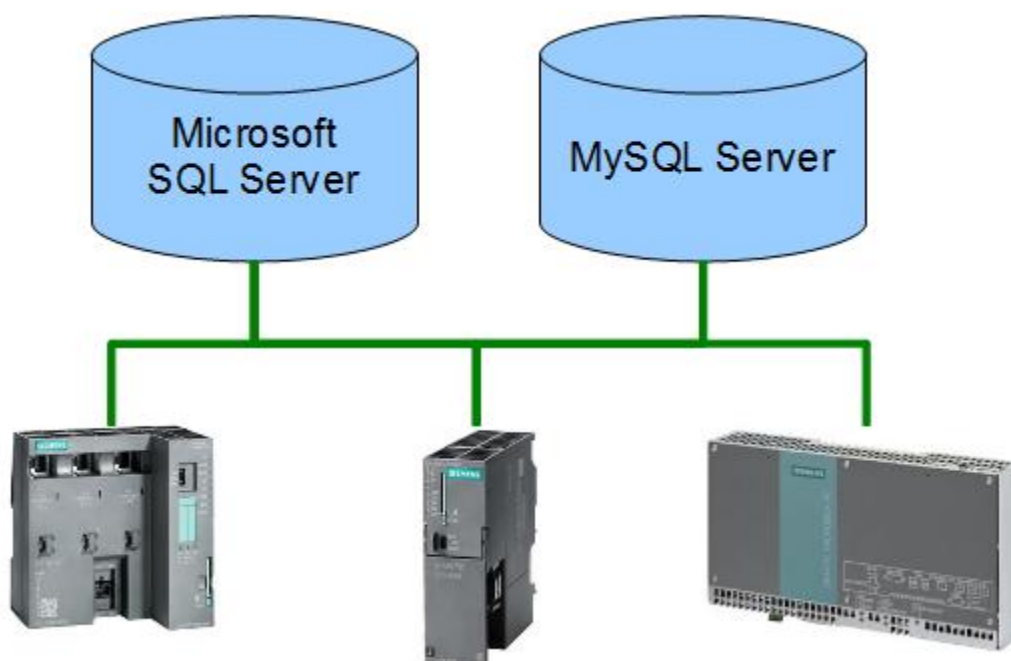


Installation Manual

MySQL for PLCSQL link

*SQL Client in a
Siemens S7 PLC*



Revision date: 2018-09-17

Revised by: Michael Petersen, ALSMATIK A/S

Version: 2018-1

Revision date: 2019-03-27

Revised by: FBH, ALSMATIK A/S

Version: 2018-3

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Introduction

In order to get it to work, it is important to setup the database, to fit with the design for PLCSQL link.

This manual is for MySQL 5.7, 8.0012 but can also be used as guidance for previous versions. PLCSQL Link don't support MySQL above version 8.

For guidance in setting up PLCSQL link PLC program, we refer to the document "PLCSQL PLC Installation Manual".

If you still have questions after reading this manual, please send them to info@plcsql.com

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How does the system work?

We have tried to make a system where it is possible to communicate with a SQL data base without being an “SQL expert”, nor being an “PLC expert” regarding communication etc. the system contains a “standard” PLC program, and a “standard” SQL data base that “fits” together.

In the PLC we are using the following basic tag types:

Bool.	Is stored in an “Bool” table in the database.
Int.	Is stored in an “Int” table in the database.
Dint.	Is stored in an “Dint” table in the database.
Real	Is stored in an “Real” table in the database.
String	Is stored in an “String” table in the database.

To distinguish between the different tags, every tag has a specific number. In the PLC there is an “Array” that contains all the tags, and in the database the different tables contain the corresponding data types and numbers as in the PLC, so you have complete control with the tags.

Now, somebody will ask, “but we have to connect an existing data base”, yes that is no problem, you can easily interconnect between different data bases, so we strongly recommend to “make” a data base exclusively for PLCSQL, so you easily can check where the problem could be when something is not working.

On the following pages there is a schematic view of the layout and the possibilities you have with the PLCSQL system.



Please note the following.

Parameter 10001, 15001, and 30001 is used internally in the “Log” parameters and in the “Recipe” parameters. DON'T write to these parameters.

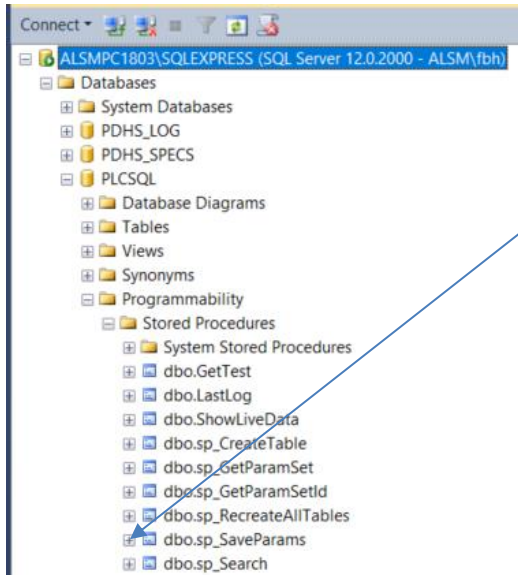
10001:	SetCount
15001:	SetID
30001:	DateTimeStamp.

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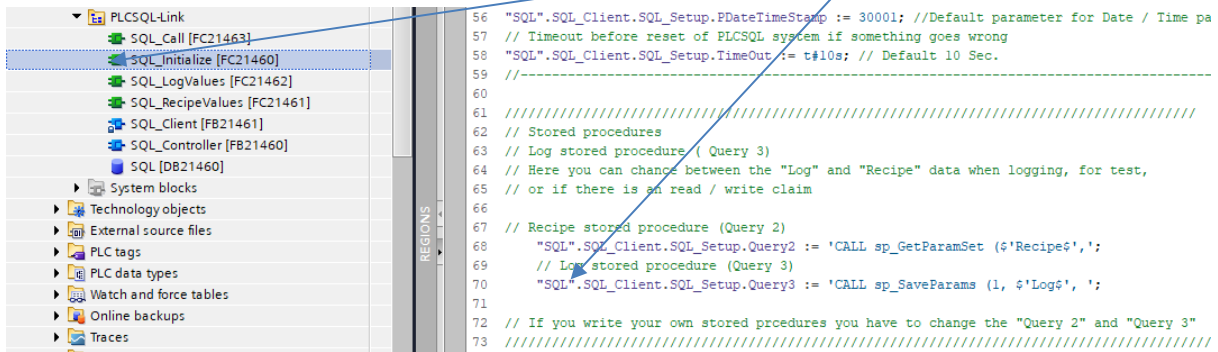
How does PLCSQL work, Log, write to SQL server

In Mssql we want to store the Value 2.3009 in the ParamID[1].

First we need to setup the Call in the PLC for the stored procedure in Mssql.



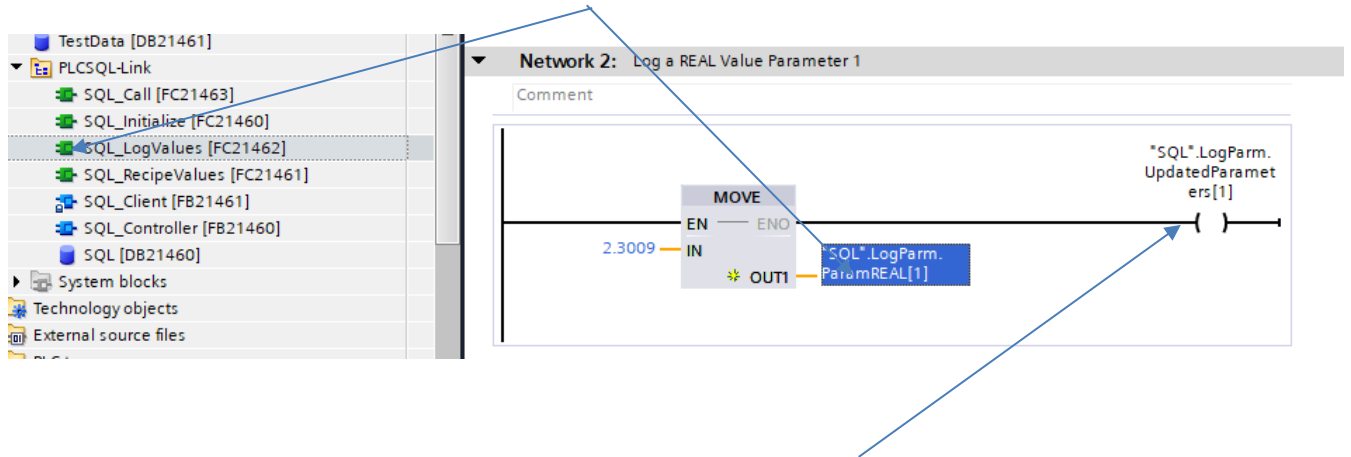
In SQL_Initialize DB you setup the SQL.SQL_Client.SQL_Setup.Query3 to match the procedure in Mssql: "SQL".SQL_Client.SQL_Setup.Query3 := 'CALL sp_SaveParams (1, '\$Log\$', ';



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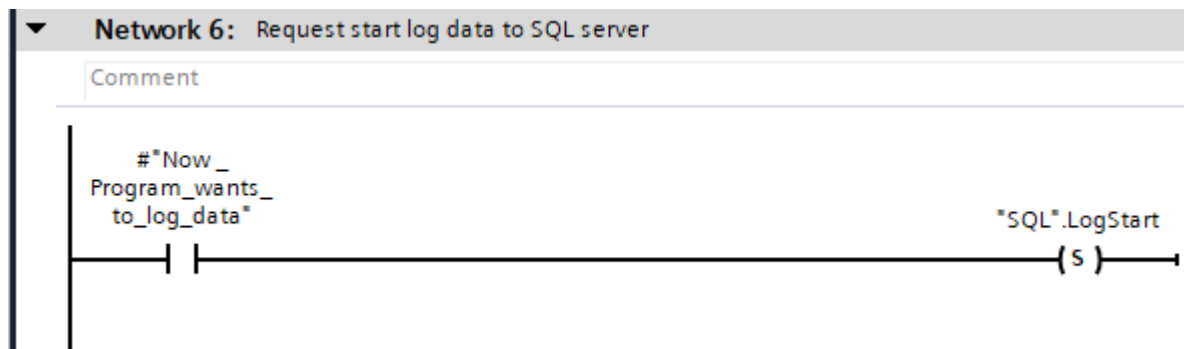
Installation Manual: MySQL for PLCSQL link

In the PLC we move the value 2.3009 to the SQL DB



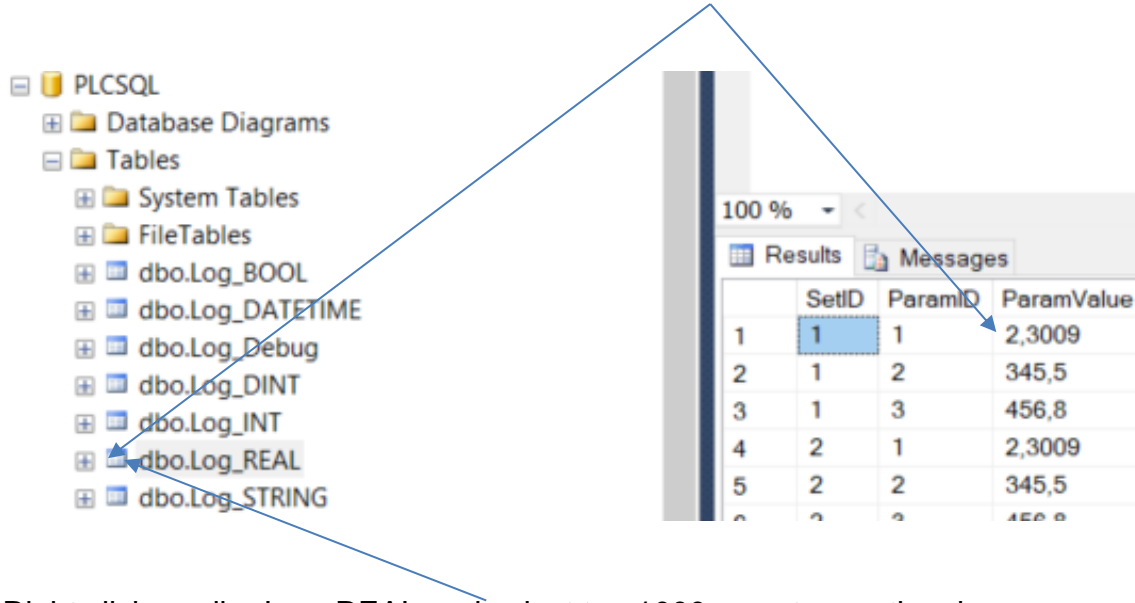
And we tell the system that there is an updated value on ParamID[1].

Last we set the bit SQL.LogStart and the value is stored in mssql.



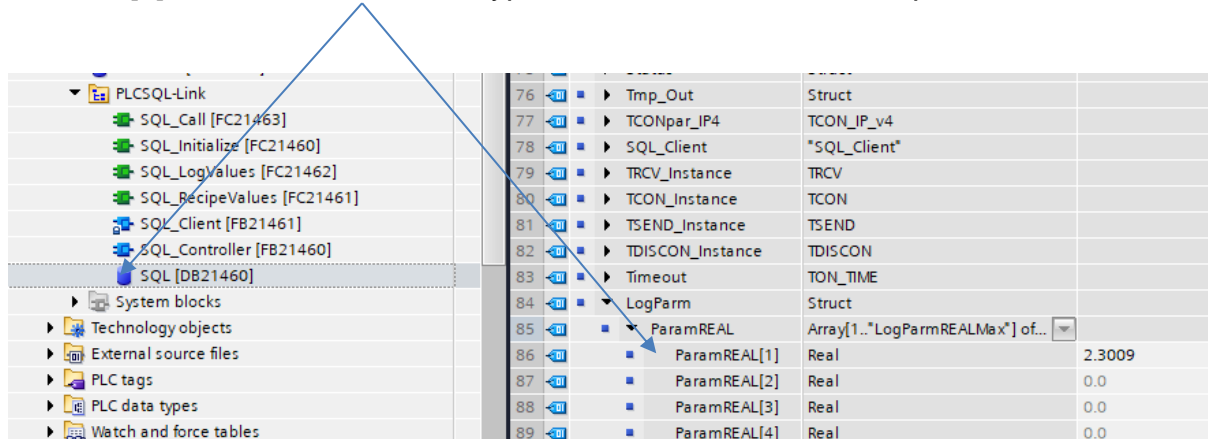
Subject	MySQL for PLC SQL	Document:	MySQL Installation Manual_V18-3.docx
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In Mssql we can see that the Value 2.3009 is stored in ParamID[1].



