

SmBO Time Series Database for IoT API for LabVIEW

Manual

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SmBO API

Overview

SmBO Time Series Database API for LabVIEW (SmBO-API) allows users to write and read time-series data to NoSQL SmBO Time Series Database for IoT.

The Driver is implemented to read and write the following data types:

One can easily write to or read from Database the following Data types: Boolean, I32 (32-bit integer), I64 (64-bit integer), Single (single-precision floating-point numbers), Double (double-precision floating-point numbers), String (text), Variant (any type) and Waveform. Each data point has the Timestamp of the following form hh/mm/sec.ms , dd/mm/yyyy. The API allows users to create or destroy channels.

System Requirements

Windows 7, 8, 10 versions, both x64 and x86 architectures

LabVIEW 2015 and later

SmBO Time Series Database for IoT

API Vis

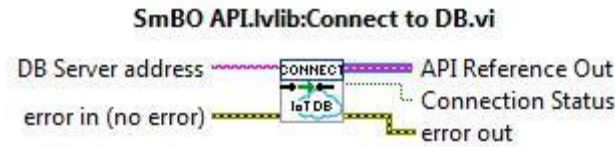
Users can find the API VIs under Functions-Addons-Grovf-SmBO API VIs

The LabVIEW pallet of the toolkit has the following look.



SmBO API

Connect to DB.VI



The VI creates connection to Database. The VI requires DB Server address as an input and returns API Reference as an output. The following inputs and outputs are used:

DB Server address – Database server address, which is 127.0.0.1 by default.

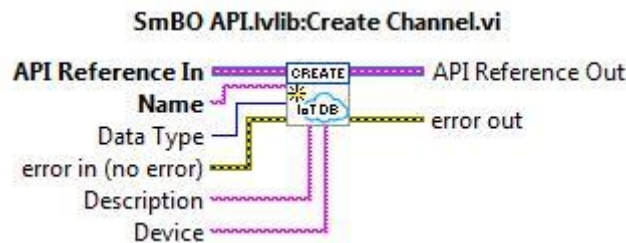
error in(no error) – describes error conditions that occur before this node runs.

API Reference Out – Reference of the API.

error out – contains error information of the VI.

Connection Status – Shows is the API connected to SmBO HDB for IoT or not.

Create Channel.VI



The VI creates new channel of specified data type by name, device and description. Lats two inputs are not mandatory. The following inputs and outputs are used:

API Reference In – Reference of API.

Name – The name of channel you want to create.

Data Type – data type of channel you want to create.

Description – description of channel.

Device – a note about Device that includes the channel you are creating.

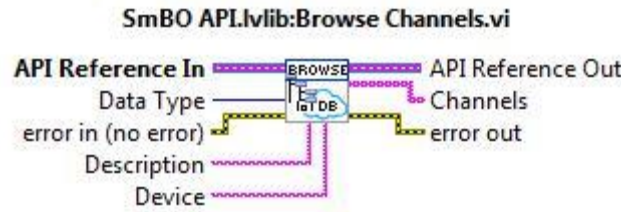
error in(no error) – describes error conditions that occur before this node runs.

API Reference Out – Reference of the API.

error out – contains error information of the VI.

SmBO API

Browse Channels.VI



The VI browses all channels according to data type. The following inputs and outputs are used:

API Reference In – Reference of API.

Data Type – data type of channel/s you want to brows.

Description – description of channel.

Device – a note about Device that includes the channel.

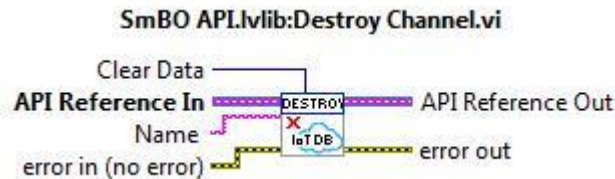
error in(no error) – describes error conditions that occur before this node runs.

API Reference Out – Reference of the API.

Channels –List of channels according to Data type, Device and Description.

error out – contains error information of the VI.

