Automation Bus transfer

1 Introduction

This application note describes configuring automatic bus transfer (ABT) logic with two V57 relays.

In the Figure 1 is presented the single line principal diagram of the system. In normal situation the tie breaker is open and the A/B sides are feeding loads independently of each other. Loads in the network are mainly motors loaded with pump applications. When the voltage in either of A/B sides decreases lower than 70 % of nominal for time over 3 seconds the automatic bus transfer is activated. V57 relays operate breakers A and B and also the tie breaker.

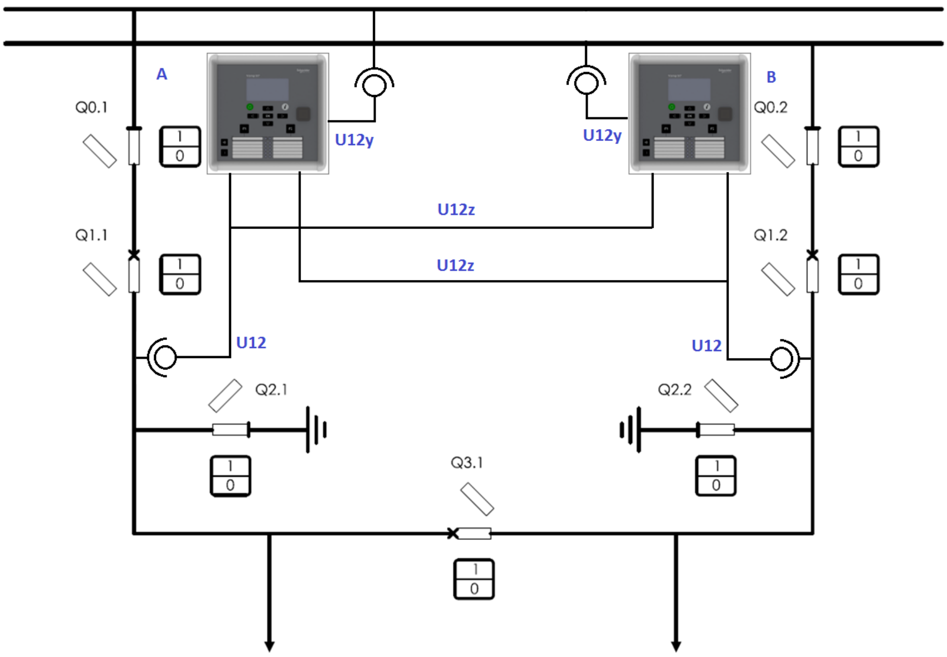


Figure 1. Single line diagram of the automatic bus transfer (ABT) system.

The sequence of the bus transfer opens the faulty side breaker A or B and closes the tie breaker when the remaining voltage of the bus is under 20 % of nominal or synchrocheck gives permission. Return in to the normal feeding situation is operated ether manually or automatically when initiation for closing breaker is given.

2 Description of operation

In this chapter are described the automatic bus transfer logic, relay settings, relay connections and the simulation model with the relay testing equipment.

The principle of the testing was to simulate the bus transfer sequence with Omicron and with the simulation data verify the operation of the relays is expected.

2.1 Automatic bus transfer logic

Automatic bus transfer logic is based in to the undervoltage detection of the measured incomer. The logic in the V57 relays is identical to both of the relays. In this document the V57 controlled breaker is called breaker X and the monitored breaker is called breaker Y in the adjacent incomer.

In the V57 logic the following binary input signals were used:

DI5	V57 controlled breaker X open indication
DI6	V57 controlled breaker X closed indication
NI3	V57 controlled breaker Y open indication
NI4	V57 controlled breaker Y closed indication
DI7	Tie breaker open indication
DI8	Tie breaker closed indication
F1	Automatic bus transfer permitted
F2	Manual control override

In the V57 logic the following binary output signals were used:

T3	V57 controlled breaker X open command
T4	V57 controlled breaker X close command
T5	Tie breaker open command
T6	Tie breaker close command
LA led	Automatic bus transfer back to normal possible
LC led	Protection stage start indication
LD led	Protection stage trip indication

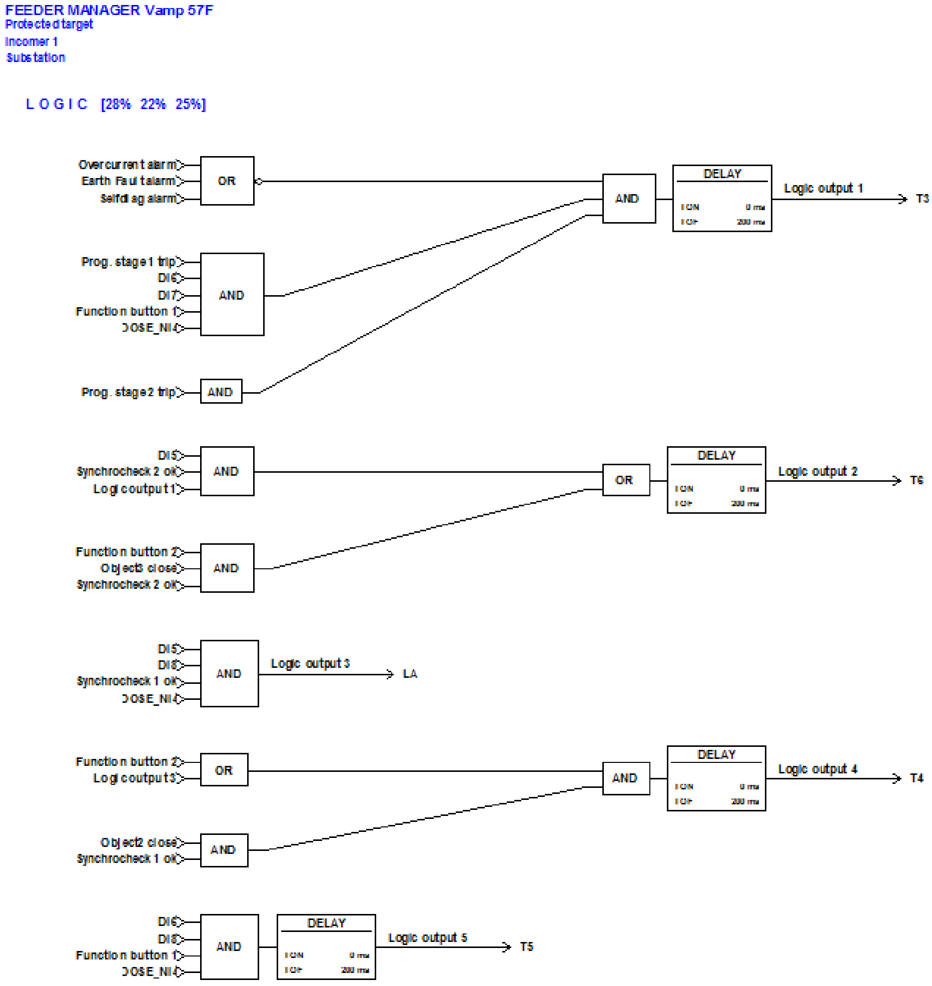


Figure 2. Automatic bus transfer logic

In the logic is found four major parts divided by the breakers controls.

