

FUNCTION BLOCK DESCRIPTION

Synchro check, synchro switch function

ANSI: 25, IEC: SYNC





VERSION INFORMATION

VERSION	DATE	MODIFICATION	COMPILED BY
Preliminary	2000-11-24	Preliminary version, without technical information	Petri
	2010-06-18	Technical information added	Petri
	2010-10-05	Naming revision	Csipke
1.0	2010-11-11	First edition	Petri
2.0	2024-11-14	New format, new chapter (overview) Changes due to graphical analogue function block included IEC 61850 data object information included in Table 2-6	Saina, Erdős

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1 Synchro check / synchro switch function

1.1 Application

Several problems can occur in the electric power system if the circuit breaker closes and connects two systems operating asynchronously. The high current surge can cause damage in the interconnecting elements, the accelerating forces can overstress the shafts of rotating machines, or the actions taken by the protective system can result in the unwanted separation of parts of the electric power system.

To prevent such problems, this function checks whether the systems to be interconnected are operating synchronously. If yes, then the close command is transmitted to the circuit breaker. In case of asynchronous operation, the close command is delayed to wait for the appropriate vector position of the voltage vectors on both sides of the circuit breaker. If the conditions for safe closing cannot be fulfilled within an expected time, then closing is declined.

The conditions for safe closing are as follows:

- The difference of the voltage magnitudes is below the declared limit,
- The difference of the frequencies is below the declared limit and
- The angle difference between the voltages on both sides of the circuit breaker is within the declared limit.

1.2 Mode of operation

The function processes both automatic reclosing and manual close commands.

The limits for automatic reclosing and manual close commands can be set independently of each other.

The function compares the voltage of the line and the voltage of one of the bar sections (Bus1 or Bus2). The bus selection is made automatically based on a binary input signal defined by the user applying the graphic equation editor.

As to voltages: any phase-to-ground or phase-to-phase voltage can be selected.

The function processes the signals of the voltage transformer supervision function and enables the close command only in case of plausible voltages.

There are three modes of operation:

- Energizing check:
 - Dead bus, live line,
 - Live bus, dead line,
 - Any Energizing Case (including Dead bus, dead line),
 - Any live.
- Synchro check (Live line, live bus)
- Synchro switch (Live line, live bus)

If the conditions for “Energizing check” or “Synchro check” are fulfilled, then the function generates the release command, and in case of a manual or automatic close request, the close command is generated.

If the conditions for energizing and synchronous operation are not met when the close request is received, then synchronous switching is attempted within the set time-out. In this case, the rotating vectors must fulfill the conditions for safe switching within the declared waiting time: at the moment the contacts of the circuit breaker are closed, the voltage vectors must match each other with appropriate accuracy. For this mode of operation, the expected operating time of the circuit breaker must be set as a parameter value, to generate the close command in advance taking the relative vector rotation into consideration.

The started checking procedure can be interrupted by a cancel command defined by the user in the graphic equation editor.

In “bypass” operation mode, the function generates the release signals and simply transmits the close command.

1.3 Structure of the synchro check/synchro switch function

The synchro check/synchro switch function contains two kinds of software blocks (See Figure 1-1):

- SYN25_Com is a common block for manual switching and automatic switching
- SYN25_EVA is an evaluation block, duplicated for manual switching and for automatic switching

These software blocks are explained in detail below.

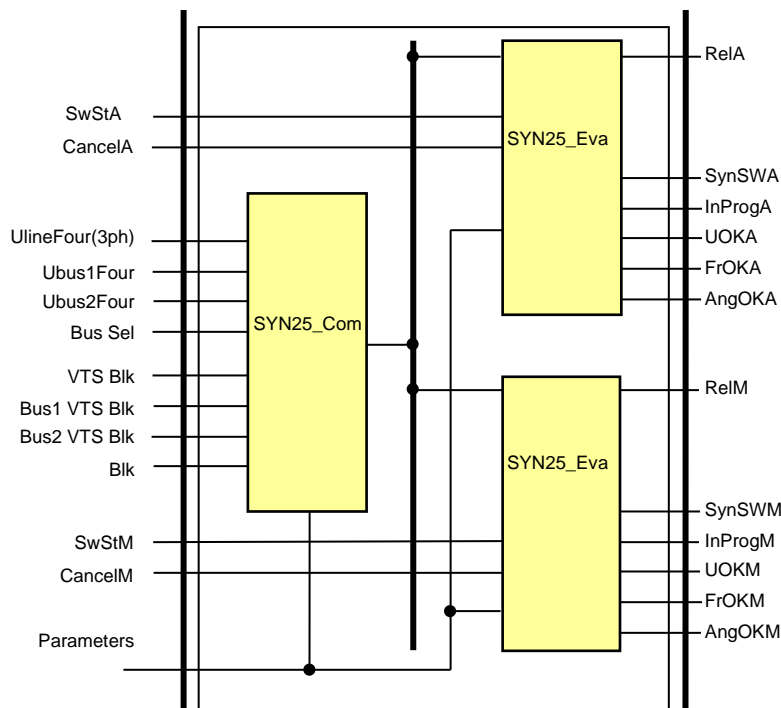


Figure 1-1 Structure of the synchro check/ synchro switch function

Analog input signals

The function processes the result of three Fourier calculation blocks. These modules process the following voltages of the line and those of two bus sections.

