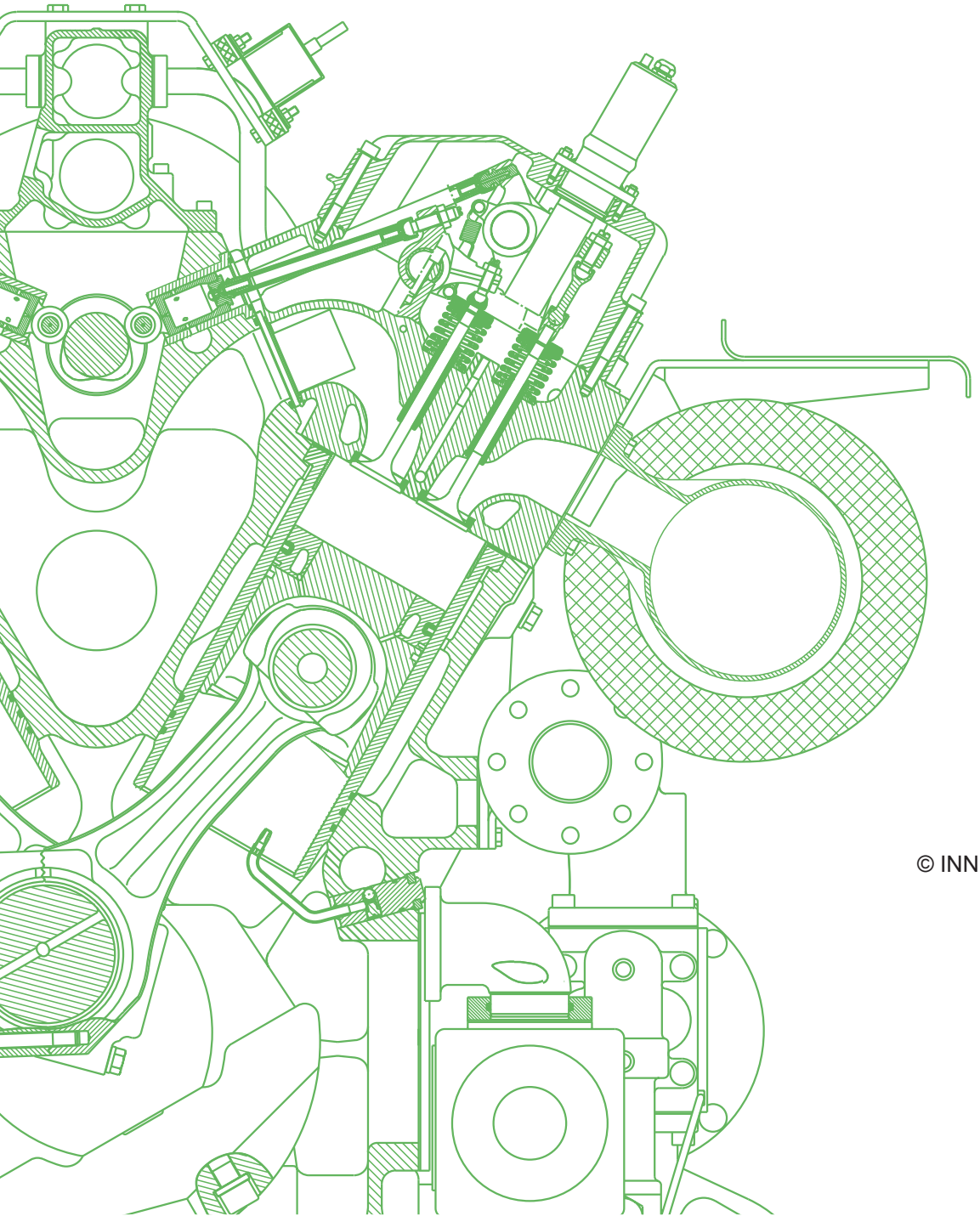
JENBACHER

# TA 1510-0064

Technical Instruction

## Gas quantity controller (TecJet 110, 50 plus and 52)

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## 1 Scope

This Technical Instruction applies to all INNIO Jenbacher Type 2, 3, 4 and 6 modules with a gas quantity controller (TecJet).

