PFEIFFER VACUUM

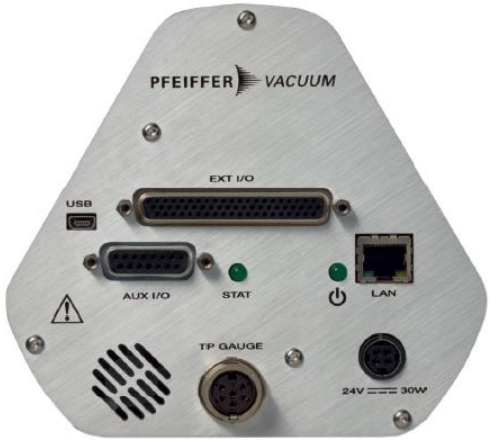
PRISMAPRO

Communication Possibilities

Thomas Busch • R&D Measurement and Analysis Equipment

Agenda

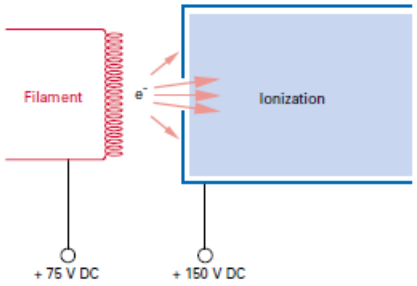
1. Introduction to PrismaPro

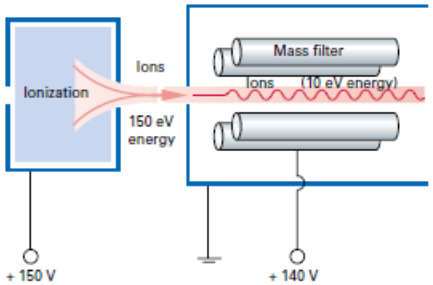


Standard: 1x AI, 2x DI, 1 Relay

Extended: 8x AI, 5x DI, 10x DO, 8x AO
1x total Pressure-Transmitter

2. Functionallity





The PrismaPro is a quadrupole mass spectrometer.

The neutral gas paticles are ionized in an ion source and the ions are separated from each other in a high-frequncy electric quadropole field according to their mass and charge conditions.
The detection of the filtered ions is carried out using Farady Cup or secondary electron multiplier.
The detected ion flow is proportional to the partial pressure of the respective gas components

We are measuring Ion-Current for adjusted amu

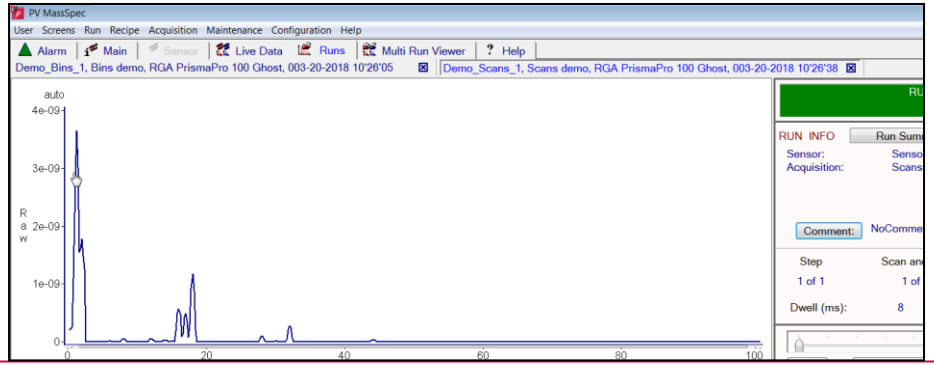
https://www.youtube.com/watch?v=TrLMNRyQiaA

3. Communication possibilities

- WebUI:
  http://192.168.1.100

- PVMassSpec
  Start exe

  YouTube-Video:



3. Communication possibilities

- MMSP-API: (**M**odular **M**ass **Sp**ec - Web-API, http port: 80)
  Is a web server, whose API is accessed over HTTP.

API: Application Programming Interface

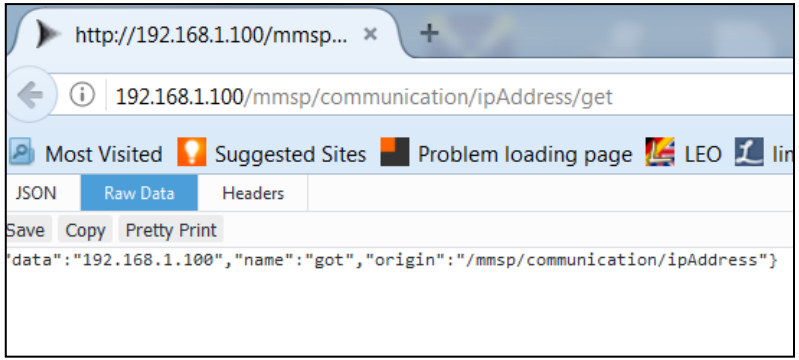
Is a set of subroutine definitions, protocols and tools for building application software. In general terms, it is a set of clearly defined methods of communication between various software components (*wikipedia*)

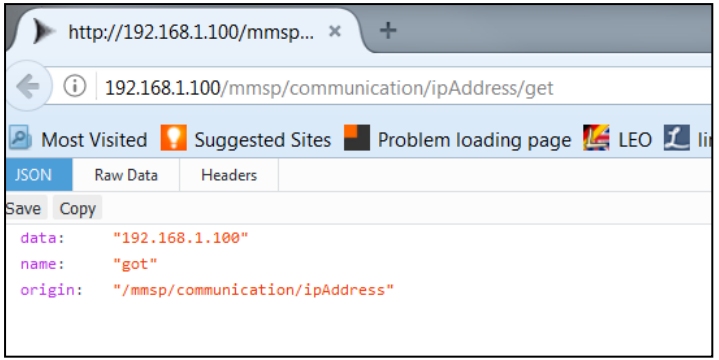
Documentation for the API usually is provided to facilitate usage and Implementation.

