



# Holon

PLATFORM

## Holon JDBC Datastore

Version 5.0.1

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# 1. Introduction

The Holon **JDBC Datastore** is the *Java DataBase Connectivity* reference implementation of the [Datastore](#) abstraction.



See the [Datastore](#) documentation for further information about **Datastores**.

This Datastore uses the Java **DataSource** interface as a factory to obtain database connections and perform operations on the persistence store using the *SQL* language through the JDBC API.

# 2. Obtaining the artifacts

The Holon Platform uses [Maven](#) for projects build and configuration. All the platform artifacts are published in the **Maven Central Repository**, so there is no need to explicitly declare additional repositories in your project **pom** file.

At the top of each *section* of this documentation you will find the Maven *coordinates* (group id, artifact id and version) to obtain the artifact(s) as a dependency for your project.

A **BOM (Bill Of Materials)** **pom** is provided to import the available dependencies for a specific version in your projects. The Maven coordinates for the core BOM are the following:

*Maven coordinates:*

```
<groupId>com.holon-platform.jdbc</groupId>  
<artifactId>holon-datastore-jdbc-bom</artifactId>  
<version>5.0.1</version>
```

The BOM can be imported in a Maven project in the following way:

```
<dependencyManagement>
  <dependencies>
    <dependency>
      <groupId>com.holon-platform.jdbc</groupId>
      <artifactId>holon-datastore-jdbc-bom</artifactId>
      <version>5.0.1</version>
      <strong><type>pom</type></strong>
      <strong><scope>import</scope></strong>
    </dependency>
  </dependencies>
</dependencyManagement>
```

## 2.1. Using the Platform BOM

The Holon Platform provides an **overall Maven BOM (Bill of Materials)** to easily obtain all the available platform artifacts.

See [Obtain the platform artifacts](#) for details.

## 3. Datastore

The `holon-datastore-jdbc` artifact is the main entry point to use the JDBC Datastore.

*Maven coordinates:*

```
<groupId>com.holon-platform.jdbc</groupId>
<artifactId>holon-datastore-jdbc</artifactId>
<version>5.0.1</version>
```

The `JdbcDatastore` interface represents the **JDBC Datastore**, which extends the core **Datastore** interface.

The `withConnection` method can be used to execute a JDBC operation using a Datastore managed `java.sql.Connection`, providing the operation execution code through the `ConnectionOperation` functional interface. The connection finalization operations are executed by the JDBC Datastore after the execution of the provided operation.

```
JdbcDatastore datastore = getJdbcDatastore(); // build or obtain a JdbcDatastore

String name = datastore.withConnection(connection -> {
    try (ResultSet rs = connection.createStatement().executeQuery("select name from test
where id=1")) {
        rs.next();
        return rs.getString(1);
    }
});
```



If you want to reach the goal of a **complete abstraction** from the persistence store technology and the persistence model, the core **Datastore** interface should be used as a reference for persistence operations, instead of the specific **JdbcDatastore** interface. This way, the concrete Datastore implementation may be replaced by a different one at any time, without any change to rest of the code.

## 3.1. Setup

The JDBC Datastore supports default Datastore configuration properties:

- `holon.datastore.trace`: To enable/disable Datastore operations tracing
- `holon.datastore.dialect`: To configure the JDBC dialect class to use (providing the fully qualified class name). See [Dialects](#) for the available default JDBC dialects.

To create a **JdbcDatastore** instance, the `builder()` static method of the interface can be used.

```
JdbcDatastore datastore = JdbcDatastore.builder() // obtain the builder
    .dataSource(getDataSource()) ①
    .database(DatabasePlatform.ORACLE) ②
    .build();

datastore = JdbcDatastore.builder() // obtain the builder
    .dataSource(DataSourceConfigProperties.builder().withPropertySource(
"jdbc.properties").build()) ③
    .dialect(new MyDialect()) ④
    .build();

datastore = JdbcDatastore.builder() // obtain the builder
    .dataContextId("db1") ⑤
    .dataSource(DataSourceConfigProperties.builder("db1").withPropertySource(
"jdbc.properties").build()) ⑥
    .configuration(
        DatastoreConfigProperties.builder("db1").withPropertySource(
"datastore.properties").build()) ⑦
    .build();
```

