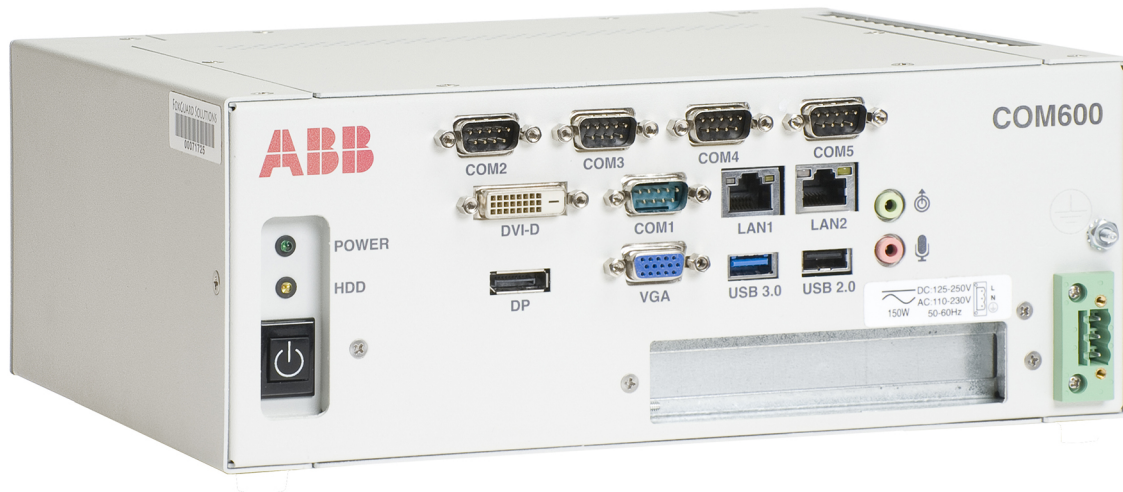


# COM600 series 5.1

## GOOSE Analyzer Operator's Manual





**Contents:**

<b>1. About this manual .....</b>	<b>5</b>
1.1. Copyrights .....	5
1.2. Trademarks .....	5
1.3. General information .....	5
1.4. Document conventions .....	5
1.5. Use of symbols .....	6
1.6. Terminology .....	7
1.7. Abbreviations .....	7
1.8. Related documents .....	8
1.9. Document revisions .....	8
<b>2. Introduction .....</b>	<b>9</b>
2.1. General information about the COM600 series .....	9
2.2. COM600 product series variants and rationale .....	9
2.3. Overview of GOOSE Analyzer .....	10
<b>3. Getting started with COM600 GOOSE Analyzer .....</b>	<b>11</b>
3.1. Starting COM600 GOOSE Analyzer .....	11
3.2. Logging in to GOOSE Analyzer .....	11
3.3. Logging out from GOOSE Analyzer .....	12
3.4. General overview of GOOSE Analyzer WebHMI .....	12
3.4.1. GOOSE Analyzer WebHMI .....	12
3.4.2. Title bar .....	13
3.4.3. Menu bar .....	13
3.4.4. Content page .....	13
<b>4. GOOSE Connection Viewer .....</b>	<b>14</b>
4.1. Using GOOSE Connection Viewer .....	14
4.2. Viewing subnetworks .....	15
4.2.1. Viewing subnetwork level connections .....	15
4.2.2. Highlighting GOOSE connection .....	15
4.2.3. Exploring GOOSE configuration .....	16
4.2.4. Monitoring GOOSE bus status .....	17
4.2.5. Monitoring subnetwork status .....	18
4.3. Viewing GOOSE connections .....	18
4.3.1. Viewing IED level connections .....	18
4.3.2. Monitoring GOOSE control block status .....	19
4.4. Viewing VLAN level connections .....	19
4.5. Exporting views .....	20
<b>5. Monitoring of events .....</b>	<b>22</b>
5.1. Monitoring events .....	22
5.2. Viewing real-time event list .....	22

5.3.	Using Historical Events .....	25
<b>6.</b>	<b>GOOSE Tester Manager .....</b>	<b>27</b>
6.1.	Using GOOSE Tester Manager .....	27
6.2.	Creating and handling test cases .....	28
6.3.	Exploring test record .....	29
6.3.1.	Viewing test records .....	29
6.3.2.	Exploring GOOSE packets .....	30
6.3.3.	Exploring GOOSE events .....	31
6.3.4.	Exploring GOOSE diagnosis .....	32
<b>7.</b>	<b>Network statistics .....</b>	<b>33</b>
7.1.	Viewing network statistics information .....	33
<b>8.</b>	<b>Interaction with COM600 WebHMI .....</b>	<b>35</b>
8.1.	Viewing GOOSE Analyzer diagnostic events in COM600 WebHMI .....	35
<b>9.</b>	<b>GOOSE Analyzer Engine .....</b>	<b>37</b>
9.1.	Using GOOSE Analyzer Engine .....	37
9.2.	Subnetwork analyzers .....	37
9.2.1.	Subnetwork analyzer group .....	37
9.2.2.	Intrusion analyzer .....	37
9.2.3.	Statistic analyzer .....	37
9.3.	IED analyzers .....	38
9.3.1.	IED analyzer group .....	38
9.3.2.	GOOSE bus analyzer .....	38
9.3.3.	Statistic analyzer .....	38
9.4.	GOOSE control block analyzers .....	39
9.4.1.	GOOSE control block analyzer group .....	39
9.4.2.	Destination MAC address analyzer .....	39
9.4.3.	APPID analyzer .....	39
9.4.4.	VLAN ID analyzer .....	40
9.4.5.	VLAN user priority analyzer .....	40
9.4.6.	VLAN tag analyzer .....	41
9.4.7.	Timeout (flow status) analyzer .....	41
9.4.8.	DatSet reference analyzer .....	41
9.4.9.	ConfRev analyzer .....	41
9.4.10.	NdsCom analyzer .....	42
9.4.11.	Simulation analyzer .....	42
9.4.12.	Disorder analyzer .....	42
9.4.13.	DatSet structure analyzer .....	43
9.4.14.	Data changes analyzer .....	43
9.4.15.	Statistic analyzer .....	43

## **1. About this manual**

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### **1.2. Trademarks**

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### **1.3. General information**

This manual provides thorough information on COM600 GOOSE Analyzer and the use of GOOSE Analyzer WebHMI.

GOOSE Analyzer can be used for monitoring and tracing real-time substation events, and for analyzing their delivery in terms of GOOSE.

### **1.4. Document conventions**

The following conventions are used for the presentation of material:

- The words in names of screen elements (for example, the title in the title bar of a window, the label for a field of a dialog box) are initially capitalized.
- Capital letters are used for the name of a keyboard key if it is labeled on the keyboard. For example, press the ENTER key.

- Lowercase letters are used for the name of a keyboard key that is not labeled on the keyboard. For example, the space bar, comma key, and so on.
- Press CTRL+C indicates that you must hold down the CTRL key while pressing the C key (to copy a selected object in this case).
- Press ESC E C indicates that you press and release each key in sequence (to copy a selected object in this case).
- The names of push and toggle buttons are boldfaced. For example, click **OK**.
- The names of menus and menu items are boldfaced. For example, the **File** menu.
  - The following convention is used for menu operations: **MenuName > MenuItem > CascadedMenuItem**. For example: select **File > New > Type**.
  - The **Start** menu name always refers to the **Start** menu on the Windows taskbar.
- System prompts/messages and user responses/input are shown in the Courier font. For example, if you enter a value out of range, the following message is displayed:

`Entered value is not valid. The value must be 0 - 30 .`

- You can be asked to enter the string MIF349 in a field. The string is shown as follows in the procedure:

`MIF349`

- Variables are shown using lowercase letters:

`sequence name`

## 1.5. Use of symbols

This publication includes warning, caution, and information icons that point out safety-related conditions or other important information. It also includes tip icons to point out useful information to the reader. The corresponding icons should be interpreted as follows.



The electrical warning icon indicates the presence of a hazard which could result in electrical shock.



The warning icon indicates the presence of a hazard which could result in personal injury.



The caution icon indicates important information or warning related to the concept discussed in the text. It may indicate the presence of a hazard which could result in corruption of software or damage to equipment or property.



The information icon alerts the reader to relevant facts and conditions.



The tip icon indicates advice on, for example, how to design your project or how to use a certain function.

## 1.6. Terminology

The following is a list of terms associated with COM600 that you should be familiar with. The list contains terms that are unique to ABB or have a usage or definition that is different from standard industry usage.

Term	Description
Alarm	An abnormal state of a condition.
Alarms and Events; AE	An OPC service for providing information about alarms and events to OPC clients.
Device	A physical device that behaves as its own communication node in the network, for example, a protection relay.
Event	Change of process data or an OPC internal value. Normally, an event consists of value, quality, and timestamp.
Intelligent Electronic Device	A physical IEC 61850 device that behaves as its own communication node in the IEC 61850 protocol.
OPC	Series of standards specifications aiming at open connectivity in industrial automation and the enterprise systems that support industry.
Property	Named data item.

## 1.7. Abbreviations

The following is a list of abbreviations associated with COM600 that you should be familiar with.

Abbreviation	Description
APPID	Application Identifier
DCS	Distributed Control System
DOI	Data Object Instance
FCD	Functional Constraint Data
FCDA	Functional Constraint Data Attribute

Abbreviation	Description
GoCB	GOOSE Control Block
GOOSE	Generic Object Oriented Substation Event
WebHMI	Web Human Machine Interface
IEC	International Electrotechnical Commission
IED	Intelligent Electronic Device
NCC	Network Control Center
SCD	Substation Configuration Description
SCL	Substation Configuration Language

## 1.8. Related documents

Name of the manual	MRS number
COM600 User's Manual	1MRS756125
COM600 Operator's Manual	1MRS756705
COM600 HMI Configuration Manual	1MRS756740

## 1.9. Document revisions

Document version/date	Product revision	History
A/31.5.2012	4.0	Document created
B/Not released	-	Not released
C/13.3.2015	4.1	Document revised
D/24.5.2017	5.0	Document revised
E/6.3.2018	5.1	Document revised



## 2. Introduction

### 2.1. General information about the COM600 series

The COM600 product series are versatile Substation Management Units that help realize smart substation and grid automation solutions in industrial and utility distribution networks.

They get deployed together with protection and control IEDs, substation devices such as RTUs, meters and PLCs in dedicated cabinets and switchgear.

The COM600 product is an all-in-one unit that functions as:

- Communication gateway
- Web Human Machine Interface (WebHMI)
- Automation controller
- Real-time and historical data management unit

The COM600 product series use process information and device data, acquired over Ethernet or serial communication protocol interfaces to execute specific substation functions and applications. Thus, they are critical building blocks to realize substation secondary system solutions and in the process solving diverse customer needs.

### 2.2. COM600 product series variants and rationale

To facilitate substation and grid automation solutions in IEC and ANSI market areas, a variant-based system similar to Relion® 615 and 620 series is being followed from COM600 5.0 release.

The main reasons for such an approach are the following:

- To ensure all COM600 product series features are advantageously used in end-customer projects in the medium voltage substation automation domain.
- To ensure an optimum feature set to be bundled together to realize specific applications required in IEC and ANSI market areas.
- To ensure a future-proof product approach.

