

# 61850 Avenue 2.1

## Substation Communication Tool

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### User guide

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# INFO TECH sp.j.

- Experts in the field of communication solutions for power automation and industrial automation.
- Renowned supplier of protocol software libraries and tools for communication testing and device simulation.
- As of January 2020, the licensed INFO TECH software is the basis for implementing IEC 61850 interfaces in the products of 40 companies and institutions from 15 countries of Europe, Asia and North America.
- INFO TECH offers also:
  - **Hands-on trainings** on IEC 61850 communication,
  - **Conformance testing** of the IEC 61850 interfaces,
  - **Audits and diagnostics of systems** using IEC 61850 communication.

# Product from the renowned supplier of communication software libraries and testing tools for automation systems

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Other known products from this area:

- ❑ **ProtAn** – protocol analyzer for serial asynchronous communication (RS-232, RS-485)
- ❑ **ProtAn for Ethernet** – protocol analyzer for Ethernet networks
- ❑ **ProTester** – simulation tools for master and slave stations of protocols operating on serial and TCP/IP based networks
- ❑ **IEC 61850 Software Library (source code)**
- ❑ **61850 SCL Runner** – simulator of IEC 61850 server devices based on their description in SCL files

# 61850 Avenue toolset

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- ❑ **61850 Avenue**: set of tool programs for testing IEC 61850 communication, developed with the use of **INFO TECH IEC61850 Software Library**
- ❑ First tool of the package - **61850 Avenue client tool**: beta version supplied to selected customers already in January 2007
- ❑ First official release: May 2007 (together with the server program **61850 Relay Simulator**)
- ❑ Updates and functional extensions in the following years
- ❑ **GOOSE toolset**: added in January 2008
- ❑ **Sampled Values toolset**: added in December 2011
- ❑ **File Transfer toolset**: added in February 2012
- ❑ **61850 Avenue 2.0**: released in April 2013
- ❑ Added support of **Edition 2**
- ❑ Added message logging
- ❑ **Update of IEC 61850 client GUI**: version **2.1** released in April 2018
- ❑ **Routable GOOSE and Routable SV** options added in September 2019

The name **61850 Avenue** was adopted to the whole toolset package.

# Awarded product

- INFO TECH IEC61850 Software Library (source code) together with the testing and simulation toolsets (61850 Avenue and 61850 SCL Runner) – was honored with a prestigious award – **Honorable Commendation of the International Power Industry Fair ENERGETAB 2017**



# Wide applicability of the toolset

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- Suitable for:
  - testing devices and systems with IEC 61850 communication,
  - commissioning of IEC 61850 based systems,
  - development projects implementing IEC 61850 communication,
  - verification of product conformance with the IEC 61850 standard,
  - practical learning of the IEC 61850 standard.
- Truly easy to learn and apply ...
- All programs include the **context help function** invocable with **F1** key.

# 61850 Avenue

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Your safe and easy road to learn and use the IEC 61850 standard.

Welcome!





# Installation procedure

Supported platforms:

PC running

**MS Windows Vista  
or newer (7,8,10)**

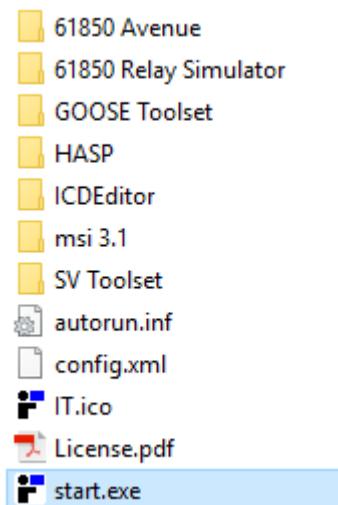


# To install the software

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From the supplied CD: possible start in autorun mode.

Alternatively: invoke the program **start.exe**



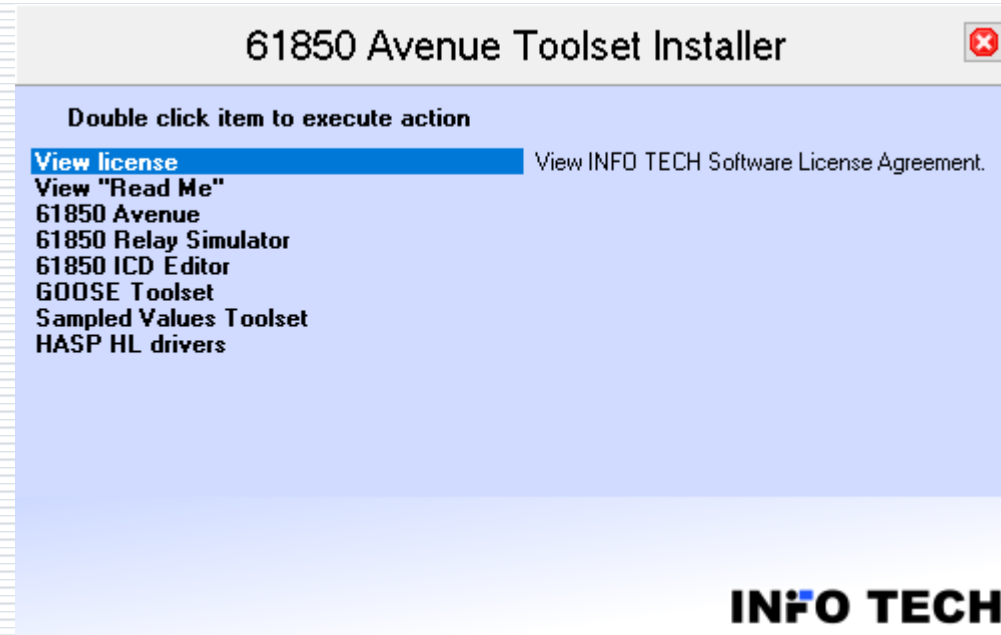
# License

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- **Before installing the software please learn and accept the licensing terms described in the paper note attached to the CD and/or in the file License.pdf**
- Please acknowledge the following notice concerning the USB license key:
  - The supplied license key represents the value you have purchased. Please take care of it and protect it from losing or damaging like any other object of value. Please understand that we cannot replace lost, corrupted or physically damaged keys.

# Installation steps

- ❑ After starting the installation program the following list of documents, applications and drivers will be displayed – it is possible to install only selected tool programs and omit those which will not be used.
- ❑ At first, begin with viewing the license agreement.



# Third party components

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- **HASP HL drivers** – to manage the USB license key
- **WinPcap 4.1.3** used by Relay Simulator, GOOSE toolset, SV toolset (alternatively, it is possible to use Win10Pcap or Npcap if already installed)

# IEC 61850 client tool (**61850 Avenue**)



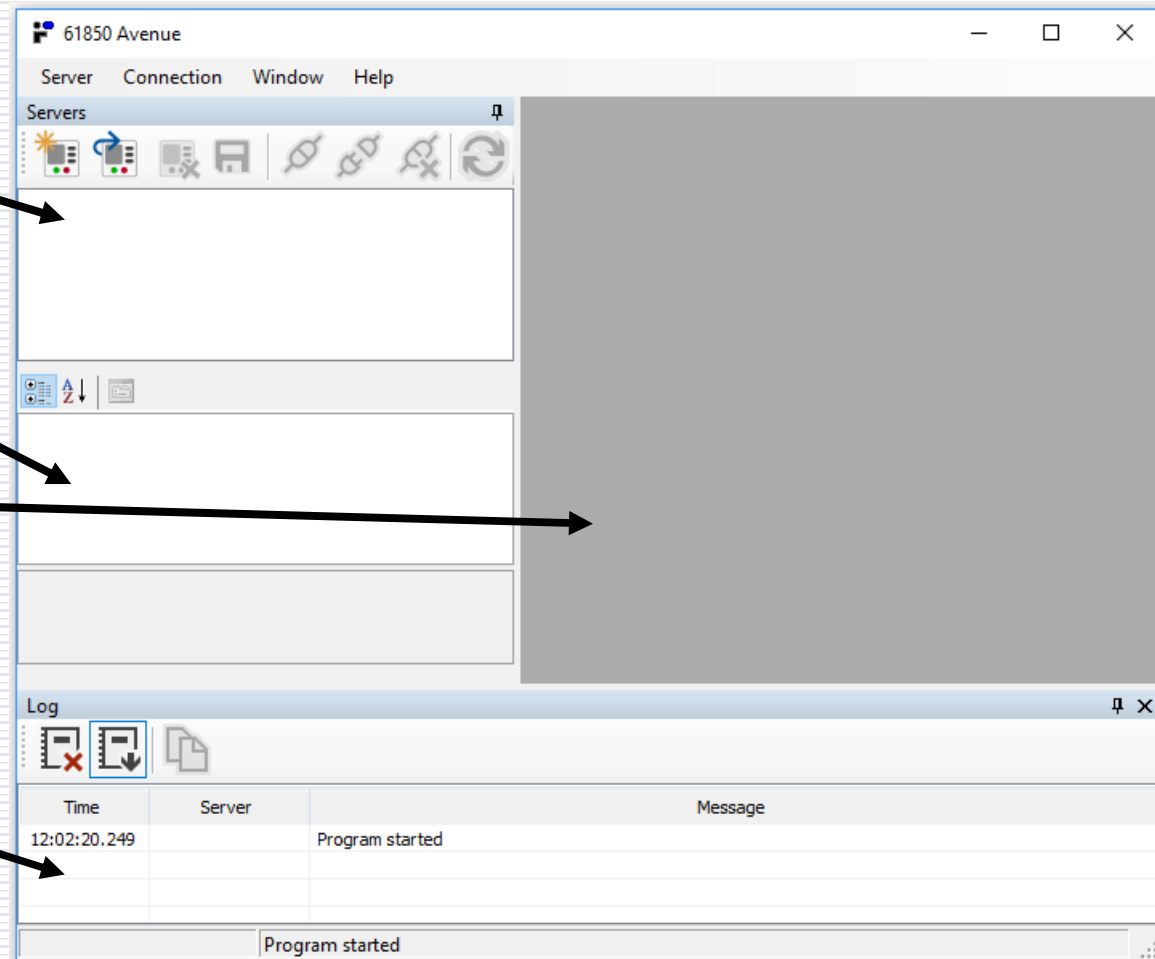
# Initial view after the first start-up of 61850 Avenue client

**Servers** – window with the list of server devices to communicate with.

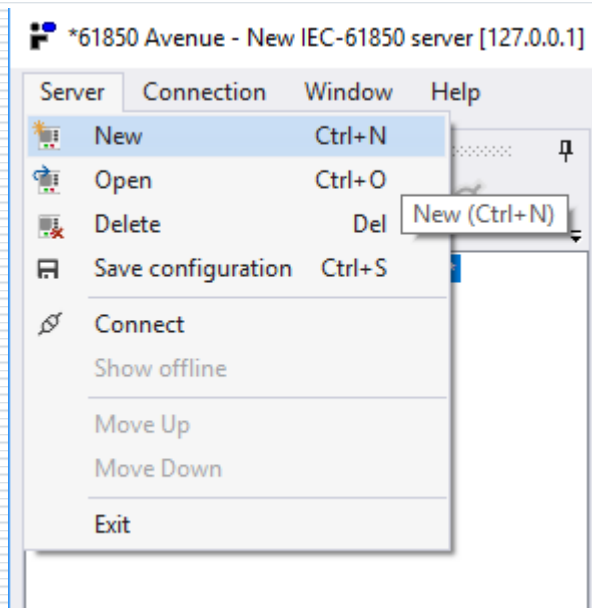
**Properties** – window with the list of connection parameters of the selected server (connection parameters can be saved in the configuration file).

**Main operation view** – for folders with server data models.

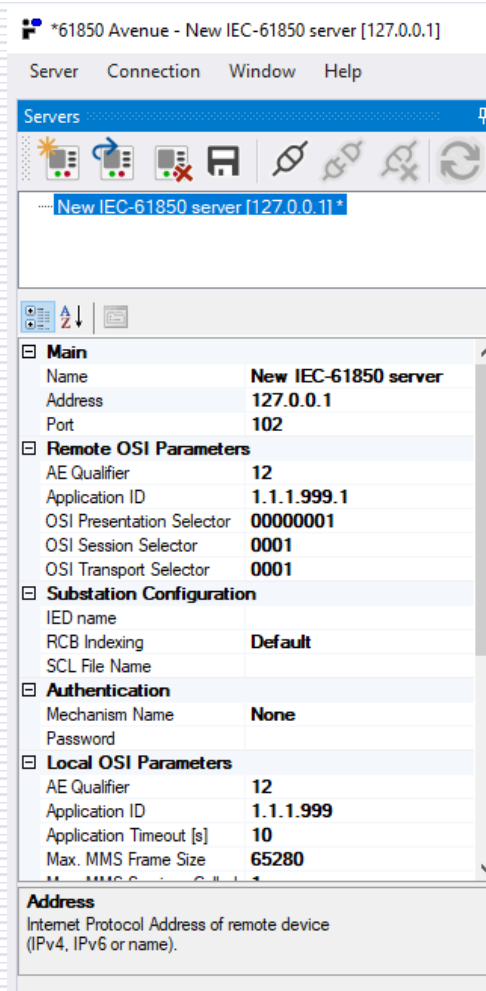
**Log view** – chronological view of operations (commands, responses and events) occurring during the interactions with server devices.



# Connection to a new server device with data model browsing



From **Server** menu select **New** command to define a new server device.



A new server IED with the name **New IEC-61850 server** and IP address **[127.0.0.1]** will appear in **Properties** window.

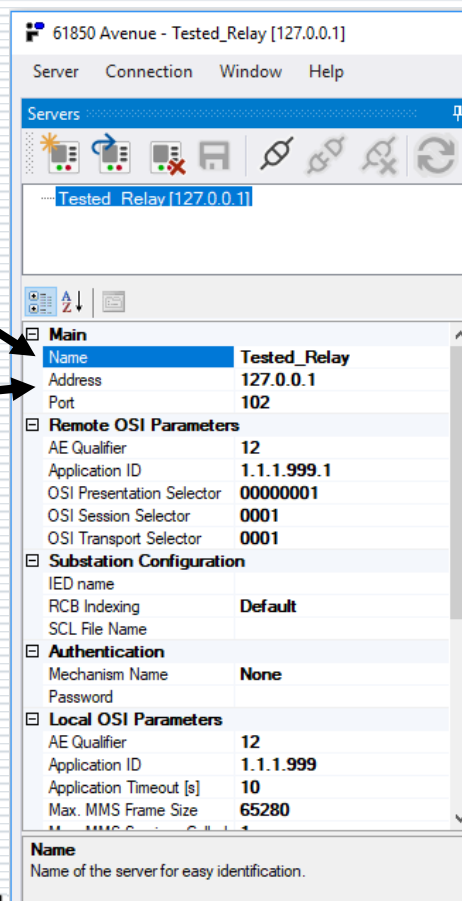


\* **after** the name of the IED server device means **unsaved configuration**.



# Assigning target name and IP address to a new server device for browsing

In **Servers** window write the target device name in place of default **New IEC-61850 server** and the target IP address in place of **127.0.0.1**.



Now the client-server connection can be established: in **Server** window from context menu of the selected device invoke the command **Connect**

# Server device data model displayed after connecting and browsing

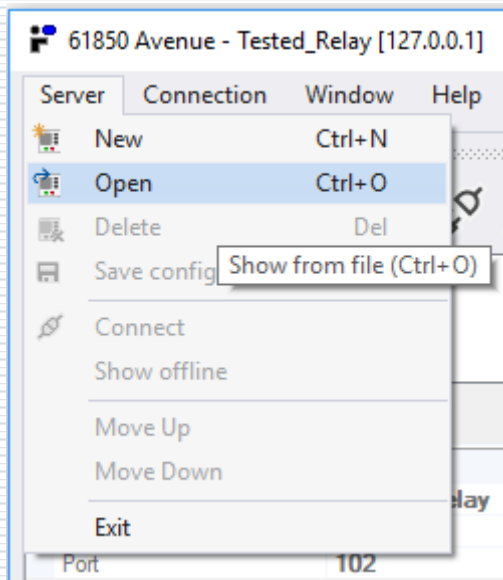
Fast exploration of the server device data model.

The screenshot displays a software interface for exploring a server device data model. The window title is "61850 Avenue - Tested\_Relay [127.0.0.1]". The interface includes a menu bar (Server, Connection, Window, Help) and a toolbar with various icons. The main area is divided into several sections:

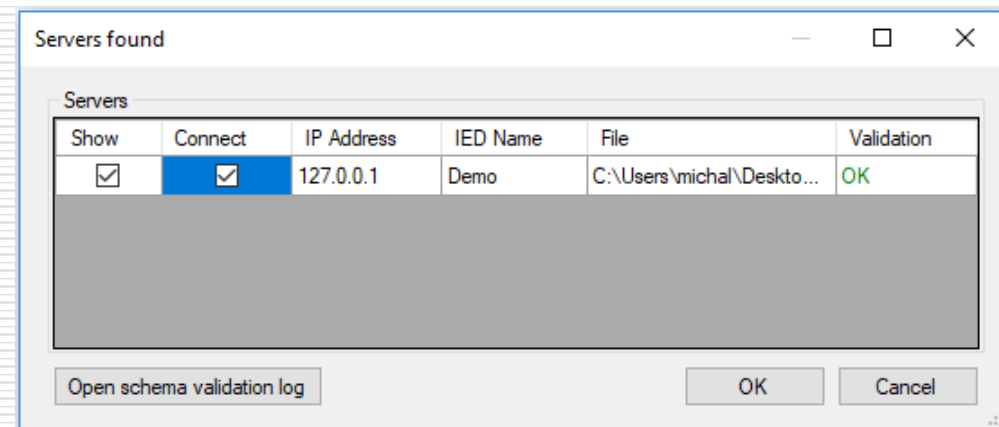
- Servers:** A list of servers, with "Tested\_Relay [127.0.0.1]" selected and expanded to show "Tested\_Relay [127.0.0.1]".
- Properties Table:** A table showing details for the selected server:

Main	
Name	Tested_Relay
Address	127.0.0.1
Port	102
Remote OSI Parameters	
AE Qualifier	12
Application ID	1.1.1.999.1
OSI Presentation Selector	00000001
OSI Session Selector	0001
OSI Transport Selector	0001
Substation Configuration	
IED name	
RCB Indexing	Default
SCI File Name	
- Tree View:** A hierarchical tree view showing the data model structure:
  - Association
    - DemoMeasurement
      - LN LLNO
      - LN LPHD1
      - LN I3pMHAI1
      - LN I3pMMXU1
      - LN U3pMMXU2
    - DemoProtCtrl
      - LN LLNO
      - LN LPHD1
      - LN DIGGIO1
      - LN I3GPTOC1
      - LN I3GPTRC1
      - LN Obj1CSWI1
      - LN Obj1XCBR1
      - LN Obj2XSWI1
      - LN Obj3CSWI2
      - LN Obj3XCBR2

# Connection to a new server device using its SCL description file



Invoke **Open** command and select an SCL file describing the server device.



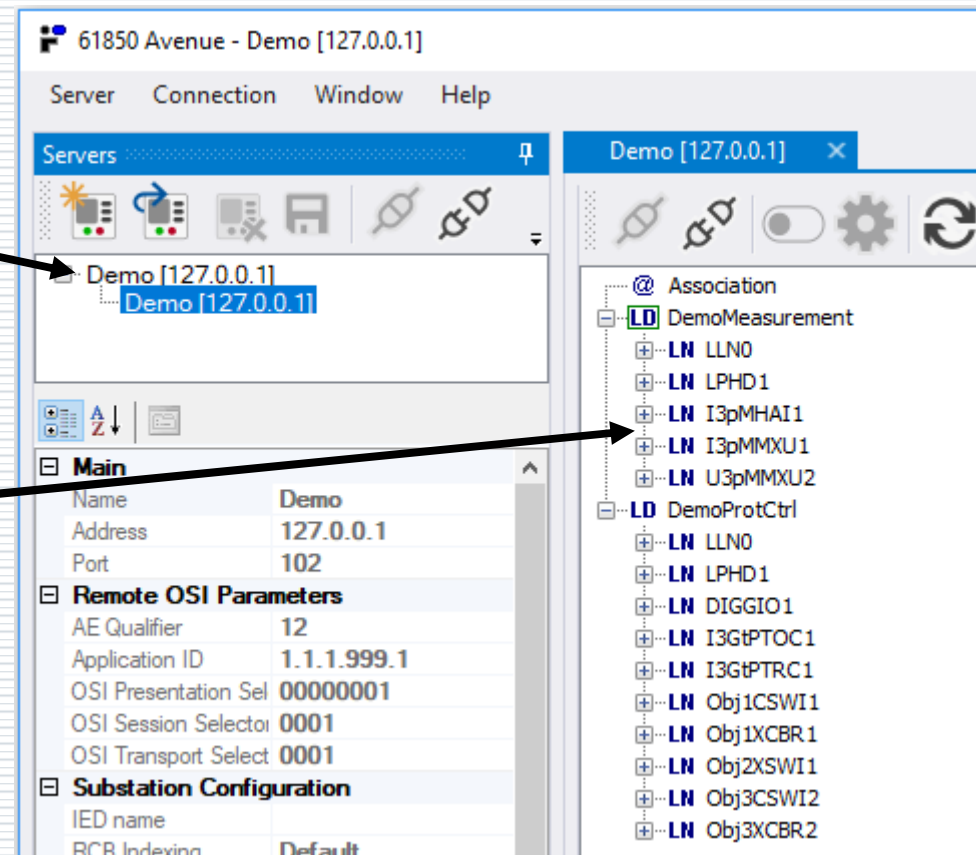
After selecting the file set check boxes:

- **Show** - to display the server preview (offline mode),
- **Connect** - to automatically connect to the server.

# Explanation of Show and Connect options

After selecting the **Connect** option, the client will be automatically connected to the server.

When the **Show** option is checked, the device data model will appear in the **Main** operation view.



# Connection establishing after importing SCL file

Click **Connect** icon to connect with the device in the network and then **Refresh Current Object** on LD, LN or DO/DA level to read data.

The screenshot shows a software interface with a 'Servers' list on the left containing 'Demo [127.0.0.1]'. The main area displays a tree view of the device's structure, including 'LN I3pMHA11', 'LN I3pMMXU1', 'LN U3pMMXU2', 'LD DemoProtCtrl', and 'LN LLNO'. A table on the right lists objects with columns for Name, FC, and Value. A 'Connect' icon is highlighted in the top toolbar, and a 'Refresh Current Object' icon is highlighted in the bottom toolbar. Arrows point from the text above to these icons.

