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# HEINZMANN®
## Electronic Speed Governors

# Basic Systems

# E 1-F / E 2-F



Manual E 82 001-e / 11-10


**The appropriate manuals must be thoroughly studied before installation, initial start-up and maintenance**.

All instructions pertaining to the system and safety must be followed in full. Non-observance of the instructions may lead to injury to persons and/or material damage.

HEINZMANN shall not be held liable for any damage caused through non-observance of instructions.

Independent tests and inspections are of particular importance for all applications in which a malfunction could result in injury to persons or material damage.

All examples and data, as well as all other information in this manual are there solely for the purpose of instruction and they may not be used for special application without the operator running independent tests and inspections beforehand.

**HEINZMANN** does not guarantee, neither expressly nor tacitly, that the examples, data or other information in this manual is free from error, complies with industrial standards or fulfils the requirements of any special application.


**To avoid any injury to persons and damage to systems, the following monitoring and protective systems must be provided:**

– overspeed protection independent of the rpm controller

HEINZMANN shall not be held liable for any damage caused through missing or insufficiently rated overspeed protection.

– thermal overload protection

**The following must also be provided for alternator systems:**

– Overcurrent protection

– Protection against faulty synchronisation for excessively-large frequency, voltage or phase difference

– Directional contactor

The reasons for overspeeding may be:

– Failure of positioning device, control unit or its auxiliary devices

– Linkage sluggishness and jamming

**The following must be observed before an installation:**

– Always disconnect the electrical mains supply before any interventions to the system.

– Only use cable screening and mains supply connections that correspond with the *European Union EMC Directive*

– Check the function of all installed protection and monitoring systems

| | |
|---|---|
|  | **Please observe the following for electronically controlled injection (MVC):**<br>– For **common rail** systems each injector line must be equipped with a separate mechanical flow-rate limiter.<br>– For **unit pump (PLD)** and **pump-injector unit (PDE)** systems, the fuel enable is first made possible by the solenoid valve's control plunger motion. This means that in the event of the control plunger sticking, the fuel supply to the injection valve is stopped. |
|  | As soon as the positioning device receives power, it can actuate the controller output shaft automatically at any given time. The range of the controller shaft or control linkage must therefore be secured against unauthorised access. |
| | **HEINZMANN** expressly rejects any implied guarantee pertaining to any marketability or suitability for a special purpose, including in the event that **HEINZMANN** was notified of such a special purpose or the manual contains a reference to such a special purpose. |
| | **HEINZMANN** shall not be held liable for any indirect and direct damage nor for any incidental and consequential damage that results from application of any of the examples, data or miscellaneous information as given in this manual. |
| | **HEINZMANN** shall not provide any guarantee for the design and planning of the overall technical system. This is a matter of the operator its planners and its specialist engineers. They are also responsible for checking whether the performances of our devices match the intended purpose. The operator is also responsible for a correct initial start-up of the overall system. |

# Contents

**Page**

# 1 Abbreviations

| | | |
|---|---|---|
| E | . . . | complete Basic System |
| IA | . . . | Magnetic Pickup |
| KG | . . . | Control Unit |
| StG | . . . | Actuator |
| SW | . . . | Setpoint Potentiometer |
| KB | . . . | Harness |
| SyG | . . . | Synchronizer Unit |
| LMG | . . . | Load Measuring Unit |
| SA | . . . | Load Anticipation Unit |
| LKG | . . . | Load Control Unit |
| LSchG | . . . | Load Switch Unit |
| FSchG | . . . | Frequency Switch |
| EA-KG | . . . | Flexible Mount for Control Unit |
| BSBG | . . . | Acceleration Limiter |
| LTG | . . . | Load Sharing Unit |
| EFP | . . . | Electronic Foot Pedal (Transducer) |
| ESW | . . . | Electronic Setpoint Potentiometer |
| ÜG | . . . | Monitoring Unit |
| SFBG | . . . | Fuel Limiter |
| VFSchG | . . . | Fuel Switch |
| PG | . . . | Test Unit |
| SV | . . . | Plug Connection |
| SpAG | . . . | Voltage Matching Unit |

# 2 Safety Instructions and Related Symbols

This publication offers practical safety instructions to indicate the unavoidable residual risks involved when operating the machine. These residual risks involve hazards to

- Personnel
- Product and machine
- The environment

**The primary aim of the safety instructions is to prevent personal injury!**

The signal words used in this publication are specifically designed to direct your attention to possible damage extent!

**⚠ DANGER** ***DANGER indicates a hazardous situation the consequence of which could be fatal or severe injuries if it is not prevented.***

**⚠ WARNING** ***WARNING indicates a hazardous situation which could lead to fatal injury or severe injuries if it is not prevented.***

**⚠ CAUTION** ***CAUTION indicates a hazardous situation which could lead to minor injuries if it is not prevented.***

**NOTICE** ***NOTICE indicates possible material damage.***



***Safety instructions are not only denoted by a signal word but also by hazard warning triangles. Red hazard warning triangles indicate immediate danger to life. Yellow hazard warning triangles indicate a possible risk to life and limb. Hazard warning triangles can contain different symbols to illustrate the danger. However, the symbol used is no substitute for the actual text of the safety instructions. The text must therefore always be read in full!***


***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 practised. The respective text is printed in italics.***

**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

The electronic HEINZMANN speed governors of the series E 1-F and E 2-F are all-electronic and therefore do not require mechanical drives. The respective electric actuators StG 1-F and StG 2-F are actively positioned in either direction by a power output stage.

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 requirements with respect to governing quality are high. These governors offer very short response times with little overshooting and high accuracy of speed control both with and without droop as may be required by the application.

Tasks such as automatic synchronization, load sharing, load anticipation, etc., can be carried out in a very simple manner by means of a series of accessories (please refer to our leaflet “Accessories“ and to our manuals for accessories).

# 4 Block Diagram of Control Circuit

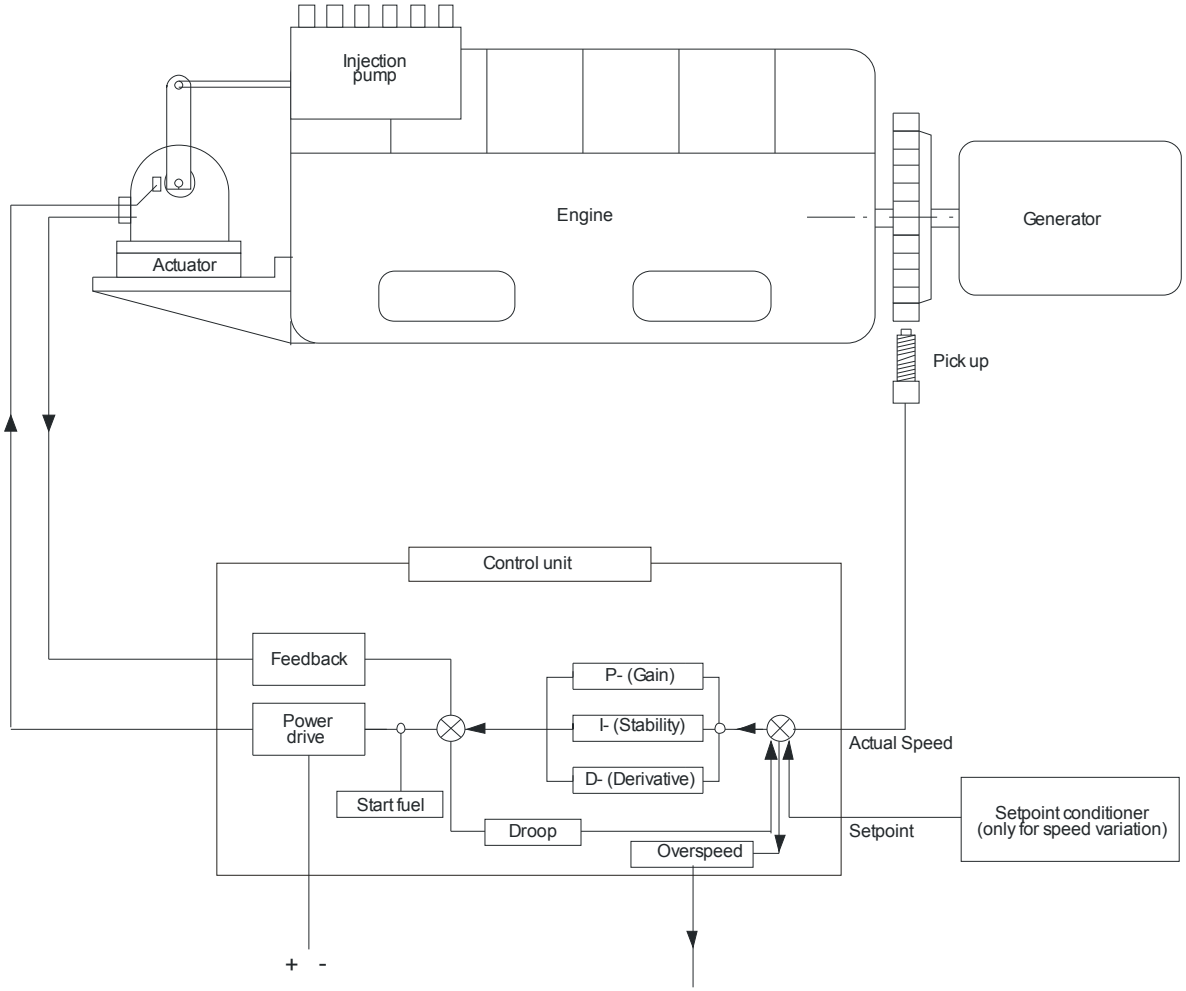



**Figure 1: Block Diagram of Control Circuit**

# 5 Mode of Operation

The electronic speed governors of the basic systems E 1-F and E 2-F are PID-governors designed for diesel or gas engines. The actuator output shaft rotation is 68°, thus allowing direct coupling to a carburator butterfly valve or a gas mixer.

Current speed is normally sensed as magnetic pickup frequency by means of a contactless inductive sensor on the starting gear ring and compared with set speed. If there is a difference between current and set speed the actuator is made to react accordingly and to eliminate the speed deviation.

The governors are designed as PID controls that depending on the specific application allow of operation both by the functions droop zero and by droop.

Droop zero is to be understood as adjusting speed to the pre-defined speed setpoint independently of engine load (for instance, 1,500 rpm for generator sets).

Droop, i.e. a permanent speed deviation in dependence on engine load, is required for vehicle applications as well as for retrofitting or modernizing existing generator sets where a mechanical speed governor has been replaced by an electronic one.

The basic systems E 1-F and E 2-F can be combined with accessories such as synchronizers, load measuring/sharing units and current anticipation units, etc.

## 5.1 Frequency Range

The control units are designed for a frequency range of:

Standard f = 3100 – 7000 Hz

Other frequency ranges are available on request.

## 5.2 Start Fuel Limitation

To prevent heavy smoke bursts during the engine starting phase, particularly with supercharged diesel engines, the start fuel limitation function can be activated by applying battery voltage to the switch input (green cable) until the starting procedure is completed. With generator sets, it is recommended to install an interconnection with the generator breaker (opening contact keeping the limitation active until the breaker is closed) whereas for other applications a speed dependent switching point is to be provided that will turn off this limitation when idling speed (e.g., 800 rpm) is reached.

