Original Operating Instructions

Combustion Calorimeter

CWD2005,
CWD2005 Plus

UNION Instruments GmbH

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1 Technical data

1.1 Dimensions

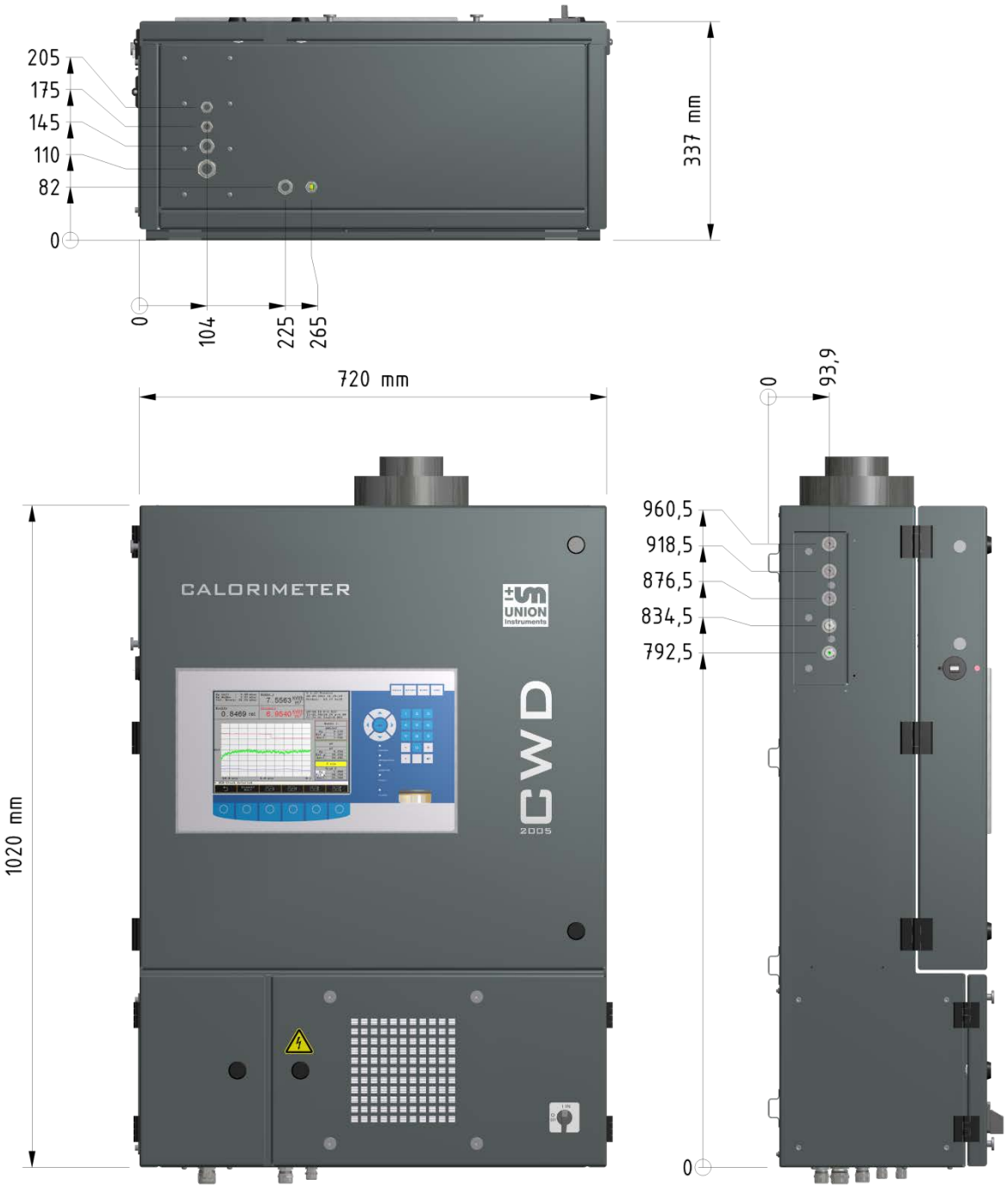

Fig. 1.1: Housing dimensions

Weight: approx. 54 kg

1.2 Device overview

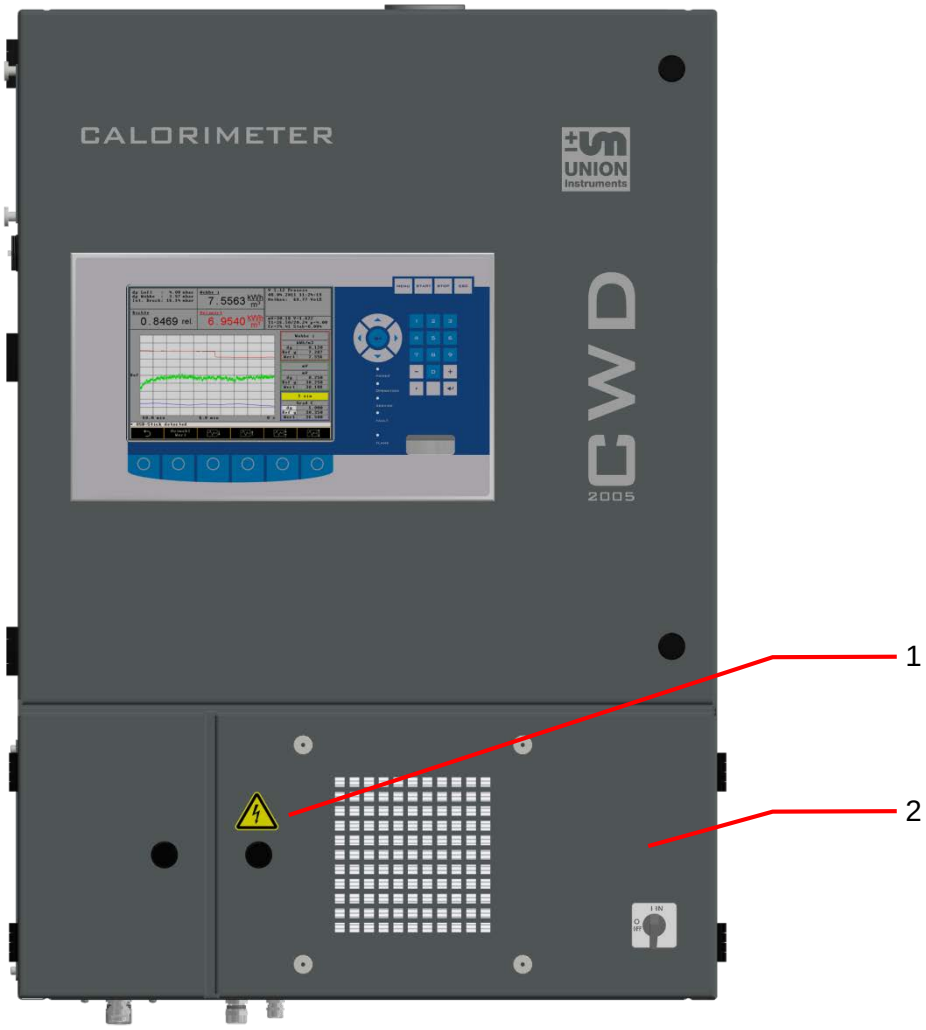

Fig. 1.2: Markings and warning information

1. Warning information for electricity
2. Name plate

1.3 Voltage supply

Voltage:	230 Volt or 115 Volt 50/60 Hz alternating current
Power consumption:	185 VA max.
Protection class:	I
Degree of protection:	IP50

1.4 Interfaces

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

1.5 Display times of combustion value measurement[1]

Dead time:	3 seconds
50% time:	7 seconds
90% time:	CWD2005: 20 seconds, CWD2005 PLUS: 15 seconds
99% time:	CWD2005: 60 seconds, CWD2005 PLUS: 55 seconds

1.6 Gas inputs

Process gas:	1, optionally 2 for dual measuring ranges
Calibration inputs:	1, optionally 2 for dual measuring ranges
Test gas inputs:	1
Fast loop:	optional
Gas connections:	Compression fitting 6 mm

1.7 Calibration gas / Test gas

Calibration gas:	Dependent on the process gas
Calibration interval:	Dependent on the process 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:	40 mbar
Input pressure, min.:	20 mbar, dependent on the gas

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

1.8 Process gas

NOTE

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

Gas connection inlet pressure: 20 - 40 mbar
Gas consumption: 30 - 40 l/h (min. rel. density 0.50 with 0.55 mm nozzle)

Measuring range [MJ/m] / Accuracy [± MBE]												
CWD device series	**CWD2005**		**CWD2005 CT**		**CWD2005 PLUS**		**CWD2005 DPC**		**CWD2005 SPC**		**CWD2000 Ex**	
Flare gas	0 – 15	3.0	—	—	—	—	0 – 15	2.0	0 – 15	2.0	—	—
Blast furnace gas	3.5 – 6	3.0	—	—	3.5 – 6	3.0	3.5 – 6	3.0	3.5 – 6	3.0	—	—
Converter gas	4.5 – 9	1.5	—	—	—	—	4.5 – 9	1.5	4.5 – 9	1.5	—	—
Mixed gas	5 – 10	2.0	—	—	5 – 10	2.0	5 – 10	2.0	5 – 10	2.0	—	—
Coke oven gas	15 – 30	1.5	—	—	15 – 30	1.5	15 – 30	1.5	15 – 30	1.5	—	—
Biogas	25 – 35	1.5	—	—	25 – 35	1.5	25 – 35	1.5	25 – 35	1.5	—	—
Natural gas	25 – 48	1.5	30 – 47	1.0	25 – 48	1.0	25 – 48	1.0	25 – 48	1.0	25 – 47	1.0
Refinery gas	25 – 50	1.5	—	—	25 – 50	1.5	25 – 50	1.5	25 – 50	1.5	—	—
Liquefied petroleum gas (LPG)	40 - 90	1.5	—	—	40 - 90	1.5	40 - 90	1.5	40 - 90	1.5	—	—

1.9 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 N_2, O_2, or CO_2, reduce the measuring range span.

1.10 Environmental conditions

NOTICE

When the combustion calorimeter is used outside of the environmental conditions, additional measures (air conditioning of the combustion calorimeter, etc.) must be agreed on with UNION Instruments GmbH!

Installation location:	Installation room required (☞ *Chapter 4*)
Room temperature:	5 – 40 °C
Temperature change	≤ 5 °C per hour
Air humidity:	0 – 95 % rel. humidity
Ambient pressure:	800 – 1100 hPa (0.8 – 1.1 bar)

2 EU Declaration of Conformity

CE

Der Hersteller / The manufacturer

UNION Instruments GmbH
Zeppelinstraße 42
76185 Karlsruhe

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

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

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

2014/30/EU	**Elektromagnetische Verträglichkeit**
2014/30/EU	**Electromagnetic compatibility**
2014/35/EU	**Elektrische Betriebsmittel zur Verwendung innerhalb bestimmter Spannungsgrenzen**
2014/35/EU	**electrical equipment designed for use within certain voltage limits**

Angewandte harmonisierte Normen / Used harmonized standards:

EN 61010-1:2010	Sicherheitsbestimmungen für elektrische Mess-, Steuer-, Regel- und Laborgeräte - Teil 1: Allgemeine Anforderungen Safety requirements for electrical equipment for measurement, control, and laboratory use - Part 1: General requirements
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: Name delegate of documentation	Schlichter
Adresse des Dokumentationsbevollmächtigten: address delegate of documentation	siehe Adresse des Herstellers 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 information

3.1 Warning information and symbols

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

DANGER

For an immediate danger that can lead to serious physical 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 observance of these operating instructions! In addition to the following safety information, the safety information of linked system components must also be observed!

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

The combustion calorimeter is a sensor system for determining the combustion value of different process gases. The analysis serves the process control.

The combustion calorimeter is intended for use in weather-proof areas and for fixed mounting and installation.

The combustion calorimeter is not suitable for operation in hazardous areas.

In the case of toxic or explosive gases, the safety provisions applicable at the installation location must be complied with.

Any use beyond this is regarded as intended use. The manufacturer is not liable for damage resulting from this. In this case, the risk is borne solely by the installation engineer/commissioning engineer/owner/operator.
Only skilled persons are permitted to make changes to the combustion calorimeter (mechanical/electrical/pneumatic changes).

3.3 Personnel and qualification

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

3.4 Safety information

3.4.1 General safety information

⚠ WARNING

Only operate the combustion calorimeter when all protective equipment is present and operational!

Further safety information:

☞ Before the corresponding chapters!

3.4.2 Information on specific hazards

⚠ DANGER

- **After installation, all gas-conveying parts must be checked for leak tightness according to national regulations.**
- **Any type of repair that requires opening of the protective cover may only be carried out by instructed qualified personnel!**

3.4.3 Note on explosion protection

NOTE

The operation/installation of a UNION combustion calorimeter does not produce a hazardous area because combustible gas does not escape from the calorimeter and form an explosive atmosphere.

