Fault annunciator systems
Interface description

➔ Interface description IEC 61850 for USM and WAP-K

Operating manual

MSM-S850-BA-UK-000

Table of content

1 Validity

This description is valid for the IEC 61850 interface of the following devices

Window facia annunciators (WAP-K)   from Software Packet Version 003.000.000
Annunciators with protocol interface (USM)   from Software Packet Version 003.000.000.

2 General notes

2.1 Additional instructions

> **Note!**
>
> This manual provides the safe and efficient use with the protocol interface of the annunciator series USM and WAP-K (in the following called „ fault annunciator" or "device"). The manual is part of the device and must be stored always accessible for the personnel in direct proximity of the device.
>
> The personnel are supposed to thoroughly read and fully understand this manual prior to starting any works. The major condition for secure handling is to obey to all security and usage procedures described in this manual.
> Furthermore the local prevention advices and general security preventions in the installation site are obligatory.
>
> The illustrations included in this manual serve for essential comprehension and are subject to modifications matching the application.

2.2 Usage

This manual is a prerequisite for secure mounting and safe operation of the product and must be read and understood before mounting.

2.3 Target group

This manual was written for qualified personnel which – based on their specific education and knowledge and experience as well as their knowledge of the relevant norms and regulations – are subject to deal with electrical sites and able to recognize and prevent possible hazards.

The qualified personnel are trained especially for the working environment and are familiar with the norms and regulations.

2.4 Symbol definition

Security advice

Security advices are indicated with symbols in this manual. The security advices are expressed through signal words that characterize the extent of the hazard.

> **Note!**
> This symbol warns of a situation which can lead to malfunction or dangerous situations if not noted.

ENVIRONMENTAL PROTECTION!
This combination of symbol and signal word warns of possible hazards for the environment.

Important passage

This symbol accentuates especially important passages.

Tips and recommendations

This symbol accentuates useful tips and recommendations for an efficient and failure-free operation.

Cross reference

This symbol refers to figures and other passages in this document or to further reading.

Further markings

To accentuate operation instructions, results, listings, cross references and other elements, the following markings are used in this manual:

Marking	Description
	Step-by-step operation instructions
	Results of operation steps
	Cross reference to sections of this manual and to further applicable documents
	Listings without fixed sequence
[Button]	Control elements (e.g. buttons, switches), Indication elements (e.g. signal lamps)
„Display"	Display elements (e.g. push buttons, assignment of function buttons)

2.5 Safety instructions

The interface of the fault annunciators is intended for use according to the applications described in this manual only and may only be used according to the conditions as described in the section "Technical Data". Every use that exceeds the appropriate use or unauthorized use is considered as incorrect use.

> **WARNING!**
> **Hazard of incorrect use!**
> Incorrect use of the annunciator can lead to hazardous situations.
>
> - Do never use the annunciator in EX-areas.
> - Do never use the annunciator within the range of irradiation sensitive devices without considering the special precautions therefor.
> - The annunciators may not be opened or improperly modified.

2.6 Customer service

For further technical information please contact our customer service:

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Further we are looking forward to receiving feedback and experiences which result from the application and are useful for improvement of our products.

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3 Introduction

This documentation comprises the description of the IEC 61850 interface of the annunciator series USM and WAP. For information on the basic characteristics of the annunciators and the parameterisation of the annunciator functions, please refer to the separate documentation of the devices. In this manual only the interface and its parameterisation are explained.

> In this manual only the possible settings of the annunciator will be explained (→ interoperability list of the respective device).
>
> In the following sections, we will refer to the respective parts of the standard, where further information can be found to the respective topic.

For communication with superior or inferior third party systems in the control or process level the annunciators provide one or two interface cards. Through one of the Ethernet interfaces (the respective interface can be freely chosen) the annunciators can be linked to third party systems through the protocol IEC 61850 (→ **annunciator is IEC 61850 server**).

> Additionally the annunciator can be linked to third party systems through the protocols IEC 60870-5-101 and -104, respectively. For details on these protocol interfaces please refer to the separate documentation MSM-S10M-BA-UK. A combination of these protocols within one device is possible.

In automated substations information from field- and protection devices are transmitted through the protocol IEC 61850.

In addition, various specific single point alarms are available which – depending on the type of information – need to be transmitted to the SCADA system or to other devices on field or station level.

The WAP-K adopts this "rag-man" functionality and provides these single point information on the integrated IEC 61850 server.

Individual reports and datasets can be configured easily which contain all relevant information about the alarm and device status.

