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HEINZMANN®
Digital Electronic Speed Governors



Digital Basic System

PANDAROS - IV

DG 2005DP.6-01 up to -05

DG 2040DP.6-01 up to -05

	<p>The appropriate manuals must be thoroughly studied before installation, initial start-up and maintenance.</p> <p>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.</p> <p>HEINZMANN shall not be held liable for any damage caused through non-observance of instructions.</p> <p>Independent tests and inspections are of particular importance for all applications in which a malfunction could result in injury to persons or material damage.</p> <p>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.</p> <p>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.</p>
	<p>To avoid any injury to persons and damage to systems, the following monitoring and protective systems must be provided:</p> <ul style="list-style-type: none"> – Overspeed protection independent of the rpm controller <p>HEINZMANN shall not be held liable for any damage caused through missing or insufficiently rated overspeed protection.</p> <ul style="list-style-type: none"> – thermal overload protection <p>The following must also be provided for alternator systems:</p> <ul style="list-style-type: none"> – Overcurrent protection – Protection against faulty synchronisation for excessively-large frequency, voltage or phase difference – Directional contactor <p>The reasons for overspeeding may be:</p> <ul style="list-style-type: none"> – Failure of positioning device, control unit or its auxiliary devices – Linkage sluggishness and jamming
	<p>The following must be observed before an installation:</p> <ul style="list-style-type: none"> – Always disconnect the electrical mains supply before any interventions to the system. – Only use cable screening and mains supply connections that correspond with the <i>European Union EMC Directive</i> – Check the function of all installed protection and monitoring systems

 <p>NOTICE</p>	<p>Please observe the following for electronically controlled injection (MVC):</p> <ul style="list-style-type: none"> – For common rail systems each injector line must be equipped with a separate mechanical flow-rate limiter – 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.
 <p>WARNING</p>	<p>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.</p>
	<p>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.</p>
	<p>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.</p>
	<p>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.</p>

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1 Safety instructions and related symbols


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


- 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. 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 practiced.

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

1.1 Basic safety measures for normal operation

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

1.2 Basic safety measures for servicing and maintenance

- Before performing any maintenance or repair work make sure the working area of the engine has been closed to unauthorized persons. Put on a sign warning that maintenance or repair work is being done.
- Before performing any maintenance or repair work switch off the master switch of the power supply and secure it by a padlock! The key must be kept by the person performing the maintenance and repair works.
- Before performing any maintenance and repair work make sure that all parts of engine to be touched have cooled down to ambient temperature and are dead!
- Refasten loose connections!
- Replace at once any damaged lines and/or cables!
- Keep the cabinet always closed. Access should be permitted only to authorized persons having a key or tools.
- Never use a water hose to clean cabinets or other casings of electric equipment!

1.3 Before putting an installation into service after maintenance and repair works

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

2 General

The HEINZMANN Digital Governors of the PANDAROS series have been designed as speed governors for diesel and gas engines with low and medium power. In addition to their primary purpose of controlling speed, these governors are capable of performing some other tasks and functions.

The control system consists of the control unit, the actuator, the setpoint adjusters, the sensors, and the connection cables.

The control unit includes the control electronics. At the core of the control unit is a very fast and powerful 16 bit microprocessor. The actual controller program on which the processor operates, is permanently stored in a FLASH-EPROM.

The current engine speed is sensed by a magnetic pick-up on the flywheel or a measuring wheel.

One temperature sensor can measure the engine temperature and can cause changings of governor parameters or alarm messages.

The speed setpoint, additional sensor inputs and the inputs for the analogue accessory are depending on variations.

In the case of the DC 6-00 variant, which offers the largest functional scope and flexibility, the user must configure all inputs and outputs themselves.

With regard to the other variants, no additional outputs are provided aside from the error message output. In certain cases, the inputs are already specifically pre-configured and all parameters that are not required for the respective application are omitted so as to maintain a clearer overview of the controller and to make start-up easier to perform.

With the serial interface ISO 9141 resp. RS 232 is communication to other devices possible.

3 Functions

The HEINZMANN digital controllers from the PANDAROS series are speed governors in which, depending on the variant in question, further variant-specific functions are available in addition to the speed control and the general functions.

3.1 General functions

a) Start fuel adjustment

For setting start fuel, minimum start quantity or maximum start quantity may alternatively be selected. If necessary either can be configured in dependence of temperature. Furthermore, variable start quantity can be provided, by which start quantity is automatically increased during start-up.

b) Speed ramps

For applications where speed is not supposed to respond to changes of setpoint values as fast as possible, a speed ramp is available. According to requirements, it may be parametrized separately for increasing or decreasing speed. In addition, a separate speed ramp is provided for start-up which will make the engine ramp slowly to operating speed after starting.

c) All speed governing with adjustable droop

Several applications e.g. generators in parallel without HEINZMANN load measuring unit might require speed control with droop (proportional band). The droop can be adjusted as desired. With droop adjusted to 0, the governor operates in isochronous mode.

d) Setting the speed range

The minimum and maximum speed adjustable by the (external) setpoint, can be parametrized.

e) Engine stop

When the switch input for engine shutdown is activated, the governor will cause the actuator to fully pull to stop direction until the engine has stopped.

f) Overspeed protection

An overspeed point can be parametrized. If this point is overcome, the governor will issue an alarm and the actuator will fully pull to stop direction.

g) Gradient monitoring

The engine speed signal can be monitored for a permissible change speed (gradient).

h) Correction of PID parameters

To optimize the dynamics for every operating point, the PID parameters may be corrected in dependence of speed, temperature and load by means of freely programmable stability maps.

i) Speed dependent fuel limitation

It is possible to program fuel limitation curves in dependence of speed so that for all speeds there can be torque reduction as is admissible for the engine or desired by the user.

j) Temperature dependent idling speed and fuel limitation

At low temperatures, the engine can be run at some higher idling speed. With the engine warming up, idling speed is reduced to its normal value. It is possible to program fuel limitation curves in dependence of temperature so that for every temperature there will be torque reduction available as is admissible for the engine or desired by the user.

k) Operating hour meter

The operating hours when the engine is turning (speed is detected) will be added.

l) Failure diagnosis and display

If a sensor or the actuator is at fault, an alarm is issued and there will be a change-over to emergency operation if so provided or an engine shutdown. Internal errors get detected also and they will be stored as all other failures. All failures can be read out with an external hand programmer or with a communication program on a PC or laptop with communication cable.

m) Communication

An ISO 9141 interface is provided to enable communication with a Heinzmann communication tool.

3.2 Variation specific additional functions

3.2.1 Variation DC 6-01 (Standard Generator)

(refer to connection diagram DC 6-01)

The speed setpoint is realized with two push buttons: increase speed and decrease speed.

3.2.2 Variation DC 6-02 (Standard General)

(refer to connection diagram DC 6-02)

The speed setpoint is given by an analogue setpoint source (voltage source 0 ... 5 V, current 4 ... 20 mA or potentiometer 5 k Ω) and one switch input for fixed speed.

3.2.3 Variation DC 6-03 (Extended Generator)

(refer to connection diagram DC 6-03)

The assignment of the function and the calibration of the inputs must be performed by the customer themselves in this context. The following functions are also available, although the limited number of inputs means that they cannot all be used simultaneously:

a) Free configurability of inputs

Five digital inputs are available in total, up to three of which can also optionally be configured as analogue inputs featuring 0 ... 5 V or 4 ... 20 mA if required.

b) Speed offset selection

All analogue or digital control signals that are conventionally used on the market for the purpose of generating a speed offset selection for a superordinate generator control may be applied. This naturally also includes signals from ComAp, Deapsea, Deif, Kuhse, Stucke, etc. as well as analogue additional devices from Heinzmann.

c) Communication with Heinzmann generator management DGM-02

If the corresponding parameter settings have been made, the digital generator management from Heinzmann (THESEUS DGM-02) can be connected via CAN bus.

d) Idling speed

It is possible to switch to the idling speed for a warm-up or cool-down phase.

e) P-range changeover

It is possible to switch between two different P-ranges.

f) Speed range changeover

It is possible to switch between two different speed ranges.

g) Manual/automatic mode

It is possible to switch between manual and automatic mode.

h) Generator switch

In order to make quicker adjustments when opening the power generator switch, it is possible to activate a special function that queries the status of the power generator switch. This status can be assigned to a digital input.

i) Deleting errors

The current errors can be deleted by pressing an assigned button at a digital input.

j) Automatic calibration of the actuator

After replacing the control device or the actuator, the feedback of the actuator can be recalibrated by pressing an assigned button (actuator and control device are adjusted in line with one another).

3.2.4 Variation DC 6-05 (Extended General, especially vehicle)

(refer to connection diagram DC 6-05)

a) Speed setpoint

The speed setpoint is given by an analogue setpoint source (voltage source 0 ... 5 V, current 4 ... 20 mA or potentiometer 5k Ω) and a switch input for fixed speed.

b) Boost pressure sensor

An analogue input is already specified for use with a boost pressure sensor. The input can be configured for a 0 ... 5 V or 4 ... 20 mA signal.

For turbocharged engines, fuelling can be reduced to achieve smokeless operation whenever there is no boost pressure (e.g., during start-up or on load changes). The respective limit curves can be programmed accordingly.

c) Oil pressure sensor

An analogue input is already specified for use with an oil pressure sensor. The input can be configured for a 0 ... 5 V or 4 ... 20 mA signal.

For the purpose of oil pressure monitoring, speed/pressure dependent limit curves can be provided. If oil pressure is low, an alarm is issued; if oil pressure continues to drop, the engine is shut down.

d) Idle-/Maximum speed governor

The governor may also be adjusted as an idle/max speed governor.

3.2.5 Variation DC 6-00 (ful flexibility)

This variant is not pre-configured and contains all the previously described functions of the different variants.

The only option that is not provided is that of communication with the digital generator management THESEUS via CAN bus.

