



TA 1510-0066

Technical Instruction

Gas mixing with two gas control valves



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1 General

Using the gas control valve it is possible to specify a desired gas volume. The gas control valve itself sets the desired gas volume using an internal control circuit. A gas mixture is formed using at least two gas control valves which are fed using different fuel gases. The energy required to operate the engine must be generated by the total of the gas volumes made available by both control valves.

In the gas pressure control system diagram (see illustration 1) both gas pressure control systems for both fuel gases and both gas control valves (2) can be seen.

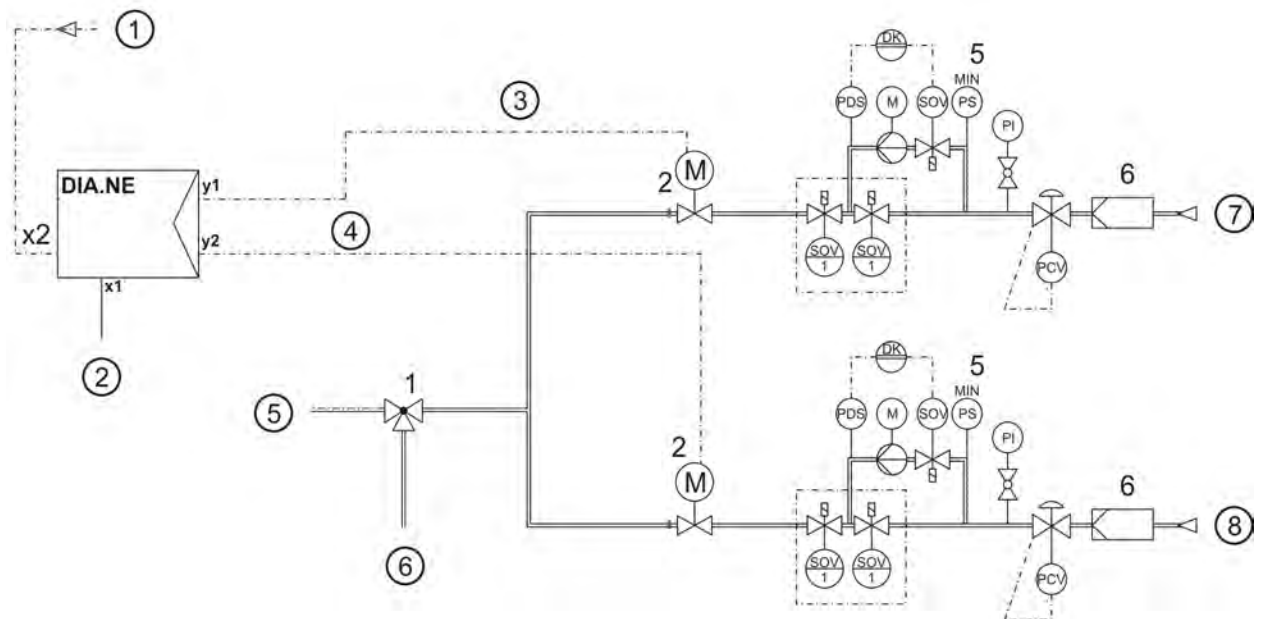


Figure 1: Gas pressure control system diagram

1 Mixture housing	4 Solenoid valve
2 Gas quantity controller	5 Leak test
3 Pre-pressure regulator	6 Fine filter
① Gas type 1_2	② Mixing ratio
③ Gas mixture set point	④ Gas mixture set point
⑤ Air	⑥ to engine
⑦ Gas train 1	⑧ Gas train 2

2 Possible gas type switch-over options, gas mixture

The engine control system features the following functionalities:

2.1 Operation with gas type 1 to 4, operation with gas type 1_2

Operation with gas type 1 to 4 and gas type 1_2 is carried out as before. The gas volume is calculated using various gas and engine constants. The Leanox control corrects the Lambda offset value. During gas type 1_2 operation, the relevant parameters are interpolated between the gas type 1 and gas type 2 parameters on the basis of a "gas quality signal".