Destroy Channel.VI



The VI destroys a channel by name and all data which are received from the channel. It is also possible to clear all specified data by data type - I32, Double, String and so on. If the Clear Data input is chosen to "Destroy Channel", VI destroys channel of Name you typed, otherwise, if you choose one of remaining actions (Clear Boolean data, Clear I32 data and so on), VI will clear all data of data type you chosed. The following inputs and outputs are used:

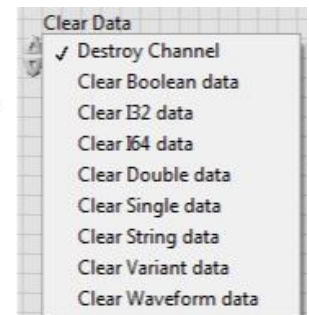
API Reference In – Reference of API.

Name – name of channel you want to delete. Works if *Clear Data* input is "Destroy channel".

Clear Data– action type you want to do. See picture on the right side.

error in(no error) – describes error conditions that occur before this node runs.

API Reference Out – Reference of the API.



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error out – contains error information of the VI.

Read Channel.VI

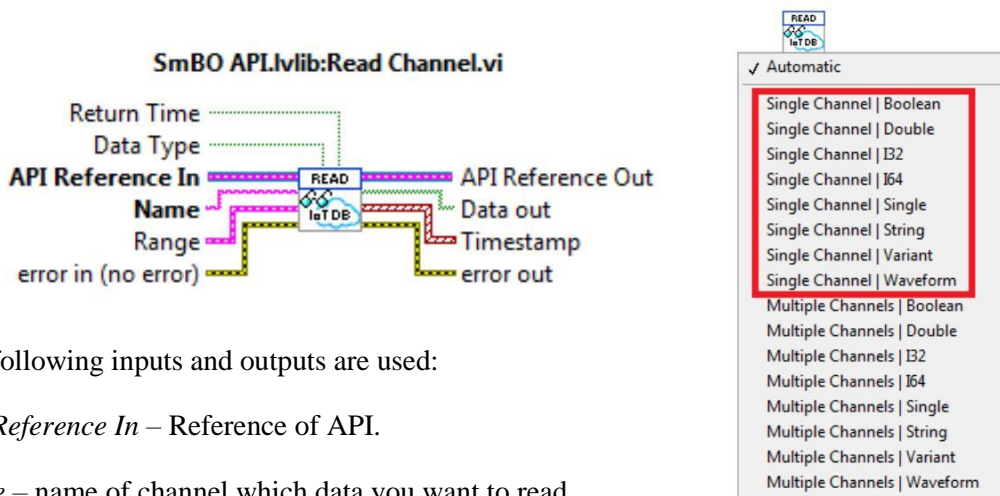
Read Channel Polymorphic VI allows users to read multiple Data types from SmBO Database. One can choose to read Data from single and multiple channels (See drop-down menu of the polymorphic Read Channel VI).

Output data of the Read single channel are *Data out* array (Booleana, DBL, I32, I64, SGL, String, Variant or Waveform) and *Timestamp* array.

Output data of the Read multiple channels is *Data out* array of clusters. Every element of the array includes “Data out” and “Timestamp” arrays.

Read Single Channel | Data type

Allows users to read data from single channel.



The following inputs and outputs are used:

API Reference In – Reference of API.

Name – name of channel which data you want to read.

Range –time range within which you want to read data. Every data point of the written data has its timestamp. VI browses all data of specified channel which timestamp is between timestamps "From" and "To" controls of Range control cluster.

Data type – you can choose data type from drop-down menu of polymorphic VI or by direct connecting data type control you want to read.

Return Time – allows users to display Timestamps of data points.

error in(no error) – describes error conditions that occur before this node runs.

API Reference Out – Reference of the API.

Data Out – all data which came from channel *Name* and with timestamp between "From" and "To" of the *Range* control cluster.