The IEC 61850 communication can be enabled in every WAP-K or USM annunciator by means of a license key.
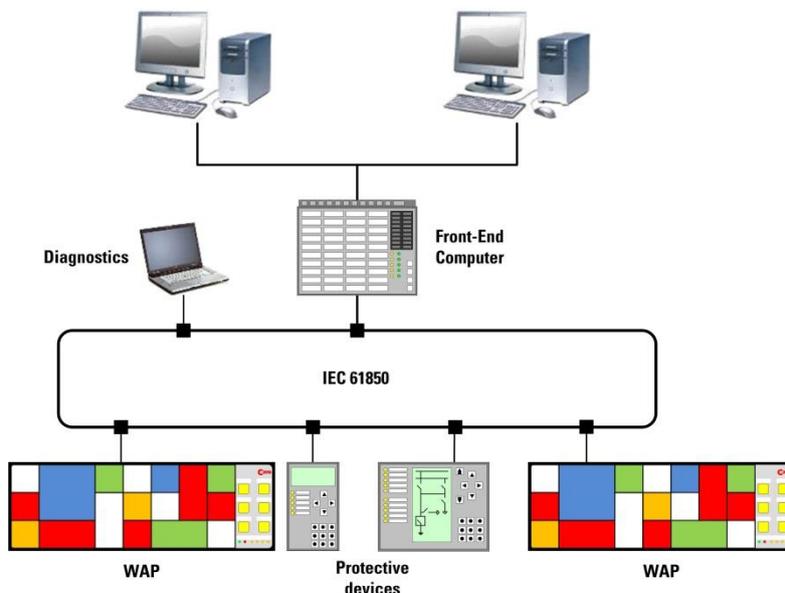
Bild 3.1: Application example for use of WAP-K annunciators as IEC 61850 „rag-man"

The IEC norm defines different ways of communication for data exchange between devices.

The annunciators of the series USM and WAP-K work as IEC 61850 server and provide signal and device information which can be subscribed in reports from IEC 61850 clients or directly be read by command.

Additionally, commands which are received through the IEC 61850 interface can be executed in the annunciator.

The available data objects are structured as GGIOs (→ for details please refer to section 4 „Data objects").

> ℹ The single alarm channels can alternatively be triggered from the galvanic input or from the IEC interface. These options can be chosen individually for each channel. Acknowledgement through the IEC interface is possible as well.

4 Data objects

4.1 Data object types

The USM provides numerous information about alarm and device status, which are available on the IEC 61850 interface. The different data objects are enlisted in the following:

4.1.1 Data object types for reading

LPHD1	Physical Health:	Device status or device error, respectively (1=ok, 3=alarm) PhyHealth
GGIO1	Input:	Physical activation of the input SPCSO1 – SPCSO48 correlate with the respective inputs
GGIO2	Input delayed:	Input is activated, after expiration of the response delay SPCSO1 – SPCSO48 correlate with the respective inputs
GGIO3	Alarm unacknowledged:	Alarm at issue or receded (stored alarm, unacknowledged) SPCSO1 – SPCSO48 correlate with the respective inputs
GGIO4	Alarm:	Alarm at issue and stored (output-parallel) for 2-frequency: not reset (acknowledged and stored) SPCSO1 – SPCSO48 correlate with the respective inputs
GGIO8	Function input:	Function input 1 or 2 is operated SPCSO1 – SPCSO2 correlate with the respective inputs
GGIO71	Collective report:	Collective report 1, 2 or 3 is triggered SPCSO1 – SPCSO3 correlate with the respective collective reports
GGIO72	Horn:	Horn is triggered SPCSO1 correlates with the horn
GGIO6	Function output:	Function relay 1…4 is triggered SPCSO1 – SPCSO4 correlates with the respective relays
GGIO7	Output:	Repeat relay is activated SPCSO1 – SPCSO40 correlate with the respective relays
GGIO09	Button:	Button 1 .. 6 is operated (USM: Button 1 .. 4 is operated) SPCSO1 – SPCSO6 correlate with the respective buttons
GGIO73	Lamp test:	Lamp test was triggered and is still active SPCSO1 correlates with the lamp test
GGIO100	Input as double report:	2 inputs as one double report (undelayed) (always 1st channel odd, 2nd channel even) DPCSO1– DPCSO24 correlate with the respective pairs of inputs
GGIO74	Error:	Device error

	SPCSO1	Device error is triggered
	SPCSO11	Parameter Init error
	SPCSO12	Internal communication error
	SPCSO13	Overflow alarm buffer
	SPCSO14	Relay card faulty
	SPCSO15	Slave error
	SPCSO17	Power supply 1 missing
	SPCSO18	Power supply 2 missing
	SPCSO19	Configuration inconsistent
	SPCSO31	IEC61850 licence faulty
	SPCSO32	CID file missing
	SPCSO33	XML file missing
	SPCSO34	XML import faulty
	SPCSO35	CID file faulty
	SPCSO41	Slave address faulty
	SPCSO42	Slave address conflict
	SPCSO63	IEC104 client error
	SPCSO64	Ethernet connection 1 faulty
	SPCSO65	Ethernet connection 2 faulty
	SPCSO67	IEC104 client GI incomplete

