DEIF A/S

Application note

Multiple generators parallel to grid
Multi-line 2 – version 2

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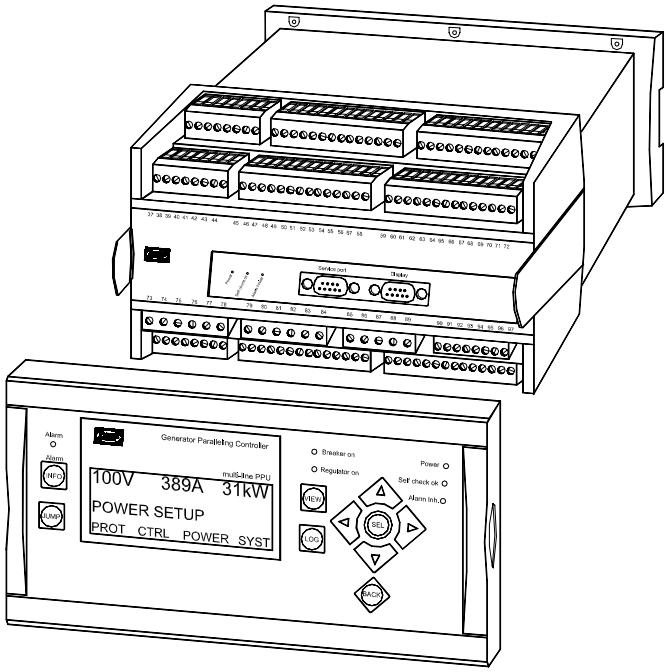

- *Application description*
- *Functional description*
- *Wiring*
- *Flowcharts*

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Table of contents

This application note refers to Multi-line 2 GPC version 2.20.0 or later.

1. Warnings and legal information

This chapter includes important information about general legal issues relevant in the handling of DEIF products. Furthermore, some overall safety precautions will be introduced and recommended. Finally, the highlighted notes and warnings, which will be used throughout this handbook, are presented.

Legal information and responsibility

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

The units are not to be opened by unauthorised personnel. If opened anyway, the warranty will be lost.

Electrostatic discharge awareness

Sufficient care must be taken to protect the terminals against static discharges during the installation. Once the unit is installed and connected, these precautions are no longer necessary.

Safety issues

Installing the unit implies work with dangerous currents and voltages. Therefore, the installation should only be carried out by authorised personnel who understand the risks involved in working with live electrical equipment.

Be aware of the hazardous live currents and voltages. Do not touch any AC measurement inputs as this could lead to injury or death.

Definitions

Throughout this document a number of notes and warnings will be presented. To ensure that these are noticed, they will be highlighted in order to separate them from the general text.

Notes

The notes provide general information which will be helpful for the reader to bear in mind.

