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HEINZMANN[®]
Electronic Speed Governor

Basic System

E 2000

 <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

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.

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1 Abbreviations

E	Complete Control System
EA-KG	Elastic Suspension of the Control Unit
EFP	Electronic Foot Pedal
FSchG.....	Frequency/Speed Switch Unit
IA.....	Speed Pickup
KG	Control Unit
LKG.....	Load Control Unit
LMG	Load Sharing/Measuring Unit
LR.....	Load Ramp Unit
LSchG.....	Load Switch Unit
LTG	Load Sharing Unit
NG + NSV.....	Battery Backup Supply Unit
SA.....	Load Anticipation Unit
StG.....	Actuator
SW	Speed Set Point Potentiometer
SyG.....	Synchroniser

2 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.

2.1 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!

2.2 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!

2.3 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!

3 Application

Electronic HEINZMANN - governors are fully electronic and therefore do not require mechanical drive. This provides for very simple and cost- efficient installation on the engine, so that these governors can be used for relatively simple governing tasks.

Their use is especially recommendable when the demands on governing quality are high. These governors provide for very short response times with little overshooting and high speed accuracy with zero droop on the standard model.

Tasks such as automatic synchronization, load sharing, load anticipation, etc. can be handled in a very simple manner through a series of accessories (please refer to our leaflet “Accessories“ and to our accessory brochures).

4 Block Circuit Diagram, Control Circuit

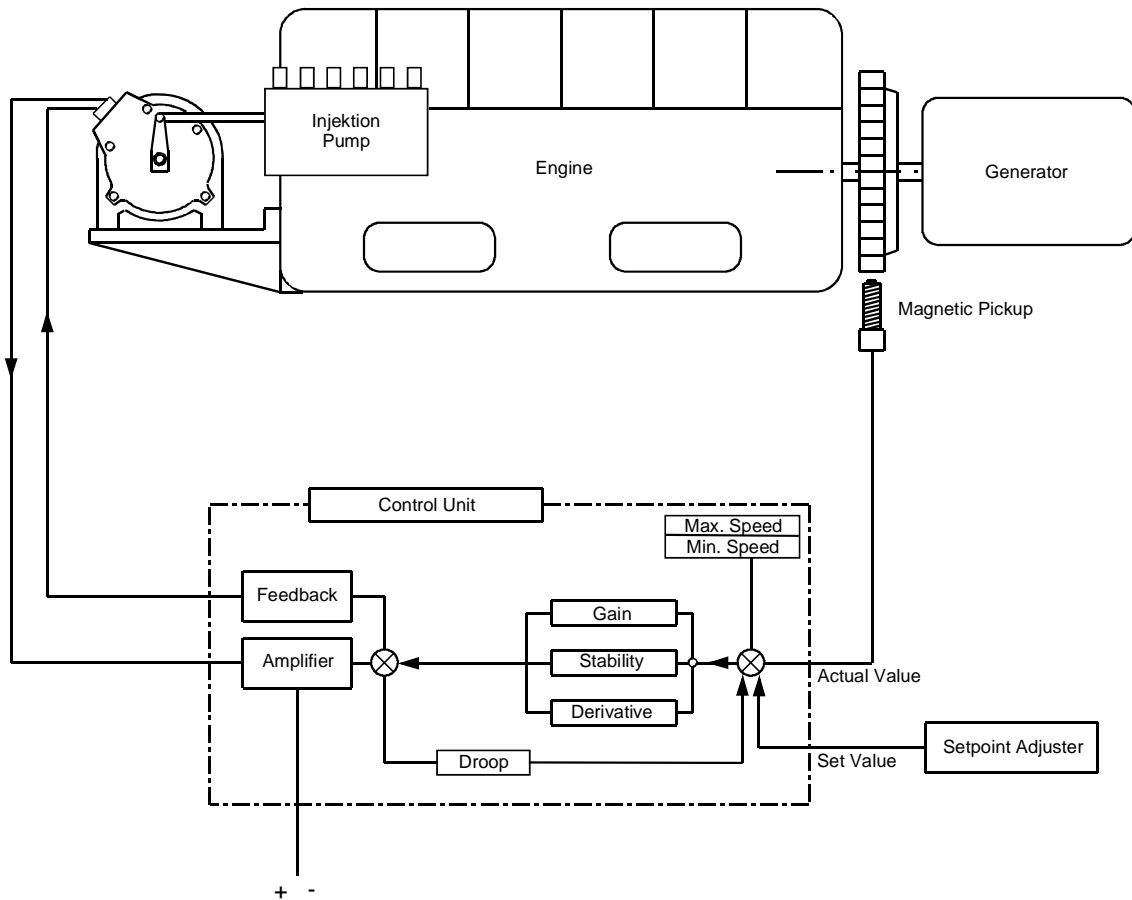


Figure 1: Block Circuit Diagram

5 Mode of Operation

The magnetic pickup detects the actual speed from a gear or punched disk and passes it on to the control unit where it is compared with the required present speed. Output current is directed through various control circuits in the control unit to the actuator. Any deviation in speed from the preset speed modifies the strength of actuator setting and alters the level of fuel injections accordingly. Since the engine speed is compared with a fixed, present value at every stage of loading, the speed in a steady-state condition is always the same, i.e. droop is zero. It is possible, however, to operate the governor with a droop, if required.

In case a magnetic pickup cable or setpoint potentiometer cable breaks, the actuator will move to the stop position with full power for approx. 5 seconds.

In the steady state, a special control circuit permits the governor to pickup the current only from the control unit, taking care that is no current flow towards the actuator motor.

6 Block Diagram of Governor

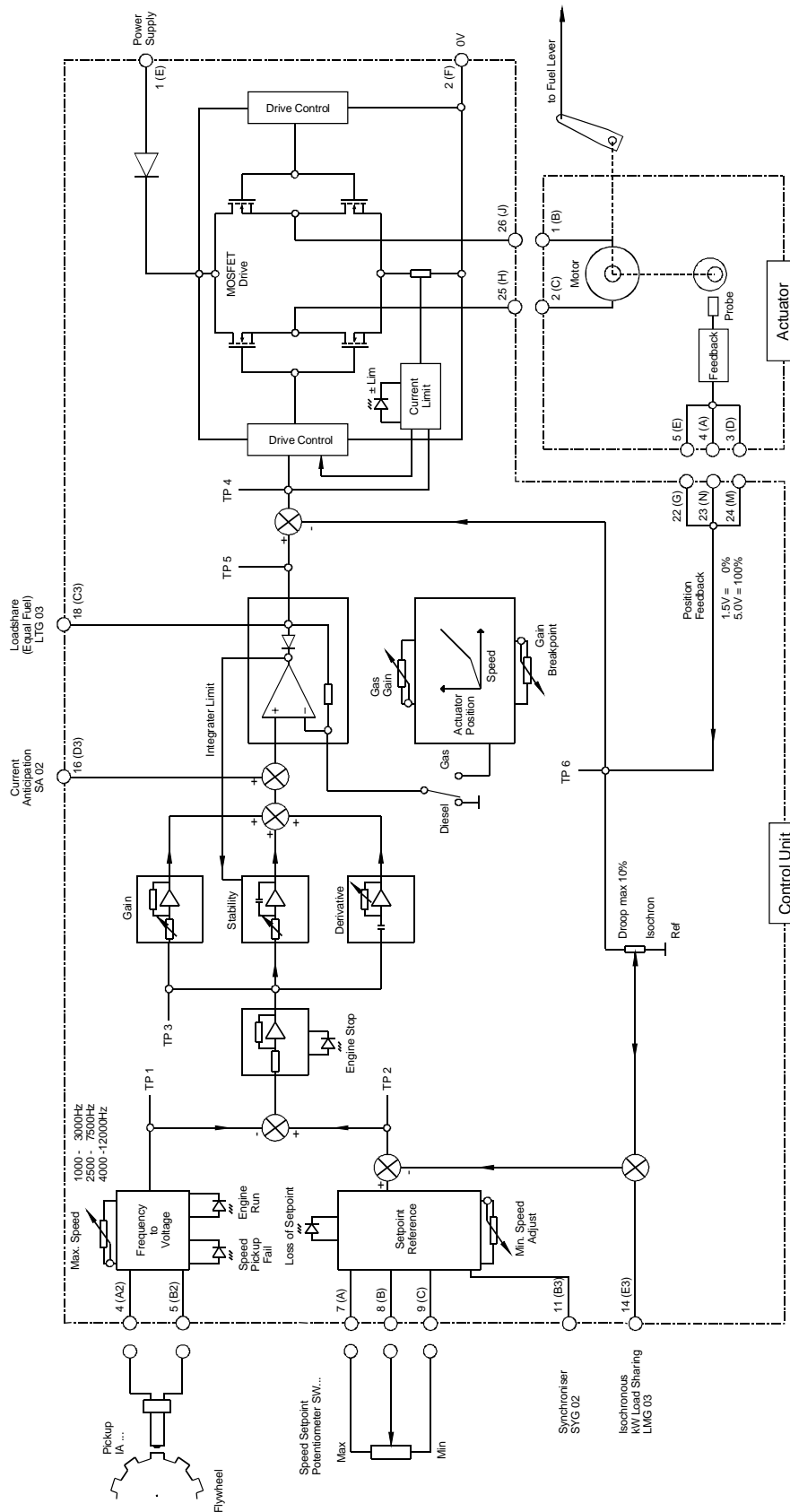


Figure 2: Block Diagram of Governor

7 Magnetic Pickup IA ...

7.1 Technical Datas

Operating principle	inductive sensor
Distance from sensing gear	0.5 to 0.8 mm
Output	0 V .. 10 V AC
Signal form	sine (depending on tooth shape)
Resistance	approx. 52 Ohm
Temperature range	-55°C up to +125°C
Protection grade	IP 55
Vibration	< 10g, 10 .. 100 Hz
Shock	< 50g, 11 ms half sine wave
Corresponding plug	SV 6 - IA - 2K (EDV- No.: 010-02-170-00)

7.2 Installation

The installation of the pickup has to be arranged in such a way as to obtain a frequency as high as possible. Normally, the HEINZMANN governors are designed for a maximum frequency of 12.000 Hz. Frequency (by Hz) is calculated according to the formula

$$f \text{ (Hz)} = \frac{n(1/\text{min}) * z}{60}$$

$$z = \text{number of teeth on the pickup wheel}$$

Example:

$$n = 1.500$$

$$z = 160$$

$$f = \boxed{} = 4000 \text{ Hz}$$

It is preferable to mechanically mount the speed pickup on the starter gear of the toothed flywheel rather than on the camshaft, since the latter only runs at half-speed and therefore only half as many speed readings per rotation are possible.

The pickup gear must consist of magnetic material (e.g., steel, cast iron). Aluminium and plastic materials therefore are not suited!

7.3 Tooth Profile

Any tooth profile is admissible. The top width of the tooth should be 2.5 mm minimum, the gap and the depth of the gap at least 4 mm. For index plates the same dimensions are valid.

Due to tolerances, a radial arrangement of the magnetic pickup is preferable.

7.4 Clearance of Magnetic Pickup

The distance between the magnetic pulse pickup and the tooth top should range from 0.5 to 0.8 mm. (It is possible to screw in the magnetic pickup till it touches the tooth and then unscrew it for about half a turn.)

