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HEINZMANN®

Engine & Turbine Management

Digital Positioning System 2000

StG 2040.xx-SV-PD
and
StG 2080.xx-SV-PD

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

 **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

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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 the 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 General

HEINZMANN Positioning Systems are complements of the **HEINZMANN** Electronic Governors that have proved their efficiency and reliability in decades of service.

They can be used for a wide range of control applications or in conbination with superior control systems for control purposes of any kind.

In positioning systems, there is a proportional correlation between the position of the actuator output shaft and a command input signal. The following curve shows this relation for the 4 – 20 mA input signal exemplary.

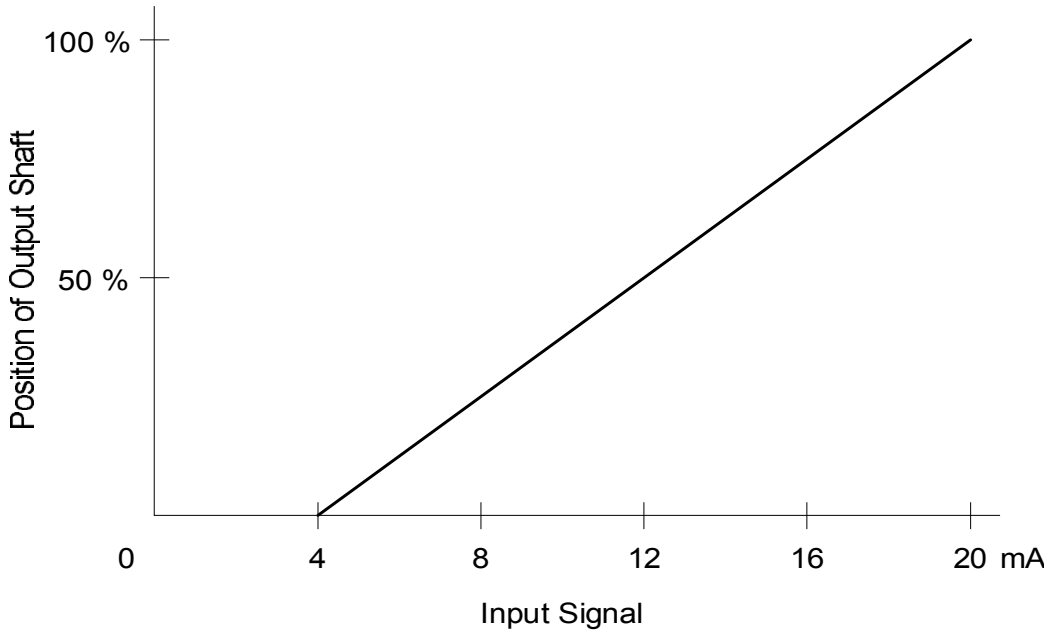


Figure 1: Example for relation between current input signal and position

3 Functional Block Diagram

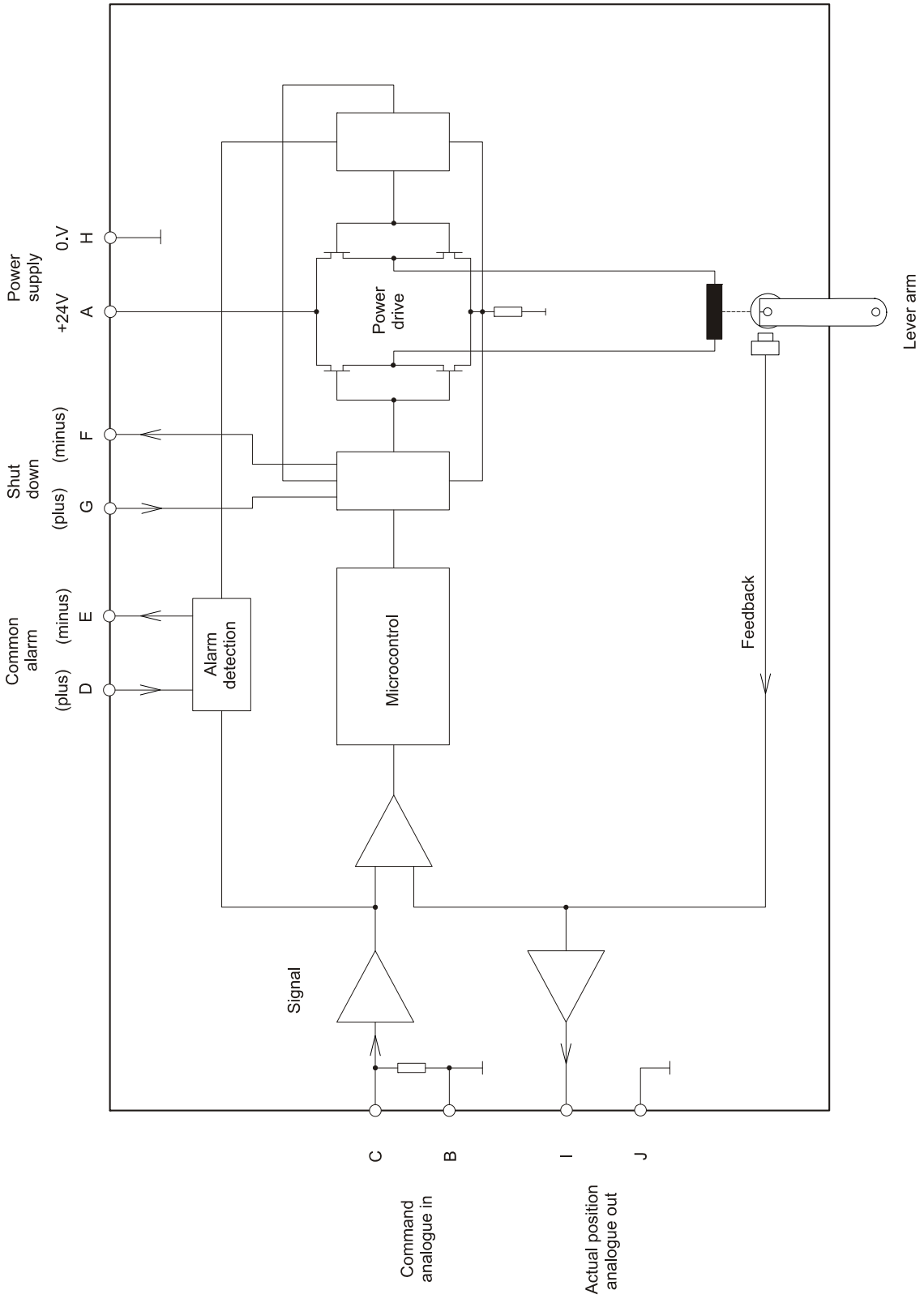


Figure 2: Functional block diagram

4 Operating Mode

The input signal, i.e. the position setpoint for the actuator output shaft is sent to an actual/setpoint comparator receiving the actual value from the actuator feedback. Subsequent signal processing for position control is performed by a microcontrol.

The position control circuit incorporates a 4-quadrant amplifier which allows to drive the actuator electrically in either direction. This ensures optimum utilization of the actuator's rotational force. Together with very low current consumption in steady state operation heat build-up in the actuator also is reduced.

The feedback signal, i.e. the output shaft position signal, is available analogue as 4 – 20 mA current signal or as PWM-signal. It can be used as well for further processing as for indicating actuator position.

Due to the programable microcontrol a lot of functions and capabilities of the Digital Positioning System 2000 can be determined by parameterization. This offers various options for the systems setting up and its configuration.

For instance linear output characteristic, range, type and sense of input and output etc. can be adapted to users requirements.