This variant continues to feature the following additional functions:

a) Second speed sensor

A digital input can be reconfigured in order to support the use of a second speed sensor (featuring a Hall design).

b) Second fixed speed

It is possible to assign a second fixed speed.

c) Setpoint selection via notches

For simple applications for locomotive operation, the speed setpoint selection can be performed via notches. In this context, the bit combinations of up to four digital inputs can be assigned to corresponding speed setpoints.

d) Changeover between limiting curves

It is possible to switch between two different limiting curves.

e) Jet Assist

A Jet Assist function can also be activated in order to perform quick adjustments for load compensation at low levels of boost pressure.

f) Analogue outputs

The multifunctional ports (terminals 1 and 2) can also be configured as analogue outputs featuring 4 ... 20 mA. In this way, every available analogue measured value or calculated setpoint can be output.

g) PWM outputs

The multifunctional ports (terminals 1 and 2) can also be configured as PWM outputs. In this way, every available analogue measured value or calculated setpoint can be output.

h) Digital outputs

The multifunctional ports (terminals 1 and 2) can also be configured as digital outputs. This makes it possible for every digital measured value to be output.

i) PWM inputs

The multifunctional ports (terminals 1 and 2) and digital input 3 can also be configured as PWM inputs. In this way, every available analogue measured value or calculated setpoint can be output.

j) PE module adjustment

Via CAN bus, it is possible to communicate with an additional PE module of type DC 6. This can then control a second actuator and provide additional inputs and outputs that can be configured from the speed governor. The typical application in this regard is the control of V-type engines with two actuators.

3.2.6 Variation DC 6-06 (positioner)

This variant does not feature an integrated speed governor. In this context, the corresponding actuator is controlled via an actuator setpoint position signal received from an external source. This variant is described in a dedicated publication.

4 Further information

This publication describes in detail the technical data and connections of the control electronics, of the sensors, of the setpoint adjusters and of the actuators.

The functions of the different adjustment parameters and characteristics are described in detail in the manual

Basic Information Control device for conventional injection Manual DG 07 001-e

The mode of operation of the communication program DcDesk 2000 is described in detail in the manual

*Operation Instructions of Communication Program DcDesk 2000,
Manual-No. DG 00 003-e*

5 Block diagram

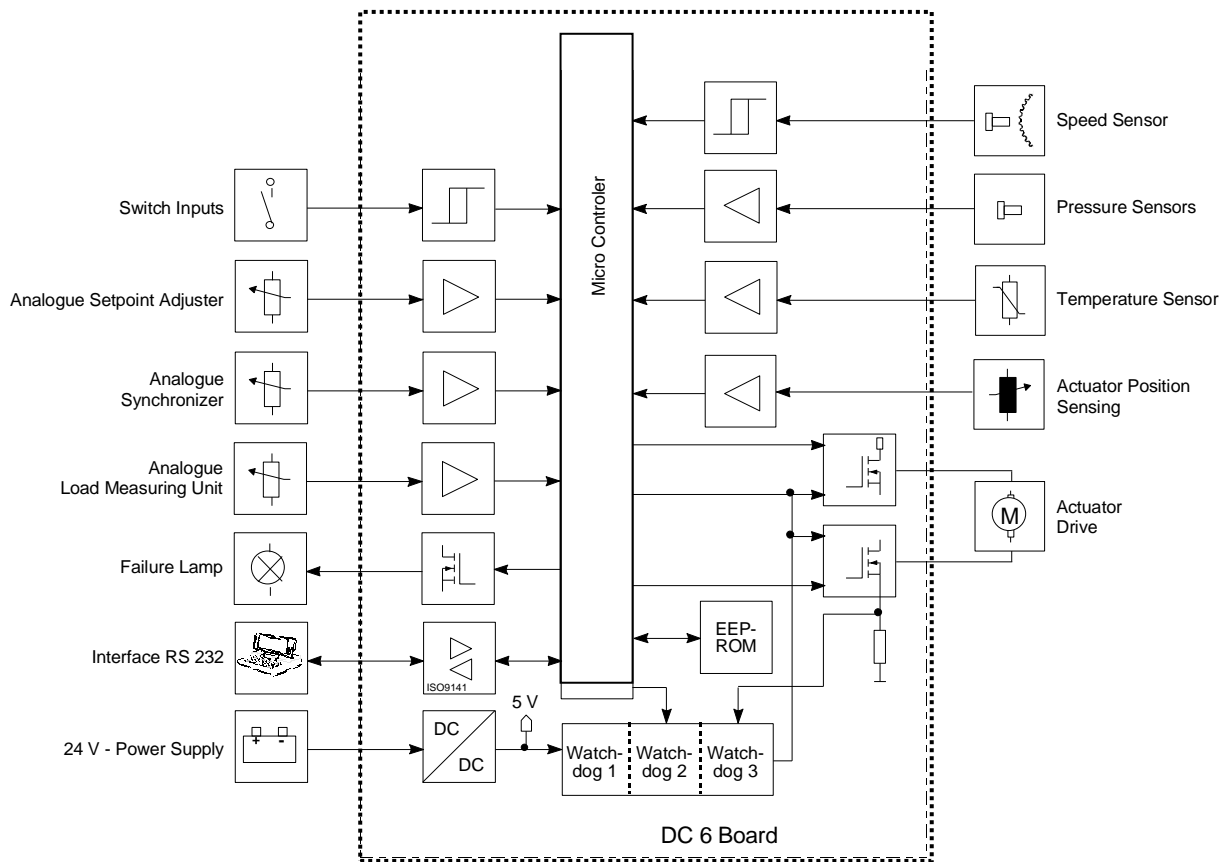


Fig. 1: Block diagram

According to the different types, there are not all functions and inputs available!

6 Sensors

6.1 Overview

Sensor	Speed	Coolant Temperature	Oil Pressure	Boost Pressure
HZM - Designation	IA ..	TS 01-28-PT1000	DSO 01-6 DSO 01-10	DSL/G 0..-2 DSL/G 0..-5 DSL/G 0..-10
Connection	SV 6-IA-2K 2 pole	SV 6-IA-2K 2 pole	DIN 43650 A 2 line system	DIN 43650 A 2 line system
Measuring Procedure	inductive, active	PT1000, passive	active	active
Measuring Range	50 ... 9.000 Hz	-50 ... +150°C	0 ... 6 bar 0 ... 10 bar	0 ... 2 bar 0 ... 5 bar 0 ... 10 bar
Supply Voltage Range		passiv	10 ... 34 V DC	12 ... 36 V DC
Output Signal Range	0 ... 10 V AC	ca. 700 ... 1500 Ohm	4 ... 20 mA	4 ... 20 mA
Operating Temperature Range	-55 ... +120°C	-50 ... +150°C	-25 ... +125°C	-40 ... +100°C

In order to ensure maximum flexibility with regard to the sensors, the minimum/ maximum current values and the measuring ranges of the pressure and temperature sensors have been provided programmable.

6.2 Magnetic pick-up IA ...

6.2.1 Technical data

Operating principle	inductive sensor
Distance from sensing gear	0.5 ... 0.8 mm
Output	0 ... 10 V AC
Signal form	Sine (depending on tooth shape)
Resistance	approx.. 52 Ohm
Temperature range	-55°C ... +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)

6.2.2 Installation

The installation of the pick-up has to be arranged in such a way as to obtain a frequency as high as possible. Normally, the **HEINZMANN** governors of the series Pandaros are designed for a maximum frequency of 9000 Hz. Frequency (by Hz) is calculated according to the formula

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

z = number of teeth on the pick-up wheel

Example:

$$n = 1.500$$

$$z = 160$$

$$f = \frac{1500 * 160}{60} = 4.000 \text{ Hz}$$



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

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

6.2.3 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 pick-up is preferable.

6.2.4 Clearance of magnetic pick-up

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

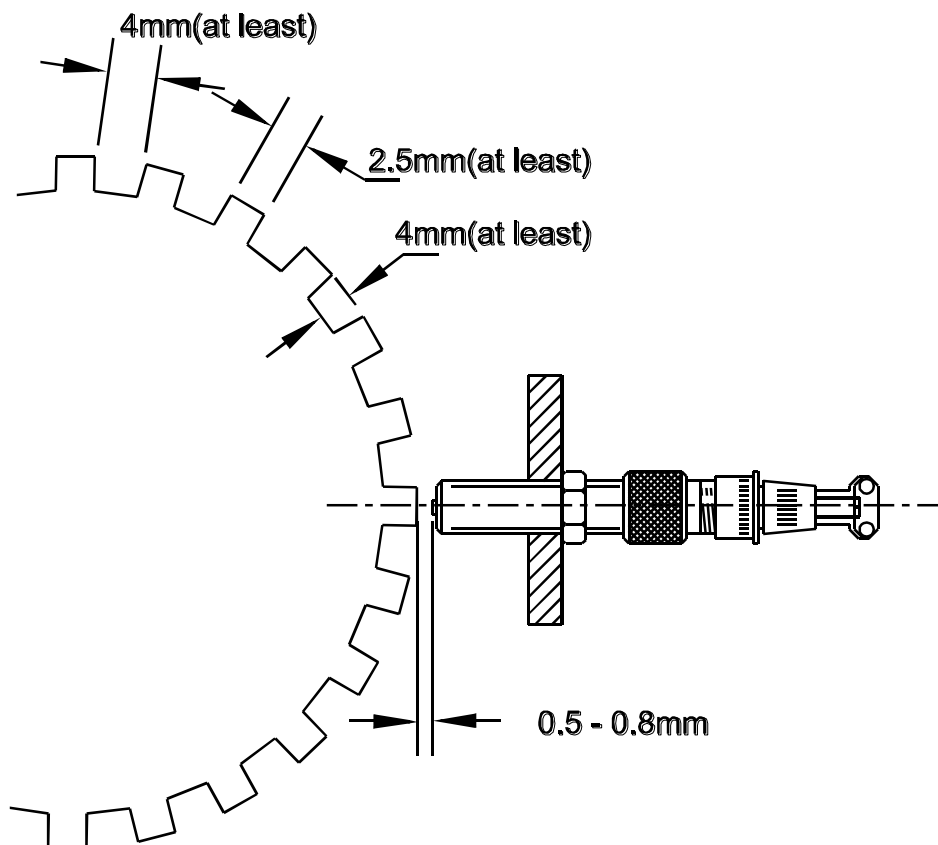


Fig. 2: Clearance of pick-up

6.2.5 Dimensions

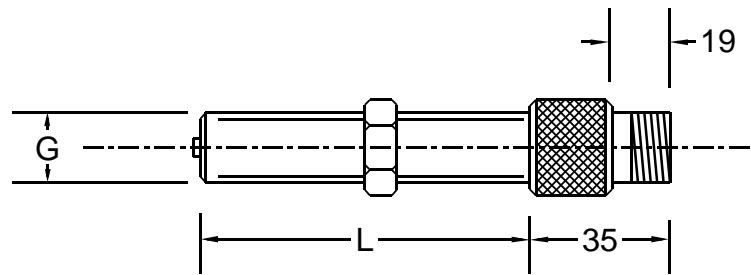


Fig. 3: Dimensions of pick-up

Measures Type	L (mm)	G	Remarks
01-38	38	M 16 x 1,5	appropriate plug SV 6-IA-2K (010-02-170-00)
02-76	76	M 16 x 1,5	
03-102	102	M 16 x 1,5	
11-38	38	5/8"-18UNF-2A	
12-76	76	5/8"-18UNF-2A	
13-102	102	5/8"-18UNF-2A	

