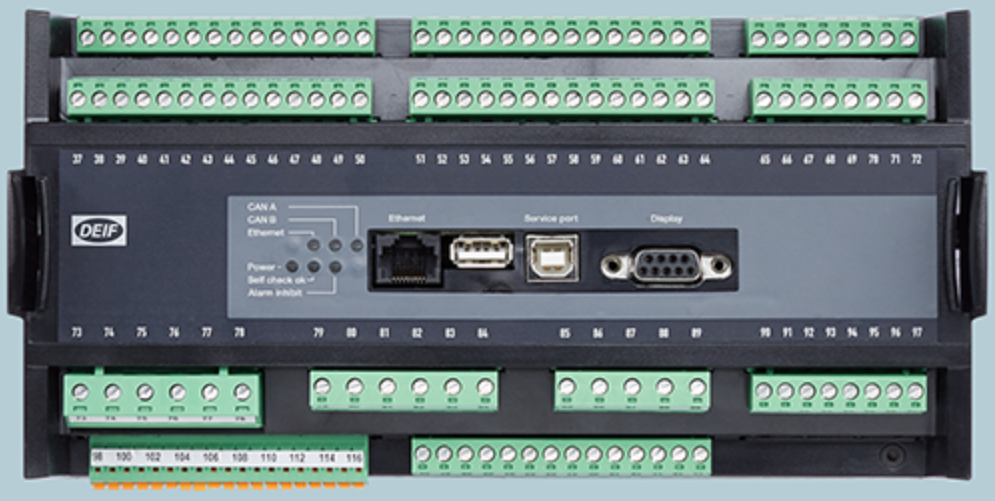
AGC-4

Option G3

Analogue load sharing, and external analogue set points



DEIF A/S · Frisenborgvej 33 · DK-7800 Skive
Tel.: +45 9614 9614 · Fax: +45 9614 9615
info@deif.com · www.deif.com

Document no.: 4189341261A
SW version: 4.79.x or later

1. Option G3

If option M12 is already installed in the controller, option G3 is a software upgrade. Together, these options allow:

- Analogue load sharing
- External analogue set points

ANSI number

Function	ANSI no.
Analogue load sharing between gensets	90

1.1 Legal information and safety

1.1.1 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.

INFO
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.

1.1.2 Factory settings

The Multi-line 2 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.

2. Analogue load sharing

Option G3 enables the controller to use analogue load sharing lines to share the active load (and reactive load (option D1)) equally (as a percentage of the nominal power).

When is analogue load sharing active?

Analogue load sharing is active automatically when:

- The mains breaker is open and the genset breaker is closed. That is, the connected genset is not parallel to the mains (island operation).
  - You can use M-Logic to disable analogue load sharing.

Analogue load sharing is automatically not active when:

- The genset breaker is open.

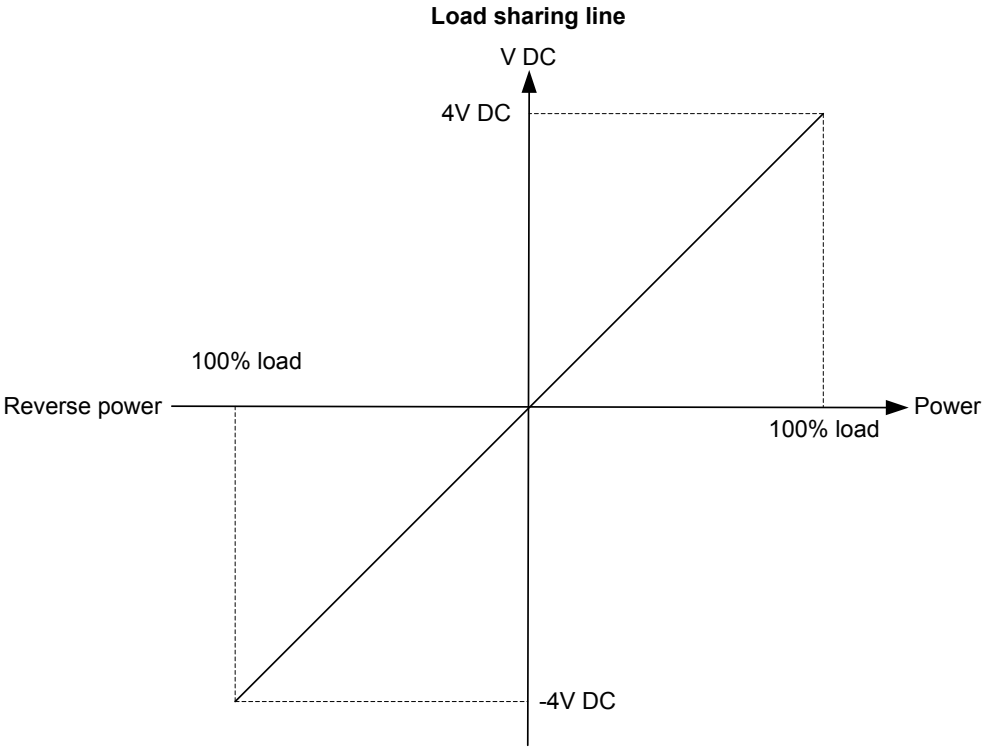
Analogue load sharing is automatically ignored when the power management system gives the genset controller a power set point:

- You can use M-Logic to force the controller to use analogue load sharing. This allows analogue load sharing with externally controlled gensets. See Load sharing type for more information.
- You can also use M-Logic to activate analogue load sharing if the power management CAN bus communication fails.

More information
See **Genset functions, Load sharing** in **Option G4 G5 and G8 Power management** for more information.

How does it work

A voltage signal proportional to the load produced by the genset is supplied on the load sharing line. When the generator load is 0 %, 0 V DC is supplied. When the load is 100 %, the voltage is 4 V DC, as shown below. Active load sharing is shown. Reactive load sharing is similar.



2.1 Analogue load sharing terminals

Term.	Function	Technical data	Description	Comment
37	-5/+5 V DC	Analogue I/O	Active load sharing line	Requires option G3
38	Com.	Common	Common	
39	-5/+5 V DC	Analogue I/O	Reactive load sharing	Requires option D1 and G3

2.2 Working principle

The controller supplies a voltage on the load sharing line proportional to the genset's actual load. This voltage comes from an internal power transducer. At the same time, the actual voltage on the load sharing line is measured.

If the measured voltage is higher than the voltage from the internal power transducer, the controller increases its load to match the voltage on the load sharing line.

If the measured voltage is lower than the voltage from the internal power transducer, the controller decreases its load to match the voltage on the load sharing line.

The voltage on the load sharing line only differs from the voltage from the internal power transducer, if two or more controllers are connected to the load share line.

When option G3 is activated, the analogue load share line is active. That it, it is active both when one generator is running in a single application, and when a number of generators are actually sharing the load. For generator running alone, disabling the load share line is recommended to keep the frequency regulator active.

INFO
To disable the load sharing line, use M-Logic *Output, Inhibits, Inh. analogue load share*.

To improve the handling of several generators in the same application, option G3 works as backup system for power management option G5. This means that if both option G3 and power management are available in the same controller, load sharing is done by the CAN bus communication as the primary choice. If a CAN bus error occurs, load sharing continues on the analogue load sharing line. The generators stay stable even though the power management is lost.

Example 1: Load adjustment

Two generators are running in parallel. The loads of the generators are:

Generator	Actual load	Voltage on load sharing line
Generator 1	100 %	4 V DC
Generator 2	0 %	0 V DC

The voltage level on the load sharing line can be calculated to:

U_{LS}: (4 + 0) / 2 = 2.0 V DC

Now generator 1 decreases the load to match the voltage on the load sharing line (in this example, 2.0 V DC). Generator 2 increases the load to match the 2.0 V DC.

The new load share situation is:

Generator	Actual load	Voltage on load sharing line
Generator 1	50 %	2.0 V DC
Generator 2	50 %	2.0 V DC