5 Positioning Control System

StG 2040.XX-SV-PD and StG 2080.XX-SV-PD

5.1 Specification

nom. supply voltage	24 V DC
max. voltage	33 V DC
min. voltage	9 V DC
maximum ripple voltage at max. actuator current	10 % at 100 Hz
acceptable voltage drop at max. actuator current	max. 10 % at control unit
fuse protection	8 A (external, by user)
current consumption	approx. 250 mA, additionally current of actuator
steady state variation	±0.25 %.
storage temperature	-40°C to +100°C.
operating ambient temperature	-25°C to +85°C.
humidity	up to 98 %

"***command***"

proportional input		
alternatively :		
current signal	4 ... 20 mA	350 Ω input resistance
voltage signal	0 … 5 V	100 kΩ input resistance
	0 … 10 V	20 kΩ input resistance
PWM	50 … 500 Hz	100 kΩ input resistance (pull up optional)

"***actual position***"

proportional output		
alternatively		
current signal	4 ... 20 mA	max. 220 Ω burden resistance
PWM	50 … 500 Hz	lowside switch, 4,7 kΩ pullup U_{rest} < 1 V at I_{max} I_{max} = 0.3 A

"***common alarm***"

binary output, galvanically insulated

residual voltage when switching	U_{rest} < 3 V at I_{max} I_{max} = 15 mA

Alarms:

- command out of range - actuator in current limitation - difference from command to actual position	when signal < 2 mA or signal > 22 mA

"***shut down***" binary input

	open	→	normal operation
current signal	> 4mA	→	stop
voltage signal	> 6 V	→	stop
input resitance	Ri > 500 Ω		

NOTE: All specified values for inputs and outputs etc. are standard values.

For the Digital Positioning System 2000 is programmable, these values can be adapted and determined specifically to users requirements to a wide range.

5.2 Design and Mode of Operation

With this type of positioner, a multi-polar magnetized permanent magnet is mounted on the output shaft. Opposite the permanent magnet an armature with the working coils is mounted. When current is applied to the working coils, torque in one direction is generated. Reversing current polarity will generate torque in the opposite direction.

By using special materials and long-term lubricants the positioners are maintenance-free and have a long service life.

The actuator output shaft is provided with a feedback cam for contactless sensing by a probe transmitting the accurate output shaft position to the control unit.

The control unit is installed on the back side of the positioner under a separate cover, opposite of the output shaft journal.

When the actuator is driven against a mechancial stop current limitation will take effect after approx. 20 seconds and reduce current to the actuator to a value sufficiently low to prevent damage to the actuator.