A gas pressure control system is required. To enable a large throughput volume in the case of low calorific gases, the option of simultaneously operating three gas valves exists.

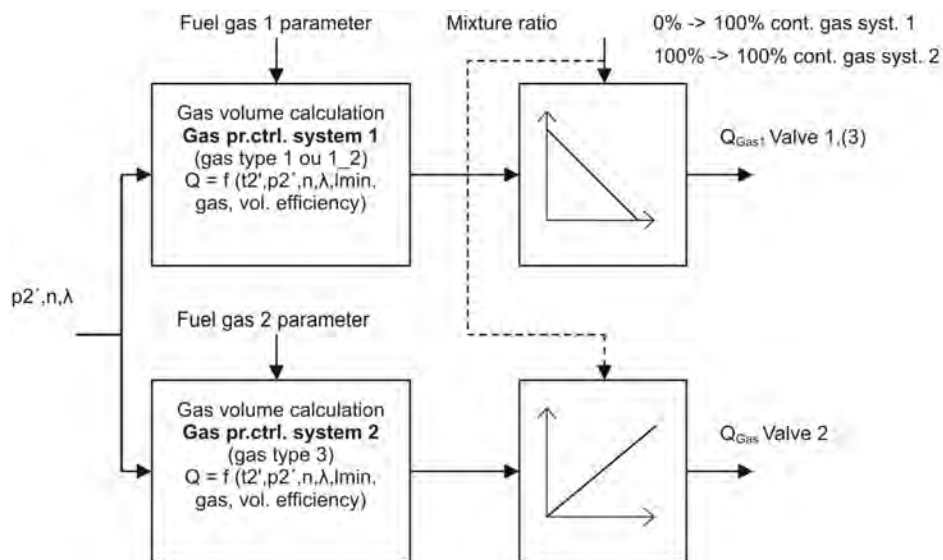
2.2 Gas type switch-over at engine standstill (gas type 1 <-> 3, or gas type 1_2 <-> 3)

For dual fuel gas operation, two gas pressure control systems must be provided with each having their own gas control valve (see illustration 1). To enable a large throughput volume in the case of low calorific gases, the option of simultaneously operating two gas valves (valve 1 and valve 3) exists. The gas volume is calculated using various gas and engine constants for every gas type. The relevant preset gas volume is transmitted to the required gas control valve depending on the gas type selected. The Leanox

control corrects the Lambda set point value which in turn is used for the gas volume calculation of both fuel gases. During gas type 1_2 operation, the relevant parameters are interpolated between the gas type 1 and gas type 2 parameters on the basis of a "gas quality signal".

2.3 Gas mixture during operation (gas type 1 <-> 3, or gas type 1_2 <-> 3)

For dual fuel gas operation, two gas pressure control systems must be provided with each having their own gas control valve. To enable a large throughput volume in the case of low calorific gases, the option of simultaneously operating two gas valves (valve 1 and valve 3) exists. The gas volume is calculated using various gas and engine constants for every gas type. The relevant preset gas volume is then linearly interpolated with the mixture ratio transmitted to the gas control valve. At a 0% mixture ratio 100% gas type 1 or gas type 1_2 is used; at a 100% mixture ratio 100% gas type 3. The Leanox control corrects the Lambda offset value which in turn is used for the gas volume calculation of both fuel gases. During gas type 1_2 operation, the relevant parameters are interpolated between the gas type 1 and gas type 2 parameters on the basis of a "gas quality signal". When switching over from gas type 1 or gas type 1_2 to gas type 3 or vice versa, the relevant parameters are interpolated again between gas type 1 or gas type 1_2 and gas type 3.

