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SIPROTEC 5 Application Note

SIP5-APN-019:
Flexible Engineering –
Modeling the System with the Options of IEC 61850

Answers for infrastructure and cities.

SIPROTEC 5 - Application:
SIP5-APN-019
Flexible Engineering – Modeling the System with the Options of IEC 61850

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1 Flexible Engineering – Modeling the System with the Options of IEC 61850

1.1 Summary

For the complete conversion of a system to IEC 61850 it is important that the modeling options of the standard can be used. In particular when assigning the IEC 61850 names for user-defined information and functions, flexibility is needed in order to make the modeling the customer desires actually visible on the interface. With the "Flexible Engineering" concept DIGSI 5 offers the solution.

1.2 Introduction

The IEC 61850 standard provides a large number of logical nodes (LN) in part 7-4. These nodes describe the functions made available by a protection device or bay controller. In this context we differentiate between integral device functions and functionality configured by the user. The first category comprises mainly protection functions but also e.g. the synchrocheck. These are type-tested functionalities the quality of which the manufacturer guarantees. These functions are assigned to the LN classes P (Protection) and R (Protection-related Functions), e.g. PDIS for distance protection or RSYN for synchrocheck. A fixed, unchangeable assignment of the function with its information to the standardized logical node is essential here for the sake of clarity.

The second categry comprises the other LN classes. These describe functions that are not permanently installed in the devices but are created by engineering or connection to external circuits. Typical examples are the nodes in the LN class S (Sensors and Monitoring), e.g. SIMG.

Although "circuit breaker" and "disconnector" switching devices are no functions in the protection device, modeling of control, interlocking and physical switch is performed so that these devices belong to the first categry and are permanently modeled as XCBR (circuit breakers) or XSWI (disconnetors).

This note describes how functions and information of the second category can be modeled freely with DIGSI 5 so that you can use the IEC 61850-7-4 description language for your system.

1.3 Task

With a SIPROTEC 5 device three gas-filled compartments of a gas-insulated switchgear are monitored. For this purpose the gas pressure is montiored using gas sensors that transmit the values measured to the device via 20mA interface. If a pre-defined limit value is reached an alarm is issued per gas compartment. Additionally, a group alarm is generated consisting of the OR logic operation of all individual gas compartment alarms.

For transmitting the warning messages via the IEC 61850 interface the logical node "SIMG" shall be used, which is provided for this purpose in the IEC 61850-7-4. (Description: Insulation Medium Supervision (Gas)).

The logical node is described in part 7-4 of the IEC 61850 standard (see Figure 1). Like the Common Logical Node Class it also possesses the "mandatory data objects" (mode, behaviour, health). In addition, the SIMG logical node has the data object „InsAlm“ (Insulation alarm) of the SPS type (Insulation gas critical, refill medium). This data object shall be supplied with the group alarm.

Additionally three measured values for gas pressure, gas density and gas temperature shall be transmitted.

SIMG class				
Attribute Name	**Attr. Type**	**Explanation**	**T**	**M/O**
LNName		Shall be inherited from Logical-Node Class (see IEC 61850-7-2)		
Data				
Common Logical Node Information				
		LN shall inherit all Mandatory Data from Common Logical Node Class		M
EEHealth	INS	External equipment health		O
EEName	DPL	External equipment name plate		O
Measured values				
Pres	MV	Isolation gas pressure		O
Den	MV	Isolation gas density		O
Tmp	MV	Isolation gas temperature		O
Status Information				
InsAlm	SPS	Insulation gas critical (refill isolation medium)		M
InsBlk	SPS	Insulation gas not safe (block device operation)		O
InsTr	SPS	Insulation gas dangerous (trip for device isolation)		O
PresAlm	SPS	Isolation gas pressure alarm		C

Figure 1: Specifications of IEC61850-7-4 for SIMG node (excerpt)
M=Mandatory, O=Optional; C=Conditional

1.4 Solution

The basis is a bay controller of the 6MD85 type with two transducer modules ANAI (each 4 x 20mA) for data acquisition, see Figure 2

