
Translation of operating instructions

Explosion-Protected Combustion Calorimeter CWD3000 EXP



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Technical data subject to change.

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1 Technical data

1.1 Name plate

Device type:	CWD3000 EXP	1
Product Code:	CWD5I1E1A001P0H0U2G2B002S0C0	
Serial no.:	99999	2
Power Supply:	230 <u>VAC</u>	
Power Consumption:	max. 185 VA	3
Protection class:	IP44	
Ambient temperature	-10°C – +50°C	
Operating pressure	23 – 35 mbar	
Date of manufacturing:	MM/JJJJ	
Approval:	BVS 19 ATEX 012 X II 2G Ex pxb IIC T4 <u>Gb</u> IECEX BVS 19.0000X Ex pxb IIC T4 <u>Gb</u>	


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0123
Made in Germany

Fig. 1.1: Name plate (example)

1. Device description and product code
2. Technical information
3. Approval information (example)

1.2 Dimensions

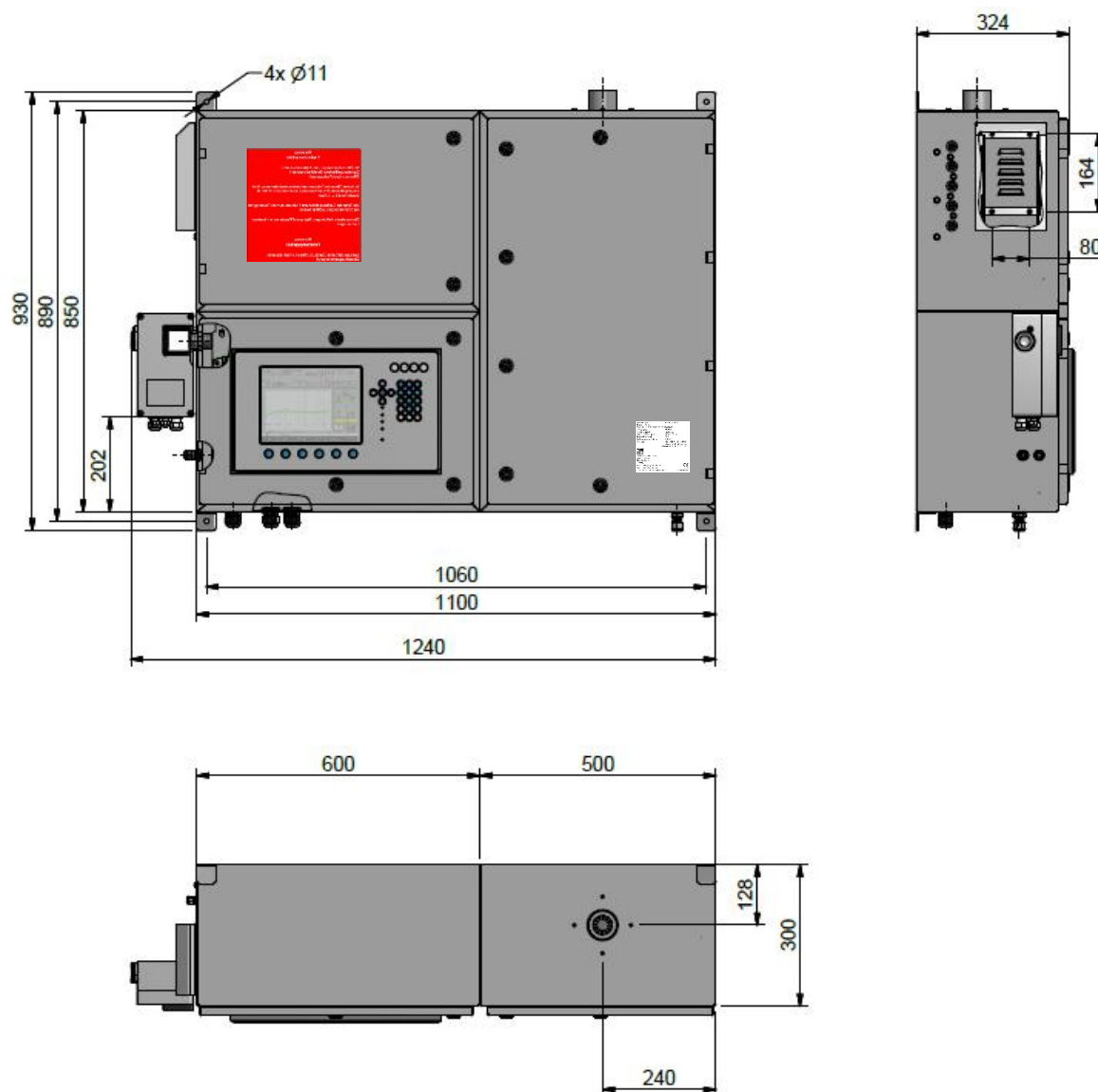


Fig. 1.2: Housing dimensions

Weight: approx. 140 kg

1.3 Device overview

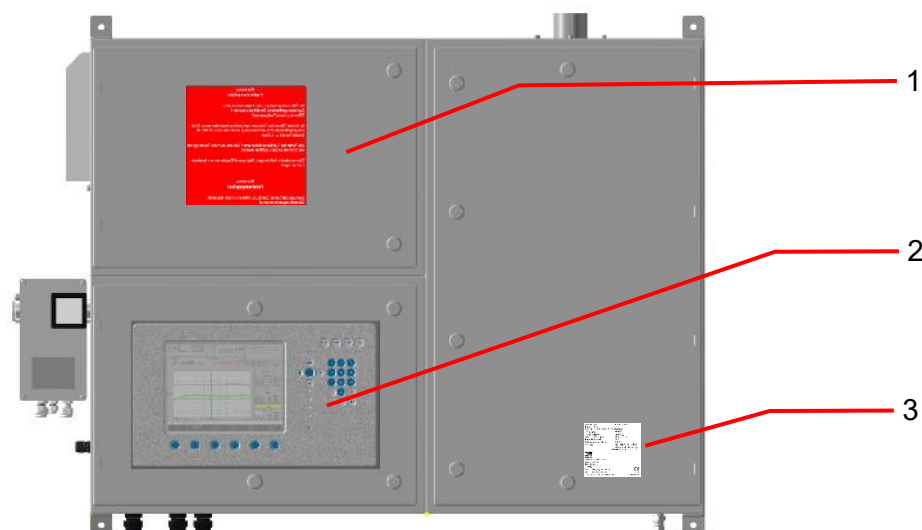


Fig. 1.3: Markings and warning information

1. Explosion-protection warning information
2. Warning information for electricity
3. Name plate

1.4 Explosion marking as per EC type examination

Explosion marking:  II 2G Ex pxb IIC T4 Gb
 EC type examination: BVS 19 ATEX 012 X
 Ambient temperature: $-10^{\circ}\text{C} \leq T_{\text{amb}} \leq +50^{\circ}\text{C}$

1.5 Marking as per the IECEx scheme

IECEx marking and data provisional.

Explosion marking: Ex pxb IIC T4 Gb
 IECEx certificate (CoC): BVS 19.0000X
 Ambient temperature: $-10^{\circ}\text{C} \leq T_{\text{amb}} \leq +50^{\circ}\text{C}$

1.6 Voltage supply

Voltage: 230 volts or 115 volts, 50/60 Hz alternating current
 Power consumption: 185 VA max.
 Protection class: I
 IP rating: IP44

1.7 Interfaces

Interfaces:	RS232, Profibus, Fieldbus, Industr. Ethernet
Analog outputs:	3, 4 – 20 mA for heating value, Wobbe index and density
Digital outputs:	3 relays

1.8 Heating value measurement display times¹

90% time:	CWD3000: ≤ 15 seconds
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1.9 Gas inputs

Process gas:	1
Calibration inputs:	1, optional 2
Test gas input:	1, optional
Carrier gas input:	1, optional
Gas connections:	Compression fitting: 6 mm

1.10 Process gas, calibration gas and test gas

Calibration gas:	Dependent upon combustion gas
Calibration interval:	Dependent upon combustion gas
Calibration duration:	Process lasts up to 20 minutes, gas flow approx. 10 minutes
Gas consumption:	Approx. 7 l gas per calibration (dependent on the calibration gas)
Input pressure, max.:	Max. 500 mbar
Input pressure, min.:	20 mbar, dependent on the gas

1.11 Ignition protection gas

Ignition protection gas:	Compressed air, instrument air
Input pressure, max.:	5 bar
Input pressure, min.:	4.5 bar
Temperature, max.:	50°C
Consumption:	Max. 30,000 l/h under normal conditions
Operating pressure:	23 – 35 mbar
Operating pressure, min.:	23 mbar
Operating pressure, max.:	40 mbar
pre-purge volume, min.:	1020 l

¹ The display times are measured from the time the new gas reaches the burner. Display times are based on measurements with pure methane.

	NOTE
	Provide sufficient buffer volume for ignition protection gas; volume is dependent upon the switching frequency of the compressor and the possible operating time without the compressor. UNION recommends compressed air of class 533 as per ISO 8573-1 corresponding to solids of 40 µm (class 5)/dew point of –20°C (class 3)/oil quality of 1 mg/m³ (class 3).

	 DANGER
	The calorimeter may not be operated outside the specified ambient temperature range: $-10^{\circ}\text{C} \leq T_{\text{amb}} \leq 50^{\circ}\text{C}$. The approval is void outside this temperature range.

1.12 Combustion gas



NOTE

The combustion gas must be free of condensate, dust and other contaminants, such as naphthalene.

Gas connection inlet pressure:	Max. 500 bar, min. 20 mbar
Combustion gas consumption:	30 – 40 l/h (min. rel. density 0.50 with 0.55 mm nozzle)
Calibration gas consumption:	Approx. 1/6 of the combustion gas; gas flow during calibration: approx. 10 minutes ≈ 1/6 hour

1.13 Linearity and measuring ranges

The measuring ranges cannot be utilized from 0% to 100%. The range is dependent on the gas composition. Ranges of 45 – 100% are typical for a measuring range. Hydrogen content in the gas increases the measuring range span. Inert gases such as N₂, O₂ and CO₂ reduce the measuring range span.

Application			
Applic. No.	Application (process gas type) Measuring range (Wobbe index)	Measuring accuracy [Wobbe index]	
		Series CWD2500	Series CWD3000
Industries producing and using natural gas			
001	Natural gas and biomethane (and gases associated with crude oil) 30 – 60 MJ/m3 8.0 – 16.0 kWh/7,000 – 14,000 kcal/750 – 1,500 BTU	±1% FS	±1% MV
Refineries			
004	Refinery gas 25 – 70 MJ/m3 7.0 – 20.0 kWh/6,000 – 16,500 kcal/650 – 1,800 BTU	±1.5% FS	±1.5% MV
Iron and steel			
005	Blast furnace gas (BFG) 3 – 5 MJ/m3 0.8 – 1.4 kWh/700 – 1,200 kcal/80 – 130 BTU	±2% FS	Not used
006	Coke oven gas (COG) 19 – 29 MJ/m3 5.3 – 8.0 kWh/4,500 – 7,000 kcal/480 – 740 BTU	±1% FS	±1% MV
007	Mixed gas (BFG + COG) 4 – 7 MJ/m3 1.1 – 1.9 kWh/1,000 – 1,700 kcal/100 – 180 BTU	±2% FS	Not used
008	Mixed gas (BFG + COG) 3 – 5 MJ/m3 0.8 – 1.4 kWh/700 – 1,200 kcal/80 – 130 BTU	±2% FS	Not used
009	Mixed gas (BFG + COG) 3.2 – 6.2 MJ/m3 0.9 – 1.7 kWh/750 – 1,500 kcal/80 – 160 BTU	±2% FS	Not used
010	Mixed gas (BFG + COG) 5.0 – 12.5 MJ/m3 1.4 – 3.5 kWh/1,200 – 3,000 kcal/130 – 320 BTU/ft³	±2% FS	Not used

Application			
Applic. No.	Application (process gas type) Measuring range (Wobbe index)	Measuring accuracy [Wobbe index]	
		Series CWD2500	Series CWD3000
011	Mixed gas (BFG + COG) 5.2 – 10.5 MJ/m ³ 1.4 – 2.9 kWh/1,250 – 2,500 kcal/130 – 260 BTU/ft ³	±2% FS	Not used
012	Mixed gas (BOFG + NG) 4.2 – 12.6 MJ/m ³ 1.2 – 3.5 kWh/1,000 – 3,000 kcal/110 – 320 BTU/ft ³	±2% FS	Not used
Biogas plants			
017	Raw biogas 4.0 – 7.0 MJ/m ³ 1.1 – 1.9 kWh/950 – 1,650 kcal/100 – 175 BTU/ft ³	±1.5% FS	±1.5% MV
Oil & gas chemicals			
019	Flare gas 0 – 90 MJ/m ³ 0 – 25 kWh/0 – 21,500 kcal/0 – 2,290 BTU	±3% FS	±2% FS
020	Flare gas 0 – 118 MJ/m ³ 0 – 32.8 kWh/0 – 28,180 kcal/0 – 3,000 BTU	±3% FS	±2% FS
021	Flare gas > 800 MJ/m ³ > 222 kWh/> 191,000 kcal/> 20,340 BTU/ft ³	±3% FS	±2% FS
Synthesis gas			
024	Synthesis gas 0 – 10 MJ/m ³ 0 – 2.8 kWh/0 – 2,390 kcal/0 – 250 BTU/ft ³	±3% FS	±2% FS
Metallurgy			
025	Carbide gas “low” 8.4 – 12.4 MJ/m ³ 2.3 – 3.4 kWh/2,010 – 2,960 kcal/210 – 320 BTU/ft ³	±1.5% FS	±1.5% MV
026	Carbide gas “high” 12.5 – 19 MJ/m ³ 3.5 – 5.3 kWh/2,990 – 4,540 kcal/320 – 480 BTU/ft ³	±1.5% FS	±1.5% MV
Testing and certification			
027	Mixed gas LPG (Liquefied Petroleum Gas) + air (compliance) 32 – 58 MJ/m ³ 8.9 – 16.1 kWh/7,640 – 13,850 kcal/810 – 1,480 BTU	±1% FS	±1% MV
LPG			
029	Mixed gas LPG + air 42 – 59 MJ/m ³ 11.7 – 16.4 kWh/10,030 – 14,090 kcal/1,070 – 1,500 BTU/ft ³	±1% FS	±1% MV
030	LPG 70 – 87 MJ/m ³ 19.4 – 24.2 kWh/16,720 – 20,780 kcal/1,780 – 2,220 BTU/ft ³	±1% FS	±1% MV
MJ: Mega Joule; BTU: British Thermal Unit; FS: Full Scale; MV: Measured Value			

Fig. 1.4: Measuring ranges and accuracy

1.14 Ambient conditions of installation location

 A yellow triangular warning symbol with a black border and the letters 'EX' in black.	 A yellow triangular warning symbol with a black border and an exclamation mark inside. NOTICE
	Use of the combustion calorimeter outside the approved range of ambient conditions results in voiding of the approval! Risk of serious accidents.

Installation location:	Protect against direct sunlight and ensure sufficient shade.
Temperature change:	$\leq 5^{\circ}\text{C}$ per hour
Air humidity:	0 – 95% rel. humidity
Ambient pressure:	800 – 1,100 hPa (0.8 – 1.1 bar)

Direct sunlight can cause changes in temperature; temperature changes above 5°C/h affect measurement results.

For other requirements, see Section 6.3.

2 EU Declaration of Conformity



Der Hersteller/The manufacturer

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

Produktbezeichnung:	Verbrennungskalorimeter	Gerätegruppe:	CWD3000 EXP
Product name:	Calorimeter	device group:	CWD3000 EXP

Explosionsgruppe:	II 2G Ex pxb IIC T4 Gb	EG-Baumusterprüfung:	BVS 19 ATEX 012 X
Explosion group:	II 2G Ex pxb IIC T4 Gb	EC type examination certificate:	BVS 19 ATEX 012 X

Benannte Stelle für Baumusterprüfung/Notified body for type examination:
DEKRA Testing and Certification GmbH, Bochum, Germany, No. 0158

Benannte Stelle für QS-Überwachung/Notified body for QA assessment:
TÜV Product Service GmbH, Munich, Germany, No. 0123

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

2014/34/EU	ATEX Richtlinie
2014/34/EU	ATEX directive
2014/30/EU	Elektromagnetische Verträglichkeit
2014/30/EU	Electromagnetic compatibility

Angewandte harmonisierte Normen/Harmonized standards used:

EN 60079-0:2012	Explosionsfähige Atmosphäre Teil 0: Betriebsmittel -Allgemeine Anforderungen Explosive atmospheres - Part 0: Equipment - General requirements
EN 60079-2:2014	Explosionsgefährdete Bereiche – Teil 2: Geräteschutz durch Überdruckkapselung “p” Explosive atmospheres – Part 2: Equipment protection by pressurized enclosure “p”
EN 61326-1:2013	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 of documentation delegate:	

Adresse des Dokumentationsbevollmächtigten:	siehe Adresse des Herstellers
Address of documentation delegate:	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 instructions

3.1 Warning information and symbols

These operating instructions use the following nomenclature and symbols for especially important information:

	 DANGER
	The combustion calorimeter is approved for use in hazardous areas as per the EC type examination/IECEx certification. In these operating instructions, information on possible dangerous situations which could arise in hazardous areas is marked with the symbol shown here.

