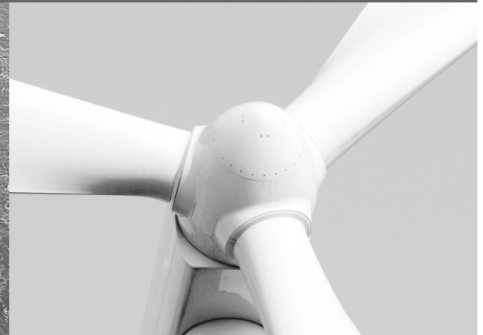




-power in control



## DATA SHEET



### **var load sharing unit, LSU-122DG** **ANSI code 90**

- For control of diesel or gas generators
- Built-in reactive power transducer
- Control of AVR
- LED indication of status
- LED indication for activated control
- 35 mm DIN rail or base mounting



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## Application

The LSU-122DG is a control unit for control of the generator in a power unit.

The LSU-122DG can control the power unit

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

The unit is designed for connection to a motor potentiometer for control of the AVR, however in conjunction with the DEIF electronic potentiometer type EPN-110DN or EPQ-96 it can control most electronic AVRs.

All the LSU-122DGs in the power plant must be connected to a common voltage transducer. If a number of generators are to be synchronised to the busbar at the same time, the voltage may likewise be controlled externally.

## Function

The LSU-122DG is measuring the voltage and the current from which the reactive power produced by the power unit is calculated. The built-in reactive power transducer is based on an  $I \times \sin \phi$  principle.

The following couplings are available:

- 1var single phase
- 1var3 1 element, 3-phase 3-wire balanced load

If unbalanced load can be expected, an external reactive power transducer with an output of 4 to 20 mA can be connected to the LSU-122DG. In this case the built-in  $I \times \sin \phi$  transducer is automatically interrupted.

The reactive power measured by each LSU-122DG is fed to a common line for comparison with the reactive power (QS) of the other connected LSU-122DG. The voltage line (US) from each LSU-122DG is connected to the common voltage transducer.

If L1 or L2 is disconnected from the LSU-122DG 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-122DG ensure that the reactive power output (QS) and the voltage input (US) of the associated unit are disconnected from the paralleling lines. Likewise the reactive power and voltage lines are disconnected, if the auxiliary voltage to the LSU-122DG is disconnected.

The LSU-122DG is equipped with an unload input. When activated this input will control the power unit (generator) to zero reactive power, and at the same time the reactive power output of the LSU-122DG is disconnected from the paralleling line.

The calibration of the LSU-122DG 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 units in the plant. For example a 100 kVA generator and a 150 kVA generator running in parallel will share a total load of 125 kvar into 50 kvar and 75 kvar.

## Regulator output

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

### Reactive power and voltage control:

The regulating speed of the motor potentiometer for the AVR is controlled by the built-in P controller of the LSU-122DG according to its setting for:

$T_N$  (pulse length):

The min. duration of the control pulse.

$X_P$  (proportional band):

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

Deadband:

The zone within which no control pulses are emitted:

Power:  $\pm 0.5\%$  of  $P_n$

Voltage:  $\pm 1\%$  of  $U_n$

## Self-monitoring

The LSU-122DG 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	
1var3 (standard)	L1 to term. 24	L2 to term. 26
1var (between phase/neutral)	L1 (P) to term. 24	Neutral to term. 26

