IEC 61850 Converter for OPUS power systems

One IEC61850 converter can monitor 1-6 x OPUS systems

User Manual

Master controller/IEC61850 interface: Wago 750-8212/025-002
Slave Controller: 1-6 x Enedo OPUS VIDI
Modbus TCP/IP between master and slaves

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Change History of this document DOC078562:

Rev.	Changes	Date
	First draft	26.8.2019, TRä, PLa
A.00	First release	12.09.2019, TRä, PLa
A.01	Commissioning instructions improved	18.11.2020, TRä, PLa
B	New Wago PLC design Added ethernet switch to monitor up to 6 x OPUS system by one PLC	16.09.2024, TRä, PLa

Contents

1. Order information

Enedo part numbers IEC61850 SCADA adapter and DC/DC supply converters

Order number	Description
8320X0015545	Wago 750-8212/025-002 IEC61850 master controller KIT (OPUS VIDI slave), DC 24V input
ADC5721	DC/DC converter 85-200VDC / 24VDC 2,5A, Enedo
C01353	DC/DC converter 120-373VDC / 24VDC 2,5A, Wago
C02305	Industrial-ECO-Switch; 8-port 100Base-TX; black, Wago 852-112/000-001 IEC61850 monitoring up to 6 x OPUS system

2. General information about the standard and system

Configure IEC 61850 devices generally

IEC 61850 is the current international standard used for electrical grid data communication and electrical substation modeling. It is optimized for efficient and reliable transfer of process data and commands within and between Intelligent Electronic Devices (IEDs) and substations. IEC 61850 has been designed for use over a (high-speed) data network.

Typically, the IEC 61850 protocol is used in substation internal communication with a fixed IP address on an Ethernet network. If like to use on public network it is strongly recommend to use a VPN tunneling and / or private APN network. The standard does not contain security solutions in itself. The aspect of cyber-security is outside the scope of the standard, and therefore it is mainly up to manufacturer and distribution companies to consider their communication solution and system protection.

Normally the client, for example RTU (Remote Terminal Unit) configuration tools are designed that they when connecting to the server (IED) starts automatically discovering the server configuration. After a time, all servers nodes and attributes appears on the client program display. Now the configuration work is only connects the IEC61850 attributes to the upper level of protocol messages for creating ready communication witch goes outside the substation. The upper level protocol can be for example IEC 60870-5-104.

The server (IED) device has an individual ICD-file describes all nodes and attributes it has. This file can be used when configure the client instead of the actual connection to the IED. ICD-file doesn’t consist IP-addresses and therefore they must be gave manually or by using other program or configuration tool is designed for configure all the substation’s IED devices.

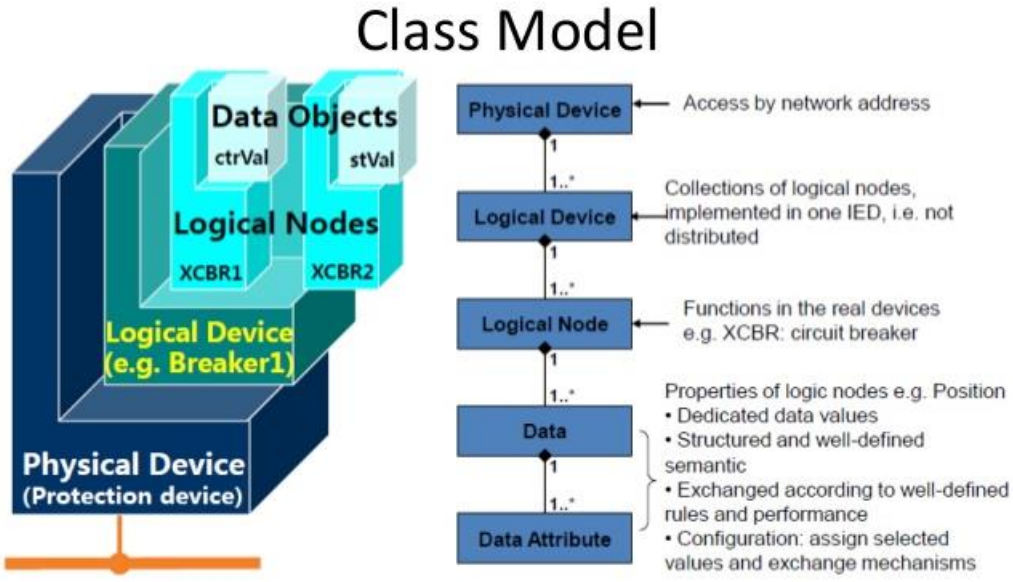
.SSD	Describes the single line diagram of the designed substation and the logical nodes which are required	System specification tool → System configuration tool
.ICD	Describes the capabilities of an IED	IED configuration tool → System configuration tool
.SCD	Contain the communication information of the substation, all IED's and describes substation	System configuration tool → IED configuration tools
.CID	Contains the individual IED's communication configurations. Describes the initiated IED	IED configuration tool → IED

SCL-file extension descriptions

All of these files are same SCL (Substation Configuration description Language), based on XML. All configuration tools accept ICD-file but during the configuration the extension changes.

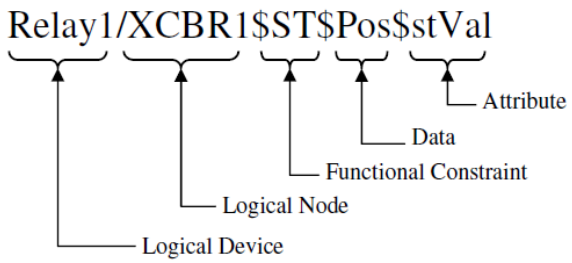
IED modelling

Individual IED's are connected to the network by one network address. One physical device can be defined by one (or many logical devices by a proxy server or as a gateway). Logical nodes are construct from data classes, each of which contains data attributes. The standard defines concepts and some rules for physical devices and for logical devices, but from logical nodes to data attributes the definition is stricter. There are 355 different data classes which can be divided into seven categories. These categories are: system information, physical device information, measurand information, metered values, controllable data, status information, and settings.



The data point reference constructs in the same way as the IED is modelled. The reference maps the data to understandable form, instead of an index number. The information can be

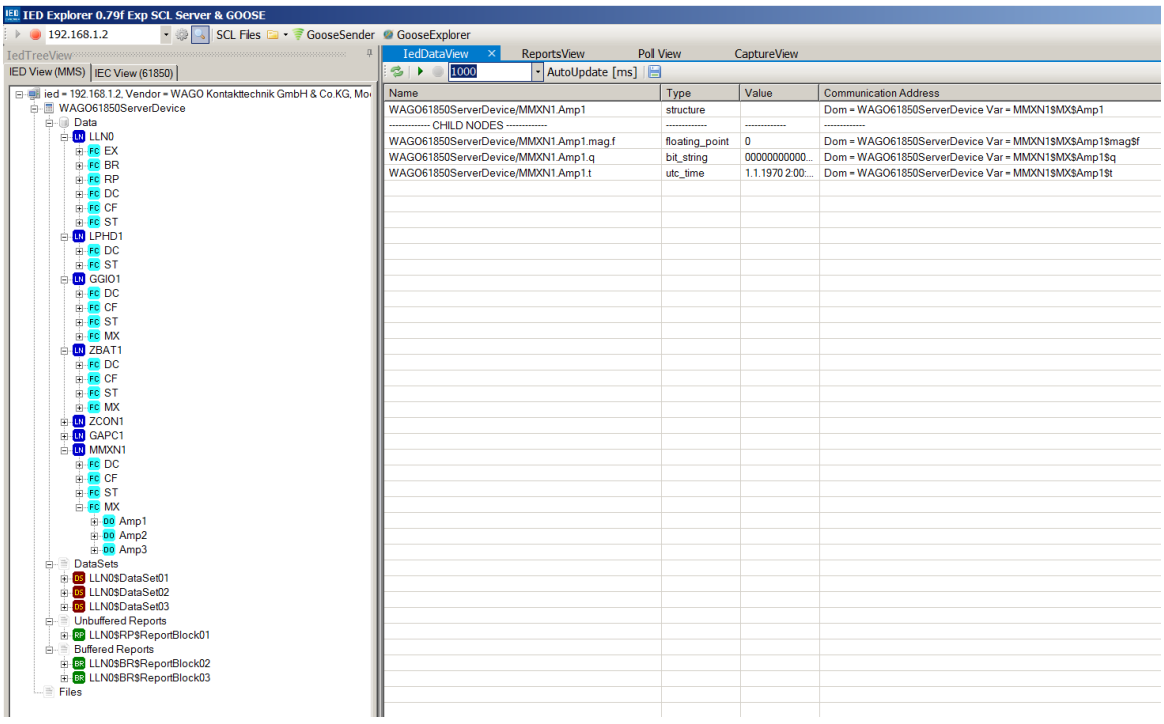
understood without additional decoding aid. By using the IEC 61850 mappings in setting software, monitoring software and in all such systems, the naming systems are universal and easily understood. Notes, however, that the standard was originally designed specifically for protection relays and therefore other devices are not as precisely defined between different manufacturers.