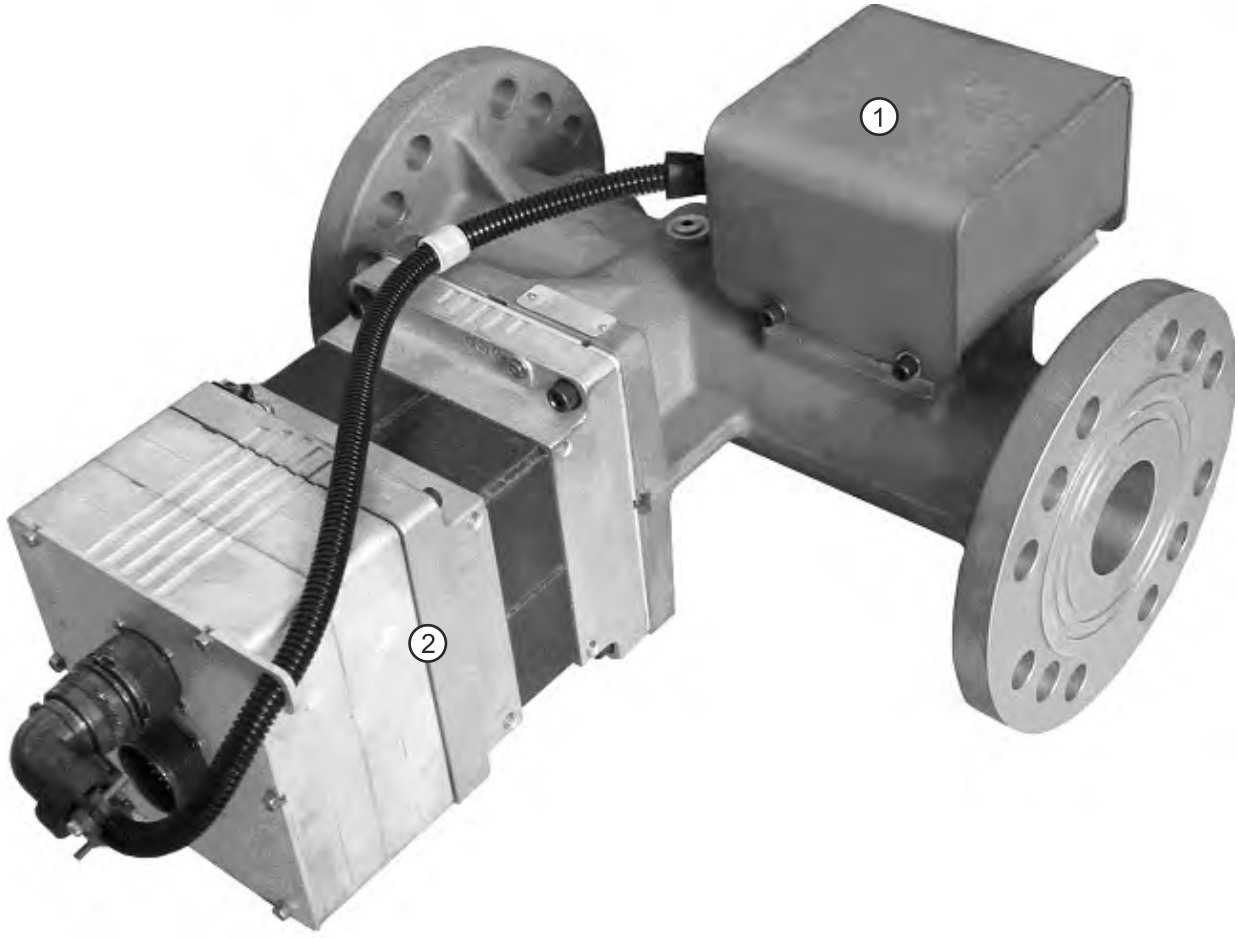
## 2 Purpose

This Technical Instruction provides basic information about the installation, settings, commissioning and background conditions for the gas quantity controller (TecJet) Types 110, 50 plus, and 52.

