SIEMENS

Set CEM CERT

Continuous Gas Analysis

Standardized and Certified
Continuous Emission Monitoring System

Operating Instructions

Edition 03/2020

siemens.com

SIEMENS

Continuous Gas Analysis

Set CEM CERT Standard Measuring System for Continuous Emission Monitoring Set CEM CERT

Operating Instructions

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Legal information

Warning notice system

This manual contains notices you have to observe in order to ensure your personal safety, as well as to prevent damage to property. The notices referring to your personal safety are highlighted in the manual by a safety alert symbol, notices referring only to property damage have no safety alert symbol. These notices shown below are graded according to the degree of danger.

⚠ DANGER

indicates that death or severe personal injury **will** result if proper precautions are not taken.

⚠ WARNING

indicates that death or severe personal injury **may** result if proper precautions are not taken.

⚠ CAUTION

indicates that minor personal injury can result if proper precautions are not taken.

NOTICE

indicates that property damage can result if proper precautions are not taken.

If more than one degree of danger is present, the warning notice representing the highest degree of danger will be used. A notice warning of injury to persons with a safety alert symbol may also include a warning relating to property damage.

Qualified Personnel

The product/system described in this documentation may be operated only by **personnel qualified** for the specific task in accordance with the relevant documentation, in particular its warning notices and safety instructions. Qualified personnel are those who, based on their training and experience, are capable of identifying risks and avoiding potential hazards when working with these products/systems.

Proper use of Siemens products

Note the following:

⚠ WARNING

Siemens products may only be used for the applications described in the catalog and in the relevant technical documentation. If products and components from other manufacturers are used, these must be recommended or approved by Siemens. Proper transport, storage, installation, assembly, commissioning, operation and maintenance are required to ensure that the products operate safely and without any problems. The permissible ambient conditions must be complied with. The information in the relevant documentation must be observed.

Trademarks

All names identified by ® are registered trademarks of Siemens AG. The remaining trademarks in this publication may be trademarks whose use by third parties for their own purposes could violate the rights of the owner.

Disclaimer of Liability

We have reviewed the contents of this publication to ensure consistency with the hardware and software described. Since variance cannot be precluded entirely, we cannot guarantee full consistency. However, the information in this publication is reviewed regularly and any necessary corrections are included in subsequent editions.

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Introduction 1

1.1 Purpose of this document

This instruction manual contains all the information you need for commissioning and using the system.

It is aimed at all persons involved in the mechanical installation, electrical connection and commissioning of the system and who work with the system.

Read this instruction manual carefully and make sure that you understand its contents before you work with the system.

1.2 History

The following table includes information on the different editions of this document.

Table 1- 1 History

Edition	Comment
03/2020	First edition

1.3 Intended use

Proper use within the context of this document means that the product may be used only for the applications described in the catalog or the technical description, and only in combination with the equipment, components and devices of other manufacturers recommended or permitted by Siemens.

The product described in this document has been developed manufactured, tested and documented in compliance with relevant safety standards. When the handling rules described for the configuration, installation, proper operation and maintenance, as well at the safety guidelines are adhered to, therefore, there is normally no risk to the health of persons or in respect to damage to property.

This product was designed to ensure safe isolation of the primary and secondary circuits. Low voltages that are connected must therefore also be generated with safe isolation.

1.4 Disclaimer of Liability

We have reviewed the contents of this publication to ensure consistency with the hardware and softwaredescribed. Since variance cannot be precluded entirely, we cannot guarantee full consistency. However, the information in this publication is reviewed regularly and any necessary corrections are included in subsequent editions.

General information 2

2.1 Disclaimer

Industrial security

Siemens provides products and solutions with industrial security functions that support the secure operation of plants, systems, machines and networks.

In order to protect plants, systems, machines and networks against cyber threats, it is necessary to implement – and continuously maintain – a holistic, state-of-the-art industrial security concept. Siemens' products and solutions only form one element of such a concept.

Customer is responsible to prevent unauthorized access to its plants, systems, machines and networks. Systems, machines and components should only be connected to the enterprise network or the internet if and to the extent necessary and with appropriate security measures (e.g. use of firewalls and network segmentation) in place.

Additionally, Siemens' guidance on appropriate security measures should be taken into account. For more information about industrial security, please visit: Industrial security (https://www.siemens.com/industrialsecurity).

Siemens' products and solutions undergo continuous development to make them more secure. Siemens strongly recommends to apply product updates as soon as available and to always use the latest product versions. Use of product versions that are no longer supported, and failure to apply latest updates may increase customer's exposure to cyber threats.

To stay informed about product updates as they occur, you can sign up for our product-specific newsletter. For further information, see Support (https://support.industry.siemens.com/cs/start?lc=en-WW)

2.2 Safety information

DANGER

Explosions due to explosive atmosphere

Explosions in an explosive atmosphere can result in death or injuries.

- **Never** operate this system in an explosive atmosphere

⚠ WARNING

Toxic and/or corrosive gases

When measuring toxic or corrosive gases, leaks in the gas path may cause harmful sample gas concentrations to accumulate in the system or in individual analyzers.

Health risks up to and including danger to life exist in the case of the following sample gas components:

- Carbon monoxide (CO):
  Colorless, odorless and tasteless, highly flammable, toxic; can result in death depending on concentration and duration of exposure.
- Carbon dioxide (CO_2):
  Colorless, odorless and tasteless, heavier than air, displaces breathing air and can thereby result in death by asphyxiation.
- Sulfur dioxide (SO_2):
  Colorless, pungent-smelling and sour-tasting, toxic, irritates mucous membranes.
- Nitric oxide (NO):
  Colorless, oxidizing, toxic, causes chemical burns to eyes and skin.
- Nitrogen dioxide (NO_2):
  Colorless, toxic, causes chemical burns to eyes and skin.

To prevent a poisoning hazard or damage to analyzer parts, the relevant analyzer or the system must be purged with inert gas (e.g. nitrogen). The gas displaced by purging must be collected using appropriate equipment and disposed of environmentally-friendly via an exhaust line.

⚠ WARNING

Harmful substances in the condensate

The condensate at the sample gas cooler or condensation trap can be corrosive, depending on the composition of the sample gas (e.g.: through SO_2, NO, H_2S, HCl, etc.). When you dip litmus paper into the condensate it will turn red.

- Wear protective clothing, protective goggles and protective gloves when handling the condensate!
- Prior to its disposal, dilute the condensate with tap water until it turns neutral and the litmus paper does not change color. Alternatively, you can also neutralize the condensate with a weak sodium carbonate solution (Na_2CO_3).

⚠ DANGER

Electric shock due to electrical voltage

This system is operated with electric current. This inevitably produces dangerous voltages that, if contacted, may result in death or injuries.

- Before working on the system, disconnect it from the power supply system and secure it against being inadvertently connected again.
- When the system is in normal measuring mode, ensure that no conductive parts are openly accessible.

NOTICE

Manipulation of the system

Physical access to the system allows undesired manipulations of the system to take place. As a result of this, the system can lose its measuring characteristics and become unusable.

- Make sure that the system is installed in a protected area that only authorized persons can access.
- If no settings have to be made, lock the system to prevent unauthorized or unintentional access.

The information in the manuals below must also be observed for proper operation of the Set CEM CERT system:

- SIMATIC S7 – S7-1200 Programmable Controller – System Manual
- SIMATIC HMI – HMI Devices – Comfort Panels – Operating Instructions

There you will also find safety information to be observed when operating the HMI or connecting the system to the S7-1200 programmable controller.

2.3 Notes on use

2.3.1 Requirements for safe use

In terms of safety, this system left the factory in perfect condition. In order to maintain this condition and to ensure safe operation of the system, adhere to the instructions in this instruction manual and all safety-relevant information.

Also observe the notices and symbols on the device. Do not remove any notices or symbols from the system. Always keep the notices and symbols in a completely legible condition.

Only qualified personnel are permitted to operate this measuring system or carry out interventions on the system.

Qualified personnel for the purpose of these instructions or the safety notices on the product itself are persons that are familiar with the setup, installation, commissioning and operation of the product. These persons have the following qualifications:

- As configuration personnel, they are familiar with the safety concepts of automation engineering
- As operating personnel, they are trained to handle automation engineering equipment and know the content of this manual related to operation
- As commissioning and service personnel, they have had training that qualifies them to repair this type of automation engineering equipment or are authorized to commission, ground and mark electric circuits and systems/devices in accordance with safety engineering standards.

2.3.2 Additional information

This measuring system includes various individual components that can be customized according to customer needs.

