Heinzmann GmbH & Co. KG
Engine & Turbine Controls

Am Haselbach 1
D-79677 Schönau (Schwarzwald)
Germany

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

USt-IdNr.: DE145551926

HEINZMANN®

Engine & Turbine Controls

Gas Metering System

ELEKTRA

Lambda Control System

KRONOS 30-M

Integrated AFR / Speed-Load Control System

Manual AFR 03 003-e / 01-08

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

Warning	The examples, data and any other information in this manual are intended exclusively as instruction aids and should not be used in any particular application without independent testing and verification by the person making the application.
Danger	Independent testing and verification are especially important in any application in which malfunction might result in personal injury or damage to property.
	All of the components described in this manual may only be used in accordance with applicable regulations. Any uses other than those described in this manual are not permissible
	HEINZMANN make no warranties, express or implied, that the examples, data, or other information in this volume are free of error, that they are consistent with industry standards, or that they will meet the requirements for any particular application.
	HEINZMANN expressly disclaim the implied warranties of merchantability and of fitness for any particular purpose, even if **HEINZMANN** have been advised of a particular purpose and even if a particular purpose is indicated in the manual.
	HEINZMANN also disclaim all liability for direct, indirect, incidental or consequential damages that result from any use of the examples, data, or other information contained in this manual.
	HEINZMANN make no warranties for the conception and engineering of the technical installation as a whole. This is the responsibility of the user and of his planning staff and specialists. It is also their responsibility to verify whether the performance features of our devices will meet the intended purposes. The user is also responsible for a correct commissioning of the overall installation.

Contents

Page

1 Safety Instructions and Related Symbols

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

persons

product and engine

the environment.

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

Warning

This symbol is to indicate that there may be danger to the engine, to the material and to the environment.

Danger

This symbol is to indicate that there may be a danger to persons. (Danger to life, personal injury)

Danger! High Voltage

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

Note

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

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

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

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

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

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

1.1 Basic Safety Measures for Normal Operation

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

1.2 Basic Safety Measures for Servicing and Maintenance

- Before performing any maintenance or repair work make sure the working area of the engine has been closed to unauthorized persons. Put on a sign warning that maintenance or repair work is being done.
- Before performing any maintenance or repair work switch off the master switch of the power supply and secure it by a padlock! The key must be kept by the person who performs the maintenance and repair work.
- Before performing any maintenance and repair work make sure that all parts of the engine to be touched have cooled down to ambient temperature and are dead!
- Refasten loose connections!
- Replace at once any damaged lines and/or cables!
- Always keep the cabinet 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 Performing Maintenance and Repair Work

- 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 working properly!

2 Summary

The increasing use of bio gases and low heat value gases, as well as the stronger fluctuations of the gas quality frequently associated with it and the current emission regulations cause an growing demand for the Lambda control system of gas engines regarding range of application, control quality and flexibility. Over and above that, there is a need for appropriate air fuel mixture control systems which meet the requirements of engine manufacturers regarding the integration of partial components and functionalities and can also be applied in the context of retrofit measures as independent solutions for the complete Lambda control.

On the basis of a modular concept HEINZMANN have developed a system which is available in different versions as a pure gas dosing system, as a Lambda control system with external Lambda setpoint or as a complete stand alone control system with integrated speed and load dependant Lambda map. The system is combined of single modules and consists of proven components, such as a butterfly valve, actuator and digital controller which have already been used as independent units or integrated in other systems. This concept enables an economical and very flexible solution that permits also customized adaptations.

The gas metering valve is based on a butterfly valve with a directly flanged brushless and gearless solenoid actuator and a highly precise and stable non-contact position measuring system. Together with sensitive pressure sensors for inlet and differential pressures, as well as an inlet temperature sensor a high dosing accuracy is possible under any operating condition. The integrated and highly sophisticated digital electronic control as well as the algorithms used ensure a fast flow and Lambda control. The applied calculation model guarantees the dosing accuracy in a wide pressure and temperature range. The maximum compensation of input pressure fluctuations within the range up to 200 mbar permits the omission of the zero-pressure regulator normally used with Venturi based systems, which can result in substantial cost savings, in particular with weak gases due to the necessary pressure control valve size.

With additional information on the air or mixture mass flows the gas dosing system can be extended to a complete Lambda control system. In the standard version the flow measurement is made by pressure sensors at the calibrated Venturi gas mixer. As a Full Authority system no fundamental restrictions exist in the gas air to fuel proportion, so that a given device configuration can be used for all gas qualities.

The available, freely configurable analogue inputs and outputs as well as the CAN-bus capability of the flow control system permit various possibilities of integration into existing engine management systems.

The available test results on our own test stands and at several customers' confirm expectations concerning accuracy, control dynamics and compensation of interference.

3 Introduction

Within the gas engine range the use of gases from renewable sources has increased enormously over the past years. Certainly, the decrease of CO_2 emissions is the centre of interest, but the perspective of a decentralised energy supply independent of imports plays also a role. Increasing There is an increasing interest exists infor the use of wood gas and further other weak gases. Apart from the conditioning of these gases the provision of the demanded gas air mixture mixture ratio relationship under all any operating conditions for a trouble free engine operation is an important task for trouble free engine operation. In addition wWith the use of these gases we have to meet the observance ofaggravating emission demands and take into account that the increasing requirements of actual the mixture quality required by these current gas engines must be strictly observedrequired mixture quality within a close band have to be regarded.

Entirely Venturi based mixture control systems are no longer applicable for weak gases with a low minimum air requirement, because their function is based on a minimum gas air ratio. Thus also the electronic trim systems which are based on Venturi systems come up to their limiting factors. Frequently a multi-gas ability of the mixture control system is desired to ensure a continuous engine operation also due to the uncertain availability of the renewable gases. Furthermore, the system should compensate for gas quality fluctuations as far as possible and offer a wide Lambda range for the start, no-load, partial load and full load operation ranges. In order to avoid both engine knocking and ignition misfire the mixture control system should provide a high accuracy and a fast response.

Engine manufacturers usually use their own engine management system, which normally requires the integration of supplier devices. An important factor is a comprehensive and simple integration of these components as well as quite often the integration of standard communication interfaces. Consequently, there is a need for gas metering systems, which convert a flow setpoint value with high accuracy and a good compensation of ambient influences. If the engine management is realized by packagers, you frequently need a solution which is capable of covering a complete functionality such as the Lambda control, and can be used also for a multiplicity of different applications without any hardware modifications. A further potential market is the retrofit of existing systems. Complete solutions which cover extensive engine management functions are in demand.

The goal of the development was a flexible system that meets the requirements of the diverse customer segments, i. e. engine manufacturers, packagers and end customers, and is expandable by new functions that meet the demands regarding gas metering and Lambda control. The use of existing and proven components and the modular concept of the gas metering valve should lead to an economical solution that also permits to realize customized special equipments.

A concept was implemented that integrates all the essential components in one system in order to minimize installation expenses. It is based on a standard butterfly valve with integrated actuator and uses a built-in sensor and controller box as well as measuring flanges on both sides. Two sizes cover an engine performance range from 250 to 4000 kW, dependent on the gas quality and the pressure ratio.

4 System Concept

Current emission regulations, increasing requirements by modern gas engines concerning the air/fuel mixture quality as well as the use of gases with a low heat value and strongly varying gas quality result in high demands regarding the air/fuel mixture system. On the one hand, the gas air mixture ratio is expected to be freely adjustable over a wide range dependent on load and speed, as required, on the other hand the Lambda must be retained at a given value with a high accuracy under any operating condition and changing ambient conditions.

An ideal system should be universally usable for different kinds of gas and diverse areas of application, and should be adaptable to the particular application by a mere change of the parametrisation.

From the economic point of view, the rising share of bio gases within the range of gas operated Gensets makes low-pressure based mixture control systems advantageous compared with gas injecting valves, which are operated with pressures of >3 bar and require a complex compressor technology. Thus the gas supply can be realized without an increase in pressure or using economical blowers.

For gases with very low heat values, such as e. g. wood gas, which is currently experiencing increasing attention, a Lambda control is no longer possible with conventional venturi mixers based on Bernoullis law. The mixture control can no longer be carried out conventionally.

The requirements to be met by current mixture control systems are concerning new engines, which call for a particularly high control accuracy due to the narrow Lambda band between knocking and lean-run limits. Furthermore, it concerns old engines which are meant to be adapted to current emission limits by retrofitting.

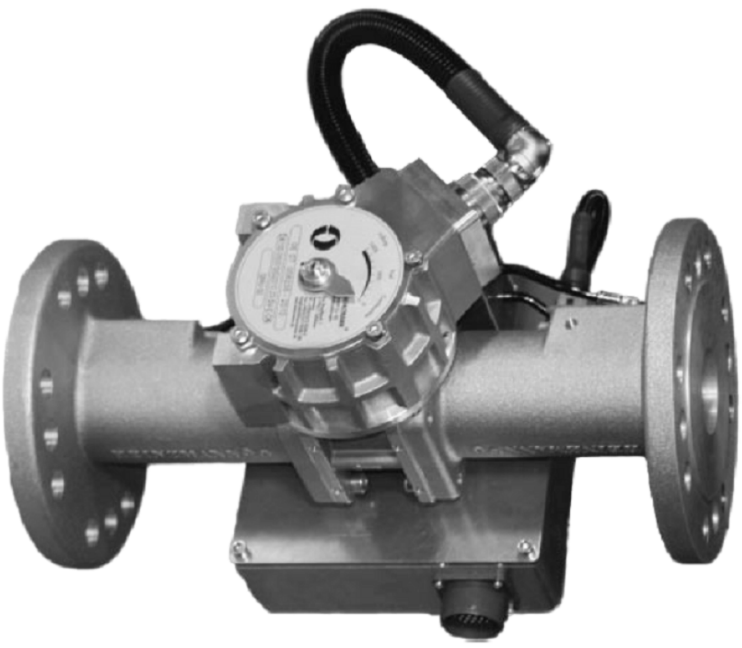


Figure 1: Gas Metering Control Unit GMCU

The aim was to develop a complete system with integrated electronics for gas metering of and control of the Lambda value, which covers the need both for retrofit applications and new engines with a high accuracy in a flexible way. It should alternatively provide the functions which are needed for the respective application. The system presented here (fig. 1) can be adapted regarding the aspects described below:

Engine Size

Two sizes cover a wide power output range, with natural gas from approx. 250 to 4000 KW, with biogas at present up to approx. 2000 KW, depending upon gas pressure and gas quality.

Function Range

- Pure gas metering system with flow setpoint value
- Lambda control system with external Lambda setpoint
- Stand alone Lambda control with integrated Lambda map (speed and load dependant)
- Open/Closed loop operation
- Measurement principle for air/mixture flow measurement:
  - Venturi differential pressure measurement
  - Air mass measurement
  - Externally provided flow value
- Measured value for Closed Loop operation for compensation of changes in the site ambient conditions and/or the gas characteristics:
- Output power signal, Lambda sensor, heat value information, methane content information
- Ignition misfire identification

Flange Version

Standard flange or special solutions

Signal Specification

- Analogue control with voltage/current signal or PWM as well as additional freely configurable inputs and outputs
- CAN bus communication with different protocols

Integration

Expandability with HEINZMANN systems for speed/load control, knock control, generator management, monitoring devices, human-machine interfaces up to the complete engine management.

5 Operating Principle of the Lambda Control System

In an extended version with additional sensors, a Venturi gas mixer and the appropriated software a stand alone air fuel ratio system is realized. For this purpose, in addition to the gas flow measurement/control the air or mix flow has to be measured, too, in order to determine the Lambda value. In order to implement a speed and load dependent Lambda set point map the required values are picked by a speed sensor and a load representing signal. If the direct load signal is not available the load can be represented by the manifold pressure. All signals can also be transmitted via CAN bus. This solution offers a simple integration into an existing gas engine management system.

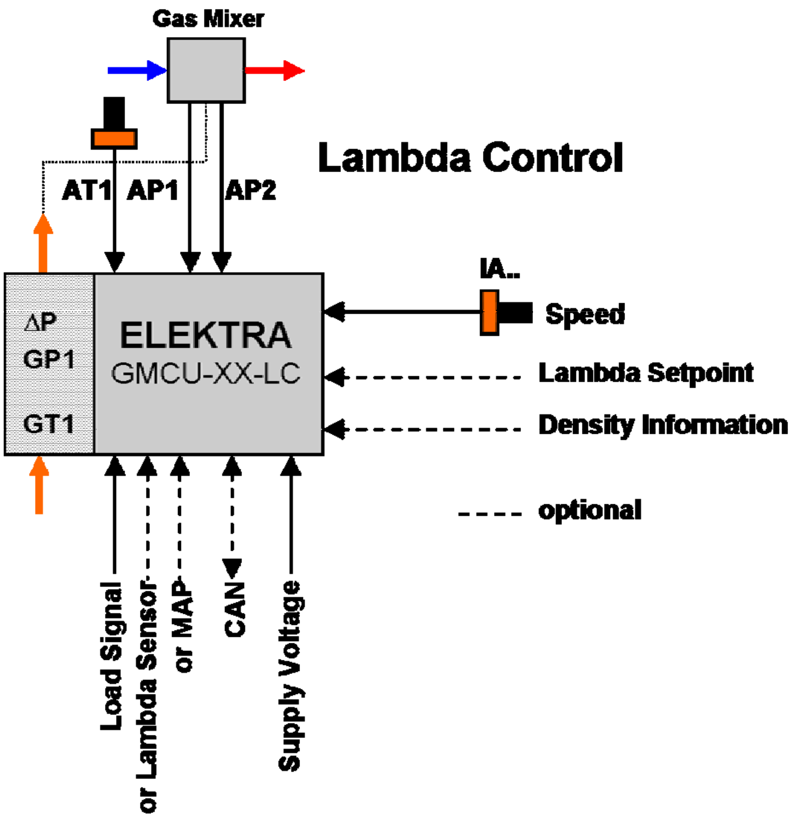


Figure 2: Control of Lambda Control Unit

For measuring the air mass flow with a calibrated Venturi gas mixer a differential pressure measurement is performed. Contrary to conventional Venturi based mix control systems working within the zero-pressure range where the gas mixer determines the air fuel ratio considerably, we are dealing here with a Full Authority system, in which the gas mixer geometry does not affect the air fuel ratio. This flexibility permits practically any Lambda values and permits the multi-gas operation with different gas qualities without any change to the mechanical configuration. The slightly modified gas mixer serves to homogenize the mixture and works as an air flow sensor. An additional temperature sensor compensates changes of the intake air temperature. The additional pressure sensors are located in the sensor box. The connection to the measuring points in the gas mixers is made with suitable pipes. On

V-engines with two gas mixers the flow measurement is carried out at both mixers. The control system compares both flows. When the max. specified pressure difference is exceeded this is regarded as a system error or an engine problem, and an error signal is issued. Thus, to a large extent, the mixture control system can also work as an engine condition monitoring system to detect leakage of the air intake system or for problems of the turbocharger.

The square dependence of the Venturi mixer's differential pressure on the flow rate and/or the speed in the Venturi leads to the fact that on the one hand the dimensioning of the gas mixer must agree with the respective engine, in order to achieve a sufficient pressure difference in no-load operation and with small load. On the other hand the engine operation in a higher partial load and full load reaches a very high accuracy so that the Lambda control shows a good quality in essential operating ranges altogether.

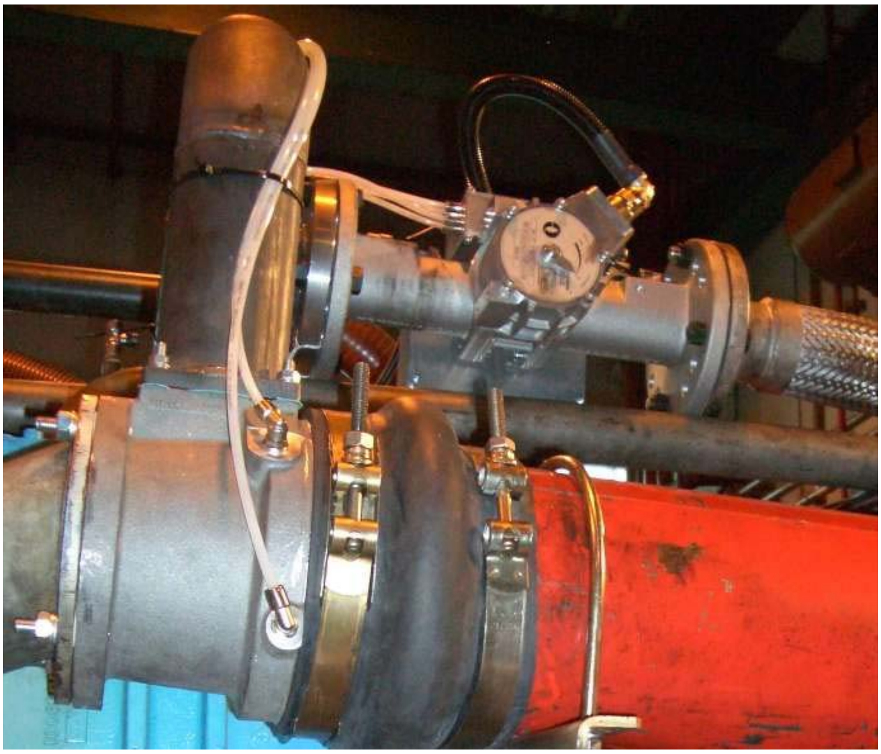


Figure 3: **Test configuration of a complete Lambda Control Unit**

Regarding the Lambda setpoint the ELEKTRA mixture control system can be operated in two modes:

1. The Lambda set point value is preset by an external control. By measurement of the intake air flow and the control of the gas flow the current Lambda value can be set.
2. The system uses an integrated, speed and load dependant Lambda map and performs the Lambda control self-sufficiently. Via the measured load signal a closed-loop operation is possible by determining the current mixture heat value which compensates any change of the gas quality or the site ambient conditions with a high accuracy. Furthermore, a closed-loop operation can also be realized alternatively with a Lambda sensor.

These configurations allow to adapt the system to the diverse requirements of engine manufacturers, packagers and engine operators and permit a flexible integration into an engine management system of HEINZMANN or an external supplier.

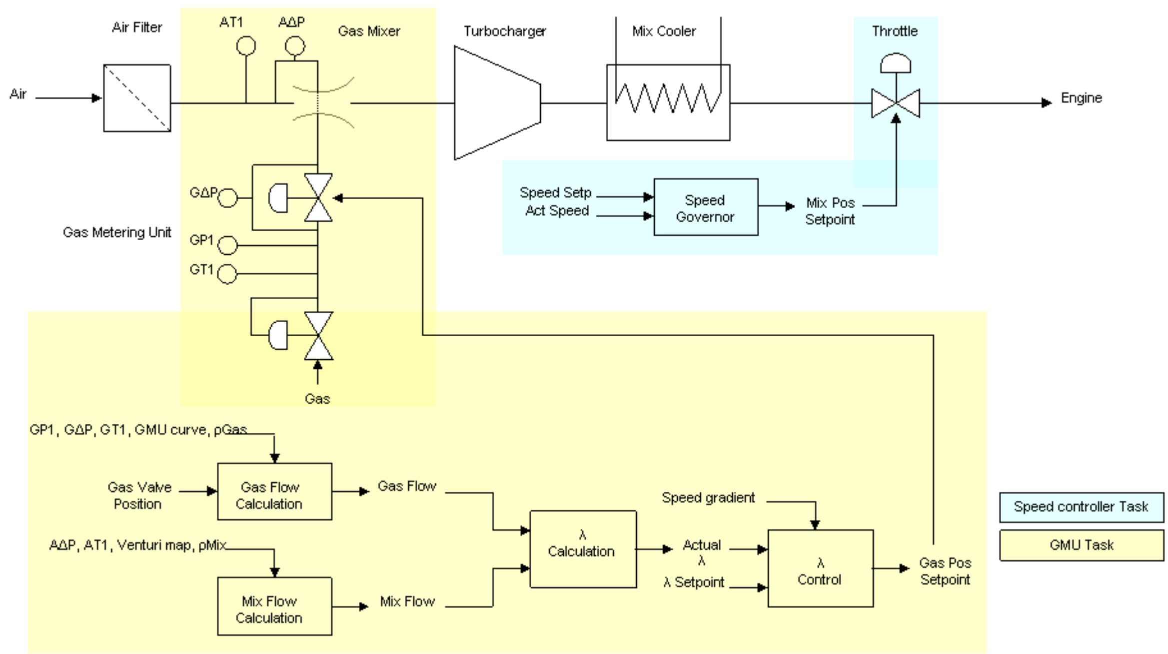


Figure 4: **Principle of Lambda Control**

Combined with a HEINZMANN speed/load control system a complete solution for the gas engine control is obtained. Both functions are generally independent, however the total expenditure can be reduced and the overall control quality can be improved by the exchange of operational data via CAN and by the common use of the sensors.

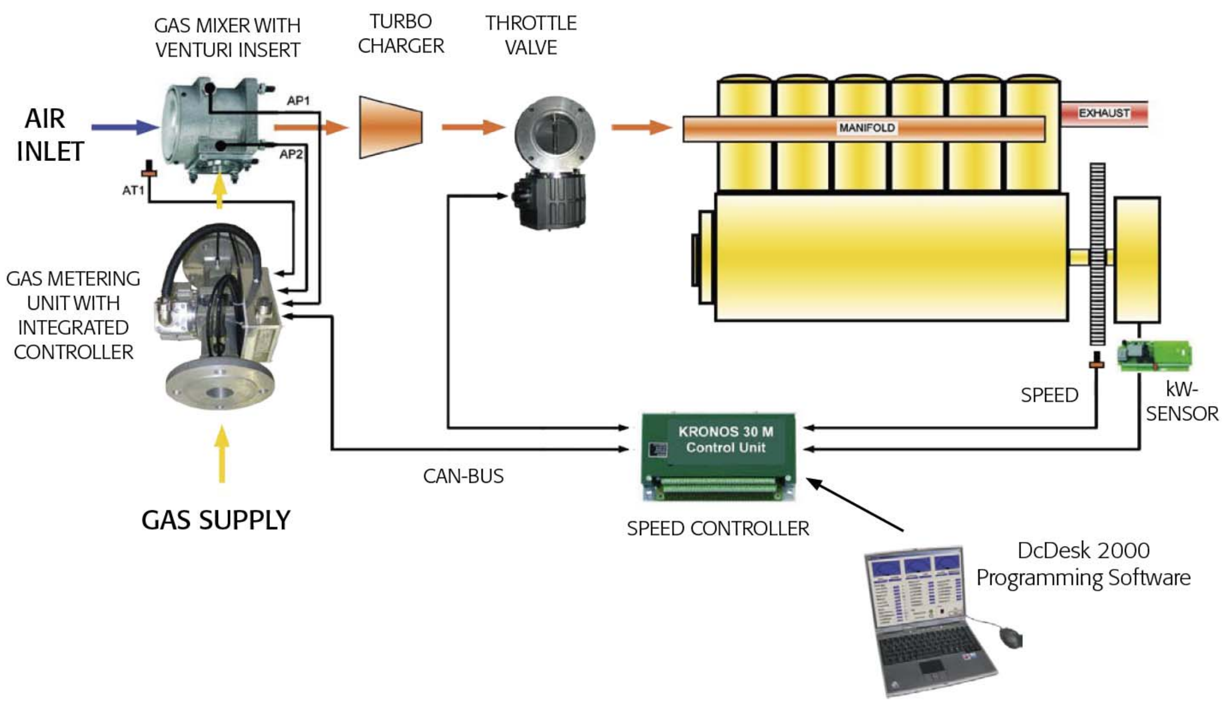


Figure 5: **Lambda Control System with Speed / Load Control System (KRONOS 30-M)**

6 Sensors

6.1 Overview

Sensor	Speed	Inlet Manifold Pressure	Inlet Manifold Temperature
HZM-Designation	IA ..	DSU 01	TS 05-NTC
Measuring Procedure	inductive, active	Piezo Resistance, active	NTC, passive
Measuring Range	50..9.000 Hz	0.1..1.15 bar abs.	-50 to+150°C
Supply Voltage Range		4.5..5.5 V DC	
Output Signal Range	0..10 V AC	0.3..4.8 V	100 Ohm up to 50 kOhm
Operating Temperature Range	-8..+120°C	-40..+ 130°C	-40..+ 130°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 are programmable.

6.2 Magnetic Pickup IA ...

6.2.1 Technical Data

Operating principle	inductive sensor
Distance from sensing gear	standard 0.5 to 0.8 mm
Output	0 V .. 10 V AC
Signal form	Sine (depending on tooth shape)
Resistance	approx. 52 Ohm
Temperature range	-55°C up to +125°C
Degree of protection	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 pickup has to be arranged in such a way as to obtain a frequency as high as possible. Normally, the HEINZMANN governors of the series HELENOS are designed for a maximum frequency of 12,000 Hz. The frequency (in 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

$$f = \frac{1500 * 160}{60} = 4{,}000 \text{ Hz}$$

It should be taken care that the speed can be measured by the pulse pickup without any bias. For best results, the speed pickup 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 pickup gear must be made 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 pickup is preferable.

6.2.4 Clearance of Magnetic Pickup

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

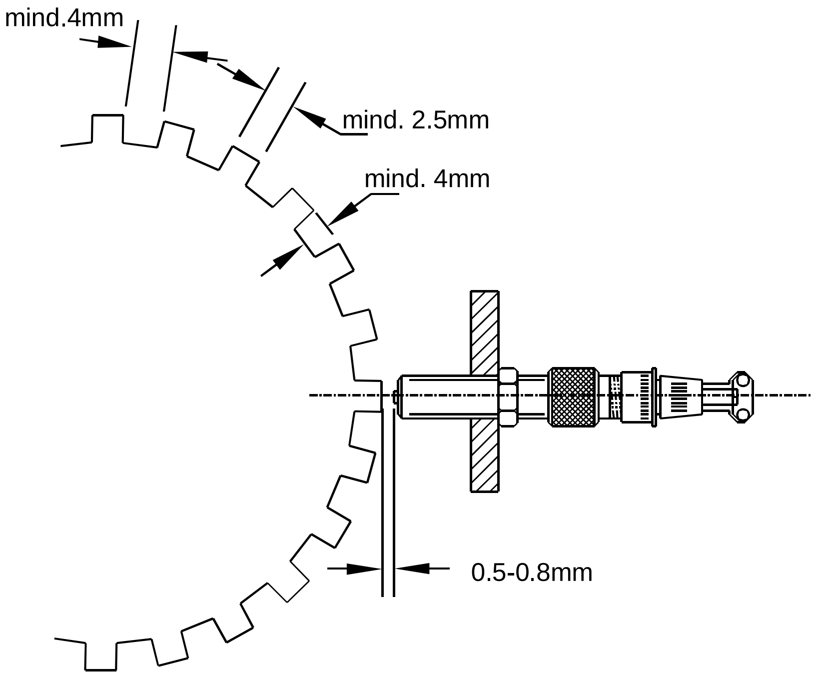


Figure 6: Clearance of Pickup

6.2.5 Mounting Measurements

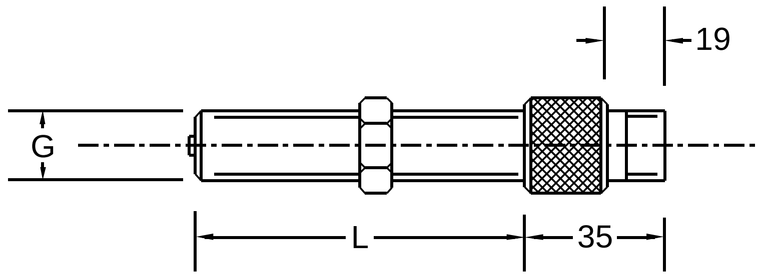


Figure 7: Magnetic Pickup

TYPE	Thread Length (mm)	Thread Size	Remarks
IA 01-38	38	M 16 x 1.5	associated plug: SV6-IA-2K
IA 02-76	76	M 16 x 1.5	
IA 03-102	102	M 16 x 1.5	
IA 04-125	125	M16 x 1.5	
IA 11-38	38	5/8"-18UNF-2A	
IA 12-76	76	5/8"-18UNF-2A	
IA 13-102	102	5/8"-18UNF-2A	

Ordering specification, e.g. IA 02-76.

In order to ensure a sufficient flexibility with the sensors the minimum and maximum values of the pressure and temperature sensors are programmable.

6.2.6 Certification of the Magnetic Pickups according to ATEX

All magnetic pickups described in the previous chapters are certified according to EN 50021:1999 ignition protection grade “n“ ATEX. If the magnetic pickups are used in the corresponding areas and an ATEX certification is necessary, the wiring of the magnetic pickup has to be purchased from HEINZMANN, too. The following signboard has to be fixed to the cable near the magnetic pickup plug:

HEINZMANN GmbH & Co. KG Germany
www.heinzmann.de Tel.: +49 7673 8208-0
Type: z.B. IA 02-76, Ex II3G EEx nA II T4
T_{cable}: -5°C to +80°C, $T_{housing}$: -8°C to +120°C
TÜV 06 ATEX 552893

WARNING - EXPLOSION HAZARD -
DO NOT DISCONNECT WHILE CIRCUIT
IS LIVE UNLESS AREA IS KNOWN
TO BE NON-HAZARDOUS

Figure 8: Signboard at Magnetic Pickup Cable, Front and Back Sides

6.3 DSU 01 Pressure Sensor between Air Filter and Venturi Mixer

6.3.1 Technical Data

Supply voltage	5±0.5 V
Current consumption	6..12.5 mA at 5 V
Pressure range	0.1..1.15 bar abs.
Tolerance	±1.5 %
Signal voltage	0.3..40.8 V linear
Response $time_{10/90}$	1 ms
EMC	100 V/m
Operating temperature	-40°C up to +130°C
Storing temperature	-40°C up to +130°C
Degree of protection	IP 55
EDV No.:	600-00-102-00
Associated cable	Pressure Sensor Cable (EDV-No.: xxx-xx..)

6.3.2 Measurements

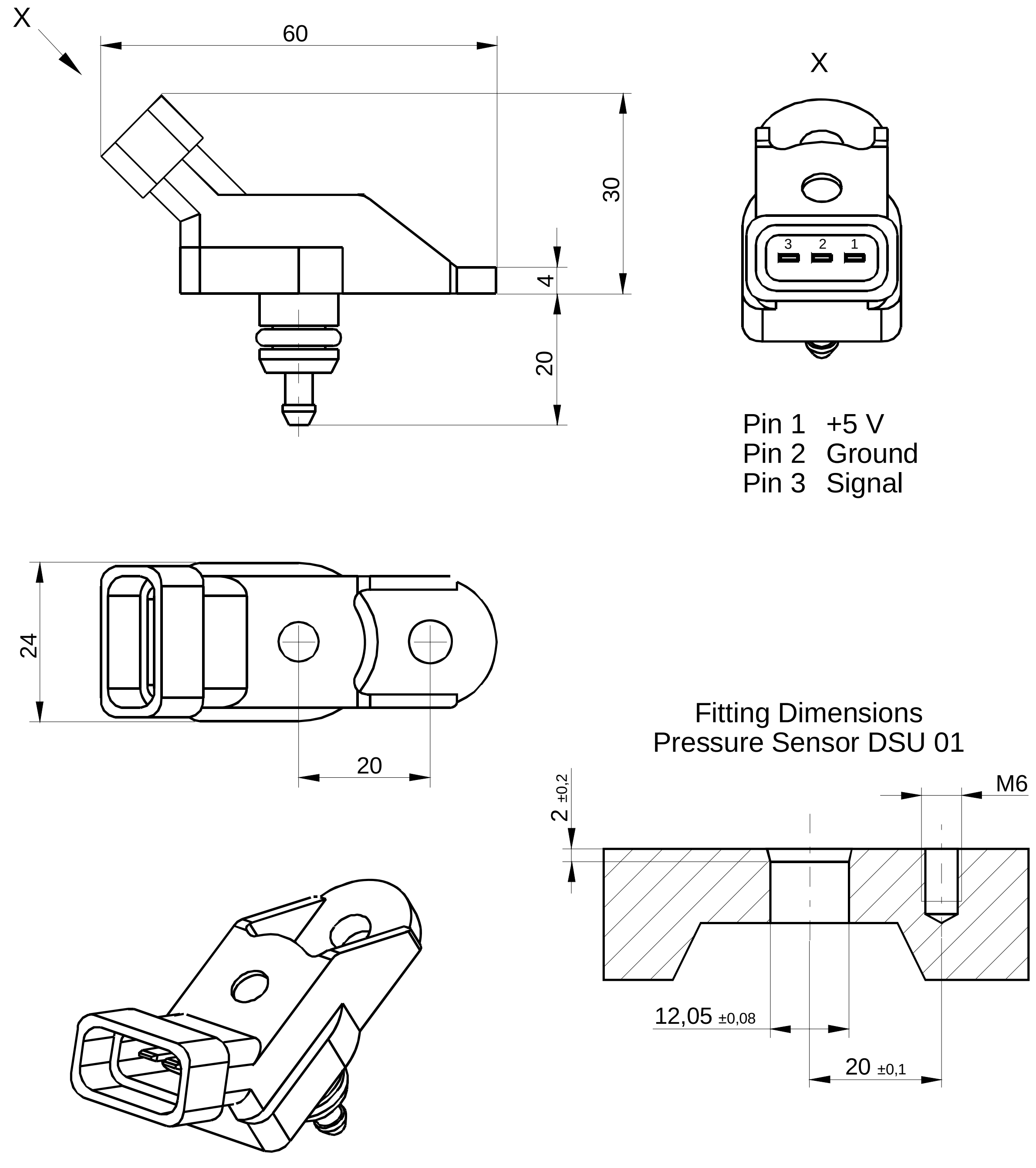


Figure 9: Measures of Pressure Sensor DSU 01

6.3.3 Installation

The sensor is designed for mounting to a planar surface at the inlet manifold between air filter and venturi mixer. The pressure nozzle protrudes into the inlet manifold and is sealed to the atmosphere by an O-ring.

It must be ensured that no condensate can be taken up in the pressure cell by mounting the unit adequately (such as pressure tapping on top of the pipe, pressure nozzle showing downward, and so on).

Additionally, the mounting should be made in such a way that the sensor is neither too close to the air filter nor too close to the throttle valve.

6.3.4 Certification of the DSU 01 Pressure Sensor according to ATEX

The pressure sensor DSU 01 is certified according to EN 50021:1999 ignition protection grade "n" ATEX. If the sensor is used in the corresponding areas and an ATEX certification is required, the wiring of the sensor has to be delivered by HEINZMANN, too. In this case, the following signboard has to be fixed to the cable near the sensor plug:

Front	Back
HEINZMANN GmbH & Co. KG Germany www.heinzmann.de Tel.: +49 7673 8208-0 Type: DSU 01, Ex II3G EEx nA II T4 T_{cable}: -5°C to +80°C, $T_{housing}$: -40°C to +130°C TÜV 07 ATEX xxxxxx	WARNING - EXPLOSION HAZARD - DO NOT DISCONNECT WHILE CIRCUIT IS LIVE UNLESS AREA IS KNOWN TO BE NON-HAZARDOUS

Figure 10: Signboard at DSU Sensor Cable, Front and Back Sides

6.4 TS 05-NTC Temperature Sensor between Air Filter and Venturi Mixer

6.4.1 Technical Data

Type	NTC
Supply voltage	5±0.5 V
Temperature measuring range	-50°C up to +15°C
Resistance at 20 °C (R20)	2.3 kOhm ±5 %
Resistance over measuring range	approx. 100 Ohm to approx. 50 kOhm
Maximum measuring current	1 mA (5 V with 1 kOhm series resistance)
Time constant in fluids	approx. 10 seconds
EMC	100 V/m
Ambiente temperature	-40°C up to +125°C
Storing temperature	-40°C up to +130°C
Degree of protection	IP 55

EDV-No.:	600-00-102-00
Associated cable	Temperature sensor cable (EDV-No.: xxx-xx-..)

