Altibase 3rd Party Connector Guide

Altibase® Application Development

Altibase Application Development Altibase 3rd Party Connector Guide
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Altibase Corp
10F, Daerung PostTower II,
306, Digital-ro, Guro-gu, Seoul 08378, Korea
Telephone : +82-2-2082-1000
Fax : +82-2-2082-1099
Customer Service Portal : http://support.altibase.com/en/
Homepage : http://www.altibase.com

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Preface

About This Manual

This manual describes how to integrate with Altibase.

Audience

This manual has been prepared for the following users of Altibase:

- Database administrators
- Performance administrators
- Database users
- Application developers
- Technical Supporters

It is recommended that those reading this manual possess the following background knowledge:

- Basic knowledge of the use of computers, operating systems, and operating system utilities
- Experience in using relational databases and an understanding of database concepts
- Computer programming experience
- Experience in database server management, operating system management, or network administration
- Knowledge related to the storage, management, and processing of data in distributed environments

Organization

This manual is organized as follows:

- Chapter 1: DBeaver

  This chapter describes the overview of DBeaver, how to install and uninstall the DBeaver, and how to connect it with the Altibase database system.

- Chapter 2: SQuirreL SQL Client
  This chapter describes how to install SQuirreL SQL Client and Altibase Plugin for SQuirreL SQL and integrate with Altibase via Altibase JDBC.

- Chapter 3: Hibernate

- Chapter 4: OpenLDAP
  This chapter describes how to integrate openLDAP and Altibase.

Documentation Conventions

This section describes the conventions used in this manual. Understanding these conventions will make it easier to find information in this manual and in the other manuals in the series.

There are two sets of conventions:

- Syntax diagram convetions

Sample Code Conventions

The code examples explain SQL statements, stored procedures, iSQL statements, and other command line syntax.

The following table describes the printing conventions used in the code examples.

Rules	Meaning	Example
[ ]	Indicates an optional item	VARCHAR [(*size*)] [[FIXED |] VARIABLE]
{ }	Indicates a mandatory field for which one or more items must be selected.	{ ENABLE | DISABLE | COMPILE }
|	A delimiter between optional or mandatory arguments.	{ ENABLE | DISABLE | COMPILE } [ENABLE | DISABLE | COMPILE]
. . .	Indicates that the previous argument is repeated, or that sample code has been omitted.	SQL> SELECT ename FROM employee; ENAME ---------- SWNO HJNO HSCHOI . . . 20 rows selected.
Other Symbols	Symbols other than those shown above are part of the actual code.	EXEC :p1 := 1; acc NUMBER(11,2)
Italics	Statement elements in italics indicate variables and special values specified by the user.	SELECT * FROM *table_name*; CONNECT *userID*/*password*;
Lower case words	Indicate program elements set by the user, such as table names, column names, file names, etc.	SELECT ename FROM employee;
Upper case words	Keywords and all elements provided by the system appear in upper case.	DESC SYSTEM.*SYS_INDICES*;

Related Documentations

For more detailed information, please refer to the following documents.

- Installation Guide
- Getting Started Guide
- Administrator's Manual
- General Reference
- Error Message Reference

Altibase Welcomes Your Comments and Feedback

Please let us know what you like or dislike about our manuals. To help us with better future versions of our manuals, please tell us if there are any corrections or classifications that you would find useful.

Include the following information:

- The name and version of the manual that you are using
- Any comments about the manual
- Your name, address, and phone number

If you need immediate assistance regarding any errors, omissions, and other technical issues, please contact Altibase's Support Portal.

Thank you. We always welcome your feedback and suggestions.

1.DBeaver

This chapter introduces the DBeaver overview, system requirements, installation and uninstallation methods, and how to connect to the Altibase database system.

Overview

DBeaver Community is a free database tool provided by DBeaver Corp. It enables connection to over 80 different database systems, offering functionalities such as data manipulation, database object management, SQL editor, SQL Plan viewer, session monitoring for database connections, etc.

The DBeaver package provided by Altibase provides the connection to Altibase and the diverse range of functionalities mentioned earlier, in addition to other compatible database systems.

For detailed information on DBeaver, refer to https://github.com/dbeaver/dbeaver/wiki.

System Requirements

Software Requirements

DBeaver Version

DBeaver versions compatible with Altibase Server are as follows:

- DBeaver 23.3.3 and higher

Altibase Server Version

Altibase server versions compatible with the DBeaver are as follows:

- Altibase 7.1.0 and higher

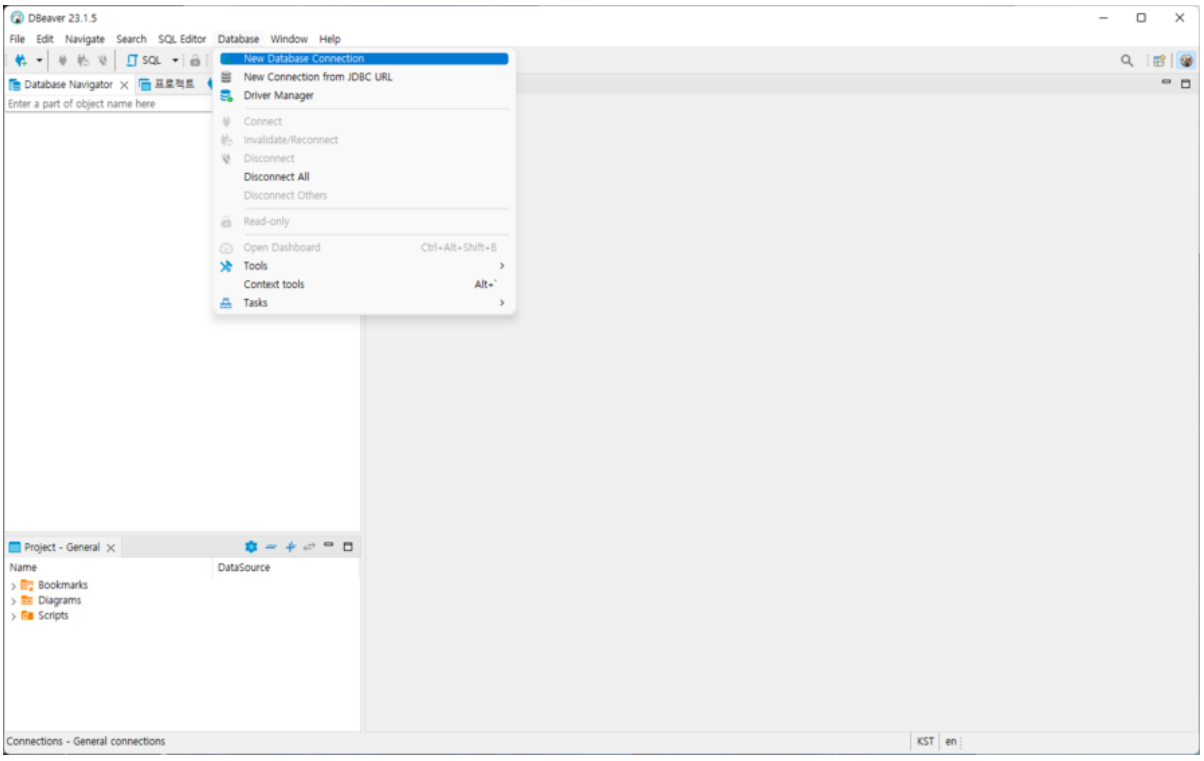
Installing and Uninstalling DBeaver

Users can download the DBeaver installation file from https://dbeaver.io/download/. For detailed information about installation and uninstallation, refer to https://github.com/dbeaver/dbeaver/wiki/Installation.

Altibase Database System Connection

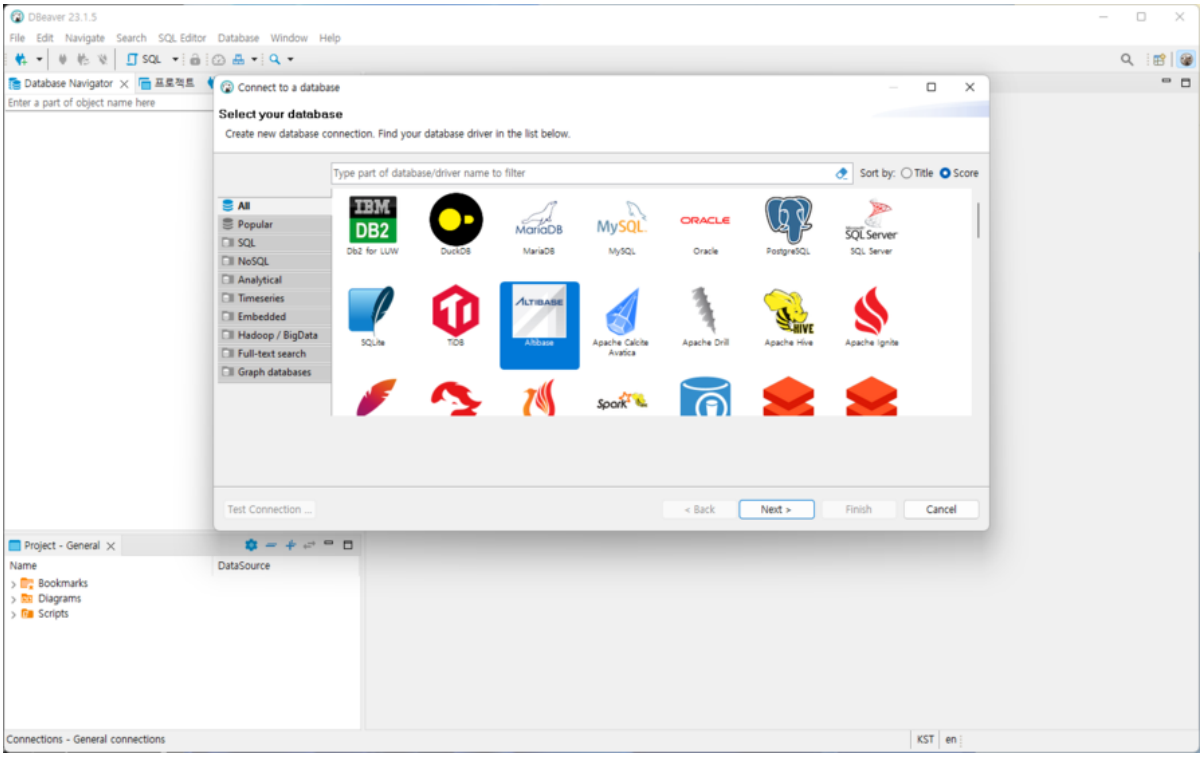
1. Connect to New Database

Click [Database] → [New Database Connection]



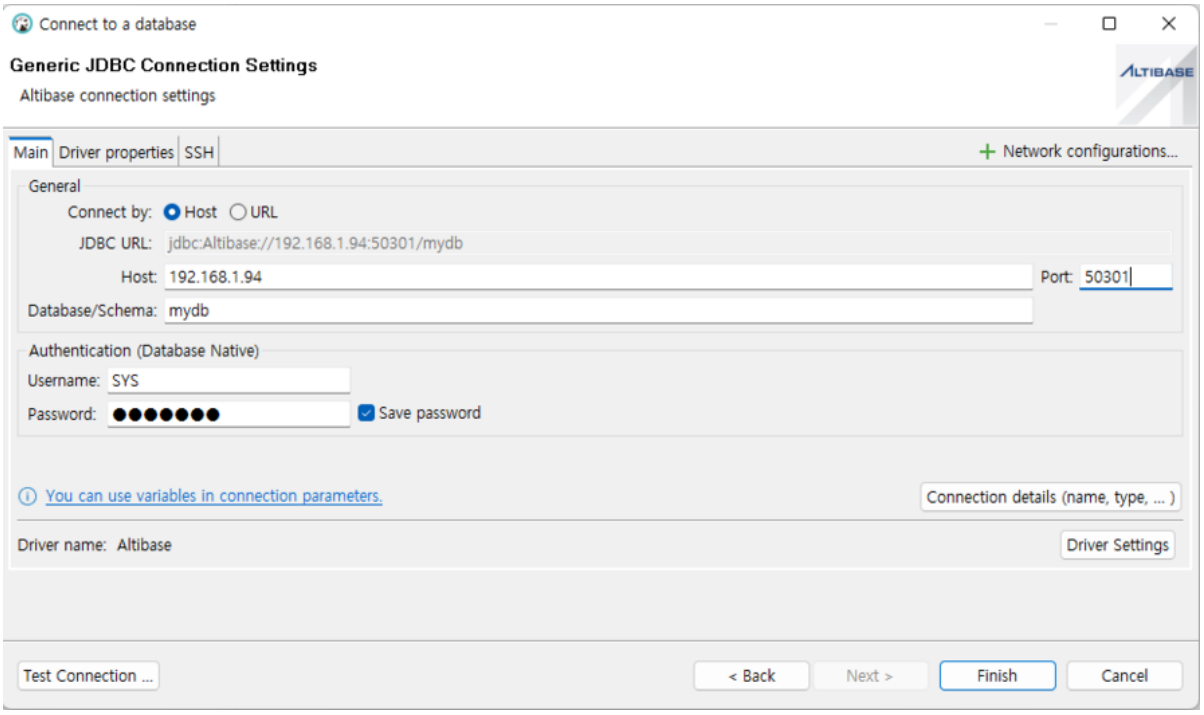
2. Select Altibase Database

Select Altibase in ALL or SQL tab, and click the [Next >].

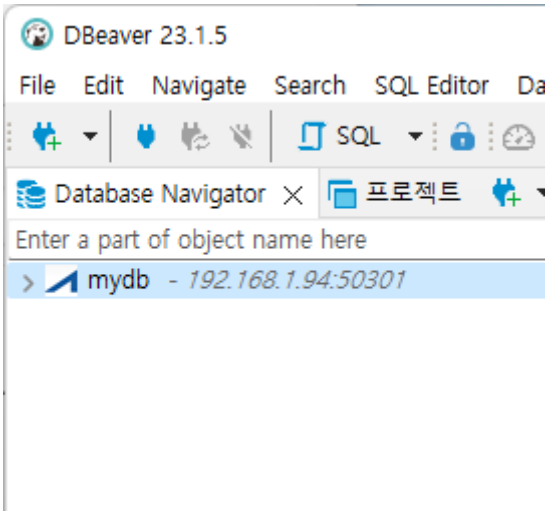


3. Set the Altibase Connection Information

Configure Altibase connection settings. Host IP address, Port Number, Database/Schema, Username, and Password are required. Click the [Finish] after configuration.



Now users can find the Altibase database set above on the Database Navigator tab as follows:

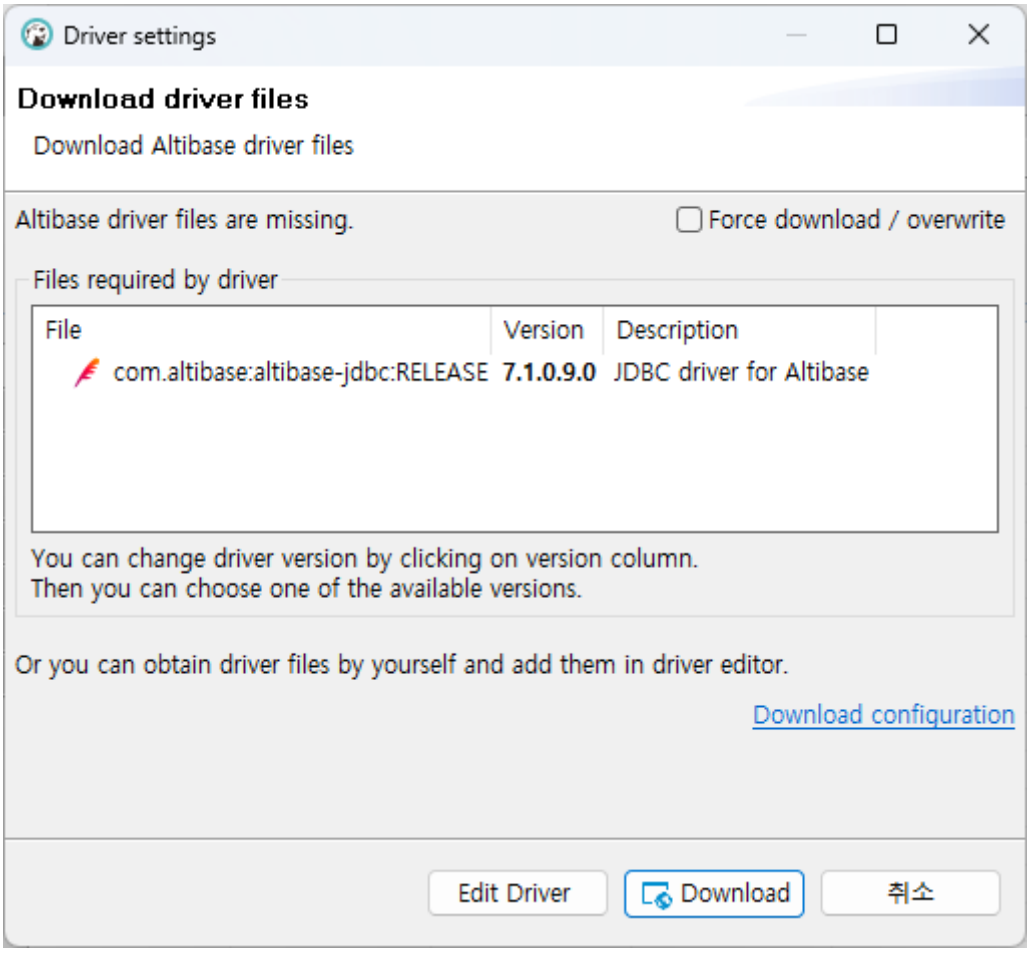


4. Download JDBC Driver Files

To connect the Altibase database, Altibase JDBC driver file is required. If users can access the internet, please refer to '4.1 Download JDBC Driver Files'. If users can not access the internet or want to register JDBC driver files manually, please refer to '4.2 Register JDBC Driver Manually'.

4.1 Download JDBC Driver Files

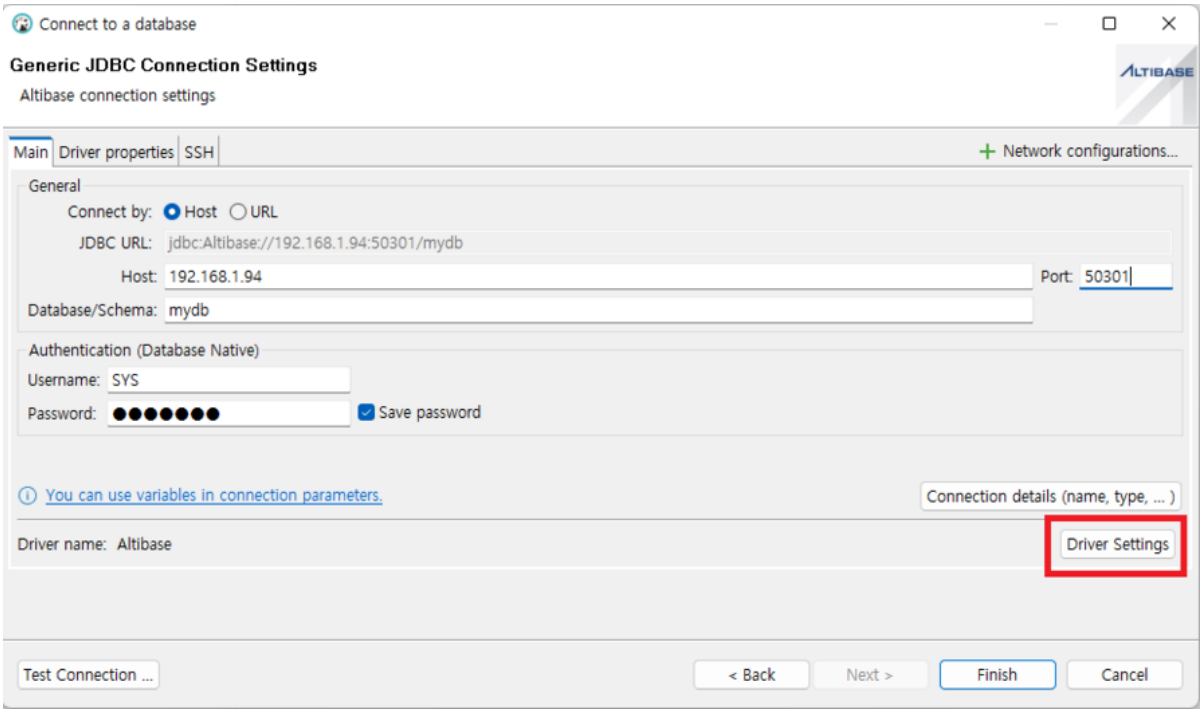
Double click the Altibase connection information(mydb) on the Database Navigator tab. Then the 'Driver settings' window pops up to download Altibase JDBC driver files. Select a Altibase JDBC driver file and click [Download].



