

ANSI code 25

Type HAS-111DG

- **Synchronisation of generator to busbar**
- **Setting of phase angle difference**
- **Setting of frequency and voltage diff.**
- **LED indication of status**
- **LED for synchronising signal**
- **35 mm DIN rail or base mounting**

### Application

The HAS-111DG synchroniser is applied to check the synchronisation conditions. The paralleling relay transmits a synchronisation pulse when the phase angle, frequency and voltage deviations are within the set limits. Besides this the HAS-111DG is equipped with 2 analogue outputs. These outputs can be used for regulating purposes together with DEIF A/S load sharing units.

### Function

The HAS-111DG can be used in installations where manual or semi-automatic synchronising is required, or by using the  $\Delta f$  and/or the  $\Delta U$  output for automatic synchronisation of a generator island to another utility (shaft generator).

### Settings

The HAS-111DG is equipped with 5 potentiometers accessible from the front of the unit.

#### Phase:

Here the phase window for synchronisation is chosen. It can be set symmetrically or asymmetrically.

#### Frequency:

Here the max. slip frequency difference is chosen. It can be set both symmetrically and asymmetrically around 0Hz.

#### Voltage:

Here the allowed voltage difference between  $U_{GEN}$  and  $U_{BUSBAR}$  is chosen. It can be set symmetrically.

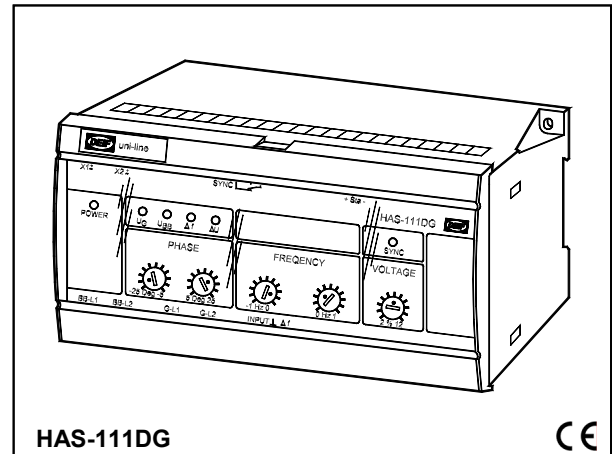
Because of the separate adjustments for positive and negative slip frequency the HAS-111DG may be set to transmit a synchronisation pulse so that either a supersynchronous or a subsynchronous connection of the generator will be obtained.

In case of harmonic distortion or noise on the voltage inputs, the HAS-111DG is equipped with special filters on the AC voltage inputs to avoid incorrect synchronisation pulse to be transmitted. Furthermore a  $df/dt$  (ROCOF) function is implemented, if the filters are unable to make the necessary filtering of the input signals, the  $df/dt$  function will prevent unprecise activation of the sync. relay. If the  $df/dt$  function is

## Paralleling relays

uni-line

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active, the situation will be indicated by a flashing  $\Delta f$  LED (see option C).

The HAS-111DG is provided with an analogue frequency output and an analogue voltage output, intended for common control of the frequency and the voltage of DEIF load sharing units type LSU-112/113/114-DG and LSU-122DG, a function applied for simultaneous synchronisation of all generators of a plant to the busbar. By means of the input marked INPUT a supersynchronous or a subsynchronous connection of the generator(s) can be obtained.

The HAS-111DG measures the busbar and generator voltages in order to obtain data on frequency, phase and voltage deviation. A synchronising signal is transmitted when the following conditions are fulfilled:

1. The voltage difference is within  $\pm 2\% \dots \pm 12\%$  of the busbar voltage set on the VOLTAGE potentiometer, and
2. the frequency difference  $\Delta f$  is within  $-1 \dots 0$  Hz and  $0 \dots 1$  Hz of the values set on the FREQUENCY potentiometers, and
3. the phase angle difference is within  $-25 \dots -5^\circ$  el. and  $5 \dots 25^\circ$  el. of the value set on the PHASE potentiometers, and
4. the  $\Delta f$  allows a synchronisation pulse of min. 100 ms without exceeding the setting of the PHASE potentiometers.

When the above 4 conditions are fulfilled, a synchronising signal is transmitted and the yellow LED SYNC is lit. The pulse length (100 ms ... 3 s) depends on the other settings of the relay, but the signal continues as long as the above conditions are fulfilled, however max. 3 s (see option D).

