

## Reporting from Relational Databases

### Overview

**XLReporter** can report on data stored in the most popular relational databases on the market today including (but not limited to) Microsoft SQL Server, Microsoft Access, Oracle and MySQL.

The following roadmap shows the methods **XLReporter** provides to retrieve data from a database to produce a complete report.

### Database Tables

**XLReporter** produces reports from narrow or wide tables which will be defined later.

Start by identifying the table(s) and or view(s) that provide the data for the report. If multiple tables are needed, if possible, consider creating a view to join those tables together in the database. This can make the configuration in **XLReporter** much easier.

Once the data source is identified, determine if the data is timestamped. If it is, then determine if it is stored in a narrow or wide format.

#### Wide

In a wide table or view each row consists of a timestamp and a separate column for each data point (tag). For example the following table contains a timestamp four data points: *Temperature*, *Pressure*, *Speed* and *Flow*.

DateAndTime	Temperature	Pressure	Speed	Flow
1/1/2020 00:00	63	38	30	16
1/1/2020 04:00	69	45	52	13
1/1/2020 08:00	90	22	51	22
1/1/2020 12:00	70	27	23	21
1/1/2020 16:00	90	44	57	9
1/1/2020 20:00	78	36	38	16
1/2/2020 00:00	81	45	43	11

#### Narrow

In a narrow table or view each row consists of a timestamp, tag and value so for a particular time there maybe several records, one for each tag. For example, consider the following table:

DateAndTime	Tag	Value
1/20/2020 00:00	Temperature	63
1/20/2020 00:00	Pressure	38
1/20/2020 00:00	Speed	30
1/20/2020 00:00	Flow	16

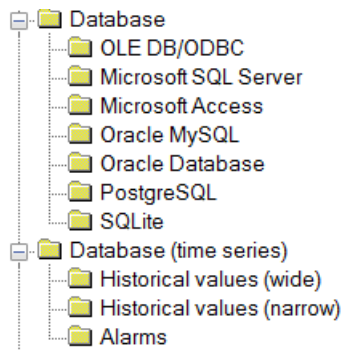
1/20/2020 04:00	Temperature	69
1/20/2020 04:00	Pressure	45
1/20/2020 04:00	Speed	52
1/20/2020 04:00	Flow	13
1/20/2020 08:00	Temperature	90
1/20/2020 08:00	Pressure	22
1/20/2020 08:00	Speed	51
1/20/2020 08:00	Flow	22

This table contains a timestamp and four individual records, one for each tag.

## Connector

In **XLReporter** to retrieve data from any data source a data connector must be defined. This is done in the **Project Explorer** under the **Data** tab by selecting **Connectors**.

The **Add** button is used to add a new connector to the project.



The **Database (time series)** connectors can not only be used to retrieve data recorded over a period of time but can also return summary data such as hourly averages over the day or daily minimums and maximums over the month.

