv access data in the NATURAL DDM named INVOICE. The following output shows the result of the new temporary data file, Work.NotPaid.

Output 3.8 *Results of Selecting and Combining Data Using a WHERE Statement*

```
                           High Bills--Not Paid

 OBS    INVOICEN    BILLEDTO              AMTBILLE    BILLEDON      PAIDON

  1       12102     18543489           11063836.00    17NOV88            .
  2       11286     43459747           12679156.00    10OCT88            .
  3       12051     39045213         1340738760.90    02NOV88            .
  4       12471     39045213         1340738760.90    27DEC88            .
  5       12476     38763919           34891210.20    24DEC88            .
```

The first line of the DATA step uses the KEEP= data set option. This option works with view descriptors just as it works with other SAS data sets. That is, the KEEP= option specifies that you want only the listed variables to be included in the new data file, NotPaid, although you can use the other variables within the DATA step.

Notice that the WHERE statement includes two conditions to be met. First, it selects only observations that have missing values for the variable PAIDON. As you can see, it is important to know how the ADABAS data is configured before you can use this data in a SAS program.

Second, the WHERE statement requires that the amount in each bill be higher than a certain figure. Again, you need to be familiar with the ADABAS data so that you can determine a reasonable figure for this expression.

When referencing a view descriptor in a SAS procedure or DATA step, it is more efficient to use a SAS WHERE statement than to use a subsetting IF statement. A DATA step or SAS procedure passes the SAS WHERE statement as a WHERE clause to the interface view engine, which adds it (using the Boolean operator AND) to any WHERE clause defined in the view descriptor. The view descriptor is then passed to ADABAS for processing. Processing ADABAS data using a WHERE clause might reduce the number of logical records read and therefore often improves performance.

For more information about the SAS WHERE statement, see the *SAS DATA Step Statements: Reference*.

Selecting and Combining Data Using the SQL Procedure

Examples Using the SAS SQL Procedure

This section provides two examples of using the SAS SQL procedure on ADABAS data. The SQL procedure implements the Structured Query Language (SQL) and is included in Base SAS software. The first example illustrates using the SQL procedure to combine data from three sources. The second example shows how to use the PROC SQL GROUP BY clause to create new variables from data that is described by a view descriptor.

Combining Data from Various Sources

Suppose you have the view descriptors Vlib.CusPhon and Vlib.CusOrdr based on the NATURAL DDMs CUSTOMERS and ORDER, respectively, and a SAS data file, MyData.OutOfStk, that contains names and numbers of products that are out of stock. You can use the SQL procedure to join all these sources of data to form a single output file. The SAS WHERE or subsetting IF statements would not be appropriate in this case because you want to compare variables from several sources, rather than simply merge or concatenate the data.

The following example contains the code to print the view descriptors and the SAS data file:

```
proc print data=vlib.cusphon;
   title "Data Described by VLIB.CUSPHON";
run;

proc print data=vlib.cusordr;
   title "Data Described by VLIB.CUSORDR";
run;

proc print data=mydata.outofstk;
   title "SAS Data File MYDATA.OUTOFSTK";
run;
```

The following three outputs show the results of the PRINT procedure performed on the data that is described by the view descriptors Vlib.CusPhon and Vlib.CusOrder and on the SAS data file MyData.OutOfStk.

Output 3.9 *Data That Is Described by the View Descriptor Vlib.CusPhon*

```
                    Data Described by VLIB.CUSPHON

         OBS    CUSTNUM     PHONE

           1    12345678    919/489-5682
           2    14324742    408/629-0589
           3    14569877    919/489-6792
           4    14898029    301/760-2541
           5    15432147    616/582-3906
           6    18543489    512/478-0788
           7    19783482    703/714-2900
           8    19876078    209/686-3953
           9    24589689    (012)736-202
          10    26422096    4268-54-72
          11    26984578    43-57-04
          12    27654351    02/215-37-32
          13    28710427    (021)570517
          14    29834248    (0552)715311
          15    31548901    406/422-3413
          16    38763919    244-6324
          17    39045213    012/302-1021
          18    43290587    (02)933-3212
          19    43459747    03/734-5111
          20    46543295    (03)022-2332
          21    46783280    3762855
          22    48345514    213445

         OBS    NAME

           1
           2    SANTA CLARA VALLEY TECHNOLOGY SPECIALISTS
           3    PRECISION PRODUCTS
           4    UNIVERSITY BIOMEDICAL MATERIALS
           5    GREAT LAKES LABORATORY EQUIPMENT MANUFACTURERS
           6    LONE STAR STATE RESEARCH SUPPLIERS
           7    TWENTY-FIRST CENTURY MATERIALS
           8    SAN JOAQUIN SCIENTIFIC AND INDUSTRIAL SUPPLY, INC.
           9    CENTAR ZA TECHNICKU I NAUCNU RESTAURIRANJE UMJETNINA
          10    SOCIETE DE RECHERCHES POUR DE CHIRURGIE ORTHOPEDIQUE
          11    INSTITUT FUR TEXTIL-FORSCHUNGS
          12    INSTITUT DE RECHERCHE SCIENTIFIQUE MEDICALE
          13    ANTONIE VAN LEEUWENHOEK VERENIGING VOOR MICROBIOLOGIE
          14    BRITISH MEDICAL RESEARCH AND SURGICAL SUPPLY
          15    NATIONAL COUNCIL FOR MATERIALS RESEARCH
          16    INSTITUTO DE BIOLOGIA Y MEDICINA NUCLEAR
          17    LABORATORIO DE PESQUISAS VETERNINARIAS DESIDERIO FINAMOR
          18    HASSEI SAIBO GAKKAI
          19    RESEARCH OUTFITTERS
          20    WESTERN TECHNOLOGICAL SUPPLY
          21    NGEE TECHNOLOGICAL INSTITUTE
          22    GULF SCIENTIFIC SUPPLIES
```

Output 3.10 *Data That Is Described by the View Descriptor Vlib.Cusordr*

```
                  Data Described by VLIB.CUSORDR

                      OBS    STOCKNUM    SHIPTO

                        1      9870      19876078
                        2      1279      39045213
                        3      8934      18543489
                        4      3478      29834248
                        5      2567      19783482
                        6      4789      15432147
                        7      3478      29834248
                        8      1279      14324742
                        9      8934      31548901
                       10      2567      14898029
                       11      9870      48345514
                       12      1279      39045213
                       13      8934      18543489
                       14      2567      19783482
                       15      9870      18543489
                       16      3478      24589689
                       17      1279      38763919
                       18      8934      43459747
                       19      2567      15432147
                       20      9870      14324742
                       21      9870      19876078
                       22      1279      39045213
                       23      8934      18543489
                       24      3478      29834248
                       25      2567      19783482
                       26      4789      15432147
                       27      3478      29834248
                       28      1279      14324742
                       29      8934      31548901
                       30      2567      14898029
                       31      9870      48345514
                       32      1279      39045213
                       33      8934      18543489
                       34      2567      19783482
                       35      9870      18543489
                       36      3478      24589689
                       37      1279      38763919
                       38      8934      43459747
                       39      2567      15432147
                       40      9870      14324742
```

Output 3.11 *Data in the SAS Data File MyDataOutOfStk*

```
             SAS Data File MYDATA.OUTOFSTK

              OBS    FIBERNAM    FIBERNUM

               1      olefin       3478
               2      gold         8934
               3      dacron       4789
```

The following SAS code selects and combines data from these three sources to create a PROC SQL view, SQL.BadOrdr. The SQL.BadOrdr view retrieves customer and product information that the sales department can use to notify customers of unavailable products.

```
proc sql;
create view sql.badordr as
   select cusphon.custnum, cusphon.name,
          cusphon.phone, cusordr.stocknum,
          outofstk.fibernam as product
      from vlib.cusphon, vlib.cusordr,
           mydata.outofstk
      where cusordr.stocknum=outofstk.fibernum
           and cusphon.custnum=cusordr.shipto
      order by cusphon.custnum, product;
   title "Data Described by SQL.BADORDR";
   select * from sql.badordr;
```

The CREATE VIEW statement incorporates a WHERE clause as part of its SELECT statement. The last SELECT statement retrieves and displays the PROC SQL view, SQL.BadOrdr. To select all columns from the view, use an asterisk (*) in place of variable names. The order of the columns displayed matches the order of the columns as specified in the view descriptor SQL.BadOrdr. (Note that an ORDER BY clause requires an ADABAS descriptor data field.)

The following output shows the data that is described by the SQL.BadOrdr view. Note that the SQL procedure uses the column labels in the output by default.

Output 3.12 *Results of Combining Data from Various Sources*

```
                    Data Described by SQL.BADORDR

CUSTOMER  NAME
TELEPHONE     STOCKNUM  PRODUCT
----------------------------------------------------------------------
15432147  GREAT LAKES LABORATORY EQUIPMENT MANUFACTURERS
616/582-3906      4789  dacron

15432147  GREAT LAKES LABORATORY EQUIPMENT MANUFACTURERS
616/582-3906      4789  dacron

18543489  LONE STAR STATE RESEARCH SUPPLIERS
512/478-0788      8934  gold

18543489  LONE STAR STATE RESEARCH SUPPLIERS
512/478-0788      8934  gold

18543489  LONE STAR STATE RESEARCH SUPPLIERS
512/478-0788      8934  gold

18543489  LONE STAR STATE RESEARCH SUPPLIERS
512/478-0788      8934  gold

24589689  CENTAR ZA TECHNICKU I NAUCNU RESTAURIRANJE UMJETNINA
(012)736-202      3478  olefin

24589689  CENTAR ZA TECHNICKU I NAUCNU RESTAURIRANJE UMJETNINA
(012)736-202      3478  olefin

29834248  BRITISH MEDICAL RESEARCH AND SURGICAL SUPPLY
(0552)715311      3478  olefin

29834248  BRITISH MEDICAL RESEARCH AND SURGICAL SUPPLY
(0552)715311      3478  olefin

29834248  BRITISH MEDICAL RESEARCH AND SURGICAL SUPPLY
(0552)715311      3478  olefin

29834248  BRITISH MEDICAL RESEARCH AND SURGICAL SUPPLY
(0552)715311      3478  olefin

31548901  NATIONAL COUNCIL FOR MATERIALS RESEARCH
406/422-3413      8934  gold

31548901  NATIONAL COUNCIL FOR MATERIALS RESEARCH
406/422-3413      8934  gold

43459747  RESEARCH OUTFITTERS
03/734-5111       8934  gold

43459747  RESEARCH OUTFITTERS
03/734-5111       8934  gold
```

The view SQL.BadOrdr lists entries for all customers who have ordered out-of-stock products. However, it contains duplicate rows because some companies have ordered the same product more than once. To make the data more readable for the sales department, you can create a final SAS data file, MyData.BadNews, using the results of the PROC SQL view as input in the SET statement and the special variable FIRST.PRODUCT. This variable identifies which row is the first in a particular BY group. You need only a customer's name once to notify them that a product is out of stock, regardless of the number of times the customer has placed an order for it.

```
data mydata.badnews;
   set sql.badordr;
   by custnum product;
   if first.product;
run;

proc print;
   title "MYDATA.BADNEWS Data File";
quit;
```

The data file MyData.BadNews contains an observation for each unique combination of customer and out-of-stock product. The following output displays this data file.

Output 3.13 *Results of Grouping Data Using First.variable*

```
                         MYDATA.BADNEWS Data File

OBS   CUSTNUM     NAME

 1    15432147    GREAT LAKES LABORATORY EQUIPMENT MANUFACTURERS
 2    18543489    LONE STAR STATE RESEARCH SUPPLIERS
 3    24589689    CENTAR ZA TECHNICKU I NAUCNU RESTAURIRANJE UMJETNINA
 4    29834248    BRITISH MEDICAL RESEARCH AND SURGICAL SUPPLY
 5    31548901    NATIONAL COUNCIL FOR MATERIALS RESEARCH
 6    43459747    RESEARCH OUTFITTERS

OBS   PHONE           STOCKNUM    PRODUCT

 1    616/582-3906      4789      dacron
 2    512/478-0788      8934      gold
 3    (012)736-202      3478      olefin
 4    (0552)715311      3478      olefin
 5    406/422-3413      8934      gold
 6    03/734-5111       8934      gold
```

For more information about FIRST.*variable*, see the *SAS DATA Step Statements: Reference*.

Creating New Variables with the GROUP BY Clause

It is often useful to create new variables with summarizing or variable functions such as AVG or SUM. Although you cannot use the ACCESS procedure to create new variables, you can easily use the SQL procedure with data that is described by a view descriptor to display output that contains new variables.

This example uses the SQL procedure to retrieve and manipulate data accessed by the view descriptor Vlib.AllEmp, which accesses data in the NATURAL DDM named EMPLOYEE. When this *query* (as a SELECT statement is often called) is submitted, it calculates and displays the average salary for each department; the AVG function is the SQL procedure's equivalent of the SAS MEAN function.

```
proc sql;
   title "Average Salary Per Department";
   select distinct dept,
         avg(salary) label="Average Salary"
            format=dollar12.2
      from vlib.allemp
      where dept is not missing
      group by dept;
```

The order of the variables that are displayed matches the order of the variables as specified in the SELECT list of the query. The following output shows the query's result.

Output 3.14 *Results of Creating New Variables with the GROUP BY Clause*

```
            Average Salary Per Department
                                 Average
                 DEPT             Salary
                 --------------------
                 ACC013    $54,591.33
                 ACC024    $55,370.55
                 ACC043    $75,000.34
                 CSR004    $17,000.00
                 CSR010    $44,324.19
                 CSR011    $41,966.16
                 SHP002    $40,111.31
                 SHP013    $41,068.44
                 SHP024    $50,000.00
```

For more information about the SQL procedure, see the *SAS SQL Procedure User's Guide*.

Updating a SAS Data File with ADABAS Data

You can update a SAS data file with ADABAS data that is described by a view descriptor, just as you can update a SAS data file with data from another data file. In this section, the term *transaction data* refers to the new data that is to be added to the original file. You can even do updates when the file to be updated is a Version 6 data file and the transaction data is from a Version 7 and later source.

Suppose you have a Version 6 data file, Lib6.BirthdayY, that contains employee ID numbers, last names, and birthdays. You want to update this data file with data that is described by Vlib.emps, a view descriptor that is based on the EMPLOYEE DDM. To perform the update, enter the following SAS statements.

```
proc sort data=lib6.birthday;
   by lastname;
run;

proc print data=lib6.birthday;
   title "LIB6.BIRTHDAY Data File";
   format birthdat date7.;
run;

proc print data=vlib.emps;
   title "Data Described by VLIB.EMPS";
run;

data mydata.newbday;
   update lib6.birthday vlib.emps;
   by lastname;
run;

proc print;
   title 'MYDATA.NEWBDAY Data File';
run;
```

In this example, the new, updated SAS data file, Mydata.NewBDay, is a Version 7 or later data file. It is stored in the Version 7 or later SAS library associated with the libref MyData.

When the UPDATE statement references the view descriptor Vlib.emps and uses a BY statement in the DATA step, the BY statement causes a BY clause to be generated for the variable LASTNAME. (Note that a BY statement must reference an ADABAS descriptor data field.) Thus, the BY clause causes the ADABAS data to be presented to SAS in a sorted order for use in updating the MyData.NewBDay data file. However, the data file Lib6.Birthday had to be sorted before the update, because the UPDATE statement expects both the original file and the transaction file to be sorted by the BY variable.

The following three outputs show the results of PRINT procedures on the original data file, the transaction data, and the updated data file.

Output 3.15 *Data in the Data File to Be Updated, Lib6.Birthday*

```
                  LIB6.BIRTHDAY Data File

        OBS     EMPID    BIRTHDAT    LASTNAME

          1     129540    31JUL60     CHOULAI
          2     356134    25OCT60     DUNNETT
          3     127845    25DEC43     MEDER
          4     677890    24APR65     NISHIMATSU-LYNCH
          5     459287    05JAN34     RODRIGUES
          6     346917    15MAR50     SHIEKELESLAN
          7     254896    06APR49     TAYLOR-HUNYADI
```

Output 3.16 *Data That Is Described by the View Descriptor Vlib.Emps*

```
                 Data Described by VLIB.EMPS

   OBS      EMPID    JOBCODE    BIRTHDAT    LASTNAME

     1     456910       602     24SEP53     ARDIS
     2     237642       602     13MAR54     BATTERSBY
     3     239185       602     28AUG59     DOS REMEDIOS
     4     321783       602     03JUN35     GONZALES
     5     120591       602     12FEB46     HAMMERSTEIN
     6     135673       602     21MAR61     HEMESLY
     7     456921       602     12MAY62     KRAUSE
     8     457232       602     15OCT63     LOVELL
     9     423286       602     31OCT64     MIFUNE
    10     216382       602     24JUL63     PURINTON
    11     234967       602     21DEC67     SMITH
    12     212916       602     29MAY28     WACHBERGER
    13     119012       602     05JAN46     WOLF-PROVENZA
```

Output 3.17 *Results of Updating a Data File with ADABAS Data*

```
                      MYDATA.NEWBDAY Data File

   OBS      EMPID    BIRTHDAT    LASTNAME              JOBCODE

     1     456910    24SEP53     ARDIS                   602
     2     237642    13MAR54     BATTERSBY               602
     3     129540    31JUL60     CHOULAI                   .
     4     239185    28AUG59     DOS REMEDIOS            602
     5     356134    25OCT60     DUNNETT                   .
     6     321783    03JUN35     GONZALES                602
     7     120591    12FEB46     HAMMERSTEIN             602
     8     135673    21MAR61     HEMESLY                 602
     9     456921    12MAY62     KRAUSE                  602
    10     457232    15OCT63     LOVELL                  602
    11     127845    25DEC43     MEDER                     .
    12     423286    31OCT64     MIFUNE                  602
    13     677890    24APR65     NISHIMATSU-LYNCH          .
    14     216382    24JUL63     PURINTON                602
    15     459287    05JAN34     RODRIGUES                 .
    16     346917    15MAR50     SHIEKELESLAN              .
    17     234967    21DEC67     SMITH                   602
    18     254896    06APR49     TAYLOR-HUNYADI            .
    19     212916    29MAY28     WACHBERGER              602
    20     119012    05JAN46     WOLF-PROVENZA           602
```

For more information about the UPDATE statement, see *SAS DATA Step Statements: Reference*.

Note: You cannot update ADABAS data directly using the DATA step, but you can update ADABAS data using the following procedures: APPEND, FSEDIT, FSVIEW, and SQL. For more information about updating ADABAS data, see “Introduction to Browsing and Updating ADABAS Data” on page 43.

Performance Considerations

While you can generally treat view descriptors like other SAS data sets in SAS programs, here are a few things that you should keep in mind:

- It is sometimes better to extract ADABAS data and place it in a SAS data file rather than to read it directly. Here are some circumstances when you should probably extract:
  - If you plan to use the same ADABAS data in several procedures during the same SAS session, you might improve performance by extracting the ADABAS data. Placing this data in a SAS data file requires a certain amount of disk space to store the data and I/O to write the data. However, SAS data files are organized to provide optimal performance with PROC and DATA steps. Programs using SAS data files often use less CPU time than programs that directly read ADABAS data.
  - If you plan to read large amounts of ADABAS data and the data is being shared by several users, your direct reading of the data could adversely affect all users' response time.
  - If you are the creator of an ADABAS file and think that directly reading this data would present a security risk, you might want to extract the data and not distribute information about either the access descriptor or view descriptor.
- If you intend to use the data in a particular sorted order several times, it is usually best to run the SORT procedure on the view descriptor, using the OUT= option. This is more efficient than requesting the same sort repeatedly (with a BY clause) on the ADABAS data. Note that you cannot run the SORT procedure on a view descriptor unless you use the SORT procedure's OUT= option.
- Sorting data can be resource-intensive, whether it is done with the SORT procedure, with a BY statement (which generates a BY clause), or with a SORT clause stored in the view descriptor. You should sort data only when it is needed for your program.
- If you reference a view descriptor in SAS code and the code includes a BY statement for a variable or variables (up to three) that corresponds to a descriptor data field in the ADABAS file, the interface view engine is called, and it will support the BY clause if possible. Thus, the BY clause sorts the ADABAS data before it uses the data in your SAS program. If the ADABAS file is very large, this sorting can affect performance.

  If the view descriptor already has a SORT clause and you specify a BY statement in your SAS code, the BY statement overrides the view descriptor's SORT clause.
- When writing a SAS program and referencing a view descriptor, it is more efficient to use a SAS WHERE statement in the program than it is to use a subsetting IF statement. The SAS program passes the WHERE statement as a WHERE clause to the interface view engine, which adds it (using the Boolean operator AND) to any WHERE clause stored in the view descriptor. The view descriptor is then passed to ADABAS for processing. Applying a WHERE clause to the ADABAS data might reduce the number of logical records read. Therefore, it often improves performance.

- See “Creating and Using ADABAS View Descriptors Efficiently” on page 78 for more details about creating efficient view descriptors.

4 Browsing and Updating ADABAS Data

Introduction to Browsing and Updating ADABAS Data

The SAS/ACCESS interface to ADABAS enables you to browse and update ADABAS data directly from a SAS session or program. This section shows you how to use SAS procedures to browse and update ADABAS data that is described by SAS/ACCESS view descriptors.

For definitions of the view descriptors used in this section as well as their associated access descriptors, and the ADABAS files, NATURAL DDMs, and SAS data files used throughout the document, see “Introduction to the ADABAS Example Data” on page 158.

Before you can browse or update ADABAS data, you must have access to the data through appropriate security options. ADABAS and NATURAL have several levels of security options, and you might display or browse data but not update values. Check with your Database Administrator (DBA) or the ADABAS file's or NATURAL DDM's creator to see what security options you have. If you have been granted the appropriate ADABAS security options, you can use the SAS procedures described in this section to update ADABAS data with a SAS/ACCESS view descriptor. For more information about ADABAS and NATURAL security, see "Introduction to ADABAS Essentials" on page 9.

Browsing and Updating ADABAS Data with the SAS/FSP Procedures

Using FSBROWSE, FSEDIT, and FSVIEW

If your site has SAS/FSP software as well as SAS/ACCESS software, you can browse and update ADABAS data from within a SAS program.

You can use three SAS/FSP procedures: FSBROWSE, FSEDIT, and FSVIEW. The FSBROWSE and FSEDIT procedures show you one ADABAS logical record at a time, whereas the FSVIEW procedure displays multiple logical records in a tabular format similar to the PRINT procedure. PROC FSVIEW enables you to both browse and update ADABAS data, depending on which option you choose.

Browsing Data Using the FSBROWSE Procedure

The FSBROWSE procedure enables you to look at ADABAS data that is described by a view descriptor but does not enable you to change it. For example, the following SAS statements enable you to view one record at a time of the view descriptor Vlib.UsaCust:

```
proc fsbrowse data=vlib.usacust;
run;
```

The FSBROWSE procedure retrieves one logical record of ADABAS data at a time. To browse each logical record, issue the FORWARD and BACKWARD commands.

Updating Data Using the FSEDIT Procedure

The FSEDIT procedure enables you to update ADABAS data that is described by a view descriptor if you have access to the data through the appropriate ADABAS and NATURAL security options. For example, the following SAS statements enable you to browse one record of Vlib.UsaCust at a time:

```
proc fsedit data=vlib.usacust;
run;
```

A window similar to the FSBROWSE window appears to enable you to edit the ADABAS data one observation at a time.

Note: When using PROC FSEDIT, you can cancel an edit only before you scroll. The CANCEL command redisplays the observation as it was before you began to edit it and cancels your editing changes. After you scroll, the changes are saved.

Browsing and Updating Data Using the FSVIEW Procedure

Browsing Data Using the FSVIEW Procedure

Browse mode is the default for the FSVIEW procedure. For example, to browse ADABAS data, submit the PROC FSVIEW statement as follows:

```
proc fsview data=vlib.usacust;
run;
```

The statements display the data as shown in the following output.

Output 4.1 *Results of Browsing Data Using the FSVIEW Procedure*

```
FSVIEW: VLIB.USACUST (B)
 Command ===>
   ROW      CUSTNUM   STATE  ZIPCODE  COUNTRY

       1    12345678  NC       27702  USA
       2    14324742  CA       95123  USA
       3    14324742  CA       95123  USA
       4    14569877  NC       27514  USA
       5    14569877  NC       27514  USA
       6    14898029  MD       20850  USA
       7    14898029  MD       20850  USA
       8    14898029  MD       20850  USA
       9    15432147  MI       49001  USA
      10    18543489  TX       78701  USA
      11    18543489  TX       78701  USA
      12    18543489  TX       78701  USA
      13    19783482  VA       22090  USA
      14    19783482  VA       22090  USA
      15    19876078  CA       93274  USA
      16    19876078  CA       93274  USA
```

To see the rest of the accessed ADABAS data, you must scroll the window to the right multiple times. You can do this by entering the RIGHT command on the command line or by pressing the function key assigned to this command.

Updating Data Using the FSVIEW Procedure

You can use the FSVIEW procedure to update ADABAS data. To edit the ADABAS data in a listing format, you have to add EDIT or MODIFY to the PROC FSVIEW statement, as shown in the following statement:

```
proc fsview data=vlib.usacust edit;
run;
```

The same window as shown in Output 4.1 on page 45 appears, except the window title contains an (E) for edit, not a (B). *SAS/FSP Procedures Guide* discusses in detail how to edit data using the FSVIEW procedure.

Note: The CANCEL command in the FSVIEW window does not cancel your changes, whether you have scrolled or not.

Specifying a SAS WHERE Expression While Browsing or Updating Data

You can specify a SAS WHERE statement or a SAS WHERE command to retrieve a subset of ADABAS data while you are using the FSP procedures. The WHERE statement is submitted when the FSP procedure is invoked and retrieves only the observations that meet the conditions of the WHERE statement. The other observations are not available until you exit the procedure. This is called a *permanent* WHERE clause. A SAS WHERE command is a WHERE expression that is invoked from the command line within an FSP procedure. You can clear the command to make all the observations available so it is known as a *temporary* WHERE clause.

The following example of a WHERE statement retrieves the customers from California. These customers are a subset of the customers for the CUSTOMERS DDM.

```
proc fsview data=vlib.usacust edit;
   where state='CA';
run;
```

The following output shows the FSVIEW window after the statements have been submitted.

Output 4.2 *Results of Specifying a WHERE Statement While Updating Data*

```
FSVIEW: VLIB.USACUST (Subset)
 Command ===>
   ROW      CUSTNUM   STATE  ZIPCODE  COUNTRY

       2   14324742  CA       95123  USA
       3   14324742  CA       95123  USA
      15   19876078  CA       93274  USA
      16   19876078  CA       93274  USA
```

Only the logical records with a STATE value of `CA` are retrieved for editing. Note that (Subset) appears after Vlib.UsaCust in the window title to remind you that the data retrieved is a subset of the data that is described by the view descriptor. You can then edit each observation by typing over the information that you want to modify. Issue the END command to end your editing session.

The following output shows the FSVIEW window when the subset of data is generated by the WHERE command:

```
where state='CA'
```

Output 4.3 *Results of Specifying a WHERE Command While Updating Data*

```
FSVIEW VLIB.USACUST                       WHERE ...
Command ===>
 ROW      CUSTNUM   STATE  ZIPCODE  COUNTRY

       2   14324742  CA       95123  USA
       3   14324742  CA       95123  USA
      15   19876078  CA       93274  USA
      16   19876078  CA       93274  USA
```

Output 4.2 on page 47 and Output 4.3 on page 47 are identical, except (Subset) after the title is replaced with **WHERE** in the upper right corner. You can then update each observation, as described earlier.

Although these examples have shown a SAS WHERE statement and a SAS WHERE command with the FSVIEW procedure, you can also retrieve a subset of data using the FSBROWSE and FSEDIT procedures. For more information about the SAS WHERE statement, see *SAS DATA Step Statements: Reference*. For more information about using the SAS WHERE command within the SAS/FSP procedures, see *SAS/FSP Procedures Guide*.

Adding and Deleting Data with the SAS/FSP Procedures

Adding Data

Adding ADABAS data with the SAS/FSP procedures is different for view descriptors than for SAS data files. Adding ADABAS data as a result of any SAS update operation can cause the interface view engine to decide whether to add a new ADABAS logical record or to modify an existing one, such as to add an occurrence to a periodic group.

If there are no periodic group fields accessed by the view descriptor or within the ADABAS file, doing an insert is straightforward. However, if a periodic group does exist, then doing an insert is more complicated, because the interface view engine generates multiple SAS observations from a single ADABAS record that contains a periodic group.

Values in the observation to be added are compared to values in the previous observation. If the contents of the previous observation do not help determine whether to add or modify, a new logical record is added. However, it is possible that some of the new values might already reside in the ADABAS file, which would mean that a new logical record is not necessary. This occurs if a periodic group is selected by the view descriptor, and the new data occurs only in variables corresponding to data fields that are part of that periodic group.

You can help the interface view engine resolve whether to add a new logical record or modify an existing one by specifying BY keys. For information about and examples of using BY keys, see “Using a BY Key to Resolve Ambiguous Inserts” on page 141.

Deleting Data

Deleting ADABAS data with the SAS/FSP procedures is different for view descriptors than for SAS data files. When you delete a logical record, the results depend on whether the observation is part of a periodic group. If the logical record is not part of a periodic group, deleting an observation causes a logical record to be deleted from the ADABAS file. However, if the logical record is part of a periodic group, the results of deleting an observation depend on the status of the ADBDEL systems option for the interface view engine, which is set in the ADBEUSE CSECT. For more information, see “System Options for PROC ACCESS and the Interface View Engine” on page 131.

- If ADBDEL=N (which is the default setting), the selected values for that occurrence in the periodic group are set to null (missing), but the logical record is not deleted.
- If ADBDEL=P, the entire logical record is deleted.

The following example illustrates using the DELETE command in the FSEDIT procedure. (Note that the ADBDEL systems option is set to N.)

