

IEC 61850 interface configuration for VAMP 50/51/52/55/210/230/245/255/257/259/260/265

1. Overview

This document applies to VAMP protection relays, which have a so called “native” 61850 interface, this is available starting from software version 10.1.

IEC 61850 protocol is available with the optional inbuilt Ethernet port. IEC 61850 protocol can be used to read / write static data from the relay or to receive events and to receive / send GOOSE messages to other relays.

IEC 61850 server interface is capable to do the following:

- Configurable data model: selection of logical nodes corresponding to active application functions
- Configurable pre-defined data sets
- Supported dynamic data sets created by clients
- Supported reporting function with buffered and unbuffered Report Control Blocks
- Supported control model: direct with normal security
- Supported horizontal communication with GOOSE: configurable GOOSE publisher data sets, configurable filters for GOOSE subscriber inputs, GOOSE inputs available in the application logic and output matrix

The inbuilt Ethernet is available as communication option, consult the manuals of the individual devices for more information.

2. Configuration

The configuration of the 61850 is done with VAMPSET. VAMPSET may be connected to the relay either via serial interface to the front panel connector or via the Ethernet network. Correct version of the VAMPSET is 2.2.41 or later. Also the ICD file can be generated with VAMPSET.

2.1 Setting the main parameters TCP PORT, IP address and NetMask

The configuration is started by selecting the IEC-61850 protocol as the “ETHERNET PORT protocol” and setting the IP Address and the NetMask of the device (see figure 2.1-2).

Please notice that IP address and netmask must be properly set in reference to client system in order to get the communication to work properly. In customer

network please consultant with IT responsible to obtain proper addresses allowed to be used.

Also notify that the device doesn't support DHCP while PC can obtain different addresses each time connected to a network. Such trouble might occur especially if testing the communication in office environment.

Two useful commands for trouble shooting can be found under dos prompt. The command **ipconfig** show the current address and netmask of your PC.

The command **ping** can verify if LAN connection work. A successful ping response indicates that physical connection between client and server. Furthermore it proves that TCP/IP address and netmask setting is accepted. Illegal address might disturb network communication so if available, customer IT support should always be consulted if the device is connected to existing network.

C:\Documents and Settings\vahanaki>ipconfig
Windows IP Configuration

Ethernet adapter Local Area Connection:

 Connection-specific DNS Suffix : intra.velco.fi
 IP Address. : 10.4.16.167
 Subnet Mask : 255.255.255.0
 Default Gateway : 10.4.16.254

C:\Documents and Settings\vahanaki>ping 10.4.128.7
Pinging 10.4.128.7 with 32 bytes of data:
Reply from 10.4.128.7: bytes=32 time=18ms TTL=99
Reply from 10.4.128.7: bytes=32 time=5ms TTL=99
Reply from 10.4.128.7: bytes=32 time=5ms TTL=99
Reply from 10.4.128.7: bytes=32 time=5ms TTL=99
Ping statistics for 10.4.128.7:
 Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
 Approximate round trip times in milli-seconds:
 Minimum = 5ms, Maximum = 18ms, Average = 8ms

Figure 2.1-1 Example of ipconfig and ping command.

ETHERNET PORT	
Ethernet port protocol	IEC-61850
IP port for protocol	102
IP Address	10.4.1.254
NetMask	255.255.255.0
Gateway	0.0.0.0
HTTP server	0.0.0.0
IP port for Vampset	23
TCP keepalive interval	0 s
MAC address	001AD3000090
Message counter	0
Error counter	0
Timeout counter	0

Figure 2.1-2 Setting for the Ethernet port protocol, IP Address and NetMask (seen the “PROTOCOL CONFIGURATION” menu).

The “IEC 61850 main config” –menu first part contains some 61850 parameters, which normally do not have to be changed (see figure 2.1-3).

The IED Name parameter is unique identifier and must be set differently for each device connected to the same network.

IEC 61850 main config

Port: 102

Check upper addresses: ☐

AP ID: 1.1.1.999.1

AE Qualifier: 12

P Selector: 1

S Selector: 1

T Selector: 0

IED Name: Vamp

Delete dynamic datasets: -

Set unique

Figure 2.1-3 The “IEC 61850 main config” menu.

