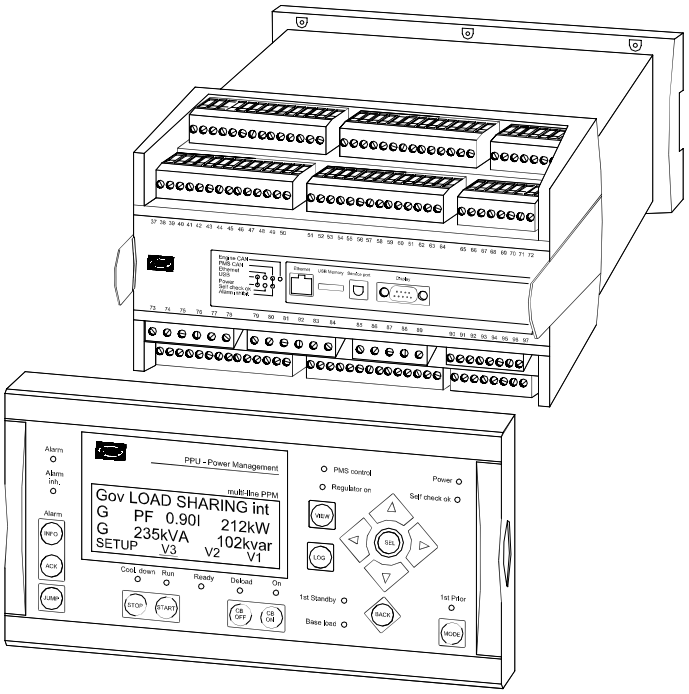
DEIF A/S

Factory Acceptance Test

PPU Power Management (PPM)

4199400001D (UK)



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APPROVAL OF TEST FOR PPM SYSTEM 01-03:

DATE:

LOCATION:

Customer: **DEIF A/S:**

_____ _____

Signature **Signature**

Classification Society:

_____

Signature

Switchboard control

If the operator wants to control a diesel generator set manually, then SWBD control must be selected for the specific generator.

SWBD control of DG

STARTING CONDITIONS	Plant mode = AUTO DG 1 is connected to the busbar (PMS) DG 2 and DG 3 are in stand-by (PMS) TB is connected (PMS) (only system 03) SG is in stand-by (PMS) (only system 02/03) Start priority: 1-2-3		
ACTION	**REACTION**	**NOTES**	**APP.**
Select SWBD control on DG 1	The "PMS CONTROL" LED on the display corresponding to DG 1 goes out	"SWBD control" is displayed at DG 1 under view 3 The regulator of DG 1 is OFF	
Select SEMI-AUTO plant mode. Press the "CB OFF" push-button for DG 1	No reaction	The info. message "I 6 NOT IN PMS CTRL." is displayed	
Start DG 2 and select SWBD control on DG 2. Press the "STOP" push-button for DG 2	No reaction	The info. message "I 6 NOT IN PMS CTRL." is displayed	

SWBD control of frequency

STARTING CONDITIONS	Plant mode = SEMI-AUTO DG 1 is connected to the busbar (PMS) DG 2 is running, but not connected (SWBD) DG 3 is in stand-by (PMS) TB is connected (PMS) (only system 03) SG is in stand-by (PMS) (only system 02/03) Start priority: 1-2-3		
ACTION	**REACTION**	**NOTES**	**APP.**
Activate the "GOV UP" function of DG 2 in the switchboard	The frequency of DG 2 is in-creased		
Activate the "GOV DOWN" function of DG 2 in the switchboard	The frequency of DG 2 is de-creased		
Select PMS control on DG 2	The frequency of DG 2 is automatically corrected to f-Nom	"GOV FIXED FREQUENCY" is displayed at DG 2 under view 3	

SWBD control of load

STARTING CONDITIONS	Plant mode = SEMI-AUTO DG 1 and DG 2 are connected to the busbar (SWBD) DG 3 is in stand-by (SWBD) TB is connected (PMS) (only system 03) SG is in stand-by (PMS) (only system 02/03) Start priority: 1-2-3		
ACTION	**REACTION**	**NOTES**	**APP.**
Activate the "GOV DOWN" function for DG 1 in the switchboard	The load on DG 1 is decreased		
Activate the "GOV UP" function for DG 2 in the switchboard	The load on DG 2 is increased		

Supervision and protection functions

The tested alarm sequences must be enabled, and the desired fail classes must be selected.

DG/SG supervision of voltage and frequency

Supervision of the DG frequency

STARTING CONDITIONS	Plant mode = SEMI-AUTO DG 2 is connected (PMS) DG 1 is running but not connected (SWBD) DG 3 is in stand-by (PMS) TB is connected (PMS) (only system 03) SG is in stand-by (PMS) (only system 02/03) Start priority: 1-2-3		
ACTION	**REACTION**	**NOTES**	**APP.**
Press the “JUMP” push-button and enter the service menu (no. 9120) In the alarm menu find 1210 Gen high-freq 1 Press the “VIEW” push-button to find the display read-out Activate the "GOV UP" function of DG 1 in the switchboard, until the generator frequency is above the set point	When the timer runs out:		
	Gen high-freq 1 alarm ID. 1210	Set point: 105% Timer: 15s	
	Gen high-freq 2 alarm ID. 1220	Set point: 107% Timer: 5s	
	Gen high-freq 3 alarm ID. 1230	Set point: 110% Timer: 1s	

