DEIF A/S

Application note

Generators parallel with mains
Multi-line 2 – version 2

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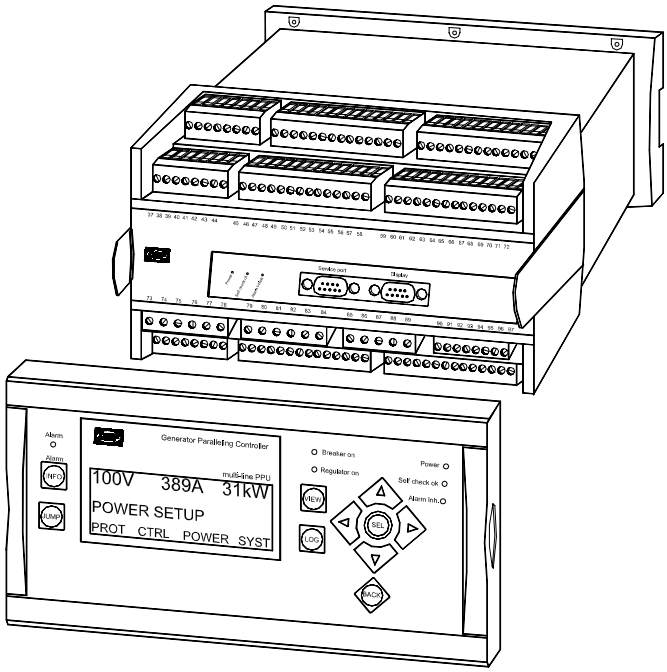

- *Application description*
- *Power import control*
- *Power export control*

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Table of contents

These application notes refer 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

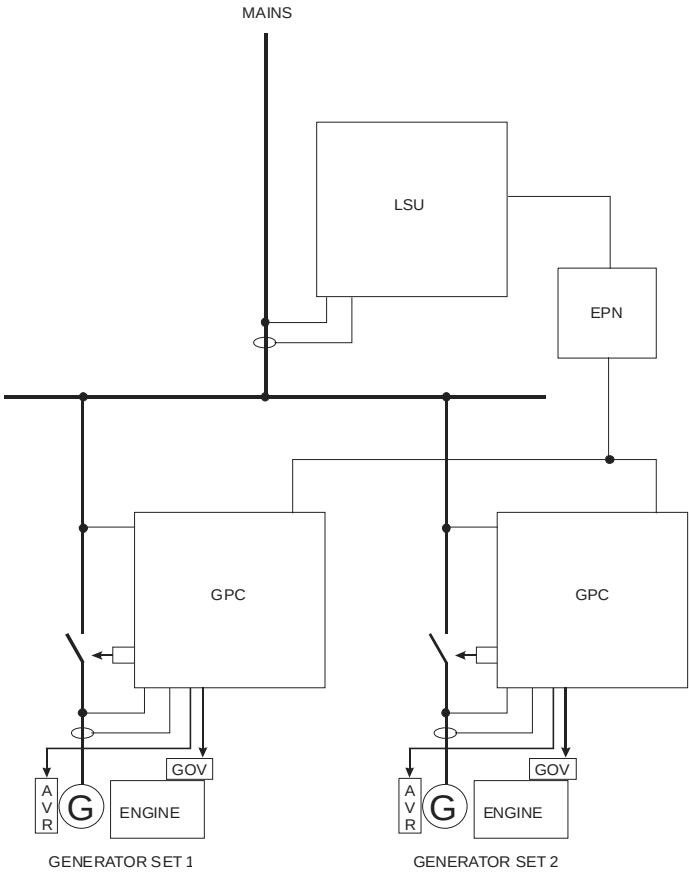
The warnings indicate a potentially dangerous situation which could result in death, personal injury or damaged equipment, if certain guidelines are not followed.

2. Application description

System overview

This document describes the basic control system for multiple generators parallel with mains. The application is made with the multi-line 2 GPC controllers for gen-set control and protection and the uni-line LSU for mains import/export control.

Note that the drawing shows 2 generators, but the system can be used for any number of generators.



This application note describes how to make mains power control with the following functionality:

1. Control of mains power import or export
2. Fixed power factor control
3. Island load and var sharing (mains breaker open)

Control of mains power import or export

This application is designed to control the power level imported or exported through the mains breaker. This is controlled by the LSU and it regulates the gen-set according to its set point on the 'reference' input. This input is a 0.5 - 5V DC input which corresponds to 10-100%. (0V DC equals 0 kW) In this application note, the power set point is adjusted on a remote potentiometer.

Fixed power factor control

The fixed power factor control is performed on each gen-set. The LSU does not control the power factor and this is done by the GPCs. (This is not a mains power factor control).