Right click on dbo.Log_REAL and select top 1000 rows to see the view.

ParamID[1] is defined as a REAL type in both the PLC and Mssql.



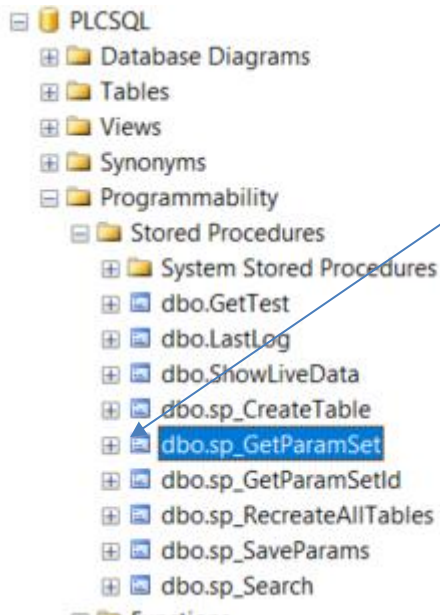
How does PLCSQL work, Recipe, read from SQL server

In Mssql we want to read the stored value in ParamID[3].

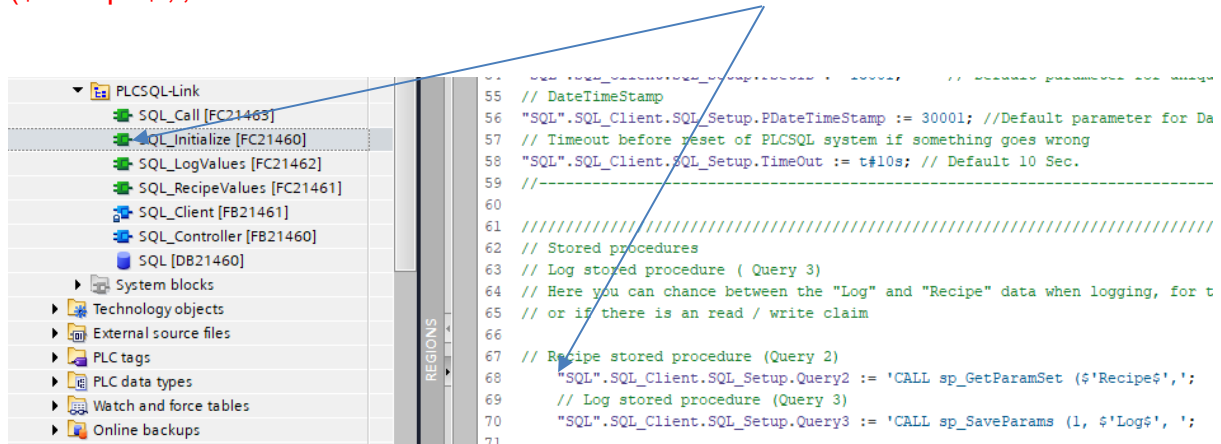
Subject	MySQL for PLC SQL	Document:	MySQL Installation Manual_V18-3.docx
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Installation Manual: MySQL for PLCSQL link

First we need to setup the Call in the PLC for the stored procedure in Mssql.



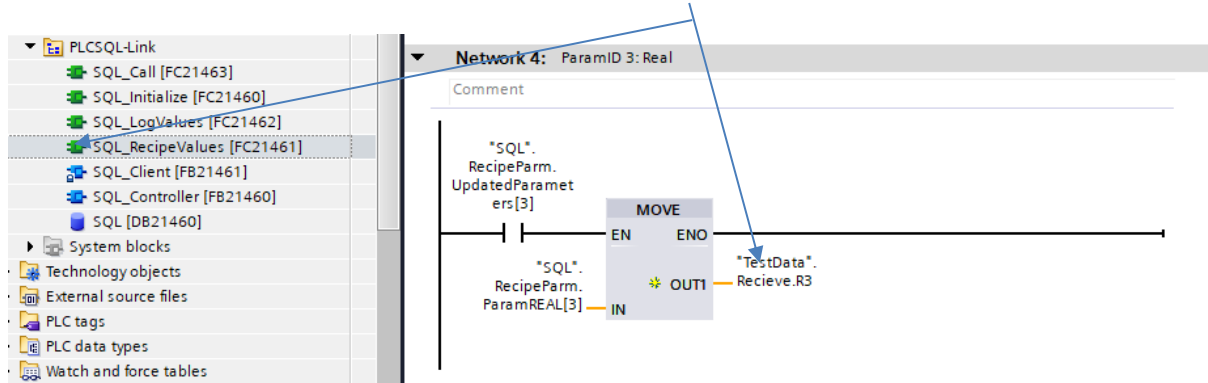
SQL_Initialize DB you setup the SQL.SQL_Client.SQL_Setup.Query2 to match the procedure in Mssql: "SQL".SQL_Client.SQL_Setup.Query2 := 'CALL sp_GetParamSet (\$Recipe\$)';



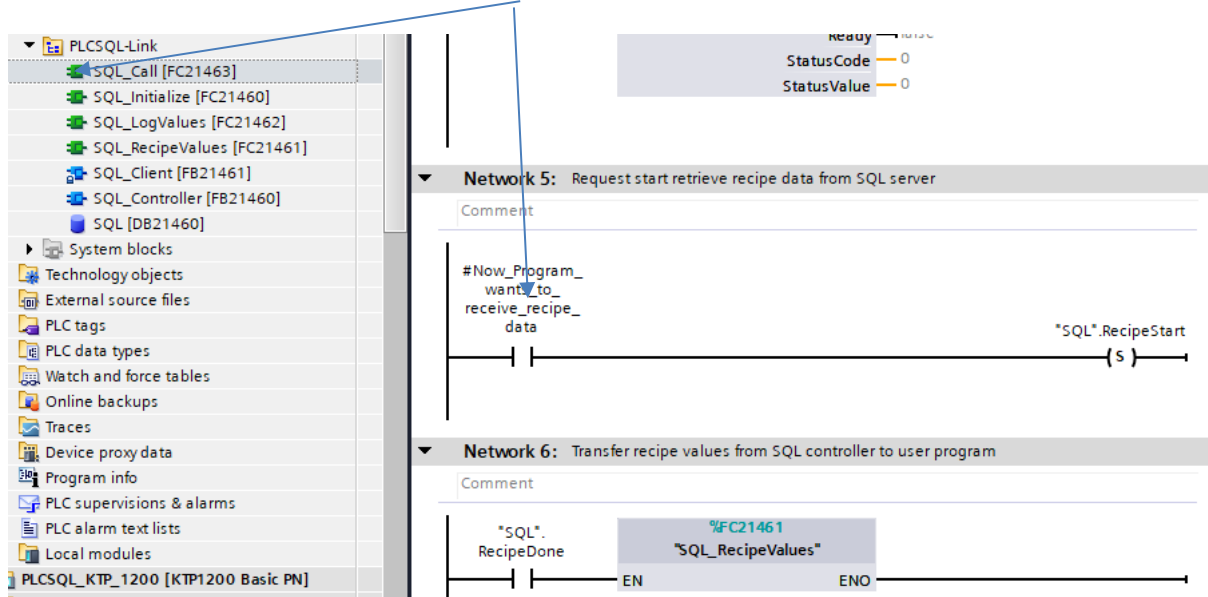
Subject	MySQL for PLC SQL	Document:	MySQL Installation Manual_V18-3.docx
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Installation Manual: MySQL for PLCSQL link

Move the received data from Mssql to your variable in the PLC.



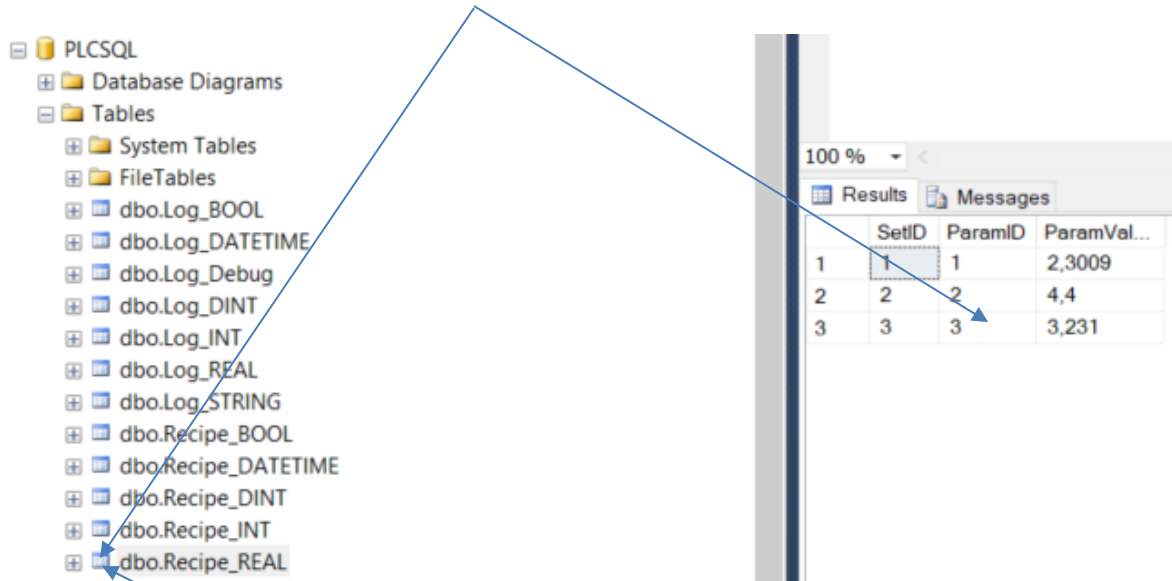
In the Plc we need to trigger the start log bit.



Subject	MySQL for PLC SQL	Document:	MySQL Installation Manual_V18-3.docx
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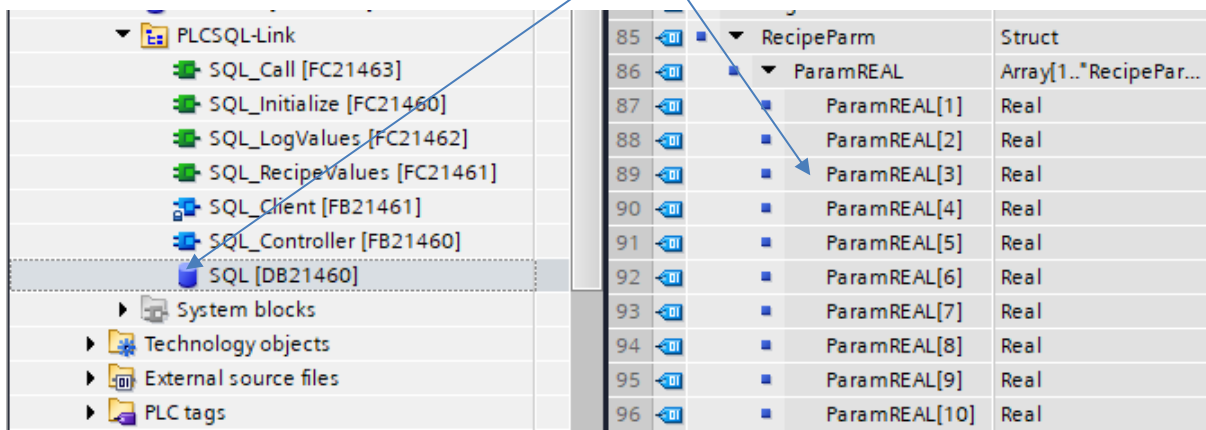
Installation Manual: MySQL for PLCSQL link

In Mssql we want to read a Real value with ParamID 3 from Recipe



Right click on dbo.Log_REAL and select Top 1000 rows to see the view.

ParamId[3] is defined as a REAL type in both the PLC and Mssql.



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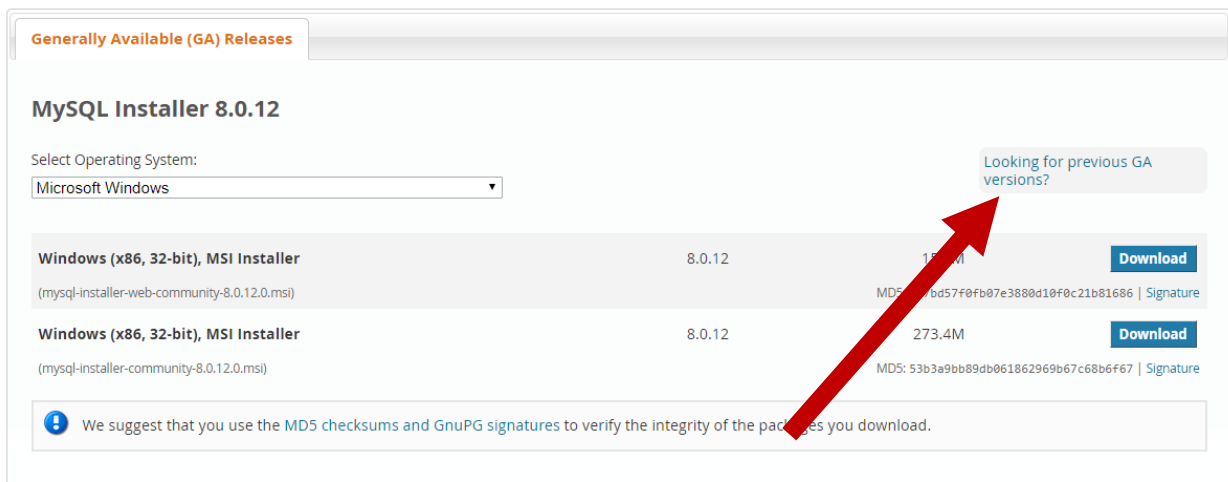
Example software

In this example we are using the program “MySQL Server” Ver. 5.7.23 Installed on “Windows 10 Professional 64 bit”.