2.2 Selecting the Logical Nodes and Datasets for event reporting

The Logical Nodes (LN) to be visible via the IEC 61850 interface are selected in “IEC 61850 data map (1)”... “IEC 61850 data map (n)” (see figures 2.2-1 and figure 2.2-2).

```

+ SUPERVISOR...
RELEASE OUTPUT MATRIX LATCHES
+ MATRIX...
LOGIC
MIMIC
+ LOCAL...
SCALING
STAGE EVENT ENABLING
+ EVENT MASKS for...
DI EVENT TEXTS
+ EVENT ENABLING...
CLOCK SYNC
PROTOCOL CONFIGURATION
+ SPABUS...
EXTERNAL I/O CONFIGURATION
+ MODBUS...
+ PROFIBUS...
MODEBUS & PROFIBUS: SCALINGS
+ IEC 60870-5-101...
+ IEC 60870-5-103...
+ DNP3...
IEC 61850 main config
IEC 61850 data map (1)
IEC 61850 data map (2)
IEC 61850 data map (3)
IEC 61850 data map (4)
IEC 61850 data map (5)
IEC 61850 data map (6)
IEC 61850 data map (7)
IEC 61850 data map (8)
IEC 61850 deadband config
IEC 61850 BRCE configuration
IEC 61850 URCE configuration
+ GOOSE...
ETHERNET

```

{

Data maps

IEC 61850 data map(1)

Index	LN	Description	Dataset 1
0	AR1RGGIO16	AR1 final trip	No
1	AR2RGGIO17	AR2 final trip	No
2	AR3RGGIO18	AR3 final trip	No
3	AR4RGGIO19	AR4 final trip	No
4	AR5REC1	Auto-reclose (AR)	Yes
5	AR6RGGIO15	AR critical final trip	No
6	AR6RGGIO13	AR critical request	No
7	AR6RGGIO14	AR final trip	No
8	AR6RGGIO2	AR Logical output locked	No
9	AR6RGGIO3	AR request 1	No
10	AR6RGGIO4	AR request 2	No
11	AR6RGGIO5	AR request 3	No
12	AR6RGGIO6	AR request 4	No
13	AR6RGGIO7	AR request 5	No
14	AR6RGGIO1	AR running	No
15	AR6RGGIO8	AR shot 1	No
16	AR6RGGIO9	AR shot 2	No
17	AR6RGGIO10	AR shot 3	No
18	AR6RGGIO11	AR shot 4	No
19	AR6RGGIO12	AR shot 5	No
20	AR6RGGIO4	AR failure protection	Yes

Figure 2.2-1 IEC 61850 configuration menus in VAMPSET.

The data maps contain the 61850 names for the functions of the device, maps are edited as follows:

- Set “In use” field of the needed functions to “Yes”
- Select which Dataset is used for sending reports from the function: set “Dataset x” to “Yes”
- Edit the “Description” field of the selected function if needed

Note: If there is no special reason to use many datasets, use only Dataset 1.

Note: The data maps may contain Logical Nodes, which are not functional in the relay which is being configured. Consult the manual of the device to see what functions are really operational in the relay type being configured.

VAMPSET IEC 61850 data map configuration view

IEC 61850 data map						
Index	LN	Description	Dataset 1	Dataset 2	Dataset 3	In use
90	DI9GGIO53	Digital input 9	No	No	Yes	No
91	DOC1PTOC12	IDir>	Yes	No	No	No
92	DOC2PTOC13	IDir>>	Yes	No	No	No
93	DOC3PTOC14	IDir>>>	Yes	No	No	No
94	DOC4PTOC15	IDir>>>>	Yes	No	No	No
95	EF1PTOC4	Io>	Yes	No	No	No
96	EF2PTOC5	Io>>	Yes	No	No	No
97	EF3PTOC6	Io>>>	Yes	No	No	No
98	EF4PTOC7	Io>>>>	Yes	No	No	No

Figure 2.2-2 Description of the contents of the “IEC 61850 data map (x)”.

Datasets are assigned to Report Control Blocks in the “IEC 61850 BRCB configuration” and “IEC 61850 URCB configuration” menus. A VAMP device has 3 predefined data sets DS1...DS3, these can be assigned to one or more of the 3 buffered report control blocks BRCB 1...BRCB 3 and to one or more of the 3 un-buffered report control blocks URCB 1...URCB 3.

Some clients may create their own so called dynamic data sets and assign these to report control blocks. Both persistent and non-persistent dynamic data sets are supported.

Note: The clients (e.g. the RTU) reserve one or more RCBs to get events. The relay sends events to those clients who have done reservations.

Note: The maximum number of simultaneous client connections is 3.

