Transact-SQL (TSQL) Migration Guide

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InterSystems IRIS Data Platform Version 2023.3 2024-05-16

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Planning and Performing TSQL Migration

InterSystems TSQL is an implementation of the Transact-SQL procedural language which supports many of the features of both the Sybase and Microsoft implementations. Transact-SQL is used with Sybase Adaptive Server, Microsoft SQL Server (MSSQL), and other platforms.

Note: Sybase Adaptive Server (ASE) is the implementation primarily described on this page, though much of this information is relevant to any Transact-SQL implementation.

InterSystems TSQL also contains a few proprietary extensions not found in either of these implementations. These are described in Commands and System Stored Procedures.

This document will help you to effectively migrate your schemas, stored procedures and data from a Transact-SQL database application and it will provide you with an understanding of the TSQL (Transact-SQL) implementation for InterSystems IRIS® data platform to maintain and enhance it after the initial migration.

1.1 Why Migrate to InterSystems IRIS?

InterSystems IRIS provides an efficient and modern SQL implementation delivering speed, scale and security to mission-critical applications in many industries. These performance benefits, the vertical and horizontal scalability and enterprise-grade security also apply to TSQL applications migrated to InterSystems IRIS.

All data in an InterSystems IRIS database is stored in efficient, tree-based sparse multidimensional arrays called globals. Because they are accessed directly with no file system layer needed, InterSystems IRIS globals provide very fast, flexible storage and retrieval. Globals underlie the InterSystems IRIS object and SQL interfaces, support the Key/Value and No SQL paradigms, and allow InterSystems IRIS to easily handle dynamic data types such as XML or JSON.

InterSystems SQL provides high-performance access through highly optimized ODBC and JDBC drivers that have been enhanced to fully support TSQL syntax. It also provides a SQL Gateway capability to facilitate accessing and importing data from other relational databases.

1.1.1 Running your TSQL Applications on InterSystems IRIS

When you run TSQL code on the InterSystems IRIS platform, the code is compiled into the corresponding InterSystems SQL and ObjectScript code. ObjectScript is InterSystems object-oriented programming language. The compiled code is run on InterSystems IRIS and available for debugging purposes, if needed. This compilation step is fully automated and not a one-time migration task. The migration effort consists of loading the schema, data and TSQL code from the old environment to InterSystems IRIS. From then on you can continue to use and modify the TSQL application code, simply recompiling it after making any changes.

InterSystems IRIS provides many interfaces for running TSQL code. These interfaces provide a dialect option that specifies either Sybase or MSSQL.

Regardless of which of these interfaces or dialects is used, InterSystems IRIS will only execute the corresponding InterSystems SQL and ObjectScript code. InterSystems IRIS does not run TSQL natively.

1.1.2 Migrating off Sybase Products

The initial implementation of InterSystems TSQL was designed to support the migration of Sybase ASE code. It provides support for the vast majority of native ASE TSQL commands and system stored procedures.

It fully supports or accepts most ASE schema options, including datetime formats. It supports compiling ASE TSQL stored procedure code to InterSystems SQL and ObjectScript.

InterSystems IRIS performance is significantly higher than Sybase ASE when run on the same hardware. InterSystems Mirroring capability offers more robust resiliency than Sybase ASE database replication and InterSystems Enterprise Cache Protocol (ECP) and sharding offer more flexible options for scaling out.

Sybase's other products, Sybase ASA and Sybase IQ, involves slight differences in TSQL support and dialect. While some customers have migrated successfully from Sybase ASA, it is recommended that you work with InterSystems Support when planning such a migration.

While Sybase IQ is well-known for its high performance, customers that have moved their workloads from Sybase IQ to InterSystems IRIS have experienced even higher levels of performance than they did on their previous platform.

1.1.3 Migrating off Microsoft Products

Microsoft SQL Server (MSSQL) and Azure Database use a different TSQL dialect that has evolved significantly since it parted ways with Sybase TSQL. InterSystems IRIS supports a subset of the MSSQL dialect. However, InterSystems IRIS TSQL was principally designed to support migration of code in the Sybase dialect. It provides more limited support for Microsoft TSQL compatibility and migration.

1.2 Planning your Migration

While migrating a TSQL application means you will end up with the same schema, data and application code (but just on a different platform), it is still worthwhile planning this project carefully.

1.2.1 Planning the Infrastructure

InterSystems IRIS typically requires fewer hardware resources than other database platforms to run the same TSQL workload. This means migrating to InterSystems IRIS is an appropriate time to consider the infrastructure on which to run your TSQL application:

- Leverage InterSystems IRIS efficiencies and vertical scalability to determine the minimal hardware for your TSQL application.
- InterSystems IRIS also runs in the cloud, where the different Cloud Service Providers offer a wide range of options to right-size your environment.
- Mirroring offers a robust and proven mechanism to implement your High Availability and Disaster Recovery requirements.

- InterSystems IRIS can use Asynchronous Mirrored Reporting Servers to offload queries from the database server, providing significantly enhanced performance in high query usage systems. A Reporting Server can provide a subset of the data on the database server, if desired.
- For the most demanding workloads, InterSystems IRIS also supports scaling out for user and data volume independently by deploying multiple machines in a cluster.

InterSystems Technology Architects are available for consultation to assist you in this process.

1.2.2 Reviewing your Application Schema and Code

InterSystems IRIS TSQL supports the vast majority of TSQL concepts and language elements and will accept most schema options. Still, it is appropriate to review your TSQL application to determine if it relies on any of the few constructs not currently supported. The easiest way to validate this is by simply importing the TSQL schema and code on IRIS and compile it. The InterSystems IRIS TSQL compiler will flag any issues it finds in the imported code so they can be addressed, either by changing the original TSQL code to use a supported alternative, or by choosing to re-implement specific procedures in ObjectScript.

1.2.2.1 TSQL features not supported on InterSystems IRIS

InterSystems IRIS coverage of TSQL features differs depending on the dialect the code was originally developed for. Due to differences in how schema and aliases are handled, there are some limitations with certain specific handling of SQL aliases as well as schema naming. These can be circumvented by appropriately matching schema names in the DDL, and careful use of mixing table names and aliases in SQL queries.

Many table properties and other schema options are platform-specific. These may not make a difference in the behavior of the table from the user or application point of view. This includes many storage-related properties such as partitioning and compression clauses, but also orthogonal features such as encryption. InterSystems IRIS TSQL will silently accept and ignore many properties that have no impact on behavior, but will report a compilation error when they do.

1.2.2.2 Client access to TSQL code on InterSystems IRIS

InterSystems IRIS TSQL supports a command-line SQL Shell which you can use to issue TSQL commands and queries directly. You must initially set the dialect for the current SQL Shell session to the preferred value. For example, `SET DIALECT = Sybase`.

TSQL commands can also be issued from Java-based applications through the JDBC or ODBC driver by setting the dialect accordingly.

InterSystems SQL provides an even broader set of accessibility options when using InterSystems SQL and ObjectScript, including ultra-fast, native access to the underlying storage paradigm. For further details, refer to InterSystems IRIS documentation.

1.2.3 Reviewing your Data

InterSystems IRIS is a full multi-model database and supports a broad variety of data types. Most data types available in TSQL are also available on InterSystems IRIS and the Data Definition Language (DDL) statements to create tables will automatically map those types appropriately. InterSystems IRIS also supports both traditional row-oriented storage models, as are typical for Sybase ASE, Sybase ASA, and Microsfot SQL Server, and an analytics-focused columnar storage model, as is the case for Sybase IQ.

1.2.4 Project Planning

The following are important consideration when determining the scope of your migration to InterSystems IRIS:

- Availability of TSQL expertise for a general understanding of the code.
- Availability of the original TSQL application developers for functional questions.
- Availability of unit tests or other test scripts to validate the migration.
- Initial assessment of schema and code. Determining complexity and presence of unsupported features.
- Assessing the size of the data set.
- Agreement on your requirements for switching over, either an all-at-once conversion or a phased conversion.

In the process of migration you may use any combination of the following approaches:

- Migrating all TSQL code and then fixing incompatible code.
- Migrating compatible TSQL code and then augmenting with new development in InterSystems SQL and ObjectScript.
- Letting TSQL and IRIS SQL systems run side-by-side, leveraging the benefits of each and keeping the data in sync. InterSystems can assist you in determining what to migrate based upon an agreed-upon level of performance and service.

1.2.5 Testing the Migration

Unit tests are an essential part of any application development project and crucial for testing application code changes as well as upgrades of the underlying infrastructure. As such, they are also extremely valuable when migrating an application to a new platform, such as InterSystems IRIS. For TSQL applications, unit tests written in TSQL can be migrated along with the TSQL application code. Unit tests driven from an external facility, such as Java-based application code or frameworks such as Jenkins, can also be reused as-is.

In testing the migration of TSQL code and data sets the following are important additional considerations:

- Performance tests. Are application response times as good or better than the previous platform?
- Scalability tests. Can I support larger user and/or data volumes compared to the previous platform, optionally engaging additional hardware resources?
- Correctness tests. Some semantics may differ between InterSystems TSQL and the previous platform (as they do between different TSQL implementations), such as the resolution of outer joins in SQL queries offered by Sybase ASE. Correctness tests are particularly important to guarantee users observe the same behavior and results after the migration.

1.3 Executing the Plan

To migrate existing TSQL applications to InterSystems TSQL, you need to perform four operations: configure InterSystems IRIS for TSQL, migrate the TSQL source code, migrate the metadata (DDL), and migrate the data. InterSystems and its implementation partners are available to assist in each of these tasks.

1.3.1 Setting Up the System

Some of InterSystems IRIS default system settings differ from the default configuration of Sybase ASE and other TSQL platforms. InterSystems and professional service partners with TSQL migration experience can provide scripts to prepare a freshly installed InterSystems IRIS instance for use with TSQL applications.

To configure your system for TSQL manually, using the InterSystems IRIS configuration utilities:

- Go into the InterSystems IRIS Management Portal. Select **System Administration**, **Configuration**, **SQL and Object Settings**, then select **TSQL Compatibility**. Here you can specify the dialect (Sybase or MSSQL), and turn on or off the ANSI_NULLS, CASEINSCOMPARE, and QUOTED_IDENTIFIER settings. The default for all three is “off”, which is the appropriate setting for Sybase ASE.
- From the Management Portal, select **System Administration**, **Configuration**, **SQL and Object Settings**, then **SQL**. From here, you can set the **Default Schema**. This is the default schema name (which maps to a package) for all unqualified DDL entities, such as table names and procedure names.
- Set Equal Literal Replacement to OFF. This is the appropriate setting for Sybase ASE.
- Set the default collation sequence to %SQLSTRING. Collation options perform string conversions only for the purpose of index collation; the stored data is not changed. The %SQLSTRING option corresponds to the default binary collation on Sybase ASE. It is important to verify that this setting matches the Sybase sort order. *This step must be done before loading any data*.
- Truncation settings may be required for Sybase implementations where there are trailing spaces in the database at the end of strings. Truncating these strings will allow for proper string matching. See Data Collation and String Truncation.
- Consider using Posix time instead of the default timestamp to increase performance. See Timestamp and Time Precision.
- Temporary tables are fully supported. Their settings should be optimized for speed if they are heavily used. See Settings for Temporary Databases.
- From the Management Portal, select **System Administration**, **Configuration**, **SQL and Object Settings**, then **User DDL Mappings**. You can use this option to map any needed user-defined data types.

1.3.2 Migrating the Code

The initial application migration is simple:

1. *Import the DDL:* Import table and view definitions using either the **%SYSTEM.SQL.Schema.ImportDDL()** method (for single files) or the **$SYSTEM.SQL.Schema.ImportDDLDir()** method (for multiple files in a directory). Within these methods, you set the *DDLMode* parameter to either `"MSSQLServer"` or `"Sybase"`. These methods import DDL statements, as well as DML statements such as INSERT, convert them to equivalent InterSystems IRIS SQL, and execute them. For further details, see Importing SQL Code.

   Alternatively, you can invoke the **$SYSTEM.SQL.Schema.LoadSybase()** or **$SYSTEM.SQL.Schema.LoadMSSQLServer()** method to import the schema. For further details, see Importing SQL Code.

   If the TSQL source contains CREATE PROC statements, then a class method containing the CREATE PROC source is created. InterSystems IRIS places this class method in either an existing class or in a new class whose name is based on the schema and procedure name. If the procedure already exists, then the existing version is replaced by the new version. If a class matching the class name generated from the schema and procedure already exists, then this class name is used — if it was previously generated by the TSQL utility. If not, then a unique class name is generated, based on the schema and procedure name. The resulting class is compiled once the procedure has been successfully created. If logging is requested then the source statements are logged along with the name of the containing class, class method, and the formal arguments generated. Any errors encountered by the process are also reported in the log. If an error is detected during CREATE PROC processing, InterSystems IRIS deletes any new class that was generated for that procedure.
2. *Inspect the log file for errors:* Search by Error #. A summary count of errors and successful imports will appear at the end of the log. In most cases, errors can be worked around or addressed by using information found in this document.
3. *Compile:* When you import DDL, table and view definition compilation is automatically performed. To compile other TSQL source code, it is best to use the command as follows:

ObjectScript

```
DO $SYSTEM.OBJ.CompileAll("-l")
```

The lowercase “L” qualifier flag specifies that locking *is not* applied for the duration of the compile. For a full list of flag qualifiers, call `DO $SYSTEM.OBJ.ShowFlags()`.

1.3.3 Migrating the Data

The following are options for migrating data:

- Set up an SQL Gateway Connection, using either JDBC or ODBC for data export/import. In the Management Portal select **System Administration**, **Configuration**, **Connectivity**, **SQL Gateway Connections**, then select the **Create New Connection** button to define an **SQL Gateway Connection**.
- Use the Data Migration Wizard. In the Management Portal select **System Explorer**, **SQL**, then from the **Wizards** drop-down list select **Data Migration** to configure a Data Migration Wizard. Select an existing SQL Gateway Connection from the drop-down list. This runs a wizard to migrate data from an external source and creates an InterSystems IRIS class definition to store it.
- Use a bulk loader. InterSystems has utilities that understand the various formats in which Sybase stores datetime fields and can normalize these into a standard internal format in InterSystems IRIS. Without these transformations, data load may experience issues with datetime fields, depending on how these are stored in Sybase.

  For a large volume of data, use a bulk loader that provides support for reading Bulk Copy Program (BCP) files, or use your preferred Extract Transform and Load (ETL) utility. InterSystems Support can provide tools for bulk data ingestion. Contact InterSystems Support for further details.

1.3.4 Troubleshooting

Inspect the compile log by turning on the TSQL Trace facility. See TRACE. This produces a log that records a timestamp for each operation, the elapsed time for each operation, a global references count and a %ROWCOUNT. The log provides detailed information by TSQL statement in processed stored procedures.

Additionally, consider retaining cached query source code as well as the generated cached queries to provide detailed information on the compiled code. See Cached Query Source.

1.4 Writing and Executing TSQL on InterSystems IRIS

You can write and execute TSQL using the InterSystems Studio integrated development environment, or by using InterSystems SQL.

1.4.1 Working with TSQL Using an IDE

InterSystems IRIS includes InterSystems Studio, an Integrated Development Environment (IDE) to build and manage your server-side application code. Studio fully supports TSQL development through the ability to include TSQL method bodies in ObjectScript classes and project them as stored procedures accessible through SQL.

You can write and maintain TSQL stored procedures (SPs) in Studio. A TSQL SP can be either a class method or a query. A class method takes parameters and returns a single scalar result, a query takes parameters and returns rows. If you put plain **SELECT** statements into a class method they will be executed but you won't be able to get the rows.

To create a TSQL stored procedure in InterSystems Studio, create a class method marked as a stored procedure using the SqlProc keyword and enter the language as tsql. You can use the following template as a starting point:

```
ClassMethod MyTestMethod() As %Integer
   [ Language = tsql, ReturnResultSets, SqlName=name, SqlProc ]
{
}
```

See the Language, SqlProc, and SqlName keywords for method definition in the *Class Definition Reference*.

You can write and maintain triggers in TSQL. A trigger is a set of instructions that appear in TSQL code that are executed in response to a specified SQL event. You can use the Language=tsql class definition keyword to specify that a trigger is written in TSQL. The UpdateColumnList class definition keyword is only supported for TSQL. Row-level triggers are not supported for TSQL. See "Using Triggers" in the *Using InterSystems SQL* manual.

1.4.2 Working with TSQL Using SQL

As an alternative to developing TSQL code using Studio, TSQL code can be invoked using any of the interfaces through which SQL statements can be issued. TSQL stored procedures can also be created, replaced and dropped through Data Definition Language (DDL) using that same set of interfaces.

- *Using the TSQL Shell*

  The InterSystems TSQL Shell can be used to execute Transact-SQL code directly on InterSystems IRIS. To use the TSQL Shell, invoke the **TSQLShell()** (or **$SYSTEM.SQL.Schema.LoadTSQL()**) method from the Terminal as follows: `DO $SYSTEM.SQL.TSQLShell()`. This invokes the InterSystems SQL Shell and sets its DIALECT configuration parameter to the currently configured TSQL dialect (MSSQL or Sybase). The initial configuration default is MSSQL.

  When entering SQL code interactively, the TSQL Shell supports, but does not require, the semicolon (;) statement delimiter at the end of each SQL statement.

  You can use the Shell's RUN command to execute a TSQL script file. The RUN command displays a series of prompts, including `Please enter the end-of-statement delimiter (Default is 'GO'): GO=>`. This enables you to specify the TSQL semicolon (;) as the statement delimiter in your script file, rather than the InterSystems IRIS default GO statement. See "Using the SQL Shell Interface" in the *Using InterSystems SQL* manual.

- *Using the InterSystems SQL Shell*

  The InterSystems SQL Shell can be used to execute lines of TSQL code by using the SET DIALECT command to set the Shell's dialect to Sybase or MSSQL.

  When the Shell's dialect is set to Sybase or MSSQL, the SQL Shell supports, but does not require, the semicolon (;) statement delimiter at the end of each SQL statement. When the Shell's dialect is set to IRIS, a semicolon (;) statement delimiter results in an SQLCODE -25 error.

  You can use the Shell's RUN command to execute a TSQL script file. The RUN command displays a series of prompts, including `Please enter the end-of-statement delimiter (Default is 'GO'): GO=>`. This enables you to specify the TSQL semicolon (;) as the statement delimiter in your script file, rather than the InterSystems IRIS default GO statement. See "Using the SQL Shell Interface" in the *Using InterSystems SQL* manual.

- *Using the Management Portal SQL Interface*

  In the Management Portal SQL interface, the Dialect option allows you to set the SQL dialect to IRIS, Sybase, or MSSQL. The default is IRIS. Note that the dialect you select becomes the user customized default the next time you access the Management Portal. See "Using the Management Portal SQL Interface" in the *Using InterSystems SQL* manual.

- *Using Dynamic SQL*

  InterSystems IRIS Dynamic SQL, a feature of ObjectScript, can be used to execute TSQL code queries and a limited subset of other DML and DDL statements from ObjectScript code.

- You can create a Dynamic SQL statement class instance, then set the %Dialect property to Sybase or MSSQL. You then prepare and execute a TSQL command within that object instance.
- You can execute Dynamic SQL without creating a statement class instance by invoking the **%SYSTEM.SQL.Prepare()** method which prepares an SQL command, or the **%SYSTEM.SQL.Execute()** method, which both prepares and executes an SQL command. Both of these methods provide a *Dialect* parameter.

See "Using Dynamic SQL" in the *Using InterSystems SQL* manual.

2

InterSystems TSQL Constructs

2.1 Table References

InterSystems TSQL supports table references with the InterSystems IRIS® data platform SQL format:

```
schema.table
```

The only mandatory table reference component is `table`. If the schema is omitted, TSQL uses the default schema name.

Other forms of Transact-SQL may use table references with up to four components, separated by dots: `server.database.owner.table`. Here is how a Transact-SQL table reference is processed:

- The `server.` component, if present, is ignored.
- If the `database.` component is present and the `owner.` component is omitted, `database` is mapped to the *schema* name. Therefore, `database..table` maps to `schema.table`. This conversion is not performed if the database name is 'master'.
- If the `owner.` component is present, it is mapped to the *schema* name.

For the purposes of name translation, a field name has the field suffix removed while translation is performed and then replaced afterwards.

2.2 Temporary Tables

InterSystems TSQL supports `#tablename` temporary tables. A `#tablename` temporary table is visible to the current procedure of the current process. It is also visible to any procedure called from the current procedure. `#tablename` syntax is only supported in TSQL procedures (class methods projected as procedures with language tsql).

A temporary table is defined by using **CREATE TABLE** with a table name starting with "#". The temporary table is created at runtime. A `#tablename` table definition goes out of scope when you exit the procedure. All temporary table definitions go out of scope when the connection is dropped. You can also explicitly delete a temporary table using **DROP TABLE**.

However, if a temporary table is referenced by an active result set, the temporary table may become invisible to the process, but the data and definition are retained until the result set goes out of scope.

A `#tablename` temporary table is visible both to the creating procedure and to any procedures called from that procedure. Temporary tables are visible to nested procedure calls. It is not necessary to declare the temporary table in the called procedure. If the called procedure also creates a temporary table with the same name, InterSystems IRIS uses the most recently

created table definition. Because a temporary table is defined using an ObjectScript local variable, the creation, modification, and deletion of these tables are not journaled transaction events; rolling back the transaction has no effect on these operations.