SPCSO68   NTP server not available

4.1.2 Data object types for writing

GGIO40	Input set:	Input is triggered by command SPCSO1 – SPCSO48 correlate with the respective inputs Writing triggers the respective input and the alarm sequence, value change triggers the alarm.
GGIO50	Function output set:	Function relay is triggered by command SPCSO1 – SPCSO4 correlate with the respective relays The relay is set, value change triggers the relay.
GGIO60	Output set:	Repeat relay is triggered by command SPCSO1 – SPCSO40 correlate with the respective repeat relays The relay is set, value change triggers the relay.
GGIO110	Output set as double command:	Repeat relay is triggered by command as double command (always 1st relay odd, 2nd relay even) The corresponding relays are triggered as pulse command with the defined pulse width (as defined in Tab „repeat relays"). DPCSO1– DPCSO20 correlate with the respective pairs of relays Both relays are triggered according to the value.
GGIO80	Commands:	SPCSO1: Acknowledgement collective report group 1 SPCSO2: Acknowledgement collective report group 2 SPCSO3: Acknowledgement collective report group 3 SPCSO4: Reset collective report group 1 SPCSO5: Reset collective report group 2 SPCSO6: Reset collective report group 3 SPCSO7: Acknowledgement horn SPCSO8: Lamp test SPCSO9: Function test The corresponding command is triggered.

4.1.3 Data object types for multiple devices in a cascaded system

The data objects are available for the master device as well as for slave devices within a cascaded system.

To differentiate the same object types between different devices, the objects are identified with the number of the respective device (Master device = 0, slave devices 1…3 = 1…3).
In the following overview the object types for the maximum number of 4 devices in a cascaded system are enlisted with the following sequence:

GGIO(master device), GGIO(slave1), GGIO(slave2), GGIO(slave3)

Read:

Input:	GGIO1, GGIO11, GGIO21, GGIO31
Input delayed:	GGIO2, GGIO12, GGIO22, GGIO32
Alarm unacknowledged:	GGIO3, GGIO13, GGIO23, GGIO33
Alarm:	GGIO4, GGIO14, GGIO24, GGIO34
Function input:	GGIO8, GGIO18, GGIO28, GGIO38
Collective report:	GGIO71
Horn:	GGIO72
Function output:	GGIO6, GGIO16, GGIO26, GGIO36
Output:	GGIO7, GGIO17, GGIO27, GGIO37

Parameterisation

Button: GGIO9, GGIO19, GGIO29, GGIO39
Error: GGIO74
Lamp test: GGIO73
Input as double report: GGIO100, GGIO101, GGIO102, GGIO103

Write:
Input set: GGIO40, GGIO41, GGIO42, GGIO43
Function output set: GGIO50, GGIO51, GGIO52, GGIO53

Output set: GGIO60, GGIO61, GGIO62, GGIO63
Output set
As double command: GGIO110, GGIO111, GGIO112, GGIO113
Commands: GGIO80

4.2 Read data objects

4.2.1 Read data object through command

A data object (e.g. SPCSO1) can be read with a „read-command". The current value of the object will be returned.
If the value of the object changes, a new „read"-command is mandatory to notice the change.
Also, all data objects of a GGIO can be selected and read at once with a „read"-command.

To capture value changes of single data objects spontaneously, these can also be read periodically by means of a „poll"-command.

4.2.2 Read data objects dataset and report

To capture value changes, the respective data objects are written into a dataset and read by a report.
Thus any changes will be transmitted spontaneously and don't have to be read periodically.

4.2.2.1 Dataset

A dataset is formed from a table which contains the data objects that are to be monitored.
The datasets can be compiled from the respective data objects on the web-interface by drag and drop.

4.2.2.2 Report

A report is the control object for a dedicated dataset which is registered in the report.
For each dataset a report is necessary for activation of reading of the values.
The reports are listed in the logical node LLN0 in the tag „RP" and can be activated there.

4.3 Write data objects

The data object to be changed offers different services:
Operate   (Oper)   Write value of the object
Select   (SBO)   Select object before changing the value (Select before operate)
Abort   (Cancel)   Abort previous command

To change a value, the command „write" has to be selected and the value has to be set to „true" or „false".

4.3.1 Direct control

The value can be changed directly with the service „oper".

4.3.2 SBO control

The object has to be selected first with the service „SBO" and can then be changed with the service „oper".

