



Heinzmann GmbH & Co. KG
Engine & Turbine Controls

Am Haselbach 1
D-79677 Schönau (Schwarzwald)
Germany






Phone +49 7673 8208-0
Fax +49 7673 8208-188
E-mail info@heinzmann.com
www.heinzmann.com

V.A.T. No.: DE145551926

HEINZMANN®
Electronic Speed Governors

Synchronizing Unit

SyG 02 and SyG 02-SB

 <p>Warning</p>	<p>Read this entire manual and all other publications appertaining to the work to be performed before installing, operating or servicing your equipment.</p> <p>Practice all plant and safety instructions and precautions.</p>
 <p>Danger</p>	<p>Failure to follow instructions may result in personal injury and/or damage to property.</p> <p>HEINZMANN will refuse all liability for injury or damage which results from not following instructions</p>
 <p>Danger! High Voltage</p>  <p>Danger</p>	<p>Please note before commissioning the installation:</p> <p>Before starting to install any equipment, the installation must have been switched dead!</p> <p>Be sure to use cable shieldings and power supply connections meeting the requirements of the <i>European Directive concerning EMI</i>.</p> <p>Check the functionality of the existing protection and monitoring systems.</p>
 <p>Danger</p>	<p>To prevent damages to the equipment and personal injuries, it is imperative that the following monitoring and protection systems have been installed:</p> <p>Overspeed protection acting independently of the speed governor</p> <p>Overtemperature protection</p> <p>HEINZMANN will refuse all liability for damage which results from missing or insufficiently working overspeed protection</p> <p>Generator installation will in addition require:</p> <p>Overcurrent protection</p> <p>Protection against faulty synchronization due to excessive frequency, voltage or phase differences</p> <p>Reverse power protection</p>
	<p>Overspeeding can be caused by:</p> <p>Failure of the voltage supply</p> <p>Failure of the actuator, the control unit or of any accessory device</p> <p>Sluggish and blocking linkage</p>



Warning

Electronically controlled injection (MVC) will in addition require to observe the following:

With **Common Rail** systems a separate mechanical flow limiter must be provided for each injector pipe.

With **Pump-Pipe-Nozzle (PPN)** and **Pump Nozzle (PNE)** systems fuel release may be enabled only by the movement of control piston of the solenoid valve. This is to inhibit fuel from being delivered to the injection nozzle in case of seizure of the control piston.



Warning

The examples, data and any other information in this manual are intended exclusively as instruction aids and should not be used in any particular application without independent testing and verification by the person making the application.



Danger

Independent testing and verification are especially important in any application in which malfunction might result in personal injury or damage to property.

HEINZMANN make no warranties, express or implied, that the examples, data, or other information in this volume are free of error, that they are consistent with industry standards, or that they will meet the requirements for any particular application.

HEINZMANN expressly disclaim the implied warranties of merchantability and of fitness for any particular purpose, even if HEINZMANN have been advised of a particular purpose and even if a particular purpose is indicated in the manual.

HEINZMANN also disclaim all liability for direct, indirect, incidental or consequential damages that result from any use of the examples, data, or other information contained in this manual.

HEINZMANN make no warranties for the conception and engineering of the technical installation as a whole. This is the responsibility of the user and of his planning staff and specialists. It is also their responsibility to verify whether the performance features of our devices will meet the intended purposes. The user is also responsible for correct commissioning of the total installation.

Contents

	Page
1 Safety Instructions and Related Symbols	1
1.1 Basic Safety Measures for Normal Operation.....	2
1.2 Basic Safety Measures for Servicing and Maintenance	2
1.3 Before Putting an Installation into Service after Maintenance and Repair Works	3
2 Application.....	4
3 Method of Operation.....	5
4 Block Diagram of the Synchronizer	6
5 Technical Data	7
6 Electrical Details.....	8
6.1 Specification.....	8
6.2 Electrical Connections.....	9
7 Dimensional Drawing.....	10
8 Setting Up Procedure	11
8.1 Initial.....	11
8.2 Adjusting the Synchronizer	11
8.3 Note for Maintenance Work at the Plant.....	12
9 Special Applications	13
9.1 Synchronization of Island Sets to the Mains	13
9.2 Switch-off of Synchronizer	13
9.3 Stand-by Synchronization	14
10 Ordering Specifications	15
11 Wiring Diagrams	16
12 Trouble Shooting	17
13 Figure List.....	19
14 Order Specifications for Manuals.....	20

1 Safety Instructions and Related Symbols

This publication offers wherever necessary practical safety instructions to indicate inevitable residual risks when operating the engine. These residual risks imply dangers to

persons

product and engine

environment.