Warnings

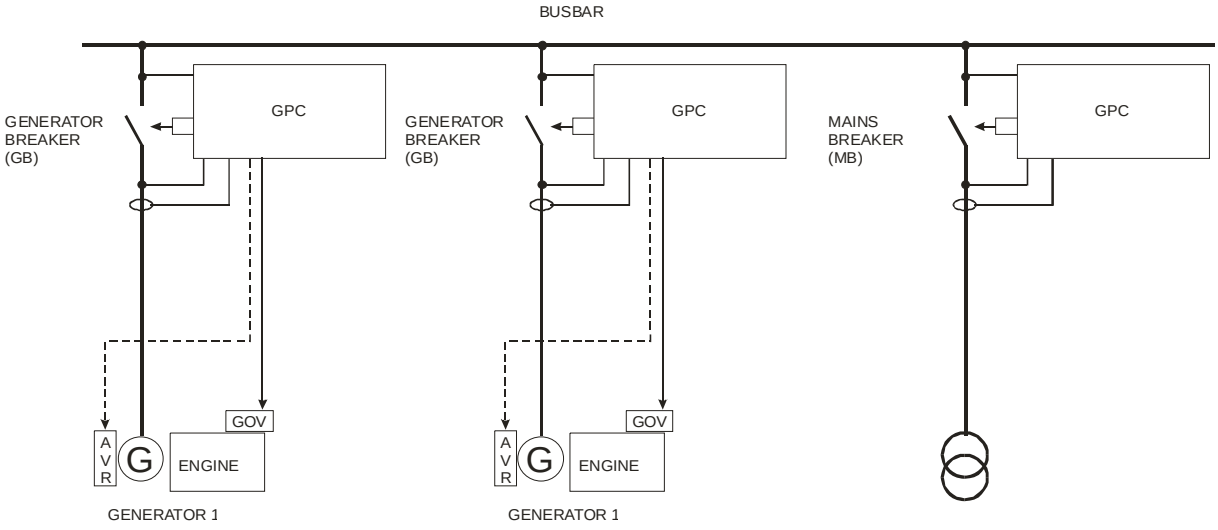
The warnings indicate a potentially dangerous situation which could result in death, personal injury or damaged equipment, if certain guidelines are not followed.

2. Application description

System overview

This document describes the basic control system for a system controlling two (or more) diesel generators and one mains breaker. The system is made with the Multi-line GPC controllers for gen-set control and protection and also a GPC controller for the mains breaker control.

The GPC installed to control the mains breaker can also be used as mains protection. Please refer to the data sheet for option availability.



Note that the drawing shows two generators, but the system can be used for any number of generators.

This application note describes how to make a system with the following functionalities:

1. Start and stop engines
2. Synchronise generators/mains breakers
3. Transfer load to/from mains
4. Peak shaving operation

The system can be operated manually, semi-automatically or automatically.

Start and stop engines

The GPC will control the start and stop of the engine. This is done automatically or controlled by the operator.

Synchronise generators/mains breakers

Synchronisation of the breakers is done automatically or it can be controlled by the operator.

Transfer load to/from mains

When the running mode selector switch is moved to the position ‘MAINS’, then the MB is automatically synchronised. As soon as the MB is closed then the DGs start to deload their load and subsequently cool down and stop.

Peak shaving operation

When the running mode selector switch is moved to the position ‘Peak shaving’, then the MB is automatically synchronised. Then gen-sets will change running mode so they use their input for remote setpoint as reference. Then they can be controlled by the GPC installed at the mains breaker side.

Needed options

The GPCs must be equipped with the following options in order to carry out the controls and protection described in this application note:

For GPCs carrying out mains breaker control and mains protection:

- Option A1 or A2 or A3 to carry out mains failure protection
- Option D1 to carry out mains power factor and voltage synchronisation control
- Option E1 to make analogue command setpoints for speed, power, voltage and power factor to the generator GPC units

For generator GPCs:

- Option D1 to carry out power factor and voltage synchronisation control
- Option M1 or M2 to carry out engine start/stop and protection