Suppose you want to edit the ADABAS data described by Vlib.UsaCust. You can use the FSEDIT procedure with a PROC FSEDIT statement. Scroll forward to the observation to be deleted. In this example, there are three occurrences for the periodic group SIGNATURE-LIST. The following output shows the third occurrence, which you want to delete. (Notice that the variable SL_OCCUR displays the value 3, which tells you that this is the observation for the third occurrence.) Enter the DELETE command on the command line, as shown in the following output, and press ENTER.

Output 4.4 *Results of Deleting an ADABAS Logical Record*

```
FSEDIT VLIB.USACUST
 Command ===> delete
    CUSTNUM: 18543489

    STATE:  TX

    ZIPCODE: 78701

    COUNTRY: USA

    NAME:   LONE STAR STATE RESEARCH SUPPLIERS

    FIRSTORD: 10SEP79

    SL_OCCUR:       3

    LIMIT:           100000.00

    SIGNATUR: EVAN MASSEY

    BRANCH_2: DALLAS
```

The DELETE command processes the deletion and displays a message to that effect, as shown in the following output. There is no indication of what actions the interface view engine actually took.

Output 4.5 *Deletion Message Displayed*

```
FSEDIT VLIB.USACUST                         DELETED
 Command ===>
 NOTE: Observation has been deleted.
    CUSTNUM: ________
    STATE:  __

    ZIPCODE: ______

    COUNTRY: ____________________

    NAME:   _____________________________________

    FIRSTORD: _______

    SL_OCCUR: _________

    LIMIT:  __________________

    SIGNATUR: ______________________________

    BRANCH_2: _________________________
```

The entire observation seems to have been removed from the ADABAS file, but this is not the case. For the third occurrence, the interface view engine sets the values for data fields LIMIT and SIGNATUR to missing; the other data remains the same. Regardless of the actions though, the observation that you deleted is no longer available for processing. For more information about using the SAS/FSP procedures, see *SAS/FSP Procedures Guide*.

Browsing and Updating ADABAS Data with the SQL Procedure

The SAS SQL procedure enables you to retrieve and update ADABAS data. You can retrieve and browse ADABAS data by specifying a view descriptor in a PROC SQL SELECT statement.

To update the data, you can specify view descriptors in the PROC SQL DELETE, INSERT, and UPDATE statements. You must have access to the data through appropriate ADABAS and NATURAL security options before you can edit ADABAS data. Here is a summary of the pertinent PROC SQL statements:

DELETE
: deletes logical records from an ADABAS file.

INSERT
: inserts logical records in an ADABAS file.

SELECT
: retrieves and displays data from an ADABAS file. A SELECT statement is usually referred to as a query because it queries the ADABAS file for information.

UPDATE
: updates values in an ADABAS file.

When using the SQL procedure, note that the data is displayed in the SAS OUTPUT window. The procedure displays output data automatically without using the PRINT procedure and executes without using the RUN statement when an SQL procedure statement is executed.

Browsing Data with the SELECT Statement

You can use the SELECT statement to browse ADABAS data that is described by a view descriptor. The query in the following example retrieves and displays specified data fields and logical records in the CUSTOMERS DDM that are described by the Vlib.UsaCust view descriptor. The LINESIZE= system option is used to reset the default output width to 120 columns.

Note: The following SQL procedure examples assume that the CUSTOMERS DDM has not been updated by the earlier SAS/FSP examples.

```
options linesize=120;

proc sql;
   title 'ADABAS Data Output by a SELECT Statement';
   select custnum, state, name, limit,signatur
      from vlib.usacust;
```

The following output displays the query's results. Notice in the output that the SQL procedure displays the ADABAS data field names, not the corresponding SAS variable names.

Output 4.6 *Results of Browsing Data with a PROC SQL Query*

```
                              ADABAS Data Output by a SELECT Statement


 CUSTOMER  STATE  NAME                                                                      LIMIT SIGNATURE
-----------------------------------------------------------------------------------------------------------------
 12345678  NC                                                                                0.00

 14324742  CA     SANTA CLARA VALLEY TECHNOLOGY SPECIALISTS                               5000.00 BOB HENSON

 14324742  CA     SANTA CLARA VALLEY TECHNOLOGY SPECIALISTS                              25000.00 KAREN DRESSER

 14569877  NC     PRECISION PRODUCTS                                                      5000.00 JEAN CRANDALL

 14569877  NC     PRECISION PRODUCTS                                                    100000.00 STEVE BLUNTSEN

 14898029  MD     UNIVERSITY BIOMEDICAL MATERIALS                                        10000.00 MASON FOXWORTH

 14898029  MD     UNIVERSITY BIOMEDICAL MATERIALS                                        50000.00 DANIEL STEVENS

 14898029  MD     UNIVERSITY BIOMEDICAL MATERIALS                                       100000.00 ELIZABETH PATTON

 15432147  MI     GREAT LAKES LABORATORY EQUIPMENT MANUFACTURERS                         10000.00 JACK TREVANE

 18543489  TX     LONE STAR STATE RESEARCH SUPPLIERS                                     10000.00 NANCY WALSH

 18543489  TX     LONE STAR STATE RESEARCH SUPPLIERS                                     50000.00 TED WHISTLER

 18543489  TX     LONE STAR STATE RESEARCH SUPPLIERS                                    100000.00 EVAN MASSEY

 19783482  VA     TWENTY-FIRST CENTURY MATERIALS                                          5000.00 PETER THOMAS

 19783482  VA     TWENTY-FIRST CENTURY MATERIALS                                         10000.00 LOUIS PICKERING

 19876078  CA     SAN JOAQUIN SCIENTIFIC AND INDUSTRIAL SUPPLY, INC.                      7500.00 EDWARD LOWE

 19876078  CA     SAN JOAQUIN SCIENTIFIC AND INDUSTRIAL SUPPLY, INC.                     25000.00  E.F. JENSEN
```

You can specify a WHERE clause as part of the SELECT statement to retrieve a subset of the logical records for display. The following example displays the companies that are located in North Carolina:

```
title 'ADABAS Data Output by a WHERE Clause';
select custnum, state, name, limit, signatur
   from vlib.usacust
   where state='NC';
```

Notice that the PROC SQL statement is not repeated in this query. With the SQL procedure, you do not need to repeat the PROC SQL statement unless you use another SAS procedure, a DATA step, or a QUIT statement between PROC SQL statements. The following output displays the companies from North Carolina described by Vlib.UsaCust.

Output 4.7 *Results of Browsing Data Subset by a WHERE Clause*

```
                        ADABAS Data Output by a WHERE Clause


CUSTOMER  STATE  NAME                                                                    LIMIT SIGNATURE

-------------------------------------------------------------------------------------------------------------
12345678  NC                                                                              0.00

14569877  NC     PRECISION PRODUCTS                                                    5000.00 JEAN CRANDALL

14569877  NC     PRECISION PRODUCTS                                                  100000.00 STEVE BLUNTSEN
```

Updating Data with the UPDATE Statement

You can use the UPDATE statement to update ADABAS data. Remember that when you reference a view descriptor in a PROC SQL statement, you are not updating the view descriptor, but rather the ADABAS data described by the view descriptor.

The following UPDATE statements update the values described by the logical record that meets the WHERE clause criteria. The SELECT statement then displays the view's output as shown in Output 4.8 on page 54. The ORDER BY clause in the SELECT statement causes the data to be presented in ascending order by the CUSTOMER data field. (Because you are referencing a view descriptor, you use the SAS variable names for data fields in the UPDATE statement. However, the SQL procedure displays the ADABAS data field names.)

```
update vlib.usacust
   set zipcode=27702
   where custnum='12345678';
update vlib.usacust
   set name='DURHAM SCIENTIFIC SUPPLY COMPANY'
   where custnum='12345678';
update vlib.usacust
   set firstord='02JAN88'd
   where custnum='12345678';
update vlib.usacust
   set limit=5000.00
   where custnum='12345678';
update vlib.usacust
   set signatur='MARC PLOUGHMAN'
   where custnum='12345678';
update vlib.usacust
   set branch_2='DURHAM'
   where custnum='12345678';
title 'Updated ADABAS Data in CUSTOMERS';
select custnum, state, name, limit, signatur
```

```
         from vlib.usacust;
```

Output 4.8 *Results of Updating Data with the UPDATE Statement*

```
                                 Updated ADABAS Data in CUSTOMERS

CUSTOMER  STATE  NAME                                                                      LIMIT SIGNATURE
----------------------------------------------------------------------------------------------------------------
12345678  NC     DURHAM SCIENTIFIC SUPPLY COMPANY                                        5000.00 MARC PLOUGHMAN

14324742  CA     SANTA CLARA VALLEY TECHNOLOGY SPECIALISTS                               5000.00 BOB HENSON

14324742  CA     SANTA CLARA VALLEY TECHNOLOGY SPECIALISTS                              25000.00 KAREN DRESSER

14569877  NC     PRECISION PRODUCTS                                                     5000.00 JEAN CRANDALL

14569877  NC     PRECISION PRODUCTS                                                   100000.00 STEVE BLUNTSEN

14898029  MD     UNIVERSITY BIOMEDICAL MATERIALS                                        10000.00 MASON FOXWORTH

14898029  MD     UNIVERSITY BIOMEDICAL MATERIALS                                        50000.00 DANIEL STEVENS

14898029  MD     UNIVERSITY BIOMEDICAL MATERIALS                                       100000.00 ELIZABETH PATTON

15432147  MI     GREAT LAKES LABORATORY EQUIPMENT MANUFACTURERS                          10000.00 JACK TREVANE

18543489  TX     LONE STAR STATE RESEARCH SUPPLIERS                                      10000.00 NANCY WALSH

18543489  TX     LONE STAR STATE RESEARCH SUPPLIERS                                      50000.00 TED WHISTLER

18543489  TX     LONE STAR STATE RESEARCH SUPPLIERS                                     100000.00 EVAN MASSEY

19783482  VA     TWENTY-FIRST CENTURY MATERIALS                                          5000.00 PETER THOMAS

19783482  VA     TWENTY-FIRST CENTURY MATERIALS                                         10000.00 LOUIS PICKERING

19876078  CA     SAN JOAQUIN SCIENTIFIC AND INDUSTRIAL SUPPLY, INC.                      7500.00 EDWARD LOWE

19876078  CA     SAN JOAQUIN SCIENTIFIC AND INDUSTRIAL SUPPLY, INC.                     25000.00 E.F. JENSEN
```

Inserting and Deleting Data with the INSERT and DELETE Statements

You can use the INSERT statement to add logical records to an ADABAS file or the DELETE statement to remove logical records. In the following example, the logical record containing the CUSTOMER value 15432147 is deleted by using the CUSTOMERS DDM. The SELECT statement then displays the Vlib.UsaCust data in the following output, ordering them again by the CUSTOMER data field.

```
delete from vlib.usacust
   where custnum='15432147';
   title 'Logical Record Deleted from
      CUSTOMERS';
select custnum, state, name, limit, signatur
```

```
           from vlib.usacust;
```

Output 4.9 *Results of Deleting Data with the DELETE Statement*

```
                                 Updated ADABAS Data in CUSTOMERS

CUSTOMER  STATE  NAME                                                                 LIMIT SIGNATURE
--------------------------------------------------------------------------------------------------------------
12345678  NC     DURHAM SCIENTIFIC SUPPLY COMPANY                                   5000.00 MARC PLOUGHMAN

14324742  CA     SANTA CLARA VALLEY TECHNOLOGY SPECIALISTS                          5000.00 BOB HENSON

14324742  CA     SANTA CLARA VALLEY TECHNOLOGY SPECIALISTS                         25000.00 KAREN DRESSER

14569877  NC     PRECISION PRODUCTS                                                 5000.00 JEAN CRANDALL

14569877  NC     PRECISION PRODUCTS                                               100000.00 STEVE BLUNTSEN

14898029  MD     UNIVERSITY BIOMEDICAL MATERIALS                                   10000.00 MASON FOXWORTH

14898029  MD     UNIVERSITY BIOMEDICAL MATERIALS                                   50000.00 DANIEL STEVENS

14898029  MD     UNIVERSITY BIOMEDICAL MATERIALS                                  100000.00 ELIZABETH PATTON

18543489  TX     LONE STAR STATE RESEARCH SUPPLIERS                                10000.00 NANCY WALSH

18543489  TX     LONE STAR STATE RESEARCH SUPPLIERS                                50000.00 TED WHISTLER

18543489  TX     LONE STAR STATE RESEARCH SUPPLIERS                               100000.00 EVAN MASSEY

19783482  VA     TWENTY-FIRST CENTURY MATERIALS                                     5000.00 PETER THOMAS

19783482  VA     TWENTY-FIRST CENTURY MATERIALS                                    10000.00 LOUIS PICKERING

19876078  CA     SAN JOAQUIN SCIENTIFIC AND INDUSTRIAL SUPPLY, INC.                 7500.00 EDWARD LOWE

19876078  CA     SAN JOAQUIN SCIENTIFIC AND INDUSTRIAL SUPPLY, INC.                25000.00 E.F. JENSEN
```

CAUTION

Always use the WHERE clause in a DELETE statement. If you omit the WHERE clause from a DELETE statement, you delete all the data in the ADABAS file that is accessed by the view descriptor.

For more information about SAS SQL procedure, see the *SAS SQL Procedure User's Guide*.

Appending ADABAS Data with the APPEND Procedure

In earlier releases of SAS, the APPEND procedure operated only on SAS data files. You can append data that is described by SAS/ACCESS view descriptors and PROC SQL views to SAS data files and vice versa. You can also append data that is described by view descriptors to each other.

In the following example, two personnel managers have kept separate employee records. One manager has kept records in a NATURAL DDM named EMPLOYEE, which is described by the view descriptor Vlib.AdaEmps. The other manager has kept records in a SAS data file that is named MyData.SASEmps. Due to a corporate reorganization, the two sources of data must be combined so that all employee data is stored in the EMPLOYEE DDM. The APPEND procedure can do this.

The data that is described by the view descriptor Vlib.AdaEmps and the data that is in the SAS data file MyData.SASEmps are printed with the following statements and displayed in the following two outputs:

```
options linesize=80;

proc print data=vlib.adaemps;
   title 'Data Described by VLIB.ADAEMPS';
run;

proc print data=mydata.sasemps;
   format birthdat date7.;
   title 'Data in MYDATA.SASEMPS Data File';
run;
```

Output 4.10 *Data That Is Described by Vlib.AdaEmps*

```
                  Data Described by VLIB.ADAEMPS

OBS   EMPID BIRTHDAT LASTNAME           FIRSTNAM        MIDDLENA

  1  119012 05JAN46  WOLF-PROVENZA      G.              ANDREA
  2  120591 12FEB46  HAMMERSTEIN        S.              RACHAEL
  3  123456        .  VARGAS             PAUL            JESUS
  4  127845 25DEC43  MEDER              VLADIMIR        JORAN
  5  129540 31JUL60  CHOULAI            CLARA           JANE
  6  135673 21MAR61  HEMESLY            STEPHANIE       J.
  7  212916 29MAY28  WACHBERGER         MARIE-LOUISE    TERESA
  8  216382 24JUL63  PURINTON           PRUDENCE        VALENTINE
  9  234967 21DEC67  SMITH              GILBERT         IRVINE
 10  237642 13MAR54  BATTERSBY          R.              STEPHEN
 11  239185 28AUG59  DOS REMEDIOS       LEONARD         WESLEY
 12  254896 06APR49  TAYLOR-HUNYADI     ITO             MISHIMA
 13  321783 03JUN35  GONZALES           GUILLERMO       RICARDO
 14  328140 02JUN51  MEDINA-SIDONIA     MARGARET        ROSE
 15  346917 15MAR50  SHIEKELESLAM       SHALA           Y.
 16  356134 25OCT60  DUNNETT            CHRISTINE       MARIE
 17  423286 31OCT64  MIFUNE             YUKIO           TOSHIRO
 18  456910 24SEP53  ARDIS              RICHARD         BINGHAM
 19  456921 12MAY62  KRAUSE             KARL-HEINZ      G.
 20  457232 15OCT63  LOVELL             WILLIAM         SINCLAIR
 21  459287 05JAN34  RODRIGUES          JUAN            M.
 22  677890 24APR65  NISHIMATSU-LYNCH   CAROL           ANNE
```

Output 4.11 *Data in MyData.SASEmps*

```
                Data in MYDATA.SASEMPS Data File

OBS     EMPID    BIRTHDAT    LASTNAME     FIRSTNAM    MIDDLENA

 1     245962    30AUG64     BEDORTHA     KATHY        MARTHA
 2     765432    01MAR59     POWELL       FRANK        X.
 3     219223    13JUN47     HANSINGER    BENJAMIN     HAROLD
 4     326745    21FEB52     RAWN         BEATRICE     MAY
```

The following statements use the APPEND procedure to combine the data from these two sources:

```
proc append base=vlib.adaemps
   data=mydata.sasemps;
run;

proc print data=vlib.adaemps;
   title 'Appended Data';
run;
```

The following output displays the appended data that is described by the view descriptor Vlib.AdaEmps. Notice that the data in MyData,SASEmps follows the data that is described by Vlib.AdaEmps.

Output 4.12 *Results of Appending Data with the APPEND Procedure*

```
                           Appended Data

OBS   EMPID BIRTHDAT LASTNAME           FIRSTNAM        MIDDLENA

  1  119012 05JAN46  WOLF-PROVENZA      G.              ANDREA
  2  120591 12FEB46  HAMMERSTEIN        S.              RACHAEL
  3  123456        .  VARGAS             PAUL            JESUS
  4  127845 25DEC43  MEDER              VLADIMIR        JORAN
  5  129540 31JUL60  CHOULAI            CLARA           JANE
  6  135673 21MAR61  HEMESLY            STEPHANIE       J.
  7  212916 29MAY28  WACHBERGER         MARIE-LOUISE    TERESA
  8  216382 24JUL63  PURINTON           PRUDENCE        VALENTINE
  9  234967 21DEC67  SMITH              GILBERT         IRVINE
 10  237642 13MAR54  BATTERSBY          R.              STEPHEN
 11  239185 28AUG59  DOS REMEDIOS       LEONARD         WESLEY
 12  254896 06APR49  TAYLOR-HUNYADI     ITO             MISHIMA
 13  321783 03JUN35  GONZALES           GUILLERMO       RICARDO
 14  328140 02JUN51  MEDINA-SIDONIA     MARGARET        ROSE
 15  346917 15MAR50  SHIEKELESLAM       SHALA           Y.
 16  356134 25OCT60  DUNNETT            CHRISTINE       MARIE
 17  423286 31OCT64  MIFUNE             YUKIO           TOSHIRO
 18  456910 24SEP53  ARDIS              RICHARD         BINGHAM
 19  456921 12MAY62  KRAUSE             KARL-HEINZ      G.
 20  457232 15OCT63  LOVELL             WILLIAM         SINCLAIR
 21  459287 05JAN34  RODRIGUES          JUAN            M.
 22  677890 24APR65  NISHIMATSU-LYNCH   CAROL           ANNE
 23  245962 30AUG64  BEDORTHA           KATHY           MARTHA
 24  765432 01MAR59  POWELL             FRANK           X.
 25  219223 13JUN47  HANSINGER          BENJAMIN        HAROLD
 26  326745 21FEB52  RAWN               BEATRICE        MAY
```

The APPEND procedure also accepts a WHERE= data set option or a SAS WHERE statement to retrieve a subset of the data. In the following example, a subset of the observations from MyData,SASEmps is added to Vlib.AdaEmps.

```
proc append base=vlib.adaemps
   data=mydata.sasemps
      (where=(birthdat>='01JAN60'd));
run;
proc print data=vlib.adaemps;
   title 'Appended Data with a WHERE= Data Set
      Option';
run;
```

The results are displayed in the following output.

Output 4.13 *Results of Appending Data with a WHERE= Data Set Option*

```
             Appended Data with a WHERE= Data Set Option

OBS   EMPID BIRTHDAT LASTNAME           FIRSTNAM        MIDDLENA

  1  119012 05JAN46  WOLF-PROVENZA      G.              ANDREA
  2  120591 12FEB46  HAMMERSTEIN        S.              RACHAEL
  3  123456        .  VARGAS             PAUL            JESUS
  4  127845 25DEC43  MEDER              VLADIMIR        JORAN
  5  129540 31JUL60  CHOULAI            CLARA           JANE
  6  135673 21MAR61  HEMESLY            STEPHANIE       J.
  7  212916 29MAY28  WACHBERGER         MARIE-LOUISE    TERESA
  8  216382 24JUL63  PURINTON           PRUDENCE        VALENTINE
  9  234967 21DEC67  SMITH              GILBERT         IRVINE
 10  237642 13MAR54  BATTERSBY          R.              STEPHEN
 11  239185 28AUG59  DOS REMEDIOS       LEONARD         WESLEY
 12  254896 06APR49  TAYLOR-HUNYADI     ITO             MISHIMA
 13  321783 03JUN35  GONZALES           GUILLERMO       RICARDO
 14  328140 02JUN51  MEDINA-SIDONIA     MARGARET        ROSE
 15  346917 15MAR50  SHIEKELESLAM       SHALA           Y.
 16  356134 25OCT60  DUNNETT            CHRISTINE       MARIE
 17  423286 31OCT64  MIFUNE             YUKIO           TOSHIRO
 18  456910 24SEP53  ARDIS              RICHARD         BINGHAM
 19  456921 12MAY62  KRAUSE             KARL-HEINZ      G.
 20  457232 15OCT63  LOVELL             WILLIAM         SINCLAIR
 21  459287 05JAN34  RODRIGUES          JUAN            M.
 22  677890 24APR65  NISHIMATSU-LYNCH   CAROL           ANNE
 23  245962 30AUG64  BEDORTHA           KATHY           MARTHA
```

For more information about the APPEND procedure, see the *Base SAS Procedures Guide*.

PART 2

SAS/ACCESS Interface to ADABAS: Reference

5

ACCESS Procedure Reference

Introduction to ACCESS Procedure Reference

The ACCESS procedure enables you to create and edit descriptor files that are used by the SAS/ACCESS interface to ADABAS. This section provides reference information for the ACCESS procedure statements, including procedure syntax and statement options.

In addition, the following sections provide information to help you optimize the use of the interface:

- "Creating and Using ADABAS View Descriptors Efficiently" on page 78 presents efficiency considerations for using the SAS/ACCESS interface to ADABAS.
- "ACCESS Procedure Formats and Informats for ADABAS" on page 79 summarizes how the SAS/ACCESS interface converts each type of ADABAS data into its equivalent SAS variable format.
- "Effects of the SAS/ACCESS Interface on ADABAS Data" on page 82 explains how the SAS/ACCESS interface handles specific ADABAS data fields.

If you need help with SAS data sets and data libraries, their naming conventions, or any terms used in regard to the ACCESS procedure, see the *SAS Language Reference: Concepts* and the *SAS Companion for z/OS*.

Introduction to SAS/ACCESS Interface to ADABAS Software

SAS/ACCESS Interface to ADABAS Software provides the ACCESS procedure for accessing data in an ADABAS database. You use the ACCESS procedure to create and edit descriptor files that can be used to query and update data in an ADABAS database through SAS System procedures.

- Description on page 65
- Invoking the ACCESS Procedure on page 83
- Syntax on page 66

Description of ACCESS and VIEW Files

The ACCESS procedure creates SAS files of type ACCESS and VIEW. These files are referred to as descriptor files because they describe an ADABAS database to SAS.

An ACCESS file describes the data in one ADABAS file or NATURAL Data Definition Module (DDM). The ACCESS file is a master copy of all or part of a database definition.

You grant access to the actual database by creating different views under the ACCESS file. The VIEW files can identify a subset of the data described by the ACCESS file. The data specified in a VIEW can be used in SAS in much the same way that a SAS data file is used.

Case Sensitivity in the ACCESS Procedure

SAS names are not case sensitive; they can be entered in either uppercase or lowercase. The ACCESS procedure converts DBMS column names to uppercase including names enclosed in quotation marks. Any DBMS names that contain special or national characters must be enclosed in quotation marks.

ACCESS Procedure Syntax for ADABAS

Syntax

PROC ACCESS <*options*>;

Creating and Updating Statements

CREATE *libref.member-name*.ACCESS | VIEW;

UPDATE *libref.member-name*.ACCESS | VIEW <*password-level=SAS-password*>;

Database-Description Statements

DDM = *data-definition-module-name*;

NSS (LIBRARY | LIB= *library-identifier*
USER= *user-identifier*
PASSWORD | PW= *Natural-Security-password*);

ADBFILE (NUMBER | NUM= *Adabas-file-number*
PASSWORD | PW= *Adabas-password*
CIPHER | CC= *Adabas-cipher-code*
DBID= *Adabas-database-identifier*);

SYSFILE (NUMBER | NUM= *Adabas-system-file-number*
PASSWORD | PW= *Adabas-password*
CIPHER | CC= *Adabas-cipher-code*
DBID= *Adabas-database-identifier*);

SECFILE (NUMBER | NUM= *Natural-Security-system-file-number*
PASSWORD | PW= *Adabas-password*
CIPHER | CC= *Adabas-cipher-code*
DBID= *Adabas-database-identifier*);

Editing Statements

ASSIGN <=> YES | NO | Y | N;

CONTENT *column-identifier-1<=>SAS-date-format* | *length* | *E*
<… *column-identifier-n<=> SAS-date-format* | *length* | *E* >;

DROP *column-identifier-1* <…*column-identifier-n*>;

EXTEND <ALL | VIEW | *column-identifier-1* <…*column-identifier-n*>>;

FORMAT *column-identifier-1<=>SAS-format-name*
<…*column-identifier-n <=> SAS-format-name*>;

INFORMAT *column-identifier-1 <=>SAS-format-name*
<… *column-identifier-n<=> SAS-format-name*>;

KEY<=> *column-identifier-1* <…*column-identifier-n*>;

LIST <ALL | VIEW | *column-identifier-1* <…*column-identifier-n*>>;

LISTINFO <ALL | VIEW | *column-identifier-1* <…*column-identifier-n*>>;

LISTOCC *column-identifier-1* <…*column-identifier-n*>;

MVF *column-identifier*
CONTENT *occurrence-1<=>SAS-date-format* | *length* | E

<... *occurrence-n*<=>*SAS-date-format* | *length* | *E* >;
|
DROP *occurrence-1* <<TO>... *occurrence-n*>;
|
FORMAT *occurrence-1* <=>*SAS-format-name*
<...*occurrence-n*<=>*SAS-format-name*>;
|
INFORMAT *occurrence-1*<=>*SAS-format-name*
<...*occurrence-n*<=>*SAS-format-name*>;
|
OCCURS<=>*number-of-occurrences*;
|
RENAME *occurrence-1*<=>*SAS-variable-name*
<...*occurrence-n*<=>*SAS-variable-name*>;
|
RESET *occurrence-1* <<TO>... *occurrence-n*>;
|
SELECT *occurrence-1* <<TO>... *occurrence-n*>;

RENAME *column-identifier-1* <=> *SAS-variable-name*
<... *column-identifier-n*<=> *SAS-variable-name*>;

RESET ALL | *column-identifier-1* <... *column-identifier-n*>;

SECURITY <=> YES | NO | Y | N;

SELECT ALL | *column-identifier-1* <... *column-identifier-n* >;

SUBSET *selection-criteria*;

QUIT;

RUN;

Description

You use the ACCESS procedure to create and edit access descriptors and view descriptors, and to create SAS data files. Descriptor files describe DBMS data so that you can read, update, or extract the DBMS data directly from within a SAS session or in a SAS program.

The ACCESS procedure runs in interactive line and batch modes. The following sections provide complete information about PROC ACCESS options and statements.

Options for the ACCESS Procedure

Depending on which options you use, the PROC ACCESS statement performs several tasks.

You use the PROC ACCESS statement with database-description statements and certain procedure statements to create descriptors or SAS data files from DBMS data. See "Invoking the ACCESS Procedure" on page 83 for information about which procedure statements to use for each task.

ACCDESC=*libref.access-descriptor*
: specifies an access descriptor.

  ACCDESC= is used with the DBMS= option to create a view descriptor that is based on the specified access descriptor. You specify the view descriptor's name in the CREATE statement. You can also use a SAS data set option on the ACCDESC= option to specify any passwords that have been assigned to the access descriptor.

  The ACCDESC= option has two aliases: AD= and ACCESS=.

DBMS=*ADABAS*
: specifies which database management system you want to use. DBMS= can be used with the ACCDESC= option to create a view descriptor, which is then named in the CREATE statement.

OUT=*<libref.>member-name*
: specifies the SAS data file to which DBMS data are written. OUT= is used only with the VIEWDESC= option.

VIEWDESC=*<libref.>view-descriptor*
: specifies a view-descriptor that accesses the ADABAS data. VIEWDESC= is used only with the OUT= option. For example:

```
proc access dbms=adabas viewdesc=vlib.invq4 out=dlib.invq4;
run;
```

  The VIEWDESC= option has two aliases: VD= and VIEW=.

CAUTION
Altering a DBMS table can invalidate descriptors. Altering the format of a DBMS table that has descriptor files defined on it might cause these descriptors to be out-of-date or no longer valid. For example, if you add a column to a table and an existing access descriptor is defined on that table, the access descriptor and any view descriptors that are based on it do not show the new column. You must re-create the descriptors to be able to show and select the new column.

SAS Passwords for SAS/ACCESS Descriptors

SAS Password Levels

SAS enables you to control access to SAS data sets and access descriptors by associating one or more SAS passwords with them. You must first create the descriptor files before assigning SAS passwords to them.

When the VIEW file is being used to access the data in the underlying database tables, a Read password on the VIEW file protects the underlying data and it or a higher level password must be supplied to read the data. Similarly, a Write password on the VIEW file protects the underlying data and it or an Alter password must be supplied to write data through the VIEW to the database tables.

When the view descriptor or access descriptor is being accessed to either modify or describe the descriptor itself, the most restrictive password on the file must be provided.

