

Generator Controllers FlexGen



Flexible solutions for
synchronizing and load sharing
of generators

SELCO FlexGen

The SELCO FlexGen product line is a range of integrated generator controllers. FlexGen is the second generation of the C6200 GenController and is built on the same state of the art technology platform. As well it is a further development of the SELCO SIGMA system, including many unique power management features.

FlexGen is complementing to the various solutions for synchronizing and load sharing available from the SELCO T-Line range.

FlexGen provides a broad variety of options with regard to user configuration and interfacing to machinery and peripheral control. The extended flexibility makes the FlexGen controllers an optimum choice in numerous applications within both stationary and maritime power installations.

The range consists of 3 controller units, FlexGen Basic, FlexGen Compact and FlexGen Advanced, offering different levels of functionality, thus ensuring an optimum match to specific user requirements.

In line with the SELCO quality concept FlexGen controllers are undergoing thorough burn-in testing before delivery. Also FlexGen has been tested by accredited test laboratory to ensure compliance with international standards for electrical equipment.

In connection with marine installation FlexGen furthermore carries type approvals from major marine classification societies.



FlexGen Controllers

FlexGen controllers are designed for installation in electrical switch board panels. The sturdy aluminium casing furnishes clear LED indication and easy accessible connection terminals.

The FlexGen range offers

- 3 phase true RMS measurement
- Automatic synchronizing
- Voltage matching
- Load sharing (active and reactive)
- Protection against reverse power, excitation loss, over load, over-current and short-circuit
- Dead bus monitoring with black-out limiting dead bus lock
- RoCoF (df/dt) and vector shift detection
- Direct control of both mechanic/hydraulic and electronic speed governors and AVR's
- Preferential load tripping
- Large consumer control

FlexGen offers an alternative to combining several units of the SELCO T-Line range of protection and control relays.

FlexGen controllers all furnish a built in synchroscope convenient in service and commissioning situations.

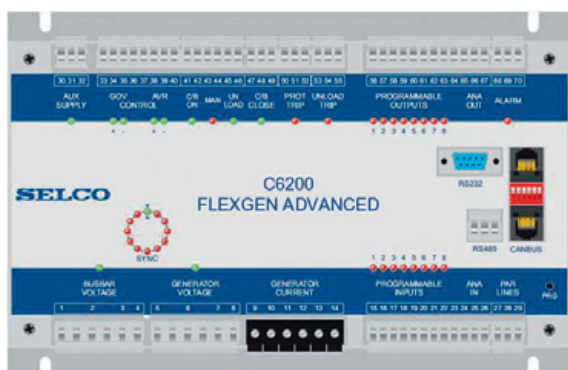
FlexGen furthermore provides various interface options such as MODBUS RTU for external PC or PLC control, and user configurable inputs and outputs enabling designated extended functionality.

User Interfaces

FlexGen includes a user interface unit FlexGen UI that can be connected to any FlexGen controller through the RS232 serial link. The user interface is designed for mounting in the switch panel door. It furnishes a large back-lit display showing all electrical measurements and control parameters, and separate LEDs providing clear indication



tion of the generator mode and general alarms. In addition to showing actual alarms when they appear, the unit includes a valuable alarm log, showing previous alarms with information about the time and date when they occurred. This feature is providing a powerful tool in maintenance and service of the installation. Furthermore control keys are included enabling on-site configuration.



FlexGen controllers are also compatible with the smaller C6250 display and configuration unit made for the C6200 GenController, and the S6500 user interface of the SIGMA system, which could be included as a common display for the whole installation, e.g. for remote monitoring.

FlexGen Features

FlexGen controllers are intended for paralleling of generators with each other or with the main power grid. The controllers can be set for local frequency and voltage control, or work with an external frequency and load set point from the main grid or an isochronous power source, such as a wind turbine or a solar panel transformer.

One FlexGen controller is installed for each generator in the installation and handles all electrical control. The controllers include inputs for changing between manual and automatic operation.

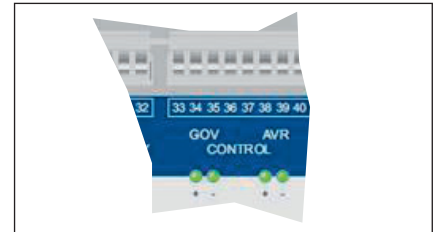
The 3 FlexGen versions all include the same basic functions such as auto-synchronizing, frequency control, active load sharing, dead bus monitoring and reverse power protection, which are the functions contained in the basic model, FlexGen Basic.

