

# IEC 61850 interface configuration for VAMP products and WIMO

**This application note applies to Vamp 50, Vamp 200, Vamp 300 series and WIMO**

## 1 Overview

This document applies to VAMP protection relays, which have a so called “native” IEC 61850 interface. This is available starting from software version 10.10.

The IEC 61850 protocol is available with the optional inbuilt Ethernet port. The 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.

The IEC 61850 server interface supports the following features:

- Configurable data model: selection of logical nodes corresponding to active application functions
- Configurable pre-defined data sets
- Dynamic data sets created by clients
- Reporting function with buffered and unbuffered Report Control Blocks
- Control model: direct with normal security and with enhanced security, SBO with normal and with enhanced security
- 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 a communication option. Consult the manuals of the individual devices for more information.

## 2 Configuration

The configuration of the IEC 61850 protocol is done with VAMPSET. VAMPSET can be connected to the relay either via serial interface to the front panel connector or via the Ethernet network. The version of VAMPSET that is needed will vary depending on the version of the device firmware (for instance, firmware version 10.108 requires VAMPSET

version 2.2.85 or higher).Furthermore, an ICD (IED Capability Description) file can be generated with VAMPSET.

## 2.1 Setting the main parameters IP Address, TCP port, and Network Mask

The configuration is started by setting the appropriate values for the IP address (IP address of the VAMP device), NetMask (Network Mask) and Gateway (IP address of the gateway).

Please note that the IP address and network mask must be correctly set in reference to the client system in order to get the communication to work properly. When adding a device to an existing network, please consult with a network administrator to obtain proper IP addresses that you are allowed to use.

Also note that the devices do not support DHCP, in contrast to PC's, which are able to obtain different IP addresses each time they are connected to a network. This may cause trouble if the communication is tested in an office network. The use of a separate test network is recommended.

Next, the IEC 61850 protocol is activated selecting "IEC-61850" as the Ethernet port protocol for one of the two instances of TCP ports available, see Figure 2.1, where the IEC-61850 protocol has been set as the port protocol for the first instance of TCP ports. The IP port for protocol selection is by default set to 102, and does generally not need to be changed.

ETHERNET PORT	
IP Address	10.4.128.42
NetMask	255.255.255.0
Gateway	10.4.128.254
IITP server	0.0.0.0
IP port for setting tool	23
TCP keepalive interval	0 s
Enable FTP server	<input type="checkbox"/>
FTP password	config
FTP max speed	4 kB/s
MAC address	001AD3005651
Storm protection	<input type="checkbox"/>
Storm protection limit	1.0 %

TCP PORT 1st INST	
Ethernet port protocol	IEC-61850
IP port for protocol	102
Message counter	0
Error counter	0
Timeout counter	0

TCP PORT 2nd INST	
Ethernet port protocol 2nd inst	None
IP port for protocol 2nd inst	502
Message counter	0
Error counter	0
Timeout counter	0

Figure 2.1. Ethernet and TCP port instances configuration menu in VAMPSET.

## NOTICE

1. A change of protocols on any port, serial port or TCP port instance, will require a reboot of the device.
2. If a VAMP device equipped with dual Ethernet ports is configured, a menu showing settings for RSTP (Rapid Spanning Tree Protocol) will also be visible in the PROTOCOL CONFIGURATION menu in VAMPSET. See figure 2.3 for a screenshot of these settings. The RSTP is described further in a different Application Note (ANCOM.EN013).

Two useful commands for troubleshooting can be found in the CommandPrompt (Microsoft Windows OS), ipconfig and ping.

