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# **SIPROTEC 5 Application Note**

SIP5-APN-008: Enhanced IEC 61850 GOOSE features in SIPROTEC 5 devices

Answers for infrastructure and cities.

## SIPROTEC 5 Application Enhanced IEC 61850 GOOSE features in SIPROTEC 5 devices

## SIPROTEC 5 - Application: SIP5-APN-008 Enhanced IEC 61850 GOOSE features in SIPROTEC 5 devices

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## 1 Enhanced IEC 61850 GOOSE features in SIPROTEC 5 devices

### 1.1 Summary

This application describes enhanced IEC61850 GOOSE features available in SIPROTEC5 devices together with DIGSI 5. It intends to make Siemens users aware about new engineering and testing possibilities of their GOOSE configurations in order to use new GOOSE functionalities and speed up the project delivery with the highest project quality.

## **1.2 Application Introduction**

GOOSE communication has been used successfully in the past years in a lot of different applications. SIPROTEC 5 devices with IEC61850 provide you not only the same GOOSE possibilities than SIPROTEC 4 devices, but also offer you additionally new features, especially helpful for testing or interoperability.

Following GOOSE applications have been field proven in the past years:

- Busbar protection schemes with overcurrent (reverse interlocking)
- Substation Interlocking
- Intertripping
- Load shedding
- ...

Besides being conform to IEC 61850 Ed1 and Ed2 and therefore interoperable with other IEDs (including SIPROTEC 4 devices), SIPROTEC 5 devices together with DIGSI 5 offer following new features:

- Flexible GOOSE engineering via the GOOSE Editor
- Advanced testing features via the support of more quality bits
- Diagnostics

### **1.2.1 Flexible GOOSE engineering via the GOOSE Editor**

#### Integrated IEC61850 System Configurator

No need to jump anymore from an IED tool to a separated System Configurator. Intuitive engineering in few steps.



Figure 1: DIGSI 5 – Integrated GOOSE Editor

#### Use of different communication modules.

For users who want to separate physically the GOOSE communication or run different communication protocols (GOOSE; MMS, DNP 3 TCP), SIPROTEC 5 support several communication modules. One module could be used e.g. exclusively for GOOSE.

During your GOOSE engineering you have the possibility to send the GOOSE in any of those subnets.

#### Highest flexibility at GOOSE publisher

As used in DIGSI 4, GOOSE applications remain fully configurable.

GOOSE Datasets can be now assigned to any LLN0 of the IEC61850 structure.

Any Data Attributes (including. stSeld, t) can be published if required by IED subscribers (for example if timestamp needed)

Information can even be send as complete Data Objects at the Functional Constraint level (ST or MX).

IED_SIPROTEC5/Ln1/PTRC0/Str		
General GOOSE connection	50/04	
FC/DA groups Processing of quality attributes User information	Select group content using:	<ul> <li>Functional constraints (FC)</li> <li>Data attribute (DA) group(s)</li> </ul>
	ST	<ul> <li>✓ general</li> <li>dirGeneral</li> <li>phsA</li> <li>dirPhsA</li> <li>phsB</li> <li>dirPhsB</li> <li>phsC</li> <li>dirPhsC</li> <li>neut</li> <li>dirNeut</li> <li>✓ q</li> <li>t</li> </ul>

Figure 2: DIGSI 5 and SIPROTEC 5 – High flexibility for configuration of GOOSE Data Attributes

#### 2-in-one: Edition 1 or Edition 2

SIPROTEC 5 devices can be configured in Edition 1 mode in case of extensions of existing IEC61850 substations, or support by default Edition 2.

The use of LDname provides you further engineering flexibility and makes a step forward to the concept of interchangeability.

#### Automatic creation of signals on subscriber side

No need to create external signals or use virtual outputs anymore, advanced GOOSE engineering according IEC 61850-6 is now available via drag&drop of a Logical Node to the published signal.

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Hardware and protocols		IED_SIPROTECS	F.	Application	LUHO		LocSta	SPC		:- IED_subscriber	1	Application	LTRET	Service track			
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Function-group connection:		IED_SIPROTECS	F.	Application	LUNO		FnctLO	SPC		:-IED_subscriber	1	Pow2	GAPC1	Power system General			
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Figure 3: DIGSI 5 with full support of IEC 61850-6 for GOOSE subscription

#### **Bandwidth estimator**

In an IEC61850 system, GOOSE messages cause most of the communication traffic. DIGSI 5 provides an indicator monitoring the expected GOOSE bandwidth depending on what is configured. This makes the user easily aware of the situation to let him decide if configuration optimization or network segregation as defined in IEC 61850-90-4 should be used.