This release then comprises of two variants, based on the primary intent or application are defined as follows:

- COM600S IEC – COM600 for substation automation, analysis and data management (for IEC markets)
  - COM600S IEC is a substation automation, analyzer and data management unit that integrates devices, facilitates operations, manages communication and runs analysis applications pertinent to equipment or operations in utility or industrial distribution substations.
- COM600F ANSI – COM600 as distribution automation controller (for ANSI markets)

- COM600F is a dedicated distribution automation controller unit that runs distributed grid and feeder applications for ANSI power networks and inherits all core features of the COM600 series.

## 2.3. Overview of GOOSE Analyzer

The GOOSE Analyzer functionality in COM600 can be used throughout the whole life cycle of the IEC 61850 substation automation system. It supports the commissioning, maintenance and upgrade phases of the IEC 61850 system by means of communication diagnosis enabling features, communication status follow-up and storing of GOOSE events for auditing purposes.

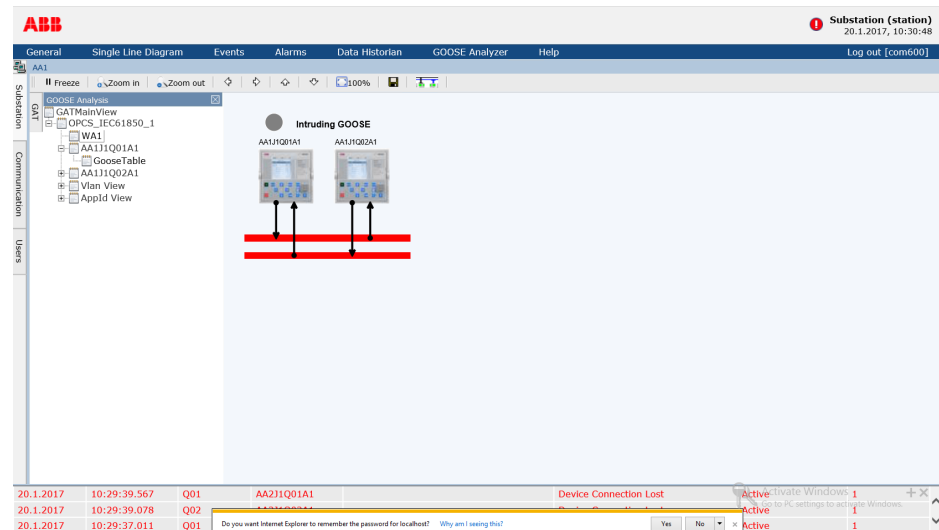
GOOSE Analyzer consists of a server and a WebHMI. The GOOSE Analyzer server includes a real-time analysis engine to diagnose live GOOSE packets (messages) over the connected subnetwork and output GOOSE events and GOOSE diagnostic events to the historical database.

With the GOOSE Analyzer WebHMI, you can view the GOOSE connection diagram with a real-time diagnosis and event list, query historical events, build GOOSE test cases, view reports and plot specific network load trend graphs.

### 3. Getting started with COM600 GOOSE Analyzer

#### 3.1. Starting COM600 GOOSE Analyzer

GOOSE Connection Viewer is available in the WebHMI page, user can navigate to different views here in the GOOSE Analyzer diagnostics page.



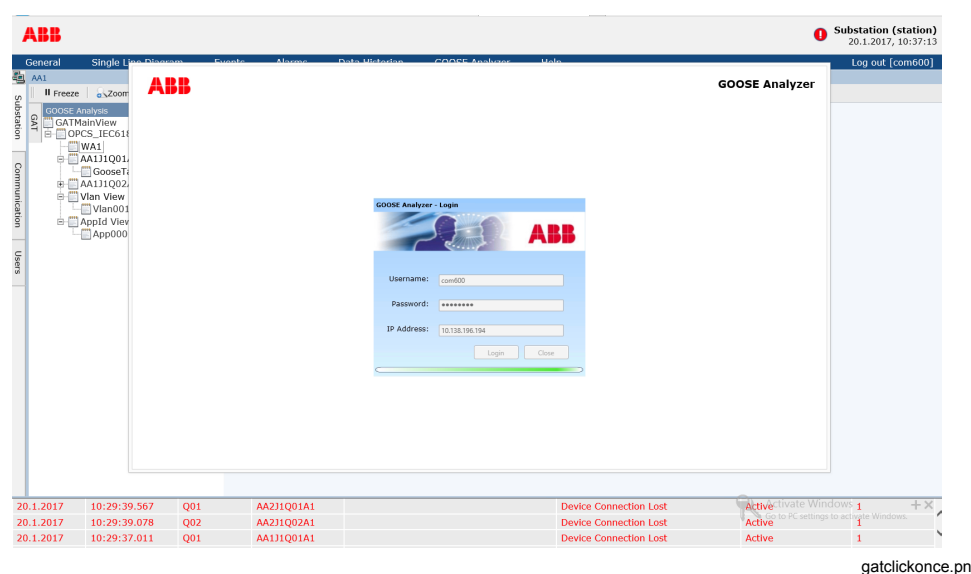
gathmi.png

Figure 3.1-1 GOOSE Analyzer tab on COM600 WebHMI menu bar

#### 3.2. Logging in to GOOSE Analyzer

To log in to GOOSE Analyzer:

1. Click the GOOSE Analyzer diagnostics Icon in the tool box in GOOSE Analyzer diagnostics WebHMI page.
2. Password, user name and IP are automatically filled in, and GOOSE Analyzer diagnostics application should be automatically logged in.




gatclickonce.png

Figure 3.2-1 Logging in to GOOSE Analyzer

### 3.3. Logging out from GOOSE Analyzer

To log out from GOOSE Analyzer:

1. Move the cursor to the top of the screen to show the title bar. The title bar is displayed (see Figure 3.3-1).
2. Click  or **Logout** on the title bar to exit GOOSE Analyzer.



GOOSELogout.jpg

Figure 3.3-1 Title bar

### 3.4. General overview of GOOSE Analyzer WebHMI

#### 3.4.1. GOOSE Analyzer WebHMI


When logging in, you are prompted to the main screen of the WebHMI (see Figure 3.3-1).

The user interface consists of:

- Title bar
- Menu bar
- Content page

### 3.4.2. Title bar

By default, the title bar is hidden in the main screen. To show the title bar, move the cursor to the top of the screen (see Figure 3.3-1 and Figure 3.3-1).

- To exit GOOSE Analyzer, click  or **Logout** on the title bar.
- To access general information about GOOSE Analyzer, click **About** on the title bar.
- To open the GOOSE Analyzer help document, click **Help** on the title bar.

### 3.4.3. Menu bar

On the menu bar, you can see GOOSE Analyzer functionalities (see Figure 3.3-1):

- **GOOSE Connection Viewer** shows GOOSE connection views on the content page.
- **Historical Events** provides means to query historical events.
- **GOOSE Tester Manager** provides means to manage GOOSE test cases and view test reports.
- **Network Statistic** shows historical network statistic trends.

### 3.4.4. Content page

The content page is the center of the WebHMI screen for displaying information. It is located below the menu bar (see Figure 3.3-1).

## 4. GOOSE Connection Viewer

### 4.1. Using GOOSE Connection Viewer

GOOSE Connection Viewer presents graphical views of GOOSE signal flow from publishers to subscribers on the content page. The real-time diagnosis of the GOOSE signal flow dynamically controls the display of the graphical views.

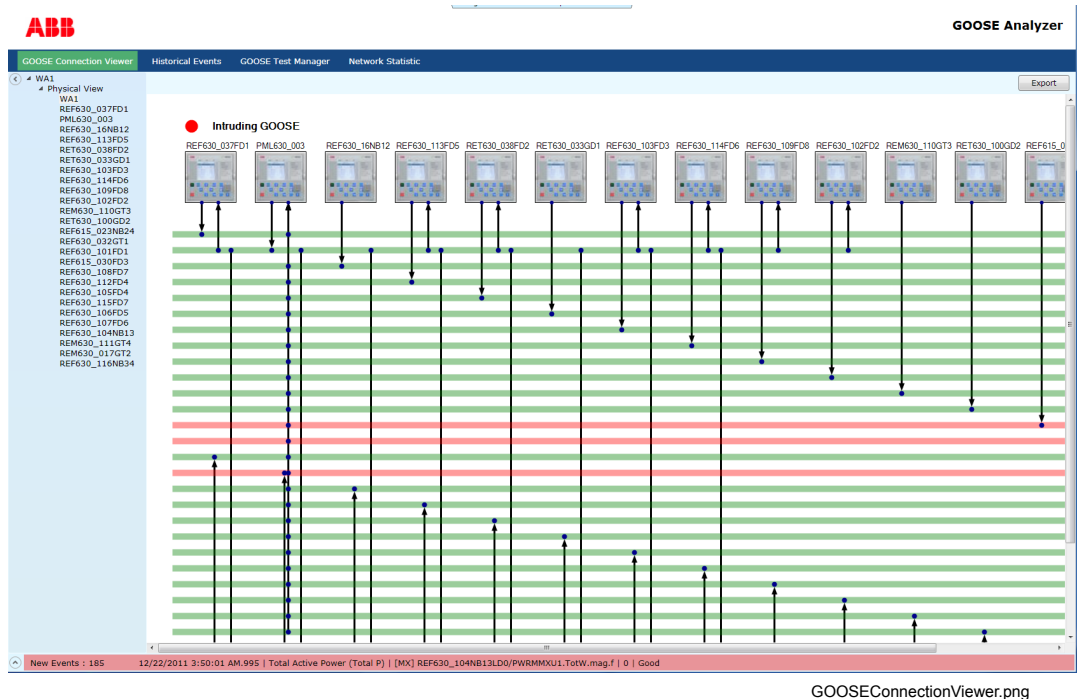


Figure 4.1-1 GOOSE Connection Viewer

To open the connection viewer, click on **GOOSE Connection Viewer** on the menu bar.

The viewer is split into two panels, the left panel is a navigation tree and the right panel shows the corresponding connection diagram (see Figure 4.1-1).

You can use the navigation tree to view the selected GOOSE connection diagram. The tree consists of different nodes for various GOOSE connection diagrams. The navigation tree provides a Physical View that groups the natural initial publishing/subscription diagrams from the system configurations. The Physical View consists of the subnetwork level, IED level and VLAN level views.

To expand/collapse the navigation tree, click the arrow.

## **4.2. Viewing subnetworks**

### **4.2.1. Viewing subnetwork level connections**

To see GOOSE connections for a chosen subnetwork, select the name of the subnetwork in the navigation tree.

In Figure 4.1-1, each GOOSE publisher connects to a horizontal bar (later referred to as GOOSE bus) with an outward arrow exclusively, representing the publishing of all signals despite its internal GOOSE configuration.

In Figure 4.1-1, each GOOSE subscriber connects to several existing GOOSE buses with an inward arrow, representing different subscriptions to other IEDs. Dots are used on the inward connecting lines to IEDs for the notation of multiple subscriptions.

### **4.2.2. Highlighting GOOSE connection**

To quickly position connection relationships within a large system, click each GOOSE bus to view the data flow from a single publisher to one or multiple subscribers in different

colors (see Figure 4.2.2-1). The publishing IED is differentiated from the subscribing IEDs by coloring.

