MsSQL Library SL for CODESYS V3.5 Without Store

User guide

V1.4.0.5

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Chapter 1

Product description

This library allows you to connect your CODESYS V3.5 application to Microsoft SQL database. With this library you are able to store and read process data. Read recipes from ERP, save breakdown report and etc. No more OPC servers and other middleware.

Basic requirement for this library is CODESYS V3.5 and Microsoft SQL Server (2005-2014).

Microsoft SQL Server 2014 Express is there: `https://www.microsoft.com/en-us/download/details.aspx?id=42299`

1.1 Range of function

This library allows to the user connect to Microsoft SQL Server from 2005 to 2016. This library use for communication with server TDS protocol.

Supported commands:

- SELECT
- INSERT
- UPDATE
- DELETE
- Execute stored procedures

1.2 Tested PLCs

- M241
- M251
- M258
- Magelis SCU

1.3 Supported datatypes

Other datatypes, which are not in the table below, will cause **xExecuteSQLError** Unsupported datatype.

Datatype	**SQL datatype**	**PLC datatype**	**ID of datatype**
boolean	bit	BOOL	16#32 or 16#68
string	nvarchar(n)	STRING(255)	16#E7 or #A7
int	int	DINT	16#26 or 16#38 or 16#34
bigInt	bigint	DINT	16#7F
float	float	REAL	16#6D
real	real	REAL	16#3E or 16#3B
datetime	datetime	DATETIME(DT)	16#3D or 16#6F

1.4 Function blocks

1.4.1 fbMsSQL

FB for complete connecting and executing commands with Microsoft SQL from 2005 to 2017.
Author: krajcart
V1.4.0.5

Table 1.1: fbMsSQL

Scope	Name	Type	Inital	Comment
Input	sHost	STRING		hostname or ip address of msssql server
	uiPort	Uint	1433	port of MsSQL server
	tTimeout	Time	T#1s	timeout
	sHostName	STRING		hostname for database
	sUserName	STRING		username
	sPassword	STRING		password
	sDatabase	STRING		database name
	sActivationNumber	String		activation number received after purchase
Output	xConnectSucessfully	Bool		indication of sucessfull conection to SQL
	xLoginFailed	Bool		login to SQL failed
	xExecuteSQLError	Bool		execution of SQL command failed
	xCommandExecutedOK	Bool		execution of SQL command was sucessfull
	wRowDoneCnt	Word		no. of rows done
	dwError	DWord		error identifier
	sStatus	String		status message
	xLicenseValid	Bool		info about license
	xDone	Bool		signal that operation was finished OK
	xBusy	Bool		signal that operation is busy
	xError	Bool		signal that operation ended with Error
	xAborted	Bool		signal that operation ended with Aborted
	sMacAddress	STRING		Mac Address
	xActivated	Bool		info that library is activated by Activation Number
InOut	astQuery	astQuery		structure for stQuery
	xConnectSQL	Bool		trigger for login,to SQL
	xDisconnectSQL	Bool		trigger for logout from SQL
	xExecuteSQL	Bool		trigger to execute SQL command executing
	stSqlResponse	stSqlResponse		structure for SQL Response
	sStatus	STRING(255)		response of SQL server
	sErrorMessage	STRING(255)		error message from SQL server

1.4.2 fbMsSQL_compact

FB for complete connecting and executing commands with Microsoft SQL from 2005 to 2017.
Author: krajcart
V1.4.0.5

Table 1.2: fbMsSQL_compact

Scope	Name	Type	Inital	Comment
Input	sHost	STRING		hostname or ip address of msssql server
	uiPort	Uint	1433	port of MsSQL server
	tTimeout	Time	T#1s	timeout
	sHostName	STRING		hostname for database
	sUserName	STRING		username
	sPassword	STRING		password
	sDatabase	STRING		database name
	queryString	STRING		string with SQL query
	sActivationNumber	STRING		activation number received after purchase
Output	xConnectSucessfully	Bool		indication of sucessfull conection to SQL
	xLoginFailed	Bool		login to SQL failed
	xExecuteSQLError	Bool		execution of SQL command failed
	xCommandExecutedOK	Bool		execution of SQL command was sucessfull
	wRowDoneCnt	Word		no. of rows done
	dwError	DWord		error identifier
	sStatus	String		status message
	xLicenseValid	Bool		info about license
	xDone	Bool		signal that operation was finished OK
	xBusy	Bool		signal that operation is busy
	xError	Bool		signal that operation ended with Error
	xAborted	Bool		signal that operation ended with Aborted
	bFIFOreadAdr	Byte		address of pointer in FIFO reader
	bFIFOwriteAdr	Byte		address of pointer in FIFO write
	xFIFOEmpty	Bool		info that FIFO buffer is empty
	sMacAddress	STRING		Mac Address
	xActivated	Bool		info that library is activated by Activation Number
InOut	xWriteData	Bool		trigger to write data to FIFO Buffer
	stSqlResponse	stSqlResponse		structure for SQL Response
	sStatus	STRING(255)		response of SQL server
	sErrorMessage	STRING(255)		error message from SQL server

1.4.3 fbPing

FB for testing ping function to the other side.
Author: krajcart
V1.2.0.0

Table 1.3: fbPing

Scope	Name	Type	Comment
Input	sIpAddress	STRING	
Output	xResult	BOOL	
Inout	xTryPing	BOOL	var for try ping to host

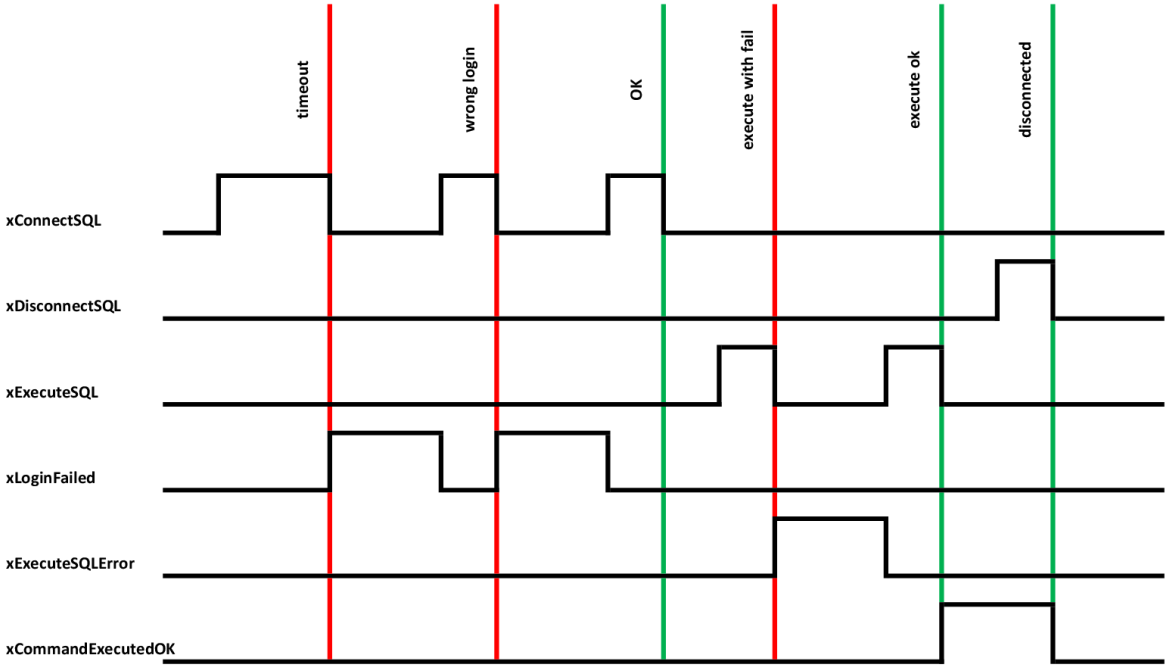
1.4.4 fbFIFOQuery

FB for storing queries into FIFO array. **Author:** krajcart
V1.2.0.0

Table 1.4: fbFIFOQuery

Scope	Name	Type	Inital	Comment
Input	sInput	STRING(255)		input data
Output	sOutput	STRING(255)		output data
	xFIFOEmpty	BOOL		login to SQL failed
	bFIFOreadAdr	BYTE		FIFO address from which are data stored to Database
	bFIFOwriteAdr	BYTE		FIFO address to which is written actual data
InOut	xRead	BOOL		command to read
	xWrite	BOOL		command to write

1.5 Transition diagram



1.6 Functions

1.6.1 fcGetBOOL

FC for converting raw SQL data to datatype BOOL.
Allowed data types: 16#32(TDS_DATA_BIT1) or 16#68(TDS_DATA_BITN)
Author: krajcart
V1.4.0.5

Table 1.5: fcGetBOOL

Scope	Name	Type	Inital	Comment
Return	fcGetBool	eConvertErrors		
Input	iCol	Int		index of selected column
	iRow	Int		index of selected row
InOut	stSqlResponse	stSqlResponse		response structure
	xValue	Bool		return value

