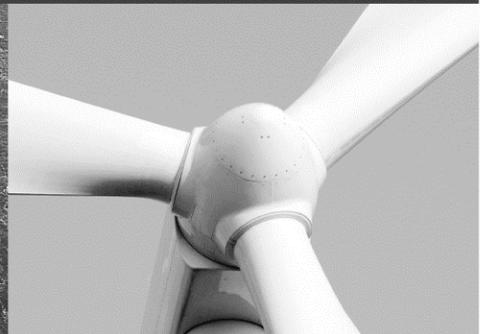
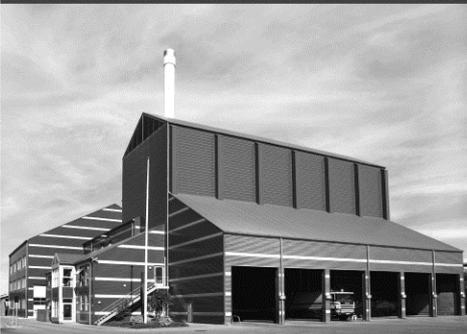




-power in control



## DATA SHEET



### Load sharing units, LSU-112DG ANSI code 90

- For control of diesel and gas generators
- Built-in power and frequency transducer
- Constant power or isochronous mode
- LED indication of status
- LED indication for activated control
- 35 mm DIN rail or base mounting



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## Application

The LSU-112DG is a control unit for control of the prime mover in a power unit.

The LSU-112DG can control the power unit

- in stand-alone mode, performing frequency control
- parallel with grid, performing power control
- parallel with other power units, performing frequency and power control

The unit is designed for connection to a mechanical speed governor, however in conjunction with the DEIF electronic potentiometer type EPN-110DN or EPQ-96 it can control electronic speed governors as well.

The LSU-112DG has a built-in frequency transducer. If a very stable frequency is wanted, an external frequency transducer common for all the LSU-112DGs in the power plant can be connected. If a number of power units are to be synchronised to the busbar at the same time, the frequency may likewise be controlled externally.

## Function

The LSU-112DG is measuring the voltage and the current from which the frequency and the power produced by the power unit are measured. The built-in power transducer is based on an  $I \times \cos \phi$  principle.

The following couplings are available:

- 1W(4) – single phase
- 1W3 – 1-element 3-phase, 3-wire, balanced load

If unbalanced load can be expected, an external power transducer with an output of 4 to 20 mA can be connected to the LSU-112DG. In this case the built-in  $I \times \cos \phi$  transducer is automatically interrupted.

The power and frequency measured by each LSU-112DG are fed to two paralleling lines for comparison with the frequency (FS) and power (PS) of the other connected LSU-112DG.

If L1 or L2 is disconnected from the LSU-112DG at the same time as a power unit in a power plant is disconnected from the power line (busbar), built-in relays in the LSU-112DG ensure that the power output and the frequency output of the associated unit are disconnected from the paralleling lines. Likewise the power and frequency outputs are disconnected if the auxiliary voltage to the LSU-112DG is disconnected.

The LSU-112DG is equipped with an unload input. When activated this input will control the power unit to zero power, and at the same time the power output of the LSU-112DG is disconnected from the paralleling line.

The calibration of the LSU-112DG is done so it matches its power unit. This means that load sharing between power units with different size will be performed according to the actual size of the individual power unit in the plant. For example a 100 kW PU and a 150 kW PU running in parallel will share a total load of 125 kW into 50 kW and 75 kW. If the 150 kW PU is derated to 100 kW by means of the DERATING potentiometer on the front of the LSU-112DG, the load in the above example will then be shared equally between the two power units.

## Regulator output

The unit is provided with two contact outputs for speed control:

### Power and frequency control:

The regulating speed of the servomotors for the prime mover is controlled by the built-in P controller of the LSU-112DG according to its setting for:

$T_N$  (min. ON time):

The min. duration of the control pulse when inside the proportional band  $X_p$ .

$X_P$  (proportional band):

The zone within which the pulse/pause ratio changes proportionally to the frequency/power deviation from the required value.

$T_P$  (period time):

The time between the beginnings of two subsequent relay pulses.

Deadband:

The zone within which no control pulses are emitted.

## Self-monitoring

The LSU-112DG is equipped with a self-monitoring function. The function supervises the built-in micro-controller and hereby verifies if the programme is running correctly. The green LED marked "POWER" is connected to this function. Constant green light indicates that the supply voltage is accepted and the unit is running correctly. Flashing green light 2-3 Hz indicates that the supply voltage is accepted but the unit is running incorrectly. In this situation the status output terminals 17 and 18 are activated (open).