No combustible gas escapes from the UNION combustion calorimeter because:

- **in conformity with the intended use of the combustion calorimeter, the gas is combusted in the device,**
- **the gas supply in the device is shut off as soon as the flame in the burner goes out or if the fan fails, and**
- **the gas-conveying lines can be regarded as technically leak-proof on a continuing basis (compression fittings) or through a systematically recurring testing of tubes and membranes described in the operating instructions.**

All gas inputs in the combustion calorimeter are provided with solenoid valves. The solenoid valves close automatically in the event of a fault during combustion or ignition of the gas mixture.

The solenoid valves are closed in current-free state.

3.5 Safety precautions on the owner side

⚠ WARNING

- **The owner must provide suitable protective equipment for the combustion calorimeter that can reliably prevent injuries to personnel, e.g., from escaping gas.**
- **Exhaust discharged process gas to a safe environment!**
- **Tripping hazard from improperly routed supply lines!**

Other owner-side safety precautions ☞ *corresponding chapter!*

3.5.1 Recurring operator training

NOTE

Country-specific regulations regarding recurring training of operators must be observed by the owner, particularly with regard to the handling of hazardous areas, gases, and electrical equipment.

3.5.2 Performing a workplace hazard analysis

NOTE

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

Deviations from these operating instructions may occur due to further technical developments. If you desire additional information or if specific problems arise that are not covered in detail in this manual, you will receive information by contacting the following address:

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💻 http://www.union-instruments.com

4 Protective equipment

4.1 Main switch

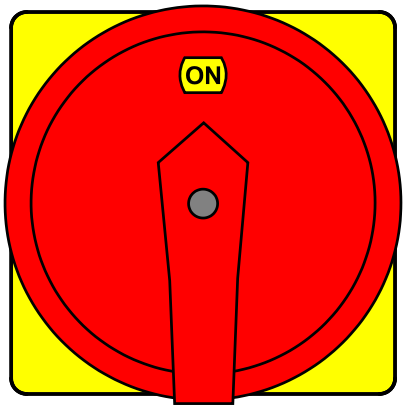


Fig. 4.1: Main switch (example)

4.2 Safety switch

The safety switch disconnects the ignition transformer from the voltage supply when the upper door is opened.

Fig. 4.2: Figure Safety switch (example)

4.3 Thermal cutoff

NOTE

The tripping temperature of the thermal cutoff is 72 °C.

When tripped, the thermal cutoff disconnects the 24 V voltage supply of the solenoid valves.

4.4 Solenoid valve

In the event of malfunctions, the solenoid valves of the combustion calorimeter close automatically. A restart of the combustion calorimeter is necessary.

4.5 Fan

The fan mixes exhaust gases produced during combustion with fresh air and ensures an appropriate volume flow. The fan is speed-monitored. If the fan fails, the combustion calorimeter goes to a safe state.

4.6 Door enclosure

Protective covers of the housing separate electrical components and hot surfaces of the environment.

4.7 Markings and warning information

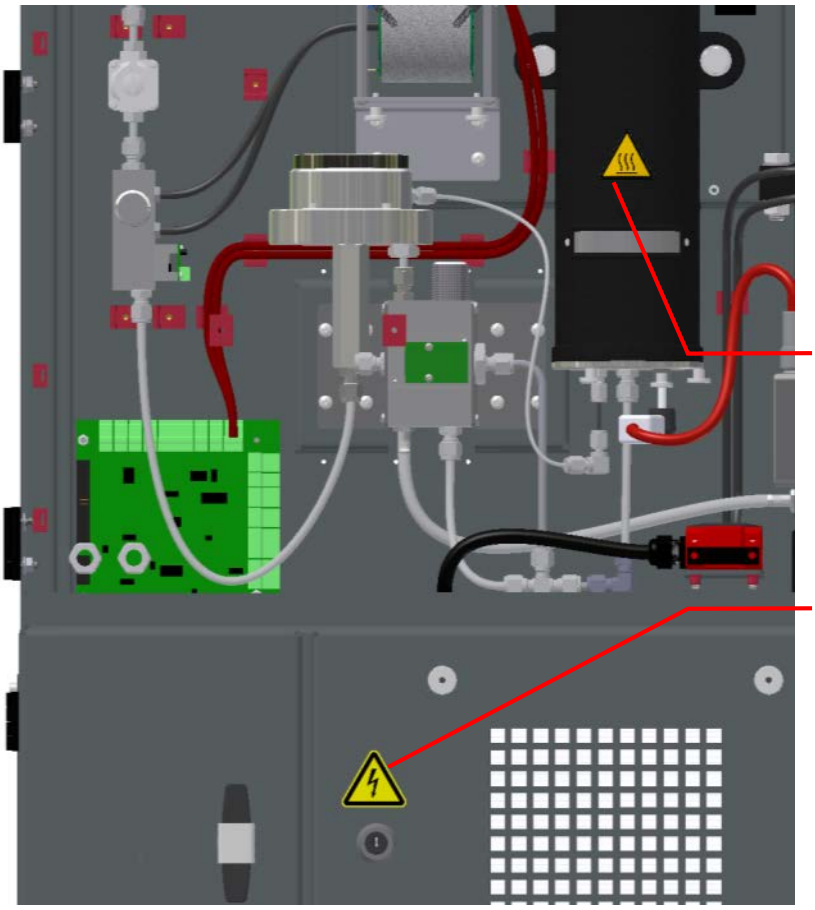


Fig. 4.3: Markings and warning information (example)

Item No.	Description
1	Warning information: hot surface (internal)
2	Warming information: electricity (external)

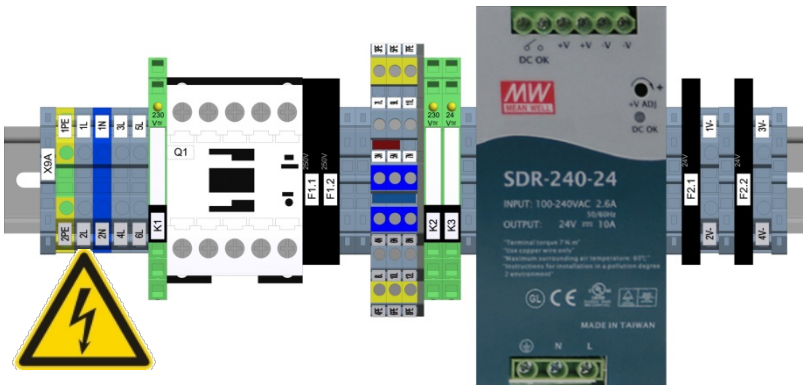


Fig. 4.4: Warning information on electrical connection plate (example)

5 Description and connections

5.1 Enclosure connections outside

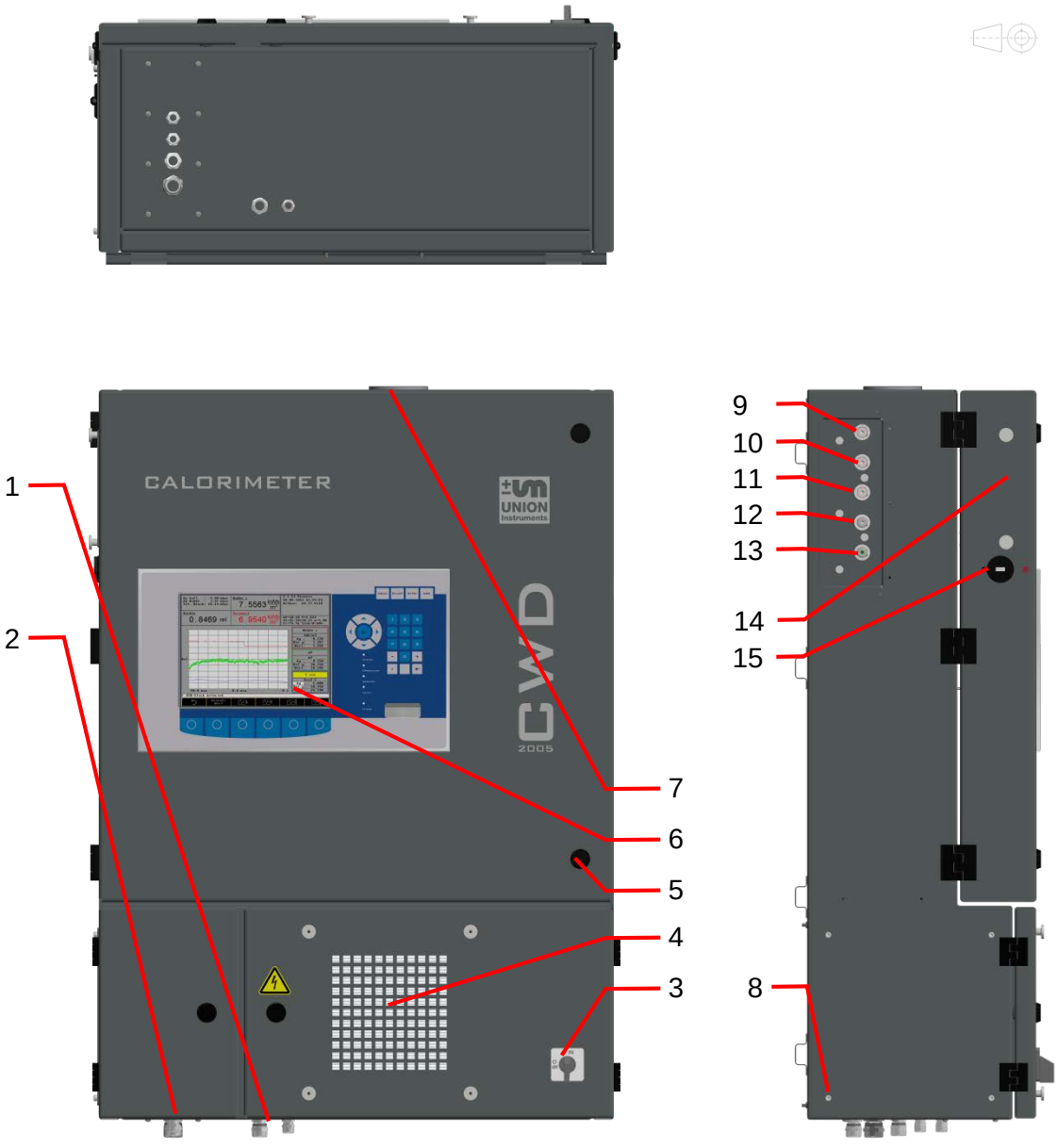


Fig. 5.1: Housing connections

Item No.	Description
1	Cable glands for power supply
2	Cable glands for signals
3	Main switch
4	Filter cover

Item No.	Description
5	Door interlock (4 pieces)
6	Display
7	Flue exhaust
8	Cover for analog signals (4 pieces)
9	Fast Loop output (optional)
10	Carrier gas input
11	Calibration gas input (SV X14/3-4)
12	Calibration gas input (SV X14/1-2)
13	Process gas input (SV X11/1-2)
14	Cover for interface connections (2 pieces)
15	USB connection

5.2 Connections and components inside

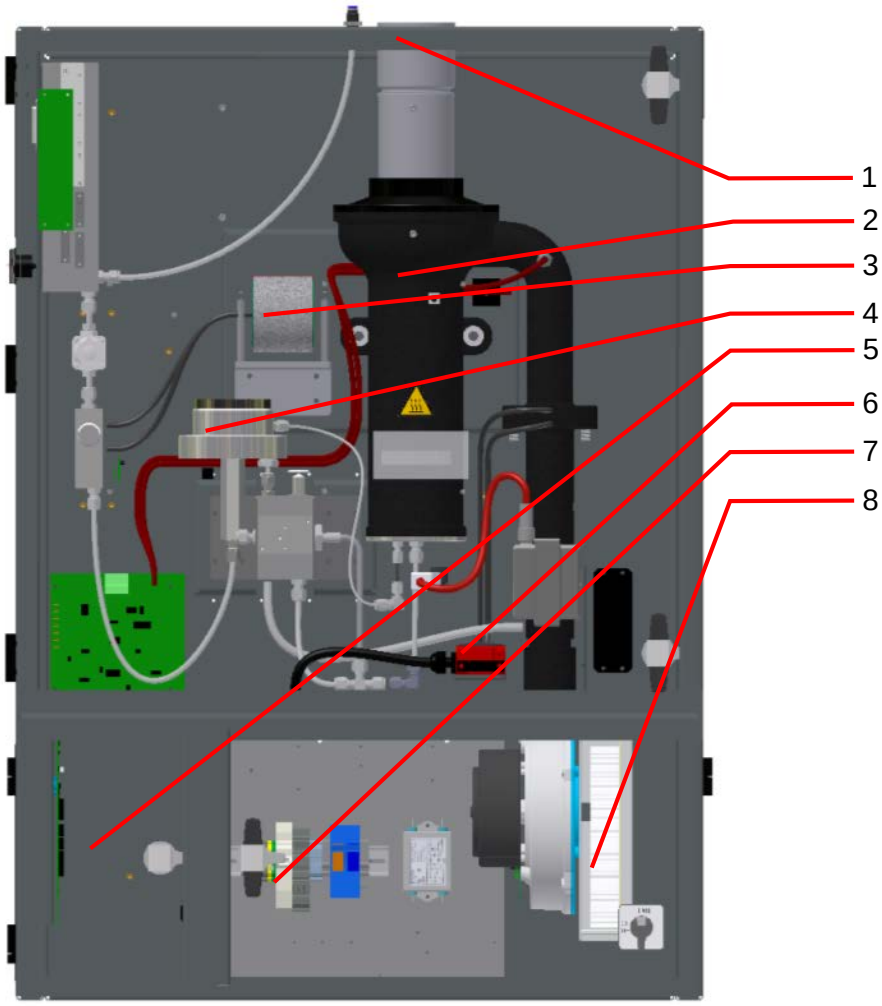


Fig. 5.2: Housing without doors, example

Item No.	Description
1	Thermal cutoff (behind the exhaust gas pipe, on the rear wall)
2	Thermal element
3	Density measuring cell
4	Precision pressure controller
5	Electronic input and output signals
6	Safety switch for ignition transformer
7	Power supply distribution rail, example
8	Fan

5.3 Accessories

WARNING

Risk of injury/damage!