1.6.2 fcGetDINT

FC for converting raw SQL data to datatype DINT.
Allowed data types: 16#26(TDS_DATA_INTN) or 16#38(TDS_DATA_INT4)
or 16#7F(TDS_DATA_INT8) or 16#34(TDS_DATA_INT2)
Author: krajcart
V1.4.0.5

Table 1.6: fcGetDINT

Scope	Name	Type	Inital	Comment
Return	fcGetDINT	eConvertErrors		
Input	iCol	Int		index of selected column
	iRow	Int		index of selected row
InOut	stSqlResponse	stSqlResponse		response structure
	diValue	Dint		return value

1.6.3 fcGetSTRING

FC for converting raw SQL data to datatype STRING.
Allowed data types: 16#E7(TDS_DATA_NVARCHAR) or 16#A7(TDS_DATA_BIGVARCHAR)
Author: krajcart
V1.4.0.5

Table 1.7: fcGetSTRING

Scope	Name	Type	Inital	Comment
Return	fcGetSTRING	eConvertErrors		
Input	iCol	Int		index of selected column
	iRow	Int		index of selected row
InOut	stSqlResponse	stSqlResponse		response structure
	uiLen	Uint		length of string variable
	sString	String		return value

1.6.4 fcGetREAL

FC for converting raw SQL data to datatype REAL(4 bytes) and LREAL(8 bytes) only S7-1500.
Allowed data types: 16#6D(TDS_DATA_FLOATN) or 16#3E(TDS_DATA_FLOAT8)
or 16#3B(TDS_DATA_FLOAT4)
Author: krajcart
V1.4.0.5

Table 1.8: fcGetREAL

Scope	Name	Type	Inital	Comment
Return	fcGetREAL	eConvertErrors		
Input	iCol	Int		index of selected column
	iRow	Int		index of selected row
InOut	stSqlResponse	stSqlResponse		response structure
	rValue	Real		return Value

1.6.5 fcGetDATETIME

FC for converting raw SQL data to datatype DTL
Allowed data types: 16#3D(DATETIME8) or 16#6F(DATETIMEN)
Author: krajcart
V1.4.0.5

Table 1.9: fcGetDATETIME

Scope	Name	Type	Inital	Comment
Return	fcGetDATETIME	eConvertErrors		
Input	iCol	Int		index of selected column
	iRow	Int		index of selected row
InOut	stSqlResponse	stSqlResponse		response structure
	dtlDateTime	DTL		return Value

1.6.6 fcGetIpAddr

FC for conversion hostname to IP address
Author: krajcart
V1.4.0.5

Table 1.10: fcGetIpAddr

Scope	Name	Type	Inital	Comment
Return	fcGetIpAddr	STRING		
Input	sHost	STRING		

1.6.7 fcSQLInsertDateTimeFormat

FC for DT datatype conversion to SQL string datetime format
Author: krajcart
V1.4.0.5

Table 1.11: fcGetIpAddr

Scope	Name	Type	Inital	Comment
Return	fcSQLInsertDateTimeFormat	STRING		
Input	dtValue	DT		

1.7 Parameters

Here is a list of global parameters for setup length of arrays according data output PLC. Changeable by double click on value in Library Manager.

Table 1.12: GlobalParameters

Scope	Name	Type	Inital	Comment
Constant	gc_iNoOfColumns	INT	10	number of columns in result
	gc_iNoOfRows	INT	10	number of rows in result
	gc_iLengthOfDataArray	INT	50	length of byte array for result =(length of datatypes in bytes)*gc_iNoOfCollumns
	gc_iLengthOfByteArrays	INT	2000	internal value for bytes arrays
	gc_iLengthOfQuery	INT	5	length of string array for query
	gc_bLengthFIFO	INT	10	length of FIFO array

1.8 Errors

List of errors stored in value **dwError** as output from **fbMsSql** or **fbMsSql_compact**.

Table 1.13: Error table

Code	Error message	Advice
16#400000	No error.	
16#400001	Timeout destination server is unreachable.	Remote server unreachable, try fbPing and firewall.
16#400002	Login failed.	Wrong login or security settings on server side.
16#400003	Command failed.	Executed command failed.
16#400004	SQL error ocurred.	Read the description of error.
16#400005	Query has unsupported data type.	Use supported datatype according 1.2 Supported datatypes.
16#400006	Error data row affected.	MS SQL error.
16#400007	Wrong flag on received row affected.	MS SQL error.
16#400008	Wrong row done.	MS SQL error.
16#400009	No command to execute.	Write some SQL command.
16#400010	More columns than are defined in gc_iNoOfColumns.	Increase gc_iNoOfColumns constant in global parameters.
16#400011	More rows than are defined in gc_iNoOfRows.	Increase gc_iNoOfRows constant in global parameters
16#400012	More raw data than are defined in gc_iLengthOfDataArray.	Increase gc_iLengthOfDataArray constant in global parameters.
16#400013	gc_iLengthOfByteArrays is longer than PLC can handle.	Decrease gc_iLengthOfByteArrays.
16#400014	License is not valid! Demo expired.	Buy the license.
16#400015	Network socket error.	Connect again.
16#400016	sUserName is not filled.	Fill sUserName.
16#400017	sHost is not filled.	Fill sHost.
16#400018	sHost wasn't recognised. DNS-request failed.	Change sHost or check DNS settings on your PLC.
16#400019	Receiving invalid or unexpected PACKET from server.	
16#400020	MSSQL-ERROR: Login Ack Token not received.	MS SQL error.
16#400021	MSSQL-ERROR: Receiving unknown TOKEN FROM server.	MS SQL error.
16#400022	MSSQL-ERROR: Could NOT obtain length information of column data.	MS SQL error.
16#400023	Name of column is longer than is defined in c_iMaxIdentifierLength.	MS SQL error.
16#400024	MSSQL Library DO NOT support SQL-Batch.	

Table 1.14: Error table convert functions

eError	Error message	Advice
16#00	No error.	
16#01	iRow is 0.	Set variable iRow bigger than 0.
16#02	iRow is out of range.	Set variable iRow between 1 and stSqlResponse.uiRowCount.
16#03	iColumn is 0.	Set variable iColumn bigger than 0.
16#04	iColumn is out of range.	Set variable iRow between 1 and stSqlResponse.uiColumnCount.
16#05	Requested value is NULL.	Fill this column in database.
16#06	Structure stSqlResponse is empty.	Execute some SQL query.
16#68	Wrong datatype for BOOL to convert.	Allowed is TDS_DATA_BITN or TDS_DATA_BIT1.
16#3D6F	Wrong datatype for DATETIME to convert.	Allowed is TDS_DATA_DATETIME8 or TDS_DATA_DATETIMEN.
16#2638	Wrong datatype for DINT to convert.	Allowed is TDS_DATA_INT4 or TDS_DATA_INT2 or TDS_DATA_INT8 or TDS_DATA_INTN.
16#6D	Wrong datatype for REAL to convert.	Allowed is TDS_DATA_FLOATN or TDS_DATA_FLOAT4 or TDS_DATA_FLOAT8.
16#E7	Wrong datatype for STRING to convert.	Allowed is TDS_DATA_NVARCHAR or TDS_DATA_BIGVARCHAR.

1.9 Licensing

MsSQL Library SL for CODESYS V3.5 Without Store is licensed per runtime license. Each license is binded to SN of PLC. Price for one runtime license is **199€ without VAT.** Without valid license library works only 2 hours after startup. Link for purchase: `https://www.plc2sql.com/products/mssql-library-for-codesys-v3-5-without-store/#license`

Chapter 2

Installation

2.1 Installation package for CODESYS

Run CODESYS V3.5. Choose from the main menu Tools -> Library Repository -> Install and choose **MsSqlLibraryWithoutStore.compiled-library** from the folder.