The symbols used in this publication are in the first place intended to direct your attention to the safety instructions!



Warning

This symbol is to indicate that there may exist dangers to the engine, to the material and to the environment.



Danger

This symbol is to indicate that there may exist dangers to persons. (Danger to life, personal injury)



Danger!
High
Voltage

This symbol is to indicate that there exist particular danger due to electrical high tension. (Mortal danger).



Note

This symbol does not refer to any safety instructions but offers important notes for better understanding the functions that are being discussed. They should by all means be observed and practiced. The respective text is printed in italics.

The primary issue of these safety instructions is to prevent personal injuries!

Whenever some safety instruction is preceded by a warning triangle labelled “Danger” this is to indicate that it is not possible to definitely exclude the presence of danger to persons, engine, material and/or environment.

If, however, some safety instruction is preceded by the warning triangle labelled “Caution” this will indicate that danger of life or personal injury is not involved.

The symbols used in the text do not supersede the safety instructions. So please do not skip the respective texts but read them thoroughly!

In this publication the Table of Contents is preceded by diverse instructions that among other things serve to ensure safety of operation. It is absolutely imperative that these hints be read and understood before commissioning or servicing the installation.

1.1 Basic Safety Measures for Normal Operation

- The installation may be operated only by authorized persons who have been duly trained and who are fully acquainted with the operating instructions so that they are capable of working in accordance with them.
- Before turning the installation on please verify and make sure that
 - only authorized persons are present within the working range of the engine;
 - nobody will be in danger of suffering injuries by starting the engine.
- Before starting the engine always check the installation for visible damages and make sure it is not put into operation unless it is in perfect condition. On detecting any faults please inform your superior immediately!
- Before starting the engine remove any unnecessary material and/or objects from the working range of the installation/engine.
- Before starting the engine check and make sure that all safety devices are working properly!

1.2 Basic Safety Measures for Servicing and Maintenance

- Before performing any maintenance or repair work make sure the working area of the engine has been closed to unauthorized persons. Put on a sign warning that maintenance or repair work is being done.
- Before performing any maintenance or repair work switch off the master switch of the power supply and secure it by a padlock! The key must be kept by the person performing the maintenance and repair works.
- Before performing any maintenance and repair work make sure that all parts of engine to be touched have cooled down to ambient temperature and are dead!
- Refasten loose connections!
- Replace at once any damaged lines and/or cables!
- Keep the cabinet always closed. Access should be permitted only to authorized persons having a key or tools.

- Never use a water hose to clean cabinets or other casings of electric equipment!

1.3 Before Putting an Installation into Service after Maintenance and Repair Works

- Check on all slackened screw connections to have been tightened again!
- Make sure the control linkage has been reattached and all cables have been reconnected.
- Make sure all safety devices of the installation are in perfect order and are working properly!

2 Application

The HEINZMANN synchronizer was designed to be used for the synchronization of a single generator set to island sets, or the whole island to the mains in connection with any of the electronic governors produced by the HEINZMANN company.

The synchronizer compares the frequency and the phase at zero crossing between two generators or between generator and the mains respectively and brings both up to the same values.

The measuring voltage will be checked at zero crossing and if the difference is more than 80 volt, the connection will be suppressed.



Warning

The real generator voltage has to be adjusted before synchronizing with the voltage governor of the generator or a voltage adjusting unit.

When the values agree the synchronization switch in the device is closed. With the closing of the synchronization switch the main contactor resp. (in the case of insufficient switching capacity) an auxiliary contactor may be closed; as an alternative, a standby indication is activated, and the generator set can any time be connected to the mains manually or automatically.

With mains operation, synchronization presupposes appropriate load sharing resp. load adjustment which can be obtained by speed droop or by zero speed droop in conjunction with a load sharing device. The different methods of load sharing are described in our manual E 80 003.

3 Method of Operation

The synchronizer SyG 02 measures the frequency, phase angle and voltage between two generators, or between a generator and the mains. Measurement extends to three phases.

From the circuits for comparison of frequency and phase, the integrator and the output amplifier receive a signal corresponding to the actual deviation. This signal is handed on to the control unit of the electronic speed governor of the prime mover.

Measuring voltage comparison is used as an additional synchronization window; it will be operative only within the range of the zero crossings and have no effect upon the generator voltage. The light emitting diode “Voltage“ will signal that the voltage difference is within the synchronization window.