Example 2: Different generator size

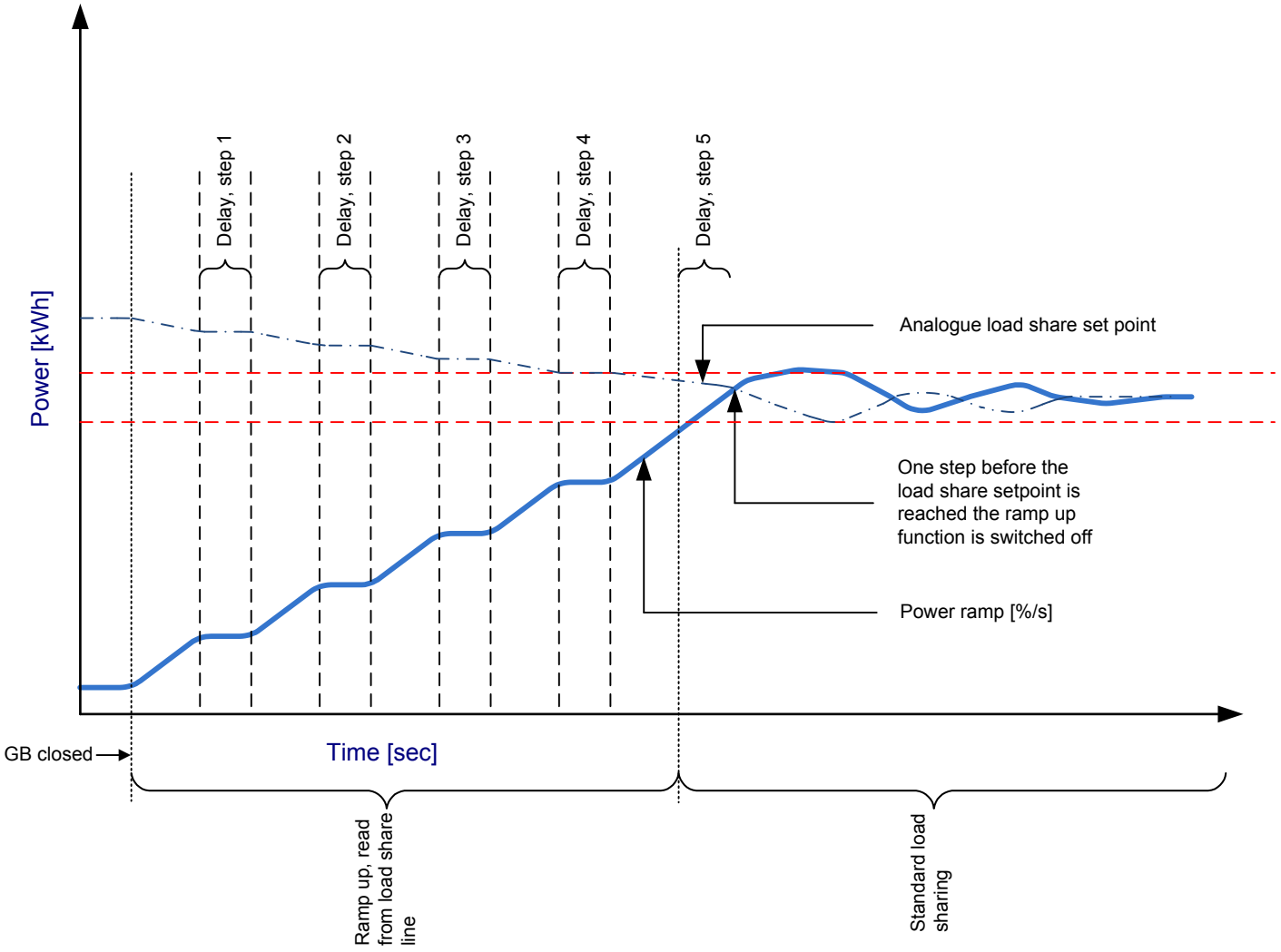
If the generator size differs, the load sharing is still done based on a percentage of the nominal power.

Two generators supply the busbar. The total load is 550 kW.

Generator	Nominal power	Actual load	Voltage on load sharing line
Generator 1	1000 kW	500 kW	2.0 V DC
Generator 2	100 kW	50 kW	2.0 V DC

Both generators are supplying 50 % of their nominal power.

2.2.1 Island ramp up with load steps



The genset controller includes a load ramp up function. If enabled, this also controls the load ramp up for analogue load sharing.

When menu 2614 is enabled, the power set point continues to rise in ramp up steps, determined by menu 2615, towards the load sharing set point. The delay time between each ramp up step will be determined by menu 2613. The ramp up continues until the load sharing set point is reached. The regulator is then switched to standard load sharing mode.