Name	FC	Value
DemoProtCtrl/Ob...	ST	{stVal= {interr
DemoProtCtrl/Ob...	ST	{stVal= {interr
DemoProtCtrl/LL...	ST	{stVal=false, c
DemoProtCtrl/I3...	ST	{stVal=0, q=0
DemoProtCtrl/I3...	ST	{general=false
DemoProtCtrl/I3...	ST	{general=false
DemoProtCtrl/I3...	ST	{general=false
DemoProtCtrl/Ob...	ST	{stVal= {interr
DemoProtCtrl/Ob...	ST	{stVal= {interr

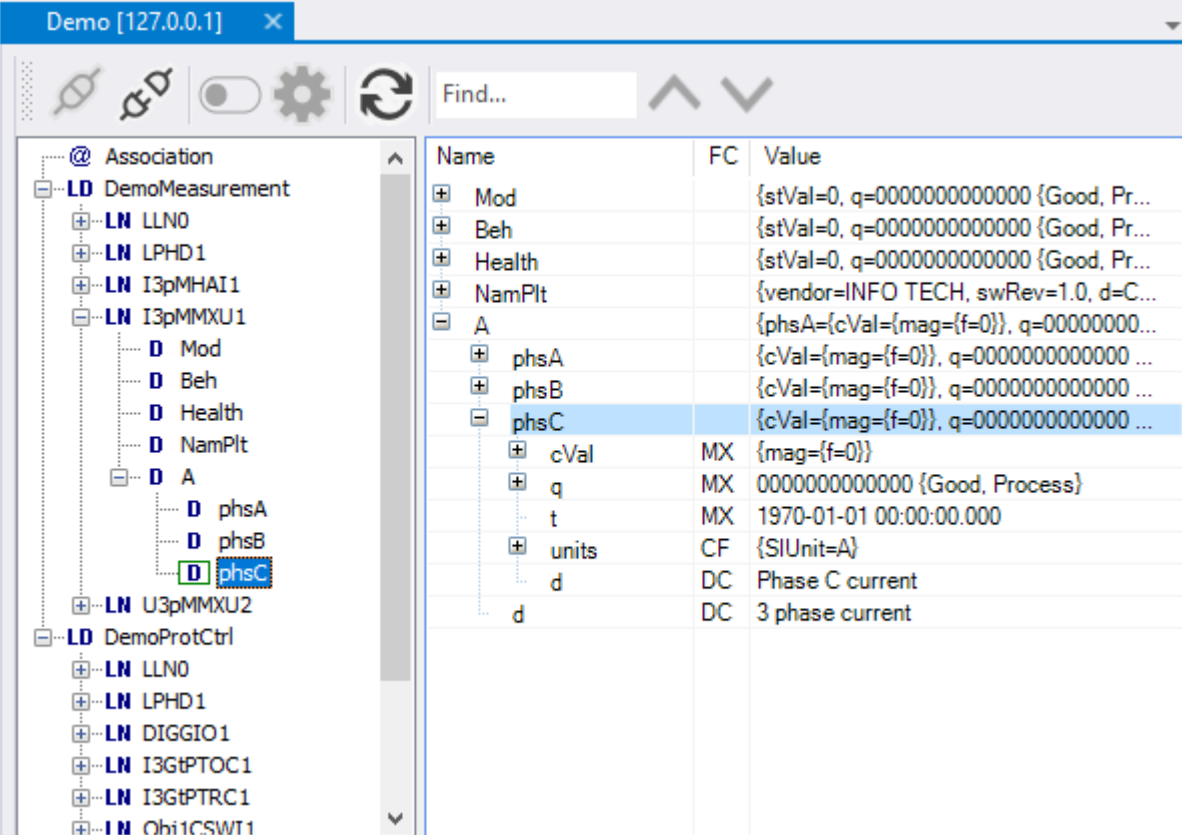
Off-line model browsing possible.

# Data model view

True data model as defined in IEC 61850-7.

No confusion with MMS Named Variable space.

The tool can maintain connections to multiple server devices.



Name	FC	Value
Mod		{stVal=0, q=0000000000000000 {Good, Pr...
Beh		{stVal=0, q=0000000000000000 {Good, Pr...
Health		{stVal=0, q=0000000000000000 {Good, Pr...
NamPlt		{vendor=INFO TECH, swRev=1.0, d=C...
A		{phsA={cVal={mag={f=0}}, q=00000000...
phsA		{cVal={mag={f=0}}, q=0000000000000000 ...
phsB		{cVal={mag={f=0}}, q=0000000000000000 ...
phsC		{cVal={mag={f=0}}, q=0000000000000000 ...
cVal	MX	{mag={f=0}}
q	MX	0000000000000000 {Good, Process}
t	MX	1970-01-01 00:00:00.000
units	CF	{SIUnit=A}
d	DC	Phase C current
d	DC	3 phase current



# Possible simultaneous connections with multiple servers

In **Main operation view** the tabs of server devices can be arranged as preferred by the tool user.

The screenshot displays a network management application with multiple tabs for different server devices. The tabs include 'Demo [127.0.0.1]', 'RegrTestEd1 [192.168.11.157]', and another 'Demo [127.0.0.1]'. The interface shows a hierarchical tree view of network elements, including Association, LD DemoMeasurement, LN LLNO, LN LPHD1, LN I3pMHAI1, LN I3pMMXU1, D Mod, D Beh, D Health, D NamPlt, D A, D phsA, D phsB, D phsC, LN U3pMMXU2, LD DemoProtCtrl, LN LLNO, LN LPHD1, LN DIGGIO1, LN I3GtPTOC1, LN I3GtPTRC1, and LN OhitCSWI1. A table on the right side of the interface lists the following data:

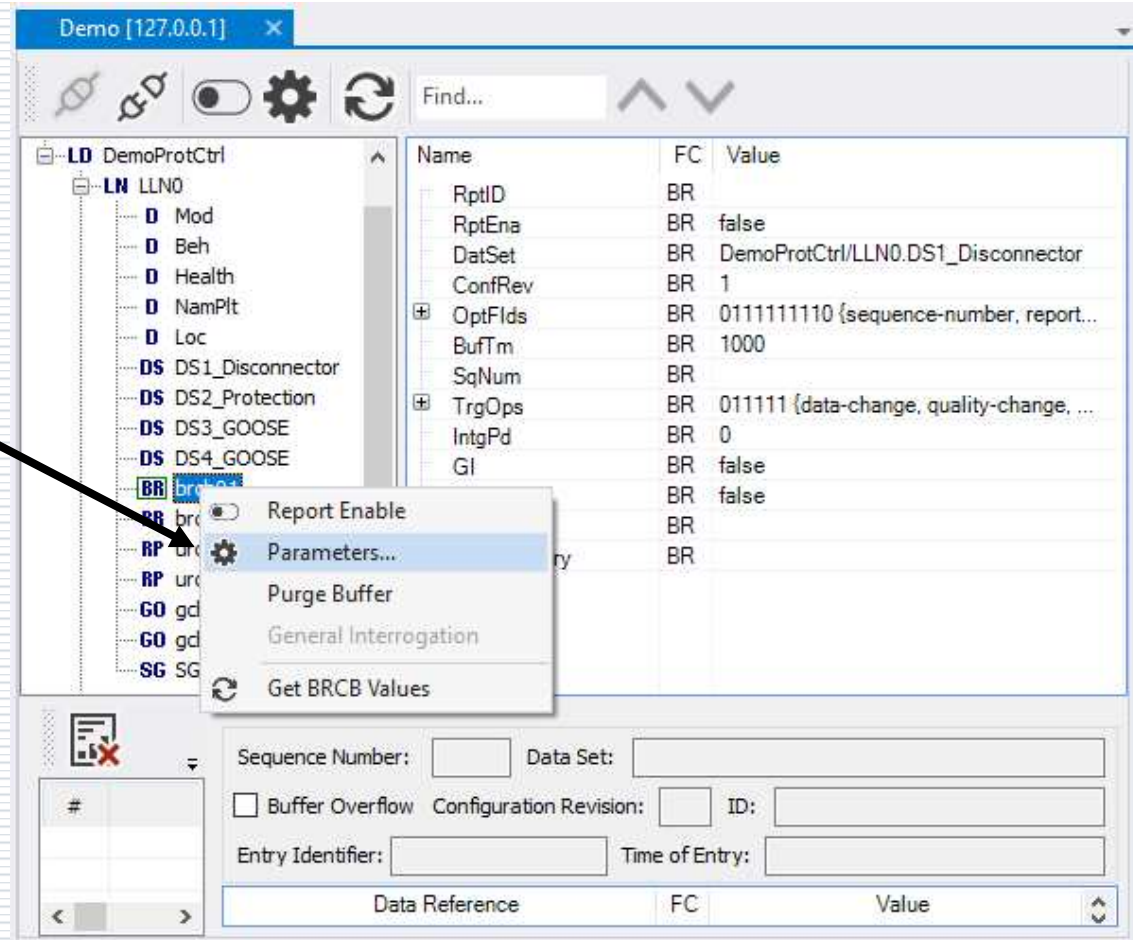
Name	FC	Ve
Mod		{st
Beh		{st
Health		{st
NamPlt		{ve

At the bottom of the interface, there are input fields for 'Sequence Number', 'Data Set', 'Buffer Overflow', 'Configuration Revision', 'Entry Identifier', 'Time of Entry', and 'Data Reference'.

# Reporting function in IEC 61850

Reporting services as defined in IEC 61850-7-2.

Reporting configuration can be invoked from the context menu of a chosen rcb or using the program icon.





# Configuration of the reporting function

**BR / RP:** dedicated windows for review and modification of reporting parameters of BRCB / URCB.

The screenshot shows a configuration window titled "Demo [127.0.0.1]: DemoProtCtrl/LLN0.brcb01". The window contains the following fields and options:

- Report Identifier: (empty text box)
- Data Set Reference: DemoMeasurement/LLN0.DS2\_All (dropdown menu)
- Configuration Revision: 2 (text box)
- Integrity Period [ms]: 0 (text box)
- Buffer Time [ms]: 1000 (text box)
- Entry Identifier: 0000000000000000 (text box)
- Sequence Number: 0 (text box)
- Time Of Entry: 1984-01-01 00:00:00.000 (text box)
- Reservation Time [s]: (empty text box)
- Optional Fields (checkboxes):
  - Sequence Number
  - Data Reference
  - Report Time Stamp
  - Buffer Overflow
  - Reason For Inclusion
  - Entry Identifier
  - Data Set Name
  - Configuration Revision
- Trigger Options (checkboxes):
  - Data Change (dchg)
  - Quality Change (qchg)
  - Data Update (dupd)
  - Integrity
  - General Interrogation

Buttons at the bottom: Apply, Enable, GI, Refresh, Close.

# Selection of dataset for reporting

Selection from dropdown list of all datasets present in the device.

The list results from the imported or explored device data model and includes also dynamically created datasets.

Demo [127.0.0.1]: DemoProtCtrl/LLN0.brcb01

Report Identifier:

Data Set Reference: DemoMeasurement/LLN0.DS2\_All

Configuration Revision: DemoMeasurement/LLN0.DS1\_Measurement  
DemoMeasurement/LLN0.DS2\_All

Buffer Time [ms]: DemoProtCtrl/LLN0.DS1\_Disconnector

Sequence Number: DemoProtCtrl/LLN0.DS2\_Protection  
DemoProtCtrl/LLN0.DS3\_GOOSE  
DemoProtCtrl/LLN0.DS4\_GOOSE

Reservation Time [s]:

Optional Fields

<input checked="" type="checkbox"/> Sequence Number	<input checked="" type="checkbox"/> Data Reference
<input checked="" type="checkbox"/> Report Time Stamp	<input checked="" type="checkbox"/> Buffer Overflow
<input checked="" type="checkbox"/> Reason For Inclusion	<input checked="" type="checkbox"/> Entry Identifier
<input checked="" type="checkbox"/> Data Set Name	<input checked="" type="checkbox"/> Configuration Revision

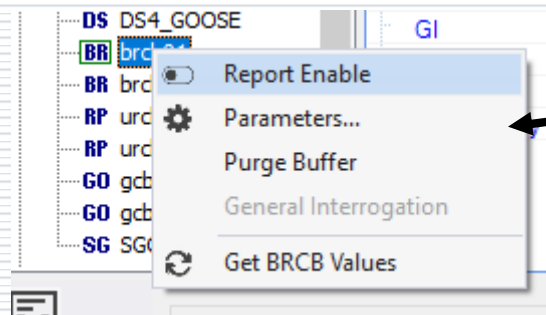
Trigger Options

<input checked="" type="checkbox"/> Data Change (dchg)
<input checked="" type="checkbox"/> Quality Change (qchg)
<input checked="" type="checkbox"/> Data Update (dupd)
<input checked="" type="checkbox"/> Integrity
<input checked="" type="checkbox"/> General Interrogation

Apply Enable GI Refresh Close

# Activation of the reporting function and reports viewing

Report control block (BRCB or URCB) can be enabled by invoking **Report Enable** command from the context menu or using the program icon.



#	Report ID	Reason code	
0	DemoMeasurement/LLN0\$BR\$brcb01	data-update	20
1	DemoMeasurement/LLN0\$BR\$brcb01	data-update	20
2	DemoMeasurement/LLN0\$BR\$brcb01	data-update	20
3	DemoMeasurement/LLN0\$BR\$brcb01	data-update	20
4	DemoMeasurement/LLN0\$BR\$brcb01	data-update	20
5	DemoMeasurement/LLN0\$BR\$brcb01	data-update	20

Sequence Number: 0    Data Set: DemoMeasurement/LLN0\$DS1\_Measurement

Buffer Overflow    Configuration Revision: 1    ID: DemoMeasurement/LLN0\$BR\$brcb01

Entry Identifier: 0000000000000001    Time of Entry: 2018-06-26 10:49:42.593

Data Reference	FC	Value
DemoMeasurement/I3pMHAI1.HA	MX	Reason code: data-update
q	MX	0000000000000000 {Good, Process}
t	MX	2018-06-26 10:49:42.527 [Leap Se...
phsAHar.[0].mag.f	MX	0
phsAHar.I11.mao.f	MX	100

Incoming reports are displayed in a traceable list.  
A selected report content can be easily viewed.

# List of reports

All incoming reports are collected into a list and presented with the following information:

- #** - report number in the list,
- Report ID** – report identifier,
- Received** – reception timestamp,
- SN** – report sequence number set by the reporting server (other formats in case of segmented reports:
  - SN.s - where s is a segment number,
  - SN.sF - where s is a segment number and F indicates the last segment),
- Data Set** – reference name of the dataset used for reporting,
- Details off/on** – show/hide the details of the selected report.

The screenshot shows a software interface with a tree view on the left and a data table on the right. The tree view shows a hierarchy of reports under 'DemoMeasurement', including 'LLN0' and 'LLN LPHD1'. The data table on the right lists various fields like 'RptID', 'RptEna', 'DatSet', etc., with their corresponding values. Below the tree view, there is a table with columns '#', 'Report ID', and 'R'. Below the data table, there are input fields for 'Sequence Number', 'Data Set', 'Buffer Overflow', 'Configuration Revision', 'ID', 'Entry Identifier', and 'Time of Entry'. At the bottom right, there is a 'Data Reference' table with columns 'Data Reference', 'FC', and 'Value'.

#	Report ID	R
0	DemoMeasurement/LLN0\$BR\$brcb01	data-1
1	DemoMeasurement/LLN0\$BR\$brcb01	data-1
2	DemoMeasurement/LLN0\$BR\$brcb01	data-1
3	DemoMeasurement/LLN0\$BR\$brcb01	data-1
4	DemoMeasurement/LLN0\$BR\$brcb01	data-1
5	DemoMeasurement/LLN0\$BR\$brcb01	data-1

Name	FC	Value
RptID	BR	
RptEna	BR	true
DatSet	BR	DemoMeasurement/LLN0\$DS1_Measurement
ConfRev	BR	1
OptFlDs	BR	01111111111 {sequence-number, report-time-stamp, reason-for-inclusion, ...
BufTm	BR	1000
SqNum	BR	1
TrgOps	BR	011111 {data-change, quality-change, data-update, integrity, general-inter...
IntgPd	BR	0
GI	BR	false
PurgeBuf	BR	false
EntryID	BR	0000000000000001
TimeOfEntry	BR	2018-06-26 10:49:42.593

Data Reference	FC	Value
DemoMeasurement/I3pMHAI1.HA	MX	Reason code: data-update
q	MX	0000000000000000 {Good, Process}
t	MX	2018-06-26 10:49:42.527 [Leap Se...
phsAHar.[0].mag.f	MX	0
phsAHar.I11.mao.f	MX	100

List of reports

Detailed view of selected report

# Report detailed content viewing

For each report from the list its detailed content can be examined. The following information is presented:

**Sequence Number** – report sequence number set by the server,

**Data Set** – reference name of the dataset,

**ID** – report identifier,

**Buffer Overflow** – indication of buffer overflow occurrence (for reports from BRCB only),

**Configuration Revision** – version of RCB configuration,

**Time of Entry** – time of report generation (report time stamp – equal to Time of Entry for BRCB),

**Entry Identifier** – report identifier (for reports from BRCB only),

and the **view of reported data** including:

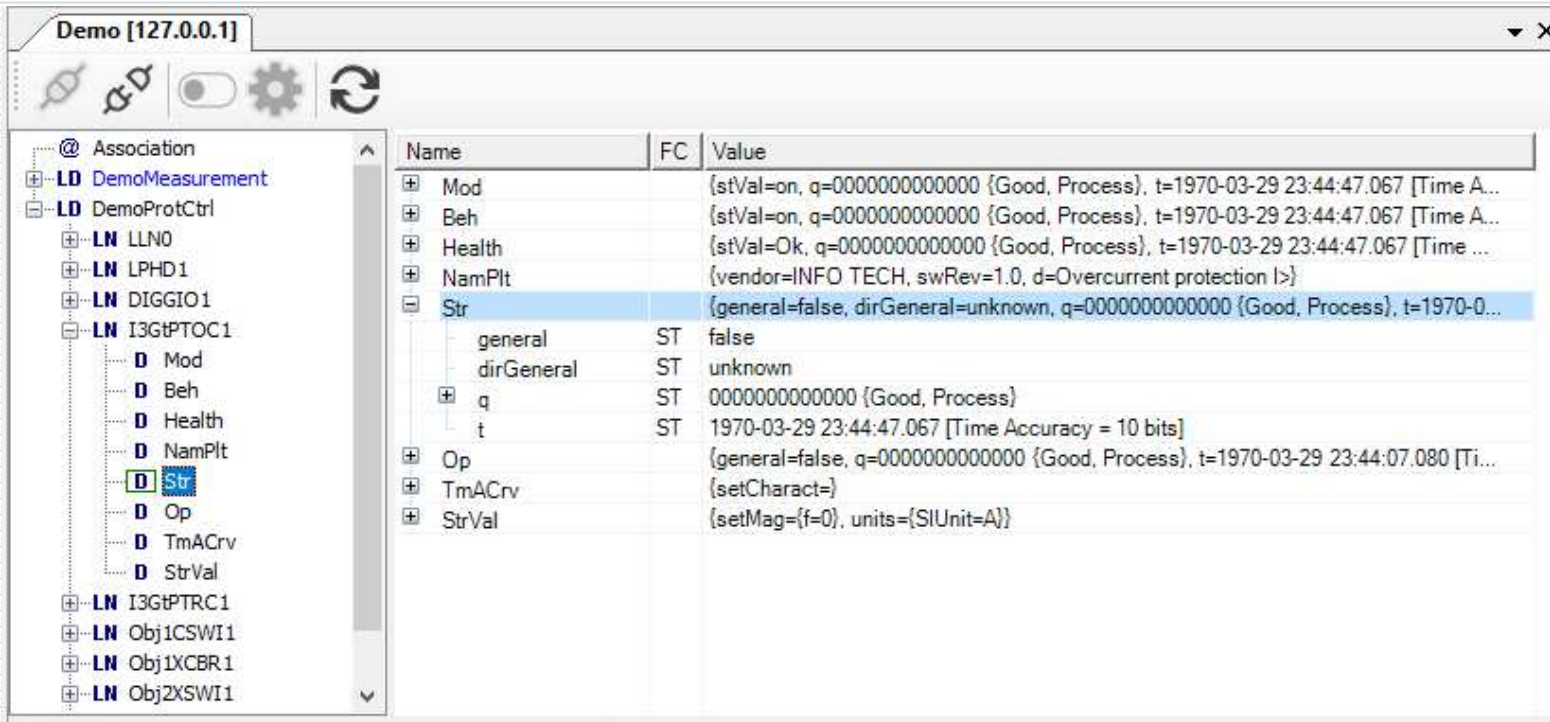
- reference name of reported data (**Data Reference**) with functional constraint (**FC**),
- reason (**Reason Code**) of including data in the report,
- names and values of data components.

Data Reference	FC	Value
⊖ DemoProtCtrl/Obj1CSW1.Pos	ST	Reason code: general-interrogation
- stVal	ST	10
- q	ST	0000000000000
- t	ST	2013-01-28 10:06:59.755 [Time ...
⊕ DemoProtCtrl/Obj3CSW12.Pos	ST	Reason code: general-interrogation
⊕ DemoProtCtrl/LLN0.Loc.stVal	ST	Reason code: general-interrogation
⊖ DemoProtCtrl/I3GtPTOC1.Str	ST	Reason code: general-interrogation
- general	ST	False
- dirGeneral	ST	3
- q	ST	000000000100
- t	ST	1970-01-01 00:00:00.000 [Clock ...
⊕ DemoProtCtrl/I3GtPTOC1.Op	ST	Reason code: general-interrogation
⊖ DemoProtCtrl/I3GtPTRC1.Tr	ST	Reason code: general-interrogation
- general	ST	False
- q	ST	000000000100
- t	ST	1970-01-01 00:00:00.000 [Clock ...
⊖ DemoProtCtrl/Obj1XCBR1.Pos	ST	Reason code: general-interrogation
- stVal	ST	10
- q	ST	0000000000000
- t	ST	2013-01-28 10:06:59.755 [Time ...
⊖ DemoProtCtrl/Obj3XCBR2.Pos	ST	Reason code: general-interrogation
- stVal	ST	10
- q	ST	0000000000000
- t	ST	2013-01-28 10:06:59.795 [Time ...



# Data model view updates by reports

Data values received in reports update also the view of the data model. The name and value of each updated data is emphasized using **blue font**. The same visualization is applied to updates obtained upon read requests.



