

AS/400 V4R5 Maximum Capacities

Robert Gintowt

IBM Rochester

gintowt@us.ibm.com

July 24, 2000 8:29 a.m.

Contents

Appendix A. AS/400 V4R5 Maximum Capacities	12
Limits for Database and SQL	ii
Limits for Communications	iii
Limits for Work Management and Security	iv
Limits for Save and Restore	1
File System Limits	13
Miscellaneous Limits	14

Tables

1.	DB2 for AS/400—Database Manager Limits	3
2.	DB2 for AS/400—SQL Identifier Limits	5
3.	DB2 for AS/400—Numeric Limits	5
4.	DB2 for AS/400—String Limits	6
5.	DB2 for AS/400—Date and Time Limits	6
6.	DB2 for AS/400—Datalink Limits	7
7.	General Communications Limits	7
8.	SNA Communications Limits	7
9.	TCP/IP Communications Limits	8
10.	OptiConnect Limits	9
11.	Communications Trace Service Tool Limits	10
12.	Work Management Limits	11
13.	Security Limits	11
14.	Save and Restore Limits	12
15.	File System Limits	13
16.	Miscellaneous Limits	14

Preface

The tables in this document list the limits or maximum values corresponding to V4R5. These limits are published as part of the Additional Materials available for the AS/400 System Handbook (GA19-5486) on the Redbooks Web Site at the following URLs:

<ftp://www.redbooks.ibm.com/redbooks/GA195486/limitv45.pdf> (for V4R5)

<ftp://www.redbooks.ibm.com/redbooks/GA195486/limitred.pdf> (for V4R4)

These V4R5 limits are also documented in the Support Line Knowledge Base at

<http://as400service.ibm.com/supporthome.nsf/Document/10000051>

under the topic "Operating System - General" or by searching for document 19690531. Document 15704052 contains limits for V4R4 and document 12761736 contains limits for V4R2.

V4R2 information can also be found in Appendix A of the redbook titled "The System Administrator's Companion to AS/400 Availability and Recovery" (SG24-2161) which can be viewed on the Web at

<http://publib.boulder.ibm.com:80/cgi-bin/bookmgr/BOOKS/SG242161/A.0>

A PDF version of this redbook can be found on the Redbooks Web Site.

Appendix A. AS/400 V4R5 Maximum Capacities

Exceeding system limitations can cause an application or system outage. These limitations can be difficult to predict. However, an administrator can avoid these types of outages by being aware of the system limitations and maximum capacities in advance.

The following tables itemize some of the capacity limitations and restrictions that can affect the availability of large systems and their applications. For example, an on-line application halts when the size of a file or the number of its members reaches the size limitation.

- | These tables list the limits or maximum values corresponding to V4R5. Some of these maximum values are different (lower) on prior releases. Also, there are environments or configurations where the actual limit may be less than the stated maximum. For example, certain high-level languages can have more restrictive limits.

Note

The values listed in these tables represent theoretical limits, not thresholds or recommendations. Approaching some of these limits may be unreasonable and can degrade performance. Therefore, practical limits may be lower, depending on system size, configuration, and application environment.