Ordering specification, e.g. IA 02-76

6.3 Coolant temperature sensor TS 01-28-PT1000 (EDV- No.: 600-00-053-00)

Measuring range	-50°C ... +150°C
Precision	±1.5°C
Resistance at 25 °C (R25)	1000 Ohm ±0.5 %
Maximum operating voltage	5 V
Maximum operating current	3 mA
Recommended operating current	approx. 1 mA
Time constant in fluids	approx. 13 seconds
Admissible temp. range of connector	-40°C ... +105°C
Protection grade	IP 65
Vibration	< 20 g, 10 ... 300 Hz
Shock	< 50 g, 11 ms half-sine wave
Tightening torque	50 Nm ±15 %
Appropriate connector	SV 6-IA-2K (EDV- No.: 010-02-170-00)

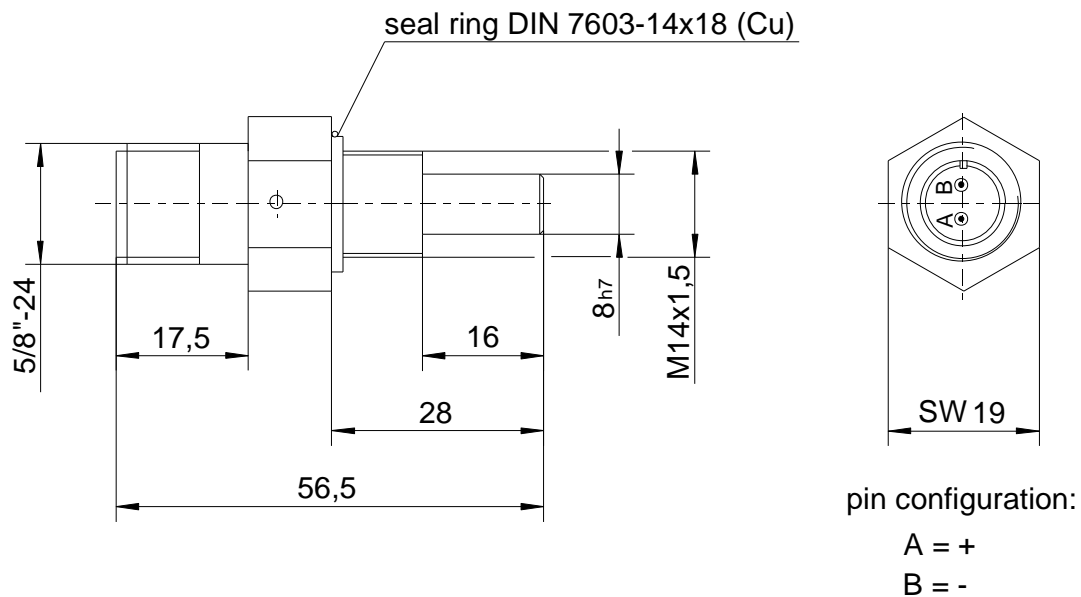


Fig. 4: Temperature sensor TS 01-28-PT1000

6.4 Pressure sensors

6.4.1 Oil pressure sensor

Measuring range	0 ... 6 bar or 0 ... 10 bar
Over pressure	15 bar resp. 20 bar
Supply voltage	10 ... 34 V DC
Output signal	4 ... 20 mA
Storage temperature	-25°C ... +85°C
Ambient temperature	-25°C ... +85°C
Oil temperature	-25°C ... +125°C
Protection grade	IP 65
Vibration	< 20 g, 10 ... 300 Hz
Shock	< 50 g, 11 ms half-sine wave
Tightening torque	max. 25 Nm
Connection	DIN 43650-A, 2-line system

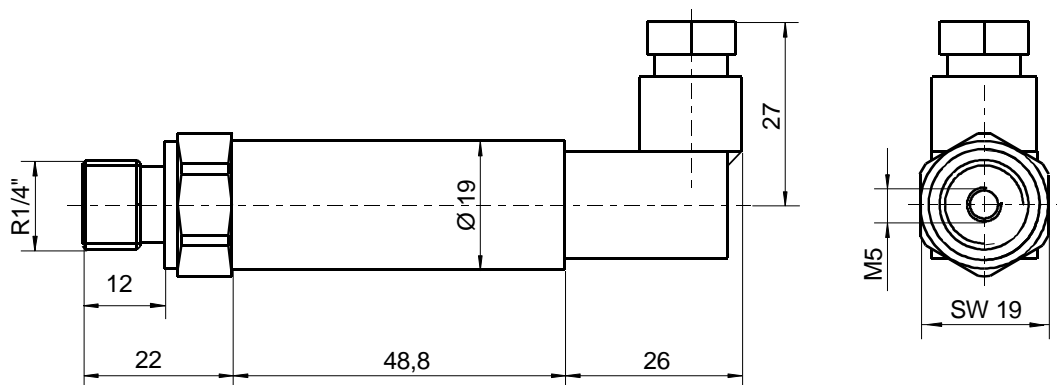


Fig. 5: Oil pressure sensor

Pressure Sensor	EDV- No.	Max. Oper. Pressure (bar)
DSO 01-6	600-00-058-00	6
DSO 01-10	600-00-058-01	10

6.4.2 Boost pressure sensors

The boost pressure sensors are also available in an additional housing with terminal strip.

Measuring range	0 ... 2 bar, 0 ... 5 bar or 0 ... 10 bar
Over pressure	4 bar resp. 10 bar resp. 16 bar
Supply voltage	12 ... 36 V DC
Output signal	4 ... 20 mA
Storage temperature	-55°C ... +100°C
Ambient temperature	-40°C ... +100°C
Protection grade	IP 65
Vibration	< 2 g, 5 ... 500 Hz
Shock	< 50 g, 11 ms half-sine wave
Connection	DIN 43650-A or terminal strip, 2-line system

6.4.2.1 Boost pressure sensor with plug

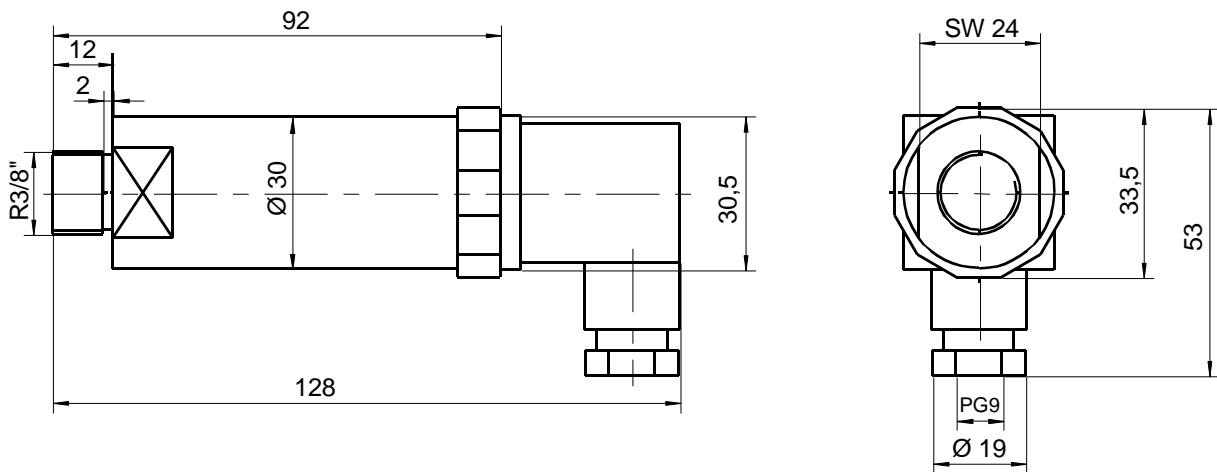


Fig. 6: Boost pressure sensor with plug

Pressure Sensor	EDV- No.	Maximum Operating Pressure (bar rel.)
DSL 01-2	600-00-057-00	2
DSL 01-5	600-00-057-01	5
DSL 01-10	600-00-057-02	10

6.4.2.2 Boost pressure sensor with housing and terminal strip

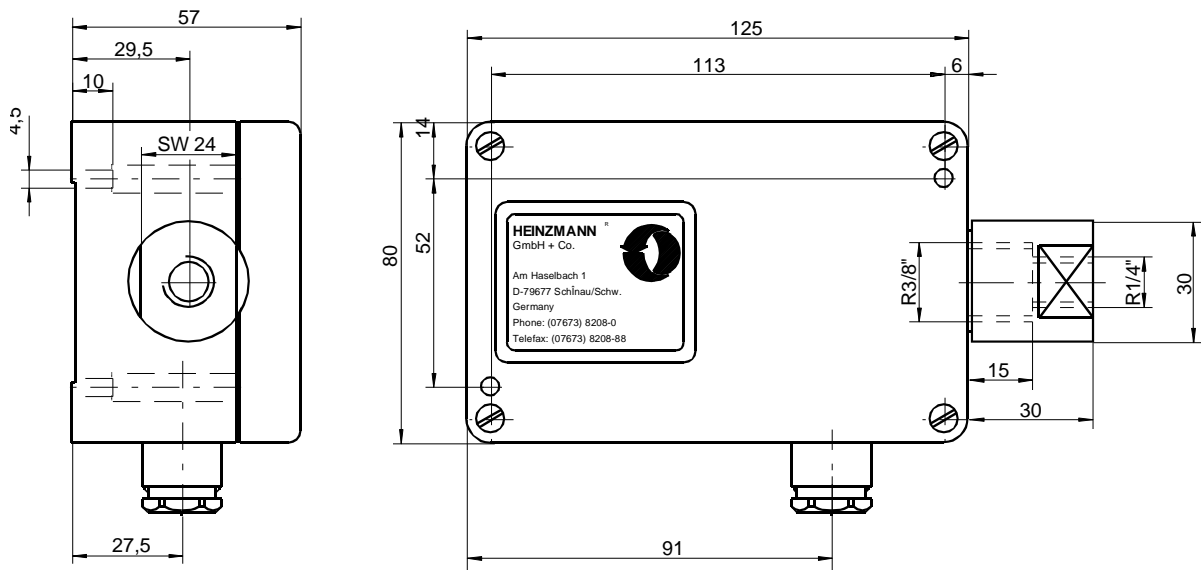


Fig. 7: Boost pressure sensor with housing

Pressure Sensor	EDV- No.	Maximum Operating Pressure (bar rel.)
DSG 04-2	600-00-056-00	2
DSG 04-5	600-00-056-01	5
DSG 04-10	600-00-056-02	10

7 Setpoint adjusters

With regard to the variety of applications, various setpoint adjusters are available for the HEINZMANN digital speed governors of series PANDAROS. The customer specifies the setpoint selection type by means of parameter settings. As a result, it is not necessary for HEINZMANN to adapt the hardware prior to delivering the controller.