1. T3, Open command of the Breaker X
2. T4, Close command of the breaker X
3. T5, Open command of tie breaker
4. T6, Close command of tie breaker

In following pages are presented the logic operations in detail.

2.1.1 T3, Open command of the Breaker X

In the figure 3 is presented the logic for the breaker X open command T3.

Automatic open command is given for the breaker X (Trip relay T3) in conditions:

1. No overcurrent is detected
2. No earth fault is detected
3. No relay error is detected
4. Opposite site voltage is OK (Programmable stage 1)
5. Breaker X is closed (DI6)
6. Tie breaker is open (DI7)
7. Automatic bus transfer is permitted (Function button 1)
8. Breaker Y is closed (Goose NI4)
9. Voltage is lost in from Incomer bus U12y (Programmable stage 2)

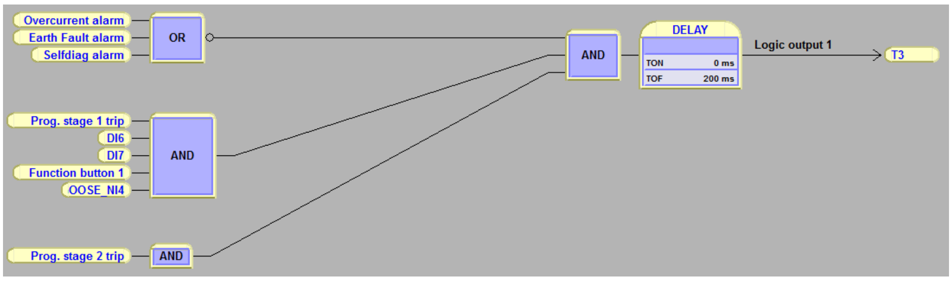


Figure 3. Open control of the breaker X

Programmable stage 2 is activated when the measured voltage from the incomer U12y is under 70% of nominal over 3 seconds. With the logic is made sure that the feeding breaker is not opened in the situation when the tie breaker is open so that the loads in the bus would be unenergized.

2.1.2 T4, Close command of the Breaker X

In the figure 4 is presented the logic for the breaker X close command T4.

Manual close command is given for the breaker X (Trip relay T4) in conditions:

1. Breaker X is open (DI5)
2. Tie breaker is closed (DI8)
3. Breaker Y is closed (Goose NI4)
4. Voltages are synchronized U12 and U12y (Synchrocheck 1)
5. Breaker X close command is given (Object 2 close)

OR

1. Manual control override is active (Function button 2)
2. Breaker X close command is given (Object 2 close)
3. Voltages are synchronized U12 and U12y (Synchrocheck 1)

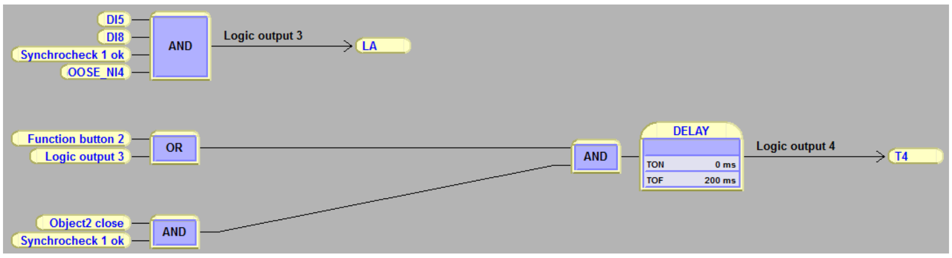


Figure 4. Close control of the Breaker X.

Synchrocheck 1 monitors the U12 (busbar) and U12y (feeding) voltages. With the logic is made sure that the feeding breaker is not closed in asynchronous situation.

2.1.3 T5, Open command of the tie breaker

In the figure 5 is presented the logic for the tie breaker open command T5.

Automatic open command is given for the tie breaker (Trip relay T5) in conditions:

1. Breaker X is closed (DI6)
2. Breaker Y is closed (Goose NI4)
3. Tie breaker is closed (DI8)
4. Automatic bus transfer is permitted (Function button 1)

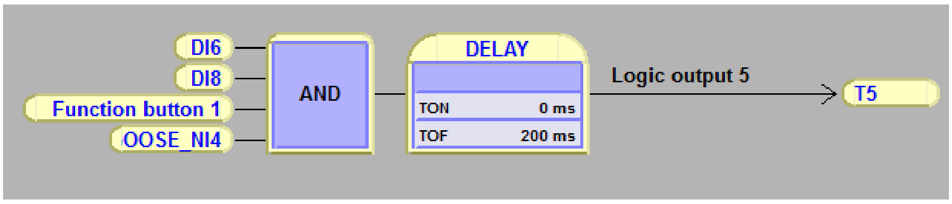


Figure 5. Open command of the tie breaker.

With the logic is prevented the situation where both of the busbars A and B are fed with one feeding A or B and the tie breaker must not be allowed to open.

2.1.4 T6, Close command of the tie breaker

In the figure 6 is presented the logic for the tie breaker close command T6. For the close command of the tie breaker in the logic is two separate conditions.