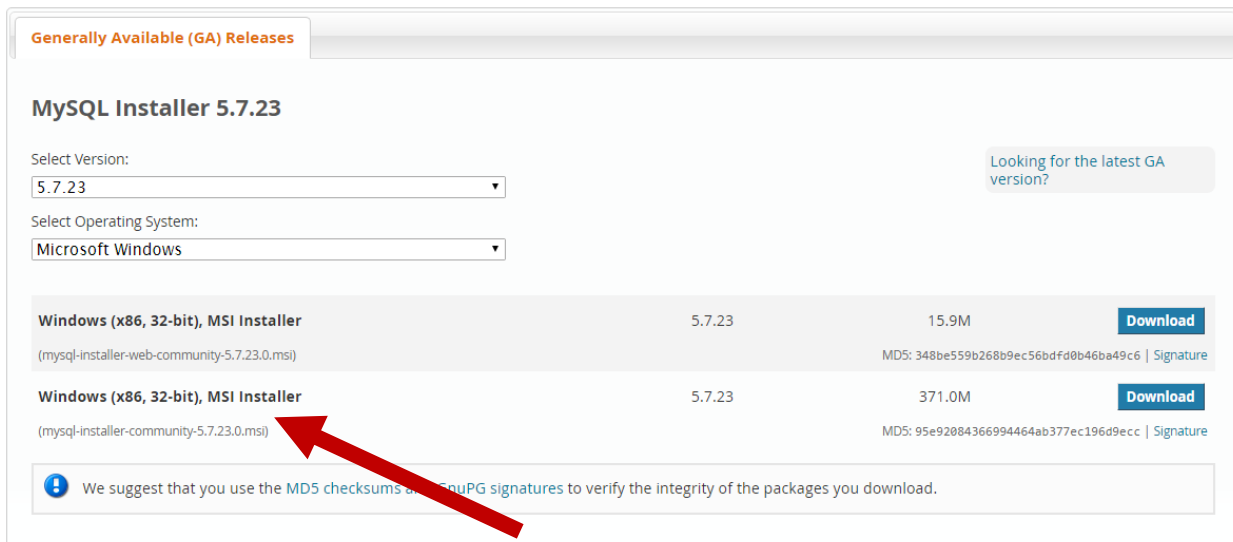
With this installation manual you are able to setup the database server, for getting and putting data by the PLC SQL link.

Downloading MySQL

Download MySQL Installer from <https://dev.mysql.com/downloads/installer/>.



MySQL suggest to download the latest version. Click on “Looking for previous GA versions?” to find the 5.7.23 version.

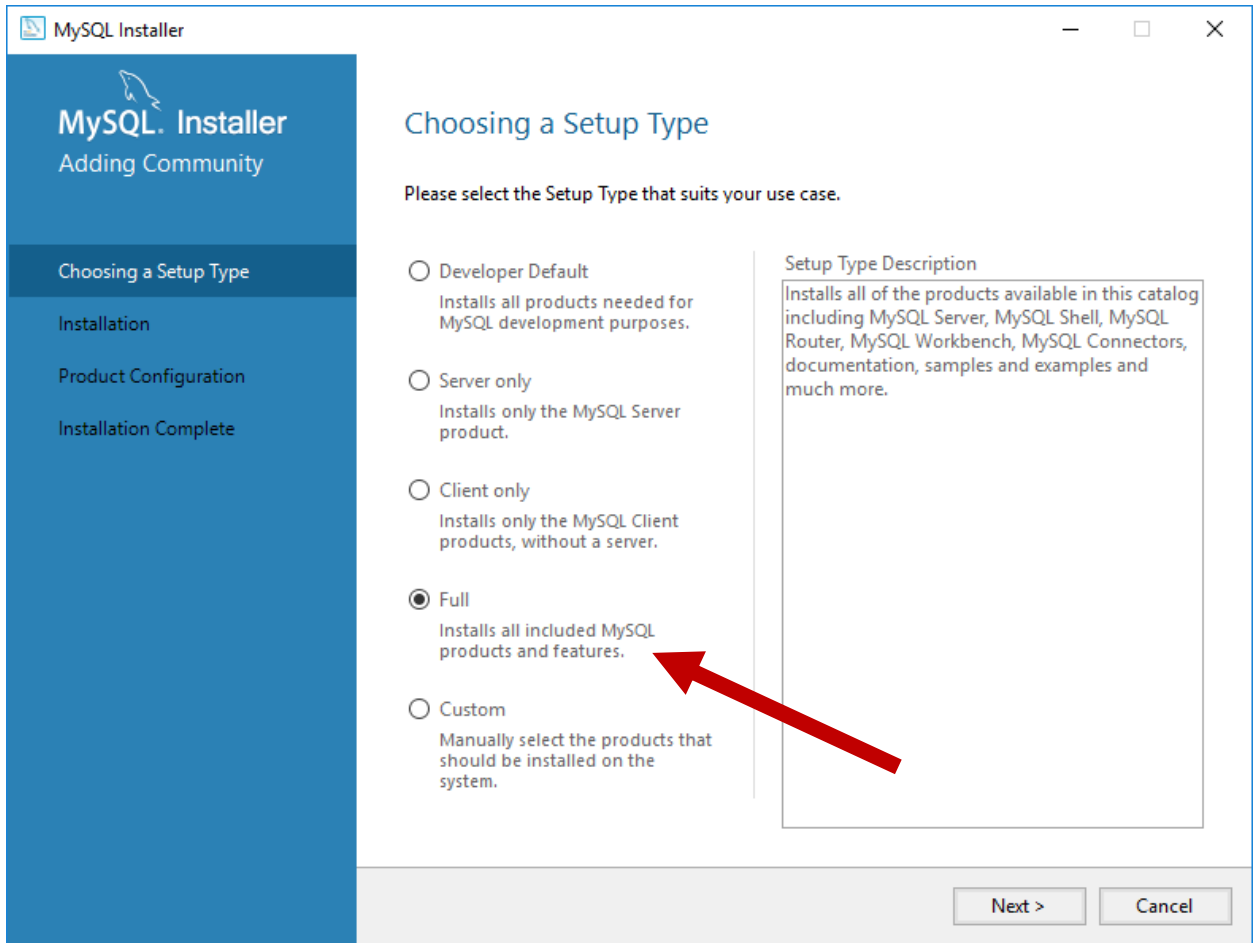


Download the complete package (my-installer-community-5.7.23.0.msi)

Subject	MySQL for PLC SQL	Document:	MySQL Installation Manual_V18-3.docx
Ref.	MySQL Version 2018-3	Revision:	2019-03-27 by FBH

Install MySQL Server

After download execute my-installer-community-5.7.23.0.msi.



Under Choosing a Setup Type, select Full to install MySQL Server, MySQL Workbench and more.

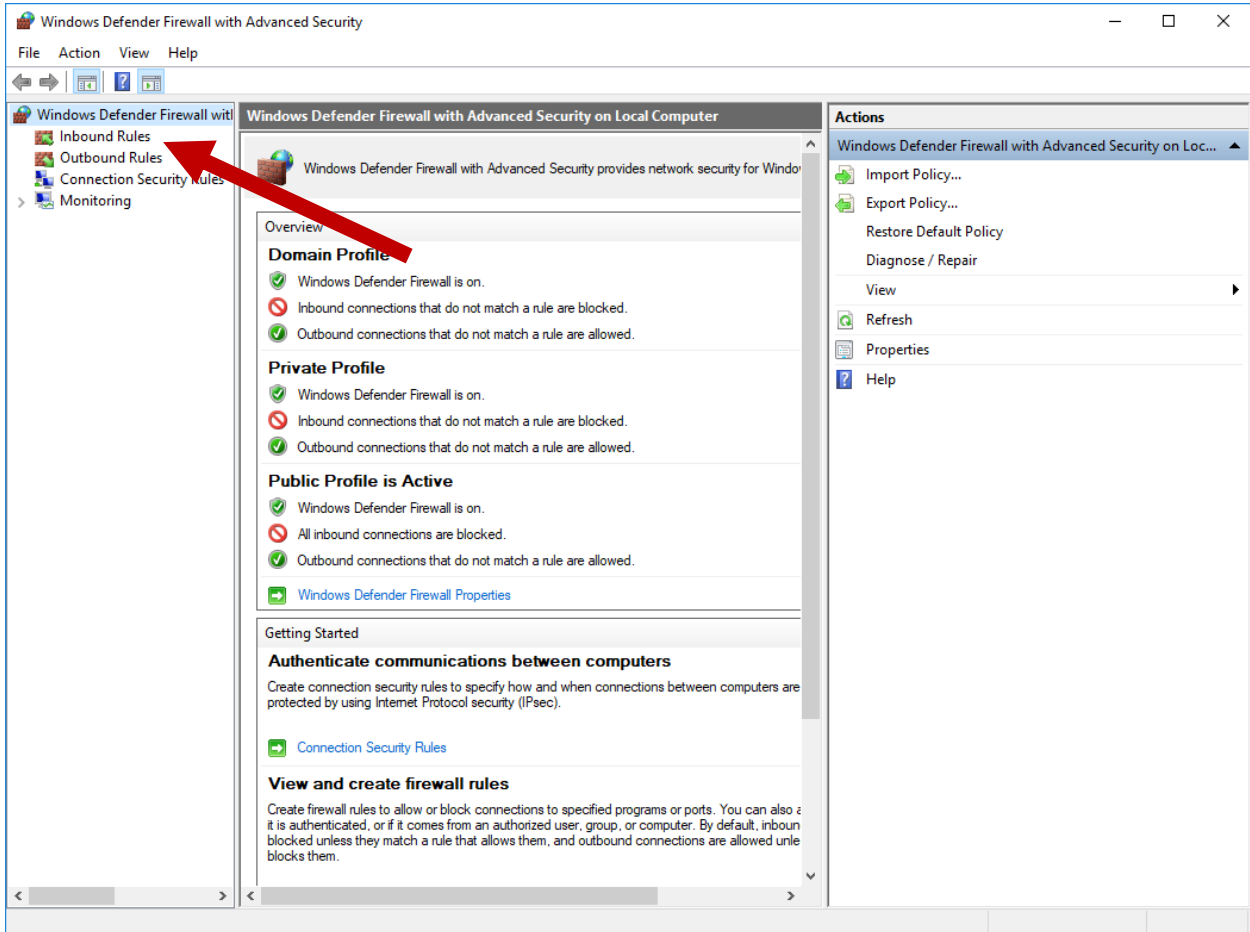
Follow the installation guide of the software.

Subject	MySQL for PLC SQL	Document:	MySQL Installation Manual_V18-3.docx
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Firewall

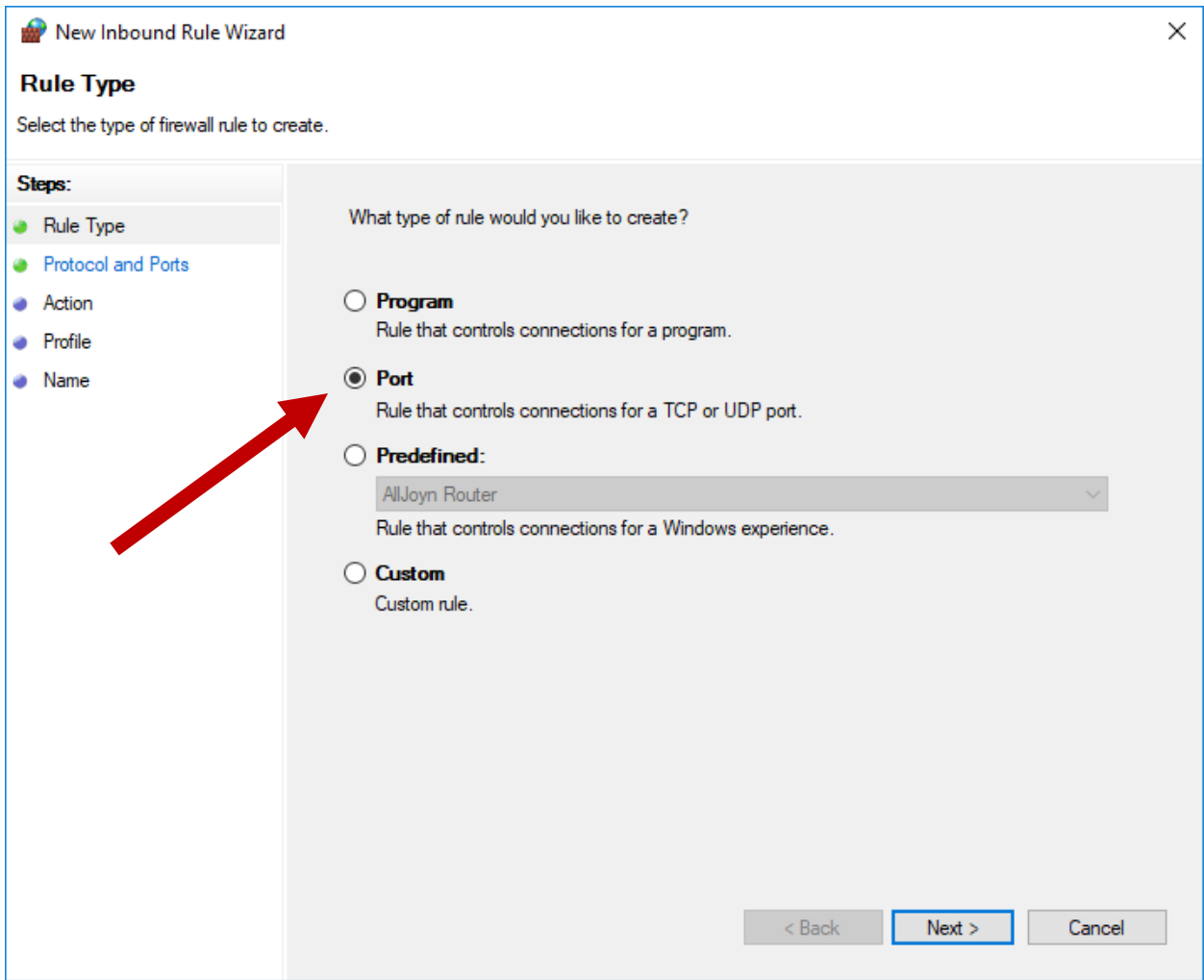
After installing MySQL server port 3306 need to be opened in the firewall.