- **UlineFour(3ph)** the Fourier components of the three phase voltages. The module selects one phase or one line-to-line voltage based on this set to be matched to the bus voltages.
- **Ubus1Four and Ubus2Four** the Fourier components characteristic for the bus sections. These can be phase voltages of the same phase as it is selected from UlineFour(3ph) or matching line-to-line voltages. The selection is made by the parameter value *Voltage select* (see Table 1-4). Between the two bus sections, a binary input signal controls the selection SYN25_BusSel_GrO_ (Bus select).

Binary input status signals

The synchro check / synchro switch function has binary input signals. **The conditions are defined by the user, applying the graphic equation editor.**

The **binary input status signals** of the synchro check / synchro switch function are listed in Table 1-1.

Table 1-1 The binary input status signals of the synchro check / synchro switch function

BINARY INPUT SIGNALS	SIGNAL TITLE	EXPLANATION
SYN25_ Blk _GrO_	Blk	Signal for blocking the function
SYN25_ BusSel _GrO_	Bus select	If this signal is logic TRUE, then the voltage of Bus2 is selected for evaluation
SYN25_ VTSBlk _GrO_	VTS Block	Blocking signal of the voltage transformer supervision function evaluating the line voltage
SYN25_ Bus1VTSBlk _GrO_	VTS Bus1 Block	Blocking signal of the voltage transformer supervision function evaluating the Bus1 voltage
SYN25_ Bus2VTSBlk _GrO_	VTS Bus2 Block	Blocking signal of the voltage transformer supervision function evaluating the Bus2 voltage
SYN25_ SwStA _GrO_	SySwitch Auto	Switching request signal initiated by the automatic reclosing function
SYN25_ CancelA _GrO_	Cancel Auto	Signal to interrupt (cancel) the automatic switching procedure
SYN25_ SwStM _GrO_	SySwitch Manual	Switching request signal initiated by manual closing
SYN25_ CancelM _GrO_	Cancel Manual	Signal to interrupt (cancel) the manual switching procedure

The function is disabled if

- The binary input SYN25_**Blk**_GrO_ (Block) signal is TRUE
- The voltage transformer supervision circuit for the line voltage blocks the operation SYN25_**VTSBlk**_GrO_ (VTS Block)
- The voltage transformer supervision circuit for the selected bus section blocks the operation SYN25_**Bus1VTSBlk**_GrO_ (VTS Bus1 Block) or SYN25_**Bus2VTSBlk**_GrO_ (VTS Bus2 Block)
- Parameter settings disable the operation (see details below)

The function can be started by the following binary input signals:

- SYN25_**SwStA**_GrO_ (SySwitch Auto) automatic starting
- SYN25_**SwStM**_GrO_ (SySwitch Manual) manual starting

If the function is in operation, then the process can be stopped (canceled) by the following binary input signals:

- SYN25_**CancelA**_GrO_ (Cancel Auto) canceling the automatic operation
- SYN25_**CancelM**_GrO_ (Cancel Manual) canceling the manual operation.

The **binary output status signals** of the synchro check / synchro switch function are listed in Table 1-2.

Table 1-2 The binary output status signals of the synchro check / synchro switch function

BINARY OUTPUT SIGNALS	SIGNAL TITLE	EXPLANATION
SYN25_ReIA_Grl_	Release Auto	Releasing the close command initiated by the automatic reclosing function
SYN25_InProgA_Grl_	SynInProgr Auto	Switching procedure is in progress, initiated by the automatic reclosing function
SYN25_SynSWA_Grl_	Syn Cmd Auto	Switching command initiated by the automatic reclosing function
SYN25_UOKA_Grl_	Udiff OK Auto	The voltage difference is appropriate for automatic closing command
SYN25_FrOKA_Grl_	FreqDiff OK Auto	The frequency difference is appropriate for automatic closing command, evaluated for synchro-check
SYN25_AngOKA_Grl_	Angle OK Auto	The angle difference is appropriate for automatic closing command
SYN25_ReIM_Grl_	Release Man	Releasing the close command, initiated by manual closing request
SYN25_InProgM_Grl_	SynInProgr Man	Switching procedure is in progress, initiated by the manual closing command
SYN25_SynSWM_Grl_	Syn Cmd Man	Switching command initiated by the manual closing command
SYN25_UOKM_Grl_	Udiff OK Man	The voltage difference is appropriate for manual closing command
SYN25_FrOKM_Grl_	FreqDiff OK Man	The frequency difference is appropriate for manual closing command, evaluated for synchro-check
SYN25_AngOKM_Grl_	Angle OK Man	The angle difference is appropriate for manual closing command
SYN25_SynSW_Grl_	Syn Cmd	Switching command, OR connection of manual and automatic closing

1.3.1 The common software block

In this paragraph the operation of the software block SYN25_Com of the Figure 1-1 is described. This block selects the appropriate voltages for processing and calculates the voltage difference, the frequency difference, and the phase angle difference between the selected voltages. The magnitude of the selected voltages is passed for further evaluation, too. The structure of this software block is shown on Figure 1-2.

