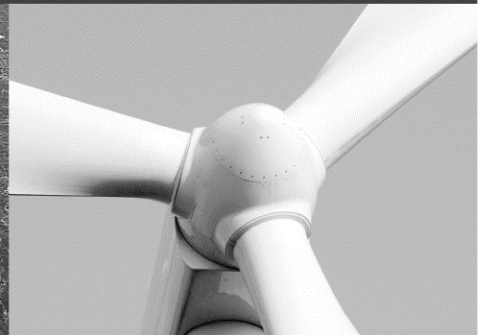
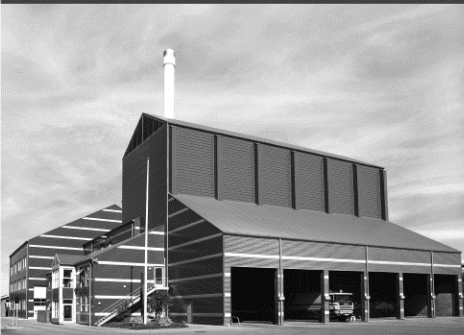




-power in control



## DATA SHEET



### **Paralleling relays, HAS-111DG** ANSI code 25

- 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



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**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 two 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 five 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 0 Hz.

**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 super-synchronous 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 imprecise activation of the sync. relay. If the  $df/dt$  function is 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, an oversynchronous or an undersynchronous 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  $\pm 2$  to  $\pm 12$  % of the busbar voltage set on the VOLTAGE potentiometer, and
2. the frequency difference  $\Delta f$  is within -1 to 0 Hz and 0 to 1 Hz of the values set on the FREQUENCY potentiometers, and
3. the phase angle difference is within -25 to -5 ° el. and 5 to 25 ° 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 four conditions are fulfilled, a synchronising signal is transmitted and the yellow SYNC LED is lit. The pulse length (100 ms to 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 2-3 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	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  $-50$  to  $-10$  ° el. and  $10$  to  $50$  ° el.

Dead bus, option B1

When B1 is 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 the busbar voltage is below 25 % of nominal voltage, the HAS-111DG will transmit a 200 ms closing signal to the breaker. If option D is enabled, the sync. signal will stay on as long as the conditions are OK (see option D).

Dead bus, option B2

When B2 is implemented, the dead bus function enables the HAS-111DG to transmit a closing signal to the breaker when no busbar **or** no generator voltage is present. When the voltage is within 80 % of nominal voltage on the active side of the breaker and below 25 % of nominal voltage on the passive side of the breaker, a 200 ms closing signal is transmitted. If option D is enabled, the sync. signal will stay on as long as the conditions are OK (see option D).

Dead bus, option B3

When B3 is implemented, the function – in addition to the function described under B2 – also enables the HAS-111DG to transmit a closing signal to the breaker when no busbar **and** no generator voltage is present. When the voltage is below 25 % of nominal, a 200 ms closing signal is transmitted. If option D is enabled, the sync. signal will stay on as long as the conditions are OK (see option D).



**Options B2 and B3: Please contact DEIF for status on marine approvals.**

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 80 % or goes higher than 120 % of nominal voltage.

Functionality with option B enabled: Whenever the status of the generator or busbar conditions are changed, the sync. relay output is reset. If the conditions are still OK, the relay is activated again after 1 s. For example, in case of dead bus on one side, the sync. relay will be activated and the breaker closed. Now, the HAS-111DG will “see” a new situation (voltage on both sides of the breaker), a reset will be carried out, and after 1 s the relay is activated again. In this case, the sync. relay output cannot be used to operate contactors directly.

Voltage difference analogue output, option F

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

## Technical specifications

<b>Accuracy:</b>		<b>Temperature drift:</b>	Set points: Max. $\pm 0.2\%$ of full scale per 10 °C/50 °F
Breaker closing:	Slip frequency 0 Hz: $\pm 2^\circ$ el. Slip frequency 0.1 to 0.5 Hz: $\pm 3^\circ$ el. Slip frequency 0.5 to 1 Hz: $\pm 5^\circ$ el.	<b>Galv. separation:</b>	Between inputs and outputs: 3250 V - 50 Hz - 1 min.
<b>Meas. voltage:</b>	57.7-63.5-100-110-127-200-220- 230-240-380-400-415-440-450- 480-660-690 V AC UL/cUL Listed: 57.7 to 450 V AC	<b>Supply voltage (U<sub>n</sub>):</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)
Load:	2 k $\Omega$ /V		24-48-110-220 V DC -25/+30 % (max. 2.5 W)
<b>Frequency range:</b>	40 to <u>45</u> to <u>65</u> to 70 Hz		UL/cUL Listed: Only 24 V DC and 110 V AC
<b>Digital input:</b>	Potential-free contact Open: 5 V. Closed: 5 mA		DC supply must be from a class 2 power source
<b>Contact output:</b>			
Sync. pulse output:	1 change-over switch	<b>Climate:</b>	HSE, to DIN 40040
Contact ratings:	AC1/DC1: 250V AC/24V DC, 8 A AC15/DC13: 250V AC/24V DC, 3 A  UL/cUL Listed: Resistive load only	<b>EMC:</b>	To IEC/EN 61000-6-1/2/3/4
<b>Life electrical:</b>	1 $\times 10^5$ (nominal value)	<b>Connections:</b>	Max. 4.0 mm <sup>2</sup> (single-stranded) Max. 2.5 mm <sup>2</sup> (multi-stranded)
<b>Analogue output:</b>		<b>Materials:</b>	All plastic parts are self- extinguishing to UL94 (V1)
Freq. difference:	1 analogue output: -10 to 0 to 10 V DC $\sim$ -5 to 0 to 5 Hz	<b>Protection:</b>	Case: IP40. Terminals: IP20, to IEC 529 and EN 60529
Volt. difference:	1 analogue output: 0 to 5 to 10 V DC $\sim$ 80 to 100 to 120 % of U <sub>n</sub> -10 to 0 to 10 V DC $\sim$ 90 to 100 to 110 % of U <sub>n</sub> with option E activated  UL/cUL Listed: +/-10 V DC	<b>Type approval:</b>	The Uni-line components are approved by the major classifica- tion societies. For current appro- vals see <a href="http://www.deif.com">www.deif.com</a> or contact DEIF A/S.
<b>Optocoupler outp.:</b>	System status off = Failure Max. voltage 30 V DC, max. cur- rent 5 mA Voltage drop 1.5 V $\sim$ 2 mA  UL/cUL Listed: 30 V DC, 5 mA	<b>UL markings:</b>	UL Listed only on request  UL Listing will be lost if the prod- uct is re-customised outside DEIF DK's production plant
<b>Temperature:</b>	-25 to 70 °C (-13 to 158 °F) (oper- ating) UL/cUL Listed: Max. surrounding air temp. 60 °C/140 °F		Wiring: Use 60/75 °C (140/167 °F) cop- per conductors only  Wire size: AWG 12-16 or equivalent  Installation: To be installed in accordance with the NEC (US) or the CEC (Cana- da)