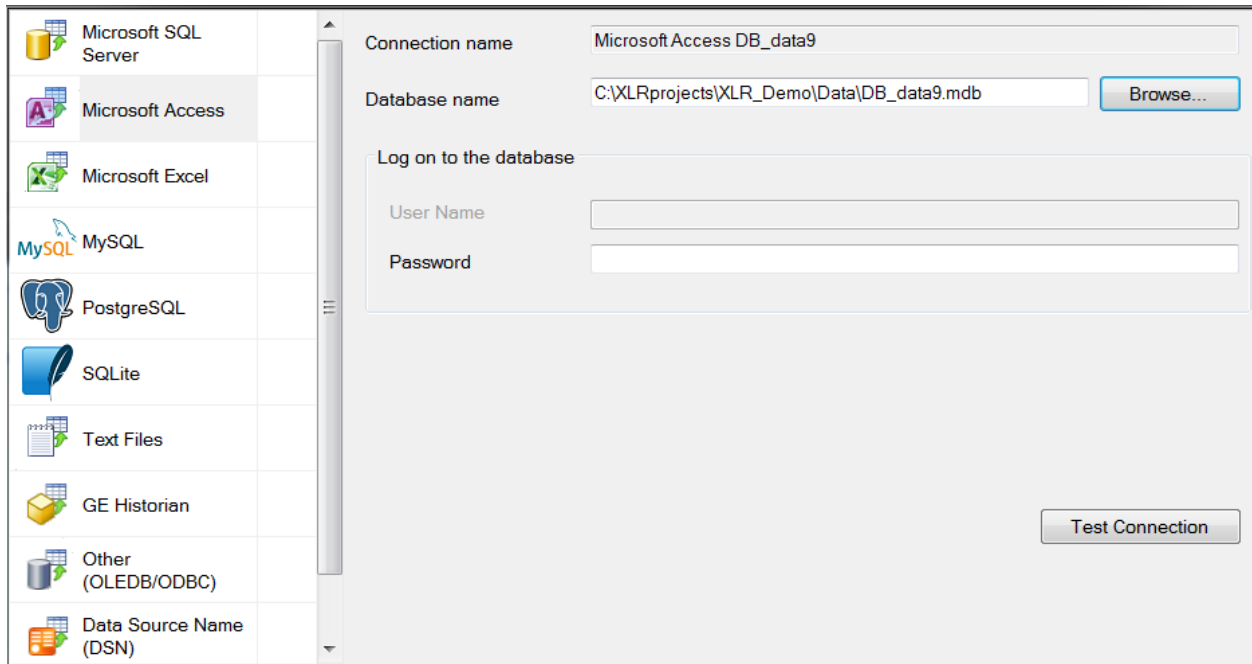
The standard **Database** connectors can be used to configure a query to retrieve any data from the database. However, this does not require you to write any SQL. Instead, there are a series of options to select which build the query for you.

## Database Connection

No matter what connector type is selected, the first thing that needs to be specified is the connection to the database.

The image shows a dialog box titled 'Primary Database'. It has two input fields: 'Type' and 'Data Source'. The 'Type' field has a small blue square button with three dots (a browse button) to its right. The 'Data Source' field is empty.

This is done by clicking the browse pushbutton ([...]) for **Type**.



A list of specific relational databases is provided to select from. Once selected, the specific information for that database is prompted.

If the database you want to use is not listed, there are two general options available:

- Other (OLEDB/ODBC)**  
 This option can be used to connect to a relational database using the OLEDB provider or ODBC driver installed on the machine. For more information, see the documentation provided with the database.
- Data Source Name (DSN)**  
 If the database provides an ODBC driver, you can define a Data Source Name (DSN) within Windows that defines how to connect to the database. **XLReporter** provides easy access to creating DSNs in the **Project Explorer** under the **Tools** tab by clicking **DSN settings**.  
 Note that **XLReporter** only supports 32 bit DSNs. The **DSN settings** option in **XLReporter** always creates 32 bit DSNs on both 32 and 64 bit Windows Operating Systems.

The **Test Connection** button is provided to verify the connection before continuing.

## Settings

The **Settings** button is provided to define specific settings for the database.

Client Wait Time (sec)	60
Table/Column Delimiter	_____
Start	[ _____ End ] _____
	<input type="checkbox"/> Delimit all tables and columns
Date/Time Delimiter	_____
Start	# _____ End # _____
Date/Time Storage	_____
	Local Date and Time
	<input type="checkbox"/> Use YYYY-MM-DD

Typically these settings do not need to be changed, however there are some items that need to be configured if the data returned is filtered by date and time.

When timestamps are logged to a database they can either be logged in local time or in UTC time. This can be toggled using the drop down under **Date/Time Storage**. If *UTC Date and Time* is selected, when **XLReporter** queries the database, it converts the local timestamp(s) submitted to UTC for the query and then converts the timestamps returned from the query back to local timestamps for the report.

Also, some databases do not support filtering timestamps using the local date/time format of the system. By default, when **XLReporter** queries the database, the timestamp(s) in the filter are formatted using the local date/time format of the system. If the **Use YYYY-MM-DD** option is selected, the date format of all timestamps submitted in the query will use the YYYY-MM-DD format.

## Historical values (wide) and Alarms

The screenshot shows a configuration panel titled "Table/Column". It contains the following fields:

- Table:** A dropdown menu with "tblProduction" selected.
- Date Column:** A dropdown menu with "DateTime" selected.
- Date includes Time:** A checked checkbox.
- Time Column:** An empty dropdown menu.

