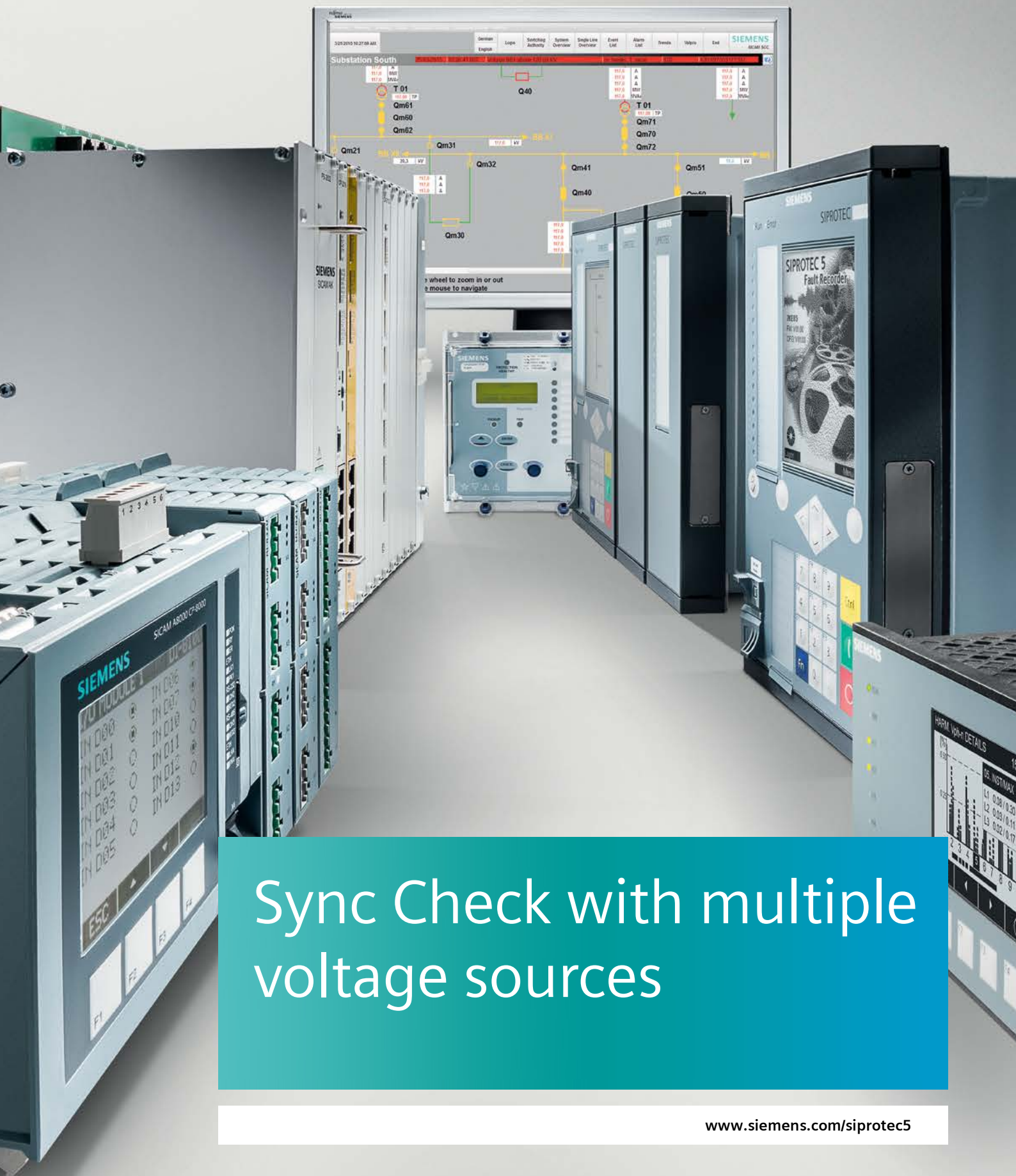


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Sync Check with multiple voltage sources

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SIPROTEC 5 Application

Sync Check with multiple voltage sources

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APN-004, Edition 1

Content

1	Sync Check with multiple voltage sources	3
1.1	Summary	3
1.2	Introduction.....	3
1.3	Definitions:.....	4
1.4	Device Configuration	4
1.5	Selection Logic	5
1.6	Implementation of Selection Logic	8

1 Sync Check with multiple voltage sources

1.1 Summary

This application describes how to use multiple voltage sources for Synch Check within SIPROTEC 5 devices.