IEC 61850 BRCB configuration

BRCB 1	
Dataset	DS1
Name of selected Dataset	LLN0.DS1
Integrity Period	0
Buffer Timer	0
Triggering Options	
- Data Change	<input checked="" type="checkbox"/>
- Quality Change	<input checked="" type="checkbox"/>
- Data Update	<input checked="" type="checkbox"/>
- Integrity	<input checked="" type="checkbox"/>
- General Interrogation	<input checked="" type="checkbox"/>
Optional Fields	
- Sequence Number	<input checked="" type="checkbox"/>
- Report Time Stamp	<input checked="" type="checkbox"/>
- Reason For Inclusion	<input checked="" type="checkbox"/>
- Dataset Name	<input checked="" type="checkbox"/>
- Data Reference	<input checked="" type="checkbox"/>
- Buffer Overflow	<input checked="" type="checkbox"/>
- Entry ID	<input checked="" type="checkbox"/>
- Configuration Revision	<input checked="" type="checkbox"/>
- Segmentation	<input checked="" type="checkbox"/>

Figure 2.2-3 Report Control Block configuration.

2.3. Configuration of the GOOSE communication

The working principle of the GOOSE communication is described in figure 2.3.1.

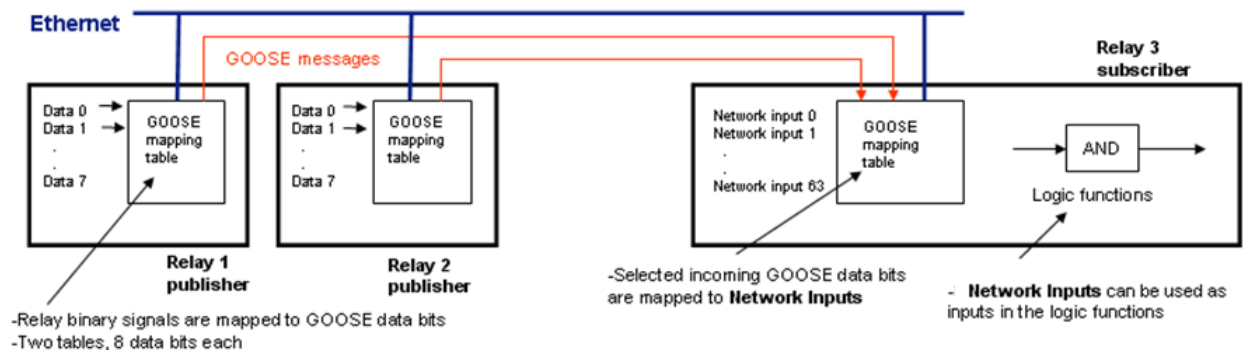


Figure 2.3-1 Operation principle of the GOOSE communication.

One-bit binary signals can be sent/received as GOOSE data. One device can send max. two GOOSE data packets containing 8 bits of data, thus max. number of data points from one device is 16 bits. Goose control block 1 (GCB1) and Goose control block 2 (GCB2) are used to control the sending of these two 8-bit GOOSE data packets.

GOOSE data is multi-casted to the Ethernet network. The multicast MAC Address, Application ID and Configuration Revision are the main parameters when routing the information from one relay to the other.

Note: The MAC Address used in GOOSE communication is totally independent from the MAC Addresses of the devices in the Ethernet network !

One device can receive max. 64 bits of GOOSE data. These can be utilized in the device internal logic and output matrix - these are named as GOOSE NI1...GOOSE NI64.

The main parameters of the GOOSE communication are available via "GOOSE configuration" menu (see figure 2.3-2).

The screenshot shows the "GOOSE configuration" menu. On the left is a tree view with "GOOSE configuration" selected. The main area displays the configuration for two GOOSE Control Blocks (GCB1 and GCB2) as Publishers, and a Subscriber configuration.

Publisher parameters:

- Max retransmission timeout: 20 s

Publisher configuration GCB 1:

- Enable: ☒ (Annotation: Main configurations to enable sending of the first outgoing 8-bit GOOSE data packet.)
- GOOSE ID: VAMP
- Configuration Revision *: 1 (Annotation: Configuration Revision number, which may be used to block usage of wrong data in the GOOSE data receiver.)
- Needs Commissioning: ☐
- Test mode: ☐
- MAC Address: 01-0C-CD-01-00-00 (Annotation: MAC Address for GOOSE data, allowed range 01-0C-CD-01-00-00 ... 01-0C-CD-01-01-FF)
- VLAN Priority: 4
- VLAN ID: 0
- Application ID *: 1 (Annotation: Application ID. This is a number which identifies the GOOSE data packet and is used in the receiver to receive correct data package)
- * Important for VAMP subscriber

Publisher configuration GCB 2:

- Enable: ☐ (Annotation: Main configurations to enable sending of the second outgoing 8-bit GOOSE data packet.)
- GOOSE ID: VAMP
- Configuration Revision *: 1
- Needs Commissioning: ☐
- Test mode: ☐
- MAC Address: 01-0C-CD-01-00-00
- VLAN Priority: 4
- VLAN ID: 0
- Application ID *: 1
- * Important for VAMP subscriber

Subscriber configuration:

- Enable: ☐ (Annotation: Main configurations to enable reception of GOOSE data from other devices.)
- MAC Address: 01-0C-CD-01-00-00

Figure 2.3-2 The main parameters of GOOSE configuration.