Island load and var sharing

When the CB (mains breaker) is open then the generators will operate in load sharing and var sharing.

Needed options

The GPC units must be equipped with the following options in order to carry out the controls described in this application note:

- Option M1 or M2 engine control in order to carry out the start/stop functions
- Option D1 to carry out voltage and power factor control when parallel to grid
- Option A1/2/3 to carry out mains protection if this is not carried out by other protection relays

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.

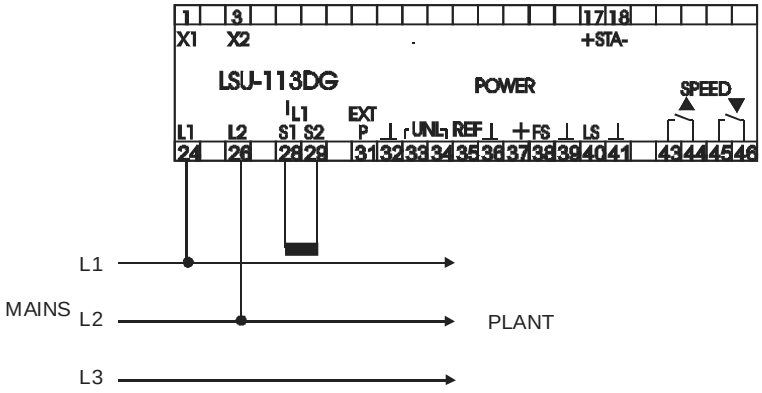
3. Power import control

The LSU must be selected to match the mains voltage, nominal current, voltage transformer (if present) and current transformer as stated in the data sheet for LSU.

LSU AC connections

Controlling power import from mains requires the following LSU AC connections:

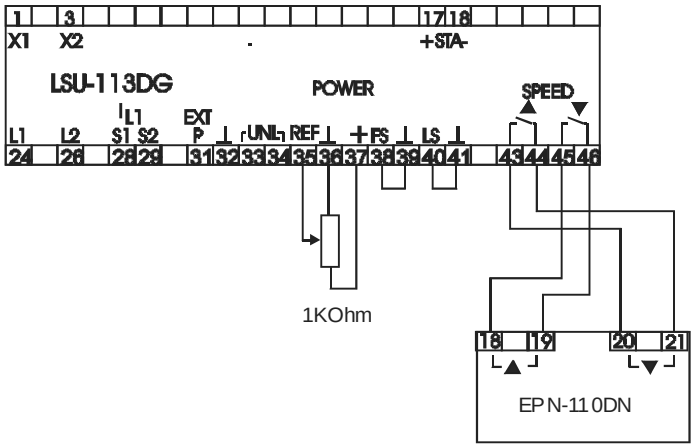
The LSU is to be connected as if the mains is a generator, i.e. the energy flow positive direction is from the mains into the plant:



LSU and EPN DC and control connections

The 1 kOhm potentiometer is used for adjusting the level of power consumed from the mains. It will control the power between 5-100% load. If the potentiometer is set below 5%, the resulting power consumption from mains will be 0%. Note the connections on the LSU 38-39 and 40-41. This disables the normal load sharing and frequency control.