The use of non-approved accessories may cause damage and endanger persons. Any warranty is voided in this case! The owner is then liable for damage that occurs!

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.

When it is not commissioned by UNION Instruments GmbH (e.g., internal transport/resale), the suitable procedure must be agreed with UNION Instruments GmbH *(☞ Chapter 13 Service)*.

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) must be arranged within seven days.

Ensure before starting or restarting transport that all transport securing devices are attached.

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 environmental conditions!

6.2.1 Storage conditions

NOTE

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

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

6.3 Installing and connecting

6.3.1 Installation location

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

- Clean room that may be used only for purposes of gas analysis and measurements.
- At least 50 cm working space on the left side
- Lockable windows
- Protected from direct influence by the weather and direct solar radiation
- Stable room temperature
- Provided with clean and adequate ambient air for unbiased measurement result (combustion calorimeter requires approximately 30 m³/h air)
- Adequate load bearing capacity of the wall is ensured
- Mounting on a solid wall

6.3.2 Room ventilation

WARNING

Risk of injury due to temperature of exhaust gas/housing!

The exhaust gas temperature is between 8 - 20 °C above the housing temperature!

Use personal safety equipment to prevent burns!

NOTE

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

The following conditions must be met:

- No direct fresh air introduction in the combustion calorimeter.
- Exhaust gases must be discharged to the environment protected from air draft using a suitable pipe/tube and with the help of corresponding fresh air mixing. Connection points must be checked for leak tightness.

6.3.3 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!

NOTE

Adequate distance must be provided between the side wall of the installation location and the combustion calorimeter for service and maintenance.

The combustion calorimeter is intended to be wall-mounted. The wall brackets are provided and must be secured to the wall.

The wall used for mounting must be sufficiently sturdy to bear the weight of the combustion calorimeter.
Cross-struts are installed in a fixed manner on the back of the combustion calorimeter as the counterpart of the wall brackets.

Fig. 6.1: Wall mounting

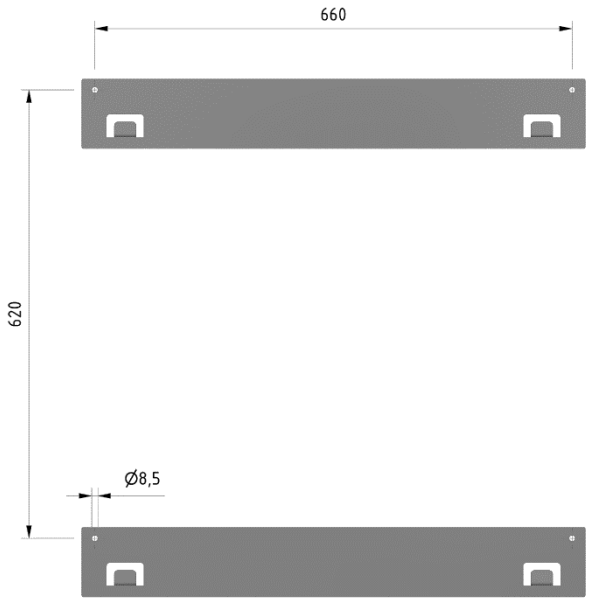


Fig. 6.2: Dimensions wall mounting

6.3.4 Process gas

WARNING

Gas connections may only be installed by qualified personnel!

Exhaust gases must be discharged by the owner to a safe environment!

NOTE

- **Connection parts must be clean and free of residues. Contaminants may reach inside the combustion calorimeter and may cause false measurements and/or damage.**
- **Process gas connection / compression fitting on side of combustion calorimeter**
- **Gas input pressure depending on gas between 20 - 40 mbar.**
  ☞ *Chapter 1* Technical data
- **The input pressure for the gas connections must not exceed the specifications of the technical data of the combustion calorimeter.**
- **Process gas must be free of contaminants and condensate.**
- **Each connection point must be carefully checked for leak tightness. When leaks are present, the system draws air and indicates false measured values.**
- **Do not use sealant for sealing the gas connections. Sealant ingredients may falsify the measurement result.**
- **Only suitable lines may be used.**

6.3.5 Carrier gas supply

NOTE

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

6.3.6 Calibration gas

⚠ WARNING

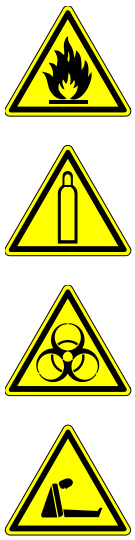
Gas connections may only be installed by qualified personnel!

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

NOTE

- **Connection parts must be clean and free of residues. Contaminants may reach inside the combustion calorimeter and may cause false measurements and/or damage.**
- **Calibration gas connection / compression fitting on side of combustion calorimeter**
- **The input pressure for the gas connections must not exceed the specifications of the technical data of the combustion calorimeter.**
- **Calibration gas must be free of contaminants and condensate.**
- **The calibration gas quality must be similar to the process gas quality.**
- **Each connection point must be carefully checked for leak tightness. When leaks are present, the system draws air and indicates false measured values.**
- **Do not use sealant for sealing the gas connections. Sealant ingredients may falsify the measurement result.**
- **Only suitable lines may be used.**
- **For device versions with 2 or 3 measuring ranges, up to 2 calibration gases may be necessary.**
- **Software-side configuration of the calibration gas.**
  (☞ Chapter 9.3 Available Displays)

6.3.7 Flue gas



WARNING

Risk of serious injury from escaping flue gases!

- **Flue gases must be discharged to the outside!**
- **For flue gases containing CO, H_2, and H_2S, adequate room ventilation must be ensured.**

NOTE

Flue gases/residual heat must be discharged to the outside protected from air draft and without interruption through a vent.

An accumulation of residual heat leads to false measurement results.

6.3.8 Electrical connection

DANGER

Danger of electric shock!

Changes to the electrical equipment of the combustion calorimeter may be carried out only be skilled electricians in accordance with 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, disconnect the combustion calorimeter from the supply network.

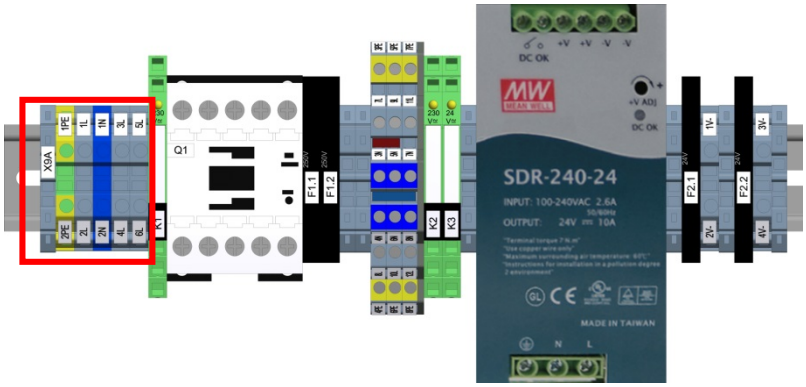


Fig. 6.3: Electrical connection plate, example

Connect the combustion calorimeter to the voltage supply using connections L1, N, PE in accordance with national requirements.

⚠ 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.

NOTE

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

6.3.9 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!

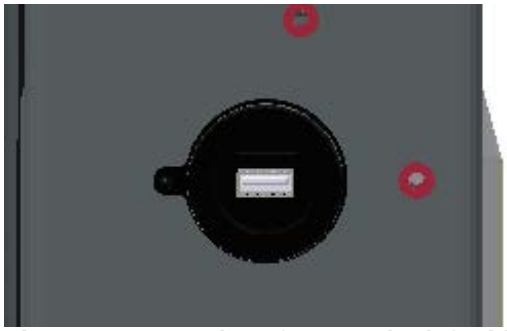


Fig. 6.4: USB interface on the left side of the housing

The USB interface is used for transferring data. A memory stick is supplied with the device.

6.3.10 Connector assignment Input-Output IOexternal

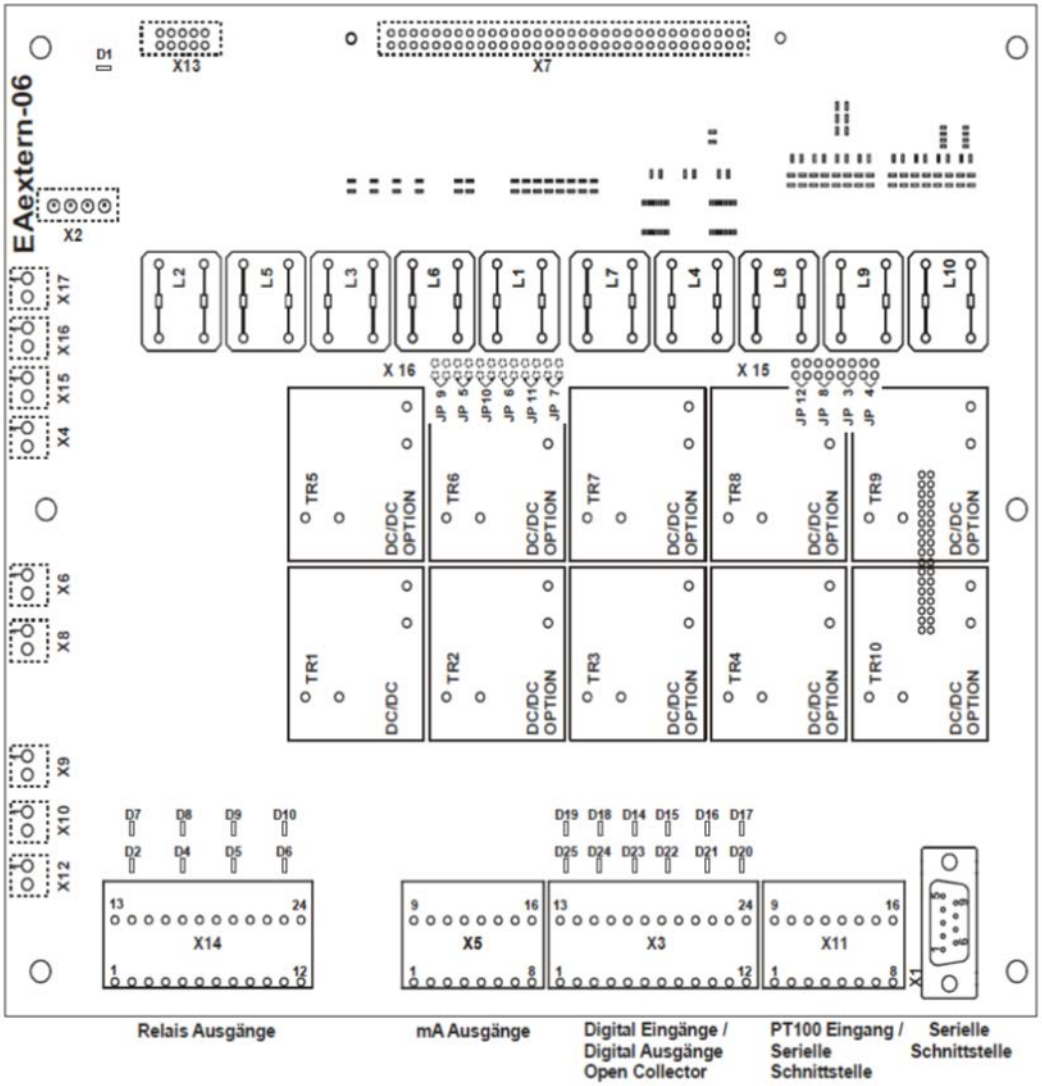


Fig. 6.5: Connector assignment Input-Output IO type 06

WARNING

Do not connect to line voltage!

