ODBC SimApi User Guide

1. Introduction

This document is the user guide for the *ODBC SimApi* from Umetrics.

This SimApi connects to an ODBC (Open Database Connectivity) data source. For the SimApi to be able to interpret the data, the ODBC data source needs to be structured as described in this document (for example, there needs to be a Date/Time column).

For a detailed list of changes in different versions of this SimApi, see the *Version Info.txt* file that comes with the installation.

This SimApi can be used by SIMCA-online, SIMCA-Batch On-Line, SIMCA-4000, or SIMCA.

For more information on available SimApis, see www.umetrics.com/simapi.

1.1 Features

- Handles SQL dialects for Microsoft SQL Server, Oracle, Microsoft Access, IBM db2, denodo, MySQL, PostgreSQL and standard SQL.
- ODBC connection string authentication with a user name and password or Windows authentication.
- Accessing multiple tables or views for reading continuous process data (current and historical). Two modes; Lookup view mode and Direct Mode (reading directly from a database view).
- Multiple batch nodes (with a single row for each batch with start- and end times).
- Reading batch data (batch conditions) from additional columns in batch nodes, or from *Batch Data Views* that store batch conditions in two columns (tag name and value).
- Discrete data support: reading discrete data from one node.
- Write back from SIMCA-online: historical process data and batch data to the ODBC data source.
- Supports both numerical and text data for tags.
- Works with numerical data or text (qualitative) data.
- Built in *synthetic process batch id* in the batch node, which can be used if the process data doesn't have a batch id tag. Can be used in phase conditions when the batch id is otherwise not available in the process data.
- *Synthetic process batch id tags* in Batch Data Views that can be filtered by other columns. Can be used in phase conditions when the batch id is otherwise not available in the process data
- *Synthetic batch data instance tags* handle multiple measurements of batch data per batch. Useful if you want be able to create batch level models that use two or more measurements of each batch condition variable per batch.
- Multiple instances of the ODBC SimApi to be configured and used from the same SIMCA-online server. This lets you connect to multiple databases on one or more database servers.

Each feature (continuous, batch or discrete) can be configured and used on its own, and you don't need to configure all features if you don't intend to use them.

1.1.1 Synthetic process batch id

In a batch project, the process data has to have a batch id tag (column) that is specified on the **Phase conditions** section of the project configuration in SIMCA-online. This tag is matched against the batch node to know if a phase should execute.

If the process data doesn't have a batch id tag, the ODBC SimApi feature *synthetic process batch id* can be used. It generates the process data batch id using data from the batch node.

To use this feature, go to the **Phase conditions** section of the project configuration in the SIMCA-online client and configure the **Batch identifier tag** to be the batch id of *the batch node*. Whenever the server reads the batch id for the process data, the synthetic batch id from the batch node will be returned ensuring that the unit will execute.

Note that this feature does *not* work with concurrent (parallel) batches. Thus for any given time there must be only one batch active in the batch node.

Note synthetic batch id tags generates an overhead in the SimApi which can lead to lower performance, especially during catch-up and repredict.

1.1.2 Generated synthetic process batch id tags; one per unique Unit ID

This feature builds on the synthetic process batch id described above, but uses an additional column in the batch node that contains the UnitID. The batch node is segmented into classes of batches that share the same value in the UnitID column. This can be seen as a way to filter out batches in the batch node that have a certain value for UnitID.

For each unique value in the UnitID column (looking in the entire batch node) the SimApi creates a synthetic tag in the batch node with the name BatchID_Unit_[Value].

For example: if values 1 and 2 are the two unique values in the UnitID column, it will result in two synthetic tags; BatchID_Unit_1 and BatchID_Unit_2. Reading process data from the synthetic batch id tag BatchID_Unit_1 will return only batch ids for batches whose UnitID column has the value 1. Batches with 2 in the UnitID column will be ignored.

To use this feature you configure the **Batch identifier** tag in the **Phase Conditions** page for each unit to use the synthetic BatchID_Unit_[Value] tags as described in 1.1.1.

See 2.3.4 for details on how to setup the unit id column. The name of the column is configured in the XML file, see 2.4.5 for details.

Restrictions:

- As for the regular synthetic batch id described above, by extension, this does not work with concurrent (parallel) batches sharing the same value of UnitID (concurrent batches with different UnitIDs works fine).
- All unit ids must be specified in the batch node before the SIMCA-online Server is started (the synthetic tags are created at startup). This could be done by adding one dummy batch in the batch node for each unit id that should be used.
- Batch ids still have to be unique in the batch node and there can be only one row for each batch id. As a consequence each batch can only have one value of UnitID.
- The value of UnitID must not change for a specific batch during its lifetime.

Note; an alternative to using a synthetic process batch id filtered by UnitID like this is to use multiple batch nodes; one for each unique value of UnitID. In the case of multiple batch nodes, the same batch id can of course be present in many batch nodes (unlike when the UnitID filter is used) so in some cases multiple batch nodes might be the preferred solution.

1.1.3 Batch Data Views

A batch data view is a database view or table for storing batch conditions. It should have three columns: Batch identifier, Tag name and Value. One row in that view stores a value for a specific tag

and batch. There will be many rows in this view for each batch when there are many batch condition variables.

Here's an example of a batch data view in the database with its three columns:

BatchID	*Tag name*	*Value*
Batch7	Yield	0.95
Batch7	ProductQuality	Excellent
Batch8	Yield	0.90
Batch8	ProductQuality	Poor

This batch data view will be exposed through the SimApi as two tags Yield and ProductQuality. Reading values for those tags for Batch8 would result in the values 0.90 and "Poor" respectively.

Note: If there are multiple rows for the same *BatchID* and *Tag name* combination in the database view, the SimApi will return the value from the last of those rows.

There are no batch start or batch end times columns in batch data views, so they cannot be used as batch nodes.

This SimApi supports many batch data views at once.

Tip: As an alternative to Batch Data Views, batch condition data can also be stored in a *batch node*. In that case one column is needed for each batch condition variable. Thus there will only be one row for each batch in batch nodes, but many more columns are needed.

Tip for SIMCA-online Extract functionality: To extract data from a batch data view you need to also include one tag (such as the Batch Identifier tag) from a batch node, so that SIMCA-online can know the batches to extract data for.

1.1.3.1 Synthetic batch data instance tags

Batch data always consists of a single observation per batch[1].

But what if the values of a batch data tag might change (for example because you rerun some measurement) and if you want to use *multiple* measurements per batch in a SIMCA-online batch level model?

Then you can use the optional feature *synthetic batch data instance tags*. These are tags that are added as additional tags in the batch data view, each mapping to a particular instance of the batch data for the tag.

Here's an example:

BatchID	*TimeColumn*	*Tag name*	*Value*
Batch7	2015-06-23 09:00	Yield	0.90
Batch7	2015-06-23 17:00	Yield	0.99

The SimApi will then expose this batch data view with two tags; *Yield_1* and *Yield_2*. When data is read for the batch Batch7 it will result in the values 0.90 for Yield_1 and 0.99 for Yield_2.

Notice that there is a new TimeColumn added in this example, with a timestamp for each row. This column is required for the synthetic batch data instance tag feature, in order for the SimApi to know how to order the values for the tags into the instance tags.

[1] For more information about the different data retrieval modes, of which batch data is one, see the SIMCA-online Technical Guide.

1.1.3.2 Synthetic process batch id tags filtered on column values

This feature is similar to the *Generated synthetic process batch id tags; one per unique Unit ID* described in 1.1.2 with the difference that this is read from a batch data view and the batch id can be filtered on multiple columns.