Then in addition the FlexGen Compact model contains reactive load sharing, voltage matching, power factor control, grid-parallel operation control, and protection against excitation loss, RoCoF (df/dt), and vector shift.

The most versatile model is the FlexGen Advanced which also contains extended protection against over-current and short-circuit protection and power management features like preferential load trip, load depending start/stop and large consumer control.

All models include MODBUS RTU interface enabling integration with equipment from other manufacturers, e.g. control and monitoring from PC with a graphic SCADA interface made specifically for the installation.

Speed Control, Voltage Control
FlexGen is able to control speed governors and automatic voltage regulators (AVR) by speed/voltage up/down pulses, analogue voltage and current signals and pulse width modulated signals (PWM).



Subsequently the FlexGen controllers are compatible with most commonly used speed governors and AVRs such as

- Caterpillar speed controllers ADEM and PEEC and voltage regulators CDVR
- Cummins EFC speed controllers
- GAC ESD series speed governors
- Heinzmann E-series electronic speed governors
- Woodward 2301 and APECS electronic speed governors
- Woodward UG-MAS mechanical governors
- Newage AVK SEG MX 300 series voltages regulators
- Leroy Somer R448

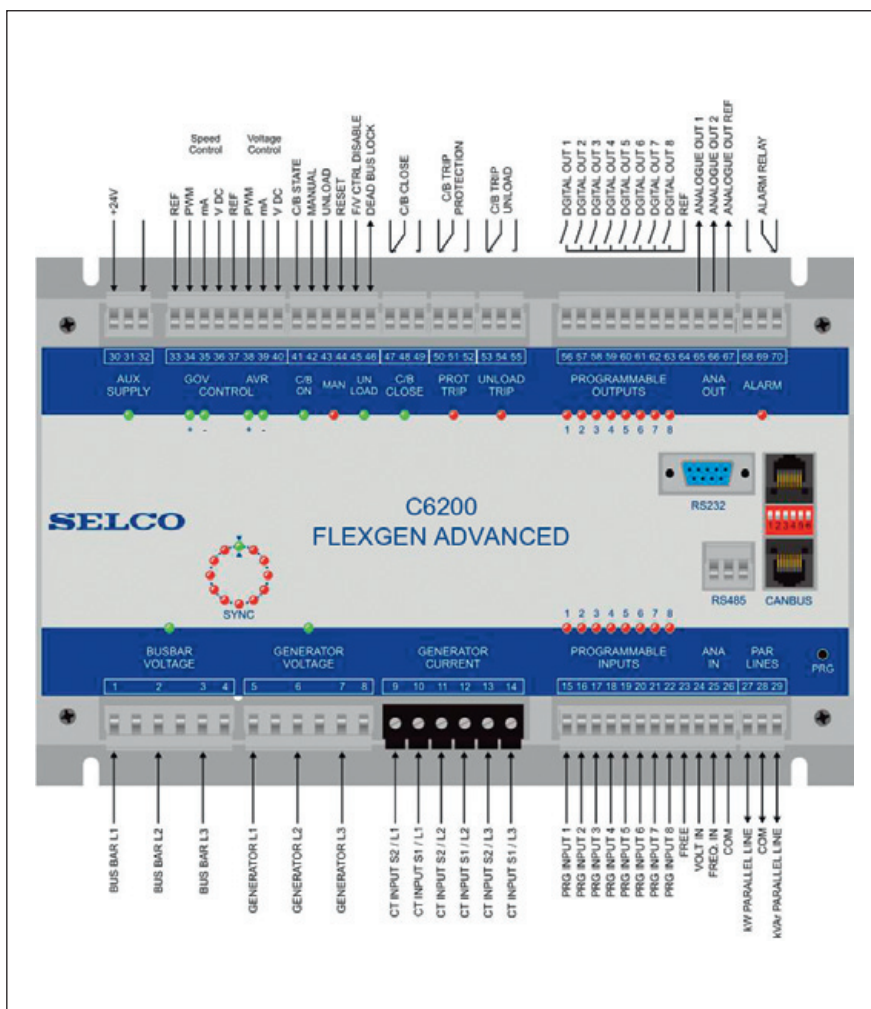
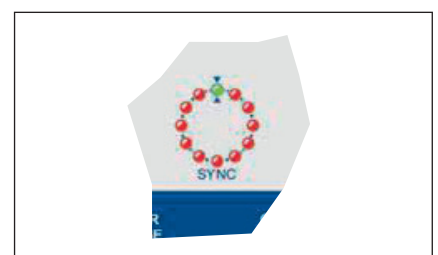
A comprehensive list with connection description can be found in the SELCO web-page, www.selco.com

Synchronizing

FlexGen controllers are equipped with a built-in synchroscope for manual or semi-automatic synchronization, convenient for service and commissioning situations.