5 Parameterisation
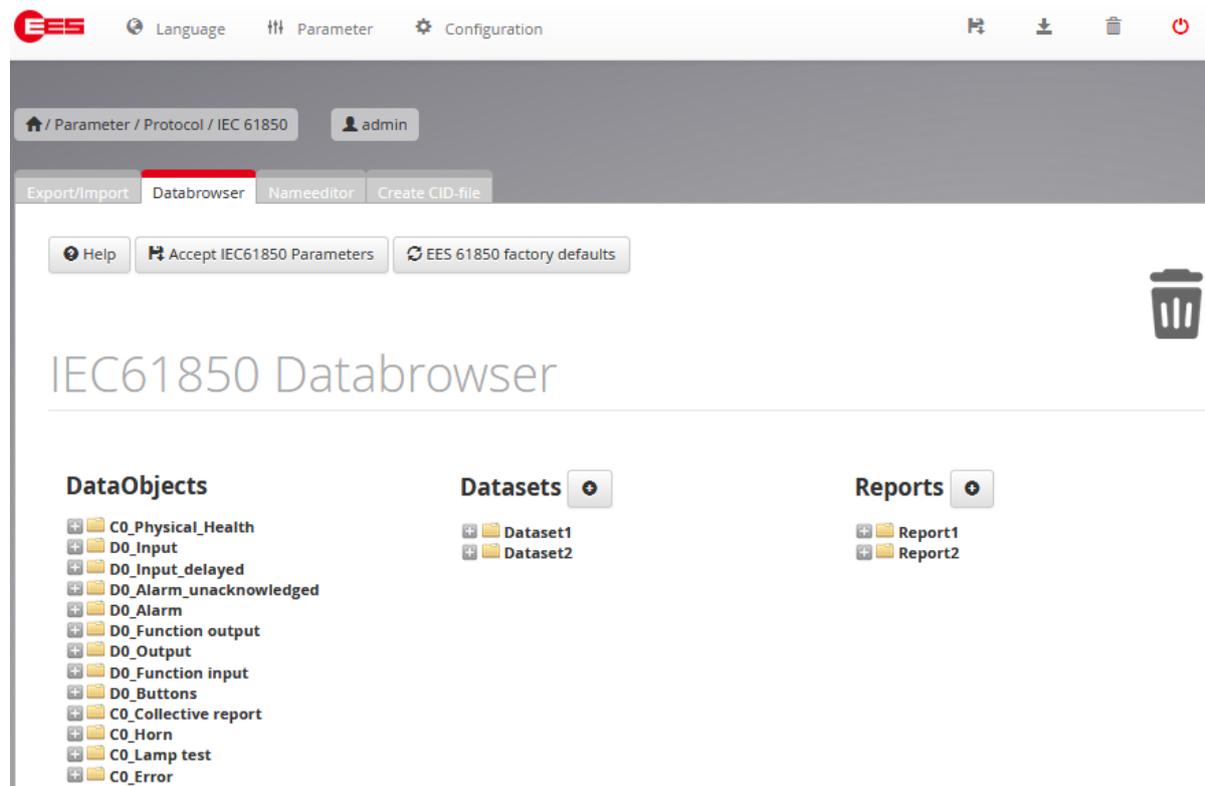
Fig. 5.1: Menu IEC 61850

The settings for the IEC 61850 protocol interface can be done in the menu „IEC 61850". This menu is available only in the online parameterisation interface of annunciators with integrated Web-server (USM, WAP-K).
The annunciator can communicate as IEC 61850 server with up to 16 clients at a time.

The page is structured into 4 sub-menus by tabs:

- Export/Import
- Data browser
- Name editor
- Create CID-file

Any changes done to the parameterisation will be transferred to and included into the CID-file, which is locally stored on the annunciator, with the button „accept IEC61850 settings". The IEC 61850 stack will be restarted with the changed settings subsequently.

With the button „61850 factory settings" the default settings (→ section 5.1.4 Default settings) can be loaded.