7.1 Setpoint potentiometer SW 01-1-b (1 turn) (EDV- No.: 600-00-041-01)

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

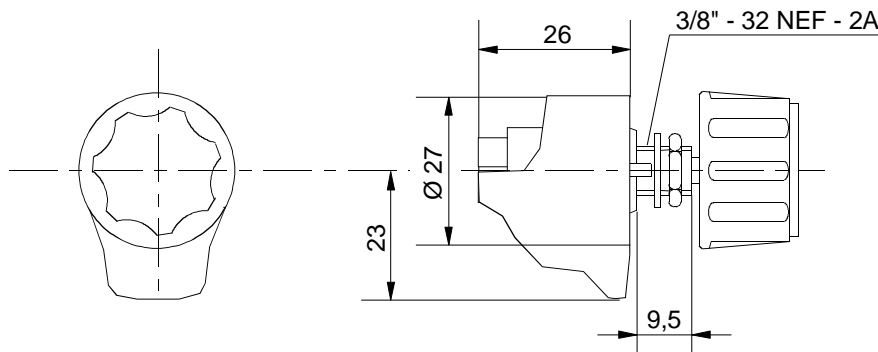


Fig. 8: Potentiometer SW 01-1-b

7.2 Setpoint potentiometer SW 02-10-b (10 turn) (EDV- No.: 600-00-042-01)

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

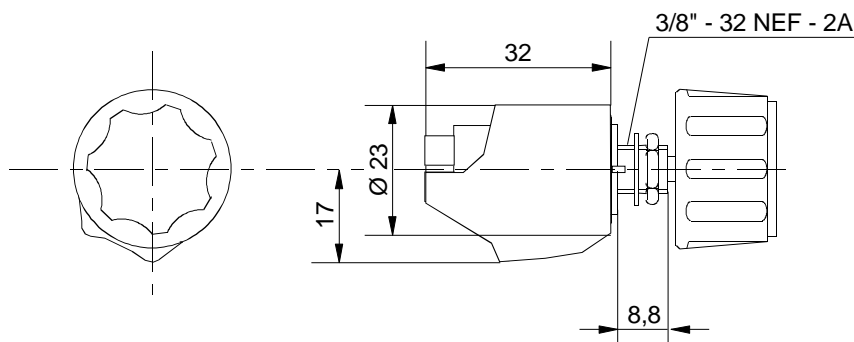


Fig. 9: Potentiometer SW 02-10-b

On request, the potentiometers, as specified under 6.1. and 6.2. can be supplied with analogue adjustment knob with lock in place of the standard rotating knob. In this case, ordering specification is SW...-m.

Likewise, a clamping fixture can be installed instead of the knob. The ordering specification will then be SW ...-k.

7.3 Setpoint value adjustment by current signal

For the speed setpoint value a current signal of 4 ... 20 mA can be directly connected to the control unit. If the signal fails, the governor will adjust minimum speed according to the 4 mA value or use a pre-programmed substitute value.

7.4 Digital presetting of setpoint values

With the corresponding configuration, a digital setpoint selection (e.g. digital synchronization performed manually or via PLC) can be implemented directly via two switch inputs (higher/lower speed).

7.5 Setpoint value adjustment by pedal

The electrical foot pedal EFP is basically an angular position transducer that translates gas pedal positions into a proportional current or voltage for 0 ... 45° rotational displacement. The resulting output can be used for speed setting. For more information refer to manual E 83 005 - e.

7.6 Pneumatic setpoint adjuster

If pneumatic setpoint adjustment is desired, the boost pressure sensors may be used to supply the signals. For detailed specifications of these sensors refer to chapter 6.4.2.

8 Control unit DC 6-00 ... 05

8.1 Specification

8.1.1 General

Supply voltage	12 V DC or 24 V DC
Min. voltage	9 V DC or 18 V DC
Max. voltage	33 V DC
Max. ripple voltage	max. 10 % at 100 Hz
Maximum power rating	max. 7 A, and max. 11 A for max. 60 seconds
Permissible voltage dip at maximum current consumption	max. 10 % at control unit
Fuse protection of governor	12 A
Storing temperature	-40°C ... +85°C
Operating temperature	-40°C ... +80°C
Humidity	up to 98% at 55°C
Dynamic strength	max. 2 mm at 10 ... 20 Hz, max. 0,24 m/s at 21 ... 63 Hz max. 7 g at 64 ... 2000 Hz
Shock	50 g, 11 ms- half-sine wave
Protection grade	IP 00
Insulation resistance	> 1 MOhm at 48 V DC
Weight	approx. 0.5 kg
EMC directives	2004/108/EG 2004/104/EG
according to EMC standards:	ISO 11452-2 ISO 7637-2 / -3 DIN EN 61000-6

8.1.2 Inputs and outputs

All inputs and outputs are protected against reverse-voltage and short circuit to battery plus and minus.

Speed input	for inductive sensor, with $f_i = 25 \dots 9000 \text{ Hz}$, $U_i = 0.5 \dots 30 \text{ V AC}$
Temperature input	for PT1000 / Ni1000 sensors tolerance: $< \pm 2^\circ\text{C}$ at $0^\circ\text{C} \dots 130^\circ\text{C}$, rest $< \pm 4^\circ\text{C}$
Reference voltage setpoint adjuster	$U_{\text{ref}} = 5 \text{ V} \pm 1 \%$, $I_{\text{ref}} < 30 \text{ mA}$
Analogue input 1	$U = 0 \dots 5 \text{ V}$, $R_i > 100 \text{ k}\Omega$, when for HZM SyG, $R_{\text{pu}} > 100 \text{ k}\Omega$ or $U = 0 \dots 10 \text{ V}$, $R_i > 17 \text{ k}\Omega$, or $I = 4 \dots 20 \text{ mA}$, $R_i > 250 \Omega$
Analogue input 2	$U = 0 \dots 5 \text{ V}$, $R_i > 100 \text{ k}\Omega$, when for HZM LMG, $R_{\text{pu}} > 10 \text{ k}\Omega$ or $U = 0 \dots 10 \text{ V}$, $R_i > 17 \text{ k}\Omega$, or $I = 4 \dots 20 \text{ mA}$, $R_i > 250 \Omega$
Analogue input 3	$U = 0 \dots 5 \text{ V}$, $R_i > 100 \text{ k}\Omega$, or $I = 4 \dots 20 \text{ mA}$, $R_i > 250 \Omega$
Digital inputs 1 to 5	$U_0 < 1.0 \text{ V}$, $U_1 > 3.5 \text{ V}$, $R_i > 100 \text{ k}\Omega$
PWM inputs 1 to 3	$U_0 < 1.0 \text{ V}$, $U_1 > 3.5 \text{ V}$ typical 5 V max. 24 V , $R_i > 100 \text{ k}\Omega$, frequency = $50 \dots 500 \text{ Hz}$
Analogue outputs 1 and 2	$I = 0 \dots 22 \text{ mA}$, $R_{\text{Lmax}} = 420 \text{ Ohm}$
Digital outputs 1 and 2	$I_{\text{max}} = 300 \text{ mA}$, low side switched
PWM outputs 1 and 2	$I_{\text{max}} = 300 \text{ mA}$, low side switched frequency = $50 \dots 500 \text{ Hz}$
Digital output failure lamp	$I_{\text{max}} = 300 \text{ mA}$, low side switched
Actuator position sensing	internal in actuator with reference feedback
analogue	$U = 1.4 \dots 3.0 \text{ V}$, $U_{\text{ref}} = 8 \text{ V} \pm x \%$, $I_{\text{ref}} < 20 \text{ mA}$
digital	only with HEINZMANN-StG and Bosch EDC
Drive output	$I < 7 \text{ A}$, $I < 11 \text{ A}$ for $T < 60 \text{ s}$, PWM
Serial interface ISO 9141,	variable from $2.4 \text{ kbit/s} \dots 57.6 \text{ kbit/s}$ standard 9.6 kbit/s