### Self-monitoring

The HAS-111DG 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 2-3Hz 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).

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### Terminals/function

Connection	Connect	
	Busbar	L1 to term. 24
Generator	L1 to term. 29	L2 to term. 31

Terminal no.	Description/action
1 and 3 X1/X2	Input for supply voltage
8, 9 and 10	Relay contact for circuit breaker
17 and 18 Sta	Status output, activated (closed) when the supply voltage is connected and the unit is working correctly
24 and 26 BB/L1 BB/L2	Input for busbar voltage measurement. This input becomes active when the voltage level exceeds 60% of nominal voltage
29 and 31 G/L1 G/L2	Input for generator voltage measurement. This input becomes active when the voltage level exceeds 60% of nominal voltage
33 ("ΔU") Option E	This output is intended for common control of the voltage of all the connected reactive power load sharing units type LSU-122DG in a generator island. If terminal 33 is connected to the common voltage line (US) on the LSU-122DGs, the HAS-111DG will regulate the voltage on the generator island so it matches the voltage on the unit the island is about to be connected to
34 and 35 ("INPUT")	May be connected to a potential-free N/O contact. When this contact is activated, the HAS-111DG will control the connected LSU-112/113/114DG unit(s) to control the generator island frequency towards the busbar frequency less 50% of the setting of the negative FREQUENCY potentiometer. Vice versa if the input is opened
36 ("Δf")	This output is intended for common control of the frequency of all the connected load sharing units type LSU-112/113/114DG in a generator island. If terminal 36 is connected to the common frequency line (FS) on the LSUs, the HAS-111DG will control the frequency on the generator island so it matches the frequency on the unit the island is about to be connected to (see above regarding INPUT)
35 ("⊥")	Common earth terminal for the above input/output

### Options

The HAS-111DG can be configured with the following options:

#### Increased phase window, option A

When implemented the accept phase window can be adjusted in the range from -50...-10° el. and 10...50° el.

#### Dead bus, option B

When implemented the dead bus function enables the HAS-111DG to transmit a closing signal to the generator breaker when no busbar voltage is present. When the generator voltage is within the setting on the potentiometer marked VOLTAGE with nominal voltage as reference and no busbar voltage is present (below 20% of nominal voltage), the HAS-111DG will transmit a closing signal to the breaker (400 ms).

#### Deactivation of the df/dt protection function, option C

If instability in the speed loop control system occurs resulting in jitter on the voltage signals (fast instability typically occurs, if the governor is responding to engine firings), and it is not possible to adjust this on the governor, or in applications with much noise and harmonic distortion (frequency converters), the df/dt protection function can be activated resulting in NO sync. pulse. If this is the case, and the switchgear is properly protected against wrong synchronisation, the df/dt protection function can be disabled. Please note that when this function is disabled, noise on the busbar and the generator inputs of the HAS-111DG can, at worst, result in a 180° out of phase synchronisation.

#### Continuous sync. pulse, option D

When implemented the sync. relay contact will stay on, as long as the conditions are OK. The following will deactivate the relay: If the voltage gets outside the settings on the potentiometer marked VOLTAGE, or the phase angle gets outside the set phase window, or if the busbar or the generator voltage drops below 60% or goes higher than 120% of nominal voltage.

#### Voltage difference analogue output, option E

This output is standard 0...5...10V corresponding to 80...100...120% of  $U_{nom}$  for controlling of the LSU-122DG. If option E is selected, the output is changed to -10...0...10V corresponding to 90...100...110% of  $U_{nom}$  for control of the units in the multi-line series, e.g. PPU/GPC.

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### Technical specifications

#### Accuracy:

Breaker closing: Slip frequency 0Hz:  $\pm 2^\circ$  el.  
Slip frequency 0.1...0.5Hz:  $\pm 3^\circ$  el.  
Slip frequency 0.5...1Hz:  $\pm 5^\circ$  el.