For safe operation of this system, all operating instructions and technical documents for the individual components must be observed in addition to this instruction manual. These components are:

- Gas analyzers
- Gas sampling components
- Gas preparation components
- System controller
- Components for heating, air conditioning and temperature control
- System cabinets
- NO_x converter

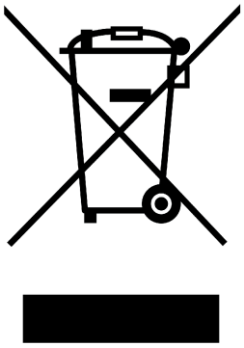
2.3.3 Information on recycling

This product is from an environmentally-friendly manufacturer and complies with the directive 2012/19/EU on Waste Electrical and Electronic Equipment (WEEE).

This product may contain substances that are potentially harmful to the environment if disposed of improperly (landfills, incineration plants). It must therefore not be disposed of in this way.

Therefore, please be environmentally conscious:

- Ensure that this product is recycled at the end of its life cycle through the relevant local facilities.
- Observe the relevant regulations in your country.



Description

3

3.1 Overview

Set CEM CERT is a standardized and certified continuous emission monitoring system. The Set CEM CERT system is suitable for use in many plants that require a permit in accordance with EU Directive 2010/75/EU, the Industrial Emissions Directive.

The modular CEMS meets the current quality standards of EU directives EN 15267 and EN 14181 (QAL1/2/3, AST). The number of components that need to be measured depends on the type of plant as well as the fuel used. The measurement of gas components takes place according to the cold-extractive measuring procedure. A sample flow for measurement is continuously extracted by a gas sampling probe in the exhaust gas stack and fed to the analysis cabinet. This cabinet can be equipped with up to three analyzers and different sample preparation components.

The measuring system is used for simultaneous measurement of the following performance-tested measured components: CO; NO; SO_2; NO_2; O_2; CO_2.

Figure 3-1 Set CEM CERT

Benefits

- The tested measuring ranges are selected in such a way that a wide range of application for the CEMS is ensured (performance-tested according to EN 15267-3: TÜV and MCERTS).
- The complete modular package allows the certified use of system components from different manufacturers (performance-tested according to EN 15267-3: TÜV and MCERTS).
- Easy and fast to configure
- Very cost-effective to purchase and operate
- Modular design
  - Up to 3 analyzers with different measuring ranges can be configured
  - Sample gas coolers and NO_X converters of leading manufacturers can be selected
  - Electric heaters and air conditioning units can be configured to extend the ambient temperature range
  - Version with appropriate sampling probes and heated sample gas lines can be selected

Range of application

- Emission monitoring
  Power plants with solid, liquid or gaseous fossil fuels and incineration plants that exceed a certain size or a defined mass flow of pollutants require a permit. They must be continuously monitored on a plant-specific basis for compliance with limits for certain air pollutants using a suitable and complete emission monitoring system, which also requires approval. This is prescribed by the following:
  - European Industrial Emissions Directive (IED)
  - European Medium Combustion Plant Directive (MCPD) and its national implementations
  - Separate emission standards in EU member states and associated countries (in Germany, for example, 13. BImSchV; 17. BImSchV; 27. BImSchV; 30. BImSchV; 44. BImSchV; TA Luft)
- Flue gas monitoring
- Process optimizations for the following:
  - Emission measurements for upstream boiler controllers
  - DeNOx systems
  - DeSOx systems

Note

Plants in which corrosive aerosols (acid mist) are likely

Suitable measures must be taken to remove the corrosive aerosols from the gas matrix. This requires project-specific technical clarification in advance.

3.2 Design

Tested component design

The overall modular measuring system consists of the following tested individual components:

- Analyzers for measurement of multiple components. The Set CEM CERT modular measuring system can consist of up to three analyzers in combination with a system cabinet. The performance-tested analyzer(s) are selected separately from the system using the specific article number(s). The system is certified for use of the following analyzers:

Analyzer	Article No.	Design
ULTRAMAT 23*	7MB2358	3 NDIR components on 2 optical benches or 2 NDIR and 2 UV components on 2 optical benches
ULTRAMAT 23*	7MB2357	2 NDIR components on 2 optical benches or 1 NDIR and 2 UV components on 2 optical benches
ULTRAMAT 23*	7MB2355	1 NDIR component on 1 optical bench or 1 NDIR component or 2 UV components on 1 optical bench
SIPROCESS UV600	7MB2621	3 UV components on 1 optical bench
ULTRAMAT 6	7MB2121 7MB2011	1 NDIR component on 1 optical bench
ULTRAMAT 6, 2-channel 19" rack unit	7MB2123 7MB2124	2 NDIR components on 2 optical benches
OXYMAT 6	7MB2021	1 paramagnetic O_2 sample chamber
ULTRAMAT/ OXYMAT 6	7MB2023 7MB2024	1 NDIR component on 1 optical bench and 1 paramagnetic O_2 sample chamber

* Each measuring module of the ULTRAMAT 23 analyzer type can be additionally equipped with different O_2 sensors.
The configuration with an O_2 sensor is specified by adding the following identifiers:
-Z-T13/T14: Paramagnetic O_2 sensor
-Z-T23/24/T25: Electrochemical O_2 sensor
-Z-T33/T34/T35: No O_2 sensor

- Sampling probe:
  - M&C, type: SP2000
  - Bühler, type: GAS222
- Heated sample gas line: max. length 50 m, hold temperature 180 ... 200 ° C, 100 W/m Core: PTFE DN 4/6
- Temperature controller: Siemens, type 3RS1042-1GW70
- Two-stage compressor gas cooler:
  - M&C, type: CSS-V;
  - Bühler, type: EGK 2-19
- Sample gas pump: Bühler, type: P2.3
- NO_x converter: M&C, type: CG-2

Performance-tested measuring ranges

Measured component	Analyzer module	Smallest certified measuring range	Additional measuring ranges	
CO	ULTRAMAT 23 7MB2355-Z-T13/-T23/-T33 ULTRAMAT 23 7MB2357-Z-T13/-T23/-T33	0 ... 200 mg/m³	0 ... 1250 mg/m³	-
	ULTRAMAT 23 7MB2358-Z-T13/-T23	0 ... 375 mg/m³	0 ... 1250 mg/m³	-
	ULTRAMAT 23 7MB2355-Z-T14/-T24/-T34 ULTRAMAT 23 7MB2357-Z-T14/-T24/-T34	0 ... 1250 mg/m³	0 ... 6000 mg/m³	-
	ULTRAMAT 6 LR Z+Y27 ULTRAMAT 6-2K LR-Z+Y27+Y28 ULTRAMAT/OXYMAT 6 LR-Z-Y27+Y28	0 ... 75 mg/m³	0 ... 1250 mg/m³	0 ... 3000 mg/m³
	ULTRAMAT 6 HR Z+Y27 ULTRAMAT 6-2K HR-Z+Y27+Y28 ULTRAMAT/OXYMAT 6 HR-Z+Y27+Y28	0 ... 1000 mg/m³	0 ... 10000 mg/m³	-
	ULTRAMAT 6-2K LR-HR-Z+Y27+Y28	0 ... 75 mg/m³ 0 ... 1000 mg/m³	0 ... 750 mg/m³ 0 ... 10000 mg/m³	-
NO_x	ULTRAMAT 23 7MB2355-Z-T13/-T23/-T33 ULTRAMAT 23 7MB2357-Z-T13/-T23/-T33	0 ... 150 mg/m³ 0 ... 230 mg/m³	0 ... 750 mg/m³ 0 ... 1150 mg/m³	0 ... 2000 mg/m³ 0 ... 3067 mg/m³
	ULTRAMAT 23 7MB2358-Z-T13/-T23	0 ... 400 mg/m³ 0 ... 613 mg/m³	0 ... 2000 mg/m³ 0 ... 3067 mg/m³	-
NO	SIPROCESS UV600 7MB2621-Z-Y17	0 ... 50 mg/m³	0 ... 200 mg/m³	0 ... 2000 mg/m³
	ULTRAMAT 23 7MB2355-Z-T14/-T24/-T34 ULTRAMAT 23 7MB2357-Z-T14/-T24/-T34	0 ... 600 mg/m³	0 ... 3000 mg/m³	-
	U6 LR Z+Y27 U6-2K LR-Z+Y27+Y28 U/O6 LR-Z+Y27+Y28	0 ... 100 mg/m³	0 ... 2000 mg/m³	-
	ULTRAMAT 6 HR Z+Y27 ULTRAMAT 6-2K HR-Z+Y27+Y28 ULTRAMAT/OXYMAT 6 HR-Z+Y27+Y28	0 ... 1000 mg/m³	0 ... 10000 mg/m³	-
	ULTRAMAT 6-2K LR-HR-Z+Y27+Y28	0 ... 100 mg/m³ 0 ... 1000 mg/m³	0 ... 2000 mg/m³ 0 ... 10000 mg/m³	-