8.2 Dimensions

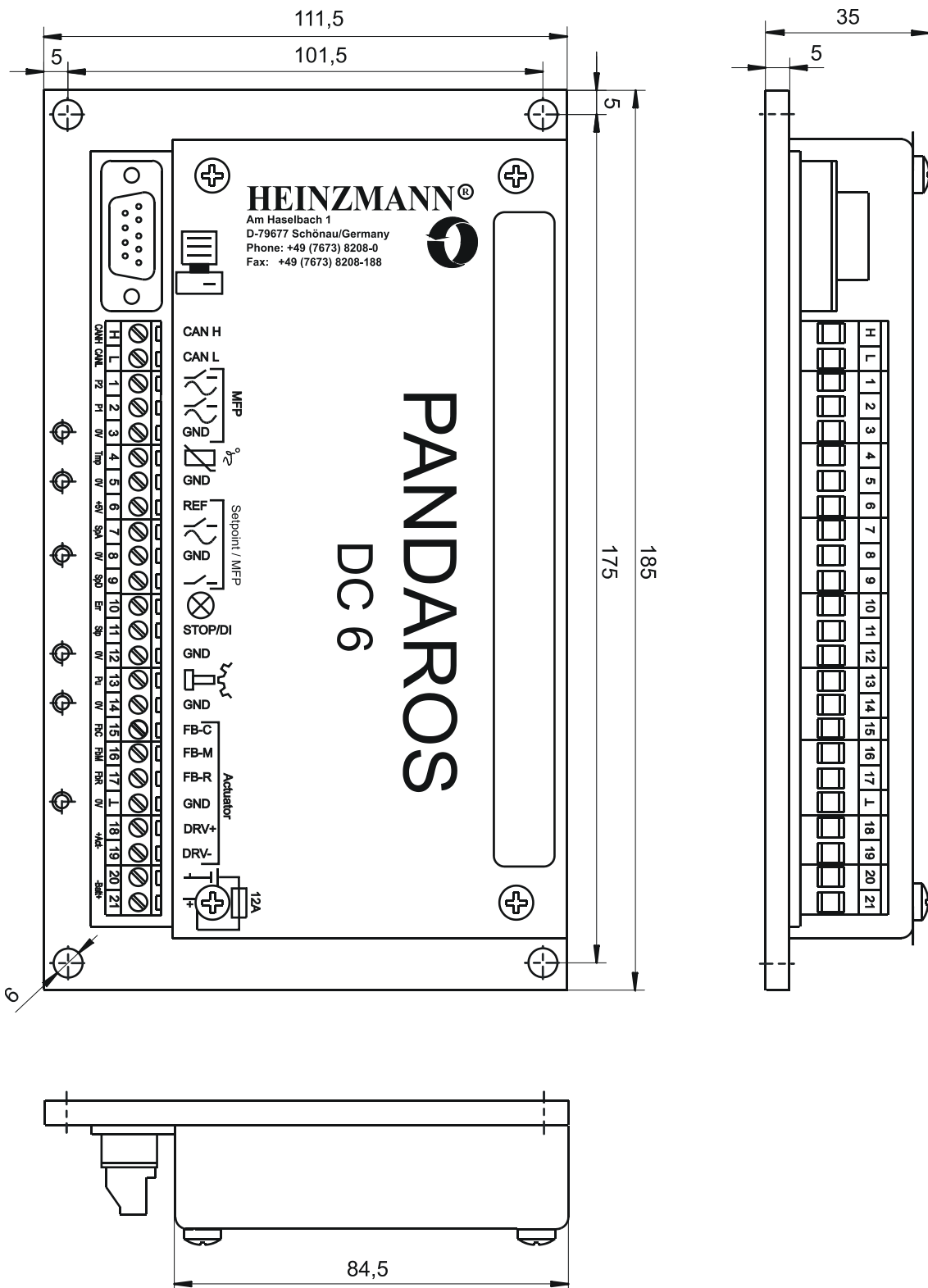


Fig. 10: Housing of control unit DC 6-01 ... 05

8.3 Mounting

When selecting the location, care should be taken for easy access in order to facilitate read-out of the failure indication and replacement of the device under field conditions. Any mounting position is admissible. When fitting the device directly on the engine, it should be mounted using vibration absorbers.

9 Actuators

9.1 Design and mode of operation

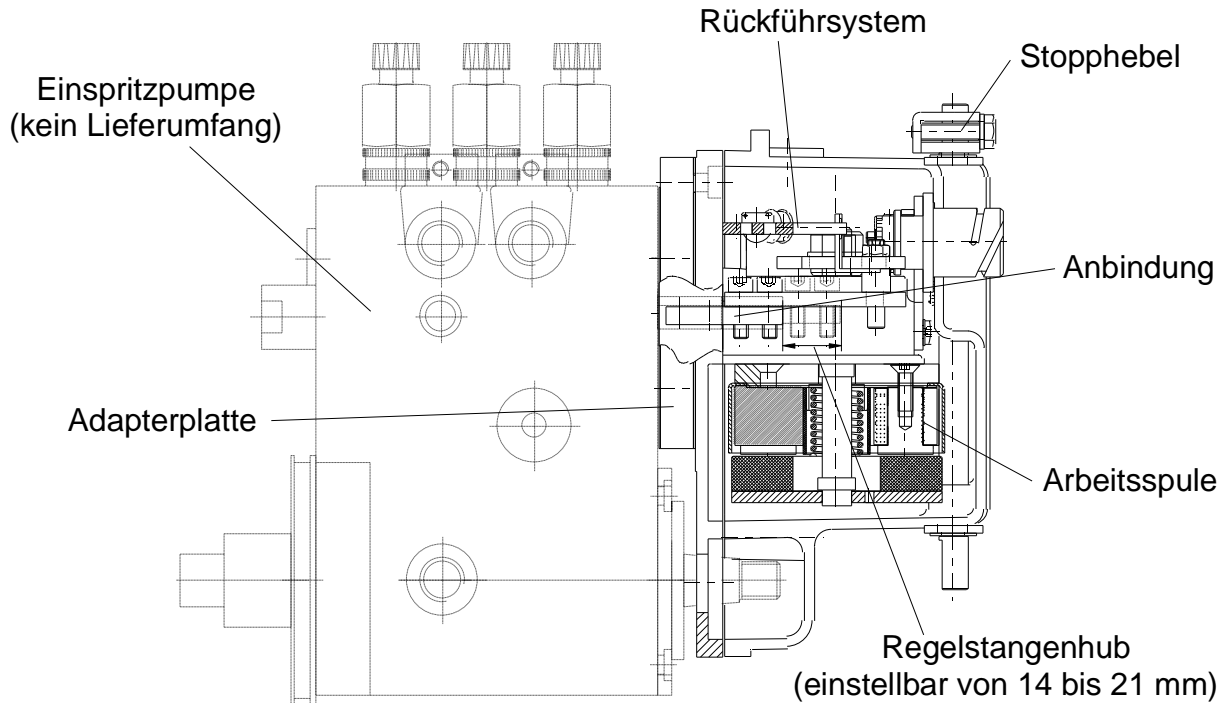


Fig. 11: Sectional drawing of actuator

A multipole-magnetised permanent magnet is mounted on the internal actuator shaft. Opposite the permanent magnet a coil shell with the working coils is fixed. On feeding current through the coils, torque and rotary motion in one direction is produced. Reversing current polarity will produce torque in the opposite direction.

The lever which is fixed to the internal shaft is connected to the control rod of the injection pump by a special linkage system. By this, the rotary motion of the internal shaft is directly transmitted as a linear motion to the control rod.

On the actuator shaft, also the governor feedback is firmly mounted which operates contact-free and transmits the position of the governor output shaft accurately to the control unit. By this, the control unit is able to rapidly calculate the linkage adjustment as required by speed changes, and to accommodate current accordingly.

An additional external lever provides the possibility of executing an emergency shutdown. However, in order to stop the engine by means of this stop lever it will be necessary to overcome the electric positioning force working in the direction of 100%. Therefore, before executing an emergency shutdown by the stop lever, the voltage supply should first be switched off.

Due to the direct mounting the fuel rack is fully protected and therefore the design assures maintenance-free operation and long working life of the actuators.

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. This reduces the current via an e-function such that no damage can occur on the actuator.

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

9.2 Installation

For the different pump systems, a variety of assembly kits is provided consisting mainly of the adapter plate and the customer-specific linkage connection.

The assembly kits come with detailed assembling instructions which will help the user to do the mounting easily by himself.

9.3 Specification

	StG 2005DP	StG 2040DP
Maximum control rod travel	21 mm	
Spring power of back spring in stop position	approx. 9 N	approx. 30 N
Spring power of back spring in full position	approx. 14 N	50 N
Maximum positioning force	approx. 20 N	approx. 110 N
Maximum current consumption	6 A	
Current consumption in operation	1.5 ... 3 A	
Coil resistance of governing magnet	1.4 Ohm	2 Ohm
Storage temperature	-55°C ... +110°C	
Ambiente temperature in operation	-25°C ... +90°C	
Humidity	up to 100 %	
Protection grade	IP 55	
Weight	approx. 2.4 kg	approx. 4.2 kg

9.4 Dimensions

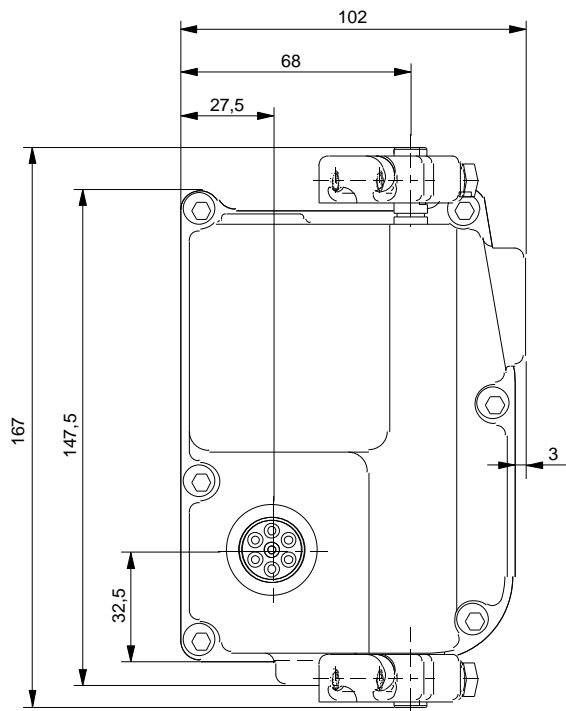


Fig. 12: Actuator StG 2005DP

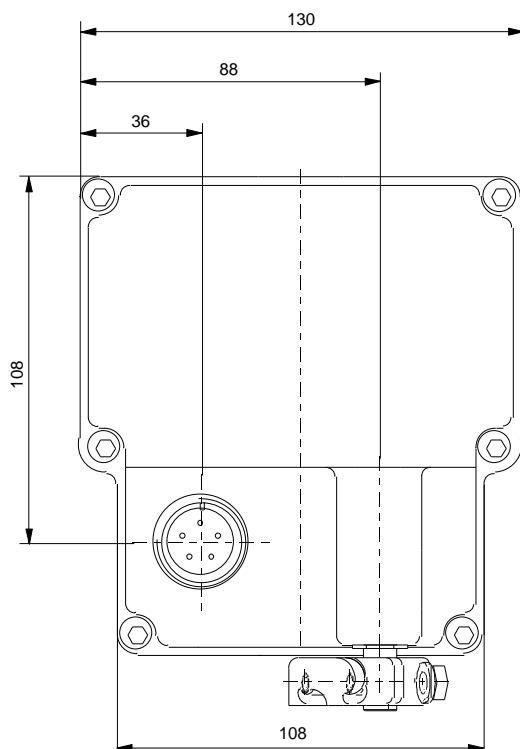


Fig. 13: Actuator StG 2040DP

10 Electrical connection

The electrical connection possibilities are depending on the variation of the control unit.

As the pin connections for the DG 6-00 variant support highly flexible configuration, a terminal connection diagram for this purpose would be too unclear. In the case of this variant, the potential connection options and functions of the inputs and outputs are therefore identified using a table.