**Terminals/function**

| Connection type          | Connect            |                     |
|--------------------------|--------------------|---------------------|
| 1W3 (standard)           | L1 to term. 24     | L2 to term. 26      |
| 1W (betw. phase/neutral) | L1 (P) to term. 24 | Neutral to term. 26 |

| Terminal no.                          | Description/action   |
|---------------------------------------|--|
| 1 and 3<br>X1/X2                      | Input for supply voltage.  |
| 17 and 18<br>Sta                      | Status output, activated (closed) when the supply voltage is connected and the unit is working correctly.  |
| 28 and 29<br>IL1                      | Input for the current measurement. Note that S1 on the external current transformer is connected to terminal 28, and S2 is connected to terminal 29.   |
| 31 and 32<br>Ext. P.                  | Must be short-circuited, if the internal power transducer is used (normal). For applications with unbalanced load it is recommended to use an external power transducer (replacing the built-in one). Connect external power transducer to 31 (+) and 32 (-). The output of the external transducer must be 4 to 20 mA DC. The output of the connected transducer must limit the output to min. 2 mA and max. 22 mA. DEIF transducer type TAS-331DG is recommended.                              |
| 33 and 34<br>("Unl")                  | May be connected to a potential-free N/O relay contact. When this contact is activated, the power of the generator is regulated to zero (unloading) and the LSU-112DG is disconnected from the PS power line.  |
| 35<br>("Ref.")                        | Reference input. Must be connected to term. 36 ("⊥"), if not used. This input is used to control the power unit running in power control mode (fixed load to grid). A +0.5 V to 5 V connected to the input with respect to ⊥ will control the PU in the range 10 to 100 % power. The input activates at 0.55 V and deactivates at 0.45 V. Please notice that when this input is active the LSU-112DG is still connected to the PS and FS lines. In this mode the PS line acts only as an output. |
| 37<br>("+5V")                         | Reference output. This voltage output can be used for local power control mode. If terminal 37 is feeding a voltage divider, and the output from the voltage divider is connected to terminal 35, local power control can be performed.  |
| 36<br>("⊥")                           | Common earth terminal for the above reference input/output.  |
| 38 (FS) and<br>39 ("⊥")               | Paralleling line for frequency sharing of the connected LSU-112DGs.  |
| 40 (PS) and<br>41 ("⊥")               | Paralleling line for power sharing of the connected LSU-112DGs. Normally 5 V at nominal busbar voltage and cos phi = 1. If cos phi 0.8 is stated on the label, 4 V correspond to 100 % power.  |
| 43 and 44<br>Relay con-<br>tacts "SG" | Relay contact for increase of the speed.   |
| 45 and 46<br>Relay con-<br>tacts "SG" | Relay contact for decrease of the speed.   |
| <b>NOTE:</b><br>Relay<br>contacts     | Relays (SG) should always be connected via external auxiliary relays when a DC pilot motor is applied. A transient suppressor should always be connected across the relay coil of the external relays.   |

**NOTE:**

All terminals marked "⊥" are internally connected.

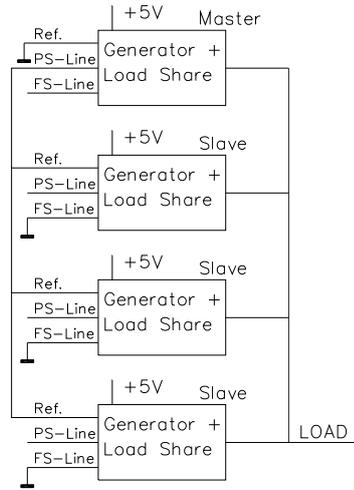
For correct function of the LSU-112DG any analogue DC input must not exceed 110 % of its nominal value. To ensure correct power measurement it is important that the AC current input does not exceed 110 % of its nominal value. To accomplish this it is important to take the value of the max. cos phi into consideration when ordering/configuring the LSU-112DG, for example by using the kVA figure of the generator and cos phi = 1.