The screenshot shows a software interface with a data model tree on the left and a table of data points on the right. The tree on the left shows a hierarchy starting with 'Association' and 'DemoMeasurement'. Under 'DemoMeasurement', there is a 'DemoProtCtrl' object, which contains several 'LN' (Logical Node) objects: 'LLN0', 'LPHD1', 'DIGGIO1', and 'I3GtPTOC1'. The 'I3GtPTOC1' object is expanded to show its data points: 'Mod', 'Beh', 'Health', 'NamPlt', 'Str', 'Op', 'TmACrv', and 'StrVal'. The 'Str' data point is highlighted in blue. The table on the right shows the details of the 'Str' data point, with its name and value highlighted in blue. The table has three columns: 'Name', 'FC', and 'Value'. The 'Str' data point is expanded to show its sub-objects: 'general', 'dirGeneral', 'q', and 't'. The 'q' and 't' data points are also highlighted in blue.

Name	FC	Value
Mod		{stVal=on, q=00000000000000 {Good, Process}, t=1970-03-29 23:44:47.067 [Time A...
Beh		{stVal=on, q=00000000000000 {Good, Process}, t=1970-03-29 23:44:47.067 [Time A...
Health		{stVal=Ok, q=00000000000000 {Good, Process}, t=1970-03-29 23:44:47.067 [Time ...
NamPlt		{vendor=INFO TECH, swRev=1.0, d=Overcurrent protection I>}
Str		{general=false, dirGeneral=unknown, q=00000000000000 {Good, Process}, t=1970-0...
general	ST	false
dirGeneral	ST	unknown
q	ST	00000000000000 {Good, Process}
t	ST	1970-03-29 23:44:47.067 [Time Accuracy = 10 bits]
Op		{general=false, q=00000000000000 {Good, Process}, t=1970-03-29 23:44:07.080 [Ti...
TmACrv		{setCharact=}
StrVal		{setMag={f=0}, units={SIUnit=A}}

# Control services in IEC 61850

The image displays two screenshots of a software interface for IEC 61850 control services. The left screenshot shows a tree view of objects under 'Demo [127.0.0.1]'. The 'Pos' object is selected, and a context menu is open with options: 'Control...', 'Get Data Values', and 'Set Data Values'. The right screenshot shows the same tree view, but the 'Pos' object is highlighted with a blue box, and a toggle switch icon is visible in the toolbar above it.

Name	FC	Value
Mod		{stVal=on, q=00000000000000 {G
Beh		{stVal=on, q=00000000000000 {G
Health		{stVal=Ok, q=00000000000000 {G
NamPlt		{vendor=INFO TECH, swRev=1.1
Loc		{stVal=false, q=00000000000000 {
OpCntRs		{stVal=0, q=00000000000000 {Go
Pos		{Oper={ctlVal=false, origin={orCt
Oper	CO	{ctlVal=false, origin={orCat=not-t
stVal	ST	00 {intermediate}
q	ST	00000000000000 {Good, Process}
t	ST	1970-02-07 04:02:50.067 [Time A
ctlModel	CF	direct-with-enhanced-security

Services as defined in IEC 61850-7-2.

Control services can be invoked in the context menu of the data model or using the program icon.

# Control models and control command parameters

Control command window **CO** shows:

- present status of an object to be controlled,
- parameters of control command,
- buttons for control procedure steps in accordance with assigned control model,
- log of the control procedure performance with client requests, server responses and reports with control results.

Demo [127.0.0.1]: DemoProtCtrl/Obj1CSWI1.Pos

Status Information

Value: 01 {off} Control Number:

Quality: 00000000000000 {Good, Process}

Time Stamp: 2018-03-26 13:14:14.016 [Leap Second Known][Time Accuracy = 10 bits]

Originator

Category:  Id:

Control

Value: on (true) Control Number: 0

Time

Time Stamp: 2018-03-26 15:14:21  Use Current Time

Originator

Category: remote-control Id: COA80862 HEX

Test

Check

Synchrocheck

Interlock Check

Select With Value Select Operate Cancel Refresh Close

Log

Time	Service	Message
------	---------	---------



# Control commands in test mode

The tool user should be aware of consequences of sending control commands to devices.

When a server device is intentionally switched to TEST or TEST-BLOCKED mode, it is possible to set **Test** flag for control commands and perform control operation as specified for this mode.

Demo [127.0.0.1]: DemoProtCtrl/Obj1CSWI1.Pos

Status Information

Value: 01 {off} Control Number:

Quality: 00000000000000 {Good, Process}

Time Stamp: 2018-03-26 13:14:14.016 [Leap Second Known][Time Accuracy = 10 bits]

Originator

Category:  Id:

Control

Value: on (true) Control Number: 0

Time

Time Stamp: 2018-03-26 15:14:21  Use Current Time

Originator

Category: remote-control Id: COA80862 HEX

Test  
 Synchrocheck  
 Interlock Check

Select With Value Select Operate Cancel Refresh Close

Log

Time	Service	Message
------	---------	---------

# Tracing control commands performance

If the new controlled object position is reported, the status information will be updated in the **CO** window and in the data model view.

Command execution and its result are easy to trace in the log.

Demo [127.0.0.1]: DemoProtCtrl/Obj1CSWI1.Pos

Status Information

Value: 01 {off} Control Number:

Quality: 000000000000 {Good, Process}

Time Stamp: 2018-03-26 13:14:14.016 [Leap Second Known][Time Accuracy = 10 bits]

Originator

Category: Id:

Control

Value: on (true) Control Number: 0

Time

Time Stamp: 2018-03-26 15:14:21  Use Current Time

Originator

Category: remote-control Id: COA80862 HEX

Test

Check

Synchrocheck

Interlock Check

Select With Value Select Operate Cancel Refresh Close

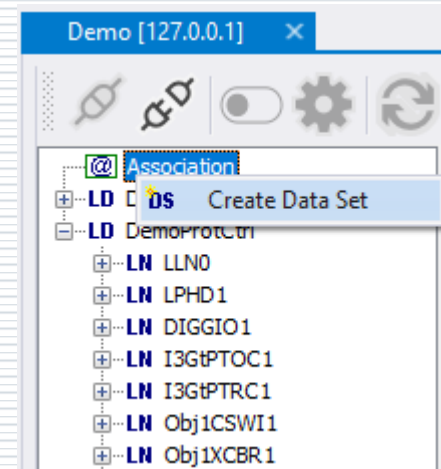
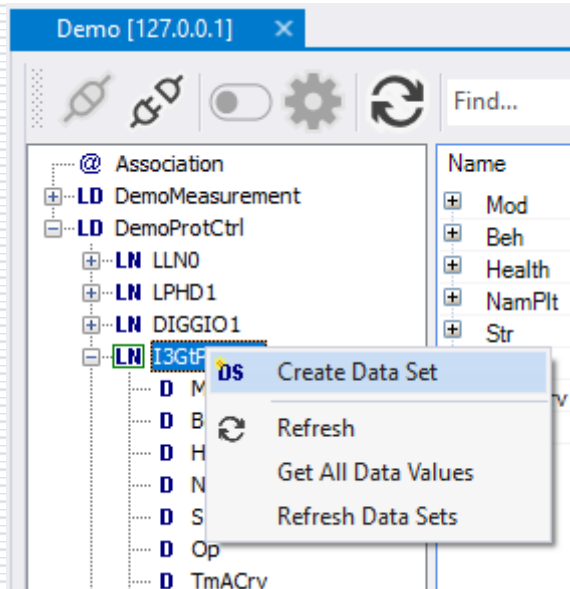
Log

Time	Service	Message
03:15:35.393	Operate	Request (ctlValue.true)
03:15:35.426	Operate	Response positive
03:15:35.427	Command Term.	Positive (ctlValue.true)

# Creating dynamic data sets

Persistent – created in LN context

Non-persistent – created in Association context



# Steps of defining a new dataset

Upon invoking **Create Data Set** command a dedicated window pops up to enable dataset definition. The created dataset can be given a name and its elements can be selected from the data model by the command from context menu or by drag-and-drop operation.

Demo [127.0.0.1] x

Find...

Association

- LD DemoMeasurement
- LD DemoProtCtrl
  - LN LLN0
  - LN LPHD1
  - LN DIGGIO1
  - LN I3GtPTOC1
    - D Mod
    - D Beh
    - D Health
    - D NamPit
    - D Str
    - D T
    - D S
  - LN I3GtP
  - LN Obj1CSWI1

Name	FC	Value
Mod		{stVal=0, q=00000000}
Beh		{stVal=0, q=00000000}
Health		{stVal=0, q=00000000}
NamPit		{vendor=INFO TECH
Str		{general=false, dirGe
Op		{general=false, q=000
general	ST	false
q	ST	00000000000000 {Goc
t	ST	1970-01-01 00:00:00.
TmACrv		{setCharact=Multiline
StrVal		{setMag={f=50}, units

DS Add to Data Set

DemoProtCtrl/I3GtPTOC1.NewDataSet

Get Data Values

Demo [127.0.0.1] \*: Create data set

Data Set Reference

Scope: DemoProtCtrl/I3GtPTOC1

Name: NewDataSet

Data Set Members

Name	FC
DemoProtCtrl/I3GtPTOC1.Str	ST
DemoProtCtrl/I3GtPTOC1.Op	ST
DemoProtCtrl/I3GtPTOC1.Tr	ST

Name	FC
DemoProtCtrl/I3GtPTOC1.Op	ST

Create Cancel

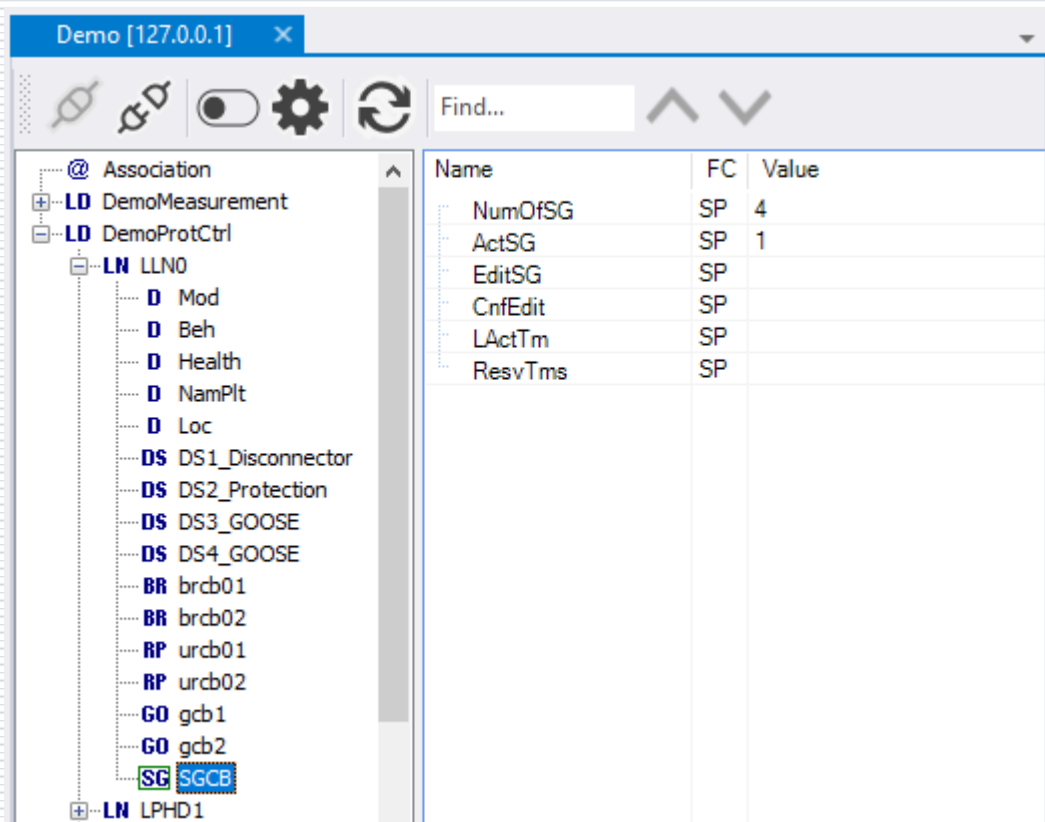
When the list of elements is complete press **Create** button – a command will be sent to the server device.

# Activation and edition of Setting Groups

The data model of a server device implementing setting groups includes a Setting Group Control Block object (**SGCB**), placed always in LLN0 logical node.

SGCB attributes:

- NumOfSG – how many setting groups are included in the logical device (LD),
- ActSG – which setting group (number) is currently in use,
- EditSG – which setting group is currently available for editing values.



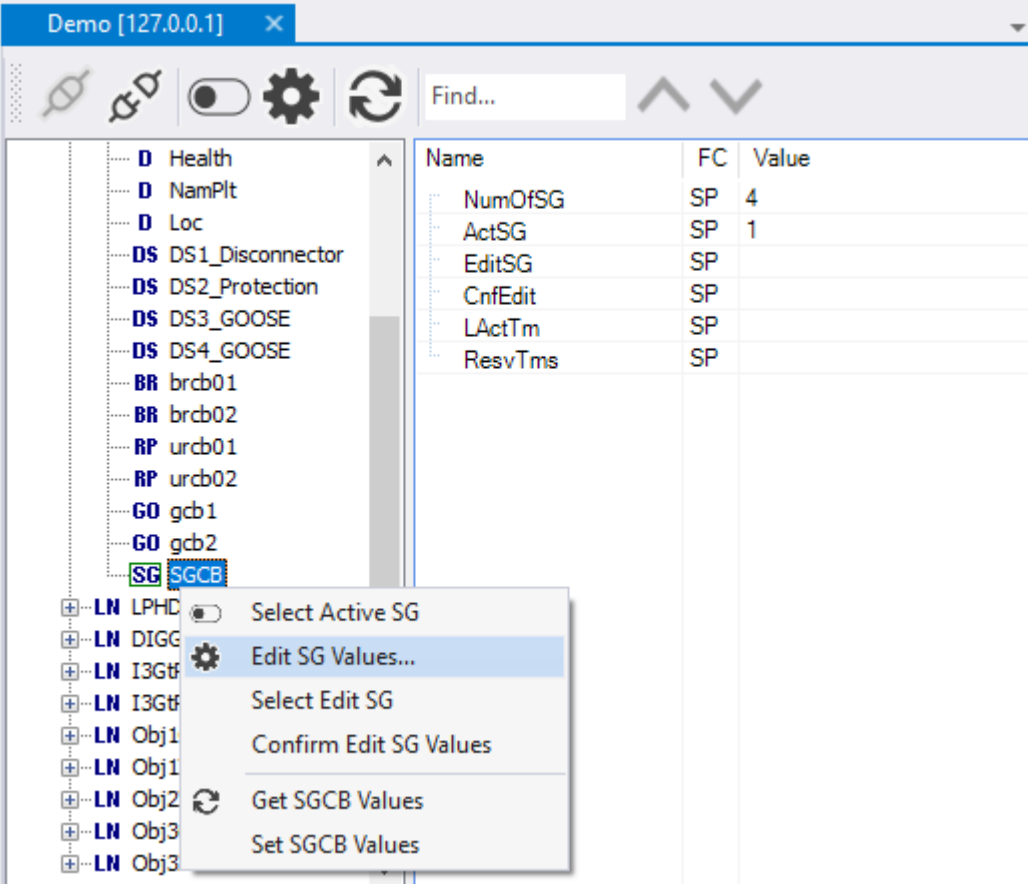
The screenshot shows a software interface with a tree view on the left and a table on the right. The tree view shows a hierarchy starting with 'Association', followed by 'LD DemoMeasurement' and 'LD DemoProtCtrl'. Under 'LD DemoProtCtrl', there is a sub-tree for 'LN LLNO' containing various objects like 'Mod', 'Beh', 'Health', 'NamPlt', 'Loc', 'DS DS1\_Disconnector', 'DS DS2\_Protection', 'DS DS3\_GOOSE', 'DS DS4\_GOOSE', 'BR brcb01', 'BR brcb02', 'RP urcb01', 'RP urcb02', 'GO gcb1', 'GO gcb2', and 'SG SGCB'. The 'SG SGCB' object is highlighted. The table on the right has columns 'Name', 'FC', and 'Value'. It lists the following attributes for the selected object:

Name	FC	Value
NumOfSG	SP	4
ActSG	SP	1
EditSG	SP	
CnfEdit	SP	
LActTm	SP	
ResvTms	SP	

# Operations on SGCB

SGCB context menu allows to read all attribute values and to write attributes ActSG, EditSG, CnfSG, ResvTms. A new value should be set in **Value** field of the attribute and confirmed with a proper command.

But a more user-friendly option to configure SGCB and edit settings is to invoke **Edit SG Values** command.



Name	FC	Value
NumOfSG	SP	4
ActSG	SP	1
EditSG	SP	
CnfEdit	SP	
LActTm	SP	
ResvTms	SP	

# Setting Group Control window

Upon invoking **EditSGValues** command a dedicated **Setting Group Control** window pops up to enable all operations on SGCB as well as editing of values of the selected setting group.

Setting Group Control: DemoProtCtrl/LLN0.SGCB

Name	FC	Value
NumOfSG	SP	4
ActSG	SP	1
EditSG	SP	0
CnfEdit	SP	false
LActTm	SP	2018-06-27 06:30:1...

Control

Active Group: #1

Last Activation Time: 2018-06-27 06:30:12.091 [Leap Sec]

Edit Group: none

Reservation Time [s]: n/a

Confirm Editing

Refresh SGCB

Settings

Setting Name	ve Bu	Edit Buffer
I3GtPTOC1.TmACrv.setCharact	M.	n/a
I3GtPTOC1.StrVal.setMag.f	50	n/a

Refresh Edit Buffer Values

Refresh Active Buffer Values



# Change of the active setting group

Selection of an active setting group is made from the drop-down list with assigned numbers of all groups implemented in the device.

After changing the active setting group the device should set a new value of **Last Activation Time**.

Setting values from the active group are presented in the list below (**Active** column informs that these are the attributes of FC=SG) – there is no need to search this information in the data model.

Setting Group Control: DemoProtCtrl/LLN0.SGCB

Control

Active Group: #1

Last Activation Time: #1

Edit Group: #2

Reservation Time [s]: n/a

Confirm Editing

Refresh SGCB

Settings

Setting Name	Active Buffer	Edit Buffer
I3GtPTOC1.TmACrv.setCharact	Multiline 1	n/a
I3GtPTOC1.StrVal.setMag.f	50	n/a

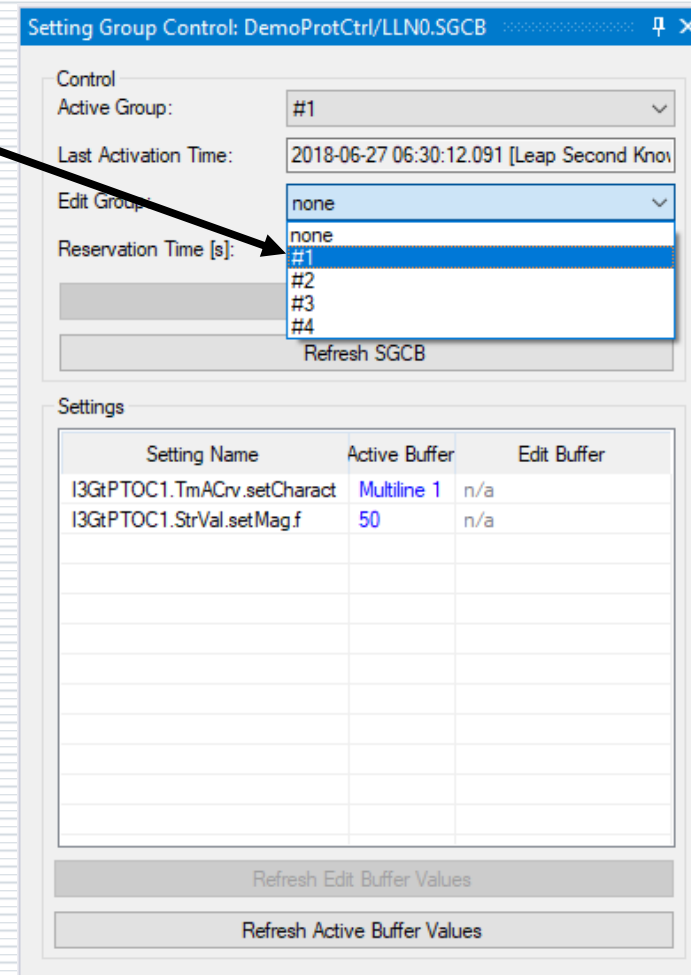
Refresh Edit Buffer Values

Refresh Active Buffer Values



# Selection of the setting group for editing

Selection of the setting group for editing is made from the drop-down list with assigned numbers of all groups implemented in the device. (none – denotes that none of the setting groups shall be available for editing).



Setting Group Control: DemoProtCtrl/LLN0.SGCB

Control

Active Group: #1

Last Activation Time: 2018-06-27 06:30:12.091 [Leap Second Know]

Edit Group: none

Reservation Time [s]:

#1  
#2  
#3  
#4

Refresh SGCB

Settings

Setting Name	Active Buffer	Edit Buffer
I3GtPTOC1.TmACrv.setCharact	Multiline 1	n/a
I3GtPTOC1.StrVal.setMag f	50	n/a

Refresh Edit Buffer Values

Refresh Active Buffer Values

# Change of setting values in the group selected for editing

Setting values from the group selected for editing are presented in the list below (**Edit Buffer** column shows attributes of FC=SE) – there is no need to search this information in the data model.

For settings of enum type a new value can be selected from a drop-down list.

New values are checked for being accepted by the server device.

