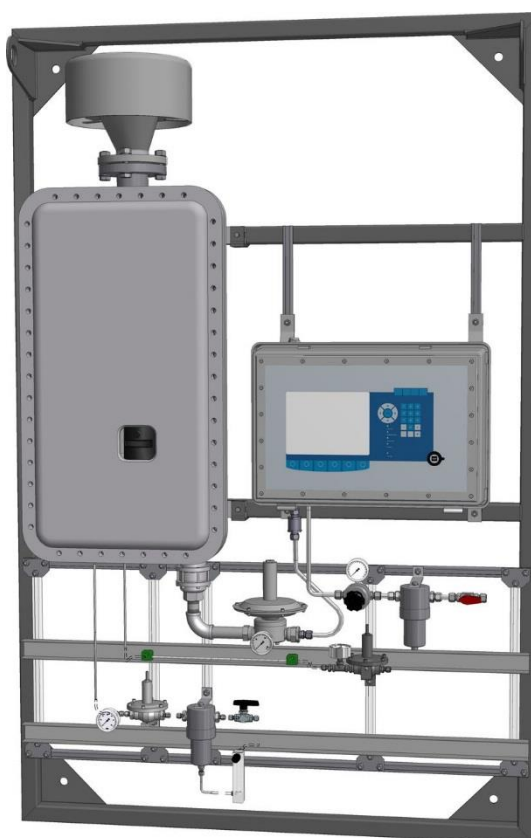

Original operating instructions



Combustion calorimeter

CWD2000 EX



Union Instruments GmbH

Zeppelinstraße 42
76185 Karlsruhe
Germany

 +49 (0)721-680381-0
 +49 (0)721-680381-33
 support@union-instruments.com
 <http://www.union-instruments.com>

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1 Technical data

1.1 Dimensions

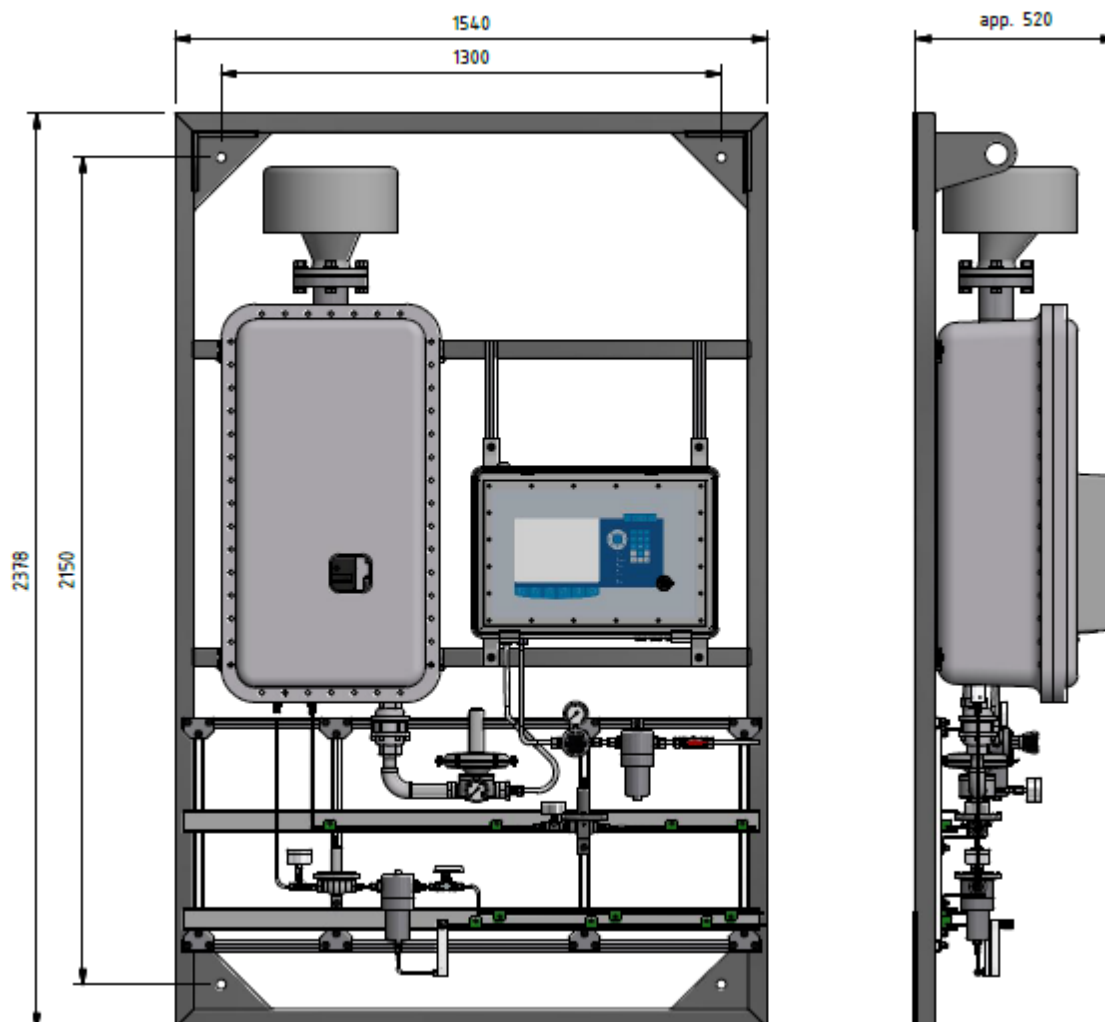



Fig. 1.1: Dimensions of rack, System overview (exemplary)



1.2 Ex marking according to EC type examination

| | |
|-----------------------|--|
| Ex marking : |  II 2G Ex d IIA T3 Gb |
| EC type examination : | BVS 04 ATEX E 018 X |
| Ambient temperature: | $-20^{\circ}\text{C} \leq T_{\text{amb}} \leq + 45^{\circ}\text{C}$ |

1.3 Device specifications

| | |
|--------------------------|---|
| Parameter: | calorific value |
| Other parameters: | net calorific value, Wobbe index, rel. density, air consumption |
| Measuring range: | 8.4 – 13.1 kWh/m ³ 30.2 – 47.2 MJ/m ³ |
| Accuracy | ± 1% measured value |
| calorific value / Wobbe: | |
| Accuracy of density: | ± 0.5% full scale |
| Linearity: | ± 0.2% |
| Reproducibility: | ± 0.1% |
| 0 point stdev: | ± 0.2% per month |

1.4 Interfaces

| | |
|------------------|--|
| Analog outputs: | 4 - 20mA for heating value, Wobbe and density |
| Digital outputs: | 8 relays and 4 open-collectors |
| Digital inputs: | Start calibration, start measurement, hold signals, cancel calibration |

1.5 Display times of calorific value measurement¹

| | |
|-------------|------------|
| Dead time: | 3 seconds |
| 50% - time: | 7 seconds |
| 90% - time: | 20 seconds |
| 99% - time: | 45 seconds |

1.6 Calibration gas

| | |
|--------------------------|--|
| Calibration gas: | Methane, max. 0.05% impurity (purity ≥ 3.5) |
| Calibration interval: | At least once per day (recommended by the manufacturer) |
| Duration of calibration: | Up to 20 minutes |
| Gas consumption: | Up to 5 l/calibration |

1.7 Process gas

| | |
|----------------------------------|---|
| Process gas: | Natural gas |
| Gas connection primary pressure: | 20 - 40 mbar |
| Gas consumption: | 15 - 20 l/h (min. rel. density 0.555 with 0.50 mm nozzle) |

¹ The display times are measured when the new gas reaches the burner. Display times refer to measurements with pure methane.



Air requirement

Approx. 30 m³ per hour (air in installation room: contains max. 50 ppm combustibile components)

1.8 Linearity and measuring range

The measuring ranges cannot be used from 0% to 100%. The range depends on the gas composition. Typical for a measuring range are 45 – 100 %. The hydrogen content in the gas increases the measuring range span. Inert gases, such as N₂, O₂ or CO₂, limit the measuring range.

1.9 Ambient conditions

| | |
|---|--|
|  |  DANGER |
| | <p>The calorimeter must not be operated outside the specified ambient temperature, -20 ° C ≤ Tamb ≤ + 45 ° C.</p> <p>Beyond this temperature, the type approval expires.</p> |

Installation site:

Installation room required

(☞ *enclosed documentation!*)

Climate:

Recommended room temperature -10°C – 40°C

Temperature changes:

≤ 5°C per hour

Humidity:

95 % rel. humidity

1.10 Power supply

Voltage:

240 VAC 50/60 Hz

Power consumption:

1200 VA max.

Protection class:

I

Degree of protection

IP54

1.11 Weight

Weight:

app. 400 kg

Further information:

☞ *enclosed documentation!*

2 EC declaration of conformity

Further information:



☞ *enclosed documentation!*



3 Safety instructions

3.1 Warnings and symbols


In the operating instructions, the following names and symbols are used to denote particularly important information:

| | |
|---|--|
|  |  DANGER |
| | <p>The calorimeter is approved in accordance with the EC type approval for use in hazardous areas.</p> <p>Immediate danger in potentially explosive areas that can lead to serious physical injury or death!</p> |

| |
|--|
|  DANGER |
| <p>Immediate danger that can lead to serious physical injury or death.</p> |

| |
|--|
|  WARNING |
| <p>Potentially hazardous situations that can lead to serious injury or death.</p> |

| |
|--|
|  ATTENTION |
| <p>Potentially hazardous situations that can lead to minor physical injury. This can also be used for property damage.</p> |

| | |
|--|-------------|
|  | NOTE |
| <p>Denotes information that can make it easier to handle the combustion calorimeter or help prevent property damage.</p> | |

3.2 Principle, correct use

| | |
|---|--|
|  |  WARNING |
| | <p>Proper use includes following these operating instructions! In addition to the following safety notes, always follow the safety instructions of the linked system components.</p> <p>Additional equipment or accessories that are not installed, delivered or manufactured by UNION Instruments GmbH require the approval of UNION Instruments GmbH as the manufacturer! Otherwise the guarantee expires.</p> |

The combustion calorimeter is a digitally controlled calorimeter. It measures using the dry measurement principle. The heat is transferred from the burner to the measuring elements through air.

The combustion calorimeter is a sensor system to determine the calorific values of different process gases, the analysis serves for process control.

The combustion calorimeter is designed for use in weather-protected areas for fixed mounting and installation.

Is determined according to the ex-markings for use in EX zone 1, group II category 2 G.

In the case of toxic and explosive gases, observe the safety instructions at the setup site.

The process gas must be free from condensate.



Any other use is considered improper. The manufacturer is not liable for the resulting damage; the associated risk is borne by the installer, fitter, operator or user. Changes to the combustion calorimeter (mechanical/electrical) must only be done by specialists.

3.3 Personnel and qualifications

Establishing gas connections and working on the electric equipment of the combustion calorimeter may only be carried out by specialists adhering to the safety regulations, especially those regarding explosive areas.

3.4 Safety instructions




3.4.1 General safety notes

| | |
|---|---|
|  |  <h2 style="margin: 0;">WARNING</h2> |
| | <p>The combustion calorimeter may only be operated when all of the protective equipment is available and operable.</p> <p>Additional safety notes:</p> <p>☞ <i>before the corresponding chapters!</i></p> |

3.4.2 Notes on specific hazards


| | |
|--|---|
|   |  <h2 style="margin: 0;">DANGER</h2> |
| | <ul style="list-style-type: none"> • Observe national regulations for the installation and construction, e.g. IEC/EN 60079-14! • After installation, all gas conducting parts must be checked for leaks according to national regulations. • All repairs that require the protective covering to be opened may only be performed by specifically instructed trained personnel. |

3.5 Operator safety precautions


| | |
|---|--|
|   |  <h2 style="margin: 0;">WARNING</h2> |
| | <ul style="list-style-type: none"> • The operator needs to provide suitable safety equipment for the combustion calorimeter to reliably prevent individuals from being injured from gas leaks. • Any leaking process gas needs to be diverted into a safe environment. • Danger of stumbling over improperly laid supply lines. |

Other safety precautions taken by the operator: ☞ *corresponding chapters!*

3.5.1 Regular operator training

| | |
|---|---|
|  | NOTE |
| | Country-specific regulations about regular user training by the operator must be observed, in particular training on handling explosive areas, gases, and electrical equipment. |

3.5.2 Workplace hazard analysis

| | |
|---|---|
|  | NOTE |
| | Depending on national regulations and possibly independent of the CE marking of this combustion calorimeter, the operator has to create a workplace risk analysis and to specify the personal protective equipment for the different phases of operation. |

Technical developments can give rise to deviations from these operating instructions. If you require additional information or if particular problems arise that are not fully addressed in this manual, please contact the following address:

4 Safety devices

The calorimeter is a combination of an explosion proof box (analyzer) and pressurized box with an air heater and PLC. The connection between the boxes is the Instrument air tube. In the case of loosing the instrument air pressure a non-return valve prevent a flow back to the heating system. In addition the total system is powered down and solenoid valves are closed. The heating element is PTC heating with a self-limitation function (between 200 and 300 °C).

4.1 Ex- enclosure

Inside of the housing components are installed, which could cause an ignition. The design of the openings of the enclosure are designed for preventing a possible ignition hazard to the outside.

4.2 Flame arrestor

Flame arresters preventing the dispersal of a possible ignition hazard to other system components.

4.3 Purging system

The pressurized system ensures by continuous flushing with air, that no explosive mixture inside of the overall system can occur.

Also ensures a permanent overpressure inside of the EX-p box, that no explosive gas mixtures can penetrate.

The pre- purge time and the over- pressure is monitored all the time.

Further information:

 *enclosed documentation! - Manual Pressurized enclosure system -*

4.4 Cable glands

Cables and wires which are connected to the housing must guarantee the sealing and withstand a potential explosion pressure.


The selection of cables and the installation is done by operators.

Exchanging or adding of cable glands leads to the loss of the type approval.

Further information:

 *enclosed documentation! - Cert cable glands -*

4.5 Thermal fuse

| | |
|---|----------------------------------|
|  | <h1 style="margin: 0;">NOTE</h1> |
| <p>The irreversible thermal fuse (melting fuse) triggers at 72 °C.</p> <p>The self-resetting thermal fuse switches off the heater at 50 °C.</p> | |

4.6 Solenoid valve

In case of faults, the solenoid valves of the combustion calorimeter close automatically. The combustion calorimeter then needs to be restarted.

4.7 Markings and warnings

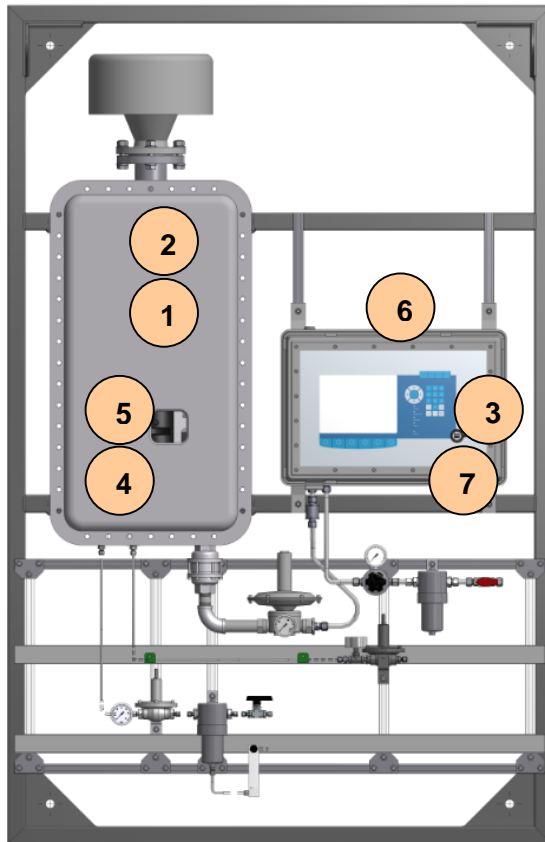


Fig. 4.1: Markings and warnings (exemplary)

1.

