



**Manual Version: IEDScout.AE.5**

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# IEDScout Examples

This document provides a quick introduction to some common applications performed with *IEDScout* and some tips to optimize the work with *IEDScout*.

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# 1 Requirements and Setup

## 1.1 System Requirements

A physical computer with Intel x86 architecture (no virtual machine)  
Windows 2000 (SP4), Windows XP (SP2), or Windows Vista operating system  
Administrator or Power User rights for the installation  
A free USB port for the USB license key  
An Ethernet adapter with TCP/IP protocol bound to it.

Note: Wireless adapters typically do not work with GOOSE/GSSE.

If a firewall is present, port 102 must be opened

## 1.2 Installation

On executing the setup program of *IEDScout*, the installer will start up:  
Follow the instructions provided during the installation procedure.

## 1.3 Prerequisites

### Windows - Network Settings

Before starting work with *IEDScout*, the network settings on the PC have to be configured properly. It is assumed that the user has administrator or power user rights for changing the network settings. The network adapter must be enabled and must have a valid IP address. In applications with IEC 61850 and substation devices normally static IP addresses are used. The following steps describe how to set such an address in Windows 2000/XP.

The Windows network connection settings can be accessed through *Start > Settings > Control Panel > Network Connections*.

Select the corresponding network adapter for use with *IEDScout* and open its *Properties* (right-click to access the context menu).

From the list of protocols, select *Internet Protocol (TCP/IP)* (typically at the bottom of the list) and open its *Properties* again.

Select "Use the following IP address" and enter IP address and subnet mask.

The values entered must be compatible with the connected network and devices.

### IEDScout

To use the full featured *IEDScout*, the USB license Key has to be plugged into a free USB port; otherwise *IEDScout* will run in evaluation mode.

In the *GOOSE* Tab of the *IEDScout* configuration, the network adapter for GOOSE must be selected in the field *Adapter*; the same steps are needed for GSSE. *IEDScout* only displays adapters that are able to send and receive GOOSE/GSSE messages.

### Multiple Network Adapters

To avoid problems due to other programs that also use port 102 (e.g. Microsoft Outlook with Exchange server), *IEDScout* must be set to use a specific adapter (a specific IP address):

In the RFC1006 tab of the *IEDScout* Configuration window, the *Local IP* must be set to the IP address of the interface to be used for connecting to the IEDs. When the PC running *IEDScout* has only one network interface, the *Local IP* may be left at the default value "0.0.0.0".

## 2 Examples

### 2.1 Discovering and Browsing an IED

#### Defining the IED

A new IED is added with the *New* Button in the *Servers* tab of the *Configuration* window.



A name for the new device must be specified (e.g. "Q0\_S"), along with the IP address. In this example the IED's IP address is 192.168.0.77.

If a similar device is already present, the option *Use existing server definition* is useful. In this case only the parameters that differ between the two server definitions have to be changed.

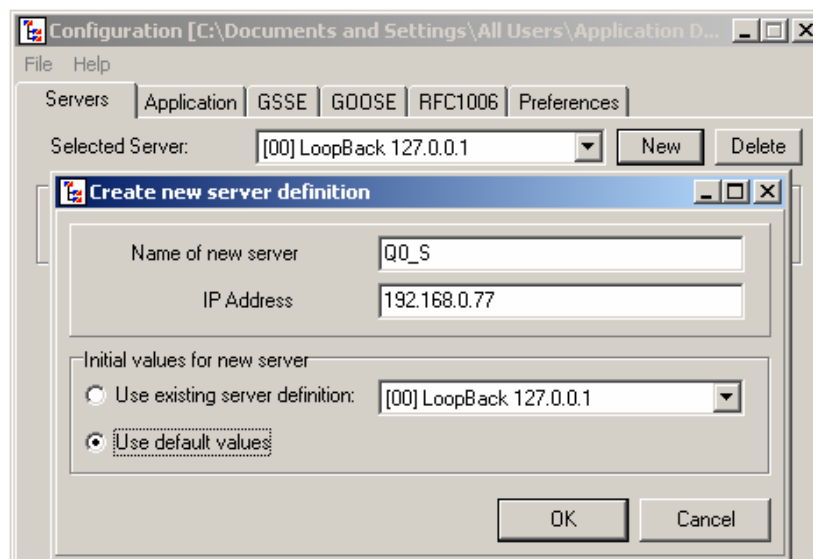


Figure 1 Defining the IED (Create new Server)

The parameters needed to connect to a device should be specified in the documentation for the IED. Usually the IP address is sufficient to connect to an IED.

If special parameters need to be set, the *Advanced* Button will reveal all available options.

## Discovering the IED

The *Discover* button offers a list of servers to connect to. Pick the new server and the *Server Query Progress* window will open.



*IEDScout* now reads the self-description of the IED. It discovers the data model of the IED and then reads the actual values contained in the data. Depending on the size of the data model, the speed of the connection, and the server, this may take more than a minute.

*IEDScout* creates a new server section for the discovered IED on the main screen. Double click on the subsections of the IED provides access to all the services that the IED supports.