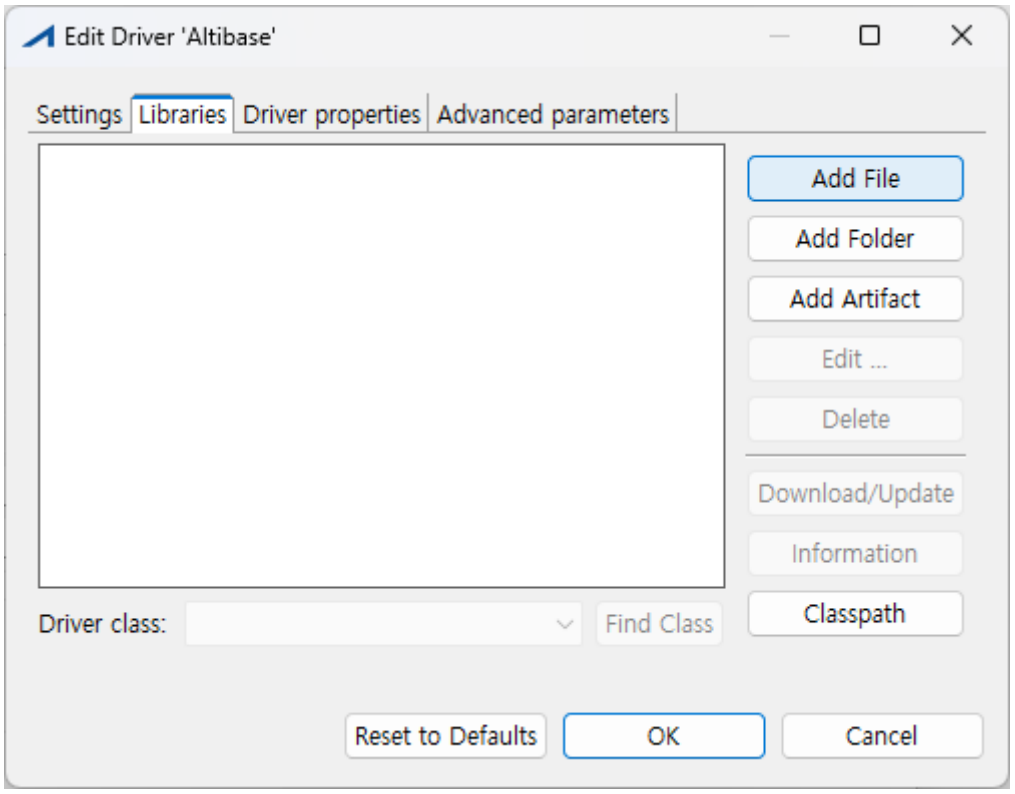
The database connection is processed after downloading. This only needs to be done the first connection.

4.2 Register JDBC Driver Manually

Users can manually register Altibase JDBC driver files. To do this, click on the [Driver Settings] located at the bottom of the 'Connect to a database' window.

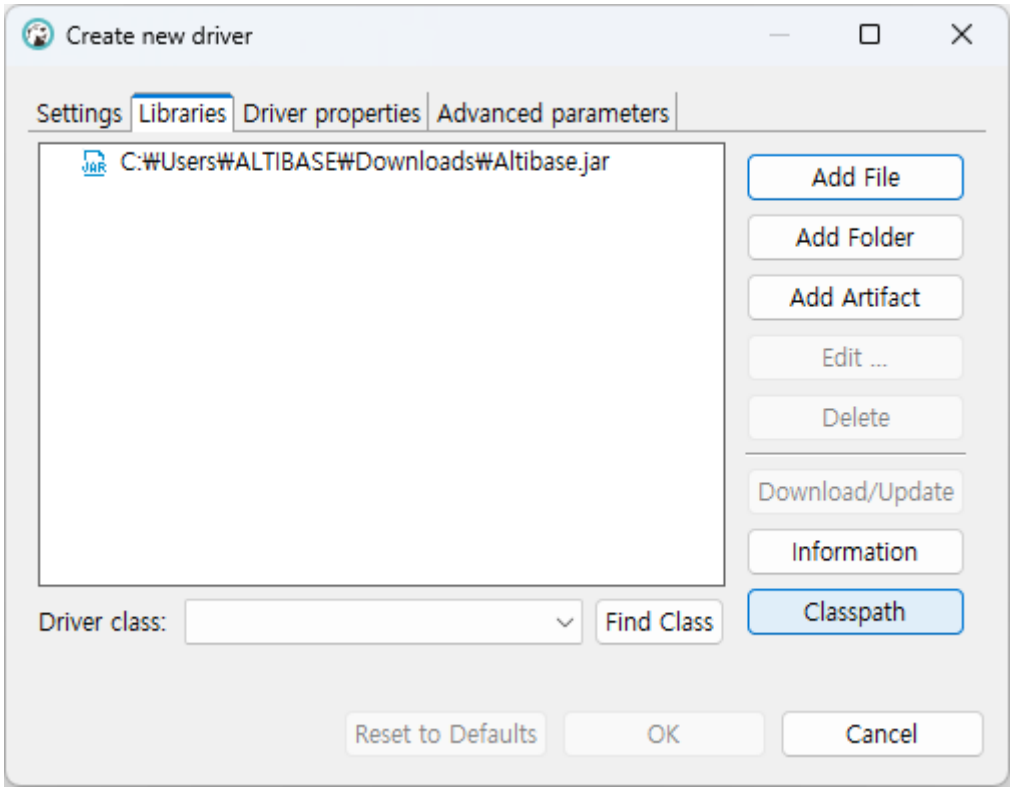


Click [Add File] on the Libraries tab.

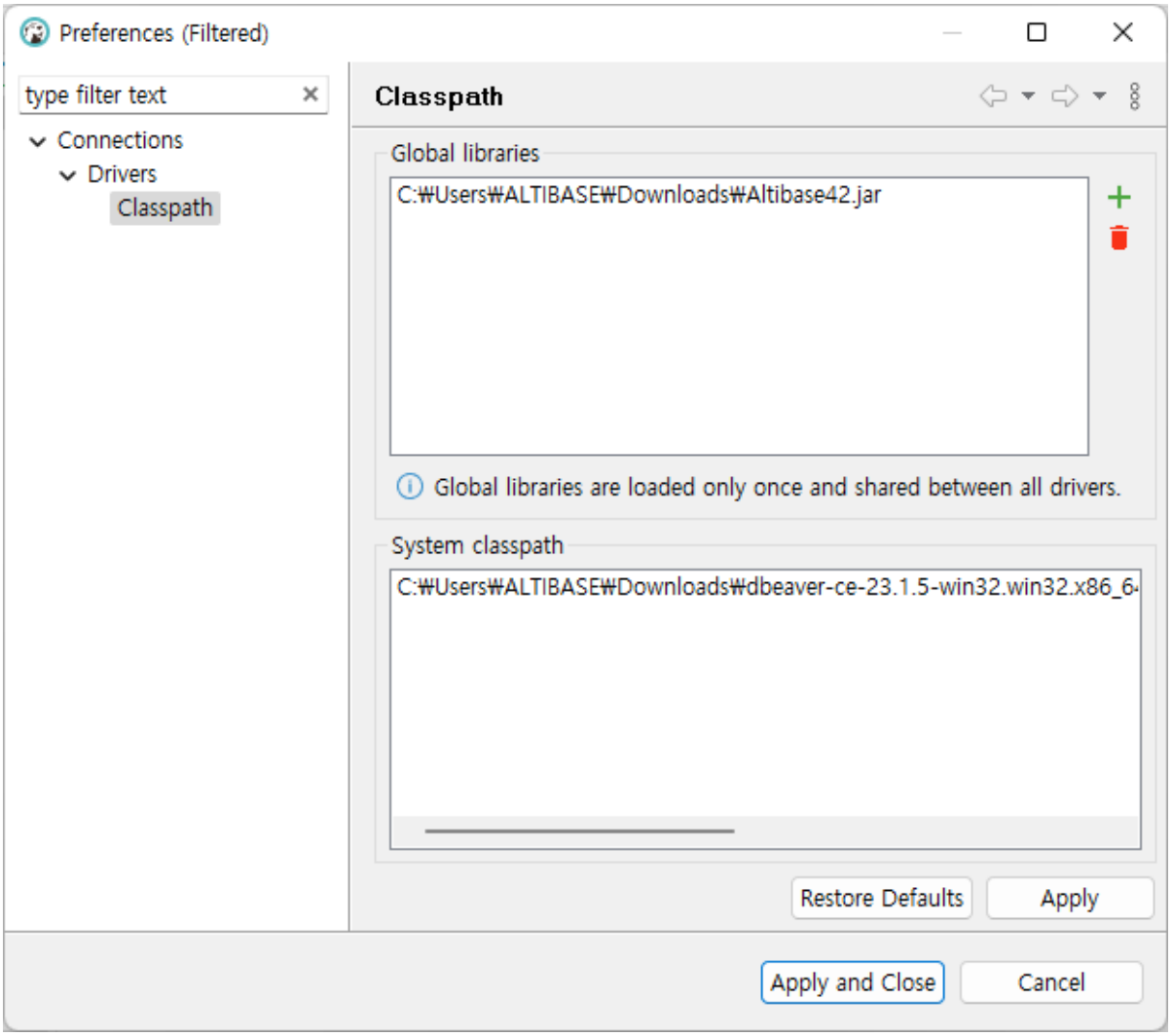


Select the Altibase JDBC driver file.

Click [Classpath].



Add the location of the JDBC driver file to be used in Global libraries and click [Apply and Close].



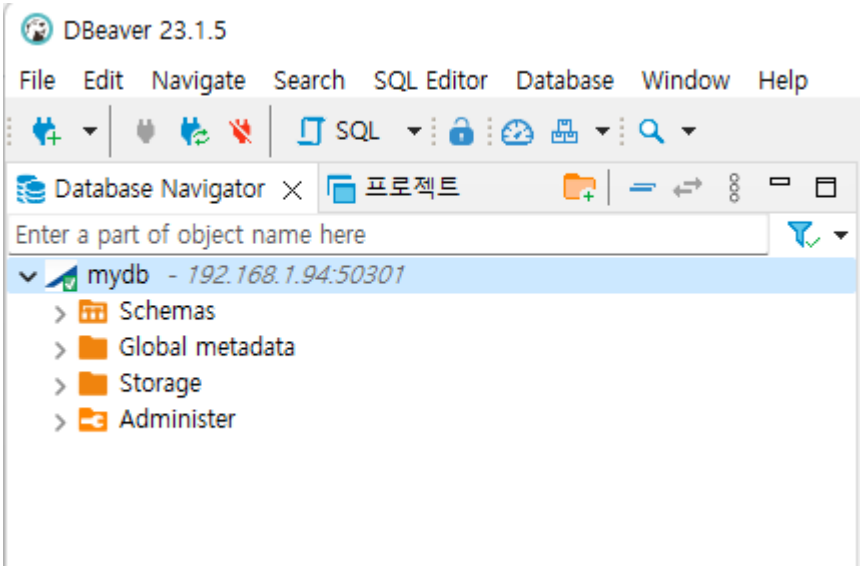
After all settings, click [OK] .

Click [Finish] to complete the configuration.

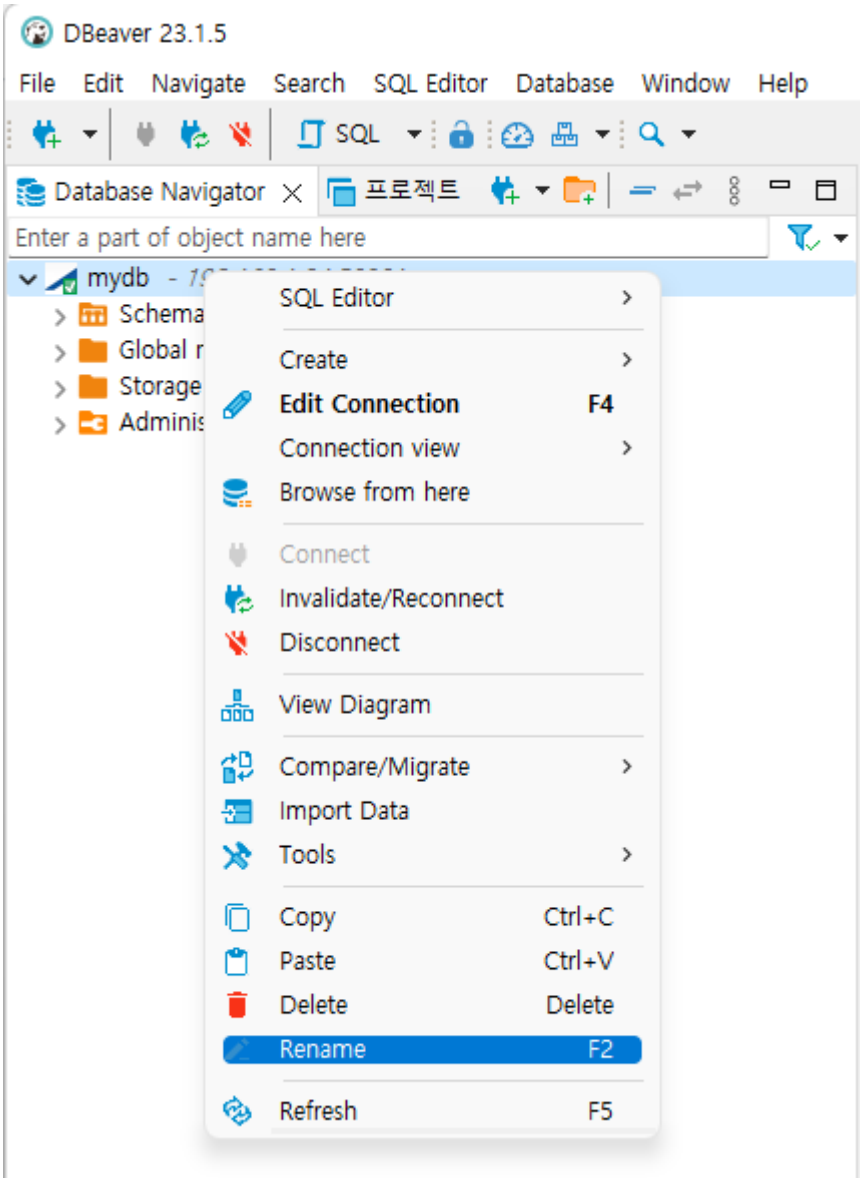
5. Complete Database Connection

Users can review the list of registered database connection information on the Database Navigator tab.

Double-clicking on the database connection information in the list attempts to establish a connection. A green check mark next to the icon signifies a successful connection has been established.



If needed, users can rename the database connection information to the desired name.



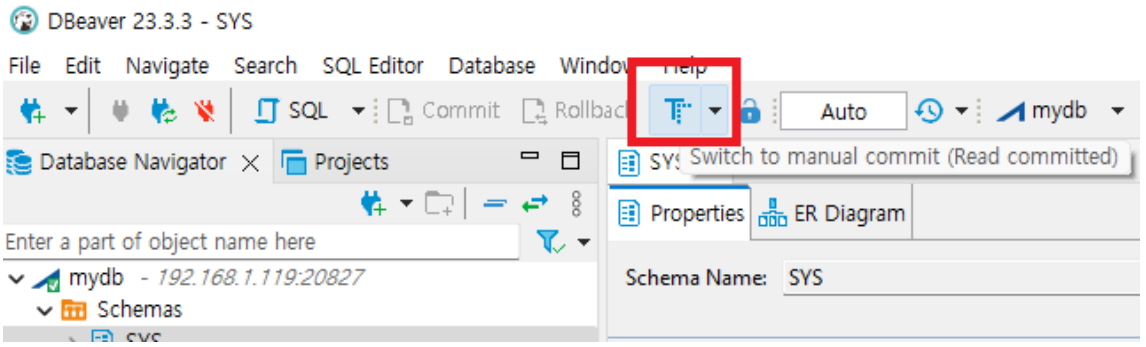
FAQ

Unable to Retrieve LOB Type Data.

DBeaver is configured with Auto-Commit as the default setting. To retrieve Altibase LOB type data, users need to change the commit mode from Auto-Commit to Manual Commit.

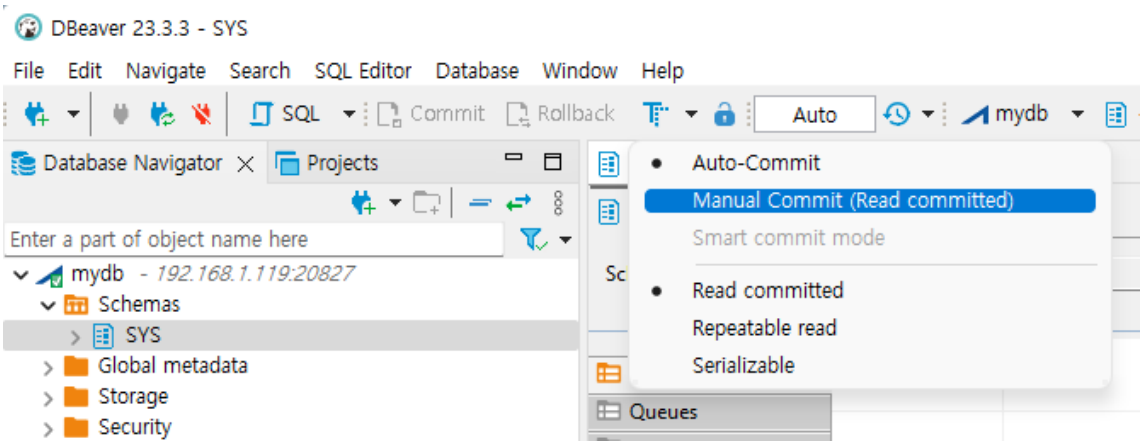
There are three methods to change the commit mode:

1. Click on the ▼ in the toolbar to switch to Manual Commit mode.



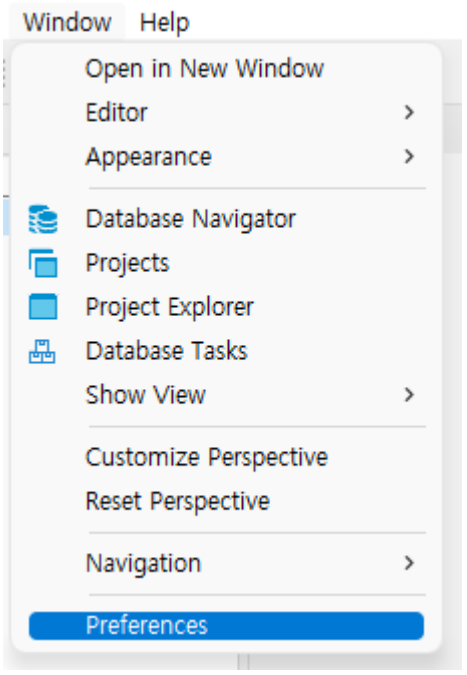
Button Icon	Commit Mode
	Auto-Commit
	Manual Commit

2. Select "Manual Commit" from the list of commit modes.



3. Deselect the "Auto-commit" default setting option in the menu and reconnect to the database.

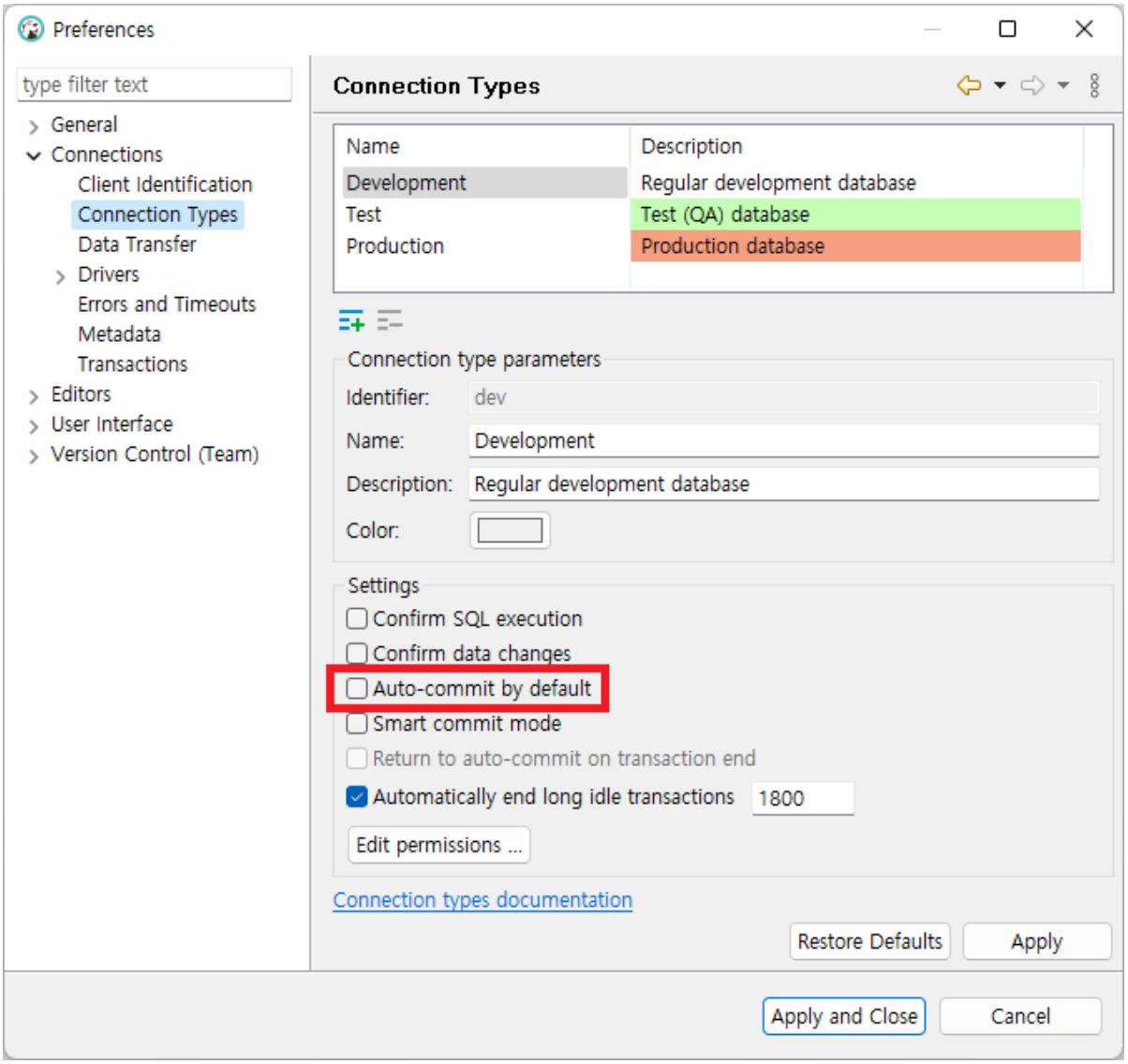
   [Window] → [Preferences]



Click [Connections] → [Connection Types]

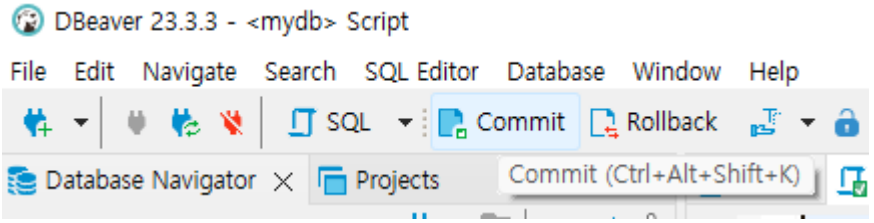
Uncheck the "Auto-commit by default" check box, then click [Apply and Close].