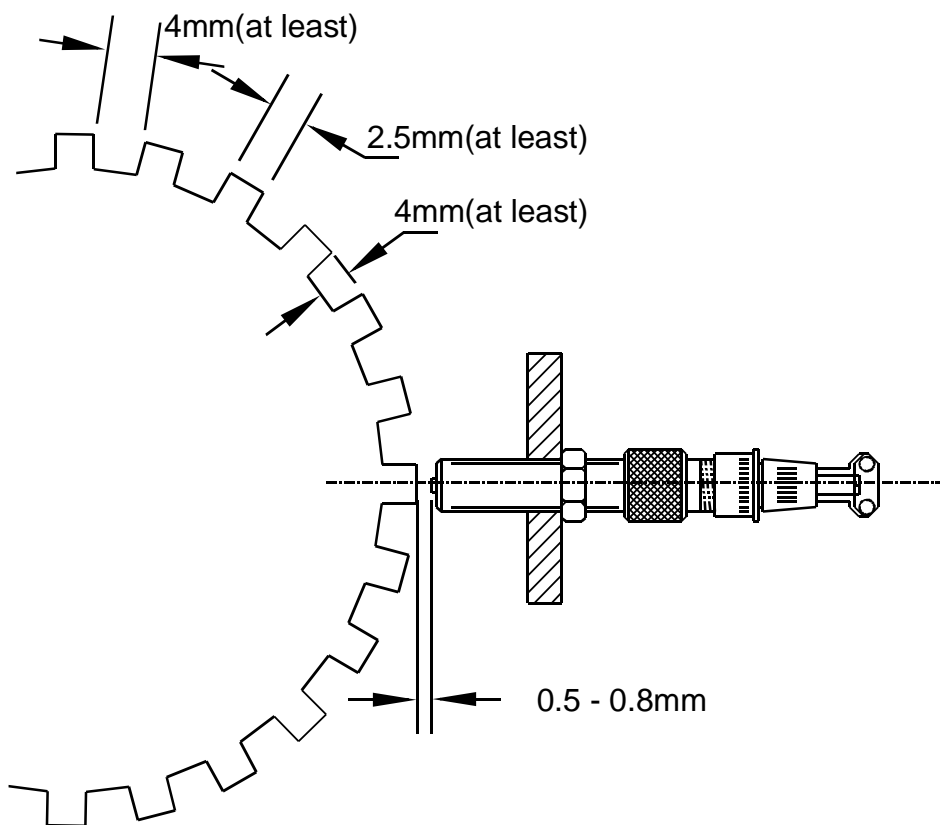


Figure 3: Clearance of Pickup

7.5 Mounting Measurements

7.5.1 Magnetic Pickup with Cable (for Control Unit Version IP 00)

The cable is mounted directly on the pickup and is secured with epoxy resin. The control unit side is prepared with pig tails.

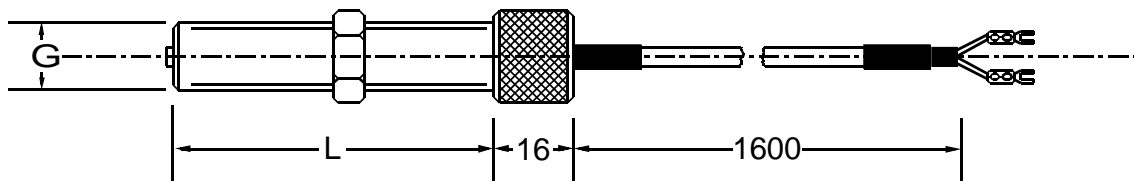


Figure 4: Magnetic Pickup with Cable

TYPE	Thread Length (mm)	Size	Remarks
IA 00-38	38	M 16 x 1,5	cable encapsulated, 1.6 m long, cable end with pig tails
IA 00-76	76	M 16 x 1,5	cable encapsulated, 1.6 m long, cable end with pig tails
IA 10-38	38	5/8"-18UNF-2A	cable encapsulated, 1.6 m long, cable end with pig tails
IA 10-76	76	5/8"-18UNF-2A	cable encapsulated, 1.6 m long, cable end with pig tails

7.5.2 Magnetic Pickup with Plug-in Connector (Version IP 55)

At the pickup has to be connected a cable with plug.

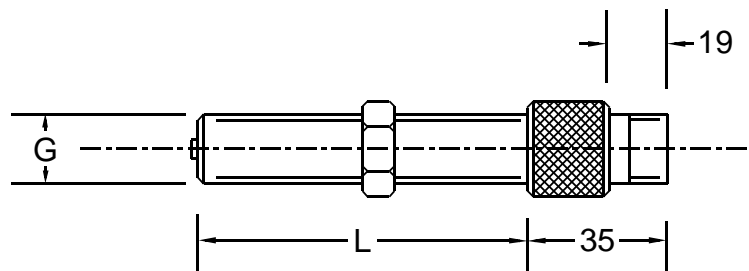


Figure 5: Magnetic Pickup with Plug-in Connector

TYPE	Thread Length (mm)	Size	Remarks
IA 01-38	38	M 16 x 1,5	corresponding plug: SV6-IA-2K
IA 02-76	76	M 16 x 1,5	corresponding plug: SV6-IA-2K
IA 03-102	102	M 16 x 1,5	corresponding plug: SV6-IA-2K
IA 04-125	125	M16 x 1,5	corresponding plug: SV6-IA-2K
IA 11-38	38	5/8"-18UNF-2A	corresponding plug: SV6-IA-2K
IA 12-76	76	5/8"-18UNF-2A	corresponding plug: SV6-IA-2K
IA 13-102	102	5/8"-18UNF-2A	corresponding plug: SV6-IA-2K

Please order e.g. IA 02-76

8 Setpoint Adjuster

The speed setting potentiometer or resistor link must always be connected. When not connected, the governor will not work. The actuator will then always be in a shutdown condition.

Depending on the different applications, various speed set point potentiometers are available for the HEINZMANN electronic speed governors.

8.1 Setpoint Potentiometer SW 01 - 1 - o (one turn)

Displacement angle	approx. 312°
Resistance	5 kOhm
Temperature range	-55°C to + 120°C
Protection grade	IP 00

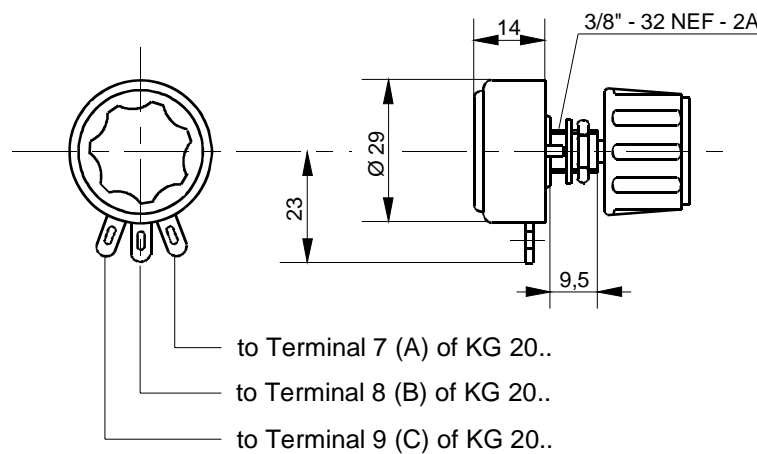


Figure 6: Potentiometer SW 01 - 1

8.2 Setpoint Potentiometer SW 02 - 10 - 0

Displacement angle	10 turns
Resistance	5 kOhm
Temperature range	-55°C to + 105°C
Protection grade	IP 00

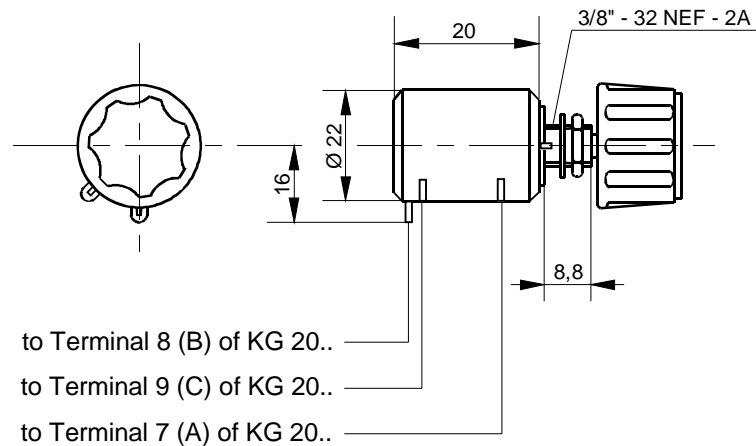


Figure 7: Potentiometer SW 02 - 10

On request, the potentiometers, as specified under 8.1 and 8.2 can be supplied with analogue adjustment knob with lock in place of the standard rotating knob. In this case, ordering specification is SW...-m.

Equally, instead of the knob a clamping fixture can be installed. Ordering specification is to be changed to SW ...-k.

8.3 Motor Potentiometer

These potentiometers permit manual adjustment via the potentiometer or electrical adjustment from various positions via switchers. Motor potentiometer with different adjustment times and with or without optional limit switchers are available. For more information refer brochure E 83 006 - e.

8.4 Setpoint Range

The E 2000 electronic governor has a maximum and minimum speed adjustment. The minimum speed is fully adjustable from approx. 25% up to approx. 85% with respect to the adjusted maximum speed. This high adjusted minimum speed level is very useful with genset applications.

The governor has to be factory preadjusted to the desired maximum pickup frequency. The maximum frequency is divided into three ranges:

- 1000 Hz up to 3000 Hz
- 2500 Hz up to 7500 Hz
- 4000 Hz up to 12000 Hz

The desired maximum frequency should be given with the order, otherwise the unit is set to 4000 Hz.

8.5 Limiting the Adjustment Range of Setpoint Potentiometers

When working with a maximum frequency of 4000 Hz, for example, the "min. speed" potentiometer in the control unit allows the setting of a lower frequency limit of between 1000 and 3500 Hz. If the adjustment range is to be further limited, then the set point potentiometer must be wired in the following way.

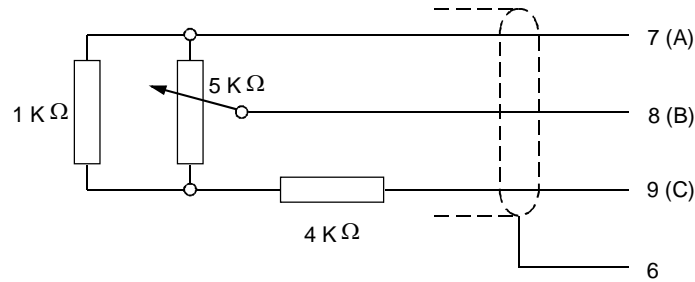


Figure 8: Connection of Limiting Resistors

If the maximum frequency is again 4000 Hz, then the minimum frequency can now be adjusted in the range between approx. 3450 and 3870 Hz.

8.6 Internal Speed Setting

For constant speed governing there is no external setpoint potentiometer necessary. The terminal strip must be connected with a resistor as follows:

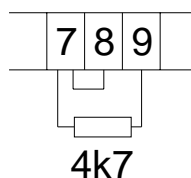


Figure 9: Wiring for internal Speed Setting

The desired speed is adjusted by using the internal "max. speed" potentiometer.

8.7 Setpoint Value Adjustment by Current or Voltage Signal

The setpoint adjuster SW 09 - URI allows setpoint adjustment using voltages between 1 and 5V or currents between 4 and 20 mA. If the signal fails, the governor will set minimum speed according to the 4 mA or 1 V value. For more information refer brochure E 85 003 - e.

8.8 Setpoint Value Adjustment by Adjusting Pulses

The electronic setpoint potentiometer ESW 1 - 01 may be used as an interconnection unit between HEINZMANN speed governors and devices by other companies. It will mainly be used for gensets, perhaps in combination with other load governing equipment. An internal potentiometer is used to adjust the basic speed which may be decreased or increased by pulses from the external equipment. The sensitivity of the unit is adjustable. For more information refer brochure E 97 001 - e.

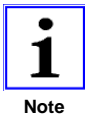
8.9 Setpoint Value Adjustment by Electronic Footpedal

The non- contact signal transducer unit EFP is basically an angular position transducer that translates a foot pedal into a proportional current or voltage for 45° angle rotation. The resulting output can be used for speed setting. For more information refer brochure E 83 005 - e.

8.10 Setpoint Value Adjustment by Pressure

The pneumatic speed setting unit BG 03 can be used for pneumatic speed adjustment. The following types are available:

pressure range	up to 5 bar	BG 03 - 5
	up to 10 bar	BG 03 - 10



Note

In case that electrical setpoint units such as SW 09 - URI, ESW 01- -1, EFP or other non- HEINZMANN units are used, the common negative for this setpoint unit must be taken from the HEINZMANN governor (terminal 2). If this is not done, differences in the electrical potential will guide to a worse governing quality or even to failure of the governor.

9 Control Unit KG 20 ...

9.1 General

There are three types of control units available:

KG 2010	for actuator	StG 2010
KG 2040	for actuator	StG 2040
KG 2080	for actuator	StG 2080

In this manual only the speed governor is described. Load anticipation, load sharing, synchronizer, etc., are shown in our accessories leaflet and in the corresponding manuals.

The control unit can be equipped with either a terminal strip or a plug-in connector. This causes two different kinds of housings.