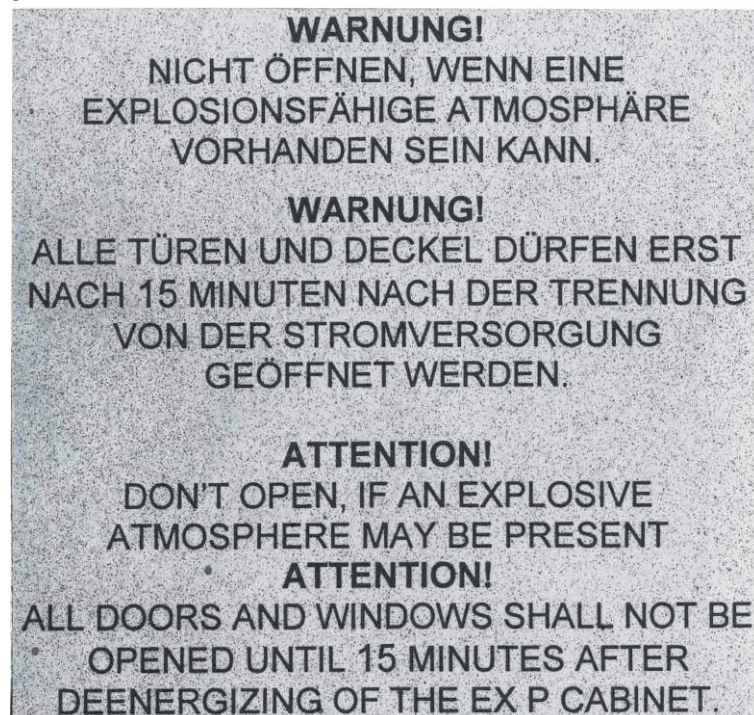
Attention !

Do not open before
device is powered down !




2.




3.



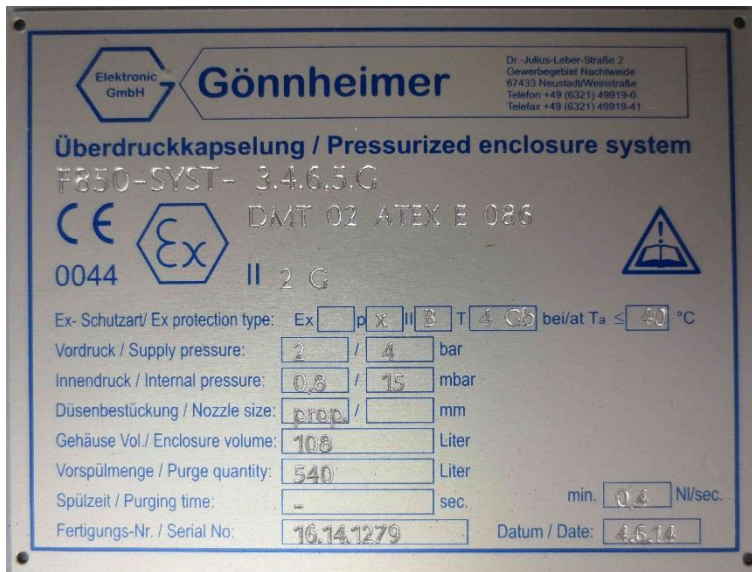
4.

| | |
|--|---|
|  | UNION Instruments GmbH Zeppelinstraße 42 76185 Karlsruhe GERMANY |
|  II 2G Ex d IIA T3 Gb | -20°C ≤ T _{amb} ≤ +45°C |
| Certification No.: BVS 04 ATEX E018X |  0123 |
| Type: CWD2000 EX | |
| Date of Manufacture: 04/2015 | |
| Serial No.: 95610 | |

5.

| | |
|--|---|
|  | UNION Instruments GmbH Zeppelinstraße 42 76185 Karlsruhe GERMANY |
| Type: CWD2000 EX | |
| Serial No.: 95610 | |
| <u>Electrical Data</u> | <u>Fuses</u> |
| Power Supply: 230 VAC 50 Hz | 1x 6.3 A slow blow (-2F2) |
| Power Consumption: 1200 VA | 1x 500 mA fast blow (-2F1) |

6.



Exemplary image

The identification plate is created after acceptance and approval by the manufacturer of the purge control unit (Gönzheimer) and added by Union Instruments.

7.



5 Description and connections

NOTE

Up to 2 process gas lines can be connected.

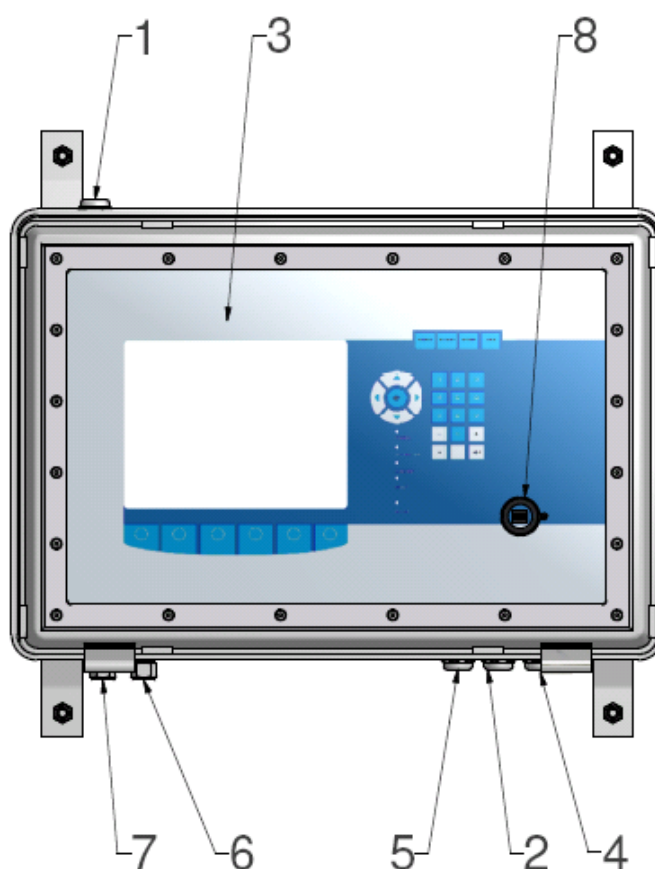


Fig. 5.1: Housing connections

| Item No. | designation |
|----------|------------------------------------|
| 1 | Cable gland signals to calorimeter |
| 2 | Cable gland power supply |
| 3 | Control panel |
| 4 | Cable gland signals customer |
| 5 | Cable gland power supply heater |
| 6 | Instrument air in |
| 7 | Instrument air out |
| 8 | USB port |

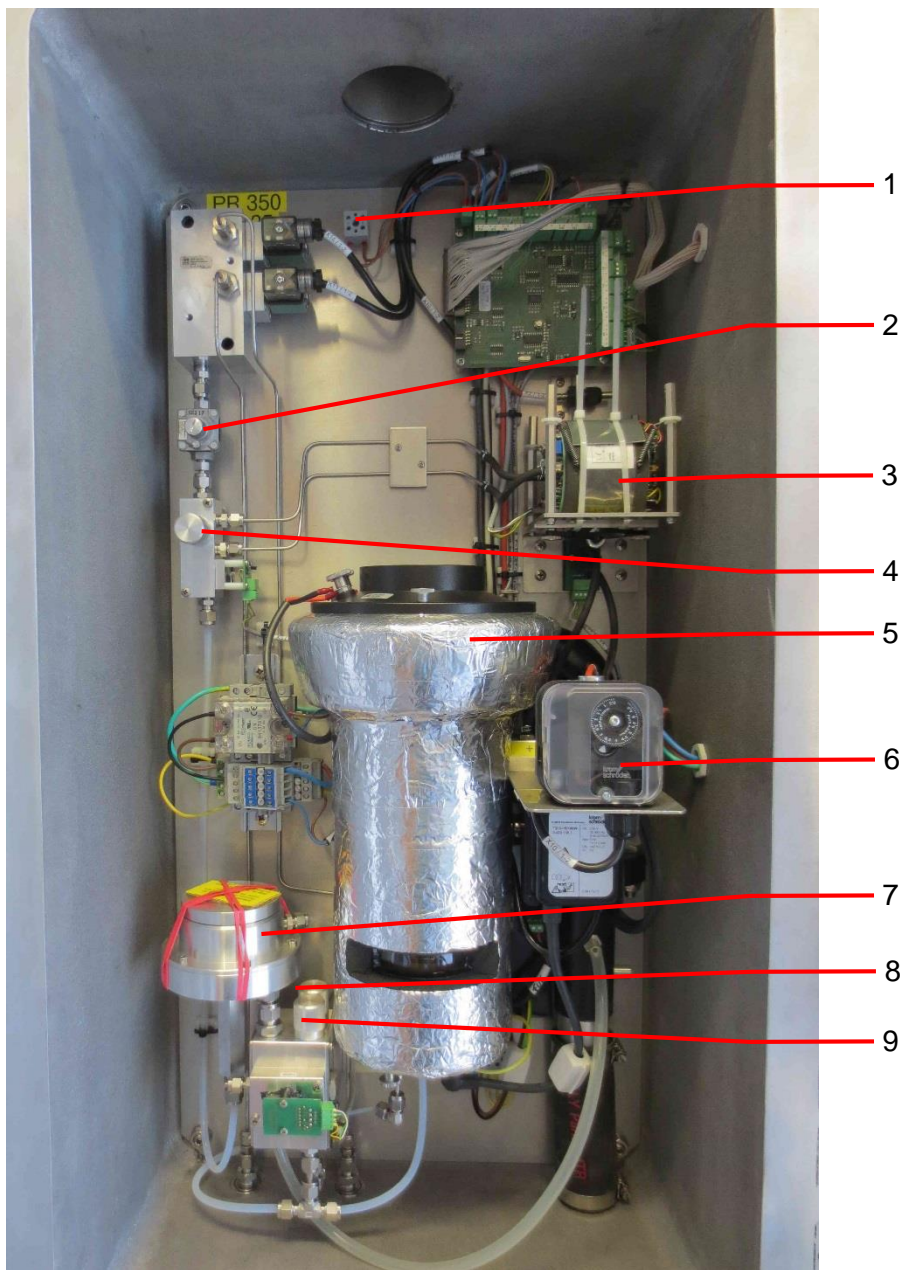






Fig. 5.2: Housing without doors

| Item No. | designation |
|----------|--|
| 1 | Thermal fuse |
| 2 | Pre- pressure regulator (Set: 16 mbar) |
| 3 | Density measuring cell |
| 4 | Nozzel differential pressure density cell (dp: 4 mbar) |
| 5 | Thermal body |
| 6 | Pressure switch air pressure 4 mbar |
| 7 | Precision pressure controller (Set: 4 mbar) |
| 8 | Nozzel air (Ø 0,80) |
| 9 | Nozzel gas (Ø 0,50) |



5.1 Accessories


| | |
|--|---|
|   |  WARNING |
| | <p>Risk of injury/defective!</p> <p>Use of non-approved accessories can cause defects and be hazardous. This will render the warranty null and void! The operator is liable for incurring damage!</p> <p>Observe to EX type examination!</p> <p>Only use original accessories or accessories that have been approved by Union Instruments GmbH.</p> |

6 Transport, installation and acceptance

| | |
|---|--|
|  | NOTE |
| | <p>The combustion calorimeter is generally put into service by Union Instruments GmbH or a service technician with appropriate qualification.</p> <p>If it is not transported, set up and started up by Union Instruments GmbH (for example in-house transportation and resale), coordinate the appropriate procedure with Union Instruments GmbH (☞ <i>Chapter 13 Service</i>).</p> |

6.1 Transport

| | |
|---|--|
|   | WARNING |
| | <p>Possible injury from the combustion calorimeter tipping over or falling from pallets and load carrying equipment.</p> <p>Use suitable hoisting equipment for unpacking and transport!</p> <p>Check the load bearing capacity and condition of the slinging equipment and carefully attach it.</p> <p>Never stand under suspended loads.</p> |

| | |
|---|---|
|  | NOTE |
| | <p>If shocks occur during transport, they can impair the housing. Therefore check the transport container for damage before opening it!</p> <p>In case of damage during transport from improper handling, the carrier should perform a damage report within seven days (railway, post office, freight forwarder).</p> <p>Before start/restart of the transport, make sure that all transport safeguards are in place.</p> |

| | |
|--|--|
|   | DANGER |
| | <p>Injury/defect!</p> <p>The protective function of the enclosure may be affected by damage. Damage at the packaging or remarks to improper transport requiring an inbound check of the housing!</p> |

6.1.1 Specific Gravity Sensor

Remove the transport tie wraps and transport screws from the specific gravity cell. The body of the cell must hang free on the springs and not come into contact with the sides of the bracket. The screw should be removed and stored and the following diagram illustrates the process.

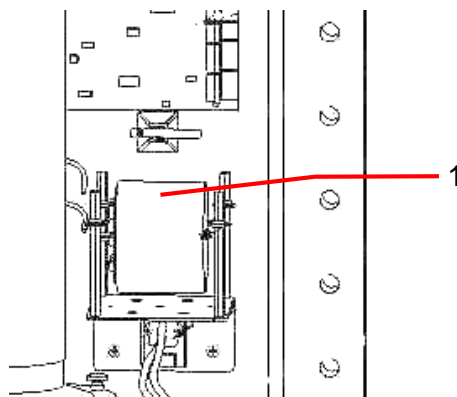


Fig. 6.1: 1. Specific gravity sensor

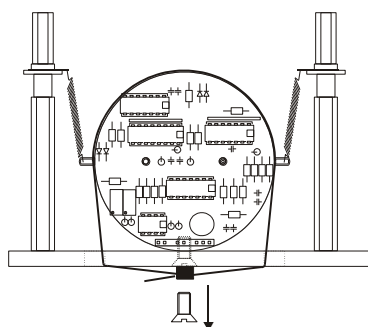


Fig. 6.2: Specific Gravity cell shown locked for transport

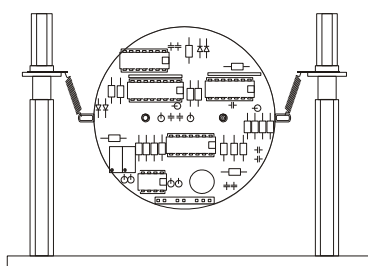


Fig. 6.3: Specific Gravity cell shown in its operating position

6.1.2 Gas pressure regulator

Remove the transport packing from the gas pressure regulator. Polystyrene foam is located beneath the removable regulator cover and must be removed before use.

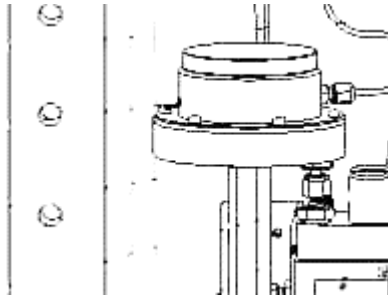


Fig. 6.4: Gas pressure regulator

6.1.3 Flue Stack

The flue stack has to be mounted. The flue stack is delivered as loose part and attached at the rack.