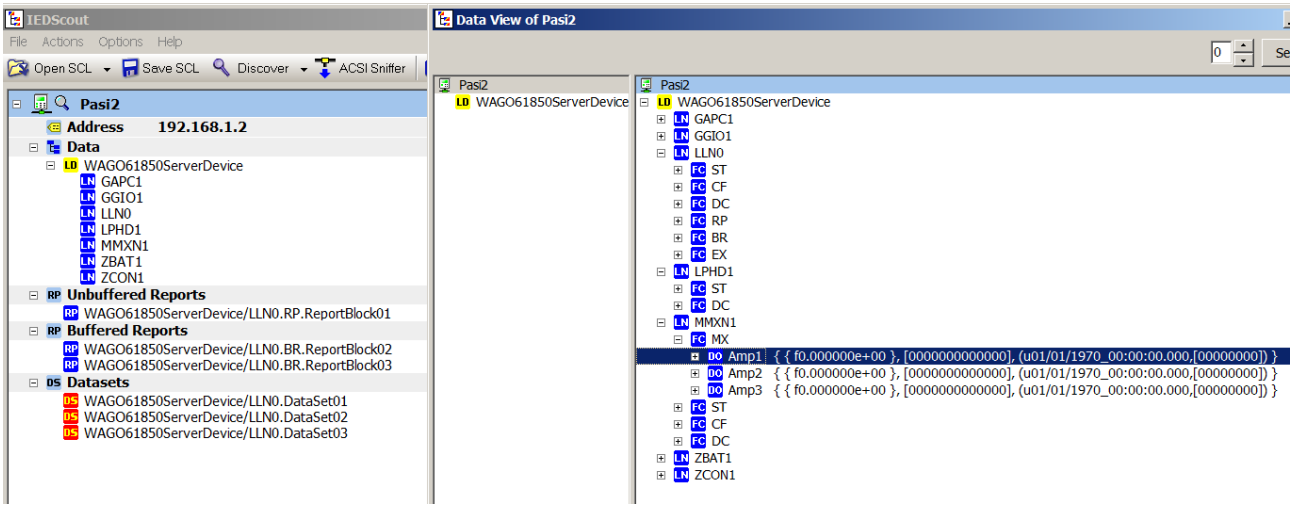
IEC 61850 object name structure consist all information. Instead of $ sig can be used also dot (.)

Testing and monitoring IEC61850 server (IED)

In the market is lot of IEC61850 testing and monitoring tools. Most of the programs are commercial and pay, but there are also free downloadable programs on internet. In this case the programming community is anyhow not responsible about the code quality as well as in commercial programs.



Free IED Explorer has automatic updating and is enough for testing one IED device



Omicron IEDScout is a commercial very commonly used test program. The free demo version is without automatic updating.

3. TCP/IP and hardware description

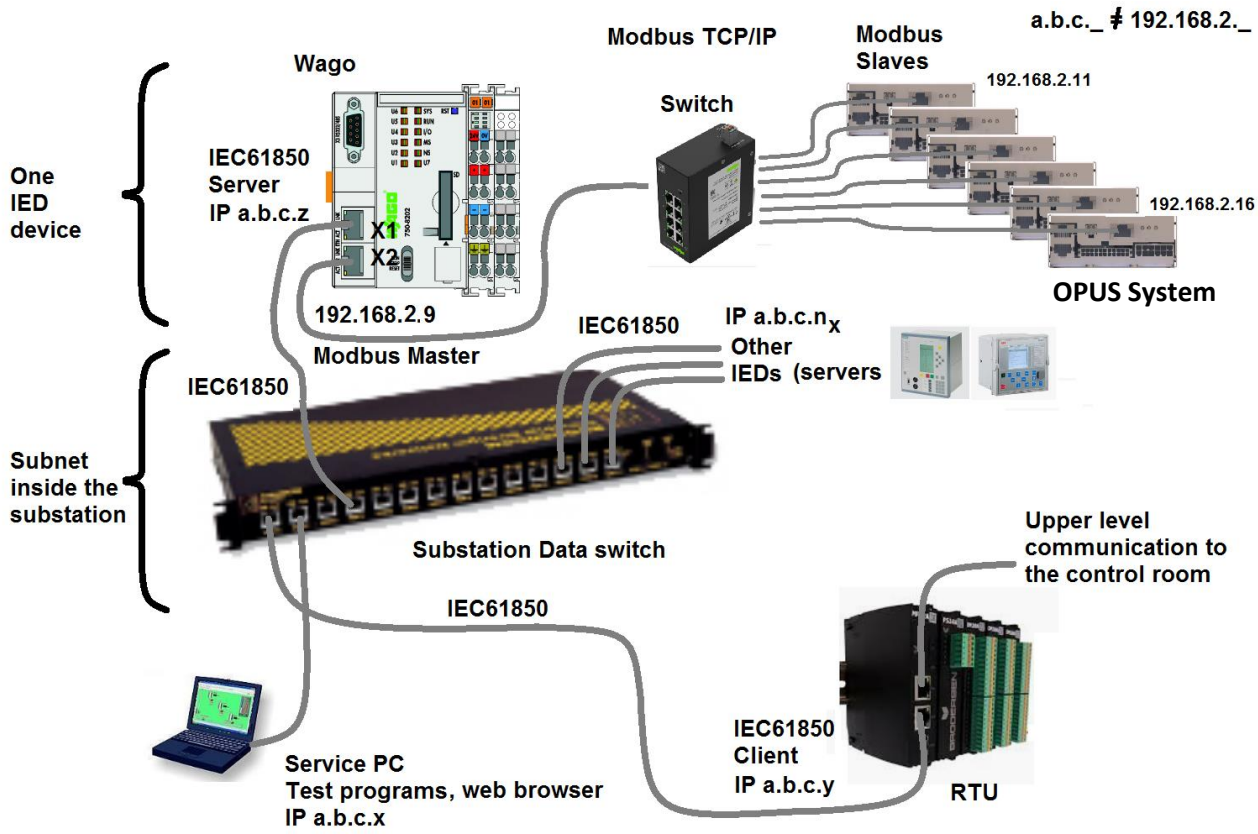
Wago 750-8212/025-002

The Wago 750-8212 controller is a compact PLC for the modular WAGO-I/O-SYSTEM. Besides network and fieldbus interfaces, the controller supports all digital, analog and specialty modules found within the 750/753 Series. Model 750-8212/025-002 has a limit of up to three active modules. The passive 750-600 end module is always necessary.

- Two Ethernet interfaces and an integrated switch enable line topology wiring.
- An integrated Webserver provides user configuration options, while displaying controller status information.
- Programming standard IEC 61131-3, when use IEC 61850 protocol with WAGO-I/O-PRO (Codesys) V2.3
- RS-232/RS-485
- Linux operating system
- Micro SD memory card and remote programming/updating is possible.
- Firewall, OpenVPN and IPsec features
- Dimensions: H 71,9mm x W 78,6mm x D 1000mn
- Weight 231g
- Enclosure IP20, material polycarbonate, polamide 6.6
- Operating temperature -20 … 60 °C

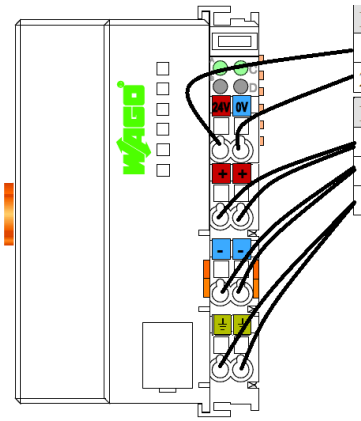
Data cables and IPs in protocol converter application

The Wago controller Ethernet is now defined that the lower RJ-45 port X2 is for Modbus IP master communication with Enedo Opus which is slave. This is a separate subnet and therefore the IP-addresses can be constant in both ends (Wago and Enedo). The upper RJ-45 port X1 is defined for IEC61850 communication and its IP must be changed in case to case to fits to the customer system subnet address. This port is also used for configure Wago (Web Base Management (WBM).



Powering Wago

Wago 750-8212 controller auxiliary voltage is 24 Vdc. It can be vary between 18.0 - 31.2V (-25+30%). Current consumption is 100 mA with this application. It is recommended that the converter also be supplied with electricity in the absence of a mains AC power supply, as this will ensure the operation of the SCADA connection in normal substation failure (battery voltage backup).