9.2 Specification

Operating voltage	24 V DC
Maximum voltage	35 V DC
Minimum voltage	20 V DC
Special version	12 V DC \pm 20 %
Maximum ripple voltage	10 % at 100 Hz
Maximum control current	5 A.
Fuse protection of governor	8 A
Current consumption	approx. 150 mA + current of actuator
Storing temperature	-55°C to +85°C.
Operating ambient temperature	-40°C to +70°C.
Humidity	up to 80 %.
Frequency range	500 to 12.000 Hz.
Steady State Variation	\pm 0.25 %.
Speed variation due to temperature for Frequency greater than than 1500 Hz between -40°C and +70°C	\pm 1 %.
Droop or Isochronous Running	0 - 10 % droop.
Protection grade	
KG 20 ... - 01 - 00	IP 00
KG 20 ... - 01 - 55	IP 55
Weight	
KG 20 ... - 01 - 00	1 kg
KG 20 ... - 01 - 55	2.8 kg

9.3 Measurements

Control Unit with terminal strip (KG 20 ... - 01 - 00)

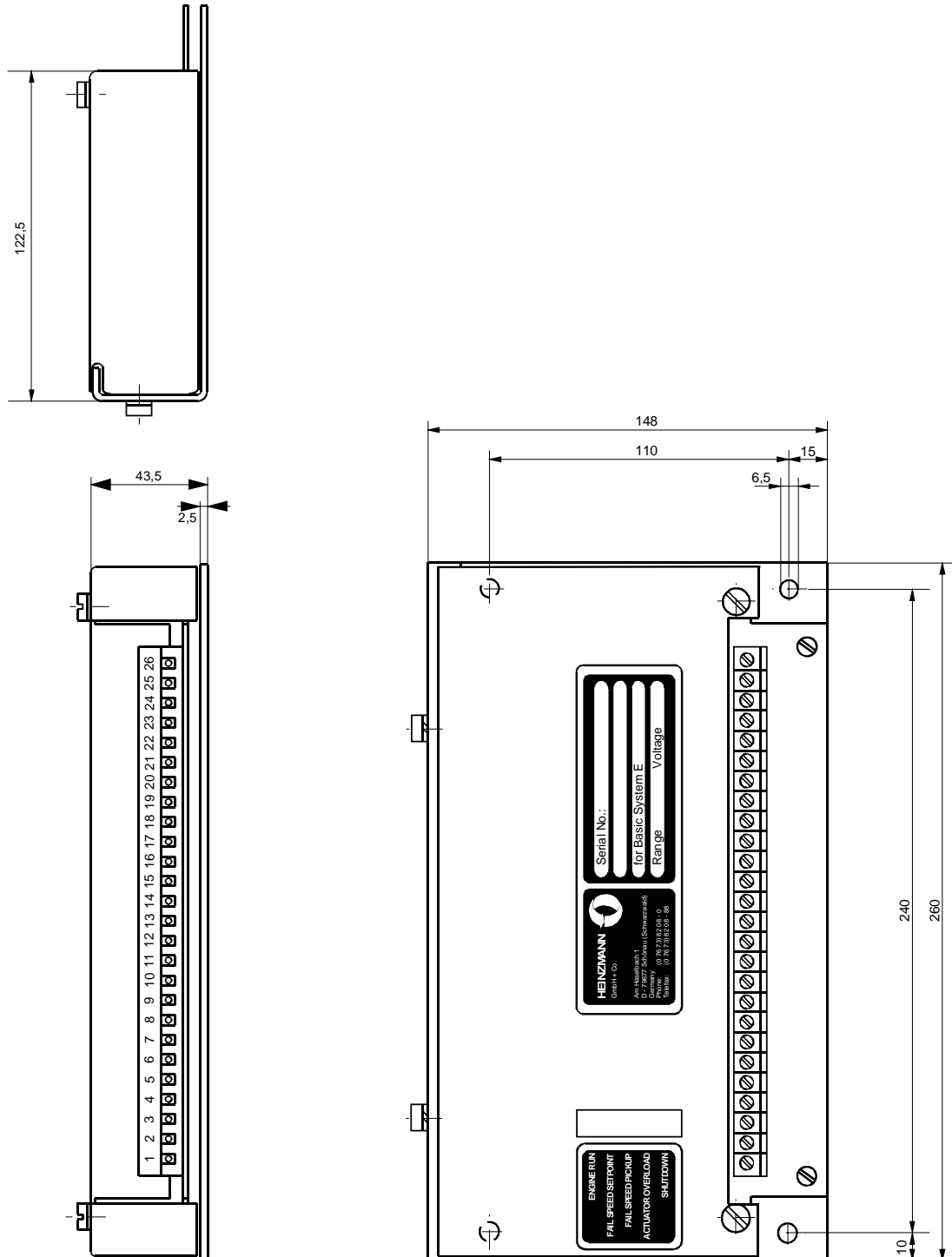


Figure 10: Housing of KG 20 ... - 01 - 00

Control Unit with plug-in connectors (KG 20 ... - 01 - 55)

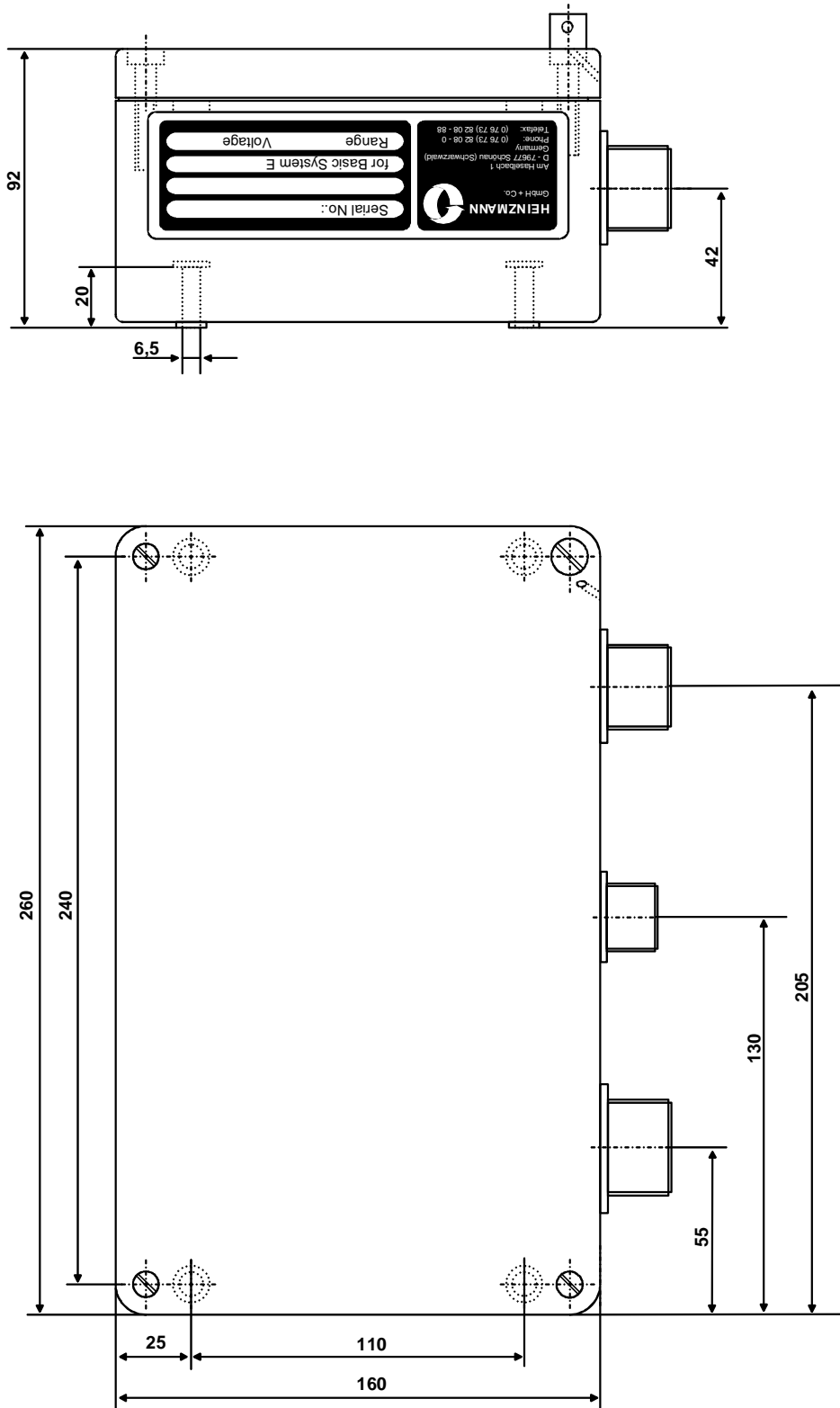


Figure 11: Housing of KG 20 ... - 01 - 55

9.4 Installation

The installation can be done in any place with the least amount of vibration possible and the lowest ambient temperature possible; the maximum cable lengths have to be taken into consideration. There should be no strong magnetic fields in the vicinity of the control unit to avoid disturbances.

The unit cover must be removed for mounting. The mounting positions are outside the housing seal, so that the tightness of the control unit is not negatively influenced by mounting (only version IP 55).

The control unit with terminal strip (version IP 00) has been designed for cabinet installation only. For mounting the unit, please remove the top cover.

10 Actuators

10.1 Design and Mode of Operation

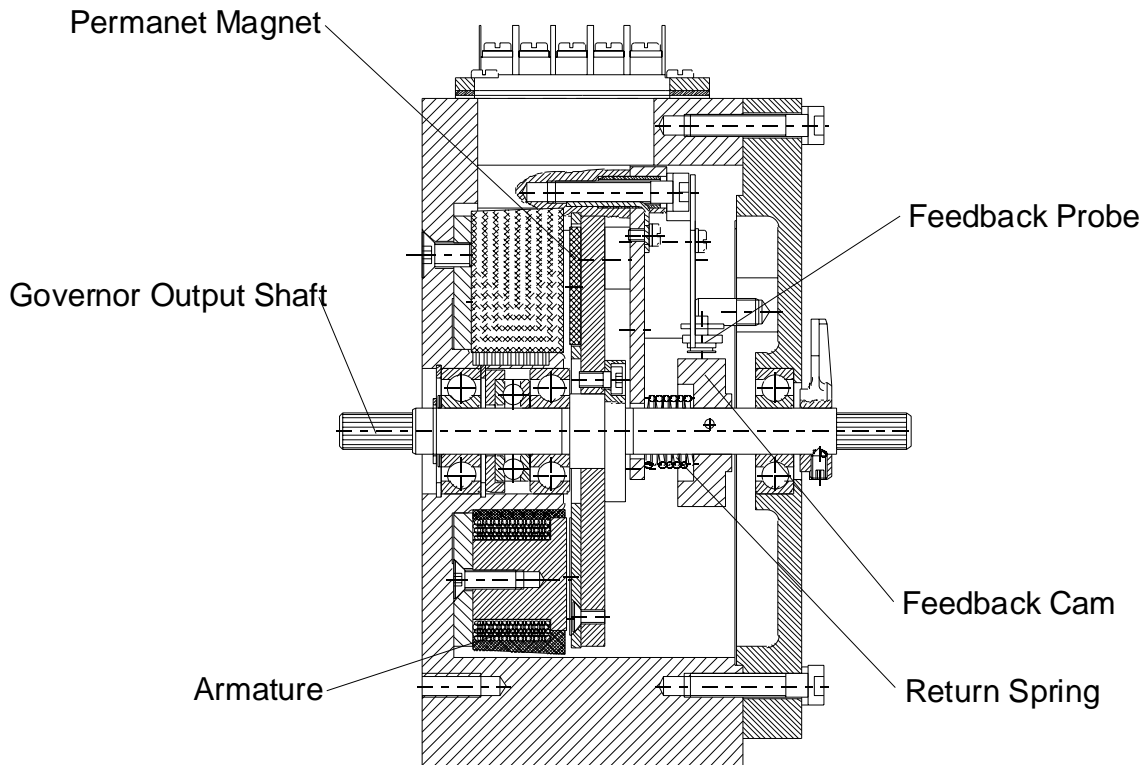


Figure 12: Sectional Drawing of Actuator

A multi-polar magnetised permanent magnet is mounted on the actuator shaft. Opposite the permanent magnet an armature is fixed. When current is given to the armature, a torque in one direction is obtained. Changing the polarity of the current results in direction changes.

The use of special materials and long-duration lubricants assure maintenance-free operation and long life of the actuators.

A feedback cam is mounted on the governor output shaft which is scanned without contact by a probe, with the result that the precise position of the output shaft is transmitted to the control unit.

In addition a return spring is mounted on the output shaft, which is normally strong enough to turn the shaft to stop position in case the governor supply voltage fails.

If the actuator strikes against a stop, as may occur, e.g., under parallel mains operation or may be caused by engine overload or cylinder failure, the current limitation will take effect after approx. 20 seconds; by this the current to the actuator is reduced to a value that cannot harm the motor.

Altogether, this type of actuator provides the following advantages:

- High regulation power working in both directions.
- Extremely low current consumption during steady state and relatively low current consumption on change of load.
- Indifference to slow voltage changes of the supply; abrupt voltage changes cause governor disturbances.
- maintenance-free

10.2 Models

The standard actuators of the series E 2000 are available in three different sizes, with plug or terminal strip and with two different rotation angles.