## 5.3 Speed Switching Point

The controls E 1-F and E 2-F have an adjustable speed switching point that is capable of activating an external relay (yellow cable). This switching point is often used to cut off the starter or to sense over speeding.

# 6 Block Circuit Diagram of Governors E 1-F and E 2-F

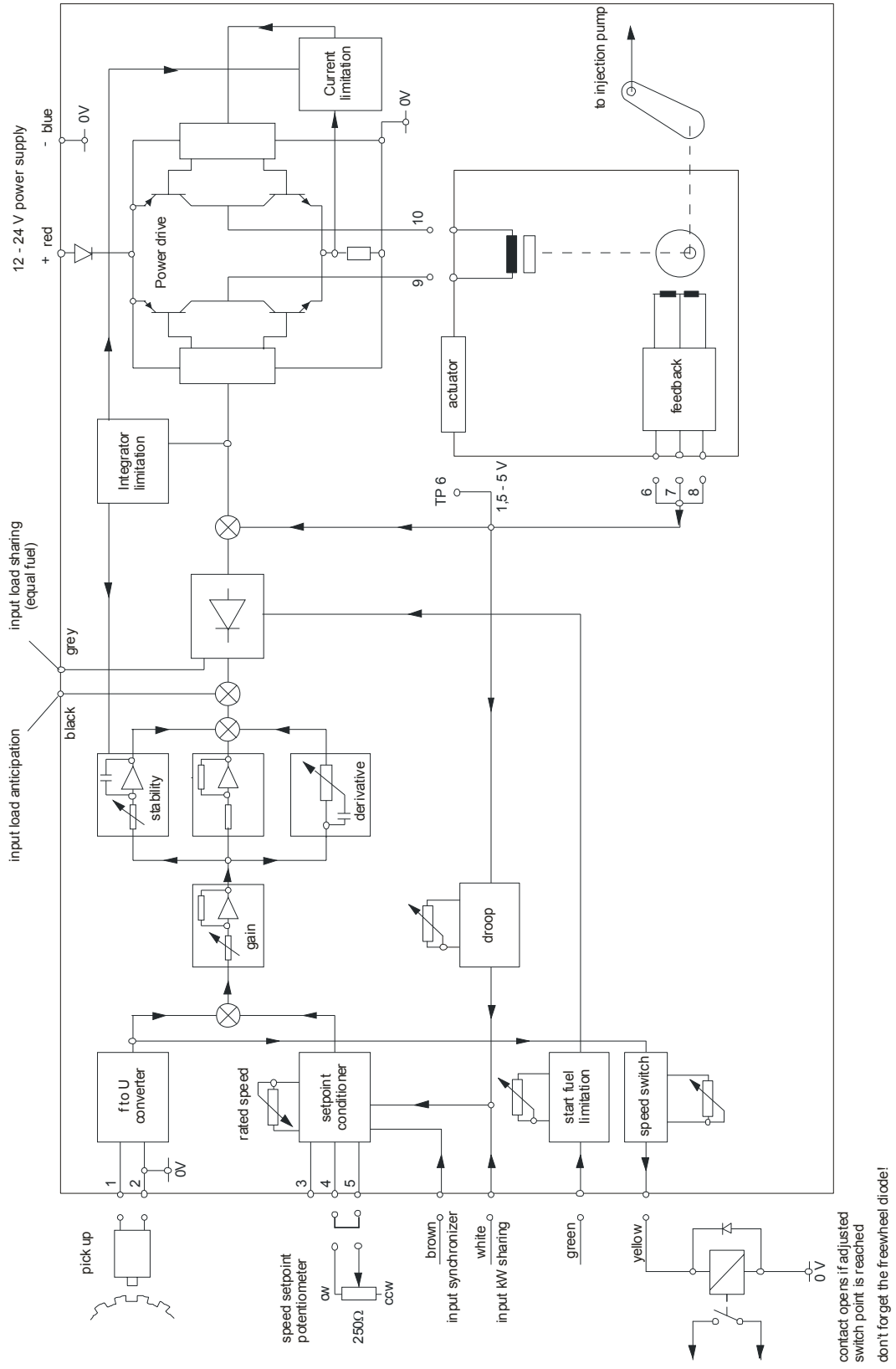



**Figure 2: Block Circuit Diagram of Governors E 1-F and E 2-F**

# 7 Magnetic Pickup IA...

## 7.1 Specification

| | |
|---|---|
| Principle | Inductive sensor |
| Distance to pickup wheel | 0.3 up to 0.6 mm |
| Output voltage | 0.5 up to 20 Volt |
| Signal form | Sine (depending on tooth shape) |
| Resistance | approx. 52 Ohm |
| Temperature range | - 55 °C up to +120 °C |
| Vibration | < 10g, 10 up to 100 Hz |
| Shock | < 50g, 11 ms half sine wave |
| Protection grade | |
| magnetic pickup | IP54 |
| plug | IP20 |

## 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. The Frequency (by Hz) is calculated according to the formula

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

z = number of teeth on the pickup wheel

Example:

n = 1500

z = 160

$$f = \frac{1500 * 160}{60} = 4000 \text{ Hz}$$

It should be taken care that speed can be measured by the pulse pickup without any bias. For best results therefore, the speed pickup should take engine speed from the crankshaft. A suitable position for this is, e.g., the starter gear (but not the injection pump wheel).

The pickup gear must consist of magnetic material (e.g., steel, cast iron).

## 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 the magnetic pickup on till it touches the tooth and then unscrew it for about half a turn.)

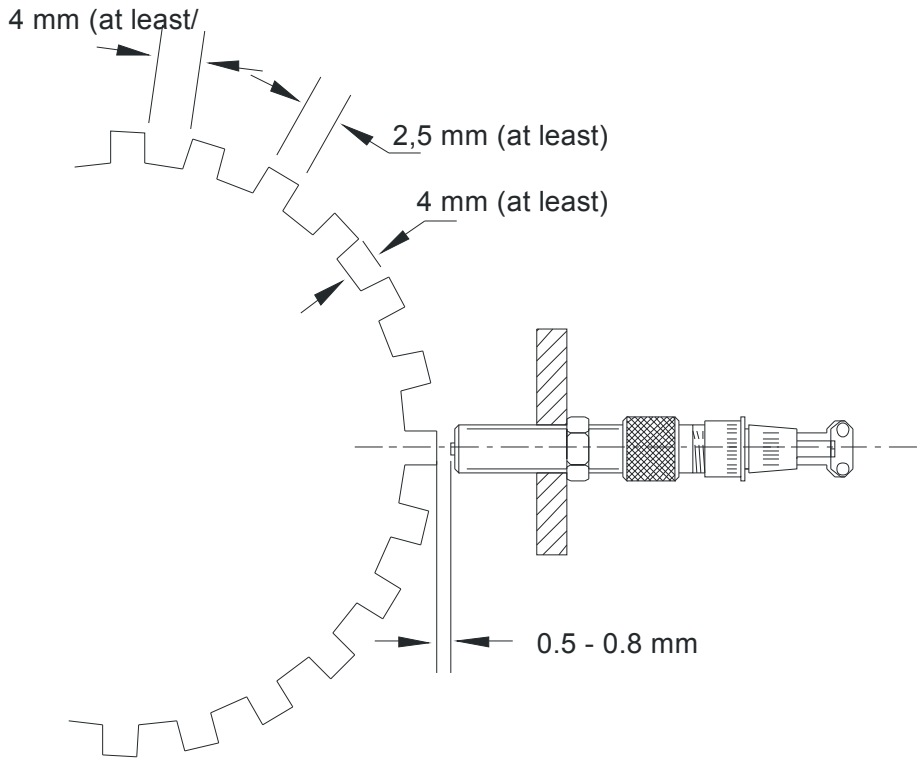



**Figure 3: Clearance of Magnetic Pickup**

## 7.5 Dimensions

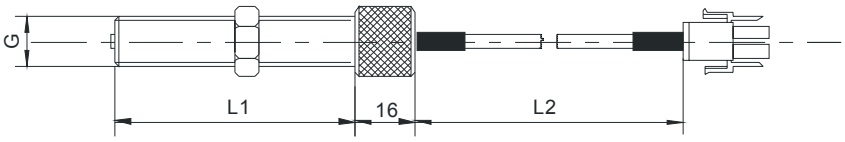



**Figure 4: Dimensions of Pickup with CableStandard Version**

IA 00-38 with G = M 16 x 1.5, L = 38 mm or
IA 10-38 with G = 5/8“-l8UNF-2A, L = 38 mm

### 7.5.1 Special Version

IA 00-76 with G = M 16 x 1.5, L = 76 mm or
IA 10-76 with G = 5/8“-l8UNF-2A, L = 76 mm

### 7.5.2 Special Version with Plug

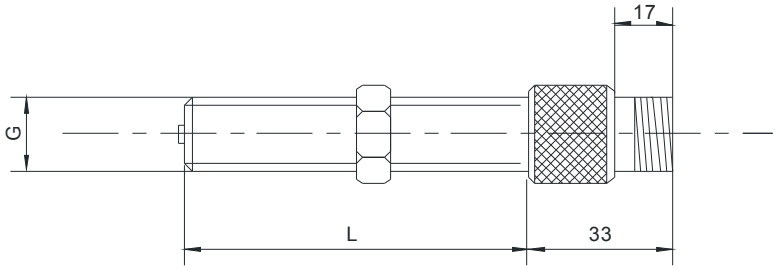



**Figure 5: Dimensions of Pickup with Plug**

| Dimension Type | L (mm) | G | Remarks |
|---|---|---|---|
| IA 01 - 38 | 38 | M 16 x 1,5 | corresponding plug SV6-IA-2K (010-02-170-00) |
| IA 02 - 76 | 76 | M 16 x 1,5 | |
| IA 03 - 102 | 102 | M 16 x 1,5 | |
| IA 11 - 38 | 38 | 5/8"-18UNF-2A | |
| IA 12 - 76 | 76 | 5/8"-18UNF-2A | |
| IA13 - 102 | 102 | 5/8"-18UNF-2A | |

Order specification e.g. IA 02-76

# 8 Setpoint Adjuster

The standard versions of the basic system E 1-F with control unit KG 1-04-F or KG 1-08-F and of the basic system E 2-F with control unit KG 2-04-F or KG2-08-F are shipped as idle/maximum speed governors and will therefore not normally require an external setpoint adjuster except a jumper on the 3-pole setpoint plug.

Note

*The setpoint plug with the link must always be connected. When not connected, the governor will not work. For safety reasons the actuator will then always be in a shutdown condition.*

By connecting an external setpoint potentiometer the control unit may be used as a variable speed governor. The 5 kΩ potentiometers as described in chapter 8.2 provide an adjustment range of 1:3.

On request, the potentiometers 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 provided. In this case, order specification should be SW ..-..-k instead.