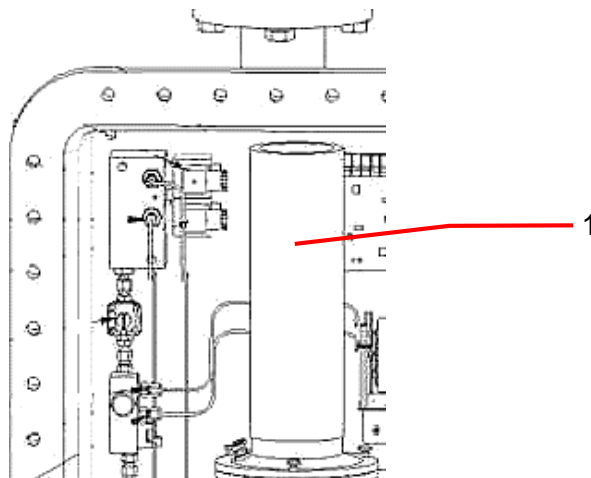





Fig. 6.5: 1. Flue stack

6.2 Ambient conditions

| | |
|---|--|
|  |  ATTENTION |
| | Observe the ambient conditions during storage and set up! Contact Union Instruments GmbH if the combustion calorimeter has been stored for more than three months or needs to be operated or stored under ambient conditions other than those specified! |

6.2.1 Storage conditions

| | |
|---|---|
|  | NOTE |
| | <ul style="list-style-type: none">• Make sure that the combustion calorimeter is free from gas / humidity residue.• Freezing condensate water in the combustion calorimeter can cause defects. |

Ambient temperature: -20°C – 60°C
Humidity: 0 - 95% relative humidity
Ambient pressure: 700 - 1400 hPa (0.7 - 1.4 bar)

6.3 Installing and connecting


6.3.1 Setup site


The installation location of the combustion calorimeter must meet the following requirements:

- space of at least 50 cm to the front and below
- entrance and exit as air locks
- lockable windows
- protected from direct weather impact and direct sunlight
- stable room temperature
- provide sufficient quantities of clean ambient air for undistorted measurements
- Ensure that the load-bearing capacity of the wall is sufficient

| | |
|---|---|
|  | WARNING |
| | The operator is responsible for ensuring the escape routes! |

6.3.2 Ensure extractor hood remains unobstructed so that exhaust gas can flow freely and heat cannot accumulate. Room ventilation

| | |
|---|--|
|  | WARNING |
| | Risk of injury due to the temperature of exhausts / housing! The exhaust gas temperature is between 8 - 20°C above housing temperature! Use PPE against burns! |



| | |
|---|--|
|  | NOTE |
| | In case of adverse flow / installation conditions, appropriate deflector plates must be installed that prevent direct flow of fresh air onto the combustion calorimeter. |

6.3.3 Attachment

Further information:

☞ *enclosed documentation!*


6.3.4 Process gas

| | |
|---|---|
|  |  DANGER |
| | <ul style="list-style-type: none"> • The connecting parts need to be clean and free of residue. Impurities can enter the combustion calorimeter and cause incorrect measurements and/or damage. • Gas inlet pressure depending on the gas between 20 and 40 mbar ☞ table on page 8 • The inlet pressure for the gas connections must not exceed the values specified in the technical data of the combustion calorimeter. • Process gas must be free from impurities and condensate. • Each connection needs to be carefully checked for leaks. If there are any leaks, the system will draw air, and the measurements will be incorrect. • Do not use sealing agents to seal the gas connections. Sealing agents can distort measurements. <p>Only use suitable pipes.</p> |

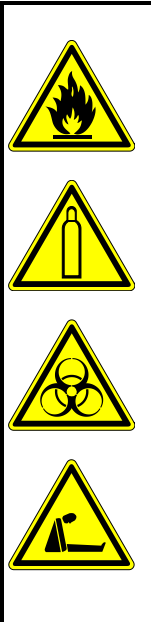
| | |
|---|--|
|  |  WARNING |
| | <p>Only qualified trained staff must install the gas connections!</p> <p>The operator must ensure to emit the exhaust gases into a safe environment!</p> |

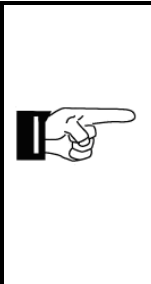
6.3.5 Calibration gas

| | |
|---|--|
|  |  WARNING |
| | <p>Only qualified trained staff must install the gas connections! If no pressure reducers are installed, the operator must make sure that escaping calibration gas is emitted to a safe environment!</p> |

| | |
|--|---|
|  | NOTE |
| | <ul style="list-style-type: none">• The connecting parts need to be clean and free of residue. Impurities can enter the combustion calorimeter and cause incorrect measurements and/or damage.• The inlet pressure for the gas connections must not exceed the values specified in the technical data of the combustion calorimeter.• Calibration gas must be free from impurities and condensate.• The quality of the calibration gas should be similar to the process gas quality.• Each connection needs to be carefully checked for leaks. If there are any leaks, the system will draw air, and the measurements will be incorrect.• Do not use sealing agents to seal the gas connections. Sealing agents can distort measurements.• Only use suitable pipes.• Software configuration of the calibration gas (☞ <i>chapter 9.4 Present displays</i>) |

6.3.6 Flue gas

| | |
|---|--|
|  | <div style="background-color: #f4a460; padding: 5px;">⚠ WARNING</div> <p>Serious risk of injury from escaping flue gas.</p> <ul style="list-style-type: none"> • Flue gas must be emitted to the open air! • For flue gases with the components CO, H₂, and H₂S ensure sufficient room ventilation. |
|---|--|


| | |
|---|--|
|  | <div style="background-color: #0070c0; color: white; padding: 5px;">NOTE</div> <p>Flue gases / residual heat must be emitted to the open air through a suitable exhaust system.</p> <p>This exhaust system must be taken into account during the workstation risk analysis.</p> |
|---|--|

6.3.7 Opening, closing of cover plate

| | |
|---|--|
|  |  DANGER |
| | Loss of explosion protection! Danger of explosion in hazardous areas by open or not properly closed device! |

Before closing the door of the EX-d box, the intactness and cleanness of the machined flange surfaces and the gasket is to check in any case.



Further information:

 *enclosed documentation!*

KILLARK - *Installation, Operation & Maintenance Data sheet*

Before closing the lid of the PLC- box (EX-p box) the intactness and cleanness of the gasket is to check in any case.

6.3.8 Electrical connection

| | |
|---|---|
|  |  DANGER |
| | Danger from electrical shock! Only a trained electrician may modify the electrical equipment of the combustion calorimeter in accordance with the relevant guidelines! When the combustion calorimeter has been opened, the parts identified by the adjacent symbol may still be live even when the master switch has been turned off. If necessary, disconnect combustion calorimeter from the voltage mains! |

Further information:

 *enclosed documentation! – Wiring diagram -*

The connections for the power supply are located at the inside of the PLC -box (EX-P box).

6.3.9 Grounding of the EX-d box

| | |
|---|-------------|
|  | NOTE |
| The enclosure must be earthed separately in each case. | |

The port is located on the outside, in the lower-right corner. The Connector kit, is attached to the earth connector on delivery.



Fig. 6.6: Grounding connector EX-d box

Further information:

☞ *enclosed documentation!*

KILLARK - *Installation, Operation & Maintenance Data sheet*

6.3.10 Removing / attaching the transport safeguard

| | |
|---|---|
|  | NOTE |
| | <p>Before commissioning/transport of the combustion calorimeter, make sure that all transport safeguards are removed/attached.</p> |

The following transport safeguards must be removed/attached in the combustion calorimeter:

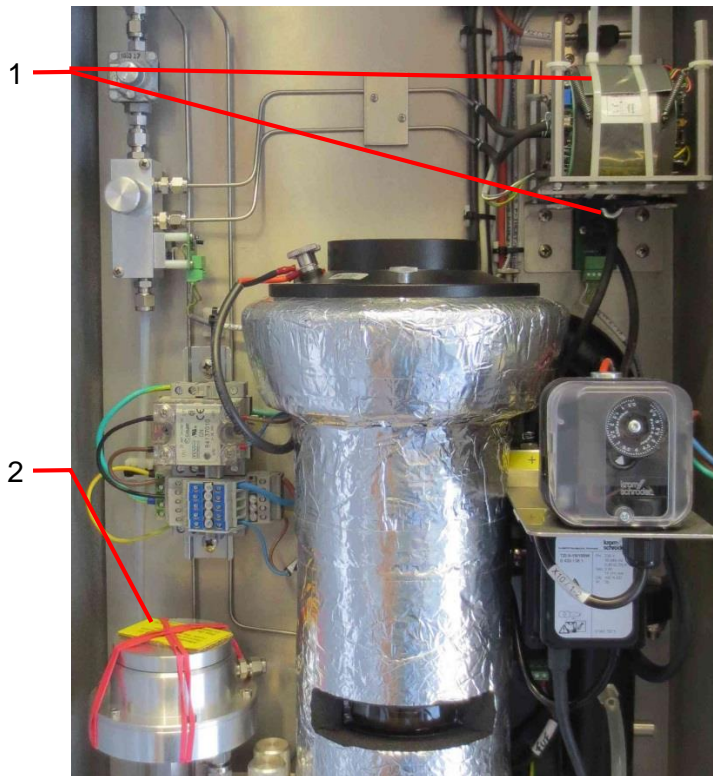


Fig. 6.7: Transport safeguards (example)

| Item No. | Component | Type of safeguard |
|----------|--|--|
| 1 | Transport safeguard density measuring cell | 4x cable strap; 1x ring screw |
| 2 | Transport safeguard pressure controller | 2x safety rubber; 1x bubble wrap (inside) |

Transport safeguard in the pressure controller

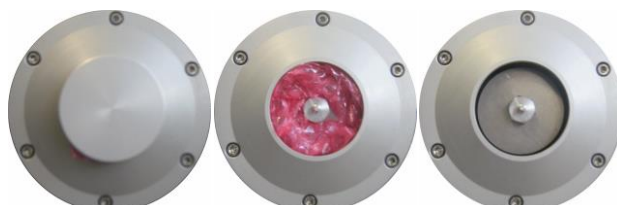


Fig. 6.8: Transport safeguards in the pressure controller

| Transport safeguard | Order of removing/attaching the transport safeguard |
|---|--|
| Transport safeguard pressure controller | <ul style="list-style-type: none"> • Remove the rubber. • Open the cover (screw connection or cover cap). • Remove the transport safeguard (bubble wrap). • Close the cover again. |


To re-attach the transport safeguard, proceed in reverse order.

Transport safeguard density measuring cell

| Transport safeguard | Order of removing/attaching the transport safeguard |
|--|---|
| Transport safeguard density measuring cell | <ul style="list-style-type: none"> • Remove the black cable straps of the centre eyebolt. • Remove the white cable straps around the density measuring cell. • Unscrew the eyebolt. • The density measuring cell must swing freely. |



To re-attach the transport safeguard, proceed in reverse order.


6.4 Documentation


| | |
|---|--|
|  | NOTE |
| | Union Instruments GmbH recommends keeping a maintenance manual and documenting all jobs and tests. |






7 Commissioning/start-up



| | |
|---|--|
|  |  <h1 style="margin: 0;">ATTENTION</h1> |
| | <p>To establish operational readiness, including of the linked system components, according to the corresponding operating instructions.</p> |

| | |
|---|---|
|  | <h1 style="margin: 0;">NOTE</h1> |
| | <p>For first starting or before a long downtime, save the device configuration. Let a service technician do the backup or ask Service for special instructions.</p> |


| | |
|---|--|
|  | <h1 style="margin: 0;">NOTE</h1> |
| | <p>The following table includes abridged instructions for commissioning the system after a longer standstill.</p> <p>If the combustion calorimeter is to be switched on again after a short period of standstill, some steps are not necessary: ☞ <i>right column!</i></p> |

| | |
|---|--|
|  | <h1 style="margin: 0;">NOTE</h1> |
| | <p>Check the proper installation of the system in conformity with the manufacturer and sub supplier instructions, the national-specific regulations and the plant regulations.</p> |

| | |
|---|---|
|  |  <h1 style="margin: 0;">DANGER</h1> |
| | <ul style="list-style-type: none"> • By an improper assembly the device can be damaged, destroyed or be affected in the functioning. Improper Assembly inevitably leads to the loss of explosion protection. • Work on the system, must be carried out by trained and authorised staff or by the specialists of UNION Instruments service team. |

| Steps | Startup | Turning on |
|--|---------|------------|
| Check if the transport safeguard of the density measuring cell has been removed. The density measuring cell must be able to swing freely at the springs. | X | |
| Check if the transport safeguard of the gas pressure controller has been removed. The foamed plastic within the controller be taken out. | X | |
| Check whether the ambient conditions (☞ <i>Technical Data</i>) meet the requirements. | X | |
| Check if the combustion calorimeter is attached safely. | X | |
| Check that the device is suitable for the process gas. | X | |
| Check that the process gas is correct. | X | |
| Check that the gas connections are correct and tight. | X | |
| Check, if necessary, that the calibration gas is correct. | X | |
| Establish/switch on the operator energy and media supply. | X | |
| Check the voltage. | X | |
| Make sure that the overpressure housings are closed and the screws are pressed tight. | X | X |
|  Further information, enclosed documentation! Consider in each case the manufacture instructions: KILLARK - Installation, Operation & Maintenance Data sheet | X | X |
| Make sure that the purging unit is clean, closed and locked. | X | X |
| Make sure the linked system components are ready to start. | X | X |
|  If the combustion calorimeter was only switched off temporarily, production can be resumed! | | |

8 Description of the workplaces / operating elements

| | |
|---|------|
|  | NOTE |
| <p>This chapter only discusses the elements used by normal operators to operate the combustion calorimeter.</p> | |

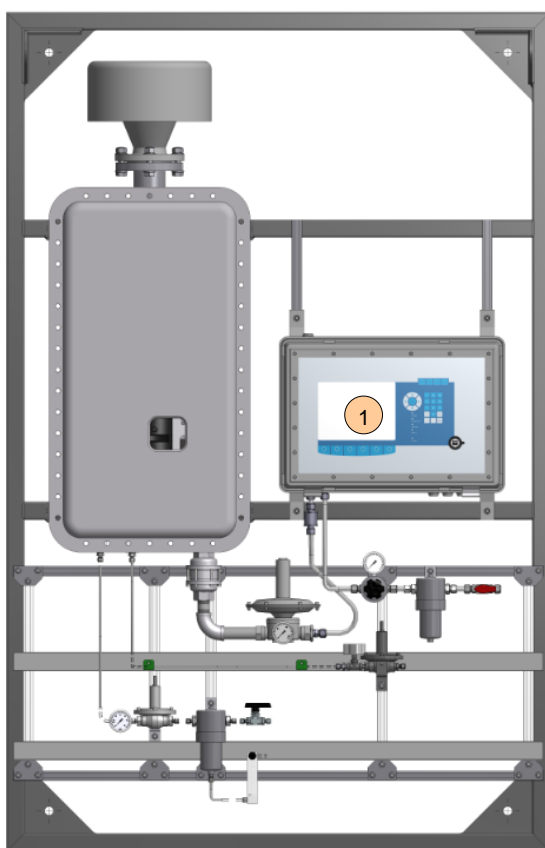





Fig. 8.1: Workplaces (exemplary)

| Item No. | designation | Function / activity |
|----------|-------------|-------------------------------|
| 1 | Display | Status display and operation. |



9 Operation

| | |
|--|--|
|   |  <h1 style="margin: 0;">WARNING</h1> |
| | <p>Danger of injury!</p> <p>Only use the combustion calorimeter when all lines have been installed and checked for leaks according to national regulations.</p> |

9.1 Starting – Switching on


After closing the lid, wait for 10 minutes. The overpressure will be built up. Then the combustion calorimeter starts automatically.

1. Closing the lid of the PLC box
2. Open the respective air supply valve 15 A/B
3. After approx. 10 minutes the system starts automatically
4. Open the respective gas supply valve

After closing the air supply valve the system shuts down. The whole system is voltage-free.

