1 Preface

The functions and architectural features of the SESAM/SQL-Server database system meet all the demands placed on a powerful database server in today's world. These characteristics are reflected in its name: SESAM/SQL-Server.

SESAM/SQL-Server is available in a standard edition for single-task operation and in an enterprise edition for multitask operation.

For the sake of simplicity, we shall use the name SESAM/SQL throughout this manual to refer to SESAM/SQL-Server.

1.1 Brief product description

SESAM/SQL is the relational database server for BS2000/OSD systems. SESAM/SQL combines the advantages of the relational data model with all the characteristics expected of a system which is subject to high loads in productive operation. On the one hand, this offers simple operation and data which is independent of the physical storage method used and, on the other, it means that the system is suitable for high transaction rates and large volumes of data and possesses outstanding security and availability characteristics.

The SQL interface implemented in SESAM/SQL has been based across the board on the ISO/IEC 9075:1992 standard and on ISO/IEC 9075:1999. This standardized SQL interface means that SESAM/SQL allows you to create portable, future-proof database applications which can be transferred to different database systems and operating systems.

SESAM/SQL fulfils all the demands placed on a modern database system in today's world:

– SESAM/SQL uses SQL, a uniform language and a consistent set of terms for defining, structuring and maintaining a relational database and for creating application programs.

– SESAM/SQL runs on all BS2000/OSD systems and can be used as a powerful SQL server for BS2000/OSD, SINIX/UNIX and MS-DOS/MS-Windows clients.

– SESAM/SQL excels in terms of high availability, security and data integrity.

- SESAM/SQL fulfils all the security criteria for level C2 of the Department of Defense (Orange Book) and level F2/Q3 of the Bundesamt für Sicherheit in der Informationstechnik (BSI - The German Federal Authority for Information Technology Security) with the exception of the Security Audit Trail function (SAT) for providing evidence of operations. Trusted communications between the application program and the database system are provided along with trusted authentication of users.
- SESAM/SQL supports modern parallel processing techniques for multi-user operation and multi-database processing.
- The Universal Transaction Monitor *open*UTM and the SESAM/SQL database system together form a powerful DB/DC system including fully coordinated transaction processing and restart facilities for online applications.
- The product SESAM/SQL-DCN allows transparent, efficient and trusted access to distributed databases in BS2000/OSD networks.
- PC users can use SESAM-DBAccess to access SESAM/SQL databases.
- A large range of add-on products increases the range of application of SESAM/SQL. These products range from database design tools, programming languages and third and fourth generation software development environments through to easy-to-use products for end users and the use of SESAM/SQL in World Wide Web applications.

Brief description of CALL DML

CALL DML is a CALL interface for processing SESAM/SQL databases.
CALL DML provides statements for the following functions:

- open and close a CALL DML table, which must be part of a SESAM/SQL database
- add, update and delete data in a CALL DML table
- search and record output in a CALL DML table
- transaction-oriented security and administration of the DBH

1.2 Target group

This manual is intended for all CALL DML application programmers.

This manual provides the user with a description of CALL DML language constructs, a description of how to create CALL DML programs, and a description of the CALL DML utility routines together with examples.

In order to better understand the information contained in this manual, it would be helpful to be familiar with the concept of transactions and have a basic knowledge of the BS2000 operating system and the Universal Transaction Monitor *open*UTM.

1.3 Summary of the contents of the manuals

The documentation for the SESAM/SQL database system can be found in the following manuals:

- Core Manual
- SQL Reference Manual, Part 1: SQL Statements
- SQL Reference Manual, Part 2: Utilities
- CALL DML Applications
- Database Operation
- Utility Monitor
- Messages
- Glossary

The following additional documentation is also available:

- Migrating SESAM Databases and Applications to SESAM/SQL-Server
- Performance

The following manual describes how to create ESQL-COBOL programs:

- ESQL-COBOL User Guide

The following manuals describe remote access with SESAM-DBAccess:

- DBAccess V2.0A Client Installation, Administration, ODBC
- DBAccess V2.0A Service Installation, Administration
- DBAccess V2.0A ESQL/C
- SESAM-DBAccess (JDBC) V3.0A

If you are searching for information on a specific topic, you can use the table of contents, the index or the running headers. References to other documents are given in abbreviated form in the text. The complete title of the document referenced is included under ‘Related Publications’ at the back of the manual.

1.3.1 Summary of the contents of this manual

This manual describes the transfer areas at the CALL DML interface. It contains all DML statements and includes information on the old data types.

Examples of the DML statements are included in a separate chapter. All the examples are based on the same CALL DML tables.

Other chapters provide information on programming transactions, on compiling, linking and loading, and on using UTM and DCAM.

A description of the CALL DML utility programs SEDI61 and SEDI63, including examples, has been included in a separate chapter.

1.3.2 Guide to the SESAM/SQL manuals

Core Manual

The “Core Manual“ provides an overview of the database system and describes basic principles, concepts and interrelationships. It provides the basis for understanding all the other SESAM/SQL manuals.

SQL Reference Manual
Part 1: SQL Statements and Part 2: Utilities

The SQL Reference Manual, Part 1 deals with the embedding of programs and describes the syntax and semantics of the SQL language constructs in alphabetical order.

The utility statements are not included in this alphabetical list and are dealt with separately in the “SQL Reference Manual, Part 2: Utilities”.

Both simple and complex examples are used to clarify the functions of the SQL language constructs.

The “ESQL-COBOL User Guide” explains how to create ESQL programs.

CALL DML Applications

This manual is aimed at CALL DML programmers and describes the language constructs used in the CALL DML interface and explains how to create CALL DML programs.

Database Operation

This manual is aimed at the system administrator and covers database operation. It includes details on starting and terminating the DBH and DCN and the associated load options and administration statements. The manual also describes the utilities required for database operation.

Utility Monitor

This manual describes how to use the utility monitor and the functions it provides. The utility monitor is a component part of SESAM/SQL and provides a menu-driven interface for creating, loading, backing up and reconstructing a database using SQL statements. The utility monitor also provides simple methods of querying the metadata.

Messages

This manual contains all the messages from the SESAM/SQL database system and the distribution component SESAM/SQL-DCN. The messages are usually accompanied by brief texts explaining the meaning and suggesting response measures. The SQL codes and CALL DML status codes are also listed here.

Glossary

This manual contains the glossary.

Migrating SESAM Databases and Applications to SESAM/SQL-Server

This manual gives an overview of the new concepts and functions contained in SESAM/SQL-Server V2. The main emphasis is on the relationship to previous versions in order to facilitate migration to the new SESAM/SQL-Server environment for existing SESAM/SQL users.

Performance

This manual is aimed at experienced SESAM/SQL users. It describes how users can identify performance bottlenecks and indicates which parameters can be used to influence system performance.

1.4 README file

Information on any functional changes and additions to the current product version described in this manual can be found in the product-specific README file. You will find the README file on your BS2000 computer under the name SYSRME.*product.version.language*.

The user ID under which the README file is located can be obtained from your systems support staff. You can view the README file with the /SHOW-FILE command or in an editor, and print it on a standard printer using the following command:

```
/PRINT-DOCUMENT filename, LINE-SPACING=*BY-EBCDIC-CONTROL

or, if SPOOL with a version earlier than 3.0A is used:

/PRINT-FILE FILE-NAME=filename,LAYOUT-CONTROL=
    PARAMETERS(CONTROL-CHARACTERS=EBCDIC)
```

1.5 Changes in V3.0 made since V2.2

A list of the most important changes made in SESAM/SQL-Server V3.0 compared with V2.2 is contained in table 1. The table also shows the manual and chapter /section in which you will find a description of each change. If a topic is described in more than one manual, the one which contains a complete description is listed first. The entries in the “Manual” column have the following meanings:

Core	Core Manual	RM P1	Reference Manual, Part 1
RM P2	Reference Manual, Part 2	DBO	Database Operation
Utilmon	Utility Monitor	CALL-DML	CALL-DML Applications
Perf	Performance		

Topic	**Manual**	**Chapter/ section**
System architecture		
Task concept, multitask operation	Core	7.1
Notational conventions		
Syntax descriptions are based on SDF Version 4.1A	DBO	1.6
Working with the SESAM/SQL-DBH		
New: special start commands	DBO	2.1
DBH start statements and options		
New DBH-TASKS In the STORAGE-SIZE option, the STACK-POOL parameter is no longer used In the TRANSFER-CONTAINER option, the THREAD-BUFFER and REORGANISATION parameters are no longer used; the maximum values for the INITIAL and MAXIMUM parameters have been increased	DBO Core	3.2 7.1
SESDCN control statements		
New option: SESDLG-PASSWORD	DBO Core	4.5 7.11
Administration using SESADM		
New start command	DBO	5.1
Administration statements and administration commands		
Various minor changes	DBO	5.2
SESMON		
New: TASKS form	DBO	7.4

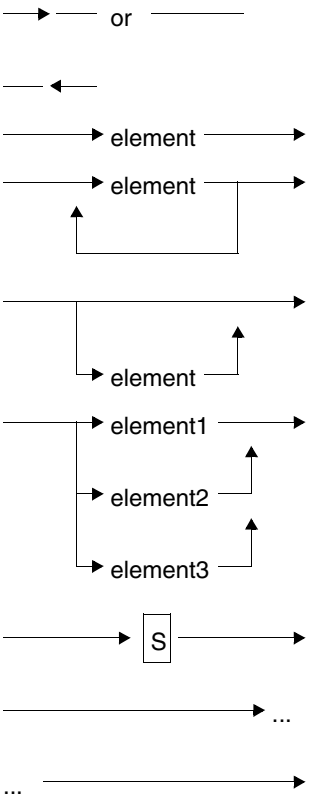
Table 1: Changes made in Version 3.0 since Version 2.2 (part 1 of 2)

Topic	Manual	Chapter/ section
Modified: SERVICE ORDERS, STATEMENTS, SYSTEM-INFORMATION, TRANSACTIONS	DBO	7.4
Omitted: QUEUES form	DBO	7.4
Output to file Modified: DBH record Modified: output to SYSLST	 DBO DBO	 7.5 7.6
Error handling		
New: messages in special situations	DBO	8.2
SEDI70		
New: editing the CAT-LOG and DA-LOG files	DBO	9.3
CALL-DML		
Number of Open flags allowed has changed	CALL-DML	3.2
SEDI61		
New start command	CALL-DML	7.1
SEDI63		
New start command	CALL-DML	7.2
Distributed processing		
Communication between different versions has been modified	Core	7.4.
Files and job variables		
Export via WORK files is no longer supported: WORK file has been omitted Job variables SESAM.START, SESAM.END and SESAM.ERROR are omitted	Core DBO	7.7 9.5
Buffers and containers		
Stack pool and thread buffer are omitted	Core	7.7
Utility monitor		
New start command	Utilmon	3
UTM interface		
Now described in a separate chapter	Core	9
Performance		
Brought into line with V3.0	Perf	

Table 1: Changes made in Version 3.0 since Version 2.2 (part 2 of 2)

1.6 Notational conventions

The DML statements are described by means of syntax diagrams using the following notation:



Read direction left to right (default): the right-pointing arrow can be omitted.

Read direction right to left

Mandatory syntax element

Mandatory syntax element: must be specified at least once and may be repeated

Optional syntax element

Syntax elements, just one of which must be specified

Subfunction that is described in a separate syntax diagram

End of a section of a syntax diagram (continued)

Continuation of a section of a syntax diagram

These forms of notation can be combined as required.

Each syntax diagram contains a header line which contains the names of the syntax elements, and also their displacement from the start of the statement and their length in the form displacement/length.

Example:

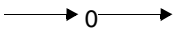
Password 0/3	The password must be entered at displacement 0 with a length of 3.

The displacement and length are specified in exactly the same way in the description of “Password”.

Syntax elements of a DML statement may be constants or variables:

– The *constants* must be entered by the user exactly as shown in the syntax diagram.

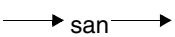
Example:



You must enter “0” on issuing the statement.

– With *variables*, the user must substitute the appropriate value for the variable names. Names of variables are shown in lowercase.

Example:



When you give this statement, you must substitute the appropriate value for "san", e.g. "AD7".

The following metacharacters are used to define the acknowledgment, response and inquiry areas:

{ } Braces enclose a series of values, of which one may occur.

[ ] Square brackets indicate that the contents of the brackets are optional.

- The contents of the field are of no interest to the user.

... Repetition of the preceding specification.

2 CALL DML interface

SESAM/SQL databases are accessed via application programs that contain DML statements to the SESAM/SQL DBH for retrieving and updating data and for administration.

– Retrieval statements are used to select individual attributes or records.

– Update statements are used to update individual attributes or selected records.

– Administration statements are used to issue commands to the SESAM/SQL DBH and SESAM/SQL-DCN.

Retrieval and update statements access a section of the CALL DML table. This section is referred to as a logical file and represents the user´s view of the CALL DML table at the time the database is accessed.

CALL DML can only be used to process CALL DML tables.
In CALL DML tables there is a null attribute value for each attribute.
When a CALL DML table is created with SQL, each attribute is automatically assigned a null attribute value (see “SQL Reference Manual, Part 1”, CREATE CALL DML TABLE).

DML statements can be tested with the SESAM utility routine SEDI63. This allows the user to ensure that all DML statements are correct before including them in the application program.

2.1 CALL DML calls

A database is accessed via the CALL interface of the various programming languages.

CALL DML calls can be used to access CALL DML tables in SESAM/SQL databases. A CALL DML call comprises the areas that make up a DML statement:

Statement area: This contains a definition of the statement to be executed by the SESAM/SQL DBH.

Acknowledgment area:
The SESAM/SQL DBH returns status messages and, in certain cases, the number of response records here (execution messages in the case of statement execution, or error messages in the case of errors).

Response area: This is where retrieval statements return response records.

Inquiry area: This contains comparison values for retrieval statements in which comparison conditions are applied to attributes or primary key values. For direct updates, it contains the data to be updated or inserted, or the primary key value of a record to be deleted.

The application program transfers the areas of a DML statement for processing SESAM/SQL databases when the connection module is called.
The program must define the transfer areas with a sufficient length for these CALL DML calls. When the areas are passed to the connection module, it must be in the sequence in which they are listed above.

CALL DML calls can call the appropriate connection module at various entry addresses in the application program. The following table shows the possible entry addresses of the connection modules:

Connection module	**Entry addresses (CALL DML calls)**
SESMOD	SESAM, SESPUT, SESGET, SESGETW
SESUTMC	SESAM
SESDCAM	SESAM, SESPUT, SESGET, SESGETW

Table 2: Entry addresses in the connection module

The CALL DML calls have the following meanings:

SESAM The application program passes a DML statement to the DBH and fetches an acknowledgment and a response from the DBH.

SESPUT The application program passes a DML statement and continues processing.

SESGET The application program inquires whether a DML statement issued by means of SESPUT has received a response.
If no response was returned, status message 83 appears in the acknowledgment area. The application program repeats the inquiry until a response is available.

SESGETW The application program inquires whether a DML statement issued by means of SESPUT has received a response.
The application program waits until a response is indicated.

2.2 Format and meaning of the transfer areas

Statement area

The application program places the DML statement in the statement area. The length of the statement area is variable.

Acknowledgment area

The acknowledgment area has a fixed length of 16 bytes.

In the acknowledgment area, the application program passes the file identifier of the logical file on which the DML statement is to operate.

After execution of a DML statement, the SESAM/SQL DBH places information about the execution of the statement in the acknowledgment area. The acknowledgment area has the following format:

Displ.	Length	Entry	Meaning
0	2	st	Status
2	4		The information placed in these bytes depends on the statement involved.
6	2	ff	File identifier of the logical file
8	2		The information placed in these bytes depends on the statement involved.
10	2	ss	Status subnumber
12	4		The information placed in these bytes depends on the statement involved.

Table 3: Format of the acknowledgment area

The status must be interrogated by the application program and appropriate action taken by the program. Otherwise, a misleading status may occur in the next statement.
The status subnumber provides additional diagnostic information which cannot, however, be interpreted by the application program.

Response area

After a retrieval statement, the DBH places the first response record of the logical file in the response area. In block mode, the first group of response records is placed in the response area.

A response record contains:
– the primary key value (in the default case)
– the attribute values in the order in which the attributes were referenced in the statement, and in the format defined in the attribute catalog.

The maximum number of bytes per response that can be placed in the response area is defined in the open statement. Thus the length of the response area defined in the program must be large enough for this number of bytes.

The remaining responses can be output to the response area by means of the *response polling* statement.

Inquiry area

In retrieval statements that select records based on comparison values, the comparison values must be placed by the application program in the inquiry area, and their length must be that defined in the attribute catalog.

In direct update statements, the attribute values that are to be updated or inserted are placed in the inquiry area. For *deletion*, this area contains the primary key value of the record to be deleted.

The order of entries in the inquiry area must be the same as the order in which the attributes are specified in the statement.

Format of statement and inquiry areas

The statement and inquiry areas are of variable length and must therefore include a length field:

Displ.	Length	Entry	Meaning
0	2	length+4	Length of statement area (entry) + 4 or inquiry area (entry) + 4
2	2	␣␣	
4	-	{ statement inquiry }	DML statement Inquiry area entries

Table 4: Format of the statement and inquiry areas

The length fields can either contain the maximum value or be set to the actual value dynamically by the program.

Please note:
The connection module transfers to the DBH statement and inquiry areas of the length specified. If the lengths defined are too long, unnecessarily long messages are passed by the application program to the DBH, thereby degrading the performance.

If the inquiry area is not analyzed by a statement, X´FFFFFFFF´ can be passed to the DBH instead of the address of the inquiry area. If this cannot be done, an empty inquiry area must be passed with a value of 4 in the length field.

The length specification in the length field of the inquiry area is compared with the lengths of the attributes as defined in the attribute catalog. If the inquiry area is too small, the statement is rejected with a status code.

The minimum length of the inquiry area can be calculated as follows:

2 x length of primary key

In a follow-up statement, the inquiry area must be formatted as for the preceding base statement. This applies even if the follow-up statement does not reference all the fields in the inquiry area. In the CALL DML call, the 4-byte length fields must not be transferred with the statement and inquiry area.

The application program can monitor the occurrence of errors by checking the acknowledgment area for particular status codes. The appropriate actions must be included in the program.

None of the four areas may be changed between a SESPUT call and a SESGET call. Otherwise, the SESGET call will be rejected with a status code.

2.3 Mixed operation of SQL and CALL DML interfaces

SESAM/SQL supports both CALL DML and SQL interfaces. Implementing ESQL-COBOL makes it possible to use both interfaces in the same application program. A COBOL program that is to employ both interfaces can sign on to the SESAM/SQL DBH with either a DML statement or an SQL statement:

- CALL DML statements only access resources reserved in the SESAM/SQL DBH specifically by CALL DML statements.
- Similarly, SQL statements can only access resources reserved by SQL statements.

A program is in

– CALL DML mode if the last statement to the SESAM/SQL DBH was a CALL DML statement

– SQL mode if the last statement to the SESAM/SQL DBH was an SQL statement

and is handled like a program with the appropriate interface. The format of the status codes is that of the last mode activated.

The following notes refer to mixed operation of CALL DML and SQL interfaces in the same application program:

– DML statements can only be used to process CALL DML tables.

– An application program that uses both interfaces has only signed off from the SESAM/SQL DBH correctly once the resources of both interfaces have been released.

For more information on the transaction concept, please also refer to the “Core Manual”.

The following applies to application programs that pass CALL DML statements to the SESAM/SQL DBH with SESPUT:
Switching from CALL DML mode to SQL mode is not possible if SESPUT calls are open for the task.

2.4 Examples of the various programming languages

CALL DML call in COBOL programs

Format:

```
CALL "SESAM" USING statement acknowledgment response inquiry.
```

The four transfer areas of the CALL DML call must be defined in the WORKING-STORAGE SECTION or, for subprograms, in the LINKAGE SECTION.

The following example shows a definition of the data areas and the corresponding CALL DML call:

```
01 STATEMENT-AREA.
   02 STA-LENGTH           PIC 9(4) COMP VALUE 57.
   02 FILLER               PIC XX        VALUE SPACE.
   02 STATEMENT.
      03 PASSWORD          PIC X(3).
      03 OPERATION         PIC X(50).
01 AKNOWLEDGMENT.
   02 STATU                PIC XX.
   02 FILLER               PIC X(4).
   02 FILE-ID              PIC XX.
   02 FILLER               PIC X(8).
01 RESPONSE.
   02 PRIMARY-KEY          PIC X(8).
   02 RESPONSE-RECORD      PIC X(70).
01 INQUIRY-AREA.
   02 INQ-LENGTH           PIC 9(4) COMP VALUE 12.
   02 FILLER               PIC XX        VALUE SPACE.
   02 INQUIRY              PIC X(8).
   . . .
   PROCEDURE DIVISION.
   . . .
    CALL "SESAM" USING STATEMENT ACKNOWLEDGMENT RESPONSE INQUIRY.
   IF STATU NOT = "00"
   THEN
   GO TO STATPROC.
   . . .
   STATPROC.
   . . .  User processing of status message
```

The length fields of the statement and inquiry areas must be 2-byte binary fields. They can be defined by means of the following PIC clauses:

```
PIC 9(num) COMP. where 1 ≤ num ≤ 4.
```

CALL DML call in Assembler programs

```
 LA   1,param
 L    15,=V(SESAM)
 BALR 14,15
```

Statement section:

```
       STM  14,1,SAVE
       LA   1,PARAM
       L    15,=V(SESAM)
       BALR 14,15
       LM   14,1,SAVE

       CLC  STATUS,C'00'
       BE   ...processing
       B    ...status handling
```

Definition section:

```
PARAM  DC   A(STA...)
       DC   A(ACK...)
       DC   A(RES...)
       DC   A(INQ...)

SAVE   DS   4F
```

CALL DML call in PASCAL programs

Format:

```
sesam (sp.sta,sp.ack,sp.res,sp.inq);
```

Definition section:

```
type area    = array(.1..1000.) of char;
     lfield  = 1..1004;
     spacef  = array(.1..2.) of char;
     sespar  = record

               statl   : lfield;      {statement area}
               stats   : spacef;
               stat    : area;

               ack     : area;        {acknowledgment area}

               resp    : area;        {response area}

               inql    : lfield;      {inquiry area}
               inqs    : spacef;
               inq     : area;
     end;
var  sp      : sespar;
procedure sesam (var s,a,r,i : area); external;
     . . .
```

Statement section:

```
sesam (sp.sta,sp.ack,sp.res,sp.inq);
     . . .
```

The underlined numbers are sample values and must be updated to suit the application.

CALL DML call in FORTRAN programs

Format:

```
CALL␣SESAM␣(statement,acknowledgment,response,inquiryarea)
```

The statement areas should be set up with the aid of DIMENSION, COMMON, EQUIVALENCE and DATA.

Database operations can however only be performed successfully on attributes with data formats (such as INTEGER 2, INTEGER or REAL) which correspond with those of FORTRAN (i.e. halfword, word and double word).

CALL DML call in PL/I programs

Format:

```
CALL␣SESAM␣(STATEMENT,ACKNOWLEDGMENT,RESPONSE,INQUIRY);
```

Definition section:

```
DCL SESAM   ENTRY OPTIONS (ASSEMBLER);
DCL SESAREA AREA(6000);
      /                                                                  */
DCL 1 STA BASED (ZSTA),                          /    STATEMENT AREA      */
      5 LENGTH BIN FIXED(15),
      5 SPACE  CHAR(2) INIT('  '),
      5 STATEMENT,
        10 PASSWORD CHAR(3),
        10 OPCODE   CHAR(1),
        10 TEXT     CHAR(LSTA-4);
      /                                                                  */
DCL 1 ACKNOWLEDG,                                /    ACKNOWLEDGMENT AREA */
      5 STATUS   CHAR(2) INIT(' '),
      5 RES1     CHAR(4) INIT(' '),
      5 FILE-ID  CHAR(2) INIT(' '),
      5 RES2     CHAR(2) INIT(' '),
      5 ADD-INFO CHAR(2) INIT(' '),
      5 RES3     CHAR(4) INIT(' ');
      /                                                                  */
DCL   RESPONSE   CHAR(LRSP) BASED (PRSP);        /    RESPONSE AREA       */
      /                                                                  */
DCL 1 INQ BASED (PINQ),                          /    INQUIRY AREA        */
      5 LENGTH BIN FIXED(15),
      5 SPACE  CHAR(2) INIT('  '),
      5 INQUIR CHAR(LINQ);
      /                                                                  */
DCL STATEMENTAREA       CHAR(2044) VAR;          /    INPUT BUFFER        */
DCL INQUIRYAREA         CHAR(2044) VAR;          /    INPUT BUFFER        */
DCL (LSTA,LRSP,LINQ)    BIN FIXED(15);           /    LENGTH FIELDS       */
DCL (PSTA,PRSP,LINQ)    POINTER INIT (NULL);     /    POINTER -> AREA     */
```

CALL DML call in ALGOL programs

Format:

```
CALLFO(SESAM,STA,ACK,RES,INQ);
```

Definition section:

```
'PROCEDURE'INITFO;'CODE';
'PROCEDURE'SESAM;'CODE',SESMOD;
'PROCEDURE'CALLFO;'CODE';
. . .
```

Statement section:

```
INITFO(1);
CALLFO(SESAM,STA,ACK,RES,INQ);
. . .
```

CALL DML call in RPG programs

RPG programs process SESAM/SQL databases by means of EXIT calls.

The transfer areas are formatted as data structures and transferred using the RLABL statement. Both data structure names and partial field names can be specified.

The length fields of the statement and inquiry areas must be 2-byte partial fields which can be set to the appropriate values by means of the Z-ADD statement.

C statements for the call section:

```
0         1         2         3         4         5         6         7
12345678901234567890123456789012345678901234567890123456789012345678901234567890
     |                    |    |         |
     C                    EXIT SESAM
     C                    RLABL          STATEM
     C                    RLABL          ACKNO
     C                    RLABL          RESPO
     C                    RLABL          INQUI
```

Data structure statements for the definition section:

```
0        1         2         3         4         5         6         7
12345678901234567890123456789012345678901234567890123456789012345678901
     ||           |                      |   |   |||
     ISTADS       DS
     I                                   B   1   20STAL
     I                                       5 200 STATEM
     I                                       5   7 PASSWO
     I                                       8   8 OPCODE
     I                                       ... (redefinition)
     IACKNO       DS
     I                                       1   2 STATUS
     I                                       ... (redefinition)
     IRESPO       DS
     I                                       1   8 CUST
     I                                       9  29 NAME
     I                                       ... (redefinition)
     IINQDS       DS
     I                                   B   1   20INQL
     I                                       5 200 INQUI
     I                                       5  12 PKEY
I                                        ... (redefinition)
```

Existing RPG application programs not yet generated using the RPG3 compiler can continue to be used via the special file routine SESRPGS.

3 DML statements

3.1 Overview of DML statements

Function group	Statement	Function
Logical file management	Open	Open a logical file
	Close	Close logical files
Retrieval functions	Search	Define a logical input file by selection, projection
	Search with join	Define a logical input file by selection, projection and join
	Restrict a join cursor file	Select responses after a search with join that has created a cursor file
	Index browsing	Determine frequency of attribute values
	Define comparison values	Replace the default mask character for a masked search Replace the default string identifier for the string search
	Record output	Define a logical input file by projection and selection. Output the significant attribute values. Record output for tables with old data types
	Inquiry	Define a logical input file by projection and selection. Output the significant and null attribute values. Inquiry on tables with old data types

Table 5: Overview of DML statements (part 1 of 2)

Function group	Statement	Function
	Response polling	Process a logical input file after a search, record output or inquiry
	Cursor file handling	Process cursor files after a search
Direct update functions	Addition	Add records
	Update	Insert, update or delete attribute values or occurrences of a multiple attribute
	Deletion	Delete records
	Follow-up update	Process a logical file after a direct update
	Set and delete deletion identifier	Define deletion identifier for deleting an attribute value or release deletion identifier (for old data types only)
Inquire on general table characteristics	Attribute information	Inquire on the attribute definitions of a table Attribute information for tables with old data types
Transaction-oriented security	Begin transaction	Initiate a transaction
	End transaction	Terminate a transaction
	Reset transaction	Reset a transaction
Administration	Administrator open	Open communication between administrator program and DBH
	Administration statement for DBH	Control SESAM/SQL DBH
	Administration statement for SESDCN	Control SESAM/SQL DCN

Table 5: Overview of DML statements (part 2 of 2)

3.2 Open

The open statement allows a requester to open a logical file. The logical file is identified by the file identifier. A user can thus open several logical files and process them in parallel. Logical files can only be opened for CALL DML tables (see the “SQL Reference Manual, Part 1”). Otherwise, the open statement is rejected.
In the following sections, the CALL DML table is generally referred to simply as the table.

The function identifiers in the open statement specify which operations can be performed under the specified file identifier and under the requester’s other file identifiers.

Contents of transfer areas:

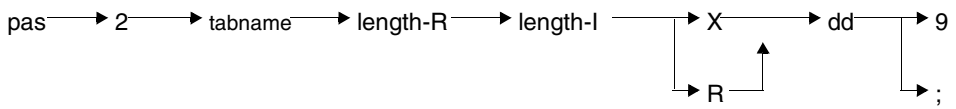
Statement area: The application program supplies the statement.

Acknowledgment area:
The DBH returns the acknowledgment to the statement.

The inquiry and response areas are not used, but must be made available.

Statement area

Pass-word	Op. code	Table name	Length of resp.area	Length of inq.area	Func. code	File ident.	End ident.
0/3	3/1	4/17	21/5	26/5	31/1	32/2	34/1



Key

Function identifier	X	this file identifier: read
	R	this file identifier: update
End identifier	9	end of statement
	;	chain statement

Password (0/3)

pas Password for protected CALL DML table,
any three-character string for unprotected CALL DML table.

Operation code (3/1)

2 Operation code for the open statement

Table name (4/17)

tabname
Name of the CALL DML table for which the logical file is to be opened.
The table name must be entered in the CALL DML table catalog list (see the "Database Operation" manual, ADD-OLD-TABLE-CATALOG-LIST).
Table names comprising less than 17 characters must be right-filled with blanks to a length of 17.

Length of response area (21/5)

SESAM/SQL knows the maximum length of the response area and can thus create buffers of the required size (see the "Database Operation" manual, TRANSFER-CONTAINER).

length-R
maximum length of response area in bytes:
The decimal number to be entered here is the longest response this application expects to receive.
In block mode (&BLNnnn or &BLKnnn), the length must be multiplied by the number of response records per block (nnn).

The length must be as exact as possible, to avoid excessive use of resources.

Minimum value: 2 *(primary key length)
Maximum value: 32000

Where block mode is used (&BLKnnn or &BLNnnn), the following should be noted:

If the response area is too small to hold a full block, a blocking factor is defined internally based on the size of the response area. The number (nnn) defined in the statement by &BLKnnn or &BLNnnn is ignored in response output.

Length of inquiry area (26/5)

SESAM/SQL knows the maximum length of the inquiry area and can thus create buffers of the required size (see the “Database Operation” manual, TRANSFER-CONTAINER).

length-I

Maximum length of inquiry area in bytes:
The decimal number to be entered here is the total of the primary key and attribute comparison values.

The length must be as exact as possible, to avoid excessive use of resources.

Minimum value: 2 *(primary key length)
Maximum value: 32000

Function code (31/1)

The function code defines, for the period during which the file identifier applies, the functions permitted under this file identifier.

At the same time, a hierarchical structure defines whether, in conjunction with transaction-oriented security, a record is locked exclusively or is shared. The function code X requests exclusive locks.

X Direct updating may be performed under this file identifier.
Function identifier X is normally used in online application programs.

R Retrieval functions only are performed under this file identifier.
Function R thus provides no security against data being changed under other file identifiers.

File identifier (32/2)

The file identifier identifies a logical file under which retrieval and/or direct update functions can be performed.

ff File identifier which must be entered in the acknowledgment area for all subsequent statements.

The permitted characters are numbers 0 to 8 and any letter.

End identifier (34/1)

9 Indicates the end of the statement

; End of statement. The statement is chained to a subsequent open statement and passed in a call to the DBH. The following rules must be observed:
- Open statements can be chained as often as required. Thus several open statements can be sent to the DBH in one call, thereby reducing processing time.
- In the last open statement, 9 must be specified as the end identifier.
- When all open statements have been executed, the application program receives status code 00 and the file identifier of the last open statement.
- Execution of the open statements is terminated if any one of them cannot be carried out. The status code and the file identifier of the failed open statement are output in the acknowledgment area.

Acknowledgment area

Displ.	Length	Entry	Meaning
0	2		Status
2	4	␣␣␣␣␣ MOD␣ DCN␣ Dxxx	Reported by DBH, by SESMOD, by SESDCN or DVS error
6	2	ff	File identifier
8	2	-	-
10	1	-	-
11	1	-	-

Table 6: Acknowledgment area after opening the logical file

Displ.	Length	Entry	Meaning
0	2	10 20 21 22 25 26 29 2A 2B 2C 2I 2M 2S 2U 2X 2Y 2Z	Status
2	4	␣␣␣␣ MOD␣ DCN␣ Dxxx	Reported by – DBH, – SESMOD, – SESDCN – or DVS error
6	2	ff	File identifier
8	2	-	-
10	2	uu	Status subnumber
12	4	-	-

Table 7: Acknowledgment area on an error

3.3 Close

The close statement is used to close logical files.

The close statement carries out the following specific functions:

user close	Close all logical files for this requester (user)
file close	Close just one logical file for this requester (user)

Contents of transfer areas:

Statement area: The application program supplies the statement.

Acknowledgment area:
On a file close, the application program must supply the file identifier.
The DBH returns the acknowledgment to the statement.

The inquiry and response areas are not used, but must be made available.

User close

The user close closes all logical files for a requester.

If the user close occurs within transaction boundaries, the following applies:

– A user close is only permitted within transaction boundaries if all logical files were also opened within the transaction. If a logical file was opened outside the transaction, the close statement is rejected with status code 8T.

– If the transaction is reset after the close, the close will already have released all resources used by the logical files. Thus the logical files will no longer be available after the reset.

File close

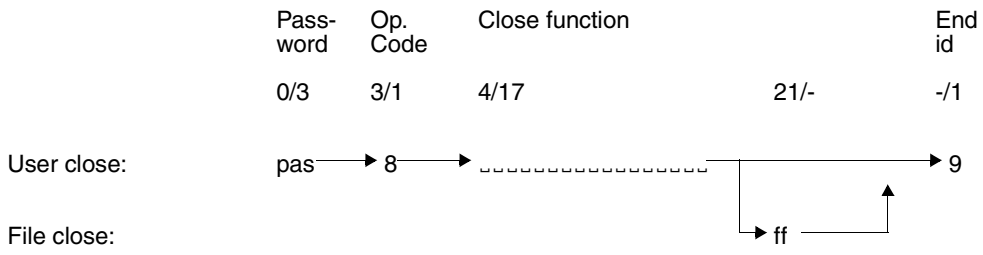
Logical file ff belonging to the requester is closed.

If the file close occurs within transaction boundaries, the following applies:

– A file close within a transaction is permitted if the logical file was also opened in the transaction.

– If the transaction is reset after the close, the close will already have released all resources used by the logical files. Thus the logical files will no longer be available after the reset.

Statement area



Password (0/3)

pas Password for a protected CALL DML table,
any three-character string for an unprotected CALL DML table.

Operation code (3/1)

8 Operation code for the close statement

Close function (4/17), (21/-)

ff File identifier of the logical file to be closed (file close)

End identifier (-/1)

9 Indicates the end of the statement

Acknowledgment area

Displ.	Length	Entry	Meaning
0	2	00 10 80 8N 8C 8T 9U	Status
2	4	-	-
6	2	[ff]	File identifier (file close)
8	2	-	-
10	2	uu	Status subnumber
12	2	-	-

Table 8: Acknowledgment area

3.4 Search

The search defines a logical input file, also called a view. Records can be selected conditionally based on primary key value or on attribute values (selection).

The search also defines which attributes a record of the logical input file should contain (projection). The records of a logical input file can also be sorted.

The record numbers of a logical input file can also be stored in a cursor file for further processing. This cursor file can be restricted, overwritten or processed by another search.

A search can handle a maximum of 256 attributes or occurrences of a multiple attribute. If this number is not sufficient, it can be increased to a maximum value of 1024 when the SESAM/SQL DBH is loaded (see the “Database Operation” manual, COLUMNS).

Contents of transfer areas:

Statement area: The application program supplies the statement.

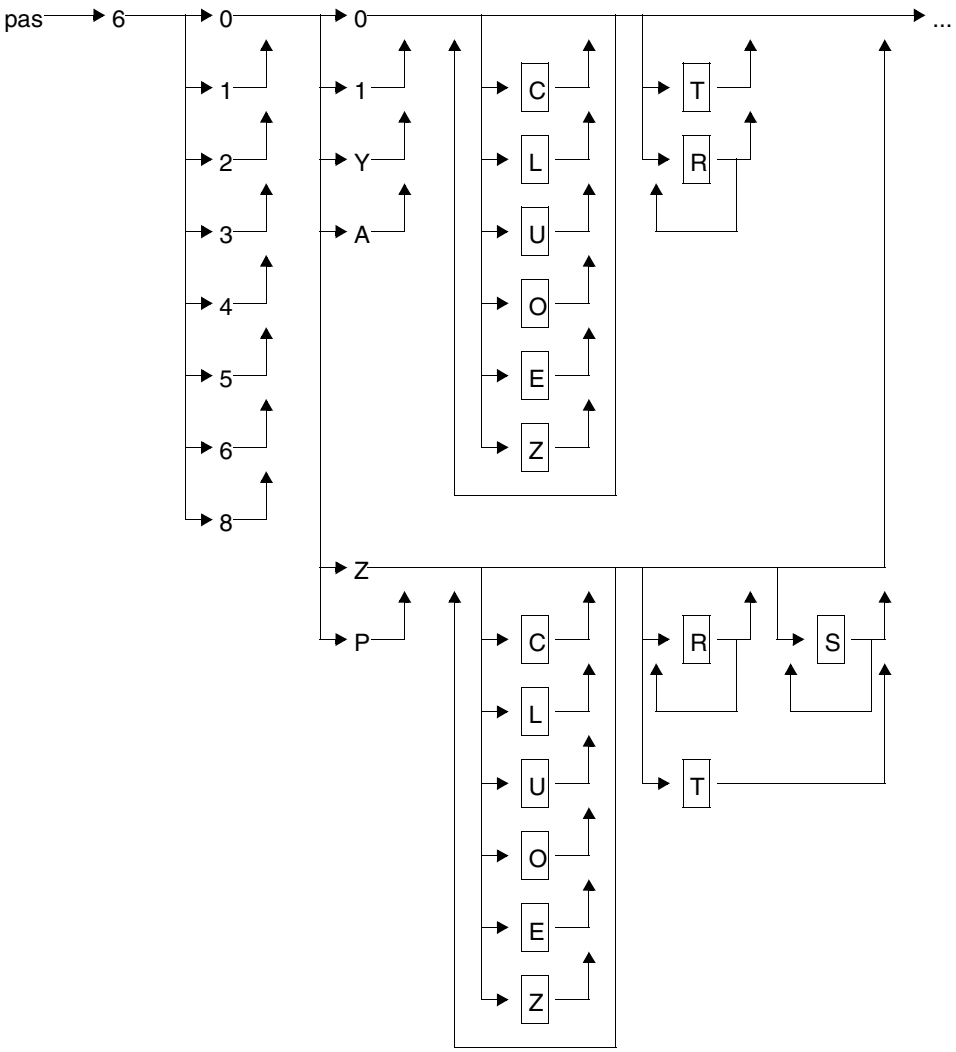
Acknowledgment area: The application program supplies the file identifier, and the DBH returns the acknowledgment to the statement.

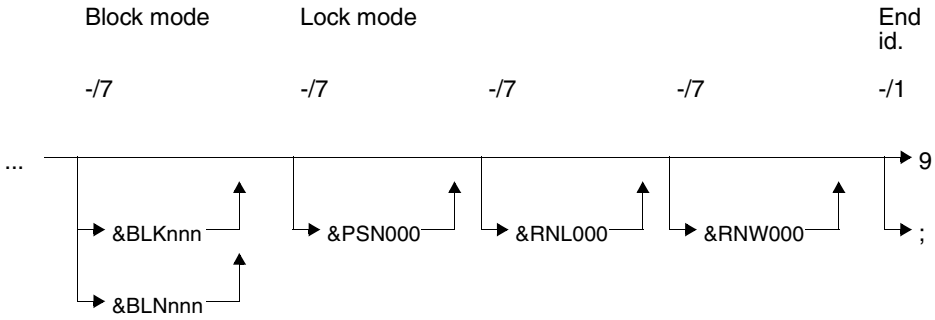
Response area: The SESAM/SQL DBH supplies the first response or, in block mode, the first group of responses.

Inquiry area: If the statement requires comparison values, the application program must make these available in the inquiry area.

Statement area

Pass-word	Op.-code	PK function	Strategy	Subquestions
0/3	3/1	4/1	5/1	6/-




Block mode
Lock mode
End id.
-/7
-/7
-/7
-/7
-/1
...
9
&BLKnnn
&BLNnnn
&PSN000
&RNL000
&RNW000
;

Key

PK (primary key) function	0	all data
	1	equal to PK group value
	2	range of PK group values
	3	larger than PK group value
	4	equal to PK value
	5	range of PK values
	6	larger than PK value
	8	equal to record number
Strategy	0	sequential search, output responses
	1	output responses
	Y	output number of responses
	A	restrict cursor file, output responses
	Z	record numbers in cursor file, output number of responses
	P	restrict cursor file, store record numbers in cursor file and output number of responses
Subquestions	C	AND operator, projection, selection
	L	OR operator, projection, selection
	U	AND operator, selection
	O	OR operator, selection
	E	projection
	Z	count significant occurrences of a multiple attribute
	T	sort responses on secondary index, projection
	S	sort responses, projection
	R	selection by boundary condition, projection
End id.	9	end of statement
	;	chain statement

The suggested order of T, R and S subquestions as the last subquestions in the search, as shown in the diagram, is recommended but not mandatory.

The following rules must always be observed:

– S subquestions must follow U, O, C, L and R subquestions. A maximum of 6 S subquestions are allowed in a search.
– R subquestions must follow U, O, C and L subquestions and come before S subquestions. A maximum of 6 R subquestions are allowed in a search.
– The T subquestion must not immediately precede an O or L subquestion. It is not permitted if the search contains R or S subquestions.

Password (0/3)

pas Password for protected CALL DML table,
any three-character string for unprotected CALL DML table.

Operation code (3/1)

6 Operation code for the search statement

Primary key function (PK function) (4/1)

The primary key function allows records to be selected by applying conditions to the primary key or record number. The comparison values are placed in the inquiry area. A primary key group value can be used for selection instead of the whole primary key value:
The primary key group value identifies a group of records whose primary key value contains the primary key group value in the left of the key. The comparison value in the inquiry area must be blank-filled to the full length of the primary key. A blank at the end of the comparison value will therefore not be recognized.

With compound keys, the only primary key group value that may be used is a value of the compound key attribute AAB or of several compound key attributes (starting at AAB, ascending AAC, etc.), with the compound key attribute whose value is furthest to the right in the primary key group value not being of type INTEGER or SMALLINT. It is possible, however, for the compound key attribute furthest to the right to be only partially covered by the primary key group value. Blanks must be inserted in the inquiry area for the remaining compound key attributes.

0 All data:
All records are selected.

1 Equal to primary key group value:
A primary key group value must be entered in the inquiry area as comparison value.
All records containing the primary key group value left-justified in their primary key value are selected.

2 Range of primary key group values:
Two primary key group values that define a range of primary key group values must be placed in the inquiry area.
All records whose primary key values are greater than or equal to the first comparison value and less than or equal to the second comparison value are selected.
The first comparison value must not be larger than the second comparison value.

3 Greater than primary key group value:
A primary key group value must be entered in the inquiry area as the comparison value.
All records whose primary key value is greater than the comparison value are selected.

4 Equal to primary key value:
A primary key value must be entered in the inquiry area as the comparison value.
The record whose primary key value is equal to the comparison value is selected.

5 Range of primary key values:
Two primary key values defining a range of primary key values must be entered in the inquiry area as comparison values.
All records whose primary key values are greater than or equal to the first comparison value and less than or equal to the second comparison value are selected.
The first comparison value must not be larger than the second comparison value.

6 Greater than primary key value:
A primary key value must be entered in the inquiry area as the comparison value.
All records whose primary key value is greater than the comparison value are selected.

8 Equal to record number:
A record number must be entered in the inquiry area as the comparison value.
The record with the specified record number is selected.

Strategy (5/1)

The strategy specifies the type of result the search should return. The following types of result are possible:

– Response records in the response area.

– Number of responses in the acknowledgment area.

– Creation of a cursor file containing the record numbers of the response records.

The strategy also defines the search method to be used by the search:

– Strategy 0 defines a sequential search of the table.

– All other strategy specifications (1/Y/Z/A/P) leave it to SESAM/SQL to select the most appropriate search method: sequential search or search via index.

If in any one session the index of more than 4 attributes is defective, the search is sequential.
If the index of an attribute referenced by a T subquestion (see “Search subquestions” on page 45) is defective, the search is terminated with status code 9E.

0 The search processes the records sequentially and returns the first response record in the response area. If block mode (&BLKnnn or &BLNnnn) is in use, the first nnn responses are placed in the response area.
Further responses can be retrieved using the response polling statement (xxx719 or xxx799, see section “Response polling” on page 117). The responses are returned in ascending order of primary key values (sequential search).

1 SESAM/SQL determines the search method; otherwise synonymous with strategy 0.

Y The search counts the response records and places the result in the acknowledgment area with status code 10.
The response records can be retrieved with updated response polling xxx719 and all successor responses with xxx799.

Z The search counts the response records, stores the record numbers of the response records in a cursor file, and places the number of responses in the acknowledgment area with status code 10.
The responses can be retrieved from the cursor file with response polling statement xxx729, and the successor responses with xxx709.

A Precondition:
A cursor file has been created by a preceding search.

If the search specifies the same conditions as those used to create the cursor file, the search returns the response record whose record number is the first in the cursor file (or nnn records in block mode).
If the conditions are different, the records pointed to by the cursor file are tested for these conditions and the first nnn matching responses output.
Successor responses can be retrieved with response polling statement xxx799.

P Precondition:
A cursor file has been created by a preceding search.

The search processes only those records whose record numbers are stored in the cursor file. The old cursor file is restricted, the responses to the new search counted and the record numbers of the responses written to the old cursor file. The contents of the old cursor file are overwritten. The number of responses is placed in the acknowledgment area with status code 10.
The response records can be retrieved with statement xxx729, and successor responses with xxx709.

Subquestions (6/-)

Subquestions firstly allow the conditions by which records are to be selected to be specified, and secondly allow selection of the attributes whose values are to be output in the response record (projection). The response records can be sorted on output either by attribute values or by index values.
With a multiple attribute, the number of occurrences containing a significant value can be counted.

For a detailed description of subquestion elements see “Search subquestions” on page 45.

Block mode (-/7)

The user can define how many of the responses found are to be returned in the response area.

&BLKnnn
nnn responses are placed in the response area. The record number of each record is output.

&BLNnnn
nnn responses are placed in the response area. The responses are output without record numbers.

If neither &BLKnnn nor &BLNnnn is specified, the default is to place just one response record without its record number in the response area.

Lock mode (-/7)

&PSN000
: The response records are output without the primary key value.

&RNL000
: The record accessed by the search within a transaction is not locked.

&RNW000
: The search can read a record that has been locked by another transaction (dirty read). The statement is acknowledged with status code 9S. In block mode, no more responses are output to the response area after a dirty read. Further response records may, however, be read by response polling statement xxx799.
If &RNW000 is omitted, a transaction that attempts to access a locked record is placed in a wait state until the record is released.

End identifier (-/1)

9 Indicates the end of the statement

; End of statement. The statement is linked with a subsequent end TA statement.

Search subquestions

Subquestions within searches perform the following functions:

– Formulation of selection criteria and combinations thereof on which records are selected.

– Defining which attributes are to be projected in the response record.

– Formulation of sort conditions and combinations thereof for response output.

– Counting significant occurrences of a multiple attribute.

– Testing whether an attribute has a (non-)significant value.

Logical relationships between subquestions

Multiple subquestions that produce a selection are logically ANDed or ORed together. Note that unlike boolean logic, the OR in SESAM/SQL is the stronger relationship. As SESAM/SQL does not permit parenthesizing of subquestions, “multiplying out” must be used where necessary to achieve the same effect as parentheses.
If several attributes are specified in a condition within a subquestion, SESAM/SQL connects the different attributes together with OR.

Example

a, b, c and d represent subquestions within a search. The logical relationships are represented by AND and OR.
The boolean expression (a AND b) OR (c AND d) is to be represented in a subquestion. To represent it in SESAM/SQL logic, it must be “multiplied out” by relating each element in the first parenthesis with each element in the second parenthesis. The logical operator is the operator between the two expressions in parentheses (OR). This gives the following representation:

(a OR c) AND (a OR d) AND (b OR c) AND (b OR d)

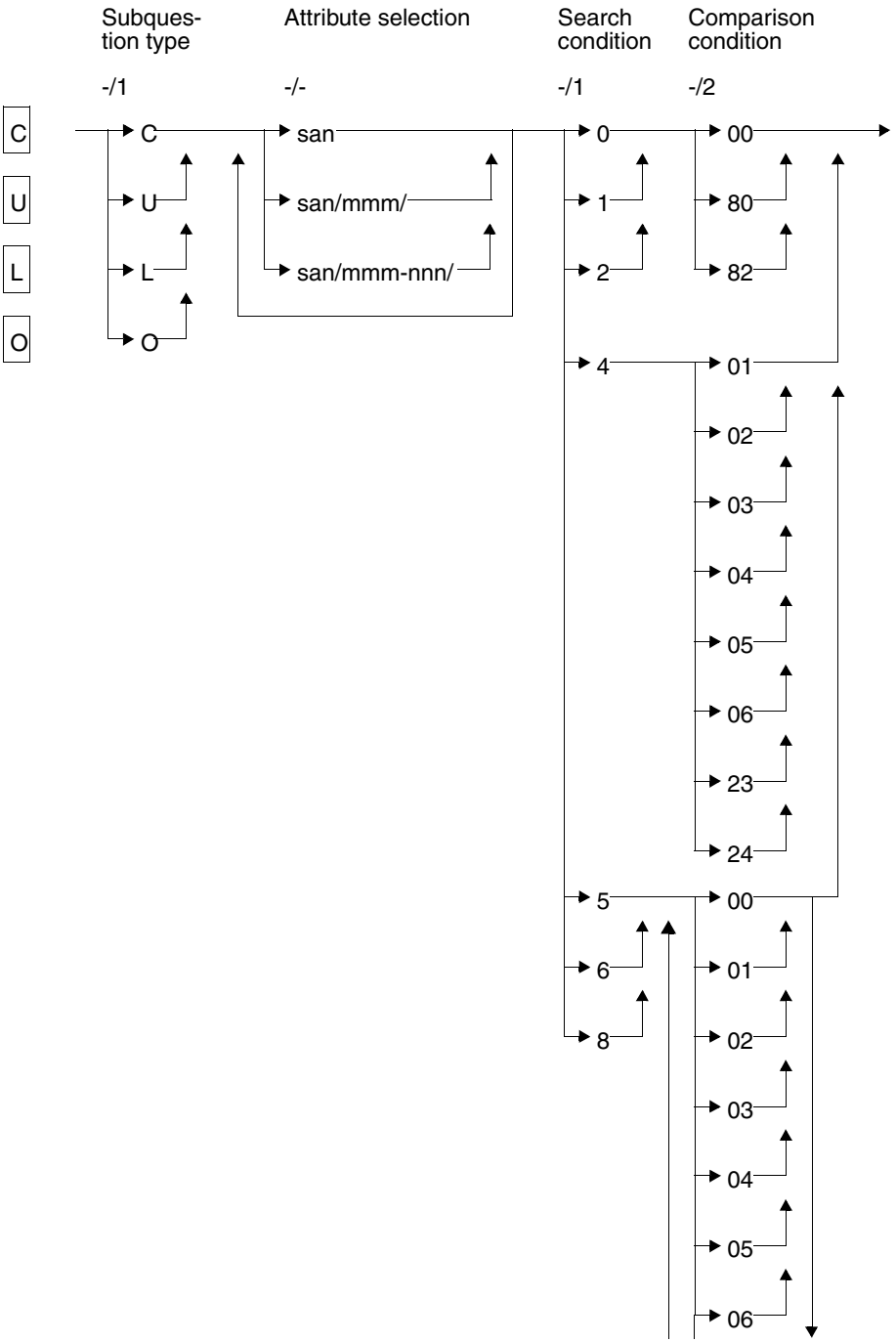
The parentheses in this expression are superfluous in SESAM/SQL logic, as the OR operator creates a stronger relationship than the AND operator.

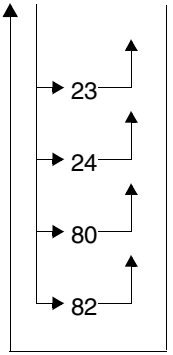
Maximum number of attributes in a search

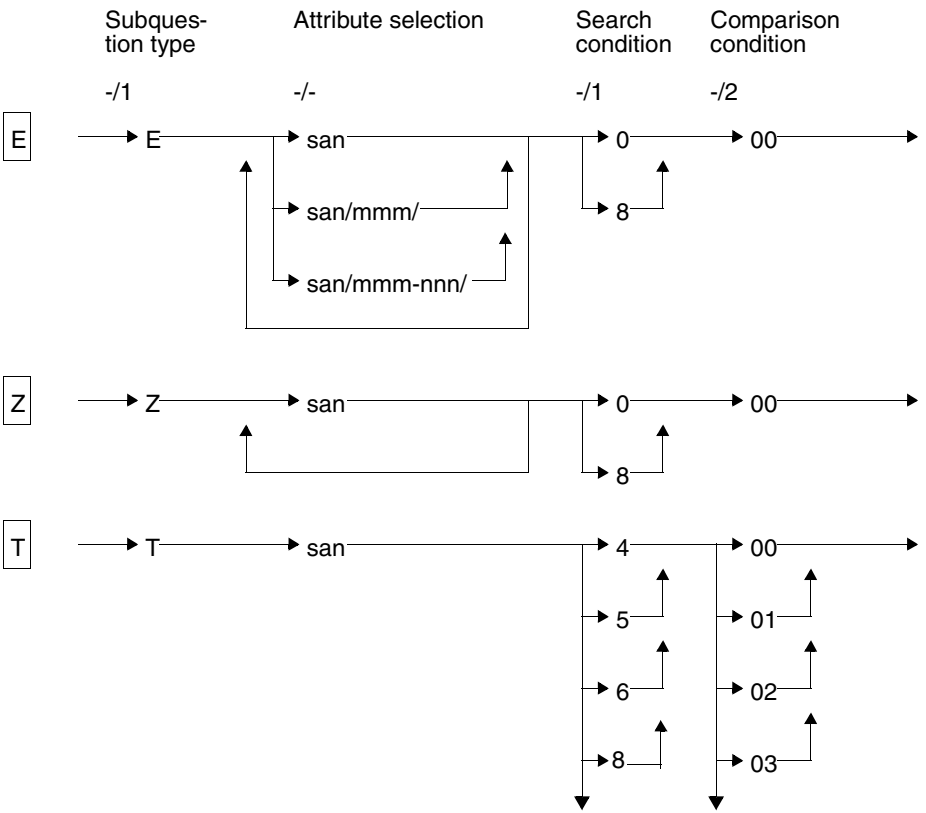
A search can reference a maximum of 256 attributes and occurrences of a multiple attribute. This value can be increased to 1024 when the SESAM/SQL DBH is loaded (see the “Database Operation” manual, COLUMNS).

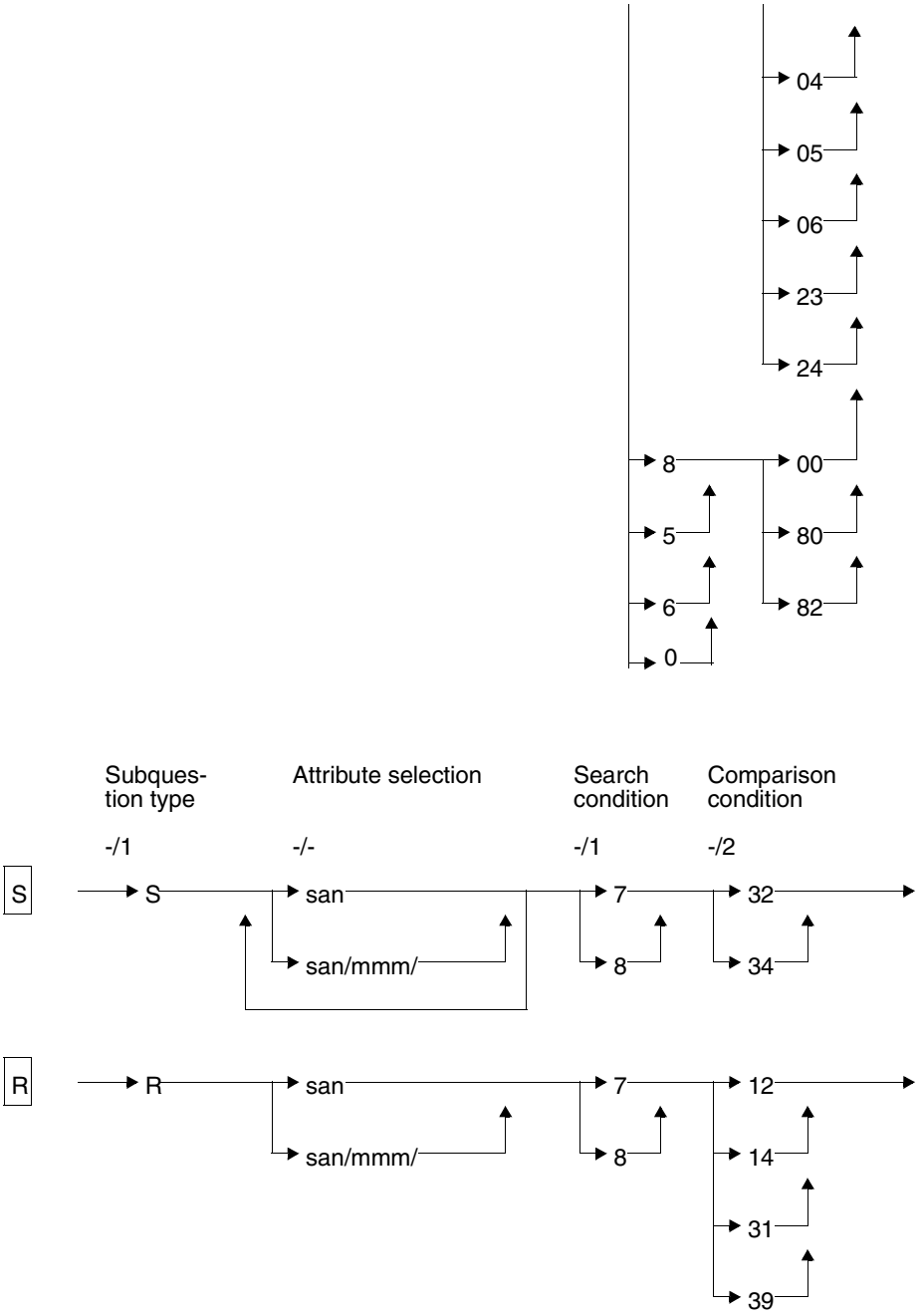
Old subquestion types

Existing application programs may still contain old types of subquestion. In this case, subquestions A, B and D are interpreted as C subquestions, and J, K and M as L subquestions.