An administrator who wants to prevent users from knowing information in the descriptors but still use them to access the underlying database data, should put an Alter password on the files that is required to modify or describe the descriptor contents. However, if only a Read password is placed on the descriptor file, then that password is required to both read the underlying data and describe or modify the descriptor. If a Write password without an Alter password is placed on the descriptor files, then that password is required to both write data to the underlying data and describe or modify the descriptor.

When you create view descriptors, you can use a data set option after the ACCDESC= option to specify the access descriptor's password (if one exists). In this case, you are *not* assigning a password to the view descriptor that is being created. Rather, using the password grants you permission to use the access descriptor to create the view descriptor. For example:

```
proc access dbms=adabas accdesc=adlib.customer
            (alter=rouge);
  create vlib.customer.view;
  select all;
run;
```

By specifying the alter-level password, you can read the Adlib.Customer access descriptor and therefore create the Vlib.Customer view descriptor.

For detailed information about the levels of protection and the types of passwords that you can use, see *SAS Language Reference: Concepts*. The following section describes how you assign SAS passwords to descriptors.

Assigning Passwords with the DATASETS Procedure

To assign, change, or delete a SAS password, use the DATASETS procedure's MODIFY statement in the PROGRAM EDITOR window. The following is the basic syntax for using PROC DATASETS to assign a password to an access descriptor, a view descriptor, or a SAS data file:

PROC DATASETS LIBRARY=*libref* MEMTYPE=*member-type*;
   MODIFY *member-name* (*password-level* = *password-modification*);
RUN;

The *password-level* argument can have one or more of the following values: READ=, WRITE=, ALTER=, or PW=. PW= assigns Read, Write, and Alter privileges to a descriptor or data file. The *password-modification* argument enables you to assign a new password or to change or

delete an existing password.

For example, this PROC DATASETS statement assigns the password MONEY with the alter level of protection to the access descriptor Adlib.Salaries.

```
proc datasets library=adlib memtype=access;
   modify salaries (alter=money);
run;
```

In this case, users are prompted for the password whenever they try to browse or edit the access Adlib.Salaries. or to create view descriptors that are based on Adlib.Salaries.

You can assign multiple levels of protection to a descriptor or SAS data file. However, for more than one level of protection (for example, both Read and Alter), be sure to use a different password for each level. If you use the same password for each level, a user to whom you grant Read privileges only (in order to read the DBMS data) would also have privileges to alter your descriptor (which you do not want to happen).

In the next example, the PROC DATASETS statement assigns the passwords MYPW and MYDEPT with Read and Alter levels of protection to the view descriptor Vlib.JobC204:

```
proc datasets library=vlib memtype=view;
   modify jobc204 (read=mypw alter=mydept);
run;
```

In this case, users are prompted for the SAS password when they try to read the DBMS data or try to browse or edit Adlib.SaleriesVlib.JobC204 itself. You need both levels to protect the data and descriptor from being read. However, a user could still update the data accessed by Vlib.JobC204, such as by using a PROC SQL UPDATE. Assign a Write level of protection to prevent data updates.

To delete a password on an access descriptor or any SAS data set, put a slash after the password:

```
proc datasets library=vlib memtype=view;
   modify jobc204 (read=mypw/ alter=mydept/);
run;
```

WHERE Clause in an ADABAS View Descriptor

Using the WHERE Clause with an ADABAS View Descriptor

You can use a WHERE clause in a view descriptor to select specific ADABAS records.

View WHERE Clause Syntax

A view WHERE clause consists of the SUBSET and WHERE (or WH) keywords, followed by one or more conditions that specify criteria for selecting records. A condition has one of the following forms:

```
field-name<(occurrence)> operator value
field-name<(occurrence)> range-operator
   low-value * high-value
```

The user-supplied elements of the WHERE clause conditions are described below:

field-name
: is the ADABAS name of the data field or corresponding SAS variable name for which you are specifying criteria. This data field must be selected in the view descriptor. (The procedure assumes that any name in a condition is a SAS name. If it is not, the procedure treats it as an ADABAS name.) If the field's ADABAS name is not unique within a NATURAL DDM, you must specify its external name.

  A referenced data field must be an ADABAS descriptor field in the following situations:

  - The view WHERE clause contains more than one condition.
  - The view WHERE clause uses the SPANS or NE operator.
  - You are also specifying a view SORT clause.
  - You are also planning to issue a SAS BY statement or a SAS ORDER BY clause in a SAS program that references a view descriptor containing a view WHERE clause.
  - You are also planning to issue a SAS WHERE clause in a SAS program that references a view descriptor containing a view WHERE clause.

(*occurrence*)
: is a numeric value from 1 to 99 identifying the *n*th occurrence of a periodic group. You must use parentheses around the number. This is an optional value. If you do not specify an occurrence number, all occurrences are selected.

operator
: can be one of the following comparison and logical operators:

  = or EQ
  : equal to

  > or GT
  : greater than

  < or LT
  : less than

  != or ¬= or NE
  : not equal to

  ≥ or GE or GTE
  : greater than or equal to

≤ or LE or LTE
: less than or equal to

range-operator
: can be one of the following operators:

= or EQ or SPANS
: within the range (inclusive)

value or *high-value* or *low-value*
: is a valid value for the data field.

View WHERE Clause Examples

Specifying Conditions with the SPANS Operator

When comparing low and high values, the asterisk is required. For example, the following WHERE clause selects those employees with employee numbers between 2300 and 2400:

```
subset where personnel-number spans 2300 * 2400
```

The following WHERE clause selects those employees with last names up through Smith:

```
subset where name spans 'A' * 'Smith'
```

Specifying Expressions

You can combine conditions to form expressions. Two conditions can be joined with OR (|) or AND (&). Since expressions within parentheses are processed before those outside, use parentheses to have the OR processed before the AND.

```
subset where cost = .50 & (type = ansi12 |   class = sorry)
```

The following WHERE clause selects all records where AVAIL is Y or W:

```
subset where avail eq y | avail eq w
```

The next WHERE clause selects all records where PART is 9846 and ON-HAND is greater than 1,000:

```
subset where part = 9846 & on-hand > 1000
```

Specifying Values in Character Fields

For character fields, you can use quoted or unquoted strings. Any value entered within quotation marks is left as is; all unquoted values are uppercase and redundant blanks are removed. For example, the following clause extracts data for SMITH:

```
subset where lastname = Smith
```

The next example extracts data for Smith:

```
subset where lastname = 'Smith'
```

The next WHERE clause selects all records where CITY is TRUTH OR CONSEQUENCES or STZIP is NM 87901. Notice in the first condition that quotation marks prevent OR from being used as an operator. In the second condition, they prevent the extra space between NM and 87901 from being removed.

```
subset where city = 'TRUTH OR CONSEQUENCES' |   stzip = 'NM  87901'
```

The following example selects all records where SHOP is Joe's Garage. Because the value is enclosed in quotation marks, the two consecutive single quotation marks are treated as one.

```
subset where shop = 'Joe''s Garage'
```

You can also use double quotation marks:

```
subset where shop = "Joe's Garage"
```

Specifying Numeric Format Values

For numeric values, use decimal or scientific notation, as shown in the following example:

```
subset where horsepower = 2.5
```

Specifying Dates

Numeric values representing dates in an ADABAS file are not automatically converted to SAS date values. They are simply treated as numbers. For example, 103098 is considered less than 113188.

However, the ACCESS procedure provides you the ability to specify a SAS date format with the CONTENT statement. Then, numeric values are converted to SAS dates. To reference them in a view WHERE clause, use informat representation (without the 'D at the end as in SAS). See "CONTENT Statement" on page 86 for more information about specifying a SAS date format with the CONTENT statement.

Specifying Values in Superdescriptor Fields

A superdescriptor field is treated as if it has an alphanumeric (character) ADABAS standard format unless all of the parent fields from which it is derived have a binary (numeric) format.

When you enter a value for a numeric superdescriptor or an alphanumeric superdescriptor where one or more of its parent fields have a numeric format, the value must be in character hexadecimal format because many data types and from-to specifications can be contained in one superdescriptor value. When you enter a value for a character superdescriptor, the value must be entered as character data.

Note: By assigning a SAS format of HEX*w*. to superdescriptors that are derived from one or more numeric fields in a view descriptor, you can see the internal hexadecimal values. You can then use these values as a guide for entering like values in the WHERE clause.

For example, the NATURAL DDM named CUSTOMERS has the character superdescriptor field STATE-ZIPLAST2, which is defined:

```
'SP=ST(1,2),ZI(1,2)'
```

The two data fields that make up STATE-ZIPLAST2 are defined as

```
DDM Name    ADABAS ID    ADABAS TYPE    LENGTH
--------    ---------    -----------    ------
STATE          ST             A            2
ZIPCODE        ZI             U            5
```

If you want to select the value `TX` from the data field STATE and the value 78701 from the data field ZIPCODE, the view WHERE clause would be as follows:

```
subset where state_zi = E3E7F0F1
```

The comparable SAS WHERE clause would be

```
where state_zi = 'E3E7F0F1'x
```

F0F1 is the hexadecimal internal representation of a positive zoned decimal value of 01. If ZIPCODE were defined as packed and the from-to specification were the same, the hexadecimal representation 001F would represent the value 01. Similarly, 0001 would be the correct representation for either binary or fixed. A sign (+ or -) must also be entered according to type and ADABAS requirements.

Suppose you want to access a character superdescriptor field named DEPT-PERSON, which is defined:

```
'S2=DP(1,6),LN(1,18)'
```

The two data fields that make up DEPT-PERSON are defined as shown here:

```
DDM Name    ADABAS ID    ADABAS TYPE    LENGTH
--------    ---------    -----------    ------
  DEPT         DP             A            6
  LASTNAME     LN             A           18
```

If you want to select the value `TECH01` from the data field DEPT and the value `BOYER` from the data field LASTNAME, the view WHERE clause would be as follows. (Note that unquoted values in the view WHERE clause are uppercase.)

```
subset where dept-person = tech01boyer
```

A comparable SAS WHERE clause would be

```
where dept-person = 'TECH01BOYER'
```

Specifying Values in Subdescriptor Fields

Subdescriptors take the ADABAS type of their parent and the length of their from-to specification. Unlike superdescriptors, subdescriptor values consist of only one data type.

For example, the NATURAL DDM named CUSTOMERS has the numeric subdescriptor field ZIPLAST, which is defined as

```
'SB=ZI(1,2)'
```

The data field that ZIPLAST is based on is defined as shown here:

```
DDM Name    ADABAS ID    ADABAS TYPE    LENGTH
--------    ---------    -----------    ------
ZIPCODE        ZI             U           5
```

If you want to select the values 78701, 82701, and 48301, the view WHERE clause and the SAS WHERE clause would be as follows.

View WHERE clause:

```
subset where ziplast2 = 01
```

SAS WHERE clause:

```
where ziplast2 = 01
```

Now suppose you want to access a character subdescriptor field named DEPT-CODE, which is defined as shown here.

```
'DC=DP(1,4)'
```

The data field that DEPT-CODE is based on is defined as shown here:

```
DDM Name    ADABAS ID    ADABAS TYPE    LENGTH
--------    ---------    -----------    ------
  DEPT         DP             A           6
```

If you want to select the values `TECH01`, `TECH04`, and `TECH23`, the view WHERE clause would be as shown here:

```
subset where dept-code = tech
```

The comparable SAS WHERE clause would be

```
where dept-code = 'TECH'
```

Specifying Values in Multiple-Value Fields

If the field name refers to a multiple-value field, all values for the field are compared with the value that you specify. For example, if CARD is a multiple-value field, the following view WHERE clause selects all records where any one of the values of CARD is Visa.

```
subset where card eq visa
```

Note that in a SAS WHERE clause, you cannot specify a value for a multiple-value field. However, in a SAS WHERE clause, you can specify an occurrence, which you cannot do in a view WHERE clause.

For more information about and examples of using multiple-value fields in selection criteria, see “Multiple-Value Fields in Selection Criteria” on page 146.

Specifying Values in Periodic Group Fields

If the field is in a periodic group, use *field-name(occurrence)* to identify the field in the *n*th occurrence of the group. For example, the following WHERE clause selects all records where PHONE is 234-9876 in the second occurrence of the periodic group containing PHONE.

```
subset where phone(2) eq 234-9876
```

Note that the 2 after PHONE refers to the second occurrence of its parent periodic group and not to the second occurrence of PHONE.

If you do not specify an occurrence number, all occurrences are checked. For example, the following WHERE clause selects all records where PHONE is 234-9876 in any occurrence of the periodic group containing PHONE.

```
subset where phone eq 234-9876
```

For more information about and examples of using periodic group fields in selection criteria, see “Periodic Group Fields in Selection Criteria” on page 148.

SORT Clause in a View Descriptor

Using the SORT Clause in a View Descriptor

When you define a view descriptor, you can also include a SORT clause to specify data order. You can reference only the data fields selected for the view descriptor, and the data fields must be descriptors. That is, they must have indexes. Without a SORT clause or a SAS BY statement, the data order is determined by ADABAS.

A SAS BY statement automatically issues a SORT clause to ADABAS. If a view descriptor already contains a SORT clause, the BY statement overrides the sort for that program. An exception is when the SAS procedure includes the NOTSORTED option. Then, the SAS BY statement is ignored, and the view descriptor SORT clause is used; a message is written to the log when NOTSORTED causes a SAS BY statement to be ignored.

View SORT Clause Syntax

The syntax for the SORT clause is

SUBSET SORT *field-name* <,*field-name*> <,*field-name*> <*option*>

The elements of the SORT clause are described below.

field-name
: is the name of an ADABAS data field or its corresponding SAS variable name to sort by. The data field must be an ADABAS descriptor. That is, it must be a key data field. You can use the data field's ADABAS field name or its DDM name.

  You can specify up to three data fields; you can separate them with commas. If you specify more than one field name, the values are ordered by the first named field, then the second, and so on.

option
: is one of the following, which applies to all specified field names. That is, you cannot specify an option for one field name and a different option for another field name.

  <ASCENDING | ASCENDISN | DESCENDING>

ASCENDING
: indicates the sort is to be in ascending order (low-to-high). For example, the sort order would be A, B, C, D or 1, 2, 3, 4. The default is ASCENDING.

ASCENDISN
: indicates the sort is to be in ascending ISN (internal sequence number) order. Each logical record in an ADABAS file has an assigned ISN for identification. If you specify ASCENDISN, you cannot specify a data field name.

DESCENDING
: indicates the sort is to be in descending order (high-to-low). For example, the sort order would be Z, Y, X, W or 9, 8, 7, 6.

SORT Clause Examples

The following SORT clause causes the ADABAS values to be presented in ascending order. Based on the data fields included in the Vlib.UsaCust view descriptor, the logical records are presented first by the values in the data field CUSTOMER, then by the values in data field ZIPCODE, and then by the values in the data field FIRSTORDERDATE.

```
subset sort customer, zipcode, firstorderdate
```

The following SORT clause causes logical records that are accessed by the VLIB.CusPhon view descriptor to be presented in descending order based on the values in the NAME data field:

```
subset sort name descending
```

Creating and Using ADABAS View Descriptors Efficiently

When creating and using view descriptors, follow these guidelines to minimize ADABAS processing and your operating system resources and to reduce the time ADABAS takes to access data.

- Specify selection criteria to subset the number of logical records ADABAS returns to SAS.
- Write selection criteria that enable ADABAS to use inverted lists when possible. This applies whether you specify the selection criteria as part of the view descriptor or in a SAS program. This is especially important when accessing a large ADABAS file.

  When ADABAS cannot use an inverted list, it sequentially scans the entire file. You cannot guarantee that ADABAS uses an inverted list to process a condition on a descriptor data field, but you can write selection criteria that enable ADABAS to use available inverted lists effectively.
- Select only the data fields your program needs. Selecting unnecessary data fields adds extra processing time and requires more memory.
- Use a BY statement to specify the order in which logical records are presented to SAS only if SAS needs the data in a particular order for subsequent processing. You can use ADABAS descriptor data fields only.

  As an alternative to using a BY statement, which consumes CPU time each time you access the ADABAS file, you could use the SORT procedure with the OUT= option to create a sorted SAS data file. In this case, SAS, not ADABAS, does the sorting. This is a better approach for data that you want to use many times.
- If a view descriptor describes a large amount of ADABAS data and you uses the view descriptor often, it might be more efficient to extract the data and place it in a SAS data file. See "Performance Considerations" on page 41 for more information about when it is best to extract data.
- If you do not need all occurrences of multiple-value fields, limit the number of occurrences with the MVF statement.
- If you reference data fields in selection criteria that are not ADABAS descriptors, it is generally more efficient to put those conditions in a SAS WHERE clause, not in the view descriptor WHERE clause.
- To optimize WHERE clause processing, the ADABAS interface view engine uses the ADABAS L3 command when possible. However, a number of restrictions must be satisfied before the L3 command can be used. For these restrictions, see "Introduction to Using ADABAS Data in SAS Programs" on page 21.

ACCESS Procedure Formats and Informats for ADABAS

When you create SAS/ACCESS descriptor files from ADABAS data, the ACCESS procedure converts data field types and lengths to default SAS variable formats and informats.

The following summary information can help you understand the data conversion.

- The ADABAS interface view engine uses ADABAS standard length and type for reading and updating ADABAS data (except for variable-length fields and DB Content overrides). NATURAL DDMs have no effect other than to use DDM length and decimals to set SAS formats.
- Length and decimal points specified by DDMs might conflict with the ADABAS file definition (for example, not big enough, too big, and so on). If so, the ADABAS standard length is used to set default SAS formats.
- Packed, unpacked, and binary types can hold very large numeric data values. SAS can maintain precision up to 16 digits. Unpacked fields larger than 16 bytes are converted to the character hexadecimal type upon which no numeric operations can occur. Therefore, precision is not a problem. For large packed and binary fields, however, you must be aware that precision can be lost when data values exceed 16 digits.
- If the standard length is 0 (that is, if the data field has a variable length), the ACCESS procedure chooses a default length.
  - The default length for an alphanumeric is 20.
  - The default length for a numeric is the maximum length before assuming a character hexadecimal type. Packed is 15 bytes (29 digits and a sign), unpacked is 16 bytes (16 digits and a sign), binary is 8 bytes, fixed is 4 bytes, and float is 8 bytes.
- Superdescriptors and subfields are given an ADABAS type of character unless all of the parent fields are numeric. Then, they are given an ADABAS type of binary. Their length is calculated by totaling the number of bytes in the individual parent's from-to specification. If the length of a binary superdescriptor or binary subdescriptor is greater than 8, the SAS format is changed from numeric to character hexadecimal.
- Subdescriptors and subfields take the type of their parent and the length of their from-to specification.
- Phonetic descriptors are alphanumeric and use the length of the phonetic parent. Any retrieval of a phonetic descriptor is actually retrieval of its parent.
- If ADABAS data falls outside the valid SAS data ranges, you get an error message in the SAS log when you try to read the data. For example, an ADABAS date might not fall in the valid SAS date range.

The following table shows the default SAS variable formats and informats that the ACCESS procedure assigns to each ADABAS data type in an ADABAS file.

Table 5.1 SAS Formats and Informats for ADABAS Data Types in an ADABAS File

ADABAS Type	Description	Standard Length in Bytes	SAS Format and Informat
A	alphanumeric		$*ADBLEN*.
B	binary	< = 4	(2 x *ADBLEN*) + 1
	(unsigned)	> 4 and < =8	(2 x *ADBLEN*).
		> 8 and < =100	$HEX(2 x *ADBLEN*).
		> 100	$HEX200.
F	fixed (signed)		8.
G	floating point (signed)		BEST12.
P	packed decimal (signed)		(2 x *ADBLEN* + 1).
U	unpacked decimal	< = 16	(*ADBLEN* + 1).
	(zoned decimal)	> 16	$HEX(2 x *ADBLEN*).
	(signed)		

The following information applies to this table:

- ADBLEN = ADABAS standard length (in bytes). If the standard length equals 0, then the interface view engine sets the length based on the data type, as follows: A=20, B=8, F=4, G=8, P=15, and U=16.
- Binary data that is
  - < = 4 bytes is treated as signed numbers
  - < = 8 bytes and > 4 bytes is treated as positive (unsigned) numbers
  - > 8 bytes is treated as character hexadecimal data.
- Numeric values greater than 16 displayable digits can lose precision.

The following table shows the default SAS variable formats and informats that the ACCESS procedure assigns to each ADABAS data type in a NATURAL DDM.

Table 5.2 SAS Formats and Informats for ADABAS Data Types in a NATURAL DDM

ADABAS Type	Description	Standard Length in Bytes	SAS Format and Informat
A	alphanumeric		$*DDMLEN.*

ADABAS Type	Description	Standard Length in Bytes	SAS Format and Informat
B	binary (unsigned)	< = 4	(*DDMLEN* + *DECPT* + *SIGNPT*) .
		> 4 and < = 8	(*DDMLEN* +*DECPT*) .
		> 8 and < = 100	$HEX(2 x ADBLEN).
		> 100	$HEX200.
F	fixed (signed)		(*DDMLEN* + *DECPT* + *SIGNPT*) .
G	floating point (signed)		BEST12.
P	packed decimal (signed)		(*DDMLEN* + *DDMDEC* + *DECPT* + *SIGNPT*) . *DDMDEC.*
U	unpacked decimal (zoned decimal) (signed)	< = 16	(*DDMLEN* + *DDMDEC* + *DECPT* + *SIGNPT*) . *DDMDEC.*
		> 16	$HEX(2 x *ADBLEN*).

The following information applies to this table:

- DDMLEN = DDM digits to the left of the decimal point.
- DDMDEC = DDM digits to the right of the decimal point.
- ADBLEN = ADABAS standard length in bytes. If the standard length equals 0, then the interface view engine sets the length based on the data type, as follows: A=20, B=8, F=4, G=8, P=15, and U=16.
- DECPT = 1 when DDM digits to the right of the decimal point are greater than 0.
- DECPT = 0 when DDM digits to the right of decimal point are equal to 0.
- SIGNPT = 1 when numeric type is signed data (fixed, float, packed, unpacked, and binary ≤4).
- SIGNPT = 0 when numeric type is unsigned data (binary > 4 and ≤ I8).
- Binary data that is
  - ≤ 4 bytes is treated as signed numbers
  - ≤ 8 bytes and > 4 bytes is treated as positive (unsigned) numbers
  - > 8 bytes is treated as character hexadecimal data.
- Numeric values greater than 16 displayable digits can lose precision.

Effects of the SAS/ACCESS Interface on ADABAS Data

When you access ADABAS data through the SAS/ACCESS interface, the interface view engine maps the ADABAS data into SAS observations.

- Multiple-value field occurrences are mapped to multiple SAS variables. For example, if the ADABAS data has a multiple-value field named JOBTITLE with two occurrences, the resulting SAS variables would be JOBTITL1 and JOBTITL2.
- Periodic group occurrences are mapped to multiple SAS observations. For example, if the ADABAS data has a periodic group field named EDUCATION consisting of data fields COLLEGE, DEGREE, and YEAR, there would be one observation for COLLEGE, DEGREE, and YEAR for each periodic group occurrence.

When you create SAS/ACCESS descriptor files for ADABAS data, you need to be aware of how some data fields are affected by the ACCESS procedure and how you can use them as variables in SAS programs.

- When you create a SAS/ACCESS descriptor file for ADABAS data, the ACCESS procedure automatically creates a SAS variable named ISN. This variable gives you access to the ISNs (internal sequence numbers) for all the ADABAS logical records.
- Selecting either a subdescriptor or a superdescriptor data field creates a SAS variable for the data field. The variable can be retrieved and used in a WHERE clause. However, the variable cannot be updated.
- Selecting a phonetic descriptor data field creates a SAS variable for that phonetic descriptor. The values of the data field for which the phonetic descriptor is defined are retrieved, and the phonetic descriptor can be used in a WHERE clause. However, this variable cannot be updated.

  If you use a variable for a phonetic descriptor in a SAS WHERE clause, the interface view engine must be able to process the entire SAS WHERE clause.
- For a multiple-value data field, the ACCESS procedure creates SAS variables that reference individual occurrences and a SAS variable that references all occurrences to perform special WHERE clause queries. For example, in the NATURAL DDM named CUSTOMERS, the BRANCH-OFFICE data field is a multiple-value data field with four occurrences. The ACCESS procedure creates SAS variables named BRANCH_1, BRANCH_2, and so on, and a SAS variable named BR_ANY. For more information and examples, see "Multiple-Value Fields in Selection Criteria" on page 146.
- For a periodic group data field, the ACCESS procedure creates a SAS variable for the occurrence number within the periodic group. For example, in the NATURAL DDM named CUSTOMERS, the SIGNATURE-LIST data field is a periodic group for data fields LIMIT and SIGNATURE. PROC ACCESS creates a SAS variable named SL_OCCUR for the occurrence numbers. For more

information and examples, see "Periodic Group Fields in Selection Criteria" on page 148.

Invoking the ACCESS Procedure

To invoke the ACCESS procedure, you use the options described in "Options for the ACCESS Procedure" on page 67 and certain procedure statements. The options and statements that you choose are determined by your task.

- To create an access descriptor, you use the following syntax:

PROC ACCESS DBMS=*ADABAS*;
    CREATE *libref.member-name*.ACCESS;
        required database-description statements;
        optional editing statements;
RUN;

- To create an access descriptor and a view descriptor in the same procedure, you use the following syntax:

PROC ACCESS DBMS=*ADABAS*;
    CREATE *libref.member-name*.ACCESS;
        required database-description statements;
        optional editing statements;
    CREATE *libref.member-name*.VIEW;
        SELECT *item-list;*
        optional editing statements;
RUN;

- To create a view descriptor from an existing access descriptor, you use the following syntax:

PROC ACCESS DBMS=*ADABAS* ACCDESC=*libref.access-descriptor*;
    CREATE *libref.member-name*.VIEW;
        SELECT *item-list;*
        optional editing statements;
RUN;

- To update an access descriptor, you use the following syntax:

PROC ACCESS DBMS=*ADABAS*;
    UPDATE *libref.member-name*.ACCESS;
        procedure statements;
RUN;

- To update a view descriptor, you use the following syntax:

PROC ACCESS DBMS=*ADABAS*;
    UPDATE *libref.member-name*.VIEW;
        procedure statements;
RUN;

See “ACCESS Procedure Syntax for ADABAS” on page 66 for a listing of database description and editing statements. For information to help you code efficient descriptor files, see “Creating and Using ADABAS View Descriptors Efficiently” on page 78.

Note that when you update an access descriptor (for example, drop another field from the display), the view descriptors based on this access descriptor are not updated automatically. You must re-create or modify any view descriptors that you want to reflect the changes made to the access descriptor. Altering a DBMS table can invalidate both access descriptors and view descriptors.

Dictionary

ADBFILE Statement

Specifies the file number of the ADABAS file to be accessed.

Type:	Optional statement
Applies to:	access descriptor or view descriptor
Interaction:	DDM, SECURITY

Syntax

ADBFILE (NUMBER | NUM = *Adabas-file-number*
PASSWORD | PW = *Adabas-password*
CIPHER | CC = *Adabas-cipher-code*
DBID =*Adabas-database-identifier*);

Details

The ADBFILE statement enables you to specify an ADABAS file number and optional password, cipher code, and database identifier for the ADABAS file to be used when reading the access descriptor. If you specified a NATURAL DDM using the DDM= statement in an access descriptor, then the file number is supplied by the DDM and the ADBFILE statement is not needed.

If you specified SECURITY=YES in the access descriptor, you cannot change the values for the password and cipher code in the view descriptor. However, if no values were entered in the access descriptor, you can enter them in the view descriptor, even if the SECURITY=YES statement has been issued.

Adabas-file number
is the ADABAS file number of the file to be accessed. The ADABAS file number is a number from 1 to the lower of 5,000 or the Association block size minus one.

It is assigned when the ADABAS files are created with the ADABAS ADACMP utility.

Adabas-password
is an ADABAS password, which provides security protection at the file or data-field level, or on the basis of a value at the logical-record level. The value is not displayed as you enter it, and it is written to the access descriptor in encrypted form.

Adabas-cipher code
is an ADABAS cipher code, which is a numeric code for ciphering and deciphering data into and from an ADABAS file. The value is not displayed as you enter it, and it is written to the access descriptor in encrypted form.

Adabas-database identifier
is the ADABAS database identifier (number) to be accessed. The database identifier is a numerical value from 1 to 65,535 that is assigned to each ADABAS database.

ASSIGN Statement

Indicates whether SAS variable names and formats are automatically generated.

Type:	Optional statement
Default:	NO
Applies to:	access descriptor
Interaction:	CONTENT, FORMAT, INFORMAT, KEY, MVF, RENAME, RESET

Syntax

ASSIGN<=> YES | NO | Y | N;

Details

The ASSIGN statement indicates whether SAS variable names are automatically generated and whether users can change SAS variable names and other column information the view descriptors created from this access descriptor.

An editing statement, such as ASSIGN, must be specified after the CREATE and database-description statements when you create an access descriptor. For more information, see “CREATE Statement” on page 87.

The value `NO` (or `N`) enables you to modify SAS variable names, formats, informats, database contents, occurrence ranges, and BY keys when you create an access descriptor and when you create view descriptors that are based on this access descriptor.

Specify a `YES` (or `Y`) value for this statement to generate unique SAS variable names from the first eight characters of the DBMS column names, according to the rules listed below. With `YES`, you can change the SAS variable names and other column information only in the access descriptor. The SAS variable names and other column information that are saved in an access descriptor are *always* used when view descriptors are created from the access descriptor; you cannot change them in the view descriptors.

Default SAS variable names are generated according to these rules:

- If the column name is longer than eight characters, SAS uses only the first eight characters. If truncating results in duplicate names, numbers are appended to the ends of the names. For example, the DBMS names `clientsname` and become the SAS names `clientsn` and `clients1`.

  If the same descriptor has another set of columns with duplicate names, the numeric suffix begins at the next highest number from the previous set of duplicate names. For example, if the descriptor has the duplicate names above and also has the DBMS names `customername`, `customernumber`, and `customernode`, the default SAS names would be `customer`,`custome1`, and `custome2`.