Here's an example:

BatchID	*TimeColumn*	*Tag name*	*Value*	*Unit*	*Line*
Batch7	2015-06-23 09:00	Yield	0.90	A	1
Batch8	2015-06-23 09:00	Yield	0.95	B	2

If we would filter the BatchID on columns Unit and Line that would give us one synthetic batch id tag for each unique combination of the values from columns Unit and Line.

Synthetic tags created would be: BatchID_A_1, BatchID_B_2

Hence reading BatchID_A_1 for the time in the table would give the value Batch7, for the same time BatchID_B_2 would give the value Batch8.

Notice that a time column with a timestamp for each row is required for this feature.

1.1.4 Discrete data

Discrete data is infrequently measured data which have no logical values in between measurements. Usually a sample is taken on each batch at semi-regular intervals (such as once every day). This sample is then sent to a lab which performs analysis on the sample and at a later stage returned with a report on the sample for the required variables. This is then entered in the database in the discrete data table.

1.1.5 Synthetic batch age tags for discrete data nodes

For discrete data nodes there are four synthetic tags named $BatchAge(d), $BatchAge(h), $BatchAge(m), $BatchAge(s). When reading their values they will return the batch age as a floating point number for each sample in four different magnitudes: days, hours, minutes and seconds respectively. These tags can be used as maturity in the SIMCA model, reducing the need to explicitly add and populate such tags to the discrete data tables.

1.2 Prerequisites

For this SimApi to work there are some requirements:

1.2.1 ODBC Drivers

In order for the ODBC SimApi to work with your database you must install ODBC drivers for your database. You obtain drivers from the manufacturer of the database. Drivers for Microsoft SQL Server are often installed on most Windows computers.

1.2.2 Database structure requirements

A database can of course contain almost any data with an arbitrary structure. The SimApi however assumes it can read current or historical data for a limited number of tags[2].

Thus, for the ODBC SimApi to work with a database, a certain predefined structure needs to be applied to the database. In many cases this can be done by creating a set of database views that re-arrange existing data into the required structure.

For details about this see 2.3 below.

[2] For more information about SimApis, see the SIMCA-online Technical Guide at http://www.umetrics.com/kb/simca-online-technical-guide.

1.3 Installation

The SimApi comes in a 32-bit (x86) and a 64-bit (x64) version. Use the one that matches the program (for example SIMCA-online or SIMCA) you will use the SimApi in.

1. (Don't forget to install the ODBC drivers as mentioned in 1.1.3 above.)
2. Run the SimApi setup program to install the SimApi on your computer where you want to use it. Refer to 2 below.
3. Configure the ODBC Data source as described in 1.4 below.
4. Then you need to set up the SimApi as described in 2.3 below.

Also refer to the following sections for information on important locations for log- and settings files and troubleshooting tips.

1.4 Configure ODBC Data Sources

The data source should be configured as a System DSN in the ODBC Data Sources control panel in Windows.

Note that there are two versions of this tool on 64-bit Windows: one for 32-bit applications and one for 64-bit[3].

In the ODBC configuration wizard for SQL Server you can select how to authenticate users (log in):

- *SQL Server Authentication* which means that the database is authenticating users using a user name and password. This username and password can be given in the ODBC wizard, or in the configuration file by filling in the credentials dialog as part of the configuration (see below).
- *Windows authentication*. Windows authentication means that the user account (typically in Active Directory) of the program using the SimApi is used to connect to the database. This user account needs to have appropriate rights in the database.

Windows authentication with a SIMCA-online server means that the service account of the SIMCA-online Server service is used (LocalSystem by default, but can be changed to a specific account by the administrator, see The SIMCA-online Technical Guide for more information).

Windows Authentication with SIMCA means the user account of the person that is running SIMCA will be used.

Verify the connection to the database with the Test Data Source button at the end of the ODBC configuration wizard. As noted above, for Window Authentication this tests with your own user account, and not necessarily with the SIMCA-online service account.

1.5 Configuration file and log file locations

The SimApi stores its settings in a XML settings file named ODBCConfiguration.xml in the *Program Data* folder[4]. This folder is located in different places depending on the Windows version:

Window Vista and Windows Server 2008 and later: C:\ProgramData\Umetrics\SimApi

Windows XP: C:\Documents and Settings\All Users\Application Data\Umetrics\SimApi

This folder also contains the log file that the SimApi writes. This log file is named ODBCSimApiLog.log and is useful for troubleshooting.

[3] On 64-bit Windows you can start the 32-bit ODBC Data Sources program by launching it manually from the SysWow64-folder, typically C:\Windows\SysWOW64. If you just start ODBC Data Sources from the start menu in 64-bit Windows 7 it will launch the 64-bit version.

[4] This folder is normally hidden in Windows so in order to see it in Windows Explorer you should configure Windows Explorer to show hidden files. Note that you still can navigate to a hidden folder by copying and pasting the folder path to Explorer's address bar.

1.5.1 File names when multiple instances is used with SIMCA-online 13.1 or later

When multiple instances is used with SIMCA-online 13.1 or later versions, each configuration get its own configuration file and log file, the naming of these files corresponds to the name the configuration is given on the SimApi tab in the SIMCA-online server options dialog and are therefore a bit different than what is mentioned in the previous section. The following example shows the naming of these files.

Configuration name given when the instance is added: *Server1*
Configuration file name: ODBC_*Server1*Configuration.xml
Log file name: ODBC_ *Server1*SimApiLog.log

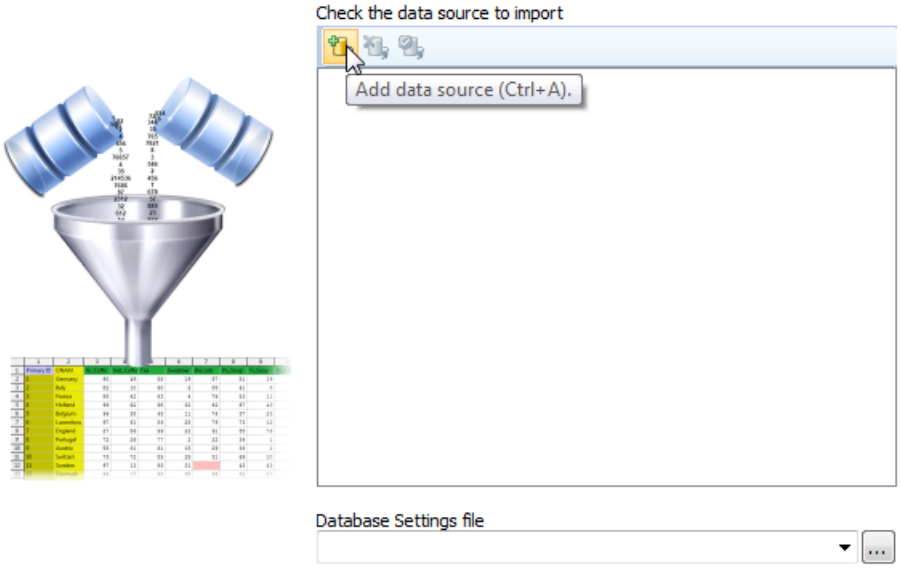
Note that the generic file ODBCSimApi.log file still is used. This log file contains entries that for technical reasons cannot be directed to the log file of the instances.

