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SIPROTEC 5

Voltage Selection for Synchrocheck for large number of voltages (APN-085)

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SIPROTEC 5 Application

SIPROTEC 5 – Voltage Selection for Synchrocheck for large number of voltages

APN-085, Edition 1

Content

1 Voltage Selection for Synchrocheck for large number of voltages

1.1 Introduction

The synchronization function (ANSI 25) checks the activation is permissible without a risk to the stability of the system when interconnection 2 parts of an electrical power system, e.g. synchronization of a line and a busbar, of two busbars via cross-coupling or of a generator and a busbar.

The dynamic measuring-point switching described in the chapter of the device manuals "Synchronization function" allows the selection of input voltages for Synchrocheck dynamically depending on conditions like positions of switches. The solution described in the manual is limited to the selection of max. 3 voltages. If more voltages are available, e.g. from merging units in a process bus solution, this application notes suggests how to make it possible

1.2 Dynamic Measuring-Point Switching

Dynamic measuring-point switching provides the capability to connect the voltages used in the Synchrocheck function to various measuring points. In this way, for example, it is possible to use the correct voltage on the basis of the switch position on the switching devices. If more than 1 measuring point is connected to **Vsync1** or **V sync2**, you must create the **V sync select**. function block in the Circuit-breaker function group.

The following figure shows an example of a Synchrocheck in a breaker-and-a-half arrangement. If circuit breaker QA2 is to be closed, the reference voltages must be selected from several possible measuring points. This selection of measuring points is dependent on the switch positions of all circuit breakers and disconnectors.

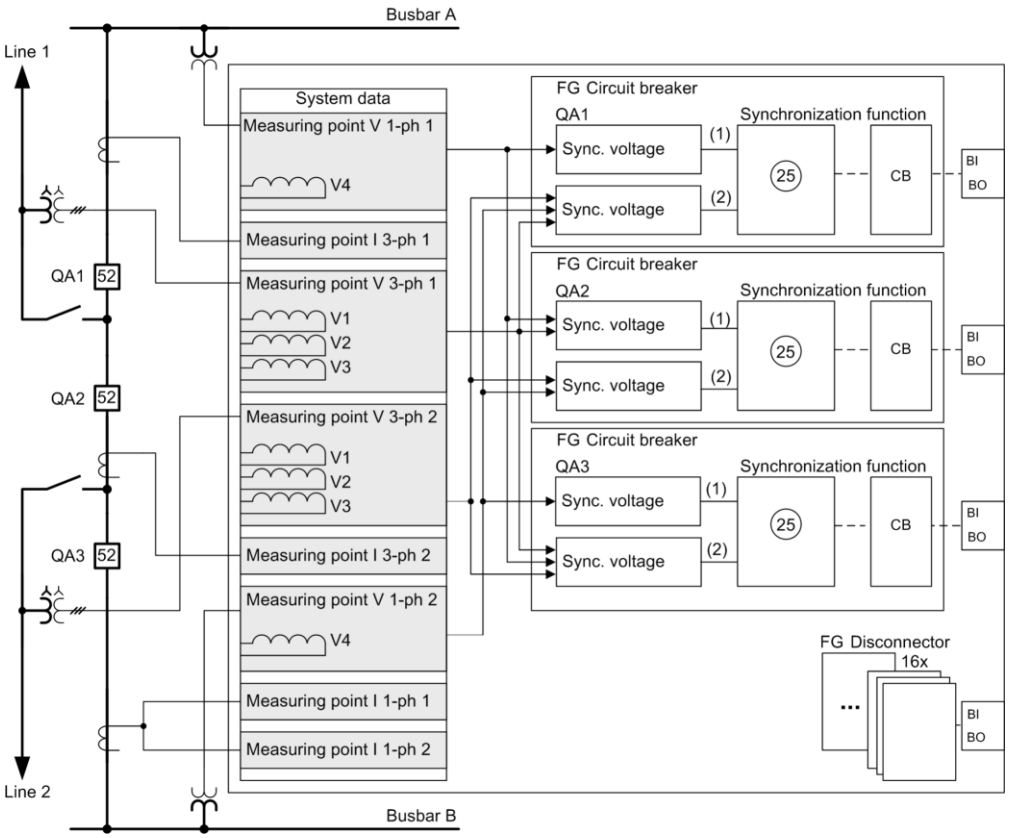

Fig. 1: Synchronization in a Breaker-and-a-half arrangement

Each synchronization function requires 2 comparison voltages. For the circuit breaker QA2 located in the middle, there are 2 options for each side (Vsync1 and Vsync2). The selection of synchronization voltages for each side depends on the position of the circuit breaker and the disconnectors.
For circuit breakers QA1 and QA3, the busbar voltage (Vsync1) is available for one side, and 3 voltages (Vsync2) are available for the other side.