Supervision of the DG voltage

STARTING CONDITIONS	Plant mode = SEMI-AUTO DG 1 is connected (PMS) DG 2 is running but not connected (SWBD) DG 3 is in stand-by (PMS) TB is connected (PMS) (only system 03) SG is in stand-by (PMS) (only system 02/03) Start priority: 1-2-3		
ACTION	**REACTION**	**NOTES**	**APP.**
Press the “JUMP” push-button and enter the service menu (no. 9120) In the alarm menu find 1150 Gen high-volt 1 Press the “VIEW” push-button to find the display read-out Activate the "VOLTAGE UP" function for DG 1, until the generator voltage is above the limit	When the timer runs out: Gen high-volt 1 alarm ID. 1150	Set point: 110% Timer: 15s	
	Gen high-volt 2 alarm ID. 1160	Set point: 115% Timer: 5s	
Press “JUMP” and enter the service menu (no. 9120) Under alarm menu find no. 1170 Gen low-volt 1 Press the “VIEW” push-button to find the display read-out Activate the "VOLTAGE DOWN" function for DG 1, until the generator voltage is below the limit	When the timer runs out: Gen low-volt 1 alarm ID. 1170	Set point: 90% Timer: 15s	
	Gen low-volt 2 alarm ID. 1180	Set point: 80% Timer: 5s	
	Gen low-volt 3 alarm ID. 1190	Set point: 70% Timer: 1s	

Supervision of the SG frequency (only system 02/03)

STARTING CONDITIONS	Plant mode = AUTO DG 1 is connected (PMS) DG 2 and DG 3 are in stand-by (PMS) TB is connected (PMS) (only system 03) SG is running (PMS) Start priority: 1-2-3		
ACTION	**REACTION**	**NOTES**	**APP.**
Press the “JUMP” push-button and enter the service menu (no. 9120) In the alarm menu find 1210 Gen high-freq 1 Press the “VIEW” push-button to find the display read-out Increase the SG frequency until the frequency is above the set point and select the SHAFT plant mode	When the timer runs out: Gen high-freq 1 alarm ID. 1210	Set point: 105% Timer: 15s	
	Gen high-freq 2 alarm ID. 1220	Set point: 107% Timer: 5s	
	Gen high-freq 3 alarm ID. 1230	Set point: 110% Timer: 1s	
Press the “JUMP” push-button and enter the service menu (no. 9120) Under alarm menu find no. 1240 Gen low-freq 1 Press the “VIEW” push-button to find the display read-out Decrease the SG frequency until the frequency is below the set point and select the SHAFT plant mode	When the timer runs out: Gen low-freq 1 alarm ID. 1240	Set point: 95% Timer: 15s	
	Gen low-freq 2 alarm ID. 1250	Set point: 93% Timer: 5s	
	Gen low-freq 3 alarm ID. 1260	Set point: 90% Timer: 1s	

Supervision of the SG voltage (only system 02/03)

STARTING CONDITIONS	Plant mode = AUTO DG 1 is connected (PMS) DG 2 and DG 3 are in stand-by (PMS) TB is connected (PMS) (only system 03) SG is running (PMS) Start priority: 1-2-3		
ACTION	**REACTION**	**NOTES**	**APP.**
Press the “JUMP” push-button and enter the service menu (no. 9120) In the alarm menu find no. 1150 Gen high-volt 1 Press the “VIEW” push-button to find the display read-out Increase the SG voltage until the voltage is above the set point and select the SHAFT plant mode	When the timer runs out: Gen high-volt 1 alarm ID. 1150 Gen high-volt 2 alarm ID. 1160	Set point: 110% Timer: 15s Set point: 115% Timer: 5s	
Press the “JUMP” push-button and enter the service menu (no. 9120) In the alarm menu find 1170 Gen low-volt 1 Press the “VIEW” push-button to find the display read-out Decrease the SG voltage until the voltage is below the set point and select the SHAFT plant mode	When the timer runs out: Gen low-volt 1 alarm ID. 1170 Gen low-volt 2 alarm ID. 1180 Gen low-volt 3 alarm ID. 1190	Set point: 90% Timer: 15s Set point: 80% Timer: 5s Set point: 70% Timer: 1s	

DG/SG protection functions

DG/SG load protection

STARTING CONDITIONS	Plant mode = SEMI-AUTO DG 1 and DG 2 are connected (PMS) DG 3 is in stand-by (PMS) TB is connected (PMS) (only system 03) SG is in stand-by (PMS) (only system 02/03) Start priority: 1-2-3		
ACTION	**REACTION**	**NOTES**	**APP.**
Press the “JUMP” push-button and enter the service menu (no. 9120) In the alarm menu find 1450 Overload 1 Press the “VIEW” push-button to find the display read-out Activate the "GOV UP" function of DG 1 in the switchboard until the generator load is above the set point	When the timer runs out: Overload 1 (warning) alarm ID. 1450	Set point: 95% Timer: 20s	
	NEL 1 P > alarm ID. 1940	Set point: 100% Timer: 5s	
	NEL 2 P > alarm ID. 1950	Set point: 100% Timer: 10s	
	NEL 1 P >> alarm ID. 1960	Set point: 110% Timer: 1s	
	NEL 2 P >> alarm ID. 1970	Set point: 110% Timer: 1s	
	Overload 2 (trip CB) alarm ID. 1460	Set point: 110% Timer: 10s	
	Overload 3 (trip CB) alarm ID. 1470	Set point: 115% Timer: 5s	
	Overload 4 (trip CB) alarm ID. 1480	Set point: 120% Timer: 3s	
	Overload 5 (trip CB) alarm ID. 1490	Set point: 130% Timer: 1s	
Activate the "GOV DOWN" function of DG 1 in the switchboard until the generator load is above the set point for reverse power	Reverse power 1 (trip CB) alarm ID. 1000	Set point: -10% Timer: 5s	
	Reverse power 2 (trip CB) alarm ID. 1010	Set point: -15% Timer: 1s	