Terminal no.	Description/action
1 and 3 (X1/X2)	Input for supply voltage.
17 (+) and 18 (-) (Sta)	Status output, activated (closed) when the supply voltage is connected and the unit is working correctly.
28 and 29 (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 ("Ext. Q.")	Must be short-circuited, if the internal reactive power transducer is used (normal). For applications with unbalanced load it is recommended to use an external reactive power transducer (replacing the built-in one). Connect external 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 swing to min. 2 mA and max. 22 mA. DEIF transducer type TAS-331DG is recommended.
33 and 34 ("Unl")	May be connected to a potential-free N/O relay contact. When this contact is activated, the reactive power of the generator is regulated to zero (unloading), and the LSU-122DG is disconnected from the paralleling QS power line.
35 ("Ref.")	Reference input. Must be connected to term. 36 ("⊥"), if not used. This input is used to control the power unit running in reactive power control mode (fixed reactive load to grid). A +0.5 V to 5 V connected to the input with respect to (⊥) will control the generator in the range 10 to 100 % reactive power. The input activates at 0.55 V and deactivates at 0.45 V. Please notice that when this input is active the LSU-122DG is still connected to the QS and US lines. In this mode the QS line acts only as an output.
37 ("+5V")	Reference output. This voltage output can be used for local reactive 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 ("⊥")	Common earth terminal for the above reference input/output.
38 ("US") and 39 ("⊥")	Paralleling line for voltage regulation of the generator. Normally connected to an external voltage transducer. The output of the external common voltage transducer must be 0 to 5 to 10 V corresponding to 80 to 100 to 120 % of $U_n$ and must be connected to terminal 37 if voltage control is not used.
40 ("QS") and 41 ("⊥")	Paralleling line for reactive power sharing of the connected LSU-122DGs. 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 % reactive power. $\cos \phi$ is used instead of $\sin \phi 0.6$ to make it comparable to the LSU-112/113/114DG.
43 and 44 Relay contacts "AVR"	Relay contact for increase of the excitation (voltage).
45 and 46 Relay contacts "AVR"	Relay contact for decrease of the excitation (voltage).
<b>NOTE:</b> Relay contacts	Relays (AVR) 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:**

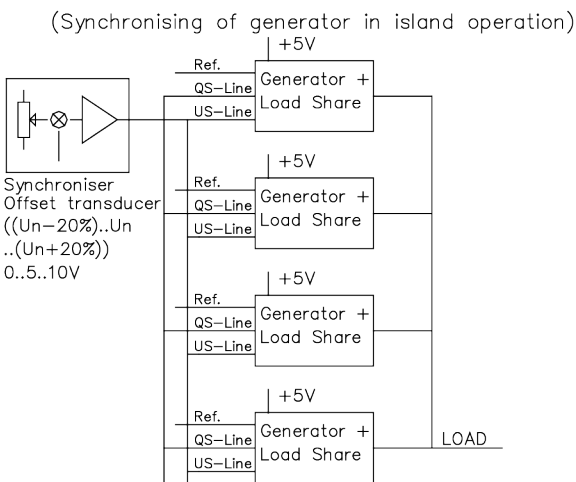
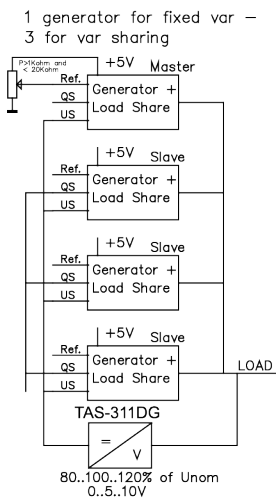
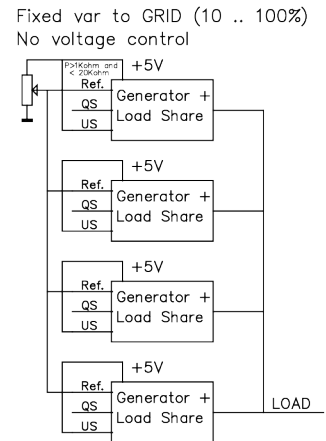
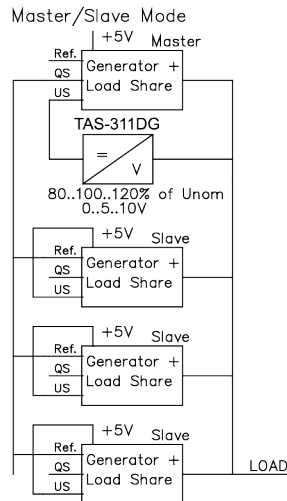
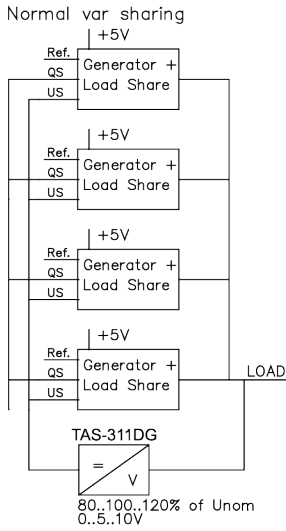
All terminals marked "⊥" are internally connected.