Measured component	Analyzer module	Smallest certified measuring range	Additional measuring ranges	
NO_2	SIPROCESS UV600 7MB2621-Z-Y17	0 ... 50 mg/m³	0 ... 500 mg/m³	-
	ULTRAMAT 23 7MB2355-Z-T25/-T35 ULTRAMAT 23 7MB2357-Z-T25/-T35 ULTRAMAT 23 7MB2358-Z-T35	0 ... 50 mg/m³	0 ... 1000 mg/m³	-
SO_2	ULTRAMAT 23 7MB2355-Z-T13/-T23/-T33 ULTRAMAT 23 7MB2357-Z-T13/-T23/-T33	0 ... 400 mg/m³	0 ... 2000 mg/m³	0 ... 7000 mg/m³
	ULTRAMAT 23 MB2358-Z-T13/-T23	0 ... 400 mg/m³	0 ... 2000 mg/m³	0 ... 7000 mg/m³
	SIPROCESS UV600 7MB2621-Z-Y17	0 ... 75 mg/m³	0 ... 130 mg/m³	0 ... 2000 mg/m³
	ULTRAMAT 6 LR Z+Y27 ULTRAMAT 6-2K LR-Z+Y27+Y28 ULTRAMAT/OXYMAT 6 LR-Z+Y27+Y28	0 ... 75 mg/m³	0 ... 1500 mg/m³	-
	ULTRAMAT 23 7MB2355-Z-T25/-T35 ULTRAMAT 23 7MB2357-Z-T25/-T35 ULTRAMAT 23 7MB2358-Z-T35	0 ... 70 mg/m³	0 ... 75 mg/m³	0 ... 1250 mg/m³
CO_2	ULTRAMAT 23 7MB2355-Z-T13/-T23/-T33 ULTRAMAT 23 7MB2357-Z-T13/-T23/-T33	0 ... 25 vol. %	-	-
	SIPROCESS GA700 ULTRAMAT7	0 ... 25 vol. %	-	-
O_2 (para-magnetic)	ULTRAMAT 23 7MB2355-Z-T13/-T14 ULTRAMAT 23 7MB2357-Z-T13/-T14 ULTRAMAT 23 7MB2358-Z-T13/-T14	0 ... 25 vol. %	-	-
	OXYMAT 6-Z+Y27	0 ... 25 vol. %	0 ... 5 vol. %	-
	ULTRAMAT/OXYMAT 6-Z+Y27+Y28	0 ... 25 vol. %	0 ... 5 vol. %	-
	SIPROCESS GA700 OXYMAT 7	0 ... 25 vol. %	0 ... 5 vol. %	-
O_2 (electro-chemical)	ULTRAMAT 23 7MB2355-Z-T23/-T24/-T25 ULTRAMAT 23 7MB2357-Z-T23/-T24/-T25 ULTRAMAT 23 7MB2358-Z-T23/-T24/-T25	0 ... 25 vol. %	0 ... 5 vol. %	-

3.3 Principle of operation

The modular measuring system consists of the following components:

- Heated sampling probe
- Sampling line (maximum 50 m)
- Sample gas cooler
- Sample gas pump
- 1 to 3 differently configurable analyzers
- Cabinet air conditioning unit (optional)

The detailed gas path of sample and calibration gases is shown in the gas flow diagram (Gas flow diagram (Page 71)).

The sample gas is removed by a heated sampling probe with ceramic filter. The sample gas is sucked at through the sampling probe -WS1 through the sample gas pump -GP1 and the heated sample gas line -EH1 (option) into the first stage of the sample gas cooler. There, the sample gas is cooled to approximately 4 ° C dew point. The heated sample gas line must be routed to the cooler with a downward slope, so that any condensate droplets that occur can run down toward the sample gas cooler without forming water pockets. Condensate droplets present in the sample gas line upstream from the cooler are therefore generally of no significance. The sample gas then flows via the 3/2-way solenoid valve -QV1 and the 3-way ball valve -RB1 into the second cooling stage. A fine filter is installed in the second stage of the cooler.

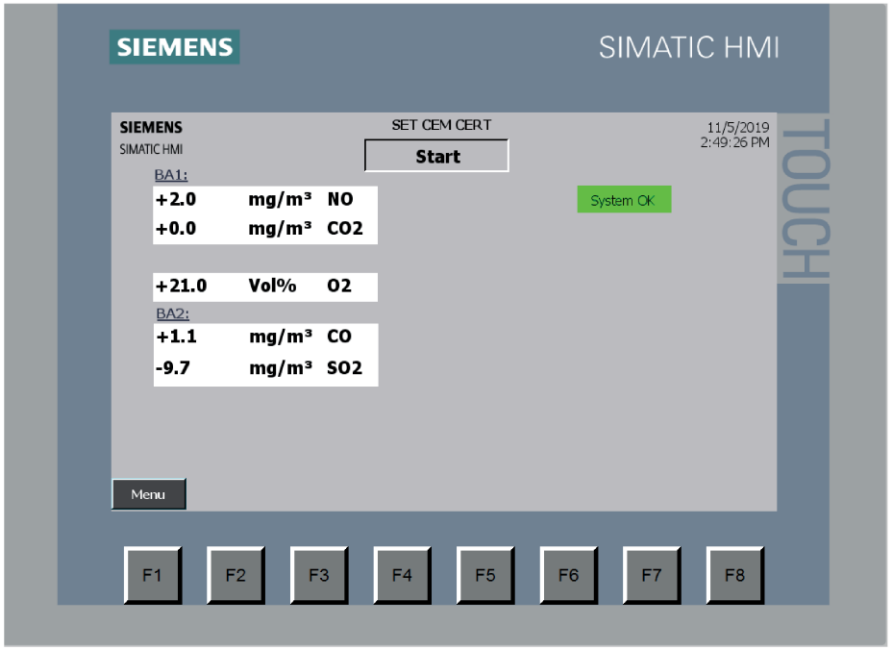
The condensate produced in the cooling stages is discharged into the condensate tank -CT (option) by the built-in hose pumps. The condensate collecting tank is equipped with a level monitor -BS4, which sends a message to the controller when a defined level is reached.

After the sample gas cooler, the gas path splits into various partial lines in order to supply up to 3 analyzers with sample gas in parallel. An additional partial flow lets the excess sample gas flow out via a bypass. To protect the analyzers, a condensate blocker is located directly upstream from the analyzers; it closes off the gas path when condensate breaks through.

A three-way valve is installed upstream from the pump for introduction of zero gas for the automatic zero calibration via ambient air. A second three-way valve is installed downstream from the pump for introduction of zero and calibration gases from compressed gas cylinders. This three-way valve can introduce calibration gases from compressed gas cylinders at set times for autocalibration of the zero point or reference point. Alternatively, calibration gases can be supplied manually via a subsequent three-way ball valve.

The gas is collected from the gas outlets of the analyzers and discharged from the cabinet via the sample gas outlet (screwed gland for tube DN10/12). Starting from the sample gas outlet, the sample gas must be discharged without back pressure or pressure variations.

The standard way of operating the Set CEM CERT system is via a touch screen control panel (SIMATIC HMI, KTP700 Basic), which is installed on the front of the system cabinet. Alternatively, the measuring system can also be operated via the individual analyzers.



Application planning

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4.1 Transport

Proper transport, storage, setup and installation, as well as careful operation and maintenance, are essential for the error-free, safe and reliable operation of this system.

In particular, both the general erection and safety regulations governing work on electrical power installations (e.g. DIN, VDE) and the regulations governing professional use of lifting equipment and machinery and the use of personal protective gear (safety glasses, etc.) must be observed.

The lifting eyes/transport shackles on the roof of the analysis cabinet must be used for transporting the cabinet.

The analysis cabinet should be mounted and secured to prevent it from falling over immediately after transport.

4.2 Checking the delivery

Each analysis cabinet is individually configured. Therefore, you should check the delivery for completeness (correspondence with packing slip) before installation.

In the case of transport damage that can be attributed to improper handling, arrange for a damage assessment by the shipping agent within 7 days.

Also check the following:

- Are the surfaces of the system and its components clean and undamaged?
- Have any lines been loosened after transport?

Installation

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5.1 Preparing the installation location

The operator is responsible for preparing the installation location.

We recommend that the analysis cabinet be installed in a dust-protected control room and that the following ambient conditions be observed:

- Level installation surface with adequate load bearing capacity (> 500 kg/m^2)
- Protection against direct thermal radiation
- Protection against heavy dust load
- Protection against corrosive atmosphere
- Protection against vibrations, as these can influence the measurement
  Therefore, in case of doubt, you should provide vibration damping on site
- Installation of the measuring system as close as possible to the point of measurement, because short sample gas lines are essential for achieving short T_{90} times

Note

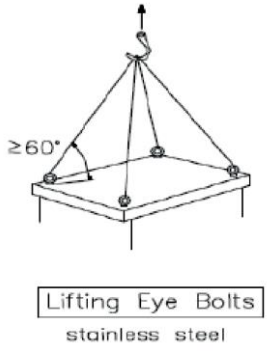
Follow the installation instructions for installing heated sample gas lines (e.g. correct bending radius, routed with a downward slope if possible, no routing of heated sample gas lines side-by-side).