Parameterisation
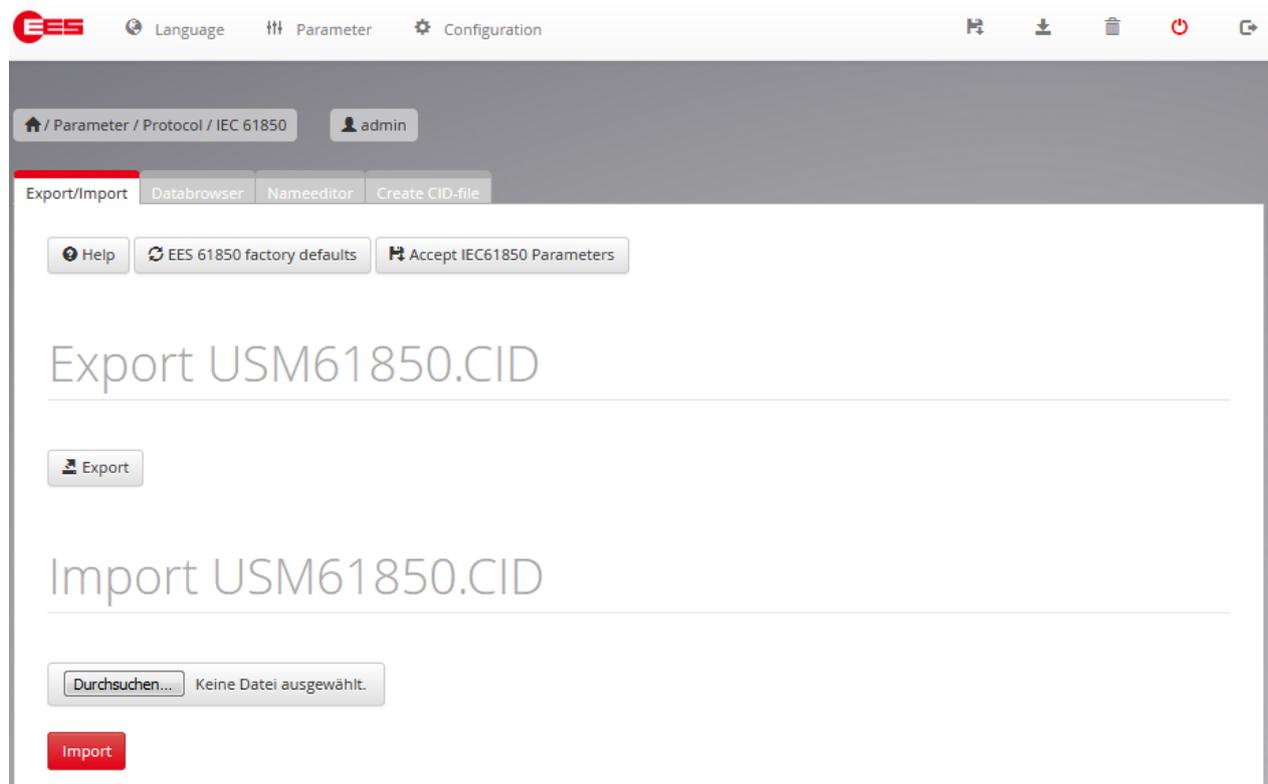
5.1 Export/Import

Fig. 5.2: Menu IEC 61850, Tab Export/Import

In this menu, the basic definitions for the IEC 61850 interface can be done.

5.1.1 Selecting the Ethernet interface

If a CID-file is imported into the annunciator, the IP-settings (IP-address, subnet mask, gateway (definition and display of these parameters in the menu "System", Tab "Network")) will be adopted from the CID-file for the respective IP-settings of the annunciator.
With the selection buttons „Eth0" and „Eth1" the respective interface is defined, which will be affected by these settings.

Eth0   Socket X8 (always equipped for annunciator if the series USM and WAP-K)
Eth1   Socket X98 (located on the optionally integrated 2nd interface card)

5.1.2 Export CID

The locally on the annunciator stored CID-file is exported to the defined path on the computer and can be further processed from there.

5.1.3 Import CID

The selected CID-file will be imported to the annunciator and processed there. In this case also the IP-settings will be changed accordingly.
The IEC 61850 stack will be restarted with the changed settings subsequently.

5.1.4 Default settings

With the button „61850 factory settings" the default settings are loaded. These can be transferred to and included into the CID-file, which is locally stored on the annunciator, with the button „accept IEC61850 settings". The IEC 61850 stack will be restarted with the changed settings subsequently.

As supplied from the factory (=default settings) a CID-file is contained in the annunciator which can be exported and further processed.
This CID-file contains all data objects as described in → chapter 4.1 for the master device. The data objects for double reports and double alarms however are not included.
If the annunciator is operated as master device within a cascaded annunciator system, the required data object for the slave devices have to be added on the parameterisation interface (→ section 5.4 Create CID-file).
In the default CID-file additionally two exemplary datasets are included:
-    Dataset 1: contains the data objects fort he delayed inputs
-    Dataset 2: contains the data objects for the device errors.
Each of these datasets is assigned to a report accordingly:
-    Report 1: contains dataset 1
-    Report 2: contains dataset 2.
These datasets and reports can be used as a basis for edification of individual application-specific datasets and reports.
Of course these datasets and reports can also be deleted and own files can be created.

