4189341262F

AGC-4 Mk II, AGC-4, ASC-4, ALC-4

Critical power

Option T1

Improve Tomorrow

1. Option T1

Option T1, Critical power, is a software option for AGC-4 Mk II, AGC-4, ASC-4 and ALC-4. Option T1 is related to power management. Each AGC-4 Mk II must have power management option G5, or extended power management option G7. Each AGC-4 must have power management option G4, G5, or G8, or extended power management option G7.

The option consists of:

- Redundant controllers
  - For an application with redundancy, EVERY controller in the power management system must have option T1. That is, even controllers without a redundant controller must have option T1.
  - The document primarily uses AGC-4 in the examples. Note however that the examples also apply to the other controller types.
- Short-circuit limitation

1.1 Software versions

This document applies to the following products and software versions.

Controller	SW version	Redundancy	Short-circuit limitation
AGC-4 Mk II	6.03	x	x*
AGC-4	4.81	x	x*
ASC-4 Solar/Battery	4.17	x	x
ALC-4	4.12	x	

NOTE * Only genset controllers.

1.2 Glossary

Term	Abbreviation	Description
AGC	AGC	For AGC-4 Mk II and AGC-4, for power management, there are genset, BTB and mains controllers. For extended power management, there are also group and plant controllers.
Automatic Load Controller	ALC-4	If there is a mains failure, the power management system automatically uses gensets to supply the load.
Automatic Sustainable Controller	ASC-4	A hybrid energy controller. The ASC-4 can be included in AGC power management applications. **Solar**: A controller to interface to PV solar inverters. **Battery**: A controller to interface to energy storage systems.
Command controller		The controller that determines the power management settings in the section. See **Option G5 Power management** for more information.
Connected		The genset is running and its breaker is closed.
Genset	DG	
Genset breaker	GB	
Hot standby		The redundant controller approach. See Redundant controllers.
Mains breaker	MB	
M-Logic		The PLC-type tool accessible from the utility software.

Term	Abbreviation	Description
Multi-line-2	ML-2	A DEIF platform, which includes the AGC-4 Mk II, and AGC-4.
Nominal power	P nom or $P_{NOMINAL}$	
Power management system	PMS	
PC utility software	USW	
Preferred controller		The controller that is active by default.
Redundant controller		The controller that takes over if the preferred controller fails. If the preferred controller recovers, the redundant controller gives control back to the preferred controller.
Software	SW	

1.3 Symbols for hazard statements

DANGER!

This shows dangerous situations.

If the guidelines are not followed, these situations will result in death, serious personal injury, and equipment damage or destruction.

WARNING

This shows potentially dangerous situations.

If the guidelines are not followed, these situations could result in death, serious personal injury, and equipment damage or destruction.

CAUTION

This shows low level risk situation.

If the guidelines are not followed, these situations could result in minor or moderate injury.

NOTICE

This shows an important notice

Make sure to read this information.

1.4 Symbols for general notes

NOTE This shows general information.

More information
This shows where you can find more information.

Example

This shows an example.

How to ...
This shows a link to a video for help and guidance.

1.5 Factory settings

The unit is delivered from the factory with default settings. These are not necessarily correct for the engine/generator set. Check all the settings before running the engine/generator set.

1.6 Legal information and disclaimer

DEIF takes no responsibility for installation or operation of the generator set. If there is any doubt about how to install or operate the engine/generator controlled by the Multi-line 2 unit, the company responsible for the installation or the operation of the set must be contacted.

NOTE The Multi-line 2 unit is not to be opened by unauthorised personnel. If opened anyway, the warranty will be lost.

Disclaimer

DEIF A/S reserves the right to change any of the contents of this document without prior notice.

The English version of this document always contains the most recent and up-to-date information about the product. DEIF does not take responsibility for the accuracy of translations, and translations might not be updated at the same time as the English document. If there is a discrepancy, the English version prevails.

2. Redundant controllers

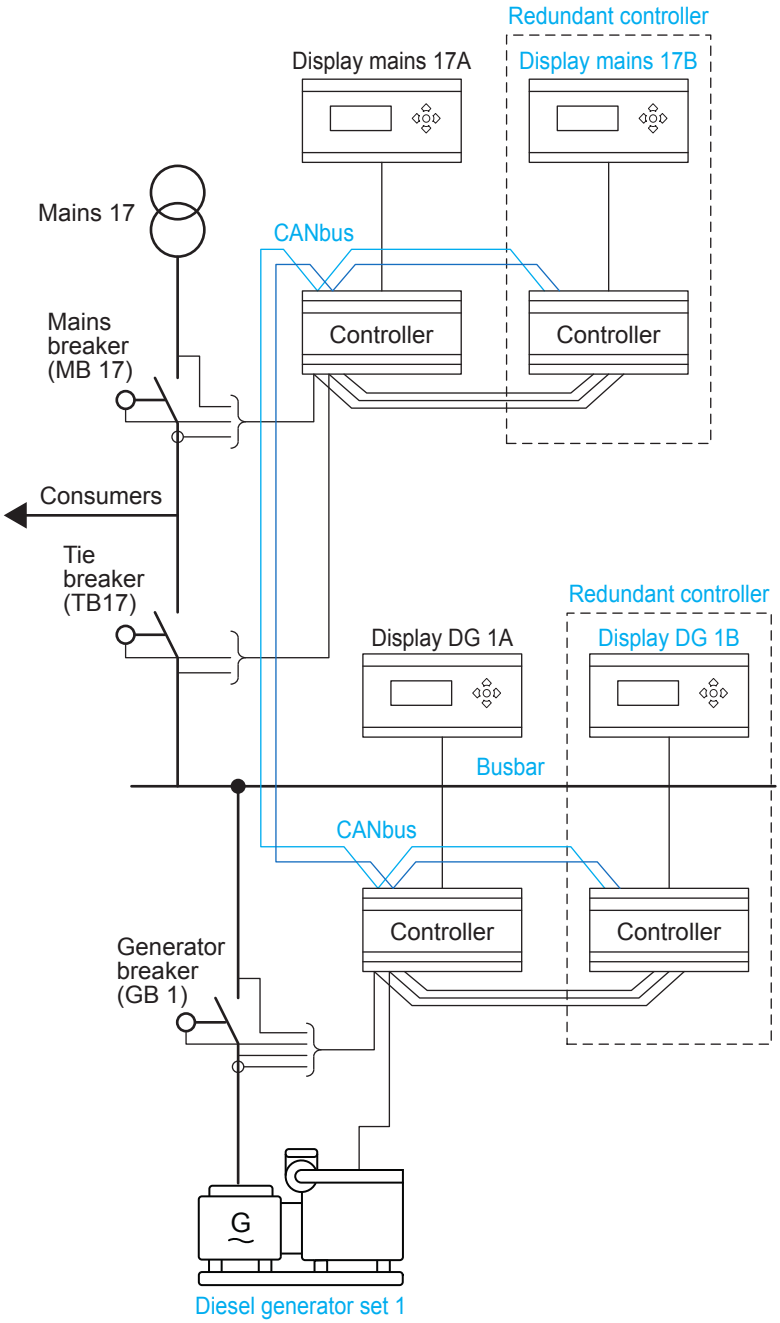
Option T1 allows a redundant controller to operate in hot standby. Hot standby means that if a problem occurs on the active controller, the redundant controller can assume control without disrupting the power set points. For a genset controller, the changeover does not affect a running engine. The redundant controller is connected to the PM CAN line at all times. PM CAN redundancy is possible.

All breaker commands are suppressed in the redundant controller. For genset controllers, engine-related commands are also suppressed.