5.2 Installing the measuring system

NOTICE
Inability of system to function Make sure that the material is not damaged during installation.

The control cabinets are designed for upright mounting on a base plate or base. Therefore, please ensure a suitable base surface.

Use lifting equipment designed for the weight of the system (approximately 200 to 400 kg depending on components) for installing the Set CEM CERT system. Generally, only the lifting eyes on the top of the base frame are to be used for lifting the cabinet.



When the device is stationary, secure it all around to prevent it from falling over. Mounting brackets are provided on the base frame of the cabinet for this purpose.

To reach the mounting brackets, you may have to open the floor covering (arrow).

5.3 Installing the individual components

5.3.1 Installation of the sampling probe

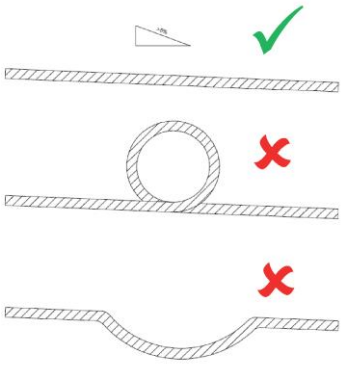
The gas sampling probes are designed for flange mounting.

Their installation location and position result from the application-relevant requirements. If possible, the probe installation fitting should be at a slight incline from the center of the channel. The installation location should be weather-protected (heat, cold, vibrations).

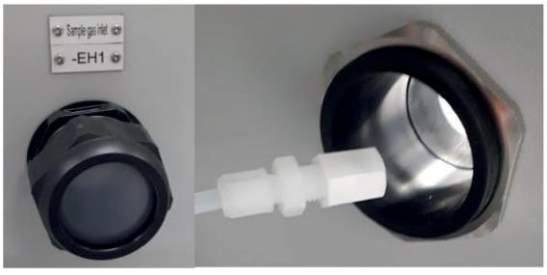
Observe the information and directions in the relevant operating instructions when installing the sampling probes.

5.3.2 Installation of the sample gas line

The heatable sample gas line must be installed according to the gas flow diagram. Beginning at the sampling probe, route the sample gas line in the direction of the cabinet. Route the sample gas line with a downward slope of > 5%. Make sure there are no loops or pockets. For additional information, refer to the manufacturer's instructions.



Connect the sample gas line to the associated connection on the outside of the cabinet and connect the heatable sample gas line to the PTFE tube.



Connection

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6.1 Mechanical installation

6.1.1 Gas connections

At least one sample gas inlet and one calibration gas inlet are always available, and up to four additional gas inlets can also be used, e.g. for

- ULTRAMAT6/OXYMAT 6: at least one zero gas inlet (e.g. nitrogen)
- FIDAMAT 6: one hydrogen inlet and one combustion gas inlet (e.g. combustion air, synthetic air)

The gas lines are typically PTFE tubes that are fastened to the cabinet wall with a PVDF screwed gland. Due to the need for leak-tightness and the high temperature load, stainless steel tubing with a stainless steel fitting (SS316) is provided for hydrogen lines.

Figure 6-1 Gas tube

Use the provided screwed glands to connect the zero and calibration gases. Unused gas inlets must be provided with blanking plugs.

NOTICE
Inability of system to function Prevent pressure variations and any back pressure at all in the line because this may cause the analyzers to be damaged. For calibration gas cylinders, a pressure reducer with a maximum output pressure of 0.5 bar is required.

6.1.2 Condensate outlet

The separated liquid from the sample gas cooler is discharged using hose pumps. Accumulated condensate produced is collected in a tank intended for that purpose (optional) or routed directly from the system through PTFE tubes. If the condensate tank is full, a warning is output on the display. This disappears after the condensate tank has been emptied. The owner must ensure proper collection and disposal of the condensate according to environmental regulations.

6.1.3 Gas outlet

6.1.3.1 Gas outlet

Ensure that the exhaust gas line is correctly dimensioned for the number of analyzers.

High pressure variations or any back pressure at all is not permitted at the sample gas outlet.

6.1.3.2 Overpressure in the gas channel

⚠ WARNING

Danger of burns

If there is overpressure in the gas channel, hot gas may escape upon opening.

- For this reason, take appropriate protective measures.

6.2 Electrical installation

6.2.1 Laws and directives

Observe the safety rules, provisions and laws applicable in your country during connection, assembly and operation. These include, for example:

- National Electrical Code (NEC - NFPA 70) (USA)
- Canadian Electrical Code (CEC) (Canada)

Further provisions for hazardous area applications are for example:

- IEC 60079-14 (international)
- EN 60079-14 (EU)

6.2.2 Supply connection

The following supply voltages are possible:

- Voltage: 230 V (-15%, +10%), 50 or 60 Hz, including main switch
- Voltage: 400 V (-15%, +10%), 50 or 60 Hz, including main switch, 3-phase

The fuse protection on the customer end must be selected according to the calculation created by Siemens. This calculation will be created individually upon receipt of the order.

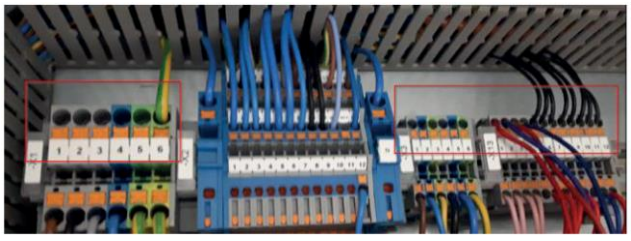
The owner must provide a UPS.

6.2.3 Connection of the power supply and signal lines

Route the cables for the analog and/or digital signals to the evaluation location, e.g. sample gas computer or process control system.

Guide the cables with the cable glands into the inside of the system and guide the cables through the cable duct to the terminals. The power and signal cables must be connected to the following terminal strips:

- -X3 Voltage for sample gas line and probe
- -X99 Test terminals for analog signals to be measured
- -X100 Messages and faults as binary signal (floating contact)
- -X101 Analog signals
- -X103 Signals for sample gas line and probe



Commissioning 7

7.1 Preparations

⚠ WARNING

Harmful gases

Danger to personnel, system and the environment can result from introducing harmful (corrosive, flammable and/or poisonous) gases into the device. If this should be required for the measuring task of the device, you must take the following measures:

- Take into account the safety measures according to the German Occupational Safety Act (Arbeitsschutzgesetz - ArbSchG) or similar international regulations. These safety measures must be coordinated with a local specialist. In particular, this includes measures to prevent any potential release of gases from the internal gas path (containment system) as well as their monitoring and disposal.
- Ensure that the discharged gas is treated according to the applicable local laws.
- Flammable gases must not be introduced into the system.
- Purge the device or the plant with a purging gas (inert gas). The gas displaced by purging must be collected using appropriate equipment and disposed of environmentally-friendly via an exhaust line.

7.1.1 Visual inspections

The system is safely installed mechanically; there is no risk of injury. All electrical connections are touch-safe and are marked. A check is also made to determine if additional warnings need to be incorporated in the documentation.
All surfaces that could become hot are isolated or covered to prevent accidental touch.

NOTICE

Danger of burns

Hot contact surfaces > 55° C are marked with a warning notice. Burns may result if these surfaces are touched with bare skin.

- Only touch these surfaces when wearing protective gloves.

Check the following:

- Are the surfaces of the system and its components clean and undamaged?
- Is the wiring correct according to VDE and customer specifications (cross-sections appropriate for current load, manner of routing, cables correctly color-coded, customer-specific wire markings)?
- Is the tubing routed according to the gas flow diagram in a functionally suitable manner?
- Have any lines been loosened after transport?

All media connections were marked at the factory and can be easily identified by the user.
If appropriate for the configured system, notices warning of toxic or asphyxiating gases have been attached.

7.1.2 Leak test

The line systems were checked for leaks prior to delivery and their leakage rate complies with the standard of the connection technology used according to EN 12266-1 (testing of valves).
The gas paths must be tested sequentially based on the gas flow diagram.
You must disconnect the analyzers for this test because they could be destroyed if the pressure is too high.
Check the system for leaks as follows:

1. Seal off the end of the respective gas path with a blanking plug.
2. Connect the test station to the gas inlet.
3. Open any solenoid valves, ball/plug valves, etc. so that the gas path is open from the inlet up to the sealed outlet.
4. Increase the calibration gas pressure to maximum 0.5 bar (500 hPa; 7.25 psi).
5. Close the gas inlet with the stopcock at the test station.
6. Wait for about 10 minutes.
   The pressure difference after 10 minutes must not exceed 1% of the test pressure.