2.3 System Tables

System tables exist per InterSystems IRIS namespace.

Systypes

Partially supported.

2.4 Transactions

Code generated for **BEGIN TRAN**, **COMMIT** and **ROLLBACK** uses explicit transaction mode, but following a transaction TSQL always restores the mode which was active before the **BEGIN TRAN** statement. TSQL restores this mode when the procedure is exited from, or when a **COMMIT** or **ROLLBACK** is issued, whichever comes first.

2.5 Cursor Name Management

You can declare the same cursor more than once, so long as only one version of the cursor is open at runtime. If the same cursor is declared more than once in a stored procedure, all but the first declaration are associated with renamed cursors. **OPEN**, **FETCH**, **CLOSE**, and **DEALLOCATE** statements are assumed to refer to the most recent **DECLARE** for the given cursor. Note that the lexical position of a statement within a stored procedure is all that is used to match up a cursor name with its **DECLARE** — no account is taken of runtime paths through the code.

Cursors inside queries are named using an extension of the scheme used in InterSystems SQL queries. For example:

TSQL

```
DECLARE C CURSOR FOR SELECT A FROM B
--
OPEN C
FETCH C
CLOSE C
DEALLOCATE C
--
DECLARE C CURSOR FOR SELECT D FROM E
--
OPEN C
FETCH C
CLOSE C
DEALLOCATE C
```

Would be effectively translated to:

TSQL

```
DECLARE C CURSOR FOR SELECT A FROM B
--
OPEN C
FETCH C
CLOSE C
DEALLOCATE C
--
DECLARE Cv2 CURSOR FOR SELECT D FROM E
--
OPEN Cv2
FETCH Cv2
CLOSE Cv2
DEALLOCATE Cv2
```

2.6 SYSOBJECTS References

Commonly, an application will have setup procedures that create tables, views, and the metadata for the application environment. Such procedures will have expressions like:

TSQL

```
IF EXISTS (SELECT * FROM SYSOBJECTS
WHERE ID = OBJECT_ID('People'))
```

This determines if a table exists, in this example. It's usually followed by a `DROP` and `CREATE` statement to reestablish the table metadata.

TSQL procedures and triggers can reference the SYSOBJECTS system table. InterSystems TSQL supports the following columns in the SYSOBJECTS table (%TSQL.sys.objects class properties):

Column	Description
name	Object name.
id	Object Id.
type	Object type: can be one of the following values: K=PRIMARY KEY or UNIQUE constraint; P=stored procedure; RI=FOREIGN KEY constraint; S=system table; TR=trigger; U=user table; V=view.
deltrig	Object ID of a delete trigger if the entry is a table. Table ID of a table if the entry is a trigger.
instrig	Object ID of a table's insert trigger if the entry is a table.
updtrig	Object ID of a table's update trigger if the entry is a table.
parent_obj	Object identification number of parent object. For example, the table ID if a trigger or constraint.
schema	Name of the schema in which the object resides.
parent_obj_name	Object name of parent_obj. If *parent_obj*=0, *parent_obj_name* is the same as *name*.

The SYSOBJECTS table is read-only. The SYSOBJECTS table may be referenced from outside a TSQL procedure or trigger by the name %TSQL_sys.objects. SYSOBJECTS is not supported for tables mapped across namespaces.

Note: InterSystems IRIS provides the %Dictionary package of class objects that can perform the same operations as SYSOBJECTS references. For further details, refer to the %Dictionary package in the *InterSystems Class Reference*.

3

InterSystems TSQL Language Elements

This page describe the specific TSQL language elements for InterSystems IRIS® data platform.

3.1 Literals

3.1.1 String Literals

A string literal must be delimited by quote characters. The preferred delimiter characters are single quote characters. You can also use double quote characters as string delimiters if you specify `SET DELIMITED_IDENTIFER OFF`. Otherwise, double quote characters are parsed as delimiting an identifier.

If you delimit a string literal with single quote characters, you can include literal double quote characters within the string. To include a literal single quote character within the string, double it by typing two single quotes.

A string containing literal single quotes, such as `'this is an ''embedded'' string'`, is compiled by InterSystems IRIS to single quotes within double quotes: `"this is an 'embedded' string"`.

3.1.2 Empty Strings

When migrating Transact-SQL code to InterSystems TSQL, it may be necessary to redefine the empty string. You can do this by setting the following InterSystems IRIS system global:

```
^%SYS("sql","sys","namespace",nspace,"empty string")
```

All of these specified values are keyword literals, except *nspace*, which is a namespace name specified as a quoted string.

CAUTION: Changing the empty string definition should be done with extreme caution. It can result in data containing different representations for an empty string. It can also cause existing programs to fail when executed in this namespace. After defining the empty string, you must purge all cached queries and recompile all classes and routines for that namespace that use the former empty string definition.

The following ObjectScript example changes the empty string definition for the SAMPLES namespace. It first sets the empty string value to a single blank space. It then sets the empty string value to the non-printing character represented by the ASCII code 0. (This example then immediately resets the empty string value to the InterSystems IRIS default):

ObjectScript

```
SET ^%SYS("sql","sys","namespace","SAMPLES","empty string")=" "
WRITE !,"Empty string set to:"
ZZDUMP ^%SYS("sql","sys","namespace","SAMPLES","empty string")
SET ^%SYS("sql","sys","namespace","SAMPLES","empty string")=$CHAR(0)
WRITE !,"Empty string set to:"
ZZDUMP ^%SYS("sql","sys","namespace","SAMPLES","empty string")
SET ^%SYS("sql","sys","namespace","SAMPLES","empty string")=""
WRITE !,"Empty string reset to:"
ZZDUMP ^%SYS("sql","sys","namespace","SAMPLES","empty string")
WRITE !,!,"End of sample program"
```

3.1.3 NULL

In TSQL a NULL supplied to a boolean operation returns as FALSE, as shown in the following example:

```
DECLARE @var BINARY(1)
SELECT @var=NULL
IF @var PRINT "true" ELSE PRINT "false"
```

In Sybase dialect, NULL is equal to NULL. A NULL=NULL comparison returns TRUE, and a NULL != NULL comparison returns FALSE.

In MSSQL dialect, a comparison of NULL with any value returns FALSE. Thus NULL=NULL and NULL != NULL comparisons both return FALSE.

```
DECLARE @var BINARY(1)
SELECT @var=NULL
IF @var=NULL PRINT "true" ELSE PRINT "false"
```

In Sybase dialect, NULL is not equal to any value. Therefore, Not Equals (!=) comparison involving NULL and any boolean, numeric, or string value (including the empty string ("")) returns TRUE. All Equals (=), Greater Than (>) or Less Than (<) comparisons return FALSE.

In MSSQL dialect, NULL cannot be compared to a value. Thus all Equals (=), Not Equals (!=), Greater Than (>) or Less Than (<) comparisons return FALSE.

In a TSQL string concatenation operation, NULL is equivalent to an empty string. In a TSQL arithmetic operation, NULL is equivalent to 0.

3.1.4 Hexadecimal

InterSystems TSQL automatically converts hexadecimal numeric literals in TSQL source code to the corresponding decimal (base-10) numeric literals.

3.1.5 Reserved Words

InterSystems TSQL cannot use as identifiers the SQL Server reserved words. InterSystems TSQL can use InterSystems SQL reserved words (that are not also SQL Server reserved words) if the **QUOTED_IDENTIFIER** SQL configuration setting is set to Yes.

3.1.6 Comments, Blank Lines, and Semicolons

InterSystems TSQL supports both single-line and multi-line comments.

- A single line comment continues to the rest of the line. When used in the TSQL shell, a comment does not encompass the end-of-line qualifier, such as /x or /c. InterSystems TSQL supports both — and // as single-line comment delimiters.
- A multi-line comment begins with /* and ends with */. A comment can include nested /* ... */ comments.

TSQL

```
PRINT 'these are comments'
-- this is a single-line comment
// this is a single-line comment
/* This is a multi-line comment
The command
PRINT 'do not print'
is part of the comment and is not executed */
```

3.1.6.1 TSQL-only Statements

InterSystems TSQL provides the means to include executable statements within InterSystems IRIS TSQL code which are parsed as nonexecutable comments in Transact-SQL. A statement prefixed with two hyphens and a vertical bar is parsed by InterSystems IRIS as an executable statement. Sybase Adaptive Server and Microsoft SQL Server consider this to be a Transact-SQL comment.

TSQL

```
PRINT 'any context'
-- PRINT 'commented out'
--| PRINT 'InterSystems only'
```

3.1.6.2 Semicolons

You can specify a blank line by using either two hyphens or a semicolon.

A semicolon either before or after a TSQL statement is ignored. They are supported for compatibility with Transact-SQL code, such as stored procedures, that ends statements with a semicolon.

TSQL

```
PRINT 'no semicolon'
--
PRINT 'trailing semicolon';
;
;PRINT 'leading semicolon'
```

3.2 Variables

TSQL uses DECLARE to declare the data type of a local variable. TSQL uses SET to set the value of a local variable.

A local variable name must be a valid identifier. An at sign (@) prefix to an identifier specifies that it is the name of a local variable.

Case-sensitivity differs for TSQL dialects:

- Sybase: local variable names are case-sensitive.
- MSSQL: local variable names are not case-sensitive.

InterSystems IRIS local variable names are case-sensitive.

3.3 Identifiers

An identifier is a name for a TSQL object, such as a table, column, view, key, index, trigger, or stored procedure. Naming conventions for identifiers are as follows:

- The first character of an identifier must be a letter, an underscore (_) or a percent (%) character.
- Subsequent characters of an identifier may be letters, numbers, underscores (_), dollar signs ($), or pound signs (#).
- Identifiers can be of any length, but must be unique within their first 30 characters.
- Identifiers are not case-sensitive.
- An identifier cannot be an SQL reserved word.
- A pound sign (#) prefix to an identifier specifies that it is the name of a temporary table.
- An at sign (@) prefix to an identifier specifies that it is the name of a variable.

Some identifiers are qualified with a schema name. For example, schema.tablename or schema.storedprocedure. If the schema name is omitted, the identifier is unqualified. TSQL resolves unqualified identifiers by using either the system-wide default schema (for DDL) or the schemaPath property (for DML), which provides a search path of schemas to check for the specified table name or stored procedure name.

3.3.1 Delimited and Quoted Identifiers

A delimited identifier is not restricted by the naming conventions of ordinary identifiers. For example, a delimited identifier can be the same word as an SQL reserved word; a delimited identifier can contain space characters.

By default, both square brackets and double quotation marks can be used to delimit an identifier. These delimiters are interchangeable; you can define a delimited identifier by enclosing it with square brackets, and invoke the same delimited identifier by specifying it enclosed with double quotation marks.

You can specify a quoted identifier if the **QUOTED_IDENTIFIER** SQL configuration setting is set to Yes. You specify a quoted identifier by enclosing it in double quotation marks. When QUOTED_IDENTIFIER is on, double quotes are parsed as delimiting an identifier. When QUOTED_IDENTIFIER is off, double quotes are parsed as alternative delimiters for string literals. The preferable delimiters for string literals are single quotes. A quoted identifier can contain any characters, including blank spaces.

3.4 Data Types

The following data types are supported for local variables and table columns. These data types are supported in that they are parsed as valid data types; however, no range or value validation is performed.

BINARY(*n*) and VARBINARY(*n*). The (*n*) size specification is mandatory.

BIT

BOOLEAN

CHAR and VARCHAR

CHAR(*n*), NCHAR(*n*), VARCHAR(*n*), and NVARCHAR(*n*)

VARCHAR(MAX), and NVARCHAR(MAX). By default, these map to %Stream.GlobalCharacter.

DATETIME and SMALLDATETIME

DECIMAL, DECIMAL(*p*), and DECIMAL(*p*,*s*). Where *p* and *s* are integers specifying precision (total digits) and scale (decimal digits).

DOUBLE and DOUBLE PRECISION

FLOAT and FLOAT(*n*)

INT, BIGINT, SMALLINT, and TINYINT

MONEY and SMALLMONEY

NATIONAL

NUMERIC, NUMERIC(*p*), and NUMERIC(*p*,*s*). Where *p* and *s* are integers specifying precision (total digits) and scale (decimal digits).

REAL

TIMESTAMP

Note: The Microsoft SQL Server TIMESTAMP data type is *not* used for date or time information. It is an integer counter of the number of times a record is inserted or updated in a table. It should not be confused with the InterSystems SQL and ODBC TIMESTAMP data type, which represents a date and time in YYYY-MM-DD HH:MM:SS.nnnnnnnnn format. In TSQL, use DATETIME and SMALLDATETIME for date and time values.

ROWVERSION

SQL_VARIANT

The following SQL Server data types are supported in a specific context:

CURSOR

NTEXT, TEXT By default, these map to %Stream.GlobalCharacter.

IMAGE

TABLE

The following are not implemented:

- UNIQUEIDENTIFIER stored as a 16-byte binary string. Instead use VARCHAR(32) as the data type for a globally unique ID.
- `SQL92` and `TSQL` options
- `UPDATE OF`

3.5 Operators

3.5.1 Arithmetic and Equality Operators

InterSystems TSQL supports + (addition), – (subtraction), * multiplication, / division, and % modulo arithmetic operators.

InterSystems TSQL supports the following equality and comparison operators:

- = (equal to)
- <> (not equal to) and != (not equal to)
- < (less than), !< (not less than), <= (less than or equal to)
- > (greater than), !> (not greater than), >= (greater than or equal to)

When performing equality comparisons (= or <>) between date values with different data types, all date and time values are compared using the TIMESTAMP data type. Thus two dates in different formats can be meaningfully compared. A date value declared as a STRING data type can be compared to a date value declared as a DATETIME data type.

3.5.2 Concatenation Operator

InterSystems TSQL supports the + (plus sign) as both a concatenation operator and the addition operator. The plus sign functions as a concatenation operator with strings. You can concatenate several strings together using this operator. If all item are strings, TSQL performs concatenation; however, if one of the items is a number, TSQL performs addition, treating non-numeric strings as 0.

'world'+'wide'+'web' concatenates to 'worldwideweb'

'world'+'33'+'web' concatenates to 'world33web'

'world'+33+'web' performs addition (0+33+0=33)

In a TSQL string concatenation operation, NULL is equivalent to an empty string. In a TSQL arithmetic operation, NULL is equivalent to 0. Note that because the plus sign (+) is used for both concatenation and addition, the data type declaration of the NULL variable is critical. The following examples all return “bigdeal”:

```
DECLARE @var1 BINARY(1)
DECLARE @var2 VARCHAR(10)
SELECT @var1=NULL,@var2=NULL
PRINT "big"+NULL+"deal"
PRINT "big"+@var1+"deal"
PRINT "big"+@var2+"deal"
```

The following example returns 0; it treats the + as an arithmetic operator and interprets the argument as 0 + 0 + 0 = 0:

```
DECLARE @var1 INT
SELECT @var1=NULL
PRINT "big"+@var1+"deal"
```

InterSystems TSQL also supports || as a concatenation operator.

3.5.3 Comparison Operators

3.5.3.1 BETWEEN

InterSystems TSQL supports the **BETWEEN** range check operator of the form: `BETWEEN num1 AND num2`. **BETWEEN** is inclusive of the specified range limits.

3.5.3.2 IS NULL

InterSystems TSQL supports the IS NULL match operator. A variable is NULL if it has been declared but not assigned a value, or if it has been explicitly specified as NULL. The empty string is not NULL.

3.5.3.3 LIKE

InterSystems TSQL supports the LIKE pattern match operator. LIKE performs not case-sensitive matching of letters. InterSystems TSQL also supports NOT LIKE.

3.5.4 NOT Logical Operator

The NOT logical operator inverts the truth value of the statement that follows it. For example, `IF NOT EXISTS(...)`. NOT is not case-sensitive.

3.5.5 Bitwise Logical Operators

InterSystems TSQL supports the AND (&), OR (|), XOR (^), and NOT (~) bitwise operators for the integer data type. The decimal integers are converted to binary, the logical operation is performed, and the resulting binary is converted to a decimal integer value. The NOT (~) operator is a unary operator that inverts bits.

4

TSQL Commands

This page lists the supported TSQL commands for InterSystems IRIS® data platform in the following groups:

- Data Definition Language (DDL) statements:

  ALTER TABLE, CREATE TABLE, DROP TABLE

  CREATE INDEX, DROP INDEX

  CREATE TRIGGER, DROP TRIGGER

  CREATE VIEW, DROP VIEW

  Parsed but ignored: CREATE DATABASE, DROP DATABASE
- Data Management Language (DML) statements:

  INSERT, UPDATE, DELETE, TRUNCATE TABLE

  READTEXT, WRITETEXT, UPDATETEXT
- Query statements:

  SELECT, JOIN, UNION, FETCH cursor
- Flow of control statements:

  IF, WHILE, CASE, GOTO, WAITFOR
- Assignment statements:

  DECLARE, SET
- Transaction statements:

  SET TRANSACTION ISOLATION LEVEL, BEGIN TRANSACTION, COMMIT, ROLLBACK, LOCK TABLE

  Parsed but ignored: SAVE TRANSACTION
- Procedure statements

  CREATE PROCEDURE, DROP PROCEDURE

  CREATE FUNCTION, ALTER FUNCTION, DROP FUNCTION

  RETURN, EXECUTE, EXECUTE IMMEDIATE, CALL
- Other statements

  CREATE USER, GRANT, REVOKE, PRINT, RAISERROR, UPDATE STATISTICS
- InterSystems IRIS extensions

OBJECTSCRIPT, IMPORTASQUERY

InterSystems IRIS implementation of TSQL accepts, but does not require, a semicolon command terminator. When importing TSQL code to InterSystems SQL, semicolon command terminators are stripped out.

4.1 Data Definition Language (DDL) Statements

The following DDL statements are supported.

4.1.1 CREATE TABLE

Defines a table, its fields, and their data types and constraints.

```
CREATE TABLE [schema. | #]tablename (fieldname datatype constraint [,...])
```

Specify *tablename* as described in Table References.

A **CREATE TABLE** can create a temporary table by prefixing a # character to the table name. A temporary table can only be defined from a stored procedure; you cannot define a temporary table from Dynamic SQL outside of a stored procedure. To create a fully-qualified temporary table name, use quotes around each name element such as the following: `"SQLUser"."#mytemp"`.

A valid table name must begin with a letter, an underscore character (_), or a # character (for a local temporary table). Subsequent characters of a table name may be letters, numbers, or the #, $, or _ characters. Table names are not case-sensitive.

A field name must be a valid TSQL identifier. A field name can be delimited using square brackets. This is especially useful when defining a field that has the same name as a reserved word. The following example defines two fields named Check and Result:

TSQL

```
CREATE TABLE mytest ([Check] VARCHAR(50),[Result] VARCHAR(5))
```

The optional CONSTRAINT keyword can be used to specify a user-defined constraint name for a field constraint or a table constraint. You can specify multiple `CONSTRAINT name type` statements for a field.

InterSystems SQL does not retain constraint names. Therefore these names cannot be used by a subsequent ALTER TABLE statement.

The table field constraints DEFAULT, IDENTITY, NULL, NOT NULL, PRIMARY KEY, [FOREIGN KEY] REFERENCES (the keywords FOREIGN KEY are optional), UNIQUE, CLUSTERED, and NONCLUSTERED are supported. The table constraint FOREIGN KEY REFERENCES is supported.

The field definition DEFAULT values can include the following TSQL functions: CURRENT_TIMESTAMP, CURRENT_USER, GETDATE, HOST_NAME, ISNULL, NULLIF, and USER.

The field definition IDENTITY constraint is supported and assigned a system-generated sequential integer. The IDENTITY arguments *seed* and *increment* are parsed, but ignored.

The TSQL **CREATE TABLE** command can create a sharded table. The syntax for the SHARD clause is the same as for the InterSystems SQL CREATE TABLE statement:

```
SHARD [ KEY fieldname { , fieldname2 } ] [ COSHARD [ WITH ] [(] tablename [)] ]
```

The CHECK field constraint is not supported. If a CHECK constraint is encountered while compiling TSQL source InterSystems IRIS generates an error message indicating that CHECK constraints are not supported. This error is logged in the compile log (if active), and the source is placed in the unsupported log (if active).

If the table already exists, an SQLCODE -201 error is issued.

The following Dynamic SQL example creates a temporary table named #mytest with four fields, populates it with data, then displays the results. The LastName field has multiple constraints. The FirstName field takes a default. The DateStamp field takes a system-defined default:

ObjectScript

```
SET sql=9
SET sql(1)="CREATE TABLE #mytest (MyId INT PRIMARY KEY,"
SET sql(2)="LastName VARCHAR(20) CONSTRAINT unq_lname UNIQUE "
SET sql(3)="  CONSTRAINT nonull_lname NOT NULL,"
SET sql(4)="FirstName VARCHAR(20) DEFAULT '***TBD***',"
SET sql(5)="DateStamp DATETIME DEFAULT CURRENT_TIMESTAMP)"
SET sql(6)="INSERT INTO #mytest(MyId,LastName,FirstName) VALUES (1224,'Smith','John')"
SET sql(7)="INSERT INTO #mytest(MyId,LastName) VALUES (1225,'Jones')"
SET sql(8)="SELECT MyId,FirstName,LastName,DateStamp FROM #mytest"
SET sql(9)="DROP TABLE #mytest"
SET statement=##class(%SQL.Statement).%New()
SET statement.%Dialect="MSSQL"
SET status=statement.%Prepare(.sql)
WRITE status,!
SET result=statement.%Execute()
DO result.%Display()
```

4.1.1.1 Parsed But Ignored

The table constraint clauses WITH, ON, and TEXTIMAGE ON are parsed for compatibility, but are ignored. The *index_options* clause for the UNIQUE or PRIMARY KEY constraint is parsed for compatibility, but is ignored.