E. g. double clicking on *Data* opens the *Data View*, which will be explained later.

Additionally, Datasets and all Control Blocks (GOOSE, Reports, Logs, Sampled Values) can be accessed from here.

Right click on the light blue colored root of the IED allows the user to *Disconnect* or *Delete* the server.

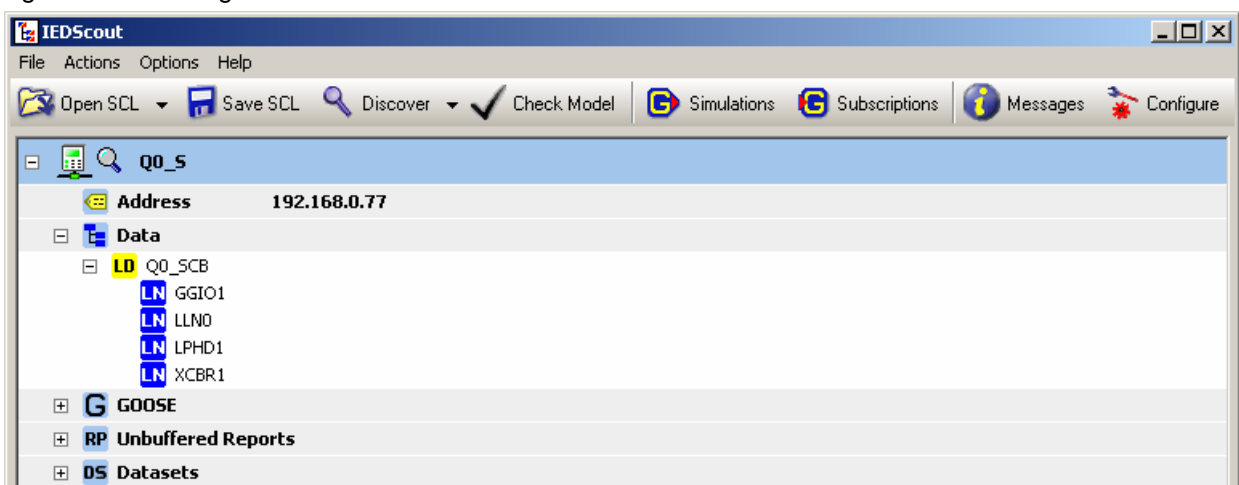






Figure 2 Connected to "Q0\_S"

The status of the connection to the IED is indicated with the following icons:

-   – Shows whether the loaded IED is connected (green) or disconnected (gray)
-  – The IED has been discovered
-  – The IED definition has been loaded from an SCL file (will be explained below)

## Browsing the IED

When one of the logical devices in the Main screen is double-clicked, the *Data View* will open. It is divided into two panes.

The nesting depth in the left pane is limited to the LD level and gives an overview of the IEDs and their top level structure. This pane is especially useful for quickly navigating between IEDs when multiple devices are loaded.

The right pane is for inspecting the IEDs' data models in detail, down to the attribute level.

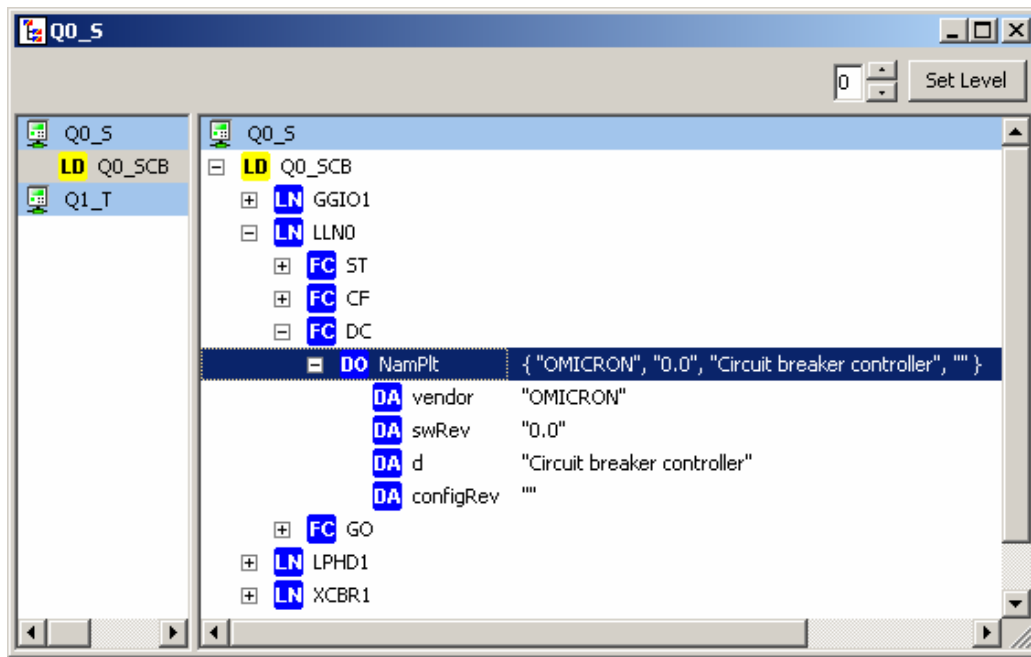


Figure 3 Data View with "Q0\_S" loaded

The data tree shows the different types of objects with different icons:

- – The server (IED), the root of the data tree
- – Logical Device
- – Logical Node
- – Functional Constraint
- – Data Object
- – Data Attributes, the leafs of the tree

The *Data View* uses colors to signalize the status and the information source of the data.