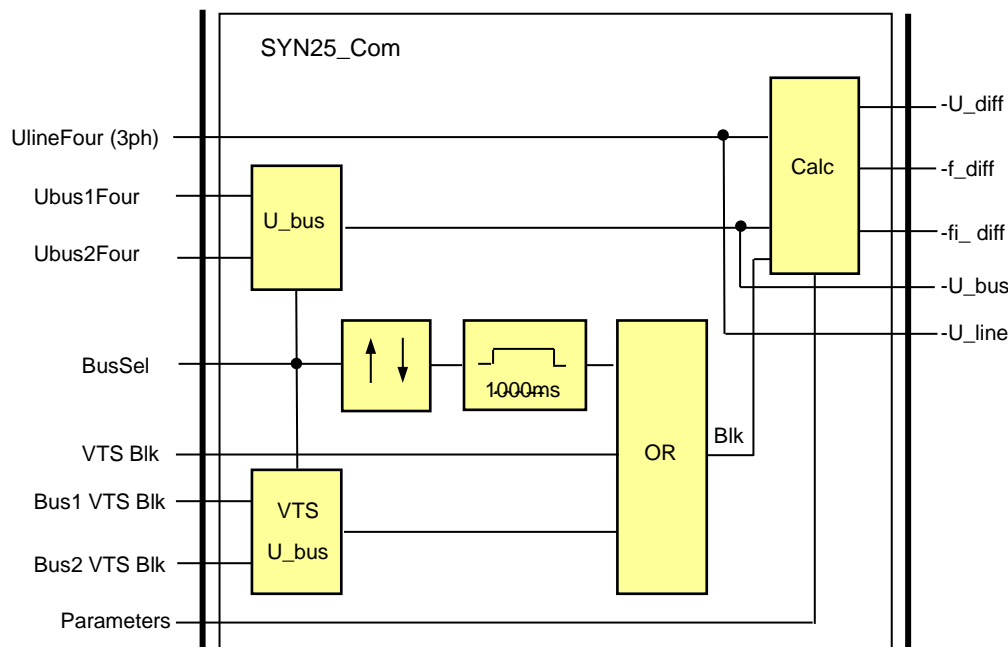


Figure 1-2 Structure of the common software block

Analog input signals

The function processes the result of three Fourier calculation blocks. These modules process the following voltages of the line and those of two bus sections.

- **UlineFour(3ph)** the Fourier components of the three phase voltages. The module selects one phase or one line-to-line voltage based on this set to be matched to the bus voltages.
- **Ubus1Four** and **Ubus2Four** the Fourier components characteristic for the bus sections. These can be phase voltages of the same phase as it is selected from UlineFour(3ph) or matching line-to-line voltages. The selection is made by the parameter *Voltage select* (see Table 1-4). Between the two bus sections, a binary input signal controls the selection SYN25_**BusSel**_GrO_ (Bus select).

Binary input status signals

The synchro check / synchro switch function has binary input signals. **The conditions are defined by the user, applying the graphic equation editor.**

The **binary input status signals** of the common software block are listed in Table 1-3.

Table 1-3 The binary input status signals of the common software block

BINARY STATUS SIGNAL	SIGNAL TITLE	EXPLANATION
SYN25_BusSel_GrO_	Bus select	If this signal is logic TRUE, then the voltage of Bus2 is selected for evaluation
SYN25_VTSBik_GrO_	VTS Block	Blocking signal of the voltage transformer supervision function evaluating the line voltage
SYN25_Bus1VTSBik_GrO_	VTS Bus1 Block	Blocking signal of the voltage transformer supervision function evaluating the Bus1 voltage
SYN25_Bus2VTSBik_GrO_	VTS Bus2 Block	Blocking signal of the voltage transformer supervision function evaluating the Bus2 voltage
SYN25_Bik_GrO_	Block	Blocking signal of the function

The calculated or selected output values are:

- U_diff the magnitude difference between the selected voltages
- f_diff the frequency difference between the selected voltages
- fi_diff the phase angle difference between the selected voltages
- U_line the magnitude of the selected line voltage
- U_bus the magnitude of the voltage of the appropriate bus section

These values are further processed by the evaluation software blocks (See Figure 1-1).

