
Operating instructions

Combustion calorimeter

CWD2005 DPC



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Table of contents

1	Technical Data CWD2005 DPC	1—1
1.1	Technical Data Combustion calorimeter	1—3
1.2	System limits and overview	1—5
1.3	Dimensions	1—6
2	EC declaration of conformity	2—1
3	Safety notes	3—1
3.1	Warnings and symbols	3—2
3.2	Fundamentals of proper use.....	3—3
3.3	Personnel and qualifications.....	3—4
3.4	Safety notes	3—5
3.5	Operator safety precautions	3—9
3.6	Regular operator training.....	3—10
3.7	Workplace hazard analysis.....	3—10
4	Safety device system	4—1
4.1	Main switch	4—2
4.2	Instrument air purged and pressurised housing	4—2
4.3	Locks and doors of the housing.....	4—2
4.4	Flame arresters	4—2
4.5	Cable / line glands.....	4—2
4.6	Pressure switch, pressure too low	4—2
4.7	Safety switch	4—3
4.8	Thermal fuse	4—3
4.9	Solenoid valve	4—3
4.10	Fan.....	4—3
4.11	Markings and warning system	4—4
5	Connections, transport, setting up	5—1
5.1	Description and connections.....	5—2
5.2	Transport.....	5—6
5.3	Ambient conditions	5—7
5.4	Installing and connecting	5—7
5.5	Startup after setup.....	5—23
5.6	Documentation	5—26
6	Commissioning, operation, removing from service	6—27
6.1	Commissioning / start-up.....	6—28
6.2	Description of the workplaces / operating elements.....	6—30
6.3	Operation	6—31
6.4	Decommissioning / switching off.....	6—32
7	Operation combustion calorimeter	7—33
7.1	Operation of film keyboard / description of display.....	7—34
7.2	Basics on operation	7—36
7.3	Available displays.....	7—36
7.4	General information on the start screen.....	7—37
7.5	Menu structure	7—38
7.6	Main menu	7—39
8	Maintenance and service	8—1
8.1	Service	8—2
8.2	Troubleshooting Ex protective housing.....	8—8
8.3	Troubleshooting Combustion Calorimeter.....	8—11

8.4	Preparations for troubleshooting.....	8—12
8.5	Changing / replacing fuses	8—13
8.6	Instable measured value.....	8—13
8.7	Service	8—16
9	Disposal	9—1
10	Spare parts	10—1
11	Annex	11—3
Index	11—3
List of figures	11—4

1 Technical Data CWD2005 DPC

1.1	Technical Data Combustion calorimeter	1—3
1.1.1	Specifications	1—3
1.1.2	Display times of calorific value measurement	1—3
1.1.3	Calibration gas.....	1—3
1.1.4	Linearity and measuring range.....	1—4
1.2	System limits and overview	1—5
1.3	Dimensions	1—6

Ex-characteristic acc. to approval

Ex characteristic	Class I, Division 2, Group B, C, D (NEC500)
Ambient temperature:	$5^{\circ}\text{C} \leq T_{\text{amb}} \leq 40^{\circ}\text{C}$

Gas inlets

Number of measuring points:	1
Calibration inlets:	1, internal through gas bottle
Gas connections:	Clamp ring connection 6 mm
Relative gas humidity:	$\leq 95\%$ condensate free
Inlet temperature gas:	max. 45°C

Power supply

Voltage:	115 VAC/50Hz
Power consumption:	185 VA max.
Protection class:	I
Degree of protection:	IP50
External circuit breaker:	required, 240VAC/120VAC, 10A

Instrument air supply

max. input pressure:	10 bar / 145 psi
min. input pressure:	5 bar / 73 psi
Quantity / power:	25000 l/h (under standard conditions)

Ambient conditions

Operating temperature:	5 - 40°C
Humidity:	0 - 95 % relative humidity
Ambient pressure:	800 - 1100 hPa (0.8 - 1.1 bar)
Storage temperature:	$-15 - 60^{\circ}\text{C}$

Interfaces



Relay:	3
Dig. interface:	RS232
Analogue interfaces:	0-20 mA

Dimensions

Height:	1798 mm, additional 300 mm for flame arrestor
Width:	822 mm
Depth:	399 mm

Weight

Weight:	up to 85 kg
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	 DANGER
	<p>The system must not be operated outside of the specified ambient temperature, $5^{\circ}\text{C} \leq T_{\text{amb}} \leq 40^{\circ}\text{C}$.</p> <p>Outside of this temperature range, the approval becomes void.</p>

1.1 Technical Data Combustion calorimeter

1.1.1 Specifications

Measured gas properties:	Lower Wobbe-index, specific gravity
Calculated gas properties:	Higher Wobbe-index, lower heating value (calorific value), higher heating value (higher calorific value)
Calculated gas properties options:	combustion air requirement index (CARI), combustion air requirement

Gas type, inlet pressure, typical consumption CWD2005 DPC

Gas type	Range [MJ / m ³]	Pressure [mbar]	Range [MJ / m ³]	Accuracy [± %FS]	Gas Flow [l/h]
Flare gas ¹⁾	0–15	40	0–15	2.0	40
Blast furnace gas	3.5–6	40	3.5–6	3.0	170
Converter gas	4.5–9	40	4.5–9	1.5	140
Mixed gas	5–10	40	5–10	2.0	140
Coke-oven gas	15–30	40	15–30	1.5	60
Biogas	25–35	40	25–35	1.5	70
Natural gas	25–48	20	25–45	1.0	25
Refinery gas	25–50	40	25–50	1.5	25
LPG	40–90	20	40–90	1.5	15

¹⁾ Gas with a heating value < 3.5 MJ/m³ does not burn autothermic, carrier gas needed. The combustibility always depends on the gas type.

²⁾ FS = linearity error in relation to full scale value

1.1.2 Display times of calorific value measurement¹

Dead time:	3 seconds
50% - time:	7 seconds
90% - time:	15 seconds
99% - time:	45 seconds

1.1.3 Calibration gas

Calibration gas:	Mixture of main gas components, Wobbe-index should be between 75% and 100% of full scale, specific gravity greater than 0.555
Calibration interval:	Programmable, from hourly to monthly
Duration of calibration:	Typical 10 minutes
Gas consumption:	Typical 1/6 of gas consumption per hour, refer to table above

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

1.1.4 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 % (Wobbe-index).

1.2 System limits and overview

The system comprises:

- a protective enclosure purged with compressed air
- two terminal boxes
- a venting system of the protective housing
- a pressure manometer and pressure switch inside the housing
- a compressed air supply with controller and ball valve
- a combustion calorimeter

List of the important assembly groups, details according to drawing and parts list, see overall drawing.

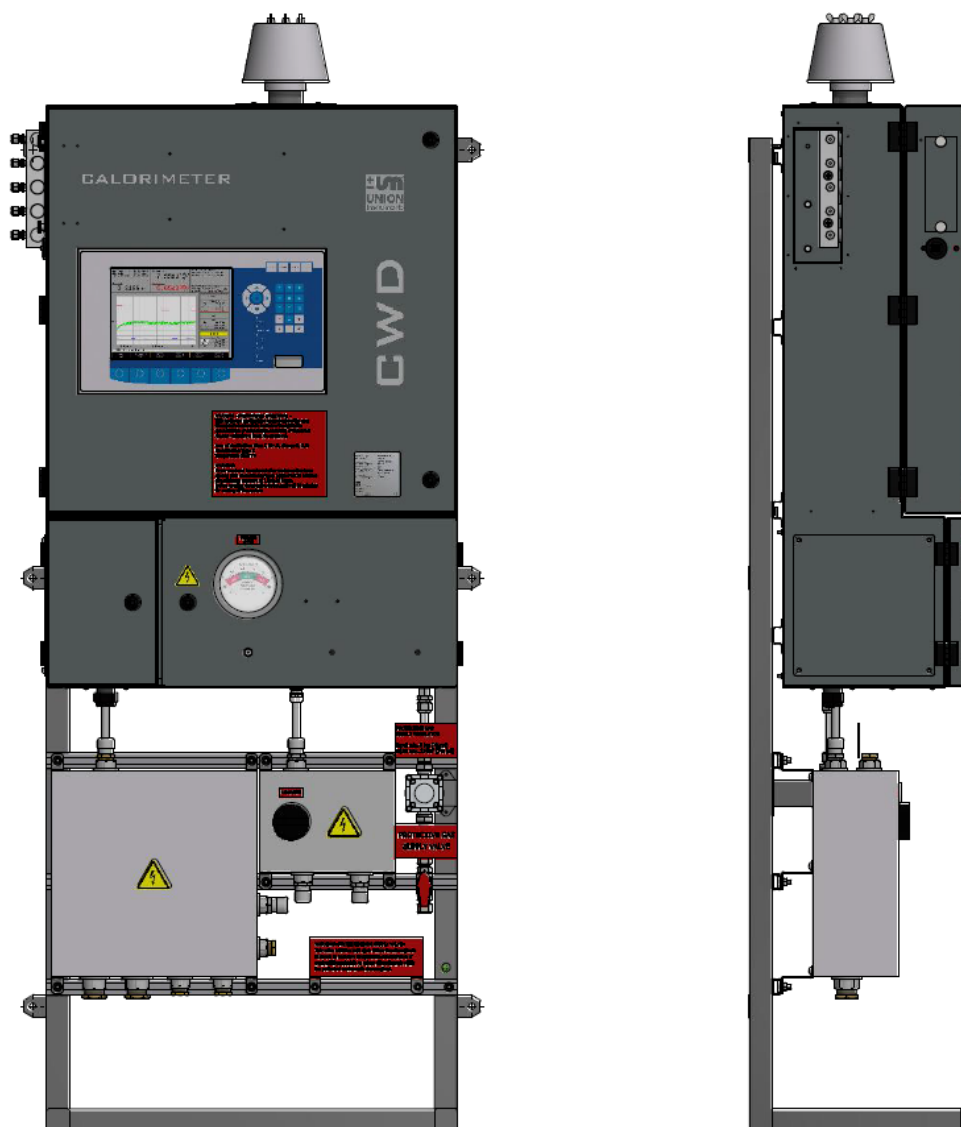


Fig. 1.1: System overview

1.3 Dimensions

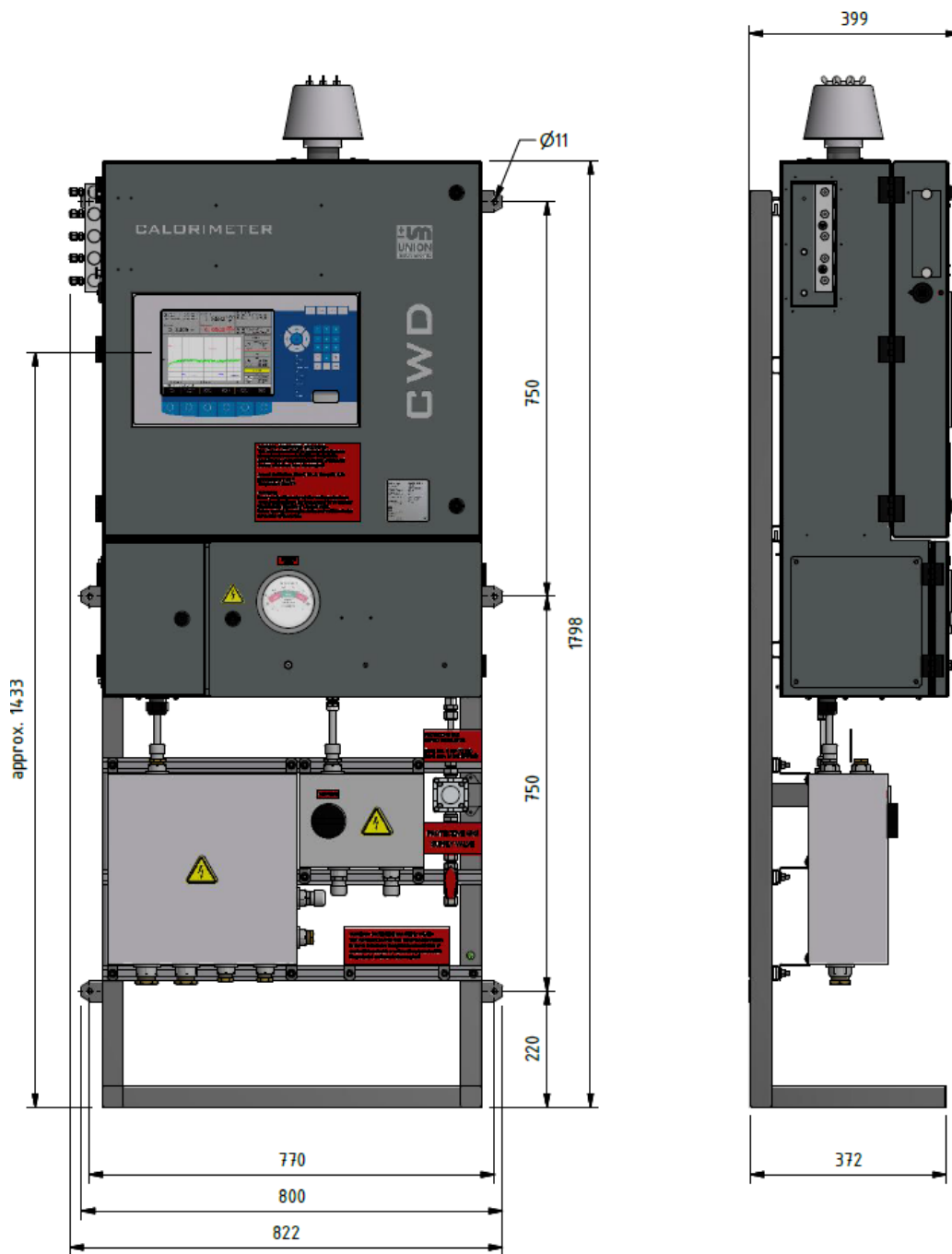


Fig. 1.2: Dimensions of system

Additional 300 mm height for flame arrester.