The screenshot shows a window titled "Setting Group Control: DemoProtCtrl/LLN0.SGCB". It contains several control elements:

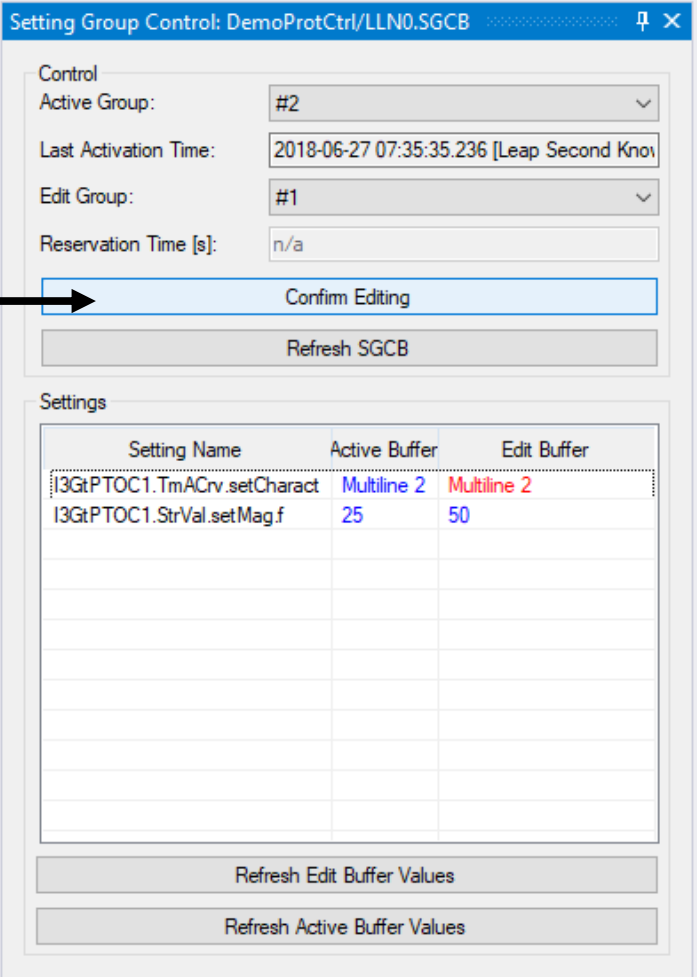
- Control** section:
  - Active Group: #2
  - Last Activation Time: 2018-06-27 07:35:35.236 [Leap Second Know]
  - Edit Group: #1
  - Reservation Time [s]: n/a
  - Buttons: Confirm Editing, Refresh SGCB
- Settings** table:

Setting Name	Active Buffer	Edit Buffer
I3GtPTOC1.TmACrv.setCharact	Multiline 2	Multiline 1
I3GtPTOC1.StrVal.setMag.f	25	Long-Time Extremely
		Long-Time Very Inver
		Long-Time Inverse
		IEC Normal Inverse
		IEC Very Inverse
		IEC Inverse
		IEC Extremely Inverse
		IEC Short-Time Invers
- Buttons: Refresh Edit Buffer Values, Refresh Active Buffer Values

An arrow points from the text "For settings of enum type a new value can be selected from a drop-down list." to the dropdown menu in the 'Edit Buffer' column of the table.

# Confirmation of new setting values from the edited group

Newly introduced setting values are temporarily memorized in the server device (if correct), but their assignment to the group selected for editing must be still confirmed by pressing the command button **Confirm Editing**. Only after that the edited setting group will acquire the new values.



The screenshot shows a window titled "Setting Group Control: DemoProtCtrl/LLN0.SGCB". It contains several fields and buttons:

- Control: Active Group: #2 (dropdown)
- Last Activation Time: 2018-06-27 07:35:35.236 [Leap Second Know]
- Edit Group: #1 (dropdown)
- Reservation Time [s]: n/a
- Buttons: Confirm Editing (highlighted with an arrow), Refresh SGCB
- Settings table:

Setting Name	Active Buffer	Edit Buffer
I3GtPTOC1.TmACrv.setCharact	Multiline 2	Multiline 2
I3GtPTOC1.StrVal.setMag.f	25	50

Buttons below the table: Refresh Edit Buffer Values, Refresh Active Buffer Values

# Log view

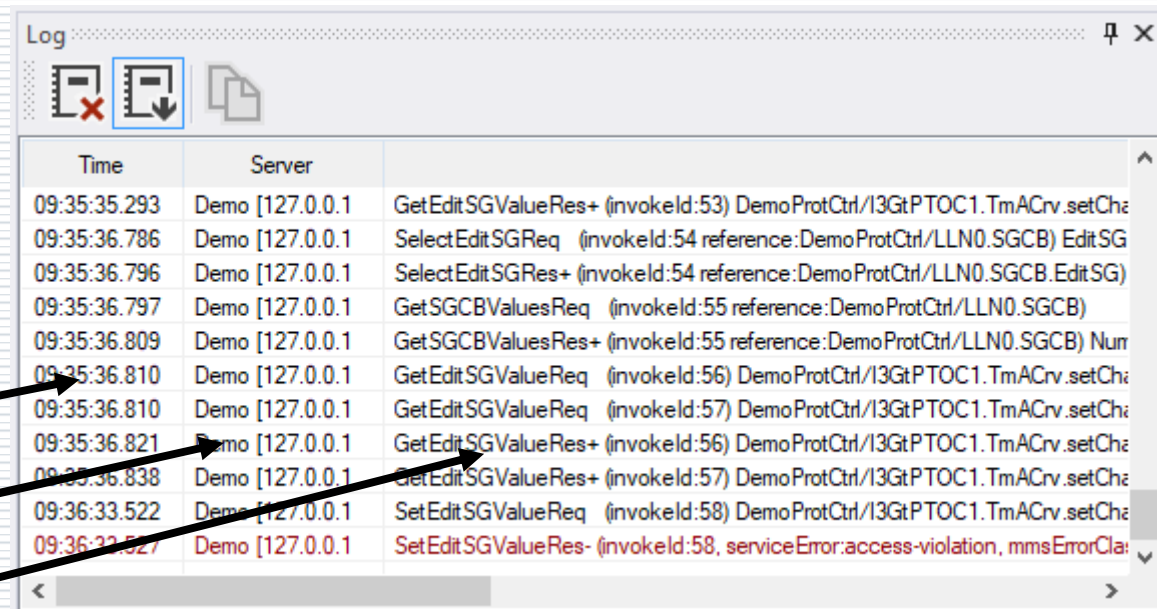
The tool provides a chronological view of operations (commands, responses and events) occurring during the interactions with server devices.

Each message in the log is described by:

**Time** – timestamp of the occurrence,

**Server** – device concerned,

**Message** – description of the operation.

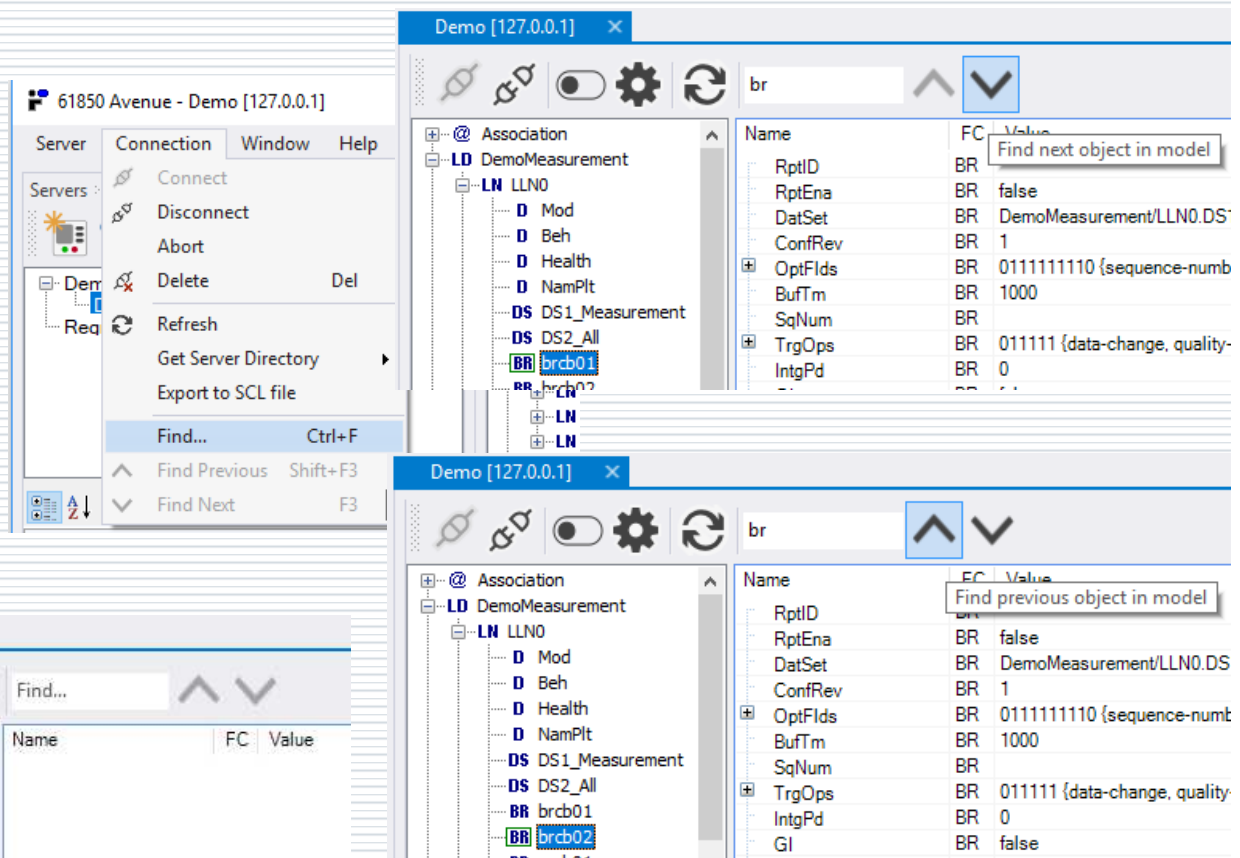


Time	Server	Message
09:35:35.293	Demo [127.0.0.1	GetEditSGValueRes+ (invokeld:53) DemoProtCtrl/13GtPTOC1.TmACrv.setCha
09:35:36.786	Demo [127.0.0.1	SelectEditSGReq (invokeld:54 reference:DemoProtCtrl/LLN0.SGCB) EditSG
09:35:36.796	Demo [127.0.0.1	SelectEditSGRes+ (invokeld:54 reference:DemoProtCtrl/LLN0.SGCB.EditSG)
09:35:36.797	Demo [127.0.0.1	GetSGCBValuesReq (invokeld:55 reference:DemoProtCtrl/LLN0.SGCB)
09:35:36.809	Demo [127.0.0.1	GetSGCBValuesRes+ (invokeld:55 reference:DemoProtCtrl/LLN0.SGCB) Nurr
09:35:36.810	Demo [127.0.0.1	GetEditSGValueReq (invokeld:56) DemoProtCtrl/13GtPTOC1.TmACrv.setCha
09:35:36.810	Demo [127.0.0.1	GetEditSGValueReq (invokeld:57) DemoProtCtrl/13GtPTOC1.TmACrv.setCha
09:35:36.821	Demo [127.0.0.1	GetEditSGValueRes+ (invokeld:56) DemoProtCtrl/13GtPTOC1.TmACrv.setCha
09:35:36.838	Demo [127.0.0.1	GetEditSGValueRes+ (invokeld:57) DemoProtCtrl/13GtPTOC1.TmACrv.setCha
09:36:33.522	Demo [127.0.0.1	SetEditSGValueReq (invokeld:58) DemoProtCtrl/13GtPTOC1.TmACrv.setCha
09:36:33.527	Demo [127.0.0.1	SetEditSGValueRes- (invokeld:58, serviceError:access-violation, mmsErrorCla

# Finding objects

The search function allows users to enter any string of characters, and then searching for objects in the model. Functionality will find all objects in the model which name including searching phrase.

User can start searching for objects using the keyboard shortcut **Ctrl + F**.



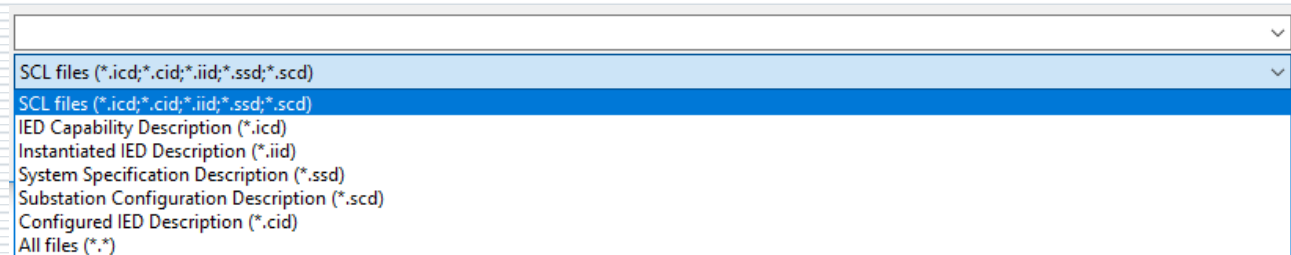
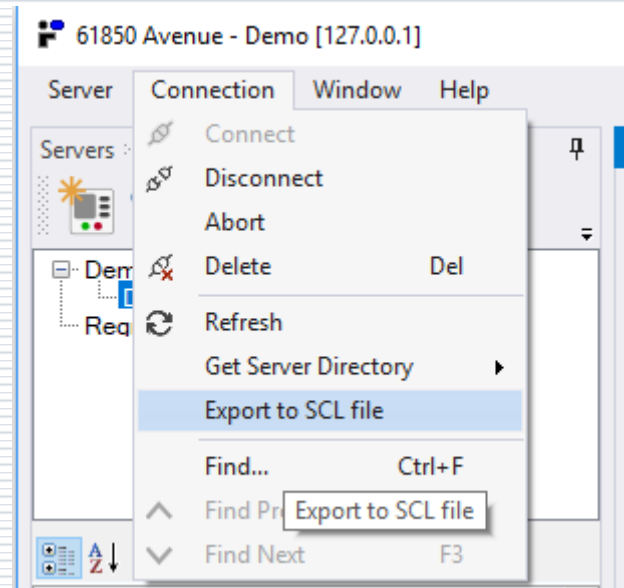
The screenshot shows the software interface with the search function active. The search bar contains the text "br". The search results are displayed in a table with columns "Name", "FC", and "Value".

Name	FC	Value
RptID	BR	
RptEna	BR	false
DatSet	BR	DemoMeasurement/LLNO.DS
ConfRev	BR	1
OptFlds	BR	011111110 {sequence-num
BufTm	BR	1000
SqlNum	BR	
TrgOps	BR	011111 {data-change, quality-
IntgPd	BR	0

# Generation of ICD/CID file

Possible for a selected server device with explored data model. By invoking **Export to SCL file...** command.

File name and extension should be defined by the user.



# What else can be found in 61850 Avenue toolset ...

IEC 61850 Relay Simulator

GOOSE testing toolset

Sampled Values testing toolset

File transfer testing toolset

IEC 61850 ICD Editor





# 61850 Relay Simulator

An excellent tool to help comprehending how a protection relay is seen in the IEC 61850 communication network.

Very easy to use for testing operations of the IEC 61850 client end.



# IEC 61850 Relay: Outgoing feeder bay simulator

Feeder bay model with circuit breaker and disconnector.

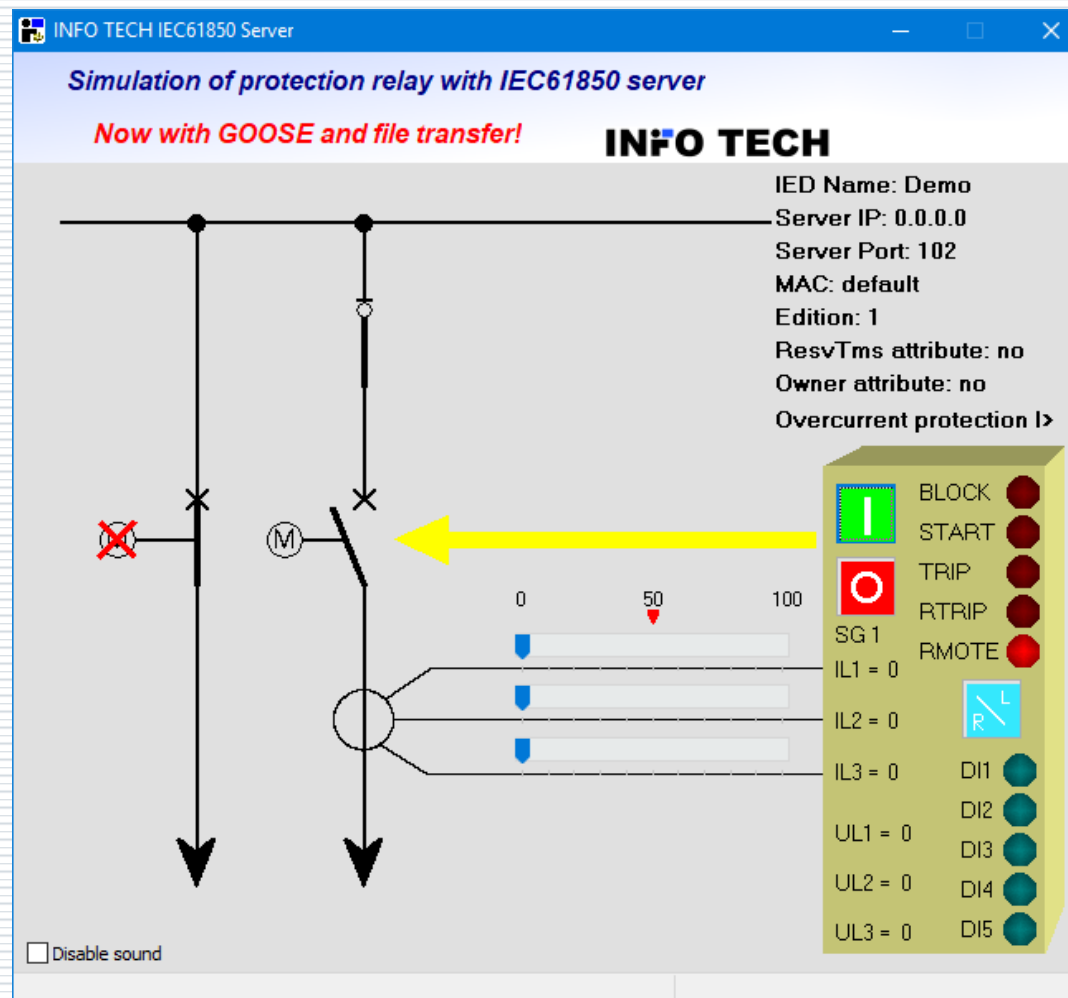
Simple overcurrent protection relay with IEC61850 server interface (representative classes of LNs, fixed data model).

Local and remote monitoring.

Local and remote control (DO-es control model) with hardwired interlocking.

Additional line with circuit breaker for demonstration of an alternative control model (SBO-es).

Simulation of CB motor failure.

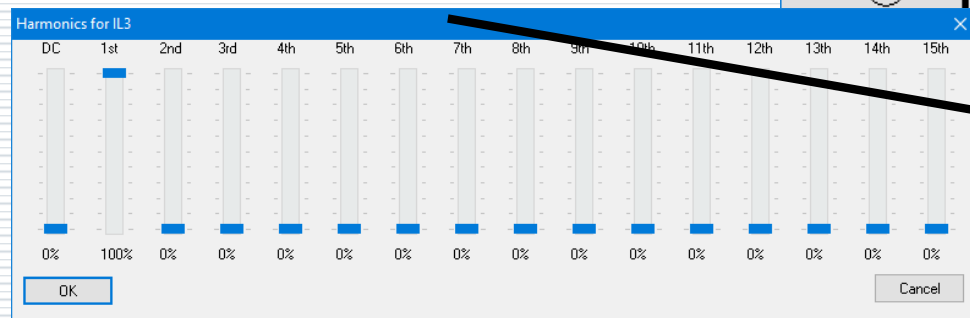


# IEC 61850 Relay: simulation of analog signals

Current level can be driven for each phase (manually or by formula, e.g. time dependent) – menu on its scroll bar.

Possibility to simulate harmonic distortion – click on signal name.

Overcurrent protection with inverse time characteristics.



INFO TECH IEC61850 Server

Simulation of protection relay with IEC61850 server

Now with GOOSE and file transfer! INFO TECH

IED Name: Demo  
Server IP: 0.0.0.0  
Server Port: 102  
MAC: default  
Edition: 1  
ResvTms attribute: no  
Owner attribute: no  
Overcurrent protection I >

IL1 = 43

IL2 = 44

IL3 = 45

UL1 = 13710  
UL2 = 13680  
UL3 = 13650

0 50 100

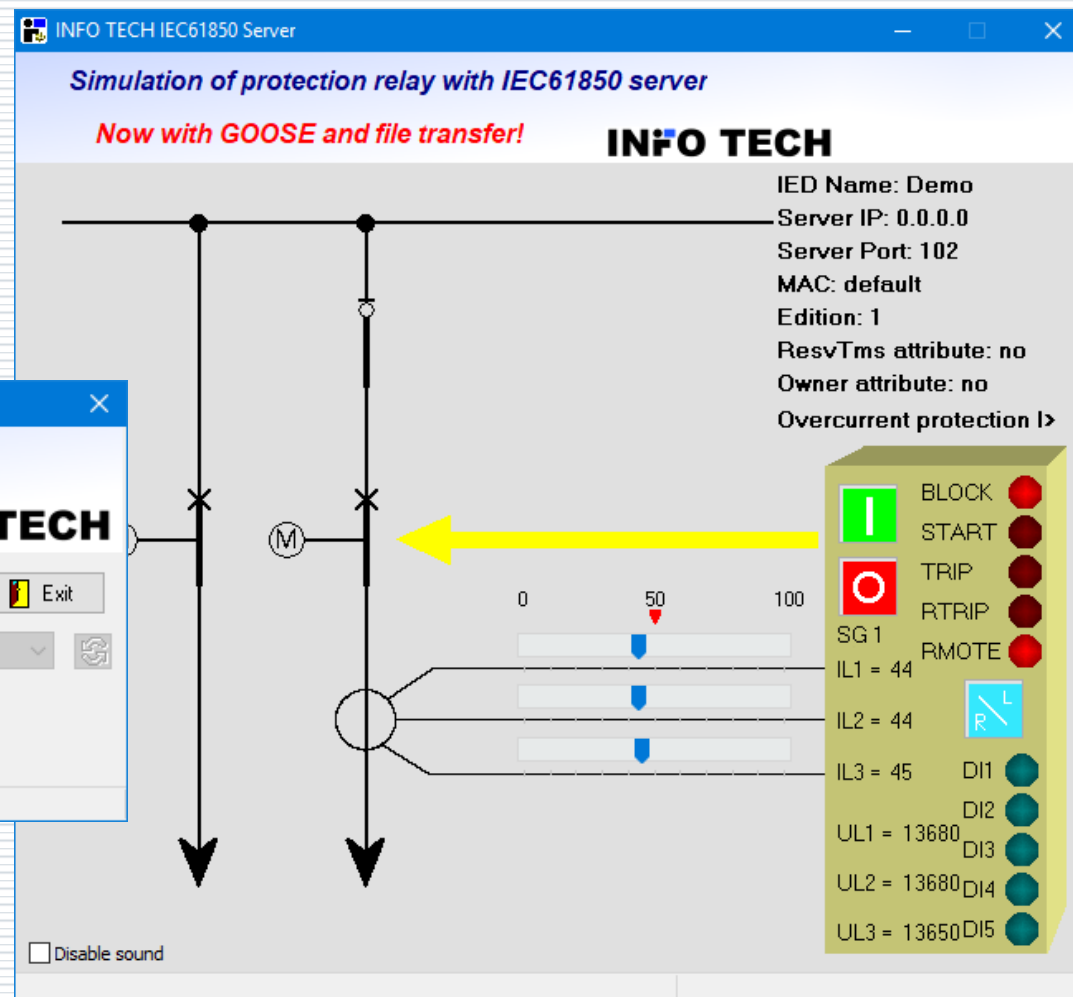
Disable sound

The screenshot shows a simulation interface for an IEC61850 relay. It features a main window with a title bar 'INFO TECH IEC61850 Server' and a subtitle 'Simulation of protection relay with IEC61850 server'. Below the subtitle, it says 'Now with GOOSE and file transfer!' and the 'INFO TECH' logo. On the right side, there is a panel with server information: 'IED Name: Demo', 'Server IP: 0.0.0.0', 'Server Port: 102', 'MAC: default', 'Edition: 1', 'ResvTms attribute: no', 'Owner attribute: no', and 'Overcurrent protection I >'. In the center, there is a diagram of a power system with two circuit breakers and a busbar. A yellow arrow points from the 'IL1 = 43' value to the first circuit breaker. A black arrow points from the 'IL1 = 43' value to the 'Edit automatic formula' dialog box. Another black arrow points from the 'IL1 = 43' value to the 'Harmonics for IL3' dialog box. The 'Edit automatic formula' dialog box has a text input field containing '43' and buttons for 'OK' and 'Cancel'. The 'Harmonics for IL3' dialog box shows a bar chart with 15 bars, each representing a harmonic component. The first bar (1st) is at 100%, and the others are at 0%. There are also buttons for 'OK' and 'Cancel'.