The following SQL Server parenthesized WITH options in a table constraint are parsed but ignored: ALLOW_PAGE_LOCKS, ALLOW_ROW_LOCKS, DATA_COMPRESSION, FILLFACTOR, IGNORE_DUP_KEY, PAD_INDEX, and STATISTICS_NORECOMPUTE.

The field constraints CLUSTERED and NONCLUSTERED are parsed for compatibility, but are ignored.

4.1.2 ALTER TABLE

Modifies the definition of a table, its fields, and their data types and constraints.

The following syntactical forms are supported:

```
ALTER TABLE tablename ADD fieldname datatype [DEFAULT value]
     [{UNIQUE | NOT NULL} | CONSTRAINT constraintname {UNIQUE | NOT NULL} ]
ALTER TABLE tablename ALTER COLUMN fieldname newdatatype
ALTER TABLE tablename DROP COLUMN fieldname [,fieldname2]
ALTER TABLE tablename ADD tableconstraint FOR fieldname
ALTER TABLE tablename DROP tableconstraint
ALTER TABLE tablename DROP FOREIGN KEY role
ALTER TABLE tablename ADD CONSTRAINT constraint DEFAULT defaultvalue FOR fieldname
ALTER TABLE tablename ADD CONSTRAINT constraint FOREIGN KEY
ALTER TABLE tablename DROP CONSTRAINT constraint
```

Specify *tablename* as described in Table References.

- **ALTER TABLE...ADD *fieldname*** can add a field definition or a comma-separated list of field definitions:
  - DEFAULT is supported.
  - NOT NULL is supported if the table contains no data. If the table contains data, you can only specify NOT NULL if the field also specifies a DEFAULT value.
  - UNIQUE is parsed but ignored. To establish a unique constraint use the CREATE INDEX command with the UNIQUE keyword.

The full supported syntax for **ALTER TABLE...ADD *fieldname*** is as follows:

```
ALTER TABLE tablename
   [ WITH CHECK | WITH NOCHECK ]
  ADD fieldname datatype [DEFAULT value]
     [{UNIQUE | NOT NULL} | CONSTRAINT constraintname {UNIQUE | NOT NULL} ]
     [ FOREIGN KEY (field1[,field2[,...]])
     REFERENCES tablename(field1[,field2[,...]]) ]
```

WITH CHECK | WITH NOCHECK is parsed by InterSystems IRIS, but is ignored. In Transact-SQL, WITH CHECK | WITH NOCHECK provides an execution time check of existing data for a new or newly enabled constraint. InterSystems TSQL does not specifically support that, although InterSystems SQL will check existing data against a new constraint.

The Sybase PARTITION BY clause is not supported.

- **ALTER TABLE...ALTER COLUMN *fieldname datatype*** can change the data type of an existing field. This command completes without error when the specified *datatype* is the same as the field's existing data type.
- **ALTER TABLE...DROP [COLUMN] *fieldname*** can drop a defined field or a comma-separated list of defined fields. The keyword **DELETE** is a synonym for the keyword **DROP**.
  - Sybase: the COLUMN keyword is not permitted, the CONSTRAINT keyword is required: ALTER TABLE...DROP *fieldname*, CONSTRAINT *constraint*
  - MSSQL: the COLUMN keyword is required, the CONSTRAINT keyword is optional: ALTER TABLE...DROP COLUMN *fieldname*, *constraint*
- **ALTER TABLE...DROP [CONSTRAINT] *constraintname*** can drop a constraint from a field. The keyword **DELETE** is a synonym for the keyword **DROP**.
  - Sybase: the CONSTRAINT keyword is required.
  - MSSQL: the CONSTRAINT keyword is optional.
- **ALTER TABLE...ADD CONSTRAINT...DEFAULT** syntax does not create a field constraint. Instead, it performs the equivalent of an **ALTER TABLE...ALTER COLUMN...DEFAULT** statement. This means that InterSystems IRIS establishes the specified field default as the field property's initial expression. Because no field constraint is defined, this "constraint" cannot be subsequently dropped or changed.

  CHECK | NOCHECK CONSTRAINT is not supported by InterSystems IRIS TSQL. Specifying this CHECK or NOCHECK keyword generates an error message.

4.1.3 DROP TABLE

Deletes a table definition.

```
DROP TABLE [IF EXISTS] tablename
```

Deletes a table definition. You can delete both regular tables and temporary tables. (Temporary table names begin with a '#' character.) **DROP TABLE** ignores a nonexistent temporary table name and completes without error.

Specify *tablename* as described in Table References.

If *tablename* has an associated view, you must delete the view before you can delete the table.

The IF EXISTS clause is parsed but ignored.

4.1.4 CREATE INDEX

Creates an index for a specified table or view.

```
CREATE [UNIQUE] INDEX indexname ON tablename (fieldname [,fieldname2])
```

You can create an index on a field or a comma-separated list of fields.

You can create an index on the IDKEY (which is treated as a clustered index), on an IDENTITY field (which create an index on the %%ID field), on the Primary Key, or on other fields.

Specify *tablename* as described in Table References.

The UNIQUE keyword creates a unique value constraint index for the specified field(s).

The following Transact-SQL features are parsed, but ignored:

- The CLUSTERED/NONCLUSTERED keywords. Other than the IDKEY, which is implicitly treated as a clustered index, InterSystems TSQL does not support clustered indexes.
- The ON *dbspace* clause.
- The ASC/DESC keywords.
- The INCLUDE clause.
- WITH clause options, such as WITH FILLFACTOR=*n* or WITH DROP_EXISTING=ON. The comma-separated list of WITH clause options can optionally be enclosed in parentheses.
- The ON filegroup or IN dbspace-name clause.

The following Transact-SQL features are not currently supported:

- Sybase index types.
- The IN *dbspace* clause.
- The NOTIFY *integer* clause.
- The LIMIT *integer* clause.
- Using a function name as an alternative to a field name.

The ALTER INDEX statement is not supported.

4.1.5 DROP INDEX

Deletes an index definition. You can delete a single index or a comma-separated list of indexes, using either of the following syntax forms:

```
DROP INDEX tablename.indexname [,tablename.indexname]
DROP INDEX indexname ON tablename [WITH (...)] [,indexname ON tablename [WITH (...)] ]
```

tablename is the name of the table containing the indexed field. Specify *tablename* as described in Table References. Specifying a #temptable is only permitted when the current namespace is part of a shard cluster.

indexname is the name of the index. It can be a regular identifier or a quoted identifier.

The WITH (...) clause, with any value within the parentheses, is accepted by syntax checking for compatibility, but is not validated and performs no operation.

The IF EXISTS clause is not supported.

4.1.6 CREATE TRIGGER

Creates a statement-level trigger.

```
CREATE TRIGGER triggername ON tablename
[WITH ENCRYPTION]
{FOR | AFTER | INSTEAD OF} {INSERT | DELETE | UPDATE}
[WITH APPEND]
[NOT FOR REPLICATION]
AS tsql_trigger_code
```

You can create a trigger for one event (INSERT), or for a comma-separated list of events (INSERT,UPDATE).

Specify *tablename* as described in Table References.

The FOR, AFTER, and INSTEAD OF keywords are synonyms. A trigger is always pulled after the event operation is performed.

If there are multiple triggers for the same event or comma-separated list of events they are executed in the order the triggers were created.

The following clauses are parsed but ignored: WITH ENCRYPTION, WITH APPEND, NOT FOR REPLICATION.

InterSystems TSQL does not support row-level triggers.

You cannot include a CREATE TRIGGER statement in CREATE PROCEDURE code.

4.1.7 DROP TRIGGER

Deletes a trigger definition.

```
DROP TRIGGER [owner.]triggername
```

4.1.8 CREATE VIEW

Creates a view definition.

```
CREATE VIEW [owner.]viewname
    [WITH {ENCRYPTION | SCHEMABINDING | VIEW_METADATA}]
    AS select_statement
   [WITH CHECK OPTION]
```

A *viewname* must be a unique TSQL identifier. Specify *viewname* as described in Table References. If the view already exists, an SQLCODE -201 error is issued. A *viewname* can be a delimited identifier. For example, `CREATE VIEW Sample.[Name/Age View]`.

By default, the view fields have the same names as the fields in the SELECT table. To specify different names for the view fields, specify field aliases in the SELECT statement. These aliases are used as the view field names:

TSQL

```
CREATE VIEW NameAgeV
AS SELECT Name AS FullName,Age AS Years FROM Sample.Person
```

You can specify a WITH clause with a single keyword or a comma-separated list of keywords. For example: `WITH SCHEMABINDING, ENCRYPTION, VIEW_METADATA`. The ENCRYPTION, SCHEMABINDING, and VIEW_METADATA keywords are parsed but ignored.

The *select_statement* can only include an ORDER BY clause if this clause is paired with a TOP clause. If you wish to include all of the rows in the view, you can pair an ORDER BY clause with a TOP ALL clause. You can include a TOP

clause without an ORDER BY clause. However, if you include an ORDER BY clause without a TOP clause, an SQLCODE -143 error is generated.

The *select_statement* can contain a UNION or UNION ALL.

The optional WITH CHECK OPTION clause prevents an update through the view that makes the record inaccessible to that view. It does this by checking the WITH clause in the SELECT statement. WITH CHECK OPTION binds to InterSystems SQL using the default of CASCADE.

The ALTER VIEW statement is not supported.

4.1.9 DROP VIEW

Deletes a view definition.

```
DROP VIEW viewname [,viewname2 [,...] ]
```

You can delete a single view, or a comma-separated list of views. Specify *viewname* as described in Table References.

DROP VIEW is not an all-or-nothing operation. It deletes existing views in the list of views until it encounters a nonexistent view in the list. At that point the delete operation stops with an SQLCODE -30 error.

The IF EXISTS clause is not supported.

4.1.10 CREATE DATABASE

CREATE DATABASE syntax is parsed to provide compatibility. No functionality is provided.

```
CREATE DATABASE dbname
```

Only this basic CREATE DATABASE syntax is parsed.

Sybase additional CREATE DATABASE clauses are not supported.

MSSQL attach a database and create a database snapshot syntax options are not supported.

The ALTER DATABASE statement is not supported.

4.1.11 DROP DATABASE

DROP DATABASE syntax is parsed to provide compatibility. No functionality is provided.

```
DROP DATABASE dbname
```

4.2 Data Management Language (DML) Statements

- TSQL can resolve an unqualified table name using a schema search path for a single DML statement in Dynamic SQL.
- TSQL *cannot* resolve an unqualified table name using a schema search path for multiple DML statements in Dynamic SQL. This includes multiple statements such as an explicit BEGIN TRANSACTION followed by a single DML statement.

4.2.1 DELETE

Deletes rows of data from a table. Both **DELETE** and **DELETE ... FROM** are supported:

```
DELETE FROM tablename  WHERE condition
DELETE FROM tablename FROM matchtablename WHERE tablename.fieldname = matchtablename.fieldname
```

Only very simple theta joins are supported (the `FROM table` clause is transformed into nested subqueries).

You can specify how **DELETE** executes by providing one or more execution options as a comma-separated list. You provide these options in a comment with the following specific syntax:

```
/* IRIS_DELETE_HINT: option,option2 */
```

Where *option* can be the following: %NOCHECK, %NOFPLAN, %NOINDEX, %NOLOCK, %NOTRIGGER, %PROFILE, %PROFILE_ALL. Refer to the InterSystems SQL DELETE command for details.

You can provide optimization hints to the **DELETE** FROM clause as a comma-separated list. You provide these hints in a comment with the following specific syntax:

```
/* IRIS_DELETEFROM_HINT: hint,hint2 */
```

Where *hint* can be the following: %ALLINDEX, %FIRSTTABLE *tablename*, %FULL, %INORDER, %IGNOREINDICES, %NOFLATTEN, %NOMERGE, %NOSVSO, %NOTOPOPT, %NOUNIONOROPT, and %STARTTABLE. Refer to the InterSystems SQL FROM clause for details.

The following *table_hints* are parsed but ignored: FASTFIRSTROW, HOLDINDEX, INDEX(name), NOLOCK, PAGLOCK, READCOMMITTED, READPAST, READUNCOMMITTED, REPEATABLEREAD, ROWLOCK, SERIALIZABLE, SHARED, TABLOCK, TABLOCKX, UPDLOCK, XLOCK. Table hints can be optionally preceded by the WITH keyword, and, if WITH is specified, optionally enclosed in parentheses. A list of table hints can be separated by either commas or blank spaces.

DELETE sets the @@ROWCOUNT system variable to the number of rows deleted, and the @@IDENTITY system variable to the IDENTITY value of the last row deleted.

A **DELETE** that has a @@ROWCOUNT of more than 100,000 automatically invokes UPDATE STATISTICS to optimize the table for future queries.

You can use either **DELETE** or TRUNCATE TABLE to delete all rows from a table. **DELETE** sets @@ROWCOUNT to the number of rows deleted. **TRUNCATE TABLE** is more efficient, but does not preserve the number of rows deleted; it sets @@ROWCOUNT to -1. **DELETE** does not reset the RowID counter and other row counters; **TRUNCATE TABLE** resets these counters.

The following options are not supported:

- MSSQL rowset functions.
- MSSQL `OPTION` clause.

4.2.2 INSERT

Inserts rows of data into a table. The following syntactic forms are supported:

```
INSERT [INTO] tablename (fieldname[,fieldname2[,...]]) VALUES (list_of_values)
INSERT [INTO] tablename (fieldname[,fieldname2[,...]]) SELECT select_list
```

The INTO keyword is optional. Specify *tablename* as described in Table References.

For the VALUES syntax, the VALUES keyword is mandatory for both MSSQL and Sybase. The (*fieldname*) list is optional if the *list_of_values* lists all user-specified fields in the order defined in the table. If field names are specified, the *list_of_values* is a comma-separated list of values that matches the list of field names in number and data type.

You can specify how **INSERT** executes by providing one or more execution options as a comma-separated list. You provide these options in a comment with the following specific syntax:

```
/* IRIS_INSERT_HINT: option,option2 */
```

Where *option* can be the following: %NOCHECK, %NOFPLAN, %NOINDEX, %NOLOCK, %NOTRIGGER, %PROFILE, %PROFILE_ALL. Refer to the InterSystems SQL INSERT command for details.

The following *table_hints* are parsed but ignored: FASTFIRSTROW, HOLDINDEX, INDEX(name), NOLOCK, PAGLOCK, READCOMMITTED, READPAST, READUNCOMMITTED, REPEATABLEREAD, ROWLOCK, SERIALIZABLE, SHARED, TABLOCK, TABLOCKX, UPDLOCK, XLOCK. Table hints can be optionally preceded by the WITH keyword, and, if WITH is specified, optionally enclosed in parentheses. A list of table hints can be separated by either commas or blank spaces.

INSERT sets the @@ROWCOUNT system variable to the number of rows inserted, and the @@IDENTITY system variable to the IDENTITY value of the last row inserted.

An **INSERT** that has a @@ROWCOUNT of more than 100,000 automatically invokes UPDATE STATISTICS to optimize the table for future queries.

The following options are not supported:

- `(fieldname) DEFAULT VALUES` or `(fieldname) VALUES (DEFAULT)`. A field's default value is used when the field is not specified in the **INSERT** statement.
- `(fieldname) EXECUTE procname`.
- Sybase insert load option clauses: LIMIT, NOTIFY, SKIP, or START ROW ID.
- Sybase insert select load option clauses: WORD SKIP, IGNORE CONSTRAINT, MESSAGE LOG, or LOG DELIMITED BY.
- Sybase LOCATION clause.
- MSSQL `INSERT TOP` clause.
- MSSQL rowset functions.

4.2.3 UPDATE

Updates values of existing rows of data in a table.

```
UPDATE tablename SET fieldname=value [,fieldname2=value2[,...]]
   [FROM tablename [,tablename2]] WHERE fieldname=value

UPDATE tablename SET fieldname=value[,fieldname2=value2[,...]]
   WHERE [tablename.]fieldname=value
```

These syntactic forms are vendor-specific:

- Sybase: the optional FROM keyword syntax is used to specify an optional table (or joined tables) used in a condition. Only very simple theta joins are supported (the `FROM table` clause is transformed into nested subqueries).
- MSSQL: the *tablename.fieldname* syntax is used to specify an optional table used in a condition.

The *value* data type and length must match the *fieldname* defined data type and length. A *value* can be a expression that resolves to a literal value or it can be the NULL keyword. It cannot be the DEFAULT keyword.

Specify *tablename* as described in Table References.

UPDATE supports the use of a local variable on the left-hand-side of a SET clause. This local variable can be either instead of a field name or in addition to a field name. The following example shows a SET to a field name, a SET to a local variable, and a SET to both a field name and a local variable:

```
UPDATE table SET x=3,@v=b,@c=Count=Count+1
```

You can specify how **UPDATE** executes by providing one or more execution options as a comma-separated list. You provide these options in a comment with the following specific syntax:

```
/* IRIS_UPDATE_HINT: option,option2 */
```

Where *option* can be the following: %NOCHECK, %NOFPLAN, %NOINDEX, %NOLOCK, %NOTRIGGER, %PROFILE, %PROFILE_ALL. Refer to the InterSystems SQL UPDATE command for details.

You can provide optimization hints to the **UPDATE** FROM clause as a comma-separated list. You provide these hints in a comment with the following specific syntax:

```
/* IRIS_UPDATEFROM_HINT: hint,hint2 */
```

Where *hint* can be the following: %ALLINDEX, %FIRSTTABLE *tablename*, %FULL, %INORDER, %IGNOREINDICES, %NOFLATTEN, %NOMERGE, %NOSVSO, %NOTOPOPT, %NOUNIONOROPT, and %STARTTABLE. Refer to the InterSystems SQL FROM clause for details.

The following *table_hints* are parsed but ignored: FASTFIRSTROW, HOLDINDEX, INDEX(name), NOLOCK, PAGLOCK, READCOMMITTED, READPAST, READUNCOMMITTED, REPEATABLEREAD, ROWLOCK, SERIALIZABLE, SHARED, TABLOCK, TABLOCKX, UPDLOCK, XLOCK. Table hints can be optionally preceded by the WITH keyword, and, if WITH is specified, optionally enclosed in parentheses. A list of table hints can be separated by either commas or blank spaces.

UPDATE sets the @@ROWCOUNT system variable to the number of rows updated, and the @@IDENTITY system variable to the IDENTITY value of the last row updated.

An **UPDATE** that has a @@ROWCOUNT of more than 100,000 automatically invokes UPDATE STATISTICS to optimize the table for future queries.

The following Dynamic SQL example shows a simple **UPDATE** operation:

ObjectScript

```
SET sql=9
SET sql(1)="CREATE TABLE #mytest (MyId INT PRIMARY KEY,"
SET sql(2)="LastName VARCHAR(20) CONSTRAINT nonull_lname NOT NULL,"
SET sql(3)="FirstName VARCHAR(20) DEFAULT '***TBD***')"
SET sql(4)="INSERT INTO #mytest(MyId,LastName,FirstName) VALUES (1224,'Smith','John')"
SET sql(5)="INSERT INTO #mytest(MyId,LastName) VALUES (1225,'Jones')"
SET sql(6)="INSERT INTO #mytest(MyId,LastName) VALUES (1226,'Brown')"
SET sql(7)="UPDATE #mytest SET FirstName='Fred' WHERE #mytest.LastName='Jones'"
SET sql(8)="SELECT FirstName,LastName FROM #mytest ORDER BY LastName"
SET sql(9)="DROP TABLE #mytest"
SET statement=##class(%SQL.Statement).%New()
SET statement.%Dialect="MSSQL"
SET status=statement.%Prepare(.sql)
WRITE status,!
SET result=statement.%Execute()
DO result.%Display()
```

The following options are not supported:

- Sybase `ORDER BY` clause.
- MSSQL `OPTION` clause.
- MSSQL `TOP` clause.

- MSSQL rowset functions.

4.2.4 READTEXT

Reads data from a stream field.

```
READTEXT tablename.fieldname textptr offset size
```

The MSSQL **READTEXT** statement returns stream data from a field of a table. It requires a valid text pointer value, which can be retrieved using the **TEXTPTR** function, as shown in the following example:

```
DECLARE @ptrval binary(16);
SELECT @ptrval = TEXTPTR(Notes) FROM Sample.Person
READTEXT Sample.Person.Notes @ptrval 0 0
```

The *textptr* must be declared as binary. A *textptr* is only defined for a text field that is not null. You can specify an initial non-null value for a text field using the INSERT statement.

The *offset* can be 0, a positive integer value, or NULL: 0 reads from the beginning of the text. A positive integer reads from the *offset* position. NULL reads from the end of the text; that is, it completes successfully but returns no value.

The *size* can be 0 or a positive integer value, or NULL: 0 reads all characters from the *offset* position to the end of the text. A positive integer reads the *size* number of characters from the *offset* position. NULL completes successfully but returns no value.