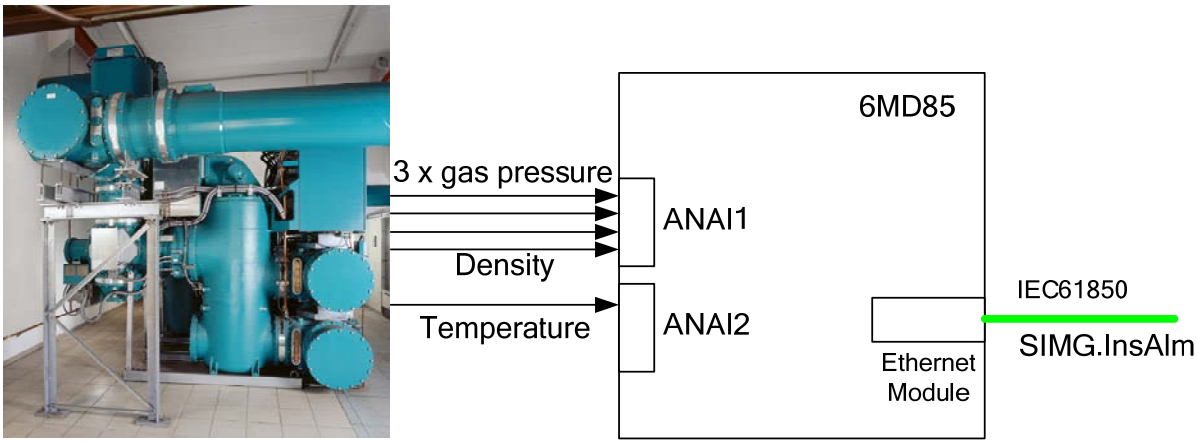

Figure 2: Acquisition of the measured values from a gas-insulated switchgear and transmission to IEC61850

After creating the two ANAI modules in the DIGSI hardware configuration the 8 channels for 20mA measured values are available in the "Information routing" editor. The three warning messages for the violation of the gas pressure limit are created in the CFC.

Below it is shown how the required function SF 6 Alarms is generated as an IEC 61850 element and adapted to the specific needs of the user.

To this purpose two editors are provided in DIGSI 5, enabling two different views of the same SIPROTEC 5 object structure. The "Information routing editor" shows the individual information from the user point of view whereas the "IEC 61850 structure editor" enables the IEC 61850 view and the adjustment of its structure to the customer requirements.

In a first step, the new customer-specific structures are created in the DIGSI 5 "Information routing editor". The library provides the appropriate function groups (FG), functions blocks (FB) and signals for this purpose. These elements can easily be moved into the routing matrix by Drag&Drop.

Figure 3 and Figure 4 show the new, user-defined function group in the "Information routing editor" and in the "IEC 61850 structure editor". The newly generated function group creates a new logical device UD1 in the IEC 61850 structure view that later on will be renamed "SF6 Alarming".

The structure is now completed by assigning a function block and further signals according to the structure of the logical node. See the representation in "Information routing" and "IEC 61850 structure editor" (Figure 5 and Figure 6)