1.2 Introduction

For the breaker-and-a-half configuration the sync check function must select the voltage depending on the switching state of the primary plant. The following schematic diagram is used to define the selection logic:

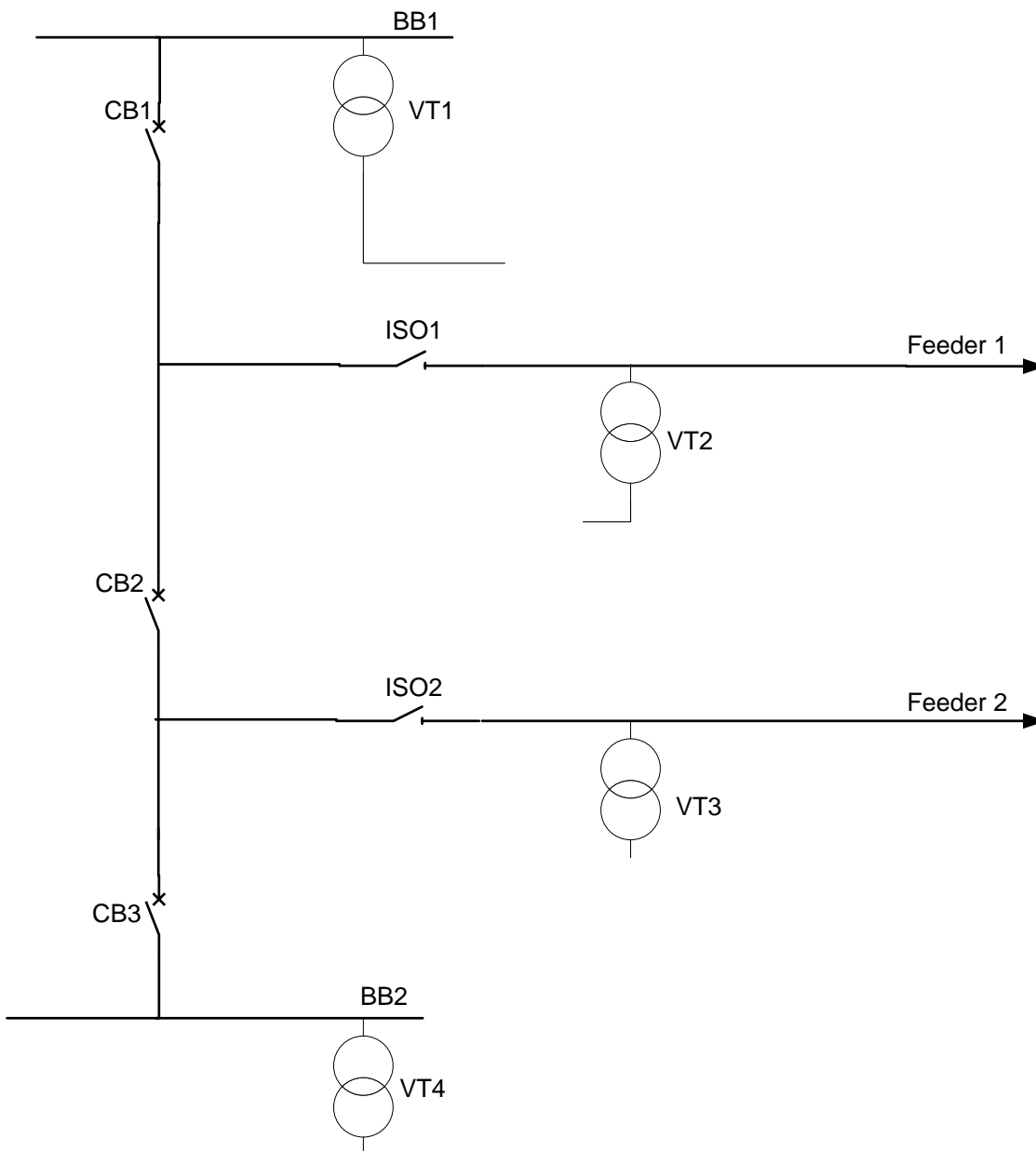


Figure 1: schematic diagram of breaker-and-a-half

As a typical physical device will only contain the breaker groups for two circuit breakers the selection logic is defined for CB1 and CB2. The selection for CB3 can be done in an analogous manner.