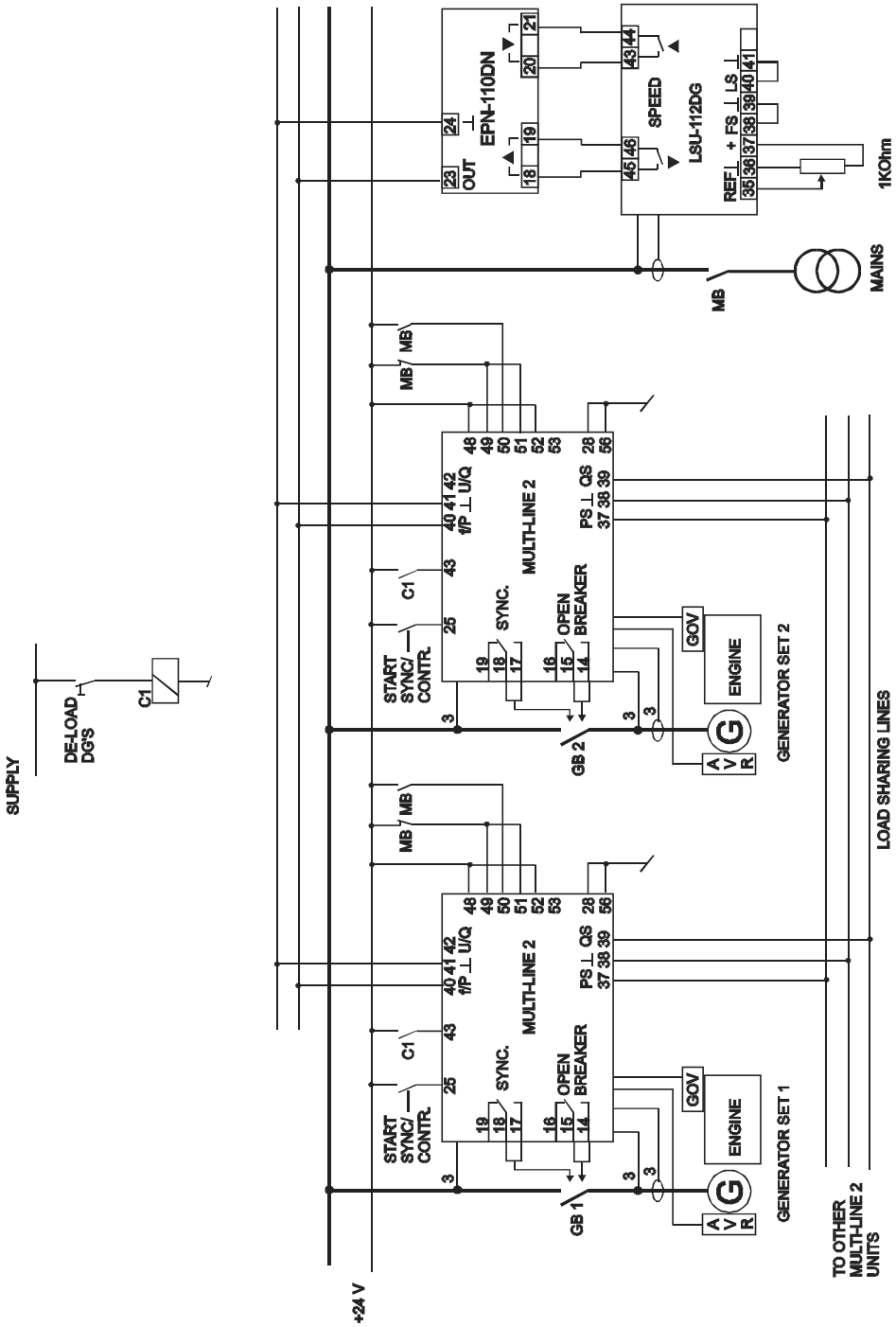
The electronic potentiometer EPN-110DN is converting the relay control outputs to a +/-10V DC signal. This signal is controlling the power of the generator(s). Note that the “increase” output from the LSU is sent to the “decrease” input of the EPN, and the “decrease” output from the LSU is sent to the “increase” input on the EPN. This is due to the fact that if decreased mains power consumption is needed, the generators must increase their power.



Plant wiring

The plant shown can shift between load sharing (island) and fixed power (parallel w. mains, generator power controlled by the LSU, generator power factor set to a fixed value). The functionality is controlled via aux. contacts on the mains breaker. If the mains breaker is open, the plant will be in island load sharing, if the mains breaker is closed, the plant will run in fixed power.

Note that the mains breaker is not controlled by the DEIF equipment.



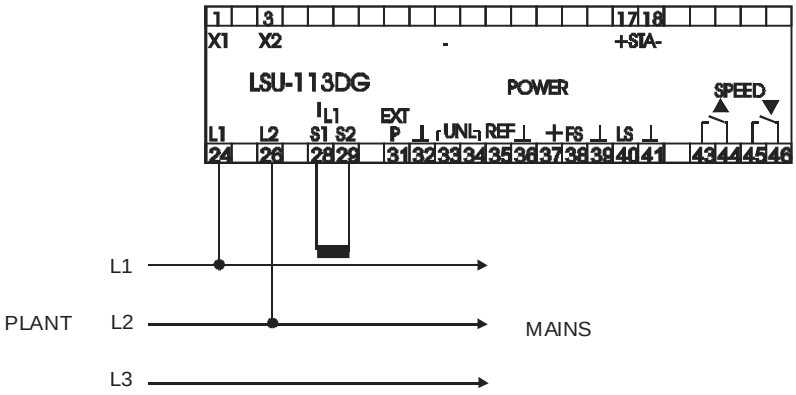
4. Power export control

The LSU must be selected to match the mains (voltage, nominal current, voltage transformer (if present), current transformer) as stated in the data sheet for LSU.