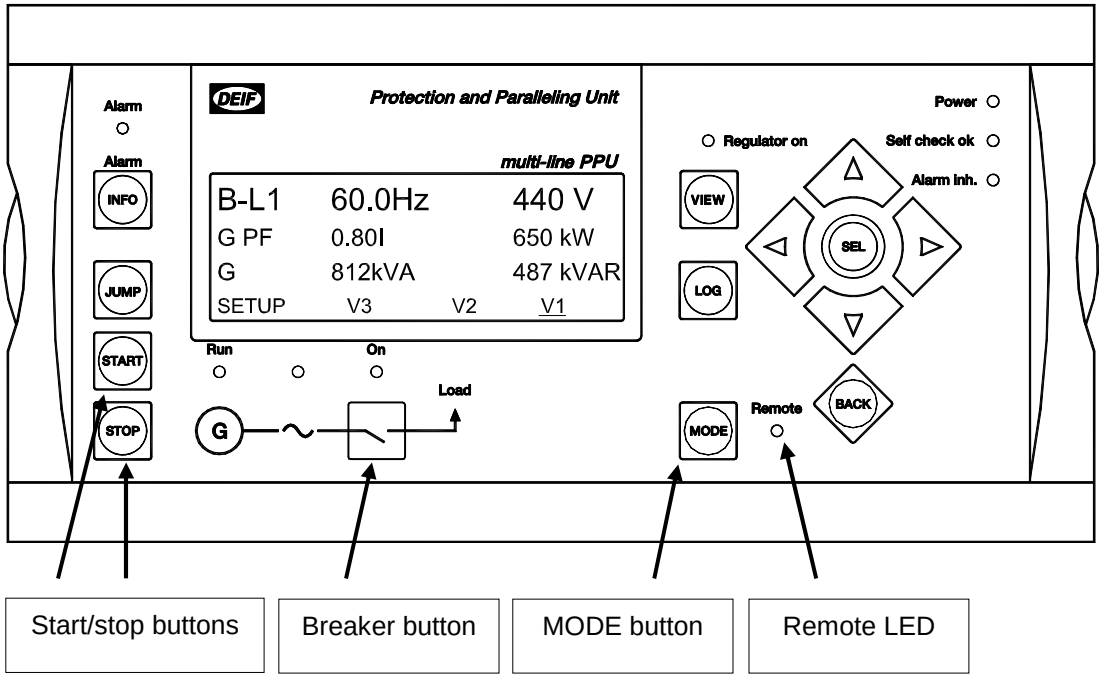
All other available options can be applied as requested. Attention must be paid to governor (AVR) interface and required protections.

Please refer to the data sheet for specific information about the possible options selection.

3. Functional description

Display

The display of the GPC used in this application looks like this:



The 'Remote' LED is indicating if the generator is controlled locally via the display unit push-buttons (LED = OFF) or remotely (LED = ON).

The selection is made on the 'Mode' button.

Selector switches

On the switchboard, a number of selector switches must be installed. The purpose is to be able to operate the system with the functionality mentioned in chapter 2.

Function / **Switch**	**Switch functionality**
Running mode selector	Selection between generator, mains supply or peak shaving
Gen. auto/manual	Allows DG to be operated in AUTO mode
Gen. start enable	Enables the gen-set to start

Running mode selections

The operation of the gen-sets depends on the selected running mode. The running mode is selected with a selector switch on the display.

AUTOMATIC

Set switch AUT/MAN on each generator switchboard to position AUTO
Set switch AUT/MAN on the mains switchboard to position AUTO
Set display mode in REMOTE

The Remote LED on the display must be ON.

This will enable the automatic generator running, meaning the generators will run constantly when the selector is in the “DIESEL” position.

SEMI-AUTOMATIC

Set switch AUT/MAN on each generator switchboard to position AUTO
Set switch AUT/MAN on the mains switchboard to position AUTO
Set display mode in LOCAL

The Remote LED on the display must be OFF.

The generators can now be started and stopped and the breaker closed (synchronised) and opened (ramp down first) using the display buttons.

MANUAL

Set switch AUT/MAN on each generator switchboard to position MANUAL
Set switch AUT/MAN on the mains switchboard to position MANUAL
Set display mode in LOCAL

The Remote LED on the display must be OFF.

Manual mode will enable the operator to use the START, STOP and generator breaker buttons on the display for start/stop and generator breaker synchronising/open.

REMEMBER:

Set the mode on the display back to Remote (LED ON) and ‘Generator AUT/MAN’ back in AUTO again when finished with manual operation. If this is not done, the result is that the generator will not participate in the automatic functions.

Manual speed control

In manual running mode, to adjust the speed (frequency) up and down, binary command inputs must be used.