- If the column name contains characters that are not valid in SAS names (including national characters), SAS replaces these characters with underscores (_). For example, the column name `func$` becomes the SAS variable name `func_`.

If you specify `YES` for this statement, SAS automatically resolves any duplicate variable names. However, if you specify `YES`, you cannot specify the CONTENT, FORMAT, INFORMAT, KEY, MVF (with OCCURS option), RENAME, or RESET statements when you create view descriptors that are based on the access descriptor.

When the SAS/ACCESS interface encounters the next CREATE statement to create an access descriptor, the ASSIGN statement is reset to the default `NO` value.

AN is the alias for the ASSIGN statement.

CONTENT Statement

Specifies a SAS date format or length.

Type:	Optional statement
Applies to:	access descriptor or view descriptor
Interaction:	ASSIGN

Syntax

CONTENT *column-identifier-1* <=> *SAS-date-format* | *length* | *E*
<... *column-identifier-n* <=> *SAS-date-format* |*length*|*E* > ;

Details

The CONTENT statement enables you to enter a SAS date format, a variable length, or an extended time format. A date format means that the ADABAS data has the specified representation. A variable length determines the number of characters to be accessed. The extended time format (E) invokes NATURAL date, time, and datetime values. SAS stores datetime values as the number of days and seconds before and after January 1, 1960. The NATURAL 4th generation language stores date and time values as the number of days and seconds since 0 A.D.

For ADABAS files, entering a SAS date or a variable length automatically changes default values for SAS formats and informats. For NATURAL DDMs, entering a date changes the default format and informat but entering a length does not. However, if you have previously changed any format and informat values, specifying a CONTENT value does not alter those values. Specifying extended time format changes default values for SAS informat and format values to DATETIME16.

For groups and periodic groups, the CONTENT field is for information only and is set to *GROUP* and *PGROUP*, respectively.

ADABAS does not have a specific date type. Therefore, the CONTENT statement enables you to identify dates for SAS processing. You can enter one of four SAS date formats.

- YYMMDD*w*. where *w* is 6 for two-digit years or 8 for four-digit years
- MMDDYY*w*. where *w* is 6 for two-digit years or 8 for four-digit years
- DDMMYY*w*. where *w* is 6 for two-digit years or 8 for four-digit years
- JULIAN*w*. where *w* is 5 for two-digit years or 7 for four-digit years.

If you specified ASSIGN=YES when creating an access descriptor, you cannot change the value for this statement when you later create a view descriptor based on that access descriptor. If you specified ASSIGN=NO, you can change the value for this statement in a subsequent view descriptor.

You do not have to issue a SELECT statement for columns named in the CONTENT statement.

Note: The SAS/ACCESS to ADABAS engine does not provide automatic conversion to the extended time format in releases of SAS before Release 6.08 TSO420. However, it is possible to convert a value to the extended time format in a SAS DATA step by using the following formulas:

```
SAS date value     = NATURAL date value - 715874
SAS datetime value = (NATURAL datetime value / 10)
                      - (715874 * 3600 *24)
SAS time value     = NATURAL time value / 10
```

CREATE Statement

Creates a SAS/ACCESS descriptor file.

Type:	Required statement
Applies to:	access descriptor or view descriptor

Syntax

CREATE *libref.member-name.*ACCESS | VIEW;

Details

CREATE Statement

The CREATE statement identifies the access descriptor or view descriptor that you want to create. This statement is required for creating a descriptor.

To create a descriptor, use a three-level name. The first level identifies the libref of the SAS library where you will store the descriptor. You can store the descriptor in a temporary (Work) or permanent SAS library. The second level is the descriptor's name (member name). The third level is the type of SAS file: specify `ACCESS` for an access descriptor or `VIEW` for a view descriptor.

You can use the CREATE statement as many times as necessary in one procedure execution. That is, you can create multiple access descriptors, as well as one or more view descriptors based on these access descriptors, within the same execution of the ACCESS procedure. Or, you can create access descriptors and view descriptors in separate executions of the procedure.

Access Descriptors

When you create an access descriptor, you must place statements or groups of statements in a certain order after the PROC ACCESS statement and its options, as listed below:

1. CREATE statement for the access descriptor: must follow the PROC ACCESS statement.

2. Database-description statements: must follow the CREATE statement. Use either the ADBFILE or the DDM statement with the SECFILE and SYSFILE statements. In addition with the DDM statement, use the NSS statement. The ADBFILE statement enables you to access an ADABAS file. The DDM statement accesses a view to an ADABAS file that you can use to reference the ADABAS file in NATURAL programs. In making your choice, note that the two statements use different naming conventions for ADABAS data field names.

   Information from database-description statements is stored in an access descriptor. Therefore, you do not need to repeat this information when you create view descriptors. However, if no security values were entered in the access descriptor or values were provided but the SECURITY statement was set to NO, then you can use the database-description statements in a view descriptor to supply or modify them.

3 Editing statements: must follow the database-description statements. ASSIGN, CONTENT, DROP, EXTEND, FORMAT, INFORMAT, KEY, LIST, LISTINFO, LISTOCC, MVF, RENAME, RESET, and SECURITY can all be used in an access descriptor. QUIT is also an editing statement but using it terminates PROC ACCESS without creating your descriptor.

4 RUN statement: this statement is used to process the ACCESS procedure.

The order of the statements within the database-description group does not matter. For example, you could submit either the DDM= or the NSS() statement first. The order of the statements within the editing group sometimes matters; see the individual statement descriptions for any restrictions.

Note: Altering a DBMS table that has descriptor files defined on it might cause these files to be out-of-date or not valid. For example, if you re-create a table and add a new column to the table, an existing access descriptor defined on that table does not show that column; in this case the descriptor is still valid. However, if you re-create a table and delete an existing column from the table, the descriptor might not be valid. If the deleted column is included in a view descriptor and this view is used in a SAS program, the view fails and an error message is written to the SAS log.

View Descriptors

You can create view descriptors and access descriptors in the same execution of the ACCESS procedure or in separate executions.

To create a view descriptor and the access descriptor on which it is based within the *same* PROC ACCESS execution, you must place the statements or groups of statements in a particular order after the PROC ACCESS statement and its options, as listed below:

1 Create the access descriptor except omit the RUN statement.

2 CREATE statement for the view descriptor: this statement must follow the PROC ACCESS statements that created the access descriptor.

3 NSS and the password and cipher code parameters of ADBFILE, SECFILE, and SYSFILE: the ADBFILE, SECFILE, and SYSFILE statements can be specified only when SECURITY=NO or when SECURITY=YES and no values have been specified in the access descriptor referenced by this view descriptor.

4 Editing statements: SELECT and SUBSET are used only when creating view descriptors. CONTENT, FORMAT, INFORMAT, KEY, and MVF OCCURS can be specified only when ASSIGN=NO is specified in the access descriptor referenced by this view descriptor. QUIT is also an editing statement, but using it terminates PROC ACCESS without creating your descriptor.

  The order of the statements within this group usually does not matter; see the individual statement descriptions for any restrictions.

5 RUN statement: this statement is used to process the ACCESS procedure.

To create a view descriptor based on an access descriptor that was created in a *separate* PROC ACCESS step, you specify the access descriptor's name in the ACCDESC= option in the new PROC ACCESS statement. You must specify the CREATE statement before any of the editing statements for the view descriptor.

If you create only one descriptor in a PROC step, the CREATE statement and its accompanying statements are checked for errors when you submit PROC ACCESS for processing. If you create multiple descriptors in the same PROC step, each CREATE statement (and its accompanying statements) is checked for errors as it is processed.

When the RUN statement is processed, all descriptors are saved. If no errors are found, the descriptor is saved. If errors are found, error messages are written to the SAS log, and processing is terminated. After you correct the errors, resubmit your statements.

Example

The following example creates the access descriptor Adlib.Customer on the ADABAS Customer file using the ADBFILE statement to specify the ADABAS file.

```
/* Create access descriptor using ADABAS file */
proc access dbms=adabas;
   create adlib.customer.access;
   adbfile(number=45  password=cuspw
           cipher=cuscc dbid=1);
   sysfile(number=15  password=cuspwsys
           cipher=cusccsys  dbid=1);
   secfile(number=16  password=cuspwsec
           cipher=cusccsec  dbid=1);
   assign=yes;
   rename cu = custnum
          ph = phone
          ad = street;
   format fo = date7.;
   informat fo = date7.;
   content fo = yymmdd8.;
   mvf br occurs = 4
run;
```

The following example creates an access descriptor to the same data using the DDM statement.

```
/* Create access descriptor using NATURAL DDM */
proc access dbms=adabas;
   create adlib.customer.access;
   nss(library=sasdemo user=demo password=demopw).
   sysfile(number=15  password=cuspwsys
           cipher=cusccsys  dbid=1);
   secfile(number=16  password=cuspwsec
           cipher=cusccsec  dbid=1);
   ddm=customers;
   assign=yes;
   rename customer = custnum
          telephone = phone
          streetaddress = street;
   format firstorderdate = date7.;
   informat firstorderdate = date7.;
   content firstorderdate = yymmdd6.;
   mvf "BRANCH-OFFICE" occurs = 4
run;
```

The following example creates an access descriptor Adlib.Employ on the ADABAS Employees file and a view descriptor Vlib.Emp1204 based on Adlib.Employ in the same PROC ACCESS step. The ADABAS file to access is referenced by a DDM.

```
/* Create access and view descriptors in one execution */
proc access dbms=adabas;

   /* Create access descriptors */
   create adlib.employ.access;
   nss(library=sasdemo user=demo password=demopw);
   sysfile(number=15  password=cuspwsys
           cipher=cusccsys  dbid=1);
   secfile(number=16  password=cuspwsec
           cipher=cusccsec  dbid=1);
   ddm=employee;
   assign=no;
   list all;

   /* Create view descriptor  */
   create vlib.emp1204.view;
   select empid lastname hiredate salary dept
   sex    birthdate;
   format empid 6.
          salary dollar12.2
          jobcode 5.
          hiredate datetime7.
          birthdate datetime7.;
   subset where jobcode=1204;
run;
```

The following example creates a view descriptor Vlib.BDays from the Adlib.Employ access descriptor, which was created in a separate PROC ACCESS step.

```
/* Create view descriptors in separate execution */
proc access dbms=adabas accdesc=adlib.employ;
   create vlib.bdays.view;
   select empid lastname birthdate;
   format empid 6.
          birthdate datetime7.;
run;
```

DDM= Statement

Indicates the NATURAL Data Definition Module (DDM) name.

Type:	Optional statement
Applies to:	access descriptor
Interaction:	NSS

Syntax

DDM= *data-definition-module-name*;

Details

The DDM= statement specifies the NATURAL DDM. The name assigned to a NATURAL DDM references an ADABAS file and its data fields. Note that a DDM is often referred to as an ADABAS file, even though it is only a view of an actual ADABAS file.

The name for a NATURAL DDM can be a maximum of 32 characters. In a NATURAL DDM, data fields can be assigned a DDM external name of 3 to 32 characters. DDMs are stored in a system file that is simply another ADABAS file.

If you delete or rename a SAS/ACCESS descriptor file, you do not delete or rename the descriptor file's underlying ADABAS file or NATURAL DDM. However, changing your DDM can affect your descriptor files. See "Effects of Changing an ADABAS File or NATURAL DDM on Descriptor Files" on page 125 for more information about how changing your DDM can affect your descriptor files.

DROP Statement

Drops a column so that it cannot be selected in a view descriptor.

Type:	Optional statement
Applies to:	access descriptor
Interaction:	RESET, SELECT

Syntax

DROP *column-identifier-1* <...*column-identifier-n*> ;

Details

The DROP statement drops the specified column from an access descriptor. The column therefore cannot be selected by a view descriptor that is based on the access descriptor. However, the specified column in the DBMS table remains unaffected by this statement.

An editing statement, such as DROP, must follow the CREATE and database-description statements when you create an access descriptor. For more information, see "CREATE Statement" on page 87.

The *column-identifier* argument can be either the column name or the positional equivalent from the LIST statement, which is the number that represents the column's place in the access descriptor. For example, to drop the third and fifth columns, submit the following statement:

```
drop 3 5;
```

If the column name contains special characters or national characters, enclose the name in quotation marks. You can drop as many columns as you want in one DROP statement.

To display a column that was previously dropped, specify that column name in the RESET statement. However, doing so also resets all the column's attributes (such as SAS variable name, format, and so on) to their default values.

EXTEND Statement

Lists columns in the descriptor and gives information about them.

Type:	Optional statement
Default:	ALL
Applies to:	access and view descriptors

Syntax

EXTEND <ALL | VIEW | *column-identifier-1* <... *column-identifier-n*> > ;

Details

The EXTEND statement lists information about the informat, DB content, occurrence range, descriptor type, and BY key columns in the descriptor. For groups and periodic groups, `*GROUP*` or `*PGROUP*` is displayed, respectively.

You can use the EXTEND statement when creating an access or a view descriptor. The EXTEND information is written to your SAS log.

If you use an editing statement, such as EXTEND, it must follow the CREATE statement and the database-description statements when you create a descriptor. See "CREATE Statement" on page 87 for more information about the order of statements.

You can specify EXTEND as many times as you want while creating a descriptor; specify EXTEND last in your PROC ACCESS code to see the completed descriptor information. Or, if you are creating multiple descriptors, specify EXTEND before the next CREATE statement to list all the information about the descriptor that you are creating.

The EXTEND statement can take one of the following arguments:

ALL
: lists all the DBMS columns in the file, the positional equivalents, the two–character ADABAS names, the SAS variable informats, the database contents, occurrence ranges, descriptor types, and BY keys that are available for the

access descriptor. When you are creating an access descriptor, `*NON-DISPLAY*` appears next to the column description for any column that has been dropped. When you are creating a view descriptor, `*SELECTED*` appears next to the column description for columns that you have selected for the view.

VIEW
: lists all the DBMS columns that are selected for the view descriptor, along with their positional equivalents, their two–character ADABAS names, their SAS variable informats, the database contents, occurrence ranges, descriptor types, BY keys, any subsetting clauses, and the word `*SELECTED*`. Any columns that are dropped in the access descriptor are not displayed. The VIEW argument is valid only for a view descriptor.

column-identifier
: lists the specified DBMS column name, its positional equivalent, its two–character ADABAS name, its SAS variable informat, the database content, occurrence range, descriptor type, BY keys that are available for the access descriptor, and whether the column has been selected or dropped. If the column name contains special characters or national characters, enclose the name in quotation marks.

The *column-identifier* argument can be either the column name, the positional equivalent from the LIST statement, which is the number that represents the column's place in the descriptor, or a list of column names or positions. For example, to list information about the fifth column in the descriptor, submit the following statement:

```
extend 5;
```

Or, to list information about the fifth, sixth, and eighth columns in the descriptor, submit the following statement:

```
extend 5 6 8;
```

FORMAT Statement

Changes a SAS format for a DBMS column.

Type:	Optional statement
Applies to:	access descriptor or view descriptor
Interaction:	ASSIGN, CONTENT, DROP, RESET

Syntax

FORMAT *column-identifier-1* <=> *SAS-format-name*
<...*column-identifier-n* <=> *SAS-format-name*> ;

Details

The FORMAT statement changes a SAS variable format from its default format; the default SAS variable format is based on the data type of the DBMS column. (See "ACCESS Procedure Formats and Informats for ADABAS" on page 79 for information about the default formats that the ACCESS Procedure assigns to your DBMS data types.)

An editing statement, such as FORMAT, must follow the CREATE statement and the database-description statements when you create a descriptor. See "CREATE Statement" on page 87 for more information about the order of statements.

The *column-identifier* argument can be either the column name or the positional equivalent from the LIST statement, which is the number that represents the column's place in the access descriptor. For example, to associate the DATE9. format with the BIRTHDATE column and with the second column in the access descriptor, submit the following statement:

```
format 2=date9. birthdate=date9.;
```

The column-identifier is specified on the left and the SAS format is specified on the right of the expression. The equal sign (=) is optional. If the column name contains special characters or national characters, enclose the name in quotation marks. You can enter formats for as many columns as you want in one FORMAT statement.

You can use the FORMAT statement with a view descriptor only if the ASSIGN statement that was used when creating the access descriptor was specified with the `NO` value.

Note: You do not have to issue a SELECT statement in a view descriptor for the columns included in the FORMAT statement. The FORMAT statement selects the columns. When you use the FORMAT statement in access descriptors, the FORMAT statement reselects columns that were previously dropped with the DROP statement.

FMT is the alias for the FORMAT statement.

INFORMAT Statement

Changes a SAS informat for a DBMS column.

Type:	Optional statement
Applies to:	access descriptor or view descriptor
Interaction:	ASSIGN, CONTENT, DROP, RESET

Syntax

INFORMAT *column-identifier-1* <=> *SAS-format-name*
<...*column-identifier-n* <=> *SAS-format-name*> ;

Details

The INFORMAT statement changes a SAS variable informat from its default informat; the default SAS variable informat is based on the data type of the DBMS column. (See “ACCESS Procedure Formats and Informats for ADABAS” on page 79 for information about the default informats that the ACCESS Procedure assigns to your DBMS data types.)

An editing statement, such as INFORMAT, must follow the CREATE statement and the database-description statements when you create a descriptor. See “CREATE Statement” on page 87 for more information about the order of statements.

The *column-identifier* argument can be either the column name or the positional equivalent from the LIST statement, which is the number that represents the column's place in the access descriptor. For example, to associate the DATE9. informat with the BIRTHDATE column and with the second column in the access descriptor, submit the following statement:

```
informat 2=date9. birthdate=date9.;
```

The column-identifier is specified on the left and the SAS informat is specified on the right of the expression. The equal sign (=) is optional. If the column name contains special characters or national characters, enclose the name in quotation marks. You can enter informats for as many columns as you want in one INFORMAT statement.

You can use the INFORMAT statement with a view descriptor only if the ASSIGN statement that was used when creating the access descriptor was specified with the `NO` value.

Note: You do not have to issue a SELECT statement in a view descriptor for the columns included in the INFORMAT statement. The INFORMAT statement selects the columns. When you use the INFORMAT statement with access descriptors, the INFORMAT statement reselects columns that were previously dropped with the DROP statement.

INFMT is the alias for the INFORMAT statement.

KEY Statement

Specifies a BY key for an elementary data field that is designated as an ADABAS descriptor.

Type:	Optional statement
Default:	blank
Applies to:	access descriptor or view descriptor
Interaction:	ASSIGN

Syntax

KEY<=> *column-identifier-1* <...*column-identifier-n*> ;

Details

The KEY statement specifies a BY key for an elementary data field. This field must be an ADABAS descriptor.

A BY key, which is an optional set of match variables, is used only when the interface view engine must examine additional ADABAS records in order to add a new periodic group occurrence. The engine uses the BY key variables in temporary WHERE clauses that are designed to locate a record for modification. Examining the additional ADABAS records is required only if data is changed above the periodic group level from one observation to the next in a view descriptor with a selected periodic group. It is suggested that you use BY key variables even if they are not always needed.

A data field is a good candidate for a BY key variable if it uniquely identifies a logical record. The incoming values of the data fields in a BY key variable are matched to existing values in order to locate a position in which to insert new periodic groups. (A BY key variable is similar to a BY group or a BY variable in SAS.)

The KEY statement can have the following values:

blank
: (default) indicates that the data field is not to be used as a KEY.

N
: specifies that the data field is not to be used as a KEY.

Y
: specifies that the data field is to be used as a KEY.

An editing statement, such as KEY, must follow the CREATE statement and the database-description statements when you create a descriptor. See “CREATE Statement” on page 87 for more information about the order of statements.

You can use the KEY statement with a view descriptor only if the ASSIGN statement that was used when creating the access descriptor was specified with the `NO` value.

You do not have to issue a SELECT statement in a view descriptor for the columns included in the KEY statement. The KEY statement selects the columns. When you use the KEY statement with an access descriptor, the KEY statement reselects columns that were previously dropped with the DROP statement.

LIST Statement

Lists columns in the descriptor and gives information about them.

Type:	Optional statement
Default:	ALL
Applies to:	access descriptor or view descriptor

Syntax

LIST <ALL | VIEW | *column-identifier-1* <... *column-identifier-n*> > ;

Details

The LIST statement lists columns in the descriptor along with information about the columns. The LIST statement can be used when creating an access descriptor or a view descriptor. The LIST information is written to your SAS log.

If you use an editing statement, such as LIST, it must follow the CREATE statement and the database-description statements when you create a descriptor. See "CREATE Statement" on page 87 for more information about the order of statements.

You can specify LIST as many times as you want while creating a descriptor; specify LIST last in your PROC ACCESS code to see the completed descriptor information. Or, if you are creating multiple descriptors, specify LIST before the next CREATE statement to list all the information about the descriptor that you are creating.

The LIST statement can take one of the following arguments:

ALL
: lists all the DBMS columns in the file, the positional equivalents, the SAS variable names, and the SAS variable formats that are available for the access descriptor. When you are creating an access descriptor, `*NON-DISPLAY*` appears next to the column description for any column that has been dropped. When you are creating a view descriptor, `*SELECTED*` appears next to the column description for columns that you have selected for the view.

VIEW
: lists all the DBMS columns that are selected for the view descriptor, along with their positional equivalents, their SAS names and formats, any subsetting clauses, and the word `*SELECTED*` . Any columns that were dropped in the access descriptor are not displayed. The VIEW argument is valid only for a view descriptor.

column-identifier
: lists the specified DBMS column name, its positional equivalent, its SAS variable name and format, and whether the column has been selected or dropped. If the column name contains special characters or national characters, enclose the name in quotation marks.

  The *column-identifier* argument can be either the column name or the positional equivalent from the LIST statement, which is the number that represents the column's place in the descriptor. For example, to list information about the fifth and eighth columns in the descriptor, submit the following statement:

```
list 5 8;
```

LISTINFO Statement

Shows additional data field information.

Type:	Optional statement
Default:	ALL
Applies to:	access descriptor or view descriptor

Syntax

LISTINFO <ALL | VIEW | *column-identifier-1* <... *column-identifier-n*> > ;

Details

The LISTINFO statement shows additional data field information for one or more DBMS columns in the descriptor. The LISTINFO statement can be used when creating an access or a view descriptor. The LISTINFO information is written to your SAS log.

An editing statement, such as LISTINFO, must follow the CREATE statement and the database-description statements when you create a descriptor. See “CREATE Statement” on page 87 for more information about the order of statements.

The LISTINFO statement is especially helpful for subfields, superfields, and descriptor data fields. It shows the ADABAS level, ADABAS name, length, data type, and first-last character positions for a given DBMS column.

When you are creating an access descriptor, `*NON-DISPLAY*` appears next to the column description for any column that has been dropped. When you are creating a view descriptor, `*SELECTED*` appears next to the column description for columns that you have selected for the view.

The LISTINFO statement can take one of the following arguments:

ALL
: lists all the DBMS columns in the file, the ADABAS levels, the lengths, ADABAS names, the data types, and the first-last character positions.

VIEW
: lists the DBMS columns that are selected for the view descriptor, along with the ADABAS levels, ADABAS names, the lengths, the data types, and the first-last character positions. Any columns that are dropped in the access descriptor are not displayed. The VIEW argument is valid only for a view descriptor.

column-identifier
: lists the specified DBMS columns, the ADABAS levels, ADABAS names, the lengths, the data types, the first-last character positions, and whether the column has been selected or dropped. If the column name contains special characters or national characters, enclose the name in quotation marks.

  The column-identifier argument can be either the column name, the positional equivalent from the LIST statement, which is the number that represents the column's place in the descriptor, or a list of column names or positions. For example, to list information about the fifth column in the descriptor, submit the following statement:

```
listinfo 5;
```

  Or, to list information about the fifth, sixth, and eighth columns in the descriptor, submit the following statement:

```
listinfo 5 6 8;
```

LISTOCC Statement

Lists occurrences for multiple value fields.

Type:	Optional statement
Applies to:	access descriptor or view descriptor

Syntax

LISTOCC *column-identifier-1* <... *column-identifier-n*> ;

Details

The LISTOCC statement lists all the requested occurrences for the specified multiple-value fields along with information such as the ADABAS level, the SAS variable name, the occurrence number, the SAS variable format and informat, the DB content, the descriptor type, and whether the occurrence has been selected or dropped. The LISTOCC statement can be used when creating an access descriptor or a view descriptor. The LISTOCC information is written to your SAS log.

If you use an editing statement, such as LISTOCC, it must follow the CREATE statement and the database-description statements when you create a descriptor. See "CREATE Statement" on page 87 for more information about the order of statements.

The LISTOCC statement takes the following argument:

column-identifier
: can be either the column name or the positional equivalent from the LIST statement, which is the number that represents the column's place in the descriptor. For example, to list occurrences for the fifth column in the descriptor, submit the following statement:

```
listocc 5;
```

The column-identifier must be a multiple-value field.

MVF Statement

Modifies the occurrences of a multiple-value field.

Type:	Optional statement
Applies to:	access descriptor or view descriptor
Interaction:	ASSIGN

Syntax

MVF *column-identifier*
CONTENT *occurrence-1* <=> *E* | *SAS-date-format* | *length*
<...*occurrence-n*<=> *E* | *SAS-date-format*| *length*> ;
|
DROP *occurrence-1* <<TO> ...*occurrence-n*> ;
|
FORMAT *occurrence-1* <=> *SAS-format-name*
<… *occurrence-n* <=> *SAS-format-name*> ;
|
INFORMAT *occurrence-1* <=> *SAS-format-name*
<… *occurrence-n* <=> *SAS-format-name*> ;
|
OCCURS<=> *number-of-occurrences*;
|
RENAME *occurrence-1* <=> *SAS-variable-name*
< ... *occurrence-n* <=> *SAS-variable-name*> ;
|
RESET *occurrence-1* <<TO> ...*occurrence-n*> ;
|
SELECT *occurrence-1* <<TO> … *occurrence-n*> ;

Details

You use the MVF statement to modify values for occurrences of a multiple-value field. The MVF statement can be used when creating an access descriptor or a view descriptor.

If you use an editing statement, such as MVF, it must follow the CREATE statement and the database-description statements when you create a descriptor. See "CREATE Statement" on page 87 for more information about the order of statements.

The MVF statement enables you to perform the following tasks:

- choose the number of occurrences by specifying a range of occurrences
- select individual occurrences or a range of occurrences
- drop individual occurrences or a range of occurrences
- reset individual occurrences or a range of occurrences
- change the format value for one or more occurrences
- change the informat value for one or more occurrences
- change the database content value for one or more occurrences
- rename the SAS variable name for one or more occurrences.

The column identifier must be a multiple-value field, and can be the column name or the positional equivalent from the LIST statement. The occurrence argument can be the occurrence name or the occurrence number. If the column name or the occurrence name contains special characters, like `-`, enclose the name in quotation marks. The `=` is optional for all subcommands.

You can use the LISTOCC statement to review your changes.

You do not have to issue a SELECT statement in a view descriptor for occurrences included in the CONTENT, FORMAT, INFORMAT, and RENAME subcommands. The subcommands select the columns.

The MVF statement can take one of the following subcommands:

CONTENT
: enables you to change the DB content attribute of an individual occurrence. This subcommand can be used when creating access or view descriptors. Changing the DB content attribute of an occurrence has the same effect on the SAS formats and informats for ADABAS files and NATURAL DDMs as changing the DB content attribute of a column. See "CONTENT Statement" on page 86 for more information. For example, if the FIRSTORDERDATE column in the CUSTOMER DDM is a multiple-value field, and you want to change the DB content attribute for occurrences nine and ten, submit the following statement:

```
mvf firstorderdate content 9 yymmdd6.
        branch10 = yymmdd6.;
```

DROP
: enables you to drop individual occurrences from your descriptor. If you drop all occurrences of a column, the column is automatically dropped. This subcommand is used only when defining access descriptors.

You can drop one or more individual occurrences or a range of occurrences. For example, if you want to drop occurrences one, two, and three of the BRANCH-OFFICE column in the CUSTOMER DDM, submit the following statement:

```
mvf "BRANCH-OFFICE" drop 1 2 3;
```

or

```
mvf "BRANCH-OFFICE" drop 1 to 3;
```

FORMAT
: enables you to change the format attribute of individual occurrences. This subcommand can be used when creating access or view descriptors. However, the format attribute cannot be changed in a view descriptor when you set ASSIGN=YES.

You can change the format attribute of one or more occurrences in one FORMAT subcommand. For example, if you want to change the format attribute for occurrences nine and ten of the BRANCH-OFFICE column in the CUSTOMER DDM, submit the following statement:

```
mvf "BRANCH-OFFICE" format 9 $21.
        branch10 = $8.;
```

INFORMAT
: enables you to change the informat attribute of an individual occurrence. This subcommand can be used when creating access or view descriptors. However, the informat attribute cannot be changed in a view descriptor when you set ASSIGN=YES.

You can change the informat attribute of one or more occurrences in one INFORMAT subcommand. For example, if the BRANCH-OFFICE column in the CUSTOMER DDM is a multiple-value field, and you want to change the informat attribute for occurrences nine and ten, submit the following statement:

```
   mvf "BRANCH-OFFICE" informat 9 $21.
        branch10 = $8.;
```

OCCURS

enables you to specify a number of occurrences or an occurrence range. The default occurrence range is displayed as 1 191, which is the maximum number of occurrences for multiple-value fields. If the value for the ASSIGN statement in an access descriptor is YES, the number of occurrences or the occurrence range cannot be changed in any view descriptor that is based on this access descriptor.

For example, if you want the BRANCH-OFFICE column in the CUSTOMER DDM to have four occurrences, submit the following statement:

```
mvf "BRANCH-OFFICE" occurs = 4
```

RENAME

enables you to rename a SAS variable name for an individual occurrence. This subcommand can be used when creating an access or view descriptor. However, this subcommand has different effects on access and view descriptors based on the value specified in the ASSIGN statement.

If you set ASSIGN=NO in the access descriptor, the SAS variable name can be renamed. If you set ASSIGN=YES, the SAS variable name can be renamed in the access descriptor but not in the view descriptor.