# IEC 61850 Relay: GOOSE communication

GOOSE Publisher function (in a separate program): publishing status changes.

GOOSE Subscriber function: enables remote tripping and remote protection blocking from another application.



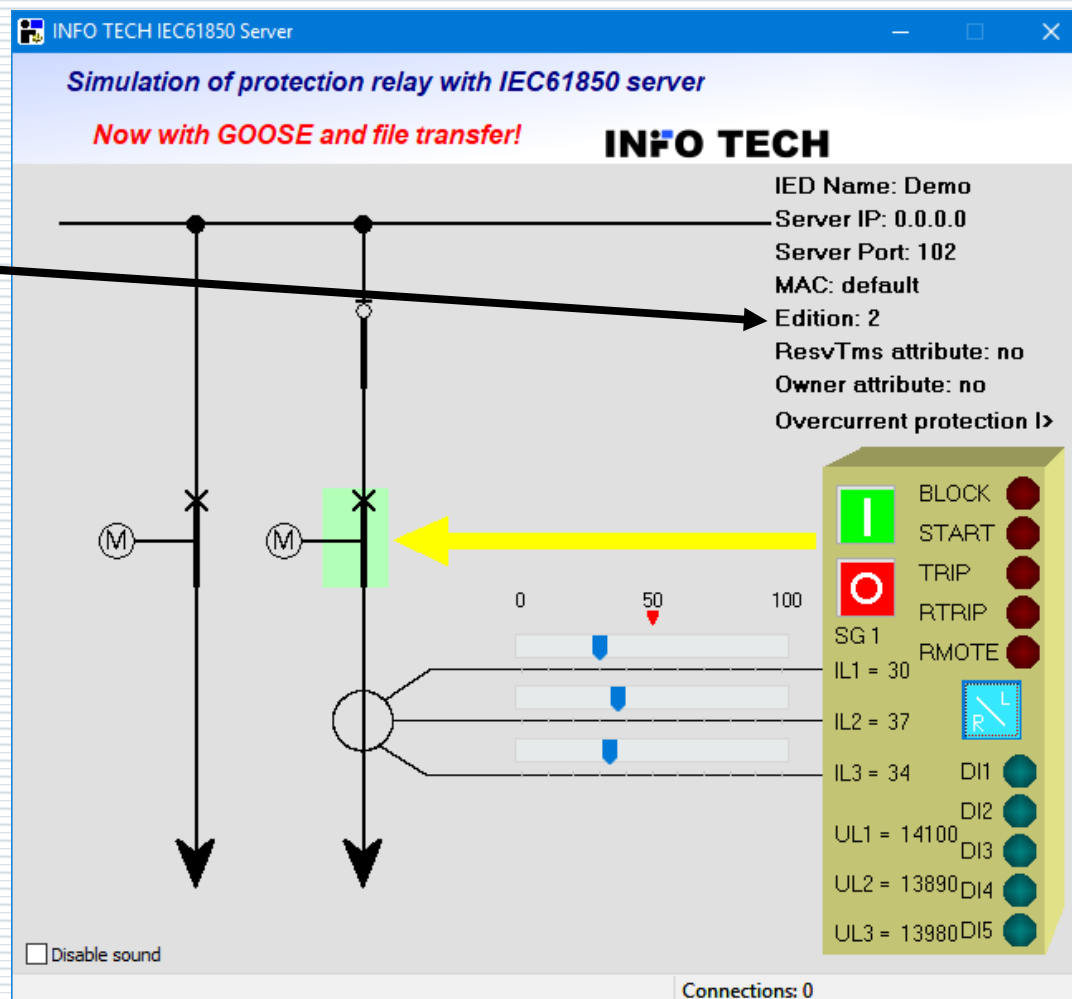
# IEC 61850 Relay: options for Edition 1 and Edition 2

Two options of the simulator program execution are available:

- Conformant with IEC 61850 Ed.1
- Conformant with IEC 61850 Ed.2  
(with separate ICD files).

Note:

Remember that on the same PC you can run only one instance of the simulator program at a time.



# GOOSE Toolset



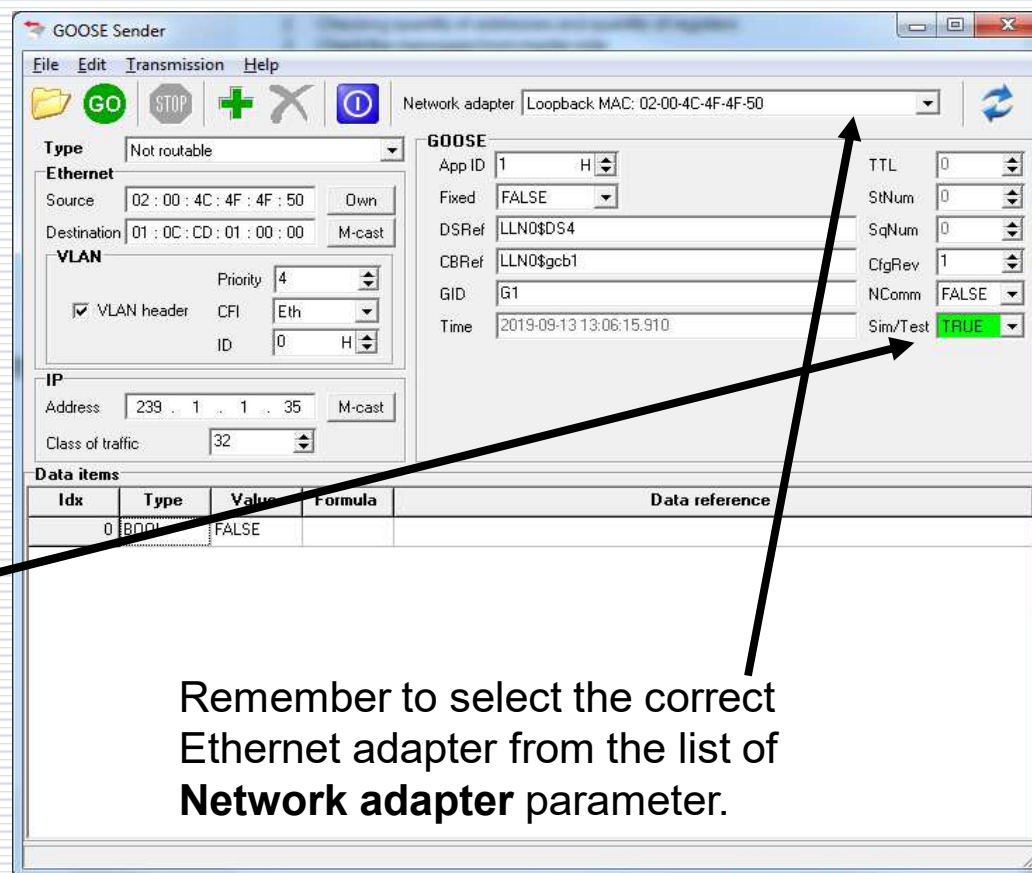


# GOOSE toolset: GOOSE Sender – configurable publisher

The program operating as GOOSE Publisher with configurable transmission parameters of GOOSE messages, including the possibility of creating a dataset with data values driven manually by the user or by calculation formulas.

Press **GO** button to start publishing and **STOP** button to terminate.

Note: The program by default sets the GOOSE message **Test** bit (**Simulation** bit in Ed.2) to TRUE to avoid unwanted consequences of transmitting GOOSE messages. It is the user's responsibility to change this bit value.



Remember to select the correct Ethernet adapter from the list of **Network adapter** parameter.



# GOOSE Sender – data values defined by formulas

if	Conditional result: if argument 1 evaluates to true (is not 0) result is equal to argument 2 otherwise result is equal to argument 3
intpower	IntPower raises argument 1 to the power specified by argument 2 (both arguments are treated as integers)
ln	Natural logarithm ( $\ln(e) = 1$ ) of the argument
log10	Logarithm of base 10 of the argument
logN	Logarithm base N of X
max	Maximum of 2 arguments
min	Minimum of 2 arguments
pi	The ratio of a circle's circumference to its diameter. Pi is approximated as 3.1415926535897932385
pow	Power raises argument 1 (base) to power given by argument 2 (exponent). For fractional exponents or exponents greater than 2147483647, base must be greater than 0
radtodeg	Converts angles measured in radians to degrees
randG	Produces random numbers with Gaussian distribution parametrized by argument 2 (standard deviation) about the argument 1 (mean).
random	Produces random number within the range $0 \leq X < 1$
round	Rounds a real-type value to an integer-type value
sin	Sine of the argument
sinh	Hyperbolic sine of the argument
sqr	Square of the argument
sqrt	Square root of the argument
tan	Tangent of X
tanh	Hyperbolic tangent of X
trunc	Truncates a real-type value to an integer-type value (value of X rounded toward zero)

Symbol	Explanation
!	Factorial i.e. !5 gives $1*2*3*4*5 = 120$
%	Percentage i.e. 10% gives 0.1
-	Negate i.e. -10 gives -10 and --10 gives 10
+	Positive value i.e. +10 gives 10
^	Power i.e. $3^2$ gives 9
*	Multiplication i.e. $2*2$ gives 4
/	Division i.e. $4/2$ gives 2
div	Integer division (result and operands are treated as integers)
mod	Remainder i.e. $3 \bmod 2$ gives 1 (result and operands are treated as integers)
+	Sum i.e. $2+2$ gives 4
-	Subtract i.e. $4-2$ gives 2
-	Subtract i.e. $4-2$ gives 2
-	Subtract i.e. $4-2$ gives 2
<	Less than i.e. $3 < 2$ gives 0 (false)
<=	Less than or equal to i.e. $1 \leq 2$ gives 1 (true)
>=	Greater than or equal to i.e. $4 \geq 2$ gives 1 (true)
>	Greater than i.e. $4 > 2$ gives 2
=	Equal to i.e. $4 = 2$ gives 0 (false)
<>	Not equal to i.e. $4 \neq 2$ gives 1 (true)
not	Logical negation i.e. not 0 gives 1 and not 1 gives 0
or	Bitwise or i.e. 1 or 4 gives 5
and	Bitwise and i.e. 3 and 6 gives 2
xor	Bitwise xor i.e. 7 xor 5 gives 2

When defining formulas for calculating data values and their changes it is possible to use various operators, functions and variable T representing time counter (in seconds) from the publisher function start, e.g.:

T mod 2 - sequence false, true, false ... (1 s interval)  
 $30+10*\sin(2*T)$  - sin wave with average value 30  
 $\text{if}(T \bmod 2, 10, -10)$  - square wave -10,10,-10 ...

# GOOSE Sender – configuration based on imported SCL file

It is possible to configure GOOSE Publisher function by the definition of GoCB object included in the imported SCL file. Transmission parameters and the dataset will be configured as specified in the chosen control block of the selected device.

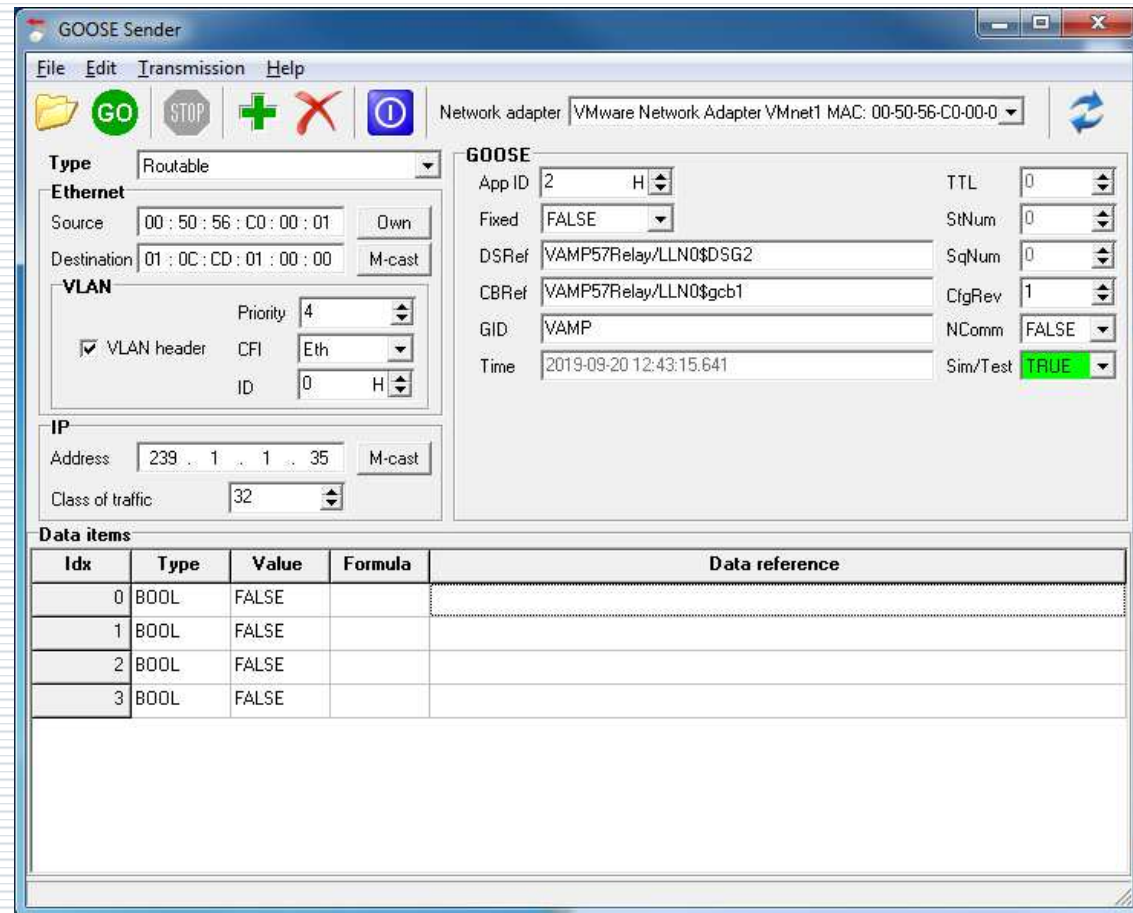
The screenshot displays the 'GOOSE Sender' application window. The 'GOOSE' configuration panel is active, showing parameters such as App ID (2), TTL (4000), StNum (2), SqNum (54), CfgRev (1), NComm (FALSE), and Sim/Test (TRUE). The 'Available GOOSE streams' dialog box is open, showing a table with columns: Idx, IED, Type, Dest..., App ID, Conf Rev, GOOSE ID, GCB Reference, and Dataset elements. Row 2 is selected, showing a GOOSE ID of G2 and a GCB Reference of DemoProtCtrl/LLN0\$GO\$. The dataset elements include five ST (Setpoint) objects: DemoProtCtrl/DIGGIO1.Ind1.stVal [ST], DemoProtCtrl/DIGGIO1.Ind2.stVal [ST], DemoProtCtrl/DIGGIO1.Ind3.stVal [ST], DemoProtCtrl/DIGGIO1.Ind4.stVal [ST], and DemoProtCtrl/DIGGIO1.Ind5.stVal [ST].

Idx	IED	Type	Dest...	App ID	Conf Rev	GOOSE ID	GCB Reference	Dataset elements
1	Demo	Not routable	01-0C...	0001	1	G1	DemoProtCtrl/LLN0\$GO\$g	DemoProtCtrl/DIGGIO1.Ind1.stVal [ST] DemoProtCtrl/DIGGIO1.Ind2.stVal [ST] DemoProtCtrl/DIGGIO1.Ind3.stVal [ST] DemoProtCtrl/DIGGIO1.Ind4.stVal [ST] DemoProtCtrl/DIGGIO1.Ind5.stVal [ST]
2	Demo	Not routable	01-0C...	0002	1	G2	DemoProtCtrl/LLN0\$GO\$g	DemoProtCtrl/DIGGIO1.Ind1.stVal [ST] DemoProtCtrl/DIGGIO1.Ind2.stVal [ST] DemoProtCtrl/DIGGIO1.Ind3.stVal [ST] DemoProtCtrl/DIGGIO1.Ind4.stVal [ST] DemoProtCtrl/DIGGIO1.Ind5.stVal [ST]

# GOOSE Sender – simulation of another device

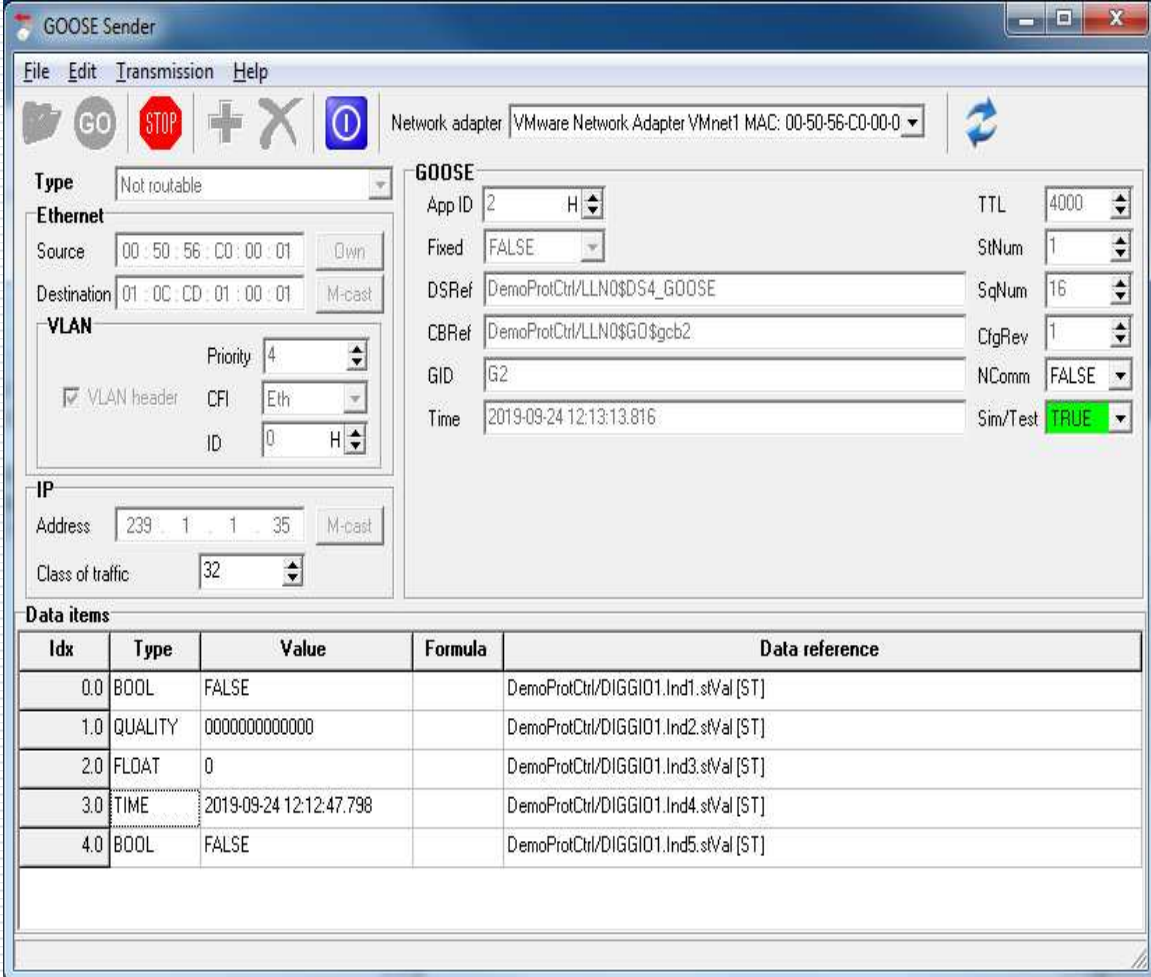
In this way the program can simulate the transmission performed by another device. It allows to test how GOOSE messages will be received and processed by devices with GOOSE Subscriber function.

In case of such a configuration the dataset description table will also include Data reference information with names of dataset elements.



# GOOSE Sender – dataset elements of both simple and structured types

An imported configuration of GOOSE Publisher function may include dataset containing elements of simple or structured types – both options are supported.



The screenshot displays the GOOSE Sender application window. The interface includes a menu bar (File, Edit, Transmission, Help), a toolbar with icons for GO, STOP, and other functions, and a network adapter selection dropdown set to 'VMware Network Adapter VMnet1 MAC: 00-50-56-C0-00-0'. The configuration is divided into several sections: Ethernet (Source: 00:50:56:C0:00:01, Destination: 01:0C:CD:01:00:01), VLAN (Priority: 4, VLAN header checked, CFI: Eth, ID: 0), IP (Address: 239.1.1.35, Class of traffic: 32), and GOOSE (App ID: 2, Fixed: FALSE, DSRef: DemoProtCtrl/LLN0\$DS4\_GOOSE, CBRef: DemoProtCtrl/LLN0\$G0\$gcb2, GID: G2, Time: 2019-09-24 12:13:13.816, TTL: 4000, StNum: 1, SqNum: 16, CfgRev: 1, NComm: FALSE, Sim/Test: TRUE). At the bottom, a 'Data items' table lists five entries with their indices, types, values, formulas, and data references.

Idx	Type	Value	Formula	Data reference
0.0	BOOL	FALSE		DemoProtCtrl/DIGGI01.Ind1.stVal [ST]
1.0	QUALITY	00000000000000		DemoProtCtrl/DIGGI01.Ind2.stVal [ST]
2.0	FLOAT	0		DemoProtCtrl/DIGGI01.Ind3.stVal [ST]
3.0	TIME	2019-09-24 12:12:47.798		DemoProtCtrl/DIGGI01.Ind4.stVal [ST]
4.0	BOOL	FALSE		DemoProtCtrl/DIGGI01.Ind5.stVal [ST]

# GOOSE toolset: GOOSE Receiver – configurable subscriber

Configurable GOOSE Subscriber function: reception parameters can be set manually or from message streams detected in the network.