On Windows 10, open Windows Defender Firewall with Advanced Security. Click Start, type Windows Defender Firewall, and the press ENTER.



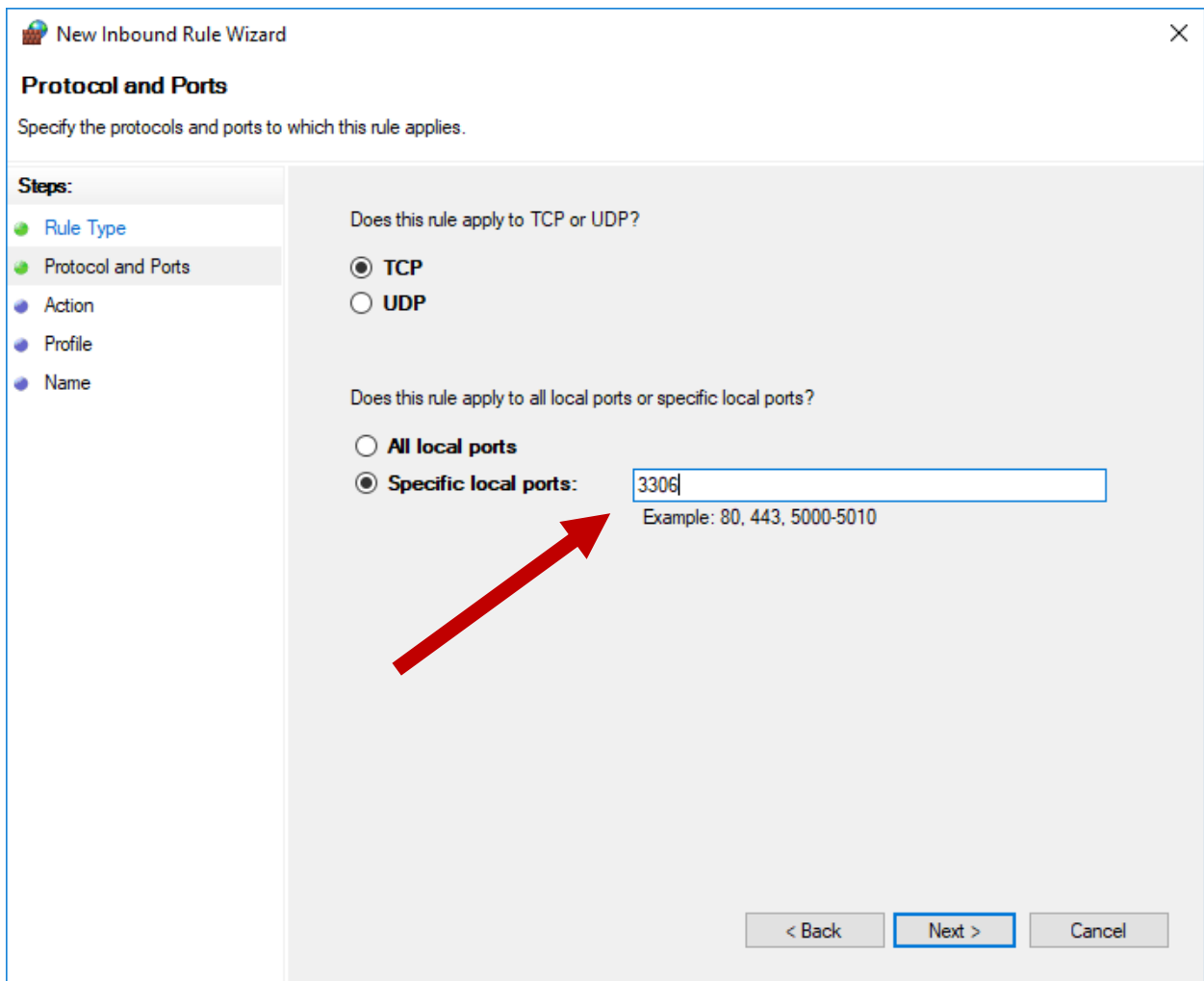
Right click on Inbound Rules and select New Rule...

Subject	MySQL for PLC SQL	Document:	MySQL Installation Manual_V18-3.docx
Ref.	MySQL Version 2018-3	Revision:	2019-03-27 by FBH



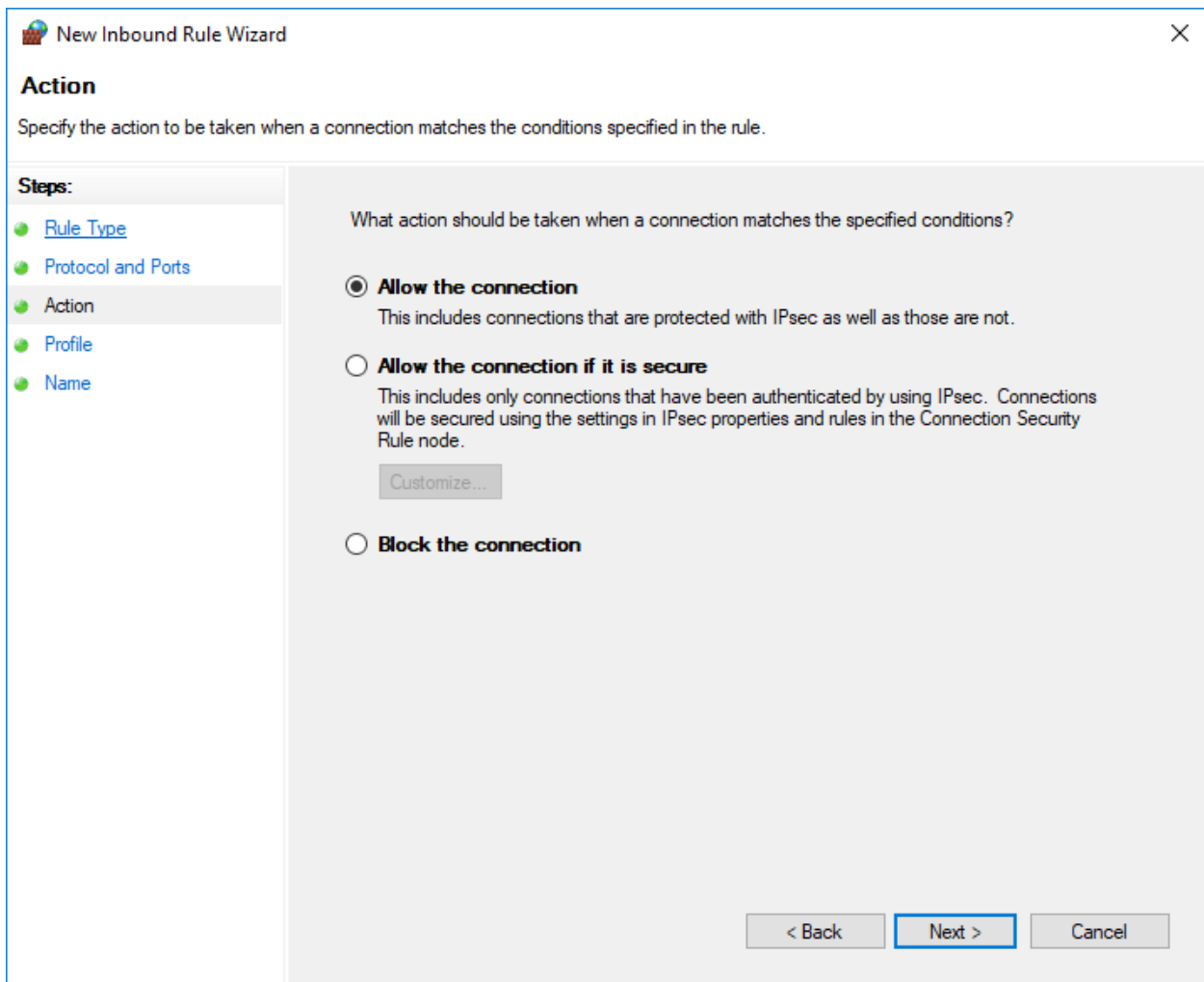
In New Inbound Rule Wizard select Port and click Next >

Subject	MySQL for PLC SQL	Document:	MySQL Installation Manual_V18-3.docx
Ref.	MySQL Version 2018-3	Revision:	2019-03-27 by FBH



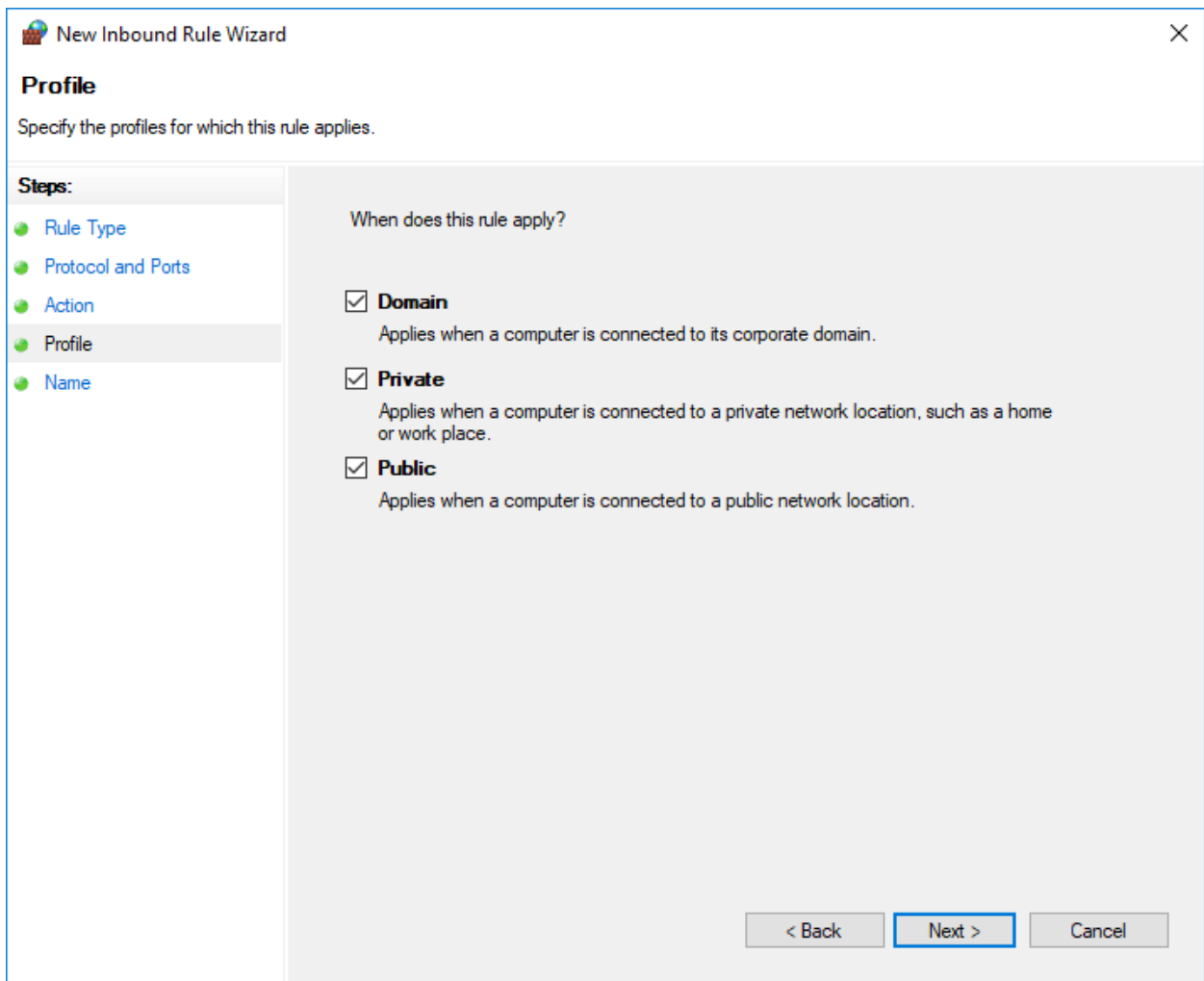
Under Specific local ports, enter 3306 and click Next >

Subject	MySQL for PLC SQL	Document:	MySQL Installation Manual_V18-3.docx
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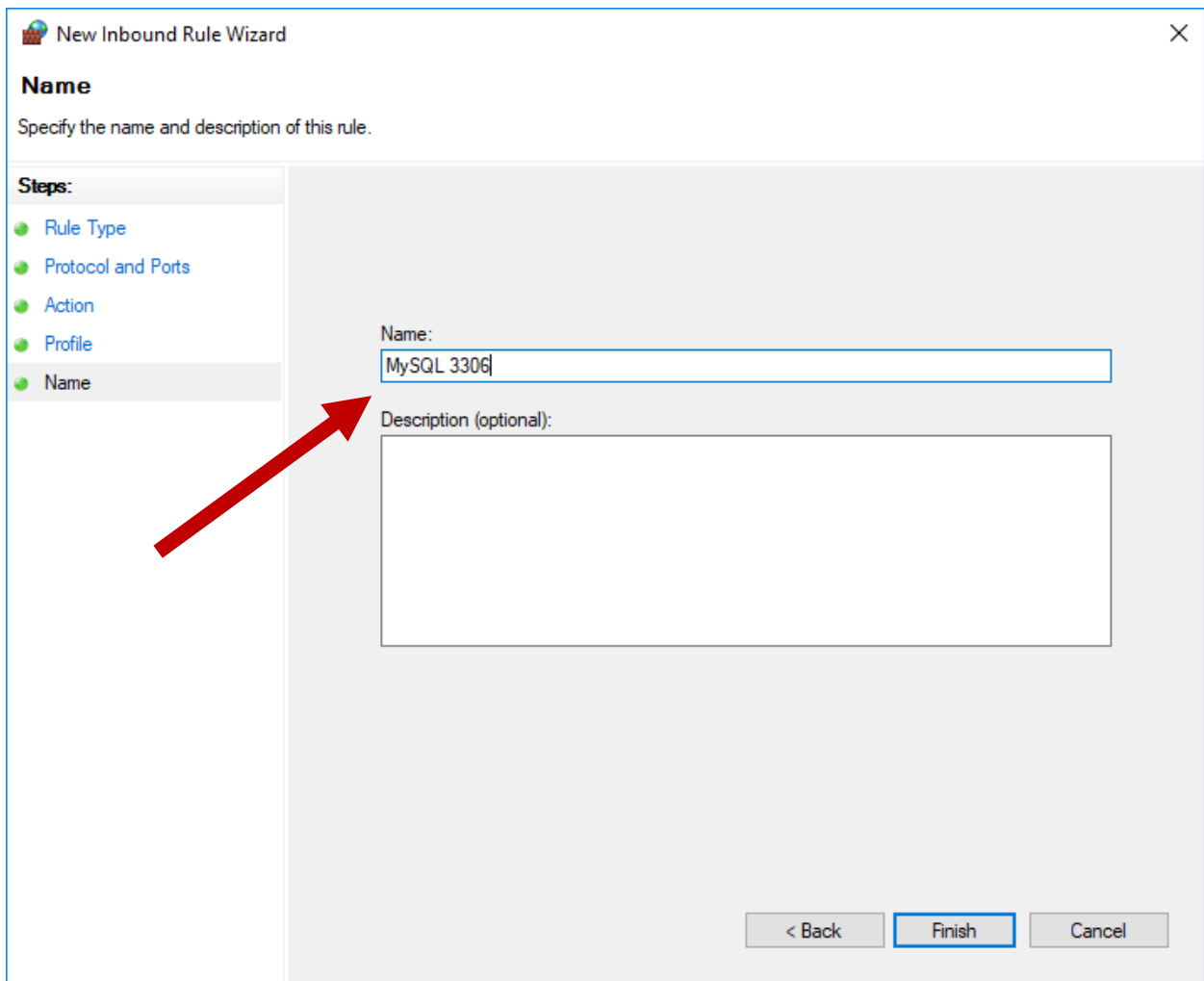
Click Next >