## 8.1 Setpoint Potentiometer for Generator Applicationen with Droop

For generator applications with droop an external potentiometer or motor potentiometer with 250 Ω is recommended with generator frequency set to 50 Hz when the potentiometer is in mid-position. The 250 Ω potentiometer will permit of variations of ± 2 Hz (with respect to the generator frequency of 50 Hz).

| | |
|---|---|
| Rotation angle | approx. 312° |
| Resistance | 250 Ω |
| Temperature range | - 55 up to + 120°C |
| Protection grade | IP 00 |

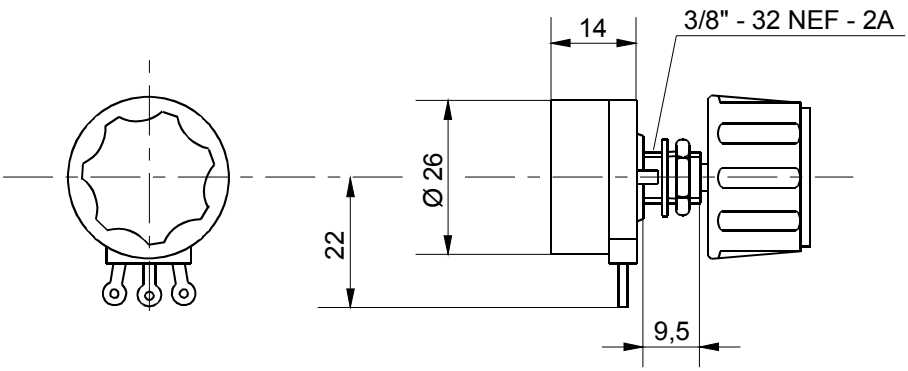



**Figure 6: Setpoint Potentiometer SW 13-1-o (250 R)**

Normally, the setpoint potentiometer is shipped completely prefabricated with a cable of 1.6 m length and with the appropriate plug for direct connection.

The following table gives the respective order specifications:

| Setpoint Potentiometer | EDV-No. | Remarks |
|---|---|---|
| SW 13-1-o (250 Ω) | 600-00-073-00 | |
| SW 13-1-(250 Ω) / E1-F | 601-81-216-00 | with 1.6 m cable & plug |

## 8.2 Setpoint potentiometer for all speed Governors with large speed variation

### 8.2.1 1-Turn Potentiometer

| | |
|---|---|
| Rotation angle | approx. 312° |
| Resistance | 5 kΩ |
| Temperature range | - 55 up to + 120°C |
| Protection grade | IP 00 |

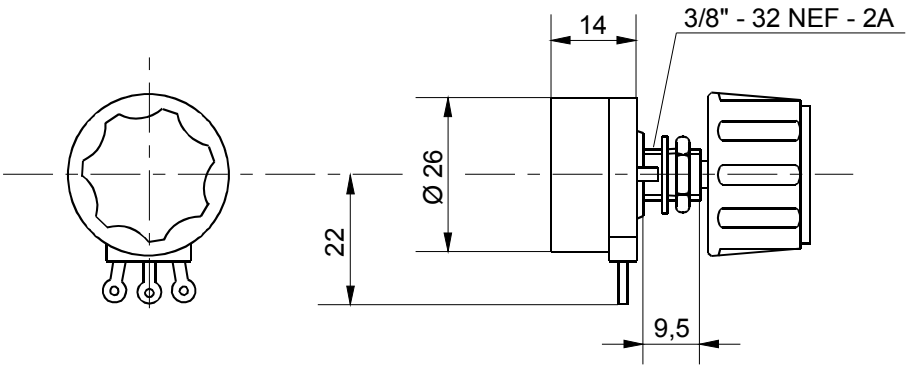



**Figure 7: Setpoint Potentiometer SW 01-1-o (5 kΩ)**

Normally, the setpoint potentiometer is shipped completely prefabricated with a cable of 1.6 m length and with the appropriate plug for direct connection.

The following table gives the respective order specifications:

| Setpoint Potentiometer | EDV-No. | Remarks |
|---|---|---|
| SW 01-1-o (5 kΩ) | 600-00-041-00 | |
| SW 01-1-(5 kΩ) / E1-F | 601-81-016-00 | with 1.6 m cable & plug |

### 8.2.2 10-Turn Potentiometer

| | |
|---|---|
| Rotation angle | 10 turns |
| Resistance | 5 kΩ |
| Temperature range | - 55 up to + 120°C |
| Protection grade | IP 00 |

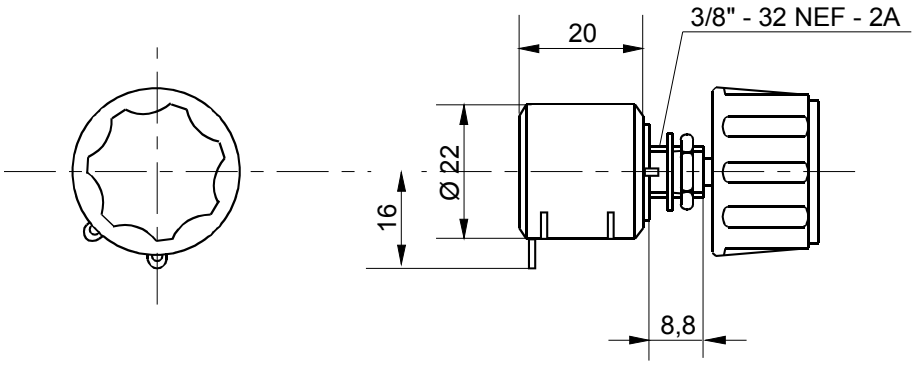



**Figure 8: Setpoint Potentiometer SW 02-10-o (5 kΩ)**

The setpoint potentiometer is shipped completely prefabricated with a cable of 1.6 m length and with the appropriate plug for direct connection.

The following table gives the respective order specifications:

| Setpoint Potentiometer | EDV-No. | Remarks |
|---|---|---|
| SW 02-10-o (5 kΩ) | 600-00-042-00 | |
| SW 02-10-(5 kΩ) / E1-F | 600-00-042-02 | with 1.6 m cable & plug |

## 8.3 Motorized Potentiometer

These potentiometers permit manual adjustment via the potentiometer knob or electrical adjustment from various positions via 24 V pulses (speed increase/decrease). Motorized potentiometers with different adjustment times and with or without optional limit switchers are available. For more information refer to manual E 83 006 - e.

## 8.4 Electronical Potentiometer

The electronical 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 synchronizer and load governing equipment. An internal potentiometer is used to adjust the basic speed which may be de-

creased or increased by pulses from the external equipment. The sensitivity and ramp time of the unit is adjustable. For more information refer to manual E 97 001 - e.


Note

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

# 9 Control Unit KG 1/2-...

## 9.1 General

Since there exist various basic systems and applications there are different control units available, e.g.,

| | |
|---|---|
| KG 1-04-F | Standard Unit for Basic System E 1-F |
| KG 1-08-F | Unit for E 1-F with plug for accessory units (e.g. SyG 02, LMG 11) |
| KG 2-04-F | Standard Unit for Basic System E 2-F |
| KG 2-08-F | Unit for E 2-F with plug for accessory units (e.g. SyG 02, LMG 11) |

Special equipment such as military versions are available on request.

## 9.2 Specification

| | |
|---|---|
| Voltage supply | 12 / 24 V DC |
| Residual ripple | max. 10 % at 100 Hz |
| Current consumption of actuator | max. 5 A |
| Current consumption of control unit | approx. 150 mA (+ current of actuator) |
| Permissible voltage dip at maximum current consumption | max. 10 % in control unit |
| Fuse protection of governor | 8 A |
| Operating temperature | - 40 up to + 70 °C |
| Humidity | up to 80 % |
| Pickup frequency | |
| Standard version | 3100 up to 7000 Hz |
| different ranges | available on request |
| Steady state variation | +/- 1/4 % |
| Speed variation due to temperature for frequency greater than 1500 Hz between -40°C and +70°C | +/- 1 % |
| Speed switchpoint | fully adjustable up to approx. 20 % above max. operating frequency |
| Start fuel limitation | 30 up to 100 % |
| Droop | 0 up to 15 % |
| Protection grade | IP 20 |
| Weight | approx. 1 kg |

## 9.3 Dimensions

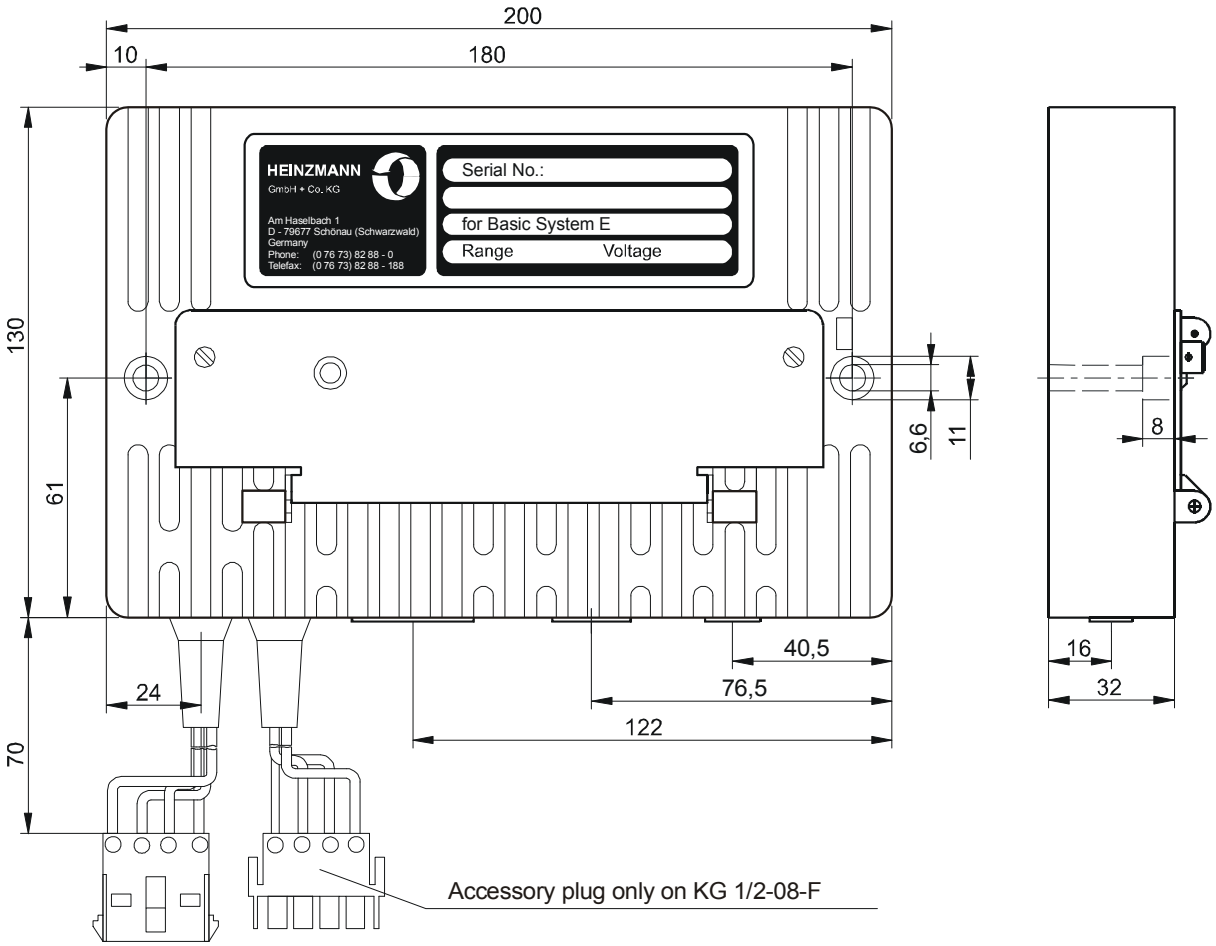



**Figure 9: Dimensions of Control Unit**

## 9.4 Mounting

For installation, any place can be chosen where there is the least possible amount of vibration and the lowest possible ambient temperature; it should be kept in mind to take the maximum cable lengths into account. There should be no strong magnetic fields in the vicinity of the control unit to avoid disturbances.