https://en.wikipedia.org/wiki/Application_programming_interface

4. API-Communication

- Web-Browser-Input:
  http://192.168.1.100/mmsp/Communication/ipAddress/get





- cURL (.bat-File) API-Get_IP API-Set_Sweep .txt
  cURL is a command line tool for getting or sending files using URL syntax (*wikipedia*)

- Access/Excel mit VBA API-Access API-Excel

4. API-Communication

- JSON (**J**ava**S**cript **O**bject **N**otation) www.json.org

is an open-standard file format that uses human-readable text to transmit data objects consisting of attribute–value pairs and array data types (*wikipedia*)

It is a syntax-analysis necessary (Parsing) to resolve the dataset into his related elements.

Parse JSON:

Raw-Data: **{"data":"192.168.1.100","name":"got","origin":"/mmsp/communication/ipAddress"}**

data	192.168.1.100
name	got
origin	/mmsp/communication/ipAddress

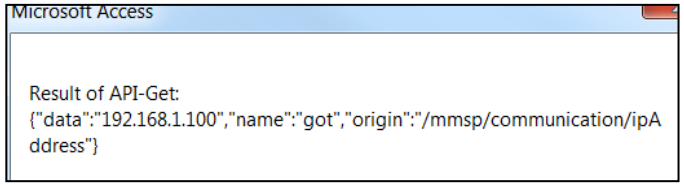
Example 1: MS-Excel: PrismaPro_API_Service.xlsm

	API-Reference "PrismaPro":			IP-Address PrismaPro:		http://192.168.1.100
	The usage of the API is at your own risk !!					API-Reference_EULA.pdf
Nbr	Target		index	set Value:		Title
1	mmsp	get	-	-		*Modular Mass Spec*
2	electronicsInfo	get	-			*Electronics Information*
3	serialNumber	get	-	STMS16064	set	*Serial Number*
4	monitorFWVersion	get	-	-	X	*Monitor Firmware Version*
5	controlFWVersion	get	-	-	X	*Control Firmware Version*
6	genus	get	-	4	set	*Genus*
7	massRange	get	-	-	X	*Mass Range*
8	communication	get	-	-		*Communications Port Configuration*
9	ipAddress	get	-	192.168.1.100	set	*IP Address*
10	macAddress	get	-	:A0:41:02:10:	set	*MMSP MAC Address*
11	gateway	get	-	0.0.0.0	set	*MMSP Gateway*
12	mask	get	-	255.255.255.0		*MMSP Mask*

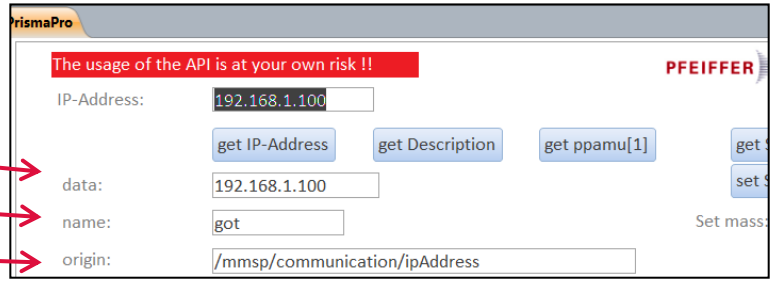
Example 2: MS-Access+VBA


```
Set httpObject = CreateObject(" MSXML2.XMLHTTP ")
httpObject.Open "GET", "" & "http://" & IPADDRESS & "/mmsp/communication/ipAddress/get", False
httpObject.Send
result = httpObject.ResponseText
```

```
MsgBox ("Result of API-Get: " & result)
Dim JSON As Object
Set JSON = JsonConverter.ParseJson(result)
```



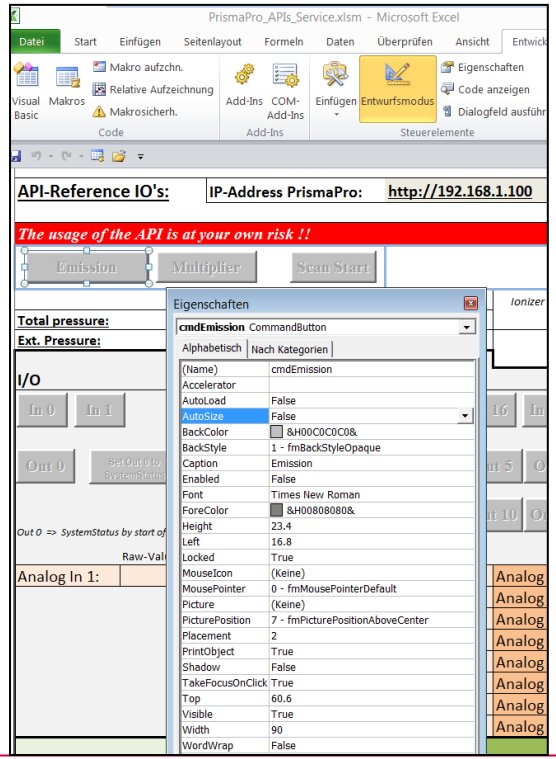

```
Text3.Value = JSON("data")
Text6.Value = JSON("name")
Text8.Value = JSON("origin")
```