You can rename the SAS variable name for one or more occurrences in one RENAME subcommand. For example, if you want to rename occurrences nine and ten of the BRANCH-OFFICE column in the CUSTOMER DDM, submit the following statement:

```
mvf "BRANCH-OFFICE" rename 9 london
        branch10 = tokyo;
```

RESET

enables you to reset the attributes of individual occurrences. This subcommand can be used when creating an access or view descriptor. Specifying the RESET subcommand for an occurrence has the same effect on occurrence attributes as specifying the RESET statement for a column. See “RESET Statement” on page 106 for more information.

You can reset one or more individual occurrences or a range of occurrences. For example, if you want to reset occurrences one, two, and three of the BRANCH-OFFICE column in the CUSTOMER DDM, submit the following statement:

```
mvf "BRANCH-OFFICE" reset 1 2 3;
```

or

```
mvf "BRANCH-OFFICE" reset 1 to 3;
```

SELECT

enables you to select individual occurrences to be included in your descriptor. This subcommand is used only when defining view descriptors.

You can select one or more individual occurrences or a range of occurrences. For example, if you want to select occurrences one, two, and three of the BRANCH-OFFICE column in the CUSTOMER DDM, submit the following statement:

```
mvf "BRANCH-OFFICE" select 1 2 3;
```

or

```
mvf "BRANCH-OFFICE" select 1 to 3;
```

You can use the LISTOCC statement to review your changes.

NSS Statement

Specifies the NATURAL SECURITY options in the access descriptor.

Type:	Optional statement
Applies to:	access descriptor
Interaction:	DDM and SECURITY

Syntax

NSS (LIBRARY | LIB = *library-identifier*
USER= *user-identifier*
PASSWORD | PW = *Natural-Security-password*);

Details

Note: This statement is used only when a DDM is specified. Otherwise, it is ignored.

The NSS statement specifies NATURAL SECURITY options, including a library identifier, user identifier, and a password.

If you specify `YES` for the SECURITY statement in an access descriptor, values declared for Library, User, and Password cannot be changed in a subsequent view descriptor based on the access descriptor.

library-identifier
: is an eight-character library identifier. The first character must be alphabetic. The library identifier is the same as the application identifier in SAS/ACCESS Interface to ADABAS, Version 6.

user-identifier
: is an eight-character user identifier.

Natural-Security-password
: is an eight-character ADABAS password. The value is written to the access descriptor in encrypted form.

QUIT Statement

Terminates the procedure.

Type:	Optional statement
Applies to:	access descriptor or view descriptor

Syntax

QUIT;

Details

The QUIT statement terminates the ACCESS procedure without any further descriptor creation.

EXIT is the alias for the QUIT statement.

RENAME Statement

Modifies the SAS variable name.

Type:	Optional statement
Applies to:	access descriptor or view descriptor
Interaction:	ASSIGN and RESET

Syntax

RENAME *column-identifier-1* <=> *SAS-variable-name*
<...*column-identifier-n* <=> *SAS-variable-name*> ;

Details

The RENAME statement enters or modifies the SAS variable name that is associated with a DBMS column. The RENAME statement can be used when creating an access descriptor or a view descriptor.

An editing statement, such as RENAME, must follow the CREATE statement and the database-description statements when you create a descriptor. See "CREATE Statement" on page 87 for more information about the order of statements.

Two factors affect the use of the RENAME statement: whether you specify the ASSIGN statement when you are creating an access descriptor, and the type of descriptor that you are creating.

- If you omit the ASSIGN statement or specify it with a `NO` value, the renamed SAS variable names that you specify in the access descriptor are retained throughout the access descriptor and any view descriptor that is based on that access descriptor. For example, if you rename the CUSTOMER column to CUSTNUM when you create an access descriptor, that column continues to be named CUSTNUM when you select it in a view descriptor unless a RESET statement or another RENAME statement is specified.

When creating a view descriptor that is based on this access descriptor, you can specify the RESET statement or another RENAME statement to rename the variable again, but the new name applies only in that view. When you create other view descriptors, the SAS variable names are derived from the access descriptor.

- If you specify the `YES` value in the ASSIGN statement, you can use the RENAME statement to change SAS variable names only while creating a specific access descriptor. As described earlier in the ASSIGN statement, SAS variable names that are saved in an access descriptor are always used when creating view descriptors that are based on it.

  Renamed SAS variable names only apply to the current access descriptor that is being created. The default SAS variable names are used for any subsequent access descriptors that are created in the same ACCESS procedure execution.

The *column-identifier* argument can be either the DBMS column name or the positional equivalent from the LIST statement, which is the number that represents the column's place in the descriptor. For example, to rename the SAS variable names that are associated with the seventh column and the nine-character FIRSTNAME column in a descriptor, submit the following statement:

```
rename 7 birthday  firstname=fname;
```

The DBMS column name (or positional equivalent) is specified on the left side of the expression, with the SAS variable name on the right side. The equal sign (=) is optional. If the column name contains special characters or national characters, enclose the name in quotation marks. You can rename as many columns as you want in one RENAME statement.

When you are creating a view descriptor, the RENAME statement automatically selects the renamed column for the view. That is, if you rename the SAS variable associated with a DBMS column, you do not have to issue a SELECT statement for that column.

RESET Statement

Resets DBMS columns to their default settings.

Type:	Optional statement
Applies to:	access descriptor or view descriptor
Interaction:	ASSIGN, CONTENT, DROP, FORMAT, INFORMAT, KEY, MVF, RENAME, SELECT

Syntax

RESET <ALL | *column-identifier-1* <... *column-identifier-n*> > ;

Details

RESET Statement

The RESET statement resets either the attributes of all the columns or the attributes of the specified columns to their default values. The RESET statement can be used when creating an access descriptor or a view descriptor. However, this statement has different effects on access and view descriptors, as described below.

If you use an editing statement, such as RESET, it must follow the CREATE statement and the database-description statements when you create a descriptor. See "CREATE Statement" on page 87 for more information about the order of statements.

Access Descriptors

When you create an access descriptor, the default setting for a SAS variable name is a blank. However, if you have previously entered or modified any of the SAS variable names, the RESET statement resets the modified names to the default names that are generated by the ACCESS procedure. How the default SAS variable names are set depends on whether you included the ASSIGN statement. If you omitted ASSIGN or set it to `NO`, the default names are blank. If you set `ASSIGN=YES`, the default names are the first eight characters of each DBMS column name.

The current SAS variable format and informat are reset to the default SAS format and informat, which was determined from the column's data type. The current DB content, occurrence range, and BY key are also reset to the default values. Any columns that were previously dropped, that are specified in the RESET command, become available; they can be selected in view descriptors that are based on this access descriptor.

View Descriptors

When you create a view descriptor, the RESET statement clears any columns that were included in the SELECT statement (that is, it "deselects" the columns).

When creating the view descriptor, if you reset a SAS variable and then select it again within the same procedure execution, the SAS variable name, format, informat, database content, occurrence range, and BY key are reset to their default values. (The SAS name is generated from the DBMS column name, and the format and informat values are generated from the data type.) This applies only if you have omitted the ASSIGN statement or set the value to `NO` when you created the access descriptor on which the view descriptor is based. If you specified `ASSIGN=YES` when you created the access descriptor, the RESET statement has no effect on the view descriptor.

The RESET statement can take one of the following arguments:

ALL

for access descriptors, resets all the DBMS columns that have been defined to their default names and format settings and re-selects any dropped columns.

For view descriptors, ALL resets all the columns that have been selected, so that no columns are selected for the view; you can then use the SELECT statement to select new columns.

column-identifier
can be either the DBMS column name or the positional equivalent from the LIST statement, which is the number that represents the column's place in the access descriptor. For example, to reset the third column, submit the following statement:

```
reset 3;
```

If the column name contains special characters or national characters, enclose the name in quotation marks. You can reset as many columns as you want in one RESET statement, or use the ALL option to reset all the columns.

SECFILE Statement

Specifies parameters for the NATURAL SECURITY system file.

Type:	Optional statement
Applies to:	access descriptor or view descriptor
Interaction:	SECURITY

Syntax

SECFILE (NUMBER | NUM = *Natural-Security-file-number*
PASSWORD | PW = *Adabas-password*
CIPHER | CC = *Adabas-cipher-code*
DBID =*Adabas-database-identifier*);

Details

The SECFILE statement enables you to specify the ADABAS file number, password, cipher code, and database identifier for the NATURAL SECURITY system file.

If you specified SECURITY=YES in the access descriptor, you cannot change the values for the password and the cipher code in the view descriptor based on this access descriptor. However, if no values were specified in the parent access descriptor, then the values can be entered in the view descriptor, even when the SECURITY=YES statement has been issued.

Note: You can associate a password, cipher code, and database identifier with an ADABAS file number, system file, and security file.

Natural-Security-file-number
is the ADABAS file number of the NATURAL SECURITY system file. This file contains the NATURAL SECURITY library identifier, user identifier, and passwords.

Adabas-password
: is an ADABAS password, which provides security protection at the file or data-field level, or on the basis of a value at the logical-record level. The value is written to the access descriptor in encrypted form.

Adabas-cipher code
: is an ADABAS cipher code, which is a numeric code for ciphering and deciphering data into and from an ADABAS file. The value is written to the access descriptor in encrypted form.

Adabas-database-identifier
: is the ADABAS database identifier (number) to be accessed. The database identifier is a numerical value from 1 to 65,535 that is assigned to each ADABAS database.

SECURITY Statement

Controls the enforcement of security specifications.

Type:	Optional statement
Default:	NO
Applies to:	access descriptor
Interaction:	ADBFILE, SECFILE, SYSFILE

Syntax

SECURITY<=> YES | NO | Y | N;

Details

The SECURITY statement has the default value `NO`. Its value controls the enforcement of security specifications when you later create view descriptors based on this access descriptor.

With a value of `NO`, when you create view descriptors based on this access descriptor, you will be able to modify specified values for ADABAS passwords and cipher codes.

With a value of `YES`, when you create view descriptors based on this access descriptor, you will not be able to modify specified values for ADABAS passwords and cipher codes. However, any values that are not specified in the access descriptor can be specified in a view descriptor or with a data set option.

SELECT Statement

Selects DBMS columns for the view descriptor.

Type:	Required statement
Applies to:	view descriptor
Interaction:	RESET

Syntax

SELECT ALL | *column-identifier-1* <...*column-identifier-n*> ;

Details

The SELECT statement specifies which DBMS columns in the access descriptor to include in the view descriptor. This is a required statement and is used only when defining view descriptors.

If you use an editing statement, such as SELECT, it must follow the CREATE statement when you create a view descriptor. See "CREATE Statement" on page 87 for more information about the order of statements.

The SELECT statement can take one of the following arguments:

ALL
: includes in the view descriptor all the columns that were defined in the access descriptor excluding dropped columns.

column-identifier
: can be either the DBMS column name or the positional equivalent from the LIST statement, which is the number that represents the column's place in the access descriptor on which the view is based. For example, to select the first three columns, submit the following statement:

```
select 1 2 3;
```

If the column name contains special characters or national characters, enclose the name in quotation marks. You can select as many columns as you want in one SELECT statement.

SELECT statements are cumulative within the same view creation. That is, if you submit the following two SELECT statements, columns 1, 5, and 6 are selected, not just columns 5 and 6:

```
select 1;select 5 6;
```

To clear all your current selections when creating a view descriptor, use the `RESET ALL` statement; you can then use another SELECT statement to select new columns.

SUBSET Statement

Adds or modifies selection criteria for a view descriptor.

Type:	Optional statement
Applies to:	view descriptor

Syntax

SUBSET <*selection-criteria*> ;

Details

You use the SUBSET statement to specify selection criteria when you create a view descriptor. This statement is optional. If you omit it, the view retrieves all the data (that is, all the rows) in the DBMS table.

An editing statement, such as SUBSET, must follow the CREATE statement when you create a view descriptor. See "CREATE Statement" on page 87 for more information about the order of statements.

The selection-criteria argument can be either a WHERE clause or a SORT clause. For more information about the WHERE clause, see "WHERE Clause in an ADABAS View Descriptor" on page 70. For more information about the SORT clause, see "SORT Clause in a View Descriptor" on page 76. You can use either SAS variable names or DBMS column names, in your selection criteria. Specify your WHERE clause and SORT clause by using separate SUBSET statements. For example, you can submit the following SUBSET statements:

```
subset where jobcode = 1204;
subset sort lastname;
```

SAS does not check the SUBSET statement for errors. The statement is verified and validated only when the view descriptor is used in a SAS program.

To delete the selection criteria, submit a SUBSET statement without any arguments.

SYSFILE Statement

Specifies parameters for the system file containing DDMs.

Type:	Optional statement
Applies to:	access descriptor or view descriptor
Interaction:	SECURITY

Syntax

SYSFILE (NUMBER | NUM = *Adabas-system-file-number*
PASSWORD | PW = *Adabas-password*
CIPHER | CC = *Adabas-cipher-code*
DBID = *Adabas-database-identifier*);

Details

The SYSFILE statement enables you to specify the ADABAS file number, password, cipher code, and database identifier for the system file containing DDMs.

If you specified SECURITY=YES in the access descriptor, you cannot change the values for the password and cipher code in the view descriptor. However, if no values were entered in the access descriptor, you can enter them in the view descriptor, even if the SECURITY=YES statement has been issued.

Note that you can associate a password, cipher code, and database identifier with an ADABAS file number, system file, and security file.

Adabas-system-file-number
: is the ADABAS file number of the system file containing DDMs.

Adabas-password
: is an ADABAS password, which provides security protection at the file or data-field level, or on the basis of a value at the logical-record level. The value is written to the access descriptor in encrypted form.

Adabas-cipher code
: is an ADABAS cipher code, which is a numeric code for ciphering and deciphering data into and from an ADABAS file. The value is written to the access descriptor in encrypted form.

Adabas-database-identifier
: is the ADABAS database identifier (number) to be accessed. The database identifier is a numerical value from 1 to 65,535 that is assigned to each ADABAS database.

UPDATE Statement

Updates a SAS/ACCESS descriptor file.

Type:	Optional statement
Applies to:	access descriptor or view descriptor

Syntax

UPDATE *libref.member-name*.ACCESS | VIEW
<*password-level*=*SAS-password*> ;

Details

The UPDATE statement identifies an existing access descriptor or view descriptor that you want to update. The descriptor can exist in either a temporary (Work) or permanent SAS library. If the descriptor has been protected with a SAS password that prohibits editing of the ACCESS or VIEW descriptor, then the password must be specified in the UPDATE statement.

Note: It is recommended that you re-create (or overwrite) your descriptors rather than update them. SAS does not validate updated descriptors. If you create an error while updating a descriptor, you will not know of it until you use the descriptor in a SAS procedure such as PROC PRINT.

To update a descriptor, use its three-level name. The first level identifies the libref of the SAS library where you stored the descriptor. The second level is the descriptor's name (member name). The third level is the type of SAS file: ACCESS or VIEW.

You can use the UPDATE statement as many times as necessary in one procedure execution. That is, you can update multiple access descriptors, as well as one or more view descriptors based on these access descriptors, within the same execution of the ACCESS procedure. Or, you can update access descriptors and view descriptors in separate executions of the procedure.

You can use the CREATE statement and the UPDATE statement in the same procedure execution.

If you update only one descriptor in a procedure execution, the UPDATE and its accompanying statements are checked for errors when you submit the procedure for processing. If you update multiple descriptors in the same procedure execution, each UPDATE statement (and its accompanying statements) is checked for errors as it is processed. In either case, the UPDATE statement must be the first statement after the PROC ACCESS statement.

Note: The ACCDESC= parameter cannot be specified in the PROC ACCESS statement).

When the RUN statement is processed, all descriptors are saved. If errors are found, error messages are written to the SAS log, and processing is terminated. After you correct the errors, resubmit your statements.

The following statements are not supported when using the UPDATE statement: ASSIGN, RESET, SECURITY, SELECT, and MVF subcommands RESET and SELECT.

Note: You cannot create a view descriptor after you have updated a view descriptor in the same procedure execution. You can create a view descriptor after updating or creating an access descriptor or after creating a view descriptor.

The following example updates the access descriptor Mylib.Order on the ADABAS file Order. In this example, the column names are changed and formats are added.

```
proc access dbms=adabas;
     update mylib.order.access;
     rename ordernum ord_num
```

```
               fabriccharges fabrics;
        format firstorderdate date7.;
        informat firstorderdate date7.;
        content firstorderdate yymmdd6.;
   run;
```

The following example updates an access descriptor Adlib.Employ on the ADABAS file Employee and then re-creates a view descriptor Vlib.Emp1024, which was based on Adlib.Employ. The original access descriptor included all of the columns in the file. Here, the salary and birthdate columns are dropped from the access descriptor so that users cannot see this data. Because RESET is not supported when UPDATE is used, the view descriptor Vlib.Emp1024 must be re-created in order to omit the salary and birthdate columns.

```
proc access dbms=adabas;
   /* update access descriptor  */
   update adlib.employ.access;
   drop salary birthdate;
   list all;

   /* re-create view descriptor */
   create vlib.emp1204.view;
   select empid hiredate dept jobcode sex
          lastname firstname middlename phone;
   format empid 6.
          hiredate date7.;
   subset where jobcode=1204;
run;
```

The following example updates a view descriptor Vlib.BDays from the Adlib.Employ access descriptor, which was created in a separate procedure execution. In this example, the WHERE clause replaces the WHERE clause that was specified in the original view descriptor.

```
proc access dbms=adabas
   update vlib.bdays.view;
   subset;
   subset where empid GT 212916;
run;
```

PART 3

Appendixes

Appendix 1

Information for the Database Administrator

Introduction to the Information for the Database Administrator

This appendix explains how the SAS/ACCESS interface to ADABAS works so that you can decide how to administer its use at your site. This appendix also discusses the effects of changing ADABAS data on SAS/ACCESS descriptor files, data security, controlling data locks, maximizing the ADABAS interface view engine performance, how to debug problems, and defaults for system options.

SAS/ACCESS Interface to ADABAS

How the SAS/ACCESS Interface to ADABAS Works

When you use the ACCESS procedure to create a SAS/ACCESS access descriptor file, SAS calls ADABAS to get a description of the ADABAS data. When you create a view descriptor file, SAS has information about the ADABAS data in the access descriptor, so it does not call ADABAS.

The ACCESS procedure writes the SAS/ACCESS descriptor files to a SAS library. Then, when you issue a SAS procedure using a view descriptor whose data is in an ADABAS file, the SAS Supervisor calls the interface view engine to access the data. The engine can access ADABAS data for reading, updating, inserting, and deleting.

When you edit either an access descriptor or a view descriptor, SAS does not call ADABAS.

ADABAS data records are uniquely identified by an Internal Sequence Number (ISN). Multiple SAS observations are generated from a single ADABAS record when the view descriptor contains periodic group fields. Creating multiple SAS observations does not preserve the unique quality of the ISN number (that is, more than one SAS observation can refer to a single ADABAS record). As a result, ADABAS records cannot be uniquely addressed by a single number within the SAS environment. [1]

In SAS terms, this means that an ADABAS record is not addressable by an observation number. Therefore, various SAS procedures behave differently when accessing ADABAS data than they do when accessing a SAS data file. For example, consider the following PRINT procedure and FSEDIT procedure behavior with ADABAS data:

1. In combination, the SAS variables that contain the ISN and periodic group occurrence number uniquely identify an observation. The periodic group occurrence number variable is a fabricated SAS variable that does not have a corresponding field in the ADABAS file. It can be selected when creating a view descriptor and is valued with the occurrence number of each periodic group accessed.

- The PRINT procedure issues messages informing you that observation numbers are not available and that the procedure has generated line numbers for its output. The numbers do not come from the ADABAS file.
- The FSEDIT procedure does not display an observation number in the upper right corner of the window. If you try to enter a number on the command line, an error message is displayed.

How the ADABAS Interface View Engine Works

Making Calls

The ADABAS interface view engine is an applications program that retrieves and updates ADABAS data. Calls are in one of the following categories:

- calls made on behalf of the ACCESS procedure when it is creating an ACCESS descriptor
- calls made by a SAS DATA step or by SAS procedures that reference a view descriptor with the DATA= option.

In all situations, the interface view engine initiates and terminates communication between SAS and ADABAS. Each time a different SAS procedure requires use of ADABAS, the program makes an initialization call to the engine. This first call establishes communication with ADABAS. Additional calls to the engine perform retrieval and Update operations required by the SAS procedure.

Calls Made on Behalf of the ACCESS Procedure

For both NATURAL DDMs and ADABAS files, the ACCESS procedure calls the interface view engine to retrieve data field information. The engine sends this information (such as, name, level number, data format, and definition options) to the ACCESS procedure for each ADABAS data field.

When you specify a DDM name, the interface view engine retrieves information from two places. First, the engine uses a combination of S1 and L1 commands to search and retrieve the DDM records that have been previously cataloged into a system file. The DDM records contain information for each field included in the DDM. Along with the field information, the engine also obtains the ADABAS file number and the database identifier on which the DDM is based. The ADABAS file number and database identifier are used in conjunction with the LF command to retrieve even more information directly from the Field Definition Table (FDT). The engine then combines the information retrieved from the DDM and the FDT to give a detailed description of each field.

When dealing directly with an ADABAS file, the engine uses only the LF command for retrieving field information from the FDT. The ACCESS procedure stores this information in the access descriptor file for later use when creating view descriptors.

If you use the ACCESS procedure to extract data and store it in a SAS data file, the ACCESS procedure calls the interface view engine to retrieve the actual data.

Calls Made by Other SAS Procedures

SAS procedures can access records in an ADABAS file by referring to a view descriptor with the DATA= option. SAS examines the view descriptor to determine which database management system is referred to and passes control to the appropriate engine. The interface view engine uses information stored in the view descriptor (such as name, level number, data format, and definition options) to process ADABAS data records as if they were observations in a SAS data file.

Before doing any retrievals, the engine processes the WHERE clause (if any) to select a subset of data records to be processed as observations. The engine inspects the view WHERE clause and the SAS WHERE clause (if any) and issues the ADABAS commands that are necessary to qualify the appropriate records. If no WHERE clause exists, all data records in the file qualify.

The interface view engine forms a SAS observation (according to the view descriptor), which it passes back to the calling procedure for processing.

Based on the capabilities of the SAS procedure, the next call to the engine might be a request to update or delete the SAS observation that was just retrieved. For updates, the engine issues reads with holds followed by the appropriate update command. Adds do not require a record to be read (except in special cases when you are dealing with ADABAS files that contain periodic group fields).

The SAS procedure then calls the engine again to retrieve another SAS observation. The engine locates another data record, constructs another SAS observation, and returns it to the SAS procedure. This cycle continues until the SAS procedure terminates or until the last qualified SAS observation has been constructed and returned to the SAS procedure.

Retrieval Processing

How the ADABAS Multifetch Feature Works

The SAS/ACCESS interface view engine uses the ADABAS multifetch feature when reading data records from ADABAS. When data records are requested from ADABAS, this feature buffers multiple data records and transfers the records to the engine. The data records are returned to the engine in the ADABAS record buffer with information about each record that is returned in the ISN buffer. Therefore, the number of records that are returned depends on the sizes of the record buffer and ISN buffer.

The read commands that use the multifetch feature in the engine are L1, L2, L3, and L9 commands (the engine does not use the feature when issuing L4 commands). In cases where there is a large number of periodic group occurrences selected in the view descriptor, the multifetch feature might not be used to read the data records from ADABAS.

The type of processing and the subset of ADABAS commands used by the interface view engine depends on the following conditions:

- whether you specify a WHERE clause (view or SAS) and sorting criteria (view SORT clause, SAS BY statement, SAS ORDER BY clause) separately or in combination
- whether the SAS procedure requires sequential or random access of the ADABAS records
- whether the SAS procedure requests exclusive control of the ADABAS data, either automatically or manually (using the SAS software CNTLLEV=MEMBER data set option)

Retrievals with No WHERE Clause and No Sorting Criteria

If you do not specify a WHERE clause or any sorting criteria, the type of ADABAS commands used for retrievals is controlled by the type of access (either sequential or random) required by the SAS procedure. A SAS procedure requiring sequential access (for example, PROC PRINT) results in the engine issuing L2 commands to retrieve the records from the ADABAS file. Since there is no WHERE clause to subset the data, the engine retrieves every ADABAS record.

A SAS procedure requiring random access (for example, PROC FSEDIT) must have the ability to navigate both forward and backward. To support forward and backward navigation, an ISN list must exist. When a WHERE clause has not been entered, the engine generates a default WHERE clause. The engine searches for the first ADABAS descriptor data field in the view descriptor. Once the engine finds an ADABAS descriptor field, its format and length are used to construct a default WHERE clause. (If no ADABAS descriptors exist, the engine displays an error message.)

The ADABAS field formats and their corresponding default WHERE clause are listed below (assuming that the data field named AA is the first ADABAS descriptor field):

Table A2.1 *ADABAS Field Formats and Corresponding Default WHERE Clauses*

Format	Default WHERE Clause
alphanumeric	where aa >= '*b*'
binary	where (aa <= 0) or (aa > 0)
fixed point	
floating point	
packed decimal	

Format	Default WHERE Clause
unpacked decimal	

The default WHERE clause results in the ADABAS interface view engine issuing S1 and S8 commands. Those commands generate an ISN list whose corresponding records are read using L1 or L4 commands. The engine uses L4 commands if the SAS procedure is capable of performing updates (that is, PROC FSEDIT). The engine uses L1 commands if the SAS procedure is not allowed to perform updates (that is, PROC FSBROWSE).

Note: A default WHERE clause can use considerable resources, depending on the number of ADABAS records. Therefore, for large amounts of ADABAS data, it is best to include either a view WHERE clause or a SAS WHERE clause. Also, the ADBDEFW systems option and ADBL3 data set option are available to alter the interface view engine's handling of the default WHERE clause. A default WHERE clause might also be issued for an ADABAS descriptor that has the NULL SUPPRESS option. That is, ADABAS records might exist that are not pointed to by the ISN list.

Retrievals with Only a WHERE Clause

If you specify a WHERE clause (either view or SAS), the engine typically issues S1, S8, and L1 or L4 commands to extract the appropriate ADABAS records. The only instance where this does not apply is when the L3 command is used. (This case is discussed later.)

If you specify both a view WHERE clause and a SAS WHERE clause, the two are combined using the Boolean AND operator, that is,

(SAS WHERE clause) AND *(view WHERE clause)*

Note: The only part of the SAS WHERE clause being logically combined is the part that ADABAS can support. See "SAS WHERE Clause" on page 152.

Combining the two WHERE clauses does not alter the set of commands used to retrieve the records. It does require the execution of an additional S8 command. The S1 and S8 commands generate an ISN list whose records are subsequently read using L1 or L4 commands.

Note: In SAS 9.1 and later, the ADABAS engine can issue an L1 command to ADABAS when an ISN is specified in a SAS WHERE clause. With this method, only one record is read instead of the complete table, resulting in a performance enhancement.

The L1 command is issued if an ISN is specified in a SAS WHERE clause and all of the following conditions are met:

- the WHERE clause must be a SAS WHERE clause

- no view descriptor SUBSET can be used
- the WHERE clause can contain only a single condition
- the operator must be EQ or =
- sorting criteria cannot be specified
- option ADBL3 must be set to NO (its default value)

To optimize WHERE clause processing, you can specify use of the L3 command with the SAS software ADBL3 data set option. The ADBL3 data set option also controls which commands are used if the L3 command cannot be used. A number of restrictions must be satisfied before the L3 command can be used.

- The SAS procedure must have exclusive control of the view descriptor and therefore exclusive control of the underlying ADABAS data. This control is accomplished automatically by some procedures and manually by using the SAS software CNTLLEV=MEMBER data set option.
- The SAS procedure must request sequential access.
- Sorting criteria cannot be specified.
- A WHERE clause can contain only a single condition.
- The field referenced in the single condition must be an ADABAS descriptor field. (Phonetic descriptors and descriptors contained within or derived from a field within a periodic group cannot be used.)
- The operator used in the single condition must be LT, LE, GT, GE, or SPANS.

The L3 command reads data records in logical sequential order based on the sequence of values for a given ADABAS descriptor field. The inverted list associated with the descriptor field controls the order in which the records are read. Unlike the S1 command that creates an ISN list, the L3 command uses an existing inverted list resulting in more optimal retrievals. The L3 command produces the most dramatic results for very large ADABAS files, or in ADABAS environments where ISN list buffer sizes are set comparatively low, or in system environments where disk space is a problem.

If the L3 command cannot be used, the ADBL3 option lets you specify the use of either the S1 or the S2 command to retrieve data records in its place. If the S2 command cannot be used, the engine returns an error.

Retrievals with Sorting Criteria

To sort data records, you can use only ADABAS descriptor fields since both ADABAS commands used for sorting rely on ADABAS descriptors. The S9 command requires an ISN list as input, and the L3 command uses an inverted list. This means that all ADABAS data fields referenced in a view descriptor SORT clause, a SAS BY statement, or a SAS ORDER BY clause must be associated with ADABAS descriptor fields.

As with the WHERE clause, certain sorting criteria can be optimized with the L3 command. However, the following conditions must apply before the L3 command can be used for sorting:

- The SAS procedure must request sequential access.
- Only one sort field is requested.

- A WHERE clause cannot be specified.
- The sorting sequence must be ascending.

You invoke the L3 command with the SAS software ADBL3 system option or data set option. The L3 command reads data records in logical sequential order using the inverted list associated with the ADABAS descriptor field. The inverted list is maintained in ascending logical order.

If the ADBL3 option is not set, or it specifies use of the L3 command only and one of the above conditions is not met, the S9 command is used to satisfy the sorting criteria. The S9 command also imposes some limitations: a maximum of three descriptor fields can be used for sorting, and the ordering sequence (either ascending or descending) applies to every sort field. In all cases, the S9 command requires an ISN list as input. Since the ISN list is generated by WHERE clause processing, a default WHERE clause must be used if a WHERE clause is not specified. The S9 command generates a final ISN list in sorted order. L1 or L4 commands are used to read the ADABAS records represented in the final ISN list.