If the pressure drop is greater, you must locate the leak. Leak detector spray can be very helpful for this. In this case, also check the gaskets and glands.

The leak test can also be performed as a vacuum test with a vacuum pump.

7.1.3 Operating gases

The following calibration gases must be provided in order to guarantee problem-free continuous operation:

- As zero gas for ULTRAMAT 23: Ambient air
- As zero gas for ULTRAMAT 6: Nitrogen with a purity of 5.0
- Specification of calibration gas (full-scale value gas): We recommend a full-scale value calibration with a calibration gas containing the component to be measured in a concentration of approximately 80% of the full-scale value.
  Example: CO component measured with an ULTRAMAT 23 in the measuring range 0 ... 200 mg/m^3. This yields an optimal calibration gas concentration of 200 mg/m^3 x 80% = 160 mg/m^3 CO. Nitrogen is typically added to make up the calibration gases. To verify the compatibility of various calibration gas components, please contact your calibration gas supplier.

7.2 Commissioning

7.2.1 Function test

You need the following documents for this:

- Circuit diagram
- Gas flow diagram
- Operating instructions for all analyzers

By switching on the supply voltage, you are putting the system into ready state. Then:

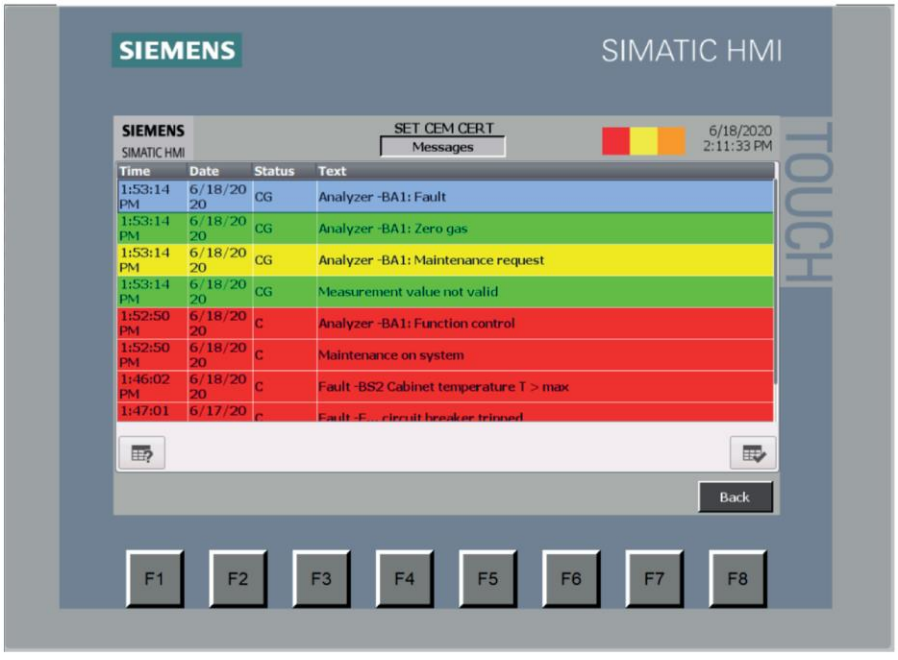
- Assign the analyzer parameters according to their function.
- Check or simulate the heating control loops.
- Check all status messages of the analyzers and the system (e.g. moisture monitoring, cooler, temperature monitoring of sample gas line, flow monitoring, reference gas monitoring, switch operation, etc.).
- Check the analog signals of the analyzers (4 - 20 mA).
- Check the pumps and solenoid valves for proper functioning.
- Simulate the status messages of the system at the S7 inputs and check the respective reaction, e.g. pump shutdown on condensate penetration, flow monitoring, switch operation, heater fault messages, cooler status messages, analyzer status messages, valve enables, automatic calibration cycle, maintenance messages and fault messages to the control center, etc.
- Introduce the calibration gases and perform a manual calibration or autocalibration.

7.2.2 Warm-up phase

Once you have completed the preparations for commissioning, you can commission the measuring system. To do this:

1. Switch on all fuses except the fuse of the sample gas pump.
2. Switch on the main switch.

Allow the measuring system to warm up for approximately 45 minutes. The group fault message can be seen during the warm-up phase.



As soon as the setpoint temperatures of the sampling probe, sample gas line and sample gas cooler have been reached, switch on the sample gas pump using the associated fuse. The sample gas pump starts up, provided that:

- No fault signal 'Moisture in gas path' is pending.
- The sample gas cooler has reached its operating temperature (approximately 4 ° C).

7.2.3 Settings after commissioning

Make the following settings on the analyzers:

- Configure and check the measuring ranges in accordance with EN 15267
- Set the analog outputs to 4 ... 20 mA (retain measured value or update measured value in the case of AUTOCAL)
- Check the relay contacts:
  - R2= Readiness for measurement
  - R4 = Function check
  - R6 = Maintenance
  - R8 = Zero gas

Note

Because these settings are made on the analyzers themselves, always observe the information contained in the respective operating instructions/manuals.

7.2.3.1 ULTRAMAT 23

Input of calibration gas concentration

Before a calibration can be performed, you must set the calibration gas concentration. This setting is made directly on the analyzer.

Proceed as follows for this purpose:

1. Press <ENTER> key → Operating menu appears
2. → Select calibration
3. → Select Calibrate IR MR
4. → Select component
5. → Select Set calibration gas setpoints
6. → Input sample gas concentration for MR1 and MR2
7. → To save, press the <MEAS> key

Repeat this procedure for other components as needed.

7.2.3.2 ULTRAMAT 6

Input of calibration gas concentrations

Before an autocalibration (AUTOCAL) can be performed, you must set the full-scale value concentration. This setting is made directly on the analyzer.

Proceed as follows for this purpose:

1. Press the softkey to the right of the menu that is located at the height of the measured component to be calibrated → Operating menu appears
2. → Select calibration
3. → (Function) 22 Select zero point/sensitivity setpoints
4. → Input sample gas concentration of the individual measuring ranges
5. → To save, press the <MEAS> key

Repeat this procedure for other components as needed.

Inputting the AUTOCAL sequence

1. Press the softkey to the right of the menu that is located at the height of the measured component to be calibrated → Operating menu appears
2. → Select calibration
3. → (Function) 24 Select AUTOCAL/check
4. → Select AUTOCAL/check mode
5. → Set AUTOCAL/check on/off to 'on' (square is solid)
6. → Set AUTOCAL/check start via binary input to 'on' (square is solid)
7. → To save these parameters, press the <MEAS> key

If a second measurement channel is present (2 components in one 19" rack unit), the sequence must also be input for this channel.

Activating the AUTOCAL sequence

Requirement: 'AUTOCAL/check start via binary input' must be activated.

1. Press the softkey to the right of the menu that is located at the height of the measured component to be calibrated → Operating menu appears
2. → Select calibration
3. → (Function) 24 Select AUTOCAL/check
4. → Select AUTOCAL/check sequence
5. You can now assemble the sequence of the AUTOCAL from various parameters
6. → To save the AUTOCAL sequence, press the <MEAS> key

Operation

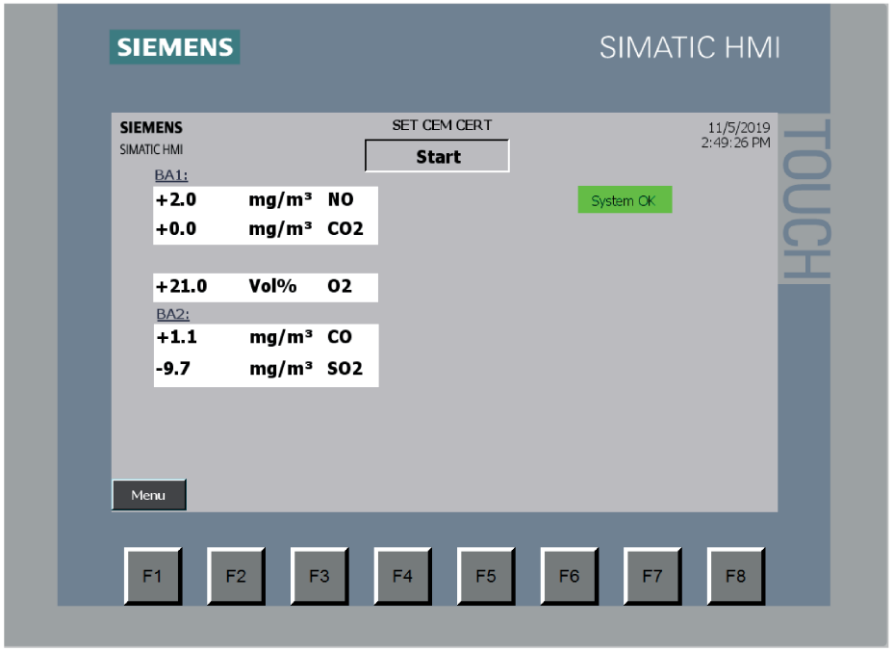
8

The Set CEM CERT system can be controlled during operation using the control panel on the door. This prevents you from having to open the door and thereby falsifying the measured values.