- – Initial value, the value has not yet been updated
- – The value has been retrieved by a read command
- – Data has changed within a report
- – Data has been updated by a report General Interrogation (GI)
- – Value comes from periodic reporting
- – This value has just been written

A context menu opens when a selected data item is right-clicked with the mouse. The context menu offers various functions to be performed with the item, such as *Read*, *Write*, *Polling*, etc. Depending on the selected item (context), some functions which do not apply to that item will be disabled (grayed out).

## 2.2 Working with SCL Files

*IEDScout* provides useful features with SCL. An SCL file can be created from a discovered IED. If an SCL file with definitions of an IED is provided, the connection and browsing process can be facilitated.

### Saving an SCL File

This function is typically used to produce an ICD file for a discovered IED. There are several usages of this SCL file: support further re-connection to the device, import of GOOSE definitions by the GOOSE Configuration module of the OMICRON Test Universe, Simulating of the IED, etc.

The **Save SCL** function is accessible from the main screen via the toolbar or the *File* menu.



The **Save SCL** window opens. First, the server is selected in the "Server" list.

Specifying the *IED Name* is mandatory and essential to get a correct SCL file. The IED discovery process delivers the IED Name and the LD names concatenated together without delimiters. In the SCL file, these two names need to be stored separately. To split IED Name and LD names correctly, the IED Name has to be known.

*IEDScout* tries to guess the IED Name, which succeeds when sufficiently different LD names are contained in the server. If there is only one LD in the server or if the LD names do not differ at the first character, *IEDScout* cannot make a correct guess. In this case, the user must provide the correct IED Name. In any case, the IED Name is not arbitrary and must at least match the leading characters of the (IED Name + LD name) string delivered by the IED.

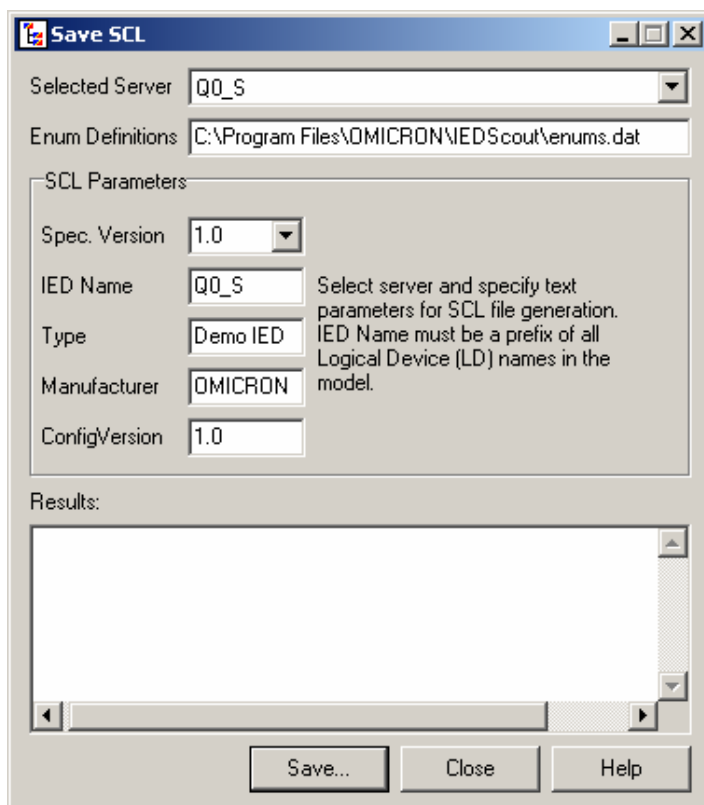


Figure 4 Save SCL window

Other information as *IED Type*, *Manufacturer* and *ConfigVersion* are optional.

As far as possible, *IEDScout* will correct deviations from the standard in the discovered data model to create a conformant SCL file. Corrections are listed in the "Results:" list.

When storing the SCL file, information about the meanings of attributes of type "Enum" is added. The default source for this information is the file "enums.dat".

While *Discover* delivers only the ordinal integer values for enumerators, the meanings are displayed in text form when connecting to the device using an SCL file (see the next example).

## Connecting Using an SCL File

When connecting using an SCL file, no parameters have to be specified and the connection operation is much faster because the data model will not be requested from the server.

### Opening the SCL File

An SCL file (.icd, .scl, .cid) is opened by selecting the *Open SCL* function from the toolbar or the *File* menu in the main screen.



It is also possible to drag-and-drop an SCL file onto the Main screen of *IEDScout*.

A tree view with all servers in the SCL file is displayed. The tree can be expanded to a certain level to examine the devices offered. A selection specifies which server's data are actually loaded into *IEDScout*. *IEDScout* creates new server sections for the selected servers on the main screen, just as if they were found through a *Discover* process.