Limits for Database and SQL

Table 1 (Page 1 of 2). DB2 for AS/400—Database Manager Limits	
DB2 for AS/400—Database Manager Limits	Value
Most columns in a table (number of fields in a record)	8 000
Most columns in a view (number of fields in a record)	8 000
Maximum number of parameters in a function	90
Maximum number of parameters in a procedure ¹	254
Maximum length of a row without LOBs including all overhead (number of bytes in a record)	32 766
Maximum length of a row with LOBs including all overhead (number of bytes in a record)	15 728 640
Maximum size of a table (number of bytes in a database physical file member)	½TB
Maximum size of an index (number of bytes in an access path) ²	1TB
Most rows in a table (number of records in a database physical file member)	4 294 967 288
Longest index key (size of key for database files)	2 000
Most columns in an index key (number of key fields in a database file)	120
Most indexes on a table (number of access paths on a database physical file member)	4 000
Most tables referenced in an SQL statement (number of members that can be joined)	256
Most tables referenced in an SQL view (number of physical file members in a logical file member)	32
Most host variable declarations in a precompiled program ³	Amount of storage
Most host variables in an SQL statement	Amount that can fit within the longest SQL statement of 32 767 bytes
Longest host variable used for insert or update	32 766
Longest SQL statement	32 767
Most elements in a select list ⁴	8 000
Most predicates in a WHERE or HAVING clause	4 690
Maximum number of columns in a GROUP BY clause	120
Maximum total length of columns in a GROUP BY clause	2 000
Maximum number of columns in an ORDER BY clause	10 000
Maximum total length of columns in an ORDER BY clause	10 000
Maximum size of an SQLDA	16 777 215
Maximum number of prepared statements	Amount of storage
Most declared cursors in a program	Amount of storage

Table 1 (Page 1 of 2). DB2 for AS/400—Database Manager Limits	
DB2 for AS/400—Database Manager Limits	Value
Maximum number of cursors opened at one time	Amount of storage
Most tables in a relational database	Amount of storage
Maximum number of constraints on a table	300
Maximum levels allowed for a subselect	32
Maximum length of a comment	2 000
Maximum length of a path	558
Maximum number of rows changed in a unit of work (number of records locked in a single transaction under commitment control)	500 000 000
Maximum number of triggers on a table	6
Maximum number of nested trigger invocations	200
Maximum procedures with result sets waiting to be fetched	100
Maximum size of a single journal receiver	1TB
Maximum sequence number for journal entries	9 999 999 999
Maximum number of objects that can be associated with one journal ⁵	250 000
Maximum number of members allowed on a single APYJRNCHG or RMVJRNCHG command	65 535
Maximum number of remote journal target systems for broadcast mode	255
Maximum number of members in a physical or logical file	32 767
Maximum number of members in a database physical file that can be saved in a single save operation	32 767
Maximum number of database format and directory objects that can be on a system to successfully execute a Reclaim Storage (RCLSTG) command ⁶	1 572 500

¹ Procedures with PARAMETER STYLE SQL are limited to 90 parameters. SQL procedures with PARAMETER STYLE GENERAL are limited to 253. Procedures with PARAMETER STYLE GENERAL WITH NULLS are limited to 254. External procedures with PARAMETER STYLE GENERAL are limited to 255. The maximum number of parameters is also limited by the maximum number of parameters allowed by the licensed program used to compile the external program.

² If ACCPTHSIZ(*MAX4GB) is specified, then the access paths associated with that file can only occupy a maximum of four gigabytes (4294966272 bytes) of auxiliary storage.

³ In RPG/400 and PL/I programs when the old parameter passing technique is used, the limit is approximately 4000. The limit is based on the number of pointers allowed in the program. In all other cases, the limit is based on architectural constraints within the operating system.

⁴ The limit is based on the size of internal structures generated for the parsed SQL statement.

⁵ This maximum includes physical file members whose changes are currently being journaled, members for which journaling was ended while the current receiver was attached, and journal receivers that are or were associated with the journal while the current journal receiver is attached. If the number of objects is larger than this maximum, journaling does not start.

⁶ Directory objects contain information about the relationships between database files. Refer to the Display Database Relations (DSPDDBR) command for more information.