The MSSQL HOLDLOCK keyword is parsed but ignored.

4.2.5 WRITETEXT

Writes data to a stream field, replacing the existing data value.

```
WRITETEXT tablename.fieldname textptr value
```

The MSSQL **WRITETEXT** statement writes data to a stream field of a table. It requires a valid text pointer value, which can be retrieved using the **TEXTPTR** function, as shown in the following example:

TSQL

```
DECLARE @ptrval binary(16);
SELECT @ptrval = TEXTPTR(Notes) FROM Sample.Person
WRITETEXT Sample.Person.Notes @ptrval 'This is the new text value'
```

The *textptr* must be declared as binary. A *textptr* is only defined for a text field that is not null. You can specify an initial non-null value for a text field using the INSERT statement.

The MSSQL BULK keyword is not supported.

The MSSQL WITH LOG keyword phrase is parsed but ignored.

4.2.6 UPDATETEXT

Updates data in a stream field.

```
UPDATETEXT tablename.fieldname textptr offset deletelength value
```

The MSSQL **UPDATETEXT** statement updates stream data from a field of a table. It requires a valid text pointer value, which can be retrieved using the **TEXTPTR** function. The following example updates the contents of the Notes stream data field by inserting the word 'New' at the beginning of the existing data value:

```
DECLARE @ptrval binary(16);
SELECT @ptrval = TEXTPTR(Notes) FROM Sample.Person
WRITETEXT Sample.Person.Notes @ptrval 0 0 'New'
```

The *textptr* must be declared as binary. A *textptr* is only defined for a text field that is not null. You can specify an initial non-null value for a text field using the INSERT statement.

The *offset* can be an integer value or NULL: 0 inserts the *value* at the beginning of the existing text. NULL inserts the *value* at the end of the existing text.

The *deletelenth* can be an integer value or NULL: 0 or NULL deletes no existing characters from the *offset* position before inserting the *value*. A positive integer deletes that number of existing characters from the *offset* position before inserting the *value*.

The MSSQL BULK keyword is not supported.

The MSSQL WITH LOG keyword phrase is parsed but ignored.

4.2.7 TRUNCATE TABLE

Deletes all of the data from a table.

```
TRUNCATE TABLE tablename
```

Invokes the InterSystems SQL TRUNCATE TABLE command, which deletes all rows from the specified table and resets the RowId (ID), IDENTITY, and SERIAL (%Counter) row counters and the stream field OID counter values. **TRUNCATE TABLE** does not preserve the number of rows deleted; it sets @@ROWCOUNT to -1.

You can specify how **TRUNCATE TABLE** executes by providing one or more execution options as a comma-separated list. You provide these options in a comment with the following specific syntax:

```
/* IRIS_DELETE_HINT: option,option2 */
```

Where *option* can be the following: %NOCHECK, %NOLOCK. Refer to the InterSystems SQL TRUNCATE TABLE for details.

4.3 Query Statements

4.3.1 SELECT

```
SELECT  [DISTINCT | ALL]
  [TOP [(]{ int | @var | ? | ALL}[)]]
  select-item {,select-item}
  [ [fieldname=IDENTITY(n)] INTO [#]copytable]
  [FROM tablename [[AS] t-alias] [,tablename2 [[AS] t-alias2]] ]
  [[WITH] [(] tablehint=val [,tablehint=val] [)] ]
  [WHERE condition-expression]
  [GROUP BY scalar-expression]
  [HAVING condition-expression]
  [ORDER BY item-order-list [ASC | DESC] ]
```

The above SELECT syntax is supported. The following features are not supported:

- `TOP nn PERCENT` or `TOP WITH TIES`

- OPTION
- WITH CUBE
- WITH ROLLUP
- GROUP BY ALL
- GROUP WITH
- COMPUTE clause
- FOR BROWSE

TOP nn specifies the number of rows to retrieve. InterSystems TSQL supports TOP nn with a integer, ?, local variable, or the keyword ALL. The TOP argument can be enclosed in parentheses TOP (nn). These parentheses are retained, preventing preparser substitution. If SET ROWCOUNT specifies fewer rows than TOP nn, the SET ROWCOUNT value is used. The following Dynamic SQL example shows the use of TOP with a local variable:

ObjectScript

```
SET sql=3
SET sql(1)="DECLARE @var INT"
SET sql(2)="SET @var=4"
SET sql(3)="SELECT TOP @var Name,Age FROM Sample.Person"
SET statement=##class(%SQL.Statement).%New()
SET statement.%Dialect="MSSQL"
SET status=statement.%Prepare(.sql)
SET result=statement.%Execute()
DO result.%Display()
```

The *select-item* list can contain the following:

- field names, functions, and expressions
- the **$IDENTITY** pseudo-field name, which always returns the RowID value, regardless of the field name assigned to the RowID.
- an asterisk: **SELECT *** is supported. The asterisk means to select all fields in the specified table. You can qualify the asterisk with the table name or table alias: **SELECT mytable.***.
- a subquery
- stream fields. A **SELECT** on a stream field returns the OREF (object reference) of the opened stream object.

An INTO clause can be used to copy data from an existing table into a new table. By default, **SELECT** creates the INTO table with the same field names and data types as the fields selected from the source table. The INTO table cannot already exist. This INTO table can be a permanent table, or a temporary table, as shown in the following examples:

TSQL

```
SELECT Name INTO Sample.NamesA_G FROM Sample.Person WHERE name LIKE '[A-G]%'
```

TSQL

```
SELECT Name INTO #MyTemp FROM Sample.Person WHERE name LIKE '[A-G]%'
SELECT * FROM #MyTemp
```

You can specify a different name for an INTO table field by using a field alias, as shown in the following example:

TSQL

```
SELECT Name AS Surname INTO Sample.NamesA_G FROM Sample.Person WHERE name LIKE '[A-G]%'
```

An INTO clause can contain an optional IDENTITY field definition, which adds the specified field as an IDENTITY field (with *n* precision) to the table created by the INTO clause.

An INTO clause cannot be used when the SELECT is a subquery or is part of a UNION.

The FROM clause is not required. A **SELECT** without a FROM clause can be used to assign a value to a local variable, as follows:

TSQL

```
DECLARE @myvar INT
SELECT @myvar=1234
PRINT @myvar
```

The FROM clause supports table hints with either of the following syntactic forms:

```
FROM tablename (INDEX=indexname)
FROM tablename INDEX (indexname)
```

Table hints can be optionally preceded by the WITH keyword, and optionally enclosed in parentheses. A list of table hints can be separated by either commas or blank spaces. The following table hints are parsed but ignored: FASTFIRSTROW, HOLDINDEX, NOLOCK, PAGLOCK, READCOMMITTED, READPAST, READUNCOMMITTED, REPEATABLEREAD, ROWLOCK, SERIALIZABLE, SHARED, TABLOCK, TABLOCKX, UPDLOCK, XLOCK.

You can provide optimization hints to the **SELECT** FROM clause as a comma-separated list. You provide these hints in a comment with the following specific syntax:

```
/* IRIS_SELECTFROM_HINT: hint,hint2 */
```

Where *hint* can be the following: %ALLINDEX, %FIRSTTABLE *tablename*, %FULL, %INORDER, %IGNOREINDICES, %NOFLATTEN, %NOMERGE, %NOSVSO, %NOTOPOPT, %NOUNIONOROPT, and %STARTTABLE. Refer to the InterSystems SQL FROM clause for details.

A WHERE clause can use AND, OR, and NOT logic keywords. It can group multiple search conditions using parentheses. The WHERE clause supports the following search conditions:

- Equality comparisons: = (equals), <> (not equals), < (less than), > (greater than), <= (less than or equals), >= (greater than or equals).
- IS NULL and IS NOT NULL comparisons.
- BETWEEN comparisons: `Age BETWEEN 21 AND 65` (inclusive of 21 and 65); `Age NOT BETWEEN 21 AND 65` (exclusive of 21 and 65). BETWEEN is commonly used for a range of numeric values, which collate in numeric order. However, BETWEEN can be used for a collation sequence range of values of any data type. It uses the same collation type as the field it is matching against. By default, string data types collate as not case-sensitive.
- IN comparisons: `Home_State IN ('MA','RI','CT')`.
- LIKE and NOT LIKE comparisons, specified as a quoted string. The comparison string can contain wildcards: _ (any single character); % (any string); [abc] (any value in the set specified as a list of items); [a-c] (any value in the set specified as a range of items). InterSystems TSQL does not support the ^ wildcard. A LIKE comparison can include an ESCAPE clause, such as the following: `WHERE CategoryName NOT LIKE 'D\_%' ESCAPE '\'`.
- EXISTS comparison check: used with a subquery to test whether the subquery evaluates to the empty set. For example `SELECT Name FROM Sample.Person WHERE EXISTS (SELECT LastName FROM Sample.Employee WHERE LastName='Smith')`. In this example, all Names are returned from Sample.Person if a record with LastName='Smith' exists in Sample.Employee. Otherwise, no records are returned from Sample.Person.
- ANY and ALL comparison check: used with a subquery and an equality comparison operator. The SOME keyword is a synonym for ANY.

WHERE clause and HAVING clause comparisons are not case-sensitive.

A HAVING clause can be specified after a GROUP BY clause. The HAVING clause is like a WHERE clause that can operate on groups, rather than on the full data set. HAVING and WHERE use the same comparisons. This is shown in the following example:

TSQL

```
SELECT Home_State, MIN(Age) AS Youngest,
  AVG(Age) AS AvgAge, MAX(Age) AS Oldest
 FROM Sample.Person
 GROUP BY Home_State
 HAVING Age < 21
 ORDER BY Youngest
```

The following Dynamic SQL example selects table data into a result set:

ObjectScript

```
  SET sql=7
  SET sql(1)="CREATE TABLE #mytest (MyId INT PRIMARY KEY,"
  SET sql(2)="LastName VARCHAR(20),"
  SET sql(3)="FirstName VARCHAR(20))"
  SET sql(4)="INSERT INTO #mytest(MyId,LastName,FirstName) VALUES (1224,'Smith','John')"
  SET sql(5)="INSERT INTO #mytest(MyId,LastName,FirstName) VALUES (1225,'Jones','Wilber')"
  SET sql(6)="SELECT FirstName,LastName FROM #mytest"
  SET sql(7)="DROP TABLE #mytest"
  SET statement=##class(%SQL.Statement).%New()
  SET statement.%Dialect="MSSQL"
  SET status=statement.%Prepare(.sql)
  SET result=statement.%Execute()
  DO result.%Display()
```

The following Dynamic SQL example selects a single field value into a local variable:

ObjectScript

```
  SET sql=9
  SET sql(1)="CREATE TABLE #mytest (MyId INT PRIMARY KEY,"
  SET sql(2)="LastName VARCHAR(20),"
  SET sql(3)="FirstName VARCHAR(20))"
  SET sql(4)="INSERT INTO #mytest(MyId,LastName,FirstName) VALUES (1224,'Smith','John')"
  SET sql(5)="INSERT INTO #mytest(MyId,LastName,FirstName) VALUES (1225,'Jones','Wilber')"
  SET sql(6)="DECLARE @nam VARCHAR(20)"
  SET sql(7)="SELECT @nam=LastName FROM #mytest"
  SET sql(8)="PRINT @nam"
  SET sql(9)="DROP TABLE #mytest"
  SET statement=##class(%SQL.Statement).%New()
  SET statement.%Dialect="MSSQL"
  SET status=statement.%Prepare(.sql)
  DO statement.%Execute()
```

An ORDER BY clause can specify ascending (ASC) or descending (DESC) order. The default is ascending. Unlike InterSystems SQL, an ORDER BY may be used in subqueries and in queries that appear in expressions. For example:

TSQL

```
SET @var = (SELECT TOP 1 name FROM mytable ORDER BY name)
```

4.3.2 JOIN

JOIN (equivalent to INNER JOIN), INNER JOIN, and LEFT JOIN supported. Parentheses can be used to rationalize parsing of multiple joins.

Sybase legacy *= and =* outer joins are supported.

4.3.3 UNION

A union of two (or more) **SELECT** statements is supported. InterSystems TSQL supports **UNION** and **UNION ALL**. If you specify **UNION ALL**, only the first **SELECT** can specify an INTO table. This INTO table can be a defined table, or a temporary table generated from the **SELECT** field list.

4.3.4 FETCH Cursor

The **OPEN**, **FETCH**, **CLOSE**, and **DEALLOCATE** commands are mainly supported. The following features are not supported:

- `OPEN/FETCH/CLOSE @local`
- `FETCH` followed by any qualifier other than `NEXT` (the qualifier can be omitted).
- Note that `DEALLOCATE` is supported, but that, by design, it generates no code.

4.4 Flow of Control Statements

4.4.1 IF

Executes a block of code if a condition is true.

The **IF** command is supported with four syntactic forms:

IF...ELSE syntax:

```
IF condition
statement
[ELSE statement]
```

IF...THEN...ELSE single-line syntax:

```
IF condition THEN statement [ELSE statement]
```

ELSEIF...END IF syntax:

```
IF condition THEN
statements
{ELSEIF condition THEN statements}
 [ELSE statements]
END IF
```

ELSE IF (SQL Anywhere) syntax:

```
IF condition THEN statement
{ELSE IF condition THEN statement}
[ELSE statement]
```

The first syntactic form is the TSQL standard format. No THEN keyword is used. You may use white space and line breaks freely. To specify more than one *statement* in a clause you must use BEGIN and END keywords to demarcate the block of statements. The ELSE clause is optional. This syntax is shown in the following example:

ObjectScript

```
SET sql=4
SET sql(1)="DECLARE @var INT"
SET sql(2)="SET @var=RAND()"
SET sql(3)="IF @var<.5 PRINT 'The Oracle says No'"
SET sql(4)="ELSE PRINT 'The Oracle says Yes' "
SET statement=##class(%SQL.Statement).%New()
SET statement.%Dialect="MSSQL"
SET status=statement.%Prepare(.sql)
SET result=statement.%Execute()
DO result.%Display()
```

The second syntactic form is single-line syntax. The THEN keyword is required. A line break restriction requires that `IF condition THEN statement` all be on the same line, though only the first keyword of the *statement* must be on that line. Otherwise, you may use white space and line breaks freely. To specify more than one *statement* in a clause you must use BEGIN and END keywords to demarcate the block of statements. The ELSE clause is optional. This syntax is shown in the following example:

ObjectScript

```
SET sql=3
SET sql(1)="DECLARE @var INT "
SET sql(2)="SET @var=RAND() "
SET sql(3)="IF @var<.5 THEN PRINT 'No' ELSE PRINT 'Yes' "
SET statement=##class(%SQL.Statement).%New()
SET statement.%Dialect="MSSQL"
SET status=statement.%Prepare(.sql)
SET result=statement.%Execute()
DO result.%Display()
```

The third syntactic form provides an ELSEIF clause. You can specify zero, one, or more than one ELSEIF clauses, each with its own *condition* test. Within an IF, ELSEIF, or ELSE clause you can specify multiple statements. BEGIN and END keywords are permitted but not required. A line break restriction requires a line break between `IF condition THEN` and the first *statement*. Otherwise, you may use white space and line breaks freely. The ELSE clause is optional. The END IF keyword clause is required. This syntax is shown in the following example:

ObjectScript

```
SET sql=14
SET sql(1)="DECLARE @var INT "
SET sql(2)="SET @var=RAND() "
SET sql(3)="IF @var<.2 THEN "
SET sql(4)="PRINT 'The Oracle' "
SET sql(5)="PRINT 'says No' "
SET sql(6)="ELSEIF @var<.4 THEN "
SET sql(7)="PRINT 'The Oracle' "
SET sql(8)="PRINT 'says Possibly' "
SET sql(9)="ELSEIF @var<.6 THEN "
SET sql(10)="PRINT 'The Oracle' "
SET sql(11)="PRINT 'says Probably' "
SET sql(12)="ELSE PRINT 'The Oracle' "
SET sql(13)="PRINT 'says Yes' "
SET sql(14)="END IF"
SET statement=##class(%SQL.Statement).%New()
SET statement.%Dialect="MSSQL"
SET status=statement.%Prepare(.sql)
SET result=statement.%Execute()
DO result.%Display()
```

The fourth syntactic form is compatible with SQL Anywhere. It provides an ELSE IF clause (note space between keywords). You can specify zero, one, or more than one ELSE IF clauses, each with its own *condition* test. To specify more than one *statement* in a clause you must use BEGIN and END keywords to demarcate the block of statements. You may use white space and line breaks freely. The ELSE clause is optional. This syntax is shown in the following example:

ObjectScript

```
SET sql=6
SET sql(1)="DECLARE @var INT "
SET sql(2)="SET @var=RAND() "
SET sql(3)="IF @var<.2 THEN PRINT 'The Oracle says No'"
SET sql(4)="ELSE IF @var<.4 THEN PRINT 'The Oracle says Possibly'"
SET sql(5)="ELSE IF @var<.6 THEN PRINT 'The Oracle says Probably'"
SET sql(6)="ELSE PRINT 'The Oracle says Yes'"
SET statement=##class(%SQL.Statement).%New()
SET statement.%Dialect="MSSQL"
SET status=statement.%Prepare(.sql)
SET result=statement.%Execute()
DO result.%Display()
```

4.4.2 WHILE

Repeatedly executes a block of code while a condition is true.

```
WHILE condition BEGIN statements END
```

The BREAK keyword exits the WHILE loop.

The CONTINUE keyword immediately returns to the top of the WHILE loop.

The BEGIN and END keywords are required if *statements* is more than one command.

The following example returns four result sets, each containing a pair of records in ascending ID sequence:

```
DECLARE @n INT;
SET @n=0;
WHILE @n<8 BEGIN
      SELECT TOP 2 ID,Name FROM Sample.Person WHERE ID>@n
      SET @n=@n+2
      END;
```

4.4.3 CASE

Returns a value from the first match of multiple specified values.

```
CASE expression WHEN value THEN rtnval
[WHEN value2 THEN rtnval2] [...]
[ELSE rtndefault]
END
```

The WHEN *value* must be a simple value. It cannot be a boolean expression.

The ELSE clause is optional. If no WHEN clause is satisfied and the ELSE clause is not provided, the **CASE** statement returns *expression* as NULL.

For example:

SQL

```
SELECT CASE Name WHEN 'Fred Rogers' THEN 'Mr. Rogers'
                WHEN 'Fred Astare' THEN 'Ginger Rogers'
                ELSE 'Somebody Else' END
       FROM Sample.Person
```

The returned value does not have to match the data type of *expression*.

CASE parses but ignores `WHEN NULL THEN rtnval` cases.

4.4.4 GOTO and Labels

InterSystems TSQL supports the **GOTO** command and labels. A label must be a valid TSQL identifier followed by a colon (:). A **GOTO** reference to a label does not include the colon.

4.4.5 WAITFOR

Used to delay execution until a specific elapse of time or clock time.

```
WAITFOR DELAY timeperiod
WAITFOR TIME clocktime
```

timeperiod is the amount of time to wait before resuming execution, expressed as 'hh:mm[:ss[.fff]] Thus `WAITFOR DELAY '00:00:03'` provides a time delay of 3 seconds; `WAITFOR DELAY '00:03'` provides a time delay of 3 minutes; `WAITFOR DELAY '00:00:00.9'` provides a time delay of nine-tenths of a second. Note that the fractional second divider is a period, not a colon.

clocktime is the time at which to resume execution, expressed as 'hh:mm[:ss[.fff]], using a 24-hour clock. Thus `WAITFOR TIME '14:35:00'` resumes execution at 2:35pm; `WAITFOR TIME '00:00:03'` resumes execution at 3 seconds after midnight.

The following options are not supported:

- Sybase CHECK EVERY clause.
- Sybase AFTER MESSAGE BREAK clause.
- MSSQL RECEIVE clause.

4.5 Assignment Statements

4.5.1 DECLARE

Declares the data type for a local variable.

```
DECLARE @var [AS] datatype [ = initval]
```

Only the form which declares local variables is supported; cursor variables are not supported. The AS keyword is optional. Unlike InterSystems SQL, you must declare a local variable before you can set it.

@var can be any local variable name. Sybase local variable names are case-sensitive. MSSQL local variable names are not case-sensitive.

The *datatype* can be any valid data type, such as CHAR(12) or INT. TEXT, NTEXT, and IMAGE data types are not allowed. For further details on data types, see TSQL Constructs.

The optional *initval* argument allows you to set the initial value of the local variable. You can set it to a literal value or to any of the following: NULL, USER, CURRENT DATE (or CURRENT_DATE), CURRENT TIME (or CURRENT_TIME), CURRENT TIMESTAMP (or CURRENT_TIMESTAMP), or CURRENT_USER. The DEFAULT and CURRENT_DATABASE keywords are not supported. Alternatively, you can set the value of a local value using the SET command or the SELECT command. For example:

```
DECLARE @c INT;
SELECT @c=100;
```

You can specify multiple local variable declarations as a comma-separated list. Each declaration must have its own data type and (optionally) its own initial value:

```
DECLARE @a INT=1,@b INT=2,@c INT=3
```

4.5.2 SET

Assigns a value to a local variable or an environment setting.

Used to assign a value to a local variable:

TSQL

```
DECLARE @var CHAR(20)
SET @var='hello world'
```

Used to set an environment setting:

```
SET option ON
```

These settings have immediate effect at parse time, whether inside a stored procedure or not. The change persists until another **SET** command alters it – even if the **SET** is made inside a stored procedure, and accessed outside the SP or in another SP.