SIPROTEC 5 Application

Sync Check with multiple voltage sources

1.3 Definitions:

Switching State:

The switching state a CB includes the associated breaker isolators so that the open state is true when any of the series connections is open.

Measured Voltage:

Each of the voltage measuring points may be a single or three phase measurement type. The single phase measurements must all be of the same type, either Ph-G or Ph-Ph. A mix of Ph-G and Ph-Ph will cause a consistency alarm.

Sync Check Functions:

Each CB will have a dedicated Sync Check function with two voltage measurements (Vsyn1 and Vsyn2). A selection logic to assign any one of the 4 measured voltages is implemented below.

1.4 Device Configuration

Assign the necessary Voltage Measuring Points.

Voltage-measuring points		Base module				Expansion module 1			
		1B				3B			
		1B1-1B2	1B3-1B4	1B5-1B6	1B7-1B8	3B1-3B2	3B3-3B4	3B5-3B6	3B7-3B8
Measuring point	Connection type	V1	V2	V3	V4	V5	V6	V7	V8
(All...)	(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 A				
Meas.point V-1ph 2						V A			
Meas.point V-1ph 3							V A		
Add new									

Figure 2: Assignment of voltage measuring points

In the above diagram the 3ph-to-gnd measured voltage (V1 – V3) corresponds to VT2, the line side VT on Feeder 1. The three single phase measured voltages (V4, V5 and V6) correspond to the other three VT's.

VT	Measuring Point	Type	Connection	ID
VT1	Measuring point V-1ph 1	VA	V4	ID 3
VT2	Measuring point V-3ph 1	3ph-to-gnd	V1 – V3	ID 2
VT3	Measuring point V-1ph 2	VA	V5	ID 4
VT4	Measuring point V-1ph 3	VA	V6	ID 6

Figure 3: Identification of measuring points

In the function group connections all these Voltage Measuring Points appear for further selection. The identification tag (ID) assigned to each measuring point must be noted:

Connect measuring points to function group											
Measuring point	Line 1			Circuit breaker 1				Circuit breaker 2			
	V 3ph	I line 3ph	V	I 3ph	V sync1	V sync2	V	I 3ph	V sync1	V sync2	
(All...)	(All...)	(All...)	(All...)	(All...)	(All...)	(All...)	(All...)	(All...)	(All...)	(All...)	(All...)
Meas.point I-3ph 1[ID 5]		x		x							
Meas.point I-3ph 2[ID 1]		x						x			
Meas.point V-3ph 1[ID 2]	x		x			x	x		x		
Meas.point V-1ph 1[ID 3]					x				x		
Meas.point V-1ph 2[ID 4]						x				x	
Meas.point V-1ph 3[ID 6]						x				x	

Figure 4: Connection of measuring points to function group.

1.5 Selection Logic

The process for this selection is explained in this chapter.

Circuit breaker 1 (CB1):