# 10 Actuators StG 1-02-F and StG 2-02-F

## 10.1 Design and Mode of Operation

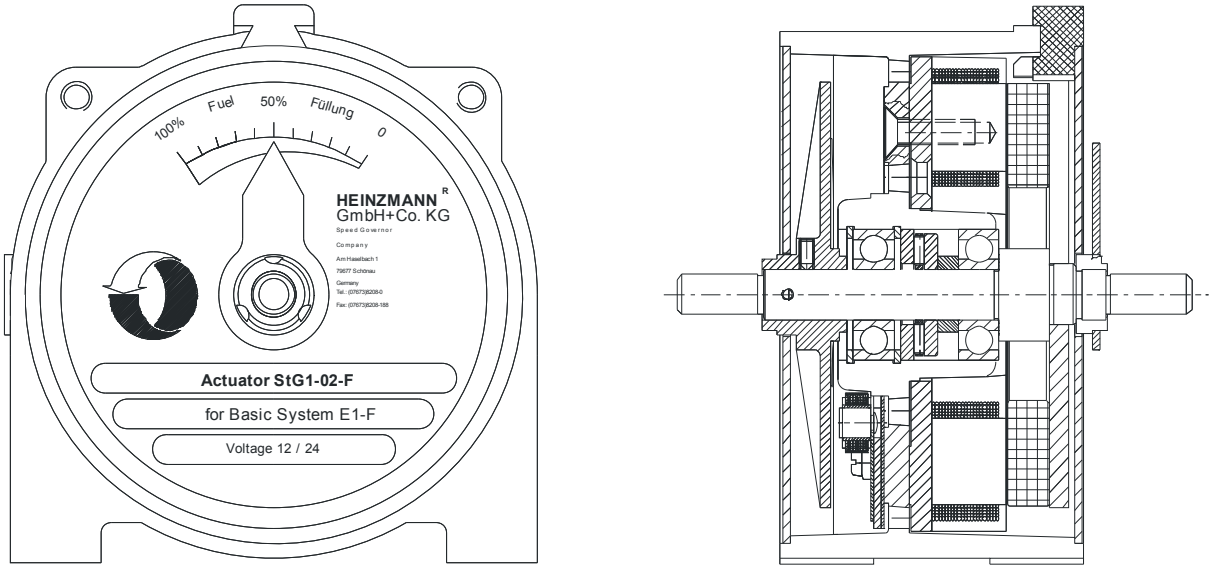



**Figure 10: Sectional Drawing of Actuator StG 1-02-F**

A multipolar magnetized permanent magnet is mounted on the actuator shaft. Opposite the permanent magnet an armature is fixed. When current is fed to the armature, torque in one direction is obtained. Changing the polarity of the current results in changing the torque direction.

The control feedback is also fixed on the shaft. The actuator has a contactless feedback system that informs the control unit of the fuel position. Therefore, when speed or load change, the control unit is able to manipulate the actuator current, so the actuator will be forced to the required position until there is no difference between set speed and actual speed.

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.

The actuator is maintenance-free.

In 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.

## 10.2 Mounting

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!

## 10.3 Specifications

| | StG 1-02-F | StG 2-02-F |
|---|---|---|
| Effective rotation at the output shaft | 68° | 68° |
| Max. torque at the governor output shaft (direction stop) | | |
| with 12V | approx. 0.6 Nm | approx. 0.9 Nm |
| with 24 V | approx. 0.9 Nm | approx. 1.4 Nm |
| Current consumption of whole governor: | | |
| in steady state condition | approx. 0.8 .. 1.5 A | approx. 0.8 .. 1.5 A |
| on load changes | max. 5 A | max. 5 A |
| Storage temperature | -55°C up to +110°C | -55°C up to +110°C |
| Operating temperature | -25°C up to +90°C | -25°C up to +90°C |
| Protection grade | IP 40 | IP 40 |
| Weight | approx. 1.9 kg | approx. 1.9 kg |

## 10.4 Actuator Versions

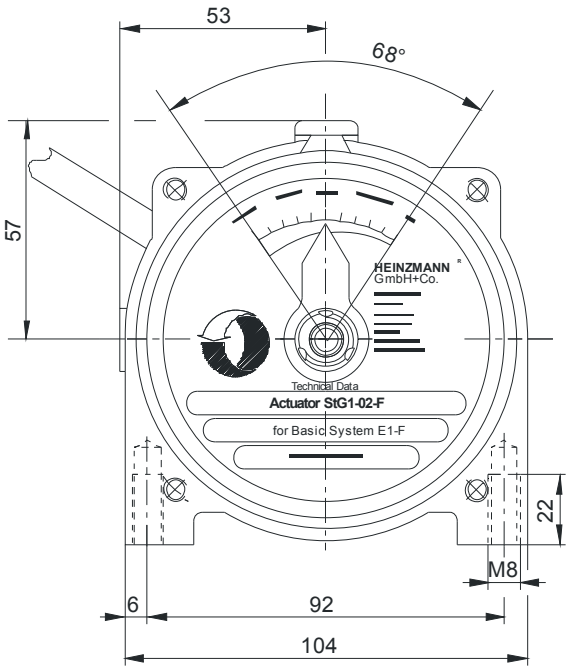
Since the leads of the actuators are mounted directly sealed-in, the actuators are being shipped with different cable lengths. The following table contains a list of all actuators that are available by standard.

| Actuator Designation | EDV-No. | Remarks |
|---|---|---|
| StG 1-02-F | 501-00-002-03 | cable length 250 cm |
| StG 1-02-F | 501-00-002-04 | cable length 500 cm |
| StG 1-02-F | 501-00-002-05 | cable length 30 cm, with Cannon plug |
| StG 1-05-F | 501-00-013-00 | military version |
| StG 2-02-F | 501-00-006-04 | cable length 250 cm |
| StG 2-02-F | 501-00-006-06 | cable length 500 cm |
| StG 2-02-F | 501-00-006-05 | cable length 30 cm, with Cannon plug |
| StG 2-02-F | 501-00-006-03 | cable length 250 cm, with return spring |

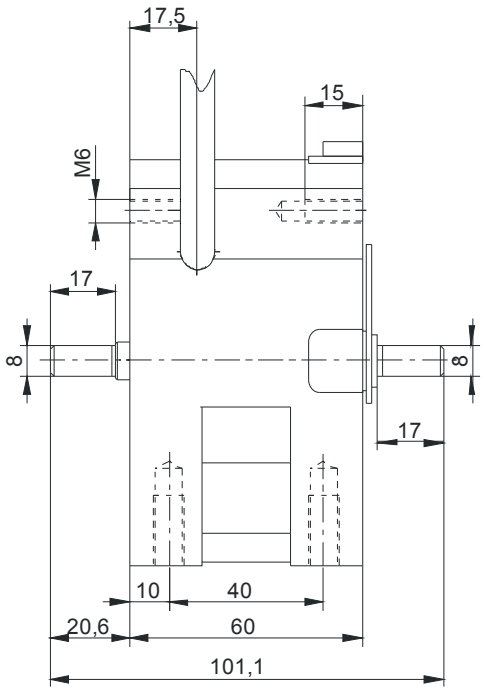

Note

*The lengths of the actuator lead must not be changed later on as this would have an adverse effect upon the measurement of the feedback as preset at the factory.*

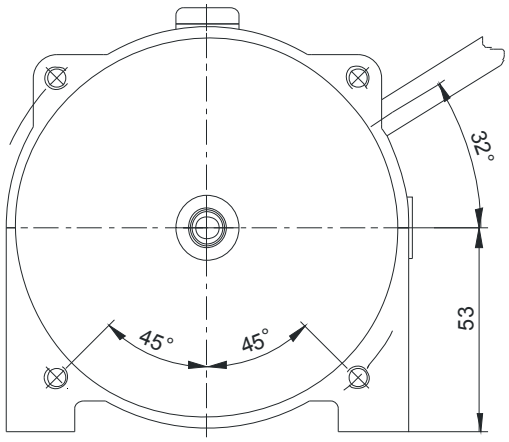
## 10.5 Dimensions



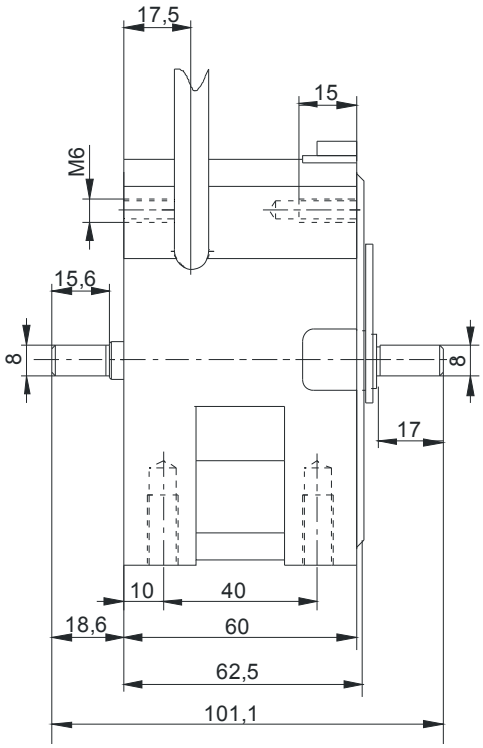

StG 1-02-F and StG 2-02-F




StG 1-02-F




StG 1-02-F and StG 2-02-F




StG 2-02-F

**Figure 11: Dimensions of StG 1-02-F and StG 2-02-F**

# 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. The lever arm on the actuator should have nearly the same length as the throttle valve lever (between 25 and 40 mm). If a larger angle at the carburettor is necessary for special applications, the lever arm may be lengthened.

For a linear displacement, e.g. injection pumps, the lever arm length is as follows:

L = 0,95 a
a = travel of the injection pump

## 11.2 Order Specification for Lever Arm

As a standard version, the lever arm as shown below is available.

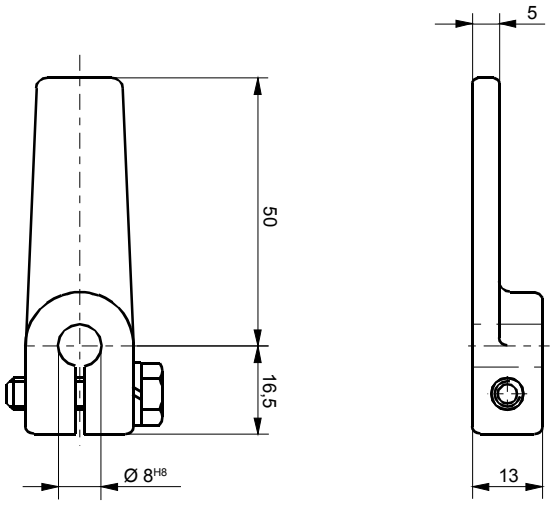



**Figure 12: Lever Arm for StG 1 and StG 2**

The order specification is RH 1-01, with EDV No.: 501-80-032-00

## 11.3 Connecting Linkage

The connecting linkage from the governor to the injection pump or the carburettor should be lengthwise adjustable. If possible, joint rod heads to 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 the actuator and the injection pump or throttle valve optimum control will not be possible.