Reconnect to the database.



Note

In Manual Commit mode, users must explicitly commit or roll back when modifying tables.

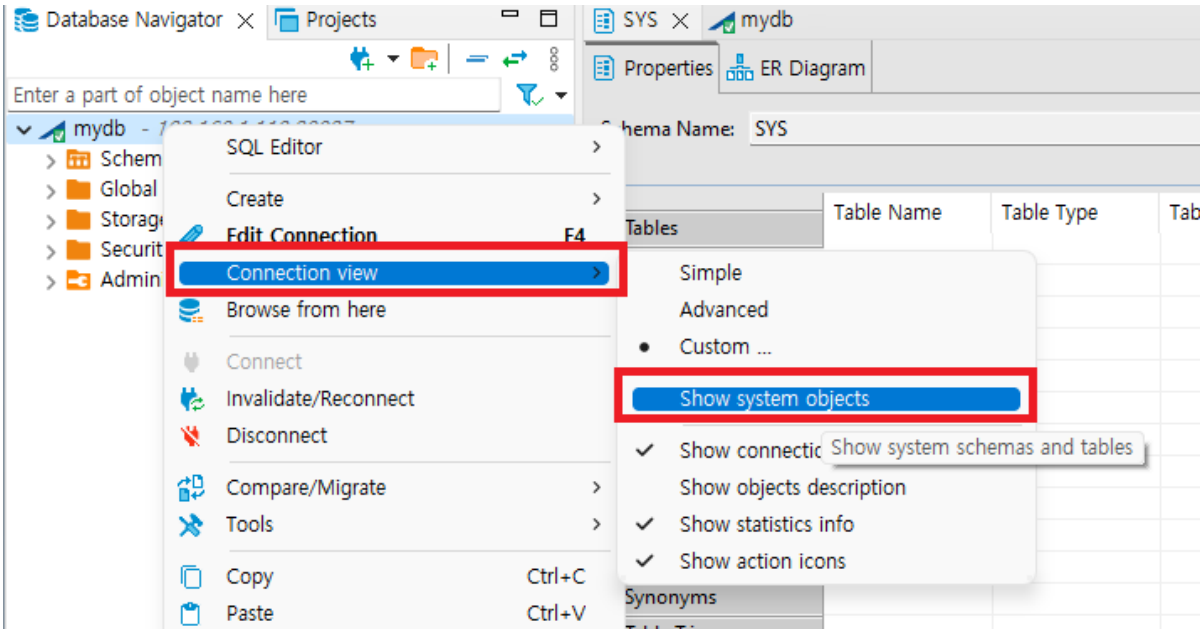


Reference: https://dbeaver.com/docs/dbeaver/Auto-and-Manual-Commit-Modes/

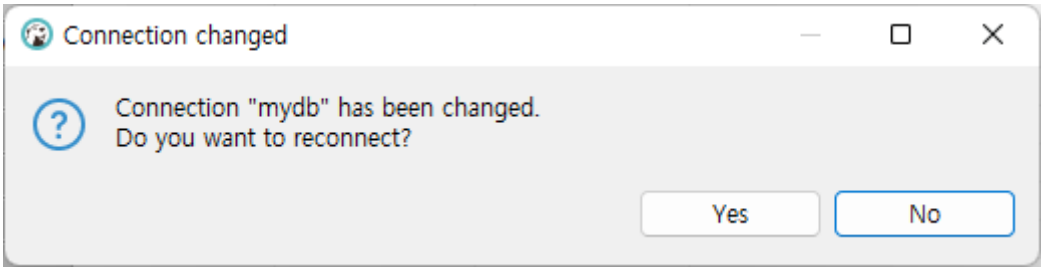
The SYSTEM_ schema is not visible.

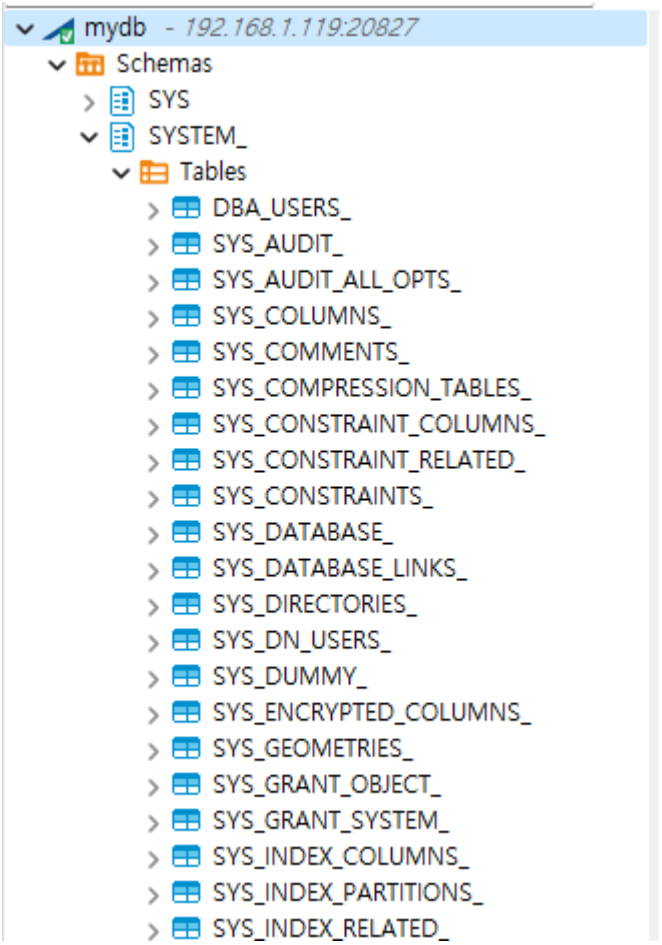
DBeaver, by default, does not display system objects. To view the SYSTEM_ schema, users need to set the "Show system objects" option.

Click on [Connection View] → [Show system objects] option.



After reconnecting to the database, users will be able to see the tables and views in the SYSTEM_ schema.





The DDL output for the object is not accurate.

To retrieve the accurate DDL statements of Altibase objects, it is essential to install the DBMS_METADATA package by SYS user.

To install the DBMS_METADATA package, connect to Altibase using the SYS account and execute the following statement:

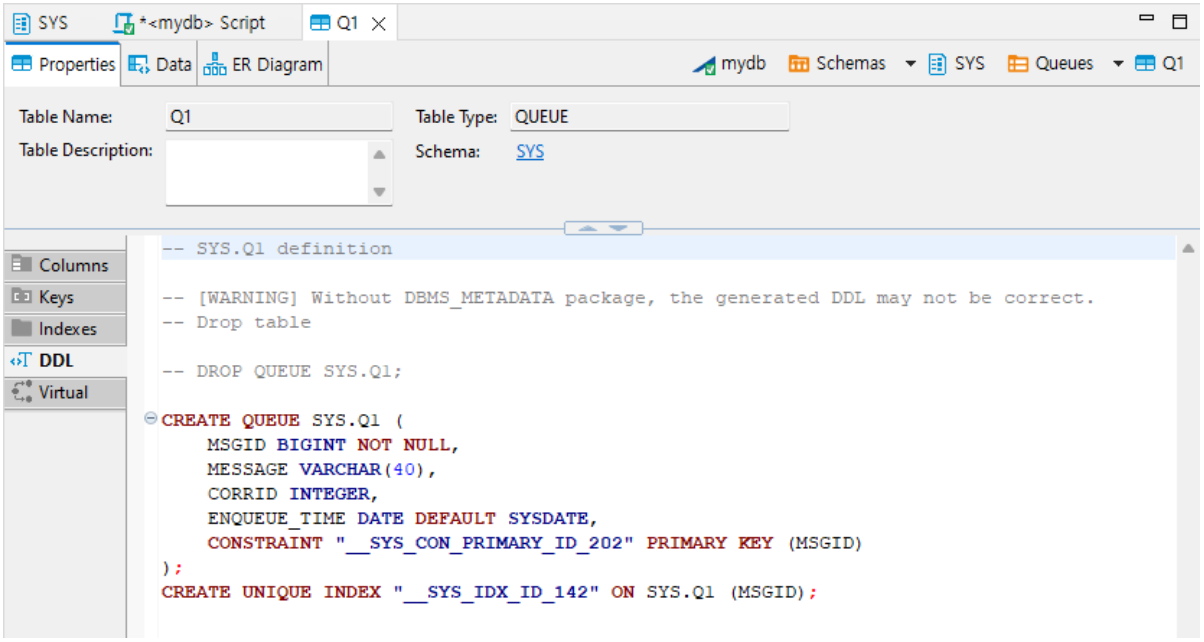
```
$ cd $ALTIBASE_HOME
$ is -f ./packages/dbms_metadata.sql
$ is -f ./packages/dbms_metadata.plb
```

Example)

The following is an example syntax for creating the queue object Q1.

```
CREATE QUEUE q1(40) MAXROWS 100000;
```

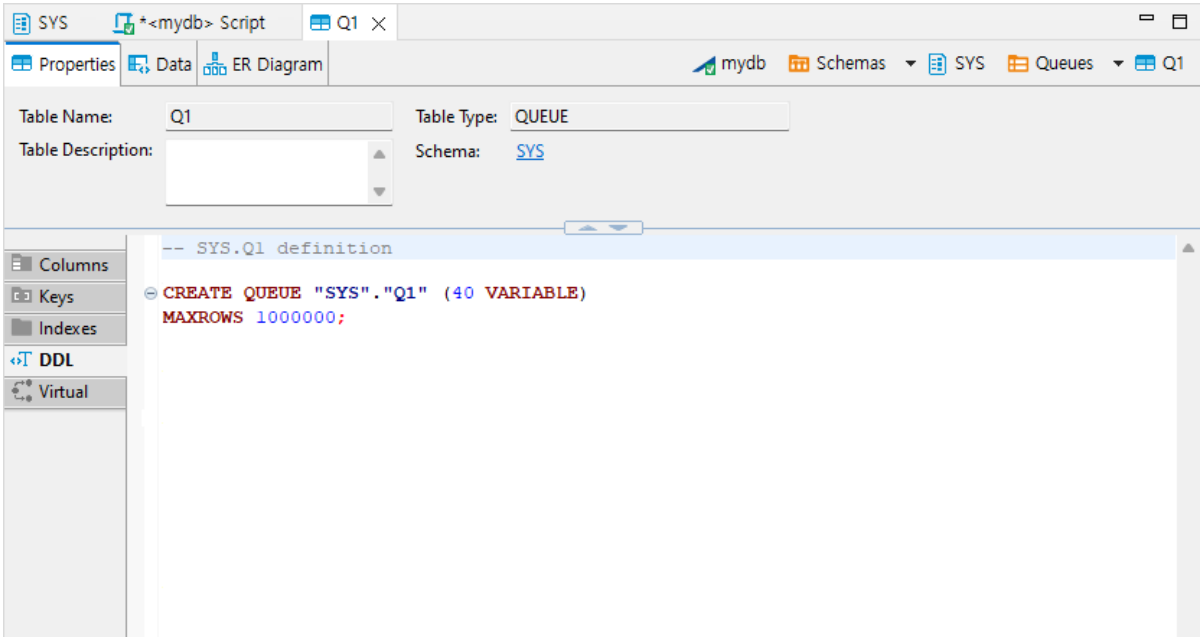
After executing the above statement and attempting to retrieve the DDL for the Q1 object in DBeaver, the wrong output may be displayed as follows.



Install the DBMS_METADATA package:

```
$ cd $ALTIBASE_HOME
$ is -f ./packages/dbms_metadata.sql
$ is -f ./packages/dbms_metadata.plb
```

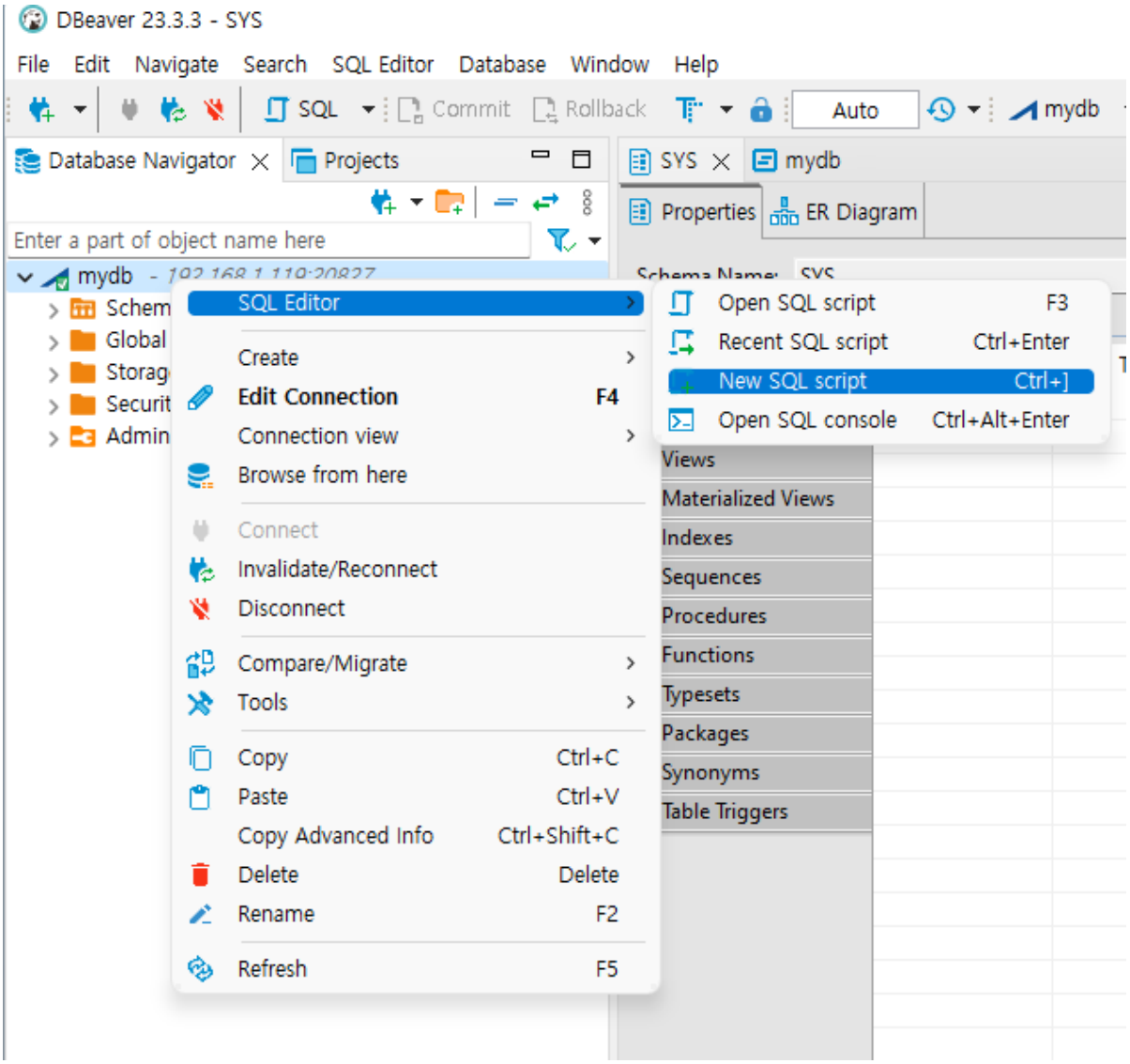
After installation, reconnect to the target Altibase in DBeaver. Users can retrieve accurate DDL statements for the Q1.



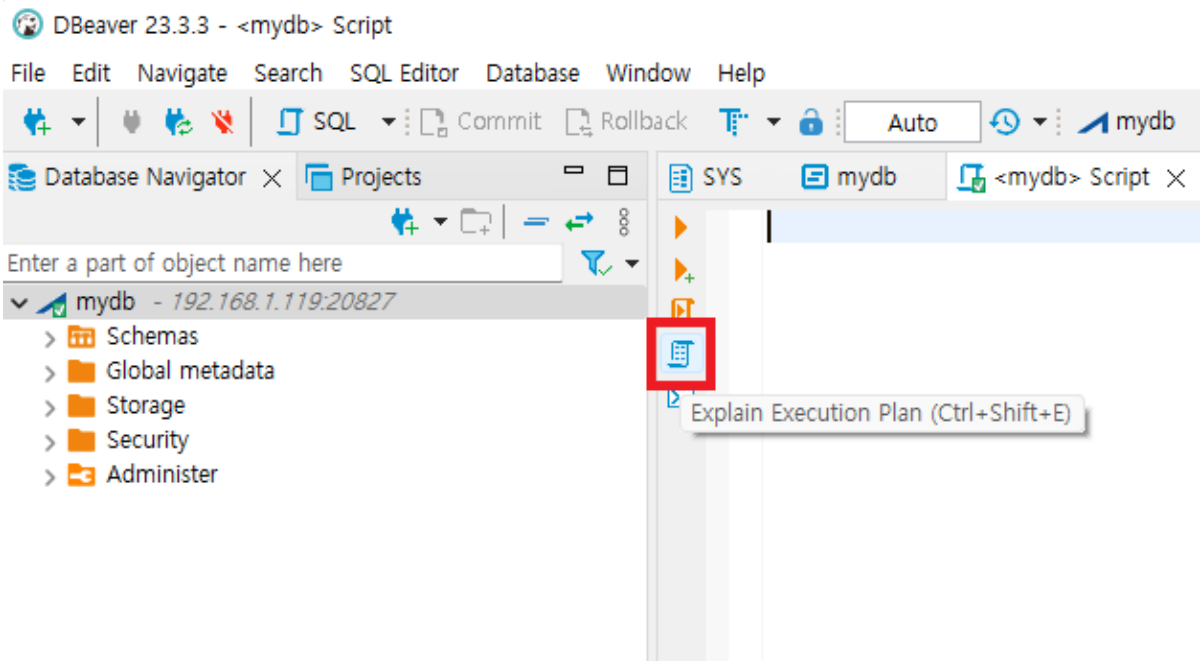
Where can I find the query execution plan for my queries?

The query execution plan can be viewed by entering a query in the SQL script window and then clicking on the "Explain Execution Plan" icon.

Click on [SQL Editor] of the connected database → [New SQL script]



In the SQL Script window, users can enter a query and then click on the "Explain Execution Plan" icon to view the query execution plan.



The default option value for the query execution plan is "Explain Plan Only."

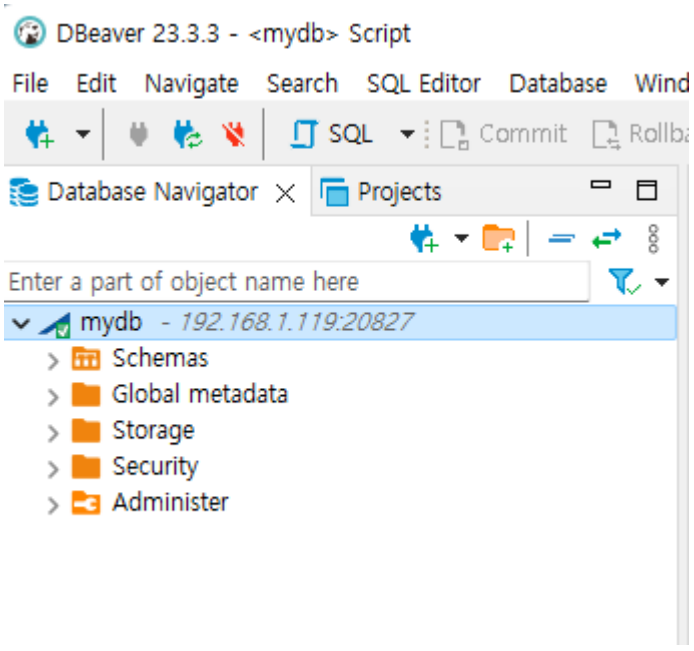
I want to execute the query execution plan with EXPLAIN_PLAN = ON.

In the DBeaver Altibase Plugin, users can specify whether to use the Explain plan ONLY or ON for each connection. The default value is ONLY.