	 DANGER
	For an immediate danger that can lead to serious injury or death.

	 WARNING
	For a potentially dangerous situation that can lead to serious physical injury or death!

	 NOTICE
	For a potentially dangerous situation that can lead to minor physical injury! This may also be used for warnings of property damage!

	NOTE
	For information that can improve the operation of the combustion calorimeter or contribute to prevention of property damage.

3.2 Principle, intended use

 	 WARNING
	Intended use also includes following these operating instructions. In addition to the following safety information, the safety information of linked system components must also be observed at all times! Additional equipment or accessory parts not installed, supplied, or made by UNION Instruments GmbH require manufacturer's approval by UNION Instruments GmbH! Any warranty is otherwise voided!

The combustion calorimeter CWD3000 EXP is an analyzer used for determining the Wobbe index and the gas density of various combustion gases. This analysis is used for process control. The principle is based on the principle of the dry calorimeter, where the gas is burned and the heat transferred by mixing it with a stream of air. The temperature increase of the stream of air, which is proportional to the energy released, is measured.

The device is based on ignition type “p” – pressurized enclosure. Compressed air is used as the ignition protection gas.

The calorimeter CWD3000 EXP is intended for use in weather-proof areas and for fixed mounting to a wall and fixed installation (temperature range: 10°C – 50°C).

The calorimeter CWD3000 EXP is designed for continuous operation – intervention is not required during operation.

The calorimeter CWD3000 EXP is suitable for operation in hazardous areas and is intended for use in explosion protection zone 1, group II, category 2G in accordance with its explosion marking. The CWD3000 EXP is approved as per Directive 2014/34/EU and the IECEx scheme.

The device is not suitable for the analysis of combustion gas mixtures which are already ignitable.

The safety provisions applicable at the installation location are to be complied with. Toxic gas risk assessments are to be carried out by the owner.

3.3 Other applicable operating instructions

The operating instructions of the Gönzheimer pressurized enclosure control unit F870S are also to be taken into account.

3.4 Additional information

The owner is responsible for supplying the ignition protection gas (compressed air, class 3). The owner is responsible for supplying electrical voltage. The device is switched on and off by a control unit. Additional separation from the voltage supply is to be installed by the owner.

3.5 Personnel and qualification

Gas connections and work on the electrical equipment of the combustion calorimeter may only be carried out by a professional in compliance with safety provisions, especially for hazardous areas.

3.6 Safety instructions

3.6.1 General safety instructions

 	WARNING Only operate the combustion calorimeter when all protective equipment is present and operational! Further safety information: ☞ <i>Preceding the corresponding sections!</i>
--	---

3.6.2 Information on specific hazards

 	DANGER • After installation, all gas-conveying parts must be checked for proper seal according to national regulations! • Observe the national regulations on installation and setup, e.g. IEC/EN 60079-14! • All repairs must be carried out by trained specialists, regardless of the type of work!
---	--

3.7 Recurring operator training

	NOTE Country-specific regulations regarding the recurring instruction of operators must be observed by the owner, particularly with regard to the handling of hazardous areas, gases and electrical equipment!
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3.7.1 Information on explosion protection

 	⚠ WARNING When opening, observe the instructions on explosion protection in hazardous areas! May be opened by specialists only! The device must first be flushed after opening the housing and switching on again! Minimum flow volume is 16,000 l/h of compressed air at 4.5 – 5 bar! You must wait for at least 5 minutes after separation of the power supply before any doors of the housing may be opened. Static electricity discharge! Warning plate may only be cleaned with a damp cloth!
--	---

3.8 Owner safety precautions

 	⚠ WARNING • Toxic gases – The owner must provide suitable protective equipment for the combustion calorimeter that can reliably prevent injuries to personnel, e.g. from escaping gas! • Tripping hazard from improperly routed supply lines!
---	---

Other owner-side safety precautions: ➞ *Corresponding section!*

3.8.1 Performing a workplace risk assessment

	NOTE
Depending on the national regulations and, if necessary, independent of the CE marking of this combustion calorimeter, the owner must prepare a hazard assessment and specify personal safety equipment for different phases of operation.	

Further technical developments may result in deviations from these operating instructions. If you would like more information or if you encounter problems that are not covered in detail in this manual, contact us at the following address:

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	http://www.union-instruments.com

4 Protective equipment

The CWD3000 EXP is supplied without a main switch, as the owner must provide suitable equipment for separating the supply voltage as part of the voltage supply equipment.

4.1 Pressurized enclosure ignition protection type

Pressurized enclosure ignition protection type “p” as per IEC EN 60079-2 enables the operation of electrical devices in explosive atmospheres in which the creation of a hazardous gas atmosphere in the device is prevented. This is achieved by always maintaining overpressure with an ignition protection gas inside the device. The housing may contain points of release. Before starting the device, the device interior is flushed with ignition protection gas to thin any gas present and flush it out of the housing.

The CWD3000 EXP is operated with compressed air as the ignition protection gas. Before startup, the the housing is flushed out with compressed air equaling several times its volume. Overpressure is then generated. These parameters are controlled and monitored with control unit FS870 S located outside.

The CWD3000 EXP is divided into containment areas. In the inner containment area, the combustible gas enters the combustion chamber for analysis. In the surrounding containment areas, the pressure is higher, which prevents uncombusted gas from being distributed further should a fault occur. The difference in pressure is monitored by the pressure switch.

For analysis of the combustion gas, the gas flows into a combustion chamber and is fully burned there through the corresponding air admixture. The combustion gas pressure is reduced to 18 mbar inside the device, and the gas flows into the combustion chamber at approx. 0.5 mbar. Thanks to the overpressure of 23 – 35 mbar in the surrounding housing, the gas cannot spread further in the device.

4.2 Protective housing with doors

Pressure-tight housing which prevents the penetration of ambient atmosphere when closed and ready for operation.



Fig. 4.1: Housing, rooms with lockable doors

Protective covers (doors) of the housing separate electrical, ignitable modules and hot surfaces from the environment. Hasps may only be opened with a tool.

4.3 Monitoring of the flushing process and overpressure of flushing system

Control unit for monitoring flush volume and overpressure of the ignition protection gas. Prevents startup and operation of the device in case of insufficient characteristic values.

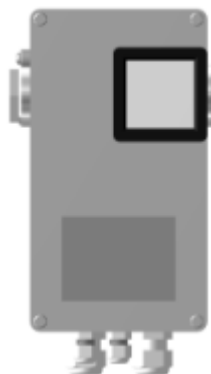


Fig. 4.2: Depiction of control unit for pre-flushing and overpressure (example)

4.4 Cable bushings

Cable bushings for control and signal lines with ATEX/IECEx approval ensure a sealed connection between the cable harness and housing/screw fitting.

4.5 Thermal cutoff

	NOTE The tripping temperature of the thermal cutoff is 72°C.
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When tripped, the thermal cutoff separates the 24 V voltage supply from the solenoid valves. The device is separated from the combustion gas. Solenoid valves are closed in the current-free state.

4.6 Solenoid valve

Should combustion malfunctions occur or the overpressure be insufficient, the solenoid valves at the combustion gas inlet of the combustion calorimeter close. A restart of the combustion calorimeter is necessary.

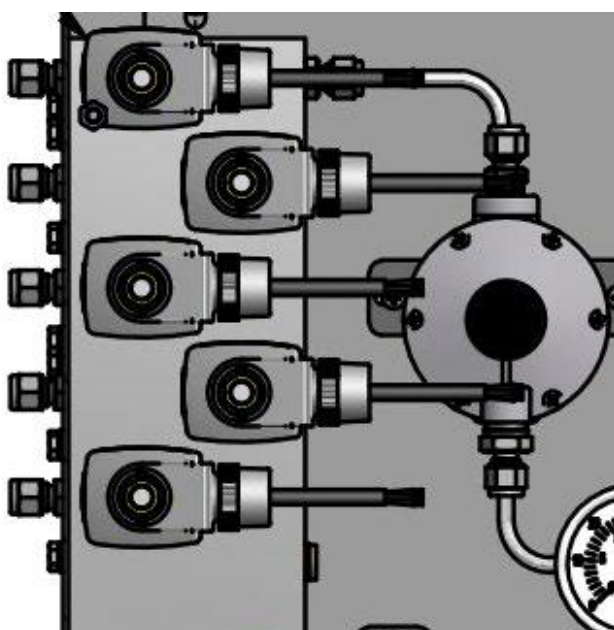


Fig. 4.3: Depiction of combustion gas inlet solenoid valves (example)

4.7 Pressure switches

Monitor differential pressures of the media in the housing, deenergize the device if limits are violated and solenoid valves at the combustion gas inlet close.

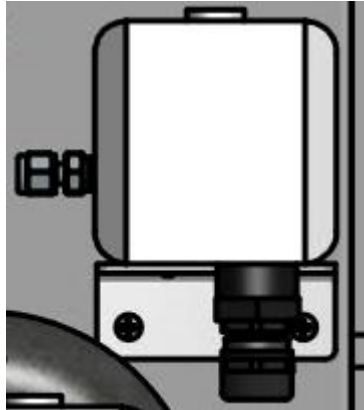


Fig. 4.4: Depiction of pressure switches (example)

4.8 Markings and warning information

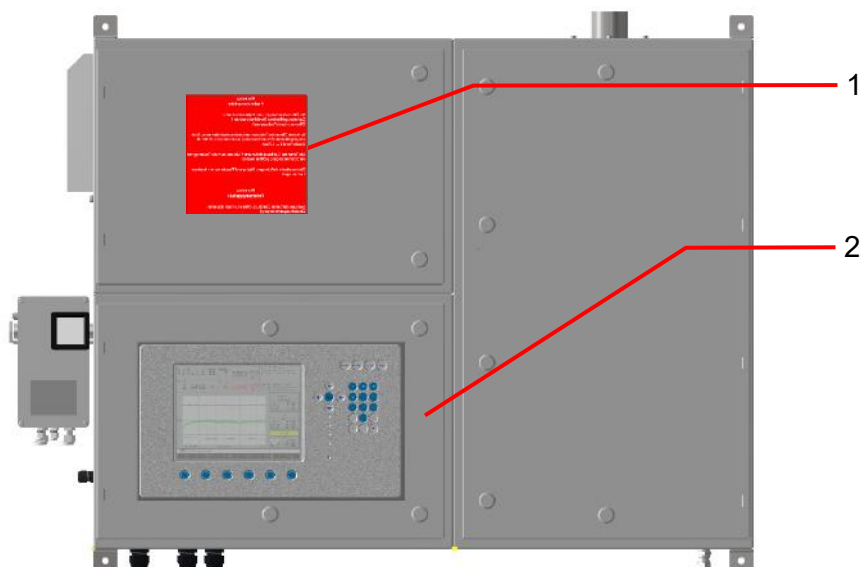


Fig. 4.5: Markings and warning information (example)

No.	Designation
	Warning information: hot surface (internal)
1	Warning information: electricity (external)
2	Warning information: risk of explosion - When opening, observe the instructions on explosion protection in hazardous areas! May be opened by specialists only! - The device must first be flushed after opening the housing and switching on again! Minimum flow volume of 16,000 l/h of compressed air at 4.5 – 5 bar! - You must wait for at least 5 minutes after separation of the power supply before any doors of the housing may be opened. - Static electricity discharge! Warning plate may only be cleaned with a damp cloth! - Housing is overpressurized! Do not open until ignition protection gas supply has been shut off!



Fig. 4.6: Warning information on electrical connection plate (example)
Interior, cell 3 – voltage supply

Name plate with explosion marking

Device type:	CWD3000 EXP
Product Code:	CWD5I1E1A001P0H0U2G2B002S0C0
Serial no.:	99999
Power Supply:	230 <u>VAC</u>
Power Consumption:	max. 185 VA
Protection class:	IP44
Ambient temperature	-10°C – +50°C
Operating pressure	23 – 35 mbar
Date of manufacturing:	MM/JJJJ
Approval:	BVS 19 ATEX 012 X Ex II 2G Ex pxb IIC T4 <u>Gb</u> IECEx BVS 19.0000X Ex pxb IIC T4 <u>Gb</u>
 UNION Instruments GmbH Zeppelinstraße 42 76185 Karlsruhe Germany Tel.: +49 (721) 680 381 – 0 Fax.: +49 (721) 680 381 -33 E-Mail: info@union-instruments.com	
 0123 Made in Germany	

Fig. 4.7: Name plate with ATEX/IECEx marking (example)

NOTE



Malfunction in case of interruption of ignition protection gas supply/compressed air!

When a valve for shutting off the ignition protection gas supply is installed by the owner, a sign is to be posted at that location. In case of accidental, unauthorized shut-off, the calorimeter switches off.

5 Description and connections

5.1 External overview and housing connections

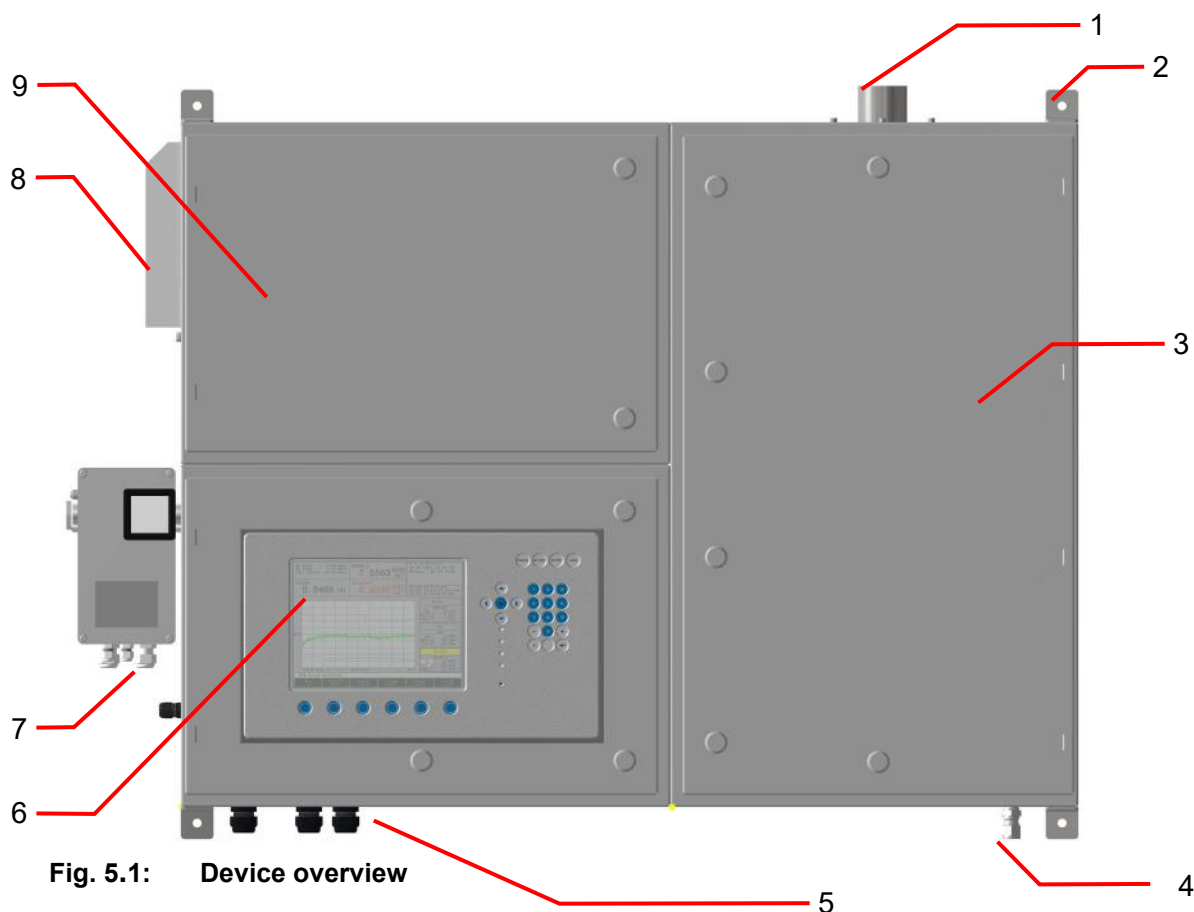


Fig. 5.1: Device overview

Item No.	Designation
1	Flue gas and cooling air outlet
2	Wall mounting eyelet, 4x
3	Door of cell 2 with 7 hasps
4	Ignition protection gas/compressed air inlet
5	Signal line cable glands of cell 2
6	Display and operating unit, door of cell 3 with 4 hasps
7	Control unit with electrical voltage supply connection
8	Gas inlets (max. 5, depending on the options)
9	Door of cell 1 with 2 hasps