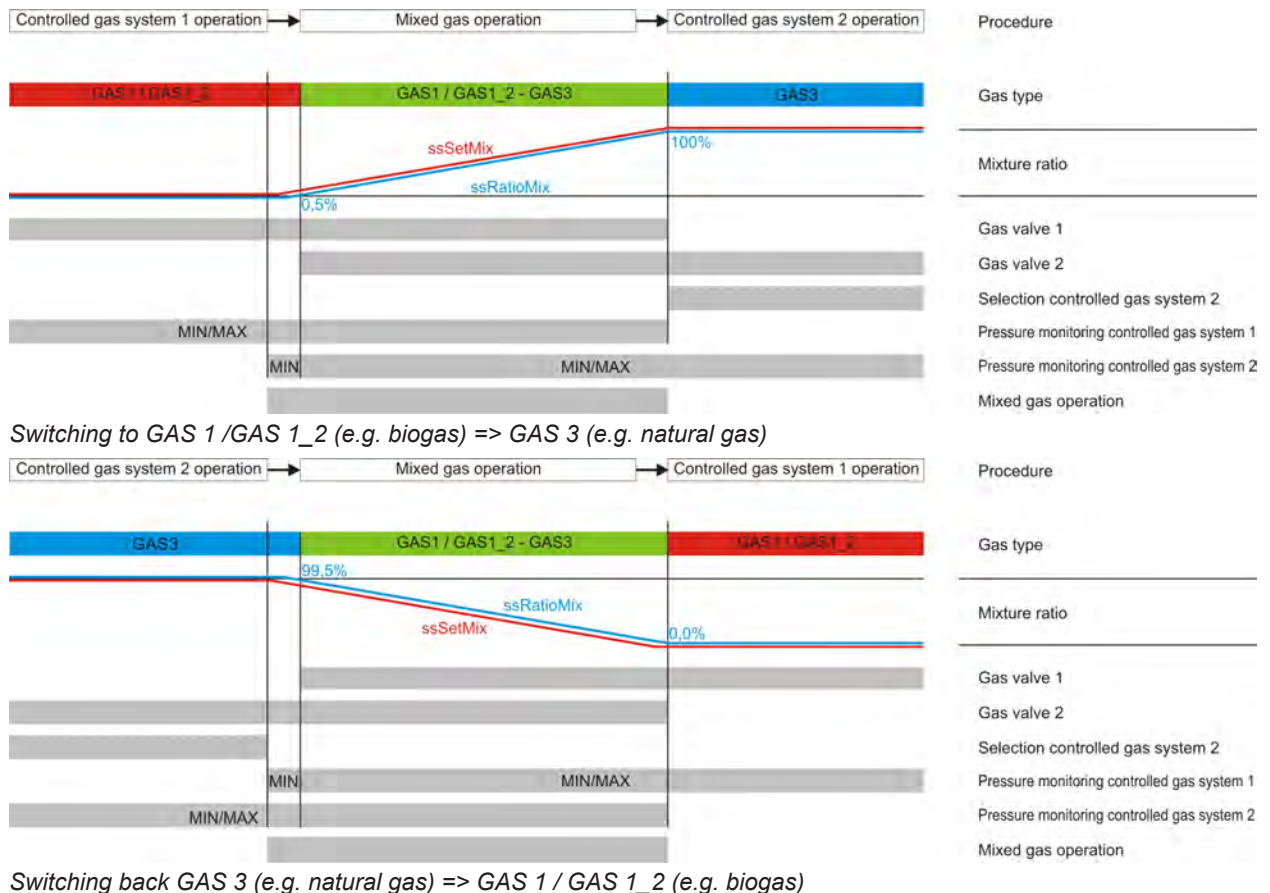


2.4 Continuous operation with gas mixture (gas type 1 <-> 3 / gas type 1_2 <-> 3)

The gas mixture mode can also be selected permanently. The mixture ratios are then preset using an external set point value or manually on the visualisation unit.

2.5 Controlling the gas valves

The following diagram illustrates the most important conditions during a gas type switch over and/or during mixed gas operation.