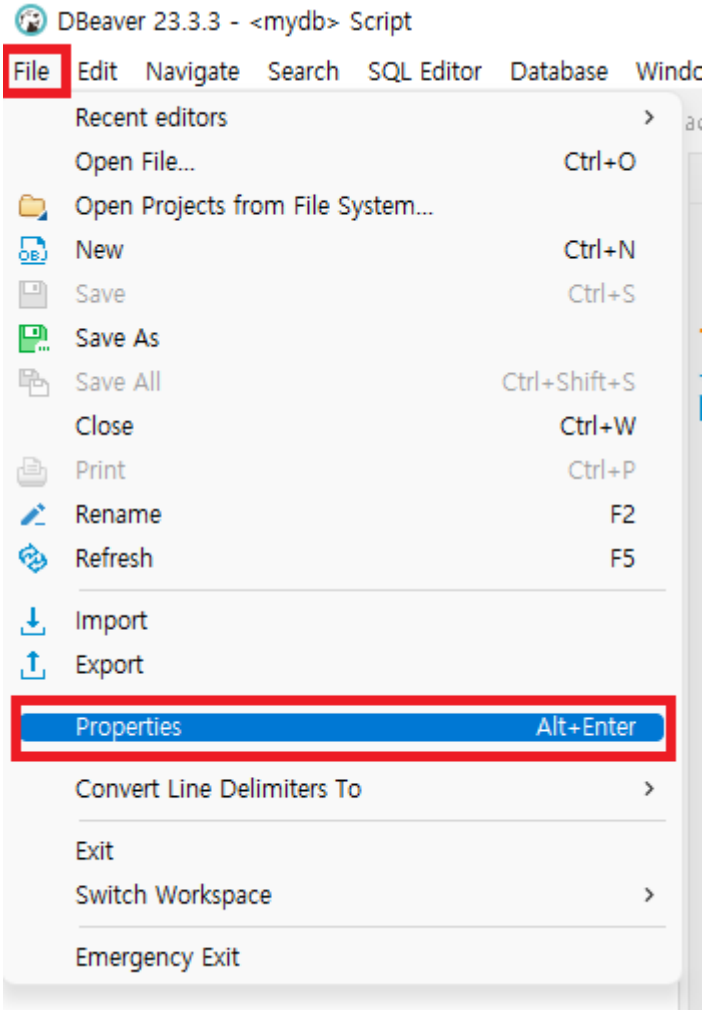
There is two methods to change the Explain plan setting:

1. Change the connected database configuration.

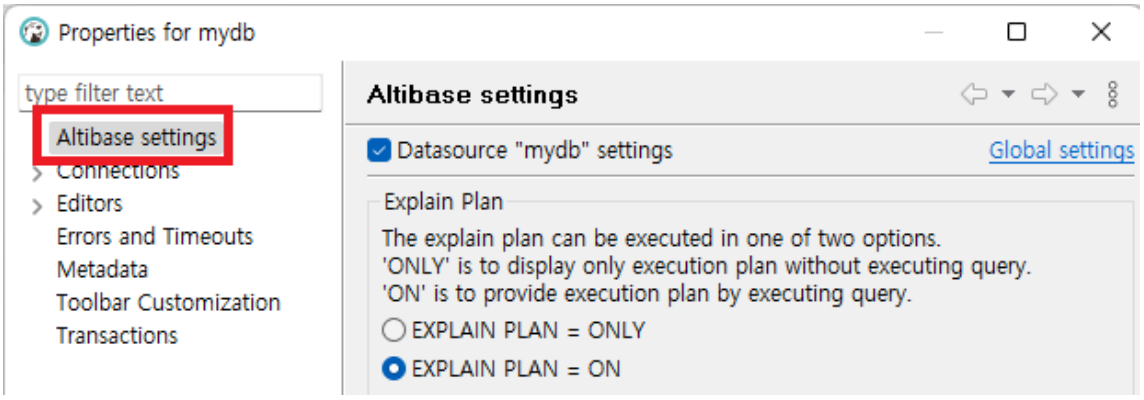
   Click on the connected database.



   Navigate to [File] → [Properties]

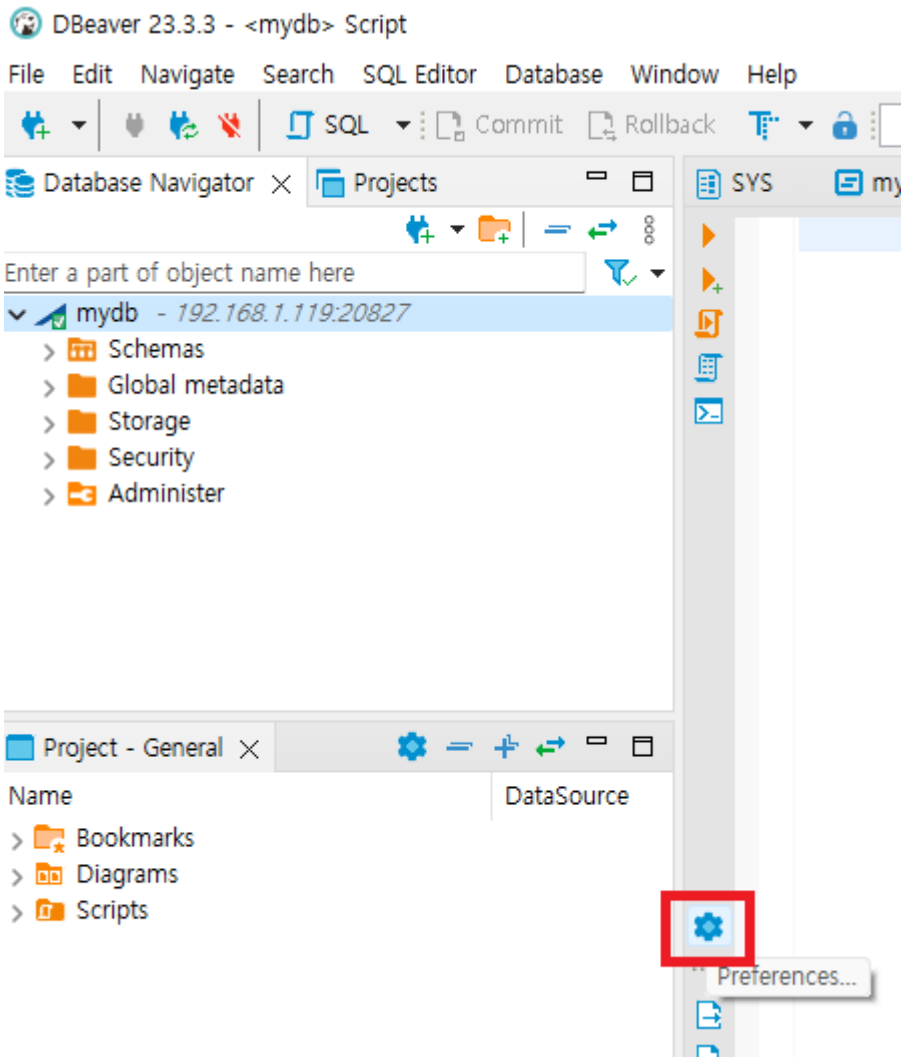


Click on [Altibase settings] → Check "Datasource settings" → Click on "Explain Plan = ON"

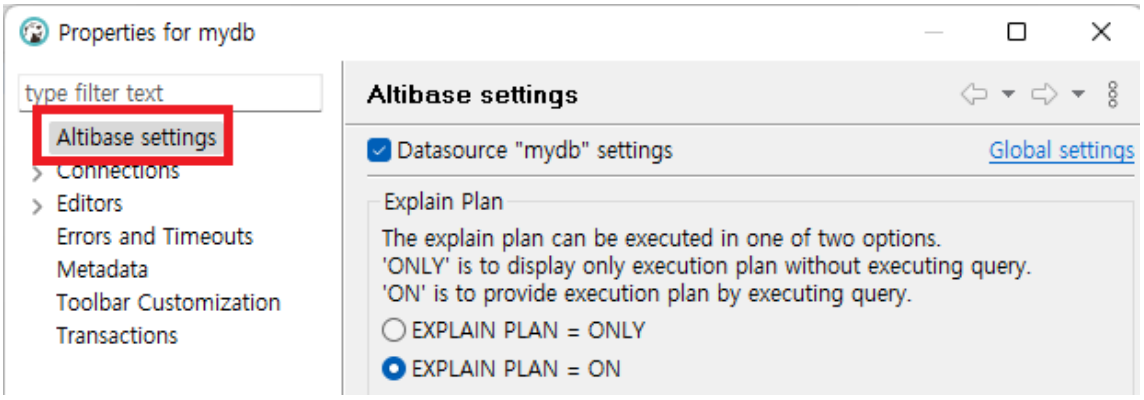


2. Call Preferences from the script panel.

   Click the Preferences button beside the SQL script panel.



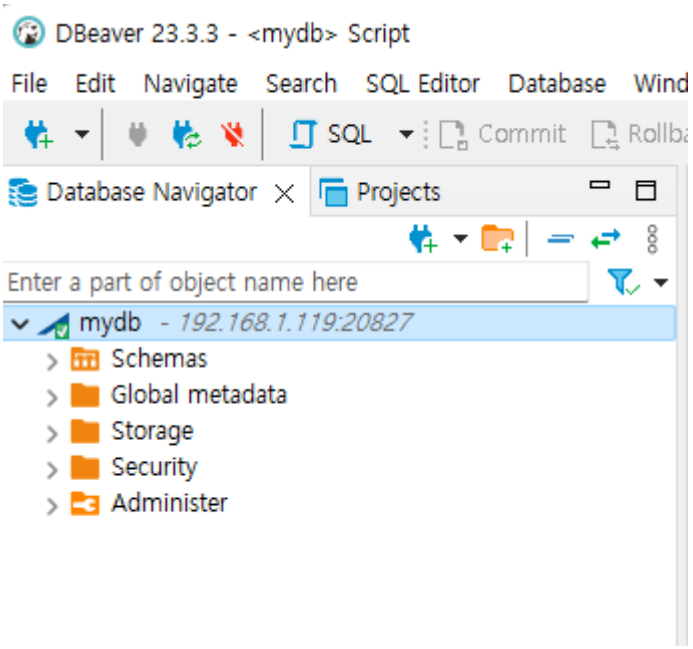
Click on [Altibase settings] → Check "Datasource settings" → Click on "Explain Plan = ON"



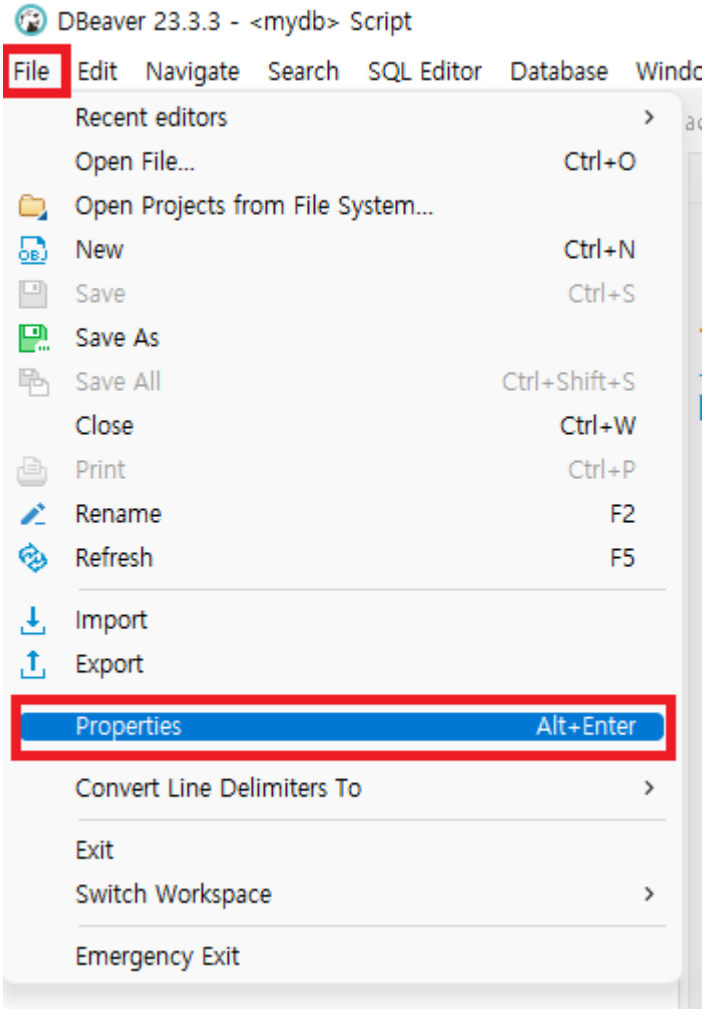
I want to see the server output (PSM PRINTLN output).

To view the server output, users need to enable the "Enable DBMS Output" option for the connected database.

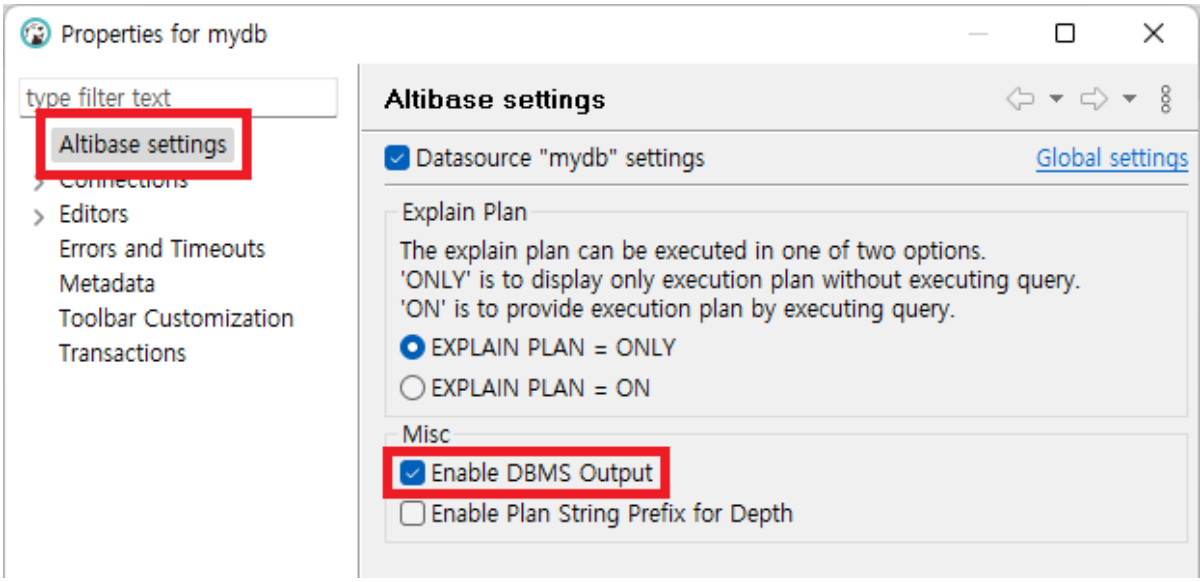
Click on the connected database.



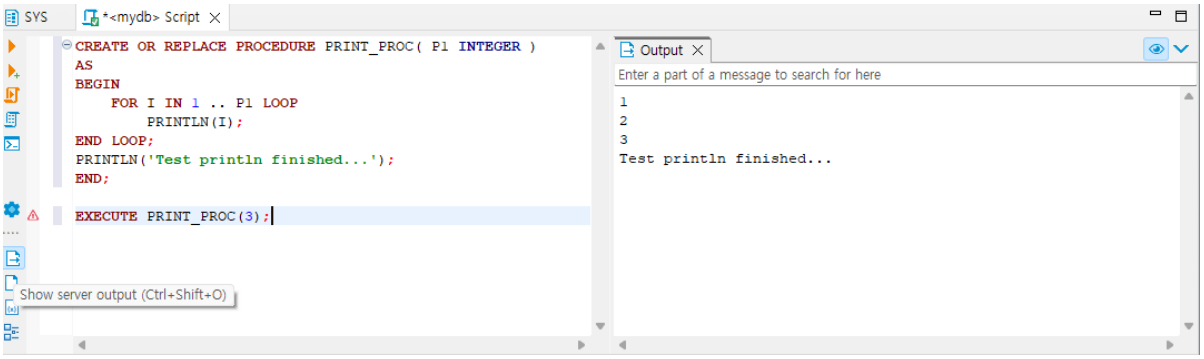
Navigate to [File] → [Properties]



Click on [Altibase settings] → Check "Datasource settings" → Check the "Enable DBMS Output"



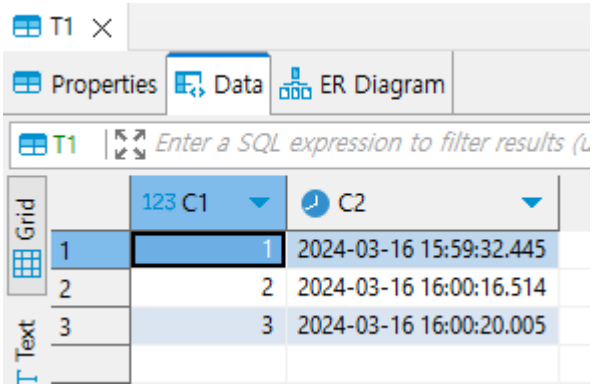
In the SQL script window of the database connection for which users changed the settings, click the "Show server output" button. After that, when users execute the SQL statement, the server output will be displayed in the Output tab.



Microseconds in DATE type are not visible.

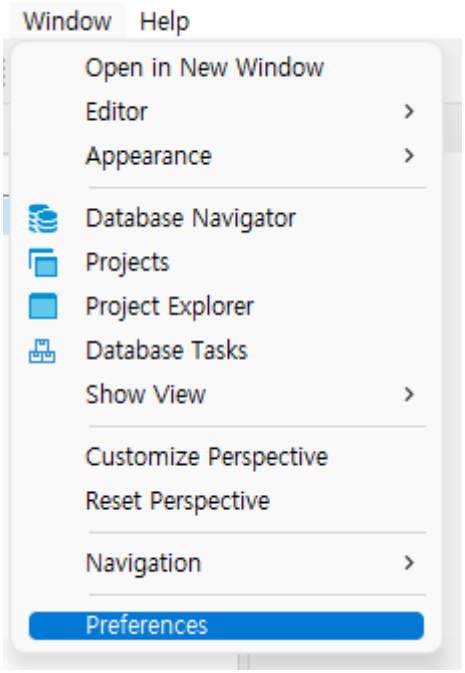
DBeaver's timestamp output format is 'yyyy-MM-dd HH:mm:ss.SSS', displaying milliseconds (3 decimal places) in contrast to Altibase's DATE type, which can represent microseconds (6 decimal places).

The query results for DATE type data under the default settings of DBeaver are as follows.

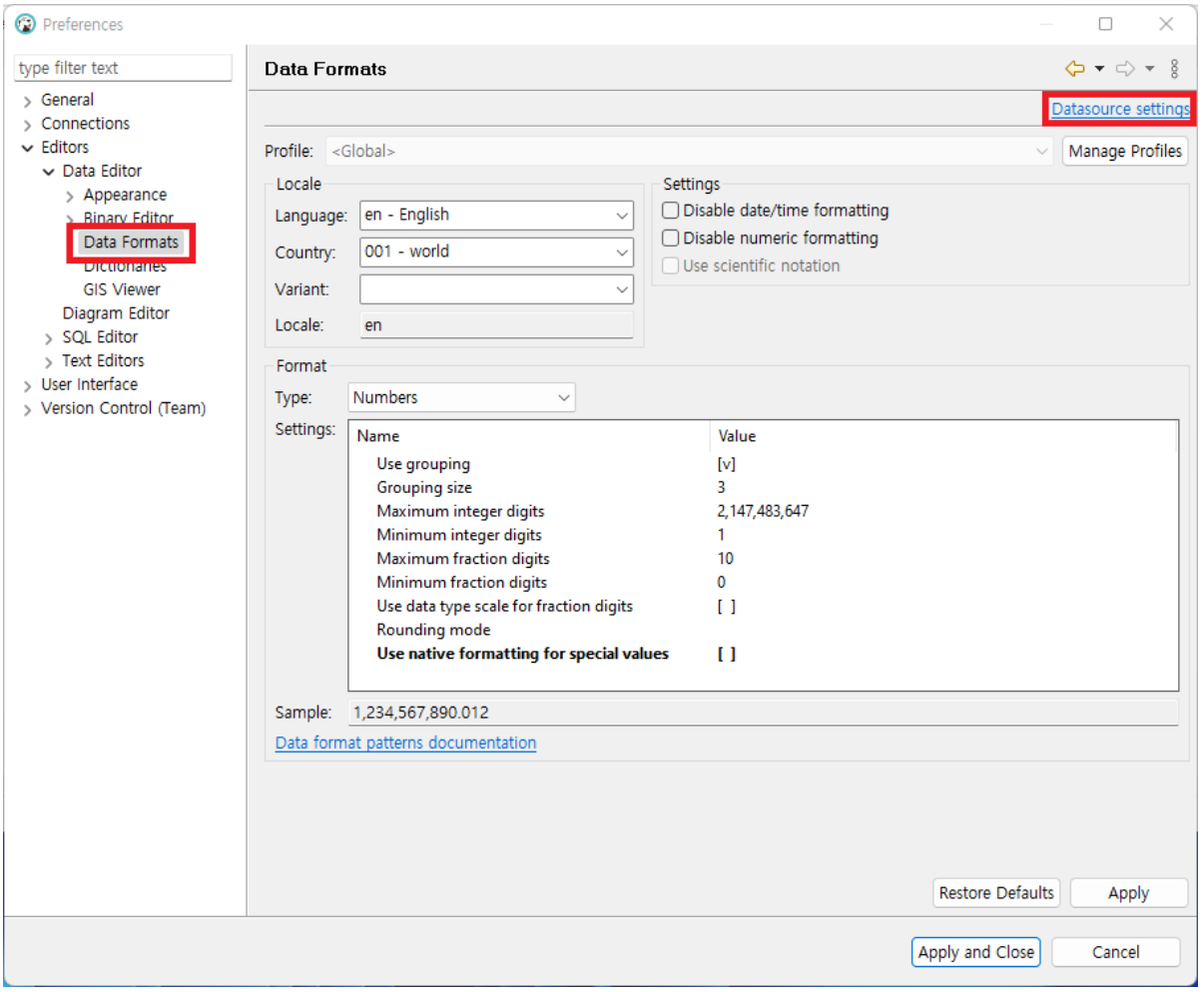


To display the DATE type in microseconds, users need to change DBeaver's data type settings. The location for changing the settings is as follows.