## 11.4 Linkage Adjustment for Diesel Engines

The E 1 and E 2 control systems can be installed on diesel engines with distributor injections pumps (such as Bosch, CAV, Lucas) or inline pumps up to 4 cylinders with RS mechanical regulators.

Older distributor injection pumps (produced before 1990 approx.) have a stop lever. In this case, the linkage connecting the actuator must be attached to this stop lever.

More recent pumps have an electric magnetic valve for shutting the engine down. With these pumps, it is only the speed adjustment lever that the linkage may be connected to. This means that the mechanical control will still be active and receive just the setting value from the electronic control.

On engines with inline pumps and RS mechanical controls the linkage must be connected to the stop lever, and the internal spring provided to pull the stop lever into maximum position must be removed.

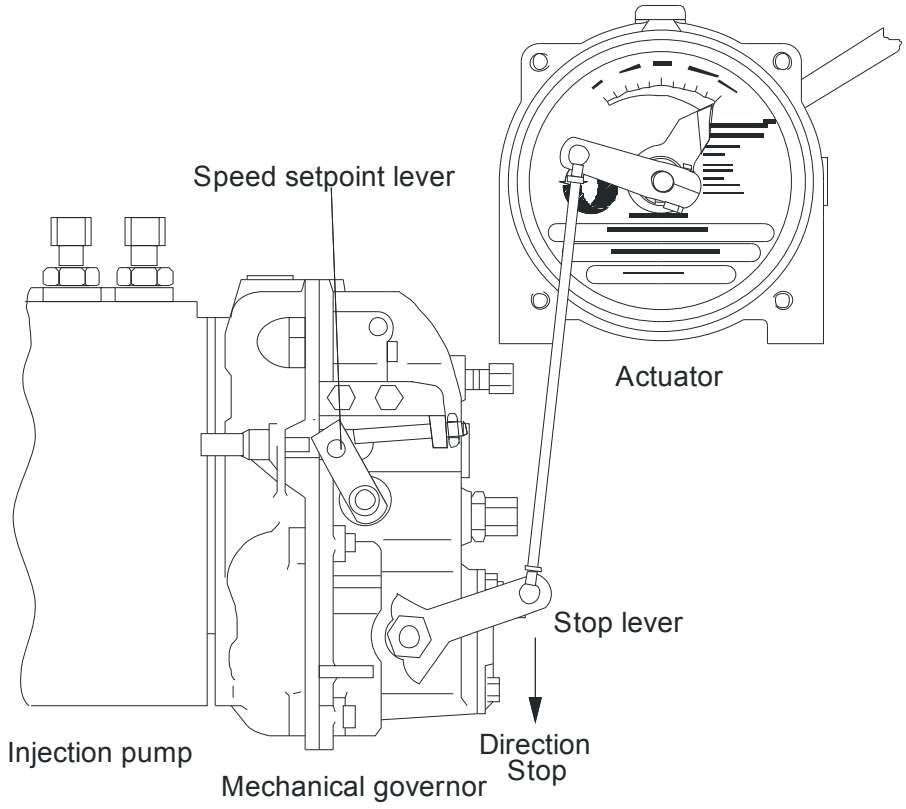



**Figure 13: Linkage for Diesel Engines**

## 11.5 Linkage Adjustment for Gas and Gasoline Engines

The throttle characteristic of gas engines and Otto engines is non-linear. This means that within the zero load range but small changes of the throttle position will already result in large changes of speed or load whereas with the throttle nearly fully open only larger changes of the throttle position will lead to distinct changes of speed or load.

To obtain the best possible control performance across the entire operating range it will be necessary to compensate for the non-linear behaviour of the throttle by means of a non-linear linkage. In this case, the length of the linkage is adjusted in such a way that with the control unit in full load position the throttle is completely open. The below figure shows the correct assembly.