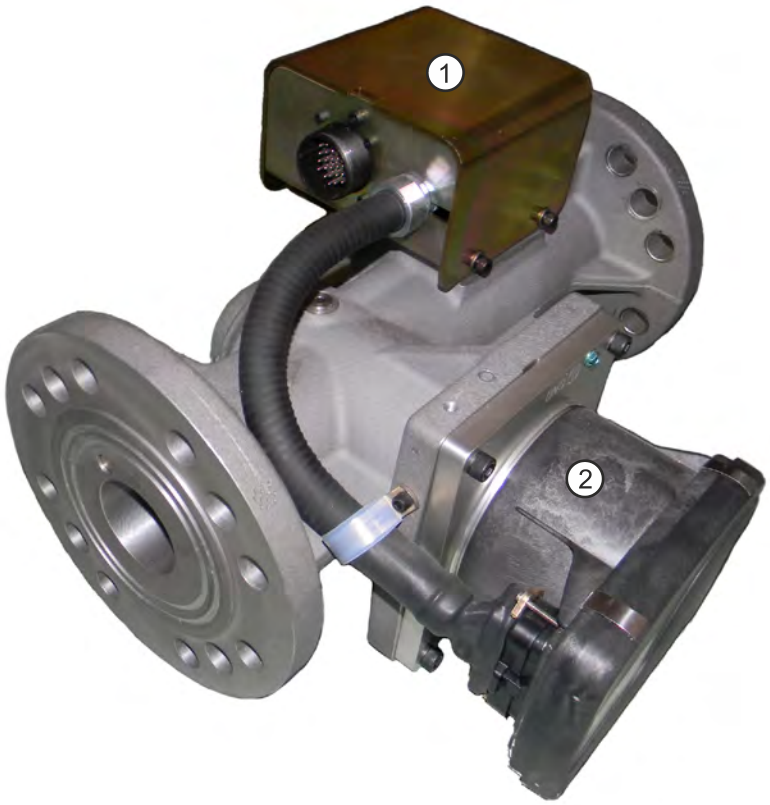
## 3 Introduction

The gas quantity controller (TecJet) allows a desired gas volume to be preset and replaces the gas mixer used until now. and allows you to actively intervene to make mixtures more lean or rich and to directly preset the fuel mixture lambda value. The fuel mixture lambda value is the ratio between the actual combustion air volume and the stochiometrically required air volume. For example, stochiometric combustion occurs where Lambda = 1. The most important advantages being an improved behaviour while starting and during isolated operation and the fact that a zero controller pressure is no longer required. This type of gas proportioning valve can be used in combination with both natural gas and special gases.

## 4 Description of the system




*TecJet 110 and 50 Plus*




*TecJet 52*

| | | | |
|---|---|---|---|
| ① | Sensor box | ② | Actuator with integrated electronics |

The actuator drive with integrated electronics is located on the side of the valve housing. A mechanical pointer is located on the opposite side, indicating the current valve position. The direction of flow is indicated using an arrow on the cast iron housing. On top of the valve is a metal housing containing the device sensors (sensor box).

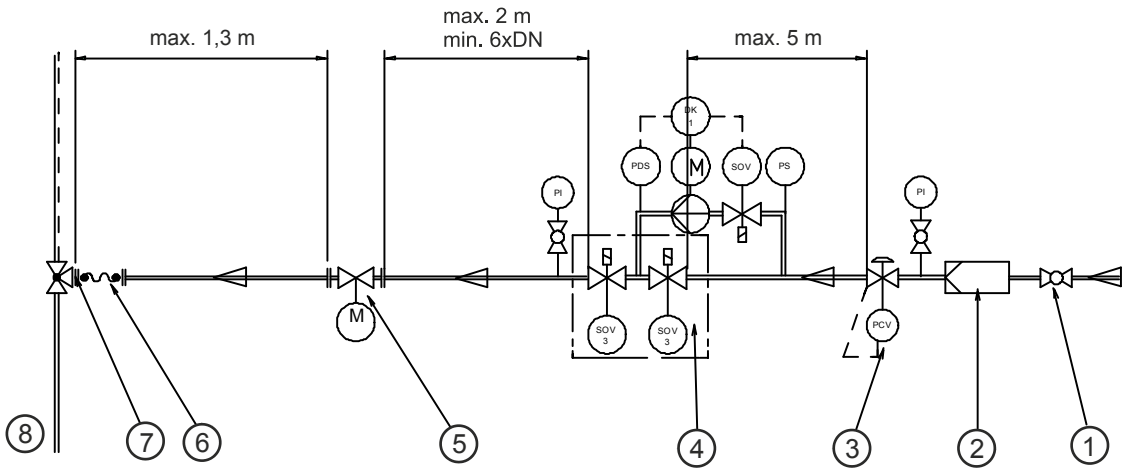
## 4.1 Mechanical assembly of the device

The TecJet should be assembled so as to protect it from engine vibrations. In view of control requirements (dead volume) use a flexible hose (approx. 0.5 m) making sure that the maximum admissible distance from the engine connection point does not exceed 1.3 m.