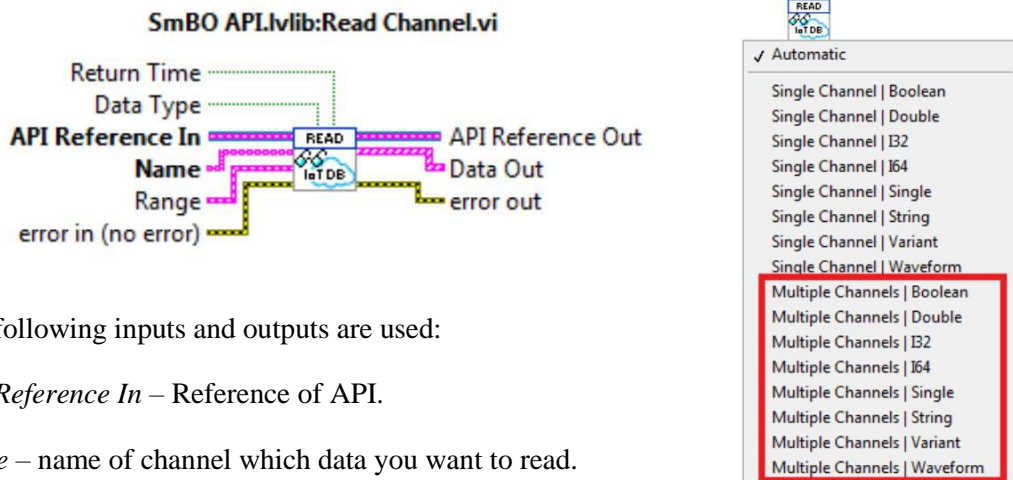
SmBO API

Timestamp – Timestamp of every data point you browse.

error out – contains error information of the VI.

Read Multiple Channels | Data type

Allows users to read data from multiple channels.



The following inputs and outputs are used:

API Reference In – Reference of API.

Name – name of channel which data you want to read.

Range –time range within which you want to read data. Every data point of the written data has its timestamp. VI browses all data of specified channel which timestamp is between timestamps "From" and "To" controls of Range control cluster.

Data type – you can choose data type from drop-down menu of polymorphic VI or by direct connecting data type control you want to read.

Return Time – allows users to display Timestamps of data points.

error in(no error) – describes error conditions that occur before this node runs.

API Reference Out – Reference of the API.

Data Out – includes “Data Out” and “Timestamp” arrays. Arrays’ sizes are equal to size of the *Name* input array. First element of the “Data Out” array of clusters represents the data of first channel in *Name* input and so on.

error out – contains error information of the VI.

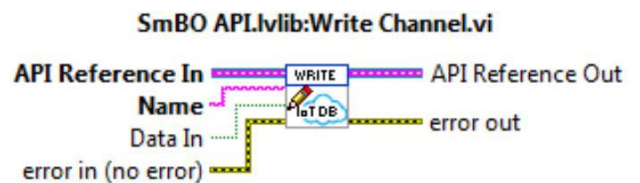
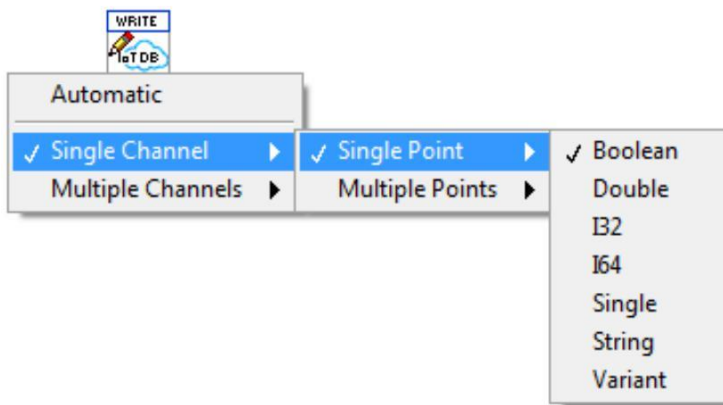
SmBO API

Write Channel.VI

Write Channel Polymorphic VI allows users to write multiple Data types to SmBO Database. The VI has several functionalities: write single point from single channel, multiple points from single channel (array), single points from multiple (appropriate) channels and multiple points from multiple channels (waveform).

Write Single Point from Single Channel

The VI writes single data point from single channel.



The following inputs and outputs are used:

API Reference In – Reference of API.

Name – name of channel you are writing data from.

Data In– single data you are writing from channel “Name”.

error in(no error) – describes error conditions that occur before this node runs.

API Reference Out – Reference of the API.