- Input terminal 44: Raise speed
- Input terminal 45: Lower speed

Breaker operation

If the breaker is open, pressing the breaker button will make the GPC/PPU act as a check synchroniser (it will close the breaker when the conditions are OK), but the speed must be controlled with the binary inputs (or by other means).

If the breaker is in closed position and the breaker button is pressed, the breaker will open immediately in the manual running mode.

4. Wiring

Plant control wiring

Abbreviations used:

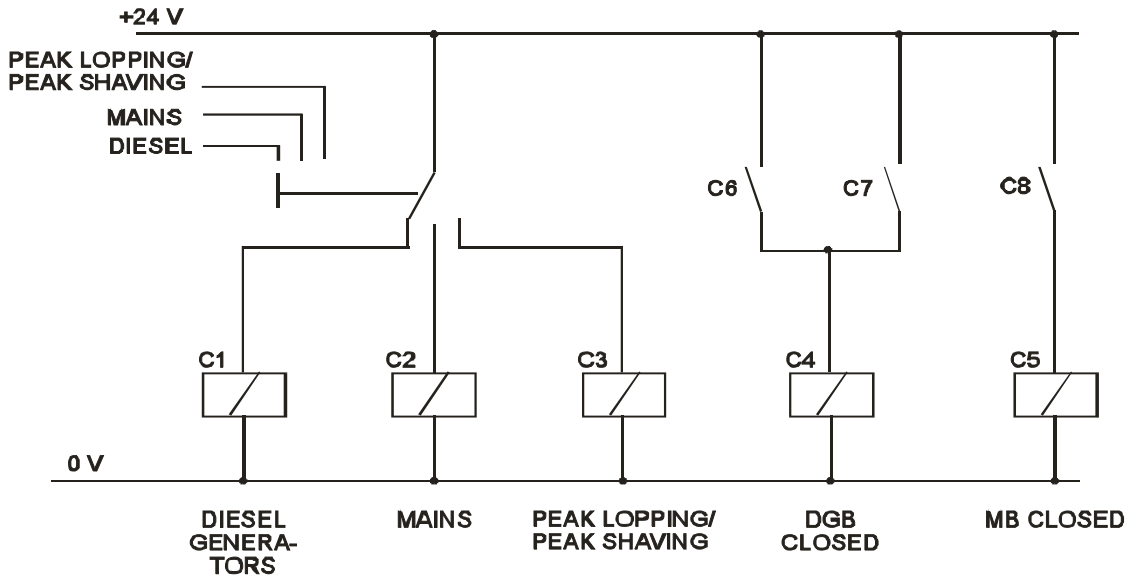
DG: Diesel generator
MAINS: Mains connection
GB: Generator breaker
MB: Mains breaker

These wirings only comprise the DC lines. The AC lines are described in the GPC Designer's Reference Handbook.