5.2 Interior connections and components

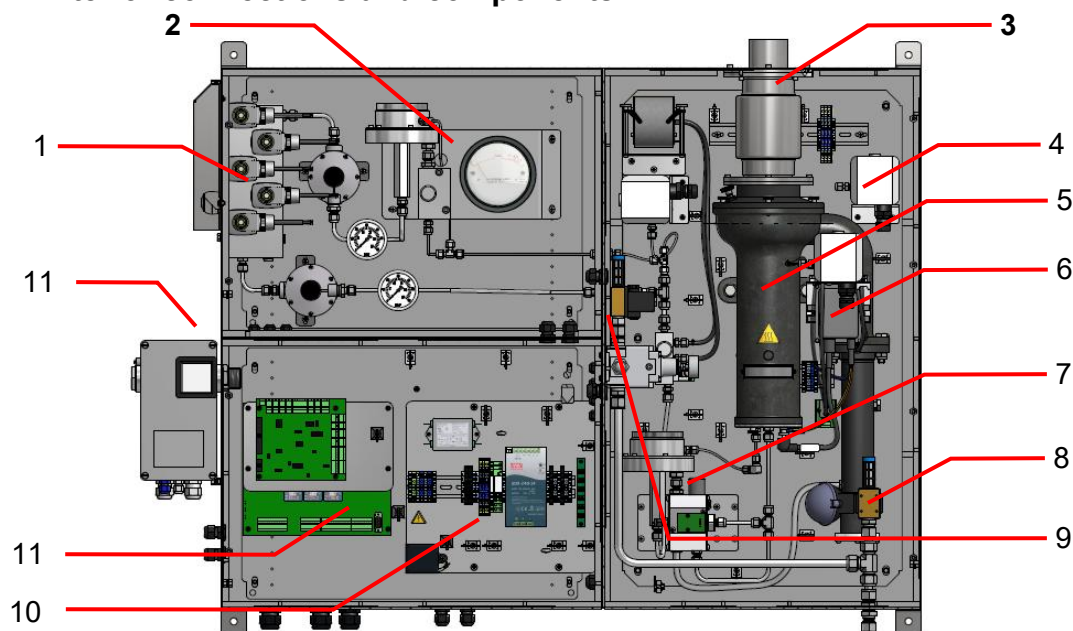


Fig. 5.2: Housing with no doors (example showing carrier gas option)

Item No.	Designation
1	Gas inlet block with solenoid valves
2	Carrier gas processing (optional)
3	Combustion gas/exhaust air outlet
4	Pressure switches, 3x
5	Thermal element with combustion chamber
6	Ignition transformer
7	Precision pressure controller with mixer block
8	Digital valve, compressed air infeed with silencer
9	Proportional valve with pressure controller, actuator for control unit and compressed air infeed with silencer
10	Voltage distribution, power supply distribution rail
11	Electronics input and output signals
12	Control unit

5.3 Accessories

 	 WARNING
	Risk of injury/damage! Using non-approved accessories may cause damage and put persons at risk. Such use will void the warranty! The owner is then liable for any resulting damage! Pay attention to the ATEX type examination/IECEx certificate! Only use genuine accessories or accessories approved by UNION Instruments GmbH!

6 Transport, installation and acceptance

	NOTE
	The combustion calorimeter is generally commissioned by UNION Instruments GmbH or correspondingly qualified service technicians. If it is not commissioned by UNION Instruments GmbH (e.g. internal transport/resale), a suitable procedure must be agreed upon with UNION Instruments GmbH (<i>☞ Chapter 13 Service</i>).

6.1 Transport

 	WARNING
	Tipping over or dropping of the combustion calorimeter from the pallet or load-carrying means may cause injuries! Use suitable load-carrying means when unpacking and transporting. Check slings, if applicable, for adequate load-bearing capacity and sound condition and fasten them carefully! Never walk or stand under suspended loads!

	NOTE
	If strong shocks occur during transport, these may damage the housing. Therefore, check the transport container for damage before opening! In case of transport damage that is indicative of improper handling, a damage assessment by the transport carrier (rail, mail, shipping company etc.) must be arranged within seven days. Ensure before starting or restarting transport that all transport securing devices are attached.

 A yellow triangular warning symbol with a black border and the letters 'EX' in black.	 A small yellow triangular warning symbol with a black border and an exclamation mark. WARNING
	Risk of injury/damage! The protective function of the housing can be adversely affected by transport damage. In case of damage to the transport packaging or signs of improper transport, closely inspect the housing!

6.2 Environmental conditions

	 NOTICE Comply with environmental conditions for storage and installation! Contact UNION Instruments GmbH if the combustion calorimeter is stored for longer than 3 months or must be operated or stored outside the prescribed ambient conditions!
---	---

6.2.1 Storage conditions

	NOTE • Ensure that the combustion calorimeter is free of gas/moisture residue. • Frozen condensate water in the combustion calorimeter may cause damage.
---	---

Ambient temperature:	0 – 60°C
Air humidity:	0 – 95% relative humidity
Ambient pressure:	700 – 1,400 hPa (0.7 – 1.4 bar)

6.3 Installing and connecting

	 NOTICE
	If there is an “X” after the certificate number, pay attention to the conditions on installation and operation in the type examination. The local installation provisions, especially the requirements of IEC/EN 60079-14, are to be observed.

	 DANGER
	Risk of explosion! Non-approved cable entry points pose a hazard! If non-approved cable entry points are used, explosion protection is no longer guaranteed! Use only cable entry points approved for the required ignition protection type! When selecting/replacing cable and line entry points, comply with the technical data! Open holes and unused cable entry points pose a hazard! Explosion protection is no longer guaranteed if there are open holes or unused cable entry points! Always close up open holes and unused cable entry points with sealing plugs or stoppers approved for this purpose! Sealing plugs must be inserted with a tool! When selecting/replacing suitable sealing plugs, comply with the technical data!

6.3.1 Installation location

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

Carry out installation in accordance with the conditions of the explosion marking.
Clean environment suitable for gas-analysis/measurement purposes.

Mounting to a solid wall – ensure sufficient load-bearing capacity of the wall.

Working space on the left-hand side of at least 60 cm, and on the right side at least 50 cm.

Protect against direct sunlight and ensure sufficient shade;
temperature changes above 5°C/h affect measurement results.

Provided with clean and adequate compressed air (ignition protection gas) for unbiased measurement result (combustion calorimeter requires max. 30,000 l/h air) (see technical data).

Off-gases must be discharged protected from air draft using a suitable pipe/tube.
Connection points must be checked for proper seal.

	 WARNING
	Risk of injury due to temperature of off-gases/housing! The off-gas temperature is between 8 – 20°C above the housing temperature! Use personal safety equipment to prevent burns!

	NOTE
	In case of unfavorable circulation/installation conditions, appropriate deflecting sheets must be provided which prevent fresh air from flowing directly onto the combustion calorimeter.

6.3.2 Wall mounting

	 WARNING
	Risk of injury due to the weight of the device!
	For weight, see technical data!
	Specify measures to prevent the device from falling down and use suitable hoisting devices!

The combustion calorimeter is intended for mounting to a solid wall. There are four 11 mm fastening eyelets on the housing $\varnothing$. The wall used for mounting must be sufficiently sturdy to bear the weight of the combustion calorimeter.

Adequate distance must be provided between the side wall of the installation location and the combustion calorimeter for service and maintenance (left side: approx. 60 cm, right side: approx. 50 cm).

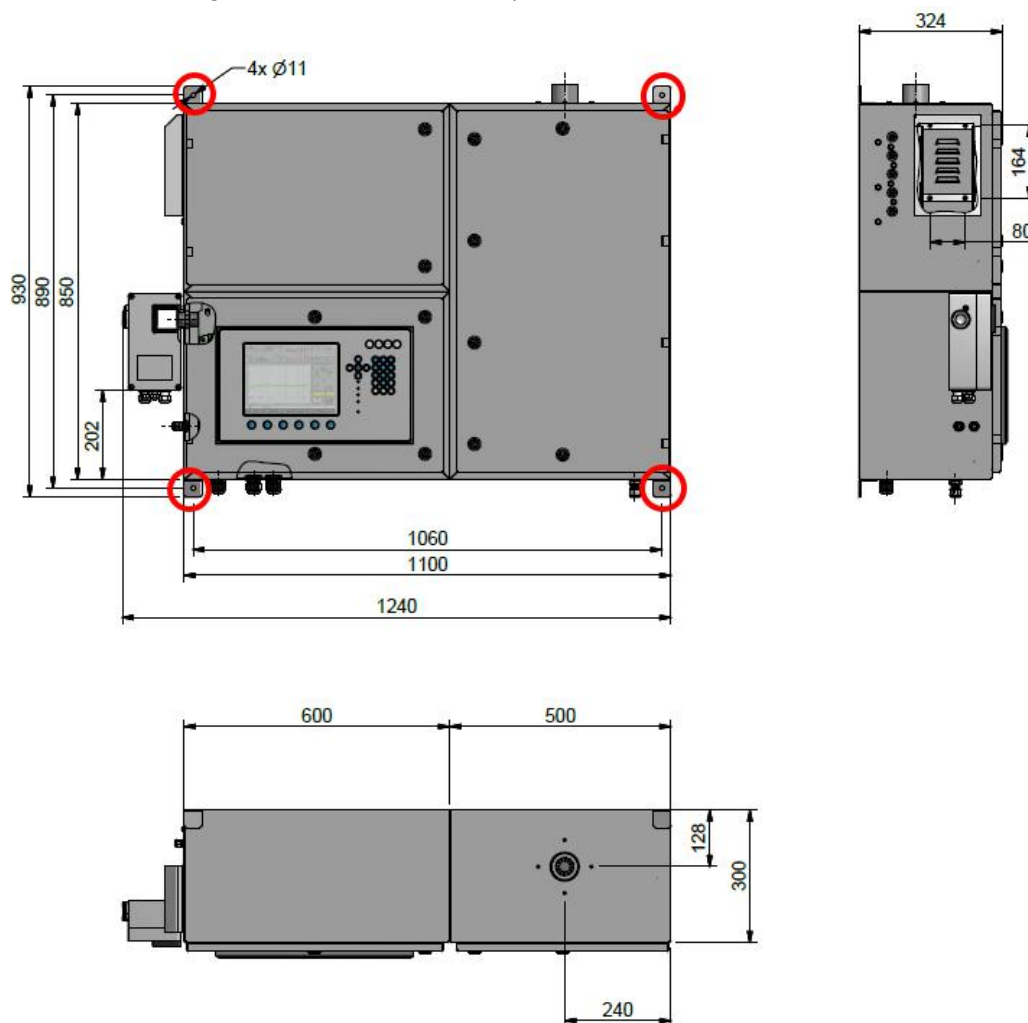


Fig. 6.1: Wall mounting

6.3.3 Gas connections

	 DANGER
	Risk of explosion! Non-approved lines and insufficient connections pose a hazard! Gas connections may only be installed by qualified personnel! Check for proper sealing of connections and ensure this during operation!

	NOTE
	- Accessories must be clean and free of residue. Contaminants may reach inside the combustion calorimeter and may cause false measurements and/or damage. - The input pressure for the gas connections must not exceed the specifications of the technical data of the combustion calorimeter. - Check each connection carefully for leaks. When leaks are present, the system draws air and indicates false measured values. - Do not use sealant for sealing the gas connections. Sealant components may falsify the measurement result. - Only suitable lines may be used.

6.3.3.1 Ignition protection gas supply – Compressed air

Compressed air is required as the ignition protection gas for operation of the combustion calorimeter. Ensure sufficient supply and seal of the connections – check connection point for proper seal.

Device requires compressed air at 4.5 – 5 bar, 16,000 – 30,000 l/h, for operation. Air recommendation as per ISO 8573-1, class 533 (solid material: 40 µm (class 5)/dew point: –20°C (class 3)/oil quality: 1 mg/m³ (class 3))

	NOTE
	When installing a shut-off valve of the ignition protection gas supply Post warning information: Warning – Valve of the ignition protection gas supply – Follow instructions before closing!



Fig. 6.2: Ignition protection gas connection, compressed air, 6 mm screw fitting

- 1 Compressed air/ignition gas connection, 6 mm pipe fitting, pressure: 4.5 – 5 bar, use preinstalled pressure controller.

Two compressed air pressure controllers (external and in device). Set external controller to no higher than 5 bar. Do not change setting of internal pressure controller.

6.3.3.2 Combustion gas

	 WARNING
	Off-gases must be discharged by the owner to a safe environment! Check connections for proper seal!

	NOTE - Gas input pressure depending on the gas, maximal 500 mbar, minimum: 20 mbar. <i>☞ Chapter 1.9</i> - Combustion gas must be free of contaminants and condensate.
---	--

6.3.3.3 Carrier gas supply

	NOTE
	• For combustion gases that do not have stable combustion, a carrier gas can be added. • Carrier gases maintain combustion and make no increased contribution to the combustion value of the combustion gas. • Combustion calorimeters can be subsequently converted to a carrier gas supply. Contact the manufacturer regarding this.

6.3.3.4 Calibration gas

	WARNING
	If a pressure reducer is not installed, escaping calibration gas must be discharged by the owner to a safe environment!

	NOTE
	• Calibration gas must be free of contaminants and condensate. • The calibration gas quality must be similar to the combustion gas quality (see Section 1.10). • For device versions with two measuring ranges, up to two calibration gases may be necessary. • Software-side configuration of the calibration gas. (☞ <i>Section 9.3 Available displays</i>)

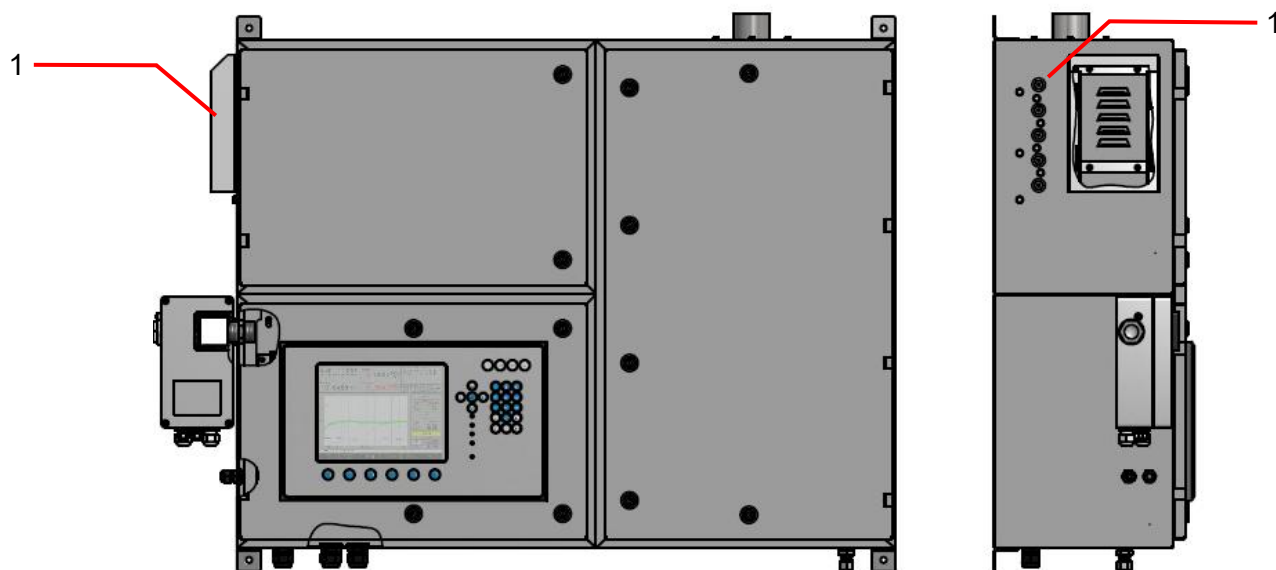
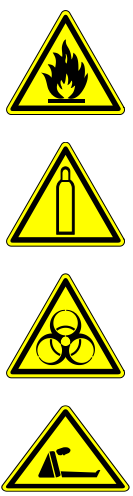


Fig. 6.3: Connections for process, calibration, carrier and test gases, 6 mm screw fitting

Number of connections optional, 1 shows input of gas from the top down

1	Carrier gas	I5.2	Input support gas
2	Test gas	I5.1	Input test gas
3	Calibration gas 2	I2.3	Input calibration gas 2
4	Calibration gas 1	I.2.2	Input calibration gas 1
5	Combustion gas	I1.1	Input process gas