1.3 Existing Solution with CFC Logic

The solution is based on the following CFC plan which selects the ID number of the voltage measuring points:

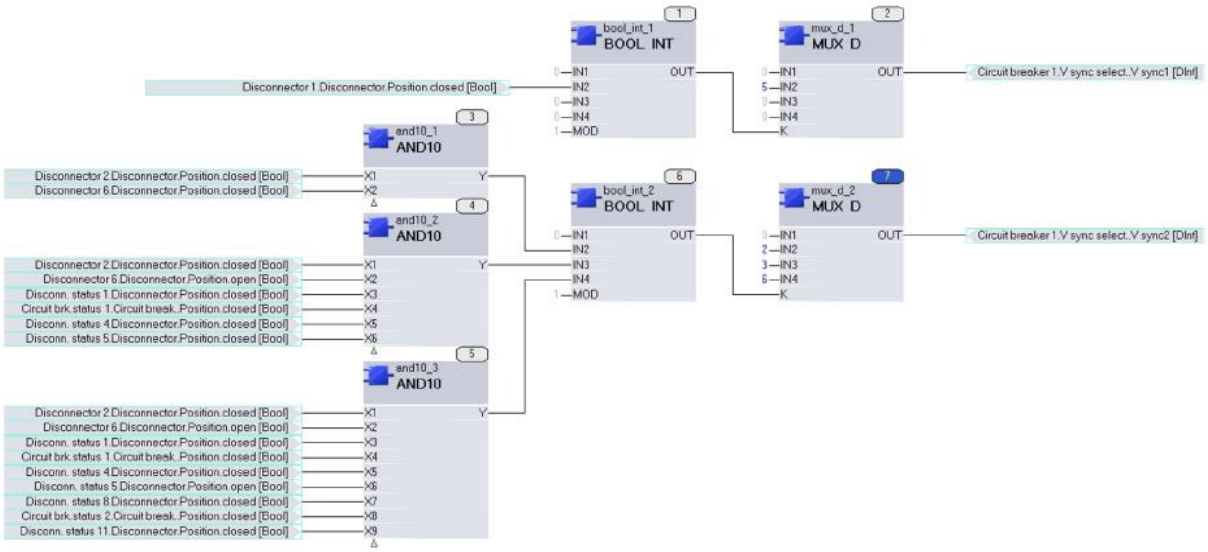

Fig.2: Example from Manual “High Voltage Bay Controller”

The proposed solution is limited for 3 voltage measuring points, as the CFC Block “MUX_D” has 4 inputs maximum available for possible numbering of measuring points, from which one is needed for the value “zero” in case no valid measuring point is selected.

This application note suggests a CFC plan which can handle more measuring points, which may become important when using process bus solutions with many merging units providing the voltages from different bays.

Main idea is to have two BOOL_INT blocks, from which the results are added together to get the number of the measuring point. This removes the need of using the limited MUX_D Block.

1.4 SIPROTEC 5 Configuration

In the example, 20 binary signals are used which indicate the selection of one of the 20 voltage measuring points of the device. The following pictures show the hardware of the device and the 20 voltage measuring points.

