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  $U_{\text{GEN}}$  and  $U_{\text{BUSBAR}}$  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 imprecise 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:

- The voltage difference is within ±2...±12% of the busbar voltage set on the VOLTAGE potentiometer, and
- the frequency difference ∆f is within -1...0Hz and 0...1Hz of the values set on the FREQUENCY potentiometers, and
- 3. the phase angle difference is within -25...-5° el. and 5...25° el. of the value set on the PHASE potentiometers, and
- the ∆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 microcontroller 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	L2 to term. 26
Generator	L1 to term. 29	L2 to term. 31

Terminal	Description/action	
no.		
1 and 3	Input for supply voltage	
X1/X2		
8, 9 and 10	Relay contact for circuit breaker	
17 and 18	Status output, activated (closed) when the supply	
Sta	voltage is connected and the unit is working	
	correctly	
24 and 26	Input for busbar voltage measurement. This input	
BB/L1 BB/L2	becomes active when the voltage level exceeds	
	60% of nominal voltage	
29 and 31	Input for generator voltage measurement. This	
G/L1 G/L2	input becomes active when the voltage level	
0.0 <i>(</i> () ) 1 (1)	exceeds 60% of nominal voltage	
33 ("∆U″)	This output is intended for common control of the	
Option E	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 veltage line (US) on the LSU 122DCe. the UAS	
	voltage line (US) on the LSO-122DGS, the HAS-	
	island as it matches the voltage on the unit the	
	island is about to be connected to	
34 and 35	May be connected to a notential free N/O	
("INPLIT")	contact When this contact is activated the HAS-	
( 11 01 )	111DG will control the connected ISU-	
	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	This output is intended for common control of the	
("∆f")	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  $-50...-10^{\circ}$  el. and  $10...50^{\circ}$  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 is 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.

Type HAS-111DG	
Technical specifi	ications
Accuracy: Breaker closing:	Slip frequency 0Hz: $\pm 2^{\circ}$ el.Slip frequency 0.10.5Hz: $\pm 3^{\circ}$ el.Slip frequency 0.51Hz: $\pm 5^{\circ}$ el.
Meas. voltage:	See supply voltage - AC ranges
Load:	2kΩ/V
	UL/cUL listed: 57.7450V AC
Frequency range:	40 <u>4565</u> 70Hz
Digital input:	Potential-free contact Open: 5V. Closed: 5mA
Contact output: Sync. pulse output:	1 change-over switch
Contact ratings:	AC1/DC1: 250V AC/24V DC, 8A AC15/DC13: 250V AC/24V DC, 3A
	UL/cUL listed: Resistive load only
Life electrical:	$1 \times 10^5$ (nominal value)
Analogue output: Freq. difference:	1 analogue output: -10010V DC ~ -505Hz
Volt. difference:	1 analogue output: 0510V DC ~ 80100120% of $U_n$ -10010V DC ~ 90100110% of $U_n$ with option E activated
	UL/cUL listed: +/-10V DC
Optocoupler output:	System status off = Failure Max. voltage 30V DC, max. current 5mA
-	
Temperature:	-2570°C (-13158°F) (operating)
	Max. surrounding air temp. 60°C/140°F
Temperature drift:	Set points: Max. ±0.2% of full scale per 10°C/50°F
Galv. separation:	Between inputs and outputs: 3250V - 50Hz - 1 min.
Supply volt. (U <sub>n</sub> ):	57.7-63.5-100-110-127-200-220-230- 240-380-400-415-440-450-660-690V AC ±20% (max. 3.5VA)
	24-48-110-220V DC -25/+30% (max. 2.5W)
	UL/cUL listed: Only 24V DC and 110V AC DC supply must be from a class 2 power source
Climate:	HSE, to DIN 40040
EMC:	To EN 61000-6-1/2/3/4, SS4361503 (PL4) and IEC 255-3

Connections:	Max. 4 mm² (single-stranded) Max. 2.5 mm² (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 or contact DEIF A/S
UL markings:	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
Acceptable phase angle difference	Negative: -255° el. Positive: 525° el.
Acceptable frequency difference	Negative: -10Hz Positive: 01Hz
Acceptable voltage difference	±2±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	
$\Delta f$	Frequency difference	
ΔU	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.

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## 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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