Note: The labeling of the buttons presented in this manual serves as an example and can be different in your system.

8.1 Display and input keys

After switch-on, the start screen with the display of measured values appears.



The current measured values are displayed in the start screen. The status of the system is indicated here with messages on a colored background (in this case 'System OK'). You reach the main menu via the <Menu> button.

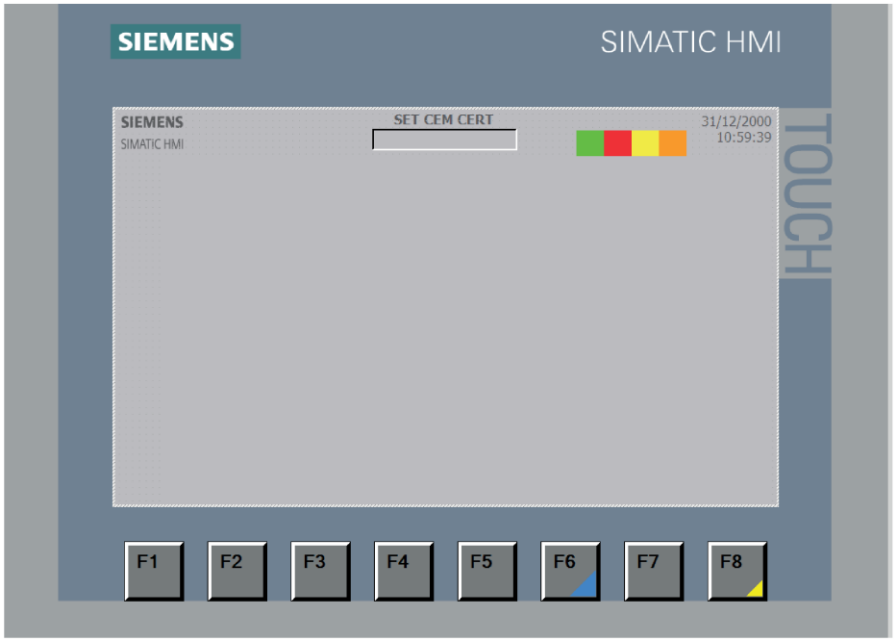
Below the display are eight function keys. On Set CEM CERT, only the <F1> and <F8> keys are active. They have the following meaning:

Key	Meaning
F1	Access to the input menus; there: advance within the menu structure
F8	Return to the previous level

8.2 Menu-based operation

8.2.1 Status traffic light

The status traffic light indicates the current status of the system.

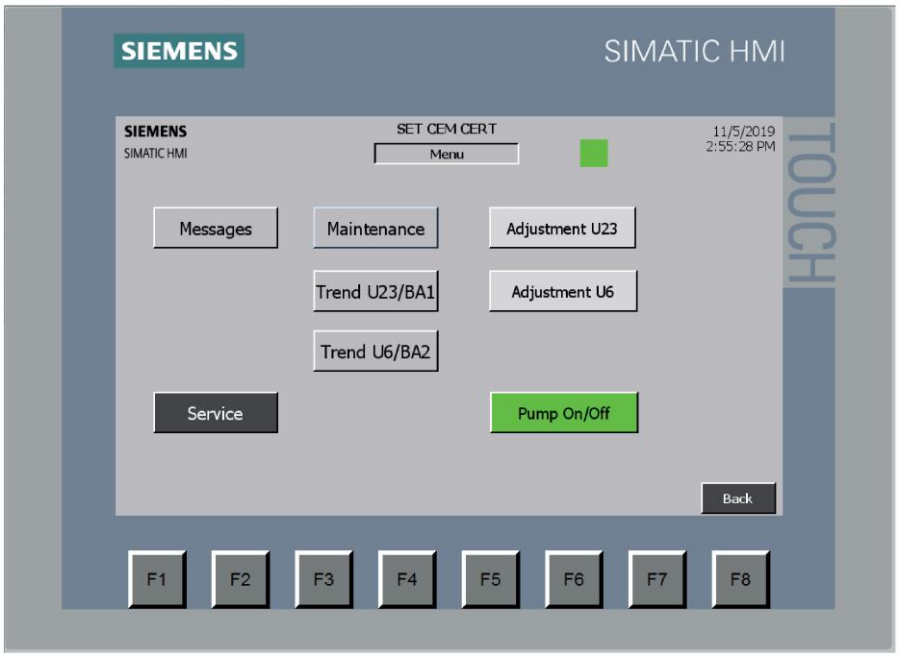


This is an example display for explanation of the individual statuses. The colors have the following meaning:

Color	Meaning
Green	System is running properly
Red	Fault with corresponding message
Yellow	Maintenance on
Orange	AUTOCAL -BAx is running

8.3 Main menu

After you touch the <Menu> button, the main menu with the control panels described in the table below appears.

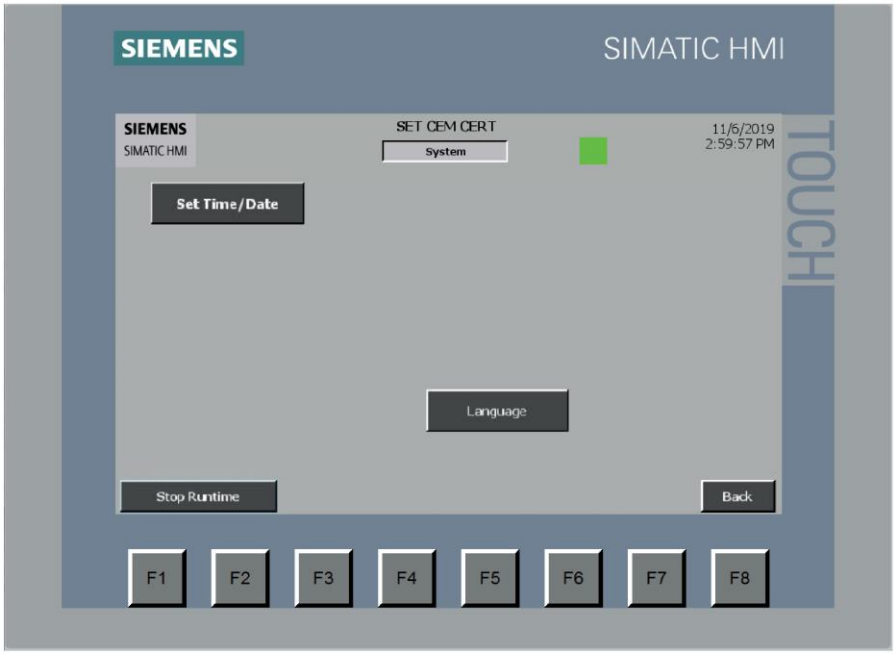


Control panel	**Meaning**
Messages	Access to all fault and warning messages
Maintenance on/off	Maintenance on/off → Signals that work is being performed on the cabinet
Calibration of U23/U6/F6	Access to the calibration menu of the U23/U6/F6
Trend U23/U6/F6	Access to the measured value trend display
Service	General settings (date/time)
Pump on/off	Switch-on/switch-off of pump
Back	Exit the menu

8.4 Submenus

8.4.1 Service submenu

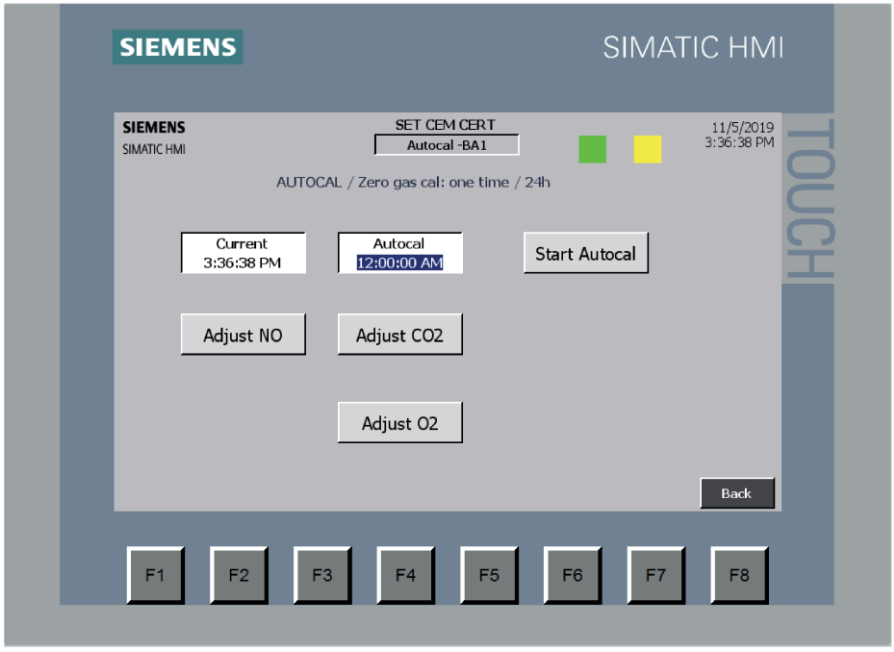
After you touch the <Service> button in the main menu, this submenu with the system parameters described in the following table appears. These system parameters can be set here.