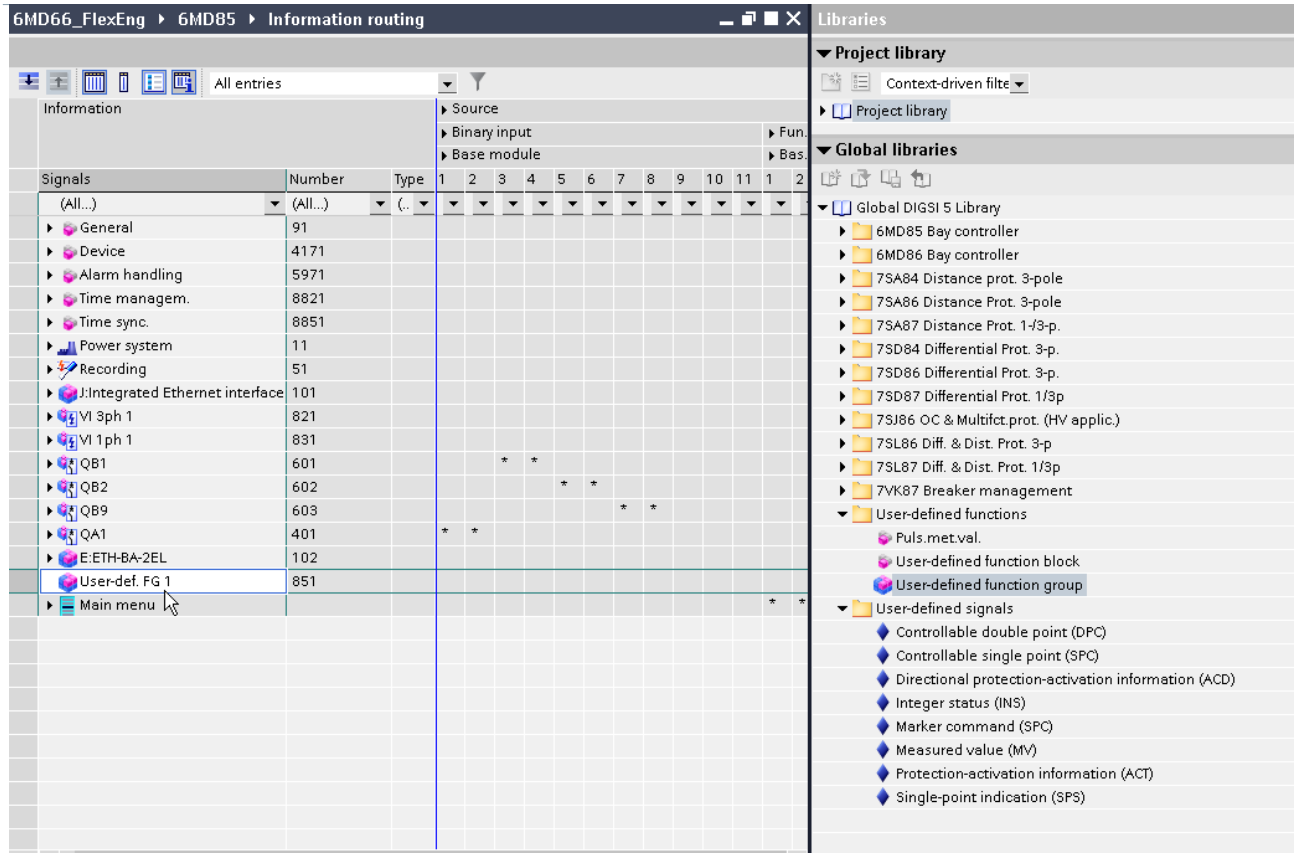

Figure 3: Creating a new function group in the "Information routing editor"

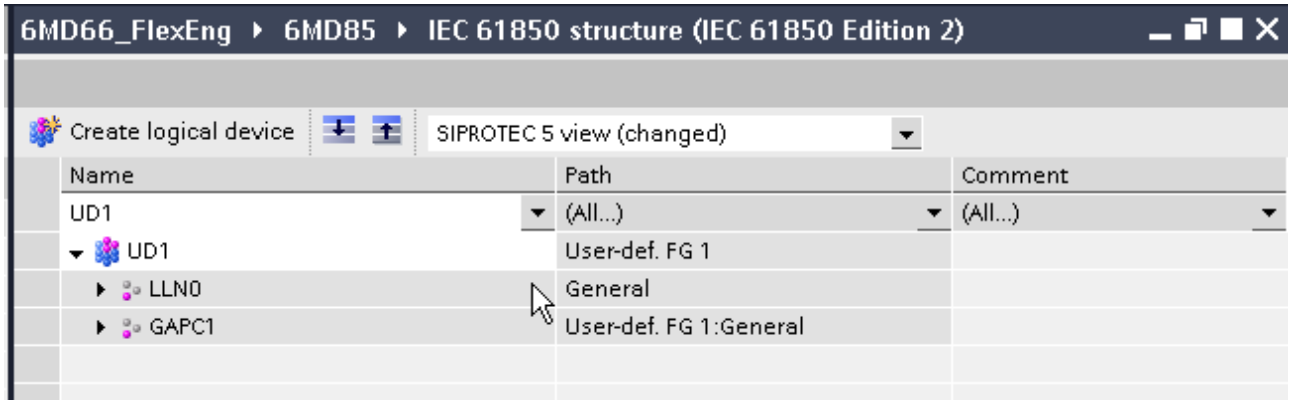

Figure 4: Representation of the user-defined function group as a logical device in the "IEC 61850 structure editor"