2 EC declaration of conformity



Der Hersteller / The manufacturer

UNION Instruments GmbH
 Zeppelinstraße 42
 G-76185 Karlsruhe

erklärt hiermit, dass folgend bezeichnete Produkte / hereby declares, that following named products:

Produktbezeichnung:	Verbrennungskalorimeter	Gerätegruppe: CWD2005
Product name:	Calorimeter	device group: CWD2005

konform sind mit den Anforderungen, die in der EG – Richtlinie festgelegt sind / are compliant with the requirements as defined in the EC directive:

2006/95/EG	Elektrische Betriebsmittel zur Verwendung innerhalb bestimmter Spannungsgrenzen
2006/95/EC	electrical equipment designed for use within certain voltage limits
2004/108/EG	Elektromagnetische Verträglichkeit
2004/108/EC	Electromagnetic compatibility

Angewandte harmonisierte Normen / Used harmonized standards:

DIN EN 61010-1:2011	Sicherheitsbestimmungen für elektrische Mess-, Steuer-, Regel- und Laborgeräte - Teil 1: Allgemeine Anforderungen Safety requirements for electrical equipment for measurement, control, and laboratory use - Part 1: General requirements
DIN EN 61326-1:2006	Elektrische Mess-, Steuer-, Regel- und Laborgeräte - EMV-Anforderungen - Teil 1: Allgemeine Anforderungen Electrical equipment for measurement, control and laboratory use - EMC requirements -- Part 1: General requirements

Name des Dokumentationsbevollmächtigten:	Schlichter
Name delegate of documentation	

Adresse des Dokumentationsbevollmächtigten:	siehe Adresse des Herstellers
address delegate of documentation	see address of manufacturer

Bei einer nicht autorisierten Änderung des Gerätes verliert diese Erklärung ihre Gültigkeit. / Any unauthorized modification of the device results in invalidity of this declaration.

3 Safety notes

3.1	Warnings and symbols	3—2
3.2	Fundamentals of proper use.....	3—3
3.3	Personnel and qualifications.....	3—4
3.4	Safety notes	3—5
3.4.1	General safety notes.....	3—5
3.4.2	Notes on specific hazards.....	3—5
3.4.3	Electrical connection.....	3—6
3.4.4	Process gas.....	3—7
3.4.5	Instrument air supply	3—8
3.4.6	Flue gas.....	3—9
3.5	Operator safety precautions	3—9
3.6	Regular operator training.....	3—10
3.7	Workplace hazard analysis.....	3—10


3.1 Warnings and symbols



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

	 DANGER
	Immediate danger that can lead to serious physical injury or death.


	 WARNING
	Potentially hazardous situations that can lead to serious injury or death.

	 ATTENTION
	Potentially hazardous situations that can lead to minor physical injury. This can also be used for property damage.

	NOTE
	Denotes information that can make it easier to handle the system or help prevent property damage.

	 DANGER
	<p>The system is approved according to the approval / limited product certification for use in potentially explosive atmospheres.</p> <p>Notices of possibly occurring dangerous situations in potentially explosive atmospheres are marked by this symbol in the operating instructions.</p>

3.2 Fundamentals of proper 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 CWD2005 Plus inside the protective housing - is a sensor system to determine the calorific value of flammable process gases. The device – calorimeter and protective housing, is designed as a device with over-pressure encapsulation and purging by compressed air.

The combustion calorimeter CWD2005 DPC is intended according to the marking for use in an EX-zone acc. to NEC Class I, Division 2, Group B, C and D.

Determining the calorific value of gas supports process control in industrial systems.


The system is intended for use inside closed rooms for stationary mounting and installation and for an external power supply and a compressed air supply.



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

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. Only certified professionals may alter the system (calorimeter and protective cabinet) (mechanical, electrical or pneumatic modifications).

3.3 Personnel and qualifications




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

	NOTE
	Changes to the electric installation, equipment or gas-bearing modules by persons without corresponding authorisation / qualification and without consulting UNION Instruments GmbH cause loss of type test approval.

	 DANGER
	Changes to the installation or modules by persons without corresponding authorisation / qualification cause loss of type test approval.

3.4 Safety notes



3.4.1 General safety notes


 	 WARNING
	<p>The system 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






 	 DANGER
	<ul style="list-style-type: none">• After installation, all gas conducting parts must be checked for leaks according to national/internal regulations!• Observe national regulations for assembly and installation, e.g. IEC/EN 60079-14, NEC500, NFPA 496!• All repairs that require the protective covering to be opened may only be performed by trained personnel.


3.4.3 Electrical connection

	 DANGER
	<p>Danger from electrical shock!</p> <p>Only a trained electrician may modify the electrical equipment of the system in accordance with the relevant guidelines!</p> <p>When the system 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 system from the voltage mains!</p>

	NOTE
	<p>Changes to the electric installation by persons without corresponding authorisation / qualification cause loss of type test approval.</p> <p>Only operate relay with functional extra low voltage.</p> <p>Do not connect to the mains power supply.</p>




3.4.4 Process gas

   	 WARNING
<p>Establishing gas connections and working on the gas-bearing equipment of the system may only be carried out by specialists adhering to the safety regulations, especially those regarding explosive areas.</p> <p>No gas warning system is installed in the system!</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. • 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. • Only use suitable pipes. • Use a separate line to drain off the condensate. 	


	 ATTENTION
<p>The process gas must be free of condensate and dust if the system has no gas preparation system (or gas cooler).</p>	

3.4.5 Instrument air supply





	 WARNING
	<p>Protective gas - instrument air generates the protective functions against explosions by purging and creating an overpressure!</p> <p>Establishing instrument air connections and working on the instrument air equipment of the system may only be carried out by specialists adhering to the safety regulations, especially those regarding explosive areas.</p>


3.4.6 Flue gas

   	 WARNING
	<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.


	NOTE
	<p>Flue gases / residual heat must be emitted to the open air through a suitable exhaust system.</p>

3.5 Operator safety precautions

  	 WARNING
	<ul style="list-style-type: none"> • The operator needs to provide suitable safety equipment for the system to reliably prevent individuals from being injured from gas leaks. • Danger of stumbling over improperly laid supply lines.

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

3.6 Regular operator training

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


3.7 Workplace hazard analysis

	NOTE
	Depending on the national regulations, the operator must perform a workplace risk analysis, if applicable, independent of the CE marking / approval of this combustion calorimeter.

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:

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4 Safety device system

4.1	Main switch	4—2
4.2	Instrument air purged and pressurised housing	4—2
4.3	Locks and doors of the housing	4—2
4.4	Flame arresters	4—2
4.5	Cable / line glands	4—2
4.6	Pressure switch, pressure too low	4—2
4.7	Safety switch	4—3
4.8	Thermal fuse	4—3
4.9	Solenoid valve	4—3
4.10	Fan	4—3
4.11	Markings and warning system	4—4

4.1 Main switch

Switches the power supply for the device, refer to terminal box on bottom.

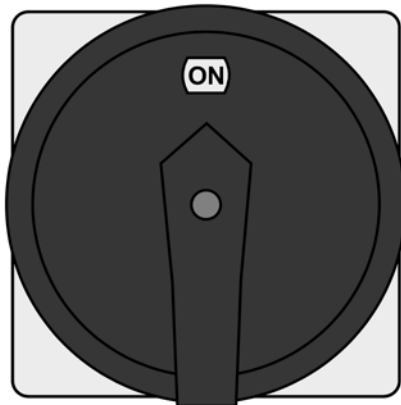


Fig. 4.1: Main switch (example)

4.2 Instrument air purged and pressurised housing

Components that can cause ignition are installed in a housing that is purged with instrument air. By the purging with air, the concentration of explosive gases remains below the lower explosibility limit. The resulting overpressure prevents the ingress of explosive gas mixed into the housing. Openings of the housing are designed in such a way that transfer of a potential ignition hazard to the outside is prevented.

4.3 Locks and doors of the housing

The purged and pressurized housing is closed with three separated doors. Each door is operated by two square box keys.

4.4 Flame arresters

Flame arresters prevent the propagation of a potential ignition hazard to other system parts.

4.5 Cable / line glands

Cables and lines connected to the housing must ensure tightness in order to enable overpressure by the instrument air purging.

4.6 Pressure switch, pressure too low

It de-energises the system as soon as the pressure value falls below 0.8 inWC. Gas inlets are closed.


4.7 Safety switch

The safety switch switches the ignition transformer voltage-free upon opening the top door.



Fig. 4.2: Figure of safety switch (example)

4.8 Thermal fuse

	NOTE The initiation temperature of the thermal fuse is 72°C.
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Upon initiation, the thermal fuse disconnects the 24 V voltage supply.

4.9 Solenoid valve

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

4.10 Fan

The fan mixes the exhaust gases generated in the combustion with fresh air and ensures an appropriate volume flow. The rotational speed of the combustion calorimeter is monitored. In case of a fan failure, the combustion calorimeter enters a safe state.

4.11 Markings and warning system

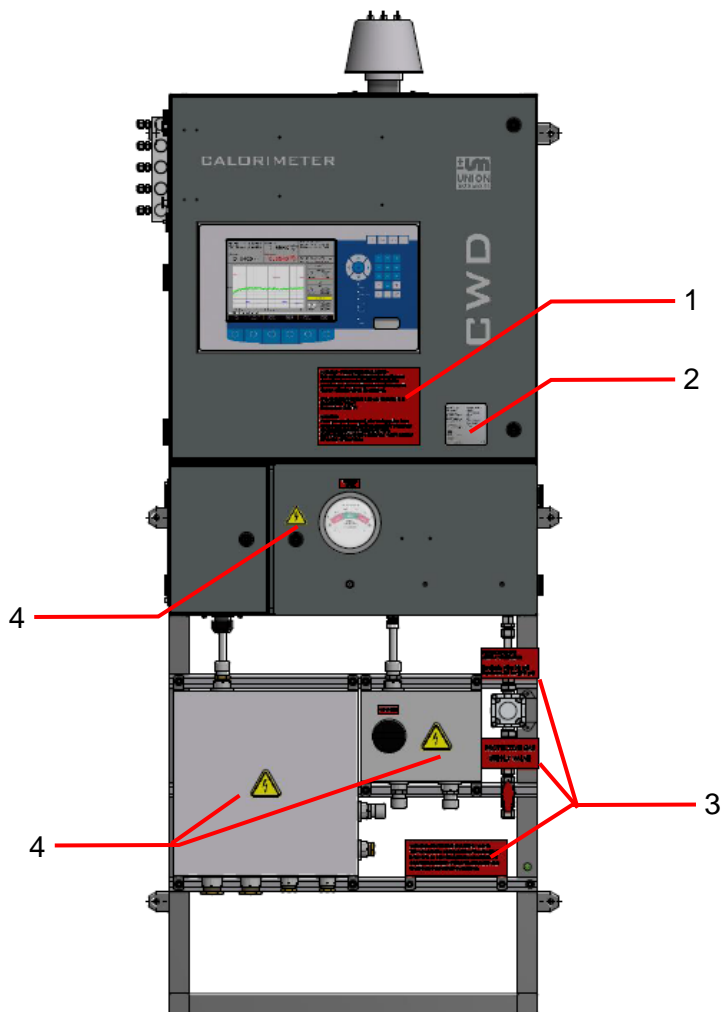


Fig. 4.3: Markings and warnings

1. Warnings, purge duration, switching on/off
2. Type plate
3. Warning note disabling protective gas (instrument air) and connection / supply
4. Warning note electricity

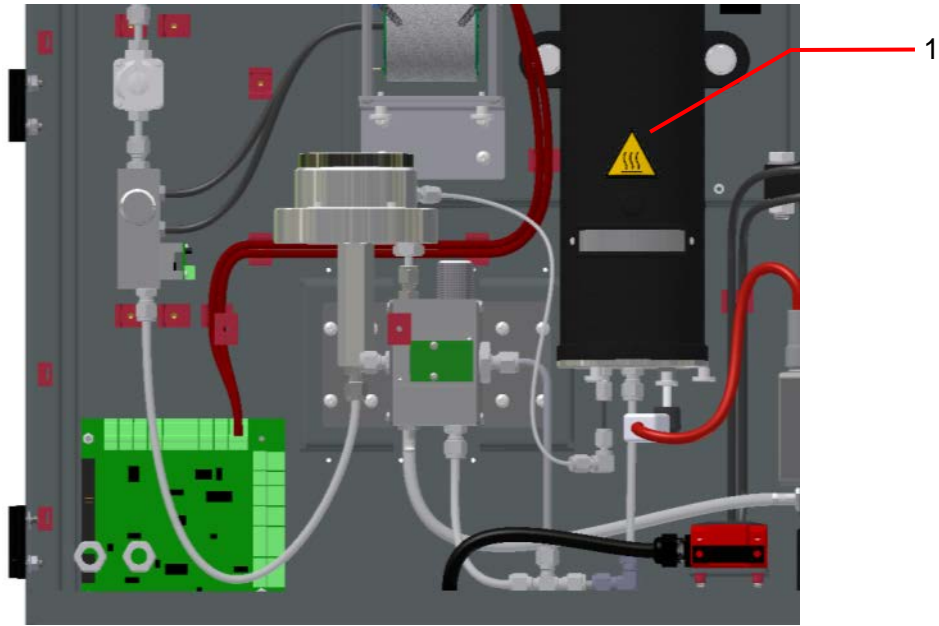


Fig. 4.4: Markings and warnings, inside the housing, top compartment

1. Warning note hot surface

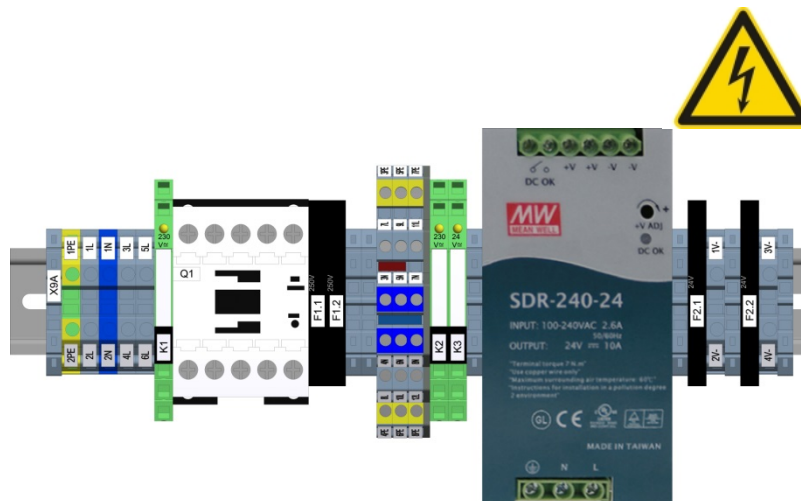



Fig. 4.5: Warning notes on the electric connection board (example, inside housing, right bottom compartment)