If the delay point is set to 20 % and the number of load steps is set to 3, the genset ramps to 20 %, waits the configured delay time, ramps to 40 %, waits, ramps to 60 %, waits and then ramps to the system set point. If the set point is 50 %, the ramp stops at 50 %.

2.2.2 Freeze power ramp

You can use a command in M-Logic (*Output, Command, Freeze ramp*) to freeze the ramp.

Freeze ramp active:

- The power ramp can be stopped at any point. The set point is maintained as long as the freeze is active.
- If the freeze is activated while ramping from one delay point to another, the ramp is fixed until the freeze is deactivated.
- If the freeze is activated while the delay timer is timing out, the timer is stopped and does not continue until the freeze is deactivated.

2.3 Load sharing type

The controller can be configured to work with different load sharing modules and different ranges for the load sharing signal. This is controlled by the parameters in 6380 (signal level) and 6390 (load sharing type). The signal level is used to adjust the maximum output of the load sharing lines. The default range is 0 to 4 V DC, and therefore 4 V DC is the voltage applied to the load sharing line at 100 % load. If the AGC is connected to another product where the load sharing range is different, then the range can be changed in 6380.

To be able to adjust the maximum range, set 6391 to *Adjustable*. The AGC can provide between 1.0 and 5.0 V DC at 100 % load. Load sharing interfacing to DEIF Uni-line LSU (load sharing unit) and Multi-line 2 version 1 and version 2 can require a 0 to 5 V DC range. If the load sharing is unequal, check the configuration.

Parameter 6391 can be:

- Adjustable
- Selco T4800
- Cummins PCC
- Woodward SPM-D11

The parameters in 6380 are only used if *Adjustable* is selected in 6391. For other selections, the AGC modifies the signal level of the long sharing lines to match the selected controller/load share unit.

2.3.1 Load sharing modules

For interfacing to unspecified load sharing modules, it may be necessary to provide galvanic separation for the load sharing lines. For proper function, the input impedance of such isolation amplifiers should be high impedance.

2.3.2 Selco T4800 load sharer

T4800 is for kW sharing only (that is, not kVAr sharing).

The signal level is +/-1 V DC, so the AGC automatically adapts to this level. The terminals of T4800 are 12 (com) and 13 (+).

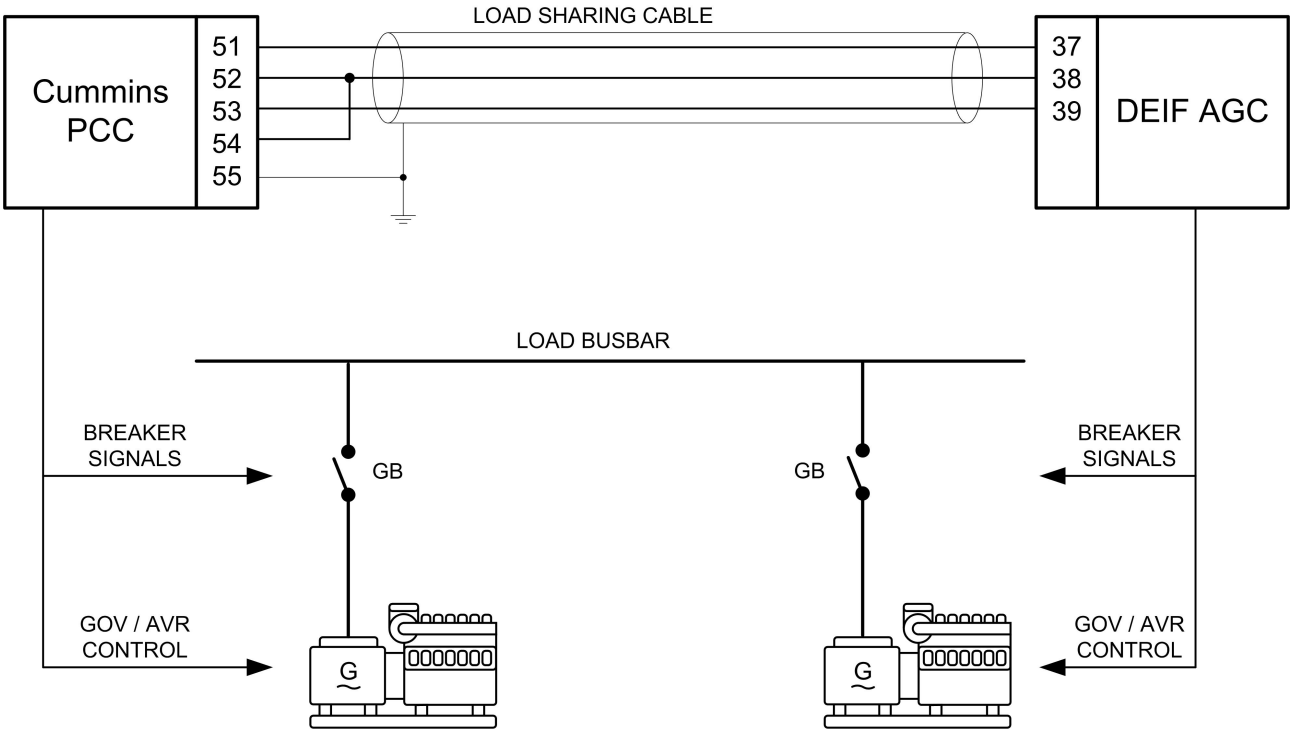
For T4800, the frequency difference of the measured compared to generator nominal is taken into account to prevent unequal load sharing. This is not user-configurable.

