

SY2 – Paralleling Unit

Manual SY2 (Revision A)

Woodward Governor Company reserves the right to update any portion of this publication at any time. Information provided by Woodward Governor Company is believed to be correct and reliable. However, no responsibility is assumed by Woodward Governor Company unless otherwise expressly undertaken.

© Woodward 1994-2008

Content

1.	Application	4
2.	Function.....	5
3.	Front plate	7
4.	Settings.....	8
4.1	Dip Switches.....	8
5.	Connection diagram	10
6.	Contact positions.....	11
7.	Technical Data.....	12
8.	Order form	13

1. Application

This unit is normally used for switching on parallel generating sets with either the mains supply or with other generating sets.

Suppositions for switching in parallel are:

- coincidence of the phase
- equal voltages
- equal frequencies

Synchronizing unit SY2 is monitoring these values and gives an output impulse, when they are within their pre-set limits.

Manual synchronization by possibly unskilled personnel is dangerous and can result in damage of the equipment. It is therefore recommendable to use an automatic synchronizing device.

The frequency equalization can be made as follows:

- **by manual adjustment** of the speed governor motor.

another possibility for small generating sets:

- **synchronization without frequency adjustment** under the following suppositions:
 - difference in revolutions between idle and full load no more than 3 %
 - closing time of the alternator circuit breaker (time from giving the command till closing the main contacts) no more than 90 ms.
 - compound alternators with voltage regulation in transient conditions no longer than 0.3 s.
 - no heavy fly wheel

After switching in parallel, start loading the generating set:

- by manual adjustment of the speed governor motor

2. Function

The synchronizer unit SY2 is supplied from one phase of each system. The unit compares the two frequencies, the difference in voltage and measures the phase coincidence and gives led impulse to close the alternator circuit breaker.

Note:

The synchronizing unit SY2 is not suitable for paralleling of synchronous mains. For paralleling, the SY2 requires a beat of the systems to be synchronized. As this "beat" is not available from synchronous mains, the SY2 cannot give the switch-on impulse, not even if the angular system difference should be "0". For paralleling of synchronous mains the Woodward synchronizing unit PSY5 can be used.

For gen. sets with a higher capacity (>1000 kVA) and an increased rotating mass, we would recommend the use of our automatic synchronizing units PSY5.

Possible adjustments, taking into account specific values are:

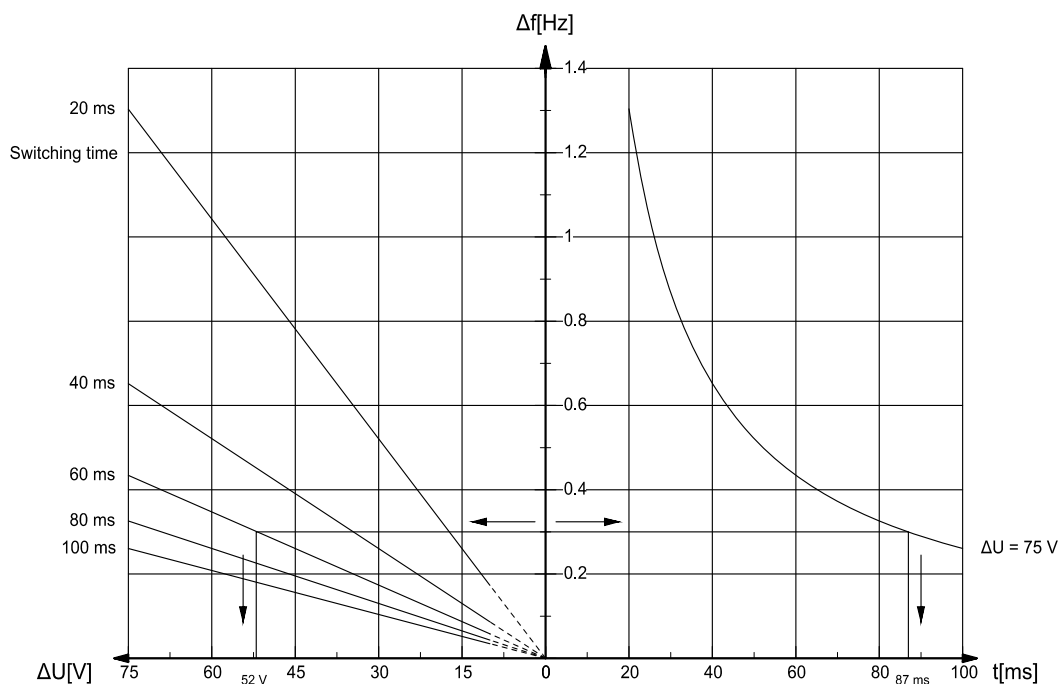
Adjustments

1. max. permissible difference in frequency

The max. permissible frequency difference is dependent on the kind and size of the driving engine and the fly wheel of the generating set, following are a few examples:

- 0.1 Hz: fly wheel sets of medium and big size
- 0.2 Hz: fly wheel sets of small size, turbine sets and Diesel engine generating sets above 500 kW.
- 0.4-0.6 Hz: Diesel engine generating sets from 50 - 500 kW
- 0.7-1.5 Hz: Diesel engine and combustion engine driven generating sets up to 60 kW, with the suppositions: no heavy fly wheel, compound alternators and quick switching circuit breakers.

The max. permissible difference in frequency should be set with DIP switch S2. This is the decisive adjustment for the permissible switching time for the alternator circuit breaker, adjusted with DIP switch S1 and S3.



2. Permissible switching time and adjustment of impulse length

Only quick switching circuit breakers should be used, e.g. air contactors, magnet operated circuit breakers. Choose the max. permissible switching time of the circuit breaker in the right hand part of the diagram.

Example

Frequency difference 0.3 Hz - cuts the line for a switching time of 87 ms. Quick circuit breakers are more advantageous, slow ones not to be used.

For adjustment of DIP switch S3 and the following:

Switching time of the circuit breaker if used, switching time of an auxiliary relay (100 ms: additional time window for switching the CB or relay safety).

e.g. switching time of the circuit breaker 40 ms plus auxiliary relay 20 ms plus 100 ms makes 160 ms, to be set at potentiometer 3.

3. Leading of the impulse

The main contacts of the circuit breaker should close exactly at the moment when the phase coincidence is given.

This is the reason why the output impulse is leaded. The necessary leading time is dependent on the max. permissible frequency difference (DIP switch S2) and the switching time of the alternator circuit breaker.

This unit measures the voltage difference of the two systems in order to give the exact lead time.

This permissible voltage difference should be set at DIP switch S1 in accordance to the left hand part of the diagram.

Example:

With the above used values:

Frequency difference 0.3 Hz; circuit breaker 40 ms; auxiliary relay 20 ms makes 60 ms starting at 0.3 Hz crossing the line for 60 ms one finds under this crossing the adjustment of 52 V to be set at DIP switch.

For alternators with a voltage difference between idle and full load a higher value up to 10 V is necessary.

The dashed range of the straight line (difference voltage below 10 V) is normally not reached, since the voltage of the alternators has a large harmonic content.

The values are related to a unit with a nominal voltage of 230 V. For units with other nominal voltages, the values of ΔU have to be multiplied by the factor $U_N/230$ V.

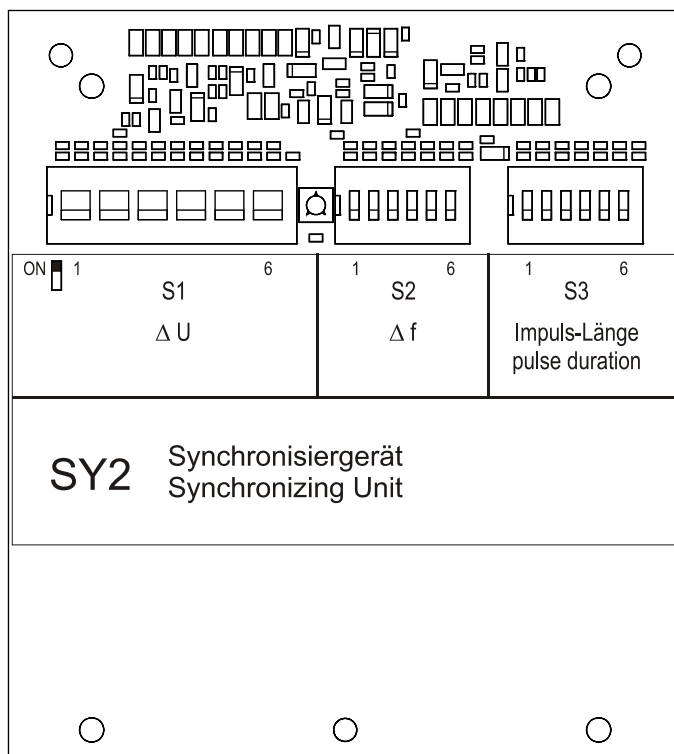
Contact: "no voltage on bus bar system"

Synchronizer unit SY2 has one additional contact which is open when the bus bar system is under voltage and closed when there is no voltage, terminals a and 6. This contact can be used to switch in the alternator circuit breaker directly without synchronization in case of no voltage on the bus bar system.