Table 2. DB2 for AS/400—SQL Identifier Limits	
DB2 for AS/400—SQL Identifier Limits	Value
Longest alias name	128
Longest authorization name	10
Longest column label	60
Longest correlation name	128
Longest cursor name	18
Longest host identifier	64
Longest server name	18
Longest SQL routine label	64
Longest statement name	18
Longest table, package, or alias label	50
Longest unqualified collection name	10
Longest unqualified column name	30
Longest unqualified constraint name	128
Longest unqualified data type name	128
Longest unqualified external program name ⁷	10
Longest unqualified function name	128
Longest unqualified nodegroup name	10
Longest unqualified package name	10
Longest unqualified procedure name	128
Longest unqualified specific name	128
Longest unqualified SQL parameter name	30
Longest unqualified SQL variable name	30
Longest unqualified table, view, and index name	128
Unqualified system column name	10
Unqualified system table, view, and index name	10

Table 3 (Page 1 of 2). DB2 for AS/400—Numeric Limits	
DB2 for AS/400—Numeric Limits	Value
Smallest BIGINT value	-9 223 372 036 854 775 808
Largest BIGINT value	+9 223 372 036 854 775 807
Smallest INTEGER value	-2 147 483 648

⁷ For a service program entry point name, the limit is 279. For REXX procedures, the limit is 33.

Table 3 (Page 1 of 2). DB2 for AS/400—Numeric Limits	
DB2 for AS/400—Numeric Limits	Value
Largest INTEGER value	+2 147 483 647
Smallest SMALLINT value	-32 768
Largest SMALLINT value	+32 767
Largest decimal precision	31
Smallest FLOAT value	-1.79x10 ³⁰⁸
Largest FLOAT value	+1.79x10 ³⁰⁸
Smallest positive FLOAT value	+2.23x10 ⁻³⁰⁸
Largest negative FLOAT value	-2.23x10 ⁻³⁰⁸
Smallest REAL value	-3.4x10 ³⁸
Largest REAL value	+3.4x10 ³⁸
Smallest positive REAL value	+1.17x10 ⁻³⁸
Largest negative REAL value	-1.17x10 ⁻³⁸

Table 4. DB2 for AS/400—String Limits	
DB2 for AS/400—String Limits	Value
Maximum length of BLOB	15 728 640
Maximum length of CHAR	32 766
Maximum length of VARCHAR	32 740
Maximum length of CLOB	15 728 640
Maximum length of C NUL-terminated	32 740
Maximum length of GRAPHIC	16 383
Maximum length of VARGRAPHIC	16 370
Maximum length of DBCLOB	7 864 320
Maximum length of C NUL-terminated graphic	16 370
Maximum length of character constant	32 740
Maximum length of a graphic constant	16 370
Longest concatenated character string	32 766
Longest concatenated graphic string	16 370

Table 5 (Page 1 of 2). DB2 for AS/400—Date and Time Limits	
DB2 for AS/400—Date and Time Limits	Value
Smallest DATE value	0001-01-01
Largest DATE value	9999-12-31
Smallest TIME value	00:00:00

Table 5 (Page 1 of 2). DB2 for AS/400—Date and Time Limits	
DB2 for AS/400—Date and Time Limits	Value
Largest TIME value	24:00:00
Smallest TIMESTAMP value	0001-01-01 - 00.00.00.000000
Largest TIMESTAMP value	9999-12-31 - 24.00.00.000000

Table 6. DB2 for AS/400—Datalink Limits	
DB2 for AS/400—Datalink Limits	Value
Maximum length of DATALINK	32 718
Maximum length of DATALINK comment	254

Limits for Communications

Table 7. General Communications Limits	
General Communications Limits	Value
Maximum number of communications configuration objects that can be varied online at IPL	32 767
Maximum number of communications configuration objects that can be in a “varied on” state	64 926
Recommended maximum number of devices allocated to an interactive or communications subsystem	250 to 300
Maximum number of virtual devices that can be specified as automatically configured (QAUTOVRT system value)	32 500 or *NOMAX
Maximum Communications/LAN hardware capabilities	See <i>AS/400 System Handbook</i> , GA19-5486