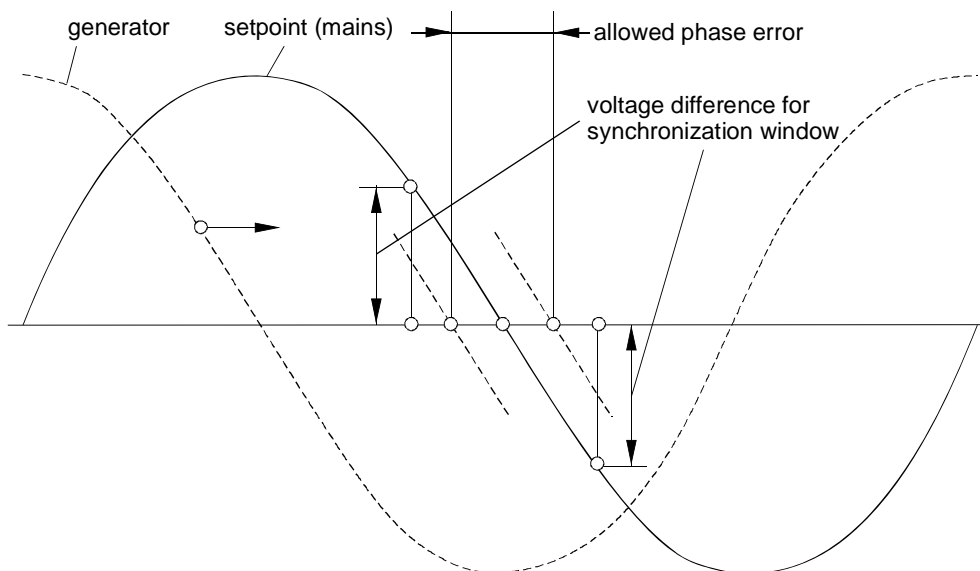


Figure 1: Synchronization Window

When the frequency and phase errors have been reduced to zero the contactor relay is energised with an adjustable time delay between 0.5 and 5 secs., this delay ensures bumpless loading of the generator. When the relay closes there is an automatic reset function which will operate with a 0.5 - 1 sec. delay, and the synchronizer is then disconnected from the governor. However, the supply voltage of the synchronizer must not be switched off by no means. This would cause a stationary speed change.



Note

The voltage supply of the synchronizer has to be connected

- *to the generator bar for synchronization of a single aggregate,*
- *to the middle bar (consumer bar) when synchronizing with several aggregates.*