1. Breaker X is open (DI5)
2. Voltages are synchronized U12 and U12z (synchrocheck 2)
3. Automatic bus transfer has tripped breaker X (Logic output 1)

OR

1. Manual override is activated (Function button 2)
2. Voltages are synchronized U12 and U12z (synchrocheck 2)
3. Tie breaker close command is given (Object 3 close)

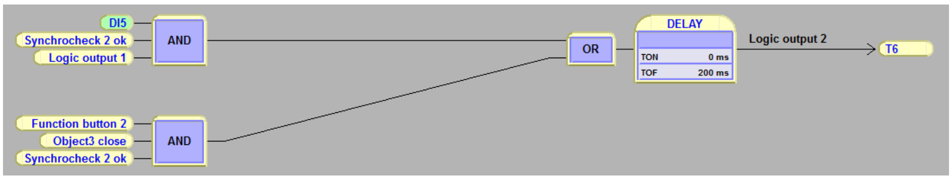


Figure 6. Close command of tie breaker.

2.2 Relay settings

In this chapter, the activated stages of V57 relays are presented.

2.2.1 V57 current stage settings

Current stages	
Enable for I>	✓
Enable for I>>	✓
Enable for I>>>	✓
Enable for I2>	
Enable for I<	
Enable for If2>	
Enable for If5>	

Figure 7. Enabled Current stages in the V57.

Set group 1 DI control	-			
Set group 2 DI control	-			
Set group 3 DI control	-			
Set group 4 DI control	-			
Group	1			
	Group 1	Group 2	Group 3	Group 4
Pick-up setting	600 A	600 A	600 A	600 A
Pick-up setting	1.20 xIn	1.20 xIn	1.20 xIn	1.20 xIn
Delay curve family	IEC	IEC	IEC	IEC
Delay type	NI	NI	NI	NI
Inv. time coefficient k	1.00	1.00	1.00	1.00
Inverse delay (20x)	2.26 s	2.26 s	2.26 s	2.26 s
Inverse delay (4x)	4.97 s	4.97 s	4.97 s	4.97 s
Inverse delay (1x)	600.02 s	600.02 s	600.02 s	600.02 s
	Common settings			
Include harmonics	On			

Figure 8. Settings of the I> stage.

Set group 1 DI control	-			
Set group 2 DI control	-			
Set group 3 DI control	-			
Set group 4 DI control	-			
Group	1			
	Group 1	Group 2	Group 3	Group 4
Pick-up setting	1250 A	1250 A	1250 A	1250 A
Pick-up setting	2.50 xIn	2.50 xIn	2.50 xIn	2.50 xIn
Operation delay	0.30 s	0.60 s	0.60 s	0.60 s
	Common settings			
Include harmonics	Off			

Figure 9. Settings of the I>> stage.

Set group 1 DI control	-			
Set group 2 DI control	-			
Set group 3 DI control	-			
Set group 4 DI control	-			
Group	1			
	Group 1	Group 2	Group 3	Group 4
Pick-up setting	2500 A	2500 A	2500 A	2500 A
Pick-up setting	5.00 xIn	5.00 xIn	5.00 xIn	5.00 xIn
Operation delay	0.03 s	0.10 s	0.10 s	0.10 s

Figure 10. Settings of the I>>> stage.

2.2.2 V57 earth-fault stage settings

Earth-fault stages	
Enable for Io>	✓
Enable for Io>>	✓
Enable for Ioφ>	
Enable for Ioφ>>	
Enable for Io>>>	✓
Enable for Io>>>>	
Enable for IoInt>	
Enable for Uo>	
Enable for Uo>>	

Figure 11. Enabled Earth-fault stages in the V57.

Set group 1 DI control	-			
Set group 2 DI control	-			
Set group 3 DI control	-			
Set group 4 DI control	-			
Group	1			
	Group 1	Group 2	Group 3	Group 4
Pick-up setting	2.50 A	2.50 A	2.50 A	2.50 A
Pick-up setting	0.050 pu	0.050 pu	0.050 pu	0.050 pu
Delay curve family	IEC	DT	DT	DT
Delay type	NI	DT	DT	DT
Operation delay	1.00 s	1.00 s	1.00 s	1.00 s
Inv. time coefficient k	1.00	1.00	1.00	1.00
Inverse delay (20x)	2.26 s	- s	- s	- s
Inverse delay (4x)	4.97 s	- s	- s	- s
Inverse delay (1x)	600.02 s	- s	- s	- s
Network grounding	Res	Res	Res	Res
	Common settings			
Intermittent time	0.00 s			

Figure 12. Settings of the I_0> stage.

Set group 1 DI control	-			
Set group 2 DI control	-			
Set group 3 DI control	-			
Set group 4 DI control	-			
Group	1			
	Group 1	Group 2	Group 3	Group 4
Pick-up setting	10.00 A	5.00 A	5.00 A	5.00 A
Pick-up setting	0.20 pu	0.10 pu	0.10 pu	0.10 pu
Operation delay	0.50 s	1.00 s	1.00 s	1.00 s
Network grounding	Res	Res	Res	Res

Figure 13. Settings of the I_0>> stage.