2. Setting up

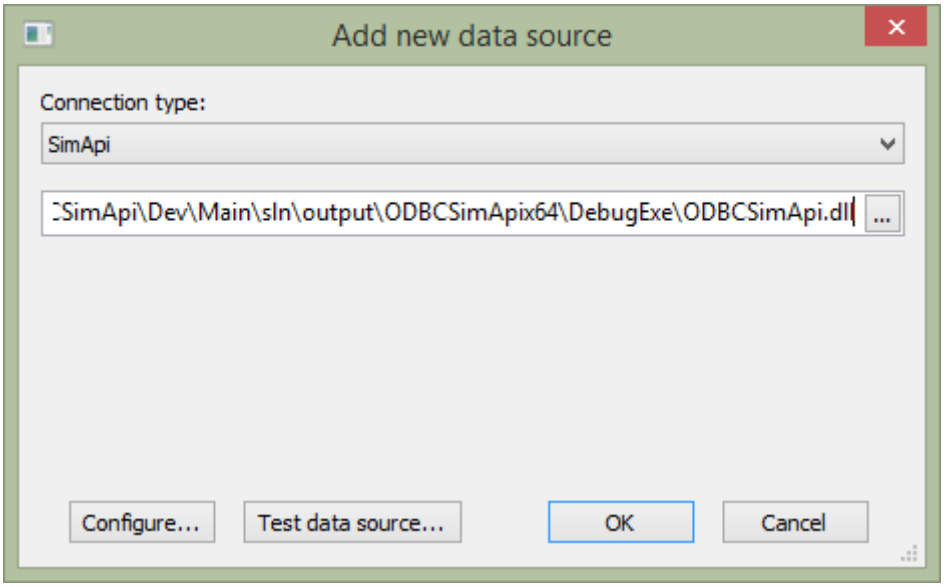
In order for SIMCA or SIMCA-online to be able to use the SimApi you need to configure it as described here.

2.1 Setting up the SimApi for use in SIMCA

1. Start the database import in SIMCA with either:
   - *File->New Regular Project or New Batch Project*. If the database import wizard is not opened automatically, open it from *File->New Spreadsheet->From Database*.
   - Import Dataset on the Data tab of an open SIMCA project.
2. Click on *Add data source*:



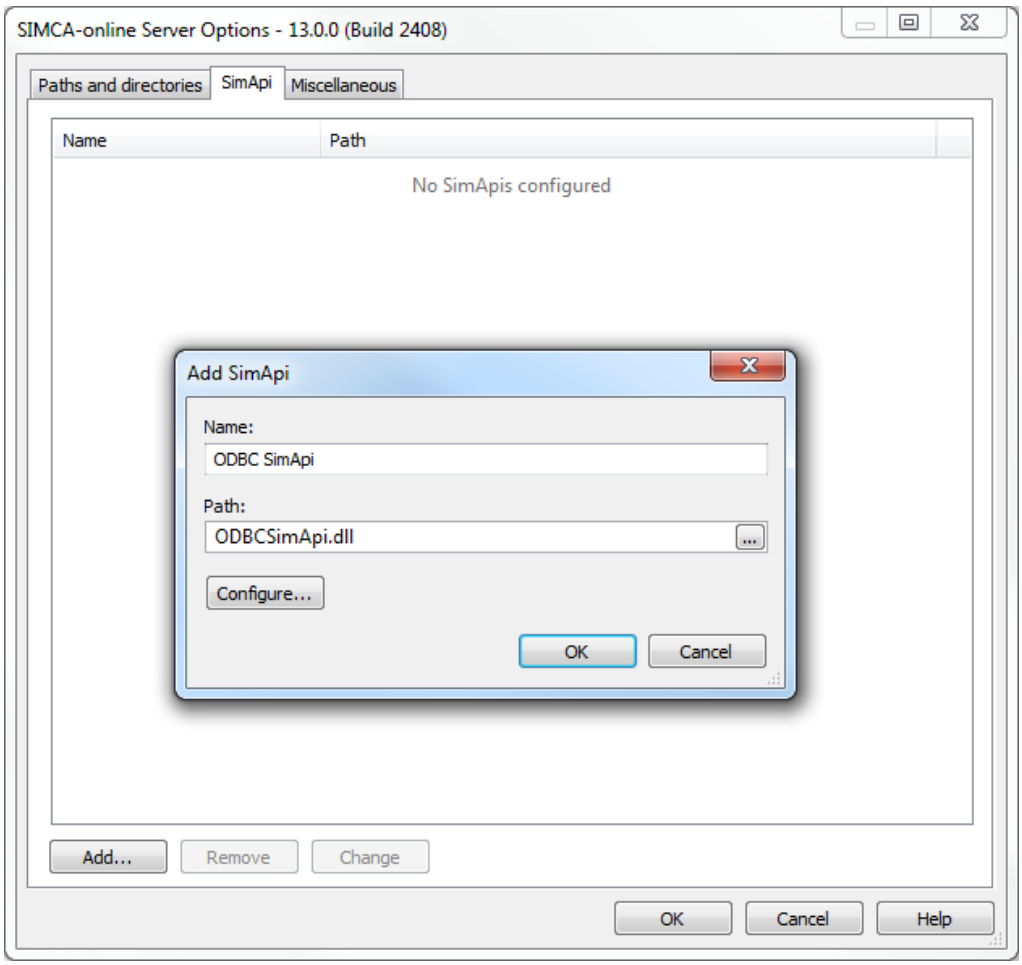
3. Select *SimApi* as the connection type, click the …-button and located the ODBCSimApi.dll, and click Open.



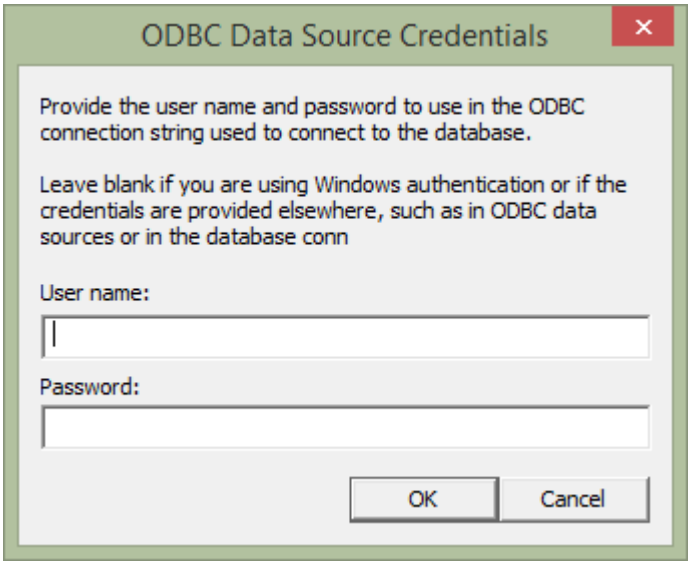
4. Continue to 2.2 and follow the steps 3 to 5 (configuring the setting in the SimApi) before clicking OK (to avoid an error message).
5. Click the Test data source connection to verify that you can connect to the database.

2.2 Setting up the SimApi for use in SIMCA-online

1. Start the SIMCA-online Server Options utility from the start menu. Go to the SimApi tab and click *Add...*



2. Give this instance of the SimApi a name and then click the …-button to browse to and select the ODBCSimApi.dll.
3. Click the Configure-button. This shows the following dialog:



   If your database is using database authentication in ODBC, for example SQL Server authentication you can provide the user name and password to use here. The user name and password is stored encrypted in the configuration file.