The following **SET** environment settings are supported:

- `SET ANSI_NULLS` Permitted values are `SET ANSI_NULLS ON` and `SET ANSI_NULLS OFF`. If `ANSI_NULLS OFF`, *a*=*b* is true if (*a*=*b* OR (*a* IS NULL) AND (*b* IS NULL)). See the ANSI_NULLS TSQL system-wide configuration setting.
- `SET DATEFIRST integer` specifies which day is treated as the first day of the week. Permitted values are 1 through 7, with 1=Monday and 7=Sunday. The default is 7.
- `SET IDENTITY_INSERT` Permitted values are `SET IDENTITY_INSERT ON` and `SET IDENTITY_INSERT OFF`. If ON, an INSERT statement can specify an identity field value. This variable applies exclusively to the current process and cannot be set on linked tables. Therefore, to use this option you should define a procedure in TSQL to perform both the SET IDENTITY_INSERT and the INSERT, then link the procedure and execute the procedure in InterSystems IRIS via the gateway.
- `SET NOCOUNT` Permitted values are `SET NOCOUNT ON` and `SET NOCOUNT OFF`. When set to ON, messages indicating the number of rows affected by a query are suppressed. This can have significant performance benefits.
- `SET QUOTED_IDENTIFIER` Permitted values are `SET QUOTED_IDENTIFIER ON` and `SET QUOTED_IDENTIFIER OFF`. When SET QUOTED_IDENTIFIER is on, double quotes are parsed as delimiting a quoted identifier. When SET QUOTED_IDENTIFIER is off, double quotes are parsed as delimiting a string literal. The preferable delimiters for string literals are single quotes. See the QUOTED_IDENTIFIER TSQL system-wide configuration setting.
- `SET ROWCOUNT` Set to an integer. Affects subsequent SELECT, INSERT, UPDATE, or DELETE statements to limit the number of rows affected. In a SELECT statement, ROWCOUNT takes precedence over TOP: if ROWCOUNT is less than TOP, the ROWCOUNT number of rows is returned; if TOP is less than ROWCOUNT, the TOP number of rows is returned. ROWCOUNT remains set for the duration of the process or until you revert it to default behavior. To revert to default behavior, `SET ROWCOUNT 0`. If you specify a fractional value, ROWCOUNT is set to the next larger integer.
- `SET TRANSACTION ISOLATION LEVEL` See Transaction Statements below.

The following **SET** environment setting is parsed, but ignored:

- `SET TEXTSIZE integer`

4.6 Transaction Statements

InterSystems TSQL provides support for transactions, including named transaction names. It does not support savepoints. Distributed transactions are not supported.

4.6.1 SET TRANSACTION ISOLATION LEVEL

Supported for the following forms only:

- `SET TRANSACTION ISOLATION LEVEL READ COMMITTED`
- `SET TRANSACTION ISOLATION LEVEL READ UNCOMMITTED`.

READ VERIFIED and other options are not supported.

Sybase `SET TRANSACTION ISOLATION LEVEL n` integer option codes (0, 1, 2, 3) are not supported.

4.6.2 BEGIN TRANSACTION

Begins the current transaction.

```
BEGIN TRAN [name]
BEGIN TRANSACTION [name]
```

Initiates a transaction. The optional *name* argument can be used to specify a named transaction, also known as a savepoint. The *name* value must be supplied as a literal; it cannot be a variable.

You can issue multiple **BEGIN TRANSACTION** statements to create multiple nested transactions. You can use the @@trancount special variable to determine the current transaction level. Each transaction level must be resolved by a **COMMIT** statement or a **ROLLBACK** statement.

Note: A Data Management Language (DML) statement that is within an explicit transaction *cannot* resolve an unqualified table name using a schema search path.

4.6.3 COMMIT TRANSACTION

Commits the current transaction.

```
COMMIT
COMMIT TRAN
COMMIT TRANSACTION
COMMIT WORK
```

These four syntactical forms are functionally identical; the **COMMIT** keyword, as specified below, refers to any of these syntactical forms. A **COMMIT** statement commits all work completed during the current transaction, resets the transaction level counter, and releases all locks established. This completes the transaction. Work committed cannot be rolled back.

If multiple **BEGIN TRANSACTION** statements have created nested transactions, **COMMIT** completes the current nested transaction. A transaction is defined as the operations since and including the **BEGIN TRANSACTION** statement. A **COMMIT** restores the transaction level counter to its state immediately prior to the **BEGIN TRANSACTION** statement that initialized the transaction. You can use the @@trancount special variable to determine the current transaction level.

A **COMMIT** cannot specify a named transaction. If you specify a transaction name as part of a **COMMIT** statement, the presence of this name is parsed without issuing an error, but the transaction name is not validated and it is ignored.

Sybase performs no operation and does not issue an error if a **COMMIT** is issued when not in a transaction.

4.6.4 ROLLBACK TRANSACTION

Rolls back the specified transaction or all current transactions.

```
ROLLBACK [name]
ROLLBACK TRAN [name]
ROLLBACK TRANSACTION [name]
ROLLBACK WORK [name]
```

These four syntactical forms are functionally identical; the **ROLLBACK** keyword, as specified below, refers to any of these syntactical forms. The optional *name* argument specifies a named transaction, as specified by a **BEGIN TRANSACTION name** statement. The *name* value must be supplied as a literal; it cannot be a variable.

A **ROLLBACK** rolls back a transaction, undoing work performed but not committed, decrementing the transaction level counter, and releasing locks. It is used to restore the database to a previous consistent state.

- A **ROLLBACK** rolls back all work completed during the current transaction (or series of nested transactions), resets the transaction level counter to zero and releases all locks. This restores the database to its state before the beginning of the outermost nested transaction.
- A **ROLLBACK** *name* rolls back all work done since the specified named transaction (savepoint) and decrements the transaction level counter by the number of savepoints undone. When all savepoints have been either rolled back or committed and the transaction level counter reset to zero, the transaction is completed. If the named transaction does not exist, or has already been rolled back, **ROLLBACK** rolls back the entire current transaction.

Sybase performs no operation and does not issue an error if a **ROLLBACK** is issued when not in a transaction.

4.6.5 SAVE TRANSACTION

The **SAVE TRANSACTION [savepoint-name]** statement is parsed but ignored in InterSystems TSQL. It performs no operation.

4.6.6 LOCK TABLE

Enables the current user to lock a table.

```
LOCK TABLE tablename IN {SHARE | EXCLUSIVE} MODE [WAIT  numsecs | NOWAIT]
```

The **LOCK TABLE** statement locks all of the records in the specified table. You can lock a table in SHARE MODE or in EXCLUSIVE MODE. The optional WAIT clause specifies the number of seconds to wait in attempting to acquire the table lock. The **LOCK TABLE** statement immediately releases any prior lock held by the current user on the specified table.

LOCK TABLE is only meaningful within a transaction. It locks the table for the duration of the current transaction. When not in a transaction, **LOCK TABLE** performs no operation.

Specify *tablename* as described in Table References. **LOCK TABLE** supports locking a single table; it does not support locking multiple tables.

LOCK TABLE supports SHARE and EXCLUSIVE modes; it does not support WRITE mode.

LOCK TABLE does not support the WITH HOLD clause.

WAIT time is specified as an integer number of seconds; **LOCK TABLE** does not support WAIT time specified as clock time.

4.7 Procedure Statements

The following standard Transact-SQL statements are supported.

4.7.1 CREATE PROCEDURE / CREATE FUNCTION

Creates a named executable procedure.

```
CREATE PROCEDURE procname [[@var [AS] datatype [= | DEFAULT value] [,...]] [RETURNS datatype] [AS] code
CREATE PROC procname [[@var [AS] datatype [= | DEFAULT value] [,...]] [RETURNS datatype] [AS] code
CREATE FUNCTION procname [[@var [AS] datatype [= | DEFAULT value] [,...]] [RETURNS datatype] [AS] code
```

You can return a single scalar value result from either a `PROCEDURE` or a `FUNCTION`. `OUTPUT` parameters and default values are also supported. These commands convert the return type from a TSQL type declaration to an InterSystems IRIS type descriptor. Currently, result sets and tables can't be returned.

Supported as either **CREATE PROCEDURE** or **CREATE PROC**. **CREATE FUNCTION** is very similar to **CREATE PROCEDURE**, but the routine type argument value is "FUNCTION", rather than "PROCEDURE".

- Any statements can be used in a **CREATE FUNCTION**.
- The RETURN keyword is allowed in a **CREATE PROCEDURE**. If a procedure completes without invoking a **RETURN** or **RAISERROR** statement, it returns an integer value of 0.
- The WITH EXECUTE keyword clause is allowed in a **CREATE PROCEDURE** and **CREATE FUNCTION**. It must appear after the RETURN keyword.

A **CREATE PROCEDURE** can specify a formal parameter list. Formal parameters are specified as a comma-separated list. Enclosing parentheses are optional. The AS keyword between the parameter variable and its data type is optional. Optionally, you can use the DEFAULT keyword or = symbol to assign a default value to a formal parameter; if no actual parameter value is specified, this default value is used. In TSQL an input formal parameter has no keyword indicator; an output formal parameter can be specified by the OUTPUT keyword following the data type. Alternatively, these formal parameters can be prefaced by the optional keywords IN, OUT, or INOUT.

The following example shows the creation of the procedure AvgAge with two formal parameters:

TSQL

```
CREATE PROCEDURE AvgAge @min INT, @max INT
AS
BEGIN TRY
  SELECT AVG(Age) FROM Sample.Person
  WHERE Age > @min AND Age < @max
END TRY
BEGIN CATCH
  PRINT 'error!'
END CATCH
```

The following statement executes this procedure. In this case, the specified actual parameter values limit the averaging to ages 21 through 65:

TSQL

```
EXEC AvgAge 20,66
```

The following example creates a procedure that returns the results of a division operation. The RETURNS keyword limits the number of decimal digits in the return value:

```
CREATE PROCEDURE SQLUser.MyDivide @a INTEGER, @b INTEGER, OUT @rtn INTEGER RETURNS DECIMAL(2,3)
BEGIN
SET @rtn = @a / @b;
RETURN @rtn;
END
```

The following statement executes this procedure:

TSQL

```
SELECT SQLUser.MyDivide(7,3)
```

The following example shows the creation of procedure OurReply:

TSQL

```
CREATE PROCEDURE OurReply @var CHAR(16) DEFAULT 'No thanks' AS PRINT @var
```

When executed without a parameter, OurReply prints the default text (“No thanks”); when executed with a parameter OurReply prints the actual parameter value specified in the **EXEC** statement.

Note that **CREATE FUNCTION** and **CREATE PROCEDURE** cannot be issued from a stored procedure.

The ALTER PROCEDURE statement is not supported.

4.7.1.1 Importing a CREATE PROCEDURE

If imported TSQL source contains a CREATE PROC statement, then a class method containing the CREATE PROC source will be created. This class method is either placed in an existing class, or in a new class whose name is based on the schema and procedure name.

If the procedure already exists, the existing implementation is replaced. If a class matching the class name generated from the schema and procedure already exists, it is used if it was previously generated by the TSQL utility. If not, then a unique class name is generated, based on the schema and procedure name. The schema defaults to the default schema defined in the system configuration. The resulting class is compiled once the procedure has been successfully created.

If logging is requested, the source statements are logged along with the name of the containing class, class method, and the formal arguments generated. Any errors encountered by the process are also reported in the log. If errors are detected during CREATE PROC processing and a new class was generated, that class is deleted.

4.7.2 ALTER FUNCTION

Supported. The WITH EXECUTE keyword clause is supported.

4.7.3 DROP FUNCTION

Deletes a function or a comma-separated list of functions.

```
DROP FUNCTION funcname [,funcname2 [,...] ]
```

The IF EXISTS clause is not supported.

4.7.4 DROP PROCEDURE

Deletes a procedure or a comma-separated list of procedures.

```
DROP PROCEDURE [IF EXISTS] procname [,procname2 [,...] ]
DROP PROC [IF EXISTS] procname [,procname2 [,...] ]
```

The optional IF EXISTS clause suppresses errors if you specify a non-existent *procname*. If this clause is not specified, an SQLCODE -362 error is generated if you specify a non-existent *procname*. **DROP PROCEDURE** is an atomic operation; either all specified procedures are successfully deleted or none are deleted.

4.7.5 RETURN

Halts execution of a query or procedure. Can be argumentless or with an argument. Argumentless **RETURN** must be used when exiting a TRY or CATCH block. When returning from a procedure, **RETURN** can optionally return an integer status code. If you specify no status code, it returns the empty string ("").

4.7.6 EXECUTE

Executes a procedure, or executes a string of TSQL commands.

```
EXECUTE [@rtnval = ] procname [param1 [,param2 [,...] ] ]
EXECUTE ('TSQL_commands')
```

EXEC is a synonym for EXECUTE.

- **EXECUTE *procname*** can be used to execute a stored procedure. Parameters are supplied as a comma-separated list. This parameter list is not enclosed in parentheses. Named parameters are supported.

  EXECUTE *procname* can optionally receive a RETURN value, using the `EXECUTE @rtn=Sample.MyProc param1,param2` syntax.

  EXECUTE *procname* is similar to the CALL statement, which can also be used to execute a stored procedure. CALL uses an entirely different syntax.

  TSQL

  ```
  CREATE PROCEDURE Sample.AvgAge @min INT, @max INT
    AS
    SELECT Name,Age,AVG(Age) FROM Sample.Person
    WHERE Age > @min AND Age < @max
    RETURN 99
  ```

  TSQL

  ```
  DECLARE @rtn INT;
  EXECUTE @rtn=Sample.AvgAge 18,65
  SELECT @rtn
  ```

  If the specified procedure does not exist, an SQLCODE -428 error (Stored procedure not found) is issued.

  The `WITH RECOMPILE` clause is parsed, but ignored.

  The following **EXECUTE *procname*** features are not supported: procedure variables, and procedure numbers (i.e. ';n').

- **EXECUTE (*TSQL commands*)** can be used to execute dynamic SQL. The TSQL command(s) are enclosed in parentheses. The TSQL commands to be executed are specified as a string enclosed in single quote characters. A TSQL command string can contain line breaks and white space. Dynamic TSQL runs in the current context.

TSQL

```
EXECUTE('SELECT TOP 4 Name,Age FROM Sample.Person')
```

or

TSQL

```
DECLARE @DynTopSample VARCHAR(200)
SET @DynTopSample='SELECT TOP 4 Name,Age FROM Sample.Person'
EXECUTE (@DynTopSample)
```

The following example shows an EXECUTE that returns multiple result sets:

TSQL

```
EXECUTE('SELECT TOP 4 Name FROM Sample.Person
         SELECT TOP 6 Age FROM Sample.Person')
```

4.7.7 EXECUTE IMMEDIATE

Executes a string of TSQL commands.

```
EXECUTE IMMEDIATE "TSQL_commands"
```

The WITH QUOTES ON/OFF, WITH ESCAPES ON/OFF, and WITH RESULT SET ON/OFF Boolean options are not supported.

4.7.8 CALL

Executes a procedure.

```
[@var = ] CALL procname ([param1 [,param2 [,...] ] ])
```

The **CALL** statement is functionally identical to the **EXECUTE *procname*** statement. It differs syntactically.

The procedure parameters are optional. The enclosing parentheses are mandatory.

The optional *@var* variable receives the value returned by the RETURN statement. If execution of the stored procedure does not conclude with a RETURN statement, *@var* is set to 0.

The following example calls a stored procedure, passing two input parameters. It receives a value from the procedure's RETURN statement:

```
DECLARE @rtn INT
@rtn=CALL Sample.AvgAge(18,34)
SELECT @rtn
```

4.8 Other Statements

4.8.1 CREATE USER

CREATE USER creates a new user.

```
CREATE USER username
```

Executing this statement creates an InterSystems IRIS user with its password set to the specified user name. You can then use the Management Portal **System Administration** interface to change the password. You cannot explicitly set a password using CREATE USER.

User names are not case-sensitive. InterSystems TSQL and InterSystems SQL both use the same set of defined user names. InterSystems IRIS issues an error message if you try to create a user that already exists.

By default, a user has no privileges. Use the GRANT command to give privileges to a user.

The DROP USER statement is not supported.

4.8.2 GRANT

Grants privileges to a user or list of users.

```
GRANT privilegelist ON tablelist TO granteelist

GRANT EXECUTE ON proclist TO granteelist
GRANT EXEC ON proclist TO granteelist
```

- *privilegelist*: a single privilege or a comma-separated list of privileges. The available privileges are SELECT, INSERT, DELETE, UPDATE, REFERENCES, and ALL PRIVILEGES. ALL is a synonym for ALL PRIVILEGES. The ALTER privilege is not supported directly, but is one of the privileges granted by ALL PRIVILEGES.
- *tablelist*: a single table name (or view name) or a comma-separated list of table names and view names. Specify a table name as described in Table References.
- *proclist*: a single SQL procedure or a comma-separated list of SQL procedures. All listed procedures must exist, otherwise an SQLCODE -428 error is returned.
- *granteelist*: a single grantee (user to be assigned privileges) or a comma-separated list of grantees. A grantee can be a user name, "PUBLIC" or "*". Specifying * grants the specified privileges to all existing users. A user created using CREATE USER initially has no privileges. Specifying a non-existent user in a comma-separated list of grantees has no effect; GRANT ignore that user and grants the specified privileges to the existing users in the list.

Specifying privileges for specified fields is not supported.

The WITH GRANT OPTION clause is parsed but ignored.

Granting a privilege to a user that already has that privilege has no effect and no error is issued.

4.8.3 REVOKE

Revokes granted privileges from a user or list of users.

```
REVOKE privilegelist ON tablelist FROM granteelist CASCADE

REVOKE EXECUTE ON proclist FROM granteelist
REVOKE EXEC ON proclist FROM granteelist
```

Revoking a privilege from a user that does not have that privilege has no effect and no error is issued.

See GRANT for further details.

4.8.4 PRINT

Displays the specified text to the current device.

```
PRINT expression [,expression2 [,...]]
```

An *expression* can be a literal string enclosed in single quotes, a number, or a variable or expression that resolves to a string or a number. You can specify any number of comma-separated expressions.

PRINT does not support the Sybase *arg-list* syntax. A placeholder such as %3! in an *expression* string is not substituted for, but is displayed as a literal.

4.8.5 RAISERROR

```
RAISERROR errnum 'message'
RAISERROR(error,severity,state,arg) WITH LOG
```

Both syntactic forms (with and without parentheses) are supported. Both spellings, RAISERROR and RAISEERROR, are supported and synonymous. **RAISERROR** sets the value of @@ERROR to the specified error number and error message and invokes the **%SYSTEM.Error.FromXSQL()** method.

The Sybase-compatible syntax (without parentheses) requires an *errnum* error number, the other arguments are optional.

TSQL

```
RAISERROR 123 'this is a big error'
PRINT @@ERROR
```

A **RAISERROR** command raises an error condition; it is left to the user code to detect this error. However, if **RAISERROR** appears in the body of a TRY block, it transfers control to the paired CATCH block. If **RAISERROR** appears in a CATCH block it transfers control either to an outer CATCH block (if it exists) or to the procedure exit. **RAISERROR** does not trigger an exception outside of the procedure. It is up to the caller to check for the error.

When an AFTER statement level trigger executes a RAISEERROR, the returned %msg value contains the *errnum* and *message* values as message string components separated by a comma: %msg="*errnum*,*message*".

The Microsoft-compatible syntax (with parentheses) requires an *error* (either an error number or a quoted error message). If you do not specify an error number, it defaults to 50000. The optional *severity* and *state* arguments take integer values.

TSQL

```
RAISERROR('this is a big error',4,1) WITH LOG
PRINT @@ERROR
```

4.8.6 UPDATE STATISTICS

Optimizes query access for a specified table. The specified table can be a standard table or a # temporary table (see **CREATE TABLE** for details.) InterSystems IRIS passes the specified table name argument to the **$SYSTEM.SQL.Stats.Table.GatherTableStats()** method for optimization. **UPDATE STATISTICS** calls **GatherTableStats()**. All other **UPDATE STATISTICS** syntax is parsed for compatibility only and ignored. In a batch or stored procedure, only the first **UPDATE STATISTICS** statement for a given table generates a call to Tune Table. For further details, see Tune Table in *SQL Optimization Guide*.

If an INSERT, UPDATE, or DELETE has a @@ROWCOUNT of more than 100,000, executing that command automatically invokes an **UPDATE STATISTICS** (TuneTable) of the table.

If the TSQL TRACE configuration option is set, the trace log file will contain records of the tables that were tuned.

4.8.7 USE database

Supported, also an extension: `USE NONE` to select no database. Effective at generation-time, persists as long as the transform object exists (e.g. in the shell or loading a batch).

4.9 InterSystems Extensions

TSQL supports a number of InterSystems extensions to Transact-SQL. To allow for the inclusion of these InterSystems-only statements in portable code, InterSystems TSQL also supports a special form of the single-line comment: two hyphens followed by a vertical bar. This operator is parsed as a comment by Transact-SQL implementations, but is parsed as an executable statement in InterSystems TSQL. For further details, refer to the Comments section in TSQL Constructs.