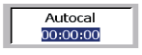


Control panel	Meaning
Set Time/Date	Access to the setting of time and date
Stop runtime	Shutdown of the display; this allows access to the basic settings of the HMI → see HMI manual
Change language	Language selection (English, German, French)

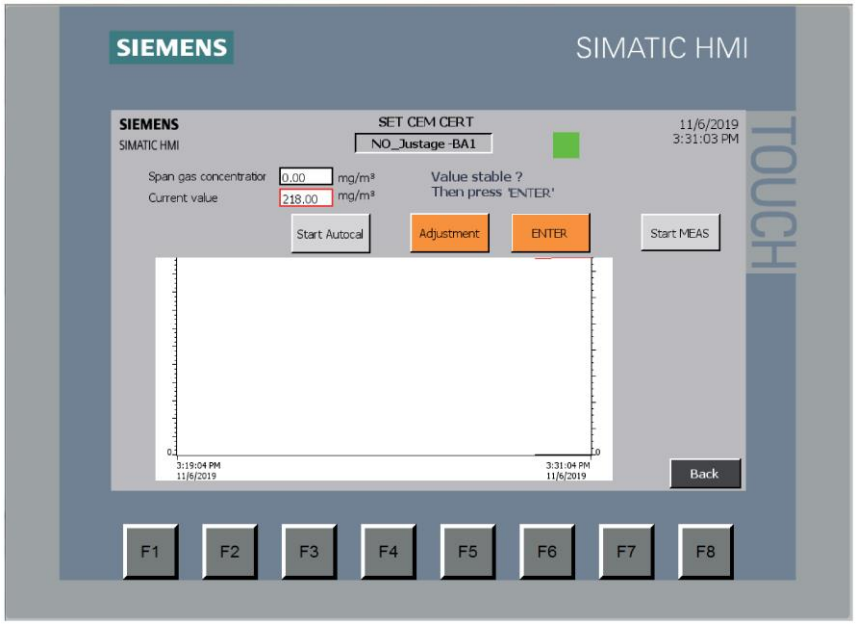
8.4.2 Calibration submenus – ULTRAMAT 23

After you touch the <Calibration U23> button in the main menu, the submenu below with the parameters described in the following table appears.



Control panel	Meaning
	Display of the current time
	Setting of the start time of a daily AUTOCAL
Start AUTOCAL	Start of AUTOCAL
Calibrate *component*, e.g. Calibrate NO	Access to the calibration menu

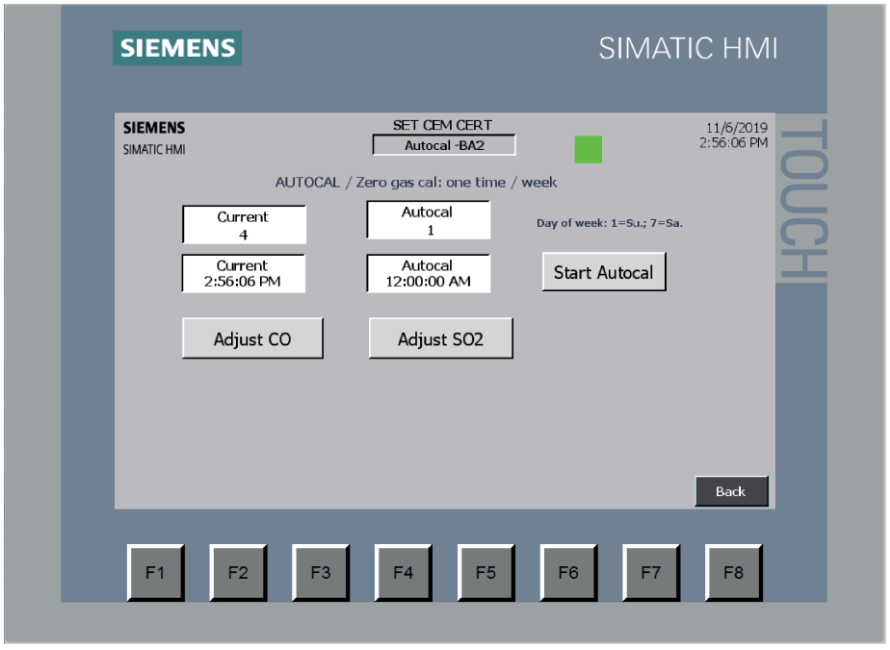
After you touch the <Calibrate *component*> button, the submenu below with the parameters described in the following table appears.



Control panel	Meaning
Start AUTOCAL	Start of AUTOCAL
Calibrate	Start of a single calibration
ENTER	Acceptance of the newly calibrated value
Start MEAS	End of the calibration, return to measuring mode
Span gas concentration 0.00 mg/m³	Input of a reference value for the calibration; is currently being used for scaling the Y-axis.

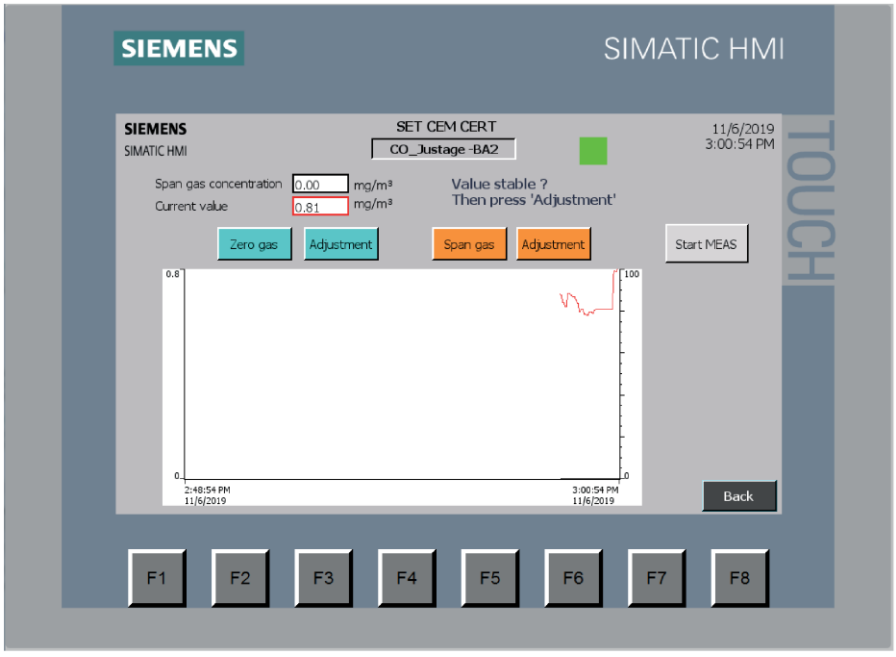
8.4.3 Calibration submenus – ULTRAMAT 6

After you touch the <Calibration U6> button in the main menu, the submenu below with the parameters described in the following table appears.