   On the other hand if you are using Windows Authentication you can leave user name and password blank.
4. When you click OK the SimApi creates the default XML configuration file (if it already existed, all settings remain, and only the username and password is updated if you changed it). Complete the settings in configuration in the XML file using a text editor as described in 2.3 and onwards.
5. Start the SIMCA-online server service, verify it starts (if not look for errors in the SimApi log files and update the XML configuration file to correct any errors). Use a SIMCA-online client and use Extract on the File-tab to test that the SimApi works as expected.
6. If you want to configure multiple instance of this SimApi, then repeat the above steps and use unique names for each instance. Tip: copy and paste settings from the XML configuration file for the first instance to the second instance XML-file and use those settings as the starting point. Read more about the different log and configuration files for the instances in 1.5.1.

2.3 Data Source prerequisites

The ODBC SimApi requires that the database has a certain structure in order for the SimApi to be able to use it. This section and its subsections describes how the database views must look like depending on if you want to use continuous/process data, batch data or discrete data. You do not need to configure all features, only the ones you plan to use. Refer to the sections that apply.

There are two different ways to configure how continuous/process data should be accessed:

1. *Direct Mode*. In this mode you specify the view names that should be exposed through the SimApi. Each view becomes a node in the SimApi, and all columns a view become tags. Direct Mode is recommended since it is relatively simple to use. Section 2.3.2 describes how to make the necessary settings.
2. *Lookup View Mode*. This mode is more complex and requires a specific view in the database called a Lookup View. This view defines the tags that should be exposed through the SimApi, but data is taken from additional related views. This is explained in section 2.3.3.

Notes:

- When the term database *view* is mentioned above it refers to a database view that aggregates data from existing tables. If you like you can use database tables instead of views, but using a view in a database is a convenient way to filter or aggregate data into a form that is suitable for the SimApi.
- It is important that all views or tables used has a unique primary key and indexing is used on date/time columns so that the performance of the queries by the SimApi won't suffer.
- The SimApi supports two data types for data columns; either numerical real values (a float or other numerical datatype) or text strings (varchar in the database). Note that nvarchar is not supported.
  Missing values (nulls) are also allowed for data columns.

The sub sections describe how to set up the SimApi and the database views in detail.

2.3.1 Global connection settings

The first section of the XML configuration file is the connection settings that describe how to connect to your database.

Required settings are (see for 2.4.8 for detailed descriptions of these settings):

- DSN – the data source name. It should match the name of the System DSN in Windows ODBC Data Sources that you created in 1.4.
- SQLDialect – set to match the database server you are using.

You may also need to set the LeftPunctuation and RightPunctuation settings if you use reserved SQL keywords as names of identifiers, or use spaces in identifier names of your views/tables/columns in the database. See 2.4.1 below.

The other connection settings are optional.

2.3.2 Direct Mode for continuous/process views

Each row in a Direct Mode view is an observation.

The columns in the view represent variables:

- There must be a single column with data/time data. This column should be the primary key, and cannot hold null values. The name of this column should match the configured TimeField setting in the configuration file, see section 2.4.4 for more details. Values for this column are the time stamp for the observations.
- The remaining columns will be exposed through the SimApi as tags with the same names as the column names. Values in these columns are process data.
- Write back is supported for all tags, however the correct permissions must be set in the ODBC data source.

Note; the SimApi enumerates the columns at startup only. This means that if new columns are added to a view the SimApi must be restarted in order for the SimApi to expose them.

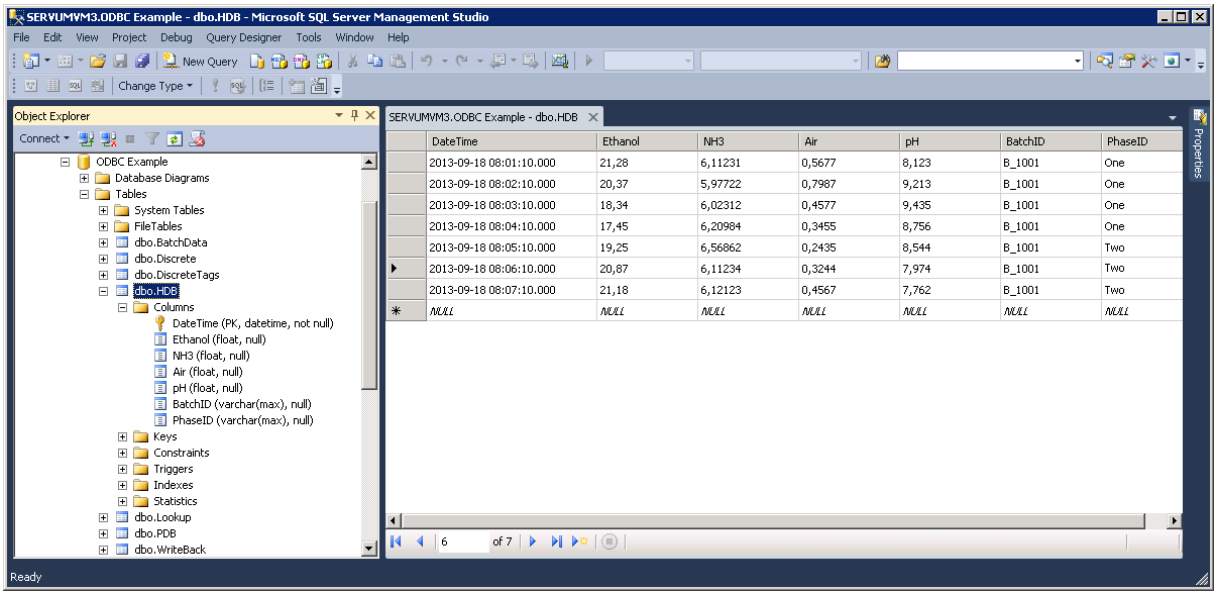


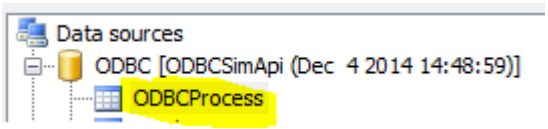
Figure 1 – Direct Mode table example.

2.3.3 Lookup View Mode for continuous/process views

This view can be used instead of, or in addition to, using Direct Mode views as described in 2.3.2.

The Lookup View is an indirect way of specifying which data columns in *other views that* should be compiled and exposed through the SimApi. The other views are either HDB sources (historical data) or PDB sources (current data) respectively. The PDB source is optional as you will see below.

The data exposed by the Lookup View is presented as a node called *ODBCProcess:*



Each row in the Lookup view defines one tag to be exposed through the SimApi and which other views to take the data from for that tag. The Lookup view thus will contain many rows. It also specifies if a tag is writeable, i.e. if SIMCA-online should be able to write values back to this tag.

There can be multiple PDB sources and multiple HDB sources in use from the Lookup View. Thus the ODBC SimApi can aggregate data from multiple views into one node with tags that are exposed through the SimApi.

The Lookup view should contain the following columns (referred to as Fields in the configuration file):

- Name – The name of a tag (Primary Key, varchar, not null).
- PDB_Source – The name of the view that contains the current data for the tag (varchar). If this column contains an empty value, the program will read all data from the HDB_Source.
- PDB_Field – The column name of the tag in the PDB Source view (varchar). If the PDB_Source value is omitted, this column will not be read.
- HDB_Source – The name of the view that contains the historical data for the tag (varchar).
- HDB_Field – The column name of the tag in the HDB Source view (varchar).
- Writeable – If SIMCA-online should be able to write data to this tag or not (bit).