6.4.2 Measurements

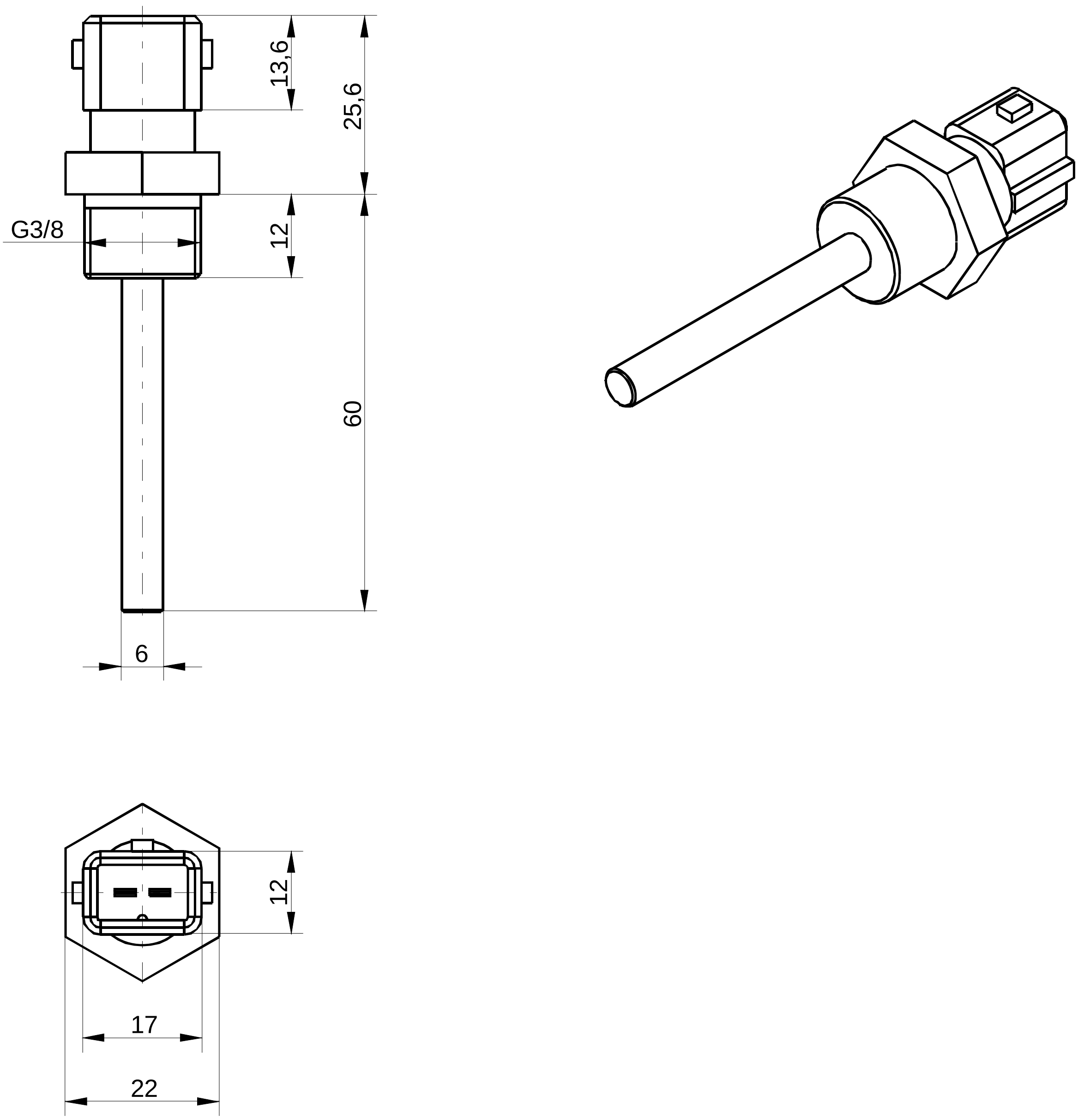


Figure 11: Measurements of Temperature Sensor TS 05-NTC

6.4.3 Installation

The sensor is designed for mounting to a planar surface at the inlet manifold between air filter and venturi mixer. The pressure nozzle protrudes into the inlet manifold and is sealed to the atmosphere by an O-ring.

In order that the front part of the sensor is directly touched by the air stream, a suitable mounting has to be provided in the inlet manifold.

Additionally, the mounting should be made in such a way that the sensor is neither too close to the air filter nor too close to the throttle valve.

6.4.4 Certification of the TS 05-NTC Temperature Sensor according to ATEX

The TS 05-NTC temperature sensor is certified according to EN 50021:1999 ignition protection grade “n“ ATEX. If the sensor is used in the corresponding areas and an ATEX certification is required, the wiring of the sensor has to be purchased from HEINZMANN, too. In this case, the following signboard has to be fixed to the cable near the sensor plug:

Front	Back
HEINZMANN GmbH & Co. KG Germany www.heinzmann.de Tel.: +49 7673 8208-0 Type: TS 05-NTC, Ex II3G EEx nA II T4 T_{cable}: -5°C to +80°C, $T_{housing}$: -50°C to +150°C TÜV 07 ATEX xxxxxx	WARNING - EXPLOSION HAZARD - DO NOT DISCONNECT WHILE CIRCUIT IS LIVE UNLESS AREA IS KNOWN TO BE NON-HAZARDOUS

Figure 12: Signboard at Temperature Sensor Cable, Front and Back Sides

7 Gas Metering Control Unit GMCU-50 / 85

As the main component of the ELEKTRA Lambda control system the gas metering unit is based on a modular structure (fig. 2). It comprises to a large extent individual components which have been used in other applications for a long time. In this way, substantial development and manufacturing expenditure has been saved and a high level of reliability has been achieved from the very beginning .

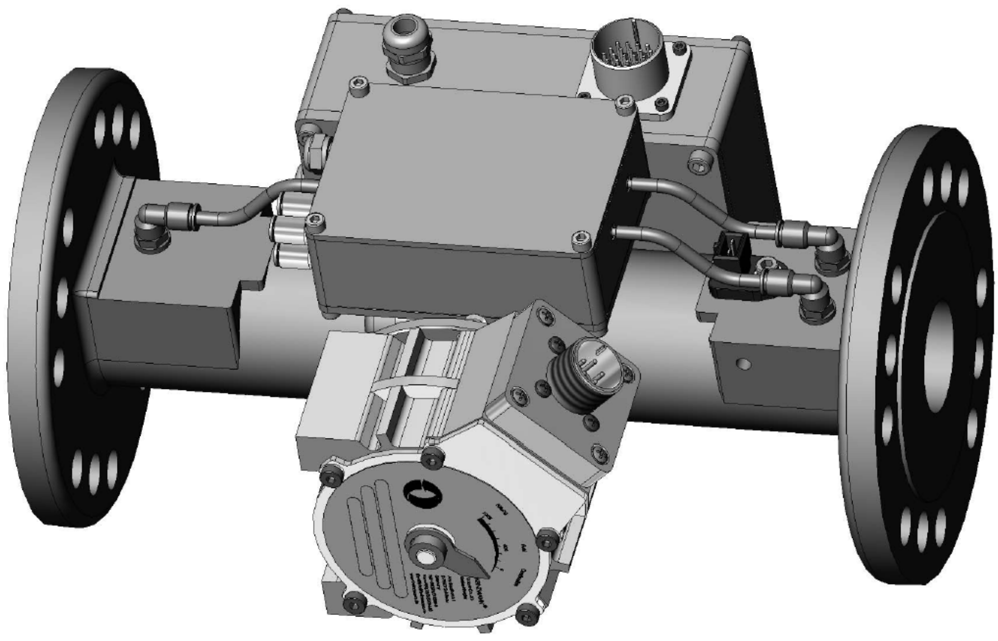


Figure 13: **Gas Metering Control Unit GMCU**

The main component is a butterfly valve with integrated actuator. This unit has already been in use as an integrated mixture butterfly valve for some time. The available diameters are 50 and 85 mm, resp. Unlike the standard version, this unit has a non-contact position measuring system which ensures an 0.5 % accuracy with good long-term stability over a wide temperature range.

The butterfly valve unit is extended by sensor flanges which contain the measuring points for the necessary pressure and temperature measurement. All sensors for the measurement of absolute and differential pressures are arranged in a sensor box. The connection between measuring points and sensor box is realized over short hose connectors. Depending upon the version of the system the box is equipped differently with precision pressure sensors.

The controller electronics for the flow control and mix control in the extended version is based on the DC 6-controller which has been already used and approved in many applications (speed governor, positioner, Lambda controller, Dual Fuel controller). Apart from the CAN bus with flexible configuration this offers easily adaptable analogue and digital inputs and outputs, which allows a simple adaptation to the customer requirements and thus an easy integration into existing environments. The integration of metering valve and electronic control represents a complete stand-alone system with little wiring and assembly work.

The system configuration, the diagnosis and calibration of the system are performed with the DcDesk 2000 communication software.

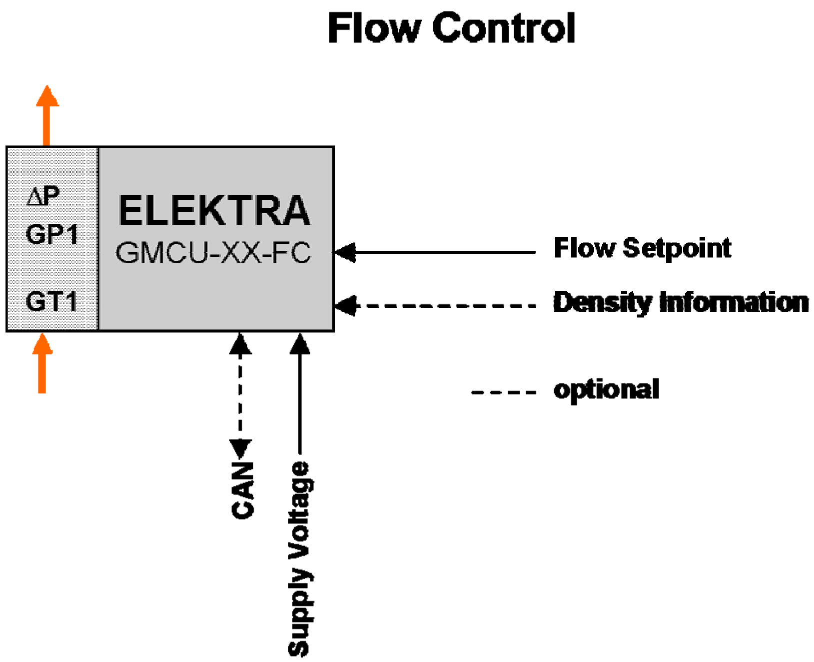


Figure 14: **Control of Gas Metering Unit**

In the version as a pure gas metering system the flow setpoint is given as analogue or digital value. Density of the gas must be known and parameterized. The actual flow value follows the given set point value in a wide pressure and temperature range and with a high dynamic and accuracy.

The flow control is realized by measuring the input pressure and temperature, as well as the differential pressure over the calibrated butterfly valve. The algorithm used shows a high accuracy of approx. 2 % in the range up to 200 mbar input pressure, as well as in a wide flow range. In the case of continuous updating of the gas data the metering accuracy can be guaranteed also when the gas quality varies.

Due to the precise compensation of changing ambient conditions the zero-pressure regulator normally used with venturi systems can be omitted, which means particularly clear cost advantages when gases with a low heat value are used. Furthermore, the possibility to operate the system with comparatively higher pressures leads to compact dimensions and a wide capacity range. So when using the 50-mm version with natural gas a capacity range up to approx. 2000 KW can be reached.

The use of corrosion resistant materials and a durable sensor technology permits the reliable operation with all usual types of gases in the natural gas, the biogas and wood gas range.

Both the gas metering unit and the gas mixers used for the air flow measurement are factory adjusted. This allows a fast and easy start-up.

Hinweis

To ensure save and reliable function the GMCU may only be combined with gas mixers that meet the HEINZMANN specifications. If a different gas mixer shall be used consult HEINZMANN.

7.1 Technical Data

7.1.1 General

Supply voltage	24 V DC
Minimum voltage	18 V DC
Maximum voltage	32 V DC
Residual ripple	max. 10 % at 100 Hz
Current consumption	max. 6 A
Permissible voltage dip at maximum current consumption	max. 10 %
Fuse Protection	12 A
Gas inlet pressure	40 mbar up to 250 mbar
Pressure difference input/output	40 mbar up to 250 mbar
Flow rate measuring precision	±5% for the whole flow rate range
Admissible concentration of (H_2S) hydrogen sulphide	max. 0.1 %

Fuels might not hold any corrosive constituents. If in doubt consult HEINZMANN

Storing temperature	-30°C up to +85°C
Operating temperature	-30°C up to +80°C
Humidity	up to 98 % at 55 °C
Vibration	max. 2 mm at 10..20 Hz max. 0.24 m/s at 21..63 Hz max. 9 g at 64..2000 Hz
Shock	50 g, 11 ms, half-sine wave
Degree of protection	IP 55

Insulation resistance	> 1 MOhm at 48 V DC
EMC	89/336/EEC and 95/54/EEC
Weight	
GMCU-50	approx. 20 kg
GMCU-85	approx. 35 kg

7.1.2 Externally used Inputs and Outputs

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

Digital input Engine Stop		$U_0 < 2$ V, $U_1 > 6{,}0$ V, $R_{pd} = 4{,}75$ kΩ
(plug X11, pin F)	or	$R_{pu} = 4{,}75$ kΩ oder $R_{pd} = 150$ kΩ
Reference voltage 5 V (plug X11, pin C)		$U_{ref} = 5$ V ±1 %, $I_{ref} < 30$ mA
External analogue setpoint		U = 0..5 V, $R_e = 100$ kΩ, $f_g = 15$ Hz
(plug X11, pin H)	or	I = 4 .. 20 mA, $R_e = 200$ Ω, $f_g = 15$ Hz
Digital output error lamp		$I_{sink} < 0.3$ A, $U_{rest} < 1.0$ V, $I_{leck} < 0.1$ mA
(plug X11, pin E)		$R_{pu} = 4.75$ kΩ oder $R_{pu} = \infty$, masseschaltend
Additional MF-Ports		$U_e = 0..10$ V, $R_e = 20$ kΩ, $f_g = 15$ Hz
(plug X11, pins A/K)	or	$U_e = 0..5$ V, $R_e = 100$ kΩ, $f_g = 15$ Hz
	or	$I_e = 4$ .. 20 mA, $R_e = 200$ Ω, $f_g = 15$ Hz
	or	$U_0 < 2$ V, $U_1 > 6.5$ V, $R_{pd} = 4.75$ kΩ
	or	$R_{pu} = 4.75$ kΩ or $R_{pd} = 150$ kΩ
CAN-Bus (plug X11, pins R,S,T,U)		HEINZMANN-CAN or on customer's request
Serial interface ISO 9141,		variable from 2.4 kbit/s to 57.6 kbit/s standard 9.6 kbit/s
Temperature input (plug X12, pin A)		for PT1000 / Ni1000 sensors tolerances: < ±2°C at 0°C up to 130°C, rest < ±4°C
Speed sensing input (plug X13, Pin B)		for inductive sensor, with $f_i = 25$ to 9000 Hz, $U_i = 0.5$ to 30 V AC

7.2 Measurements

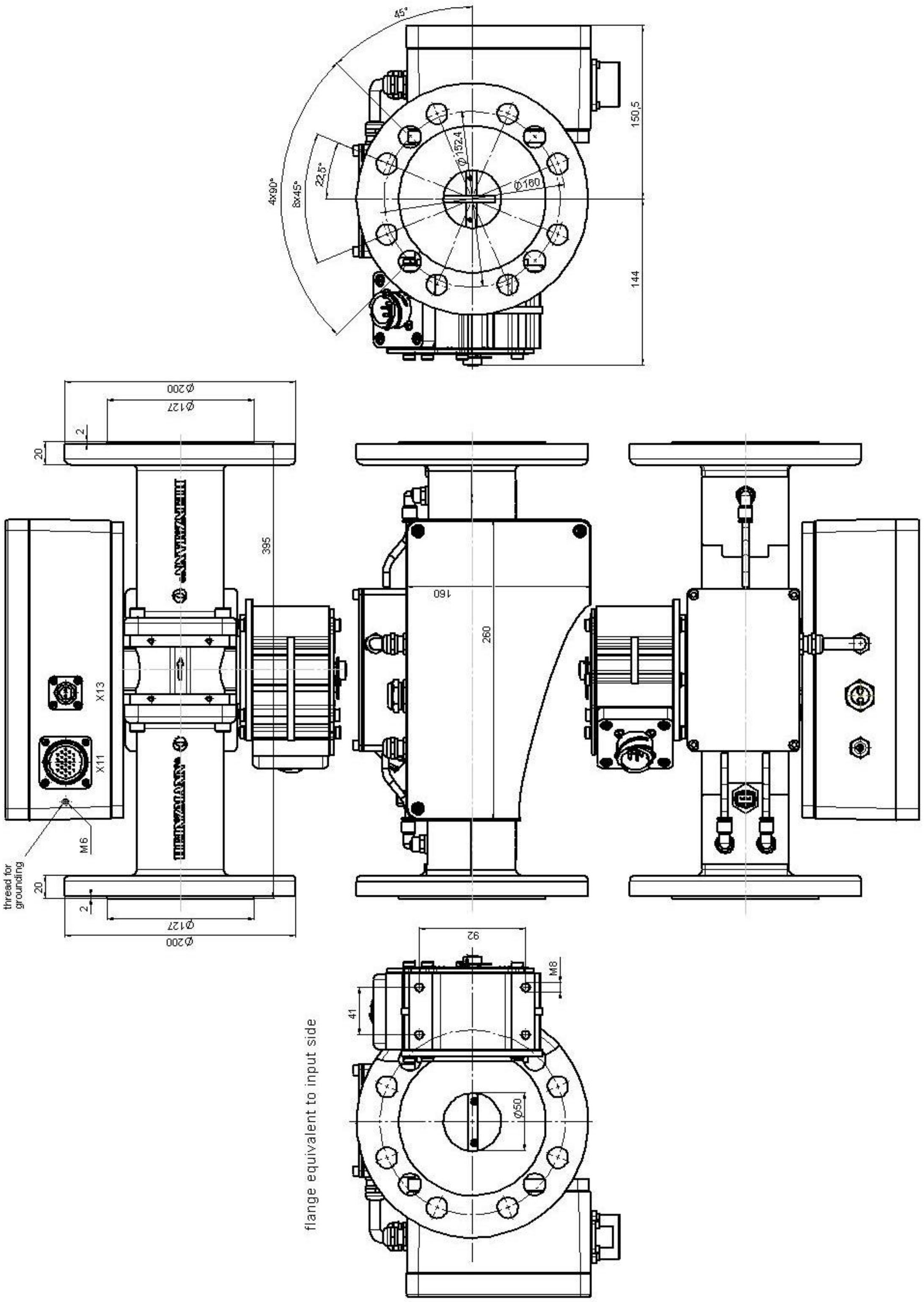


Figure 15: Dimensioned Drawing of GMCU-50-FC

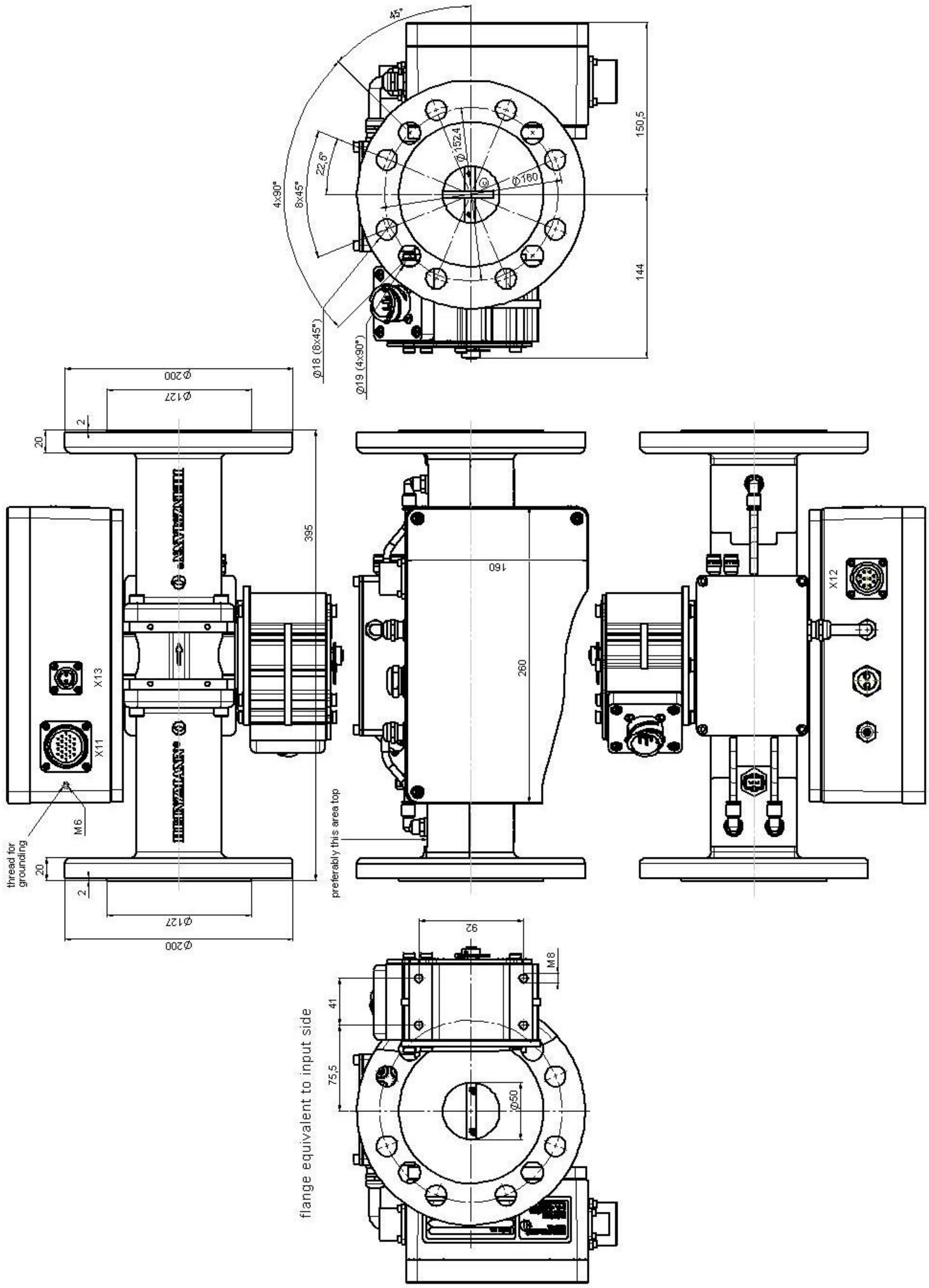


Figure 16: Dimensioned drawing of GMCU-50-LC

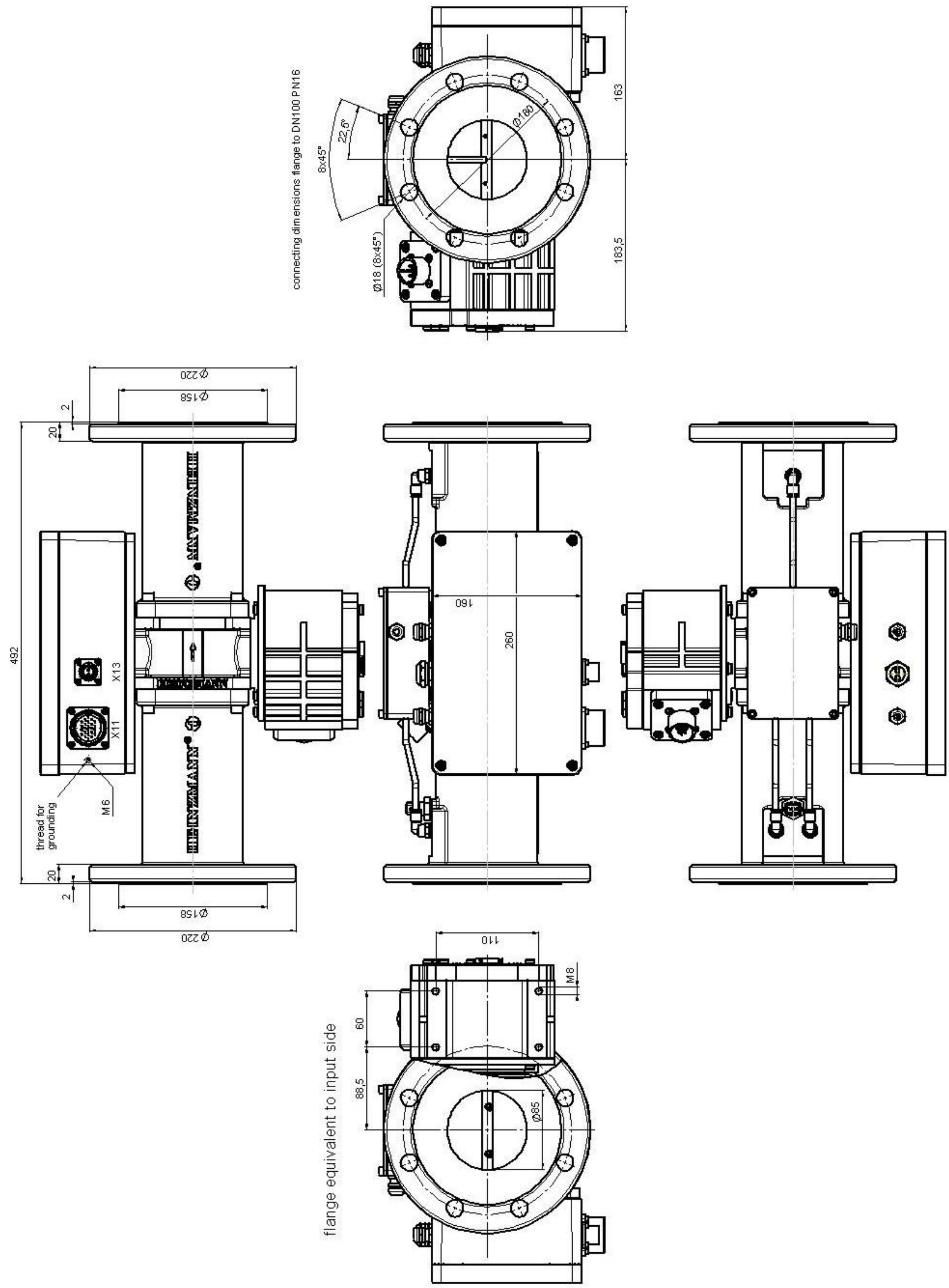


Figure 17: Dimensioned drawing of GMCU-85-FC

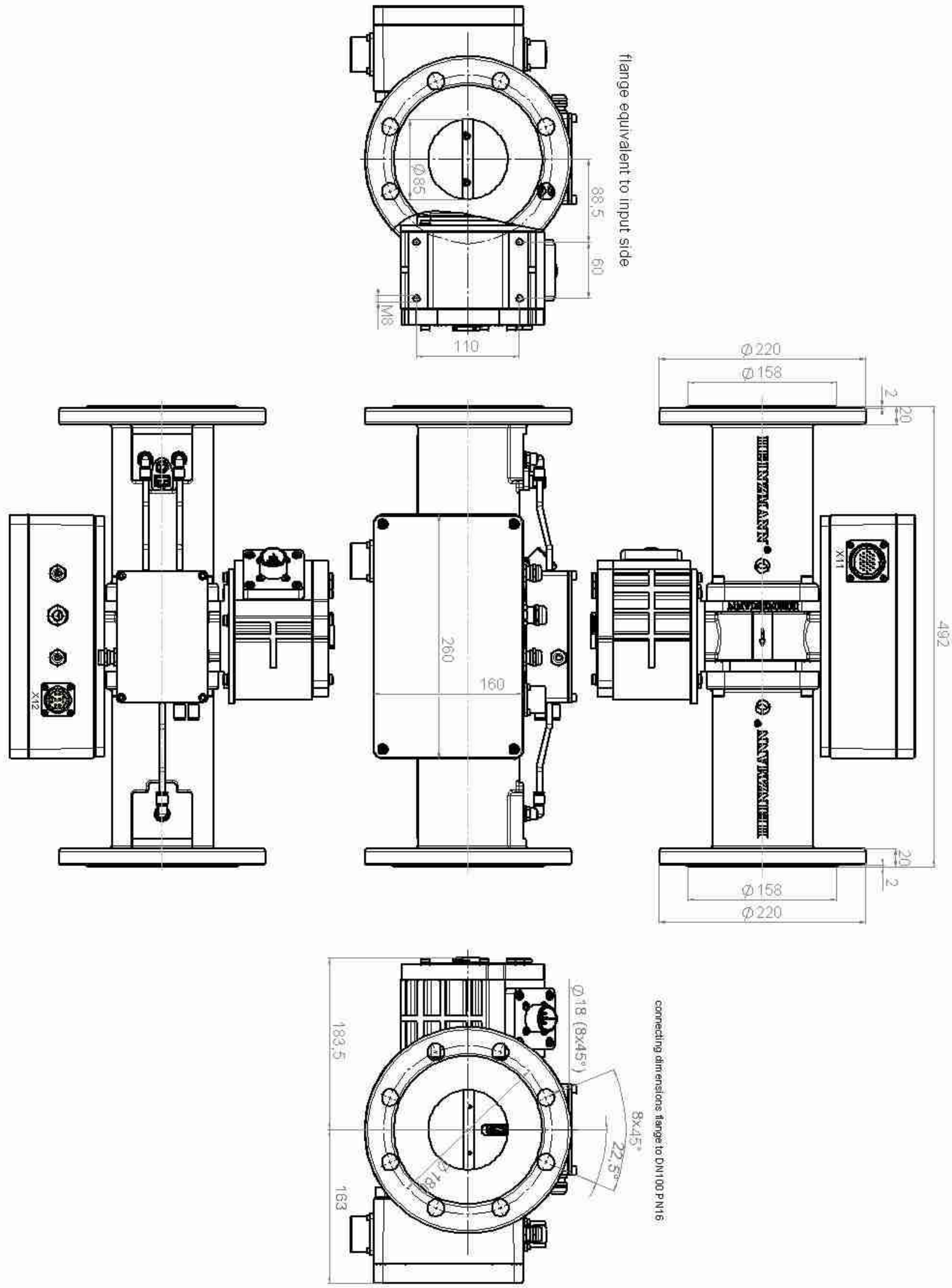


Figure 18: Dimensioned drawing of GMCU-85-LC

7.3 Installation

The gas supplies to the GMCU are designed as flanges. This allows to screw the gas valve alternatively direct to the gas mixer. The standard pipe threads employed allow an easy connection to commercial gas pipes. For a reduced level of vibration it should be installed at the end of the gas supply line and linked to the gas mixer with a flexible hose. A flexible element between gas supply line and gas mixer must be provided in any case.

To ensure an interference-free and low-wear operation, a gas filter with a maximum 50 µm mesh size has to be installed in the gas supply line.

Warning

Any work at the valves must be performed by trained and qualified personnel under observance of the standards in force.

When selecting the location, ensure minimum vibration and oscillations.

Select a location according to the degree of protection.

Recommended mounting position for the GMCU is horizontal. Hose couplings of the pressure sensors must point upward. Contrary to that the plug connectors should not point upward. If any different mounting position should be necessary consult HEINZMANN.

The GMCU must be furnished with a sufficient potential equalisation. There is an extra screw with M6 thread at the GMCU where a potential compensation line can be connected.

7.4 Certification of the Gas Metering Control Unit GMCU according to ATEX

The GMCUs are certified according to EN 50021:1999 ignition protection grade “n“ ATEX. If the units are used in the corresponding areas and an ATEX certification is necessary, the wiring of the used gas metering control unit has to be purchased from HEINZMANN, too.

Note

The ATEX evaluation does not include the inside of gas bearing parts.

The housing of the GMCU has three indicating labels.

Label 1 contains the general and ATEX relevant information

Figure 19: Label 1 with general and ATEX relevant information

Label 2 contains the particular type designation and serial number

Figure 20: Label 2 with the type designation and serial number (for GMCU-85-FC)

Label 3 contains warnings about removing the plugs and the cover.

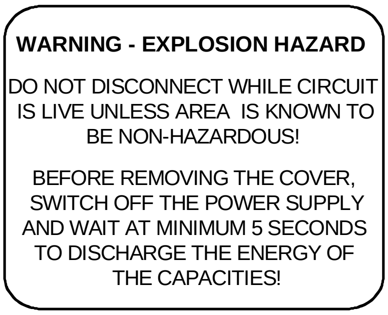


Figure 21: Label 3 with warnings about removing the plugs and the cover

8 Electrical Connections

Warning

Any work at the cabling may only be performed by trained and qualified personnel under observance of the standards in force.

When installing electrical connections, follow the wiring diagrams of HEINZMANN and/or the packager. Use only specified cables for cabling the units. Keep strictly to the indicated cable cross sections.

Warning

The control valve is driven by a HEINZMANN control unit. In special cases the valve may be connected to an external control unit of the packager. In this case, the express approval by HEINZMANN is required. The relevant specification given by HEINZMANN must be observed absolutely.