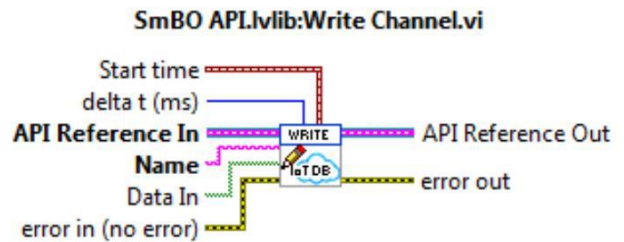
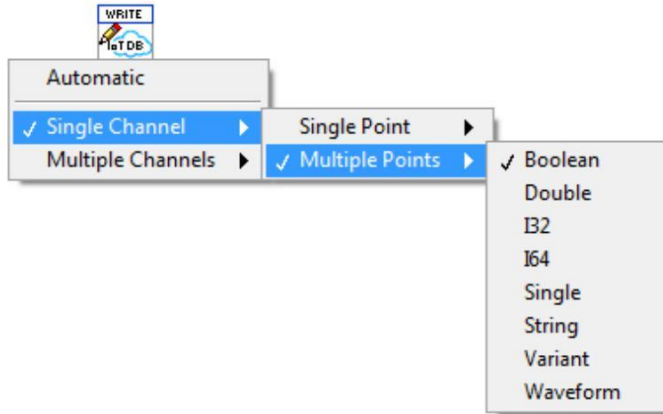
error out – contains error information of the VI.

NOTE: As a timestamp of every data point API writes the time at which data has come.

SmBO API

Write Multiple Points from Single Channel

The VI writes multiple data from single channel *Name*. Δt (ms) represents difference between time of two sequential data points of *Data In* array in milliseconds. *Start time* is the timestamp of the first element of the *Data In* control (if wired). If *Start time* is not wired, VI writes the time you are running VI as the timestamp of the last element of the *Data In* array and timestamps of previous elements differ by $\Delta t_{Aj} = t_A - (A-j) \cdot \Delta t$, where t_A is the time you have run the VI at, A is the size of *Data In* array control, j is the index of the a_j element of the *Data In* array and Δt is the value of the Δt (ms) control.



The following inputs and outputs are used:

API Reference In – Reference of API.

Name – name of channel you are writing data from.

Data In – data points you are writing from channel “Name”.

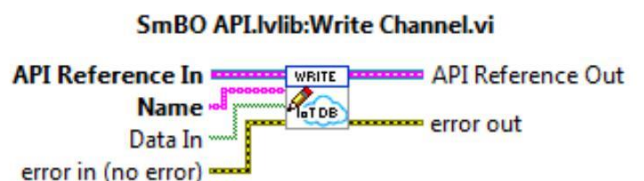
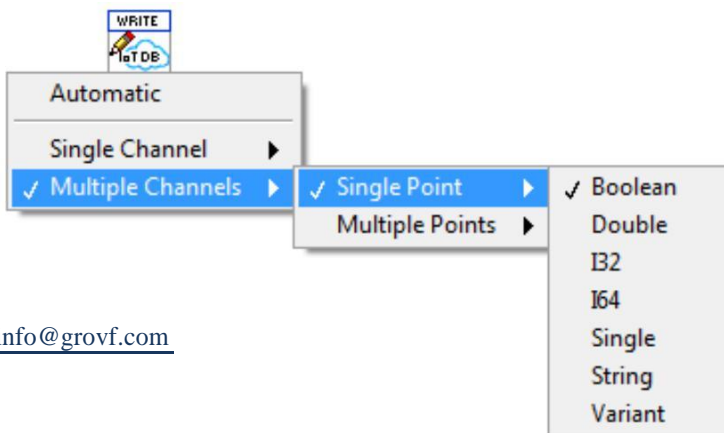
error in (no error) – describes error conditions that occur before this node runs.

API Reference Out – Reference of the API.

error out – contains error information of the VI.

Write Single Point from Multiple Channels

The VI writes single data point from multiple (appropriate) channels.



SmBO API

The following inputs and outputs are used:

API Reference In – Reference of API.

Name – names of channels you are writing data from.