Table 8 (Page 1 of 2). SNA Communications Limits	
SNA Communications Limits	Value
Maximum number of SNA controllers per LAN line plus the Network controller	256
Maximum number of SNA CDs across a Frame Relay's NWI lines	256
Maximum number of lines per Frame Relay NWI	256
Maximum number of logical channels per X.25 line	256
Maximum number of controllers on SDLC multidrop lines	254
Maximum number of communication arbiters (maximum value of QCMNARB system value)	99
Maximum number of active sessions per APPC mode	512

Table 8 (Page 1 of 2). SNA Communications Limits	
SNA Communications Limits	Value
Maximum number of modes per APPC device (or APPN location) ⁸	14
Maximum combined number of APPC devices (in any state) and APPN devices (in varied on state)	25 300
Maximum number of APPN intermediate sessions	9 999
Maximum number of devices per APPC controller	254
Maximum number of switched lines per APPC controller	64
Maximum size of APPN local location list	476
Maximum size of APPN remote location list	1 898
Maximum size of Asynchronous network address list	294
Maximum size of Asynchronous remote location list	32 000
Maximum size of Retail pass-through list	450
Maximum size of SNA pass-through group	254

Table 9 (Page 1 of 2). TCP/IP Communications Limits	
TCP/IP Communications Limits	Value
Maximum number of interfaces per line	512
Maximum number of interfaces per system	16 384
Maximum number of routes per system	65 535
Maximum number of ports for TCP	65 535
Maximum number of ports for UDP	65 535
Maximum TCP receive buffer size	8MB
Maximum TCP send buffer size	8MB
Maximum size of a transmission unit on an interface	16 388 bytes
Maximum number of TELNET server jobs	100
Maximum number of TELNET server sessions (non-SSL)	Maximum number of interactive jobs
Maximum number of TELNET server sessions using SSL protocol	20 000
Default maximum number of socket and file descriptors per job ⁹	200
Maximum number of socket and file descriptors per job	524 000
Maximum number of socket descriptors on the system	750 000
Maximum size of database files for FTP	1TB
Maximum size of integrated file system files for FTP	Amount of storage

⁸ An APPN location refers to all devices that have the same values for RMTLOCNAME, RMTNETID, and LCLLOCNAME.

Table 9 (Page 1 of 2). TCP/IP Communications Limits	
TCP/IP Communications Limits	Value
Maximum number of recipients for SMTP	14 000
Maximum number of simultaneous inbound connections for SMTP	32 000 (1 connection per prestart job)
Maximum number of simultaneous outbound connections for SMTP	32 000 (1 connection per prestart job plus 1 listening)
Maximum number of MX records handled by MX resolver (Client) for SMTP	80
Maximum document size for SMTP	2.1GB
Maximum number of active threads per HTTP Server	999
Maximum number of connections that can be displayed using WRKTCPSTS or NETSTAT commands	32 767

Table 10. OptiConnect Limits	
OptiConnect Limits	Value
Maximum number of systems that can be connected using OptiConnect	64
Maximum number of logical connection paths that can be established between two systems using OptiConnect	2
Maximum distance between systems that are connected using OptiConnect	500 meters (1063 Mbps) or 2 kilometers (266 Mbps)
Maximum number of active jobs that can communicate with any one system using OptiConnect ¹⁰	16 382
Maximum total number of active jobs on one system that can use OptiConnect ¹⁰	262 135
Maximum number of TCP/IP subnets per system ¹¹	8

⁹ Default can be changed with DosSetRelMaxFH()—Change the Maximum Number of File Descriptors (see *OS/400 UNIX-Type APIs* in the AS/400 Softcopy Library).

¹⁰ The following count as jobs toward OptiConnect job limits: DDM/DRDA source jobs (user jobs), DDM/DRDA target jobs on server, DB2 multisystem system jobs, APPC controllers and TCP/IP interfaces using OptiConnect (type *OPC, count as 2 jobs for each controller or interface), jobs using ObjectConnect over OptiConnect, jobs using OptiMover API, and active Remote Journals. Some of these uses are transient for the duration of a function (for example, ObjectConnect SAVRSTxxx) and some are more long term (for example, DDM conversations until reclaimed by RCLDDMCNV or ending the job).