Note that for each column, the above description also states which rows should be primary key and the data type for each column.

The *names* of the columns can be arbitrary since the names are specified in the configuration file (see section 2.4.2).

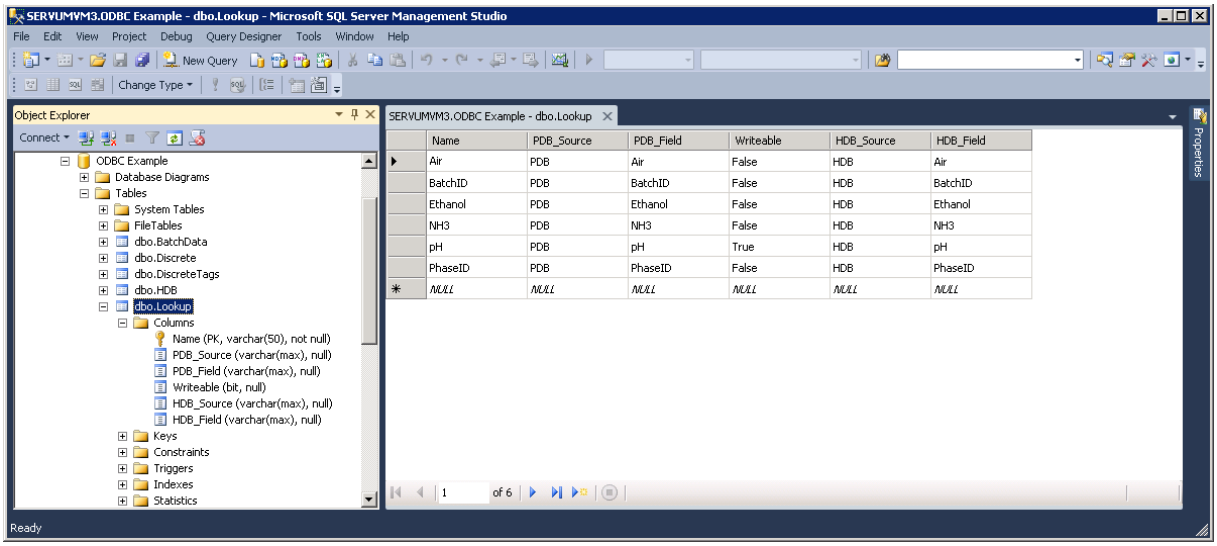


Figure 2 - Example of a Lookup view (in the form of a database table). In the screenshot you'll see that one PDB source and one HDB source are used. The Name column determines the tag names that the SimApi will use, and in this case the _Field columns use the same column names. Only one tag is writable.

2.3.3.1 PDB views and HDB views

When you use a Lookup View you also need at least one HDB view. The views for the historical data (HDB) and the optional views for current data PDB both have the same data structure (columns).

Each row in the PDB or HDB views represents an observation with values for each tag in that PDB/HDB view as specified in the lookup view.

The differences between PDB and HDB are:

- A PDB view contains only one row of data for the tags specified in the Lookup view. It should also have a time stamp column for when the table was last updated.
- A HDB view contains several rows of data for the tags specified in the Lookup table. Each row has a time stamp containing the historical timestamp for a particular observation.

The PDB and HDB views should have the following columns,

- DateTime – For a PDB: The time when the table was last updated (Primary key, datetime, not null).
  – For a HDB: The historical time for the tag values (Primary key, datetime, not null).
- [Column name] – There should be one column for each tag that was specified in the Lookup table. Contains the data for the tag in each row.

Note that for each column, the above description also states which rows should be primary key and the data type for each column.

The *names* of the columns are arbitrary in the database since the names are specified in the configuration file (see section 2.4.4 below).

The following columns are not mandatory, but are useful to add if batches are modelled with multiple phases and there are several units in the process:

- UnitBatchID – One column per unit that contains the batch ID within a certain unit (varchar). This tag can be used in the **Batch identifier tag** field for that particular unit in the Phase conditions section of the configuration of this project in SIMCA-online.

- PhaseID – One column per unit that holds the phase info for the unit (int, float or varchar). This tag can be used in logical expression in the **Phase condition** field in the Phase conditions section of the configuration of this project in SIMCA-online.

The maximum allowed number of tags (columns) fetched is 255.

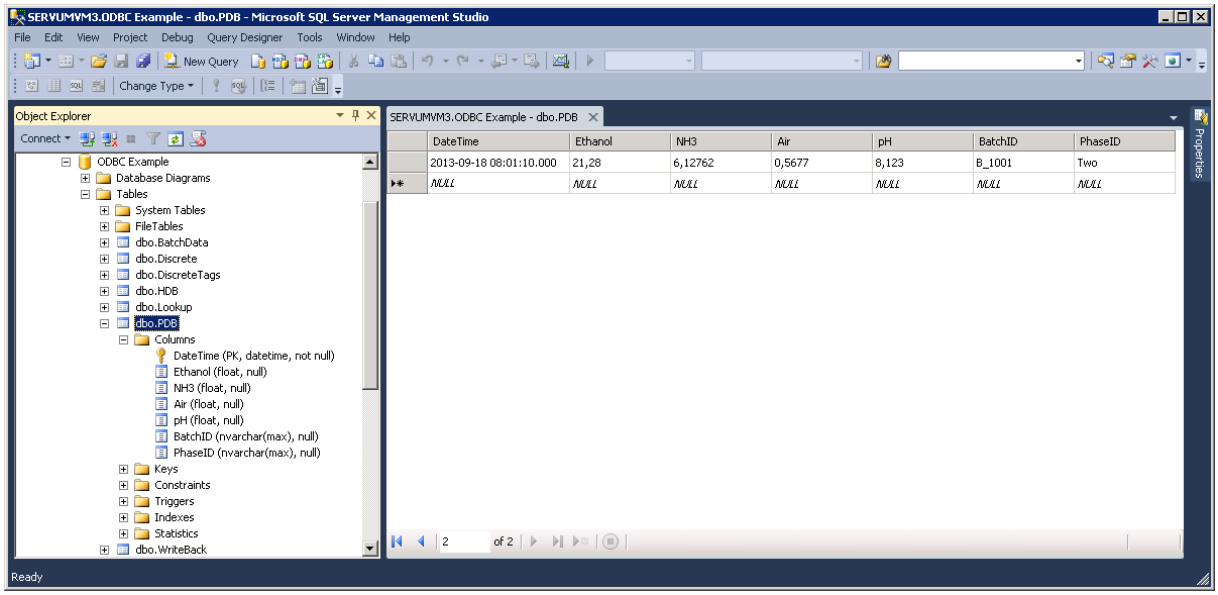


Figure 3 - PDB example.