The ipconfig command shows the current address and network mask of your PC. The ping command can be used to verify if the LAN connection is working properly. A successful ping response indicates that a physical connection between the client and the server (in this case the PC and the VAMP device). Furthermore, it proves that the TCP/IP-address and network mask setting is accepted. See figure below for an example.

```
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 2.2. An example of the ipconfig and ping commands.

RSTP PROTOCOL FOR ETHERNET		
Enable for RSTP	<input type="checkbox"/>	
Bridge priority	32768	
Hello time	2 s	
Forward delay	15 s	
Max Age	20 s	
Migrate time	3 s	
Protocol version	2	
	Port 1	Port 2
Port priority	128	128
Admin edge	llo	llo
Auto edge	llo	llo
Current state	LinkDown	LinkDown

Figure 2.1: RSTP settings visible if a device with dual Ethernet ports is configured.

Once the IEC 61850 protocol has been activated, the *IEC 61850 Main Config* will become selectable in the group list in VAMPSET (the list to the left in the VAMPSET window). See figure 2.4 for a screenshot of this menu selected.

The first part of the “IEC 61850 main config” - menu contains some 61850 parameters, which normally do not need to be changed.

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

**IEC 61850 main config**

IEC 61850 main config	
Port	102
Edition	1
Check upper addresses	No
AP ID	1.1.1.999.1
AE Qualifier	12
P Selector	00000001
S Selector	0001
T Selector	0001
IED Name	VAMP259
AP Name	S1
Delete dynamic datasets	-
Remove not valid LNs	-
Instantiated RCBs	No
ResvTms included in BRCBs	Yes
Owner included in RCBs	No
Control mode for object nodes	DirNorSec
SDO allowed in DS	Yes
Type of BCR	128BIT
Type of SBO	VisStr65
Size of array	16

LLN0 and LPHD DOs in datasets	
Dataset 1	No
Dataset 2	No
Dataset 3	No

Figure 2.2: The “IEC 61850 main config” menu (see following text for explanations of the different fields).

**Explanations for the fields presented in “IEC 61850 main config”:**

IEC 61850 main config	
Port	102
Edition	1

- Port = TCP/IP port number to be used, 102 is the default.
- Edition = IEC 61850 standard edition to be used (1 or 2), Edition 1 is the default (feature available in firmware versions 10.123 and newer)

Check upper addresses	No
AP ID	1.1.1.999.1
AE Qualifier	12
P Selector	00000001
S Selector	0001
T Selector	0001

- Check upper addresses =No/Yes – No is the default. Defines whether the following 5address parameters of the protocol layers above TCP/IP (AP ID,...) should be checked or not during the IEC 61850 connection establishing procedure. Needed only in special cases.

IED Name	VAMP259
AP Name	S1

- IED Name = IED Name to be used as part of the 61850 addressing of the data.

- AP Name = Access Point Name, a name used to refer to the communication interface of this device in SCL-file.

Delete dynamic datasets	-
Remove not valid LNs	-

- Delete dynamic datasets = this selection can be used to delete all dynamic datasets, which may have been created by client tools and stored in the relay's memory
- Remove not valid LNs = this selection can be used to remove from the data maps such Logical Nodes which are not pertinent for this VAMP type.

Instantiated RCBs	No
ResvTms included in BRCBs	Yes
Control mode for object nodes	DirNorSec
SDO allowed in DS	Yes
Type of BCR	128BIT
Type of SBO	VisStr65
Size of array	16

- Instantiated RCBs = "No" (the default): there are 8 separately defined BRCBs and 8 separately defined URCBs in the ICD file. "Yes": the report control blocks are instantiated from single BRCB and URCB definitions given in the ICD file.
- ResvTms included in BRCBs = specifies whether "ResvTms"-attribute is included in the BRCBs or not (this is actually an extension from Tissue 453 and Edition 2 and should be set to "No" if the client system does not support this)
- Control mode for object nodes = selects the control model to be used with the controllable Objects