Position	Description
1	System supply DC 24 V (-25 % … +30 %)
2	System supply 0 V
Field supply	
3	24 V (-15 % / +20 %)
4	0 V
5	Optional ground potential

4. Commissioning

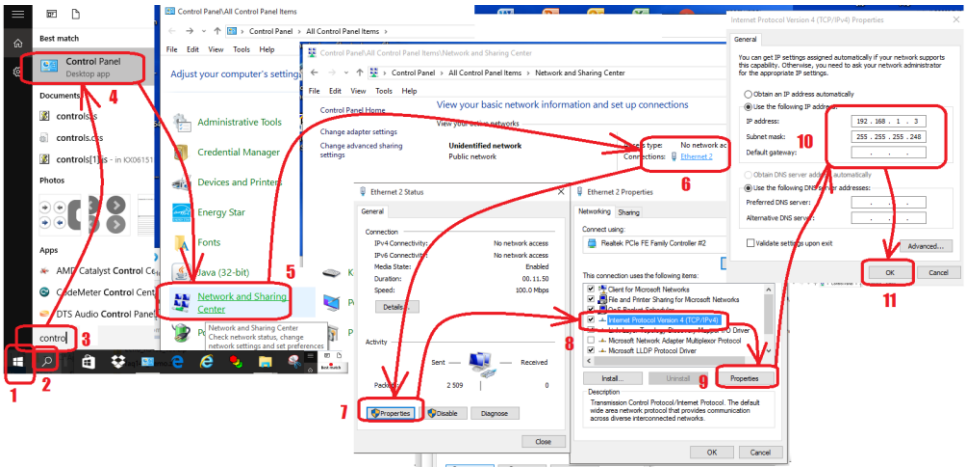
Preparation

Consult your network administrator for correct IP address and configuration details before connecting device into your environment.

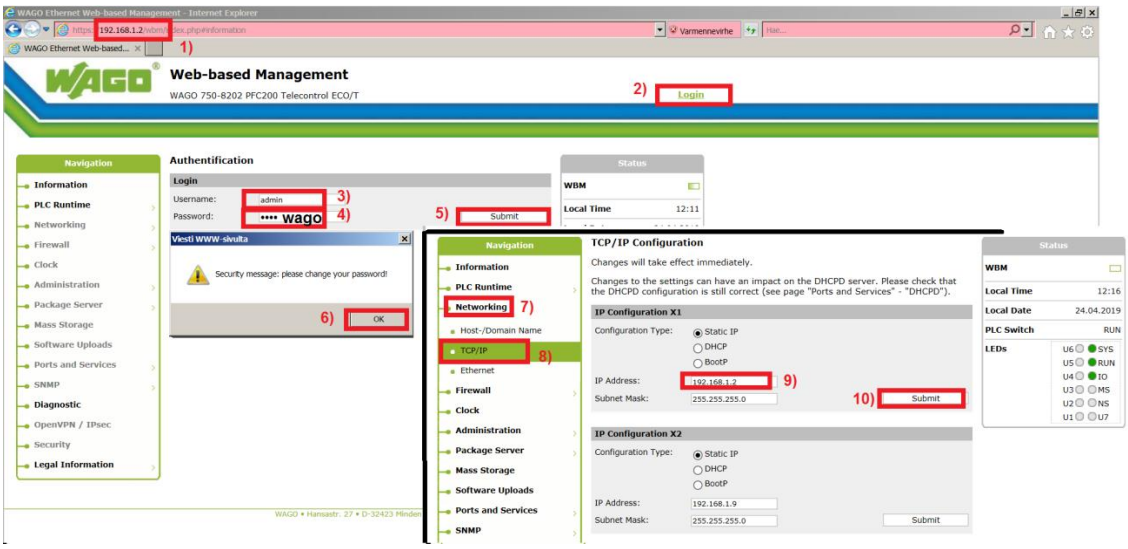
Define IPs

In begin the service computer must be directly connected to the Wagon's upper X1 RJ-45 port. The cable is an ordinary (direct) data cable. The factory setting of the Wago IP address port X1 is 192.168.1.2, so the address of the computer can be for example 192.168.1.3.

The computer IP setting when the cable is connected is with Windows 7 a follow:



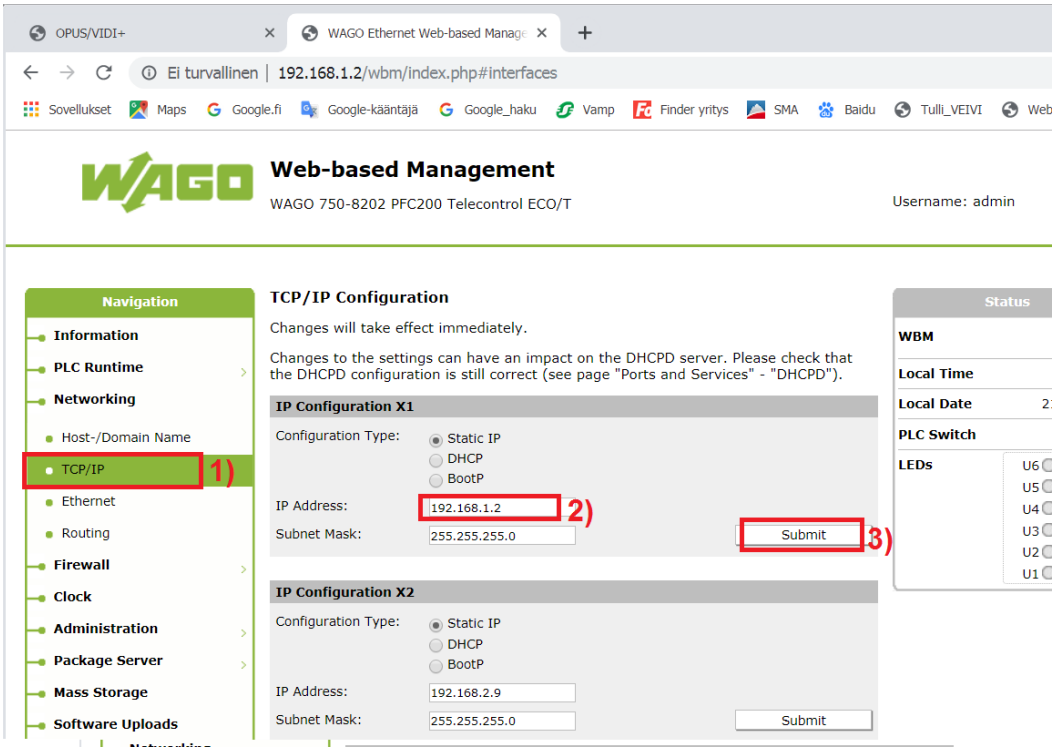
After this you can enter to the Wago WBM by calling the factory setting ip “192.168.1.2/wbm” by web browser for example MS Explorer. Note that it is not allowed use same subnet address in substation and Opus network if Wago ports X1 and X2 are in separated connection is factory setting. This means for example that if substation IP is 192.168.1.x the Opus IP must be different for example 192.168.2.x (netmask 255.255.255.0). Please note that the appearance of the WBM screen of the newer firmware versions of the Wago 750-8212 differs from the attached.

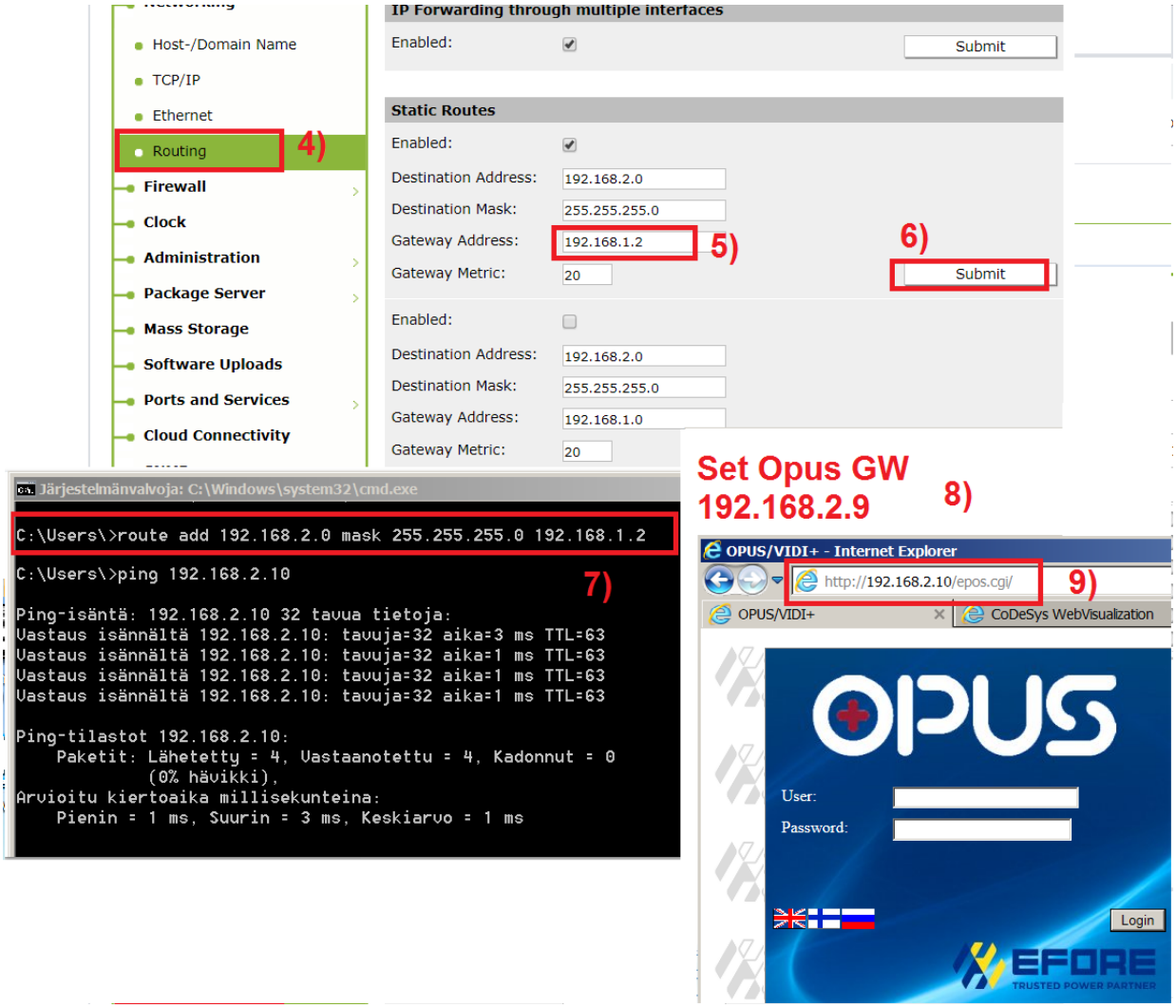


How change the Wago IP address (1-10)