① Set an explicit `DataSource` instance to use

- ② Set the database platform: if no dialect is explicitly provided, the Datastore will try to auto-detect the dialect to use relying on the database platform type
- ③ Provide a `DataSourceConfigProperties` structure using the `jdbc.properties` file, to build and configure a `DataSource` according to the available properties. See [JDBC DataSource](#)
- ④ Set a custom dialect
- ⑤ Build a Datastore bound to a *data context id*, which will be used to distinguish different data sources
- ⑥ Build a `DataSource` using given *data context id* and associate it to the Datastore. In this case, the configuration properties are expected to be expressed with the *data context id* as prefix, for example `holon.datasource.db1.url=...`

## 3.2. Data targets and paths

The JDBC Datastore relies on the following conventions regarding *\*DataTarget\*s* and *\*Path\*s*:

- The **DataTarget** *name* is interpreted as the database *table* (or *view*) name
- The **Path** *name* is interpreted as a table *column* name



See the core [Datastore](#) documentation for more informations about **DataTarget\*s** and **\*Path\*s**, and about the use of extension hooks such as **\*DataTargetResolver** for target names resolution.

## 3.3. Relational expressions

As a *relational* Datastore, the JDBC Datastore supports core relational expressions for data access and manipulation:

### 1. Sub-query:

The [SubQuery](#) interface can be used to represent a *sub-query*, which can be used in a query definition to express query restrictions (filters) that involve a sub-query as filter operand.

See the [Sub query documentation](#) for further information and code examples.

### 2. Alias and Joins:

The [RelationalTarget](#) interface can be used to express **alias** and **joins** for a `DataTarget`.

See the [Alias and Joins documentation](#) for further information and code examples.

## 3.4. Dialects

The JDBC Datastore relies on **dialects** to address and resolve any SQL language dissimilarity between RDBMS platforms.

A dialect is represented and implemented by the [JdbcDialect](#) interface.

The currently available dialect implementations are:

Database platform	Dialect class	Supported versions
DB2	<a href="#">DB2Dialect</a>	8 and higher
Derby	<a href="#">DerbyDialect</a>	10.5 and higher
H2	<a href="#">H2Dialect</a>	1.4 and higher
HyperSQL (HSQLDB)	<a href="#">HSQLDialect</a>	2.0.0 and higher
Informix	<a href="#">InformixDialect</a>	11.5 and higher
MySQL	<a href="#">MySQLDialect</a>	4.1 and higher
MariaDB	<a href="#">MariaDBDialect</a>	5.5 and higher
SAP HANA	<a href="#">HANADialect</a>	1.0 SPS12 and higher
Oracle Database	<a href="#">OracleDialect</a>	9i and higher
PostgreSQL	<a href="#">PostgreSQLDialect</a>	8.2.5 and higher
Microsoft SQL Server	<a href="#">SQLServerDialect</a>	2005 or higher
SQLite	<a href="#">SQLiteDatabase</a>	3.0.7. and higher

## 3.5. Auto-generated ids

The JDBC datastore support the retrieving of auto-generated id column values, if supported by the JDBC driver in use.

The auto-generated id values can be obtained from the `OperationResult` object, returned by Datastore data manipulation operations, through the `getInsertedKeys()` method.

The default `BRING_BACK_GENERATED_IDS` `WriteOption` can be provided to Datastore data manipulation method to bring back any auto-generated id value into the `PropertyBox` which was subject of the operation, if a corresponding `Property` (using the property name) is available in the box property set.

```
final PathProperty<Long> KEY = PathProperty.create("key", Long.class); ①
final PathProperty<String> TEXT = PathProperty.create("text", String.class);

Datastore datastore = getDatastore(); // build or obtain a Datastore

PropertyBox value = PropertyBox.builder(KEY, TEXT).set(TEXT, "test").build(); ②

datastore.insert(DataTarget.named("tableName"), value, DefaultWriteOption
    .BRING_BACK_GENERATED_IDS); ③

Long keyValue = value.getValue(KEY); ④
```

① The `key` column is supposed to be auto-generated by the database

② Create the `PropertyBox` to insert, not providing the `key` value

③ Execute the insert operation using the `BRING_BACK_GENERATED_IDS` write option

④ The **KEY** property of the inserted **PropertyBox** is updated with the auto-generated value

## 3.6. JDBC filters and sorts

Two interfaces are available to create filter and sort expression using the SQL language, extending the **QueryFilter** and **QuerySort** expressions:

### 3.6.1. JdbcWhereFilter

The **JdbcWhereFilter** interface is a **QueryFilter** representing a SQL *where* clause expression.