As a guideline, a distance of up to 2 m (at least 6x the rated diameter) between the TecJet and the solenoid valves must be maintained to provide a damping system. This should already be taken into account by the manufacturer in the design of the gas train. Pipe bends should be avoided if at all possible in the section acting as a damping system. Pipe bends directly upstream of the TecJet have an adverse effect on its regulatory precision. The manufacturer advises to maintain an intake-sided damping distance of 6x the nominal device diameter and an output-sided damping distance of 2x the nominal device diameter and to assemble the device according to ANSI/ISA-S75.02 to prevent sensitivity losses. By observing the above distances, these requirements are fulfilled.

The device is mounted horizontally with the sensor box on top. The direction of flow is indicated by means of an arrow on the cast-iron housing.

See the following illustration for the position of the individual gas pressure control system components.




| | | | |
|---|---|---|---|
| ① | Ball valve | ⑤ | TecJet gas proportioning valve |
| ② | Fine filter | ⑥ | Flexible hose |
| ③ | Pre-pressure regulator | ⑦ | Engine connection point |
| ④ | Solenoid valves with leak test | ⑧ | To the engine |

Whenever several fuel gasses need to be mixed, this arrangement is implemented for each individual fuel gas. Once they have passed the gas proportioning valves the gasses are combined and fed to the gas mixer housing or a shared piece of tubing leading to the turbocompressor/compressor intake.

## 4.2 Gas pressure/gas quality requirements

The differential pressure across the device must be in the 20 – 500 mbar range. The gas proportioning valve requires a differential pressure of at least 20 mbar to control the necessary gas quantity. The intake-side pressure must be in the 0.4 bar $_{abs}$ to 1.6 bar $_{abs}$ range. The required gas prepressure at the customer interface follows from the required gas volume, the calorific value, the engine efficiency and pressure losses along the gas train. When determining the required gas prepressure at the customer interface, the relevant guidelines need to be taken into account (the Jenbacher systems engineering and project planning departments can help you).

The zero pressure controller is no longer required. The prepressure controller is a standard feature as in practice there is no guarantee that TA 1000-0300/0301 or -0302 will actually be complied with.

Ensure that a relative gas-moisture content percentage of 80 % is not exceeded (in accordance with TI 1000-0300-0301 or -0302) and that measures are taken to prevent condensate from forming (in accordance with TI 1400-0091).

## 4.3 Electrical connection

### 4.3.1 Device connector

The TecJet is integrated into the DIA.NE system using a connector. The connector contains both the power supply and the CAN bus. The pin sequence is indicated in the table below.

| Meaning | Pin |
|---|---|
| Power supply + | W |
| Power supply - | Z |
| CAN – ID1 | H |
| CAN – ID2 | G |
| CAN – High In | R |
| CAN – Low In | S |
| CAN – High Out | T |
| CAN – Low Out | U |
| CAN – Gnd | V |
| CAN - Shield | X |

The device earthing (according to CE) is provided by fitting a braided cable which is as short as possible (< 1 m) and has a minimum cable diameter of 2.5 mm² between the relevant connection screw and the engine earth.

### 4.3.2 Relevant connecting cable

A power supply cable with the following colour/number codes and pin sequence is used to establish the electrical connection.

| Designation | Colour (number) | Pin |
|---|---|---|
| Power supply + | 1 | W |

| Designation | Colour (number) | Pin |
|---|---|---|
| Power supply - | 2 | Z |
| CAN – ID1 | 4 | H |
| CAN – ID2 | 3 | G |
| CAN – High IN | Blue | R |
| CAN – Low IN | White / blue | S |
| CAN – High OUT | White / orange | T |
| CAN – Low OUT | orange | U |

#### 4.3.3 Power supply

The supply voltage must be in the 18 - 32 $V_{DC}$ (24 $V_{DC}$ nominal) range. The is pole-error protected. It is also protected against overvoltages up to 80 $V_{DC}$. During operation, 65 W (250 W peak) for are required the TecJet 50, and 100 W (315 W peak) for the TecJet 110.