In the following table are listed the different types:

Type Designation	Connection	Rotation Angle	EDV-No.
2010.10-KV	terminal strip	36°	511-00-010-00
2010.11-SV	5-pole plug	36°	511-00-010-01
2010.20-KV-SC-TS	terminal strip	68°	511-00-013-02
2010.21-SV-SC-TS	5-pole plug	68°	511-00-013-01
2040.10-KV	terminal strip	36°	512-00-011-01
2040.11-SV	5-pole plug	36°	512-00-011-02
2040.25-SV	5-pole plug	68°	512-00-012-03
2080.10-KV	terminal strip	36°	514-00-002-00
2080.11-SV	5-pole plug	36°	514-00-002-01
2080.20-KV	terminal strip	68°	514-00-010-00
2080.21-SV	5-pole plug	68°	514-00-009-00

10.3 Installation

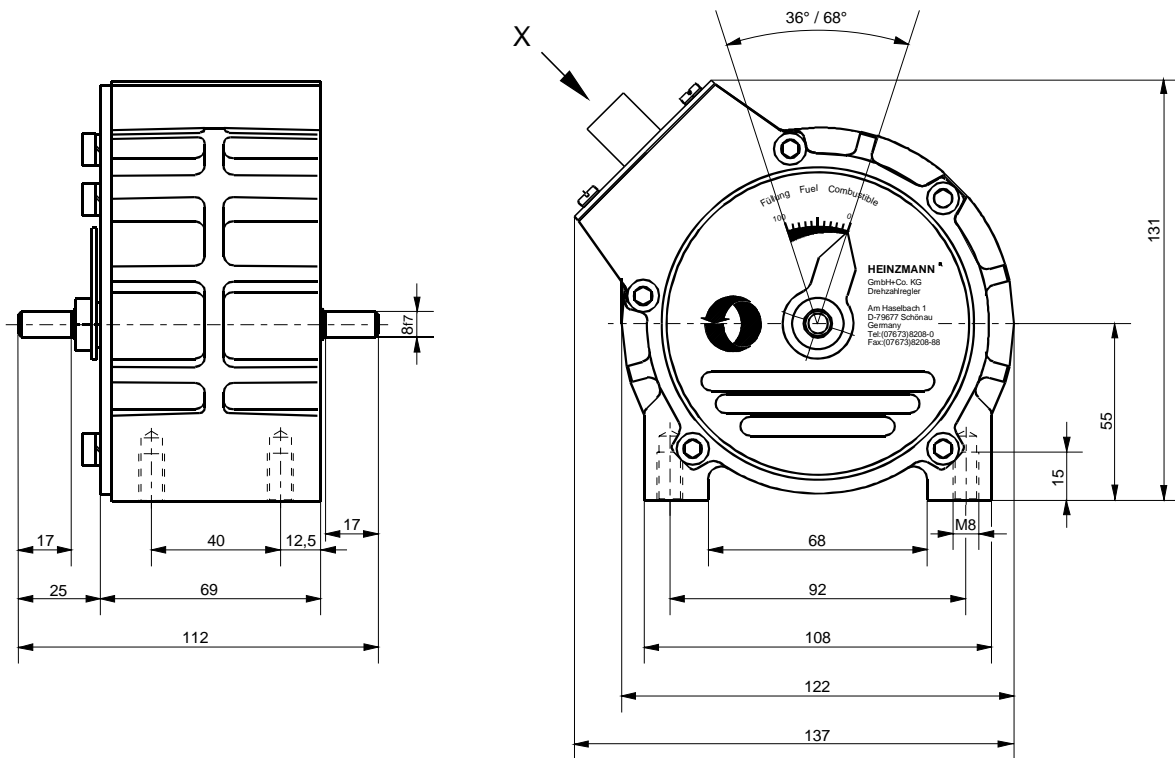
The actuator must be mounted firmly on the engine by means of reinforced brackets. Unstable arrangements, as caused by weak bracket material or missing stiffenings, have to be avoided by all means; they are bound to intensify vibrations, which will lead to premature wear of the actuator and the connecting linkage!

10.4 Specification

	StG 2010.xx	StG 2040.xx
Effective rotation at the output shaft	36° / 68°	36° / 68°
Max. torque at the governor output shaft	approx. 1.4 Nm	approx. 6.5 Nm
Torque in steady state condition	approx. 0.45 Nm	approx. 2.2 Nm
Response time 0-100 % without load	approx. 45 ms	approx. 50 ms
Current consumption of whole governor		
maximum current	approx. 5 A	approx. 5 A
safe current in steady state condition	approx. 1.7 A	approx. 1.7 A
Storage temperature	-55°C up to +110°C	-55°C up to +110°C
Ambiente temperature in operation	-25°C up to +90°C	-25°C up to +90°C
Ambiente temperature, special version	-40°C up to +90°C	-40°C up to +90°C
Humidity	up to 98 %	up to 98 %
Protection grade		
housing	IP 65	IP 65
plug	IP 65	IP 65
terminal strip	IP 00	IP 00
Weight	approx. 2.2 kg	approx. 4.6 kg

	StG 2080.xx
Effective rotation at the output shaft	36° / 68°
Max. torque at the governor output shaft	approx. 11 Nm
Torque in steady state condition	approx. 4 Nm
Response time 0-100 % without load	approx. 60 ms
Current consumption of whole governor	
maximum current	approx. 5 A
safe current in steady state condition	approx. 1.7 A
Storage temperature	-55°C up to +110°C
Ambiente temperature in operation	-25°C up to +90°C
Ambiente temperature, special version	-40°C up to +90°C
Humidity	up to 98 %
Protection grade	
housing	IP 65
plug	IP 65
terminal strip	IP 00
Weight	approx. 7.7 kg

10.5 Measurements



view X StG 2010.xx-KV with terminal strip
(shown without output shaft and pointer)

view X StG 2010.xx-SV with plug
(shown without output shaft and pointer)

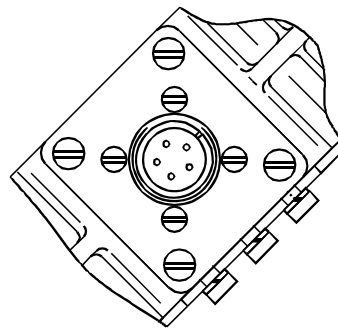
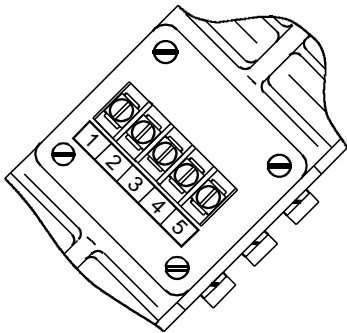
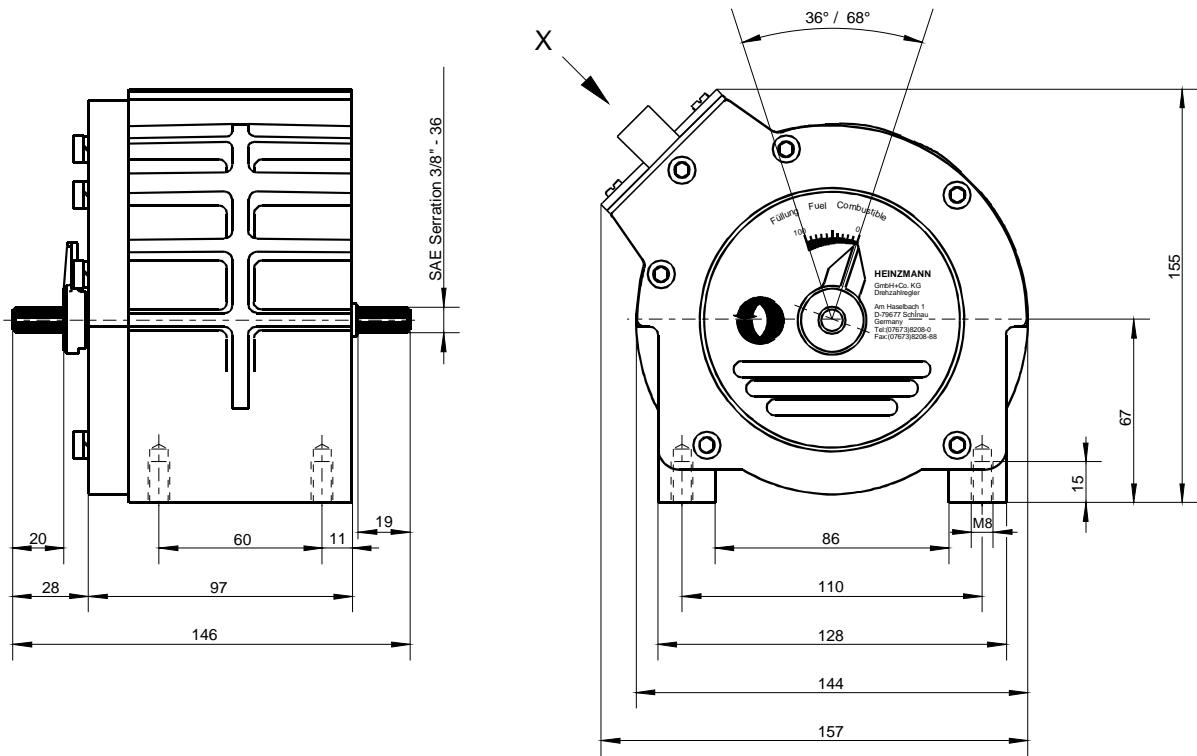


Figure 13: Actuator StG 2010



view X StG 2040.xx-KV with terminal strip
(shown without output shaft and pointer)

view X StG 2040.xx-SV with plug
(shown without output shaft and pointer)

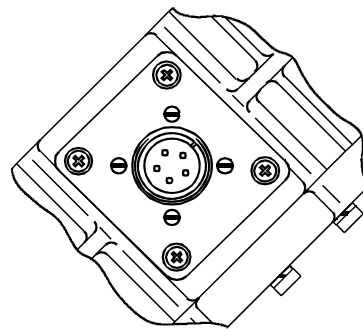
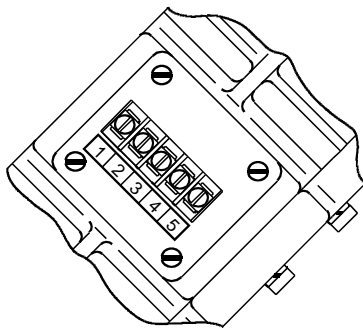
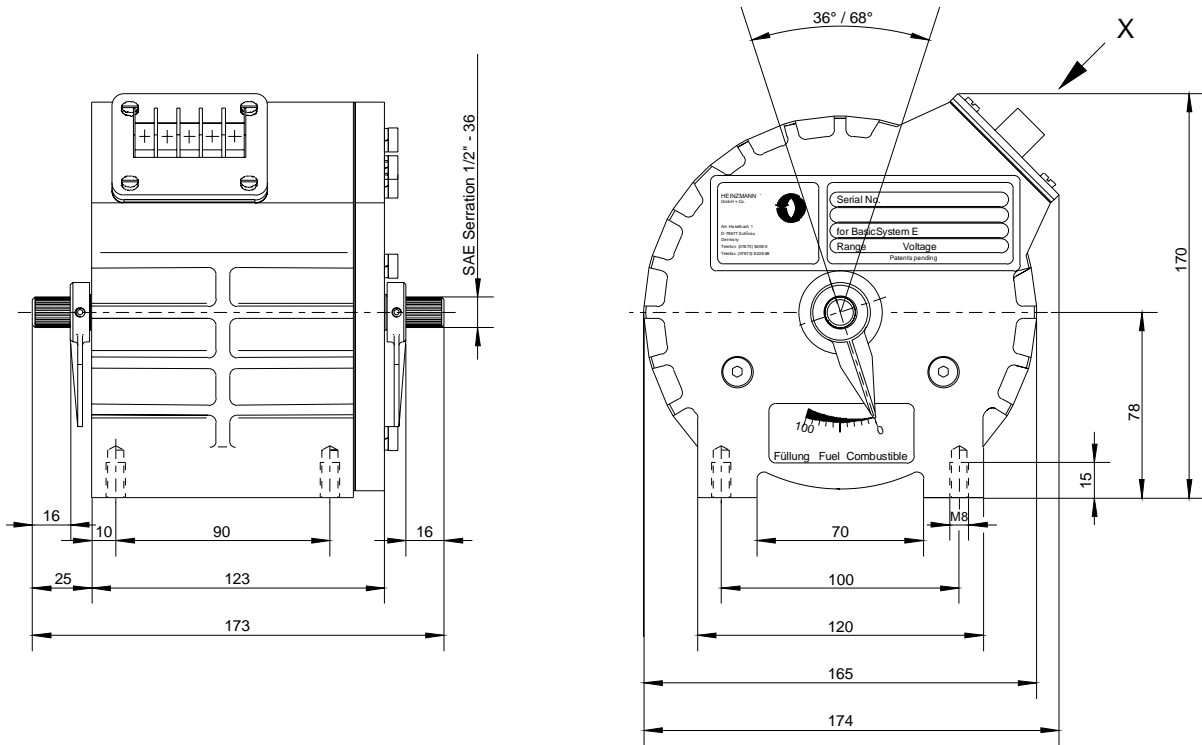