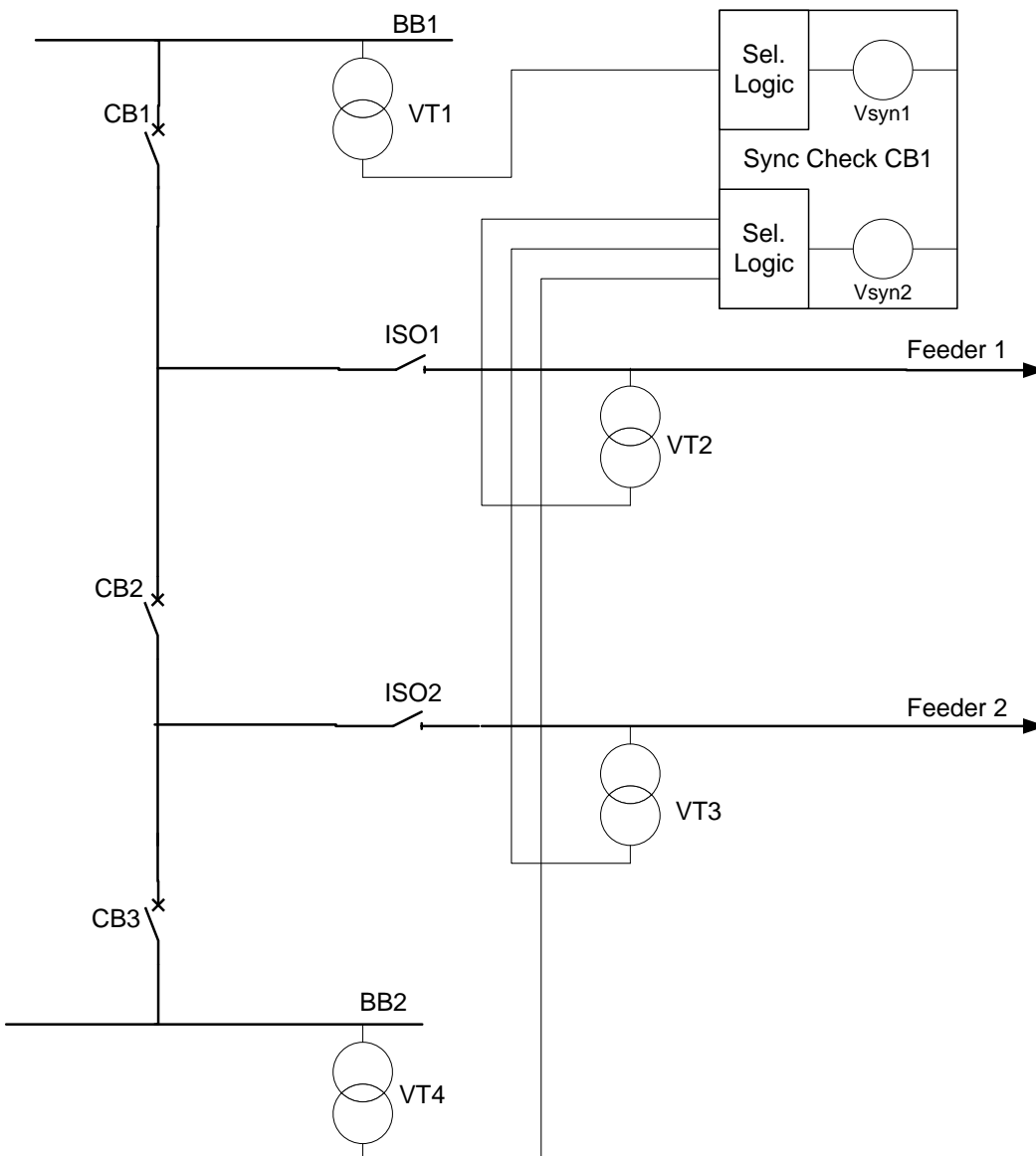


Figure 5: Selection Logic for CB1

SIPROTEC 5 Application

Sync Check with multiple voltage sources

For CB 1 the 4 voltage measurements are routed to the sync check voltage measurement as shown. The selection logic is as follows:

CB1 VSYN1

VT	ID	Logic [AND]
VT1	ID 3	-

CB1 VSYN2

VT	ID	Logic [AND]
VT2	ID 2	ISO1 = CLOSED
VT3	ID 4	ISO1 = OPEN CB2 = CLOSED ISO2 = CLOSED
VT4	ID 6	ISO1 = OPEN CB2 = CLOSED ISO2 = OPEN CB3 = CLOSED
Bypass/Alarm		ISO1 = OPEN CB2 = OPEN
Bypass/Alarm		ISO1 = OPEN CB2 = CLOSED ISO2 = OPEN CB3 = OPEN

Circuit breaker 2 (CB2):