DC controls

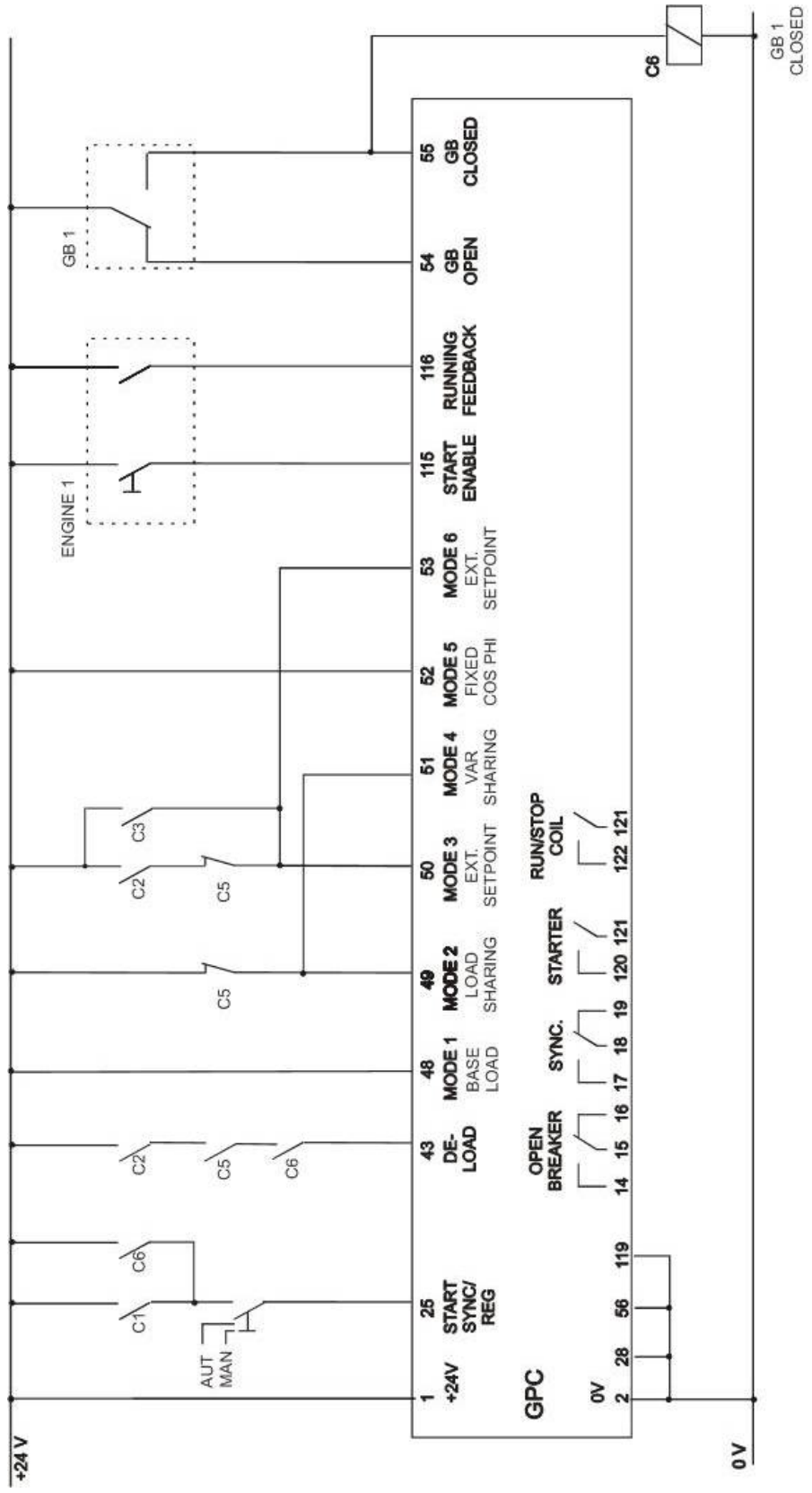
The wiring shows the necessary control circuits to carry out the task. It is assumed that all controls (except breaker commands) are carried out using 24V DC.