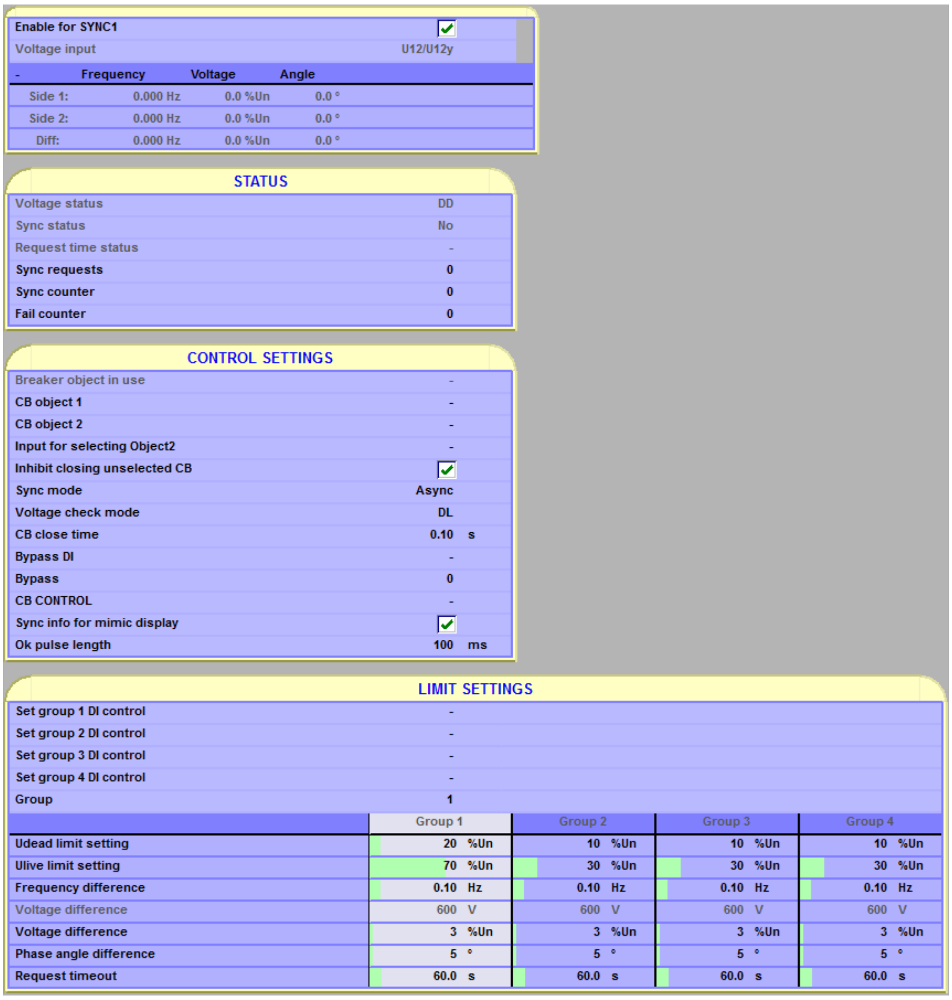
Set group 1 DI control	-			
Set group 2 DI control	-			
Set group 3 DI control	-			
Set group 4 DI control	-			
Group	1			
	Group 1	Group 2	Group 3	Group 4
Pick-up setting	50.00 A	5.00 A	5.00 A	5.00 A
Pick-up setting	1.00 pu	0.10 pu	0.10 pu	0.10 pu
Operation delay	0.04 s	0.50 s	0.50 s	0.50 s
Network grounding	Res	Res	Res	Res

Figure 14. Settings of the I_0>>> stage.

2.2.3 V57 other enabled functions

Other functions	
Enable for P<	
Enable for P<<	
Enable for T>	
Enable for Uc>	
Enable for CBFP	
Enable autoreclosing	ARoff
Enable for SYNC1	✓
Enable for SYNC2	✓
Enable for Prg1	✓
Enable for Prg2	✓
Enable for Prg3	
Enable for Prg4	
Enable for Prg5	
Enable for Prg6	
Enable for Prg7	
Enable for Prg8	

Figure 15. Enabled other functions in V57.



Enable for SYNC1	☑	
Voltage input	U12/U12y	

-	Frequency	Voltage	Angle
Side 1:	0.000 Hz	0.0 %Un	0.0 °
Side 2:	0.000 Hz	0.0 %Un	0.0 °
Diff:	0.000 Hz	0.0 %Un	0.0 °

STATUS

Voltage status	DD
Sync status	No
Request time status	-
Sync requests	0
Sync counter	0
Fail counter	0

CONTROL SETTINGS

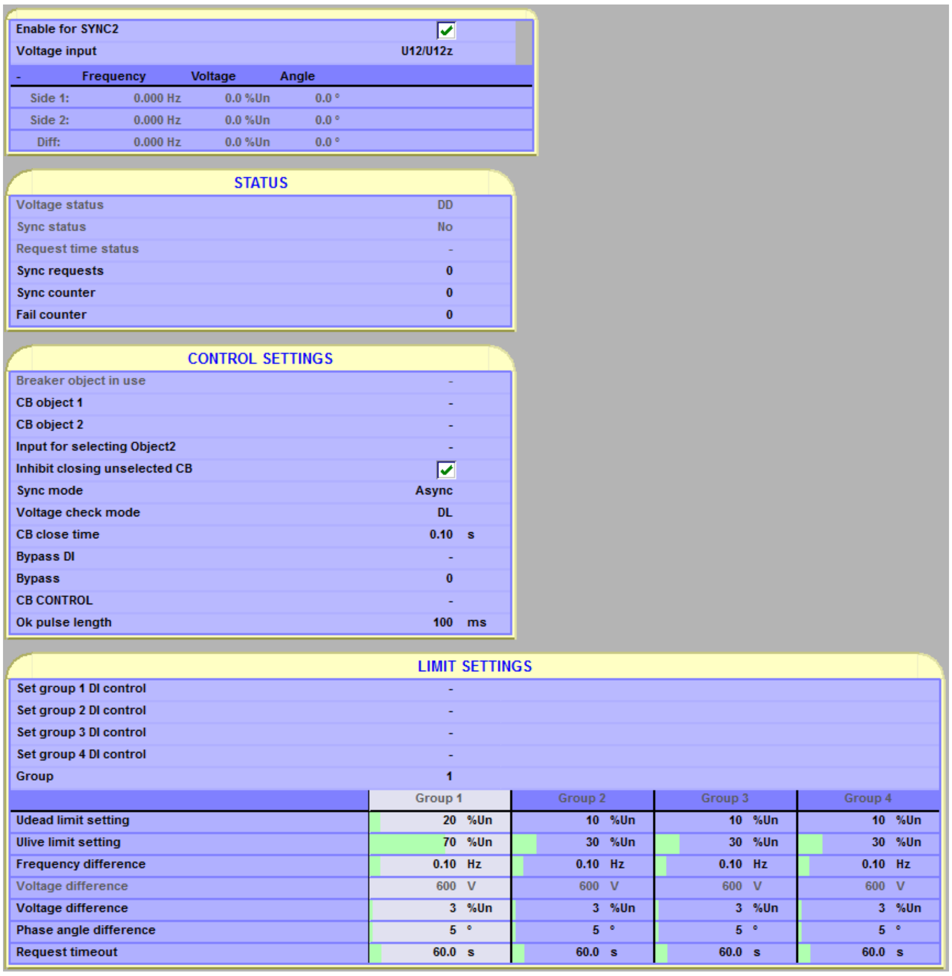
Breaker object in use	-	
CB object 1	-	
CB object 2	-	
Input for selecting Object2	-	
Inhibit closing unselected CB	☑	
Sync mode	Async	
Voltage check mode	DL	
CB close time	0.10	s
Bypass DI	-	
Bypass	0	
CB CONTROL	-	
Sync info for mimic display	☑	
Ok pulse length	100	ms

LIMIT SETTINGS

Set group 1 DI control	-
Set group 2 DI control	-
Set group 3 DI control	-
Set group 4 DI control	-
Group	1

	Group 1	Group 2	Group 3	Group 4
Udead limit setting	20 %Un	10 %Un	10 %Un	10 %Un
Ulive limit setting	70 %Un	30 %Un	30 %Un	30 %Un
Frequency difference	0.10 Hz	0.10 Hz	0.10 Hz	0.10 Hz
Voltage difference	600 V	600 V	600 V	600 V
Voltage difference	3 %Un	3 %Un	3 %Un	3 %Un
Phase angle difference	5 °	5 °	5 °	5 °
Request timeout	60.0 s	60.0 s	60.0 s	60.0 s

Figure 16. Synchrocheck 1 settings.