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

Only connect serial interface – RS232 – to an electrically safe device!

Relay outputs Connector X14

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, if applica-	D 7
	14	Normally open	ble	
	15	Normally closed	optionally assigned	
6	16	Common	Function, if applica-	D 8
	17	Normally open	ble	
	18	Normally closed	optionally assigned	
7	19	Common	Function, if applica-	D 9
	20	Normally open	ble	
	21	Normally closed	optionally assigned	
8	22	Common	Function, if applica-	D 10
	23	Normally open	ble	
	24	Normally closed	optionally assigned	

mA outputs Connector X5

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, if applica-	TR 4/JP 8
	8	-mA	ble	
			optionally assigned	
5	9	+mA	Function, if applica-	TR 5/JP 9
	10	-mA	ble	
			optionally assigned	
6	11	+mA	Function, if applica-	TR 6/JP 10
	12	-mA	ble	
			optionally assigned	
7	13	+mA	Function, if applica-	TR 7/JP 11
	14	-mA	ble	
	15	n.c.	optionally assigned	
	16	n.c.		

Digital control inputs Connector X3

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, if applica-	D 23
	6	ble	
		optionally assigned	
4	7	Function, if applica-	D 22
	8	ble	
		optionally assigned	
5	9	Function, if applica-	D 21
	10	ble	
		optionally assigned	
6	11	Function, if applica-	D 20
	12	ble	
		optionally assigned	
7	13	Function, if applica-	D 19
	14	ble	
		optionally assigned	
8	15	Function, if applica-	D 18
	16	ble	
		optionally assigned	

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

6.4 Commissioning after installation

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!

6.4.1 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:

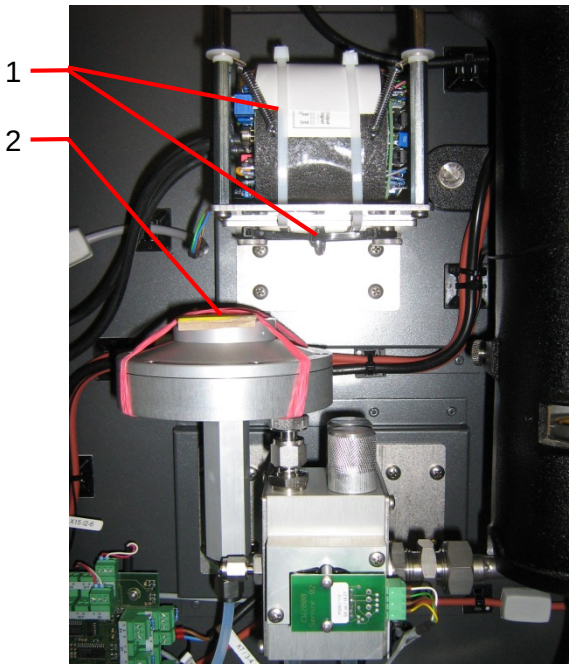


Fig. 6.6: Transport securing devices

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

Transport securing device in the pressure controller

Fig. 6.7: 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 belt. • 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 black cable ties from the center eyebolt. • Remove the white cable ties around the density measuring cell. • Loosen the eyebolt. • Density measuring cell must swing free.

Proceed in reverse order to reattach the transport securing device.

6.5 Documentation

NOTE

UNION Instruments GmbH recommends keeping a maintenance manual 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 be 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:
☞ Right column!

Steps	Commissioning	Switch-ingon
Check whether the transport securing device has been removed. The density cell must be able to swing freely at the springs.	X	
Check whether the transport securing device of the gas pressure controller has been removed. The foam material within the controller must be removed.	X	
Check whether environmental conditions (☞ *Technical data)* meet the requirements.	X	
Check whether the combustion calorimeter is securely mounted.	X	
Check whether the device is suitable for the process gas.	X	
Check whether the process gas is correct.	X	
Check whether the gas connections are correct and leak-tight.	X	
If applicable, check whether the calibration gas is correct.	X	
Furnish/switch on owner-side energy supplies and media supply.	X	

Steps	Com-mis-sioning	Switch-ingon
Check whether the transport securing device has been removed. The density cell must be able to swing freely at the springs.	X	
Ensure voltage.	X	
Ensure that the door is closed (safety switch).	X	X
Switch on the main switch.	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!		

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

Item No.	Description	Function/Activity
1	Display	Displaying status and operation
2	Main switch	Switching the device On/Off

9 Operation

WARNING

Risk of injury!

Only operate the combustion calorimeter when all lines are installed and have been checked for leak tightness in accordance with 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 pressing them.

NOTE

Damage to membrane keyboard!

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

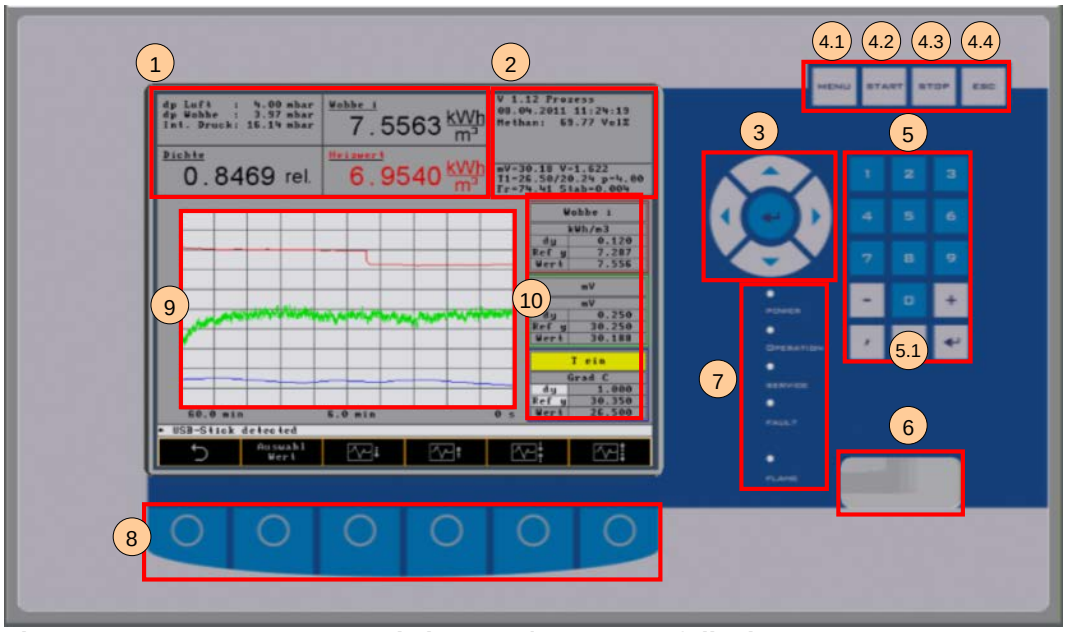


Fig. 9.1: Operator control elements/Structure of display

Item No.	Description	Function
1	Numeric display	Output of current measured values
2	Display field	Information field
3	Arrows/Return	Arrow keys enable movement to an input field. The Return 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 the 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 memory stick.
6	Inspection window	Inspection window for monitoring the ignition or combustion process.
7	LED status display	Power: Device switched on Operation: only in the process or during calibration Service: Service needed (filter, temp., etc.) Fault: Major fault Flame: Flame is burning
8	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. ☛ *Chapter 9.2* Basic operation*!*
9	Graphic display	Graphic display of current measured values
10	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

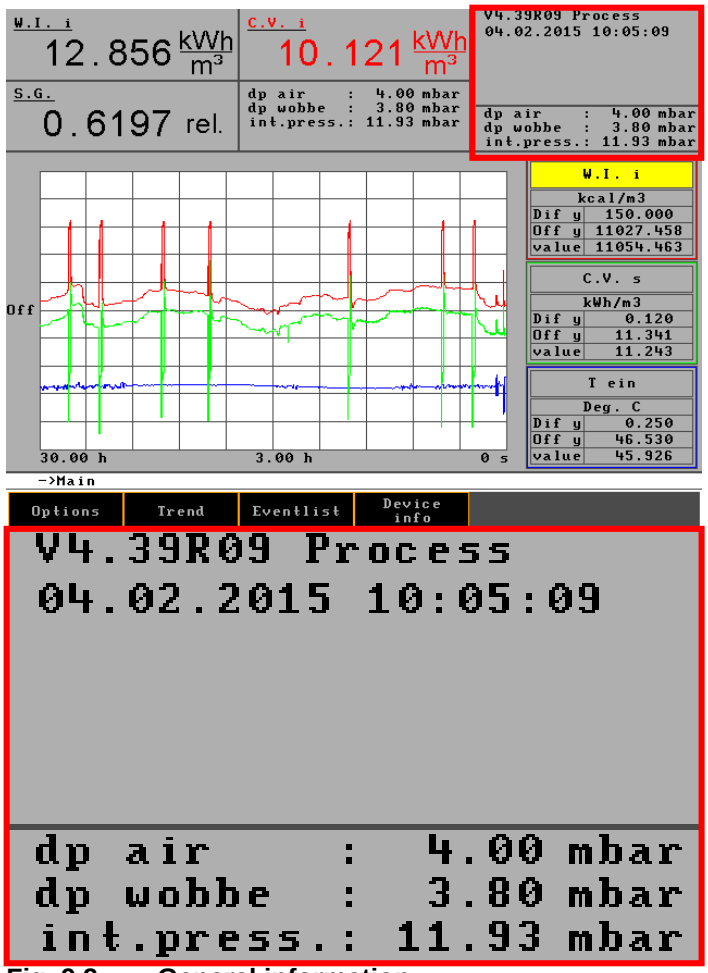


Fig. 9.2: General information

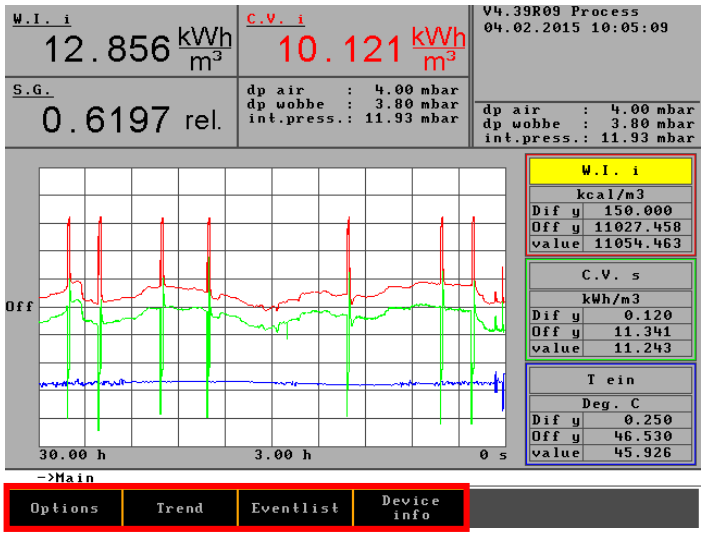
Display (example values)	Information
V 4.39R09	Version number of the software
04.02.2015 10:05:09	Current date / time
Methane: 95.01 Vol%	Volume share of methane
mV=24.56	mV signal of the thermal battery
V=1.071	Voltage signal of the density measuring cell
T1=29.04/0.24	Inlet temperature into the thermal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

NOTE

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

9.5 Menu structure

9.6 Main menu

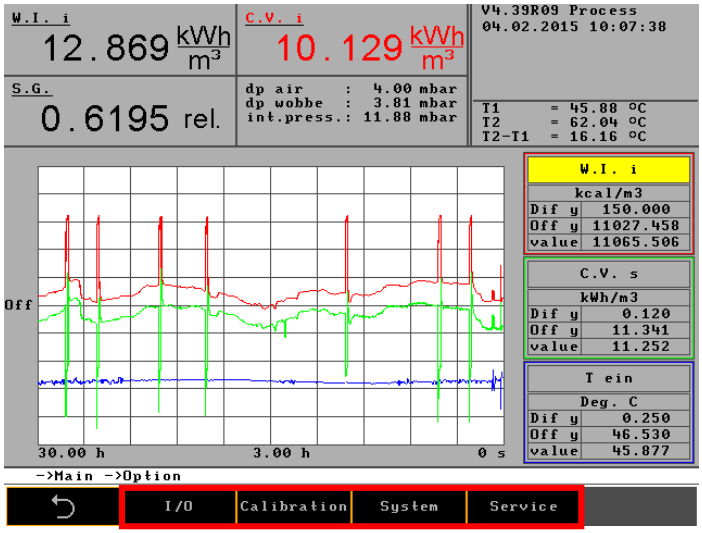


The main menu is the standard display during active operation.