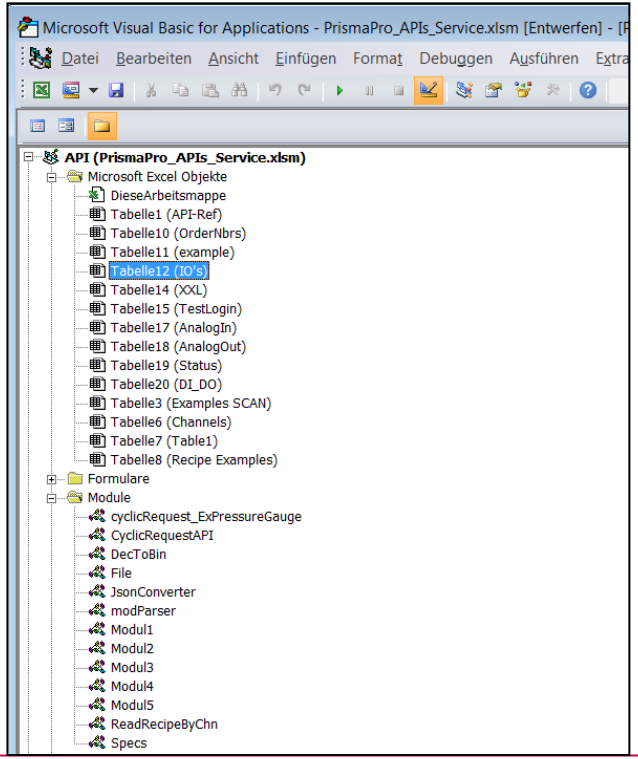
Example 3: MS-Excel+VBA:

(Microsoft Excel sheet with Macros)

PrismaPro_API_Service.xlsm



Alt + F11



Example 3:

Toggle Emission

cmdEmission | Click

```
Private Sub cmdEmission_Click()
Dim httpObject As Object
Dim i As Integer
Dim IPADDRESS As String
Dim result As String
Dim EMISSION As String

On Error GoTo fault
Set httpObject = CreateObject("MSXML2.XMLHTTP")
Dim JSON As Object

IPADDRESS = Worksheets("API-Ref").Cells(2, 12)

' Emission-------------------------------------------------------------------
httpObject.Open "GET", "" & IPADDRESS & "/mmsp/generalControl/setEmission/get", False
httpObject.Send
result = httpObject.ResponseText
Set JSON = JsonConverter.ParseJson(result)
EMISSION = JSON("data")
If (EMISSION = "On") Then
    httpObject.Open "GET", "" & IPADDRESS & "/mmsp/generalControl/setEmission/set?Off", False
    httpObject.Send
    Else
    httpObject.Open "GET", "" & IPADDRESS & "/mmsp/generalControl/setEmission/set?On", False
    httpObject.Send
End If

Exit Sub
'Fault????
fault:
    MsgBox ("No/Wrong Answer from PrismaPro! =>Error: " & ERROR)

End Sub
```

5. EULA (End User License Agreement)

- Software: API *(limited to ~350), shall be treated as confidential, …*
- Hardware: PrismaPro
- Advantage for EULA-Users:
  API-Reference-List, Login name/password
  Examples, Support, ….. free of charge
  Free access to PV-Cloud-Folder „EULA-Customer“
- Advantage for Pfeiffer Vacuum :
  Better control who uses the API + PrismaPro
  Legal certainty, …

6. PV-Cloud

- Folder: „EULA-Customer“

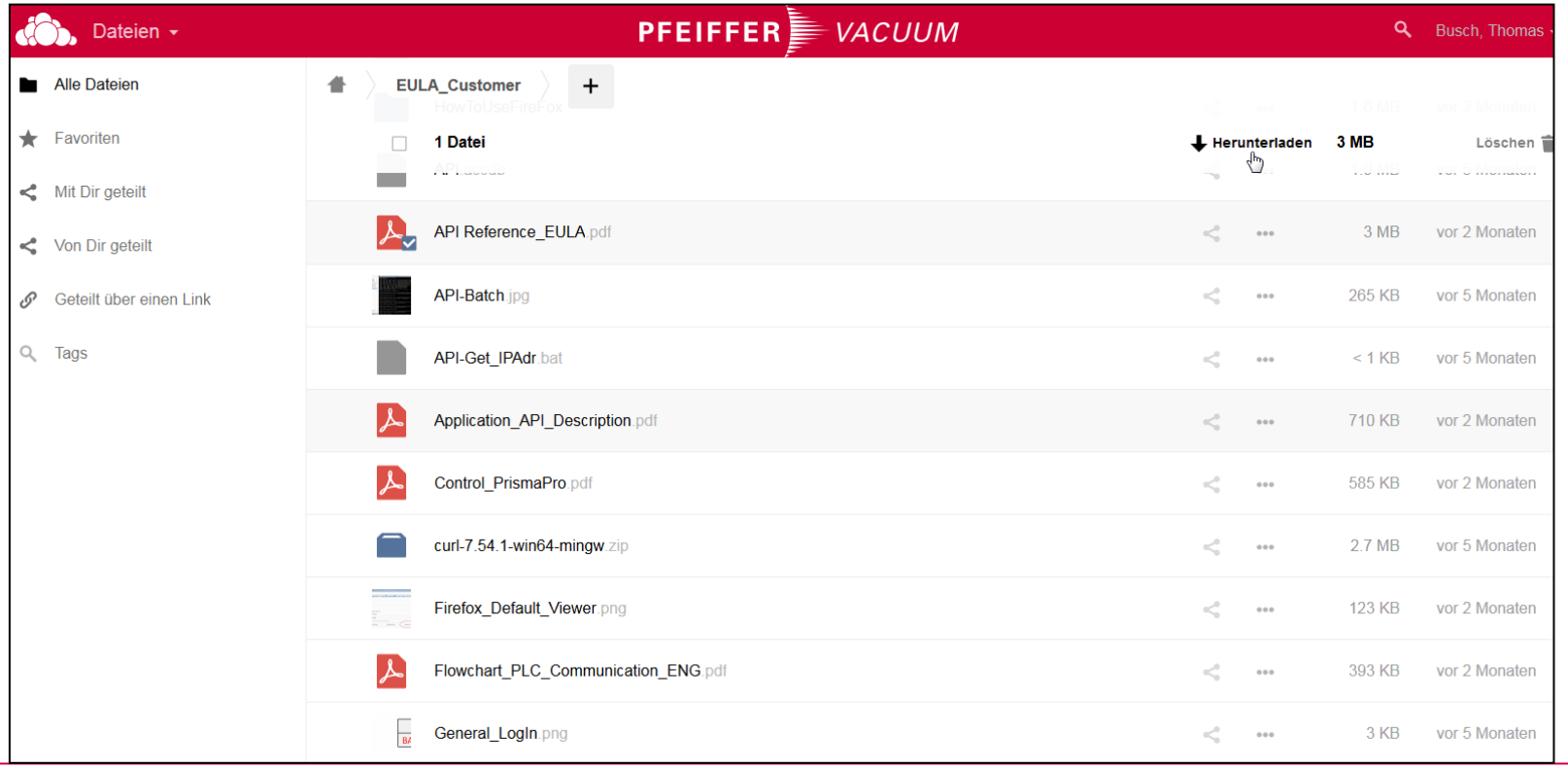
  EULA-Users are invited (by E-Mail)
  Password necessary