GOOSE Receiver

File Transmission Data Help

Network adapter: Połączenie lokalne MAC: 00-22-4D-50-E9-E5

GOOSE

App ID: 1 H  
TTL: 0  
DSRef: LLN0\$DS4  
CBRef: LLN0\$gcb1  
GID: G1

StNum: 0  
SqNum: 0  
CfgRev: 1  
NComm: FALSE  
Test: FALSE  
Status:

Start  
Stop  
Reload  
Detect streams  
Select stream

Own  
M-cast

VLAN  
Priority: 4  
VLAN header  
CFI  
Eth

09-20 12:43:27.752

Data reference

Available GOOSE streams

Idx	Type	Source MAC	Destination MAC	IP	App ID	Config Rev	GOOSE ID	GCB ref	Messages	TEST	NDSCOM
1	Not routable	00:1A:D3:01:1B:00	01:0C:CD:01:00:CC	N/A	0204	1	EASERGY	P3U 9 100Re...	2	FALSE	T
2	Not routable	00:1A:D3:01:1B:00	01:0C:CD:01:00:CC	N/A	0221	1	EASERGY	P3U 9 100Re...	2	FALSE	F

Subscribe Clear Close

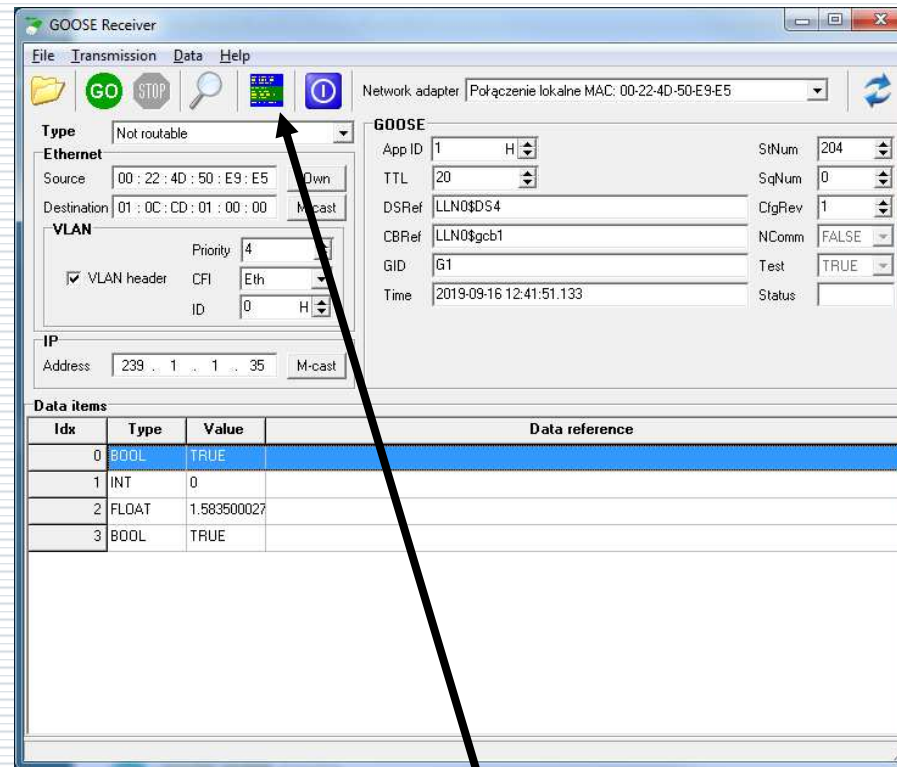
Press **GO** button to start the message reception and **STOP** button to terminate.



# GOOSE Receiver – monitoring the selected message stream

The selected GOOSE message stream can be monitored to test the performance of transmitting device (e.g. detect data changes, interruptions of transmissions, etc.).

Viewing message streams present in the networks allows also to recognize configuration errors, e.g. the same APPID or GOOSE ID values set to different publishers.



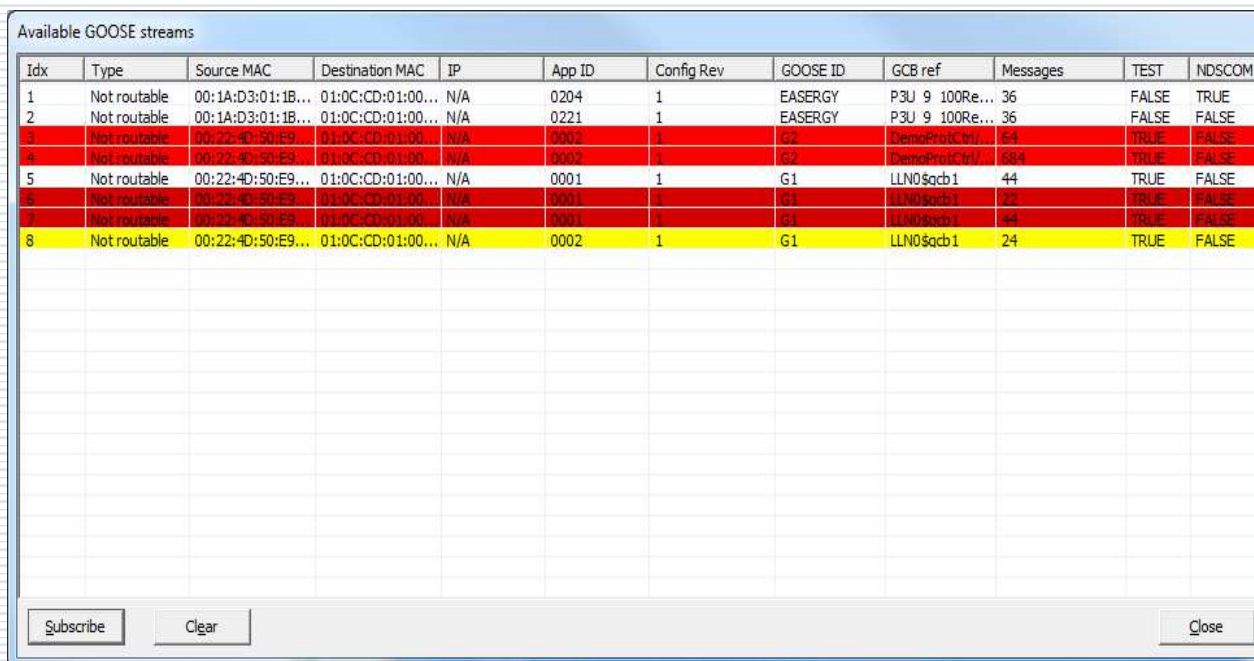
A sequence of received GOOSE messages can be traced in the invoked **Parser** window.

# GOOSE Receiver – detecting errors in configuration of message streams

The view of GOOSE message streams indicates conflicts in the system configuration:

**Error:** streams of different publishers have the same parameter values of Destination MAC, App ID and GOOSE ID

**Warning:** streams of different publishers have the same parameter values of Destination MAC and App ID.



Idx	Type	Source MAC	Destination MAC	IP	App ID	Config Rev	GOOSE ID	GCB ref	Messages	TEST	NDSCOM
1	Not routable	00:1A:D3:01:1B...	01:0C:CD:01:00...	N/A	0204	1	EASERGY	P3U 9 100Re...	36	FALSE	TRUE
2	Not routable	00:1A:D3:01:1B...	01:0C:CD:01:00...	N/A	0221	1	EASERGY	P3U 9 100Re...	36	FALSE	FALSE
3	Not routable	00:22:4D:50:E9...	01:0C:CD:01:00...	N/A	0002	1	G2	DemoProtCtrl	64	TRUE	FALSE
4	Not routable	00:22:4D:50:E9...	01:0C:CD:01:00...	N/A	0002	1	G2	DemoProtCtrl	684	TRUE	FALSE
5	Not routable	00:22:4D:50:E9...	01:0C:CD:01:00...	N/A	0001	1	G1	LLN0sqcb1	44	TRUE	FALSE
6	Not routable	00:22:4D:50:E9...	01:0C:CD:01:00...	N/A	0001	1	G1	LLN0sqcb1	22	TRUE	FALSE
7	Not routable	00:22:4D:50:E9...	01:0C:CD:01:00...	N/A	0001	1	G1	LLN0sqcb1	44	TRUE	FALSE
8	Not routable	00:22:4D:50:E9...	01:0C:CD:01:00...	N/A	0002	1	G1	LLN0sqcb1	24	TRUE	FALSE

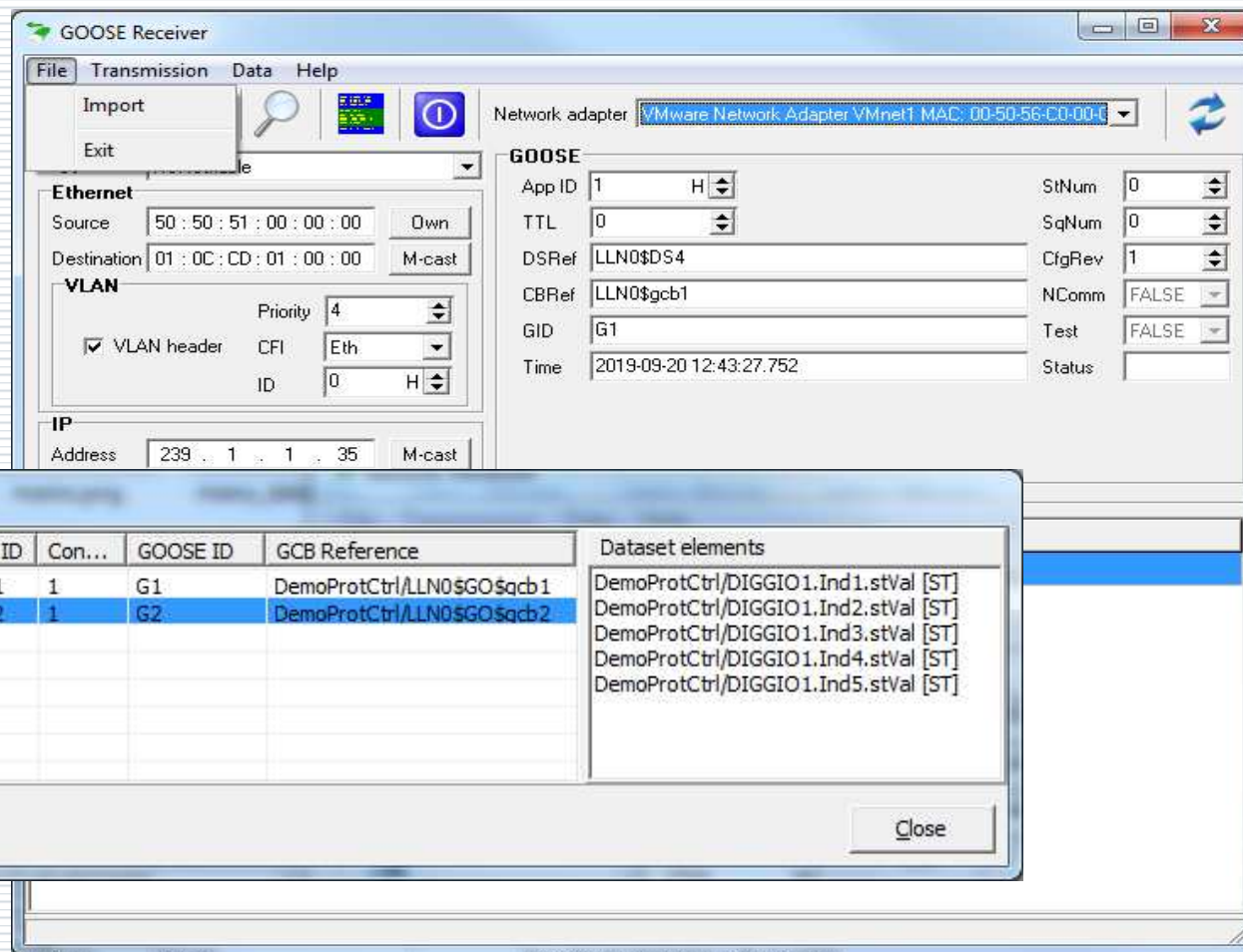
Streams with conflicts are marked with colored background:

**Red** – error, **Dark red** – error and conflict with the stream selected for monitoring, **Yellow** – warning, **Dark yellow** – warning and conflict with the stream selected for monitoring, No color – no conflict.



# GOOSE Receiver – configuration from imported SCL file

GOOSE Subscriber function can be also configured by the definition of GoCB object included in the imported SCL file. In this way it is possible to test message transmissions from each of the publishers present in the described system.



# GOOSE Receiver – dataset elements of both simple and structured types

An imported configuration of GOOSE Subscriber function may include reception of messages with dataset containing elements of simple or structured types – both options are supported.

The screenshot shows the 'GOOSE Receiver' configuration window. The 'Transmission' tab is active, displaying various settings for the network adapter and the GOOSE function.

**Network adapter:** Połączenie lokalne MAC: 00-22-4D-50-E9-E5

**GOOSE parameters:**

- App ID: 2
- TTL: 4000
- DSRef: DemoProtCtrl/LLN0\$DS4\_GOOSE
- CBRef: DemoProtCtrl/LLN0\$GO\$gcb2
- GID: G2
- Time: 2019-09-25 08:09:51.702
- StNum: 1
- SqNum: 21
- CfgRev: 1
- NComm: FALSE
- Test: TRUE
- Status: (empty)

**Ethernet parameters:**

- Type: Not routable
- Source: 00:22:4D:50:E9:E5 (Own)
- Destination: 01:0C:CD:01:00:01 (M-cast)
- VLAN: Priority 4, VLAN header checked, CFI Eth, ID 0
- IP Address: 239.1.1.35 (M-cast)

**Data items table:**

Idx	Type	Value	Data reference
0	BOOL	FALSE	
1	QUALITY	0000000000	
2	FLOAT	0	
3	TIME	2019-09-24 1	
4	BOOL	FALSE	

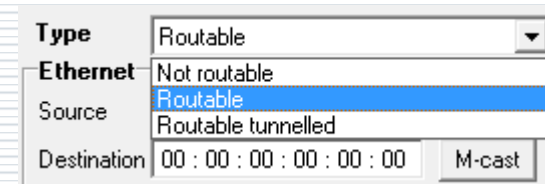
# GOOSE Sender and GOOSE Receiver support also routable messages

The **Type** of packet to be sent or to be received can be configured:

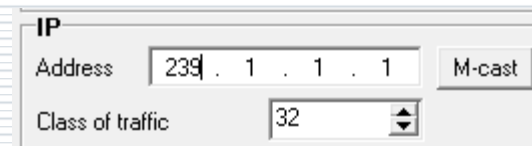
**Not routable** – GOOSE message as Ethernet frame

**Routable** – sent over IP between IEDs, data part of GOOSE frame routed using IP packets and UDP protocol, locally forwarded by receiving IED as Ethernet GOOSE frame

**Routable tunneled** – sent between routers of two subsystems, GOOSE frame routed using IP packets and UDP protocol, locally forwarded by router as Ethernet GOOSE frame



A screenshot of a configuration window. The 'Type' dropdown is set to 'Routable'. The 'Ethernet' section is expanded, showing a list with 'Routable' selected. Below it, 'Source' is 'Routable tunneled' and 'Destination' is '00 : 00 : 00 : 00 : 00 : 00' with an 'M-cast' button.



A screenshot of an IP configuration window. The 'Address' field contains '239 . 1 . 1 . 1' with an 'M-cast' button. The 'Class of traffic' dropdown is set to '32'.

For routable GOOSE the multicast destination IP address and class of traffic must be also configured.

# Routable GOOSE: differences between types of routing

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By using routable GOOSE (R-GOOSE) it is possible to transfer critical messages between different LANs of a wide area automation system.

An IP packet with **routable tunneled R-GOOSE** message contains an original destination MAC address and VLAN header – this information is then retained by the receiving router when forwarding R-GOOSE message as Ethernet GOOSE message to the local network.

An IP packet with **routable R-GOOSE** message comes without its original destination MAC address and VLAN header. This information will be set by the receiving router based on the internal setup before forwarding R-GOOSE message as Ethernet GOOSE message to the local network.

# Sampled Values Toolset





# SAV Sender –working area

Sender working area shows properties of the currently sent Sampled Values stream. This area is divided into several groups:

**Ethernet header** showing source and destination MAC address of the message

**VLAN header** showing VLAN part of the message (if present)

**Sampled Values header** used to set Sampled Values header part of the message

**Signal sampling properties** showing current sampling rate, network frequency, etc.

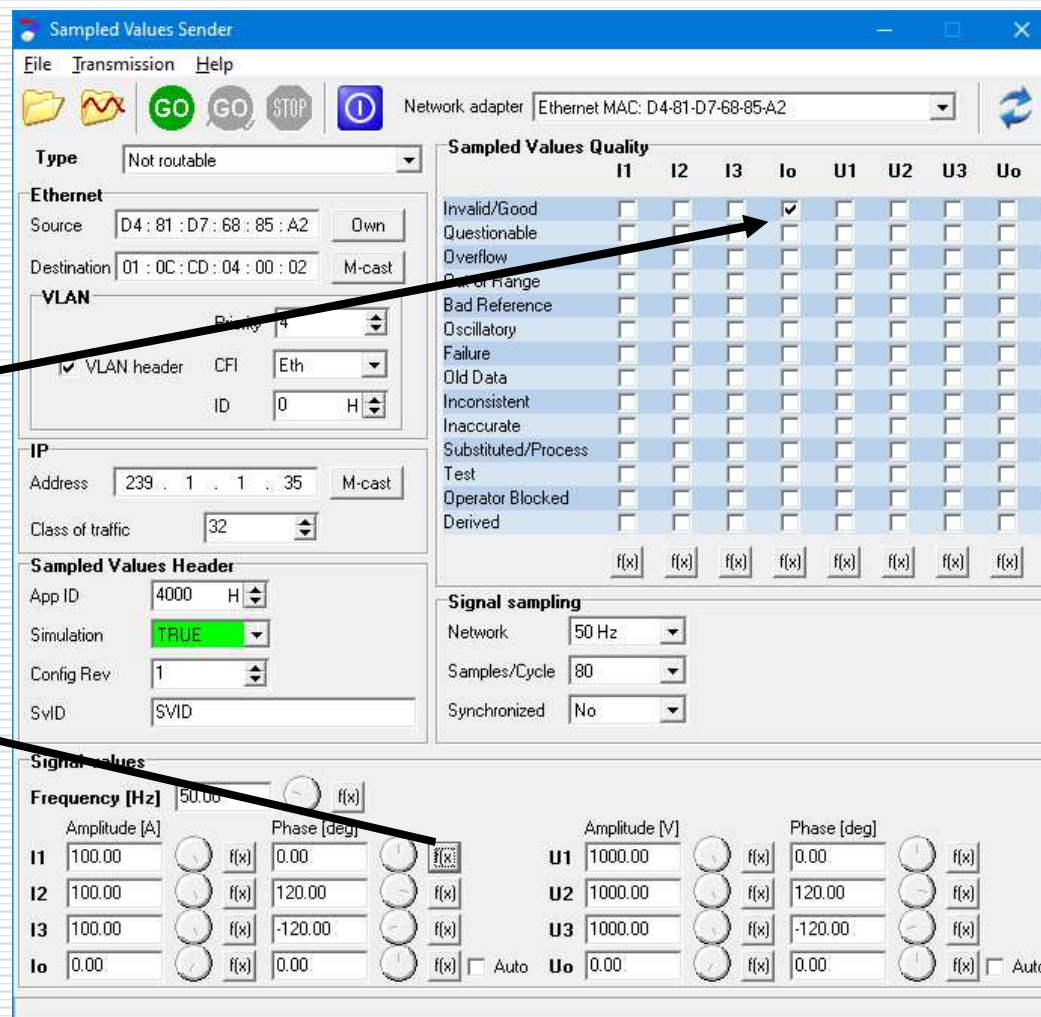
**Signal quality bits** allowing to set quality bits for each sampled signal

**Signal values** allowing to set amplitude and phase of each simulated signal

# SV toolset: SAV Sender - simulator of Merging Unit

Configurable publisher of message stream with sampled values – Merging Unit simulator.

Define characteristics of sampled signals (amplitude, phase, frequency) manually or using calculation formulas. Simulate quality problems for the transmitted sampled values, if required.

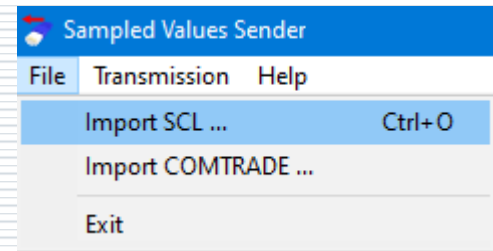


Press **GO** button to start publishing and **STOP** button to terminate.

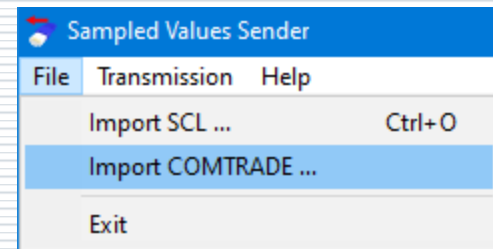


# SV toolset: SAV Sender - configuration from files

The transmission parameters of a Merging Unit to be simulated can be configured using an imported SCL file with the defined MSVCB object.



The sampled signals waveforms can be configured using a recording from an imported COMTRADE.



In this case it is necessary to assign channels from the COMTRADE file to the signals transmitted by SAV Sender.