This library package contains:

- Example CODESYS Control WIN V3

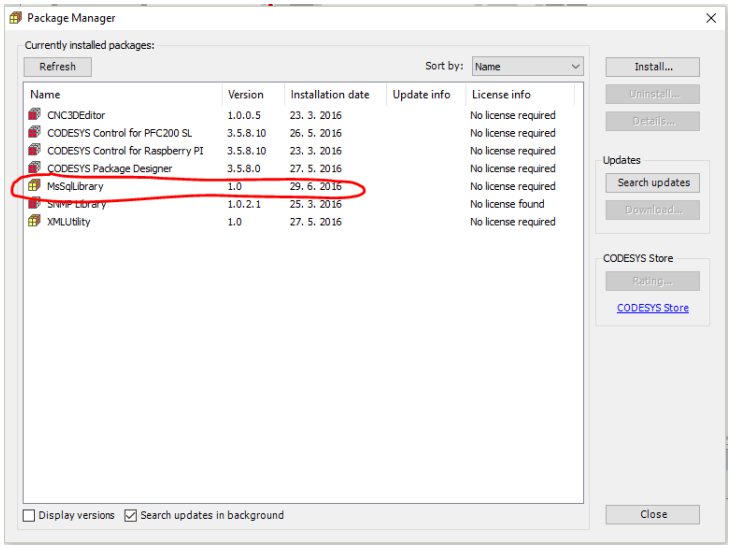
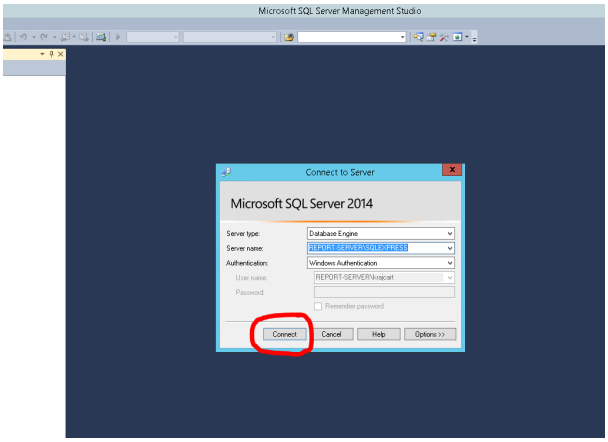


Figure 2.1: Package manager CODESYS V3.5

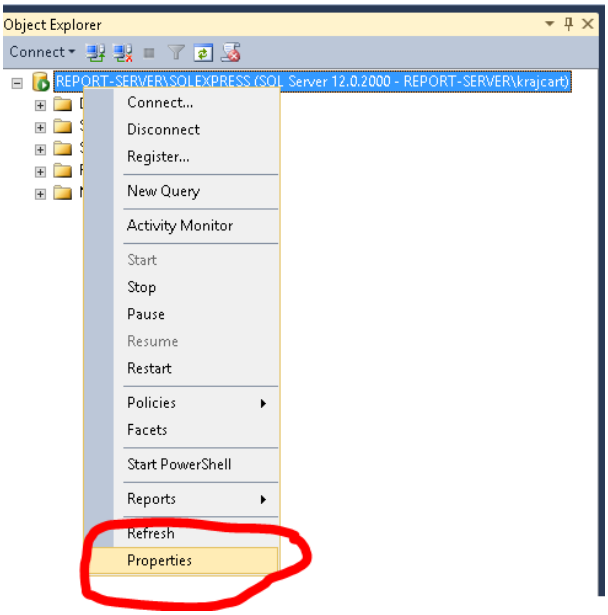
2.2 Installation of Microsoft SQL Server

How to install Microsoft SQL Server is shown on this video: `https://www.youtube.com/watch?v=QFyetK805bo`
In subsections below are shown necessary steps which has to be done on SQL Server side to be accessible from PLC.

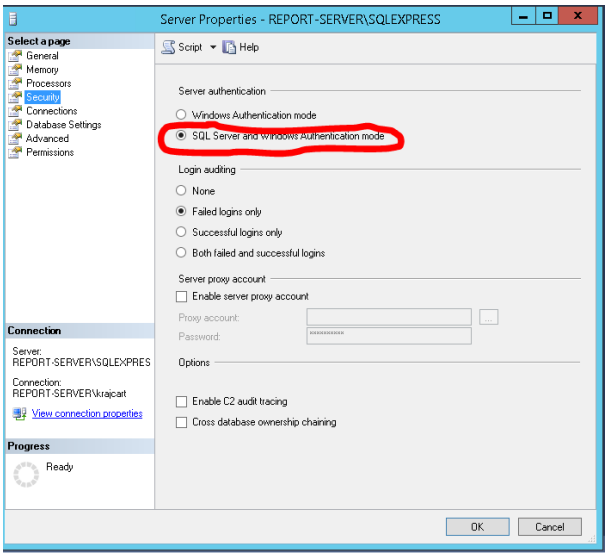


2.2.1 Enable SQL authentication

Connect to your database with Microsoft SQL Management Studio. You will login with **Windows authentication**.

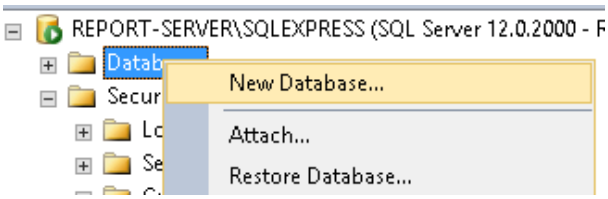


After successful connection to the SQL Server. Right click on the SQL server icon and choose **Properties**.

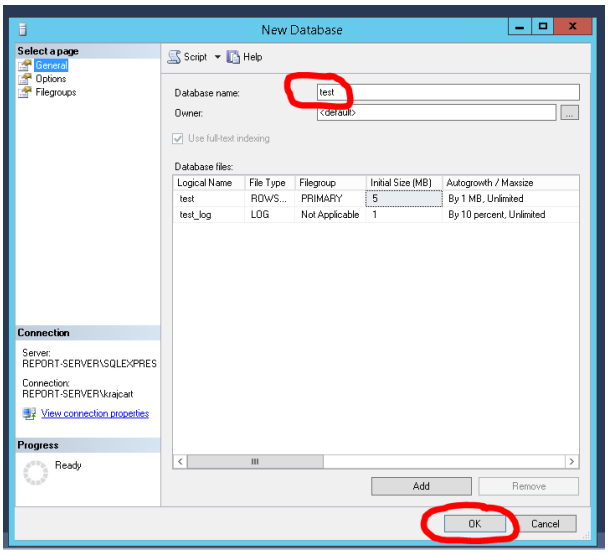


In Server Properties choose page **Security**, and choose **SQL Server and Windows Authentication mode**.

2.2.2 Create database

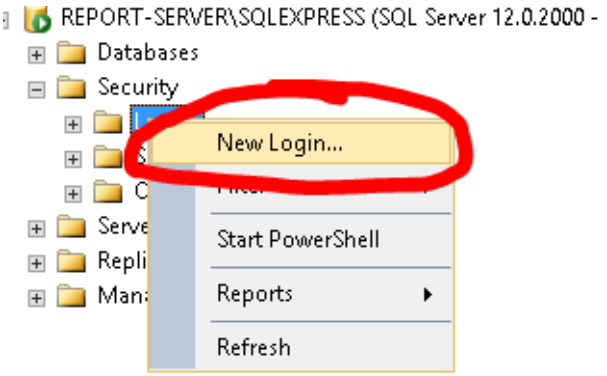


Now we need to create test database. Right click on tab **Database**, a choose **New Database**.

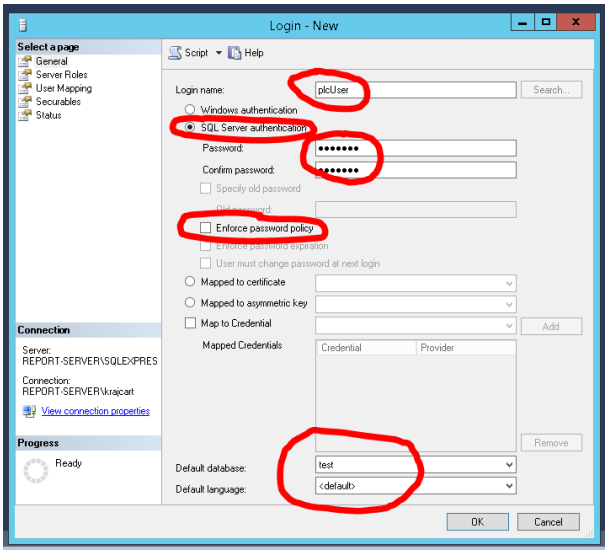


In this window we will set only **Database name:** in our case name will be **test** and press **OK**.

2.2.3 Create new user

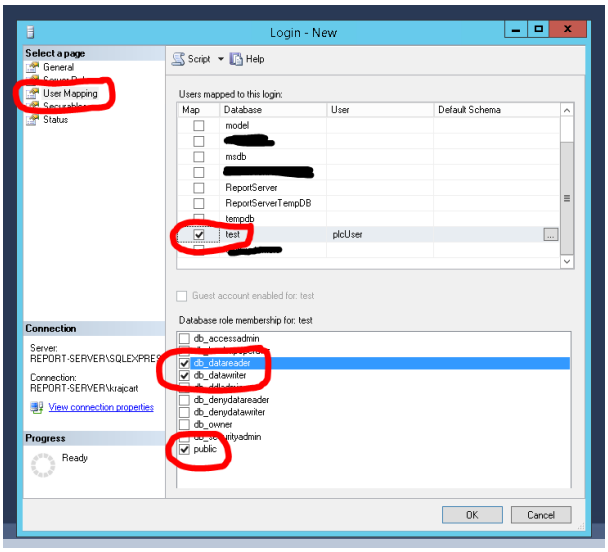


Right click on tab **Security** and click on **New Login**.