#### 4.3.4 CAN – linking

The CAN bus is contained in the connecting cable. The bus lines are linked to the device, also providing for return lines. Using the pins for CAN ID1 and CAN ID2 the node number can be set, resulting in the CAN bus identification.

| equipment | CAN ID1 | CAN ID2 | equipment | CAN node |
|---|---|---|---|---|
| **1** | **Open** | **Open** | **1** | **6** |
| **2** | **Minus** | **Open** | **2** | **7** |
| **3** | **Open** | **Minus** | **3** | **8** |
| **4** | **Minus** | **Minus** | **4** | **9** |

In the case of mixed gas applications, devices 1 and 3 are selected for the lower calorific value fuel gas, and device 2 for the higher calorific value fuel gas with a more constant fuel gas quality. See also the relevant TA.

#### 4.3.5 Coding / release of the device

As there is no release pin, the device is put into active mode by sending an amount of gas >0 nl/s through the CAN bus.

## 5 Commissioning

## 5.1 Note

The likelihood of a flashback in the exhaust system is higher on initial commissioning, when changing the engine settings to adapt the engine to a different gas quality, or when troubleshooting starting problems. To avoid unnecessary risks, all personnel should keep well clear of the exhaust system.

⚠ **Please observe the safety and hazard signs in the safety instructions (TA 2300-0005) and wear the appropriate personal protective equipment.**

## 5.2 Parameter setting

The device requires no settings itself. Some recipe entries in the DIA.NE system may need to be changed, though.

### 5.2.1 Indicative values for the GAS PROPORTIONING VALVE/TECJET RECIPE

The indicative values below are established using a type 4 engine running on natural gas. The parameters are indicative for a new Leanox controller with an oil temperature dependent starting procedure and a stationary operation lambda controller.

| Designation | Default value | Unit |
|---|---|---|
| Characteristic curve limited via oil temperature minimum | 30 | °C |
| Characteristic curve limited via oil temperature maximum | 70 | °C |
| volumetric efficiency | 0.85 | ---- |
| Oil temperature point 1 | 30 | °C |
| Lambda point 1 | 1.4 | ---- |
| Oil temperature point 2 | 70 | °C |
| Lambda point 2 | 1.4 | |
| Lambda offset for mains parallel operation | 0.3 | ---- |
| Lambda offset for isolated operation | 0.3 | ---- |
| Calorific value | 9,971 | $kWh/Nm^3$ |
| Minimum air requirement | 9.54 | l/l |
| Standard gas density | 720 | $g/m^3$ |
| Delay after start | 4 | s |
| Delay after mains parallel or isolated operation | 10 | S |
| P component | -3 | |
| I part | -20 (as from RPS 7.31 **+** 20) | |
| Throttle valve set position | 4 | % |
| Lambda control range | 0.1 | ---- |

These settings are input according to the number and nature of the different gas types. The lambda setting range runs from 1 to 2.5.

Value = **1** means **very rich**

Value = **2** means **very lean**

The volumetric efficiency parameter represents the volumetric engine efficiency according to the relevant engine configuration (values to be influenced are of a mechanical nature, e.g. camshaft type). A typical value for type 4 engines with non-Miller camshafts would be 0.85 and 0.73 for engines with Miller camshafts. These values must, however, be determined on a case-by-case basis; the correct default values are preset.

The lambda point 1 and 2 set values correspond to the mixture lambda values at the relevant points on the oil temperature dependent start-up characteristic.

When switching over from stationary operation to mains parallel or isolated operation, the lambda offset mains parallel and isolated operation parameters are added to the fuel mixture lambda value.

The calorific value corresponds to the energy content of one cubic metre of fuel gas under standard conditions (to be calculated using the software).