DG/SG current protection

STARTING CONDITIONS	Plant mode = SEMI-AUTO DG 1 is connected (PMS) DG 2 and DG 3 are in stand-by (PMS) TB is connected (PMS) – *only system 03* SG is in stand-by (PMS) – *only system 02/03* Start priority: 1-2-3		
ACTION	**REACTION**	**NOTES**	**APP.**
Press the “JUMP” push-button and enter the service menu (no. 9120) Under alarm menu find no. 1900 *“NEL 1 I >".* Press the “VIEW” push-button to find the display read-out Increase the current until the set point is reached	When the timer runs out: NEL 1 I > alarm ID. 1900	Set point: 100% Timer: 5s	
	NEL 2 I > alarm ID. 1910	Set point: 100% Timer: 10s	
	Overcurrent 1 alarm ID. 1030 (trip CB)	Set point: 110% Timer: 20s	
	Overcurrent 2 alarm ID. 1040 (trip CB)	Set point: 120% Timer: 10s	
	Overcurrent 3 alarm ID. 1050 (trip CB)	Set point: 130% Timer: 3s	
	Overcurrent 4 alarm ID. 1060 (trip CB)	Set point: 140% Timer: 1s	
	Overcurrent inv. alarm ID. 1070 (trip CB)	Set point: I1 110%, I2 120%, I3 140% Timer: T1 5.0s, T2 3.8s, T3 2.5 s	
	Overcurrent inv. alarm ID. 1080 (trip CB)	Set point: I4 160%, I5 180%, I6 200% Timer: T4 1.5s, T5 1.0s, T6 0.5 s	
	Fast overcurrent 1 alarm ID. 1130 (trip CB)	Set point: 200% Timer: 0.5s	
	Fast overcurrent 2 alarm ID. 1140 (trip CB)	Set point: 300% Timer: 0.2s	

Unbalanced current/voltage

STARTING CONDITIONS	Plant mode = SEMI-AUTO DG 1 is connected (PMS) DG 2 and DG 3 are in stand-by (PMS) TB is connected (PMS) (only system 03) SG is running (PMS) Start priority: 1-2-3		
ACTION	**REACTION**	**NOTES**	**APP.**
Disconnect 1 current phase from the unit of DG no.1	Unbalance curr. alarm ID. 1500	Set point: 30% Timer: 10.0s	
Disconnect 1 voltage phase from the unit of DG no.1	Unbalance volt. alarm ID. 1510	Set point: 10% Timer: 10.0s	

VAr import/export

STARTING CONDITIONS	Plant mode = SEMI-AUTO DG 1 and DG 2 are connected (PMS) DG 3 is in stand-by (PMS) TB is connected (PMS) (only system 03) SG is in stand-by (PMS) (only system 02/03) Start priority: 1-2-3		
ACTION	**REACTION**	**NOTES**	**APP.**
Press the “JUMP” push-button and enter the service menu (no. 9120) In the alarm menu find no. 1520 VAr import	VAr import alarm ID. 1520	Set point: 10% Timer: 10.0s	
Press the “VIEW” push-button to find the display read-out Increase the imported/ exported VAr at DG 1	VAr export alarm ID. 1530	Set point: 75% Timer: 10.0s	

Busbar supervision and protection

DG busbar

STARTING CONDITIONS	Plant mode = AUTO DG 2 is connected (PMS) DG 1 and DG 3 are in stand-by (PMS) TB is connected (PMS) (only system 03) SG is in stand-by (PMS) (only system 02/03) Start priority: 2-1-3		
ACTION	**REACTION**	**NOTES**	**APP.**
Press the “JUMP” push-button and enter the service menu (no. 9120) In the alarm menu find no. 1380 *Bus low-freq.* Press the “VIEW” push-button to find the display read-out Activate the "GOV DOWN" function for DG 2 until the frequency on the busbar is below the set point	On DG 2: Bus low-freq 1 alarm ID. 1380 (warning)	The next stand-by DG will start automatically to reduce the time period of a possible blackout Set point: 97% Timer: 5s	
	NEL 1 Bus f < alarm ID. 1920 (trip NEL 1)	Set point: 95% Timer: 5s	
	NEL 2 Bus f < alarm ID. 1930 (trip NEL 2)	Set point: 95% Timer: 10s	
	Bus low-freq 2 alarm ID. 1390 (trip CB)	Set point: 93% Timer: 10s	
	Bus low-freq 3 alarm ID. 1400 (trip CB)	Set point: 92% Timer: 5s	
	Bus low-freq 4 alarm ID. 1410 (trip CB)	Set point: 90% Timer: 1s	
Change the priority to 1-2-3 Press the “JUMP” push-button and enter the service menu (no. 9120) In the alarm menu find no. 1350 Bus low-freq 1 Press the “VIEW” push-button to find the display read-out Activate the "GOV UP" function for DG 1 until the frequency on the busbar is above the set point	On DG1: Bus high-freq 1 (warning) alarm ID. 1350	Set point: 105% Timer: 5s	
	Bus high-freq 2 (trip CB) alarm ID. 1360	Set point: 110% Timer: 5s	
	Bus high-freq 3 (trip CB) alarm ID. 1370	Set point: 120% Timer: 1s	

STARTING CONDITIONS	Plant mode = AUTO DG 2 is connected (PMS) DG 1 and DG 3 are in stand-by (PMS) TB is connected (PMS) (only system 03) SG is in stand-by (PMS) (only system 02/03) Start priority: 2-1-3		
ACTION	**REACTION**	**NOTES**	**APP.**
Press the “JUMP” push-button and enter the service menu (no. 9120) In the alarm menu find no. 1300 Bus low-volt 1 Press the “VIEW” push-button to find the display read-out Activate the input for "VOLTAGE DOWN" function for DG 1 until the voltage on the busbar is below the set point	On DG1: Bus low-volt 1 (warning) alarm ID. 1300	The next stand-by DG will start automatically to reduce the time period of a possible blackout Set point: 90% Timer: 5s	
	Bus low-volt 2 (trip CB) alarm ID. 1310	Set point: 80% Timer: 5s	
	Bus low-volt 3 (trip CB) alarm ID. 1320	Set point: 70% Timer: 3s	
	Bus low-volt 4 (trip CB) alarm ID. 1330	Set point: 60% Timer: 1s	
Press the “JUMP” push-button and enter the service menu (no. 9120) In the alarm menu find no. 1350 Bus low-freq 1 Press the “VIEW” push-button to find the display read-out Activate the "VOLTAGE UP" function for DG 1 until the voltage on the busbar is above the set point	On DG1: Bus high-volt 1 (warning) alarm ID. 1270	Set point: 110% Timer: 15s	
	Bus high-volt 1 (trip CB) alarm ID. 1280	Set point: 120% Timer: 5s	
	Bus high-volt 1 (trip CB) alarm ID. 1290	Set point: 130% Timer: 1s	