In this window we will fill these columns:

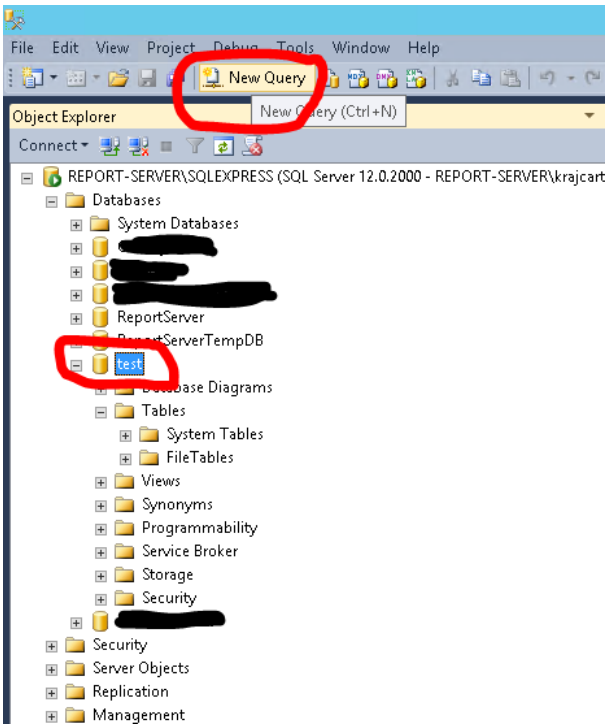
- **Login name** - name of new user
- **SQL Server authentication** - and set **password**
- uncheck **Enforce password policy**
- **Default database** - our case db test



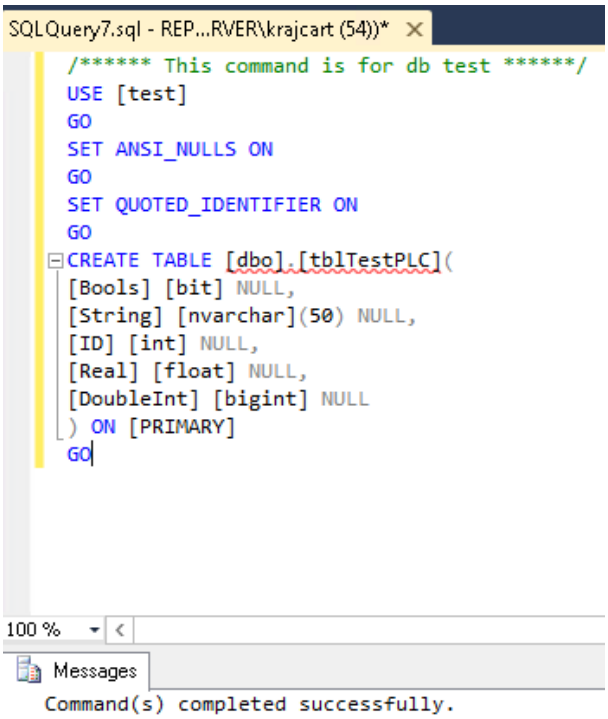
Another tab is **User Mapping**. In this tab we will set permissions for this user. We will map our database **test**. And for this database we will set these permissions:

- **db_datareader** - allows to read data from tables
- **db_datawriter** - allows to write data into tables
- **public** - this one is set by default

2.2.4 Create new table



Left click on our database **test** in tab Databases and then choose **New Query**.

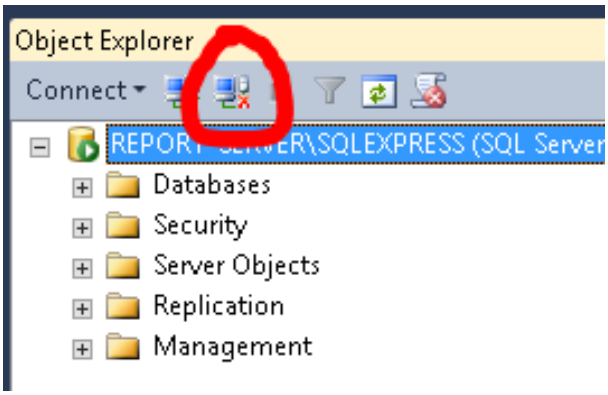


Into the new window we will insert code from figure: 2.2. And after **press F5** to execute command.

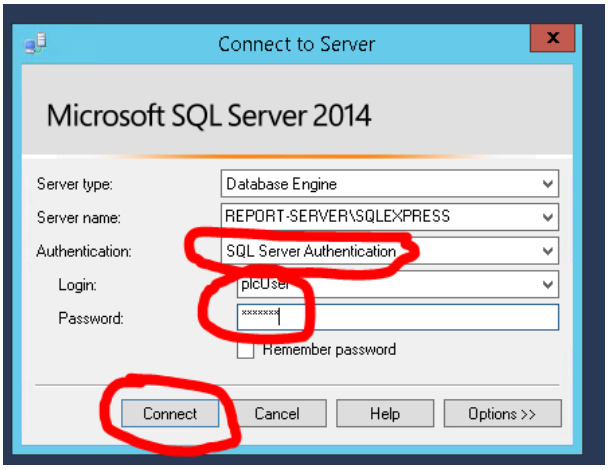
```
/****** This command is for db test ******/

USE [test]
GO

SET ANSI_NULLS ON
GO

SET QUOTED_IDENTIFIER ON
GO

CREATE TABLE [dbo].[tblTestPLC](
[Bools] [bit] NULL,
[String] [nvarchar](50) NULL,
[ID] [int] NULL,
[Real] [float] NULL,
[DoubleInt] [bigint] NULL

) ON [PRIMARY]

GO
```

Figure 2.2: Create tblTestPLC

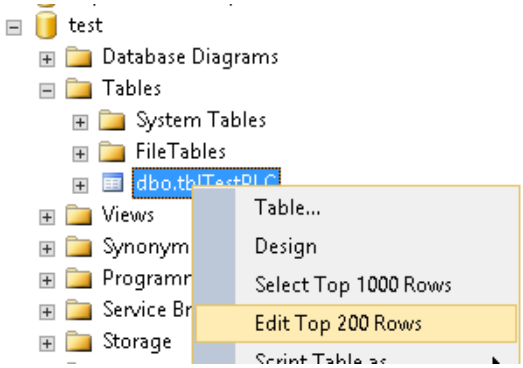
2.2.5 Test connection to the database with new user



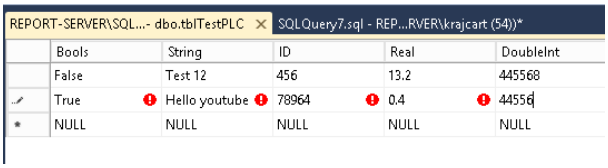
First thing is to disconnect from the database.



In the login screen we will change **Windows authentication** to **SQL Server Authentication**, and fill **Login** and **Password** of our new user.



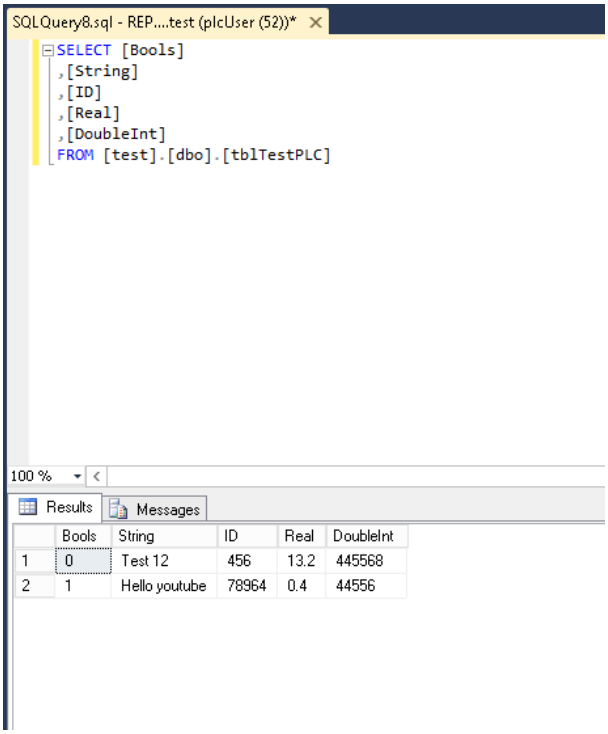
Next step is to try if permission which we set earlier to our user. So in tab Databases -> Test -> Tables -> tblTestPLC right click and choose **Edit Top 200 Rows**. And this command will open window where we can modify data in our table.



In table 2.1 are shown sample data which you can put into this table.