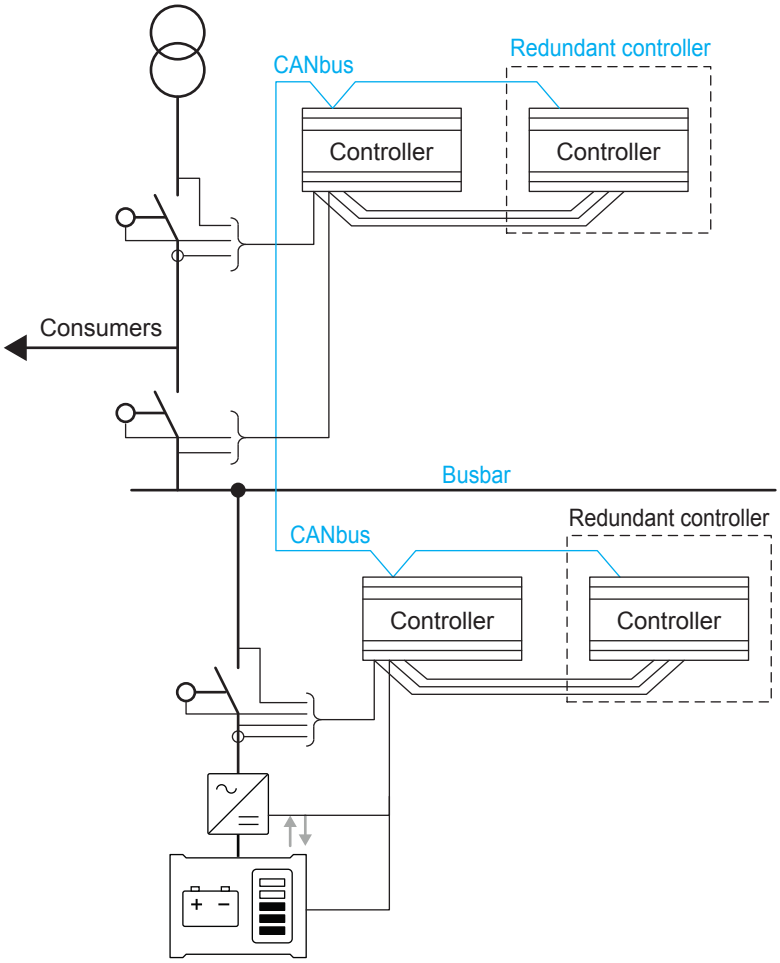
In general, alarms are not suppressed, however, *Redundant controller* is available as an inhibit. By default, only the *Breaker externally tripped* and (if applicable) *External engine stop* alarms are inhibited when a controller is redundant.

NOTE For an application with redundancy, EVERY controller in the power management system must have option T1. That is, even controllers without a redundant controller must have option T1.

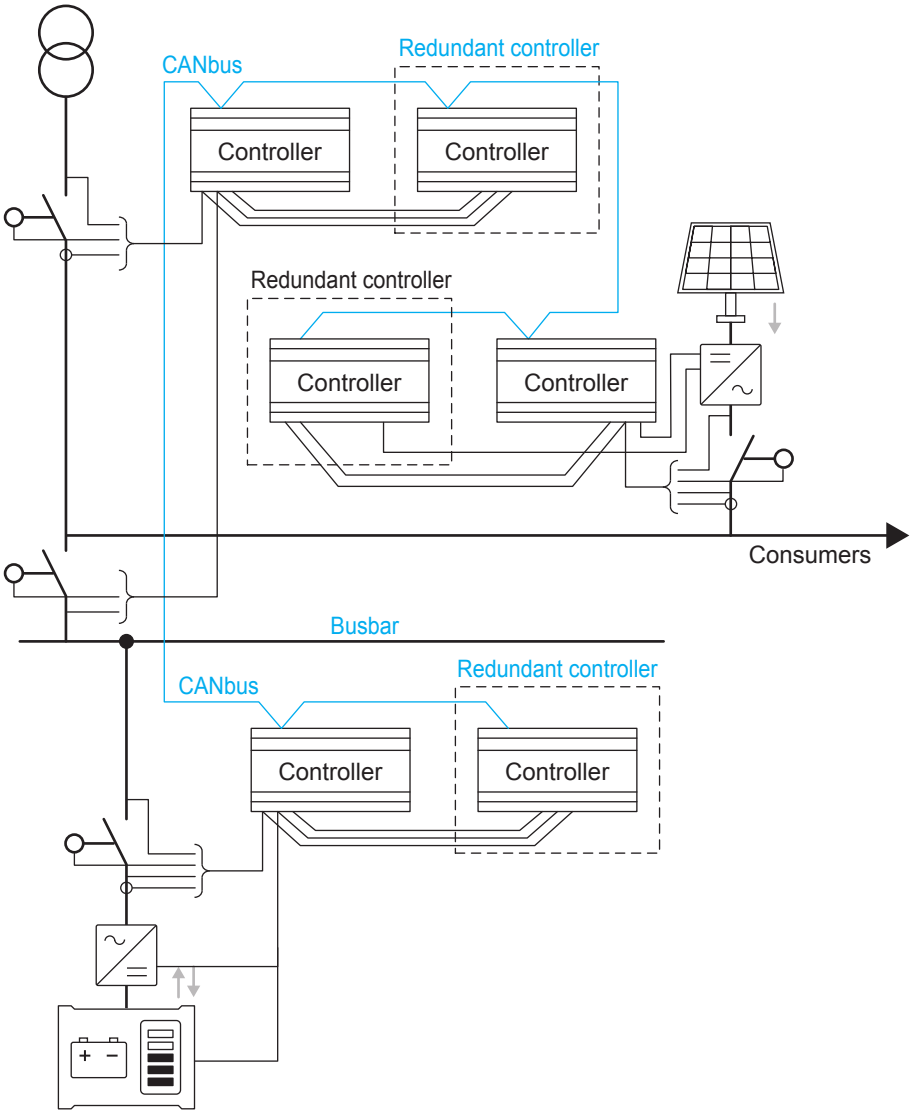
Critical power setup example (including display units)



Critical power with battery backup (display units not shown)



Critical power with battery and solar backup (display units not shown)



NOTE Redundant RS 485 connections to the inverter are possible.

2.1 General description

There are two approaches to redundant controllers:

- **Single master**: One controller is preferred (that is, one controller is the "master" controller).
- **Multi-master**: No controller is preferred.

CAN bus wiring

See the **Installation instructions** for details.

2.2 Requirements

Breaker requirements

Where a controller has a redundant controller, all breakers must be pulse-controlled. This is to avoid breaker tripping during a controller transition.

Genset controller requirements

Where a genset controller has a redundant controller:

- Prevent any load or speed jumps during transition.
  - This can be done by using relay regulation on both the GOV and AVR. For relay regulation to function correctly, droop must be enabled in both the GOV and AVR.

- Alternatively, use an electronic potentiometer (EPQ96-2) for conversion of the signal.
- You must have a stop coil system wired for start and stop. A run coil cannot be used. The stop coil ensures that if the AGC stop coil relay is de-energised, the genset keeps running. See the **Installation instructions** for stop coil wiring.

2.3 M-Logic for redundancy

The controller redundancy is set up in M-Logic.

Commands

The M-Logic commands are under **Output, Redundancy**:

Redundant controller forces the controller into standby. As a result, the commands for breakers and (if applicable) the engine are suppressed.

Redundant backup present indicates that this controller has a redundant controller to take over if there is a malfunction. The status is shown on the USW supervision page.

Events

The M-Logic events are under **Events, Redundancy**:

PM CAN ready is activated when a preferred controller is ready to regain active status from the redundant controller after power up.

Redundant controller is activated when the controller has redundant status.

Redundant backup present is activated when a redundant controller is present.

Extra events for extended power management (option G7)

For extended power management, each group controller runs two applications.

1. The top level application consists of the group and plant controllers.
2. The bottom level application consists of the gensets and the group controller.