SG busbar (only system 02+03)

STARTING CONDITIONS	Plant mode = SHAFT DG 1, DG 2 and DG 3 are in stand-by (PMS) TB is connected (PMS) (*only system 03)* SG is connected (PMS) (*only system 02/03)* Start priority: 1-2-3		
ACTION	**REACTION**	**NOTES**	**APP.**
Press the “JUMP” push-button and enter the service menu (no. 9120) In the alarm menu find no. *1380 Bus low-freq 1* Press the “VIEW” push-button to find the display read-out Activate the "GOV DOWN" function for DG 1 until the frequency on the busbar is below the set point	On SG: Bus low-freq 1 alarm ID. 1380 (warning)	The next stand-by DG will start automatically to reduce the time period of a possible blackout Set point: 97% Timer: 5s	
	NEL 1 Bus f < alarm ID. 1920 (trip NEL 1)	Set point: 95% Timer: 5s	
	NEL 2 Bus f < alarm ID. 1930 (trip NEL 2)	Set point: 95% Timer: 10s	
	Bus low-freq 2 alarm ID. 1390 (warning)	Set point: 93% Timer: 10s	
	Bus low-freq 3 alarm ID. 1400 (trip CB)	Set point: 92% Timer: 5s	
	Bus low-freq 4 alarm ID. 1410 (trip CB)	Set point: 90% Timer: 1s	
Press the “JUMP” push-button and enter the service menu (no. 9120) In the alarm menu find no. 1350 Bus low-freq 1 Press the “VIEW” push-button to find the display read-out Activate the "GOV UP" function for DG 1 until the frequency on the busbar is above the set point	On SG: Bus high-freq 1 (warning) alarm ID. 1350	The next stand-by DG will start automatically to reduce the time period of a possible blackout Set point: 105% Timer: 15s	
	Bus high-freq 2 (trip CB) alarm ID. 1360	Set point: 107% Timer: 5s	
	Bus high-freq 3 (trip CB) alarm ID. 1370	Set point: 110% Timer: 1s	

STARTING CONDITIONS	Plant mode = SHAFT DG 1, DG 2 and DG 3 are in stand-by (PMS) TB is connected (PMS) (*only system 03)* SG is connected (PMS) (*only system 02/03)* Start priority: 1-2-3		
ACTION	**REACTION**	**NOTES**	**APP.**
Press the “JUMP” push-button and enter the service menu (no. 9120) In the alarm menu find no. 1300 Bus low-volt 1 Press the “VIEW” push-button to find the display read-out Activate the input for "VOLTAGE DOWN" function for DG 1 until the voltage on the busbar is below the set point Repeat the test for bus low-volt 2, bus low-volt 3 and bus low-volt 4	On SG: Bus low-volt 1 alarm ID. 1300	The next stand-by DG will start automatically to reduce the time period of a possible blackout Set point: 90% Timer: 15s	
	Bus low-volt 2 alarm ID. 1310	Set point: 80% Timer: 10s	
	Bus low-volt 3 alarm ID. 1320	Set point: 70% Timer: 5s	
	Bus low-volt 4 alarm ID. 1330	Set point: 60% Timer: 1s	
Press the “JUMP” push-button and enter the service menu (no. 9120) In the alarm menu find no. 1350 Bus low-freq 1 Press the “VIEW” push-button to find the display read-out Activate the "VOLTAGE UP" function for DG 1 until the voltage on the busbar is above the set point Repeat the test for bus high-volt 2 and bus high-volt 3	On SG: Bus high-volt 1 alarm ID. 1270	The next stand-by DG will start automatically to reduce the time period of a possible blackout Set point: 110% Timer: 15s	
	Bus high-volt 2 alarm ID. 1280	Set point: 115% Timer: 5s	
	Bus high-volt 3 alarm ID. 1290	Set point: 120% Timer: 1s	

Binary alarm input function

All PPM alarms can be configured with a set point, delay, enable/disable and a fail class (FC). Additionally, each alarm can be configured for two relay outputs (OA and OB). There are 4 configurable binary alarm inputs available (term. 110-113) in each generator unit.

The following alarm sequences are available for each alarm input:

FC Warning = Warning (default for alarm 1)
FC DG pre. w. = DG pre-warning/safety stop (default for alarm 2)
FC Block = Block of operation
FC Trip CB = Trip of circuit breaker (default for alarm 3)
FC Trip + STOP = Trip of CB and stop of engine (incl. cooling down)
FC Shutdown = Trip of CB and stop of engine (without cooling down) (default for alarm 4)
FC CB short = Trip of CB and blocking for blackout start
FC Sys. alarm = The unit will be forced to be under switchboard (SWBD) control