4 Block Diagram of the Synchronizer

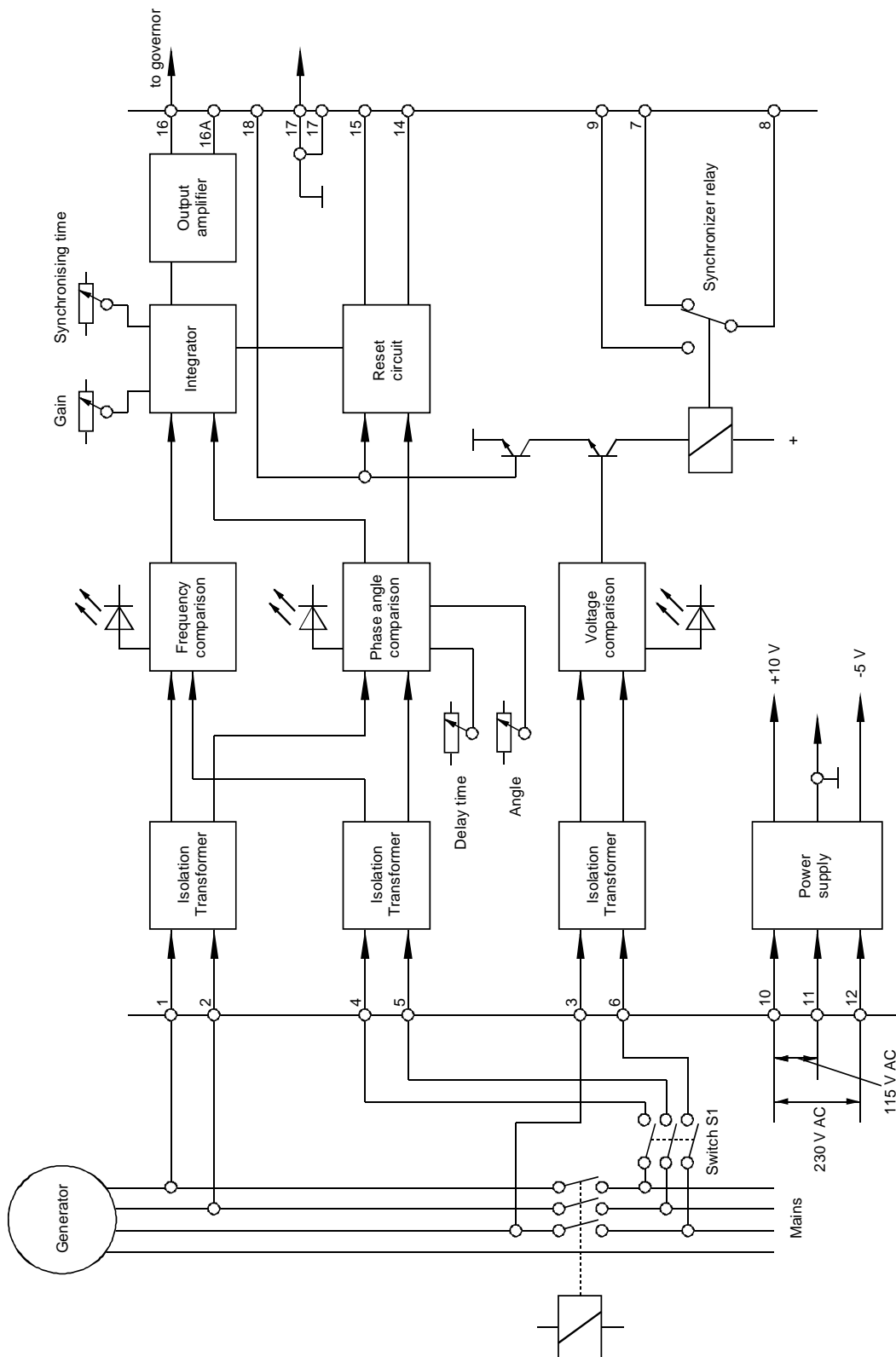


Figure 2: Block Diagramm of the Synchronizer

5 Technical Data

Supply voltage	115 or 230 V AC $\pm 10\%$
Power input	approx. 10 VA
Generator voltage range	115 - 440 V AC phase to phase
Generator frequency range	50/60 Hz (special type up to 400 Hz)
Contact load of the synchronization switch	maximum 8 A at 250 V AC
Phase angle adjustable	$\pm 2^\circ$ to $\pm 15^\circ$
Voltage detection range (synchronization window)	≤ 80 V AC
Synchronization time	approx. 3 to 15 secs. dependent upon installation
Synchronization puls	approx. 1 sec.
Output signal	1 to 9 V DC
Maximal frequency correction	± 2 Hz
Switching delay adjustable	0.5 up to 5 sec.
Temperature range	-40°C up to $+80^\circ\text{C}$
Weight	approx. 2.6 kg

6 Electrical Details

6.1 Specification

6.1.1 Wiring diagram is described on next page.

6.1.2 The synchronizer can be connected to all HEINZMANN speed governors. For connection details refer to wiring diagram on next page.

6.1.3 The voltage inputs of the synchronizer which are necessary for measuring the frequency, the phase and the voltage appear in order terminals 1 (L1), 2 (L2), 3 (L3) for the generator to be synchronized and in order terminals 4 (L1), 5 (L2), 6 (L3) for the setpoint connections, mains or bus bar.



Warning

Pay attention to correct wiring.

6.1.4 The synchronizer power supply is delivered from a 115 V AC (terminal 10 and 11) or 230 V AC (terminal 10 and 12).

If the voltage of the generator between Phase and Neutral is equal to one of these values, the synchronizer's power supply may be taken from one generator Phase and Neutral.

6.1.5 The contactor relay rating can be at 115 V AC up to 250 V AC max. 8 A resistive load, or at 24 V DC max. 1 A, resistive load. It might be used as an opener (NC, terminals 7 and 8) or as a closing contact (NO, terminals 8 and 9).

6.1.6 For governor connections use terminal 16 and 17 (16 = signal, 17 = 0 volt). The connection cable has to be screened

Terminal 16A is described later with the terminals 14, 15 and 17, 18 in chapter "special applications".