Subques-
tion type
-/1
Attribute selection
-/-
Search
condition
-/1
Comparison
condition
-/2
C
U
L
O
C
U
L
O
san
san/mmm/
san/mmm-nnn/
0
1
2
4
5
6
8
00
80
82
01
02
03
04
05
06
23
24
00
01
02
03
04
05
06


23
24
80
82


Subques-
tion type
Attribute selection
Search
condition
Comparison
condition
-/1
-/-
-/1
-/2
E
E
san
0
00
san/mmm/
8
san/mmm-nnn/
Z
Z
san
0
00
8
T
T
san
4
00
5
01
6
02
8
03


Subques-
tion type
-/1
Attribute selection
-/-
Search
condition
-/1
Comparison
condition
-/2
S
S
san
san/mmm/
7
8
32
34
R
R
san
san/mmm/
7
8
12
14
31
39
04
05
06
23
24
8
5
6
0
00
80
82

Key

Search condition	0	no condition
	4	string and mask search
	5	conditions
	6	negated conditions
	8	turn off search conditions
Comparison condition	00	no comparison condition
	01	= (equal to)
	02	< (less than)
	03	≤ (less than or equal to)
	04	> (greater than)
	05	≥ (greater than or equal to)
	06	≠ (not equal to)
	23	from ... to
	24	outside from ... to
	80	skip one inquiry area entry
	82	skip two inquiry area entries
Fixed combinations from search and comparison conditions	100	check for significant value
	200	check for non-significant value
	712	next smallest to comparison value
	714	next largest to comparison value
	731	lowest value
	739	highest value
	732	sort in descending order
	734	sort in ascending order

Subquestion type (-/1)

C C subquestion:
The C subquestion allows records to be selected conditionally on an attribute value (selection).
The value of the referenced attribute is output for each response record (projection).
A C subquestion is logically ANDed with a preceding subquestion. If the C subquestion is the first subquestion in a search, it is ANDed with the primary key function.
If the same condition is applied to several attributes, the values of all attributes specified for this condition are output. The attributes in the C subquestion are then ORed.

When the attribute values are output, null attribute values are replaced by the default value. To specify multiple attributes in a C subquestion, it is a precondition that the data definitions have the same
– attribute length,
– data type,
– number of decimal places and
– default value.

U U subquestion:
The U subquestion allows records to be selected conditionally based on an attribute value (selection). There is no projection of attribute values in the response record. The other function characteristics are the same as the C subquestion.

L L subquestion:
The L subquestion allows records to be selected conditionally based on an attribute value (selection).
The value of the referenced attribute is output in the response record (projection).
An L subquestion is logically ORed with a preceding subquestion. The L subquestion must not be the first subquestion making a selection.
If the same condition is applied to several attributes, the values of all attributes specified for this condition are output.
When the attribute values are output, null attribute values are replaced by the default value. To specify multiple attributes in an L subquestion, the data definitions must have the same
– attribute length,
– data type,
– number of decimal places and
– default value.

O O subquestion:
The O subquestion allows records to be selected conditionally based on an attribute value (selection). There is no projection of attribute values in the response record. The other function characteristics are the same as the L subquestion.

E E subquestion:
The E subquestion is used only for projection. The attribute values of the attributes listed are placed in the output record. Null attribute values are replaced by default values.

Z Z subquestion:
The Z subquestion counts the occurrences containing a significant attribute value in a multiple attribute.

T T subquestion:
The T subquestion allows records to be selected on the basis of index values (selection). The value of the referenced index is projected in the response record. The responses are sorted in ascending order of index values (see “Sorting the response records” on page 60). Records where the index attribute does not contain a significant value are not selected.

S S subquestion:
The S subquestion defines the sort sequence of response records. S subquestions are only permitted with strategy Z or P (creation of a cursor file).
A search may contain a maximum of 6 S subquestions with a total maximum of 6 attributes and 6 sort criteria. The first attribute of the first S subquestion is the high-order sort criterion. Default values are output for null attribute values.

The application program must call the SESORT module. The utility SEDI63 calls SESORT automatically.

A search with S subquestion may not be initiated whilst a sort procedure using the SORTWORK file is still running in BS2000 (e.g. COBOL SORT) for the application program. Otherwise, status 1G results if the SORTWORK file is required for the search to be processed.

R R subquestion:
The R subquestion allows records to be selected based on so-called boundary conditions. Boundary conditions are:
– smallest attribute value
– largest attribute value
– next smallest attribute value to the comparison value in the inquiry area
– next largest attribute value to the comparison value in the inquiry area

An R subquestion operates on the response set of all preceding C, L, U or O subquestions. If there was no preceding subquestion creating a selection, the R subquestion operates on the whole data base.
A search can contain a maximum of 6 R subquestions. Each R subquestion contains one symbolic attribute name and one boundary condition.

Hierarchical structure of R subquestions:

A hierarchical relationship exists between R subquestions. This means that a second or subsequent R subquestion can only be executed if the R subquestion just processed has returned more than one response. If only one response was returned, it is output immediately.

Default values are output for null attribute values.

Attribute selection (-/-)

The subquestion refers to the attributes with the specified symbolic attribute names (SAN).

san symbolic attribute name of an attribute or of the primary key (AAA).
For a compound key, individual compound key attributes (e.g. AAB) or the complete compound key may be specified.

san/mmm/
symbolic attribute name and occurrence number (mmm) of a multiple attribute.

san/mmm-nnn/
symbolic attribute name of the multiple attribute of which occurrences mmm to nnn are to be processed.

A search can reference a maximum of 256 attributes and occurrences. This value can be increased to a maximum of 1024 when loading the SESAM/SQL DBH (see the “Database Operation” manual, COLUMNS).

Search condition and comparison condition

Conditions applied to attribute values can be constructed using a search condition and one or more comparison conditions.

Search condition (-/1)

0 No condition applied to attribute value.

1 The referenced attributes are tested to see whether a significant value has been stored for any of them in the record. The subquestion is satisfied if at least one of the attributes contains a significant value.

2 The referenced attributes are tested to see whether a null value has been stored for any of them in the record. The subquestion is satisfied if at least one of the attributes contains a null value.

4 String and mask search:
String and mask searches can only be used on attributes defined with data type CHAR.

String search:
Only the comparison conditions 01 and 06 are permitted. An attribute value is checked to see whether it contains a string or not. The comparison value in the inquiry area must be enclosed in string identifiers. The length of the string is:
$1 \leq$ string length $\leq$ attribute length-2.

The default string identifier is “%”. It can be changed by means of the ‘set string identifier’ statement (see section “Define comparison values” on page 92).

Mask search:
An attribute value is tested for a specific character in a particular position. The mask character is substituted for non-relevant characters. The subquestion is satisfied if the known positions satisfy the comparison condition.

The default mask character is “?”. It can be substituted by a different character by means of the “set mask character” statement.

Mask characters and string identifiers cannot be mixed in one comparison value.

Search condition 4 can only be used with compound keys if all the compound keys have the data type CHAR.

5 The attribute value is tested for the comparison condition. If more than one condition is specified, the subquestion is satisfied providing the attribute value satisfies one of the comparison conditions (OR relationship).

6 The attribute value is tested for the comparison condition. If more than one condition is specified, the conditions are ORed. The negation then refers to the whole comparison expression.

7 Search condition for formulating boundary conditions and sort criteria.

8 Cancel search conditions (see “Flexible construction of subquestions” on page 62)

Comparison condition (-/2)

00 no condition; the inquiry area contains no comparison value

01 equal to comparison value in inquiry area

02 less than comparison value in inquiry area

03 less than or equal to comparison value in inquiry area

04 greater than comparison value in inquiry area

05 greater than or equal to comparison value in inquiry area

06 not equal to comparison value in inquiry area

23 greater than or equal to first comparison value and also less than or equal to second comparison value in inquiry area

24 less than first comparison value or greater than second comparison value in inquiry area

Turn off comparison conditions

80 skip an inquiry area entry (see “Flexible construction of subquestions” on page 62)

82 skip two inquiry area entries

Formulating boundary conditions

12 next smallest value to comparison value in inquiry area

14 next largest value to comparison value in inquiry area

31 smallest value

39 largest value

Formulating sort criteria

32 sort descending

34 sort ascending

Acknowledgment area

Displ.	Length	Entry	Meaning
0	2	00 10 16 1S 9S	Status code
2	4	no	Number of responses returned in response area or counted
6	2	ff	File identifier – of logical file (strategy 0/1/Y/A), – of cursor file (strategy Z/P)
8	2	t-length	Total length of responses
10	2	e-length	Length of each response
12	4	rno	Record number; in block mode, this is the record number of the last response record placed in the response area

Table 9: Acknowledgment area for response

Displ.	Length	Entry	Meaning
0	2	1K 60 66 67 6B 6C 6D 6T 6U 6W 6Z 9O 9E 9Q 1F 1G	Status code only for searches with S subquestions
2	4	-	-
6	2	ff	File identifier
8	2	-	-
10	2	ss	Status subnumber
12	4	-	-

Table 10: Acknowledgment area on error

Displ.	Length	Entry	Meaning
0	2	61 63 64 6A 6M	Status code
2	3	san	Symbolic attribute name
5	1	␣	Blank
6	2	ff	File identifier
8	2	-	-
10	2	ss	Status subnumber

Table 11: Acknowledgment area on error (part 1 of 2)

Displ.	Length	Entry	Meaning
12	4	-	-

Table 11: Acknowledgment area on error (part 2 of 2)

Response area

The user can define in a search statement how many response records are to be placed in the response area (block mode). SESAM/SQL returns responses of the length defined for the response area in the open statement. If the response area is too small for a complete block, the blocking factor is determined internally based on the size of the response area. The number defined by &BLNnnn or &BLKnnn in the search statement is ignored on response output.

Displ.	Length	Entry	Meaning
0	4	[rno]	Record number of the response record in block mode &BLKnnn No record number is specified in block mode &BLNnnn, or if block mode is not being used.
-	L(AC)	[pkv]	Primary key value of the length specified in the attribute catalog. The primary key value is not output if &PSN000 was specified.
-	L(AC)	[atv[...]]	Attribute values or number of counted attribute values. The attribute values are output with the length specified in the attribute catalog. The output sequence depends on the sequence in which the attributes were referenced in the subquestions. If attributes are referenced more than once, their values are also output more than once.
-	-		In block mode: Output of response records 2 to nnn; each response record has the format defined previously.

Table 12: Response area

Inquiry area

Displ.	Length	Entry	Meaning
0	L(AC) 4	[pkv1 | rno]	First comparison value for primary key: primary key value for PK function 4/5/6, primary key group value for PK function 1/2/3 Record number for PK function 8 Omitted for PK function 0.
-	L(AK)	[pkv2]	Second comparison value for primary key: primary key value for PK function 5, primary key group value for PK function 2 Omitted for all other PK functions.
-	L(AC)	[atv1]	First comparison value for an attribute for comparison conditions 01 to 06, 23, 24, 80, 82, 712 and 714. Omitted for all other comparison conditions.
-	L(AC)	[atv2]	Second comparison value for an attribute for comparison conditions 23, 24 and 82. Omitted for all other comparison conditions.
-	-	[...]	Comparison values atv1 and atv2 (where relevant) for further subquestions with comparison conditions 01 to 06, 23, 24, 80, 82, 712 and 714.

Table 13: Inquiry area

The sequence of comparison values in the inquiry area corresponds to the sequence in which the attributes are referenced in the subquestion.

The lengths of the comparison values must always be the same as that specified in the attribute catalog:

– Shorter values for an attribute with data type CHAR must be right-filled with blanks to the full attribute length.

– Shorter values for attributes with data format NUMERIC, DECIMAL, INTEGER or SMALLINT must be filled with leading zeros to the full attribute length.

A comparison value for a compound key (AAA) must be given as the full length key, consisting of the lengths of all compound key attributes (AAB, AAC, ...).

Numeric comparison values must be given as the correct type in the inquiry area:

– unpacked for data type NUMERIC

– packed for data type DECIMAL

– binary for data types INTEGER and SMALLINT

Data type	Storage format	Sample value	Compar. value in inquiry area
NUMERIC	unpacked	+3210 -3210	X´F3F2F1F0´ X´F3F2F1D0´
DECIMAL	packed	+3210 -3210	X´03210C´ X´03210D´
INTEGER	binary	+3210 -3210	X´00000C8A´ X´FFFFF376´
SMALLINT	binary	+3210 -3210	X´0C8A´ X´F376´
CHAR	alphanumeric	+3210 -3210	X´4EF3F2F1F0´ X´60F3F2F1F0´

Table 14: Examples of entering numeric comparison values

Sorting the response records

The responses returned by a search can be sorted on the following criteria:
– ascending order of primary key values
– ascending order of index values
– ascending or descending order of any attribute values

Sort in ascending order of primary key values

A search supplies the response records in ascending order of primary key values when the search is done under strategy 0 (sequential search):

xxx6x0...9

Sort in ascending order of index values

The T subquestion allows records to be selected conditionally based on the value of an attribute defined as an index. The responses are output in ascending order of the index attribute values. The records in which the attribute does not contain a significant value are not selected.

Sort in ascending or descending order of attribute values

The S subquestion allows the response records from a search to be output in ascending or descending order.

Use of the S subquestion requires that strategy Z or P was used for the search, as these strategies create a cursor file. The response area must be at least 36 bytes long.

A search can contain a maximum of 6 S subquestions, with a total maximum of 6 attributes or occurrences of a multiple attribute, and a maximum of 6 sort criteria. The first attribute of the first S subquestion is the high-order sort criterion.

Handling the S subquestion in the application program:

The first stage is for the application program to pass the search to the connection module SESMOD.

SESAM/SQL creates a sort cursor file containing the record numbers of the response records to be sorted and their attribute values. Status code 1S and the number of response records is placed in the acknowledgment area.

The application program can now decide whether the response records are to be sorted or whether the sort cursor file is to be further processed before being sorted:

1. Sorting the response records in the sort cursor file:
   The application program must pass the same search to the sort module SESORT. The response records are then sorted by BS2000 SORT. The application program is unable to intervene. The record numbers of the response records are stored in the cursor file, which can be processed by a search using strategy A or P, or the responses can be retrieved by means of the statements xxx729 and xxx709 (see section “Response polling” on page 117).
2. Processing the sort cursor file without sorting:
   The sort cursor file, which contains the record numbers and attribute values of the response records, can be compressed by means of statement xxx10K9 (see section “Cursor file handling” on page 125). This creates a cursor file containing only record numbers. This cursor file can then be processed by one of the following statements:
   - Search with strategy A or P
   - Cursor file handling statements
   - Response polling statements for paging through the cursor file

When the sort cursor file is sorted, errors may occur, and are communicated to the application program by status code 1F or 1G. Error messages from BS2000 SORT may also occur.

A search with S subquestion may not be initiated whilst a BS2000 SORT (e.g. COBOL SORT) using the SORTWORK file is still running in the application program.

Flexible construction of subquestions

Searches of a specific format can be defined in the application program. Subquestions or conditions that are not required can be disabled. The following options are available:

– Within a subquestion, the current search condition is replaced by search condition 8. Non-relevant inquiry area entries are skipped depending on the specified comparison condition. The default value is output for the disabled subquestion, provided this subquestion contains the projection (C subquestion).

– Specific comparison conditions can be disabled within a subquestion. Comparison conditions requiring a comparison value must be replaced by 80 and comparison conditions requiring two comparison conditions by 82. This means that the comparison condition is disabled and the unwanted inquiry area entries are ignored.

3.5 Search with join

Search with join links two logical files. The values of the join attribute of one logical file are compared with the values of the join attribute of the other logical file. If equal, the records in the two logical files are linked. They can be output in the response area, counted, or their record numbers stored in a join cursor file. As in any other search, records can be selected conditionally based on the primary key values or on attribute values. Attribute values can also be projected from the table into the response record.

It is a prerequisite for search with join that the two join attributes have the same data type and that their full length has been defined as an index.

The join attribute can be:

– a normal attribute

– an occurrence of a multiple attribute

– several occurrences of a multiple attribute

– a compound key attribute

– the primary key or the complete compound key

The two logical files may belong to the same or different CALL DML tables. Where they belong to the same table, the join attributes can be the same attribute. If the two logical files belong to different tables, these tables must be processed by the same SESAM/SQL DBH. They can, however, be assigned to different catalogs. Otherwise, the join will be rejected with status 6U.

Both logical files must have been opened by an open statement (see section “Open” on page 29) before the search with join. The open statement defines the size of the inquiry and response areas. When the search with join is given, the size of the inquiry and response areas of the logical file specified in the acknowledgment area must be of sufficient size.

Contents of transfer areas:

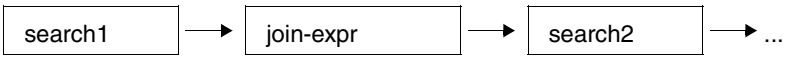
Statement area: The application program supplies the statement.

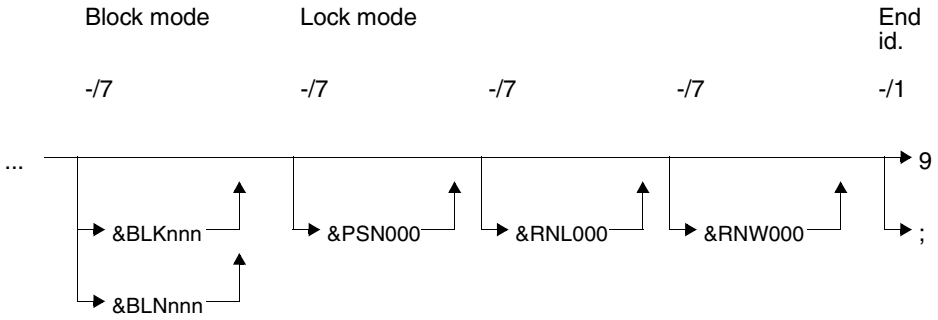
Acknowledgment area:
The application program supplies the file identifier; the DBH returns the acknowledgment of the statement.

Response area: The SESAM/SQL DBH supplies the first response or, in block mode, the first group of responses.

Inquiry area: If the statement requires comparison values, these must be made available in the inquiry area by the application program.

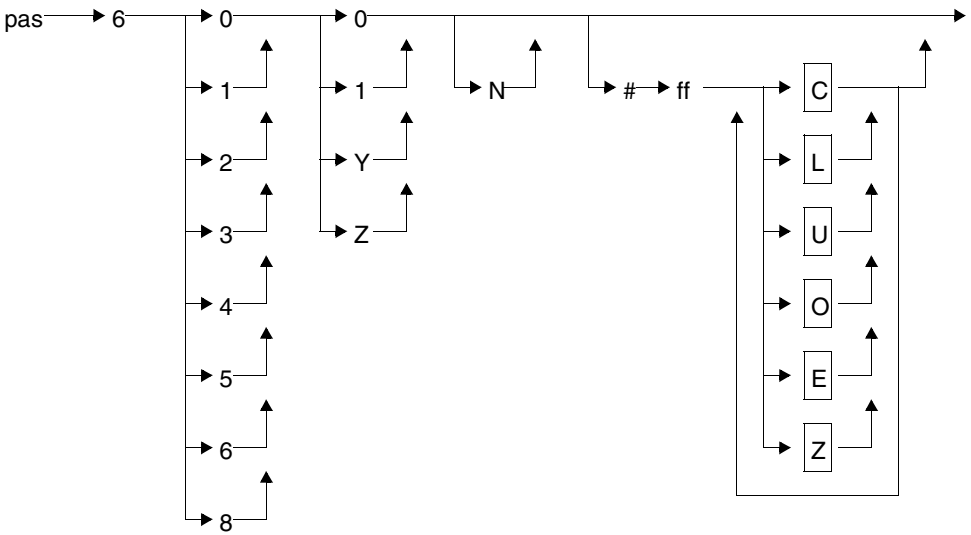
Statement area





search1 and search2

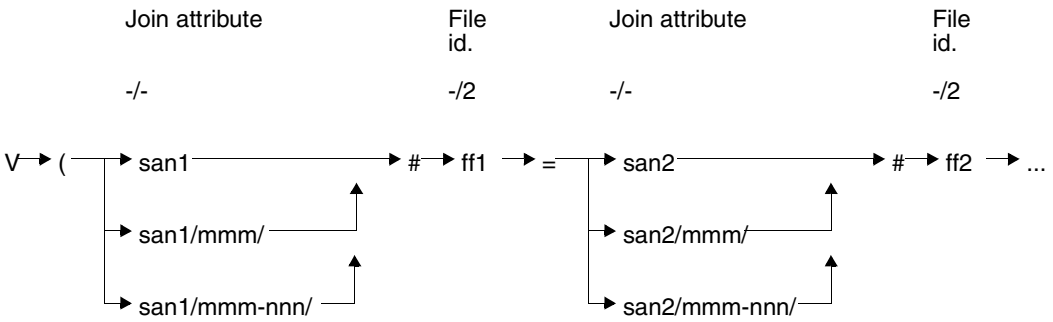
Pass-word	Op. code	PK function	Strategy	RNO function	File id.	Subquestions
0/3	3/1	4/1	5/1	6/1	-/1 -/2	-/-

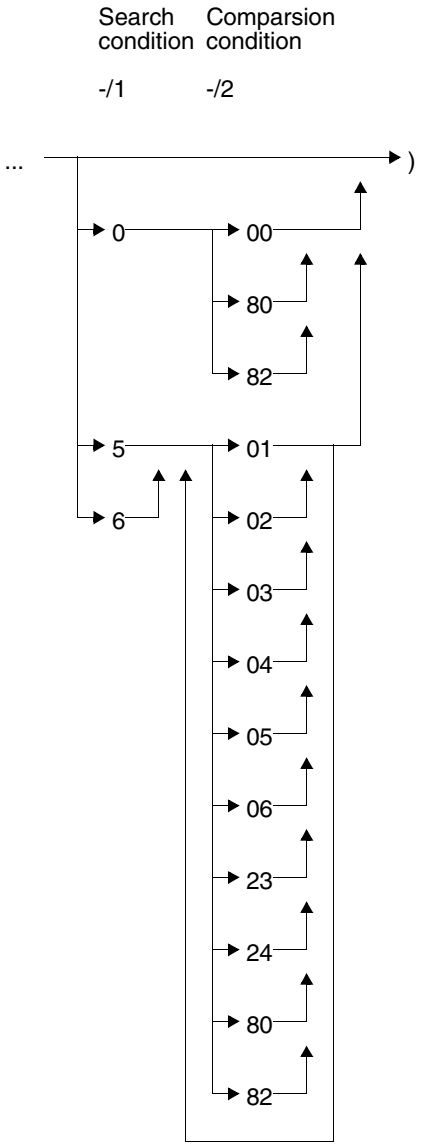


Key

PK (primary key) function	0	all data
	1	equal to PK group value
	2	range of PK group values
	3	larger than PK group value
	4	equal to PK value
	5	range of PK values
	6	larger than PK value
	8	equal to record number
Strategy	0	sequential search, output responses
	1	output responses
	Y	output number of responses
	Z	record numbers in cursor file, output number of responses
Subquestions	C	AND operator, projection, selection
	L	OR operator, projection, selection
	U	AND operator, selection
	O	OR operator, selection
	E	projection
	Z	count significant values of an attribute or occurrence
End id.	9	end of statement
	;	chain statement

join-expr




Search condition
Comparsion condition
-/1
-/2
...
)
0
00
80
82
5
01
6
02
03
04
05
06
23
24
80
82

Key

File identifiers	ff1	logical file from search1
	ff2	logical file from search2
Search condition	0	no condition
	5	conditions
	6	negated conditions
Comparison condition	00	no comparison condition
	01	= (equal)
	02	< (less than)
	03	≤ (less than or equal to)
	04	> (greater than)
	05	≥ (greater than or equal to)
	06	≠ (not equal to)
	23	from ... to
	24	outside from ... to
	80	skip one inquiry area entry
	82	skip two inquiry area entries

Statement elements

The search with join and its subfunctions contain statement elements that are identical to those in the search statement (see section “Search” on page 37).
Only those statement elements are described below that do not occur in the normal search or whose functionality differs.

Primary key function (PK function) (4/1)

The primary key function specifies the condition applied to the primary key value by which to select records.
The search2 specification is independent of that in search1, i.e. any combination is possible.

A detailed description of the individual primary key functions can be found under Search (see “Primary key function (PK function) (4/1)” on page 41).

Strategy (5/1)

The strategy defines the type of results the search is to supply. The following results are possible:

– Response records in the response area

– The number of responses in the acknowledgment area

– Creation of a cursor file containing the record numbers of the response records.

The strategy also determines the search method to be used:

– Strategy 0 causes a sequential search of the table.

– Any other strategy (1/Y/Z) allows SESAM/SQL to select the most appropriate search method: sequential search or search via index.

The following combinations are possible in a search with join:

search1	**search2**	**Meaning**
0 0 1 1	0 1 0 1	Output response records in the response area
Y	Y	– Count the responses – Output number in acknowledgment area
Z	Z	– Count the responses – Output number in acknowledgment area – Store record numbers in join cursor file

Table 15: Combinations in a search with join

The meaning of the strategies is described in detail under Search.

A join cursor file created by strategy Z is a record number cursor file. It is identified by the file identifier that was entered in the acknowledgment area in the search with join statement. The join cursor file can be restricted by a further search with join (see section “Restricting a join cursor file” on page 76).

Record numbers function (6/1)

N The responses are output with record numbers.

The specification need only be given in search1.

If N is not specified, record numbers are only output if block mode is defined with &BLKnnn.

File identifier (-/2)

ff File identifier identifying the logical file on which search1 or search2 is based.

Search1 must define a different file identifier from search2. It is, however, permitted for both file identifiers to refer to the same table.

ff1 File identifier of the logical file to which search1 refers.

ff2 File identifier of the logical file to which search2 refers.

In a search with join using strategy Z, the join cursor file is created under the file identifier specified in the acknowledgment area.

Join attribute (-/-)

The full length of the two join attributes that join the two logical files must be defined as an index.

Join attribute of logical file ff1 of search1

san1 Symbolic attribute name of an attribute or of the primary key (AAA).
A compound key attribute can also be a join attribute.

san1/mmm/
Symbolic attribute name and occurrence number (mmm) of a multiple attribute.

san1/mmm-nnn/
Symbolic attribute name of the multiple attribute whose occurrences mmm to nnn form the join attribute.

Join attribute of logical file ff2 of search2

san2 Symbolic attribute name of an attribute or of the primary key (AAA).
A compound key attribute can also be a join attribute.

san2/mmm/
Symbolic attribute name and occurrence number (mmm) of a multiple attribute.

san2/mmm-nnn/
Symbolic attribute name of the multiple attribute whose occurrences mmm to nnn form the join attribute.

Acknowledgment area

Displ.	Length	Entry	Meaning
0	2	00 10 16 1S 9S	Status
2	4	no	Number of responses counted or placed in the response area. If the number is greater than or equal to X´FFFFFFFF´ , then X´FFFFFFFF´ is entered.
6	2	ff	File identifier – of the logical file (strategy 0/1/Y), – of the cursor file (strategy Z)
8	2	t-length	Total length of responses
10	2	e-length	Length of each response
12	4	rno	Record number; in block mode, this is the record number of the last response record placed in the response area

Table 16: Acknowledgment area for response

Displ.	Length	Entry	Meaning
0	2	1K 60 66 67 6D 6J 6T 6U 6W 6Z 9O 9Q 9E	Status
2	4	-	-
6	2	ff	File identifier

Table 17: Acknowledgment area on error (part 1 of 2)

Displ.	Length	Entry	Meaning
8	2	-	-
10	2	ss	Status subnumber
12	4	-	-

Table 17: Acknowledgment area on error (part 2 of 2)

Displ.	Length	Entry	Meaning
0	2	61 63 64 6A 6M	Status
2	3	san	Symbolic attribute name
5	1	␣	Blank
6	2	ff	File identifier
8	2	-	-
10	2	ss	Status subnumber
12	4	-	-

Table 18: Acknowledgment area on error

Response area

The user can define in a search with join statement how many response records are to be placed in the response area (block mode). SESAM/SQL returns responses of the length defined for the response area in the open statement. If the response area is too small for a complete block, the blocking factor is determined internally based on the size of the response area. The number defined as &BLNnnn or &BLKnnn in the search statement is ignored when the responses are output.

Displ.	Length	Entry	Meaning
0	4	[rno1]	Record number of the response record – in block mode &BLKnnn – in non-block mode if SNR (record no.) function N is used

Table 19: Response area (part 1 of 2)

Displ.	Length	Entry	Meaning
-	L(AC)	[pkv1]	Primary key value of the length specified in the attribute catalog The primary key value is not output if &PSN000 was specified.
-	L(AC)	[atv1[...]]	Attribute values The attribute values are output with the length specified in the attribute catalog. The output sequence depends on the sequence in which the attributes were referenced in the subquestions. If attributes are referenced more than once, their values are also output more than once.
-	L(AC)	join-atv	Value of join attribute (only output once in the response)
-	4	[rno2]	Record number of response record – in block mode &BLKnnn – in non-block mode if SNR (record no.) function N is used
-	L(AC)	[pkv2]	Primary key value of the length specified in the attribute catalog The primary key value is not output if &PSN000 was specified for lock mode.
-	L(AC)	[atv2[...]]	Attribute values The attribute values are output with the length specified in the attribute catalog. The output sequence depends on the sequence in which the attributes were referenced in the subquestions. If attributes are referenced more than once, their values are also output more than once.
-	-	[...]	In block mode: Output response records 2 to nnn; each response record has the format defined previously.

Table 19: Response area (part 2 of 2)

Inquiry area

Displ.	Length	Entry	Meaning
0	L(AC)	[pkv11]	First comparison value for primary key: primary key value for PK functions 4/5/6, primary key group value for PK functions 1/2/3
	4	[rno1]	Record number for PK function 8 Omitted for PK function 0.
-	L(AC)	[pkv12]	Second comparison value for primary key: primary key value for PK function 5, primary key group value for PK function 2 Omitte3d for all other PK functions.
-	L(AC)	[atv11]	First comparison value for an attribute for comparison conditions 01 to 06, 23, 24, 80, 82, 712 and 714. Omitted for all other comparison conditions.
-	L(AC)	[atv12]	Second comparison value for an attribute for comparison conditions 23, 24 and 82. Omitted for all other comparison conditions.
-	-	[...]	Comparison values atv11 and atv12 (where relevant) for further subquestions with comparison conditions 01 to 06, 23, 24, 80, 82, 712 and 714.
-	L(AC)	[join-atv1]	First comparison value for the join attribute for comparison conditions 01 to 06, 23, 24, 80 and 82. Omitted for all other comparison conditions.
-	L(AC)	[join-atv2]	Second comparison value for the join attribute for comparison conditions 23, 24 and 82. Omitted for all other comparison conditions.
-	L(AC)	[pkv21]	First comparison value for primary key: primary key value for PK functions 4/5/6, primary key group value for PK functions 1/2/3
	4	[rno2]	Record number for PK function 8 Omitted for PK function 0.

Table 20: Inquiry area (part 1 of 2)

Displ.	Length	Entry	Meaning
-	L(AC)	[pkv22]	Second comparison value for primary key: primary key value for PK function 5, primary key group value for PK function 2 Omitted for all other PK functions.
-	L(AC)	[atv21]	First comparison value for an attribute for comparison conditions 01 to 06, 23, 24, 80, 82, 712 and 714. Omitted for all other comparison conditions.
-	L(AC)	[atv22]	Second comparison value for an attribute for comparison conditions 23, 24 and 82. Omitted for all other comparison conditions.
-	-	[...]	Comparison values atv21 and atv22 (where relevant) for further subquestions with comparison conditions 01 to 06, 23, 24, 80, 82, 712 and 714.

Table 20: Inquiry area (part 2 of 2)

The sequence of comparison values in the inquiry area corresponds to the sequence in which the attributes are referenced in the subquestion.The lengths of the comparison values must always be the same as that specified in the attribute catalog, i.e. shorter values such as primary key group values must be blank-filled on the right to the full attribute length. A comparison value for a compound key (AAA) must be given as the full length key, consisting of the lengths of all compound key attributes (AAB, AAC, ...).The data type of numeric comparison values entered in the inquiry area must be correct (see also under Search, “Inquiry area” on page 59).

3.6 Restricting a join cursor file

A cursor file created by means of a search with join using strategy Z can be further restricted.

The following options are available:

– Selection by conditions applied to the primary key value or record number via the primary key function

– Selection by applying conditions to attribute values using search1 and search2

Contents of transfer areas:

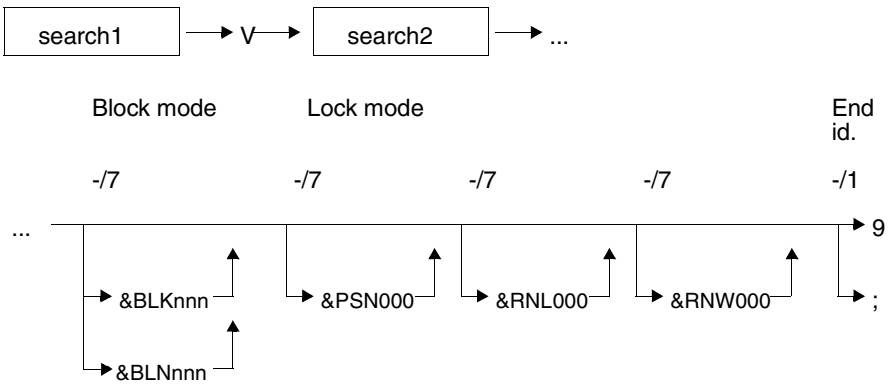
Statement area: The application program supplies the statement.

Acknowledgment area: The application program supplies the file identifier, and the DBH returns the acknowledgment to the statement.

Response area: The SESAM/SQL DBH supplies the first response or, in block mode, the first group of responses.

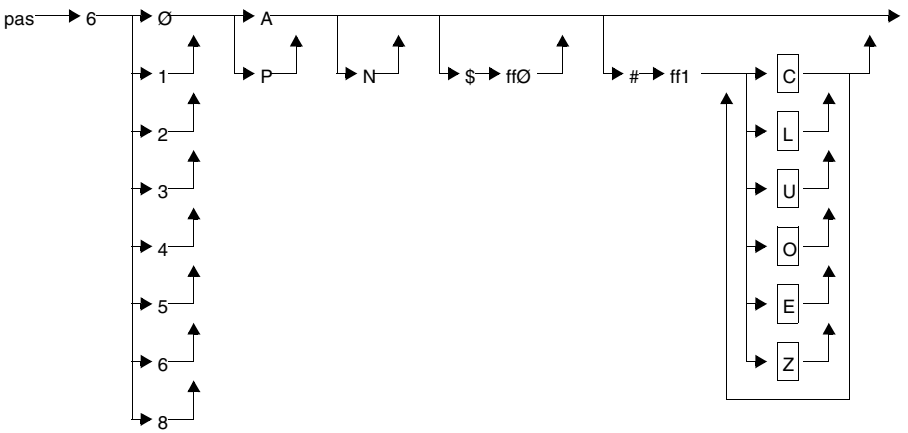
Inquiry area: If the statement requires comparison values, they must be made available in the inquiry area by the application program.

Statement area



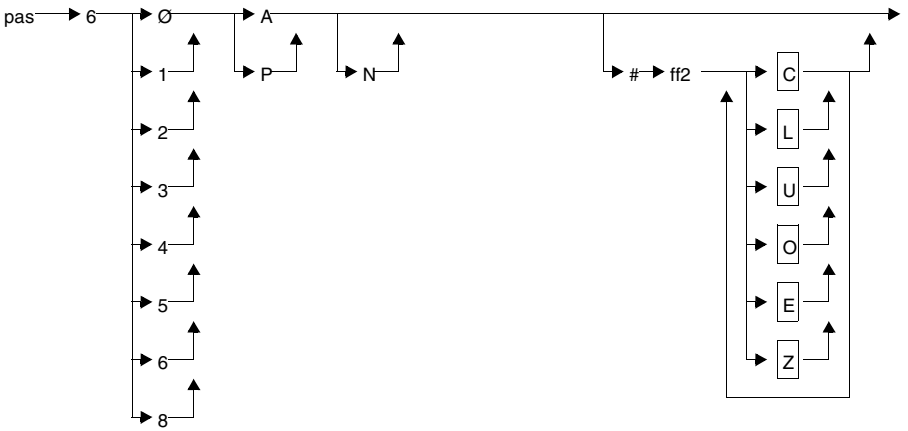
search1

Pass-word	Op. code	PK function	Strategy	RNO function	File id.		File id.	Subquestions
Ø/3	3/1	4/1	5/1	6/1	-/1	-/2	-/1 -/2	-/-



search2

Pass-word	Op. code	PK function	Strategy	RNO function			File id.	Subquestions
-/3	-/1	-/1	-/1	-/1			-/1 -/2	-/-



Key

PK (primary key) function	0	all data
	1	equal to PK group value
	2	range of PK group values
	3	larger than PK group value
	4	equal to PK value
	5	range of PK values
	6	larger than PK value
	8	equal to record number
Strategy	A	restrict cursor file, output responses
	P	restrict cursor file, record numbers in cursor file and output number of responses
File id.	ff0	cursor file to be restricted
	ff1	logical file from search1
	ff2	logical file from search2
Subquestions	C	AND operator, projection, selection
	L	OR operator, projection, selection
	U	AND operator, selection
	O	OR operator, selection
	E	projection
	Z	count significant values of an attribute or occurrence
End id.	9	end of statement
	;	chain statement

Statement elements

The statement and its subfunctions contain statement elements identical to those of the search statement (see section “Search” on page 37).
Only those statement elements are described below that do not occur in the normal search or whose functionality differs.

Primary key function (PK function) (-/1)

The primary key function specifies the condition applied to the primary key value in order to select records.
The search2 specification is independent of that in search1, i.e. any combination is possible.

A detailed description of the individual primary key functions can be found under Search (see page 41).

Strategy (-/1)

The strategy defines the type of results the search is to supply. The following results are possible:

– Response records in the response area.

– The number of responses in the acknowledgment area.

– Creation of a cursor file containing the record numbers of the response records.

With strategy A and P, SESAM/SQL determines the best search method (sequential or via index).

The following combinations of strategies for search1 and search2 are permitted for restricting the cursor file:

search1	search2	Meaning
A	A	Output response records in response area
P	P	– Count responses – Output no. of responses in acknowledgment area – Store record numbers in join cursor file

Table 21: Combinations of strategies

The meaning of the strategies is described in detail under Search.

Record numbers function (-/1)

N The responses are output with record numbers.

This option need only be specified for search1.

If N is not specified, record numbers are only output if block mode has been defined with &BLKnnn.

File identifier (-/2)

ff0 File identifier of the cursor file to be restricted

ff1 File identifier of the logical file to which search1 refers

ff2 File identifier of the logical file to which search2 refers

ff0 must be specified if the cursor file to be restricted (ff0) is to be kept. The new cursor file is created under the file identifier given in the acknowledgment area.
If ff0 is not specified, the old, restricted cursor file is deleted or overwritten. The new cursor file is created, as above, under the file identifier given in the acknowledgment area.
If ff1 or ff2 is not specified, the file identifier from the acknowledgment is used.

Acknowledgment area

Displ.	Length	Entry	Meaning
0	2	00 10 16 9S	Status
2	4	no	Number of responses counted or placed in the acknowledgment area. If the number is greater than or equal to X´FFFFFFFF´, then X´FFFFFFFF´ is entered.
6	2	ff	File identifier – of the logical file (strategy A) – of the cursor file (strategy P)
8	2	t-length	Total length of responses
10	2	e-length	Length of each response
12	4	rno	Record number; in block mode, this is the record number of the last response record placed in the response area

Table 22: Acknowledgment area for response

Displ.	Length	Entry	Meaning
0	2	1K 60 66 67 6D 6T 6U 6W 6Z 9O 9Q 9E	Status
2	4	-	-
6	2	ff	File identifier
8	2	-	-

Table 23: Acknowledgment area on error (part 1 of 2)

Displ.	Length	Entry	Meaning
10	2	ss	Status subnumber
12	4	-	-

Table 23: Acknowledgment area on error (part 2 of 2)

Displ.	Length	Entry	Meaning
0	2	61 63 64 6A 6M	Status
2	3	san	Symbolic attribute name
5	1	␣	Blank
6	2	ff	File identifier
8	2	-	-
10	2	ss	Status subnumber
12	4	-	-

Table 24: Acknowledgment area on error

Response area

This statement allows the user to define how many response records are to be placed in the response area.
SESAM/SQL returns responses of the length defined for the response area in the open statement. If the response area is too small for a complete block, the blocking factor is determined internally based on the size of the response area. The number defined as &BLNnnn or &BLKnnn in the search statement is ignored when the responses are output.

Displ.	Length	Entry	Meaning
0	4	[rno1]	Record number of the response record – in block mode &BLKnnn – in non-block mode if SNR (record no.) function N is used

Table 25: Response area (part 1 of 2)

Displ.	Length	Entry	Meaning
-	L(AC)	[pkv1]	Primary key value of the length specified in the attribute catalog The primary key value is not output if &PSN000 was specified for lock mode.
-	L(AC)	[atv1[...]]	Attribute values The attribute values are output with the length specified in the attribute catalog. The output sequence depends on the sequence in which the attributes were referenced in the subquestions. If attributes are referenced more than once, their values are also output more than once.
-	4	[rno2]	Record number of response record – in block mode &BLKnnn – in non-block mode if SNR (record no.) function N is used
-	L(AC)	[pkv2]	Primary key value of the length specified in the attribute catalog The primary key value is not output if &PSN000 was specified for lock mode.
-	L(AC)	[atv2[...]]	Attribute values The attribute values are output with the length specified in the attribute catalog. The output sequence depends on the sequence in which the attributes were referenced in the subquestions. If attributes are referenced more than once, their values are also output more than once.
-	-	[...]	In block mode: Output response records 2 to nnn; each response record has the format defined previously.

Table 25: Response area (part 2 of 2)

Inquiry area

Displ.	Length	Entry	Meaning
0	L(AC)	[pkv11]	First comparison value for primary key: primary key value for PK functions 4/5/6, primary key group value for PK functions 1/2/3
	4	[rno1]	Record number for PK function 8 Omitted for PK function 0.
-	L(AC)	[pkv12]	Second comparison value for primary key: primary key value for PK function 5, primary key group value for PK function 2 Omitte3d for all other PK functions.
-	L(AC)	[atv11]	First comparison value for an attribute for comparison conditions 01 to 06, 23, 24, 80, 82, 712 and 714. Omitted for all other comparison conditions.
-	L(AC)	[atv12]	Second comparison value for an attribute for comparison conditions 23, 24 and 82. Omitted for all other comparison conditions.
-	-	[...]	Comparison values atv11 and atv12 (where relevant) for further subquestions with comparison conditions 01 to 06, 23, 24, 80, 82, 712 and 714.
-	L(AC)	[pkv21]	First comparison value for primary key: primary key value for PK function 4/5/6, primary key group value for PK function 1/2/3
	4	[rno2]	Record number for PK function 8 Omitted for PK function 0.
-	L(AC)	[pkv22]	Second comparison value for primary key: primary key value for PK function 5, primary key group value for PK function 2 Omitted for all other PK functions.
-	L(AC)	[atv21]	First comparison value for an attribute for comparison conditions 01 to 06, 23, 24, 80, 82, 712 and 714. Omitted for all other comparison conditions.

Table 26: Inquiry area (part 1 of 2)

Displ.	Length	Entry	Meaning
-	L(AC)	[atv22]	Second comparison value for an attribute for comparison conditions 23, 24 and 82. Omitted for all other comparison conditions.
-	-	[...]	Comparison values atv21 and atv22 (where relevant) for further subquestions with comparison conditions 01 to 06, 23, 24, 80, 82, 712 and 714.

Table 26: Inquiry area (part 2 of 2)

The sequence of comparison values in the inquiry area corresponds to the sequence in which the attributes are referenced in the subquestion.

The lengths of the comparison values must always be the same as that specified in the attribute catalog, i.e. shorter values such as primary key group values must be blank-filled on the right to the full attribute length.

A comparison value for a compound key (AAA) must be given as the full length key, consisting of the lengths of all compound key attributes (AAB, AAC, ...).

The data type of numeric comparison values entered in the inquiry area must be correct (see also under Search, “Inquiry area” on page 59).

3.7 Index browsing

Index browsing outputs the frequency of attribute values. It can only be used on attributes whose full or partial length has been inverted, i.e. that have been declared as an index.

Attributes that have been partially inverted must be of the data type CHAR.

One statement processes just one attribute. With a multiple attribute, the frequencies of all significant values of all occurrences are output.

Contents of transfer areas:

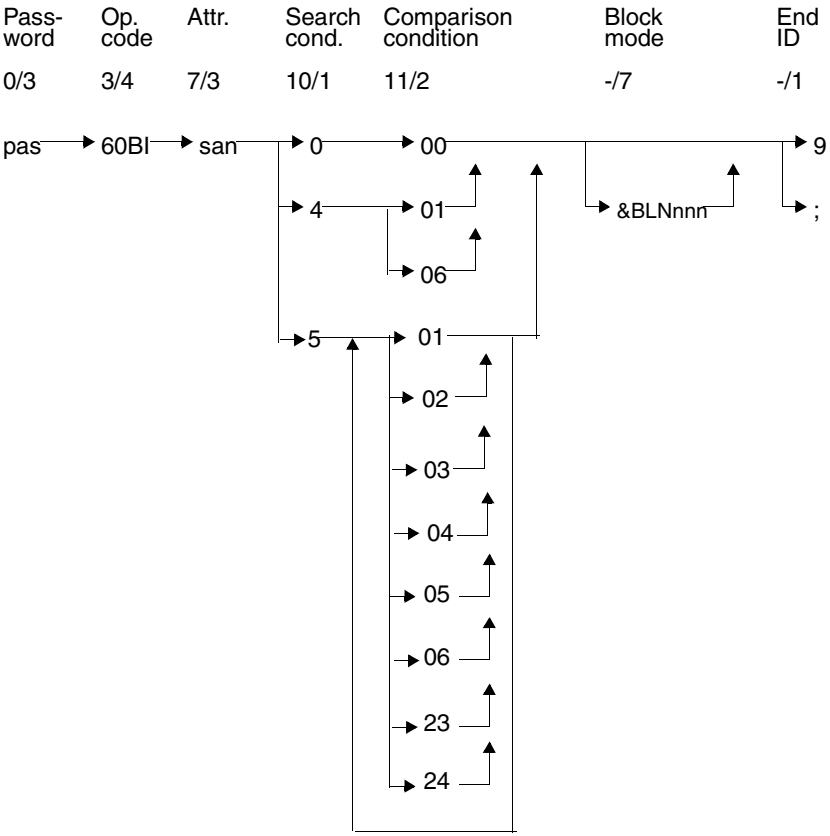
Statement area: The application program supplies the statement.

Acknowledgment area:
The application program supplies the file identifier, and the DBH returns the acknowledgment to the statement.

Response area: The DBH returns the frequency and attribute value for each response.

Inquiry area: If the comparison condition requires comparison values for the attribute values to be counted, they must be placed in the inquiry area.

Statement area



Key

Search condition	0	no condition
	4	string and mask search
	5	conditions
Comparison condition	00	no comparison condition
	01	= (equal to)
	02	< (less than)
	03	≤ (less than or equal to)
	04	> (greater than)
	05	≥ (greater than or equal to)
	06	≠ (not equal to)
	23	from ... to
	24	outside from ... to
End identifier	9	end of statement
	;	chain statement

Password (0/3)

pas Password for a protected CALL DML table,
any three-character string for an unprotected CALL DML table.

Operation code (3/4)

60BI Operation code for the index browsing statement

Attribute (7/3)

san Symbolic attribute name of the attribute of whose values the frequencies are to be output. With a multiple attribute, the occurrences cannot be referenced individually. The frequency is output for all significant values of all occurrences.

If san is an attribute with data type NUMERIC, DECIMAL, INTEGER or SMALLINT, its *full* length must have been inverted.

Search condition and comparison condition

Search and comparison conditions allow one or more conditions to be applied to the attribute values to be counted.

Search condition (10/1)

0 No conditions are applied to the attribute value.

4 String search:

Only the comparison conditions 01 and 06 are permitted. An attribute value is tested to see whether it contains a string or not. The comparison value in the inquiry area must be enclosed in string identifiers. The length of the string is: 1 ≤ string length ≤ attribute length-2. The default string identifier is “%”. It can be changed by means of the set string identifier statement (see section “Define comparison values” on page 92).

Mask search:

An attribute value is tested for a specific character in a particular position. Non-relevant characters are substituted with the mask character. The comparison condition is satisfied if the known positions satisfy the comparison condition. The default mask character is “?”. It can be changed by means of the set mask character statement.

A comparison value may contain either mask characters only or string identifiers only, but not both.

5 The attribute value is tested to see if it meets the comparison conditions. If several comparison conditions are specified, the subquestion is satisfied as soon as the attribute value fulfils one of the comparison conditions (OR relationship).

Comparison condition (11/2)

00 no condition; no comparison value in the inquiry area

01 equal to the comparison value in the inquiry area

02 less than the comparison value in the inquiry area

03 less than or equal to the comparison value in the inquiry area

04 greater than the comparison value in the inquiry area

05 greater than or equal to the comparison value in the inquiry area

06 not equal to the comparison value in the inquiry area

23 greater than or equal to the first comparison value and also less than or equal to the second comparison value in the inquiry area

24 less than the first comparison value or greater than the second comparison value in the inquiry area

Block mode (-/7)

The user can find out how many responses have been found and placed in the response area.

&BLNnnn
The response area contains nnn attribute values and their respective frequencies.

If &BLNnnn is omitted, then by default just one attribute value and its frequency is output.

End identifier (-/1)

9 Identifies the end of the statement.

; End of statement. The statement is chained to a following end TA statement.

Acknowledgment area

Displ.	Length	Entry	Meaning
0	2	{00 / 10}	Status
2	4	no	Number of attribute values found
6	2	ff	File identifier
8	2	t-length	Total length of responses
10	2	e-length	Length of each response
12	4	-	-

Table 27: Acknowledgment area for response

Displ.	Length	Entry	Meaning
0	2	1K 60 66 67 6B 6D 6U 6W 6Z 9E 9Q	Status
2	4	-	-
6	2	ff	File identifier
8	2	-	-
10	2	ss	Status subnumber
12	4	-	-

Table 28: Acknowledgment area on error

Displ.	Length	Entry	Meaning
0	2	61 63 6A	Status
2	3	san	Symbolic attribute name
5	1	␣	-
6	2	ff	File identifier
8	2	-	-
10	2	ss	Status subnumber
12	4	-	-

Table 29: Acknowledgment area on error

Response area

Displ.	Length	Entry	Meaning
0	4	no	Frequency of attribute value (binary)
4	L(AC)	atv	Attribute value
-	-	[...]	In block mode (&BLNnnn): responses 2 to nnn

Table 30: Response area

The responses are sorted in ascending order of the value of the index attribute. Where the attributes are partially inverted, non-inverted positions are replaced by the current mask character.

Inquiry area

Search condition 0 does not require an entry in the inquiry area.

For search conditions 4 and 5, the comparison values must be placed in the inquiry area:

Displ.	Length	Entry	Meaning
0	L(AC)	atv1	First comparison value for the secondary index attribute in comparison conditions 01 to 06, 23 and 24
4	L(AC)	[atv2]	Second comparison value for the secondary index attribute in comparison conditions 23 and 24
-	-	[...]	Further atv1/atv2 comparison values if more than one comparison condition was specified for search condition 5

Table 31: Inquiry area

Masked values or strings can also be used as comparison values if search condition 4 was specified.
For partially inverted attributes, the length of the string must not exceed the length of the inverted part of the attribute.
The comparison values must always be specified as the length defined in the attribute catalog. This also applies to the comparison values for a partially inverted attribute. Shorter comparison values must be blank-filled to the full attribute length.

Numeric comparison values in the inquiry area must be of the correct data type (see “Inquiry area” on page 59).

3.8 Define comparison values

In retrieval statements, records can be selected by means of partially known comparison values. The corresponding attribute must, however, be defined as alphanumeric (CHAR).

Masked search

A record is selected if an attribute value contains a particular character in a specified position. The mask character is substituted for non-relevant characters in the comparison value.

The default mask character is the question mark (?). If the attribute value and the comparison value contain a question mark, a different mask character can be defined for the logical file by means of the set mask character function. The new mask character must be entered in the inquiry area.

The new mask character must not be the same as the current string identifier and must not be contained in the comparison value.

The delete mask character function reinstates the default mask character “?”.

String search

A record is selected if an attribute value contains a particular character or character string in a specified position.

The required character or character string is enclosed in string identifiers to form the comparison value.

The default string identifier is the percent character (%). If the attribute value and the search string contain the percent character, the percent character cannot be used as the string identifier. A different one can be defined by means of the set string identifier function. The new string identifier must in this case be placed in the inquiry area.

The string identifier

– must not be the same as the current mask character and

– must not be contained in the search string itself.

The delete string character function reinstates the default string identifier “%”.

Applicability of mask character/string identifier:

The mask character/string identifier is valid

– until a new mask/string character is defined
– until the mask/string character is deleted
– until the logical file is closed.

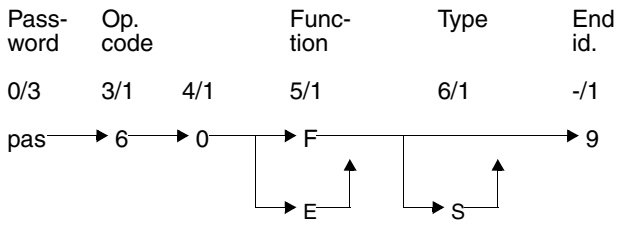
Contents of transfer areas:

Statement area: The application program supplies the statement.

Acknowledgment area:
The application program supplies the file identifier; the DBH returns the acknowledgment to the statement.

Inquiry area: The application program enters the new mask or string character (only for set mask character/string identifier).

Statement area



Password (0/3)

pas Password for a protected CALL DML table,
any three-character string for an unprotected CALL DML table.

Operation code (3/1)

6 Operation code for the define comparison values function

Function (5/1)

F Set mask character/string identifier.

The new mask character/string identifier must be entered in the inquiry area.

E Delete mask character/string identifier.

Type of character (6/1)

S The statement refers to the string identifier.
If S is not specified, the statement refers to the mask character.

End identifier (-/1)

9 Identifies the end of the statement

Acknowledgment area

Displ.	Length	Entry	Meaning
0	2	00 60 6E 6Z	Status
2	4	-	-
6	2	ff	File identifier
8	2	-	-
10	2	[ss]	Status subnumber
12	4	-	-

Table 32: Acknowledgment area

Inquiry area

The inquiry area need only be used in the functions for *set the mask character or string identifier*.

Displ.	Length	Entry	Meaning
0	1	x	String identifier, if the statement contained “S” as the type of character. Mask character if the type specifier was omitted from the statement.

Table 33: Inquiry area

3.9 Record output

Record output offers the following functions:

– Selection of records conditionally, based on primary key value

– Projection of attribute sequences; null attribute values are not output

– Optional output of the attribute definition of the projected attributes

Record output returns variable length responses, as null attribute values are suppressed in the response output. If the response area was not defined large enough in the open statement, remainder response polling can be performed (see section “Response polling” on page 117).

Record output can be used, for example, to retrieve continuous text from a table.