Subject	MySQL for PLC SQL	Document:	MySQL Installation Manual_V18-3.docx
Ref.	MySQL Version 2018-3	Revision:	2019-03-27 by FBH



Click Next >

Subject	MySQL for PLC SQL	Document:	MySQL Installation Manual_V18-3.docx
Ref.	MySQL Version 2018-3	Revision:	2019-03-27 by FBH

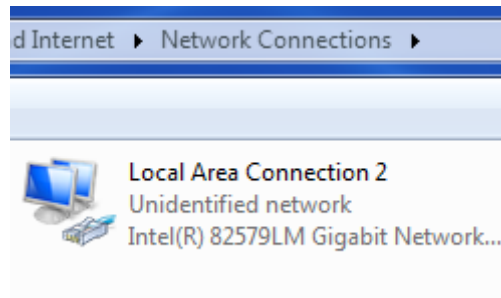


Enter a name of the rule and click Finish.

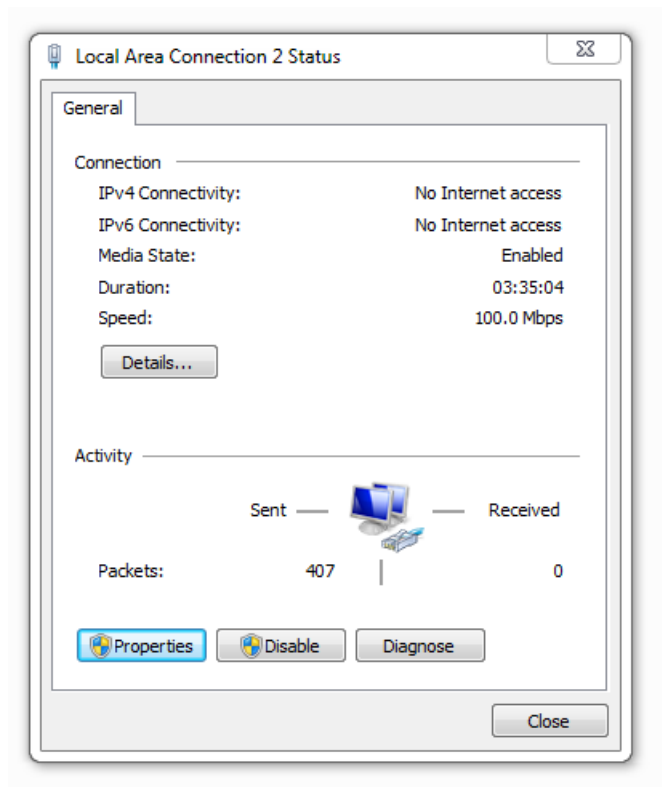
Verify that the MySQL server can be accessed remotely. Try from another computer to access the MySQL by using MySQL Workbench.

Subject	MySQL for PLC SQL	Document:	MySQL Installation Manual_V18-3.docx
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Setting up MySQL Server IP address.



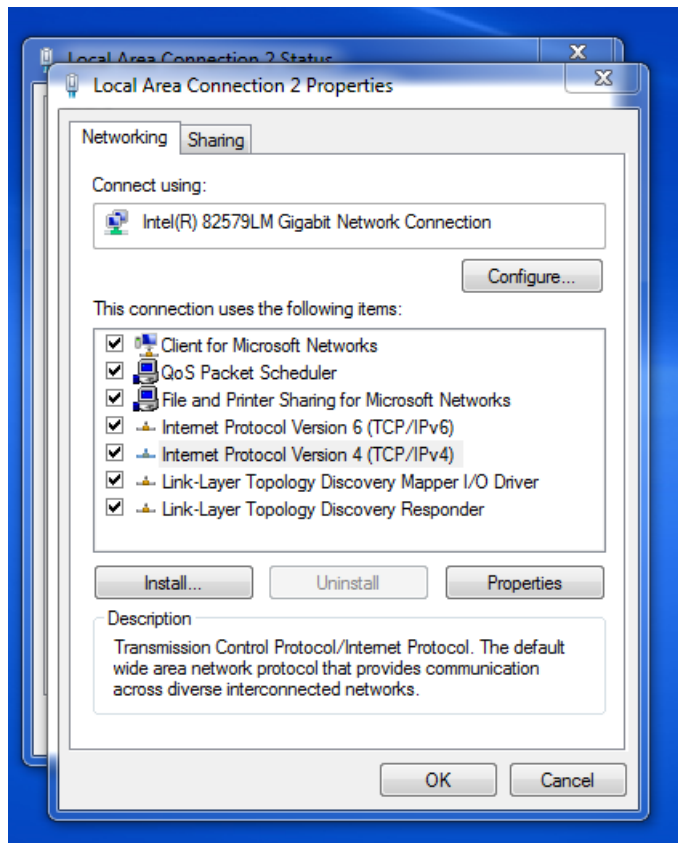
Select the net card you want to use to communicate with the PLC.



Double click on the net card to open the setup utility.

Select "Properties"

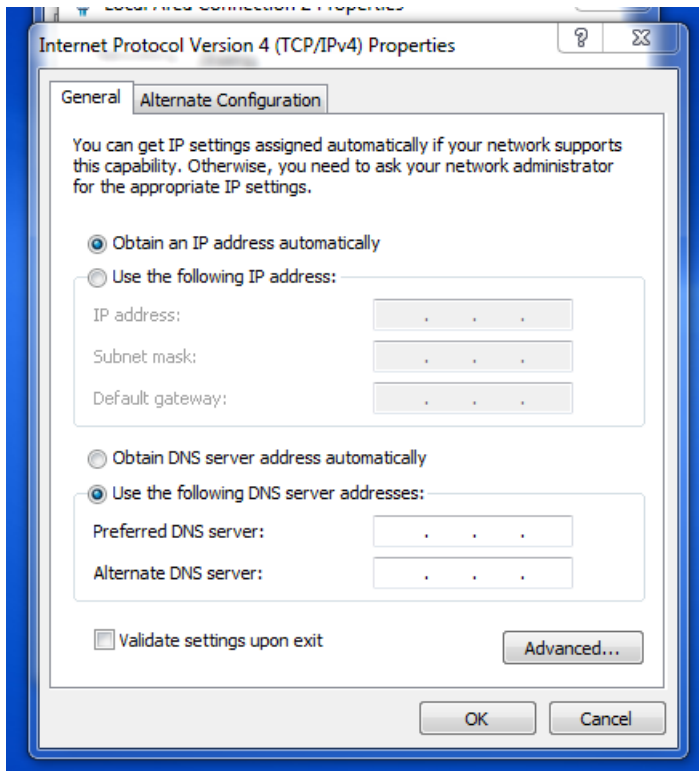
Subject	MySQL for PLC SQL	Document:	MySQL Installation Manual_V18-3.docx
Ref.	MySQL Version 2018-3	Revision:	2019-03-27 by FBH



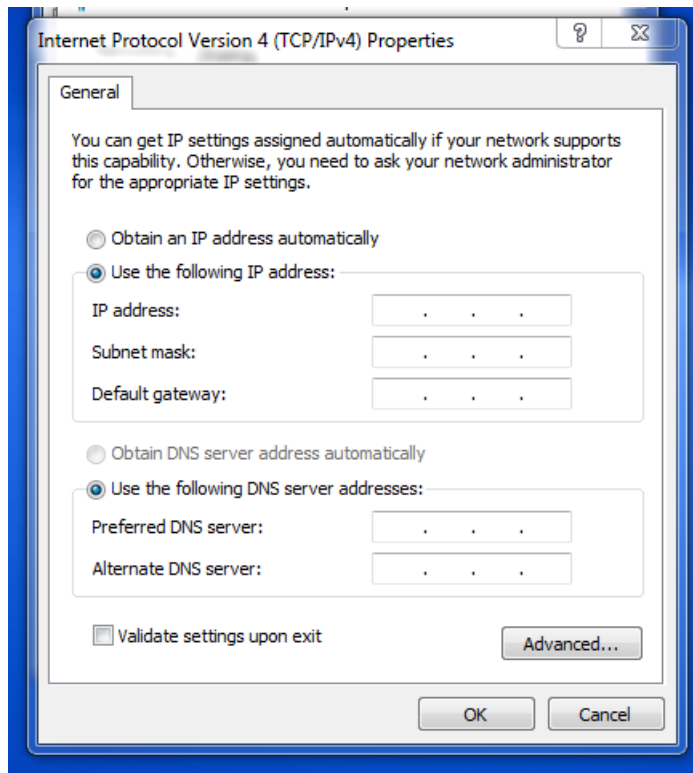
Select "Internet Protocol Version 4 (TCP/IPv4)"

Select "Properties"

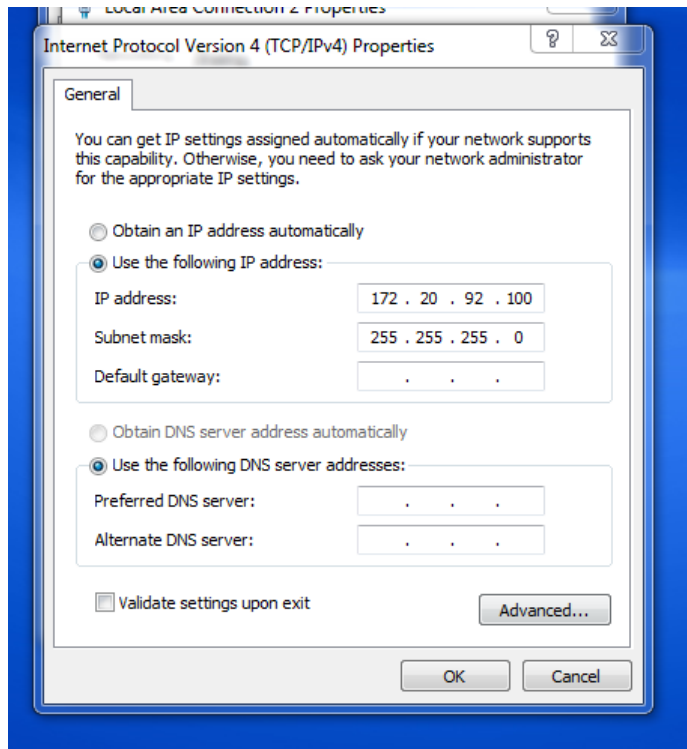
Subject	MySQL for PLC SQL	Document:	MySQL Installation Manual_V18-3.docx
Ref.	MySQL Version 2018-3	Revision:	2019-03-27 by FBH



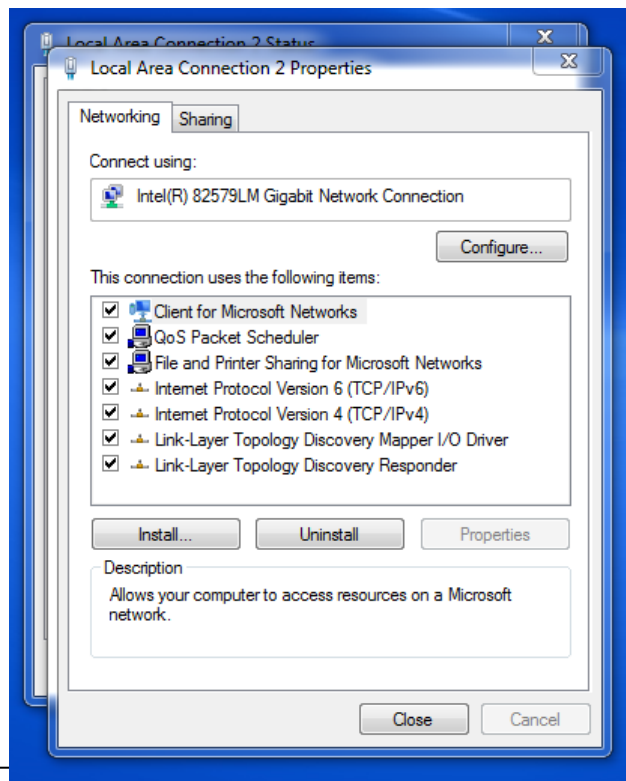
Select "Use the following IP address"