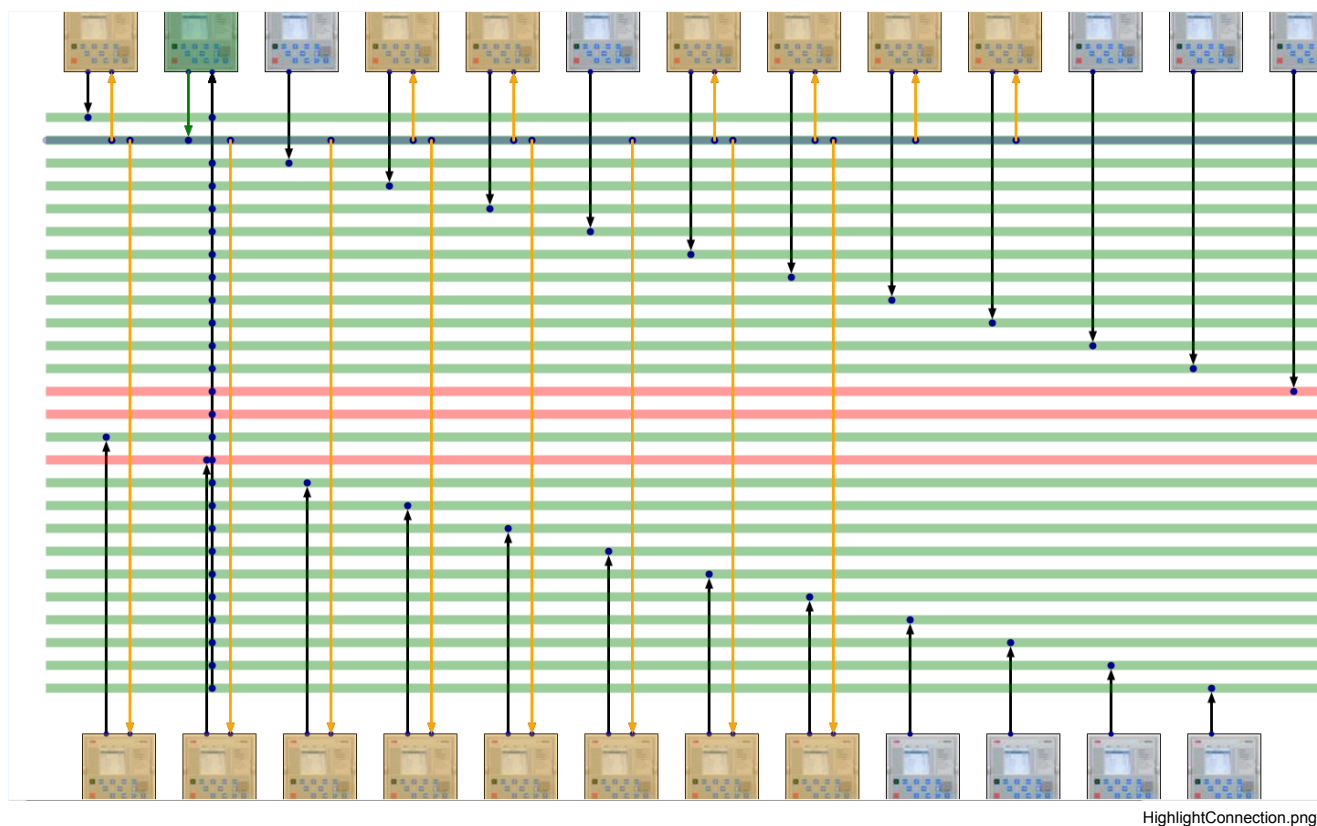


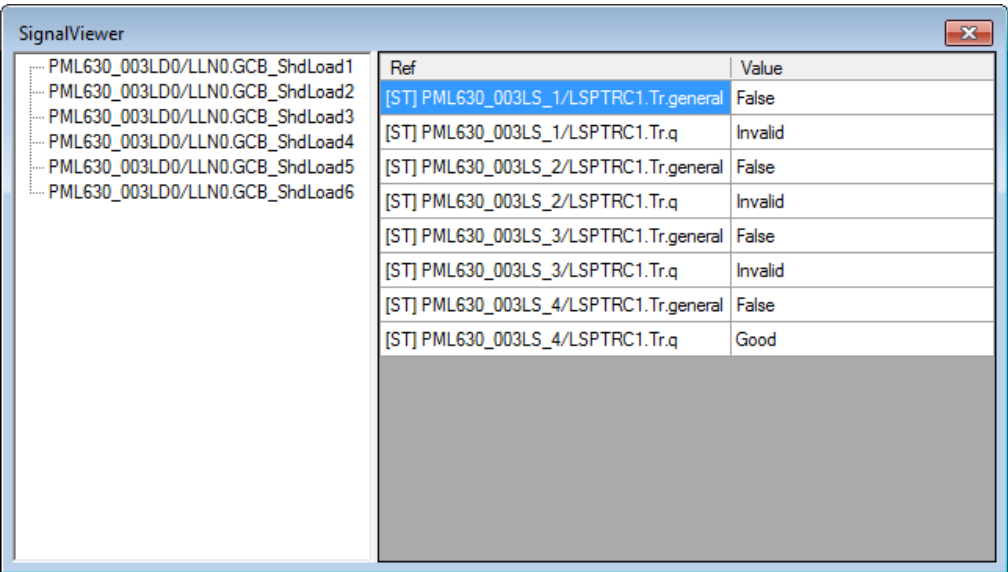
Figure 4.2.2-1 Highlighting GOOSE connection

### 4.2.3. Exploring GOOSE configuration

To explore the sets of GOOSE signals associated with GOOSE control blocks, double-click the selected GOOSE bus (see Figure 4.2.3-1).

Each set is grouped according to the DataSet configuration of a GOOSE control block.





ExploringGOOSEconfiguration.png

Figure 4.2.3-1 Exploring GOOSE configuration

4.2.4. Monitoring GOOSE bus status

You can analyze the GOOSE bus status and mark it with different colors using GOOSE Analyzer (see Figure 4.2.4-1).

GOOSE bus has four possible statuses:

- **Normal:** transmission of GOOSE packets is according to its configuration and thus treated as normal (marked with green).
- **Partial timeout:** partial unavailability of intended GOOSE messages, which means that the subscriber might not be able to receive all GOOSE messages in a defined time interval. A GOOSE receiving error might be reported by the subscribing IEDs.
- **All timeout:** unavailability of intended GOOSE messages, which means that the subscriber might not be able to receive all GOOSE messages in a defined time interval. A GOOSE receiving error might be reported by the subscribing IEDs.
- **Unknown:** unknown status, which might mean problems have been found with GOOSE Analyzer in COM600.

For a more detailed explanation of GOOSE bus statuses, see 9.3.2, GOOSE bus analyzer.

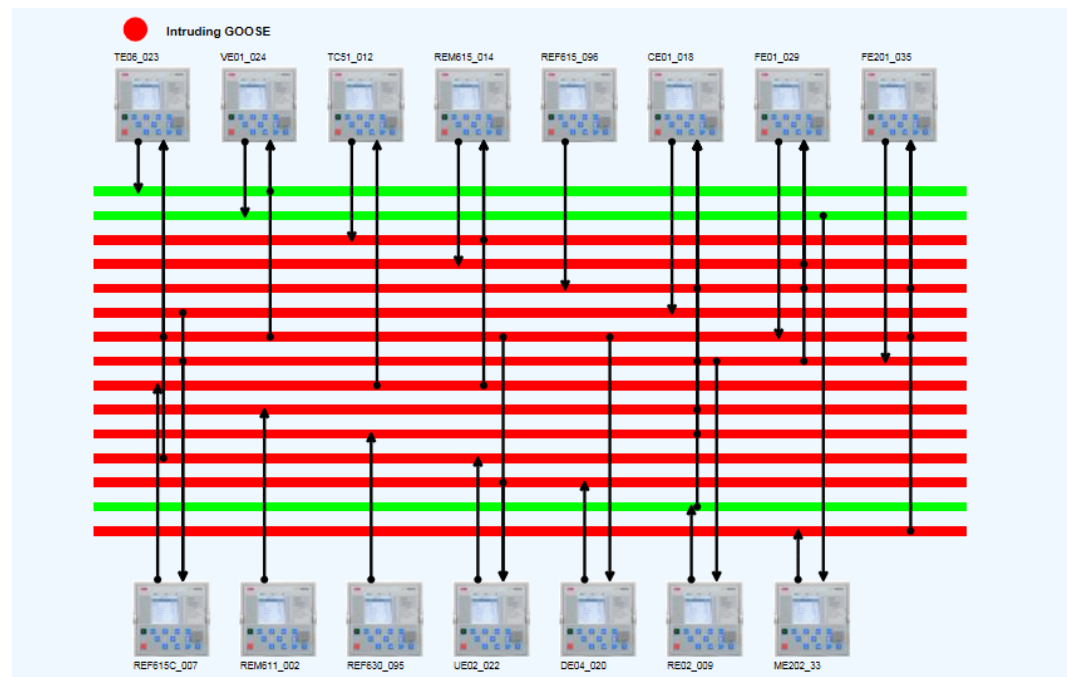


Figure 4.2.4-1 Monitoring GOOSE bus status

#### 4.2.5. Monitoring subnetwork status

GOOSE Analyzer monitors intruding GOOSE conflicts (see Figure 4.2.4-1).

For a more detailed explanation of the statuses, see 9.2.1, Subnetwork analyzer group.

### 4.3. Viewing GOOSE connections

#### 4.3.1. Viewing IED level connections

To view GOOSE connections for a selected IED, select the IED name in the navigation tree (see Figure 4.3.1-1).

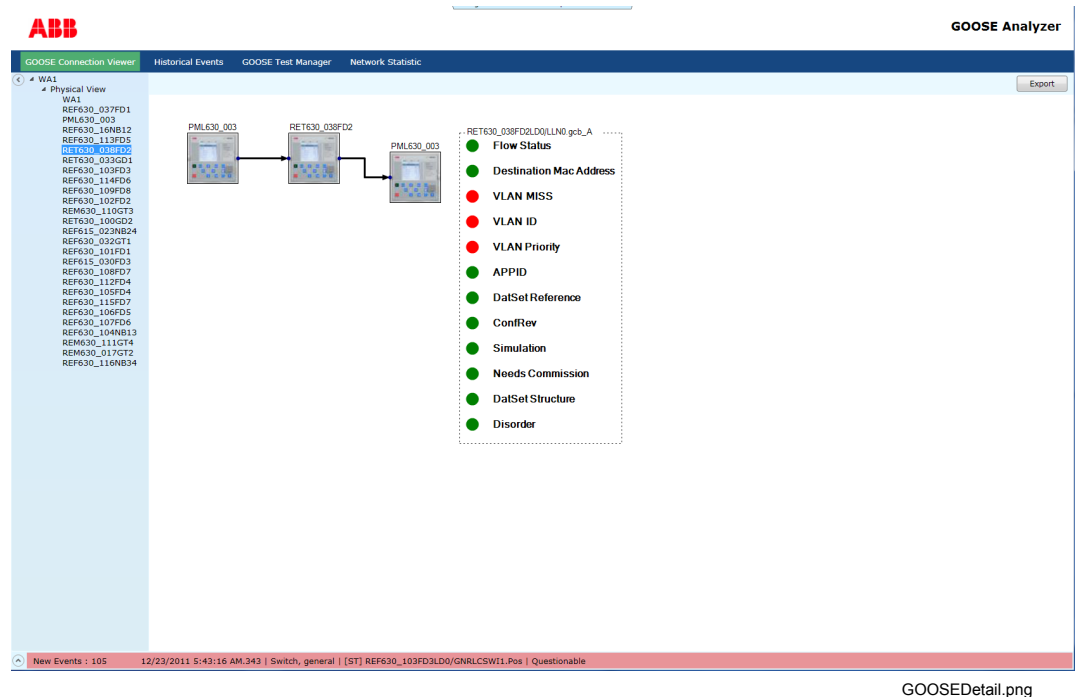


Figure 4.3.1-1 IED level GOOSE connection view

As shown in Figure 4.3.1-1, the selected IED is positioned in the middle. The arrows on the left side of the selected IED indicate the subscribed GOOSE signals from other publishers, and the arrows on the right side indicate its published GOOSE signals to be subscribed by other IEDs.