The S9 command can also sort the input ISN list in ascending ISN sequence. This is accomplished by supplying only the ordering verb ASCENDISN (no sort fields) in the view descriptor SORT clause.

Update Processing

Update processing involves updating, deleting, and adding data records. You must retrieve the data record before updating or deleting it.

Updating, deleting, and adding records is a straightforward process if there are no periodic group fields in the view descriptor or in the ADABAS data on which the view descriptor is based. In this case, the A1, E1, and N1 ADABAS commands are used for updating, deleting, and adding records, respectively.

If periodic groups do exist, adding new records and deleting existing records is more complicated. This is due to multiple SAS observations being generated from a single ADABAS record containing periodic group fields. The complexities of adding records containing periodic group fields is discussed in "Adding an ADABAS Observation" on page 141. Deleting records when the view descriptor or ADABAS data contains periodic group fields is discussed in "Deleting an ADABAS Observation" on page 140.

Competitive Updating and Logical Transaction Recovery

The interface view engine is an ET logic user application program. The ET (End Transaction) command and the record HOLD facility manage disaster recovery and multi-user concurrency issues.

SAS procedures capable of performing updates use the L4 command (read data record with hold) to read and hold data records. The held record is released with an ET command just before the next record is read. This means that any system or program failure recovers updates up to, but not necessarily including, the last ADABAS record read. When processing ADABAS data with periodic groups, remember that many SAS observations can represent one ADABAS record. Therefore, it is possible to have updated several SAS observations without issuing an ET command.

If an update procedure requests a record that another update procedure has locked, the read fails. The interface view engine recognizes this condition and re-issues the read without the HOLD option. The record is displayed with a message indicating that the record was unable to be locked and cannot be updated.

SAS procedures that do not have update authorization use the L1 command when reading records. The L1 command does not place the record in hold status, and subsequent ET commands are unnecessary.

Effects of Changing an ADABAS File or NATURAL DDM on Descriptor Files

Repairing Invalidated Descriptor FIles

Changes to an ADABAS file or NATURAL DDM can affect associated SAS/ACCESS descriptor files. If changes to ADABAS data invalidate your descriptor files, you must repair them manually by following these steps:

1. When you change an ADABAS file or NATURAL DDM, you must re-create the access descriptor(s) with PROC ACCESS, using the same access descriptor name(s).
2. Then you must update each view descriptor with PROC ACCESS. Change the view descriptor as needed.
3. The SAS/ACCESS interface view engine does a rudimentary validation of a view descriptor upon opening it. For example, the engine checks data type and data field grouping information. If a problem is found, the engine writes a message to the log and stops.

Before changing ADABAS data, consider the guidelines listed below.

Changes That Have No Effect on Existing View Descriptors

The following changes to an ADABAS file or NATURAL DDM have no effect on existing view descriptors:

- creating ADABAS descriptors.
- inserting new data fields.

- deleting data fields not referenced in any view descriptor. (Note that if an access descriptor includes the deleted data field, users could eventually create a view descriptor using that data field, which would be a problem.)

Changes That Might Have an Effect on Existing View Descriptors

The following changes to an ADABAS file or NATURAL DDM might have an effect on existing view descriptors:

- changing a data field name. If the data field name was used in selection criteria stored in the view descriptor, when you try to use the view descriptor, you receive a syntax error message indicating an unrecognized data field name.
- deleting ADABAS descriptor data fields if the field is used in selection criteria.

Changes That Cause Existing View Descriptors to Fail

The following changes to an ADABAS file or NATURAL DDM cause existing view descriptors to fail when they are used:

- changing a numeric type to a character type.
- changing a character type to a numeric type.
- deleting a data field that is referenced in a view descriptor.
- modifying a periodic group field or a multiple-value field. A field defined as a periodic group, a field within a periodic group, or a multiple-value field must retain its properties.
- changing lengths that affect a SAS format. Certain ADABAS numeric types are changed to character hexadecimal when their lengths are too large for SAS to handle. You cannot change lengths that result in changing SAS formats from character to numeric or numeric to character.
- changing superdescriptors, superfields, subdescriptors, and subfields. You cannot change the definition of these field types, such as adding or subtracting parentage information, changing the order of parentage information, or changing the from-to specification.

Data Security with ADABAS

Overview of Data Security with ADABAS

SAS preserves data security provided by ADABAS, NATURAL, and your operating system. As the DBA, you have control over who has security. You control who can create ADABAS files, and creators of the files control who can access the data. Therefore, SAS users can access only ADABAS files that they created or ones for which they have been granted specific security options.

To secure data from accidental update or deletion, you can take precautionary measures on both sides of the interface view engine.

How the Interface View Engine Uses Security Specifications

This section contains an explanation of how the interface view engine works in conjunction with both ADABAS Security and the NATURAL SECURITY System (NSS).

The twelve ADABAS Information fields and the three NSS fields discussed in this section can be passed to the interface view engine via a view descriptor or through the use of data set options. For simplicity, it is assumed that each field has been stored in a view descriptor.

If ADABAS Security is in use at your site, up to four separate fields of information might need to be provided for each of three ADABAS files that the interface view engine might reference during the execution of a single SAS procedure. The following are the three ADABAS files:

- the file from which data records are to be retrieved and updated (generally referred to as the ADABAS file)
- a system file containing DDM information
- a security file containing NSS information about the applications and users defined at your site.

The following are the four fields of information associated with each ADABAS file:

- file number
- password
- cipher code
- database identifier.

The file number is the number of the ADABAS file from which data records are actually retrieved and updated. The database identifier field indicates which database contains the file. The interface view engine obtains the file number and database identifier from one of two places: either directly from a view descriptor or from a DDM.

If you want to work directly with an ADABAS file (without referencing a DDM), you must supply the file number and database identifier in the view descriptor. (If the ADABAS file is protected using ADABAS Security, you must also supply a password, a cipher code, or both in the view descriptor.) The engine reads the file number and database identifier from the view descriptor and uses them to retrieve and update the appropriate records.

If a DDM name is stored in the view descriptor, the engine obtains the ADABAS file number and database identifier from the DDM. Since a DDM is stored as one or more records in a system file[1], the engine must read that file to obtain the file number and database identifier.

The system file containing the DDM records is just another ADABAS file. As such, it has a corresponding database identifier and can be security-protected using ADABAS Security. If the system file is protected, you must supply the necessary password and cipher code in the view descriptor. The database identifier must also be stored in the view descriptor.

Once the file number and database identifier are obtained from the DDM, the engine retrieves and updates the appropriate records.

The security file is the third and final ADABAS file that might be referenced by the interface view engine. The security file contains the NATURAL SECURITY data (for each user identifier, application identifier, file, and so on) that are defined at your site.

The interface view engine requires that the security file number, password, cipher code, and database identifier be provided in these situations:

- NSS is installed at your site.
- The view descriptor refers to a DDM name.
- The DDM referenced in the view descriptor has been defined to NSS.
- A library identifier, user identifier, and password have been supplied to the engine via the view descriptor or through data set options.

(The security file password and cipher code are required only if the security file has been security-protected using ADABAS security.)

In order to communicate with NSS, the interface view engine needs the security file number, password, cipher code, and database identifier, as well as the NSS library identifier, user identifier, and user password. The engine can use only library identifiers and user identifiers that were previously identified to NSS.

An application program must determine whether a specific library identifier and user identifier have authorization to access or update a particular DDM. To do that, Software AG developed an interface to NSS, which is delivered as a load module named NSCDDM.

The interface view engine uses this NSS interface to check access and update authorization for a library identifier and user identifier. If they do not have the appropriate authorization, an error message is displayed.

1. Using the NATURAL View Maintenance application (SYSDDM) is one method of defining and cataloging a DDM in a system file. Your site might have more than one NSS system file.

SAS Security

To secure data from accidental update or deletion, you can do the following on SAS side of the interface:

- Set up all access descriptors yourself. Drop data fields containing sensitive data from display by using the DROP statement.
- Set up all view descriptors yourself and give them to users on a selective basis. You can store the appropriate security options in the SAS/ACCESS descriptors, or you might not want to store any options so that users must supply security with data set options. You can also include view WHERE clauses to restrict data access.
- Give users Read-Only access or no access to the SAS library where you store the access descriptors. Read-Only access prevents users from editing access descriptors and enables them to see only the data fields selected for each view descriptor.
- Set up several access descriptors for multiple security options, or requires you to create them.
- Set the ADBUPD systems option to R (for read only) to disable all updates from SAS. See "View Engine ADBEUSE System Options Default Values" on page 132.

ADBSE User Exit

The SAS/ACCESS interface also provides a user exit named ADBSE for execution and access authorization. For information about user exit, contact your SAS support personnel.

Effects of Changing Security Options

The owner of an ADABAS file or NATURAL DDM can change any security option at any time. If a security option that is stored in a view descriptor is changed, you can either update the view descriptor or override the stored option each time you need to use the view descriptor. The software does not require that you use the same option, but either option must have enough authority to service the view descriptor.

Security options can be stored in access descriptors or associated view descriptors. However, changing a security option does not affect access descriptors or view descriptors. The access descriptor still has all its data fields, but you might not be able to use the view descriptor.

Note that if an access descriptor was created with Assign Security=YES, data set options cannot override security specifications included in a SAS/ACCESS view descriptor.

Controlling Data Locks with ADABAS

SAS software supports several levels of data locking, which is a means of holding information constant so that it does not change unexpectedly. The control level is the degree to which a SAS procedure can restrict access to data. SAS procedures can request locks on individual records, on library members, and so on. Locking is also controlled by the SAS software CNTLLEV data set option, which can request record-level locking and member-level locking. Some SAS procedures set CNTLLEV equal to MEM internally for their own processing reasons. Many statistical procedures must make multiple passes of the data. For example, finding the median requires more than one pass.

The ADABAS interface view engine honors all locking requests in a multi-user environment. (Locks are not required in a single-user environment.) The following conditions apply:

- If there are no locking requests, you cannot update ADABAS data.
- For record-level locking, ADABAS locks one ADABAS logical record at a time. If the record contains a periodic group, the lock includes one or more SAS observations.
- For member-level locking, ADABAS puts a hold on the entire ADABAS file.

For more information about how the interface view engine handles locking, see "Competitive Updating and Logical Transaction Recovery" on page 124.

Maximizing ADABAS Performance

Among the factors that affect ADABAS performance are the size of the file being accessed, the number of data fields being accessed, and the number of logical records qualified by the selection criteria. For files that have many data fields and many logical records, you should evaluate all SAS programs that need to access the data directly. In your evaluation, consider the following questions:

- Do the selection criteria enable ADABAS to use ADABAS descriptor data fields efficiently? See "Creating and Using ADABAS View Descriptors Efficiently" on page 78 for some guidelines on specifying efficient selection criteria.
- Does the program need all the ADABAS data fields? If not, create and use an appropriate view descriptor that includes only the data fields to be used.
- Do the selection criteria retrieve only those logical records needed for subsequent analysis? If not, specify different conditions so that the selected data is restricted for the program being used.
- Is the data going to be used by more than one procedure in a single SAS session? If so, consider extracting the data and placing it in a SAS data file for SAS procedures to use, instead of letting the data to be accessed directly by

each procedure. See “Performance Considerations” on page 41 for circumstances when extracting data is the more efficient method.

- Does the data need to be in a particular order? If so, include a SORT clause in the appropriate view descriptor or a SAS BY statement in the SAS program.
- What type of locking mechanism does ADABAS need to use? See “Controlling Data Locks with ADABAS” on page 130. .
- Are you using a view SORT clause, a SAS BY statement, or a SAS ORDER BY clause without either a view WHERE clause or a SAS WHERE clause? Without a WHERE clause, the engine qualifies all ADABAS data to be sorted, which can use a considerable amount of resources.

Debugging Information for ADABAS

If you are experiencing a problem with the SAS/ACCESS interface to ADABAS, the Technical Support staff at SAS might ask you to provide additional debugging information. They might instruct you to set a debugging option for your job and rerun it.

The ADBTRACE option is available as a data set option on your PROC statement or DATA step. For example, if ADBTRACE=1, you can look at the WHERE clause that was processed. That is, the SAS WHERE clause, if any, and the combined view WHERE clause appear on the SAS log.

The ADBTRACE= data set option can also be used to produce other types of traces for debugging purposes. Contact your SAS support personnel if you need more information.

System Options for PROC ACCESS and the Interface View Engine

Using ADBAUSE and ADEUSE System Options

Certain values used by the ACCESS procedure and the interface view engine are stored in two CSECTs (assembler language constant sections) and automatically linked with the SAS/ACCESS software load modules as system options. The two CSECTs are: ADBAUSE for the ACCESS procedure and ADBEUSE for the interface view engine.

The system options associated with PROC ACCESS control the default values used when creating a new access descriptor. The system options associated with the interface view engine control various run-time characteristics of the engine.

ADBAUSE System Options Default Values

The following system options set default values to be used by the ACCESS procedure when you create an access descriptor. You can override the default values by specifying different values by using the NSS, ADBFILE, SYSFILE, and SECFILE statements in the ACCESS procedure.

Table A2.2 ADBAUSE System Options Using the ACCESS Procedure

Option	Default	Purpose
ADBNATAP	blanks	NATURAL SECURITY system library identifier.
ADBNATPW	blanks	NATURAL SECURITY system user password.
ADBNATUS	blanks	NATURAL SECURITY system user identifier.
ADBSECCC	blanks	Security file cipher code.
ADBSECDB	0	Security file database identifier.
ADBSECFL	16	Security file number.
ADBSECPW	blanks	Security file password.
ADBSYSCC	blanks	System file cipher code.
ADBSYSDB	0	System file database identifier.
ADBSYSFL	15	System file number.
ADBSYSPW	blanks	System file password.

View Engine ADBEUSE System Options Default Values

The system options shown in the following table set default values to be used by the interface view engine to control various run-time characteristics. You can override some of these settings by specifying data set options in a SAS procedure.

Table A2.3 *ADBEUSE System Options Default Values*

Option	Default	Purpose
ADBBYMD	R	BY key mode processing:
		R - generate return code when adding a new periodic group to a record that has reached the maximum number of periodic group occurrences.
		N - add a new record.
ADBDBMD	M	Database execution mode:
		M - multi-user
		S - single user
ADBDEFW	0	Default WHERE clause setting:
		0 - creates a default WHERE clause for ADABAS data field formats as follows (assuming that the data field named AA is the first ADABAS descriptor file):
		where (aa<=0) or aa>0 (numeric)
		where aa>= " (alphanumeric blank)"
		1 - creates a default WHERE clause for ADABAS data field formats as follows (assuming that the data field named AA is the first ADABAS descriptor file):
		where aa=0 (numeric)
		where aa= "(alphanumeric blank)"
		2 - displays an error return code. A view WHERE clause or SAS WHERE clause is required when random access is desired or when performing updates.
ADBDEL	N	Deleting periodic group flag:
		N - nulls periodic group values when (1) more than one occurrence still exists or (2) other periodic groups exist within the ADABAS file but are not represented in the view descriptor.

Option	Default	Purpose
		P - always deletes the record, regardless of the existence of periodic group fields. The P means "to prune." When ADBDEL=P, you want to remove (reduce) what is superfluous, in this case, the entire logical record.
ADBDELIM	\	View WHERE clause delimiter.
ADBUPD	U	Engine authorization code:
		U - authorized to perform updates.
		R - read authorization only.
ADBFMTL	500	ADABAS format buffer length. Minimum value = 100.
ADBISNL	5000	ADABAS ISN buffer length. Minimum value = 100.
ADBMAXM	191	Maximum multiple-value occurrence number.
ADBMAXP	9	Maximum periodic group occurrence number.
ADBMINM	1	Minimum multiple-value occurrence number.
ADBRECL	7500	ADABAS record buffer length: Minimum value = 2100. Maximum value = 32767.
ADBSCHL	500	ADABAS search buffer length. Minimum value = 100.
ADBSPANS	*	View WHERE clause SPANS character.
ADBUISN	Y	User ISN flag:
		Y - user can specify ISN value when adding new records.
		N - user cannot specify ISN values.
ADBVALL	300	ADABAS value buffer length: Minimum value = 100. Maximum value = 32767.

Using ADBL3 System Option

ADBL3 system option can be used as a system option or as a data set option. The data set option overrides the system option, if both are used.

ADBL3=N | NO | Y | YES | O | ONLY

N | NO
L3 command should not be used.

Y | YES
L3 is used and S1 and S9 are used if L3 cannot be used.

O | ONLY
L3 is used and S2 is used, or an error is generated, when L3 cannot be used.

ADBL3 system option controls the use of the ADABAS L3 command by the interface view engine and what commands are used when L3 cannot be used. The L3 command optimizes WHERE and sort processing, with dramatic results for very large ADABAS files. However, there are limitations on when the command can be used.

Appendix 2
Advanced Topics

Introduction to Advanced Topics

This appendix contains details about some advanced topics such as using data set options, using multiple view descriptors, deleting and adding observations, using BY keys, and processing null values, as well as topics pertaining to selection criteria. The discussions supplement other portions of this document.

Data Set Options for ADABAS

In order for the ADABAS interface view engine to obtain ADABAS dictionary information, it needs certain ADABAS information. Specifically, the engine needs either a NATURAL DDM name or an ADABAS file number, in addition to a library identifier, a user identifier, passwords, cipher codes, and a database identifier.

If any of this information is required to access an ADABAS file or a NATURAL DDM but is not specified in the SAS/ACCESS view descriptor or cannot be obtained from either the ADBEUSE or ADBAUSE CSECT, you must use the appropriate data set option in your SAS procedure statement to supply the appropriate value.

Data set options enable you to specify these values. Data set options also enable you to override certain values that are specified in view descriptors but not enforced by ASSIGN SECURITY=YES.

Each data set option is an option in the DATA= specification where DATA= specifies a view descriptor that is used as input to a SAS procedure. Data set options apply only for the duration of that procedure.

The following example executes the FSEDIT procedure using a view descriptor named Vlib.UsaInv. The data set option specified in the PROC statement executes ADABAS using the NATURAL SECURITY password INVOICE.

```
proc fsedit data=vlib.usainv (adbnatpw='invoice');
run;
```

The available data set options appear below. Options marked with an asterisk (*) are enforced by ASSIGN SECURITY=YES. That is, if ASSIGN SECURITY=YES, the values specified in the view descriptor take precedence over values specified with a data set option; the data set option is ignored.

ADBCC=*'cipher-code'*
: specifies a cipher code for the target ADABAS file.

ADBDBID=*database-identifier*
: specifies a database identifier for the target ADABAS file.

ADBDEL=N | NO | Y | YES
: enables you to override the default value for the interface view engine's system option that determines whether a record containing periodic group fields should be completely deleted or its periodic group fields set to nulls. The default is set by the ADBDEL systems option in the ADBEUSE CSECT.

NO means set the fields to null; YES means delete the entire record.

ADBDDM=*'ddm-name'*
: specifies a NATURAL Data Definition Module (DDM) name. The ADBFILE and ADBDDM data set options are mutually exclusive. If you specified a DDM name in the view descriptor, you can use ADBDDM, but you cannot use ADBFILE. If you specified an ADABAS file number instead, you can use ADBFILE but not ADBDDM.

ADBFILE=*file-number*
: specifies an ADABAS file number. The ADBFILE and ADBDDM data set options are mutually exclusive. If you specified a DDM name in the view descriptor, you can use ADBDDM, but you cannot use ADBFILE. If you specified an ADABAS file number instead, you can use ADBFILE but not ADBDDM.

ADBFMTL=*length*
: specifies the length for the ADABAS format buffer. The minimum value is 100. The default value is 500.

ADBISNL=*length*
: specifies the length for the ADABAS ISN buffer. The minimum value is 100. The default value is 5,000.

ADBL3=N | NO | Y | YES | O | ONLY
: controls the use of the ADABAS L3 command by the interface view engine and what commands are used when L3 cannot be used. The L3 command optimizes WHERE and sort processing, with dramatic results for very large ADABAS files. However, there are limitations on when the command can be used.

NO means the L3 command should not be used; YES means that L3 is used and S1 and S9 are used if L3 cannot be used; ONLY means that L3 is used and S2 is used, or an error is generated, when L3 cannot be used.

ADBL3 data set option overrides the ADBL3 system option.

ADBNATAP=*'library-id'* *
: specifies a NATURAL SECURITY library identifier.

ADBNATPW=*'password'* *
: specifies a NATURAL SECURITY user password.

ADBNATUS=*'user-id'* *
: specifies a NATURAL SECURITY user identifier.

ADBPW=*'password'* *
: specifies an ADABAS password for the target ADABAS file.

ADBRECL=*length*
: specifies the length for the ADABAS record buffer. Acceptable values are in the range of 2,100–32,767. The default value is 7,500.

ADBSCHL=*length*
: specifies the length for the ADABAS search buffer. The minimum value is 100. The default value is 500.

ADBSECCC=*'cipher-code*' *
: specifies an ADABAS cipher code for the NATURAL SECURITY system file.

ADBSECDB=*database-identifier*
: specifies an ADABAS database identifier for the NATURAL SECURITY system file.

ADBSECFL=*file-number*
: specifies an ADABAS file number for the NATURAL SECURITY system file.

ADBSECPW=*'password'* *
: specifies an ADABAS password for the NATURAL SECURITY system file.

ADBSYSCC=*'cipher-code'* *
: specifies an ADABAS cipher code for the DDM system file.

ADBSYSDB=*database-identifier*
: specifies an ADABAS database identifier for the DDM system file.

ADBSYSFL=*file-number*
: specifies an ADABAS file number for the DDM system file.

ADBSYSPW=*'password'* *
: specifies an ADABAS password for the DDM system file.

ADBTRACE=*option*
: specifies a trace option, which analyzes problems in SAS software. The default is ADBTRACE=0. If you specify ADBTRACE=1, WHERE clauses are displayed in the log. For more information about ADBTRACE, see "Debugging Information for ADABAS" on page 131.

ADBVALL=*length*
: specifies the length for the ADABAS value buffer. Acceptable values are in the range of 100–32,767. The default value is 300.

Using Multiple View Descriptors

You can use more than one view descriptor in a single SAS session, but only one can be open for updating. This is the default mode of operation.

For information about how to modify the engine to support multiple view descriptors in a single SAS session, contact your SAS support personnel.

Deleting an ADABAS Observation

If the ADABAS file on which a view descriptor is based does not contain a periodic group, deleting an observation (for example, with the FSEDIT procedure DELETE command) causes a logical record to be deleted from the ADABAS data.

If the ADABAS file on which a view descriptor is based contains a periodic group, the results of deleting an observation depend on the status of the ADBDEL systems option. The ADBDEL systems option is set either in the ADBEUSE CSECT (see "System Options for PROC ACCESS and the Interface View Engine" on page 131) or by a data set option (see "Data Set Options for ADABAS" on page 138.)

- When ADBDEL=N (which is the default setting), the following results occur:
  - If there is only one periodic group occurrence (regardless of how many periodic group fields are in the view descriptor) and there are no other periodic group fields in the ADABAS file, deleting the observation containing

the one occurrence causes the logical record containing the occurrence to be deleted.

  - If there are multiple occurrences for any periodic group field(s) in the view descriptor or if there are other periodic group fields in the ADABAS file, deleting the observation containing values from a periodic group occurrence causes the selected values for that occurrence to be set to null. The record is not deleted.

- If ADBDEL=P, the entire logical record is deleted, even if there are multiple occurrences for periodic group fields in the view descriptor or if there are other periodic group fields in the ADABAS file.

Adding an ADABAS Observation

Adding ADABAS data as a result of Update operations from various SAS procedures might cause the interface view engine to decide whether to add a new logical record to the ADABAS file or modify an existing logical record, such as add an occurrence to a periodic group. The purpose of the engine making this determination is to reduce data redundancy.

The engine compares values in the new observation to be added to values in the previous observation. If the contents of the previous observation do not help determine whether to add or modify, a new logical record is added.

However, some of the new values might already reside in the ADABAS file, so a new record is not necessary. This situation occurs if a periodic group is included in a view descriptor, and the new data (which does not reside in the ADABAS file) occurs only in variables corresponding to data fields that are part of that periodic group.

The interface view engine can determine whether this situation exists. If not, a new logical record can be added. If so, an existing record can be modified. The optional BY key specification makes this possible. See “BY Key to Resolve Ambiguous Inserts” on page 141.

BY Key to Resolve Ambiguous Inserts

Using a BY Key to Resolve Ambiguous Inserts

When the interface view engine is called to examine additional ADABAS records in order to add a new periodic group occurrence, the engine must decide whether to add a new logical record or modify an existing one. The purpose is to reduce data redundancy.

You can help in the resolution of this decision by specifying a BY key. You can specify BY keys in the access descriptor by using the KEY statement. If ASSIGN

NAMES=NO, you can use the KEY statement to specify BY keys in the view descriptor. Only elementary data fields that are designated as ADABAS descriptors can be specified as BY keys.

A BY key is a set of match variables. A data field is a good candidate for a BY key if it uniquely identifies a logical record.

A BY key is similar to a BY group in SAS, which groups observations based on one or more fields. Many SAS procedures process records in BY groups. Also, some updates in the DATA step are performed by matching specified BY variables in different data sets. A similar matching process occurs with BY key data fields in the SAS/ACCESS interface to ADABAS.

The BY key comparison process is as follows:

1 If values for a BY key match a record already in the ADABAS file, it is modified. That is, the interface view engine inserts a new occurrence within a periodic group.

2 If values for a BY key do not match an existing record, a new record is added to the ADABAS file.

BY Key Examples

Introduction to BY Key Examples

The following examples illustrate that using a BY key helps keep data organized and prevents unnecessary duplication of data.

Suppose you are working with the following two ADABAS logical records, which make up three SAS observations as shown in the following output. The data field named DF1 is specified as a BY key. DF2 is a periodic group consisting of data fields DF21 and DF22.

Output A3.1 *By Key Example Containing Two ADABAS Logical Records of Three SAS Observations*

```
Data Fields        DF1            DF2
                                     DF21   DF22
Record 1           A                 CCC    1        (obs 1)
                                     CCC    2        (obs 2)
Record 2           B                 DDD    3        (obs 3)
```

By Key Example 1

You are in the FSEDIT procedure on observation 1. You enter an ADD or a DUP command and the values A, CCC, and 4. This is not an ambiguous insert, and a BY key is not required. The following output shows the result.

Output A3.2 *Results of Entering an ADD or DUP Command*

```
Data Fields        DF1            DF2
                                     DF21   DF22
Record 1           A                 CCC    1        (obs 1)
                                     CCC    2        (obs 2)
                                     CCC    4        (new observation (obs 4))
Record 2           B                 DDD    3        (obs 3)
```

By Key Example 2

You are in the FSEDIT procedure on observation 1. You enter an ADD or a DUP command and the values B, DDD, and 5 for data fields DF1, DF21, and DF22, respectively. This is an ambiguous insert because all the values that you are entering are different from the ones in observation 1. If there were not a BY key, the result would be as shown in the following output.

Output A3.3 *Results of an Ambiguous Insert*

```
Data Fields        DF1            DF2
                                     DF21   DF22
Record 1           A                 CCC    1        (obs 1)
                                     CCC    2        (obs 2)
                                     CCC    4        (obs 3)
Record 2           B                 DDD    3        (obs 4)
Record 3           B                 DDD    5        (new observation)
```

With a BY key, the engine locates the BY key value DF1=B. The following output shows the result.

Output A3.4 *Results with a BY Key*

```
Data Fields        DF1            DF2
                                     DF21   DF22
Record 1           A                 CCC    1        (obs 1)
                                     CCC    2        (obs 2)
                                     CCC    4        (obs 3)
Record 2           B                 DDD    3        (obs 4)
                                     DDD    5        (new observation)
```

By Key Example 3

You are in the FSVIEW procedure, looking at the first three observations. You decide to add the values B, DDD, and 7 at the end. The current position is the third observation on the display. The following output shows the result with no BY key.

Output A3.5 *Results without a BY Key*

```
Data Fields         DF1            DF2
                                      DF21   DF22
Record 1            A                 CCC    1        (obs 1)
                                      CCC    2        (obs 2)
                                      CCC    4        (obs 3)
Record 2            B                 DDD    3        (obs 4)
                                      DDD    5        (obs 5)
Record 3            B                 DDD    7        (new observation)
```

The following output shows the result with a BY key.

Output A3.6 *Results with a BY Key*

```
Data Fields         DF1            DF2
                                      DF21   DF22
Record 1            A                 CCC    1        (obs 1)
                                      CCC    2        (obs 2)
                                      CCC    4        (obs 3)
Record 2            B                 DDD    3        (obs 4)
                                      DDD    5        (obs 5)
                                      DDD    7        (new observation)
```

BY Key Considerations

When specifying BY keys for your view descriptors, keep in mind the following considerations:

- A duplicate consecutive observation results in an additional occurrence in any periodic group in the view descriptor.
- If you do an insert from an observation that has all missing values, the interface view engine inserts a record that is equivalent to all zeros and blanks.
- The APPEND function of the SAS Component Language (SCL) must be preceded by a call to the SET function. Otherwise, APPEND inserts an observation that is equivalent to all zeros and blanks because the insert is too ambiguous for the interface view engine to resolve.
- If a view descriptor includes a periodic group and you try to add an observation that is another occurrence in that periodic group, the add might fail if you are attempting to add more occurrences than the periodic group field definition allows. One of the following occurs, depending on whether a BY key is specified:
  - If no BY key is defined, and
    - if the last observation was not created from the periodic group, a new logical record is added.
    - if the last observation was created from the periodic group, the add fails with a return code, and a new record is then added.
  - If a BY key is defined and the periodic group is selected to have an added occurrence, the add fails and a message is displayed.

Missing Values (Nulls)

When the interface view engine is reading ADABAS data and constructing an observation, it could find missing (null) values for data fields within an observation.

The interface view engine uses the L1, L2, L3, and L4 commands to retrieve ADABAS data. The values are returned in the record buffer using the standard length and format defined for that field. (Standard length is not used if you have specified a value for the DB Content field or the field is a variable length field.) If the field's value is null, the data is returned in the format in effect for that field.