Enable for SYNC2	☑	
Voltage input	U12/U12z	

-	Frequency	Voltage	Angle
Side 1:	0.000 Hz	0.0 %Un	0.0 °
Side 2:	0.000 Hz	0.0 %Un	0.0 °
Diff:	0.000 Hz	0.0 %Un	0.0 °

STATUS

Voltage status	DD
Sync status	No
Request time status	-
Sync requests	0
Sync counter	0
Fail counter	0

CONTROL SETTINGS

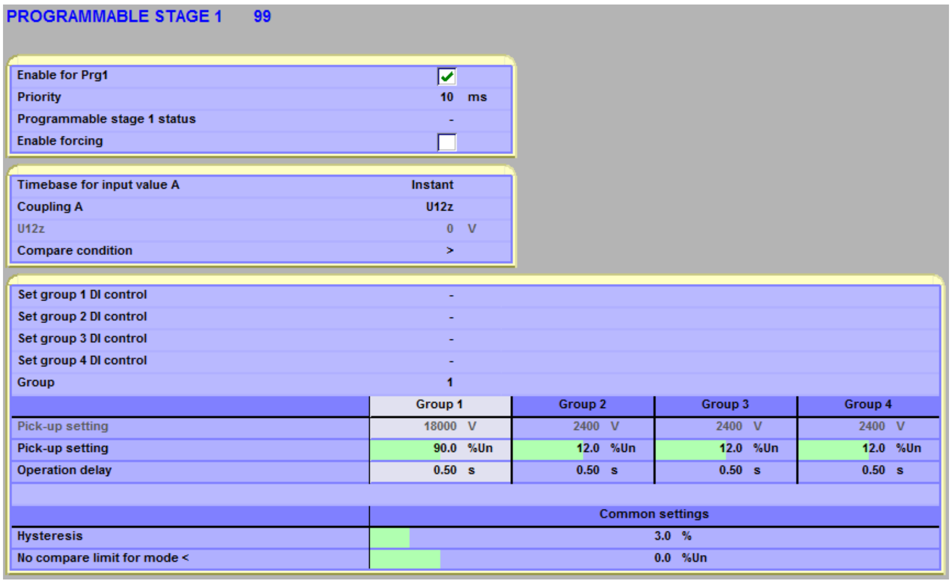
Breaker object in use	-	
CB object 1	-	
CB object 2	-	
Input for selecting Object2	-	
Inhibit closing unselected CB	☑	
Sync mode	Async	
Voltage check mode	DL	
CB close time	0.10	s
Bypass DI	-	
Bypass	0	
CB CONTROL	-	
Ok pulse length	100	ms

LIMIT SETTINGS

Set group 1 DI control	-
Set group 2 DI control	-
Set group 3 DI control	-
Set group 4 DI control	-
Group	1

	Group 1	Group 2	Group 3	Group 4
Udead limit setting	20 %Un	10 %Un	10 %Un	10 %Un
Ulive limit setting	70 %Un	30 %Un	30 %Un	30 %Un
Frequency difference	0.10 Hz	0.10 Hz	0.10 Hz	0.10 Hz
Voltage difference	600 V	600 V	600 V	600 V
Voltage difference	3 %Un	3 %Un	3 %Un	3 %Un
Phase angle difference	5 °	5 °	5 °	5 °
Request timeout	60.0 s	60.0 s	60.0 s	60.0 s

Figure 17. Synchrocheck 2 settings.



PROGRAMMABLE STAGE 1 99

Enable for Prg1	☑	
Priority	10	ms
Programmable stage 1 status	-	
Enable forcing	☐	

Timebase for input value A	Instant	
Coupling A	U12z	
U12z	0	V
Compare condition	>	

Set group 1 DI control	-
Set group 2 DI control	-
Set group 3 DI control	-
Set group 4 DI control	-
Group	1

	Group 1	Group 2	Group 3	Group 4
Pick-up setting	18000 V	2400 V	2400 V	2400 V
Pick-up setting	90.0 %Un	12.0 %Un	12.0 %Un	12.0 %Un
Operation delay	0.50 s	0.50 s	0.50 s	0.50 s

	Common settings
Hysteresis	3.0 %
No compare limit for mode <	0.0 %Un

Figure 18. Programmable stage 1 settings.

PROGRAMMABLE STAGE 2 99

Enable for Prg2	☑	
Priority	10	ms
Programmable stage 2 status	Trip	
Enable forcing	☐	

Timebase for input value A	Instant	
Coupling A	U12y	
U12y	0	V
Compare condition	<	

Set group 1 DI control	-			
Set group 2 DI control	-			
Set group 3 DI control	-			
Set group 4 DI control	-			
Group	1			
	Group 1	Group 2	Group 3	Group 4
Pick-up setting	14000 V	2400 V	2400 V	2400 V
Pick-up setting	70.0 %Un	12.0 %Un	12.0 %Un	12.0 %Un
Operation delay	3.00 s	0.50 s	0.50 s	0.50 s
	Common settings			
Hysteresis	3.0 %			
No compare limit for mode <	0.0 %Un			

Figure 19. Programmable stage 2 settings.

2.2.4 V57 general settings

SCALING

CT primary	500	A
CT secondary	5	A
Nominal input	5	A
VT primary	20000	V
VT secondary	100	V
VTy secondary	100	V
VTz secondary	100	V
Io1 CT primary	50	A
Io1 CT secondary	5.0	A
Nominal Io1 input	5.0	A
VTo secondary	100.000	V
Voltage meas. mode	LL+Uo/y/z	
Frequency adaptation mode	Auto	
Adapted frequency	50.0	Hz
Angle memory duration	0.50	s

Figure 20. Scaling settings in V57.