General	
Dataset	Bandwidth utilization
GSE control	
Bandwidth estimations User information	Utilized bandwidth: 0 100 Mbit 492.25 kbit
	Subnet-bandwidth estimations
	PN/IE_1: 0 100 Mbit 492.25 kbit



#### SED – export and import for intersubstation GOOSE

IEC 61850-90-1 communication goes beyond the substation communication by supporting substation to substation communication. SCL files - called Substation Exchange Descriptions (SED) support the exchange of GOOSE – messages between substations.

General	
Dataset	Dataset
GSE control	
Bandwidth estimations	
User information	Name: Dataset
	Hierarchical path: IED_SIPROTEC5/Application/LLN0
	Include in SED export: 🗹

Figure 5: Support of Edition 2 SCL files for easy GOOSE exchange via SED

### 1.2.2 Advanced testing features

#### Several modes of operation

Additionally to the default standard process mode, DIGSI 5 allows you online to switch the IED to a mode which supports enhanced testing (commissioning mode and simulation mode).

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🕨 🎦 Microsoft Loopback Adapter 🛛 🗮			Name.	511			
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Figure 6: DIGSI 5 online – choice of operating mode for the device

In commissioning mode, values can be forced to all their states, which make a point-to-point test of signals at communication level easily possible without interacting with the process values.

## SIPROTEC 5 Application Enhanced IEC 61850 GOOSE features in SIPROTEC 5 devices

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		T- Communicat								Charles al I	

Figure 7: Commissioning mode for point to point communication test

The simulation mode allows you to test real conditions without changing the process values neither binary inputs nor analog measurements. The values are generated by the simulation unit which simulates analogue input value and binary input values. Also CFC input signals can be simulated.



Figure 8: Simulation mode for sequence testing during maintenance

#### **Functional Logout**

Before going to maintenance, a SIPROTEC 5 can be set in functional logout state via binary input to alert its neighbours.



Figure 9: Activation of the Functional Logout state via binary input

GOOSE messages are then send with the quality bit operator Blocked. IED subscribers – which are alerted – can process the quality bits accordingly.

## SIPROTEC 5 Application Enhanced IEC 61850 GOOSE features in SIPROTEC 5 devices

#### Quality processing for GOOSE subscriber

SIPROTEC 5 provides an advanced testing feature to allow the use to substitute values when the signal quality at GOOSE subscriber is invalid or operator blocked.

	End theready managers		2_2012.201114
IED_SIPROTEC5/Ln1/PTRC0/Op			
General			
GOOSE connection	Processing of quality attributes		
FC/DA groups			
Processing of quality attributes			
Oser mormation	Replace 'invalid' w. 'good':		
	general value at 'invalid':	0	<b>v</b>
	PhsA value at 'invalid':	0	Ŧ
	PhsB value at 'invalid':	0	Ŧ
	PhsC value at 'invalid':	0	Ŧ
	neut value at 'invalid':	0	Ŧ
	dirGen value at 'invalid':	dir. unknown	-
	dirPhsA value at 'invalid':	dir. unknown	-
	dirPhsB value at 'invalid':	dir. unknown	-
	dirPhsC value at 'invalid':	dir. unknown	Ŧ
	dirNeut value at 'invalid':	dir. unknown	Ŧ
	Reset 'operatorBlk' state:		
	general value at 'opBlk':	0	Ŧ
	PhsA value at 'opBlk':	0	Ŧ
	PhsB value at 'opBlk':	0	Ŧ
	PhsC value at 'opBlk':	0	-
	neut value at 'opBlk':	0	-
		r 1	

Figure 10: Setting of substitution values for Quality 'Invalid or 'Operator blocked'

### **1.2.3 Diagnostics feature**

#### **GOOSE Monitoring**

GOOSE Inspector provides you not only with SIPROTEC 4 but also with SIPROTEC 5 the analysis about the GOOSE traffic based on the SCL files. Actually it will decode Ed1 GOOSE messages. A further version will support the monitoring of Ed. 2 of IEC 61850 GOOSE – messages.

#### Simple Network Monitoring Protocol

DIGSI 5 allows you to activate SNMPv3 in SIPROTEC5 relays for an optimal network monitoring with a secure standard.

Used with Netview, you can easily monitor over SNMP the relevant SIPROTEC 5settings (e.g. RSTP or GOOSE mismatch). Additionally, firmware version, product code or fabrication number is available to support you while doing your asset management.



Figure 11: Monitoring of SIPROTEC 5 devices with Netview over SNMP V3 protocol

## 1.3 Conclusion

Advanced features in SIPROTEC 5 and DIGSI 5 support users efficiently with the GOOSE handling over the lifecycle of the system from the GOOSE communication possibilities and engineering to the testing.

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