Formats and their corresponding null values are listed below.

Table A3.1 *ADABAS Data Formats and Null Values*

Format	Null Value
Alphanumeric	blanks
Binary	binary zeros
Fixed Point	binary zeros
Unpacked Decimal	unpacked decimal zeros
Packed Decimal	packed decimal zeros
Floating point	binary zeros

When an ADABAS record is read, the interface view engine is unable to tell whether a field has a value of zero (for numeric fields) or blanks (for alphanumeric fields) or truly has a null value. This is also true when you are updating. When you are using the FSEDIT procedure, if a value of zero or missing is used to modify an existing record, zeros are placed in the ADABAS record buffer and subsequently added to the ADABAS file. Blanks are placed in the record buffer if a blank or missing value was supplied for an alphanumeric field.

Since SAS missing values are stored as zeros and blanks in ADABAS files, some SAS WHERE clauses are also impacted. For example, if either of the following SAS WHERE clauses are issued,

```
where aa is missing;
where aa is null;
```

the resulting condition is sent to ADABAS:

```
where aa = 0 (numeric)
where aa = 'Ø' (alphanumeric)
```

Note: Null values are processed differently by ADABAS if the ADABAS descriptor used in a WHERE clause has the Null Value Suppress (NU) definition option defined for it.

Multiple-Value Fields in Selection Criteria

Using Multiple-Value Fields in Selection Criteria

A multiple-value field can have 0 to 191 values per record, and ADABAS assigns an occurrence number to each value. When you include a multiple-value field in SAS/ACCESS descriptor files, you can use SAS variables that reference individual occurrences and a SAS variable that references all occurrences to perform special WHERE clause queries.

The following table lists whether you can use a multiple-value field or its corresponding SAS variables in the SAS and view WHERE clauses.

Table A3.2 Multiple-Value Fields in WHERE Clauses

Multiple-Value Field	SAS WHERE Clause	View WHERE Clause
ADABAS data field name	no	yes
SAS name for individual Occurrence variable	yes	no
_ANY variable	yes	yes

Multiple-Value Fields WHERE Clause Examples

Introduction to Multiple-Value Fields WHERE Clause Examples

Using the multiple-value data field BRANCH-OFFICE from the CUSTOMERS DDM, the following examples illustrate using a multiple-value field in WHERE clauses.

Multiple-Value Fields WHERE Clause Example 1

In a view WHERE clause, you can reference an ADABAS multiple-value field name, but you cannot do so in a SAS WHERE clause. For example, with the following WHERE clause in a view descriptor, the interface view engine searches all values of the multiple-value field:

```
where branch-office='LONDON'
```

The view WHERE clause produces the results in the following output.

Output A3.7 *Results of ADABAS Multiple-Value Field Name in View WHERE Clause*

```
OBS    CUSTNUM     BR_ANY      BRANCH_1    BRANCH_2    BRANCH_3    BRANCH_4
  1    14324742                TORONTO     HOUSTON     TOKYO       LONDON
  2    26422096                LONDON      NEW YORK
  3    26984578                LONDON      NEW YORK    ROME
  4    27654351                LONDON      BOSTON
  5    28710427                LONDON
```

Multiple-Value Fields WHERE Clause Example 2

You can use the individual occurrence SAS variables created by the ACCESS procedure such as BRANCH_1, BRANCH_2, and so on, in SAS WHERE clauses, but you cannot use them in a view WHERE clause. Note that individual occurrence conditions must be processed by SAS after ADABAS has completed its selection processing.

For example, the following SAS WHERE clause searches the second occurrence for BRANCH-OFFICE and retrieves the London values. SAS post-processes all records returned from the interface view engine to see whether they meet the SAS WHERE clause in effect.

```
where branch_1='LONDON'
```

The SAS WHERE clause produces the results in the following output.

Output A3.8 *Results of Individual Occurrence SAS Variable in SAS WHERE Clause*

```
OBS    CUSTNUM     BR_ANY      BRANCH_1    BRANCH_2    BRANCH_3    BRANCH_4
  1    26422096                LONDON      NEW YORK
  2    26984578                LONDON      NEW YORK    ROME
  3    27654351                LONDON      BOSTON
  4    28710427                LONDON
```

Multiple-Value Fields WHERE Clause Example 3

You can use the _ANY variable created by the ACCESS procedure in both a SAS WHERE clause and a view WHERE clause. However, if you use the _ANY variable in a SAS WHERE clause, the ADABAS interface view engine must be able to process the entire SAS WHERE clause.

For example, with the following WHERE clause, the engine searches all occurrences of the multiple-value field:

```
where br_any = 'LONDON'
```

Whether that WHERE clause is a SAS WHERE clause or a view WHERE clause, the results in the following output are produced. They are the same as for Output A2.7 on page 147.

Output A3.9 *Results of _ANY Variable in View or SAS WHERE Clause*

```
OBS    CUSTNUM     BR_ANY      BRANCH_1    BRANCH_2    BRANCH_3    BRANCH_4
  1    14324742                TORONTO     HOUSTON     TOKYO       LONDON
  2    26422096                LONDON      NEW YORK
  3    26984578                LONDON      NEW YORK    ROME
  4    27654351                LONDON      BOSTON
  5    28710427                LONDON
```

This functionality prevents you from having to enter repetitive selection criteria such as the following:

```
where branch_1='LONDON' or branch_2='LONDON'
      or branch_3='LONDON' ...
```

Periodic Group Fields in Selection Criteria

Using Periodic Group Fields

For an ADABAS periodic group data field, the ACCESS procedure automatically creates a SAS variable for the occurrence number within the periodic group. For example, the NATURAL DDM named CUSTOMERS has a periodic group field named SIGNATURE-LIST, which groups data fields LIMIT and SIGNATURE. The ACCESS procedure creates a SAS variable named SL_OCCUR for the occurrence numbers in LIMIT and SIGNATURE.

By including the _OCCUR variable in a view descriptor, you can retrieve the occurrence numbers for the periodic group. You can also include the _OCCUR variable in SAS WHERE clauses to qualify data, but the condition is processed by SAS after ADABAS has completed its selection processing. You cannot update the occurrence values, and you cannot use the _OCCUR variable in a view WHERE clause.

The following table lists whether you can use periodic group SAS variable names, periodic group occurrence syntax, and a periodic group's corresponding _OCCUR variable in SAS and view WHERE clauses.

Table A3.3 Periodic Group Fields in WHERE Clauses

Periodic Group Field	SAS WHERE Clause	View WHERE Clause
SAS variable name	yes	yes
ADABAS data field name and occurrence syntax	no	yes
_OCCUR variable	yes	no

Periodic Group Fields WHERE Clause Examples

Introduction to Periodic Group Fields WHERE Clause Examples

Using the periodic group data field LIMIT from the CUSTOMERS DDM, the following examples illustrate using a periodic group data field in WHERE clauses.

Periodic Group Fields WHERE Clause Example 1

You can use the SAS variable name of a data field within a periodic group in both a SAS WHERE clause and a view WHERE clause. However, they do not always produce the same results because the SAS WHERE clause post-processes the results and, using the following example, looks at the value of variable LIMIT to determine whether it is equal to 5000. The view WHERE clause is not post-processed. When you use a periodic group field, ADABAS qualifies all periodic group occurrence values if any one meets the WHERE clause criteria.

For example, you can include the following WHERE clause in a view descriptor, and you can issue it as a SAS WHERE clause:

```
where limit = 5000
```

Stored in a view descriptor, the WHERE clause produces the results in the following output:

Output A3.10 Results of Referencing a Periodic Group Data Field in View a WHERE Clause

```
          OBS     CUSTNUM      SL_OCCUR                LIMIT

            1     12345678            1              5000.00
            2     14324742            1              5000.00
            3     14324742            2             25000.00
            4     14569877            1              5000.00
            5     14569877            2            100000.00
            6     19783482            1              5000.00
            7     19783482            2             10000.00
            8     26422096            1              5000.00
            9     26422096            2             10000.00
           10     27654351            1              5000.00
           11     29834248            1              5000.00
```

However, as a SAS WHERE clause, the results in the following output are produced.

Output A3.11 Results of Referencing Periodic Group Data Field in SAS WHERE Clause

```
          OBS     CUSTNUM      SL_OCCUR                LIMIT

            1     12345678            1              5000.00
            2     14324742            1              5000.00
            3     14569877            1              5000.00
            4     19783482            1              5000.00
            5     26422096            1              5000.00
            6     27654351            1              5000.00
            7     29834248            1              5000.00
            8     43459747            2              5000.00
```

Periodic Group Fields WHERE Clause Example 2

You can qualify a specific occurrence of a periodic group with a view WHERE clause, but only by using the periodic group occurrence syntax. However, all of the periodic group occurrence values for the qualified records are returned, not just the individual occurrence specified in the view WHERE clause. You cannot specify the occurrence syntax in a SAS WHERE clause. For example, this view WHERE clause produces the results in the following output.

```
where limit(2) = 5000
```

Output A3.12 *Results of Qualifying Periodic Group Occurrence Syntax in View WHERE Clause*

```
          OBS     CUSTNUM       SL_OCCUR                  LIMIT

            1     43459747             1                1000.00
            2     43459747             2                5000.00
```

Periodic Group Fields WHERE Clause Example 3

If you include the _OCCUR SAS variable in the view descriptor, you can use it in a SAS WHERE clause to specify an occurrence. However, you cannot use the _OCCUR variable in a view WHERE clause.

For example, this SAS WHERE clause produces the results shown in the following output.

```
where sl_occur = 2
```

Output A3.13 *Results of Including _OCCUR Variable in SAS WHERE Clause*

```
          OBS     CUSTNUM       SL_OCCUR                  LIMIT

            1     14324742             2               25000.00
            2     14569877             2              100000.00
            3     14898029             2               50000.00
            4     18543489             2               50000.00
            5     19783482             2               10000.00
            6     19876078             2               25000.00
            7     26422096             2               10000.00
            8     43459747             2                5000.00
```

To qualify the data even further, you could use this SAS WHERE clause, which produces the results in the following output.

```
where sl_occur = 2 and limit = 5000
```

Output A3.14 *Results of Including _OCCUR Variable and Occurrence Syntax in SAS WHERE Clause*

```
          OBS     CUSTNUM       SL_OCCUR                  LIMIT

            1     43459747             2                5000.00
```

SAS WHERE Clause

Using a SAS WHERE Clause

In addition to (or instead of) including a WHERE clause in your view descriptor for selection criteria, you can also specify a SAS WHERE clause in a SAS program for selection criteria.

When you specify a SAS WHERE clause, the SAS/ACCESS interface view engine translates those conditions into view WHERE clause conditions. Then, if the view descriptor includes a WHERE clause, the interface view engine connects the conditions with the Boolean operator AND. By default, the SAS WHERE clause conditions are connected before the view WHERE clause conditions. For example, if a view descriptor includes the condition

```
sex=female
```

and the SAS WHERE clause condition translates into

```
position=marketing
```

the resulting selection criteria are

```
(position=marketing) and (sex=female)
```

When the interface view engine translates SAS WHERE clause conditions into view WHERE clause conditions, some SAS WHERE clause capabilities are not available in a view WHERE clause. That is, some SAS WHERE clauses cannot be totally satisfied by the interface view engine.

For this possibility, the interface view engine first evaluates the SAS WHERE clause and determines whether the conditions can be handled. The interface view engine might be able to partially satisfy a SAS WHERE clause, as in the following example:

```
proc print data=vlib.emp1;
   where lastname < 'KAP' and payrate > 30 * overtime;
run;
```

The interface view engine translates as much of the SAS WHERE clause as possible without producing incorrect results or a syntax error. In the example above, the engine has no problem with the first condition, but the arithmetic in the second condition is not supported. The interface view engine uses the condition *where lastname* < *'KAP'* to filter out as many logical records as possible to improve performance.

Any conditions that are not supported are bypassed by the interface view engine, and post-processing (handled automatically by SAS) is required after the engine does its subsetting. The engine bypasses the following conditions:

- unacceptable conditions.
- conditions connected with OR to unacceptable conditions.

In the following table, assume DF1, DF2, and DF3 are ADABAS data fields referenced by a view descriptor. Remember that SAS never sees view WHERE clauses.

Table A3.4 Periodic Group Fields in WHERE Clauses

SAS WHERE Clause	View WHERE Clause	Translation	Processing Required?
DF2=B OR DF3>DF4+10	(DF1=A)	(DF1=A)	Yes
DF2=B & DF3>DF4+10	DF1=A	(DF2=B) & (DF1=A)	Yes
DF2=B & DF3>C	DF1=A	(DF2=B) & (DF3>C) & (DF1=A)	No
DF2=B OR DF3>C	DF1=A	(DF2=B) OR (DF3>C) & (DF1=A)	No

SAS WHERE Clause Conditions Acceptable to ADABAS

The following information explains how the interface view engine translates acceptable SAS WHERE clause conditions into view WHERE clause conditions.

- The operators are translated as shown in the following table.

  Table A3.5 Acceptable SAS WHERE Clause Conditions in View WHERE Clause Conditions

SAS WHERE Clause Syntax	View WHERE Clause Translation
=	=
>	>
<	<
<>	!=
≥	≥
≤	≤
(	(
)	)

SAS WHERE Clause Syntax	View WHERE Clause Translation
AND	AND
OR	OR

- The interface view engine also translates BETWEEN and IN conditions and the date format (if a SAS format is supplied in the DB Content field).

Table A3.6 Translating BETWEEN and IN Conditions and the Date Format

SAS WHERE Clause Syntax	View WHERE Clause Translation
DF1 BETWEEN 1 AND 3	(DF1 >= 1 AND DF1 <= 3)
DF1 IN (4,9,14)	DF1=4 OR DF1=9 or DF1=14
DF4 = '02AUG87'D	DF4 = 870802

SAS WHERE Clause Conditions Not Acceptable to ADABAS

Any SAS WHERE clause conditions that are not acceptable to the ADABAS interface view engine are handled automatically by SAS post-processing. The following are some (but not all) of those conditions:

- item-to-item comparison
- pattern matching
- arithmetic expressions:

```
WHERE DF1 = DF4 * 3
WHERE DF4 < - DF5
```

- expressions in which a variable or combination of variables assumes a value of 1 or 0 to signify true or false:

```
WHERE DF1
WHERE (DF1 = DF2) * 20
```

- concatenation of character variables
- truncated comparison:

```
DF1 =: ABC
```

- DATETIME and TIME formats:

```
'12:00'T
'01JAN60:12:00'DT
```

- SOUNDEX

- HAVING, GROUP BY
- NOT CONTAINS.

When a SAS WHERE Clause Must Reference Descriptor Data Fields

When you are using a SAS WHERE clause, a referenced ADABAS data field must be an ADABAS descriptor in the following situations:

- The SAS WHERE clause contains more than one condition.
- The SAS WHERE clause uses the SPANS or NE operator.
- You are also planning to issue a SAS BY statement or a SAS ORDER BY clause.
- The view descriptor also includes a view SORT clause.
- The view descriptor also includes a view WHERE clause.

Deciding How to Specify Selection Criteria

When to Use View WHERE Clause or SAS WHERE Clause

Use the following guidelines to determine when to use a SAS WHERE clause and when to use a view WHERE clause.

View WHERE Clause

Include a WHERE clause in your view descriptor when you want to do the following:

- restrict users of view descriptors to certain subsets of data
- prevent users from sequentially passing all the ADABAS data
- use syntax not available in the SAS WHERE clause, such as periodic group occurrence syntax or multiple-value compares.

SAS WHERE Clause

Use a SAS WHERE clause when the previous guidelines do not apply and you want to meet the following criteria:

- have more run-time flexibility in subsetting data
- use SAS WHERE clause capabilities that the view WHERE clause does not support, such as arithmetic expressions, truncated comparisons, or pattern matching
- use conditions on fabricated data fields such as ISN, periodic group _OCCUR variables, or any individually selected multiple-value fields
- combine AND and OR conditions using non-descriptor data fields.

Appendix 3
Example Data

Introduction to the ADABAS Example Data

This appendix provides information about the ADABAS files, NATURAL DDMs, access descriptors, view descriptors, and SAS data files used in the examples in this document.

It shows the ADABAS data definition statements and the data that were used to build the ADABAS files. It also shows the access descriptors and view descriptors, along with any selection criteria. In addition, this appendix shows the data and the SAS statements that were used to create the SAS data files for the examples.

If you want to run the examples in this document, contact your on-site SAS support personnel for information about accessing the sample library files. The sample files contain instructions for creating the ADABAS files. The steps are as follows:

1. Create the ADABAS files using the ADABAS data definition statements.
2. Create the NATURAL DDMs for the ADABAS files as shown in each description.
3. Create the SAS data files.
4. Create an access descriptor and an associated view descriptor for each ADABAS file. Make sure that all SAS names match between the view descriptor and the ADABAS file. Use the access descriptors in this appendix as a model. Select every field for the access descriptors, and create views that also select every field.
5. Run the APPEND procedure with the data set options shown below. Use the SAS data file to update the view.

   ```
   proc append data=SAS-file base=view-descriptor;
   run;
   ```

ADABAS Files

Customers, Employee, Invoice, and Order ADABAS Files

This section describes the ADABAS files associated with the NATURAL DDMs that are used in this document's examples. For each file, the following information is provided:

- the ADABAS data definition statements used to create the ADABAS file
- the SAS DATA step used to create the SAS data file for populating the ADABAS file
- the example data.

The four ADABAS files used in the examples are named Customers, Employee, Invoice, and Order.

Customers ADABAS File

The Customers file was created with the following ADABAS data definition statements:

```
//STEP01.DDCARD DD *
ADARUN PROGRAM=ADACMP
ADARUN DATABASE=001
ADARUN DEVICE=3380
ADARUN MODE=MULTI
ADARUN SVC=253
//STEP01.DDKARTE  DD  *
ADACMP COMPRESS
ADACMP FILE=45
ADACMP NUMREC=0
ADACMP FNDEF='01,CU,008,A,DE'
ADACMP FNDEF='01,SZ'
ADACMP FNDEF='02,ST,002,A,DE'
ADACMP FNDEF='02,ZI,005,U'
ADACMP FNDEF='01,CY,020,A,DE'
ADACMP FNDEF='01,PH,012,A'
ADACMP FNDEF='01,NA,060,A'
ADACMP FNDEF='01,CN,030,A'
ADACMP FNDEF='01,AD,040,A'
ADACMP FNDEF='01,CI,025,A'
ADACMP FNDEF='01,FO,006,U'
ADACMP FNDEF='01,SL,PE'
ADACMP FNDEF='02,LI,0014,U'
ADACMP FNDEF='02,SI,0030,A'
ADACMP FNDEF='01,BR,0025,A,MU(10)'
ADACMP SUPDE='SP=ST(1,2),ZI(1,2)'
ADACMP SUBDE='SB=ZI(1,2)'
//STEP02.DDCARD   DD  *
ADARUN PROGRAM=ADALOD
ADARUN DATABASE=001
ADARUN DEVICE=3380
ADARUN MODE=MULTI
ADARUN SVC=253
//STEP02.DDKARTE  DD  *
ADALOD LOAD FILE=45
ADALOD      DSSIZE=5B
ADALOD      NAME=CUSTOMERS
ADALOD      MAXISN=100
ADALOD      DSDEV=3380
ADALOD      TEMPDEV=3380
ADALOD      SORTSIZE=5
ADALOD      TEMPSIZE=5
```

The DATA step is as follows:

```
data customer;
     /* customer number        */
     input @1   custnum     $8.
           @10  state       $2.
           /* zipcode if company is  */
           /* in the U.S.; otherwise */
           /* it is the mail code    */
           /* appropriate for the    */
           /* country where the      */
           /* company is located     */
           @13  zipcode     5.
           @20  country     $20.
           @42  phone       $12.  /
           /* customer's company name*/
           @1   name        $60.  /
           /* contact at customer's  */
           /* company                */
           @1   contact     $30.

           @31  street      $40.  /
           @1   city        $25.
           /* date of first order    */
           @30  firstord    yymmdd6./
           /* signature limit #1     */
           @1   limit       15.2
           /* signature name  #1     */
           @20  signatur    $30. /
           /* branch office #1       */
           @1   branch_1    $25.
           /* branch office #2       */
           @30  branch_2    $25. /
           /* branch office #3       */
           @1   branch_3    $25.
           /* branch office #4       */
           @30  branch_4    $25.;
     format firstord date7.;
     datalines;
```

The data is shown in the following four outputs.

Output A4.1 *Data in Customers ADABAS File – Part 1*

```
 ************* CUSTOMER DATA ************
OBS  CUSTNUM     STATE    ZIPCODE    COUNTRY                 PHONE

  1  12345678     NC            .     USA                     919/489-5682
  2  14324742     CA        95123     USA                     408/629-0589
  3  14324742     CA        95123     USA                     408/629-0589
  4  14569877     NC        27514     USA                     919/489-6792
  5  14569877     NC        27514     USA                     919/489-6792
  6  14898029     MD        20850     USA                     301/760-2541
  7  14898029     MD        20850     USA                     301/760-2541
  8  14898029     MD        20850     USA                     301/760-2541

OBS  NAME

  1
  2  SANTA CLARA VALLEY TECHNOLOGY SPECIALISTS
  3  SANTA CLARA VALLEY TECHNOLOGY SPECIALISTS
  4  PRECISION PRODUCTS
  5  PRECISION PRODUCTS
  6  UNIVERSITY BIOMEDICAL MATERIALS
  7  UNIVERSITY BIOMEDICAL MATERIALS
  8  UNIVERSITY BIOMEDICAL MATERIALS

OBS  CONTACT                      STREET

  1
  2  A. BAUM                      5089 CALERO AVENUE
  3  A. BAUM                      5089 CALERO AVENUE
  4  CHARLES BARON                198 FAYETTVILLE ROAD
  5  CHARLES BARON                198 FAYETTVILLE ROAD
  6  S. TURNER                    1598 PICCARD DRIVE
  7  S. TURNER                    1598 PICCARD DRIVE
  8  S. TURNER                    1598 PICCARD DRIVE

OBS  CITY                FIRSTORD   LIMIT  SIGNATUR          BRANCH_1

  1                             .        .
  2  SAN JOSE            05FEB65     5000  BOB HENSON        TORONTO
  3  SAN JOSE            05FEB65    25000  KAREN DRESSER     TORONTO
  4  MEMPHIS             15AUG83     5000  JEAN CRANDALL     NEW YORK
  5  MEMPHIS             15AUG83   100000  STEVE BLUNTSEN    NEW YORK
  6  ROCKVILLE           12NOV76    10000  MASON FOXWORTH    NEW YORK
  7  ROCKVILLE           12NOV76    50000  DANIEL STEVENS    NEW YORK
  8  ROCKVILLE           12NOV76   100000  ELIZABETH PATTON  NEW YORK

OBS  BRANCH_2    BRANCH_3         BRANCH_4

  1
  2  HOUSTON     TOKYO            LONDON
  3  HOUSTON     TOKYO            LONDON
  4  CHICAGO     LOS ANGELES
  5  CHICAGO     LOS ANGELES
  6  CHICAGO     DALLAS
  7  CHICAGO     DALLAS
  8  CHICAGO     DALLAS
```

Output A4.2 *Data in Customers ADABAS File – Part 2*

```
 ************* CUSTOMER DATA ************

OBS  CUSTNUM     STATE    ZIPCODE    COUNTRY                 PHONE

  9  15432147     MI       49001     USA                     616/582-3906
 10  18543489     TX       78701     USA                     512/478-0788
 11  18543489     TX       78701     USA                     512/478-0788
 12  18543489     TX       78701     USA                     512/478-0788
 13  19783482     VA       22090     USA                     703/714-2900
 14  19783482     VA       22090     USA                     703/714-2900
 15  19876078     CA       93274     USA                     209/686-3953
 16  19876078     CA       93274     USA                     209/686-3953

OBS  NAME

  9  GREAT LAKES LABORATORY EQUIPMENT MANUFACTURERS
 10  LONE STAR STATE RESEARCH SUPPLIERS
 11  LONE STAR STATE RESEARCH SUPPLIERS
 12  LONE STAR STATE RESEARCH SUPPLIERS
 13  TWENTY-FIRST CENTURY MATERIALS
 14  TWENTY-FIRST CENTURY MATERIALS
 15  SAN JOAQUIN SCIENTIFIC AND INDUSTRIAL SUPPLY, INC.
 16  SAN JOAQUIN SCIENTIFIC AND INDUSTRIAL SUPPLY, INC.

OBS  CONTACT                      STREET

  9  D.W. KADARAUCH               103 HARRIET STREET
 10  A. SILVERIA                  5609 RIO GRANDE
 11  A. SILVERIA                  5609 RIO GRANDE
 12  A. SILVERIA                  5609 RIO GRANDE
 13  M.R. HEFFERNAN               4613 MICHAEL FARADAY DRIVE
 14  M.R. HEFFERNAN               4613 MICHAEL FARADAY DRIVE
 15  J.A. WHITTEN                 1095 HIGHWAY 99 SOUTH
 16  J.A. WHITTEN                 1095 HIGHWAY 99 SOUTH

OBS  CITY                FIRSTORD   LIMIT  SIGNATUR          BRANCH_1

  9  KALAMAZOO           28APR86    10000  JACK TREVANE      CHICAGO
 10  AUSTIN              10SEP79    10000  NANCY WALSH       HOUSTON
 11  AUSTIN              10SEP79    50000  TED WHISTLER      HOUSTON
 12  AUSTIN              10SEP79   100000  EVAN MASSEY       HOUSTON
 13  RESTON              18JUL68     5000  PETER THOMAS      WASHINGTON D.C.
 14  RESTON              18JUL68    10000  LOUIS PICKERING   WASHINGTON D.C.
 15  TULARE              11MAY79     7500  EDWARD LOWE
 16  TULARE              11MAY79    25000  E.F. JENSEN

OBS  BRANCH_2    BRANCH_3         BRANCH_4

  9  COLUMBUS
 10  DALLAS      EL PASO          LUBBOCK
 11  DALLAS      EL PASO          LUBBOCK
 12  DALLAS      EL PASO          LUBBOCK
 13  NEW YORK
 14  NEW YORK
 15
 16
```

Output A4.3 *Data in Customers ADABAS File – Part 3*

```
 ************* CUSTOMER DATA ************
OBS  CUSTNUM     STATE    ZIPCODE    COUNTRY                 PHONE

 17  24589689                  .     Yugoslavia              (012)736-202
 18  26422096               75014    France                  4268-54-72
 19  26422096               75014    France                  4268-54-72
 20  26984578                5110    Austria                 43-57-04
 21  27654351                5010    Belgium                 02/215-37-32
 22  28710427     HV         3607    Netherlands             (021)570517
 23  29834248                  .     Britain                 (0552)715311
 24  31548901     BC           .     Canada                  406/422-3413

OBS  NAME

 17  CENTAR ZA TECHNICKU I NAUCNU RESTAURIRANJE UMJETNINA
 18  SOCIETE DE RECHERCHES POUR DE CHIRURGIE ORTHOPEDIQUE
 19  SOCIETE DE RECHERCHES POUR DE CHIRURGIE ORTHOPEDIQUE
 20  INSTITUT FUR TEXTIL-FORSCHUNGS
 21  INSTITUT DE RECHERCHE SCIENTIFIQUE MEDICALE
 22  ANTONIE VAN LEEUWENHOEK VERENIGING VOOR MICROBIOLOGIE
 23  BRITISH MEDICAL RESEARCH AND SURGICAL SUPPLY
 24  NATIONAL COUNCIL FOR MATERIALS RESEARCH

OBS  CONTACT                        STREET

 17  J.V. VUKASINOVIC               TAKOVSKA 4
 18  Y. CHAVANON                    40 RUE PERIGNON
 19  Y. CHAVANON                    40 RUE PERIGNON
 20  GUNTER SPIELMANN               MECHITARISTENGASSE 5
 21  I. CLEMENS                     103 RUE D'EGMONT
 22  M.C. BORGSTEEDE                BIRMOERSTRAAT 34
 23  A.D.M. BRYCESON                44 PRINCESS GATE, HYDE PARK
 24  W.E. MACDONALD                 5063 RICHMOND MALL

OBS  CITY                FIRSTORD   LIMIT  SIGNATUR          BRANCH_1

 17  BELGRADE            30NOV81        .
 18  LA ROCHELLE         14JUN83     5000  MICHELE PICARD    LONDON
 19  LA ROCHELLE         14JUN83    10000  M.L. SEIS         LONDON
 20  VIENNA              25MAY87   100000  FRANZ BECH        LONDON
 21  BRUSSELS            14OCT86     5000  C.J. HELMER       LONDON
 22  THE HAGUE           10OCT85    10000  J.J. JASPER       LONDON
 23  LONDON, SW7 1PU     29JAN86     5000  ELVIN POMEROY     SINGAPORE
 24  VANCOUVER, V5T 1L2  19MAR84     1000  DAPHNE MARSHALL   SEATTLE

OBS  BRANCH_2    BRANCH_3         BRANCH_4

 17
 18  NEW YORK
 19  NEW YORK
 20  NEW YORK    ROME
 21  BOSTON
 22
 23  TORONTO     CAIRO
 24  TORONTO
```

Output A4.4 *Data in Customers ADABAS File – Part 4*

```
 ************* CUSTOMER DATA ************

OBS  CUSTNUM     STATE    ZIPCODE    COUNTRY                 PHONE

 25  38763919               1405     Argentina               244-6324
 26  39045213     SP        1051     Brazil                  012/302-1021
 27  43290587                  .     Japan                   (02)933-3212
 28  43459747               3181     Australia               03/734-5111
 29  43459747               3181     Australia               03/734-5111
 30  46543295                  .     Japan                   (03)022-2332
 31  46783280               2374     Singapore               3762855
 32  48345514                  .     United Arab Emirates    213445

OBS  NAME

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 27  HASSEI SAIBO GAKKAI
 28  RESEARCH OUTFITTERS
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 29  R.G. HUGHES                   191 LOWER PLENTY ROAD
 30                                4-3-8 ETCHUJMA, KOTO-KU
 31  LING TAO SOON                 356 CLEMENTI ROAD
 32  J.Q. RIFAII                   POB 8032

OBS  CITY                FIRSTORD   LIMIT  SIGNATUR          BRANCH_1

 25  BUENOS AIRES        10DEC84     2500  M.L. CARLOS       MIAMI
 26  SAO PAULO           18AUG82     1500  RICK ESTABAN      MIAMI
 27  TOKYO 101           08FEB74    10000  R. YAMOTO         SAN FRANCISCO
 28  PRAHRAN, VICTORIA   28JUL72     1000  DENNIS RICHMOND   SEATTLE
 29  PRAHRAN, VICTORIA   28JUL72     5000  JANICE HEATH      SEATTLE
 30  TOKYO 102           19APR84    10000  DAPHNE MARSHALL   SEATTLE
 31  SINGAPORE           27SEP79        .
 32  RAS AL KHAIMAH      10SEP86        .

OBS  BRANCH_2    BRANCH_3         BRANCH_4

 25  NEW YORK
 26  NEW YORK
 27
 28
 29
 30  TORONTO     SAN FRANCISCO    DENVER
 31
 32
```

Employee ADABAS File

The Employee ADABAS file was created with the following ADABAS data definition statements:

```
//STEP01.DDCARD DD *
ADARUN PROGRAM=ADACMP
ADARUN DATABASE=001
ADARUN DEVICE=3380
ADARUN MODE=MULTI
ADARUN SVC=253
//STEP01.DDKARTE  DD  *
ADACMP COMPRESS
ADACMP FILE=46
ADACMP NUMREC=0
ADACMP FNDEF='01,ID,006,U,DE'
ADACMP FNDEF='01,HD,006,U'
ADACMP FNDEF='01,SA,007,U'
ADACMP FNDEF='01,DP,006,A'
ADACMP FNDEF='01,JC,005,U,DE'
ADACMP FNDEF='01,SX,001,A'
ADACMP FNDEF='01,BD,006,U'
ADACMP FNDEF='01,LN,018,A,DE'
ADACMP FNDEF='01,FN,015,A'
ADACMP FNDEF='01,MN,015,A'
ADACMP FNDEF='01,PH,004,A'
//STEP02.DDCARD   DD  *
ADARUN PROGRAM=ADALOD
ADARUN DATABASE=001
ADARUN DEVICE=3380
ADARUN MODE=MULTI
ADARUN SVC=253
//STEP02.DDKARTE  DD  *
ADALOD LOAD FILE=46
ADALOD      DSSIZE=5B
ADALOD      NAME=EMPLOYEE
ADALOD      MAXISN=100
ADALOD      DSDEV=3380
ADALOD      TEMPDEV=3380
ADALOD      SORTSIZE=5
ADALOD      TEMPSIZE=5
```

The DATA step is as follows:

```
data employ;
    /* employee id number        */
    input @1  empid     6.
          @10 hiredate  yymmdd6.
          @20 salary    8.2
          @30 dept      $6.
          @40 jobcode   5.
          @47 sex       $1.
          @50 birthdat  yymmdd6. /
          @1  lastname  $18.
```

```
              @20 firstnam  $15.
              @40 middlena  $15.
              @60 phone     $4. ;
        format hiredate date7.;
        format birthdat date7.;
        datalines;
```

The data is shown in the following output.