Give a new unique IP address fits in the substation subnet (point 9). Note, that after the Submit (10) the communication stops. Now you must change the computer cable to the substation network and set its IP that it is inside the subnet and that it is unique. Now you can connect the Wago X1 cable to the substation network. Connect also Wago port X2 to the Opus Ethernet port and set Opus IP to address 192.168.2.10 (if the substation network is not 192.168.2.x).

It is also possible change the Wago internal routing that Opus can be communicated trough the Wago. In this case the Opus gateway must be sat to 192.168.2.9 is Wago port X2 address and in computer end you must give ROUTE ADD command.

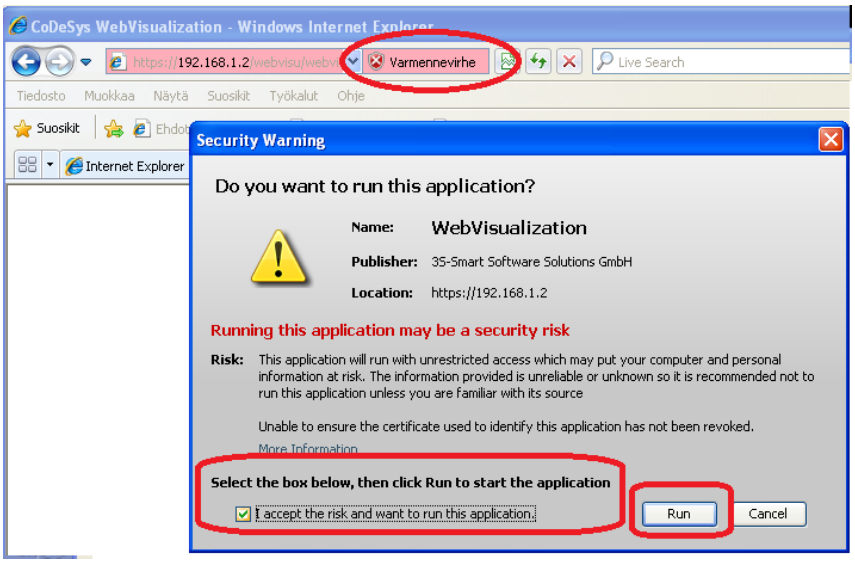




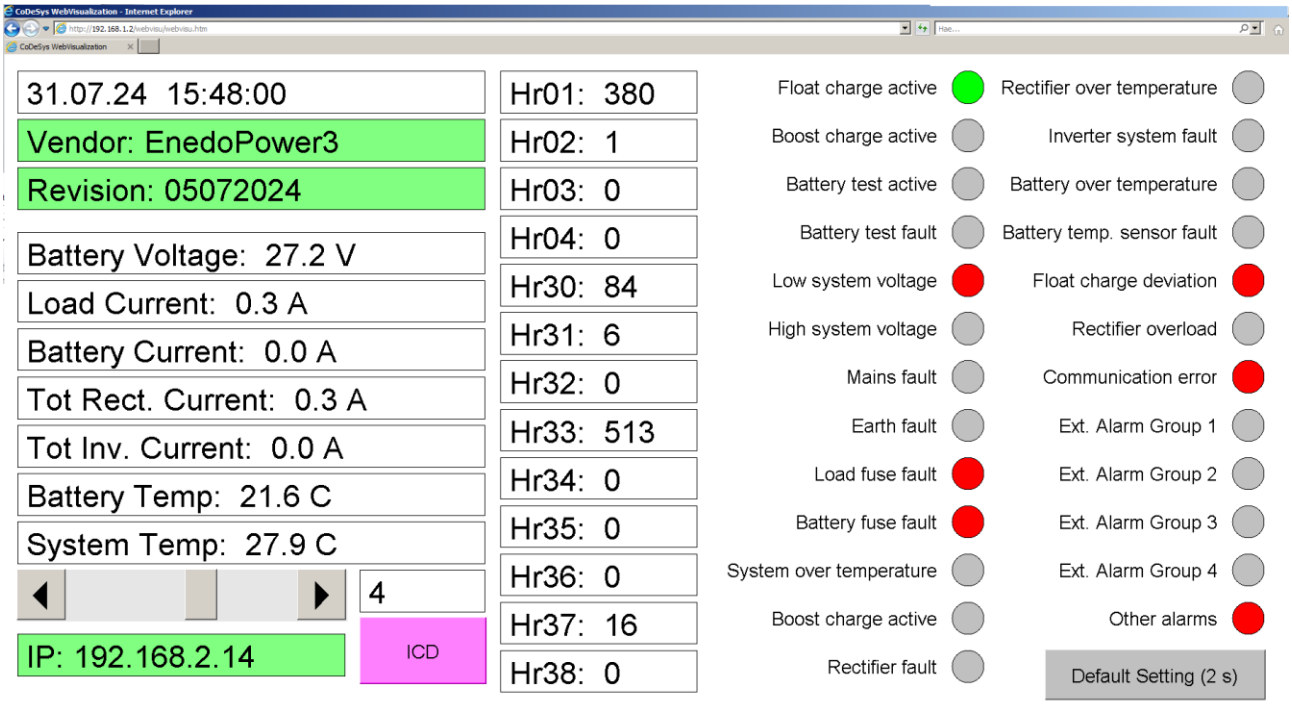
Points 2) defines the substation subnet address is in terminal X1. Routing Gateway address 5) must be equal like address 2).

Checking the Opus Modbus registers on Wago WebVisu

You can enter to the Wago WebVisu Server which shows all Opus Modbus registers. The web browser must be MS Explorer and the computer must have Java. Call the Wago by giving its IP address alone. Running Java causes warnings which must be passed. It is not absolutely necessary in commissioning use the Wago WebVisu but it is useful.



All Modbus registers, measurements and the most important alarms are visible in Wago WebVisu sheet. By using the slide switch you can change the Opus you are reading.



Changing the IED name and Opus Modbus IP addresses

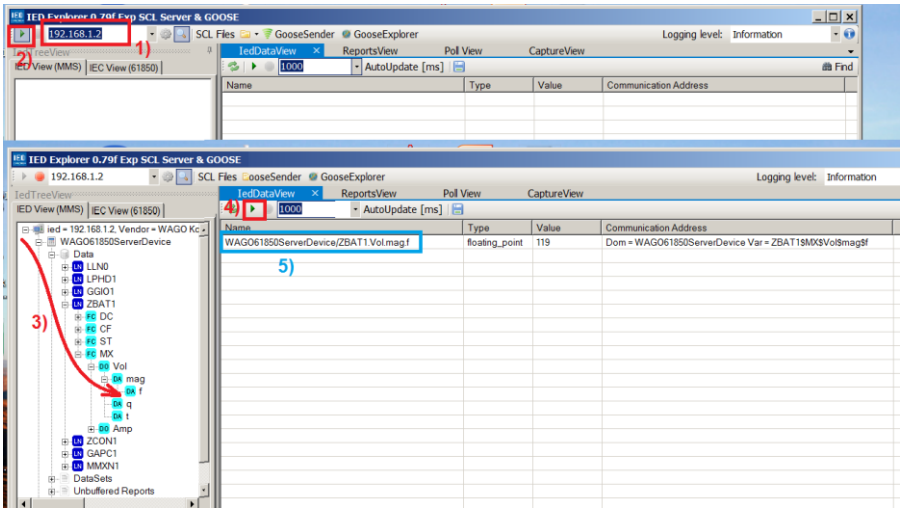
You can change the values in all green color cells. Vendor is the IED name which is also visible in IEC 61850 master messages and in all strings defines the data objects. When change the Vendor or Revision cell the system must be restarted again. Modbus TCP slave addresses can be changed by filling IP cell and using the slide switch.