The function is disabled if

- The binary input SYN25_Bik_GrO_ (Block) signal is TRUE
- The voltage transformer supervision circuit for the line voltage blocks the operation SYN25_VTSBik_GrO_ (VTS Block)
- The voltage transformer supervision circuit for the selected bus section blocks the operation SYN25_Bus1VTSBik_GrO_ (VTS Bus1 Block) or SYN25_Bus2VTSBik_GrO_ (VTS Bus2 Block)
- Parameter settings disable the operation (see details below)

If the active bus section changes, then the function is dynamically blocked for 1000 ms; no release signal or switching command is generated.

This software block has no **binary output status signals**.

The processed line voltage is selected based on the preset parameter *Voltage select*. The options are: L1-N,L2-N,L3-N,L1-L2,L2-L3,L3-L1. The parameter value must match the input voltages received from the bus sections.

The active bus section is selected by the input signal SYN25_BusSel_GrO_ (Bus select). If this signal is logic TRUE, then the voltage of Bus2 is selected for evaluation.

The parameter of this software block is shown in Table 1-4 below:

Enumerated parameter

Table 1-4 The enumerated parameter of the common software block

TITLE	DIM	RANGE	STEP	DEFAULT	EXPLANATION
Voltage Select	-	L1-N, L2-N, L3-N, L1-L2, L2-L3, L3-L1	-	L1-N	Selection of the processed voltage

1.3.2 The evaluation software block

The operation of the software block SYN25_Eva of Figure 1-1 is described in this paragraph. This software block is applied separately for automatic and manual commands. This separation allows the application to use different parameter values for the two modes of operation.

The structure of the evaluation software block is shown in Figure 1-3.

Analog input signals

The function processes the results of the common block (See Paragraph 1.3.1).

The analog input values are:

- U_diff the magnitude difference between the selected voltages
- f_diff the frequency difference between the selected voltages
- fi_diff the phase angle difference between the selected voltages
- U_line the magnitude of the selected line voltage
- U_bus the magnitude of the voltage of the appropriate bus section

Binary input status signals

The evaluation software block has binary input status signals. **The conditions are defined by the user, applying the graphic equation editor.**

The **binary input status signals** of the evaluation software block are listed in Table 1-5.

Table 1-5 The binary input signals of the evaluation software block

BINARY STATUS SIGNAL	SIGNAL TITLE	EXPLANATION
SYN25_SwStA_GrO_	SySwitch Auto	Switching request signal initiated by the automatic reclosing function
SYN25_CancelA_GrO_	Cancel Auto	Signal to interrupt (cancel) the automatic switching procedure
SYN25_SwStM_GrO_	SySwitch Manual	Switching request signal initiated by manual closing
SYN25_CancelM_GrO_	Cancel Manual	Signal to interrupt (cancel) the manual switching procedure

The **binary output status signals** of the evaluation software block are shown in Table 1-6 for automatic starting and in Table 1-7 for manual starting.

Table 1-6 The binary output signals of the evaluation software block for automatic starting

BINARY OUTPUT SIGNAL	SIGNAL TITLE	EXPLANATION
SYN25_ReIA_Grl_	Release Auto	Releasing the close command initiated by the automatic reclosing function
SYN25_InProgA_Grl_	SynInProgr Auto	Switching procedure is in progress, initiated by the automatic reclosing function
SYN25_UOKA_Grl_	Udiff OK Auto	The voltage difference is appropriate for automatic closing command
SYN25_FrOKA_Grl_	FreqDiff OK Auto	The frequency difference is appropriate for automatic closing command, evaluated for synchro-check *
SYN25_AngOKA_Grl_	Angle OK Auto	The angle difference is appropriate for automatic closing command
SYN25_SynSWA_Grl_	Syn Cmd Auto	Switching command initiated by the automatic reclosing function

* The frequency is evaluated using the weighted sum of the three phase voltages

Table 1-7 The binary output signals of the evaluation software block for manual starting

BINARY OUTPUT SIGNAL	SIGNAL TITLE	EXPLANATION
SYN25_ReIM_Grl_	Release Man	Releasing the close command, initiated by manual closing request
SYN25_InProgM_Grl_	SynInProgr Man	Switching procedure is in progress, initiated by the manual closing command
SYN25_UOKM_Grl_	Udiff OK Man	The voltage difference is appropriate for manual closing command
SYN25_FrOKM_Grl_	FreqDiff OK Man	The frequency difference is appropriate for manual closing command, evaluated for synchro-check *
SYN25_AngOKM_Grl_	Angle OK Man	The angle difference is appropriate for manual closing command
SYN25_SynSWM_Grl_	Syn Cmd Man	Switching command initiated by the manual closing command