Contents of transfer areas:

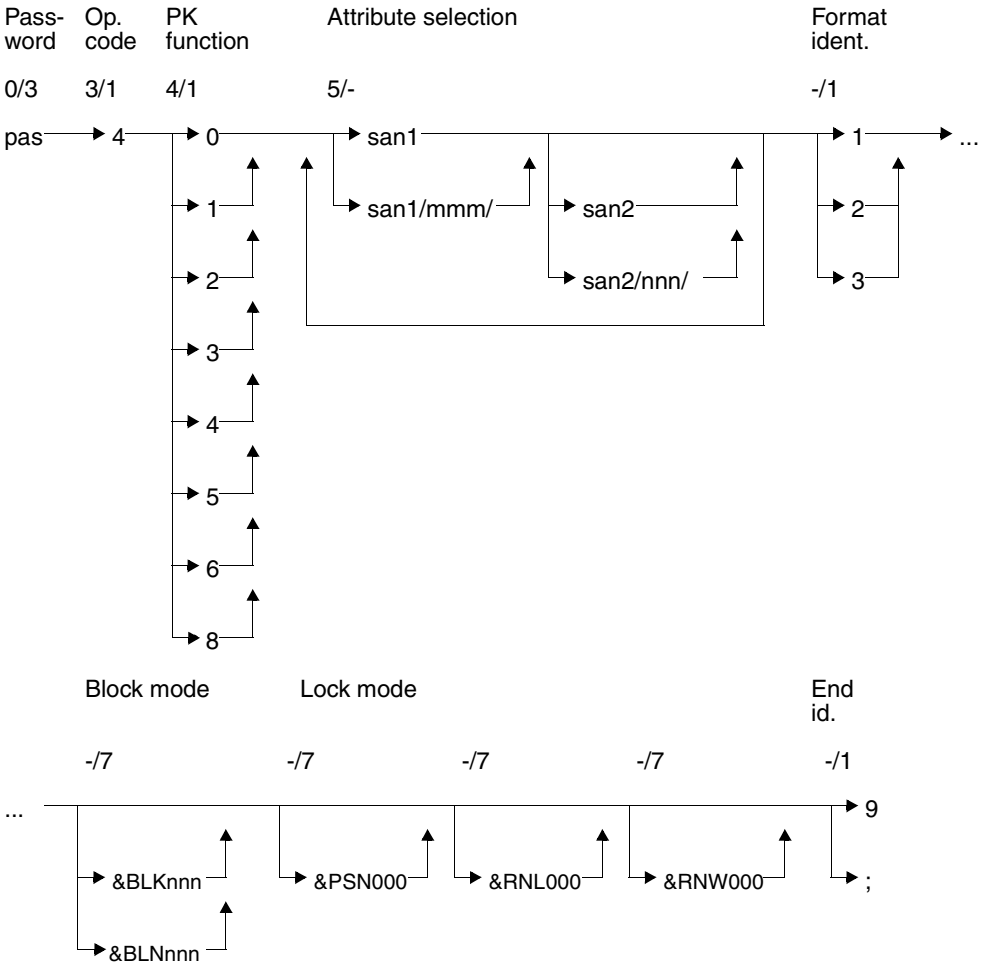
Statement area: The application program supplies the statement.

Acknowledgment area:
The application program supplies the file identifier; the DBH returns the acknowledgment to the statement.

Response area: The SESAM/SQL DBH supplies the first response or, in block mode, the first group of responses.

Inquiry area: If the statement requires comparison values for the primary key value, the application program must put them in the inquiry area.

Statement area



Key

PK (primary key) function	0	all data
	1	equal to PK group value
	2	range of PK group values
	3	larger than PK group value
	4	equal to PK value
	5	range of PK values
	6	larger than PK value
	8	equal to record number
Format identifier	1	SAN, attribute length and attribute values
	2	attribute values only
	3	both attribute definition and attribute values
End identifier	9	end of statement
	;	chain statement

Password (0/3)

pas Password for a protected CALL DML table,
any three-character string for an unprotected CALL DML table.

Operation code (3/1)

4 Operation code for the record output statement

Primary key function (PK function) (4/1)

The primary key function allows records to be selected by applying conditions to the primary key or record number. The comparison values are placed in the inquiry area. A primary key group value can be used for selection instead of the whole primary key value.
The primary key group value identifies a group of records whose primary key values contain the primary key group value in the left of the key. The comparison value in the inquiry area must be blank-filled to the full length of the primary key.

With compound keys, the only primary key group value that may be used is a value of the compound key attribute AAB or of several compound key attributes (starting at AAB, ascending AAC, etc.), with the compound key attribute whose value is furthest to the right in the primary key group value not being of the data type INTEGER or SMALLINT. It is possible, however, for the compound key attribute furthest to the right to be only partially covered by the primary key group value. Blanks must be inserted in the inquiry area for the remaining compound key attributes.

0 All data:
All records are selected.

1 Equal to primary key group value:
A primary key group value must be entered in the inquiry area as comparison value.
All records containing the primary key group value left-justified in their primary key value are selected.

2 Range of primary key group values:
Two primary key group values that define a range of primary key group values must be placed in the inquiry area.
All records whose primary key values are greater than or equal to the first comparison value and smaller than or equal to the second comparison value are selected.
The first comparison value must not be larger than the second comparison value.

3 Greater than primary key group value:
A primary key group value must be entered in the inquiry area as the comparison value.
All records whose primary key value is greater than the comparison value are selected.

4 Equal to primary key value:
A primary key value must be entered in the inquiry area as the comparison value.
The record whose primary key value is equal to the comparison value is selected.

5 Range of primary key values:
Two primary key values defining a range of primary key values must be entered in the inquiry area as comparison values.
All records whose primary key values are greater than or equal to the first comparison value and smaller than or equal to the second comparison value are selected.
The first comparison value must not be larger than the second comparison value.

6 Greater than primary key value:
A primary key value must be entered in the inquiry area as the comparison value.
All records whose primary key value is greater than the comparison value are selected.

8 Equal to record number:
A record number must be entered in the inquiry area as the comparison value.
The record with the specified record number is selected.

Attribute selection (5/-)

Record output allows attribute sequences to be projected. An attribute sequence is defined by a start and end attribute. The start and end attributes must be specified in ascending sequence.
Any number of attribute sequences can be specified. They must, however, be given in ascending sequence and must not overlap.
An attribute sequence can begin or end with an occurrence of a multiple attribute.
The start and end attributes are equal if just one attribute is to be referenced.

san1 Symbolic attribute name of the start attribute

san1/mmm/
Occurrence of a multiple attribute which is the start of the attribute sequence

san2 Symbolic attribute name of the end attribute

san2/nnn/
Occurrence of a multiple attribute which is the end of the attribute sequence

The end attribute can be omitted from the last attribute sequence of record output if the last attribute defined in the attribute catalog is to be used as the end attribute.

Format identifier (-/1)

The format identifier determines what information is to be output for the projected attributes:

1 Symbolic attribute name, attribute length and attribute values are output.

2 Only the attribute values or values of occurrences of a multiple attribute are output.

3 The whole attribute definition and the attribute values are output.

Attribute definition and attribute value are only output if the referenced attribute has a significant value.

Block mode (-/7)

The user can define how many of the responses found are to be placed in the response area.

&BLKnnn
: nnn responses are placed in the response area. The record number of each response is output.

&BLNnnn
: nnn responses are placed in the response area. The record number of the response records is not output.

If neither &BLKnnn nor &BLNnnn is specified, by default just one response record is placed in the response area with no record number.

Lock mode (-/7)

&PSN000
: The response records are output without primary key values.

&RNL000
: The record accessed by record output within a transaction is not locked.

&RNW000
: The record output can access a record that has been locked by another transaction (dirty read). In this case, the statement is acknowledged with status code 9S. After a dirty read in block mode, no further responses are placed in the response area. If &RNW000 is omitted, a transaction attempting to access a locked record is placed in a wait state until the record becomes free.

End identifier (-/1)

9 Identifies the end of the statement

; End of statement. The statement is chained to a following end TA statement.

Acknowledgment area

Displ.	Length	Entry	Meaning
0	2	{00 / 10}	Status
2	4	-	-
6	2	ff	File identifier
8	2	length	Response length
10	2	-	-
12	4	rno	Record number; in block mode, this is the record number of the last response record placed in the response area

Table 34: Acknowledgment area for response

Displ.	Length	Entry	Meaning
0	2	{4A / 9S}	Status
2	3	san	Symbolic attribute name
5	1	␣	-
6	2	ff	File identifier
8	2	length	Response length
10	2	-	-
12	4	rno	Record number; in block mode, this is the record number of the last response record placed in the response area

Table 35: Acknowledgment area on error

Status code 4A is returned if the response to the record output is longer than the response area length defined in the open statement. The symbolic attribute name of the first attribute that cannot fit into the response area is output together with the length of the response placed in the response area.

The remainder of the response can be retrieved by response polling statement xxx739 (see section “Response polling” on page 117).

Status code 9S (read a locked record) may also contain the cause of status code 4A. In this case, the acknowledgment area contains the same information as for status code 4A.

Displ.	Length	Entry	Meaning
0	2	40 41 42 47 4B 4D 4M 4Z 70 7D 9O 9S	Status
2	4	-	-
6	2	ff	File identifier
8	2	-	-
10	2	ss	Status subnumber
12	4	-	-

Table 36: Acknowledgment area on error

Response area

SESAM/SQL places in the response area the attribute values and also the full attribute definition or parts of it, depending on the format identifier.

Information is only output for attributes with a significant value. Attributes with null values are ignored.

Displ.	Length	Entry	Meaning
0	4	[rno]	Record number, only for block mode &BLKnnn
4	L(AC)	[pkv]	Primary key value The primary key value of each response is output with the length specified in the attribute catalog. If &PSN000 is specified, no primary key value is output.

Table 37: Response area for format identifiers 1 or 2 (part 1 of 2)

Displ.	Length	Entry	Meaning
-	3	[san]	Symbolic attribute name, omitted for format identifier 2
-	1	[X´00´ to X´FF´]	Attribute length -1: 1 to 256 bytes; omitted for format identifier 2
-	L(AC)	atv	Attribute value The attribute value is output with the length specified in the attribute catalog. For multiple attributes, the attribute definition and attribute value is output for each occurrence.
-	-	[...]	Attribute values 2 - n of the response
-	1	9	End of response record: end identifier that terminates the last attribute value
-	-	[...]	In block mode: responses 2 - nnn

Table 37: Response area for format identifiers 1 or 2 (part 2 of 2)

Displ.	Length	Entry	Meaning
0	4	[rno]	Record number, only for block mode &BLKnnn; the record number is not specified if the block mode is &BLNnnn or if no block mode is used.
4	L(AC)	[pkv]	Primary key value The primary key value of each response is output with the length specified in the attribute catalog. If &PSN000 is specified, no primary key value is output.
-	3	[san]	Symbolic attribute name
-	2	X´0001´ to X´0100´	Attribute length: 1 to 256 bytes
-	1	X´00´ to X´0F´	Number of decimal places: 0 to 15 places of decimals

Table 38: Response area for format identifier 3 (part 1 of 2)

Displ.	Length	Entry	Meaning
-	1	 X´11´ X´21´ X´22´ X´24´ X´28´ X´00´	Data type: CHAR NUMERIC DECIMAL INTEGER SMALLINT uninterpretable data type
-	1	 X´02´ X´04´ X´08´	Index information: Index locked Index is available Index required
-	1	i-length	Index length (binary)
-	1	X´01´ to X´FF´ X´00´	Number of occurrences of a multiple attribute as defined in attribute catalog; 1 to 255 occurrences not a multiple attribute
-	1	dfc	Default value character
-	1	 X´80´ X´40´ X´00´	Compound key information: Compound key Compound key attribute Not a compound key
-	1	ck-displ	Displacement of a compound key attribute from the start of the compound key
-	4	-	-
-	L(AC)	atv	Attribute value The attribute value is output with the length specified in the attribute catalog. For multiple attributes, the attribute definition and attribute value is output for each occurrence.
-	-	[...]	Attribute values 2 - n of the response
-	1	9	End of response record: end identifier that terminates the last attribute value
-	-	[...]	In block mode: responses 2 - nnn

Table 38: Response area for format identifier 3 (part 2 of 2)

Inquiry area

PK function 0 does not require an entry in the inquiry area.

Comparison values must be placed in the inquiry area for primary key functions 1 to 6 and 8:

Displ.	Length	Entry	Meaning
0	L(AC) 4	{ pkv1 rno }	For PK functions 1 to 6: primary key (group) value of the primary key length specified in the attribute catalog For PK function 8: record number
-	L(AC)	[pkv2]	For PK functions 2 and 5: primary key (group) value of the primary key length specified in the attribute catalog

Table 39: Inquiry area

Numeric comparison values placed in the inquiry area must be of the correct data type (see also under Search, “Inquiry area” on page 59).

3.10 Inquiry

The inquiry comprises the following functions:

– Selection of records conditionally, based on primary key value

– Projection of attribute sequences; for null attribute values, the default value is output

– Optional output of the attribute definition of the projected attributes

Unlike record output (see section “Record output” on page 96), responses are always of a fixed length, as default values are output for null attribute values.

A maximum of 1024 attributes can be specified per statement. With multiple attributes, each occurrence counts as one.

The inquiry can be used where the user only wishes to retrieve records conditionally on primary key values, and not conditionally on the values of other attributes. The inquiry enables records to be generated from the data base structure in the format required for processing by the application program.

Contents of transfer areas:

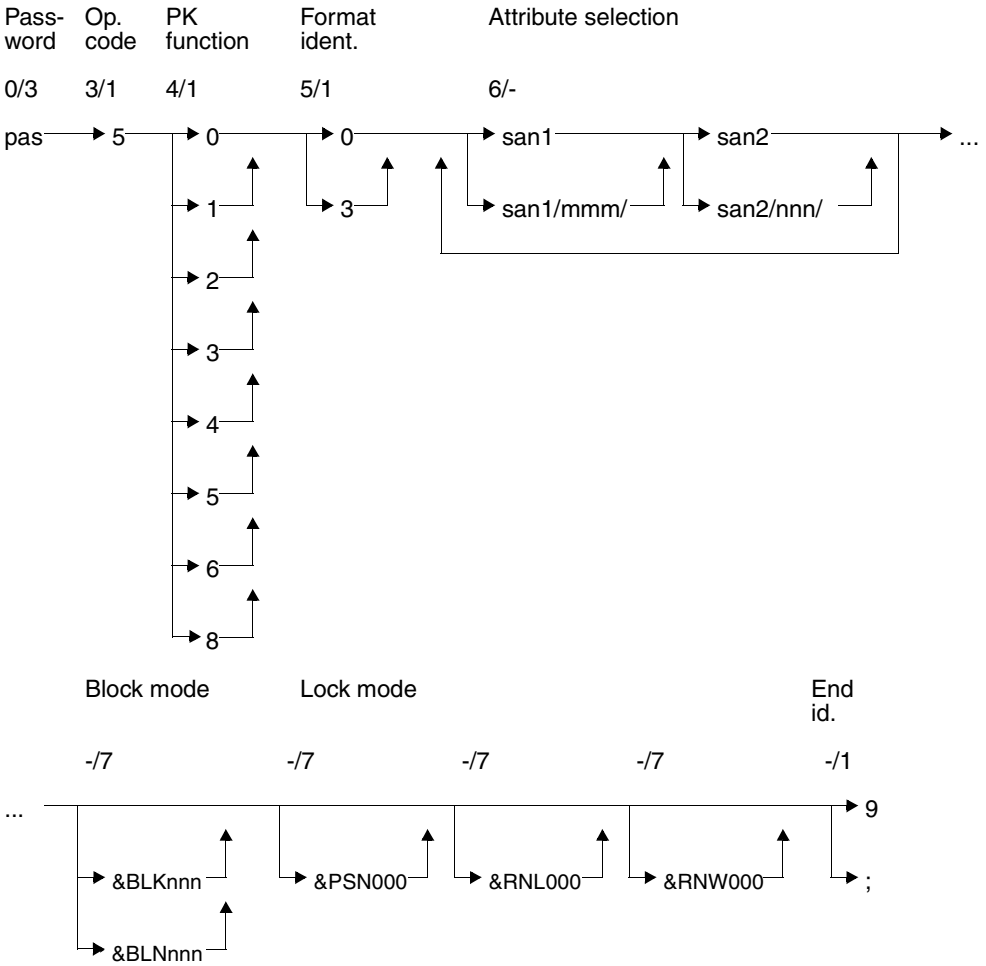
Statement area: The application program supplies the statement.

Acknowledgment area: The application program supplies the file identifier; the DBH returns the acknowledgment to the statement.

Response area: The SESAM/SQL DBH supplies the first response or, in block mode, the first group of responses.

Inquiry area: If the statement requires comparison values for the primary key value, the application program must put them in the inquiry area.

Statement area



Key

PK (primary key) function	0	all data
	1	equal to PK group value
	2	range of PK group values
	3	larger than PK group value
	4	equal to PK value
	5	range of PK values
	6	larger than PK value
	8	equal to record number
Format identifier	0	attribute values only
	3	both attribute definition and attribute values
End identifier	9	end of statement
	;	chain statement

Password (0/3)

pas Password for a protected CALL DML table,
any three-character string for an unprotected CALL DML table.

Operation code (3/1)

5 Operation code for the inquiry statement

Primary key function (PK function) (4/1)

The primary key function allows records to be selected by applying conditions to the primary key or record number. The comparison values are placed in the inquiry area (see “Inquiry area” on page 116). A primary key group value can be used for selection instead of the whole primary key value.
The primary key group value identifies a group of records whose primary key values contain the primary key group value in the left of the key. The comparison value in the inquiry area must be blank-filled to the full length of the primary key.

With compound keys, the only primary key group value that may be used is a value of the compound key attribute AAB or of several compound key attributes (starting at AAB, ascending AAC, etc.), with the compound key attribute whose value is furthest to the right in the primary key group value not being of data type INTEGER or SMALLINT. It is possible, however, for the compound key attribute furthest to the right to be only partially covered by the primary key group value. Blanks must be inserted in the inquiry area for the remaining compound key attributes.

0 All data:
All records are selected.

1 Equal to primary key group value:
A primary key group value must be entered in the inquiry area as comparison value.
All records containing the primary key group value left-justified in their primary key value are selected.

2 Range of primary key group values:
Two primary key group values that define a range of primary key group values must be placed in the inquiry area.
All records whose primary key values are greater than or equal to the first comparison value and less than or equal to the second comparison value are selected.
The first comparison value must not be larger than the second comparison value.

3 Greater than primary key group value:
A primary key group value must be entered in the inquiry area as the comparison value.
All records whose primary key value is greater than the comparison value are selected.

4 Equal to primary key value:
A primary key value must be entered in the inquiry area as the comparison value.
The record whose primary key value is equal to the comparison value is selected.

5 Range of primary key values:
Two primary key values defining a range of primary key values must be entered in the inquiry area as comparison values.
All records whose primary key values are greater than or equal to the first comparison value and less than or equal to the second comparison value are selected.
The first comparison value must not be larger than the second comparison value.

6 Greater than primary key value:
A primary key value must be entered in the inquiry area as the comparison value.
All records whose primary key value is greater than the comparison value are selected.

8 Equal to record number:
A record number must be entered in the inquiry area as the comparison value.
The record with the specified record number is selected.

Format identifier (5/1)

The format identifier determines the information output for the projected attributes:

0 Only the attribute values or values for the occurrences of a multiple attribute are output.

3 The full attribute definition and the attribute values are output.

If an attribute does not have a significant value, the default value is output instead.

Attribute selection (6/-)

An inquiry allows attribute sequences to be projected.

An attribute sequence is defined by a start and end attribute. The start and end attributes must be specified in ascending sequence.
Any number of attribute sequences can be specified, and in any sequence. Attribute sequences may also overlap.
An attribute sequence can begin or end with an occurrence of a multiple attribute. The start and end attributes are equal if just one attribute is to be referenced.

san1 Symbolic attribute name of the start attribute

san1/mmm/
Occurrence of a multiple attribute which is the start of the attribute sequence

san2 Symbolic attribute name of the end attribute

san2/nnn/
Occurrence of a multiple attribute which is the end of the attribute sequence

With format identifier 0, the first and last attributes of each group must be present and authorized to be read. All attributes in an attribute sequence for which read authorization does not exist are ignored.

Block mode (-/7)

The user can define how many of the responses found are to be placed in the response area.

&BLKnnn
nnn responses are placed in the response area. The record number of each response is output.

&BLNnnn
nnn responses are placed in the response area. The record numbers of the response records are not output.

If neither &BLKnnn nor &BLNnnn is specified, by default just one response record is placed in the response area with no record number.

Lock mode (-/7)

&PSN000
: The response records are output without primary key values.

&RNL000
: The record accessed by inquiry within a transaction is not locked.

&RNW000
: The inquiry can access a record that has been locked by another transaction (dirty read). The statement is acknowledged with status code 9S. After a dirty read in block mode, no further responses are placed in the response area.
If &RNW000 is omitted, a transaction attempting to access a locked record is placed in a wait state until the record becomes free.

End identifier (-/1)

9 Identifies the end of the statement

; End of statement. The statement is chained to a following end TA statement.

Acknowledgment area

Displ.	Length	Entry	Meaning
0	2	{00 / 10}	Status
2	4	-	-
6	2	ff	File identifier
8	2	t-length	Total length of responses
10	2	e-length	Length of each response
12	4	rno	Record number; in block mode, this is the record number of the last response record placed in the response area

Table 40: Acknowledgment area for response output

Displ.	Length	Entry	Meaning
0	2	57 5A 5B 5C 9O 9S	Status
2	3	[san]	Symbolic attribute name (omitted for status code 9S)
5	1	-	-
6	2	ff	File identifier
8	2	t-length	Total length of responses
10	2	e-length	Length of each response
12	4	rno	Record number; in block mode, this is the record number of the last response record placed in the response area

Table 41: Acknowledgment area on error with response output

Displ.	Length	Entry	Meaning
0	2	50 51 53 54 57 5B 5D 5M 5Z 70 7D 9O	Status
2	3	[san]	Symbolic attribute name, only with 51, 53, 54, 5M
5	1	-	-
6	2	ff	File identifier

Table 42: Acknowledgment area on error without response output (part 1 of 2)

Displ.	Length	Entry	Meaning
8	2	-	-
10	2	ss	Status subnumber
12	4	-	-

Table 42: Acknowledgment area on error without response output (part 2 of 2)

Response area

SESAM/SQL places in the response area the attribute values and possibly also the full attribute definition, depending on the format identifier.

For attributes with null values, the default value is output.

Displ.	Length	Entry	Meaning
0	4	[rno]	Record number, only for block mode &BLKnnn; the record number is not specified if the block mode is &BLNnnn or if no block mode is used.
4	L(AC)	[pkv]	Primary key value The primary key value of each response is output with the length specified in the attribute catalog. If &PSN000 is specified, no primary key value is output.
-	L(AC)	atv	Attribute value The attribute value is output with the length specified in the attribute catalog.
-	-	[...]	Attribute values 2 - n of the response
-	-	[...]	In block mode: responses 2 - nnn

Table 43: Response area for format identifier 0

Displ.	Length	Entry	Meaning
0	4	[rno]	Record number, only for block mode &BLKnnn
4	L(AC)	[pkv]	Primary key value The primary key value of each response is output with the length specified in the attribute catalog. If &PSN000 is specified, no primary key value is output.

Table 44: Response area for format identifier 3 (part 1 of 3)

Displ.	Length	Entry	Meaning
-	3	san	Symbolic attribute name
-	2	X´0001´ to X´0100´	Attribute length: 1 to 256 bytes
-	1	X´00´ to X´0F´	Number of decimal places: 0 to 15 places of decimals
-	1	 X´11´ X´21´ X´22´ X´24´ X´28´ X´00´	Data type: CHAR NUMERIC DECIMAL INTEGER SMALLINT uninterpretable data type
-	1	 X´02´ X´04´ X´08´	Index information: Index locked Index is available Index required
-	1	i-length	Index length (binary)
-	1	 X´01´ to X´FF´ X´00´	Number of occurrences of a multiple attribute as defined in attribute catalog; 1 to 255 occurrences Not a multiple attribute
-	1	dfc	Default value character
-	1	 X´80´ X´40´ X´00´	Compound key information: Compound key Compound key attribute Not a compound key
-	1	ck-displ	Displacement of a compound key attribute from the start of the compound key
-	4	-	-
-	L(AC)	atv	Attribute value The attribute value is output with the length specified in the attribute catalog. For multiple attributes, the attribute definition and attribute value is output for each occurrence.
-	-	[...]	Attribute values 2 - n of the response

Table 44: Response area for format identifier 3 (part 2 of 3)

Displ.	Length	Entry	Meaning
-	1	9	End of response record: end identifier that terminates the last attribute value
-	-	[...]	In block mode: responses 2 - nnn

Table 44: Response area for format identifier 3 (part 3 of 3)

Inquiry area

PK function 0 does not require an entry in the inquiry area.

Comparison values must be placed in the inquiry area for primary key functions 1 to 6 and 8:

Displ.	Length	Entry	Meaning
0	L(AC) 4	pkv1 rno	For PK functions 1 to 6: primary key (group) value of the primary key length specified in the attribute catalog For PK function 8: record number
-	L(AC)	[pkv2]	For PK functions 2 and 5: primary key (group) value of the primary key length specified in the attribute catalog

Table 45: Inquiry area

Numeric comparison values placed in the inquiry area must be of the correct data type (see also under Search, “Inquiry area” on page 59).

3.11 Response polling

The retrieval statements search, record output and inquiry select records based on specified conditions, and by default return a result of the first response found in the application program response area. For block modes &BLKnnn or &BLNnnn, the first nnn responses are output.

With the response polling statement, all subsequent responses are polled successively.

The number of responses output by a response polling statement depends on the block mode used by the base statement.

Response polling can also be used in updated form, whereby the new comparison values for the primary key value must be entered in the same way as in the base statement. The range of primary key values of the records to be selected can thus be extended or restricted.

Strategy Z or P used with a search enables cursor files to be created. These only contain the record numbers of the selected records. The response polling statement allows the complete records whose numbers are stored in the cursor file to be retrieved. Polling conditions allow the user to page through the cursor file at will, e.g. to call off responses in any sequence.

Contents of transfer areas:

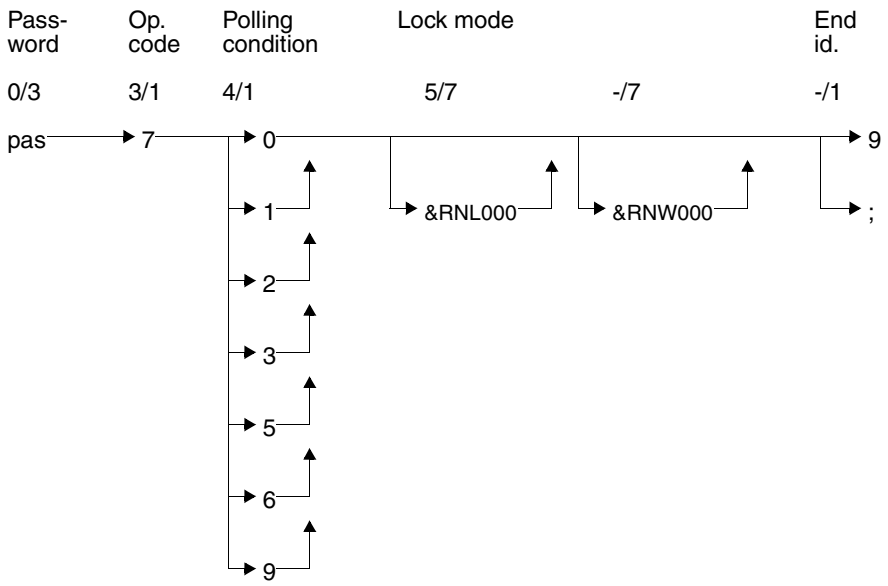
Statement area: The application program supplies the statement.

Acknowledgment area:
The application program supplies the file identifier; the DBH returns the acknowledgment to the statement.

Response area: The SESAM/SQL DBH supplies the responses. These have the same format as the responses in the base statement. If the base statement uses block mode, nnn responses are also returned by response polling.

Inquiry area: With updated response polling, the new comparison value(s) for the primary key must be entered here.

Statement area



Key

Polling condition	0	next response from cursor file
	1	first response from the set of responses
	2	first response from cursor file
	3	remainder response polling following record output
	5	previous response from cursor file
	6	last response from cursor file
	9	next response from set of responses
End identifier	9	End of statement
	;	chain statement

Password (0/3)

pas Any three-character string, as password protection has already been performed by the base statement.

Operation code (3/1)

7 Operation code for the response polling statement

Polling condition (4/1)

Response polling after a base statement of search without cursor file creation, record output or inquiry as base statement

1 Poll first response:

The first response from the base statement is output with the content of the inquiry area unchanged.

Depending on the primary key function in the base statement, one or two new comparison values can be entered in the inquiry area. The first response that satisfies the new primary key value condition is then output (updated response polling).

9 Poll next response:

The next response is output.

This may have been preceded either by a base statement or by response polling with polling condition 1 or 9.

Response polling after record output as the base statement

3 Poll remainder of response after record output if the response was longer than the response area (status code 4A or 9S).

Paging in a cursor file

2 Poll first response:

The first response from the cursor file is output with the content of the inquiry area unchanged.

Depending on the primary key function in the base statement, one or two new comparison values can be entered in the inquiry area. The first response from the cursor file that satisfies the new condition is then output.

This statement may have been preceded by response polling with response condition 0, 2, 5 or 6. The base statement must have been a search with strategy Z or P.

0 Poll next response:

The next response is output from the cursor file,

This statement may have been preceded by response polling with polling condition 0, 2, 5 or 6. The base statement must have been a search with strategy Z or P.

6 Poll last response:

The last response from the cursor file is output with the content of the inquiry area unchanged.
Depending on the primary key function in the base statement, one or two new comparison values can be entered in the inquiry area. The last response from the cursor file that satisfies the new condition is then output (updated response polling).

This statement may have been preceded by response polling with polling condition 0, 2, 5 or 6. The base statement must have been a search with strategy Z or P.

5 Poll preceding response:

The content of the inquiry area must remain unchanged. The preceding response in the cursor file is output.

This statement may have been preceded by response polling with polling condition 0, 2, 5 or 6. The base statement must have been a search with strategy Z or P.

Lock mode (5/7 or -/7)

&RNL000
The record accessed by response polling within a transaction is not locked.

&RNW000
The response polling statement can access a record that has been locked by another transaction (dirty read). The statement is acknowledged with status code 9S. After a dirty read in block mode, no further responses are placed in the response area.
If &RNW000 is omitted, a transaction attempting to access a locked record is placed in a wait state until the record becomes free.

If the base statement was a search with join, the same lock mode must be used in response polling as was used in the search with join.

End identifier (-/1)

9 Identifies the end of the statement

; End of statement. The statement is chained to a following end TA statement.

If a record number cursor file has been processed by cursor file handling statements (see section “Cursor file handling” on page 125), only the response polling statements xxx729 or xxx769 can be used immediately afterwards.

If a record number cursor file has been processed by response polling statements for paging in the cursor file, the next record number must not subsequently be read by xxx11R9. The cursor file must be read from the beginning with xxx10R9 or xxx12R9.

Acknowledgment area

Displ.	Length	Entry	Meaning
0	2	00 10 16 9S	Status
2	4	[r-no]	Number of responses, only if base statement was search, not with status code 16
6	2	ff	File identifier
8	2	t-length	Total length of responses
10	2	e-length	Length of each response
12	4	rno	Record number; in block mode, this is the record number of the last response record placed in the response area

Table 46: Acknowledgment area for response

If the open statement did not define a response area large enough to hold a complete block, then each response poll only returns the number of responses that can be held in the response area. A status code of 00 is returned. The next response polling statement returns the next responses.

Displ.	Length	Entry	Meaning
0	2	70 7D 7T	Status
2	4	-	-
6	2	ff	File identifier
8	2	-	-
10	2	ss	Status subnumber
12	4	-	-

Table 47: Acknowledgment area on error

Response area

The format of the response area corresponds with that of the base statement:
– Search (see page 58)
– Search with join (see page 72)
– Index browsing (see page 91)
– Record output (see page 103 or page 312)
– Inquiry (see page 114 or page 324)

Inquiry area

For updated response polling, the new comparison values for the primary key function must be placed in the inquiry area:

Displ.	Length	Entry	Meaning
0	L(AC) 4	[pkv1 rno1]	For PK functions 1 to 6 (base statement): primary key (group) value of the primary key length specified in the attribute catalog For PK function 8 (base statement):record number Omitted for PK function 0.
-	L(AC)	[pkv2]	For PK functions 2 and 5 (base statement): primary key (group) value of the primary key length specified in the attribute catalog

Table 48: Inquiry area

Numeric comparison values placed in the inquiry area must be of the correct data type (see “Inquiry area” on page 59).

Paging in a cursor file in block mode

In a search that creates a cursor file, block mode can be activated using &BLKnnn or &BLNnnn. nnn response records will then be output for each response poll.

Within a block, the response records are always output in the sequence in which they are held in the cursor file, irrespective of the read direction.

If exactly nnn response records are output for a response poll, SESAM/SQL returns status code 00 in the acknowledgment area. The cursor file can be read by the response polling statements xxx729, xxx709, xxx769 and xxx759.

If the cursor file has been processed to the stage where response polling returns less than nnn or even no response records, then SESAM/SQL indicates status code 10 in the acknowledgment area. The cursor file can be reread from the beginning using xxx729 or from the end using xxx769.

Example of paging in a cursor file

A cursor file has been created with blocking factor 3 in the search (xxx60Z&BLK0039). The response records whose record numbers are held in the cursor file have the following primary key values:

P00333, P00708, P01000, P03674, P05408, P05583, P09980, P11444, P11500, P12921

During response polling, the content of the inquiry area remains unchanged, i.e. no updated response polling is executed.

Effect of the possible response polling statements:

	Paging with no direction change		Paging with direction change	
	only forwards	only backwards	forwards, backwards	backwards, forwards
Statement 1:	xxx729	xxx769	xxx729	xxx769
Response:	P00333 P00708 P01000	P11444 P11500 P12921	P00333 P00708 P01000	P11444 P11500 P12921
Acknowledgment:	Status 00	Status 00	Status 00	Status 00
Statement 2:	xxx709	xxx759	xxx709	xxx759
Response:	P03674 P05408 P05583	P05408 P05583 P09980	P03674 P05408 P05583	P05408 P05583 P09980
Acknowledgment:	Status 00	Status 00	Status 00	Status 00
Statement 3:	xxx709	xxx759	xxx759	xxx709
Response:	P09980 P11444 P11500	P00708 P01000 P03674	P00333 P00708 P01000	P11444 P11500 P12921
Acknowledgment:	Status 00	Status 00	Status 00	Status 00
Statement 4:	xxx709	xxx759	xxx759	xxx709
Response:	P12921 - -	P00333 - -	- - -	- - -
Acknowledgment:	Status 10	Status 10	Status 10	Status 10

The results of using updated response polling are similar, except that the set of response records is a subset of the response records referred to by the cursor file as a whole.

3.12 Cursor file handling

A cursor file can be created for any logical file. This cursor file, like the logical file, is identified by the file identifier.

The cursor file handling statements enable the user to process a record number cursor file created by a search:

– Output the record numbers in the cursor file or join cursor file
– Write record numbers in the cursor file
– Delete record numbers from the cursor file

The user can also create and process a cursor file with records of any contents (user cursor file):

– Write variable-length records in a cursor file
– Delete records from a cursor file
– Read records in a cursor file

This type of user cursor file can be used, for example, for intermediate storage of records.

Searches with S subquestions generate a so-called sort cursor file containing for each record the record number and associated attribute values. The user can compress the sort cursor file into a pure record number cursor file.

Contents of transfer areas:

Statement area: The application program supplies the statement.

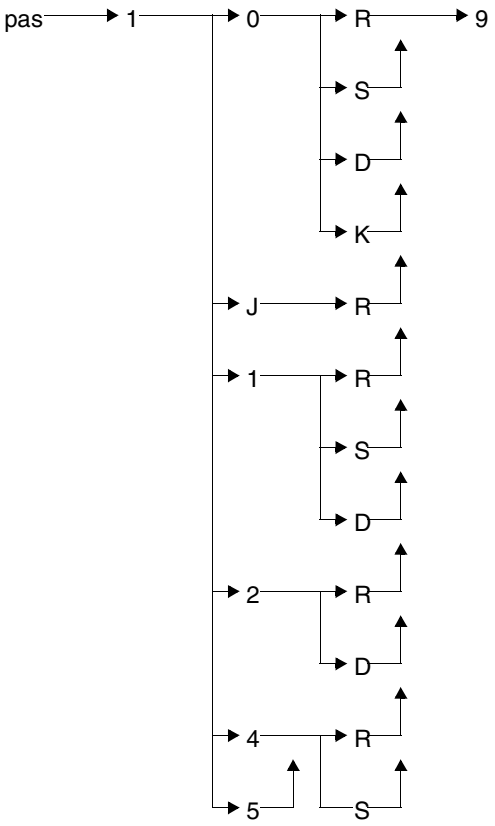
Acknowledgment area:
The application program supplies the file identifier; the DBH returns the acknowledgment to the statement.

Response area: For the statements that read a cursor file, the DBH places the record numbers or the records read in the response area.

Inquiry area: For the statements that write to a cursor file, the application program must make the record numbers or records available in the inquiry area.

Statement area

Pass-word	Op. code	Stra-tegy	Func-tion	End id.
0/3	3/1	4/1	5/1	6/1



Key

Strategy, function	0R	Read first and subsequent record numbers in record number cursor file
	0S	Write record numbers to new record number cursor file
	0D	Delete complete cursor file
	0K	Compress sort cursor file
	1R	Read next record numbers in record number cursor file
	1S	Write record numbers to existing record number cursor file
	1D	Delete unread records or record numbers
	2R	Read only the first record number in record number cursor file
	2D	Delete records or record numbers that have been read
	4R	Read first record in user cursor file
	4S	Write first record to new user cursor file
	5R	Read next record in user cursor file
	5S	Write record to existing user cursor file

Password (0/3)

pas Password for a protected CALL DML table,
any three-character string for an unprotected CALL DML table.

Operation code (3/1)

1 Operation code for the cursor file handling statements

Strategy and function (4/1 and 5/1)

A combination of strategy and function allows the user to specify how he wishes to process a record number, user or sort cursor file.

Reading a record number cursor file

0R The cursor file is read starting with the first record number. The response area is filled with record numbers from the cursor file to the length specified in the open statement.

1R Follow-up statement following xxx10R9:

The next record numbers are read. The response area is filled with the record numbers read.

Follow-up statement following xxx12R9:

The next record number is read. This one record number is made available in the response area.

2R The first record number in the cursor file is read. This record number is made available in the response area.

Read a user cursor file

4R The first record in the user cursor file is read and written to the response area.

5R The next record is read and stored to the response area.

Read a join cursor file

JR The record numbers of the first component of the join cursor file are read, starting with the first record number. The next record numbers are read in the next call. The response area is filled in the same way as for 0R or 1R.

Write to a record number cursor file

0S A new cursor file is created with the record numbers specified in the inquiry area. If a cursor file already exists with the same file identifier, it is deleted.

1S An existing cursor file is extended with the record numbers in the inquiry area.

Write to a user cursor file

4S A new cursor file is created and the record in the inquiry area inserted in it. Any existing cursor file with the same file identifier is deleted.

5S An existing user cursor file is extended with the record in the inquiry area.

The records in a user cursor file are of variable length. Thus each record in the inquiry area must be preceded by a 2-byte record length field containing the actual record length + 4, followed by two blanks. This is also necessary where one or more record numbers are written to a record number cursor file.

When a join cursor file is read, only the first component is processed

Delete a record number or user cursor file

0D The whole cursor file is deleted.

1D All unread records or record numbers in the cursor file are deleted.

2D All records or record numbers that have been read are deleted from the cursor file.

Deletion of single records or record numbers using 1D or 2D is only possible if preceded by at least one read.

Compress a sort cursor file

0K A sort cursor file created by a search with an S subquestion is compressed into a record number cursor file.

End identifier (6/1)

9 Indicates end of statement

If a record number cursor file has been read by means of response polling statements in order to page through the cursor file (see section “Response polling” on page 117), the next record number cannot be read by xxx11R9. The cursor file must be read from the beginning using xxx10R9 or xxx12R9.

If a record number cursor file has been processed using the cursor file handling statements, the only response polling statements that can be used immediately afterwards are xxx729 (poll first response) or xxx769 (poll last response).

When a join cursor file is read, only the first component is processed.

Acknowledgment area

Displ.	Length	Entry	Meaning
0	2	{00 / 01}	Status
2	4	r-no	Number of responses
6	2	ff	File identifier
8	2	t-length	Total length of responses
10	2	e-length	Length of each response

Table 49: Acknowledgment area for response

Displ.	Length	Entry	Meaning
0	2	12 13 15 18 19 1Z	Status
2	4	-	-
6	2	ff	File identifier
8	8	-	-

Table 50: Acknowledgment area on error

Response area

The response area is only filled by statements that read a cursor file (function R).

Displ.	Length	Entry	Meaning
0	2	length	Length of actual response area (binary)
2	2	X´4040´	-
4	-	rno[...] v-rec	One or more record numbers in a record number cursor file A variable-length record in a user cursor file.

Table 51: Response area

Inquiry area

The record numbers or records to be written to the cursor file must be made available in the inquiry area (function S).

Displ.	Length	Entry	Meaning
0	2	length	Length of the actual inquiry area (binary)
2	2	X´4040´	-
4	-	rno[...] v-rec	One or more record numbers to be written to a record number cursor file. A variable-length record to be written to a user cursor file.

Table 52: Inquiry area

3.13 Addition

The addition statement allows the user to add records to a table. A record consists of at least a primary key value.

The DBH checks the addition to see whether the specified primary key value already exists in the CALL DML table. If it does, the addition is rejected.

When making an addition, the user can use a compound key attribute as an automatic count field. The value of the count field is incremented by one for each addition (see “Automatic count field in a compound key” on page 139).

The addition statement belongs to the group of direct updating statements.

Contents of transfer areas:

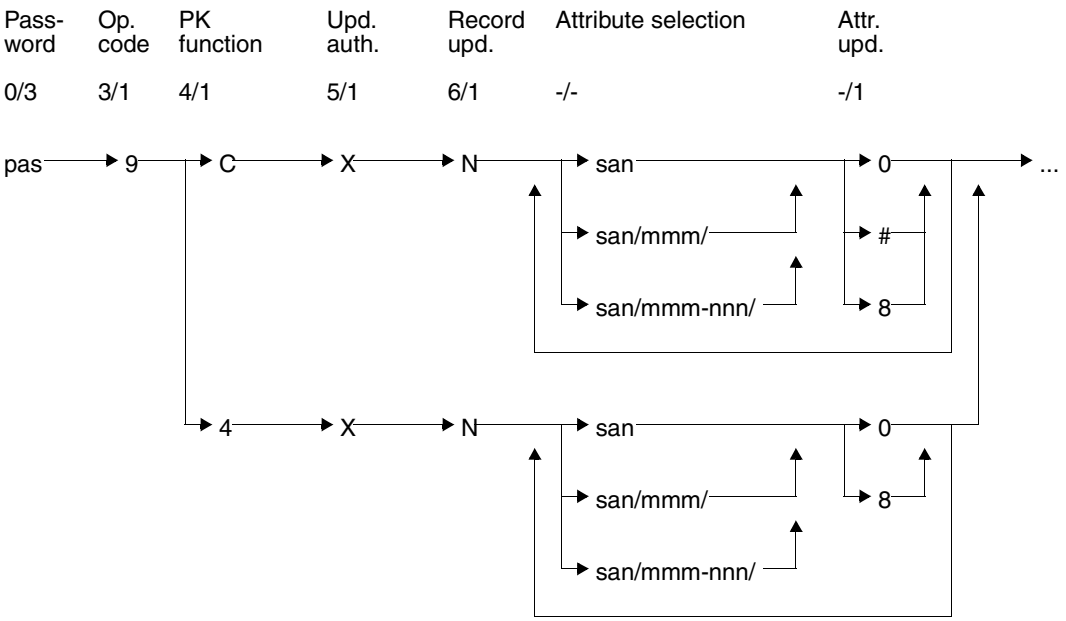
Statement area: The application program supplies the statement.

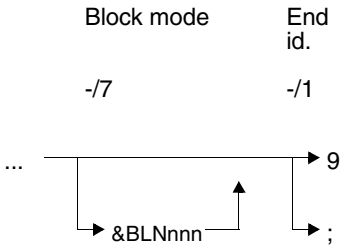
Acknowledgment area:
The application program supplies the file identifier; the DBH returns the acknowledgment to the statement.

Inquiry area: The application program supplies the record to be added.

Response area: The application program gives the value of the automatic count field (if used).

Statement area





Key

PK function	C	Primary key at any position in the input record
	4	Primary key at the beginning of the input record
Attribute update function	0	Add attribute value
	#	Compound key attribute for automatic count field
	8	Skip attribute
End identifier	9	End of statement
	;	Chain statement

Password (0/3)

pas Password for a protected CALL DML table,
any three-character string for an unprotected CALL DML table.

Operation code (3/1)

9 Operation code for the direct update statement addition

Primary key function (PK function) (4/1)

C The primary key value or the attribute values of the compound key are located anywhere in the input record. A value must be specified for each compound key attribute. The null value can also be entered for individual compound key attributes, but the compound key as a whole must be unique.

4 The primary key value or the attribute values of the compound key are at the beginning of the input record. The attribute values for the compound key must be given in the sequence of the symbolic attribute names AAB, AAC etc.

Update authorization (5/1)

The statement logs a direct update under the file identifier ff in the acknowledgment area, and obtains update authorization.

X After execution of the statement, update authorization is cancelled again.

V For compatibility reasons, this former update authorization is still syntactically permitted, but has the same meaning as X.

Update record (6/1)

N Add a new record to the table:

The table is first checked to see if a record with the specified primary key or record number already exists. If so, the addition is rejected. If not, the record is added with the attribute values from the input record.

Attribute selection (-/-)

Specifying symbolic attribute names defines the attributes to which attribute values are to be assigned in a new record. The attribute value for each named attribute must be made available in the inquiry area.

san Symbolic attribute name of an attribute or of the primary key (AAA).
For a compound key, individual compound key attributes with the symbolic attribute names AAB, AAC etc. can be specified instead of the higher-level symbolic attribute name AAA.

san/mmm/
Symbolic attribute name and occurrence number (mmm) of a multiple attribute.

san/mmm-nnn/
Symbolic attribute name of a multiple attribute for whose occurrences mmm to nnn attribute values are to be inserted in the new record.

A maximum of 512 attributes can be specified in a direct updating statement. This includes compound key attributes, irrespective of whether they are specified individually or by the symbolic attribute name AAA. Each separate occurrence of a multiple attribute counts as one.

Each attribute and each occurrence of a multiple attribute can only be referenced once in a statement. Ranges of occurrences must not overlap.

With primary key function 4, no primary key and thus also no compound key attributes may be included.

Attribute update function (-/1)

The attribute update function defines how the specified attribute is to be treated when a record is added.

0 Addition of the attribute value in the inquiry area for the named attribute

The compound key attribute is used as an automatic count field. The attribute is incremented by 1 for the addition. If the compound key attributes to the left of the count field have an as yet unallocated combination of attribute values, the count field is given a value of 1.
If the count field overflows, the addition is rejected with status code 9D.
This function is only permitted for compound key attributes of the data type DECIMAL, NUMERIC, INTEGER or SMALLINT (see “Automatic count field in a compound key” on page 139)
The value in the inquiry area is ignored.

8 Skip attribute. This function is not possible for compound key attributes.

Block mode (-/7)

The user can define how many records are to be passed to the DBH in one statement.

&BLNnnn
nnn records are passed to the DBH in the inquiry area for addition to the table.

If &BLNnnn is omitted, the default is to add one record per statement.

If a status code other than 00 is returned on adding a record, block mode processing is terminated. The number of correctly executed additions is returned in the acknowledgment area.

If transaction-oriented security is in force and block mode is used outside transaction boundaries, the entire block is bracketed as one system transaction. If a status occurs, the transaction is closed.

End identifier (-/1)

9 Indicates end of statement

; End of statement. The statement is chained to a subsequent begin TA, end TA or reset TA statement.

Acknowledgment area

The format of the acknowledgment area is the same for the addition, update and delete statements. The following description applies to the update (see section “Update” on page 141) and delete (see section “Deletion” on page 150) statements as well as to the addition statement.

Displ.	Length	Entry	Meaning
0	2	00	Status
2	4	␣␣␣␣	-
6	2	ff	File identifier
8	2	[r-length]	Response length; only applies to addition with PK function C and automatic count field
10	2	[no]	For block mode &BLNnnn: number of additions/updates/deletes executed
12	4	rno	Record number; in block mode this is the record number of the last record added/updated/deleted

Table 53: Acknowledgment area after successful direct updating

Displ.	Length	Entry	Meaning
0	2	90 91 93 94 95 96 97 98 99 9A 9B 9D 9E 9F 9H 9I 9K 9M 9O 9Q 9R 9S 9U 9Z	Status
2	4	san␣ ␣␣␣␣ MOD␣ LINK DCN␣	Symbolic attribute name of the attribute at which the error occurred; reported by – DBH – SESMOD – SESLINK – SESDCN
6	2	ff	File identifier
8	2	[r-length]	Response length; only applies to addition with PK function C and automatic count field

Table 54: Acknowledgment area on error after direct updating (part 1 of 2)

Displ.	Length	Entry	Meaning
10	2	ss no	Status subnumber For block mode &BLNnnn: number of additions/updates/deletes successfully executed
12	4	-	-

Table 54: Acknowledgment area on error after direct updating (part 2 of 2)

Response area

The response area is used for output of the count field value for additions using primary key function C and attribute update function #:

Displ.	Length	Entry	Meaning
0	L(AC)	count	Value of compound key attribute used as automatic count field.

Table 55: Response area

Inquiry area

The input records to be added to the table must be made available in the inquiry area.

Numeric attribute values placed in the inquiry area must be of the correct data type (see under Search, “Inquiry area” on page 59).
The attribute values of a numeric compound key attribute must not be negative.

Displ.	Length	Entry	Meaning
0	L(AC) L(AC) L(AC)	pkv [atv] [...] ckv	Primary key value of the record to be added (must be specified once only) Attribute value to be inserted in the new record Compound key attribute value of the record to be added
-	-	[...]	For block mode: input records 2 to nnn

Table 56: Inquiry area for primary key function C

Displ.	Length	Entry	Meaning
0	L(AC)	pkv	Primary key value of the record to be added
-	L(AC)	[atv[...]]	Attribute value(s) of the record to be added
-	-	[...]	For block mode: input records 2 to nnn

Table 57: Inquiry area for primary key function 4

Automatic count field in a compound key

In a table with a compound key, one of the compound key attributes can be used as an automatic count field. The compound key attribute must, however, be one of the data types NUMERIC, INTEGER, SMALLINT or DECIMAL.

The count field always refers to records with the same base. By “records with the same base” we mean records where the values for the compound key attributes to the left of the count field are the same.

An addition causes the count field to be given the currently highest value plus one for this base. For every further addition of a record with the same base, the value of the count field is incremented by one. This technique enables a self-generating primary key to be implemented for a table with a compound key.

The compound key attribute used as an automatic count field can be given an explicit value for an addition, just like a “normal” compound key attribute. If the count field mechanism is used subsequently, the base value for incrementing is the highest value of the attribute, irrespective of whether it was generated by the user or automatically.

Addition with automatic count field incrementing after deletion

When records have been deleted from the table by a delete statement, these records are initially simply flagged internally for deletion. When another record is added with automatic count field incrementing, the count field values of the flagged records are not reassigned. The count field of the new record to be added is given the highest value before the deletion, plus one.

Example

	Example 1	Example 2
Initial situation: A database contains records with the compound key count attribute values shown on the right. The records whose count attribute value is underlined are deleted.	0001 0002 0003 0004	0001 0002 0003 0004
Resulting situation: The database now only contains the records with the following values for the count attribute:	0001	0001 0004

Case A		
Addition: with automatic count field incrementing	0001 0005	0001 0004 0005

or:

Case B		
First addition: explicit, with count field value 0002	0001 0002	0001 0002 0004
Second addition: with automatic count field incrementing	0001 0002 0003	0001 0002 0004 0005

3.14 Update

The update statement allows existing records to be updated. It comprises the following functions:

– Addition, update and deletion of attribute values

– Addition, update and deletion of occurrences of a multiple attribute

– Insert occurrences in front of an existing occurrence of a multiple attribute

– Append occurrences after the last significant occurrence of a multiple attribute

The update statement also allows attribute values to be deleted by overwriting the current attribute value with the null attribute value.

The update statement is one of the group of direct updating statements.

Contents of transfer areas:

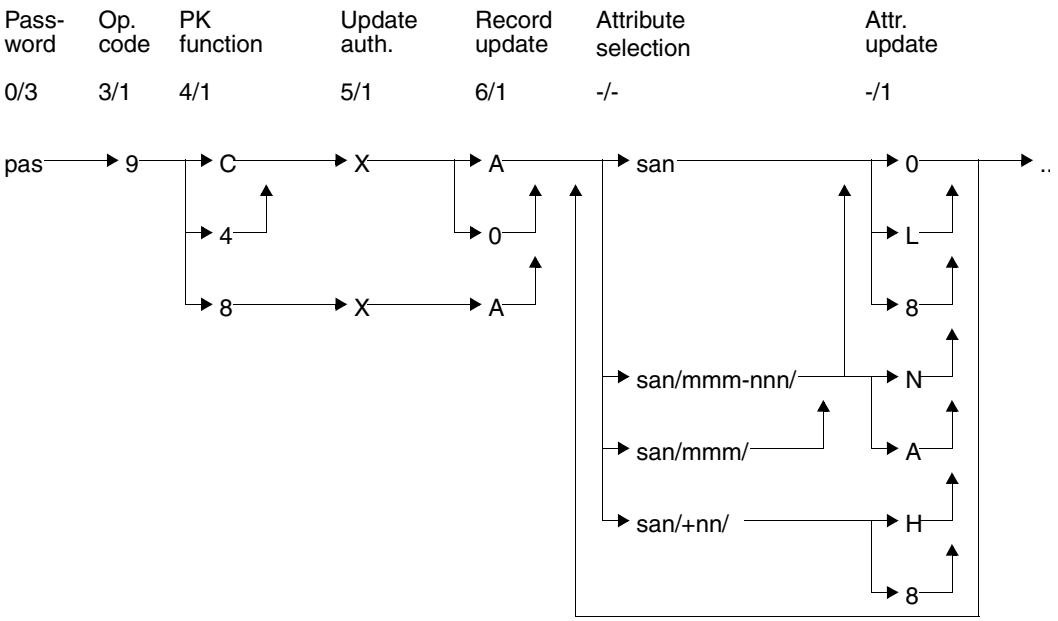
Statement area: The application program supplies the statement.

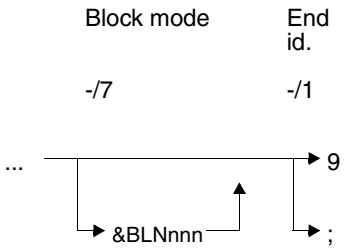
Acknowledgment area:
The application program supplies the file identifier; the DBH returns the acknowledgment to the statement.

Inquiry area: The application program supplies the new data for the record to be updated.

The response area is not used.

Statement area





Key

PK function	C	Primary key at any location in the input record
	4	Primary key at the beginning of the input record
	8	Record number at the beginning of the input record
Record update function	A	Update an existing record
	0	Update or add a record
Attribute update function	0	Update or add an attribute value
	L	Delete an attribute value
	N	Insert values for occurrences
	A	Update the value of an occurrence
	H	Append values to last significant occurrence
	8	Skip attribute
End identifier	9	End of statement
	;	Chain statement

Password (0/3)

pas Password for protected CALL DML table,
any three-character string for unprotected CALL DML table.

Operation code (3/1)

9 Operation code for the direct updating statement update

Primary key function (PK function) (4/1)

C The primary key value or the attribute values of the compound key are located anywhere in the input record. A value must be specified for each compound key attribute. The null value can also be entered for individual compound key attributes provided the standard default value character was used when the CALL DML table was first loaded. The compound key as a whole must be unique.

8 The record is accessed by means of the record number, which is entered in the inquiry area.

4 The primary key value or the attribute values of the compound key are at the beginning of the input record. The attribute values for the compound key must be given in the sequence of the symbolic attribute names AAB, AAC etc.

Update authorization (5/1)

The statement logs a direct update under the file identifier ff in the acknowledgment area, and obtains update authorization.

X After execution of the statement, update authorization is cancelled again.

V For compatibility reasons, this former update authorization is still syntactically permitted, but has the same meaning as X.

Record update function (6/1)

A Update an existing record:
All attribute values except for the primary key value can be added, updated or deleted.
An attempt to update a non-existent record is rejected with a status code.

0 Update or add a record:
The attribute values in an existing record are overwritten by those in the input record.
If an attempt is made to update a non-existent record, a new record is added with the primary key value and the attribute values from the input record.

Attribute selection (-/-)

Specifying symbolic attribute names defines the attributes to which attribute values are to be assigned in a new record. The attribute value for each named attribute must be made available in the inquiry area.

san Symbolic attribute name of an attribute or of the primary key (AAA).
For a compound key, individual compound key attributes with the symbolic attribute names AAB, AAC etc. can be specified instead of the higher-level symbolic attribute name AAA. The value of the primary key cannot be changed.

san/mmm/
Symbolic attribute name and occurrence number (mmm) of a multiple attribute.

san/mmm-nnn/
Symbolic attribute name of a multiple attribute for whose occurrences mmm to nnn attribute values are to be updated or inserted.

san/+nn/
Symbolic attribute name of a multiple attribute to which nn occurrences are to be appended.

A maximum of 512 attributes can be specified in a direct updating statement. This includes compound key attributes, irrespective of whether they are specified individually or using the symbolic attribute name AAA. Each separate occurrence of a multiple attribute counts as one.

With primary key function 4, no primary key and thus also no compound key attributes may be included.

Attribute update function (-/1)

The attribute update function defines whether the value of the specified attribute is to be updated, deleted or added. A value of the length of the attribute must be placed in the inquiry area for each attribute update function. For attribute update function L or 8, this entry is ignored. For all other attribute update functions, the value in the inquiry area is either added to the record or replaces an existing attribute value.

0 Updating or adding an attribute value:

With a multiple attribute, the value of occurrence mmm or of occurrences mmm to nnn is updated if it contains a significant value. Otherwise the value(s) is (are) inserted in the multiple attribute starting from the first free, i.e. null occurrence. The new attribute values, to the full length of the attribute, must be placed in the inquiry area.

L A significant value of the attribute or occurrence of the multiple attribute is deleted. A null value remains unchanged. If an occurrence of a multiple attribute is deleted, all following significant attributes move back.
A field of the length of the attribute must be reserved in the inquiry area, although it is not used by the statement.

8 The attribute is ignored. Any value can be entered for the attribute in the inquiry area, and is also ignored.
Attribute update function 8 cannot be used with compound key attributes or with the primary key.

Only for multiple attributes:

N The value of an occurrence or the values of several occurrences are inserted in front of occurrence mmm if the latter has a significant value. Otherwise the values are inserted starting with the first free occurrence.

A Significant values of occurrence mmm or of occurrences mmm to nnn are updated. If an occurrence does not have a significant value, the update is rejected with a status code.