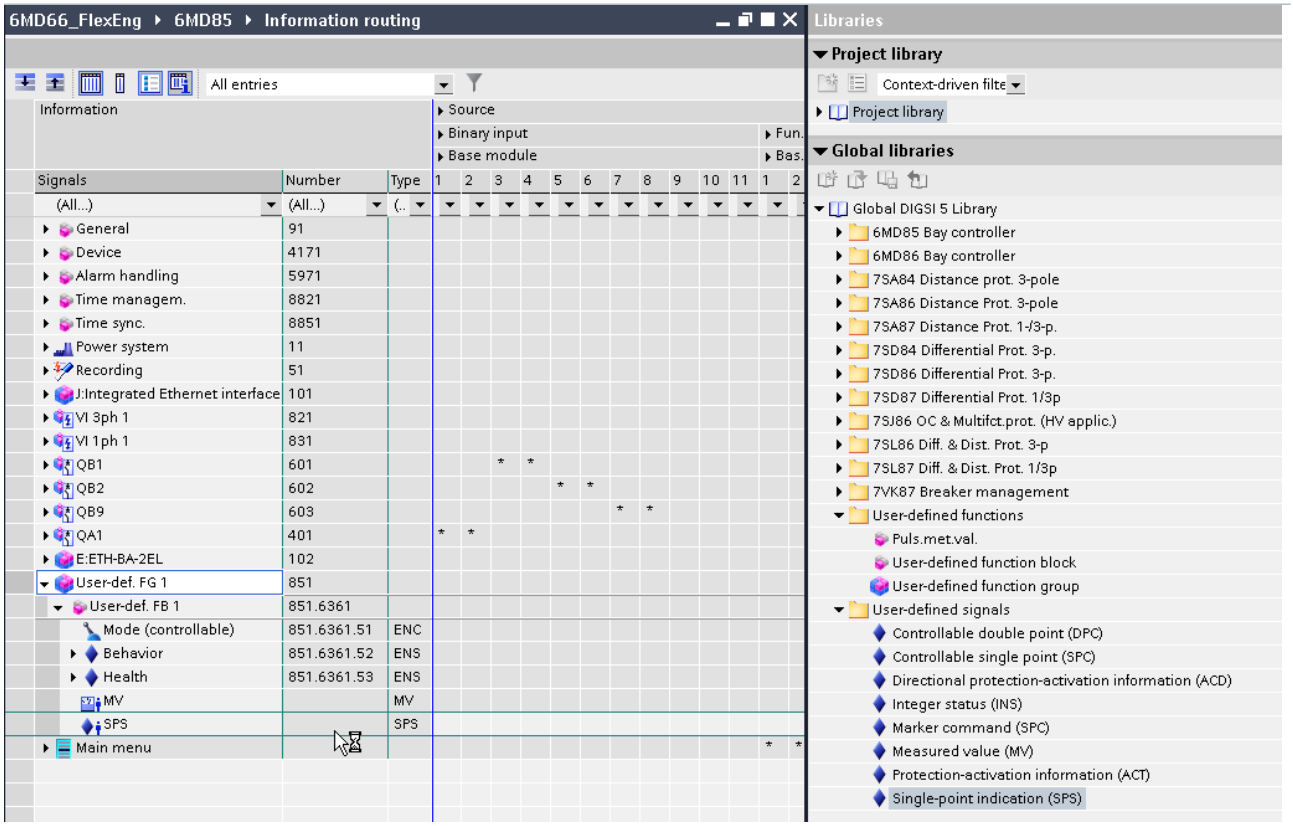

Figure 5: Representation of the complete new structure in the "Information routing editor"