To explore the subscribed GOOSE signals, click the connection line from the source IED to the destination (see Figure 4.3.1-1).

#### 4.3.2. Monitoring GOOSE control block status

GOOSE Analyzer can monitor the transmission of specific GOOSE messages for each GOOSE control block within a selected IED (see Figure 4.3.1-1).

For a more detailed explanation, see 9.4.1, GOOSE control block analyzer group.

#### 4.4. Viewing VLAN level connections

The VLAN level view of GOOSE connections is shown according to the actual configurations in the substation automation system.

## 4.5. Exporting views

To export the GOOSE connection views and GOOSE configurations into external html files, click **Export**.

Exported information contains a subnetwork level view (see Figure 4.5-1), an IED level view (see Figure 4.5-2), and a detailed view of GOOSE configuration (see Figure 4.5-3).

To navigate to different views, click the IED name in the first column.

*GOOSE Connection - WAI*

	AA1PX_439_23	AA1PX_433_21	IED_0001	AA1PX_437_27	AA1PX_439_26	AA1J1Q08A1	AA1J1Q19A1	AA1J1Q01A1	AA1J1Q04A1	AA1J1Q21A1	AA1J1Q12A1	AA1J1Q26A1	AA1J1Q02A1	AA1J1Q03A1	AA1PX_439_25	AA1J1Q20A1	AA1J1Q24A1	AA1J1Q17A1	AA1J1Q09A1	AA1J1Q22A1	AA1J1Q06A1	AA1J1Q07A1	AA1J1Q10A1	AA1PX_433_17	AA1PX_631_22	AA1PX_439_24	AA1PX_435_28
AA1PX_439_23	+	+	+	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AA1PX_433_21	+	+	+	+	+	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	+	+	+	+	+
IED_0001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AA1PX_437_27	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+
AA1PX_439_26	+	-	+	+	+	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-
AA1J1Q08A1	-	-	-	-	-	+	+	+	+	+	+	+	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-
AA1J1Q19A1	-	-	-	-	-	-	+	+	-	-	-	+	+	+	-	-	+	-	-	-	-	+	+	-	-	-	-

SubnetworkGOOSEConnections.png

Figure 4.5-1 Subnetwork level view of GOOSE connections

*GOOSE Connection - AA1J1Q04A1*

	AA1PX_439_23	AA1PX_433_21	IED_0001	AA1PX_437_27	AA1J1Q08A1	AA1J1Q19A1	AA1J1Q01A1	AA1J1Q04A1	AA1J1Q21A1	AA1J1Q12A1	AA1J1Q26A1	AA1J1Q02A1	AA1J1Q03A1	AA1PX_439_25	AA1J1Q20A1	AA1J1Q24A1	AA1J1Q17A1	AA1J1Q09A1	AA1J1Q22A1	AA1J1Q06A1	AA1J1Q07A1	AA1J1Q10A1	AA1PX_433_17	AA1PX_631_22	AA1PX_439_24	AA1PX_435_28
AA1J1Q04A1LD0/LLN0.gcbProt	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
[ST] AA1J1Q04A1LD0/PHHPTOC1.Str.general	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

IEDLevelGOOSEConnections.png

Figure 4.5-2 IED level view of GOOSE connections

*AA1J1Q04A1LD0/LLN0.gcbProt*

GoCBName	<b>gcbProt</b>
GoCBRef	<b>AA1J1Q04A1LD0/LLN0.gcbProt</b>
AppID	<b>AA1J1Q04A1LD0/LLN0.gcbProt</b>
DataSet	<b>AA1J1Q04A1LD0/LLN0.HorizProt</b>
Min Time(ms)	<b>4</b>
Max Time(ms)	<b>10000</b>
Mac Address	<b>01-0C-CD-01-00-00</b>
APPID	<b>3004</b>
VLAN ID	<b>001</b>
VLAN Priority	<b>4</b>

GOOSEConfigurationDetailedView.png

*Figure 4.5-3 Detailed view of GOOSE configuration*

## 5. Monitoring of events

### 5.1. Monitoring events

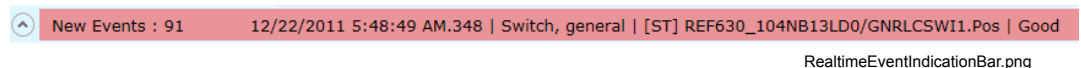
GOOSE provides fast and reliable system-wide distribution of substation events over the switched networks. GOOSE Analyzer enables you to monitor these substation events transmitted over the subnetwork.

GOOSE Analyzer monitors the transmission reliability of GOOSE messages and provides you with diagnostic events to verify the health of GOOSE with comparison to its configuration.

GOOSE Analyzer provides a continuous list view of real-time events, and you can query the historical database for information.


### 5.2. Viewing real-time event list

You can check the real-time event list on the status bar at the bottom of the GOOSE Connection Viewer screen.



RealtimeEventIndicationBar.png

Figure 5.2-1 Real-time event indication bar

To expand the real-time event indication bar, click the  arrow (see Figure 5.2-2). The list view is displayed.

Events are grouped into two categories, GOOSE events and GOOSE diagnosis events.

Each GOOSE event record has the following properties:

- Arrival Time: date and time of received events in the UTC format
- Object Text: descriptive text for data
- Reference: reference of data attribute
- Event: specific event of reference transmitted by the GOOSE message
- Quality: attribute q of Data Object Instance (DOI)
- Timestamp: attribute t of DOI
- Subnetwork: subnetwork name
- IED: IED name
- GOOSE Control Block: reference of GOOSE control block
- StNum: GOOSE state number
- SqNum: GOOSE sequence number

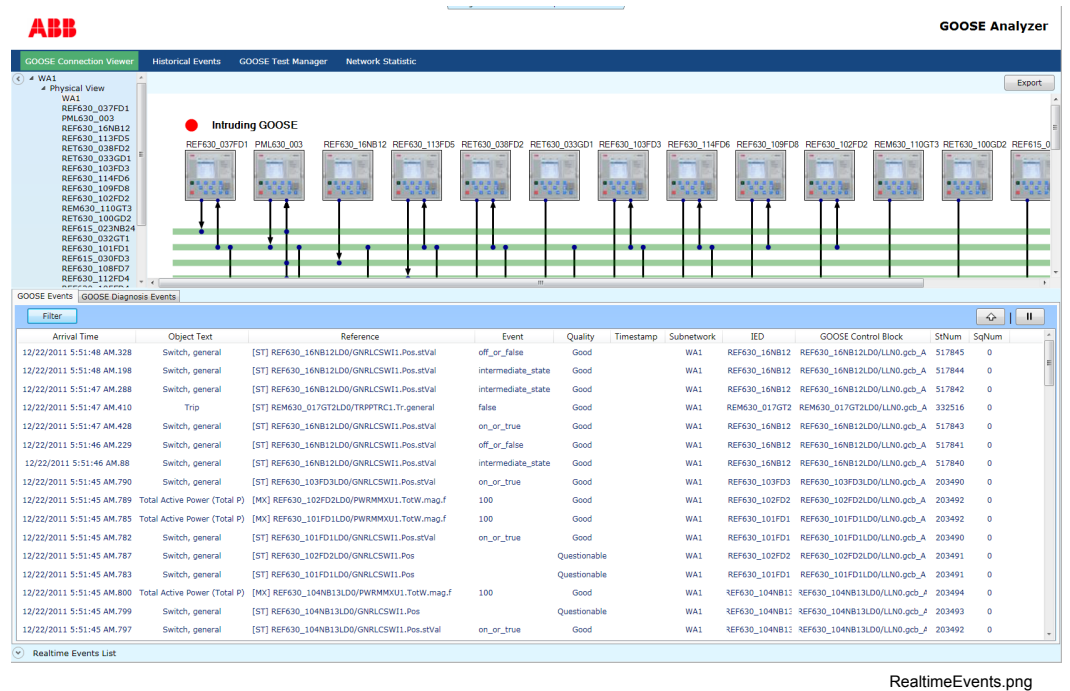


Figure 5.2-2 Real-time event list – GOOSE Events

Each GOOSE diagnosis event record has the following properties:

- Detected Time: date and time of a diagnostic event
- Subnetwork: subnetwork name
- IED: IED name
- GOOSE Control Block: GOOSE control block reference
- Object Text: descriptive text for the event
- Event: diagnostic event