Actuators StG 2040.XX-SV-PD and 2080.XX-SV-PD

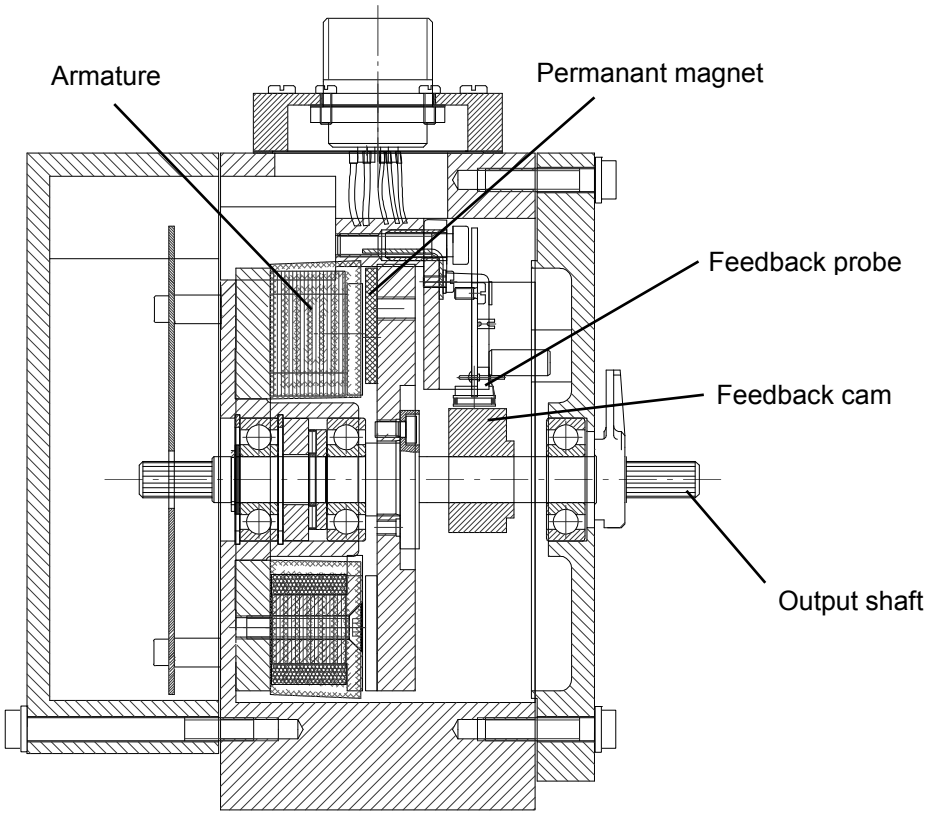


Figure 3: Principle of StG 2040.24-SV-P and 2080.22-SV-P

Altogether, this type of positioner offers following advantages:

- High regulating power working in either direction.
- Extremely low current consumption during steady state and relatively low current consumption on changes of load.
- Indifference to slow voltage changes of power supply; abrupt voltage changes, however, will cause governor disturbances.

5.3 Installation

The positioner must be firmly mounted on the engine using a support with stiffened brackets. Vibrating arrangements as may be caused by weak bracket material or missing stiffenings must be avoided by all means as this will increase vibrations and lead to faster wear of positioner and linkage.

5.4 Actuator Specification

	StG 2040.XX-SV-PD	StG 2080.XX-SV-PD
Effective rotation at the output shaft	68°	68°
Max. torque at the governor output shaft	approx. 4.5 Nm	approx. 8 Nm
Torque in steady state condition	approx. 1.5 Nm	approx. 2,7 Nm
Response time 0-100 % without load	< 100 ms	< 100 ms
Current consumption		
maximum current	approx. 5 A	approx. 5 A
safe current in steady state condition	max. 1.7 A	max. 1.7 A
Storage temperature	-40°C up to +100°C	-55°C up to +110°C
Ambiente temperature in operation	-25°C up to +90°C	-25°C up to +90°C
Humidity	up to 98 %	up to 98 %
Protection grade	IP 65	IP 65
Weight	approx. 6,5 kg	approx. 8,6 kg