- SDO allowed in DS = "Yes": the "Structured Data Objects", e.g. A.phsA, are allowed in pre-defined datasets DS1, DS2, DS3. "No": the "Structured Data Objects" are not allowed in pre-defined datasets. Should be set to "No" if the client system is able to handle only complete 3-phase data types like A, PhV, PPV.
- Type of BCR = 32/64/128BIT, length of binary counters.
- Type of SBO = VisStr64/VisStr65, can be used to select the length of visible strings.
- Size of array = Number of elements in the arrays used to transfer the harmonics.

LLN0 and LPHD DOs in datasets	
Dataset 1	No
Dataset 2	No
Dataset 3	No

- Can be used to include LLN0 and LPHD in predefined datasets DS1, DS2, DS3.

## 2.2 Selecting the Logical Nodes and Datasets for event reporting

The Logical Nodes (LN) to be visible via the IEC 61850 interface can be selected in "IEC 61850 data map (1)"... "IEC 61850 data map (n)", see Figure 2.3 and Figure 2.4.

The screenshot displays the VAMPSET configuration interface. On the left, a tree view shows the configuration structure, with 'IEC 61850 data map(1)' highlighted. A red bracket on the left side of the tree view is labeled 'Data maps'. On the right, a window titled 'IEC 61850 data map(1)' displays a table with the following data:

Index	LN	Description	Dataset 1	Dataset 2	Dataset 3	In use
0	AR1FGG1016	AR1 final trip	No	No	Yes	No
1	AR2FGG1017	AR2 final trip	No	No	Yes	No
2	AR3FGG1018	AR3 final trip	No	No	Yes	No
3	AR4FGG1019	AR4 final trip	No	No	Yes	No
4	ARSRREC1	Auto-reclose (AR)	Yes	No	No	No
5	ARctFGG1015	AR critical final trip	No	No	Yes	No
6	ARreGG1013	AR critical request	No	No	Yes	No
7	ARFGG1014	AR final trip	No	No	Yes	No
8	ARlocGG102	AR locked	No	No	Yes	No
9	ARre1GG103	AR request 1	No	No	Yes	No
10	ARre2GG104	AR request 2	No	No	Yes	No
11	ARre3GG105	AR request 3	No	No	Yes	No
12	ARre4GG106	AR request 4	No	No	Yes	No
13	ARre5GG107	AR request 5	No	No	Yes	No
14	ARrunGG101	AR running	No	No	Yes	No
15	ARsh1GG108	AR shot 1	No	No	Yes	No
16	ARsh2GG109	AR shot 2	No	No	Yes	No
17	ARsh3GG1010	AR shot 3	No	No	Yes	No
18	ARsh4GG1011	AR shot 4	No	No	Yes	No
19	ARsh5GG1012	AR shot 5	No	No	Yes	No
20	CBFFPIOC4	CB failure protection	Yes	No	No	No
21	CBWA1GG1020	CB wear alarm 1	No	No	Yes	No
22	CBWA2GG1021	CB wear alarm 2	No	No	Yes	No
23	CH01GG10103	Counter 1	No	No	Yes	No
24	CH02GG10104	Counter 2	No	No	Yes	No
25	CH03GG10105	Counter 3	No	No	Yes	No
26	CH04GG10106	Counter 4	No	No	Yes	No
27	CH05GG10107	Counter 5	No	No	Yes	No
28	CH06GG10108	Counter 6	No	No	Yes	No
29	CH07GG10109	Counter 7	No	No	Yes	No

Figure 2.3: IEC 61850 configuration menus in VAMPSET.

The data maps contain the IEC 61850 names of the functions of the device. Data maps are edited as follows:

- Set the “In use” field of the needed logical nodes to “Yes”
- Select to which pre-defined Dataset the data from the given function are assigned (e.g. for reporting purpose): set “Dataset x” to “Yes”
- Edit the “Description” field of the selected function if needed (this description will be visible in the IEC 61850 data model – in d attribute of NamPIt data in the LN).

## NOTICE

1. If there is no special reason to use many datasets, use only dataset 1.
2. The data maps may contain Logical Nodes, which are not functional in the device which is being configured. Consult the manual of the device to see what functions are really operational in the relay type being configured.
3. Logical nodes may appear or hide in the data maps of VAMP relays which can be set to different protection modes (motor, generator, feeder). Due to this, it is recommended to set the relay to required protection function before configuring the IEC-61850 protocol.



**VAMPSET IEC 61850 data map configuration view**

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 2.4: Description of the contents of the "IEC 61850 data map (x)" menu.

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 eight buffered report control blocks BRCB 1...BRCB 8 and to one or more of the eight unbuffered report control blocks URCB 1...URCB 8.

The configurations menus of buffered and unbuffered report control blocks are shown in Figure 2.6.