Subject	MySQL for PLC SQL	Document:	MySQL Installation Manual_V18-3.docx
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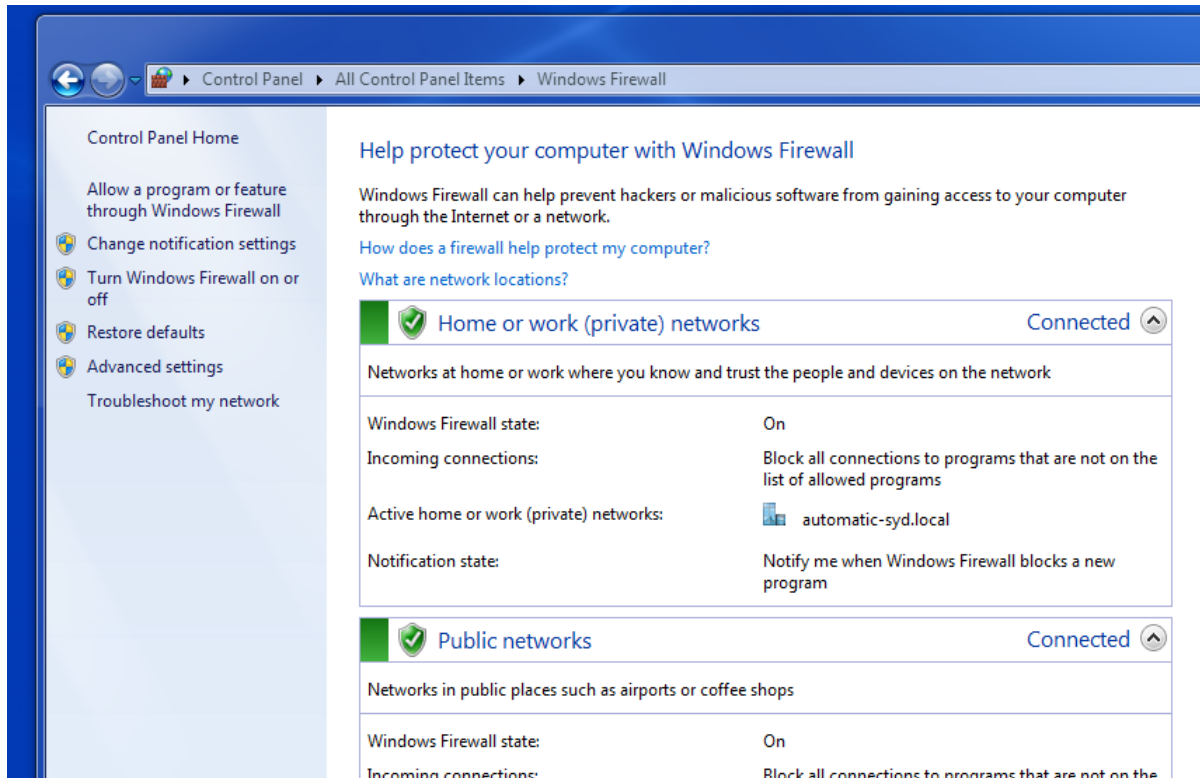
Type the IP address you want the server to have, Click “OK”.
It is necessary that the SQL server has a fixed IP address.



Subject	MySQL for PLC SQL	Document:	MySQL Installation Manual_V18-3.docx
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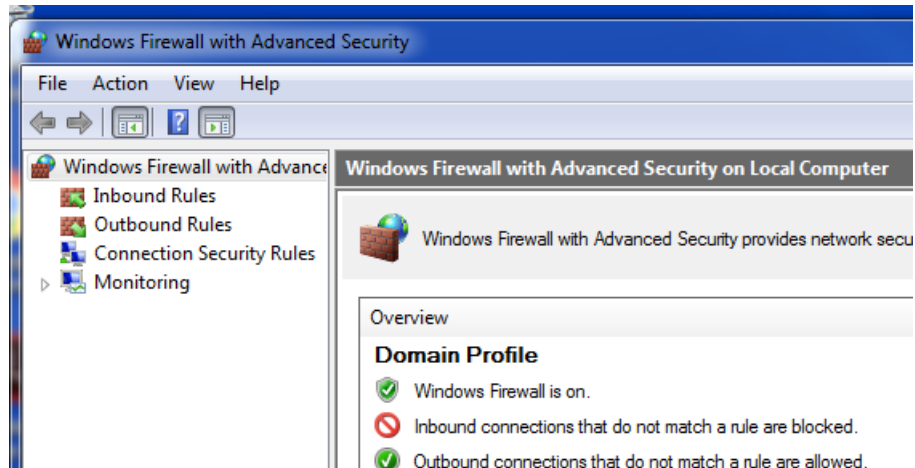
If you want to test the connection to the SQL server from another PC, you may use the built-in command “Ping”.

From Windows 10, the “Ping” answer is blocked by the firewall, so you have to enable the server to answer the “Ping” request.

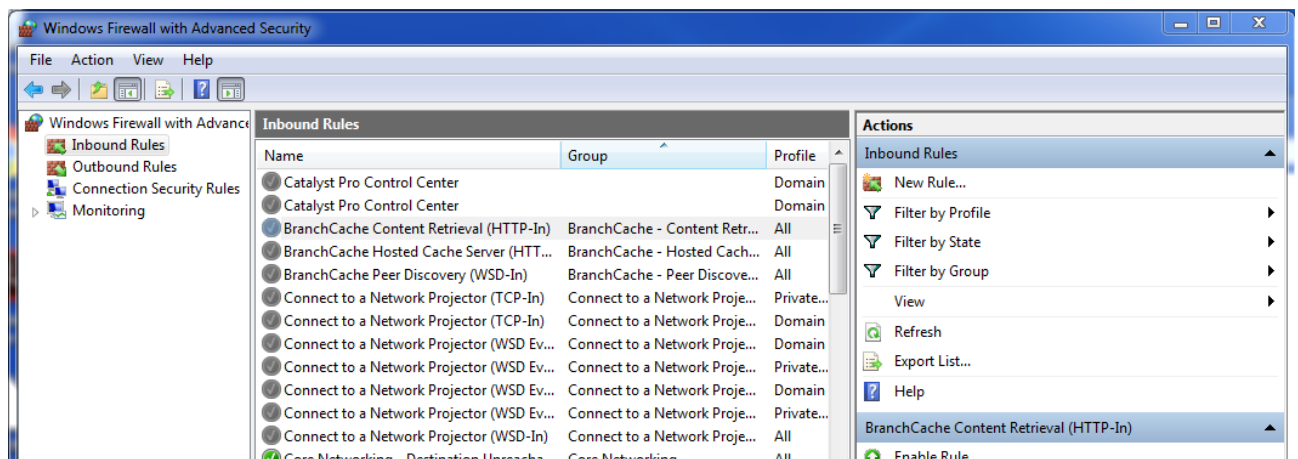


Open firewall, and select “Advanced settings”

Subject	MySQL for PLC SQL	Document:	MySQL Installation Manual_V18-3.docx
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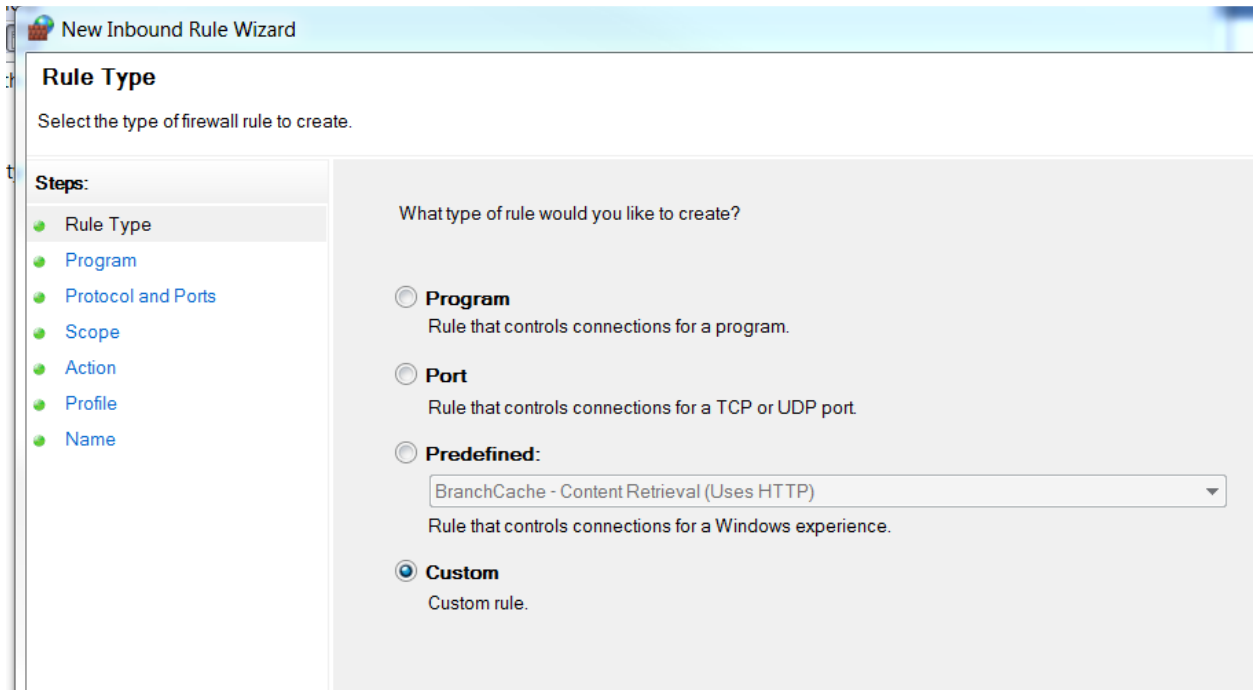


Select "Inbound Rules"

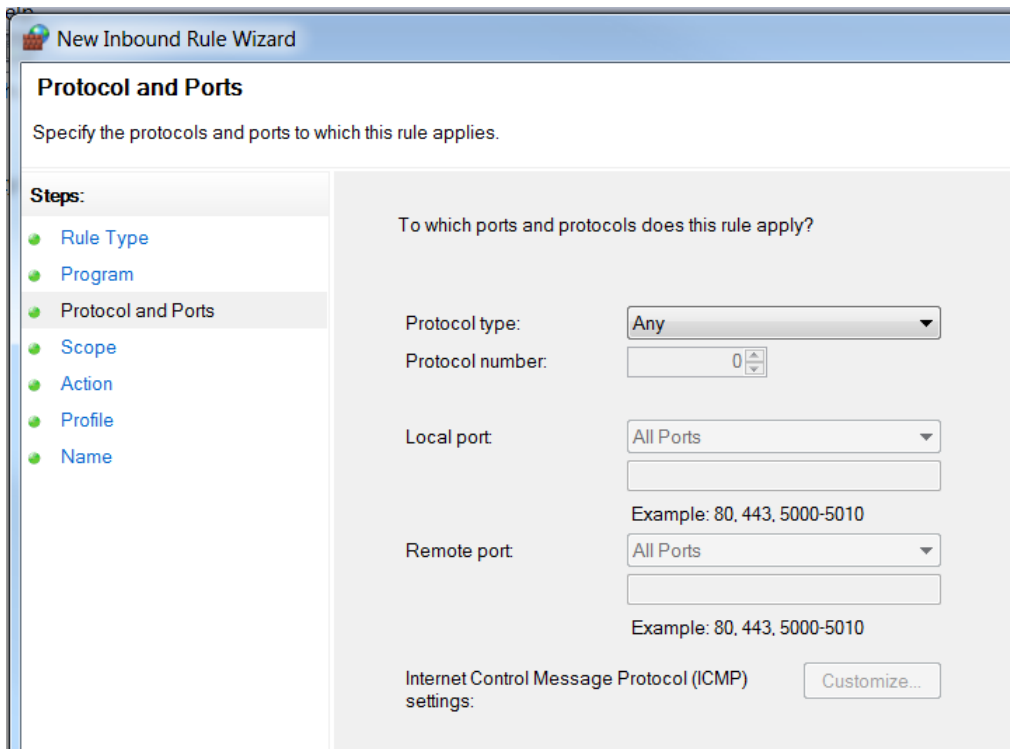


Select "New Rule....."

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As "Rule Type", select "Custom".



Select "Protocols and Ports".

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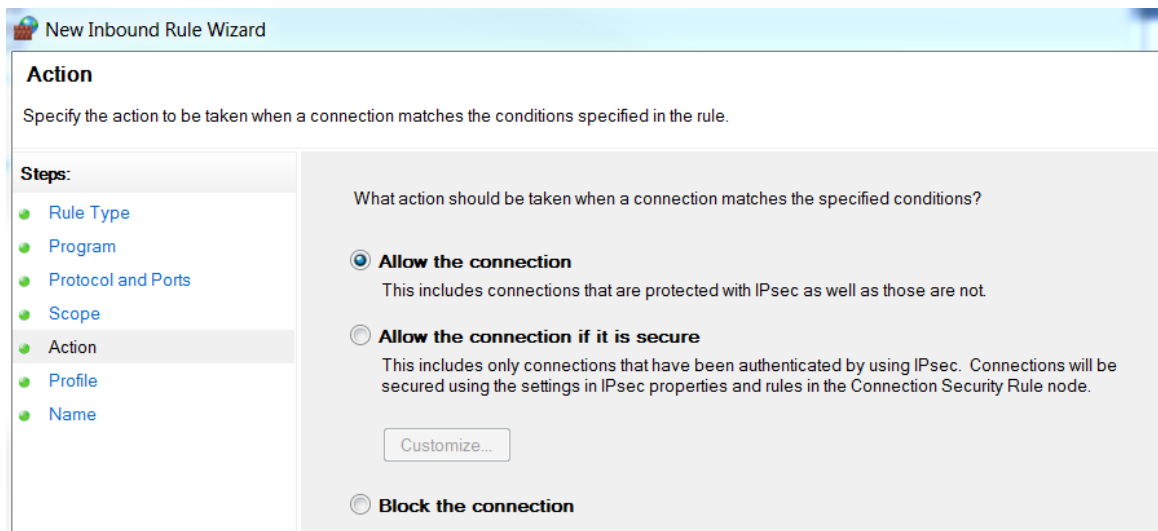
Protocol and Ports

Specify the protocols and ports to which this rule applies.

Select "ICPMv4", next.