8.1 Wiring Diagram

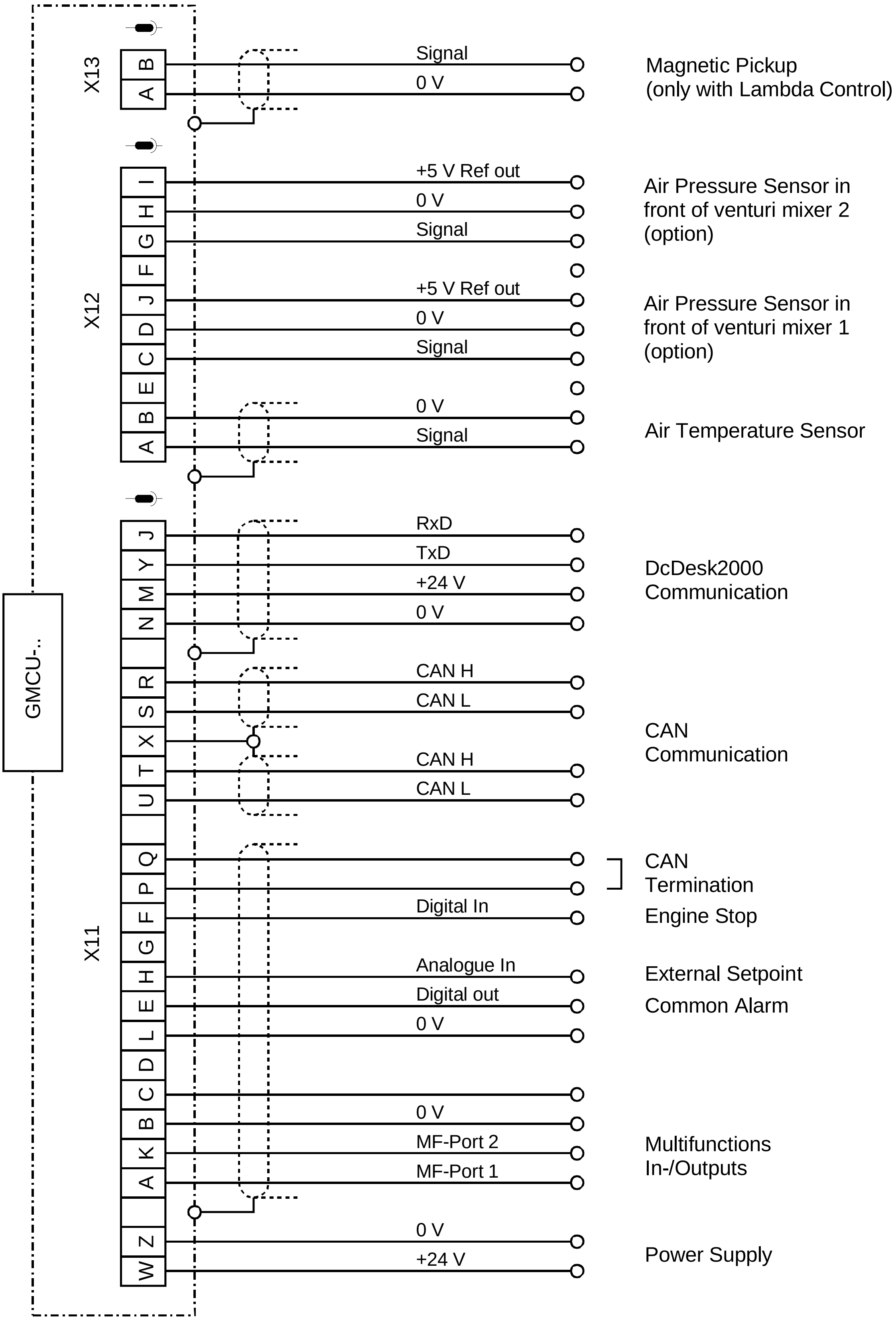
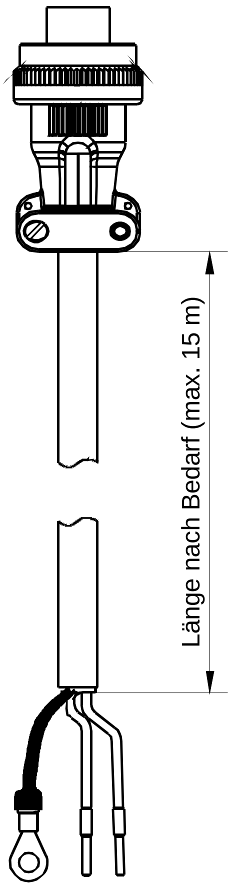


Figure 22: Wiring Diagram ELEKTRA

8.2 Cables supplied by HEINZMANN

The following cables are supplied by HEINZMANN in the required lengths.

8.2.1 Cable to Magnetic Pickup



Anschlussbelegungen der Kabel			
Klemme	**Steckerpin**	**Funktion**	**No.**
12	A	Masse	1
13	B	Signal	2
Gehäuse		Abschirmung	

Figure 23: Cable W4

8.2.2 Cable to Air Temperature Sensor

8.2.3 Cable to ELEKTRA Main Plug

8.2.4 Pressure Pipes to Gas Mixer Delta-P Sensors

9 General Mounting Instructions

For the assembly, make sure to install the components free from vibrations.

Tighten the screws firmly.

All the components must be integrated into equipotential bonding.

The components may only be installed in the permitted zones.

All the components must be installed in such a way that their plug-in connections are only subjected to a low risk of impact.

Note

The inside of the components (gas-bearing components) is not included in the ATEX Specification.

10 Parametrisation of ELEKTRA / KRONOS 30 Governors

The software for HEINZMANN digital controllers is conceived in such a way that parameters can be set either at the engine manufacturer’s or at the final customer’s, if the necessary instruments (communications tool) are available. Only a few basic parameters are pre-set at the HEINZMANN factory. This means that the digital governor usually gets its definitive set of data from a source outside HEINZMANN.

An exception is made for control units delivered in large quantities. If HEINZMANN have been provided with a definitive set of data in advance this data can be supplied to the units at the factory.

As a principle, initial programming should be conducted by experienced personnel and must be verified before the first commissioning of the engine.

The adjustment and meaning of parameters are explained in detail in the "Basic information 2000" manual.

The following sections describe the possible parametrisation of the control unit:

10.1 Parametrisation with Hand Held Programmer HP 03

The complete parametrisation can be made via the hand held programmer HP 03. This handy device is particularly suited for development and series calibration as well as for servicing. This unit needs no external power supply.

10.2 Parametrisation via PC / Laptop

Parametrisation can also be conducted using a PC and the comfortable HEINZMANN DcDesk 2000 communication software. As compared with the hand held programmer, it offers the great advantage that various curves are graphically represented on the screen and changes can be made. Besides, time diagrams can be displayed without any oscilloscope when the control unit is commissioned on the engine. Furthermore, the PC offers a better overview, because the PC programme has a menu structure and allows to have several parameters continuously displayed.

Besides, the PC programme permits to save and download the operational data to and from the data media. Additionally, the following useful application is available:

> Once the parameterisation has been completed for a specific engine type and its application, the data set can be stored to disk. For future applications of a similar type, the data sets can be downloaded and re-used with the new control units.

11 CAN-Bus

The HEINZMANN CAN bus allows to expand the functionality of the overall system by further modules. With a knock control unit, which can communicate directly with the ignition system via an additional CAN or Modbus interface, or by a HEINZMANN generator management system and further devices the system can be extended and adapted. Alternative extensions are e. g. a simple user interface unit or a high-resolution touch screen monitor with data logging functions for system parameterisation and monitoring.

12 General Safety Information for Commisioning

The parametrisation, visualisation of measured data and diagnosis are performed by the DcDesk 2000 communication software. The well approved program is used for all digital HEINZMANN control devices and characterised by an extensive functionality and easy operation. Thus the configuration for the ELEKTRA start-up can be accomplished without difficulty, the representation of parameters and measured values is shown clearly in the form of tables, curves and maps. Furthermore, the software permits to store and load parameter sets and recorded data. The representation of measured values as curves over the time facilitates the evaluation and optimisation of dynamic procedures. DcDesk 2000 can also be used for remote control together with the HEINZMANN remote control system SATURN.

12.1 General Safety Information for Commissioning

Warning

Any commissioning work may only be performed by trained and qualified personnel observing the standards in force.

The user is responsible for the correct commissioning of the total installation.

Before commissioning the installation, please note the following information:

- Before starting to install any equipment, the installation must have been switched dead!
- Check the perfect functioning of the existing protection and monitoring systems.
- Commissioning may only be performed with the terminal box cover plate installed.

12.2 General notes concerning the first start of the engine

- Adjust speed pickup distance according to instructions.
- Verify correct software and essential parameters engine data, number of teeth, mixer data, gas valve data, sensor data, gas data, Lambda data etc.!
- Adjust the sensors, if necessary.
- **Before** starting the engine, check the electrical connections as well as the basic functions of the system in positioning mode (parameters 5705 and 5706)!
- It is recommendable to start the engine first of all without the control unit being connected.

Danger

Overspeed protection must be ensured!

- Start the engine after finishing the presetting according to the description below.
- Optimise the Lambda map and correction values following the description below.

Warning

Knock monitoring must be activated or pay attention to audible knocking.

13 Configuration and Calibration of Inputs and Outputs

The ELEKTRA Gas Metering Control Unit has two multi-function ports which can be configured as analog input, analog output or digital output.

All other inputs and outputs are permanently preconfigured at the factory.

User definable parameters allow the analog inputs or outputs to ascertain whether the signal being utilized is meant to be a current or voltage signal.

Note

All adjustments for inputs and outputs can be carried out comfortably using DcDesk 2000, where there are specific windows for all the important aspects, considerably simplifying the process of parameter setting.

13.1 Selectable Inputs and Outputs

Note

The assignments of the channels cannot be altered during operation. It will therefore be necessary to save the data and restart the control unit with a reset of the control unit after configuration. The value ranges of analogue inputs and outputs then must be adapted again to the newly chosen electric unit.

The following table shows the configuration parameters of the selectable inputs and outputs.

Connection Designantion	Terminal / Pin	Configuration-Parameter	Configuration
P1	2 / A	4800 *Port1Type*	0 = Analogue 1 1 = Digital 1
		4801 *Port1OutOrIn*	0 = Input 1 1 = Output 1 if analogue output: 4..20 mA
		5510 *AnalogIn1_Type*	if analogue input: 1 = 0..5 V 2 = 4..20 mA 3 = 0..10 V
P2	1 / K	4802 *Port2Type*	0 = Analogue 2 1 = Digital 2
		4803 *Port2OutOrIn*	0 = Input 2 1 = Output 2 if analogue output: 4..20 mA
		5520 *AnalogIn2_Type*	if analogue input: 1 = 0..5 V 2 = 4..20 mA 3 = 0..10 V

Parameterizing Example:

Multifunctional port 1 is used as current input 1 and multifunctional port 2 as digital output 2.

Nummer	Parameter	Wert	Einheit
4800	*Port1Type*	*0*	
4801	*Port1OutOrIn*	*0*	
5510	*AnalogIn1_Type*	*2*	
4802	*Port2Type*	*2*	
4803	*Port2OutOrIn*	*1*	
4804	*AnaIn3OrDigIn3*	*0*	

13.2 Analogue Inputs

The Gas Metering Control Unit has a maximum of three external analog inputs. Analog input no. 3 already has Pin H reserved for the setpoint.

All three inputs can be configured for current or voltage by setting their respective parameters. Analog input 3 is set, similar to analog inputs 1 and 2, to either current or voltage via Parameter 5530 *AnalogIn3Type* (see previous chapter).

Input	Designation	Terminal / Pin	Range
Analogue input 1	P1	2 / A	0..5 V or 4..20 mA or 0..10 V
Analogue input 2	P2	1 / K	0..5 V or 4..20 mA or 0..10 V
Analogue input 3	SpA	7 / H	0..5 V or 4..20 mA

Moreover, there are six internal analog inputs to measure the pressure and two internal analog inputs to measure the temperature, to which the sensors, which are part of the ELEKTRA Gas Metering Control Unit, have already been connected at the factory. These inputs are already permanently assigned, but can be recalibrated if necessary.

13.2.1 Sensor Overview

Sensors are needed to measure set values, pressures, temperatures, etc., and to execute functions depending on these quantities.

The following table provides an overview:

Parameter	Meaning	Usage
2900 *SetpointExtern*	Setpoint	External setpoint input
2906 Air*Pressure1* (i)	Air pressure before venturi mixer	Absolute air pressure before venturi mixer for calculation of air flow
2907 *Air Pressure2* (i)	Air pressure before venturi mixer at bank 2	Absolute air pressure before venturi mixer for calculation of air flow at bank 2
2908 *AirTemp* (i)	Air temperature	Air temperature for calculation of air flow
2910 *GasTemp* (i)	Gas temperature	Gas temperature for calculation of gas flow
2914 *GasPressure* (i)	Gas pressure	Absolute gas pressure for calculation of gas flow
2915 *GasDeltaPressure* (i)	Gas delta pressure	Gas delta pressure for calculation of gas flow
2916 *Vent1DeltaPressure* (i)	Venturi delta pressure	Venturi delta pressure for calculation of air flow
2917 *Vent2DeltaPressure* (i)	Venturi delta pressure at bank 2	Venturi delta pressure for calculation of air flow at bank 2
2918 *MeasuredPower*	External load signal	Load signal for closed loop operation
2924 *Measured GasQuality*	Gas quality	Gas quality for determining of methan content for calculation of gas heating vale

The sensors marked with (i) are those internal sensors which are already permanently configured and connected.

13.2.2 Assigning Inputs to Sensors and Setpoint Adjusters

Assignment of inputs to sensors and setpoint adjusters is made by entering the desired analogue input in the assigning parameters from 900 *AssignIn...* onward.

Entering the number 0 in the assignment parameter will signify that the respective sensor has neither been connected nor activated. Consequently, the input will not be subject to monitoring. Therefore, the assignment parameters of any sensors not needed should be set to 0. The sensor value during operation will then constantly be equal to the minimum value.

Note

If an external analog setpoint is required, it must always be assigned to analog input 3 (pin H).

Parameterizing Example:

The external setpoint adjuster (indication parameter 2900) is to be connected to analogue input 3 and the current load value (indication parameter 2918) to analogue input 1. For the other sensors remaining unused the value 0 is to be entered.

Number	Parameter	Value	Unit
900	*AssignIn_SetpExt*	*3*	
918	*AssignIn_MeasPower*	*1*	

13.2.3 Measuring Ranges of Sensors

In HEINZMANN controls, all sensor parameters and all relating values are provided with the maximum possible value range. Thus, temperature sensors can be utilized for a range from –100 to +1,000 °C and the current load signal up to 2500 kW. Pressure sensors cover a maximum range from 0 to 5 bar. Indication for sensors without physical ranges (setpoint adjuster) is by per cent

Since there exist pressure sensors with different measuring ranges, the control unit must be informed about the particular value ranges which may differ from the maximum possible physical value range. These ranges are defined as the physical values corresponding to minimum and maximum input values such as 0.5 to 4.5 Volts or 4 to 20 mA.

As temperature sensors show a non-linear behaviour, suitable linearization characteristics for the various types of temperature sensors are already implemented at the factory so there will be no need to specify physical measuring ranges for these sensors.

Sensor	Minimum Measuring Value	Maximum Measuring Value
External setpoint	950 *SetpExtLow*	951 *SetpExtHigh*
Air pressure bank 1	966 *AirPress1Low*	967 *AirPress1High*
Air pressure bank 2	968 *AirPress2Low*	969 *AirPress2High*
Gas pressure	978 *GasPressLow*	979 *GasPressHigh*
Gas delta pressure	980 *GasDeltaPressLow*	981 *GasDeltaPressHigh*
Venturi delta pressure Bank 1	982 *Vent1DeltaPressLow*	983 *Vent1DeltaPressHigh*
Venturi delta pressure Bank 2	984 *Vent2DeltaPressLow*	985 *Vent2DeltaPressHigh*
External current load signal	986 *MeasPowerSensorLow*	987 *MeasPowerSensorHigh*
External gas quality signal	998 *MeasGasQualityLow*	999 *MeasGasQualityHigh*

Parameterizing Example:

A gas pressure sensor with a measuring range from 0 to 2 bar is to be used.

Number	Parameter	Value	Unit
978	*GasPressLow*	*0.0*	*bar*
979	*GasPressHigh*	*2.0*	*bar*

13.2.4 Modifying Reactions to Sensor Errors

Setpoint adjusters and sensors are being monitored with regard to their valid measuring ranges. On exceeding these ranges in either direction, a sensor error is detected. For any detected error, the respective response to this error can be modified by appropriate configuration which will allow to adjust the control's behaviour to the specific application and mode of operation in case of failure.

Substitute values may be set for setpoint adjusters and sensors by means of the parameters 1000 *Subst.*. This will permit the control to continue operation should the respective sensor fail. There also exists the possibility of reverting to the last valid value before the failure occurred rather than to maintain operation by resorting to a default value. The parameters 5000 *SubstOrLast..*. are used to decide by which value the control is to continue operation in case the setpoint adjuster or the sensor is at fault. If the respective parameter is set to "1" the substitute value will be used as defined, if set to "0" the last valid value will be used. This method of error handling will in most cases permit to maintain safe emergency operation of the installation.

The below table lists both the parameters where the substitute values are stored and the associated parameters for selecting operation by default value or by the last valid value.

Substitute Value	Selection of substitute Value	Substitute Value for
1000 *SubstSetpExt*	5000 *SubstOrLastSetpExt*	External setpoint
1006 *SubstAirPress1*	5006 *SubstOrLastAirPress1*	Air pressure bank 1
1007 *SubstAirPress2*	5007 *SubstOrLastAirPress2*	Air pressure bank 2
1008 *SubstAirTemp*	5008 *SubstOrLastAirTemp*	Air temperature
1010 *SubstGasTemp*	5010 *SubstOrLastGasTemp*	Gas temperature
1014 *SubstGasPress*	5014 *SubstOrLastGasPress*	Gas pressure
1015 *SubstGasDeltaPress*	5015 *SubstOrLastGasDeltaP*	Gas delta pressure
1016 *SubstVent1DeltaPress*	5016 *SubstOrLastVent1DP*	Venturi delta pressure bank 1
1017 *SubstVent2DeltaPress*	5017 *SubstOrLastVent2DP*	Venturi delta pressure bank 2
1018 *SubstMeasuredPower*	5018 *SubstOrLastMeasPower*	External load signal
1024 *SubstMeasGasQuality*	5024 *SubstOrLastGasQy*	External gas quality signal

For setpoint and sensor inputs, the parameters 5040 *HoldOrReset…* offer the option to decide how the control is to react if an error clears itself (e.g., loose contact in wiring). If the respective parameter is set to "1" the error will be regarded to be latching. Therefore, there will be no reaction by the control when the sensor measurement is back within the valid range. If the parameter is set to "0" the error will be reset and operation continue using the signal coming from the sensor.

Parameter	Reaction to Error at
5040 *HoldOrResetSetpExt*	External setpoint
5046 *HoldOrResetAirPress1*	Air pressure bank 1
5047 *HoldOrResetAirPress2*	Air pressure bank 2
5048 *HoldOrResetAirTemp*	Air temperature
5050 *HoldOrResetGasTemp*	Gas temperature
5054 *HoldOrResetGasPress*	Gas pressure
5055 *HoldOrResetGasDeltaPress*	Gas delta pressure
5056 *HoldOrResetVent1DeltaPress*	Venturi delta pressure bank 1
5057 *HoldOrResetVent2DeltaPress*	Venturi delta pressure bank 2
5058 *HoldOrResetMeasuredPower*	External load signal
5064 *HoldOrResetMeasGasQuality*	External gas quality signal

13.2.5 Calibration of analogue Inputs

Sensors convert physical quantities (e.g., pressure) to electric quantities (voltage, current). The control unit measures voltage/current and indicates them directly. To enable the control to operate with the physical value transmitted by the sensor, it is necessary that the control be provided with two reference values informing it about the relation between the electrically measured values and the actual physical quantities. The two reference values are the sensor output values associated with the minimum and maximum measuring values as described in ↑ *13.2.3 Measuring Ranges of Sensors*. With this information, the control is capable of normalizing the measured values and of displaying them specified in per cent of the sensor range or directly in terms of their physical values.

Each of the analogue inputs is associated with a low reference value (parameters 15xx *AnalogInx_RefLow* resp. *IntAnalogInx_RefLow*) and a high reference value (parameters 15xx *AnalogInx_RefHigh* resp. *IntAnalogInx_RefHigh*).

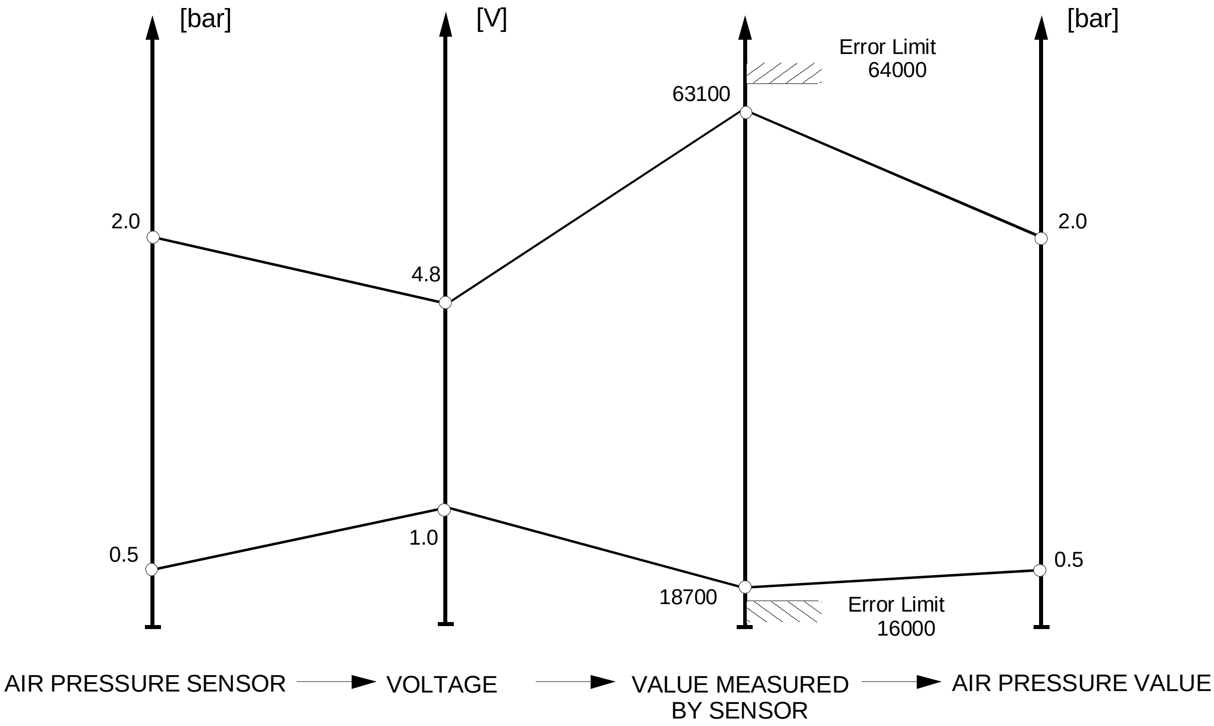


Figure 24: Calibration Procedure

<u>Parameterizing example:</u>

The delta pressure sensor from venturi mixer 1 has been connected to internal input 3. Its measuring range is supposed to be from 0 mbar to 100 mbar and is to be converted into voltages ranging from 0.5 V to 4.5 V. The parameter 3555 *IntAnalogIn3* will display the actual measurement and the parameter 2916 *Vent1DeltaPressure* will read the converted measuring value in bar.

Number	Parameter	Value	Unit
916	*AssignIn_Vent1Dpress*	*3*	
982	*Vent1DeltaPressLow*	*0*	*mbar*
983	*Vent1DeltaPressHigh*	*100*	*mbar*
1560	*IntAnalogIn3_RefLow*	*0.5*	*V*
1561	*IntAnalogIn3_RefHigh*	*4.5*	*V*

13.2.6 Filtering of Analogue Inputs

The measured value of an analogue input can be filtered through a digital filter. The respective parameters are stored at the numbers 15x4 *AnalogInx_Filter* resp. *IntAnalogInx_Filter*.

Each of these parameters is to hold a filter value ranging from 1 to 255. The value 1 signifies that there will be no filtering. The filtering time constant can be derived from the filter values by the following equation:

$$\tau = \frac{\textit{filtering value}}{62{,}5} \; [s].$$

For normally fast sensor changes filter value 8 will be best suited. For measuring quantities that change more slowly, such as temperatures, a filter value of about 50 can be used. The filtering time constant should correspond approximately to the sensor's time constant.

Parameterizing Example:

Number	Parameter	Value	Unit
1524	*AnalogIn2_Filter*	*8*	

$$\tau = \frac{8}{62.5} \; [s] = 0.128 \text{ s}$$

13.2.7 Error Detection for Analogue Inputs

If a sensor fails (e.g., by short circuit or cable break), the control will read voltages or currents lying outside the normal measuring range. These irregular measuring values can be used to define inadmissible operating ranges by which the control can recognize that the sensor is at fault.

The error limits are like the reference values entered in electric units.

The parameters 15x2 *AnalogInx_ErrorLow* resp. *IntAnalogInx_ErrorLow* and *TempInx_ErrorLow* resp. *IntTempIn_ErrorLow* define the lower error limits. The parameters 15x3 *AnalogInx_ErrorHigh* resp. *IntAnalogInx_ErrorHigh* and *TempInx_ErrorHigh* resp. *IntTempIn_ErrorHigh* determine the upper error limits.

Parameterizing Example:

The delta pressure mixer from venturi mixer 1 at internal analogue input 3 normally supplies measuring values ranging between 0.5 and 4.5 Volt. In case of a short circuit or a cable break the measurements will be below or above these values, respectively. The ranges below a measurment value of 0.3 Volt and above a measurment value of 4.7 volt are defined as inadmissible by the following parameters:

Number	Parameter	Value	Unit
916	*AssignIn_Vent1Dpress*	*3*	
982	*Vent1DeltaPressLow*	*0*	*mbar*
983	*Vent1DeltaPressHigh*	*100*	*mbar*
1560	*IntAnalogIn3_RefLow*	*0.5*	*V*
1561	*IntAnalogIn3_RefHigh*	*4.5*	*V*
1562	*IntAnalogIn3_ErrorLow*	*0.3*	*V*
1563	*IntAnalogIn3_ErrorHigh*	*4.7*	*V*

These error limits should not be chosen too close to the minimum and maximum values in order to prevent natural fluctuations of the values measured by the sensors from being mistaken as errors. On the other hand, it must be ensured that short circuits or cable breaks are unambiguously recognized as such.

Once an error is detected, the sensor error parameter (error flag) associated with the analogue input is set. For the actions to be taken in the event that any such error occurs, please refer to chapter ↑*18.5 Error Parameter List*. If an analogue input is not used due to not being assigned to a sensor it will not be monitored for errors.

13.2.8 Overview of the Parameters associated with one analogue Input

For inputs relating to setpoints and pressure the following parameters are provided:

Parameter	Meaning
15x0 *AnalogInx_RefLow* resp. *IntAnalogInx_RefLow*	lower reference value
15x1 *AnalogInx_RefHigh* resp. *IntAnalogInx_RefHigh*	upper reference value
15x2 *AnalogInx_ErrLow* resp. *IntAnalogInx_ErrLow*	lower error limit
15x3 *AnalogInx_ErrHigh* resp. *IntAnalogInx_ErrHigh*	upper error limit
15x4 *AnalogInx_Filter* resp. *IntAnalogInx_Filter*	filtering constant
35x0 *AnalogInx* resp. *IntAnalogInx*	current measuring value in %
35x1 *AnalogInx_Value* resp. *IntAnalogInx_Value*	current measuring value in electrical unit

For temperature inputs the following parameters are provided:

Parameter	Meaning
1542 *TempIn_ErrorLow* bzw. 1592 *IntTempInErrorLow*	lower error limit
1543 *TempIn_ErrorHigh* bzw. 1593 *IntTempIn_ErrorHigh*	upper error limit
1544 *TempIn_Filter* bzw. 1594 *IntTempIn_Filter*	filtering constant
3540 *TempIn* bzw. 3590 *IntTempIn*	current measuring value in °C
3541 *TempIn_Value* bzw. 3591 *IntTempIn_Value*	current measuring value in digits

Any inputs that have not been assigned a sensor will not be monitored for errors, and indicate only the measuring value 35xx *AnalogInx_Value* resp. *TempIn_Value.*

13.3 Digital Inputs

The ELEKTRA Gas Metering Control Unit has only one digital input. This input has already been permanently allocated by the factory for the stop signal. If this input is activated, the gas valve will close.

Parameter 4810 *StopImpulseOrSwitch* is meant to define whether a switching pulse is sufficient enough to close the gas valve, or if the switch needs to remain closed.

4810 *StopImpulseOrSwitch* = 0	the gas valve will only close when the switch is off
4810 *StopImpulseOrSwitch* = 1	Switching pulse is sufficient to close the gas valve

Using the parameter 4811 4811 StopOpenOrClose a switching input can be defined to be high active, i. e. active while the switch is closed, or to be "low" active, i. e. active while the switch is open.

4811 *StopOpenOrClose* = 0	active when switch is closed
4811 *StopOpenOrClose* = 1	active when switch is open

The 2810 *SwitchEngineStop* parameter indicates whether the relevant function is activated. The number "1" shows the function to be active while "0" means that it is inactive.

Hinweis

Since the input signal is debounced by the control electronics it must be supplied for at least 20 ms in order to be identified.

13.4 Analogue Outputs

The ELEKTRA Gas Metering Control Unit is equipped with two multi-function ports which may also be used as analog outputs with 4..20-mA current signals (↑*13.1 Selectable Inputs and Outputs*). These outputs may be used to indicate speed or actuator position or as a setpoint output for other devices.

13.4.1 Assignment of Output Parameters to analogue Outputs

Every parameter of the control unit can be read out via analogue outputs. Therefore only the parameter number of the output value has to be put-in in the following parameters.

1640 *CurrentOut1_Assign*	Current Output 1
1645 *CurrentOut2_Assign*	Current Output 2

Parameterizing Example:

We want to read out speed (indication parameter 2000) from analogue output 1 and actuator position (indication parameter 2300) from analogue output 2.

Number	Parameter	Value	Unit
1640	*AnalogOut1_Assign*	*2000*	
1645	*AnalogOut2_Assign*	*2300*	

Note

Signal output can be inverted (e.g., low current for high speeds) by entering the parameter numbers negative in sign.

13.4.2 Value Range of Output Parameters

When values are read out, sometimes it is convenient not to read out the entire range but only a part of it, for instance one might not wish to see the whole control unit's speed range of 0..4000 rpm on an instrument but only the actually used range of 700..2100 rpm.

It is therefore possible to limit the output range with parameters 16x3 *AnalogOutx_ValueMin* and 16x4 *AnalogOutx_ValueMax*.

As there are a great many different value ranges, these parameters are to be set to the required low and high output values specified in per cent of the value range of the respective output parameter. If the entire value range is required, the minimum value is to be set to 0 % and the maximum value to 100 %.

Note

The PC programme DcDesk 2000 allows to display output ranges in the parameter's specific measurement unit.

Parameterizing Example:

Current speed 2000 *Speed* is to be read out via a current output of 4..20 mA. The output range shall be restricted to 500 rpm through 1500 rpm. i.e., 500 rpm correspond to 4 mA and 1500 rpm to 20 mA. Since the values of this parameter have a range from 0 to 4000 rpm, output will have to be adjusted accordingly:

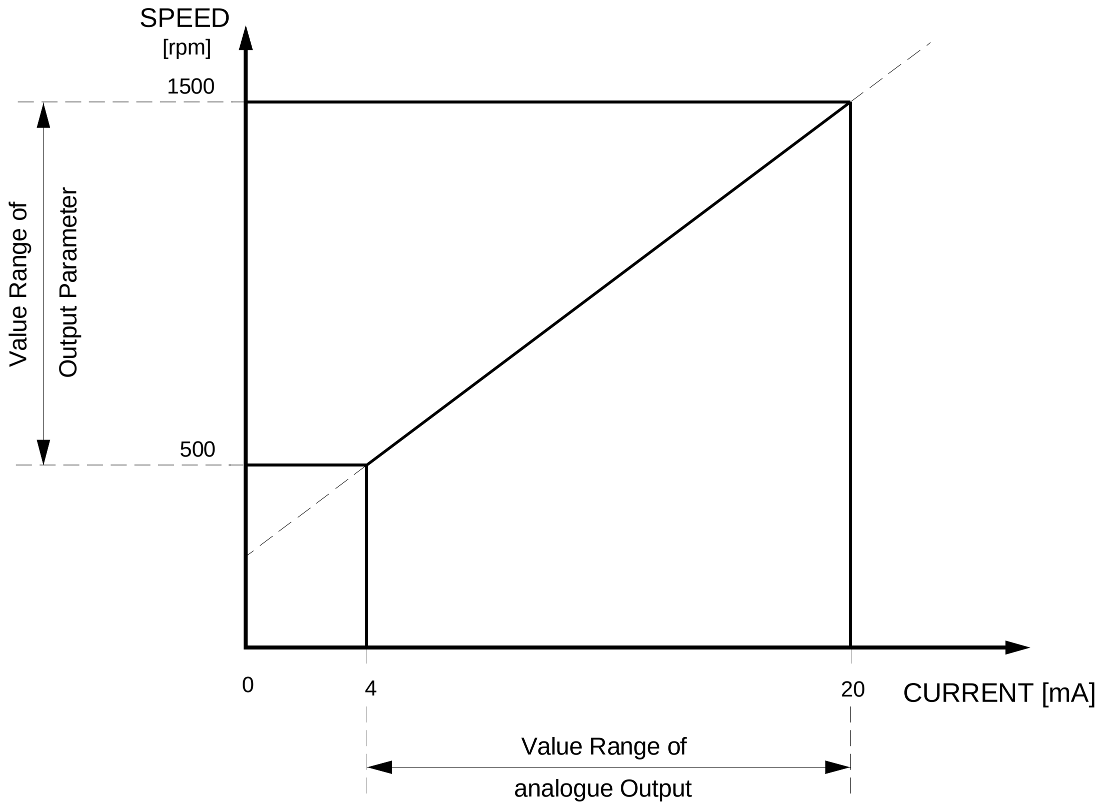


Figure 25: Reading out a Parameter via an analogue Output

$$1643\ CurrentOut1\_ValueMin = \frac{500}{4000} * 100\% = 12.5\%$$

$$1644\ CurrentOut1\_ValueMax = \frac{1500}{4000} * 100\% = 37.5\%$$

Number	Parameter	Value	Unit
1640	*CurrentOut1_Assign*	*2000*	
1643	*CurrentOut1_ValueMin*	*12.5*	*%*
1644	*CurrentOut1_ValueMax*	*37.5*	*%*

13.4.3 Value Range of analogue Outputs

In the majority of cases not the maximum output range of approx. 0..22 mA is required but the standard output range of 4..20 mA.

Parameters 16x1 *AnalogOutx_RefLow* and 16x2 *AnalogOutx_RefHigh* are provided to adapt the output range. The value to be entered is specified directly in mA.

Parameterizing Example:

Current speed 2000 *Speed* is to be output out via a current output of 4..20 mA, but with the range restricted to 500 rpm to 1500 rpm, Only the range from 500 rpm to 1500 rpm is to be output, i.e., 500 rpm correspond to 4 mA and 1500 rpm correspond to 20 mA.

Number	Parameter	Value	Unit
1640	*CurrentOut1_Assign*	*2000*	
1641	*CurrentOut1_RefLow*	*4.00*	*mA*
1642	*CurrentOut1_RefHigh*	*2.00*	*mA*
1643	*CurrentOut1_ValueMin*	*1.5*	*%*
1644	*CurrentOut1_ValueMax*	*37.5*	*%*

13.5 Digital Outputs

The ELEKTRA Gas Metering Control Unit is equipped with two multi-function ports which may also be used as digital outputs (↑ *13.1 Selectable Inputs and Outputs*). These outputs can be used to activate optical or acoustical signal transmitters or to transmit signals to other devices. The maximum output current is 0.3 amps, each.

Every measured and indicated value of the [0.1] range from parameter list 2 can be assigned to a digital output. The currently displayed values are shown in parameters 2851 *DigitalOut1* and 2852 *DigitalOut2*.

Note

The parameter settings described in the following sections can be achieved in an easy and comfortable way using a dedicated window of DcDesk 2000. In addition, this window allows to conduct a test of the digital output's connections.