2.3.3 Cummins PCC

The signal level is 0.3 to 2.1 V DC, so the AGC adapts automatically to this level. The terminals (TB3) of the Cummins PCC (for example PCC3100 and PCC3201) are on connector 8, and the terminals are 51 (kW), 53 (kVAr), 52 and 54 (common). Terminal 55 is a dedicated terminal for the shield of the load sharing cable. Note that kVAr sharing requires option D1.

Cummins PCC applications

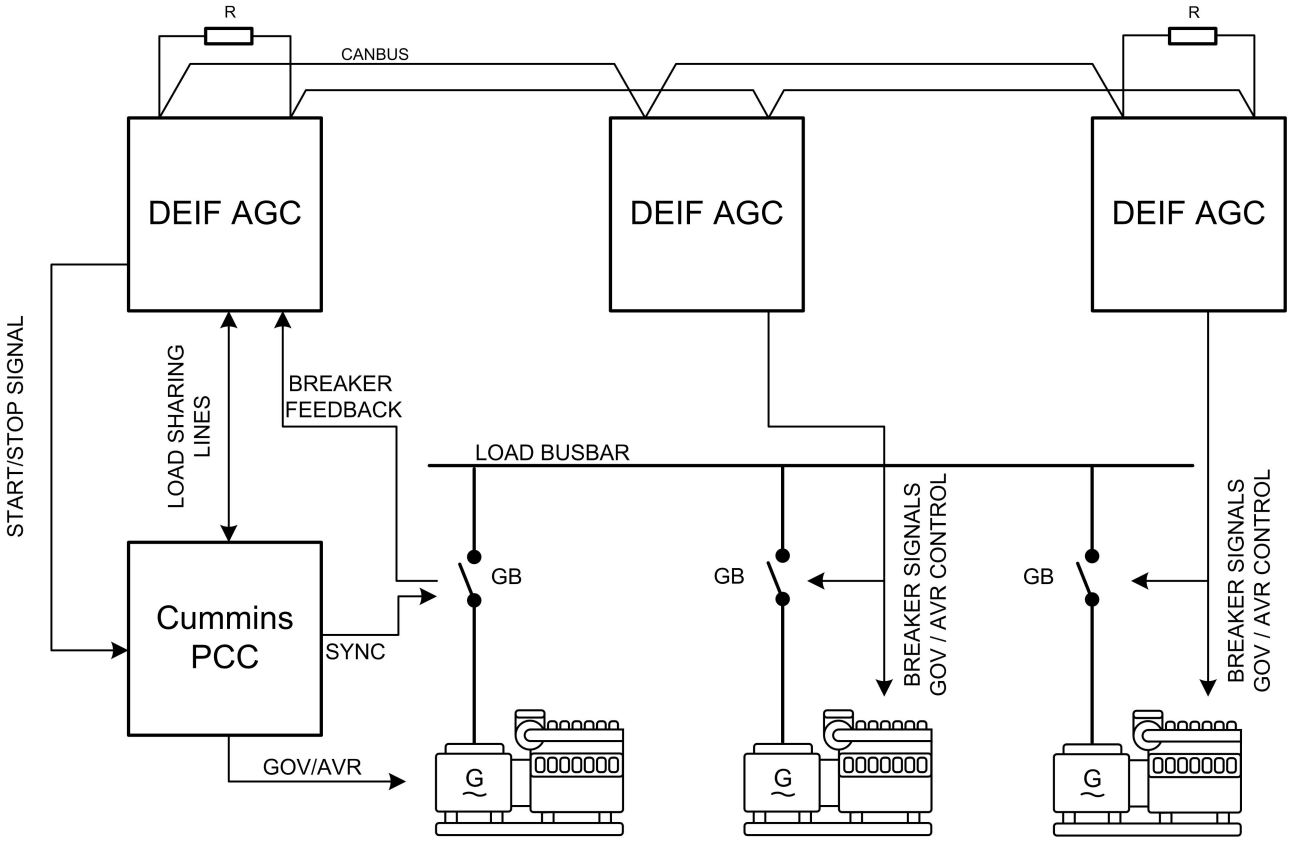
Figure 2.1 PCC interface to AGC



PCC in the DEIF power management system

If the AGC is part of a power management system, it normally gets load sharing information from the power management system over CAN bus. You can force an AGC to use the analogue load sharing lines: Activate *Output, Command, Use Ana LS instead of CAN* in M-Logic. This allows the Cummins PCC to share the load with the AGCs.

This is useful if the AGC is placed on all gensets only sending start and stop commands to the PCC. This means that the Cummins ILSI unit is not necessary.


R
R
CANBUS
DEIF AGC
DEIF AGC
DEIF AGC
START/STOP SIGNAL
LOAD SHARING LINES
BREAKER FEEDBACK
LOAD BUSBAR
GB
GB
GB
BREAKER SIGNALS GOV / AVR CONTROL
BREAKER SIGNALS GOV / AVR CONTROL
Cummins PCC
SYNC
GOV/AVR
G
G
G

3. External analogue set points

3.1 External analogue set points using option G3

The genset can be controlled from external set points. The external analogue set point inputs are only available if option G3 is selected. A digital input must be used to activate each external set point.

Five inputs can be selected using the PC utility software (USW):

Input	Ext. set point active condition*	Comment
Ext. frequency ctrl	Stand-alone generator or GB opened	
Ext. power ctrl	Parallel to mains	
Ext. voltage ctrl	Stand-alone generator or GB opened	
Ext. PF ctrl	Parallel to mains	Requires option D1
Ext. VAr ctrl	Parallel to mains	