3 Parameters for the gas type switch over

No additional parameters are required for the gas type switch over. The gas type switch over functionality is already activated when writing the program.

As far as assembly and operation using TecJet gas dosing valves are concerned, please follow the instructions in TA 1510-0064 / gas quantity controller (TecJet 110 and 50 plus). Because the gas dosing valve leaks small quantities of gas even when closed, the engine mixture might become slightly more richer or leaner respectively when 0% or 100% gas mixture is reached. This effect can be minimised by reducing the pressures in front of the gas control valves to the absolute minimum required for operation. For high-calorific gas applications (e.g. propane), a special gas control valve version for low gas volumes (LowFlow) is available.

As a gas switch-over between and/or a gas mixture of gas type 1 and/or gas type 1_2 and gas type 3 is concerned, the parameters (Leanox, ignition point, knock controller, ...) for gas type 1 and/or gas type 1_2 and gas type 3 must be optimised separately. Therefore, the engine must first be set at 100% gas type 1 and/or gas type 1_2 (only gas pressure control system 1 active). Subsequently, the settings for 100% gas type 3 (only gas pressure control system 2 active) must be carried out. Make sure that you take into account the relevant Technical Instructions for the engine type concerned when setting the Leanox controller for the various gas types.

After you have set all relevant gas types and have checked the settings for the entire load range during engine operation, the gas switch over and/or gas mixture operation can be released and requested.

A gas switch over is based on a linear ramp with a 60 second duration. This period is preset in the program. If you require a different switch over speed, please contact us in order to modify the program.

4 Gas type selection and visualisation

The possible gas type selection options for a mixed gas operation configuration are shown below.