### Connecting

If the addressing (for example the IP address) of the server has changed since the SCL file was created, according modifications can be made by double-clicking on *Address*.

A connection is then established by simply clicking *Connect* in the right click popup menu of the light blue IED root node.

Connecting to a server by using its SCL file speeds up the process considerably, since the discovery of the data model structure is not necessary. This information is already delivered by the SCL file.

The actual data can then be read with the *Read Data* function in the context menu of the IED or by using the *Read* function (from the context menu of a data item) in the *Data View*.

Additionally, the SCL file contains information about the meanings of attributes of type "Enum". This information is then displayed in text form along with the ordinal values for enumerators.

## 2.3 Polling Data

Data to be polled are collected in the *Polling* window. All polled data can be viewed together in one place. This is especially convenient when data from different IEDs are to be observed together, which would not be simultaneously visible in the data view.

The Polling Window opens as soon as a data object or attribute is added for polling. Adding data items is done in the *Data View* by focusing an item (DO or DA) and selecting *Poll* from the context menu or by dragging & dropping items from the *Data View* to the *Polling* window.

Items can be individually removed by using the context menu in the *Polling* window.

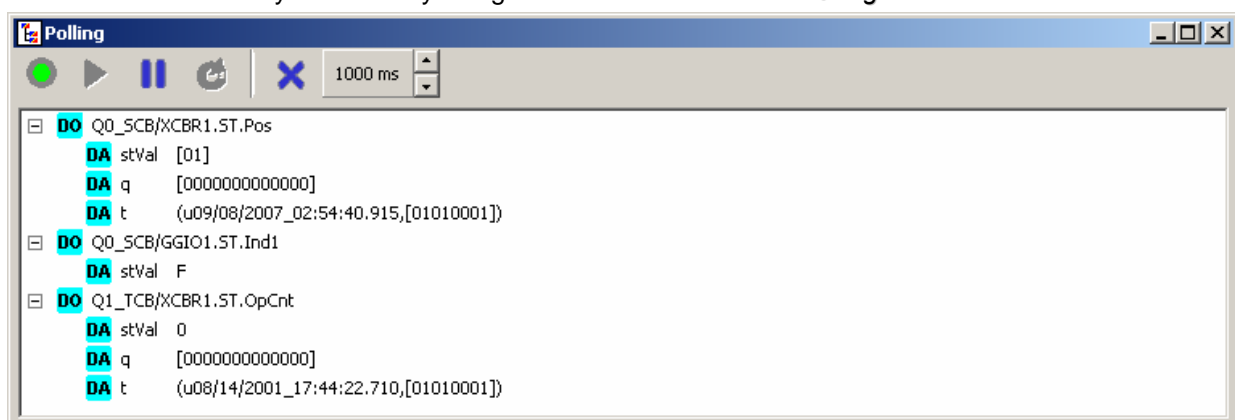


Figure 5 Polling Window with data

All data are polled with the same rate. The polling interval can be selected from preset values.

The green dot on the toolbar flashes when the data are polled.

If polling is paused, the data can be refreshed manually.

## 2.4 Working with Reports

### Enabling a Report

To enable a report from the device, a report control block (RCB) must be selected. This is done by browsing the object model in the Data View and setting the focus on a RCB. The context menu then offers the function *Enable*. The values in the RCB that are changed by *IEDScout* by this action are then marked in purple.