H nn values are appended starting with the first free occurrence.

Block mode (-/7)

The user can define how many records are to be passed to the DBH in one statement.

&BLNnnn
: nnn records are passed to the DBH in the inquiry area for updating in the table.

If &BLNnnn is omitted, the default is to process one record per statement.

If a status code other than 00 is returned on updating a record, block mode processing is terminated. The number of correctly executed updates is returned in the acknowledgment area.

If transaction-oriented security is in force and block mode is used outside transaction boundaries, the entire block is bracketed as one system transaction. If a status occurs, the transaction is closed.

End identifier (-/1)

9 Indicates end of statement

; End of statement. The statement is chained to a subsequent begin TA, end TA or reset TA statement.

Acknowledgment area

The format of the acknowledgment area is identical to that of the addition statement; see “Acknowledgment area” on page 136.

Inquiry area

The primary key or record number of the record to be updated, and also the new attribute values, are entered in the inquiry area.
Numeric attribute values entered in the inquiry area must be of the correct data type (see under Search, “Inquiry area” on page 59).

Displ.	Length	Entry	Meaning
0	L(AC)	pkv	Primary key value of the record to be updated (must be specified once only)
	L(AC)	[atv] [...]	Attribute value to replace the value in the existing record
	L(AC)	ckv	Compound key attribute value of the record to be updated
-	-	[...]	For block mode: input records 2 to nnn

Table 58: Inquiry area for primary key function C

Displ.	Length	Entry	Meaning
0	4	rno	Record number of the record to be updated
4	L´PKV-4´	-	The record number must be padded out with any text to the full length of the primary key as specified in the attribute catalog.
-	L(AC)	[atv[...]]	Attribute value(s) to replace those in the existing record
-	-	[...]	For block mode: input records 2 to nnn

Table 59: Inquiry area for primary key function 8

Displ.	Length	Entry	Meaning
0	L(AC)	pkv	Primary key value of the record to be updated
-	L(AC)	[atv[...]]	Attribute value(s) of the record to be updated
-	-	[...]	For block mode: input records 2 to nnn

Table 60: Inquiry area for primary key function 4

Deletion by changing to the null attribute value

Individual attribute values can be deleted in a record by replacing them with the null attribute value. The value of the primary key cannot be deleted in this way.

The null attribute value is the attribute value in the value range of the attribute that consists only of the default value character in printable form. The characters that can be used to form the null attribute value depend on the data type as follows:

Data type	Permitted default value characters	Standard default value char.
CHAR	any printable character ≤ X´40´	X´40´ (blank)
NUMERIC DECIMAL INTEGER SMALLINT	single-digit positive number +0 to +9 or single-digit negative number -1 to -9; with NUMERIC and DECIMAL, -0 is also possible	+0

Table 61: Characters for the null attribute value

Data type	Default value character	Null attribute value (printable)	Null attribute value (binary)
INTEGER	1	F´1111111111´	X´423A35C7´
	2	F´222222222´	X´0D3ED78E´
	3	F´333333333´	X´13DE4355´
	4	F´444444444´	X´1A7DAF1C´
	5	F´555555555´	X´211D1AE3´
	6	F´666666666´	X´27BC86AA´
	7	F´777777777´	X´2E5BF271´
	8	F´888888888´	X´34FB5E38´
	9	F´999999999´	X´3B9AC9FF´
	-1	F´-1111111111´	X´BDC5CA39´
	-2	F´-222222222´	X´F2C12382´
	-3	F´-333333333´	X´EC21BCAB´
	-4	F´-444444444´	X´E58250E4´
	-5	F´-555555555´	X´DEE2E51D´
	-6	F´-666666666´	X´D8437956´
	-7	F´-777777777´	X´D1A40D8F´
	-8	F´-888888888´	X´CB04A1C8´
	-9	F´-999999999´	X´C4653601´

Table 62: Summary of the null attribute values for the binary data types INTEGER and SMALLINT (part 1 of 2)

Data type	Default value character	Null attribute value (printable)	Null attribute value (binary)
SMALLINT	1	H´11111´	X´2B67´
	2	H´22222´	X´56CE´
	3	H´3333´	X´0D05´
	4	H´4444´	X´115C´
	5	H´5555´	X´15B3´
	6	H´6666´	X´1A0A´
	7	H´7777´	X´1E61´
	8	H´8888´	X´22B8´
	9	H´9999´	X´270F´
	-1	H´-11111´	X´D499´
	-2	H´-22222´	X´A932´
	-3	H´-3333´	X´F2FB´
	-4	H´-4444´	X´EEA4´
	-5	H´-5555´	X´EA4D´
	-6	H´-6666´	X´E5F6´
	-7	H´-7777´	X´E19F´
	-8	H´-8888´	X´DD48´
	-9	H´-9999´	X´D8F1´

Table 62: Summary of the null attribute values for the binary data types INTEGER and SMALLINT (part 2 of 2)

Example

Default value character: -5

Null attribute value for

data type NUMERIC for a 4-character attribute:	X´F5F5F5D5´
data type DECIMAL for a 4-character attribute:	X´05555D´
data type SMALLINT:	X´EA4D´
data type INTEGER:	X´DEE2E51D´

3.15 Deletion

The deletion statement allows the user to delete complete records from the table.

The deletion statement is one of the group of direct update statements.

Contents of transfer areas:

Statement area: The application program supplies the statement.

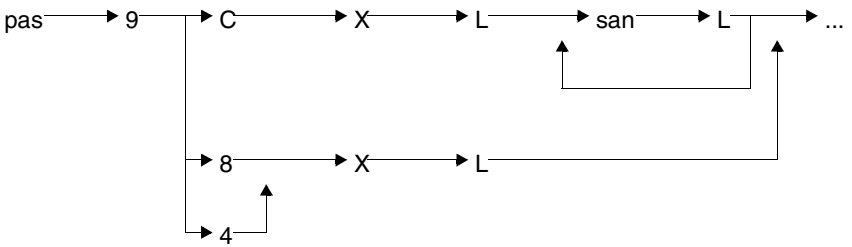
Acknowledgment area:
The application program supplies the file identifier; the DBH returns the acknowledgment to the statement.

Inquiry area: The application program supplies the primary key value or the record number of the record to be deleted.

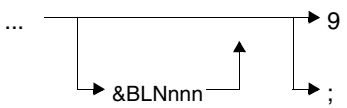
The response area is not used.

Statement area

Pass-word	Op. code	PK function	Update auth.	Record update	Attribute selection	Attribute update
0/3	3/1	4/1	5/1	6/1	-/3	-/1



Block mode	End id.
-/7	-/1



Key

PK function	C	Primary key at any location in the input record
	4	Primary key at the beginning of the input record
	8	Record number at the beginning of the input record
End identifier	9	End of statement
	;	Chain statement

Password (0/3)

pas Password for a protected CALL DML table,
any three-character string for an unprotected CALL DML table.

Operation code (3/1)

9 Operation code for the direct updating statement deletion

Primary key function (PK function) (4/1)

C The primary key value or the attribute values of the compound key are located in any order in the input record. A value must be specified for each compound key attribute. The null value can also be entered for individual compound key attributes, provided the standard default value character was used when the CALL DML table was first loaded. The compound key as a whole must be unique.

8 The record is accessed by means of the record number, which is entered in the inquiry area.

4 The primary key value or the attribute values of the compound key are at the beginning of the input record. The attribute values for the compound key must be given in the sequence of the symbolic attribute names AAB, AAC etc.

Update authorization (5/1)

The statement logs a direct update under the file identifier ff in the acknowledgment area, and obtains update authorization.

X After execution of the statement, update authorization is cancelled again.

V For compatibility reasons, this former update authorization is still syntactically permitted, but has the same meaning as X.

Record update(6/1)

L Delete an entire record

Attribute selection (-/3)

san Symbolic attribute name of an attribute or of the primary key (AAA).
For a compound key, individual compound key attributes with the symbolic attribute names AAB, AAC etc. can be specified instead of the higher-level symbolic attribute name AAA.

Attribute update function(-/1)

L A significant value of the attribute or occurrence of the multiple attribute is deleted. A null value remains unchanged. If an occurrence of a multiple attribute is deleted, all subsequent attributes with a significant value move up.
A field with the length of the attribute must be reserved in the inquiry area. It is not, however, used by the statement.

Block mode (-/7)

The user can define how many records in the table are to be deleted via a statement to the DBH.

&BLNnnn
The DBH deletes a maximum of nnn records with one statement.

If &BLNnnn is omitted, the default is to delete one record per statement.

If a status code other than 00 is returned on deleting a record, block mode processing is terminated. The number of correctly executed record deletions is returned in the acknowledgment area.

If transaction-oriented security is in force and block mode is used outside transaction boundaries, the entire block is bracketed as one system transaction. If a status occurs, the transaction is closed.

End identifier (-/1)

9 Indicates end of statement

; End of statement. The statement is chained to a subsequent begin TA, end TA or reset TA statement.

Acknowledgment area

The format of the acknowledgment area for the deletion statement is identical to that of the addition statement; see “Acknowledgment area” on page 136.

Inquiry area

Displ.	Length	Entry	Meaning
0	L(AC)	pkv ckv	Primary key value of the record to be deleted Value of a compound key attribute in the record to be deleted
-	L(AC)	[ckv[...]]	Attribute values of the remaining compound key attributes
-	-	[...]	In block mode: primary key value or attribute values of the compound key for records 2 to nnn to be deleted

Table 63: Inquiry area for primary key function C

Displ.	Length	Entry	Meaning
0	4	rno	Record number of the record to be deleted
4	L´ PKV -4´	-	The record number must be padded with any text to the full length of the primary key as defined in the attribute catalog.
-	-	[...]	In block mode: record numbers of records 2 to nnn to be deleted, padded as necessary to the full primary key length

Table 64: Inquiry area for primary key function 8

Displ.	Length	Entry	Meaning
0	L(AC)	pkv	Primary key value of the record to be deleted
-	-	[...]	In block mode: primary key value of records 2 to nnn to be deleted

Table 65: Inquiry area for primary key function 4

3.16 Follow-up update

The follow-up update statement resumes operation following one of the direct updating base statements. These base statements may be

– addition (see section “Addition” on page 131),

– update (see section “Update” on page 141), or

– deletion (see section “Deletion” on page 150).

The follow-up update is a simplified form of the direct updating statements. Details of the attributes to be added, updated or deleted are omitted, as they are already defined in the base statement.
The follow-up update can be used from the second record or, in block mode, from the second group of records.

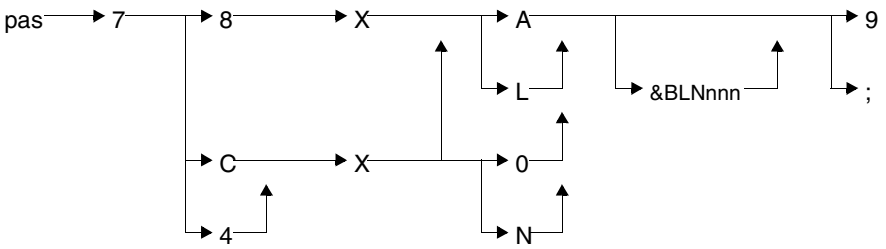
The follow-up update statement saves on processing time compared with a base statement.

Transfer areas:

The transfer areas of the follow-up update are supplied and analyzed in the same way as the base statement.

Statement area

Pass-word	Op. code	PK function	Update auth.	Record update	Block mode	End id.
0/3	3/1	4/1	5/1	6/1	-/7	-/1



Key

PK function	C	Primary key at any location in the input record
	4	Primary key at the beginning of the input record
	8	Record number at the beginning of the input record
Record update function	L	Delete an existing record
	A	Update an existing record
	0	Update or add a record
	N	Add a record
End identifier	9	End of statement
	;	Chain statement

Password (0/3)

pas Any three-character string, as password protection has already been dealt with in the base statement.

Operation code (3/1)

7 Operation code for the direct updating statement follow-up update

Primary key function (PK function) (4/1)

C The primary key value or the attribute values of the compound key are located in any position in the input record. A value must be specified for each compound key attribute. The null value can also be entered for individual compound key attributes, provided the standard default value character was used when the CALL DML table was first loaded. The compound key as a whole must be unique.

8 The record is accessed by means of the record number, which is entered in the inquiry area.

4 The primary key value or the attribute values of the compound key are at the beginning of the input record. The attribute values for the compound key must be given in the sequence of the symbolic attribute names AAB, AAC etc.

The primary key function of the follow-up update must be compatible with the primary key function of the base statement. Permitted combinations:

Base statement	Follow-up update
4	4
8	8
4	8
8	4
C	C

Table 66: Combinations of base statements and follow-up statements

Update authorization (5/1)

The statement logs a direct update under the file identifier ff in the acknowledgment area, and obtains update authorization.

X After execution of the statement, update authorization is cancelled again.

V For compatibility reasons, this former update authorization is still syntactically permitted, but has the same meaning as X.

Record update function (6/1)

A Update an existing record:

All attribute values except for the primary key value can be added, updated or deleted.
An attempt to update a non-existent record is rejected with a status code.

0 Update or add a record:

If the record already exists, the attribute values are overwritten by those in the input record.
If an attempt is made to update a non-existent record, a new record is added with the primary key value and attribute values from the input record.

L Delete a complete record

N Add a record to the table:

The table is first checked to see if a record with the specified primary key or record number already exists. If so, the addition is rejected. If not, the record is added with the attribute values from the input record.

Block mode (-/7)

The user can define how many records are to be passed to the DBH in one statement.

&BLNnnn
nnn records are updated, added or deleted in one statement.

If &BLNnnn is omitted, the default is to process one record per statement.

If a status code other than 00 is returned on a follow-up update, block mode processing is terminated. The number of correctly executed updates is returned in the acknowledgment area.

If transaction-oriented security is in force and block mode is used outside transaction boundaries, the entire block is bracketed as one system transaction. If a status occurs, the transaction is closed.

End identifier (-/1)

9 Indicates end of statement

; End of statement. The statement is chained to a subsequent begin TA, end TA or reset TA statement.

Acknowledgment area

Displ.	Length	Entry	Meaning
0	2	00	Status
2	4	␣␣␣␣	-
6	2	ff	File identifier
8	2	[r-length]	Response length, only for addition with PK function C and automatic count field
10	2	[no]	In block mode &BLNnnn: number of additions/updates/record deletions executed
12	4	rno	Record number; in block mode, record number of the record last added/updated/deleted

Table 67: Acknowledgment area after successful direct update

Displ.	Length	Entry	Meaning
0	2	70 7T 91 93 94 95 96 97 98 99 9A 9B 9D 9E 9F 9H 9I 9K 9M 9O 9Q 9R 9S 9U	Status
2	4	san␣ ␣␣␣␣ MOD␣ LINK DCN␣	Symbolic attribute name of the attribute at which the error occurred; reported by – DBH, – SESMOD – SESLINK – SESDCN
6	2	ff	File identifier
8	2	[r-length]	Response length, only for addition with PK function C and automatic count field in block mode

Table 68: Acknowledgment area on error after direct update (part 1 of 2)

Displ.	Length	Entry	Meaning
10	2	[ss / no]	Status subnumber In block mode &BLNnnn: number of additions/updates/record deletions successfully executed
12	4	-	-

Table 68: Acknowledgment area on error after direct update (part 2 of 2)

Response area

The response area is used to output the count field value when primary key function C and attribute update function # were used in an addition base statement:

Displ.	Length	Entry	Meaning
0	L(AC)	count	Value of the compound key attribute used as an automatic count field

Table 69: Response Area

Inquiry area

The inquiry area of the follow-up update must have the same format as the inquiry area for the base statement:

– addition (see page 138)

– update (see page 147)

– deletion (see page 153)

3.17 Attribute information

The attribute information statements provides information about the definition of one or more attributes. The following information can be obtained:

– symbolic and/or verbal attribute name

– data type

– attribute length and number of decimal places

– details of the index number of occurrences of a multiple attribute

– default value character

– details of the compound key

Unlike the record output (see section “Record output” on page 96) and inquiry (see section “Inquiry” on page 107) statements, only the above information is output for the attribute information statements. The attribute values cannot be obtained.

Contents of transfer areas:

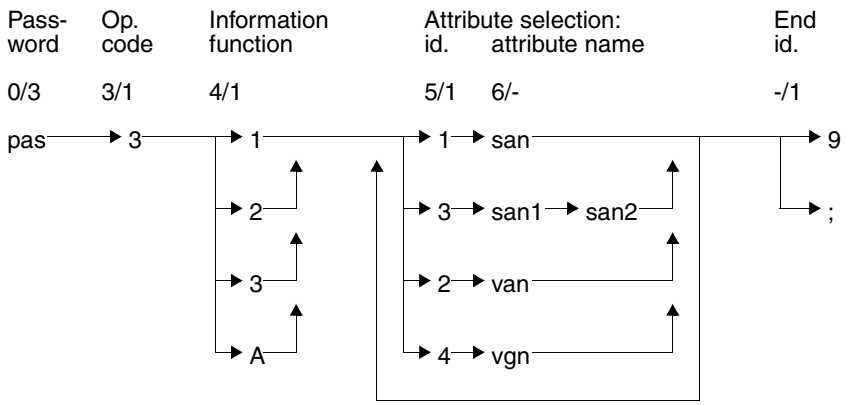
Statement area: The application program supplies the statement.

Acknowledgment area:
The application program supplies the file identifier; the DBH returns the acknowledgment to the statement.

Response area: The DBH returns the requested information.

The inquiry area is not used.

Statement area



Key

Information function	1	Information about the symbolic attribute name
	2	Information about the verbal attribute name
	3	Information about the symbolic and verbal attribute name
	A	Information about the complete attribute definition
End identifier	9	End of statement
	;	chain statement

Password (0/3)

pas Password for a protected CALL DML table,
any three-character string for an unprotected CALL DML table.

Operation code (3/1)

3 Operation code for the attribute information statement

Information function (4/1)

The information function defines what information is to be output about an attribute.

1 Output symbolic attribute name

2 Output verbal attribute name

3 Output symbolic and verbal attribute names

A Output complete attribute definition, including the symbolic and verbal attribute names

Attribute selection (5/-)

Attribute selection requires a code number indicating the type of attribute name to follow, and the attribute name itself.

id	*attribute name*	
1	san	Symbolic attribute name
3	san1	Symbolic attribute name of the start attribute in an attribute sequence
	san2	Symbolic attribute name of the end attribute in an attribute sequence
2	van	Verbal attribute name: verbal attribute names less than 31 characters long must be blank-filled on the right to the full length of 31 characters.
4	vgn	Group name for verbal attribute names: common part of verbal attribute names all beginning with the same character string, blank-filled on the right to the full length of 31 characters if necessary.

The maximum number of attributes is limited by the capacity of the response area (max. 32000 bytes).

End identifier (-/1)

9 Indicates end of statement

; End of statement. The statement is chained to a following end TA statement.

Acknowledgment area

Displ.	Length	Entry	Meaning
0	2	00	Status

Table 70: Acknowledgment area for response

Displ.	Length	Entry	Meaning
2	4	-	-
6	2	ff	File identifier
8	2	r-length	Response length (binary)
10	6	-	-

Table 70: Acknowledgment area for response

Displ.	Length	Entry	Meaning
0	2	{ 1K | 30 | 31 | 33 | 3B | 3V | 3Z }	Status
2	4	[{ van | san␣ }]	Verbal attribute name for status code 31, 3V Symbolic attribute name for status code 31, 33
6	2	ff	File identifier
8	2	r-length	Response length (binary)
10	6	-	-

Table 71: Acknowledgment area on error

Response area

Displ.	Length	Entry	Meaning
0	3	san	Symbolic attribute name
-	-	[...]	Responses for attributes 2 to n

Table 72: Response area for information function 1

Displ.	Length	Entry	Meaning
0	31	van	Verbal attribute name
-	-	[...]	Responses for attributes 2 to n

Table 73: Response area for information function 2

Displ.	Length	Entry	Meaning
0	3	san	Symbolic attribute name
3	31	van	Verbal attribute name
-	-	[...]	Responses for attributes 2 to n

Table 74: Response area for information function 3

Displ.	Length	Entry	Meaning
0	3	san	Symbolic attribute name
3	31	van	Verbal attribute name
34	2	X´0001´ to X´0100´	Attribute length: 1 to 256 bytes
36	1	X´00´ to X´0F´	Number of decimal places: 0 to 15 decimal places
37	1	 X´11´ X´21´ X´22´ X´24´ X´28´ X´00´	Data type: CHAR NUMERIC DECIMAL INTEGER SMALLINT uninterpretable data format

Table 75: Response area for information function A (part 1 of 2)

Displ.	Length	Entry	Meaning
38	1	 X´02´ X´04´ X´08´	Index information: Index locked Index available Index required
39	1	i-length	Index length (binary)
40	1	 X´01´ to X´FF´ X´00'´	Number of occurrences of a multiple attribute defined in the attribute catalog: 1 to 255 occurrences Not a multiple attribute
41	1	dfc	Default character
42	1	 X´80´ X´40´ X´00´	Compound key information: Compound key Compound key attribute Not a compound key
43	1	ck-displ	Displacement of a compound key attribute from the start of the compound key
44	4	-	-
-	-	[...]	Responses for attributes 2 to n

Table 75: Response area for information function A (part 2 of 2)

3.18 Statements for transaction-oriented security

The following statements are involved in transaction-oriented security:

– The “begin transaction” (BTA) statement opens a transaction for the application program with SESAM/SQL DBH.

– The “end transaction” (ETA) statement closes the transaction for the DBH.

  BTA and ETA form what are called the transaction boundaries:
  The statements between BTA and ETA are either executed in full or not at all.

  ETA implicitly closes all logical files that have not yet been closed in the transaction. It is thus not absolutely necessary to close logical files explicitly.

– Reset transaction (RTA) terminates processing within a transaction boundary. The following action is taken for the transaction:

  – all direct and follow-up updates performed are reset

  – all locks and save data are released

  – base statements (for search and direct updating) are invalidated.

  No follow-up statements are permitted after RTA. It does not matter if the base statement was issued before or in the reset transaction.

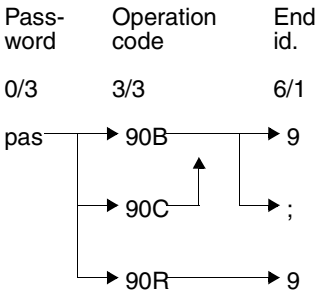
Contents of transfer areas:

Statement area: The application program supplies the statement.

Acknowledgment area:
The application program supplies the file identifier; the DBH returns the acknowledgment to the statement.

The inquiry and response areas are not used.

Statement area



Password (0/3)

pas Any three-character string for a protected or unprotected CALL DML table.

Operation code (3/3)

90B Operation code for the “begin transaction” statement (BTA).

90C Operation code for the “end transaction” statement (ETA).

90R Operation code for the “reset transaction” statement (RTA).

End identifier (6/1)

9 Indicates end of statement

; End of statement;
the following combinations are permitted:

- BTA; open1; open2; etc.
- BTA; statement
- ETA; BTA (not under UTM)
- ETA; user close
- ETA; logical file close

Acknowledgment area

Displ.	Length	Entry	Meaning
0	2	00 90 91 9K 9N 9R	Status
2	4	␣␣␣␣ MOD␣ DCN␣	reported by the DBH, by SESMOD, by SESDCN
6	2	ff	File identifier
8	2	-	-
10	2	[ss]	Status subnumber
12	4	-	-

Table 76: Acknowledgment area

3.19 Administrator Open

The administrator open statement opens communication between an administrator program and the SESAM/SQL DBH. This statement may only be issued in programs that have not opened any logical files and in which administration in the DBH is permitted (see the “Database Operation” manual).

Contents of transfer areas:

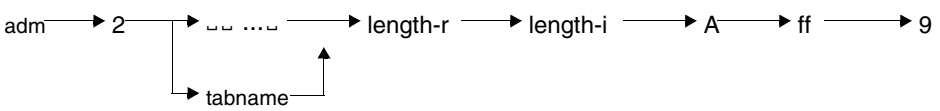
Statement area: The application program supplies the statement.

Acknowledgment area:
The DBH returns the acknowledgment to the statement.

The inquiry and response areas must be made available, but are not used.

Statement area

Pass-word	Op. code	Database/ table name	Length of resp. area	Length of inq. area	Funct. code	File id.	End id.
0/3	3/1	4/17	21/5	26/5	31/1	32/2	34/1



Password (0/3)

adm Administrator password

Operation code (3/1)

2 Operation code for the administrator open statement

Table name (4/17)

␣␣...␣ For local access, 17 blanks can be entered instead of the table name.

tabname

For SESAM/SQL DCN: name of a table operating under the DBH to be administered.

The table name must be held in the CALL DML catalog list (see the “Database Operation” manual, ADD-OLD-TABLE-CATALOG-LIST).
Data base names less than 17 characters long must be right-filled with blanks to the full length of 17.

Length of response area (21/5)

SESAM/SQL knows the maximum length of the response area and can therefore work out the buffer size required (see the “Database Operation” manual, TRANSFER-CONTAINER).

length-r

Maximum length of response area in bytes:
The decimal number to be entered is the largest response length expected by the application program.
Minimum value: 0
Maximum value: 32000

Length of inquiry area (26/5)

SESAM/SQL knows the maximum length of the inquiry area and can therefore work out the buffer size required.

length-i

Maximum length of inquiry area in bytes:
The decimal number to be entered is the total length of the primary key and attribute comparison values.

Minimum value: 0
Maximum value: 32000

Function code (31/1)

A Administration of the SESAM/SQL DBH

File identifier (32/2)

ff File identifier under which the SESAM/SQL DBH is administered.

Permitted characters are the numbers 0 to 8 and any letter.

End identifier (34/1)

9 Indicates the end of the administrator open statement

Acknowledgment area

Displ.	Length	Entry	Meaning
0	2	00 20 2B 2M 2X 2Y	Status
2	4	␣␣␣␣ MOD␣ DCN␣ Dxxx	reported by the DBH, – SESMOD, – SESDCN – DMS error
6	2	ff	File identifier
8	2	-	-
10	1	-	-
11	5	-	-

Table 77: Acknowledgment area

3.20 Administration statements for the DBH

The administration statement allows administration commands to be sent to the SESAM/SQL DBH.

The following administration activities can be carried out:

– Output of information about SESAM/SQL operation

– Control of SESAM/SQL operation

– Output of diagnostic documentation

A detailed description of the administration commands can be found in the “Database Operation” manual.

Contents of transfer areas:

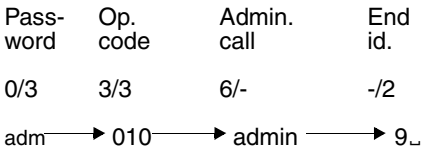
Statement area: The application program supplies the statement.

Acknowledgment area:
The DBH returns the acknowledgment to the statement.

Response area: The responses to administration commands are output in the response area.

The statement does not use the inquiry area.

Statement area



Password (0/3)

adm Administrator password;
this password must be identical to the password specified for the DBH option ADMINISTRATOR when the DBH was started. If restrictions for the system administrator were set for this DBH option, these restrictions also apply to the current user.

Operation code (3/3)

010 Operation code for DBH administration

Administration command (6/-)

Only SEND-MSG formats are permitted at the CALL DML interface. The administration commands are described in the “Database Operation” manual.

End identifier (-/2)

9␣ Indicates the end of the administration command

Acknowledgment area

Displ.	Length	Entry	Meaning
0	2	00 01 0A 0B 0K 0Y 0Z	Status
2	4	-	-
6	2	ff	File identifier
8	2	a-length	Response length
10	2	[ss]	Status subnumber
12	4	-	-

Table 78: Acknowledgment area

Response area

The response is the message from the respective administration command from the terminal.
A detailed description of the administration commands can be found in the “Database Operation” manual.

The response is edited for printing and can be printed in units of 79 characters per line by means of the WRTRD macro.
The contents of the response area must not be analyzed, as the format may change from version to version.

3.21 Administration statement for SESDCN

The SESDCN administration statement allows administration commands to be sent to SESAM/SQL-DCN.

The following administration activities can be carried out:

– Output of information about SESAM/SQL-DCN operation

– Control of SESAM/SQL-DCN operation

– Output of diagnostic documentation

A detailed description of the SESDCN administration commands can be found in the “Database Operation” manual.

Contents of transfer areas:

Statement area: The application program supplies the statement.

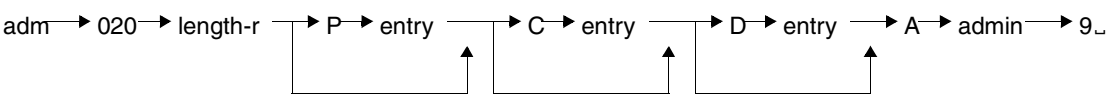
Acknowledgment area:
SESDCN returns the acknowledgment to the statement.

Response area: The responses to administration commands (SESDCN administration) are output in the response area.

The statement does not use the inquiry area.

Statement area

Pass-word	Op. code	Length of resp. area	Computer entry		Conf. entry		DCN entry		DCN admin. command		End id.
0/3	3/3	6/2	8/1	9/8	-/1	-/1	-/1	-/1	-/1	-/≤65	-/2



Password (0/3)

adm Administrator password;
this password must be identical to the password entered for the SESDCN option ADMINISTRATOR when the DBH was started.

Operation code (3/3)

020 Operation code for SESDCN administration

Length of response area (6/2)

length-r
Maximum value: 32000

Processor entry (8/9)

P Identifier of the processor entry

entry Symbolic device name of the processor on which the executing SESDCN is located;
Content: A-Z, 0-9, or blanks.
The first character must be a letter. If the content is shorter than 8 characters, the field must be right-filled with blanks.

If no processor is entered, DBCON uses the HOME processor.

Configuration entry (-/2)

C Identifier for the configuration entry;
Content: A-Z, 0-9, or blanks.

entry Name of the configuration in which SESDCN is running;
Content: A-Z, 0-9, or blanks.

If no configuration is entered, DBCON uses the HOME configuration.

DCN entry (-/2)

D Id for the DCN entry

entry Communication name of the SESDCN that is to perform administration;
Content: A-Z, 0-9, or blanks.

If no communication name is entered, DBCON uses blanks.

DCN administration command (-/≤65)

A Id for the SESDCN administration command

admin The administration commands are described in the “Database Operation” manual; Maximum length of an entry: 64.

End identifier (-/2)

9␣ Indicates the end of the administration command

Acknowledgment area

Displ.	Length	Entry	Meaning
0	2	{ 00 / 0A / 0Y / 02 }	Status
2	4	MOD␣	Identifier
6	4	-	-
10	[ss]	[ss]	Status subnumber
12	4	-	-

Table 79: Acknowledgment area

Response area

Output is in table form with “num” of rows. Each row corresponds to an element. The first 4 rows comprise the table headings.

Displ.	Length	Entry	Meaning
0	2	l-tot	Length used in response area hexadecimal: ≤32000
2	2	l-elem	Length of the individual element or part of the response hexadecimal: ≤80
4	2	num	Number of elements or parts of the response in hexadecimal notation
6	l-elem	elem1	Parts of the response;
	l-elem	elem2	
	l-elem	elem3	

Table 80: Response area

4 Using DML statements

This chapter contains a description of the following functions of the DML statements using examples:

4.1 Examples

The application examples for the DML statements are based on the CALL DML tables COMPANY and SALES.

CALL DML table COMPANY

This CALL DML table was created by migrating a “diagonalized” database in a previous version.

The original COMPANY database contains the relations ARTICLE, CUSTOMER and PERSONNEL. The relations consist of the following attributes:

ARTICLE = article-number, article-name, price, stock

CUSTOMER = customer-number, c-lastname, c-firstname, c-street, c-zip, c-city, customer since, c-discount

PERSONNEL = personnel-number, p-lastname, p-firstname, p-street, p-zip, p-city, dateofbirth, department, languages, salary

PK		Attributes																	
	PKEY	ANAME	APRICE	ASTOCK	CLASTNAME	CFIRSTNAME	CSTREET	CZIP	CCITY	CSINCE	CDISCOUNT	PLASTNAME	PFIRSTNAME	PSTREET	PZIP	PCITY	PDOFB	PDEPT	PLANGS(1-6)	PSALARY(1-10)
ARTICLE relation	A... A... A... A...																			
CUSTOMER relation	C... C... C... C...																			
PERSONNEL relation	P... P... P... P...																			

Table 81: COMPANY database

ARTICLE

SAN	verbal attribute name (VAN)	FORMAT	LTH	DP	MF	DF	KEY	I-LTH
AAA	PKEY	CHAR	006					KEY
AA8	ANAME	CHAR	015				␣	
AB6	APRICE	NUMERIC	005	02			-0	
AC4	ASTOCK	NUMERIC	004	00			-0	

CUSTOMER

SAN	verbal attribute name (VAN)	FORMAT	LTH	DP	MF	DF	KEY	I-LTH
AAA	PKEY	CHAR	006					KEY
AD2	CLASTNAME	CHAR	015				␣	
AEZ	CFIRSTNAME	CHAR	012				␣	
AFX	CSTREET	CHAR	015				␣	
AGV	CZIP	CHAR	005				␣	
AHT	CCITY	CHAR	015				␣	
AJR	CSINCE	CHAR	006				␣	
AKP	CDISCOUNT	NUMERIC	004	02			0	

PERSONNEL

SAN	verbal attribute name (VAN)	FORMAT	LTH	DP	MF	DF	KEY	I-LTH
AAA	PKEY	CHAR	006					KEY
ALM	PLASTNAME	CHAR	015				␣	
AMK	PFIRSTNAME	CHAR	012				␣	
ANH	PSTREET	CHAR	015				␣	
APF	PZIP	CHAR	005				␣	
AQD	PCITY	CHAR	015				␣	
ARB	PDOFB	CHAR	006				␣	
AR9	PDEPT	CHAR	004				␣	
AS7	PLANGS	CHAR	005			006	␣	
AT5	PSALARY	NUMERIC	007	02		010	0	

where:

LTH	attribute length
DP	number of decimal places
MF	number of occurrences of a multiple attribute
DF	default value character
KEY	KEY: primary key, COMP: compound key or compound key attribute
I-LTH	length of index

Output of the information schema

The way in which CALL DML is used has not been changed in any way by the migration process.

The utility monitor output below contains the CALL DML table COMPANY (see the “Utility-Monitor” manual):

```
***   INF.9.3.7   INFORMATION SCHEMA, BASETABLE, COLUMNS   ***   - 1 -

CATALOG : CALLCOMPANY SCHEMA : COMPANYSCH
                               TABLE  : COMPANY

COLUMN

ASTOCK
ANAME
APRICE
CLASTNAME
CZIP
CDISCOUNT
CSINCE
CCITY
CSTREET
CFIRSTNAME
PDEPT
PLANGS
PDOFB
PSALARY
PLASTNAME
PZIP
PCITY
PSTREET
PFIRSTNAME
PKEY
***   INF.9.3.3   INFORMATION SCHEMA, BASETABLE, KEY COLUMN   ***   - 2 -

CATALOG : CALLCOMPANY          SCHEMA : COMPANYSCH
                               TABLE  : COMPANY

KEY COLUMN                       CONSTRAINT                      POSITION

PKEY                             PK9941108093845000              00001
```

The original “relations” ARTICLE, CUSTOMER and PERSONNEL are not included in the CALL DML table.

CALL DML table SALES

This is a CALL DML table created by migration from a database in a previous version.

The original SALES database contains the relation ORDER. The relation consists of the following attributes:

ORDER= order-number, quantity, customer-number, date

ORDER

SAN	verbal attribute name (VAN)	FORMAT	LTH	DP	MF	DF	KEY	I-LTH
AAA	CMPDKEY	CHAR	010					COMP
AAB	ORDNO	NUMERIC	004		00			COMP
AAC	ARTNO	CHAR	006					COMP
ABB	QUANTITY	NUMERIC	004		00		0	
AB9	CUSTNO	CHAR	006				␣	
AC7	ORDDATE	CHAR	006				␣	

where:

LTH	attribute length
DP	number of decimal places
MF	number of occurrences of a multiple attribute
DF	default value character
KEY	KEY: primary key, COMP: compound key or compound key attribute
I-LTH	length of index

Output of the information schema

The CALL DML application was not changed in any way by the migration process.

The utility monitor output below contains the CALL DML table COMPANY (see the “Utility-Monitor” manual):

```
***   INF.9.3.7   INFORMATION SCHEMA, BASETABLE, COLUMNS   ***   - 3 -

CATALOG : CALLCOMPANY          SCHEMA : SALESSCH
                               TABLE  : SALES

COLUMN

ARTNO
ORDDATE
ORDNO
CUSTNO
QUANTITY
***   INF.9.3.3   INFORMATION SCHEMA, BASETABLE, KEY COLUMN   ***   - 4 -

CATALOG : CALLCOMPANY          SCHEMA : SALESSCH
                               TABLE  : SALES

KEY-COLUMN                       CONSTRAINT                        POSITION

ARTNO                            CMPDKEY                           00002
ORDNO                            CMPDKEY                           00001
```

The original “relation” ORDER is not included in the CALL DML table.

Contents of the CALL DML tables COMPANY and SALES

COMPANY; ARTICLE

AAA	AA8	AB6	AC4
A00100	PENCIL	0,59	7576
A00200	RULER	1,89	503
A00300	WRITING PAD	1,79	1763
A00340	BALL-POINT PEN	2,19	4908
A00400	BRUSH	1,19	1054
A00650	FOLDER	3,95	107
A01400	ERASER	1,59	816
A01750	GLUE	3,99	35
A08880	CALENDER	2,56	84
A09000	DRAWING PAD	1,79	527
A09050	NOTEPAD	0,99	750

COMPANY; CUSTOMER

AAA	AD2	AEZ	AFX	AGV	AHT	AJR	AKP
C01732	HUBER	GEORG	MAINSTRASSE	60311	FRANKFURT	860114	20,00
C13486	MILLER	PETER	LEOPOLDSTRASSE	80802	MUENCHEN	860325	10,00
C17109	KELLER	MICHAEL	GOETHESTRASSE	80336	MUENCHEN	860520	15,00
C20070	REITER	ALEXANDER	ANNASTRASSE	86150	AUGSBURG	861217	5,00
C23979	STEINER	WALTER	BURGSTRASSE	90403	NUERNBERG	870420	10,00
C37424	MAYER	ROBERT	WALDSTRASSE	63457	HANAU	870901	5,00
C37597	FISCHER	OTTO	SIEMENSSTRASSE	91052	ERLANGEN	871118	0,00
C38210	HUBER	GEORG	LESSINGSTRASSE	63073	OFFENBACH	880223	20,00
C40013	SCHNEIDER	WERNER	DONAUSTRASSE	93059	REGENSBURG	880927	0,00

COMPANY: PERSONNEL

AAA	ALM	AMK	ANH	APF	AQD	ARB	AR9	AS7	AT5
P00333	HUBER	ANDREAS	GOETHEPLATZ	80337	MUENCHEN	430127	ABT1	see “AS7/” on page 187 and “AT5/” on page 188	
P00708	BINDER	THOMAS	STEINSTRASSE	81667	MUENCHEN	501117	ABT4		
P01000	MAYER	DORIS	BAADERSTRASSE	80469	MUENCHEN	470416	ABT3		
P01140	STOLL	WERNER	POSTWEG	85221	DACHAU	600301	ABT1		
P03674	WINKLER	ANDREA	BELGRADSTRASSE	80796	MUENCHEN	520928	ABT2		
P05408	BAUER	RUDOLF	SEESTRASSE	82319	STARNBERG	640421	ABT2		
P05583	BOTT	MICHAEL	ROSENSTRASSE	60313	FRANKFURT	590603	ZST1		
P09980	RICHTER	STEFAN	BRAHMSSTRASSE	64625	BENSHEIM	560710	ZST1		
P11444	METZGER	KLAUS	BORSIGSTRASSE	60388	FRANKFURT	491001	ZST1		
P11500	KAISER	FRANZ	KOPPSTRASSE	81379	MUENCHEN	530823	ABT4		
P12921	RUF	MICHAEL	LUDWIGSTRASSE	80359	MUENCHEN	620114	ABT1		
P13345	BERGER	FRED	GARTENSTRASSE	85354	FREISING	660420	ABT1		
P15863	BARTEL	ELVIRA	FELDSTRASSE	83022	ROSENHEIM	541010	ABT1		
P19478	MAIER	MICHAEL	BAHNHOFSTRASSE	85435	ERDING	551130	ABT2		
P19479	SCHUBER	PETER	MILCHSTRASSE	81667	MUENCHEN	401129	ABT4		
P20099	KAISER	SUSANNE	KOPPSTRASSE	81379	MUENCHEN	580208	ABT3		
P21500	WEISS	HANS	ROEMERSTRASSE	60311	FRANKFURT	570520	ZST1		

AS7/ 001-006 /
ENGL
ENGL ITAL PORT SPAN
ENGL
ENGL FRANZ
ENGL
ENGL SPAN

ENGL
ENGL FRANZ
ENGL
ENGL
ENGL
ENGL FRANZ
ENGL FRANZ ITAL
ENGL RUSS

AT5/	**001-010/**								
4140,00	4000,00	3675,00	3500,00	3400,00	0,00	0,00	0,00	0,00	0,00
3312,00	3200,00	2992,50	2850,00	2700,00	2600,00	0,00	0,00	0,00	0,00
3312,00	3200,00	2992,50	2850,00	2700,00	0,00	0,00	0,00	0,00	0,00
3933,00	3800,00	3675,00	3500,00	0,00	0,00	0,00	0,00	0,00	0,00
3622,50	3500,00	3250,00	3100,00	0,00	0,00	0,00	0,00	0,00	0,00
3933,00	3800,00	3675,00	3500,00	0,00	0,00	0,00	0,00	0,00	0,00
3200,50	3100,00	2992,50	2850,00	0,00	0,00	0,00	0,00	0,00	0,00
3933,00	3800,00	3675,00	3500,00	0,00	0,00	0,00	0,00	0,00	0,00
3622,50	3500,00	3255,00	3100,00	0,00	0,00	0,00	0,00	0,00	0,00
4140,00	4000,00	3675,00	3500,00	0,00	0,00	0,00	0,00	0,00	0,00
3933,00	3800,00	3675,00	3500,00	0,00	0,00	0,00	0,00	0,00	0,00
3312,00	3200,00	2992,50	2850,00	0,00	0,00	0,00	0,00	0,00	0,00
3933,00	3800,00	3675,00	3500,00	0,00	0,00	0,00	0,00	0,00	0,00
2992,50	2850,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
3675,00	3500,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
3255,00	3100,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
2992,50	2850,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00

SALES; ORDER

AAA AAB	AAC	ABB	AB9	AC7
1011		0	K23979	880930
1011	A00200	50		
1011	A00650	30		
1012		0	K01732	880930
1012	A01400	120		
1013		0	K38210	881003
1013	A00100	500		
1013	A01400	70		
1013	A09050	230		
1014		0	K20070	881004
1014	A00400	10		
1014	A09000	90		

4.2 Opening logical files

A logical file is opened by means of the open statement (see section “Open” on page 29) in which the user defines the following variables:

– two-character file identifier for the logical file

– length of the response area

– length of the inquiry area

– access authorization for statements under this and other file identifiers

Example

A logical file with file identifier CO is to be opened for the CALL DML table COMPANY. For subsequent processing, response and inquiry areas each 1000 bytes in length are required. Only read access is to be allowed under file identifier CO, but direct updating is allowed under any other file identifier. This is defined by means of function code R in the statement.

Statement area:

xxx	2	COMPANY␣␣␣␣␣␣␣␣␣␣	01000	01000	R	FI	9

xxx any three-character string, as the CALL DML table is not password-protected

2 operation code for the open statement

COMPANY␣␣␣␣␣␣␣␣␣␣
CALL DML table name

01000 response area length

01000 inquiry area length

R function code

CO file identifier

9 end identifier

4.3 Closing logical files

Logical files are closed by means of the close statement (see section “Close” on page 34). The statement can be used to close a single logical file, or all the logical files for a requester.

Example 1

Close logical file CO (file close).

Statement area:

xxx	8	␣␣␣␣␣␣␣␣␣␣␣␣␣␣␣␣␣␣	CO	9

xxx	any three-character string instead of the password
8	operation code for the close statement
CO	file identifier of the file to be closed
9	end identifier

Example 2

Close all logical files for the requester (user close).

Statement area:

xxx	8	␣␣␣␣␣␣␣␣␣␣␣␣␣␣␣␣␣␣	9

xxx	any three-character string instead of the password
8	operation code for the close statement
9	end identifier

4.4 Retrieval using search

Inquiry using the search statement offers the following functions:

Projection: Selection of the attributes whose values are to be extracted from the CALL DML table and placed in the response area.

Selection: Selection of records conditionally on primary key value, record number or an attribute value.

Response records can also be sorted, and more than one response per statement can be placed in the response area (block mode).

Retrieval using search assumes that an open statement has been used to open a logical file for the CALL DML table to be searched.

Projection

The E subquestion used within a search defines which attributes are contained in the response record. The value of the primary key is, by default, projected into the response record.

The projection can also be updated by subquestions for selection purposes.

Example 1

Extract the values of the attributes ANAME and APRICE from all records in the CALL DML table COMPANY.

Statement area:

xxx	6	0	0	E	AA8	AB6	000	9

xxx	any three-character string instead of the password
6	operation code for the search statement
0	primary key function: select all records
0	strategy: search table sequentially
E	E subquestion for projecting attribute values
AA8	symbolic attribute name of attribute ANAME
AB6	symbolic attribute name of attribute APRICE
000	mandatory entry for E subquestion

9 end identifier

Acknowledgment area:

CO file identifier of the logical file

On successful execution of the statement, the DBH returns status code 00 in the acknowledgment area and writes the first response record in the response area:

A00100	PENCIL␣␣␣␣␣␣␣␣␣	00059

The remaining response records can be brought into the response area by means of the response polling statement.

Statement area:

xxx	7	9	9

xxx any three-character string instead of the password

7 operation code for the response polling statement

9 poll next response record

9 end identifier

Acknowledgment area:

CO file identifier of the logical file

Response area:

A00200	RULER␣␣␣␣␣␣␣␣␣␣	00189

When all response records have been output, status code 10 is returned in the acknowledgment area.

Example 2

Extract just the article names (AA8), without the primary key value, from the CALL DML table COMPANY.

Statement area:

xxx	6	0	0	EAA8000	&PSN000	9

xxx	any three-character string instead of the password
6	operation code for the search statement
0	primary key function: select all records
0	strategy: search table sequentially
EAA8000	projection of article names (symbolic attribute name AA8)
&PSN000	do not output primary key value in response record
9	end identifier

Acknowledgment area:

CO	file identifier of the logical file

On successful execution of the statement, the DBH returns status code 00 in the acknowledgment area and the first response record in the response area:

PENCIL␣␣␣␣␣␣␣␣␣␣

Selection on conditions applied to primary key value

The search allows selection of records whose primary key value fulfils a particular condition. The condition is defined by means of the primary key function and one or two comparison values in the inquiry area.

Example 1

Select all records from the CALL DML table COMPANY whose primary key value falls between A00200 and A00500. Just the primary key value is to be output in the response record.

Statement area:

xxx	6	5	0	9

xxx	any three-character string instead of the password
6	operation code for the search statement

5	primary key function: only those records whose primary key falls between the comparison values in the inquiry area are selected (including limit values).
0	strategy: sequential search of the table.
9	end identifier

Acknowledgment area:

CO	file identifier of the logical file

Inquiry area:

A00200	A00500

On successful execution of the statement, the DBH returns status code 00 in the acknowledgment area. The primary key value of the first response record is output in the response area:

A00200

All further responses can be retrieved by means of the response polling statement:

Statement area:

xxx	7	9	9

xxx	any three-character string instead of the password
7	operation code for the response polling statement
9	poll next response record
9	end identifier

Acknowledgment area:

CO	file identifier of the logical file

Response area:

A00300

Further responses, which can also be output by means of the above response polling statement, are:

A00340
A00400

Example 2

Select all records whose primary key value begins with ‘A’ from the CALL DML table COMPANY. This type of selection is called selection on primary key group value. Just the primary key value is placed in the response record.

Statement area:

xxx	6	1	0	9

xxx	any three-character string instead of the password
6	operation code for the search statement
1	primary key function: only those records whose primary key contains primary key group value ‘A’ left-justified are selected. The primary key group value must be placed in the inquiry area as the comparison value.
0	strategy: sequential search of the table.
9	end identifier

Acknowledgment area:

CO	file identifier of the logical file

Inquiry area:

A␣␣␣␣␣

A␣␣␣␣␣ primary key group value for all primary key values beginning with ‘A’. The primary key group value must be right-filled with blanks to the full length of the primary key.

The first response placed in the response area by the DBH is:

A00100

Subsequent responses, which can be retrieved by means of the response polling statement (see section “Response polling” on page 117), are:

A00200
A00300
A00340
A00400
. .
A09050

Selection by conditions applied to the record number

The search allows a record with a particular record number to be selected.

Example

Select the record with binary record number 0000000A.

Statement area:

xxx	6	8	0	9

xxx any three-character string instead of the password

6 operation code for the search statement

8 primary key function:
the record with the record number specified in the inquiry area is selected.

0 strategy:
the table is searched sequentially.

9 end identifier

Acknowledgment area:

CO file identifier of the logical file

Inquiry area:

X‘0000000A‘

X‘0000000A‘ record number in binary form

The DBH returns the primary key value of record number 0000000A in the response area:

A09000

Selection by conditions applied to attribute values

The search allows records to be selected in which an attribute value satisfies one or more conditions. It is also possible to formulate conditions for the values of different attributes. The conditions can be logically ANDed and/or ORed.

Selection by a single condition

Example 1

Output from the CALL DML table COMPANY all articles with stock less than 1000. The article names (AA8) are to be projected into the response record.

Statement area:

xxx	6	1	1	EAA8000	U	AC4	502	9

xxx any three-character string instead of the password

6 operation code for the search statement

1 primary key function:
all records whose primary key value contains primary key group value ‘A’ left-justified are selected. This selects all records for ARTICLE.

1 strategy:
the DBH decides whether the table is searched sequentially or on the index.

EAA8000 E subquestion for projecting the article names (AA8)

U	U subquestion: a condition is applied to the primary key value, and is ANDed with the primary key function.
AC4	symbolic attribute name of the attribute to whose value a condition is applied.
502	search condition and comparison condition: the search selects all records whose attribute value for AC4 is *less* than the comparison value in the inquiry area.
9	end identifier

Acknowledgment area:

CO	file identifier of the logical file

Inquiry area:

A␣␣␣␣␣␣	1000

A␣␣␣␣␣␣	comparison value for the primary key function: primary key group value identifying the records for ARTICLE.
1000	comparison value for the comparison condition in the U subquestion.

The comparison values must appear in the inquiry area in the same sequence as the respective attributes are referenced in the statement.

The DBH returns status code 00 in the acknowledgment area if the statement is successfully executed and a match has been found. The first response record is then output in the response area:

A00200	RULER␣␣␣␣␣␣␣␣␣␣

The remaining responses, which can be obtained by response polling, are as follows:

A00650	FOLDER␣␣␣␣␣␣␣␣␣
A01400	ERASER␣␣␣␣␣␣␣␣␣
A01750	GLUE␣␣␣␣␣␣␣␣␣␣␣
A08880	CALENDER␣␣␣␣␣␣␣
A09000	DRAWING␣PAD␣␣␣␣
A09050	NOTEPAD␣␣␣␣␣␣␣␣

Example 2

In addition to the specifications in example 1, the values of the attribute STOCK (AC4) are to be projected.

Statement area:

xxx	6	1	1	EAA8000	C	AC4	502	9

xxx	any three-character string instead of the password
6	operation code for the search statement
1	primary key function: all records whose primary key value contains primary key group value ‘A’ left-justified are selected. This selects all records for ARTICLE.
1	strategy: the DBH decides whether the table is searched sequentially or on the index.
EAA8000	E subquestion for projecting the article names (AA8)
C	C subquestion: a condition is applied to the primary key value, and is ANDed with the primary key function. The values of the referenced attribute are also projected.
AC4	symbolic attribute name of the attribute to whose value a condition is applied.
502	search condition and comparison condition: the search selects all records whose attribute value for AC4 is *less* than the comparison value in the inquiry area.
9	end identifier

Acknowledgment area:

CO	file identifier of the logical file

Inquiry area:

A␣␣␣␣␣	1000

A␣␣␣␣␣ comparison value for the primary key function:
primary key group value identifying the records for ARTICLE.

1000 comparison value for the comparison condition in the C subquestion.

The DBH returns status code 00 in the acknowledgment area if the statement is successfully executed and a match has been found. The first response record is then output in the response area:

A00200	RULER␣␣␣␣␣␣␣␣␣	0503

The remaining responses, which can be obtained by response polling, are as follows:

A00650	FOLDER␣␣␣␣␣␣␣␣	0107
A01400	ERASER␣␣␣␣␣␣␣␣	0816
A01750	GLUE␣␣␣␣␣␣␣␣␣␣	0035
A08880	CALENDER␣␣␣␣␣␣	0084
A09000	DRAWING␣PAD␣␣␣␣	0527
A09050	NOTEPAD␣␣␣␣␣␣␣	0750

Selection by significance test

The search allows selection of all records in which an attribute has a significant or null attribute value.

Example

All records are to be selected from the CALL DML table SALES where the quantity (AAB) has the null attribute value ‘0’. The response records are to contain the values of the attributes quantity (ABB), customer number (AB9) and order date (AC7), in addition to the compound key value.

Statement area:

xxx	6	0	1	CABB200	EAB9AC7000	9

xxx	any three-character string instead of the password
6	operation code for the search statement
0	primary key function: no selection conditions are applied to the primary key value.
1	strategy: the DBH decides whether the table is searched sequentially or on the index.
C	C subquestion for selection and projection
ABB	symbolic attribute name of the attribute quantity, which is to be tested for non-significance.
200	search and comparison condition: select the records where the specified attribute ABB does not have a significant value.
EAB9AC7000	E subquestion for projection of the attribute values of AB9 and AC7
9	end identifier

Acknowledgment area:

SA	file identifier of the logical file

Inquiry area:

No entry, as neither the primary key function nor the C subquestion requires a comparison value.

The DBH returns status code 00 in the acknowledgment area after successful execution of the statement. The response area contains the first response record:

1011	␣␣␣␣␣␣	0000	C23979	880930

The other responses can be output by means of the response polling statement (see section “Response polling” on page 117). They are as follows:

1012	␣␣␣␣␣␣	0000	C01732	880930
1013	␣␣␣␣␣␣	0000	C38210	881003
1014	␣␣␣␣␣␣	0000	C20070	881004

Selection by applying several conditions to an attribute

The search allows records to be selected in which an attribute value fulfils one of a number of conditions. The individual conditions are ORed.

Example

All customers are to be selected from the CALL DML table COMPANY who obtain a discount of 15.00% or 20.00%. In addition to the customer number (AAA), the last name (AD2), city (AHT) and discount (AKP) are to be output.

Statement area:

xxx	6	1	1	EAD2AHT000	CAKP50101	9

xxx	any three-character string instead of the password
6	operation code for the search statement
1	primary key function: all records whose primary key value contains primary key group value ‘C’ left-justified are selected. This selects all records for CUSTOMER.
1	strategy: the DBH decides whether the table is searched sequentially or on the index.
EAD2AHT000	E subquestion for projecting the last names (AD2) and cities (AHT)
C	C subquestion for selection and projection
AKP	symbolic attribute name of the attribute discount
50101	search condition (5) and comparison conditions (01): the value of attribute AKP must be equal to either the first OR the second comparison value in the inquiry area for the record to be selected.
9	end identifier

Acknowledgment area:

CO	file identifier of the logical file

Inquiry area:

C␣␣␣␣␣	1500	2000

C␣␣␣␣␣ comparison value for the primary key function:
primary key group value identifying the records for CUSTOMER.

1500 first comparison value for the attribute AKP of the C subquestion (15.00 %)

2000 second comparison value for the attribute AKP of the C subquestion (20.00 %)

The DBH returns status code 00 in the acknowledgment area after successful execution of the statement. The response area contains the first response record:

C01732	HUBER␣␣␣␣␣␣␣␣␣␣	FRANKFURT␣␣␣␣␣␣	2000

The remaining response records, which can be output by response polling (see section “Response polling” on page 117) are as follows:

C17109	KELLER␣␣␣␣␣␣␣␣␣	MUENCHEN␣␣␣␣␣␣␣	1500
C38210	HUBER␣␣␣␣␣␣␣␣␣␣	OFFENBACH␣␣␣␣␣␣	2000

The customer number is the primary key value and is output automatically.

Selection by setting the same condition for several attributes

The search allows records to be selected where at least one of several attributes contains or does not contain a particular attribute value. The attributes must have identical attribute definitions in the attribute catalog. Several occurrences of a multiple attribute can also be tested for the same condition, as an alternative to testing several attributes.
The occurrences will always have the same attribute definition.

Example

Those staff are to be selected from the CALL DML table COMPANY who speak Italian as their first, second or third foreign language. The personnel number (AAA), last name (ALM), first name (AMK), department (AR9) and the first three foreign languages (AS7) are to be output for each employee.

Statement area:

xxx	6	1	1	EALMAMKAR9000	CAS7/001/AS7/002/AS7/003/501	9

xxx — any three-character string instead of the password

6 — operation code for the search statement

1 — primary key function:
all records whose primary key value contains primary key group value ‘P’ left-justified are selected. This selects all records for PERSONNEL.

1 — strategy:
the DBH decides whether the table is searched sequentially or on the index.

EALMAMKAR9000
E subquestion for projecting the last name (ALM), first name (AMK) and department (AR9)

C — C subquestion for selection and projection

AS7/001/ — first occurrence of the multiple attribute foreign language

AS7/002/ — second occurrence of the multiple attribute foreign language

AS7/003/ — third occurrence of the multiple attribute foreign language

501 — search and comparison condition:
the preceding three occurrences are tested for equality with the comparison value in the inquiry area. A record is selected as soon as one of the three occurrences satisfies the condition.

9 — end identifier

Acknowledgment area:

CO — file identifier of the logical file

Inquiry area:

P␣␣␣␣␣	ITAL␣

P␣␣␣␣␣ — comparison value for the primary key function:
primary key group value identifying the records for PERSONNEL.