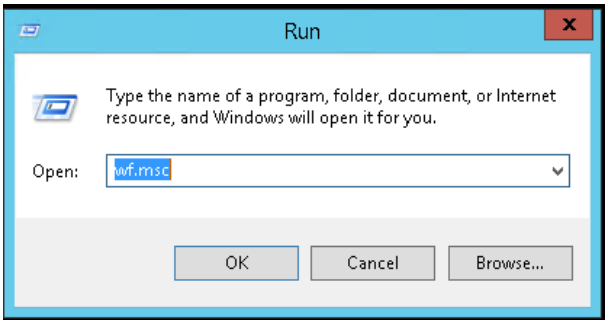
Table 2.1: Example of values, which you can add to your tblTestPLC table

[rows]	Bools	String	ID	Real	DoubleInt
1	0	Test 12	456	13.2	445568
2	1	Hello youtube	78964	0.4	44556

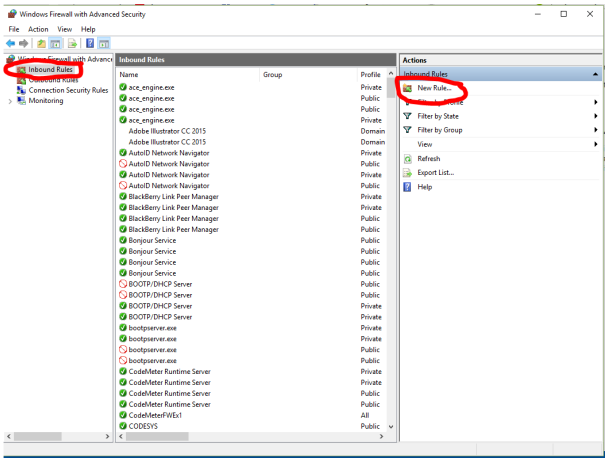


Last step is to try which data are in the table. Example of Select command is here: 2.1.

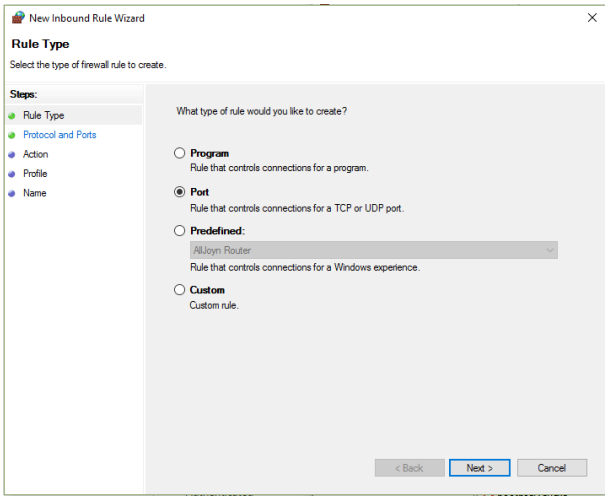
2.2.6 Setup firewall permission for SQL Server



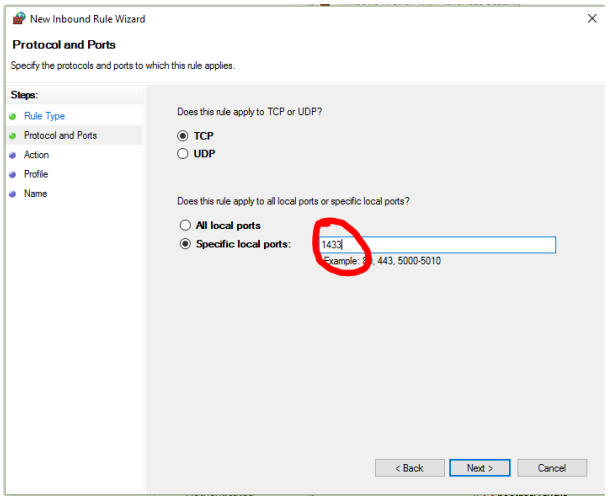
Open **Windows Firewall with Advanced Security**. Open **Run** and insert command **wf.msc**



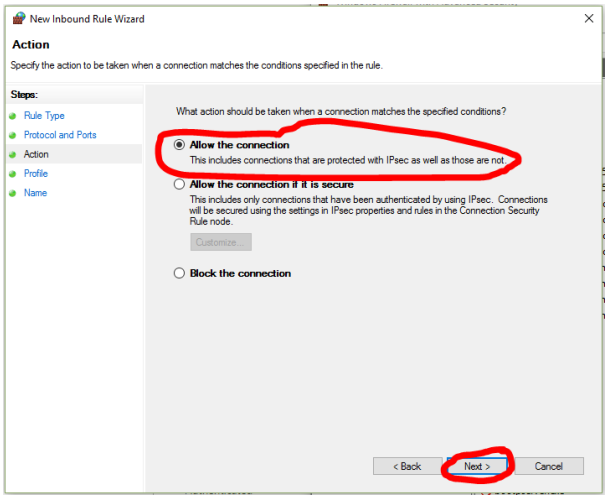
On left side choose **Inbound Rules** by left click. This will open list with all Inbound rules set for your PC. On right side choose **New Rule**.



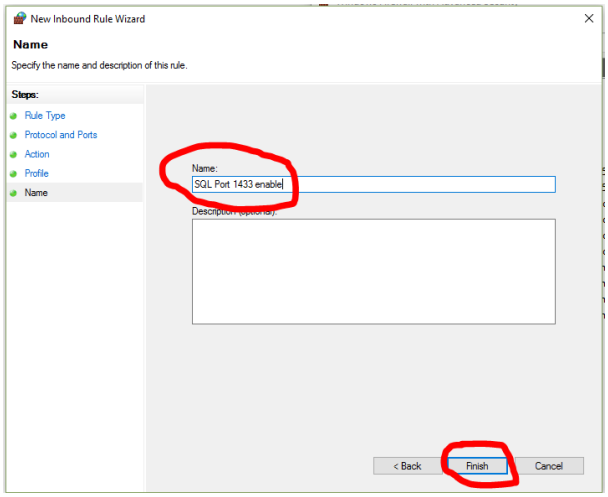
This wizard will help us to set correct firewall rule for our PC. First we have to choose **Port** and press **Next**.



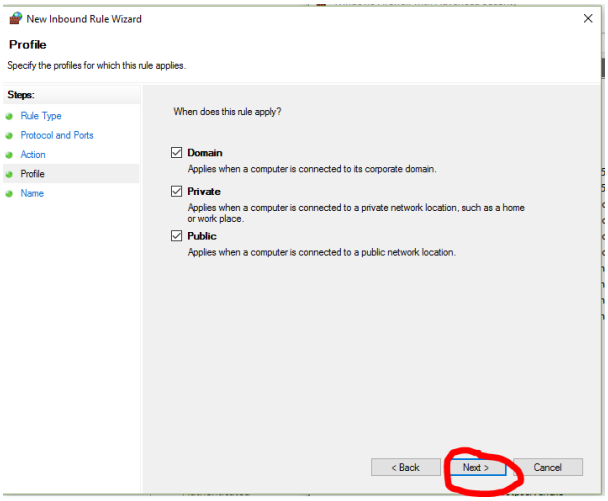
Here we will specify on which port is our SQL server running, default port is **1433**. It's adjustable in settings of SQL Server.



Just choose **Allow the connection** and press **Next**.

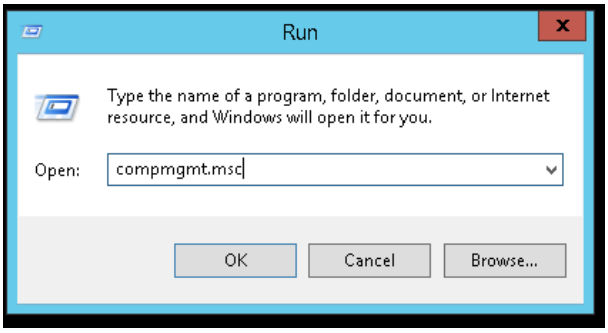


Insert name of the firewall rule and press **Next**.

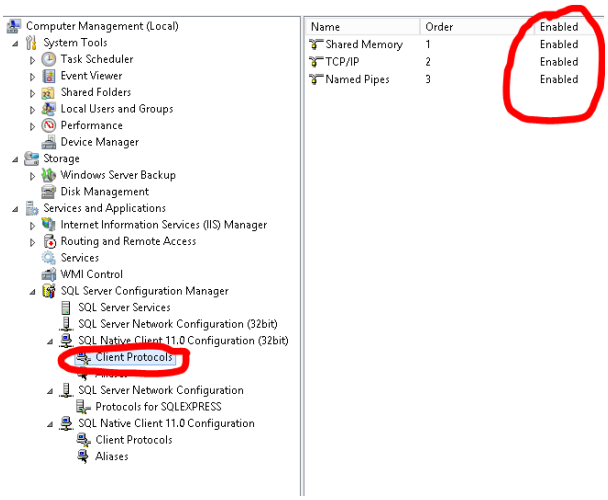


In this last windows we will choose for which types of zones will be rule applied.
Note: this is just basic example for enable firewall!!