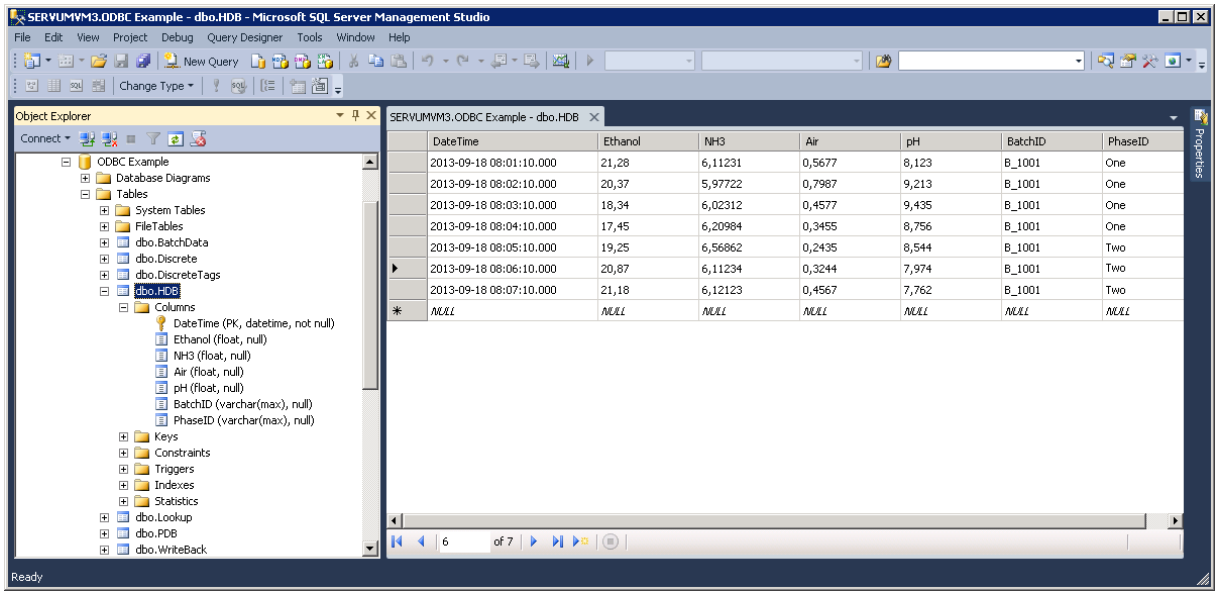


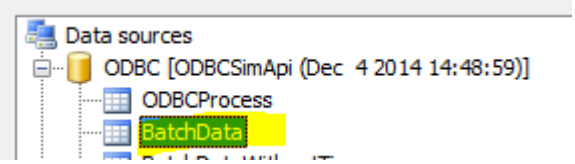
Figure 4 - HDB example.

2.3.4 Batch node

Batch nodes are optional.

A batch node contain meta-information about batches such as start time, stop time, and also optionally batch conditions. A batch node is required by SIMCA-online to analyze batch data.

The name of a batch node seen from SIMCA-online or SIMCA is the original name of the view or table in the database, in this example “BatchData”:



Each row in a batch node represents one batch.

A batch view needs to have the following columns:

- BatchID – The name of the batch (Primary key, varchar, not null).
- BatchStart – The start time of the batch when it first enters the entire process (not when it starts in a unit (part of) in the process) (datetime, not null).
- BatchStop – The time when the whole batch is completed in the system (not in a unit), null if not completed (datetime).

Note that the BatchID column should be the primary key.

In addition there can be optional columns as follows, for each batch condition variable:

- [Batch condition name] – One column for each batch condition. The column name will be used as tag name. (float for numerical values or varchar for text such as the configuration id).
- UnitID – The name of the unit to which the batch is associated with (varchar).

The *names* of the batch node and columns are arbitrary in the database since the names are specified in the configuration file (see section 2.4.5 below).

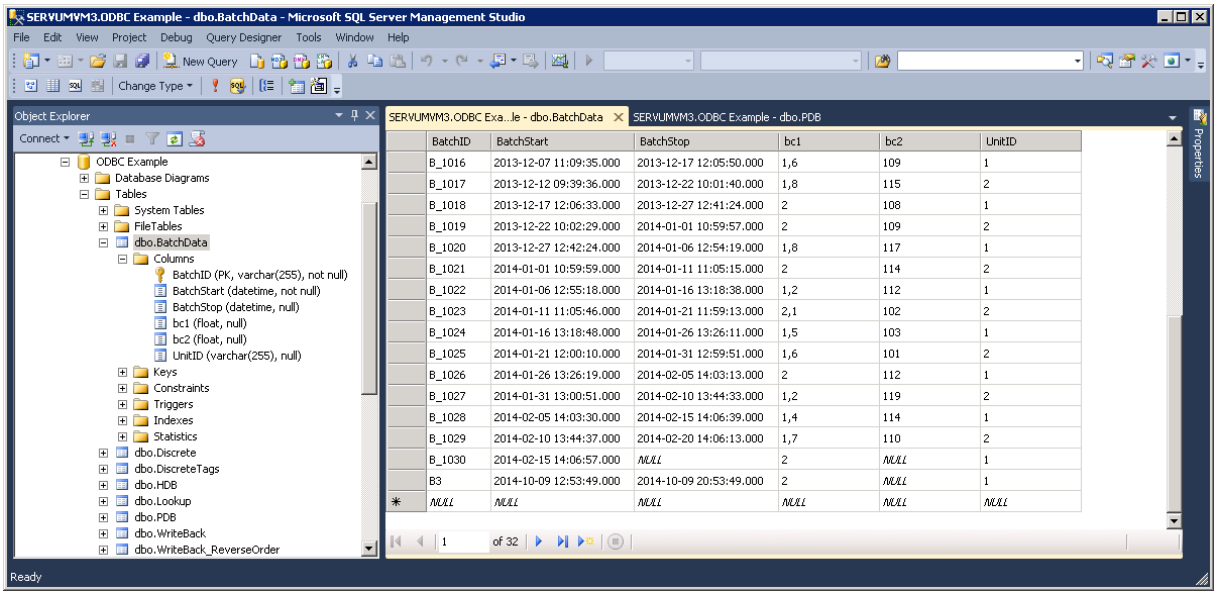


Figure 1 - Batch node example with two batch conditions (bc1 and bc2) and a UnitID column.

2.3.5 Batch Data Views

Each batch data view must have these three columns (additional columns will be ignored):

- BatchID – name of the batch (varchar, not null)
- Tag name – name of the batch condition variable (varchar, not null)
- Value – value of the batch condition variable (*float* for numerical values, or *varchar* for text or float[5]).

[5] By using a varchar text column you can store text (data for qualitative variables in a SIMCA project). However you can also store numerical numbers in text format, and the SimApi will convert these to numbers. This way you can have some tags that are numerical and some that contain text like the example in 1.1.3.

The combination of BatchID and Tag name should be the primary key (unless you want to use the multiple batch data instance feature, see below).

Each batch data view is exposed as a node by the SimApi. The name of the node is the view name in the database. The view name and the column names are configured in the XML configuration file using the attributes of a single BatchDataView element like this:

<BatchDataView ViewName="DatabaseViewOrTableName" BatchIDColumn="BatchID" TagNameColumn="Tag name" ValueColumn="Value" />

Note that the values used here matches the table in 1.1.3 above.

Add multiple batch data views by adding more BatchDataView elements.

2.3.5.1 Synthetic batch data instance tags

To configure the optional batch data instance tags, you need to add the attributes *NumSyntheticBatchTags* and *TimeColumn* to the BatchDataView element:

<BatchDataView ViewName="DatabaseViewOrTableName" BatchIDColumn="BatchID" TagNameColumn="Tag name" ValueColumn="Value" ***TimeColumn="TimeColumn" NumSyntheticBatchTags="3"*** */>*

TimeColumn should be the name of the time column in your database view. This column must be provided for batch data instance tags.

Allowed value for NumSyntheticBatchTags are numerical values between 1 and 10. This controls how many synthetic instance tags are created per real tag. For example; for the tag “tag” new tags “tag_1”, “tag_2”, … “tag_N” will be created until N= NumSyntheticBatchTags.