5 Connections, transport, setting up

5.1	Description and connections.....	5—2
5.1.1	Accessories	5—5
5.2	Transport.....	5—6
5.3	Ambient conditions	5—7
5.3.1	Storage conditions	5—7
5.4	Installing and connecting	5—7
5.4.1	Setup site	5—8
5.4.2	Room ventilation	5—9
5.4.3	Wall / Ground Attachment.....	5—10
5.4.4	Opening and closing the housing lids/doors	5—11
5.4.5	Process gas.....	5—12
5.4.6	Connection of process and calibration gas	5—13
5.4.7	Carrier gas supply.....	5—14
5.4.8	Calibration gas.....	5—15
5.4.9	Flue gas.....	5—16
5.4.10	Instrument air connection.....	5—17
5.4.11	Electrical connection.....	5—18
5.4.12	Electrical interfaces.....	5—18
5.4.13	Operator safety precautions.....	5—23
5.5	Startup after setup.....	5—23
5.5.1	Removing / attaching the transport safeguard.....	5—24
5.6	Documentation	5—26

	NOTE
	<p>Generally, the system is started up by UNION Instruments GmbH or service technicians.</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 12 Service</i>).</p>

5.1 Description and connections

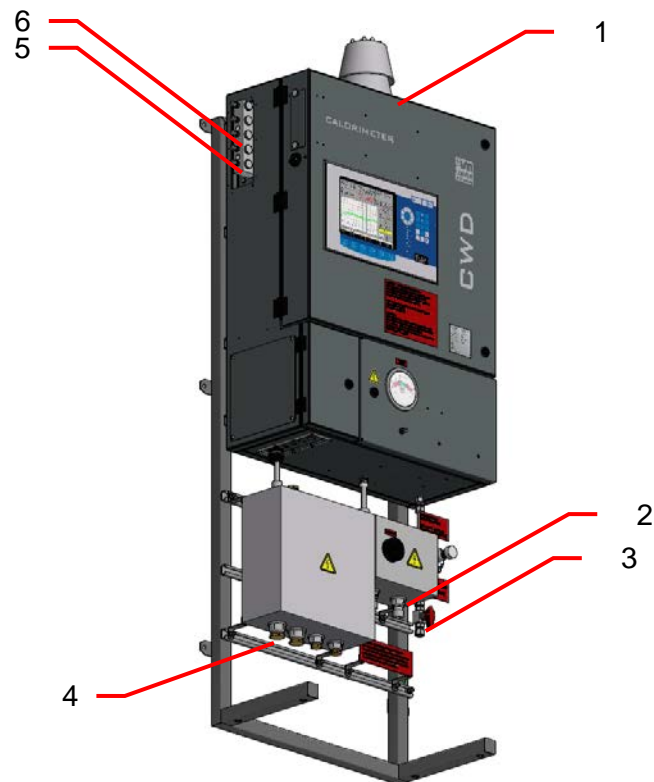


Fig. 5.1: Connections

1. Output flue gas and protective gas (instrument air)
2. Connection of power supply
3. Input compressed air
4. Connection of signal lines
5. Input process gas
6. Input calibration gas

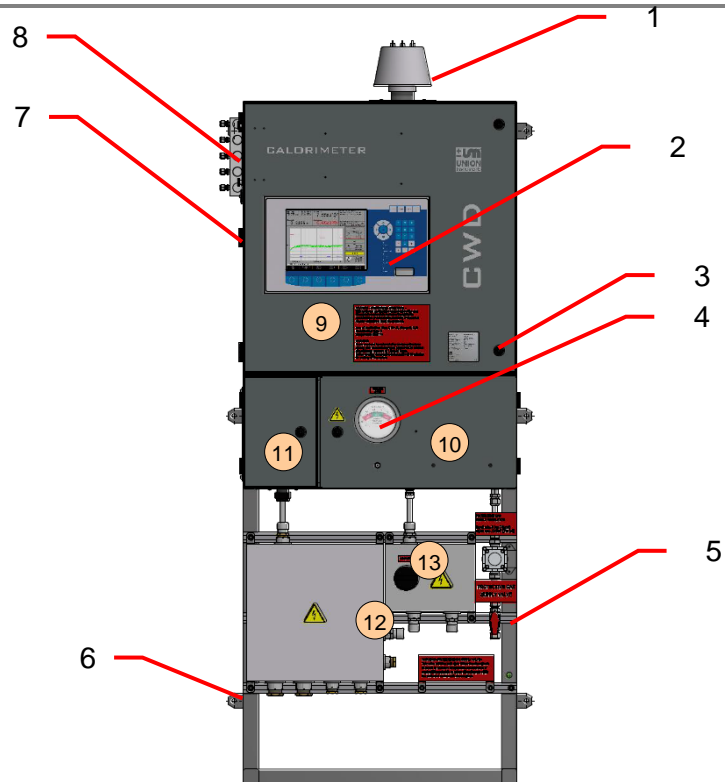


Fig. 5.2: Description

1. Output flue gas and compressed air
2. Display
3. Door lock, 2 for each door
4. Pressure indicator
5. Input protective gas (instrument air
6. Mounting rack with fixation points (6)
7. USB connection for service
8. Input process and calibration gas
9. Compartment combustion calorimeter
10. Compartment internal power supply
11. Compartment internal signal output
12. Terminal boxes with external power supply, signal output
13. Power Switch, main

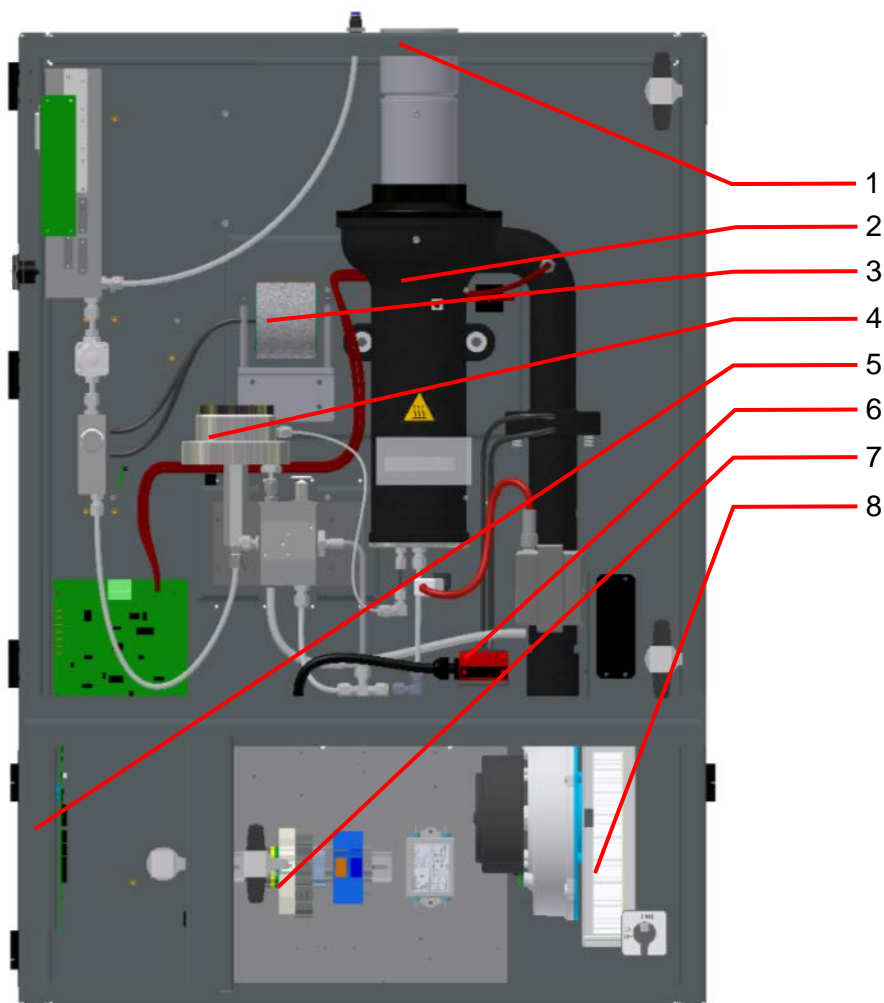







Fig. 5.3: Combustion calorimeter, Housing without doors




- 1 Thermal fuse (behind the exhaust pipe, at the rear wall)
- 2 Thermal body
- 3 Density measuring cell
- 4 Precision pressure controller
- 5 Electronics - input and output signals, internal
- 6 Safety switch ignition transformer
- 7 Bus bar for power supply, example
- 8 Fan


5.1.1 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! Observe the Ex approval!</p> <p>Only use original accessories or accessories that have been approved by UNION Instruments GmbH.</p>



5.2 Transport

	 <h1 style="margin: 0;">WARNING</h1>
	<p>Risk of injury / defective!</p> <p>Transport damage can impede the protective function of the protective housing. In case of damage to the transport packaging or indications for improper transport, check the housing thoroughly!</p>

 	 <h1 style="margin: 0;">WARNING</h1>
	<p>Possible injury from the system tipping over or falling from pallets and load carrying equipment.</p> <ul style="list-style-type: none"> • Use suitable hoisting equipment for unpacking and transport! • Check the load bearing capacity and condition of the slinging equipment and carefully attach it. • Never stand under suspended loads.

	<h1 style="margin: 0;">NOTE</h1>
	<p>Shocks during transport can impair the protective housing. Therefore check system / protective housing after transport for damage!</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>

5.3 Ambient conditions



	 ATTENTION
	<p>Ambient conditions during storage and set up.</p> <p>Observe the ambient conditions! Contact UNION Instruments GmbH if the system has been stored for more than three months or needs to be operated or stored under ambient conditions other than those specified!</p>

5.3.1 Storage conditions

Freezing condensate water in the system can cause defects. Make sure that the system is free from gas / humidity residue.

Storage temperature:	-15 - 60°C
Humidity:	0 - 95% relative humidity
Ambient pressure:	700 - 1400 hPa (0.7 - 1.4 bar)

5.4 Installing and connecting


	 DANGER
	<p>Risk of explosion!</p> <p>Danger due to invalid cable glands!</p> <p>If improper cable glands are used, the explosion protection cannot be ensured anymore!</p> <ul style="list-style-type: none"> • Only use cable glands approved for the required ignition protection type! • Observe the technical data when selecting / using cable and line glands! <p>Danger due to open drilled holes or unused cable glands!</p> <p>If drilled holes are open or cable glands unused, the explosion protection cannot be ensured anymore!</p> <ul style="list-style-type: none"> • Always close open drilled holes and unused cable glands with approved sealing plugs! • Sealing plugs must be inserted with a tool! • Observe the technical data when selecting/replacing suitable sealing plugs!

5.4.1 Setup site



The installation location of the system must meet the following requirements:


- Observe the requirements acc. to the technical data, especially the ambient conditions and the IP protection type.
- Clean, closed room
- Protected from direct sunlight
- Insure a clean, sufficient amount of compressed / ambient air for undistorted measurements
- Ensure that the load-bearing capacity of the environment is sufficient
- Design sufficient space on the sides for mounting and connecting lines
- Install according to the requirements of explosion protection marking

	 WARNING
	Leaking process gas needs to be discharged by the operator into a safe environment!

	NOTE
	The compressed air must be dry and free from dust and oil! Humid, dirty air will distort the measurement results of the analyser.

5.4.2 Room ventilation



	 WARNING
	<p>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!</p>

	NOTE
	<p>In case of adverse flow / installation conditions, appropriate deflector plates must be installed that prevent direct flow of fresh air onto the combustion calorimeter. Exhaust gases must be emitted to the environment through a suitable pipe/tube after being mixed with a sufficient amount of fresh air. The connections must be checked for tightness.</p>



5.4.3 Wall / Ground Attachment

The CWD2005 DPC is designed for fixed installation on the wall / ground. Provide suitable means of attachment.

Ensure sufficient load-bearing capacity of the environment and the means of attachment.

	 WARNING
	<p>Danger of injury due to the weight of the system! Weight and dimensions see technical data! Use measures against falling and suitable hoisting tools!</p>

5.4.4 Opening and closing the housing lids/doors

	 DANGER
	<p>Risk of explosion!</p> <p>Terminal boxes</p> <p>See operating instructions of the terminal boxes</p> <ul style="list-style-type: none"> • Danger due to damaged seals and sealing surfaces, danger due to improper screw connections! <p>Protective housing of combustion calorimeter</p> <p>See operating instructions protective housing</p> <ul style="list-style-type: none"> • Danger due to damaged seals and sealing surfaces! • If seals are damaged seals and the doors closed improperly, the explosion protection cannot be ensured anymore! • If the doors are improperly locked, the explosion protection cannot be ensured anymore! <p>A repair must only be done according to the design specifications of the manufacturer.</p>

Terminal boxes

Loosen screws at the housing lid and remove lid carefully.
Make sure not to remove / lose the spacer sleeves!



Protective housing


Observe notes to open the doors - see notes on the housing!

Protective housing is under pressure – do not open doors before overpressure is relieved!

Observe door locks two per door leaf!

5.4.5 Process gas

	 DANGER
	<p>Risk of explosion!</p> <p>Danger due to invalid line glands!</p> <p>If improper line glands are used, the explosion protection cannot be ensured anymore!</p> <ul style="list-style-type: none"> • Only use line glands approved for the required ignition protection type! • Observe the technical data when selecting / using cable and line glands! <p>Danger due to open drilled holes or unused line glands!</p> <p>If drilled holes are open or cable glands unused, the explosion protection cannot be ensured anymore!</p> <ul style="list-style-type: none"> • Always close open drilled holes and unused line glands with approved sealing plugs! • Observe the technical data when selecting/replacing suitable sealing plugs!

	NOTE
	<ul style="list-style-type: none"> • The connecting parts need to be clean and free of residue. Impurities can enter the 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. • 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.

	 ATTENTION
	<p>The process gas must be free of condensate and dust if the system has no gas preparation system!</p>

5.4.6 Connection of process and calibration gas

Maximum gas input pressure see technical data.

The input for process and calibration gas to the protective housing and combustion calorimeter is suited on the left side.

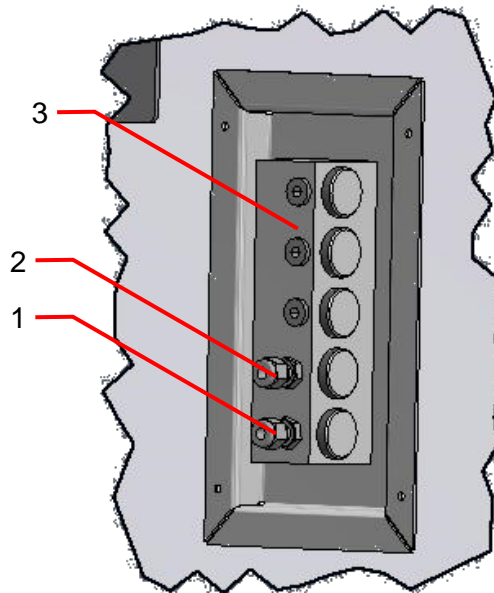


Fig. 5.4: Terminal block, inlet process and calibration gas

1. Calibration gas inlet
2. Process gas inlet
3. Nozzle block inlet gas

Recommended material for connecting lines is stainless steel, outer diameter \varnothing 6mm.