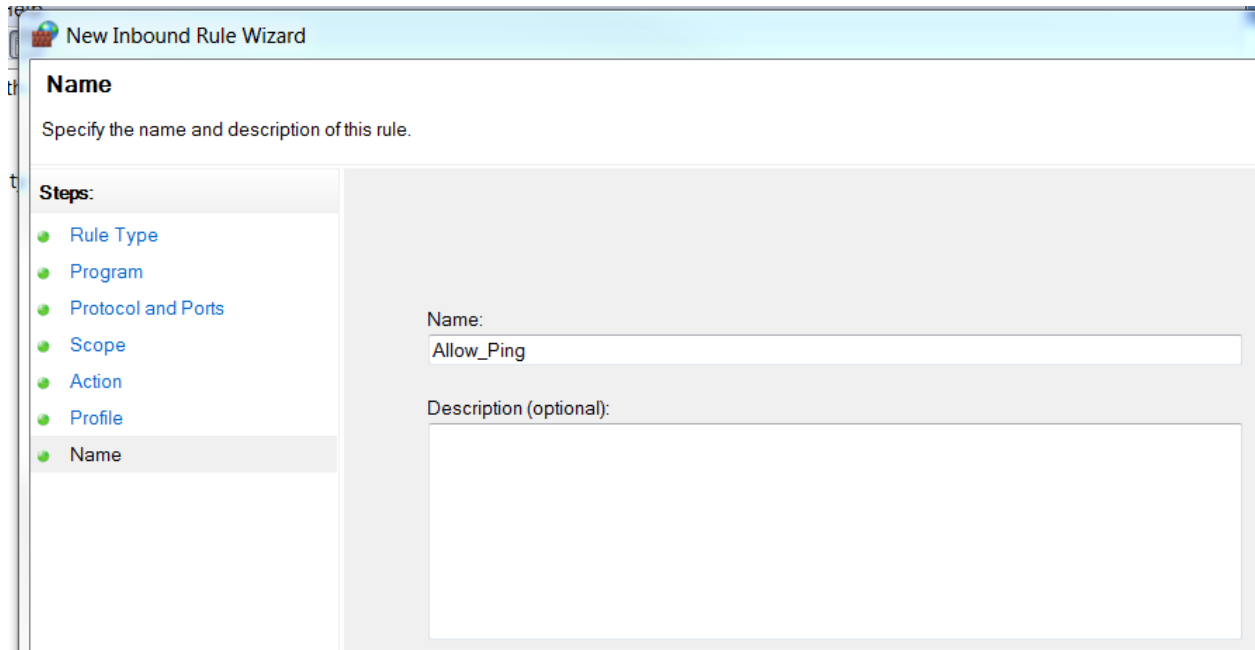
Here you can specify witch IP the rule apply to.

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If the connection not is “allowed” it makes no sense in this case.

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Give the rule a name.

Now you should have the possibility to “Ping” the server IP with the build in “Ping” command.

I want also to check if the port 1433 is available, and I found a free tool on the internet that can check the IP and the Port with the same tool.

The tool is called “Tcping”, just search on the internet.

The tool is running in the “CMD” prompt, just like “Ping”.

```
C:\Users\KJA>tcping64 172.20.92.100 1433

Probing 172.20.92.100:1433/tcp - Port is open - time=7.728ms
Probing 172.20.92.100:1433/tcp - Port is open - time=1.098ms
Probing 172.20.92.100:1433/tcp - Port is open - time=1.023ms
Probing 172.20.92.100:1433/tcp - Port is open - time=1.094ms

Ping statistics for 172.20.92.100:1433
    4 probes sent.
    4 successful, 0 failed.
Approximate trip times in milli-seconds:
    Minimum = 1.023ms, Maximum = 7.728ms, Average = 2.736ms
```

The connection is OK and the port is open.

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Create PLCSQL database.

Included in the delivery, there is a script that creates the following in the SQL database.
The default name of the database is "PLCSQL"

- 1: Tables for "Log" data from the PLC to SQL.
- 2: Tables for "Recipe" data from SQL to PLC.
- 3: Default user "plcsql" (you may change the user before you run the script).
- 4: Permissions to the user "plcsql" to access, read, and write in PLCSQL database.
(you may change the name of the database before you run the script)
- 5: Stored procedures that is used to handle the data flow between SQL and PLC.



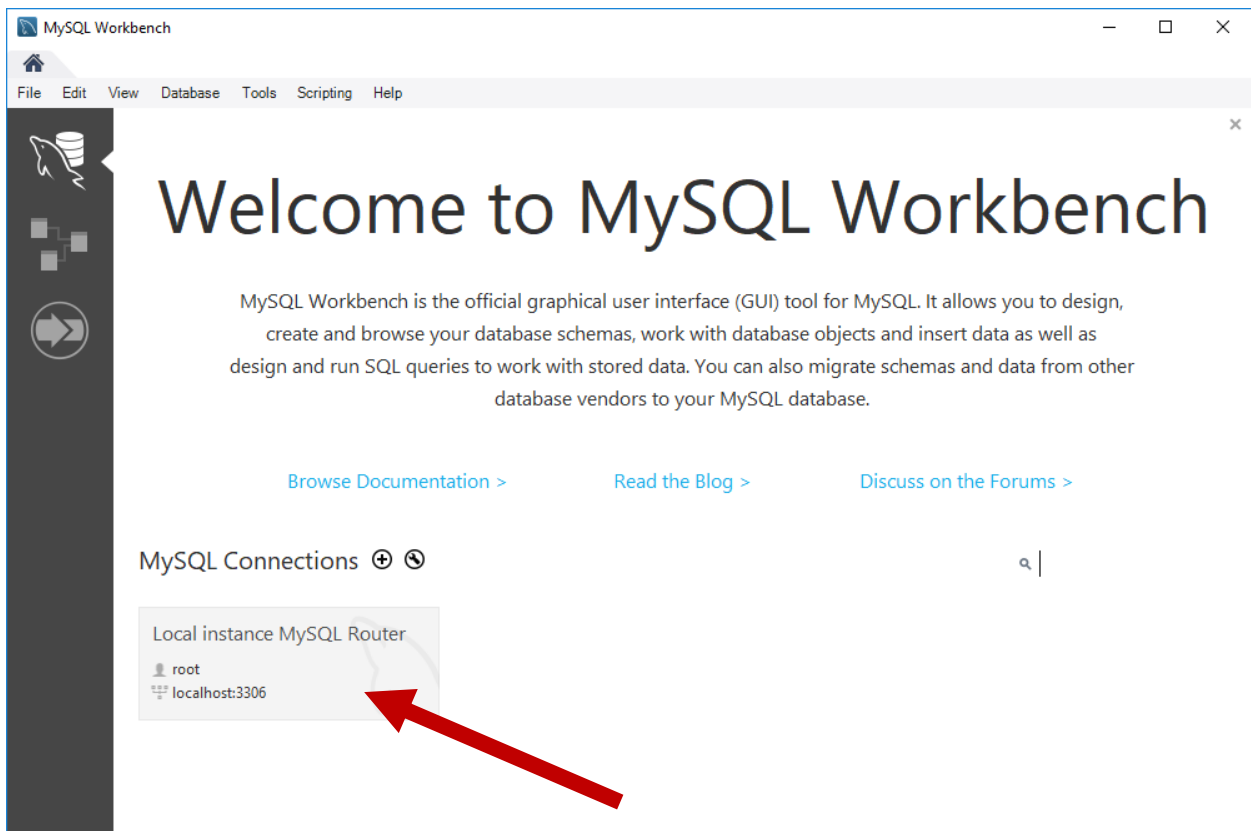
To Create the database needed for PLCSQL, you will need the program MySQL Workbench. If you have chosen Setup Type Full server installation, then the file is already installed, if not, then you have to download it from <https://dev.mysql.com/downloads/workbench/>. Select the newest version of MySQL Workbench.

The name of the script, is "Create-database-plcsql_mysql_v02.sql", and is included in the delivery.

Subject	MySQL for PLC SQL	Document:	MySQL Installation Manual_V18-3.docx
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Installation Manual: MySQL for PLC SQL link

On Windows 10, open MySQL Workbench. Click Start, type mysql workbench, and the press ENTER.

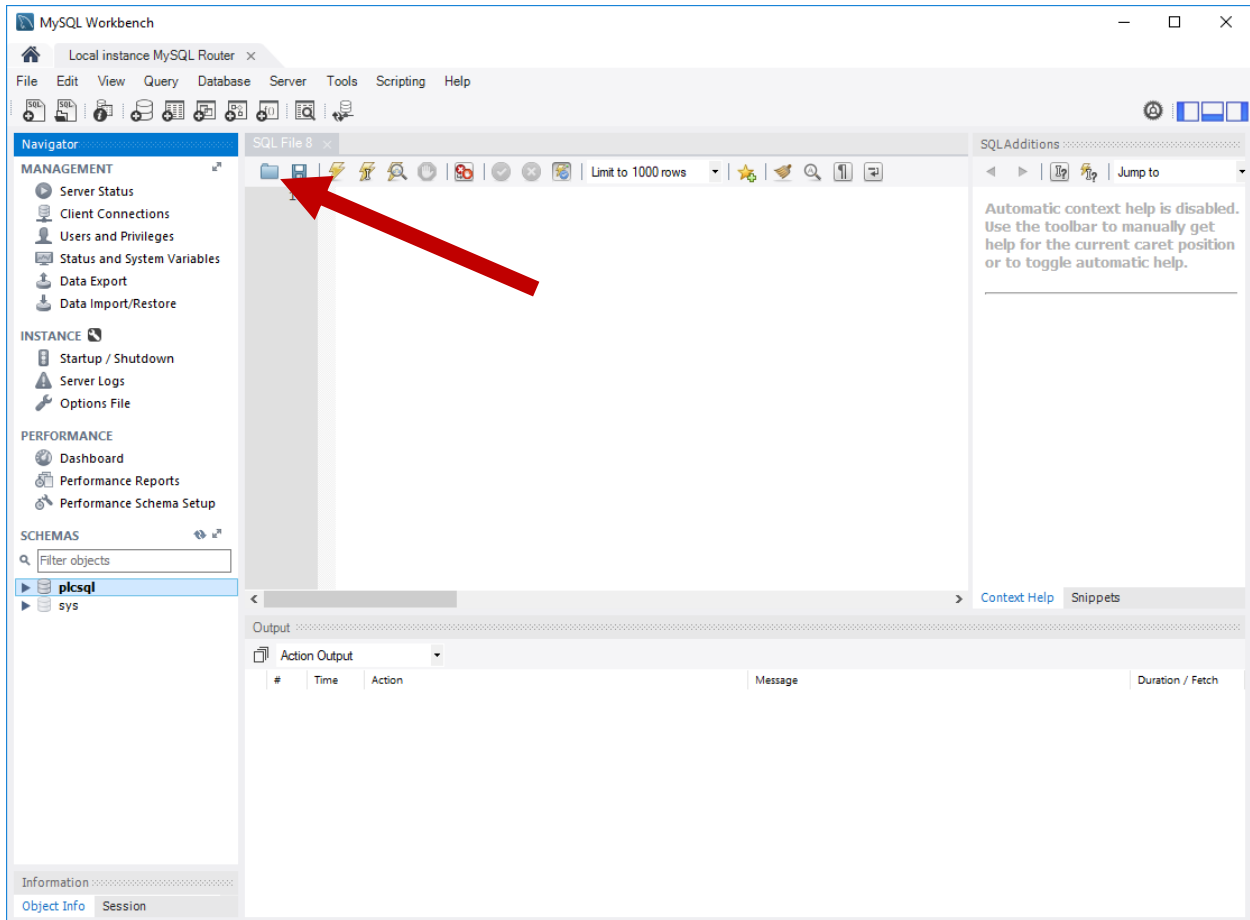


Click on Local instance MySQL Router

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Installation Manual: MySQL for PLCSQL link

After connected to the Local instance, you will able to manage the MySQL server.

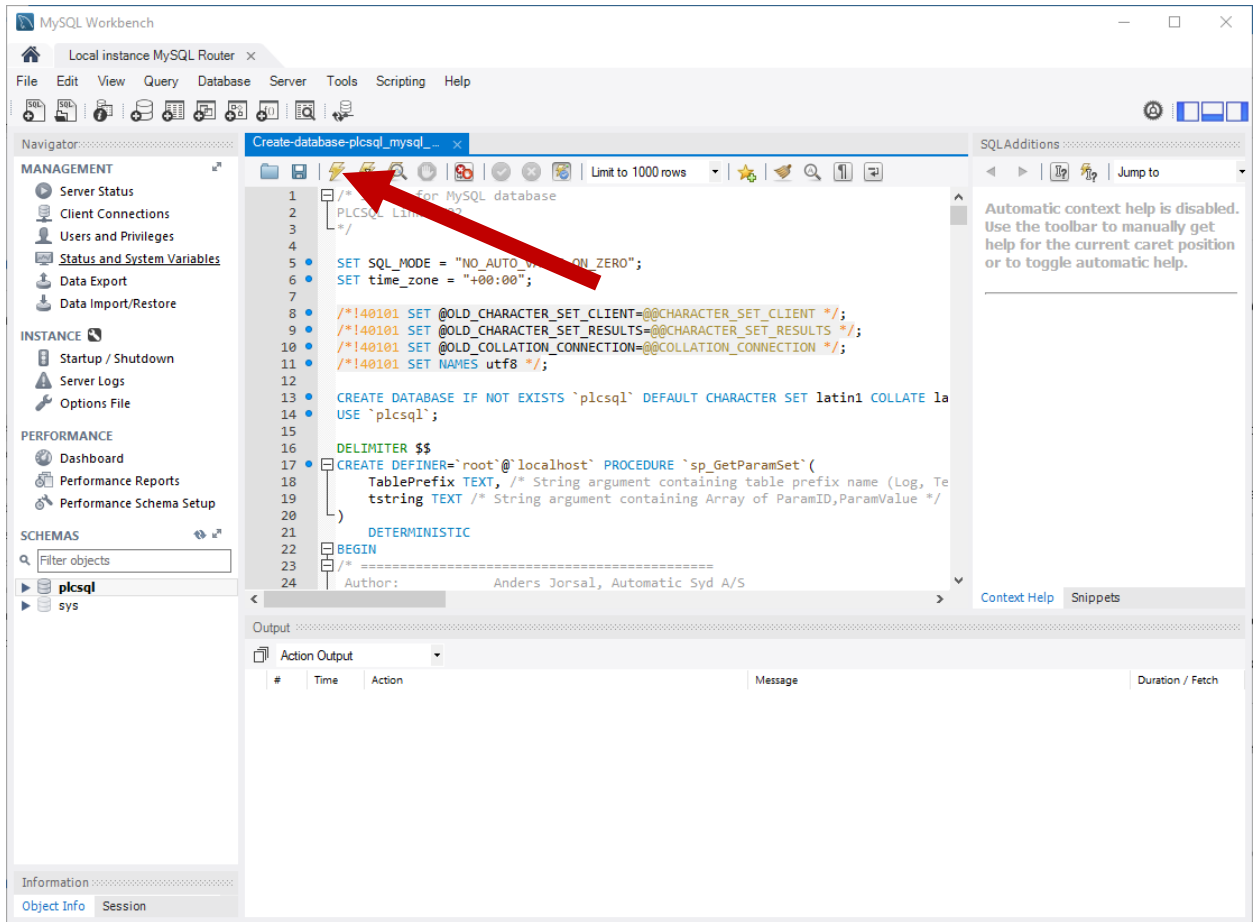


Click on Open SQL Script and select Create-database-plcsql_mysql_v02.sql.