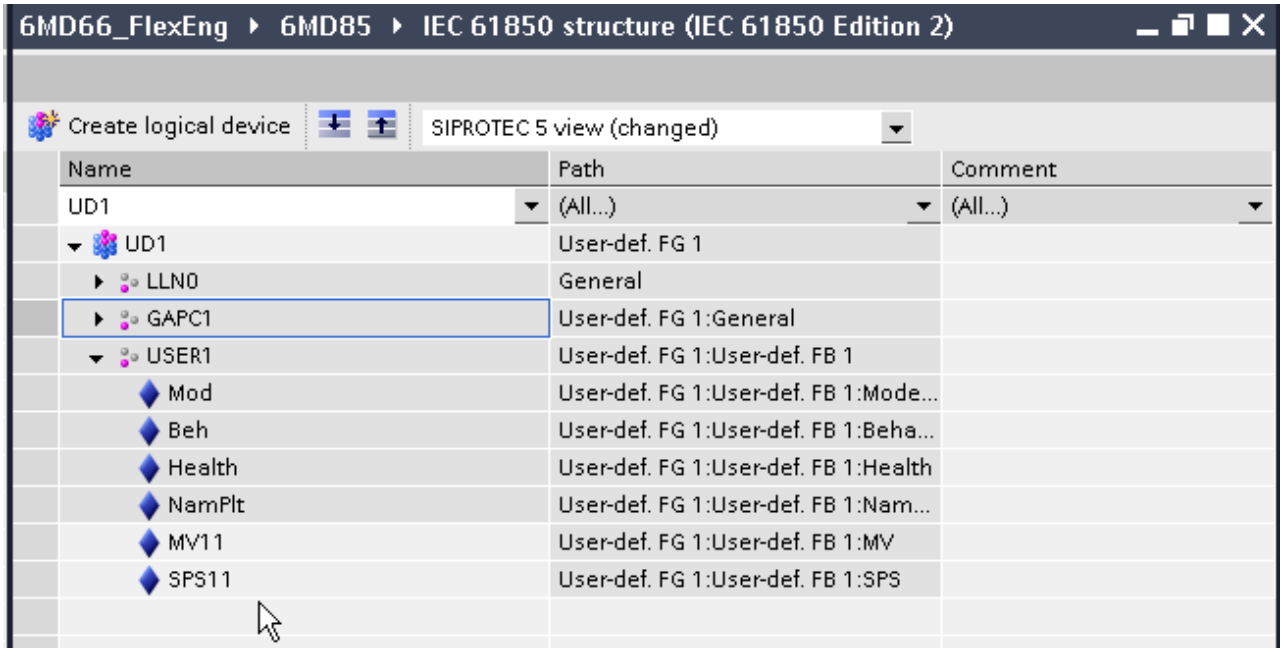

Figure 6: Representation in the "IEC 61850 structure editor"

The signals can now be moved and adjusted at will in the "IEC 61850 structure editor".

In the "Name" column the data is described in the IEC 61850 nomenclature and can be renamed within the limits of the standard. In the right column the "Path" appears with the user-specific texts, equally called description. These texts can easily be adjusted in the "Information routing editor".

With the help of this editor a flexible arrangement of the information from the IEC 61850 view can be achieved in DIGSI 5.