5.4.7 Carrier gas supply

NOTE




- Combustion calorimeters can later be refit to carrier gas supply. Contact the manufacturer.
- Process gases without stable combustion properties can be mixed with a carrier gas.
- Non-flammable gases are automatically mixed with flammable or not flammable carrier gases by the combustion calorimeter. The carrier gas will be reckoned up in the combustion calorimeter.
- Carrier gases maintain the combustion and do not increase the calorific value of the process gas.

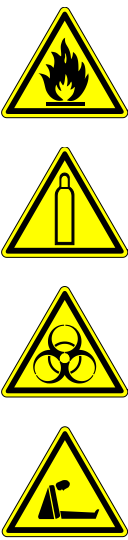

carrier gas	consumption	Ø nozzle
methane	10 l/h	0,40 mm
propane	6,0 l/h	0,40 mm
hydrogen	51,5 l/h	0,30 mm


5.4.8 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.• Calibration gas connection / clamping ring screw connection on the side of the combustion calorimeter.• 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.• For device variants 2 or 3 measuring ranges, up to 2 calibration gases can be required.• Software configuration of the calibration gas. (☞ <i>chapter 7.3 Present displays</i>)

5.4.9 Flue gas

	 WARNING	
	Serious risk of injury from escaping flue gas.	
	<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.	

	NOTE	
	Flue gases / residual heat must be emitted to the open air through an exhaust system.	

5.4.10 Instrument air connection

Maximum input pressure of instrument air, see technical data and plate at pressure controller.

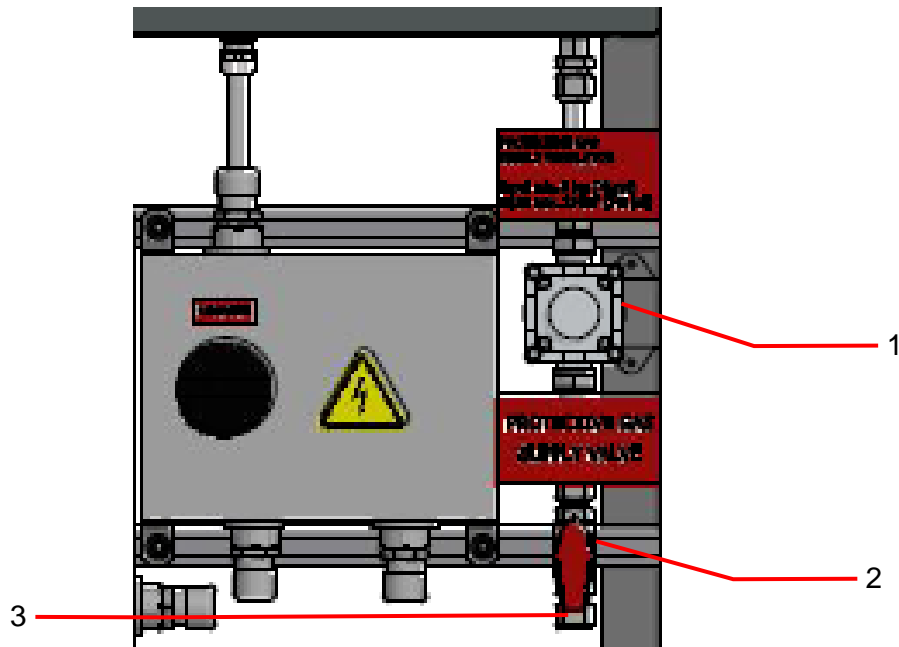




Fig. 5.5: Purge air, supply and distribution

1. Pressure controller, overpressure in protective housing
2. Shut-off valve for instrument air
3. Instrument air inlet

5.4.11 Electrical connection

	 DANGER
	<p>Danger from electrical shock!</p> <p>Only a trained electrician shall connect the power supply and electrical signal wires!</p> <p>Only a trained electrician may modify the electrical equipment of the system in accordance with the relevant guidelines!</p> <p>When the system 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 system from the voltage mains!</p>



The electric line to the power supply must meet the requirements for operation in potentially explosive atmospheres, e.g. IEC/EN 60079-14, as well as national regulations.

The cable gland must meet the requirements of EX zones and be matched to the cable and the threaded hole in the housing. Observe the operating instructions of the cable glands!




Integrate all blank, not energised metal parts independent of the operating voltage into the protective ground system.

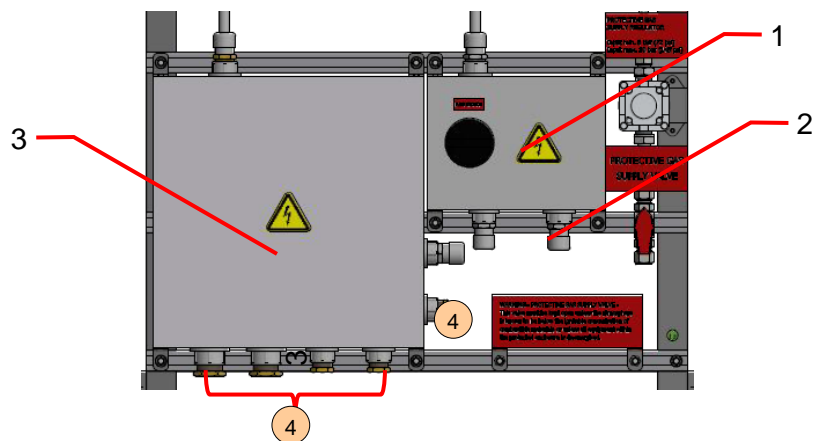
The outer protective ground connection at the system is designed for cable lugs. Avoid loosening of the cable, lay the cable close to the housing.

5.4.12 Electrical interfaces

	 WARNING
	<p>Untrained personnel starting the system may endanger people and equipment.</p> <p>Only trained service technicians may start up the analyser.</p>

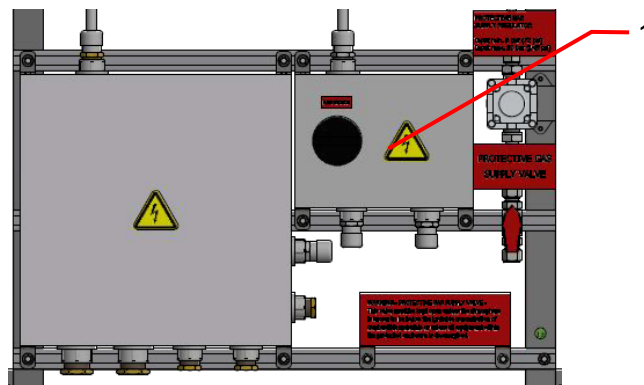
	 DANGER
	<p>Danger of explosion!</p> <p>Not used holes for lines must be closed with stopper plugs. Tighten stopper plugs with tools. Use stopper plugs supplied by the terminal box manufacturer!</p>

 	 WARNING
	<p>Standard safety requirement</p> <p>An external circuit breaker is required in accordance to national requirements and IEC 60947-1.</p> <p>Install the circuit breaker in close proximity to the unit. An assignment to the unit must be ensured.</p> <p>Note additional requirements for operation the hazardous area!</p>



1. Terminal box for power supply
2. Connection power supply
3. Terminal box for electrical signals
4. Optional ports for connection electrical signals

Fig. 5.6: Electric connection system – optional connections



1. Terminal box for power supply

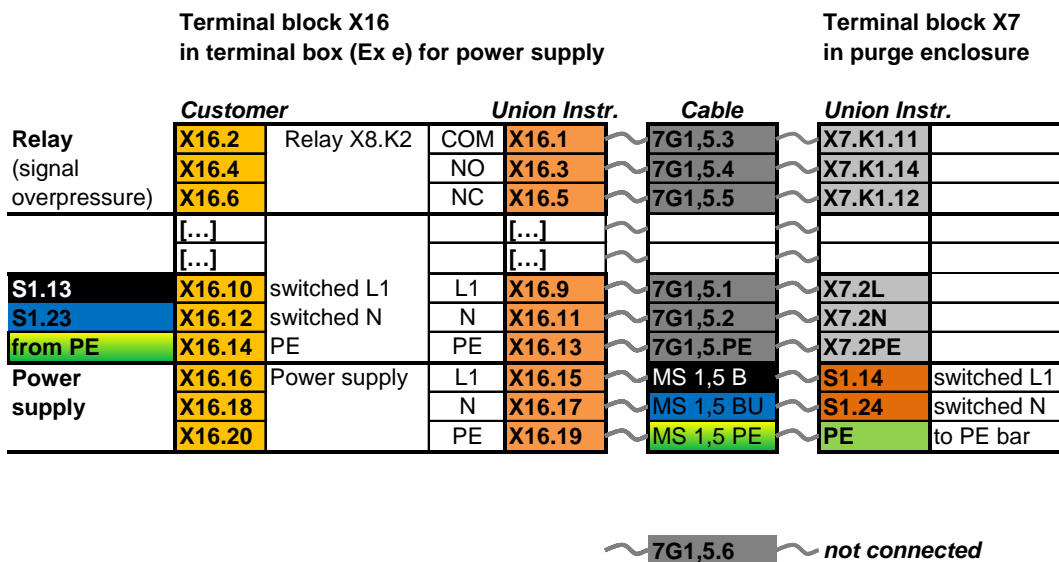


Fig. 5.7: Electric connection system – power supply X16

Assignment see provided wiring diagram! Connect the system via terminals L1, N, PE to the voltage supply according to national/internal regulations.

- X16.16. Connection L1
- X16.18. Connection N1
- X16.20. Connection PE

The power supply must be designed according to the power consumption, refer to type plate. The circuit must be protected by an external circuit breaker according to national requirements, ratings according to type plate und technical data.

Connection Pressure Switch via Relay X8.K2, connection to terminal X17 installed, refer to Fig. 5.9

- X16.2. COM
- X16.4. NO
- X16.6. NC

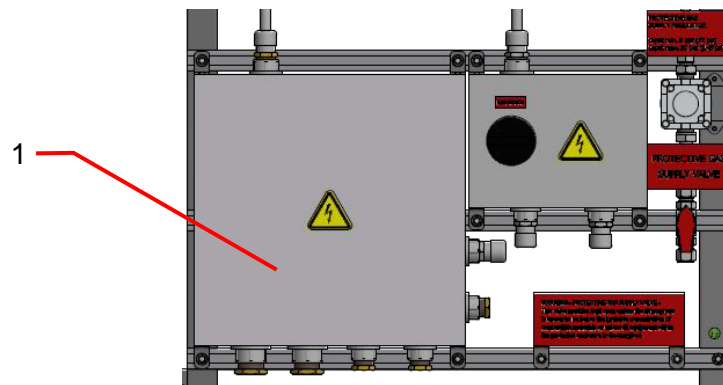


Fig. 5.8: Electric connection system – signal lines X17

1. Terminal box for signals

Assignment see provided wiring diagram.

	<i>Customer</i>		<i>Union Instr.</i>		<i>Cable</i>	<i>Union Instr.</i>		
Relay	X17.2 X17.4 X17.6	Relay K1	COM	X17.1	25G1.1	X14.1	lower row	Process
			NO	X17.3	25G1.2	X14.2		
			NC	X17.5	25G1.3	X14.3		
	X17.8 X17.10 X17.12	Relay K2	COM	X17.7	25G1.4	X14.4		Service request
			NO	X17.9	25G1.5	X14.5		
			NC	X17.11	25G1.6	X14.6		
	X17.14 X17.16 X17.18	Relay K3	COM	X17.13	25G1.7	X14.7		Error
			NO	X17.15	25G1.8	X14.8		
			NC	X17.17	25G1.9	X14.9		
	[...]		[...]		[...]			
	[...]		[...]		[...]			
4..20mA outputs	X17.50 X17.52	IOut1	+	X17.49	25G1,5.10	X5.1	lower row	Wobbe index 30-60 MJ/m ³
			-	X17.51	25G1,5.11	X5.2		
	X17.54 X17.56	IOut2	+	X17.53	25G1,5.12	X5.3		Calorific value 30-60 MJ/m ³
			-	X17.55	25G1,5.13	X5.4		
	X17.58 X17.60	IOut3	+	X17.57	25G1,5.14	X5.5		Specific gravity 0,2 - 2.2
			-	X17.59	25G1,5.15	X5.6		
	X17.62 X17.64	IOut4	+	X17.61	25G1,5.16	X5.7		not installed
			-	X17.63	25G1,5.17	X5.8		

Fig. 5.9: Electric connection X17 – Relay K1 – K3, analogue output

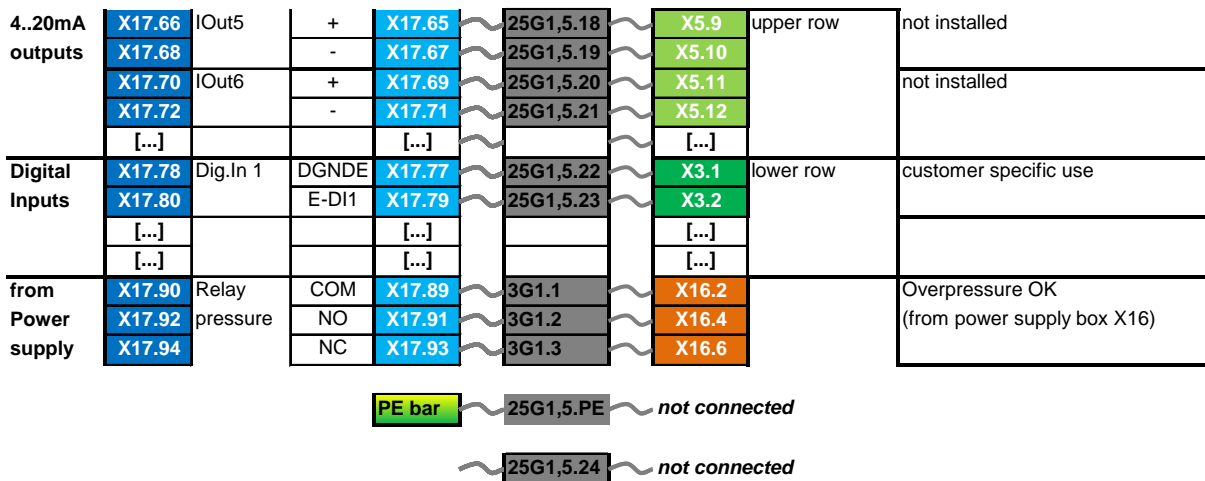


Fig. 5.10: Electric connection X17 – analogue and digital output, digital input

	WARNING
	Outputs (relay, analogue, digital) and inputs must only be operated with safety extra-low voltage! Do not connect to mains / supply voltage!