9.2 Operation of film keyboard/ description of display

The software controls are operated using a membrane keypad. The displayed buttons can be selected by pressing the key.

| | |
|---|--|
|  | <h1 style="margin: 0;">NOTE</h1> |
| | <p>Damage to the membrane keypad!</p> <p>Operation with pointed/sharp objects can damage the film keyboard!</p> |

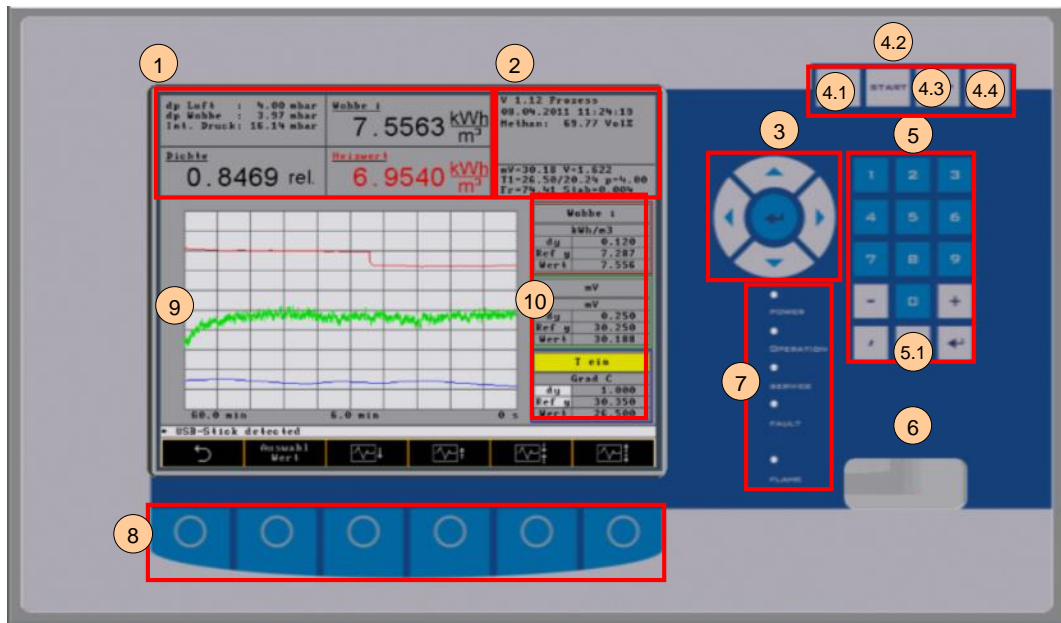




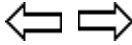



Fig. 9.1: Operating elements/layout of display

| Item No. | designation | Function |
|----------|--------------------|---|
| 1 | Numeric display | Output of current measurement values after reaching the operating mode. |
| 2 | Display field | Information field, start screen. |
| 3 | Position buttons | Position buttons move the cursor in a current input field to the input position. With the return button you confirm the entered value. |
| 4.1 | Menu button | The menu button causes a jump from any menu level back to the main menu. |
| 4.2 | Start, stop button | This button stops the system without switching the power supply off. The fan can also stop or keep running. This function can be programmed. The button also saves the input data in the memory. |
| 4.3 | ESC button | The ESC button cancels the current input process independent of the menu level. |
| 5 | Input buttons | Input buttons serve for input of numeric data. For this purpose, a value field must be active on the screen. |
| 6 | Burner window | Check window to monitor the ignition or combustion process. |
| 7 | LED status display | Power: lights up when the machine is switched on Operation: only on during processes or calibration Service: service required (filter, temperature, etc.) Fault: severe error Flame: flame is burning |
| 8 | Menu keys | Menu buttons are described in the software. Their meanings change depending on the selected menu. The function is indicated on the current screen. |
| 9 | Graphic display | Graphic display of current measurement values/information. |
| 10 | Trend | Values for the trends |

9.3 Basics on operation

The buttons described in the following serve for operation via the software of the combustion calorimeter.

| Symbol | Function |
|---|--|
|  | <p>Symbol "Back" in the menu buttons:</p> <ul style="list-style-type: none"> • Cause a jump to one menu level up at a time until the main menu is reached. |
|  | <p>Symbol "Browse" in the menu buttons:</p> <ul style="list-style-type: none"> • Causes the display of other menu which cannot be shown on the currently displayed screen due to space limitations. The individual menus are shown in an endless loop. |
|  | <p>Symbol "Rotation" in the menu buttons:</p> <ul style="list-style-type: none"> • Causes the highlighted area to move left or right. |
|  | <p>Symbols "Plus" and "Minus" in the menu buttons:</p> <ul style="list-style-type: none"> • Calculates the sum of the marked numbers/fields, or subtracts from that sum. |
|  | <p>Symbol "Arrow" in the menu buttons:</p> <ul style="list-style-type: none"> • Causes a jump to the adjacent field (vertically/horizontally). In the position button field you can set the next lines. |

| | |
|---|--|
|  | NOTE |
| | <p>Other symbols not described above refer to the different menus. They are described on the corresponding screens.</p> |

9.4 Available displays

The available displays and corresponding functions are described below. The navigation path to the displays is indicated by the menu and function keys in the chapter headings.

The control system is based on the structure shown in section 8.2.1. Different colours represent the different depth within the menu structure.

9.5 General information on the start screen

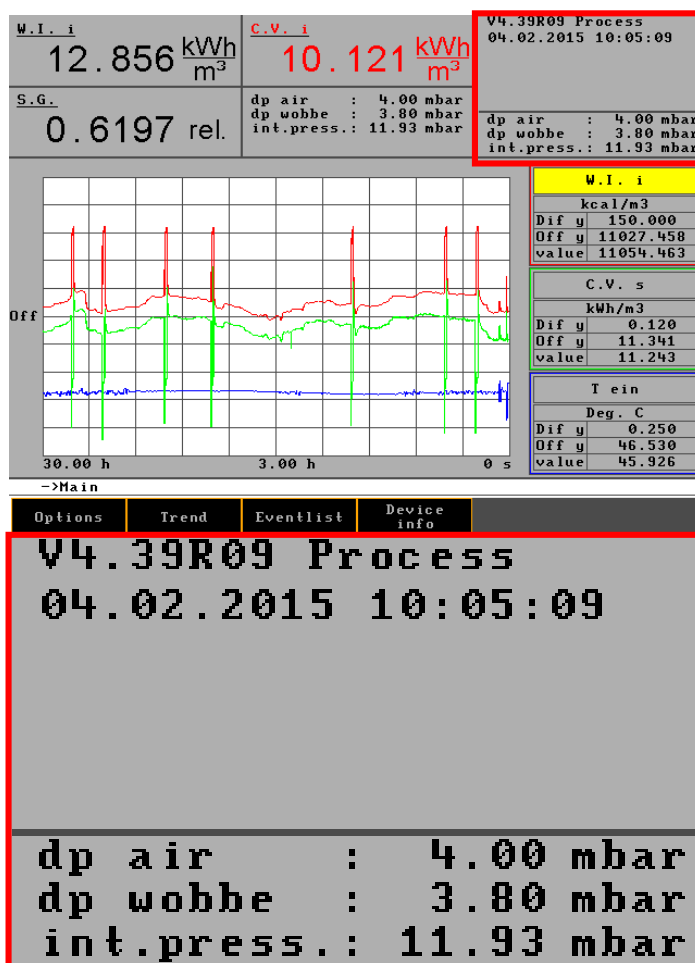


Fig. 9.2: Information field, start screen.

| Display (example values) | Information |
|--------------------------|--|
| V 4.39R09 | Version number of the software |
| 04.02.2015 10:05:09 | Current date / time |
| Methane: 95.01 Vol% | Volume share of methane |
| mV=24.56 | mV signal of the thermal battery |
| V=1.071 | Voltage signal of the density measuring cell |
| T1=29.04/0.24 | Inlet temperature into the thermal body / heating of the air |
| p=4.00 | Air differential pressure |
| Fr=51.13 | Controlled fan frequency |
| Stabi=0.011 | Standard deviation of the measurement value over 2 minutes |



NOTE

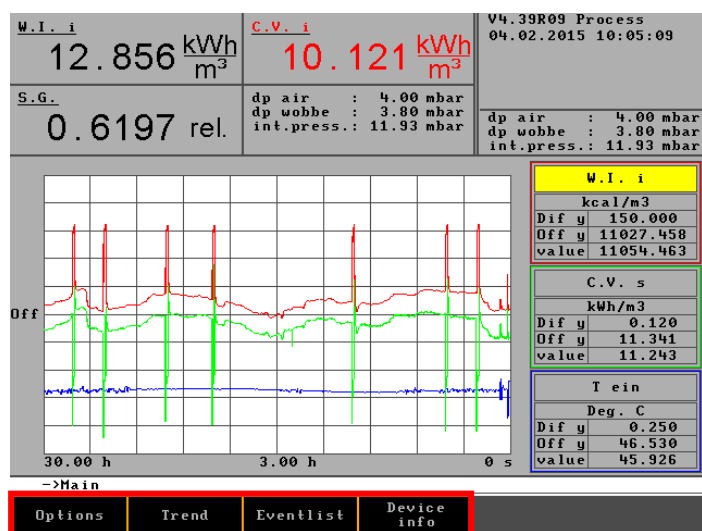
Stabi: Typical result of a calibration is 0.015. Then calibration is finished.

9.6 Menu structure

9.6 Menu structure |

| | | |
|-------|--|----|
| 9.7 | Main menu | 49 |
| 9.7.1 | Main menu - Options | 50 |
| | Main menu - Options - I/O | 51 |
| | Main menu - Options - I/O - Analog outputs | 52 |
| | Main menu - Options - I/O - Digital outputs | 53 |
| | Main menu - Options - I/O - mA display | 54 |
| | Main menu - Options - I/O - Digital inputs | 55 |
| | Main menu - Options - I/O - display | 56 |
| | Main menu - Options - Calibration | 57 |
| | Main menu - Options - Calibration - Configuration of calibration gas | 58 |
| | Main menu - Options - Calibration - Automatic calibration | 59 |
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| | Main menu - Options - System - Database | 72 |
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| 9.7.2 | Main menu - Trend | 74 |
| | Main menu - Trend - Time selection | 75 |
| | Main menu - Trend - Value selection | 76 |
| | Main menu - Trend - Signal selection | 77 |
| | Main menu - Trend - Unit selection | 77 |
| | Main menu - Trend - Curve selection | 78 |
| 9.7.3 | Main menu - Events list | 79 |
| 9.7.4 | Main menu - Device info | 80 |

9.7 Main menu



The main menu is the standard display in running operation.

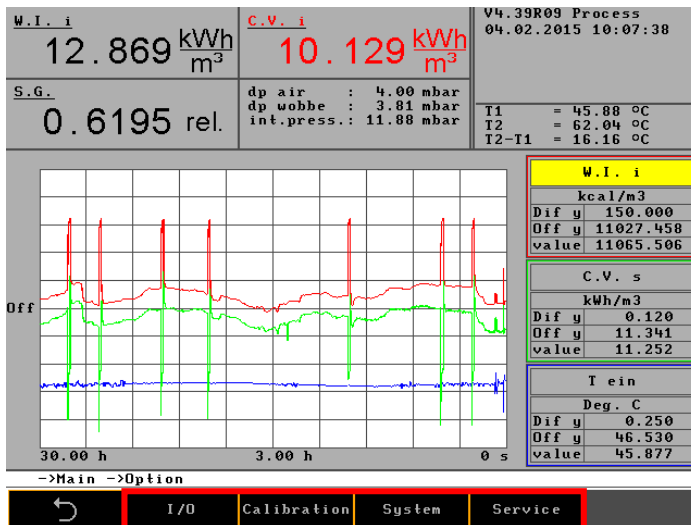
From the main menu you can access the following sub-menus:

- Options
- Trend
- Eventlist
- Device info

9.7.1 **Main menu** - **Options**

NOTE

The free part of the info field is filled with important information, depending on the menu selection, which refers to current activities, e.g. filter change, temperature too high.



I/O

Option to configure the following parameters:

- Analog and digital outputs
- Digital inputs
- mA display and display

Calibration

Option to configure the following parameters:

- Calibration gas settings
- Calibration limits
- Calibration

System

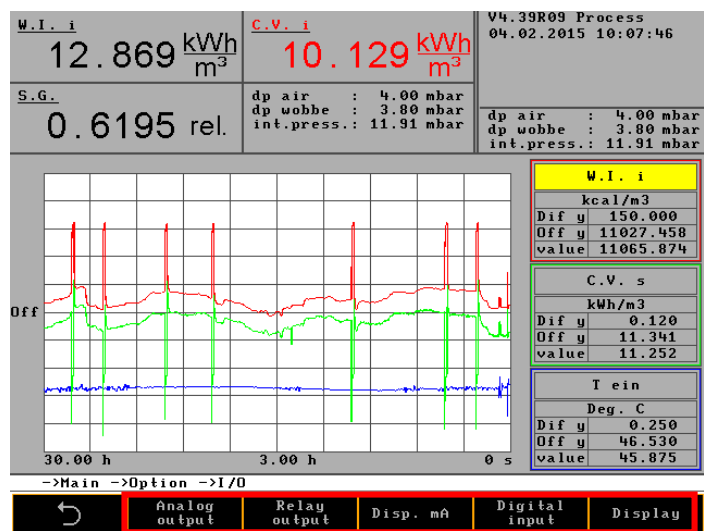
Option to configure the following parameters:

- General
- Ignition
- Hold signal
- Settings
 - Date, language, etc.

Service

For service technicians only

Main menu - Options - I/O



Options for configuration for the following parameters:

- Analog outputs
- Relay outputs
- Disp. mA
- Digital inputs
- Display

Main menu - Options - I/O - Analog outputs

| | | |
|---|--|--|
| W.I. i 12.840 kWh m ³ | C.V. i 10.119 kWh m ³ | V4.39R09 Process 04.02.2015 15:32:34 |
| S.G. 0.6210 rel. | dp air : 4.00 mbar dp wobbe : 3.79 mbar int.press.: 11.90 mbar | T1 = 45.84 °C T2 = 61.97 °C T2-T1 = 16.12 °C |

| Configuration of analog outputs | | | | | |
|---------------------------------|--------|--------|--------------------|------------|----------|
| No | Signal | | Unit | Range from | Range to |
| 1 | W.I. s | 4 - 20 | kWh/m ³ | 8.000 | 16.000 |
| 2 | S.G. | 4 - 20 | kg/m ³ | 0.500 | 1.000 |
| 3 | C.V. s | 4 - 20 | kWh/m ³ | 8.400 | 13.100 |
| 4 | --- | | | | |
| 5 | --- | | | | |
| 6 | --- | | | | |
| 7 | --- | | | | |

->Main ->Option ->I/O ->Configuration of analog outputs

Signal (list field)
Type (list field)
Unit (list field)
MB from MB to

Wobbe index, density, heating value
 4 – 20 mA
 kcal/m³, relative
 value fields for numeric input

Units:

xxx/m³ and BTU/ft³ correspond to a gas temperature of 0 °C and a barometric pressure of 1013 mbar.

xxx/Sm³ corresponds to a gas temperature of 15 °C (60 °F) and a barometric pressure of 1013 mbar.

☞ xxx stands for MJ, kcal, or kWh.

BTU/ft³ corresponds to a gas temperature of 15 °C (60 °F) and a barometric pressure of 1013 mbar.