2.3.5.2 Synthetic process batch id tags filtered on column values

To configure the optional batch id filter tags that can be used for continuous data retrieval mode, you need to add the attributes *FilterColumns* and *TimeColumn* to the BatchDataView element:

<BatchDataView ViewName="DatabaseViewOrTableName" BatchIDColumn="BatchID" TagNameColumn="Tag name" ValueColumn="Value" ***FilterColumns="Column1|Column2" TimeColumn="TimeColumn"****/>*

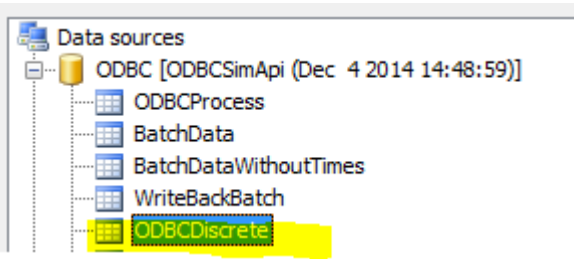
FilterColumns should be one or more column names in your database view. If several column names are used separate them with the pipe character (|).

TimeColumn should be the name of the time column in your database view. This column must be provided for batch data instance tags.

2.3.6 Discrete Node

The optional discrete node contains discrete data measurements. A discrete node is required by SIMCA-online if it should be able to analyze discrete data.

There can be only one discrete node. It is exposed as *ODBCDiscrete* through the SimApi:



Each row in a discrete node represents one measurement for a batch and tag at a given time.

A discrete node needs to have the following columns:

- BatchID – The name of the batch (varchar, not null).

- TagName – The name of the tag (varchar, not null).
- Time – The time when the sample was taken (datetime, not null).
- Value – The measurement value (float). Discrete data cannot be string data.

Note that the combination of BatchID+TagName+Time should be the primary key.

The *names* of the discrete node and columns are arbitrary in the database since the names are specified in the configuration file (see section 2.4.5 below).

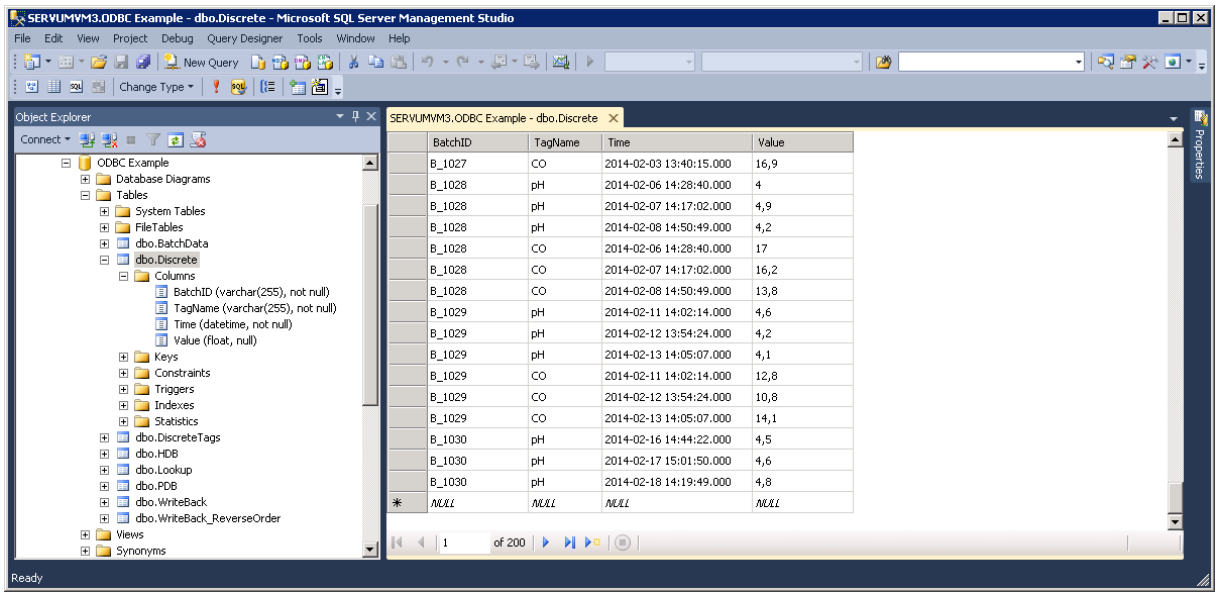


Figure 2 - Discrete node example with two tags sampled three times (at roughly 24 hour intervals) per batch.

2.3.6.1 Discrete Tag Definition View

This optional view is used by the SimApi to enumerate the discrete tags that should be available through the SimApi. This happens at SimApi startup.

You may want to use this view for performance optimizations when loading the SimApi or if you want to control what tags are exposed from the SimApi. For instance if you want to expose tags that doesn't have any measurements yet when the SimApi is started.

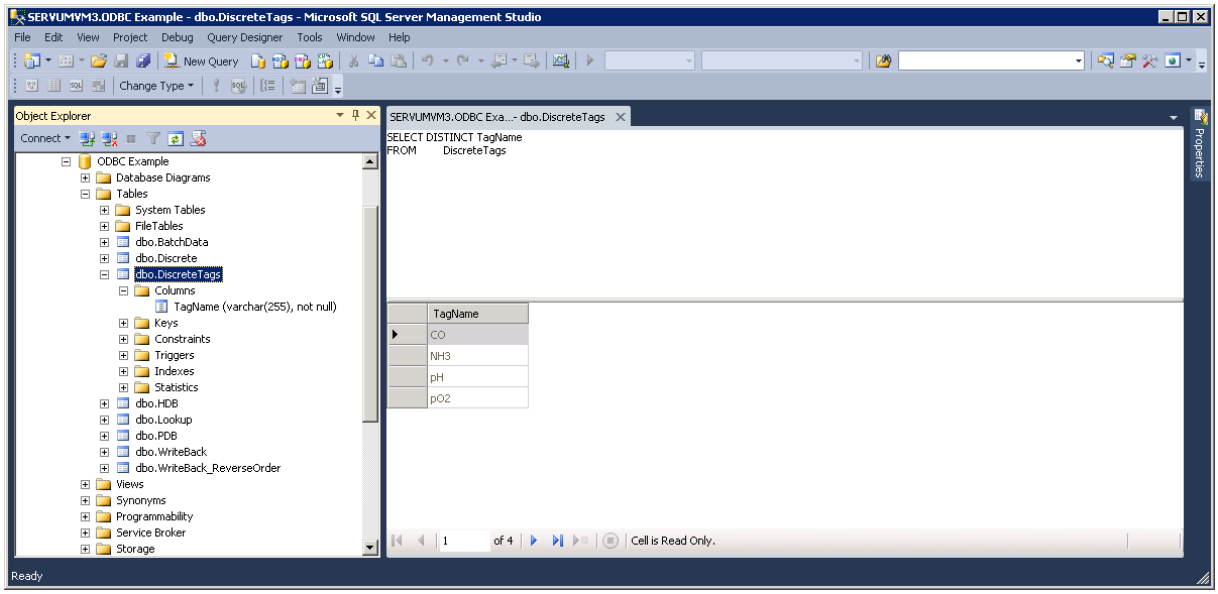


Figure 3 - Simple discrete tag lookup view which use the discrete table.

2.3.6.2 Discrete data as seen by SIMCA-online

The following is how the discrete data in Figure 2 will look in SIMCA-online when combined with the batches in Figure 1.