5.5 Dimensions

StG 2040.XX-SV-PD

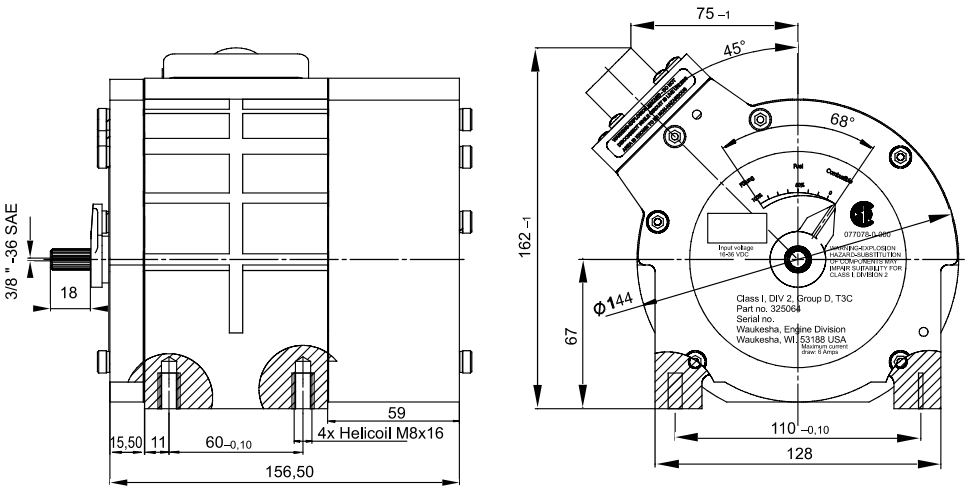


Figure 4: Dimensional drawing StG 2040.XX-SV-PD

StG 2080.XX-SV-PD

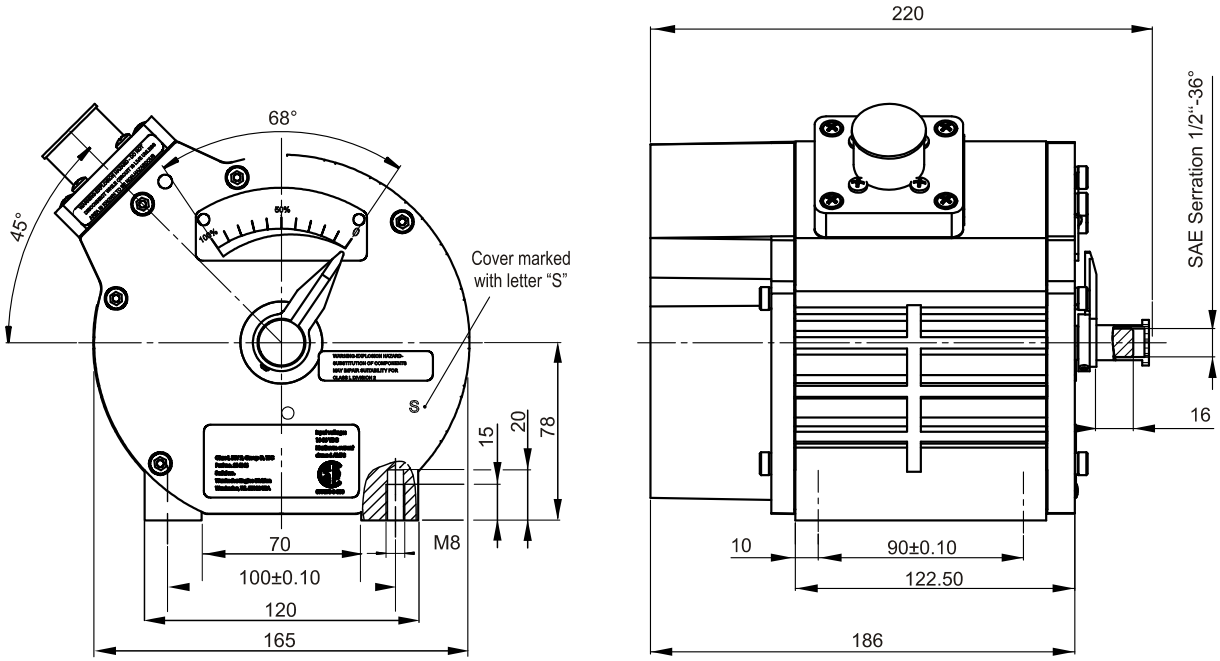


Figure 5: Dimensional drawing StG 2080.XX-SV-PD

6 Regulating Linkage

6.1 Length of Lever Arm

The length of the lever arm is determined in such a way that approx. 90 % of the governor output shaft adjustment angle can be used. Based on this, the rack length L of governors with 68° adjustment angle is calculated as L = 1.8 a, "a" being the travel distance of the injection pump or the carburettor.

6.2 Connecting Linkage

The connecting linkage from the governor to the injection pump or the carburettor should be length-adjustable and have a (pressure or tension) elastic link. If the actuators torque is less than 10 Nm, the elastic link is not needed. If possible, joint rod heads in accordance with DIN 648 should be used as connecting links. The linkage must operate easily and without clearance.

In case of friction or backlash in the linkage connecting actuator and injection pump resp. throttle valve no optimal control is possible.

6.3 Linkage Adjustment for Diesel Engines

The length of the connecting linkage is adjusted in such a way that with the governor in stop position the injection pump is set to 0 - 2 fuel marks. (Travel of the injection pump control rack is limited by the governor.)