Maximum load of the relay connections 30VDC / 1A.

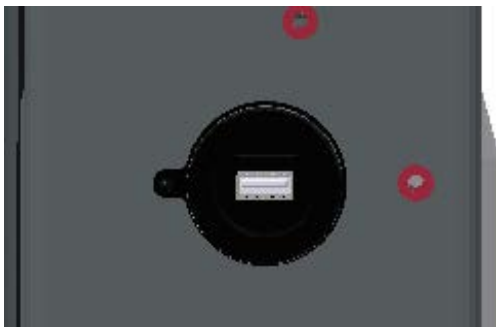






Fig. 5.11: USB interface on the left side of the housing


The USB interface serves for data transfer; the USB stick is provided with the device.


5.4.13 Operator safety precautions

  	 WARNING
	<ul style="list-style-type: none"> • Operate the system according to the requirements for potentially explosive atmospheres. • The operator needs to provide suitable safety equipment for the system to reliably prevent individuals from being injured from gas leaks. • Any leaking process gas needs to be diverted into a safe environment. • Identify the exit point of the diverted gas with a warning. • Danger of stumbling over improperly laid supply lines.


Install the supply lines in a suitable manner.

5.5 Startup after setup

 NOTE	<p>Before commissioning / transport of the combustion calorimeter, make sure that all transport safeguards are removed / attached.</p> <p>See separate operating instructions for combustion calorimeter!</p>
---	---

 WARNING	<p>Untrained personnel starting the system may endanger people and equipment.</p> <p>Only trained service technicians may start up the analyser.</p>
--	--

5.5.1 Removing / attaching the transport safeguard



NOTE

Before commissioning / transport of the combustion calorimeter, make sure that all transport safeguards are removed / attached.

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

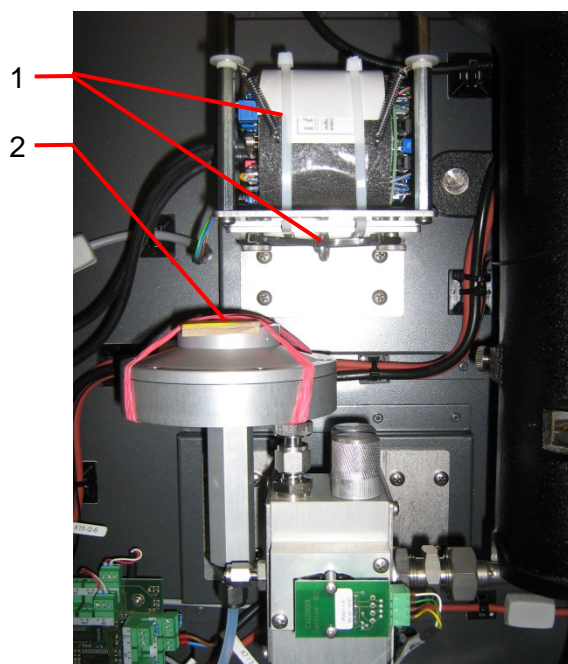


Fig. 5.12: Transport safeguards

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)

5.5.1.1.1 Transport safeguard in the pressure controller



Fig. 5.13: 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 protective flap (screw connection). • Remove the transport safeguard (bubble wrap). • Close the protective flap again.

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

5.5.1.1.2 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.

5.6 Documentation





NOTE


UNION Instruments GmbH recommends keeping maintenance manual and documenting all jobs and tests.


6 Commissioning, operation, removing from service

6.1	Commissioning / start-up.....	6—28
6.2	Description of the workplaces / operating elements.....	6—30
6.2.1	Workplaces.....	6—30
6.3	Operation	6—31
6.4	Decommissioning / switching off.....	6—32


6.1 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>The following table includes abridged instructions for commissioning the system after a longer standstill.</p> <p>To turn on the system after a short downtime, a few steps can be omitted: <i>☞ right column!</i></p>

Steps	Start-up	Turning on
Check whether the ambient conditions (☞ <i>Technical Data</i>) and the EX marking meet the requirements.	X	X
Check if the system is attached safely.	X	
Check that the gas analysis device is suitable for the process gas.	X	
Check that the process gas is correct.	X	
Check that the calibration gas is correct.	X	
Check that the gas connections are correct and tight.	X	X
Check the filters (water / fine filter), – check for condensate/dirt.	X	X
Establish/switch on the operator energy and media supply.	X	X
Switch on / open instrument air.	X	X
Purge for 30 minutes.	X	X
Check overpressure in protective housing, min. 1.0 inch of water, see Fig. 5.2.	X	X
Turn on the main switch, see Fig. 5.2.	X	X
Make sure the linked system components are ready to start.	X	X
 If the system was only switched off temporarily, production can be resumed!		

Open calibration gas supply when combustion calorimeter is configured with automatic calibration.

 A simple line drawing of a hand with the index finger pointing to the right.	<p>NOTE</p> <p>For first stating or starting up after a long downtime, back up the configuration of the combustion calorimeter.</p> <p>Let a service technician do the backup or ask Service for special instructions.</p>
--	---

6.2 Description of the workplaces / operating elements

NOTE

This chapter only discusses the elements normal operators use to operate the system to establish the protective function by purging and overpressure.

6.2.1 Workplaces

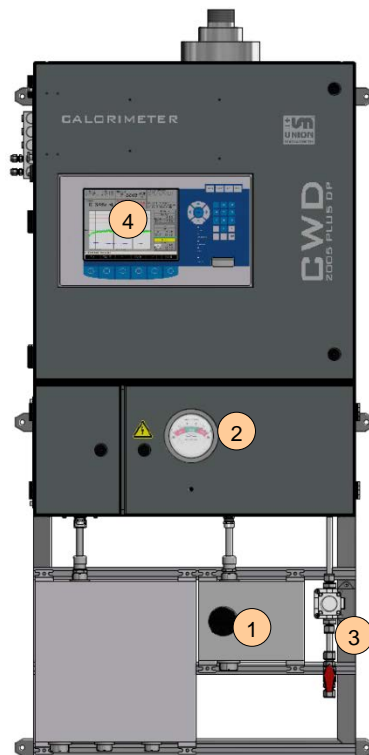





Fig. 6.1: Workplaces

Item No.	Designation	Function / activity
1	Main switch	Switch on/off, de-energises the system
2	Pressure display, manometer	Displays overpressure in protective housing, displays status
3	instrument air inlet	Opens / closes the instrument air supply, regulator for pre-pressure
4	Display, Keyboard	Operating the combustion calorimeter, see following chapter

6.3 Operation



 	 WARNING
	<p>Danger of injury!</p> <p>Only operate combustion calorimeter</p> <ul style="list-style-type: none">• if all lines have been installed and checked for leaks according to national regulations.• if an overpressure of 1.0 inWC is displayed!


In order to ensure the function of protection and automatic analysis operation,


- check the pressure indicator – display in the safety range (green range) – 1.0 inch of water
- adjust the overpressure in the housing using the controller

Operation of the combustion calorimeter is described in the following chapter.

6.4 Decommissioning / switching off

	 <h1 style="margin: 0;">ATTENTION</h1>
	<p>To remove the system from service, the linked system components must also be removed from service according to their operating instructions.</p>

	<h1 style="margin: 0;">NOTE</h1>
	<p>The following table contains the steps for decommissioning the analyser for a long period.</p> <p>If the system shall only be switched off for a short time, some of the steps are not necessary: ☞ <i>column <u>Turn off!</u></i></p> <p>At first start-up or before longer downtime, back up the configuration of the system / gas analysis device.</p> <p>Let a service technician do the backup or ask Service for special instructions.</p>

Steps	Turn off	Decommissioning
Turn off the main switch.	X	X
Rinse system for 30 minutes – let compressed air switched on until device has cooled down and no voltage is applied anymore.	X	X
Shut compressed air supply.	X	X
Disconnect the device from the process, close the line professionally.		X
Shut down the linked system components.	X	X
 If the system 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 system in a suitable way.		X

7 Operation combustion calorimeter

7.1	Operation of film keyboard / description of display.....	7—34
7.2	Basics on operation.....	7—36
7.3	Available displays.....	7—36
7.4	General information on the start screen.....	7—37
7.5	Menu structure	7—38
7.6	Main menu.....	7—39
7.6.1	Main menu - Options.....	7—40
7.6.2	Main menu - Trend.....	7—62
7.6.3	Main menu - Event list.....	7—67
7.6.4	Main menu - Device info.....	7—68

7.1 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.

NOTE

Damage to the membrane keypad!
Operation with pointed/sharp objects can damage the film keyboard!

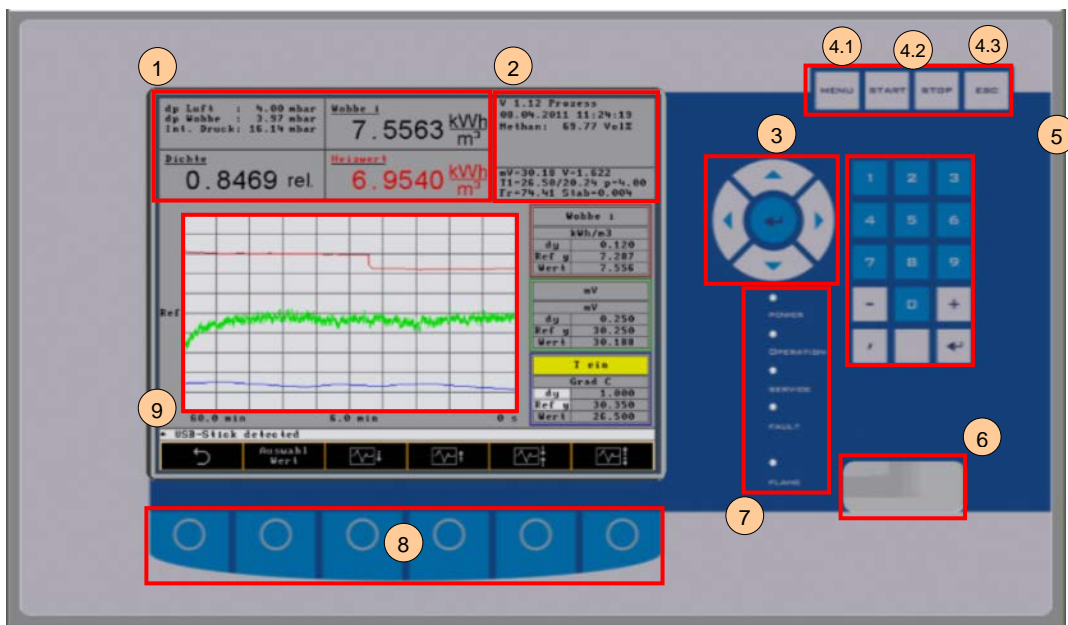







Fig. 7.1: Operating elements / layout of display

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.

7.2 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 menus 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

Other symbols not described above refer to the different menus. They are described on the corresponding screens.

7.3 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.

7.4 General information on the start screen

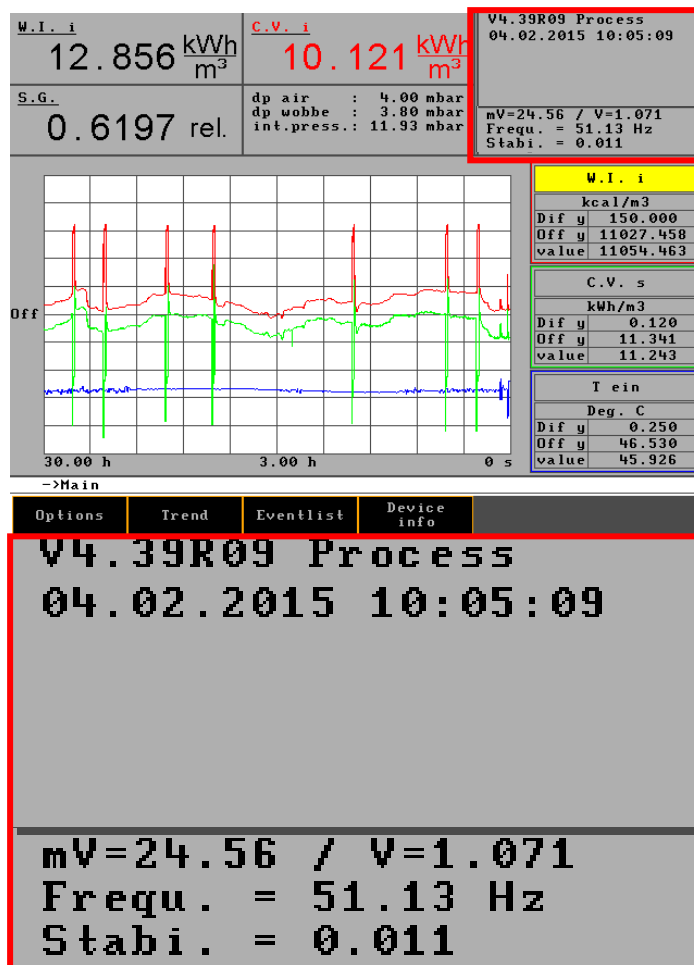


Fig. 7.2: Information field, start screen

Indication (screen)

- 1 V 4.39R09
- 2 04.02.2015 10:05:09
- 3 Methane: 95.01 Vol%
- 4 mV=24.56
- 5 V=1.071
- 6 T₁=29.04/0.24
- 7 p=4.00
- 8 Fr=51.13
- 9 Stabi=0.011

Information

- Version number of the software
Current date / time
Volume share of methane
mV signal of the thermal battery
Voltage signal of the density measuring cell
Inlet temperature into the thermal body / heating of the air
Air differential pressure
Controlled fan frequency
Standard deviation of the measurement value over 2 minutes