TSQL includes the following InterSystems extensions:

4.9.1 OBJECTSCRIPT

This extension allows you to include ObjectScript code or InterSystems SQL code in the compiled output. It takes one or more lines of InterSystems code inside curly brackets.

The following Dynamic SQL example uses **OBJECTSCRIPT** because TSQL does not support the InterSystems SQL %STARTSWITH predicate:

```
SET myquery = "OBJECTSCRIPT {SELECT Name FROM Sample.Person "
              _"WHERE Name %STARTSWITH 'A'}"
SET tStatement = ##class(%SQL.Statement).%New(,,"Sybase")
WRITE "language mode set to ",tStatement.%Dialect,!
SET qStatus = tStatement.%Prepare(myquery)
IF qStatus'=1 {
   WRITE "%Prepare failed:"
   DO $System.Status.DisplayError(qStatus)
   QUIT
}
SET rset = tStatement.%Execute()
DO rset.%Display()
WRITE !,"End of data"
```

The following Dynamic SQL example uses **OBJECTSCRIPT** to include ObjectScript code in a TSQL routine:

```
SET tempDDL="CREATE TABLE Sample.MyTest(Name VARCHAR(40),Age INTEGER)"

SET newtbl=2
SET newtbl(1)=tempDDL
SET newtbl(2)="OBJECTSCRIPT
DO $SYSTEM.SQL.Stats.Table.GatherTableStats(""Sample.MyTest"")
WRITE ""TuneTable Done"",!"
SET tStatement = ##class(%SQL.Statement).%New(,,"Sybase")
WRITE "language mode set to ",tStatement.%Dialect,!
SET qStatus = tStatement.%Prepare(.newtbl)
IF qStatus'=1 {
   WRITE "%Prepare failed:"
   DO $System.Status.DisplayError(qStatus)
   QUIT
}
SET rset = tStatement.%Execute()
DO rset.%Display()
WRITE !,"End of data"
```

Note that in the above example the **WRITE** command specifies a new line (,!); this is necessary because the **OBJECTSCRIPT** extension does not issue a new line following execution.

4.9.2 IMPORTASQUERY

This extension forces a stored procedure to be imported as a query rather than as a class method. This is useful for stored procedures that contain only an EXEC statement, because InterSystems IRIS cannot otherwise determine at import whether such a stored procedure is a query or not.

5

TSQL Settings

Settings are used to tailor the behavior of the compiler and colorizer. The TSQL configuration options are part of the standard InterSystems IRIS® data platform configuration.

InterSystems IRIS supports the following TSQL settings:

- DIALECT
- ANSI_NULLS
- CASEINSCOMPARE (String comparison is not case-sensitive.)
- QUOTED_IDENTIFIER
- Equal Literal Replacement
- TRACE

These values are used to set the corresponding ^%SYS("tsql","SET",...) global array values.

You can view and modify these settings using the InterSystems IRIS Management Portal and/or the %SYSTEM.TSQL Get and Set class methods.

- Go into the InterSystems IRIS Management Portal. Go to **System Administration**, **Configuration**, **SQL and Object Settings**, **TSQL Compatibility**. Here you can specify the **DIALECT** (Sybase or MSSQL, default is Sybase), and turn on or off the **ANSI_NULLS**, **CASEINSCOMPARE**, and **QUOTED_IDENTIFIER** settings.

  If you change one or more configuration settings, this is indicated by an asterisk (*) in the upper left-hand corner of the screen immediately following the Management Portal path. For example, `System > Configuration > TSQL Settings (configuration settings)*`. You must press the **Save** button for configuration changes to take effect.

- Invoke the **$SYSTEM.TSQL.CurrentSettings()** method to display the settings:

  ### ObjectScript

  ```
  DO ##class(%SYSTEM.TSQL).CurrentSettings()
  ```

  You can use %SYSTEM.TSQL class methods to get or set these settings. These methods take a dialect string and change both the current dialect and the specified setting. There are not separate settings for each TSQL dialect. For example, changing CaseInsCompare changes this configuration setting for both Sybase and MSSQL.

You can also change InterSystems IRIS configuration settings to be more compatible with TSQL and to provide better performance. The following configurable options are described on this page:

- Save cached query source

- Data collation and string truncation
- Timestamp data types and time precision
- Settings for temporary databases

5.1 DIALECT

The DIALECT configuration option allows you to select the Transact-SQL dialect. The available options are Sybase and MSSQL. The default is Sybase. You can return the current setting using **$SYSTEM.TSQL.GetDialect()**. This option is set system-wide using the InterSystems IRIS Management Portal or by using the **$SYSTEM.TSQL.SetDialect()** method:

ObjectScript

```
WRITE ##class(%SYSTEM.TSQL).SetDialect("Sybase")
```

This method returns the prior Dialect setting.

If DIALECT=MSSQL: a DECLARE statement binds host variable values.

If DIALECT=Sybase: host variable values are refreshed for each cursor OPEN.

Note: You can also set InterSystems SQL to handle Transact-SQL source code by overriding the InterSystems SQL default:

To set the Transact-SQL dialect in InterSystems Dynamic SQL.

To set the Transact-SQL dialect in the Management Portal SQL interface

To set the Transact-SQL dialect in the InterSystems SQL Shell.

To set the Transact-SQL dialect in JDBC.

5.2 ANSI_NULLS

The ANSI_NULLS configuration option allows you to specify whether comparisons to a null value return true or false. The default is OFF.

- ON: All comparisons to a null value evaluate to Unknown. For example, Age = Null returns false, even when Age is null. Null is unknown, so it is false/unknown to specify null=null.
- OFF: For each row, a comparison of a field value to NULL evaluates to True if the field does not contain a value. For example, Age = Null returns True for each row where Age does not contain a value. However, you cannot use ANSI_NULLS OFF to compare null values in two different fields. Comparisons of two fields that do not contain a value are always false. For example, Age = DateOfBirth and Age != DateOfBirth both return False when both fields do not contain a value.

You can determine the current ANSI_NULLS setting using %SYSTEM.TSQL class methods, or from the *TSQLAnsiNulls* property, as follows:

ObjectScript

```
SET context=##class(%SYSTEM.Context.SQL).%New()
WRITE "ANSI_NULLS is = ",context.TSQLAnsiNulls
```

You can return the current setting using **$SYSTEM.TSQL.GetAnsiNulls()**. This method returns both the current default dialect and the current ANSI_NULLS setting as a comma-separated string: for example, `MSSQL, ON`.

You can activate (ON) or deactivate (OFF) ANSI_NULLS system-wide using the InterSystems IRIS Management Portal or by using the **$SYSTEM.TSQL.SetAnsiNulls()** method:

ObjectScript

```
WRITE ##class(%SYSTEM.TSQL).SetAnsiNulls("Sybase","OFF")
```

This method sets both the default dialect and the ANSI_NULLS setting, returns the prior settings as a comma-separated string: for example, `MSSQL, ON`.

5.3 CASEINSCOMPARE

The CASEINSCOMPARE setting specifies non-case-sensitive equality comparisons, such as 'A'='a'. The default is OFF. If this option is set to ON, the comparison operators = and <> operate without regard to case in most contexts. However, there are a few contexts where such insensitivity does not apply:

- Where a comparison is the `ON` condition for a `JOIN`.
- Where either operand is a subquery.

These exceptions exist because InterSystems SQL does not accept the `%SQLUPPER` operator in these contexts.

You can determine the current CASEINSCOMPARE setting using `%SYSTEM.TSQL` class methods, or from the *TSQLCaseInsCompare* property, as follows:

ObjectScript

```
SET context=##class(%SYSTEM.Context.SQL).%New()
WRITE "ANSI_NULLS is = ",context.TSQLCaseInsCompare
```

You can return the current setting using **$SYSTEM.TSQL.GetCaseInsCompare()**. You can activate (ON) or deactivate (OFF) CASEINSCOMPARE system-wide using using the InterSystems IRIS Management Portal or by using the **$SYSTEM.TSQL.SetCaseInsCompare()** method:

ObjectScript

```
WRITE ##class(%SYSTEM.TSQL).SetCaseInsCompare("Sybase","OFF")
```

This method returns the prior CASEINSCOMPARE setting.

5.4 QUOTED_IDENTIFIER

The QUOTED_IDENTIFIER configuration option allows you to select whether quoted identifiers are supported. The default is OFF (not supported). This option is set using the InterSystems IRIS Management Portal. When QUOTED_IDENTIFIER is on, double quotes are parsed as delimiting an identifier. When QUOTED_IDENTIFIER is off, double quotes are parsed as alternative delimiters for string literals. The preferable delimiters for string literals are single quotes.

You can determine the current QUOTED_IDENTIFIER setting using `%SYSTEM.TSQL` class methods, or from the *TSQLQuotedIdentifier* property, as follows:

ObjectScript

```
SET context=##class(%SYSTEM.Context.SQL).%New()
WRITE "ANSI_NULLS is = ",context.TSQLQuotedIdentifier
```

You can return the current setting using **$SYSTEM.TSQL.GetQuotedIdentifier()**. You can activate (ON) or deactivate (OFF) QUOTED_IDENTIFIER system-wide using using the InterSystems IRIS Management Portal or by using the **$SYSTEM.TSQL.SetQuotedIdentifier()** method:

ObjectScript

```
WRITE ##class(%SYSTEM.TSQL).SetQuotedIdentifier("Sybase","OFF")
```

This method returns the prior QUOTED_IDENTIFIER setting.

5.5 Equal Literal Replacement

The Equal Literal Replacement configuration option is set using a method; is not available from the Management Portal. It controls the behavior of the TSQL compiler. You can return the current setting using **$SYSTEM.TSQL.GetEqualLiteralReplacement()**. The default is ON.

You can activate (ON) or deactivate (OFF) Equal Literal Replacement system-wide using the **$SYSTEM.TSQL.SetEqualLiteralReplacement()** method:

ObjectScript

```
WRITE ##class(%SYSTEM.TSQL).SetEqualLiteralReplacement("Sybase","OFF")
```

Setting **SetEqualLiteralReplacement("Sybase","OFF")** means TSQL queries with a WHERE clause equal sign (=) predicate or an IN(...) predicate will not perform literal substitution for literal values on the left or right side of the equal sign, or for any literal value in the IN predicate. This can help the query optimizer choose a better plan when the condition includes fields that have an outlier value.

5.6 TRACE

The TRACE configuration option creates a log file of the execution of TSQL procedures. When a TSQL stored procedure (method or system stored procedure) is compiled with TRACE active, running a TSQL procedure will log trace messages to the active tsql log file.

A separate tsql trace log file is created for each process from which TSQL procedures are run. Trace is activated system-wide; trace log files are namespace-specific.

TRACE is not set using the Management Portal. This option is set system-wide using the **$SYSTEM.TSQL.SetTrace()** method. No dialect is specified:

ObjectScript

```
WRITE ##class(%SYSTEM.TSQL).SetTrace("ON")
```

You can return the current setting using **$SYSTEM.TSQL.GetTrace()**.

You can also activate (1) or deactivate (0) TRACE system-wide using the following ObjectScript command:

ObjectScript

```
SET ^%SYS("tsql","TRACE")=1
```

To return the current trace setting:

ObjectScript

```
WRITE ^%SYS("tsql","TRACE")
```

The TRACE log file records a timestamp for each operation, the elapsed time for each operation, a global references count and a %ROWCOUNT (where applicable). Note that TRUNCATE TABLE always returns a %ROWCOUNT of -1. If an operation involves sharded tables, the global references count is only for the process the procedure is executed on. Work sent to the other shards is not included in the global reference count.

The TRACE log file represents a temporary table using the internal temporary table name; it displays the corresponding user-specified #TempTable name in a /* mytemptable */ comment.

The TRACE log file is created in your InterSystems IRIS instance in the mgr directory, in the subdirectory for the current namespace. It is named using the current process number. For example: IRIS/mgr/user/ tsql16392.log. The following is a typical TRACE log file:

```
IRIS TSQL Log, created 07/06/2020 13:44:41.020101 by process 16392
   Version: IRIS for Windows (x86-64) 2020.2 (Build 211U) Fri Jun 26 2020 13:19:52 EDT
     User: glenn

   07/06/2020 13:44:41.020488
PREPARE EXECUTEPROC: Sample.StuffProc
   07/06/2020 15:02:44.270773
PREPARE EXECUTEPROC: sp_addtype
   07/06/2020 15:04:50.625108
PREPARE EXECUTEPROC: sp_addtype

Log restarted: 07/06/2020 15:15:42
   07/06/2020 15:15:42.623033
CALLSP:: CreateMyTableProc()
   07/06/2020 15:15:42.624807
EXECUTE CREATE TABLE Sample.MyTable (Name SHORTSTR, BigName MIDSTR):
      Elapsed time = .313114s       # Global Refs = 17,446
RETURN:: CreateMyTable with value = 0
   07/06/2020 15:15:42.938084
   context object: 154@%Library.ProcedureContext

      Context status is OK

   07/06/2020 15:23:42.171761
CALLSP:: CreateMyTable()
   07/06/2020 15:23:42.174175
EXECUTE CREATE TABLE Sample.MyTable (Name SHORTSTR, BigName MIDSTR):
      ERROR: -201 Table 'Sample.MyTable' already exists
      SQLCODE = -400       Elapsed time = .002356s       # Global Refs = 151
RETURN:: CreateMyTable with value = 0
   07/06/2020 15:23:42.176979
   context object: 485@%Library.ProcedureContext


         Error:
ERROR #5540: SQLCODE: -201 Message: Table 'Sample.MyTable' already exists
```

5.6.1 Cached Query Source

To aid in debugging, it is also desirable to retain cached query source code as well as the generated cached queries. You can configure this option as follows:

ObjectScript

```
SET status=$SYSTEM.SQL.Util.SetOption("CachedQuerySaveSource",1,.oldval)
```

5.7 Data Collation and String Truncation

The default collation for InterSystems SQL is SQLUPPER. This is not the best match for the collation order native to TSQL.

Sybase supports several different collation sort orders. The default is binary. This default is described as follows: “Sorts all data according to numeric byte values for that character set. Binary order sorts all ASCII uppercase letters before lowercase letters. Accented or ideographic (multibyte) characters sort in their respective standards order, which may be arbitrary. All character sets have binary order as the default.”

This binary collating order best matches the InterSystems IRIS SQLSTRING collating order. Therefore, changing the SQL collation sequence from SQLUPPER to SQLSTRING is likely the best compatibility option, though it is not guaranteed to be correct for all characters.

- To set the default collation for the current namespace: `SET status=$$SetEnvironment^%apiOBJ("COLLATION","%Library.String","SQLSTRING")`
- To set the default collation system-wide: `SET ^%oddENV("collation","%Library.String")="SQLSTRING"`

SQLSTRING collation preserves trailing blank spaces in strings when data is loaded in the database. When these strings are processed by stored procedures, these trailing blank spaces can cause errors. It is therefore recommended that you configure string data types to truncate strings when they are read. You can configure string data types as follows:

ObjectScript

```
SET status=$$SetSysDatatypes^%SYS.CONFIG(,"CHAR","%Library.String(MAXLEN=1,TRUNCATE=1)")
SET status=$$SetSysDatatypes^%SYS.CONFIG(,"CHAR(%1)","%Library.String(MAXLEN=%1,TRUNCATE=1)")
SET status=$$SetSysDatatypes^%SYS.CONFIG(,"VARCHAR","%Library.String(MAXLEN=1,TRUNCATE=1)")
SET status=$$SetSysDatatypes^%SYS.CONFIG(,"VARCHAR(%1)","%Library.String(MAXLEN=%1,TRUNCATE=1)")
SET status=$$SetSysDatatypes^%SYS.CONFIG(,"VARCHAR(%1,%2)","%Library.String(MAXLEN=%1,TRUNCATE=1)")
```

5.8 Timestamp and Time Precision

The default timestamp data type for InterSystems SQL is %TimeStamp. If a TSQL database has many datetime fields (as is often the case with financial databases) using %PosixTime as the default timestamp data type can reduce the amount of disk space required, therefore increasing row access speed, both for reading and writing. You can configure timestamp data types as follows:

ObjectScript

```
SET status=$$SetSysDatatypes^%SYS.CONFIG(,"DATETIME","%Library.PosixTime")
SET status=$$SetSysDatatypes^%SYS.CONFIG(,"DATETIME2","%Library.PosixTime")
SET status=$$SetSysDatatypes^%SYS.CONFIG(,"TIMESTAMP","%Library.PosixTime")
```

You should also configure the default time precision to the desired number of decimal places of precision, as shown in the following example:

ObjectScript

```
SET status=$SYSTEM.SQL.Util.SetOption("DefaultTimePrecision",6,.oldval)
```

5.9 Settings for Temporary Databases

For improved performance, it may be advantageous to change temporary database settings and work database settings to remove standard checks. These changes may not be appropriate for all TSQL environments. Note that work tables are temporary in nature, but could survive from one stored procedure run to another.

6

TSQL Functions

This page describes TSQL functions supported by InterSystems IRIS® data platform.

6.1 ABS

`ABS(num)`

Returns the absolute value of *num*. Thus both 123.99 and –123.99 return 123.99.

6.2 ACOS

`ACOS(float)`

Arc cosine: returns the angle in radians whose cosine is *float*. Thus 1 returns 0.

6.3 ASCII

`ASCII(char)`

Returns the integer value corresponding to the first character in string *char*. Thus, `ASCII('A')` returns 65.

ASCII is functionally identical to **UNICODE**. The reverse of this function is **CHAR**.

6.4 ASIN

`ASIN(float)`

Arc sine: returns the angle in radians whose sine is *float*. Thus 1 returns 1.570796326...

6.5 ATAN

```
ATAN(float)
```

Arc tangent: returns the angle in radians whose tangent is *float*. Thus 1 returns .785398163...

6.6 AVG

```
AVG(numfield)
AVG(DISTINCT numfield)
```

Aggregate function: used in a query to return the average of the values in the *numfield* column. For example, `SELECT AVG(Age) FROM Sample.Person`. AVG(DISTINCT numfield) averages the number of unique values in the *numfield* column. Fields with NULL are ignored.

6.7 CAST

```
CAST(expression AS datatype)
```

Returns the *expression* converted to the specified *datatype*. **CAST** can be used with any supported data type. For further details, refer to Data Types in the *InterSystems SQL Reference*. **CAST** supports user-defined data types created using the sp_addtype stored procedure.

When *expression* is a date value string, such as '2004–11–23' and *datatype* is TIMESTAMP or DATETIME, a time value of '00:00:00' is supplied.

When *expression* is a time value string, such as '1:35PM' and *datatype* is TIMESTAMP or DATETIME, the time is converted to a 24-hour clock, the AM or PM suffix is removed, a missing seconds interval is filled in with zeros, and the default date value of '1900–01–01' is supplied. Thus '1:35PM' is converted to '1900–01–01 13:35:00'.

When *expression* is a date value string, such as '2004–11–23' and *datatype* is DATE, the date is returned in InterSystems IRIS $HOROLOG date format, such as `60703` (March 14, 2007).

InterSystems TSQL does not support data type XML. However, instead of generating an error during compilation, CAST(x AS XML) in SQL mode generates CAST(x AS VARCHAR(32767)). In procedure mode, CAST(x AS XML) does not generate any conversion.

See **CONVERT**.

6.8 CEILING

```
CEILING(num)
```

Returns the closest integer greater than or equal to *num*. Thus 123.99 returns 124, –123.99 returns –123.

The Sybase CEIL synonym is not supported.

6.9 CHAR

```
CHAR(num)
```

Returns the character corresponding to the integer value *num*. Thus `CHAR(65)` returns A.

CHAR is functionally identical to **NCHAR**. The reverse of this function is **ASCII**.

6.10 CHAR_LENGTH / CHARACTER_LENGTH

```
CHAR_LENGTH(string)
CHARACTER_LENGTH(string)
```

Returns the number of characters in *string*.

6.11 CHARINDEX

```
CHARINDEX(seekstring,target[,startpoint])
```

Returns the position in *target* (counting from 1) corresponding to first character of the first occurrence of *seekstring*. You can use the optional *startpoint* integer to specify where to begin the search. The return value counts from the beginning of *target*, regardless of the *startpoint*. If *startpoint* is not specified, specified as 0, 1, or as a negative number, *target* is searched from the beginning. **CHARINDEX** returns 0 if *seekstring* is not found.

6.12 COALESCE

```
COALESCE(expression1,expression2,...)
```

Returns the first non-null expression from the specified list of expressions.

6.13 COL_NAME

```
COL_NAME(object_id,column_id)
```

Returns the name of the column. Can be used in procedure code or trigger code.

TSQL supports the two-argument form of this function. It does not support a third argument.

The following example returns the column name of the 4th column of Sample.Person:

ObjectScript

```
SET sql=2
SET sql(1)="SELECT 'column name'=COL_NAME(id,4) FROM Sample.Person"
SET sql(2)="WHERE id=OBJECT_ID('Sample.Person')"
SET statement=##class(%SQL.Statement).%New()
SET statement.%Dialect="MSSQL"
SET status=statement.%Prepare(.sql)
SET result=statement.%Execute()
DO result.%Display()
```

COL_NAME does not support the Sybase third argument.

6.14 CONVERT

`CONVERT(`*`datatype`*`,`*`expression`* `[,`*`style`*`])`

Returns the *expression* converted to the specified *datatype*.