* The frequency is evaluated using the weighted sum of the three phase voltages

SYNCHRO CHECK / SYNCHRO SWITCH FUNCTION

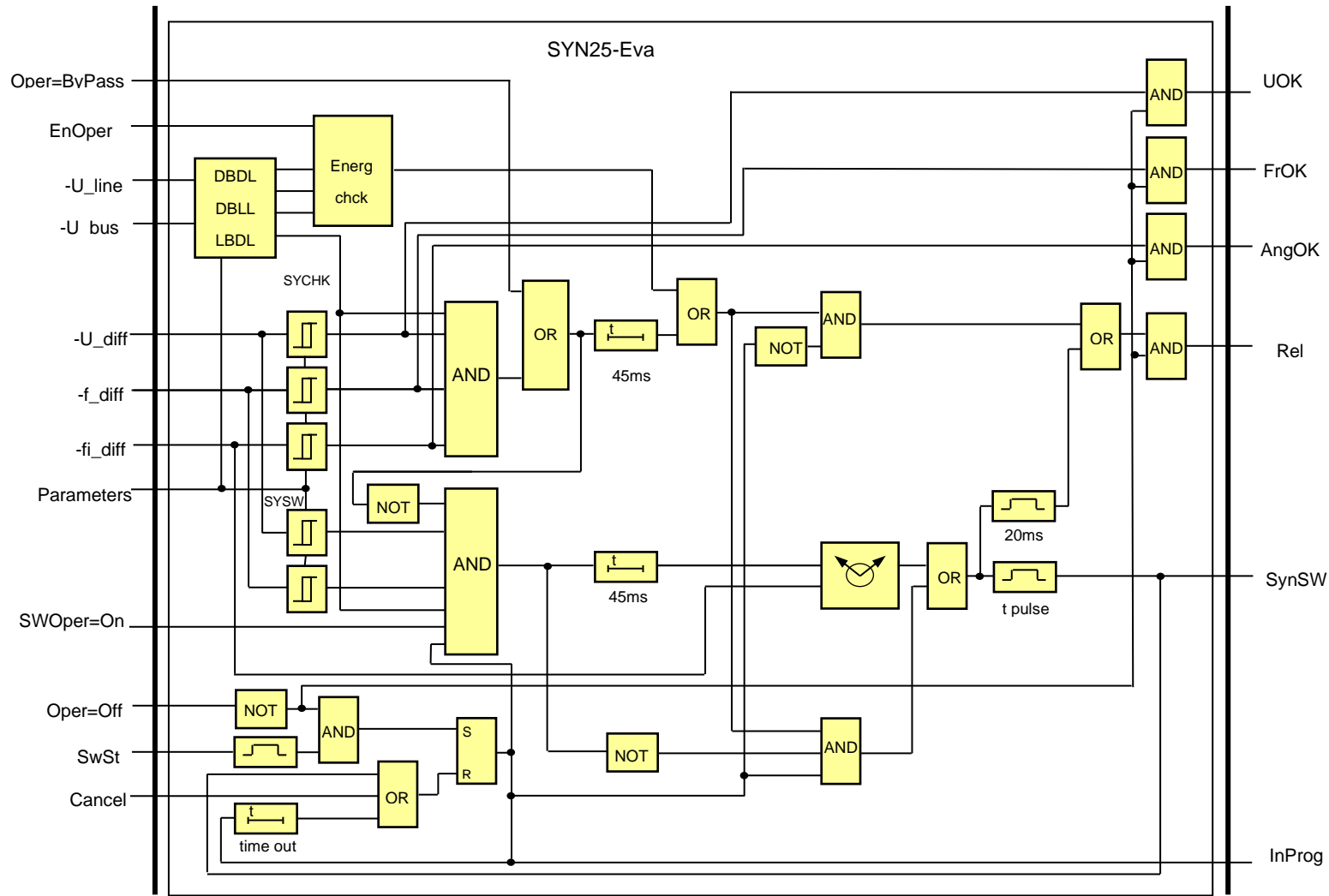
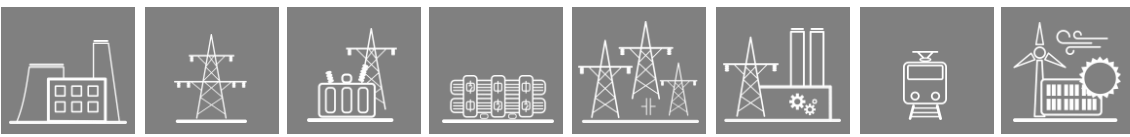


Figure 1-3 Structure of the evaluation software block



Explanation of the operation

This evaluation software block is used for two purposes: for the automatic reclosing command (the signal names have the suffix “A”) and for the manual close request (the signal names have the suffix “M”).

As the first step, based on the selected line voltage and bus voltage, the state of the required switching is decided (Dead bus-Dead line, Dead bus-Live line, Live bus-Dead line or Live bus-Live line). The parameters for decision are *U Live* and *U Dead*. The enumerated parameters *Energizing Auto/Manual* enable the operation individually. The options are: (Off, Dead bus – Live line, Live bus – Dead line, Any energizing case, Any live). In simple energizing modes, no further checking is needed.