More information
See **Option G7 Extended power management** for more information.

There are therefore two extra events in group controllers under **Events, Redundancy**:

PM CAN G5 ready is activated when the group's power management communication (bottom level) is okay.

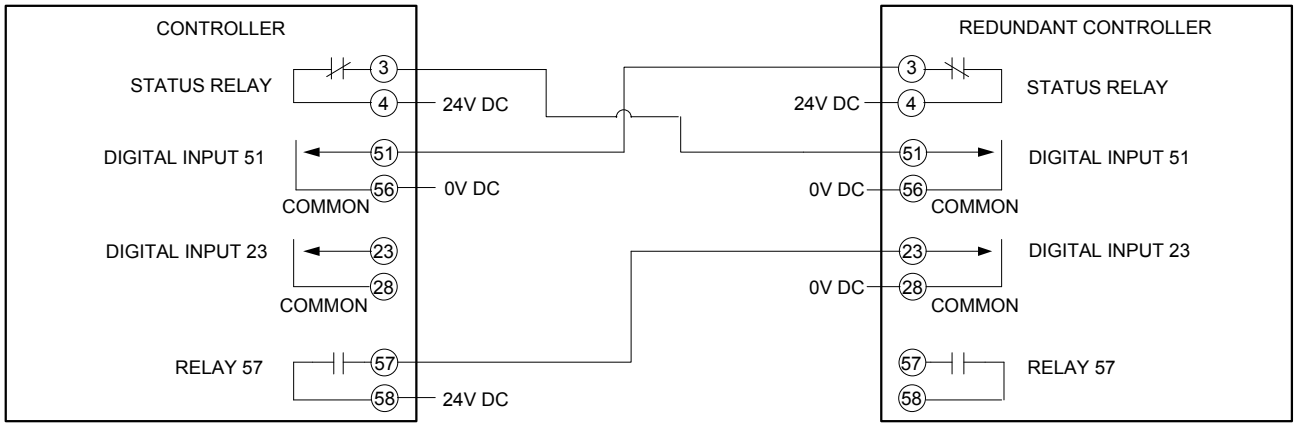
PM CAN G7 ready is activated when the plant's extended power management communication (top level) is okay.

2.4 Single master

Wiring

The status relay (terminals 3 and 4) of the two controllers must be connected. Apart from the status relay, the positions of the other inputs and outputs are configurable.

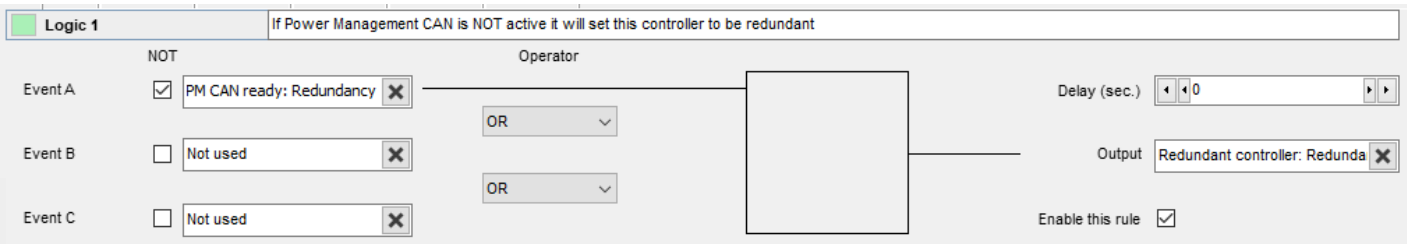
NOTE To minimise the risk of failure, always wire to controller inputs (and not to external IOs).
The example below shows the wiring for the M-Logic example.



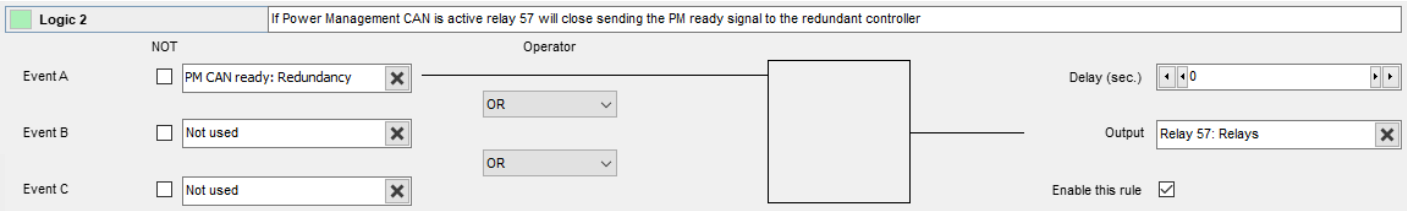
The connections between the status relay and input 51 on both controllers are used to show the status of controllers for the application supervision.

The connection between relay 57 and input 23 is to determine which controller has the control. With the wiring shown, the controller on the left side with the relay output is the preferred controller. That is, unless it fails, the preferred controller is the active controller.

M-Logic in the preferred controller

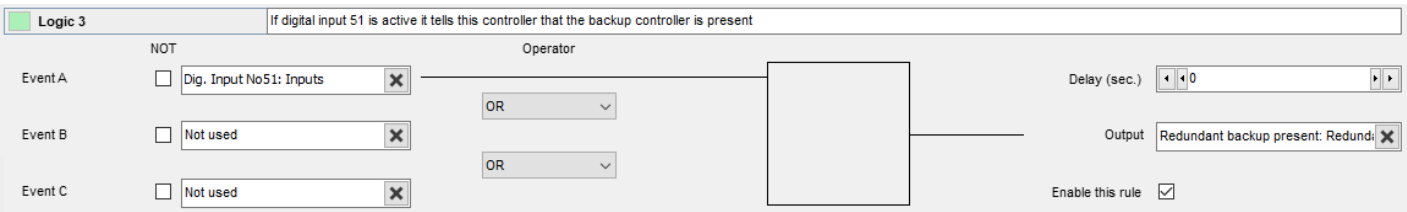


The line above keeps the preferred controller in standby mode when powering up, to prepare the CAN communication. The preferred controller does not interrupt control of the redundant controller until the preferred controller is ready for operation.



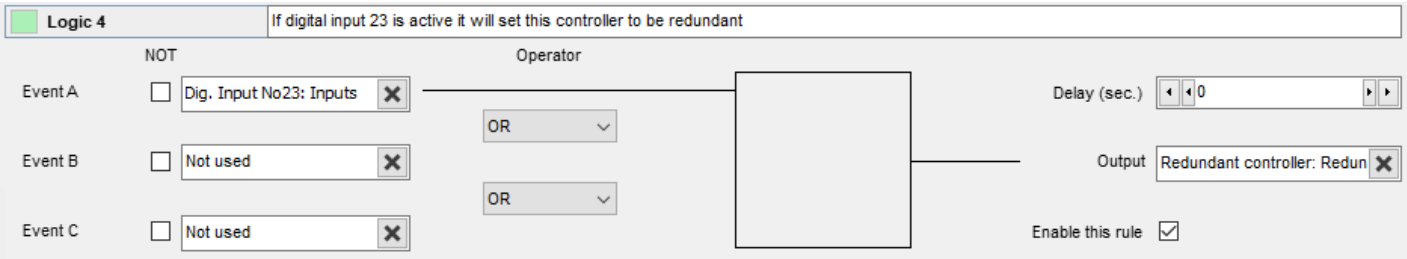
When power management CAN is ready for operation, the preferred controller requests control, putting the redundant controller in standby mode.

NOTE Remember to change relay 57 to limit relay so it is accessible to M-Logic. This is done in parameter 5110.