- Content :

  API Reference List
  MS-Excel-Sheets with VBA
  cURL
  API-Batch
  LabView-Driver
  Flowcharts, …

  Folder will be updated from time to time

6. PV-Cloud

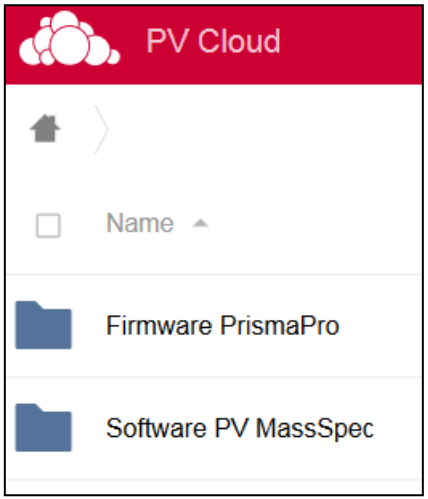

Dateien
PFEIFFER VACUUM
Busch, Thomas
Alle Dateien
Favoriten
Mit Dir geteilt
Von Dir geteilt
Geteilt über einen Link
Tags
EULA_Customer
1 Datei
Herunterladen
3 MB
Löschen
API Reference_EULA.pdf 3 MB vor 2 Monaten
API-Batch.jpg 265 KB vor 5 Monaten
API-Get_IPAdr.bat < 1 KB vor 5 Monaten
Application_API_Description.pdf 710 KB vor 2 Monaten
Control_PrismaPro.pdf 585 KB vor 2 Monaten
curl-7.54.1-win64-mingw.zip 2.7 MB vor 5 Monaten
Firefox_Default_Viewer.png 123 KB vor 2 Monaten
Flowchart_PLC_Communication_ENG.pdf 393 KB vor 2 Monaten
General_LogIn.png 3 KB vor 5 Monaten

6. PV-Cloud

- Folder: „PrismaPro“

  PrismaPro-User are invited
  Password necessary

- Content: *Current Software PVMassSpec*
  Current Firmware for PrismaPro



Folder will be updated from time to time

7. Overview Applications

- **MPP-S7** PLC: SIEMENS S7-300/400/1500
  PC: SIMATIC IPC227E Nanobox PC
  Windows 7 / Windows 10

- MPP-AB — Rockwell, ….
  MPP-IQ-R — Mitsubishi
  MPP-OPC-UA — Beckhoff, Mitsubishi, Rockwell, ….
  (*any PLC/PC who can use „OPC-UA-Server“)*

- **LabView-Driver** Free of charge for EULA-Users

8. Application: MPP-S7

Network example 1:

Provide by Pfeiffer Vacuum

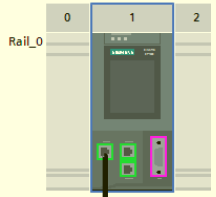
Siemens Box-PC
+ MPP-S7-Application

192.168.1.100
(Standard-IP-Addr.)