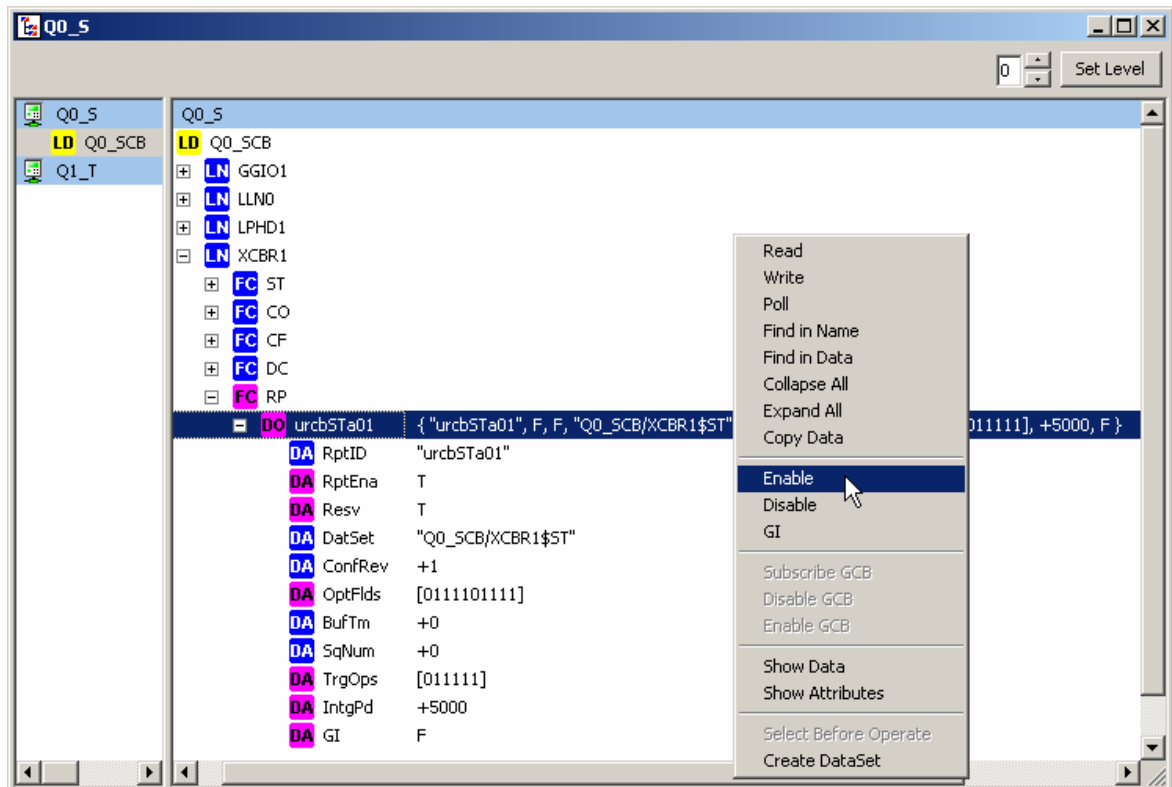


Figure 6 Data tree with enabled report (purple)

Depending on the trigger options, the server will then send the reports to *IEDScout*. The updated data will be marked red in the data tree.

### General Interrogation

When the report control block is enabled (as mentioned before) and the trigger option allows a general interrogation, the *GI* function triggers a report that is sent regardless of the other trigger conditions.

## 2.5 Subscribing and Recording GOOSE

IEDScout provides four different methods to subscribe to a GOOSE.

### Subscribing using GOOSE Control Blocks

#### Subscribing by the Control Blocks displayed in the Main Screen

The Main screen lists all available GOOSE Control Blocks (GCBs) of the IED. When one is double-clicked, the GCB detail window opens. The menu bar has a *Subscribe* button.

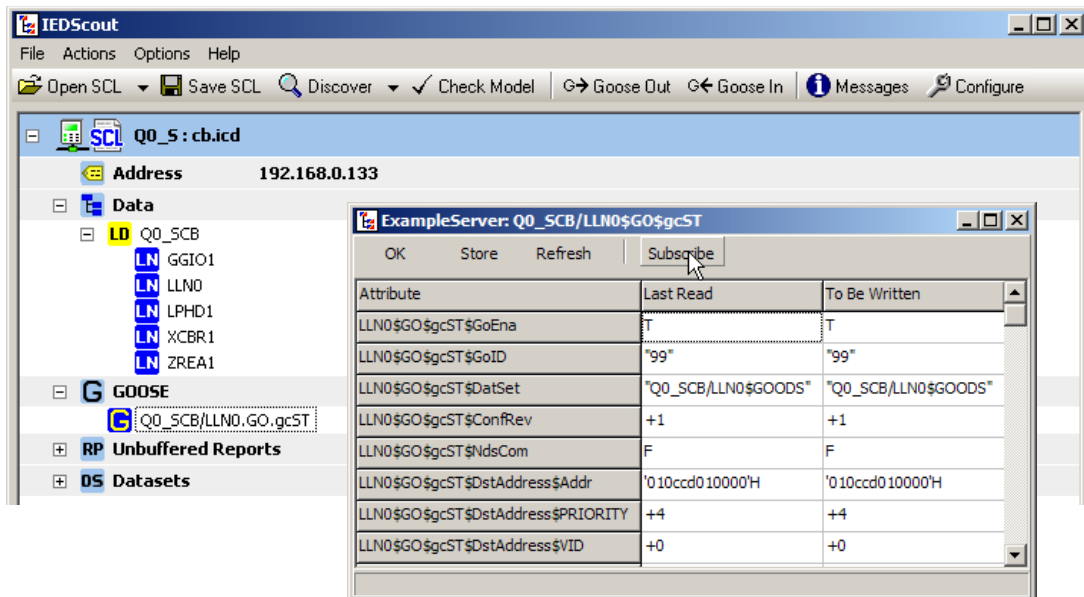


Figure 7 Subscribing from the GOOSE Control Block detail view

On pressing the *Subscribe* button, the GOOSE Subscription Window opens and the GOOSE is displayed in detail.