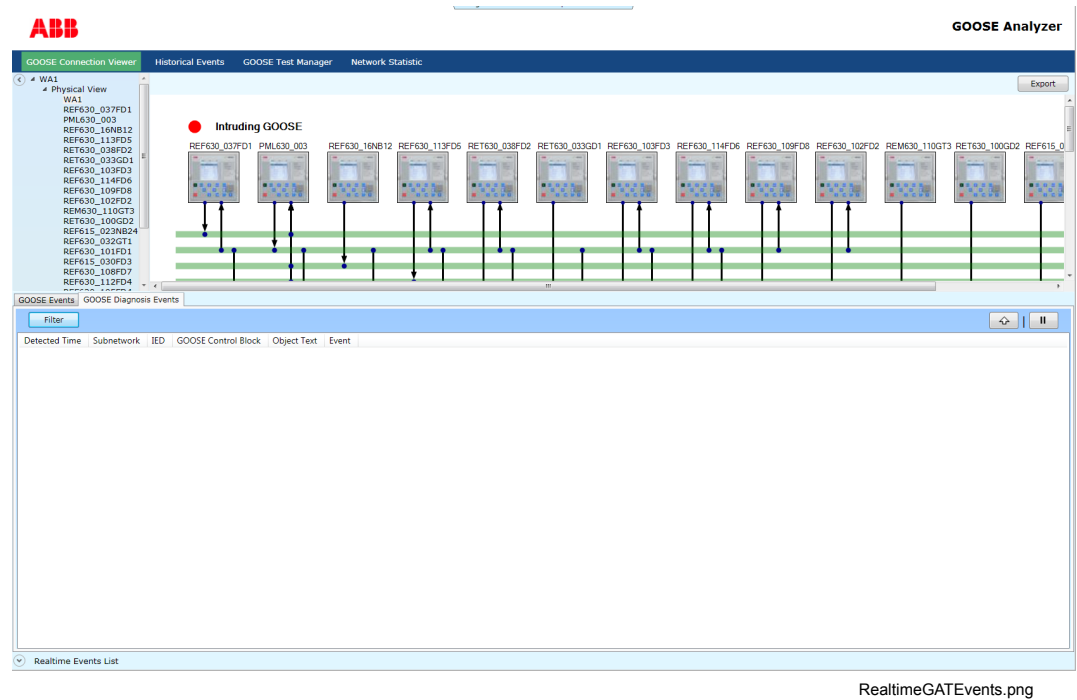
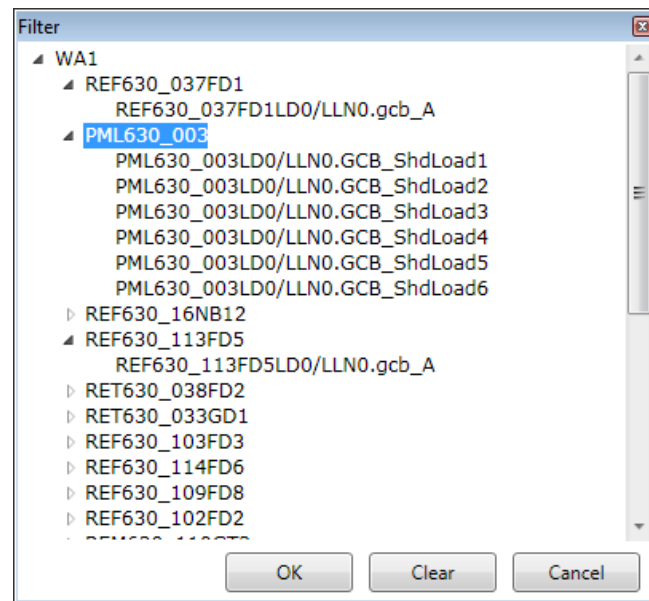


Figure 5.2-3 Real-time event list – GOOSE Diagnosis Events

To configure the filter of the displayed list:



1. Click **Filter**.  
The **Filter** configuration dialog (see Figure 5.2-4) appears.
2. Select the specific branch to view.
3. Click **OK**, or click **Cancel** to cancel filtering.





RealtimeEventListFilter.png

*Figure 5.2-4 Real-time event list filter*

To freeze/unfreeze the display of the event list, click  or  respectively (see Figure 5.2-2).

### 5.3. Using Historical Events

To view historical events, click on **Historical Events** on the menu bar. A new dialog box opens displaying all historical events (see Figure 5.3-1).

GOOSE Analyzer Operator's Manual

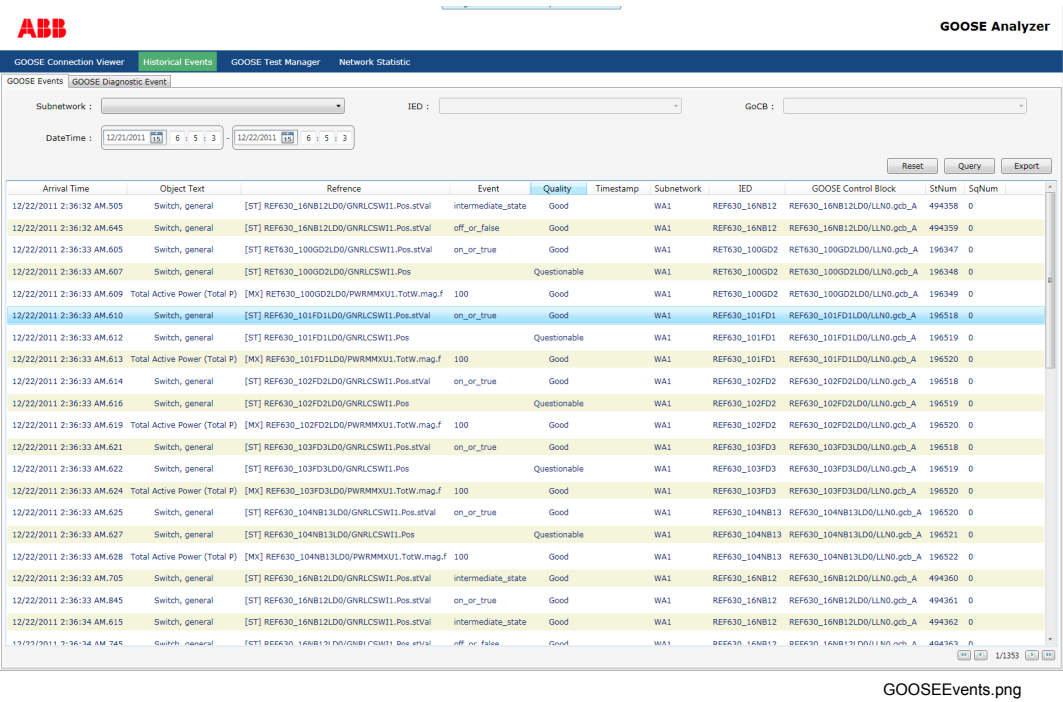


Figure 5.3-1 Historical event list

The historical event list is similar to the real-time event list but its data source is the historical database.

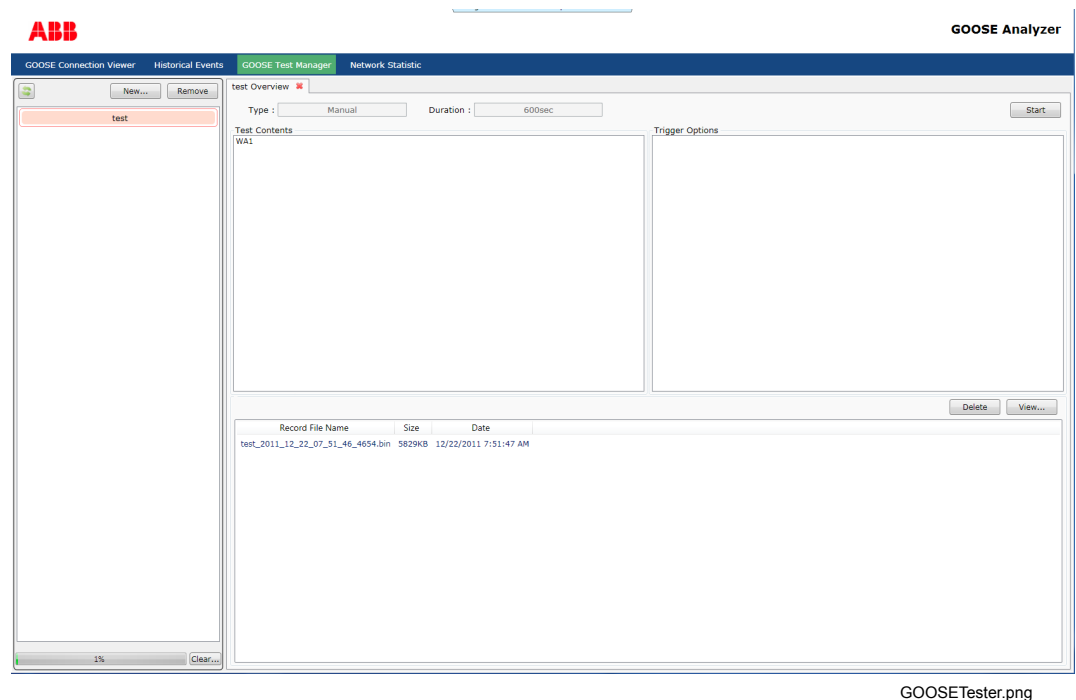
To query specific events from the database, use conditional settings. You can reset the query conditions for new queries and export the queried events to text in csv format.

## 6. GOOSE Tester Manager

### 6.1. Using GOOSE Tester Manager

GOOSE Tester Manager enables capturing raw GOOSE packets and associated events into a single record, and presenting graphical and system-oriented views of the recorded information.

To start the GOOSE Tester Manager, click on **GOOSE Tester Manager** on the menu bar. The Tester Manager page opens (see Figure 6.1-1).



GOOSETester.png

Figure 6.1-1 Main view of GOOSE Tester Manager

On the left side of the Tester Manager, you can see the list of all test cases. Each test case can be activated to capture the defined GOOSE packets as well as their associated events. At the bottom of the left panel, you can see the disk consumption of the generated test records on the Server side. When the disk is almost full, an empty record file with zero packet & event will be generated. It occupies about 4 KB of the server's disk. When there is no space left for the empty record file, no records can be generated.

To remove all test records, click **Clear**. To remove single test cases, select a test case and click **Remove**.

To create a configuration, click **New**.

To see the configuration details of a test case, double-click the test case. The details are shown on the right. To start or stop a test case, click **Start** or **Stop**. Test records created in the test case are listed at the lower part of the page. You can view the record details by clicking **View** and delete the record by clicking **Delete**.

## 6.2. Creating and handling test cases

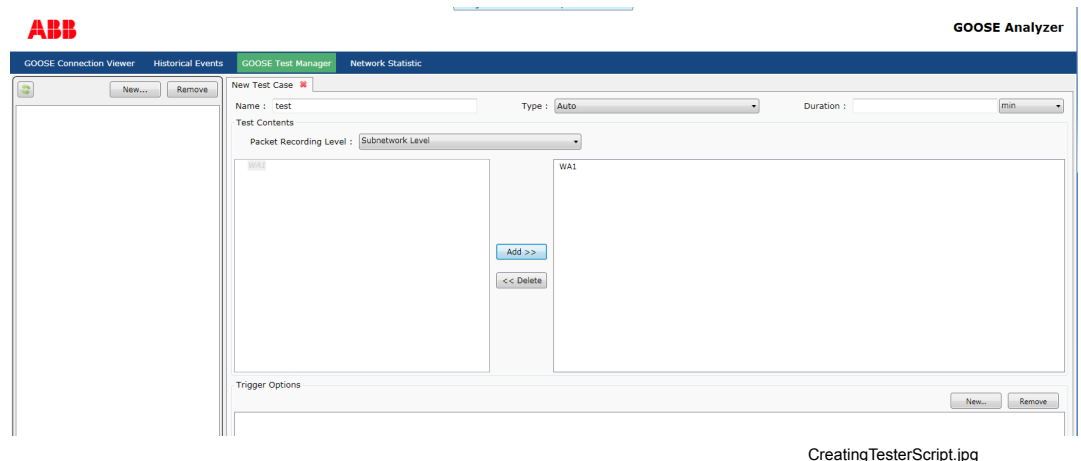
GOOSE Tester Manager provides two different types of scripts, manual and auto.

- To run a manual script, you have to start it manually. These tests can be stopped either manually, or they stop when the pre-configured duration time elapses.
- Auto scripts do not need to be started manually, as they are triggered by the configured conditions.

To create a new tester script:

1. Go to the **Tester Overview** tab.
2. Click **New**.

A new tab opens for creating a test case (see Figure 6.2-1).