Main menu - Options - I/O - Digital outputs

| W.I. i 12.868 kWh m ³ | C.V. i 10.129 kWh m ³ | V4.39R09 Process 04.02.2015 10:08:54 | | | | |
|--|--|--|------|---------|---------|-----------|
| S.G. 0.6195 rel. | dp air : 4.00 mbar dp wobbe : 3.80 mbar int.press.: 11.94 mbar | dp air : 4.00 mbar dp wobbe : 3.80 mbar int.press.: 11.94 mbar | | | | |
| Configuration of relay outputs | | | | | | |
| No | Signal | Oprtr | Unit | Value 1 | Value 2 | Zero pos. |
| 1 | Operation | | | | | low |
| 2 | Maintenance | | | | | low |
| 3 | Filter change | | | | | low |
| 4 | Fault | | | | | low |
| 5 | Operation | | | | | low |
| 6 | Operation delayed | | | | | low |
| 7 | --- | | | | | |
| 8 | --- | | | | | |
| * ->Main ->Option ->I/O ->Configuration of relay outputs | | | | | | |

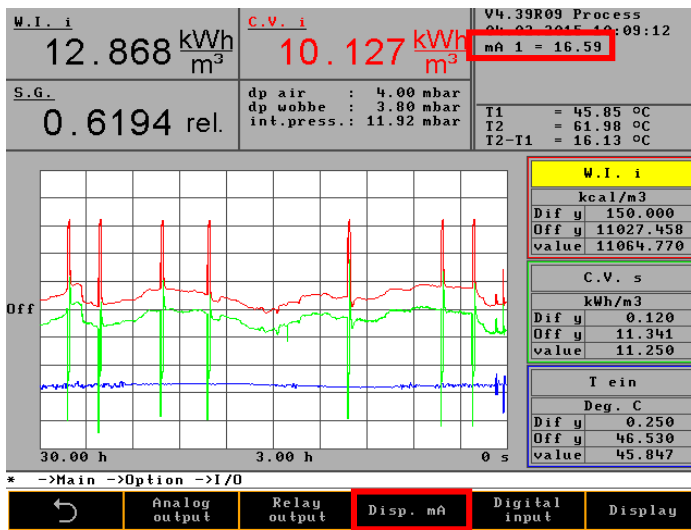
The digital output can e.g. comprise signals in combination with limit values or operation messages.

Example:

The Wobbe signal in MJ/m³ has an alarm value at 47,000 and 50,000 MJ. The zero position is high. The relay for the signals described in the following are switched under the following conditions:

- Process: The solenoid valve for process gas is open and the flame is burning.
- Calibrate: The solenoid valve for calibration gas is open and the flame is burning.
- Service: Filter change of air filter (the frequency of the frequency converter is > 48 Hz) or air inlet temperature > 41°C.
- Filter change: Filter change of air filter (The frequency of the frequency converter is > 48 Hz)
- Fault: The air filter is heavily soiled. The differential air pressure is thus < 3.5 mbar
- Operation: The flame is burning.
- Operation delayed: The flame is burning and the delay time has expired.
- Over temperature: The flame is too hot. The Wobbe signal is larger than 76 mV, i.e. the temperature increase in the inner pipe of the thermal battery is more than 50°C.
- Calibration deviation: In a basic calibration you can set a signal which will trigger and alarm when the deviation to the basic calibration exceeds the alarm value. This is possible in negative and positive direction.
- Int. pressure: An alarm is triggered in case of lack of process gas or lack in the calibration gas line.

Main menu - Options - I/O - mA display



In the menu item Disp. mA you can display the mA values for all 7 outputs. The display is located on the upper right below the date. With the button **Disp. mA** you can show all channels one after the other.

Main menu - Options - I/O - Digital inputs

| | | |
|---|--|---|
| W.I. i 6.7866 kWh m ³ | C.V. i 5.3208 kWh m ³ | U4.39R09 Process 04.02.2015 10:10:06 Gas in 2 sec |
| S.G. 0.6146 rel. | dp air : 4.00 mbar dp wobbe : -0.17 mbar int.press.: 2.70 mbar | I1 = 45.84 °C I2 = 53.64 °C I2-I1 = 7.80 °C |

| Configuration of contact inputs | | |
|---------------------------------|--------|-----------|
| No | Signal | Zero pos. |
| 1 | --- | low |
| 2 | --- | low |
| 3 | --- | low |

->Main ->Option ->I/O ->Configuration of contact inputs

Signal and zero position are list fields. These inputs can start a calibration or switch a holding amplifier on or off. The inputs are queried once per second. i.e. a change must be pending for at least one second in order to be detected by the system.

| Signals | Zero position | Contact | Combustion calorimeter |
|--------------------|---------------|---------|-----------------------------|
| Start calibration | high | open | Calibration starts |
| | | closed | No calibration |
| | low | open | No calibration |
| | | closed | Calibration starts |
| Start measurement | high | open | Measurement starts |
| | | closed | Measurement stops |
| | low | open | Measurement stops |
| | | closed | Measurement starts |
| Signals hold | high | open | mA hold |
| | | closed | mA online |
| | low | open | mA online |
| | | closed | mA hold |
| Calibration cancel | high | open | Calibration cancellation |
| | | closed | No calibration cancellation |
| | low | open | No calibration cancellation |
| | | closed | Calibration cancellation |

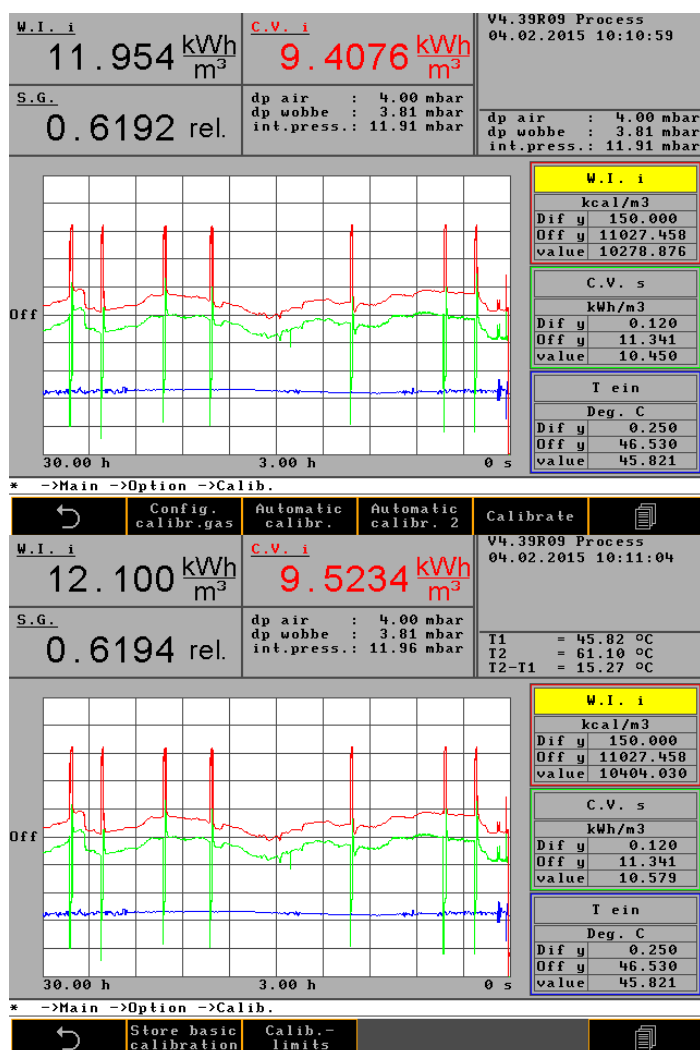
Main menu - Options - I/O - display

| W.I. i 7.0238 kWh m ³ | C.V. i 5.5289 kWh m ³ | V4.39R09 Process 04.02.2015 10:10:30 | | | | | | | | | | | | | | | | | | |
|---|--|---|-----------------------|--|--|----|-------------|------|---|--------|--------------------|---|------|----------|---|--------|--------------------|---|----------|------|
| S.G. 0.6196 rel. | dp air : 4.00 mbar dp wobbe : 3.84 mbar int.press.: 11.94 mbar | T1 = 45.83 °C T2 = 55.44 °C T2-T1 = 9.62 °C | | | | | | | | | | | | | | | | | | |
| <table border="1"> <thead> <tr> <th colspan="3">Display configuration</th> </tr> <tr> <th>No</th> <th>Phys. value</th> <th>Unit</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>W.I. i</td> <td>kWh/m³</td> </tr> <tr> <td>2</td> <td>S.G.</td> <td>Specific</td> </tr> <tr> <td>3</td> <td>C.V. i</td> <td>kWh/m³</td> </tr> <tr> <td>4</td> <td>Pressure</td> <td>mbar</td> </tr> </tbody> </table> | | | Display configuration | | | No | Phys. value | Unit | 1 | W.I. i | kWh/m ³ | 2 | S.G. | Specific | 3 | C.V. i | kWh/m ³ | 4 | Pressure | mbar |
| Display configuration | | | | | | | | | | | | | | | | | | | | |
| No | Phys. value | Unit | | | | | | | | | | | | | | | | | | |
| 1 | W.I. i | kWh/m ³ | | | | | | | | | | | | | | | | | | |
| 2 | S.G. | Specific | | | | | | | | | | | | | | | | | | |
| 3 | C.V. i | kWh/m ³ | | | | | | | | | | | | | | | | | | |
| 4 | Pressure | mbar | | | | | | | | | | | | | | | | | | |
| * ->Main ->Option ->I/O ->Display configuration | | | | | | | | | | | | | | | | | | | | |

The numeric display in the display can be selected arbitrarily. Any pre-set value can be entered in the display on the upper left.

Size and unit are list fields, they determine the numeric display on the device's screen. The display can be selected arbitrarily.

Main menu - Options - Calibration



Enter the calibration point numerically as Wobbe index and as relative density.

The density variation will be added as error into the measurement. Relative density and heating value show the error, the Wobbe index is measured physically and shown as exact value.

Main menu - Options - Calibration - Configuration of calibration gas

| | | |
|--|--|--|
| Wobbe i 69.345 kcal/m ³ | Heizwert 68.918 kcal/m ³ | V4.08 Zuendung 06.09.2013 08:42:27 |
| Dichte 0.9877 rel. | dp Luft : 4.00 mbar dp Wobbe : 0.01 mbar Int. Druck: 0.01 mbar | mV= 0.68 V=1.997 Ti=29.05/ 0.38 p=4.00 Fr=53.75 Stab=0.260 |

| Konfiguration Kalibriergase | | | | | |
|-----------------------------|---------------------|---------|---------|---------|--------|
| Nr | Einheit | Wobbe i | Wobbe s | Einheit | Dichte |
| 1 | kcal/m ³ | 2337 | 2546 | relativ | 0.737 |
| 2 | BTU/ft ³ | 0.00 | 0.00 | relativ | 0.000 |

* ->Hauptmenue ->Optionen ->Calib. ->Konfiguration Kalibriergase

The calibration gas values are entered as Wobbe index and relative density. These values are calculated from the gas components of the calibration gas if the calibration gas producer only specified %-numbers of the gas components and not dv and heating value. Take into account of the calorific value or the heating value are to be used for the calculation.

The literature values of the components refer to dry or humid gas. The temperature reference point (0°C or 15°C) also results in a difference in reference value. The producer always bases the specification on 0°C and 1013°mbar with dry gas.

Units:

xxx/m³ and BTU/ft³ correspond to a gas temperature of 0 °C and a barometric pressure of 1013 mbar.

xxx/Sm³ corresponds to a gas temperature of 15 °C (60 °F) and a barometric pressure of 1013 mbar.

☞ xxx stands for MJ, kcal, or kWh.

BTU/ft³ corresponds to a gas temperature of 15 °C (60 °F) and a barometric pressure of 1013 mbar.

Main menu - Options - Calibration - Automatic calibration

| | | |
|--|--|--|
| W.I. i 12.624 kWh m ³ | C.V. i 9.9370 kWh m ³ | V4.39R09 Process 04.02.2015 10:11:45 |
| S.G. 0.6195 rel. | dp air : 4.00 mbar dp wobbe : 3.80 mbar int.press.: 11.95 mbar | T1 = 45.82 °C T2 = 61.72 °C T2-T1 = 15.90 °C |

| Configuration auto calibration | | | |
|--------------------------------|-----------|-------|-------|
| Program | Day | Time | Every |
| 1 | Every day | 00:00 | 1 |
| 2 | Every day | 06:00 | 1 |
| 3 | Every day | 08:00 | 1 |
| 4 | Every day | 12:00 | 1 |
| 5 | Every day | 15:00 | 1 |
| 6 | --- | 00:00 | 0 |
| 7 | --- | 00:00 | 0 |
| 8 | --- | 00:00 | 0 |
| 9 | --- | 00:00 | 0 |
| 10 | --- | 00:00 | 0 |

* ->Main ->Option ->Calib. ->Configuration auto calibration

Day is a list field (Son, Mon, Tue, ...) while time and cycle are value fields.

The device itself determines the duration of purge time for the calibration gas. For this purpose it uses a stability criterion. This criterion is reached after 6 to 10 min, depending on the gas. Afterwards the device automatically switches back to process gas. If the criterion is not reached, the calibration is aborted after 10 min. The abortion is documented in the events list.

Attention: After a device restart or a change of calibration gas, the calibration might need to be repeated 2-3 times. Successful calibration is only possible after the pulse line to the calibration gas has been purged sufficiently and the entire air has been displaced out of the line.

Main menu - Options - Calibration - Automatic calibration 2

| | | |
|--|--|--|
| W.I. i 12.681 kWh m ³ | C.V. i 9.9808 kWh m ³ | V4.39R09 Process 04.02.2015 10:12:02 |
| S.G. 0.6194 rel. | dp air : 4.00 mbar dp wobbe : 3.82 mbar int.press.: 11.91 mbar | T1 = 45.82 °C T2 = 61.79 °C T2-T1 = 15.97 °C |

| Configuration auto calibration 2 | | |
|----------------------------------|-----------|-------|
| Program 2 | Situation | Value |
| 1 | --- | 0 |
| 2 | --- | 0 |
| 3 | --- | 0 |
| 4 | --- | 0 |
| 5 | --- | 0 |
| 6 | --- | 0 |
| 7 | --- | 0 |
| 8 | --- | 0 |
| 9 | --- | 0 |
| 10 | --- | 0 |

* ->Main ->Option ->Calib. ->Configuration auto calibration 2

There are 2 situations in which a calibration is done automatically:

- absolute deviation of the current outside temperature and the temperature during the previous calibration (unit °C), and
- minutes after device restart (in minutes)

Main menu - Options - Calibration - Calibration

In this menu item you can start the automatic calibration manually. The entered calibration time in the menu "Automatic calibration" is skipped but remains active for the next calibration.

Main menu - Options - Calibration - Saving basic calibration

The Basic calibration is done immediately after pressing the button. It determines a calibration point which will serve as basis for further calibrations so that any deviation can be detected. This deviation is entered in the events list and can be monitored with min-max limits, ☞ *next chapter!*

A new basic calibration checks the limits and indicates a deviation if the limits are exceeded (red actual value) or shows no red value if the value is within the limits.

Main menu - Options - Calibration - Calibration limits

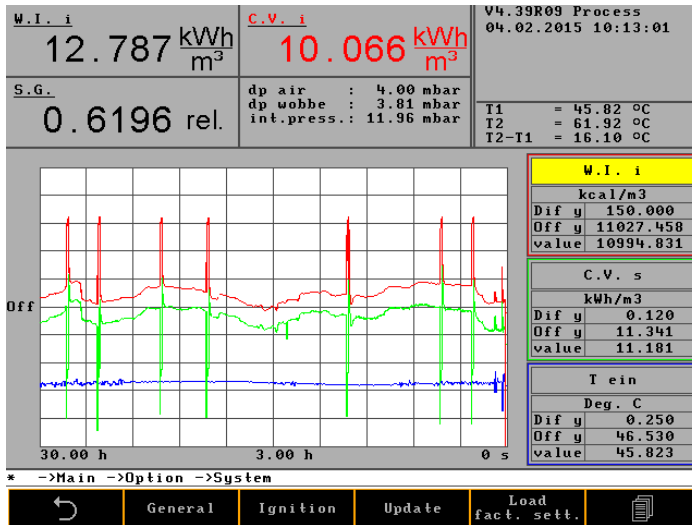
| | | |
|--|--|--|
| W.I. i 12.681 kWh m ³ | C.V. i 9.9808 kWh m ³ | V4.39R09 Process 04.02.2015 10:12:02 |
| S.G. 0.6194 rel. | dp air : 4.00 mbar dp wobbe : 3.82 mbar int.press.: 11.91 mbar | T1 = 45.82 °C T2 = 61.79 °C T2-T1 = 15.97 °C |

| Configuration auto calibration 2 | | |
|----------------------------------|-----------|-------|
| Program 2 | Situation | Value |
| 1 | --- | 0 |
| 2 | --- | 0 |
| 3 | --- | 0 |
| 4 | --- | 0 |
| 5 | --- | 0 |
| 6 | --- | 0 |
| 7 | --- | 0 |
| 8 | --- | 0 |
| 9 | --- | 0 |
| 10 | --- | 0 |

* ->Main ->Option ->Calib. ->Configuration auto calibration 2

In this screen you can specify the calibration limits. If the value differs by a specific value or if the calibration thresholds are exceeded in either direction (smaller/higher), an alarm is issued.