2.2.7 SQL Server configuration

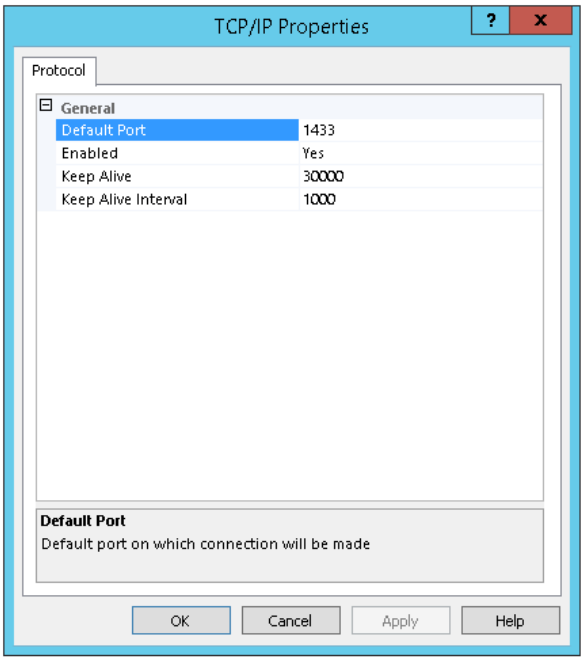


First thing is to open **Computer management**. Easiest way how to do that is to open **Run**: insert command **compmgmt.msc**



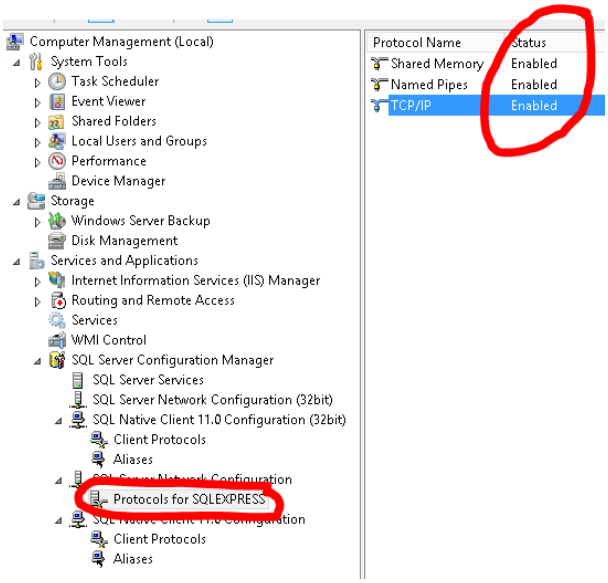
On left side choose Services and Applications -> SQL Server Configuration Manager -> SQL Native Client 11.0 Configuration -> Client Protocols. All 3 protocols has to be **Enabled**.

Note: SQL Native Client 11.0 Configuration naming is different in every version of SQL Server and also version(32 or 64 bits)!!

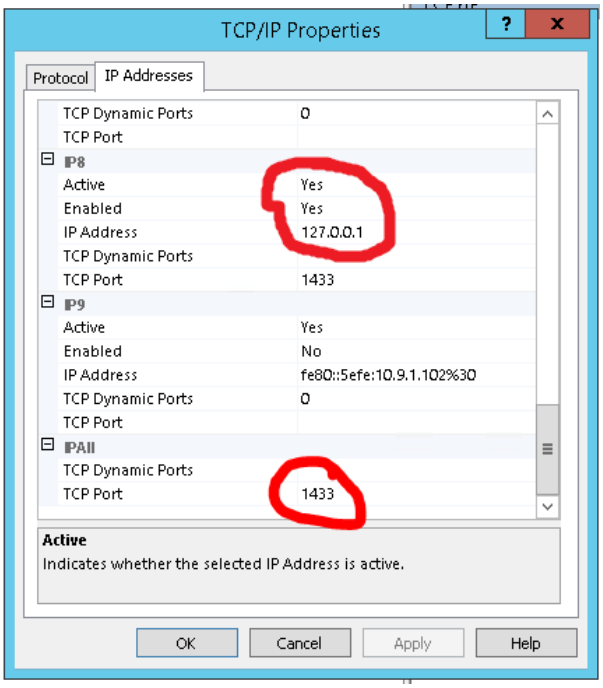


By right click on **TCP/IP** you can edit **Properties**:

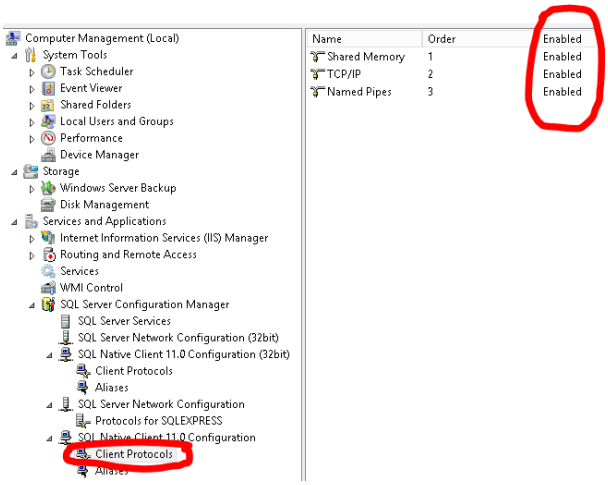
- **Default Port** - port on which will be your SQL server reachable across network
- **Enabled** - Enabling of TCP/IP protocol



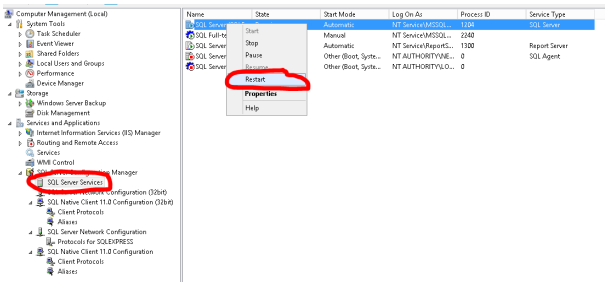
Another settings will be made in SQL Server Network Configuration. Click on **Protocols for SQL-EXPRESS**. Also all 3 protocols has to be **Enabled**. We need to check if port is set correctly right click on **TCP/IP** and choose tab **IP Addresses**.



Here is set the default port for **SQL Server** and also all **IP addresses** for connection to the SQL Server. And click yes to parameter **Enabled** on each IP address which you want to have active for SQL. We activated 127.0.0.1(localhost). So for your ip 192.168.1.1 you have to scroll up and find the right interface.



In case you have 64 bit SQL Server you have to also Enable Protocols in 64 bits client.



All these changes requires restart of SQL Server.

Chapter 3

Example application

Example project have two subprograms: **prgCompactExample** and **prgExample**.

3.1 prgCompactExample

In this program is used function block **fbMsSQL_compact**. To make this function block work you have to fill:

- **sHost** fill IP address or Hostname of MsSQL server
- **uiPort** set TCP port on which MsSQL server listen (eg. 1433)
- **tTimeout** timeout for connection
- **sUserName** username for login to MsSQL server
- **sPassword** password for login to MsSQL server
- **sDatabase** name of target database on MsSQL server
- **sActivationNumber** activation number for full functionality(if it's empty it runs 2 hours after start)
- **queryString** fill this string with SQL query (eg. SELECT * FROM tblData)

To execute **queryString** on MsSQL server put **xWriteData** to **TRUE**. Function block will connect to MsSQL server is it's reachable and execute queryString and if there is no more request, will disconnect from server. This function block has **FIFO buffer** for queries so it can handle string queries from 0 to gc_bLengthFIFO.