- BIT: When *datatype* is BIT and *expression* is a boolean value: if the input value is a non-zero number, the result is 1. if the input value is 0, the result is 0. If the input value is the string 'TRUE' (case insensitive), the result is 1. If the input value is the string 'FALSE' (case insensitive), the result is 0. If the input value is NULL, the result is NULL. Any other input value generates an SQLCODE -141 error.
- CHAR: When the length of CHAR is not specified, converts to a length of 30 characters.
- DATETIME: When *datatype* is datetime or timestamp:
  - When *expression* is a date value string, such as '2004–11–23', a time value of '00:00:00' is supplied.
  - When *expression* is a time value string, such as '1:35PM' and *datatype* is datetime or timestamp, the time is converted to a 24-hour clock, the AM or PM suffix is removed, a missing seconds interval is filled in with zeros, and the default date value of '1900–01–01' is supplied. Thus '1:35PM' is converted to '1900–01–01 13:35:00'.
  - When *expression* is the empty string or a string of one or more blank spaces, **CONVERT** returns '1900–01–01 00:00:00'.

  By default DATETIME data type is mapped to %Library.TimeStamp. **CONVERT** also supports data type mapping of DATETIME to %Library.PosixTime.

  CONVERT supports the DATETIME2 data type. InterSystems IRIS maps DATETIME2 to system-defined DDL mapping %Library.TimeStamp. This mapping is supplied with new installs; if you are using an upgrade install, you may need to create this mapping.

  CONVERT supports user-defined data types created using the sp_addtype stored procedure.

The optional *style* argument is used to specify a date/time format when converting a datetime or timestamp value to a string. By specifying various *style* codes you can return a dates and times in a variety of different formats. The available *style* codes are 100 through 116, 120 through 123, 126, 130 and 131, 136 through 140. (the corresponding codes 0 through 7 and 10 through 40 return the same values with two-digit years); The default *style* for a datetime is 0:

```
mon dd yyyy hh:mmAM
```

The following are some of the supported datetime styles for Sybase:

15 / 115 = format dd/[yy]yy/mm
16 / 116 = format mon dd yyyy HH:mm:ss
22 / 122 = format [yy]yy/mm/dd HH:mm AM (or PM)
23 / 123 = format [yy]yy-mm-ddTHH:mm:ss
36 / 136 = format hh:mm:ss.zzzzzzAM(PM)
37 / 137 = format hh:mm.ss.zzzzzz
38 / 138 = format mon dd [yy]yy hh:mm:ss.zzzzzzAM(PM)
39 / 139 = format mon dd [yy]yy HH:mm:ss.zzzzzz
40 / 140 = format yyyy-mm-dd hh:mm:ss.zzzzzz

The 20 & 21 (120 & 121) *style* codes return the ODBC timestamp format; 20 truncates to whole seconds, 21 returns fractional seconds:

```
yyyy-mm-dd hh:mm:ss.fff
```

For further details, refer to the functionally identical InterSystems SQL CONVERT function in the *InterSystems SQL Reference*.

See **CAST**.

6.15 COS

```
COS(float)
```

Cosine: returns the cosine of the angle specified in *float*. Thus 1 returns .540302305...

6.16 COT

```
COT(float)
```

Cotangent: returns the cotangent of the angle specified in *float*. Thus 1 returns .64209261593...

6.17 COUNT

```
COUNT(field)
COUNT(DISTINCT field)
COUNT(*)
COUNT(1)
```

Aggregate function: used in a query to return the count of the values in the *field* column. Fields with NULL are not counted. For example, `SELECT COUNT(Name) FROM Sample.Person`. COUNT(*) and COUNT(1) are synonyms, they count all rows. COUNT(DISTINCT field) counts the number of unique values in the *field* column. Fields with NULL are not counted.

6.18 CURRENT_DATE

```
CURRENT_DATE
CURRENT DATE
```

Returns the current local date in the following format:

```
yyyy-mm-dd
```

The two syntax forms, with and without an underscore, are identical. Note that no parentheses are used with this function.

This function is provided for compatibility with SQL Anywhere; it is supported by both the Sybase and MSSQL dialects.

6.19 CURRENT_TIME

```
CURRENT_TIME
CURRENT TIME
```

Returns the current local time in the following format:

```
hh:mm:ss
```

Time is specified using a 24-hour clock, Fractional seconds are not returned.

The two syntax forms, with and without an underscore, are identical. Note that no parentheses are used with this function.

This function is provided for compatibility with SQL Anywhere; it is supported by both the Sybase and MSSQL dialects.

6.20 CURRENT_TIMESTAMP

```
CURRENT_TIMESTAMP
CURRENT TIMESTAMP
```

Returns the current local date and time in the following format:

```
yyyy-mm-dd hh:mm:ss
```

Time is specified using a 24-hour clock, Fractional seconds are not returned.

The two syntax forms, with and without an underscore, are identical. Note that no parentheses are used with this function.

6.21 CURRENT_USER

```
CURRENT_USER
```

Returns the name of the current user.

Note that no parentheses are used with this function.

6.22 DATALENGTH

```
DATALENGTH(expression)
```

Returns an integer specifying the number of bytes used to represent *expression*. Thus 'fred' returns 4, and +007.500 returns 3.

6.23 DATEADD

`DATEADD(code,num,date)`

Returns the value of *date* modified by adding the interval specified in *code* the *num* number of times. The *date* can be a date, time, or date/time string in a variety of formats. You can specify any of the following *code* values, either the abbreviation (left column) or the name (right column):

Abbreviation	Name
yy	Year
qq	Quarter
mm	Month
dy	DayofYear
dd	Day
dw, w	Weekday
wk	Week
hh	Hour
mi	Minute
ss	Second
ms	Millisecond

Code values are not case-sensitive. Day, DayofYear, and Weekday all return the same value.

The value returned by DATEADD always includes both date and time in the format:

```
yyyy-mm-dd hh:mm:ss.n
```

Fractional seconds are only returned if the source contained fractional seconds.

If a date is not specified (that is, if *date* contains only a time value), it defaults to 1/1/1900.

If a time is not specified in *date*, it defaults to 00:00:00. Hours are always returned based on a 24-hour clock.

6.24 DATEDIFF

`DATEDIFF(code,startdate,enddate)`

Returns the number of *code* intervals between *startdate* and *enddate*. The two dates can be a date, a time, or a date/time string. in the following format:

```
yyyy-mm-dd hh:mm:ss.n
```

You can specify any of the following *code* values, either the abbreviation (left column) or the name (right column):

Abbreviation	Name
yy	Year
mm	Month
dd	Day
dw, w	Weekday
wk	Week
hh	Hour
mi	Minute
ss	Second
ms	Millisecond

Code values are not case-sensitive. Day, DayofYear, and Weekday all return the same value.

If a date is not specified (that is, if *startdate* or *enddate* contains only a time value), it defaults to 1/1/1900.

If a time is not specified in *startdate* or *enddate*, it defaults to 00:00:00.

6.25 DATENAME

`DATENAME(`*`code`*`,`*`date`*`)`

Returns the value of the part of the date specified by *code* as a string. The *date* can be a date, time, or date/time string in a variety of formats. *date* must be specified as a quoted string; *code* permits, but does not require enclosing quotes. Available *code* values are:

Value	Description
yyyy, yy year	Year. Returns a four-digit year. If a two-digit year is specified, DATENAME supplies '19' as first two digits.
qq, q quarter	Quarter. Returns an integer 1 through 4.
mm, m month	Month. Returns the full name of the month. For example, 'December'.
dy, y dayofyear	Day of Year. Returns an integer count of days 1 through 366.
dd, d day	Day of Month. Returns an integer count 1 through 31.
wk, ww week	Week of Year. Returns an integer count 1 through 53.
dw, w weekday	Day of Week. Returns the number of the day of the week, counting from Sunday. For example, 3 is Tuesday.
hh hour	Hour. Returns the hour of the day (24–hour clock), an integer 0 through 23.
mi, n minute	Minute. Returns an integer 0 through 59.
ss, s second	Second. Returns a decimal number 0 through 59 which may have a fractional part representing milliseconds.
ms millisecond	Millisecond. Returns the fractional part of a second as an integer.

Code values are not case-sensitive.

If a date is not specified, it defaults to 1/1/1900. Two-digit years default to 19xx.

If a time is not specified, it defaults to 00:00:00. Hours are always returned based on a 24-hour clock. Seconds are always returned with fractional seconds, if fractional seconds are defined. Milliseconds are returned as an integer, not a decimal fraction.

6.26 DATEPART

`DATEPART(`*`code`*`,`*`date`*`)`

Returns the value of the part of the date specified in *code* as an integer. The *date* can be a date, time, or date/time string in a variety of formats. Available *code* values are listed in **DATENAME**.

6.27 DAY

```
DAY(date)
```

Returns the day portion of the specified date or date/time string. The *date* can be specified in ODBC timestamp format:

```
yyyy-mm-dd hh:mm:ss.n
```

The *date* must contain a date component. The date separator must be a hyphen (-).

The *date* can also be specified in InterSystems IRIS $HOROLOG date format, such as `60703` (March 14, 2007).

6.28 DB_NAME

```
DB_NAME(database-id)
```

Returns the current namespace name. The *database-id* argument is optional.

6.29 DEGREES

```
DEGREES(float)
```

Converts an angle measurement in radians to the corresponding measurement in degrees.

6.30 ERROR_MESSAGE

When invoked from within a CATCH block, returns the current error message. Otherwise, returns NULL.

6.31 ERROR_NUMBER

When invoked from within a CATCH block, returns the current SQLCODE error. Otherwise, returns NULL.

6.32 EXEC

```
EXEC(@var)
```

Executes dynamic SQL at runtime, as shown in the following example:

TSQL

```
DECLARE @dyncode VARCHAR(200)
SELECT @dyncode='SELECT TOP 4 Name,Age FROM Sample.Person'
EXEC(@dyncode)
```

Compare this dynamic execution with the EXECUTE command that executes a stored procedure.

6.33 EXP

```
EXP(num)
```

Returns the exponential of *num*. This is the e constant (2.71828182) raised to the power of *num*. Thus EXP(2) returns 7.3890560989.

6.34 FLOOR

```
FLOOR(num)
```

Returns the closest integer less than or equal to *num*. Thus 123.99 returns 123, –123.99 returns –124.

6.35 GETDATE

```
GETDATE()
```

Returns the current local date and time in the following format:

```
yyyy-mm-dd hh:mm:ss.n
```

Time is specified using a 24-hour clock, Fractional seconds are returned.

6.36 GETUTCDATE

```
GETUTCDATE()
```

Returns the current UTC (Greenwich Mean Time) date and time in the following format:

```
yyyy-mm-dd hh:mm:ss.n
```

Time is specified using a 24-hour clock, Fractional seconds are returned.

6.37 HOST_NAME

```
HOST_NAME()
```

Returns the system name of the current host system.

6.38 INDEX_COL

```
INDEX_COL(table_name,index_id,key,[,user_id])
```

Returns the name of the indexed column in the specified table. *table_name* can be fully qualified. *index_id* is the number of the table's index. *key* is a key in the index, a value between 1 and sysindexes.keycnt (for a clustered index) or sysindexes.keycnt+1 (for a non-clustered index). *user_id* is parsed but ignored.

6.39 ISNULL

```
ISNULL(expr,default)
```

If *expr* is NULL, returns *default*. If *expr* is not NULL, returns *expr*.

6.40 ISNUMERIC

```
ISNUMERIC(expression)
```

A boolean function that returns 1 if *expression* is a valid numeric value; otherwise, returns 0.

If the specified *expression* is a field with a null value, ISNUMERIC returns null.

6.41 LEFT

```
LEFT(string,int)
```

Returns *int* number of characters from *string*, counting from the left. If *int* is larger than *string*, the full string is returned. See RIGHT.

6.42 LEN

```
LEN(string)
```

Returns the number of characters in *string*.

6.43 LOG

```
LOG(num)
```

Returns the natural logarithm of *num*. Thus LOG(2) returns .69314718055.

6.44 LOG10

```
LOG10(num)
```

Returns the base-10 logarithm of *num*. Thus LOG10(2) returns .301029995663.

6.45 LOWER

```
LOWER(string)
```

Returns *string* with all uppercase letters converted to lowercase. See UPPER.

6.46 LTRIM

```
LTRIM(string)
```

Removes leading blanks from *string*.

If *string* consists entirely of blank spaces, the dialect determines behavior:

- Sybase: returns NULL.
- MSSQL: returns the empty string.

See RTRIM.

6.47 MAX

```
MAX(numfield)
```

Aggregate function: used in a query to return the largest (maximum) of the values in the *numfield* column. For example:

TSQL

```
SELECT MAX(Age) FROM Sample.Person
```

Fields with NULL are ignored.

6.48 MIN

```
MIN(numfield)
```

Aggregate function: used in a query to return the smallest (minimum) of the values in the *numfield* column. For example:

TSQL

```
SELECT MIN(Age) FROM Sample.Person
```

Fields with NULL are ignored.

6.49 MONTH

```
MONTH(date)
```

Returns the month portion of the specified date or date/time string. The *date* can be specified in ODBC timestamp format:

```
yyyy-mm-dd hh:mm:ss.n
```

The date separator must be a hyphen (-). Dates in any other format return 0.

The *date* can also be specified in InterSystems IRIS $HOROLOG date format, such as `60703` (March 14, 2007).

6.50 NCHAR

```
NCHAR(num)
```

Returns the character corresponding to the integer value *num*. Thus `NCHAR(65)` returns A.

NCHAR is functionally identical to **CHAR**. The reverse of this function is **ASCII**.

6.51 NEWID

```
NEWID()
```

Returns a unique value of a type compatible with the SQL Server UNIQUEIDENTIFIER data type. UNIQUEIDENTIFIER is a system-generated 16-byte binary string, also known as a a globally unique ID (GUID). A GUID is used to synchronize databases on occasionally connected systems. A GUID is a 36-character string consisting of 32 hexadecimal numbers separated into five groups by hyphens. InterSystems TSQL does not support UNIQUEIDENTIFIER; it instead uses VARCHAR(36) as the data type for a Globally Unique ID.

The **NEWID** function takes no arguments. Note that the argument parentheses are required.

NEWID() can be used to specify the DEFAULT value when defining a field.

The corresponding InterSystems SQL function is $TSQL_NEWID:

SQL

```
SELECT $TSQL_NEWID()
```

6.52 NOW

```
NOW(*)
```

Returns the current local date and time in the following format:

```
yyyy-mm-dd hh:mm:ss
```

Time is specified using a 24-hour clock, Fractional seconds are not returned.

Note that the asterisk within the parentheses is required.

6.53 NULLIF

```
NULLIF(expr1,expr2)
```

Returns NULL if *expr1* is equivalent to *expr2*. Otherwise, returns *expr1*.

6.54 OBJECT_ID

```
OBJECT_ID(objname,objtype)
```

Takes the object name as a quoted string, and optionally the object type, and returns the corresponding object ID of the specified object as an integer. The available *objtype* values are as follows: RI = FOREIGN KEY constraint; K = PRIMARY KEY or UNIQUE constraint; P = Stored procedure; S = System table; TR = Trigger; U = User table; V = View. If *objtype* is omitted, **OBJECT_ID** tests all object types and returns the first match.

TSQL

```
CREATE PROCEDURE GetObjIds
AS SELECT OBJECT_ID('Sample.Person','U'),OBJECT_ID('Sample.Person_Extent','P')
GO
```

Returns NULL if *objname* does not exist, or if the optional *objtype* is specified and does not match the *objname*. Can be used within procedure code or trigger code. The inverse of **OBJECT_NAME**.

6.55 OBJECT_NAME

```
OBJECT_NAME(id)
```

Takes the object ID integer and returns the corresponding object name of the specified object. Returns the empty string if *id* does not exist. Can be used within procedure code or trigger code. The inverse of **OBJECT_ID**.

TSQL

```
CREATE PROCEDURE GetObjName
AS SELECT OBJECT_NAME(22)
GO
```

6.56 PATINDEX

```
PATINDEX(pattern,string)
```

Returns an integer specifying the beginning position of the first occurrence of *pattern* in *string*, counting from 1. If *pattern* is not found in *string*, 0 is returned. Specify *pattern* as a quoted string. Comparisons are case-sensitive. The *pattern* can contain the following wildcard characters:

Character	Description
%	Zero or more characters. For example, '%a%' returns the position of the first occurrence of 'a' in *string*, including 'a' as the first character in string.
_	Any single character. For example, '_l%' returns 1 if *string* begins with a substring such as 'Al', 'el', and 'il'.
[xyz]	Any single character from the specified list of characters. For example, '[ai]l%' returns 1 if *string* begins with the substring 'al' or 'il', but not 'el' or 'Al'.
[a-z]	Any single character from the specified range of characters. For example, `'%s[a-z]t%'` matches 'sat', 'set', and 'sit'. A range must be specified in ascending ASCII sequence.

The caret (^) character is a not a wildcard character; if included within square brackets it is treated as a literal. A *pattern* commonly consists of a search string enclosed in percent (%) characters `'%Chicago%'` indicating that the entire *string* should be searched.

PATINDEX is supported for sharded, parallel, and linked table queries.

6.57 PI

```
PI()
```

Returns the constant pi. The parentheses are required; no argument is permitted. Thus PI() returns 3.141592653589793238.

6.58 POWER

```
POWER(num,exponent)
```

Returns the value *num* raised to *exponent*.

6.59 QUOTENAME

```
QUOTENAME(value)
```

Returns *value* as a delimited identifier. TSQL supports double quotes ("value") as delimiter characters. For example:

TSQL

```
PRINT 123
  // returns 123
PRINT QUOTENAME(123)
  // returns "123"
```

6.60 RADIANS

```
RADIANS(float)
```

Converts an angle measurement in degrees to the corresponding measurement in radians.

6.61 RAND

```
RAND([seed])
```

Returns a random number as a fractional number less than 1. The optional *seed* integer argument is ignored; it is provided for compatibility. If **RAND** is used more than once in a query it returns different random values.

6.62 REPLACE

```
REPLACE(target,search,replace)
```

Finds every instance of the *search* string in the *target* string and replaces it with the *replace* string, and returns the resulting string. To remove the *search* string from the *target* string, specify *replace* as an empty string.

6.63 REPLICATE

```
REPLICATE(expression,repeat-count)
```

REPLICATE returns a string of *repeat-count* instances of *expression*, concatenated together.

If *expression* is NULL, **REPLICATE** returns NULL. If *expression* is the empty string, **REPLICATE** returns an empty string.

If *repeat-count* is a fractional number, only the integer part is used. If *repeat-count* is 0, **REPLICATE** returns an empty string. If *repeat-count* is a negative number, NULL, or a non-numeric string, **REPLICATE** returns NULL.

6.64 REVERSE

```
REVERSE(string)
```

Reverses the order of the characters in *string*.

6.65 RIGHT

```
RIGHT(string,int)
```

Returns *int* number of characters from *string*, counting from the right. If *int* is larger than *string*, the full string is returned. See LEFT.

6.66 ROUND

```
ROUND(num,length)
```

Returns *num* rounded to the number of decimal digits specified by the integer *length*. If *length* is greater than the number of decimal digits, no rounding is performed. If *length* is 0, *num* is rounded to an integer. If the *length* argument is omitted, it defaults to 0. If *length* is a negative integer, *num* is rounded to the left of the decimal point. A third argument is not accepted by **ROUND**.

6.67 RTRIM

```
RTRIM(string)
```

Removes trailing blanks from *string*.

If *string* consists entirely of blank spaces, the dialect determines behavior:

- Sybase: returns NULL.
- MSSQL: returns the empty string.

See LTRIM.

6.68 SCOPE_IDENTITY

Returns the last identity value inserted into an IDENTITY column in the same scope. However, the last IDENTITY is not limited to the scope of the current procedure. Therefore, you should only use **SCOPE_IDENTITY** when you know that a statement within the current procedure has generated an IDENTITY value. For example, **SCOPE_IDENTITY** should be used after an **INSERT** command in the same procedure.

The following Dynamic SQL example returns the IDENTITY value from the second **INSERT**:

ObjectScript

```
SET sql=6
SET sql(1)="CREATE TABLE #mytest (MyId INT IDENTITY(1,1),"
SET sql(2)="Name VARCHAR(20))"
SET sql(3)="INSERT INTO #mytest(Name) VALUES ('John Smith')"
SET sql(4)="INSERT INTO #mytest(Name) VALUES ('Walter Jones')"
SET sql(5)="PRINT SCOPE_IDENTITY()"
SET sql(6)="DROP TABLE #mytest"
SET statement=##class(%SQL.Statement).%New()
SET statement.%Dialect="MSSQL"
SET status=statement.%Prepare(.sql)
SET result=statement.%Execute()
DO result.%Display()
```

6.69 SIGN

`SIGN(num)`

Returns a value indicating the sign of *num*. If *num* is negative (for example, -32), it returns -1. If *num* is positive (for example, 32 or +32), it returns 1. If *num* is zero (for example, 0 or -0), it returns 0.

6.70 SIN

`SIN(float)`

Sine: returns the sine of the angle specified in *float*. Thus 1 returns .841470984807...

6.71 SPACE

`SPACE(num)`

Returns a string of blank spaces of length *num*.

6.72 SQRT

`SQRT(num)`

Returns the square root of *num*. Thus SQRT(9) returns 3.

6.73 SQUARE

`SQUARE(num)`

Returns the square of *num*. Thus SQUARE(9) returns 81.