The following menus are accessed from the main menu:

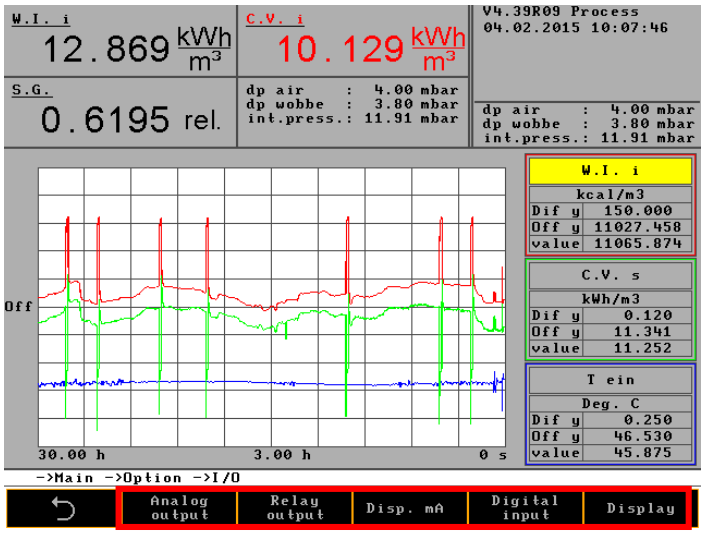
- Options
- Trend
- Eventlist
- Device info

9.6.1 Main menu - Options



I/O	Configuration possibility for the following parameters: • Analog outputs • Digital (relay) outputs • mA display • Digital inputs • Display
Calibration	Configuration possibility for the following parameters: • Configuration of calibration gas • Automatic calibration • Automatic calibration 2 • Calibration • Save base calibration • Calibration limits
System	Configuration possibility for the following parameters: • General • Ignition • Update • Load factory settings • CSV export • Hold signal On/Off • Settings (e.g., date, language, password) • Disable system
Service	For service technician only

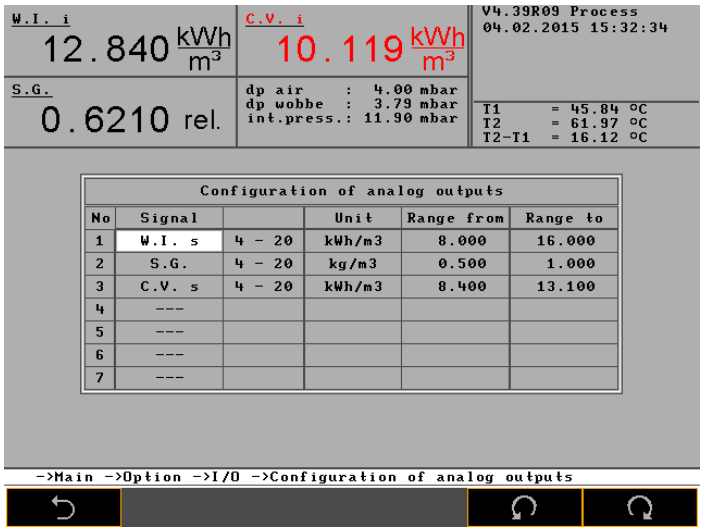
Main menu - Options - I/O



Options for configuration for the following parameters:

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

Main menu - Options - I/O - Analog outputs



The mA signals are configured in this menu.

Signal (list field)	Wobbe-index, density, heating value,
Type (list field)	4 – 20 mA
Unit (list field)	kcal/m³, relative
MB from MB to	value fields for numeric input

The following must be observed for this:

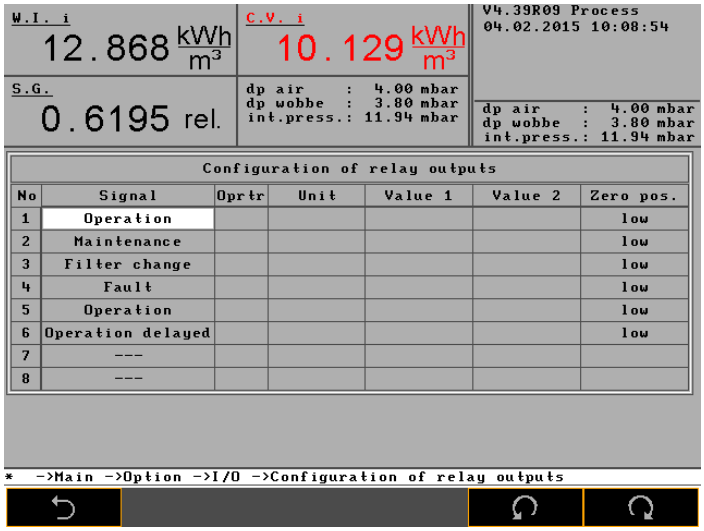
Units:

xxx/m³ and BTU/ft³ correspond to a gas temperature of 0 °C and a barometric pressure of 1013 mbar.
xxx/Sm³ corresponds to a gas temperature of 15 °C (60 °F) and a barometric pressure of 1013 mbar.

☞ xxx stands for MJ, kcal, or kWh.

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

Main menu - Options - I/O - Digital outputs



Digital signals (relay outputs, 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 process 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 a foreseeable time, but is still ready for operation. The reason for maintenance can be obtained from the "General information" field. Examples of reasons include:

- Filter change (air filter)
- No calibration gas (calibration canceled)
- Room temperature too high (air inlet temperature > 41 °C)
- Gas pressure 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, 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.

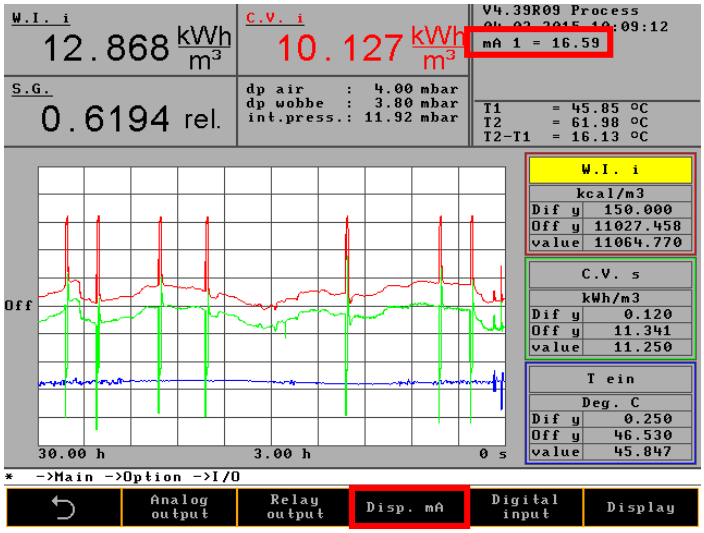
Calibration deviation:

The value determined during base calibration is exceeded or fallen below.

Internal pressure:

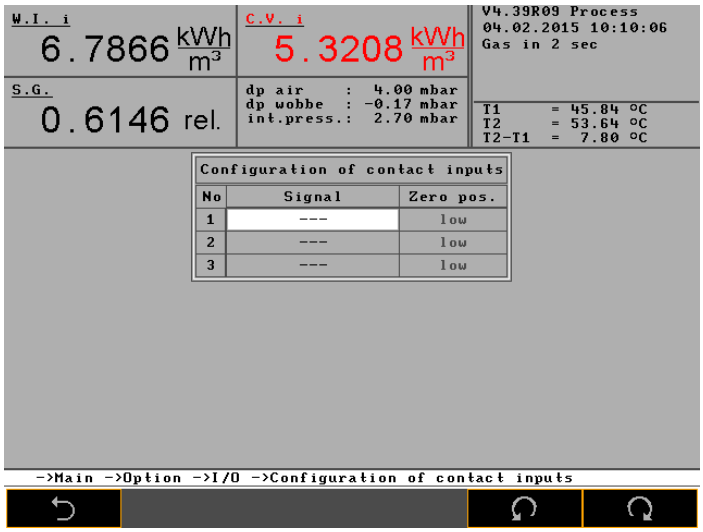
Insufficient process or calibration gas.

Main menu - Options - I/O - mA display



The mA values for the currently active outputs are displayed in this menu. With the Disp. mA 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



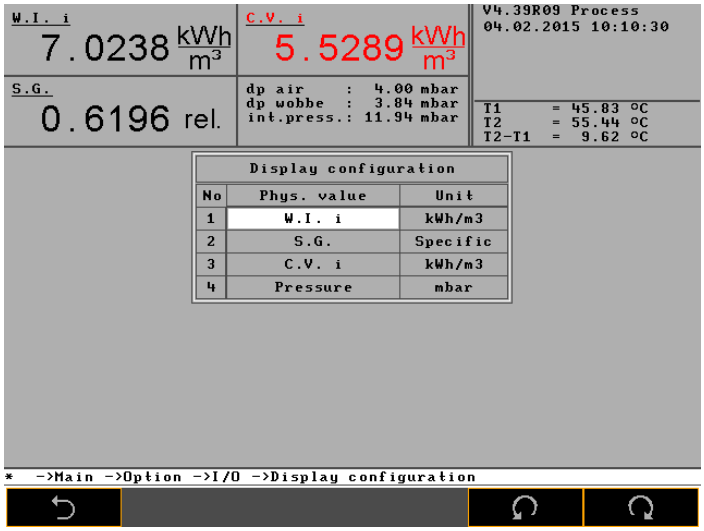
Various digital signals are configured in this menu.
The following must be observed for this:

The pin assignment is preassigned.

☞ *Chapter 6.3.10 Connector assignment Input-Output IOexternal!*

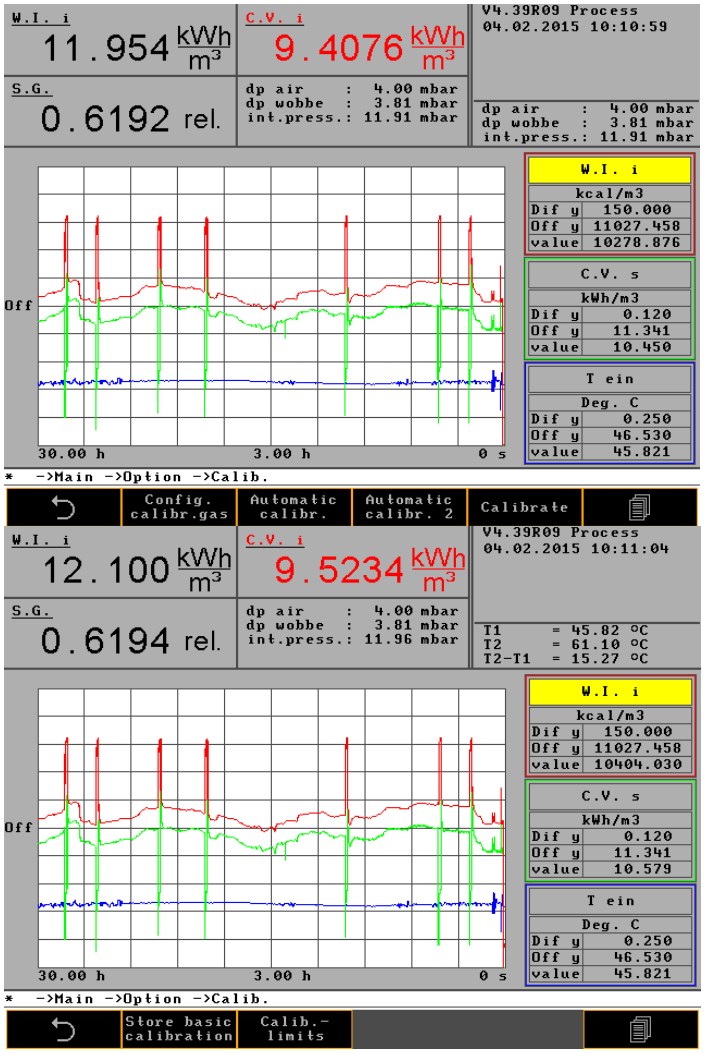
Signals	Zero position	Contact	CWD2005
Start calibration	high	open	Calibration starts
		closed	No calibration
	low	open	No calibration
		closed	Calibration starts
Start measurement	high	open	Measuring starts
		closed	Measuring stops
	low	open	Measuring stops
		closed	Measuring starts
Hold signals	high	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



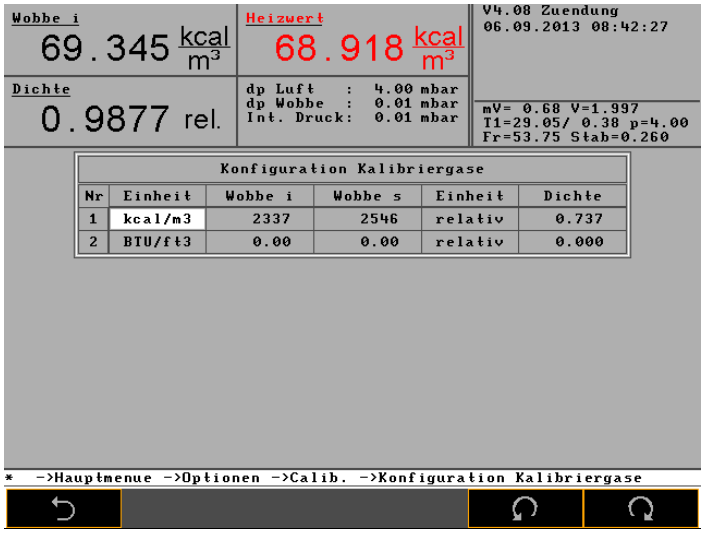
The display of measured values is configured in this display.
A signal and a unit is assigned to each of the 4 display windows.