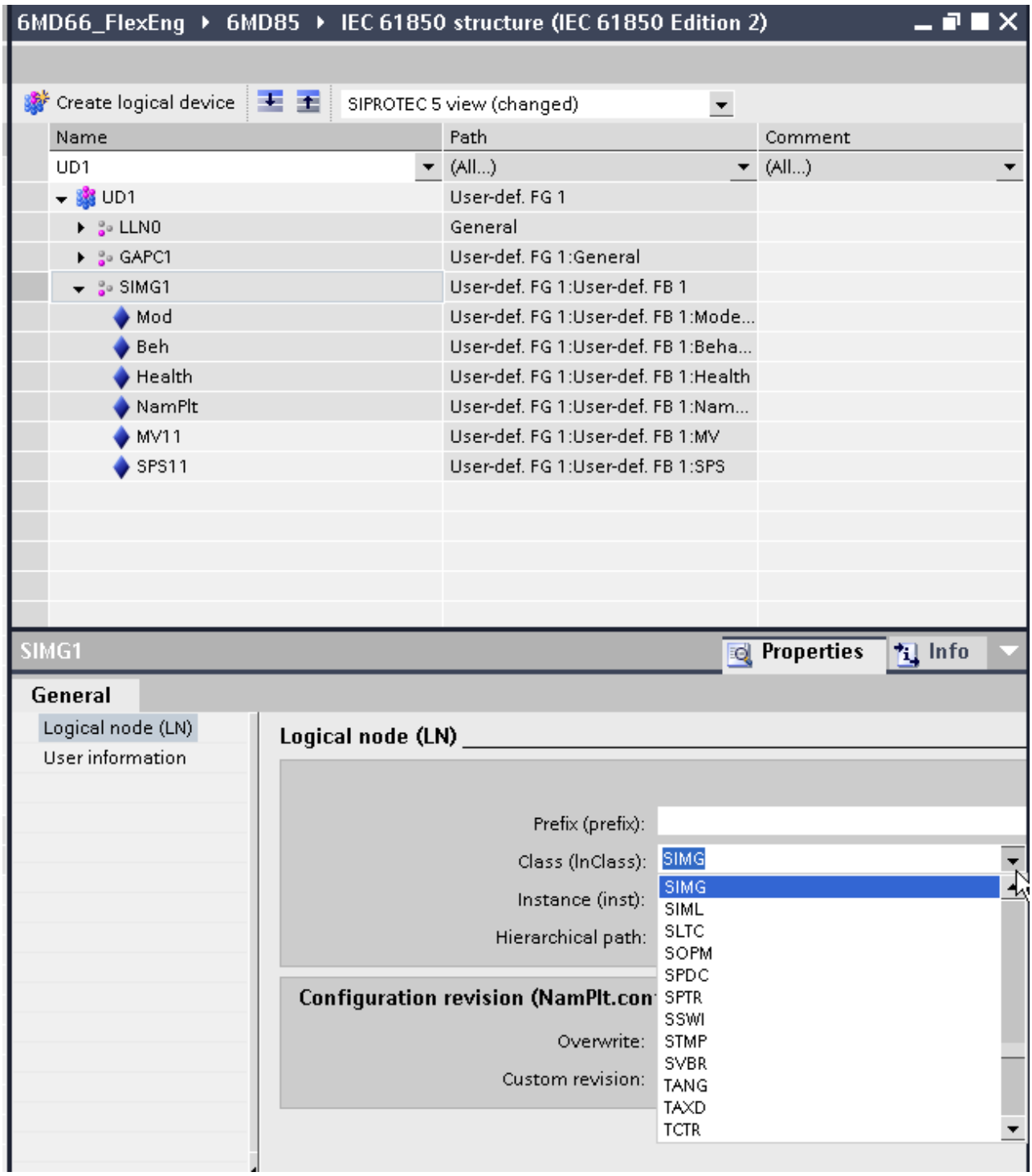

Figure 7: List box for names of the logical nodes (LN) for assigning the logical USER1 to the LnClass SIMG

The function block creates a logical node which at first is called "UD1" for user-defined. This node is renamed "SIMG" in DIGSI . To this purpose a selection of LN names according to IEC61850-7-4 is provided.

Figure 8 shows the newly created function SF6 Alarms and other data objects created and the desired names InsulationAlarm, InsulationBlock, InsulationTrip and Pressure Alarm, as well as the measured values InsGas Pressure, Densitiy and Temperature in the "Information routing editor".

The blue icon "Person" indicates that it is user-created information.

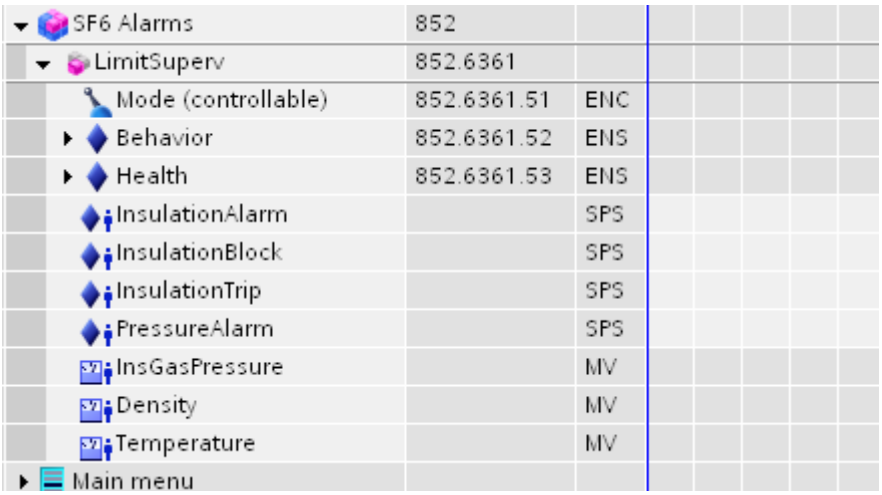

Figure 8: Object view in the "Information routing editor"