**Application**

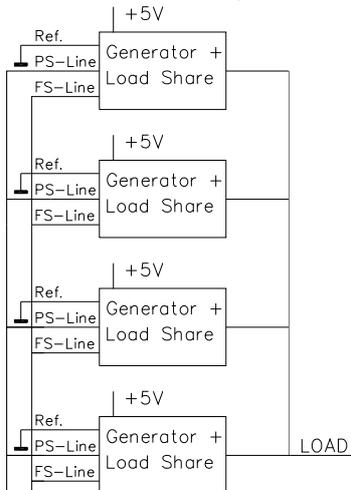
The schematic drawings on the next page show the different couplings for the LSU-112DG. For further information, please see the Application notes for Uni-line, doc. no. 4189340150.

Schematic drawings

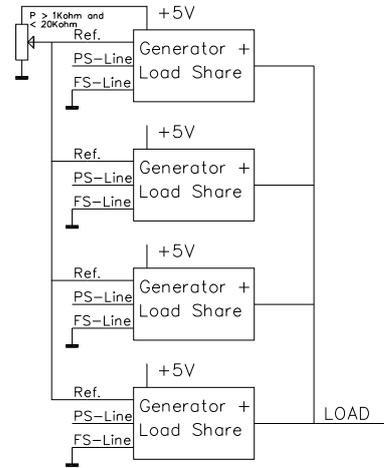
Master/Slave Mode



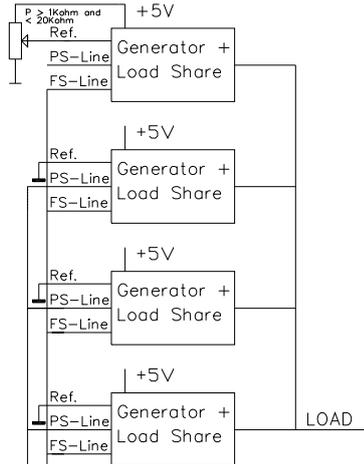
Normal load sharing



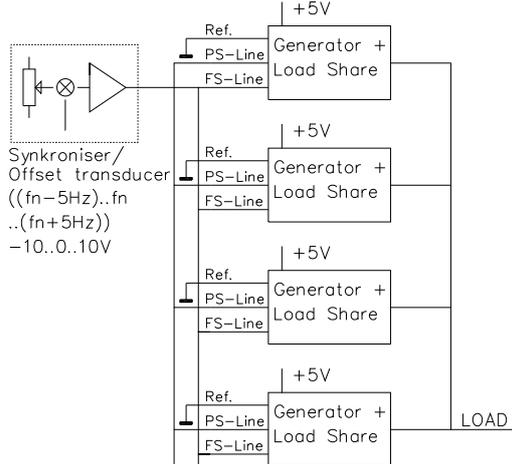
Fixed load to busbar - No frequency control



1 generator for fixed load  
3 for load sharing



Load sharing with external frequency control  
(Synchronising of generator in island operation)