Changing the IED name and Opus Modbus IP addresses

The purple ICD button creates a top part of the ICD file and stores it to converter internal permanent memory. When the vendor field has been changed and the device is restarted, the ICD button must be pressed twice, in which case the device will save the top part of a new ICD file with the new given IED name and the current IP addresses of the X1 port (IP, Mask, Gw).

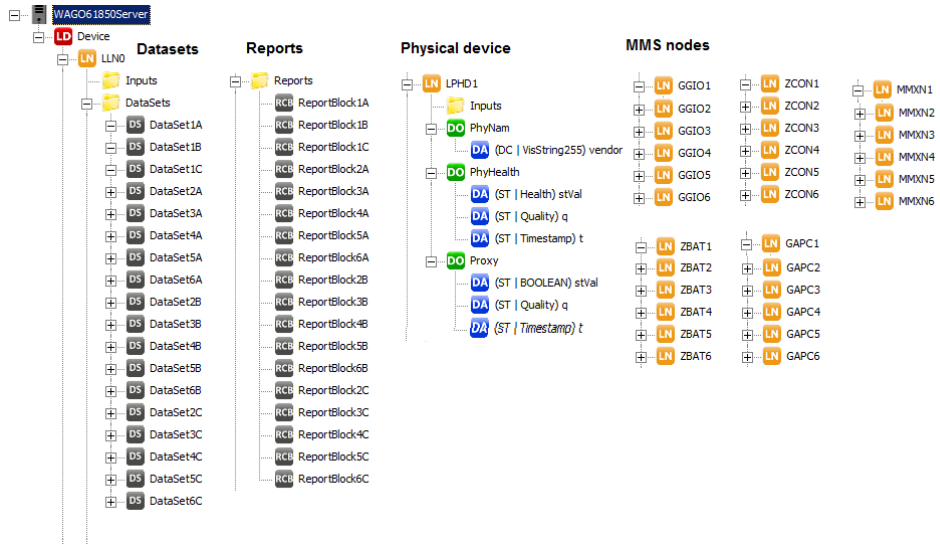
Testing IEC61850 MMS messages

For ensure proper operation, it is useful test the system with some IEC61850 testing and monitoring tools (client). For example IED Explorer or Omicron IEDScout is suitable for this. Find example how read battery voltage by using freeware IED Explorer:

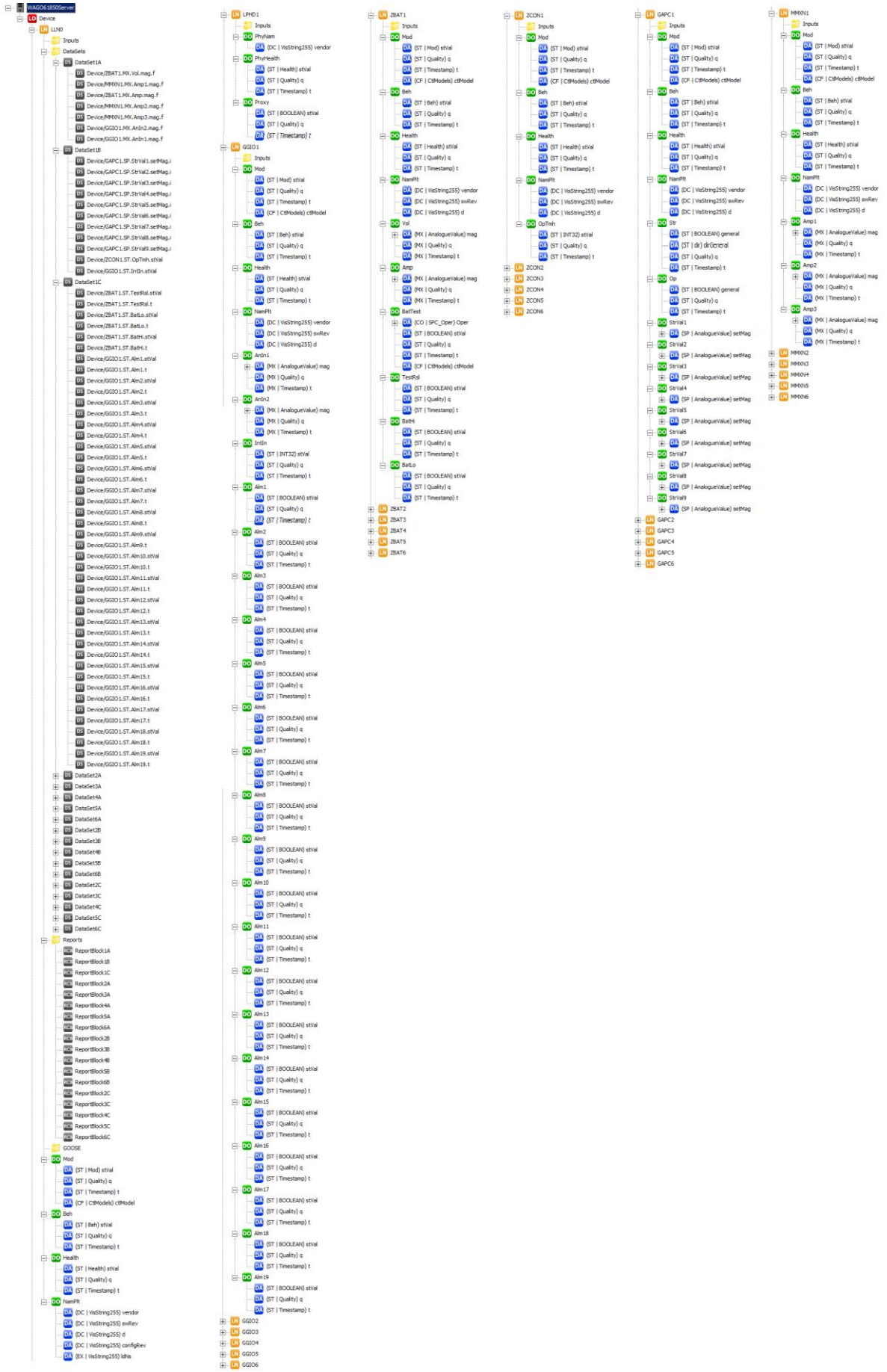


1) Give the Wago X1 RJ45 port IP address
2) Start automatic server inspection
3) When server appears, go to the end of the object and see the attribute value.
4) This starts automatic value updating which is useful if like to see the attributes are changed during the test.
5) This is the name of the object or data point that is required when configuring the RTU or Client device.

The IEC 61850 structure must be quite complex so that one converter can present the messages of six VIDI devices. The message structure is the same as in the single VIDI converter, but now there are six instead of one for each node and they differ only by number.



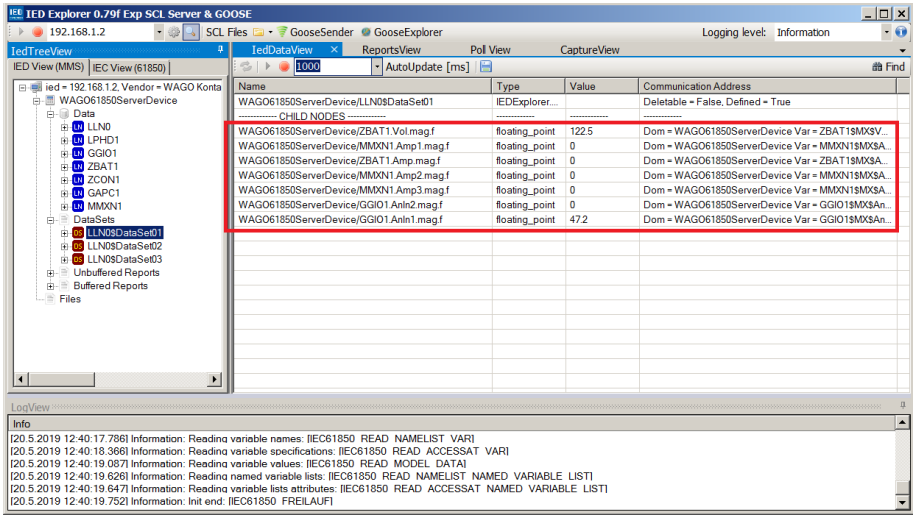
Full structure:



Testing IEC61850 DataSets

In IEC61850 configuration the messages are grouped Datasets which can be buffered or unbuffered. Each Dataset has triggering feature which is useful when like to minimize the communication. The converter has three different datasets:

1) Measurements witch are float values and unbuffered (DataSetXA)
2) Alarm and state registers which are integer values and buffered (DataSetXB)
3) Alarms which are Boolean type, equipped with timestamp and are buffered (DataSetXC)

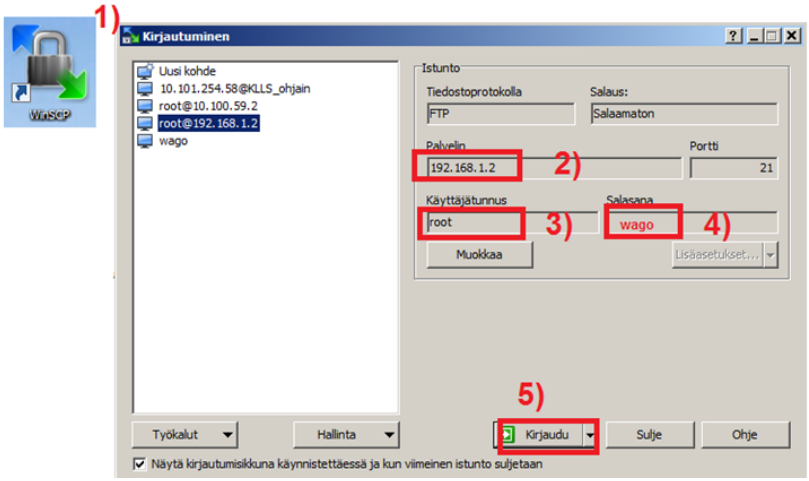


Note that the picture shows the dataset names of one VIDI. On a six-VIDI device, these measurement datasets are LLN0$DataSet1A - LLN0$DataSet6A

Using and getting ICD-file

Depending on the RTU hardware manufacturer, the IEC61850 protocol system can be implemented either by using ICD files provided by different devices (IEDs) or, alternatively, by reading the corresponding information directly from the device.