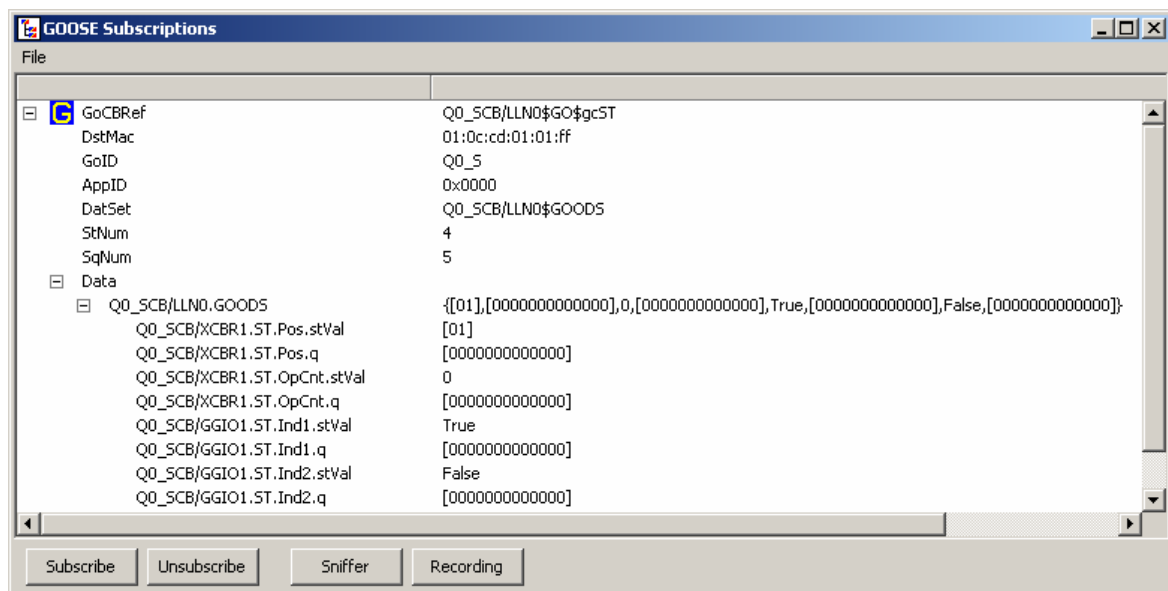


Figure 8 Subscribed GOOSE

All subscription actions lead to the GOOSE Subscription Window or can be initiated from there (see further examples).



### Subscribing by the Control Blocks displayed in the Data View

With the focus on a GOOSE Control Block (GCB), the context menu (accessible via right-click) offers the function *Subscribe GCB*. Selecting this function will automatically set up a GOOSE subscription.