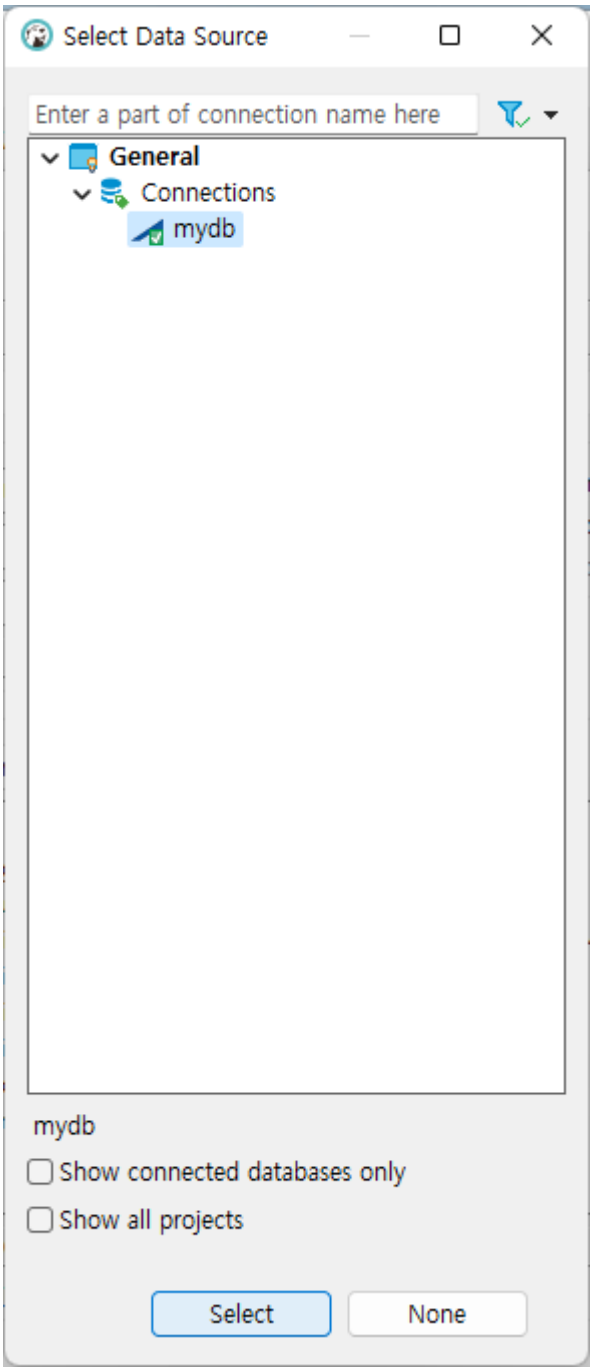
Navigate to [Windows] → [Preference]



Navigate to [Editors] → [Data Editor] → [Data Formats] → Click on "Datasource settings"



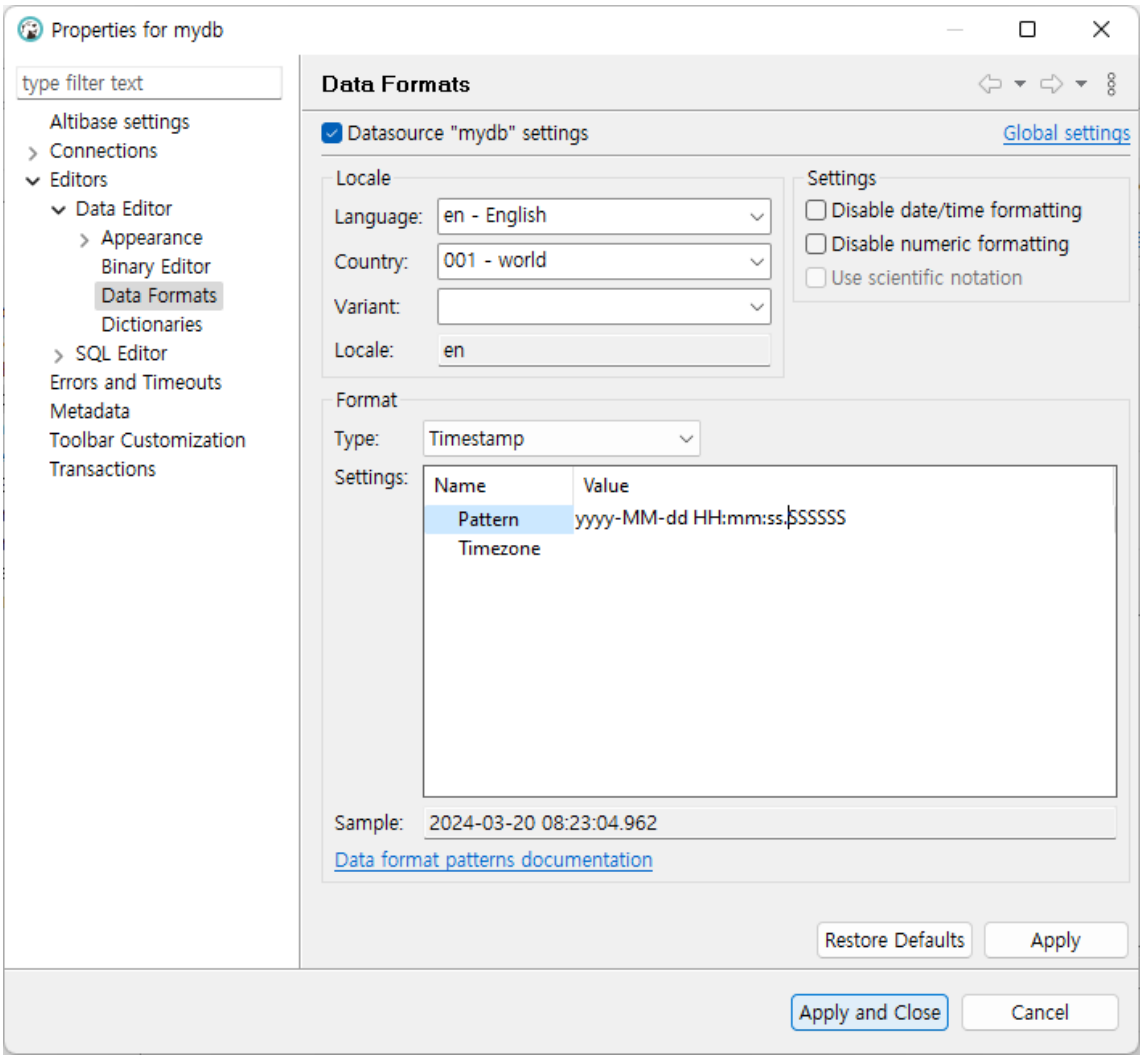
Select the database connection and click [Select].



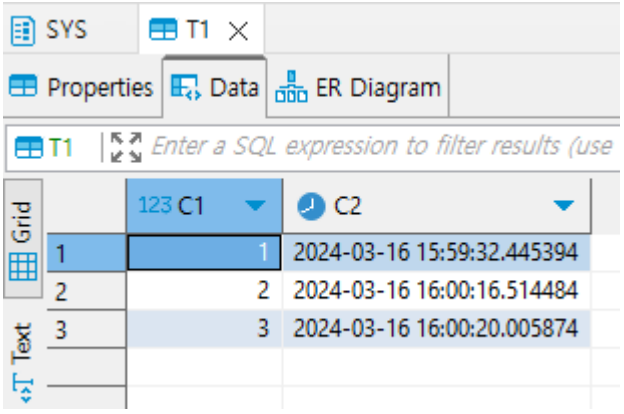
There are two methods to change the settings to view DATE type up to microseconds.

1. Change the data type Value Settings:

   Navigate to [Datasource settings]→ [Format], set the Type to Timestamp, change the Value to 'yyyy-MM-dd HH:mm.ss.SSSSSS', and then click [Apply and Close].

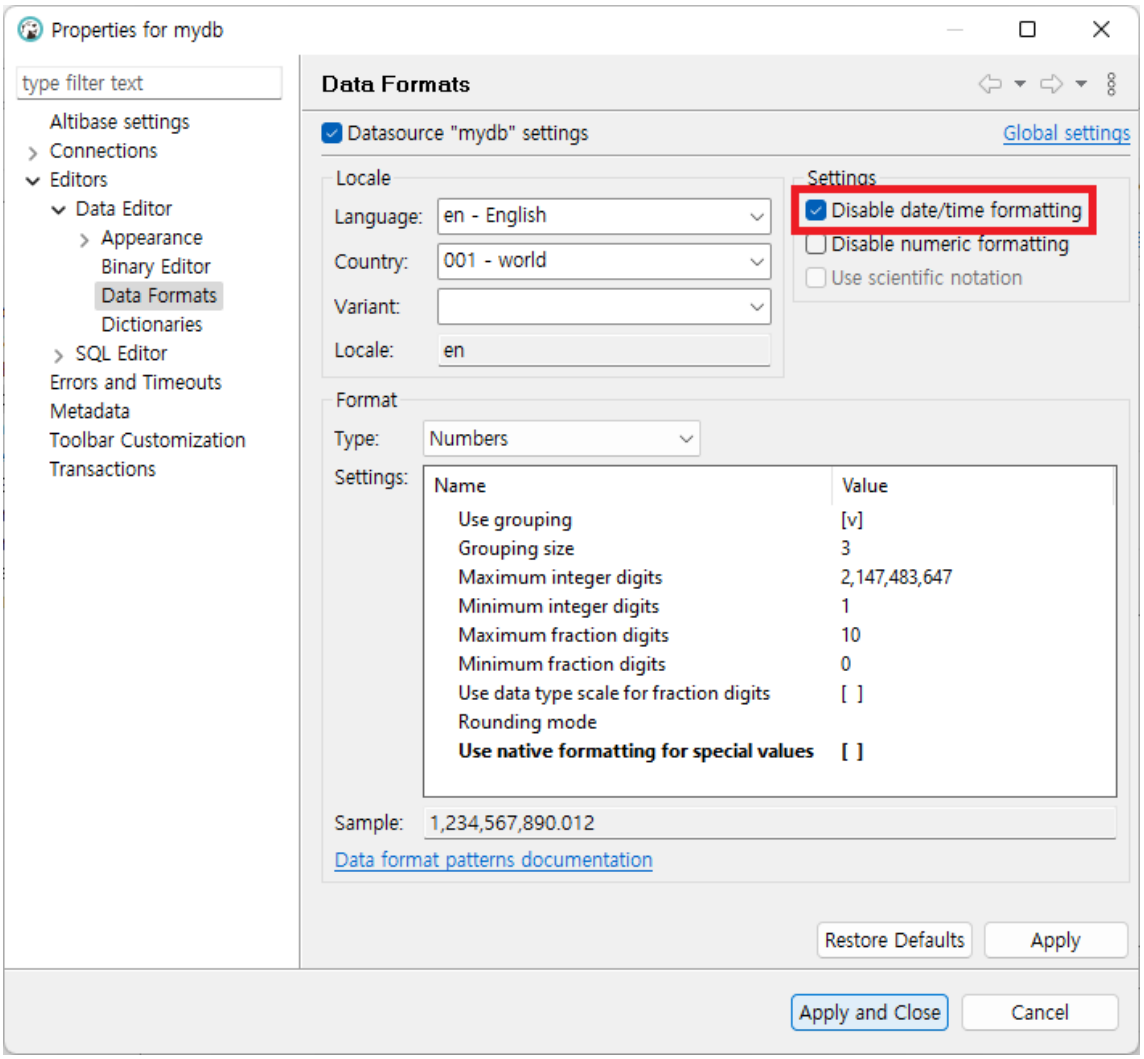


When querying DATE type data, it displays a fixed six digits after the decimal point, including zero, as shown below.

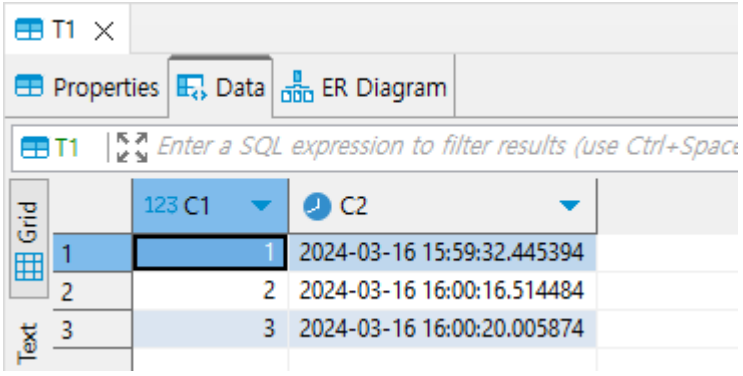


2. Set the Data formats "Disable date/time formatting" option

   Click on [Datasource settings] → [Settings], check the "Disable date/time formatting" checkbox, then click on [Apply and Close].



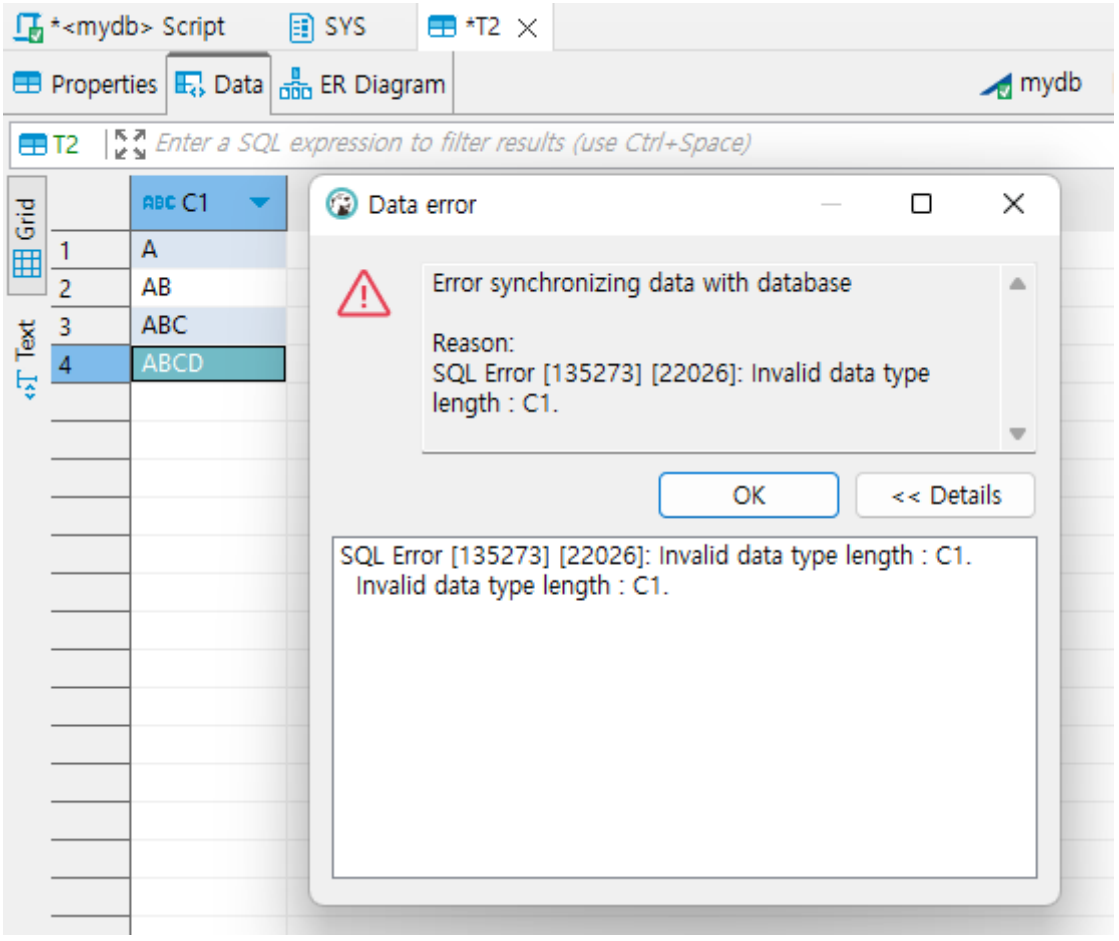
When querying DATE type data, it displays valid fixed six digits after the decimal point as shown below.



Reference: https://dbeaver.com/docs/dbeaver/Managing-Data-Formats/

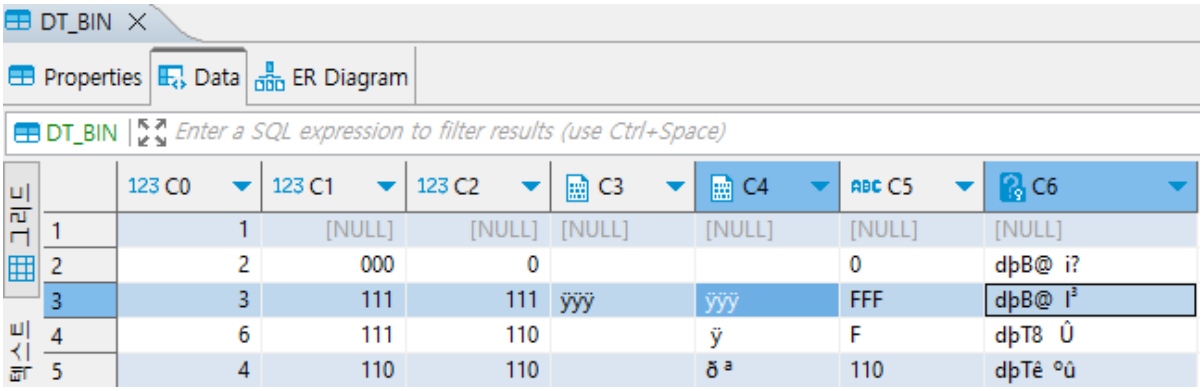
"Invalid data type length" error message is displayed when modifying CHAR type.

DBeaver Data Editor defaults to executing INSERT statements when modifying data. Before saving the changes made with the Data Editor, ensure that the modified data does not exceed the column size.

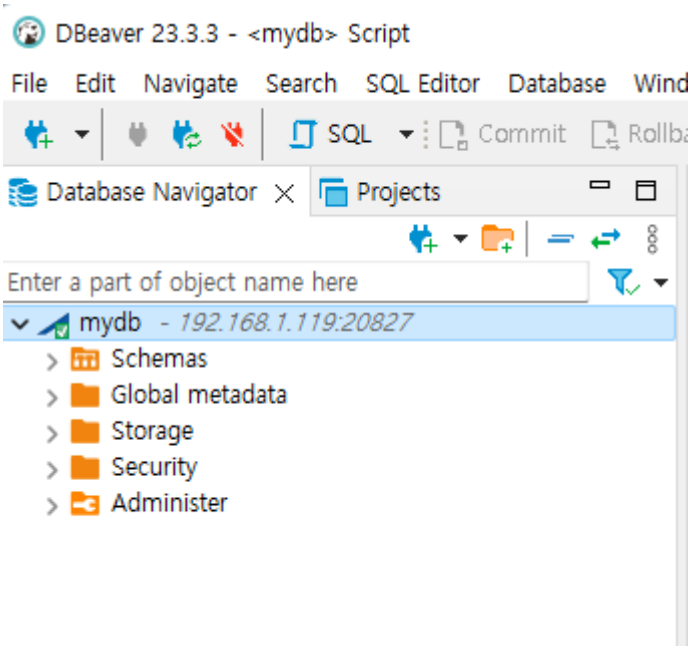


I want to see Binary Data type as Hex.

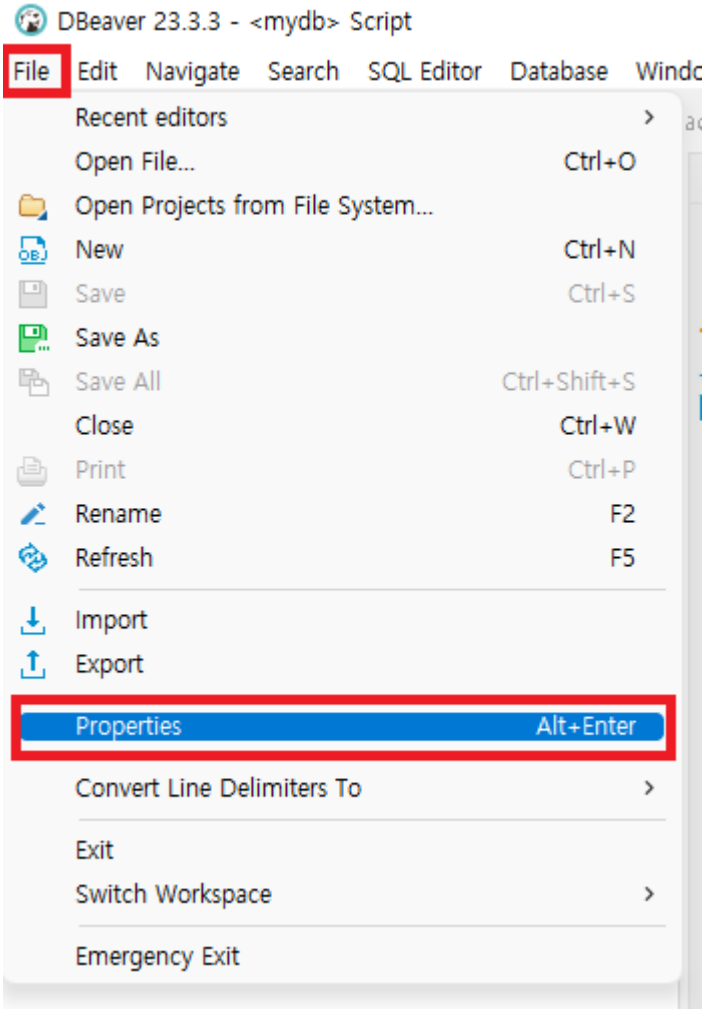
DBeaver's default setting displays binary data as a String type. To view binary data as Hex, users need to change the setting.



Click on database connection.