5.2 Databrowser
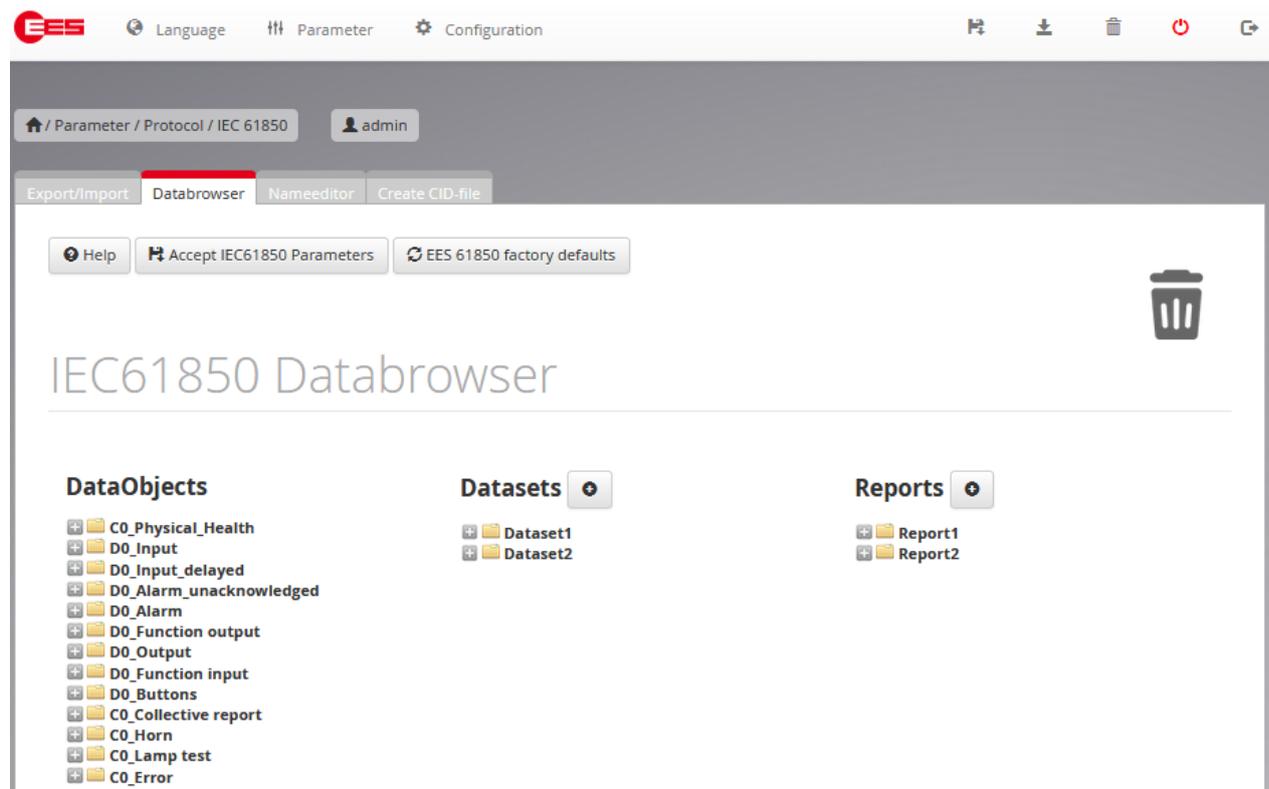
Fig. 5.3: Menu IEC 61850, Tab Databrowser

In this dialog the reports can be defined, which will be sent to the subscribing clients from the annunciator. For this, the required data objects can be dragged into the respective datasets by drag and drop and then the datasets can be assigned to the reports accordingly.

5.2.1 Available data object types

Always all data objects as defined in the CID-file will be displayed and are available for integration into datasets. In this menu, only the datasets and report can be edited. The defined objects are always available and can only be assigned to or deleted from the respective datasets.

As described in → section 4.1, in the default settings all data object types for the master device are available, except for double reports and double commands.
If an individual CID-file is generated from the menu „Create CID", any unrequired data object types can be omitted – these will then not be available in the CID-file and can thus not be selected in the data browser. This allows for a clearly arranged breakdown of the data browser, especially for cascaded annunciator systems that consist of multiple devices with various data object types each.

> Please note that empty datasets are allowed, each dataset has to contain at least one data object.
> In a report, a valid dataset-name must be registered.

5.2.2 Deleting datasets and reports

To delete a dataset or report, the respective object can be dragged into the paper bin.
If a dataset is deleted, the corresponding name has to be removed from the report or the respective report has to be deleted as well.

5.2.3 Parameters of the reports

By clicking on the respective element an additional dialog is opened for changing the value of the element:

Available and editable parameters in a report are (please also refer to the standard IEC 61850-7-1)

Dataset:
- Name — Name of the report
- datSet — Name of the corresponding dataset
- bufTime — Time to elapse after the first value change until the data will be sent
- intgpd — Cycle time until all data of the report will be sent automatically (integrity period)
- buffered — buffered or unbuffered data transmission
- confRev — Configuration revision: version number for identification if an object has been added to or deleted from the dataset

Trigger: — defines when the data transmission will be started:
- dchg — Data change
- qchg — Quality change

Options: — set options:
- seqNum — Sequence number of the report will be transmitted
- reasonCode — Cause for transmission will be transmitted