¹¹ The following count as TPC/IP subnets: Each OptiConnect TCP/IP interface with no associated local interface (ADDTCPIFC keyword LCLIFC(*NONE)). Each unique interface associated with an OptiConnect TCP/IP interface.

Table 11. Communications Trace Service Tool Limits	
Communications Trace Service Tool Limits	Value
Maximum amount of storage allocated for a single communications trace buffer	64MB
Maximum total amount of storage allocated for all communications trace buffers	128MB
Maximum number of active traces per multiline IOP on pre-V4R1 IOP hardware (limit is removed with new V4R1 IOP hardware)	2
Maximum record size when using the TRCTCPAPP trace tool for Host Server and DDM/DRDA Server	6 000 bytes

Limits for Work Management and Security

Table 12. Work Management Limits	
Work Management Limits	Value
Maximum number of jobs on the system	163 520
Maximum number of active subsystems	32 767
Maximum number of jobs in a subsystem	32 767
Maximum number of prestart jobs initially started when subsystem started	9 999
Maximum number of spooled files per job	9 999
Maximum amount of temporary auxiliary storage that can be specified for a job	2TB or *NOMAX
Maximum number of active memory storage pools	64

Table 13. Security Limits	
Security Limits	Value
Maximum number of entries for a user profile ^{12 13 14}	5 000 000
Maximum number of private authorities a user profile can have to successfully save the profile using SAVSYS or SAVSECDTA commands ¹⁴	200 000
Maximum number of user profiles that can be saved using SAVSYS or SAVSECDTA commands ¹⁵	116 500
Maximum number of objects that can be secured by an authorization list	2 097 070
Maximum number of private authorities to an authorization list ¹⁶	4 999 999
Maximum number of entries in a validation list	2 147 483
Maximum number of user profiles on a system	340 000

¹² A user profile contains four categories of entries: 1) every object owned by the profile, 2) every private authority the profile has to other objects, 3) every private authority other profiles have to objects owned by this profile, and 4) every object for which this profile is the primary group. The sum of these categories equals the total number of entries for the profile.

¹³ OS/400 maintains internal user profiles that own objects that are shared or cannot be assigned to a single individual user (for example, QDBSHR owns shared database objects such as database formats, access paths, and so on). These internal user profiles are subject to the same limits as any other user profile on the system.

¹⁴ Using authorization lists or group profiles reduces the number of private authorities and helps avoid this limit (see *Security - Reference*, SC41-5302).

¹⁵ Prior to V4R4, this limit was 58,200 user profiles. PTFs SF52612/SF52500 (V4R3) and SF53772/SF53758 (V4R2) are available to increase this limit to 116,500.

¹⁶ Limit is due to the maximum number of entries allowed for the user profile that owns the authorization list (one less because a category 01 entry is used for the ownership of the authorization list).

Limits for Save and Restore

Table 14. Save and Restore Limits	
Save and Restore Limits	Value
Maximum number of related internal objects that can be saved in a single save operation ¹⁷	65 500
Maximum number of members in a database physical file that can be saved in a single save operation	32 767
Maximum number of database files in a library that can be saved in a single save operation	55 000
Maximum number of private authorities a user profile can have to successfully save the profile using SAVSYS or SAVSECDTA commands ¹⁴	200 000
Maximum number of user profiles that can be saved using SAVSYS or SAVSECDTA commands ¹⁵	116 500
Maximum number of names in a save or restore command specifying which objects or libraries to include or exclude in the save or restore operation ¹⁸	300
Maximum number of concurrent save or restore operations	Limited only by available machine resources
Maximum size of an object that can be saved	1TB
Maximum size of a save file	256GB

¹⁷ Some examples of related objects are:

- All database file objects in a library that are related to each other by dependent logical files.
- All database file objects in a library that are journaled to the same journal when using the save-while-active function.
- All objects in a library when SAVACT(*LIB) is specified.
- All objects in a library when saving to a diskette device.