# SV toolset: SAV Sender – COMTRADE channels selection

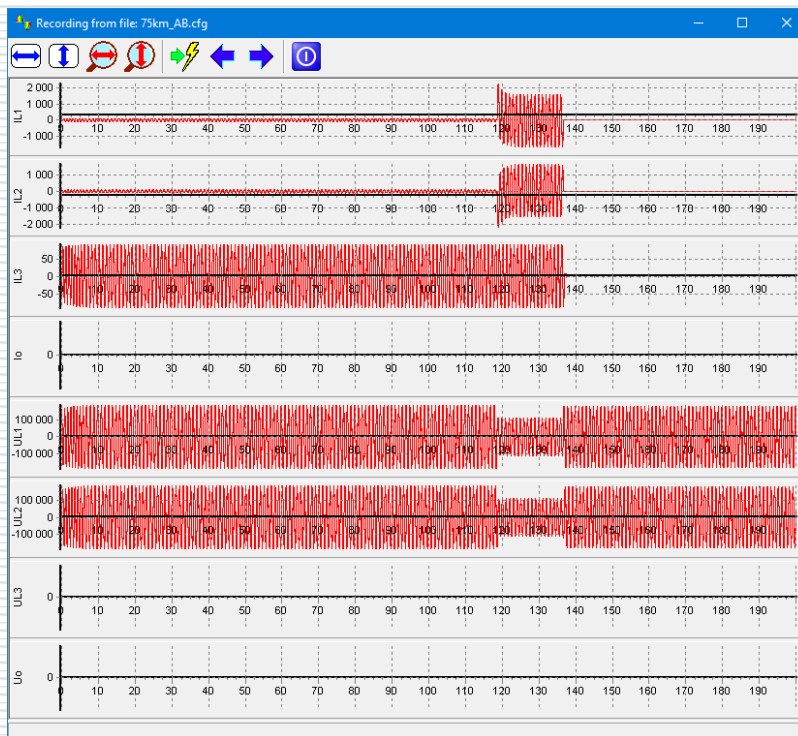
This window allows to select signals from an imported COMTRADE file and assign them to channels defined in the IEC 61850-9-2LE specification. Io and Uo signals can be artificially calculated from phase signals if needed (in this case the DERIVED bit in quality attribute will be set for those signals). Not assigned channels will have values 0 and INVALID quality bit set.

It is possible to view selected signals by pressing **Preview button**. If the selection is acceptable, press **OK** button. Then invoke **Play COMTRADE** command from Transmission menu and the SAV stream will be sent to the network.

Signal	Channel in COMTRADE file	
I1	IL1 [A]	
I2	IL2 [A]	
I3	IL3 [A]	
Io	Not assigned	<input type="checkbox"/> Calculate
U1	UL1 [V]	
U2	UL2 [V]	
U3	UL3 [V]	
Uo	Not assigned	<input type="checkbox"/> Calculate

# SV toolset: SAV Sender – COMTRADE Preview

**Preview** button from channels selection window allows visualize selected signals from the imported COMTRADE file.



Shortcuts available in the viewer's toolbox are shown below



**Original width** - command rescales plot to fit horizontally complete waveform



**Original height** - command rescales plot to fit vertically complete waveform



**Magnify horizontally** - command magnifies plot horizontally



**Magnify vertically** - command magnifies plot vertically



**Go to trigger** - command moves plot to make trigger point visible on the screen



**Move left** - command moves plot one step left



**Move right** - command moves plot one step right



**Close** - command closes viewer window

# SV toolset: SAV Receiver - signal processing from received samples

Configurable sampled values subscriber: reception parameters can be set manually or defined using the selected SV message stream from the list of streams detected in the network.

Available SAV streams

Idx	Type	Source MAC	Destination ...	IP	App ID	Config Rev	SV ID	Mess...	Simul...
1	Notr...	00:22:4D:5...	01:0C:CD:0...	N/A	4001	1	INFOTECHM...	30772	FALSE

Subscribe Clear Close

Sampled Values Receiver

File Transmission Data Help

Start Stop Refresh adapters Detect streams

Network adapter: Pojęcie lokalne MAC: 00-22-4D-50-E9-E5

Communication status: Status: OFF line, Lost messages: 0

Sampled Values Quality

	I1	I2	I3	Io	U1	U2	U3	Uo
Invalid/Good	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Questionable	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Overflow	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Out of Range	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Bad Reference	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Oscillatory	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Failure	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Old Data	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Inconsistent	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Inaccurate	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Substituted/Process	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Test	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Operator Blocked	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Derived	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Measurements: Nominal frequency: 50 Hz, Measured frequency [Hz]: 50.00, Resample to measured frequency:

I1 Mag:10.00, Ang:0.00  
I2 Mag:10.00, Ang:120.00  
I3 Mag:10.00, Ang:240.00  
Io Mag:0.00, Ang:0.00

U1 Mag:10.00, Ang:0.00  
U2 Mag:10.00, Ang:120.00  
U3 Mag:10.00, Ang:240.00  
Uo Mag:0.00, Ang:0.00

# SV toolset: SAV Receiver – computation of signal characteristics

Signal characteristics are computed in real-time based on the incoming sampled values message stream.

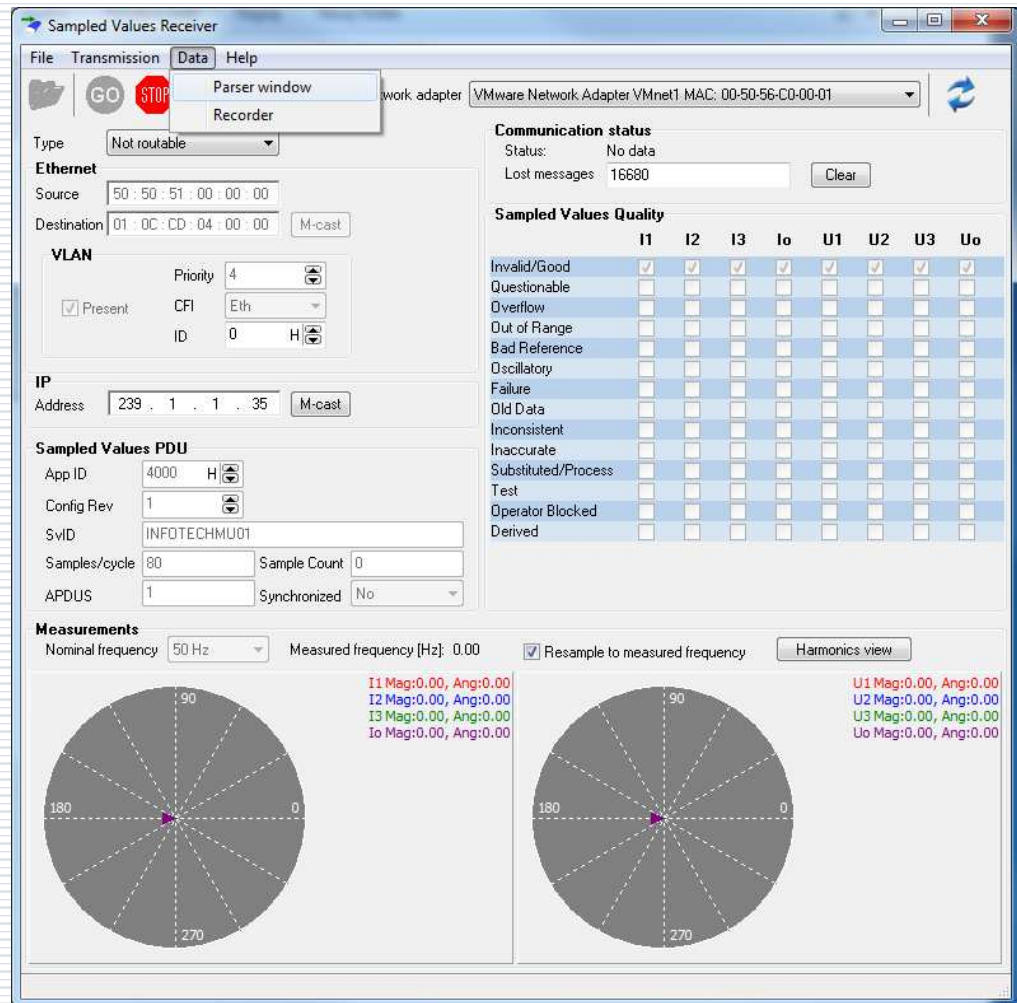
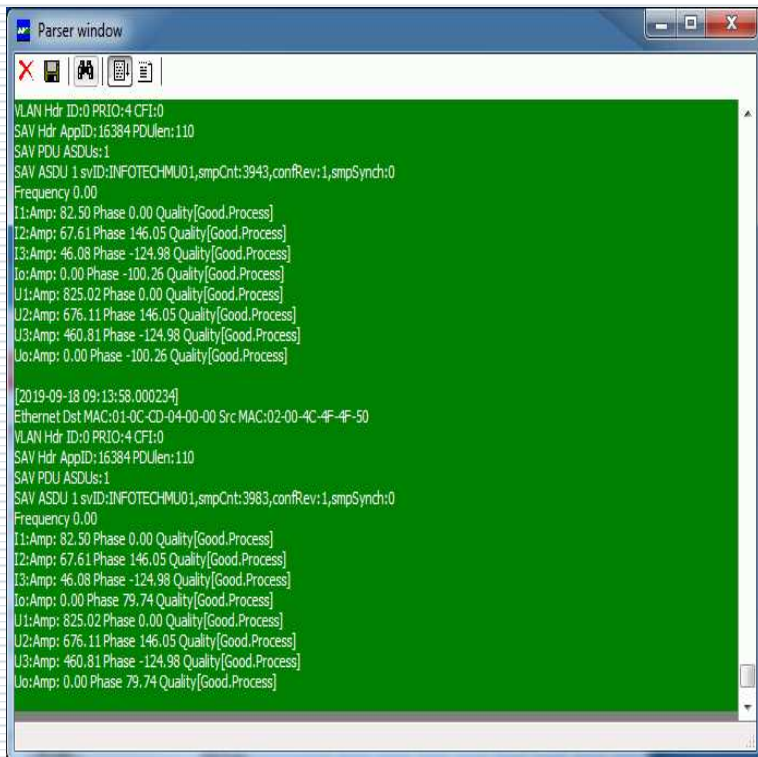
The computation may (optionally) apply resampling in case of detecting a deviation of the actual signal frequency from the nominal signal frequency specific for power systems.

The screenshot shows the 'Sampled Values Receiver' application window. The interface includes a menu bar (File, Transmission, Data, Help) and a toolbar with icons for GO, STOP, and a waveform. The 'Network adapter' is set to 'Pokożenie lokalne MAC: 00-22-4D-50-E9-E5'. The 'Type' is 'Not routable'. The 'Ethernet' section shows 'Source' as '50:50:51:00:00:00' and 'Destination' as '01:0C:CD:04:00:00'. The 'VLAN' section has 'Priority' set to 4 and 'ID' set to 0. The 'IP Address' is '239.1.1.35'. The 'Sampled Values PDU' section shows 'App ID' as 4000, 'Config Rev' as 1, 'SvID' as 'INFOTECHMU01', 'Samples/cycle' as 80, and 'APDUS' as 1. The 'Measurements' section shows 'Nominal frequency' as 50 Hz and 'Measured frequency [Hz]' as 0.00. A checkbox for 'Resample to measured frequency' is checked. The 'Sampled Values Quality' table has columns for I1, I2, I3, Io, U1, U2, U3, and Uo. The 'Communication status' shows 'Status: No data' and 'Lost messages: 8000'. The 'Measurements' section also displays two phasor diagrams and their corresponding data: I1 Mag:0.00, Ang:0.00; I2 Mag:0.00, Ang:0.00; I3 Mag:0.00, Ang:0.00; Io Mag:0.00, Ang:0.00; U1 Mag:0.00, Ang:0.00; U2 Mag:0.00, Ang:0.00; U3 Mag:0.00, Ang:0.00; Uo Mag:0.00, Ang:0.00.



# SV toolset: SAV Receiver - tracing SV message stream

SV messages are displayed in Parser window.



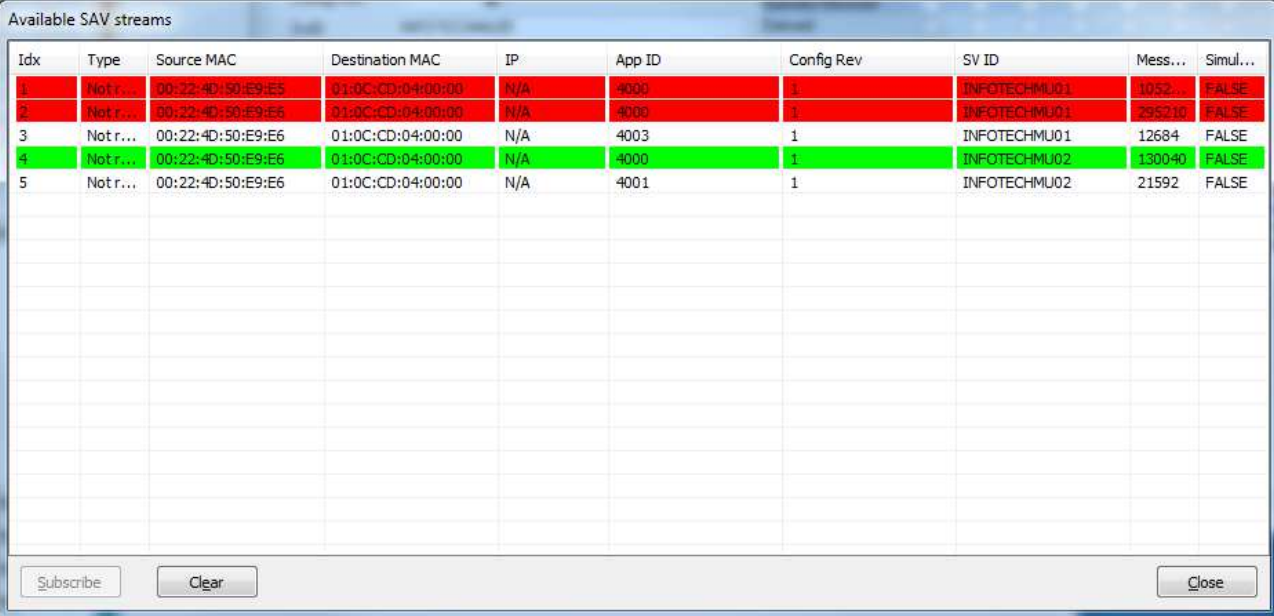
# SAV Reciever – detecting errors in configuration of message stream

The view of SAV Reciever message streams indicates conflicts in the system configuration:

Stream viewer can also detect possible conflicts in process bus network. Application is using following rule to mark streams:

**Error** state: two streams with different source MAC and the same Destination MAC, App ID and SV ID

**Warning** state: two streams with different source MAC and the same Destination MAC and App ID



Idx	Type	Source MAC	Destination MAC	IP	App ID	Config Rev	SV ID	Mess...	Simul...
1	Not r...	00:22:4D:50:E9:E5	01:0C:CD:04:00:00	N/A	4000	1	INFOTECHMU01	1052...	FALSE
2	Not r...	00:22:4D:50:E9:E6	01:0C:CD:04:00:00	N/A	4000	1	INFOTECHMU01	295210	FALSE
3	Not r...	00:22:4D:50:E9:E6	01:0C:CD:04:00:00	N/A	4003	1	INFOTECHMU01	12684	FALSE
4	Not r...	00:22:4D:50:E9:E6	01:0C:CD:04:00:00	N/A	4000	1	INFOTECHMU02	130040	FALSE
5	Not r...	00:22:4D:50:E9:E6	01:0C:CD:04:00:00	N/A	4001	1	INFOTECHMU02	21592	FALSE

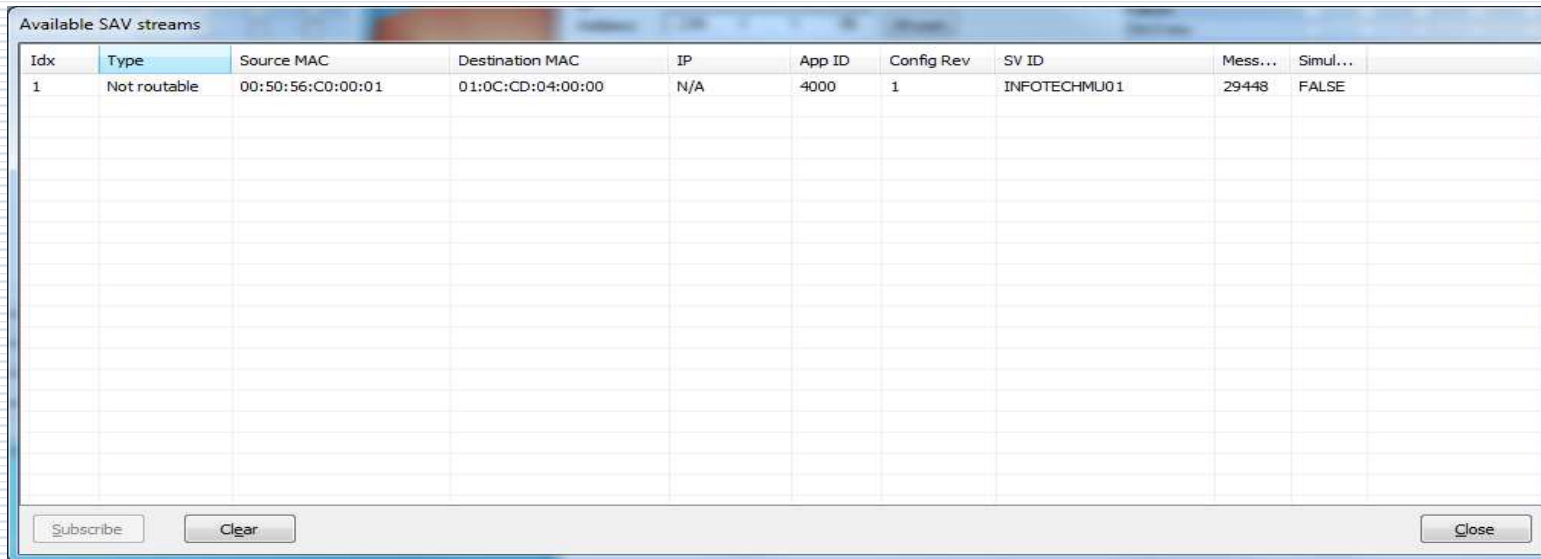
Streams with conflicts are marked with colored background:

Red – error, Yellow – warning, No color – no conflict. Lime background - conflict warning with selected stream, Aqua background - conflict error with selected stream



# SAV Reciever – Import streams definitions from SCL

Definitions of data sent over the network can be imported from standard SCL files. Application can use System Configuration Description files (SCD files) describing whole system in the substation or files for single IED like for example Configured IED Description (CID file). Selecting appropriate stream and clicking at **Use** button will start reception of the stream according to parameters defined in SCL file.



The screenshot shows a window titled "Available SAV streams" containing a table with the following data:

Idx	Type	Source MAC	Destination MAC	IP	App ID	Config Rev	SV ID	Mess...	Simul...
1	Not routable	00:50:56:C0:00:01	01:0C:CD:04:00:00	N/A	4000	1	INFOTECHMU01	29448	FALSE

At the bottom of the window, there are three buttons: "Subscribe", "Clear", and "Close".

# SV toolset: SAV Receiver

## – recording samples in COMTRADE file

Received sequence of sampled values can be also recorded and saved in a COMTRADE format file (manual trigger or determined by condition formula).

The screenshot displays the SAV Receiver software interface. It features a 'Recorder' window with parameters for duration (1000 ms), pretrigger time (50%), and trigger condition. A table shows the status of 8 recording slots, with slot #1 being 'Done' and others 'Waiting' or 'Empty'. The main window shows 'Communication status' (No data) and a 'Sampled Values Quality' table. Below these are two phasor diagrams and a 'Measured frequency [Hz]: 0.00' display.

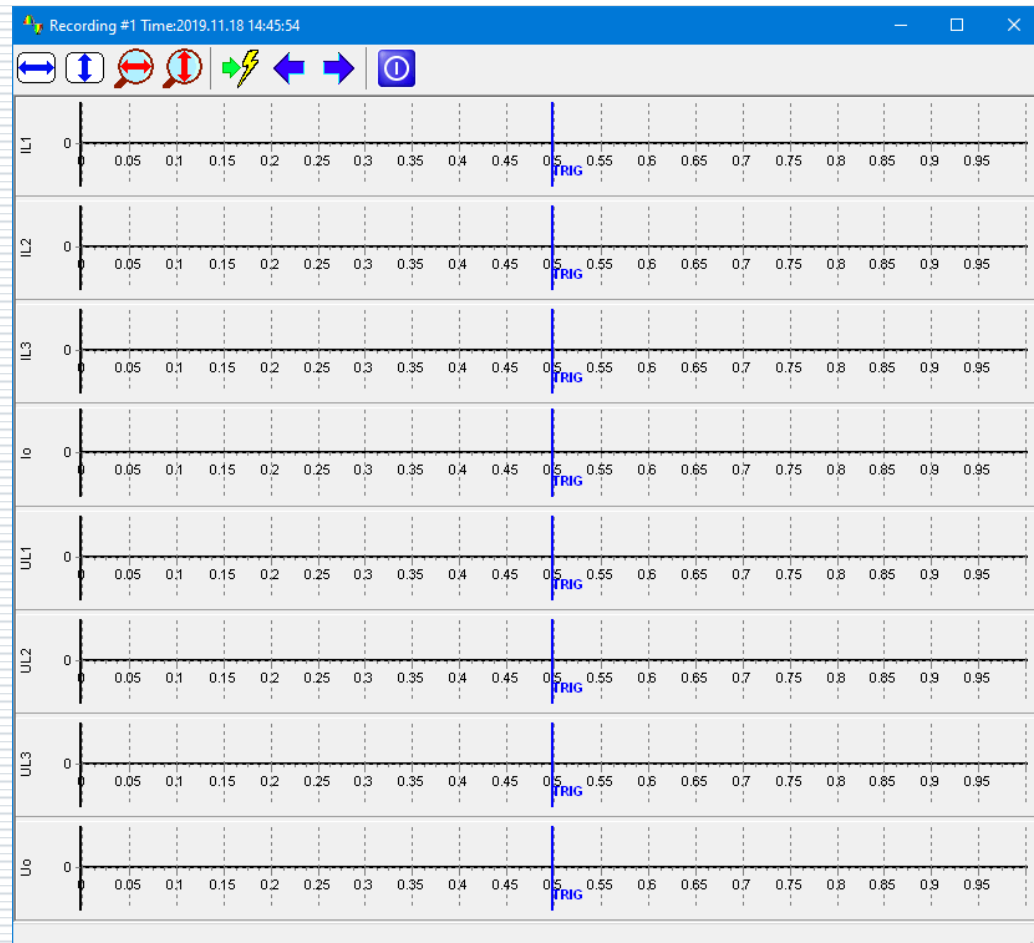
Slot	State	Trigger time	Progress	Save	Clear	View
#1	Done	2019-09-25 12:35:33	<div style="width: 100%; height: 10px; background-color: green;"></div>	Save	Clear	View
#2	Waiting	-	<div style="width: 25%; height: 10px; background-color: green;"></div>	Save	Clear	View
#3	Empty	-	<div style="width: 0%; height: 10px; background-color: green;"></div>	Save	Clear	View
#4	Empty	-	<div style="width: 0%; height: 10px; background-color: green;"></div>	Save	Clear	View
#5	Empty	-	<div style="width: 0%; height: 10px; background-color: green;"></div>	Save	Clear	View
#6	Empty	-	<div style="width: 0%; height: 10px; background-color: green;"></div>	Save	Clear	View
#7	Empty	-	<div style="width: 0%; height: 10px; background-color: green;"></div>	Save	Clear	View
#8	Empty	-	<div style="width: 0%; height: 10px; background-color: green;"></div>	Save	Clear	View

Sampled Values Quality	I1	I2	I3	Io	U1	U2	U3	Uo
Invalid/Good	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Questionable	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Overflow	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Out of Range	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Bad Reference	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Oscillatory	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Failure	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Old Data	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Inconsistent	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Inaccurate	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Substituted/Process	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Test	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Operator Blocked	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Derived	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

# SV toolset: SAV Receiver

## – viewing recorded COMTRADE file

**View** button in **Recorder** window allows to examine the waveforms of the signals received and recorded.



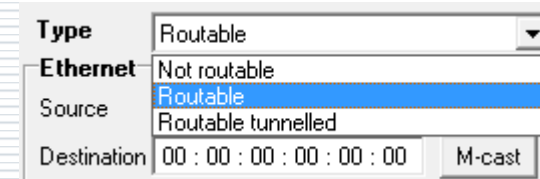
# SAV Sender and SAV Receiver support also routable messages

The **Type** of packet to be sent or to be received can be configured:

**Not routable** – SV message as Ethernet frame

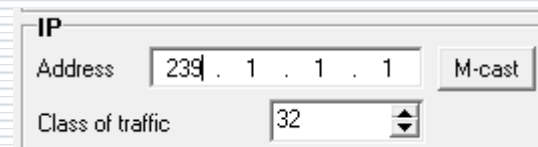
**Routable** – sent over IP between IEDs, data part of SV frame routed using IP packets and UDP protocol, locally forwarded by receiving IED as Ethernet SV frame

**Routable tunneled** – sent between routers of two subsystems, SV frame routed using IP packets and UDP protocol, locally forwarded by router as Ethernet SV frame



The screenshot shows a configuration window with the following fields:

- Type**: A dropdown menu set to "Routable".
- Ethernet**: A list box containing "Not routable", "Routable" (highlighted in blue), and "Routable tunneled".
- Source**: A text field.
- Destination**: A text field containing "00 : 00 : 00 : 00 : 00 : 00" and an "M-cast" button.