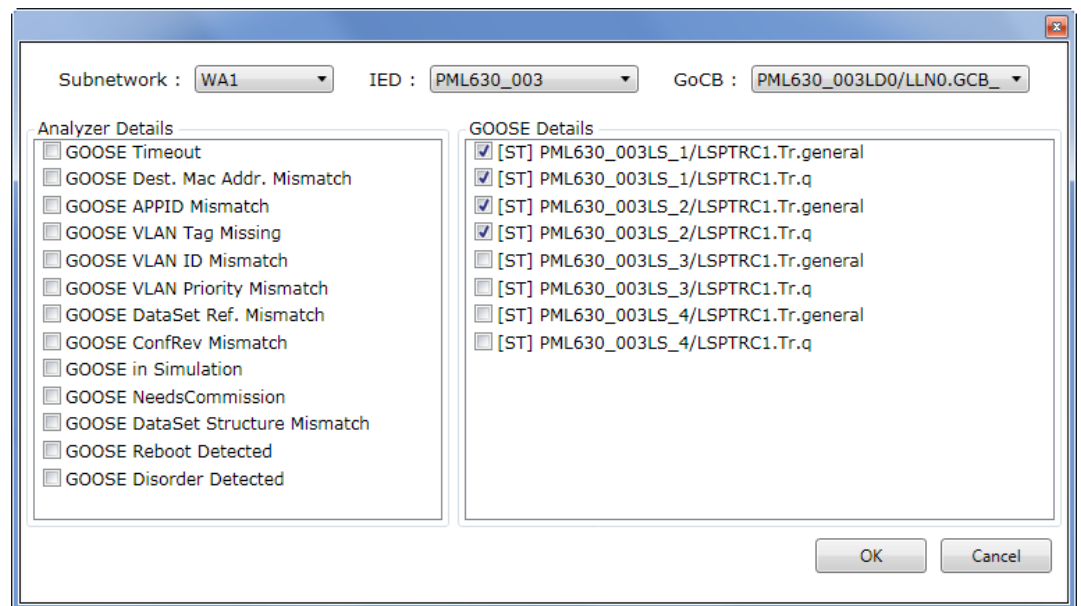


CreatingTesterScript.jpg

Figure 6.2-1 Creating a tester script

3. Enter a name for the script.
4. Select script type: **Auto** or **Manual**.
5. Set the parameter for how long the script runs. To change the unit of duration, click the drop-down list and select the suitable unit. The default value is minute (min).
6. Configure the testing scope.
  - Select the packet recording level by clicking on the drop-down list and selecting the correct value (specific subnetwork, GOOSE sending IED or control block).
  - Select one or multiple subnetworks, IEDs, or GoCBs. The selections are listed.
7. For manual scripts, click **OK** to close the script creation process. For auto scripts, configure the trigger options, by clicking **New...**. The configuration dialog box is displayed (see Figure 6.2-2).
8. Select GOOSE events or diagnostic events as trigger options (see Figure 6.2-2).
9. Click **OK** to close the configuration.


The newly created tester script is added to the Test Overview list (see Figure 6.1-1).



AddNewTriggerOptions.png

Figure 6.2-2 Configuring trigger options for auto tester scripts

Handling tester scripts:

- To view existing scripts in COM600, click  (refresh).
- To activate the execution of a script, select the script and click **Start**. Manual scripts are started immediately, while auto scripts are only started when the configured conditions become active.
- To delete a script, select the script and click **Remove**.

## 6.3. Exploring test record

### 6.3.1. Viewing test records

To view test records, open the test overview tab, select the record file and click **View**. A new tab opens displaying the record details.

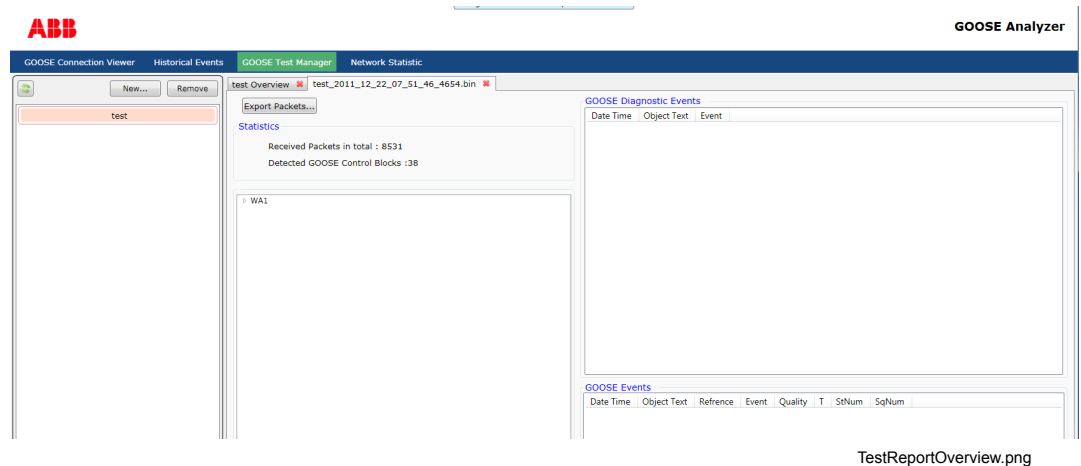


Figure 6.3.1-1 Test report overview

The record tab shows:

- Statistics information about received packets
- Detected GOOSE control blocks

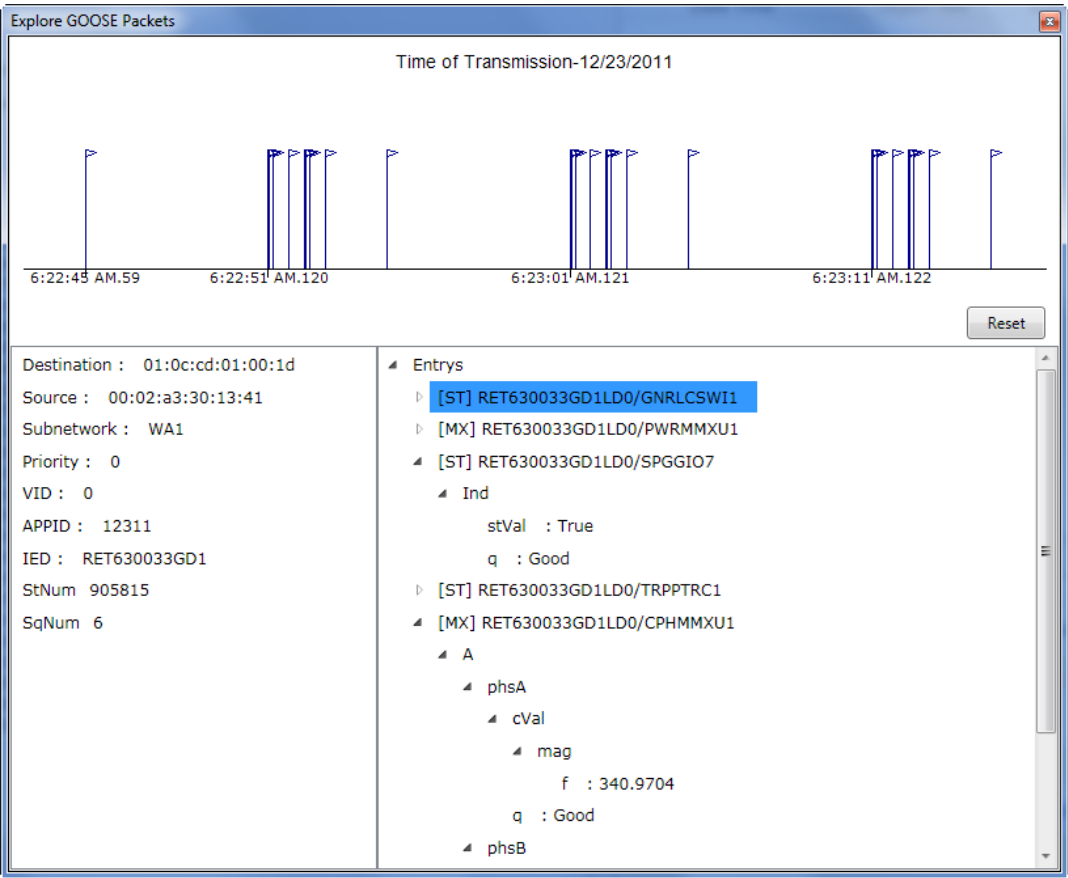
You can export the packets by clicking **Export Packets...**

Details of GOOSE control blocks are listed in the navigation tree under **subnetwork > IED > GoCB**.

- To view associated GOOSE Diagnostic Events and GOOSE Events, select a GOOSE control block.
- To explore GOOSE Packets, GOOSE Events and GOOSE Diagnosis, right-click a GOOSE control block entry.  
A context menu opens.

### 6.3.2. Exploring GOOSE packets

To open a new dialog box for the graphical and system-oriented presentation of GOOSE packets and their decoding, click the context menu for **Explore GOOSE Packets** (see Figure 6.3.2-1).



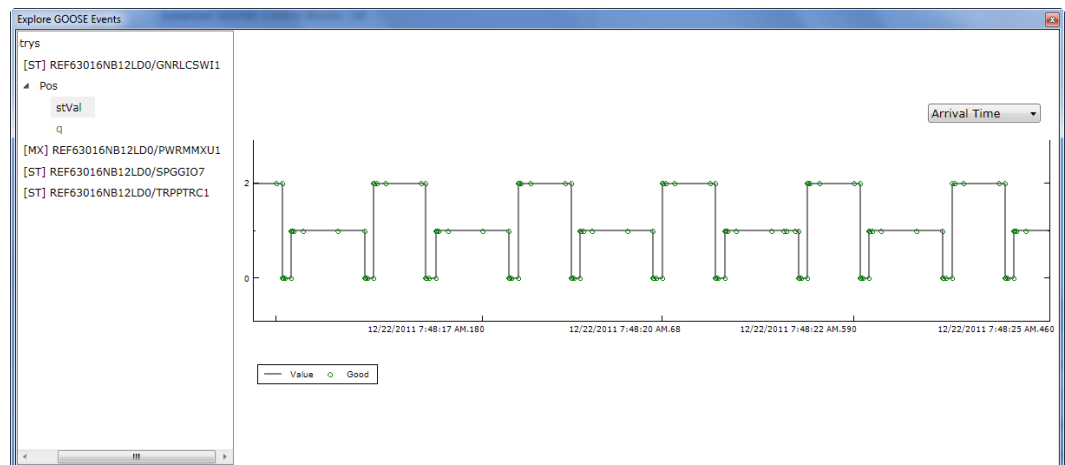
ExploringGOOSEPackets.png

Figure 6.3.2-1 Exploring GOOSE packets

GOOSE Packets Diagnosis explore the time based view of specific GOOSE packets that are captured from the network.

6.3.3. Exploring GOOSE events

To open a new dialog box for the graphical representation of GOOSE events, click the context menu for **Explore GOOSE Events** (see Figure 6.3.3-1).



ExploringGOOSEEvents.png

Figure 6.3.3-1 Exploring GOOSE events

GOOSE Event Diagnosis discover and plot the trend of GOOSE message values of certain GOOSE Signal within the Tester's triggering time frame.