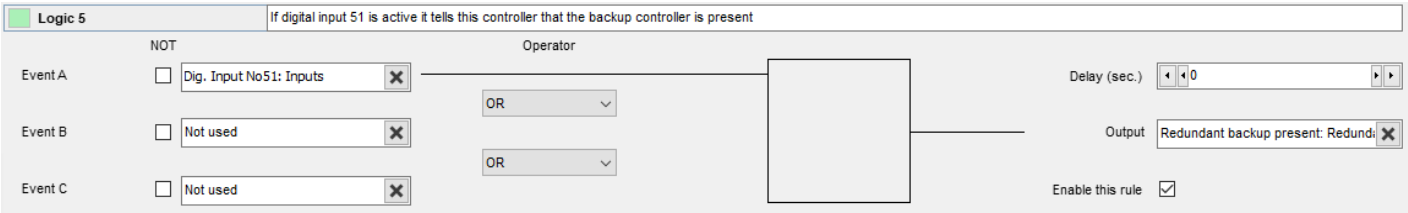


This line is used in application supervision to show that a redundant controller is present.

M-Logic in the redundant controller



When the preferred controller is fully operational, this input is activated to keep the redundant controller in standby mode.



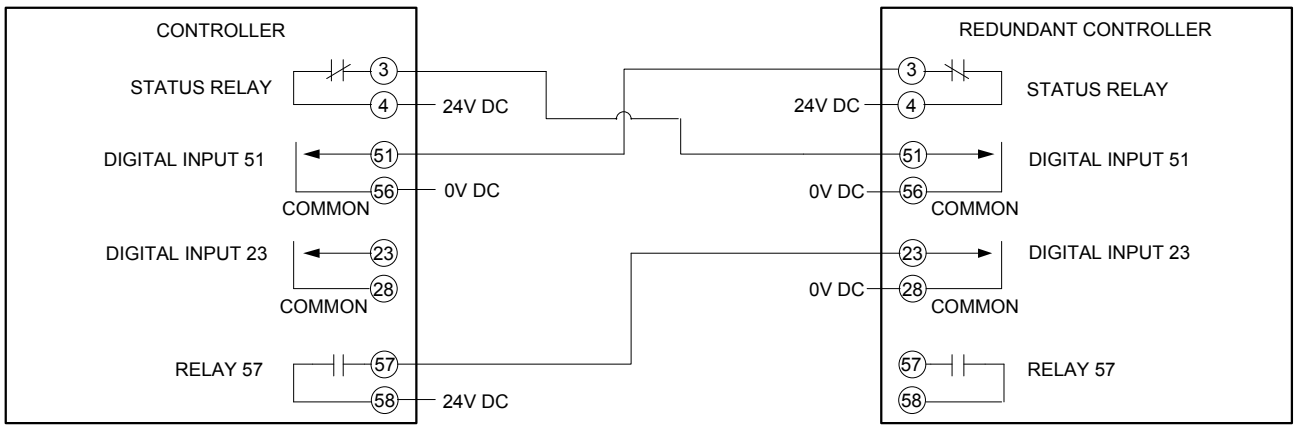
This line is used in application supervision to show that a redundant controller is present.

2.4.1 Single master for extended power management example

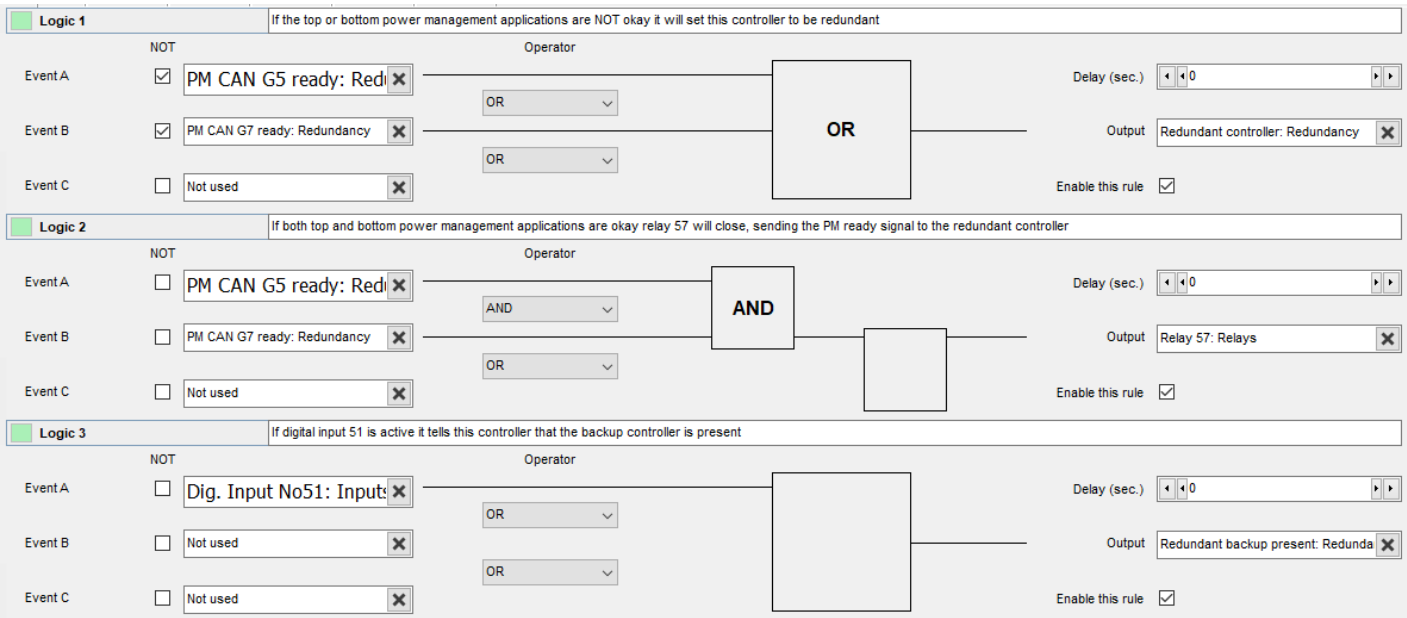
For extended power management, the group controllers must have the following M-Logic.

Wiring

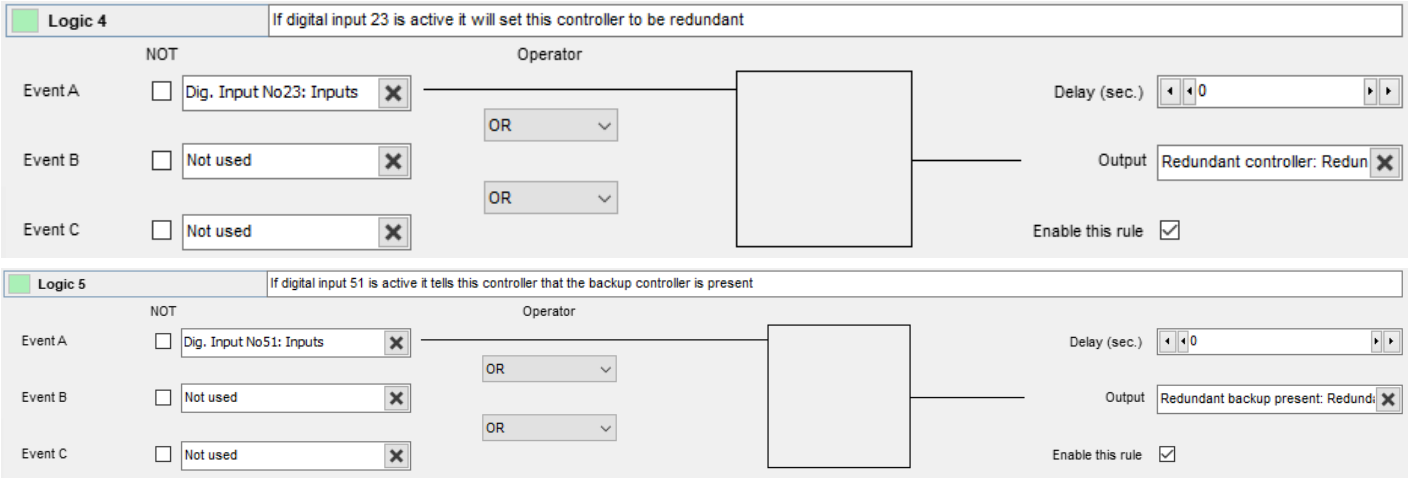
The status relay (terminals 3 and 4) of the two group controllers must be connected. Apart from the status relay, the positions of the other inputs and outputs are configurable. The diagram below shows the wiring for the M-Logic example.