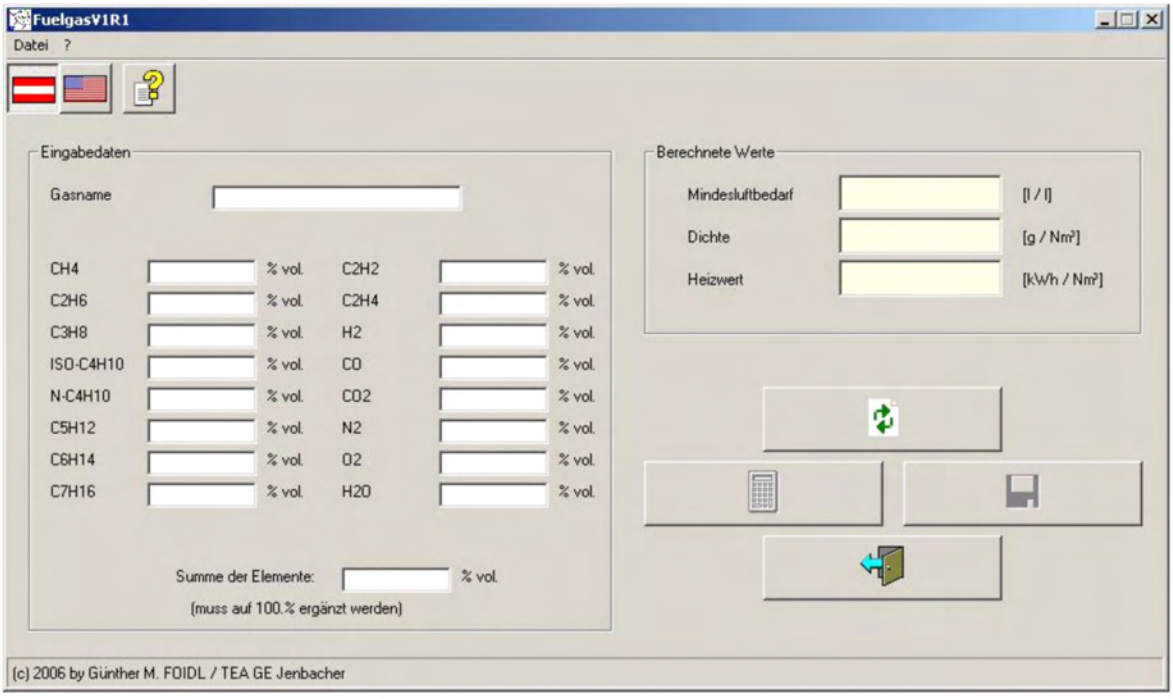
The minimum air requirement corresponds to the air quantity that must be added per fuel gas quantity in order to obtain stoichiometric combustion (Lambda=1) (to be calculated using the software).

Before commissioning (at least in the case of special gas fuelled installations), a recent gas analysis must be available and/or the CH4 content must be determined using a gas analysis device. Ideally, also other components such as CO2, O2 and N2 could be established. We would recommend, however, that you calibrate such devices on a weekly basis or have this done.

If the gas analysis is carried out online and is used to determine the gas type interpolation, the following items must receive special attention: the detection time (ideally less than one second), the position of the measurement location in view of the flow times in the piping system (ideally just ahead of TecJet), the reaction time of the analysis devices (ideally in seconds), and the measurement results themselves (verification using a reference measurement device).

The parameters must be set as follows (the tables are indicative only). You can use the software on the service laptop for accurate calculations in the case of complex gas compositions.

You can find the program at "https://information.jenbacher.com" under the menu item: " Service --> Service Database --> Service Bulletins, no.: 66".




**Calorific value:** Reduce this parameter in accordance with the CH4 content if the remaining volume parts are complemented using ambient air only (e.g. mine gas application).

| CH4 content [%] | Calorific value [kWh/Nm3] |
|---|---|
| 100 | 9.9 |
| 50 | 4.95 |
| 30 | 2.97 |

Otherwise, the following guide values apply:

| Gas | Calorific value [kWh/ Nm3] |
|---|---|
| Natural gas, dry | 9.8 – 11.7 |
| Landfill gas | 6 – 5 |
| Landfill gas, drawn in | 3 – 5 |
| Mine gas, active | 3 – 5 |
| Mine gas, passive | 5.5 – 7.7 |
| Biogas | 4 - 6 |

**Standard gas density:**

| Gas | Density [g/m3] |
|---|---|
| Natural gas, dry | 720 - 860 |
| Landfill gas | 1220 – 1350 |
| Landfill gas, drawn in | 1200 - 1280 |
| Mine gas, active | 1000 - 1180 |
| Mine gas, passive | 880 – 950 |
| Biogas | 1200 - 1500 |

**Minimum air requirement:** Describes the air volume required for λ =1 combustion and can be set in accordance with the CH4 content if the remaining volume parts are complemented using ambient air only (e.g. mine gas application).