6.3.3.5 Flue gas/Exhaust air

	! WARNING Risk of serious injury from escaping flue gases! • Flue gases must be discharged safely! • For flue gases containing CO, H₂, and H₂S, a safe environment must be ensured!
---	--

	NOTE Flue gases/residual heat must be discharged protected from air draft and without interruption through a vent. An accumulation of residual heat leads to false measurement results.
---	---

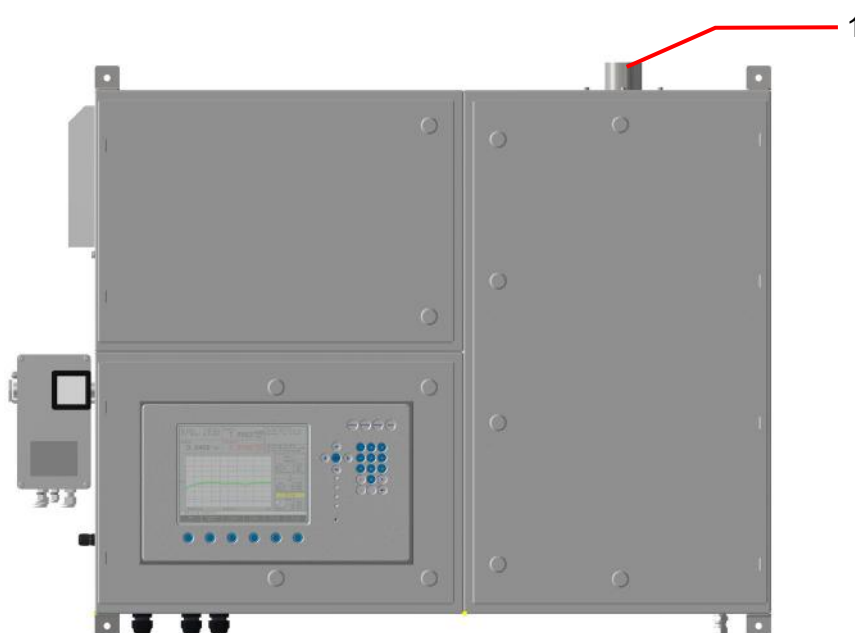


Fig. 6.4: Flue gas/exhaust air connection

1 Flue gas/exhaust air connection

6.3.4 Opening and closing of the housing doors

	 DANGER Risk of explosion! Damaged seal/improper closing pose a hazard! Explosion protection is no longer guaranteed if seals are damaged or doors are closed improperly!
 	 WARNING Risk of severe injury – Housing is overpressurized! • Switch the device off first, then shut off the ignition gas supply and finally open the doors! • Wait 5 minutes after switching off and allow thermal element to cool down!

Keep doors (one door per cell) closed during operation. Open only when switched off, and observe safety provisions.

Close all hasps of all doors. Close with key/tool!

6.3.5 Electrical connection

 	 DANGER Risk of electric shock! Changes to the electrical equipment of the combustion calorimeter may be carried out only by skilled electricians in accordance with the electrotechnical rules. Parts of the open combustion calorimeter marked with the adjacent symbol may still carry voltage even when the main switch is switched off! If required, separate the combustion calorimeter from the supply network!
--	--

	 DANGER Risk of explosion! Non-approved cable bushings pose a hazard! Cable bushings which are not suitable for the cable cross section pose a hazard! Use only cable bushings with ATEX/IECEx approval which fit the cable cross section! Explosion protection is no longer guaranteed if seals are damaged or doors are closed improperly!
--	---

6.3.5.1 Voltage supply

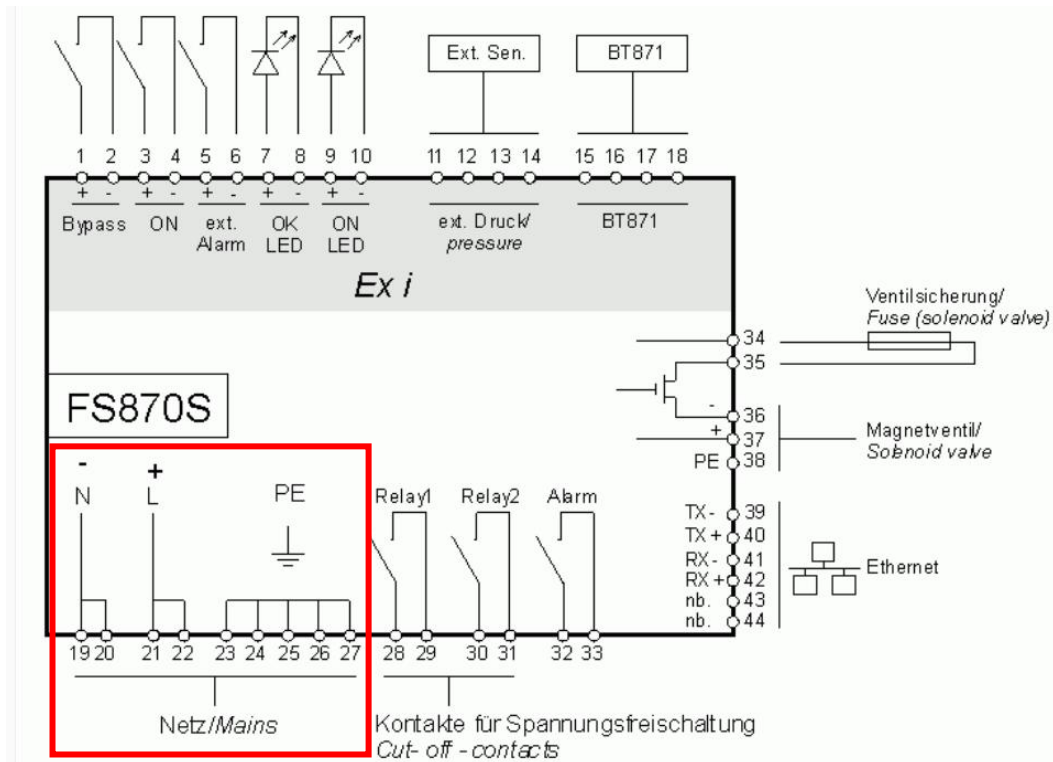


Fig. 6.5: Electrical connection, control unit (example)

Connect the combustion calorimeter to the voltage supply using connections 19, 20 – 21, 22 and PE (23, 24, 25 and 26) of the control unit in accordance with national requirements.

Observe control unit operating instructions!

When making connection in terminal box of the control unit, observe the following:

Tightening torques, min/max min.: 0.3 Nm, max.: 0.4 Nm
Wire cross section, min/max rigid: 0.2 – 2.5 mm², flexible: 0.2 – 2.5 mm²

Use external protective conductor terminal (grounding bolt) on left side of housing!

Connect protective conductor firmly, secure against loosening. Protect connecting parts effectively against corrosion, pay attention to suitable material. Cable cross-section at least phase conductor cross-section.

 	WARNING After the line voltage is switched off, the device capacitors still carry voltage for up to 5 minutes! This time must be allowed to elapse before starting work on the high-voltage electrical system. The specifications of the VDE, the local and regional safety regulations, and the factory-internal safety rules must be complied with at all times during work on the combustion calorimeter!
--	---

	NOTE • Check whether the line voltage present is consistent with the device voltage of the combustion calorimeter. • The combustion calorimeter may only be operated with effective protective conductor connection in accordance with local requirements for high operating currents.
---	---

6.3.6 Electrical interfaces

	 WARNING
	Endangerment of people and equipment when the combustion calorimeter is commissioned by non-instructed personnel! Allow only instructed/trained service technicians to carry out commissioning!

	 DANGER
	Risk of explosion! Electrical interfaces - only connect analog signals and relays using the disconnecter unit supplied!

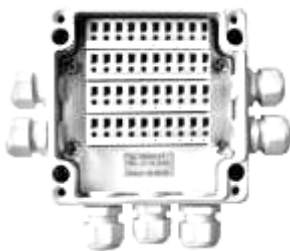


Fig. 6.6: Disconnector unit Gönzheimer FS852, example

The disconnecter unit SR852 could be placed in hazardous area. It is certified on its own in protection type Ex e.

6.3.7 Connector assignment for input/output signals

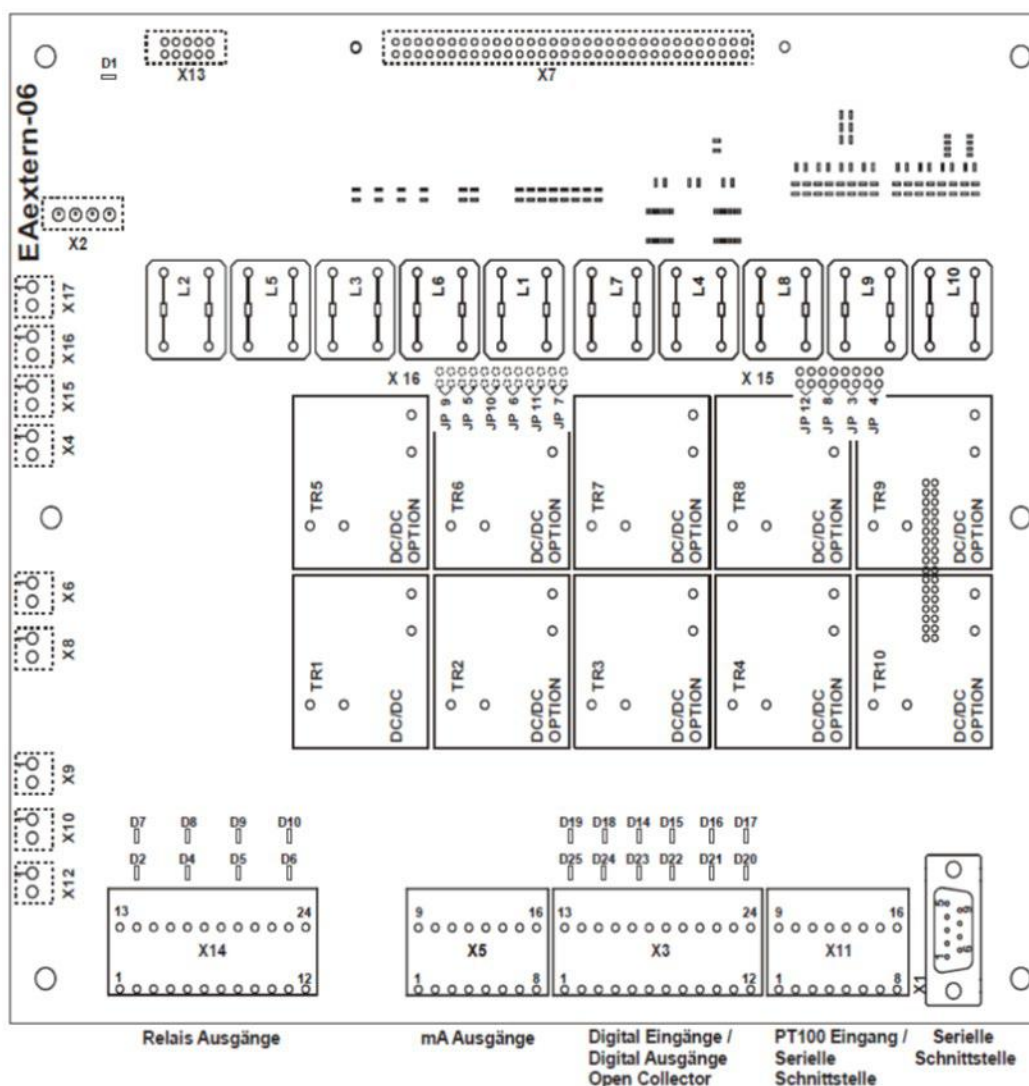


Fig. 6.7: Connector assignment of input/output IO external type 06



WARNING

Do not connect to line voltage!

Only operate outputs (relay, analog and digital) and inputs with safety extra-low voltage!

Connector X14 relay outputs

Digital output	Pin/Connector X14	Function	Status display
1	1 Common	Process	D 2
	2 Normally open		
	3 Normally closed		
2	4 Common	Maintenance	D 4
	5 Normally open		
	6 Normally closed		
3	7 Common	Filter change	D 5
	8 Normally open		
	9 Normally closed		
4	10 Common	Fault	D 6
	11 Normally open		
	12 Normally closed		
5	13 Common	Function, optionally assigned if applicable	D 7
	14 Normally open		
	15 Normally closed		
6	16 Common	Function, optionally assigned if applicable	D 8
	17 Normally open		
	18 Normally closed		
7	19 Common	Function, optionally assigned if applicable	D 9
	20 Normally open		
	21 Normally closed		
8	22 Common	Function, optionally assigned if applicable	D 10
	23 Normally open		
	24 Normally closed		

Connector X5 mA outputs

Analog output	Pin/Connector X5	Function	Disconnecting module No./Jumper No. open
1	1 +mA	Wobbe	TR 1/JP 5
	2 -mA		
2	3 +mA	Density	TR 2/JP 6
	4 -mA		
3	5 +mA	Heating value	TR 3/JP 7
	6 -mA		
4	7 +mA	Function, optionally assigned if applicable	TR 4/JP 8
	8 -mA		
5	9 +mA	Function, optionally assigned if applicable	TR 5/JP 9
	10 -mA		
6	11 +mA	Function, optionally assigned if applicable	TR 6/JP 10
	12 -mA		
7	13 +mA	Function, optionally assigned if applicable	TR 7/JP 11
	14 -mA		
	15 n.c.		
	16 n.c.		

Connector X3 digital control inputs

Control inputs	Pin/Connector X3	Function	Status display diode
1	1	Start measurement	D 25
	2	Start measurement	
2	3	Start calibration	D 24
	4	Start calibration	
3	5	Function, optionally assigned if applicable	D 23
	6	Function, optionally assigned if applicable	
4	7	Function, optionally assigned if applicable	D 22
	8	Function, optionally assigned if applicable	
5	9	Function, optionally assigned if applicable	D 21
	10	Function, optionally assigned if applicable	
6	11	Function, optionally assigned if applicable	D 20
	12	Function, optionally assigned if applicable	
7	13	Function, optionally assigned if applicable	D 19
	14	Function, optionally assigned if applicable	
8	15	Function, optionally assigned if applicable	D 18
	16	Function, optionally assigned if applicable	

Serial interface RS232

Pin/Connector X11	Signal
1	-mA analog input 1
2	+mA analog input 1
3	-mA analog input 2
4	+mA analog input 2
5	PT 100 air conditioner
6	PT 100 air conditioner
7	Not assigned
8	RI
9	RTS
10	CTS
11	DSR
12	DTR
13	TXD
14	RXD
15	DCD
16	RS232 GND
Pin/Connector X1	Signal
1	DCD
2	RXD
3	TXD
4	DTR
5	RS232 DND
6	DSR
7	RTS
8	CT
9	RI

6.3.8 Removing/attaching transport securing devices



NOTE

Before commissioning/transport of the combustion calorimeter, it must be ensured that all transport securing devices are removed/attached.

The following transport securing devices must be removed/attached within the combustion calorimeter:

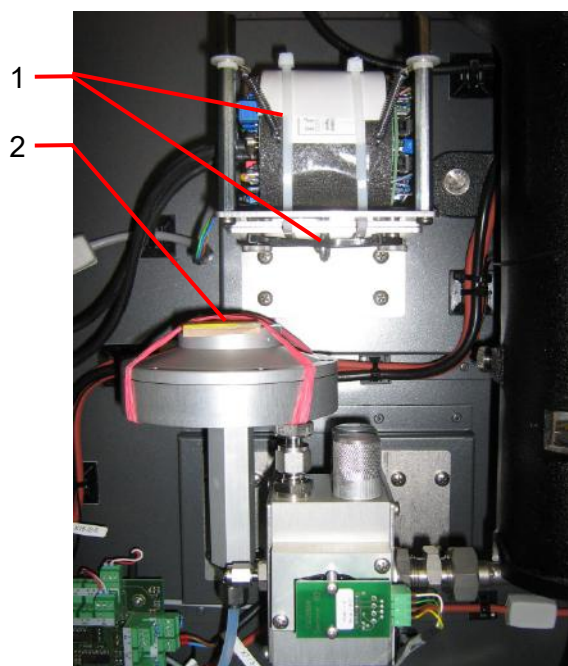


Fig. 6.8: Transport securing devices (example shown)

Item No.	Component	Type of securing device
1	Transport securing device for density measuring cell	4x cable ties; 1x screw 5x16
2	Transport securing device of pressure controller	2x retaining belts; 1x bubble wrap (inside)

Transport securing device in the pressure controller



Fig. 6.9: Transport securing devices of pressure controller

Transport securing device	Order of removal/attachment of transport securing device
Transport securing device of pressure controller	• Remove the retaining belts. • Open the protective flap (screw closure). • Remove the transport securing device (bubble wrap). • Reclose the protective flap.