Terminal connection diagrams are available for all other variants.

The parameter settings for the configurable terminals and the functions of the individual parameters are described in detail in the publication

Basic information on control units for conventional injection via actuators, publication no. DG 07 001-d.

10.1 Connection table for variation DG 6-00

Terminal	Function
H	CAN communication high-connection
L	CAN communication low-connection
1	Digital input 2 (switch to +24 V), or Analogue input 2, 0 ... 5 V or 0 ... 10 V or 0 ... 22 mA, or PWM input 2, or Digital output 2 (low side switched), or Analogue output 2, 0 ... 20 mA, or PWM output 2
2	Digital input 1 (switch to +24 V), or Analogue input 1, 0 ... 5 V or 0 ... 10 V or 0 ... 22 mA, or PWM input 1, or Digital output 1 (low side switched), or Analogue output 1, 0 ... 20 mA, or PWM output 1
3	GND for terminals 1 and 2
4	Temperature sensor signals
5	GND for temperature sensor
6	+5V reference supply voltage for setpoint potentiometer
7	Digital input 3 (switch to +24 V), or Analogue input 3, 0 ... 5 V or 0 ... 22 mA, or

Terminal	Function
8	GND
9	Digital input 4 (switch to +24 V)
10	Error output (low side switched)
11	Digital input 5 (switch to +24 V), or PWM input 3, or speed sensor 2 (Halls ensor)
12	Speed sensor GND
13	Speed sensor signal
14	GND
15	Actuator feedback GND, pin E at actuator plug
16	Actuator feedback signal 1.6 ... 2.8 V, pin A at actuator plug
17	Actuator feedback + 8 V reference, pin D at actuator plug
20	Power supply GND
21	Power supply +24 V
24	Actuator drive line minus, pin B at actuator plug
25	Actuator drive line plus, pin C at actuator plug

10.2 Optional assignment of inputs and outputs, variation DG 6-00

10.2.1 Digital Inputs

The following parameters are available for assignment of digital inputs:

810	FunctEngineStop
811	FunctIdleSpeed
812	FunctDroop2Or1
813	FunctForcedLimit
814	FunctSpeedRange2Or1
815	FunctSpeedFix1
816	FunctSpeedFix2
817	FunctSpeedLimit2Or1
819	FunctNotch3
820	FunctNotch2
821	FunctNotch1
822	FunctNotch0
825	FunctSpeedInc

826	FunctSpeedDec
827	FunctSetpoint2Or1
828	FunctErrorReset
829	FunctFreezeSetp1
830	FunctFreezeSetp2
831	FunctIMOrAllSpeedGov
833	FunctForcedStart
834	FunctSyncEnable
835	FunctLoadEnable
836	FunctAutoOrManual
845	FunctAutoAdjust
846	FunctGenBreaker

10.2.2 Analogue and PWM Inputs

The following parameters are available for assignment of analogue or PWM inputs:

900	AssignIn_Setp1Ext
901	AssignIn_Setp2Ext
902	AssignIn_LoadCtrlInp
903	AssignIn_SyncInput
904	AssignIn_BoostPress
905	AssignIn_OilPress
907	AssignIn_CoolantTemp
908	AssignIn_ChAirTemp
909	AssignIn_OilTemp
910	AssignIn_FuelTemp
911	AssignIn_ExhaustTemp
918	AssignIn_MeasPower
923	AssignIn_FuelLimExt

10.2.3 Digital Outputs

All parameters that can only adopt a value of 0 or 1 can be assigned to digital outputs, regardless of whether these are set parameters or measured value parameters.

10.2.4 Analogue and PWM Outputs

All parameters that feature an analogue value range can be assigned to analogue or PWM outputs, regardless of whether these are set parameters or measured value parameters.

10.3 Connection for variation DG 6-01 (standard generator)

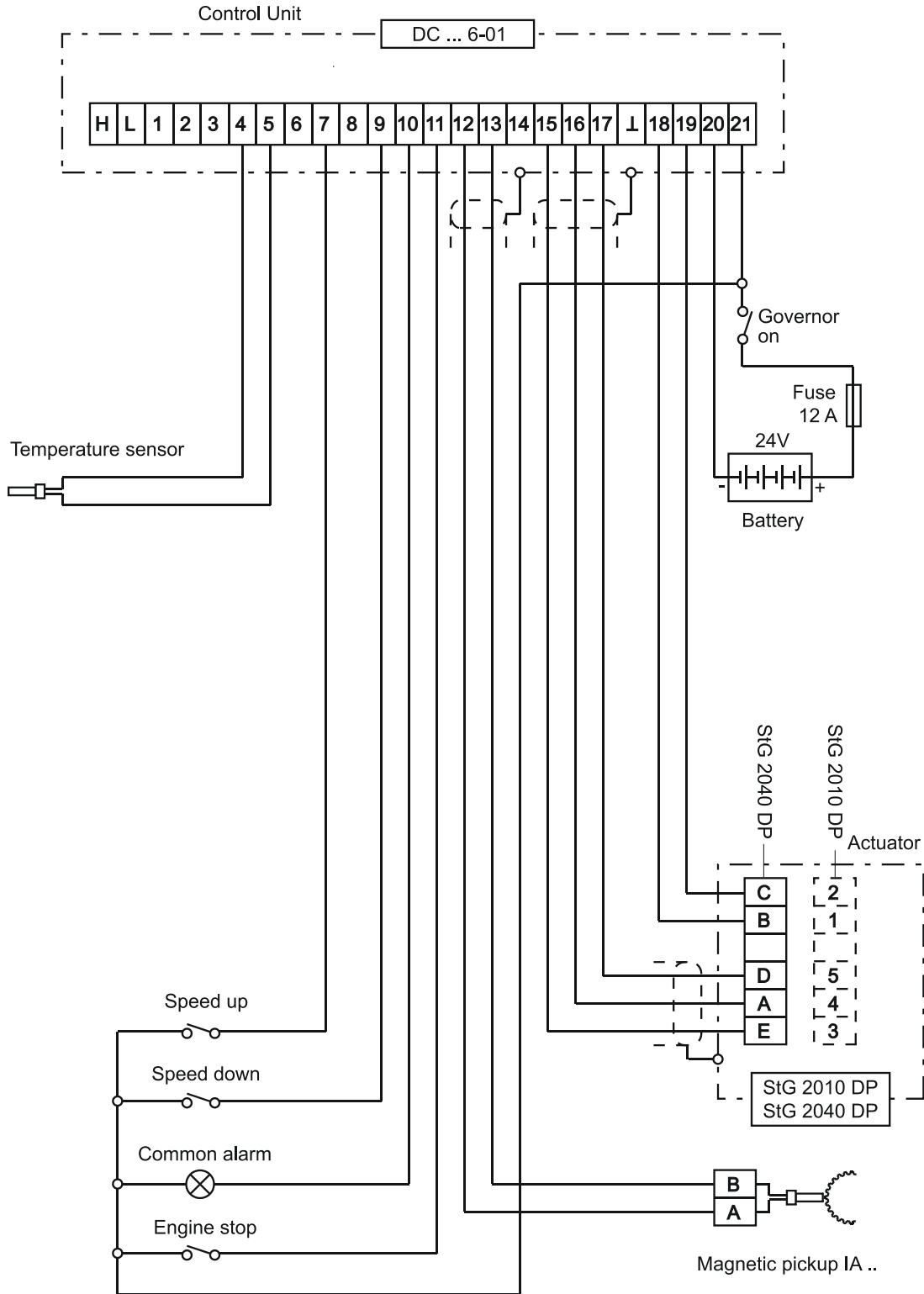


Fig. 14: Connection diagram for variation DG 6-01

10.4 Connection for variation DG 6-02 (standard general)

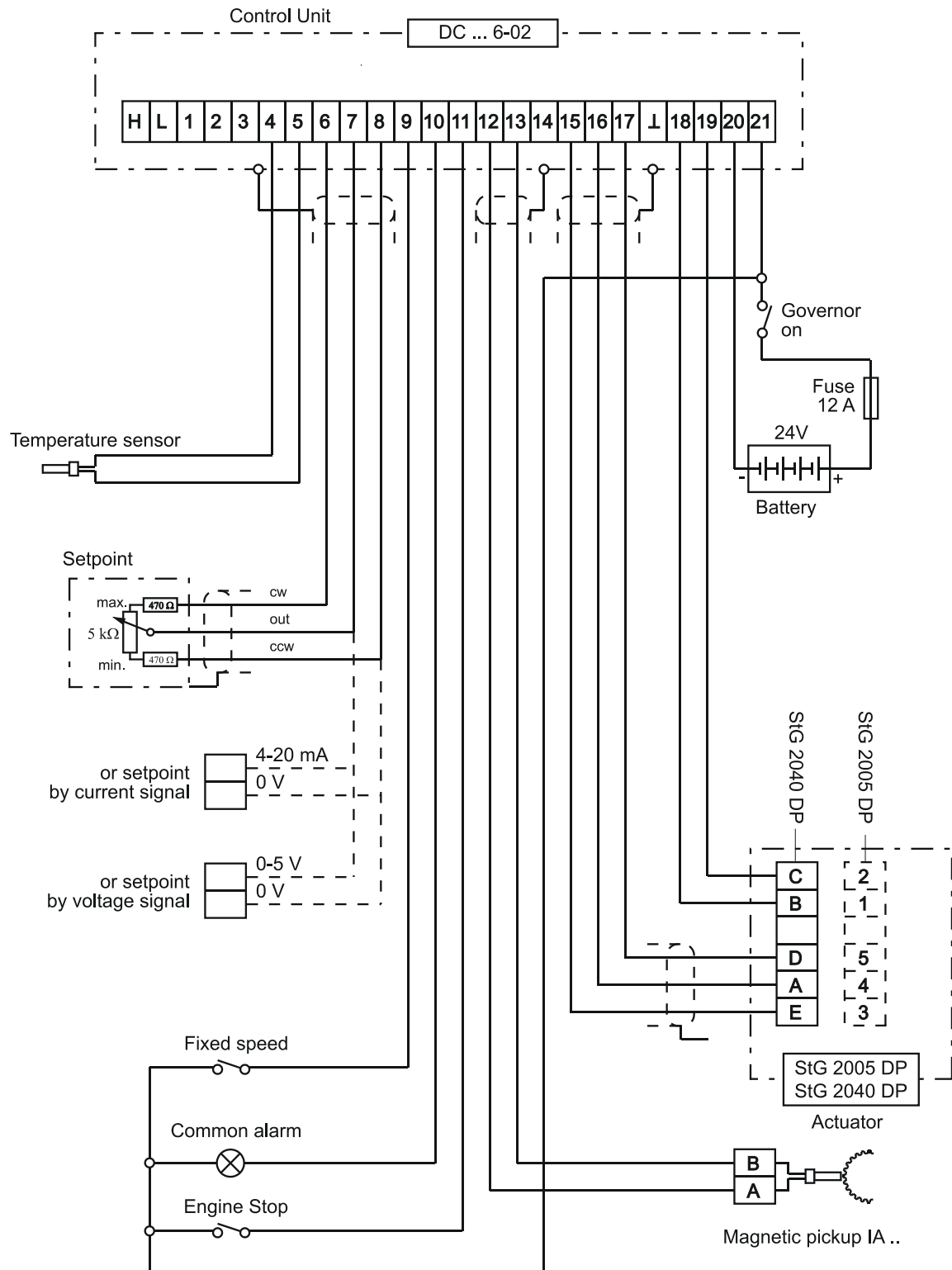


Fig. 15: Connection diagram for variation DG 6-02

10.5 Connection for variation DG 6-03 (extended generator)

As a result of the numerous options for assigning analogue and digital inputs, the following terminal connection diagram only indicates the types of the potential inputs. The functions that can be assigned to these inputs are listed below.