Running mode selector switch

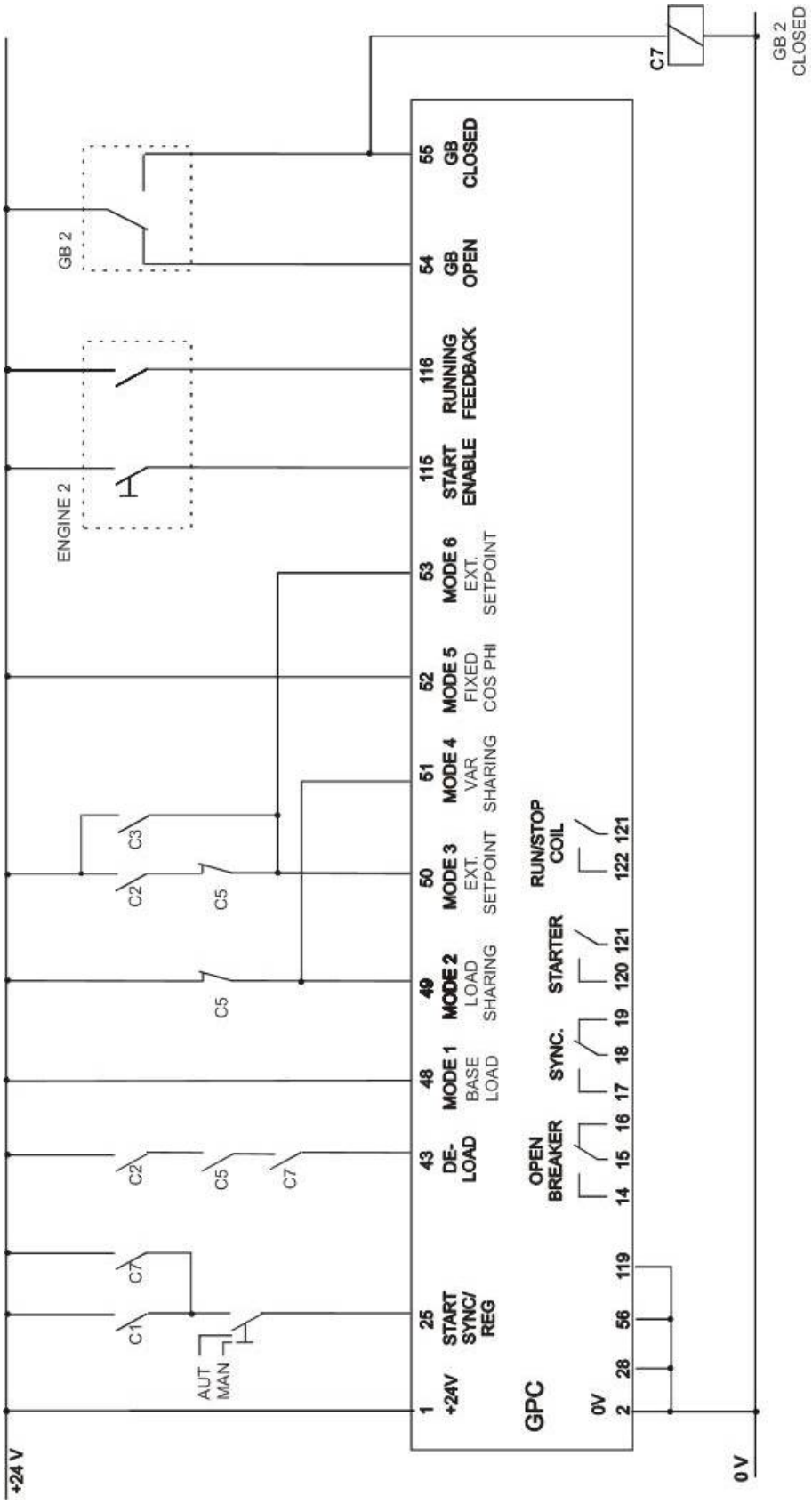


The selector switch is the operator's selector for diesel generator running or mains connection. Note that for the switching to take effect, the GPCs must be in "remote" mode (selected on the display).