Proceed in reverse order to reattach the transport securing device.

Transport securing device of density measuring cell

Transport securing device	Order of removal/attachment of transport securing device
Transport securing device of density measuring cell	• Remove the white cable ties around the density measuring cell. • Loosen the screw. • Density measuring cell must swing freely.

Proceed in reverse order to reattach the transport securing device.

Observe the length of the screw!

6.4 Owner safety precautions

  	 WARNING • Operate combustion calorimeter in accordance with the requirements for hazardous areas. • Exhaust discharged flue gas/off-gas to a safe environment! • In case of toxic gases, mark outlet location of discharged flue gas/off-gas with a warning! • Tripping hazard from improperly routed supply lines!
---	--

6.5 Documentation

	NOTE UNION Instruments GmbH recommends keeping a maintenance log and documenting all work and tests.
---	--

7 Commissioning/Switching on

	NOTICE In order to establish start readiness, also establish the start readiness of linked system components according to their operating instructions!
---	--

	NOTE For initial commissioning or before an extended operating shutdown, back up the device configuration. Have the backup made by service technicians or in response to a special service instruction.
---	---

	NOTE The following table contains significantly shortened steps for commissioning after an extended downtime. To switch on the combustion calorimeter again after a short shutdown, some steps can be omitted: ☞ <i>Right column!</i>
---	--

Steps	Commissioning	Switching on
Check whether the transport securing device of the density cell has been removed. The density cell must be able to swing freely.	X	
Check whether the transport securing device of the gas pressure controller has been removed. The bubble wrap within the controller must be removed.	X	
Check whether the ambient conditions correspond to the ATEX approval and IECEx certificate.	X	
Check whether the ambient conditions correspond to the requirements.	X	
Check whether the combustion calorimeter is securely mounted.	X	
Check whether the device is suitable for the combustion gas.	X	
Check whether the combustion gas is correct.	X	
Check whether the calibration gas (and carrier/test gas if applicable) is correct.	X	
Check whether the gas connections are correct and sealed.	X	
Check whether the compressed air supply is correct.	X	
Furnish/switch on owner-side energy supplies and media supply.	X	
Ensure voltage.	X	
Ensure that the doors are closed and that all hasps are closed.	X	X
Switch on compressed air.	X	X
Switch on voltage.	X	X
Establish start readiness of linked system components.	X	X
 When the combustion calorimeter has been switched off only temporarily, production can be resumed!		

During startup, the device is first flushed with compressed air. Following this rinsing and once overpressure is reached, the control unit activates voltage to the combustion calorimeter. The CWD3000 EXP starts up.

8 Description of the work stations/operator control elements



NOTE

This chapter contains only elements for operation of the combustion calorimeter by the normal operator.

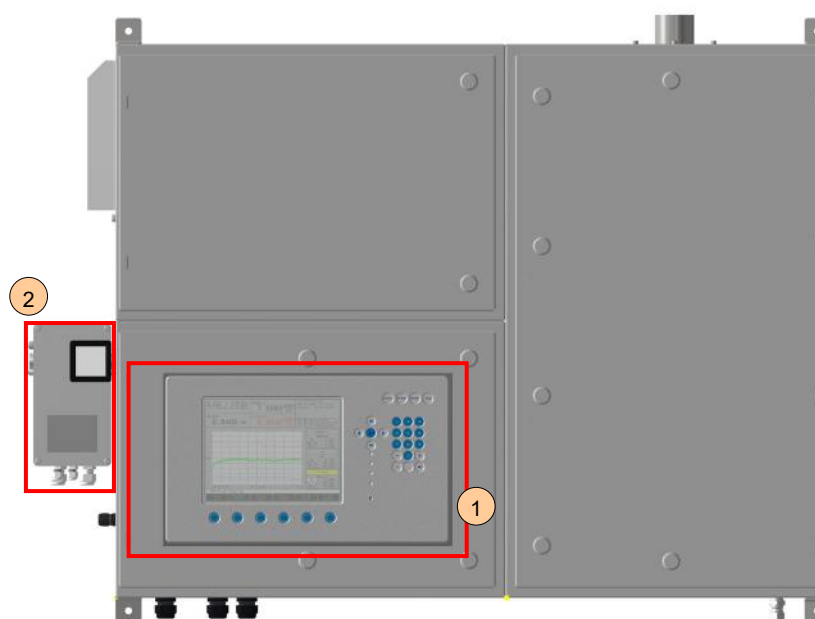


Fig. 8.1: Work stations (example)

Item No.	Designation	Function/Activity
1	Display	Status display and calorimeter operation
2	Control unit	Status display and operate control unit

9 Operation

 	 WARNING Risk of injury! Only operate the combustion calorimeter when all lines are installed and checked for proper seal in accordance with the country-specific regulations!
--	--

9.1 Operation of membrane keyboard/Description of display

The software controller is operated using a membrane keyboard. The buttons shown can be selected by a key press.

	NOTE Damage to membrane keyboard! Operation with pointed or sharp objects may damage the membrane keyboard!
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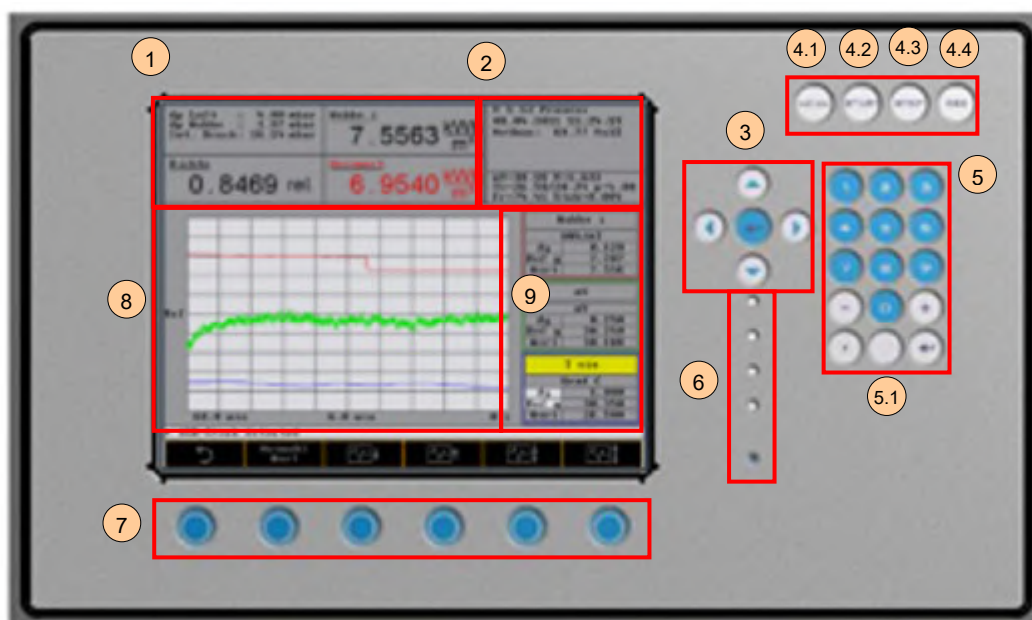


Fig. 9.1: Operator control elements/Structure of display

Item No.	Designation	Function
1	Numeric display	Output of current measured values
2	Display field	Information field
3	Arrows/Enter	Arrow keys enable movement to an input field. The Enter key confirms the entered value.
4.1	Menu	Menu key returns you to the main menu from any other menu level. The key simultaneously saves the input data in memory.
4.2	Start	Start key starts the measurement.
4.3	Stop	Stop key stops the measurement without switching off the power supply.
4.4	ESC	ESC key cancels the current input operation regardless of the menu level.
5	Input	Input keys are used to input numeric data. A value field on the screen must be active for this.
5.1	Screenshot	This key creates and automatically saves a screenshot on the inserted USB memory stick. For service purposes only!
6	LED status display	Power: Device switched on Operation: Process, calibration Service: Service required Fault: Major fault Flame: Flame is burning
7	Menu keys	Menu keys are described in the software. Their meaning changes according to which menu is selected. The function is labeled on the current screen. ☞ <i>Section 9.2 Grundsätzliche Bedienung!</i>
8	Graphic display	Graphic representation of current measured values.
9	Curve values	Value display for selected curves.

9.2 Basic operation

The keys described in the following are used for operation of the combustion calorimeter on the part of the software.

Symbol	Function
	Back: Causes the menu to jump to the next higher menu level all the way back to the main menu.
	Scroll: Causes the display of other menus that cannot be displayed in the currently displayed screen due to limited space. The individual menus are displayed in a rolling manner over and over from the start.
	Selection: Enables a selection from a list.
	Plus/Minus: Causes the selected numbers/fields to be summed or unsummed.
	Arrow: Causes a jump to the next digit of a numeric input.



NOTE

Other symbols not described above refer to the different menus. These are described in the corresponding screens.

9.3 Available displays

The available displays and their function are described below. The displays are accessed using the menu and function keys shown in the chapter headings.

The structure shown in item 9.5 forms the basis of the controller. Different colors represent the different depth of the menu structure.

9.4 General information

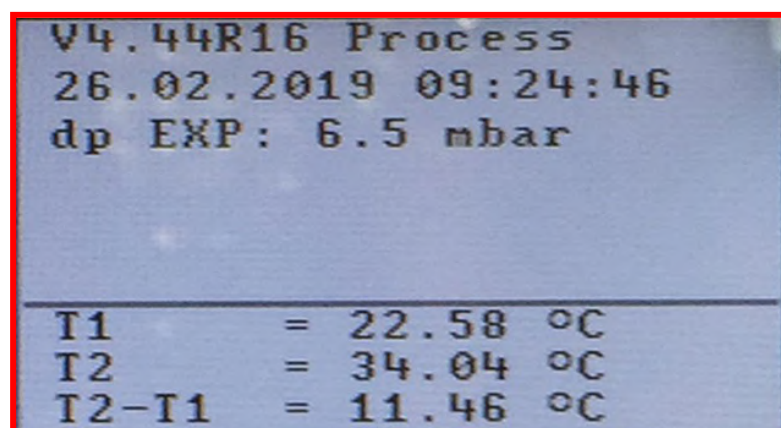


Fig. 9.2: General information

Display (example values)	Information
V 4.44R16	Version number of the software
Process	Current status of the device (e.g. START, STOP, Process, Cal.)
26.02.2019 09:24:46	Current date/time
T1	Temperature of cooling air at thermoelectric battery input
T2	Temperature of cooling air at thermoelectric battery output
T2 – T1	Temperature differential



NOTE

STD: During a calibration, 0.015 is typically achieved. The calibration is concluded after that.



dp air : 7.26 mbar

dp wobbe : 4.09 mbar

int.press.: 29.30 mbar

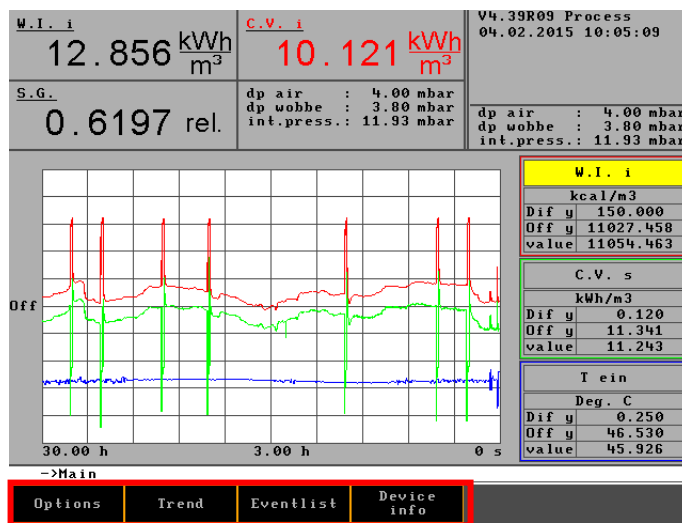
Fig. 9.3: Information on overpressure differential pressure

Display (example values)	Information
dp air	Pressure at thermal pipe aperture – housing overpressure to combustion air pressure differential
dp wobbe	Pressure at density cell – housing overpressure to combustion gas pressure differential

9.5 Menu structure

9.6	Main Menu	64
9.6.1	Main Menu - Options	65
	Main Menu - Options - I/O	66
	Main Menu - Options - I/O - Analog Outputs	67
	Main Menu - Options - I/O - Digital Outputs	68
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	Main Menu - Options - I/O - Digital Inputs	71
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	Main menu - Graphic - Select signal	92
	Main menu - Graphic - Select unit	92
	Main menu - Graphic - Select curve	93
9.6.3	Main menu - Event list	94
9.6.4	Main menu - Device information	96

9.6 Main Menu

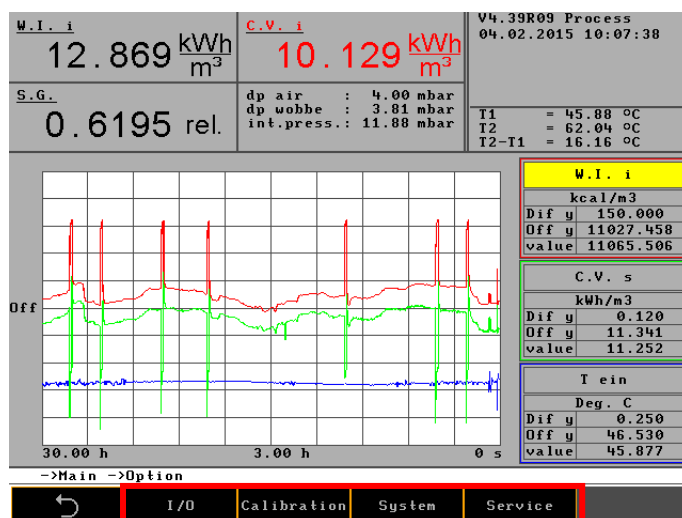


The main menu is the standard display during active operation.

The following submenus are accessed from the main menu:

- Options
- Trend
- Eventlist
- Device Info

9.6.1 Main Menu - Options



I/O

Configuration option for the following parameters:

- Analog outputs
- Digital (relay) outputs
- mA display
- Digital inputs
- Display

Calibration

Configuration option for the following parameters:

- Configuration of calibration gas
- Automatic calibration
- Automatic calibration 2
- Calibration
- Save base calibration
- Calibration limits

System

Configuration option for the following parameters:

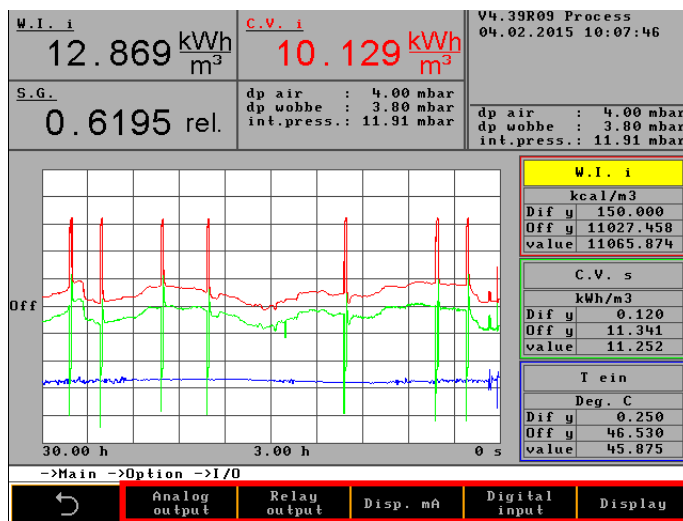
- General
- Ignition
- Update
- Load factory settings
- CSV export
- Hold signal On/Off
- Settings (e.g. date, language and password)
- Disable system

Service

For service technician only.

- Activate serial interface.

Main Menu - Options - I/O



Options for configuration for the following parameters:

- Analog outputs
- Digital outputs
- mA display
- Digital inputs
- Display

Main Menu - Options - I/O - Analog Outputs

W.I. i
12.840 kWh
m³

S.G.
0.6210 rel.

C.V. i
10.119 kWh
m³

dp air : 4.00 mbar
dp wobbe : 3.79 mbar
int.press.: 11.90 mbar

V4.39R09 Process
04.02.2015 15:32:34

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

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The mA signals are configured in this menu. The following must be observed for this:

Units:

xxx/m³ correspond to a gas temperature of 0°C and a barometric pressure of 1,013 mbar.
 xxx/Sm³ corresponds to a gas temperature of 15°C (60°F) and a barometric pressure of 1,013 mbar.

☞ xxx stands for MJ, kcal or kWh.

BTU/ft³ corresponds to a gas temperature of 15°C (60°F) and a barometric pressure of 1,013 mbar.