13.5.1 Assignment of Output Parameters

Assignment is made by means of the parameters 851 *DigitalOut1_Assign* and 852 *DigitalOut2_Assign*. The parameter numbers of the desired measuring values must be entered there. If inverted output of the measurement is desired, the number of the measuring parameter is to be entered negative in sign.

Parameterizing Example:

Output 1 is to indicate that the maximum fuel limitation is active and output 2 has to be active as long as engine start has not been enabled (i.e., as long as 3806 *EngineRelease* has not been activated):

Number	Parameter	Value	Unit
851	*DigitalOut1_Assign*	*2711*	
852	*DigitalOut2_Assign*	*-3806*	

14 Commissioning of ELEKTRA with Flow Control

14.1 General IO Configuration

For general information about the configuration and calibration of the inputs and outputs for ELEKTRA please refer to the chapter ↑*13 Configuration and Calibration of Inputs and Outputs*.

SetpExt (external flow setpoint) and GasQuality are the only available sensors in ELEKTRA. Additionally 3 so called internal sensors are also present in the control unit: GasTemp (Gas Temperature), GasPressure (Gas absolute Pressure before throttle) and GasDeltaPressure (Delta Pressure over throttle). They are calibrated at the HEINZMANN factory before delivery and normally do not need any further tuning. The actual values of these sensors are visible in parameters 2910 *GasTemp*, 2914 *GasPressure* and 2915 *GasDeltaPressure*.

It is recommended to regularly (for example every 6 months) check the calibration of the GasDeltaPressure Sensor and compensate a possible reasonable drift of the sensor. This should be done while the motor is stopped and no gas pressure is applied before the gas throttle (Gas Pressure regulator closed and gas vent valves open). In this case, the output of the GasDeltaPressure Sensor, visible in parameter 3556 *IntAnalogIn2_Value* should be around 0.5V (Delta pressure near to 0 mBar). To check the calibration of the sensor, please proceed as follows:

- Check the actual value of par. 3556 *IntAnalogIn2_Value*. If this value is bigger than 0.55V or lower than 0.45 V, the drift of the sensor is too big, the sensor should be replaced, please contact Heinzmann.
- Compare the values of parameter 3556 *IntAnalogIn2_Value* and parameter 1555 *IntAnaIn2_RefLow*. If a difference can be noticed, please copy the value of parameter 3556 *IntAnalogIn2_Value* into parameter 1555 *IntAnaIn2_RefLow* and save all the parameters in the control unit (F6 or Control Unit->Store parameters in control unit)

14.2 Functional Description and Configuration

14.2.1 ELEKTRA Setpoint

There are four different ways to give a Flow/Position setpoint to ELEKTRA:

14.2.1.1 External Flow Setpoint

This is ELEKTRA’s normal way of working: the flow setpoint is given by sensor ExtSetp. In order to use the external flow setpoint, follow the next steps:

Configure the sensor according to ↑*13 Configuration and Calibration of Inputs and Outputs*.

Set parameter 5300 *GMUPosSetpointPCOn* and parameter 5301 *GMUFlowSetpoint-PCOn* to 0.

When this configuration has been made the external flow setpoint value is visible in parameter 2900 *SetpointExtern* and 3303 *NormGasFlowSetp*.

14.2.1.2 Flow Setpoint over DcDesk2000

To support functional tests and commissioning, and assist trouble shooting it is possible, independent of the external setpoint, to give a flow setpoint via DcDesk2000. In this case, the external setpoint is deactivated and ELEKTRA controls the gas throttle to reach the DcDesk2000 flow setpoint. In order to use the DcDesk2000 flow setpoint, follow the next steps:

Set parameter 1301 *GMUFlowSetpointPC* to the desired flow setpoint

Set parameter 5300 *GMUPosSetpointPCOn* to 0 and 5301 *GMUFlowSetpointPCOn* to 1.

When this configuration has been made the actual value of the flow setpoint is visible in Par. 3303 *NormGasFlowSetp*. This means that both parameters 1301 *GMUFlowSetpointPC* and 3303 *NormGasFlowSetp* should have the same value.

14.2.1.3 Gas Throttle Position Setpoint over DcDesk2000

As an additional feature to support functional tests, commissioning and assist trouble shooting, it is possible to switch off the flow control algorithm and send a simple gas throttle position setpoint via DcDesk2000. In this case ELEKTRA will not regulate the gas flow anymore but will only drive the throttle to the given position setpoint. To configure this operation mode, please follow the next steps:

Set parameter 1300 *GMUPosSetpointPC* to the desired gas throttle position setpoint.

Set parameter 5300 *GMUPosSetpointPCOn* to 1 and parameter 5301 *GMUFlow-SetpointPCOn* to 0.

When this configuration has been made the actual value of the position setpoint is visible in Par. 2330 *ActPosSetpoint*. This means that both parameters 1300 *GMUPosSetpointPC* and 2330 *ActPosSetpoint* should have the same value.


Warning

If both parameters 5300 GMUPosSetpointPCOn and 5301 GMUFlowSetpointPCOn are set to 1, the DcDesk2000 gas throttle position setpoint will be active whereas the DcDesk2000 flow setpoint will be inactive.

14.2.1.4 Safety Remarks

It is possible to use the DcDesk2000 flow and position setpoints while the engine is running. It is also possible to switch between the different setpoint modes during engine operation. It is important to understand that in these cases the normal external flow setpoint normally controlled by an external AFR-controller is deactivated. In other words, the AFR-control of the engine is inactive and the DcDesk2000 user is the only one responsible for the gas fuel feed and air fuel ratio control of the engine. This quasi manual control of the engine is slow and potentially dangerous; errors may easily occur and lead to severe damage to persons and material. HEINZMANN explicitly recommends to restrict the use of these features to advanced and experienced users.

14.2.2 Flow Control Parameters

While in gas flow control mode parameter 5300 *GMUPosSetpointPCOn* = 0, ELEKTRA regulates the gas flow by a PID control loop. The associated P, I and D-factors can be found in parameters 1322 *GasFlowGovGain*, 1323 *GasFlowGovStability* and 1324 *GasFlowGovDerivative*. They are normally set at the HEINZMANN factory but can be individually modified to optimize the behaviour of the gas flow controller on customer-specific engines.

14.2.3 Gas Gravity

The gas gravity is an essential information in ELEKTRA’s control algorithm and must be available to accurately regulate the gas flow. There are 2 ways to provide this information to ELEKTRA.

14.2.3.1 Constant Gas Gravity

For installations with constant gas quality, the gas gravity can be configured as a fixed value in ELEKTRA. To do that, please follow the next steps:

Set parameter 1303 *NormGasGravity* to the desired value in [kg/Nm³]

Verify that parameter 5303 *GasQualityInputOn* is set to 0

14.2.3.2 Variable Gas Gravity

Certain installations make use of different gases or one gas of variable quality. In those cases, it might be of interest to make the internally used gas gravity information in ELEKTRA follow an external analogue signal. Please follow the next steps:

Configure the GasQuality sensor according to ↑*13.2 Analogue Inputs*. Once this is done, the actual gas quality is displayed in parameter 2911 *GasQuality* in [%].

A curve of gas gravity depending on gas quality is provided in ELEKTRA (parameters 9600-9609 *GasQty:Input(0-9)*, 9620-9629 *GasQty:Gravity(0-9)*). It contains 10 points which can be freely defined. Each point associates one gas quality to one gas gravity. Please set this curve according to demand.

Set parameter 5303 *GasQualityInputOn* to 1

The currently used gas gravity is displayed in parameter 3304 *NormGasGravity*.

14.2.4 Engine States

ELEKTRA determines 4 different engine states depending on the actual position or flow setpoint and the errors detected by the control unit. These 4 states are displayed in parameters 3802-3806 and are briefly described below:

Parameter 3802 *EngineStop* is set when a stop condition is detected (fatal error or external stop command).

If carried out as a switch (4810 *StopImpulseOrSwitch* =0), parameter 3802 *EngineStop* will be reset when no stop condition is present (no fatal error and no external stop command).

If carried out as an impulse (4810 *StopImpulseOrSwitch* = 1), parameter 3802 *EngineStop* will be reset when no stop condition is present (no fatal error and no external stop command) and the EngineStopped condition is detected.

Summarised by using just the parameter numbers and logic operators, this means:

3802 *EngineStop* = 1	if 3800 *EmergencyAlarm* = 1 (fatal error) or 2810 *SwitchEngineStop* = 1 (external stop command)
3802 *EngineStop* = 0	if 3800 *EmergencyAlarm* = 0 (no fatal error) and 2810 *SwitchEngineStop* = 0 (no external stop command) and (4810 *StopImpulseOrSwitch* = 0 (Switch)

or
3803 *EngineStopped* = 1

Parameter 3806 *EngineReleased* is set when EngineStop is not active (parameter 3802 *EngineStop* = 0). This means

3806 *EngineReleased* = 1,	if 3802 *EngineStop* = 0
3806 *EngineReleased* = 0,	if 3802 *EngineStop* = 1

Parameter 3805 *EngineRunning* is set when EngineRelease is set (3806 *EngineReleased* = 1, 3802 *EngineStop* = 0), the actual valid position or flow setpoint is not 0 and a zero-pressure condition is not detected over the unit.

Parameter 3805 *EngineRunning* is reset when the actual valid position or flow setpoint is 0.

This means:

3805 *EngineRunning* = 1,	if 3806 *EngineReleased* = 1 (EngineRelease set, EngineStop not active) and [(5300 *GMUPosSetpointPCOn* = 1 and 1300 *GMUPosSetpointPC* > 0) (Position setpoint modus and position setpoint not 0) or (5300 *GMUPosSetpointPCOn* = 0 and 3303 *NormGasFlowSetp* > 0)] (Flow setpoint modus and flow setpoint not 0) and 2915 *GasDeltaPressure* > 1350 *GasZero-Delta-PLimit* (Deltapressure over unit > zero-pressure limit)
3805 *EngineRunning* = 0,	if (5300 *GMUPosSetpointPCOn* = 1 and 1300 *GMUPosSetpointPC* = 0) (Position setpoint modus and position setpoint 0) or (5300 *GMUPosSetpointPCOn* = 0 and 3303 *NormGasFlowSetp* = 0) (Flow setpoint modus and flow setpoint 0)

3303 *NormGasFlowSetp* = 0,	if (5301 *GMUFlowSetpointPCOn* = 0 and 2900 *SetpointExtern* = 0) (external flow setpoint active and external flow setpoint 0) or (5301 *GMUFlowSetpointPCOn* = 1 and 1301 *GMUFlowSetpointPC* = 0) (DcDesk2000 flow setpoint active and DcDesk2000 flow setpoint 0)

Parameter 3803 *EngineStopped* is set when EngineRunning is not active (3805 *EngineRunning* = 0). This means

3803 *EngineStopped* = 1,	if 3805 *EngineRunning* = 0
3803 *EngineStopped* = 0,	if 3805 *EngineRunning* = 1

Note

A position or flow setpoint is active only in EngineRunning mode, this means only if EngineStop is not active and a certain (>1350 GasZeroDelta-PLimit) gas delta pressure has been detected over the gas throttle. In other cases, for example if no gas delta pressure is present, the gas throttle will remain closed.

14.2.5 Safety Functions

This chapter describes the safety functions included in ELEKTRA, the corresponding parameters, and the way to set a customer-specific configuration.

14.2.5.1 Zero Gas Delta Pressure

A zero gas delta pressure condition is detected by ELEKTRA if the gas delta pressure is below a certain limit:

2915 *GasDeltaPressure* ≤ 1350 *GasZeroDeltaPLimit*

As it is a normal state while the engine is stopped, the corresponding error 3030 *ErrZeroGasDeltaP* is only set and displayed if the zero gas delta pressure condition occurs while the engine is running (3805 *EngineRunning* = 1), EngineStop is not active and after a configurable time delay 1359 *ThresholdSetDelay*. During engine operation, this error is fatal, which means that it produces an engine stop condition (3800 *EmergencyAlarm* = 1) and the gas throttle closes. The error is reset when the

EngineStopped condition is detected and after a configurable time delay 1360 *ThresholdResetDelay*.

14.2.5.2 Low Gas Delta Pressure

A low gas delta pressure condition is detected by ELEKTRA if the gas delta pressure is below a certain limit:

2915 *GasDeltaPressure* ≤ 1351 *GasDeltaPressureMin*

As it is a normal state while the engine is stopped, the corresponding error (parameter 3031 *ErrLowGasDeltaP* is only set and displayed if the low gas delta pressure condition occurs while the engine is running (3805 *EngineRunning* = 1), EngineStop is not active and after a configurable time delay 1359 *ThresholdSetDelay*. This error is only an alarm, it is not fatal and does not produce an engine stop condition (3800 *EmergencyAlarm* = 0, 3801 *CommonAlarm* =1), the gas throttle does not close. The error is reset when the low gas delta pressure condition disappears and after a configurable time delay 1360 *ThresholdResetDelay*.

14.2.5.3 High Gas Delta Pressure

A high gas delta pressure condition is detected by ELEKTRA if the gas delta pressure has exceeded a certain limit:

2915 *GasDeltaPressure* ≥ 1352 *GasDeltaPressureMax*

The corresponding error 3032 *ErrHighGasDeltaP* is always active independently from the engine running situation, and is set and displayed after a configurable time delay 1359 *ThresholdSetDelay*. During engine operation, this error is fatal, which means that it produces an engine stop condition (3800 *EmergencyAlarm* = 1) and the gas throttle closes. The error is reset when the EngineStopped condition is detected and after a configurable time delay 1360 *ThresholdResetDelay*.

14.2.5.4 Low Gas Pressure

A low gas pressure condition is detected by ELEKTRA if the absolute gas pressure before throttle is below a certain limit:

2914 *GasPressure* ≤ 1353 *GasPressureMin*

As it is a normal state while the engine is stopped, the corresponding error 3033 *ErrLowGasPress* is only set and displayed if the low gas pressure condition occurs while the engine is running (3805 *EngineRunning* = 1), EngineStop is not active and after a configurable time delay 1359 *ThresholdSetDelay*. This error is only an alarm, it is not fatal and does not produce an engine stop condition (3800 *EmergencyAlarm*

= 0, 3801 *CommonAlarm* =1), the gas throttle does not close. The error is reset when the low gas pressure condition disappears and after a configurable time delay 1360 *ThresholdResetDelay*.

14.2.5.5 High Gas Pressure

A high gas Pressure condition is detected by ELEKTA if the gas pressure before throttle is above a certain limit:

2914 *GasPressure* ≥ 1354 *GasPressureMax*

The corresponding error 3034 *ErrHighGasPress* is always active independently from engine running situation and is set and displayed after a configurable time delay 1359 *ThresholdSetDelay*. During engine operation, this error is fatal, which means that it produces an engine stop condition (3800 *EmergencyAlarm* = 1) and the gas throttle closes. The error is reset when the EngineStopped condition is detected and after a configurable time delay 1360 *ThresholdResetDelay*.

14.2.5.6 Low Gas Temperature

A low gas temperature condition is detected by ELEKTRA if the gas temperature before throttle is below a certain limit:

2910 *GasTemp* ≤ 1355 *GasTemperatureMin*

The corresponding error 3035 *ErrLowGasTemp* is always active independently from engine running situation and is set and displayed after a configurable time delay 1359 *ThresholdSetDelay*. This error is only an alarm, it is not fatal and does not produce an engine stop condition (3800 *EmergencyAlarm* = 0, 3801 *CommonAlarm* =1), the gas throttle does not close. The error is reset when the low gas temperature condition disappears and after a configurable time delay 1360 *ThresholdResetDelay*.

14.2.5.7 High Gas Temperature

A high gas temperature condition is detected by ELEKTRA if the gas temperature before throttle has exceeded a certain limit:

2910 *GasTemp* ≥ 1356 *GasTemperatureMax*

The corresponding error 3036 *ErrHighGasTemp* is always active independently from engine running situation and is set and displayed after a configurable time delay 1359 *ThresholdSetDelay*. During engine operation, this error is fatal, which means that it produces an engine stop condition (3800 *EmergencyAlarm* = 1) and the gas throttle closes. The error is reset when the EngineStopped condition is detected and after a configurable time delay 1360 *ThresholdResetDelay*.

14.2.5.8 Gas Flow Deviation

A gas flow deviation is detected by ELEKTRA if the difference between measured gas flow 3309 *NormGasFlow* and gas flow setpoint 3303 *NormGasFlowSetp* has exceeded a certain limit 1361 *GasFlowDevLimit*:

|3309 *NormGasFlow*–3303 *NormGasFlowSetp*| > 1361 *GasFlowDevLimit**3303/100

The corresponding error 3039 *ErrGasFlowDeviation* is only set and displayed while ELEKTRA is in flow setpoint mode (position setpoint off, 5300 *GMUPosSetpoint-PCOn* = 0), if the gas flow deviation occurs while the engine is running (3805 *EngineRunning* = 1), EngineStop is not active and after a configurable time delay 1362 *GasFlowDevSetDelay*. During engine operation, this error is fatal, which means that it produces an engine stop condition (3800 *EmergencyAlarm* = 1) and the gas throttle closes. The error is reset when the EngineStopped condition is detected and after a configurable time delay 1363 *GasFlowDevResetDelay*.

15 Commisioning of ELEKTRA with Lambda Control

15.1 General IO Configuration

For general information about the configuration and calibration of the inputs and outputs for ELEKTRA please refer to the chapter ↑ *13 Configuration and Calibration of Inputs and Outputs*.

SetpExt (external flow setpoint), GasQuality and MeasPower (electrical load) are the only available sensors in Elektra. Additionally up to 8 pre-configured sensors are also present in the control unit: GasTemp (Gas Temperature), GasPressure (Gas absolute Pressure before throttle), GasDeltaPressure (Delta Pressure over throttle), AirTemp (Air Temperature), Vent1DeltaPressure (Gas Mixer 1 Delta Pressure), Vent2DeltaPressure (Gas Mixer 2 Delta Pressure), AirPressure1 (Air Pressure before Gas Mixer 1), AirPressure2 (Air Pressure before Gas Mixer 2). They are calibrated at the Heinzmann factory before delivery and normally do not need any further tuning. The actual values of these sensors are visible in parameters 2910 *GasTemp*, 2914 *GasPressure*, 2915 *GasDeltaPressure*, 2908 *AirTemp*, 2916 *Vent1DeltaPressure*, 2917 *Vent2Delta-Pressure*, 2906 *AirPressure1* and 2907 *AirPressure2*.

The *Vent2DeltaPressure* sensor is only used if 2 gas mixers are mounted on the engine and 5315 *TwoOrOneGasMixer* is set.

In normal cases, air pressure sensors before gas mixers are not used: air pressure before gas mixers is normally calculated using other sensors (GasPressure, GasDeltaPressure and Venturi1DeltaPressure/Venturi2DeltaPressure). Certain applications (for example wood-gas) require the use of special inserts in the gas mixers. In those cases, the calculation of the air pressure before gas mixers may be more complex, and the use of additional AirPressure1 and AirPressure2 sensors may be preferable. If these additional sensors are used, 5304 *AirPressSensorOn* should be 1. Otherwise the air pressures are calculated using the other present sensors.

It is recommended to regularly (for example every 6 months) check the calibration of the GasDeltaPressure, Vent1DeltaPressure and Vent2DeltaPressure sensors and to compensate any possible reasonable drift of the sensors. This should be done while the motor is stopped and no gas pressure is applied before the gas throttle (Gas Pressure regulator closed and gas vent valves open). In this case, the output of the GasDeltaPressure, Vent1DeltaPressure and Vent2DeltaPressure sensors, visible in parameters 3556 *IntAnalogIn2_Value*, 3561 *IntAnalogIn3_Value*, 3566 *IntAnalogIn4_-Value* should be around 0.5V (Delta pressures near 0 mbar). To check the calibration of the sensors, please proceed as follows:

- Check the actual value of par. 3556 *IntAnalogIn2_Value*. If this value is higher than 0.55V or lower than 0.45 V, the drift of the sensor is too big, the sensor should be replaced, please contact HEINZMANN.

- Compare values of 3556 *IntAnalogIn2_Value* and 1555 *IntAnaIn2_RefLow*. If a difference can be noticed, please copy the value of 3556 *IntAnalogIn2_Value* in 1555 *IntAnaIn2_RefLow* and save all parameters in the control unit (F6 or Control Unit->Store parameters in control unit)
- Check the actual value of 3561 *IntAnalogIn3_Value*. If this value is higher than 0.55V or lower than 0.45 V, the drift of the sensor is too big, the sensor should be replaced, please contact HEINZMANN.
- Compare values of 3561 *IntAnalogIn3_Value* and 1560 *IntAnaIn3_RefLow*. If a difference can be noticed, please copy the value of 3561 *IntAnalogIn3_Value* in 1560 *IntAnaIn3_RefLow* and save all the parameters in the control unit (F6 or Control Unit->Store parameters in control unit)
- Check the actual value of 3566 *IntAnalogIn4_Value*. If this value is higher than 0.55V or lower than 0.45 V, the drift of the sensor is too big, the sensor should be replaced, please contact HEINZMANN.
- Compare values of 3566 *IntAnalogIn4_Value* and 1565 *IntAnaIn4_RefLow*. If a difference can be noticed, please copy the value of 3566 *IntAnalogIn4_Value* in 1565 *IntAnaIn4_RefLow* and save all parameters in the control unit (F6 or Control Unit ⇒ Store parameters in control unit)

If the two sensors *Vent1DeltaPressure* and *Vent2DeltaPressure* are used (5315 *TwoOrOneGasMixer* = 1), and one of these sensors is faulty, a degraded mode is temporarily possible by assigning the faulty sensor to the right one. In this case, only one sensor will be used to calculate the air flows through both gas mixers. Examples:

- *Vent1DeltaPressure* is OK, but *Vent2DeltaPressure* is considered faulty (3566 *IntAnalogIn4_Value* < 0.45V). Assign *Vent2DeltaPressure* to *Vent1DeltaPressure* sensor by setting 917 *AssignIn_Vent2DPress* to 3.
- *Vent2DeltaPressure* is OK, but *Vent2DeltaPressure* is considered faulty (3561 *IntAnalogIn3_Value* < 0.45V). Assign *Vent1DeltaPressure* to *Vent2DeltaPressure* sensor by setting 916 *AssignIn_Vent1DPress* to 4.

Note

The degraded mode should only be used if there is no unbalance between both air intakes (air filters in same state, no problem with one turbocharger …). It is recommended to use it only for a limited time.

15.2 CAN Communication

When an ELEKTRA Lambda Control is used together with a HEINZMANN Speed/Load controller (for example HELENOS), the complete system is called KRONOS 30M. In fact, the lambda and the speed/load controllers can still continue to work separately, but it is a good practice to establish a CAN-communication between both control units: in most cases it reduces the amount of sensors needed and allows a good interaction between the 2 controllers and a quick reaction in case a failure is detected by one of the units.

For switching-on the CAN-Communication, follow the next steps:

- Set 4416 *CanSegmentOrBaudrate* to 1.
- Set 416 *CanBaudrate* to the desired CAN baud rate (125, 250, 500 or 1000 kBit/s). Please note: The CAN baud rates of all the devices present on the CAN bus should be the same. Particularly, par. 416 should have the same value in both the speed/load controller and ELEKTRA.
- Set 402 *CanMyNodeNumber* and 403 *CanTxNodeNumber* according to the CAN-Bus configuration. If possible, we recommend setting both parameters to the same value, for example 1 for the first KRONOS 30M on the bus, 2 for the second etc. In all cases, 402 *CanMyNodeNumber* in ELEKTRA and 404 *CanPENodeNumber* in HELENOS shall have the same value. Also 403 *CanTxNodeNumber* in ELEKTRA and 401 *CanMyNodeNumber* in HELENOS shall be identical.
- Set 4400 *CanCommDCOn* to 1. The CAN Communication is now activated.

Some parameters are available to switch on/off the communication of certain information by CAN:

- If 4440 *CanTelActuatorPosOn* = 1, ELEKTRA will send the gas throttle position to the speed/load controller. This information will be displayed in 2305 *PEActPos* of the speed/load controller. The sent rate of this message can be adjusted with the help of 440 *CanActPosSendRate*. If this par. is set to 0, the message will be sent every 16ms if the gas throttle position has changed since the last transmission.
- If 4447 *CanTelMeasurementsOn* = 1, ELEKTRA will send to the speed/load controller the main AFR-measurements parameters (parameters between 3300 and 3347). These measurements will be displayed in the speed/load controller in the same parameter-range.
- If 4448 *CanErrorResetOn* = 1, an error reset initiated by the user of DcDesk2000 connected to ELEKTRA will also produce an error reset in the speed/load controller. The error reset command will be transmitted to the speed/load controller by CAN.
- If 5305 *SpeedOverCanOn* = 1, ELEKTRA will receive the engine speed information from the speed/load governor over CAN, provided it is not set from the separate pickup which is directly connected to ELEKTRA.
- If 5306 *MeasPowerOverCanOn* = 1, ELEKTRA will receive the engine load information from the speed/load governor over CAN, provided it is not set from a separate load sensor directly connected to ELEKTRA.

15.3 Functional Description and Configuration

15.3.1 ELEKTRA Setpoint

There are four different ways to give a Lambda/Position setpoint to ELEKTRA:

15.3.1.1 Internal Lambda Setpoint

In this operating mode, the lambda setpoint is calculated using a map depending on engine speed 2000 *Speed* and thermal power 3301 *ThermalPower*. The map contains 10 speed, 10 thermal power base points and 100 lambda setpoint values, which can be freely defined, and associates a couple (speed, thermal power) to a specific lambda setpoint. The map uses the following parameters:

9120-9129: *LambdaMap:n(0)-(9)*,	speed base points for the lambda map
9130-9139: *LambdaMap:ThPow(0)-(9)*,	thermal power base points for the lambda map
9140-9239: *LambdaMap:Lambda(0)-(99)*,	lambda setpoint values

In order to use the internal lambda setpoint, follow the next steps:

- Configure the sensors according to ↑*13.2 Analogue Inputs*.
- Configure the lambda map according to engine performances.
- Set 5300 *GMUPosSetpointPCOn* to 0, 5301 *LambdaSetpointPCOn* to 0 and 5302 *ExtOrIntLambdaSetp* to 0.

When this configuration has been made, the value of the internal lambda setpoint is visible in 3303 *LambdaSetpoint*.

15.3.1.2 External Lambda Setpoint

In this operating mode, the lambda setpoint is directly given by the sensor ExtSetp, without use of the lambda map. In order to use the external lambda setpoint, follow the next steps:

- Configure the sensor according ↑*13.2 Analogue Inputs*.
- Set 5300 *GMUPosSetpointPCOn* to 0, 5301 *LambdaSetpointPCOn* to 0 and 5302 *ExtOrIntLambdaSetp* to 1.

When this configuration has been made, the value of the external lambda setpoint is visible in 2900 *SetpointExtern* and 3303 *LambdaSetpoint.*

15.3.1.3 Lambda Setpoint over DcDesk2000

To support functional tests and commissioning, and to assist trouble shooting, it is possible, independent from the internal and external lambda setpoints, to give a lambda setpoint via DcDesk2000. In this case, the internal/external setpoint is deactivated and ELEKTRA controls the gas throttle to reach the DcDesk2000 lambda setpoint. To use the DcDesk2000 lambda setpoint, follow the next steps:

- Set 1301 *LambdaSetpointPC* to the desired lambda setpoint
- Set 5300 *GMUPosSetpointPCOn* to 0, 5301 *LambdaSetpointPCOn* to 1

When this configuration has been made, the actual value of the lambda setpoint is visible in 3303 *LambdaSetpoint*. This means that both parameters 1301 *LambdaSetpointPC* and 3303 *LambdaSetpoint* should have the same values.

15.3.1.4 Gas Throttle Position Setpoint over DcDesk2000

As an additional feature to support functional tests and commissioning, and to assist trouble shooting it is also possible to switch off the lambda control algorithm and use DcDesk2000 to send a simple gas throttle position setpoint. In this case, ELEKTRA will not regulate the air-fuel ratio anymore, but will only drive the throttle to the given position setpoint. To configure this operation mode, please follow these steps:

- Set 1300 *GMUPosSetpointPC* to the desired gas throttle position setpoint.
- Set 5300 *GMUPosSetpointPCOn* to 1, 5301 *LambdaSetpointPCOn* to 0.

When this configuration has been made, the actual value of the position setpoint is visible in 2330 *ActPosSetpoint*. This means that both parameters. 1300 *GMUPosSetpointPC* and 2330 *ActPosSetpoint* should have the same values.

Note

If both Par. 5300 GMUPosSetpointPCOn and 5301 LambdaSetpoint-PCOn are set to 1, the DcDesk2000 gas throttle position setpoint will be active whereas the DcDesk2000 lambda setpoint will be inactive.

15.3.1.5 Safety Remarks

It is possible to use the DcDesk2000 gas throttle position setpoint while the engine is running. It is also possible to change over between the different setpoint modes during engine operation. It is important to understand that using the DcDesk2000 gas throttle position setpoint deactivates the AFR-control performed by ELEKTRA. In other words, the AFR-control of the engine is inactive and the DcDesk2000 user is the only one responsible for the gas fuel feed and air fuel ratio control of the engine. This quasi manual control of the engine is slow and potentially dangerous; mistakes can easily occur and lead to severe damages to persons and material. HEINZMANN explicitly recommends to restrict the use of this feature to advanced and experienced users.

15.3.2 Lambda Control Parameters

While in lambda control mode (5300 *GMUPosSetpointPCOn* = 0), ELEKTRA regulates the lambda by a PID control loop. The associated P, I and D-factors can be found in 1322 *LambdaGovGain*, 1323 *LambdaGovStability* and 1324 *LambdaGovDerivative*. They are normally set at the HEINZMANN factory but can be individually modified to optimize the behaviour of the lambda controller on customerspecific engines.

If the lambda control needs to be fine-tuned to different engine loads, a PID correction curve depending on the thermal power is provided (9550-9559 *PowToPIDCorr:Pth(0-9)*, 9560-9569 *PowToPIDCorr:Corr(0-9)*). It contains 10 points which can be freely defined. Each point associates one thermal power to one PID-correction. This correction is applied to the P, I and D-factors 1322 *LambdaGovGain*, 1323 *LambdaGovStability* and 1324 *LambdaGovDerivative* of the lambda control.

15.3.3 Gas Quality

The gas quality is an essential information in ELEKTRA's control algorithm and must be provided to accurately regulate the air-fuel ratio. There are 2 ways to provide this information to ELEKTRA.

15.3.3.1 Constant Gas Quality

For installations with constant gas quality, the gas data can be configured as fixed values in ELEKTRA. To do that, please follow the next steps:

- Set 1303 *NormGasGravity* to the desired value in [kg/Nm³]
- Set 1320 *AFRAtStoichiometry* to the desired value in [Nm³/Nm³]
- Set 1340 *GasLowHeatingValue* to the desired value in [MJ/Nm³]
- Verify that 5303 *GasQualityInputOn* is set to 0

15.3.3.2 Variable Gas Quality

Certain installations use different gases or one gas of variable quality. In those cases, it may be of interest to make the internally used gas quality information in ELEKTRA follow an external analogue signal. Please follow the next steps:

- Configure the GasQuality sensor according to ↑*13.2 Analogue Inputs*. Once this has been done, the actual gas quality is displayed in par. 2911 (GasQuality) in [%].
- A curve of gas gravity depending on gas quality is provided in Elektra (9600-9609 *GasQty:Input(0-9)*, 9620-9629 *GasQty:Gravity(0-9)*). It contains 10 points which can be freely defined. Each point associates one gas quality to one gas gravity. Please set this curve according to demand.
- A curve of gas stoichiometric air-fuel ratio depending on gas quality is provided in ELEKTRA (9600-9609 *GasQty:Input(0-9)*, 9640-9649 *GasQty:AFRStoich(0-9)*). It contains 10 points which can be freely defined. Each point associates one gas quality to one stoichiometric air-fuel ratio. Please set this curve according to demand.
- A curve of gas low heating value depending on gas quality is provided in ELEKTRA (9600-9609 *GasQty:Input(0-9)*, 9660-9669 *GasQty:LHV(0-9)*). It contains 10 points which can be freely defined. Each point associates one gas quality to one gas low heating value. Please set this curve according to demand.
- Set 5303 *GasQualityInputOn* to 1

The currently used gas gravity, AFR at stoichiometry and low heating value are displayed in par. 3304 *NormGasGravity*, 3338 *AFRAtStoichiometry* and 3341 *GasLowHeatingValue*.

15.3.4 Engine States

ELEKTRA determines five different engine states depending on the engine speed and the errors detected by the control unit. These five states are displayed in parameters 3802-3806 and briefly described below:

3802 *EngineStop* is set when a stop condition is detected (fatal error or external stop command).

If carried out as a switch (4810 *StopImpulseOrSwitch* =0), 3802 *EngineStop* will be reset when no stop condition is present (no fatal error and no external stop command).

If carried out as an impulse (4810 *StopImpulseOrSwitch* = 1), 3802 *EngineStop* will be reset when no stop condition is present (no fatal error and no external stop command) and the *EngineStopped* condition is detected.

Summarised by just using parameter numbers and logic operators, this means:

3802 *EngineStop* = 1,	if 3800 *EmergencyAlarm* = 1 (fatal error) or

2810 *SwitchEngineStop* = 1
(external stop command)

3802 *EngineStop* = 0, if
3800 *EmergencyAlarm* = 0
(no fatal error)
and
2810 *SwitchEngineStop* = 0
(no external stop command)
and
4810 *StopImpulseOrSwitch* = 0
(Switch)
or
3803 *EngineStopped* = 1

3803 *EngineStopped* is set when engine speed is 0. It is reset when the engine speed exceeds the certain limit 255 *StartSpeed1*.

3804 *EngineStarting* is set if the engine speed exceeds a certain limit while the engine is stopped.

3804 *EngineStarting* is reset if the engine stopped condition or if the engine running condition is detected.

This means:

3804 *EngineStarting* = 1, if
3803 *EngineStopped* = 1
and
2000 *Speed* >= 255 *StartSpeed1*

3804 *EngineStarting* = 0, if
3803 *EngineStopped* = 1
or
3805 *EngineRunning* = 1

3805 *EngineRunning* is set if the engine start condition is detected (with a certain delay if the variable starting fuel limitation has been chosen) and the engine speed exceeds the certain limit 256 *StartSpeed2*. It is reset when the "engine stopped" condition is detected.

In case of fixed starting fuel limitation (250 *StartType* = 1),

3805 *EngineRunning* = 1, if
3804 *EngineStarting* = 1
and
2000 *Speed* >= 256 *StartSpeed2*

In case of variable starting fuel limitation (250 *StartType* = 2),

3805 *EngineRunning* = 1,	if 3804 *EngineStarting* = 1 with a time delay corresponding to 265 *StartDuration1* + 266 *StartDuration2* and 2000 *Speed* >= 256 *StartSpeed2*

In both cases,

3805 *EngineRunning* = 0,	if 3803 *EngineStopped* = 1

3806 *EngineReleased* is set when EngineStop is not active (3802 = 0). This means:

3806 *EngineReleased* = 1,	if 3802 *EngineStop* = 0
3806 *EngineReleased* = 0,	if 3802 *EngineStop* = 1

15.3.5 Gas Fuel Limitation

711 *FuelLimitMaxAbsolut* defines the absolute maximal gas throttle position. It is always active.