X1: 192.168.1.3
LAN-2

Customer part

Siemens PLC
S7-300/400/1500



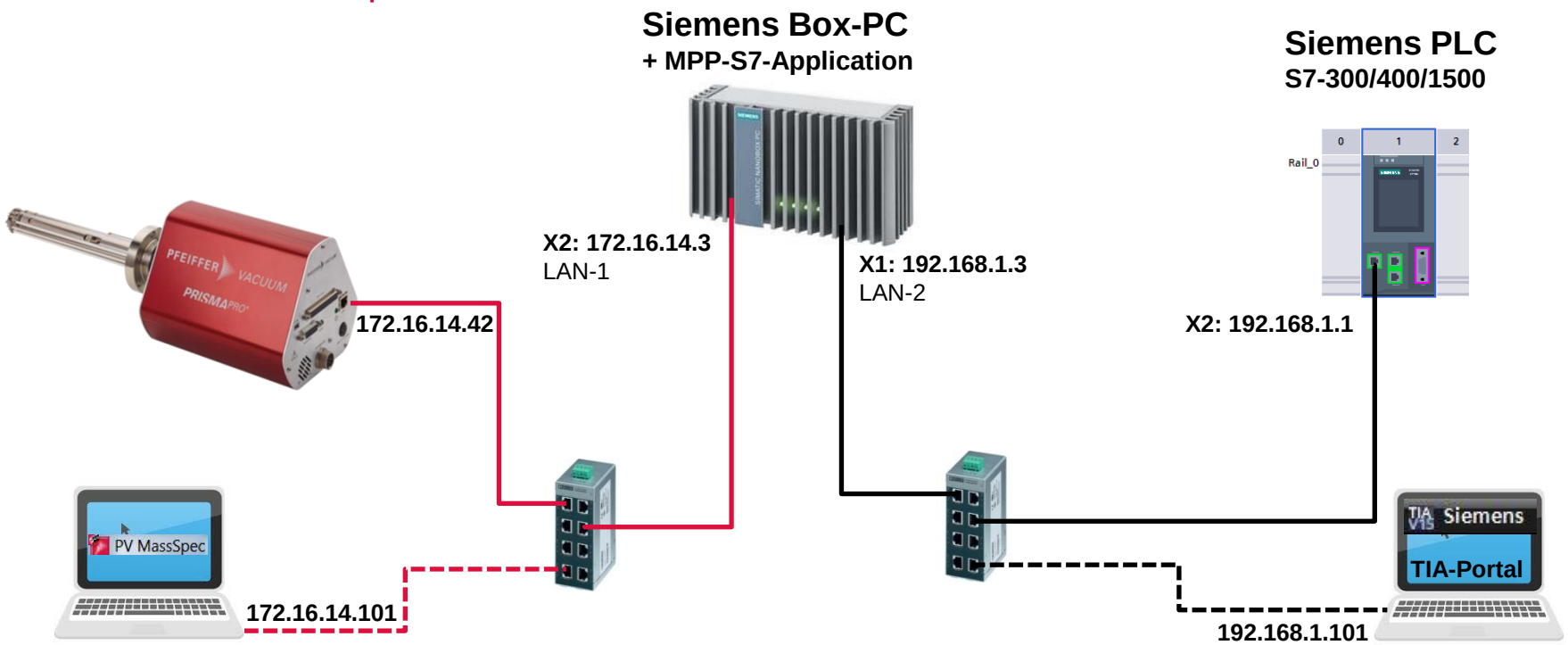
X2: 192.168.1.1

192.168.1.101

*(MPP-S7 : Application for Communication **Mass**-Spectrometer **Prisma****Pro** <=> Siemens SIMATIC-**S7** PLC)*

8. Application: MPP-S7

Network example 2:



8. Application: MPP-S7

MPP-S7 Description
Interface Description

SIEMENS

Main topics:

- Establish a connection to the PrismaPro and to the PLC
- Only work together with PrismaPro! and Siemens-PLC
- Switch On/Off Emission + EM
- Read/Write a recipe from/to the PrismaPro (currently 20 Channels/Recipe)
- Start/Stop a RUN with „Lock“ and „Release“ the PrismaPro for other Applications
- Read the measured values after each RUN (max. 3001 Datapoints/RUN)
- Cyclic reading: Internal + external Pressure (mBar & Pas & Torr)
  Faults and Warnings
  State of Emission, EM, Scan, …..
  Digital/Analog Inputs + Outputs (Option)

Feature: Adjust a recipe in PVMassSpec and use it in the Application

8. Application: MPP-S7

PLC 1516-3 PN/DP PLC Online (Watch-List):

Name	Adresse	Anzeigeformat	Beobachtungswert	Steu..	...	Variablen-Kommentar
"PrismaPro".Common.Lifebit	%DB100.DBX0.0	BOOL	TRUE	TRUE		Lifebit, is set all 1s by PLC, Reset by PrismaPro
"PrismaPro".Common.PrismaProErrorCode	%DB100.DBD2	DEZ	0	0		Errorcode from PrismaPro Device
"PrismaPro".Common.DriverErrorCode	%DB100.DBD6	DEZ	0	0		Errorcode from PrismaPro Device Driver
"PrismaPro".DeviceInfo.Genus	%DB100.DBB10	DEZ	4			PrismaPro: Communication Device Type: 4=PrismaPro
"PrismaPro".DeviceInfo.massRange	%DB100.DBW12	DEZ	100			PrismaPro: Possible mass Range
"PrismaPro".DeviceInfo.SensorName	P#DB100.DBX1...	String	'QMSPrismaPro'			PrismaPro: Sensor Name
"PrismaPro".Communication.IPAdress	P#DB100.DBX3...	String	'172.16.14.42'	' '		PrismaPro: PrismaPro Device IP Adress
"PrismaPro".Communication.Control	%DB100.DBW54	DEZ	256			PrismaPro: controlled by PrismaPro Driver; 0=none,1=self,2=other
"PrismaPro".Control.SetEmissionOn	%DB100.DBX58.(	BOOL	FALSE	TRUE		Set emission State On (PLC 0->1, 1->0 by Driver)
"PrismaPro".Control.SetEmissionOff	%DB100.DBX58.	BOOL	FALSE	TRUE		Set emission State Off (PLC 0->1, 1->0 by Driver)
"PrismaPro".Control.SetEMOn	%DB100.DBX58.	BOOL	FALSE	TRUE		Set electron Multiplier State On (PLC 0->1, 1->0 by Driver)
"PrismaPro".Control.SetEMOff	%DB100.DBX58.	BOOL	FALSE	TRUE		Set electron Multiplier State Off (PLC 0->1, 1->0 by Driver)
"PrismaPro".Control.StartScan	%DB100.DBX58.(	BOOL	FALSE	TRUE		Start Measurement (PLC 0->1, 1->0 by Driver)
"PrismaPro".Control.StopScan	%DB100.DBX58.	BOOL	FALSE	TRUE		Stop Measurement (PLC 0->1, 1->0 by Driver)
"PrismaPro".Control.SaveSetup	%DB100.DBX58.(	BOOL	FALSE	TRUE		Save Scan Setup (PLC 0->1, 1->0 by Driver) => PLC to PrismaPro
"PrismaPro".Control.ReadHardware	%DB100.DBX58.	BOOL	FALSE	FALSE		Switch for Hardware IO reading (0 = off, 1 = on)