**Indicative values:**

| CH4 content [%] | Air requirement [l/l] |
|---|---|
| 100 | 9.54 |
| 50 | 4.77 |
| 30 | 2.86 |

**Otherwise, the following guide values apply:**

| Gas | Air requirement [g/ m3] |
|---|---|
| Natural gas, dry | 9.5 – 11.1 |
| Landfill gas | 4.8 – 5.7 |
| Landfill gas, drawn in | 2.5 – 4.5 |
| Mine gas, active | 2.1 – 4.2 |
| Mine gas, passive | 5.7 – 7.6 |
| Biogas | 3.8 – 5.3 |

### 5.2.2 LEANOX recipe

Settings as usual. Because the gas proportioning valve reacts faster than the gas mixer in the case of incorrect settings, we advise against manually adjusting the Leanox characteristic parameters (without making a Leanox calculation using dia.ne).

#### 5.2.3 ENGINE DATA recipe

This recipe is used to switch free the TecJet gas proportioning valve for the visualisation unit and to set the number of gas proportioning valves (important for mixed gas applications).

## 5.3 DIA.NE visualisation screens

#### 5.3.1 LEANOX

The device is manually operated by entering the fuel mixture lambda value indicated as LAMBDA in the DIA.NE visualisation system.

If the air requirement and gas density are correctly set, the following applies:

TECJET – value in the range [1.0 ... 1.3] Very rich mixture

TECJET – value in the range [1.3 ... 1.8] Lean mixture

TECJET – value in the range [1.8 ... 2.0] Very lean mixture

Manual adjustments must take place in 0.05 increments maximum.

#### 5.3.2 DETAILS - GAS

Measurement values indicated include gas pressure, gas temperature, differential gas pressure across the device and throttle valve position. These data are only available using dia.ne XT/WIN.

#### 5.3.3 SYSTEM

Apart from the known version numbers, the system screen shows the gas proportioning valve programme version (2.02 or higher required).

# 6 Fault correction

## 6.1 Error messages

#### 6.1.1 Shutdown

| Message text and number | Error | Solution |
|---|---|---|
| TJ CAN KOPPLUNG DEFEKT<br>TJ CAN COUPLING FAILURE<br>3093 Priority 1<br>As of DIANE XT 2.10 the additional operating notification 3241 is displayed indicating the device concerned. | CAN messages could not be sent. | Check the CAN bus connection.<br>The CAN bus connection must not be interrupted. Check CAN bus terminators and wiring.<br>See CAN bus 1531-0012 Technical Instruction |

| Message text and number | Error | Solution |
|---|---|---|
| TJ FALSCHE SOFTWARE<br>TJ WRONG SOFTWARE<br>3094 Priority 3<br>As of DIANE XT 2.10 the additional operating notification 3242 is displayed indicating the device concerned. | TJ software version not DIA.NE compatible and/or not up-to-date. | Install device using correct software and/or have INNIO Jenbacher mechanic install correct software<br>(version > 2.02). |
| TJ GASTEMPERATUR NICHT ERFUELLT<br>TJ FUEL GAS TEMPERATURE OUT OF LIMITS<br>3095 Priority 1<br>As of DIANE XT 2.10 the additional operating notification 3243 is displayed indicating the device concerned. | Gas temperature too high or too low; normally, the temperature must be in the -20 to 90 °C range. | Check the gas temperature |
| TJ GASVORDRUCK NICHT ERFUELLT<br>TJ FUEL GAS PRESSURE OUT OF LIMITS<br>3096 – Priority 1<br>As of DIANE XT 2.10 the additional operating notification 3244 is displayed indicating the device concerned. | Gas temperature or differential pressure too high or too low; normally, the prepressure must be in the 500 to 1600 mbar abs range.<br>The differential pressure across the device must be between 20 and 500 mbar. | Check the prepressure controller settings; check the pipe system for frozen condensate. |
| TJ INTERNER FEHLER<br>TJ INTERNAL FAILURE<br>3097 Priority 1<br>As of DIANE XT 2.10 the additional operating notification 3245 is displayed indicating the device concerned. | Defective integrated electronics. | Check the voltage supply and the wiring. The power supply must be reset at the upstream overload cut-out (to acknowledge the fault). If the error message cannot be acknowledged or if the fault is reactivated, replace the device |
| TJ MECHANISCHE FEHLFUNKTION<br>TJ MECHANICAL MALFUNCTION<br>3098 Priority 1<br>As of DIANE XT 2.10 the additional operating notification 3246 is displayed indicating the device concerned. | Mechanical damage, valve stuck, broken shaft. | Visually check for damages. |