Besides this absolute limitation, there are 2 different ways to limit the gas fuel amount during engine start procedure. While the engine is running it is also possible to limit the gas throttle position depending on the engine speed.

15.3.5.1 Fixed Starting Fuel Limitation

On reaching the speed as set by 255 *StartSpeed1*, the control recognises that the engine is being cranked, and releases the starting fuel quantity as set by 260 *StartFuel1*. On reaching the speed as set by 256 *StartSpeed2*, the control recognizes that the engine is running. Starting fuel limitation 260 *StartFuel1*, however, is sustained for the duration set by 251 *LimitsDelay*. After that, the control will go over to using the speed dependent fuel limitation (if configured) or the absolute maximal fuel limitation.

In order to use the fixed starting fuel limitation set 250 *StartType* to 1.

15.3.5.2 Variable Starting Fuel Limitation

If within the time defined by 265 *StartDuration1* the engine does not start off with starting fuel limitation set to 260 *StartFuel1*, the control will progressively increase the fuel limitation to 261 *StartFuel2* for the time defined by 266 *StartDuration2*. This fuel limitation is kept until the engine starts off or the cranking sequence is aborted. On reaching speed as set by 256 *StartSpeed2*, the control recognizes that the engine is running. The starting limitation however, with which the engine had started off is sustained as a fuel limitation for the duration set by 251 *LimitsDelay*. After that, the control will go over to using the speed dependent fuel limitation (if configured) or the absolute maximal fuel limitation.

In order to use the variable starting fuel limitation set 250 *StartType* to 2.

15.3.5.3 Speed dependent Fuel Limitation

While the engine is running and the start limitation delay 251 *LimitsDelay* has elapsed, it is possible to switch on a speed dependent fuel limitation. To do that, please follow the next steps:

- A curve of gas throttle position limits depending on engine speed is provided in ELEKTRA (6700-6729 *SpeedLimit1:n(0-29)*, 6750-6779 *SpeedLimit1:f(0-29)*). It contains 30 points which can be freely defined. Each point associates one engine speed to one gas throttle position limit. Please set this curve according to demand.
- Set 4700 *SpeedLimitOn* to 1.

15.3.6 Closed Loop Lambda Control

To compensate variations of gas quality, ambient air temperature, back pressure and other factors which affect the engine operation and emissions, a closed loop mode has been implemented. It uses the electrical power measurement as afeedback and tries to keep the mix heating value constant. To switch the closed loop lambda control on, please follow the next steps:

- Configure the sensor MeasPower according to ↑ *13.2 Analogue Inputs*. For KRONOS 30 systems, which include a HELENOS speed/load governor, it is possible to use only one electrical power sensor connected to the Helenos and to send this information to ELEKTRA via CAN. In this case, you do not need to configure the sensor MeasPower in ELEKTRA. Follow the configuration of the CAN communication with HELENOS as described in ↑*15.2 CAN Communication* and set 5306 *MeasPowerOverCanOn* to 1. An electrical power measurement is needed for closed loop operation. If this information is not provided to ELEKTRA either as a hardwired sensor or as a CAN information from HELENOS, or in case of a sensor failure or CAN-bus errors, the closed loop operation will be switched off.
- In order to calculate the engine thermal power from the electrical power measurement, an efficiency curve (9100-9109 *ElPowToThPow:Pel(0)-(9)*, 9110-9119 *ElPowToThPow:Pth(0)-(9)* is provided and must be calibrated. Each point of the curve associates one engine electrical power to the corresponding engine thermal power. During calibration of the efficiency curve, the gas quality must be constant and the actual gas data must be configured correctly in ELEKTRA (1303

NormGasGravity, 1320 *AFRAtStoichiometry* and 1340 *GasLowHeatingValue*). Once this is done, the engine can be run step by step from 0 kWe to rated power. At each step, report the electrical power of the engine into a X-Value of the curve (9100-9109 *ElPowToThPow:Pel(0)-(9)*) and copy the thermal power calculated from the gas flow 3302 *GasFlowThermalPower* into the corresponding Y-value of the curve (9110-9119 *ElPowToThPow:Pth(0)-(9)*). Once the complete power range of the engine has been calibrated, save all parameters into the control unit.

- Set 1341 *ClosedLoopPowerMin* according to demand. Closed loop operation will only be allowed above this limit. When closed loop operation is active, 3340 *ClosedLoopActive* = 1. The closed loop lambda setpoint offset is visible in 3346 *ClosedLoopLambdaTrim*.
- 1342 *ClosedLoopGov*:I determines how fast the closed loop governor works. As closed-loop operation is normally a slow process, this parameter should not be set to high values (for example, 2% is suitable in most applications).
- To activate the closed loop control, set 5340 *AFRClosedOrOpenLoop* to 1.

15.3.7 Safety Functions

This chapter describes the safety functions included in ELEKTRA, the corresponding parameters and the way to set a customer-specific configuration.

15.3.7.1 Overspeed

The engine overspeed limit is configurable by 21 *SpeedOver*. If this limit is exceeded, the gas throttle closes. An overspeed error needs to be reset by the operator.

15.3.7.2 Zero Gas Delta Pressure

A zero gas delta pressure condition is detected by ELEKTRA if the gas delta pressure is below a certain limit:

2915 *GasDeltaPressure* ≤ 1350 *GasZeroDeltaPLimit*

As it is a normal state while the engine is stopped, the corresponding error 3030 *ErrZeroGasDeltaP* is only set and displayed if the zero gas delta pressure condition occurs while the engine is running (3805 *EngineRunning* = 1), EngineStop is not active and after a configurable time delay 1359 *ThresholdSetDelay*. During engine operation, this error is fatal, which means that it produces an engine stop condition (3800 *EmergencyAlarm* = 1) and the gas throttle closes. The error is reset when the

EngineStopped condition is detected and after a configurable time delay 1360 *ThresholdResetDelay*.

15.3.7.3 Low Gas Delta Pressure

A low gas delta pressure condition is detected by ELEKTRA if the gas delta pressure is below a certain limit:

2915 *GasDeltaPressure* ≤ 1351 *GasDeltaPressureMin*

As it is a normal state while the engine is stopped, the corresponding error (parameter 3031 *ErrLowGasDeltaP* is only set and displayed if the low gas delta pressure condition occurs while the engine is running (3805 *EngineRunning* = 1), EngineStop is not active and after a configurable time delay 1359 *ThresholdSetDelay*. This error is only an alarm, it is not fatal and does not produce an engine stop condition (3800 *EmergencyAlarm* = 0, 3801 *CommonAlarm* =1), the gas throttle does not close. The error is reset when the low gas delta pressure condition disappears and after a configurable time delay 1360 *ThresholdResetDelay*.

15.3.7.4 High Gas Delta Pressure

A high gas delta pressure condition is detected by ELEKTRA if the gas delta pressure has exceeded a certain limit:

2915 *GasDeltaPressure* ≥ 1352 *GasDeltaPressureMax*

The corresponding error 3032 *ErrHighGasDeltaP* is always active independently from engine running situation and is set and displayed after a configurable time delay 1359 *ThresholdSetDelay*. During engine operation, this error is fatal, which means that it produces an engine stop condition (3800 *EmergencyAlarm* = 1) and the gas throttle closes. The error is reset when the EngineStopped condition is detected and after a configurable time delay 1360 *ThresholdResetDelay*.

15.3.7.5 Low Gas Pressure

A low gas pressure condition is detected by ELEKTRA if the absolute gas pressure before throttle is below a certain limit:

2914 *GasPressure* ≤ 1353 *GasPressureMin*

As it is a normal state while the engine is stopped, the corresponding error 3033 *ErrLowGasPress* is only set and displayed if the low gas pressure condition occurs while the engine is running (3805 *EngineRunning* = 1), EngineStop is not active and after a configurable time delay 1359 *ThresholdSetDelay*. This error is only an alarm, it is not fatal and does not produce an engine stop condition (3800 *EmergencyAlarm*

= 0, 3801 *CommonAlarm* =1), the gas throttle does not close. The error is reset when the low gas pressure condition disappears and after a configurable time delay 1360 *ThresholdResetDelay*.

15.3.7.6 High Gas Pressure

A high gas Pressure condition is detected by ELEKTA if the gas pressure before throttle has exceeded a certain limit:

2914 *GasPressure* ≥ 1354 *GasPressureMax*

The corresponding error 3034 *ErrHighGasPress* is always active independently from engine running situation and is set and displayed after a configurable time delay 1359 *ThresholdSetDelay*. During engine operation, this error is fatal, which means that it produces an engine stop condition (3800 *EmergencyAlarm* = 1) and the gas throttle closes. The error is reset when the EngineStopped condition is detected and after a configurable time delay 1360 *ThresholdResetDelay*.

15.3.7.7 Low Gas Temperature

A low gas temperature condition is detected by ELEKTRA if the gas temperature before throttle is below a certain limit:

2910 *GasTemp* ≤ 1355 *GasTemperatureMin*

The corresponding error 3035 *ErrLowGasTemp* is always active independently from engine running situation and is set and displayed after a configurable time delay 1359 *ThresholdSetDelay*. This error is only an alarm, it is not fatal and does not produce an engine stop condition (3800 *EmergencyAlarm* = 0, 3801 *CommonAlarm* =1), the gas throttle does not close. The error is reset when the low gas temperature condition disappears and after a configurable time delay 1360 *ThresholdResetDelay*.

15.3.7.8 High Gas Temperature

A high gas temperature condition is detected by ELEKTRA if the gas temperature before throttle has exceeded a certain limit:

2910 *GasTemp* ≥ 1356 *GasTemperatureMax*

The corresponding error 3036 *ErrHighGasTemp* is always active independently from engine running situation and is set and displayed after a configurable time delay 1359 *ThresholdSetDelay*. During engine operation, this error is fatal, which means that it produces an engine stop condition (3800 *EmergencyAlarm* = 1) and the gas throttle closes. The error is reset when the EngineStopped condition is detected and after a configurable time delay 1360 *ThresholdResetDelay*.

16 Operation

The system must be operated in such a way that any damages are definitely ruled out.

In particular, the system must be operated exclusively within the relevant specifications as far as the electrical and technical conditions are concerned.

Examine all the components at regular intervals, check if they are working correctly, and if there are any damages or wear.

Warning

The maximum content of H_2S (hydrogen sulphide) in the gas must not exceed 0.1 %.

The gas must be dry.

A corrosion inspection must be carried out every six months on components of biogas installations which come into contact with the gas.

Corrosion damage caused either by excessive hydrogen sulphide content or residual moisture may cause the mechanical components to seize and could result in the motor being destroyed due to an overspeed condition.

The GMCU is designed only to be used as control valve! Never use as shut-off valve!

17 Maintenance and Service

Warning

Any repairs of the HEINZMANN equipment must be carried out at the manufacturer's plant exclusively.

Danger

Before cleaning the system, make sure to disconnect it completely from the power supply.

The KRONOS 30 system is constructed free from maintenance and requires no particular regular support. Nevertheless, the condition of the components, such as cables, plugs, sensors and gas valves has to be assessed and their correct operation examined at regular intervals. Under normal load it is recommended to examine with the engine at a standstill the dismantled valve once a year and inspect the throttle and the inside surface for corrosive aspect. Under a higher load, e. g. caused by vibration or soiling, the inspection has to be carried out more frequently at suitable intervals. If there is visible wear, make sure to replace the complete valve.

The control valve must remain in a perfect outer condition. Its surface must not be affected mechanically nor by chemical substances. Make sure to avoid any soiling of the surface, especially for preventing any accumulation of heat.

For cleaning, use only procedures which are approved for the relevant degree of protection.

Warning

The device must not be opened by the customer under any circumstances!

Warning

A corrosion inspection must be carried out every six months on components of Biogas installations which come into contact with the gas!

Corrosion damage caused either by excessive hydrogen sulphide content or residual moisture may cause the mechanical components to seize and could result in the motor being destroyed due to an overspeed condition! The GMCU must only be used as control valve! Never use as shut-off valve!

18 Error Handling

18.1 General

The HEINZMANN Digital Controls of the KRONOS 30 series include an integrated error monitoring system by which errors caused by sensors, speed pickups, etc., can be detected and reported. By means of one permanently assigned digital output the error types can be output via some visual or audible signal.

The different errors can be taken from the parameters 3000..3099. A currently set error parameter will show the value “1”, otherwise the value “0”.

Generally, the following types of errors can be distinguished:

- Errors in configuring the control and adjusting the parameters
  These errors are caused by erroneous input on the part of the user and cannot be intercepted by either the PC or the Hand Held Programmer. They usually do not occur with controls from series production.
- Errors occurring during operation
  These errors are the most significant ones when using governors produced in series. Errors such as failure of the speed pickups, setpoint adjusters, pressure and temperature sensor, or logical errors, such as excessive temperature or low boost pressure are typical of this category.
- Internal computational errors of the control
  These errors may be due to defective components or other inadmissible operating conditions. Under normal circumstances, they are not likely to occur.

To eliminate an error, first find and eliminate its cause before clearing any of the current errors. Some errors are cleared automatically as soon as the cause of failure has been eliminated. Errors can be cleared via PC or the Hand Held Programmer. If the system does not stop reporting an error, the search for its cause must go on.

In general, the control starts operating on the assumption that there is no error and will only then begin to check for possible occurrences of errors. This implies that the control can be put into an error free state by a reset, but will immediately begin to report any errors that are currently active.

There are two categories of errors. One category comprises errors that permit to maintain the engine operation although the functionality will be restricted in some cases (e.g., sensor failures). The other category consists of so-called fatal errors that will cause an emergency shutdown of the engine (e.g. overspeeding, failure of both speed pickups).

These error categories are signalled by the following two parameters:

3800 *EmergencyAlarm*	Emergeny alarm
3801 *CommonAlarm*	Common alarm.

The parameter 3801 *CommonAlarm* will be set on the occurrence of any error, 3800 *EmergencyAlarm* only for fatal errors. Thus, 3800 *EmergencyAlarm* will never occur alone by itself.

These two parameters are output to a permanently assigned digital output, each, in order to enable signalization of the error state. The emergency alarm is usually output inverted (low-active) and interpreted as the signal “Governor ready” which would also signal a fatal error in case of missing power supply.

With this assignment, the outputs are to be interpreted as follows:

Status „Common alarm“	Status „Governor ready“	Signification
not active	not active	no power supply
not active	active	no error
active	not active	emergency alarm
active	active	common alarm

The “Governor ready” output, i.e., the inverted emergency alarm signal, is usually used to activate the overspeed protection device.

18.2 Error Memories

When the control is powered down it will lose any existing information on current errors. In order to be able to check upon which errors have occurred, a permanent error memory has been incorporated in the control. Any errors that have occurred at least once will be stored, the order and the time of their occurrence, however, will be ignored.

The control handles the values stored in the error memory merely as monitor values and they are not taken account of any further. In other words, it is only the errors occurring during operation that the control will respond to.

The permanent error memory can be inspected by means of the parameters that have been assigned numbers from 3100 upward so that the numbers of permanently stored errors will differ by 100 from those of the respective actual errors.

The permanent error memory can be cleared by means of the PC or the Hand Programmer only. After clearance, the control will revert to accumulating any occurring errors in the empty error memory.

Note

When the parameter 5100 NoStoreSerrOn is set to “1” and the error memory is cleared, no errors will be stored in the error memory before the next reset of the control unit. This feature is meant to provide the possibility of shipping a control with customer specific data in an error-free state without having to stimulate the inputs with the correct values. The parameter 5100 itself cannot be stored.

18.3 Bootloader

The HEINZMANN Digital Controls include a so-called bootloader. This programme section is stored at a specific location of the read-only memory (ROM) and is programmed once for all at the factory. The bootloader cannot be cleared except by means of special devices.

On starting the control programme by powering it up or by a reset, the bootloader programme is always executed first. This programme performs various relevant tests to see whether the actual control programme is or is not operable. Based on these tests the bootloader decides whether the further execution of the programme can be handed on to the control programme or if the execution must remain confined to the bootloader to rule out any risk of personal injury or damage to the engine. As long as the programme is in bootloader mode, the engine cannot be started.

Note

The entire bootloader tests and the subsequent initialization of the main programme will take about 500 ms.

18.3.1 Bootloader Start Tests

The following section describes the tests performed by the bootloader and the measures that may have to be taken. As long as these test are being conducted, there will be no communication with the device, especially when the programme is caught in an infinite loop due to some fatal error. For this reason, the current test mode is indicated on different displays of the circuit board.

- Watchdog-Test
  This is to check whether the watchdog integrated into the processor is operable. This is to ensure that in case of an undefined programme execution the control will go to a safe status after a pre-defined time. If the outcome of the watchdog test is negative, the bootloader programme will remain in an endless loop, and the above indications will not change.

- External RAM Test
  During this test, various binary patterns are written to the external RAM memory on the control circuit board and read out again. If at least one storage location does not contain the expected code, the bootloader programme enters into an endless loop, and the above indications are maintained.
- Internal RAM-Test
  During this test, various binary patterns are written into the internal RAM memory and read out again. If at least one storage location does not contain the expected code, the booloader programme enters into an endless loop, and the above indications are retained.
- Bootloader Programme Test
  A check-sum is calculated over the memory area containing the bootloader programme and compared with the check-sum pre-programmed at the factory. If the sums do not match, the bootloader programme will remain in an endless loop, and the above indications will be maintained.
- Control Programme Test
  A check-sum is calculated over the memory area containing the control programme and compared with the check-sum pre-programmed at the factory. If the sums do not match, the bootloader will go into a state which is indicated by the error 3087 *ErrMainCheckSum* via serial communication (DcDesk 2000 PC programme or Hand Held Programmer).
- Watchdog Triggering
  The bootloader passes into a state which is indicated as “watchdog error” 3089 *ErrWatchdog* via serial communication (DcDesk 2000 PC programme or Hand Held Programmer).

18.3.2 Bootloader Communication

With a HEINZMANN diagnostic tool the communication to the bootloader is enabled when the error output triggers the signal three times briefly with a long pause. The communication to the bootloader can also be recognized from the low number of parameters, as well as measured or indicated values. This operating condition serves on the one hand for indicating errors, but on the other hand it is the initial point for loading a new main program which is generally executed by the bootloader.

Note

If the system remains in the bootloader unexpectedly please notify HEINZMANN, the control unit manufacturer. For a more detailed error diagnosis, read out the parameters or indicated values directly and give this error description to HEINZMANN.

18.4 Emergency Shutdown Errors

The following list offers a summary of all the errors that will cause an emergency shutdown during operation or inhibit an engine start.

When at least one so-called fatal error has occurred 3800 *EmergencyAlarm* is activated and the signal “Governor ready” is cancelled.

Error	Reason
3001 *ErrPickup*	Error at pickup
3004 *ErrOverspeed*	Overspeed
3005 *ErrSetpointExtern*	Error at external setpoint
3019 *ErrGasPress*	Error at gas pressure sensor before ELEKTRA
3020 *ErrGasDeltaPress*	Error at gas delta pressure sensor on the ELEKTRA throttle valve
3030 *ErrZeroGasDeltaP*	Error zero pressure condition at ELEKTRA throttle valve - Drosselklappe detected
3032 *ErrHighGasDeltaP*	Error gas delta pressure to high
3034 *ErrHighGasPress*	Error gas pressure to high
3036 *ErrHighGasTemp*	Error gas temperature to high
3039 *ErrGasFlowDeviation*	Error gas flow deviation (only GasFlowControl)
3050 *ErrFeedback*	Error at feedback of actuator
3053 *ErrActuatorDiff*	Error difference between actuator position setpoint and actual position
3060 *ErrAmplifier*	Error output drive
3070 *ErrCanBus*	For KRONOS 30M, CAN-Bus error, communication with HELENOS interfered
3071 *ErrCanComm*	For KRONOS 30M, CAN communication error with HELENOS
3076 *ErrParamStore*	Error when saving the parameters in flash memory
3077 *ErrProgramTest*	Error during permanent check of programme memory
3078 *ErrRAMTest*	Error during permanent check of RAM memory
3089 *ErrMasterFatal*	For KRONOS 30M, fatal error in HELENOS
3090 *ErrData*	No parameters or check sum over parameters wrong
3093 *ErrStack*	Stack overflow, internal programming error
3094 *ErrIntern*	Exception, internal programming error

18.5 Error Parameter List

The error parameter list below contains descriptions of the causes of each single error and of the control's response. Furthermore, it lists the appropriate actions to be taken for removing the respective error.

The errors are stored in the volatile error memory under parameter numbers 3000 and higher and (as far as provided) in the permanent error memory under parameter numbers from 3100 onward.

The errors are sorted by ascending numbers with the parameter on the left indicating the current error as stored in the volatile memory and with the parameter on the right indicating the error stored as a sentinel in the permanent error memory. As explained above, the control will only react to current errors whereas the permanent error memory serves no other purpose than to accumulate information about the occurrence of errors.

3001 ErrPickUp **3101 SErrPickUp**

Cause:
- Speed pickup is at fault.
- Distance between speed pickup and gear rim is too large.
- Speed pickup is supplying faulty redundant pulses.
- Interruption of cable from speed pickup.
- Speed pickup wrongly mounted.

Response:
- Error message: Emergency alarm due to fatal error.
- fale-safe operation with substitute value of valve position.

Action:
- Check distance between speed pickup and gear rim.
- Check preferred direction of speed pickup.
- Check cable to speed pickup.
- Check speed pickup, replace if necessary.

3004 ErrOverSpeed **3104 SErrOverSpeed**

Cause:
- Engine speed was/is exceeding overspeed.

Response:
- Error message: Emergency alarm due to fatal error.
- Fale-safe operation with substitute value of valve position.

Action:
- Check overspeed parameter (21 *SpeedOver*).
- Check pickup, possibly it sends wrong speed data.
- Check numbers of teeth (1 *TeethPickUp*).

3005 ErrSetpointExtern **3105 SErrSetpointExtern**
3011 ErrAirPress1 **3111 SerrAirPress1**
3012 ErrAirPress2 **3112 SerrAirPress2**
3013 ErrAirTemp **3113 SErrAirTemp**
3015 ErrGasTemp **3115 SErrGasTemp**

Cause: - Some error has been detected for the respective sensor input (e.g., short circuit or cable break).

Response: - Error message: Common alarm.
- Fale-safe operation with substitute value or with last valid sensor depending on the parametrization.
- Depending on the selection, the error may disappear automatically when the values measured by the control are back within the error limits.

Action: - Check sensor cable for short circuit or cable break.
- Check the respective sensor, replace if necessary.
- Check error limits for this sensor.

3019 ErrGasPress **3119 SErrGasPress**
3020 ErrGasDeltaPress **3120 SErrGasDeltaPress**
3021 ErrVent1DeltaPress **3121 SErrVent1DeltaPress**
3022 ErrVent2DeltaPress **3122 SErrVent2DeltaPress**

Cause: - Some error has been detected for the respective sensor input (e.g., short circuit, cable break or leak at the connection hose).

Response: - Emergency shut down

Action: - Check tightness of corresponding connection hose between measuring place and sensor box
- Check corresponding sensor cable between senor box and control unit for short circuit or cable break.
- Check error limits for this sensor.
- Check corresponding sensor, replace PCB in sensor box, if necessary.
- Restart governor by reset.

3023 ErrMeasPower **3123 SErrMeasPower**

Cause: - Some error has been detected for the respective sensor input (e.g., short circuit or cable break).

Response: - Closed loop operation will be disactivated.

Action: - Check sensor cable for short circuit or cable break.
- Check corresponding sensor, replace if necessary.
- Check error limits for this sensor.

3029 ErrMeasGasQuality **3129 SErrMeasGasQuality**

Cause: - Some error has been detected for the respective sensor input (e.g., short circuit or cable break).

Response: - Closed loop operation will be disactivated.

Action: - Check sensor cable for short circuit or cable break.
- Check corresponding sensor, replace if necessary.
- Check error limits for this sensor.

3030 ErrZeroGasDeltaP **3130 SErrZeroGasDeltaP**

Cause: - Refer to chapter 14.2.5.1 (gas flow control) or chapter 15.3.7.2 (Lambda control). The gas delta pressure at the trottle valve drops under a determined limitation value when engine is running.

Response: - Refer to chapter 14.2.5.1 (gas flow control) or Chapter 15.3.7.2 (lambda control).

Action: - Check of gas supply or change of pressure limitation.

3031 ErrLowGasDeltaP **3131 SErrLowGasDeltaP**

Cause: - Refer to chapter 14.2.5.2 (gas flow control) or chapter 15.3.7.3 (lambda control). The gas delta pressure at the trottle valve drops under a determined limitation value when engine is running.

Response: - Refer to chapter 14.2.5.2 (gas flow control) or chapter 15.3.7.3 (lambda control).

Action: - Check of gas supply or change of pressure limitation.

3032 ErrHighGasDeltaP **3132 SErrHighGasDeltaP**

Cause: - Refer to chapter 14.2.5.3 (gas flow control) or chapter 15.3.7.4 (lambda control). The gas delta pressure at the trottle valve raises over a determined limitation value when engine is running.

Response: - Refer to chapter 14.2.5.3 (gas flow control) or chapter 15.3.7.4 (lambda control).

Action: - Check of gas supply or change of pressure limitation.

3033 ErrLowGasPress **3133 SErrLowGasPress**

Cause: - Refer to chapter 14.2.5.4 (gas flow control) or chapter 15.3.7.5 (lambda control). The gas pressure before the trottle valve drops under a determined limitation value.

Response: - Refer to chapter 14.2.5.4 (gas flow control) or chapter 15.3.7.5 (lambda control).

Action: - Check of gas supply or change of pressure limitation.

3034 ErrHighGasPress **3134 SErrHighGasPress**

Cause: - Refer to chapter 14.2.5.5 (gas flow control) or chapter 15.3.7.6 (lambda control). The gas pressure before the trottle valve raises over a determined limitation value.

Response: - Refer to chapter 14.2.5.5 (gas flow control) or chapter 15.3.7.6 (lambda control).

Action: - Check of gas supply or change of pressure limitation.

3035 ErrLowGasTemp **3135 SErrLowGasTemp**

Cause: - Refer to chapter 14.2.5.6 (gas flow control) or chapter 15.3.7.7 (lambda control). The gas temperature before the trottle valve drops under a determined limitation value.

Response: - Refer to chapter 14.2.5.6 (gas flow control) or chapter 15.3.7.7 (lambda control).

Action: - Check of gas supply and temperature sensor or change of temperature limitation

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3036 ErrHighGasTemp **3136 SErrHighGasTemp**

Cause: - Refer to chapter 14.2.5.7 (gas flow control) or chapter 15.3.7.8 (lambda control). The gas temperature before the trottle valve raises over a determined limitation value.

Response: - Refer to chapter 14.2.5.7 (gas flow control) or chapter 15.3.7.8 (lambda control).

Action: - Check of gas supply and temperature sensor or change of temperature limitation

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3037 ErrLowPowerSupply **3137 SErrLowPowerSupply**

Cause: - The supply voltage drops under a determined limitation value.

Response: - Error message

Action: - Check of voltage supply

3038 ErrHighPowerSupply **3138 SErrHighPowerSupply**

Cause: - The supply voltage raises over a determined limitation value.

Response: - Error message

Action: - Check of voltage supply

3039 ErrGasFlowDeviation **3139 SErrGasFlowDeviation**

Cause: - Only with gas flow control. Refer to chapter 14.2.5.8. To large deviation between gas flow setpoint and current gas flow.

Response: - Emergency shut down

Action: - Check of actuator and throttle valve movability
- Check of feedback
- Check of gas supply and gas pressure before throttle valve
- Restart governor by a reset.

3050 ErrFeedback **3150 SerrFeedback**

Cause: - Error in feedback system of actuator, actuator not connected.

Response: - Governor cannot be put into operation.
- Emergency shutdown.

Actions: - Check feedback cable to actuator.
- Check actuator, replace if necessary.
- Check error limits for feedback:
1952 *FeedbackErrorLow* / 1953 *FeedbackErrorHigh*
- Restart governor by a reset.

3053 ErrActuatorDiff **3153 SerrActuatorDiff**

Cause: - The difference between the actuator travel set and the actual actuator travel has exceeded 10 % of the total actuator travel for more than one second. This error occurs if the injection pump or the actuator are jamming or are not connected.

Response: - Error message.
- Error will be cleared automatically, as soon as the difference is again below 10 %.

Actions: - Check injection pump resp. throttle valve, replace if necessary.
- Check mechanical parts (linkage).
- Check cables to actuator.
- Check actuator, replace if necessary.

3060 ErrAmplifier **3160 SErrAmplifier**

Cause: - Overload, overtemperature at amplifier.

Response: - Error message.

Actions: - Restart governor by reset.
- Notify HEINZMANN.

3070 ErrCanBus **3170 SErrCanBus**

Cause: - The CAN controller makes errors like BusStatus, ErrorStatus or DataOverrun. In spite of reinitialization of controller it is not possible to clear the errors permanently.

Response: - Depending on application

Action: - Check CAN module
- Check CAN connection.

3071 ErrCanComm **3171 SErrCanComm**

Cause: - There is an overrun in the destination buffer or a message cannot be fed into CAN bus.

Response: - Depending on the application.

Action: - Check CAN module.
- Check CAN connection.

3076 ErrParamStore **3176 SErrParamStore**

Cause: - Occurrence of an error on programming the control's flash memory.

Response: - Control cannot be put into operation.
- Emergency shutdown.

Action: - Restart governor by a reset.
- Notify HEINZMANN.

3077 ErrProgramTest **3177 SErrProgramTest**

Cause: - Current monitoring of the programme memory reports an error.

Response: - Engine cannot be started.
- Emergency shutdown.

Action: - Restart governor by a reset.
- Notify HEINZMANN.

3078 ErrRAMTest **3178 SErrRAMTest**

Cause: - Current monitoring of the working memory reports an error.

Response: - Engine cannot be started.
- Emergency shutdown.

Action: - Note down the values of the parameters 3895 *RAMTestAddrHigh* and 3896 *RAMTestAddrLow*.
- Restart governor by a reset.
- Notify HEINZMANN.

3081 Err5V_Ref **3181 SErr5V_Ref**

Cause: - The 5 V sensor reference voltage 3603 *5V_Ref* is not within the permissible range of 4.5 to 5.5 V.

Response: - Error message.
- Error is cleared automatically as soon as the voltage is back within the normal range.

Action: - Sensorversorgung überprüfen.

3085 ErrVoltage **3185 SErrVoltage**

Cause: - The supply voltage for the governor is not within the permissible range of 18 to 33 V.

Response: - Error message.
- Error is cleared automatically as soon as the voltage is back within the normal range.

Action: - Check voltage supply.

3089 ErrMasterFatal **3189 SErrMasterFatal**

Cause: - Fatal error in HELENOS (only at KRONOS 30 M)

Response: - Emergency shut down.

Action: - Check of errors in HELENOS
- Restart governor by a reset.

3090 ErrData **3190 SErrData**

Cause: - No data found, or check sum over data is wrong.

Response: - Engine cannot be started.
- Governor is operating by default parameters.

Action: - Check data for correct setting, save parameters and restart control unit by a reset.

Note: *This error will occur only when adjusting and saving parameters.*

3092 ErrConfiguration **3192 SErrConfiguration**

Cause: - Configuration error

Response: - Engine cannot be started.
- Control unit is operating with default parameters.

Action: - Check data for correct setting,
- Restart control by a reset.

3093 ErrStack **3193 SErrStack**

Cause: - Internal programming or computing error, “stack-overflow”.

Response: - Control cannot be started.
- Emergency shutdown.

Action: - Write down the value of parameter 3897 *StackTestFreeBytes* and notify HEINZMANN
- Restart control by a reset.

3094 ErrIntern **3194 SErrIntern**

Cause: Internal programming or computing error, so-called "EXCEPTION" error.

Response: - Control cannot be started.
- Emergency shutdown.

Action: - Notify HEINZMANN.
- Restart control by a reset.

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19 Parameter Description

19.1 Overview Table

The following table shows the individual groups of parameters arranged side by side. After that, a second table shows all the parameters with their numbers and designations in four lists side by side. This makes the functional interrelationship between the individual parameters obvious.

Parameter		**Measurements**		**Functions**		**Curves**	
No.	Designation	No.	Designation	No.	Designation	No.	Designation
1	Number of teeth, speed	2000	Speed pickup, speed				
250	Start						
300	Standard route	2300	Standard route				
400	CAN	2400	CAN	4400	CAN		
700	Limitations	2700	Limitations	4700	Limitations	6700	Speed dependent fuel limitation 1
800	Switching functions, digital outputs	2800	Digital inputs and outputs	4800	Digital inputs and outputs		
900	Setpoint generator, sensors	2900	Setpoint generator, sensors	4900	Setpoint generator, sensors		
1000	Error Handling	3000	Current errors	5000	Error handling		
		3100	Error memory				
1300	AFR	3300	AFR	5300	AFR		
1500	Analogue inputs	3500	Analogue inputs	5500	Analogue inputs		
1600	PWM and analogue outputs						
1700	Positioner			5700	Positioner		
1800	Status	3800	Status			7800	Sensor characteristics
1900	Servo loop, feedback	3900	Servo loop, feedback	5900	Servo loop, feedback	7900	Correction characteristic

Note

In the following list of all the parameters, those parameters marked with an (L) are only present with Lambda Control, whereas those marked with (G) are only present with Gas Flow Control.