Main menu - Options - Calibration



Calibration values are configured in this menu.

Main menu - Options - Calibration - Configuration of calibration gas



The calibration gas is configured in this menu.

The following must be observed for this:

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.

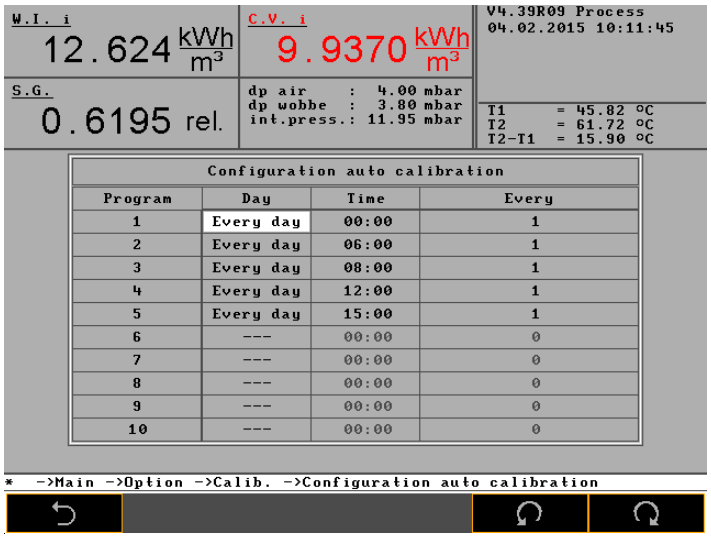
Units:

xxx/m³ and BTU/ft³ correspond to a gas temperature of 0 °C and a barometric pressure of 1013 mbar.
xxx/Sm³ corresponds to a gas temperature of 15 °C (60 °F) and a barometric pressure of 1013 mbar.

☞ xxx stands for MJ, kcal, or kWh.

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

Main menu - Options - Calibration - Automatic calibration



The automatic calibration is configured in this menu.

The following must be observed for this:

Input:

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

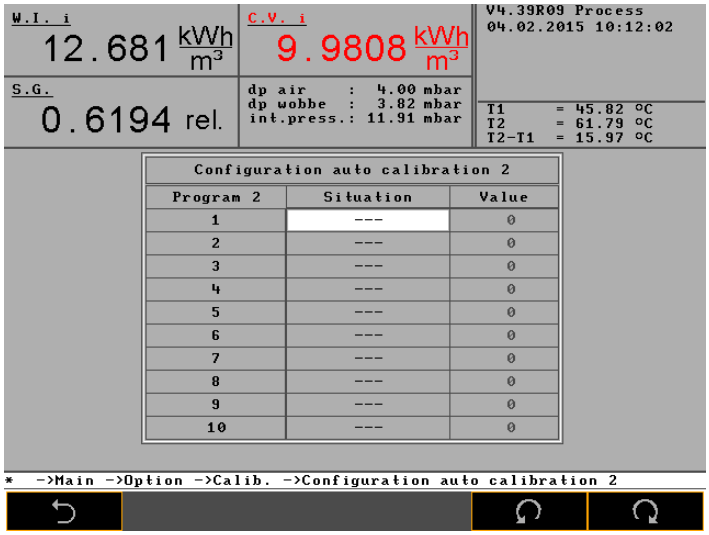
Duration of calibration:

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

NOTE

At a restart of the device or at 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



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.

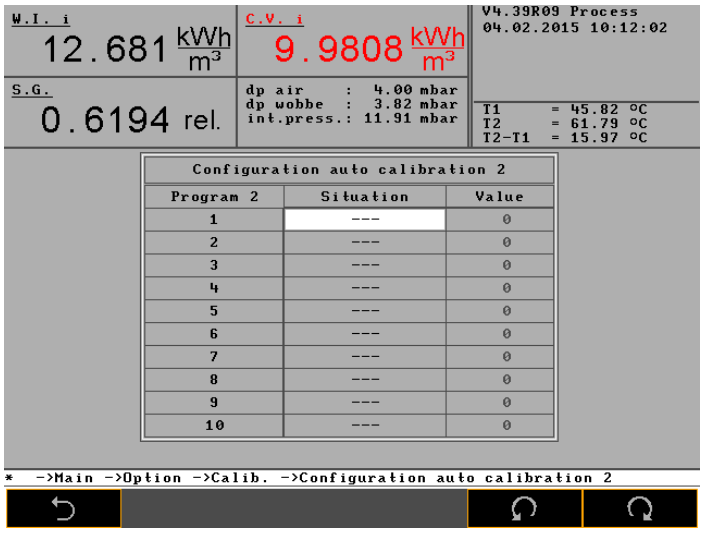
Main menu - Options - Calibration - Calibration

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

Main menu - Options - Calibration - Save base calibration

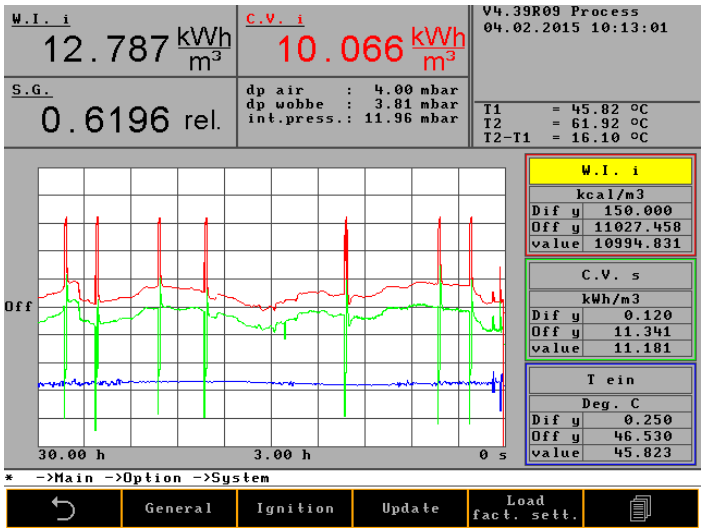
The measured values are saved with this key. These values are reference values for additional calculations during the next calibration. Any deviations from these reference values are stored in the event list.

Main menu - Options - Calibration - Calibration limits



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.

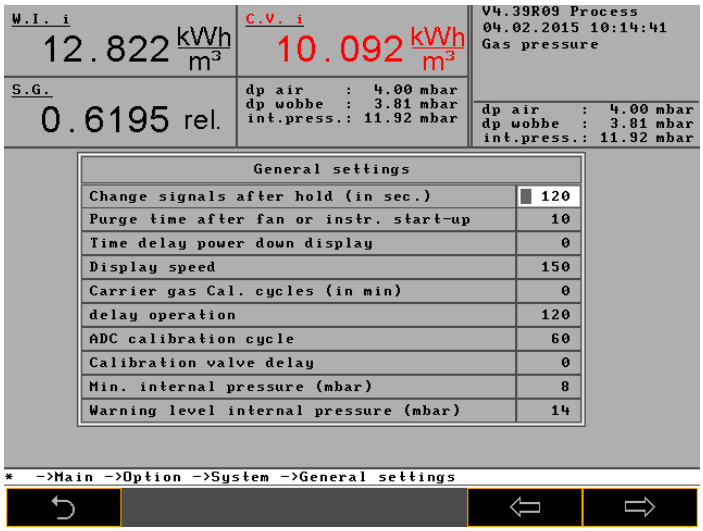
Main menu - Options - System



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.



General system values are configured in this menu.

The following must be observed for this:

Change signals after holding:

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

Purge time after cooling:

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

Screen switch-off time:

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

Display speed:

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

Carrier gas check cycles:

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

Operation delay:

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

Minimum internal pressure:

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

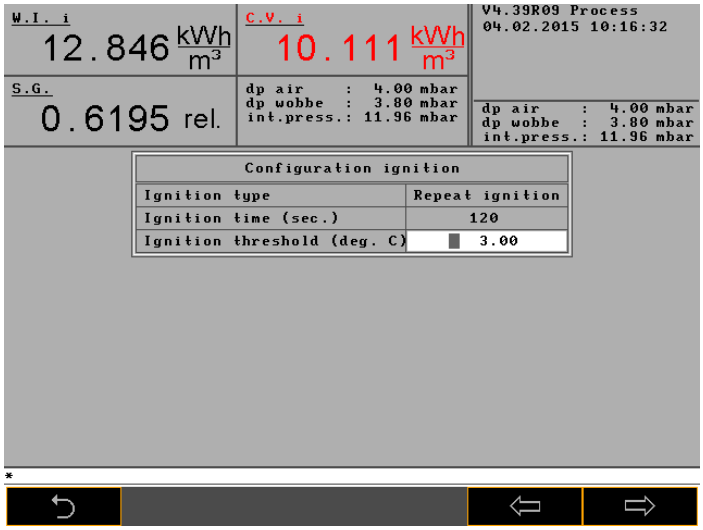
Internal pressure warning threshold:

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

Main menu - Options - System - Ignition

NOTE

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



The ignition monitoring is configured in this menu.

The following must be observed for this:

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 STOP state.

Interval ignition:

After device start and the flushing time period (10 sec), 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 - Ignition

An update from a memory 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 ASCI 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, for example, with MS Excel.

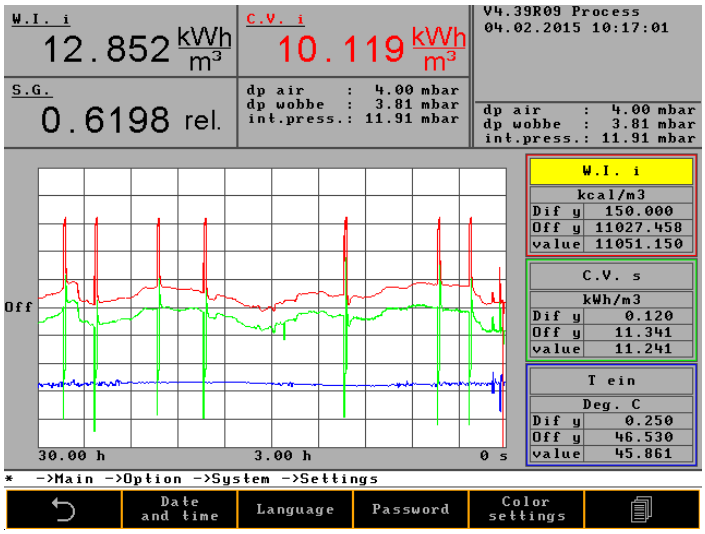
Main menu - Options - System - Hold signal On/Off

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

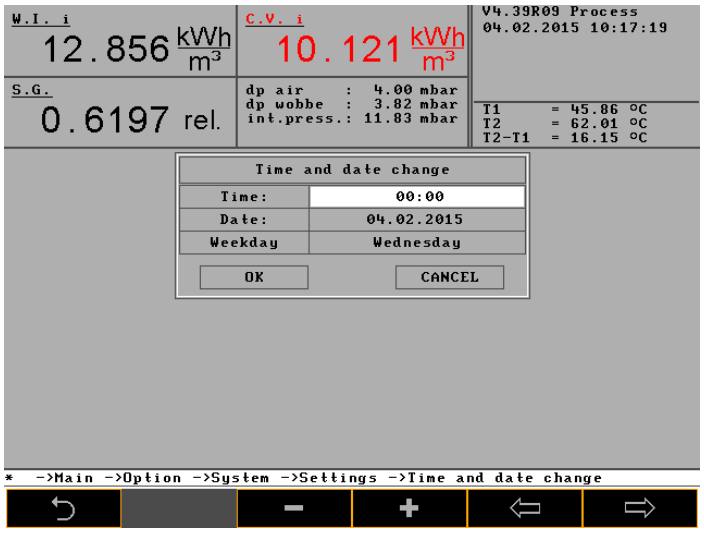
Hold signal:

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 sec).