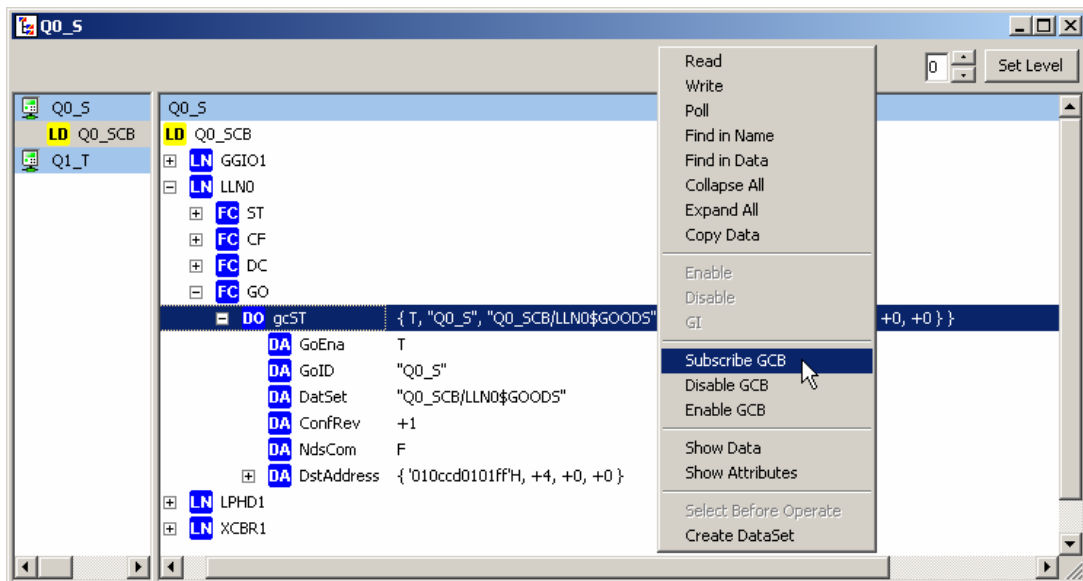


Figure 9 Subscription using a GOOSE Control Block

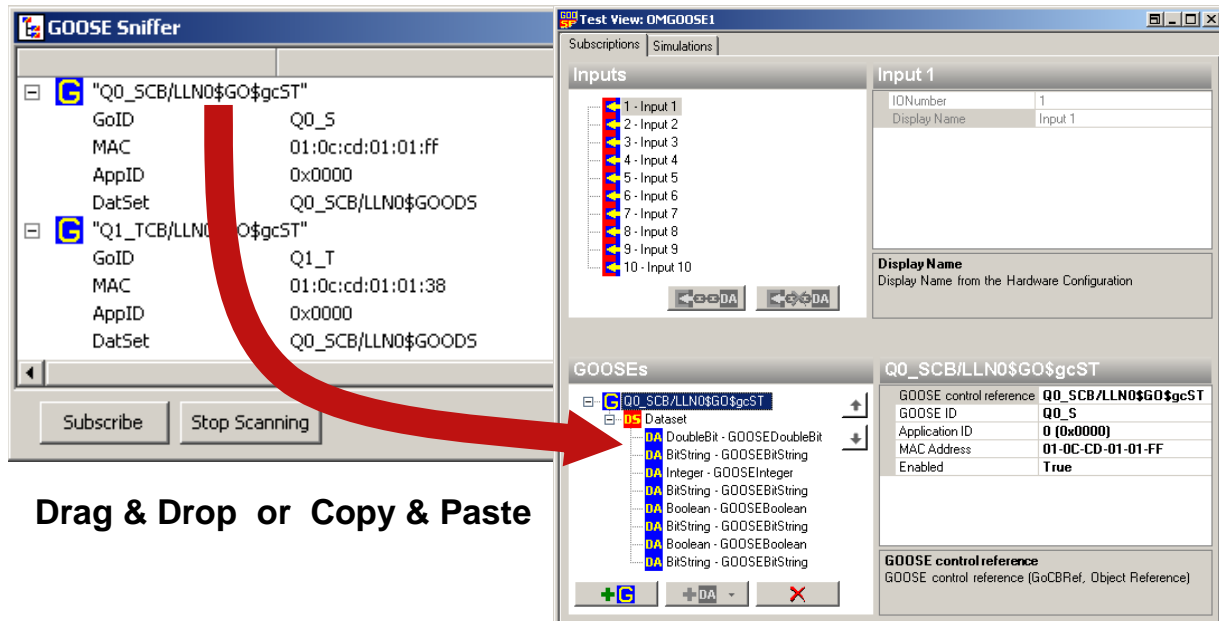
## GOOSE Sniffing

The GOOSE Sniffer can be started from the *GOOSE Subscription* window or the *Action* menu of the Main window. It finds all GOOSE messages arriving at the GOOSE adapter (as specified in the Configuration dialog).

These GOOSEs can then be subscribed with the *Subscribe* button. Various other functions are accessible from the context menu of a GOOSE entry.

## Transferring GOOSE Information to Configure a CMC Test Set

The GOOSE Sniffer also supports Drag & Drop or Copy & Paste to the OMICRON Test Universe GOOSE Configuration Module to subscribe/simulate GOOSEs with the CMC test set.



**Drag & Drop or Copy & Paste**

Figure 10 Transferring a data from the GOOSE Sniffer to the GOOSE Configuration Module

## Subscribing Manually

Additionally, a GOOSE can be subscribed "from scratch" without using the IED's data model and access to the control blocks. All relevant GOOSE parameters must be known and specified manually. This can be done in *GOOSE Subscriptions* with the *Subscribe* button. The GOOSE parameters have to be entered in the opening subscription dialog.

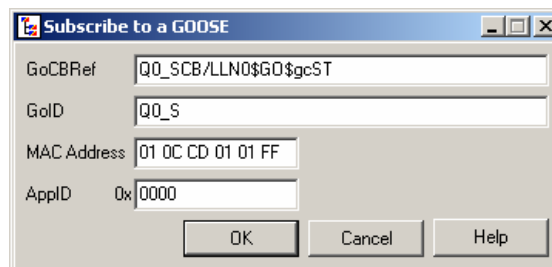


Figure 11 Subscribing manually by specifying parameters

## GOOSE Recording

IEDScout has a powerful function for recording GOOSE traffic. Complex relations between data in multiple GOOSEs can be analyzed this way.

The data are recorded into COMTRADE files which can be analyzed in several viewer applications. OMICRON TransView may be available for this purpose if the OMICRON Test Universe software (with EnerLyzer) is installed.

The name template defines the location where the COMTRADE records are stored and the base file name. Incrementing numbers are appended to the filenames for further recordings.