Parameter		Measurements		Functions		Curves	
		2000	Drehzahl (L)				
1	TeethPickUp (L)	2001	SpeedPickup (L)				
		2003	SpeedPickUpValue (L)				
10	SpeedMin (L)						
12	SpeedMax (L)						
21	SpeedOver (L)						
250	StartTyp (L)						
251	LimitsDelay (L)						
255	StartSpeed1 (L)						
256	StartSpeed2 (L)						
260	StartFuel1 (L)						
261	StartFuel2 (L)						
265	StartDuration1 (L)						
266	StartDuration2 (L)						
		2300	ActPos				
		2305	PEActPos				
310	ActPosSecureMin						
312	ActPosSecureMax						
		2330	ActPosSetpoint				
400	CanStartTimeOutDelay			4400	CanCommDCOn (L)		
401	CanRxTimeOut	2401	CanTxBufferState (L)				
402	CanMyNodeNumber	2402	CanRxBufferState (L)				
403	CanTxNodeNumber	2403	CanRxTimeout (L)				
		2404	CanTypeMismatch (L)				
		2405	CanOnline (L)				
410	CanPrescaler	2410	CanDCNodeState31to16 (L)				
411	CanSyncJumpWidth	2411	CanDCNodeState15to01 (L)				
412	CanSamplingMode						
413	CanPhaseSegment1						
414	CanPhaseSegment2						
415	CanPropSegment (L)						
416	CanBaudrate (L)			4416	CanSegmentOrBaudrate (L)		
		2424	CanPCNodeState31to16 (L)				
		2425	CanPCNodeState15to01 (L)				
440	CanActPosSendRate (L)			4440	CanTelActuatorPosOn (L)		
				4447	CanTelMeasurementsOn (L)		
				4448	CanErrorResetOn (L)		
		2450	CanDCRxBufferUsed (L)				
		2457	CanPCRxBufferUsed (L)				
		2466	CanTxBufferUsed (L)				
				4700	SpeedLimitOn (L)	6700	SpeedLimit1:n(x) (L)
		2702	FuelLimitStart (L)				
		2703	FuelLimitSpeed (L)				
		2710	FuelLimitMinActive				
711	FuelLimitMaxAbsolut	2711	FuelLimitMaxActive				
		2712	StartLimitActive (L)				
		2713	SpeedLimitActive (L)				
						6750	SpeedLimit1:fQ(x) (L)
				4800	Port1Type		
				4801	Port1OutOrIn		
				4802	Port2Type		
				4803	Port2OutOrIn		
		2810	SwitchEngineStop	4810	StopImpulseOrSwitch		
				4811	StopOpenOrClose		
		2851	DigitalOut1				
		2852	DigitalOut2				
900	AssignIn_SetpExt	2900	SetpoinExtern				

Parameter		Measurements		Functions		Curves	
906	AssignIn_AirPress1 (L)	2906	AirPressure1 (L)				
907	AssignIn_AirPress2 (L)	2907	AirPressure2 (L)				
		2908	AirTemp (L)				
		2910	GasTemp				
		2911	GasQuality				
		2914	GasPressure				
		2915	GasDeltaPressure				
916	AssignIn_Vent1Dpress (L)	2916	Vent1DeltaPressure (L)				
917	AssignIn_Vent2Dpress (L)	2917	Vent2DeltaPressure (L)				
918	AssignIn_MeasPower (L)	2918	MeasuredPower (L)				
924	AssignIn_MeasGasQty	2924	MeasuredGasQuality				
950	SetpExtLow						
951	SetpExtHigh						
966	AirPress1Low (L)						
967	AirPress1High (L)						
968	AirPress2Low (L)						
969	AirPress2High (L)						
978	GasPressLow						
979	GasPressHigh						
980	GasDeltaPressLow						
981	GasDeltaPressHigh						
982	Vent1DeltaPressLow (L)						
983	Vent1DeltaPressHigh (L)						
984	Vent2DeltaPressLow (L)						
985	Vent2DeltaPressHigh (L)						
986	MeasPowerSensorLow (L)						
987	MeasPowerSensorHigh (L)						
998	MeasGasQualityLow						
999	MeasGasQualityHigh						
1000	SubstSetpExt	3000	ConfigurationError	5000	SubstOrLastSetpExt		
		3001	ErrPickUp (L)				
		3004	ErrOverSpeed (L)				
		3005	ErrSetpointExtern				
1006	SubstAirPress1 (L)			5006	SubstOrLastAirPress1 (L)		
1007	SubstAirPress2 (L)			5007	SubstOrLastAirPress2 (L)		
1008	SubstAirTemp (L)			5008	SubstOrLastAirTemp (L)		
1010	SubstGasTemp			5010	SubstOrLastGasTemp		
		3011	ErrAirPress1 (L)				
		3012	ErrAirPress2 (L)				
		3013	ErrAirTemp (L)				
1014	SubstGasPress			5014	SubstOrLastGasPress		
1015	SubstGasDeltaPress	3015	ErrGasTemp	5015	SubstOrLastGasDeltaP		
1016	SubstVent1DeltaPress (L)			5016	SubstOrLastVent1DP (L)		
1017	SubstVent2DeltaPress (L)			5017	SubstOrLastVent2DP (L)		
1018	SubstMeasuredPower (L)			5018	SubstOrLastMeasPower (L)		
		3019	ErrGasPress				
		3020	ErrGasDeltaPress				
		3021	ErrVent1DeltaPress (L)				
		3022	ErrVent2DeltaPress (L)				
		3023	ErrMeasPower (L)				
1024	SubstMeasGasQuality			5024	SubstOrLastGasQy		
		3029	ErrMeasGasQuality				
		3030	ErrZeroGasDeltaP				
		3031	ErrLowGasDeltaP				
		3032	ErrHighGasDeltaP				
		3033	ErrLowGasPress				
		3034	ErrHighGasPress				

Parameter		Measurements		Functions		Curves	
		3035	ErrLowGasTemp				
		3036	ErrHighGasTemp				
		3037	ErrLowPowerSupply				
		3038	ErrHighPowerSupply				
		3039	ErrGasFlowDeviation (G)				
				5040	HoldOrResetSetp1Ext (G)		
				5046	HoldOrResetAirPress1 (L)		
				5047	HoldOrResetAirPress2 (L)		
				5048	HoldOrResetAirTemp (L)		
		3050	ErrFeedback	5050	HoldOrResetGasTemp		
		3053	ErrActuatorDiff				
				5054	HoldOrResetGasPress		
				5055	HoldOrResetGasDeltaP		
				5056	HoldOrResetVent1DP (L)		
				5057	HoldOrResetVent2DP (L)		
				5058	HoldOrResetMeasPower (L)		
		3060	ErrAmplifier				
				5064	HoldOrResetMeasGasQy		
		3070	ErrCanBus				
		3071	ErrCanComm				
		3076	ErrParamStore				
		3077	ErrProgramTest				
		3078	ErrRAMTest				
		3081	Err5V_Ref				
		3085	ErrVoltage				
		3087	ErrMainCheckSum				
		3089	ErrMasterFatal				
		3090	ErrData				
		3092	ErrConfiguration				
		3093	ErrStack				
		3094	ErrIntern				
		3099	EEPROMErrorCode				
		3101	SErrPickUp (L)	5100	NoStoreSErrOn		
		3104	SErrOverSpeed (L)				
		3105	SErrSetpointExtern				
		3111	SErrAirPress1 (L)				
		3112	SErrAirPress2 (L)				
		3113	SErrAirTemp (L)				
		3115	SErrGasTemp				
		3119	SErrGasPress				
		3120	SErrGasDeltaPress				
		3121	SErrVent1DeltaPress (L)				
		3122	SErrVent2DeltaPress (L)				
		3123	SErrMeasPower (L)				
		3129	SErrMeasGasQuality				
		3130	SErrZeroGasDeltaP				
		3131	SErrLowGasDeltaP				
		3132	SErrHighGasDeltaP				
		3133	SErrLowGasPress				
		3134	SErrHighGasPress				
		3135	SErrLowGasTemp				
		3136	SErrHighGasTemp				
		3137	SErrLowPowerSupply				
		3138	SErrHighPowerSupply				
		3139	SErrGasFlowDeviation (G)				
		3150	SErrFeedback				
		3153	SErrActuatorDiff				

Parameter		Measurements		Functions		Curves	
		3160	SErrAmplifier				
		3170	SErrCanBus				
		3171	SErrCanComm				
		3176	SErrParamStore				
		3177	SErrProgramTest				
		3178	SErrRAMTest				
		3181	SErr5V_Ref				
		3185	SErrVoltage				
		3189	SErrMasterFatal				
		3190	SErrData				
		3192	SErrConfiguration				
		3193	SErrStack				
		3194	SErrIntern				
		3195	SExceptionNumber				
		3196	SExceptionAddrLow				
		3197	SExceptionAdrrHigh				
		3198	SExceptionFlag				
1300	GMUPosSetpointPC	3300	MeasElectricalPower (L)	5300	GMUPosSetpointPCOn		
1301	GMUFlowSetpointPC (G)	3301	EngineThermalPower (L)	5301	GMUFlowSetpointPCOn (G)		
1301	LambdaSetpointPC (L)			5301	LamdaSetpointPCOn (L)		
		3302	GasFlowThermalPower (L)	5302	ExtOrIntLambdaSetp (L)		
1303	NormGasGravity	3303	LambdaSetpoint (L)	5303	GasQualityInputOn		
		3303	NormGasFlowSetp (G)				
		3304	GasQuality	5304	AirPressSensorOn (L)		
		3305	NormGasGravity (G)	5305	SpeedOverCanOn (L)		
		3306	GasGravity	5306	MeasPowerOverCanOn (L)		
		3307	GasVelocity				
		3308	GasFlow				
		3309	NormGasFlow				
1310	GasMeteringHolesArea (L)	3310	GasVelocityHoles (L)				
		3311	HolesCorrFactor (L)				
		3312	HolesDeltaPressure (L)				
1315	ThroadArea (L)	3315	Throat1DeltaPressure (L)	5315	TwoOrOneGasMixer (L)		
		3316	AirPressure1 (L)				
		3317	AirGravity1 (L)				
		3318	Throat1Velocity (L)				
		3319	Throat1CorrFactor (L)				
1320	AFRAtStoichiometry (L)	3320	AirFlow1 (L)				
1321	LambdaFilter (L)	3321	MixFlow1 (L)				
1322	LambdaGovGain (L)						
1322	GasFlowGovGain (G)						
1323	LamdaGovStability (L)						
1323	GasFlowGovStability (G)						
1324	LambdaGovDerivative (L)						
1324	GasFlowGasDerivative (G)						
		3325	Throat2DeltaPressure (L)				
		3326	AirPressure2 (L)				
		3327	AirGravity2 (L)				
		3328	Throat2Velocity (L)				
		3329	Throat2CorrFactor (L)				
		3330	AirFlow2 (L)				
		3331	MixFlow2 (L)				
		3335	AirFlow (L)				
		3336	MixFlow (L)				
		3337	AirFuelRatio (L)				
		3338	AFRAtStoichiometry (L)				
		3339	Lambda (L)				

Parameter		Measurements		Functions		Curves	
1340	GasFlowHeatingValue (L)	3340	ClosedLoopActive (L)	5340	AFRClosedOrOpenLoop (L)		
1341	ClosedLoopPowerMin (L)	3341	GasLowHeatingValue (L)				
1342	ClosedLoopGov:I (L)	3342	ClosedLoopGasFlow (L)				
		3343	ClosedLoopAirFlow (L)				
		3344	ClosedLoopAirFuelRat (L)				
		3345	ClosedLoopLambda (L)				
		3346	ClosedLoopLambdaTrim (L)	5346	LambdaPIDCorrOn (L)		
		3347	LambdaPIDCorr (L)				
1350	GasZeroDeltaPLimit						
1351	GasDeltaPressureMin						
1352	GasDeltaPressureMax						
1353	GasPressureMin						
1354	GasPressureMax						
1355	GasTemperatureMin						
1356	GasTemperatureMax						
1359	ThresholdDelay						
1360	GasFlowDevLimit (G)						
1361	GasFlowDevDelay (G)						
1362	GasFlowDevSetDelay (G)						
1363	GasFlowDevResetDelay (G)						
1510	AnalogIn1_RefLow	3510	AnalogIn1	5510	AnalogIn1_Type		
1511	AnalogIn1_RefHigh	3511	AnalogIn1_Value				
1512	AnalogIn1_ErrorLow						
1513	AnalogIn1_ErrorHigh						
1514	AnalogIn1_Filter						
1520	AnalogIn2_RefLow	3520	AnalogIn2	5520	AnalogIn2_Type		
1521	AnalogIn2_RefHigh	3521	AnalogIn2_Value				
1522	AnalogIn2_ErrorLow						
1523	AnalogIn2_ErrorHigh						
1524	AnalogIn2_Filter						
1530	AnalogIn3_RefLow	3530	AnalogIn3	5530	AnalogIn3_Type		
1531	AnalogIn3_RefHigh	3531	AnalogIn3_Value				
1532	AnalogIn3_ErrorLow						
1533	AnalogIn3_ErrorHigh						
1534	AnalogIn3_Filter						
		3540	TempIn (L)				
		3541	TempIn_Value (L)				
1542	TempIn_ErrorLow						
1543	TempIn_ErrorHigh						
1544	TempIn_Filter						
1550	IntAnaIn1_RefLow	3550	IntAnalogIn1				
1551	IntAnaIn1_RefHigh	3551	IntAnalogIn1_Value				
1552	IntAnaIn1_ErrorLow						
1553	IntAnaIn1_ErrorHigh						
1554	IntAnaIn1_Filter						
1555	IntAnaIn2_RefLow	3555	IntAnalogIn2				
1556	IntAnaIn2_RefHigh	3556	IntAnalogIn2_Value				
1557	IntAnaIn2_ErrorLow						
1558	IntAnaIn2_ErrorHigh						
1559	IntAnaIn2_Filter						
1560	IntAnaIn3_RefLow (L)	3560	IntAnalogIn3 (L)				
1561	IntAnaIn3_RefHigh (L)	3561	IntAnalogIn3_Value (L)				
1562	IntAnaIn3_ErrorLow (L)						
1563	IntAnaIn3_ErrorHigh (L)						
1564	IntAnaIn3_Filter (L)						
1565	IntAnaIn4_RefLow (L)	3565	IntAnalogIn4 (L)				
1566	IntAnaIn4_RefHigh (L)	3566	IntAnalogIn4_Value (L)				

Parameter		Measurements		Functions		Curves	
1567	IntAnaIn4_ErrorLow (L)						
1568	IntAnaIn4_ErrorHigh (L)						
1569	IntAnaIn4_Filter (L)						
1570	IntAnaIn5_RefLow (L)	3570	IntAnalogIn5 (L)				
1571	IntAnaIn5_RefHigh (L)	3571	IntAnalogIn5_Value (L)				
1572	IntAnaIn5_ErrorLow (L)						
1573	IntAnaIn5_ErrorHigh (L)						
1574	IntAnaIn5_Filter (L)						
1575	IntAnaIn6_RefLow (L)	3575	IntAnalogIn6 (L)				
1576	IntAnaIn6_RefHigh (L)	3576	IntAnalogIn6_Value (L)				
1577	IntAnaIn6_ErrorLow (L)						
1578	IntAnaIn6_ErrorHigh (L)						
1579	IntAnaIn6_Filter (L)						
		3590	IntTempIn1 (L)				
		3591	IntTempIn1_Value (L)				
1592	IntTempIn1_ErrorLow (L)						
1593	IntTempIn1_ErrorHigh (L)						
1594	IntTempIn1_Filter (L)						
		3600	PowerSupply				
		3603	5V_Ref				
1640	CurrentOut1_Assign						
1641	CurrentOut1_RefLow						
1642	CurrentOut1_RefHigh						
1643	CurrentOut1_ValueMin						
1644	CurrentOut1_Value1Max						
1645	CurrentOut2_Assign						
1646	CurrentOut2_RefLow						
1647	CurrentOut2_RefHigh						
1648	CurrentOut2_ValueMin						
1649	CurrentOut2_Value1Max						
1700	PositionerSetpoint			5700	PositionerOn		
1701	PositionerAmplitude			5701	PositionerMode		
1702	PositionerFrequency						
1800	Level	3800	EmergencyAlarm				
		3801	CommonAlarm				
		3802	EngineStop				
		3803	EngineStopped				
		3804	EngineStarting (L)				
		3805	EngineRunning				
		3806	EngineReleased				
		3807	MasterStopRequest (L)				
		3808	SystemRunning (L)				
		3830	Phase				
		3840	HardwareVersion				
		3841	AddHardwareVersion				
		3842	SoftwareVersion				
		3843	BootSoftwareVersion				
		3844	SerialDate				
		3845	SerialNumber				
		3850	Identifier				
		3851	LastIdentifier				
						7860	SensorIn2:Nm³/h(x) (L)
		3865	CalculationTime				
		3870	Timer				
		3871	OperatingHourMeter				
		3872	OperatingSecondMeter				

Parameter		Measurements		Functions		Curves	
1876	ValueStep						
		3895	RAMTestAddr				
		3896	RAMTestPattern				
		3897	CStackTestFreeBytes				
		3898	IStackTestFreeBytes				
1900	FeedbackAdjustTime						
1905	ServoCorrFactor	3905	ServoPIDCorr				
1906	ServoCorrRange						
				5910	ActuatorOn		
1911	ServoGain			5911	Amplifier2QOr4Q		
1912	ServoStability						
1913	ServoDerivative						
1914	ServoAcceleration						
		3916	ServoCurrentSetpoint				
1917	ServoCurrentMax						
1918	ServoCurrentRed						
1919	ServoCurrentAdjust						
1920	ServoCurrentPC			5920	ServoCurrentPCOn		
1950	FeedbackRefLow	3950	Feedback	5950	FeedbDigitalOrAnalog		
1951	FeedbackRefHigh			5951	FeedbSlopeFallOrRise		
1952	FeedbackErrorLow			5952	FeedbackLinearOn		
1953	FeedbackErrorHigh						
1955	FeedbackReference	3955	FeedbackReference				
1956	FeedbackRefErrLow						
1957	FeedbackRefErrHigh						
		3960	FeedbackCorrection				
						7980	Feedback:digit(x)
						8000	Feedback:Pos(x)
						9100	ElPowToThPow:Pel(x) (L)
						9110	ElPowToThPow:Pth(x) (L)
						9120	LambdaMap:n(x) (L)
						9130	LambdaMap:ThPow(x) (L)
						9140	LambdaMap:Lambda(x) (L)
						9260	GasPosToArea:Pos(x)
						9300	GasPosToArea:Area(x)
						9350	GasVelToCorr:Vel(x) (L)
						9370	GasVelToCorr:Corr(x) (L)
						9400	ThrCorrMap:AirDP(x) (L)
						9420	ThrCorrMap:AP1(x) (L)
						9440	ThrCorrMap:Corr(x) (L)
						9550	PowToPIDCorr:Pth(x) (L)
						9560	PowToPIDCorr:Corr(x) (L)
						9600	GasQty:Input(x)
						9620	GasQty:Gravity(x)
						9640	GasQty:AFRStoich(x) (L)
						9660	GasQty:LHV(x) (L)

19.2 List 1: Parameters

No.	Name		Signification
1	**TeethPickUp**		*Only with Lambda Control*
	Level: Range: Page(s):	4 1..400 	Number of teeth of the measuring wheel for speed pickup
10	**SpeedMin**		*Only with Lambda Control*
	Level: Range: Page(s):	2 0..4000 rpm 	Minimum speed
12	**SpeedMax**		*Only with Lambda Control*
	Level: Range: Page(s):	2 0..4000 rpm 	Maximum speed
21	**SpeedOver**		*Only with Lambda Control*
	Level: Range: Page(s):	4 0..4000 rpm 75	Speed trip for emergency stop in case of overspeed
250	**StartTyp**		*Only with Lambda Control*
	Level: Range: Page(s):	3 1..2 73	Type of starting fuel adjustment: 1: Fixed starting fuel 2: Variable starting fuel
251	**LimitsDelay**		*Only with Lambda Control*
	Level: Range: Page(s):	3 0..100 s 73	Delay time for enabling boundary functions. This time starts running when the governor detects engine start-off
255	**StartSpeed1**		*Only with Lambda Control*
	Level: Range: Page(s):	3 0..4000 rpm 72, 73	Minimum speed above which engine is recognized as being cranked (beginning of starting phase 1)
256	**StartSpeed2**		*Only with Lambda Control*
	Level: Range: Page(s):	3 0..4000 rpm 72, 73	Minimum speed above which engine is recognized to be running.
260	**StartFuel1**		*Only with Lambda Control*
	Level: Range: Page(s):	3 0..100 % 73	Starting fuel 1
261	**StartFuel2**		*Only with Lambda Control*
	Level: Range: Page(s):	3 0..100 % 73	Starting fuel 2 (needed only for start type)
265	**StartDuration1**		*Only with Lambda Control*
	Level: Range: Page(s):	3 0..100 s 73	Holding time for operation with starting fuel 1 (required only for start type 2)
266	**StartDuration2**		*Only with Lambda Control*
	Level: Range: Page(s):	3 0..100 s 73	Time during which fuel is increased linearly from 260 *StartFuel1* to 261 *StartFuel2* (required only for start type 2)

No.	Name		Signification
310	**ActPosSecureMin**		
	Level: Range: Page(s):	6 0..100 %	Minimum actuator position to protect actuator against mechanical and thermal overload (approx. 3 %)
312	**ActPosSecureMax**		
	Level: Range: Page(s):	6 0..100 %	Maximum actuator position to protect actuator against mechanical and thermal overload (approx. 97 %)
400	**CanStartTimeOutDelay**		
	Level: Range: Page(s):	6 0..100 s	Delay time of monitoring of CAN connection after reset
401	**CanRxTimeOut**		
	Level: Range: Page(s):	6 0..100 s	For KRONOS 30M, timeout monitoring time of CAN-communication with HELENOS
402	**CanMyNodeNumber**		
	Level: Range: Page(s):	6 1..31 67	Own node number in CAN network
403	**CanTxNodeNumber**		
	Level: Range: Page(s):	6 1..31 67	For KRONOS 30M, node number of HELENOS control unit in HZM CAN network
410	**CanPrescaler**		
	Level: Range: Page(s):	6 0..63	Prescaler of HZM CAN baud rate if 4416 *CanSegmentOrBaudrate* = 1
411	**CanSyncJumpWidth**		
	Level: Range: Page(s):	6 0..3	Synchronizier jumping distance of HZM CAN baud rate if 4416 *CanSegmentOrBaudrate* = 1
412	**CanSamplingMode**		
	Level: Range: Page(s):	6 0..1	Sampling mode of HZM CAN baud rate if 4416 *CanSegmentOrBaudrate* = 1
413	**CanPhaseSegment1**		
	Level: Range: Page(s):	6 0..7	Phase segment 1 of HZM CAN baud rate if 4416 *CanSegmentOrBaudrate* = 1
414	**CanPhaseSegment2**		
	Level: Range: Page(s):	6 0..7	Phase segment 2 of HZM CAN baud rate if 4416 *CanSegmentOrBaudrate* = 1
415	**CanProbSegment**		*Only with Lambda Control*
	Level: Range: Page(s):	6 0..7	Propagation segment for HZM CAN baud rate if 4416 *CanSegmentOrBaudrate* = 1

No.	Name		Signification
416	**CanBaudrate**		*Only with Lambda Control*
	Level:	4	HZM CAN baud rate if
	Range:	125..1000	4416 *CanSegmentOrBaudrate* = 1
	Page(s):	67	
440	**CanActPosSendRate**		*Only with Lambda Control*
	Level:	6	For KRONOS 30M, send rate of ELEKTRA actuator
	Range:	0..100 s	position to HELENOS via CAN
	Page(s):	67	
711	**FuelLimitMaxAbsolut**		
	Level:	4	Absolute limitation of actuator travel
	Range:	0..100 %	
	Page(s):	73	
900	**AssignIn_SetpExt**		
	Level:	6	Input configuration of external setpoint to chanel x:
	Range:	0..4	assignment = 0: not used
	Page(s):	43	
906	**AssignIn_AirPress1**		*Only with Lambda Control*
	Level:	6	Input configuration of air pressure sensor before venturi
	Range:	0..4	mixer to chanel x:
	Page(s):		assignment = 0: not used
907	**AssignIn_AirPress2**		*Only with Lambda Control*
	Level:	6	Input configuration of air pressure sensor before venturi
	Range:	0..4	mixer at bank 2 to chanel x:
	Page(s):		assignment = 0: not used
916	**AssignIn_Vent1Dpress**		*Only with Lambda Control*
	Level:	6	Input configuration of venturi delta pressure sensor to
	Range:	0..4	chanel x:
	Page(s):		assignment = 0: not used
917	**AssignIn_Vent2Dpress**		*Only with Lambda Control*
	Level:	6	Input configuration of venturi delta pressure sensor at
	Range:	0..4	bank 2 to chanel x:
	Page(s):		assignment = 0: not used
918	**AssignIn_MeasPower**		*Only with Lambda Control*
	Level:	6	Input configuration of external load signal to chanel x:
	Range:	0..4	assignment = 0: not used
	Page(s):		
924	**AssignIn_MeasGasQty**		
	Level:	4	Input configuration of external gas quality sensor to
	Bereich:	0..4	chanel x:
	Seite(n):		assignment = 0: not used
950	**SetpExtLow**		
	Level:		Minimum value of external setpoint
	Range:		
	Page(s):	45	
951	**SetpExtHigh**		
	Level:		Maximum value of external setpoint
	Range:		
	Page(s):	45	

No.	Name		Signification
966	**AirPress1Low**		*Only with Lambda Control*
	Level:	4	Minimum value of air pressure sensor before venturi mixer
	Range:	0..5 bar	
	Page(s):	45	
967	**AirPress1High**		*Only with Lambda Control*
	Level:	4	Maximum value of air pressure sensor before venturi mixer
	Range:	0..5 bar	
	Page(s):	45	
968	**AirPress2Low**		*Only with Lambda Control*
	Level:	4	Minimum value of air pressure sensor before venturi mixer at bank 2
	Range:	0..5 bar	
	Page(s):	45	
969	**AirPress2High**		*Only with Lambda Control*
	Level:	4	Maximum value of air pressure sensor before venturi mixer at bank 2
	Range:	0..5 bar	
	Page(s):	45	
978	**GasPressLow**		
	Level:	4	Minimum value of gas pressure sensor at input
	Range:	0..5 bar	
	Page(s):	45	
979	**GasPressHigh**		
	Level:	4	Maximum value of gas pressure sensor at input
	Range:	0..5 bar	
	Page(s):	45	
980	**GasDeltaPressLow**		
	Level:	4	Minimum value of gas delta pressure sensor
	Range:	0..5000 mbar	
	Page(s):	45	
981	**GasDeltaPressHigh**		
	Level:	4	Maximum value of gas delta pressure sensor
	Range:	0..5000 mbar	
	Page(s):	45	
982	**Vent1DeltaPressLow**		*Only with Lambda Control*
	Level:	4	Minimum value of venturi delta pressure sensor
	Range:	0..5000 mbar	
	Page(s):	45	
983	**Vent1DeltaPressHigh**		*Only with Lambda Control*
	Level:	4	Maximum value of venturi delta pressure sensor
	Range:	0..5000 mbar	
	Page(s):	45	
984	**Vent2DeltaPressLow**		*Only with Lambda Control*
	Level:	4	Minimum value of venturi delta pressure sensor at bank 2
	Range:	0..5000 mbar	
	Page(s):	45	
985	**Vent2DeltaPressHigh**		*Only with Lambda Control*
	Level:	4	Maximum value of venturi delta pressure sensor at bank 2
	Range:	0..5000 mbar	
	Page(s):	45	

No.	Name		Signification
986	**MeasPowerSensorLow**		*Only with Lambda Control*
	Level:	4	Minimum value of power sensor
	Range:	0..2500 kW	
	Page(s):	45	
987	**MeasPowerSensorHigh**		*Only with Lambda Control*
	Level:	4	Maximum value of power sensor
	Range:	0..2500 kW	
	Page(s):	45	
998	**MeasGasQualityLow**		
	Level:	4	Minimum value of external gas quality sensor
	Range:	0..100 %	
	Page(s):	45	
999	**MeasGasQualityHigh**		
	Level:	4	Maximum value of external gas quality sensor
	Range:	0..100 %	
	Page(s):	45	
1000	**SubstSetpExt**		
	Level:	2	Substitute value for external setpoint in case of failure
	Range:	0..100 %	
	Page(s):	46	
1006	**SubstAirPress1**		*Only with Lambda Control*
	Level:	4	Substitute value for air pressure before venturi mixer in case of failure
	Range:	0..5 bar	
	Page(s):	46	
1007	**SubstAirPress2**		*Only with Lambda Control*
	Level:	4	Substitute value for air pressure before venturi mixer at bak 2 in case of failure
	Range:	0..5 bar	
	Page(s):	46	
1008	**SubstAirTemp**		*Only with Lambda Control*
	Level:	4	Substitute value for air temperature in case of failure
	Range:	-100..1000 °C	
	Page(s):	46	
1010	**SubstGasTemp**		
	Level:	4	Substitute value for gas temperature in case of failure
	Range:	-100..1000 °C	
	Page(s):	46	
1014	**SubstGasPress**		
	Level:	4	Substitute value for gas pressure in case of failure
	Range:	0..5 bar	
	Page(s):	46	
1015	**SubstGasDeltaPress**		
	Level:	4	Substitute value for gas delta pressure in case of failure
	Range:	0..5000 mbar	
	Page(s):	46	
1016	**SubstVent1DeltaPress**		*Only with Lambda Control*
	Level:	4	Substitute value for venturi delta pressure in case of failure
	Range:	0..5000 mbar	
	Page(s):	46	

No.	Name	Signification
1017	**SubstVent2DeltaPress** Level: 4 Range: 0..5000 mbar Page(s): 46	*Only with Lambda Control* Substitute value for venturi delta pressure at bank 2 in case of failure
1018	**SubstMeasuredPower** Level: 4 Range: 0..2500 kW Page(s): 46	*Only with Lambda Control* Substitute value for measured power in case of failure
1024	**SubstMeasGasQuality** Level: 4 Range: 0..100 % Page(s): 46	Substitute value for gas quality in case of failure
1300	**GMUPosSetpointPC** Level: 6 Range: 0..100 % Page(s): 57, 60	GMU positioner setpoint via DcDesk2000, active if 5300 *GMUPosSetointPCOn* = 1
1301	**GMUFlowSetpointPC** Level: 6 Range: 0..5000 Nm³/h Page(s): 57, 69	*Only with Gas Flow Control* GMU flow setpoint via DcDesk2000, active if 5301 *GMUFlowSetpointPCOn* = 1 and 5300 *GMUPosSetointPCOn* = 0
1303	**NormGasGravity** Level: 4 Range: 0,5..3 kg/Nm³ Page(s): 58, 70, 74	Gas density in kg/Nm³ (fill in at test on test bench with air 1.29 kg/Nm³)
1310	**GasMeteringHolesArea** Level: 4 Range: 100..10000 mm² Page(s):	*Only with Lambda Control* Total area of gas holes in mixer insert
1315	**ThroatArea** Level: 4 Range: 300..30000 mm² Page(s):	*Only with Lambda Control* Effective throat area of mixer insert
1320	**AFRAtStoichiometry** Level: 4 Range: 0..40 Nm³/Nm³ Page(s): 70, 75	*Only with Lambda Control* Stoichiometric mixing ratio
1321	**LambdaFilter** Level: 4 Range: 1..255 Page(s):	*Only with Lambda Control* Filter of lambda measuring
1322	**LambdaGovGain** Level: 4 Range: 0..100 % Page(s): 70	*Only with Lambda Control* Proportional factor for lambda control
1322	**GasFlowGovGain** Level: 4 Range: 0..100 % Page(s): 58	*Only with Gas Flow Control* Proportional factor for gas flow control

No.	Name		Signification
1323	**LambdaGovStability**		*Only with Lambda Control*
	Level:	4	Stability factor for lambda control
	Range:	0..100 %	
	Page(s):	70	
1323	**GasFlowGovStability**		*Only with Gas Flow Control*
	Level:	4	Stability factor for gas flow control
	Range:	0..100 %	
	Page(s):	58	
1324	**LambdaGovDerivative**		*Only with Lambda Control*
	Level:	4	Derivative factor for lambda control
	Range:	0..100 %	
	Page(s):	70	
1324	**GasFlowGovDerivative**		*Only with Gas Flow Control*
	Level:	4	Derivative factor for gas flow control
	Range:	0..100 %	
	Page(s):	58	
1340	**GasLowHeatingValue**		*Only with Lambda Control*
	Level:	4	Low heating value
	Range:	5.. 100 MJ/Nm³	
	Page(s):	70, 75	
1341	**ClosedLoopPowerMin**		*Only with Lambda Control*
	Level:	4	Minimum electrical power for closed loop control
	Range:	0..2500 kW	
	Page(s):	75	
1342	**ClosedLoopGov:I**		*Only with Lambda Control*
	Level:	4	Integral factor for closed loop control
	Range:	0..100 %	
	Page(s):	75	
1350	**GasZeroDeltaPLimit**		
	Level:	4	Low limit value of gas delta pressure for ELEKTRA zero pressure monitoring
	Range:	0..5000 mbar	
	Page(s):	60, 61, 75	
1351	**GasDeltaPressureMin**		
	Level:	4	Low reference value (default) of gas delta pressure monitoring
	Range:	0..5000 mbar	
	Page(s):	62, 76	
1352	**GasDeltaPressureMax**		
	Level:	4	High reference value (default) of gas delta pressure monitoring
	Range:	0..5000 mbar	
	Page(s):	62, 76	
1353	**GasPressureMin**		
	Level:	4	Low reference value (default) of gas pressure monitoring
	Range:	0..5 bar	
	Page(s):	62, 76	
1354	**GasPressureMax**		
	Level:	4	High reference value (default) of gas pressure monitoring
	Range:	0..5 bar	
	Page(s):	63, 77	

No.	Name		Signification
1355	**GasTemperatureMin**		
	Level:	4	Low reference value (default) of gas temperature monitoring
	Range:	-100..1000 °C	
	Page(s):	63, 77	
1356	**GasTemperatureMax**		
	Level:	4	High reference value (default) of gas temperature monitoring
	Range:	-100..1000 °C	
	Page(s):	63, 77	
1359	**ThresholdDelay**		
	Level:	4	Delay time for gas delta pressure, gas pressure, gas temperature and power supply monitoring
	Range:	0..100 s	
	Page(s):	61, 62, 63, 75	
1360	**GasFlowDevLimit**		*Only with Gas Flow Control*
	Level:	4	Limit value of gas flow deviation monitoring
	Range:		|current gas flow – gas flow setpoint| > parameter 1360
	Page(s):	62, 63, 76	-> alarm
1361	**GasFlowDevDelay**		*Only with Gas Flow Control*
	Level:	4	Limit value of gas flow deviation monitoring
	Range:		|current gas flow – flow setpoint| > 1361 *GasFlowLimit*
	Page(s):	64	⇒ Alarm
1362	**PressSensorDevLimit**		*Only with Lambda Control*
	Level:	4	Error setting delay time of gas flow deviation monitoring
	Range:	0..5000 mbar	
	Page(s):	64	
1363	**PressSensorDevDelay**		*Only with Lambda Control*
	Level:	4	Error reset delay time of gas flow deviation monitoring
	Range:	0..100 s	
	Page(s):	64	
1510	**AnalogIn1_RefLow**		
	Level:	4	Low reference value of analogue input 1
	Range:	0..22,7 mA	
	Page(s):	47, 50	
1511	**AnalogIn1_RefHigh**		
	Level:	4	High reference value of analogue input 1
	Range:	0..22,7 mA	
	Page(s):	47, 50	
1512	**AnalogIn1_ErrorLow**		
	Level:	4	Low error limit of analogue input 1
	Range:	0..22,7 mA	
	Page(s):	48, 50	
1513	**AnalogIn1_ErrorHigh**		
	Level:	4	High error limit of analogue input 1
	Range:	0..22,7 mA	
	Page(s):	48, 50	
1514	**AnalogIn1_Filter**		
	Level:	4	Filter value of analogue input 1
	Range:	1..255	
	Page(s):	48, 50	