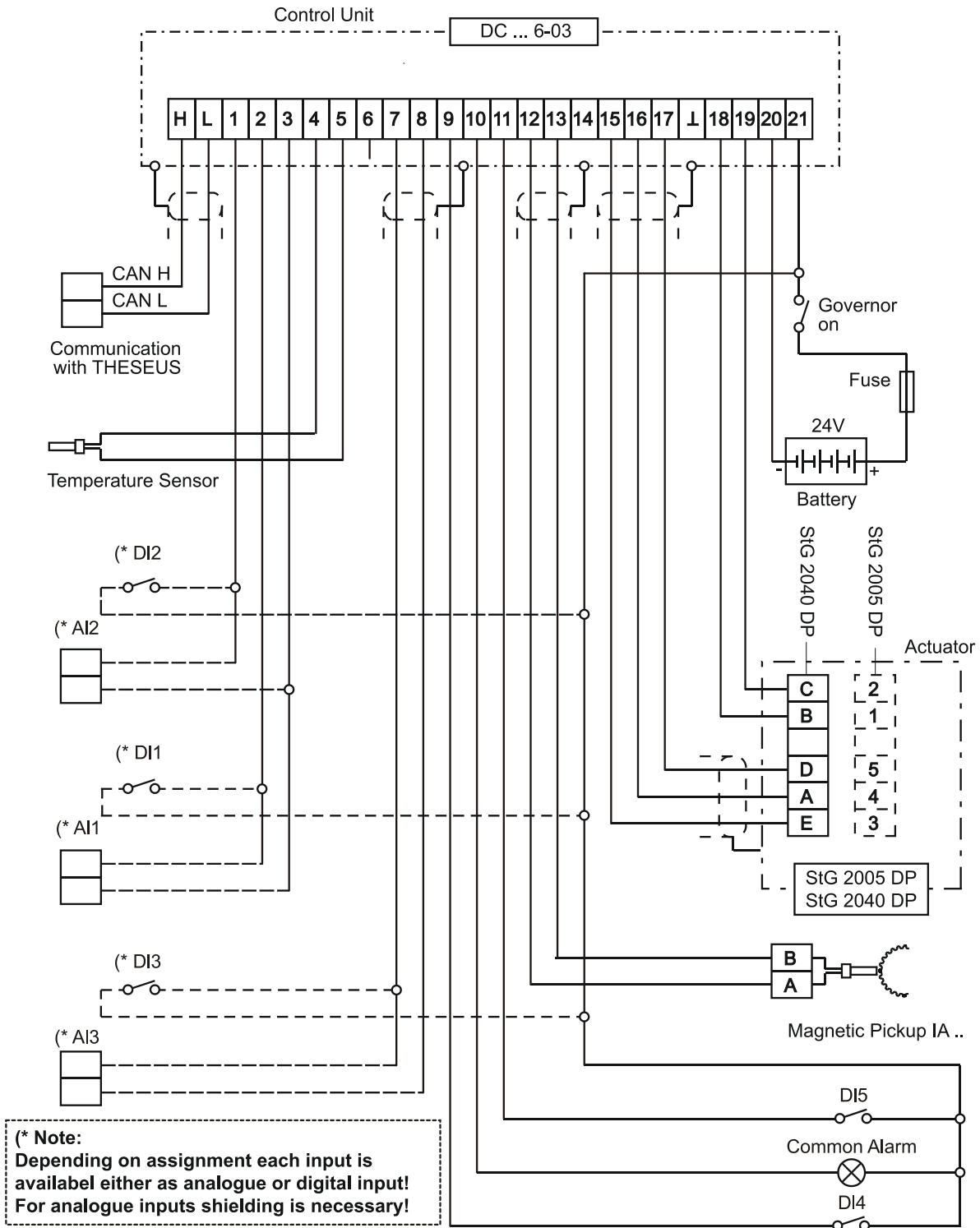


Fig. 16: Connection diagram for variation DG 6-03

10.5.1 Digital Inputs

The following parameters are available for assignment of digital inputs:

810	FuncEngineStop
811	FuncIdleSpeed
812	FuncDroop2Or1
814	FuncSpeedRange2Or1
815	FuncSpeedFix1
825	FuncSpeedInc
826	FuncSpeedDec
828	FuncErrorReset
834	FuncSyncEnable
835	FuncLoadEnable
836	FuncAutoOrManual
845	FuncAutoAdjust
846	FuncGenBreaker

10.5.2 Analogue and PWM Inputs

The following parameters are available for assignment of analogue or PWM inputs:

900	AssignIn_SetpExt
902	AssignIn_LoadCtrlInp
903	AssignIn_SyncInput
904	AssignIn_BoostPress
907	AssignIn_CoolantTemp
918	AssignIn_MeasPower

10.6 Connection for variation DG 6-05 (extended general)

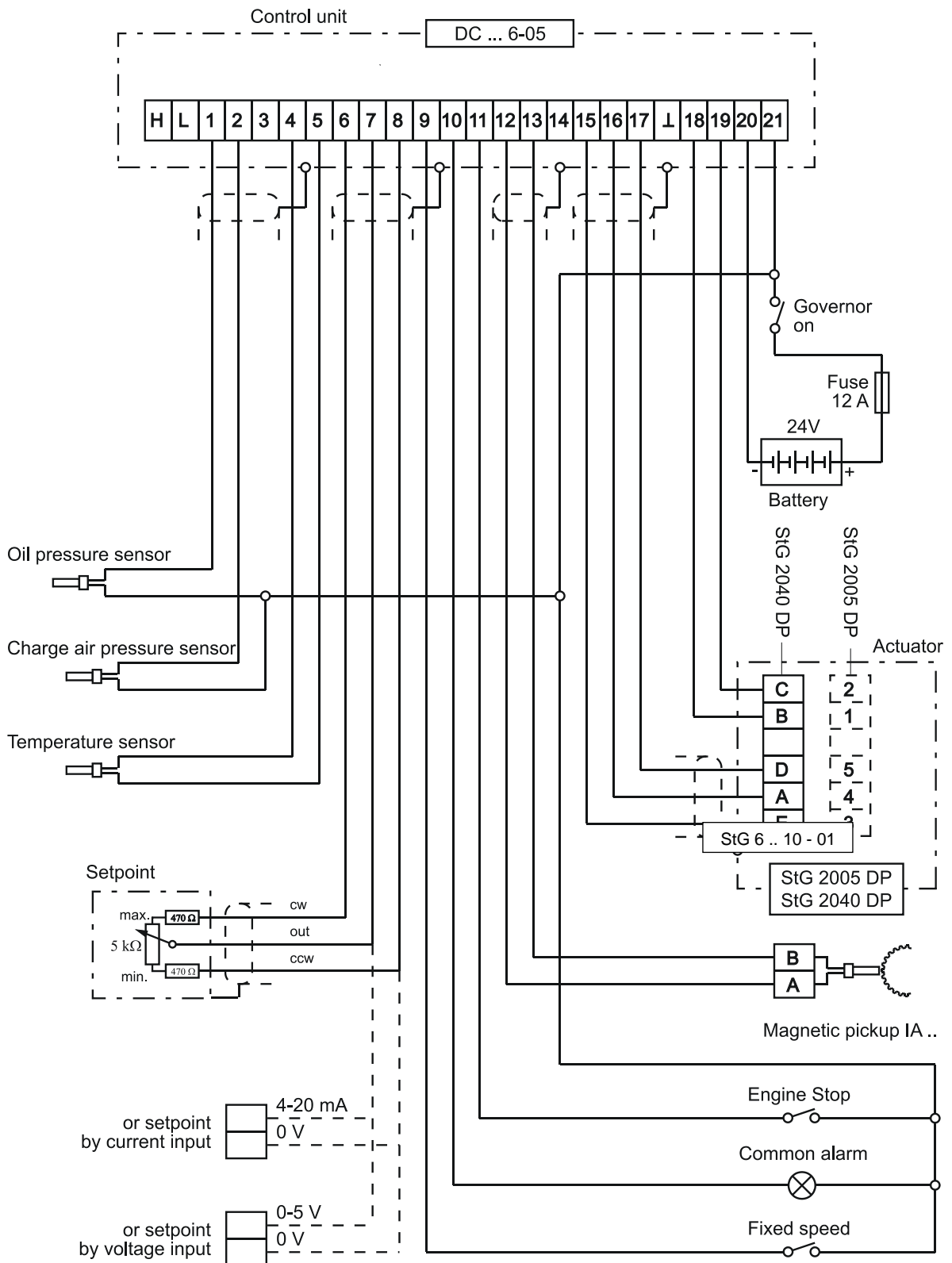


Fig. 17: Connection diagram for variation DG 6-05

10.7 Harness



It is not possible to use all offered signals at the same time, because some inputs have to be assigned differently depending on the variation.