M-Logic in the preferred controller



M-Logic in the redundant controller

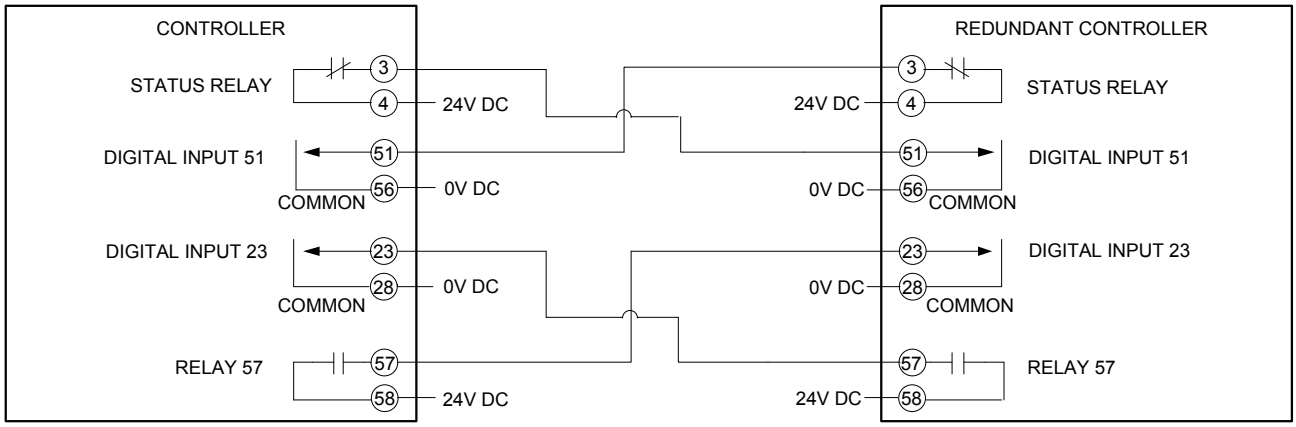


2.5 Multi-master

Wiring

The status relay (terminals 3 and 4) of the two controllers must be connected. Apart from the status relay, the positions of the other inputs and outputs are configurable.

NOTE To minimise the risk of failure, always wire to controller inputs (and not to external IOs).
The example below shows the wiring for the M-Logic example.

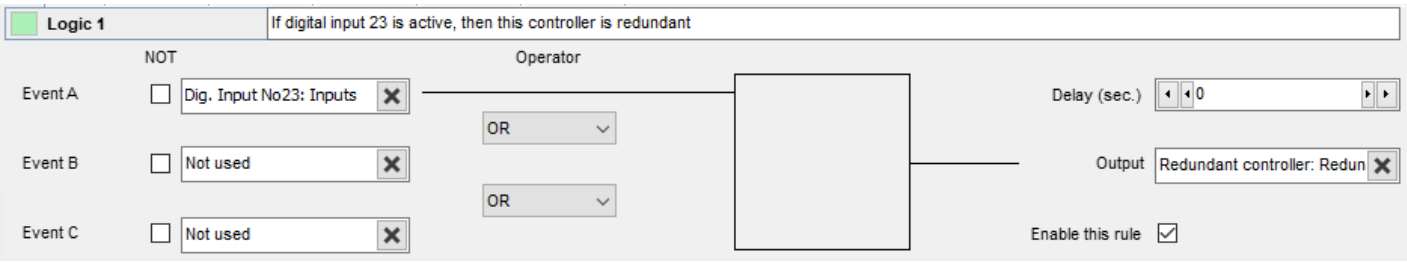


The connections between the status relay and input 51 on both controllers are used to show the status of controllers for the application supervision.

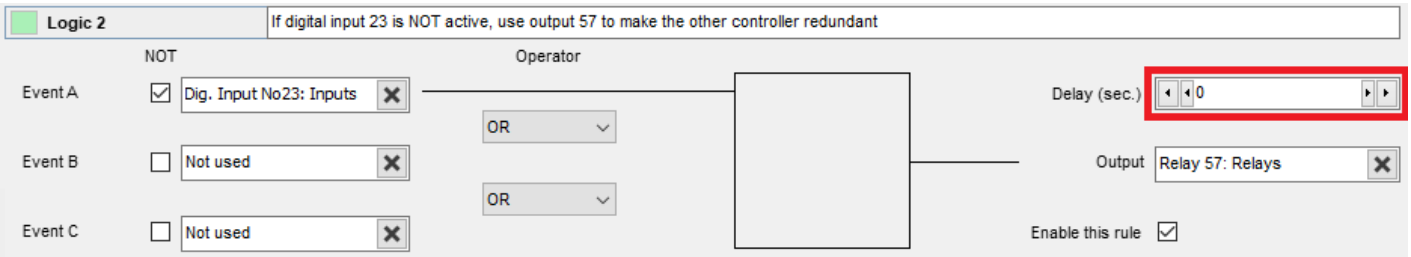
The connection between relay 57 and input 23 on both controllers is to determine which controller has the control. In this case, both controllers have the opportunity to be the active controller.

Redundancy functions in M-Logic

In this setup, the M-Logic lines for the controllers can be almost identical.

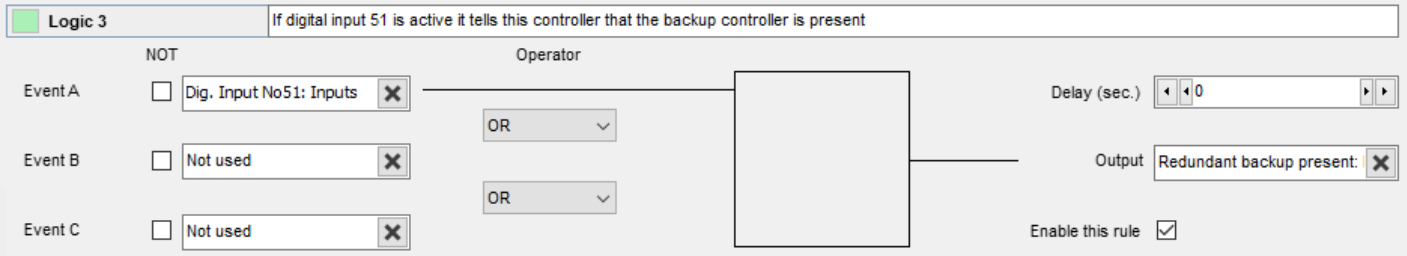


Both controllers have this line saying that if input 23 is active, then this controller is redundant. When both controllers are powered up at the same time, the first one ready sets the other controller as redundant.



Both controllers have this line. If input 23 is **not** active (thus it is the controller that has control), then the controller sets the other controller as redundant (using output 57). One of the controllers needs a small delay on relay output 57 (see the red box) to avoid timing issues when both controllers are powered up at the same time.

NOTE Remember to change relay 57 to limit relay so it is accessible to M-Logic. This is done in parameter 5110.