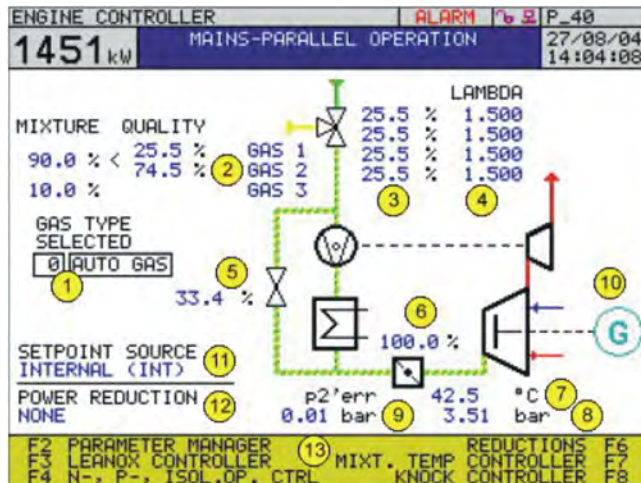


Figure 2: Engine controller overview screen with mixed gas extensions

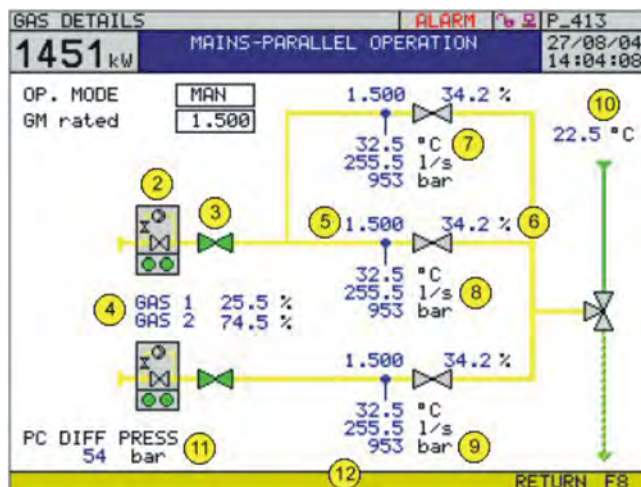


Figure 3: Gas detail screen with relevant mixed gas data

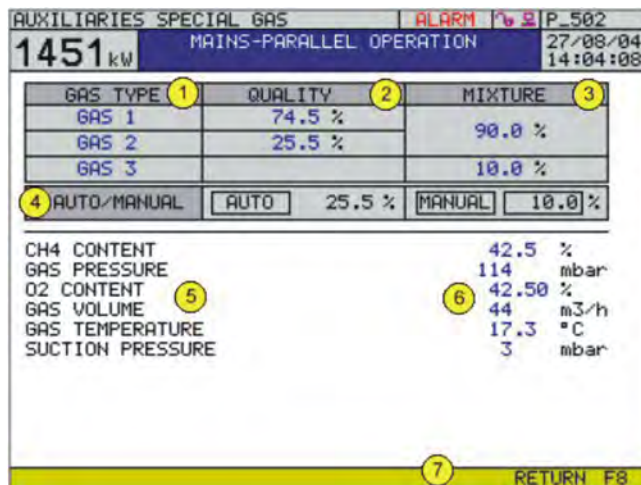


Figure 4: Auxiliary equipment special gas screen with data concerning mixed gas operation and gas quality information

4.1 Selection options

4.1.1 Selection option gas type 1 <-> gas type 3 or gas type 1_2 <-> gas type 3

For mixed gas operation, the PARAM. LIST ENGINE DATA / **NUMBER OF GAS TYPES** parameter must be set to 3.

Mixed gas operation / interpolation gas type 1_2 activated

When changing between modes, the current gas type 1_2, gas type 3 or gas type 1_2/3 (mixed gas) remains unchanged. In the input field (see Figure 2: Engine controller overview screen with mixed gas extensions ❶) **Gas 1_2**, **Gas 3** and **Gas 1_2/3** can be selected.

Mixed gas operation 1_2/3 can only be selected during engine operation.

Mixed gas operation / interpolation gas type 1_2 activated

When changing between modes, the current gas type 1, gas type 3 or gas type 1/3 (mixed gas) remains unchanged. In the input field (see Figure 2: Engine controller overview screen with mixed gas extensions ❶) **Gas 1_2**, **Gas 3** and **Gas 1_2/3** can be selected.

Mixed gas operation 1/3 can only be selected during engine operation.

4.1.2 Autogas function

Using the Autogas selection option (see Figure 2: Engine controller overview screen with mixed gas extensions ❶) manual selection of the gas type can be deactivated. In this case, the selection is activated depending on the control inputs.

4.1.3 Manual gas mixture signal selection

For the gas types 1-2/3 and 1/3 a "Mixture ratio automatic / manual" selection button is available (see Figure 4: Auxiliary equipment special gas screen with data concerning mixed gas operation and gas quality information ❹). This button can be accessed as from the "Advanced customer" authorisation level (15) and higher

In the automatic mode the percentage value is preset by the control system.

When switching to manual, this value is copied. Set point values can be preset as of the "Advanced customer" authorisation level 15 and higher.

If the password expires, the manual operation remains activated.

The manual preset remains activated until the engine is switched off or until a switch over is made to another gas type than 1-2/3 or 1/3 (e.g. gas type 3), or the Autogas function is activated.

The engine can thus be operated without an analog signal.

4.1.4 LEANOX manual operation

During LEANOX manual operation no gas type switch over is allowed, either internally or externally.

When switching over to LEANOX manual operation the gas quality and gas mixture interpolation are switched to the manual preset mode and therefore "frozen". When leaving the LEANOX manual operation, the original mode conditions (AUTO/MAN) are restored again.

5 Revision code

Revision history			
Index	Date	Description / Revision summary	Expert Auditor
2	21.05.2019	GE durch INNIO ersetzt/ GE replaced by INNIO	Stojiljkovic T. Pichler R.
1	06.10.2010	Umstellung auf CMS / Change to Content Management System ersetzt / replaced Index: -	Schartner Pichler