STARTING CONDITIONS	Plant mode = SEMI-AUTO DG 1 is connected (PMS) DG 2 is running but not connected (PMS) DG 3 is in stand-by (PMS) TB is connected (PMS) (only system 03) SG is in stand-by (PMS) (only system 02/03) Start priority: 1-2-3		
ACTION	**REACTION**	**NOTES**	**APP.**
Activate the Alarm 1 on DG 2	The pre-selected alarm sequence for Alarm input 1 is activated	(Warning) Function can be changed!	
Activate the Alarm 1 on DG 1	The pre-selected alarm sequence for Alarm input 2 is activated	(Block) Function can be changed!	
Close CB of DG 2 and activate the Alarm 3 on DG 2	The pre-selected alarm sequence for Alarm input 3 is activated	(Trip of breaker) Function can be changed!	
Close CB of DG 2 and activate the Alarm 4 on DG 2	The pre-selected alarm sequence for Alarm input 4 is activated	(Shutdown) Function can be changed!	
Choose a different fail class for Alarm 1 and activate the binary alarm input	The desired alarm sequence is activated		
Choose a different delay time for Alarm 1 and activate the binary alarm input	The desired alarm will be activated after the timer has run out		
Define the Alarm 1 to the relay function OA and select relay 1 (NEL 1) Activate the binary alarm input	The Alarm 1 will trip the NEL group no.1		

Trip of NEL groups

NEL load trip

STARTING CONDITIONS	Plant mode = SEMI-AUTO DG 1 is connected (PMS) DG 2 and DG 3 are in stand-by (SWBD) TB is connected (PMS) (only system 03) SG is in stand-by (PMS) (only system 02/03) Start priority: 1-2-3		
ACTION	**REACTION**	**NOTES**	**APP.**
Select the set point and timer for load NEL trip 1 and increase the load on the busbar until the load is above the set point	On DG 1: When the timer runs out, the 1st NEL group is tripped: “NEL 1 P> “ alarm ID. 1940	Set point: 100% Timer: 5s	
Select the set point and timer for load NEL trip 2 and increase the load on the busbar until the load is above the set point	On DG 1: When the timer runs out, the 2nd NEL group is tripped: “NEL 2 P>” alarm ID. 1950	Set point: 100% Timer: 10s	
Select the set point and timer for load NEL trip 3 and increase the load on the busbar until the load is above the set point	On DG 1: When the timer runs out, both NEL groups are tripped: “NEL 1 P>>” alarm ID. 1960 “NEL 2 P>>” alarm ID. 1970	Set point: 110% Timer: 1s	

NEL current trip

STARTING CONDITIONS	Plant mode = SEMI-AUTO DG 1 is connected (PMS) DG 2 and DG 3 are in stand-by (SWBD) TB is connected (PMS) (only system 03) SG is in stand-by (PMS) (only system 02/03) Start priority: 1-2-3		
ACTION	**REACTION**	**NOTES**	**APP.**
Select the set point and timer for current NEL trip 1 and increase the load on the busbar until the current is above the set point	On DG 1: When the timer runs out, the 1st NEL group is tripped: “NEL 1 I>” alarm ID. 1900	Set point: 100% Timer: 5s	
Select the set point and timer for current NEL trip 2 and increase the load on the busbar until the current is above the set point	On DG 1: When the timer runs out, the 2nd NEL group is tripped: “NEL 2 I>” alarm ID. 1910	Set point: 100% Timer: 10s	

NEL frequency trip

STARTING CONDITIONS	Plant mode = SEMI-AUTO Generator 1 is connected (SWBD) Generator 2 and generator 3 are in stand-by (SWBD) TB is connected (PMS) (only system 03) SG is in stand-by (PMS) (only system 02/03) Start priority: 1-2-3		
ACTION	**REACTION**	**NOTES**	**APP.**
Select the set point and timer for underfrequency NEL trip 1 and activate the “GOV DOWN” function for DG 1 until the frequency on the busbar is below the set point	On DG 1: When the timer runs out, the 1st NEL group is tripped: “NEL 1 BUS f<” alarm ID. 1920	Set point: 95% Timer: 5s	
Select the set point and timer for underfrequency NEL trip 2 and activate the "GOV DOWN" function for DG 1 until the frequency on the busbar is below the set point	On DG 1: When the timer runs out, the 2nd NEL group is tripped: “NEL 2 BUS f<” alarm ID. 1930	Set point: 95% Timer: 10s	

Short circuit protection

STARTING CONDITIONS	Plant mode = AUTO DG 1 is connected (PMS) DG 2 and DG 3 are in stand-by (PMS) TB is connected (PMS) (only system 03) SG is in stand-by (PMS) (only system 02/03) Start priority: 1-2-3		
ACTION	**REACTION**	**NOTES**	**APP.**
Find a spare binary input on DG1 and define the fail class as short circuit. Define the delay time and the text message	CB is tripped and no blackout start until alarm is acknowledged!		
Change the settings for start attempts in case of short circuit (8043) to 1 and activate the defined binary SHORT CIRCUIT input on DG 1	CB is tripped and DG 2 starts up and connects to the busbar		

Shore connection

Supervision of the breaker position

STARTING CONDITIONS	Plant mode = AUTO DG 1 is connected (PMS) DG 2 and DG 3 are in stand-by (PMS) TB is connected (PMS) (only system 03) SG is in stand-by (PMS) (only system 02/03) Start priority: 1-2-3		
ACTION	**REACTION**	**NOTES**	**APP.**
Disconnect the “SHORE CONN. POSITION OFF” input on DG 1	The PMS blocked LED is activated and the plant mode is forced to be in SEMI-AUTO	An open/closed shore connection breaker position will be indicated at the AOP	
Connect the "SHORE CONN. POSITION OFF" input on DG 1	The PMS blocked LED is deactivated and AUTO mode can be selected again	An open/closed shore connection breaker position will be indicated at the AOP	

Forced switchboard control

Supervision of the binary input function “FORCED SWBD”

STARTING CONDITIONS	Plant mode = SEMI-AUTO DG 1 is connected (PMS) DG 2 and DG 3 are in stand-by (PMS) TB is connected (PMS) (only system 03) SG is in stand-by (PMS) (only system 02/03) Start priority: 1-2-3		
ACTION	**REACTION**	**NOTES**	**APP.**
Connect the “FORCED SWBD” input on DG 1	The PMS blocked LED is activated and the entire system is forced to be in switchboard control	No frequency control on busbar The activated input will be indicated at the AOP-2 and on each unit by a yellow PMS control LED	

Semi-auto operation

The SEMI-AUTO mode is an operator initiated AUTO mode, meaning that the automatic sequences such as the start/stop sequences for the diesel engines, the CB ON/OFF sequences etc. are only carried out, when the operator activates the wanted sequences.