ITAL␣ — comparison value for occurrences 1 to 3 of the multiple attribute AS7 in the C subquestion.

The DBH returns status code 00 in the acknowledgment area if the statement is successfully executed, and places the first response in the response area:

P00708	BINDER␣␣␣␣␣␣␣␣␣	THOMAS␣␣␣␣␣␣	DPT4	ENGL␣	ITAL␣	PORT␣

The second and last response can be retrieved by response polling (see section “Response polling” on page 117):

P19479	SCHUBER␣␣␣␣␣␣␣␣	PETER␣␣␣␣␣␣␣	DPT4	ENGL␣	FR␣␣␣	ITAL␣

Selection by string search

The search allows records to be selected where an attribute value contains or does not contain a particular string (string search). A string search is only possible for attributes defined as alphanumeric (data types CHAR).
For a string search, the character string is enclosed in string identifiers, blank-filled to the full attribute length and placed in the inquiry area. The default string identifier is the percentage sign (%). It can be changed to another character by means of the set string identifier function (see section “Define comparison values” on page 92), for example when the character string in question contains a percentage character.

Example

All pads are to be retrieved from the CALL DML table COMPANY. The article number (AAA) and article name (AA8) are to be output for all articles containing the string PAD.

Statement area:

xxx	6	1	1	CAA8401	9

xxx	any three-character string instead of the password
6	operation code for the search statement
1	primary key function: all records whose primary key value contains primary key group value ‘A’ left-justified are selected. This selects all records for ARTICLE.
1	strategy: the DBH decides whether the table is searched sequentially or on the index.
C	C subquestion for selection and projection
AA8	symbolic attribute name of the attribute article name
4	search condition for the string search

01 comparison condition for equality

9 end identifier

Acknowledgment area:

CO file identifier of the logical file

Inquiry area:

A␣␣␣␣␣	%PAD%␣␣␣␣␣␣␣␣␣␣

A␣␣␣␣␣ comparison value for the primary key function:
primary key group value identifying the records for ARTICLE.

%PAD%␣␣␣␣␣␣␣␣␣␣
comparison value for the attribute AA8:
the character string PAD is enclosed in string identifiers (%) and blank-filled to a length of 15 as defined in the attribute catalog.

The DBH returns status code 00 in the acknowledgment area if the statement is successfully executed, and places the first response in the response area:

A00300	WRITING␣PAD␣␣␣␣

The remaining responses can be retrieved by response polling (see section “Response polling” on page 117):

A00300	DRAWING␣PAD␣␣␣␣␣
A09050	NOTEPAD␣␣␣␣␣␣␣␣

Selection by search with masked comparison values

The search allows records to be selected where an attribute value does or does not contain a particular character in a particular position. The mask character must be substituted for the non-relevant characters in the comparison value. The default mask character is the question mark (?). If one of the search characters is a question mark, the default mask character can be changed to another character by means of the set mask character function (see section “Define comparison values” on page 92).
The search with masked comparison values is only permitted for attributes of the data type CHAR.

Example

The CALL DML table COMPANY is searched for all employees whose department name begins with the number 1. The last name (ALM), first name (AMK) and the department (AR9) are to be output in addition to the personnel number (AAA).

Statement area:

xxx	6	1	1	EALMAMK000	CAR9401	9

xxx	any three-character string instead of the password
6	operation code for the search statement
1	primary key function: all records whose primary key value contains primary key group value ‘P’ left-justified are selected. This selects all records for PERSONNEL.
1	strategy: the DBH decides whether the table is searched sequentially or on the index.
EALMAMK000	E subquestion for projecting the last name (ALM) and first name (AMK)
C	C subquestion for selection and projection
AR9	symbolic attribute name of the attribute department
4	search condition for the search with masked comparison value
01	comparison condition for equality
9	end identifier

Acknowledgment area:

CO	file identifier of the logical file

Inquiry area:

P␣␣␣␣␣	???1

P␣␣␣␣␣	comparison value for the primary key function: primary key group value identifying the records in PERSONNEL.
???1	comparison value for attribute AR9

The DBH returns status code 00 in the acknowledgment area if the statement is successfully executed, and places the first response in the response area:

P00333	HUBER␣␣␣␣␣␣␣␣␣␣	ANDREAS␣␣␣␣␣␣	DPT1

Subsequent response records are as follows:

P01140	STOLL␣␣␣␣␣␣␣␣␣␣	WERNER␣␣␣␣␣␣	DPT1
P05583	BOTT␣␣␣␣␣␣␣␣␣␣	MICHAEL␣␣␣␣␣	BRO1
P09980	RICHTER␣␣␣␣␣␣␣␣	STEFAN␣␣␣␣␣␣	BRO1
P11444	METZGER␣␣␣␣␣␣␣␣	KLAUS␣␣␣␣␣␣␣	BRO1
P12921	RUF␣␣␣␣␣␣␣␣␣␣␣␣	MICHAEL␣␣␣␣␣	DPT1
P13345	BERGER␣␣␣␣␣␣␣␣␣	FRED␣␣␣␣␣␣␣␣	DPT1
P15863	BARTEL␣␣␣␣␣␣␣␣␣	ELVIRA␣␣␣␣␣␣	DPT1
P21500	WEISS␣␣␣␣␣␣␣␣␣␣	HANS␣␣␣␣␣␣␣␣	BRO1

Selection by boundary value conditions

The R subquestion of the search allows so-called boundary value conditions to be formulated for selection. A boundary value condition may be:

– the smallest attribute value

– the largest attribute value

– the next smallest attribute value to the comparison value in the inquiry area

– the next largest attribute value to the comparison value in the inquiry area

Boundary value conditions can be applied to a maximum of 6 attributes in one search. Each R subquestion limits the set of responses to the previous R subquestion. Once an R subquestion returns just one response, the response is placed directly in the response area and further R subquestions are ignored.

Example

The SALES table is searched to find the date (AC7) on which the oldest orders that have not yet been processed were entered. The order with the largest customer number (AB9) is to be selected from these orders.

Statement area:

xxx	6	0	1	RAC7731	RAB9739	9

xxx	any three-character string instead of the password
6	operation code for the search statement
0	primary key function: select all records
1	strategy: the DBH decides whether the table is searched sequentially or on the index.
R	R subquestion to formulate the first boundary value condition
AC7	symbolic attribute name of the attribute date
731	search and comparison condition: “smallest attribute value”
R	R subquestion to formulate the second boundary value condition
AB9	symbolic attribute name of the attribute customer number
739	search and comparison condition: “largest attribute value”
9	end identifier

Acknowledgment area:

SA	file identifier of the logical file

Inquiry area:

No entry as neither the primary key function nor the R subquestions require comparison values.

The DBH returns status code 00 in the acknowledgment area if the statement is successfully executed, and places the first response in the response area:

1011	␣␣␣␣␣␣␣	880930	C23979

Selection on complex conditions

The search subquestions enable complex selection conditions to be formulated. The individual subquestions are connected by logical AND or OR depending on the subquestion type.

Example

All pads are to be selected from the CALL DML table COMPANY where the stock is still more than 700 items. Additionally, all articles are to be retrieved that cost less than $ 1. The article number (AAA), article name (AA8), price (AB6) and stock (AC4) are to be output for the articles found by the search.

Notation for the selection conditions:

```
[(article=%PAD%) AND (stock>700)] OR [(price<1,00)]
```

This expression must be “multiplied out” in order to be converted to subquestions, as in SESAM/SQL logic, logical OR links more strongly than logical AND, and no parentheses are possible. To “multiply out”, each element in the first parenthesis is combined with the element in the second parenthesis. The logical operator is the operator between the two parentheses (OR).
After “multiplying out”, the following expression is obtained:

```
[(article=%PAD%) OR (price<1,00)] AND [(stock>700) OR (price<1,00)]
```

The parentheses are now superfluous in SESAM/SQL logic. The resultant structure of logical relationships is:

```
(primary key=A␣␣␣␣␣)
AND (article=%PAD%)
OR (price<1,00)
AND (stock>700)
OR (price<1,00)
```

The U and C subquestions can be used to represent the AND operator, the O and L subquestions the OR operator. The C and L subquestions enclose the projection of the attribute value.

Statement area:

xxx	6	1	1	CAA8401	LAB6502	CAC4504	OAB6502	9

xxx	any three-character string instead of the password
6	operation code for the search statement
1	primary key function: all records whose primary key value contains primary key group value ‘A’ left-justified are selected. This selects all records for ARTICLE.
1	strategy: the DBH decides whether the table is searched sequentially or on the index.
C	C subquestion for selection and projection; AND operator

AA8	symbolic attribute name of the attribute article name
401	string search: “equal to comparison value in inquiry area”
L	L subquestion for selection and projection; OR operator
AB6	symbolic attribute name of the attribute price
502	search and comparison condition: “less than comparison value in inquiry area”
C	C subquestion for selection and projection; AND operator
AC4	symbolic attribute name of the attribute stock
504	search and comparison condition: “greater than comparison value in inquiry area”
O	O subquestion for selection; OR operator
AB6	symbolic attribute name of the attribute price
502	search and comparison condition: “less than comparison value in inquiry area”
9	end identifier

Acknowledgment area:

CO	file identifier of the logical file

Inquiry area:

A␣␣␣␣␣	%PAD%␣␣␣␣␣␣␣␣␣␣	00100	0700	00100

A␣␣␣␣␣	comparison value for the primary key function: primary key group value identifying the records for ARTICLE.
%PAD%␣␣␣␣␣␣␣␣␣␣	comparison value for subquestion CAA8401
00100	comparison value for subquestion LAB6502
0700	comparison value for subquestion CAC4504
00100	comparison value for subquestion OAB6502

The DBH returns status code 00 in the acknowledgment area if the statement is successfully executed, and places the first response in the response area:

A00100	PENCIL␣␣␣␣␣␣␣␣␣	00059	7576

The remaining responses are as follows:

A00300	WRITING␣PAD␣␣␣␣	00179	1763
A09050	NOTEPAD␣␣␣␣␣␣␣␣	00099	0750

Selection by conditions applied to index values

The T subquestion of the search allows records to be output sorted on the values of a index attribute. A selection condition can also be applied to the index attribute.

Example

All employees who are not employed in department DPT4 are to be selected from the CALL DML table COMPANY. Employees are to be output sorted by department.

Statement area:

xxx	6	1	1	TAR9601	9

xxx	any three-character string instead of the password
6	operation code for the search statement
1	primary key function: all records whose primary key value contains primary key group value ‘P’ left-justified are selected. This selects all records for PERSONNEL.
1	strategy: the DBH decides whether the table is searched sequentially or on the index.
T	T subquestion for selection and projection
AR9	symbolic attribute name of the attribute department
601	search and comparison condition: “not equal to comparison value in inquiry area”
9	end identifier

Acknowledgment area:

CO file identifier of the logical file

Inquiry area:

P␣␣␣␣␣	DPT4

P␣␣␣␣␣ comparison value for the primary key function:
primary key group value identifying the records for PERSONNEL.

DPT4 Comparison value for the T subquestion

The DBH returns status code 00 in the acknowledgment area if the statement is successfully executed, and places the first response in the response area:

P00333	DPT1

Subsequent responses are as follows:

P01140	DPT1
P12921	DPT1
P13345	DPT1
P15863	DPT1
P03674	DPT2
P05408	DPT2
P19478	DPT2
P01000	DPT3
P20099	DPT3
P05583	BR01
P09980	BR01
P11444	BR01
P21500	BR01

Retrieval in block mode

The search offers the facility to process response records in blocks, in other words, each statement results in several responses being placed in the response area. The number of responses is defined in the statement, and also applies to any subsequent response polling.

Example

The CALL DML table COMPANY is to be processed and for all customers the customer number (AAA), last name (AD2), zip code (AGV) and city (AHT) output. Each response is to contain 5 response records.

Statement area:

xxx	6	1	1	EAD2AGVAHT000	&BLN005	9

xxx — any three-character string instead of the password

6 — operation code for the search statement

1 — primary key function:
all records whose primary key value contains primary key group value ‘C’ left-justified are selected. This selects all records for CUSTOMER.

1 — strategy:
the DBH decides whether the table is searched sequentially or on the index.

EAD2AGVAHT000
E subquestion for projecting the last name, zip code and city

&BLN005 — block mode:
Up to 5 response records are returned, without record numbers, in the response area.

9 — end identifier

Acknowledgment area:

CO — file identifier of the logical file

Inquiry area:

C␣␣␣␣␣

C␣␣␣␣␣ comparison value for the primary key function:
primary key group value identifying the records for CUSTOMER.

The DBH places the first 5 response records in the response area and returns status code 00 in the acknowledgment area.

C01732	HUBER␣␣␣␣␣␣␣␣␣␣	60311	FRANKFURT␣␣␣␣␣␣
C13486	MILLER␣␣␣␣␣␣␣␣␣	80802	MUENCHEN␣␣␣␣␣␣␣
C17109	KELLER␣␣␣␣␣␣␣␣␣	80336	MUENCHEN␣␣␣␣␣␣␣
C20070	REITER␣␣␣␣␣␣␣␣␣	86150	AUGSBURG␣␣␣␣␣␣␣
C23979	STEINER␣␣␣␣␣␣␣␣	90403	NUERNBERG␣␣␣␣␣␣

The remaining response records are output by means of the response polling statement (see section “Response polling” on page 117):

Statement area:

xxx	7	9	9

xxx any three-character string instead of the password

7 code for the response polling statement

7 poll the next block of response records

9 end identifier

Acknowledgment area:

CO file identifier of the logical file

The response polling statement also processes 5 response records, exactly as specified in the search. The search only produced 9 responses in total, so the response polling statement can only output 4 responses. The DBH reports status code 10, to indicate that all the response records have been output.

C37424	MAYER␣␣␣␣␣␣␣␣␣␣	63457	HANAU␣␣␣␣␣␣␣␣␣␣
C37597	FISCHER␣␣␣␣␣␣␣␣	91052	ERLANGEN␣␣␣␣␣␣␣
C38210	HUBER␣␣␣␣␣␣␣␣␣␣	63073	OFFENBACH␣␣␣␣␣␣
C40013	SCHNEIDER␣␣␣␣␣␣	93059	REGENSBURG␣␣␣␣␣

Flexible formulation of subquestions

The application program can define extensive searches, which can be adapted to suit specific requirements. This is achieved by activating or deactivating search or comparison conditions.
The search condition is deactivated by overwriting it by an 8. Comparison conditions with one entry in the inquiry area are replaced by 80, those with two entries in the inquiry area by 82.

Example

The application program defines the following statement, which references PERSONNEL in the CALL DML table COMPANY:

Statement area:

xxx611	EALM000	CAPF52324	UAPF52324	9

Acknowledgment area:

CO file identifier of the logical file

Inquiry area:

P␣␣␣␣␣	80000	81999	80000	81999	80000	81999	80000	81999

Case A

– Selection of all employees who live in Munich (zip code between 80000 and 81999 inclusive)
– Projection of employee name and zip codes

Statement area:

xxx611	EALM000	CAPF52382	UAPF82324	9

Acknowledgment area:

CO file identifier of the logical file

Inquiry area:

P␣␣␣␣␣	80000	81999	80000	81999	80000	81999	80000	81999

Case B

– Selection of all employees who do not live in Munich (zip code < 80000 or >81999)
– Projection of the zip code

Statement area:

xxx611	EALM800	CAPF58224	UAPF82324	9

Acknowledgment area:

CO file identifier of the logical file

Inquiry area:

P␣␣␣␣␣	80000	81999	80000	81999	80000	81999	80000	81999

Case C

– Selection of all employees who do not live in Munich (zip code < 80000 or >81999)
– Projection of employee names

Statement area:

xxx611	EALM000	CAPF82324	UAPF58224	9

Acknowledgment area:

CO file identifier of the logical file

Inquiry area:

P␣␣␣␣␣	80000	81999	80000	81999	80000	81999	80000	81999

4.5 Retrieval using search with join

Search with join combines the records from two logical files. The values of the join attribute in one logical file are compared with the values of the join attribute in the other logical file. If they are equal, the two records are combined.

Example

The name, zip code and city are extracted from the CALL DML table COMPANY for those customers with an open order in the CALL DML table SALES. Only customers whose customer number is greater than C10000 are of interest. The following information is to appear in the response record:
customer number (join attribute), zip code, city, order number and order date.

To perform a search with join, the full length of the two join attributes must be declared as an index, and a logical file must have been opened for both tables. The file identifier of the CALL DML table COMPANY is CO and of the SALES table SA.

Statement area:

xxx	6	0	1	#CO	EAD2AGVAHT000	V(	AAA	#CO	=	AB9	#SA	504	)	...

...	xxx	6	0	1	#SA	EAABAC7000	&BLN010	&PSN000	9

xxx	any three-character string instead of the password
6	operation code for the search statement
0	primary key function: select all records
1	strategy: the DBH decides whether the table is searched sequentially or on the index.
#CO	CO is the file identifier of the logical file to which the primary key function and the subsequent E subquestion refer.
EAD2AGVAHT000	E subquestion for projecting name, zip code and city from the CALL DML table CUSTOMER
V(	mandatory entry
AAA	symbolic attribute name of the join attribute of logical file CO
#CO	CO is the file identifier of the logical file opened for the CALL DML table COMPANY. It identifies the logical file containing the join attribute AAA.

=	mandatory entry
AB9	symbolic attribute name of the join attribute of logical file SA
#SA	SA is the file identifier of the logical file opened for the CALL DML table SALES. It identifies the logical file containing the join attribute AB9.
504	search and comparison condition for the join attribute: “greater than the comparison value in the inquiry area”
)	mandatory entry
xxx	any three-character string instead of the password
6	operation code for the search statement
0	primary key function: select all records
1	strategy: the DBH decides whether the table is searched sequentially or on the index.
#SA	SA is the file identifier of the logical file to which the primary key function and the subsequent E subquestion refer.
EAABAC7000	E subquestion for projecting the order number and order date of ORDER
&BLN010	block mode: 10 response records without record numbers are output in the response area.
&PSN000	the response records are output without primary key values.
9	end identifier

Acknowledgment area:

CO	file identifier of one of the two logical files

Inquiry area:

```
C10000
```

C10000	comparison value for the join attribute

The DBH returns status code 10 in the acknowledgment area to confirm that the statement has been successfully executed and that all responses have been output in the response area. The responses are:

Projection from the SALES table			JOIN attribute	Projection from the COMPANY table	
REITER␣␣␣␣␣␣␣␣␣	86150	AUGSBURG␣␣␣␣␣␣␣	C20070	1014	881004
STEINER␣␣␣␣␣␣␣␣	90403	NUERNBERG␣␣␣␣␣␣	C23979	1011	880930
HUBER␣␣␣␣␣␣␣␣␣␣	63073	OFFENBACH␣␣␣␣␣␣	C38210	1013	881003

Table 82: Responses to the search with join

4.6 Cursor technique for search/search with join

Search (see section “Search” on page 37) and search with join (see section “Search with join” on page 63) statements enable a record number cursor file to be created. This cursor file contains just the record numbers of the response records. It can be restricted by a further search/search with join. The responses can be output by means of response polling statements (see section “Response polling” on page 117).

Creating and processing a cursor file

The search enables a cursor file to be created containing just the record numbers of the response records (record number cursor file). This cursor file can be processed as follows:

– Output (updated) responses using response polling statements

– Output the first (updated) response with a search and subsequent responses by response polling

– Restrict the cursor file by a search. This search only processes those records whose record numbers appear in the cursor file.

Example

Step 1

Select all customers from the CALL DML table COMPANY who were customers prior to 1.1.88. The record numbers of the relevant customer records are to be stored in a cursor file. The response records are to contain the precise date (AJR) in addition to the customer number (AAA).

Statement area:

xxx	6	1	Z	CAJR502	9

xxx	any three-character string instead of the password
6	operation code for the search statement
1	primary key function: all records whose primary key value contains primary key group value ‘C’ left-justified are selected. This selects all records for CUSTOMER.
Z	strategy: the response records are counted, the number output in the acknowledgment area and the record numbers stored in a cursor file.

C	C subquestion for selection and projection
AJR	symbolic attribute name of the attribute ‘customer since’
502	search and comparison condition: the attribute values of attribute AJR are checked to see if they are smaller than the comparison value in the inquiry area.
9	end identifier

Acknowledgment area:

CO	file identifier of the logical file

Inquiry area:

C␣␣␣␣␣	880101

C␣␣␣␣␣	comparison value for the primary key function: primary key group value identifying the records in CUSTOMER.
880101	comparison value for the C subquestion

After successful execution of the search, the DBH returns status code 10 in the acknowledgment area together with 7, which is the number of responses. No information is output in the response area.

Step 2

The customer records are output in the response area.

Statement area:

xxx	7	2	9

xxx	any three-character string instead of the password
7	operation code for the response polling statement
2	output the first response
9	end identifier

Acknowledgment area:

CO file identifier identifying the cursor file

Inquiry area:

C␣␣␣␣␣	880101

The content of the inquiry area remains unchanged, as no new conditions are applied to the primary key value.

The DBH outputs the first response record in the response area:

C01732	860114

The remaining responses must be output individually using the following response polling statement:

Statement area:

xxx	7	0	9

xxx any three-character string instead of the password

7 operation code for the response polling statement

0 output the next response

9 end identifier

Acknowledgment area:

CO file identifier identifying the cursor file

Inquiry area:

C␣␣␣␣␣	880101

The content of the inquiry area remains unchanged.

The DBH reports status code 00 and places the response record in the response area:

C13486	860325

The remaining response records are polled in the same way until the DBH returns status code 10. The response records are as follows:

C17109	860520
C20070	861217
C23979	870420
C37424	870901
C37597	871118

Step 3

From the customer records indicated by the record numbers in the cursor file, select those with a customer number beginning with ‘C1’ and who live in Munich (zip code starts with the ‘80’ or ‘81’). The record numbers of these customer records are to be stored in the cursor file. The information output for these customers is:
customer number (AAA), zip code (AGV) and date (AJR)

Statement area:

xxx	6	1	P	CAGV423	EARJ000	9

xxx	any three-character string instead of the password
6	operation code for the search statement
1	primary key function: all records whose primary key value contains primary key group value ‘C1’ left-justified are selected.
P	strategy: only records whose record number appears in the cursor file are processed. The old contents of the cursor file are deleted and the new record numbers stored.
C	C subquestion for selection and projection
AGV	symbolic attribute name of the attribute zip code
423	search and comparison condition for masked search: “greater than or equal to first comparison value and less than or equal to second comparison value in inquiry area”
E	E subquestion for projection
AJR	symbolic attribute name of the attribute ‘customer since’

000	mandatory entry
9	end identifier

Acknowledgment area:

CO	file identifier identifying the cursor file

Inquiry area:

C1␣␣␣␣	80???	81???

C1␣␣␣␣	comparison value for the primary key function
80???	first masked comparison value for the C subquestion
81???	second masked comparison value for the C subquestion

After successful execution of the search, the DBH returns status code 10 in the inquiry area together with 2, which is the number of responses. No information is output in the response area.
Both responses can be output into the response area using response polling statements xxx729 and xxx709 (see “Step 2” on page 223). They are:

C13486	80802	860325
C17109	80336	860520

Sort on attribute values

The S subquestion of the search enables records to be sorted on the value of any attribute. The S subquestion can only be used in searches that create a cursor file.

Example

All employee records are to be extracted from the CALL DML table COMPANY and output sorted alphabetically on first name within last name.

Statement area:

xxx	6	1	Z	SALMAMK734	9

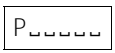
xxx	any three-character string instead of the password
6	operation code for the search statement

1	primary key function: all records whose primary key value contains primary key group value ‘P’ left-justified are selected. This selects all records for PERSONNEL.
Z	strategy: the response records are counted, the number output in the acknowledgment area and the record numbers stored in a cursor file.
S	S subquestion for sorting and projection
ALM	symbolic attribute name of the attribute last name
AMK	symbolic attribute name of the attribute first name
734	search and comparison condition: “ascending sort”
9	end identifier

Acknowledgment area:

CO	file identifier of the logical file

Inquiry area:



P␣␣␣␣␣	comparison value for the primary key function

In the application program, the statement must first be passed in this form to the connection module SESMOD. On successful completion of the statement the DBH returns status code 1S and the number of response records in the acknowledgment area. The *same* statement must then be passed to the SORT module SESORT, which sorts the record numbers in the cursor file on the criteria specified in the search statement.
The response records can be output from the cursor file, e.g. by means of response polling statements. The sorted response records are as follows:

P15863	BARTEL␣␣␣␣␣␣␣␣␣␣	ELVIRA␣␣␣␣␣␣␣
P15863	BAUER␣␣␣␣␣␣␣␣␣␣␣	RUDOLF␣␣␣␣␣␣␣
. . .		
P11500	KAISER␣␣␣␣␣␣␣␣␣	FRANZ␣␣␣␣␣␣␣␣
P20099	KAISER␣␣␣␣␣␣␣␣␣	SUSANNE␣␣␣␣␣␣
. . .		
P03674	WINKLER␣␣␣␣␣␣␣␣	ANDREA␣␣␣␣␣␣␣

Creating and processing a join cursor file

The search with join (see section “Search with join” on page 63) enables a so-called join cursor file to be created containing in each response record the two record numbers of the records combined by the search.
The join cursor file can be processed in the following ways:

– Output (updated) responses using response polling statements (see section “Response polling” on page 117)

– Output the first (updated) response with a further search with join and output subsequent responses by response polling

– Restrict the join cursor file by a search with join. This search only processes those records flagged by record number pairs in the join cursor file. The responses to the new search are written as record number pairs either to a new cursor file, or overwrite the old one.

Example

The CALL DML table COMPANY is to be searched for customers who have an open order in the CALL DML table SALES, and the name, zip code and city extracted. The order number and order date is to be output for each customer.

Step 1

The join attribute is the customer number (AAA in the CALL DML table COMPANY and AB9 in the SALES table). Two logical files, C1 and C2, are opened for the CALL DML table COMPANY, and one logical file, SA, for the SALES table.
The record numbers of the response records are to be stored in a join cursor file with file identifier C1.

Statement area:

xxx	6	0	Z	#C1	EAD2AGVAHT000	V(	AAA	#C1	=	AB9	#SA	504	)	...

...	xxx	6	0	Z	#SA	EAABAC7000	&PSN000	9

xxx any three-character string instead of the password

6 operation code for the search statement

1 primary key function: select all records

Z strategy:
the response records are counted, the number output in the acknowledgment area and the record numbers stored in a cursor file.

#C1 C1 is the file identifier of the logical file to which the primary key function and the subsequent E subquestion refer.

EAD2AGVAHT000
E subquestion for projecting name, zip code and city from CUSTOMER

V(mandatory entry

AAA symbolic attribute name of the join attribute of logical file C1

#C1 C1 is the file identifier of the logical file opened for the CALL DML table COMPANY. It identifies the logical file that contains the join attribute AAA.

= mandatory entry

AB9 symbolic attribute name of the join attribute of logical file SA

#SA SA is the file identifier of the logical file opened for the SALES table. It identifies the logical file containing the join attribute AB9.

504 search and comparison condition for the join attribute: “greater than the comparison value in the inquiry area”

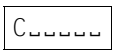
) mandatory entry

xxx	any three-character string instead of the password
6	operation code for the search statement
0	primary key function: select all records
Z	strategy: the response records are counted, the number output in the acknowledgment area and the record numbers stored in a cursor file.
#SA	SA is the file identifier of the logical file to which the primary key function and the subsequent E subquestion refer.
EAABAC7000	E subquestion for projecting the order number and order date from ORDER
&PSN000	the response records are output without primary key values.
9	end identifier

Acknowledgment area:

C1	file identifier of the logical file for which the cursor file is created

Inquiry area:



C␣␣␣␣␣	comparison value for the primary key function

After successful execution of the search with join, the DBH returns status code 10 in the inquiry area together with 4, which is the number of responses. No information is output in the response area.

Step 2

This join cursor file is to be further restricted: for those customers whose customer number starts with ‘C2’, the name (AD2 in the table COMPANY) and the order number (AAB in the SALES table) are to be output in addition to the customer number (the join attribute). The record numbers of the response records are to be stored in a join cursor file with file identifier C2. The join cursor file with file identifier C1 is to be retained.

Statement area:

xxx	6	1	P	$C1	#C1	EAAAAD2000	V	xxx	6	0	P	#SA	EAAB000	&PSN000	9

xxx	any three-character string instead of the password
6	operation code for the search statement
1	primary key function: all records flagged in join cursor file C1 whose primary key value contains primary key group value ‘C2’ left-justified are selected.
P	strategy: only those records are processed whose record numbers are in join cursor file C1.
$C1	C1 is the file identifier of the join cursor file to be restricted and retained.
#C1	C1 is the file identifier of the logical file to which the primary key function and the following E subquestion refer.
EAAAAD2000	E subquestion for projecting the customer number and date from CUSTOMER
V	mandatory entry
xxx	any three-character string instead of the password
6	operation code for the search statement
0	primary key function: all COMPANY records flagged in join cursor file C1 are selected.
P	strategy: only those records are processed whose record numbers are in join cursor file C1.
#SA	SA is the file identifier of the logical file to which the primary key function and the following E subquestion refer
EAAB000	E subquestion for projecting the order number from ORDER
&PSN000	the response records are output without primary key values
9	end identifier

Acknowledgment area:

C2	file identifier of the logical file for which the new join cursor file is to be created. The old join cursor file C1 is retained.

Inquiry area:

C2␣␣␣␣

C2␣␣␣␣ comparison value for the primary key function referring to logical file C1.

After successful execution of the statement, the DBH returns status code 10 in the inquiry area together with 2, which is the number of responses whose record numbers are in the acknowledgment area.

Step 3

The response polling statement xxx729 allows the first response to be polled from a join cursor file (see “Step 2” on page 223). The file identifier of the join cursor file must be placed in the acknowledgment area.
The remaining responses are polled using statement xxx709. Again, the file identifier of the join cursor file must be placed in the acknowledgment area.

The responses from join cursor file C1 are as follows:

HUBER␣␣␣␣␣␣␣␣␣␣	60311	FRANKFURT␣␣␣␣␣␣	C01732	1012	880930
REITER␣␣␣␣␣␣␣␣␣	86150	AUGSBURG␣␣␣␣␣␣␣	C20070	1014	881004
STEINER␣␣␣␣␣␣␣␣	90403	NUERNBERG␣␣␣␣␣␣	C23979	1011	880930
HUBER␣␣␣␣␣␣␣␣␣␣	63073	OFFENBACH␣␣␣␣␣␣	C38210	1013	881003

The responses from join cursor file C2 are as follows:

C20070	REITER␣␣␣␣␣␣␣␣␣	1014
C23979	STEINER␣␣␣␣␣␣␣␣	1011

4.7 Inquiring on attribute value frequency (index browsing)

The index browsing statement enables all the values of an attribute to be listed. The frequency of each attribute value is also output.
To use index browsing, the full or partial length of the attribute in question must have been declared as an index.

Example 1

Obtain from the CALL DML table SALES the number of orders for a particular article number (AAC).

Statement area:

xxx	60BI	AAC	000	9

xxx	any three-character string instead of the password
60BI	operation code for the index browsing statement
AAC	symbolic attribute name of the attribute article number
000	search and comparison condition: “no conditions for the attribute value”
9	end identifier

Acknowledgment area:

SA	file identifier of the logical file

Inquiry area:

No entry, as condition 000 requires no comparison value.

The DBH returns status code 00 in the acknowledgment area when the statement has been successfully executed. The response area contains the first pair of values, consisting of frequency and attribute value. The responses are sorted in ascending order of index values.

00000004	␣␣␣␣␣␣

00000004	frequency in binary format
␣␣␣␣␣␣	attribute value for the article number

The remaining responses can be output by means of the response polling statement (see section “Response polling” on page 117). They are as follows:

00000001	A00100
00000001	A00200
00000001	A00400
00000001	A00650
00000002	A01400
00000001	A09000
00000001	A09050

Example 2

From the CALL DML table COMPANY we want to know the number of customers from Munich or Nuremberg. Customers from Munich can be identified by a zip code starting with ‘80’ or ‘81’, those from Nuremberg with ‘90’. The first two bytes of the customer zip code attribute (AGV) are inverted. Thus we need to find out the number of zip codes where the first two digits are ‘80’, ‘81’ or ‘90’.

Statement area:

xxx	60BI	AGV	52301	9

xxx	any three-character string instead of the password
60BI	operation code for the index browsing statement
AGV	symbolic attribute name of the attribute customer zip code
523	search and comparison condition: The first two digits of the zip code must be less than the first comparison value and greater than the second comparison value in the inquiry area.
01	The first two digits of the zip code must be equal to the comparison value in the inquiry area.
9	end identifier

Acknowledgment area:

CO	file identifier of the logical file

Inquiry area:

80␣␣␣	81␣␣␣	90␣␣␣

80␣␣␣ first comparison value for the attribute customer zip code, blank-filled to the full attribute length.

81␣␣␣ second comparison value for the attribute customer zip code, blank-filled to the full attribute length.

90␣␣␣ comparison value for the attribute customer zip code, blank-filled to the full attribute length.

Following successful execution of the statement, the DBH returns status code 00 in the acknowledgment area. The response records are:

00000002	80???
00000001	90???

00000002/00000001

80???/90??? attribute value: the non-inverted positions are replaced by the current mask character.

4.8 Defining comparison values

The set mask character/string identifier function allows the default mask character “?” or the default string identifier “%” to be changed to another character. The delete mask character/string identifier function resets the current mask character or string identifier to the default character “?” or “%”.

Example 1

The @ character is to be used instead of the default mask character “?” for logical file CO of the CALL DML table COMPANY. The table is then to be searched for all employees whose department number ends in 1. For these employees, the last name (ALM), first name (AMK) and department (AR9) are to be output in addition to the personnel number (AAA). Afterwards, the mask character is to be reset to the default character “%”.

Statement area:

xxx	6	0	F	9

xxx	any three-character string instead of the password
6	operation code for the define comparison values statement
0	mandatory entry
F	set mask character
9	end identifier

Acknowledgment area:

CO	file identifier of the logical file

Inquiry area:

@	new mask character: applies until it is replaced by another character, or until logical file CO is closed.

Following successful execution of the statement, the DBH returns status code 00 in the acknowledgment area. The search is then performed to retrieve the required employee information.

Statement area:

xxx	6	1	1	EALMAMK000	CAR9401	9

xxx	any three-character string instead of the password
6	operation code for the search statement
1	primary key function: all records whose primary key value contains primary key group value ‘P’ left-justified are selected. This selects all records in PERSONNEL.
1	strategy: the DBH decides whether the table is searched sequentially or on the index.
EALMAMK000	E subquestion for projecting the last name (ALM) and first name (AMK)
C	C subquestion for selection and projection
AR9	symbolic attribute name of the attribute department
4	search condition for the search with masked comparison value
01	comparison value for equality
9	end identifier

Acknowledgment area:

CO	file identifier of the logical file

Inquiry area:

P␣␣␣␣␣	@@@1

P␣␣␣␣␣	comparison value for the primary key function: primary key group value identifying the records in PERSONNEL.
@@@1	comparison value for the attribute AR9

Following successful execution of the statement, the DBH returns status code 00 in the acknowledgment area. The first response record is placed in the response area.

P00333	HUBER␣␣␣␣␣␣␣␣␣␣	ANDREAS␣␣␣␣␣	DPT1

Further response records can be output by means of the response polling statement (see section “Response polling” on page 117).
The mask character @ is then replaced by the default mask character “?”:

Statement area:

xxx	6	0	E	9

xxx	any three-character string instead of the password
6	operation code for the define comparison values statement
0	mandatory entry
E	delete mask character
9	end identifier

Acknowledgment area:

CO	file identifier of the logical file

Example 2

The default string identifier “%” is to be replaced by the character # for logical file CO of the CALL DML table COMPANY. All pads are then to be retrieved from the table. For every article whose name includes the string PAD, the article number (AAA) and article name (AA8) are to be output. Afterwards, the string identifier is to be reset to the default character “%”.

Statement area:

xxx	6	0	F	S	9

xxx	any three-character string instead of the password
6	operation code for the define comparison values statement
0	mandatory entry
F	set string identifier
S	the statement refers to the string identifier
9	end identifier

Acknowledgment area:

CO file identifier of the logical file

Inquiry area:

new string identifier:
applies until replaced by another character or until logical file CO is closed.

Following successful execution of the statement, the DBH returns status code 00 in the acknowledgment area. The search is then performed to retrieve the required article information.

Statement area:

xxx	6	1	1	CAA8401	9

xxx any three-character string instead of the password

6 operation code for the search statement

1 primary key function:
all records whose primary key value contains primary key group value ‘A’ left-justified are selected. This selects all records in ARTICLE.

1 strategy:
the DBH decides whether the table is searched sequentially or on the index.

C C subquestion for selection and projection

AA8 symbolic attribute name of the attribute article name

4 search condition for the string search

01 comparison condition for equality

9 end identifier

Acknowledgment area:

CO file identifier of the logical file

Inquiry area:

A␣␣␣␣␣	#PAD#␣␣␣␣␣␣␣␣␣␣

A␣␣␣␣␣ comparison value for the primary key function:
primary key group value identifying the records in ARTICLE.

#PAD#␣␣␣␣␣␣␣␣␣␣
comparison value for attribute AA8:
the search string PAD is enclosed in string identifiers (#) and blank-filled to a length of 15 as defined in the attribute catalog.

Following successful execution of the statement, the DBH returns status code 00 in the acknowledgment area. The first response record is placed in the response area.

A00300	WRITING␣PAD␣␣␣␣

The remaining response records can be output by means of the response polling statement (see section “Response polling” on page 117).
The string identifier # is then replaced by the default string identifier “%”:

Statement area:

xxx	6	0	E	S	9

xxx any three-character string instead of the password

6 operation code for the define comparison values statement

0 mandatory entry

E delete string identifier

S the statement refers to the string identifier

9 end identifier

Acknowledgment area:

CO file identifier of the logical file

4.9 Retrieval using record output

Record output enables records to be selected conditionally on their primary key values. Information can optionally be output about the attribute definitions of the attributes projected in the response record. No information at all is output for null attribute values.

Example

Output the following information from the CALL DML table SALES for the attributes quantity (ABB) and customer number (AB9):

– symbolic attribute name (SAN)

– length of attribute

– attribute value

Statement area:

xxx	4	0	ABB	AB9	1	9

xxx	any three-character string instead of the password
4	operation code for the record output statement
0	primary key function: select all records
ABB	symbolic attribute name of the attribute quantity
AB9	symbolic attribute name of the attribute customer number
1	format identifier: output the symbolic attribute name (SAN), attribute length and attribute value
9	end identifier

Acknowledgment area:

SA	file identifier of the logical file

Inquiry area:

No entry

Following successful execution of the statement, the DBH returns status code 00 in the acknowledgment area. The first response record is placed in the response area:

1011	␣␣␣␣␣␣␣	AB9	05	C23979	9

1011	order number
␣␣␣␣␣␣␣	indicates order record
AB9	symbolic attribute name of the attribute customer number
05	binary specification of attribute length -1, i.e. the attribute customer number is defined in the attribute catalog with a length of 6 bytes.
C23979	customer number
9	identifies the end of the response record

The attribute quantity (ABB) does not have a significant value and is therefore skipped. The remaining responses can be output by means of the response polling statement (see section “Response polling” on page 117).

4.10 Retrieval using inquiry

The inquiry enables records to be selected conditionally on primary key values. Each response record contains the values of the specified attributes and for each attribute, if required, the current attribute definition.
The default value is output for null attribute values.

Example

The order and article number, which form the primary key, are to be retrieved from the CALL DML table SALES together with the values of attributes quantity (ABB) and customer number (AB9). The attribute definitions are not output.

Statement area:

xxx	5	0	0	ABB	AB9	9

xxx	any three-character string instead of the password
5	operation code for the inquiry statement
0	primary key function: select all records
0	format identifier: output attribute values only
ABB	symbolic attribute name of the attribute quantity
AB9	symbolic attribute name of the attribute customer number
9	end identifier

Acknowledgment area:

SA	file identifier of the logical file

Inquiry area:

No entry as primary key function 0 does not require a comparison value.

Following successful execution of the statement, the DBH returns status code 00 in the acknowledgment area. The first response record is placed in the response area:

1011	␣␣␣␣␣␣␣	0000	C23979

1011	order number
␣␣␣␣␣␣␣	indicates the order record
0000	default value for the attribute customer number, which does not have a significant value.
C23979	customer number

The remaining response records can be retrieved by means of the response polling statement (see section “Response polling” on page 117).

4.11 Adding new records

The addition statement (see section “Addition” on page 131) enables records to be added to a table. If several records of the same format are to be added, the first record is added using the addition statement, and subsequent records by means of the follow-up update statement (see section “Follow-up update” on page 154).

Example

Two new customers with the following data are to be added to the CALL DML table COMPANY:

SAN	Value for cust1	Value for cust2
AD2	WEBER␣␣␣␣␣␣␣␣␣␣	HIRNER␣␣␣␣␣␣␣␣␣
AEZ	ANDREAS␣␣␣␣␣␣	CHRISTIAN␣␣␣
AFX	TALSTRASSE␣␣␣␣␣	BERGSTRASSE␣␣␣␣
AGV	70372	89081
AHT	STUTTGART␣␣␣␣␣␣	ULM␣␣␣␣␣␣␣␣␣␣␣
AJR	951019	951019
AAA	C40050	C40100

Statement area:

xxx	9	C	X	N	AD20	AEZ0	AFX0	AGV0	AHT0	AJR0	AAA0	9

xxx	any three-character string instead of the password
9	operation code for the addition statement
C	primary key function: the primary key value can appear at any position in the input record.
X	update authorization: following the direct update, update authorization for logical file CO is cancelled.
N	mandatory entry
AD2	symbolic attribute name for the attribute last name
AEZ	symbolic attribute name for the attribute first name
AFX	symbolic attribute name for the attribute street
AGV	symbolic attribute name for the attribute zip code
AHT	symbolic attribute name for the attribute city

AJR	symbolic attribute name for the attribute ‘customer since’
AAA	symbolic attribute name for the attribute customer number
0	attribute update authorization: the value in the input record (inquiry area) is adopted as the attribute value for the attribute.
9	end identifier

Acknowledgment area:

CO	file identifier of the logical file

Inquiry area:

WEBER␣␣␣␣␣␣␣␣␣␣	ANDREAS␣␣␣␣␣␣	TALSTRASSE␣␣␣␣␣␣	70372

STUTTGART␣␣␣␣␣␣␣	951019	C40050

The values must be placed in the inquiry area in the same sequence as their associated symbolic attribute names are specified in the statement. All the values must also be the same length as that specified in the attribute catalog.

When the DBH has added the new record to the table, it returns status code 00 in the acknowledgment area.
The second record is then inserted using the follow-up update statement.

Statement area:

xxx	7	C	X	N	9

xxx	any three-character string instead of the password
7	operation code for the follow-up update statement
C	primary key function: the primary key value can appear at any position in the input record.
X	update authorization: following the direct update, update authorization for logical file CO is cancelled.
N	mandatory entry
9	end identifier

Acknowledgment area:

CO file identifier of the logical file

Inquiry area:

HIRNER␣␣␣␣␣␣␣␣␣	CHRISTIAN␣␣␣	BERGSTRASSE␣␣␣␣	89081

ULM␣␣␣␣␣␣␣␣␣␣␣␣	951019	C40100

The DBH confirms the successful addition of the new record by returning status code 00 in the acknowledgment area.

4.12 Updating records

The direct update statement (see section “Update” on page 141) enables existing records to be updated.

Example

The following entries are to be made in the CALL DML table COMPANY for the employee with employee number (AAA) P11500:

Foreign language (AS7): Spanish to be added as third foreign language

Department (AR9): The new department is DPT2.

Salary (AT5): The salary is raised to $4300.00. It must be inserted before the current first occurrence of the multiple attribute.

Statement area:

xxx	9	C	X	A	AAA0	AS7/+01/H	AR90	AT5/001/N	9

xxx	any three-character string instead of the password
9	operation code for the update statement
C	primary key function: the primary key value can appear at any position in the input record.
X	update authorization: following the direct update, update authorization for logical file CO is cancelled.
A	record update statement: an existing record is to be updated.
AAA	symbolic attribute name of the attribute personnel number (primary key)
0	attribute update function: update attribute value (ignored, however, as the primary key value cannot be updated).
AS7/+01/	an occurrence is added to the multiple attribute foreign languages (AS7).
H	attribute update function: append to the last significant occurrence.
AR9	symbolic attribute name of the attribute department

0	attribute update function: the current attribute value in the table is replaced by the value in the inquiry area.
AT5/001/	first occurrence of the attribute salary
N	attribute update function: insert an occurrence before occurrence AT5/001
9	end identifier

Acknowledgment area:

CO	file identifier of the logical file

Inquiry area:

P11500	SPAN␣	DPT2	0430000

The values in the inquiry area must be in the sequence in which the attributes are referenced in the statement.

The DBH confirms the successful update by returning status code 00 in the acknowledgment area.

4.13 Deleting records

The deletion direct update statement (see section “Deletion” on page 150) enables complete records to be removed from the table. If several records need to be deleted, just the first record is deleted by record deletion, and all subsequent records by the follow-up update statement (see section “Follow-up update” on page 154).

Example

The two records with the primary key values C40050 and C40100 are to be deleted from the CALL DML table COMPANY.

Alternative 1

The record with the primary key value C40050 is deleted by the deletion statement.

Statement area:

xxx	9	C	X	L	AAAL	9

xxx	any three-character string instead of the password
9	operation code for the deletion statement
C	primary key function: the primary key value can appear at any position in the input record.
X	update authorization: following the direct update, update authorization for logical file CO is cancelled.
L	mandatory entry
AAA	symbolic attribute name of the attribute customer number (primary key)
L	mandatory entry
9	end identifier

Acknowledgment area:

CO	file identifier of the logical file

Inquiry area:

C40050

The DBH reports status code 00 when the record has been successfully deleted.
The record with the primary key value P40100 is then deleted using the follow-up update statement.

Statement area:

xxx	7	C	X	L	9

xxx	any three-character string instead of the password
7	operation code for the follow-up update statement
C	primary key function: the primary key value can appear at any position in the input record.
X	update authorization: following the direct update, update authorization for logical file CO is cancelled.
L	record update function: delete the record
9	end identifier

Acknowledgment area:

CO	file identifier of the logical file

Inquiry area

C40100

Alternative 2:

The records with the primary key values C40050 and C40100 are deleted in block mode with the deletion statement.

Statement area:

xxx	9	C	X	L	AAAL	&BLN002	9

xxx	any three-character string instead of the password
9	operation code for the deletion statement
C	primary key function: the primary key value can appear at any position in the input record.
X	update authorization: following the direct update, update authorization for logical file CO is cancelled.
L	mandatory entry
AAA	symbolic attribute name of the attribute customer number (primary key)
L	mandatory entry
&BLN002	block mode: a maximum of two records are deleted.
9	end identifier

Acknowledgment area:

CO	file identifier of the logical file

Inquiry area:

C40050
C40100

The DBH reports status code 00 when the records have been successfully deleted.

5 Programming transactions

This chapter contains a description of

– Open and close statements and transaction boundaries
– Chained statements
– Database operations in transactions
– Resetting transactions
– Database accesses outside transaction boundaries

5.1 Open, close and transaction boundaries

In transaction programming, open and close statements can be used both inside and outside transaction boundaries. The following rules must be observed with regard to the sequence of open/close statements and transaction statements (BTA, ETA):

(1) Logical files opened outside the transaction boundary must also be closed outside the boundary.

(2) The end transaction statement implicitly closes all the user's logical files that were opened within the transaction.

(3) If a logical file is opened outside a transaction boundary, a close statement within a transaction boundary for any logical file belonging to the user is rejected with status code 8T.

Example

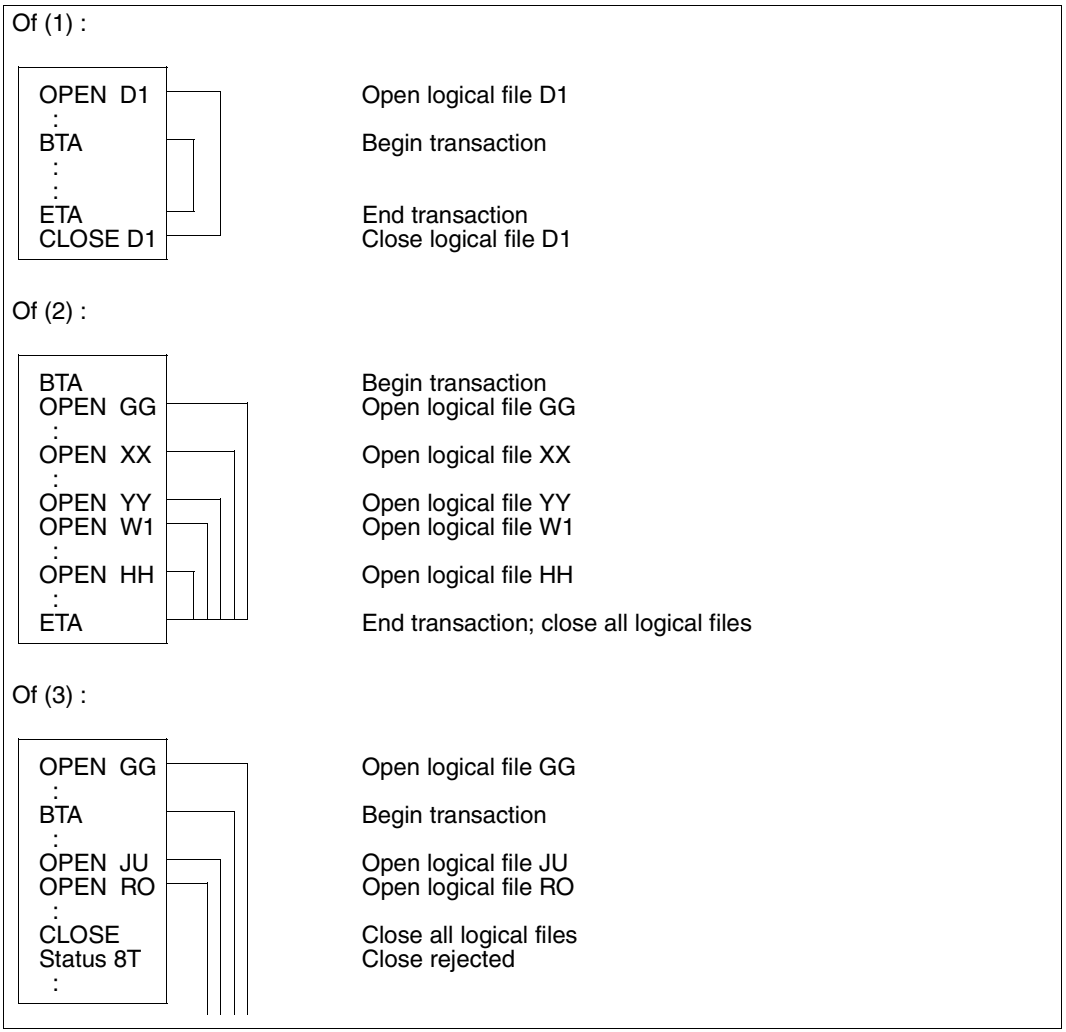


Figure 1: Example of open and close statements and transaction boundaries

5.2 Chained statements

The statements “begin transaction” (BTA) and “end transaction” (ETA) can be chained to other DML statements. This reduces the number of communication steps and thus improves processing times.

Statement 1	**Separator**	**Statement 2**	**Separator**
BTA	;	DML statement	9
DML statement	;	ETA	9
ETA	;	Close statement	9
ETA	;	BTA	9

Table 83: Structure of chained statements

Statement 2 is not executed until statement 1 has terminated with status code 00 or 10.

Example

BTA chained with search:	xxx90B;xxx611...9
Follow-up update chained with end TA:	xxx74XA;xxx90C9
ETA chained with begin TA:	xxx90C;xxx90B9
ETA chained with close statement:	xxx90C;xxx8...9

5.3 Operations in transactions

DML statements permitted in transactions

Defining and processing logical input files:

– Search

– Search with join

– Index browsing

– Inquiry

– Record output

– Response polling

– Cursor file handling

Defining and processing logical output files:

– Direct updating (addition, update, record deletion)

– Follow-up update

Information about attribute formats:

– Attribute information

Retrieval in transactions

If a retrieval statement accesses the user data in a CALL DML table, the SESAM/SQL DBH locks this record against access by other transactions until the executing transaction finishes or is reset. Depending on the open mode, either a shared or exclusive lock is set (see section “Open” on page 29).
If the retrieval statement only access the indexes in the system data, no record is locked.

SESAM/SQL also allows the following updated versions of locking:

– Read without locking

– Ignore lock

Read without locking

Retrieval statements within transactions can choose not to lock the record. The user indicates this by means of the &RNL000 option in the retrieval statement.

Ignore lock

If a retrieval statement with the &RNW000 option occurs in a transaction, it locks the record which it is accessing. It can, however, access a record that has been locked by another transaction. This means that the highest level of consistency is no longer guaranteed, so SESAM/SQL outputs the response to the retrieval statement with a dirty read status message (status code 9S). On receiving dirty read status, the user can decide whether to start the next transaction step or to reset the transaction.

Read without locking and ignoring the lock

Both modifications of the locking principle can be used simultaneously in *one* retrieval statement. Where this is so, the record read by the retrieval statement is not locked, while the retrieval statement can access a record that has been locked by another transaction.

The SESAM/SQL DBH treats a retrieval transaction step with the &RNL000 and &RNW000 options as being outside the scope of any transaction.

Example

BTA		
Search ...		Record is read and locked.
Search ...	&RNL000 ...	Record is read without a read lock entry being made for this record.
Search ...	&RNW000 ...	Record is read and locked. A record that has been locked by another transaction can however be read.
Search ...	&RNL000&RNW000	Record is read without a read lock entry being made for this record. A record that has been locked by another transaction can be read.
Update ...		Record is updated and locked.
ETA		

Response polling

It is advisable to process all responses from a retrieval statement within *one* transaction. The end of the responses to a search is indicated by status code 10.

If the response polling statement is in a different transaction from the base statement (e.g. search), this may result in the following errors:

– On a restart following system failure, the base operation is missing (search etc.).

– A further response polling statement after a restart may return all responses, including those that have already been processed within correctly closed transactions. This may result in data errors such as duplicated additions or subtractions.

Where a single continuation response is polled, e.g. primary key function “equal to primary key value”, this type of error cannot occur.

Database updates in transactions

The SESAM/SQL DBH locks any record accessed by a direct update statement.
A transaction that attempts to access a locked record is placed in a wait state. The application program receives no status message. As soon as the record is free, the SESAM/SQL DBH automatically activates the waiting transaction (see also the “Core Manual”).

The following rules must be followed when programming updates in transactions:

Update authorization

X must be specified for update authorization.

Follow-up update

The follow-up update does not have to occur in the same transaction as the base statement for direct updating.

Reset transaction

When a transaction is reset, the “direct update” base statement must be repeated. Otherwise a follow-up update will result in status code 7T.

5.4 Resetting transactions

If a user discovers processing errors (e.g. after validity checks) he can reset the transaction using the DML statement reset transaction. The database administrator can also reset open transactions by means of an administration call.

5.5 Database accesses outside transaction boundaries

Database accesses can still take place outside the transaction boundary even when transaction-oriented security is in use.
In this case, the SESAM/SQL DBH proceeds as follows:

– A database access outside a transaction boundary is treated by the SESAM/SQL DBH implicitly as an independent transaction with the transaction boundaries of this one step.
  Uncompleted update statements are reset after a system failure.

– If a retrieval is performed outside the transaction boundary, again the affected record is not locked. A record that has been locked by another transaction is returned with status code 9S (dirty read). In this case the user decides whether or not to process the record.

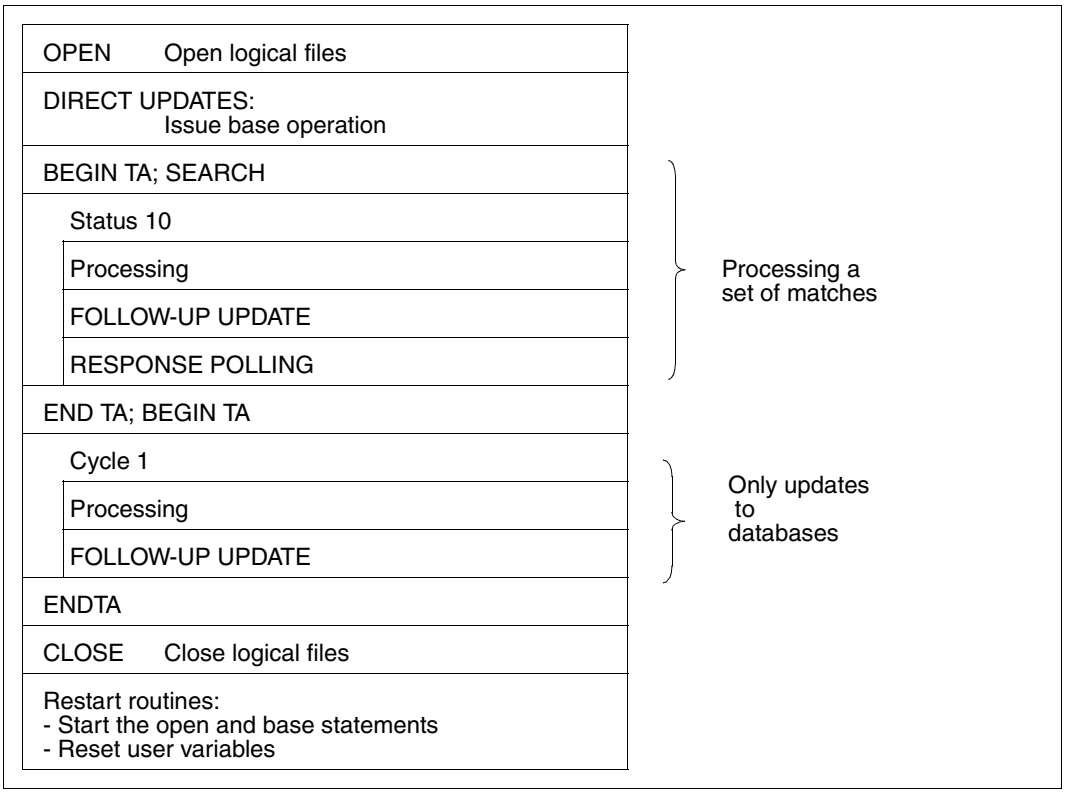


Figure 2: Skeleton of an application program

6 From compiling to starting the CALL DML programs

This chapter contains information on

6.1 Compiling and entering in a library

```
/START-COBOL85-COMPILER *LIBRARY-ELEMENT(LIBRARY=modlib-
/,ELEMENT=source),COMPILER-ACTION=MODULE-GENERATION
/ASSIGN-SYSDTA TO-FILE=*SYSCMD
/START-LMS
//OPEN-LIBRARY LIBRARY=modlib,MODE=UPDATE
//MODIFY-LMS-DEFAULTS WRITE-MODE=REPLACE
//ADD-ELEMENT FROM-FILE=*OMF,TO-ELEMENT=LIBRARY-ELEMENT(TYPE=R)
//END
```

where:

modlib	Module library containing the application program, source programs and user modules
source	Name of the application source program

6.2 Linking

There are several ways of using the DBH:

– independent DBH and

– linked-in DBH

6.2.1 Linking with the independent DBH

An application program must be linked as follows, regardless of the BS2000 version and the addressing mode of the DBH:

```
/START-BINDER
//START-LLM-CREATION INTERNAL-NAME=program
//INCLUDE-MODULES LIBRARY=modlib,ELEMENT=module
//INCLUDE-MODULES LIBRARY=SYSLNK.SESAM-SQL.030,ELEMENT=SESMOD
//RESOLVE-BY-AUTOLINK LIBRARY=$TSOS.SYSLNK.CRTE
//SAVE-LLM LIBRARY=modlib,ELEMENT=program,OVERWRITE=YES
//END
```

Where:

program Program name of the application program

module User module

SYSLNK.SESAM-SQL.030
SESAM/SQL module library

SESMOD Connection module

The connection module SESMOD dynamically loads the connection modules corresponding to the current version of BS2000. Note the sequence in which the module libraries are searched (see section “Starting” on page 265).