Figure 14: Actuator StG 2040



view X StG 2080.xx-KV with terminal strip

view X StG 2080.xx-SV with plug

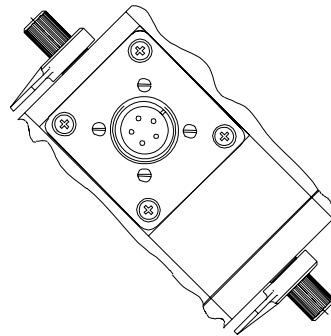
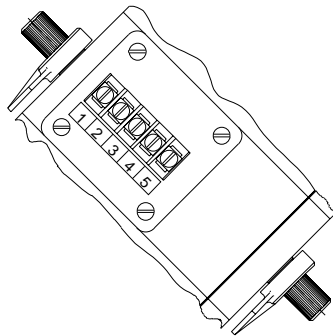


Figure 15: Actuator StG 2080

11 Regulating Linkage

11.1 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 lever length L of governors with 36° adjustment angle is calculated as $L = 1.8 \cdot a$, "a" being the travel distance of the injection pump or the carburettor.

11.2 Ordering Specification for Lever Arm

Actuator 2010	Please order RH 2010 – 01 EDV- No.: 511 80 004 00
Actuator 2040	Please order RH 2040 – 01 EDV- No.: 502 80 017 00
Actuator 2080	Please order RH 2080 – 01 EDV- No.: 504 80 010 00

11.3 Connecting Linkage

The connecting linkage from the governor to the injection pump should be length-adjustable. If possible, joint rod heads in accordance with DIN 648 should be used as connecting links. The linkage must operate easily and without play.

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

11.4 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.)

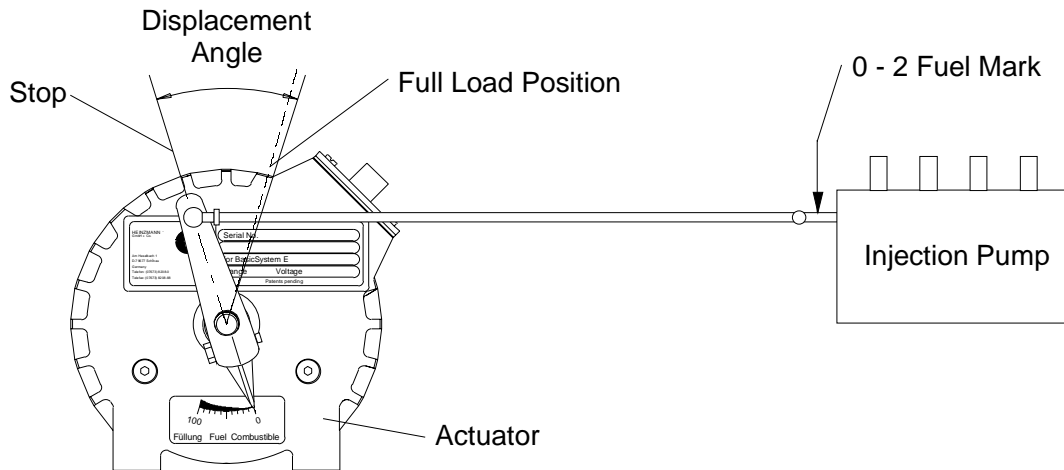


Figure 16: Linkage for Diesel Engines

11.5 Linkage Adjustment for Gas and Gasoline 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.

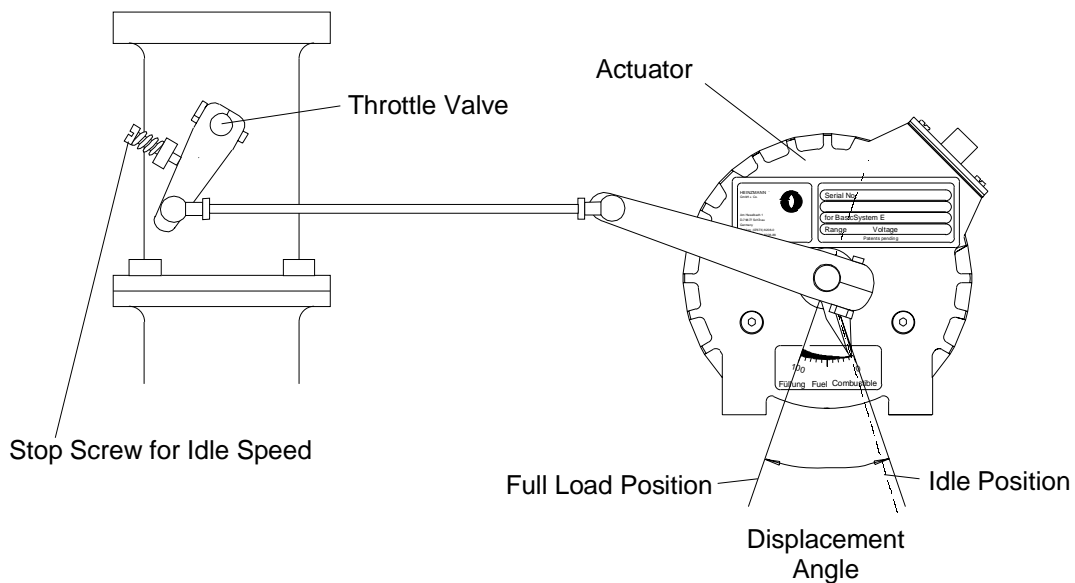


Figure 17: Linkage for Gas Engines

12 Electrical Connections

12.1 Governor Connection Diagram KG 20 ... - 01 - 00

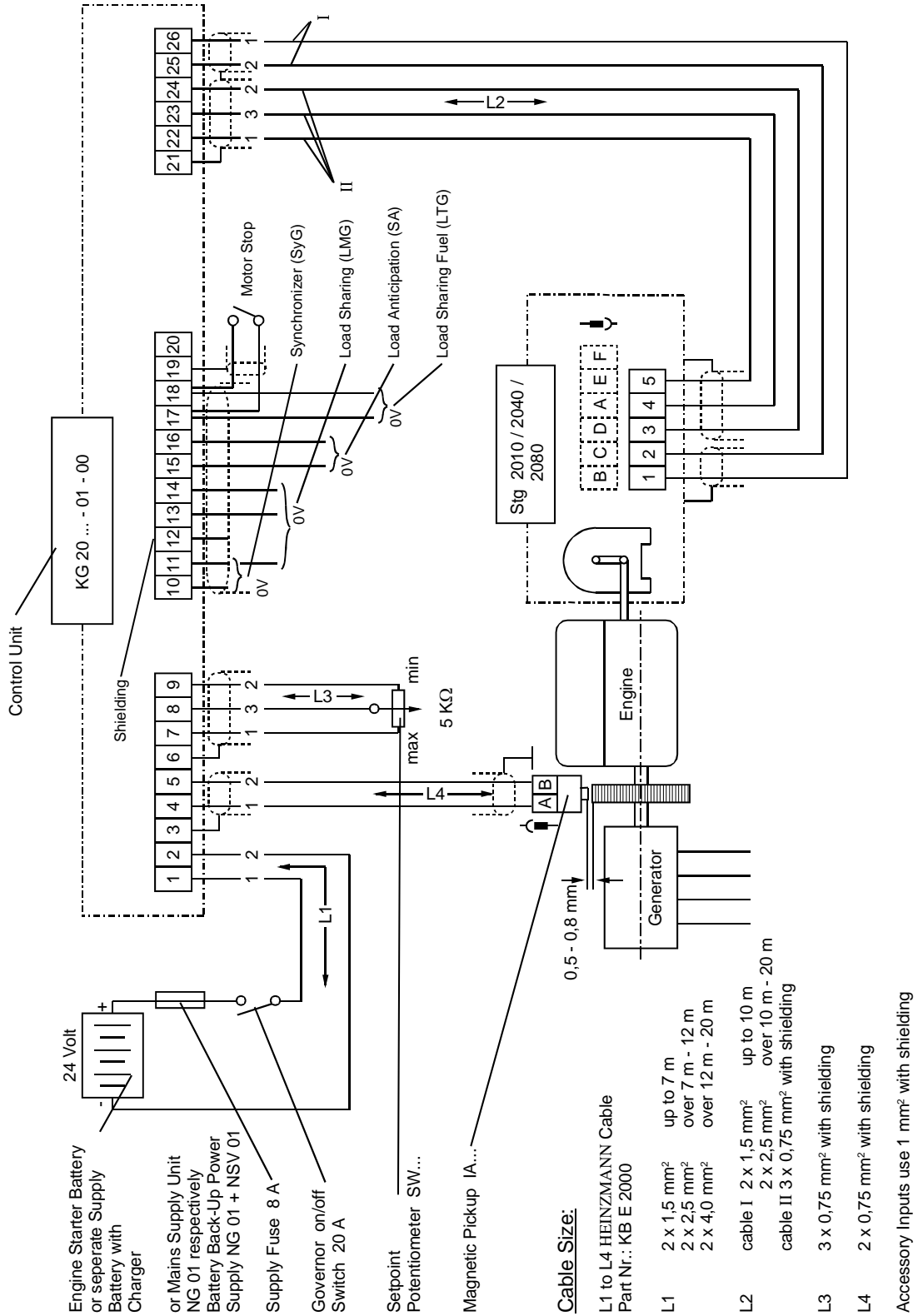


Figure 18: Connection Diagram KG 20 ... - 01 - 00

12.3 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 actuator are bound to 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 actuator drive. The high current consumption will in its turn lead to overheating of the actuator or the amplifier in the control unit, and the vibration will result in premature wear of the gear and bearing parts or of the linkage.



Note

As a rule, the lifetime of the control system is distinctly reduced by the errors described above.

In order to avoid that the voltage supply is not interfered by the „hum voltage“ of the battery charger – and as a consequence the voltage at the control unit will not suddenly drop too much when starting – the control unit must be connected **directly** over a fuse and a switch with the battery.



Warning

In case the control unit is directly connected with the battery charger or the starter there might happen a failure of the control unit or actuator after a certain time. The necessary repair of the units resulting thereof is not covered by warranty.



Warning

If there are battery chargers with rapid charge mode installed in the plant, the rapid charge mode should not be used during operation.

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

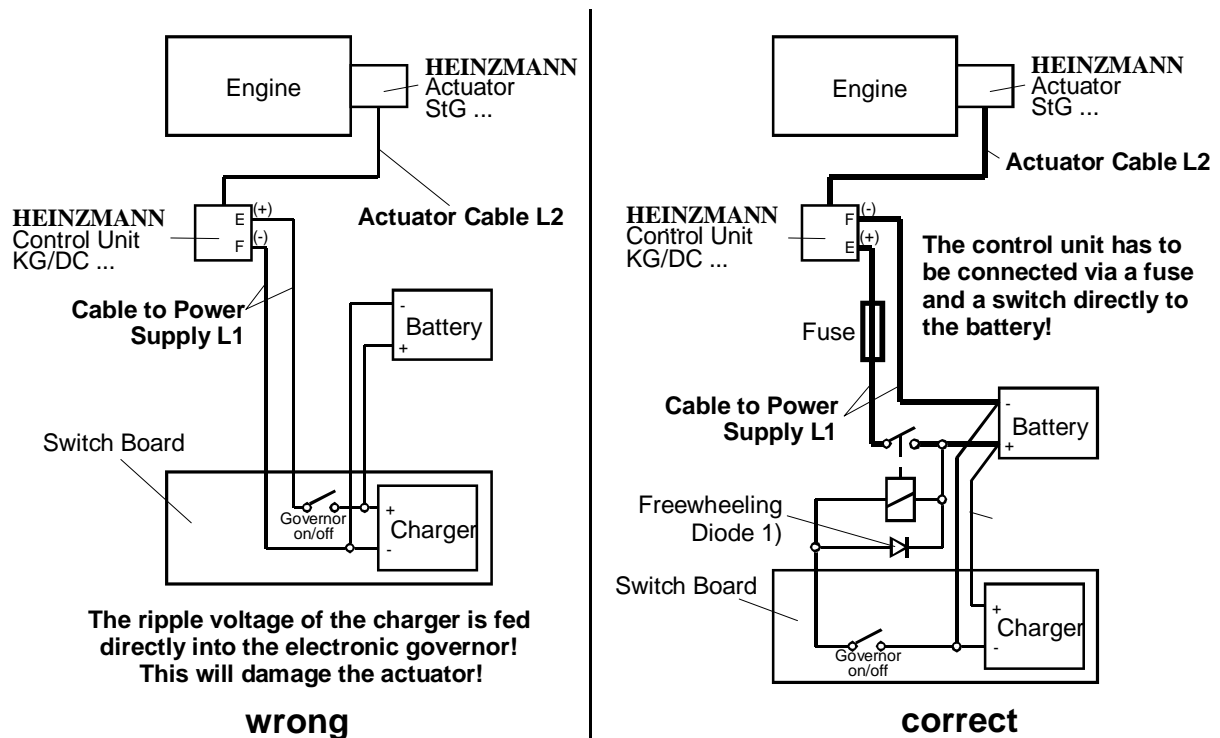
HEINZMANN offers for the control system E 2000 the power supply NG 01 and if an additional backup system is required, the power supply NG 01 + NSV 01 and NG 04. For more informations, refer to the separate manuals E 88 002-e and E 97 002-e.