Automatic synchronization is a basic function on all FlexGen controllers. It is possible to synchronize complete bus bar sections to each other.

FlexGen can handle both forward and reverse synchronization



Voltage matching and Frequency control

FlexGen Compact and FlexGen Advanced can control both the voltage and the speed/frequency of the generator.

Active load sharing (kW)

Generators running in parallel operation. Through connection of dedicated load sharing lines all FlexGen controllers can handle paralleling of a generator to other generators controlled by FlexGen, C6200, SIGMA, T4400, T4800 or B6000 load sharing units.

Reactive load sharing (kVAr)

Reactive load sharing between generators controlled by FlexGen Compact, FlexGen Advanced, C6200, SIGMA or T4900.



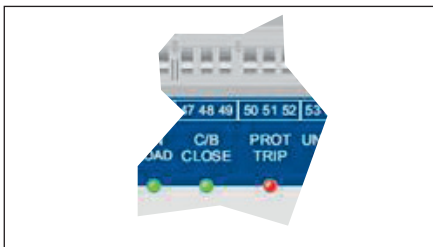
Generator protection

Reverse Power protection is standard on all FlexGen controllers. In addition the FlexGen Compact and FlexGen Advanced includes Loss of excitation protection.

For grid parallel operation Vector shift or RoCoF (df/dt) protection can be activated in the FlexGen Compact and Advanced.

Over load, Over current and Short circuit protection is furthermore included in FlexGen Advanced.

Voltage and Frequency monitoring is standard in all FlexGen controllers.



Dead bus monitoring

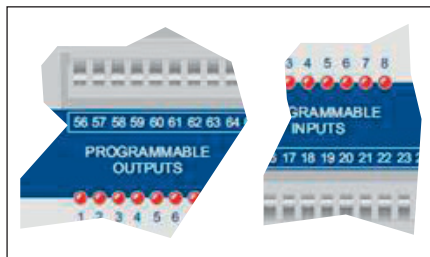
All FlexGen controllers include dead-bus monitoring, and are furnished with a dead-bus interlock function that prevents non-synchronized generators

connect at the same time following a black-out.



Load depending start and stop

FlexGen offers 8 programmable inputs and outputs. The outputs can be programmed to give a start or stop signal depending on the load on the system. In case the load of the running generators increases above a predefined limit, an additional available generator will be started. Likewise a generator will be stopped in case the load drops below a predefined limit. The specific generator start/stop sequence depends on a priority given by external selector switch on inputs 5-8.



Operation of Generators running in parallel with the Grid

FlexGen Compact and FlexGen Advanced both have dedicated functionality for grid parallel operation.

- **Active load control (kW)**
During grid-parallel operation the load of the generators can be controlled without additional equipment. Both peak shaving and base load operation are possible. In peak shaving mode load depending start and stop is also available.
- **Reactive load control (kVAr) – power factor control**
FlexGen offers power factor control. During grid parallel operation the power factor of the installation can be kept constant by the controller.

Both FlexGen Compact and FlexGen Advanced furthermore offer predefined import/export load control schemes that

can be activated/deactivated from the programmable inputs, enabling seamless mode change over between island mode and grid-parallel mode with almost no additional wiring.

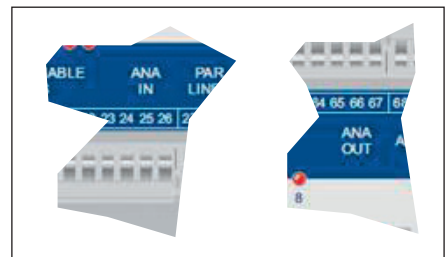


Preferential load trip and Large consumer control

Extended Power management functionality is included in the FlexGen Advanced. It comprises 2 levels of non-essential load tripping, large consumer requests, light load cancelling and engine error trip.