This mode selection is bypassed if the parameter *Operation Auto/Manual* is set to “ByPass”. In this case the command is transmitted without any further checking.

First, the function tries switching with synchro check (SYCHK on the Figure 1-3). This is possible if:

- the voltage difference is within the defined limits (parameters *U diff SynCheck Auto/Manual*)
- the frequency difference is within the defined limits (parameters *f diff SynCheck – Auto/Manual*) and
- the phase angle difference is within the defined limits (parameters *Phase diff - Auto/Manual*).

These conditions are signaled on dedicated binary outputs:

- SYN25_UOKM_GrI_ / SYN25_UOKA_GrI_ if the voltage magnitudes are OK
- SYN25_FrOKM_GrI_ / SYN25_FrOKA_GrI_ if the frequency difference is OK
- SYN25_AngOKM_GrI_ / SYN25_AngOKA_GrI_ if the angle difference is OK

If the conditions are fulfilled for at least 45 ms, then the function generates a release output signal SYN25_ReIM_GrI_ / SYN25_ReIA_GrI_ (Release Auto/Manual).

If the conditions for synchro check operation are not fulfilled and a close request is received as the input signal SYN25_SwStA_GrO_ / SYN25_SwStM_GrO_ (SySwitch Auto/Manual), then synchro switching is attempted. (SYSW in Figure 1-3). This is possible if:

- the voltage difference is within the defined limits (parameters *U diff SynSwitch Auto/Manual*)
- the frequency difference is within the defined limits (parameters *f diff SynSwitch Auto / Manual*).

These parameters are independent of those for the synchro check function.

If the conditions for synchro check are not fulfilled and the conditions for synchro switch are OK, then the relative rotation of the voltage vectors is monitored. The command is generated before the synchronous position, taking the breaker closing time into consideration *Breaker Time*. The pulse duration is defined by the parameter *Close Pulse*.

In case of slow rotation and if the vectors are for a long time near-opposite vector positions, the waiting time is limited by the preset parameter *Max Switch Time*.

The progress is indicated by the output status signal SYN25_InProgA_GrI_ / SYN25_InProgM_GrI_ (SynInProgr Auto/Manual).

The started command can be canceled using the input signal SYN25_CancelA_GrO_ / SYN25_CancelM_GrO_ (Cancel Auto/Manual).

2 Synchro check, synchro switch function overview

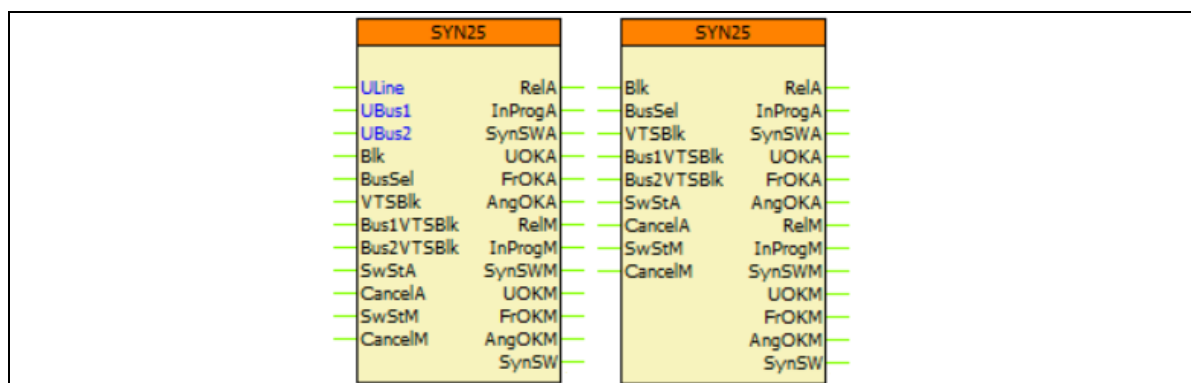


Figure 2-1 Graphic appearance of the synchro check, synchro switch function block

2.1 Settings

2.1.1 Parameters

Table 2-1 Parameters of the function

TITLE	DIM	RANGE	STEP	DEFAULT	EXPLANATION
Voltage Select	-	L1-N, L2-N, L3-N, L1-L2, L2-L3, L3-L1	-	L1-N	Selection of the processed voltage
U Live	%	60 – 110	1	70	Voltage limit for “live line” detection
U Dead	%	10 – 60	1	30	Voltage limit for “dead line” detection
Breaker Time	ms	0 – 500	1	80	Breaker operating time at closing
Close Pulse	ms	10 – 60000	1	1000	Impulse duration for close command
Max Switch Time	ms	100 – 60000	1	2000	Maximum allowed switching time
Operation Auto	-	Off, On, ByPass	-	Off	Operation mode for automatic switching
Synchro switch - Auto	-	Off, On	-	Off	Enabling/disabling automatic switching
Energizing - Auto	-	Off, Dead bus – Live line, Live bus – Dead line, Any energizing case, Any live	-	Off	Energizing mode for automatic switching
Udiff SynCheck - Auto	%	5 – 30	1	10	Voltage difference for automatic synchro checking mode
Udiff SynSwitch - Auto	%	5 – 30	1	20	Voltage difference for automatic synchro switching mode
Phase diff - Auto	deg	5 – 80	1	20	Max. phase difference for automatic switching
f diff SynCheck - Auto	Hz	0.02 – 0.50	0.01	0.02	Frequency difference for automatic synchro checking mode