This filter supports **query parameters**, which must be expressed in SQL statement using the default **?** placeholder. The parameters values can be setted using the **create** static method:

```
QueryFilter filter = JdbcWhereFilter.create("name=? and id=?", "TestName", 1); ①
```

① Create a SQL filter expression with to parameters, providing **TestName** as first parameter value and **1** as second parameter value

### 3.6.2. JdbcOrderBySort

The **JdbcOrderBySort** interface is a **QuerySort** representing a SQL *order by* clause expression.

```
QuerySort sort = JdbcOrderBySort.create("id asc, name desc"); ①
```

① Create a SQL order by expression to order by **id** ascending and **name** descending

## 3.7. Extensions

## 3.8. Expression resolvers

The **JDBC Datastore** supports **ExpressionResolver** automatic registration using the **JdbcDatastoreExpressionResolver** base type and default *Java service extensions*.

To automatically register an **ExpressionResolver** this way, a class implementing **JdbcDatastoreExpressionResolver** has to be created and its qualified full name must be specified in a file named **com.holonplatform.datastore.jdbc.config.JdbcDatastoreExpressionResolver** and placed in the **META-INF/services** folder in classpath.

## 3.9. Commodity factories

The **JDBC Datastore** supports **DatastoreCommodityFactory** automatic registration using the **JdbcDatastoreCommodityFactory** base type and default *Java service extensions*.

To automatically register an **DatastoreCommodityFactory** this way, a class implementing **JdbcDatastoreCommodityFactory** has to be created and its qualified full name must be specified in a

file named `com.holonplatform.datastore.jdbc.config.JdbcDatastoreCommodityFactory` placed in the `META-INF/services` folder in classpath.

The `JdbcDatastoreCommodityContext` interface represents the JDBC Datastore specific commodity context and it is provided at commodity creation time to factories.

The context extends the `JdbcDatastore` interface itself and provides the following additional resources:

- The `DataSource` bound the JDBC Datastore;
- The `DatabasePlatform` to which the DataSource is connected, if available;
- The `JdbcDialect` used by the JDBC Datastore;
- Whether the Datastore *trace* mode is enabled.

## 4. Spring framework integration

The `holon-datastore-jdbc-spring` artifact provides integration with the `Spring` framework for the JDBC Datastore.

*Maven coordinates:*

```
<groupId>com.holon-platform.jdbc</groupId>
<artifactId>holon-datastore-jdbc-spring</artifactId>
<version>5.0.1</version>
```

### 4.1. Datastore setup

To create a JDBC Datastore and register it as a Spring bean, the `SpringJdbcDatastore` interface is provided, with the convenience `builder()` method.

This interface creates and represents a JDBC Datastore implementation which supports Spring JDBC and transaction management architecture, for example the `DataSource` connection and transaction synchronization support to provide a consistent integration with the Spring infrastructure.

### 4.2. Datastore auto-configuration

The `EnableJdbcDatastore` annotation can be used on Spring configuration classes to enable automatic JDBC Datastore configuration. An available `DataSource` bean must be present in context to enable the JDBC Datastore.

The *data context id* to which the JDBC Datastore is bound can be configured using the `dataContextId` annotation attribute, useful when multiple `DataSource` are available and it is required to configure multiple JDBC Datastore instances.

When a *data context id* is not specified, the JDBC Datastore is bound to the unique `DataSource` type bean registered in context. If the bean is not unique or is not present, a configuration error is

thrown. The `dataSourceReference` annotation attribute can be used to specify the explicit `DataSource` bean name to use for the JDBC Datastore.