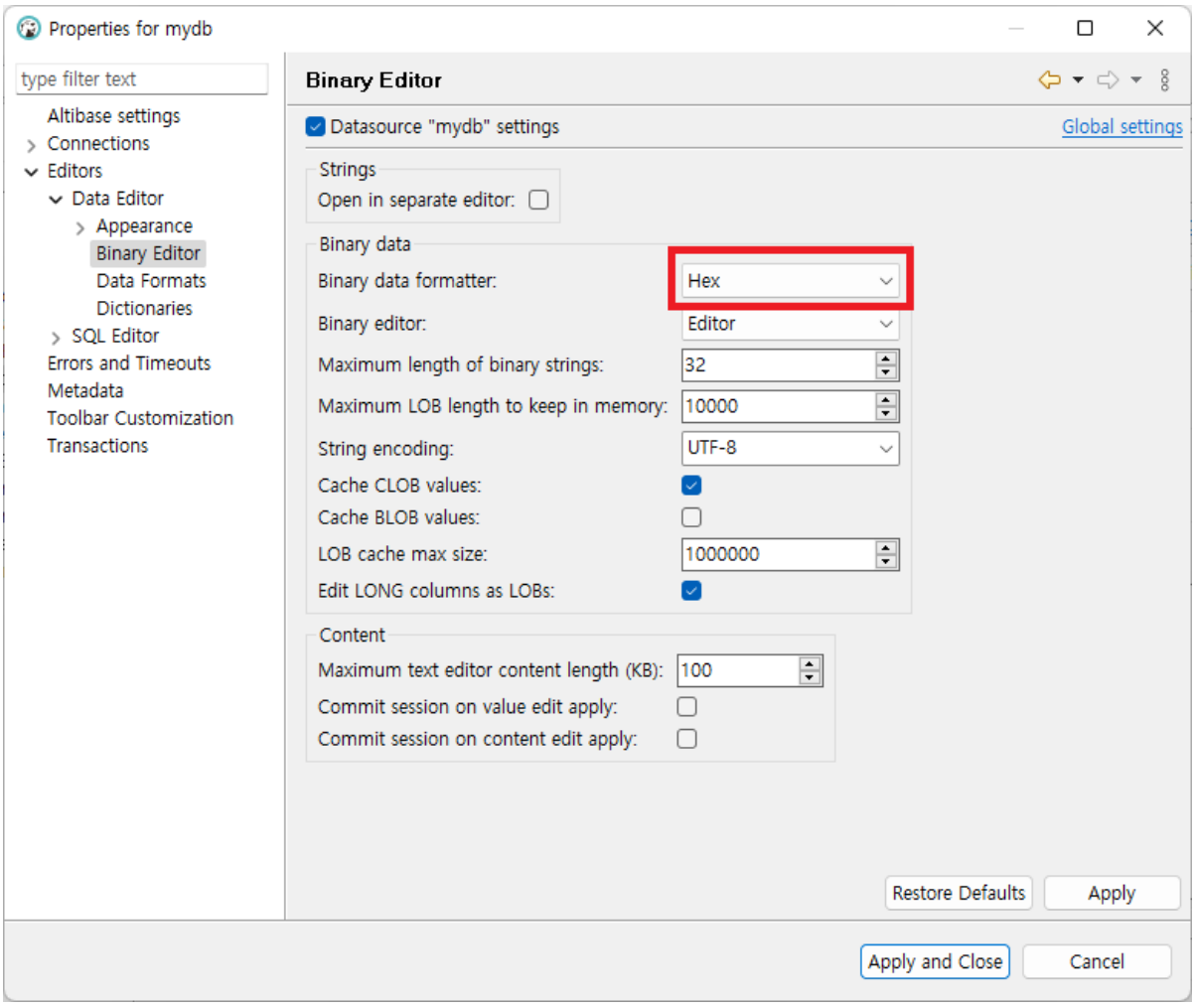


Navigate to [File] → [Properties]

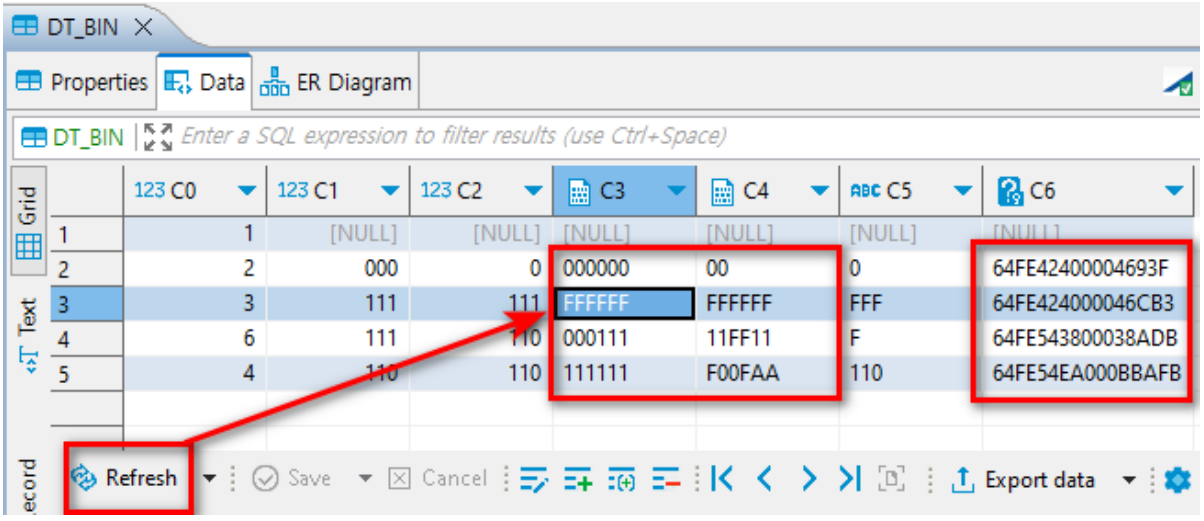


Navigate to [Editors] → [Data Editor] → [Binary data]

Change the Binary data formatter setting to Hex, then click on [Apply and Close].



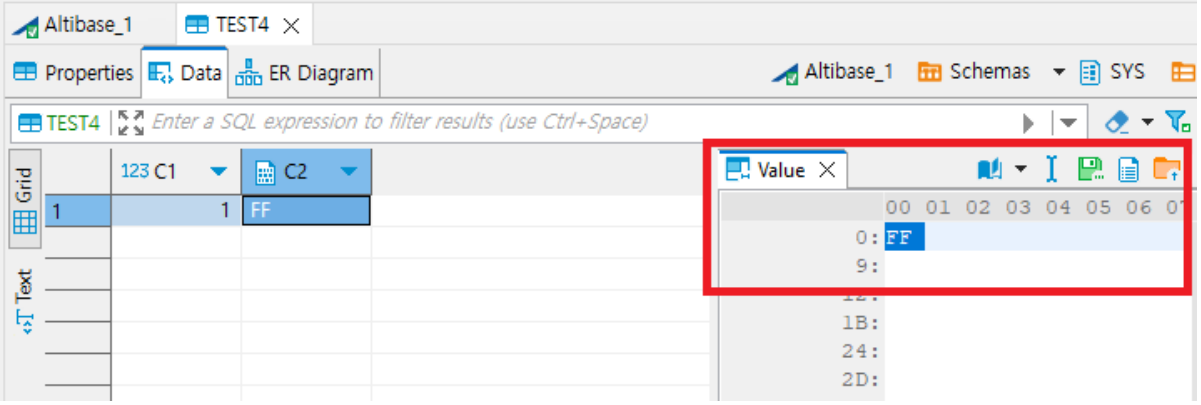
Press the [Refresh] button at the bottom of the table, then the binary type data will be displayed in Hex format.



Reference: https://dbeaver.com/docs/dbeaver/Data-View-and-Format/

Unable to Modify Binary Type Data in DBeaver Data Editor

To modify binary type data in DBeaver, users need to enter the data to be modified in the "Value" field of the Data Editor. Data directly entered into the cell of the grid is converted to the binary value and stored.



How does DBeaver handle BIT, VARBIT, and NIBBLE of Binary Data Types?

In DBeaver, binary data is processed on a byte-unit basis. For binary data types such as BIT, VARBIT, and NIBBLE, which can be smaller than a byte, DBeaver handles them as numeric or character types inevitably.

How to completely delete DBeaver Settings and reinstall?

If users want to completely reset previous DBeaver settings and reinstall it, users need to completely remove the DBeaver application and user data before reinstalling.

Check the default DBeaver workspace folder location based on the operating system and remove all DBeaver data:

OS	Default location of DBeaver workspace
Windows	`%APPDATE$\DBeaverData`
MacOS	`~/Library/DBeaverData/`
Linux	`$XDG_DATA_HOME/DBeaverData/` ($XDG_DATA_HOME=`~/.local/share` if not set)

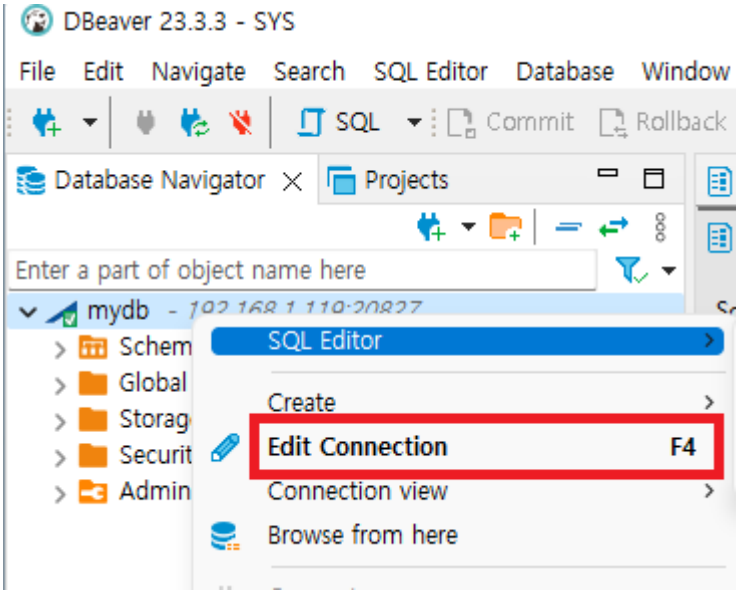
Reference: https://dbeaver.com/docs/dbeaver/Workspace-Location/

In SQL Editor, I would like to set Auto commit off as default.

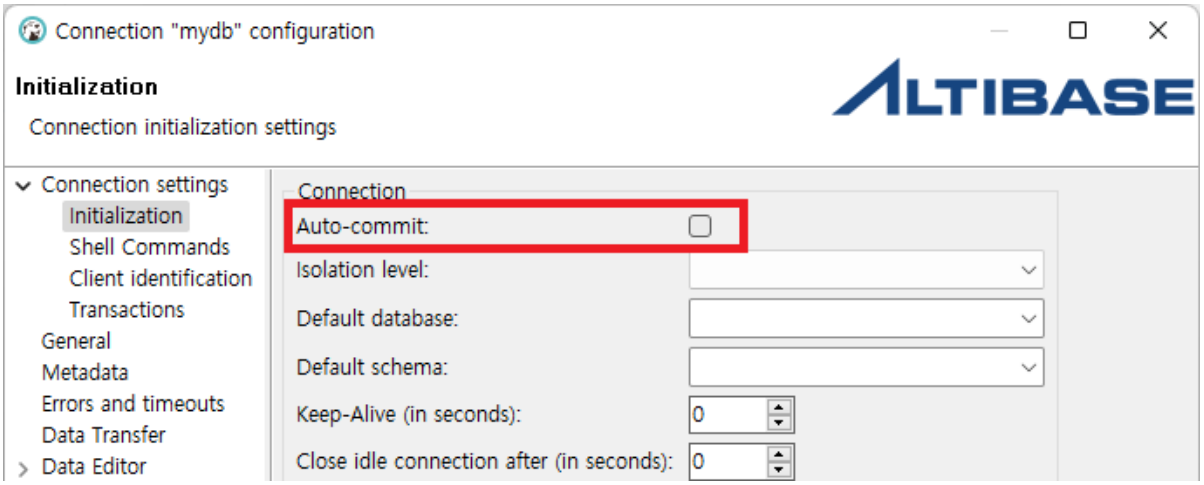
"Auto-commit" setting of DBeaver is on as default.

If users want to set "Auto commit" to off as default, please follow the below steps:

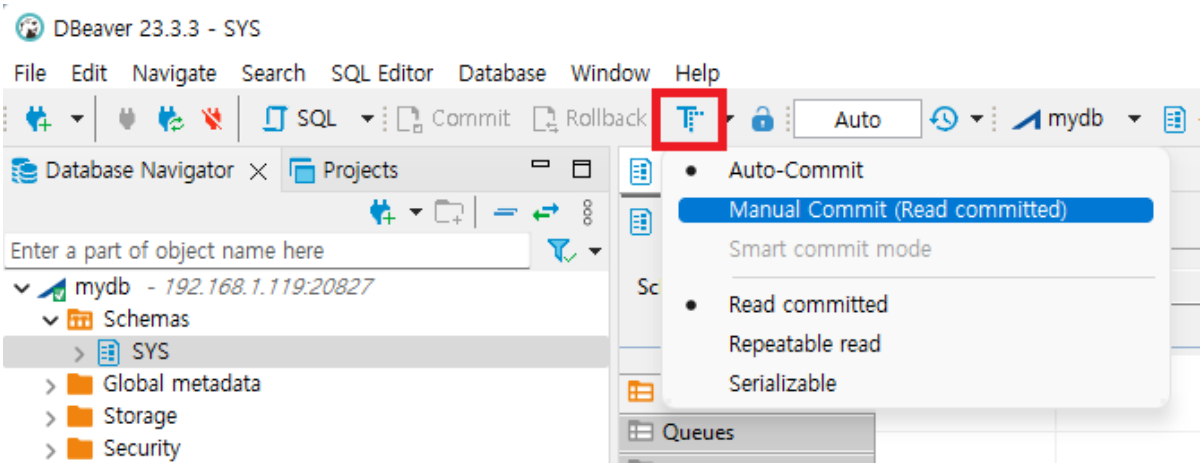
1. Right-click on the connection → [Edit Connection] or press the F4 to open the Configuration window.



2. Navigate to [Connection settings] → [Initialization] → [Connection] → Uncheck "Auto-commit"



If users want to temporarily change the auto-commit mode, press the transaction button, as shown in the capture below.



2.SQuirreL SQL Client

This chapter describes how to install SQuirreL SQL Client and Altibase Plugin for SQuirreL SQL and integrate with Altibase via Altibase JDBC.

Installing Altibase Plugin for SQuirreL SQL Client

Altibase Plugin is not an official plugin for SQuirreL SQL Client, so users must download and install it separately from SQuirreL SQL Client.

System Requirements

This is the list of the software and system requirements to install and run the Altibase plugin and the database management system.

Software Requirements	SQuirreL SQL Client 3.7.1 or 3.8.0	SQuirreL SQL Client 3.8.1 or 3.9.0
Compatible Database System	Altibase 6.5.1 or later	Altibase 6.5.1 or later
Compatible Java	Java 1.8.0	Java 1.8.0 or later

Installing and Removing Altibase Plugin

This section describes how to install, prepare, and remove the Altibase Plugin

Installation Procedure

1. SQuirreL SQL Client Download: Download and install SQuirreL SQL Client from http://squirrel-sql.sourceforge.net .
2. Altibase Plugin Download: Download <altibase4squirrel.zip from http://support.altibase.com/en/ — download item and extract it. Among the extracted files, copy the altibase4squirrel.jar(Altibase Plugin) file to the plugins subdirectory of the installed SQuirreL SQL Client directory. (Example: C:\Program Files\squirrel-sql-3.8.0\plugins\altibase4squirrel.jar)
3. Running SQuirreL SQL Client: Now it is ready to use the Altibase Plugin.
   When running SQuirreL SQL Client, altibase4squirrel.jar is automatically loaded.
   Plug loading can be checked by clicking 'Plugin-Summary' in the main menu after running SQuirreL SQL Client. SQuirreL SQL Client runs squirrel-sql.bat on Windows and squirrel-sql.sh on Linux. For more information on running SQuirreL SQL Client, please refer to the SQuirreL SQL Client manual.

Removing Altibase Plugin

To uninstall the Altibase Plugin, after finishing the SQuirreL SQL Client program, delete the altibase4squirrel.jar from the SQuirreL SQL Client plugin directory.

Features of Altibase Plugin

The features of Altibase Plugin are as follows:

Altibase Database Objects

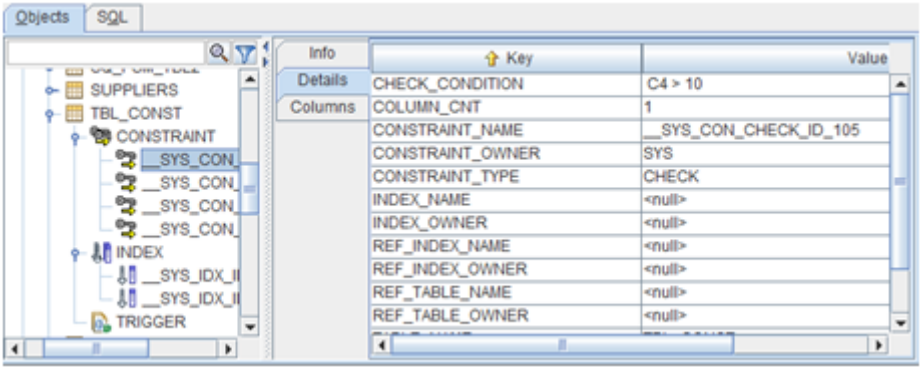
The Altibase database objects are displayed in the SQuirreL SQL Client Object Tree.

The objects shown are:

Object Type	Types
Table	Table, Queue, Materialized View, System Table, System View
PSM	Stored Procedure, Function, Packages, Trigger
Others	Index, Sequence, Synonym, Library, Job

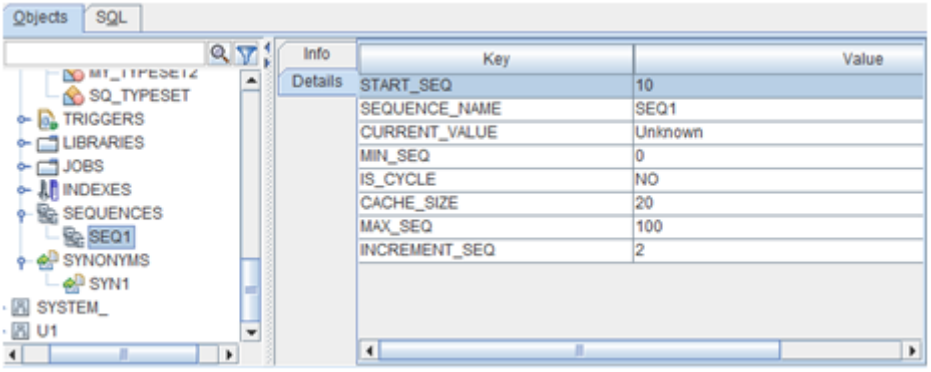
Table and Dependent Objects (Constraint, Index, Trigger)

Dependent objects, such as constraint, index, and trigger, for the table objects are expressed as sub-objects of the table.



Object Details

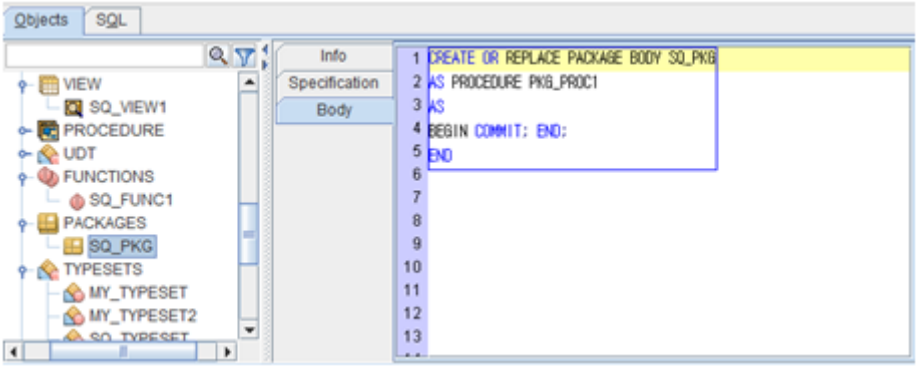
This shows detailed information about database objects. For example, index, sequence, synonym, constraint, and others support detailed information about objects.



Source View

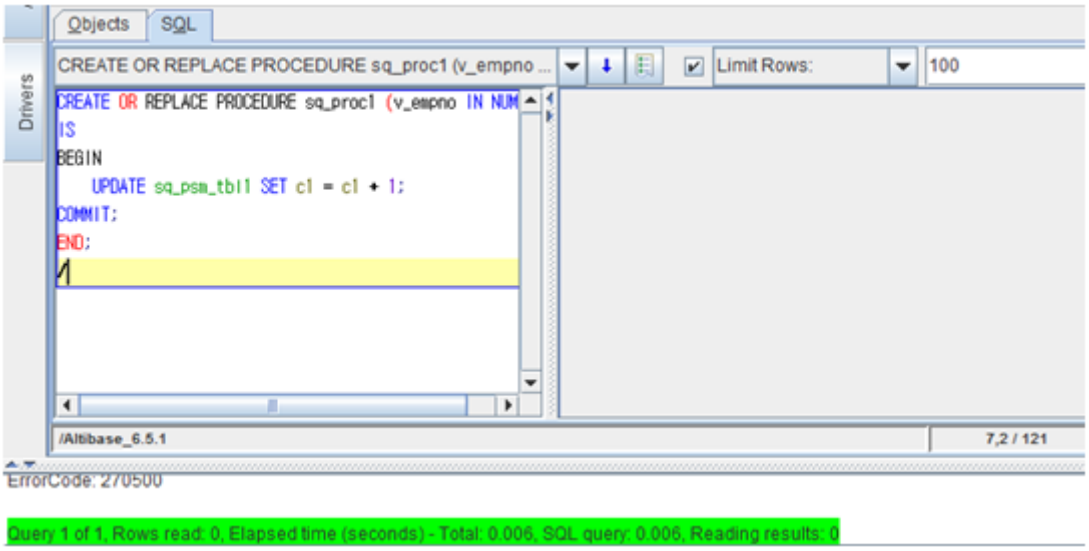
The following object creation DDL is shown for the PSM object type and required objects:

Stored Procedure, Function, Package, Typeset, Trigger, Library, Synonym,
View, Materialized View



PSM DDL grammar Support

Altibase PSM DDL grammar is supported in the SQL editor of SQuirreL SQL Client. If altibase.jar is not installed, the SQuirreL SQL Client's own parser fails to parse the Altibase PSM generated DDL.



Installing SQuirreL SQL Client

This chapter describes how to install SQuirreL SQL Client.

Installation Procesdure

1. Download the SQuirreL SQL Client that can be installed on the system from the link below.
   http://squirrel-sql.sourceforge.net/#installation
2. Double click on the downloaded "squirrel_sql-3.7.1-standard.jar" to start installation.