## Technical specifications

|  |   |   |  |
|--|---|---|--|
| <b>Meas. current (<math>I_n</math>):</b> | 0.3-0.4-0.5-0.6-0.8-1.0-1.3-1.5-2.0-2.5-3.0-4.0-5.0 A AC<br>(calibration modules)<br>UL/cUL Listed: 0.4 to 5.0 A AC     | <b>Analogue outputs:</b>                  | PS line, FS line: 2 parallel, analogue lines<br>(-5 to 0 to 5 V)<br>5 V $\pm 2\%$ = 2.5 Hz ~ 100 % power<br>0 V $\pm 2\%$ = 0 Hz ~ 0 % power   |
| Adjusted range:                          | 75 to 100 % of $I_n$ (for example 0.45, adjusted by means of a built-in potentiometer)<br>(Lowest meas. range: 0.3 A)   | Reference output:                         | Reference voltage: 5.0 V $\pm 1\%$<br>Load: Max. 5 mA ( $R \geq 1\text{ k}\Omega$ )<br><br>UL/cUL Listed: +/-5 V DC  |
| Overload:                                | $4 \times I_n$ , continuously<br>$20 \times I_n$ for 10 s (max. 75 A)<br>$80 \times I_n$ for 1 s (max. 300 A)           | <b>Optocoupler outp.:</b>                 | System status off = Failure<br>Max. voltage 30 V DC, max. current 5 mA<br>Voltage drop 1.5 V ~ 2 mA<br><br>UL/cUL Listed: 30 V DC, 5 mA  |
| Load:                                    | Max. 0.5 VA (per phase) at $I_n$  | <b>Temperature:</b>                       | -25 to 70 °C (-13 to 158 °F) (operating)<br>UL/cUL Listed:<br>Max. surrounding air temp. 60 °C/140 °F  |
| <b>Meas. voltage (<math>U_n</math>):</b> | 57.7-63.5-100-110-127-200-220-230-240-380-400-415-440-450-480-660-690 V AC<br>UL/cUL Listed: 57.7 to 450 V AC           | <b>Temperature drift:</b>                 | Set points:<br>Max. $\pm 0.2\%$ of full scale per 10 °C/50 °F  |
| Voltage range:                           | $U_n$ 60 to 120 %   | <b>Galv. separation:</b>                  | Between meas. voltage, meas. current, relay outputs, analogue inputs/outputs and aux. voltage: 3250 V - 50 Hz - 1 min.   |
| Overload:                                | $1.2 \times U_n$ , continuously<br>$2 \times U_n$ for 10 s  | <b>Supply voltage (<math>U_n</math>):</b> | 57.7-63.5-100-110-127-220-230-240-380-400-415-440-450-480-660-690 V AC $\pm 20\%$ (max. 3.5 VA)<br><br>24-48-110-220 V DC -25/+30 % (max. 2.5 W)<br><br>UL/cUL Listed:<br>Only 24 V DC and 110 V AC<br><br>DC supply must be from a class 2 power source |
| Load:                                    | 2 k $\Omega$ /V   | <b>Climate:</b>                           | HSE, to DIN 40040  |
| <b>Frequency range:</b>                  | 40 to <u>45 to 65</u> to 70 Hz  | <b>EMC:</b>                               | To IEC/EN 61000-6-1/2/3/4  |
| <b>Inputs:</b>                           |   | <b>Connections:</b>                       | Max. 4.0 mm <sup>2</sup> (single-stranded)<br>Max. 2.5 mm <sup>2</sup> (multi-stranded)  |
| Unload:                                  | Potential-free relay contact<br>Open: 5 V. Closed: 5 mA<br><br>UL/cUL Listed: +/-5 V DC (using pot. free ext. contacts) | <b>Materials:</b>                         | All plastic parts are self-extinguishing to UL94 (V1)  |
| Reference input:                         | 0.5 to 5 V $\pm 1\%$ (10 to 100 % power)<br>Input resistance: $\geq 2\text{ M}\Omega$                                   |   |  |
| Ext. power input:                        | 4 to 20 mA DC $\pm 2\%$   |   |  |
| Ext. frequency input:                    | -5 to 0 to 5 V $\pm 2\%$ ~ 0 to $\pm 2.5$ Hz<br>Max. -10 to 0 to 10 V ~ -5 to 0 to 5 Hz                                 |   |  |
| <b>Contact outputs:</b>                  |   |   |  |
| Speed control:                           | 2 make contacts   |   |  |
| Contact ratings:                         | AC1/DC1: 250V AC/24V DC, 8 A<br>AC15/DC13: 250V AC/24V DC, 3 A<br><br>UL/cUL Listed: Resistive load only                |   |  |
| <b>Life electrical:</b>                  | $1 \times 10^5$ (nominal value)   |   |  |

## **Data sheet**

## **LSU-112DG**

**Protection:** Case: IP40. Terminals: IP20, to IEC 529 and EN 60529

**Type approval:** The Uni-line components are approved by the major classification societies. For current approvals see [www.deif.com](http://www.deif.com) or contact DEIF A/S.

**UL markings:** UL Listed only on request

UL Listing will be lost if the product is re-customised outside DEIF DK's production plant

Wiring:  
Use 60/75 °C (140/167 °F) copper conductors only

Wire size:  
AWG 12-16 or equivalent

Installation:  
To be installed in accordance with the NEC (US) or the CEC (Canada)

Settings

| Setting of                       | Range  |
|----------------------------------|--|
| T <sub>N</sub> Min. ON time      | 25 to 500 ms   |
| X <sub>P</sub> Proportional band | 0 to ±50 % of P <sub>n</sub><br>0 to ±2.5 Hz of set frequency  |
| Frequency                        | 45 to 65 Hz  |
| Derating                         | 50 to 0 % of P <sub>n</sub>  |
| Period time, T <sub>P</sub>      | 10*T <sub>N</sub><br>(5*T <sub>N</sub> , 15*T <sub>N</sub> and 20*T <sub>N</sub> available with jumper settings) |
| Power deadband                   | +/- 2 % of P <sub>n</sub> (or for derated value)<br>(+/- 4 % available by jumper setting)                        |
| Frequency deadband               | +/- 0.1 Hz<br>(+/- 0.25 Hz available by jumper setting)  |