Reports enabled:
- max — maximum number of entities of a report

5.3 Nameeditor
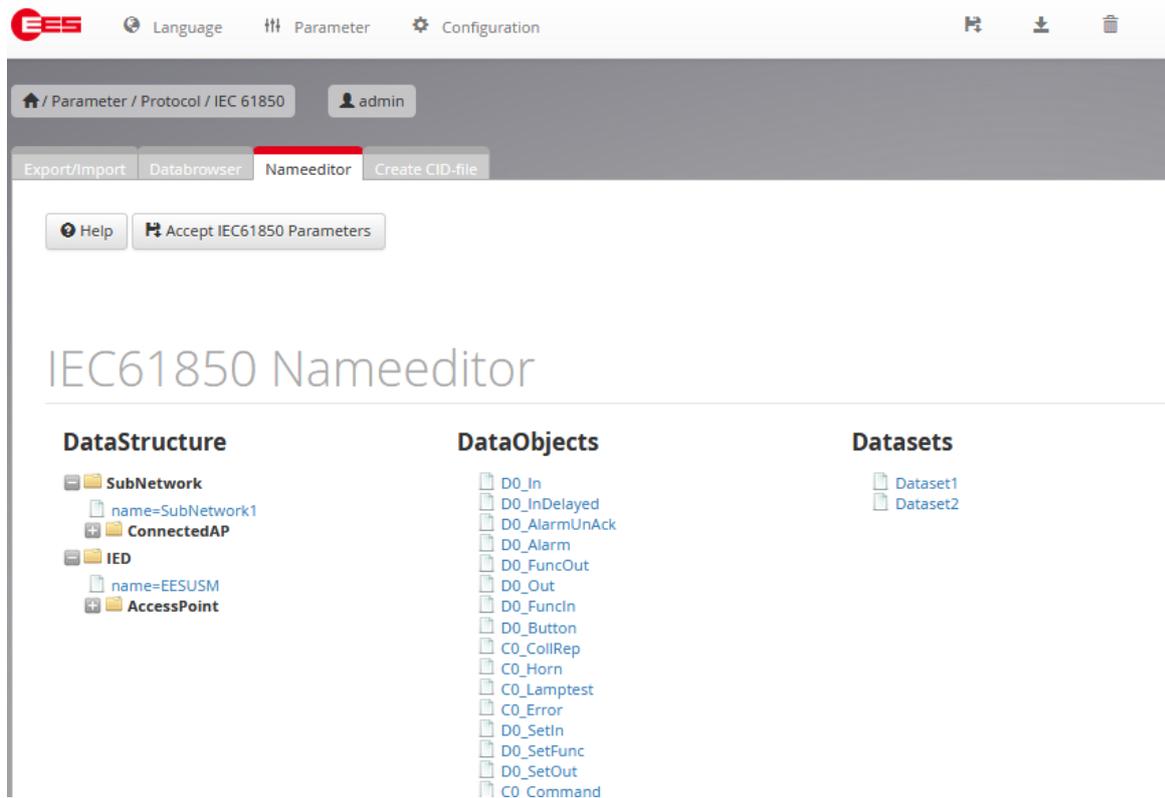
Fig. 5.4: Menu IEC 61850, Tab Nameeditor

In this menu the names of single elements in the CID-file can individually be adapted.
By clicking on an element, an additional dialog is opened for changing the default name of this element:

Fig 5.5: Name editor

Only the names of the available objects can be edited, in this menu no objects can be added or deleted – this is only possible in the menu „Data browser".

The editing of certain designations may be necessary since some client systems only accept certain designation lengths or the designations have to start with a certain character. In this menu the designations can be adapted to the requirements of the utilised client system.
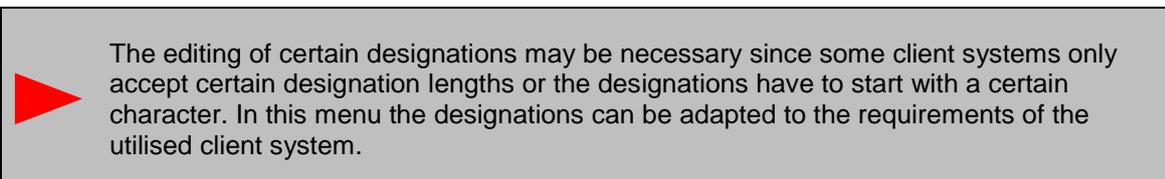
5.3.1 Data structure

Here the general designations in the CID-file can be changed:

SubNetwork:
- Name   Subnetwork-Name   Name of the network in which the device is included (defined by Subnet-Mask)

ConnectedAP:
- iedName   IED-Name   Device name within the IEC 61850 stack for addressing the USM functionality

- apName   Accesspoint-Name   Name of the entry point which defines the server within the system

IED:
- name   IED-Name   (see above)

AccessPoint:
- name   Accesspoint-Name   (see above)

LDevice:
- inst   LDevice Instance   Name of the logical device which provides all defined functions (objects) in the server

5.3.2 Data objects

Here the designations of all data objects in the CID-file can be changed.

5.3.3 Datasets

Here the designations of all datasets in the CID-file can be changed.