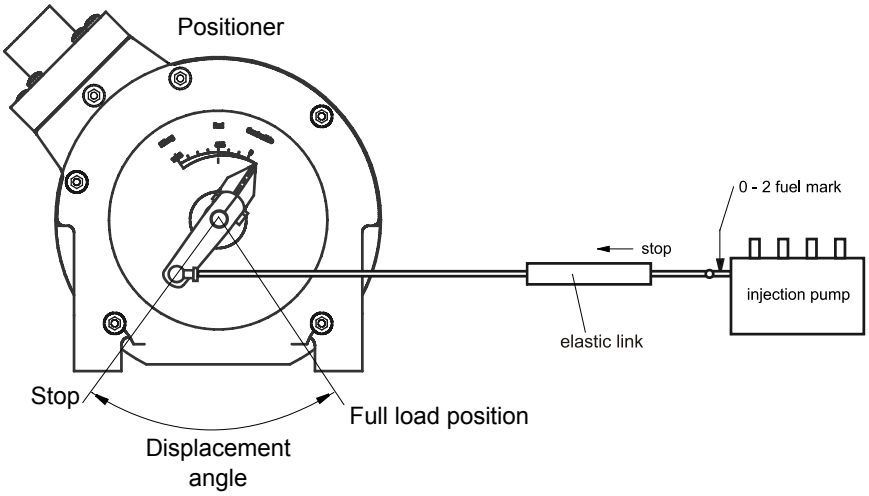


Figure 6: Example of linkage for diesel engines

The resistance of the pressure elastic link is overcome when the control rack has reached the full load stop and the speed continues to decrease (overload). Furthermore, the elastic link is overcome when stopping via the emergency switch.

6.4 Linkage Adjustment for Carburettor Engines

For carburettor or gas engines, the length of the connecting linkage is adjusted in such a way that with the governor in full load position the throttle valve is completely open. In idling speed position, the elastic link must be slightly overcome. This allows adjustment of the idle screw without changing the governor adjustment.

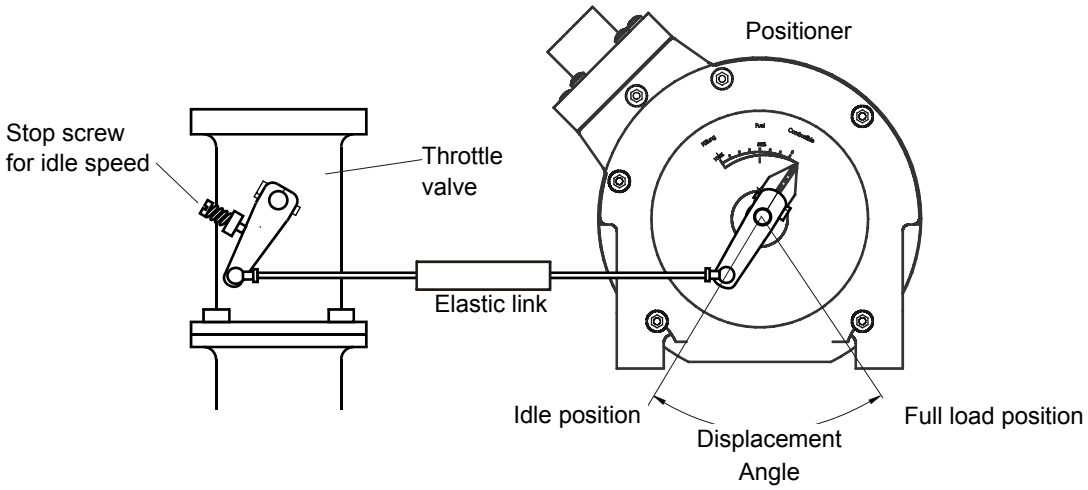


Figure 7: Example of linkage for gas engines

If carburettor or injektion pump are to the left of the governor as opposed to their position on the drawings, then the direction of motion of the elastic link must also be reversed.