Additional information for marine applications

According to the germanischer Lloyd it is not allowed to set the frequency difference higher than 1 Hz.

3. Front plate



4. Settings

4.1 Dip Switches

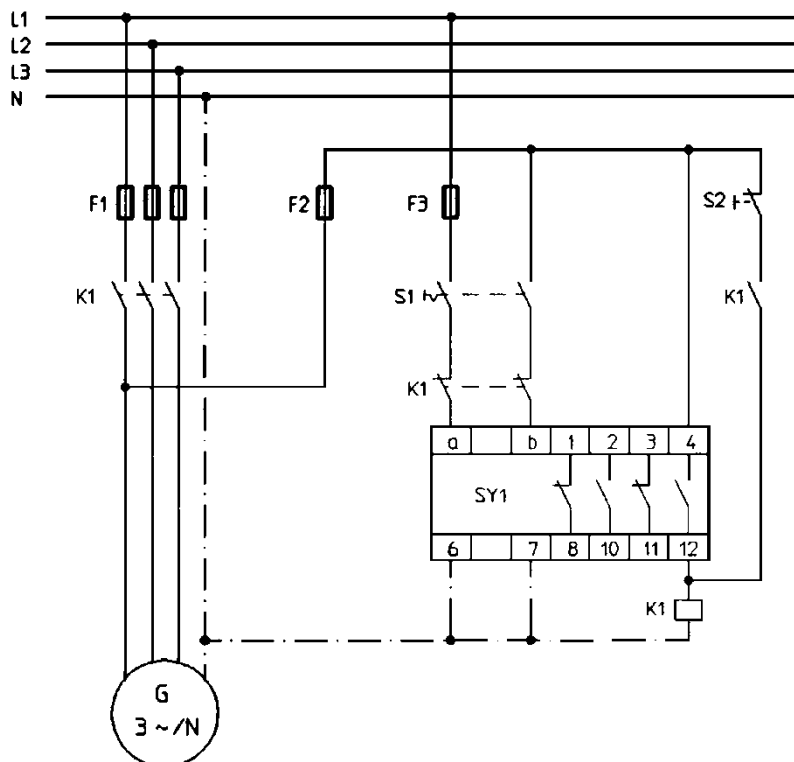
At the DIP switch blocks S1, S2 and S3 64 different values for voltage difference, frequency difference and pulse duration can be adjusted

The table on the following page is used for adjusting the above-mentioned quantities.

For adjusting the max. permissible voltage difference ΔU (DIP switch block S1) the rated voltage U_N of the device has to be observed.