Warning

Cable sizes and maximal cable lengths indicated in the following chapter must be respected at all costs!

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 inductance voltages. Diode type e.g. 1N4002

Figure 20: Correct Cabeling of the Power Supply

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

12.4 Checking the Power Supply including Supply Cable and possible Intermediate Terminals (at Engine Stop):

1. Switch off power supply
2. Clip voltmeter (rang 200 V DC) to terminals 1 and 2. Care must be taken to avoid a short circuit.
3. Switch on supply voltage. The actuator turns with power to direction stop. Read the voltage value from the voltmeter.
4. After 20 seconds the LED 5 begins to light (The actuator no longer has any power). Read the voltage value from the voltmeter again.

The difference between value 2 (at min. power) and value 1 (at max. power) must be less than 10 %.

5. Switch off power supply and disconnect voltmeter.

12.5 Connection of Shielding

To avoid elektromagnetic influences it is necessary to connect cable shields at both ends. This includes shielding from control housing to sensors, from control housing to potentiometers, from control housing to actuator and from control housing to accessory units. If there is a potential difference between the control housing and any of these other componets, to avoid currents via the shielding it is necessary to run a separate wire from the control housing to each of these components.

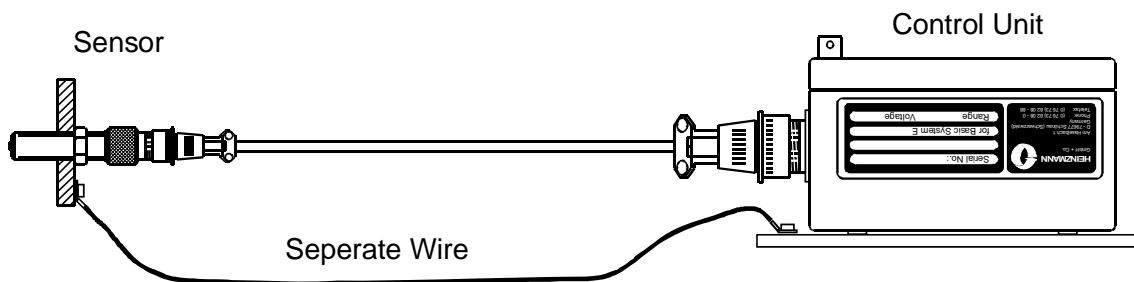


Figure 21: Connection of seperat Wire

At cable ends without plugs (e.g. terminal strip or pins) the shielding must be connected at the housing near the contacts.

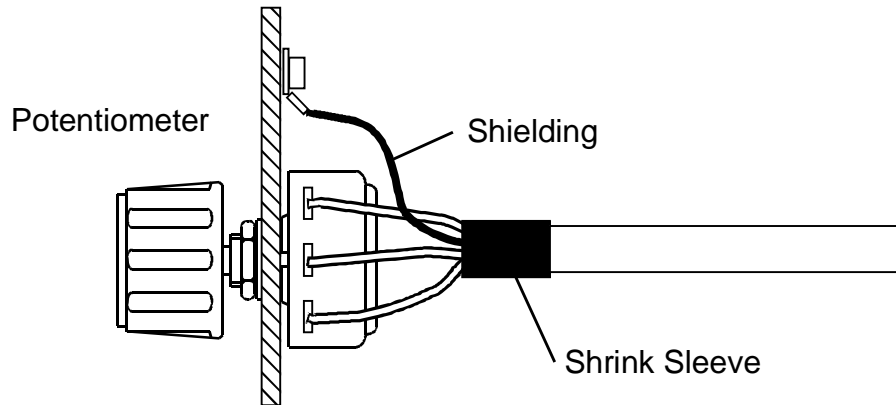


Figure 22: Shield Connection without Plug

With the plug the strain relief presses directly on the cable screen. In addition, a separate wire connects the strain relief section to the plug housing.

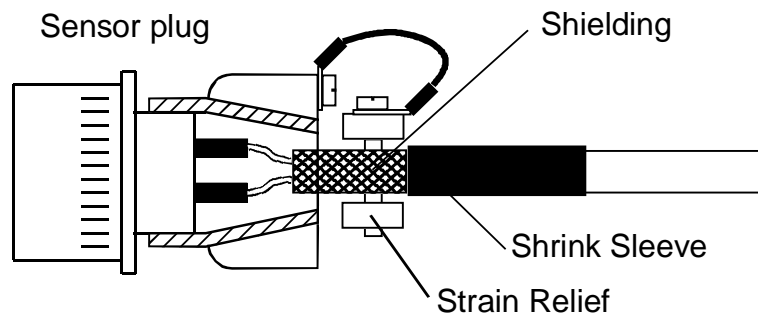


Figure 23: Shield Connection in the Plug

13 Harness

13.1 Cable lengths

It is best to obtain the harness from the same source as the governor.

a) KG 20 ... - 01 - 00

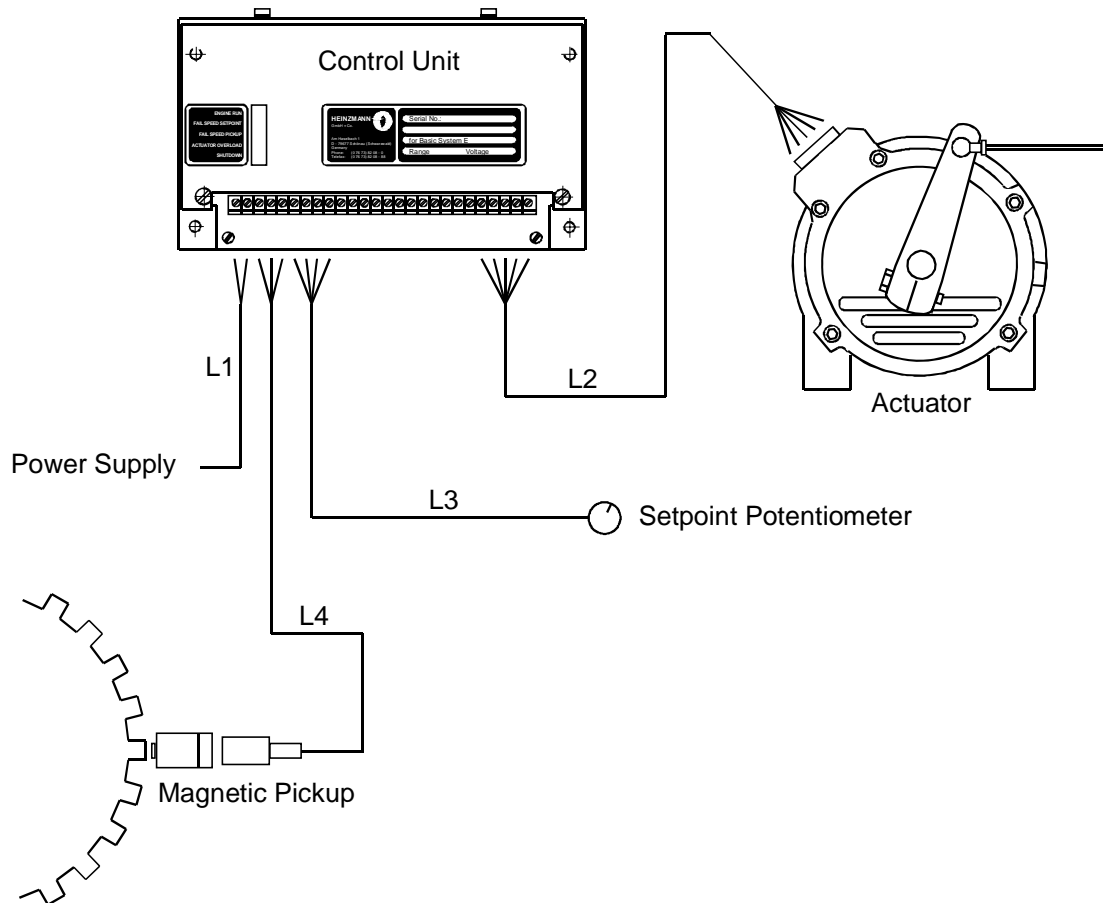
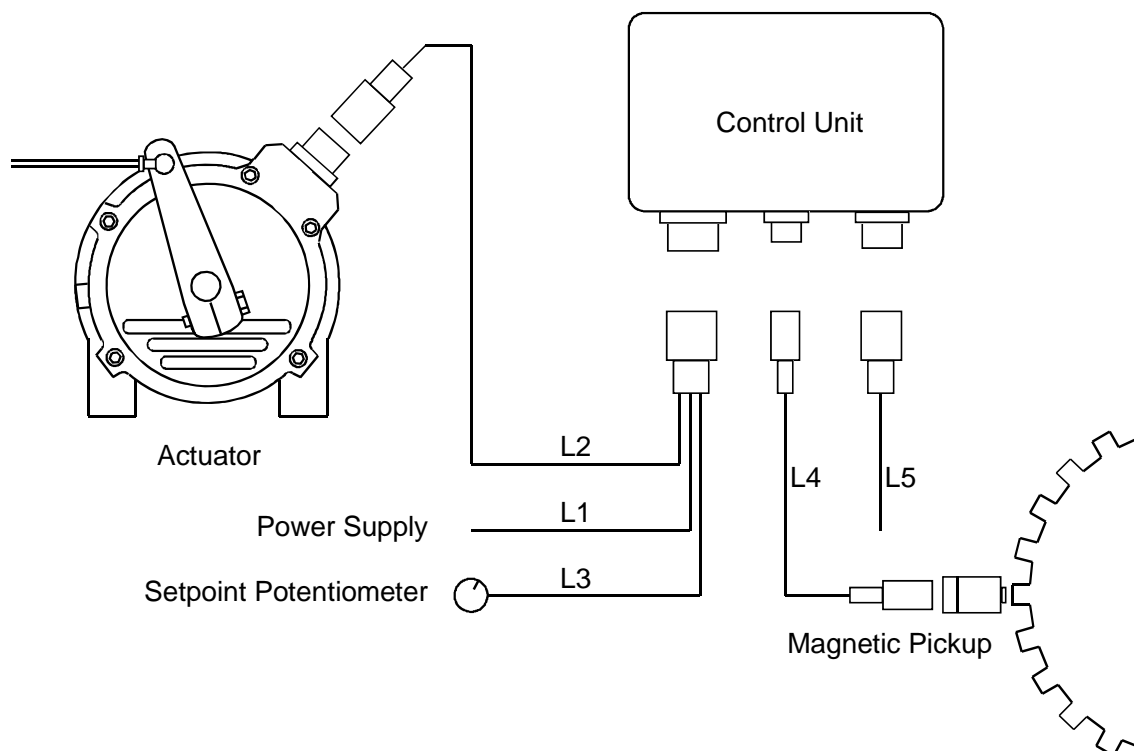


Figure 24: Cable Lengths for KG 20 ... - 01 - 00

Cable Lengths

L1	=	Control Unit	-	Battery
L2	=	Control Unit	-	Actuator
L3	=	Control Unit	-	Set Point Potentiometer
L4	=	Control Unit	-	Magnetic Pickup
L5	=	Control Unit	-	Accessory Unit

For orders, the individual lengths must be specified in cm.

b) KG 20 ... - 01 - 55

Figure 25: Cable Lengths for KG 20 ... - 01 - 55
Cable Lengths

L1	=	Control Unit	-	Battery
L2	=	Control Unit	-	Actuator
L3	=	Control Unit	-	Set Point Potentiometer
L4	=	Control Unit	-	Magnetic Pickup
L5	=	Control Unit	-	Accessory Unit

For orders, the individual lengths must be specified in cm.