The module SESORT must be linked in if a sort operation is to be initiated with a DML statement (SESORT call).

Non-XS compatible application programs can still use the extended address space of an XS system, as the connection module automatically loads the corresponding modules into the top part of address space. Existing application programs do not need to be relinked in order to do so.

6.2.2 Linking with the linked-in DBH

SESAM/SQL-LINK is a chargeable optional product for the SESAM/SQL database system. SESAM/SQL-LINK can be used wherever one or more databases are to be processed exclusively by one program.

The module for the linked-in DBH is called SESLINK. It is linked with the user module. In BS2000, SESLINK can be located anywhere in the linkage editor structure.

The name or ENTRY of an application program cannot start with the string “SE” as this can lead to conflicts during execution of the program.

The first time it is called, the DBH core is fetched into main memory. The user must ensure that the DBH core is contained in one of the SESAM/SQL module libraries.

SESLINK assumes responsibility for obtaining the remaining storage space required.

A linked in application program must be linked with the connection module SESLINK as follows regardless of the BS2000 version:

```
/START-BINDER
//START-LLM-CREATION INTERNAL-NAME=program
//INCLUDE-MODULES LIBRARY=modlib,ELEMENT=module
//INCLUDE-MODULES LIBRARY=SYSLNK.SESAM-SQL.030,ELEMENT=SESLINK
//RESOLVE-BY-AUTOLINK LIBRARY=$TSOS.SYSLNK.CRTE
//SAVE-LLM LIBRARY=modlib,ELEMENT=program,OVERWRITE=YES
//END
```

Where:

program Program name of the application program

modlib Module library containing the user modules

module User module

SYSLNK.SESAM-SQL.030
SESAM/SQL module library

SESLINK Connection module

6.3 Parameterizing the connection modules

There is exactly one SESMOD, SESLINK, SESDCAM or SESUTMC connection module for each operating mode. Connection modules require a number of parameters in order to function. These parameters are entered in the SESMOD and SESDCAM connection modules using CALL DML calls or the configuration file (see the “Core Manual”). The parameters for the SESUTMC connection module are entered in the UTM start parameters or the configuration file (see the “Core Manual”).

Parameter entry via configuration file

The configuration file is a SAM file with a freely selectable name in which the user enters parameters with a file editor. The SET-FILE-LINK command is used to assign the configuration file to the connection module with the link name SESCONF (see the “Core Manual”, configuration file).

It is also possible to group together local configuration files for a SESAM/SQL configuration in a global configuration file (see the “Core Manual”, global configuration file). In this event, the configuration file is assigned using the CONNECT-SESAM-CONFIGURATION command.

When the application is started, the connection modules are supplied with the specified parameters (see the “Database Operation” manual), and any CALL DML statements for program control are ignored. The UNT, NOUNT and TRACE statements are an exception (see also section “Special statements” on page 340).

If no configuration file is assigned, the SESMOD connection module is parameterized with the corresponding default value “␣” for the parameters CNF and NAM.
Only the DBH can be addressed with the communication name “␣” of the configuration “␣”.

Using the configuration file gives a high degree of flexibility:

– An application program can be assigned to another SESAM/SQL DBH or configuration without altering the source or requiring a new linkage run.

– A linked-in application program can be converted to an application program executable under an independent DBH without altering the source. This only requires a linkage run (SESMOD and not SESLINK) and the exchange of the DBH configuration file for the application configuration file. Similarly, an application program executable under an independent DBH can be converted to a linked-in application program.

6.4 Starting

There are several ways of using the DBH

– independent DBH and

– linked-in DBH

6.4.1 Starting an independent DBH application

```
. . .
/SET-FILE-LINK LINK-NAME=SESAMOML,FILE-NAME=$KENN.SYSLNK.SESAM-SQL.030

/SET-FILE-LINK LINK-NAME=SESCONF,FILE-NAME=dbhconf
or
/CONNECT-SESAM-CONFIGURATION TO-FILE=globconf-
/,CONFIGURATION-LINK=linkname

/START-PROGRAM FROM-FILE=*MODULE(LIBRARY=modlib-
/,ELEMENT=program-
/,PROGRAM-MODE=ANY-
/,RUN-MODE=ADVANCED(ALTERNATE-LIBRARIES=YES))
. . .
```

Where:

dbhconf	DBH configuration file
globconf	Global configuration file
modlib	Module library containing the user modules
program	Program name of the application program
linkname	Link name under which the DBH options are defined in the global configuration file

6.4.2 Starting a linked-in DBH application

```
. . .
/ASSIGN-SYSDTA TO-FILE=*SYSCMD
/MODIFY-SDF-OPTIONS SYNTAX-FILE=USER(NAME= -
/                  $KENN.SYSSDF.SESAM-SQL.030.USER)
/MODIFY-MSG-FILE-ASSIGNMENT ADD-FILE=$KENN.SYSMES.SESAM-SQL.030
/MODIFY-MSG-ATTR TASK-LANG=D
/SET-FILE-LINK LINK-NAME=BLSLIB00,FILE-NAME=$TSOS.SYSLNK.CRTE
/SET-FILE-LINK LINK-NAME=SESAMOML,FILE-NAME=$KENN.SYSLNK.SESAM-SQL.030

/SET-FILE-LINK LINK-NAME=SESCONF,FILE-NAME=dbhkonf
or
CONNECT-SESAM-CONFIGURATION TO-FILE=globconf-
/,CONFIGURATION-LINK=linkname

/START-PROGRAM FROM-FILE=*MODULE(LIBRARY=modlib-
/,ELEMENT=program-
/,PROGRAM-MODE=ANY-
/,RUN-MODE=ADVANCED(ALTERNATE-LIBRARIES=YES))
. . .
```

Where:

dbhconf	DBH configuration file
globconf	Global configuration file
linkname	Link name under which the DBH options are defined in the global configuration file
modlib	Module library containing the user modules
program	Program name of the application program

6.4.3 Assigning module libraries

The connection modules dynamically load modules from the following module libraries when running application programs:

1. The module library assigned by /SET-FILE-LINK LINK-NAME=SESAMOML.
2. The module library assigned by /SET-FILE-TASKLIB.
   This module library is ignored if it is the TASKLIB library of the default user ID.
3. The module library SYSLNK.SESAM-SQL.030 of the current user ID.
4. The module library SYSLNK.SESAM-SQL.030 of the default user ID.
5. The module library TASKLIB of the default user ID ($TASKLIB).

These module libraries are only searched in the specified sequence when the first module is dynamically loaded. All the other modules are loaded from the module library in which the first module was found. Therefore, all the SESAM/SQL modules that are to be dynamically loaded must be located in a single module library.

When the SESAM/SQL-DBH or a SESAM/SQL application program is started, the CRTE library must be assigned the link name BLSLIB<xx> (if possible: <xx>=00) (see the “CRTE” manual).

6.5 Execution with the linked-in DBH

- The linked in DBH is parameterized using a DBH configuration file which has been assigned with the link name SESCONF or by means of the CONNECT-SESAM-CONFIGURATION command. If no configuration file has been assigned, the linked-in DBH requests entry of the DBH start statements and options with "//".
- SESAM/SQL calls can be executed from within an application in 24-bit or 31-bit addressing mode. It is also possible to switch back and forth between the addressing modes from call to call.
- SESAM/SQL is administered with /SEND-MSG commands, which are identified by the string SES:

```
/SEND-MSG TO=PROGRAM(JOB-ID=OWN),MSG=´SES,call´
```

6.5.1 Terminating the program

The linked-in DBH is normally terminated with the command

```
/SEND-MSG TO=PROGRAM(JOB-ID=OWN),MSG=´SES,STOP´
```

The application program or utility routine can then be terminated, or SESAM/SQL operation can be started again.

Under the linked-in DBH, the administration command STOP does not take effect until the application program issues another DML statement to the linked-in DBH. This DML statement is acknowledged with status code 99. If no further DML statements follow during program execution, the linked-in DBH is terminated when the application program is terminated with STXIT.

6.5.2 General notes

Interrupt handling (STXIT)

SESLINK contains a STXIT routine for handling program errors and administration commands which is activated with:

```
/SEND-MSG TO=PROGRAM(JOB-ID=OWN),MSG='SES,...'
```

The user module may also have its own STXIT routine, which can also be activated with /SEND-MSG commands. In this case, the data in the /SEND-MSG command is passed on to the user module's STXIT routine:

```
/SEND-MSG TO-PROGRAM(JOB-ID=OWN),MSG='text'
```

The SESLINK STXIT routine has the following functions:

1. Recoverable program errors
   In the event of a program error, a program dump is executed, followed by an attempt to terminate the SESLINK session normally. The databases must be kept in a consistent state.
2. Timer interrupt
   Not assigned
3. Messages to the program
   Administration calls to the linked-in DBH are sent with the /SEND-MSG command.
4. Administration calls are stored by SESLINK and not processed until the next SESAM/SQL CALL request. The SESAM/SQL CALL request is performed after the administration request has been processed.
5. Unrecoverable program errors
   The procedure is the same as for recoverable program errors.
6. Time runout
   In the event of time runout, an attempt is likewise made to terminate the SESLINK session normally, i.e. to maintain the consistency of the databases.
7. ABEND event
   If an event of the ABEND class occurs, an attempt is made to terminate the SESLINK session normally. If this is not possible, the procedure is as for a program error except that no dump is taken.

Multiple loading of linked-in applications

The linked-in DBH uses the DBH files

SESLK[*cn*].CURSOR.*nnnn*	Cursor files
SESLK[*cn*].TA-LOG1 and SESLK[*cn*].TA-LOG2	Transaction log files
SESLK[*cn*].WA-LOG	Restart file
SESLK[*cn*].WORK.TEMP1	Temporary work file
SESLK[*cn*].WORK.TEMP2	Temporary work file

Where:

c Configuration identifier

n Communication name

It is not possible to have several DBHs with the same communication name and configuration identifier on a single computer (neither independent nor linked-in DBH, nor mixed).

Transaction-oriented security and restart

Transaction-oriented security is the default value:
SYSTEM-STRATEGIES=*PARAMETERS(TRANSACTION-SECURITY=*YES(...))

For restarts following system failures, the transaction log files and the restart file must be available:

SESLK[*cn*].TA-LOG1
SESLK[*cn*].TA-LOG2
SESLK[*cn*].WA-LOG

Transaction restart is performed when a linked-in program using the same configuration and DBH names as the aborted session is started. The restart information from the corresponding transaction log file and restart file is evaluated and the affected databases recovered.

6.6 Using CALL DML in transaction mode

There are two ways of using CALL DML in transaction mode:

– *open*UTM

– DCAM

Comprehensive information on *open*UTM can be found in the “Core Manual“.

6.6.1 DCAM

The SESAM/SQL DCAM DB/DC system is a software system for processing SESAM/SQL databases in transaction mode.

Automatic restart by transaction-oriented security is not supported under DCAM.

The connection module SESDCAM manages the connection of a DCAM application program to the SESAM/SQL DBH. SESDCAM must be linked to the application program.

The connection module SESDCAM enables as many requesters to issue DML statements to the SESAM/SQL DBH in parallel in a DCAM task as specified in the REQUEST-USERS parameter in the configuration file.

Function of the SESDCAM calls

To process SESAM/SQL databases with a DCAM program, the user has available the following calls to the connection module SESDCAM:
– SESAM
– SESPUT
– SESGET
– SESGETW

In all calls, the application program must pass certain transfer areas to the connection module SESDCAM, e.g. SESAM call in a COBOL program:

```
CALL "SESAM" USING statement acknowledgment response inquiry identification
```

The calls are described below, indicating which areas are required for each call and what function the call fulfils:

SESAM

Transfer areas:
Statement area, acknowledgment area, response area, inquiry area and identification area

Meaning:
The application program passes a DML statement to the DBH and waits for an acknowledgment and a response.

SESPUT

Transfer areas:
Statement area, acknowledgment area, response area, inquiry area and identification area

Meaning:
The application program passes a DML statement to the DBH. It does not wait for an acknowledgment or a response from the DBH, but continues processing.

SESGET

Transfer areas:
Statement area, acknowledgment area, response area, inquiry area and identification area

Meaning:
The application program inquires whether the DBH has acknowledged a DML statement issued with a SESPUT. If it has, the application program obtains the acknowledgment and the response. Otherwise it has to repeat the SESGET call.

SESGETW

Transfer areas:
Statement area, acknowledgment area, response area, inquiry area and identification area

Meaning:
The application program inquires whether the DBH has already acknowledged a DML statement issued with SESPUT. If it has, the program accepts the acknowledgment and the response from the DBH. If not, it waits until the DBH supplies the acknowledgment and response.

Differences between CALL DML and TIAM

– Identification area

– In a task there can be as many SESPUT request open as specified in the REQUEST-USERS parameter in the configuration file.

– For SESGET/SESGETW, SESAM/SQL enters the requester identification transferred in the corresponding SESPUT in the identification area.

Transfer areas for the SESDCAM calls

The transfer areas must be defined with the correct length in the application program. The application program must assign them the correct values before the call is issued. The addresses of the transfer areas must be passed to SESDCAM when the call is issued.

The statement, acknowledgment, response and inquiry areas contain all the information required for the DML statement (see section “CALL DML calls” on page 14).

Content of the identification area

This area is used to pass a unique identification code to the SESDCAM connection module. It must consist of the processor name, application name and an extension string.

Displ.	Length	Entry	Meaning
0	8	host	processor name
8	8	application	application name
16	8	user	extension string

Table 84: Structure of the identification area

host Processor name:
the same processor name must be used in all DCAM applications for a processor.

application Name of the DCAM application:
the same application name must be used throughout a DCAM application.

user user is a character string that makes the 24-byte string unique. The logical terminal name could, for example, be used.

The identification may only contain uppercase letters and numbers.

The application name may also be passed to SESDCAM via the configuration file (see the “Core Manual”). To do this, the configuration file must be assigned with the link name SESCONF.

Processor and application names

Processor and application names in DCAM applications can be passed to SESDCAM with the CALL DML interface by means of the identification area or the configuration file. If the configuration file is used, the processor name is determined by SESDCAM. The application name can be specified in the configuration file.

The following overview shows how processor and application names are assigned with and without a configuration file in DCAM applications.

Case	Configuration file	Processor name	Application name
1	with application name	Processor name as used by DCAM[1]	as in configuration file
2	without application name	Processor name as used by DCAM[1]	TSN=tsn
3	-	as in ID area	as in ID area

Table 85: Assigning processor and application names in DCAM applications

[1] If DCAM is not available, the fixed name string HOMEPROC is used.

In cases 1 and 2 only the user name (bytes 17 - 24) is passed from the identification area. Processor and application names are ignored.

In case 3 (configuration file not assigned), the processor and application names are passed from the identification area at the first CALL DML call. These names must not subsequently be changed.

In case 2,only single task applications are possible due to TSN=tsn.

In cases 1 and 2, the user name is formed from
– the processor name for DCAM or the constant HOMEPROC and
– the application name from the configuration file and
– the last 8 bytes of the identification area

irrespective of the other entries in the identification area. Under SESGET(W), this name, which has been updated compared with the application, is returned to the application program, whilst under CALL SESAM, the identification area is not overwritten. This behavior should be noted if the first 24 positions of the user name are checked in the application program.

7 CALL DML utility routines

The following utility routines are available for the CALL DML interface:

SEDI61(L) Output retrieval responses

SEDI63(L) Test DML statements.

The variants with “L” (SESLK) are linked-in applications with the software product SESAM/SQL-LINK.

SESAM/SQL-LINK is a chargeable optional product for the SESAM/SQL database system.

Starting the CALL DML utility routines

The SESAM/SQL utility routines can be started with START-PROGRAM or with the corresponding START-SESAM... commands.

In the first case, the start command is:

```
/START-PROGRAM FROM-FILE=*MODULE(ELEMENT=SEDInn,
               PROGRAM-MODE=ANY,
               RUN-MODE=ADVANCED(ALTERNATE-LIBRARIES=YES),
               LIBRARY=SYSLNK.SESAM-SQL.030))
```

The second case is used in all other examples in the manual:

```
/SET-FILE-LINK LINK-NAME=SESCONF,FILE-NAME=dbhconf
or
/CONNECT-SESAM-CONFIGURATION TO-FILE=globconf-
/,CONFIGURATION-LINK=linkname                                    (1)
/START-SESAM-RETRIEVAL-DIALOGUE
or
/START-SESAM-CDML-DIALOGUE                                       (2)
```

(1) Assigns the corresponding configuration file.

(2) Starts SEDI61 or SEDI63 with the special start command (see also “Database Operation”). The following variants are permitted:

	For SEDI61 and SEDI61L	**For SEDI63 and SEDI63L**
indep.	START_SESAM-RETRIEVAL-DIALOGUE SESAM-RETRIEVAL-DIALOGUE START-SEDI61 SEDI61	START_SESAM-CDML-DIALOGUE SESAM-CDML-DIALOGUE START-SEDI63 SEDI63
linked-in	START-SESLK-RETRIEVAL-DIALOGUE SESLK-RETRIEVAL-DIALOGUE START-SEDI61L SEDI61L	START-SESLK-CDML-DIALOGUE SESLK-CDML-DIALOGUE START-SEDI63L SEDI63L

The CALL DML utility routines SEDI61 or SEDI61(L) and SEDI63 or SEDI63(L) load modules dynamically from the module library SYSLNK.SESAM-SQL.030.

Before the start of a SESAM/SQL utility, the user must ensure that the following files have been assigned:

– The module library SYSLNK.SESAM-SQL.030 (see section “Linking” on page 262).

– The CRTE library under the link name BLSLIB<xx> (if possible: <xx>=00) (see the “CRTE” manual).

7.1 Outputting retrieval responses (SEDI61)

Two variants are available:

– For the independent DBH: SEDI61

– For the linked-in DBH: SEDI61L.
Certain condition apply when working with the linked-in DBH (see section “Special statements” on page 340).

7.1.1 Functions of SEDI61/SEDI61L

Under SEDI61, or SEDI61L, the responses from retrieval statements can be output to a SAM file.

SEDI61 carries out communication with the database for the following DML statements:

– Open

– Attribute information

– Search

– Record output

– Inquiry

SEDI61 performs the following operations automatically:

– Response polling

– Close

7.1.2 Overview of the control statements

Control statements and operands	Meaning
[STATUSnn]	Status statement: output additional error information for status messages
[␣H␣'filename' ␣W␣´filename´]	Define the output file ␣H␣statement: Status code 10 after a base statement causes SEDI61 to abort ␣W␣statement: Status code 10 never causes SEDI61 to abort
[$ ␣A␣open, [length-T],length-B,length-S]	Enter the DML statement open $ statement: activate the default open statement for the CALL DML table ␣A␣statement: enter an open statement
[␣T␣S	␣T␣statements: Initiate definition of the output record structure
␣T␣U,r, san / san/mmm/ / san/mmm-nnn/	Move attribute values to the output record
␣T␣D,r,l,´c´	Move constants to the output record
␣T␣M,r1, san / san/mmm/ / san/mmm-nnn/ ,r2,l	Move parts of attribute values to the output record
␣T␣P,r1,l1, san / san/mmm/ / san/mmm-nnn/ ,r2,l2	Move numeric attribute values to the output record in packed form
...]	Not permitted in record output

Table 86: Overview of the control statements (part 1 of 2)

Control statements and operands	Meaning
␣A␣statement ␣AC´statement´ ␣AX´statement´	␣A␣statement: Enter the statement area of a DML statement
␣F␣inquiry area ␣FC´inquiry area´ ␣FX´inquiry area´	␣F␣statement: Enter comparison values
␣Q␣nn ␣QC´nn´ ␣QX´nn´	␣Q␣statement: Enter the file identifier
␣* $	␣* statement and $ statement: Enter the file identifier
/* END	/* statement or END statement: Terminate the SEDI61 control statements and end the program

Table 86: Overview of the control statements (part 2 of 2)

7.1.3 Control statements and operands

STATUS statement

An error message to simplify diagnosis is output in addition to the status number. The error messages are in the module called STATUSnn.

STATUSnn

nn	Two-character extension to the STATUS module name; e.g. GB for STATUS module STATUSGB
XX	The module STATUSXX contains standard error messages.

Default function

If the STATUS statement is not given, only the status number is output.

␣H␣statement

The ␣H␣ statement causes the response output to be placed in a SAM file. After status code 10 for a retrieval statement (base statement), SEDI61 is aborted. If status code 10 occurs after a follow-up statement (automatic response polling), SEDI61 is not terminated and the next control statement is processed.

␣H␣'filename'

filename	Name of the SAM file in which the responses are to be output. The file is given the link name ZDAUS by SEDI61. If another file was given the link name ZDAUS by a SET-FILE-LINK command before SEDI61 was called, the file name in the ␣H␣ statement is ignored and the file specified in the SET-FILE-LINK command is used as the output file.

␣W␣ statement

The ␣W␣ statement causes the response output to be placed in a SAM file. After status code 10, the SEDI61 run is always continued and the next control statement executed.

␣W␣´filename´

filename — Name of the SAM file in which the responses are to be output. The file is given the link name ZDAUS by SEDI61.

If another file was given the link name ZDAUS by a SET-FILE-LINK command before SEDI61 was called, the file name in the ␣W␣ statement is ignored and the file specified in the SET-FILE-LINK command is used as the output file.

Use of the ␣H␣ and ␣W␣ statements

If neither an ␣H␣ nor a ␣W␣ statement is specified, SEDI61 checks that the control statements can be executed. The responses are not output.

If the output is to be to a tape file, it must be set up using the following commands:

```
/CREATE-FILE FILE-NAME=filename,SUPPORT=TAPE(VOLUME=archivno
,DEVICE-TYPE=device-type)

/SET-FILE-LINK LINK-NAME=ZDAUS,FILE-NAME=filename
```

If the file assigned in the ␣H␣ or ␣W␣ statement does not exist, it is created by SEDI61 on the public volume in accordance to the following command:

```
/CREATE-FILE FILE-NAME=filename
,SUPPORT=PUBLIC-DISC(SPACE=RELATIVE(PRIMARY-ALLOCATION=192,SECONDARY-
ALLOCATION=24)

/SET-FILE-LINK LINK-NAME=ZDAUS,...
```

The ␣H␣ or ␣W␣ statement must be entered before the first open statement.

Open statement

The open statement must be entered with the following statements:

```
␣A␣open,[length-T],length-B,length-S
␣Q␣ff
{␣*}
{$ }
```

open — Open statement (see section “Open” on page 29):

pas	2	tabname	length-A	length-F	function code	ff	9

length-T — Length of the area for ␣T␣ statements:
length-T is calculated thus: number of ␣T␣ statements * 11
The statements ␣T␣D and ␣T␣S are not included.
Maximum value: 9999 bytes
Default value: 2000 bytes

length-B — Block length on output to a tape file:
1 byte < length-B ≤ 2048 bytes

length-S — Record length on output to a tape file:
1 byte < length-B ≤ 2048 bytes

ff — File identifier of the logical file

{␣* / $} — End of the open statement

Any further open statement can omit *length-T*, *length-B* and *length-S*, as they are not analyzed by SEDI61 which uses the length specifications from the first open statement. The lengths of the inquiry and response areas must be less than or equal to those in the first open statement (*length-R*, *length-I*).

If no more open statements are given, the file identifier ff can be omitted from the ␣Q␣ statement.

For structured output, it should be borne in mind when specifying the length of the response area for the search and inquiry statements that attribute information statements are executed internally.
The additional length of the response area is a maximum of:
number of requested attributes * 48

For structured output, SEDI61 can process a maximum of 256 attributes for the search and 145 attribute groups for the inquiry.

The block length must be a multiple of the record length or equal to it.

Default open

Entry of the $ statement with no preceding ␣A␣ and ␣Q␣ statement causes the following standard open statement to be executed:

```
␣A␣XXX2SESAM␣␣␣␣␣␣␣␣␣␣␣␣0204802048R619,2000,2048,256
```

The following sizes apply:

tabname	SESAM␣␣␣␣␣␣␣␣␣␣␣␣
length-R	2048 bytes
length-I	2048 bytes
length-T	2000 bytes
length-B	2048 bytes
length-S	256 bytes

␣T␣ statement

The ␣T␣ statements define the structure of an output record. Every sequence of ␣T␣ statements starts with the statement ␣T␣S. Several output records can be defined within a SEDI61 run.

If no ␣T␣ statements are specified, the responses are transferred unchanged to the output file:

– with the response length in the case of attribute information

– with the response record length in the case of a search, inquiry or record output.

␣T␣ statements are not permitted within record output.
␣T␣ statements are ignored in attribute information.

Initiate definition of output record structure

␣T␣S

S Initiate definition of output record structure and, if it exists, delete the previous definition

The statement ␣T␣S must always be the first in a series of ␣T␣ statements.

Transferring an attribute

␣T␣U, r, { san / san/mmm/ / san/mmm-nnn/ }

U Transfer the attribute value to the output record

r Address relative to address 0 of the output record to which the attribute value is to be transferred

san Symbolic attribute name of the attribute to be transferred

san/mmm/ Symbolic attribute name and occurrence number of a multiple attribute

san/mmm-nnn/
Symbolic attribute name and range of occurrences of a multiple attribute

Transferring constants

␣T␣D,r,l,´c´

D	Transfer a constant into the output record
r	Address relative to address 0 of the output record to which the constant is to be transferred
l	Length of the constant; the figure given for l must correspond to the length of c
c	Constant (max. 50 characters) to be transferred to the output record

Transferring subattributes

␣T␣M, r, { san / san/mmm/ / san/mmm-nnn/ } ,r1,l

M	Transfer parts of attribute values into the output record
r	Address relative to address 0 of the output record to which the subattribute value is to be transferred
san	Symbolic attribute name of the attribute to be transferred
san/mmm/	Symbolic attribute name and occurrence number of a multiple attribute
san/mmm-nnn/	Symbolic attribute name and range of occurrences of a multiple attribute
r1	Address relative to displacement 0 of the attribute from which the value is to be transferred
l	Length of the value to be transferred

Transferring packed attributes

␣T␣P, r, l, { san / san/mmm/ / san/mmm-nnn/ } ,r1,l1

P	Pack numeric attribute values or subattribute values into the output record
r	Address, relative to address 0 in the output record, at which the part of the attribute value is to be inserted
l	Length of the packed field in the output record
san	Symbolic attribute name of the attribute to be transferred

san/mmm/	Symbolic attribute name and occurrence number of a multiple attribute
san/mmm-nnn/	Symbolic attribute name and range of occurrences of a multiple attribute
r1	Address relative to displacement 0 of the attribute from which the value is to be transferred
l1	Length of the attribute value to be transferred

The following rules apply when specifying ␣T␣ statements:

– The end identifiers ";" and "&" (with &BLKnnn, &BLNnnn, &RNW000 and &RNL000) in DML statements are replaced by "9".

– Search with join is not permitted.

– In a search, only strategies 0 or 1 are permitted.

– Subquestions O and U, and the old subquestions F, H, Q, X, W and Z are not permitted.

– Primary key functions 4 and 8 are permitted, but in this case no internal response polling is performed.

– The DML statements "set mask character" and "change mask character" are permitted.

– ␣T␣ statements for multiple attributes:

  Where different occurrences of a multiple attribute are referenced in different ␣T␣ statements, they cannot be referenced individually in the ␣A␣ statement; for example:

```
␣T␣S
␣T␣U,0,ABA/001/
␣T␣U,5,ABA/002/
␣T␣U,10,ABA/004/
␣A␣XXX500ABA/001/ABA/004/9
```

– Output of the attribute values takes place according to the relative addresses in the ␣T␣ statement. No check is made that the addresses given are compatible with the lengths of the attribute values. This may mean that attribute values in the output record are overwritten.

␣A␣ statement

The ␣A␣ statement enables the user to specify the statement area of a DML statement.

The statements can be entered as character values (␣A␣ or ␣AC statement) or in hexadecimal form (␣AX statement):

␣A␣statement

statement — DML statement
An ␣A␣ statement allows a DML statement of up to 68 characters to be entered. If the DML statement is longer, it must be split over more than one ␣A␣ statement.

␣AC´statement´

statement — DML statement
An ␣AC statement allows a DML statement of up to 66 characters to be entered. If the DML statement is longer, it must be split over more than one ␣AC statement.

␣AX´statement´

statement — DML statement in hexadecimal form
An ␣AX statement allows a DML statement of up to 66 hexadecimal characters (characters 0 to 9 and A to F) to be entered. If the DML statement is longer, it must be split over more than one ␣AX statement.

The following rules apply when specifying ␣A statements:

– Chained DML statements are not permitted.
– Block mode for response output is not permitted.

␣F␣ statement

The ␣F␣ statement allows the user to enter the values of the inquiry area of a DML statement.

The values can be entered as character values (␣F␣ or ␣FC statement) or in hexadecimal form (␣FX statement):

␣F␣inquiry area

inquiry area — Inquiry area entries
An ␣F␣ statement allows up to 68 characters to be written to the inquiry area. Longer inquiry area entries must be split over several ␣F␣ statements.

␣FC´inquiry area´

inquiry area — Inquiry area entries
An ␣FC statement allows up to 66 characters to be written to the inquiry area. Longer inquiry area entries must be split over several ␣FC statements.

␣FX´inquiry area´

inquiry area — Inquiry area entries, in hexadecimal form
An ␣FX statement allows up to 66 hexadecimal characters (characters 0 to 9 and A to F) to be entered. Longer inquiry area entries must be split over several ␣FX statements.

The following rules apply when specifying ␣F␣ statements:

– Each value for the inquiry area can be in a separate ␣F␣ statement.
– Attribute values must be of the length defined for the attribute in the attribute catalog.

␣Q␣ statement

The ␣Q␣ statement is used to specify the file identifier of the open logical file. If only one logical file is open, the ␣Q␣ statement can be omitted.

The acknowledgment area has a fixed length of 2 bytes.

The file identifier can be entered in character (␣Q␣- or ␣QC statement) or hexadecimal form (␣QX statement).

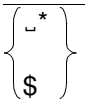
␣Q␣ff	
ff	File identifier, two characters

␣QC´ff´	
ff	File identifier, two characters

␣QX´ff´	
ff	File identifier, four hexadecimal characters (0 to 9 and A to F)

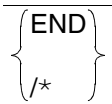
␣* statement and $ statement

The ␣* or $ statement terminates the entry of a DML statement.



END statement and /* statement

The END or /* statement marks the end of the SEDI61 control statements and causes all tables to be closed automatically.



7.1.4 Example of SEDI61/SEDI61L

A procedure is used to extract all SEDI61 article data from the CALL DML table COMPANY and output it into the file ARTICLE.DATA (see section “Examples” on page 180).

```
. . .
/SET-FILE-LINK LINK-NAME=SESCONF,FILE-NAME=conf
/SET-FILE-LINK LINK-NAME=ZDAUS,FILE-NAME=output-file
/START-SESAM-RETRIEVAL-DIALOGUE
STATUSXX
$
␣A␣XXX2COMPANY 0100001000RFM9,2000,2048,128
$
␣T␣S
␣T␣U,1,AAA
␣T␣D,7,1,':'
␣T␣U,9,AA8
␣T␣D,27,7,'Price: '
␣T␣U,34,AB6
␣T␣D,43,9,'Stock: '
␣T␣U,52,AC4
␣A␣XXX611EAA8AB6AC40009
␣Q␣FM
␣FC'A     '
$
END
. . .
```

Where:

conf	DBH configuration file
output-file	Output file for SEDI61

Contents of the output file ARTICLE.DATA:

A00100: PENCIL	Price: 00059	Stock: 7576
A00200: RULER	Price: 00189	Stock: 0503
A00300: WRITING PAD	Price: 00179	Stock: 1763
A00340: BALL-POINT PEN	Price: 00219	Stock: 4908
A00400: BRUSH	Price: 00119	Stock: 1054
A00650: FOLDER	Price: 00395	Stock: 0107
A01400: ERASER	Price: 00159	Stock: 0816
A01750: GLUE	Price: 00399	Stock: 0035
A08880: CALENDAR	Price: 00256	Stock: 0084
A09000: DRAWING PAD	Price: 00179	Stock: 0527
A09050: NOTEPAD	Price: 00099	Stock: 0750

7.2 Testing DML statements (SEDI63)

There are two variants available:

– For the independent DBH: SEDI63

– For the linked-in DBH: SEDI63L.
Certain conditions apply when working with the linked-in DBH (see section “Special statements” on page 340).

7.2.1 Functions of SEDI63/SEDI63L

SEDI63, or SEDI63L, handles communication with the CALL DML table for all DML statements to be tested.

SEDI63 reads the statement, inquiry and acknowledgment areas of each DML statement from SYSDTA. SEDI63 places the responses and acknowledgment area in a runtime log which is output to SYSLST and optionally also to SYSOUT.

7.2.2 Overview of control statements

Control statements and operands	Meaning
[WROUT]	WROUT statement: Log to SYSLST and SYSOUT
[STATUSnn]	STATUS statement: Output additional error information with status messages
{[SEDECIMAL] [HEXADECIMAL]}	SEDEZIMAL/HEXADECIMAL statement: Output responses edited and in hexadecimal form
[LOW{ON] OFF]}	LOW statement: Differentiate between uppercase and lowercase letters Interpret lowercase as uppercase
{␣A␣statement ␣AC´statement´ ␣AX´statement´}	␣A␣ statement: Enter the statement area of a DML statement
{␣F␣inquiry area ␣FC´inquiry area´ ␣FX´inquiry area´}	␣F␣ statement: Enter attribute values
{␣Q␣nn ␣QC´nn´ ␣QX´nn´}	␣Q␣ statement: Enter the file identifier
{␣* $ $nn}	␣* statement and $ statement: Finish a DML statement Repeat DML statement nn times
[␣A␣xxx79LOOP]	Repeated response polling after a base statement
{/* END}	/* statement and END statement: Terminate the SEDI63 control statements and end the program

Table 87: Overview of the control statements

The WROUT, STATUS, HEXADECIMAL/SEDEZIMAL and LOW statements can be given in any order.

The ␣A␣, ␣F␣ and ␣Q␣ statements for entering a DML statement can be given in any order. The last statement must be a ␣* or $ statement. This terminates entry of the DML statement and passes it to the DBH.

7.2.3 Control statements and operands

WROUT statement

SEDI63 logs the control statements and responses from a retrieval statement to the terminal as well as to SYSOUT.

WROUT

Default function

If WROUT is not specified, SEDI63 only outputs control statements and responses to the SYSLST.

STATUS statement

An error text to simplify diagnosis is output in addition to the status number. The error texts are in the module called STATUSnn.

STATUSnn

nn	Two-character extension to the name of the STATUS module; e.g. GB for STATUS module STATUSGB
XX	The module STATUSXX contains standard error texts.

If no STATUS statement is given, only the status number is output.

SEDECIMAL statement and HEXADECIMAL statement

Acknowledgment and responses are output in edited *and* hexadecimal form.

{[SEDECIMAL] / [HEXADECIMAL]}

If no SEDEZIMAL statement is given, the responses are output in edited form only. Any unprintable character is shown as X´00´ , i.e. the encrypted information in these bytes is lost. The HEXADECIMAL statement has the same function as the SEDEZIMAL statement.

LOW statement

SEDI63 can accept lowercase letters as they are or can convert them to uppercase (default function).

[LOW{ON] / OFF]}

LOWON	SEDI63 differentiates between uppercase and lowercase letters. SEDI63 control statements must be entered in uppercase.
LOWOFF	Default function: SEDI63 interprets lowercase letters as uppercase.

␣A␣ statement

The ␣A␣ statement enables the user to enter the statement area of a DML statement.

The statements can be entered as characters (␣A␣ or ␣AC statement) or in hexadecimal (␣AX statement) form.

␣A␣statement

statement DML statement
An ␣A␣ statement allows a DML statement of up to 253 characters to be entered. If the DML statement is longer, it must be split over more than one ␣A␣statement.

␣AC´statement´

statement DML statement
An ␣AC statement allows a DML statement of up to 251 characters to be entered. If the DML statement is longer, it must be split over more than one ␣AC statement.

␣AX´statement´

statement DML statement, hexadecimal
An ␣AX statement allows a DML statement of up to 250 hexadecimal characters (0 to 9 and A to F) to be entered. If the DML statement is longer, it must be split over several ␣AX statements.

Standard-Open

If a ␣* or $ statement is given as the first statement for the CALL DML table without a preceding ␣A␣ and ␣Q␣ statement, the following default open statement is executed:

```
␣A␣XXX2SESAM␣␣␣␣␣␣␣␣␣␣␣␣0100001000X639
```

The following values are used:

tabname	SESAM␣␣␣␣␣␣␣␣␣␣␣␣
inquiry area	1000 bytes
response area	1000 bytes
logical file:	63

␣F␣ statement

The ␣F␣ statement allows the user to enter the values of the inquiry area of a DML statement.

The values can be entered as characters (␣F␣ or ␣FC statement) or in hexadecimal (␣FX statement) form.

␣F␣inquiry area

inquiry area — Inquiry area entries
An ␣F␣ statement enables a maximum of 253 characters to be written to the inquiry area. Inquiry area entries longer than this must be split over several ␣F␣ statements.

␣FC´inquiry area´

inquiry area — Inquiry area entries
An ␣FC statement enables a maximum of 251 characters to be written to the inquiry area. Inquiry area entries longer than this must be split over several ␣FC statements.

␣FX´inquiry area´

inquiry area — Inquiry area entries, hexadecimal
An ␣FX statement enables a maximum of 250 hexadecimal characters (0 to 9 and A to F) to be entered. Inquiry area entries longer than this must be split over several ␣FX statements.

The following rules apply when specifying ␣F␣ statements:

– Each value in the inquiry area can be put in a separate ␣F␣ statement.
– Attribute values must be given the length defined for them in the attribute catalog.

␣**Q**␣ statement

The ␣Q␣ statement enables the file identifier of the logical file to be entered. If only one logical file is opened, the ␣Q␣ statement can be omitted.

The acknowledgment area has a fixed length of 16 bytes.

The file identifier can be entered as characters (␣Q␣ or ␣QC statement) or in hexadecimal (␣QX statement) form in the acknowledgment area.

␣Q␣ff	
ff	File identifier, two characters

␣QC´ff´	
ff	File identifier, two characters

␣QX´ff´	
ff	File identifier, four hexadecimal characters (0 to 9 and A to F)

␣* statement and $ statement

The ␣* or $ statement finishes the entry of a DML statement.

{ ␣* | $ | $nn }

nn Number of times the statement is to be executed: two digits with leading zeros if necessary; if the $nn statement is not preceded by an ␣A␣, ␣F␣ or ␣Q␣ statement, nn specifies the number of times the *previous* statement is to be executed.

Response polling

After a retrieval statement, the responses can be polled by means of the DML response polling statement.

SEDI63 offers a facility to retrieve all responses by means of the following statement:

```
␣A␣xxx79LOOP
```

xxx Password

The xxx79LOOP statement is designed specifically for SEDI63 and must not be used in application programs.

END statement and /* statement

The END or /* statement terminates SEDI63.

```
{ END }
{ /*  }
```

7.2.4 Examples of SEDI63/SEDI63L

The following examples show how the transfer areas (statement, acknowledgment and inquiry areas) are entered in SEDI63. The DML statements in the examples are based on the CALL DML tables COMPANY and SALES (see section “Examples” on page 180). SEDI63 logs all input and output to SYSLST.

Example 1

The statement area is to be filled by the following search:

```
XXX611CAA8401LAB6502CAC4504OAB65029
```

For ease of interpretation, the subquestions of the search are entered individually in the statement area.

The statement only contains printable characters and can therefore be entered using the ␣A␣ or ␣AC statement:

```
␣A␣XXX611
␣A␣CAA8401
␣A␣LAB6502
␣A␣CAC4504
␣A␣OAB6502
␣A␣9

␣AC´XXX611´
␣AC´CAA8401´
␣AC´LAB6502´
␣AC´CAC4504´
␣AC´OAB6502´
␣AC´9´
```

Example 2

The binary record number X´0000001B´ and the printable values ´ITAL␣´ and ´SPAN␣´ are to be entered in the inquiry area.

Enter the 4-byte record number:

```
␣FX´0000001B´
```

Enter the printable values:

```
␣F␣ITAL␣SPAN␣
```

Example 3

Use SEDI63 to execute the following search on logical file FM:

```
XXX611CAA8401LAB6502CAC4504OAB65029
```

The comparison values to be entered in the inquiry area are as follows:
´A␣´, ´%BLOCK%␣␣␣␣␣␣␣␣´, ´00100´, ´0700´ and ´00100´.

```
␣A␣XXX611CAA8401LAB6502CAC45040AB65029
␣Q␣FM
␣F␣A␣␣␣␣␣%BLOCK%␣␣␣␣␣␣␣␣00100070000100
$
```

or:

```
␣A␣XXX611
␣A␣CAA8401
␣A␣LAB6502
␣A␣CAC4504
␣A␣OAB6502
␣A␣9
␣Q␣FM
␣F␣A␣␣␣␣␣
␣F␣%BLOCK%␣␣␣␣␣␣␣␣
␣F␣00100
␣F␣0700
␣F␣00100
$
```

Extract from the SEDI63 runtime log:

```
            . . .
%  SES1201 13:27:18 OPEN    DBC-NR: 02  LD:  FM
0 0          F M . . . . . . . .
F0F040404040C6D400000000000000000
0 0 . . . . F M . . . . . . . . A 0 0 1 0 0 P E N C I L                    0 0
F0F000000001C6D4001E001E00000001C1F0F0F1F0F0C2D3C5C9E2E3C9C6E340404040404F0F0
0 5 9 7 5 7 6
F0F5F9F7F5F7F6
0 0 . . . . F M . . . . . . . . A 0 0 3 0 0 W R I T I N G   P A D          0 0
F0F000000002C6D4001E001E00000003C1F0F0F3F0F0E2C3C8D9C5C9C2C2D3D6C3D2404040F0F0
1 7 9 1 7 6 3
F1F7F9F1F7F6F3
0 0 . . . . F M . . . . . . . . A 0 9 0 5 0 N O T E   P A D                0 0
F0F000000003C6D4001E001E00000000BC1F0F9F0F5F0D5D6E3C9E9C2D3D6C3D24040404040F0F0
0 9 9 0 7 5 0
F0F9F9F0F7F5F0
1 0 . . . . F M . . . . . . . .
F1F000000003C6D40000001E00000000

            . . .
```

8 DML statements for old data types

Before writing an application program, the user must know whether the CALL DML tables to be processed only contain the new data types CHAR, NUMERIC, DECIMAL, INTEGER and SMALLINT, or whether they also contain old data types from SESAM versions < V13.1.

Chapter 3 on page 27 describes the DML statements for tables containing only new data types.

Chapter 9 summarizes the special points that must be taken into account where old data types are being used.

There are two types of old data types:

– Old data types that can be interpreted as new data types: these attributes can be processed without restriction by the DML statements described in chapters 3 and 9.
– Old data types that cannot be interpreted as new data types: the DML statements and conditions described in chapter 9 apply here.

8.1 Differences when working with old data types

The following points must be observed when working with old data types:

The DML statement index browsing (see section “Index browsing” on page 85) can only be used for attributes that have been declared in full or in part as an index.

All data types are allowed for attributes declared in full as an index.

Attributes that are partially inverted must have the following data type:

Alignment:	left-justified
Storage format:	character with/without filler bytes

8.2 Record output

Record output comprises the following functions:

– Selection of records conditionally based on the primary key value

– Projection of attribute sequences; null attribute values are not output

– Optional output of the attribute definition of the projected attributes

Record output produces variable length responses, as null attribute values are suppressed from response output. If the response area defined in the open statement was not large enough, remainder response polling (see section “Response polling” on page 117) can be performed.

Record output can be used, for example, to retrieve continuous text from a table.

Contents of transfer areas:

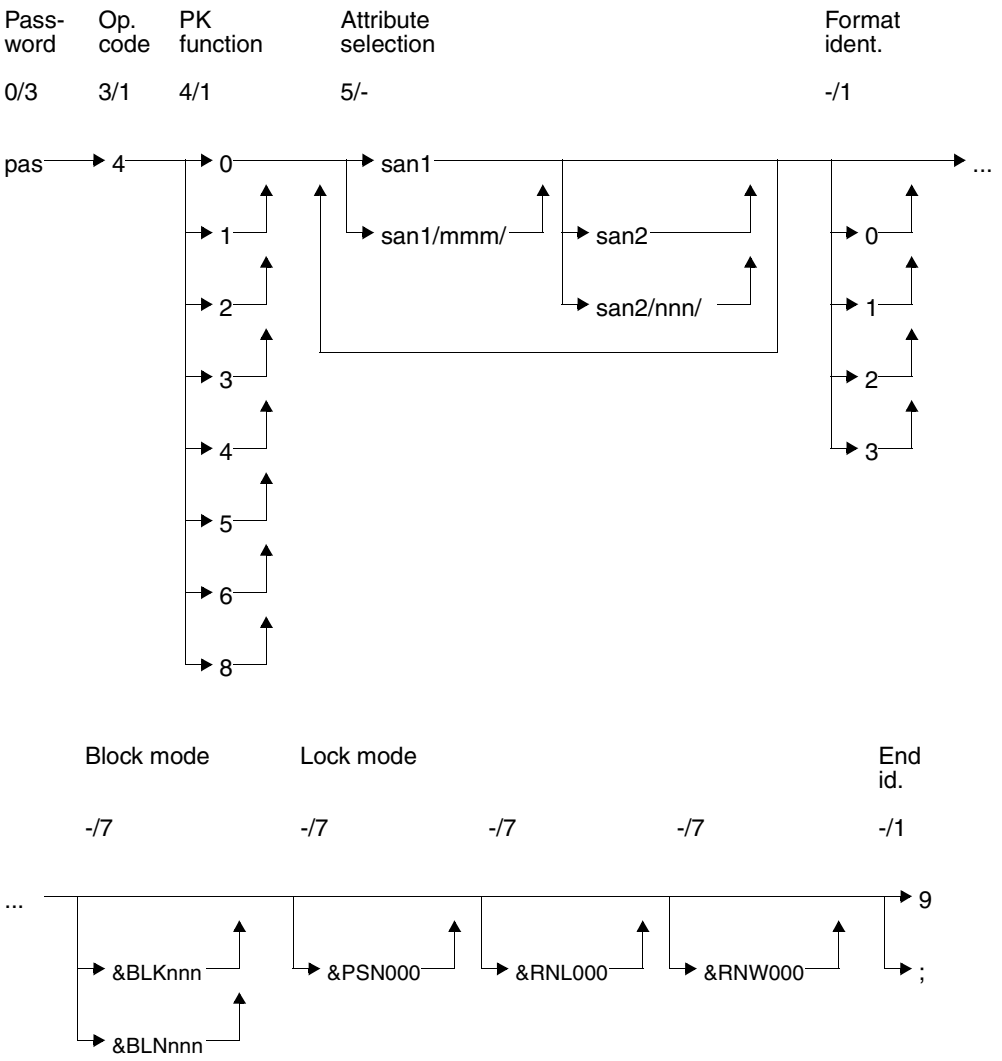
Statement area: The application program supplies the statement.

Acknowledgment area:
The application program supplies the file identifier, and the DBH returns the acknowledgment to the statement.

Response area: The SESAM/SQL DBH supplies the first response or, in block mode, the first group of responses.

Inquiry area: If the statement requires comparison values for the primary key value, they must be made available in the inquiry area.

Statement area



Key

PK (primary key) function	0	All data
	1	Equal to primary key group value
	2	Range of primary key group values
	3	Greater than primary key group value
	4	Equal to primary key value
	5	Range of primary key values
	6	Greater than primary key value
	8	Equal to record number
Format identifier	0	Full attribute definition and attribute values for old data types
	1	SAN, attribute length and attribute values
	2	Only attribute values
	3	Full attribute definition and attribute values
End identifier	9	End of statement
	;	Chain statement

Password (0/3)

pas Password for a protected CALL DML table,
any three-character string for an unprotected CALL DML table.

Operation code (3/1)

4 Operation code for the record output statement

Primary key function (PK function) (4/1)

The primary key function enables records to be selected conditionally based on primary key value or record number. The comparison values used for selection are entered in the inquiry area (see “Inquiry area” on page 316). A primary key group value can be used for selection as an alternative to the primary key value:
The primary key group value designates a group of records in which the primary key group value is contained, left-justified, in the primary key. The comparison value in the inquiry area must be blank-filled to the full length of the primary key.

With a compound key, the primary key must be a value of compound key attribute AAB or of several compound key attributes (beginning AAB and ascending AAC etc.). Blanks must be entered in the inquiry area for the remaining compound key attributes.

0 All data:
All records are selected.

1 Equal to primary key group value:
A primary key group value must be entered in the inquiry area as the comparison value.
All records whose primary key value contains the primary key group value left-justified are selected.

2 Range of primary key group values:
Two primary key group values defining a range of primary key group values must be entered in the inquiry area as comparison values.
All records with a primary key value greater than or equal to the first comparison value and less than or equal to the second comparison value are selected.
The first comparison value must not be larger than the second.

3 Greater than primary key group value:
A primary key group value must be entered in the inquiry area as the comparison value.
All records whose primary key value is greater than the comparison value are selected.

4 Equal to primary key value:
A primary key value must be entered in the inquiry area as a comparison value.
The record whose primary key value is equal to the comparison value is selected.

5 Range of primary key values:
Two primary key values defining a range of primary key values must be entered as comparison values in the inquiry area.
All records whose primary key value is greater than or equal to the first comparison value and less than or equal to the second comparison value are selected.
The first comparison value must not be greater than the second.

6 Greater than primary key value:
A primary key value must be entered as the comparison value in the inquiry area.
All records whose primary key value is greater than the comparison value are selected.

8 Equal to record number:
A record number must be entered as the comparison value in the inquiry area.
The record with the specified record number is selected.

Attribute selection (5/-)

Record output enables attribute sequences to be projected into the output record. An attribute sequence is defined by means of a start and end attribute. The start and end attributes must be specified in ascending order. Any number of attribute sequences may be specified. They must, however, be given in ascending sequence and must not overlap. An attribute sequence can also begin or end with an occurrence of a multiple attribute. The start and end attributes are equal if just one attribute needs to be referenced.

san1 Symbolic attribute name of the start attribute

san1/mmm/
Occurrence of a multiple attribute with which the attribute sequence begins

san2 Symbolic attribute name of the end attribute

san2/nnn/
Occurrence of a multiple attribute with which the attribute sequence ends

The end attribute can be omitted from the last attribute sequence in record output if the last attribute defined in the attribute catalog is to be used as the end attribute.

Format identifier (-/1)

The format identifier defines what information is to be output for the projected attributes:

0 Only for old data types:
The full attribute definition and the attribute values are output.
Attributes with a new data type are treated as non-existent attributes (status code 42).

1 Symbolic attribute name, attribute length and attribute values are output.

2 Only the attribute values or values of occurrences of a multiple attribute are output.

3 The full attribute definition and the attribute values are output.

If no format identifier is specified, format identifier 0 is used as the default.
Attribute definition and attribute value are only output if the attribute has a significant value.

Block mode (-/7)

The user can specify how many of the responses that have been found are to be placed in the response area.

&BLKnnn
: nnn responses are to be placed in the response area. The record number of each response is output.

&BLNnnn
: nnn responses are to be placed in the response area. The record numbers of the responses are not output.

If neither &BLKnnn nor &BLNnnn is specified, just one response record is placed in the response area without a record number.

Lock mode (-/7)

&PSN000
: The response records are output without the primary key value.

&RNL000
: The record being accessed by a record output within a transaction is not locked.

&RNW000
: The record output can access a record that has been locked by another transaction (dirty read). The statement is acknowledged with status code 9S. Following a dirty read in block mode, no further responses are placed in the response area.
If &RNW000 is omitted, a transaction attempting to access a locked record is placed in a wait state until the record becomes free.

End identifier (-/1)

9 Indicates the end of the statement

; End of statement. The statement is chained to a subsequent end transaction statement.

Acknowledgment area

Displ.	Length	Entry	Meaning
0	2	{00 / 10}	Status
2	4	-	-
6	2	ff	File identifier
8	2	length	Response length
10	2	-	-
12	4	rno	Record number; in block mode, this is the record number of the last response record placed in the response area

Table 88: Acknowledgment area on a response

Displ.	Length	Entry	Meaning
0	2	{4A / 9S}	Status
2	3	san	Symbolic attribute name
5	1	␣	-
6	2	ff	File identifier
8	2	length	Response length
10	2	-	-
12	4	rno	Record number; in block mode, this is the record number of the last response record placed in the response area

Table 89: Acknowledgment area on error

Status code 4A is reported if the response to record output is longer than the response area length defined in the open statement. The symbolic attribute name of the first attribute that cannot be fitted into the response area is output together with the length of the response placed in the response area.

The remainder of the response can be retrieved by response polling statement xxx739 (see section “Response polling” on page 117).

Status code 9S (read locked record) may also contain the cause of the error giving status code 4A. In this case, the acknowledgment area contains the same information as for status code 4A.

Displ.	Length	Entry	Meaning
0	2	40 41 42 47 4D 4M 4Z 70 7D 98 9S	Status
2	4	-	-
6	2	ff	File identifier
8	2	-	-
10	2	ss	Status subnumber
12	4	-	-

Table 90: Acknowledgment area on error

Response area

In the response area, SESAM/SQL returns the attribute values and possibly also the full attribute definition, or parts of it, depending on the format identifier.

Information is only output for attributes that have a significant value. Null attributes are ignored.

Displ.	Length	Entry	Meaning
0	4	[rno]	Record number, only for block mode &BLKnnn
4	L(AC)	[pkv]	Primary key value The primary key value of each response is output with the length specified in the attribute catalog. If &PSN000 is specified, no primary key value is output.
-	3	san	Symbolic attribute name
-	1	X´00´ to X´FF´	Attribute length: 1 to 256 bytes
-	1	X´00´ to X´0F´	Number of decimal places: 0 to 15 decimal places
-	1		
Bit 2^7			Alignment:
		0	– right-justified
		1	– left-justified
Bit 2^6			– Attribute type:
		0	– normal attribute
		1	– multiple attribute
Bit 2^3			– Index lock:
		0	– index not locked
		1	– index locked

Table 91: Response area for format identifier 0 (part 1 of 2)

Displ.	Length	Entry	Meaning
- Bit 2^7 Bit 2^6 Bit 2^5 Bit 2^4 Bit 2^3, 2^2	1	 0 1 0 1 0 1 0 1 00 01 10 11	 Search strategy: – search via primary data – search via index Null as attribute value: – not permitted – permitted Result of calculation: – no – yes, possible Index information: – index non-existent – index available Storage format: – binary – packed – character without filler bytes – character with filler bytes
-	1	X´01´ to X´FF´	Number of occurrences of a multiple attribute as defined in the attribute catalog: 1 to 255 occurrences
-	L(AC)	atv	Attribute value The attribute value is output with the length given in the attribute catalog. With multiple attributes, the attribute definition and value are output for each occurrence.
-		[...]	Attribute values 2 - n of the response
-		[...]	In block mode: responses 2 - nnn

Table 91: Response area for format identifier 0 (part 2 of 2)

Displ.	Length	Entry	Meaning
0	4	[rno]	Record number, only for block mode &BLKnnn
4	L(AC)	[pkv]	Primary key value The primary key value of each response is output with the length specified in the attribute catalog. If &PSN000 is specified, no primary key value is output.
-	3	[san]	Symbolic attribute name, omitted for format identifier 2
-	1	[X´00´ to X´FF´]	Attribute length: 1 to 256 bytes; omitted for format identifier 2
-	L(AC)	atv	Attribute value The attribute value is output with the length given in the attribute catalog. With multiple attributes, the attribute definition and value are output for each occurrence.
-		[...]	Attribute values 2 - n of the response
-	1	9	End of response record: end identifier that terminates the last attribute value
-		[...]	In block mode: responses 2 - nnn

Table 92: Response area for format identifier 1 or 2

Displ.	Length	Entry	Meaning
0	4	[rno]	Record number, only for block mode &BLKnnn
4	L(AC)	[pkv]	Primary key value The primary key value of each response is output with the length specified in the attribute catalog. If &PSN000 is specified, no primary key value is output.
-	3	san	Symbolic attribute name
-	2	X´0001´ to X´0100´	Attribute length: 1 to 256 bytes

Table 93: Response area for format identifier 3 (part 1 of 3)

Displ.	Length	Entry	Meaning
-	1	X´00´ to X´0F´	Number of decimal places: 0 to 15 decimal places
-	1	 X´11´ X´21´ X´22´ X´24´ X´28´ X´00´	Data type: CHAR NUMERIC DECIMAL INTEGER SMALLINT Uninterpretable old data type } or corresponding old, interpretable data type for Index specification X´10´
-	1	 X´00´ X´02´ X´04´ X´08´ X´10´ X´20´	Index information: Index non-existent Index locked Index available Index required Old data type Null not permitted as attribute value (old data type)
-	1	i-length	Index length (binary)
-	1	 X´01´ to X´0F´ X´00´	Number of occurrences of a multiple attribute as defined in attribute catalog: 1 to 255 occurrences Not a multiple attribute
-	1	dfc	Default value character
-	1	 X´80´ X´40´ X´00´	Compound key details: Compound key Compound key attribute Not a compound key
-	1	ck-displ	Displacement of a compound key attribute from the start of the compound key
-	4	-	-
-	L(AC)	atv	Attribute value Output with the length specified in the attribute catalog. With multiple attributes, the attribute definition and attribute value are output for every occurrence.
-			Attribute values 2 - n of the response

Table 93: Response area for format identifier 3 (part 2 of 3)

Displ.	Length	Entry	Meaning
-	1	9	End of response record: end identifier that terminates the last attribute value
-			In block mode: responses 2 - nnn

Table 93: Response area for format identifier 3 (part 3 of 3)

Inquiry area

PK function 0 does not require an entry in the inquiry area.