For **Historical values (wide)** and **Alarms** connectors, once the connection to the database is established, the **Table** (or view) containing the data must be selected.

Once the **Table** is selected, the **Date Column** and **Time Column** from the table must be defined. If in the table the date and time are in the same column check the **Date includes Time** option, otherwise define the separate columns for date and time.

## Historical values (narrow)

The screenshot shows a configuration panel titled "Table/Column" with a grid layout. It contains the following fields:

- Table:** A dropdown menu with "vData" selected.
- Columns:** A dropdown menu with "TagName" selected.
- Rows:** A dropdown menu with "DateAndTime" selected.
- Values:** A dropdown menu with "Val" selected.
- Date includes Time:** A checked checkbox.
- Time Column:** An empty dropdown menu.

For a **Historical values (narrow)** connector, once the connection to the database is established, the **Table** (or view) containing the data must be selected.

Once the Table is specified, there are three columns that need to be defined:

**Rows** define the date and time columns that define each row of data returned from the database. If the column contains both the date and time, the **Date includes Time** option should be checked. Otherwise, this option should be unchecked with the top drop down defined with the date column and the bottom drop down defined with the time column.

**Columns** defines the column that contains the names of the tags to report on.

**Values** defines the column containing the value for every tag in the table.



Under the **Columns** tab, all the tags in the table (or view) defined in the **Connector** are available to select from. If the group is **Summary Values**, a comprehensive list of calculations are available.

Under the **Time Period** tab, the overall time period of the group is defined. For **Summary Values** the Interval defines the duration of the calculations over the time period. In the example above hourly calculations are returned over the day.

For **Raw Values** the Interval defines the number of rows returned, either **All** or a fixed **Count**.

Name	Criteria	Or...	Or...	Or...
* Temperature_F	>= 65			

Perform by Server

Under the **Filters** tab, additional (non-timestamp) filtering can be defined for the group. For **Summary Values**, these filters are applied to the data before the calculations are performed. For **Raw Values**, these filters remove any records where the filter criteria are not met.

Depending on the connector, the Perform by Server option adds the filters to the query submitted to the database. If not checked, **XLReporter** applies the filters after the data is returned from the database.

## Database Data Group

For **Database** connectors, a Database Data Group is configured.

**Standard**  
Retrieve values for selected columns.

**Cross Tab**  
Retrieve values for selected columns by cross tabulating.

A Database Data Group can return data either as it is recorded in the database (**Standard**) or cross tabulated (**Cross Tab**). **Cross Tab** lends itself best to narrow tables and views as described above.