Main menu - Options - System



In this menu item, you specify the basis configuration of the device, such as ignition, time, language and code key.

Main menu - Options - System - General

The command "Change signals after hold" causes a smooth transition after a calibration or after switching off the signal stop condition. This avoids a sudden rise or drop of the measurement value in the measurement curve. The continuous transition is specified in seconds.

| | | |
|--|--|--|
| W.I. i 12.822 kWh m ³ | C.V. i 10.092 kWh m ³ | V4.39R09 Process 04.02.2015 10:14:41 Gas pressure |
| S.G. 0.6195 rel. | dp air : 4.00 mbar dp wobbe : 3.81 mbar int.press.: 11.92 mbar | dp air : 4.00 mbar dp wobbe : 3.81 mbar int.press.: 11.92 mbar |

| General settings | |
|---|-----|
| Change signals after hold (in sec.) | 120 |
| Purge time after fan or instr. start-up | 10 |
| Time delay power down display | 0 |
| Display speed | 150 |
| Carrier gas Cal. cycles (in min) | 0 |
| delay operation | 120 |
| ADC calibration cycle | 60 |
| Calibration valve delay | 0 |
| Min. internal pressure (mbar) | 8 |
| Warning level internal pressure (mbar) | 14 |

* ->Main ->Option ->System ->General settings

General system values are configured in this menu.

The following must be observed for this:

Change signals after holding:

When the Hold signals (mA) function is ended, an adjustment of the old and new measured values is made over a time ramp.

Purge time after cooling:

Specifies the length of time after the device start that the solenoid valve is open until ignition starts.

Screen switch-off time:

Specifies the time after which the screen will be switched off if no input is made.

Display speed:

Refers to a time constant for various burners. It is preset by the manufacturer and dependent on the burner type.

Carrier gas check cycles:

The time intervals for carrier gas calibrations, in hours, is defined.

Operation delay:

The "Operation" relay output is activated only after the delay time elapses.

Minimum internal pressure:

When the minimum internal pressure is fallen below, the device goes to STOP state, default value is 8 mbar.

Internal pressure warning threshold:

Below the warning threshold, insufficient gas is signaled for internal pressure and Service. Default value is 14 mbar.

Main menu - Options - System - Ignition

| | | |
|--|--|--|
| W.I. i 12.846 kWh m ³ | C.V. i 10.111 kWh m ³ | 04.39R09 Process 04.02.2015 10:16:32 |
| S.G. 0.6195 rel. | dp air : 4.00 mbar dp uobbe : 3.80 mbar int.press.: 11.96 mbar | dp air : 4.00 mbar dp uobbe : 3.80 mbar int.press.: 11.96 mbar |

| Configuration ignition | |
|-----------------------------|-----------------|
| Ignition type | Repeat ignition |
| Ignition time (sec.) | 120 |
| Ignition threshold (deg. C) | 3.00 |

*

The ignition type can be individual ignition or interval ignition. The ignition break always equals the ignition duration. The longest possible ignition duration is 100 sec. Normally it should be between 15 and 20 sec. Upon reaching the ignition threshold the ignition stops.

The ignition threshold specifies at which centigrade value the thermal battery considers the flame to be burning. The flame temperature depends on the gas composition. The settings are done accordingly. The manufacturer pre-sets the optimum temperature for the ordered measuring range. In this example 3°C differential temperature between cooling air and flue gas.

Main menu - Options - System - CSV export

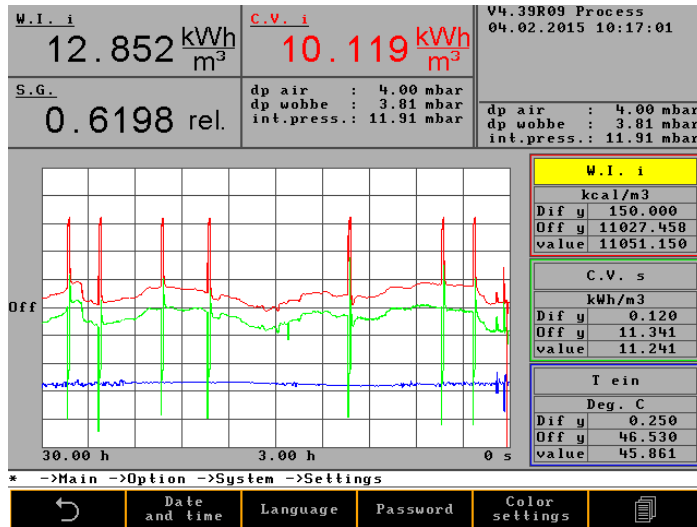
Here you export the data as ASCII files. The values are TAB-separated. In one go, all possible 25 curves are written in one CSV file. This file can be processed with Excel.

Main menu - Options - System - Signal hold on/off

Here, the last measured values are issued as constant signal during the calibration. This refers to all 4-20 mA signals. They are always switched on or off jointly.

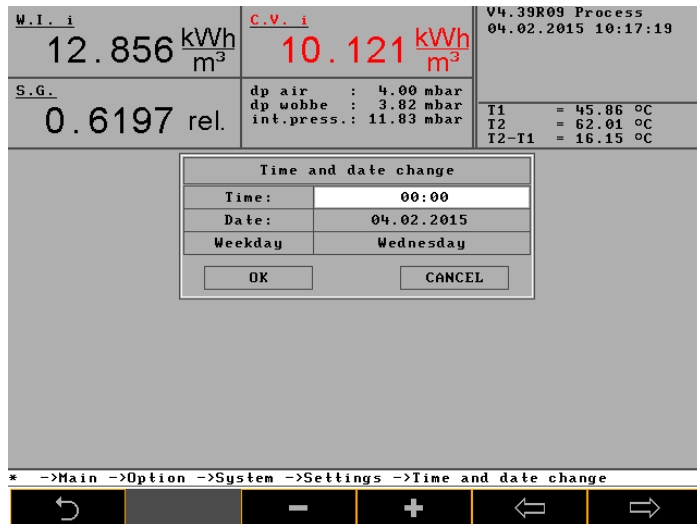
Main menu - Options - System - Settings

Settings includes all menu items referring to the basic settings which are used only rarely or once.



Main menu - Options - System - Settings - Date/time

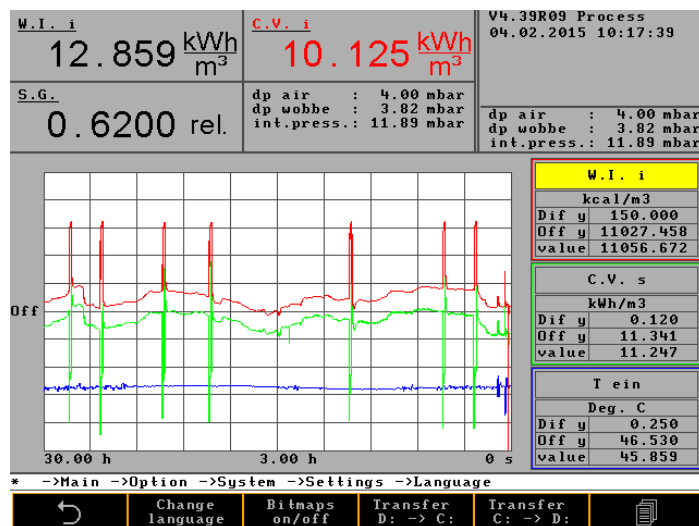
System time and date are set here. With OK in the position button field you confirm the settings. With Cancel you exit the screen mask without changes.



Counts up marked digits
Counts down marked digits
Next field to the left
Next field to the right

Main menu - Options - System - Settings - Language

The menu item Language contains 10 sub-menus to introduce or to correct different language, including those displays as bitmaps (e.g. Chinese). Languages can be downloaded to a memory stick, corrected and uploaded onto the hard drive of the combustion calorimeter again.



Main menu - Options - System - Settings - Password

| W.I. i | C.V. i | V4.39R09 Process |
|--|--|---------------------|
| 12.862 $\frac{\text{kWh}}{\text{m}^3}$ | 10.124 $\frac{\text{kWh}}{\text{m}^3}$ | 04.02.2015 10:17:57 |

| S.G. | dp air | dp wobbe | int.press. |
|-------------|-----------|-----------|------------|
| 0.6196 rel. | 4.00 mbar | 3.80 mbar | 11.93 mbar |

| |
|------------------|
| T1 = 45.86 °C |
| T2 = 62.00 °C |
| T2-T1 = 16.14 °C |

| Password | |
|--------------------------|-------|
| Code | Code |
| Old Password | |
| New Password | |
| Unlocked duration (min.) | 0 |
| APPLY | CLOSE |

* ->Main ->Option ->System ->Settings ->Password

Input of the password numbers can be confirmed with OK or quit with Cancel. Without entering the password digits, nothing on the system can be changed. After release, the system locks again automatically after 30 seconds. Then the system prompts for the password again.

Entering 0 annuls the password system.

Main menu - Options - System - Settings - Change colour

| | | |
|--|--|---|
| W.I. i 12.864 kWh m ³ | C.V. i 10.126 kWh m ³ | V4.39R09 Process 04.02.2015 10:18:19 |
| S.G. 0.6197 rel. | dp air : 4.00 mbar dp wobbe : 3.80 mbar int.press.: 11.94 mbar | mV=24.56 / V=1.071 Frequ. = 51.13 Hz Stabi. = 0.011 |
| Color settings | | |
| Menue Hintergrund | Black | |
| Menue Rahmen | Orange | |
| Menue Schrift | Grey 30 | |
| Dialog Auswahl | White | |
| Kurve 1 | Red | |
| Kurve 2 | Green | |
| Kurve 3 | Blue | |
| Kurve Auswahl | Yellow | |
| * ->Main ->Option ->System ->Settings ->Color settings | | |

Here you can change the display colours.

Main menu - Options - System - Settings - Hardware 1

This menu should only be modified after consulting the manufacturer.

It controls the limits of measuring devices over two or three ranges. The overlap is optimised. For this purpose you need to specify functional parameters. The time constants of the burners are specified.

The calibration values of the carrier gas is entered and the time of connection is determined. In case of changing the carrier gas, the manufacturer can provide the new data. They are entered in the screen mask shown below.

All values are tested according to customer's specifications before delivery.

| W.I. i 12.869 kWh/m ³ | | C.V. i 10.130 kWh/m ³ | | V4.39R09 Process 04.02.2015 10:19:41 | |
|-------------------------------------|----------|--|-------------|---|-----------|
| S.G. 0.6196 rel. | | dp air : 4.00 mbar dp wobbe : 3.81 mbar int.press.: 11.91 mbar | | mV=24.56 / V=1.072 Frequ. = 51.22 Hz Stabi. = 0.005 | |
| Configuration hardware 1 | | | | | |
| Range No. | Dia.WJet | Range cfg. | Calibr. gas | Blending | |
| 1 | 0.00 | 0 | 1 | 180 | |
| 2 | 0.00 | 0 | 1 | Fan type | |
| 3 | 0.00 | 0 | 1 | digital | |
| No | Signal | Unit | Value | Switch (Z) | Bus type |
| 1 | --- | kcal/Sm3 | 0.00 | 0.00 | Union |
| 2 | --- | kJ/m3 | 0.00 | 0.00 | Bus Comm. |
| Change range | | | | none | COM 2 |
| Burner time constant | | | | 300 | |
| Max. temp. inside tube (deg.C) | | | | 50.00 | Def. RED |
| Calibration constant off | | | | 0.00 | 3 |

* ->Main ->Option ->System ->Settings ->Configuration hardware 1

The parameters for a multi-range measuring device are configured in this menu.

The screen shows all possible configurations.

Range No. indicates the number of installed measuring ranges. A maximum of 3 measuring ranges are possible. In this example, 3 measuring ranges are configured.

Dia. WJet. indicates the nozzle diameter in mm of the measuring range nozzle. This specification is information only and is meant to help later in calculating the gas volumes.

Range cfg. is a binary coding for the measurement conditions while a measuring range switchover is in process.

- 1 measuring range not loaded
- 1 nozzle set 2 or nozzle set 1
- 2 air nozzle on or off
- 4 flammable carrier gas on or off
- 8 not flammable carrier gas (oxygen) on or off
- 16 flammable carrier gas that does not burn by itself on or off

The number 6 indicates that the measuring range is operated with nozzle set 1 and a flammable carrier gas with an air nozzle.

The number 2 indicates that nozzle 1 has an air nozzle.

Calibr. gas indicates the number of the calibration gas for the measuring range. The upper nozzle set has number 1, the lower nozzle set the number 2.

No. indicates switchover point 1 and 2.

Signal indicates the physical unit of the measurement value.

Unit indicates the switchover point in the specified dimension between the measuring ranges. In the example, the first measuring range is switched over at 650 +5% kcal/m³.

Switch (%) indicates the overlap of the measuring ranges in %. In the example, the hysteresis is 5 %.

Measuring range switchover can be done automatically or manually. If manual measuring range switchover is set, an additional menu item appears under Number 6.2.1.3.9. Change range. Here you do the manual switchover to another measuring range.

- non
- automatic
- manual

The time constant of the burner is a factor determined for every burner. Sewage gas burners have another factor than burners for natural gas. Every burner type has its own coefficient.

Max temp of inner pipe is a switch-off temperature if in case of a fault highly calorific gas flows to a too large nozzle and generates a significant over-temperature.

MB config is a binary coding for the measurement conditions while a measuring range switchover is in process.

- 1 measuring range not loaded
- 1 nozzle set 2 or nozzle set 1
- 2 air nozzle on or off
- 4 flammable carrier gas on or off
- 8 not flammable carrier gas (oxygen) on or off
- 16 flammable carrier gas that does not burn by itself on or off

The number 6 indicates that the measuring range is operated with nozzle set 1 and a flammable carrier gas with an air nozzle.

The number 2 indicates that nozzle 1 has an air nozzle.

Calibration gas indicates the number of the calibration gas for the measuring range. The upper nozzle set has number 1, the lower nozzle set the number 2.

No. indicates switchover point 1 and 2

Signal indicates the physical unit of the measurement value.

Value indicates the switchover point in the specified dimension between the measuring ranges. In the example, the first measuring range is switched over at 650 +5% kcal/m³.

Window (%) indicates the overlap of the measuring ranges in %. In the example, the hysteresis is 5 %.

Measuring range switchover can be done automatically or manually. If manual measuring range switchover is set, an additional menu item appears under Number 6.2.1.3.9. Change range. Here you do the manual switchover to another measuring range.

- non
- automatic
- manual

The time constant of the burner is a factor determined for every burner. Sewage gas burners have another factor than burners for natural gas. Every burner type has its own coefficient.