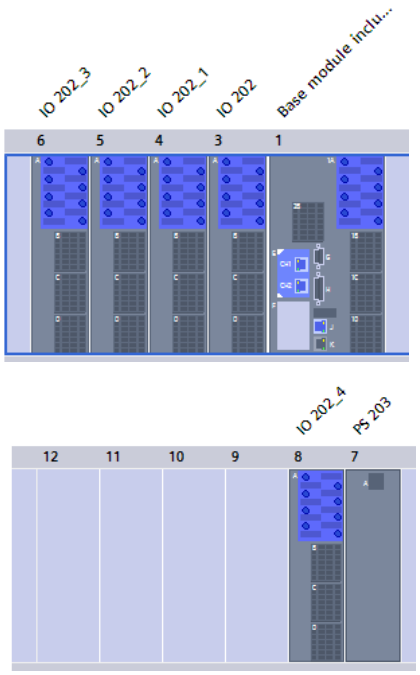

Fig.3: Hardware of the SIPROTEC 5 device

Voltage-measuring points

		Base module				Expansion module 3		
		1B				3B		
		1B1-1B2	1B3-1B4	1B5-1B6	1B7-1B8	3B1-3B2	3B3-3B4	3B5-3
Measuring point	Connection type	V 1.1	V 1.2	V 1.3	V 1.4	V 3.1	V 3.2	V 3.3
(All)	(All)	(All)	(All)	(All)	(All)	(All)	(All)	(All)
Meas.point V-3ph 1	3 ph-to-gnd voltages	V A	V B	V C				
Meas.point V-1ph 1					V AB			
Meas.point V-1ph 2						V A		
Meas.point V-1ph 3							V A	
Meas.point V-1ph 4								V A
Meas.point V-1ph 5								
Meas.point V-1ph 6								
Meas.point V-1ph 7								
Meas.point V-1ph 8								
Meas.point V-1ph 9								
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Meas.point V-1ph 20								

Fig.4: List of voltage measuring points

1.5 DIGSI 5 Parameterization

In this example, the Vsync2 voltage (see next picture) shall be selected to be one of the 20 voltage measuring points, depending on the status of the 20 SPS signals which decide the selection. (We do not care about Vsync1 in this example).

Voltage Selection for Synchrocheck for large number of voltages

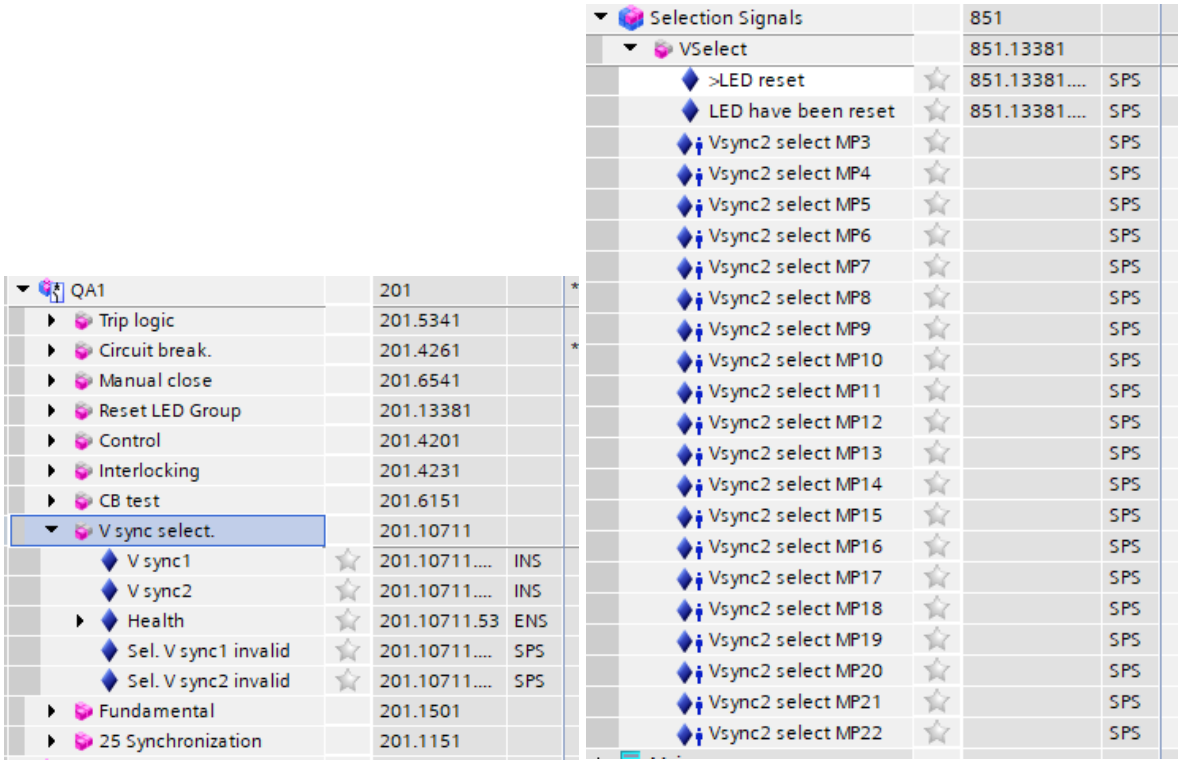

Fig.5: View of V sync select function block and selection signals

According to the numbering of the voltage measuring points in the “function group connections” view in DIGSI, the selection signals are named Vsync2 select MP3 – 22. If one of these signals is “high”, the respective measuring point shall be input to Vsync 2 of the synchrocheck. If more than one signal is high, the selection has to be invalid (value larger than 22 for more than one selection, we use value 23 in this case). If no selection signal is “high”, the value Zero is supplied as Measuring point ID, that results in a valid status of the synchrocheck, but no measuring point is selected and the synchrocheck does not operate (e.g. status during moving time of disconnectors).