For correct function of the LSU-122DG any analogue DC input must not exceed 110 % of its nominal value. To ensure correct reactive 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.  $\cos \phi$  for the generator into consideration when ordering/configuring the LSU-122DG, for example by using the kVA figure of the generator and  $\cos \phi = 1$ . Please notice that if the LSU-122DG is to be used in an installation which also includes our LSU-112/113/114DG, the measuring power (W/var) and the  $\cos \phi$  must be identical for both units, because the current input values for both units are alike.

**Application**

The schematic drawings below show the different couplings for the LSU-122DG. For further information, see the Application notes for Uni-line, document no. 4189340150.

**Schematic drawings**



Please notice that unused ref. inputs must be connected to terminal 36 ("⊥").

**Technical specifications**

<p><b>Meas. current (I<sub>n</sub>):</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 (calibration modules) UL/cUL Listed: 0.4 to 5.0 A AC</p> <p>Adjusted range: 75 to 100 % of I<sub>n</sub> (for example 0.45 adjusted by means of a built-in potentiometer) (Lowest meas. range: 0.3 A)</p> <p>Overload: 4 × I<sub>n</sub>, continuously 20 × I<sub>n</sub> for 10 s (max. 75 A) 80 × I<sub>n</sub> for 1 s (max. 300 A)</p> <p>Load: Max. 0.5 VA (per phase) at I<sub>n</sub></p> <p><b>Meas. voltage (U<sub>n</sub>):</b> (See supply voltage - AC ranges)</p> <p>Voltage range: U<sub>n</sub> 60 to 120 %</p> <p>Overload: 1.2 × U<sub>n</sub>, continuously 2 × U<sub>n</sub> for 10 s</p> <p>Load: 2 kΩ/V UL/cUL Listed: 57.7 to 450 V AC</p> <p><b>Frequency range:</b> 40 to <u>45 to 65</u> to 70 Hz</p> <p><b>Inputs:</b></p> <p>Unload: Potential-free relay contact Open: 5 V. Closed: 5 mA UL/cUL Listed: +/-5 V DC (using pot. free ext. contacts)</p> <p>Reference input: 0.5 to 5 V ±1 % (10 to 100 % reactive power) Input resistance: ≥2 MΩ</p> <p>Ext. power input: 4 to 20 mA DC ±2 %</p> <p>Ext. voltage input: 0 to 5 to 10 V ±2 % ~ 80 to 100 to 120 % of U<sub>n</sub> from external voltage transducer</p> <p><b>Contact outputs:</b></p> <p>Voltage control: 2 make contacts</p> <p>Contact ratings: AC1/DC1: 250V AC/24V DC, 8 A AC15/DC13: 250V AC/24V DC, 3 A UL/cUL Listed: Resistive load only</p> <p><b>Life electrical:</b> 1 × 10<sup>5</sup> (nominal value)</p> <p><b>Analogue outputs:</b></p> <p>QS line: 1 analogue line (-5 to 0 to 5 V) 5 V ±2 % = 100 % reactive power 0 V = 0 % reactive power</p> <p>Reference output: Reference voltage: 5.0 V ±1 % Load: Max. 5 mA (R ≥ 1 kΩ) UL/cUL Listed: +/-5 V DC</p> <p><b>Optocoupler outp.:</b> System status off = Failure Max. voltage 30 V DC, max. current 5 mA Voltage drop 1.5 V ~ 2 mA UL/cUL Listed: 30 V DC, 5 mA</p>	<p><b>Temperature:</b> -25 to 70 °C (-13 to 158 °F) (operating) UL/cUL Listed: Max. surrounding air temp. 60 °C/140 °F</p> <p><b>Temp. drift:</b> Set points: Max. ±0.2 % of full scale per 10 °C/50 °F</p> <p><b>Galv. separation:</b> Between meas. voltage, meas. current, relay outputs, analogue inputs/outputs and aux. voltage: 3250 V - 50 Hz - 1 min.</p> <p><b>Supply volt. (U<sub>n</sub>):</b> 57.7-63.5-100-110-127-200-220-230-240-380-400-415-440-450-480-660-690 V AC ±20 % (max. 3.5 VA) 24-48-110-220 V DC -25/+30 % (max. 2.5 W) UL/cUL Listed: Only 24 V DC and 110 V AC DC supply must be from a class 2 power source</p> <p><b>Climate:</b> HSE, to DIN 40040</p> <p><b>EMC:</b> To IEC/EN 61000-6-1/2/3/4</p> <p><b>Connections:</b> Max. 4 mm<sup>2</sup> (single-stranded) Max. 2.5 mm<sup>2</sup> (multi-stranded)</p> <p><b>Materials:</b> All plastic parts are self-extinguishing to UL94 (V1)</p> <p><b>Protection:</b> Case: IP40. Terminals: IP20, to IEC 529 and EN 60529</p> <p><b>Type approval:</b> The Uni-line components are approved by the major classification societies. For current approvals see <a href="http://www.deif.com">www.deif.com</a> or contact DEIF A/S</p> <p><b>UL markings:</b> 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)</p>
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**Settings**