f diff SynSwitch - Auto	Hz	0.10 – 1.00	0.01	0.20	Frequency difference for automatic synchro switching mode
Operation - Man	-	Off, On, ByPass	-	Off	Operation mode for manual switching
Synchro switch - Man	-	Off, On	-	Off	Enabling/disabling manual switching
Energizing - Man	-	Off, Dead bus – Live line, Live bus – Dead line, Any energizing case, Any live	-	Off	Energizing mode for manual switching
Udiff SynCheck - Man	%	5 – 30	1	10	Voltage difference for manual synchro checking mode
Udiff SynSwitch - Man	%	5 – 30	1	20	Voltage difference for manual synchro switching mode
Phase diff - Man	deg	5 – 80	1	20	Max. phase difference for manual switching
f diff SynCheck - Man	Hz	0.02 – 0.50	0.01	0.02	Frequency difference for manual synchro checking mode
f diff SynSwitch - Man	Hz	0.10 – 1.00	0.01	0.20	Frequency difference for manual synchro switching mode

2.2 Function I/O

2.2.1 Analogue inputs

For configurations running on firmware version 2.10.2.3010 and above, i.e. with graphical analogue signals Table 2-2 below shows the analogue inputs. Parts written in **bold** are seen on the left side of the function block in the logic editor.

Table 2-2 The graphical analogue input signals of the synchro check, synchro switch function

ANALOGUE INPUT SIGNALS	SIGNAL TITLE	EXPLANATION
SYN25_ U Line_AnIn_	Line voltage	Input for sampled values of the 3-Phase voltages for the line
SYN25_ U Bus1_AnIn_	Bus 1 voltage	Input for sampled values of the 3-Phase voltages for bus 1
SYN25_ U Bus2_AnIn_	Bus 2 voltage	Input for sampled values of the 3-Phase voltages for bus 2

2.2.2 Analogue outputs

There are no analogue outputs for this function block.

2.2.3 Binary input signals (graphed output statuses)

The **binary input status signals** of the synchro check, synchro switch function are listed in Table 2-3. Parts written in **bold** are seen on the function block in the logic editor.

Table 2-3 The binary input status signals of the synchro check, synchro switch function

BINARY INPUT SIGNALS	SIGNAL TITLE	EXPLANATION
SYN25_ Blk _GrO_	Blk	Signal for blocking the function
SYN25_ BusSel _GrO_	Bus select	If this signal is logic TRUE, then the voltage of Bus2 is selected for evaluation
SYN25_ VTSBlk _GrO_	VTS Block	Blocking signal of the voltage transformer supervision function evaluating the line voltage
SYN25_ Bus1VTSBlk _GrO_	VTS Bus1 Block	Blocking signal of the voltage transformer supervision function evaluating the Bus1 voltage
SYN25_ Bus2VTSBlk _GrO_	VTS Bus2 Block	Blocking signal of the voltage transformer supervision function evaluating the Bus2 voltage
SYN25_ SwStA _GrO_	SySwitch Auto	Switching request signal initiated by the automatic reclosing function
SYN25_ CancelA _GrO_	Cancel Auto	Signal to interrupt (cancel) the automatic switching procedure
SYN25_ SwStM _GrO_	SySwitch Manual	Switching request signal initiated by manual closing
SYN25_ CancelM _GrO_	Cancel Manual	Signal to interrupt (cancel) the manual switching procedure

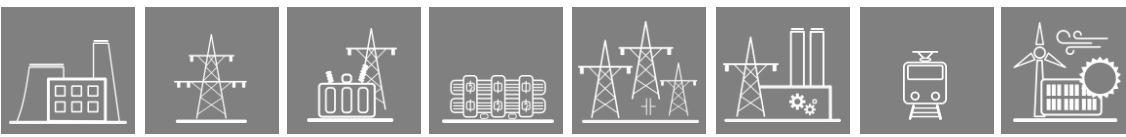
2.2.4 Binary output signals (graphed input statuses)

The **binary output status signals** of the synchro check, synchro switch function are listed in Table 2-4. **Parts** written in **bold** are seen on the function block in the logic editor.