Settings

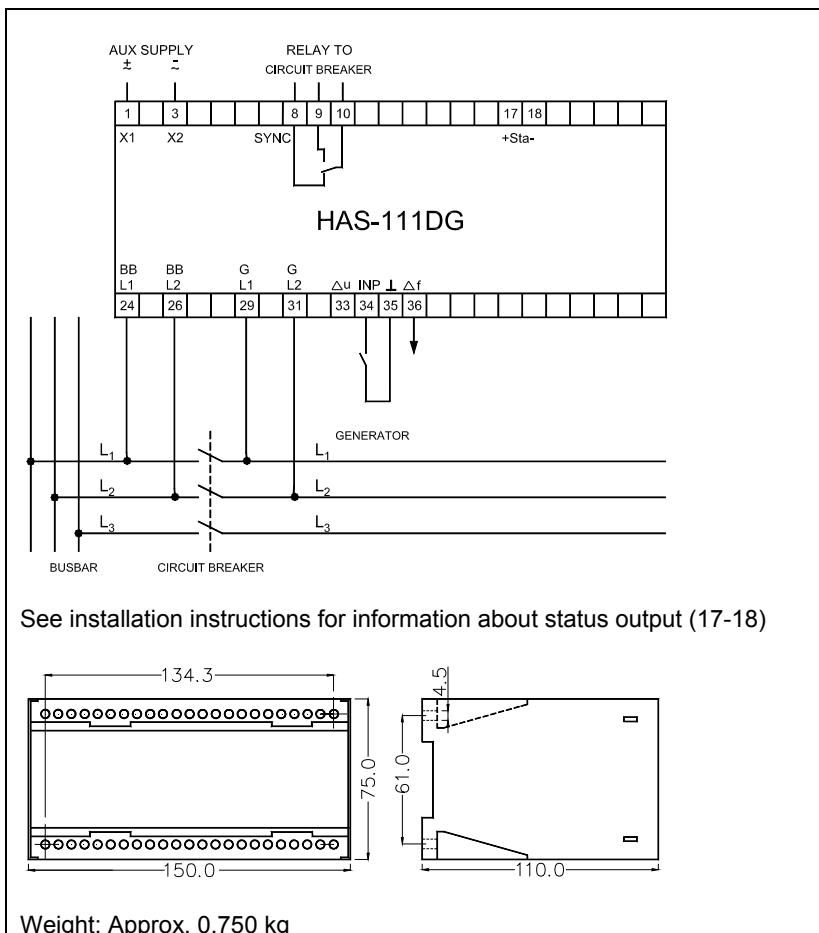
Setting of	Range
Acceptable phase angle difference	Negative: -25 to -5 ° el. Positive: 5 to 25 ° el.
Acceptable frequency difference	Negative: -1 to 0 H z Positive: 0 to 1 H z
Acceptable voltage difference	±2 to ±12 % of U <sub>n</sub>

Indication

LEDs	Light
U <sub>G</sub> Generator voltage	Green, when value is within the acceptable range Switched off, if outside this range
U <sub>BB</sub> Busbar voltage	
Δf Frequency difference	
ΔU Voltage difference	Yellow, when relay is activated
SYNC Synchronising	

Once the relay 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
2913020060	01	HAS-111DG - DC supply
2913020060	02	HAS-111DG - AC supply

**Order specifications**

Variants:

Mandatory information						Additional options to the standard variant
Item no.	Type	Variant no.	Measuring voltage	Supply voltage	Generator frequency	Option

Example:

Mandatory information						Additional options to the standard variant
Item no.	Type	Variant no.	Measuring voltage	Supply voltage	Generator frequency	Option
2913020060-01	HAS-111DG	01	380 V AC	24 V DC	50 Hz	Option A

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



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