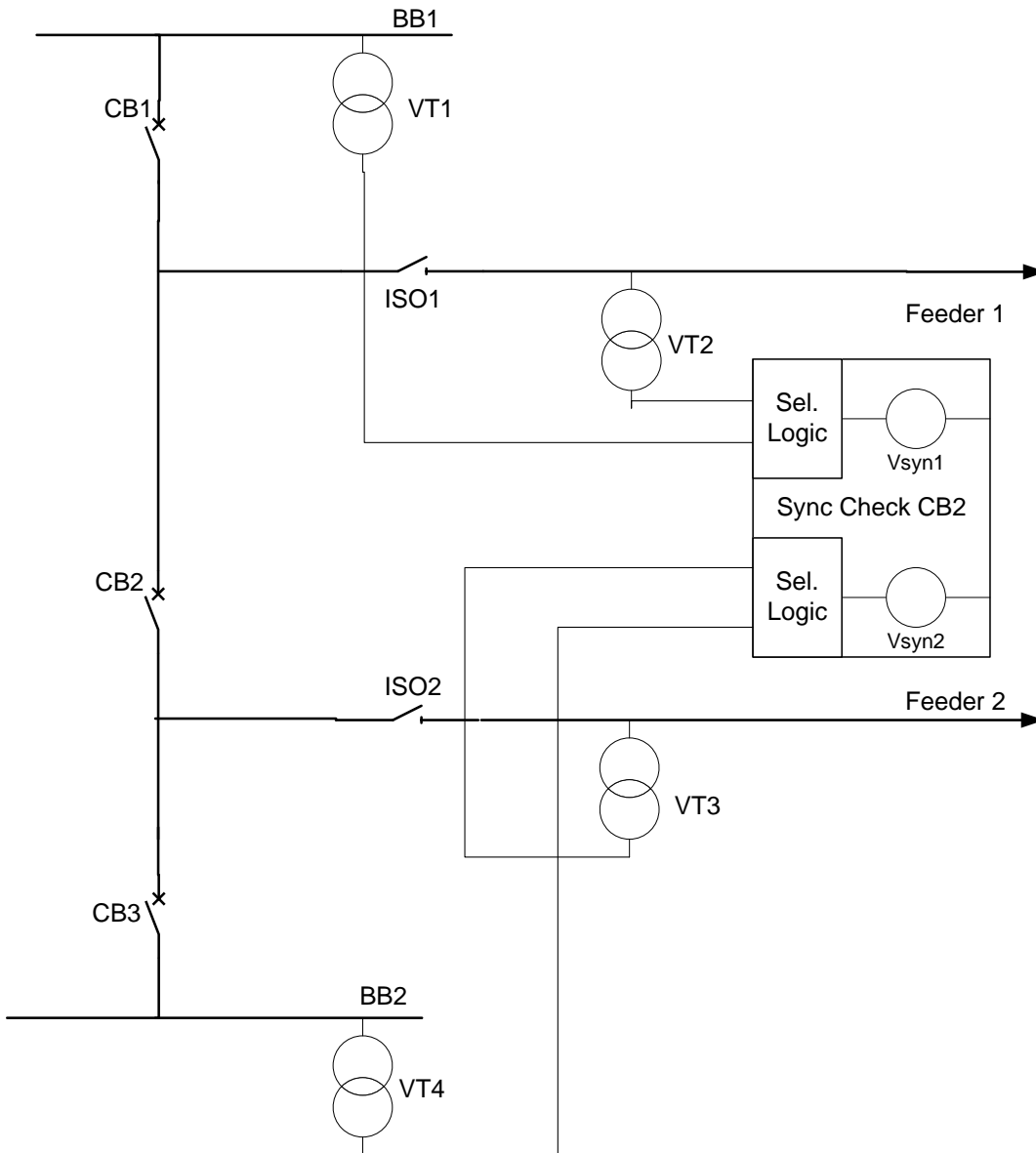


Figure 6: Selection Logic for CB2

For CB 2 the 4 voltage measurements are routed to the sync check voltage measurement as shown. The selection logic is as follows:

CB2 VSYN1

VT	ID	Logic [AND]
VT2	ID 2	ISO1 = CLOSED
VT1	ID 3	ISO1 = OPEN CB1 = CLOSED
Bypass/Alarm		ISO1 = OPEN CB1 = OPEN

SIPROTEC 5 Application

Sync Check with multiple voltage sources

CB2 VSYN2

VT	ID	Logic [AND]
VT3	ID 4	ISO2 = CLOSED
VT4	ID 6	ISO2 = OPEN CB3 = CLOSED
Bypass/Alarm		ISO2 = OPEN CB3 = OPEN

1.6 Implementation of Selection Logic

For each circuit breaker function group a "Voltage selection" is applied from the Global Library.