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. However, these can only be viewed with VAMPSET, not created. IEC 61850 client tool software is needed for creating these. The "dynamic datasets" menu is shown in Figure 2.5.

Dynamic dataset 1	
Name	-
Type	Empty
IEC-61850 Variable	FC
[1]	-

Dynamic dataset 2	
Name	-
Type	Empty
IEC-61850 Variable	FC
[1]	-

Figure 2.5: Dynamic dataset menu in VAMPSET.

**NOTICE**

1. The clients (e.g. the RTU) reserve one or more RCBs to subscribe for reports (events from the relay functions). The relay sends reports to those clients who have done subscriptions to RCBs.

- The maximum number of simultaneous client connections is 8 (from firmware version 10.96 onward. Before this, the limit was three clients).

BRCB 1		URCB 1	
Dataset	DS1	Dataset	DS1
Name of selected Dataset	LLH0.DS1	Name of selected Dataset	LLH0.DS1
Report ID	BRCB1	Report ID	URCB1
Integrity Period	0 ms	Integrity Period	0 ms
Buffering Time	1000 ms	Buffering Time	1000 ms
Triggering Options		Triggering Options	
- Data Change	Yes	- Data Change	Yes
- Quality Change	Yes	- Quality Change	Yes
- Data Update	Yes	- Data Update	Yes
- Integrity	Yes	- Integrity	Yes
- General Interrogation	Yes	- General Interrogation	Yes
Optional Fields		Optional Fields	
- Sequence Number	Yes	- Sequence Number	Yes
- Report Time Stamp	Yes	- Report Time Stamp	Yes
- Reason For Inclusion	Yes	- Reason For Inclusion	Yes
- Dataset Name	Yes	- Dataset Name	Yes
- Data Reference	Yes	- Data Reference	Yes
- Buffer Overflow	Yes	- Buffer Overflow	Yes
- Entry ID	Yes	- Entry ID	Yes
- Configuration Revision	Yes	- Configuration Revision	Yes
Lost reports count	0		

Figure 2.6: Report Control Block configuration. Left: buffered. Right: unbuffered.

## 2.3 Measurement config settings

The Deadband values, Deadband integration time and Unit multipliers used by the IEC 61850 protocol can be configured in the “IEC 61850 Measurement Config” in VAMPSET. See Figure 2.7 for screenshots of the configurable items.

Deadband values		Unit multiplier	
Energy	2.000 MWh	Energy	k
Reactive energy	2.000 Mvarh	Reactive energy	k
Frequency f	0.100 Hz	Frequency f	-
Current I	10 A	Current I	-
Residual current Io	0.10 A	Residual current Io	-
Active power	100 kW	Active power	k
Reactive power	100 kvar	Reactive power	k
Apparent power	100 kVA	Apparent power	k
Power factor	0.10	Power factor	-
Current THD	5.0 %	Current THD	%
Voltage THD	5.0 %	Voltage THD	%
Voltage U	1000 V	Voltage U	-
Residual voltage Uo	10.0 %	Residual voltage Uo	%
External AI1	1.0 C	External AI1	-
External AI2	1.0 C	External AI2	-
External AI3	1.0 C	External AI3	-
External AI4	1.0 C	External AI4	-
External AI5	1.0 C	External AI5	-
External AI6	1.0 C	External AI6	-
External AI7	1.0 C	External AI7	-
External AI8	1.0 C	External AI8	-
External AI9	1.0 C	External AI9	-
External AI10	1.0 C	External AI10	-
External AI11	1.0 C	External AI11	-
External AI12	1.0 C	External AI12	-
External AI13	1.0 C	External AI13	-
External AI14	1.0 C	External AI14	-
External AI15	1.0 C	External AI15	-
External AI16	1.0 C	External AI16	-
Counters	1	Counters	-

Deadband integration time	
Integration time	1 s

Figure 2.7: "Measurement config" menu in VAMPSET.

There are two variants of the deadband calculation: absolute deadband and integrated deadband. To select absolute deadband, set the Deadband integration time to zero.

Set the deadband values with caution – too small values may cause unnecessary overhead in the data transfer.

A short example: if the Current I deadband value is set to 5 A, and the Integration time set to 0 (absolute deadband), the change condition will be satisfied when the value changes more than 5 A from the previously reported value. If, on the other hand, the Integration time is set to 1, the change condition will be satisfied for instance, if the signal value changes more than 1 A from the previously reported value and remains as such for five seconds.