13.2 Plug Connections

Units with Plug-in Connectors (KG 20 ... - 01 - 55 or StG.. - SV)

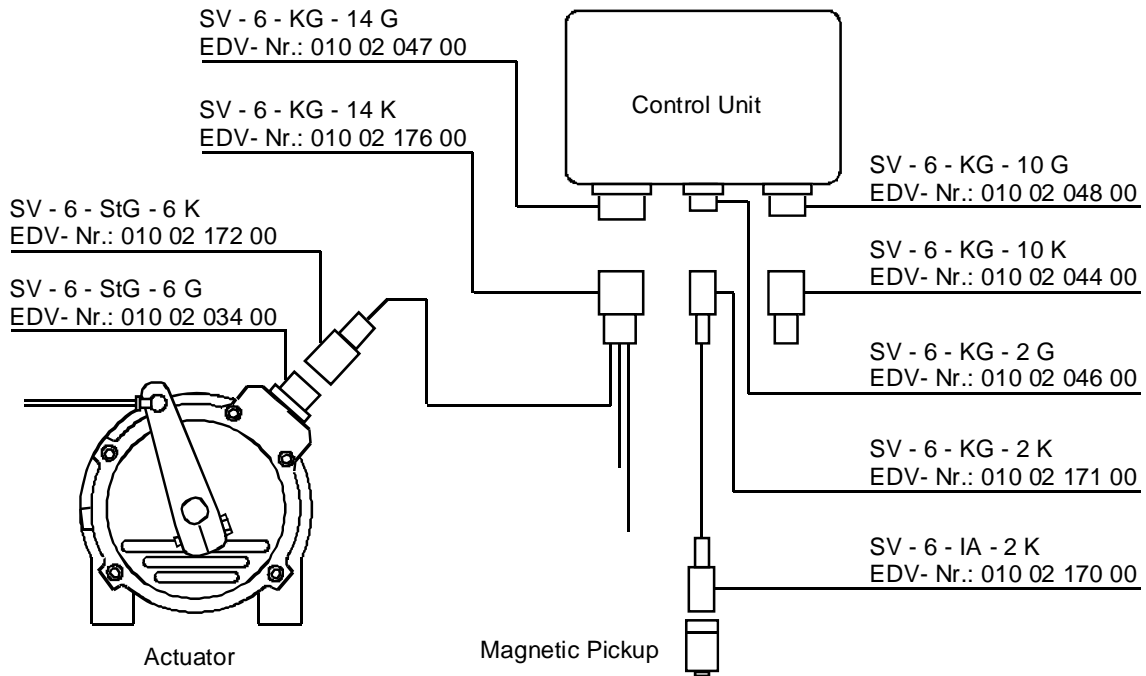


Figure 26: Plug Connections

14 Adjustment of E 2000 Governor

14.1 Governor Adjustment Sheet

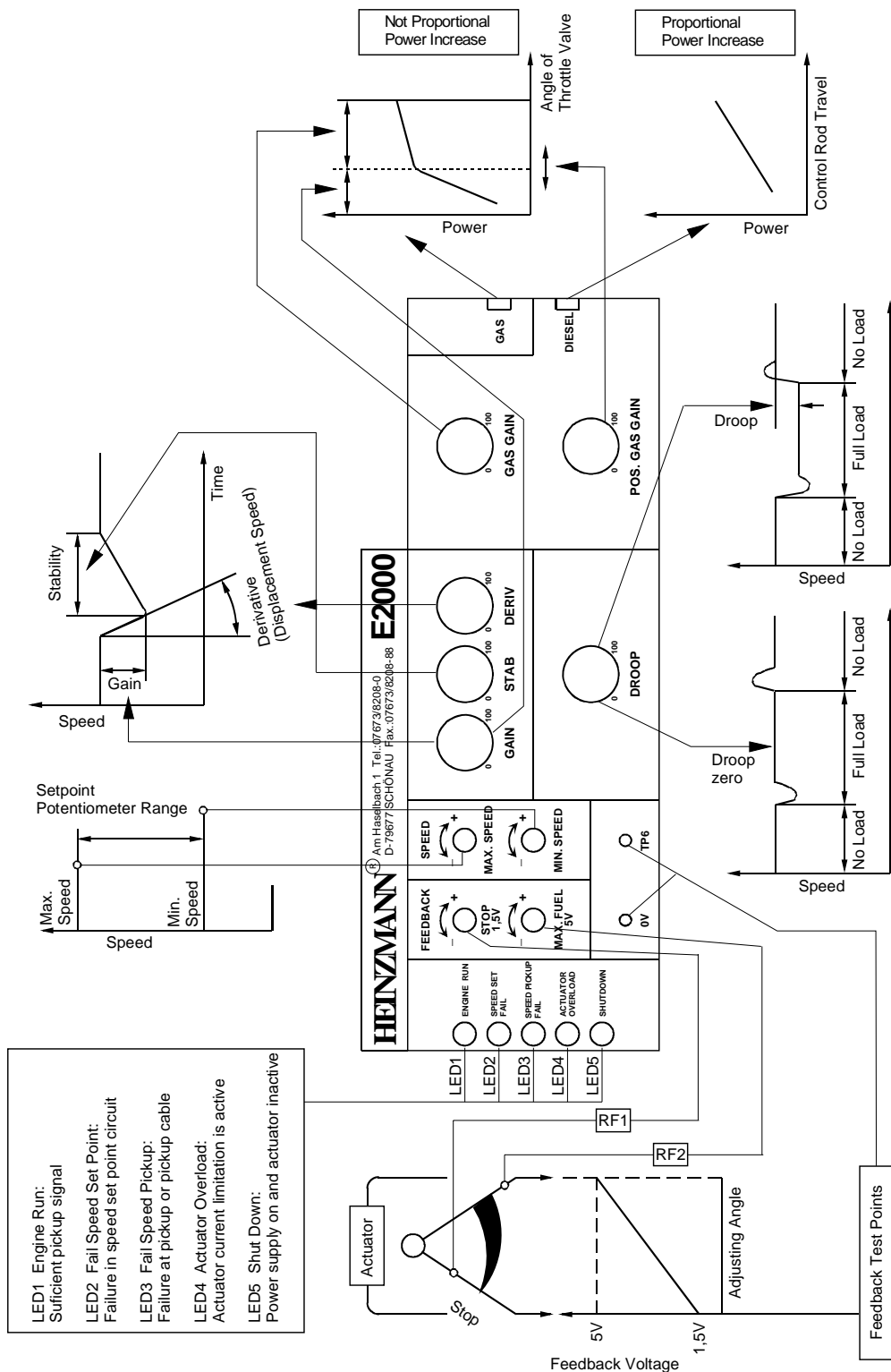


Figure 27: Governor Adjustment Sheet

- 14.2 Set the pickup distance on 0.5 to 0.8 mm from the highest point of the gear wheel. At cranking speed the voltage must be 0.5V AC or more (refer chapter 7.4).
- 14.3 Make cable connections between the control box and the pickup, speed set point potentiometer, actuator and battery.
- 14.4 Mount the linkage between the actuator and the fuel system according to instructions (refer chapter 9).
- 14.5 a) **E 2000 - 01 - 00 Version**

Disconnect pickup cable and accessory terminals from control unit. Connect lead of test instrument PG 01 to magnetic pickup terminals and test point TP 6.



Note

A 1kΩ resistor is build into our simulator plug to simulate a pickup being connected. If a signal generator is to be used instead of our simulator, place a 1kΩ resistor across speed pickup terminals.

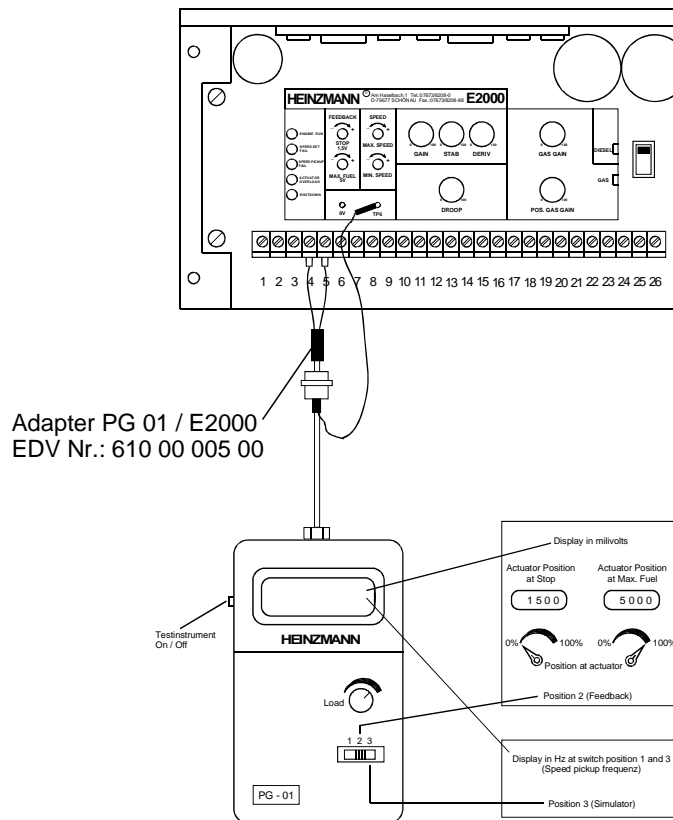


Figure 28: Connection of Test Instrument PG 01 with Terminal Strip

b) E 2000 - 01 - 55 Version

Withdraw magnetic pickup plug and accessory plug from control unit. Connect lead of test instrument PG 01 to magnetic pickup socket and test point TP 6.



A 1kΩ resistor is build into our simulator plug to simulate a pickup being connected. If a signal generator is to be used instead of our simulator, place a 1kΩ resistor across speed pickup terminals.

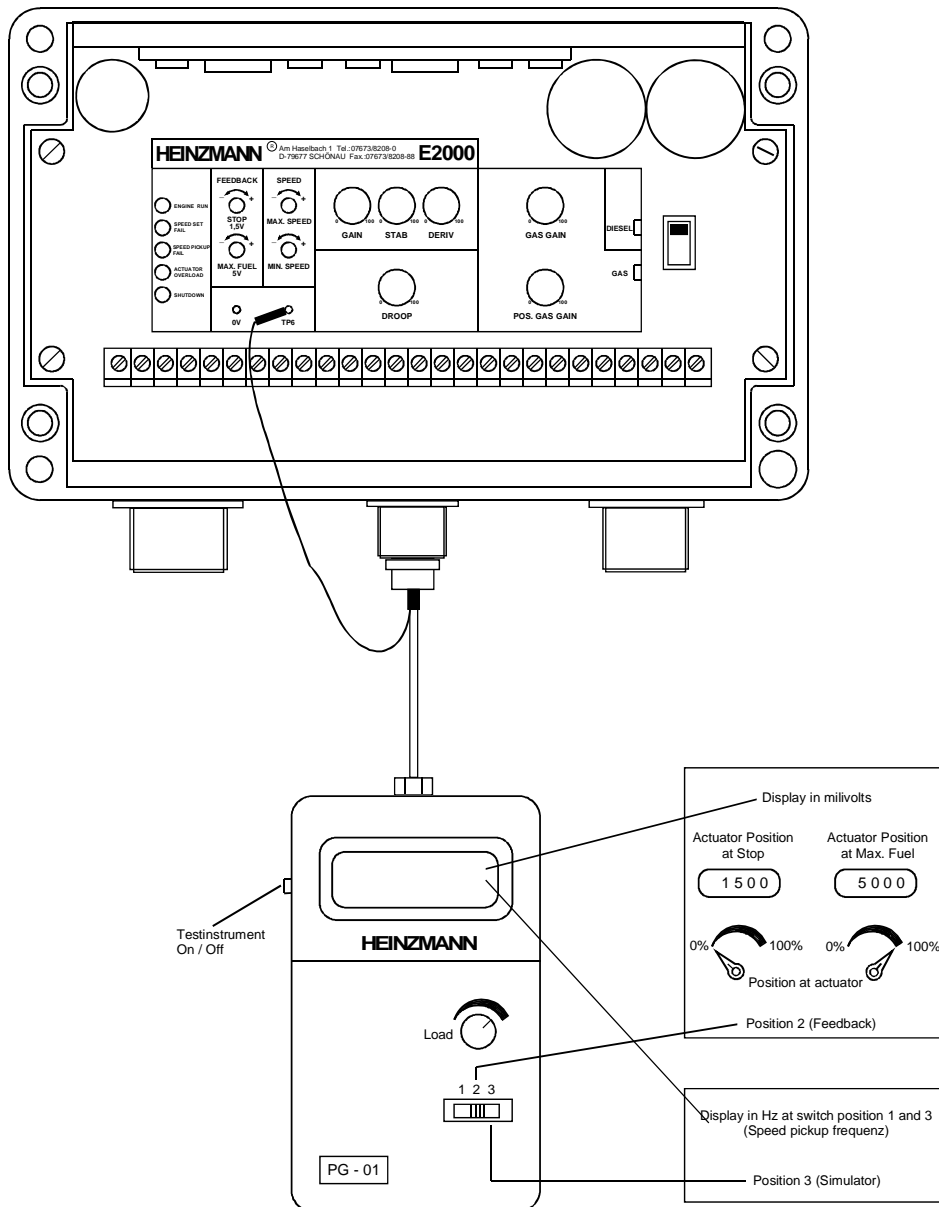


Figure 29: Connection of Test Instrument PG 01 with Plug-in Connectors

14.6 Turn on power supply to control unit and turn on test instrument.



Note

Actuator will turn to stop with power for a time of 20 seconds after turning on power supply.