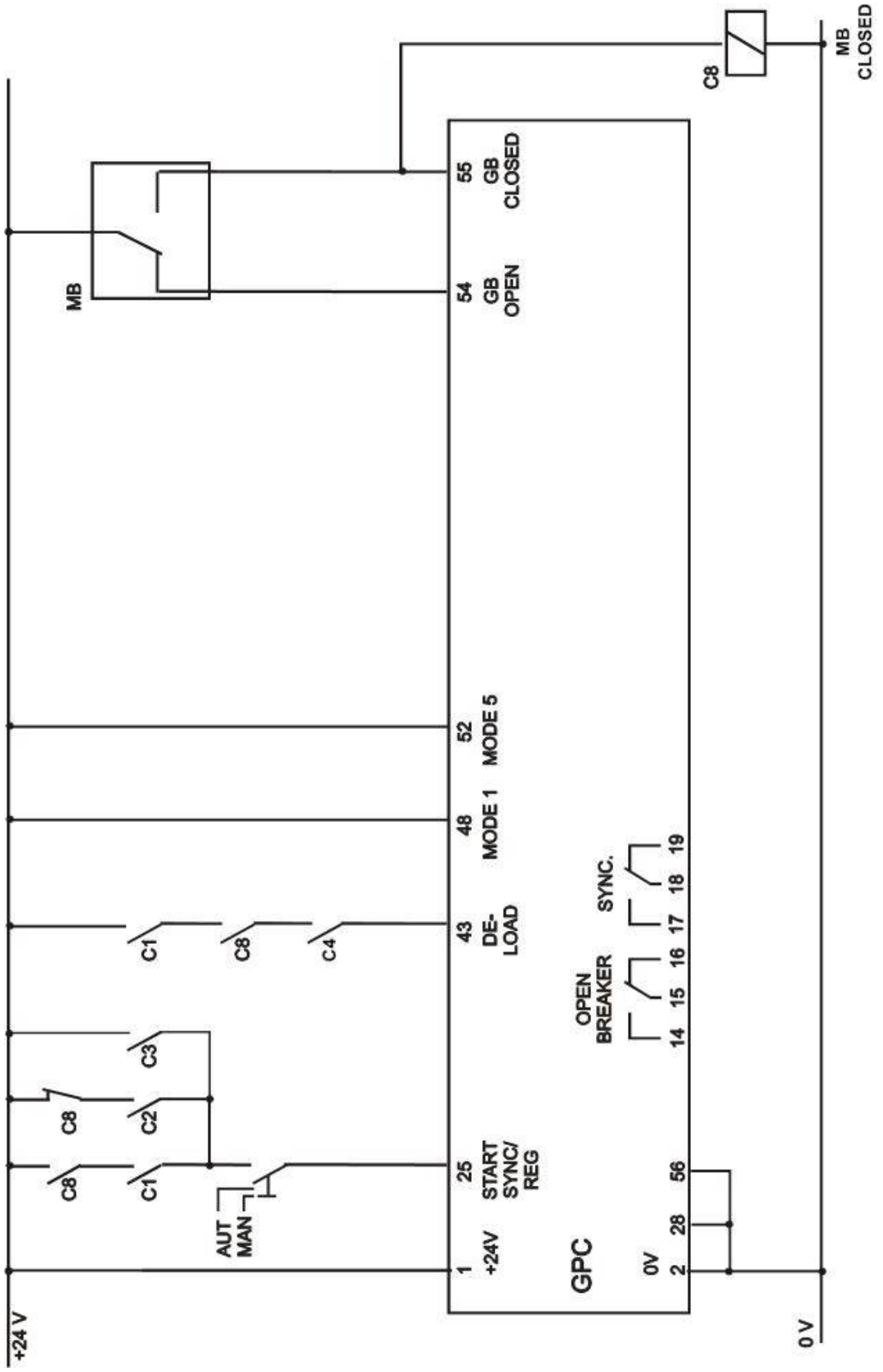
DG 1 GPC controls



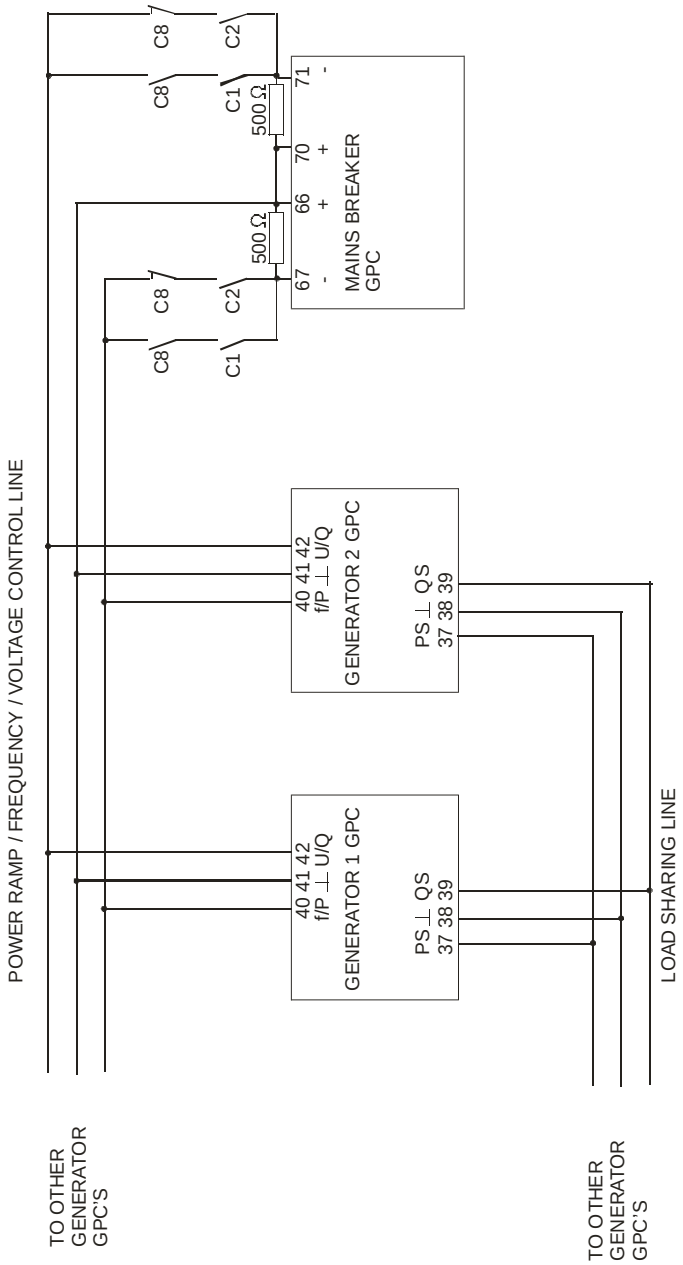
DG 2 GPC controls



MB GPC controls



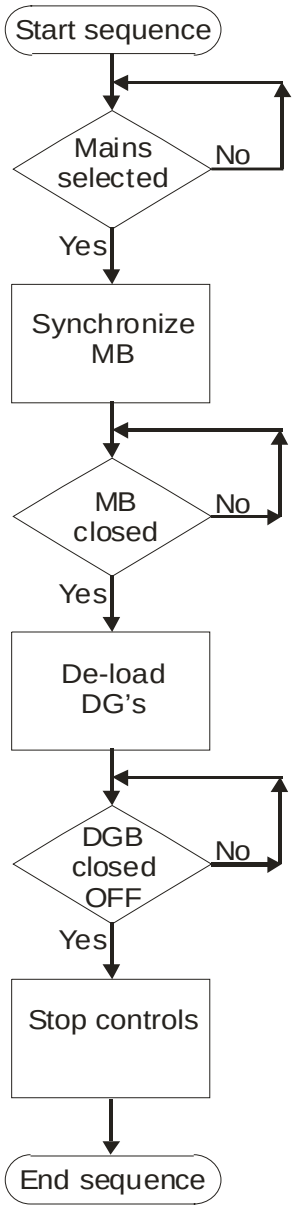
DC analogue lines between units



5. Flowcharts

Load transfer to mains supply

The flowchart describes AUTO load transfer from diesel generator to mains supply.



Load transfer to diesel generators

The flowchart describes AUTO load takeover from mains to diesel generator supply.