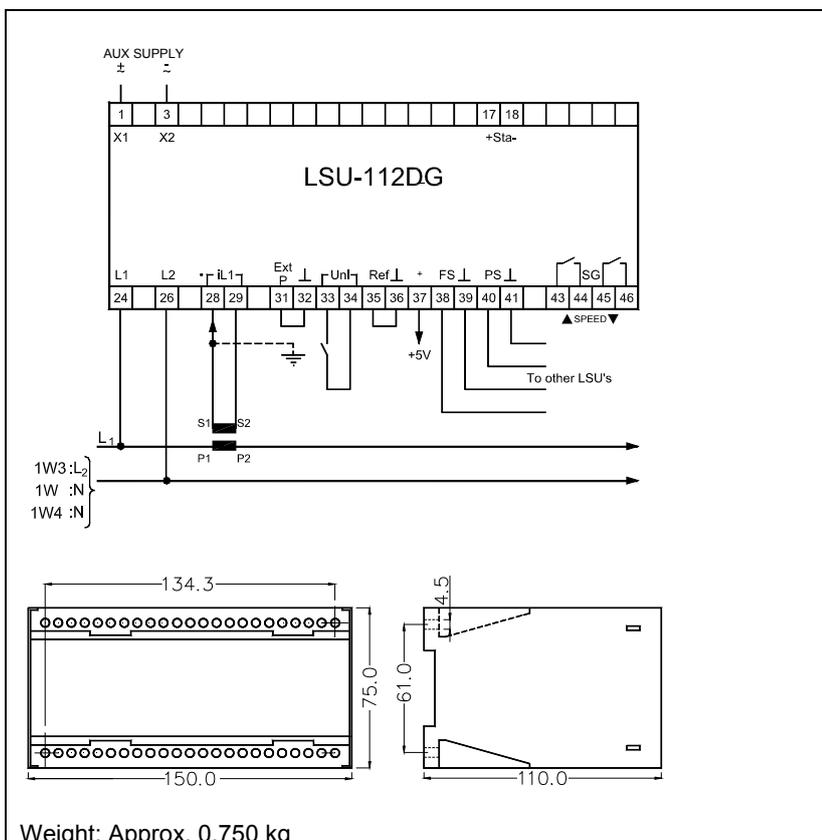
Please refer to the “Customisation manual” for details about jumper settings.

Indication

| LEDs                               | Lit                         | Switched off        |
|------------------------------------|-----------------------------|---------------------|
| U <sub>G</sub> Generator voltage   | (Green)<br>Present          | Failure             |
| Unload Unloading of this generator | (Green)<br>Gen. unloaded    | Normal load         |
| SG▲ Increase speed (power)         | (Yellow)<br>Relay activated | Relay not activated |
| SG▼ Decrease speed (power)         |                             |                     |

Once the unit has been mounted and adjusted, the transparent front cover may be sealed to prevent unwanted change of the setting.

Connections/dimensions (in mm)



Available variants

| Item no.   | Variant no. | Variant description   |
|------------|-------------|-----------------------|
| 2913060120 | 01          | LSU-112DG - DC supply |
| 2913060120 | 02          | LSU-112DG - AC supply |

Order specifications

Variants:

| Mandatory information |      |             |          |                                   |         |                   |                | Additional options to the standard variant |
|-----------------------|------|-------------|----------|-----------------------------------|---------|-------------------|----------------|--|
| Item no.              | Type | Variant no. | Coupling | Measuring power (P <sub>n</sub> ) | Cos Phi | Measuring voltage | Supply voltage | Option                                     |
|                       |      |             |          |                                   |         |                   |                |  |

Example:

| Mandatory information |           |             |          |                                   |         |                   |                | Additional options to the standard variant |
|-----------------------|-----------|-------------|----------|-----------------------------------|---------|-------------------|----------------|--|
| Item no.              | Type      | Variant no. | Coupling | Measuring power (P <sub>n</sub> ) | Cos Phi | Measuring voltage | Supply voltage | Option                                     |
| 2913060120-01         | LSU-112DG | 01          | 1W3      | 100 W                             | 0.8     | 100 V             | 24 V DC        | No options available                       |

Note: Measuring power =  $\frac{\text{Primary power}}{\text{CT ratio} \times \text{VT ratio}}$

Due to our continuous development we reserve the right to supply equipment which may vary from the described.



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