| Message text and number | Error | Solution |
|---|---|---|
| GASMENGENSPRUNG<br>GAS AMOUNT STEP TOO HIGH<br>3099 Priority 1<br>As of DIANE XT 2.10 the additional operating notification 3247 is displayed indicating the device concerned. | Gas volume change inadmissibly large | Inadmissible operational conditions, e.g. erratic engine behaviour, rpm variations, sudden charge pressure increases, sudden fuel mixture temperature increases. |

### 6.1.2 Warning

| Message text and number | Error | Solution |
|---|---|---|
| GASMENGE OBERGRENZE<br>FUEL GAS AMOUNT TOO HIGH<br>3212<br>As of DIANE XT 2.10 the additional operating notification 3248 is displayed indicating the device concerned. | Calorific value drop towards the “insufficient” range, charge pressure increase, overspeed | Check the fuel gas constraints, gas/calorific value, and engine boundary conditions. |
| TJ GASMENGE NICHT ERREICHT<br>TJ FUEL GAS AMOUNT NOT REACHED 3213<br>As of DIANE XT 2.10 the additional operating notification 3249 is displayed indicating the device concerned. | Prepressure too low and solenoid valves not opening | Check and/or adjust the prepressure controller, check whether the solenoid valves work properly. |

## 6.2 Troubleshooting

### 6.2.1 Power supply problems (voltage supply, CAN bus)

| Symptoms | Error | Solution |
|---|---|---|
| No TecJet data present on visualisation unit. | No voltage supply | Check the 24 V voltage supply in the interface cabinet for a blown fuse. Otherwise, check the TecJet connection plug. |
| No TecJet data present on visualisation unit, CAN error messages | CAN bus wiring not OK, incorrect node number | Check signal circuit at CAN bus (terminators 120 Ω, forward resistance CAN-Low → CAN-High). You must connect the TecJet to the CAN bus before the ignition. If the remaining devices at the CAN bus are OK, check the connecting plug at the TecJet. |

## 6.3 Mechanical problems (gas quality and pressure)

| Symptoms | Error | Solution |
|---|---|---|
| Unstable engine running behaviour, excessive richness, excessive gas moisture (>80 %). | Condensate in sensor compensation line (possibly frozen). | Disassemble TecJet, open gas flow system and dry using hot air. |
| Unstable engine running, insufficient gas pressure. | Excessive gas prepressure fluctuations or gas prepressure too high/low. | Check the prepressure controller, check the gas pressure control system for pressure loss. |
| Unstable engine running, "Lox Limit" engine tripping. | Significant gas quality fluctuations. | Check on gas supply, current gas analysis and volume of gas actually supplied. |

## 6.4 Electronic problems (internal errors)

| Symptoms | Error | Solution |
|---|---|---|
| Internal device error. | Defective electronics. | Replace equipment. |

## 7 Revision code

**Revision history**

| Index | Date | Description / Revision summary | Expert<br>*Auditor* |
|---|---|---|---|
| 3 | 15.04.2019 | GE durch INNIO ersetzt / GE replaced by INNIO | **Opoku**<br>*Pichler R.* |
| 2 | XX.XX.2014 | TecJet 52 neu hinzu / newly TecJet 52 | **Bilek**<br>*Greuter* |
| 1 | 27.05.2010 | Umstellung auf CMS / Change to **C**ontent **M**anagement **S**ystem ersetzt / replaced Index: **k** | **Schartner**<br>*Pichler* |