6.2 Electrical Connections

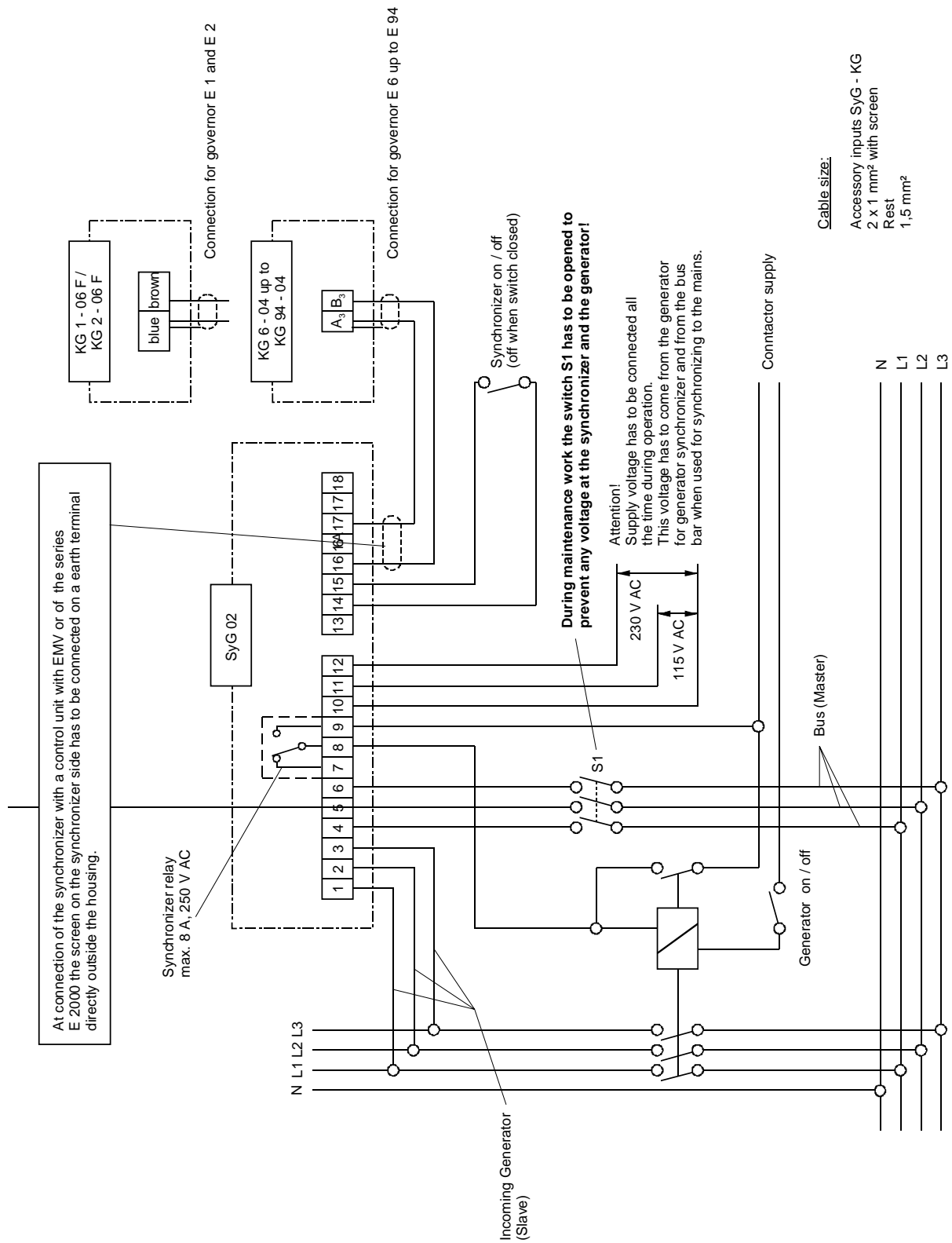


Figure 3: Electrical Connections

7 Dimensional Drawing

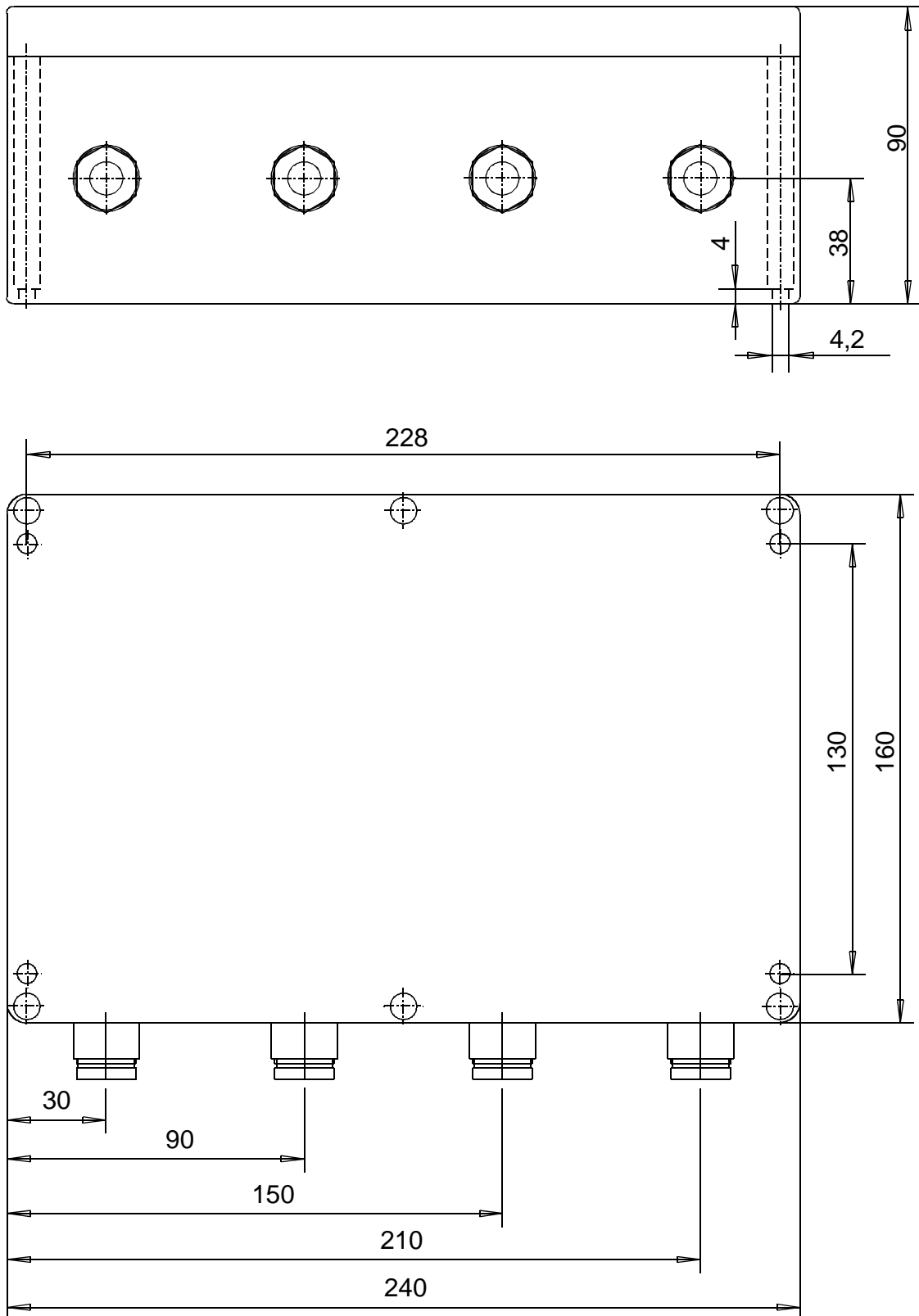


Figure 4: Dimensional Drawing of the Synchronizer

8 Setting Up Procedure

8.1 Initial

Before adjusting the synchronization unit, the voltages of the generators must be set to the same values. Furthermore, the reactive load sharing must be ensured, e.g., by paralleling the generator brushes. If necessary, supplementary information can be obtained from the generator manufacturers.

With links connected between terminals 14 and 15 and terminals 17 and 18 resp. on the synchronizer, start the generators and supply voltage to