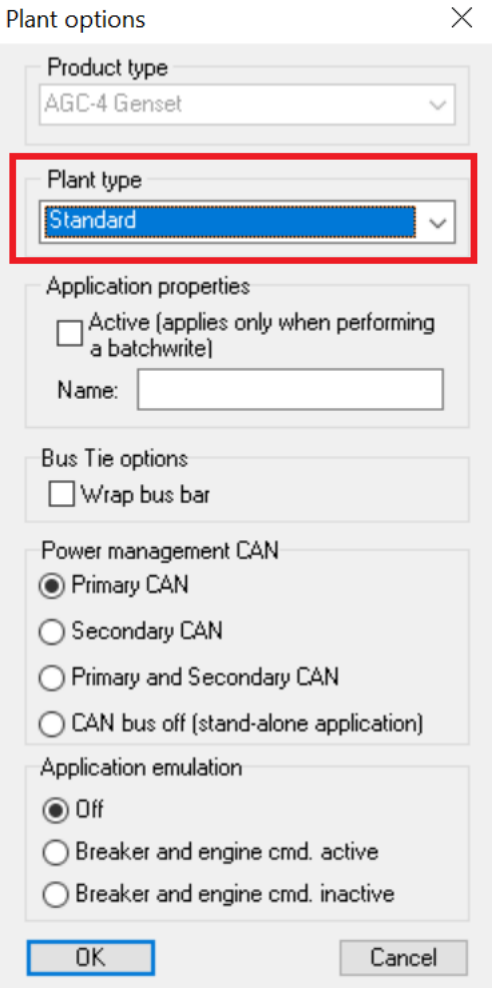
This line is used in both controllers to show that a redundant controller is present in application supervision.

2.6 Application configuration

The application has to be configured for the redundant controllers. Set the controller ID (*Int. comm. ID*, parameter 7531) on all controllers before mounting the CAN lines.

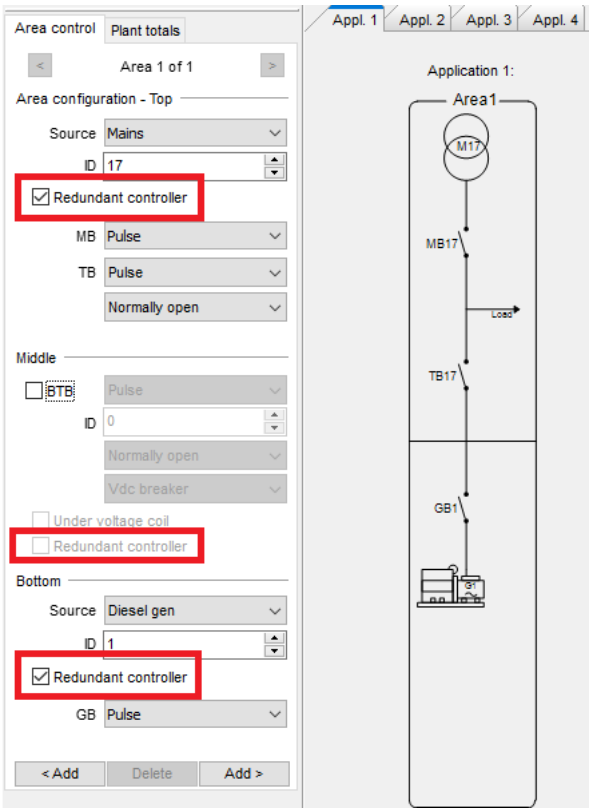
Power management (option G5 for AGC-4 Mk II, and option G4 G5 G8 for AGC-4)

The plant type has to be *Standard*, as shown below:



Redundant CAN bus communication between the controllers is not required for option T1. If you want redundant CAN bus, select *Primary and Secondary CAN*.

When configuring the plant, in the area control, check boxes are available to configure the redundant controllers on each of the three levels. Redundancy can be selected independently in the different levels. The controllers that are redundant to each other must have the same internal ID on the PM CAN line (parameter 7530). It is not possible to broadcast applications from a redundant controller.



Extended power management (option G7)

The plant type has to be *Gen-set group*, or *Gen-set Group Plant*.

Like standard power management, when configuring the plant, in the area control, check boxes are available to configure redundant controllers on each of the three levels.

2.7 Application supervision

Before the application supervision can see the redundant controllers, it is necessary to set up each controller as described below. This is done in identifiers and is necessary to make the supervision work properly. These settings have no effect on the performance of the redundancy; it is only for visual purposes in the supervision.

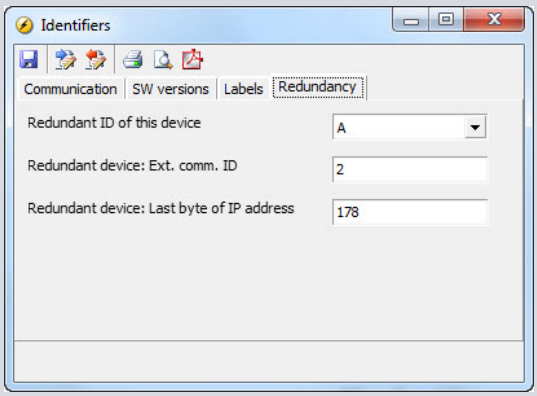
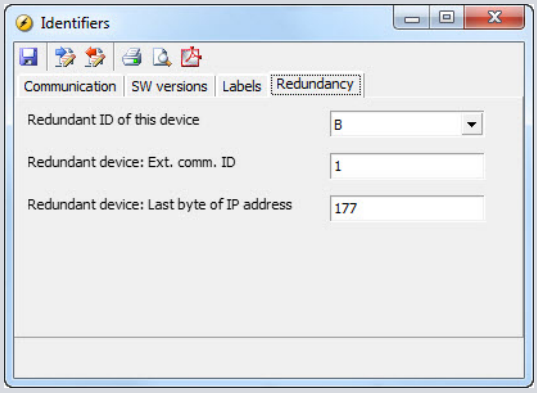
For AGC-4, ASC-4 and ALC-4, to have full visibility over the redundant controllers in the supervision, either the option N (TCP/IP) or the option H2 (Modbus) is needed. For AGC-4 Mk II, TCP/IP is included in the standard controller configuration.

Identifiers

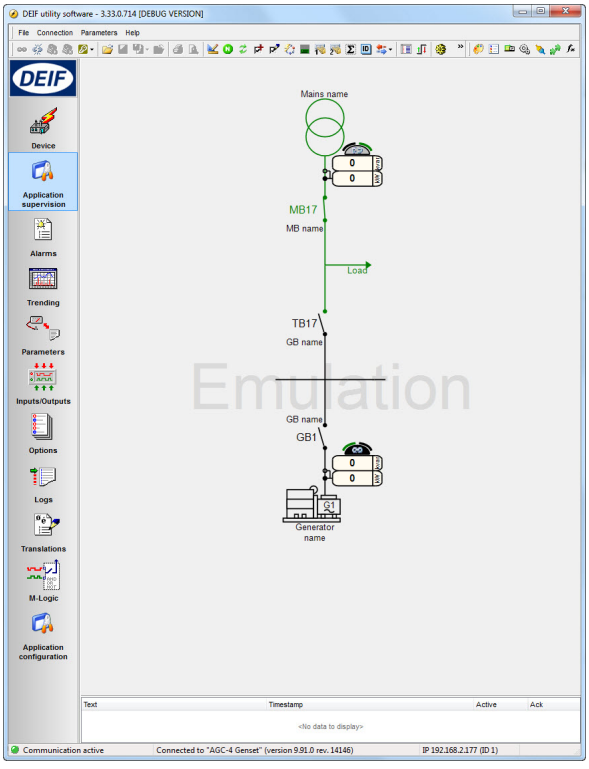
On both controllers, identifiers must be set up.

When redundant controllers are used, each controller must have the following information:

- *Redundant ID of this device*: The ID letter (A or B) for the controller.
- *Redundant device: Ext. comm. ID*: The external communication ID of the other controller.
- *Redundant device: Last byte of IP address*: The last byte (XXX) of the IP address of the other controller 192.168.2.XXX.