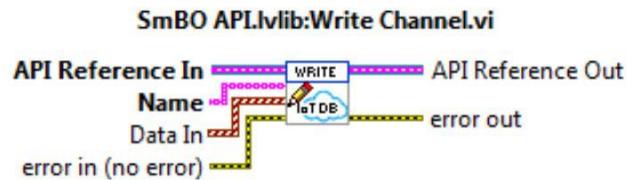
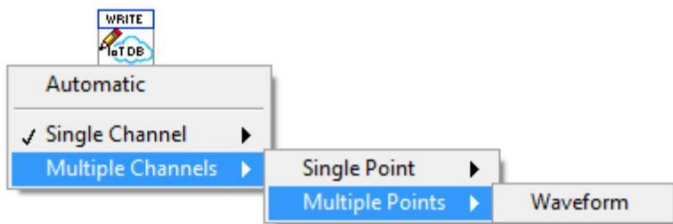
Data In– single data points you are writing from appropriate channels “Name”.

error in(no error) – describes error conditions that occur before this node runs.

API Reference Out – Reference of the API.

error out – contains error information of the VI.

Write Multiple Points from Multiple Channels



This part of Write Channel VI is implemented to write waveform data type.

Data In	
t0	Y
4:58:17 PM	11
02/16/2018	22
dt	33
1.000000	44
	0

Waveform Data type

t0 – timestamp of the first element of the *Y* array.

dt – difference of time between every two sequential data points of the *Y* array.

Y – data points of the waveform.

The following inputs and outputs are used:

API Reference In – Reference of API.

Name – names of channels you are writing data from.

Data In– single data points you are writing from appropriate channels “Name”.

error in(no error) – describes error conditions that occur before this node runs.

API Reference Out – Reference of the API.

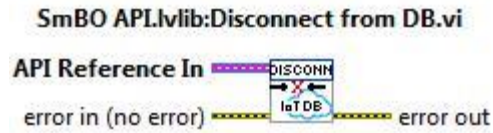
error out – contains error information of the VI.

NOTE: Do not write waveform data from the same channel with two different *dt*. For every new waveform data create new channel to avoid *dt* errors.

SmBO API

Disconnect from DB.VI

The VI closes connection to the SmBO Database.



The following inputs and outputs are used:

API Reference In – Reference of API.

error in(no error) – describes error conditions that occur before this node runs.

error out – contains error information of the VI.

SmBO API

Examples

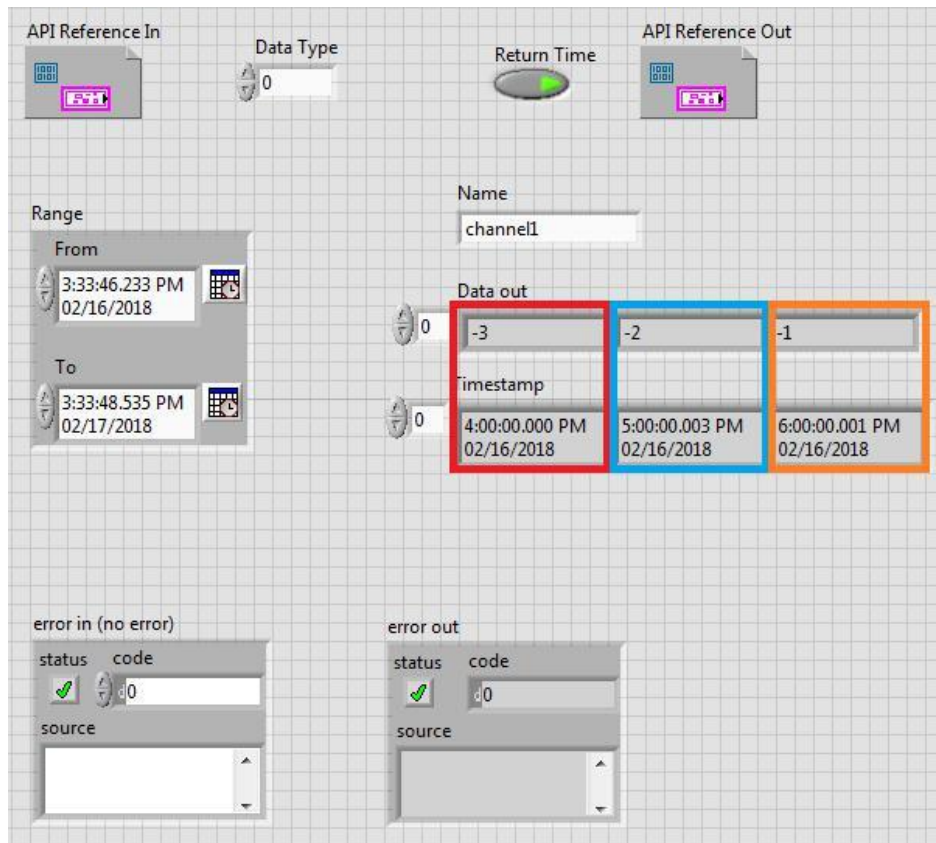
This section is intended to help users to understand Front panel controls and indicators and make it easy to use SmBO API.