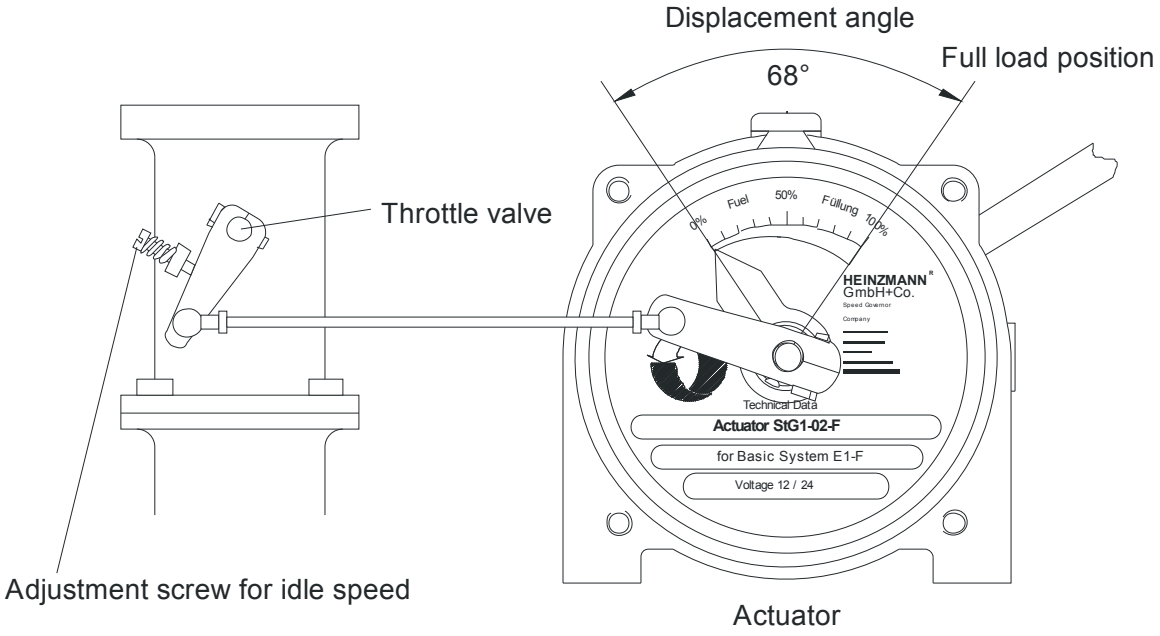



**Figure 14: Linkage for Gas Engines**

# 12 Electrical Connection

## 12.1 Governor Connection Diagram for KG 1-04-F and KG 2-04-F

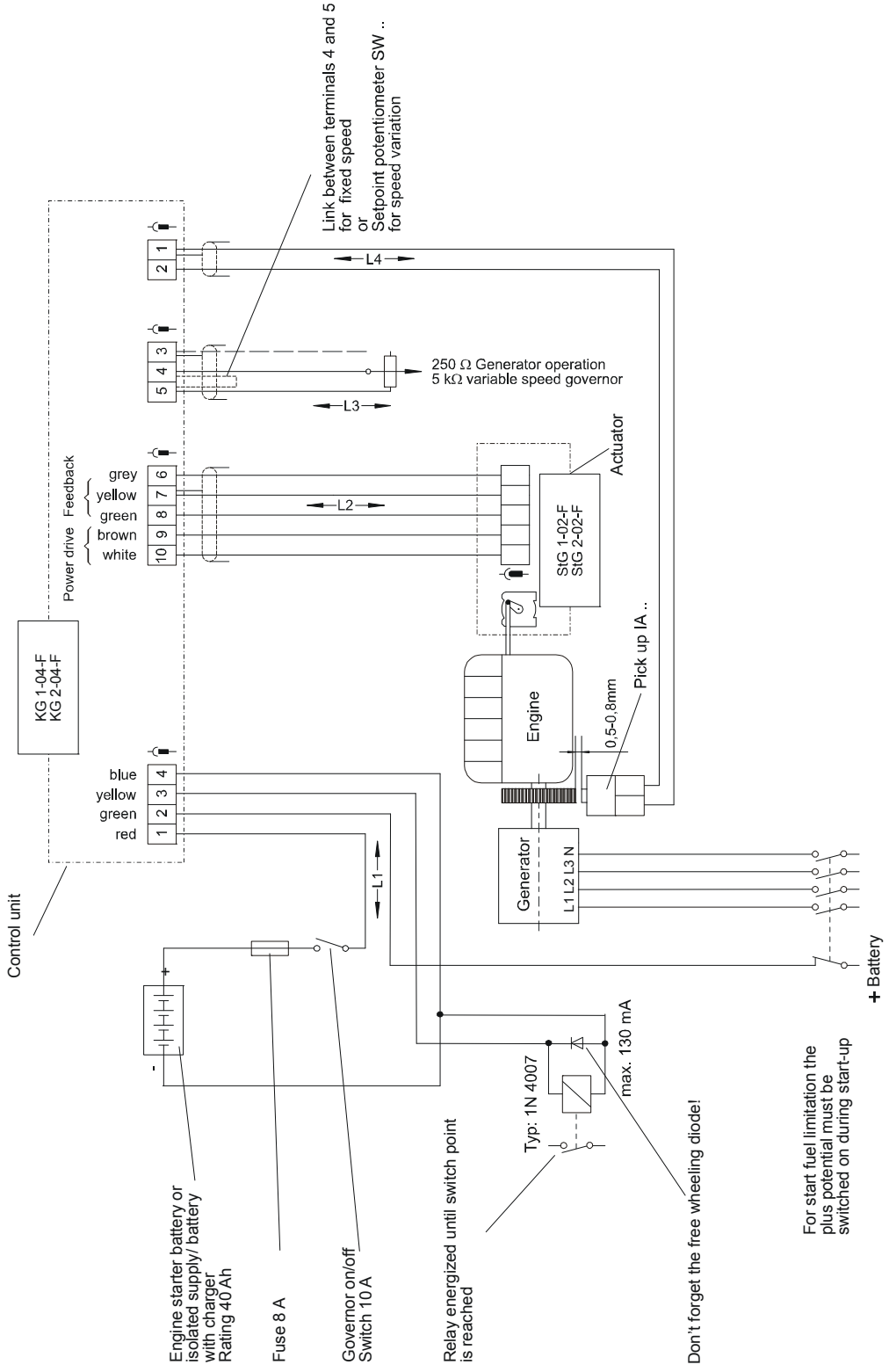



**Figure 15: Connection Diagram for KG 1-04-F and KG 2-04-F**

## 12.2 Governor Connection Diagram for KG 1-08-F and KG 2-08-F

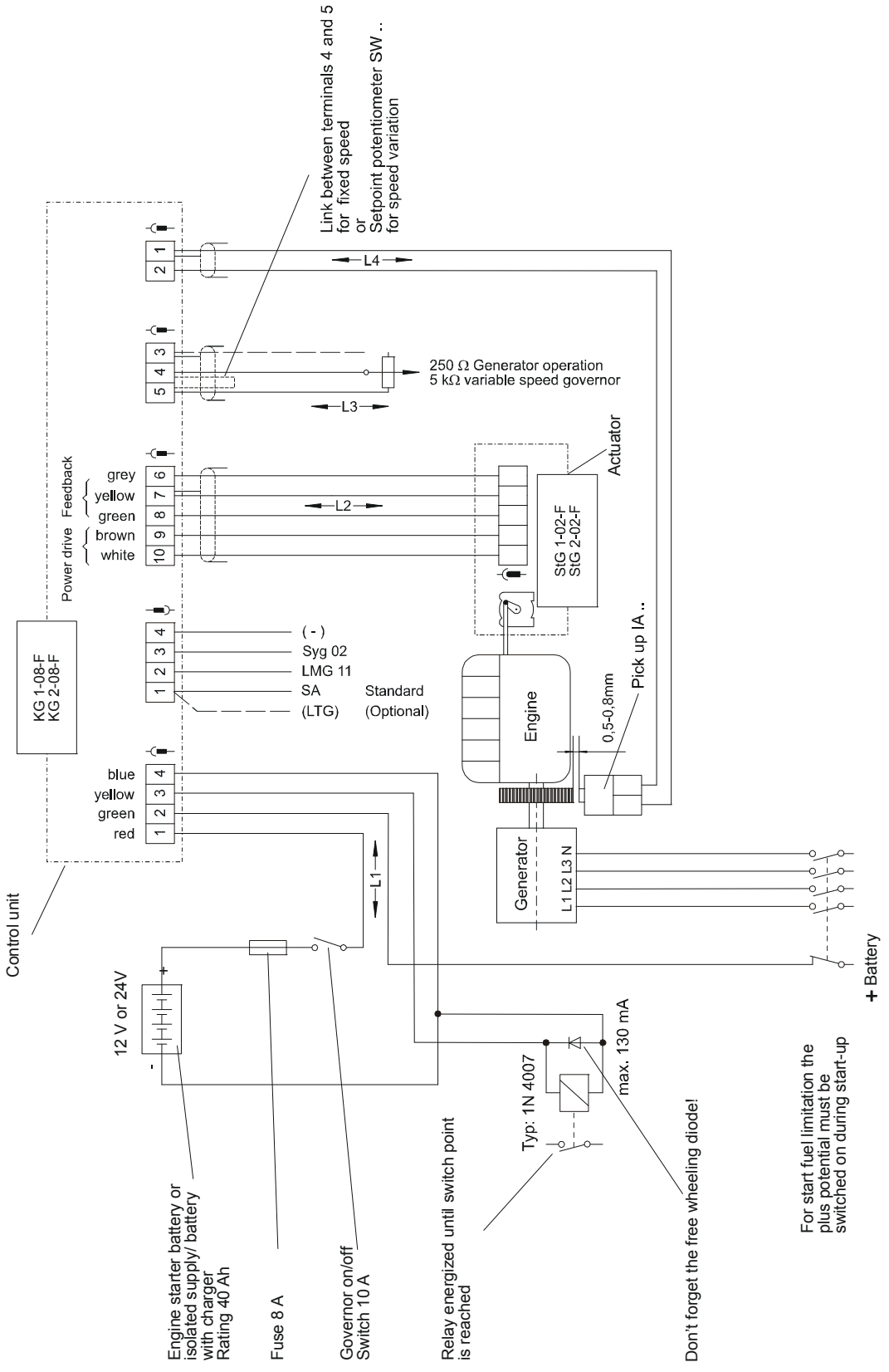



**Figure 16: Connection Diagram for KG 1-08-F and KG 2-08-F**

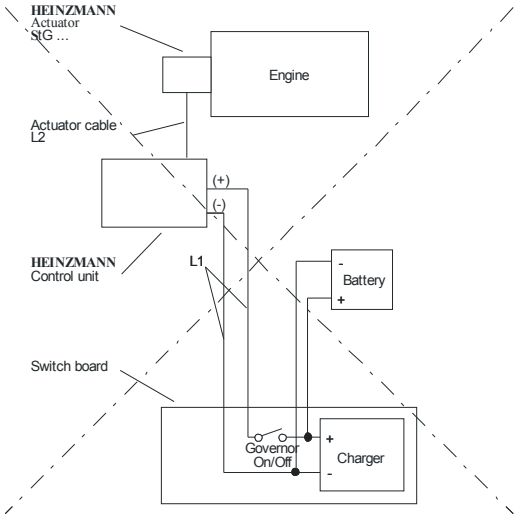
## 12.3 Connection of Power Supply

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 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.

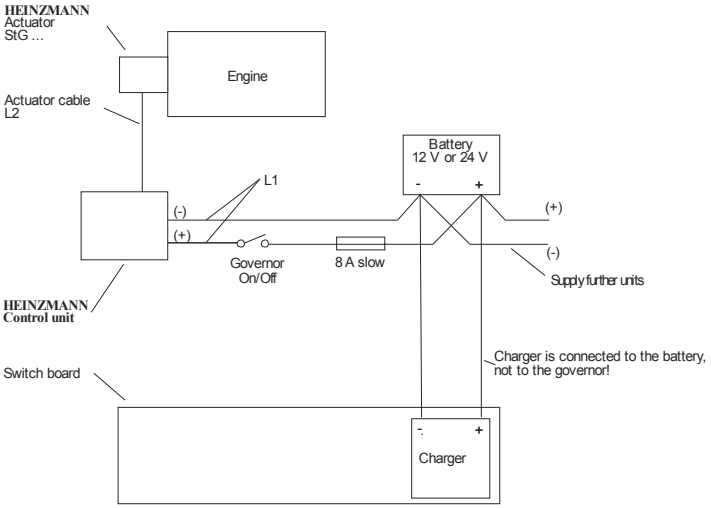
**Warning**

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

The following figures show both a wrong and a correct cabling:




**WRONG,** the ripple voltage fromn the charger is fed directly to the electronic speed governor .
This will damage the actuator!




**CORRECT,** the electronic speed governor is connected directly to the battery.
In this application the governor doesn't see the ripple from the charger.

**Notice!** Coils (e.g. stopping solendoids gas valves) have to be equipped with a protective circuit to elimenate inductance voltages.
Diode type e.g. 1N4002

**Figure 17: 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 **stabilized** power supply with at least 24 V DC, 10 Amps output power **be used** as a power source.

The minimum line sizes for the feed line **L1** must be for lengths of

| | |
|---|---|
| up to 7 m | 2 x 1,5 mm², |
| from 7 to 12 m | 2 x 2,5 mm² and |
| from 12 to 20 m | 2 x 4,0 mm². |

**Warning**

***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. 5 Amps), there may occur no greater a drop of the supply voltage directly at the control unit than of approx. 2 Volts maximum.***

## 12.4 Connection of Shielding

Trouble-free operation of the electronic governor requires a shielding for important connection lines.

The shielding has to be connected to minus potential of the control unit or the accessories of the governor.

In this case the shielding **has to be connected on one side only**, the other side must not be connected and there may not be any connection to ground.

Example: magnetic pickup for governors E 1-F and E 2-F

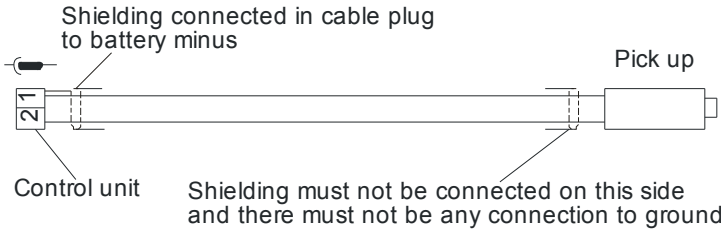
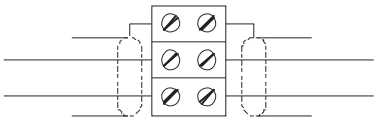



**Figure 18: Shielding of Magnetic Pickup**

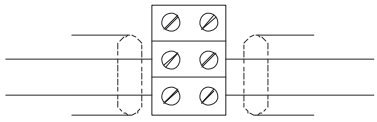
If a line with shielding is wired via a terminal strip, the shielding has to be connected to the terminal strip without contact to a negative line or ground.



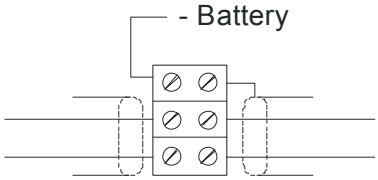
Correct shielding connection

**Figure 19: Shielding via Terminal Strip**

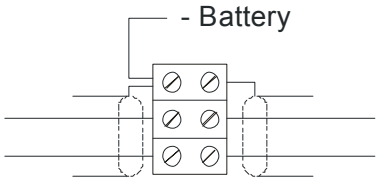
The following arrangements are frequently encountered, they may, however, cause governor disturbances.



Wrong! Shielding is discontinued




Wrong! Right and left side of shielding
connected to different negative terminals




Wrong! Shielding is additionally connected
to minus on terminal strip

**Figure 20: Faulty Shieldings**

To summarize, the following should be noted:

Shieldings of governor cables have to be connected to the control unit or the governor asseccories (connected to the control unit via the 0 Volt line). The shielding may not anywhere else be connected with minus or ground.

## 12.5 Checking of Shielding

a) Remove the plugs from the control unit and check the shielding connections from the cable plugs against ground. For the governors E 1-F and E 2-F these are the contacts 1 and 3. There may no connection be indicated.

b) With the plug screwed on, connect the other side of the shielding to the negative line via the test instrument. The test instrument must indicate connection. If no negative line is in the cable, then for testing purpose only, a connection with another line must be established via a link in the cable socket.