The next figure shows an overview about the functionality.

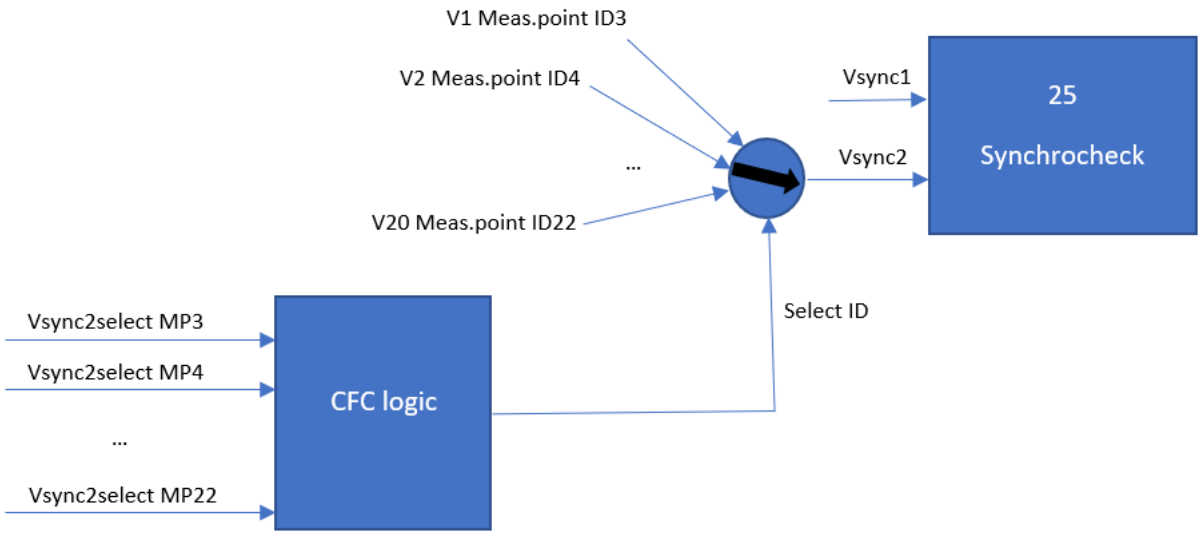

Fig.6: Overview Voltage Selection functionality

The CFC logic for determining the measuring point ID from the status of the sync select signals has the following parts:

1. Logic to determine the valid number from the status information. Therefore, two blocks of type “BOOL_INT” are controlled by “OR” blocks which calculate the correct BCD input for these blocks. The results from the two ”BOOL_INT”-blocks are added.