## 2.4 Generic events

It is also possible to configure so called Generic events, which can be done in the table shown in Figure 2.10. This provides means to map any application events of the relay to maximum 8 indication data objects of the EvtGGIO183 logical node of the IEC 61850 interface. The status of the indication data object will be determined by ON and OFF events set for the corresponding index in the table.

IEC 61850 generic events

IEC 61850 generic events				
Ind idx	ON event channel	ON event code	OFF event channel	OFF event code
1	69	1	69	2
2	0	0	0	0
3	0	0	0	0
4	0	0	0	0
5	0	0	0	0
6	0	0	0	0
7	0	0	0	0
8	0	0	0	0

Figure 2.8: Generic events menu.

Figure 2.8 also features an example, where the status of Virtual Input 1 is mapped to the generic events table. The *channel* and *code* correspond to the SPA bus representation of events, which is defined in a separate document, “Modbus Profibus SPA Bus Events”. If the value of Virtual Input 1 is changed, then the value stored in the IEC 61850 address *EvtGGIO183.Ind1.stVal* will indicate the current value of Virtual Input 1.

## NOTICE

If only an “ON event” is defined for an indication then the transition to OFF state is generated automatically after reporting the ON state (momentary ON state). And the same applies if only an “OFF event” is defined for an indication (momentary OFF state).

## 2.5 Configuration of the GOOSE communication

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

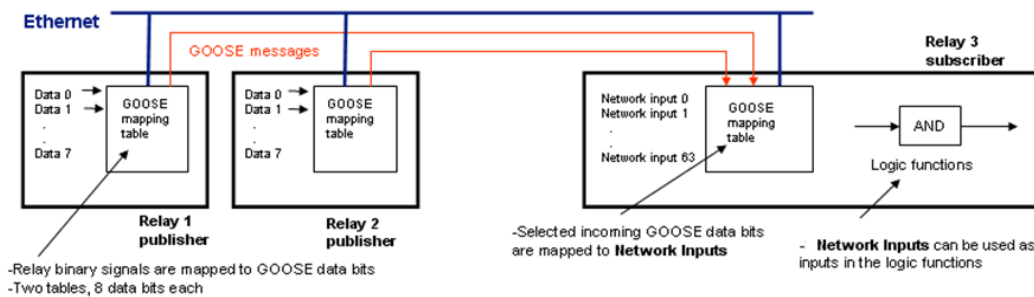


Figure 2.9: Operation principle of the GOOSE communication

One-bit binary signals can be sent/received as GOOSE data. One device can send a maximum of two GOOSE data packets containing 8 bits of data, thus the maximum number of data points that can be sent 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.

### NOTICE

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

One device can receive a maximum of 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 2.10).

### NOTICE

Extensions in GOOSE communication starting from firmware version 10.116

- the maximums number of data points that can be sent from one device is 2 x 16 signals.
- also analog values (IL1, IL2, IL3, UL1, UL2, UL3, Io1, IoCalc, P, Q, S, P.F) can be sent in GOOSE messages
- changes of analog values are checked by IEC-61805 server with cycle of 500ms and are subject to deadband calculation, so the minimum cycle of receiving new values of analog signals is 500ms.

### NOTICE

Extensions in GOOSE communication starting from firmware version 10.125

- also states of objects 1..8 can be sent in GOOSE messages
- specific bits from received bit string (i.e. objects status or quality) or integer can be selected as input for binary NIs

GOOSE configuration	
<b>Publisher parameters</b>	
Max retransmission timeout	20 s
Fixed length GOOSE	No
<b>Publisher configuration GCB 1</b>	
Enable	Yes
GOOSE ID *	VAMP
Configuration Revision *	1
Needs Commissioning	No
Test mode	No
MAC Address	01-0C-CD-01-00-00
VLAN Priority	4
VLAN ID	000 Hex
Application ID *	0091 Hex
* Important for VAMP subscriber	
<b>Publisher configuration GCB 2</b>	
Enable	No
GOOSE ID *	VAMP
Configuration Revision *	1
Needs Commissioning	No
Test mode	No
MAC Address	01-0C-CD-01-00-00
VLAN Priority	4
VLAN ID	000 Hex
Application ID *	0001 Hex
* Important for VAMP subscriber	
<b>Subscriber configuration</b>	
Enable	Yes
MAC Address	01-0C-CD-01-00-00
Min supervision time	1.0 s
GOOSE ID 1	VAMP1
GOOSE ID 2	VAMP2
GOOSE ID 3	VAMP3
GOOSE ID 4	VAMP4
GOOSE ID 5	VAMP5

Figure 2.10: GOOSE main configuration menu.

### Explanations for the fields presented in “GOOSE configuration”:

Publisher parameters	
Max retransmission timeout	20 s
Fixed length GOOSE	No

- Max retransmission timeout = GOOSE background sending cycle
- Fixed length GOOSE = No/Yes: disable/enable sending the GOOSE messages in flexible or fixed format (fixed length is a feature defined by Edition 2).

Publisher configuration GCB 1	
Enable	Yes
GOOSE ID *	VAMP
Configuration Revision *	1
Needs Commissioning	No
Test mode	No
MAC Address	01-0C-CD-01-00-00
VLAN Priority	4
VLAN ID	000 Hex
Application ID *	0008 Hex
* Important for VAMP subscriber	