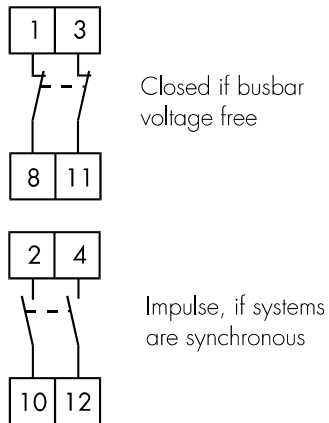
U _N = 110 V S1 ΔU [V]	U _N = 230 V S1 ΔU [V]	U _N = 400 V S1 ΔU [V]	S2 Δf [Hz]	S3 Pulse duration [ms]	DIP 1	DIP 2	DIP 3	DIP 4	DIP 5	DIP 6
45.0	90.0	135.0	0.10	500	0	0	0	0	0	0
44.6	89.2	133.7	0.10	494	0	0	0	0	0	1
43.9	87.8	131.6	0.11	487	0	0	0	0	1	0
43.2	86.4	129.6	0.12	481	0	0	0	0	1	1
42.5	85.0	127.5	0.13	475	0	0	0	1	0	0
41.9	83.7	125.6	0.14	468	0	0	0	1	0	1
41.2	82.4	123.6	0.15	462	0	0	0	1	1	0
40.6	81.1	121.7	0.16	456	0	0	0	1	1	1
39.9	79.9	119.8	0.17	449	0	0	1	0	0	0
39.3	78.6	117.9	0.18	443	0	0	1	0	0	1
38.7	77.4	116.1	0.20	437	0	0	1	0	1	0
38.1	76.2	114.3	0.21	430	0	0	1	0	1	1
37.5	75.0	112.6	0.23	424	0	0	1	1	0	0
36.9	73.9	110.8	0.24	417	0	0	1	1	0	1
36.4	72.8	109.1	0.26	411	0	0	1	1	1	0
35.8	71.7	107.5	0.27	405	0	0	1	1	1	1
35.3	70.6	105.9	0.29	398	0	1	0	0	0	0
34.8	69.5	104.3	0.31	392	0	1	0	0	0	1
34.2	68.5	102.7	0.32	386	0	1	0	0	1	0
33.7	67.5	101.2	0.34	379	0	1	0	0	1	1
33.2	66.5	99.7	0.35	373	0	1	0	1	0	0
32.8	65.5	98.3	0.37	367	0	1	0	1	0	1
32.3	64.6	96.8	0.38	360	0	1	0	1	1	0
31.8	63.6	95.4	0.40	354	0	1	0	1	1	1
31.4	62.7	94.1	0.42	348	0	1	1	0	0	0
30.9	61.9	92.8	0.43	341	0	1	1	0	0	1
30.5	61.0	91.5	0.45	335	0	1	1	0	1	0
30.1	60.2	90.2	0.46	329	0	1	1	0	1	1
29.7	59.3	89.0	0.47	322	0	1	1	1	0	0
29.3	58.6	87.8	0.49	316	0	1	1	1	0	1
28.9	57.8	86.7	0.50	310	0	1	1	1	1	0
28.5	57.0	85.6	0.52	303	0	1	1	1	1	1
28.2	56.3	84.5	0.53	297	1	0	0	0	0	0
27.8	55.6	83.4	0.55	290	1	0	0	0	0	1
27.5	54.9	82.4	0.57	284	1	0	0	0	1	0
27.1	54.3	81.4	0.58	278	1	0	0	0	1	1
26.8	53.6	80.5	0.60	271	1	0	0	1	0	0
26.5	53.0	79.6	0.62	265	1	0	0	1	0	1
26.2	52.4	78.7	0.64	259	1	0	0	1	1	0
25.9	51.9	77.8	0.66	252	1	0	0	1	1	1
25.7	51.3	77.0	0.68	246	1	0	1	0	0	0
25.4	50.8	76.2	0.70	240	1	0	1	0	0	1
25.2	50.3	75.5	0.73	233	1	0	1	0	1	0
24.9	49.8	74.8	0.75	227	1	0	1	0	1	1
24.7	49.4	74.1	0.78	221	1	0	1	1	0	0
24.5	49.0	73.4	0.81	214	1	0	1	1	0	1
24.3	48.5	72.8	0.85	208	1	0	1	1	1	0
24.1	48.2	72.2	0.88	202	1	0	1	1	1	1
23.9	47.8	71.7	0.92	195	1	1	0	0	0	0
23.7	47.5	71.2	0.97	189	1	1	0	0	0	1
23.6	47.1	70.7	1.01	183	1	1	0	0	1	0
23.4	46.8	70.3	1.06	176	1	1	0	0	1	1
23.3	46.6	69.8	1.12	170	1	1	0	1	0	0
23.2	46.3	69.5	1.18	164	1	1	0	1	0	1
23.0	46.1	69.1	1.24	157	1	1	0	1	1	0
22.9	45.9	68.8	1.31	151	1	1	0	1	1	1
22.8	45.7	68.5	1.39	144	1	1	1	0	0	0
22.8	45.5	68.3	1.47	138	1	1	1	0	0	1
22.7	45.4	68.1	1.55	132	1	1	1	0	1	0
22.6	45.3	67.9	1.65	125	1	1	1	0	1	1
22.6	45.2	67.7	1.75	119	1	1	1	1	0	0
22.5	45.1	67.6	1.86	113	1	1	1	1	0	1
22.5	45.0	67.6	1.97	106	1	1	1	1	1	0
22.5	45.0	67.5	2.00	100	1	1	1	1	1	1

5. Connection diagram



S1 - Automatic synchronization ON - OFF
S2 - alternator circuit breaker OFF
K1 - generator contactor