For more details the examples are under the following direction: `\\National Instruments\LabVIEW 201x\examples\Grovf\SmBO API`

Read Single Channel | I32 VI

The example shows the front panel of the VI which reads 32-bit integer data from a single channel.

For more details and to see how to connect VIs, take a look at the example "Example.Read I32 from single channel.vi".



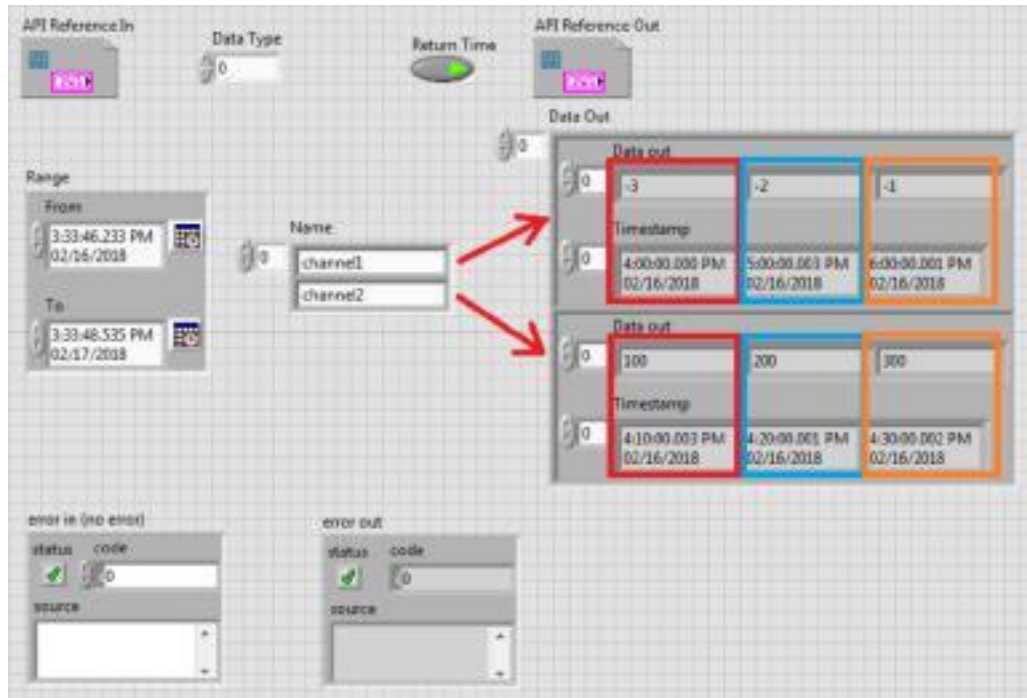
This Front Panel shows an example of reading I32 data from channel "channel1". All data points were written between **3:33:46.233 PM 02/16/2018** and **3:33:48.535 PM 02/17/2018**. The timestamp of the first element of the *Data Out* indicator is the first element of the *Timestamp* indicator (Red box) and so on. Since *Return Time* control is enabled, users can see the timestamps of the *Data out* indicator elements.

SmBO API

Read Multiple Channels | I32 VI

The example shows the front panel of the VI which reads 32-bit integer data from multiple channels.