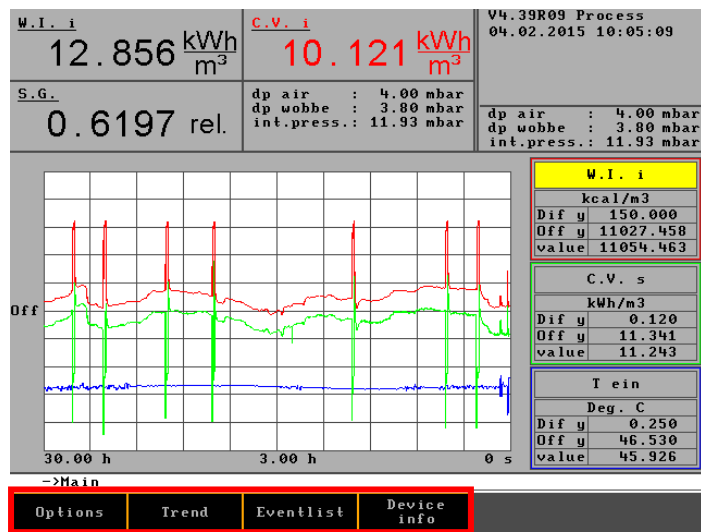
NOTE

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

7.5 Menu structure

7.6	Main menu	7—39
7.6.1	Main menu - Options	7—40
7.6.1.1.1	Main menu - Options - I/O	7—41
7.6.1.1.1.1	Main menu - Options - I/O - Analogue outputs	7—42
7.6.1.1.1.2	Main menu - Options - I/O - Relay output	7—43
7.6.1.1.1.3	Main menu - Options - I/O - mA display	7—44
7.6.1.1.1.4	Main menu - Options - I/O - Digital inputs	7—45
7.6.1.1.1.5	Main menu - Options - I/O - display	7—46
7.6.1.1.2	Main menu - Options - Calibration	7—47
7.6.1.1.2.1	Main menu - Options - Calibration - Configuration of calibration gas	7—48
7.6.1.1.2.2	Main menu - Options - Calibration - Automatic calibration	7—49
7.6.1.1.2.3	Main menu - Options - Calibration - Automatic calibration 2	7—50
7.6.1.1.2.4	Main menu - Options - Calibration - Calibration	7—50
7.6.1.1.2.5	Main menu - Options - Calibration - Saving basic calibration	7—50
7.6.1.1.2.6	Main menu - Options - Calibration - Calibration limits	7—51
7.6.1.1.3	Main menu - Options - System	7—52
7.6.1.1.3.1	Main menu - Options - System - General	7—53
7.6.1.1.3.2	Main menu - Options - System - Ignition	7—54
7.6.1.1.3.3	Main menu - Options - System - CSV export	7—54
7.6.1.1.3.4	Main menu - Options - System - Signal hold on/off	7—54
7.6.1.1.3.5	Main menu - Options - System - Settings	7—55
7.6.1.1.3.6	Main menu - Options - System - Settings - Date and time	7—55
7.6.1.1.3.7	Main menu - Options - System - Settings - Language	7—56
7.6.1.1.3.8	Main menu - Options - System - Settings - Password	7—56
7.6.1.1.3.9	Main menu - Options - System - Settings - Change colour	7—57
7.6.1.1.3.10	Main menu - Options - System - Settings - Hardware 1	7—58
7.6.1.1.3.11	Main menu - Options - System - Database	7—60
7.6.1.1.4	Main menu - Options - Service	7—61
7.6.2	Main menu - Trend	7—62
7.6.2.1.1	Main menu - Trend - Time selection	7—63
7.6.2.1.2	Main menu - Trend - Value selection	7—64
7.6.2.1.3	Main menu - Trend - Signal selection	7—65
7.6.2.1.4	Main menu - Trend - Unit selection	7—65
7.6.2.1.5	Main menu - Graphics - Curve selection	7—66
7.6.3	Main menu - Event list	7—67
7.6.4	Main menu - Device info	7—68

7.6 Main menu



The main menu is the standard display in running operation.

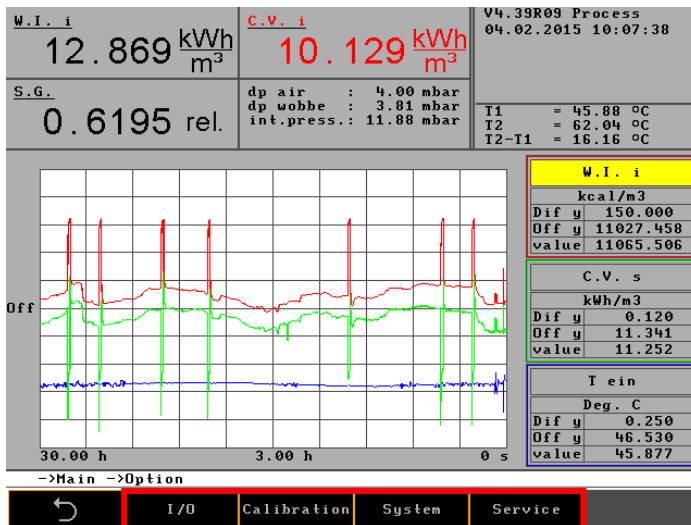
From the main menu you can access the following sub-menus:

- Options
- Trend
- Event list
- Device info

7.6.1 **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:

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

Calibration

Option to configure the following parameters:

- Calibration gas settings
- Calibration limits
- Calibration

System

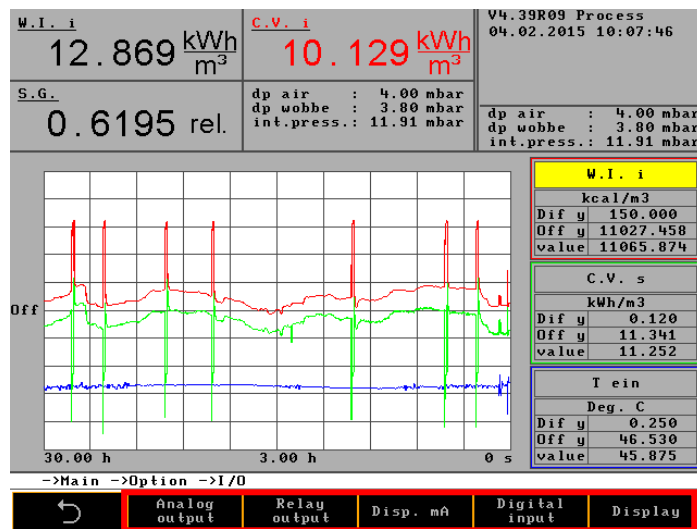
Option to configure the following parameters:

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

Service

For service technicians only

7.6.1.1.1 Main menu - Options - I/O



Option to configure the following parameters:

- Analogue outputs
- Relay outputs
- Disp. mA
- Digital input
- Display

7.6.1.1.1 Main menu - Options - I/O - Analogue 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

7.6.1.1.2 Main menu - Options - I/O - Relay output

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						

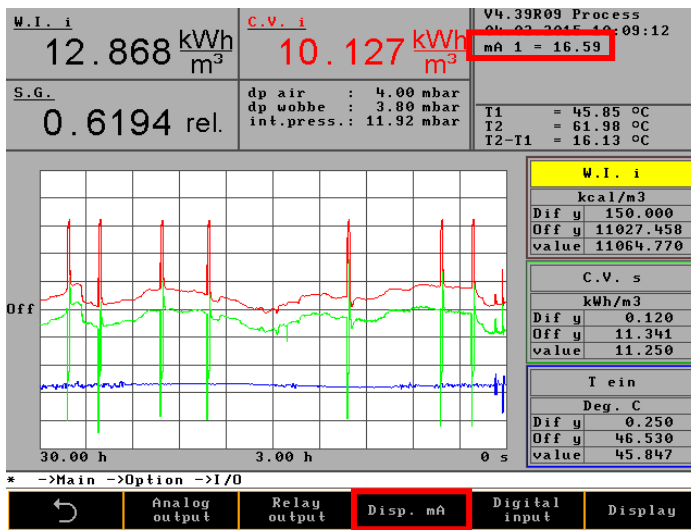
The digital output can e.g. comprise signals in combination with limit values or operation messages.

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:

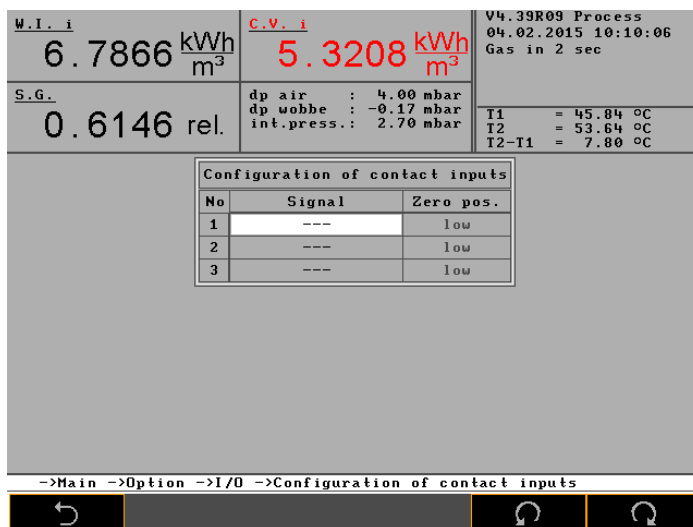
- Process: The solenoid valve for process gas is open and the flame is burning.
- Calibrate: The solenoid valve for calibration gas is open and the flame is burning.
- Service: Filter change of air filter (the frequency of the frequency converter is > 48 Hz) or air inlet temperature > 41°C.
- Filter 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.

7.6.1.1.1.3 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.

7.6.1.1.4 Main menu - Options - I/O - Digital 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	CWD2005
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

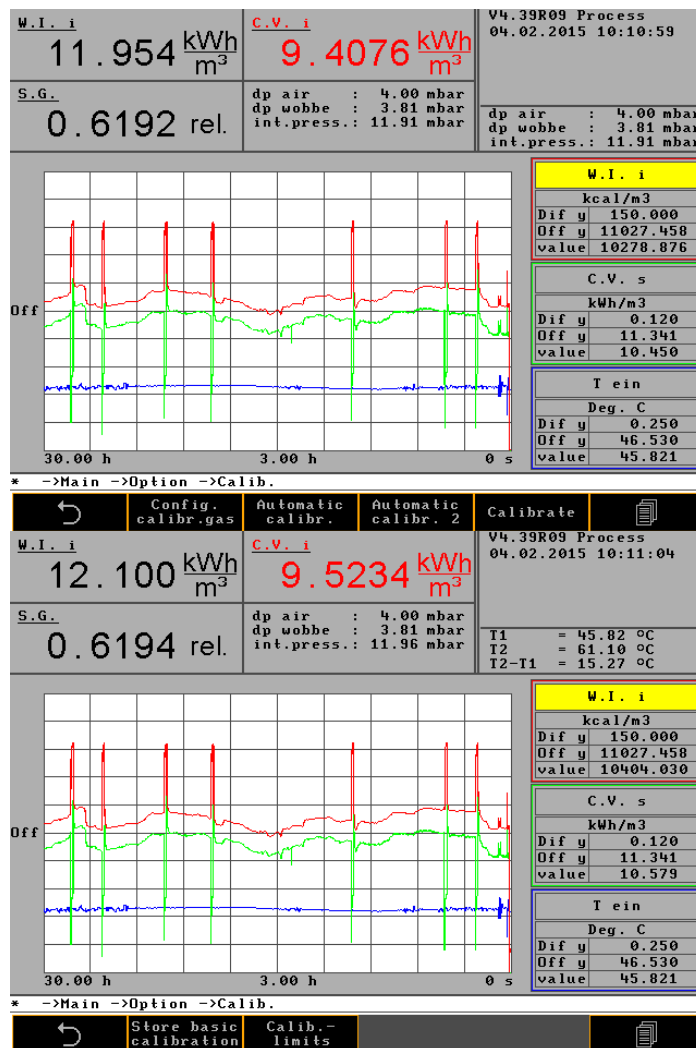
7.6.1.1.1.5 Main menu - Options - I/O - display

<u>W.I. i</u> 7.0238 kWh m ³	<u>C.V. i</u> 5.5289 kWh m ³	V4.39R09 Process 04.02.2015 10:10:30																		
<u>S.G.</u> 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.

7.6.1.1.2 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.

7.6.1.1.2.1 Main menu - Options - Calibration - Configuration of calibration gas

W.I. i 12.387 kWh/m³		C.V. i 9.7509 kWh/m³		V4.39R09 Process 04.02.2015 10:11:19	
S.G. 0.6196 rel.		dp air : 4.00 mbar dp wobbe : 3.82 mbar int.press.: 11.91 mbar		T1 = 45.82 °C T2 = 61.44 °C T2-T1 = 15.62 °C	
Configuration of calibration gases					
No	Unit	W.I. i	W.I. s	Unit	S.G.
1	kWh/m ³	13.379	14.862	Specific	0.555
2	BTU/ft ³	0.00	0.00	Specific	0.000

* ->Main ->Option ->Calib. ->Configuration of calibration gases

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 is 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.

7.6.1.1.2 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.

7.6.1.1.2.3 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).

7.6.1.1.2.4 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.

7.6.1.1.2.5 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.

7.6.1.1.2.6 Main menu - Options - Calibration - Calibration limits

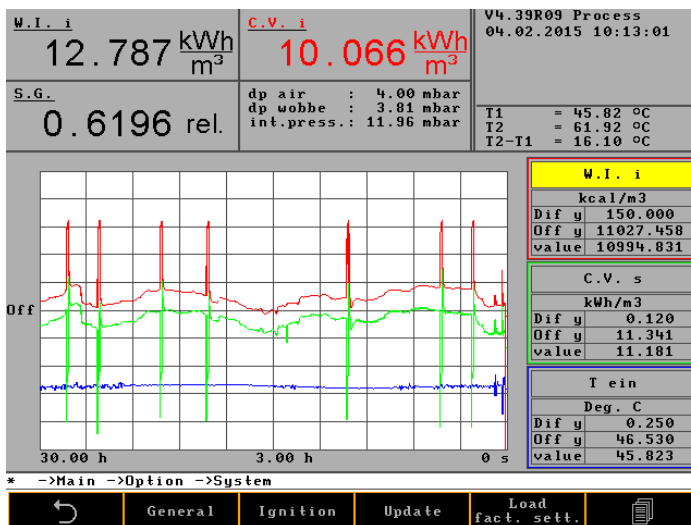
W.I. i 12.681 kWh m ³	C.V. i 9.9808 kWh m ³	V4.39R09 Process 04.02.2015 10:12:02
S.G. 0.6194 rel.	dp air : 4.00 mbar dp wobbe : 3.82 mbar int.press.: 11.91 mbar	I1 = 45.82 °C I2 = 61.79 °C I2-I1 = 15.97 °C

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.

7.6.1.1.3 Main menu - Options - System



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

7.6.1.1.3.1 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

Purge time after cooling

Specifies the time period after which the screen is switched off after no input has been given.