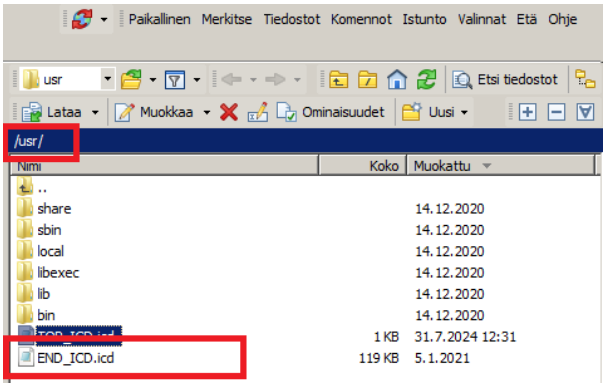
To ensure that the ICD file is always available during system commissioning, it is stored in the converter's memory. The file can be downloaded from memory by using the FTP protocol. The figure below shows how to download a file with WinSCP from the converter's memory. The default username is “root” and password “wago”. The FTP protocol is also available directly in browsers, in which case the address is given as FTP://a.b.c.d with the rest being the IP address of the converter.



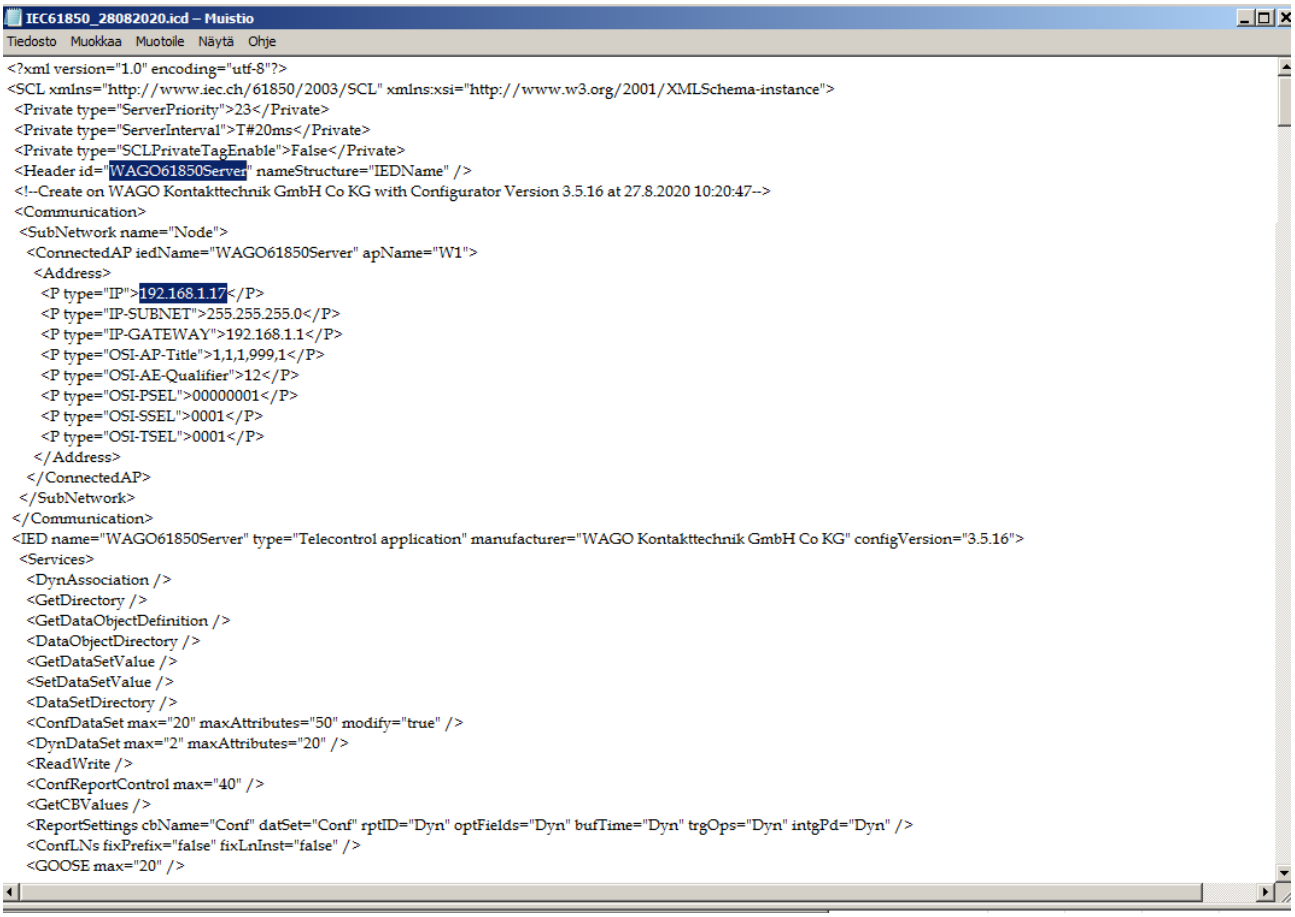
The six-VIDI converter has two different ICD files in the device memory:

1) TOP_ICD.icd which is generated by pressing the purple button twice. It consists of the IED name and other parameters that can be changed.
2) END_ICD.icd, which is the end of a long ICD file and is always constant.

To make an ICD file that contains a complete description of the IED device, you need to add the END_ICD file to the TOP_ICD file using a text editor (eg. MS Notes).



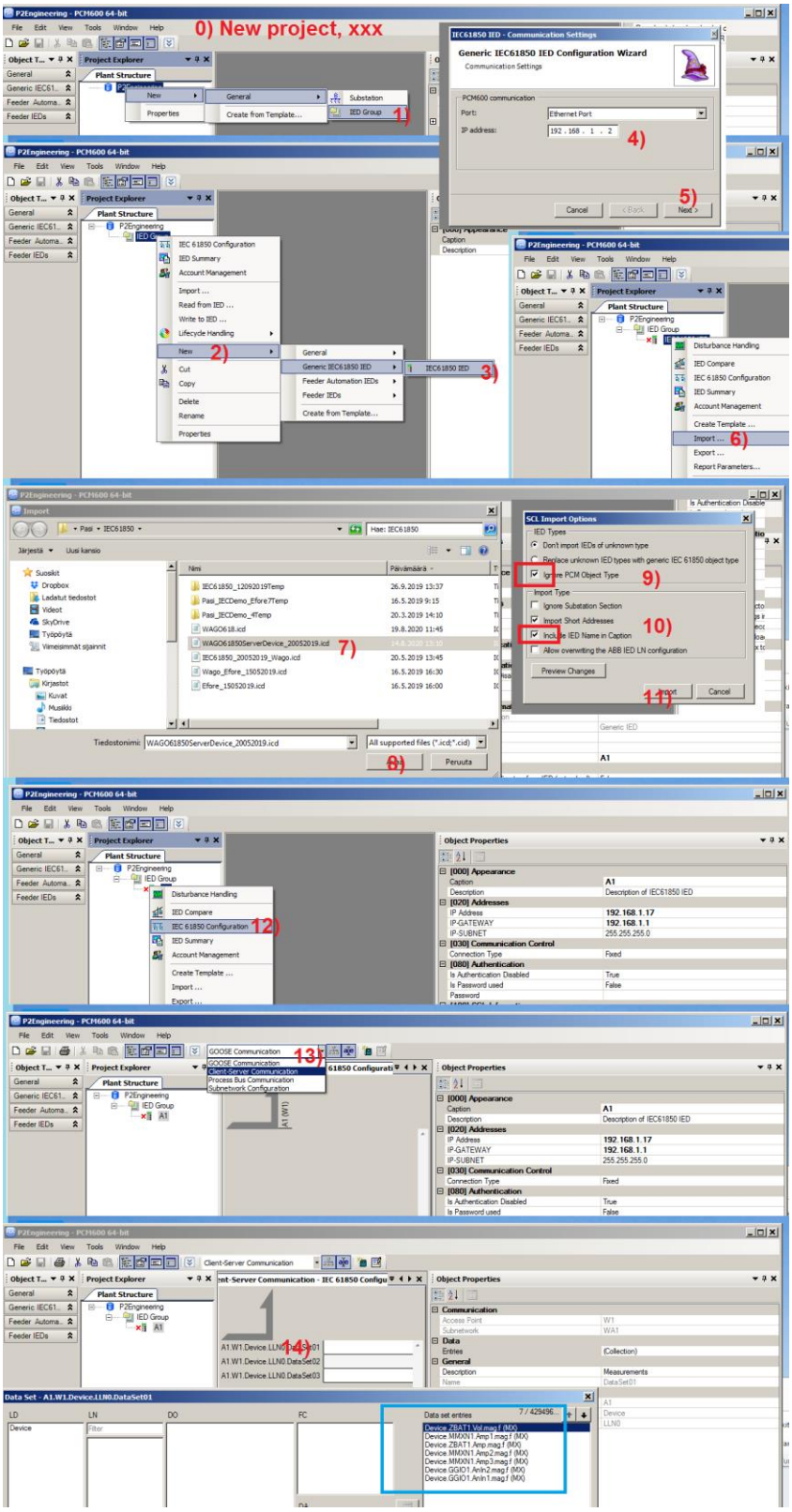
It is also possible manually edit the ICD-file. IED name and IP address is highlighted in next picture.