#### 6.3.4. Exploring GOOSE diagnosis

To open a new dialog box for the graphical representation of GOOSE diagnosis events, click the context menu for **Explore GOOSE Diagnosis** (see Figure 6.3.4-1).



ExploringGOOSEDIagnosis.png

Figure 6.3.4-1 Exploring GOOSE diagnosis

GOOSE Diagnosis explore the GOOSE analyze Events, for instance GOOSE Packets time out, and plot out the Diagnosis result in Time based.



## 7. Network statistics

### 7.1. Viewing network statistics information

GOOSE Analyzer can calculate the amount of GOOSE load periodically and store the calculations in the historical database. The configuration of the statistic interval is set in SAB600.

From the network statistics you can query the GOOSE load and GOOSE diagnostic counters.

To view statistics:

1. Click **Network Statistic** on the menu bar.  
The Network Statistic dialog box opens. The statistic trend view is structured according to the queried information. It provides statistics information on GOOSE packets, events, or bytes.



Figure 7.1-1 The Network Statistic dialog

2. Select a network, IED or GoCB.
3. Set the appropriate time span.
4. Click **Analyze** to open a new tab showing the query results.
5. Click the subtab for Diagnostic Events Statistic for the relevant diagnostic counters.

## GOOSE Analyzer Operator's Manual

WA1 [X] WA1|REF630\_16NB12|REF630\_16NB12LD0/LLN0.gcb\_A [X]

12/25/2011 7:17:29 AM - 12/26/2011 7:15:00 AM Statistic Interval : 3 min

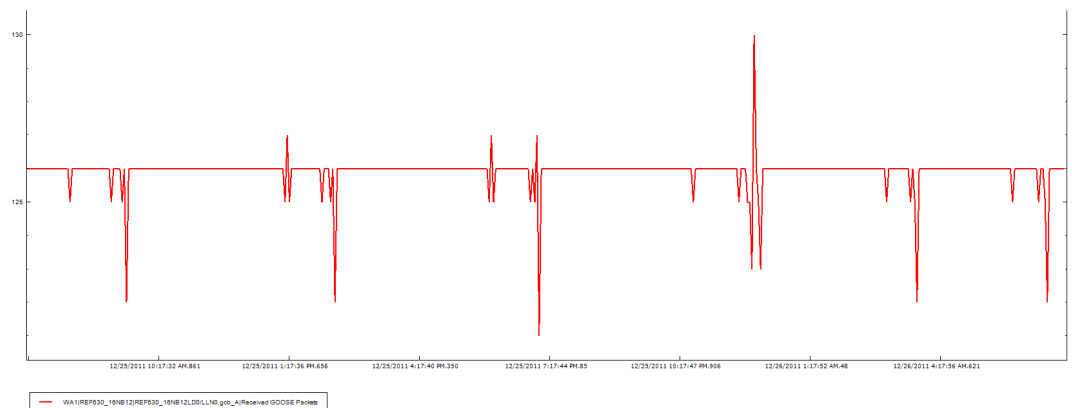
Network Statistic Diagnostic Events Statistic

Description	Value
GOOSE Timeout Counter	0
Dest Mac Address Mismatch Counter	0
VLAN Miss Counter	0
VLAN ID Mismatch Counter	0
VLAN Priority Mismatch Counter	0
APDD Mismatch Counter	0

DiagnosticStatisticTab.png

Figure 7.1-2 Diagnostic Events Statistic

To view a statistic trend, click an entry in the Network Statistic tab to plot the corresponding trend.



GraphPanel.png

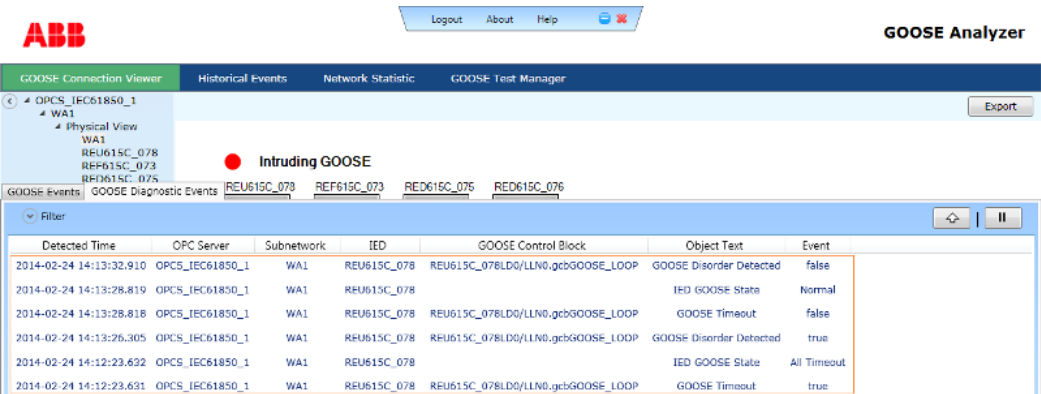
Figure 7.1-3 Network statistic trend

You can compare different trends on the plotting area by clicking a similar trend. To remove the plotting, click the entry again.

8. Interaction with COM600 WebHMI

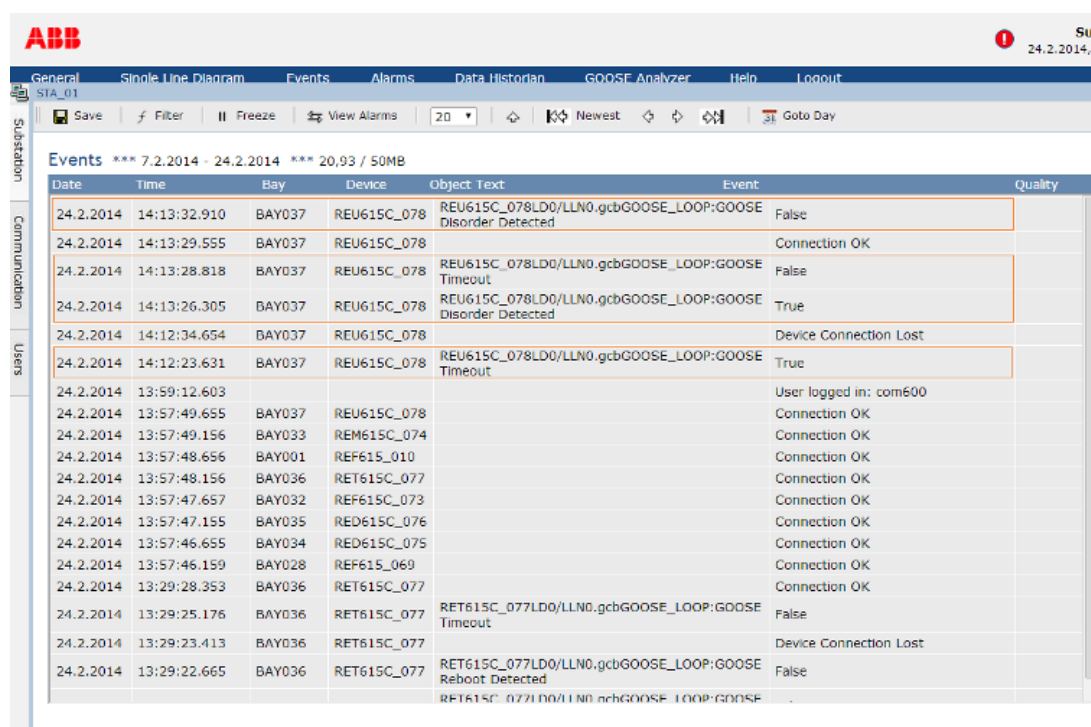
8.1. Viewing GOOSE Analyzer diagnostic events in COM600 WebHMI

The diagnostic events generated in GOOSE Analyzer can be viewed in the Events List in COM600 WebHMI. This functionality is used in cases where the GOOSE Analyzer diagnostics WebHMI is not started.



GATFigure 1.1-1.png

Figure 8.1-1 GOOSE Analyzer diagnostic events in GOOSE Analyzer diagnostics WebHMI



The screenshot shows the ABB COM600 WebHMI interface with the 'GOOSE Analyzer' tab selected. The interface includes a top menu bar with options like 'General', 'Single Line Diagram', 'Events', 'Alarms', 'Data Historian', 'GOOSE Analyzer', 'Help', and 'Logout'. Below the menu is a toolbar with buttons for 'Save', 'Filter', 'Freeze', 'View Alarms', and a dropdown menu set to '20'. The main area displays a table of events for the period 7.2.2014 to 24.2.2014, totaling 20,93 events and 50MB of data. The table has columns for Date, Time, Bay, Device, Object Text, Event, and Quality. Several events are highlighted with orange borders, indicating diagnostic events related to GOOSE connection disorders and timeouts.

Date	Time	Bay	Device	Object Text	Event	Quality
24.2.2014	14:13:32.910	BAY037	REU615C_078	REU615C_078LD0/LLN0.gcbGOOSE_LOOP:GOOSE Disorder Detected	False	
24.2.2014	14:13:29.555	BAY037	REU615C_078		Connection OK	
24.2.2014	14:13:28.818	BAY037	REU615C_078	REU615C_078LD0/LLN0.gcbGOOSE_LOOP:GOOSE Timeout	False	
24.2.2014	14:13:26.305	BAY037	REU615C_078	REU615C_078LD0/LLN0.gcbGOOSE_LOOP:GOOSE Disorder Detected	True	
24.2.2014	14:12:34.654	BAY037	REU615C_078		Device Connection Lost	
24.2.2014	14:12:23.631	BAY037	REU615C_078	REU615C_078LD0/LLN0.gcbGOOSE_LOOP:GOOSE Timeout	True	
24.2.2014	13:59:12.603				User logged in: com600	
24.2.2014	13:57:49.655	BAY037	REU615C_078		Connection OK	
24.2.2014	13:57:49.156	BAY033	REM615C_074		Connection OK	
24.2.2014	13:57:48.656	BAY001	REF615_010		Connection OK	
24.2.2014	13:57:48.156	BAY036	RET615C_077		Connection OK	
24.2.2014	13:57:47.657	BAY032	REF615C_073		Connection OK	
24.2.2014	13:57:47.155	BAY035	RED615C_076		Connection OK	
24.2.2014	13:57:46.655	BAY034	RED615C_075		Connection OK	
24.2.2014	13:57:46.159	BAY028	REF615_069		Connection OK	
24.2.2014	13:29:28.353	BAY036	RET615C_077		Connection OK	
24.2.2014	13:29:25.176	BAY036	RET615C_077	RET615C_077LD0/LLN0.gcbGOOSE_LOOP:GOOSE Timeout	False	
24.2.2014	13:29:23.413	BAY036	RET615C_077		Device Connection Lost	
24.2.2014	13:29:22.665	BAY036	RET615C_077	RET615C_077LD0/LLN0.gcbGOOSE_LOOP:GOOSE Reboot Detected	False	
24.2.2014	13:29:22.665	BAY036	RET615C_077	RET615C_077LD0/LLN0.gcbGOOSE_LOOP:GOOSE		

GATFigure 1.1-2.png

Figure 8.1-2 Corresponding GOOSE Analyzer diagnostic events in COM600 WebHMI



Note that only diagnostic events can be viewed in COM600 WebHMI. These can be used to verify the health of GOOSE.