synchronizer (refer to electrical connection). Set and adjust engine to the synchronous speed, i.e. 50 Hz (refer to the governor manuals). Stop the generator sets and remove the link between terminal 14 and 15.

8.2 Adjusting the Synchronizer

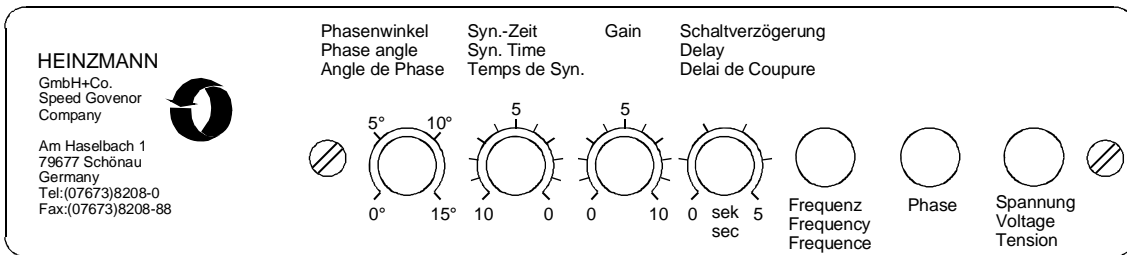


Figure 5: Adjusting Potentiometers and LED's

When the frequency, phase and voltage of both generators are equal, the „synchronizer relay“ will close with an adjustable delay time from 0.5 to 5 secs. For all adjustments, the link between terminals 17 and 18 must remain to inhibit the above “synchronizing relay“. However, the frequency, phase and voltage indicators will remain working to assist with adjusting.