Comparison values must be entered for PK functions 1 to 6 and 8:

Displ.	Length	Entry	Meaning
0	L(AC) 4	pkv1 rno	For PK functions 1 to 6: primary key (group) value with the length of the primary key as defined in the attribute catalog For PK function 8: record number
-	L(AC)	[pkv2]	For PK functions 2 and 5: Primary key (group) value with the length of the primary key as defined in the attribute catalog

Table 94: Inquiry area

Numeric comparison values entered in the inquiry area must be of the correct data type (see under Search, “Inquiry area” on page 59).

8.3 Inquiry

The inquiry offers the following functions:

– Selection of records conditionally based on primary key value

– Projection of attribute sequences, where the default value is output for null attribute values

– Optional output of the attribute definition of the projected attributes

Unlike record output (see section “Record output” on page 304), the responses are always of fixed length as the default value is output for null attribute values.

Up to 1024 attributes can be specified in any one statement. Every occurrence of a multiple attribute counts as one attribute.

The inquiry can be used when the user wishes to select records conditionally on primary key value and not on the values of other attributes. An inquiry allows the record structure required by the application program to be created from the original record structure.

Contents of the transfer areas:

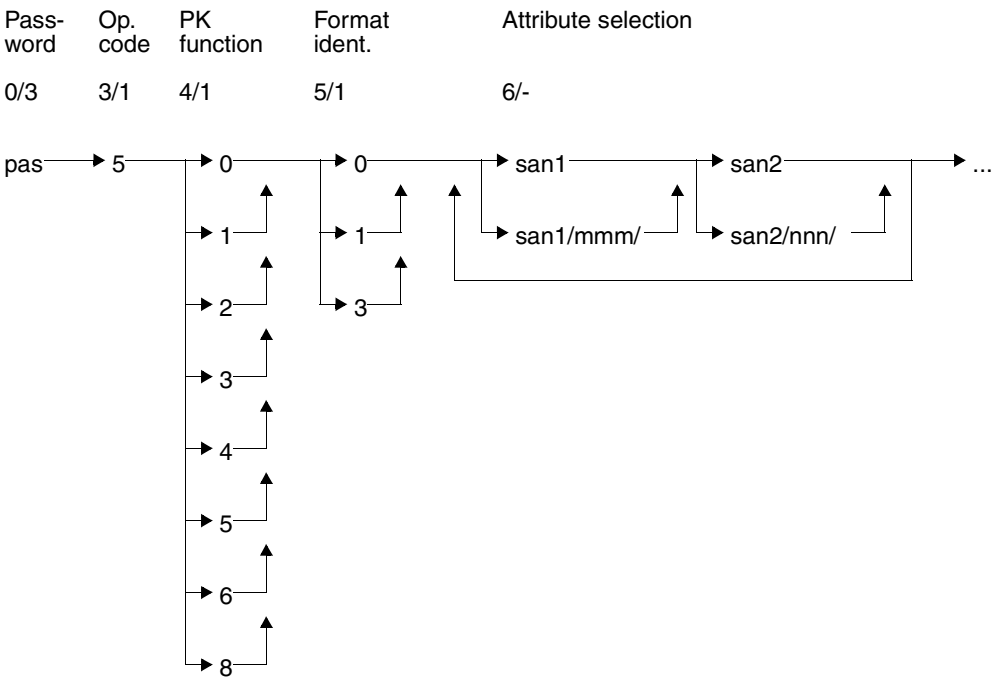
Statement area: The application program supplies the statement.

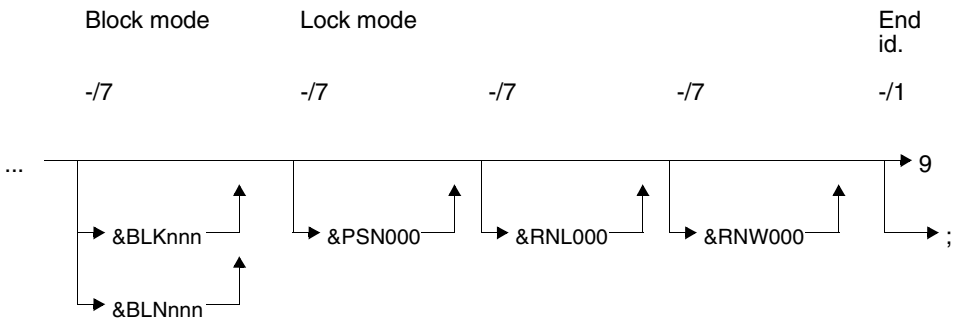
Acknowledgment area: The application program supplies the file identifier, and the DBH returns the acknowledgment to the statement.

Response area: The SESAM/SQL DBH supplies the first response or, in block mode, the first group of responses.

Inquiry area: If the statement requires comparison values for the primary key value, the application program must make them available in the inquiry area.

Statement area





Key

PK (primary key) function	0	All data
	1	Equal to primary key group value
	2	Range of primary key group values
	3	Greater than primary key group value
	4	Equal to primary key value
	5	Range of primary key values
	6	Greater than primary key value
	8	Equal to record number
Format identifier	0	Attribute values only
	1	Full attribute definition and attribute values for old data types
	3	Full attribute definition and attribute values
End identifier	9	End of statement
	;	Chain statement

Password (0/3)

pas Password for a protected CALL DML table,
any three-character string for an unprotected CALL DML table.

Operation code (3/1)

5 Operation code for the inquiry statement

Primary key function (PK function) (4/1)

The primary key function enables records to be selected conditionally based on primary key value or record number. The comparison values used for selection are entered in the inquiry area (see “Inquiry area” on page 328). A primary key group value can be used for selection as an alternative to the primary key value:
The primary key group value designates a group of records in which the primary key group value is contained, left-justified, in the primary key. The comparison value in the inquiry area must be blank-filled to the full length of the primary key.

With a compound key, the primary key must be a value of compound key attribute AAB or of several compound key attributes (beginning AAB and ascending AAC etc.). Blanks must be entered in the inquiry area for the remaining compound key attributes.

0 All data:
All records are selected.

1 Equal to primary key group value:
A primary key group value must be entered in the inquiry area as the comparison value.
All records whose primary key value contains the primary key group value left-justified are selected.

2 Range of primary key group values:
Two primary key group values defining a range of primary key group values must be entered in the inquiry area as comparison values.
All records with a primary key value greater than or equal to the first comparison value and less than or equal to the second comparison value are selected.
The first comparison value must not be larger than the second.

3 Greater than primary key group value:
A primary key group value must be entered in the inquiry area as the comparison value.
All records whose primary key value is greater than the comparison value are selected.

4 Equal to primary key value:
A primary key value must be entered in the inquiry area as a comparison value.
The record whose primary key value is equal to the comparison value is selected.

5 Range of primary key values:
Two primary key values defining a range of primary key values must be entered as comparison values in the inquiry area.
All records whose primary key value is greater than or equal to the first comparison value and less than or equal to the second comparison value are selected.
The first comparison value must not be greater than the second.

6 Greater than primary key value:
A primary key value must be entered as the comparison value in the inquiry area.
All records whose primary key value is greater than the comparison value are selected.

8 Equal to record number:
A record number must be entered as the comparison value in the inquiry area.
The record with the specified record number is selected.

Format identifier (5/1)

The format identifier defines what information is to be output for the projected attributes:

0 Only the attribute values or values of occurrences of a multiple attribute are output.

1 Only for old data types:
The full attribute definition and the attribute values are output.

3 The full attribute definition and the attribute values are output.

If an attribute does not have a significant value, the default value is output instead.

Attribute selection (6/-)

The inquiry enables attribute sequences to be projected.

An attribute sequence is defined by means of a start and end attribute. The start and end attributes must be specified in ascending order. Any number of attribute sequences may be specified in any order. The sequences may also overlap.
An attribute sequence can also begin or end with an occurrence of a multiple attribute. The start and end attributes are equal if just one attribute needs to be referenced.

san1 Symbolic attribute name of the start attribute

san1/mmm/
Occurrence of a multiple attribute with which the attribute sequence begins

san2 Symbolic attribute name of the end attribute

san2/nnn/
Occurrence of a multiple attribute with which the attribute sequence ends

With format identifier 0, the first and last attribute in each group must be present and able to be read. Any attributes in a sequence that do not have read authorization are ignored.

Block mode (-/7)

The user can specify how many of the responses that have been found are to be placed in the response area.

&BLKnnn
nnn responses are to be placed in the response area. The record number of each response is output.

&BLNnnn
nnn responses are to be placed in the response area. The record numbers of the responses are not output.

If neither &BLKnnn nor &BLNnnn is specified, just one response record is placed in the response area without a record number.

Lock mode (-/7)

&PSN000
: The response records are output without the primary key value.

&RNL000
: The record being accessed by a record output within a transaction is not locked.

&RNW000
: The inquiry can access a record that has been locked by another transaction (dirty read). The statement is acknowledged with status code 9S. Following a dirty read in block mode, no further responses are placed in the response area.
If &RNW000 is omitted, a transaction attempting to access a locked record is placed in a wait state until the record becomes free.

End identifier (-/1)

9 Indicates the end of the statement

; End of statement. The statement is chained to a subsequent end transaction statement.

Acknowledgment area

Displ.	Length	Entry	Meaning
0	2	{00 / 10}	Status
2	4	-	-
6	2	ff	File identifier
8	2	t-length	Total length of responses
10	2	e-length	Length of each response
12	4	rno	Record number; in block mode, this is the record number of the last response record placed in the response area

Table 95: Acknowledgment area on response output

Displ.	Length	Entry	Meaning
0	2	5A 5C 9S	Status
2	3	[san]	Symbolic attribute name (omitted with status code 9S)
5	1	␣	-
6	2	ff	File identifier
8	2	t-length	Total length of responses
10	2	e-length	Length of each response
12	4	rno	Record number; in block mode, this is the record number of the last response record placed in the response area

Table 96: Acknowledgment area on error with response output

Displ.	Length	Entry	Meaning
0	2	50 51 53 54 5D 5M 5Z 70 7D	Status
2	3	[san]	Symbolic attribute name
5	1	␣	-
6	2	ff	File identifier
8	2	-	-
10	2	ss	Status subnumber
12	4	-	-

Table 97: Acknowledgment area on error without response output

Response area

In the response area, SESAM/SQL returns the attribute values and possibly also the full attribute definition, depending on the format identifier.

The default value is output for attributes that do not have a significant value.

Displ.	Length	Entry	Meaning
0	4	[rno]	Record number, only for block mode &BLKnnn
4	L(AC)	[pkv]	Primary key value The primary key value of each response is output with the length specified in the attribute catalog. If &PSN000 is specified, no primary key value is output.
-	L(AC)	atv	Attribute value The attribute value is output with the length specified in the attribute catalog.
-		[...]	Attribute values 2 to n of the response
-		[...]	In block mode: responses 2 to nnn

Table 98: Response area for format identifier 0

Displ.	Length	Entry	Meaning
0	4	[rno]	Record number, only for block mode &BLKnnn
4	L(AC)	[pkv]	Primary key value The primary key value of each response is output with the length specified in the attribute catalog. If &PSN000 is specified, no primary key value is output.
-	3	san	Symbolic attribute name
-	1	X´00´ to X´FF´	Attribute length: 1 to 256 bytes
-	1	X´00´ to X´0F´	Number of decimal places: 0 to 15 decimal places

Table 99: Response area for format identifier 1 (part 1 of 3)

Displ.	Length	Entry	Meaning
- Bit 2^7 Bit 2^6 Bit 2^3	1	 0 1 0 1 0 1	 Alignment: – right-justified – left-justified Attribute type: – normal attribute – multiple attribute Index lock: – index not locked – index locked
- Bit 2^7 Bit 2^6 Bit 2^5 Bit 2^4 Bit 2^3, 2^2	1	 0 1 0 1 0 1 0 1 00 01 10 11	 Search strategy: – search via primary data – search via index Null as attribute value: – not permitted – permitted Result of calculation: – no – yes, possible Index information: – index non-existent – index available Storage format: – binary – packed – character without filler bytes – character with filler bytes
-	1	 X´01´ to X´FF´ X´00´	Number of occurrences of a multiple attribute as defined in the attribute catalog: 1 to 255 occurrences Not a multiple attribute
-	L(AC)	atv	Attribute value The attribute value is output with the length given in the attribute catalog.
-		[...]	Attribute values 2 - n of the response
-	1	9	End of response record: end identifier that terminates the last attribute value

Table 99: Response area for format identifier 1 (part 2 of 3)

Displ.	Length	Entry	Meaning
-		[...]	In block mode: responses 2 - nnn

Table 99: Response area for format identifier 1 (part 3 of 3)

Displ.	Length	Entry	Meaning
0	4	[rno]	Record number, only for block mode &BLKnnn
4	L(AC)	[pkv]	Primary key value The primary key value of each response is output with the length specified in the attribute catalog. If &PSN000 is specified, no primary key value is output.
-	3	san	Symbolic attribute name
-	2	X´0001´ to X´0100´	Attribute length: 1 to 256 bytes
-	1	X´00´ to X´0F´	Number of decimal places: 0 to 15 decimal places
-	1	 X´11´ X´21´ X´22´ X´24´ X´28´ X´00´	Data type: CHAR NUMERIC DECIMAL INTEGER SMALLINT Uninterpretable old data type } or corresponding old, interpretable data type for Index specification X´10´
-	1	 X´00´ X´02´ X´04´ X´08´ X´10´ X´20´	Index information: Index non-existent Index locked Index available Index required Old data type Null not permitted as attribute value (old data type)
-	1	i-length	Index length (binary)
-	1	 X´01´ to X´0F´ X´00´	Number of occurrences of a multiple attribute as defined in attribute catalog: 1 to 255 occurrences Not a multiple attribute

Table 100: Response area for format identifier 3 (part 1 of 2)

Displ.	Length	Entry	Meaning
-	1	dfc	Default value character
-	1	 X´80´ X´40´ X´00´	Compound key details: Compound key Compound key attribute Not a compound key
-	1	ck-displ	Displacement of a compound key attribute from the start of the compound key
-	4	-	-
-	L(AC)	atv	Attribute value Output with the length specified in the attribute catalog. With multiple attributes, the attribute definition and attribute value are output for every occurrence.
-		[...]	Attribute values 2 - n of the response
-	1	9	End of response record: end identifier that terminates the last attribute value
-		[...]	In block mode: responses 2 - nnn

Table 100: Response area for format identifier 3 (part 2 of 2)

Inquiry area

PK function 0 does not require an entry in the inquiry area.

Comparison values must be entered for PK functions 1 to 6 and 8:

Displ.	Length	Entry	Meaning
0	L(AK)	pkv1	For PK functions 1 to 6: primary key (group) value with the length of the primary key as defined in the attribute catalog
	4	rno	For PK function 8: record number
-	L(AC)	[pkv2]	For PK functions 2 and 5: primary key (group) value with the length of the primary key as defined in the attribute catalog

Table 101: Inquiry area

Numeric comparison values entered in the inquiry area must be of the correct data type (see under Search, “Inquiry area” on page 59).

8.4 Setting and deleting the delete identifier

The value of an attribute can be deleted in an update or a follow-up update by entering the delete identifier instead of the attribute value in the inquiry area. This can avoid the need for interrupting a follow-up update and issuing another statement.

The delete identifier is assigned by means of the set delete identifier statement and cancelled by means of the delete delete identifier statement.

The delete identifier applies

– until a new delete identifier is defined,

– until it is cancelled by a delete delete identifier statement, or

– until the logical file is closed.

The delete identifier *cannot* be used to delete a record by deleting the primary key value.

Content of the transfer areas:

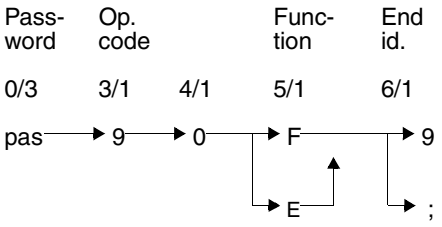
Statement area: The application program supplies the statement.

Acknowledgment area:
The application program supplies the file identifier; the DBH returns the acknowledgment to the statement.

Inquiry area: The application program supplies the character to be used as the delete identifier.

The response area and, on deletion of the delete identifier, the inquiry area, are not evaluated.

Statement area



Password (0/3)

pas Password for a protected CALL DML table,
any three-character string for an unprotected CALL DML table.

Operation code (3/1)

9 Operation code for the set/delete delete identifier statement

Function (5/1)

F Set delete identifier.
The new delete identifier must be placed in the inquiry area (see “Inquiry area” on page 331).

E Delete current delete identifier.

End identifier (6/1)

9 Indicates end of statement

; The statement can be chained to a following end transaction statement.

Acknowledgment area

Displ.	Length	Entry	Meaning
0	2	00 91 9A 9F	Status
2	4	-	-
6	2	ff	File identifier
8	2	-	-
10	2	[ss]	Status subnumber
12	4	-	-

Table 102: Acknowledgment area

Inquiry area

The inquiry area only need be given a value when *setting* the delete identifier.

Displ.	Length	Entry	Meaning
0	1	x	Character to which the function of the delete identifier is assigned.

Table 103: Inquiry area

8.5 Attribute information

The attribute information statement provides information about the definition of one or more attributes. The following information can be obtained:

– symbolic and/or verbal attribute name

– data type

– attribute length and number of decimal places

– index information

– number of occurrences of a multiple attribute

– default value character

– compound key details

The attribute information statement differs from the record output (see section “Record output” on page 96) and inquiry (see section “Inquiry” on page 107) statements in that only the above information is output. The attribute values cannot be obtained.

Contents of the transfer areas:

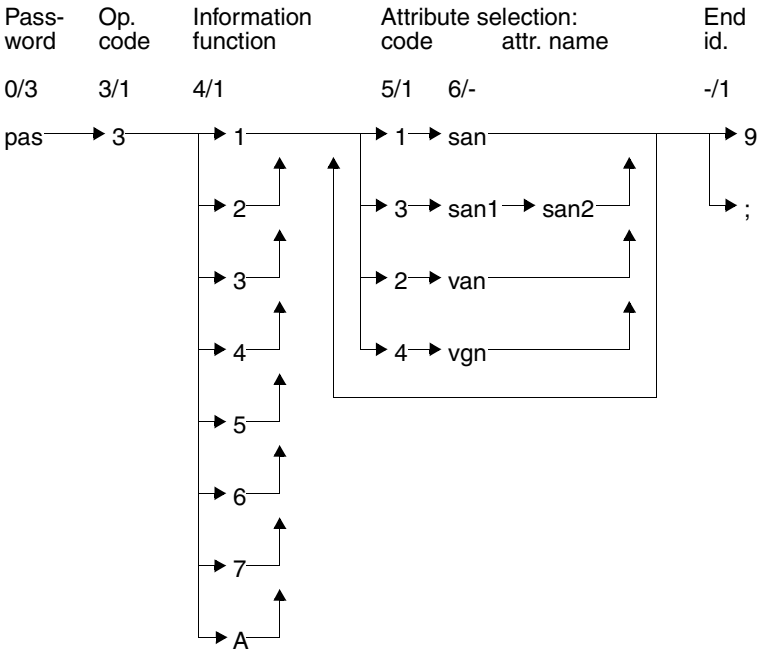
Statement area: The application program supplies the statement.

Acknowledgment area:
The application program supplies the file identifier; the DBH returns the acknowledgment to the statement.

Response area: The DBH returns the required information.

The inquiry area is not evaluated.

Statement area



Key

Information function	1	SAN (old and new data types)
	2	VAN (old and new data types)
	3	SAN and VAN (old and new data types)
	4	Attribute definition (old data types)
	5	SAN and attribute definition (old data types)
	6	VAN and attribute definition (old data types)
	7	SAN, VAN and attribute definition (old data types)
	A	SAN, VAN and attribute definition (old data types)
End identifier	9	End of statement
	;	Chain statement

Password (0/3)

pas Password for a protected CALL DML table,
any three-character string for an unprotected CALL DML table.

Operation code (3/1)

3 Operation code for the attribute information statement

Information function (4/1)

The information function specifies what information is to be output about an attribute.

For old and new data types:

1 Output symbolic attribute name

2 Output verbal attribute name

3 Output symbolic and verbal attribute names

Only for old data types:

4 Output attribute definition

5 Output symbolic attribute name and attribute definition

6 Output verbal attribute name and attribute definition

7 Output full attribute definition including symbolic and verbal attribute names

For new and old interpretable data types:

A Output full attribute definition including symbolic and verbal attribute names

Attribute selection (5/-)

Attribute selection requires a code number indicating the type of attribute name to follow, and the attribute name itself.

id.. attribute name

1 san Symbolic attribute name

3 san1 Symbolic attribute name of the start attribute in an attribute sequence

san2 Symbolic attribute name of the end attribute in an attribute sequence

2 van Verbal attribute name:
verbal attribute names less than 31 characters long must be blank-filled on the right to the full length of 31 characters.

4 vgn Group name for verbal attribute names:
common part of verbal attribute names all beginning with the same character string, blank-filled on the right to the full length of 31 characters if necessary.

The maximum number of attributes is limited by the capacity of the response area (max. 32000 bytes).

End identifier (-/1)

9 Indicates the end of the statement

; End of statement. The statement is chained to a following end transaction statement.

Acknowledgment area

Displ.	Length	Entry	Meaning
0	2	00	Status
2	4	-	-
6	2	ff	File identifier
8	2	r-length	Response length (binary)
10	6	-	-

Table 104: Acknowledgment area for response

Displ.	Length	Entry	Meaning
0	2	{30 / 31 / 33 / 3V / 3Z}	Status
2	4	[{van / san␣}]	Verbal attribute name for status codes 31, 3V Symbolic attribute name for status codes 31, 33
6	2	ff	File identifier
8	2	r-length	Response length (binary)
10	6	-	-

Table 105: Acknowledgment area on error

Response area

Displ.	Length	Entry	Meaning	Info. function
0	3	[san]	Symbolic attribute name	1, 3, 5, 7
-	31	[van]	Verbal attribute name	2, 3, 6, 7
-	1	X´00´ to X´FF´	Attribute length: 1 to 256 bytes	4, 5, 6, 7
-	1	X´00´ to X´0F´	Number of decimal places: 0 to 15 decimal places	4, 5, 6, 7
- Bit 2^7 Bit 2^6 Bit 2^3	1	 0 1 0 1 0 1	 Alignment: – right-justified – left-justified Attribute type: – normal attribute – multiple attribute Index lock: – index not locked – index locked	4, 5, 6, 7

Table 106: Response area for information functions 1, 2, 3, 4, 5, 6, and 7 (part 1 of 2)

Displ.	Length	Entry	Meaning	Info. function
- Bit 2^7 Bit 2^6 Bit 2^5 Bit 2^4 Bit 2^3, 2^2	1	 0 1 0 1 0 1 0 1 00 01 10 11	 Search strategy: – search via primary data – search via index Null as attribute value: – not permitted – permitted Result of calculation: – no – yes, possible Index information: – Index non-existent – Index available Storage format: – binary – packed – character without filler bytes – character with filler bytes	4, 5, 6, 7
-	1	X´01´ to X´FF´ X´00´	No. of occurrences of a multiple attribute as defined in attribute catalog: 1 to 255 occurrences Not a multiple attribute	4, 5, 6, 7
-	-	[...]	Responses for attributes 2 to n	1 to 7

Table 106: Response area for information functions 1, 2, 3, 4, 5, 6, and 7 (part 2 of 2)

Displ.	Length	Entry	Meaning
0	3	san	Symbolic attribute name
3	31	van	Verbal attribute name
34	2	X´0001´ to X´0100´	Attribute length: 1 to 256 bytes
36	1	X´00´ to X´0F´	Number of decimal places: 0 to 15 decimal places

Table 107: Response area for information function A (part 1 of 2)

Displ.	Length	Entry	Meaning
37	1		Data type:
		X´11´	CHAR
		X´21´	NUMERIC
		X´22´	DECIMAL
		X´24´	INTEGER
		X´28´	SMALLINT
			} or corresponding old, interpretable data type for Index specification X´10´
		X´00´	Uninterpretable old data type
38	1		Index information:
		X´00´	Index non-existent
		X´02´	Index locked
		X´04´	Index available
		X´08´	Index required
		X´10´	Old data type
		X´20´	Null not permitted as attribute value (old data type)
39	1	i-length	Index length (binary)
40	1		Number of occurrences of a multiple attribute as defined in attribute catalog:
		X´01´ to X´FF´	1 to 255 occurrences
		X´00´	Not a multiple attribute
41	1	dfc	Default value character
42	1		Compound key details:
		X´80´	Compound key
		X´40´	Compound key attribute
		X´00´	Not a compound key
43	1	ck-displ	Displacement of a compound key attribute from the start of the compound key
44	4	-	-
-	-	[...]	Responses for attributes 2 to n

Table 107: Response area for information function A (part 2 of 2)

9 Appendix

In this chapter you will find

– special statements
– the table of operation codes
– examples of database accesses

9.1 Special statements

The following statements can be entered in the application program:

NAM	Selection of the Database Handler
NOTYPE	Suppress messages to SYSOUT
UNT	Search interrupt is indicated to the application program.
NOUNT	Search interrupt is not indicated to the application program.
TRACE	Activate/deactivate trace

The parameters NAM, NOTYPE and TRACE are normally specified in the configuration file (see the “Core Manual”). The configuration must be assigned with the link name SESCONF or by means of the CONNECT-SESAM-CONFIGURATION command.

The following statements meet with differing responses in the independent DBH and linked-in DBH:

Statement	**Independent DBH**		**Linked-in DBH**	
	Response	Reply in acknowledgment area	Response	Reply in acknowledgment area
NAM	Evaluated	Status 00MOD␣	Ignored	Status 00LINK
NOTYPE	Evaluated	Status 00	Ignored	Status 00LINK

Table 108: Differing responses in the two SESAM/SQL variants

The user program may contain any one of these statements, and knows from the reply in the acknowledgment area which DBH variant is involved. It can (and should) be fully tested on the independent DBH before it is linked via SESLINK to the linked-in application.

9.1.1 NAM statement

The NAM statement is used to select the DBH with which the application program is to operate.

The format of the NAM statement is different for TIAM and DCAM operation. The NAM statement must be given before the first statement that results in contact with a DBH. Otherwise, SESAM/SQL returns the status code 90.

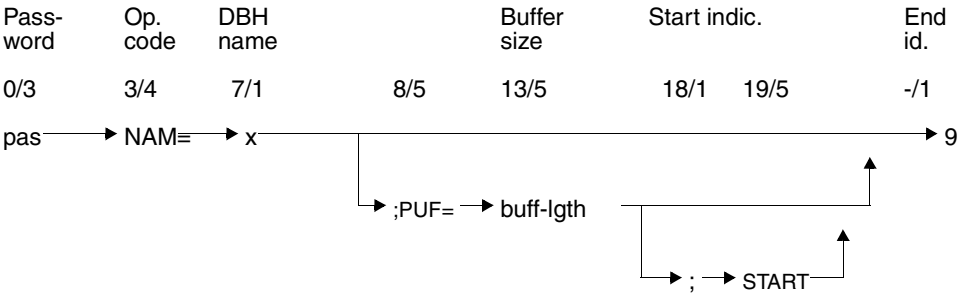
Contents of transfer areas:

Statement area: The application program supplies the statement.

Acknowledgment area:
The DBH returns the acknowledgment to the statement.

The inquiry and response areas are not used.

Statement area



Key

DBH name	**x**	**Name of the SESAM/SQL DBH**
Buffer size	buff-lgth	DCAM: maximum size of send and receive buffer
Start indic.	START	DCAM: delete all reserved resources

Password (0/3)

pas — Password for a protected CALL DML table,
any three-character string for an unprotected CALL DML table.

Operation code (3/4)

NAM — Selects the DBH with which the application program is going to operate.

DBH name (7/1)

x — DBH name of the SESAM/SQL DBH with which the application program is going to operate.
The communication name is also called the NAM identifier.

End identifier (-/1)

9 — Indicates the end of the statement

; — End of statement. The statement is chained to a following ETA, RTA or BTA statement.

Only for DCAM application programs:

Buffer size (13/5)

buff-lgth — Defines maximum size of send and receive buffers for a DCAM application. The send and receive buffers are required by the communication modules for communication with the SESAM/SQL DBH.
Maximum value: 32000
Minimum value: Maximum length of response and inquiry areas as defined in the open statement.
Default value: 4096

Start indicator (19/5)

START — The start indicator refers to the DCAM application whose identification is passed in bytes 0 to 15 of the identification area in the NAM statement. The start statement causes the communication module and the SESAM/SQL DBH to delete all resources used by the DCAM application. The start indicator must be given in the primary task each time a cold start is performed for a DCAM application. It must not be given in the secondary task, otherwise it will cause an unauthorized release of all resources reserved for the DCAM application.

Acknowledgment area

Displ.	Length	Entry	Meaning
0	2	{00 / 90}	Status code
2	4	{MOD␣ / LINK}	reported by – SESMOD, – SESLINK
6	10	-	-

Table 109: Acknowledgment area

9.1.2 NOTYPE statement

The NOTYPE statement causes messages to be suppressed that would otherwise be output to SYSOUT by the connection module SESMOD.

For DCAM application programs, values must be placed in the identification area (see section “DCAM” on page 271).

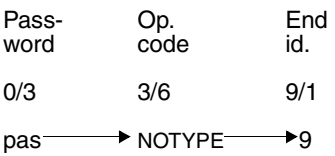
Contents of transfer areas:

Statement area: The application program supplies the statement.

Acknowledgment area:
The DBH returns the acknowledgment to the statement.

The inquiry and response areas are not used, but must be made available.

Statement area



Password (0/3)

pas Password for a protected CALL DML table,
any three-character string for an unprotected CALL DML table.

Operation code (3/6)

NOTYPE SYSOUT messages from SESMOD are suppressed.

End identifier (9/1)

9 Indicates the end of the statement

Acknowledgment area

Displ.	Length	Entry	Meaning
0	2	{00 / 90}	Status code
2	4	{MOD␣ / LINK}	reported by – SESMOD, – SESLINK
6	10	-	-

Table 110: Acknowledgment area

9.1.3 UNT/NOUNT statement

With the RETRIEVAL-CONTROL option, a search can be interrupted after a specified number of accesses.

The UNT statement causes the search interrupt to be indicated to the application program with status code 16.
The application program can continue the search with a follow-up statement, or terminate it.

The NOUNT statement (default function) cancels the effect of the UNT statement, i.e. status code 16 is not passed to the application program.

Contents of transfer areas:

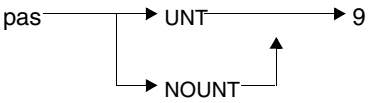
Statement area: The application program supplies the statement.

Acknowledgment area:
The DBH returns the acknowledgment to the statement.

The inquiry and response areas are not used, but must be made available.

Statement area

Pass-word	Operation code	End id.
Ø/3	3/-	-/1



Password (0/3)

pas Any three-character string

Operation code (3/-)

UNT If a search is interrupted, status code 16 is passed to the application program.

NOUNT If a search is interrupted, status code 16 is *not* passed to the application program.

End identifier (-/1)

9 Indicates the end of the statement

If no UNT statement is given, NOUNT applies by default.

Acknowledgment area

Displ.	Length	Entry	Meaning
0	2	{00 / 90}	Status code
2	4	{MOD␣ / LINK}	reported by – SESMOD, – SESLINK
6	10	-	-

Table 111: Acknowledgment area

9.1.4 TRACE statement

The TRACE statement can be used in the current session to activate and deactivate the trace.

– The statements passed to SESAM/SQL and the corresponding responses are logged, or

– the message transferred from the user task to the SESAM/SQL DBH task and the corresponding response are logged.

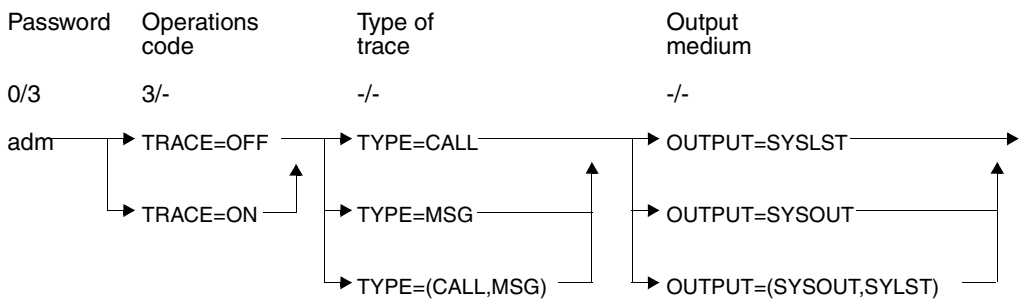
Contents of the transfer areas:

Statement area: The application program supplies the statement.

Acknowledgment area:
The DBH returns the acknowledgment to the statement.

The inquiry and response areas are not used, but must be made available.

Statement area



Password (0/3)

adm Administrator password;
this password must be the password defined for the DBH option ADMINISTRATOR when the DBH was started.

Operation code (3/-)

TRACE=ON activates the trace function

TRACE=OFF deactivates the trace function

The other parameters can be omitted for OFF. The trace function is deactivated.

Type of trace (-/-)

TYPE=CALL statements used in the CALL-DML interface are logged.

TYPE=MSG messages exchanged between the user task and the SESAM/SQL DBH are logged.

Output medium (-/-)

OUTPUT=SYSOUT
logging is performed to SYSOUT

OUTPUT=SYSLST
logging is performed to SYSLST

Default value is SYSLST.

9.2 Table of operation codes

Op. code	DML statement	Function	see section
010	Administration statement for the DBH	Issue administration commands to the SESAM/SQL DBH	3.20 on page 172
020	Administration statement for SESDCN	Issue administration commands to SESAM/SQL-DCN	3.21 on page 174
1	Cursor file handling	Process cursor files, e.g. after a search	3.12 on page 125
2	– Open – Administrator open	Open a logical file	3.2 on page 29
		Open communication between the administrator program and the DBH	3.19 on page 169
3	Attribute information	Inquire on the attribute definitions of a table; attribute information for tables with old data formats	3.17 on page 160 8.5 on page 332
4	Record output	Define a logical input file by projection and selection; output the significant attribute values, optional output of the attribute definitions	3.9 on page 96 8.2 on page 304
5	Inquiry	Define a logical input file by projection and selection; output the significant and null attribute values, optional output of the attribute definitions	3.10 on page 107 8.3 on page 317
6	– Search	Define a logical input file by projection and selection	3.4 on page 37
	– Search with join	Define a logical input file by projection, selection and join	3.5 on page 63
	– Restrict a join cursor file	Select responses after a search with join that created a cursor file	3.6 on page 76
	– Define comparison values	Replace the default mask character/string identifier for a masked or string search	3.8 on page 92
60BI	Index browsing	Determine frequency of attribute values	3.7 on page 85

Table 112: Operation codes (part 1 of 2)

Op. code	DML statement	Function	see section
7	– Response polling	Process a logical input file after a search, record output or inquiry	3.11 on page 117
	– Follow-up update (direct update)	Process a logical output file after a direct update	3.16 on page 154
8	Close	Close a logical file	3.3 on page 34
9	– Addition (direct update)	Add records	3.13 on page 131
	– Update (direct update)	Insert, update or delete attribute values or occurrences of a multiple attribute	3.14 on page 141
	– Deletion (direct update)	Delete records	3.15 on page 150
90B	Begin transaction	Initiate a transaction	3.18 on page 166
90C	End transaction	Terminate a transaction	3.18 on page 166
90R	Reset transaction	Reset a transaction	3.18 on page 166
90F	Set the deletion identifier	Define the deletion identifier for deleting an attribute value (for old data formats only);	8.4 on page 329
90E	Delete the current deletion identifier	Release the deletion identifier (for old data formats only);	8.4 on page 329

Table 112: Operation codes (part 2 of 2)

9.3 Examples of database accesses

The following section contains examples of database accesses by means of application programs:

– Assembler program

– COBOL program

– FORTRAN program

– PL/I program

Example of an Assembler program

```
PROG1    START 0
         BALR  3,0
         USING *,3,4
         LA    4,1
         LA    4,4095(4,3)
         B     ANF
* THIS PROGRAM OPERATES WITH THE INDEPENDENT DBH SESAMC.(NAM=C)
* IT OPENS THE FOLLOWING LOGICAL FILES:
* LOGICAL FILE A1 = DB FOR DIRECT UPDATES AND SEARCHES
* LOGICAL FILE B1 = DB FOR SEARCH WITH JOIN 1
* LOGICAL FILE C1 = DB FOR SEARCH WITH JOIN 2
*
* THIS ASSEMBLER PROGRAM PERFORMS THESE FUNCTIONS:
* - SELECTS THE REQUIRED DIRECT UPDATES (ADDITION, UPDATE, DELETION),
*   OR SEARCHES, ALL WITH TRANSACTION-ORIENTED SECURITY
* - CALLS THE APPROPRIATE INQUIRY AREA
*   (THE USER READS IN THE CURRENT VALUES FROM THE TERMINAL INTERACTIVELY)
* - OUTPUTS THE RESPONSES AT THE TERMINAL
*
* IN THE EVENT OF ERRORS STATUS CODE NOT '00', THE LOGICAL FILE IS
* CLOSED. PRIOR TO THIS THE STATUS CODE IS DISPLAYED AT THE TERMINAL.
*************************************************************************
*  A.RABOESE                                                            *
*************************************************************************
*
* STATEMENT AREA FOR OPEN
*
LANWOP   DC    H'39'
         DC    X'4040'
ANWOP    DC    C'XXX'                          PASSWORD
         DC    C'2'                            OP CODE FOR OPEN
DBNAME   DC    CL17' '                         SPACES FOR DB NAME
         DC    C'01000'                        MAXIMUM LENGTH OF
*                                              RESPONSE AREA
         DC    C'01000'                        MAXIMUM LENGTH OF
*                                              INQUIRY AREA
         DC    C'X'                            READ/WRITE ALLOWED FOR
*                                              ALL USERS
KZOP     DS    CL2                             FILE IDENTIFIER
         DC    C'9'                            END OF STATEMENT
*
* STATEMENT AREA FOR NAM
*
LANWNAM  DC    H'13'
         DC    X'4040'
```

```
ANWNAM   DC    C'XXXNAM=C9'                    SELECT DBH SESAM
*
* ACKNOWLEDGMENT AREA FOR ALL OPERATIONS
*
QUIT     DS    OCL16
STATUS   DS    CL2
         DS    CL4
LOGKZ    DS    CL2
         DS    CL8
*
* STATEMENT AREA FOR CLOSE WITH TRANSACTION
*
LANWCLO  DC    H'33'
         DC    X'4040'
ANWCLO   DC    C'XXX90C;XXX8                9'
*
* STATEMENT AREA FOR SEARCH
*
LANWSUC  DC    H'35'
         DC    X'4040'
ANWSUC   DC    C'XXX90B;XXX601EAC7AB9000UAB95019'
*
* RESPONSE AREA FOR SEARCH
*
ANTWSUC  DC    CL12' '
*
* INQUIRY AREA FOR SEARCH
*
LFRASUC  DC    H'10'
         DC    X'4040'
FRASUC   DC    C'K23450'
*
* STATEMENT AREA FOR RESPONSE POLLING
*
LANWANT  DC    H'10'
         DC    X'4040'
ANWANT   DC    C'XXX799'
*
* STATEMENT AREA FOR SEARCH WITH JOIN 1
*
LAWJOIN1 DC    H'80'
         DC    X'4040'
ANWJOIN1 DC    C'XXX90B;XXX601#A1EAB9AC7000UAB9501UAC7501V(AAB#A1='
         DC    C'AAB#B1)XXX601#B1EAACABB0009'
*
* RESPONSE AREA FOR SEARCH WITH JOIN 1
*
ANTJOIN1 DC    CL32' '
```

```
*
* INQUIRY AREA FOR SEARCH WITH JOIN 1
*
LFRJOIN1 DC     H'16'
         DC     X'4040'
FRAJOIN1 DC     C'K23450840401'
*
* STATEMENT AREA FOR SEARCH WITH JOIN 2
*
LAWJOIN2 DC     H'73'
         DC     X'4040'
ANWJOIN2 DC     C'XXX90B;XXX601#A1EAB9000UAC7501V(AB9#A1=AAA#C1)'
         DC     C'XXX601#C1EAD2AGVAFX0009'
*
* RESPONSE AREA FOR SEARCH WITH JOIN 2
*
ANTJOIN2 DC    CL50' '
*
* INQUIRY AREA FOR SEARCH WITH JOIN 2
*
LFRJOIN2 DC    H'10'
         DC    X'4040'
FRAJOIN2 DC    C'840401'
*
* STATEMENT AREA FOR DIRECT UPDATING - ADDITION1
*
LAWDIRN1 DC     H'35'
         DC     X'4040'
ANWDIRN1 DC     C'XXX90B;XXX9CXNAAB#AB90AC70AAC09'
*
* RESPONSE AREA FOR ADDITION1
*
ANTDIRN1 DC     CL50' '
*
* INQUIRY AREA FOR ADDITION1
*
LFRDIRN1 DC     H'26'
         DC     X'4040'
FRADIRN1 DC     CL22' '
*
* STATEMENT AREA FOR DIRECT UPDATING - ADDITION2
*
LAWDIRN2 DC     H'39'
         DC     X'4040'
ANWDIRN2 DC     C'XXX90B;XXX9CXNAAB0AAC0ABB0&&BLN0039'
*
* RESPONSE AREA FOR ADDITION2
*
```

```
ANTDIRN2 DC     CL50' '
*
* INQUIRY AREA FOR ADDITION2
*
LFRDIRN2 DC     H'46'
         DC     X'4040'
FRADIRN2 DC     CL42' '
*
* STATEMENT AREA FOR DIRECT UPDATING - UPDATE
*
LANWDIRA DC    H'31'
         DC    X'4040'
ANWDIRA  DC    C'XXX90B;XXX9CXAAABOAAC0ABB09'
*
* RESPONSE AREA FOR UPDATE
*
ANTDIRA  DC    CL50' '
*
* INQUIRY AREA FOR UPDATE
*
LFRADIRA DC    H'18'
         DC    X'4040'
FRADIRA  DC    CL14' '
*
* STATEMENT AREA FOR DIRECT UPDATING - DELETION1
*
LAWDIRL1 DC    H'35'
         DC    X'4040'
ANWDIRL1 DC    C'XXX90B;XXX9CXLAABLAACL&&BLN0029'
*
* RESPONSE AREA FOR DELETION1
*
ANTDIRL1 DC    CL50' '
*
* INQUIRY AREA FOR DELETION1
*
LFRDIRL1 DC    H'14'
         DC    X'4040'
FRADIRL1 DC    CL10' '
*
* STATEMENT AREA FOR DIRECT UPDATING - DELETION2
*
LAWDIRL2 DC    H'35'
         DC    X'4040'
ANWDIRL2 DC    C'XXX90B;XXX9CXLAABLAACLAB9LAC7L9'
*
* RESPONSE AREA FOR DELETION2
*
```

```
ANTDIRL2 DC    CL50' '
*
* INQUIRY AREA FOR DELETION2
*
LFRDIRL2 DC    H'26'
         DC    X'4040'
FRADIRL2 DC    CL22' '
*
* AUXILIARY FIELDS, SWITCHES, PARAM.AREAS
*
TERMOUT  DC    H'128'                          OUTPUT RESPONSE AREA
         DC    X'404040'                       AT TERMINAL
ASATZ    DS    CL30
DIRANTW1 DC    CL12' '
DIRANTW2 DC    CL32' '
DIRANTW3 DC    CL49' '
*
TERMFEHL DC    H'42'                           OUTPUT ACKNOWLEDGMENT AREA
         DC    X'404040'                       ON ERROR STATUS CODE
         DC    C'FEHLERSTATUS: '
STAT     DS    CL2
         DC    C' '
AUSG     DS    CL20
SICHER   DS    4F
SAFE1    DS    F
SAFE2    DS    F
*
MKARTE1  DC    H'77'                           DIRECT UPDATE/SEARCH
         DC    X'404040'                       FUNCTION CALL
         DC    C'DIREKTAENDERUNG: '
         DC    C'NEUAUFNAHME =N/'
         DC    C'AENDERUNG =A/'
         DC    C'LOESCHUNG =L/'
         DC    C'SUCHFRAGE =S: '
*
MKARTE2  DC    H'143'
         DC    X'404040'
         DC    C'WELCHE SUCHFRAGE ? '
         DC    C'UEBER KDNR ZUM AUFTRAG (1) '
         DC    C'UEBER KDNR UND DATUM ZUM ARTIKEL UND ZUR MENGE (2) '
         DC    C'UEBER DATUM ZUR ANSCHRIFT DES KUNDEN (3) '
*
FNEU     DC    H'32'                             ADDITION1 INQUIRY AREA
         DC    X'404040'                         FUNCTION CALLS
         DC    C'FRAGEBEREICH NEUAUFNAHME1: '
FNEU1    DC    H'19'
         DC    X'404040'
         DC    C'KUNDENNUMMER: '
```

```
FNEU2    DC    H'12'
         DC    X'404040'
         DC    C'DATUM: '
*
FNEU3    DC    H'32'                          ADDITION2 INQUIRY AREA
         DC    X'404040'                      FUNCTION CALLS
         DC    C'FRAGEBEREICH NEUAUFNAHME2: '
FNEU4    DC    H'22'
         DC    X'404040'
         DC    C'ARTIKELNUMMER 1: '
FNEU5    DC    H'14'
         DC    X'404040'
         DC    C'MENGE 1: '
FNEU6    DC    H'22'
         DC    X'404040'
         DC    C'ARTIKELNUMMER 2: '
FNEU7    DC    H'14'
         DC    X'404040'
         DC    C'MENGE 2: '
FNEU8    DC    H'22'
         DC    X'404040'
         DC    C'ARTIKELNUMMER 3: '
FNEU9    DC    H'14'
         DC    X'404040'
         DC    C'MENGE 3: '
*
FAEND    DC    H'29'                          UPDATE INQUIRY AREA
         DC    X'404040'                      FUNCTION CALLS
         DC    C'FRAGEBEREICH AENDERUNG: '
FAEND1   DC    H'21'
         DC    X'404040'
         DC    C'AUFTRAGSNUMMER: '
FAEND2   DC    H'20'
         DC    X'404040'
         DC    C'ARTIKELNUMMER: '
FAEND3   DC    H'12'
         DC    X'404040'
         DC    C'MENGE: '
*
FLOESCH  DC    H'30'                          DELETION1 INQUIRY AREA
         DC    X'404040'                      FUNCTION CALLS
         DC    C'FRAGEBEREICH LOESCHUNG1: '
FLOESCH1 DC    H'21'
         DC    X'404040'
         DC    C'AUFTRAGSNUMMER: '
FLOESCH2 DC    H'20'
         DC    X'404040'
         DC    C'ARTIKELNUMMER: '
```

```
*
FLOESCH3 DC    H'30'                          DELETION2 INQUIRY AREA
         DC    X'404040'                      FUNCTION CALLS
         DC    C'FRAGEBEREICH LOESCHUNG2: '
FLOESCH4 DC    H'21'
         DC    X'404040'
         DC    C'AUFTRAGSNUMMER: '
*
FSUCH    DC    H'50'
         DC    X'404040'
         DC    C'WANN HAT KUNDE K23450 EINEN AUFTRAG GEGEBEN ?'
*
FJOIN1   DC    H'80'
         DC    X'404040'
         DC    C'WELCHE ARTIKEL UND WELCHE MENGE HAT KUNDE K23450 '
         DC    C'AM DATUM 840401 BESTELLT ?'
*
FJOIN2   DC    H'73'
         DC    X'404040'
         DC    C'WELCHE ANSCHRIFT (NAME,WOHNORT,STRASSE) HAT KUNDE '
         DC    C'MIT DATUM 840401 ?'
*
FBNEU1   DS    CL10
FBNEU2   DS    CL10
FBNEU4   DS    CL10
FBNEU5   DS    CL8
FBNEU6   DS    CL10
FBNEU7   DS    CL8
FBNEU8   DS    CL10
FBNEU9   DS    CL8
FBAEND1  DS    CL8
FBAEND2  DS    CL10
FBAEND3  DS    CL8
FBLOE1   DS    CL8
FBLOE2   DS    CL10
FBLOE4   DS    CL8
BUCHST1  DS    CL5
BUCHST2  DS    CL5
SATZ     DS    CL30
ANTDIR   DC    CL50' '
ANTDIR1  DC    CL12' '
ANTDIR2  DC    CL32' '
ANTDIR3  DC    CL49' '
*
* ADDRESS AREAS FOR ALL OPERATIONS
*
POPEN    DC    A(ANWOP)
         DC    A(QUIT)
```

```
         DC    A(ANTWSUC)
         DC    A(FRASUC)
*
PNAM     DC    A(ANWNAM)
         DC    A(QUIT)
         DC    A(ANTWSUC)
         DC    A(FRASUC)
*
PCLOSE   DC    A(ANWCLO)
         DC    A(QUIT)
         DC    A(ANTWSUC)
         DC    A(FRASUC)
*
PANT     DC    A(ANWANT)
         DC    A(QUIT)
         DC    A(ANTJOIN2)
         DC    A(FRAJOIN2)
*
PSUCHEN  DC    A(ANWSUC)
         DC    A(QUIT)
         DC    A(ANTWSUC)
         DC    A(FRASUC)
*
PJOIN1   DC    A(ANWJOIN1)
         DC    A(QUIT)
         DC    A(ANTJOIN1)
         DC    A(FRAJOIN1)
*
PJOIN2   DC    A(ANWJOIN2)
         DC    A(QUIT)
         DC    A(ANTJOIN2)
         DC    A(FRAJOIN2)
*
PDIRN1   DC    A(ANWDIRN1)
         DC    A(QUIT)
         DC    A(ANTDIRN1)
         DC    A(FRADIRN1)
*
PDIRN2   DC    A(ANWDIRN2)
         DC    A(QUIT)
         DC    A(ANTDIRN2)
         DC    A(FRADIRN2)
*
PDIRA    DC    A(ANWDIRA)
         DC    A(QUIT)
         DC    A(ANTDIRA)
         DC    A(FRADIRA)
*
```

```
PDIRL1   DC    A(ANWDIRL1)
         DC    A(QUIT)
         DC    A(ANTDIRL1)
         DC    A(FRADIRL1)
*
PDIRL2   DC    A(ANWDIRL2)
         DC    A(QUIT)
         DC    A(ANTDIRL2)
         DC    A(FRADIRL2)
*
*
ANF      EQU   *                              START OF ASSEMBLER
* COMMUNICATION NAME FOR SESMOD               PROGRAM
         STM   14,1,SICHER
         LA    1,PNAM
         L     15,=V(SESAM)
         BALR  14,15
         LM    14,1,SICHER
         CLC   STATUS,=C'OO'
         BNE   ENDE
* OPEN LOGICAL FILES A1,B1 AND C1
         MVC   DBNAME,=C'VERTRIEB          '
         MVC   KZOP,=C'A1'
         MVC   LOGKZ,=C'A1'
         BAL   5,SESOP
         CLC   STATUS,=C'OO'
         BNE   ENDE
         MVC   DBNAME,=C'VERTRIEB         '
         MVC   KZOP,=C'B1'
         MVC   LOGKZ,=C'B1'
         BAL   5,SESOP
         CLC   STATUS,=C'OO'
         BNE   END2
         MVC   DBNAME,=C'FIRMA            '
         MVC   KZOP,=C'C1'
         MVC   LOGKZ,=C'C1'
         BAL   5,SESOP
         CLC   STATUS,=C'OO'
         BNE   END2
* MENU SELECTION1                             SELECT DIRECT UPDATE/
         WRTRD MKARTE1,,BUCHST1,,,FEHL        SEARCH
         CLI   BUCHST1+4,C'N'
         BE    NEUAUF1
         CLI   BUCHST1+4,C'A'
         BE    AENDERN
         CLI   BUCHST1+4,C'L'
         BE    LOESCHE1
         CLI   BUCHST1+4,C'S'
```

```
         BNE   FEHL
* MENU SELECTION2
         WRTRD MKARTE2,,BUCHST2,,,FEHL
         CLI   BUCHST2+4,C'1'
         BE    SUCHEN
         CLI   BUCHST2+4,C'2'
         BE    JOIN1
         CLI   BUCHST2+4,C'3'
         BE    JOIN2
         B     FEHL
*
NEUAUF1  EQU   *                              DIRECT UPDATE SUBPROGRAM
         WROUT FNEU,FEHL                      ADDITION
         WRTRD FNEU1,,FBNEU1,,,FEHL
         MVC   FRADIRN1,=C'bbbb'
         MVC   FRADIRN1+4(L'FRADIRN1-4),FBNEU1+4
         WRTRD FNEU2,,FBNEU2,,,FEHL
         MVC   FRADIRN1+10(L'FRADIRN1-10),FBNEU2+4
         MVC   LOGKZ,=C'A1'
         STM   14,1,SICHER
         LA    1,PDIRN1
         L     15,=V(SESAM)
         BALR  14,15
         LM    14,1,SICHER
         CLC   STATUS,=C'00'
         BE    NEUAUF2
         MVC   STAT,STATUS
         MVC   AUSG,=C'SATZNEUAUFNAHME1'
         WROUT TERMFEHL,FEHL
         B     END1
NEUAUF2  EQU   *
         MVC   SATZ,=C'NEUAUFNAHME1 DURCHGEFUEHRT !  '
         BAL   6,TERMINAL
         WROUT FNEU3,FEHL
         WRTRD FNEU4,,FBNEU4,,,FEHL
         MVC   FRADIRN2(4),ANTDIRN1
         MVC   FRADIRN2+4(L'FRADIRN2-4),FBNEU4+4
         WRTRD FNEU5,,FBNEU5,,,FEHL
         MVC   FRADIRN2+10(L'FRADIRN2-10),FBNEU5+4
         MVC   FRADIRN2+14(L'FRADIRN2-14),ANTDIRN1
         WRTRD FNEU6,,FBNEU6,,,FEHL
         MVC   FRADIRN2+18(L'FRADIRN2-18),FBNEU6+4
         WRTRD FNEU7,,FBNEU7,,,FEHL
         MVC   FRADIRN2+24(L'FRADIRN2-24),FBNEU7+4
         MVC   FRADIRN2+28(L'FRADIRN2-28),ANTDIRN1
         WRTRD FNEU8,,FBNEU8,,,FEHL
         MVC   FRADIRN2+32(L'FRADIRN2-32),FBNEU8+4
         WRTRD FNEU9,,FBNEU9,,,FEHL
```

```
         MVC   FRADIRN2+38(L'FRADIRN2-38),FBNEU9+4
         MVC   LOGKZ,=C'A1'
         STM   14,1,SICHER
         LA    1,PDIRN2
         L     15,=V(SESAM)
         BALR  14,15
         LM    14,1,SICHER
         MVC   SATZ,=C'SATZ AUFGENOMMEN !            '
         CLC   STATUS,=C'00'
         BE    END1
         MVC   STAT,STATUS
         MVC   AUSG,=C'SATZNEUAUFNAHME2    '
         WROUT TERMFEHL,FEHL
         B     END2
*
AENDERN  EQU   *                              DIRECT UPDATE SUBPROGRAM
         WROUT FAEND,FEHL                     UPDATE
         WRTRD FAEND1,,FBAEND1,,,FEHL
         MVC   FRADIRA,FBAEND1+4
         WRTRD FAEND2,,FBAEND2,,,FEHL
         MVC   FRADIRA+4(L'FRADIRA-4),FBAEND2+4
         WRTRD FAEND3,,FBAEND3,,,FEHL
         MVC   FRADIRA+10(L'FRADIRA-10),FBAEND3+4
         MVC   LOGKZ,=C'A1'
         STM   14,1,SICHER
         LA    1,PDIRA
         L     15,=V(SESAM)
         BALR  14,15
         LM    14,1,SICHER
         MVC   SATZ,=C'SATZ GEAENDERT !              '
         CLC   STATUS,=C'00'
         BE    END1
         MVC   STAT,STATUS
         MVC   AUSG,=C'SATZAENDERUNG       '
         WROUT TERMFEHL,FEHL
         B     END2
*
LOESCHE1 EQU   *                              DIRECT UPDATE SUBPROGRAM
         WROUT FLOESCH,FEHL                   DELETION
         WRTRD FLOESCH1,,FBLOE1,,,FEHL
         MVC   FRADIRL1,FBLOE1+4
         WRTRD FLOESCH2,,FBLOE2,,,FEHL
         MVC   FRADIRL1+4(L'FRADIRL1-4),FBLOE2+4
         MVC   LOGKZ,=C'A1'
         STM   14,1,SICHER
         LA    1,PDIRL1
         L     15,=V(SESAM)
         BALR  14,15
```

```
         LM    14,1,SICHER
         CLC   STATUS,=C'00'
         BE    LOESCHE2
         MVC   STAT,STATUS
         MVC   AUSG,=C'SATZLOESCHUNG       '
         WROUT TERMFEHL,FEHL
         B     END1
LOESCHE2 EQU   *
         MVC   SATZ,=C'SATZLOESCHUNG1 DURCHGEFUEHRT !'
         BAL   6,TERMINAL
         MVC   FRADIRL2,FBLOE1+4
         MVC   LOGKZ,=C'A1'
         STM   14,1,SICHER
         LA    1,PDIRL2
         L     15,=V(SESAM)
         BALR  14,15
         LM    14,1,SICHER
         MVC   SATZ,=C'SATZ GELOESCHT !              '
         CLC   STATUS,=C'00'
         BE    END1
         MVC   STAT,STATUS
         MVC   AUSG,=C'SATZLOESCHUNG2      '
         WROUT TERMFEHL,FEHL
         B     END2
*
SUCHEN   EQU   *                              SEARCH SUBPROGRAM
         WROUT FSUCH,FEHL
         MVC   LOGKZ,=C'A1'
         STM   14,1,SICHER
         LA    1,PSUCHEN
         L     15,=V(SESAM)
         BALR  14,15
         LM    14,1,SICHER
         MVC   SATZ,=C'GESUCHTES DATUM:              '
         MVC   ANTDIR1,ANTWSUC+10
         CLC   STATUS,=C'00'
         BE    ANTWORT1
         MVC   STAT,STATUS
         MVC   AUSG,=C'SATZSUCHE           '
         WROUT TERMFEHL,FEHL
         B     END2
*
ANTWORT1 EQU   *
         BAL   6,TERMINAL
         MVC   LOGKZ,=C'A1'
         STM   14,1,SICHER
         LA    1,PANT
         L     15,=V(SESAM)
```

```
         BALR  14,15
         LM    14,1,SICHER
         CLC   STATUS,=C'00'
         BNE   END2
         MVC   SATZ,=C'                                '
         MVC   ANTDIR1,ANTWSUC+10
         B     ANTWORT1
*
JOIN1    EQU   *                              SEARCH WITH JOIN 1
         WROUT FJOIN1,FEHL                    SUBPROGRAM
         MVC   LOGKZ,=C'B1'
         STM   14,1,SICHER
         LA    1,PJOIN1
         L     15,=V(SESAM)
         BALR  14,15
         LM    14,1,SICHER
         MVC   SATZ,=C'GESUCHTER AUFTRAG:             '
         MVC   ANTDIR2,ANTJOIN1+10
         MVC   ANTDIR2+16(L'ANTDIR2-16),ANTJOIN1+30
         CLC   STATUS,=C'00'
         BE    ANTWORT2
         MVC   STAT,STATUS
         MVC   AUSG,=C'SATZSUCHE MIT JOIN  '
         WROUT TERMFEHL,FEHL
         B     END2
*
ANTWORT2 EQU   *
         BAL   6,TERMINAL
         MVC   LOGKZ,=C'B1'
         STM   14,1,SICHER
         LA    1,PANT
         L     15,=V(SESAM)
         BALR  14,15
         LM    14,1,SICHER
         CLC   STATUS,=C'00'
         BNE   END2
         MVC   SATZ,=C'                               '
         MVC   ANTDIR2,ANTJOIN1+10
         MVC   ANTDIR2+16(L'ANTDIR2-16),ANTJOIN1+30
         B     ANTWORT2
*
JOIN2    EQU   *                              SEARCH WITH JOIN 2
         WROUT FJOIN2,FEHL                    SUBPROGRAM
         MVC   LOGKZ,=C'C1'
         STM   14,1,SICHER
         LA    1,PJOIN2
         L     15,=V(SESAM)
         BALR  14,15
```

```
         LM    14,1,SICHER
         MVC   SATZ,=C'GESUCHTER SATZ:               '
         MVC   ANTDIR3,ANTJOIN2+22
         CLC   STATUS,=C'00'
         BE    END1
         MVC   STAT,STATUS
         MVC   AUSG,=C'SATZSUCHE MIT JOIN  '
         WROUT TERMFEHL,FEHL
         B     END2
*
ANTWORT3 EQU   *
         BAL   6,TERMINAL
         MVC   LOGKZ,=C'A1'
         STM   14,1,SICHER
         LA    1,PANT
         L     15,=V(SESAM)
         BALR  14,15
         LM    14,1,SICHER
         CLC   STATUS,=C'00'
         BNE   END2
         MVC   SATZ,=C'                               '
         MVC   ANTDIR3,ANTJOIN2+22
         B     ANTWORT3
*
FEHL     EQU   *
         B     END1
END1     EQU   *
         BAL   6,TERMINAL
END2     EQU   *                              CLOSE ALL LOGICAL
         STM   14,1,SICHER                    FILES
         LA    1,PCLOSE
         L     15,=V(SESAM)
         BALR  14,15
         LM    14,1,SICHER
         B     ENDE
ENDE     EQU   *
         B     STOP
SESOP    EQU   *                              OPEN SUBP
         ST    5,SAFE2
         ST    6,SAFE1
         STM   14,1,SICHER
         LA    1,POPEN
         L     15,=V(SESAM)
         BALR  14,15
         LM    14,1,SICHER
         L     5,SAFE2
         BR    5
         L     6,SAFE1
```

```
         BR    6
*
TERMINAL EQU   *
         ST    6,SAFE1
         BAL   5,BILD
         L     6,SAFE1
         BR    6
         B     END1
BILD     EQU   *                              OUTPUT TO TERMINAL
         ST    5,SAFE2
         MVC   ASATZ,SATZ
         CLI   BUCHST2+4,C'1'
         BE    BILD1
         CLI   BUCHST2+4,C'2'
         BE    BILD2
         CLI   BUCHST2+4,C'3'
         BE    BILD3
BILD1    MVC   DIRANTW1,ANTDIR1
         WROUT TERMOUT,FEHL
         B     BILD5
BILD2    MVC   DIRANTW2,ANTDIR2
         WROUT TERMOUT,FEHL
         B     BILD5
BILD3    MVC   DIRANTW3,ANTDIR3
         WROUT TERMOUT,FEHL
BILD5    L     5,SAFE2
         BR    5
STOP     EQU   *                              END OF ASSEMBLER
         TERM                               PROGRAM
         END PROG1
```

Example of a COBOL program

This program opens three logical files:

– logical file A1 = CALL DML table SALES for direct updates and searches

– logical file B1 = CALL DML table SALES for B-search

– logical file C1 = CALL DML table COMPANY for C-search

This program offers users facilities for processing the CALL DML table SALES to suit their own requirements in the following ways:

– adding orders

– deleting orders

– amending article quantities

– inquiring on the CALL DML table SALES by means of three searches

Each of these processes is split into a statement, inquiry, response and acknowledgment area. It is then immediately checked for validity by means of a status comparison (statu= “00”). If an error has occurred (statu≠ “00”), the complete acknowledgment area is displayed for the user at the terminal so that the error condition can be ascertained.