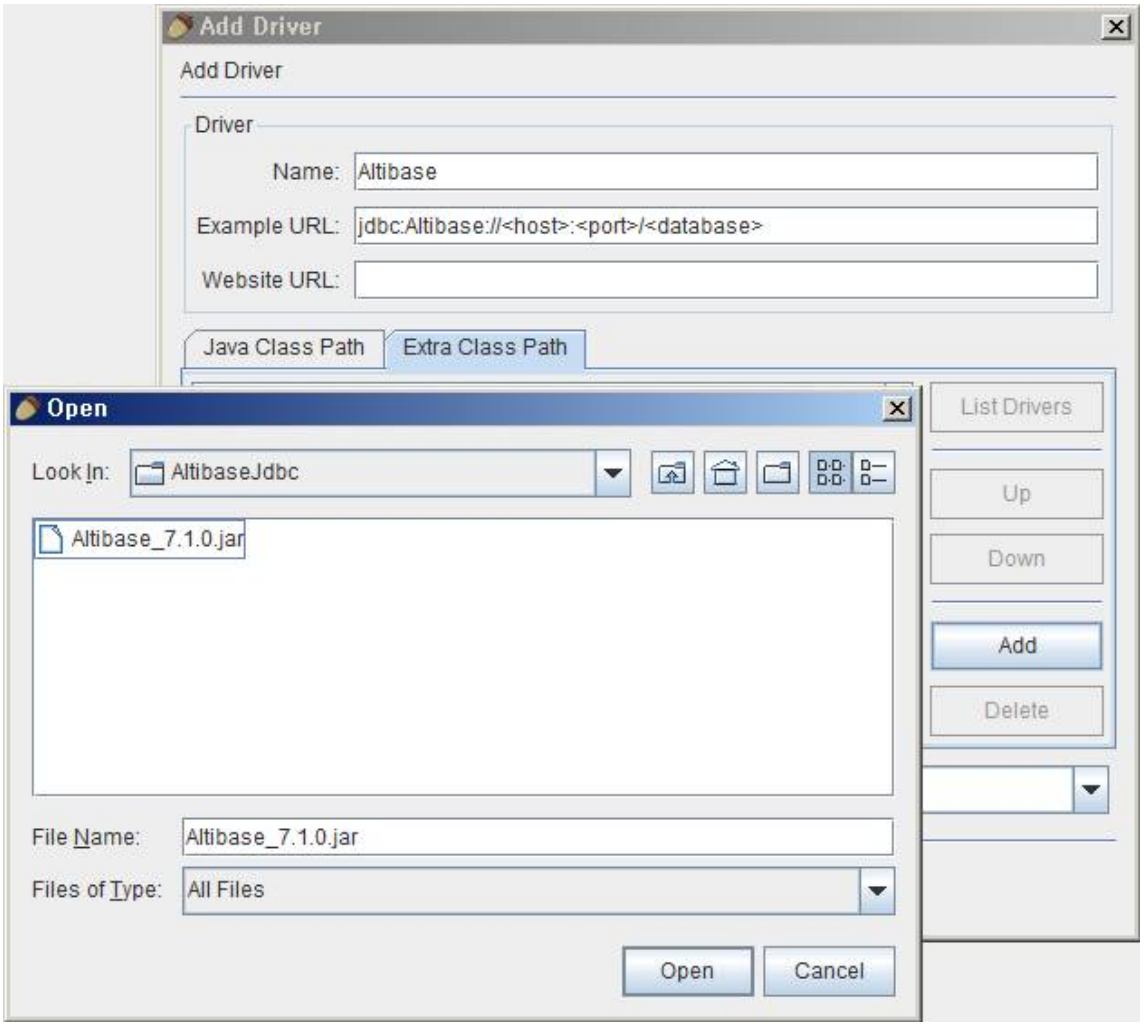
Altibase JDBC Driver Registration

Registration Procedure

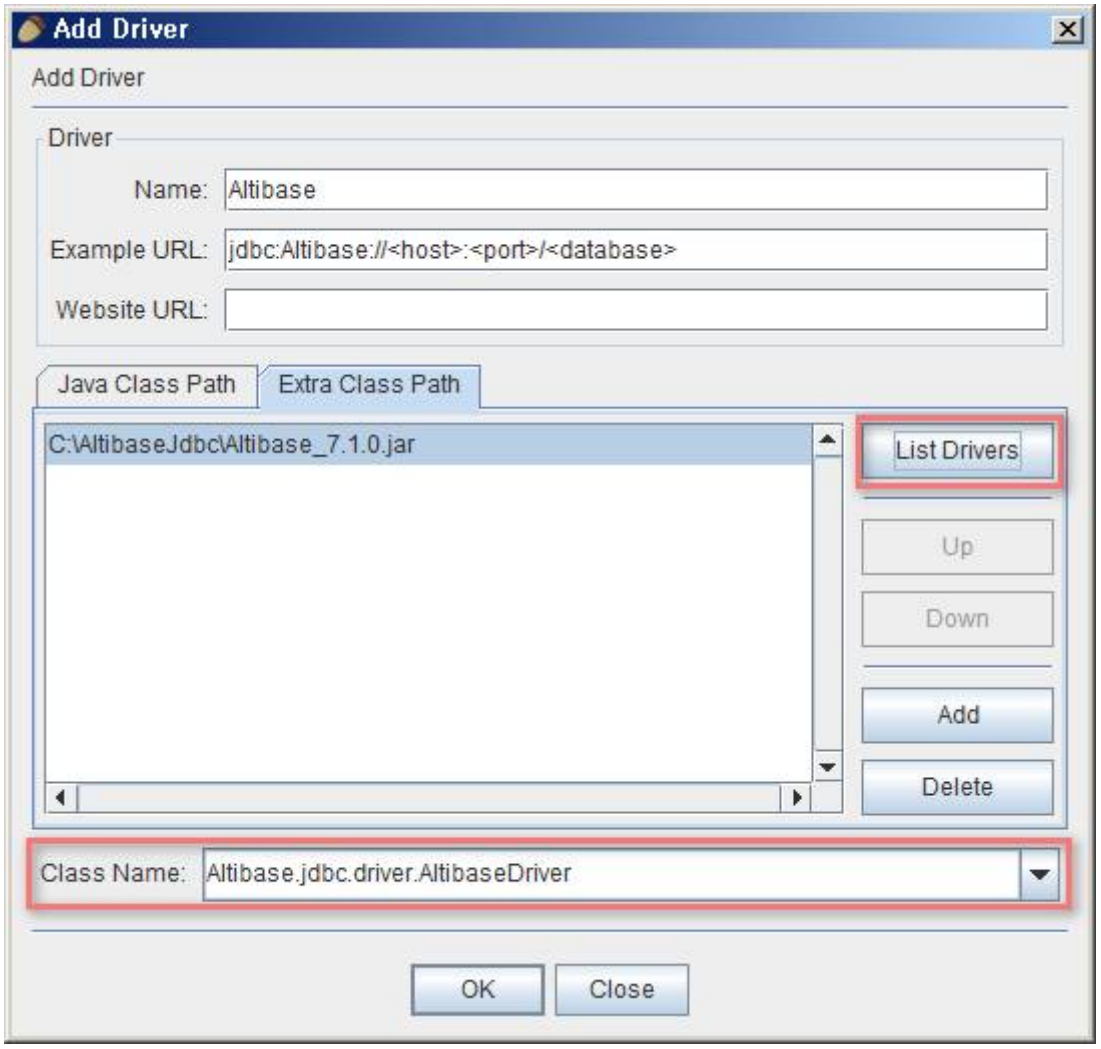
1. Double-click "squirrel-sql.bat" in the directory where SQuirreL SQL Client is installed to run the program.
2. Click Driver → New Driver to register the Altibase JDBC driver. If the Drivers menu is inactive, click Windows → View Drivers to activate it.
3. Enter the following in the Driver section of the Add Driver window.

```
Name: Altibase
Example URL:jdbc:Altibase://<host>:<port>/<database>
```

4. Click the "Add" button on the Extra Class Path tab at the bottom to select the Altibase JDBC drier file to be used for connection.



After selecting the file, press the "List Drivers" button, and check if "Altibase.jdbc.driver.AltibaseDriver" has been added to the Class Name combo box at the bottom.



5. Click the "OK" button to complete Altibase JDBC driver registration.

Integration with Altibase

Database Connection Information Registration

1. Click Aliases → New Alias in the main menu to register the database information to be accessed. If the Aliases menu is disabled, click Windows → View Aliases to activate it.
2. Enter the information below:

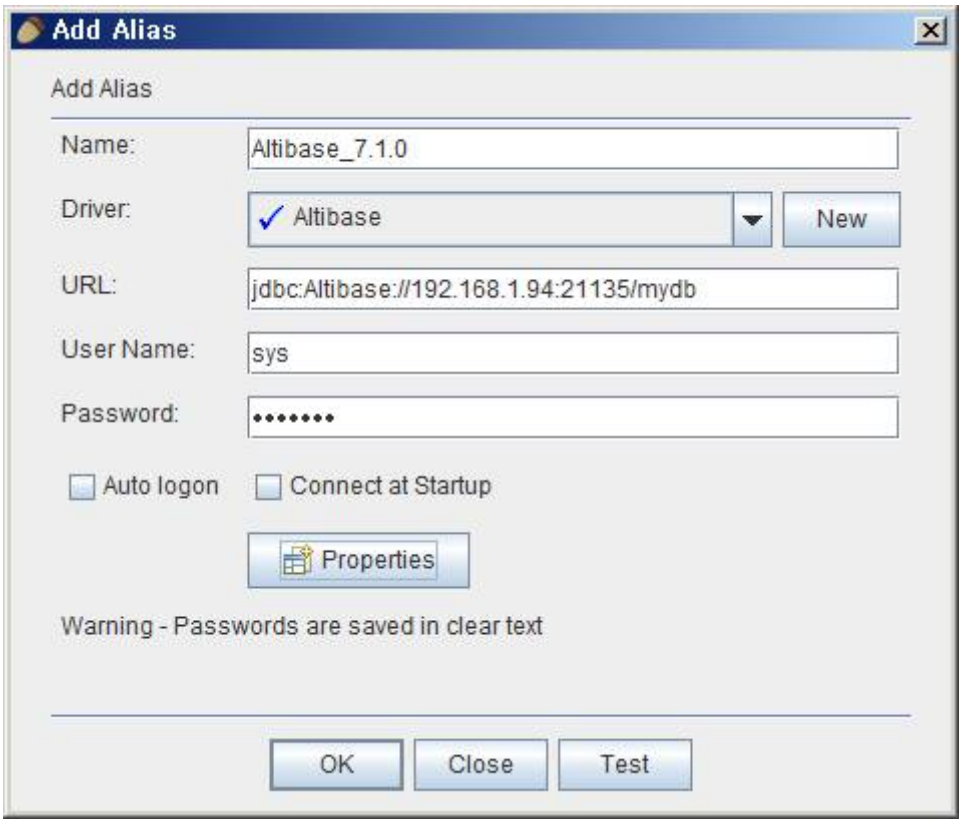
   Name: Database Connection Name

   Driver: Select the Altibase registered earlier

   URL: Enter the host, port, and database name to the connect

   User Name: Database user name to access

   Password: Password of the database user to use for access
3. After completing the input, click the "Test" button at the bottom to confirm that the entered connection information is correct.



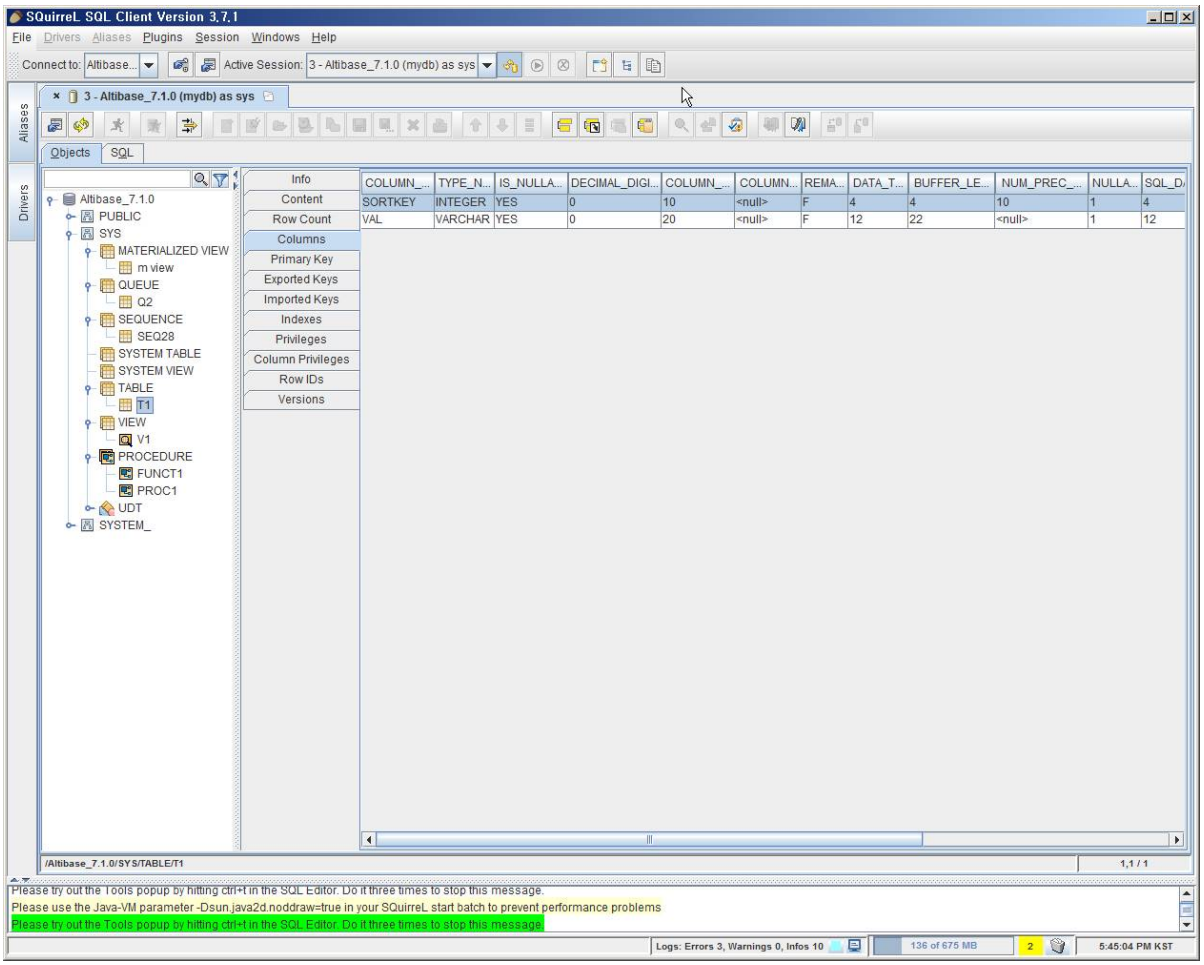
Using Database

1. Click Aliases → Connect in the main menu to open the connection window.

2. Click the "Connect" button to access the registered database.

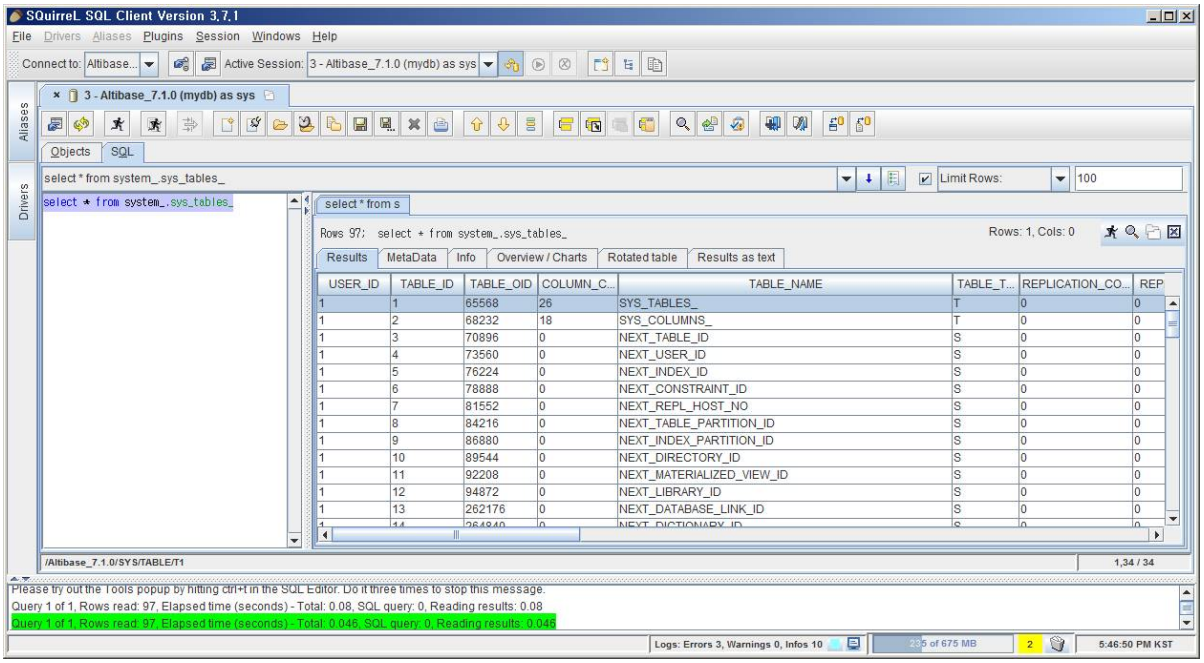
Objects

If the connection is successful, a window consisting of two tabs will open as shown below. The object window is selected by default, and users can view the objects and detailed information existing in the connected database.



SQL

By selecting SQL from the two tabs at the top, users can enter and execute queries.



FAQ

After installing the latest JDK version, when running the SQuirreL SQL client, it fails with the message "Your Java Virtual Machine must be at least 1.6 to run SQuirrel 3.x and above".

This error occurs because the SQuirreL SQL client does not recognize the latest Java version.

Find the JavaVersionChecker line in the squirrel-sql.bat or squirrel-sql.sh file and add the version to use. For example, when using OpenJDK 18 version, add '18' at the end of the JavaVersionChecker line and save it, then run the SQuirreL SQL client.

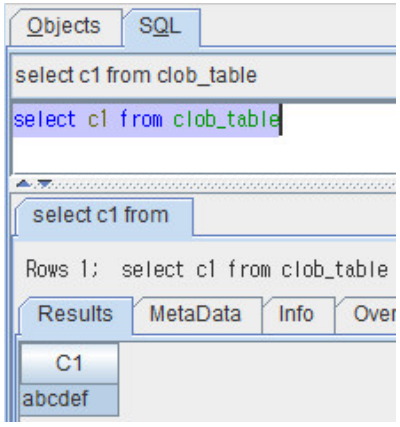
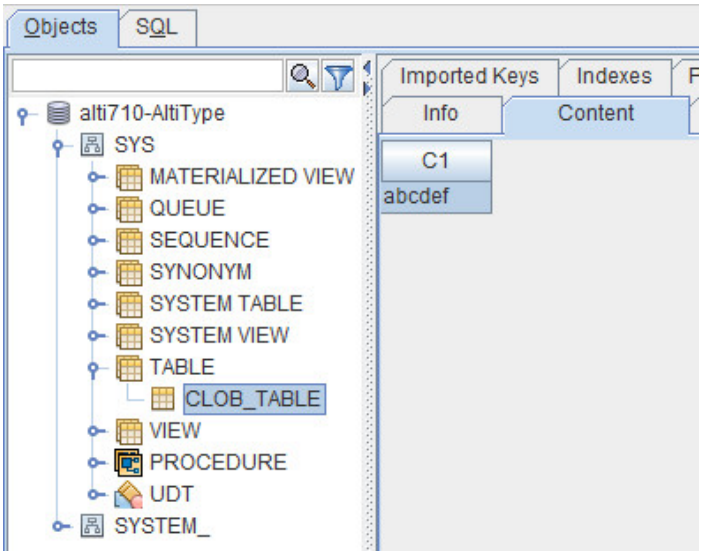
```
$JAVACMD -cp "$UNIX_STYLE_HOME/lib/versioncheck.jar" JavaVersionChecker 1.6 1.7 1.8 18
```

If you use Java version 9 or later, SQuirreL SQL client version 3.8.1 or 3.9.0 is required.

Please refer to https://sourceforge.net/p/squirrel-sql/bugs/1347/

How to retrieve LOB data.

In the SQuirreL SQL client, LOB data can be retrieved in the SQL tab or the Objects tab.

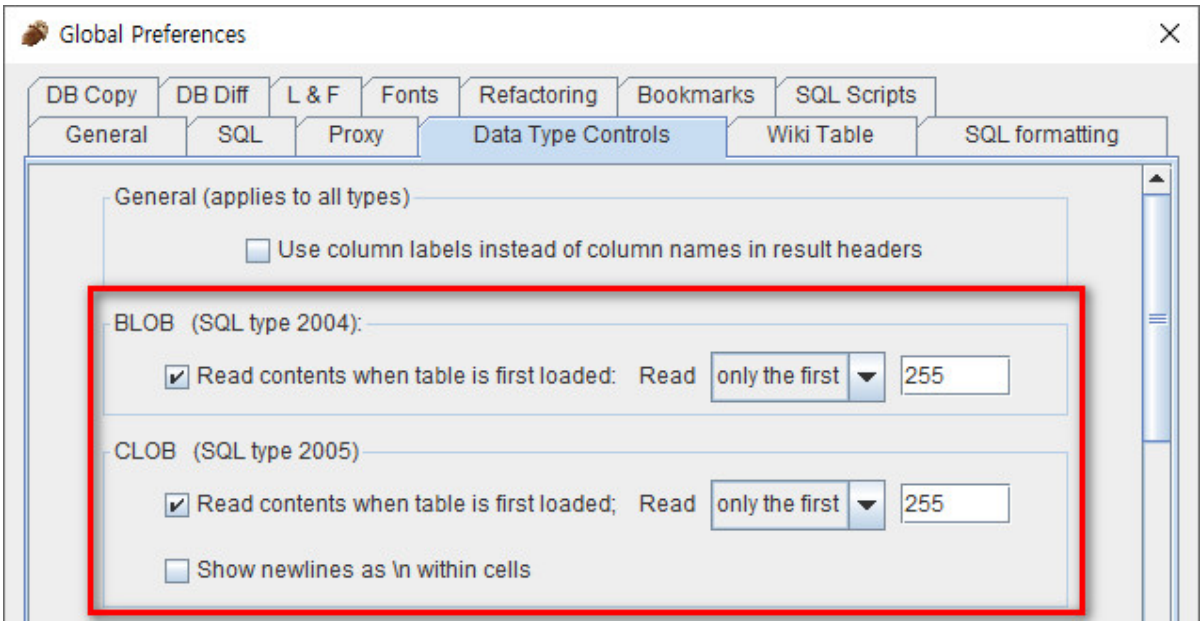
SQL	Objects
	

Settings for LOB data retrieval in the SQuirreL SQL client

The following setting is required to display LOB data in the SQL tab or the Objects tab.