Analogue i/o

Two analogue inputs and two analogue outputs are available in addition to the digital programmable inputs and outputs. The inputs are used for dynamic control or external frequency control, the outputs for connection of analogue measurement instruments or meters.



RS485 MODBUS RTU

FlexGen controllers all include RS485 MODBUS RTU interface, enabling external control by PC or PLC systems.

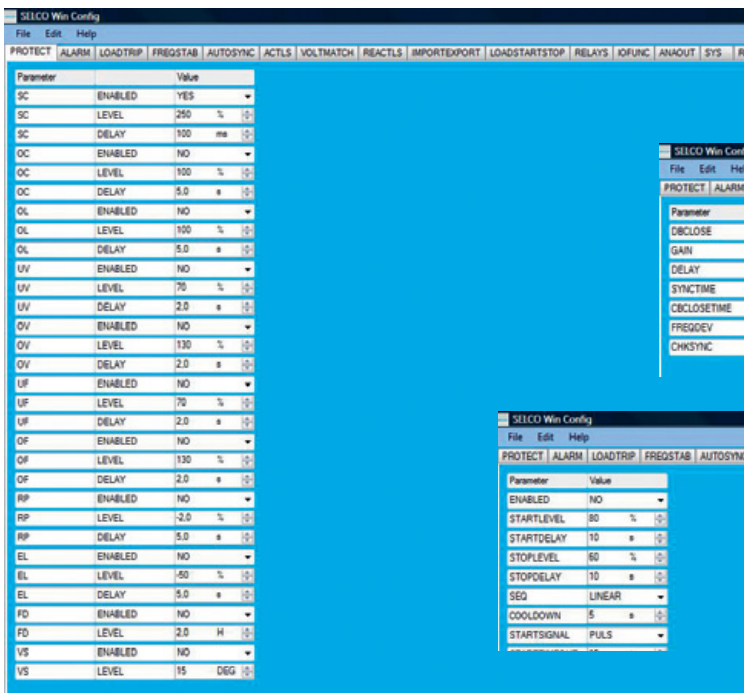


Configuration and installation

FlexGen can be configured from PC using the SELCO WinConfig software.



The WinConfig software provides a user friendly screen lay-out. Easy access to all parameters is available from a logical flat menu structure.



Configuration is carried out in real time. Subsequently parameters are immediately updated when changes are made. Complete configurations can be saved and uploaded in new controller units in a few steps, thus making it a flexible tool both in the design work when trying out different ways of operating the system, and in the actual installation work.

Alternatively the FlexGen controllers can be configured through the user interfaces FlexGen UI and C6250. Instead of mounting it permanently the C6250, in this connection, can be used as practical hand tool for making minor adjustments of systems already put into operation.

FlexGen controller configurations are pin code protected. The default code is "0000", but this can easily be changed using the WinConfig software. The SELCO WinConfig software can be downloaded from the SELCO web-page, www.selco.com.



Applications

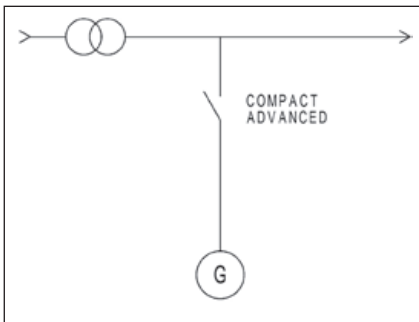
From the simple one generator power back-up installation to the more complex grid-parallel or island mode operation FlexGen is always ensuring a cost effective power control solution due to the possible choice between the 3 levels of functionality included in the different FlexGen versions.

FlexGen is well suitable for use in:

- Back-up power systems where down time is critical for safety or economic reasons, like in hospitals, airports, cable ways, energy generation and distribution, processing of food or pharmaceutical products, storage of food, chemicals and pharmaceutical products.
- Island mode applications, providing the main power supply in ships, offshore platforms, small islands or remote areas.
- Co-generation applications including peak shaving or base load operation in heavy energy consuming industries like oil refineries, petrochemical refineries, steel mills, mines, cement factories, food processing, etc.
- Generators in container enclosures for temporary use

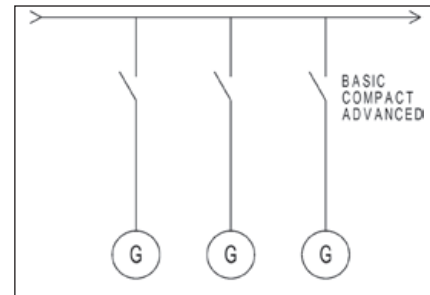
Single Generator as emergency back-up or power stabilization

- Grid-transfer or grid-parallel mode.