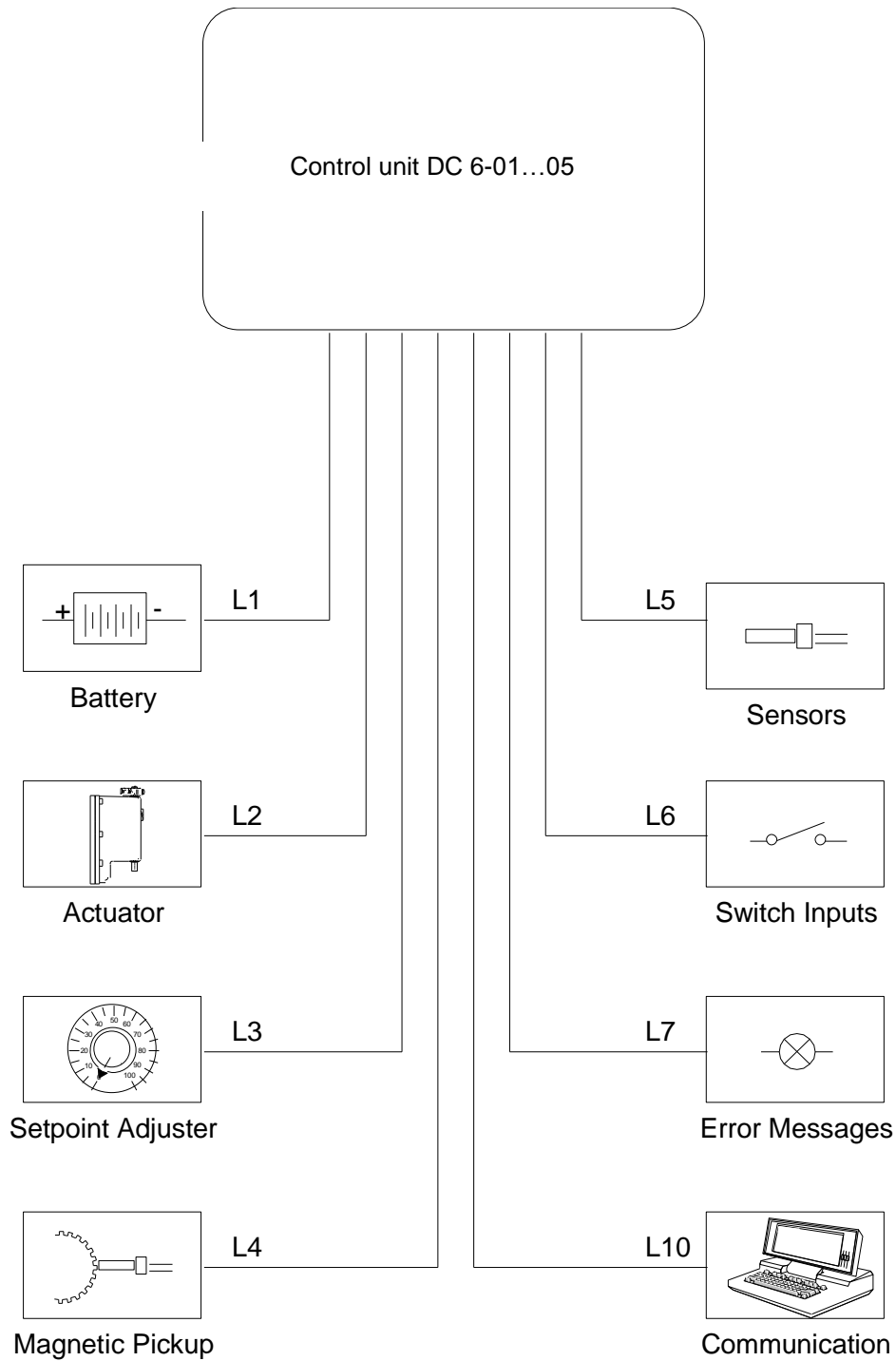


Fig. 18: Cable designation

The allowed length and necessary cross-sections of the cables to connect are as follows:

L 1	Power supply	max. 15 m	2 x 2,50 mm ²
L 2.1	Actuator feedback		3 x 0,75 mm ² shielded
L 2.2	Actuator drive	up to 10 m	2 x 2,50 mm ²
		over 10 ... 20 m	2 x 4,00 mm ²
L 3.1	Setpoint potentiometer		3 x 0,75 mm ² shielded
L 3.2	4 ... 20 mA input		2 x 0,75 mm ²
L 3.3	0 ... 5 V input		2 x 0,75 mm ² shielded
L 3.4	Synchronizer		2 x 0,75 mm ² shielded
L 3.5	Load measuring unit		2 x 0,75 mm ² shielded
L 4	Magnetic pick-up		2 x 0,75 mm ² shielded
L 5.1	Temperature sensor		2 x 0,75 mm ²
L 5.2	Boost pressure sensor		2 x 0,75 mm ²
L 5.3	Oil pressure sensor		2 x 0,75 mm ²
L 6.1	Engine stop		1 x 0,75 mm ²
L 6.2	Increase speed		1 x 0,75 mm ²
L 6.3	Decrease speed		1 x 0,75 mm ²
L 6.4	other switch functions (the switches have to be supplied with battery plus)		1 x 0,75 mm ²
L 7	Error message (the error lamp has to be supplied with battery plus, ground is switched)		1 x 0,75 mm ²
L 13	CAN communication with DGM 02		2 x 0,14 mm ² shielded

11 Parametrization options

The software of the HEINZMANN digital controllers is designed in such a way that the parameter settings can be implemented both at the premises of the engine manufacturer and, with the help of corresponding resources (communication tools), also at the premises of the end customer. Upon leaving the HEINZMANN factory, only selected parameters are preset to practical values. This means that the digital control device normally receives its final parameter setting from a source other than HEINZMANN.

Controllers featuring larger piece counts are an exception to this rule. If HEINZMANN is able to provide a final parameter setting, this can be integrated ex works.

As a principle, first programming should always be conducted by experienced personnel and must be checked before first commissioning the engine.

The publication 'Basic information 2000' provides a detailed description of the significance of the parameters and how they are set.

The following sections describe the possibilities of parametrizing the control unit:

11.1 Parametrization at the factory

During final inspection at the factory, the functionability of the unit is checked by a test programme. If the operational data for the control unit is available, the test programme is carried out using this data. It is then only the dynamics data and if need be the fuel limitations and sensors that will have to be calibrated on the engine.

11.2 Parametrization with the Hand Held Programmer HP 03

All parametrization can also be done by means of the hand held programmer 'Programmer 3'. This handy device is particularly suited for development and series calibration as well as for servicing. The device does not require an external voltage supply.

11.3 Parametrierung mit dem PC / Laptop

Parametrization can also be conducted using a PC and the comfortable **HEINZMANN** software DcDesk 2000. As compared with the hand held programmer, it offers the great advantage of having various curves graphically represented on the screen and being at the same time able to introduce changes as well as of having time diagrams displayed without an oscilloscope when commissioning the control unit on the engine. Furthermore, the PC offers a better overview as the PC programme has a menu structure and allows to have several parameters continuously displayed.

DcDesk 2000 also makes it possible for operating data to be saved to and loaded from data carriers. This results in the following practical application:

Once the parameter settings for an engine design and its application have been specified, the parameter setting can be saved. If there are other applications of the same type, the setting can simply be transferred to new controllers.

11.4 Parametrization with user mask

Principally, parametrization may be performed with the help of user masks that have been provided by HEINZMANN or may conveniently be created by the user himself. Within a user mask, only those parameters are accessible which are actually needed.

11.5 Transferring data sets

Once parametrizing a particular engine model and its application has been completed, the data set can be saved (in the hand held programmer or on a floppy disk). For other applications of the same kind the data set can then be downloaded into the respective control units.

11.6 Assembly line end programming

This type parametrizing is used by the engine manufacturer during the test bench run when the control unit is programmed in accordance with the engine requirements as laid down in the order.

12 Starting the engine - brief instruction

- 13.1 Adjust clearance of magnetic pulse pick-up.
- 13.2 Check program with respect to relevant parameters: number of teeth, speed, etc.
- 13.3 Calibrate sensors and setpoint adjusters, if necessary.
- 13.4 Make autoadjustment of actuator. Autoabgleich.
- 13.5 Set point potentiometer in mid-position
 - P - Gain to 10
 - I - Stability to 5
 - D - Derivative to 5

If the dynamic values have already been determined for an installation, they can be programmed directly at this point.

NOTICE

> Additional overspeed protection independent of the speed controller is compulsory!

- 13.6 Start engine and run it up to nominal speed using the set point potentiometer.
- 13.7 Increase gain (P-fraction) up to instability and reduce until stability is attained. Increase stability (I-fraction) up to instability and reduce until stability is attained. Increase derivative (D-fraction) up to instability and reduce until stability is attained.

With these values set, engine speed is to be disturbed briefly (e.g., by shortly pressing the stop switch), and the transient oscillations are to be observed.
- 13.8 Check over the entire speed range.

If for maximum and minimum speed other values than the programmed ones should result, this will be due to tolerances of the set point potentiometer. If the speed derivation is not acceptable, it will be necessary to measure the setpoint source.
- 13.9 Gain-correction (P-correction) for gas engines resp. for variable speed governors with larger speed ranges; adjust map if necessary.
- 13.10 Checking the remaining program items, e.g., starting fuel injection, ramp time, etc.

13 Ordering details

Control device:

Designation	DC X .6-0Y
X = actuator type used	2005DP or 2040DP
Y = application variant	0 ... 5 (see terminal connection diagrams)

The hardware and software of the control device are adapted prior to delivery in line with the application variant, including the control device type. All other settings that are required, such as the number of teeth, speed range, limiting curves, dynamic parameters and start procedure, must be set by the customer themselves.

In the case of the variants $Y = 0$ or $Y = 3$, the customer must also configure the inputs and outputs. This requires a Heinzmann communication tool with access to level 6 parameters (access to all parameters).

Actuator:

One of the types listed in chapter 9.3 must be specified here.

Speed pickup:

One of the types listed in chapter 6.2.5 must be specified here.

Additional sensors:

If additional sensors or a setpoint adjuster are required, the ordering details can be found in the corresponding chapters.

Harness:

It is recommended to have the cable set produced at HEINZMANN. The necessary cable lengths must be stated for the individual connections.

The cabling to the actuator and to the speed pickup must be performed by HEINZMANN in all cases, as it is necessary in this context to use HEINZMANN plugs: the cables are soldered onto the contacts of these plugs.

The order designations of the individual cables can be found in chapter 10.7.

14 Download of manuals

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

www.heinzmann.com

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