*Note: The controller set points are ignored if the condition is not present. For example, it is not possible to use the frequency controller when paralleling to the mains.

The table below shows the set points that are possible for external analogue inputs.

Controller	Input voltage	Description	Comment
Frequency	+/-10 V DC	f_{NOM} +/-10 %	Active when MB is OFF
Power	+/-10 V DC	P_{NOM} +/-100 %	
Voltage	+/-10 V DC	U_{NOM} +/-10 %	Active when GB is OFF
Reactive power	+/-10 V DC	Q_{NOM} +/-100 %	
Power factor	÷10 V…0…10 V DC	0.6 capacitive…1.0…0.6 inductive	

The external set points can be used in all genset modes, when auto or semi-auto mode is selected.

INFO
The standard genset controller has a limited number of digital inputs. To have all the required the digital inputs, the controller may need additional hardware options.

3.1.1 External analogue set point terminals

Term.	Function	Technical data	Description	Comment
40	-10/+10 V DC	Analogue input	f/P set point	Requires option G3
41	Com.	Common	Common	
42	-10/+10 V DC	Analogue input	U/Q set point	Requires option D1 and G3

3.2 Other sources of external analogue set points

The AGC does not require option G3 (and digital inputs for set point activation) if it uses these other sources of external analogue set points.

External analogue set points using Modbus

The external analogue set points can be sent over Modbus.

More information
See **Option H2 and H9 Modbus communication** and **AGC-4 Modbus tables** for more information.

External analogue set points using CIOs

External analogue set points can come from a CIO. Use M-Logic to activate the set point(s).

More information
See **CIO 308 Installation and commissioning guide** and **Option A10** for more information.

RRCR external set point control

The grid can use a Radio Ripple Control Receiver (RRCR) for load management.

More information
See **Additional Functions, RRCR external set point control** in the **Designer's Reference Handbook** for more information.