DI for Remote/Local	-	
Input for Remote control block	-	
Pwd for mimic control	☑	
Remote/Local State	LOCAL	
Remote control block state	-	
Object for control buttons	Obj2	
Mode for control buttons	Selective	
Synchrocheck connected objects	-	
Request time status	-	
Request time status	-	

Figure 21. Object common settings in V57.

CTRL OBJECT 1		
Label(Obj1)	Obj1	
Obj1 state	Close	
Obj1 final trip by	-	
DI for 'obj open'	DI3	
DI for 'obj closed'	DI4	
DI for 'obj ready'	-	
Max ctrl pulse length	0.20	s
Completion timeout	10.00	s
Object 1 control	-	
DI for remote open ctr	-	
DI for remote close ctr	-	
DI for local open ctr	-	
DI for local close ctr	-	
Inactivity days limit	500	
Last state change	2015-07-17	
Inactivity days left	499	
Inactivity alarm	inactive	
Clear alarm	-	

Figure 22. Object1 settings in V57.

CTRL OBJECT 2		
Label(Obj2)	Obj2	
Obj2 state	Open	
Obj2 final trip by	-	
DI for 'obj open'	DI5	
DI for 'obj closed'	DI6	
DI for 'obj ready'	-	
Max ctrl pulse length	0.20	s
Completion timeout	10.00	s
Object 2 control	-	
DI for remote open ctr	-	
DI for remote close ctr	-	
DI for local open ctr	-	
DI for local close ctr	-	
Inactivity days limit	500	
Last state change	2015-07-18	
Inactivity days left	500	
Inactivity alarm	inactive	
Clear alarm	-	

Figure 23. Object2 settings in V57.

CTRL OBJECT 3		
Label(Obj3)	Obj3	
Obj3 state	Open	
Obj3 final trip by	-	
DI for 'obj open'	DI7	
DI for 'obj closed'	DI8	
DI for 'obj ready'	-	
Max ctrl pulse length	0.20	s
Completion timeout	10.00	s
Object 3 control	-	
DI for remote open ctr	-	
DI for remote close ctr	-	
DI for local open ctr	-	
DI for local close ctr	-	
Inactivity days limit	500	
Last state change	2015-07-18	
Inactivity days left	500	
Inactivity alarm	inactive	
Clear alarm	-	

Figure 24. Object3 settings in V57.

CTRL OBJECT 4		
Label(Obj4)	Obj4	
Obj4 state	Open	
Obj4 final trip by	-	
DI for 'obj open'	DI9	
DI for 'obj closed'	DI10	
DI for 'obj ready'	-	
Max ctrl pulse length	0.20	s
Completion timeout	10.00	s
Object 4 control	-	
DI for remote open ctr	-	
DI for remote close ctr	-	
DI for local open ctr	-	
DI for local close ctr	-	
Inactivity days limit	500	
Last state change	2015-06-30	
Inactivity days left	482	
Inactivity alarm	inactive	
Clear alarm	-	

Figure 25. Object4 settings in V57.

CTRL OBJECT 5		
Label(Obj5)	Obj5	
Obj5 state	Close	
Obj5 final trip by	-	
DI for 'obj open'	GOOSE_NI1	
DI for 'obj closed'	GOOSE_NI2	
DI for 'obj ready'	-	
Max ctrl pulse length	0.20	s
Completion timeout	10.00	s
Object 5 control	-	
DI for remote open ctr	-	
DI for remote close ctr	-	
DI for local open ctr	-	
DI for local close ctr	-	
Inactivity days limit	500	
Last state change	2015-07-17	
Inactivity days left	499	
Inactivity alarm	inactive	
Clear alarm	-	

Figure 26. Object5 settings in V57.

CTRL OBJECT 6		
Label(Obj6)	Obj6	
Obj6 state	Close	
Obj6 final trip by	-	
DI for 'obj open'	GOOSE_NI3	
DI for 'obj closed'	GOOSE_NI4	
DI for 'obj ready'	-	
Max ctrl pulse length	0.20	s
Completion timeout	10.00	s
Object 6 control	-	
DI for remote open ctr	-	
DI for remote close ctr	-	
DI for local open ctr	-	
DI for local close ctr	-	
Inactivity days limit	500	
Last state change	2015-07-18	
Inactivity days left	500	
Inactivity alarm	inactive	
Clear alarm	-	

Figure 27. Object6 settings in V57.

OBJECT 7		
Label(Obj7)	Obj7	
Obj7 state	Open	
DI for 'obj open'	GOOSE_NI5	
DI for 'obj closed'	GOOSE_NI6	
Object timeout	0.20	s

Figure 28. Object7 settings in V57.

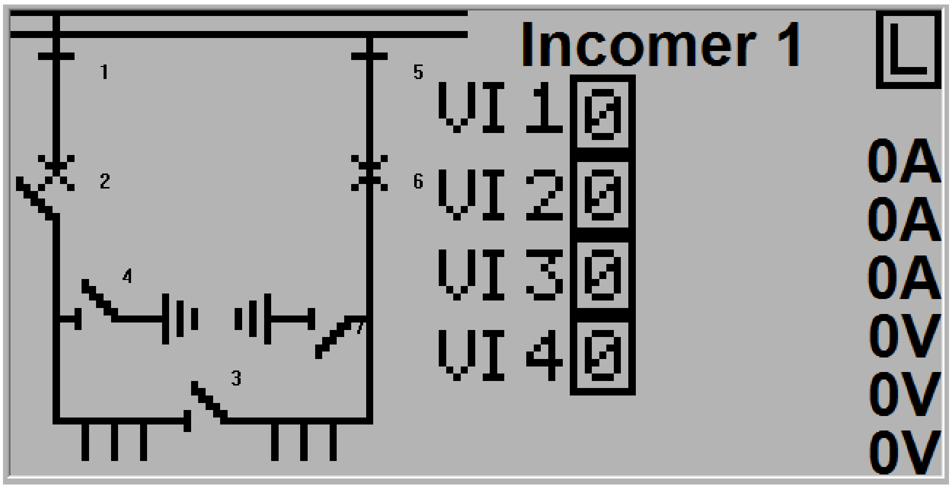


Figure 29. HMI of V57 A.