The screenshot shows an IP configuration window with the following fields:

- IP**: A section header.
- Address**: A text field containing "239 . 1 . 1 . 1" and an "M-cast" button.
- Class of traffic**: A dropdown menu set to "32".

For routable SV the multicast destination IP address and class of traffic must be also configured.

# File Transfer Tool



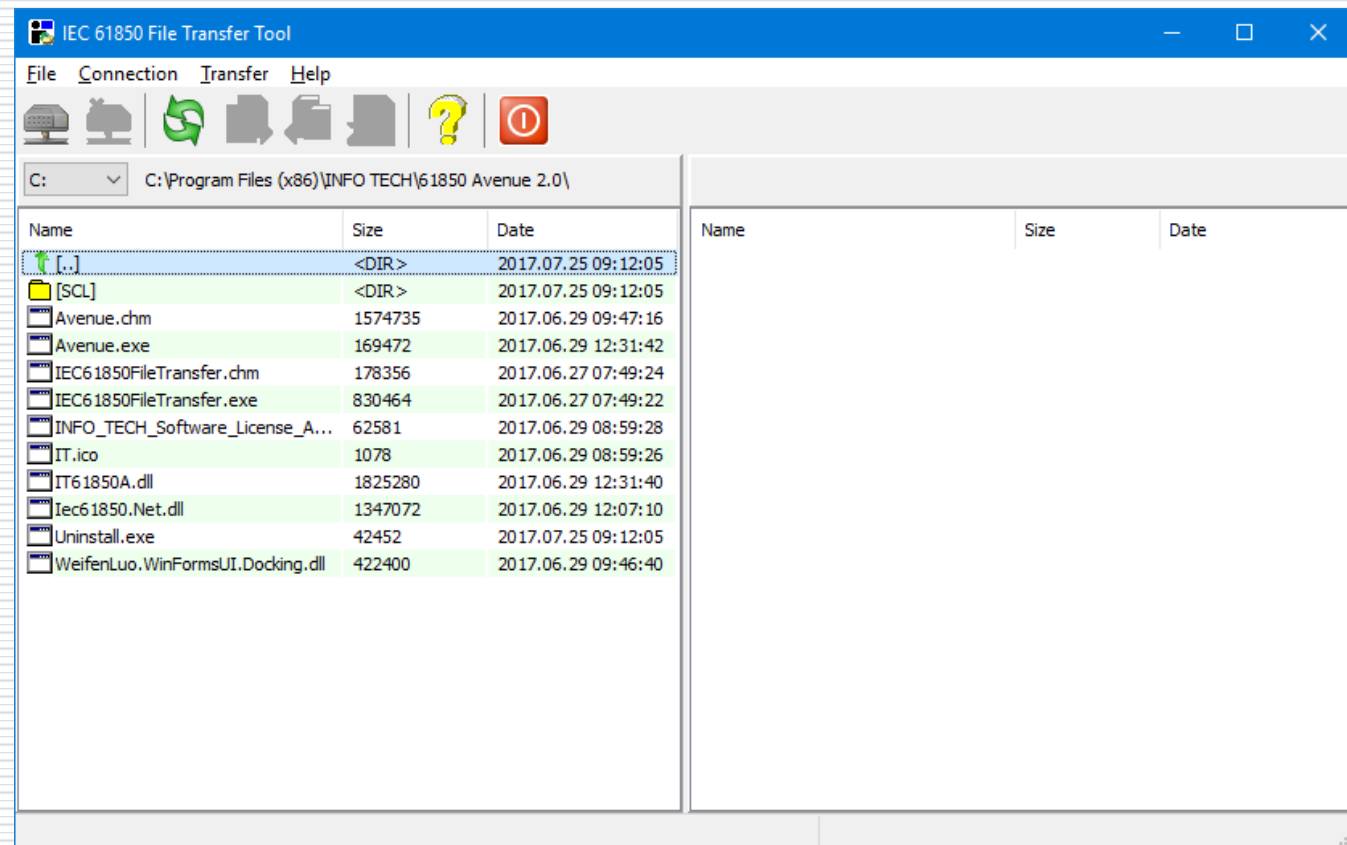
# File Transfer Tool – to test access to files in server devices

Initial view:

Left side: selected directory of the file system on PC.

Right side: file system of the server device.

The program operated as MMS protocol client using file services.



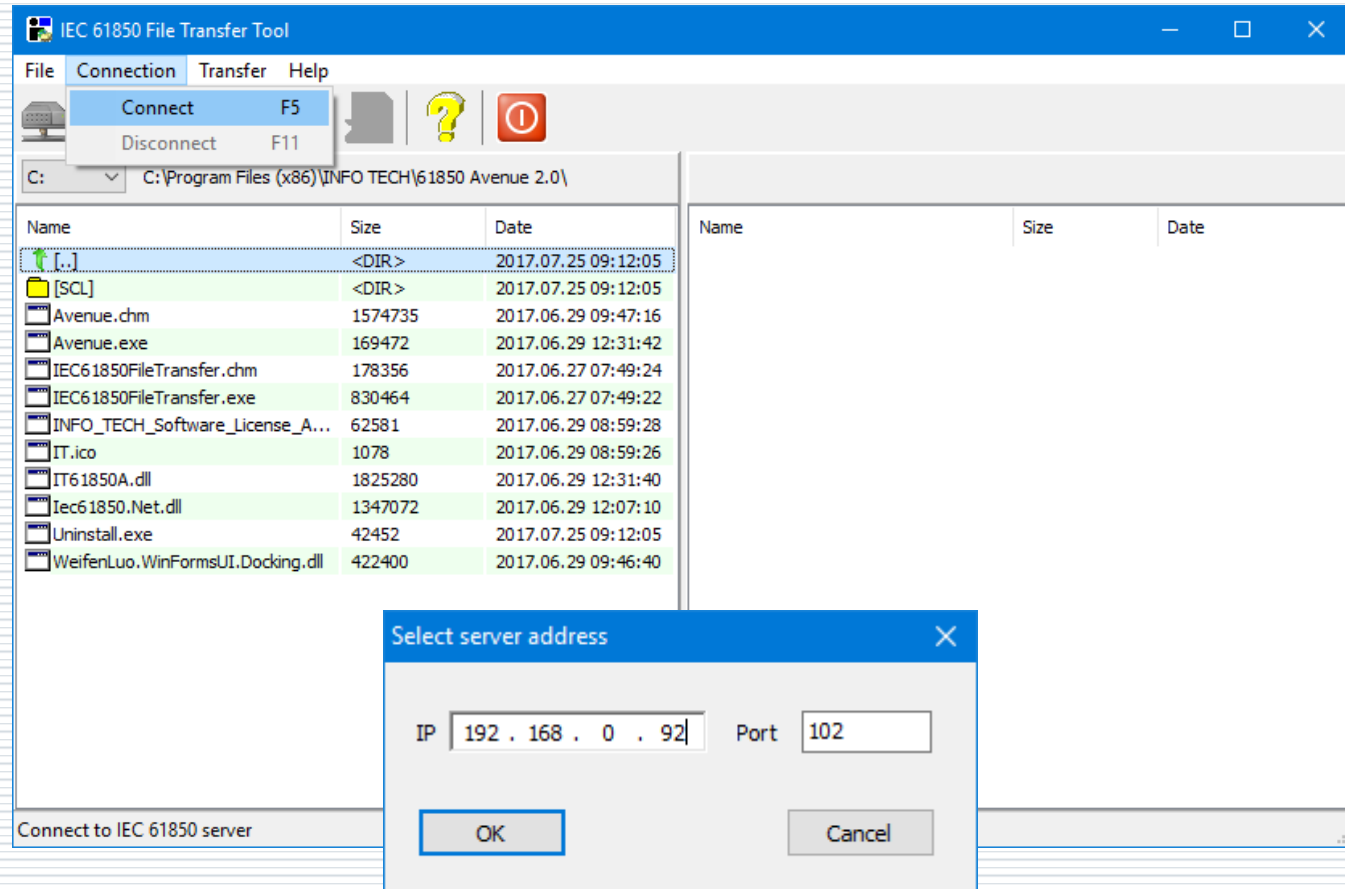


# Connection to server device as a file server

From **Connection** menu select **Connect** command.

Next, enter an IP address of the server device to connect to.

Port number 102 is default for MMS which is used for file transfer.



# View of the file system in the server device

## Note:

IEC 61850 Edition 1 allows server devices to present their file system as hierarchical with subdirectories.

IEC 61850 Edition 2 requires server devices to present a flat file system (as specified in MMS protocol) and then the names of subdirectories (e.g. COMTRADE) shall be a part of the file name – as shown here.

The screenshot shows the IEC 61850 File Transfer Tool interface. The left pane displays a hierarchical file system view for the local path C:\Program Files (x86)\INFO TECH\61850 Avenue 2.0\, listing files like Avenue.chm, Avenue.exe, and IEC61850FileTransfer.exe. The right pane shows a flat file list for the remote path 192.168.0.92:102\, where subdirectories are represented as part of the file names, such as COMTRADE/2017-09-08T10.18.4... and COMTRADE/2017-09-28T14.55.2...

Name	Size	Date
[..]	<DIR>	2017.07.25 09:12:05
[SCL]	<DIR>	2017.07.25 09:12:05
Avenue.chm	1574735	2017.06.29 09:47:16
Avenue.exe	169472	2017.06.29 12:31:42
IEC61850FileTransfer.chm	178356	2017.06.27 07:49:24
IEC61850FileTransfer.exe	830464	2017.06.27 07:49:22
INFO_TECH_Software_License_A...	62581	2017.06.29 08:59:28
IT.ico	1078	2017.06.29 08:59:26
IT61850A.dll	1825280	2017.06.29 12:31:40
Iec61850.Net.dll	1347072	2017.06.29 12:07:10
Uninstall.exe	42452	2017.07.25 09:12:05
WeifenLuo.WinFormsUI.Docking.dll	422400	2017.06.29 09:46:40

Name	Size	Date
COMTRADE/2017-09-08T10.18.4...	1103	2017-09-27 10:0...
COMTRADE/2017-09-08T10.18.4...	364500	2017-09-27 10:07:10
COMTRADE/2017-09-28T14.55.2...	1103	2017-09-28 14:00:05
COMTRADE/2017-09-28T14.55.2...	364500	2017-09-28 14:00:04
COMTRADE/2017-11-08T11.56.4...	1103	2017-11-08 10:59:04
COMTRADE/2017-11-08T11.56.4...	364500	2017-11-08 10:59:04
kombisave.icd	86961	2017-11-15 11:08:13
rcode256.log	6291	2017-09-28 13:09:47
run-update.sh	163	2017-10-09 09:50:17
run.sh	150	2016-01-12 06:13:44
s61850.last.log	814390	2017-11-15 14:14:11
s61850.log	1526211	2017-11-16 12:23:40

# File transfer operations

The set of supported operations is determined when establishing connection with the server device.

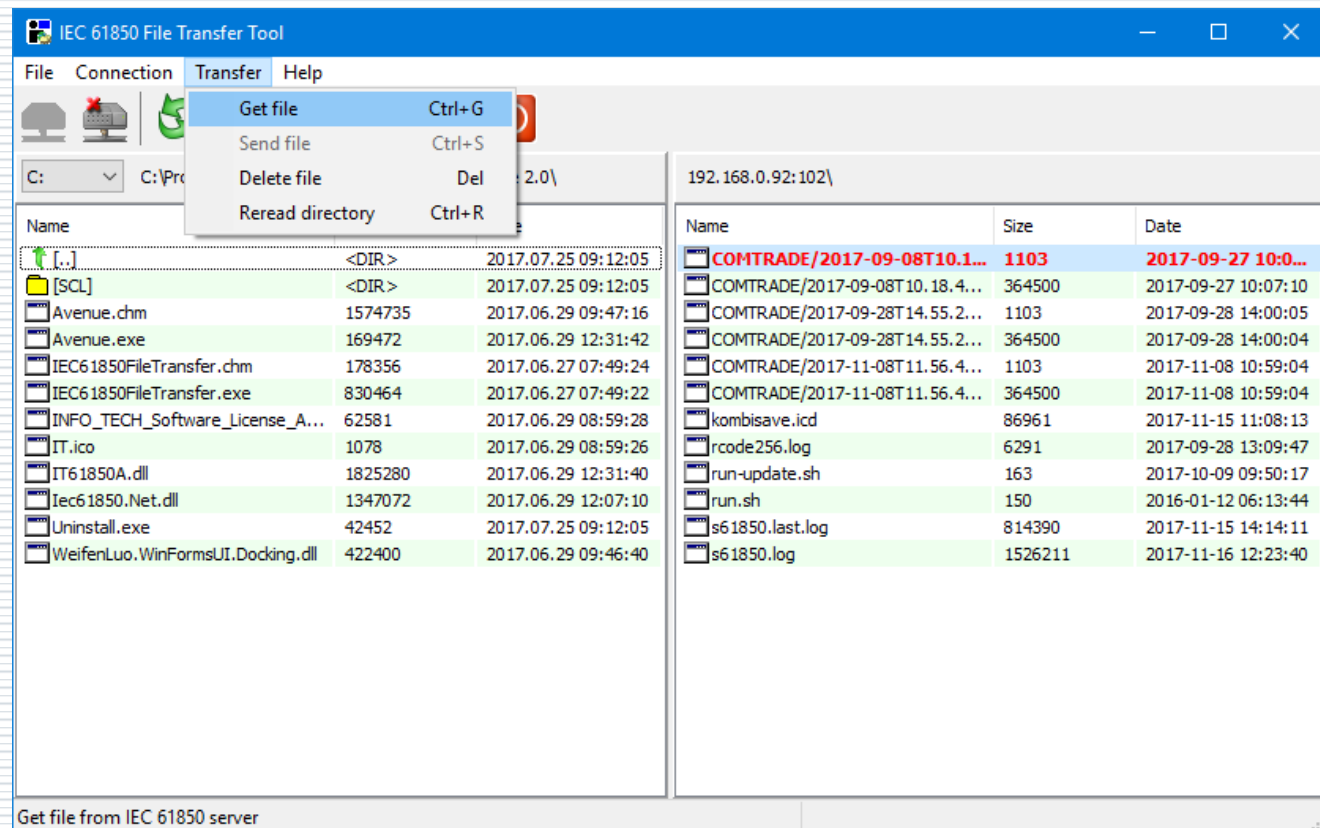
Possible operations in **Transfer** menu:

**Get file** – file reading from the server

**Send file** – file writing to the server

**Delete file** – file removal

**Reread directory** – refresh of the file list



# 61850 ICD Editor

A tool to create and modify SCL files.



# 61850 ICD Editor allows to build an ICD file of the server device

From scratch or by modification of an existing file.

The screenshot displays the 61850 ICD Editor interface with three overlapping dialog boxes:

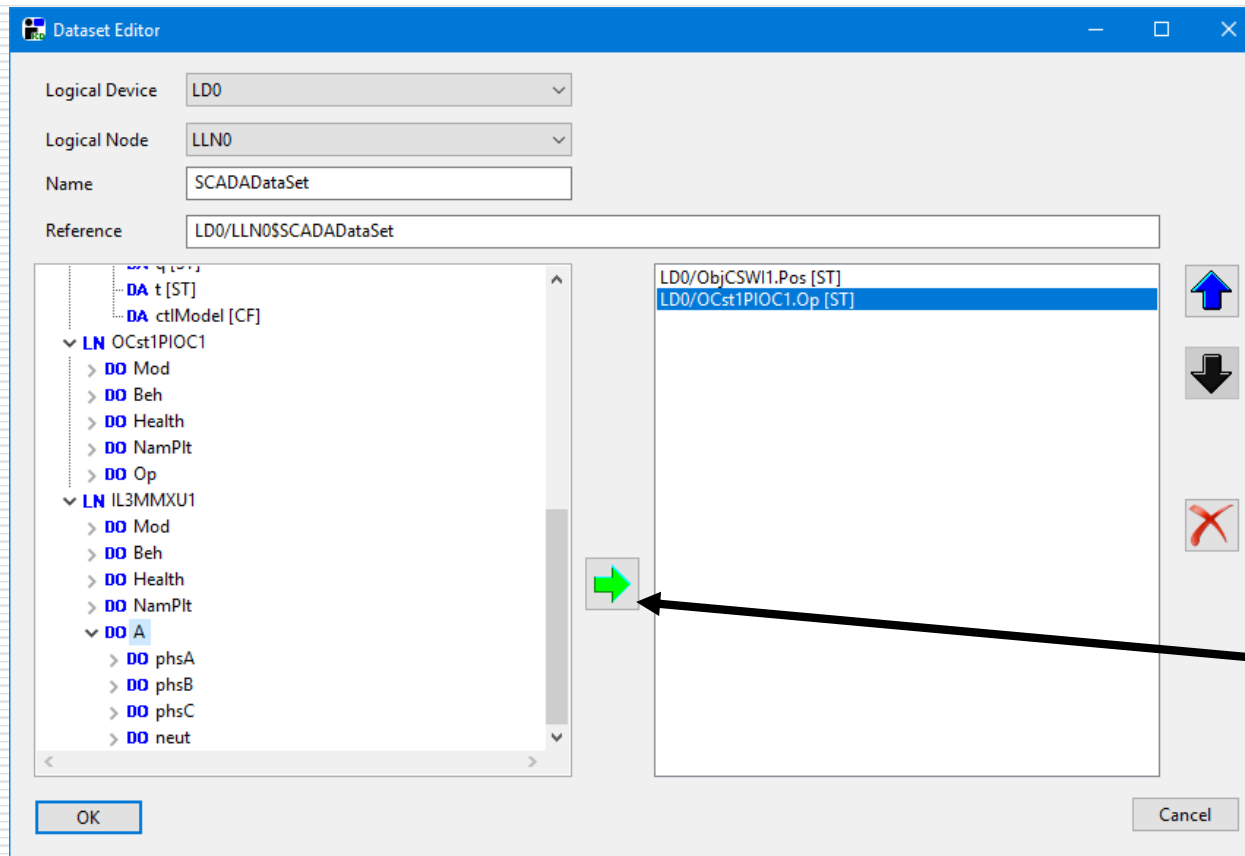
- Create new Logical Device:** A dialog box for adding a new LD. The Name field is set to "LD0". The Type dropdown is set to "61850-7-4". The Logical Device dropdown lists "61400-25", "61850-7-410", and "61850-7-420". An "OK" button is at the bottom.
- Add new Logical Node:** A dialog box for adding a new LN. The Class dropdown is set to "XCBR". The Prefix field is "Obj1" and the Instance field is "1". The LN name dropdown lists "SARC", "SIMG", "SIML", "SPDC", "XSWI", "TCTR", and "TVTR". A list of DO types is visible below, including "DO [M] Mod", "DO [M] Beh", "DO [M] Health", "DO [M] NamPlt", "DO [M] Loc", "DO [O] EEHealth", "DO [O] EEName", "DO [M] OpCnt", "DO [M] Pos", "DO [M] BlkOpn", "DO [M] BlkCls", "DO [O] ChaMotEna", "DO [O] SumSwARs", "DO [M] CBOpCap", "DO [O] POWCap", and "DO [O] MaxOpCap".
- Control Block Editor:** A dialog box for configuring a control block. The Control block type dropdown is set to "Buffered Report CB". The Name field is "brcb0". The DataSet dropdown is set to "Buffered Report CB". The Report ID field is empty. The Buffering time is set to "1000" and the Integrity period is "0". The Config revision is "1" and Instances is "1". There are sections for "Option fields" (with checkboxes for Sequence number, Time stamp, DataSet reference, Reason code, Data reference, Entry ID, Configuration revision, and Buffer overflow) and "Triggering options" (with checkboxes for Data change, Quality change, Data update, Integrity scan, and General interrogation). A "Control block is indexed" checkbox is also present. "OK" and "Cancel" buttons are at the bottom.

Add LD

Add LN with selection of optional DO and DA

Add RCB, GCB, SGCB, SVCB with setting attribute values

# Dataset creation by selection of elements from the data model



Buttons for changing order of elements in dataset.

Button for removing element of dataset.

Button for adding an element of data model to dataset.



# Possible applications of 61850 ICD Editor program

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- ❑ Creation and modification of ICD/CID file for the device under configuration.
- ❑ Processing of an ICD file into a CID file (addresses, datasets, parameters of control blocks).
- ❑ Creation and modification of ICD/CID file to be used for server device simulation (e.g. with the use of INFO TECH 61850 SCL Runner tool).
- ❑ Modification of ICD/CID file for the IEC 61850 client program (e.g. 61850 Avenue client), for example to enable execution of negative test cases on the server device.

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