8. Application: MPP-S7

TIA 15 SIEMENS

PLC 1516-3 PN/DP PLC Online (DB100 Part 1)

PrismaPro

	Name	Datentyp	Offset	Beobachtungswert	Kommentar
1	Static				
2	Common	Struct	0.0		Common Control and State
3	Lifebit	Bool	0.0	TRUE	Lifebit, is set all 1s by PLC, Reset by PrismaPro
4	PrismaProErrorCode	DInt	2.0	0	Errorcode from PrismaPro Device
5	DriverErrorCode	DInt	6.0	0	Errorcode from PrismaPro Device Driver
6	DeviceInfo	Struct	10.0		Electronic Info from Prisma Device
7	Genus	Byte	10.0	16#04	PrismaPro: Communication Device Type: 4=PrismaPro
8	massRange	Word	12.0	16#0064	PrismaPro: Possible mass Range
9	SensorName	String[20]	14.0	'QMSPrismaPro'	PrismaPro: Sensor Name
10	Communication	Struct	36.0		Communication Info from Prisma Device
11	IPAdress	String[15]	36.0	'172.16.14.42'	PrismaPro: PrismaPro Device IP Adress
12	Control	Int	54.0	256	PrismaPro: controlled by PrismaPro Driver; 0=none,1=self,2=other
13	ControlInfo	Int	56.0	0	PrismaPro: controlled by external device; not used
14	Control	Struct	58.0		=== PrismaPro Control ===
15	SetEmissionOn	Bool	58.0	FALSE	Set emission State On (PLC 0->1, 1->0 by Driver)
16	SetEmissionOff	Bool	58.1	FALSE	Set emission State Off (PLC 0->1, 1->0 by Driver)
17	SetEMOn	Bool	58.2	FALSE	Set electron Multiplier State On (PLC 0->1, 1->0 by Driver)
18	SetEMOff	Bool	58.3	FALSE	Set electron Multiplier State Off (PLC 0->1, 1->0 by Driver)
19	StartScan	Bool	58.4	FALSE	Start Measurement (PLC 0->1, 1->0 by Driver)
20	StopScan	Bool	58.5	FALSE	Stop Measurement (PLC 0->1, 1->0 by Driver)
21	SaveSetup	Bool	58.6	FALSE	Save Scan Setup (PLC 0->1, 1->0 by Driver) => PLC to PrismaPro
22	ReadHardware	Bool	58.7	FALSE	Switch for Hardware IO reading (0 = off, 1 = on)
23	UserTimer1	Time	60.0	T#0MS	Set User Timer 1 (Set value by PLC)
24	UserTimer2	Time	64.0	T#0MS	Set User Timer 2 (Set value by PLC)

8. Application: MPP-S7

PLC 1516-3 PN/DP PLC Online (DB100 Part 2)