## **9. GOOSE Analyzer Engine**

### **9.1. Using GOOSE Analyzer Engine**

GOOSE Analyzer Engine provides means to verify and validate GOOSE signals against GOOSE configurations in the substation configuration description (SCD). The engine continuously analyzes the decoded GOOSE packets and monitors the availability, reliability, and status transitions of GOOSE. Outputs from the engine are updated to the user interface in various ways.

Three types of analyzers are implemented in the analyzer engine:

- Subnetwork analyzer group
- IED analyzer group
- GOOSE control block analyzer group

### **9.2. Subnetwork analyzers**

#### **9.2.1. Subnetwork analyzer group**

This group is designed to analyze subnetwork wide GOOSE with comparison to the corresponding configurations in the SCD.

The following analyzers belong to this group:

- Intrusion analyzer
- Statistic analyzer

#### **9.2.2. Intrusion analyzer**

GOOSE intrusion is a GOOSE message whose configuration is not listed in the system configuration. It might harm the switched network and the distribution applications.

The analyzer compares the GOOSE control block references of the received GOOSE messages (packets) with those in the SCD. In normal status, all references conform to the values in the configuration description.

When a GOOSE control block reference is not listed in the active configuration, the analyzer issues a specific diagnostic event to warn users of the status transition.

#### **9.2.3. Statistic analyzer**

Network load and GOOSE load within the specific subnetwork determine the secure operation of the communication system. The analyzer continuously calculates the network load and GOOSE load of the subnetworks during the configured interval.

For each interval, the analyzer sums up:

- Received network packets
- Received network bytes
- Received GOOSE packets
- Received GOOSE bytes
- Received GOOSE events for users

## 9.3. IED analyzers

### 9.3.1. IED analyzer group

The IED analyzer group is designed to analyze IED wide GOOSE with comparison to the corresponding configurations in the SCD.

The following analyzers belong to this group:

- GOOSE bus analyzer
- Statistic analyzer

### 9.3.2. GOOSE bus analyzer

GOOSE bus is a unique representation of each GOOSE sending IED. It is used to mirror the transmission status of GOOSE messages.

Each GOOSE bus can have three statuses:

- **Unknown:** unknown status, which might mean problems have been found with GOOSE Analyzer in COM600 (see 9.4.7, Timeout (flow status) analyzer).
- **Normal:** transmission of GOOSE packets is according to its configuration and thus treated as normal (marked with green).
- **Alarm:** indicates that the transmission of GOOSE by the sending IED is abnormal, when the timeout analyzer shows timeout.

The analyzer is a synergy of different timeout analyzers within the same server of the IED.

### 9.3.3. Statistic analyzer

The analyzer traces the GOOSE load from the specific sending IED. It calculates the GOOSE load from the specific sending IEDs based on the GOOSE control block references during the configured interval.

For each interval, the analyzer sums up respectively:

- Received GOOSE packets
- Received GOOSE bytes
- Received GOOSE events for users

## **9.4. GOOSE control block analyzers**

### **9.4.1. GOOSE control block analyzer group**

This group is designed to analyze GoCB wide GOOSE with comparison to the corresponding configurations in the SCD.

The following analyzers belong to this group:

- Destination MAC address analyzer
- Application Identifier (APPID) analyzer
- VLAN ID analyzer
- VLAN User Priority analyzer
- Vlan Tag analyzer
- Timeout (flow status) analyzer
- DataSet reference analyzer
- ConfRev analyzer
- Needs Commission (NdsCom) analyzer
- Simulation analyzer
- Disorder analyzer
- DataSet structure analyzer
- Data changes analyzer
- Statistic analyzer

### **9.4.2. Destination MAC address analyzer**

The multicast destination MAC address is configured to allow chip level filtering at all receivers of GOOSE messages. This way the analyzer can secure IED performance.

The allowed GOOSE multicast address range is 01-0C-CD-01-00-00 until 01-0C-CD-01-FF-FF.

The destination MAC address analyzer compares the multicast MAC address contained in the received GOOSE message (packet) with that in SCD based on the reference of the GOOSE control block. In normal status, the MAC address conforms to the value in the configuration.

When a destination MAC address mismatch is detected, the analyzer issues a specific diagnostic event to warn users of the status transition.

### **9.4.3. APPID analyzer**

APPID is used to select ISO/IEC 8802-3 frames containing GSE management and GOOSE messages and to distinguish application association. In addition to destination MAC address, APPID is also used for GOOSE message filtering at a low level.

The reserved value range for GOOSE type 1 is 0x0000 to 0x3FFF. For GOOSE type 1A (Trip), the reserved value range is 0x8000 to 0xBFFF. If no APPID is configured, the default value is 0x0000. This default value indicates the lack of configuration.

It is recommended to use a unique, source-orientated GOOSE APPID within a system. For more detailed explanation of APPID, refer to Annex C.2 in the IEC standard IEC 61850-8-1.

The APPID analyzer compares the APPID contained in the received GOOSE message (packet) with that in the SCD based on the reference of the GOOSE control block. In normal status, the APPID conforms to the value in the configuration.

When an APPID mismatch is detected, the analyzer issues a specific diagnostic event to warn users of the status transition.

#### **9.4.4. VLAN ID analyzer**

VLAN specification restricts the data flow of multicast messages to those IEDs that need the messages. This way the load over a switched network can be optimized. VLAN specification is handled in the switches and it needs the switches to support it.

The value range for VLAN is 000 to FFF.

The VLAN ID analyzer compares the VLAN ID contained in the received GOOSE message (packet) with that in the SCD based on the reference of the GOOSE control block. In normal status, the VLAN ID conforms to the value in the configuration.

When a VLAN ID mismatch is detected, the analyzer issues a specific diagnostic event to warn users of the status transition.

#### **9.4.5. VLAN user priority analyzer**

User priority can help guarantee real-time performance, especially in a burst situation. User priority is handled in the switches and it needs the switches to support it.

Priority value is between 0-7, where a higher number indicates a higher priority message, which is handled in the priority queues of the switches (vendor specific). 4 is the recommended value for GOOSE.

VLAN user priority analyzer compares the user priority contained in the received GOOSE message (packet) with that in the SCD based on the reference of the GOOSE control block. In normal status, the user priority conforms to the value in the configuration.

When a user priority mismatch is detected, the analyzer issues a specific diagnostic event to warn users of the status transition.



**9.4.6. VLAN tag analyzer**

VLAN tag analyzer allows users to check the existence of a VLAN tag in the GOOSE frames, in case a VLAN tag is not supported and removed by ethernet switches. When a VLAN tag is missing from the GOOSE frames, the analyzer issues a specific event to warn users of the status transition.

**9.4.7. Timeout (flow status) analyzer**

The timeout attribute of GOOSE messages indicates whether the association to the GOOSE publisher is lost or not. A timeout alarm usually indicates a break in the communication bus, a power-down in an IED, or other problems. It is a crucial parameter for validating the correct operations of distributed functionalities.

The timeout analyzer checks the time interval between the previous GOOSE message and the current one. In normal status, the interval is within the configured due time. Otherwise, a timeout is detected and the analyzer issues a specific diagnostic event to alarm users of such status transition.

**9.4.8. DataSet reference analyzer**

The attribute DataSet represents the reference of the data set whose values are transmitted. The members of the data set are uniquely numbered starting with 1. This number is called the MemberOffset of a given member. Each member of the data set has a unique number and a MemberReference, Functional Constraint Data (FCD), or Functional Constraint Data Attribute (FCDA).

The DataSet reference analyzer compares the DataSet contained in the received GOOSE message (packet) with that in the SCD based on the reference of the GOOSE control block. In normal status, the DataSet reference conforms to the value in the configuration.

When a DataSet mismatch is detected, the analyzer issues a specific diagnostic event to warn users of the status transition.

**9.4.9. ConfRev analyzer**

The attribute ConfRev represents the number of times that the configuration of the data-set referenced by DataSet has been changed.

Changes to be counted are:

- Deleting a member of the data set
- Adding a member to the data set
- Reordering members of the data set
- Changing the value of the attribute DataSet

The counter is incremented when the configuration changes. At configuration time, the configuration tool is responsible for incrementing/maintaining the ConfRev value. When configuration changes occur due to SetGoCBValues, the IED is responsible for incrementing the value of ConfRev. If the value of DatSet is set through a SetGoCBValues service to the same value, the ConfRev value is still to be incremented.

The initial value for ConfRev is outside the scope of this part of IEC 61850. Value 0 is reserved. The value of ConfRev, when the IED is restarted, is a local issue.

The ConfRev analyzer compares the ConfRev contained in the received GOOSE message (packet) with that in the SCD based on the reference of the GOOSE control block. In normal status, the ConfRev conforms to the value in the configuration.

When a ConfRev mismatch is detected, the analyzer issues a specific diagnostic event to warn users of the status transition.

#### **9.4.10. NdsCom analyzer**

The NdsCom attribute has the value TRUE if the GoCB requires further configuration.

Further configuration is required in the following cases:

- The attribute DatSet has the value NULL.
- The number or size of values conveyed by the elements in the data set referenced by DatSet exceeds the constraint determined by the SCSM or the implementation.

When the NdsCom bit changes, the analyzer verifies the NdsCom bit contained in the received GOOSE message (packet) and issues a specific diagnostic event to warn users of the status transition.

#### **9.4.11. Simulation analyzer**

Simulation indicates with the value TRUE that a message and its value have been issued by a simulation unit. The GOOSE subscriber reports the value of the simulated message to its application instead of the “real” message depending on the setting of the receiving IED.

When the simulation bit changes, the analyzer verifies the simulation bit contained in the received GOOSE message (packet) and issues a specific diagnostic event to warn users of the status transition.

#### **9.4.12. Disorder analyzer**

Disorder means that StNum and SqNum for GOOSE packets from the specific GOOSE Control Block are not in series.

StNum and SqNum are integers ranging from 1 to 4 294 967 295. If counter SqNum overruns, it has to be set to 1.

The disorder analyzer verifies StNum and SqNum contained in the received GOOSE message (packet) for each GOOSE control block. If counters for StNum and SqNum do not behave serially as stated above, the analyzer treats it as a disorder and issues a specific diagnostic event to warn users of the status transition.

#### **9.4.13.                   DatSet structure analyzer**

DatSet structure represents the structure of members in the referenced data set.

The DatSet structure analyzer compares the structure contained in the received GOOSE message (packet) with that in the SCD based on the reference of the GOOSE control block. In normal status, the DatSet structure conforms to the value in the configuration.

When a DatSet structure mismatch is detected, the analyzer issues a specific diagnostic event to warn users of the status transition.

#### **9.4.14.                   Data changes analyzer**

The analyzer continuously monitors the data values in the received GOOSE message (packet), comparing it with the corresponding recordings from the previous GOOSE message. If the data changes analyzer detects a value change, it reports the change.

#### **9.4.15.                   Statistic analyzer**

The analyzer traces GOOSE load from a specific GOOSE control block of the sending IED.

The analyzer calculates the GOOSE load from the specific GOOSE control block references during the configured interval.

For each interval, the analyzer sums up respectively:

- Received GOOSE packets
- Received GOOSE bytes
- Received GOOSE events for users







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