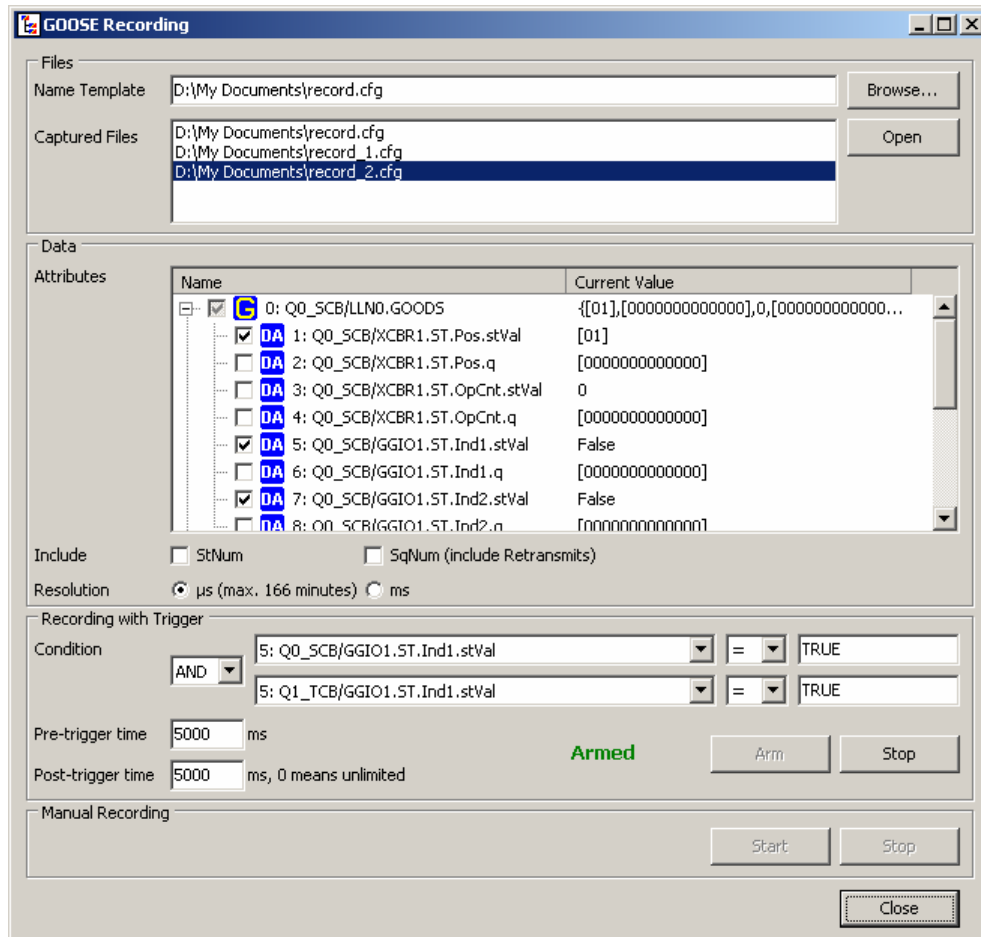


Figure 12 GOOSE Recording Window

The *Open* function will launch the application associated with the COMTRADE configuration files (CFG file extension) to view the COMTRADE files.

When using OMICRON TransView, the maximum recording time is limited to approximately 35 minutes with a  $\mu$ s resolution.

Data attributes to be included in the recording need the checkmark next to them checked. Normally, only state changes are recorded. When the sequence number (SqNum) is included, all retransmits will be recorded as well.

Trigger conditions can be set up with attributes selected for recording.

## 2.6 Simulating GOOSE

The GOOSE message to be created for the example shall have the following properties:

### GOOSE Parameters

GOOSE Control Reference:	IEDScout/LLN0\$GO\$Eval
Dataset Reference:	IEDScout/LLN0\$Eval_DataSet
GOOSE ID:	GOOSEID
Application ID:	0x3FFF
Multicast MAC Address:	01:0C:CD:01:01:FF
Retransmission:	First Interval: 1000ms, Multiplier: 2, Max Interval: 8000ms, default strategy
Data:	Boolean; Integer; BitString[4]

### Creating a GOOSE

Open the *GOOSE Output* view by selecting *GOOSE Simulations* from the toolbar.



Create a new GOOSE with *Add GOOSE*.

In the Destination MAC address field specify the last two bytes of 01 0C CD 01 01 FF.

The initial data must be entered in the *Data* field.

For this example, "{False, 0, [1000]}" is the initial data. The data can also be edited with the ... button next to the *Data* field.

The other fields are filled out according to the parameters given above:

**GoID:** "GOOSEID"

**GcRef:** "IEDScout/LLN0\$GO\$Eval"

**DatSet:** "IEDScout/LLN0\$Eval\_DataSet".

Set the AppID and the VLAN parameters with the *Advanced* button at the *Advanced Addressing Window*.

The strategy can be changed through the *Strategy* button. For this example, the defaults are used.

### Creating a GOOSE Sequence

The data shall change every second between four different states:

Step 1:	{False, 0, [1000]}
Step 2:	{True, 1, [0100]}
Step 3:	{False, 2, [0010]}
Step 4:	{True, 3, [0001]}

With the *Insert Step* button, four steps are inserted. The *Delay* field is set to 1000ms on all steps.

The corresponding data are specified in the data fields.

The GOOSE will be published as soon the setup is confirmed with *OK* on the *Edit GOOSE/GSSE* window.

The screenshot shows the 'Edit GOOSE/GSSE Output' dialog box. It has a title bar with a minus, maximize, and close button. The main area is divided into several sections. The top section contains fields for Time (01/01/1970\_00:00:00.000), Test (0), Data ({False, 0, [1000]}), MAC (00 10 a4 1b b0 e0 -> 01 0c cd 01 01 ff), GoID (GOOSEID), Hold (0), Remaining (0), GcRef (IEDScout/LLN0\$GO\$Eval), StNum (0), SqNum (0), and DatSet (IEDScout/LLN0\$Eval\_DataSet). Below this are four rows, each with a Delay field (all set to 1000) and a Data field (containing {False, 0, [1000]}, {True, 1, [0100]}, {False, 2, [0010]}, and {True, 3, [0001]} respectively). At the bottom, there are buttons for 'Insert Step', 'Delete Step', 'Strategy', 'Advanced', 'OK', 'Cancel', and 'Help'.

Figure 13 The example GOOSE with all parameters filled in

The GOOSE and the sequence shown in Figure 13 is the one used in the evaluation version of *IEDScout*.

### Running a GOOSE Sequence

By clicking on *Run* in the *GOOSE Out* view, the data changes every second according to the setting in the steps.