LSU AC connections

Controlling power export to mains requires the following LSU AC connections:

The LSU is to be connected as if the mains is the consumer side, i.e. the energy flow positive direction is to the mains from the plant:



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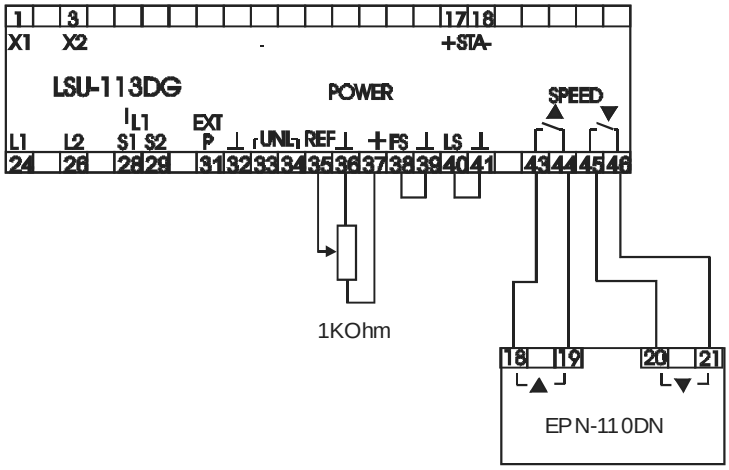

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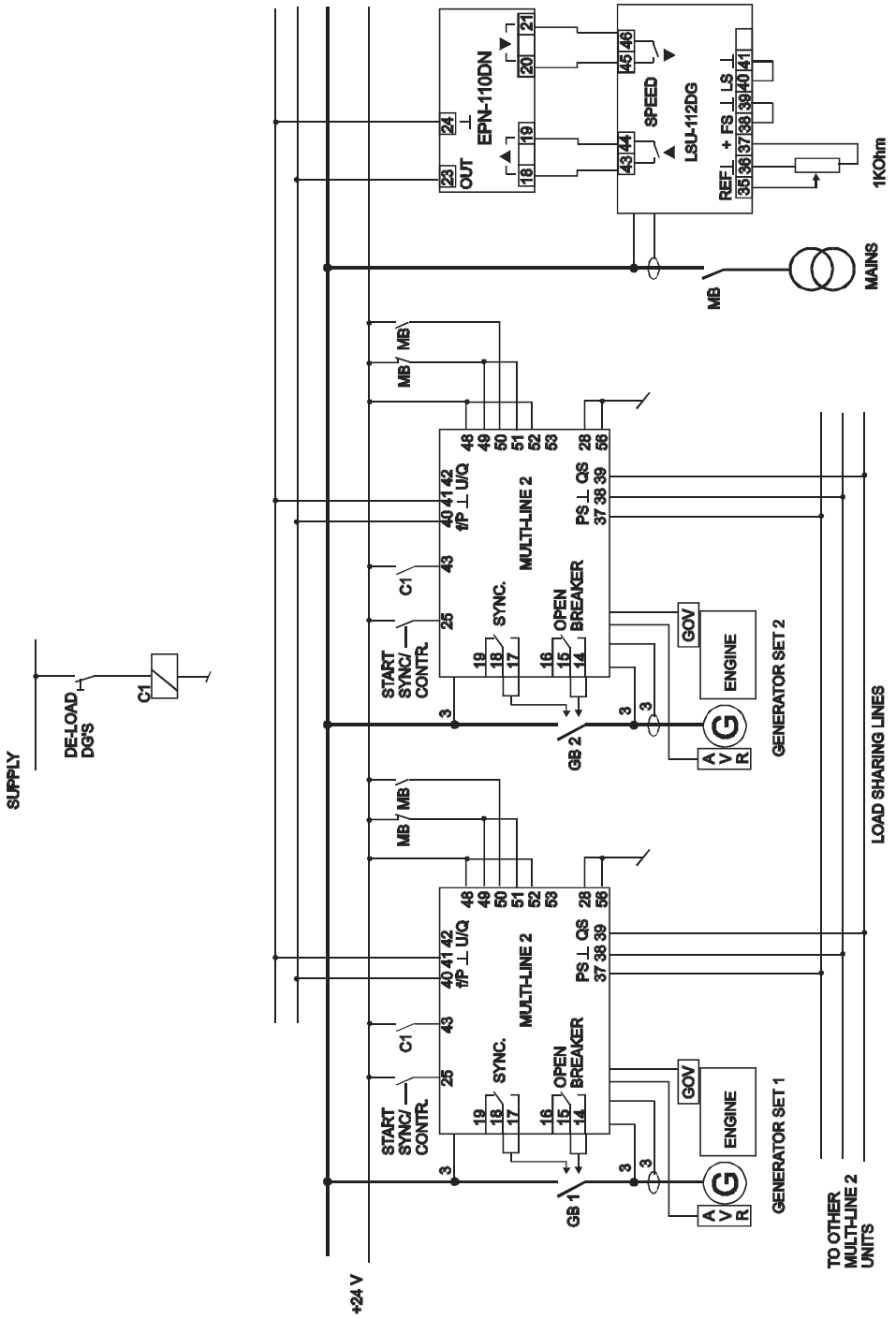

DEIF A/S reserves the right to change any of the above