For most object types, one internal object is saved for each OS/400 object. Some exceptions are:

- Subsystem descriptions:
 - 9 internal objects per subsystem description.
- Database files:
 - At least 1 internal object per physical file member.
 - At least 2 internal objects per member for physical files of TYPE(*DATA) with keyed access paths or constraints.
 - At least 1 internal object per dependent logical file member when ACCPTH(*YES) is specified.

¹⁸ Using generic names to specify groups of objects or libraries can help avoid this limit.

File System Limits

Table 15. File System Limits	
File System Limits	Value
Maximum number of libraries in a library list	43
Maximum number of libraries in the user portion of the library list	25
Maximum number of objects in a library	360 000
Maximum number of documents and folders (DLOs) in a user ASP	349 000
Maximum number of DLOs in a folder	65 510
Maximum number of objects on the system	1 073 741 823
Maximum number of directories in one directory in the "root" (/), QOpenSys, or user-defined file systems	32 765
Maximum number of directories in an ASP	250 000
Maximum number of links for an object in the "root" (/), QOpenSys, or user-defined file systems	32 767
Maximum size of a stream file	256GB
Default maximum number of file and socket descriptors per job ¹⁹	200
Maximum number of file and socket descriptors per job	524 000
Maximums for directory levels, path names, and object attributes and links	See "File System Comparison" in <i>Integrated File System Introduction</i> , SC41-5711

¹⁹ Default can be changed with DosSetRelMaxFH()—Change the Maximum Number of File Descriptors (see *OS/400 UNIX-Type APIs* in the AS/400 Softcopy Library).

Miscellaneous Limits

Table 16. Miscellaneous Limits	
Miscellaneous Limits	Value
Maximum system and I/O hardware configurations and capacities	See <i>AS/400 System Handbook</i> , GA19-5486
Maximum number of DASD arms	1080
Minimum number of DASD arms required for acceptable performance ²⁰	Contact your IBM technical representative
Maximum number of auxiliary storage pools (ASPs)	1 system ASP and 15 user ASPs
Maximum number of logical partitions	24 (one per processor)
Maximum number of cluster nodes	128
Maximum database size for Domino for AS/400	256GB (Domino R5.0) or 4GB (Domino R4.6.2)
Maximum size of a user space ²¹	16 773 120 bytes
Maximum size of a data queue	2GB
Maximum size of QSYSOPR message queue ²²	16MB (75 000 messages)
Maximum number of new messages of any one message type on a message queue	65 535
Maximum number of records for each version of the history log	32 767
Maximum number of input fields that can be specified for a display file	256
Maximum size of files when filing OfficeVision mail locally	16MB

²⁰ IBM employees should refer to current guidelines contained in *AS4ARMCT PACKAGE* on MKTTOOLS.

²¹ Listed size is the maximum when the machine is allowed to choose the alignment. Absolute maximum size of a user space is 16 776 704 bytes.

²² As of V4R3, message queue QSYSOPR is shipped with a message queue full action of *WRAP. When the message queue is full, the oldest informational and answered messages are removed from the message queue to allow space for new messages to be added. If the removing of the informational and answered messages does not provide enough space, then unanswered inquiry messages are removed until there is space to add the new message. The default reply is sent before an unanswered inquiry message is removed. For more information, see the MSGQFULL parameter on the CHGMSGQ command.

Prior to V4R3, when the QSYSOPR message queue gets full, message CPF2460 is issued that states the QSYSOPR message queue could not be extended. PTFs SF44163 (V4R1) and SF45613 (V4R2) are available to avoid this situation and allow the QSYSOPR message queue to wrap. Refer to the PTF cover letters for special instructions.