Some IEC61850 system configuration software does not read third-party devices, although the standard was originally intended to be device-independent. However, since all IEDs must be

included in the system, the software must always have a so-called the possibility of adding a generic IED device.

The figure below shows how to create and display a generic device in ABB's PCM600 software. ABB's commercial IET600 configuration software is quite similar. In the picture is assured that the ICD files are already stored in the computer's memory. The most important things in the figure are sections 9 and 10 how to handle the downloadable ICD file when downloading it to the system.



The PCM600 and IET600 software does not display the contents of attributes, which makes generic IED commissioning a little more difficult. If desired, they can be checked with IEDscout or IEDExplorer software.

5. Configure the Client device

Find correct data points

The following list consist of all objects and data points are defined for one OPUS system (VIDI) in converter program. IEC61850 standard defines much more objects are mandatory and available for reading or writing by the client.

MMS Atributes have defined contents

No:	IEC node	IEC61850 definition	Format in IEC	Holding register	Efore definition
1	WAGO61850ServerDevice/LPHD1.PhyNam.vendor	Name plate vendor	String32	Changeable on WebVisu	
2	WAGO61850ServerDevice/LLN0.ReportBlock01	Unbuffered report DataSet01	Many attributes		
3	WAGO61850ServerDevice/LLN0.ReportBlock02	Buffered report DataSet02	Many attributes		
4	WAGO61850ServerDevice/LLN0.ReportBlock03	Buffered report DataSet03	Many attributes		
5	WAGO61850ServerDevice/GGIO1.NamPlt.vendor	Name plate vendor	String32	Changeable on WebVisu	
6	WAGO61850ServerDevice/GGIO1.NamPlt.swRev	Name plate revision	String32	Changeable on WebVisu	
7	WAGO61850ServerDevice/GGIO1.Alm1.stVal	General single alarm	True when fault	HR30.0	Mains fault
8	WAGO61850ServerDevice/GGIO1.Alm2.stVal	General single alarm	True when fault	HR31.0	Earth fault
9	WAGO61850ServerDevice/GGIO1.Alm3.stVal	General single alarm	True when fault	HR31.1	Load fuse fault
10	WAGO61850ServerDevice/GGIO1.Alm4.stVal	General single alarm	True when fault	HR31.2	Battery fuse fault
11	WAGO61850ServerDevice/GGIO1.Alm5.stVal	General single alarm	True when fault	HR31.8	System over temperature
12	WAGO61850ServerDevice/GGIO1.Alm6.stVal	General single alarm	True when fault	HR32.0	Boost charge active
13	WAGO61850ServerDevice/GGIO1.Alm7.stVal	General single alarm	True when fault	HR33.5	Rectifier fault
14	WAGO61850ServerDevice/GGIO1.Alm8.stVal	General single alarm	True when fault	HR33.7	Rectifier over temperature
15	WAGO61850ServerDevice/GGIO1.Alm9.stVal	General single alarm	True when fault	HR34.5	Inverter system fault
16	WAGO61850ServerDevice/GGIO1.Alm10.stVal	General single alarm	True when fault	HR36.5	Battery over temperature
17	WAGO61850ServerDevice/GGIO1.Alm11.stVal	General single alarm	True when fault	HR36.7	Battery temperature sensor fault
18	WAGO61850ServerDevice/GGIO1.Alm12.stVal	General single alarm	True when fault	HR30.4	Float charge deviation
19	WAGO61850ServerDevice/GGIO1.Alm13.stVal	General single alarm	True when fault	HR31.3	Rectifier Overload
20	WAGO61850ServerDevice/GGIO1.Alm14.stVal	General single alarm	True when fault	HR33.0	Communication Error
21	WAGO61850ServerDevice/GGIO1.Alm15.stVal	General single alarm	True when fault	HR38.0	Ext. Alarm Group 1
22	WAGO61850ServerDevice/GGIO1.Alm16.stVal	General single alarm	True when fault	HR38.1	Ext. Alarm Group 2
23	WAGO61850ServerDevice/GGIO1.Alm17.stVal	General single alarm	True when fault	HR38.2	Ext. Alarm Group 3
24	WAGO61850ServerDevice/GGIO1.Alm18.stVal	General single alarm	True when fault	HR38.3	Ext. Alarm Group 4
25	WAGO61850ServerDevice/GGIO1.Alm19.stVal	General single alarm	True when fault	HR30..38 with mask	Summary of the other alarms
26	WAGO61850ServerDevice/GGIO1.AnIn1.mag.f	General single alarm	Float32	HR16	Maximum system temperature
27	WAGO61850ServerDevice/GGIO1.AnIn2.mag.f	General single alarm	Float32	HR15	Maximum battery temperature
28	WAGO61850ServerDevice/GGIO1.IntIn.stVal	General integer value	Int16U	HR04	Boost charge state
29	WAGO61850ServerDevice/ZBAT1.NamPlt.vendor	Name plate vendor	String32	Changeable on WebVisu	
30	WAGO61850ServerDevice/ZBAT1.NamPlt.swRev	Name plate revision	String32	Changeable on WebVisu	
31	WAGO61850ServerDevice/ZBAT1.Vol.mag.f	Battery voltage	Float32	HR10	System voltage
32	WAGO61850ServerDevice/ZBAT1.Amp.mag.f	Battery drain current	Float32	HR12	Battery current
33	WAGO61850ServerDevice/ZBAT1.BatTest.ctlModel	Battery test	Int16U	HR03	Battery Test State
34	WAGO61850ServerDevice/ZBAT1.BatTest.stVal	(Start) battery test	True when On	HR02.1	Battery test active
35	WAGO61850ServerDevice/ZBAT1.TestRsl.stVal	Battery test result	True when fault	HR36.4	Battery test fault
36	WAGO61850ServerDevice/ZBAT1.BatLo.stVal	Battery low	True when fault	HR30.2	Low System Voltage
37	WAGO61850ServerDevice/ZBAT1.BatHi.stVal	Battery high (Overcharge)	True when fault	HR30.3	High System Voltage
38	WAGO61850ServerDevice/ZCON1.NamPlt.vendor	Name plate vendor	String32	Changeable on WebVisu	
39	WAGO61850ServerDevice/ZCON1.NamPlt.swRev	Name plate revision	String32	Changeable on WebVisu	
40	WAGO61850ServerDevice/ZCON1.OpTmh.stVal	Operation (time)	Int16U	HR02	Operation mode
41	WAGO61850ServerDevice/GAPC1.NamPlt.vendor	Name plate vendor	String32	Changeable on WebVisu	
42	WAGO61850ServerDevice/GAPC1.NamPlt.swRev	Name plate revision	String32	Changeable on WebVisu	
43	WAGO61850ServerDevice/GAPC1.StrVal1.setMag.i	General application value	Int16U	HR30	System voltage alarms
44	WAGO61850ServerDevice/GAPC1.StrVal2.setMag.i	General application value	Int16U	HR31	System fault alarms
45	WAGO61850ServerDevice/GAPC1.StrVal3.setMag.i	General application value	Int16U	HR32	Miscellaneous system alarms
46	WAGO61850ServerDevice/GAPC1.StrVal4.setMag.i	General application value	Int16U	HR33	Rectifier alarms
47	WAGO61850ServerDevice/GAPC1.StrVal5.setMag.i	General application value	Int16U	HR34	Inverter system alarms
48	WAGO61850ServerDevice/GAPC1.StrVal6.setMag.i	General application value	Int16U	HR35	Other modules alarms
49	WAGO61850ServerDevice/GAPC1.StrVal7.setMag.i	General application value	Int16U	HR36	Battery alarms
50	WAGO61850ServerDevice/GAPC1.StrVal8.setMag.i	General application value	Int16U	HR37	Low voltage disconnection alarms
51	WAGO61850ServerDevice/GAPC1.StrVal9.setMag.i	General application value	Int16U	HR38	External alarms
52	WAGO61850ServerDevice/MMXN1.NamPlt.vendor	Name plate vendor	String32	Changeable on WebVisu	
53	WAGO61850ServerDevice/MMXN1.NamPlt.swRev	Name plate revision	String32	Changeable on WebVisu	
54	WAGO61850ServerDevice/MMXN1.Amp1.mag.f	Current for thermal model	Float32	HR11	Load current
55	WAGO61850ServerDevice/MMXN1.Amp2.mag.f	Current for thermal model	Float32	HR13	Total rectifier current
56	WAGO61850ServerDevice/MMXN1.Amp3.mag.f	Current for thermal model	Float32	HR14	Total inverter current