Main Menu - Options - I/O - Digital Outputs

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

Digital signals (relay outputs and floating change-over contacts) are configured in this menu.

The following must be observed for this:

Zero position:

The zero position of the digital outputs can be freely selected: low/high.

Process:

The combustion gas solenoid valve is open, and the flame is burning.

Calibration:

The calibration gas solenoid valve is open, and the flame is burning.

Maintenance:

The device must be checked in the foreseeable future, but is still ready for operation. The reason for maintenance can be obtained from the "General information" field.

Examples reasons include:

- Filter change (air filter)
- No calibration gas (calibration canceled)
- Room temperature too high (air inlet temperature > 52°C)
- Gas pressure is too low
- Calibration deviation outside of tolerances
- The calibration was unstable and was canceled

Fault:

Device is no longer usable because

Air differential pressure is too low (< 3.5 mbar)

Sensor break (PT100, thermoelectric battery or temperature at burner is too high)

Gas pressure is too low

Operation:

The flame is burning. Thermoelectric voltage of process or calibration gas is greater than the ignition threshold.

Operation delayed:

The flame is burning. Thermoelectric voltage of process or calibration gas is greater than the ignition threshold and the delay time has elapsed.

Overtemperature:

The flame is too hot. The Wobbe signal is greater than 76 mV, i.e. the temperature rise in the inner tube of the thermoelectric battery is greater than 50°C.

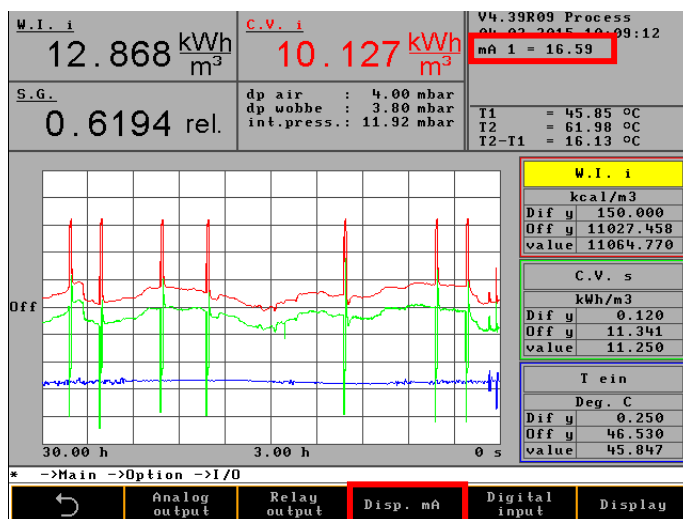
Calibration deviation:

The value determined during base calibration is exceeded or undershot.

Internal pressure:

Insufficient process or calibration gas.

Main Menu - Options - I/O - mA display



The mA values for the currently active outputs are displayed in this menu. With the **mA display** key, all channels can be displayed one after the other. The value can be obtained from the "General information" field.

Main Menu - Options - I/O - Digital Inputs

W.I. i 6.7866 kWh m ³	C.V. i 5.3208 kWh m ³	V4.39R09 Process 04.02.2015 10:10:06 Gas in 2 sec
S.G. 0.6146 rel.	dp air : 4.00 mbar dp wobbe : -0.17 mbar int.press.: 2.70 mbar	T1 = 45.84 °C T2 = 53.64 °C T2-T1 = 7.80 °C

No	Signal	Zero pos.
1	---	low
2	---	low
3	---	low

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

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Various digital signals are configured in this menu.
The following must be observed here:

The pin assignment is preassigned.

☞ *Section 6.3.7 !*

Signals	Zero position	Contact	CWD3000
Start calibration	high	open	Calibration starts
		closed	No calibration
	low	open	No calibration
		closed	Calibration starts
Start measurement	high	open	Measuring starts
		closed	Measuring stops
	low	open	Measuring stops
		closed	Measuring starts
Hold signals	high	open	Hold mA
		closed	mA online
	low	open	mA online
		closed	Hold mA
Cancel calibration	high	open	Calibration cancellation
		closed	No calibration cancellation
	low	open	No calibration cancellation
		closed	Calibration cancellation

Main Menu - Options - I/O - Display

W.I. i 7.0238 kWh m ³	C.V. i 5.5289 kWh m ³	V4.39R09 Process 04.02.2015 10:10:30
S.G. 0.6196 rel.	dp air : 4.00 mbar dp wobbhe : 3.84 mbar int.press.: 11.94 mbar	T1 = 45.83 °C T2 = 55.44 °C T2-T1 = 9.62 °C

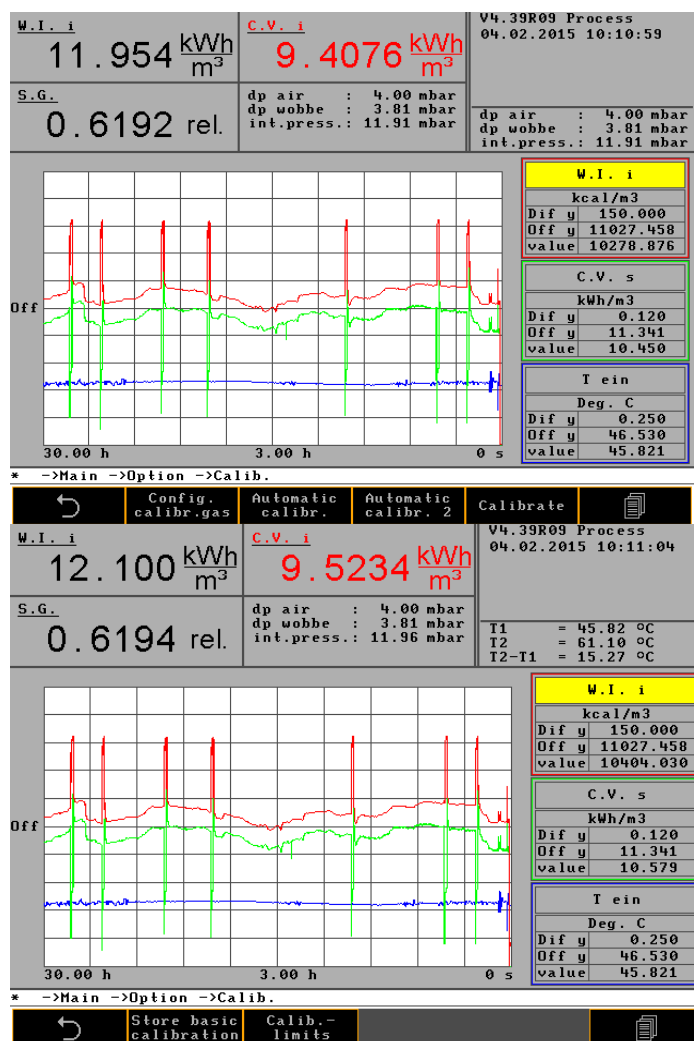
Display configuration		
No	Phys. value	Unit
1	W.I. i	kWh/m ³
2	S.G.	Specific
3	C.V. i	kWh/m ³
4	Pressure	mbar

* ->Main ->Option ->I/O ->Display configuration

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The display of measured values is configured in this menu. A signal and a unit are assigned to each of the four display windows.

Main Menu - Options - Calibration



In this menu, the calibration values are configured and calibration can be started manually (*Calibrate*).

Main Menu - Options - Calibration - Configuration of calibration gas

Wobbe i 69.345 $\frac{\text{kcal}}{\text{m}^3}$		Heizwert 68.918 $\frac{\text{kcal}}{\text{m}^3}$		V4.08 Zuendung 06.09.2013 08:42:27																									
Dichte 0.9877 rel.		dp Luft : 4.00 mbar dp Wobbe : 0.01 mbar Int. Druck: 0.01 mbar		mV= 0.68 V=1.997 T1=29.05/ 0.38 p=4.00 Fr=53.75 Stab=0.260																									
<table border="1"> <thead> <tr> <th colspan="6">Konfiguration Kalibrier gases</th> </tr> <tr> <th>Nr</th> <th>Einheit</th> <th>Wobbe i</th> <th>Wobbe s</th> <th>Einheit</th> <th>Dichte</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>kcal/m³</td> <td>2337</td> <td>2546</td> <td>relativ</td> <td>0.737</td> </tr> <tr> <td>2</td> <td>BTU/ft³</td> <td>0.00</td> <td>0.00</td> <td>relativ</td> <td>0.000</td> </tr> </tbody> </table>						Konfiguration Kalibrier gases						Nr	Einheit	Wobbe i	Wobbe s	Einheit	Dichte	1	kcal/m ³	2337	2546	relativ	0.737	2	BTU/ft ³	0.00	0.00	relativ	0.000
Konfiguration Kalibrier gases																													
Nr	Einheit	Wobbe i	Wobbe s	Einheit	Dichte																								
1	kcal/m ³	2337	2546	relativ	0.737																								
2	BTU/ft ³	0.00	0.00	relativ	0.000																								
* ->Hauptmenue ->Optionen ->Calib. ->Konfiguration Kalibrier gases																													
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The calibration gas is configured in this menu.

The following must be observed here:

The calibration gas is input as a Wobbe index (Wobbe i and Wobbe s) and as a relative density. These values are calculated from the gas components of the calibration gas.

The manufacturer always uses dry gas as the basis.

Units:

xxx/m³ correspond to a gas temperature of 0°C and a barometric pressure of 1,013 mbar.
xxx/Sm³ corresponds to a gas temperature of 15°C (60°F) and a barometric pressure of 1,013 mbar.

☞ xxx stands for MJ, kcal or kWh.

BTU/ft³ corresponds to a gas temperature of 15°C (60°F) and a barometric pressure of 1,013 mbar.

Main menu - Options - Calibration - Automatic calibration

W.I. i 12.624 $\frac{\text{kWh}}{\text{m}^3}$	C.V. i 9.9370 $\frac{\text{kWh}}{\text{m}^3}$	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

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The automatic calibration is configured in this menu.

The following must be observed here:

Input:

Day is a list field (Su, Mo, Tu, We etc.). Time and Cycle are value fields.

Duration of calibration:

Depending on the device type, the calibration duration is 10 – 20 min.

	NOTE
	With a restart of the device or a change of calibration gas, the calibration may have to be started multiple times until the pulse line is sufficiently flushed with calibration gas and the stability criterion is met.

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																																				
<table border="1"> <thead> <tr> <th colspan="3">Configuration auto calibration 2</th> </tr> <tr> <th>Program 2</th> <th>Situation</th> <th>Value</th> </tr> </thead> <tbody> <tr><td>1</td><td>---</td><td>0</td></tr> <tr><td>2</td><td>---</td><td>0</td></tr> <tr><td>3</td><td>---</td><td>0</td></tr> <tr><td>4</td><td>---</td><td>0</td></tr> <tr><td>5</td><td>---</td><td>0</td></tr> <tr><td>6</td><td>---</td><td>0</td></tr> <tr><td>7</td><td>---</td><td>0</td></tr> <tr><td>8</td><td>---</td><td>0</td></tr> <tr><td>9</td><td>---</td><td>0</td></tr> <tr><td>10</td><td>---</td><td>0</td></tr> </tbody> </table>			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
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																																						

The automatic calibration that is defined by a situation is configured in this menu.

Criterion 1:

Automatic calibration after restart.

Criterion 2:

Automatic calibration at a defined change in ambient temperature compared to the last calibration.

Main menu - Options - Calibration - Calibration

The calibration is started with this key.
This stops the automatic calibrations.

Main menu - Options - Calibration - Save base calibration

The measured values are saved with this key. These values are reference values for additional calculations during the next calibration. Any deviations from these reference values are stored in the event list.

Main menu - Options - Calibration - Calibration limits

W.I. i

12.681 kWh
m³

C.V. i

9.9808 kWh
m³

V4.39R09 Process

04.02.2015 10:12:02

S.G.

0.6194 rel.

dp air : 4.00 mbar
dp wobbbe : 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

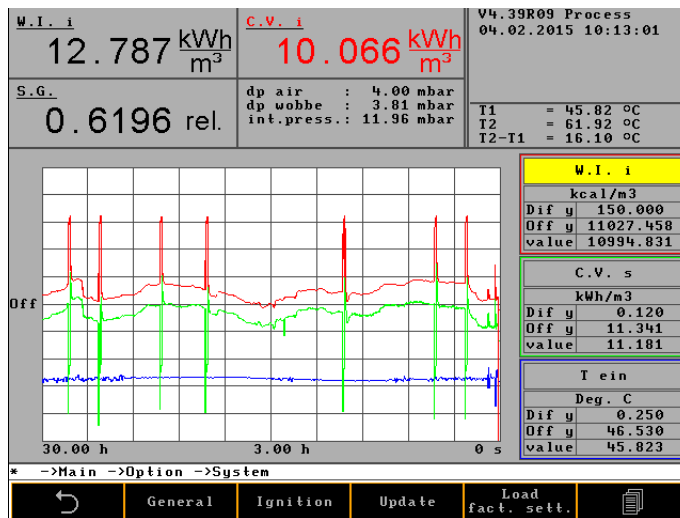






The calibration tolerances are set and the deviations from the base calibration are displayed in this menu. If the calibration values exceed the defined tolerances, this is indicated as a calibration deviation for digital outputs.

Main menu - Options - System



The basic configurations of the device, such as ignition, time of day, language and code key, are specified in this menu.

Main menu - Options - System - General

The “Change signals after holding” command causes a smooth transition after calibration or removal of the signal holding state. A sudden rise or fall of the measured value in the analog output signal is avoided. The continuous transition is specified in seconds.

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

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

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

General system values are configured in this menu.

The following must be observed here:

Change signals after holding:

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

Flushing time after cooling air or device start:

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

Screen switch-off time:

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

Display rate:

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

Carrier gas test cycles:

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

Operation delay:

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

Minimum internal pressure:

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

Internal pressure warning threshold:

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

Main menu - Options - System - Ignition



NOTE

The combustion calorimeter can only be ignited when the door is closed.

W.I. i 12.846 kWh m³	C.V. i 10.111 kWh m³	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	

Configuration ignition

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

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The ignition monitoring is configured in this menu.

The following must be observed here:

Single ignition or interval ignition must be chosen.

Single ignition:

After device start and the flushing time period (10 s), the ignition starts for the maximum set ignition duration. This time can turn out to be shorter if the ignition threshold is reached before the ignition duration elapses. If the ignition threshold is not reached within the specified time, the combustion calorimeter goes to the STOP state.

Interval ignition:

After device start and the flushing time period (10 s), the ignition starts for a maximum set ignition duration and is repeated after a pause equal to the ignition duration. This is repeated until the ignition threshold is reached.

The ignition threshold specifies the differential temperature between the cooling air and flue gas. Default value is 3°C.

Main menu - Options - System - Update

An update from a USB data stick is initiated with this key.

Main menu - **Options** - **System** - **Load factory settings**

The factory settings are loaded with this key.

Main menu - **Options** - **System** - **CSV Export**

Three files are exported as an ASCII file with this key: 30 min at 1-second intervals, 3 hours at 10-second intervals and 5 days at 1-minute intervals.

The values are separated by TAB. All possible 25 curves are written at once to a CSV file. This file can be processed, e.g. with a conventional spreadsheet.

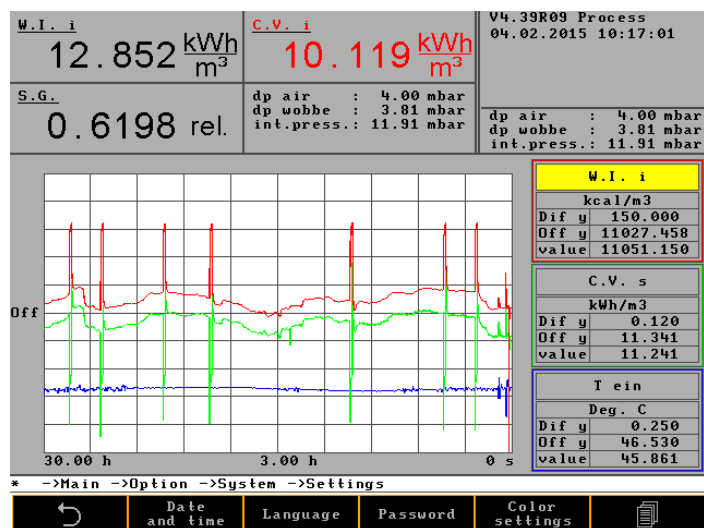
Main menu - **Options** - **System** - **Hold signal On/Off**

The “Hold signal” function is switched on and off with this key.