The program continues running until terminated by the user, i.e. the user can carry out several operations in succession.

The statements open, close and TA-security are executed automatically by the program.

An order in the CALL DML table SALES is created as follows (see B-search):

ORDER NO.	CU-NO.	DATE
Generated by the DBH itself when an order is added	Entered by the user when adding an order	

Entered by the user when adding an order:	ARTICLE 1:	QUANT 1
	ARTICLE 2:	QUANT 2
	ARTICLE 3:	QUANT 3

Thus the user is able to enter a maximum of three articles per order. If only one or two articles are required, the user responds to the redundant requests for article and quantity by pressing the DUE key without making any further entries.

All lines beginning with an asterisk are comments lines clarifying the action of the program.

```
ID DIVISION.
 PROGRAM-ID.    COBSES.
 REMARKS.       PROGRAM FOR DATABASE PROCESSING
                BY THE USER.
 ENVIRONMENT DIVISION.
 CONFIGURATION SECTION.
 SPECIAL-NAMES.
     TERMINAL IS T.
     DECIMAL-POINT IS COMMA.
 DATA DIVISION.
 WORKING-STORAGE SECTION.
*
* SWITCH FOR THE PROCESSING REQUIREMENT ENTERED BY THE
*  TERMINAL USER.
*
 01  SCHALTER.
     02  ARBEIT           PIC X.
     02  WIEDERHOLUNG     PIC X.
     02  SUCHE            PIC X.
*
/
******************************************
*    STANDARD AREAS FOR ALL SESAM CALLS    *
******************************************
 01  ANWEISUNG.
     02  ANW-LAENGE       PIC 9(04)   COMP.
     02  FILLER           PIC XX      VALUE SPACES.
     02  ANW              PIC X(76).
 01  FRAGEBEREICH.
     02  FRA-LAENGE       PIC 9(04)   COMP.
     02  FILLER           PIC XX      VALUE SPACES.
     02  FRAGE            PIC X(95).
 01  QUITTUNG.
     02  STATU            PIC XX.
     02  FILLER           PIC X(04).
     02  Q-LOG-DAT        PIC XX.
     02  FILLER           PIC X(08).
*
* RESPONSE AREA FOR ALL DIRECT UPDATES AND THE A-SEARCH.
*
 01  ANTWORT.
     02  ANTW.
 03  ANT          PIC X(04).
 03  FILLER       PIC X(06).
     02  S-DATUM          PIC X(06).
     02  ANT-KNR          PIC X(06).
```

```
     02  REST             PIC X(132).
*
* RESPONSE AREA FOR THE B-SEARCH.
*
 01  B-ANTWORT.
     02  B-ANT-AUFTR-NR   PIC X(04).
     02  FILLER           PIC X(32).
     02  B-ANT-ART        PIC X(06).
     02  B-ANT-MENGE      PIC X(04).
     02  FILLER           PIC X(108).
*
* RESPONSE AREA FOR THE C-SEARCH.
*
 01  C-ANTWORT.
     02  C-ANT-AUFTR-NR   PIC X(04).
     02  FILLER           PIC X(06).
     02  C-ANT-KNR        PIC X(06).
     02  FILLER           PIC X(12).
     02  C-ANT-NAME       PIC X(15).
     02  C-ANT-STADT      PIC X(15).
     02  C-ANT-STRASSE    PIC X(15).
     02  C-ANT-PLZ        PIC 9(05).
     02  FILLER           PIC X(77).
*
/
******************************************************
*
* OPEN STATEMENT.
*
 01  ANWOP.
   02  OP-LAENGE        PIC 9(04)   COMP  VALUE 39.
     02  FILLER           PIC XX      VALUE SPACES.
     02  FILLER           PIC X(04)   VALUE "XXX2".
     02  TAB-NAME         PIC X(17).
     02  FILLER           PIC X(11)   VALUE "0100001000X".
     02  OP-LOG-DAT       PIC XX.
     02  FILLER           PIC X       VALUE "9".
     02  FILLER           PIC X(41)   VALUE SPACES.
*
* CLOSE STATEMENT (WITH TRANSACTION-ORIENTED SECURITY END) FOR ALL
*   DIRECT UPDATES.
*
 01  ANWCL.
     02  CL-LAENGE        PIC 9(04)   COMP  VALUE 33.
     02  FILLER           PIC XX      VALUE SPACES.
     02  FILLER           PIC X(07)   VALUE "XXX90C;".
     02  FILLER           PIC X(04)   VALUE "XXX8".
     02  FILLER           PIC X(17)   VALUE SPACES.
```

```
     02  FILLER           PIC X       VALUE "9".
     02  FILLER           PIC X(47)   VALUE SPACES.
*
* CLOSE STATEMENT (WITHOUT TRANSACTION-ORIENTED SECURITY END) FOR ALL
*   SEARCHES.
*
 01  SUCH-CL.
     02  SUCH-CL-LAENGE   PIC 9(04)   COMP  VALUE 26.
     02  FILLER           PIC XX      VALUE SPACES.
     02  FILLER           PIC X(04)   VALUE "XXX8".
     02  FILLER           PIC X(17)   VALUE SPACES.
     02  FILLER           PIC X       VALUE "9".
     02  FILLER           PIC X(54)   VALUE SPACES.
*
/
*****************************************************************
*
* STATEMENT AREA FOR ADDITION (STEP 1)
*       (WITH TRANSACTION-ORIENTED SECURITY START).
*
 01  A1-NEU.
     02  A1-NEU-LAENGE    PIC 9(04)  COMP  VALUE 35.
     02  FILLER           PIC XX     VALUE SPACES.
     02  FILLER           PIC X(07)  VALUE "XXX90B;".
     02  FILLER           PIC X(19)  VALUE "XXX9CXNAAB#AB90AC70".
     02  FILLER           PIC X(05)  VALUE "AAC09".
     02  FILLER           PIC X(45)  VALUE SPACES.
*
* INQUIRY AREA FOR ADDITION (STEP 1).
*
 01  F1-NEU.
     02  F1-NEU-LAENGE    PIC 9(04)  COMP  VALUE 26.
     02  FILLER           PIC XX     VALUE SPACES.
     02  FILLER           PIC X(04)  VALUE "BBBB".
     02  K-NR             PIC X(06).
     02  DATUM            PIC X(06).
     02  ARTIKEL          PIC X(06)  VALUE SPACES.
*
* STATEMENT AREA FOR ADDITION (STEP 2)
*
 01  A2-NEU.
     02  A2-NEU-LAENGE    PIC 9(04)  COMP  VALUE 31.
     02  FILLER           PIC XX     VALUE SPACES.
     02  FILLER           PIC X(19)  VALUE "XXX9CXNAABOAACOABB0".
     02  FILLER           PIC X(08)  VALUE "&BLNO039".
     02  FILLER           PIC X(49)  VALUE SPACES.
*
* INQUIRY AREA FOR ADDITION (STEP 2).
```

```
*
 01  F2-NEU.
     02  F2-NEU-LAENGE    PIC 9(04)  COMP  VALUE 46.
     02  FILLER           PIC XX     VALUE SPACES.
     02  AUF1-NEU         PIC 9(04).
     02  ART1-NEU         PIC X(06).
     02  M1-NEU           PIC X(04).
     02  AUF2-NEU         PIC 9(04).
     02  ART2-NEU         PIC X(06).
     02  M2-NEU           PIC X(04).
     02  AUF3-NEU         PIC 9(04).
     02  ART3-NEU         PIC X(06).
     02  M3-NEU           PIC X(04).
*
/
*****************************************************************
*
* STATEMENT AREA FOR UPDATE.
*
 01  A-AENDERUNG.
     02  A-AEND-LAENGE    PIC 9(04)  COMP  VALUE 31.
     02  FILLER           PIC XX     VALUE SPACES.
     02  FILLER           PIC X(07)  VALUE "XXX90B;".
     02  FILLER           PIC X(15)  VALUE "XXX9CXAAABOAAC0".
     02  FILLER           PIC X(05)  VALUE "ABB09".
     02  FILLER           PIC X(49)  VALUE SPACES.
*
* INQUIRY AREA FOR UPDATE.
*
 01  F-AENDERUNG.
     02  F-AEND-LAENGE    PIC 9(04)  COMP  VALUE 18.
     02  FILLER           PIC XX     VALUE SPACES.
     02  AUFTR-NR         PIC X(04).
     02  ART-NR           PIC X(06).
     02  MENGE            PIC X(04).
*
/
*****************************************************************
*
* STATEMENT AREA FOR DELETION (STEP 1)
*     (WITH TRANSACTION-ORIENTED SECURITY START).
*
 01  A1-LOESCHEN.
     02  A1-LOE-LAENGE    PIC 9(04)  COMP  VALUE 35.
     02  FILLER           PIC XX     VALUE SPACES.
     02  FILLER           PIC X(07)  VALUE "XXX90B;".
     02  FILLER           PIC X(15)  VALUE "XXX9CXLAABLAACL".
     02  FILLER           PIC X(09)  VALUE "AB9LAC7L9".
```

```
     02  FILLER           PIC X(45)  VALUE SPACES.
*
* INQUIRY AREA FOR DELETION (STEP 1).
*
 01  F1-LOESCHEN.
     02  F1-LOE-LAENGE    PIC 9(04)  COMP  VALUE 26.
     02  FILLER           PIC XX     VALUE SPACES.
     02  F1-AUFTR         PIC X(04).
     02  FILLER           PIC X(06)  VALUE SPACES.
     02  FILLER           PIC X(12)  VALUE "BBBBBBBBBBBB".
*
* STATEMENT AREA FOR DELETION (STEP 2)
*
 01  A2-LOESCHEN.
     02  A2-LOE-LAENGE    PIC 9(04)  COMP  VALUE 31.
     02  FILLER           PIC XX     VALUE SPACES.
     02  FILLER           PIC X(19)  VALUE "XXX9CXLAABLAACLABBL".
     02  FILLER           PIC X(08)  VALUE "&BLNO039".
     02  FILLER           PIC X(49)  VALUE SPACES.
*
* INQUIRY AREA FOR DELETION (STEP 2).
*
 01  F2-LOESCHEN.
     02  F2-LOE-LAENGE    PIC 9(04)  COMP  VALUE 46.
     02  FILLER           PIC XX     VALUE SPACES.
     02  AUF1-LO          PIC X(04).
     02  ART1-LO          PIC X(06).
     02  M1-LO            PIC 9(04)  VALUE 0.
     02  AUF2-LO          PIC X(04).
     02  ART2-LO          PIC X(06).
     02  M2-LO            PIC 9(04)  VALUE 0.
     02  AUF3-LO          PIC X(04).
     02  ART3-LO          PIC X(06).
     02  M3-LO            PIC 9(04)  VALUE 0.
*
*****************************************************************
*
* LOOP STATEMENT FOR AUTOMATICALLY REPEATING THE
*    PRECEDING DML STATEMENT (RESPONSE POLLING).
*
 01  SCHLEIFE.
     02  SCHLEIFE-LAENGE  PIC 9(04)  COMP  VALUE 10.
     02  FILLER           PIC XX     VALUE SPACES.
     02  ANW-SCHLEIFE     PIC X(06)  VALUE "XXX799".
     02  FILLER           PIC X(70)  VALUE SPACES.
*
*****************************************************************
*
```

```
* STATEMENT AREA FOR A-SEARCH.
*
 01  ANW-A-SUCHE.
     02  AAS-LAENGE       PIC 9(04)  COMP  VALUE 28.
     02  FILLER           PIC XX     VALUE SPACES.
     02  FILLER           PIC X(13)  VALUE "XXX601UAB9501".
     02  FILLER           PIC X(11)  VALUE "EAC7AB90009".
     02  FILLER           PIC X(52)  VALUE SPACES.
*
* INQUIRY AREA FOR A-SEARCH.
*
 01  FRA-A-SUCHE.
     02  FAS-LAENGE       PIC 9(04)  COMP  VALUE 10.
     02  FILLER           PIC XX     VALUE SPACES.
     02  FAS-KNR          PIC X(06).
*
*****************************************************************
*
* STATEMENT AREA FOR B-SEARCH.
*
 01  ANW-B-SUCHE.
     02  ABS-LAENGE       PIC 9(04)   COMP  VALUE 73.
     02  FILLER           PIC XX      VALUE SPACES.
     02  FILLER           PIC X(19)   VALUE "XXX601#A1EAB9AC7000".
     02  FILLER           PIC X(19)   VALUE "UAB9501UAC7501V(AAB".
     02  FILLER           PIC X(19)   VALUE "#A1=AAB#B1)XXX601#B".
     02  FILLER           PIC X(12)   VALUE "1EAACABB0009".
     02  FILLER           PIC X(07)   VALUE SPACES.
*
* INQUIRY AREA FOR B-SEARCH.
*
 01  FRA-B-SUCHE.
     02  FBS-LAENGE       PIC 9(04)   COMP  VALUE 16.
     02  FILLER           PIC XX      VALUE SPACES.
     02  FBS-KUNDE        PIC X(06).
     02  FBS-DATUM        PIC X(06).
*
*****************************************************************
*
* STATEMENT AREA FOR C-SEARCH.
*
 01  ANW-C-SUCHE.
     02  ACS-LAENGE       PIC 9(04)   COMP  VALUE 69.
     02  FILLER           PIC XX      VALUE SPACES.
     02  FILLER           PIC X(16)   VALUE "XXX601#A1EAB9000".
     02  FILLER           PIC X(16)   VALUE "UAC7501V(AB9#A1=".
     02  FILLER           PIC X(16)   VALUE "AAA#C1)XXX601#C1".
     02  FILLER           PIC X(17)   VALUE "EAD2AGVAFXAFY0009".
```

```
     02  FILLER           PIC X(11)   VALUE SPACES.
*
* INQUIRY AREA FOR C-SEARCH.
*
 01  FRA-C-SUCHE.
     02  FCS-LAENGE       PIC 9(04)   COMP  VALUE 10.
     02  FILLER           PIC XX      VALUE SPACES.
     02  FCS-DATUM        PIC X(06).
*****************************************************************
/
*****************************************************************
*               M A I N  P R O G R A M                          *
*        ON AN ERROR IN "DATABASE OPEN"                         *
*        THE PROGRAM IS IMMEDIATELY TERMINATED WITH AN          *
*        APPROPRIATE ERROR MESSAGE (ACKNOWLEDGMENT AREA).       *
*                                                               *
*        PARAGRAPH ST93 GIVES THE USER THE OPTION OF            *
*        CONTINUING DATABASE PROCESSING OR TERMINATING          *
*        THE PROGRAM.                                           *

 PROCEDURE DIVISION.
 STEUER SECTION.
 ST15.
     PERFORM DATENBANK-OEFFNEN.
     IF STATU NOT EQUAL "00" THEN PERFORM FEHLER
  GO TO ST95.
 ST20.
     PERFORM BEARBEITUNGSART.
     IF       ARBEIT = "S" THEN PERFORM SUCHFRAGE
GO TO ST93
      ELSE IF ARBEIT = "N" THEN PERFORM NEUAUFNAHME
      ELSE IF ARBEIT = "A" THEN PERFORM AENDERN
      ELSE IF ARBEIT = "L" THEN PERFORM LOESCHEN
      ELSE    DISPLAY "FEHLERHAFTE EINGABE" UPON T
      GO TO ST20.
 ST90.
     PERFORM DATENBANK-SCHLIESSEN.
     IF STATU NOT EQUAL "00" THEN PERFORM FEHLER.
 ST93.
     PERFORM WIEDERHOLUNGEN.
     IF         WIEDERHOLUNG = "Y" THEN GO TO ST15
ELSE IF WIEDERHOLUNG = "N" THEN GO TO ST95
ELSE    DISPLAY "FEHLERHAFTE EINGABE!" UPON T
GO TO ST93.
 ST95.
     PERFORM PROG-BEENDEN.
 ST99.
     STOP RUN.
```

```
*****************************************************************
 RUECKSETZEN SECTION.
*                                                               *
*           STATEMENT, INQUIRY AND RESPONSE AREA                *
*           ARE SET TO BLANKS.                                  *
*           ( TO ENSURE THAT ONLY THE REQUIRED INFORMATION      *
*             SUBSEQUENTLY APPEARS IN EACH AREA. )              *
*                                                               *
 RU10.
     MOVE SPACES TO ANW.
     MOVE SPACES TO FRAGE.
     MOVE SPACES TO ANTWORT.
 RU20.
     EXIT.
*****************************************************************
 SESAMU SECTION.
*                                                               *
*  SESAM CALL FOR ALL OPEN STATEMENTS, ALL                      *
*                 DIRECT UPDATES, BOTH CLOSE STATEMENTS         *
*                 AND THE A-SEARCH.                             *
*                                                               *
 SE10.
     CALL "SESAM" USING ANW QUITTUNG ANTWORT FRAGE.
 SE20.
     EXIT.
*****************************************************************
 SESAMB SECTION.
*                                                               *
*  SESAM CALL FOR B-SEARCH.                                     *
*                                                               *
 SB10.
     CALL "SESAM" USING ANW QUITTUNG B-ANTWORT FRAGE.
 SB20.
     EXIT.
*****************************************************************
 SESAMC SECTION.
*                                                               *
*  SESAM CALL FOR C-SEARCH.                                     *
*                                                               *
 SC10.
     CALL "SESAM" USING ANW QUITTUNG C-ANTWORT FRAGE.
 SC20.
     EXIT.
*****************************************************************
 DATENBANK-OEFFNEN SECTION.
*                                                               *
*          ON ERROR, THE ACKNOWLEDGMENT AREA IS DISPLAYED       *
*          AND THE USER IS ALSO INFORMED WHICH "OPEN" CAUSED    *
```

```
*          THE ERROR.                                                  *
*                                                                      *
 DA10.
     PERFORM RUECKSETZEN.
     MOVE "VERTRIEB         " TO TAB-NAME.
     MOVE "A1" TO OP-LOG-DAT Q-LOG-DAT.
     MOVE ANWOP TO ANWEISUNG.
     PERFORM SESAMU.
     IF STATU NOT EQUAL "00" THEN DISPLAY "VERTRIEB (1)"
  UPON T
  GO TO DA99.
 DA20.
     PERFORM RUECKSETZEN.
     MOVE "VERTRIEB         " TO TAB-NAME.
     MOVE "B1" TO OP-LOG-DAT Q-LOG-DAT.
     MOVE ANWOP TO ANWEISUNG.
     PERFORM SESAMU.
     IF STATU NOT EQUAL "00" THEN DISPLAY "VERTRIEB (1)"
  UPON T
  GO TO DA99.
 DA30.
     PERFORM RUECKSETZEN.
     MOVE "FIRMA            " TO TAB-NAME.
     MOVE "C1" TO OP-LOG-DAT Q-LOG-DAT.
     MOVE ANWOP TO ANWEISUNG.
     PERFORM SESAMU.
     IF STATU NOT EQUAL "00" THEN DISPLAY "FIRMA"
    UPON T.
 DA99.
     EXIT.
*********************************************************************
 BEARBEITUNGSART SECTION.
 BE10.
     DISPLAY "WELCHE DATENBANKBEARBEITUNG WOLLEN SIE VORNEHMEN ?"
      UPON T.
     DISPLAY "(SUCHFRAGE=S,NEUAUFNAHME=N,AENDERN=A,LOESCHEN=L)"
      UPON T.
     DISPLAY "BITTE GROSSBUCHSTABEN VERWENDEN !"   UPON T.
     ACCEPT ARBEIT FROM T.
 BE20.
     EXIT.
*********************************************************************
 WIEDERHOLUNGEN SECTION.
 WI10.
     DISPLAY "IST EINE WEITERE DATENBANKBEARBEITUNG ERWUENSCHT ?"
     "(JA=Y,NEIN=N):"  UPON T.
     DISPLAY "BITTE GROSSBUCHSTABEN VERWENDEN !"   UPON T.
     ACCEPT WIEDERHOLUNG FROM T.
```

```
 WI20.
     EXIT.
*****************************************************************
 FEHLER SECTION.
 FE10.
     DISPLAY "QUITTUNGSBEREICH: " UPON T.
     DISPLAY QUITTUNG UPON T.
 FE20.
     EXIT.
*****************************************************************
 DATENBANK-SCHLIESSEN SECTION.
*                   FOR ALL DIRECT UPDATES.                     *
 DS10.
     PERFORM RUECKSETZEN.
     MOVE ANWCL TO ANWEISUNG.
     PERFORM SESAMU.
 DS20.
     EXIT.
*****************************************************************
 PROG-BEENDEN SECTION.
 PR10.
     DISPLAY "DAS PROGRAMM IST BEENDET. AUF WIEDERSEHEN!"
             UPON T.
 PR20.
     EXIT.
*****************************************************************
 NEUAUFNAHME SECTION.
 NU10.
     PERFORM RUECKSETZEN.
 NU20.
*               A D D I T I O N   ( STEP 1 )
     DISPLAY "KUNDENNUMMER (6-STELLIG) : " UPON T.
     ACCEPT K-NR FROM T.
     DISPLAY "DATUM (IN DER FORM JJMMTT) : " UPON T.
     ACCEPT DATUM FROM T.
 NU25.
     MOVE "A1" TO Q-LOG-DAT.
*                              THE FILE IDENTIFIER IS WRITTEN     *
*                              INTO THE ACKNOWLEDGMENT AREA TO    *
*                              ENSURE THAT THE DBH 'SESAMI'       *
*                              SEARCHES THE CORRECT DATABASE      *
*                              (AND THE CORRECT ATTRIBUTE CATALOG)*
*                              FOR THE SPECIFIED ATTRIBUTES.      *
     MOVE A1-NEU TO ANWEISUNG.
     MOVE F1-NEU TO FRAGEBEREICH.
 NU30.
     PERFORM SESAMU.
     IF STATU NOT EQUAL "00" THEN PERFORM FEHLER
```

```
  GO TO NU99.
 NU40.
*             N E U A U F N A H M E ( 2.SCHRITT )
     MOVE ANT TO AUF1-NEU AUF2-NEU AUF3-NEU.
     DISPLAY "ARTIKEL 1 (6-STELLIG) : " UPON T.
     ACCEPT ART1-NEU FROM T.
     DISPLAY "MENGE 1 (4STELLIG) : " UPON T.
     ACCEPT M1-NEU FROM T.
     DISPLAY "ARTIKEL 2 (6-STELLIG) : " UPON T.
     ACCEPT ART2-NEU FROM T.
     DISPLAY "MENGE 2 (4STELLIG) : " UPON T.
     ACCEPT M2-NEU FROM T.
     DISPLAY "ARTIKEL 3 (6-STELLIG) : " UPON T.
     ACCEPT ART3-NEU FROM T.
     DISPLAY "MENGE 3 (4STELLIG) : " UPON T.
     ACCEPT M3-NEU FROM T.
 NU50.
     PERFORM RUECKSETZEN.
     MOVE "A1" TO Q-LOG-DAT.
     MOVE A2-NEU TO ANWEISUNG.
     MOVE F2-NEU TO FRAGEBEREICH.
 NU60.
     PERFORM SESAMU.
     IF STATU = "9D" THEN GO TO NU70
*           ERROR 9D (SUBNO.01) CAN BE IGNORED FOR AN ADDITION
*           IF THE ORDER CONTAINS LESS THAN THREE (DIFFERENT)
*           ORDER ITEMS.
     ELSE IF STATU NOT EQUAL "00" THEN PERFORM FEHLER
                                       GO TO NU80.
 NU70.
*           TELLS THE USER THAT THE ORDER HAS BEEN SUCCESSFULLY
*           ADDED.
     DISPLAY "SATZ NEUAUFGENOMMEN." UPON T.
 NU80.
*           B L A N K  L I N E
     DISPLAY " " UPON T.
 NU99.
     EXIT.
*****************************************************************
 AENDERN SECTION.
*                    THE ORDER QUANTITY FOR THE ARTICLE          *
*                    IS AMENDED.                                 *
*                    THE ORDER NUMBER AND ARTICLE NUMBER         *
*                    NEED TO BE SPECIFIED.
 AE10.
     PERFORM RUECKSETZEN.
 AE20.
     DISPLAY "AUFTRAGSNUMMER (4-STELLIG) : " UPON T.
```

```
     ACCEPT AUFTR-NR FROM T.
     DISPLAY "ARTIKELNUMMER (6-STELLIG) : " UPON T.
     ACCEPT ART-NR FROM T.
     DISPLAY "MENGE (4-STELLIG) : " UPON T.
     ACCEPT MENGE FROM T.
 AE30.
     MOVE "A1" TO Q-LOG-DAT.
     MOVE A-AENDERUNG TO ANWEISUNG.
     MOVE F-AENDERUNG TO FRAGEBEREICH.
 AE40.
     PERFORM SESAMU.
     IF STATU NOT EQUAL "00" THEN PERFORM FEHLER
  GO TO AE60.
 AE50.
*           TELLS THE USER THAT THE UPDATE HAS BEEN SUCCESSFULLY
*           PERFORMED.
     DISPLAY "AENDERUNG DURCHGEFUEHRT." UPON T.
 AE60.
     DISPLAY " " UPON T.
 AE99.
     EXIT.
*****************************************************************
 LOESCHEN SECTION.
*                IF ANY ERROR OTHER THAN "95" OR "9G" OCCURS     *
*                THE USER IS GIVEN BOTH AN ERROR MESSAGE         *
*                (ACKNOWLEDGMENT AREA) AND AN INDICATION OF THE  *
*                DELETION STEP (DEL 1,DEL 2) IN WHICH IT OCCURRED*
*                   - 95 AND 9G ERRORS CAN BE IGNORED FOR        *
*                     A DELETION IF THE ORDER CONTAINS LESS      *
*                     THAN THREE (DIFFERENT) ORDER ITEMS         *
*                                                                *
 LO10.
     PERFORM RUECKSETZEN.
 LO20.
     DISPLAY "AUFTRAGSNUMMER (4-STELLIG) : " UPON T.
     ACCEPT AUF1-LO FROM T.
     MOVE AUF1-LO TO AUF2-LO AUF3-LO F1-AUFTR.
 LO25.
     DISPLAY "ARTIKEL 1 ? (GROSSBUCHSTABEN!)" UPON T.
     ACCEPT ART1-LO FROM T.
     DISPLAY "ARTIKEL 2 ? (GROSSBUCHSTABEN!)" UPON T.
     ACCEPT ART2-LO FROM T.
     DISPLAY "ARTIKEL 3 ? (GROSSBUCHSTABEN!)" UPON T.
     ACCEPT ART3-LO FROM T.
 LO30.
*              D E L E T I O N ( STEP 1 )
     MOVE "A1" TO Q-LOG-DAT.
     MOVE A1-LOESCHEN TO ANWEISUNG.
```

```
     MOVE F1-LOESCHEN TO FRAGEBEREICH.
 LO40.
     PERFORM SESAMU.
     IF STATU NOT EQUAL "00" THEN PERFORM FEHLER
  DISPLAY "LO 1" UPON T
  GO TO LO80.
 LO50.
*              D E L E T I O N ( STEP 2 )
     PERFORM RUECKSETZEN.
     MOVE "A1" TO Q-LOG-DAT.
     MOVE A2-LOESCHEN TO ANWEISUNG.
     MOVE F2-LOESCHEN TO FRAGEBEREICH.
 LO60.
     PERFORM SESAMU.
     IF STATU = "95" OR STATU = "9G" THEN GO TO LO70
     ELSE IF STATU NOT EQUAL "00" THEN PERFORM FEHLER
     DISPLAY "LO 2" UPON T
   GO TO LO80.
 LO70.
*                     TELLS THE USER THAT THE ORDER HAS
*                     BEEN SUCCESFULLY DELETED.
     DISPLAY "SATZ GELOESCHT!" UPON T.
 LO80.
*                     B L A N K  L I N E .
     DISPLAY " " UPON T.
 LO99.
     EXIT.
*****************************************************************
 SUCHFRAGE SECTION.
 SU10.
     PERFORM SU-AUSWAHL.
 SU20.
     IF       SUCHE = "A" THEN PERFORM A-SUCHE
      ELSE IF SUCHE = "B" THEN PERFORM B-SUCHE
      ELSE IF SUCHE = "C" THEN PERFORM C-SUCHE
      ELSE    DISPLAY " FEHLERHAFTE EINGABE!" UPON T
      GO TO SU10.
 SU30.
*          CLOSE STATEMENT FOR SEARCHES (WITHOUT TA-SECURITY).   *
     PERFORM RUECKSETZEN.
     MOVE SUCH-CL TO ANWEISUNG.
 SU40.
     PERFORM SESAMU.
  IF STATU NOT EQUAL "00" THEN PERFORM FEHLER.
 SU99.
     EXIT.
*****************************************************************
 SU-AUSWAHL SECTION.
```

```
 SA10.
     DISPLAY "WELCHE SUCHFRAGE ?"  UPON T.
     DISPLAY "      -WANN HAT KUNDE X EINEN AUFTRAG BESTELLT ?"
     "(=A)"          UPON T.
     DISPLAY "      -WELCHEN AUFTRAG(AUFTR-NR,ART-NR,MENGE) HAT "
    "KUNDE X AM TAG X BESTELLT ?" UPON T.
     DISPLAY "       (=B)" UPON T.
     DISPLAY "      -WIE LAUTET DIE ANSCHRIFT(NAME,STADT,STRASSE)"
    " DER KUNDEN,DIE AM TAG X " UPON T.
     DISPLAY "       EINEN AUFTRAG BESTELLT HABEN? (=C)"
     UPON T.
 SA20.
     ACCEPT SUCHE FROM T.
 SA99.
     EXIT.
*****************************************************************
 A-SUCHE SECTION.
*                                                               *
*                THE CUSTOMER NUMBER IS USED TO FIND            *
*                OUT ALL DATES ON WHICH THE CUSTOMER PLACED     *
*                AN ORDER.                                      *
*                ERROR STATUS "10" INDICATES THAT NO SUCH       *
*                RECORD WAS FOUND.                              *
*                                                               *
 AC10.
     DISPLAY "KUNDENNUMMER (6-STELLIG) : " UPON T.
     ACCEPT FAS-KNR FROM T.
 AC20.
     PERFORM RUECKSETZEN.
     MOVE "A1" TO Q-LOG-DAT.
     MOVE ANW-A-SUCHE TO ANWEISUNG.
     MOVE FRA-A-SUCHE TO FRAGEBEREICH.
 AC30.
     PERFORM SESAMU.
     IF STATU = "10" THEN DISPLAY "ES LIEGT KEIN AUFTRAG MIT"
" DIESER KUNDENNUMMER VOR!" UPON T
  DISPLAY " " UPON T
  GO TO AC99
       ELSE IF STATU NOT EQUAL "00" THEN PERFORM FEHLER
 GO TO AC99
       ELSE DISPLAY "GESUCHTES DATUM: " S-DATUM " " ANT-KNR
    UPON T.
 AC40.
*              L O O P  FOR OUTPUTTING FURTHER RESPONSES (DATES)
     MOVE "A1" TO Q-LOG-DAT.
     MOVE SCHLEIFE TO ANWEISUNG.
 AC45.
     PERFORM SESAMU.
```

```
     IF STATU = "10" THEN GO TO AC50
ELSE IF STATU = "00" THEN
 DISPLAY "GESUCHTES DATUM: " S-DATUM " " ANT-KNR
  UPON T
 GO TO AC40
ELSE PERFORM FEHLER.
 AC50.
     DISPLAY " " UPON T.
 AC99.
     EXIT.
*****************************************************************
 B-SUCHE SECTION.
*                                                               *
*                 THE CUSTOMER NUMBER AND DATE ARE USED TO      *
*                 INQUIRE ON THE FULL CONTENTS OF THE ORDER     *
*                 THE CUSTOMER PLACED ON THIS DATE.             *
*                                                               *
 BS10.
     DISPLAY "KUNDENNUMMER (6STELLIG) : " UPON T.
     ACCEPT FBS-KUNDE FROM T.
     DISPLAY "DATUM (JJMMTT) : " UPON T.
     ACCEPT FBS-DATUM FROM T.
 BS20.
     PERFORM RUECKSETZEN.
     MOVE "A1" TO Q-LOG-DAT.
     MOVE ANW-B-SUCHE TO ANWEISUNG.
     MOVE FRA-B-SUCHE TO FRAGEBEREICH.
     PERFORM SESAMB.
     IF STATU = "00"
*        H E A D E R  L I N E  FOR ORDER OUTPUT.
       THEN DISPLAY "KUNDENNUMMER: " FBS-KUNDE "  DATUM: "
     FBS-DATUM "  AUFTR.NR: " B-ANT-AUFTR-NR UPON T
    DISPLAY " " UPON T
ELSE IF STATU = "10" THEN DISPLAY "KUNDE HAT AN DIESEM "
     "TAG KEINEN AUFTRAG GEGEBEN!" UPON T
      DISPLAY " " UPON T
      GO TO BS99
ELSE PERFORM FEHLER
     GO TO BS99.
 BS30.
*              L O O P   FOR OUTPUTTING THE ORDER ITEMS
*                        FOR AN ORDER.
     MOVE "A1" TO Q-LOG-DAT.
     MOVE SCHLEIFE TO ANWEISUNG.
     PERFORM SESAMB.
     IF STATU = "10" THEN GO TO BS99
ELSE IF STATU = "00"
     THEN DISPLAY "ARTIKEL: " B-ANT-ART "  MENGE: "
```

```
   B-ANT-MENGE UPON T
  DISPLAY " " UPON T
  GO TO BS30
ELSE PERFORM FEHLER.
 BS99.
     EXIT.
*****************************************************************
 C-SUCHE SECTION.
*                                                               *
*               THE DATE IS USED TO INQUIRE ON WHICH CUSTOMERS  *
*               (WITH ADDRESSES) PLACED AN ORDER ON THIS DATE.  *
*                                                               *
*                                                               *
 CS10.
     DISPLAY "DATUM : " UPON T.
     ACCEPT FCS-DATUM FROM T.
 CS20.
     PERFORM RUECKSETZEN.
     MOVE "A1" TO Q-LOG-DAT.
     MOVE ANW-C-SUCHE TO ANWEISUNG.
     MOVE FRA-C-SUCHE TO FRAGEBEREICH.
     PERFORM SESAMC.
 CS30.
*          H E A D E R  L I N E  FOR CUSTOMER LISTING.
     IF STATU = "00" THEN DISPLAY "AUFTR-NR :   "
  "K-NR :   "
  "NAME :          "
  "STADT :         "
  "STRASSE :       " UPON T
*           C U S T O M E R  1 .
  DISPLAY "    " C-ANT-AUFTR-NR
  "       " C-ANT-KNR
  "    " C-ANT-NAME
  " " C-ANT-PLZ " " C-ANT-STADT
  "   " C-ANT-STRASSE
     UPON T
  DISPLAY " " UPON T
ELSE IF STATU = "10" THEN DISPLAY "AN DIESEM TAG WURDE "
  "KEIN AUFTRAG BESTELLT ! "
   UPON T
  DISPLAY " " UPON T
  GO TO CS99
ELSE PERFORM FEHLER
     GO TO CS99.
 CS40.
*            L O O P  FOR OUTPUTTING FURTHER RESPONSES (CUSTOMERS).
     MOVE "A1" TO Q-LOG-DAT.
     MOVE SCHLEIFE TO ANWEISUNG.
```

```
     PERFORM SESAMC.
     IF STATU ="10" THEN GO TO CS99
ELSE IF STATU = "00" THEN DISPLAY "    " C-ANT-AUFTR-NR
  "      " C-ANT-KNR
  "    " C-ANT-NAME
    " " C-ANT-PLZ " " C-ANT-STADT
  "   " C-ANT-STRASSE
    UPON T
  DISPLAY " " UPON T
                                  GO TO CS40
       ELSE PERFORM FEHLER.
 CS99.
     EXIT.
*****************************************************************
```

Example of a FORTRAN program

```
C.....................................................................
C   PROGRAM  SESDML
C   FORTRAN PROGRAM WITH AN INTERFACE FOR SESAM DML CALLS
C
C   TO MAINTAIN A SIMPLE USER INTERFACE, THE DML STATEMENTS TO THE
C   SESAM DBH ARE CALLED FROM A SUBROUTINE
C
      IMPLICIT COMPLEX (A-Z)
      CHARACTER*(80,V) ANWEISUNG /' '/
      CHARACTER*(80,V) FRAGE     /' '/
      CHARACTER*(80,V) ANTWORT   /' '/
      CHARACTER*(16,V) QUITTUNG  /' '/
C...
      INTEGER*4 SYSDTA /1/
      INTEGER*4 SYSOUT /2/
      INTEGER*4 MODE /0/
C...
      CHARACTER*3 KENNWORT /'XXX'/
      CHARACTER*2 LOGDAT /'HH'/
C...
10000 IF (MODE .LT. 5) THEN
      WRITE (SYSOUT, *) '    NAM-ANWEISUNG       : (1)   '
      WRITE (SYSOUT, *) '   OPEN-ANWEISUNG       : (2)   '
      WRITE (SYSOUT, *) '   SUCH-ANWEISUNG       : (3)   '
      WRITE (SYSOUT, *) '  CLOSE-ANWEISUNG       : (4)   '
      WRITE (SYSOUT, *) '              END       : (5)   '
C...
      READ  (SYSDTA, '(I1)') MODE
      QUITTUNG(7:8) = LOGDAT
C...
      IF (MODE .EQ. 1) THEN
         WRITE (SYSOUT, *) '*  NAM-ANWEISUNG      NAM = I'
         ANWEISUNG(5:13) = KENNWORT//'NAM=I9'
      ELSE IF (MODE .EQ. 2) THEN
         ANWEISUNG(5:39) = KENNWORT//'2FIRMA       '//
     1   '0102401024X'//LOGDAT//'9'
         WRITE (SYSOUT, *) '* OPEN DATENBANK FIRMA LOG.DATEI HH'
      ELSE IF (MODE .EQ. 3) THEN
         ANWEISUNG(5:19) = KENNWORT//'601EAA80009'
         FRAGE(5:80)     = ' '
         WRITE (SYSOUT, *) '*  SUCHEN IN DER DATENBANK FIRMA'
      ELSE IF (MODE .EQ. 4) THEN
         ANWEISUNG(5:39) = KENNWORT//'8                9'
```

```
         WRITE (SYSOUT, *) '*  CLOSE LOG. DATEI HH'
      END IF
C...
      CALL SESSUB (ANWEISUNG, QUITTUNG, ANTWORT, FRAGE)
C...
      WRITE (SYSOUT, *) 'SES-STATUS :', QUITTUNG(1:16)
C...
      IF ((MODE .EQ. 3) .AND. (QUITTUNG(1:2) .EQ. '00')) THEN
         WRITE (SYSOUT, *) 'SES-ANTWORT :', ANTWORT(1:80)
      END IF
C...
      END IF
      GOTO 10000
      END
C.....................................................................
C   SUBROUTINE SESSUB (COMMAND, QUIT, ANSWER, QUESTION)
C
C   THE SESSUB SUBROUTINE PROVIDES THE LENGTH FIELDS FOR THE STATEMENT
C   AND INQUIRY AREAS.
C
C   BYTES 1-2 : HEXADECIMAL LENGTH OF VARIABLE AREA
C   BYTES 3-4 : BLANK FIELDS (X'40')
C
C   DESCRIPTORS OF CHARACTER VARIABLES ARE NOT TRANSFERRED IN A
C   SUBROUTINE CALL. THUS THE FORMAL TRANSFER PARAMETER MUST BE
C   EXPLICITLY ASSIGNED TO ANOTHER VARIABLE IN THE SUBROUTINE.
C
      SUBROUTINE SESSUB (COMMAND, QUIT, ANSWER, QUESTION)
      IMPLICIT COMPLEX (A-Z)
C...
      CHARACTER*(*) COMMAND
      CHARACTER*(*) QUIT
      CHARACTER*(*) ANSWER
      CHARACTER*(*) QUESTION
C...
      CHARACTER*(80) NEWCOM
      CHARACTER*(80) NEWQUEST
C...
      CHARACTER*4 HEXKOPF
C...
      DATA HEXKOPF /Z00504040/
C...
      COMMAND(1:4) = HEXKOPF
      QUESTION(1:4) = HEXKOPF
      NEWCOM(1:80) = COMMAND(1:80)
      NEWQUEST(1:80) = NEWQUEST(1:80)
C...
      CALL SESAM (NEWCOM(5:80), QUIT, ANSWER, NEWQUEST(5:80))
```

```
C...
      RETURN
      END
```

Example of a PL/I program

```
PLI1SES: PROC OPTIONS(MAIN);
        /*****************************************
         *   STANDARD PL/I PROGRAM FOR SESAM CALLS   *
         *                                           *
         * THE PROGRAM READS STATEMENT AND INQUIRY   *
         * AREAS FROM THE SCREEN AND PASSES THE      *
         * CALL DML STATEMENT TO THE SESAM DBH.      *
         *****************************************/
/*                                                                    */
DCL SESAM ENTRY OPTIONS (ASSEMBLER);
DCL SESAREA AREA(6000);
/*                                                                    */
DCL 1 ANW BASED (ZANW),                          /* Statement area    */
      5 LAENGE BIN FIXED(15),
      5 LEER   CHAR(2) INIT('  '),
      5 ANWEISUNG,
        10 KENNWORT CHAR(3),
        10 OPCODE   CHAR(1),
        10 TEXT     CHAR(LANW-4);
/*                                                                    */
DCL 1 QUITTUNG,                                  /* Acknowledgment area */
      5 STATUS   CHAR(2) INIT(' '),
      5 RES1     CHAR(4) INIT(' '),
      5 DATEIKZ  CHAR(2) INIT(' '),
      5 RES2     CHAR(2) INIT(' '),
      5 ZUSINFO  CHAR(2) INIT(' '),
      5 RES3     CHAR(4) INIT(' ');
/*                                                                    */
DCL ANTWORT CHAR(LANT) BASED (ZANT);             /* Response area     */
/*                                                                    */
DCL 1 FRA      BASED (ZFRA),                     /* Inquiry area      */
      5 LAENGE BIN FIXED(15),
      5 LEER   CHAR(2) INIT('  '),
      5 FRAGE  CHAR(LFRA);
/*                                                                    */
DCL ANWEISUNGSBEREICH CHAR(2044) VAR;            /* Input buffer for sta. */
DCL FRAGEBEREICH      CHAR(2044) VAR;            /* Input buffer for inq. */
DCL (LANW,LANT,LFRA)  BIN FIXED(15);             /* Length fields     */
DCL (ZANW,ZANT,ZFRA)  POINTER INIT (NULL);       /* Pointer to AREA   */
DCL (SUBSTR,NULL,ONSOURCE) BUILTIN;
/*                                                                    */
ON CONVERSION BEGIN;                             /* OPEN error handling */
   DISPLAY ('FALSCHE EINGABE FUER MAX. ANTWORTBEREICHS-GROESSE: '||
            ONSOURCE() );
   DISPLAY ('BITTE EINGABE WIEDERHOLEN ODER E(=ENDE)')
```

```
     REPLY (ANWEISUNGSBEREICH);
   GOTO ANF;
   END;
/*                                                                    */
DISPLAY ('BITTE SESAM-ANWEISUNG ODER E(=ENDE) EINGEBEN:')
    REPLY (ANWEISUNGSBEREICH);
/*                                                                    */
ANF:
DO WHILE (ANWEISUNGSBEREICH ?= 'E');
/*                                                                    */
LANW      = LENGTH (ANWEISUNGSBEREICH);         /* Set up statement area  */
ALLOCATE ANW IN (SESAREA);
ANW.LAENGE = LANW+4;                            /* Set statement area to  */
ANW.KENNWORT = SUBSTR(ANWEISUNGSBEREICH,1,3);   /* current statement      */
ANW.OPCODE   = SUBSTR(ANWEISUNGSBEREICH,4,1);
ANW.TEXT     = SUBSTR(ANWEISUNGSBEREICH,5);
/*                                                                    */
IF ANW.OPCODE = '2' THEN DO;                    /* For OPEN statement:    */
   LFRA = 0;                                    /* set up inquiry area    */
   ALLOCATE FRA IN (SESAREA);
   FRA.LAENGE = LFRA + 4;
   LANT = SUBSTR(ANW.TEXT,18,5);                /* Read response length   */
   ALLOCATE ANTWORT IN (SESAREA);               /* from OPEN statement    */
   ANTWORT = ' ';                               /* Set up response area   */
   END;
   ELSE DO;                                     /* Other than OPEN sta.:  */
    DISPLAY ('BITTE SESAM-ATTRIBUTE FUER FRAGEBEREICH EINGEBEN:')
         REPLY (FRAGEBEREICH);
    LFRA = LENGTH (FRAGEBEREICH);               /* Determine inq. area    */
    ALLOCATE FRA IN (SESAREA);                  /* length and set up and  */
    FRA.LAENGE = LFRA + 4;                      /* put values in inq.area */
    FRA.FRAGE = FRAGEBEREICH;
   END;
/*                                                                    */
CALL SESAM (ANWEISUNG,QUITTUNG,ANTWORT,FRAGE);  /* CALL DML call          */
/*                                                                    */
IF STATUS = '00' THEN DO;                       /* SESAM statement o.k.:  */
   IF ANTWORT = ' ' THEN;                       /* Output response area   */
      ELSE DO;                                  /* if not empty           */
      DISPLAY (ANTWORT);
      ANTWORT = ' ';
      END;
   END;
   ELSE DO;                                     /* Status handling:       */
   DISPLAY ('STATUS:'||QUITTUNG.STATUS);        /* Display ack. area      */
   DISPLAY ('ZUSATZ-INFO:'||QUITTUNG.ZUSINFO);
   END;
/*                                                                    */
```

```
FREE ANW IN (SESAREA);                          /* Release statement area */
FREE FRA IN (SESAREA);                          /* Release inquiry area   */
ANWEISUNGSBEREICH,FRAGEBEREICH = ' ';           /* Delete input buffers   */
/*                                                                        */
DISPLAY ('BITTE SESAM-ANWEISUNG ODER E(=ENDE) EINGEBEN:')
    REPLY (ANWEISUNGSBEREICH);
END;                                            /* End WHILE loop         */
/*                                                                        */
END PLI1SES;
```

Related publications

Ordering manuals

Please apply to your local office for ordering the manuals.

SESAM/SQL-Server (BS2000/OSD)
Core Manual
User Guide

Target group
The manual is intended for all users and to anyone seeking information on SESAM/SQL.
Contents
The manual gives an overview of the database system. It describes the basic concepts. It is the foundation for understanding the other SESAM/SQL manuals.

SESAM/SQL-Server (BS2000/OSD)
SQL Reference Manual Part 1: SQL Statements
User Guide

Target group
The manual is intended for all users who wish to process an SESAM/SQL database by means of SESAM/SQL statements.
Contents
The manual describes how to embed SQL statements in COBOL, and the SQL language constructs. The entire set of SQL statements is listed in an alphabetical directory.

SESAM/SQL-Server (BS2000/OSD)
SQL Reference Manual Part 2: Utilities
User Guide

Target group
The manual is intended for all users responsible for SESAM/SQL database administration.
Contents
An alphabetical directory of all utility statements, i.e. statements in SQL syntax implementing the SESAM/SQL utility functions.

SESAM/SQL-Server (BS2000/OSD)
Database Operation
User Guide

Target group
The manual is intended for SESAM/SQL system administrators.
Contents
The manual covers the options available to the system administrator for controlling and monitoring database operation.

SESAM/SQL-Server (BS2000/OSD)
Utility Monitor
User Guide

Target group
The manual is intended for SESAM/SQL-Server database and system administrators.
Contents

The manual describes the utility monitor. The utility monitor can be used to administer the database and the system. One aspect covered is its interactive menu interface.

SESAM/SQL-Server (BS2000/OSD)
Glossary and Master Index
User Guide

Target group
This manual is addressed to anyone who uses or wishes to find out about SESAM/SQL.
Contents
The manual contains all technical terms and keywords relevant for all SESAM/SQL manuals, as well as the keywords for ESQL, UTM, DRIVE and DBA.

SESAM/SQL-Server (BS2000/OSD)
Messages
User Guide

Target group
All users of SESAM/SQL.
Contents
All SESAM/SQL messages, sorted by message number.

SESAM/SQL-Server (BS2000/OSD)
Migrating SESAM Databases and Applications to SESAM/SQL-Server
User Guide

Target group
Users of SESAM/SQL-Server.
Contents
This manual gives an overview of the new concepts and functions. Its primary subject is, however, the difference between the previous and the new SESAM/SQL version(s). It contains all the information a user may require to migrate to SESAM/SQL-Server V2.0.

SESAM/SQL-Server (BS2000/OSD)
Performance
User Guide

Target group
Experienced users of SESAM/SQL.
Contents
The manual covers how to recognize bottlenecks in the behavior of SESAM/SQL and how to remedy this behavior.

ESQL-COBOL (BS2000/OSD)
ESQL-COBOL for SESAM/SQL-Server
User Guide

Target Group
COBOL programmers wishing to work with SESAM/SQL databases using SQL statements.
Contents
The manual describes the structure of an ESQL-COBOL program, how to embed SQL in COBOL, and how to compile, link and start such a program.

***open*UTM** (BS2000/OSD)
Generating and Handling Applications
User Guide

Target group
This manual is intended for application planners, technical programmers, administrators and users of UTM applications.
Contents
The manual describes the generation of UTM applications with distributed processing, the tools available with *open*UTM for this purpose, and the UTM objects created in the course of generation. It also contains all the information necessary for structuring, operating and monitoring a productive UTM application.

***open*UTM**
Concepts and Functions
User Guide

Target group
Anyone who wants information about the functionality and performance capability of *open*UTM.
Contents
The manual contains a general description of all the functions and features of *open*UTM, plus introductory information designed to help first-time users of *open*UTM.

FHS (TRANSDATA)
User Guide

Target group
Programmers
Contents
Program interfaces of FHS for TIAM, DCAM and UTM applications. Generation, application and management of formats.

CRTE (BS2000/OSD)
Common RunTime Environment
User Guide

Target group
This manual addresses all programmers and system administrators in a BS2000 environment.
Contents
It describes the common runtime environment for COBOL85, COBOL2000, C and C++ objects and for "language mixes":
– CRTE components
– ILCS program communication interface
– linkage examples

BS2000/OSD
Softbooks English

Target group
BS2000/OSD users

Contents
The CD-ROM "BS2000/OSD SoftBooks English" contains almost all of the English manuals and README files for the BS2000 system software of the latest BS2000/OSD version and also of the previous versions, including the manuals listed here.
These Softbooks can also be found in the Internet on our manual server. You can browse in any of these manuals or download the entire manual.

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Es gilt folgende Sortierreihenfolge: Symbole vor Ziffern vor Buchstaben. Satzzeichen sind Symbole. Bindestrich und Leerzeichen werden ignoriert. Beispielsweise steht das Stichwort *Datei, Rekonfiguration* vor *Datei 123* vor *Datei-Attribut* und *Datei bearbeiten*.

Contents

SESAM/SQL-Server V3.0A (BS2000/OSD)

CALL DML Applications

Target group
SESAM application programmers
Contents
– CALL DML statements for processing SESAM databases using application programs
– Transaction mode with UTM and DCAM
– Utility routines SEDI61 and SEDI63 for data retrieval and direct updating
– Notes on using both CALL DML and SQL modes

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Submitted by

Comments on SESAM/SQL-Server V3.0A
CALL DML Applications

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