Main menu - Options - System - Settings



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

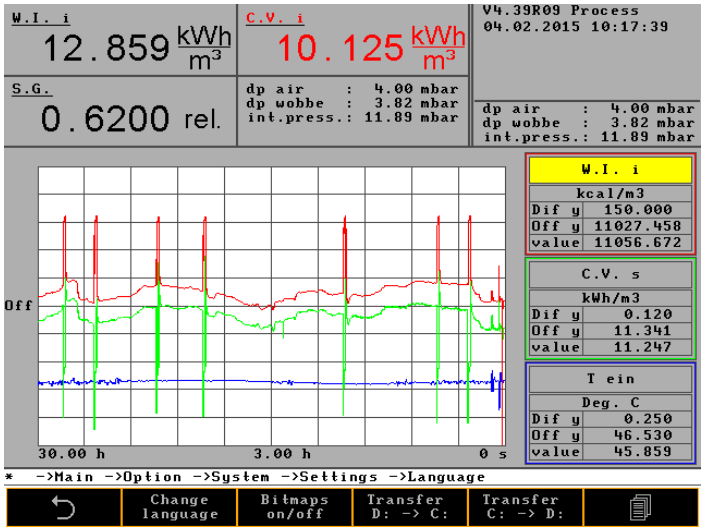


The date and time are set in this menu.

+	Increments selected numbers
–	Decrements selected numbers
⇦	Moves one field left
⇨	Moves one field right

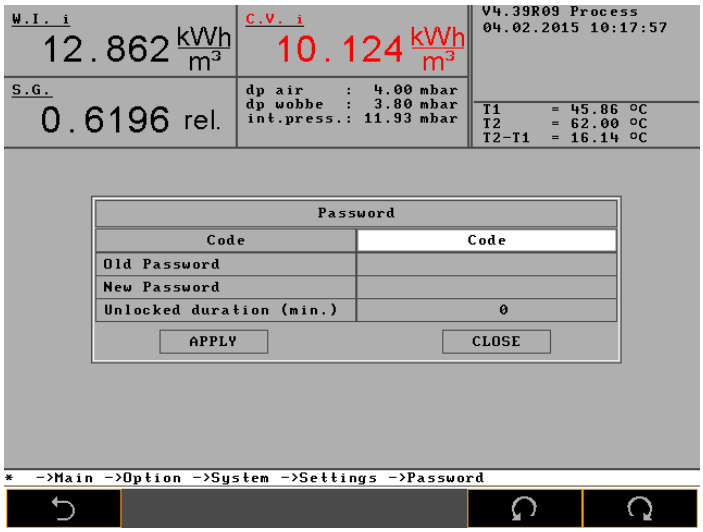
Main menu - Options - System - Settings - Language

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). Download languages onto a memory stick, correct them, and then re-import them to the combustion calorimeter.



The language is changed or your own bitmaps are configured in this menu.

Main menu - Options - System - Settings - Password



The password is changed in this menu.

The following must be observed for this:

Factory password:

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

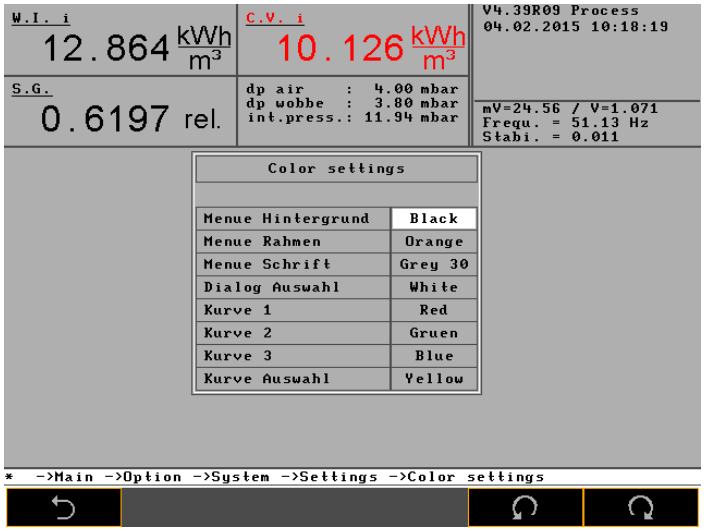
Unlock time:

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 then no longer be unlocked!

Main menu - Options - System - Settings - Change color

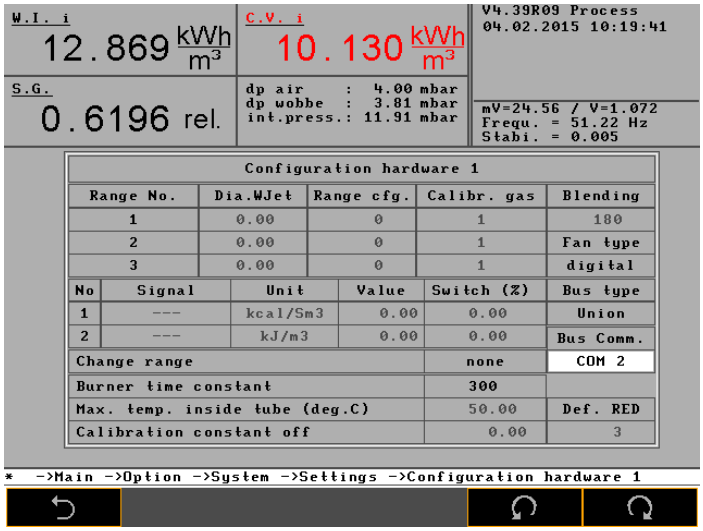


The display colors can be changed here.

Main menu - Options - System - Settings - Hardware 1

NOTE

Only change this menu in consultation with the manufacturer.



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

The screen shows all possible configurations.

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

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

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

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

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

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

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

No. indicates switchover point 1 and 2.

Signal indicates the physical unit of the measurement value.

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

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

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

- non
- automatic
- manual

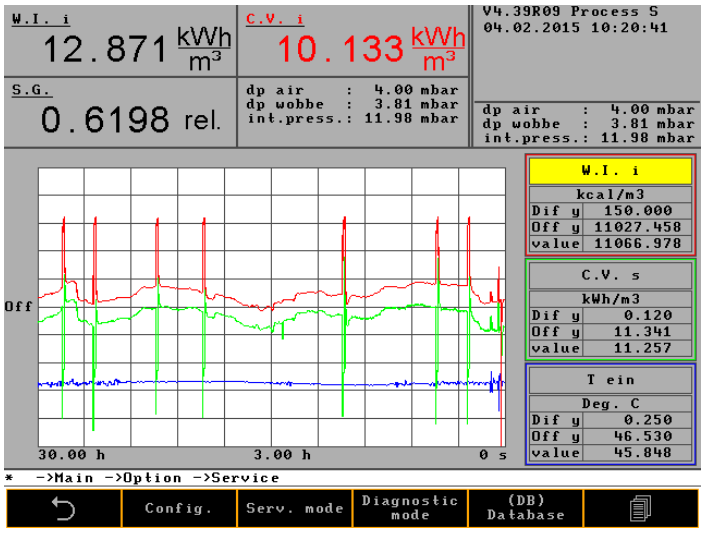
The time constant of the burner is a factor determined for every burner. Sewage gas burners have another factor than burners for natural gas. Every burner type has its own coefficient.

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

Main menu - Options - Service

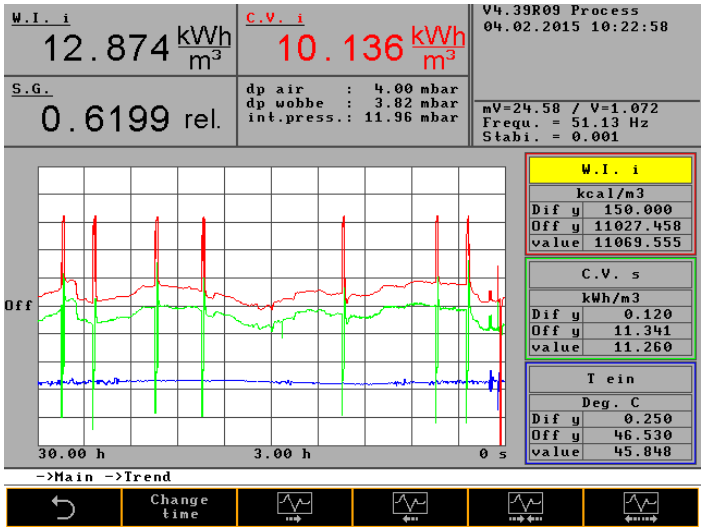
NOTE

Only change this menu in consultation with the manufacturer.



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

9.6.2 Main menu - Trend



The graphics are configured in this menu.

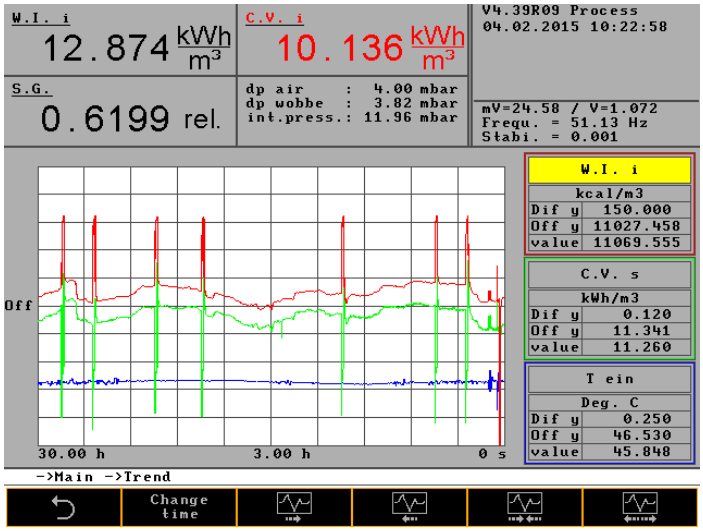
The following must be observed for this:
Up to three different curves in various colors can be displayed.

Selection:

A selection can be made from the following parameters:

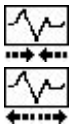
- Select time
- Select value
- Select signal
- Select unit
- Select curve

Main menu - **Graphic** - **Select time**



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

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

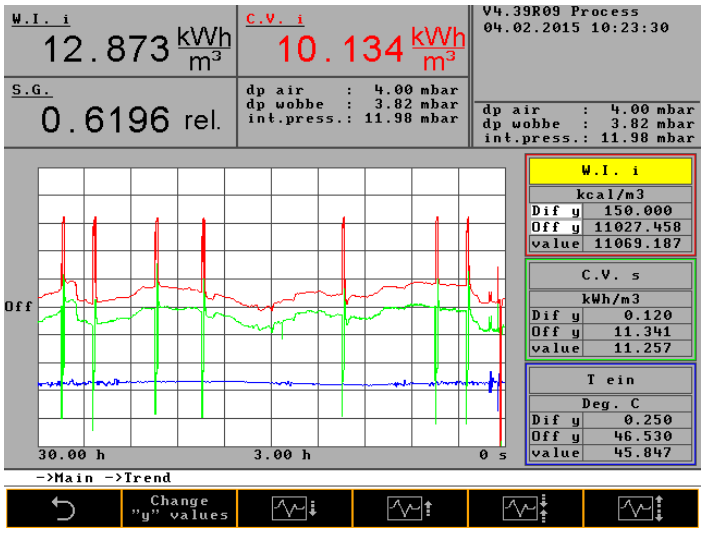
Minimum segment time: 1 s
Maximum segment time: 12 h

The time values can be viewed as follows:

Shift to later values

Shift to earlier values

Main menu - Graphic - Select value

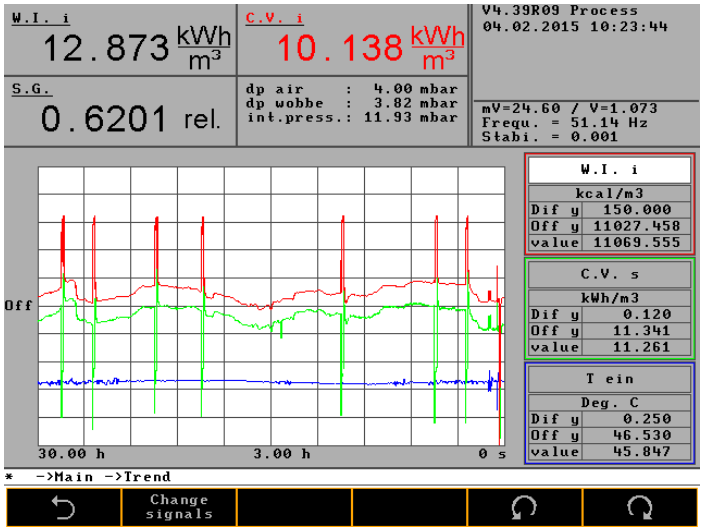


- Values for the curves can be set in this menu.