- Enable = Yes / No: Enable/disable the publishing of data defined by GCB 1 (data points group in 1)
- GOOSE ID = a textual string used to describe this GOOSE data packet, this may be used in the receiving end to identify the correct message
- Configuration Revision = a number describing the GOOSE configuration revision (if this is changed then the revision number must be aligned also in the receiving end to make the connection work again)
- Need Commissioning = No/Yes: a flag which can be used to indicate that some change has been done in the configuration and a new commissioning is needed.

When the VAMP device receives a message with this flag set, the data is not delivered to the logics or matrix but the status is shown in the subscriber view.

- Test mode = No: normal operation. Yes: Test mode. When the VAMP device receives a message with this flag set, the data is not delivered to the logics or matrix but the status is shown in the subscriber view.
- MAC Address = the MAC Address (01-0C-CD-01-00-00...01-0C-CD-01-01-FF) to be used as destination address for the GOOSE message
- VLAN priority = a priority number, which may be used (in the Ethernet switches) to give higher priority to the GOOSE messages
- VLAN ID = if Virtual LAN is used to deliver this GOOSE message, VLAN ID can be used to identify the correct Virtual LAN
- Application ID = a number which is used to identify this GOOSE message source, this is used in the receiving end to identify the correct message.

Subscriber configuration	
Enable	No
MAC Address	01-0C-CD-01-00-00
Min supervision time	1.0 s

- Enable =No/Yes, disable/enable the GOOSE subscriber (receiver) functionality.
- MACAddress = the MAC destination address which is valid for the incoming GOOSE messages
- Min supervision time: minimum timeout for indicating invalid status of GOOSE Network Inputs due to no incoming GOOSE messages (exceeded supervision time or time allowed to live from the last GOOSE message, whichever is greater)

GOOSE ID 1	VAMP1
GOOSE ID 2	VAMP2
GOOSE ID 3	VAMP3
GOOSE ID 4	VAMP4
GOOSE ID 5	VAMP5

- GOOSE ID 1...5 = List of GOOSE IDs which can be used to check incoming GOOSE messages (in addition to checking MAC address, Application ID and Configuration Revision).

## NOTICE

1. Use different "Application ID" in different relays, because this is the main identification criteria when receiving GOOSE data in the VAMP relays. Also use different "Application ID" for GCB1 and GCB2.
2. VAMP devices can receive GOOSE data only with one defined MAC Destination Address (Subscriber configuration).
3. The VLAN ID and Application ID are given as hexadecimal values in this menu.

The data values to be sent are selected in the GOOSE mapping tables “GOOSE GCB1: DATA POINTS” and “GOOSE GCB2: DATA POINTS” (see Figure 2.11).

Index	IEC-61850 Variable	Signal	Status
0	DI01GGIO45.Ind.stVal(ST)	DI1	OK
1	VHGGIO137.SPSCO.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

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 2.11: GOOSE Control Block configuration menu.

## NOTICE

All the lines in the GOOSE GCB data point lists must indicate OK, otherwise no data is sent. See Figure 2.11.

The bit values to be received as GOOSE data are defined in the “GOOSE Subscriber: DATA POINTS” menu. See Figure 2.12.

NI	App ID(Hex)	Conf Rev	Data index	Bit index	Matching GOID	Value	Status	In use	Supervision group
1	0001	1	4	0	NoCheck	0	NO DATA	Yes	Group1
2	0001	1	4	1	NoCheck	0	NO DATA	Yes	Group1
3	0002	1	2	0	NoCheck	0	NO DATA	Yes	Group1
4	0002	1	2	1	NoCheck	0	NO DATA	Yes	Group1

NI	App ID(Hex)	Conf Rev	Data index	Matching GOID	Value	VAI Unit	Status	In use	Supervision group
1	0002	1	1	NoCheck	0.00 C	C	NO DATA	No	Group1
2	0002	1	1	NoCheck	0.00 C	C	NO DATA	No	Group1
3	0002	1	2	NoCheck	0.00 C	C	NO DATA	No	Group1
4	0002	1	3	NoCheck	0.00 C	C	NO DATA	No	Group1
5	0002	1	4	NoCheck	0.00 C	C	NO DATA	No	Group1

Figure 2.12: GOOSE Subscriber data points (see explanations in the text below).

Explanations to “GOOSE Subscriber: DATA POINTS”:

- NI = index of GOOSE Network Input for the received GOOSE data point (can be binary or analog). Binary NIs can be used as inputs for the user-defined logic blocks or as control inputs in the other functions of the relay (e.g. the output matrix). Analog Nis (Virtual Analog Inputs) can be used as coupling in programmable stages.
- App ID = Application ID of the incoming GOOSE message
- Conf Rev = Configuration Revision of the incoming GOOSE message
- Data index = Index of the data element in the incoming GOOSE message
- Bit index = Index of the bit inside received value to be taken as value for binary NI (in this way for example particular bit from 2bit encoded object position can be taken)



- Matching GOID = if the “GOOSE ID” of the incoming message is to be checked, then this column defines the number of the GOOSE ID from the list of GOOSE IDs defined in “GOOSE main configuration menu”
- Value = data value received in the GOOSE data packet
- VAI unit = unit of the incoming analogue data
- Status = status of the GOOSE data NO DATA / OLD etc...
- Supervision group = number of the group which is used to indicate possible communication problems

### NOTICE

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. If this is not possible due to publisher configuration capabilities validation can be also made by using GOOSE ID strings.

VAMP devices accept following data types as a source of binary signals: BOOLEAN and starting from firmware version 10.125: BITSTRING (for example object position or quality), INTEGER and UNSIGNED INTEGER. Reception of data of not supported type will cause that corresponding NI will get “BAD TYPE” status and will be invalid. Setting bit index out of range (for example 2 for 2 bit long bit string or 32 for integer) will also cause that corresponding NI will get “BAD TYPE” status.

VAMP devices accept following data types as a source of analog signals: FLOAT, INTEGER and UNSIGNED INTEGER. Reception of data of not supported type will cause that corresponding NI will get “BAD TYPE” status and its value will be set to 0. Internally analog signals are stored as scaled integer values with accuracy of 0.01. Due to that reason received integer value of 100 will be seen as value 1.00. In contrary received floating point value if 100.0 will be seen as 100.00.

## 2.6 Creating ICD files with VAMPSET

An 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.

### 2.6.1 Creating an ICD file online

In order to create the IEC61850 description file, connect the device with VAMPSET and select “Communication” → “Get ICD File”. From the ICD file generation options you can select whether the RCB names in the file contain indexes or not (selection of “RCB names with indexes” means that in the ICD file each RCB name will include an explicit two digit

index, otherwise this index is assumed to be added by the client when referencing the RCB). The need for indexed or non-indexed report control block names in the ICD file depends on the client system – in most cases the indexes are not required in the ICD file and will be added by the client system.

You can also enable some features of the 61850 Edition 2 – normally you can skip these. However, to be able to set up GOOSE data exchange using system configuration tool (like e.g. VAMP SCD Editor), in SCL Generation Options it is recommended to check Edition 2: Not configured GOOSE network inputs. In this way the ICD file will inform the system configuration tool about the GOOSE Subscriber capability of the relay.

After the selection of wanted features, press OK. The ICD file is generated and you will be prompted to choose a directory and name for saving the ICD file.

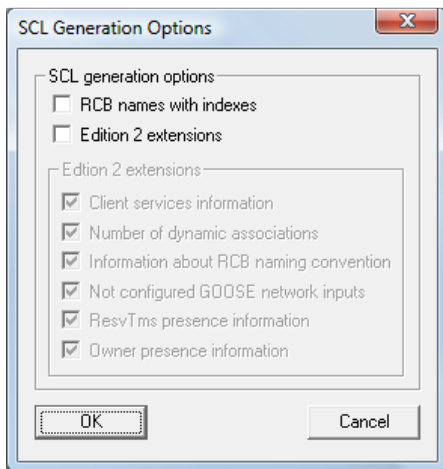


Figure 2.13: Creating an ICD file with VAMPSET.

## 2.6.2 Creating an ICD file offline

ICD files can also be created with VAMPSET offline, without opened connection to the device. This is, however, possible for firmware versions for which the resource files are available in VAMPSET tool (from 10.93 version onwards). The resource file is located in VAMPSET tool folder “ICD”.