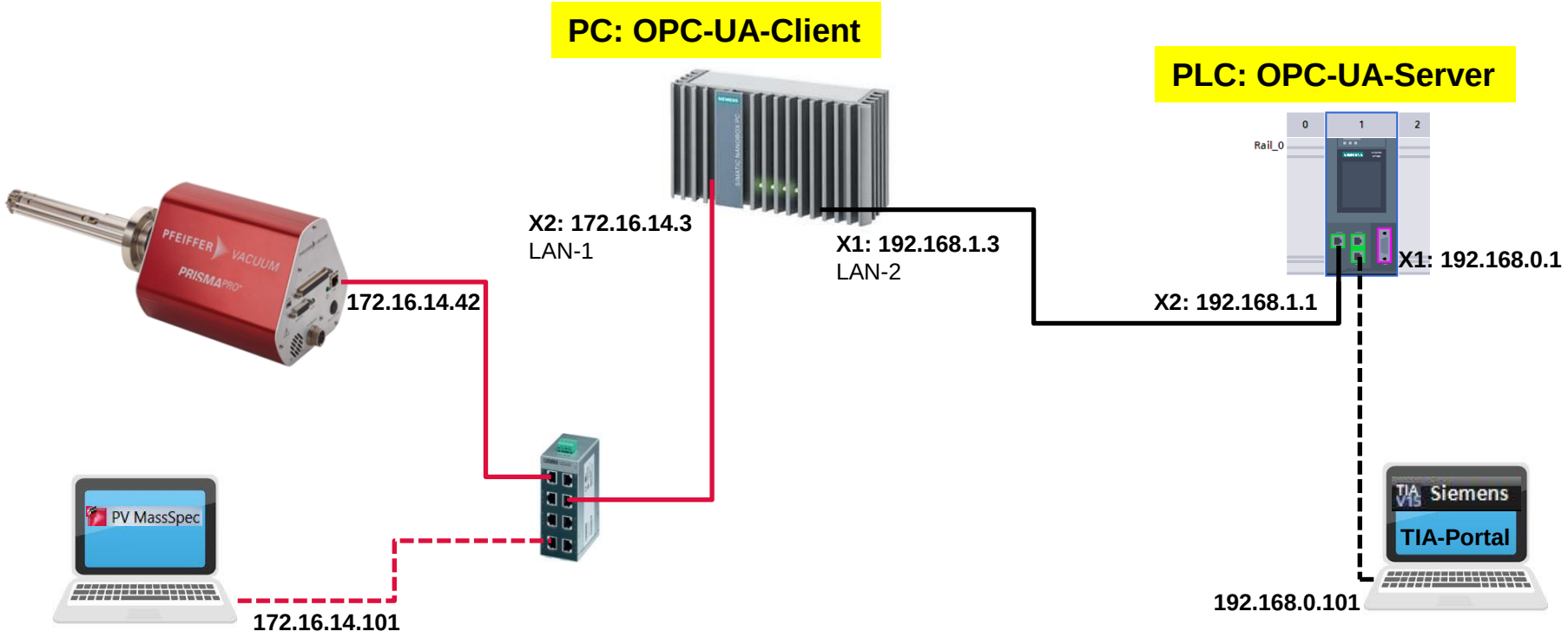
TIA 15 SIEMENS

In_ScanSetup	Struct	98.0		=== Scan Setup === PLC to PrismaPro
Out_ScanSetup	Struct	6920.0		=== Feedback of Scan Setup === PrismaPro to PLC
IOState	Struct	13742.0		PrismaPro: State of the interated IO signals
Scans	Struct	13838.0		=== Single Channel Scan results ===
DateTime	Date_And_Time	13838.0	DT#2019-03-11-09:50:06.1(	PrismaPro: Date and Time of last Scan - Current DateTime of PC (UTC)
Result	Array[0..3000] of Struct	13846.0		PrismaPro: Measured Channel Value
Result[0]	Struct	13846.0		PrismaPro: Measured Channel Value
Mass	Real	13846.0	0.0	PrismaPro: Measured Mass
Value	Real	13850.0	4.760849E-12	PrismaPro: Measured Mass Value
Result[1]	Struct	13854.0		PrismaPro: Measured Channel Value
Mass	Real	13854.0	0.2	PrismaPro: Measured Mass
Value	Real	13858.0	2.154627E-12	PrismaPro: Measured Mass Value
Result[2]	Struct	13862.0		PrismaPro: Measured Channel Value
Mass	Real	13862.0	0.4	PrismaPro: Measured Mass
Value	Real	13866.0	1.589171E-12	PrismaPro: Measured Mass Value
Result[3]	Struct	13870.0		PrismaPro: Measured Channel Value
Mass	Real	13870.0	0.6	PrismaPro: Measured Mass
Value	Real	13874.0	1.703431E-12	PrismaPro: Measured Mass Value
Result[4]	Struct	13878.0		PrismaPro: Measured Channel Value
Mass	Real	13878.0	0.8	PrismaPro: Measured Mass
Value	Real	13882.0	2.200243E-12	PrismaPro: Measured Mass Value
Result[5]	Struct	13886.0		PrismaPro: Measured Channel Value
Result[6]	Struct	13894.0		PrismaPro: Measured Channel Value

8. Application: MPP-OPC-UA

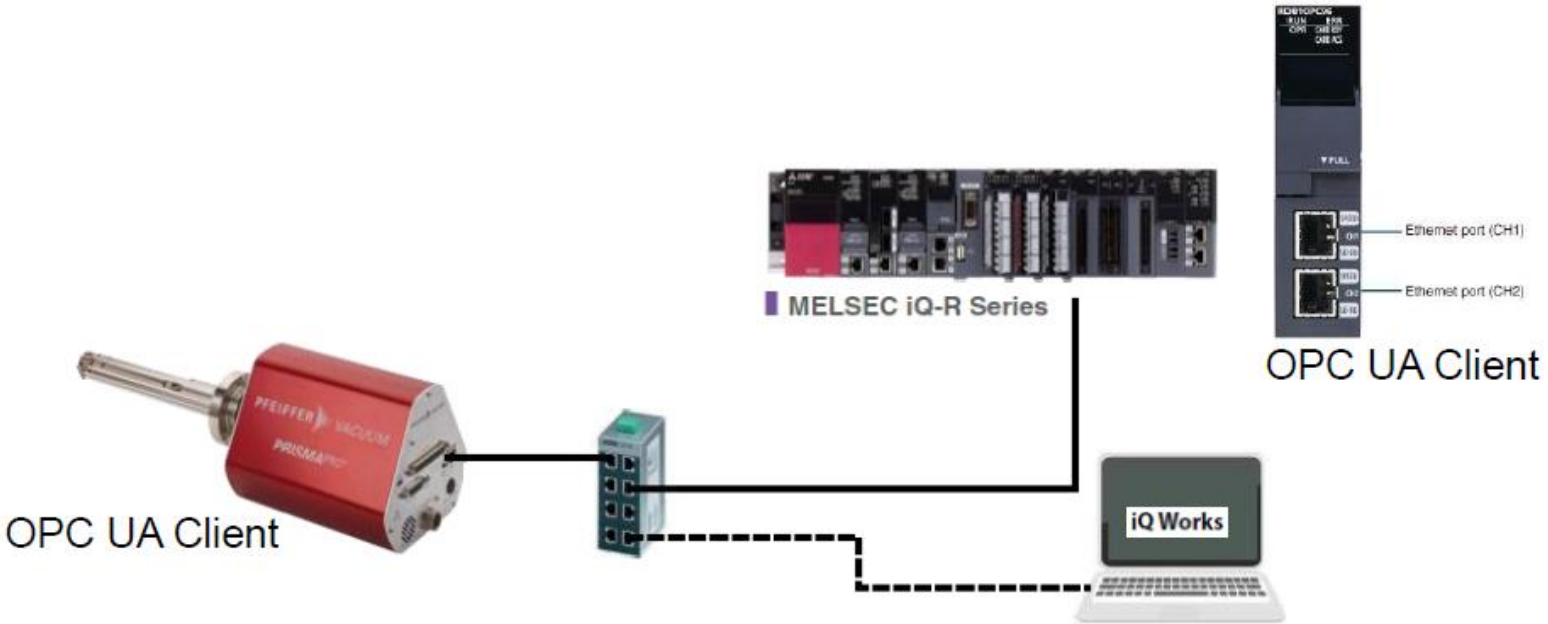
Network concept:

(wikipedia: OpenPlatformCommunications-UnifiedArchitecture)

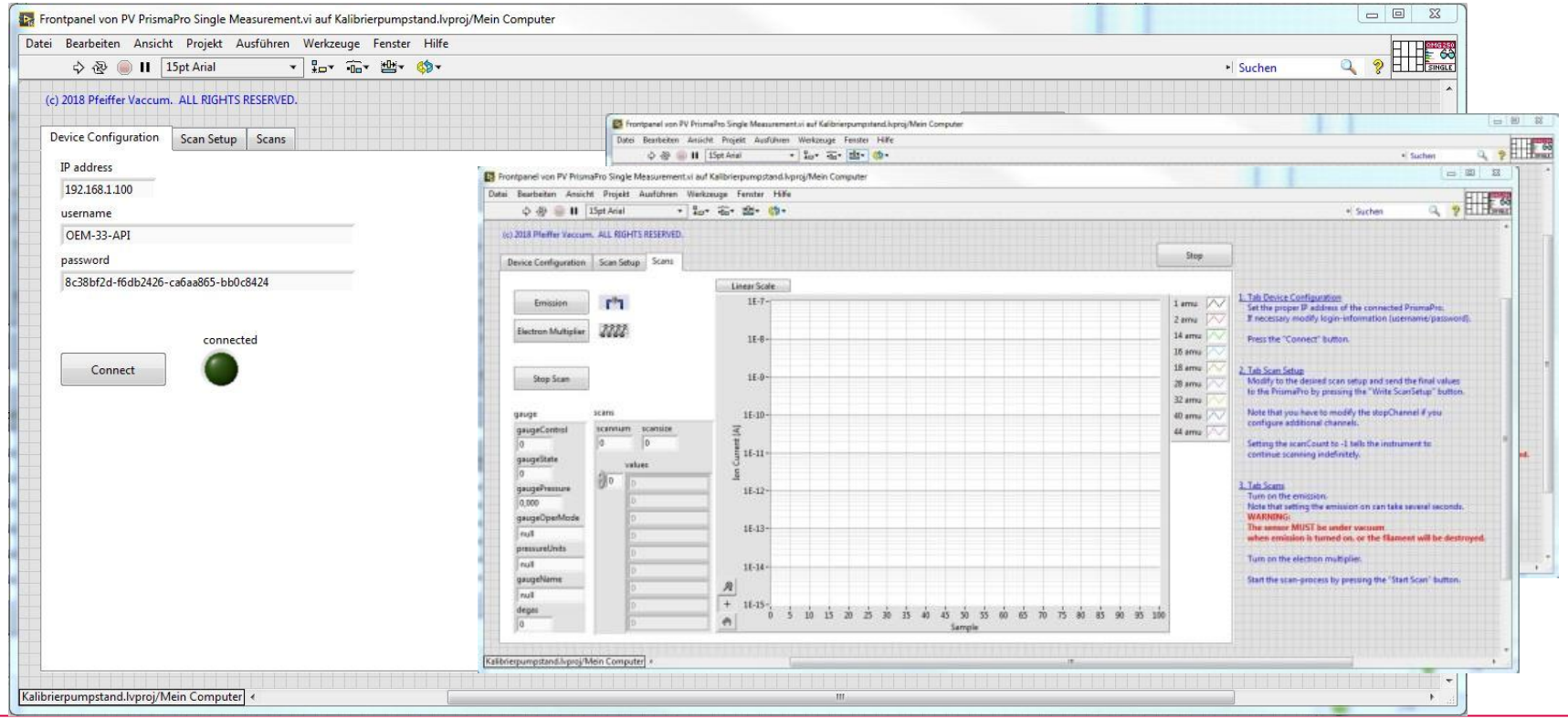


8. Application: MPP-IQ-R

Network concept study:



8. Application: LabView-Driver+Example



9. Summary

- For this Communication, a **PrismaPro** is required.
- For general Application and Calibration use **PVMassSpec**
- For a higher-level Communication (e.g. LabView, PC, …) use additional the **MMSP-API**
- For the Communication with the API, the signed **EULA** is necessary but not for the MPP-S7-Application.

Thank you very much for your attention!