No.	Name		Signification
1520	**AnalogIn2_RefLow**		
	Level:	4	Low reference value of analogue input 2
	Range:	0..5 V	
	Page(s):	47, 50	
1521	**AnalogIn2_RefHigh**		
	Level:	4	High reference value of analogue input 2
	Range:	0..5 V	
	Page(s):	47, 50	
1522	**AnalogIn2_ErrorLow**		
	Level:	4	Low error limit of analogue input 2
	Range:	0..5 V	
	Page(s):	48, 50	
1523	**AnalogIn2_ErrorHigh**		
	Level:	4	High error limit of analogue input 2
	Range:	0..5 V	
	Page(s):	48, 50	
1524	**AnalogIn2_Filter**		
	Level:	4	Filter value of analogue input 2
	Range:	1..255	
	Page(s):	48, 50	
1530	**AnalogIn3_RefLow**		
	Level:	4	Low reference value of analogue input 3
	Range:	0..5 V	
	Page(s):	47, 50	
1531	**AnalogIn3_RefHigh**		
	Level:	4	High reference value of analogue input 3
	Range:	0..5 V	
	Page(s):	47, 50	
1532	**AnalogIn3_ErrorLow**		
	Level:	4	Low error limit of analogue input 3
	Range:	0..5 V	
	Page(s):	48, 50	
1533	**AnalogIn3_ErrorHigh**		
	Level:	4	High error limit of analogue input 3
	Range:	0..5 V	
	Page(s):	48, 50	
1534	**AnalogIn3_Filter**		
	Level:	4	Filter value of analogue input 3
	Range:	1..255	
	Page(s):	48, 50	
1542	**TempIn_ErrorLow**		
	Level:	4	Low error limit of temperature input, used for inlet manifold temperature as standard
	Range:	0..65472	
	Page(s):	48, 50	
1543	**TempIn_ErrorHigh**		
	Level:	4	High error limit of temperature input
	Range:	0..65472	
	Page(s):	48, 50	

No.	Name		Signification
1544	**TempIn_Filter**		
	Level:	4	Filter value of temperature input
	Range:	1..255	
	Page(s):	50	
1550	**IntAnaIn1_RefLow**		
	Level:	4	Low reference value of internal analogue input 1,
	Range:	0..5 V	approx. 0.5 V
	Page(s):	47, 50	(for gas pressure sensor)
1551	**IntAnaIn1_RefHigh**		
	Level:	4	High reference value of internal analogue input 1,
	Range:	0..5 V	approx. 4.5 V
	Page(s):	47, 50	(for gas pressure sensor)
1552	**IntAnaIn1_ErrorLow**		
	Level:	4	Low error limit of internal analogue input 1
	Range:	0..5 V	(for gas pressure sensor)
	Page(s):	48, 50	
1553	**IntAnaIn1_ErrorHigh**		
	Level:	4	High error limit of internal analogue input 1
	Range:	0..5 V	(for gas pressure sensor)
	Page(s):	48, 50	
1554	**IntAnaIn1_Filter**		
	Level:	4	Filter value of internal analogue input 1
	Range:	1..255	(for gas pressure sensor)
	Page(s):	48, 50	
1555	**IntAnaIn2_RefLow**		
	Level:	4	Low reference value of internal analogue input 2,
	Range:	0..5 V	approx. 0.5 V
	Page(s):	47, 50	(for gas delta pressure sensor)
1556	**IntAnaIn2_RefHigh**		
	Level:	4	High reference value of internal analogue input 2,
	Range:	0..5 V	approx. 4.5 V
	Page(s):	47, 50	(for gas delta pressure sensor)
1557	**IntAnaIn2_ErrorLow**		
	Level:	4	Low error limit of internal analogue input 2
	Range:	0..5 V	(for gas delta pressure sensor)
	Page(s):	48, 50	
1558	**IntAnaIn2_ErrorHigh**		
	Level:	4	High error limit of internal analogue input 2
	Range:	0..5 V	(for gas delta pressure sensor)
	Page(s):	48, 50	
1559	**IntAnaIn2_Filter**		
	Level:	4	Filter value of internal analogue input 2
	Range:	1..255	(for gas delta pressure sensor)
	Page(s):	48, 50	
1560	**IntAnaIn3_RefLow**		*Only with Lambda Control*
	Level:	4	Low reference value of internal analogue input 3,
	Range:	0..5 V	approx. 0.5 V
	Page(s):	47, 50, 66	(for venturi delta pressure sensor)

No.	Name		Signification
1561	**IntAnaIn3_RefHigh**		*Only with Lambda Control*
	Level:	4	High reference value of internal analogue input 3,
	Range:	0..5 V	approx. 4.5 V,
	Page(s):	47, 50	(for venturi delta pressure sensor)
1562	**IntAnaIn3_ErrorLow**		*Only with Lambda Control*
	Level:	4	Low error limit of internal analogue input 3
	Range:	0..5 V	(for venturi delta pressure sensor)
	Page(s):	48, 50	
1563	**IntAnaIn3_ErrorHigh**		*Only with Lambda Control*
	Level:	4	High error limit of internal analogue input 3
	Range:	0..5 V	(for venturi delta pressure sensor)
	Page(s):	48, 50	
1564	**IntAnaIn3_Filter**		*Only with Lambda Control*
	Level:	4	Filter value of internal analogue input 3
	Range:	1..255	(for venturi delta pressure sensor)
	Page(s):	48, 50	
1565	**IntAnaIn4_RefLow**		*Only with Lambda Control*
	Level:	4	Low reference value of internal analogue input 4,
	Range:	0..5 V	approx. 0.5 V
	Page(s):	47, 50, 66	(for venturi delta pressure sensor at bank 2)
1566	**IntAnaIn4_RefHigh**		*Only with Lambda Control*
	Level:	4	High reference value of internal analogue input 4,
	Range:	0..5 V	approx. 4.5 V
	Page(s):	47, 50	(for venturi delta pressure sensor at bank 2)
1567	**IntAnaIn4_ErrorLow**		*Only with Lambda Control*
	Level:	4	Low error limit of internal analogue input 4
	Range:	0..5 V	(for venturi delta pressure sensor at bank 2)
	Page(s):	48, 50	
1568	**IntAnaIn4_ErrorHigh**		*Only with Lambda Control*
	Level:	4	High error limit of internal analogue input 4
	Range:	0..5 V	(for venturi delta pressure sensor at bank 2)
	Page(s):	48, 50	
1569	**IntAnaIn4_Filter**		*Only with Lambda Control*
	Level:	4	Filter value of internal analogue input 4
	Range:	1..255	(for venturi delta pressure sensor at bank 2)
	Page(s):	48, 50	
1570	**IntAnaIn5_RefLow**		*Only with Lambda Control*
	Level:	4	Low reference value of internal analogue input 5,
	Bereich:	0..5 V	approx. 0.5 V
	Seite(n):	47, 50, 66	(for air pressure sensor before venturi mixer)
1571	**IntAnaIn5_RefHigh**		*Only with Lambda Control*
	Level:	4	High reference value of internal analogue input 5,
	Bereich:	0..5 V	approx. 4.5 V
	Seite(n):	47, 50	(for air pressure sensor before venturi mixer)
1572	**IntAnaIn5_ErrorLow**		*Only with Lambda Control*
	Level:	4	Low error limit of internal analogue input 5
	Bereich:	0..5 V	(for air pressure sensor before of venturi mixer)
	Seite(n):	48	

No.	Name		Signification
1573	**IntAnaIn5_ErrorHigh**		*Only with Lambda Control*
	Level:	4	High error limit of internal analogue input 5
	Bereich:	0..5 V	(for air pressure sensor before venturi mixer)
	Seite(n):	48, 50	
1574	**IntAnaIn5_Filter**		*Only with Lambda Control*
	Level:	4	Filter value of internal analogue input 5
	Bereich:	1..255	(for air pressure sensor before venturi mixer)
	Seite(n):	48, 50	
1575	**IntAnaIn6_RefLow**		*Only with Lambda Control*
	Level:	4	Low reference value of internal analogue input 6,
	Bereich:	0..5 V	approx. 0.5 V
	Seite(n):	47, 50	(for air pressure sensor before venturi mixer at bank 2)
1576	**IntAnaIn6_RefHigh**		*Only with Lambda Control*
	Level:	4	High reference value of internal analogue input 6,
	Bereich:	0..5 V	approx. 4.5 V
	Seite(n):	47, 50	(for air pressure sensor before venturi mixer at bank 2)
1577	**IntAnaIn6_ErrorLow**		*Only with Lambda Control*
	Level:	4	Low error limit of internal analogue input 6
	Bereich:	0..5 V	(for air pressure sensor before venturi mixer at bank 2)
	Seite(n):	48, 50	
1578	**IntAnaIn6_ErrorHigh**		*Only with Lambda Control*
	Level:	4	High error limit of internal analogue input 6
	Bereich:	0..5 V	(for air pressure sensor before venturi mixer at bank 2)
	Seite(n):	48, 50	
1579	**IntAnaIn6_Filter**		*Only with Lambda Control*
	Level:	4	Filter value of internal analogue input 6
	Bereich:	1..255	(for air pressure sensor before venturi mixer at bank 2)
	Seite(n):	48, 50	
1592	**IntTempIn1_ErrorLow**		*Only with Lambda Control*
	Level:	4	Low error limit of internal temperature input 1,
	Range:		used for gas temperature sensor
	Page(s):	48, 50	
1593	**IntTempIn1_ErrorHigh**		*Only with Lambda Control*
	Level:	4	High error limit of internal temperature input 1,
	Range:	0..65472	used for gas temperature sensor
	Page(s):	48, 50	
1594	**IntTempIn1_Filter**		*Only with Lambda Control*
	Level:	4	Filter value of internal temperature input 1,
	Range:	0..65472	used for gas temperature sensor
	Page(s):	50	
1640	**CurrentOut1_Assign**		
	Level:	4	Function assignment to current output 1
	Range:	-9999..9999	
	Page(s):	51	
1641	**CurrentOut1_RefLow**		
	Level:	4	Minimum value of current output 1
	Range:	0..22,7 mA	
	Page(s):	53	

No.	Name		Signification
1642	**CurrentOut1_RefHigh**		
	Level:	4	Maximum value of current output 1
	Range:	0..22,7 mA	
	Page(s):	53	
1643	**CurrentOut1_ValueMin**		
	Level:	4	Minimum value for current output 1 by per cent of value range of output parameter
	Range:	0..100 %	
	Page(s):	52, 53	
1644	**CurrentOut1_ValueMax**		
	Level:	4	Maximum value at current output 1 by per cent of value range of output parameter
	Range:	0..100 %	
	Page(s):	52, 53	
1645	**CurrentOut2_Assign**		
	Level:	4	Function assignment to current output 2
	Range:	-9999..9999	
	Page(s):	51	
1646	**CurrentOut2_RefLow**		
	Level:	4	Minimum value of current output 2
	Range:	0..22,7 mA	
	Page(s):	53	
1647	**CurrentOut2_RefHigh**		
	Level:	4	Maximum value of current output 2
	Range:	0..22,7 mA	
	Page(s):	53	
1648	**CurrentOut2_ValueMin**		
	Level:	4	Minimum value at current output 2 by per cent of value range of output parameter
	Range:	0..100 %	
	Page(s):	52	
1649	**CurrentOut2_ValueMax**		
	Level:	4	Maximum value at current output 2 by per cent of value range of output parameter
	Range:	0..100 %	
	Page(s):	52	
1700	**PositionerSetpoint**		
	Level:	2	Setpoint for actuator position in positioner mode
	Range:	0..100 %	
	Page(s):		
1701	**PositionerAmplitude**		
	Level:	2	Amplitude of actuator travel jump generator in positioner mode
	Range:	0..20 %	
	Page(s):		
1702	**PositionerFrequency**		
	Level:	2	Frequency adjustment for positioning
	Range:	0..16 Hz	
	Page(s):		
1800	**Level**		
	Level:	1	User level
	Range:	1..7	
	Page(s):		

No.	Name		Signification
1876	**ValueStep**		
	Level:	2	Step width of value changes for Programmer PG 02
	Range:	0..65535	
	Page(s):		
1900	**FeedbackAdjustTime**		
	Level:	6	Position holding time during autocalibration
	Range:	0..100 s	
	Page(s):		
1905	**ServoCorrFactor**		
	Level:	6	Correction factor of PID values of servo circuit
	Range:	0..400 %	
	Page(s):		
1906	**ServoCorrRange**		
	Level:	6	Positioning range for correction factor
	Range:	0..50 %	
	Page(s):		
1911	**ServoGain**		
	Level:	6	Gain for servo circuit
	Range:	0..100 %	
	Page(s):		
1912	**ServoStability**		
	Level:	6	Stability for servo circuit
	Range:	0..100 %	
	Page(s):		
1913	**ServoDerivative**		
	Level:	6	Derivative for servo circuit
	Range:	0..100 %	
	Page(s):		
1914	**ServoAcceleration**		
	Level:	6	DD-factor for servo circuit
	Range:	0..100 %	
	Page(s):		
1917	**ServoCurrentMax**		
	Level:	6	Maximum current for actuator (when moving)
	Range:	0..12,5 A	
	Page(s):		
1918	**ServoCurrentRed**		
	Level:	6	Reduced current for steady state of actuator
	Range:	0..12,5 A	
	Page(s):		
1919	**ServoCurrentAdjust**		
	Level:	6	Current during autocalibration of actuator
	Range:	0..12,5 A	
	Page(s):		
1920	**ServoCurrentPC**		
	Level:	6	Current setpoint from PC
	Range:	-12.5..12.5 A	
	Page(s):		

No.	Name		Signification
1950	**FeedbackRefLow**		
	Level:	4	Low reference value for feedback
	Range:	0..65535	
	Page(s):		
1951	**FeedbackRefHigh**		
	Level:	4	High reference value for feedback
	Range:	0..65535	
	Page(s):		
1952	**FeedbackErrLow**		
	Level:	4	Low error value for feedback
	Range:	0..65535	
	Page(s):	89	
1953	**FeedbackErrHigh**		
	Level:	4	High error value for feedback
	Range:	0..65535	
	Page(s):	89	
1955	**FeedbackReference**		
	Level:	4	Reference value for reference coil
	Range:		
	Page(s):		
1956	**FeedbackRefErrLow**		
	Level:	4	Low error value for reference coil
	Range:	0..65535	
	Page(s):		
1957	**FeedbackRefErrHigh**		
	Level:	4	High error value for reference coil
	Range:	0..65535	
	Page(s):		

19.3 List 2: Measurements

No.	Name	Signification
2000	**Speed** Level: 1 Range: 0..4000 rpm Page(s): 52, 68, 72	*Only with Lambda Control* Current speed value
2001	**SpeedPickUp** Level: 1 Range: 0..4000 rpm Page(s):	*Only with Lambda Control* Current speed signal from speed pickup
2003	**SpeedPickUpValue** Level: 4 Range: 0..4000 rpm Page(s):	*Only with Lambda Control* Unfiltered speed signal from speed pickup
2300	**ActPos** Level: 1 Range: 0..100 % Page(s): 52	Current actuator position
2330	**ActPosSetpoint** Level: 1 Range: 0..100 % Page(s): 57, 69	Setpoint for actuator position
2401	**CanTxBufferState** Level: 1 Range: 0000..FFFF Hex Page(s):	*Only with Lambda Control* State of CAN sending buffer
2402	**CanRxBufferState** Level: 1 Range: 0000..FFFF Hex Page(s):	*Only with Lambda Control* State of CAN receiving buffer
2403	**CanRxTimeout** Level: 1 Range: 0000..FFFF Hex Page(s):	*Only with Lambda Control* State of CAN receiving timeout monitoring
2404	**CanTypeMismatch** Level: 1 Range: 0..1 Page(s):	*Only with Lambda Control* State of CAN unit number
2405	**CanOnline** Level: 1 Range: 0..1 Page(s):	*Only with Lambda Control* General state
2410	**CanDCNodeState31to16** Level: 6 Range: 0000..FFFF Hex Page(s):	*Only with Lambda Control* HZM CAN: activity display speed governor with node number 16..31
2411	**CanDCNodeState15to01** Level: 60000..FFFF Hex Range: Page(s):	*Only with Lambda Control* HZM CAN: activity display speed governor with node number 1..15

No.	Name		Signification
2424	**CanPCNodeState31to16**		*Only with Lambda Control*
	Level:	6	HZM CAN: activity display PC with node number 16..31
	Range:	0000..FFFF Hex	
	Page(s):		
2425	**CanPCNodeState15to01**		*Only with Lambda Control*
	Level:	6	HZM-CAN: activity display PC with node number 1..15
	Range:	0000..FFFF Hex	
	Page(s):		
2702	**FuelLimitStart**		*Only with Lambda Control*
	Level:	1	Fuel limit as determined by starting fuel limitation
	Range:	0..100 %	
	Page(s):		
2703	**FuelLimitSpeed**		*Only with Lambda Control*
	Level:	1	Fuel limit as determined by speed dependent fuel limitation
	Range:	0..100 %	
	Page(s):		
2710	**FuelLimitMinActive**		
	Level:	1	Indication that actuator position is at lower limit
	Range:	0..1	
	Page(s):		
2711	**FuelLimitMaxActive**		
	Level:	1	Indication that actuator position is at upper limit
	Range:	0..1	
	Page(s):		
2712	**StartLimitActive**		*Only with Lambda Control*
	Level:	1	Indication that actuator travel is limited by starting fuel limitation
	Range:	0..1	
	Page(s):		
2713	**SpeedLimitActive**		*Only with Lambda Control*
	Level:	1	Indication that actuator travel is limited by speed dependent fuel limitation
	Range:	0..1	
	Page(s):		
2810	**SwitchEngineStop**		
	Level:	1	Switch position of "Engine stop" switch
	Range:	0..1	
	Page(s):	59, 72	
2851	**DigitalOut1**		
	Level:	1	Condition of digital output 1
	Range:	0..1	
	Page(s):	54	
2852	**DigitalOut2**		
	Level:	1	Condition of digital output 2
	Range:	0..1	
	Page(s):	54	
2900	**SetpointExtern**		*Only with Gas Flow Control*
	Level:	1	Current value of external setpoint
	Range:	0..5000 Nm^3 / 0..2500	
	Page(s):	43, 44, 57, 61, 68	

No.	Name		Signification
2906	**AirPressure1**		*Only with Lambda Control*
	Level:	1	Current value of air pressure before venturi mixer
	Range:	0..5 bar	
	Page(s):	43, 65	
2907	**AirPressure2**		*Only with Lambda Control*
	Level:	1	Current value of air pressure before venturi mixer at bank 2
	Range:	0..5 bar	
	Page(s):	43, 65	
2908	**AirTemp**		*Only with Lambda Control*
	Level:	1	Current value of air temperature
	Range:	-100..1000 °C	
	Page(s):	43, 65	
2910	**GasTemp**		
	Level:	1	Current value of gas temperature
	Range:	-100..1000 °C	
	Page(s):	43, 56, 63, 65, 77	
2911	**Gas Quality**		
	Level:	1	Current value of gas quality
	Range:	0..100 % CH_4	
	Page(s):	59, 71	
2914	**GasPressure**		
	Level:	1	Current value of gas pressure
	Range:	0..5 bar	
	Page(s):	43, 56, 62, 65, 76	
2915	**GasDeltaPressure**		
	Level:	1	Current value of gas delta pressure
	Range:	0..5000 mbar	
	Page(s):	43, 56, 60, 61, 62, 65, 75	
2916	**Vent1DeltaPressure**		*Only with Lambda Control*
	Level:	1	Current value of venturi delta pressure
	Range:	0..5000 mbar	
	Page(s):	43, 65	
2917	**Vent2DeltaPressure**		*Only with Lambda Control*
	Level:	1	Current value of venturi delta pressure at bank 2
	Range:	0..5000 mbar	
	Page(s):	43, 65	
2918	**MeasuredPower**		*Only with Lambda Control*
	Level:	1	Current value of measured power
	Range:	0..2500 kW	
	Page(s):	43, 44	
2924	**MeasuredGasQuality**		
	Level:	1	Current value of gas quality
	Range:	0..100 %	
	Page(s):	43	
3000	**ConfigurationError**		
	Level:	1	Error code in software configuration
	Range:	0..65535	
	Page(s):		

No.	Name		Signification
3001	**ErrPickUp**		*Only with Lambda Control*
	Level:	1	Error indication of speed sensor
	Range:	0..1	
	Page(s):	84, 85	
3004	**ErrOverSpeed**		*Only with Lambda Control*
	Level:	1	Error indication due to overspeed
	Range:	0..1	
	Page(s):	84, 85	
3005	**ErrSetpointExtern**		*Only with Gas Flow Control*
	Level:	1	Error indication of external speed setpoint adjuster
	Range:	0..1	
	Page(s):	84, 86	
3011	**ErrAirPress1**		*Only with Lambda Control*
	Level:	1	Error indication of air pressure 1 sensor
	Range:	0..1	
	Page(s):	86	
3012	**ErrAirPress2**		*Only with Lambda Control*
	Level:	1	Error indication of air pressure 2 sensor
	Range:	0..1	
	Page(s):	86	
3013	**ErrAirTemp**		*Only with Lambda Control*
	Level:	1	Error indication of air temperature sensor
	Range:	0..1	
	Page(s):	86	
3015	**ErrGasTemp**		
	Level:	1	Error indication of gas temperature sensor
	Range:	0..1	
	Page(s):	86	
3019	**ErrGasPress**		
	Level:	1	Error indication of gas pressure sensor
	Range:	0..1	
	Page(s):	84, 86	
3020	**ErrGasDeltaPress**		
	Level:	1	Error indication of gas delta pressure sensor
	Range:	0..1	
	Page(s):	84, 86	
3021	**ErrVent1DeltaPress**		*Only with Lambda Control*
	Level:	1	Error indication of venturi delta pressure sensor
	Range:	0..1	
	Page(s):	86	
3022	**ErrVent2DeltaPress**		*Only with Lambda Control*
	Level:	1	Error indication of venturi delta pressure sensor at bank 2
	Range:	0..1	
	Page(s):	86	
3023	**ErrMeasPower**		*Only with Lambda Control*
	Level:	1	Error indication of power sensor
	Range:	0..1	
	Page(s):	86	

No.	Name		Signification
3029	**ErrMeasGasQuality**		
	Level:	1	Error indication of gas quality sensor
	Range:	0..1	
	Page(s):	87	
3030	**ErrZeroGasDeltaP**		
	Level:	1	Error indication at gas zero pressure condition at ELEKTRA throttle valve
	Range:	0..1	
	Page(s):	61, 75, 84, 87	
3031	**ErrLowGasDeltaP**		
	Level:	1	Error indication of to low gas delta pressure
	Range:	0..1	
	Page(s):	62, 76, 87	
3032	**ErrHighGasDeltaP**		
	Level:	1	Error indication of to high gas delta pressure
	Range:	0..1	
	Page(s):	62, 76, 84, 87	
3033	**ErrLowGasPress**		
	Level:	1	Error indication of to low gas pressure
	Range:	0..1	
	Page(s):	62, 76, 88	
3034	**ErrHighGasPress**		
	Level:	1	Error indication of to high gas pressure
	Range:	0..1	
	Page(s):	63, 77, 84, 88	
3035	**ErrLowGasTemp**		
	Level:	1	Error indication of to low gas temperature
	Range:	0..1	
	Page(s):	63, 77, 88	
3036	**ErrHighGasTemp**		
	Level:	1	Error indication of to high gas temperature
	Range:	0..1	
	Page(s):	63, 77, 84, 88	
3037	**ErrLowPowerSupply**		
	Level:	1	Error indication of to low supply voltage
	Range:	0..1	
	Page(s):	89	
3038	**ErrHighPowerSupply**		
	Level:	1	Error indication of to high supply voltage
	Range:	0..1	
	Page(s):	89	
3039	**ErrGasFlowDeviation**		*Only with Gas Flow Control*
	Level:	1	Error indication of to high gas flow deviation
	Range:	0..1	
	Page(s):	64, 84, 89	
3050	**ErrFeedback**		
	Level:	1	Error of actuator feedback
	Range:	0..1	
	Page(s):	84, 89	

No.	Name		Signification
3053	**ErrActuatorDiff**		
	Level:	1	Too great difference between set value and actual value of actuator position
	Range:	0..1	
	Page(s):	84, 89	
3060	**ErrAmplifier**		
	Level:	1	Error of amplifier
	Range:	0..1	
	Page(s):	84, 90	
3070	**ErrCanBus**		
	Level:	1	Error indication from CAN Bus
	Range:	0..1	
	Page(s):	84, 90	
3071	**ErrCanComm**		
	Level:	1	Error indication from CAN Communication
	Range:	0..1	
	Page(s):	84, 90	
3076	**ErrParamStore**		
	Level:	1	Error reported on storing parameters
	Range:	0..1	
	Page(s):	84, 90	
3077	**ErrProgramTest**		
	Level:	1	Error reported on programming check sum
	Range:	0..1	
	Page(s):	84, 91	
3078	**ErrRAMTest**		
	Level:	1	Error reported during RAM Test
	Range:	0..1	
	Page(s):	84, 91	
3081	**Err5V_Ref**		
	Level:	1	Error indication of 5 V reference voltage
	Range:	0..1	
	Page(s):	91	
3085	**ErrVoltage**		
	Level:	1	Error indication of power supply voltage
	Range:	0..1	
	Page(s):	91	
3087	**ErrMainCheckSum**		
	Level:	1	Error indication of check summery test
	Range:	0..1	
	Page(s):	83	
3089	**ErrMasterFatal**		
	Level:	1	Error indication of fatal error at HELENOS
	Range:	0..1	
	Page(s):	83, 84, 91	
3090	**ErrData**		
	Level:	1	Error indication of data block
	Range:	0..1	
	Page(s):	84, 92	

No.	Name		Signification
3092	**ErrConfiguration**		
	Level:	1	Error indication of software configuration
	Range:	0..1	
	Page(s):	92	
3093	**ErrStack**		
	Level:	1	Error indication of internal parameter management
	Range:	0..1	
	Page(s):	84, 92	
3094	**ErrIntern**		
	Level:	1	Error indication for internal software fault
	Range:	0..1	
	Page(s): **Fehler! Textmarke nicht definiert.**, 92		
3099	**EEPROMErrorCode**		
	Level:	6	Error code at loading of parameters from the EEPROM
	Range:	0000..FFFF Hex	
	Page(s):	85	
3101	**SerrPickUp**		*Only with Lambda Control*
	Level:	1	Sentinel for the occurrence of 3001 *ErrPickUp*
	Range:	0..255	
	Page(s):	85	
3104	**SerrOverSpeed**		*Only with Lambda Control*
	Level:	1	Sentinel for the occurrence of 3004 *ErrOverSpeed*
	Range:	0..255	
	Page(s):	85	
3105	**SerrSetpointExtern**		*Only with Lambda Control*
	Level:	1	Sentinel for the occurrence of 3005 *ErrSetpointExtern*
	Range:	0..255	
	Page(s):	86	
3111	**SErrAirPress1**		*Only with Lambda Control*
	Level:	1	Sentinel for the occurrence of 3011 *ErrAir Press1*
	Range:	0..255	
	Page(s):	86	
3112	**SErrAirPress2**		*Only with Lambda Control*
	Level:	1	Sentinel for the occurrence of 3012 *ErrAirPress2*
	Range:	0..255	
	Page(s):	86	
3113	**SerrAirTemp**		*Only with Lambda Control*
	Level:	1	Sentinel for the occurrence of 3013 *ErrAirTemp*
	Range:	0..255	
	Page(s):	86	
3115	**SerrGasTemp**		
	Level:	1	Sentinel for the occurrence of 3015 *ErrGasTemp*
	Range:	0..255	
	Page(s):	86	
3119	**SerrGasPress**		
	Level:	1	Sentinel for the occurrence of 3019 *ErrGasPress*
	Range:	0..255	
	Page(s):	86	

No.	Name		Signification
3120	**SerrGasDeltaPress**		
	Level:	1	Sentinel for the occurrence of 3020 *ErrGasDeltaPress*
	Range:	0..255	
	Page(s):	86	
3121	**SErrVent1DeltaPress**		*Only with Lambda Control*
	Level:	1	Sentinel for the occurrence of 3021 *ErrVent1DeltaPress*
	Range:	0..255	
	Page(s):	86	
3122	**SErrVent2DeltaPress**		*Only with Lambda Control*
	Level:	1	Sentinel for the occurrence of 3022 *ErrVent2DeltaPress*
	Range:	0..255	
	Page(s):	86	
3123	**SerrMeasPower**		*Only with Lambda Control*
	Le vel:	1	Sentinel for the occurrence of 3023 *ErrMeasPower*
	Range:	0..255	
	Page(s):	86	
3129	**SErrMeasGasQuality**		
	Level:	1	Sentinel for the occurrence of 3029 *ErrMeasGasQuality*
	Range:	0..255	
	Page(s):	87	
3130	**SerrZeroGasDeltaP**		
	Level:	1	Sentinel for the occurrence of 3030 *ErrZeroGasDeltaP*
	Range:	0..255	
	Page(s):	87	
3131	**SerrLowGasDeltaP**		
	Level:	1	Sentinel for the occurrence of 3031 *ErrLowGasDeltaP*
	Range:	0..255	
	Page(s):	87	
3132	**SerrHighGasDeltaP**		
	Level:	1	Sentinel for the occurrence of 3032 *ErrHighGasDeltaP*
	Range:	0..255	
	Page(s):	87	
3133	**SerrLowGasPress**		
	Level:	1	Sentinel for the occurrence of 3033 *ErrLowGasPress*
	Range:	0..255	
	Page(s):	88	
3134	**SerrHighGasPress**		
	Level:	1	Sentinel for the occurrence of 3034 *ErrHighGasPress*
	Range:	0..255	
	Page(s):	88	
3135	**SerrLowGasTemp**		
	Level:	1	Sentinel for the occurrence of 3035 *ErrLowGasTemp*
	Range:	0..255	
	Page(s):	88	
3136	**SerrHighGasTemp**		
	Level:	1	Sentinel for the occurrence of 3036 *ErrHighGasTemp*
	Range:	0..255	
	Page(s):	88	

No.	Name		Signification
3137	**SerrLowPowerSupply**		
	Level: Range: Page(s):	1 0..255 89	Sentinel for the occurrence of 3037 *ErrLowPowerSupply*
3138	**SerrHighPowerSupply**		
	Level: Range: Page(s):	1 0..255 89	Sentinel for the occurrence of 3038 *ErrHighPowerSupply*
3139	**SerrGasFlowDeviation**		*Only with Gas Flow Control*
	Level: Range: Page(s):	1 0..255 89	Sentinel for the occurrence of 3039 *ErrGasFlowDeviation*
3150	**SerrFeedback**		
	Level: Range: Page(s):	1 0..255 89	Sentinel for the occurrence of 3050 *ErrFeedback*
3153	**SerrActuatorDiff**		
	Level: Range: Page(s):	1 0..255 89	Sentinel for the occurrence of 3053 *ErrActuatorDiff*
3160	**SerrAmplifier**		
	Level: Range: Page(s):	1 0..255 90	Sentinel for the occurrence of 3060 *ErrAmplifier*
3170	**SerrCanBus**		
	Level: Range: Page(s):	1 0..255 90	Sentinel for the occurrence of 3070 *ErrCanBus*
3171	**SerrCanComm**		
	Level: Range: Page(s):	1 0..255 90	Sentinel for the occurrence of 3071 *ErrCanComm*
3176	**SerrParamStore**		
	Level: Range: Page(s):	1 0..255 90	Sentinel for the occurrence of 3076 *ErrParamStore*
3177	**SerrProgramTest**		
	Level: Range: Page(s):	1 0..255 91	Sentinel for the occurrence of 3077 *ErrProgramTest*
3178	**SErrRAMTest**		
	Level: Range: Page(s):	1 0..255 91	Sentinel for the occurrence of 3078 *ErrRAMTest*
3181	**SErr5V_Ref**		
	Level: Range: Page(s):	1 0..255 91	Sentinel for the occurrence of 3081 *Err5V_Ref*

No.	Name		Signification
3185	**SerrVoltage**		
	Level:	1	Sentinel for the occurrence of 3085 *ErrVoltage*
	Range:	0..255	
	Page(s):	91	
3189	**SerrMasterFatal**		
	Level:	1	Sentinel for the occurrence of 3089 *ErrMasterFatal*
	Range:	0..255	
	Page(s):	91	
3190	**SerrData**		
	Level:	1	Sentinel for the occurrence of 3090 *ErrData*
	Range:	0..255	
	Page(s):	92	
3192	**SerrConfiguration**		
	Level:	1	Sentinel for the occurrence of 3092 *ErrConfiguration*
	Range:	0..255	
	Page(s):	92	
3193	**SerrStack**		
	Level:	1	Sentinel for the occurrence of 3093 *ErrStack*
	Range:	0..255	
	Page(s):	92	
3194	**SerrIntern**		
	Level:	1	Sentinel for the occurrence of 3094 *ErrIntern*
	Range:	0..255	
	Page(s):	92	
3195	**SExceptionNumber**		
	Level:	1	Sentinel for the occurrence of 3095 *ExceptionNumber*
	Range:	0..65535	
	Page(s):		
3196	**SExceptionAddrLow**		
	Level:	1	Low extended error number of software error
	Range:	0000..FFFF Hex	
	Page(s):		
3197	**SExceptionAddrHigh**		
	Level:	1	High extended error number of software error
	Range:	0000..FFFF Hex	
	Page(s):		
3198	**SExceptionFlag**		
	Level:	1	Sentinel of software error
	Range:	0000..FFFF Hex	
	Page(s):		
3300	**MeasPower**		
	Level:	1	Current measured power
	Range:	0..2500 kW	
	Page(s):		
3301	**EngineThermalPower**		*Only with Lambda Control*
	Level:	1	Current thermal power
	Range:	0..10000 kWth	
	Page(s):		

No.	Name		Signification
3302	**GasFlowThermalPower**		*Only with Lambda Control*
	Level:	1	Current thermal power of gas flow
	Bereich:	0..2,5	
	Seite(n):		
3303	**LambdaSetpoint**		*Only with Lambda Control*
	Level:	1	Current lambda setpoint
	Range:	0..255	
	Page(s):	68, 68	
3303	**NormGasFlowSetp**		*Only with Gas Flow Control*
	Level:	1	Current norm gas flow setpoint
	Range:		
	Page(s):	57, 60, 64	
3304	**Gas Quality**		*Only with Gas Flow Control*
	Level:	1	Current norm gas gravity
	Range:	0..100 %	
	Page(s):	59, 71	
3305	**NormGasGravity**		*Only with Gas Flow Control*
	Level:	1	Current norm gas gravity
	Range:	0,5..3 kg/m³	
	Page(s):		
3306	**GasGravity**		
	Level:	1	Current gas gravity
	Range:	0,5..3 kg/m³	
	Page(s):		
3307	**GasVelocity**		
	Level:	1	Current calculated gas velocity in GMU
	Range:	0..500 m/s	
	Page(s):		
3308	**GasFlow**		
	Level:	1	Current calculated gas flow
	Range:	0..5000 m³/h	
	Page(s):		
3309	**NormGasFlow**		
	Level:	1	Current calculated norm gas flow
	Range:	0..5000 Nm³/h	
	Page(s):	64	
3310	**GasVelocityHoles**		*Only with Lambda Control*
	Level:	4	Current calculated gas velocity at the gas holes in venturi mixer
	Range:	0..500 m/s	
	Page(s):		
3311	**HolesCorrFactor**		*Only with Lambda Control*
	Level:	4	Current correction value for calculation of gas delta pressure at the gas holes in venturi mixer
	Range:	1..2	
	Page(s):		
3312	**HolesDeltaPressure**		*Only with Lambda Control*
	Level:	4	Current gas delta pressure at the gas holes in venturi mixer
	Range:	0..5000 mbar	
	Page(s):		