Redundant controller example	
AGC controller: **A**	AGC controller: **B** (redundant)
Own ext. comm. ID: **1**	Own ext. comm. ID: **2**
Own IP address: 192.168.2.**177**	Own IP address: 192.168.2.**178**
	

When the settings are done, the application supervision will look like this.

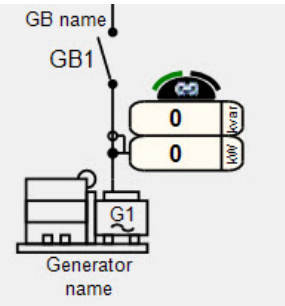


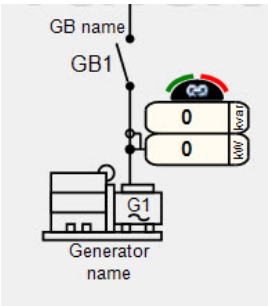
In the above setup, there is redundancy on both mains and DG level.

The redundancy status is indicated by the two arcs above the connect symbol. The left arc indicates status of the controller assigned with the letter A, and the right arc indicates status of the controller assigned with the letter B.

An arc can have three different status assigned with default colours:

1. Green indicates that the controller is in control
2. Black indicates that the controller is ready
3. Red indicates that the controller is not ready

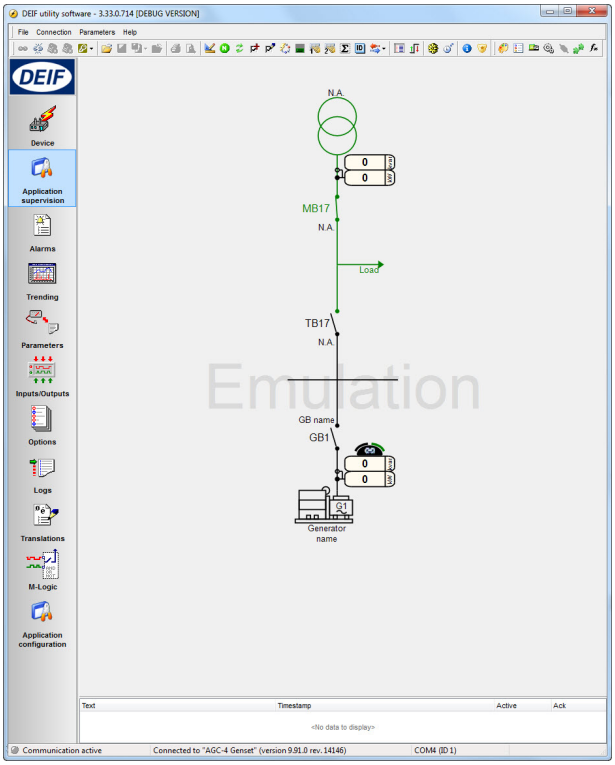




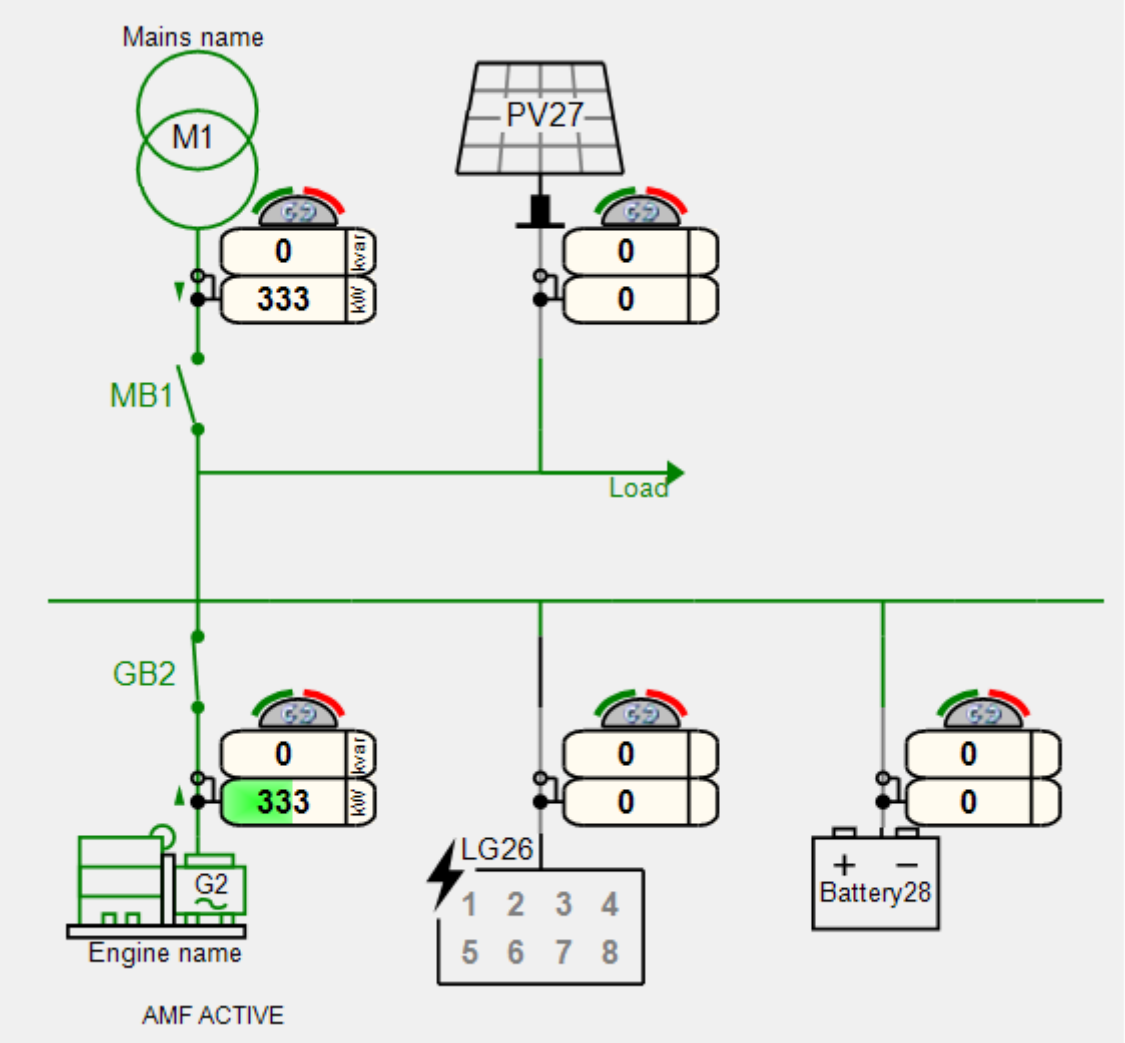
These colours can be changed with the colour scheme editor.

Note that if you are connected to the controller via USB, you will only be able to see the redundancy status between the controller you are connected to and the redundant controller. Other redundant controllers in the system will not be shown.

Below, the same setup as above is shown, but connected to one of the DG controllers with USB instead. Here redundancy is not shown on the mains, even though it is installed.