Datasets

Measurements in RP DataSet1A (Unbuffered report)

No:	IEC node	IEC61850 definition	Format in IEC	Holding register	Efore definition
1	WAGO61850ServerDevice/ZBAT1.Vol.mag.f	Battery voltage	Float32	HR10	System voltage
2	WAGO61850ServerDevice/MMXN1.Amp1.mag.f	Current for thermal model	Float32	HR11	Load current
3	WAGO61850ServerDevice/ZBAT1.Amp.mag.f	Battery drain current	Float32	HR12	Battery current
4	WAGO61850ServerDevice/MMXN1.Amp2.mag.f	Current for thermal model	Float32	HR13	Total rectifier current
5	WAGO61850ServerDevice/MMXN1.Amp3.mag.f	Current for thermal model	Float32	HR14	Total inverter current
6	WAGO61850ServerDevice/GGIO1.AnIn2.mag.f	General analoque input	Float32	HR15	Maximum battery temperature
7	WAGO61850ServerDevice/GGIO1.AnIn1.mag.f	General analoque input	Float32	HR16	Maximum system temperature

Alarm registers in BR DataSet1B (Buffered report)

No:	IEC node	IEC61850 definition	Format in IEC	Holding register	Efore definition
1	WAGO61850ServerDevice/GAPC1.StrVal1.setMag.i	General application value	Int16U	HR30	System voltage alarms
2	WAGO61850ServerDevice/GAPC1.StrVal2.setMag.i	General application value	Int16U	HR31	System fault alarms
3	WAGO61850ServerDevice/GAPC1.StrVal3.setMag.i	General application value	Int16U	HR32	Miscellaneous system alarms
4	WAGO61850ServerDevice/GAPC1.StrVal4.setMag.i	General application value	Int16U	HR33	Rectifier alarms
5	WAGO61850ServerDevice/GAPC1.StrVal5.setMag.i	General application value	Int16U	HR34	Inverter system alarms
6	WAGO61850ServerDevice/GAPC1.StrVal6.setMag.i	General application value	Int16U	HR35	Other modules alarms
7	WAGO61850ServerDevice/GAPC1.StrVal7.setMag.i	General application value	Int16U	HR36	Battery alarms
8	WAGO61850ServerDevice/GAPC1.StrVal8.setMag.i	General application value	Int16U	HR37	Low voltage disconnection alarms
9	WAGO61850ServerDevice/GAPC1.StrVal9.setMag.i	General application value	Int16U	HR38	External alarms
10	WAGO61850ServerDevice/ZCON1.OpTmh.stVal	Converter operation value	Int16U	HR02	Operation mode
11	WAGO61850ServerDevice/ZBAT1.BatTest.ctlNum	Battery test control number	Int16U	HR03	Battery test state
12	WAGO61850ServerDevice/GGIO1.IntIn.stVal	General integer value	Int16U	HR04	Boost charge state

Alarms in BR DataSet1C (Buffered report)

No:	IEC node	IEC61850 definition	Meaning	Holding register.Bit	Efore definition
1	WAGO61850ServerDevice/ZBAT1.TestRsl.stVal WAGO61850ServerDevice/ZBAT1.TestRsl.t	Battery test result Battery test UTC timestamp	True when fault	HR36.4	Battery test fault
2	WAGO61850ServerDevice/ZBAT1.BatLo.stVal WAGO61850ServerDevice/ZBAT1.BatLo.t	Battery low Battery low UTC timestamp	True when fault	HR30.2	Low System Voltage
3	WAGO61850ServerDevice/ZBAT1.BatHi.stVal WAGO61850ServerDevice/ZBAT1.BatHi.t	Battery high (Overcharge) Battery high UTC timestamp	True when fault	HR30.3	High System Voltage
4	WAGO61850ServerDevice/GGIO1.Alm1.stVal WAGO61850ServerDevice/GGIO1.Alm1.t	General single alarm Single alarm UTC timestamp	True when fault	HR30.0	Mains fault
5	WAGO61850ServerDevice/GGIO1.Alm2.stVal WAGO61850ServerDevice/GGIO1.Alm2.t	General single alarm Single alarm UTC timestamp	True when fault	HR31.0	Earth fault
6	WAGO61850ServerDevice/GGIO1.Alm3.stVal WAGO61850ServerDevice/GGIO1.Alm3.t	General single alarm Single alarm UTC timestamp	True when fault	HR31.1	Load fuse fault
7	WAGO61850ServerDevice/GGIO1.Alm4.stVal WAGO61850ServerDevice/GGIO1.Alm4.t	General single alarm Single alarm UTC timestamp	True when fault	HR31.2	Battery fuse fault
8	WAGO61850ServerDevice/GGIO1.Alm5.stVal WAGO61850ServerDevice/GGIO1.Alm5.t	General single alarm Single alarm UTC timestamp	True when fault	HR31.8	System over temperature
9	WAGO61850ServerDevice/GGIO1.Alm6.stVal WAGO61850ServerDevice/GGIO1.Alm6.t	General single alarm Single alarm UTC timestamp	True when fault	HR32.0	Boost charge active
10	WAGO61850ServerDevice/GGIO1.Alm7.stVal WAGO61850ServerDevice/GGIO1.Alm7.t	General single alarm Single alarm UTC timestamp	True when fault	HR33.5	Rectifier fault
11	WAGO61850ServerDevice/GGIO1.Alm8.stVal WAGO61850ServerDevice/GGIO1.Alm8.t	General single alarm Single alarm UTC timestamp	True when fault	HR33.7	Rectifier over temperature
12	WAGO61850ServerDevice/GGIO1.Alm9.stVal WAGO61850ServerDevice/GGIO1.Alm9.t	General single alarm Single alarm UTC timestamp	True when fault	HR34.5	Inverter system fault
13	WAGO61850ServerDevice/GGIO1.Alm10.stVal WAGO61850ServerDevice/GGIO1.Alm10.t	General single alarm Single alarm UTC timestamp	True when fault	HR36.5	Battery over temperature
14	WAGO61850ServerDevice/GGIO1.Alm11.stVal WAGO61850ServerDevice/GGIO1.Alm11.t	General single alarm Single alarm UTC timestamp	True when fault	HR36.7	Battery temperature sensor fault
15	WAGO61850ServerDevice/GGIO1.Alm12.stVal WAGO61850ServerDevice/GGIO1.Alm12.t	General single alarm Single alarm UTC timestamp	True when fault	HR30.4	Float charge deviation
16	WAGO61850ServerDevice/GGIO1.Alm13.stVal WAGO61850ServerDevice/GGIO1.Alm13.t	General single alarm Single alarm UTC timestamp	True when fault	HR31.3	Rectifier Overload
17	WAGO61850ServerDevice/GGIO1.Alm14.stVal WAGO61850ServerDevice/GGIO1.Alm14.t	General single alarm Single alarm UTC timestamp	True when fault	HR33.0	Communication Error
18	WAGO61850ServerDevice/GGIO1.Alm15.stVal WAGO61850ServerDevice/GGIO1.Alm15.t	General single alarm Single alarm UTC timestamp	True when fault	HR38.0	Ext. Alarm Group 1
19	WAGO61850ServerDevice/GGIO1.Alm16.stVal WAGO61850ServerDevice/GGIO1.Alm16.t	General single alarm Single alarm UTC timestamp	True when fault	HR38.1	Ext. Alarm Group 2
20	WAGO61850ServerDevice/GGIO1.Alm17.stVal WAGO61850ServerDevice/GGIO1.Alm17.t	General single alarm Single alarm UTC timestamp	True when fault	HR38.2	Ext. Alarm Group 3
21	WAGO61850ServerDevice/GGIO1.Alm18.stVal WAGO61850ServerDevice/GGIO1.Alm18.t	General single alarm Single alarm UTC timestamp	True when fault	HR38.3	Ext. Alarm Group 4
22	WAGO61850ServerDevice/GGIO1.Alm19.stVal WAGO61850ServerDevice/GGIO1.Alm19.t	General single alarm Single alarm UTC timestamp	True when fault	HR30..38 with mask	Summary of the other alarms