Subject	MySQL for PLC SQL	Document:	MySQL Installation Manual_V18-3.docx
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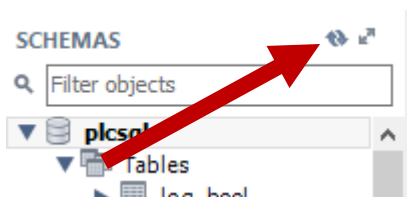
Installation Manual: MySQL for PLCSQL link

After the Create-database-plcsql_mysql_v02 script has been loaded press Execute.



The script will now create database, tables, stored procedures and user.

After script has successful executed. Click on Refresh SCHEMAS to show the plcsql database.



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Ref.	MySQL Version 2018-3	Revision:	2019-03-27 by FBH

System parameters.

There are 3 “system parameters” placed in “Log” and “Recipe”
In both tables it is the following 3 parameters.

10001:	SetCount	Data type “Int”
15001:	SetID	Data type “Dint”
30001:	DateTimeStamp.	Data type “String”

The “SetCount” parameter 10001 contains the number of parameters excluding parameter 10001,15001, and 30001 in “this” actual “dataset”.

The “SetID” parameter 15001, contains the unique number that every “dataset” get when something is stored in the SQL database. The “SetID” number changes only when something is stored in the SQL database, e.g. you trigger the “Log data” function from the PLC or you generate a new “Recipe” in the SQL database. Every time you save a “dataset” in the SQL database, all parameters in this specific “dataset” will get the same “SetID” number, it is the “SetID” number that “connects” all the parameters in this specific “dataset” together.

The “DateTimeStamp” contains the date and time when this “dataset” was stored in the SQL database.

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Appendix, Code Snippets



Attention! Some the following code examples is not intended to use on a “Company” data base, they are intended to use on a local “test” data base, so you can find out how the system is working.

Generate a “Recipe” in the SQL data base.

Normally the “Recipe” data will be generated elsewhere in the “system”, but for testing purposes you can generate you own recipes.

```
CALL sp_SaveParams(1, N'Recipe',N'1;1.111;10002;1;15002;11111111;30003>HelloWorld 1');
```

Explanation

sp_SaveParams, is the name of the “Procedure” that saves the data

“1”, is a “user” number, the number is mandatory, but you can change the value.

“N” sets the character set to Unicode.

‘Recipe’ is the “Table” we are using.

“1;1.111” the first “1” is the parameter number, the “1.111” is the value to place in the parameter

“10002;1” is again parameter number “10002” and value “1”

“15002;11111111” is again parameter number “15002”, and value “11111111”

“30003>HelloWorld 1” is again parameter number “30003”, and value “HelloWorld 1”

All parameter and values are typed as “strings”, the “” at start and end defines a string.

Type definitions

1..9999	REAL type.
10001..14999	INT type, signed.
15001..19999	DINT type, signed
20001..29999	BOOL type
30001..30999	STRING types, length 1..254 characters.

CAUTION

Parameter number 10001, 15001, and 30001 are used internally and may not be written to by the user.

Output from the PLCSQL data base

SetID	ParamID	ParamValue
1	1	0.45
1	2	-45.23

Table “Recipe_REAL”

The “SetID” is “1”

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Result Grid	Filter Rows:	
SetID	ParamID	ParamValue
1	10002	12345
2	10002	2311

Table “Recipe_INT”
The “SetID” is “1”

Result Grid	Filter Rows:	
SetID	ParamID	ParamValue
1	15002	12345678
2	15002	121111111
3	15002	121111111

Table “Recipe_DINT”
The “SetID” is “1”

Result Grid	Filter Rows:	
SetID	ParamID	ParamValue
1	30002	Recipe A
2	30002	AJOTEST

Table “Recipe_STRING”
The “SetID” is “1”

Result Grid	Filter Rows:	Ed	
SetID	SetCount	UserID	ParamValue
1	7	1	2018-08-06 08:23:09
2	6	1	2018-09-12 11:11:15
3	6	1	2018-09-12 11:39:46

Table “Recipe_DATETIME”
The “SetID” is “1”

“SetCount” is 4, meaning we have 4 entries in this recipe.

“UserID” is 1

“ParamValue” the date and time where this recipe was stored in the data base.

If you now from the PLC run the following command “GetParamSet;30003;HelloWorld 1”,(syntax not correct, only shown for better understanding).

Then you will get the 4 parameter’s in this recipe. You can choose any of the 4 parameter in the “GetParamSet” command, because all other parameters with the same “SetID” will be send to the PLC.

Next time you store the same recipe or another recipe, the “SetID” will change (+1)

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!!!!!!!!!!!!!!!!!!!!!! Attention, the following 2 example's will result in DATALOSS !!!!!!!!!!!!!!!

Delete the CONTENT of the "Log" tables.

```
use PLCSQL
truncate table Log_string
truncate table Log_bool
truncate table Log_dint
truncate table Log_int
truncate table Log_real
truncate table Log_datetime
```

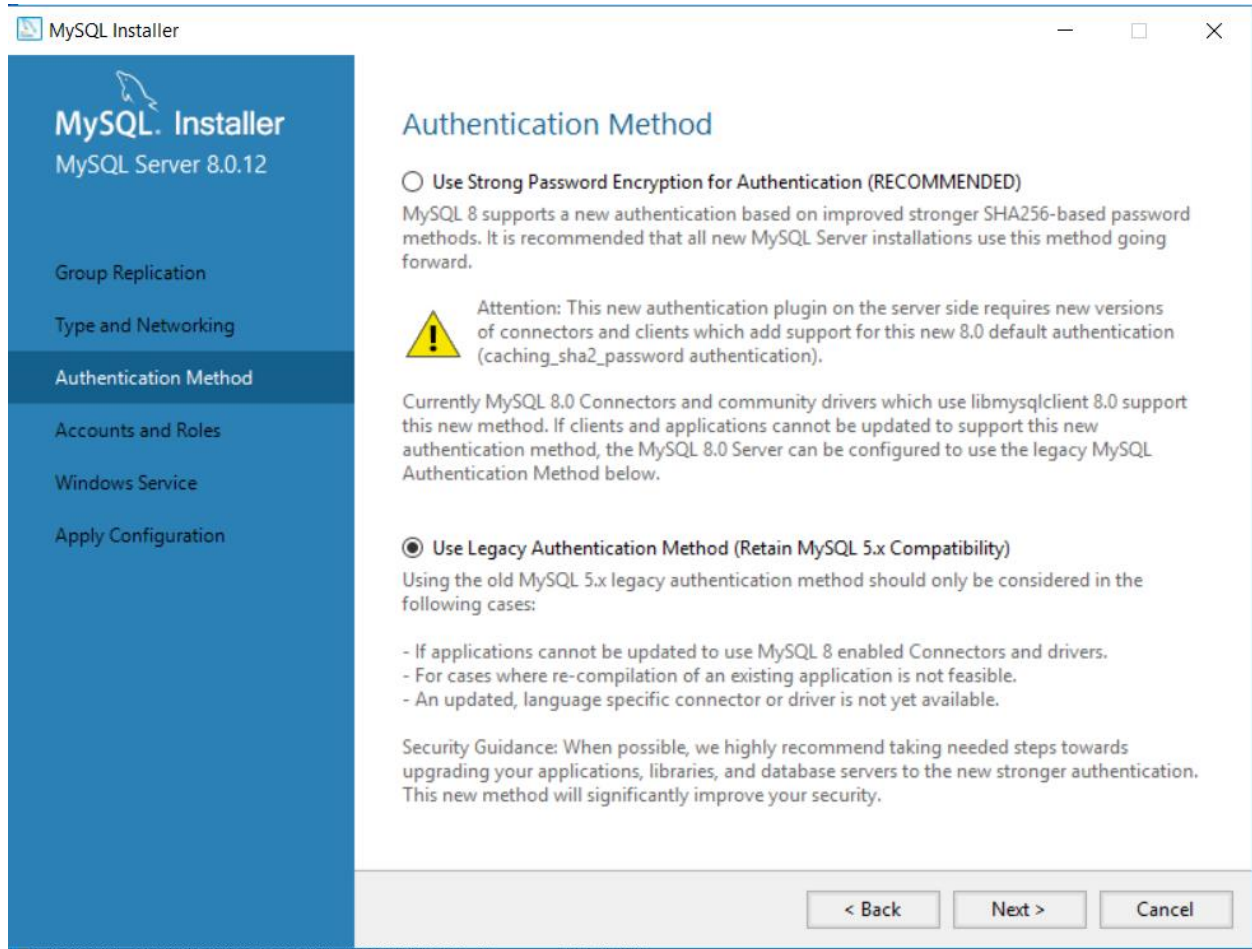
Delete the CONTENT of the "Recipe" tables.

```
use PLCSQL
truncate table Recipe_string
truncate table Recipe_bool
truncate table Recipe_dint
truncate table Recipe_int
truncate table Recipe_real
truncate table Recipe_datetime
```

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MySQL 8.xx Authentication and User

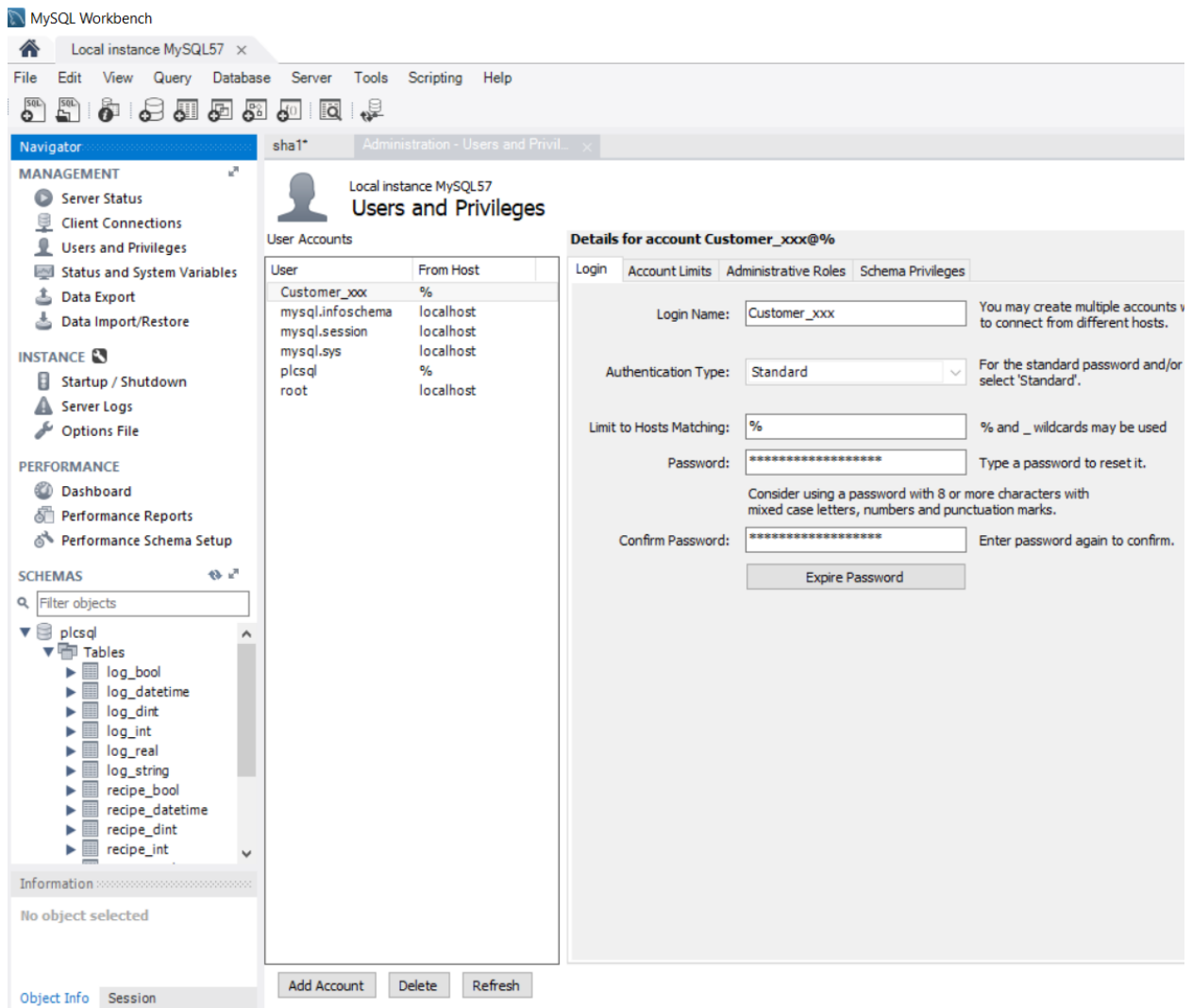
Be aware when installing MySQL 8.xx to use Legacy Authentication Method.



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Installation Manual: MySQL for PLCSQL link

If you want to use password to connect to Mysql database please select Authentication Type Standard. Only implemented in TIA V 15.1



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