Semi-auto control of DG

The operator may initiate start, stop, the CB ON/OFF sequence by pressing the corresponding push-buttons on the display unit.

SEMI-AUTO start/stop of aux. engine

STARTING CONDITIONS	Plant mode = SEMI-AUTO DG 1 is running and connected (PMS) DG 2 and DG 3 are stand-by (PMS) TB is connected (PMS) (only system 03) SG is in stand-by (PMS) (only system 02/03) Start priority 1-2-3		
ACTION	**REACTION**	**NOTES**	**APP.**
Press the START push-button at the display corresponding to DG 2	DG 2 is started	Under view 3 the text message “Start Relay On” is displayed until the generator has achieved running status. The display message then automatically changes to “FIXED FREQUENCY”	
Press the STOP push-button at the display corresponding to DG 2	DG 2 is stopped incl. cooling down period	Under view 3 the text message “Cooling Down” is displayed. After cooling down the text message “Ext. Stop T.” is activated	

SEMI-AUTO generator breaker operation

STARTING CONDITIONS	Plant mode = SEMI-AUTO DG 1 is running and connected (PMS) DG 2 is running but not connected (PMS) DG 3 is in stand-by (PMS) TB is connected (PMS) (only system 03) SG is in stand-by (PMS) (only system 02/03) Start priority 1-2-3		
ACTION	**REACTION**	**NOTES**	**APP.**
Press the CB ON push-button at the display corresponding to DG 2	The breaker of DG 2 is closed	Under view 3 a synchronoscope picture is displayed	
Press the CB OFF push-button corresponding to DG 2	DG 2 is de-loaded and then disconnected	Under view 3 the text message “RAMP DOWN” is displayed	
Press the CB OFF push-button corresponding to DG 1	No reaction, the DG is indispensable	The info message I14: “GB OFF NOT POSS.” will be shown	

STARTING CONDITIONS	Plant mode = SEMI-AUTO DG 1 is running and connected (PMS) DG 2 is running but not connected (PMS) DG 3 is in stand-by (PMS) TB is connected (PMS) (only system 03) SG is in stand-by (PMS) (only system 02/03) Start priority 1-2-3		
ACTION	**REACTION**	**NOTES**	**APP.**
Press the “CB ON” push-button corresponding to DG 2, and when it starts to synchronise press the CB OFF push-button imme-diately	The GB ON sequence is started and then interrupted		
Press the "CB ON" push-button corresponding to DG 2 After the breaker is closed, press the “CB OFF” push-button. When it starts de-loading, press the “CB ON”.	The deloading is interrupted and the breaker stays closed		

SEMI-AUTO remote start/stop

STARTING CONDITIONS	Plant mode = SEMI-AUTO DG 1 is running and connected (PMS) DG 2 and DG 3 are in stand-by (PMS) TB is connected (PMS) (only system 03) SG is in stand-by (PMS) (only system 02/03) Start priority: 1-2-3		
ACTION	**REACTION**	**NOTES**	**APP.**
Activate the Remote Start input at DG 3 Terminal 117	DG 3 is starting up, synchronising and closing the breaker		
Activate the Remote Stop input at DG 3 Terminal 118	DG 3 is deloading, opening the breaker and stopping the engine (incl. cooling down)		
Increase the load on the busbar until DGs 1/2 are loaded with more than 50% of their nominal load and activate the “Remote Stop” push-button on DG 2	No reaction		
Decrease the busbar load until DGs 1/2 are loaded with less than 50% of their nominal load and activate the “Remote Stop” push-button on DG 2	DG 2 is deloading and opening the generator breaker followed by cooling down and stop		

Power management functions

Plant mode selection

Selection of SEMI-AUTO mode

STARTING CONDITIONS	Plant mode = AUTO DG 1 is running and connected (PMS) DG 2 and DG 3 are stand-by (PMS) TB is connected (PMS) (only system 03) SG is in stand-by (PMS) (only system 02/03) Start priority 1-2-3		
ACTION	**REACTION**	**NOTES**	**APP.**
Activate the push-button at the AOP-2 for selection of SEMI-AUTO mode	The LED at the AOP-2 for indicating SEMI-AUTO plant mode is set		
Select switchboard control for all DGs	The LED at the AOP-2 for indicating SEMI-AUTO plant mode is OFF	The LED at the AOP-2 for indicating “PMS blocked” is activated	

Selection of AUTO mode

STARTING CONDITIONS	Plant mode = SEMI-AUTO DG 1 is running and connected (PMS) DG 2 and DG 3 are stand-by (PMS) TB is connected (PMS) (only system 03) SG is in stand-by (PMS) (only system 02/03) Start priority 1-2-3		
ACTION	**REACTION**	**NOTES**	**APP.**
Activate the push-button at the AOP-2 for selection of AUTO mode	The LED at the AOP-2 for indicating AUTO plant mode is set		
Activate the push-button for Secured ON (AOP-2)	The next stand-by generator will start up and connect.	The LED “Secured ON” is ON on AOP-2	
Activate the push-button for Secured OFF (AOP-2)	The 2nd DG will deload and stop	The LED “Secured ON” is OFF on AOP-2	

Selection of SHAFT mode (only system 02/03)

STARTING CONDITIONS	Plant mode = AUTO DG 1 is running and connected (PMS) DG 2 and DG 3 are stand-by (PMS) TB is connected (PMS) (only system 03) SG is in stand-by (PMS) (only system 02/03) Start priority 1-2-3		
ACTION	**REACTION**	**NOTES**	**APP.**
Activate the push-button at the AOP-2 for selection of SHAFT mode	The LED at the AOP-2 for indicating SHAFT plant mode is yellow until the SHAFT mode is complete, then green		