**Meas. voltage:** See supply voltage - AC ranges

Load: 2k $\Omega$ /V

**Frequency range:** 40...45...65...70Hz

**Digital input:** Potential-free contact  
Open: 5V. Closed: 5mA

#### Contact output:

Sync. pulse output: 1 change-over switch

Contact ratings: AC1: 8A, 250V AC  
DC1: 8A, 24V DC  
AC15: 3A, 250V AC  
DC13: 3A, 24V DC

**Life electrical:**  $1 \times 10^5$  (nominal value)

#### Analogue output:

Freq. difference: 1 analogue output:  
-10...0...10V DC  $\sim$  -5...0...5Hz

Volt. difference: 1 analogue output:  
0...5...10V DC  $\sim$  80...100...120% of  $U_n$   
-10...0...10V DC  $\sim$  90...100...110% of  $U_n$   
with option E activated

**Optocoupler output:** System status off = Failure  
Max. voltage 30V DC, max. current 5mA

**Temperature:** -25...70°C (operating)

**Temperature drift:** Set points:  
Max.  $\pm 0.2\%$  of full scale per 10°C

**Galv. separation:** Between inputs and outputs:  
3250V - 50Hz - 1 min.

**Supply volt. ( $U_n$ ):** 57.7-63.5-100-110-127-200-220-230-  
240-380-400-415-440-450-660-690  
V AC  $\pm 20\%$  (max. 3.5VA)  
24-48-110-220V DC -25/+30%  
(max. 2W)

**Climate:** HSE, to DIN 40040

**EMC:** To EN 50081-1/2, EN 50082-1/2,  
SS4361503 (PL4) and IEC 255-3

**Connections:** Max. 4 mm<sup>2</sup> (single-stranded)  
Max. 2.5 mm<sup>2</sup> (multi-stranded)

**Materials:** All plastic parts are self-extinguishing  
to UL94 (V1)

**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

### Settings

Setting of	Range
Acceptable phase angle difference	Negative: -25...-5° el. Positive: 5...25° el.
Acceptable frequency difference	Negative: -1...0Hz Positive: 0...1Hz
Acceptable voltage difference	$\pm 2... \pm 12\%$ of $U_n$

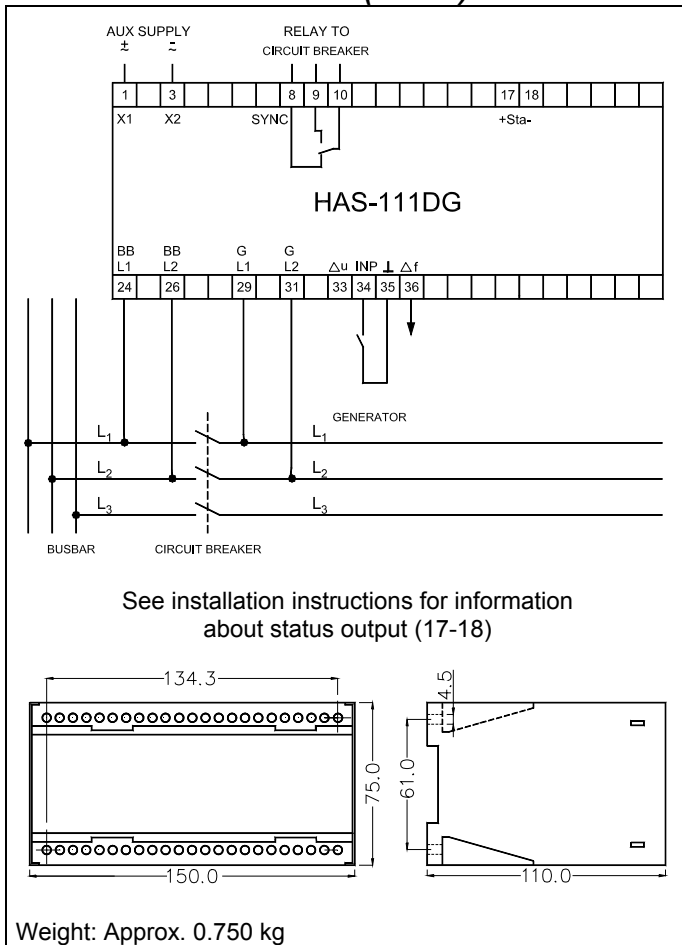
### Indication

LEDs	Light
$U_G$ Generator voltage	Green, when value is within the acceptable range
$U_{BB}$ Busbar voltage	
$\Delta f$ Frequency difference	Switched off, if outside this range
$\Delta U$ Voltage difference	
SYNC Synchronising	Yellow, when relay is activated

Once the relay has been mounted and adjusted, the transparent front cover may be sealed, preventing unwanted change of the setting.

## Type HAS-111DG

### Connections/dimensions (in mm)



### Order specifications

**Type - Measuring voltage - Supply voltage - (Option)**

*Example:*

HAS-111DG - 380V AC - 24V DC - Option A

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



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