No.	Name		Signification
3315	**Throat1DeltaPressure**		*Only with Lambda Control*
	Level:	1	Current calculated gas delta pressure at throat from venturi mixer
	Range:	0..5000 mbar	
	Page(s):		
3316	**AirPressure1**		*Only with Lambda Control*
	Level:	1	Current air pressure before venturi mixer
	Range:	0..5 bar	
	Page(s):		
3317	**AirGravity1**		*Only with Lambda Control*
	Level:	4	Current air gravity in venturi mixer
	Range:	0,5..3 kg/m³	
	Page(s):		
3318	**Throat1Velocity**		*Only with Lambda Control*
	Level:	4	Current calculated mixture velocity in venturi mixer
	Range:	0..500 m/s	
	Page(s):		
3319	**Throat1CorrFactor**		*Only with Lambda Control*
	Level:	4	Current correction value for calculation of air flow in venturi mixer
	Range:	0,5..2	
	Page(s):		
3320	**AirFlow1**		*Only with Lambda Control*
	Level:	1	Current air flow in venturi mixer
	Range:	0..60000 Nm³/h	
	Page(s):		
3321	**MixFlow1**		*Only with Lambda Control*
	Level:	1	Current mixure flow in venturi mixer
	Range:	0..60000 Nm³/h	
	Page(s):		
3325	**Throat2DeltaPressure**		*Only with Lambda Control*
	Level:	1	Current calculated gas delta pressure at throat from venturi mixer at bank 2
	Range:	0..5000 mbar	
	Page(s):		
3326	**AirPressure2**		*Only with Lambda Control*
	Level:	1	Current air pressure before venturi mixer at bank 2
	Range:	0..5 bar	
	Page(s):		
3327	**AirGravity2**		*Only with Lambda Control*
	Level:	4	Current air gravity in venturi mixer at bank 2
	Range:	0,5 3 kg/m³	
	Page(s):		
3328	**Throat2Velocity**		*Only with Lambda Control*
	Level:	4	Current calculated mixture velocity in venturi mixer at bank 2
	Range:	0..500 m/s	
	Page(s):		
3329	**Throat2CorrFactor**		*Only with Lambda Control*
	Level:	4	Current correction value for calculation of air flow in venturi mixer at bank 2
	Range:	0,5..2	
	Page(s):		

No.	Name		Signification
3330	**AirFlow2**		*Only with Lambda Control*
	Level:	1	Current air flow in venturi mixer at bank 2
	Range:	0..60000 Nm³/h	
	Page(s):		
3331	**MixFlow2**		*Only with Lambda Control*
	Level:	1	Current mixture flow in venturi mixer at bank 2
	Range:	0..60000 Nm³/h	
	Page(s):		
3335	**AirFlow**		*Only with Lambda Control*
	Level:	1	Current calculated air flow
	Range:	0..60000 Nm³/h	
	Page(s):		
3336	**MixFlow**		*Only with Lambda Control*
	Level:	1	Current calculated mixture flow
	Range:	0..60000 Nm³/h	
	Page(s):		
3337	**AirFuelRatio**		*Only with Lambda Control*
	Level:	1	Current calculated mixture ratio
	Range:	0..40 Nm³/Nm³	
	Page(s):		
3338	**AFRAtStoichiometry**		*Only with Lambda Control*
	Level:	4	Current stoichiometric mixture ratio
	Range:	0..40 Nm³/Nm³	
	Page(s):	71	
3339	**Lambda**		*Only with Lambda Control*
	Level:	1	Current calculated lambda value of air gas mixture
	Range:	0..2,5	
	Page(s):		
3340	**ClosedLoopActive**		*Only with Lambda Control*
	Level:	1	Indication for closed loop operation
	Range:	0..1	
	Page(s):	75	
3341	**GasLowHeatingValue**		*Only with Lambda Control*
	Level:	4	Current low gas heating value
	Range:	5..100 MJ/Nm³	
	Page(s):	71	
3342	**ClosedLoopGasFlow**		*Only with Lambda Control*
	Level:	6	From closed loop algorithm calculated gas flow
	Range:	0..5000 Nm³/h	
	Page(s):		
3343	**ClosedLoopAirFlow**		*Only with Lambda Control*
	Level:	6	From closed loop algorithm calculated air flow
	Range:	0..60000 Nm³/h	
	Page(s):		
3344	**ClosedLoopAirFuelRat**		*Only with Lambda Control*
	Level:	6	From closed loop algorithm calculated mixture ratio
	Range:	0..40 Nm³/Nm³	
	Page(s):		

No.	Name		Signification
3345	**ClosedLoopLambda**		*Only with Lambda Control*
	Level:	6	From closed loop algorithm calculated lambda value
	Range:	0..2,5	
	Page(s):		
3346	**ClosedLoopLambdaTrim**		*Only with Lambda Control*
	Level:	1	From closed loop algorithm calculated offset for lambda setpoint
	Range:	-1.25..1,25	
	Page(s):	75	
3347	**LambdaPIDCorr**		*Only with Lambda Control*
	Level:	1	Current correction value for lambda PID-parameter
	Range:	0..400 %	
	Page(s):		
3510	**AnalogIn1**		
	Level:	1	Normalized value of analogue input 1
	Range:	0..100 %	
	Page(s):		
3511	**AnalogIn1_Value**		
	Level:	1	Unnormalized value of analogue input 1
	Range:	0..22.7 mA	
	Page(s):		
3520	**AnalogIn2**		
	Level:	1	Normalized value of analogue input 2
	Range:	0..100 %	
	Page(s):		
3521	**AnalogIn2_Value**		
	Level:	1	Unnormalized value of analogue input 2
	Range:	0..5 V	
	Page(s):		
3530	**AnalogIn3**		*Only with Lambda Control*
	Level:	1	Normalized value of analogue input 3
	Range:	0..100 %	
	Page(s):		
3531	**AnalogIn3_Value**		*Only with Lambda Control*
	Level:	1	Unnormalized value of analogue input 3
	Range:	0..5 V	
	Page(s):		
3540	**TempIn**		*Only with Lambda Control*
	Level:	1	Normalized value of temperature input
	Range:	-100..1000 °C	
	Page(s):	50	
3541	**TempIn_Value**		*Only with Lambda Control*
	Level:	1	Unnormalized value of temperature input
	Range:	0..65535	
	Page(s):	50	
3550	**IntAnalogIn1**		
	Level:	1	Normalized value of internal analogue input 1 (for gas pressure)
	Range:	0..100 %	
	Page(s):		

No.	Name		Signification
3551	**IntAnalogIn1_Value**		
	Level:	1	Unnormalized value of internal analogue input 1
	Range:	0..5 V	(for gas pressure)
	Page(s):		
3555	**IntAnalogIn2**		
	Level:	1	Normalized value of internal analogue input 2
	Range:	0..100 %	(for gas delta pressure)
	Page(s):		
3556	**IntAnalogIn2_Value**		
	Level:	1	Unnormalized value of internal analogue input 2
	Range:	0..5 V	(for gas delta pressure)
	Page(s):	56, 65	
3560	**IntAnalogIn3**		*Only with Lambda Control*
	Level:	1	Normalized value of internal analogue input 3
	Range:	0..100 %	(for venturi delta pressure)
	Page(s):		
3561	**IntAnalogIn3_Value**		*Only with Lambda Control*
	Level:	1	Unnormalized value of internal analogue input 3
	Range:	0..5 V	(for venturi delta pressure)
	Page(s):	65	
3565	**IntAnalogIn4**		*Only with Lambda Control*
	Level:	1	Normalized value of internal analogue input 4
	Range:	0..100 %	(for venturi delta pressure at bank 2)
	Page(s):		
3566	**IntAnalogIn4_Value**		*Only with Lambda Control*
	Level:	1	Unnormalized value of internal analogue input 4
	Range:	0..5 V	(for venturi delta pressure at bank 2)
	Page(s):	65	
3570	**IntAnalogIn5**		*Only with Lambda Control*
	Level:	1	Normalized value of internal analogue input 5
	Range:	0..100 %	(for air pressure sensor before venturi mixer)
	Page(s):		
3571	**IntAnalogIn5_Value**		*Only with Lambda Control*
	Level:	1	Unnormalized value of internal analogue input 5
	Range:	0..5 V	(for air pressure sensor before venturi mixer)
	Page(s):		
3575	**IntAnalogIn6**		*Only with Lambda Control*
	Level:	1	Normalized value of internal analogue input 6
	Range:	0..100 %	(for air pressure sensor before venturi mixer at bank 2)
	Page(s):		
3576	**IntAnalogIn6_Value**		*Only with Lambda Control*
	Level:	1	Unnormalized value of internal analogue input 6
	Range:	0..5 V	(for air pressure sensor before venturi mixer at bank 2)
	Page(s):		
3590	**IntTempIn1**		*Only with Lambda Control*
	Level:	1	Normalized value of internal temperature input 1
	Range:	-100..1000 °C	(for gas temperature)
	Page(s):	50	

No.	Name		Signification
3591	**IntTempIn1_Value**		*Only with Lambda Control*
	Level:	1	Unnormalized value of internal temperature input 1
	Range:	0..65535	(for gas temperature)
	Page(s):	50	
3600	**PowerSupply**		
	Level:	1	Current value of supply voltage
	Range:	0..55 V	
	Page(s):		
3603	**5V_Ref**		
	Level:	1	Current value of 5 V reference voltage
	Range:	0..10 V	
	Page(s):	91	
3800	**EmergencyAlarm**		
	Level:	1	Indication of emergency shutdown alarm due to fatal error
	Range:	0..1	
	Page(s):	59, 61, 62, 63, 71, 75, **Fehler! Textmarke nicht definiert.**, 81	
3801	**CommonAlarm**		
	Level:	1	Indication of common alarm
	Range:	0..1	
	Page(s):	62, 63, 63, 76, 81	
3802	**EngineStop**		
	Level:	1	Indication when engine is stopped by internally or
	Range:	0..1	externally executed engine stop
	Page(s):	59, 71	(engine stop request is active)
3803	**EngineStopped**		
	Level:	1	Indication when engine is stopped
	Range:	0..1	
	Page(s):	60, 72	
3804	**EngineStarting**		*Only with Lambda Control*
	Level:	1	Indication when engine is starting
	Range:	0..1	
	Page(s):	72	
3805	**EngineRunning**		
	Level:	1	Indication when engine is running
	Range:	0..1	
	Page(s):	60, 61, 62, 64, 72, 75	
3806	**EngineReleased**		
	Level:	1	Indication when air fuel ratio control is released
	Range:	0..1	
	Page(s):	55, 60, 73	
3807	**MasterStopRequest**		*Only with Lambda Control*
	Level:	1	Indication when engine stop request is active
	Range:	0..1	
	Page(s):		
3808	**SystemRunning**		*Only with Lambda Control*
	Level:	1	Indication when system is running
	Range:	0..1	
	Page(s):		

No.	Name		Signification
3830	**Phase**		
	Level:	1	Current phase of air fuel ratio control
	Range:	0..9	
	Page(s):		
3840	**HardwareVersion**		
	Level:	1	Version number of control hardware
	Range:	00.00..99.99	
	Page(s):		
3841	**AddHardwareVersion**		
	Level:	1	Additional version number of control hardware
	Range:	00.00..99.99	
	Page(s):		
3842	**SoftwareVersion**		
	Level:	1	Version number of software (firmware)
	Range:	00.0.00..65.5.35	2 digits customer number, 1 digit variation, 2 digits amendment index
	Page(s):		or
			4 digits customer number, 2 digits variation, 2 digits amendment index
3843	**BootSoftwareVersion**		
	Level:	1	Version number of bootsoftware
	Range:	00.0.00..65.5.35	
	Page(s):		
3844	**SerialDate**		
	Level:	1	Serial date of control hardware
	Range:	0000..9912	
	Page(s):		
3845	**SerialNumber**		
	Level:	1	Serial number of control hardware
	Range:	00000..65535	
	Page(s):		
3850	**Identifier**		
	Level:	1	Identification number of PC-programme / Hand Held Programmer
	Range:	0..65535	
	Page(s):		
3851	**LastIdentifier**		
	Level:	1	Identification number of the parameter alteration saved last
	Range:	0..65535	
	Page(s):		
3865	**CalculationTime**		
	Level:	1	Necessary calculation time for main processor
	Range:	0..16,384 ms	
	Page(s):		
3870	**Timer**		
	Level:	1	Internal milli second timer
	Range:	0..65,535 s	
	Page(s):		

No.	Name		Signification
3871	**OperatingHourMeter**		
	Level:	1	Hours of operating hours counter
	Range:	0..65535 h	
	Page(s):		
3872	**OperatingSecondMeter**		
	Level:	1	Seconds of operating hours counter
	Range:	0..3599 s	
	Page(s):		
3895	**RAMTestAddr**		
	Level:	6	Value of currently tested memory address
	Range:	0000..FFFF Hex	
	Page(s):		
3896	**RAMTestPattern**		
	Level:	6	Current test pattern for RAM test
	Range:	0000..FFFF Hex	
	Page(s):		
3897	**CstackTestFreeBytes**		
	Level:	6	Indication of free bytes in c-stack
	Range:	0000..0200 Hex	
	Page(s):		
3898	**IstackTestFreeBytes**		
	Level:	6	Number of free bytes in I-stack
	Range:	0000..0200 Hex	
	Page(s):		
3905	**ServoPIDCorr**		
	Level:	6	Correction factor for PID parameters of servo circuit
	Range:	0..400 %	
	Page(s):		
3916	**ServoCurrentSetpoint**		
	Level:	1	Set value for current through actuator
	Range:	-12.5..12.5 A	
	Page(s):		
3950	**Feedback**		
	Level:	1	Unnormalized value of feedback
	Range:	0..65535	
	Page(s):		
3955	**FeedbackReference**		
	Level:	1	Unnormalized value of reference coil
	Range:	0..65535	
	Page(s):		
3960	**FeedbackCorrection**		
	Level:	1	With refernce corrected value of feedback
	Range:	0..65535	
	Page(s):		

19.4 List 3: Functions

No.	Name		Signification
4400	**CanCommDCOn**		*Only with Lambda Control*
	Level:	4	Activates the CAN communication with HELENOS
	Range:	0..1	
	Page(s):	67	
4416	**CanSegmentOrBaudrate**		*Only with Lambda Control*
	Level:	4	HZM CAN: Selection of baud rate parametrization
	Range:	0..1	0 = direct baud rate demand
	Page(s):	67	1 = baud rate demand via segment setting
4440	**CanTelActuatorPosOn**		*Only with Lambda Control*
	Level:	4	Activates the transfer of throttle valve position to HELENOS via CAN
	Range:	0..1	
	Page(s):	67	
4447	**CanTelMeasurementsOn**		*Only with Lambda Control*
	Level:	4	Activates the transfer of AFR measuring values to HELENOS via CAN
	Range:	0..1	
	Page(s):	67	
4448	**CanErrorResetOn**		*Only with Lambda Control*
	Level:	4	Activates the transfer of clear error command from ELEKTRA to HELENOS via CAN
	Range:	0..1	
	Page(s):	67	
4700	**SpeedLimitOn**		*Only with Lambda Control*
	Level:	4	Enable/Disable speed dependent fuel limitation
	Range:	0..1	
	Page(s):		
4800	**Port1Type**		
	Level:	6	Signal type of port 1:
	Range:	0..2	0 = analogue
	Page(s):	41	1 = PWM
			2 = digital
4801	**Port1OutOrIn**		
	Level:	6	Connection type of port 1 (terminal 2):
	Range:	0..1	0 = input
	Page(s):	41	1 = output
4802	**Port2Type**		
	Level:	6	Signal type of port 2 (terminal 1):
	Range:	0..2	0 = analogue
	Page(s):	41	1 = PWM
			2 = digital
4803	**Port2OutOrIn**		
	Level:	6	Connection type of port 2:
	Range:	0..1	0 = input
	Page(s):	41	1 = output
4810	**StopImpulseOrSwitch**		
	Level:	2	Mode of action of engine stop switch:
	Range:	0..1	0 = stop active only while stop command is applied
	Page(s):	51, 59, 71	1 = stop active by one single switch pulse until engine stops

No.	Name		Signification
4811	**StopOpenOrClose**		
	Level:	1	2. mode of action of engine stop switch:
	Range:	0..1	0 = engine stop command active, when contact is closed
	Page(s):		1 = engine stop command active, when contact is open
5000	**SubstOrLastSetp1Ext**		*Only with Gas Flow Control*
	Level:	4	Selection of substitute value if externalb speed setpoint
	Range:	0..1	adjuster is at fault
	Page(s):	46	(0 = last valid value, 1 = substitute value)
5006	**SubstOrLastAirPress1**		*Only with Lambda Control*
	Level:	4	Selection of substitute value if air pressure 1 sensor is at
	Range:	0..1	fault
	Page(s):	46	(0 = last valid value, 1 = substitute value)
5007	**SubstOrLastAirPress2**		*Only with Lambda Control*
	Level:	4	Selection of substitute value if air pressure 2 sensor is at
	Range:	0..1	fault
	Page(s):	46	(0 = last valid value, 1 = substitute value)
5008	**SubstOrLastAirTemp**		*Only with Lambda Control*
	Level:	4	Selection of substitute value if air temperature sensor is
	Range:	0..1	at fault
	Page(s):	46	(0 = last valid value, 1 = substitute value)
5010	**SubstOrLastGasTemp**		
	Level:	4	Selection of substitute value if gas temperature sensor is
	Range:	0..1	at fault
	Page(s):	46	(0 = last valid value, 1 = substitute value)
5014	**SubstOrLastGasPress**		
	Level:	4	Selection of substitute value if gas pressure sensor is at
	Range:	0..1	fault
	Page(s):	46	(0 = last valid value, 1 = substitute value)
5015	**SubstOrLastGasDeltaP**		
	Level:	4	Selection of substitute value if gas delta pressure sensor
	Range:	0..1	is at fault
	Page(s):	46	(0 = last valid value, 1 = substitute value)
5016	**SubstOrLastVent1DP**		*Only with Lambda Control*
	Level:	4	Selection of substitute value if venturi delta pressure
	Range:	0..1	sensor is at fault
	Page(s):	46	(0 = last valid value, 1 = substitute value)
5017	**SubstOrLastVent2DP**		*Only with Lambda Control*
	Level:	4	Selection of substitute value if gas delta pressure sensor
	Range:	0..1	at bank 2 is at fault
	Page(s):	46	(0 = last valid value, 1 = substitute value)
5018	**SubstOrLastMeasPower**		*Only with Lambda Control*
	Level:	4	Selection of substitute value if power sensor is at fault
	Range:	0..1	(0 = last valid value, 1 = substitute value)
	Page(s):	46	
5024	**SubstOrLastGasQy**		
	Level:	4	Selection of substitute value if gas quality sensor is at
	Range:	0..1	fault
	Page(s):	46	(0 = last valid value, 1 = substitute value)

No.	Name		Signification
5040	**HoldOrResetSetp1Ext**		*Only with Gas Flow Control*
	Level:	4	Selection whether the error at external speed setpoint adjuster is to be held or automatically reset
	Range:	0..1	
	Page(s):	46	(0 = to be automatically reset, 1 = error is to be held)
5046	**HoldOrResetAirPress1**		*Only with Lambda Control*
	Level:	4	Selection whether the error at air pressure 1 sensor is to be held or automatically reset
	Range:	0..1	
	Page(s):	46	(0 = to be automatically reset, 1 = error is to be held)
5047	**HoldOrResetAirPress2**		*Only with Lambda Control*
	Level:	4	Selection whether the error at air pressure 2 sensor is to be held or automatically reset
	Range:	0..1	
	Page(s):	46	(0 = to be automatically reset, 1 = error is to be held)
5048	**HoldOrResetAirTemp**		*Only with Lambda Control*
	Level:	4	Selection whether the error at air temperature is to be held or automatically reset
	Range:	0..1	
	Page(s):	46	(0 = to be automatically reset, 1 = error is to be held)
5050	**HoldOrResetGasTemp**		
	Level:	4	Selection whether the error at gas temperature sensor is to be held or automatically reset
	Range:	0..1	
	Page(s):	46	(0 = to be automatically reset, 1 = error is to be held)
5054	**HoldOrResetGasPress**		
	Level:	4	Selection whether the error at gas pressure sensor is to be held or automatically reset
	Range:	0..1	
	Page(s):	46	(0 = to be automatically reset, 1 = error is to be held)
5055	**HoldOrResetGasDeltaP**		
	Level:	4	Selection whether the error at gas delta pressure sensor is to be held or automatically reset
	Range:	0..1	
	Page(s):	46	(0 = to be automatically reset, 1 = error is to be held)
5056	**HoldOrResetVent1DP**		*Only with Lambda Control*
	Level:	4	Selection whether the error at venturi delta pressure sensor is to be held or automatically reset
	Range:	0..1	
	Page(s):	46	(0 = to be automatically reset, 1 = error is to be held)
5057	**HoldOrResetVent2DP**		*Only with Lambda Control*
	Level:	4	Selection whether the error at venturi delta pressure sensor at bank 2 is to be held or automatically reset
	Range:	0..1	
	Page(s):	46	(0 = to be automatically reset, 1 = error is to be held)
5058	**HoldOrResetMeasPower**		*Only with Lambda Control*
	Level:	4	Selection whether the error at power sensor is to be held or automatically reset
	Range:	0..1	
	Page(s):	46	(0 = to be automatically reset, 1 = error is to be held)
5064	**HoldOrResetMeasGasQy**		
	Level:	4	Selection whether the error at gas quality sensor is to be held or automatically reset
	Range:	0..1	
	Page(s):	46	(0 = to be automatically reset, 1 = error is to be held)
5100	**NoStoreSErrOn**		
	Level:	6	Enable/Disable no saving of errors before next reset
	Range:	0..1	
	Page(s):	84	

No.	Name		Signification
5300	**GMUPosSetpointPCOn**		
	Level:	6	Activates the GMU position setpoint 1300 *GMUPosSetpointPC* via DcDesk2000
	Range:	0..1	
	Page(s): 57, 58, 60, 64, 68, 68, 70		
5301	**GMUFlowSetpointPCOn**		
	Level:	6	Activates the GMU flow setpoint 1301 *GMUFlow-SetpointPC* via DcDesk2000 if 5300 *GMUPos-SetpointPCOn* = 0
	Range:	0..1	
	Page(s):	57, 61, 68, 68	
5302	**ExtOrIntLambdaSetp**		*Only with Lambda Control*
	Level:	6	Activates the external lambda setpoint. If not activated, the internal lambda setpoint map will be activated
	Bereich:	0..1	
	Seite(n):	68, 68	
5303	**GasQualityInputOn**		
	Level:	6	Activates the gas quality correction
	Bereich:	0..1	
	Seite(n):	58, 70	
5304	**AirPressSensorOn**		*Only with Lambda Control*
	Level:	6	Activates the use of a absolute air pressure sensor before the venturi mixer
	Bereich:	0..1	
	Seite(n):	65	
5305	**SpeedOverCanOn**		*Only with Lambda Control*
	Level:	6	Activates the receiving of current speed from HELENOS via CAN
	Bereich:	0..1	
	Seite(n):	67	
5306	**MeasPowerOverCanOn**		*Only with Lambda Control*
	Level:	6	Activates the receiving of current load HELENOS via CAN
	Bereich:	0..1	
	Seite(n):	67, 74	
5315	**TwoOrOneGasMixer**		*Only with Lambda Control*
	Level:	6	Selects, if one or two venturi mixers are used on the engine.
	Range:	0..1	
	Page(s):	65, 66	(0 = 1 venturi mixer, 1 = 2 venturi mixer)
5340	**AFRClosedOrOpenLoop**		*Only with Lambda Control*
	Level:	6	Activates closed loop operation
	Range:	0..1	
	Page(s):	75	
5346	**LambdaPIDCorrOn**		*Only with Lambda Control*
	Level:	6	Activates lambda control PID correction
	Range:	0..1	
	Page(s):		
5510	**AnalogIn1_Type**		
	Level:	6	Selection of signal type at analogue input 1
	Range:	1..3	1 = 0..5 V
	Page(s):	41	2 = 0..22,7 mA
			3 = 0..10 V
5520	**AnalogIn2_Type**		
	Level:	6	Selection of signal type at analogue input 2
	Range:	1..3	1 = 0..5 V
	Page(s):	41	2 = 0..22,7 mA
			3 = 0..10 V

No.	Name		Signification
5530	**AnalogIn3_Type**		*Only with Lambda Control*
	Level:	6	Type of analogue input 3
	Range:	1..2	1 = 0..5 V
	Page(s):	41	2 = 0..22.7 mA
5700	**PositionerOn**		
	Level:	2	Speed governor operating as positioner
	Range:	0..1	0 = Speed governor
	Page(s):		1 = Positioner
5701	**PositionerMode**		
	Level:	2	Selection of positioning mode for actuator
	Range:	0..2	0 = as preset by 1700
	Page(s):		1 = rectangle derived from 1700 ± 1701
			2 = triangle derived from 1700 ± 1701
5910	**ActuatorOn**		
	Level:	6	Enable/Disable servo circuit
	Range:	0..1	
	Page(s):		
5911	**Amplifier2QOr4Q**		
	Level:	6	Function mode of amplifier
	Range:	0..1	0 = 4-quadrant(current in both directions)
	Page(s):		1 = 2-Quadrant (current in direction 100 %)
5920	**ServoCurrentPCOn**		
	Level:	6	Activation of actuator test mode to output current to
	Range:	0..1	actuator as defined by 1920 *ServoCurrentPC* as test
	Page(s):		setpoint
5950	**FeedbDigitalOrAnalog**		
	Level:	6	Type of actuator feedback
	Range:	0..1	0 = DC voltage signal
	Page(s):		1 = coil feedback
5951	**FeedbSlopeFallOrRise**		
	Level:	6	Type of feedback signal slope
	Range:	0..1	0 = rising output signal for inscreasing fuel
	Page(s):		1 = falling output signal for inscreasing fuel
5952	**FeedbackLinearOn**		
	Level:	6	Enable/Disable linearization characteristic 7980/7990 of
	Range:	0..1	feedback
	Page(s):		

19.5 List 4: Characteristics and Maps

No.	Name		Signification
6700	**SpeedLimit1:n(x)**		*Only with Lambda Control*
up to	Level:	4	Speed values for speed dependent fuel limitation
6729	Range:	0..4000 rpm	characteristic 1
	Page(s):	74	
6750	**SpeedLimit1:fQ(x)**		*Only with Lambda Control*
up to	Level:	4	Fuel values for speed dependent fuel limitation
6779	Range:	0..100 %	characteristic 1
	Page(s):	74	
7980	**Feedback:digit(x)**		
up to	Level:	6	Digit values for linearization of feedback
7999	Range:	0..65535	
	Page(s):		
8000	**Feedback:Pos(x)**		
up to	Level:	6	Position values for linearization of feedback
8019	Range:	0..100 %	
	Page(s):		
9100	**ElPowToThPow:Pel(x)**		*Only with Lambda Control*
up to	Level:	4	Electrical load values for engine efficiency
9109	Range:	0..2500 kW	characteristic
	Page(s):	74	
9110	**ElPowToThPow:Pth(x)**		*Only with Lambda Control*
up to	Level:	4	Thermic load values for engine efficiency characteristic
9119	Range:	0..10,000 kWth	
	Page(s):	74	
9120	**LambdaMap:n(x)**		*Only with Lambda Control*
up to	Level:	4	Speed values for lambda setpoint map
9129	Range:	0..4000 rpm	
	Page(s):	68	
9130	**LambdaMap:ThPow(x)**		*Only with Lambda Control*
up to	Level:	4	Load values for lambda setpoint map
9139	Range:	0..10000 kWth	
	Page(s):	68	
9140	**LambdaMap:Lambda(x)**		*Only with Lambda Control*
up to	Level:	4	Lambda setpoints for lambda setpoint map
9239	Range:	0..2,5	
	Page(s):	68	
9260	**GasPosToArea:Pos(x)**		
up to	Level:	6	Gas valve position values for ELEKTRA flow
9299	Range:	0..100 %	calibration characteristic
	Page(s):		
9300	**GasPosToArea:Are(x)**		
up to	Level:	6	Gas valve throat area for ELEKTRA flow calibration
9339	Range:	0..5000 mm^3	characteristic
	Page(s):		
9350	**GasVelToCorr:Vel(x)**		*Only with Lambda Control*
up to	Level:	6	Gas velocity values for gas opening delta pressure
9369	Range:	0..500 m/s	correction characteristic
	Page(s):		

No.	Name	Signification
9370	**GasVelToCorr:Cor(x)**	*Only with Lambda Control*
up to 9389	Level: 6 Range: 1..2 Page(s):	Correction valuesKorrekturwerte for gas opening delta pressure correction characteristic
9400	**ThrCorrMap:AirDP(x)**	*Only with Lambda Control*
up to 9419	Level: 6 Range: 0..5000 mbar Page(s):	Air delta pressure values
9420	**ThrCorrMap:AP1(x)**	*Only with Lambda Control*
up to 9424	Level: 6 Range: 0..5 bar Page(s):	Air pressure values for
9440	**ThrCorrMap:Corr(x)**	*Only with Lambda Control*
up to 9539	Level: 6 Range: 0,5..2 Page(s):	Correction values for correction map of air flow calculation
9550	**PowToPIDCorr:Pth(x)**	*Only with Lambda Control*
up to 9559	Level: 4 Range: 0..10,000 kWth Page(s): 70	Thermic load values for lambda control PID correction characteristic
9560	**PowToPIDCorr:Corr(x)**	*Only with Lambda Control*
up to 9569	Level: 4 Range: 0..400 % Page(s): 70	Correction values for lambda control PID correction characteristic
9600	**GasQty:Input(x)**	
up to 9609	Level: 4 Range: 0..100 % Page(s): 59, 71	Gas quality values for gas data characteristic
9620	**GasQty:Gravity(x)**	
up to 9629	Level: 4 Range: 0.5..3 kg/Nm³ Page(s): 59, 71	Gas gravity values for gas data characteristic
9640	**GasQty:AFRStoich(x)**	*Only with Lambda Control*
up to 9649	Level: 4 Range: 0..40 Nm³/Nm³ Page(s): 71	Stoichiometric AFR values for AFR stoichiometric characteristic
9660	**GasQty:LHV(x)**	*Only with Lambda Control*
up to 9669	Level: 4 Range: 5..100 MJ/Nm³ Page(s): 71	Low heating value for LHV characteristic

20 Index of Figures

21 EU Statement of Compliance

(in accordance with ATEX 100a 94/9/EC

The declaring manufacturer

HEINZMANN GmbH & Co.KG
Am Haselbach 1
D-79677 Schönau (Schwarzwald)
Germany
Telephone 0049 (0) 76 73 82 08-0
Telefax 0049 (0) 76 73 82 08-188
e-mail info@heinzmann.de
Sales tax id. no.: DE145551926

declares with reference to the following type examination certificate issued by the TÜV NORD CERT GmbH & CO. KG, TÜV CERT auditing office, id. no. 0032

on its sole responsibility that all the components of the ELEKTRA / KRONOS 30 series

the speed sensors (speed pickups)
IA 01-38, IA 02-76, IA 03-102, IA 11-38, IA 12-76, IA 13-102

the pressure sensor
DSU 01,

the temperature sensor
TS 04-NTC,

the ELEKTRA gas metering units
GMCU-50 FC, GMCU-50 LC, GMCU-85 FC, GMCU-85 LC with integrated actuators and butterfly valves DK 100-05 / StG 2010 and/or DK 140-05 / StG 2040

following the EC Type Examination Certificates TÜV 06 ATEX 552893 and TÜV 07 ATEX yyyyyyy

are meeting the requirements

laid down in DIRECTIVE 94/9/EC OF THE EUROPEAN PARLIAMENT AND THE COUNCIL of 23 March 1994 on the approximation of the laws of the Member States concerning equipment and protective systems intended for use in potentially explosive atmospheres, as well as in the corrected version as of 10 October 1996 (Official Journal EC No. L257 p. 44)

stipulated in

The products have been developed and manufactured in accordance with the approximated European law concerning electrical equipment for use in potentially explosive atmospheres:

EN 13 463-1:2001 Fundamental methods and requirements
EN 13 463-5:2003 Protection by constructional safety "c"

The products are marked with the CE sign which confirms that all the relevant rules have been complied with.

This declaration is no undertaking as to quality as defined by the product liability act. The safety information and operating instructions must be observed!

(Anton Gromer) Managing Director Schönau/Germany, March 2007

22 Order Information for KRONOS Systems

ORDER-INFORMATION

KRONOS-CARBURETION SYSTEMS / AFR-CONTROL

This sheet helps the HEINZMANN application engineers to calculate and to advise the proper carburetion equipment for your gas engine application. Please fill in this form and do not hesitate to contact HEINZMANN in case of doubt or questions. For identical applications this procedure will not be required as HEINZMANN will inform you about part numbers, commissioning instructions and settings.

CUSTOMER INFORMATION

Company: ____________________ Address: ____

Contact Person: ____________________ Telephone: __________________ Telefax: ________________

E-Mail: ____________________

Order No.: Customer: ________________ HEINZMANN: _________________ Date: __________________

ENGINE DATA

Engine type: ________________ Configuration: ☐ In-line engine ☐ V-engine

Turbo charger: ☐ Yes ☐ No Max. boost pressure; _______ bar abs.

Cyl. displacement: ____ liter No. of cylinders: ______ Vol. eff. (Ve): ____

Rated power: _____ kW n_{start}: _______ rpm $n_{nominal}$: _______ rpm Mech. efficiency (η): ____

Max. Manifold temperature: ______ °C λ desired: ______

Application: ____________________________________

MIXING UNIT(S)

Location (see overleaf): ☐ DTNA ☐ DTTC ☐ BTTC

For V-Engine: ☐ Single mixing unit ☐ Double mixing unit

Mixture outlet: ☐ Flange ☐ Hose connector

THROTTLE VALVE

Opening: ☐ Clockwise ☐ Anti-Clockwise

For V-Engine: ☐ Single throttle valve ☐ Double throttle valve

Lever: ☐ Required ☐ Not required

Configuration: ☐ On mixing unit ☐ Stand-alone

GAS CONTROL VALVE

Operation: ☐ Manual ☐ by AFR-control

For V-Engine: ☐ Single valve ☐ Double valve

Gas street dimensioning: ☐ by Customer ☐ by HEINZMANN

Components of the gas street such as gas valve, gas filter and in particular the zero-pressure regulator form a unseparatable part in order to obtain an optimal functioning fuel system. HEINZMANN has the experience and the knowledge to supply you the right components, including the certification

FUEL PROPERTIES

Lower heat value: __________ MJ/nm³ Gas-density: ________ kg/nm³

Stoichiometric air requirement: __________ m³/m³ Range (only for variable fuel): ________ to _____ $\%CH_4$

If fuel properties are not known: __________-gas (e.g. natural, landfill, L-H-gas, propane, etc.)

HEINZMANN GmbH & Co. KG Engine & Turbine Controls
Am Haselbach 1 • D-79677 Schönau/Germany
Tel. +49 (0)7673 8208-0 • Fax +49 (0)7673 8208-188
e-Mail: info@heinzmann.de • www.heinzmann.com

K-OI-0507

23 Order Specifications for Manuals

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

Order the necessary manuals regarding our speed governors from your nearest HEINZMANN location. (Please see the list of our subsidiaries and agents around the world, on the following pages.)

Please include the following information:

- your name,
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