Selection of SPLIT mode (only system 03)

STARTING CONDITIONS	Plant mode = SEMI-AUTO DG 1, DG 2 and DG 3 are stand-by (PMS) TB is connected (PMS) (only system 03) SG is connected (PMS) (only system 02/03) Start priority 1-2-3		
ACTION	**REACTION**	**NOTES**	**APP.**
Activate the push-button at the AOP-2 for selection of SPLIT mode	The LED at the AOP-2 for indicating SPLIT plant mode is yellow until the SPLIT mode is complete, than green		
Activate the pushbutton for Secured ON (AOP-2)	The next standby generator will start up and connect.	The LED “Secured ON” is ON on AOP-2	
Activate the pushbutton for Secured OFF (AOP-2)	The 2nd DG will deload and stop.	The LED “Secured ON” is OFF on AOP-2	

Load dependent start

STARTING CONDITIONS	Plant mode = AUTO DG 1 is running and connected (PMS) DG 2 and DG 3 are stand-by (PMS) TB is connected (PMS) (only system 03) SG is in stand-by (PMS) (only system 02/03) Start priority 1-2-3		
ACTION	**REACTION**	**NOTES**	**APP.**
Increase power consumption on the busbar until the predicted available power is below the set point Menu: 8020	DG 2 is started and connected to the busbar		
Increase power consumption on the busbar until the predicted available power is below the set point	DG 3 is started and connected to the busbar		

Load dependent stop

STARTING CONDITIONS	Plant mode = AUTO DG 1, DG 2 and DG 3 are running and connected (PMS) TB is connected (PMS) (only system 03) SG is in stand-by (PMS) (only system 02/03) Start priority 1-2-3		
ACTION	**REACTION**	**NOTES**	**APP.**
Activate the load dependent stop block input (term. 53) on DG unit no. 1 and decrease power consumption on the busbar	The DG 3 will not stop. The load dependent stop function is blocked	The LED for the load dependent stop blocking function on the AOP is ON, indicating that the load dependent stop function is blocked	
Decrease power consumption on the busbar until the predicted available power is above the set point added with the nominal power of the DG to be stopped Menu: 8030	Deloading, disconnection and stop of DG 3		
Decrease power consumption on the busbar until the predicted available power is above the set point added with the nominal power of the DG to be stopped	Deloading, disconnection and stop of DG 2		

Programmable start priority

STARTING CONDITIONS	Plant mode = AUTO DG 1 is running and connected (PMS) DG 2 and DG 3 are in stand-by (PMS) TB is connected (PMS) (only system 03) SG is in stand-by (PMS) (only system 02/03) Start priority 1-2-3		
ACTION	**REACTION**	**NOTES**	**APP.**
Change start priority to: 2-1-3 and activate Tx = 1 Menu: 8050	DG 2 is started and connected to the busbar followed by deloading, disconnection and stopping of DG 1		
Change start priority to: 3-2-1 and activate Tx = 1 Menu: 8050	DG 3 is started and connected to the busbar followed by deloading, disconnection and stopping of DG 2		
Change start priority to: 1-2-3 and activate Tx = 1 Menu: 8050	DG 1 is started and connected to the busbar followed by deloading, disconnection and stopping of DG 3		

First priority push-button

STARTING CONDITIONS	Plant mode = AUTO DG 1 is running and connected (PMS) DG 2 and DG 3 are in stand-by (PMS) TB is connected (PMS) (only system 03) SG is in stand-by (PMS) (only system 02/03) Start priority 1-2-3		
ACTION	**REACTION**	**NOTES**	**APP.**
Push the 1st “PRIOR” on the display for DG 2	DG 2 is started and connected and DG 1 is disconnected, priority is now: 2-1-3		
Push the 1st “PRIOR” on the display for DG 3	DG 3 is started and connected and DG 2 is disconnected, priority is now: 3-2-1		

Stop of non-connected DG

STARTING CONDITIONS	Plant mode = SEMI-AUTO DG 1 is running and connected (PMS) DG 2 and DG 3 are in stand-by (PMS) TB is connected (PMS) (only system 03) SG is in stand-by (PMS) (only system 02/03) Start priority 1-2-3		
ACTION	**REACTION**	**NOTES**	**APP.**
Start DG 2 and select AUTO mode	When the timer for stop of non-connected DG runs out DG 2 is stopped (incl. cooling down)		

Asymmetrical load sharing/base load

STARTING CONDITIONS	Plant mode = AUTO DG 1, DG 2 and DG 3 are running and connected (PMS) TB is connected (PMS) (only system 03) SG is in stand-by (PMS) (only system 02/03) Start priority 1-2-3		
ACTION	**REACTION**	**NOTES**	**APP.**
From the display unit of DG 1 select asymmetrical load sharing Menu 8070	DG 1 is running base load and DG 2 and 3 are sharing the remaining load equally		
Change the priority to: 2-1-3	DG 2 is now running base load and DG 1 and DG 3 are sharing the remaining load equally		

STARTING CONDITIONS	Plant mode = AUTO DG 1, DG 2 and DG 3 are running and connected (PMS) TB is connected (PMS) (only system 03) SG is in stand-by (PMS) (only system 02/03) Start priority 1-2-3		
ACTION	**REACTION**	**NOTES**	**APP.**
Reduce the load on the busbar until only DG 1 and 2 are connected	DG 3 is deloaded and disconnected		
Reduce the load again until asymmetrical load sharing is cancelled	When the load becomes too low on DG 1 the asymmetrical load sharing is cancelled		
Increase the load on the busbar again	Asymmetrical load sharing is re-established		