Example with ASC redundant controllers



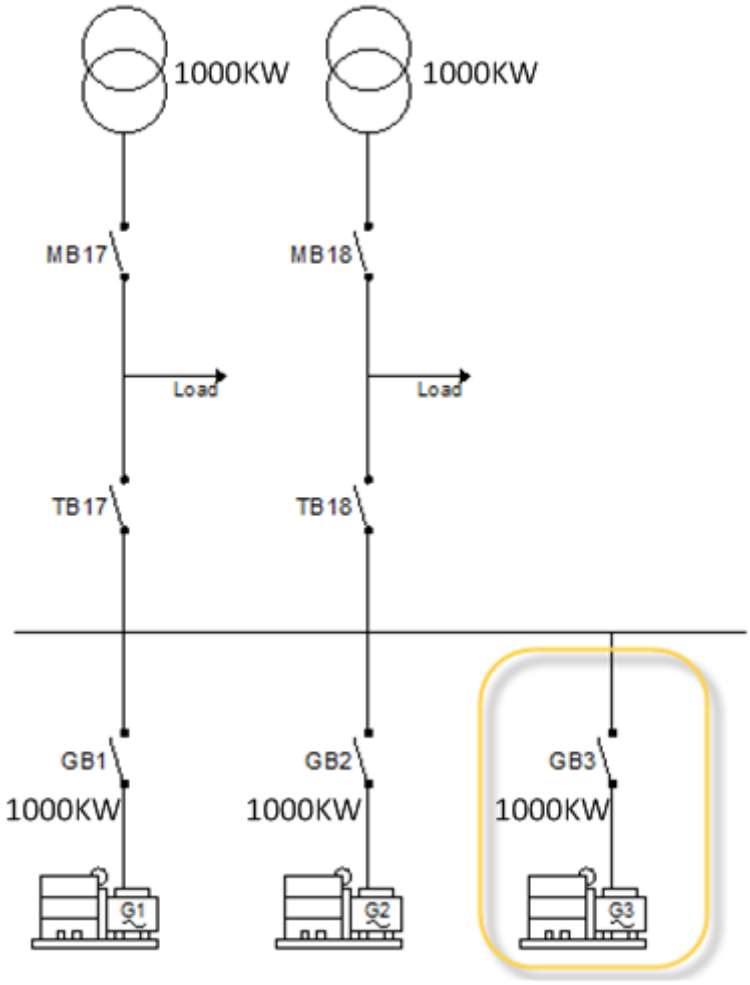
3. Short-circuit limitation

Short-circuit limitation is a critical power function to protect a system with multiple sources of power. When short-circuit limitation is active, the power management system does not allow additional sources of power to connect if this would exceed the configured limits. If the configured limits are exceeded, there is a warning alarm.

More information
The power management system can be configured to connect extra gensets. See **N+X** in **Option G5 Power management** for more information.

Short-circuit limitation is especially useful for applications in the low voltage range (400 V) where the short-circuit currents of the transformers and generators are high. These can easily exceed the rated values of the breakers.

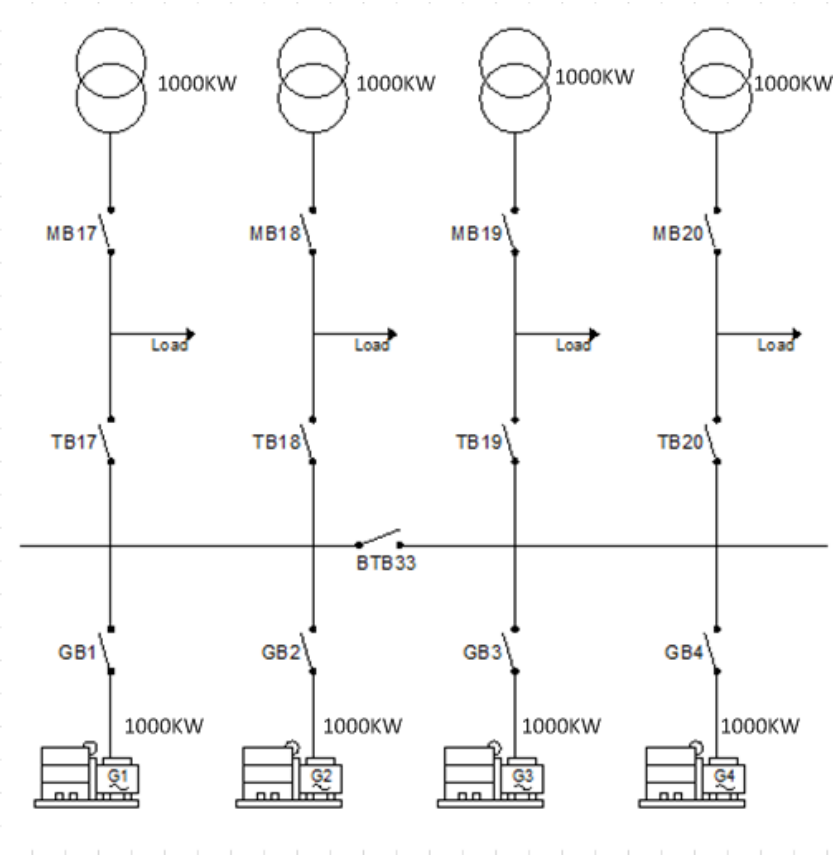
The short-circuit limitation is configured using parameters in the genset, solar and battery controllers.



NOTE For power management applications with short-circuit limitation, each controller in the system must have option T1.

3.1 General description

Short circuit limitation is used to set a busbar (or busbar section) power limit in the system.



The nominal power values of each mains, genset, solar and battery controller are used in the calculation. This means that its static nominal power values are used for the short-circuit limitation calculation.

The parameters in 2300 are common parameters used in the power management. If a mains controller is present in a section, the mains command controller spreads its setting to the other controllers in the section. If no mains controller is present, the genset command controller spreads its setting to the other controllers in the section.

In this way, it is possible to operate with different short-circuit limitation levels in different sections.

If the section has closed BTB(s), then the controllers in the section scan the settings in these BTB(s) to determine whether any of these have lower short-circuit limitation settings than themselves.

If so, the setting of the BTB with the lowest short-circuit level is used while the sections are connected.

3.2 Short-circuit limitation setup

2300 Section P>

Parameter	Setting		Range	Defaults	Description
2301	Section P>	MW	0 to 30000	0	Set point for the nominal power (in MW) allowed on busbar. The function uses the sum of the values in parameters 2301 and 2302.
2302	Section P>	kW	0 to 999	0	Set point for the nominal power (in kW) allowed on busbar.
2303	Section P>	Delay	0.0 to 999.0 s	1.0 s	Alarm activation timer when the threshold is exceeded.
2304	Section P>	Output	Depends on hardware	Not used	Relay to activate if the alarm is activated.

Parameter	Setting		Range	Defaults	Description
2305	Section P>	Enable	Not enabled Enabled	Not enabled	Enable the short-circuit limitation function and alarm.
2306	Section P>	Fail class	F1 to F8	Warning	Fail class for alarm.

3.3 Short-circuit limitation weight factor

2310 Section P> (Short-circuit limitation weight factor)

Parameter	Setting		Range	Default	Description
2311	Factor	Set point	1.0 to 25.5	1	Set point for the weighing of nominal power contribution to short-circuit calculation.

Parameter 2311 is a weighing factor. This factor can be used if two transformers or generators have the same nominal power values, but different short-circuit values.

This factor is multiplied by the nominal power of the specific mains or generator controller. The result is the controller's contribution to the overall short-circuit limitation calculation.

NOTE Parameter 2311 is not available in a BTB controller.

Short-circuit limitation example

The application has four 1500 kW gensets. The weight factor (2311) for Genset 4 is 2.0. The weight factor for Gensets 1, 2 and 3 is 1.0. The short circuit limitation (2301+2302) is 5 MW.

Gensets 1, 2 and 3 can be connected simultaneously, since the total nominal power is 4.5 MW.

However, if Genset 4 is connected, the weight factor makes its contribution to short-circuit limitation 3 MW. Therefore, to avoid exceeding the short circuit limitation, only one other genset can be connected.

3.4 AMF sequence

In an AMF sequence when load is to be returned to the mains supply and back synchronisation is enabled, the short-circuit limitation function affects the sequence of the return.

Even though parallel operation of the mains breakers is enabled in parameter 8182, it can be necessary to back synchronise one mains at a time and deload genset(s) before the next mains can come online.

NOTE The parameters in 2300 can overrule multi-start settings in AMF sequences.