## 2.7 Creating an IID file with VAMPSET

An Instantiated IED Description (IID) file defines the configuration for one IED for a substation project and is used as data exchange format from the IED configurator to the system configurator. This file contains only the data for the particular IED being configured: one IED section, the communication section with the IED’s communication parameters, the IED’s data type templates and optionally, a substation section with the binding of functions (LNnodes) to a single line diagram.

An IID file is created by connecting Vampset to a device and selecting “Communication”→ “Get IID file”. This will show the same prompt as when creating an ICD file (Figure 2.13).

From the IID generation options you can select whether the RCB names in the file contain indexes or not (selection of “RCB names with indexes” means that in the ICD file each RCB name will include an explicit two digit index, otherwise this index is assumed to be added by the client when referencing the RCB). The need for indexed or non-indexed report control block names in the ICD file depends on the client system – in most cases the indexes are not required in the ICD file and will be added by the client system.

You can also enable some features of the 61850 Edition 2 – normally you can skip these. However, to be able to set up GOOSE data exchange using system configuration tool (like e.g. VAMP SCD Editor), in SCL Generation Options it is recommended to check Edition 2: Not configured GOOSE network inputs. In this way the ICD file will inform the system configuration tool about the remaining un-configured GOOSE Network Inputs in the relay (otherwise only the configured NIs will be listed in the IID file).

After selection of wanted features, press OK. The IID file is generated and you will be prompted to select a directory in which to save the IID file.

### 3 Configuring a device with SCD file

The configuration of the IEC 61850 interface in VAMP devices can be updated according to a system setup defined in an SCD file. SCD files are created with the system configuration tool used, such as VAMP SCD Editor or some similar tool.

To configure a VAMP device using an SCD file, connect Vampset to the device and select “Communication” → “Configure using SDC file”. This will bring up a file browsing window. In this window, navigate to the SCD file intended to be used, select it and press “Open”.

After reading the SCD file with Vampset, the following parameters will be updated in the device (if they have values set in the SCD file or the default values are implied by the SCD file):

1. Relay IP Address information
  - i. IP address
  - ii. Network mask
  - iii. Gateway address
2. Network time protocol server address (NTP address)
3. IEC 61850 protocol stack addresses
  - i. AP ID
  - ii. AE Qualifier

- iii. P selector
- iv. S selector
- v. T selector
4. IED name
5. Buffered and unbuffered report control block configuration parameters
  - i. Dataset name
  - ii. Report ID
  - iii. Integrity period
  - iv. Buffering time
  - v. Triggering options
  - vi. Optional fields
6. GOOSE publisher parameters
  - i. GOOSE ID
  - ii. Configuration revision
  - iii. Application ID
  - iv. MAC Address (destination)
  - v. VLAN priority
  - vi. VLAN ID
7. GOOSE subscriber parameters
  - i. MAC Address
  - ii. For all network inputs: AppID, Configuration Revision, Data index and *In use* flag
  - iii. For binary network inputs additionally Bit index

The configuration of GOOSE subscriber parameters can be rejected if the configuration of network inputs is inconsistent, for instance:

- i. IED publisher data are sent using different MAC destination addresses (only one address is allowed in VAMP)

## NOTICE

Please remember that configuration parameters provided by SCD files overwrite the current values in the device. For instance, in the case of GOOSE subscribers, the network inputs are defined according to the SCD file, and the previous setup is cleared.

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