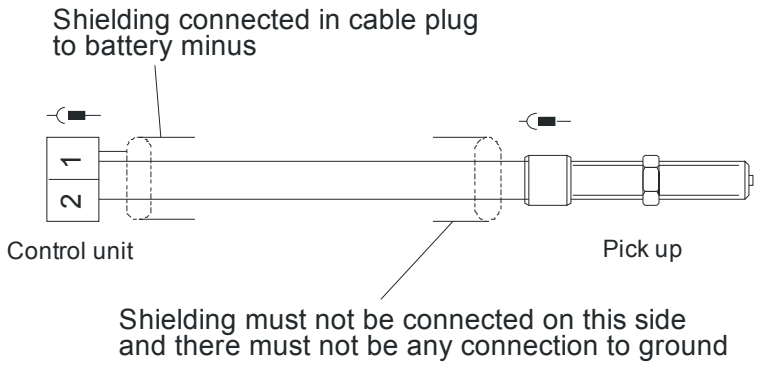



**Figure 21: e.g. Magnetic Pickup Shielding Check**

Note

*Installed HEINZMANN cables have already been checked at the factory.*

# 13 Harness and Plug Connections

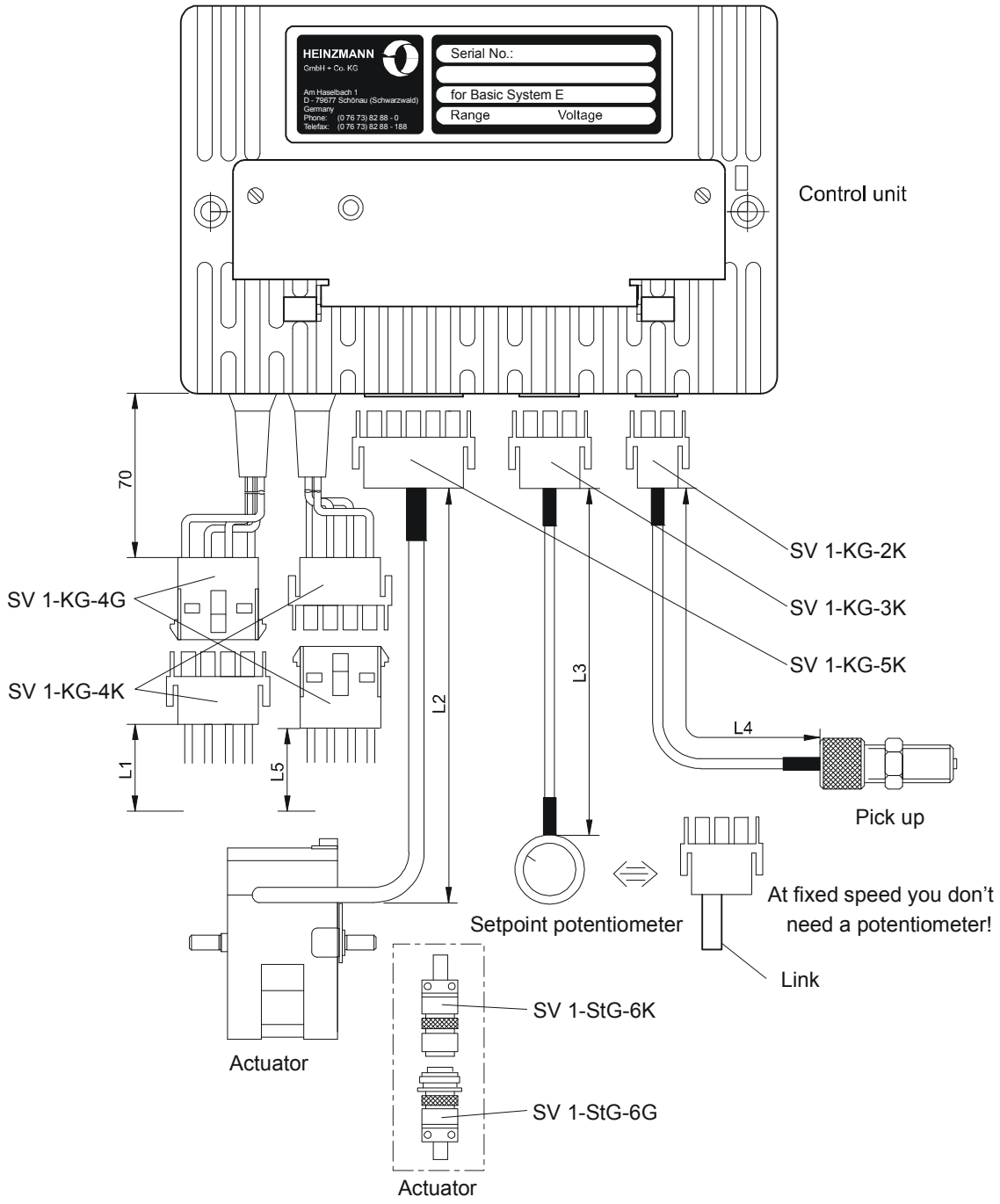



**Figure 22: Harness with Plug Designations**

| Cable Length | | Standard |
|---|---|---|
| L1 | Control Unit - Battery | 160 cm |
| L2 | Control Unit - Actuator | 250 cm |
| L3 | Control Unit - Setpoint Potentiometer (with separate order) | 160 cm |
| L4 | Control Unit - Magnetic Pickup | 160 cm |
| L5 | Control Unit - Accessory Units | variable |

# 14 Adjustment of E 1-F and E 2-F Governors

## 14.1 Governor Adjustment Sheet

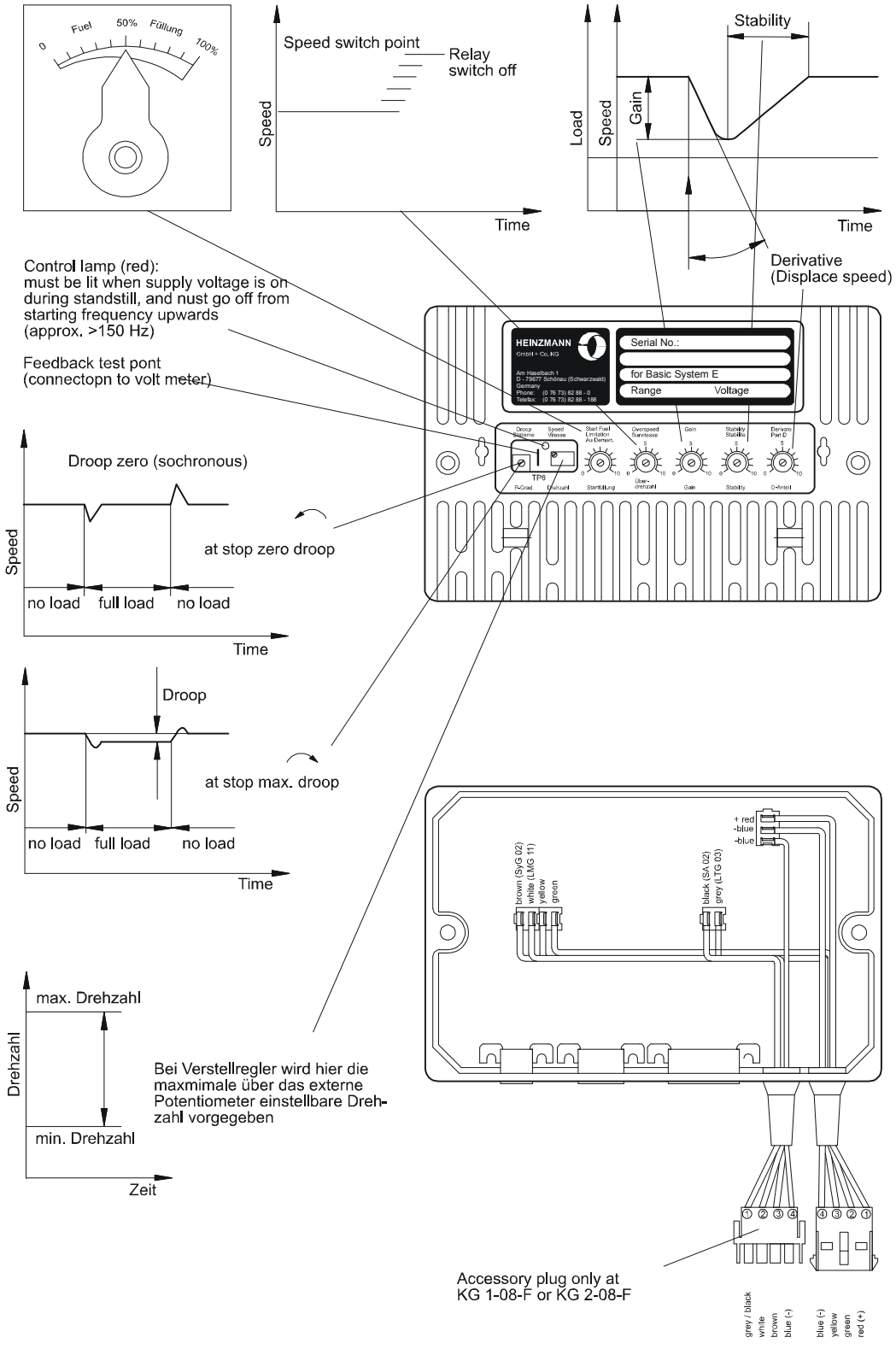



**Figure 23: Governor Adjustment Sheet**

## 14.2 Magnetic Pickup

Set the pickup distance to 0.5 to 0.8 mm from the highest point of the gear wheel (refer to chapter 6.4). At cranking speed the voltage must be minimum 0.5 V AC or more.

## 14.3 Linkage

Mount the linkage between the actuator and the fuel system according to instructions (refer to chapter 11). Check that there is no backlash in the linkage between actuator and fuel system and that the linkage is moving freely and without friction.

## 14.4 Electrical Connections

Refer to connection diagrams in chapter 12.

Make cable connections between:

Control unit
- magnetic pickup
- speed setpoint potentiometer (only with variable speed governor!)
- actuator
- battery

If the speed switch is used:

yellow cable of control unit - relay - battery ( - ); install freewheeling diode!

If start fuel limitation is used:

auxiliary contact of generator breaker (NC) or speed switch - battery - green cable of control unit

There is no need for these connections if the speed switch or start fuel limitation are not used.

## 14.5 Switching on Power Supply

The red LED below the hinged cover of the control unit lights up to indicate that voltage is being applied to the control unit.

## 14.6 Engine Start

**Warning**

***On starting the engine, you must be prepared to activate the emergency shutdown.***

The red LED will go out when cranking speed is higher than 50 rpm.

If the LED fails to go out, there is no signal from the magnetic pickup or the distance between pickup and fly wheel is too large.

## 14.7 Adjustment of Start Fuel Limitation

Start fuel limitation is active as long as battery voltage is applied to the green cable. To make the adjustment it must be ensured that the engine is rotating but does not start running. During adjustment this is achieved with gas engines by turning ignition off and with diesel engines by simultaneously activating the stop magnet. Use the start fuel potentiometer to set the desired start fuel quantity.

## 14.8 Adjustment of Speed

Various procedures are possible:

a) Adjustment with HEINZMANN test unit PG 01

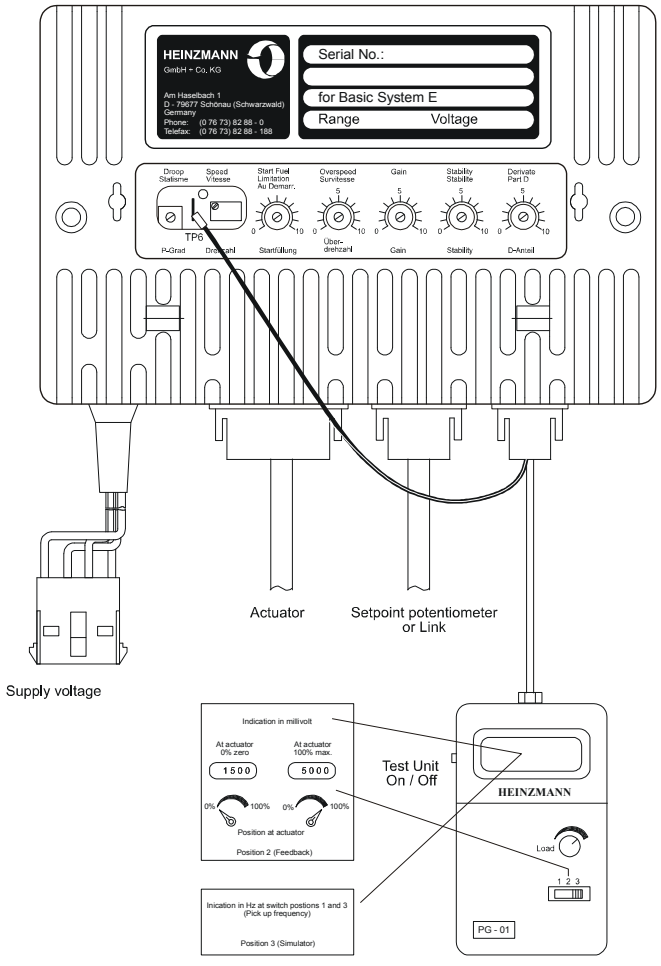



**Figure 24: Connection of Test Unit PG 01**

Connect the test unit PG 01 to the control unit as shown in the figure. Then set the switch from test unit to position 3. Turn the test unit off, then on again or carefully move the regulating linkage. The test unit will now simulate the engine (refer to manual E 83 008-e, Test Unit PG 01).