Screen switch-off time

Specifies the time period after which the screen is switched off after no input has been given.

Display speed

Refers to a time constant in different burners. This is pre-set by the manufacturer and depends on the burner type.

Carrier gas check cycles

Specifies the time periods in minutes during which the carrier gas is calibrated.

7.6.1.1.3.2 Main menu - Options - System - Ignition

W.I. i 12.846 kWh m ³	C.V. i 10.111 kWh m ³	V4.39R09 Process 04.02.2015 10:16:32
S.G. 0.6195 rel.	dp air : 4.00 mbar dp wobbe : 3.80 mbar int.press.: 11.96 mbar	dp air : 4.00 mbar dp wobbe : 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 it is 3°C differential temperature between cooling air and flue gas.

7.6.1.1.3.3 Main menu - Options - System - CSV export

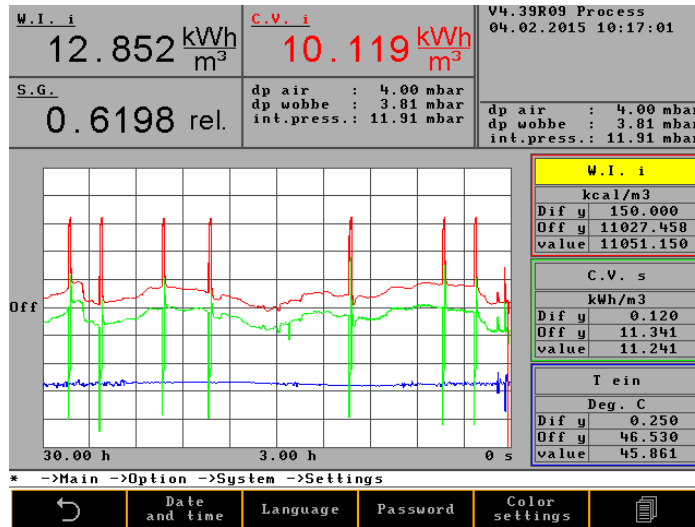
Here you export the data as ASCII files. The values are TAB-separated. In one go, all possible 25 curves are written in one CSV file. This file can be processed with Excel.

7.6.1.1.3.4 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.

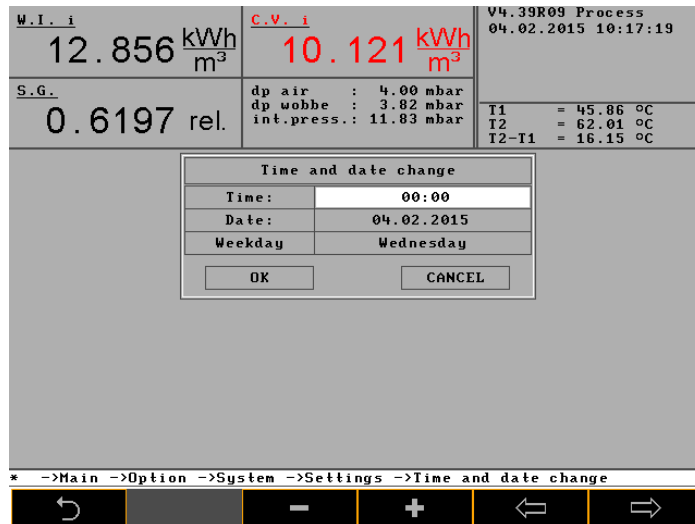
7.6.1.1.3.5 Main menu - Options - System - Settings

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



7.6.1.1.3.6 Main menu - Options - System - Settings - Date and time

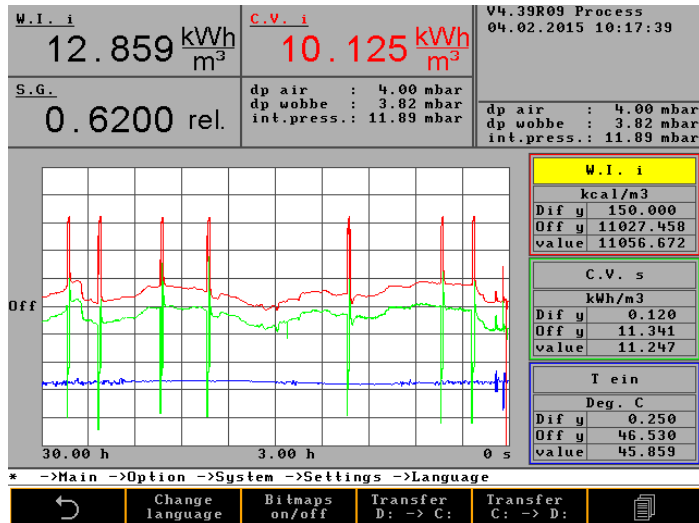
System time and date are set here. With OK in the position button field you confirm the settings. With Cancel you exit the screen mask without changes.



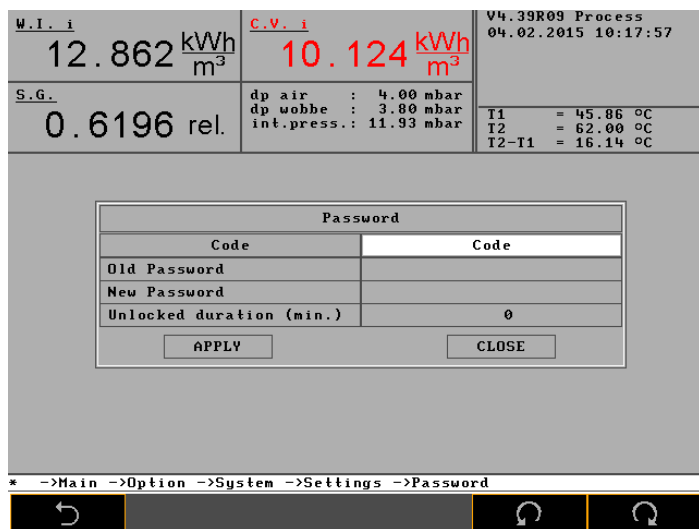
- + Counts up marked digits
- Counts down marked digits
- ← Next field to the left
- Next field to the right

7.6.1.1.3.7 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.



7.6.1.1.3.8 Main menu - Options - 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.

7.6.1.1.3.9 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.

7.6.1.1.3.10 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 of the 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 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.

7.6.1.1.3.11 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/m3		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

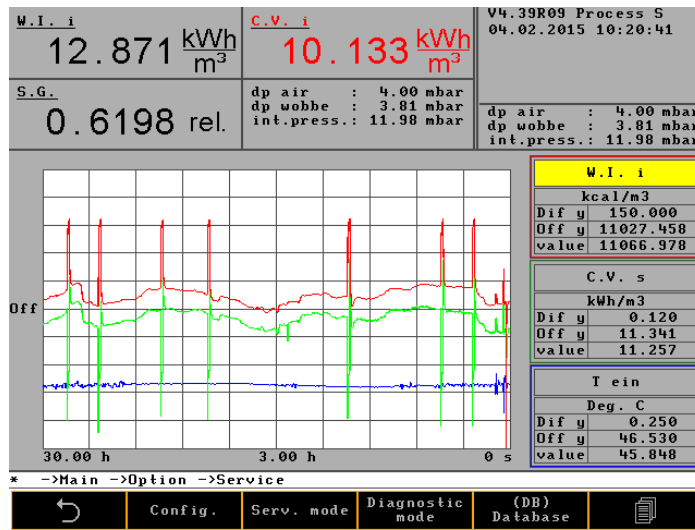
- V DVB** Relative density calibration constant
- T0** Thermal battery outer temperature (°C)

- TS** Ambient temperature: (°C)
- P Gas** Gas pressure (mbar)
- P A** Air differential pressure (mbar)
- WKAL** lower Wobbe-index of the calibration gas (kJ/Nm3)

- DVKAL** Relative density of the calibration gas

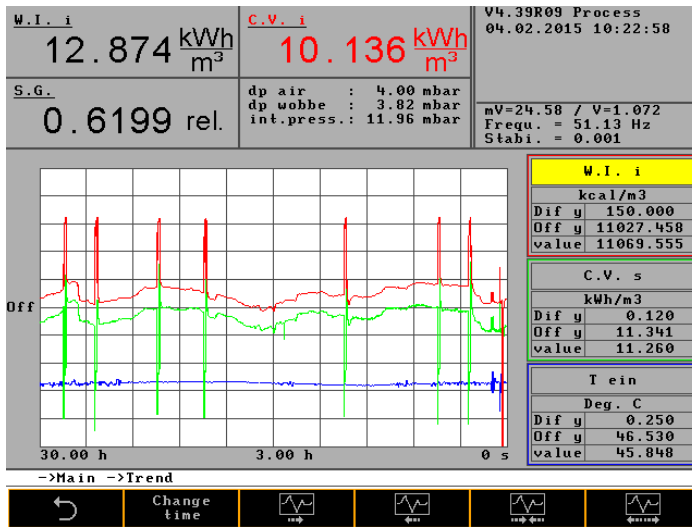
- R** Measuring range

7.6.1.1.4 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.

7.6.2 **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.

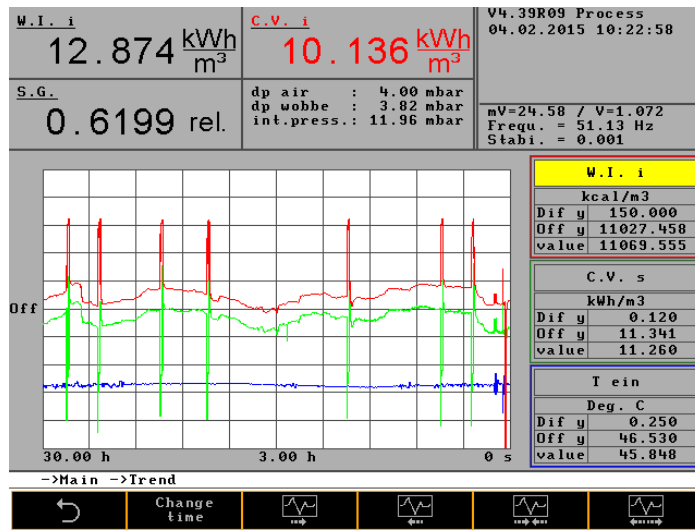
Buttons on the bottom of the screen with different symbols that change with the menu.

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

7.6.2.1.1 Main menu - Trend - Time selection



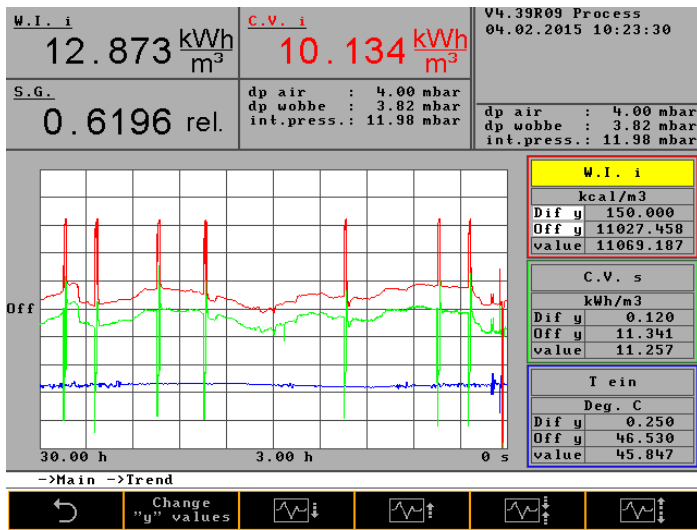
The diagram can be started optimally. The steps to increase or reduce the resolution are already programmed.

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

7.6.2.1.2 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

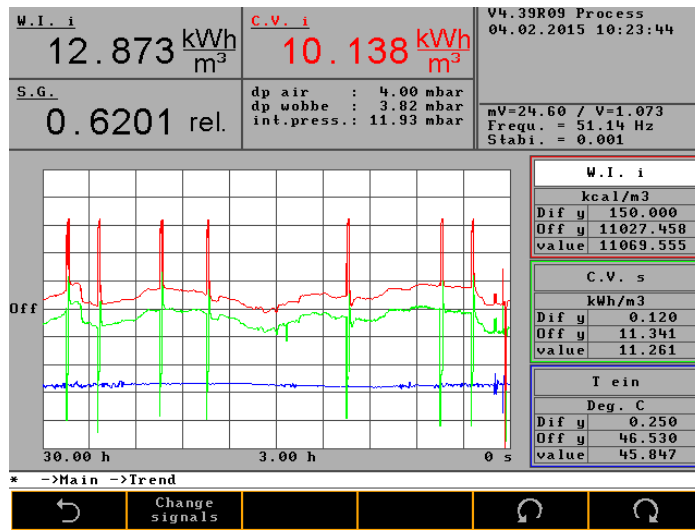
The calorific value is selected.

The three lines

Dif y	distance line to line	4.800
Off y	position from offset	0.145
Value	current value	10.988

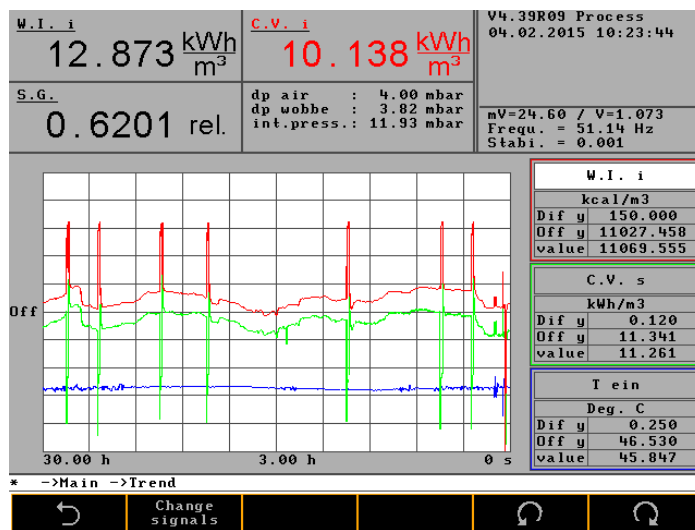
are important for an unambiguous analysis of the graphical presentation of the calorific value.