Note: Use different "Application ID" in different relays, because this is the main criteria when receiving GOOSE data in the VAMP relays. Use also different "Application ID" for GCB1 and GCB2.

Note: VAMP relays can receive GOOSE data only via one MAC Address.

The bit values to be sent are selected in GOOSE mapping tables "GOOSE GCB1: DATA POINTS" and "GOOSE GCB2: DATA POINTS" (see figure 2.3-3).

GOOSE GCB1: DATA POINTS			
DSG1 data configuration			
Index	IEC-61850 Variable	Signal	Status
0	DI01GGIO45.Ind.stVal(ST)	DI1	OK
1	VHGGIO137.SPCS0.stVal(ST)	VH	OK
2	None	None	OK
3	None	None	OK
4	None	None	OK
5	None	None	OK
6	None	None	OK
7	None	None	OK

GOOSE GCB2: DATA POINTS			
DSG2 data configuration			
Index	IEC-61850 Variable	Signal	Status
0	V01GGIO97.Ind.stVal(ST)	V01	OK
1	None	None	OK
2	None	None	OK
3	None	None	OK
4	None	None	OK
5	None	None	OK
6	None	None	OK
7	None	None	OK

Figure 2.3-3 Examples of selected data bits to be sent in the two 8-bit GOOSE data blocks.

Note: All the lines in the GOOSE GCB data point lists must indicate OK, otherwise no data is sent (see figure 2.3-3).

The bit values to be received as GOOSE data are defined in "GOOSE Subscriber: DATA POINTS" (see figure 2.3-4).

GOOSE Subscriber: DATA POINTS

GOOSE Network Inputs Error0

Subscriber data configuration

III	App ID	Conf Rev	Data index	Value	Status	In use
1	2	1	0	0	OK	Yes
2	1	1	1	0	NO DATA	No
3	1	1	2	0	NO DATA	No

Figure 2.3-4 An example of data point definition to receive GOOSE data.

Note: All devices sending GOOSE data to VAMP relays must use different "Application ID", because this is the main criteria when receiving data in the VAMP relays.

2.4 Creating ICD file with VAMPSET

IED Capability Description (.ICD) file defines complete capability of an IED. This file needs to be supplied by each manufacturer to make the complete system configuration. The file contains a single IED section, an optional communication section and an optional substation part which denotes the physical entities corresponding to the IED.

In order to create the IEC61850 description file connect the device with vampset and select "COMMUNICATION" ; "Get ICD File"

From the SCL generation options you can select whether the RCB names contain indexes or not (selection "RCB names with indexes"). The need for indexed or non-indexed report control blocks depends on the client system - in most of the cases the indexes are used. Consult the client system manufacturer about this. In case this is not known, the best way is to create both and test. You can also enable some features of the 61850 Edition 2 – normally you can skip these.

After selections press OK the .icd-file is generated and you can select directory to save the .icd file to.

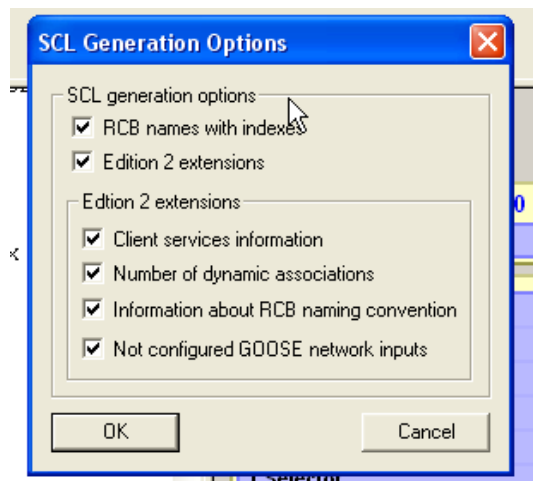


Figure 2.4-1 Create ICD file with VAMPSET program

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P.O.Box 810	Vaasa Airport Park	Fax: +358 20 753 3205
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Finland	Vaasa, Finland	http://www.vamp.fi

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