Max temp of inner pipe is a switch-off temperature if in case of a fault highly calorific gas flows to a too large nozzle and generates a significant over-temperature.

Main menu - Options - System - Database

The menu Database shows the configuration of the database. The time interval is in minutes. The Database menu displays date and time of saving the database as well as date and time of database export.

There are four status options for saving the measurement data: **all**, **process**, **w/o stop** and **DB off** (saving the measurement data switched off).

The last measurement data and the last three calibration data are also shown.

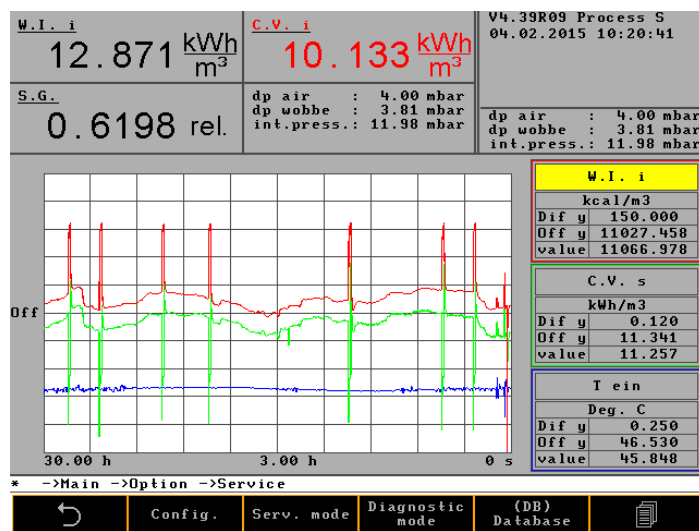
| W.I. i 12.868 kWh/m ³ | | C.V. i 10.130 kWh/m ³ | | V4.39R09 Process 04.02.2015 10:19:20 | | | | | | | |
|-------------------------------------|------------|--|----------|--|-------|--------|-------|-----|-------|-------|---|
| S.G. 0.6197 rel. | | dp air : 4.00 mbar dp wobbe : 3.81 mbar int.press.: 11.94 mbar | | T1 = 45.85 °C T2 = 61.99 °C T2-T1 = 16.14 °C | | | | | | | |
| Database Configuration | | | | | | | | | | | |
| Databases | Date | Time | Interval | Exp.date | Time | Status | | | | | |
| Measured | 04.02.2015 | 10:18 | 5 | 04.02.2015 | 10:01 | all | | | | | |
| Calibra. | 04.02.2015 | 08:08 | --- | 04.02.2015 | 10:01 | --- | | | | | |
| Event | 04.02.2015 | 00:00 | --- | 04.02.2015 | 13:14 | --- | | | | | |
| C.V.s | | Unit | | S.G. | | | | | | | |
| 9675.69 | | kcal/m ³ | | 0.6200 | | | | | | | |
| MV | MV K. | MV KB | V DV | V DVB | T0 | TS | P Gas | P A | WKAL | DVKAL | R |
| 25.56 | 25.55 | 25.55 | 0.56 | 0.56 | 45.8 | 45.5 | 3.8 | 4.0 | 48164 | 0.56 | 0 |
| 25.56 | 25.55 | 25.54 | 0.56 | 0.56 | 45.8 | 45.5 | 3.8 | 4.0 | 48164 | 0.56 | 0 |
| 25.55 | 25.54 | 25.53 | 0.56 | 0.56 | 45.8 | 45.5 | 3.8 | 4.0 | 48164 | 0.56 | 0 |
| OK | | CANCEL | | | | | | | | | |

* ->Main ->Option ->System ->Database Configuration

The menu items Options is divided into the following sub-menus:

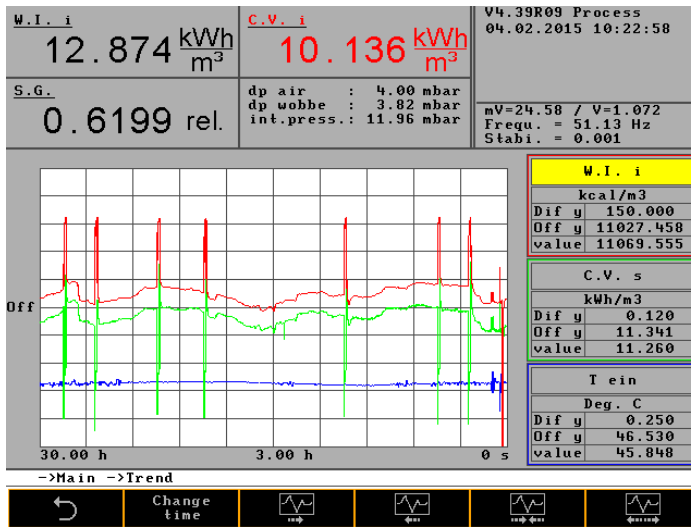
- MV Thermal voltage of the thermal battery (mV)
- MV K. Jump response of the thermal voltage
- MV KB Wobbe index calibration constant
- V DV Relative density
- V DVB Relative density calibration constant
- T0 Thermal battery outer temperature (°C)
- TS Ambient temperature: (°C)
- P Gas Gas pressure (mbar)
- P L Air differential pressure (mbar)
- WKAL lower Wobbe index of the calibration gas (kJ/Nm³)
- DVKAL Relative density of the calibration gas
- R Measuring range

Main menu - Options - Service



Service menus are only accessible by technicians of the manufacturer and are required for adjusting the compensation data for different temperatures and the internal calibration of the system.

9.7.2 Main menu - Trend



The combustion calorimeter has a very comfortable graphics display that enables the presentation of measurement values in wide ranges of time. Up to three different curves can be displayed in different colours.

In the menu item Selection you can select the parameters Time, Value selections, Signal selection, Unit selection and Curve selection.

The parameters can be varied in 2 ways.

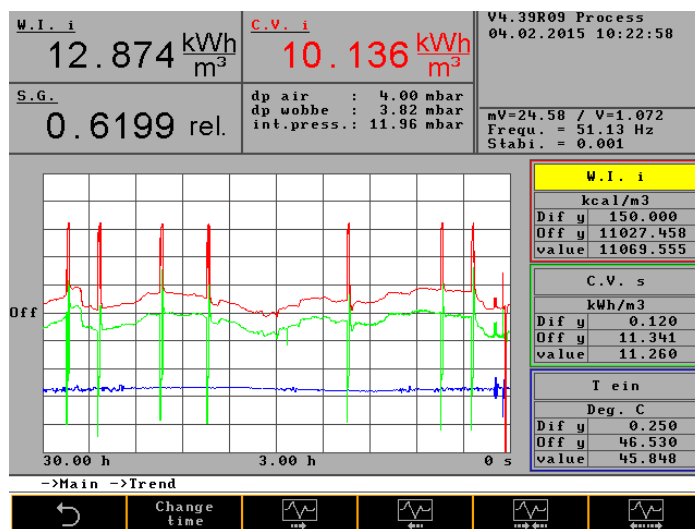
Buttons on the bottom of the screen with different symbols that change with the menu.

Arrow buttons and Return in the right-hand side of the screen with identical and additional functions.

If you press the button "Trend", the following menus are available:

- Time selection
- Value selection
- Signal selection
- Unit selection
- Curve selection

Main menu - Trend - Time selection



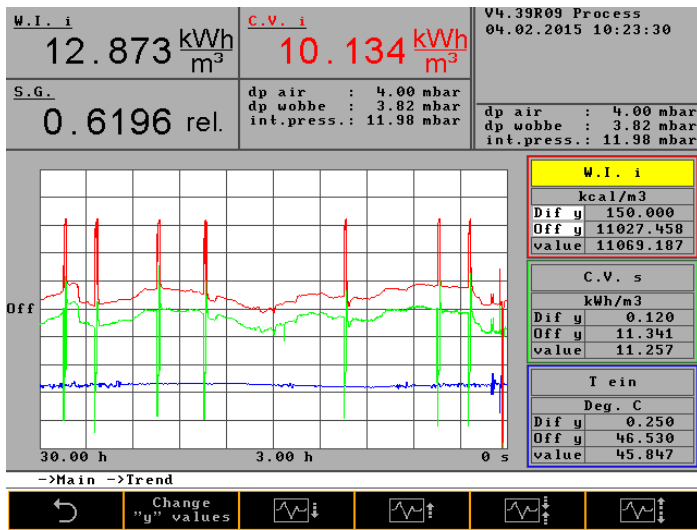
The diagram can be started optimally. The steps to increase or reduce the resolution are already programmed.

The diagram shows a window over 5 seconds with a distance of 30 minutes from line to line. In the centre of the X-axis, the distance line to line is always specified.

Every time the button is pressed, it moves one step forward. The symbols mean:

- value linear right 25% X-axis
- value linear left 25% X-axis
- value compressed 25% X-axis
- value stretched 25% X-axis

Main menu - Trend - Value selection



- value linear up 25% Y-axis
- value linear down 25% Y-axis
- value compressed 25% Y-axis
- value stretched 25% Y-axis

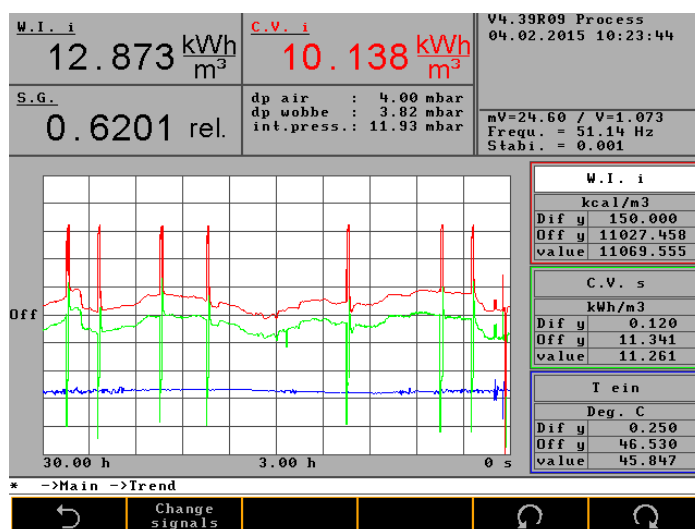
The calorific value is selected.

The three lines

| | | |
|-------|-----------------------|--------|
| Dif y | distance line to line | 4.80 |
| Off y | position from offset | 0.145 |
| value | current value | 10.988 |

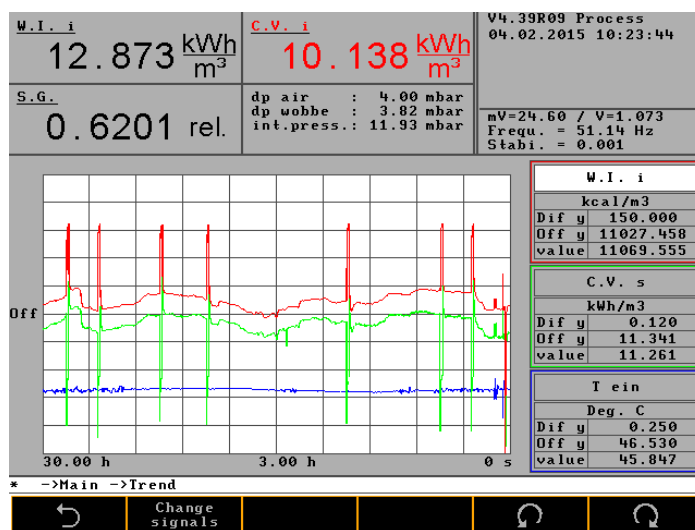
are important for an unambiguous analysis of the graphical presentation of the calorific value.

Main menu - Trend - Signal selection



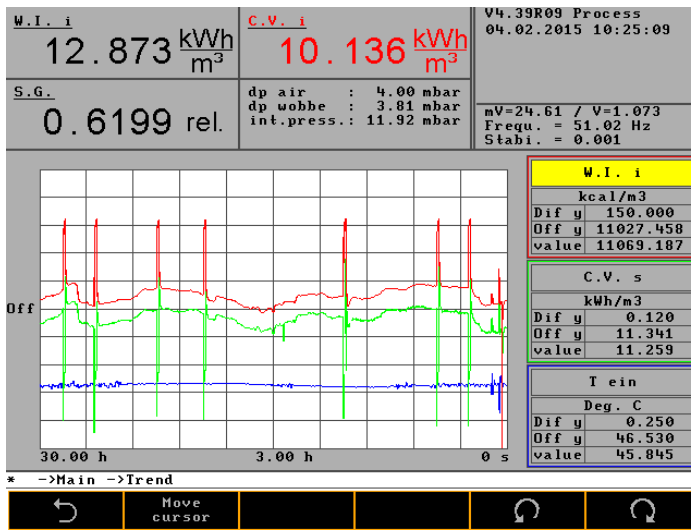
This menu corresponds to the menus described above in terms of operation.

Main menu - Trend - Unit selection



This menu corresponds to the menus described above in terms of operation.

Main menu - Trend - Curve selection



With buttons and you select the 3 Info screens. To confirm the selection and to select the physical value, the arrow buttons and "Return" are also active. Pressing any button causes a jump to the next unit. The units are:

| | | | | |
|----------|-----------|---------|-------------|----------|
| Cal Vi 2 | Wobbe l 2 | free | Spec grav 2 | Cal Vs 2 |
| Cal Vi | Wobbe i | Wobbe s | Spec grav | Cal Vs |
| T sec | T on | dT | T amb | T i |
| T Res 3 | p air | p Wobbe | p density | p res 3 |
| mV | | | | |

All three screens are prepared for all units and can be displayed arbitrarily.

9.7.3 Main menu - Eventslist

NOTE

The events list saves all events that are relevant for operation and service of the device.

1000 events can be saved.

| | | |
|--|--|--|
| W.I. i <div style="font-size: 1.2em; font-weight: bold;">12.874 kWh</div> <div style="font-size: 0.8em;">m³</div> | C.V. i <div style="font-size: 1.2em; font-weight: bold; color: red;">10.138 kWh</div> <div style="font-size: 0.8em; color: red;">m³</div> | V4.39R09 Process 04.02.2015 10:25:23 |
| S.G. <div style="font-size: 1.2em; font-weight: bold;">0.6201 rel.</div> | dp air : 4.00 mbar dp wobbe : 3.79 mbar int.press.: 11.90 mbar | mV=24.61 / V=1.073 Freq. = 51.02 Hz Stabi. = 0.001 |
| <pre> 04.02.2015 10:10:23 Status operation 04.02.2015 10:10:21 Status ignition 04.02.2015 10:09:58 Status operation 04.02.2015 10:09:53 Status fault 04.02.2015 08:08:25 Status operation 04.02.2015 08:08:24 B. cali. deviat. (density) gas 1 04.02.2015 08:08:24 Calib. deviation (density) gas 1 04.02.2015 08:08:24 B. cali. deviation (wobbe) gas 1 04.02.2015 08:08:24 Calibr. deviation gas 1 04.02.2015 07:59:02 Calib. gas 1, AutoKal 1 04.02.2015 07:59:02 Status calibration gas 1 04.02.2015 06:08:32 Status operation 04.02.2015 06:08:31 B. cali. deviat. (density) gas 1 04.02.2015 06:08:31 Calib. deviation (density) gas 1 04.02.2015 06:08:31 B. cali. deviation (wobbe) gas 1 04.02.2015 06:08:31 Calibr. deviation gas 1 04.02.2015 05:59:10 Calib. gas 1, AutoKal 1 04.02.2015 05:59:10 Status calibration gas 1 04.02.2015 00:08:23 Status operation </pre> | | |
| * ->Main | | |
| <div style="display: flex; justify-content: space-between; align-items: center;"> ↶ <div style="border: 1px solid red; padding: 2px; display: flex; gap: 5px;"> Show start-up Show calibration Show all </div> ↷ </div> | | |

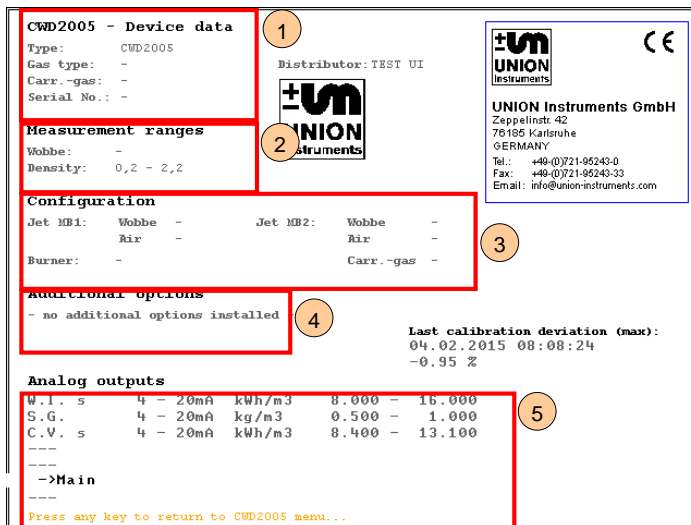
Show startup
 Show calibr.
 Show all

Selection of the different events
 Selection of the different events
 Cancel selection

9.7.4 **Main menu** - **Device info**

NOTE

The shown values are very important for remote diagnostics of any occurring errors; they can be saved on the memory stick and then sent to the manufacturer per e-mail.



```

CWD2005 - Device data
Type: CWD2005
Gas type: -
Carr.-gas: -
Serial No.: -

Measurement ranges
Wobbe: -
Density: 0,2 - 2,2

Configuration
Jet MB1: Wobbe -      Jet MB2: Wobbe -
        Rir -          Rir -
Burner: -              Carr.-gas -




Additional options
- no additional options installed



Last calibration deviation (max):
04.02.2015 08:08:24
-0,95 %


Analog outputs
W.I. s  4 - 20mA kWh/m3  8.000 - 15.000
S.G.    4 - 20mA kg/m3   0.500 -  1.000
C.V. s  4 - 20mA kWh/m3  8.400 - 13.100
-----
->Main
-----
Press any key to return to CWD2005 menu...
  