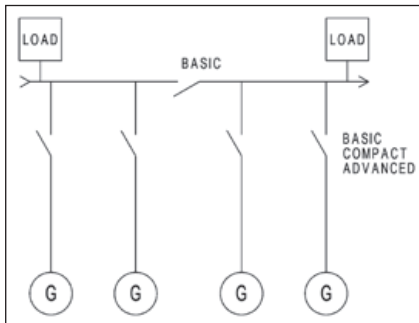
Group of generators for primary power supply – 1 common bus bar

- Island mode parallel operation - with or without load depending start/stop, preferential load trip and large consumer control.



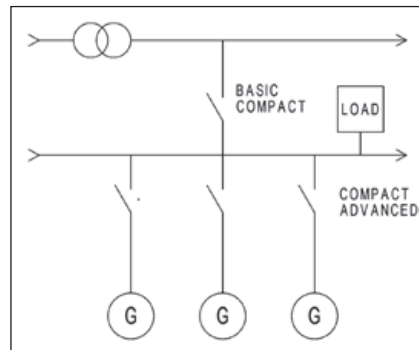
Group of generators for primary power supply – 2 bus bar sections connected with tie-breaker

- Island mode parallel operation – with or without load depending start/stop, preferential load trip and large consumer control.



Group of generators for primary supply or power stabilization

- Grid-transfer or grid-parallel mode as base load or peak shaving – with or without load depending start/stop.
- Transfer to shore connection or shaft generator in ship installation – with or without load depending start/stop.



Function overview

Function	Model	FlexGen Basic*	FlexGen Compact*	FlexGen Advanced
3 phase true RMS measurement		✓	✓	✓
Frequency control		✓	✓	✓
Automatic synchronization		✓	✓	✓
Active load sharing		✓	✓	✓
Voltage control/Voltage matching			✓	✓
Reactive load sharing			✓	✓
Reverse power protection		✓	✓	✓
Excitation loss protection			✓	✓
RoCoF protection (df/dt)			✓	✓
Vector shift protection			✓	✓
Over current protection (I >) and Over load protection (P >)				✓
Short circuit protection (I >>)				✓
Over voltage (U >)		✓	✓	✓
Under voltage (U <)		✓	✓	✓
Over frequency (F >)		✓	✓	✓
Under frequency (F <)		✓	✓	✓
Dead bus monitoring /black out limiter		✓	✓	✓
External circuit breaker trip			✓	✓
Engine error trip				✓
Preferential load trip (PM)				✓
Load depending start/stop (PM)				✓
Large consumer control (PM)				✓
Dynamic grid-parallel operation control			✓	✓
Analogue I/O			✓	✓
MODBUS RTU (RS485 interface)		✓	✓	✓

*) Available Q2 2010

About SELCO

Since the origin in 1960, SELCO technology has provided the electrical power generation market with high class equipment, living up to the major international standards.

Generator Control, Protection & Monitoring

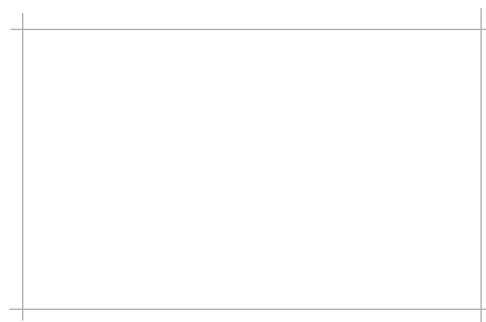
- Generator protection:
Short circuit, overcurrent, reverse power, excitation loss, engine protection.
- Generator controls:
Synchronizing, frequency control, active and reactive load sharing, load control, power management, engine control.
- Generator monitoring:
Voltage, frequency, power, insulation.

Alarm Annunciation and Indication

- Monitoring of current, temperature or pressure
- Indication of alarms
- Logging of alarms and events

Arc Detection

- Arc detecting relay
- Current relay
- Time relay



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