For more details and to see how to connect VIs take a look on the example "Example.Read I32 from multiple channels.vi "

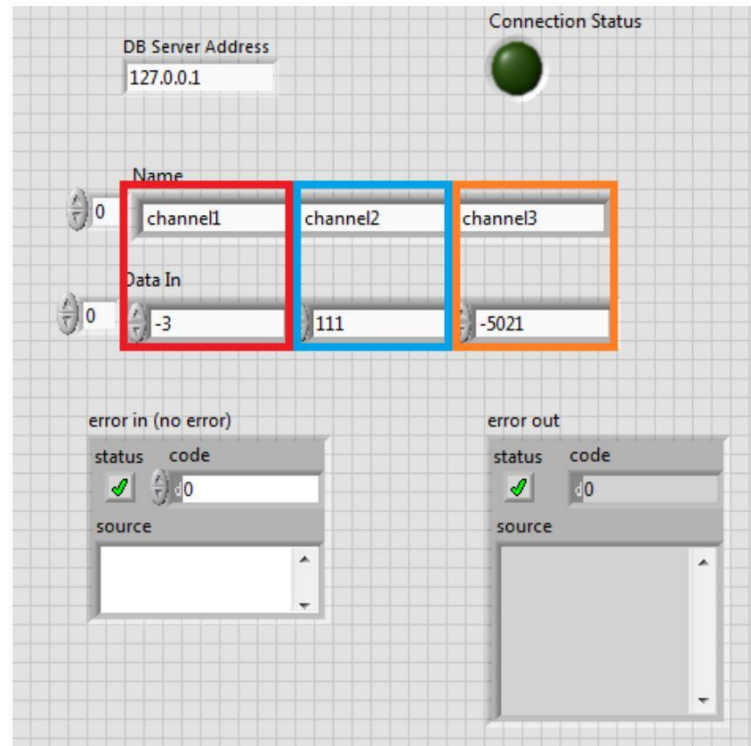


This Front Panel shows an example of reading I32 data from two (multiple) channels "**channel1**" and "**channel2**". The all data points were written between **3:33:46.233 PM 02/16/2018** and **3:33:48.535 PM 02/17/2018**. First element of the *Data Out* indicator (array of clusters) shows data of "**channel1**" and the second element- data of "**channel2**". Red, Blue and Orange boxes show the Data point-timestamp pairs. Since *Return Time* control is enabled, users can see the timestamps of the *Data out* indicator elements.

Write Multiple Channels | I32 VI

The example shows the front panel of the VI which writes 32-bit integer data from multiple channels.

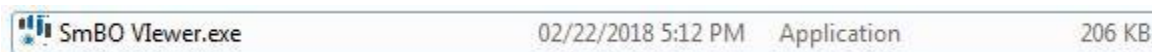
For more details and to see how to connect VIs take a look on the example "Example.Write multiple I32 from multiple channels.vi "



This Front Panel shows an example of writing I32 data from three (multiple) channels "**channel1**", "**channel2**" and "**channel3**". First element of the *Data In* control is the data of the "**channel1**" (Red box) and so on.

SmBO Viewer

SmBO HDB for IoT is a NoSQL Database. SmBO DB is required for the proper work of the SmBO API. Go to "*Your Applications Folder*\Grovf\SmBO Time Series Database for IoT" and run "*SmBO Viewer.exe*" to check connection to SmBO DB. There may appear some cmd windows.



Error Codes

smboerror code="403680" – Undefined channel name: there is no channel by name you specified.

smboerror code="403681" – The Channel Name already exists.

smboerror code="403682" – Empty channel name: the "Name" control is empty or there are empty elements in "Name" array.

smboerror code="403683" – Unequal amount of Channels and Data: the "Name" and "Data In" arrays must have the same size.

smboerror code="403684" – Noncorresponding Channel and Data type: data type you are trying to write under the channel is not match to the channel's data type.

smboerror code="403685" – Cannot Define the time range: the value of the "From" control is not greater than value of the "To" control of the "Range" cluster.

smboerror code="403686" – Value of delta t(ms) must be equal to or greater than 1.

smboerror code="403687" – SmBO API: undefined error.

smboerror code="403688" – SmBO DB: Keyspace names do not match.

smboerror code="403699" – SmBO API: could not connect to Database.

The range from "**403700**" to "**403718**" is for errors generated by SmBO Time Series Database.

Support

For support please contact us at:

Email: support@grovf.com

Phone: +1 408 709 5638; +374 94618089; +374 93752063