8.2.1 Set the required phase angle. The smaller the phase angle the longer the synchronization time.

8.2.2 Set the required “synchronizer relay“ switching delay (usually 0.5 - 1.5 secs.).

8.2.3 Turn synchronization time and gain anti-clockwise to stop.

- 8.2.4** Start the generator sets.
- 8.2.5** Turn gain clockwise until engine is unstable then turn back anti-clockwise until engine is stable.
- 8.2.6** Turn synchronisation time clockwise until engine is unstable then turn back anti-clockwise until engine is stable.
- 8.2.7** Once the above setting have been made, check that the generator synchronizes correctly by either disturbing the actuator fuel lever or by temporarily linking terminals 14 and 15.

If the generator does not have an acceptable synchronizing time then re-adjust **8.2.1** up to **8.2.6** to obtain the optimum settings.



Danger!
High
Voltage

Before closing the mains breaker for the first time it has to be checked that the voltage over the breaker is near zero volt. This is to insure that there will be no phase mismatch over the mains breaker. Take care of high voltages!

When satisfied with above synchronization, then remove link between terminals 17 and 18 which will allow the mains breaker to operate.

8.3 Note for Maintenance Work at the Plant

During maintenance work, the switch S1 shown in fig. 2 and fig. 3 has to be open!

This is to prevent any voltage coming via the synchronizer to the generator side of the mains breaker.

9 Special Applications

9.1 Synchronization of Island Sets to the Mains

When synchronizing a group of generators to the mains, the mains synchronizing unit must act upon the load sharing device. Normally, this will be resistive load sharing using the load measuring unit LMG 10.

In this case, the load measuring unit LMG 10 has to be connected to terminal 16A instead of terminal 16!

The mains synchronization unit is to be connected to only **one** of the load measuring units LMG 10. The mains synchronization unit will then act via the connection lines upon the the aggregate resp. the aggregates that are currently working. For this, please refer to manual E 02 001-e (Load Measuring Unit LMG 10).

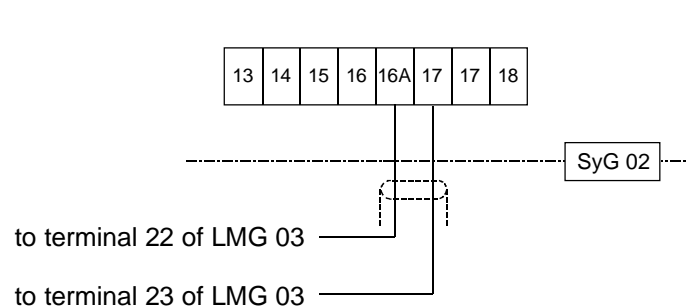


Figure 6: Connection for Group Synchronizer

9.2 Switch-off of Synchronizer

In isolated parallel operation, when there are no voltages yet applied to the bus bar the synchronization units have to be switched off. It is only after connecting the first aggregate manually to the bus bar that the synchronization units of the other aggregates may be activated (otherwise there might be undefined speed oscillations around the synchronization frequency).

Disconnection is executed by a switch. There will be no signal to the governor, and the synchronization relay will not close.

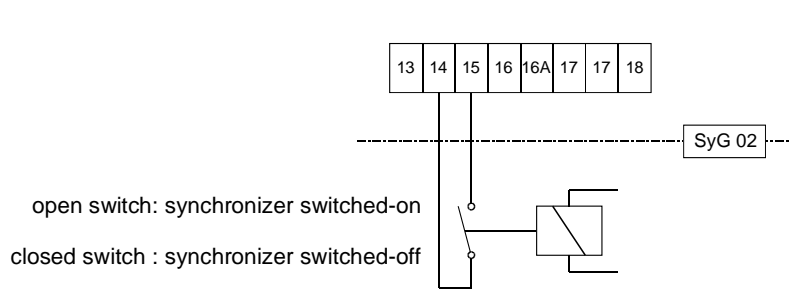


Figure 7: Switch-off of Synchronizer

It is recommended to have this circuitry always provided and to enable the synchronization unit only immediately before the desired synchronization.

9.3 Stand-by Synchronization

For stand-by synchronization the aggregate is brought up to the desired frequency and phase position and then kept in this state. After this, connection to the mains can be executed manually or automatically any time.