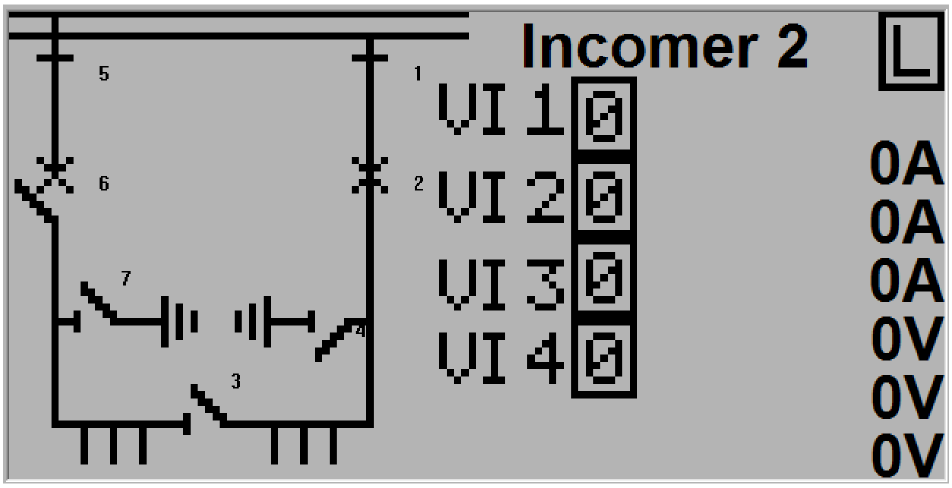


Figure 30. HMI of V57 B.

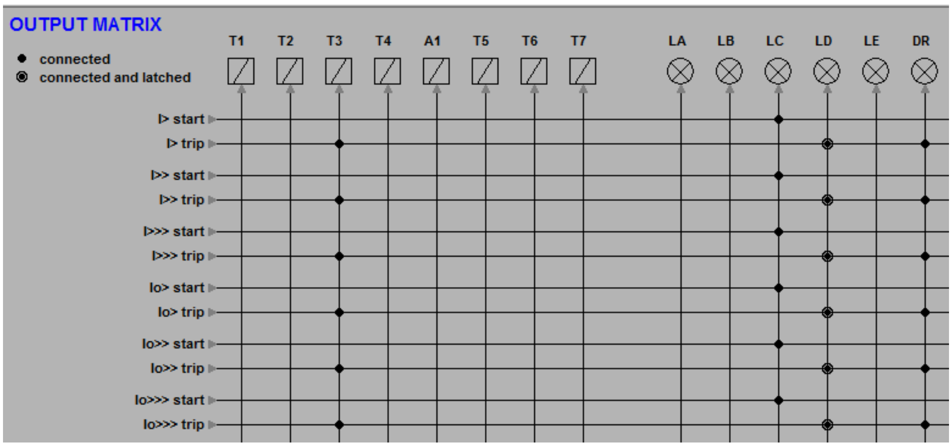


Figure 31. Output matrix settings for protection stages in V57.

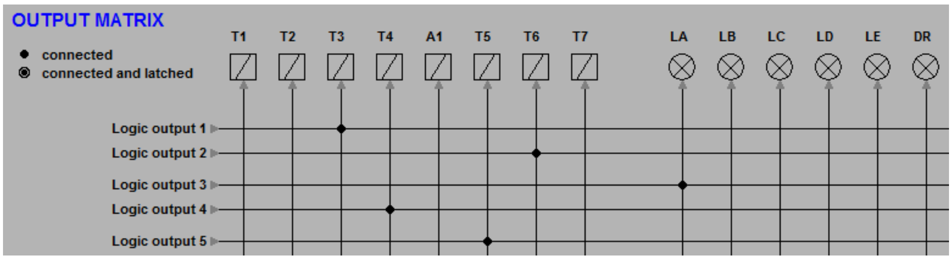
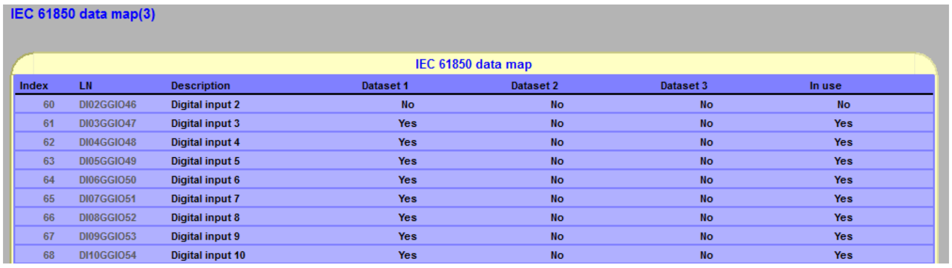


Figure 32. Output matrix settings for Logic outputs in V57.

2.2.5 V57 communication settings



IEC 61850 data map(3)

IEC 61850 data map

Index	LN	Description	Dataset 1	Dataset 2	Dataset 3	In use
60	DI02GGIO46	Digital input 2	No	No	No	No
61	DI03GGIO47	Digital input 3	Yes	No	No	Yes
62	DI04GGIO48	Digital input 4	Yes	No	No	Yes
63	DI05GGIO49	Digital input 5	Yes	No	No	Yes
64	DI06GGIO50	Digital input 6	Yes	No	No	Yes
65	DI07GGIO51	Digital input 7	Yes	No	No	Yes
66	DI08GGIO52	Digital input 8	Yes	No	No	Yes
67	DI09GGIO53	Digital input 9	Yes	No	No	Yes
68	DI10GGIO54	Digital input 10	Yes	No	No	Yes

Figure 33. IEC61850 Data map 3 in V57.