5.4 Create CID-file
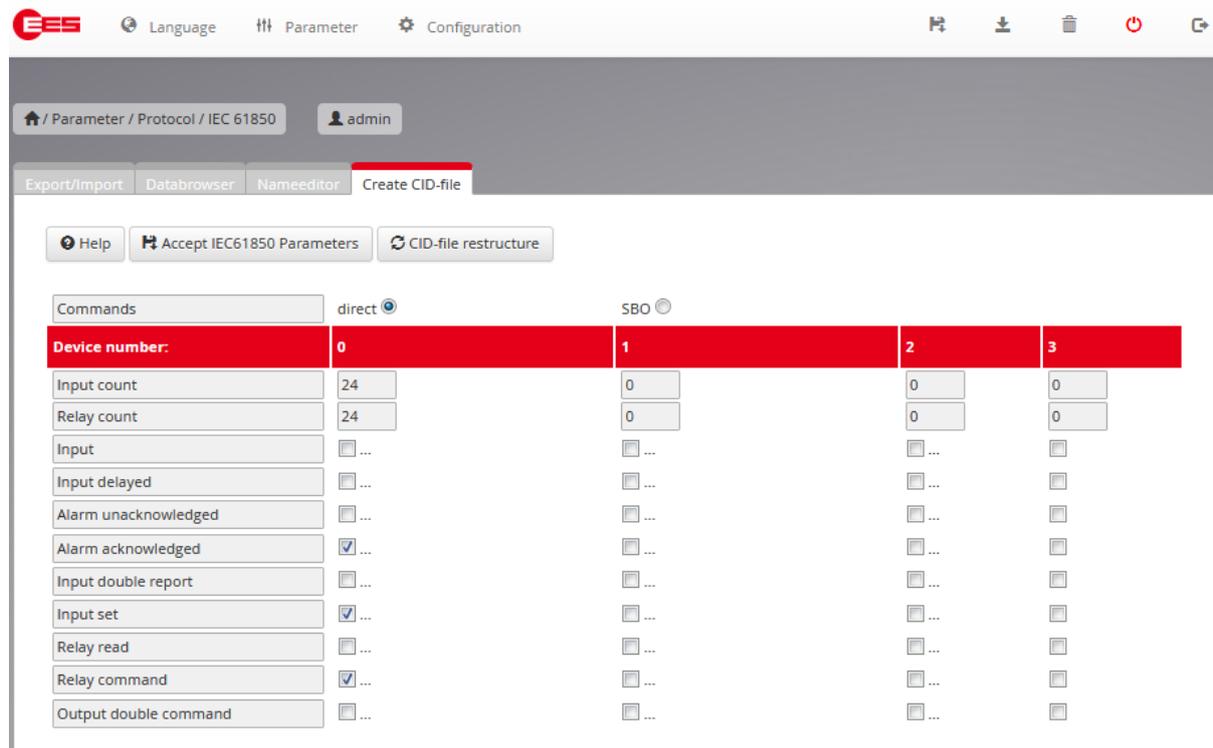
Fig. 5.6: Menu IEC 61850, Tab Create CID-file

If not all data objects as defined per default (→ section 5.1.4 Default settings) are required in the CID-file, in this menu the data objects to be contained in the CID-file can be defined.
The number of inputs and relays cannot be changed in this menu – these are defined by the hardware of the master device and the optionally connected slave devices.

When all required objects have been selected, this selection has to be updated in the CID-file of the annunciator respectively. For this, please click on the button „CID-file restructure".
To activate these changes in the CID-file for the current parameterisation of the annunciator, please complete the operation with click on the button „accept IEC 61850 parameters".

5.2.4 Mandatory data object types

The following data object types are mandatory and always included in the CID-file. These data object types cannot be removed from the CID-file:

5.2.4.1 Data object types for reading

LPHD1	Physical Health:	Device status or device error, respectively (1=ok, 3=alarm)
GGIO8	Function input:	Function input 1 or 2 is operated
GGIO71	Collective report:	Collective report 1, 2 or 3 is triggered
GGIO72	Horn:	Horn is triggered
GGIO6	Function output:	Function relay 1…4 is triggered
GGIO09	Button:	Button 1…6 is operated
GGIO73	Lamp test:	Lamp test was triggered and is still active
GGIO74	Error:	Device error 1 - 68

5.2.4.2 Data object types for writing

GGIO50	Function output set:	Function relay is triggered by command
GGIO80	Commands:	Commands: SPCSO1 - SPCSO9

5.2.5 Selectable data object types

The following data object types are facultative and can be included and removed from the CID-file, respectively:

5.2.5.1 Data object types for reading

GGIO1	Input:	Physical activation of the input
GGIO2	Input delayed:	Input is activated, after expiration of the response delay
GGIO3	Alarm unacknowledged:	Alarm at issue or receded (stored alarm, unacknowledged)
GGIO4	Alarm:	Alarm at issue and stored (output-parallel) for 2-frequency: not reset (acknowledged and stored)
GGIO7	Output:	Repeat relay is activated
GGIO100	Input as double report:	2 inputs as one double report (undelayed) (always 1st channel odd, 2nd channel even)

5.2.5.2 Data object types for writing

GGIO40	Input set:	Input is triggered by command Writing triggers the respective input and the alarm sequence, value change triggers the alarm.
GGIO60	Output set:	Repeat relay is triggered by command
GGIO110	Output set as double command:	Repeat relay is triggered by command as double command (always 1st relay odd, 2nd relay even) The respective relays are triggered as pulse command with the defined pulse width (as defined in Tab „repeat relays")

5.2.6 Options for execution of commands

To write values to the different objects, the following procedures are available.

5.2.6.1 Direct control with normal security

The value can be changed directly with the service "oper".

5.2.6.2 SBO control with normal security

The object must be selected first with the service "SBO" and can be changed with the service "oper" afterwards.

➜ **Contact**