6.74 STR

```
STR(num,[length[,precision]])
```

Returns a string of *length* characters. If the integer *length* is equal to or greater than the number of characters in the numeric *num* (including decimal point and sign characters), **STR** returns *num* converted to a string and padded with leading blanks to make the resulting string of *length* characters.

If the optional integer *precision* is specified, *num* is truncated to the specified number of decimal digits before string conversion. If *precision* is omitted, *num* is truncated to its integer portion. If *precision* is larger than the number of decimal digits, *num* is padded with trailing zeros before string conversion.

If *length* is omitted, it defaults to 10. If *length* is less than the number of characters in *num* (after adjustment by *precision*) a dummy string consisting of all asterisks of *length* number of characters is returned.

6.75 STUFF

```
STUFF(string,start,length,replace)
```

Returns *string* with *length* number of characters removed and the *replace* string inserted. The point of removal and insertion is specified by the *start* integer, counting from the beginning of *string*. If *length* is 0, no characters are removed. If *replace* is the empty string, no characters are inserted.

If *start* is greater than the number of characters in *string*, no value is returned. If *start* is 1, *length* number of characters are removed from the beginning of *string* and the *replace* string inserted. If *start* is 0, *length* minus 1 number of characters are removed from the beginning of *string* and the *replace* string inserted.

If *length* is greater than or equal to the number of characters in *string*, the *replace* string is returned. The *replace* string length is not limited by the length of *string* or *length*.

6.76 SUBSTRING

```
SUBSTRING(string,start,length)
```

Returns a substring of *string* beginning at the location *start* for the *length* number of characters. If *start* is greater than the length of *string*, or if *length* is 0, no string is returned.

6.77 SUM

```
SUM(numfield)
SUM(DISTINCT numfield)
```

Aggregate function: used in a query to return the sum of the values in the *numfield* column. For example:

TSQL

```
SELECT SUM(Age) FROM Sample.Person
```

`SUM(DISTINCT numfield)` sums the unique values in the *numfield* column. Fields with NULL are ignored.

6.78 SUSER_NAME

```
SUSER_NAME()
```

Returns the name of the current OS user. Parentheses are required, no argument is permitted. Equivalent to TSQL **USER_NAME()**, the InterSystems SQL **USER** function, and the ObjectScript **$USERNAME** special variable.

6.79 SUSER_SNAME

```
SUSER_SNAME()
```

Returns the name of the current OS user. Parentheses are required, no argument is permitted. Equivalent to TSQL **USER_NAME()**, the InterSystems SQL **USER** function, and the ObjectScript **$USERNAME** special variable.

6.80 TAN

```
TAN(float)
```

Tangent: returns the tangent of the angle specified in *float*. Thus 1 returns 1.55740772465...

6.81 TEXTPTR

```
TEXTPTR(field)
```

Returns an internal pointer to the image or text column data specified in *field*. The data type of this pointer is VARBINARY(16).

6.82 TEXTVALID

```
TEXTVALID('table.field',textpointer)
```

Takes an internal pointer to an image or text column from **TEXTPTR**, and compares it to a specified in *table.field*. Returns 1 if the pointer points to the specified *table.field*. Otherwise, returns 0.

6.83 UNICODE

```
UNICODE(char)
```

Returns the Unicode integer value corresponding to the first character in the string *char*. Thus, `UNICODE('A')` returns 65.

UNICODE is functionally identical to **ASCII**. The reverse of this function is **CHAR**.

6.84 UPPER

`UPPER(string)`

Returns *string* with all lowercase letters converted to uppercase. See LOWER.

6.85 USER

`USER`

Returns the name of the current user.

Note that no parentheses are used with this function.

6.86 USER_NAME

`USER_NAME([userid])`

Returns the name of the user specified by user ID. If the optional *userid* is omitted, returns the name of the current user. The argument is optional; the parentheses are mandatory.

6.87 YEAR

`YEAR(date)`

Returns the year portion of the specified date or date/time string. The *date* can be specified in ODBC timestamp format:

`yyyy-mm-dd hh:mm:ss.n`

The date separator can be either a hyphen (-) or a slash (/).

The *date* can also be specified in InterSystems IRIS $HOROLOG date format, such as `60703` (March 14, 2007).

6.88 Unsupported Functions

The following Microsoft Transact-SQL functions are not supported: APP_NAME, ATN2, BINARY_CHECKSUM, CHECKSUM, COL_LENGTH, COLLATIONPROPERTY, COLUMNPROPERTY, CURSOR_STATUS, DATABASE-PROPERTY, DATABASEPROPERTYEX, DB_ID, DIFFERENCE, FILE_ID, FILE_NAME, FILEGROUP_ID, FILE-GROUP_NAME, FILEGROUPPROPERTY, FILEPROPERTY, FORMATMESSAGE, FULLTEXTCATALOGPROPERTY,

FULLTEXTSERVICEPROPERTY, GETANSINULL, HOST_ID, IDENT_CURRENT, IDENT_INCR, IDENT_SEED, IDENTITY, INDEXKEY_PROPERTY, INDEXPROPERTY, ISDATE, IS_MEMBER, IS_SRVROLEMEMBER, OBJECTPROPERTY, PARSENAME, PERMISSIONS, ROWCOUNT_BIG, SERVERPROPERTY, SESSIONPROPERTY, SESSION_USER, SOUNDEX, SQL_VARIANT_PROPERTY, STATS_DATE, STDEV, STDEVP, SYSTEM_USER, TYPEPROPERTY.

7

TSQL Variables

7.1 Local Variables

By default, TSQL local variables are specified using an at sign (@) prefix, for example, @myvar. You can override this default to also allow PLAINLOCALS, TSQL local variables specified without an at sign (@) prefix. For example, myvar.

7.1.1 Declaring a Local Variable

A local variable must be declared (using DECLARE or as a formal parameter) before use. A variable name must be a valid identifier. Local variable names are not case-sensitive. The declaration must specify a data type, though strict data typing is not enforced in InterSystems TSQL. For a list of supported data types, see TSQL Constructs.

The **DECLARE** command has the following syntax:

```
DECLARE @var [AS] datatype [ = initval]
```

If declaring variables is inconvenient, you can switch this check off using the NDC setting. However, cursors must be declared, even if NDC is used.

Stored procedure arguments are automatically declared as local variables.

7.1.2 Setting a Local Variable

A local variable can be set using either the **SET** command or the **SELECT** command. A local variable can be displayed using either the **PRINT** command or the **SELECT** command. The following Dynamic SQL examples show two local variables being declared, set, and displayed:

ObjectScript

```
SET myquery = 3
SET myquery(1) = "DECLARE @a CHAR(20),@b CHAR(20) "
SET myquery(2) = "SET @a='hello ' SET @b='world!' "
SET myquery(3) = "PRINT @a,@b"
SET tStatement = ##class(%SQL.Statement).%New(,,"MSSQL")
SET qStatus = tStatement.%Prepare(.myquery)
 IF qStatus'=1 { WRITE "%Prepare failed",$System.Status.DisplayError(qStatus) QUIT}
SET rset = tStatement.%Execute()
DO rset.%Display()
```

ObjectScript

```
SET myquery = 3
SET myquery(1) = "DECLARE @a CHAR(20),@b CHAR(20) "
SET myquery(2) = "SELECT @a='hello ', @b='world!'"
SET myquery(3) = "SELECT @a,@b"
SET tStatement = ##class(%SQL.Statement).%New(,,"MSSQL")
SET qStatus = tStatement.%Prepare(.myquery)
 IF qStatus'=1 { WRITE "%Prepare failed",$System.Status.DisplayError(qStatus) QUIT}
SET rset = tStatement.%Execute()
DO rset.%Display()
```

7.1.3 Initial and Default Values

By default, **DECLARE** initializes local variables to "" (SQL NULL). Optionally, you can specify an initial value (*initval*) for a local variable in the **DECLARE** command.

If a declared variable is set to the results of a scalar subquery, and the subquery returns no rows, InterSystems TSQL sets the variable to "" (SQL NULL). This default is compatible with MS SQLServer; it is not compatible with Sybase.

7.1.4 Plain Local Variables

By default, local variables require an @ prefix. However, you can specify plain locals, local variables that do not require an @ prefix. The following command activates plain local variables:

TSQL

```
SET PLAINLOCALS ON
```

You must activate plain local variables before declaring these variables. With plain local variables activated you can declare both local variables with an @ prefix and local variables without an @ prefix. However, you cannot declare two variables that only differ by the @ prefix. For example, @myvar and myvar are considered the same variable. When declaring, selecting, or printing a plain local variable, you can specify the same variable with or without the @ prefix.

Plain local variables follow all of the other TSQL variable conventions.

The following TSQL class method specifies PLAINLOCALS ON and declares and uses both an @ local variable and a plain local variable:

```
ClassMethod Hello() As %String [Language=tsql,ReturnResultsets,SqlProc ]
{ SET PLAINLOCALS ON;
   DECLARE @a CHAR(20),b CHAR(20);
   SET @a='hello ' SET b='world!';
   PRINT @a,b;
}
```

7.2 @@ Special Variables

TSQL special variables are identified by an @@ prefix. @@ variables are system-defined; they cannot be created or modified by user processes. @@ variables are global in scope (available to all processes). They are thus sometimes referred to elsewhere in the Transact-SQL literature as “global variables.” Because the term “global variable” is used widely in InterSystems IRIS and differs significantly in meaning, these TSQL @@ variables are referred to here as “special variables” to avoid confusion.

The following special variables are implemented. Invoking an unimplemented special variable generates a #5001 '@@nnn' unresolved symbol error or a #5002 <UNDEFINED> error. The corresponding ObjectScript and InterSystems SQL generated code for each special variable is provided:

7.2.1 @@ERROR

Contains the error number of the most recent TSQL error. 0 indicates that no error has occurred. A 0 value is returned when either SQLCODE=0 (successful completion) or SQLCODE=100 (no data, or no more data). To differentiate these two results, use @@SQLSTATUS.

ObjectScript `SQLCODE`

SQL `:SQLCODE`

7.2.2 @@FETCH_STATUS

Contains an integer specifying the status of the last FETCH cursor statement. The available options are: 0=row successfully fetched; –1=no data could be fetched; –2 row fetched is missing or some other error occurred. A value of –1 can indicate that there is no data to FETCH, or that the fetch has reached the end of the data.

ObjectScript

```
SET myquery = "SELECT @@FETCH_STATUS AS FetchStat"
SET tStatement = ##class(%SQL.Statement).%New(,,"MSSQL")
SET qStatus = tStatement.%Prepare(myquery)
 IF qStatus'=1 { WRITE "%Prepare failed",$System.Status.DisplayError(qStatus) QUIT}
SET rset = tStatement.%Execute()
DO rset.%Display()
```

The corresponding InterSystems SQL function is:

SQL

```
SELECT $TSQL_FETCH_STATUS()
```

ObjectScript `$Case($Get(SQLCODE,0),0:0,100:-1,:-2)`

SQL `CASE :SQLCODE WHEN 0 THEN 0 WHEN 100 THEN –1 ELSE –2 END`

7.2.3 @@IDENTITY

Contains the IDENTITY field value of the most recently inserted, updated, or deleted row.

ObjectScript `%ROWID`

SQL `:%ROWID`

7.2.4 @@LOCK_TIMEOUT

Contains an integer specifying the timeout value for locks, in seconds. Lock timeout is used when a resource needs to be exclusively locked for inserts, updates, deletes, and selects. The default is 10.

ObjectScript

```
SET myquery = "SELECT @@LOCK_TIMEOUT AS LockTime"
SET tStatement = ##class(%SQL.Statement).%New(,,"MSSQL")
SET qStatus = tStatement.%Prepare(myquery)
 IF qStatus'=1 { WRITE "%Prepare failed",$System.Status.DisplayError(qStatus) QUIT}
SET rset = tStatement.%Execute()
DO rset.%Display()
```

The corresponding InterSystems SQL function is:

SQL

```
SELECT $TSQL_LOCK_TIMEOUT()
```

ObjectScript LOCK command

SQL SET OPTION LOCK_TIMEOUT

7.2.5 @@NESTLEVEL

Contains an integer specifying the nesting level of the current process.

ObjectScript

```
SET myquery = "PRINT @@NESTLEVEL"
SET tStatement = ##class(%SQL.Statement).%New(,,"MSSQL")
SET qStatus = tStatement.%Prepare(myquery)
 IF qStatus'=1 { WRITE "%Prepare failed",$System.Status.DisplayError(qStatus) QUIT}
SET rset = tStatement.%Execute()
DO rset.%Display()
```

The corresponding InterSystems SQL function is:

SQL

```
SELECT $TSQL_NESTLEVEL()
```

ObjectScript $STACK

7.2.6 @@ROWCOUNT

Contains the number of rows affected by the most recent **SELECT**, **INSERT**, **UPDATE**, or **DELETE** command. A single-row **SELECT** always returns a @@ROWCOUNT value of either 0 (no row selected) or 1.

When invoking an AFTER statement level trigger, the @@ROWCOUNT value upon entering the trigger is the @@ROWCOUNT immediately prior to the trigger. Rows affected within the scope of the trigger code are reflected in the @@ROWCOUNT value. Upon completion of the trigger code, @@ROWCOUNT reverts to the value immediately prior to the trigger invocation.

ObjectScript %ROWCOUNT

SQL :%ROWCOUNT

7.2.7 @@SERVERNAME

Contains the InterSystems IRIS instance name.

ObjectScript

```
SET myquery = "SELECT @@SERVERNAME AS CacheInstance"
SET tStatement = ##class(%SQL.Statement).%New(,,"MSSQL")
SET qStatus = tStatement.%Prepare(myquery)
 IF qStatus'=1 { WRITE "%Prepare failed",$System.Status.DisplayError(qStatus) QUIT}
SET rset = tStatement.%Execute()
DO rset.%Display()
```

The corresponding InterSystems SQL function is:

SQL

```
SELECT $TSQL_SERVERNAME()
```

ObjectScript `$PIECE($system,":",2)`

7.2.8 @@SPID

Contains the server process ID of the current process.

ObjectScript

```
SET myquery = "SELECT @@SPID AS ProcessID"
SET tStatement = ##class(%SQL.Statement).%New(,,"MSSQL")
SET qStatus = tStatement.%Prepare(myquery)
 IF qStatus'=1 { WRITE "%Prepare failed",$System.Status.DisplayError(qStatus) QUIT}
SET rset = tStatement.%Execute()
DO rset.%Display()
```

The corresponding InterSystems SQL function is:

SQL

```
SELECT $TSQL_SPID()
```

ObjectScript `$JOB`

7.2.9 @@SQLSTATUS

Contains an integer specifying the completion status of the most recent SQL statement. Available values are: 0=successful completion; 1=failure; 2=no (more) data available.

ObjectScript

```
SET myquery = "SELECT @@SQLSTATUS AS SQLStatus"
SET tStatement = ##class(%SQL.Statement).%New(,,"MSSQL")
SET qStatus = tStatement.%Prepare(myquery)
 IF qStatus'=1 { WRITE "%Prepare failed",$System.Status.DisplayError(qStatus) QUIT}
SET rset = tStatement.%Execute()
DO rset.%Display()
```

The corresponding InterSystems SQL function is:

SQL

```
SELECT $TSQL_SQLSTATUS()
```

ObjectScript `$Case($Get(SQLCODE,0),0:0,100:2,:1)`

SQL `CASE :SQLCODE WHEN 0 THEN 0 WHEN 100 THEN 2 ELSE 1 END`

7.2.10 @@TRANCOUNT

Contains the number of currently active transactions.

ObjectScript

```
SET myquery = "SELECT @@TRANCOUNT AS ActiveTransactions"
SET tStatement = ##class(%SQL.Statement).%New(,,"MSSQL")
SET qStatus = tStatement.%Prepare(myquery)
 IF qStatus'=1 { WRITE "%Prepare failed",$System.Status.DisplayError(qStatus) QUIT}
SET rset = tStatement.%Execute()
DO rset.%Display()
```

The corresponding InterSystems SQL function is:

SQL

```
SELECT $TSQL_TRANCOUNT()
```

ObjectScript `$TLEVEL`

7.2.11 @@VERSION

Contains the InterSystems IRIS version number and date and time of its installation.

ObjectScript

```
  SET myquery = "SELECT @@VERSION AS CacheVersion"
  SET tStatement = ##class(%SQL.Statement).%New(,,"MSSQL")
  SET qStatus = tStatement.%Prepare(myquery)
   IF qStatus'=1 { WRITE "%Prepare failed",$System.Status.DisplayError(qStatus) QUIT}
  SET rset = tStatement.%Execute()
  DO rset.%Display()
```

The corresponding InterSystems SQL function is:

SQL

```
SELECT $TSQL_VERSION()
```

ObjectScript `$ZVERSION`

8

TSQL System Stored Procedures

InterSystems IRIS® data platform provides TSQL system stored procedures to help you administer and track database objects in your system. TSQL system stored procedures can be executed in any namespace and schema. The scope of all stored procedures is the current namespace.

Stored procedures are executed using the TSQL **EXECUTE** or **EXEC** command. For a stored procedure with a name such as sp_xxx, this execute command can be explicit or implicit. Thus the following TSQL statements are functionally identical:

```
EXECUTE sp_addtype 'shortstr','varchar(6)','not null'
EXEC sp_addtype 'shortstr','varchar(6)','not null'
sp_addtype 'shortstr','varchar(6)','not null'
```

InterSystems TSQL supports the following system stored procedures:

- sp_addtype
- sp_droptype
- sp_procxmode

8.1 sp_addtype

This system stored procedure adds a user-defined data type.

```
sp_addtype typename, phystype [(length) | (precision [, scale])]
    [, "identity" | nulltype]
```

typename is a user-defined data type name. *phystype* is the physical datatype on which to base the user-defined datatype. You can optionally specify either IDENTITY or *nulltype*. The optional IDENTITY keyword specifies that the user-defined data type has the IDENTITY property, which by definition is NOT NULL. The optional *nulltype* specifies whether a column with this data type should have a NOT NULL constraint: options are NULL (allow nulls) and NOT NULL or NONULL (do not allow nulls).

A *typename* can only be used for table columns. A *typename* is defined within the current namespace; mapping of a *typename* across namespaces is not supported.

The SQL compiler looks up type mapping in the DDL Datatype Mapping definitions in the system configuration before looking up in the *typename* table. Therefore, if you define a *typename* using **sp_addtype** named My_Type, but you also have a My_Type defined in the User DDL Datatype Mappings, the mapping of My_Type comes from the User DDL Datatype Mapping definition.

This lookup of *typename* is done at runtime, so *typename* does not need to be defined at DDL compile time.

A data type defined using **sp_addtype** with a specified *nulltype* behaves as follows:

- If the DDL field specifies NULL, a value for the field is not required, even if **sp_addtype** specified NOT NULL.
- If the DDL field specifies NOT NULL, a value for the field is required, even if **sp_addtype** specified NULL.
- If the DDL field does not specify NULL or NOT NULL, a value for the field is required if **sp_addtype** specified NOT NULL.
- If the DDL field does not specify NULL or NOT NULL, a value for the field is not required if **sp_addtype** either specified NULL or did not specify a *nulltype*.

The following example creates the data type shortstr, which requires a value (NOT NULL) and this value must be six or less characters:

```
EXEC sp_addtype 'shortstr','varchar(6)','not null'
```

8.2 sp_droptype

This system stored procedure deletes a user-defined data type.

```
sp_droptype typename
```

typename is a user-defined data type name defined within the current namespace.

See sp_addtype.

8.3 sp_procxmode (Sybase only)

This system stored procedure displays or changes the execution mode associated with stored procedures.

```
sp_procxmode [procname [, tranmode]]
```

procname is the name of a stored procedure. *tranmode* is the transaction execution mode: Values are "chained", "unchained" (the default), and "anymode".

When called with no arguments, **sp_procxmode** returns a result set of all procedures defined for the namespace, their user name and transaction mode (1=unchained). When called with just the *procname* argument, **sp_procxmode** returns the user name and transaction mode of the specified procedure.

The following *tranmode* values are supported:

- Chained: implicitly begins a transaction before any data-retrieval or modification statement: delete, insert, open, fetch, select, or update. You must still explicitly end the transaction with commit transaction or rollback transaction. A procedure defined to run in chained mode will set autocommit_off at the beginning of the procedure, and restore the prior setting at the end of the procedure.
- Unchained: (the default) requires the user to explicit begin a transaction before any data-retrieval or modification statement. You must explicitly end the transaction with commit transaction or rollback transaction. A procedure defined to run in unchained mode will set autocommit_on at the beginning of the procedure, and restore the prior setting at the end of the procedure.
- Anymode: If the mode is not defined, or if it is defined as anymode, no change is made to the autocommit setting.

InterSystems IRIS does not support a SET [UN]CHAINED option to change process settings. The setting used is the current setting of the process's auto-commit mode.

InterSystems IRIS does not report an error if a procedure defined as chained is called by a process in autocommit_on mode, nor does it report an error if a procedure defined as unchained is called by a process in autocommit_off mode.

The *tranmode* metadata is not part of the actual method definition. This means that changing the *tranmode* does not require a recompile. It also means that when exporting/importing classes containing TSQL (Sybase) stored procedures, the *tranmode* setting for the procedure is not exported with the class definition. Upon import, if a procedure needs to be defined in Chained mode, you must call `EXEC sp_procxmode 'procname', 'chained'` for the procedure.