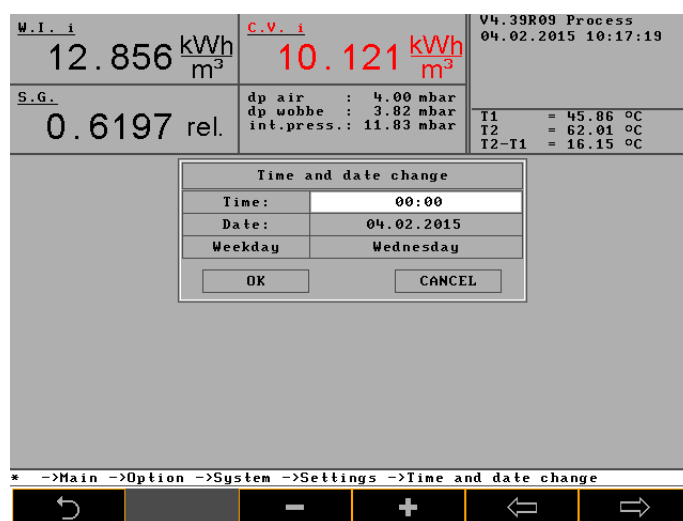
Hold signal:

Storage of the mA values is activated with this function. After the function is ended, an adjustment of the old and new mA signals is made over a time ramp (120 s).

Main menu - Options - System - Settings



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



W.I. i
12.856 $\frac{\text{kWh}}{\text{m}^3}$

C.V. i
10.121 $\frac{\text{kWh}}{\text{m}^3}$

V4.39R09 Process
04.02.2015 10:17:19

S.G.
0.6197 rel.

dp air : 4.00 mbar
dp wobbe : 3.82 mbar
int.press.: 11.83 mbar

T1 = 45.86 °C
T2 = 62.01 °C
T2-T1 = 16.15 °C

Time and date change

Time: 00:00
Date: 04.02.2015
Weekday: Wednesday

OK CANCEL

* ->Main ->Option ->System ->Settings ->Time and date change

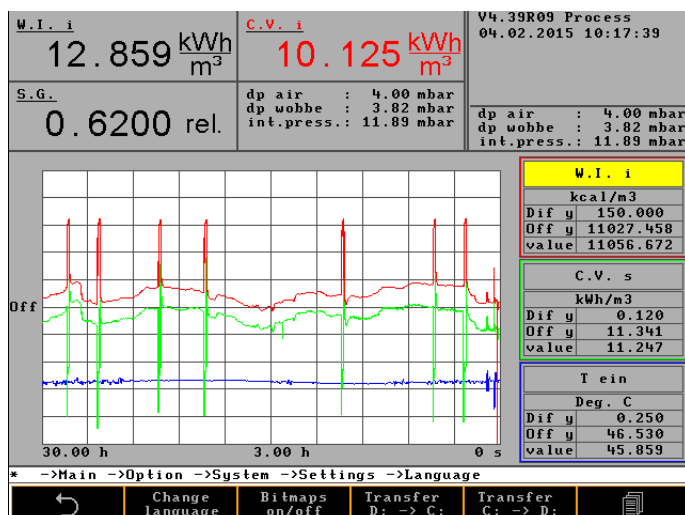
↩ - + ⬅ ➡

The date and time are set in this menu.

- +** Increments selected numbers
- Decrements selected numbers
- ⬅** Moves one field left
- ➡** Moves one field right

Main menu - Options - System - Settings - Language

The Language menu item contains 10 submenus for inserting, copying and correcting various languages, even those that have to be represented by bitmaps (e.g. Chinese). Languages can be downloaded onto a memory stick, corrected and then re-imported to the combustion calorimeter.



The language can be changed and your own bitmaps configured in this menu.

Main menu - Options - System - Settings - Password

W.I. i 12.862 kWh m ³	C.V. i 10.124 kWh m ³	V4.39R09 Process 04.02.2015 10:17:57
S.G. 0.6196 rel.	dp air : 4.00 mbar dp wobbe : 3.80 mbar int.press.: 11.93 mbar	T1 = 45.86 °C T2 = 62.00 °C T2-T1 = 16.14 °C

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

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

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The password is changed in this menu.

The following must be observed here:

Factory password:

The combustion calorimeter is delivered with factory password of **0**. This can be changed, if necessary.

Unlock time:

This time specifies when the system will be locked and the password must be re-entered.

	NOTE
	The time must be greater than 0. Otherwise, the system can no longer be unlocked!

Main menu - Options - System - Settings - Change color

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 wobb : 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

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The display colors can be changed here.

Main menu - Options - System - Settings - Hardware 1



NOTE

Only change this menu in consultation with the manufacturer.

W.I. i		C.V. i		V4.39R09 Process 04.02.2015 10:19:41	
12.869 $\frac{\text{kWh}}{\text{m}^3}$		10.130 $\frac{\text{kWh}}{\text{m}^3}$			
S.G.		dp air : 4.00 mbar dp uobbe : 3.81 mbar int.press.: 11.91 mbar		mV=24.56 / V=1.072 Frequ. = 51.22 Hz Stabi. = 0.005	
0.6196 rel.					

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

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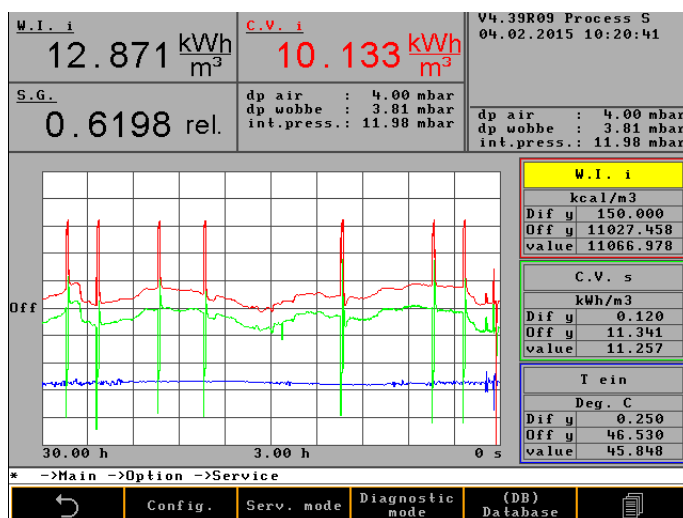
The parameters for a multi-range measuring device are configured in this menu.



NOTE

Only change this menu in consultation with the manufacturer.

The device is provided with a default password at the factory for service mode, with which the owner must specify handling!



The menu is password-protected. Setting for service only.

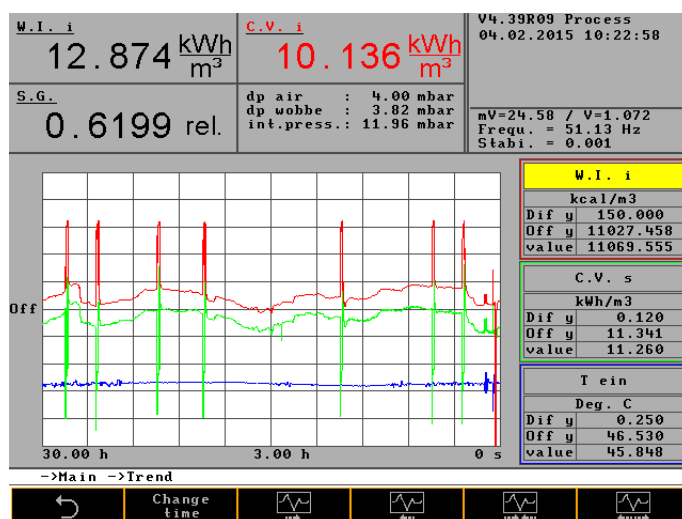
The device is provided with a default password, 0721, with which the owner must specify handling!

The serial interface can be activated with OK and Enter using the menu sequence Options | Service – entry of the service password and other customer-specific data.

For activation, the

- menu button of the keyboard must be pressed
- calorimeter must be switched off and on once

9.6.2 Main menu - Trend



The graphics are configured in this menu.

The following must be observed here:

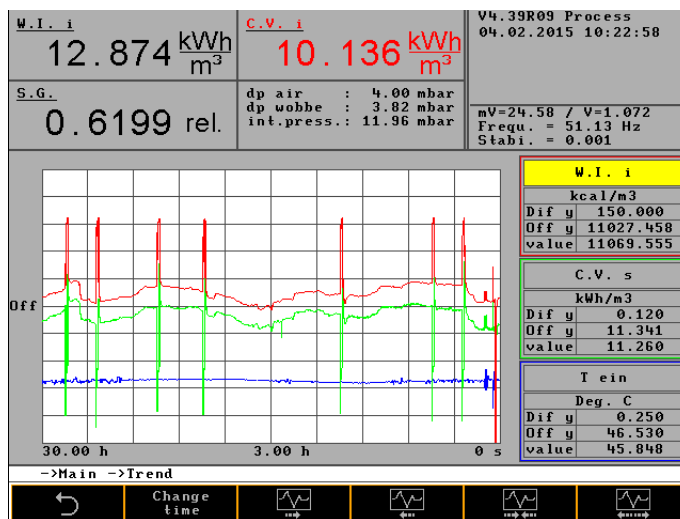
Up to three different curves in various colors can be displayed.

Selection:

A selection can be made from the following parameters:

- Select time
- Select value
- Select signal
- Select unit
- Select curve

Main menu - Graphic - Select time



The diagram can be optimally designed. The increments for increasing and reducing are programmed to obtain a resolution for this purpose.

The diagram is subdivided into 10 segments on the x-axis. The segment time and the total displayed time can be set as follows:



Increase segment time

Reduce segment time

Minimum segment time: 1 s
Maximum segment time: 12 h

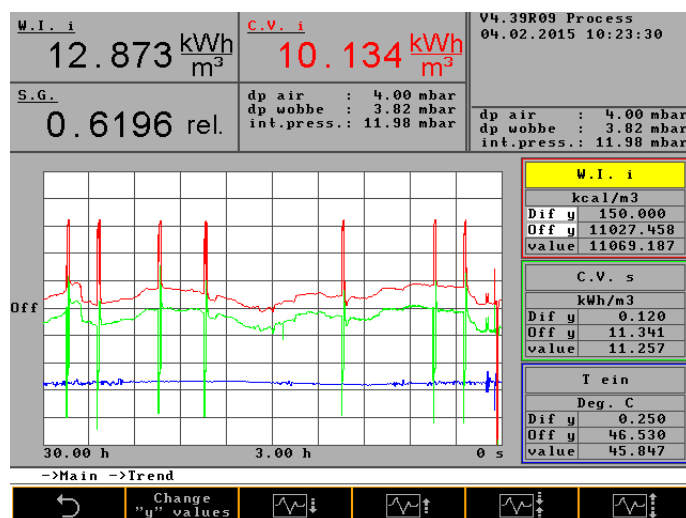
The time values can be viewed as follows:



Shift to later values

Shift to earlier values

Main menu - Graphic - Select value

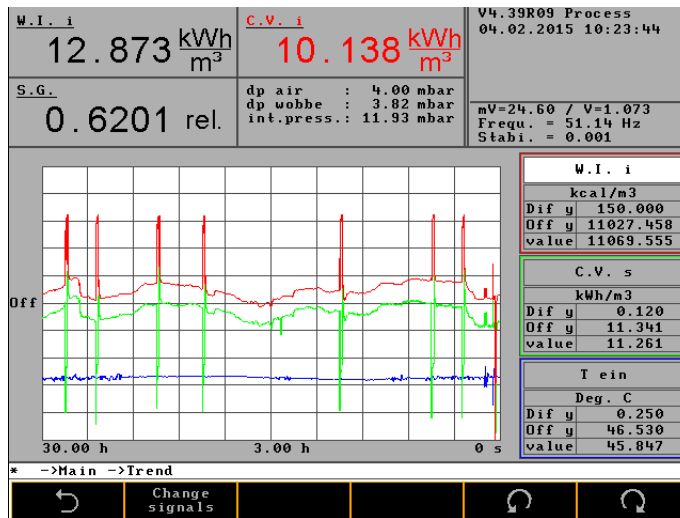


Values for the curves can be set in this menu.

The curves can be viewed as follows:

-  Ref y-value linearly toy-axis
-  Ref y-value linearly from y-axis
-  dy-value compressed y-axis
-  dy-value stretched y-axis

Main menu - Graphic - Select signal

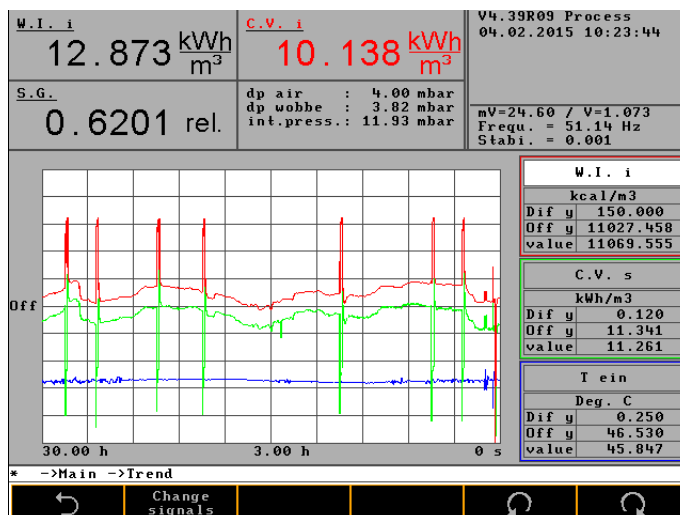


Signals for the curves can be selected in this menu.

Example signals:

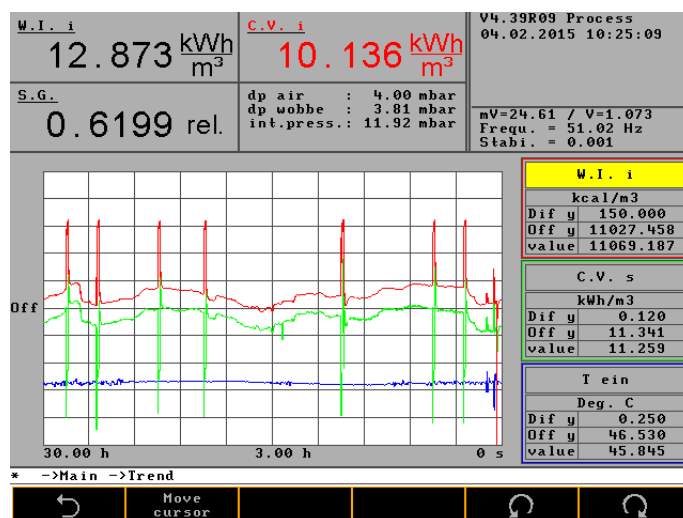
Wobbe i	Heating value	mVSA	Frequency	T amb
Wobbe s	Combustion	mV	p Wobbe	T in
	value			

Main menu - Graphic - Select unit



- Units for the signals can be selected in this menu.

Main menu - Graphic - Select curve



Individual curves can be selected in this menu in order to change parameters.

9.6.3 Main menu - Event list



NOTE

The event list stores all events that are of interest for operation and service of the device.

A total of 1,000 events can be stored.

W.I. i 12.874 kWh m ³	C.V. i 10.138 kWh m ³	V4.39R09 Process 04.02.2015 10:25:23
S.G. 0.6201 rel.	dp air : 4.00 mbar dp wobble : 3.79 mbar int.press.: 11.90 mbar	mV=24.61 / V=1.073 Frequ. = 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 (wobble) 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 (wobble) 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 all:

All events

Wobbe i 0.0000 kcal/m³	Heizwert 0.0000 kcal/m³	V4.08 STOP 11.06.2014 10:58:16 Gasmangel
Dichte 0.0000 rel.	AIRmin 1.0906	mV= 0.33 V=0.510 T1=32.62/ 0.08 p=4.00 Fr=52.76 Stab=0.003
06.06.2014 07:16:52 Kaltstart 06.06.2014 07:00:37 Kaltstart 06.06.2014 06:56:08 Kaltstart 05.06.2014 10:24:52 Kaltstart 16.01.2007 02:46:03 Kaltstart		

OK: Screenshot saved to d:\SCRSHTS\Haupt0001.pcx

Show startup:

Selection of the start events

Wobbe i 0.0000 kcal/m³	Heizwert 0.0000 kcal/m³	V4.08 STOP 11.06.2014 10:58:18 Gasmangel
Dichte 0.0000 rel.	AIRmin 1.0907	mV= 0.33 V=0.510 T1=32.62/ 0.08 p=4.00 Fr=52.76 Stab=0.003
11.06.2014 09:26:35 Abw. B.-Kalibrie. (Dichte) Gas 1: +32.11 % 11.06.2014 09:26:35 Abw. Kalibrierung (Dichte) Gas 1: -0.01 % 11.06.2014 09:26:35 Abw. B.-Kalibrier. (Wobbe) Gas 3: -24.90 % 11.06.2014 09:26:35 Kalibrierabweichung Gas 1: -0.99 % 11.06.2014 08:59:16 Abw. B.-Kalibrie. (Dichte) Gas 1: +32.10 % 11.06.2014 08:59:16 Abw. Kalibrierung (Dichte) Gas 1: -31.37 % 11.06.2014 08:59:16 Abw. B.-Kalibrier. (Wobbe) Gas 3: -24.15 % 11.06.2014 08:59:16 Kalibrierabweichung Gas 1: -23.84 % 09.06.2014 22:08:23 Abw. B.-Kalibrie. (Dichte) Gas 1: +1.05 % 09.06.2014 22:08:23 Abw. Kalibrierung (Dichte) Gas 1: +0.48 % 09.06.2014 22:08:23 Abw. B.-Kalibrier. (Wobbe) Gas 3: -0.40 % 09.06.2014 22:08:23 Kalibrierabweichung Gas 1: +0.03 % 09.06.2014 10:08:26 Abw. B.-Kalibrie. (Dichte) Gas 1: +1.53 % 09.06.2014 10:08:26 Abw. Kalibrierung (Dichte) Gas 1: -0.18 % 09.06.2014 10:08:26 Abw. B.-Kalibrier. (Wobbe) Gas 3: -0.43 % 09.06.2014 10:08:26 Kalibrierabweichung Gas 1: +0.13 % 08.06.2014 22:08:29 Abw. B.-Kalibrie. (Dichte) Gas 1: +1.34 % 08.06.2014 22:08:29 Abw. Kalibrierung (Dichte) Gas 1: +0.32 % 08.06.2014 22:08:29 Abw. B.-Kalibrier. (Wobbe) Gas 3: -0.56 %		

OK: Screenshot saved to d:\SCRSHTS\Haupt0002.pcx

Show calibration:

Selection of the calibration events

9.6.4 Main menu - Device information



NOTE

The values shown are very important for remote diagnostics when errors occur and can be loaded onto the USB memory stick and sent to the manufacturer by email (e.g. using a screenshot; see CSV keyword index).