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

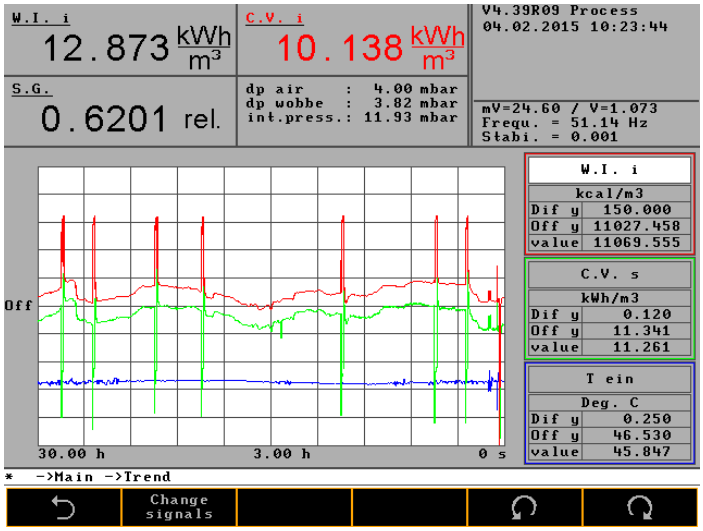
Main menu - Graphic - Select signal



- Signals for the curves can be selected in this menu.
- Examples of signals:

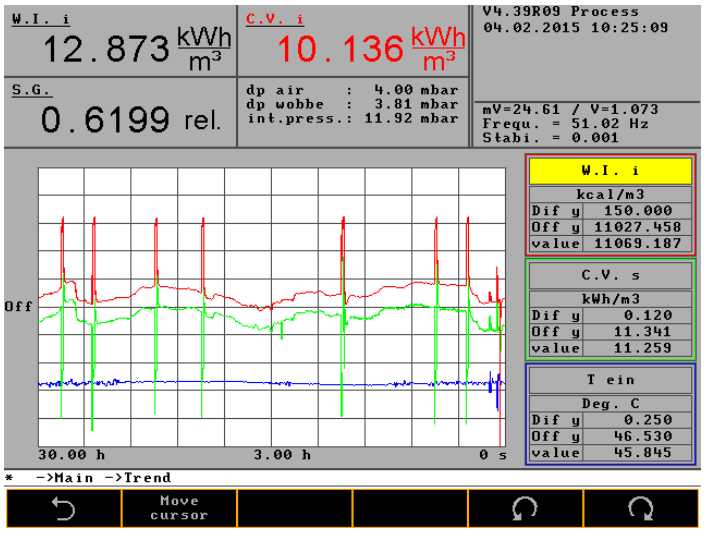
Wobbe i	Heating value	mVSA	Frequency	T amb
Wobbe s	Combustion value	mV	p Wobbe	T in

Main menu - Graphic - Select unit



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

Main menu - Graphic - Select curve



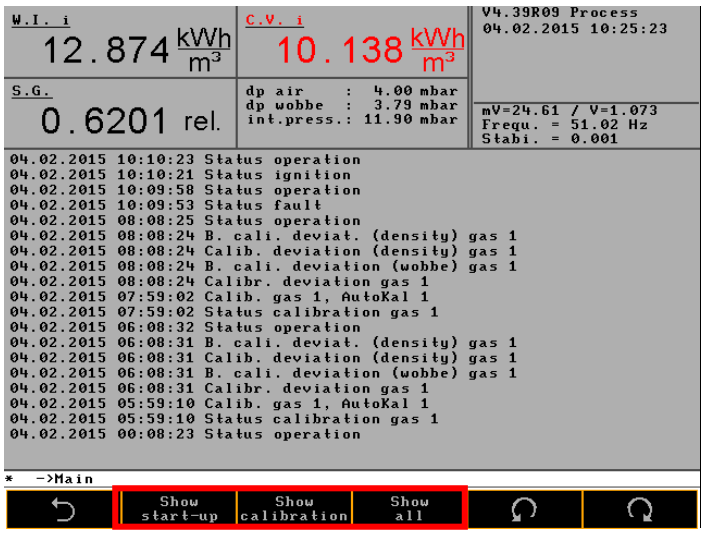
Individual curves can be selected in this menu in order to change parameters.

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 1000 events can be stored.

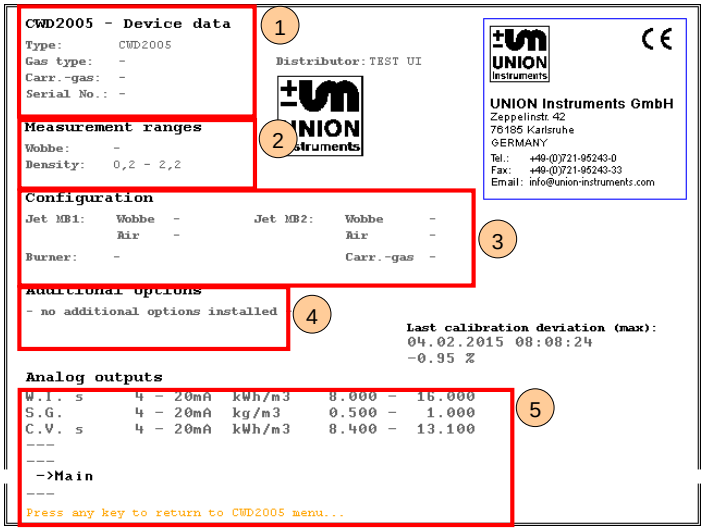


Show startup	Selection of the different events
Show calibration	Selection of the different events
Show all	Cancel selection

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 memory stick and sent to the manufacturer by email, refer to CSV Export, Index.



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 and equipment when the combustion calorimeter is decommissioned by non-instructed personnel!

Allow only instructed/trained service technicians to carry out decommissioning!

⚠ NOTICE

In order to decommission the combustion calorimeter, also decommission the linked system components according to their operating instructions!

NOTE

The following table contains steps for decommissioning for an extended downtime.

To switch off the combustion calorimeter only temporarily, some steps can be omitted:
☞Switching off column!

Steps	Switching off	Decommissioning
Disconnect the device from the process, professionally close the line.	X	X
Bring linked system components to a standstill.	X	X
Switch off the main switch.	X	X
If the combustion calorimeter is to be taken out of service only temporarily, the process ends here!		
Professionally disconnect/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

The quality of measurements by 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 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, disconnect the combustion calorimeter from the supply network!**
- **Switch off the main switch, and 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.**
- **Gas connections may only be made 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 process gas!**
- **In the 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 15 minutes for it to cool down.

11.2 Maintenance work/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
   - Frequency of the fan control
2. Notify the control room
3. If no default values via PLC are possible, activate "Hold signal" on the combustion calorimeter.
4. Close the shut-off valve on the combustion calorimeter after a leak test.

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.

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 air filter for contamination/clogging.	Every 6 months
Perform calibration (at shorter intervals depending on accuracy requirements)	As required
Check tube 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
Check the fan.	Every 6 months
Check the air intake filter (ambient air inlet, fan filter mat).	Every 6 months
Clean[4] the gas and air nozzles Change O-rings, if necessary.	Every 6 months
Annual check	
Replace air filter.	Annually
Replace neoprene tubes inside the combustion calorimeter.	Annually
Clean the complete system.	Annually

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 of the cleaned components.
[4] Clean the nozzles using a volatile solvent.

12 Troubleshooting

WARNING

Risk of serious injury from electricity and escaping gases!

- **Before carrying out maintenance work on the combustion calorimeter and whenever necessary, also bring the the linked system components to a standstill.**
- **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, disconnect the combustion calorimeter from the supply network!**

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. These must be reopened after the device is put back into service.

NOTE

Event list:

The software keeps an event list with up to 1000 events in chronological order (specification of date). The event list provides information about incorrect behavior, refer to 9.6.3.

The export of event data to a special data carrier (memory stick) is possible after consultation with Service. The exported data can be sent to the manufacturer for fault analysis, refer to CSV Export, 9.6.1.

Events are: Start, Stop, Ignition, Insufficient cooling air, 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 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 solar radiation is causing rapid temperature changes.
  Direct solar radiation must be prevented.
- Air condition is causing the temperature to change too quickly. The cooling capacity of the air conditioning is too high and the hysteresis is too large.
- The inlet pressure is inexact/cannot be maintained.
  Check whether the input pressure is too high.

12.4 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.
- Heavy filter contamination that can no longer be corrected. The filter must be replaced.

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 thermal battery is contaminated.
- The thermoelectric battery must be cleaned and carefully dried.

12.4.1 Incorrect ignition

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

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

The combustion calorimeter switches to the operation 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 the ignition electrodes.

12.4.2 Error/status messages

Filter change

- Filter change (air filter)
- The frequency of the frequency converter is > than the set threshold value.

Int. pressure

- Alarm in the event of inadequate process 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

- Filter change of air filter (the frequency of the frequency converter is > than the set threshold value)
- Gas pressure is too low
- Fault in the thermoelectric battery
- Defective PT 100 temperature sensor

Service

Filter change of air filter

- Frequency > threshold value
- Air inlet temperature > 41 °C

Operation

- Flame is burning, analyzer is running on process or calibration gas

Operation delay

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

Process

- Flame is burning, solenoid valve for process gas is open
- Analyzer is running on process gas

Calibration

- Flame is burning, solenoid valve for calibration gas is open
- Calibration is active, no mA signals are output, these are "on hold", the last current value is retained.

13 Service

NOTE

UNION Instruments GmbH is available to answer any questions.

In case of 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

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✉ 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 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 supply them to professional recyclers.

15 Spare parts

WARNING

Use of non-approved spare parts (e.g., parts of other manufacturers, parts with deviating specifications, imitation consumables and wear parts) may cause damage and endanger people! Any warranty is voided in this case. The owner isthen liable for damage that occurs!

When standard components are replaced, use only identical components of the original manufacturer! In the event that components are discontinued or components of other manufacturers are used, this requires manufacturer's approval by 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 make a note of the order number, if applicable *(☞ Included documents).*
Order part.

The following spare part packages are among those available:

Spare part package 1 year operation
Spare part package 2-3 year operation

16 Appendix

Data Structure Profibus

Nr.	Typ	Bytes	Bytes tot.	Name	Description	Source
1	FLOAT	**4**	**4**	Heating value	measuring unit: kJ/m³	CWD[5]
2	FLOAT	**4**	**8**	calorific value	measuring unit: kJ/m³	CWD
3	FLOAT	**4**	**12**	Wobbe i	lower Wobbe index: measuring unit:: kJ/m³	CWD
4	FLOAT	**4**	**16**	Wobbe s	upper Wobbe index: measuring unit:: kJ/m³	CWD
5	FLOAT	**4**	**20**	Dv	relativ density, without dimension	CWD
6	FLOAT	**4**	**24**	Reserve		CWD
7	FLOAT	**4**	**28**	Reserve		CWD
8	FLOAT	**4**	**32**	Tein	Air temp. CWD thermo, unit °C	CWD
9	FLOAT	**4**	**36**	CO	Unit: % (only CWDs with CO modul)	CWD
10	FLOAT	**4**	**40**	Air min	Min. Luftbedarf, Einheit: m³ Luft / m³ Gas (nur bei Kundenspezifischen CWDs)	CWD
11	FLOAT	**4**	**76**	Reserve		CWD
…						
20	FLOAT	**4**	**80**	Fixed test value	send: 12345,6789	CWD
21	BYTE	**1**	**81**	Operating condition	Operating condition CWD: 0 – Stop 1 – Proces 2 – Ignition 3 – Ignition pause 4 – Error 5 – over temperature 6 – calibration measuring range 1 7 – calibration measuring range 2 8 – calibration measuring range 3 9 – Test-Gas measurement (only in process)	CWD
22	BYTE	**1**	**82**	Zustand Filterwechsel	1 = Filterwechsel am CWD benötigt	CWD
23	BYTE	**1**	**92**	Reserve		CWD

Table 1: Data structure Profibus

For more information about communication with Profibus and the UNION calorimeter see Service UNION Instruments GmbH, ☞ *Kapitel 11 Service.*

[5] CWD = Calorimeter

Data struture serial interface RS 232 (option)

With the optional serial interface (RS 232) data can be transmitted. Parameters are selected in the "I / O Analog outputs". The interface has to be activated in the menu service.

Data transmission:	Transmission rate:	9600 baud
Parity-bit:	no	
Stop-bit:	1	
Data-bit:	8	

Output format

111111.111 222222.222 333333.333 … … 777777.777

111111.111	=	Output data 1
222222.222	=	Output data 2
… …		
777777.777	=	Output data 7

Assignment of the plugs/oins, ☞ *6.3.10*

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