When a *data context id* is specified, the registered Datastore is bound to the `DataSource` with a matching *data context id*, if available. During the registration phase, if a `dataSourceReference` is not specified, a `DataSource` bean is searched in context using the bean name pattern: `dataSource_[datacontextid]` where `[datacontextid]` is equal to the `dataContextId` annotation attribute.

A `DatabasePlatform` can be specified using the `platform` annotation attribute and to select a suitable dialect for the given platform. If the database platform is not specified, the JDBC Datastore tries to auto-detect it from the `DataSource` configuration.

The `transactional` annotation attribute (`true` by default) can be used to control the Spring transactions architecture integration, i.e. if a `Transactional` behaviour must be configured for the JDBC Datastore data manipulation methods, to automatically create or participate in a Spring transaction when these methods are invoked.

```
@EnableJdbcDatastore
@EnableDataSource
@PropertySource("datasource.properties")
@Configuration
class Config {

}

class MyBean {

    @Autowired
    private Datastore datastore;

}
```

## 4.3. Commodity factories

To use the `DatastoreCommodityFactory` annotation on beans to automatically register them into the `Datastore`, the `JdbcDatastoreCommodityFactory` base type must be used for such beans.

See [Commodity factories](#) for additional details about the `JdbcDatastoreCommodityFactory` type.

## 5. Spring Boot integration

The `holon-datastore-jdbc-spring-boot` artifact provides integration with `Spring Boot` for JDBC Datastore auto-configuration.

To enable Spring Boot auto-configuration the following artifact must be included in your project dependencies:

Maven coordinates:

```
<groupId>com.holon-platform.jdbc</groupId>
<artifactId>holon-datastore-jdbc-spring-boot</artifactId>
<version>5.0.1</version>
```

The JDBC datastore is auto-configured only when:

- A `JdbcDatastore` type bean is not already registered in Spring context
- A valid `DataSource` type bean is available in Spring context

When multiple `DataSource` type beans are registered in Spring context, and each of them is bound to a *data context id* (if they were configured using the Holon platform `DataSource` configuration modules), a JDBC Datastore is automatically configured and registered for each `DataSource` bean, using the *data context id* as Spring bean **qualifier** name.

To disable this auto-configuration feature the `JdbcDatastoreAutoConfiguration` class can be excluded:

```
@EnableAutoConfiguration(exclude={JdbcDatastoreAutoConfiguration.class})
```

## 5.1. Spring Boot starters

The following *starter* artifacts are available to provide a quick project configuration setup using Maven dependency system:

**1. Default JDBC Datastore starter** provides the dependencies to the Holon JDBC Datastore Spring Boot integration artifacts, in addition to default Holon *core* and *JDBC* Spring Boot starters (see the documentation for further information) and base Spring Boot starter (`spring-boot-starter`):

Maven coordinates:

```
<groupId>com.holon-platform.jdbc</groupId>
<artifactId>holon-starter-jdbc-datastore</artifactId>
<version>5.0.1</version>
```

**2. JDBC Datastore starter with HikariCP DataSource** provides the same dependencies as the default JDBC Datastore starter, adding the `HikariCP` pooling `DataSource` dependency. This way, the *HikariCP* `DataSource` will be selected by default by the `DataSource` auto-configuration strategy if the `DataSource` type is not explicitly specified using the corresponding configuration property.

Maven coordinates:

```
<groupId>com.holon-platform.jdbc</groupId>  
<artifactId>holon-starter-jdbc-datastore-hikaricp</artifactId>  
<version>5.0.1</version>
```

## 6. Loggers

By default, the Holon platform uses the [SLF4J](#) API for logging. The use of SLF4J is optional: it is enabled when the presence of SLF4J is detected in the classpath. Otherwise, logging will fall back to JUL ([java.util.logging](#)).

The logger name for the **JDBC Datastore** module is [com.holonplatform.datastore.jdbc](#).

## 7. System requirements

### 7.1. Java

The Holon Platform JDBC Datastore module requires [Java 8](#) or higher.

### 7.2. JDBC Drivers

To retrieve back database generated keys, the JDBC driver in use must be compliant to the **JDBC API version 3 or higher**.