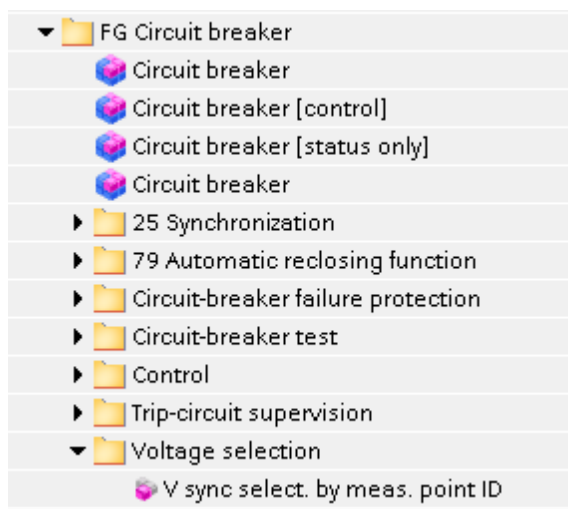


Figure 7: Global Library

The Voltage selection has no settings. It can be found in the Routing Matrix:

▼ Circuit breaker 1	301		*
▶ Trip logic	301.5341		
▶ Circuit break.	301.4261		*
▶ Manual close	301.6541		
▶ Control	301.4201		
▶ Interlocking	301.4231		
▶ CB test	301.6151		
▶ 50BF CB fail.1	301.4381		*
▼ V sync select.	301.10711		
◆ V sync1	301.10711.500	INS	
◆ V sync2	301.10711.501	INS	
▶ ◆ Health	301.10711.53	ENS	
◆ Sel. V sync1 invalid	301.10711.300	SPS	
◆ Sel. V sync2 invalid	301.10711.301	SPS	
▶ Fundamental	301.1501		

Figure 8: Routing Matrix

The elements “V sync1” and “V sync2” of type Integer Status must be defined in the CFC based on the selection Logic:

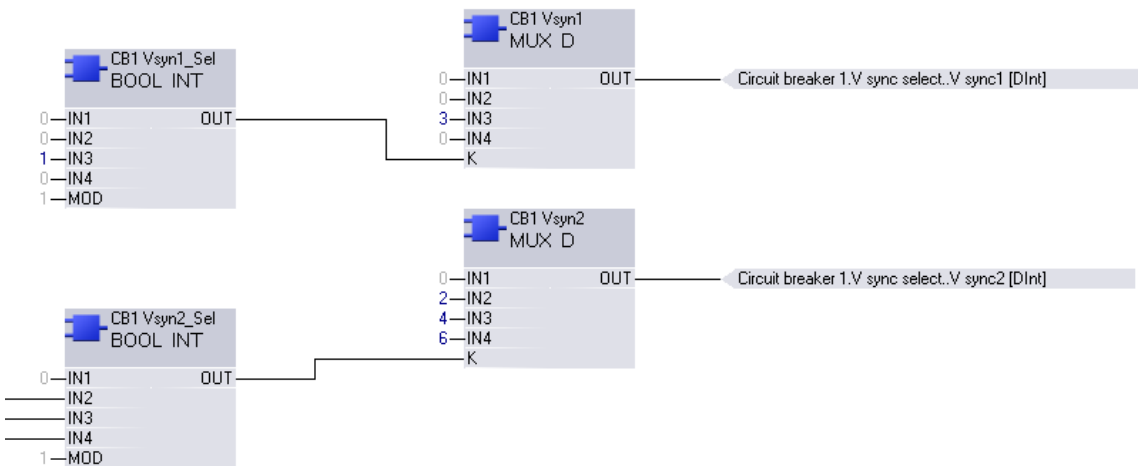


Figure 9: CFC Logic

The ID of the selected VT is routed to “V sync select, V sync1 or 2” with the MUX D gate as shown above. E.g. for CB1 the V sync1 is always VT1 (ID3) – therefore only the value “3” at “IN3” is configured. For Vsync2 the selectable Vt’s are VT2(ID2), VT3(ID4) and VT4(ID6). The values 2, 4 and 6 are therefore configured at IN2, IN3 and IN4 respectively.

The Selection Logic identifies the selected voltage via the BOOL INT gate. For CB1 the selection VT1 (ID3) is fixed to the fixed selection of IN3 = 3. For Vsync2 the selection logic selects the applicable synchronizing voltage via the Boolean inputs IN2 (ID2), IN3 (ID4) and IN4 (ID6) of the BOOL INT gate.

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