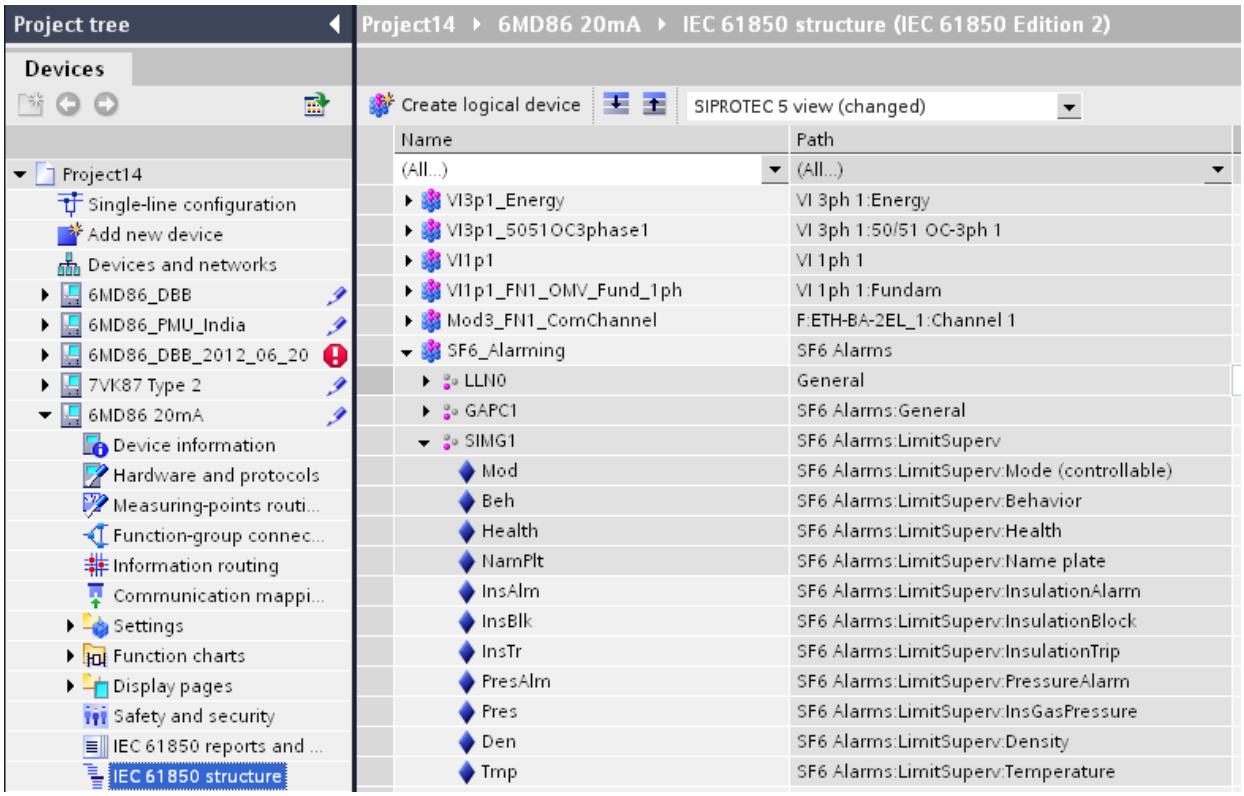

Figure 9: Adjusting the IEC 61850 view with the "IEC 61850 structure editor"

The original SIPROTEC 5 object model remains unaffected by the assignments in this editor because each object has two designations: the "Siemens name" and the "IEC 61850 name". In this case, the Siemens name is modified while the IEC 61850 name is kept.

The four alarms are created as individual messages (type SPS, single point information with status) and generated in the CFC as corresponding limit value indications.
The three measured values for pressure, density and temperature are created as measured values (type MV) and generated from the captured 20mA values equally in the CFC.

1.5 Conclusion

Using the "IEC 61850 structure editor" as well as the options of the DIGSI library allows the modeling of the IEC61850 interface whereby the device view on the information remains completely unaltered while it is possible to freely model the project-specific information. This means that the freedom offered by IEC 61850 can be used where appropriate without interfering with the classical information view. As a result the IEC61850 expert and the protection expert both are provided with their own familiar view on the device.

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