```


- 1 Device data:
 - Type
 - Gas type
 - Carrier gas
 - Device number
- 2 Measuring ranges:
 - Wobbe
 - Density
- 3 Equipment:
 - Nozzle MB1
 - Nozzle MB2
 - Burner
- 4 Additional options:
 - Here, any installed additional options are listed.
- 5 Analogue outputs:
 - Wobbe i
 - Density
 - Heating value


10 Decommissioning / switching off

| | |
|--|--|
|   |  WARNING |
| | <ul style="list-style-type: none"> • If the system is shut down by untrained personnel this poses a risk for people and equipment. • Only trained and authorized service technicians may shut down the system. • Follow in each case the steps as described in Chapter – “Starting” and “Decommissioning” – • All national and internal plant regulations, must be observed at recommissioning after repair or a longer downtime. Consider also the DIN EN 60079-17 and DIN the DIN EN 60079-19. |

| | |
|---|---|
|  |  ATTENTION |
| | <p>To remove the combustion calorimeter from service, the linked system components must also be removed from service according to their operating instructions.</p> |

| | |
|---|---|
|  | NOTE |
| | <p>For first starting or before a long downtime, save the device configuration. Let a service technician do the backup or ask Service for special instructions.</p> |

| | |
|---|--|
|  | NOTE |
| | <p>The following table contains the steps for decommissioning the analyser for a long period.</p> <p>If the combustion calorimeter shall only be switched off for a short time, some of the steps are not necessary: ☞ <i>column <u>Turn off!</u></i></p> |



| Steps | Turn off | Decommissioning |
|---|----------|-----------------|
| Disconnect the device from the process, close the line professionally. | X | X |
| Purge combustion calorimeter with ambient air (start combustion calorimeter with purge gas). | | X |
| Shut down the linked system components. | X | X |
|  If the combustion calorimeter is only to be taken out of service for a short time, the sequence stops here! | | |
| If required, disconnect / switch off the operator's energy and media supply and the signal transmission professionally. | | X |
| If feasible, pack the combustion calorimeter in a suitable way. Before start/restart of the transport, make sure that all transport safeguards are in place. | | X |

10.1 Switching off

1. Close the respective air supply valve 15 A/B
2. After closing the air supply valve the system shuts down in few seconds. The whole system is voltage-free.
3. Close the respective gas supply valve



11 Maintenance

The measurement quality of the combustion calorimeter can only be ensured if the maintenance intervals are adhered to.

| | |
|---|---|
|  |  DANGER |
| | <ul style="list-style-type: none"> • By an improper maintenance can be the device damaged, destroyed or be affected in the functioning. Improper maintenance inevitably leads to the loss of explosion protection. • Work on the system, must be carried out by trained and authorized staff or by the specialists of UNION Instruments service team. • Comply with relevant safety precautions when working in hazardous areas. • The ex-protection function of the enclosure and the flame arresters can only be guaranteed can only be ensured in compliance with the maintenance intervals. |

11.1 Preparations

The feed lines to linked system components can be closed for servicing purposes. Once operation has been resumed, they need to be reopened.

| | |
|---|---|
|  |  DANGER |
| | <p>Serious risk of injury from electricity.</p> <ul style="list-style-type: none"> • The parts of the combustion calorimeter identified by the adjacent symbol may still be live even when the main switch has been turned off. If necessary, disconnect combustion calorimeter from the voltage mains! • Turn off main switch, disconnect from power supply if necessary and secure against turning on again! • Only a trained electrician may work on the electrical equipment of the combustion calorimeter! |





WARNING

Serious risk of injury from exiting gas.

- Before maintenance works, shut down the combustion calorimeter and, if necessary, any connected system components!
- Only trained staff must install the gas connections! Follow the applicable guidelines at the installation site!
- Incomplete combustion during servicing can cause the exhaust air to be loaded with process gas!
- In the case of toxic gases, observe the safety instructions at the setup site!
- Serious risk of injury due to burns at burner components!
Observe the cool-down time of 15 min before servicing the burner system!

11.2 Maintenance work/Inspection

Ensure the following issues before starting maintenance work:

1. Write down the following values of the combustion calorimeter:
 - Wobbe i/s
 - Heating value / calorific value
 - Density
 - mV signals
 - mA signals
 - Internal pressure
 - Differential pressure Wobbe
 - Differential pressure air
 - Frequency of fan control
2. Notify the control room
3. If no standard values are possible via PLC, activate "Signal hold" at the combustion calorimeter.
4. Close the shut-off valve at the combustion calorimeter after testing for tightness.

The type and extent of the wear depends on the individual application and operating conditions. Thus, all maintenance intervals specified are guide values only.

In order to ensure operational safety, only use original spare parts by the manufacturer.

After successful maintenance works, check the proper function of the safety system. Start therefor the system acc. Chapter 9.1. After successful start-up switch off the system acc. chapter 10.1.

The system must be de-energized, in few seconds.

| Inspection | Interval (recommended) |
|------------|---------------------------|
|------------|---------------------------|

Weekly inspection

| | |
|----------------------|--------|
| Run the calibration. | weekly |
|----------------------|--------|

Monthly inspection

| | |
|---|---------|
| Check gas filter for dirt/clogging. (indicator) | monthly |
| Check air filter for dirt/clogging. (indicator) | monthly |
| Check upstream pressures of gas and air: 15-18 mbar Int. pressure | monthly |
| Differential pressure air between 3.5 and 4.5 mbar Pre pressure low air 55 mbar / high 3,5 bar | monthly |

Quarterly inspection

| | |
|--|--|
| Check neoprene tubes in the combustion calorimeter for porosity. | every 3 months, latest annually or when required |
| Calibrate combustion calorimeter according to manufacturer's specifications. | every 3 months, latest annually or when required |

Half-yearly inspection

| | |
|--|----------------|
| Check the tube connection to the density measuring cell / sensors for porosity. | every 6 months |
| Check the membrane at the gas pressure controller for porosity or insufficient elasticity. | every 6 months |
| Remove ¹ /clean ² thermal battery and heat exchanger. | every 6 months |
| Replace the seal at the heat exchanger. | every 6 months |
| Inspecting all safety shutoffs (2.4.4) | |
| Clean ³ gas and air nozzles. If necessary, replace O-rings. | every 6 months |

Yearly inspection

| | |
|---|--------|
| Replace air filter. | yearly |
| Replace neoprene tubes in the combustion calorimeter. | yearly |
| Clean the complete system. | yearly |
| Replace gas filter. | yearly |
| Inspecting the flame arrester for internal and external corrosion | |



¹ On the side of the combustion calorimeter, at the thermal battery and in the thermal body, flow members are attached. These members must not be twisted when taking out the thermal battery. Pull out the thermal battery as far as possible and then flip it sideways.

² Clean the heat exchanger with water and then dry the cleaned components thoroughly.

³ Clean the nozzles with a solvent (brake cleaner, degreasing spray).



11.3 Special note for maintenance of the flame arresters

| | |
|---|--|
|  |  DANGER |
| | <ul style="list-style-type: none">• By an improper maintenance can be the device damaged, destroyed or be affected in the functioning. Improper maintenance inevitably leads to the loss of explosion protection.• Work on the system, must be carried out by trained and authorized staff or by the specialists of UNION Instruments service team.• Comply with relevant safety precautions when working in hazardous areas.• The ex-protection function of the enclosure and the flame arresters can only be guaranteed can only be ensured in compliance with the maintenance intervals. |

The operator is responsible for the proper operation of the system. A proper functioning of the system, requires a regular maintenance of the individual components and overall system. If there are no operating experience, the operator must regularly check the system, to determine the maintenance intervals. The maintenance period depends on the particular application and should be adapted to the specific application by the user.

For all flame arresters a first maintenance is recommended after the first 3 month operation.

- Further information:
☞ *enclosed documentation!* - Manuals -

11.3.1 Maintenance flame arrester flue stack

- Further information:
☞ *enclosed documentation!* - Manuals -





11.3.2 Maintenance flame arrester air supply


- Further information:
☞ *enclosed documentation!* - Manuals -

11.3.3 Maintenance flame arrester gas supply

- Further information:
☞ *enclosed documentation!* - Manuals -

12 Troubleshooting

| | |
|--|---|
|     | <div style="background-color: #f4a460; padding: 5px;">! WARNING</div> <p>Serious risk of injury from electricity and exiting gas.</p> <ul style="list-style-type: none"> • Before maintenance works, shut down the combustion calorimeter and, if necessary, any connected system components! • Turn off main switch, disconnect from power supply if necessary and secure against connecting/turning on again! • Only a trained electrician may work on the electrical equipment of the combustion calorimeter! • The parts of the combustion calorimeter identified by the adjacent symbol may still be live even when the main switch has been turned off. • If necessary, disconnect combustion calorimeter from the voltage mains! |
|--|---|

| | |
|---|---|
|  | <div style="background-color: #0070c0; color: white; padding: 5px;">NOTE</div> <p>Troubleshooting is divided into the following categories:</p> <ul style="list-style-type: none"> • Instable measured value • Drift of the measured value • Incorrect ignition behaviour <p>The system keeps a results list. Events are registered in the order of occurrence and saved with the respective date.</p> <p>You can download the results list to a special data medium (included in the scope of delivery) and send it to UNION Instruments for fault analysis.</p> |
|---|---|

12.1 Preparations for troubleshooting

The feed lines to linked system components can be closed for servicing purposes. Once operation has been resumed, they need to be reopened.

NOTE



Events list:

The software keeps an event list with up to 1000 events in the order of occurrence (tracked date). The events list provides information about faults.

You can export the event data to a special data medium (USB stick) after consulting Service. Then you can send the exported data to the manufacturer for fault analysis.

Events are: Start, stop, ignition, lack of cooling air, calibration

12.2 Changing/replacing fuses

Fuses may only be exchanged by an electrician or service professional. Choose the type approved by UNION.

12.3 Instable measured value

- The pressure regulator cannot hold constant pressure. The process pressure is too low. A pressure increase pump must be installed.
- Direct sunlight causes rapid changes in temperature. Avoid direct sunlight.
- The pressure is imprecise and/or cannot be held.
Check if the input pressure is too high.

12.3.1 Drift of the measured value

The measured value drifts up in one direction:

The calibration does not reach the required point any more. The frequency controller has reached its maximum value.

Heavy filter soiling which cannot be compensated by controller any more. Replace the filter.

The measured value drifts down:

The heat exchanger is sooty (in case of propane, butane combustion with insufficient air).

Clean the heat exchanger (warm water). Then dry with compressed air.

12.4 Faulty ignition

The combustion calorimeter ignites permanently, the flame is burning. Combustion calorimeter does not enter operating mode.

Incorrect temperature setting (too high). Lower the temperature threshold.

The combustion calorimeter switches to operating mode even though the flame does not burn and then returns to ignition mode.

Incorrect temperature setting (too low). Increase the temperature threshold.

Ignition electrode corroded, normal wear after frequent ignition.

Replace ignition electrode.

The combustion calorimeter does not ignite.

24V power supply via pressure switch is interrupted.

12.4.1 Fault / status messages with description

Int. pressure

- Alarm in case of lack of process gas or calibration gas
- Threshold adjustable; default: 14 mbar

Overtemp

- The flame is too hot. Wobbe signal > 76 mV,
- Temperature increase in the inner tube of the thermal battery > 50°C

Fault

- Gas pressure too low
- Fault in thermal battery
- Defective PT 100 temperature sensor

Service

- No compressed air present or pressure too low
- Air inlet temperature > 41°C

Operation

- Flame is burning, analyser is running with process or calibration gas

Operation delay

- Flame is burning, analyser is running with process or calibration gas
- Delay time has expired after which the analog signals are released

Process

- Flame is burning, solenoid valve of process gas is open
- Analyser operates with process gas


Calibration

- Flame is burning, solenoid valve of calibration gas is open
- Calibration active, no mA signals are issued, these are "on hold" (the last current value is held).

No voltage





- Insufficient air supply or leak in purging unit.

13 Service

| | |
|---|---|
|  | <p>NOTE</p> <p>If you have any questions Union Instruments GmbH will be happy to assist. In case of orders or technical questions, please have the customer number, telephone number for return calls, the type and number of the combustion calorimeter (see the type plate) and the required spare parts and parts list numbers to hand.</p> |
|---|---|

Union Instruments GmbH - Service

Maria- Goeppert-Str. 22
23562 Lübeck
Germany

 +49 (0)721-680381-30
 +49 (0)721-680381-33
 support@union-instruments.com
 <http://www.union-instruments.com>



14 Disposal

| | |
|---|--|
|  |  WARNING |
| | Risk of injury from electricity and exiting gases in the combustion calorimeter, if applicable. |



| | |
|---|--|
|  Umweltgefährlich | NOTE |
| | Observe the national regulations on disposing machines and operating materials! Sort the parts according to group and recycle properly. |

Following decommissioning, the device can be returned to Union Instruments GmbH.

Suggestion: Let Union Instruments GmbH dispose of the combustion calorimeter.



15 Spare parts

| | |
|---|---|
|  |  WARNING |
| | <p>The use of non-approved spare parts (such as parts from other manufacturers, parts with different specifications, replicas of used and wear parts) can cause defects and be hazardous. This will render the warranty null and void. The operator is liable for incurring damage!</p> <p>When replacing standard components, only use identical components by the original manufacturer. If components are discontinued or components by different manufacturers are used, request the manufacturer approval by Union Instruments GmbH.</p> |

Spare parts can be ordered from Union Instruments GmbH:
☞ *Chapter 13 Service.*

Write down combustion calorimeter type and number (☞ *type plate*).
If necessary, find and make a note of the order number (☞ *Applicable documents*).

16 Annex

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