Table 2-4 The binary output signals of the synchro check, synchro switch function

BINARY OUTPUT SIGNALS	SIGNAL TITLE	EXPLANATION
SYN25_ ReIA _Grl_	Release Auto	Releasing the close command initiated by the automatic reclosing function
SYN25_ InProgA _Grl_	SynInProgr Auto	Switching procedure is in progress, initiated by the automatic reclosing function
SYN25_ SynSWA _Grl_	Syn Cmd Auto	Switching command initiated by the automatic reclosing functio
SYN25_ UOKA _Grl_	Udiff OK Auto	The voltage difference is appropriate for automatic closing command
SYN25_ FrOKA _Grl_	FreqDiff OK Auto	The frequency difference is appropriate for automatic closing command, evaluated for synchro-check *
SYN25_ AngOKA _Grl_	Angle OK Auto	The angle difference is appropriate for automatic closing command
SYN25_ ReIM _Grl_	Release Man	Releasing the close command, initiated by manual closing request
SYN25_ InProgM _Grl_	SynInProgr Man	Switching procedure is in progress, initiated by the manual closing command
SYN25_ SynSWM _Grl_	Syn Cmd Man	Switching command initiated by the manual closing command
SYN25_ UOKM _Grl_	Udiff OK Man	The voltage difference is appropriate for manual closing command
SYN25_ FrOKM _Grl_	FreqDiff OK Man	The frequency difference is appropriate for manual closing command, evaluated for synchro-check *
SYN25_ AngOKM _Grl_	Angle OK Man	The angle difference is appropriate for manual closing command
SYN25_ SynSW _Grl_	Syn Cmd	Switching command, OR connection of manual and automatic closing

* The frequency is evaluated using the weighted sum of the three phase voltages



2.2.5 Online data

The following values are visible in the *online data* page:

Table 2-5 Online data of the **synchro check, synchro switch function block**

SIGNAL TITLE	DIM.	EXPLANATION
Voltage Diff	%	Difference between the voltages of the sides to be synchronized
Frequency Diff	Hz	Difference between the frequencies of the voltages of the sides to be synchronized
Angle Diff	deg	Difference between the angles of the voltages of the sides to be synchronized
Syn Status Auto	-	Status of the manual synchro switch procedure. Options: "Blocked", "DLDB", "LLDB", "DLLB", "LLLL"
Release Auto	-	Releasing the close command initiated by the automatic reclosing function
Syn in Progress Auto	-	Switching procedure is in progress, initiated by the automatic reclosing function
Syn Cmd Auto	-	Switching command initiated by the automatic reclosing function
Udiff OK Auto	-	The voltage difference is appropriate for automatic closing command
FreqDiff OK Auto	-	The frequency difference is appropriate for automatic closing command, evaluated for synchro-check
Angle OK Auto	-	The angle difference is appropriate for automatic closing command
Syn Status Man	-	Status of the automatic synchro switch procedure. Options: "Blocked", "DLDB", "LLDB", "DLLB", "LLLL"
Release Man	-	Releasing the close command, initiated by manual closing request
Syn in Progress Man	-	Switching procedure is in progress, initiated by the manual closing command
Syn Cmd Man	-	Switching command initiated by the manual closing command
Udiff OK Man	-	The voltage difference is appropriate for manual closing command
FreqDiff OK Man	-	The frequency difference is appropriate for manual closing command, evaluated for synchro-check
Angle OK Man	-	The angle difference is appropriate for manual closing command
Line voltage input assignment	-	Status of the graphical analogue input connection ("Complete" if connected, "Missing" if not connected, "Mismatch" if wrong type of signal is connected, "Incomplete" if input is not well configured)*
Bus1 voltage input assignment	-	
Bus2 voltage input assignment	-	

*only valid for the 2.10 system version configurations

2.2.6 Events

The following events are generated in the event list as well as sent to the SCADA

Table 2-6 Events of the synchro check, synchro switch function block

EVENT	VALUE	EXPLANATION	IEC 61850 DATA OBJECT
Release Auto	on, off	Auto release signal	AutRSYN\$ST\$Rel
In progress Auto	on, off	Auto Synchro in progress	AutRSYN\$ST\$SynPrg
Close Auto	on, off	Auto Synchro close	AutRSYN\$ST\$SynOp
Release Man	on, off	Manual Release signal	ManRSYN\$ST\$Rel
In progress Man	on, off	Manual Synchro in progress	ManRSYN\$ST\$SynPrg
Close Man	on, off	Manual Synchro close	ManRSYN\$ST\$SynOp

2.3 Technical data

Table 2-7 Technical data of the synchro check, synchro switch function

FUNCTION	EFFECTIVE RANGE	ACCURACY IN THE EFFECTIVE RANGE
Voltage effective range	10-110 % of U_n	$\pm 1\%$ of U_n
Frequency	47.5 – 52.5 Hz	± 10 mHz
Phase angle		$\pm 3^\circ$
Operate time	Setting value	± 3 ms
Reset time	<50 ms	
Reset ratio	0.95 U_n	