GOOSE configuration

Publisher parameters

Max retransmission timeout	20	s
Fixed length GOOSE	No	

Publisher configuration GCB 1

Enable	Yes	
GOOSE ID *	Incomer1	
Configuration Revision *	1	
Needs Commissioning	No	
DI for test mode	-	
Test mode	No	
MAC Address	01-0C-CD-01-00-00	
VLAN Priority	4	
VLAN ID	000	Hex
Application ID *	0001	Hex
Include Quality in GOOSE Dataset	☐	
* Important for VAMP subscriber		

Publisher configuration GCB 2

Enable	No	
GOOSE ID *	VAMP	
Configuration Revision *	1	
Needs Commissioning	No	
DI for test mode	-	
Test mode	No	
MAC Address	01-0C-CD-01-00-00	
VLAN Priority	4	
VLAN ID	000	Hex
Application ID *	0001	Hex
Include Quality in GOOSE Dataset	☐	
* Important for VAMP subscriber		

Subscriber configuration

Enable	Yes	
MAC Address	01-0C-CD-01-00-00	
Min supervision time	1.0	s
GOOSE ID 1	VAMP1	
GOOSE ID 2	VAMP2	
GOOSE ID 3	VAMP3	
GOOSE ID 4	VAMP4	
GOOSE ID 5	VAMP5	

Figure 34. IEC61850 Goose configuration in V57A.

GOOSE configuration

Publisher parameters

Max retransmission timeout	20	s
Fixed length GOOSE	No	

Publisher configuration GCB 1

Enable	Yes	
GOOSE ID *	Incomer2	
Configuration Revision *	1	
Needs Commissioning	No	
DI for test mode	-	
Test mode	No	
MAC Address	01-0C-CD-01-00-00	
VLAN Priority	4	
VLAN ID	000	Hex
Application ID *	0002	Hex
Include Quality in GOOSE Dataset	☐	
* Important for VAMP subscriber		

Publisher configuration GCB 2

Enable	No	
GOOSE ID *	VAMP	
Configuration Revision *	1	
Needs Commissioning	No	
DI for test mode	-	
Test mode	No	
MAC Address	01-0C-CD-01-00-00	
VLAN Priority	4	
VLAN ID	000	Hex
Application ID *	0001	Hex
Include Quality in GOOSE Dataset	☐	
* Important for VAMP subscriber		

Subscriber configuration

Enable	Yes	
MAC Address	01-0C-CD-01-00-00	
Min supervision time	1.0	s
GOOSE ID 1	VAMP1	
GOOSE ID 2	VAMP2	
GOOSE ID 3	VAMP3	
GOOSE ID 4	VAMP4	
GOOSE ID 5	VAMP5	

Figure 35. IEC61850 Goose configuration in V57B.

GOOSE GCB1: DATA POINTS

DSG1 data configuration

Index	IEC-61850 Variable	Signal	Status
0	DI03GGIO47.Ind.stVal(ST)	Q0.1 open	OK
1	DI04GGIO48.Ind.stVal(ST)	Q0.1 close	OK
2	DI05GGIO49.Ind.stVal(ST)	Q1.1 open	OK
3	DI06GGIO50.Ind.stVal(ST)	Q1.1 close	OK
4	DI09GGIO53.Ind.stVal(ST)	Q2.1 open	OK
5	DI10GGIO54.Ind.stVal(ST)	Q2.1 close	OK

Figure 36. IEC61850 Goose publisher in V57A.

GOOSE GCB1: DATA POINTS

DSG1 data configuration

Index	IEC-61850 Variable	Signal	Status
0	DI03GGIO47.Ind.stVal(ST)	Q0.2 open	OK
1	DI04GGIO48.Ind.stVal(ST)	Q0.2 close	OK
2	DI05GGIO49.Ind.stVal(ST)	Q1.2 open	OK
3	DI06GGIO50.Ind.stVal(ST)	Q1.2 close	OK
4	DI09GGIO53.Ind.stVal(ST)	Q2.2 open	OK
5	DI10GGIO54.Ind.stVal(ST)	Q2.2 close	OK

Figure 37. IEC61850 Goose publisher in V57B.

Subscriber binary data

NI	App ID	Conf Rev	Data index	Bit index	Matching GOID	Value	Status	Initial value	In use	Supervision group
1	0002 Hex	1	0	0	NoCheck	0	OK	Last	Yes	Group1
2	0002 Hex	1	1	0	NoCheck	1	OK	Last	Yes	Group1
3	0002 Hex	1	2	0	NoCheck	0	OK	Last	Yes	Group1
4	0002 Hex	1	3	0	NoCheck	1	OK	Last	Yes	Group1
5	0002 Hex	1	4	0	NoCheck	1	OK	Last	Yes	Group1
6	0002 Hex	1	5	0	NoCheck	0	OK	Last	Yes	Group1

Figure 38. IEC61850 Goose subscriber in V57A.

Subscriber binary data

NI	App ID	Conf Rev	Data index	Bit index	Matching GOID	Value	Status	Initial value	In use	Supervision group
1	0001 Hex	1	0	0	NoCheck	0	OK	Last	Yes	Group1
2	0001 Hex	1	1	0	NoCheck	1	OK	Last	Yes	Group1
3	0001 Hex	1	2	0	NoCheck	0	OK	Last	Yes	Group1
4	0001 Hex	1	3	0	NoCheck	1	OK	Last	Yes	Group1
5	0001 Hex	1	4	0	NoCheck	1	OK	Last	Yes	Group1
6	0001 Hex	1	5	0	NoCheck	0	OK	Last	Yes	Group1

Figure 39. IEC61850 Goose subscriber in V57B.

2.3 Simulation mode

In the simulation model was constructed the typical two feeding network. Both of the feedings are feeding independently mainly motors, which are loaded with pump application. The tie breaker between the buses is in open position in normal situation.

Figure 40. Network simulation model of the ABT system.

The ABT logic purpose is to automatically change the failing feeding in to the healthy, so that the loads in the failing feeding are not disturbed for long time. The settings of the ABT allow 3 seconds voltage dip in the feeding before any action is initiated in to the system.

3 Summary and conclusions

According to the test results the ABT system operated as expected in all of the tested cases. Tested cases included voltage drop situations in the feeding transformers and short circuit faults in the busbars and feeders. According to the network and the schema of the ABT logic, the testing of the short circuit fault situations covers the fault situation studies in this type of network.

For complete selectivity one protection relay should be added to tie breaker for cases when tie breaker is closed and one incomer is feeding all loads. Leaving this tie breaker protection relay away selectivity is compromised and in bus fault situation the whole bus needs to be de-energized even it could be possible that only other end of the bus is faulty. In the protection schema should be covered all types of fault situations so that the feeder protection has enough marginal in comparison to the busbar protection so that the interruptions in to loads feeding is minimized.

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