7.6.2.1.3 Main menu - Trend - Signal selection



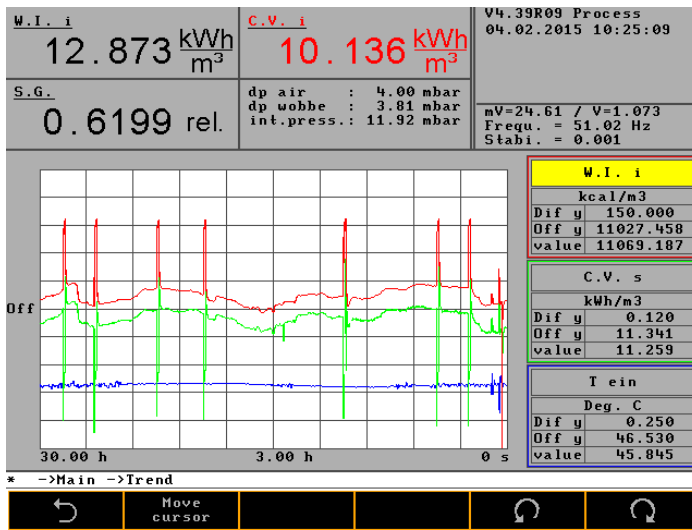
This menu corresponds to the menus described above in terms of operation.



7.6.2.1.4 Main menu - Trend - Unit selection



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

7.6.2.1.5 Main menu - Graphics - 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 i 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

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

7.6.3 **Main menu** – **Event list**

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</div> <div style="font-size: 0.8em;">kWh m³</div>	C.V. i <div style="font-size: 1.2em; font-weight: bold; color: red;">10.138</div> <div style="font-size: 0.8em;">kWh m³</div>	V4.39R09 Process 04.02.2015 10:25:23
S.G. <div style="font-size: 1.2em; font-weight: bold;">0.6201</div> <div style="font-size: 0.8em;">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
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		
* ->Main		
↶	Show start-up	Show calibration
↷	Show all	↶

Show startup
Show calibration
Show all

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

7.6.4 **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

Distributor: TEST UI

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 70185 Karlsruhe
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CE

Last calibration deviation (max):
 04.02.2015 08:08:24
 0.35 %

Analog outputs

W.I. s	4 - 20mA	kWh/m3	8.000 - 16.000
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 Measurement ranges:
 - Wobbe
 - Density
- 3 Configuration:
 - Jet MB1
 - Jet MB2
 - Burner
- 4 Additional options:
 - Here, any installed additional options are listed.
- 5 Analogue outputs:
 - Wobbe i
 - Density
 - Heating value

8 Maintenance and service

8.1	Service	8—2
8.1.1	Preparations	8—2
8.1.2	Maintenance work/Inspection	8—4
8.2	Troubleshooting Ex protective housing	8—8
8.2.1	Preparations	8—9
8.2.2	Changing / replacing fuses	8—9
8.2.3	Messages / malfunctions	8—10
8.3	Troubleshooting Combustion Calorimeter.....	8—11
8.4	Preparations for troubleshooting.....	8—12
8.5	Changing / replacing fuses	8—13
8.6	Instable measured value	8—13
8.6.1	Drift of the measured value.....	8—13
8.6.2	Faulty ignition	8—13
8.6.3	Fault / status messages with description.....	8—14
8.7	Service	8—16

8.1 Service



When working in the potentially explosive areas, observe the pertinent safety precautions.

The measuring quality of the gas analyser can only be ensured if the service intervals are maintained.

The explosion protection function of the protective housing and the flame arresters can only be ensured if the service intervals are maintained.

8.1.1 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 connecting / turning on again!• Only a trained electrician may work on the electrical equipment of the combustion calorimeter!

DANGER

Risk of explosion!

If the pressure monitoring system is bridged for maintenance / service work, the device can be operated permanently without compressed air purging and over-pressure.

There is no protection against explosions!

- Bridging only for service and maintenance work!
- Bridging only by authorised trained staff!
- Use suitable measures / warnings to prevent permanent operation!

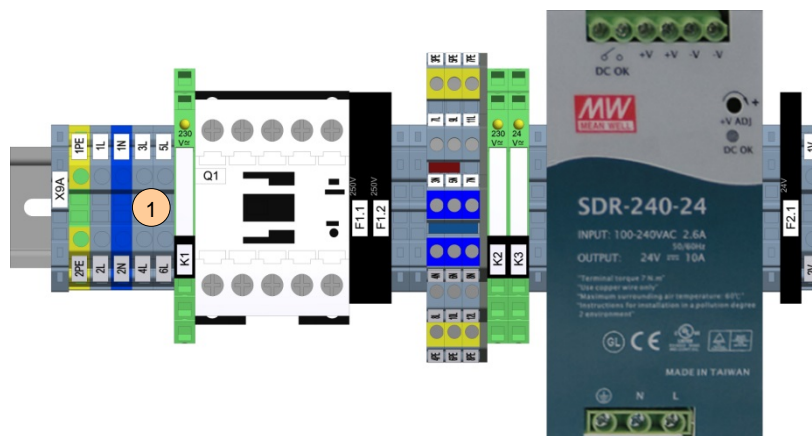










Fig. 8.1: Top hat rail X9, Service bridge

Item No.	Designation	Function / activity
1	Service bridge	bridge pressure monitoring system, combustion calorimeter can be used without protection system, Terminal 3L and 5L

   	 <h2 style="margin: 0;">WARNING</h2>
	<p>Serious risk of injury from exiting gas.</p>
	<ul style="list-style-type: none"> • Before maintenance works, shut down the combustion calorimeter and, if necessary, any connected system components!
	<ul style="list-style-type: none"> • The gas connections may only be established by trained personnel. Follow the applicable guidelines at the installation site.
	<ul style="list-style-type: none"> • 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!

8.1.2 Maintenance work/Inspection

	<h2 style="margin: 0;">NOTE</h2>
	<p>The maintenance work must be carried out in accordance with the inspection and maintenance schedule! The type and extent of the wear depends on the individual application and operating conditions. Thus, all maintenance intervals specified are guide values only.</p> <p>Maintenance work at the gas analysing device and components of the system are described in the provided documentation – observe intervals and work processes!</p>

 	<h2 style="margin: 0;">DANGER</h2>
	<p>Loss of protective function!</p> <p>The type and degree of wear and tear highly depends on the individual conditions of usage and operation. Thus, all maintenance intervals specified are guide values only.</p>

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.

	NOTE
	<p>The following overview only describes the checks / work in regard to the protective housing and the functions for explosion protection!</p>


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

Weekly inspection

Compressed air inlet free	weekly, or when required
Pressure indicator at protective cabinet readable and plausible	weekly, or when required
Flame arrester consistent and not soiled	weekly, or when required
Exhaust system free	weekly, or when required
	weekly, or when required

Quarterly inspection

Process gas analyser calibrated according to manufacturer's specifications	every 3 months, latest annually or when required
--	--

	NOTE
<p>The following overview only describes the checks/work in regard to the combustion calorimeter!</p>	



Inspection	Interval (recommended)
Weekly inspection	
Check air filter for dirt / clogging.	weekly
Calibrate (depending on the requirements for precision, shorten the intervals).	weekly
Monthly check	
Check neoprene tubes in the combustion calorimeter for porosity.	monthly
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 ² /clean ³ thermal battery and heat exchanger.	every 6 months
Replace the seal at the heat exchanger.	every 6 months
Check fan.	every 6 months
Check inlet filter (inlet ambient air, filter mat, ventilator).	every 6 months
Clean ⁴ 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


² 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.

³ Clean the heat exchanger with water and then dry the cleaned components thoroughly.

⁴ Clean the nozzles with a solvent (brake cleaner, degreasing spray).



8.2 Troubleshooting Ex protective housing

	 DANGER
	<p>Loss of protective function!</p> <ul style="list-style-type: none">• After several short-circuits / ignitions in the protective cabinet, the protective function cannot be ensured anymore!• After resetting/replacing the thermal fuse in the process gas analyser, check the device for proper function!• In case of housing damage (protective housing, terminal boxes), check their protective functions and replace! <p>Replace the flame arresters!</p> <ul style="list-style-type: none">• After fire or explosion at the flame arrester.• Visible mechanical damage at housing, lid or retaining ring of flame arrester.• Strong soiling or corrosion of the fire protection.

	NOTE
	<p>Troubleshooting in the system is divided into the following categories:</p> <ul style="list-style-type: none"> • insufficient pressure of instrument air • insufficient function of the combustion calorimeter <p>For other faults, observe related operating instructions of the combustion calorimeter and other components!</p>

8.2.1 Preparations

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

	 WARNING
	<p>Serious risk of injury from electricity and exiting gas.</p> <ul style="list-style-type: none"> • Observe the safety precautions of the corresponding EX area! • 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! • After turning off the main switch, purge for at least 30 minutes with compressed air! • Only a trained electrician may work on the electrical equipment of the process gas analyser. • Parts of the process gas analyser labelled with this symbol may still be live even when the main switch has been switched off. • If necessary, disconnect combustion calorimeter from the voltage mains!

8.2.2 Changing / replacing fuses

Fuses may only be exchanged by an electrician or service professional. Choose the type approved by UNION Instruments GmbH. Specification of the fuses, refer to UNION.

8.2.3 Messages / malfunctions

8.2.3.1.1 Display of messages / malfunctions

Pressure switch triggers, required overpressure not reached

- Check instrument air supply for free flow / dirt
- Check inlet pressure of instrument air supply, see technical data
- Check function of the pressure switch
- Check function of the faceplate in the exhaust air duct system
- Check free flow of instrument air in all concerned lines/connections

8.3 Troubleshooting Combustion Calorimeter

NOTE



Troubleshooting is divided into the following categories:

- Instable measured value
- Drift of the measured value
- Incorrect ignition behaviour

The system keeps a results list. Events are registered in the order of occurrence and saved with the respective date.

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.

8.4 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 and calibration.

8.5 Changing / replacing fuses

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

8.6 Instable measured value

- The pressure regulator cannot hold constant pressure. The process pressure (blast furnace gas) is too low. A pressure increase pump must be installed.
- Direct sunlight causes rapid changes in temperature. Avoid direct sunlight.
- Temperature changes too rapid due to the air conditioning system. The power of the air conditioning is too high and the hysteresis is too large.
- The pressure is imprecise and/or cannot be held.
Check if the input pressure is too high.

8.6.1 Drift of the measured value

The measured value drifts up in one direction:
The calibration does not reach the required point anymore. The frequency controller has reached its maximum value.
Heavy filter soiling which cannot be compensated by controller anymore. 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.

8.6.2 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). Increased the temperature threshold.

Ignition electrode corroded, normal wear after frequent ignition.
Replace ignition electrode.

8.6.3 Fault / status messages with description

8.6.3.1.1 Filter change

- Filter change of air filter
- The frequency of the frequency converter is > the set threshold

8.6.3.1.2 Int. pressure

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

8.6.3.1.3 Overtemp

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

8.6.3.1.4 Fault

- Filter change of air filter
(The frequency of the frequency converter is > the set threshold)
- Gas pressure to low
- Fault in thermal battery
- Defective PT 100 temperature sensor

8.6.3.1.5 Service

- Filter change of air filter
- Frequency > threshold value
 - Air inlet temperature > 41°C

8.6.3.1.6 Operation

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

8.6.3.1.7 Operation delay

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


8.6.3.1.8 Process

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

8.6.3.1.9 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).

8.7 Service

	NOTE
	<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 process gas analyser (see the type plate) and the required spare parts and parts list numbers to hand.</p>

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9 Disposal

Following decommissioning, the analyser can be returned to UNION Instruments GmbH.

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




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

If necessary, purge the gases; e.g. by running a calibration with ambient air.

Before disassembly, separate combustion calorimeter from energy supplies!

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

10 Spare parts

 WARNING	
 	<p>Use of non-approved spare parts causes loss of the EX approval! This will render the warranty null and void! The operator is liable for incurring damage!</p> <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:

Identify and write down type, number and designation of the part, order part.

11 Annex

Index

A			
Accessories	5—5		
Ambient conditions	5—7		
Attachment	5—10		
C			
Connecting the system	5—7		
Connections.....	5—2		
Contact			
Service	8—16		
Union Instruments GmbH.....	3—10		
D			
Decommissioning	6—32, 9—1		
Displays	7—36		
E			
EC declaration of conformity	2—1		
Electrical connection	3—6, 5—18		
Electrical interfaces.....	5—18		
Error elimination Calorimeter	8—11		
Error elimination Ex	8—8		
Ex characteristic	1—1		
F			
Fuses.....	8—13		
Changing.....	8—13		
G			
Gas connection.....	5—13		
I			
Inspection	8—4		
Installing the system	5—7		
Instrument air	3—8		
connection	5—17		
M			
Maintenance work	8—4		
O			
Operating elements	6—30		
Operation	6—31, 7—33		
P			
Personnel and qualifications.....	3—4		
Process gas	3—7, 5—12		
Proper use.....	3—3		
S			
Safety notes	3—5		
Service	8—2, 8—16		
Service bridge	8—3		
Setup site	5—8		
Spare parts.....	10—1		
Startup	6—28		
Symbols	3—2		
System limits	1—5		
T			
Transport.....	5—6		
Troubleshooting Calorimeter	8—11		
Troubleshooting Ex	8—8		
W			
Warning notes	3—2		
Workplaces	6—30		

List of figures

Fig. 1.1:	System overview	1—5
Fig. 1.2:	Dimensions of system	1—6
Fig. 4.1:	Main switch (example).....	4—2
Fig. 4.2:	Figure of safety switch (example).....	4—3
Fig. 4.3:	Markings and warnings	4—4
Fig. 4.4:	Markings and warnings, inside the housing, top compartment.....	4—5
Fig. 4.5:	Warning notes on the electric connection board (example, inside housing, right bottom compartment).....	4—5
Fig. 5.1:	Connections	5—2
Fig. 5.2:	Description	5—3
Fig. 5.3:	Combustion calorimeter, Housing without doors.....	5—4
Fig. 5.4:	Terminal block, inlet process and calibration gas	5—13
Fig. 5.5:	Purge air, supply and distribution	5—17
Fig. 5.6:	Electric connection system – optional connections.....	5—19
Fig. 5.7:	Electric connection system – power supply X16.....	5—20
Fig. 5.8:	Electric connection system – signal lines X17	5—21
Fig. 5.9:	Electric connection X17 – Relay K1 – K3, analogue output	5—21
Fig. 5.10:	Electric connection X17 – analogue and digital output, digital input.....	5—22
Fig. 5.11:	USB interface on the left side of the housing.....	5—22
Fig. 5.12:	Transport safeguards	5—24
Fig. 5.13:	Transport safeguards in the pressure controller	5—25
Fig. 6.1:	Workplaces	6—30
Fig. 7.1:	Operating elements / layout of display.....	7—34
Fig. 7.2:	Information field, start screen	7—37
Fig. 8.1:	Top hat rail X9, Service bridge	8—3