Output A4.5 *Data for Employee ADABAS File*

```
EMPID     HIREDATE     SALARY      DEPT     JOBCODE    SEX    BIRTHDAT

119012     01JUL68     42340.58    CSR010       602      F     05JAN46
120591     05DEC80     31000.55    SHP002       602      F     12FEB46
123456     04APR89            .                   .                  .
127845     16JAN67     75320.34    ACC024       204      M     25DEC43
129540     01AUG82     56123.34    SHP002       204      F     31JUL60
135673     15JUL84     46322.58    ACC013       602      F     21MAR61
212916     15FEB51     52345.58    CSR010       602      F     29MAY28
216382     15JUN85     34004.65    SHP013       602      F     24JUL63
234967     19DEC88     17000.00    CSR004       602      M     21DEC67
237642     01NOV76     43200.34    SHP013       602      M     13MAR54
239185     07MAY81     57920.66    ACC024       602      M     28AUG59
254896     04APR85     35000.74    CSR011       204      M     06APR49
321783     10SEP67     48931.58    CSR011       602      M     03JUN35
328140     10JAN75     75000.34    ACC043      1204      F     02JUN51
346917     02MAR87     46000.33    SHP013       204      F     15MAR50
356134     14JUN85     62450.75    ACC013       204      F     25OCT60
423286     19DEC88     32870.66    ACC024       602      M     31OCT64
456910     14JUN78     45000.58    CSR010       602      M     24SEP53
456921     19AUG87     33210.04    SHP002       602      M     12MAY62
457232     15JUL85     55000.66    ACC013       602      M     15OCT63
459287     02NOV64     50000.00    SHP024       204      M     05JAN34
677890     12DEC88     37610.00    CSR010       204      F     24APR65

LASTNAME            FIRSTNAM        MIDDLENA      PHONE

WOLF-PROVENZA       G.              ANDREA        3467
HAMMERSTEIN         S.              RACHAEL       3287
VARGAS              PAUL            JESUS
MEDER               VLADIMIR        JORAN         6231
CHOULAI             CLARA           JANE          3921
HEMESLY             STEPHANIE       J.            6329
WACHBERGER          MARIE-LOUISE    TERESA        8562
PURINTON            PRUDENCE        VALENTINE     3852
SMITH               GILBERT         IRVINE        7274
BATTERSBY           R.              STEPHEN       8342
DOS REMEDIOS        LEONARD         WESLEY        4892
TAYLOR-HUNYADI      ITO             MISHIMA       0231
GONZALES            GUILLERMO       RICARDO       3642
MEDINA-SIDONIA      MARGARET        ROSE          5901
SHIEKELESLAM        SHALA           Y.            8745
DUNNETT             CHRISTINE       MARIE         4213
MIFUNE              YUKIO           TOSHIRO       3278
ARDIS               RICHARD         BINGHAM       4351
KRAUSE              KARL-HEINZ      G.            7452
LOVELL              WILLIAM         SINCLAIR      6321
RODRIGUES           JUAN            M.            5879
NISHIMATSU-LYNCH    CAROL           ANNE          6245
```

Invoice ADABAS File

The Invoice ADABAS file was created with the following ADABAS data definition statements:

```
//STEP01.DDCARD DD *
ADARUN PROGRAM=ADACMP
ADARUN DATABASE=001
ADARUN DEVICE=3380
ADARUN MODE=MULTI
ADARUN SVC=253
//STEP01.DDKARTE  DD  *
ADACMP COMPRESS
ADACMP FILE=47
ADACMP NUMREC=0
ADACMP FNDEF='01,IV,005,U,DE'
ADACMP FNDEF='01,BT,008,A'
ADACMP FNDEF='01,AM,014,U,DE'
ADACMP FNDEF='01,CY,020,A,DE'
ADACMP FNDEF='01,AU,010,U'
ADACMP FNDEF='01,BB,006,U,DE'
ADACMP FNDEF='01,BO,006,U'
ADACMP FNDEF='01,PO,006,U,DE'
ADACMP FNDEF='01,CX,008,G'
//STEP02.DDCARD   DD  *
ADARUN PROGRAM=ADALOD
ADARUN DATABASE=001
ADARUN DEVICE=3380
ADARUN MODE=MULTI
ADARUN SVC=253
//STEP02.DDKARTE  DD  *
ADALOD LOAD FILE=47
ADALOD      DSSIZE=5B
ADALOD      NAME=INVOICE
ADALOD      MAXISN=100
ADALOD      DSDEV=3380
ADALOD      TEMPDEV=3380
ADALOD      SORTSIZE=5
ADALOD      TEMPSIZE=5
```

The DATA step is as follows:

```
data invoice;
    /* invoice number           */
    input  @1  invoicen 5.
           /* company that placed the order */
           @7  billedto $8.

           /* amount of bill in local currency */
           @15 amtbille 15.2
           @30 country  $20.
           /* amount of bill in U.S. dollars */
           @50 amountin 11.2 /
```

```
              /* employee who wrote the bill */
              @1  billedby 6.

              /* date that bill was sent  */
              @10 billedon yymmdd6.

              /* date that bill was paid  */
              @20 paidon   yymmdd6.

              /* time of day that the     */
              /* exchange rate to U.S.    */
              /* dollars was computed     */
              @30 computed time8. ;
       format billedon date7.;
       format paidon date7.;
       datalines;
```

The data is shown in the following output.

Output A4.6 *Data for Order ADABAS File*

```
INVOICEN    BILLEDTO        AMTBILLE    COUNTRY       AMOUNTIN

    11270     39045213    1340738760.9    Brazil        2256870.0
    11271     18543489      11063836.0    USA          11063836.0
    11273     19783482        252148.5    USA            252148.5
    11276     14324742       1934460.0    USA           1934460.0
    11278     14898029       1400825.0    USA           1400825.0
    11280     39045213    1340738760.9    Brazil        2256870.0
    11282     19783482        252148.5    USA            252148.5
    11285     38763919      34891210.2    Argentina     2256870.0
    11286     43459747      12679156.0    Australia    11063836.0
    11287     15432147        252148.5    USA            252148.5
    12051     39045213    1340738760.9    Brazil        2256870.0
    12102     18543489      11063836.0    USA          11063836.0
    12263     19783482        252148.5    USA            252148.5
    12468     14898029       1400825.0    USA           1400825.0
    12471     39045213    1340738760.9    Brazil        2256870.0
    12476     38763919      34891210.2    Argentina     2256870.0
    12478     15432147        252148.5    USA            252148.5

  BILLEDBY    BILLEDON     PAIDON    COMPUTED

    239185     05OCT88     18OCT88      39646
    457232     05OCT88     11OCT88          .
    239185     06OCT88     11NOV88          .
    135673     06OCT88     20OCT88          .
    239185     06OCT88     19OCT88          .
    423286     07OCT88     20OCT88      58154
    457232     07OCT88     25OCT88          .
    239185     10OCT88     30NOV88      55163
    423286     10OCT88           .      33827
    457232     11OCT88     04NOV88          .
    457232     02NOV88           .      31185
    239185     17NOV88           .          .
    423286     05DEC88           .          .
    135673     24DEC88     02JAN89          .
    457232     27DEC88           .      50945
    135673     24DEC88           .      39563
    423286     24DEC88     02JAN89          .
```

Order ADABAS File

The Order ADABAS file was created with the following ADABAS data definition statements:

```
//STEP01.DDCARD DD *
ADARUN PROGRAM=ADACMP
ADARUN DATABASE=001
ADARUN DEVICE=3380
ADARUN MODE=MULTI
ADARUN SVC=253
//STEP01.DDKARTE  DD  *
ADACMP COMPRESS
ADACMP FILE=48
ADACMP NUMREC=0
ADACMP FNDEF='01,ON,005,U,DE'
ADACMP FNDEF='01,SN,004,U'
ADACMP FNDEF='01,LN,004,U'
ADACMP FNDEF='01,FC,010,U'
ADACMP FNDEF='01,ST,008,A,DE'
ADACMP FNDEF='01,DO,006,U'
ADACMP FNDEF='01,DS,006,U'
ADACMP FNDEF='01,TB,006,U'
ADACMP FNDEF='01,PB,006,U'
ADACMP FNDEF='01,SF,001,A'
//STEP02.DDCARD   DD  *
ADARUN PROGRAM=ADALOD
ADARUN DATABASE=001
ADARUN DEVICE=3380
ADARUN MODE=MULTI
ADARUN SVC=253
//STEP02.DDKARTE  DD  *
ADALOD LOAD FILE=48
ADALOD      DSSIZE=5B
ADALOD      NAME=ORDER
ADALOD      MAXISN=100
ADALOD      DSDEV=3380
ADALOD      TEMPDEV=3380
ADALOD      SORTSIZE=5
ADALOD      TEMPSIZE=5
```

The DATA step is as follows:

```
data orders;
    /* order number                 */
    input @1  ordernum 5.
          /* stock number                 */
          @6  stocknum 4.

          /* length of material ordered   */
          @10 length   4.

          /* fabric charges               */
          @15 fabricch 11.2
          /* customer whom order is to be */
          /* shipped to                   */
          @27 shipto   $8.


          /* date of order                */
          @35 dateorde yymmdd6.
          /* date that order was shipped  */
          @45 shipped  yymmdd6.

          /* employee who took the order  */
          @55 takenby  6.


          /* employee who processed the order  */
          @62 processe 6.

          /* this flag signals that       */
          /* special instructions are     */
          /* associated with this order.  */
          @69 speciali $1. ;
     format dateorde date7.;
     format shipped date7.;
     datalines;
```

The data is shown in the following output.

Output A4.7 *Data for Order ADABAS File*

```
  O     S            F                     D                   P   S
  R     T            A                     A       S    T      R   P
  D     O    L       B        S            T       H    A      O   E
  E     C    E       R        H            E       I    K      C   C
  R     K    N       I        I            O       P    E      E   I
  N     N    G       C        P            R       P    N      S   A
  U     U    T       C        T            D       E    B      S   L
  M     M    H       H        O            E       D    Y      E   I

11269 9870  690           . 19876078 03OCT88       . 212916      .
11270 1279 1750   2256870.0 39045213 03OCT88 19OCT88 321783 237642 X
11271 8934  110  11063836.0 18543489 03OCT88 13OCT88 456910 456921
11272 3478 1000           . 29834248 03OCT88       . 234967      .
11273 2567  450    252148.5 19783482 04OCT88 14NOV88 119012 216382
11274 4789 1000           . 15432147 04OCT88       . 212916      .
11275 3478 1000           . 29834248 04OCT88       . 234967      .
11276 1279 1500   1934460.0 14324742 04OCT88 21OCT88 321783 120591 X
11277 8934  100  10058033.0 31548901 05OCT88       . 456910      .
11278 2567 2500   1400825.0 14898029 05OCT88 20OCT88 119012 456921
11279 9870  650           . 48345514 05OCT88       . 212916      .
11280 1279 1750   2256870.0 39045213 06OCT88 21OCT88 321783 237642 X
11281 8934  110  11063836.0 18543489 06OCT88 27OCT88 456910 216382
11282 2567  450    252148.5 19783482 06OCT88 26OCT88 119012 456921
11283 9870  690           . 18543489 07OCT88       . 212916      .
11284 3478 1000           . 24589689 07OCT88       . 234967      .
11285 1279 1750   2256870.0 38763919 07OCT88 02DEC88 321783 120591 X
11286 8934  110  11063836.0 43459747 07OCT88 03NOV88 456910 237642
11287 2567  450    252148.5 15432147 07OCT88 07NOV88 119012 216382
11288 9870  690           . 14324742 10OCT88       . 212916      . Y
11969 9870  690           . 19876078 25OCT88       . 212916      .
12051 1279 1750   2256870.0 39045213 31OCT88       . 321783      . X
12102 8934  110  11063836.0 18543489 15NOV88       . 456910      .
12160 3478 1000           . 29834248 19NOV88       . 234967      . Z
12263 2567  450    252148.5 19783482 01DEC88       . 119012      .
12464 4789 1000           . 15432147 23DEC88       . 212916      .
12465 3478 1000           . 29834248 23DEC88       . 234967      .
12466 1279 1500   1934460.0 14324742 23DEC88       . 321783      . X
12467 8934  100  10058033.0 31548901 23DEC88       . 456910      .
12468 2567 2500   1400825.0 14898029 23DEC88 03JAN89 119012 120591
12470 9870  650           . 48345514 23DEC88       . 212916      .
12471 1279 1750   2256870.0 39045213 23DEC88       . 321783      . X
12472 8934  110  11063836.0 18543489 23DEC88 03JAN89 456910 237642
12473 2567  450    252148.5 19783482 23DEC88       . 119012      .
12474 9870  690           . 18543489 23DEC88       . 212916      .
12475 3478 1000           . 24589689 23DEC88       . 234967      .
12476 1279 1750   2256870.0 38763919 23DEC88 03JAN89 321783 456921 X
12477 8934  110  11063836.0 43459747 23DEC88       . 456910      .
12478 2567  450    252148.5 15432147 23DEC88 03JAN89 119012 216382
12479 9870  690           . 14324742 23DEC88       . 212916      .
```

NATURAL DDMs Based on the ADABAS Files

CUSTOMERS DDM

The CUSTOMERS DDM contains the description in the following output.

Output A4.8 CUSTOMERS DDM

```
VIEW   : CUSTOMERS                           DEF.SEQ:   DBID:1   FNR:  45
COMMAND:
I T L DB NAME                              F LENG  S D       REMARK
- - - -- -----------bottom----------- - ----  - - ------------------
    1 CU CUSTOMER                          A 8.0     D
  G 1 SZ STATEZIP
    2 ST STATE                             A 2.0     D
    2 ZI ZIPCODE                           N 5.0
    1 CY COUNTRY                           A 20.0    D
    1 PH TELEPHONE                         A 12.0
    1 NA NAME                              A 60.0
    1 CN CONTACT                           A 30.0
    1 AD STREETADDRESS                     A 40.0
    1 CI CITY                              A 25.0
    1 FO FIRSTORDERDATE                    N 6.0
  P 1 SL SIGNATURE-LIST
    2 LI LIMIT                             N 14.2
    2 SI SIGNATURE                         A 30.0
  M 1 BR BRANCH-OFFICE                     A 25.0
    1 SP STATE-ZIPLAST2                    A 4.0
    1 SB ZIPLAST2                          N 2.0
```

EMPLOYEE DDM

The EMPLOYEE DDM contains the description shown in the following output.

Output A4.9 *EMPLOYEE DDM*

```
VIEW   : EMPLOYEE                            DEF.SEQ:   DBID:1   FNR:  46
COMMAND:
I T L DB NAME                          F LENG  S D       REMARK
- - - -- ------------all-------------- - ----  - - ------------------
    1 ID EMPID                         N 6.0     D
    1 HD HIREDATE                      N 6.0
    1 SA SALARY                        N 7.2
    1 DP DEPT                          A 6.0
    1 JC JOBCODE                       N 5.0     D
    1 SX SEX                           A 1.0
    1 BD BIRTHDATE                     N 6.0
    1 LN LASTNAME                      A 18.0    D
    1 FN FIRSTNAME                     A 15.0
    1 MN MIDDLENAME                    A 15.0
    1 PH PHONE                         A 4.0
```

INVOICE DDM

The INVOICE DDM contains the description shown in the following output.

Output A4.10 *INVOICE DDM*

```
VIEW   : INVOICE                             DEF.SEQ:   DBID:1   FNR:  47
COMMAND:
I T L DB NAME                          F LENG  S D       REMARK
- - - -- ------------all-------------- - ----  - - ------------------
    1 IB INVOICENUM                    N 5.0     D
    1 BT BILLEDTO                      A 8.0
    1 AM AMTBILLED                     N 14.2    D
    1 CY COUNTRY                       A 20.0    D
    1 AU AMOUNTINUS                    N 10.2
    1 BB BILLEDBY                      N 6.0     D
    1 BO BILLEDON                      N 6.0
    1 PO PAIDON                        N 6.0     D
    1 CX COMPUTEREXCHANGE              F 8.0   F
```

ORDER DDM

The ORDER DDM contains the description shown in the following output.

Output A4.11 *ORDER DDM*

```
VIEW   : ORDER                                 DEF.SEQ:   DBID:1   FNR:  48
COMMAND:
I T L DB NAME                          F LENG  S D       REMARK
- - - -- ------------all------------- - ----  - - ------------------
    1 ON ORDERNUM                      N 5.0     D
    1 SN STOCKNUM                      N 4.0
    1 LN LENGTH                        N 4.0
    1 FC FABRICCHARGES                 N 10.2
    1 ST SHIPTO                        A 8.0     D
    1 DO DATEORDERED                   N 6.0
    1 DS SHIPPED                       N 6.0
    1 TB TAKENBY                       N 6.0
    1 PB PROCESSEDBY                   N 6.0
    1 SF SPECIALINSTRUCTION            A 1.0
```

Access Descriptors for ADABAS

Access Descriptors Based on ADABAS Files

Adlib.Customer Access Descriptor

The Adlib.Customer access descriptor was created as follows:

```
proc access dbms=adabas;
   create adlib.customer.access;
   adbfile(number=15 password=cuspw
           cipher=cuscc dbid=1);
   sysfile(number=15 password=cuspwsys
           cipher=cusccsys dbid=1);
   secfile(number=16 password=cuspwsec
           cipher=cusccsec dbid=1);
   assign=yes;
   rename cu = custnum
          ph = phone
          ad = street;
   format fo = date7.;
   informat fo = date7.;
   content fo = yymmdd6.;
   mvf br occurs = 4
run;
```

By specifying an ADABAS file number instead of a DDM, the definition bypasses NATURAL SECURITY. The following is an example of the same access descriptor written to use NATURAL SECURITY:

```
proc access dbms=adabas;
   create adlib.customer.access;
   nss(library=sasdemo user=demo password=demopw);
   adbfile(password=cuspw cipher=cusscc dbid=1);
   sysfile(number=15 password=cuspwsys
           cipher=cuscсsys dbid=1);
   secfile(number=16 password=cuspwsec
           cipher=cusccsec dbid=1);
   ddm=customers;
   assign=yes;
   rename customer = custnum
          telephone = phone
          streetaddress = street;
   format firstorderdate = date7.;
   informat firstorderdate = date7.;
   content firstorderdate = yymmdd6.;
   mvf "BRANCH-OFFICE" occurs = 4
run;
```

Access Descriptors Based on the NATURAL DDMs

MyLib.Custs Access Descriptor

The MyLib.Custs access descriptor was created as follows:

```
proc access dbms=adabas;
   create mylib.custs.access;
   nss(library=demo user=demo1 password=demo1);
   sysfile(number=15 dbid=1);
   secfile(number=16 dbid=1);
   ddm=customers;
   assign=yes;
   drop contact;
   rename customer = custnum
          telephone = phone
          streetaddress = street;
   format firstorderdate = date7.;
   informat firstorderdate = date7.;
   content firstorderdate = yymmdd6.;
```

```
      mvf "BRANCH-OFFICE" occurs = 4;
   run;
```

MyLib.Employee Access Descriptor

The MyLib.Employee access descriptor was created as follows:

```
   proc access dbms=adabas;
      create mylib.employee.access;
      nss(library=demo user=demo1 password=demo1);
      sysfile(number=15 dbid=1);
      secfile(number=16 dbid=1);
      ddm=employee;
      assign=yes;
      format hiredate = date7.;
      informat hiredate = date7.;
      content hiredate = yymmdd6.;
      format birthdate = date7.;
      informat birthdate = date7.;
      content birthdate = yymmdd6.;
   run;
```

MyLib.Invoice Access Descriptor

The MyLib.Invoice access descriptor was created as follows:

```
   proc access dbms=adabas;
      create mylib.invoice.access;
      nss(library=demo user=demo1 password=demo1);
      sysfile(number=15 dbid=1);
      secfile(number=16 dbid=1);
      ddm=invoice;
      assign=yes;
      format billedon = date7.;
      informat billedon = date7.;
      content billedon = yymmdd6.;
      format paidon = date7.;
      informat paidon = date7.;
      content paidon = yymmdd6.;
   run;
```

MyLib.Order

The MyLib.Order access descriptor was created as follows:

```
   proc access dbms=adabas;
      create mylib.order.access;
      nss(library=demo user=demo1 password=demo1);
      sysfile(number=15 dbid=1);
      secfile(number=16 dbid=1);
      ddm=order;
      assign=yes;
      format dateordered = date7.;
      informat dateordered = date7.;
      content dateordered = yymmdd6.;
      format shipped = date7.;
      informat shipped = date7.;
      content shipped = yymmdd6.;
   run;
```

View Descriptors Based on the Access Descriptors for ADABAS

Vlib.AdaEmps View Descriptor

The Vlib.AdaEmps view descriptor was created as follows:

```
proc access dbms=adabas ad=mylib.employee;
   create vlib.adaemps.view;
   select empid birthdate;
   select lastname firstname middlename;
run;
```

Vlib.AllEmp View Descriptor

The Vlib.AllEmp view descriptor was created as follows:

```
proc access dbms=adabas ad=mylib.employee;
   create vlib.allemp.view;
   select all;
   reset isn;
run;
```

Vlib.AllOrdr View Descriptor

The Vlib.AllOrdr view descriptor was created as follows:

```
proc access dbms=adabas ad=mylib.order;
   create vlib.allordr.view;
   select all;
   reset isn;
run;
```

Vlib.CusOrdr View Descriptor

The Vlib.CusOrdr view descriptor was created as follows:

```
proc access dbms=adabas ad=mylib.order;
   create vlib.cusordr.view;
   select stocknum shipto;
run;
```

Vlib.CusPhon View Descriptor

The Vlib.CusPhon view descriptor was created as follows:

```
proc access dbms=adabas ad=mylib.custs;
   create vlib.cusphon.view;
   select customer telephone name;
run;
```

Vlib.EmpInfo View Descriptor

The Vlib.EmpInfo view descriptor was created as follows:

```
proc access dbms=adabas ad=mylib.employee;
   create vlib.empinfo.view;
   select empid dept lastname;
run;
```

Vlib.Emps View Descriptor

The Vlib.Emps view descriptor was created as follows. This descriptor includes sort and WHERE statements to specify selection criteria.

```
proc access dbms=adabas ad=mylib.employee;
   create vlib.emps.view;
   select empid jobcode birthdate lastname;
   subset where jobcode = 602;
   subset sort lastname;
run;
```

Vlib.ForInvView Descriptor

The Vlib.ForInv view descriptor was created as follows. This descriptor includes a WHERE statement to specify selection criteria.

```
proc access dbms=adabas ad=mylib.invoice;
   create vlib.forinv.view;
   select all;
   reset isn computedexchange;
   subset where country != 'USA';
run;
```

Vlib.Inv View Descriptor

The Vlib.Inv view descriptor was created as follows. This descriptor includes a sort statement to specify selection criteria.

```
proc access dbms=adabas ad=mylib.invoice;
   create vlib.inv.view;
   select invoicenum amtbilled country
      billedby paidon;
   subset sort billedby;
run;
```

Vlib.UsaCust View Descriptor

The Vlib.UsaCust view descriptor was created as follows. This descriptor includes SORT and WHERE statements to specify selection criteria.

```
proc access dbms=adabas ad=mylib.custs;
   create vlib.usacust.view;
   select all;
   reset isn telephone streetaddress
     city "STATE-ZIPLAST2" ziplast2;
   mvf "BRANCH-OFFICE" reset br_any
     branch_1 branch_3 branch_4;
   subset where country = 'USA';
   subset sort customer;
run;
```

Vlib.UsaInv View Descriptor

The Vlib.UsaInv view descriptor was created as follows. This descriptor includes a WHERE statement to specify selection criteria.

```
proc access dbms=adabas ad=mylib.invoice;
   create vlib.usainv.view;
   select all;
   reset isn computedexchange;
   subset where country = 'USA';
run;
```

Vlib.UsaOrdr View Descriptor

The Vlib.UsaOrdr view descriptor was created as follows. This view descriptor uses a SORT statement to specify selection criteria.

```
proc access dbms=adabas ad=mylib.order;
   create vlib.usaordr.view;
   select ordernum stocknum length
     fabriccharges shipto;
   subset sort shipto;
run;
```

SAS Data Files for ADABAS

MyData.OutOfStk SAS Data File

The SAS data file MyData.OutOfStk is used in “Introduction to Using ADABAS Data in SAS Programs” on page 21. It was created with the following SAS statements:

```
libname mydata 'your-SAS-library';
data mydata.outofstk;
   input fibernam $8.  /* fiber name    */
         fibernum;     /* fiber number  */
   datalines;
olefin   3478
gold     8934
dacron   4789
;
run;
```

The following PRINT procedure lists the data show in Output 3.11 on page 34.

```
proc print data=mydata.outofstk;
   title 'SAS Data File MYDATA.OUTOFSTK';
run;
```

MyData.SASEmps SAS Data File

The SAS data file MyData.SASEmps is used in “Introduction to Browsing and Updating ADABAS Data” on page 43. It was created with the following SAS statements:

```
libname mydata 'your-SAS-library';
data mydata.sasemps;
/* employee identification    */
   input empid
         /* birth date        */
         birthdat date7.
         /* last name         */
         lastname $18.
         /* first name        */
         firstnam $15.
         /* middle name       */
         middlena $15.;
   datalines;
245962 30AUG64 BEDORTHA      KATHY         MARTHA
765432 01MAR59 POWELL        FRANK         X.
219223 13JUN47 HANSINGER     BENJAMIN      HAROLD
326745 21FEB52 RAWN          BEATRICE      MAY
;
run;
```

The following PRINT procedure lists the data in Output 4.11 on page 57.

```
proc print data=mydata.sasemps;
   title 'Data in MYDATA.SASEMPS Data File';
   format birthdat date7.;
run;
```

Lib6.Birthday Data File

The SAS data file Lib6.Birthday is used in “Introduction to Using ADABAS Data in SAS Programs” on page 21. It was created with the following SAS statements:

```
libname lib6 'your-SAS-library';
data lib6.birthday;
   /* employee identification */
   input empid
         /* birth date              */
         birthdat date7.
         /* last name               */
         lastname $18.;
   datalines;
129540 31JUL60 CHOULAI
356134 25OCT60 DUNNETT
127845 25DEC43 MEDER
677890 24APR65 NISHIMATSU-LYNCH
```

```
459287 05JAN34 RODRIGUES
346917 15MAR50 SHIEKELESLAN
254896 06APR49 TAYLOR-HUNYADI
;
run;
```

The following PRINT procedure lists the data shown in Output 3.15 on page 39.:

```
proc print data=lib6.birthday;
   title 'LIB6.BIRTHDAY Data File';
   format birthdat date7.;
run;
```