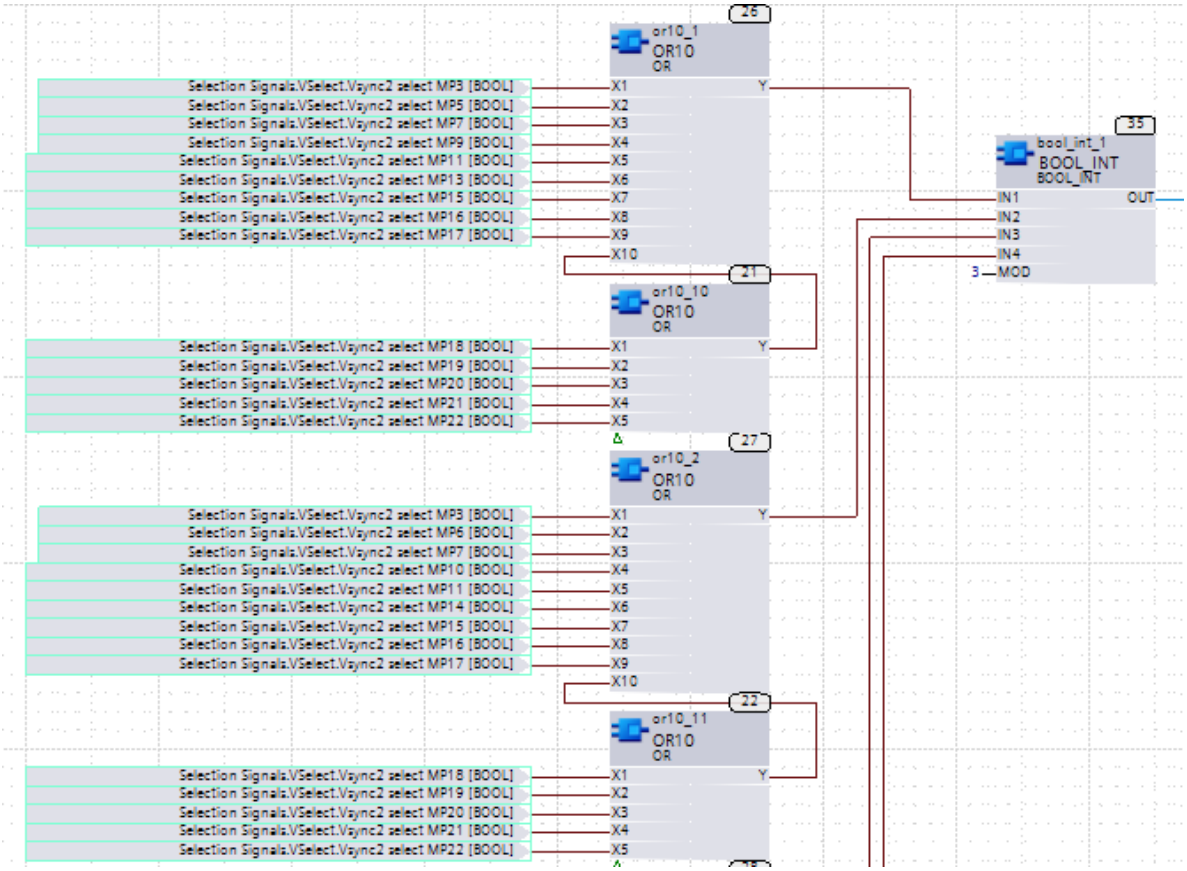

Fig.7: CFC plan, part 1: BCD coding for MP selection

2. Replacement logic to replace the value with invalid value “23” if more than one of the status inputs has value “high”, see Fig.6.

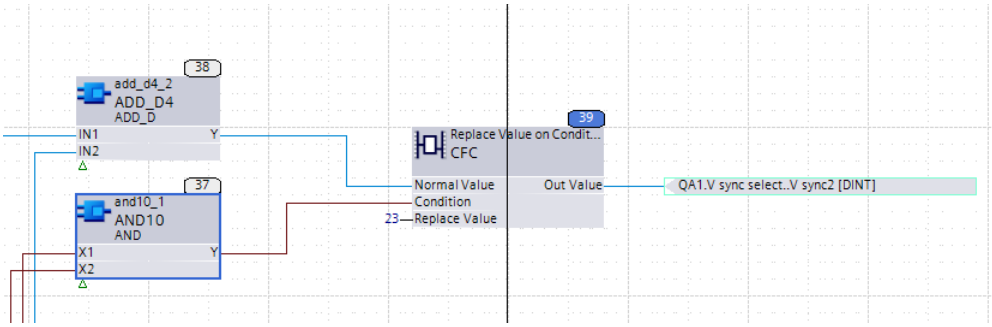

Fig.8: CFC plan, part 2: replacement of value in case of error

3. Macro for defining the replacement logic

The logic for replacement is built in a CFC macro (plan in plan), shown in Fig.7. The condition is coming from a Boolean logic: (Not all inputs) are Zero AND (Not exactly one input is high).

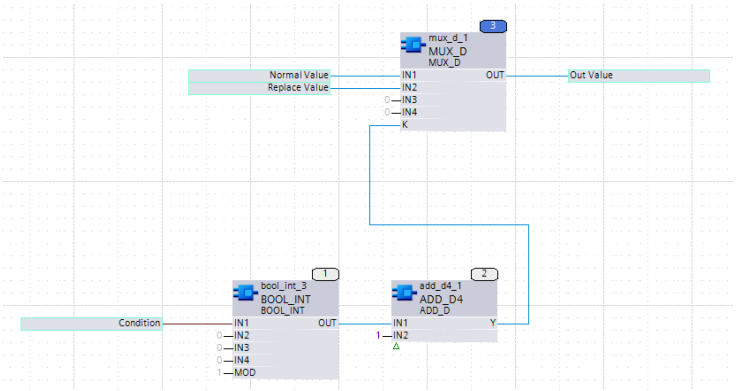

Fig.9: CFC plan for replacement of output value in case that condition is fulfilled (logical “high”).

1.6 Conclusion

With the help of a CFC plan, it is possible to build a selection mechanism for the synchrocheck voltage selection which delivers the measuring point number depending on a logic input signal. By using two BOOL_INT blocks instead of the MUX_D Block, the number of measuring points can be increased above the three possible inputs from the example in the manual. The described CFC plan is available in a Demo DEX file of a 6MD86 device.

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