7 Electrical Connection

7.1 Wiring Diagram

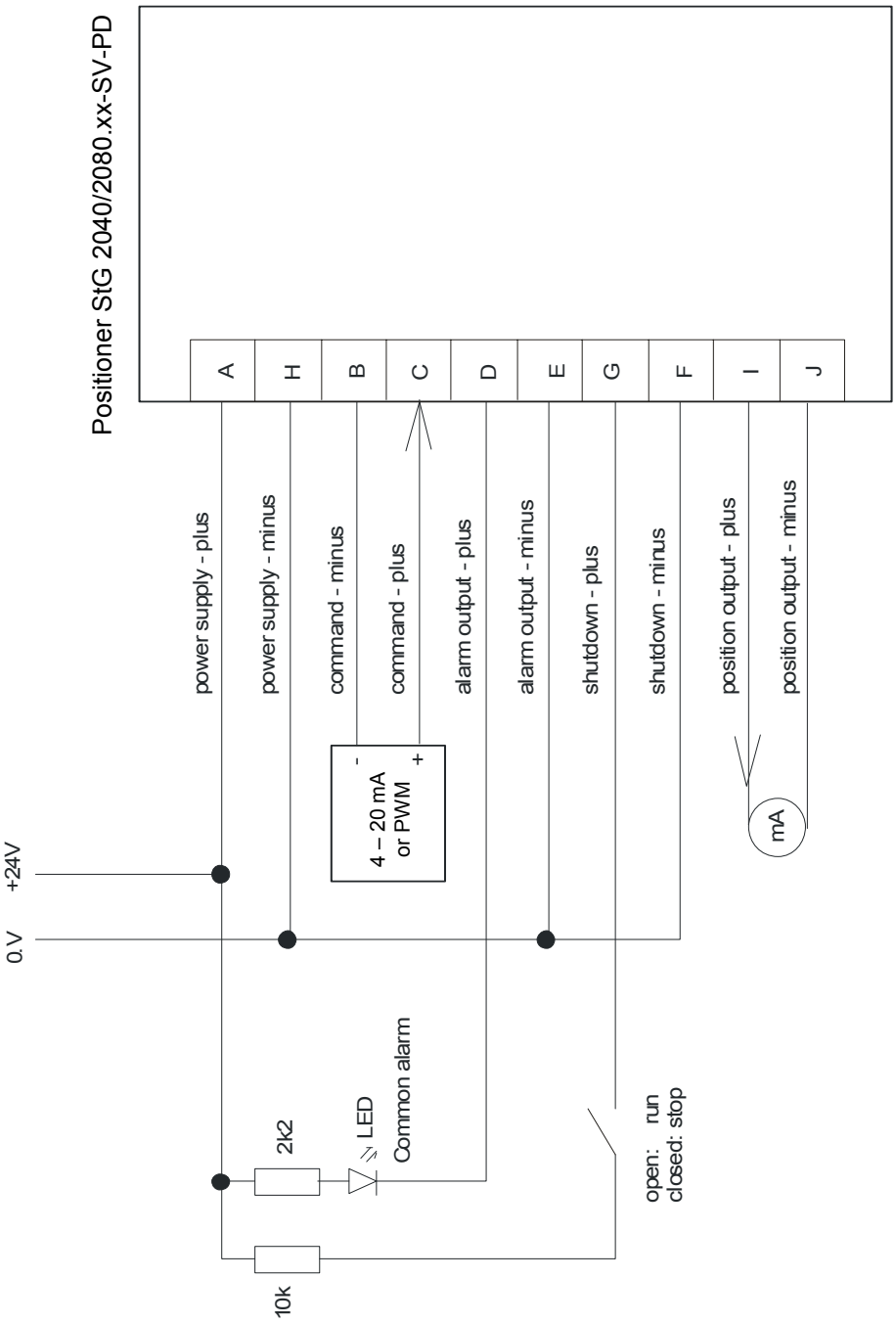


Figure 8: Example of standard wiring diagram

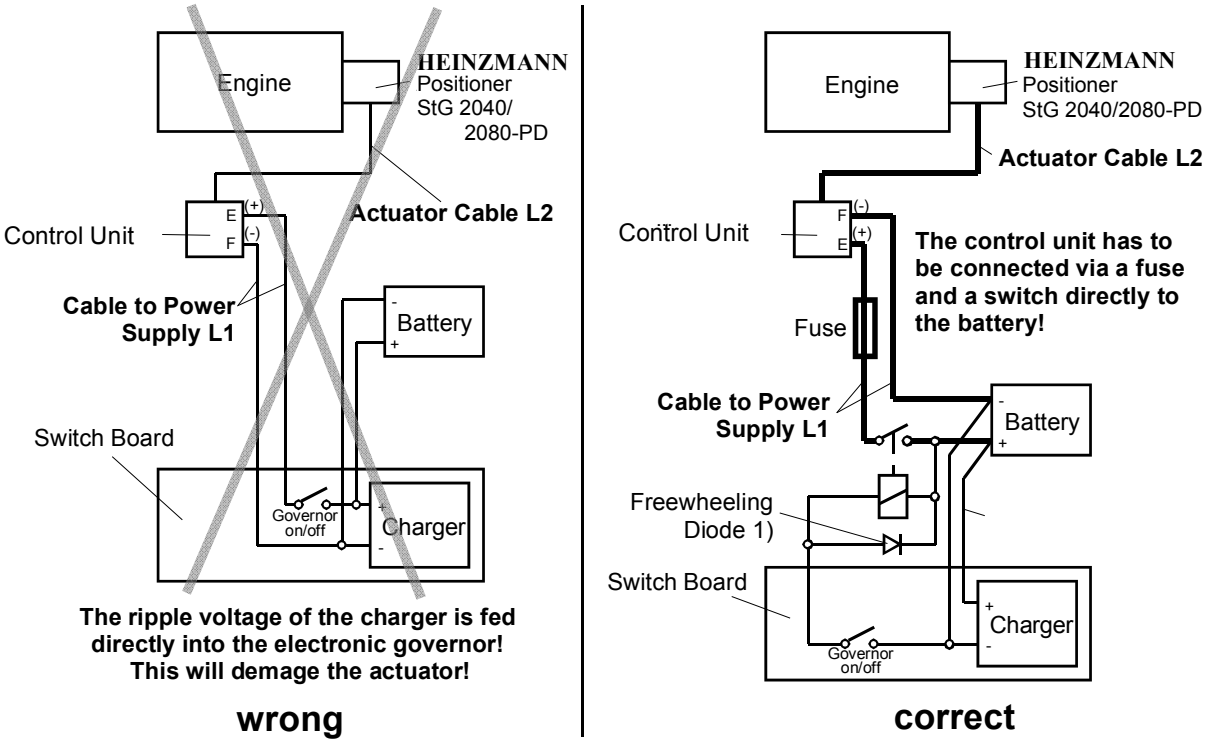
7.2 Connection of Power Supply

Inappropriate choice of power supply or insufficient battery capacitance or incorrect connection of the power supply line or too small cable sizes of the feed line and the motor line of the positioner are bound have an adverse effect upon the performance of the speed governor. In steady state operation, this will cause a heavy increase of current consumption and unnecessary vibration of the positioner drive. The high current consumption will in its turn lead to overheating of the actuator or the position control unit, and the vibration will result in premature wear of the gear and bearing parts or of the linkage.

Note

In altogether, the lifetime of the control system is distinctly reduced by the errors described above.

The following figure shows both a wrong and a correct cabling:



1) Coils (e.g. stopping solenoid, gas valve) have to be equipped with a protective circuit to eliminate high indunctance votages. Diode type e.g. 1N4002

Figure 9: Correct Connection of Power Supply

Warning

If there are battery chargers with rapid charge mode installed in the plant, the rapid charge mode should no be used during operation.

If there is no battery provided, **it is absolutely necessary** that a three phase power supply or a **stabilized** single phase power supply with at least 24 V DC, 10 Amps output power **be used** as a power source.

Warning

The cable sizes and cable lengths described in the wiring diagrams must not be exceeded!

When power supply, battery and cabling have been correctly dimensioned, then on starting the engine or with the positioner operating at maximum current consumption (approx. 6.4 A), a drop of the supply voltage directly at the control unit of approx. 2 Volts maximum only will be admissible.

8 Figure List

9 Download of Manuals

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