Discrete Extracted Data (at time 2014-05-27 11:39:48)

	1	2	3	4	5	6	7	8
1	BATCH	OBSERVATION	$BatchAge(d)	$BatchAge(h)	$BatchAge(m)	$BatchAge(s)	CO	pH
76	B_1024	2	3,03539	72,8494	4370,97	262258	17,9	4,7
77	B_1025	0	1,02872	24,6892	1481,35	88881	10,8	4,3
78	B_1025	1	2,03596	48,8631	2931,78	175907	11,3	4,1
79	B_1025	2	3,02333	72,56	4353,6	261216	14,3	4,6
80	B_1026	0	1,02106	24,5056	1470,33	88220	10,5	4,9
81	B_1026	1	2,02056	48,4933	2909,6	174576	16,8	4,8
82	B_1026	2	3,04142	72,9942	4379,65	262779	16	4,6
83	B_1027	0	1,04109	24,9861	1499,17	89950	13,7	4,1
84	B_1027	1	2,00284	48,0681	2884,08	173045	13,2	4,6
85	B_1027	2	3,02736	72,6567	4359,4	261564	16,9	4,2
86	B_1028	0	1,01748	24,4194	1465,17	87910	17	4
87	B_1028	1	2,0094	48,2256	2893,53	173612	16,2	4,9
88	B_1028	2	3,03286	72,7886	4367,32	262039	13,8	4,2
89	B_1029	0	1,01223	24,2936	1457,62	87457	12,8	4,6
90	B_1029	1	2,00679	48,1631	2889,78	173387	10,8	4,2
91	B_1029	2	3,01424	72,3417	4340,5	260430	14,1	4,1
92	B_1030	0	1,02598	24,6236	1477,42	88645	16,9	4,5
93	B_1030	1	2,03811	48,9147	2934,88	176093	11,1	4,6
94	B_1030	2	3,00894	72,2144	4332,87	259972	20	4,8

Figure 4 - Discrete data as seen by SIMCA-online. Note that the generated batch age tags represent the age of the batch for each observation/sample.

2.3.7 Some notes on SIMCA-online Write Back

Write back in SIMCA-online can be used to write data from SIMCA-online into the ODBC data source. See the SIMCA-online Technical guide for more details.

Writing continuous process data (from continuous configurations, the batch evolution level or from Control Advisor) and batch data (from the batch level) are supported.

It is not recommended to write back to the same nodes that you are using to read data, because this would attempt to add duplicate rows with the same primary keys in the database views because of the primary keys we recommend on the date/time-column and batch ID columns (see above).

Instead create one or more Direct Mode views for continuous / evolution data, or batch nodes for batch data to use for write-back.

The reason for this issue is that the ODBC SimApi uses SQL INSERT statements to add a new row of data for each observation or for each batch at the batch level.

- For continuous data the time of the observation is written back together with the values from SIMCA-online.
- For batch data the batch ID is written back together with the values from SIMCA-online.

Since the time of an observation or batch id of a batch is written-back this would violate the primary key constraint in the databases if the same values already were present (as they would be if data were read from the same nodes).

Other than these primary key differences, the same database schema applies to nodes for write back (see above for more information):

- A date/time column should exist for continuous nodes, and a batch id column for batch nodes.

- Add one data column for each tag that should be available for write back. Use the float datatype for numeric data, and varchar for text data (such as when writing back the configuration id of a configuration). For example; if you plan to write back 20 different data vectors from SIMCA-online you need to add 20 data columns to the database view.

2.4 XML Configuration File

The XML configuration file is a text file, it can be edited with for example Notepad. It has the following settings:

2.4.1 Connection Specific Settings

- DSN – Data Source Name as set up in the Windows *ODBC Administrator* control panel.
- SQLDialect – The SQL dialect to use. One these values: *standard*, *postgresql*, *db2*, *mssql*, *mysql*, *oracle*, *access*, *denodo*. If left blank then *standard* will be used, but the default for a new XML-file is mssql.
- Credentials – Stored the ODBC user name and password in an encrypted form. Use the Configure button to specify the user name and password (see 2.2 above).
- QueryTimeout – The time before a query or connection to the database will time out and fail.
- DBSchema – The database schema in the database (if applicable).
- LeftPunctuation – SQL dialect specific left delimiter used to separate identifiers from other SQL commands. The default is empty which means that no left punctuation is used. You need to specify a non-empty value if the identifiers in the database use spaces or reserved SQL keywords. For SQL Server or Access you use "[", but for Oracle and other databases using the SQL standard you should set this setting to """ (this is the XML escape sequence for the double quotation mark ").
- RightPunctuation – SQL dialect specific right delimiter used to separate identifiers from SQL commands. For SQL Server or Access you use "]", but for Oracle and other databases using the SQL standard you should set this setting to """ as for LeftPunctuation above.

2.4.2 Direct Mode Specific Settings

- Tables – The name of the views that contains continuous/process data. Multiple views can be specified by separating their names with a pipe character (|). For example: Table1|Table2|Table3|View1. The TimeField name has to be identical in all views.

2.4.3 Lookup View Specific Settings

- LookupTable – The name of the lookup view or table.
- TagNameField – The column name where the tag names are given.
- PDBTableField – The name of a column in the lookup view. For each row this column holds a name of a PDB view. The name of a view with PDB data. Can be left blank, if so the most recent row of the HDB will be used instead for current data.
- PDBTagField – The column name in the PDB table where data for the tag can be found (not used if PDBTableField is omitted).
- HDBTableField – The name of a column in the lookup view. For each row this column holds a name of a HDB view.
- HDBTagField – The name of a column in the lookup view. For each row this column holds a name of a tag in the HDB view.
- WriteableField – The column name that tells if the tag is writeable or not.

2.4.4 Direct Mode and HDB and PDB View Specific Settings

- TimeField – The name of the date/time column in the Continuous/Process View and the PDB- or HDB-views (or tables).

2.4.5 Batch Node Specific Settings

- BatchTable – The name of the view or table that contains the batch data. Multiple batch view can be specified by separating their names with a pipe character (|). For example: BT1|BT2|BT3. The following columns have to be identical in all views.
- BatchIDField – The columns name of the batch ID in the batch node.
- StartTimeField – The column name of the *start* time for the batch
- StopTimeField – The column name of the *stop* time for the batch.
- BatchIDUnitField – The column name of the unit ID in the batch node. This field can be used to generate synthetic batch id process tags filtered by unit id. See 1.1.2 above.

2.4.6 Batch Data View settings

Stored in one or more <*BatchDataView*> elements as described in 2.3.5 above.

2.4.7 Discrete View Specific Settings

- DiscreteTable – The name of the view/table that contains the discrete data.
- DiscreteLookupTable – The name of the view/table that defines the discrete tags to use. If left blank the DiscreteTable will be analyzed at startup to enumerate all tags there.
- DiscreteTimeField – The column name of the time of the measurement.
- DiscreteBatchIDField – The column name of the identity of the batch that was measured.
- DiscreteTagNameField – The column name of the name of the tag that was measured.
- DiscreteValueField – The column name of the value of the measurement.

2.4.8 Log File Specific Settings

- LogFileSize – The maximum allowed size of the log file before the file is truncated.
- LogLevel – The higher the value the more information is printed to the log file. Maximum value is 4 and minimum value is 0. (0=Critical, 1=Error, 2=Warning, 3=Information, 4=Debug).

3. Support

See http://www.umetrics.com/support