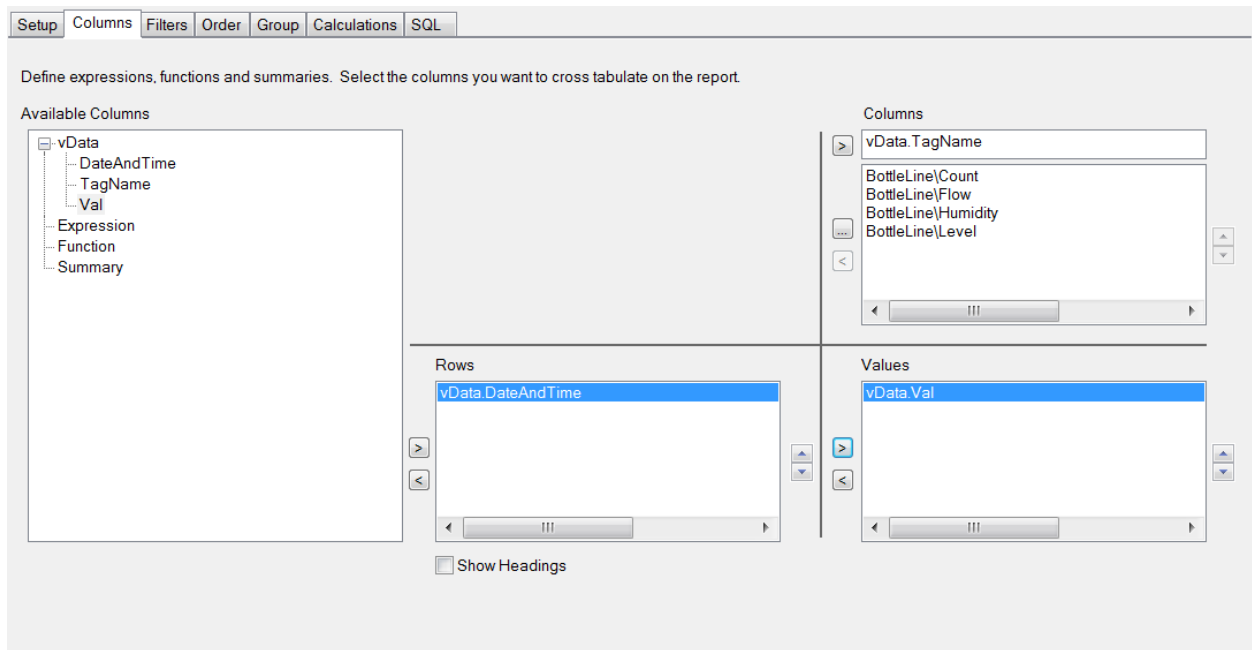
The screenshot shows the 'Setup' tab of the Database Data Group configuration window. The title bar includes 'Setup', 'Columns', 'Filters', 'Order', 'Group', 'Calculations', and 'SQL'. The main area is titled 'Connect to your database and choose the tables or query that you want to report on.' It features a 'Connection' panel on the left with 'Reconnect' and 'View ...' buttons. The 'Database Tables/Views' section has checkboxes for 'Tables' (checked), 'Views', and 'System'. A list of tables is shown, including 'AlarmsAndEvents', 'CustomerSales', 'FloatTable', 'RSDDataPoint', 'RSDDataPointSample', 'StringTable', 'TagTable', 'tblName', 'tblProduction', and 'tblISM'. A 'Selected Tables/Views' list on the right contains 'tblProduction'. Below these lists are a 'Filter' dropdown set to '\*' and an 'Apply' button, and a 'Records to Fetch' dropdown set to 'ALL'. At the bottom, there is a 'Joins' table with columns for 'Column', 'Condition', and 'Column'.

Under the **Setup tab**, the **Table** (or tables) for the group must be selected. Views and System tables can also be queried. These are shown in the list by checking the appropriate boxes.

If more than one **Table** is selected, **Joins** must be defined to link the tables together for the query. Otherwise the query is invalid.

The screenshot shows the 'Columns' tab of the Database Data Group configuration window. The title bar includes 'Setup', 'Columns', 'Filters', 'Order', 'Group', 'Calculations', and 'SQL'. The main area is titled 'Define expressions, functions and summaries. Select the columns you want to report on.' It features an 'Available Columns' list on the left, which is expanded to show columns from 'tblProduction': '[DateTime]', '[Lot\_Number]', '[Motor\_Amps]', '[Motor\_Speed]', '[Product\_Code]', and '[Temperature\_F]'. Below this are options for 'Expression', 'Function', and 'Summary'. A 'Selected Columns' list on the right contains '[DateTime]', '[Lot\_Number]', '[Motor\_Amps]', '[Motor\_Speed]', '[Product\_Code]', and '[Temperature\_F]'. The '[Temperature\_F]' column is highlighted in blue. Below the lists are navigation arrows and a 'Show Headings' checkbox.

Under the **Columns** tab, the columns for each selected table is listed. Select each column to display in the report.



For **Cross Tab** groups, the **Columns** tab appears differently. The configuration is very similar to the **History values (narrow)** connector with the addition of selecting the values of the selected column for the **Columns** setting.

Under the **Filters** tab, a set of filters can be defined to restrict the amount of data returned. A filter can be defined for any column in any selected table regardless of whether it is a **Selected Column** under the **Columns** tab.

The order of rows returned is controlled under the **Order** tab. Any **Selected Column** under the **Columns** tab can be configured for the order.

The **SQL** tab displays the query that will be submitted to the database. This is not editable but is displayed for diagnostic purposes.

## Report Generation

Once the data connection(s) are added and the template is complete, reports can be generated **On Demand** or automatically through the **XLReporter Scheduler**.