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

Analog outputs

W.I. s	4 - 20mA	kWh/m3	8.000	-	16.000
S.G. s	4 - 20mA	kg/m3	0.500	-	1.000
C.V. s	4 - 20mA	kWh/m3	8.400	-	13.100

->Main

Press any key to return to CWD2005 menu...

1 Device data:
• Type
• Gas type
• Carrier gas
• Device number

2 Measuring ranges:
• Wobbe
• Density

3 Equipment:
• Nozzle MR1
• Nozzle MR2
• Burner

4 Additional options:
• Installed additional options are listed here, if applicable.

5 Analog outputs:
• Wobbe i
• Density
• Heating value

- 1 Device data:
 - Type
 - Gas type
 - Carrier gas
 - Device number
- 2 Measuring ranges:
 - Wobbe
 - Density
- 3 Equipment:
 - Nozzle MR1
 - Nozzle MR2
 - Burner
- 4 Additional options:
 - Installed additional options are listed here, if applicable.
- 5 Analog outputs:
 - Wobbe i
 - Density
 - Heating value

10 Decommissioning/Switching off

 	 WARNING
	Endangerment of people when the combustion calorimeter is decommissioned by non-instructed personnel!

	 NOTICE
	Endangerment of equipment when the combustion calorimeter is decommissioned by non-instructed personnel! To decommission the combustion calorimeter, you must decommission the linked system components according to their operating instructions as well!

	NOTE
	The following table contains steps for decommissioning for extended periods. To switch off the combustion calorimeter only temporarily, some steps can be omitted: ☞ <u>Switching off column!</u>

Steps	Switching off	Decommissioning
Set calorimeter to Stop/End measurement, STOP button on control panel.	X	X
Disconnect the device from the process, professionally shut off the gas-carrying lines.	X	X
Bring linked system components to a standstill.	X	X
Shut off air supply.	X	X
Disconnect voltage supply.	X	X
 If the combustion calorimeter is to be taken out of service only temporarily, the process ends here!		
Professionally separate/switch off owner-side energy supplies, media supply and signal transmission.		X
When appropriate, pack the combustion calorimeter in a suitable manner. Ensure before starting or restarting transport that all transport securing devices are attached.		X

11 Maintenance

When carrying out work in hazardous areas, take the relevant safety precautions.

The quality of measurements and availability of the combustion calorimeter can only be guaranteed when the maintenance intervals are adhered to.

11.1 Preparations

Supply lines of linked system components can be closed for maintenance purposes. These must be reopened after the device is put back into service.

 	 DANGER Risk of ignition by electricity! Risk of serious injury from electricity! • Parts of the combustion calorimeter with the adjacent symbol may still carry voltage even when the main switch is switched off! If required, separate the combustion calorimeter from the supply network! • Device does not have a main switch – disconnect the device from the voltage supply if necessary and take steps to prevent reconnection! • Only skilled electricians are permitted to work on the electrical equipment of the combustion calorimeter!
---	--

    	 WARNING Risk of serious injury from escaping gases! • Before carrying out maintenance work on the combustion calorimeter and whenever necessary, also bring the the linked system components to a standstill. • Valve of the ignition protection gas supply – Follow instructions before closing! • Work on gas connections may only be carried out by qualified personnel! Guidelines applicable at the installation location must be observed! • Incomplete combustion during maintenance operation may cause the exhaust air to become polluted with combustion gas! • In case of toxic gases, the applicable safety provisions must be complied with. • Risk of serious injury from burns caused by burner components! Before carrying out maintenance work on the burner system, always wait 5 minutes for it to cool down!
---	---

11.2 Maintenance/Inspection

	NOTE
	Maintenance work must be performed according to the inspection and maintenance schedule! The nature and amount of wear depends greatly on the individual use and operating conditions. All specified intervals are therefore guide values.

The following items must be ensured before carrying out maintenance work:

1. Make a note of the following values on the combustion calorimeter!
 - Wobbe i/s
 - Heating value/Combustion value
 - Density
 - mV signals
 - mA signals
 - Internal pressure
 - Differential pressure, Wobbe
 - Differential pressure, air
2. Notify the control room
3. If no default values via PLC are possible, activate “Hold signal” on the combustion calorimeter (see 9.6.1).
4. Close combustion gas shut-off valve to combustion calorimeter and carry out leak testing.

The nature and amount of wear depends greatly on the individual use and operating conditions. All specified intervals are therefore guide values.

To guarantee operational reliability, use only genuine spare parts of the manufacturer.

	 DANGER
	The calorimeter can be operated with a door open for maintenance purposes. In this operating mode, ignition protection is no longer ensured! Make sure that there is not an explosive atmosphere around the calorimeter during operation with an open door! Maintenance operation may only be carried out by instructed persons! Observe national, local and company-internal specifications on maintenance operation in hazardous areas, e.g. fire permit!

Steps
Set calorimeter to Stop/End measurement, STOP button on control panel.
Disconnect voltage supply.
Shut off air supply.
Open door of cell 2.

Connect air supply with optional adapter to thermal pipe (4.5 bar).
Activate voltage supply.
Activate control unit bypass. See separate Gönzheimer control unit FS870S operating instructions.
Start calorimeter.
Combustion can be observed through the viewing window of the thermal element, and functions of the calorimeter can be checked using the display and control panel.

	 DANGER
	Risk of serious injury from electricity! • Ignition transformer generates high voltage during ignition! • Calorimeter is supplied with 230 V/115 V! Cell 3, voltage supply, power supply

11.2.1 Cleaning the surface and display

Clean only with a damp cloth to avoid charging with static electricity.

Check	Interval (recommended)
-------	---------------------------

After commissioning

Check and, if necessary, update the firmware version.	As required
Store the current configuration	As required

Semi-annual check

Check sieve in exhaust air duct for soiling; remove off-gas line for this purpose.	Every 6 months
Perform calibration (at shorter intervals depending on accuracy requirements).	As required
Check hose connection to the density measuring cell/sensors for porosity.	Every 6 months
Check membrane on the gas pressure controller for porosity or lack of elasticity.	Every 6 months
Remove ² / clean ³ thermoelectric battery and heat exchanger.	Every 6 months
Replace the seal on the heat exchanger.	Every 6 months
Clean ⁴ the gas and air nozzles. Change O-rings, if necessary.	Every 6 months

Annual check

Replace neoprene hoses inside the combustion calorimeter.	Annually
Clean the entire system.	Annually
Check screw fittings of line on housing and inside the device for firm seating and proper seal.	Annually
Gas inlet solenoid valves; check connections for intactness, check functioning (switching).	Annually
Check pressure switches and seal.	Annually

If necessary, use load from environment.

Check seal of housing for functioning and damage.	Each time the doors are opened
Check compressed air filter for soiling/blockage/condensate, optionally installed by owner.	As required
Check compressed air inlets/outlets for soiling (oil, dust etc.) and corrosion, have cleaned by manufacturer.	As required
Check compressed air inlets/outlets on/in housing for soiling (oil, dust etc.) and corrosion.	As required

Additional information:

☞ *Included documents*

² Flow plates are attached on the side of the thermoelectric battery and in the thermal elements of the combustion calorimeter. The flow plates must not be twisted when removing the thermoelectric battery. The thermoelectric battery must be pulled out as far as possible and then tilted to the side.

³ Cleaning of the heat exchanger with water followed by thorough drying.

⁴ Clean the nozzles using a volatile solvent.

12 Troubleshooting

   	⚠ WARNING Risk of explosion! Risk of serious injury from electricity and escaping gases! • Troubleshooting may only be carried out by instructed persons! • Before carrying out maintenance work on the combustion calorimeter and whenever necessary, bring the the linked system components to a standstill as well! • Switch off the main switch and disconnect the device from the voltage supply, if necessary, and take steps to prevent the main switch from being switched on again and the voltage supply from being reconnected! • Only skilled electricians are permitted to work on the electrical equipment of the combustion calorimeter! • Parts of the combustion calorimeter with the adjacent symbol may still carry voltage even when the main switch is switched off! • If required, separate the combustion calorimeter from the voltage supply!
--	---

	NOTE Troubleshooting is broken down into the following categories: • Unstable measured value • Drift of measured value • Incorrect ignition behavior
---	---

12.1 Preparations for troubleshooting

Supply lines of linked system components can be closed for maintenance purposes. They must be reopened after the device is recommissioned.

NOTE



Event list:

The software keeps an event list with up to 1,000 events in chronological order (specification of date). The event list provides information about abnormal behavior (see 9.6.3).

The export of event data to portable, external memory (USB stick) is possible upon consultation with UNION service. The exported data can be sent to the manufacturer for fault analysis (CSV export, Section 9.6.1).

Events include: Start, Stop, Ignition, Insufficient cooling air and Calibration

12.2 Changing/replacing fuses

Only skilled electricians or service technicians are permitted to replace fuses. Only replace with fuse types specified by UNION.

12.3 Changing/replacing the battery

The battery for backup power supply of the real-time clock of the processor may only be replaced by a professional electrician or service technician. Only replace with battery types specified by UNION.

12.4 Unstable measured value

- The inlet pressure controller cannot maintain a constant inlet pressure. The process pressure (blast furnace gas) is too high. A pressure booster pump must be installed.
- Direct sunlight is causing rapid temperature changes. Direct sunlight must be prevented.
- Changes in temperature which are too rapid (less than 5°C/h) caused by environmental influences.
- The inlet pressure is inexact/cannot be maintained. Check whether the input pressure is too high.

12.5 Drift of measured value

The measured value drifts upward in one direction:

- The calibration no longer achieves the required point. The frequency controller is at its maximum value.
- Strong compressed air supply fluctuation which can no longer be corrected.

The measured value drifts downward:

- The heat exchanger is contaminated with soot (when propane or butane is combusted with too little air).
- The heat exchanger must be cleaned (hot water) and then dried with compressed air.
- The thermoelectric battery is contaminated. The thermoelectric battery must be cleaned and carefully dried.

12.5.1 Faulty ignition

The combustion calorimeter is continually igniting, and the flame is burning. Combustion calorimeter does not switch to the operating state.

- Incorrect temperature setting (too high). The temperature threshold must be reduced.

The combustion calorimeter switches to the operating state even though the flame is not burning and then reverts to the ignition state.

- Incorrect temperature setting (too low). The temperature threshold must be increased.

Ignition electrodes are corroded, natural wear when ignition is frequent.

- Replace ignition electrode.

12.5.2 Error/status messages

Int. pressure

- Alarm in the event of inadequate combustion gas or calibration gas.
- Adjustable threshold; default: 14 mbar

Overtemp

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

Fault

- Gas pressure is too low.
- Fault in the thermoelectric battery.
- Defective PT 100 temperature sensor.

Service

- Air inlet temperature > 52°C

Operation

- Flame is burning, and calorimeter is running on combustion or calibration gas.

Operation delay

- Flame is burning, calorimeter is running on combustion or calibration gas.
- Delay time has elapsed, after which the analog signals are enabled.

Process

- Flame is burning, and solenoid valve for calibration gas is open.
- Calorimeter is running on combustion gas.

Calibration

- Flame is burning, and solenoid valve for calibration gas is open.
- Calibration is active, and no mA signals are output – they are “on hold.” The last current value is retained.

13 Service

	NOTE
	UNION Instruments GmbH is available to answer any questions. For orders or technical questions, please provide your customer number, phone number where you can be reached, the combustion calorimeter type and number (see name plate) and required spare parts/bills of material numbers, if applicable.

UNION Instruments GmbH - Service

Maria-Goeppert-Straße 22
23562 Lübeck
Germany



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

14 Disposal

In case of decommissioning, a return of the device to UNION Instruments GmbH is possible.

Suggestion: Have UNION Instruments GmbH dispose of your combustion calorimeter.

 	WARNING Risk of explosion and risk of injury from electricity and, if applicable, gases in the combustion calorimeter!
--	--

	NOTE Observe national regulations for disposal of machines and working materials. Sort parts by groups and have them recycled professionally.
--	---

15 Spare parts

 	 WARNING Use of non-approved spare parts (e.g. parts from other manufacturers, parts with deviating specifications, imitation consumables and wear parts) may cause damage and endanger people! Such use voids the warranty. The owner is then liable for any resulting damage! When replacing standard components, use only identical components from the original manufacturer. In the event that components are discontinued or components of other manufacturers are used, request approval from UNION Instruments GmbH!
--	---

Spare parts can be ordered from UNION Instruments GmbH:
☞ *Chapter 11 Service.*

Make a note of the combustion calorimeter type and number (☞ *Name plate*).
Identify and note the order number, if necessary (☞ *Other applicable documents*).
Order part.

The following spare part packages are among those available:

16 Appendix

Profibus data structure

No.	Type	Bytes	Bytes tot.	Name	Description	Source
1	FLOAT	4	4	Heating value	Unit: kJ/m ³	CWD ⁵
2	FLOAT	4	8	Combustion value	Unit: kJ/m ³	CWD
3	FLOAT	4	12	Wobbe i	Lower Wobbe index: Unit: kJ/m ³	CWD
4	FLOAT	4	16	Wobbe s	Upper Wobbe index: Unit: kJ/m ³	CWD
5	FLOAT	4	20	Dv	Relative density, dimensionless	CWD
6	FLOAT	4	24	Reserve		CWD
7	FLOAT	4	28	Reserve		CWD
8	FLOAT	4	32	Tin	Air temp. CWD thermal element, unit: °C	CWD
9	FLOAT	4	36	CO	Unit: % (only present with CWDs with CO module)	CWD
10	FLOAT	4	40	Air min	Min. air requirement, unit: m ³ air/m ³ gas (only with customer-specific CWDs)	CWD
11	FLOAT	4	76	Reserve		CWD
...						
20	FLOAT	4	80	Fixer test value	Sent: 12345.6789	CWD
21	BYTE	1	81	Operating state	Current CWD operating state: 0 – Stop 1 – Process 2 – Ignition 3 – Ignition break 4 – Fault 5 – Overtemperature 6 – Measurement range 1 calibration 7 – Measurement range 2 calibration 8 – Measurement range 3 calibration 9 – Test gas measurement (in process only)	CWD
22	BYTE	1	82	Filter change status	1 = filter change required on CWD	CWD
23	BYTE	1	92	Reserve		CWD

Table 1: Profibus data structure

For additional information on communication with Profibus and the UNION calorimeter, see UNION Instruments GmbH service, *Chapter 11, Service*.

⁵ CWD = calorimeter

Serial interface RS 232 data structure (optional)

Data can be transferred with the optional serial interface (RS 232). Parameters are selected in the “I/O Analog Outputs” menu. The interface must be activated in the Service menu.

Data transmission:	Transmission rate:	9,600 baud
Parity bit:	no	
Stop bit:	1	
Data bit:	8	

Output format

111111.111 222222.222 333333.333 777777.777

111111.111	=	Data 1 output
222222.222	=	Data 2 output
... ..		
777777.777	=	Data 7 output

Assignment of the plug/pins,  6.3.7

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