Set switch of test instrument to position 2.

1.5 V \pm 0.1 V in stop position with feedback potentiometer RF 1

5.0 V \pm 0.1 V at max. fuel injection with feedback potentiometer RF 2

For this adjustment, set the actuator on 100 % fuel injection by hand, disconnecting the control linkage if necessary. Check all adjustments, readjust if necessary.

All actuators and control units are matching and are interchangeable if required, so that only feedback adjustment may be necessary in exceptions.

14.7	External Setpoint Potentiometer SW ...	 to the stop
	Gain	to position 3
	Stability	to position 3
	Derivative	 to the stop
	Gas Gain	 to the stop
	Pos. Gas Gain	to position 5
	Diesel/Gas selektor with diesel engine	to diesel position
	Diesel/Gas selector with gas or gasoline engine	to gas position
	Min. speed	 20 turns
	Droop	 to the stop

14.8 Place test instrument PG 01 switch in position 3. Turn instrument off, then on again or carefully move regulating linkage. Test instrument will now simulate the engine.



Warning

The engine must not be started during testing, otherwise it will overspeed!

Adjust frequency with the "max. speed" potentiometer on the control unit. Frequency must be approx. 2 % above rated speed.

- 14.9** Turn external setpoint potentiometer counterclockwise ↶ to the stop and adjust min. frequency with "min. speed" potentiometer if necessary. Turn external SW ... to maximum and check upper value. SW ...in mid way.

- 14.10** Remove test instrument and connect magnetic pickup cable



Warning

Overspeed protection must be connected and tested. Prior to engine start!

Start engine and bring speed up to rated value using SW ...

- 14.11** Turn stability counterclockwise ↶ to the stop

Gain turn clockwise ↷ until unstable, then counterclockwise ↶ until stable

Stability turn clockwise ↷ until unstable, then counterclockwise ↶ until stable

Derivative turn clockwise ↷ until unstable, then counterclockwise ↶ until stable

Never attempt to electrically compensate mechanical errors e.g. friction or vibration at the actuator caused by weak brackets. (Potentiometer gain must not be at 100 % stop.

- 14.12** The E 2000 governor has the ability to change its dynamic gain for gas engine applications when the diesel gas switch is changed to the gas position. Two distinct gains can be adjusted. The first gain is that of the basic governor and is adjusted to a value for stability with a no load rated speed engine. The break point at which the gas gain comes in, is adjusted with the no load gas actuator potentiometer to a value 10% higher than the no load rated speed position on the actuator. When 50% load or more is applied to the engine, adjust the gas gain for optimum results.

- 14.13** Turn setpoint potentiometer counterclockwise ↶ and adjust min. operating speed using min. speed potentiometer. Check motor over entire speed and load range and readjust governor if necessary.

14.14 Droop Adjustment - if necessary

$$X_p = \frac{n_o - n_v}{n_v} * 100 \%$$

X_p = Droop in %

n_o = No load speed

n_v = Full load speed

Example:

n_o = 1560 1/min

n_v = 1500 1/min

$$X_p = \frac{1560 - 1500}{1500} * 100 \% = 4 \%$$

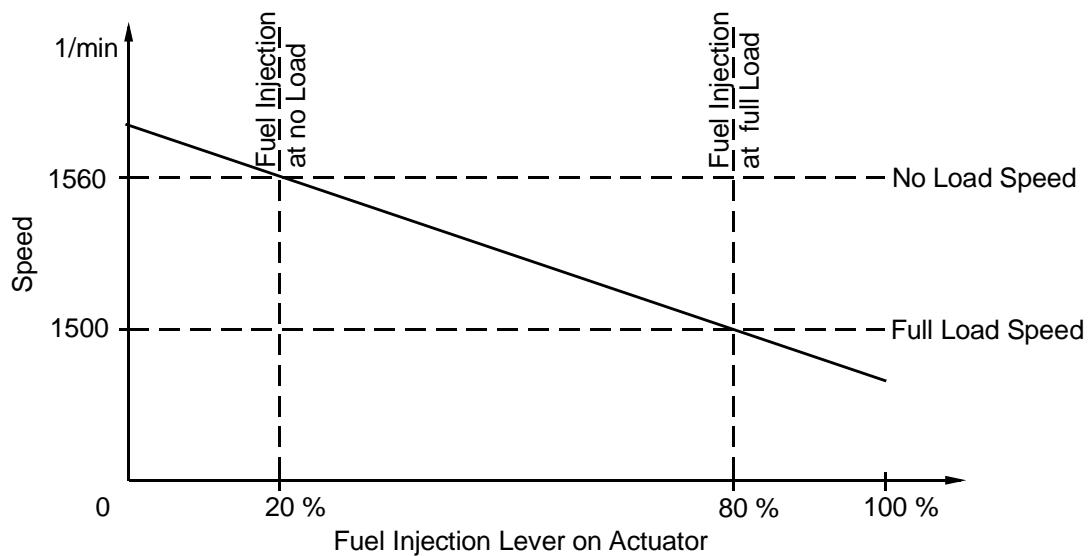


Figure 30: Droop

Droop potentiometer in position 8

Connect test instrument PG 01

Prior to making the droop adjustment, the fuel injection levels at no load and full load should be known. If these values are not known, for purposes of approximation the following values are assumed **no load position of engine at 20 % fuel injection** on actuator and **full load position of engine at 80 % fuel injection** on actuator.

Adjust actuator to 80 % fuel injection using test instrument and adjust full load frequency using setpoint potentiometer SW ... Adjust 20 % fuel injection with test instrument and read no load frequency.

If no load frequency does not correspond to the rated value, slightly adjust droop potentiometer (by approx. ¼ or ½ mark) and restart adjustment (see last paragraph).

The droop adjustment is followed by the max. frequency adjustment in accordance with **14.8**.

14.15 Governor Adjustment without HEINZMANN Test Unit

a) Feedback

Connect multimeter with 10 V - range on TP 6 and 0V and adjust feedback according to 12.6.

b) Frequency Adjustment

If the frequency is stated on delivery, the control unit will be already adjusted to operation frequency in the factory and noted on the type label.

In case of a new adjustment one has to take action as follows:

External setpoint potentiometer ↻ to the stop

Turn potentiometer max. speed ↻ 20 revolutions

Turn potentiometer min. speed ↻ 20 revolutions

Start engine (Overspeed-protection has to be safeguarded!)

If the motor does not start, adjust setpoint potentiometer to ↻ until the engine starts running; If necessary adjust pot. max. speed to ↻

External setpoint potentiometer ↻ to the stop

Adjust with pot. max. speed the max. speed

External setpoint potentiometer ↻ to the stop

Adjust with pot. min. speed the min. speed

Control high and low range and if necessary adjust

For further controls see **14.11**

15 Accessories

A series of accessories, e.g. load sharing unit, load measuring unit, load control unit, synchronizer, etc. are available for the basic system.

These accessories are described in separate brochures or manuals.

16 Meaning of LEDs

The governor board offers some LED indicators to ease the failure correction. The following list explains the function of each LED indicator:

a) LED 1 Engine Run

Lights, when the governor gets a sufficient pickup signal.

b) LED 2 Fail Speed Setpoint

Lights, when there is a failure in the speed setpoint.

c) LED 3 Fail Speed Pickup

Lights, when there is a failure at the pickup or pickup cable.

d) LED 4 Actuator Overload

When the actuator is driven against stop, e.g. with parallel mains operation and engine overload or cylinder failure, then the current limitation will take effect after approx. 20 seconds, it reduces the current to the actuator to a value that cannot harm the actuator motor. The LED 4 lights, when this current limitation is active.

e) LED 5 Shut Down

The governor offers a circuit that cuts off the actuator current as long as there is no sufficient signal from the pickup. LED 5 lights if the governor supply voltage is present but no pickup signal is received and accordingly the actuator is not yet activated.

In the following chapter you will find a detailed troubleshooting.

17 Troubleshooting

17.1 Actuator does not open during Cranking

- LED 5 must be lit, when power supply is on for more than 20 seconds and must go out once the engine is cranking and reaches rated speed.
 - LED 5 lights does not light up
 - a) No DC voltage at control unit (Terminal 1 and 2)
 - b) Supply voltage inadequate
 - c) Plus and minus reversed
 - LED 5 will not go out
 - a) LED 3 lights
 1. Wiring to pickup defect or wrong connected
 2. Pickup defect (Resistance of pickup about 52 Ohm)
 - b) LED 3 lights not
 1. Excessive pickup clearance (Set point 0,5mm to 0,8mm)
 2. Cranking speed too low (Voltage during cranking minimum 0,5 V AC)
- LED 2 lights
External setpoint potentiometer connections wrong or incomplete (Check resistance at terminals of control unit. [Set point between 7 and 9 must be 5 KOhm, between 8 and 9, and between 7 and 8 respective adjustable with setpoint potentiometer 0 to 5 KOhm])
- External setpoint potentiometer or max. speed pot. or min. speed pot. settings too low.
- Shutdown switch on
- Actuator impeded or linkage wrongly adjusted
- Actuator connections wrong or incomplete
- Actuator defect (Resistance between actuator terminal 1 and 2 is 2,5 Ohm)
- Control unit defect

17.2 Actuator opens directly when DC Voltage is applied to Control Unit

- Wiring fault in harness
- Motor connections of actuator reversed (Terminal 1 and 2 at actuator)
- Noise from pickup cable
- Control unit defect

17.3 After starting Engine goes to Overspeed

- Max. speed potentiometer setting too high
- Excessive magnetic pickup clearance; only a proportion of gear-teeth recorded
- Poor contact in pickup line
- Linkage can not move freely
- Feedback voltage incorrectly adjusted
- If actuator has only force in open direction, the fault is control unit
- Actuator defect

17.4 Governor unstable

- Faults in pickup cable (Check shielding)
- Faults in setpoint potentiometer cable (Check shielding)
- Load fluctuations
- Faults in setpoint signal, e.g. control of an motor potentiometer or setpoint by external voltage
- Supply voltage too low
- Supply voltage not constant
- Poor electrical contact
- Backlash or excessive friction in linkage or actuator
- Feedback voltage not properly adjusted (1.5 - 5 V)
- Governor incorrectly adjusted
- In case of gasoline and gas engines, check ignition and spark plugs

17.5 Reduced Speed under Load

- Droop potentiometer not in zero position
- Actuator on 100 % fuel injection stop; engine is overloaded, poor fuel quality in case of gas engines
- Stability incorrectly adjusted
- Control unit defect

17.6 Governor Linkage is hunting

- Excessive remaining ripple clearance of supply voltage
- Faults at shieldings
- Poor setpoint signal

18 Order Specification

When ordering, please note the individual units:

Magnetic Pickup	IA ..
Setpoint Source	SW ..
Control Unit	KG ..
Actuator	StG ..

Cable Length:

L1 = Control Unit - Power Supply	=	cm
L2 = Control Unit - Actuator	=	cm
L3 = Control Unit - Setpoint Source	=	cm
L4 = Control Unit - Magnetic Pickup	=	cm
L5 = Control Unit -	=	cm

Further Details:

Supply voltage	V
Number of teeth	
Speed	

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20 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

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