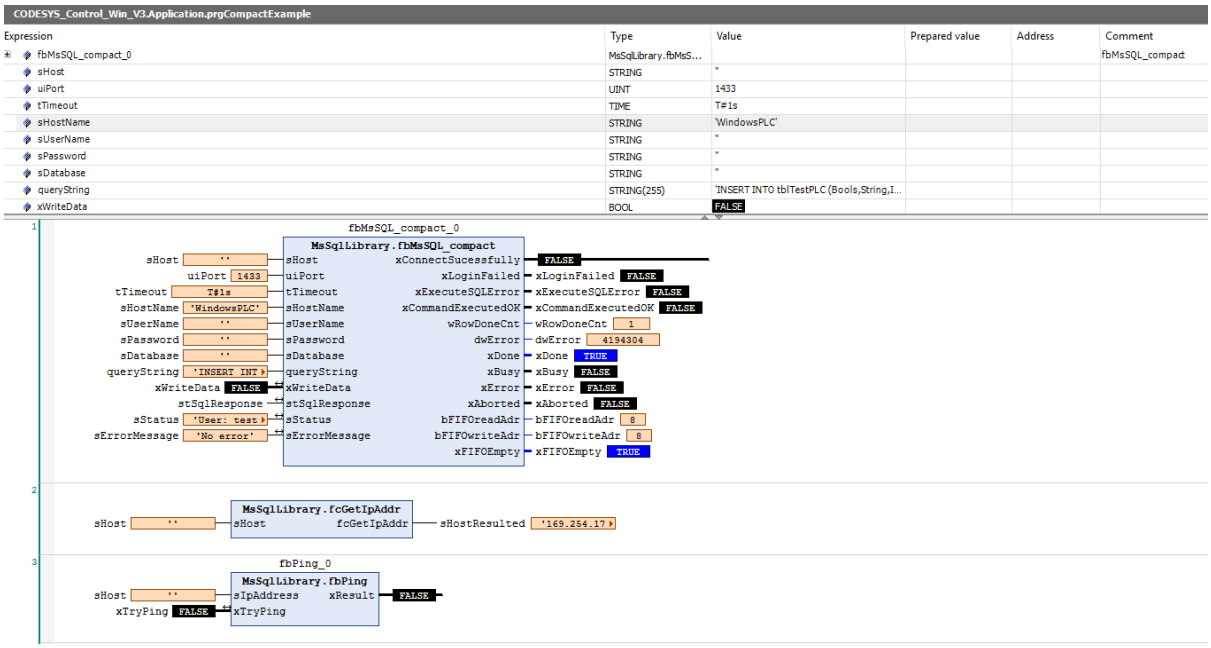


Figure 3.1: prgCompactExample

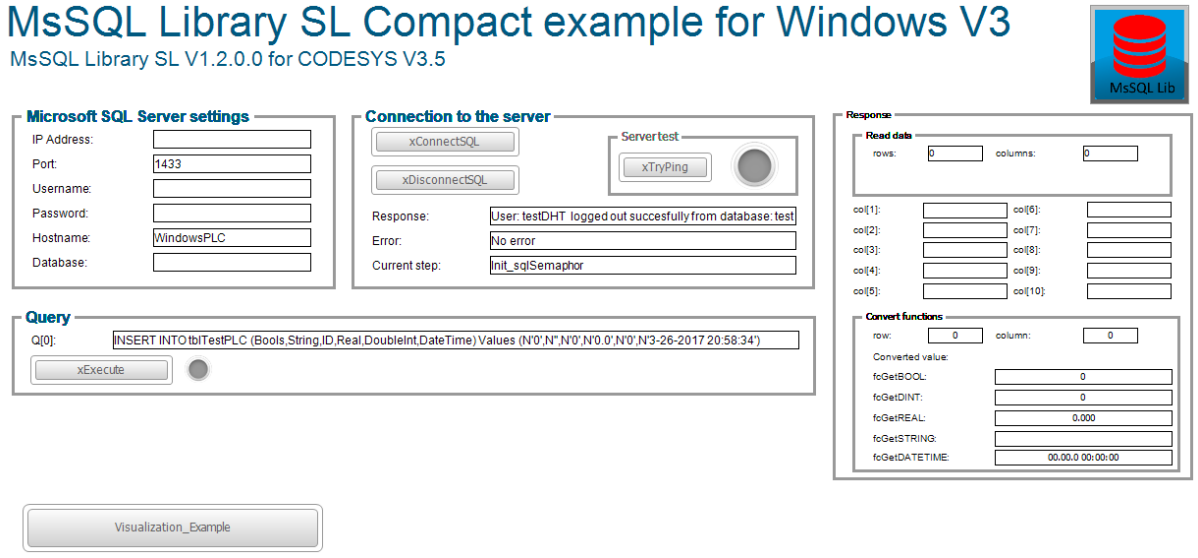


Figure 3.2: visuCompactExample

3.2 prgExample

In this program is used function block **fbMsSQL**. To make this function block work you have to fill:

- **sHost** fill IP address or Hostname of MsSQL server
- **uiPort** set TCP port on which MsSQL server listen (eg. 1433)
- **tTimeout** timeout for connection
- **sUserName** username for login to MsSQL server
- **sPassword** password for login to MsSQL server
- **sDatabase** name of target database on MsSQL server
- **sActivationNumber** activation number for full functionality(if it's empty it runs 2 hours after start)
- **astQuery** is array for strings with SQL queries (eg. SELECT * FROM tblData)

To execute **query** in **astQuery** on MsSQL server log to MsSQL Server by setting **xConnect** to **TRUE**. When is PLC connected to MsSQL execute SQL query by **xExecuteSQL** to **TRUE**. Disconnecting from database by **xDisconnectSQL** to **TRUE**.