Conditional connection of heavy consumers

STARTING CONDITIONS	Plant mode = AUTO DG 1 is running and connected (PMS) DG 2 and DG 3 are in stand-by (SWBD) TB is connected (PMS) (only system 03) SG is in stand-by (PMS) (only system 02/03) Start priority 1-2-3		
ACTION	**REACTION**	**NOTES**	**APP.**
P-Avail > HC 1.1-Max Request connection of HC1.1	HC1.1 is connected	DG 2 may start up and connect due to load dependent start!	
P-Avail < HC 1.1-Max Request connection of HC1.1	No connection of HC1.1		
Set DG 2 in PMS control P-Avail < HC 1.1-Max. Request connection of HC1.1	DG 2 is started and connected and HC1.1 is connected when DG 2 is connected to the busbar		
P-Avail < HC 2.1-Max Request connection of HC2.1	No connection of HC2.1		
P-AVAIL > HC 2.1-Max Request connection of HC2.1	HC2.1 is connected		
P-AVAIL > HC 3.1-Max. Request connection of HC3.1	HC3.1 is connected		

User defined AOP-2 function

The PPM enables the operator to define external devices for user defined functionality. By activating the user defined input on terminal 51 of DG unit no. 1, the corresponding LED no. 9 will light up at the AOP-2.

STARTING CONDITIONS	Plant mode = AUTO DG 1 is running and connected (PMS) DG 2 and DG 3 are in stand-by (SWBD) TB is connected (PMS) (only system 03) SG is in stand-by (PMS) (only system 02/03) Start priority 1-2-3		
ACTION	**REACTION**	**NOTES**	**APP.**
Activate the user defined push-button at the AOP-2	The relay output for the user defined function is set (adjustable pulse signal)		
Activate the user defined input at DG 1	The LED at the AOP is set		

Blackout handling

The blackout start sequence is active in all plant modes. It will start and connect 1-2 generator set(s) depending on the preset set point. Only when all operational units in the system have detected a busbar blackout, the blackout start sequence will be activated.

Blackout start sequence with active PMS unit

STARTING CONDITIONS	Plant mode = AUTO DG 1 is running and connected (PMS) DG 2 and DG 3 are in stand-by (PMS) TB is connected (PMS) (only system 03) SG is in stand-by (PMS) (only system 02/03) Start priority 1-2-3		
ACTION	**REACTION**	**NOTES**	**APP.**
Trip the breaker of DG 1 and block for reconnection	CB is tripped creating a busbar blackout DG 2 is started and connected to the busbar When the DG achieves satisfactory voltage and frequency, it will cut in at the busbar without synchronisation	Depending on the set point, one or two diesel generators will start up in case of blackout Menu:8040	
Trip the breaker of the connected DGs and disconnect the SHORE CONN. POSITION OFF input on DG 1 and acknowledge all alarms	CBs create a busbar blackout No blackout start due to the shore supply		

Blackout start sequence without active PMS unit

STARTING CONDITIONS	Plant mode = AUTO DG 1 is running and connected (PMS) DG 2 and DG 3 are in stand-by (PMS) TB is connected (PMS) (only system 03) SG is in stand-by (PMS) (only system 02/03) Start priority 1-2-3		
ACTION	**REACTION**	**NOTES**	**APP.**
Disconnect the power supply from the master unit Trip the breaker of DG 1, block for reconnection and activate the binary input “BLACKOUT” (term. 43)	CB is tripped creating a busbar blackout. DG 2 is started and connected to the busbar When the DG achieves satisfactory voltage and frequency, it will cut in at the busbar without synchronisation	The input BLACKOUT is set by an external device in case all breakers are in position OFF The LED “PMS BLOCKED” at the AOP indicates, whenever the PMS is blocked for normal operation When the master is dead and the communication is working, both generator 2 and 3 are able to start and connect to the busbar	

Blackout start sequence with communication failure

STARTING CONDITIONS	Plant mode = AUTO DG 1 is running and connected (PMS) DG 2 and DG 3 are in stand-by (PMS) TB is connected (PMS) (only system 03) SG is in stand-by (PMS) (only system 02/03) Start priority 1-2-3		
ACTION	**REACTION**	**NOTES**	**APP.**
Disconnect all units from the CANbus line Terminal: 29-36 Trip the breaker of DG 1, block for reconnection and activate the binary input "BLACKOUT"	CB is tripped creating a busbar blackout DG 2 is started and connected to the busbar When the DG achieves satisfactory voltage and frequency, it will cut in at the busbar without synchronisation	The input BLACKOUT is set by an external device in case all breakers are in position OFF The LED "PMS BLOCKED" at the AOP indicates, whenever the PMS is blocked for normal operation When the master is dead and the communication is down, only generator 2 will start and connect to the busbar	

PC utility software

STARTING CONDITIONS	Plant mode = AUTO DG 1 is running and connected (PMS) DG 2 and DG 3 are in stand-by (PMS) Start priority 1-2-3		
ACTION	**REACTION**	**NOTES**	**APP.**
Connect to any unit with the utility software			
Select the PLANT page	Gives an overview over the actual unit status (actual power, current, phase angle, frequency, voltage, breaker position, regulator status and no. of active alarms)		
Select the HISTORICAL ALARM page	All the alarms that are or have been active in the system including time stamp, active status and acknowledge status		
Select the TRENDING page	The trending function gives the operator the possibility to supervise measured values like e.g. actual generator power, current, frequency, voltage and much more		

STARTING CONDITIONS	Plant mode = AUTO DG 1 is running and connected (PMS) DG 2 and DG 3 are in stand-by (PMS) Start priority 1-2-3		
Select the PARAMETER page	The parameter function allows the operator to adjust parameters and timers and to configure text messages, relay outputs and alarms		
Select the INPUT/OUTPUT page	The input/output window gives the operator an overview of the actual status of all connected inputs and outputs		
Select the OPTION page	The option window gives an overview of the activated options in the unit		
Select the LOG page	The event log is a very useful window to inform the operator about the last 150 events		