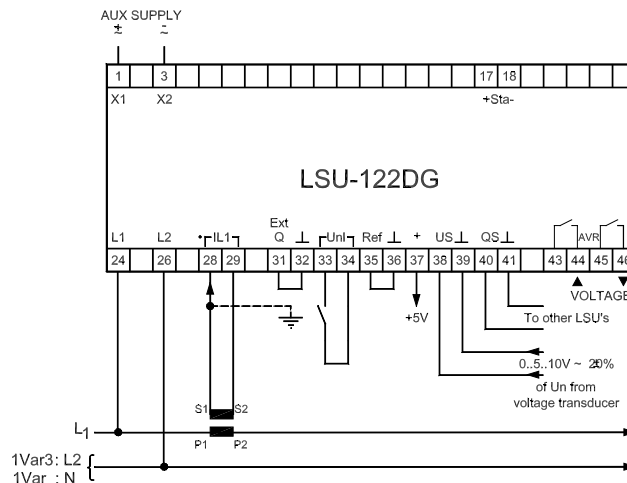
Setting of	Range
T <sub>N</sub> Control pulse length	25 to 500 ms
X <sub>P</sub> Proportional band	0 to ±50 % of Q <sub>n</sub> 0 to ±10 % of U <sub>n</sub>

**Indication**

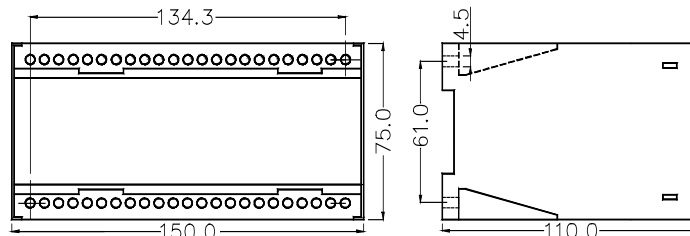
LEDs		Lit	Switched off
U <sub>G</sub>	Generator voltage	(Green) Present	Failure
Unload	Unloading of this generator	(Green) Gen. unloaded	Normal load
AVR ▲	Increase voltage (reactive power)	(Yellow)	Relay not activated
AVR ▼	Decrease voltage (reactive power)	Relay activated	

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)



See installation instructions for information about status output (17-18)



Weight: approx. 0.750 kg

Order specifications

Variants:

Mandatory information			
Item no.	Type	Variant no.	Supply

Example:

Mandatory information			
Item no.	Type	Variant no.	Supply
2913060560	LSU-122DG	01	DC
2913060560	LSU-122DG	02	AC

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



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