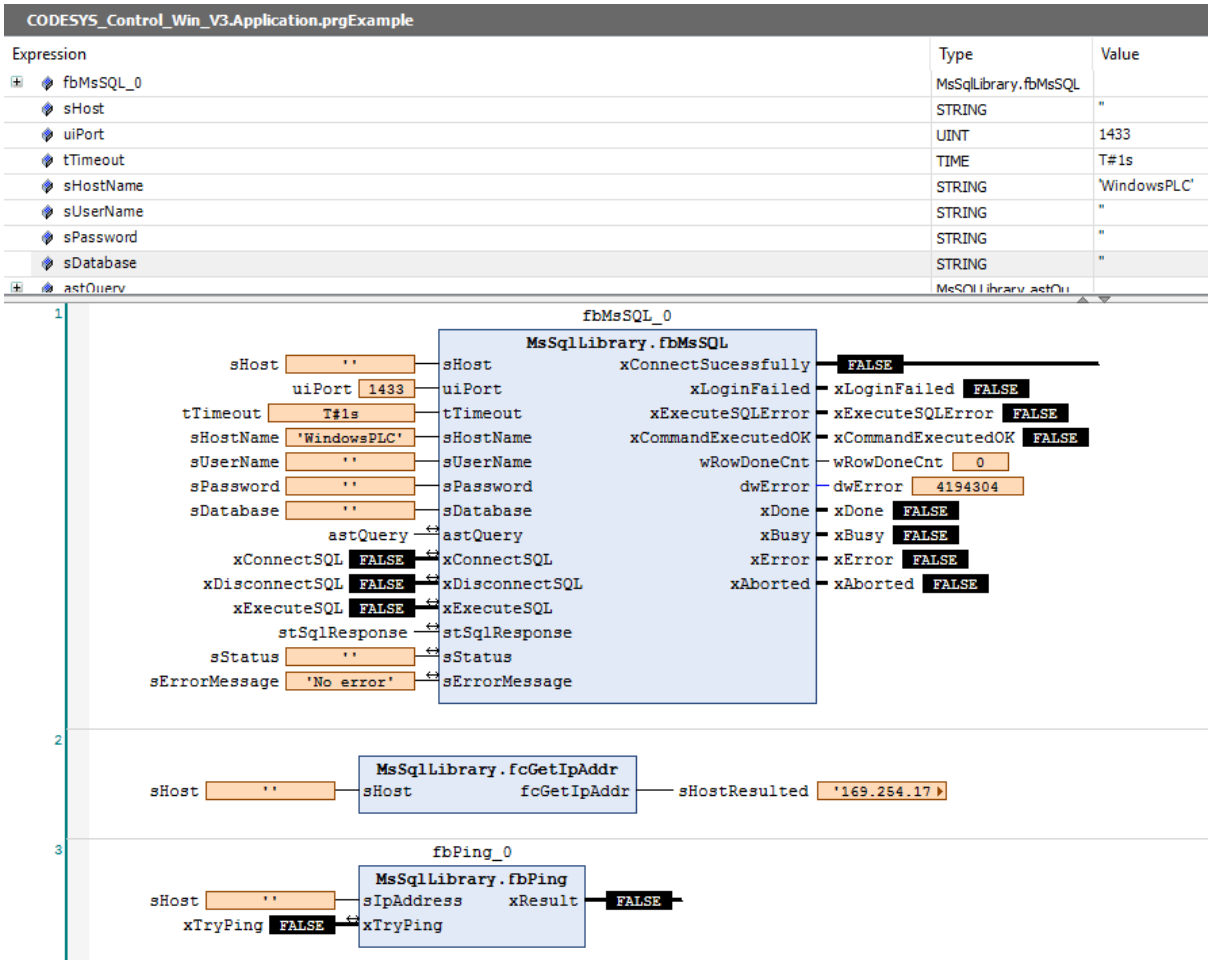


Figure 3.3: prgExample

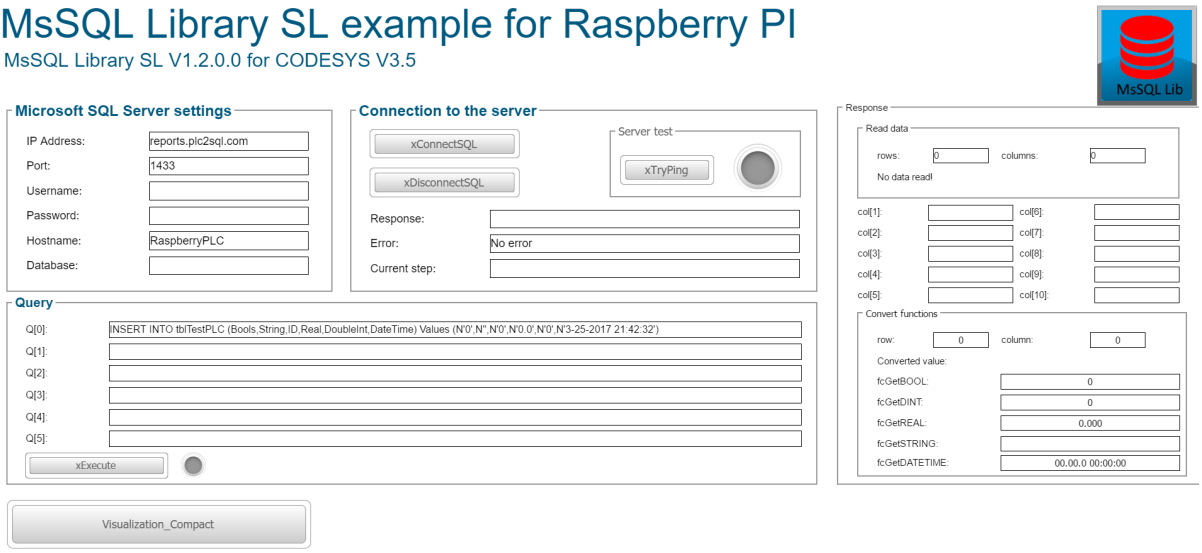


Figure 3.4: visuExample

3.3 Example Select query

fcSelectQuery in the picture 3.5 is example of fc which creates SELECT query string for MsSQL Server. This example returns **TOP 5** records from table **tblTestPLC1** WHERE is **column ID** equal variable **ID_TO_SELECT**.

```
FUNCTION fcSelectQuery : STRING(255)
VAR_INPUT
    ID_TO_SELECT    :   DINT;
END_VAR
VAR
    sSelect :   STRING(255);
END_VAR
```

```
sSelect:='SELECT TOP (5) Ident,Bools,String,ID,Real,DoubleInt,DateTime FROM tblTestPLC1 WHERE ID = N$'';
sSelect:=CONCAT(STR1:=sSelect, STR2:=DINT_TO_STRING(ID_TO_SELECT));
sSelect:=CONCAT(STR1:=sSelect, STR2:='$'');
fcSelectQuery:=sSelect;
```

Figure 3.5: fcSelectQuery

3.4 Example Insert query

fcInsertQuery in the picture 3.6 shows how to create **insert query string** for MsSQL server.

```
FUNCTION fcInsertQuery : STRING(255)
VAR_INPUT
    TestBool:BOOL;
    TestString:STRING;
    TestInt:INT;
    TestReal:REAL;
    TestDint:DINT;
    TestDateTime:DT;
END_VAR
VAR
    sQuery:STRING(255);
```

```
sQuery:='INSERT INTO tblTestPLC1 (Bools,String,ID,Real,DoubleInt,DateTime) Values (N$'';
sQuery:=CONCAT(STR1:=sQuery, STR2:=INT_TO_STRING(BOOL_TO_INT(TestBool)));
sQuery:=CONCAT(STR1:=sQuery, STR2:='$',N$'');
sQuery:=CONCAT(STR1:=sQuery, STR2:=TestString);
sQuery:=CONCAT(STR1:=sQuery, STR2:='$',N$'');
sQuery:=CONCAT(STR1:=sQuery, STR2:=INT_TO_STRING(TestInt));
sQuery:=CONCAT(STR1:=sQuery, STR2:='$',N$'');
sQuery:=CONCAT(STR1:=sQuery, STR2:=REAL_TO_STRING(TestReal));
sQuery:=CONCAT(STR1:=sQuery, STR2:='$',N$'');
sQuery:=CONCAT(STR1:=sQuery, STR2:=DINT_TO_STRING(TestDint));
sQuery:=CONCAT(STR1:=sQuery, STR2:='$',');
sQuery:=CONCAT(STR1:=sQuery, STR2:=MsSqlLibraryTurck.fcSQLInsertDateTimeFormat(dtValue:=TestDateTime));
sQuery:=CONCAT(STR1:=sQuery, STR2:=')');
fcInsertQuery:=sQuery;
```

Figure 3.6: fcInsertQuery

3.5 Example commands for SQL Server

3.5.1 tblTestPLC

In this table we have 6 collumns:

- **Bools** [bit]
- **String** [nvarchar(50)]
- **ID** [int]
- **Real** [float]
- **DoubleInt** [bigint]
- **DateTime** [datetime]

Table 3.1: Example of values, which you can add to your tblTestPLC table

[rows]	Bools	String	ID	Real	DoubleInt	DateTime
1	0	Test 12	456	13.2	445568	2014-08-05 00:00:00.000
2	1	Hello youtube	78964	0.4	44556	2012-03-04 00:00:00.000

```
SELECT [Bools]
      ,[String]
      ,[ID]
      ,[Real]
      ,[DoubleInt]
      ,[DateTime]
  FROM [test].[dbo].[tblTestPLC]
```

Figure 3.7: SELECT from tblTestPLC

Chapter 4

ChangeLog

V 1.0.0.0

- Released

V 1.1.0.0

- **BUG** - Changed declaration of variables **sStatus, sErrorMessage, astQuery.sQuery** from STRING to STRING(255).
- **BUG** - Overwrite variable **uiPort** in case of longer sErrorMessage than 80 chars.

V 1.1.0.1

- **BUG** - Parsing raw data fails in case of only one non null int. value
- **UPDATE** - Return datatype of function **fcGetSTRING** is now STRING(255).
- **UPDATE** - Supported sql datatype of function **fcGetDINT** is now bigint.
- **FEATURE** - Function for getting data-type datetime, new function **fcGetDATETIME**.
- **BUG** - If **xExecuteSQLError** was in true state also **xCommandExecutedOk** was in true state. Now only one of these two states can be true.

V 1.1.0.2

- **FEATURE** - New global parameter **gc_iNoOfRows** for defining how many rows is needed for result.
- **FEATURE** - New output value **dwError**. Which show actual error according table in **1.7 Errors**.
- **BUG** - Overflow error in case when result of query is longer than space in **stSqlResult**. Function block send error in these cases.
- **BUG** - fbMsSQL is unable to connect to server in case that byte array with length gc_iLengthOfDataArray for reading data is longer than PLC can handle. Error 16#400013

V 1.1.0.3

- **UPDATE** - All converting functions have improved process for retrieving variables from raw data.

V 1.1.0.4

- **BUG** - Data type real(16#3E) wasn't correctly converted to REAL.
- **BUG** - Name of column had ghost symbols.
- **UPDATE** - Function **fcGetREAL** now support 4byte REAL(16#3B).
- **UPDATE** - Error message **sErrorMessage**, now in case of error "Query has unsupported data type." shows which data-type is wrong.

V 1.1.0.5

- **BUG** - Product code on side of CODESYS Store was changed.
- **BUG** - Library misinterpreted DONEINPROC token in case of negative integer in result set.
- **UPDATE** - Library performance improved.
- **UPDATE** - Error message **sErrorMessage**, now in case of error "Network socket error.".
- **UPDATE** - fbMsSQL has now IEC behavioural statuses(xDone, xBusy, xError, xAbort).

V 1.2.0.0

- **FEATURE** - New function **fcGetIpAddr** to resolve ipAddress from DNS name.
- **UPDATE** - **sIpAddress** is no more input. Instead of it there is **sHost** where is possible to insert **ipAddress** or **hostname**.
- **FEATURE** - Library has now two main function blocks **fbMsSQL_compact** which has integrated FIFO buffer and StateMachine automat for storing data into SQL database easy on one trigger. And **fbMsSQL** for advanced users.
- **FEATURE** - New fb for handling FIFO **fbFIFOQuery**.
- **FEATURE** - New function **fcSQLInsertDateTimeFormat** for creating DATETIME string for MsSQL server.
- **UPDATE** - 3 new errors to check if sUserName, sHost was filled and info if DNS-request failed.

V 1.2.0.1

- **BUG** - Product code checked wrongly.

V 1.2.0.2

- **BUG** - Product code on side of CODESYS Store was wrongly assigned.

V 1.2.0.3

- **UPDATE** - Improvement of license check.

V 1.3.0.0

- **BUG** - Library now works with all types of processors.

V 1.3.0.1

- **UPDATE** - Function fcGetSTRING now support VARCHAR(16#A7) datatype.

V 1.3.0.2

- **BUG** - Reading errors from Server.

V 1.3.0.3

- **BUG** - Reading datatypes with nullable parameter.

V 1.3.0.4

- **UPDATE** - All neccesary libraries are now set to newest version due to failure with Codesys V3.5 SP14 with x64 target.
- **UPDATE** - Library now requests only neccesary core libraries.
- **UPDATE** - Visualization was deleted from origin library and moved to example project.

V 1.4.0.0

- **UPDATE** - Refactoring of whole library, delete unused variables and improve performance.

V 1.4.0.1

- **BUG** - Library stucked during connection. Wrong pointer to send data and short timeout for connection.

V 1.4.0.2

- **BUG** - Library wrongly interpretted SQL error message longer than 255 bytes and causes crash of Codesys RTE. Also when there is SQL Execute error this bit is set to TRUE.

V 1.4.0.3

- **BUG** - Error Message longer than 80 chars was out of memory due using variable STRING instead of STRING(255) caused crash of Codesys Runtime. Now it's fixed.
- **UPDATE** - Library has now implemented skiping tokens TABNAME and COLINFO. This feature is neccesary for some advanced stored procedures.

V 1.4.0.4

- **UPDATE** - Added skiping not-implemented TOKENS (RETURN_STATUS, DONEPROC, DONEINPROC) from SQL Server.

V 1.4.0.5

- **BUG** - Fix showing correct IEC behavioural statuses(xDone, xBusy, xError, xAbort).