6. Contact positions

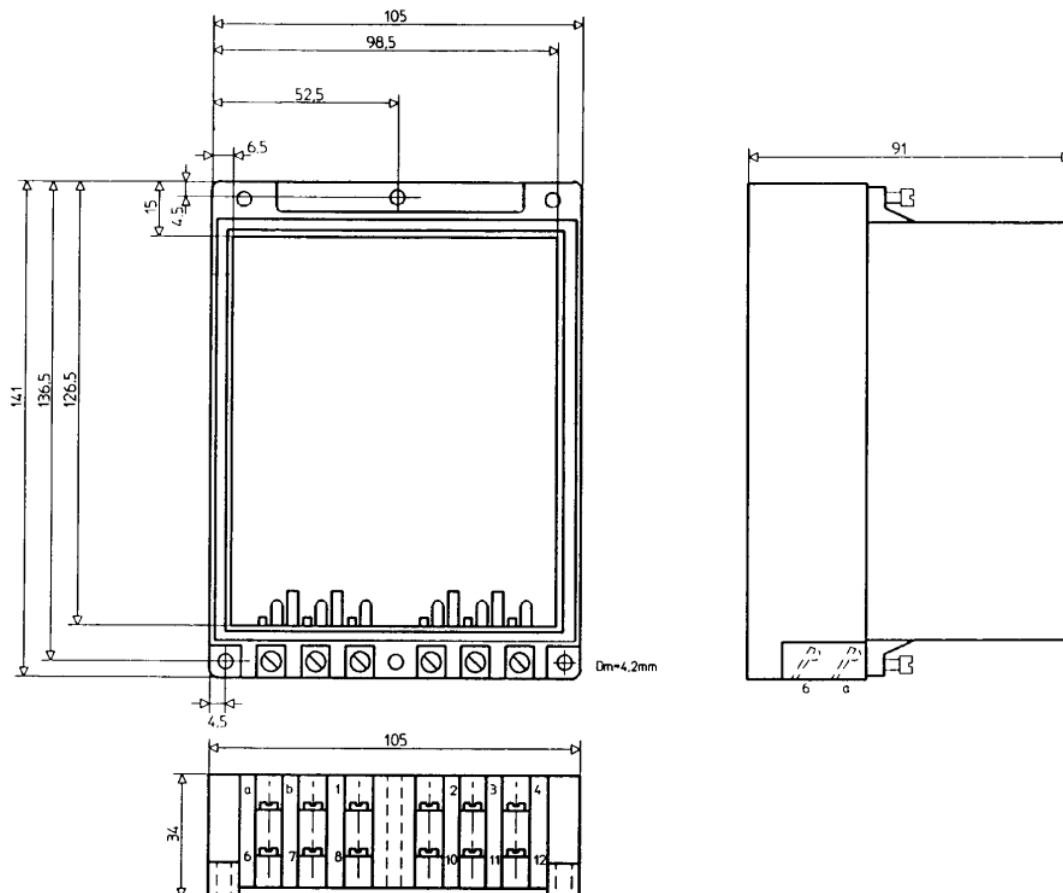
**Attention!**

This device contains electro static sensitive components. When opening the relay case measurements against electro static discharge have to be employed.

7. Technical Data

Type:	SY2
Connection voltage:	110 V, 230 V, 400 V
Nominal frequency:	50 Hz, 60 Hz
Adjustable limits of frequency difference:	0.1 ... 2 Hz
Adjustable limits of voltage difference:	22.5 ... 45 V AC at UN = 110 V 45 ... 90 V AC at UN = 230 V 67.5 ... 135 V AC at UN = 400 V
Adjustable length of impulse:	0.1 ... 0.5 s
Power consumption:	ca. 3 VA
Permissible voltage tolerance:	+10/-15%
Permissible switch-on time:	100%
Contacts:	two NO-contact for switching in parallel two NC-contact for bus bar voltage
Contact capacity:	max. 660 VA at 230 V AC
Case:	Woodward-standard case H x W x D: 141 x 105 x 91 mm
Connection terminals:	Metric 4, wires max. 2.5 mm ²
Type of protection:	Case IP10, terminals IP00
Operative position:	independent
Weight:	0.4 kg
Service life:	10 ⁶ operations
Maintenance:	none
temperature range at storage:	- 25°C bis + 70°C
operation:	- 25°C bis + 55°C

Dimensions and drill-holes



8. Order form

Synchronizing unit		SY2		
For switching in parallel alternators with the mains supply or another alternator				
Measuring voltage	110 V/ AC		110	
	127 V/AC		127	
	230 V/AC		230	
	400 V/AC		400	
Rated frequency	50 Hz			50

**Woodward Kempen GmbH**

Krefelder Weg 47 · D – 47906 Kempen (Germany)
Postfach 10 07 55 (P.O.Box) · D – 47884 Kempen (Germany)
Phone: +49 (0) 21 52 145 1

Internet

www.woodward.com

Sales

Phone: +49 (0) 21 52 145 216 or 342 · Telefax: +49 (0) 21 52 145 354
e-mail: salesEMEA_PGD@woodward.com

Service

Phone: +49 (0) 21 52 145 614 · Telefax: +49 (0) 21 52 145 455
e-mail: SupportEMEA_PGD@woodward.com