Warning

***The engine must not be started during simulation, otherwise it can go to over speed!***

If there exists an external setpoint potentiometer turn it into its rightmost position (right stop). Then use the internal multiturn potentiometer "Speed" of the control unit to set the frequency associated with operating speed.

b) HEINZMANN has been informed of the number of teeth and the operating speed when the order is placed. In this case, the control unit is set to the operating frequency specified by the customer before it leaves the factory. The operating frequency setting is indicated on the name plate.

c) If HEINZMANN has not been informed of the desired operating frequency before the control unit is shipped, the frequency is set to 4000 Hz. When commissioning the engine then speed must be corrected if necessary by means of the internal multiturn potentiometer.

Note

*If it is not possible to set the desired operating speed the jumper for determining the frequency range must be checked (see chapter 5.1).*

## 14.9 Adjustment of Dynamic

| | |
|---|---|
| Gain | in half-way position |
| Stability and derivative | ↶ to the stop |
| Speed switch point potentiometer | ↷ to the stop |

Carefully start the engine. Turn gain ↶ if engine speed is oscillating. Use the speed setpoint potentiometer to adjust operating speed.

| | |
|---|---|
| Gain | turn clockwise ↷ until unstable, then counterclockwise ↶, until stable |
| Stability | turn clockwise ↷ until unstable, then counterclockwise ↶, until stable |
| Derivative | with gas engines turn clockwise ↷ until unstable, then counterclockwise ↶, until stable |

Warning

***Never attempt to compensate mechanical errors e.g. friction or vibration of the actuator caused by weak brackets electrically. (Potentiometer gain must never be at the 100 % stop).***

## 14.10 Adjustment of Speed Switch Point

Set speed with external speed setpoint potentiometer to switch speed.

Turn speed switch point potentiometer slowly ↶ until relay actuates.

Turn speed setpoint potentiometer back to operating speed.

**Warning**

***Don't forget the freewheeling diode parallel to the relay coil! Otherwise the electronic can be damaged. (See figures 15 & 16.)***

## 14.11 Adjustment of Droop

As can be seen from the below figure the droop potentiometer is to be found on the left under the cover.

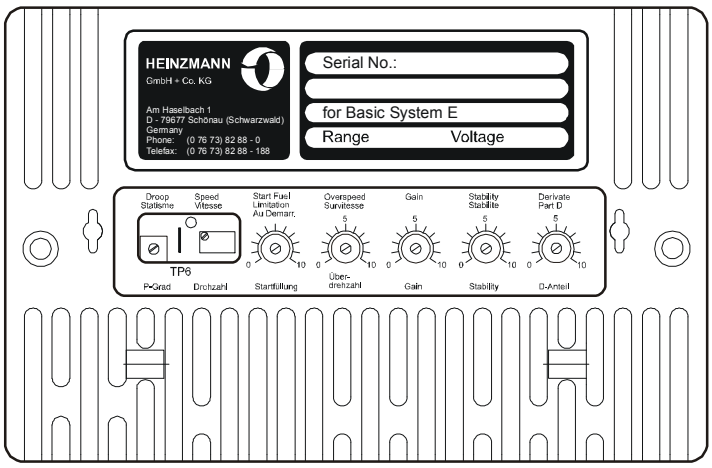



**Figure 25: Droop Potentiometer**

Droop potentiometer ↶ counter clockwise to min. stop end reduces the droop to zero (isochronous).

Droop potentiometer ↷ clockwise to max. stop end produces a droop of approx. 15 % over the complete actuator angular travel range. If for example, 40 % of the angular travel between zero load and full load is used, the max. droop is correspondingly smaller ( approx. 6 %).

**Note**

*To obtain satisfactory control results it will be necessary to utilize the largest possible operating angle of the actuator. Droop is then set to the correct value by means of the potentiometer.*

## 14.12 Using of non Heinzmann synchronizers and load setting units

For this application the KG 1-08-F or KG 2-08-F with the synchronizer input is required.

**Warning**

***Use an isolation amplifier to feed the steering signal into the Heinzmann governor to prevent disturbances.***

Adjustment procedure:

1. Start the GenSet to rated speed (e.g. 50 Hz) without connecting the external steering.
2. Measure the voltage on the synch. Input (brown cable) to 0.V (blue cable):
3. Adjust the offset voltage in the external steering exact to the measured level.
   (There must not be a speed change if you connect the steering to the governor and the synchronization is not active).
4. Turn Droop potentiometer 60 to 70% clockwise (results about 4% Droop, depending on the used actuator travel, see **Figure 26**)
5. This adjusted Droop (4% = +/- 2 Hz at 50 Hz generator frequency) gives the operating range for synchronization and load setting.
   Was the measurement on the synch. input e.g. 4V is your electrical operation range 4% from 4V = 160mV ! This is the value for your Gain adjustment.

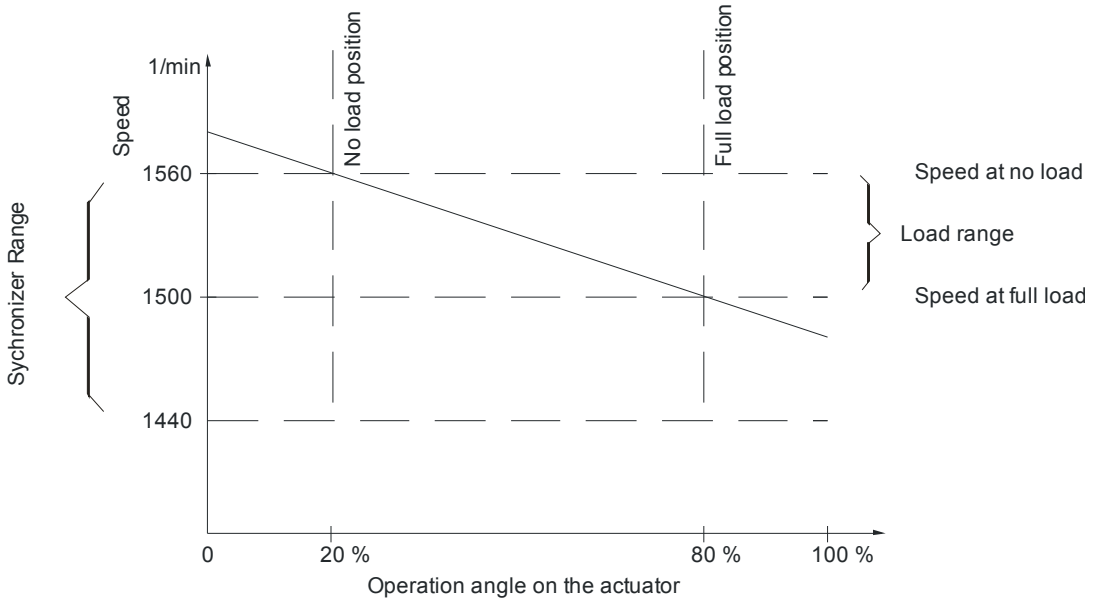



**Figure 26: Droop curve at 4% and 1500 rpm**

**Trouble Shooting**

| Symptoms | Possible Causes |
|---|---|
| Governor does not open on starting | Supply voltage not available, too low or poles reversed<br>Control lamp must be on when power supply is on and must go out from approx. 50 rpm upwards<br>No signal from magnetic pickup<br>Excessive pickup clearance (desired range approx. 0.5-0.8 mm)<br>Check resistance at plug (unplugged at control unit) from pickup cable (approx. 52 Ω). Wrong value means pickup or cable defective<br>Check starting speed voltage at plug (unplugged at control unit) from pickup cable (approx. 0.5 V AC)<br>No plug or speed setpoint potentiometer connected to setpoint input or a potentiometer with too high resistance is used. Max. value is 5 kΩ<br>Speed setting at minimum position<br>Wrong installation of actuator (rotation direction)<br>Actuator blocked or linkage adjusted wrongly<br>Control unit defective<br>Actuator defective, measure resistance between<br>brown - white approx. 4 Ω<br>yellow - green approx. 7 Ω<br>yellow - grey approx. 60 Ω<br>Poor plug contact in control box |
| Actuator opens directly when DC voltage is applied to control unit | Failure in shielding of magnetic pickup or setpoint potentiometer<br>Control unit defective |
| | |

| Symptoms | Possible Causes |
|---|---|
| Engine overspeeds on starting | Speed setting to high<br>Excessive magnetic pickup clearance; only a proportion of gear- teeth recorded<br>Poor contact in magnetic pickup line<br>Linkage cannot move freely<br>Actuator or control unit defective<br>If the actuator is working in one direction only, the fault is with the control unit |
| Governor unstable | Cable of magnetic pickup or of setpoint potentiometer captures interferences<br>Check shielding<br>Linkage between actuator and fuel system has backlash or too much friction<br>Supply voltage too low or unstable. Check residual ripple of max. 10 %<br>Misfiring at carburetor / gas engines<br>Check ignition and spark plugs<br>Governor adjustment wrong<br>Load fluctuations<br>Poor electrical contact<br>Faults in setpoint signal, e.g. control of a motor potentiometer or setpoint by external voltage |
| Reduced speed under load | Check droop potentiometer position. Counterclockwise to stop results in zero droop<br>Actuator on 100% fuel stop<br>Linkage adjusted wrongly<br>Engine is overloaded<br>In case of gas engines, poor fuel quality<br>Droop selector switch not in zero position |
| Governor linkage is hunting | Residual ripple of supply voltage is too high<br>Shieldings faulty<br>Poor setpoint signal |
| | |

### 1.1 14.12

For this application the KG 1-08-F or KG 2-08-F with the synchronizer input is required.

***Use an isolation amplifier to feed the steering signal into the Heinzmann governor to prevent disturbances.***

Adjustment procedure:

1. Start the GenSet to rated speed (e.g. 50 Hz) without connecting the external steering.
2. Measure the voltage on the synch. Input (brown cable) to 0.V (blue cable):
3. Adjust the offset voltage in the external steering exact to the measured level.
   (There must not be a speed change if you connect the steering to the governor and the synchronization is not active).
4. Turn Droop potentiometer 60 to 70% clockwise (results about 4% Droop, depending on the used actuator travel, see **Figure 26**)
5. This adjusted Droop (4% = +/- 2 Hz at 50 Hz generator frequency) gives the operating range for synchronization and load setting.
   Was the measurement on the synch. input e.g. 4V is your electrical operation range

## 15 Order Information

When ordering, please note the individual units:

**Control Unit:**
KG 1-04-F or KG 1-08-F or KG 2-04-F or KG 2-08-F

**Associated Actuator:**
refer to chapter 10.4

**Leverarm:**
RH 1 - 01

**Magnetic Pickup:**
Standard IA 00-38 with 1.6 m cable or refer to chapter 7.5

**Setpoint Adjuster:**
Standard plug with link or refer to chapter 8

**Cable for Connection of Accessory Units:**
L 5, standard plug with 1.6 m cable other lengths on request

**Further Informations:**

Supply voltage ..... V

Number of teeth of pickup wheel .....

Speed .....

Note

*Other cable lengths and special versions are available on request.*

# 16 Index of Figures

## 17 Download of Manuals

Technical manuals can be downloaded in pdf-format from our homepage:

www.heinzmann.com

If the desired manual should not be available there, send an e-mail to:

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- name and address of your company
- e-mail or address where you want the manuals to be sent to (if different from above)
- item code (as on front page, bottom right) and title of the desired manual
  or alternatively the technical data of your HEINZMANN equipment

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