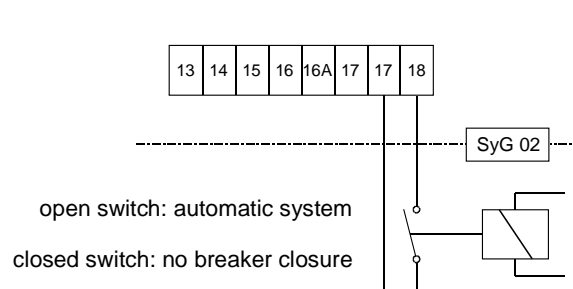


Figure 8: Stand-by Synchronization

10 Ordering Specifications

Spezification of the standard type

SyG 02

For rapid start up service generator sets (no-break generator sets) a modified unit is necessary.
Its specification is:

SyG 02 - SB

11 Wiring Diagrams

For different applications sketches are available, which can be ordered if required.

E Sk 502.01	Generator sets with automatic synchronization and effective load sharing
E Sk 503.00	Generator sets with automatic synchronization and effective load sharing, island and mains operation (basic load)
E Sk 504.00	Generator sets with automatic synchronization and effective load sharing, island and mains operation (load setting for mains operation)
E Sk 505.00	Generator sets with automatic synchronization and effective load sharing, island and mains operation (controlled mains supply)
E Sk 507.00	Generator sets with automatic synchronization and effective load sharing, load anticipation unit, island and basic load mains operation
E Sk 508.00	Generator sets with automatic synchronization and basic load mains operation

12 Trouble Shooting

Symptom	Probable Cause
Synchronizer does not correct frequency	no input voltage on terminals 1, 2, 3 or 4, 5,6 jumper between 14 - 15 input voltage too low no AC power to terminals 10 - 11 (115 V AC) or 10 - 12 (220 V AC) engine speed more than ± 2 Hz difference with bus
Before synchronizing frequency unstable	no input voltage on terminals 4, 5, 6, and nevertheless jumper between 14 - 15 open (synchronizer in operation mode)
During synchronizing frequency unstable	synchronizer gain wrong adjusted Engine governor unstable make jumper between 14 - 15 and observe governor connection governor/synchronizer no screened wire used or screen wrong connected

Symptom	Probable Cause
Synchronizer correct frequency, but no breaker closure occurs	connection between 17 - 18 check if relay on synchronizer works, all 3 LED's must be on adjustment synchronizing time and time delay far too long speed governor unstable
Generator frequency runs always high or low	connections 16 and 17 reversed or input phases incorrectly wired connection generator and bus reversed
After synchronization engine not taking power	speed offset adjust wrong engine speed too low setpoint for load measuring unit LMG 10 too low

13 Figure List

Figure 1: Synchronization Window	5
Figure 2: Block Diagramm of the Synchronizer	6
Figure 3: Electrical Connections	9
Figure 4: Dimensional Drawing of the Synchronizer	10
Figure 5: Adjusting Potentiometers and LED's	11
Figure 6: Connection for Group Synchronizer.....	13
Figure 7: Switch-off of Synchronizer.....	14
Figure 8: Stand-by Synchronization.....	14

14 Order Specifications for Manuals

There is no charge for our technical manuals ordered in reasonable quantities.

Order the necessary manuals on our speed governors from your nearest

[HEINZMANN location](#).

(Please click on “HEINZMANN location” to see the list of our subsidiaries and agents in the world).

Please include the following information:

- your name,
- the name and address of your company (you can simply include your business card),
- the address where you want the manuals sent (if different from above),
- the number(s) (as on front page bottom right) and title(s) of the desired manual(s),
- or the technical data of your **HEINZMANN** equipment,
- the quantity you want.

You can directly use the following fax-form for ordering one or several manuals.

Most of the manuals are available as acrobat PDF-files, too. On request they can be send via e-mail.

We solicit comments about the content and the presentation of our publications. Please, send your comments to:

HEINZMANN GmbH & Co. KG

Service Department

Am Haselbach 1

D-79677 Schönau

Germany

Fax Reply

Order for HEINZMANN technical manuals

Fax-Hotline +49 7673 8208 194

Please send me the following manuals:

Quantity	No. of the manual	Title

Please send me your new sales documentation about

() the HEINZMANN Analogue Governors Application:.....

() the HEINZMANN Digital Governors Application:.....

() the HEINZMANN Gas Engine Equipment Application:.....

Company

Contact Person.....

Department

Address..... Country/Code/Town.....

Phone..... Fax

E-Mail.....

Activity.....

Date