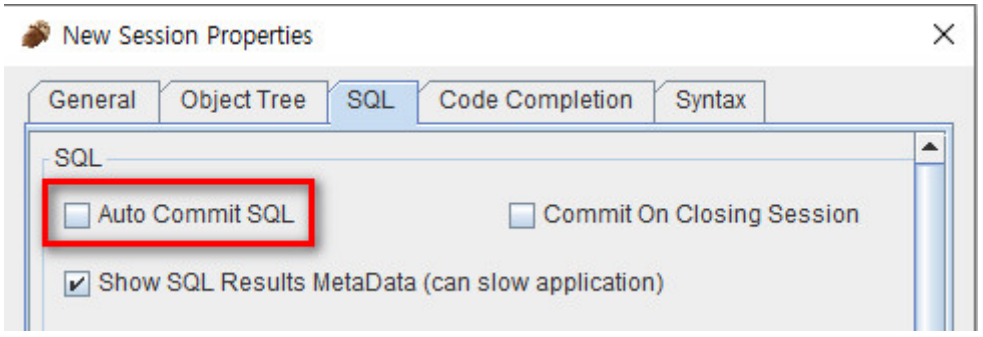
1. Change the Data Type Controls setting.

   In 'File → Global Preferences → Data Type Controls tab', check the "Read contents when table is first loaded" option of BLOB or CLOB



2. Change the autocommit mode to false in the session properties.

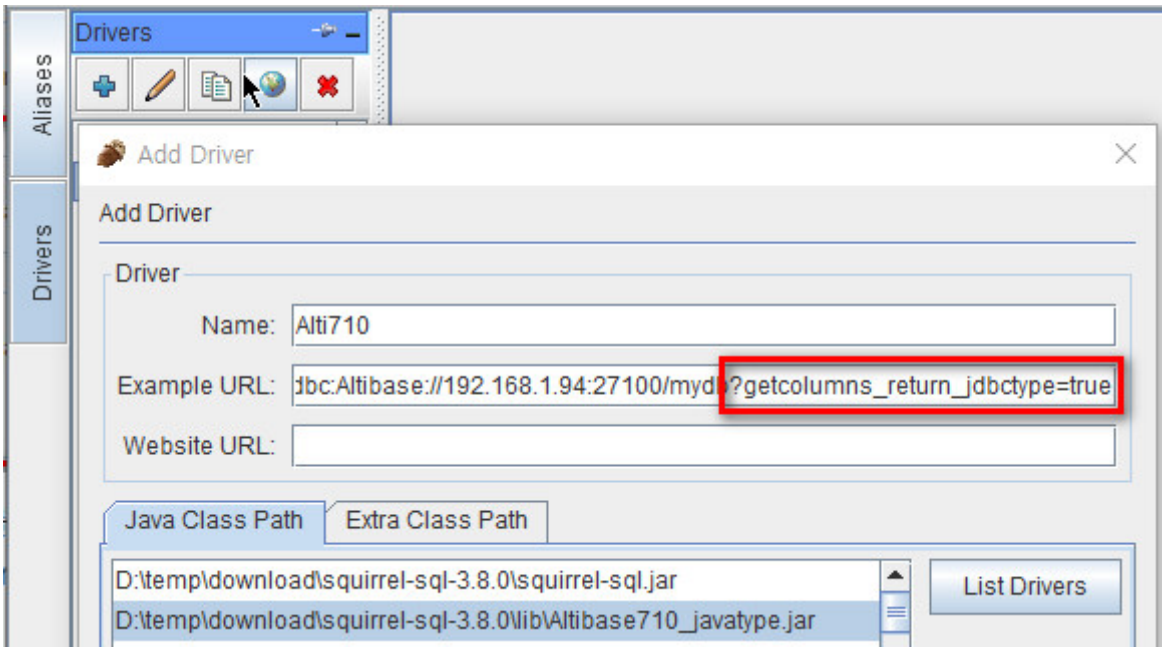
   In Altibase HDB, transactions must be managed explicitly for LOB data. To apply this, uncheck the "Auto Commit SQL" checkbox in File → New Session Properties → SQL tab.

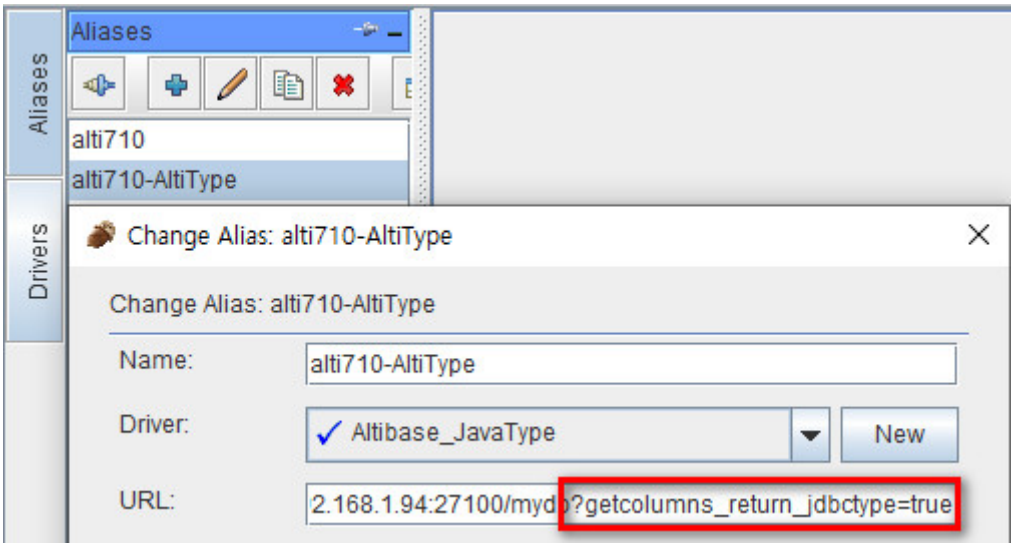


Additional required settings when retrieving LOB data in the Objects tab

1. Use the Altibase HDB JDBC Driver corresponding to the version below.
   - Altibase 7.1.0.7.2 or higher
   - Altibase 7.2.0.0.2 or higher
2. Add getcolumns_return_jdbctype=true to the JDBC connection properties.

   It can be changed in Drivers → Add Driver to designate a new driver, or Aliases → Modify the selected Alias to add or change existing connection information.


Aliases
Drivers
Drivers
Add Driver
Add Driver
Driver
Name: Alti710
Example URL: jdbc:Altibase://192.168.1.94:27100/mydb?getcolumns_return_jdbctype=true
Website URL:
Java Class Path
Extra Class Path
D:\temp\download\squirrel-sql-3.8.0\squirrel-sql.jar
D:\temp\download\squirrel-sql-3.8.0\lib\Altibase710_javatype.jar
List Drivers


Aliases
Drivers
Aliases
alti710
alti710-AltiType
Change Alias: alti710-AltiType
Change Alias: alti710-AltiType
Name: alti710-AltiType
Driver: Altibase_JavaType
New
URL: 2.168.1.94:27100/mydb?getcolumns_return_jdbctype=true

3.OpenLDAP

This chapter describes how to integrate openLDAP with Altibase.

Introduction to OpenLDAP

OpenLDAP is a Light-weight Directory Access Protocol(LDAP) as an open source implementation.

OpenLDAP supports RDBMS as a backend repository, which is called SQL Backend or back-sql. back-sql uses ODBC when linking with RDBMS.

OpenLDAP Installation

1. Download OpenLDAP
   http://www.openldap.org/
2. Unpack

```
$ tar xvfz name_of.tgz
```

3. Configure, Make, and Install

```
$ ./configure --prefix=.... --enable-sql
   ./configure --refer to help
$ make depend
$ make
$ make install (su root -c 'make install')
```

Altibase Installation

We recommend users to install Altibase 6.5.1 or later.

For more detailed information on installation, please refer to the *Installation Guide*.

Meta Data Configuration

In the meta table for LDAP, it is necessary to store which table and column of Altibase map objectClass and attributeType of LDAP.

Altibase can use 4 meta tables for LDAP.

- ldap_oc_mappings
- ldap_attr_mappings
- ldap_entries
- ldap_entry_objclasses

ldap_oc_mappings

The objectClass mapping table stores the relationship between the structuralObjectClass and the table.

Column Name	Description
ID	The unique ID Used when referencing another ldap_* table
NAME	The name of objectClass. Must match the name of one of the objectClasses loaded in slapd's schema
KEYTBL	The name of the table corresponding to objectClass. In the example, inetorgPerson objectClass is mapped to the person table.
KEYCOL	The name of the primary key column of the "keytbl" table
CREATE_PROC	SQL statement to execute when adding an entry
CREATE_KEYVAL	Query statement that receives the new ID value entered in the "CREATE_PROC" SQL statement. Create_needs_select must be set to "yes" in slap.conf to use this query.
DELETE_PROC	When deleting an entry, the SQL statement "keybl.keycol" to be executed is taken as a host variable
EXPECT_RETURN	An integer value of the bit string indicating whether the SQL statements of CREATE_PROC and DELECT_PROC return a value. The first bit corresponds to ADD_PROC, and the second bit corresponds to DELETE_PROC. Available Values: 0: Both the CREATE_PROC and DELETE_PROC SQL statements have no return value 1: SQL statement of CREATE_PROC returns a value 2: SQL statement of DELETE_PROC returns a value 3: Both the CREATE_PROC and DELETE_PROC SQL statements return values What to observer when writing an SQL statement (procedure or function) with a return value: The return value of CREATE_PROC should be the new ID value entered. The return value of DELETE_PROC should return 0 is successful, 1 otherwise. The outbinding parameter that receives the return value should be placed at the beginning.

ldap_attr_mappings

As attributeType mapping table, it stores how attributeType for specific objectClass is mapped to SQL statement.

Column Name	Description
ID	Unique ID

Column Name	Description
OC_MAP_ID	Indicates the ID of the ldap_oc_mappings table, and indicates which objectClass the attributeType belongs to.
NAME	The name of the attributeType Must match the name of one of the attributeTypes loaded in slapd's schema.
SEL_EXPR	Expression to select the attribute below. ("select <sel_expr> from ..." part)
FROM_TBLS	Table to get the below attribute: ("select ... from <from_tbls > where ..." part)
JOIN_WHERE	Condition for selecting the attribute below. ("select ... where <join_where> ..." part)
ADD_PROC	SQL statement to input in the corresponding attribute Takes the value of the attibute to be added and the "keytbl.keycol" of the entry associated with it as a host variable.
DELETE_PROC	SQL statement to delete in the attribute Takes the value of attibute to be deleted and the "keytbl.keycol" of the entry associated with it as a host variable.
PARAM_ORDER	The integer value of the bit string indicating whether the keytbl.keycol value precedes or follows the value of attibute in the SQL statements of ADD_PROC and DELETE_PROC. If the keytbl.keycol value comes before the attibute value, set 0, and if it comes after, set 1. The first bit corresponds to ADD_PROC, and the second bit corresponds to DELETE_PROC. Available Values: 0: In the CREATE_PROC and DELETE_PROC SQL statements, the keytbl.keycol vlaue precedes the attribute value. 1: In the SQL statement of CREATE_PROC, the keytbl.keycol value follows the value of attibute. 2: In the SQL statement of DELETE_PROC, the keytbl.keycol value follows the value of attibute. 3: Both the SQL statements of CREATE_PROC and DELTE_PROC have the keytbl.keycol value after the attibute value.

Column Name	Description
EXPECT_RETURN	The integer value of the bit string indicating whether the SQL statements of ADD_PROC and DELTE_PROC return a value. Available Values 0: Both the SQL statements fo CREATE_PROC and DELETE_PROC have no retun value 1: SQL statement of CREATE_PROC returns a value 2: SQL statement of DELETE_PROC returns a value 3: Both the CREATE_PROC and DELETE_PROC SQL statements return values. What to observe when writing an SQL statement (procedure or function) with a return value: The return value of CREATE_PROC and DELETE_PROC should return 0 if successful, or 1 otherwise. The outbinding parameter that receives the return value should be placed first.

ldap_entries

This is an entry mapping table. It stores the DN value that identifies each entry in the LDAP tree.

Column Name	Description
ID	Unique ID
DN	The DB of the entry is stored in "pretty" form
OC_MAP_ID	The ID of the table corresponding to the main objectClass of the entry Corresponds to one of the ID Values in the ldap_oc_mappings table.
PARENT	The ID of the parent entry The "suffix" entry has a value of 0.
KEYVAL	The value of the primary key column of the row in the table that holds the entry's data That is, the primary key column value of the table corresponding to the objectClass of this entry ("keytbl.keycol" value)

ldap_entry_objclasses

This is an objectClass mapping table. Entry has some auxiliary objectClass.

Column ID	Description
ENTRY_ID	The value of ldap_entries.id
NAME	The name of auxiliary objectClass. Must match the name of one of the objectClasses loaded in slapd's schema.

Configuration

Edit the ODBC configuration and slapd.conf file to configure the OpenLDAP environment.

.odbc.ini

```
[ldap_altibase]
Description = ODBC for Altibase
Driver = /home/altibase/altibase_home/lib/libaltibase_odbc-64bit-ul64.so
server = 127.0.0.1
port = 20030
```

odbc trace configuration: the following configuration can be used to trace the problem when a back-end error occurs.

.odbcinst.ini

```
[ODBC]
TraceFile = /home/altibase/odbc.log
Trace = Yes
```

slapd.conf

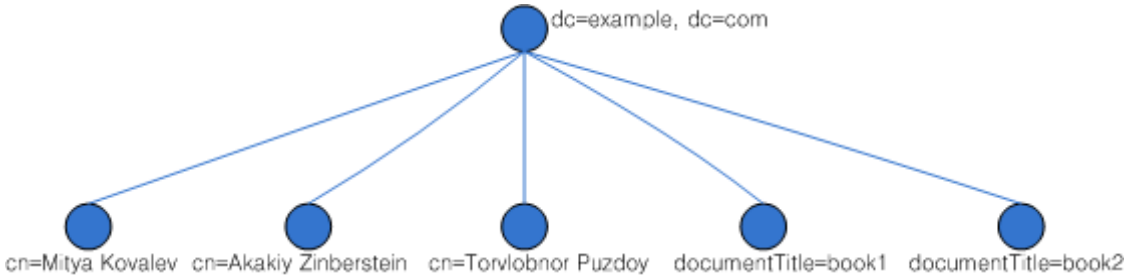
Edit slapd.conf with reference to slapd.conf provided as a sample for Altibase.

```
# $OpenLDAP$
#
# See slapd.conf(5) for details on configuration options.
# This file should NOT be world readable.
#
include         /usr/local/etc/openldap/schema/core.schema
include         /usr/local/etc/openldap/schema/cosine.schema
include         /usr/local/etc/openldap/schema/inetorgperson.schema

# Define global ACLs to disable default read access.

# Do not enable referrals until AFTER you have a working directory
# service AND an understanding of referrals.
#referral       ldap://root.openldap.org

pidfile         /usr/local/var/slapd.pid
argsfile        /usr/local/var/slapd.args

########################################################################
# sql database definitions
########################################################################

database        sql
suffix          "dc=example,dc=com"
rootdn          "cn=Manager,dc=example,dc=com"
rootpw          secret
dbname          ldap_altibase --ODBC dsn name
dbuser          ldap --Altibase user name
dbpasswd        ldap --db user pw
```

```
subtree_cond    "upper(ldap_entries.dn) LIKE CONCAT('%',upper(?))"
insentry_stmt   "insert into ldap_entries (id,dn,oc_map_id,parent,keyval) values
(ldap_entry_ids.nextval,?,?,?,?)"
has_ldapinfo_dn_ru  no
upper_func      UPPER
```

Examples

A DIT (Directory Information Tree) is build in the Altibase as shown in the figure below.



root DN is "dc=example and dc=com", ldif (LDAP Data Interchange Files, file representing tree data as text) is as follows. Please refer to the sample file except root DN "dc=exampl,dc=com". Sample file is in https://github.com/ALTIBASE/openldap/tree/master/servers/slapd/back-sql/rdbms_depend/altibase .

```
# Mitya Kovalev, example.com
dn: cn=Mitya Kovalev,dc=example,dc=com
objectClass: inetOrgPerson
cn: Mitya Kovalev
sn: Kovalev
seeAlso: documentTitle=book1,dc=example,dc=com
seeAlso: documentTitle=book2,dc=example,dc=com
givenName: Mitya
userPassword:: bWl0
telephoneNumber: 222-3234
telephoneNumber: 332-2334

# Akakiy Zinberstein, example.com
dn: cn=Akakiy Zinberstein,dc=example,dc=com
objectClass: inetOrgPerson
cn: Akakiy Zinberstein
sn: Zinberstein
givenName: Akakiy

# Torvlobnor Puzdoy, example.com
dn: cn=Torvlobnor Puzdoy,dc=example,dc=com
objectClass: inetOrgPerson
cn: Torvlobnor Puzdoy
sn: Puzdoy
seeAlso: documentTitle=book1,dc=example,dc=com
givenName: Torvlobnor
telephoneNumber: 545-4563

# book1, example.com
dn: documentTitle=book1,dc=example,dc=com
objectClass: document
description: abstract1
```

```
documentTitle: book1
documentAuthor: cn=Mitya Kovalev,dc=example,dc=com
documentAuthor: cn=Torvlobnor Puzdoy,dc=example,dc=com
documentIdentifier: document 1

# book2, example.com
dn: documentTitle=book2,dc=example,dc=com
objectClass: document
description: abstract2
documentTitle: book2
documentAuthor: cn=Mitya Kovalev,dc=example,dc=com
documentIdentifier: document 2

# example.com
dn: dc=example,dc=com
objectClass: organization
objectClass: dcObject
o: Example
dc: example
```

These entries are structual objectClass "Organization" and auxiliary objectClass contains "dcObject", and each definition is as follows.

To map objectClass to a DB table, users must select and column among attribute members of objectClass. In this example, the "o" and "dc" attributes are selected.

```
objectclass ( 2.5.6.4 NAME 'organization'
    DESC 'RFC2256: an organization'
    SUP top STRUCTURAL
    MUST o
    MAY ( userPassword $ ... ) )

objectclass ( 1.3.6.1.4.1.1466.344 NAME 'dcObject'
    DESC 'RFC2247: domain component object'
    SUP top AUXILIARY MUST dc )
```

The following is an SQL statement that creates the "institutes" table mapping the above objectClass to the Altibase table and the meta data for inserting, searching, and modifying data.

```
CREATE TABLE institutes (
        id int NOT NULL,
        name varchar(255)
);
insert into institutes (id,name) values (institute_ids.nextval,'Example');

insert into ldap_oc_mappings
(id,name,keytbl,keycol,create_proc,delete_proc,expect_return)
  values (3,'organization','institutes','id','exec create_org(?)','exec
delete_org(?)',1);

insert into ldap_attr_mappings
(id,oc_map_id,name,sel_expr,from_tbls,join_where,add_proc,delete_proc,param_order
,expect_return)
```

```
  values (11,3,'o','institutes.name','institutes',NULL,'exec
set_org_name(?,?)',NULL,0,0);

insert into ldap_attr_mappings
(id,oc_map_id,name,sel_expr,from_tbls,join_where,add_proc,delete_proc,param_order
,expect_return)
  values (12,3,'dc','lower(institutes.name)','institutes,ldap_entries
dcObject,ldap_entry_objclasses auxObjectClass',
    'institutes.id=dcObject.keyval AND dcObject.oc_map_id=3 AND
dcObject.id=auxObjectClass.entry_id AND auxObjectClass.oc_name=''dcObject''',
    NULL,NULL,0,0);

insert into ldap_entries (id,dn,oc_map_id,parent,keyval)
  values (ldap_entry_ids.nextval,'dc=example,dc=com',3,0,1);  -- id = 1

insert into ldap_entry_objclasses (entry_id,oc_name) values (1,'dcObject');

CREATE OR REPLACE PROCEDURE create_org(keyval OUT INTEGER) AS
BEGIN
INSERT INTO institutes (id,name) VALUES (institute_ids.nextval,' ');
SELECT institute_ids.currval INTO keyval FROM DUAL;
END;
/

CREATE OR REPLACE PROCEDURE delete_org(keyval IN INTEGER) AS
BEGIN
DELETE FROM institutes WHERE id=keyval;
END;
/

CREATE OR REPLACE PROCEDURE set_org_name(keyval IN INTEGER, new_name IN
varchar(255)) AS
BEGIN
UPDATE institutes SET name=new_name WHERE id=keyval;
END;
/
```

The sample example above is provided as a script file, and sample data can be built as shown below. The script file used can be downlaoded from https://github.com/ALTIBASE/openldap/tree/master/servers/slapd/back-sql/rdbms_depend/altibase.

Creating ldap User

After connection isql as sys user, execute the following SQL statement:

```
drop user ldap cascade;
create user ldap identified by ldap;
```

Creating Data

```
$ isql -s localhost -u ldap -p ldap -f backsql_create.sql
$ isql -s localhost -u ldap -p ldap -f testdb_create.sql
$ isql -s localhost -u ldap -p ldap -f testdb_metadata.sql
$ isql -s localhost -u ldap -p ldap -f testdb_data.sql
```

- backsplash_creat.sql: Create a table for storing meta data for mapping
- testdb_create.sql: Create objectClass to use as DB table
- testdb_metadata.sql: Enter meta data for mapping
- Testdb_data.sql: objectClass data input