Control panel	Meaning
Calibrate *component*, e.g. Calibrate CO	Single calibration of one component, e.g. CO
Start AUTOCAL	Start of AUTOCAL
Current 4	Display of the current day of the week (1 = Sunday; 7 = Saturday); in the example on the left, 4 = Wednesday
Current 3:36:38 PM	Display of the current time
Autocal 1	Setting of the weekday on which an AUTOCAL is to take place every week
Autocal 00:00:00	Setting of the start time of a weekly AUTOCAL

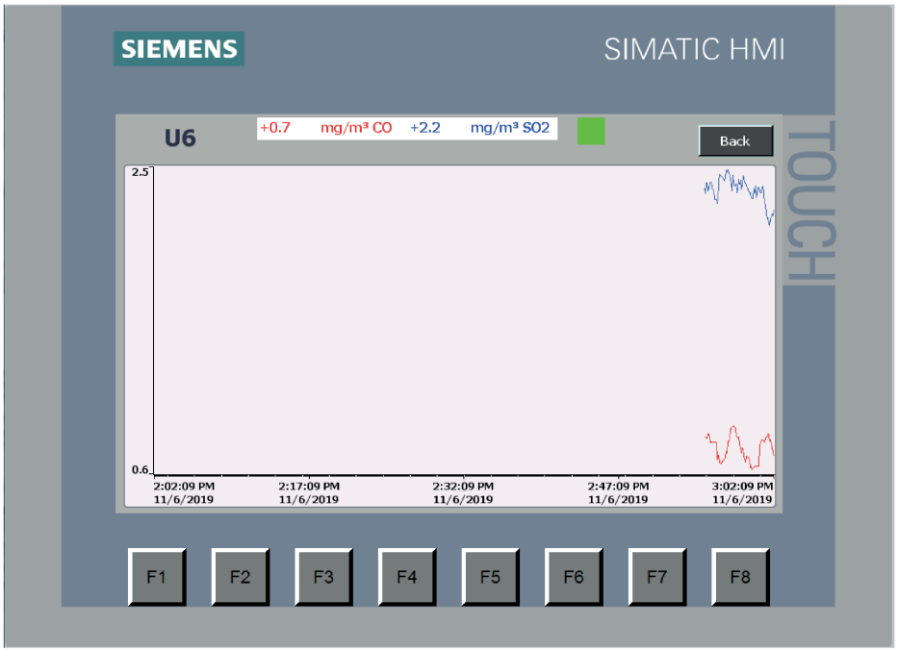
After you touch the <Calibrate *component*> button, the submenu below with the parameters described in the following table appears.



Control panel	Meaning
Zero gas	Selection of the zero point calibration
Calibration gas	Selection of the full-scale value calibration
Calibrate	Start of a single calibration
ENTER	Acceptance of the newly calibrated value
Start MEAS	End of the calibration, return to measuring mode
	Input of a reference value for the calibration

8.4.4 Trend submenu – ULTRAMAT 23/ULTRAMAT 6

In this submenu, you will find the measured value trend together with the display of the current measured values. This submenu is the same for all analyzers. The submenu for ULTRAMAT 6 is shown here by way of example.



8.4.5 Messages submenu

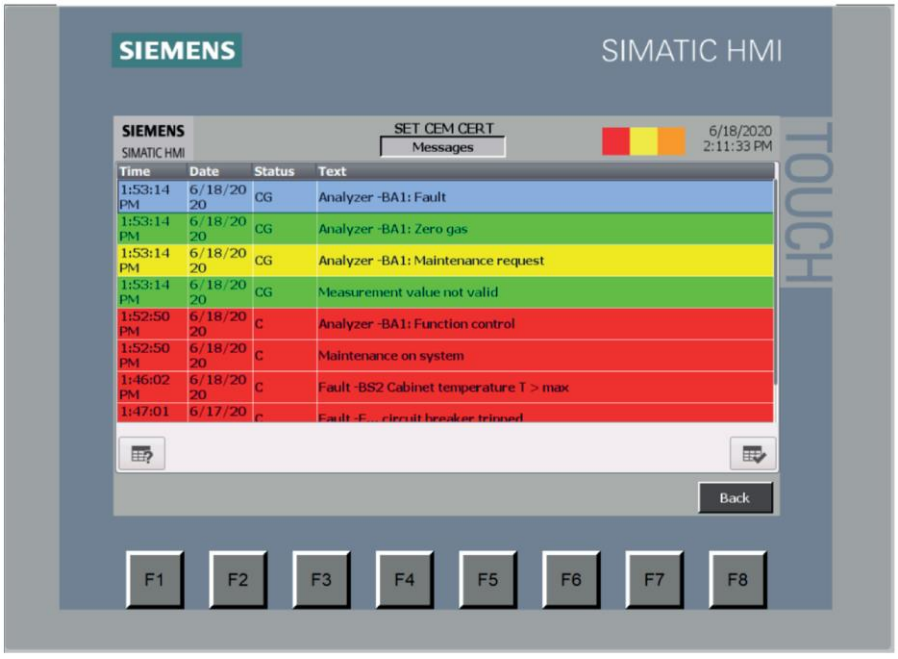
In this submenu, you will find the current error messages. Message text and meaning are described in section Error messages (Page 61).

The message colors have the following meaning:

- Red: Urgent fault message → After acknowledgment, the message turns yellow
- Yellow: Outgoing fault message → Acknowledgment possible
  Fault message that is still pending but already acknowledged → Acknowledgment not possible
- Green: Corrected fault → Acknowledgment possible

Message status:

- C (incoming): Pending message
- CG (incoming + acknowledged): Acknowledged but still pending message
- CQ (incoming + outgoing): Outgoing message



Symbol	Meaning
	Information text (none provided here)
	Selected message will be acknowledged

Functions

9

9.1 Calibrating

9.1.1 General

It is possible to calibrate the installed analyzers at the analyzer itself. For details on operating the analyzers during calibration, please refer to the manuals of the analyzers. These are included with the end customer documentation when the analyzer is delivered or can be ordered or downloaded via the Siemens Industry Online Support (SIOS) SIOS Process Analytics (https://support.industry.siemens.com/cs/products?dtp=Manual&mfn=ps&pnid=13613&lc=en-WW).

Calibration and zero gases must be connected according to the gas flow diagram before commissioning. Also make sure that adequate gas is available in the gas cylinders so that a constant gas flow is ensured.

Note

Incorrect calibration results

After the cabinet is opened, different temperatures between the interior of the cabinet and the environment may cause a drifting of the measuring instruments, in particular if the hinged frame with the devices is also swung out. In this case, wait until the measured values of the analyzer are no longer drifting before starting the calibration. This can take up to 2 hours, depending on the temperature difference.

Before starting the calibration process, set a constant flow rate of the gases between 72 l/h and 120 l/h on the flow meter of the analyzer. Ensure that this flow value remains constant throughout the calibration process.

To keep the environmental conditions constant during calibration, we recommend using the HMI display installed in the cabinet door for the calibration. After calibration is complete, the analyzer is ready for operation.

As soon as you make a setting or open the cabinet, switch on Maintenance in the menu. Switch it off again after the calibration.

9.1.2 Calibration of ULTRAMAT 23

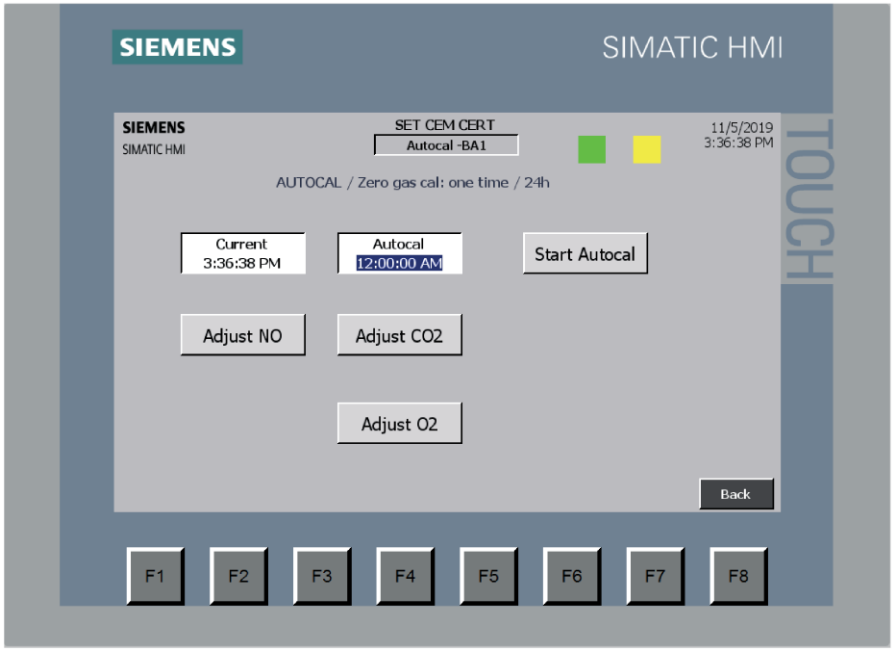
The Set CEM CERT system is configured so that the ULTRAMAT 23 analyzer (option C10, C20, C30) automatically performs an AUTOCAL with ambient air every 24 hours. This adjusts the zero point and sensitivity of the IR channels. The sensitivity of the O_2 channel (if present) is also adjusted. The timing for this can be set. (Menu → Calibration U23 → Press AUTOCAL display)

In addition, the full-scale value must be readjusted every 6 months with calibration gas.

BEFORE calibration of the full-scale value, we recommend carrying out an AUTOCAL with ambient air. Allow approximately 30 minutes for a complete calibration and take this into account if you have to guarantee regulatory availability of the AMS or provide half-hour averages.

9.1.2.1 ULTRAMAT 23 AUTOCAL calibration of zero point

Press the following buttons: *"Menu"* → *"Calibration U23"* → *"Start AutoCal"*

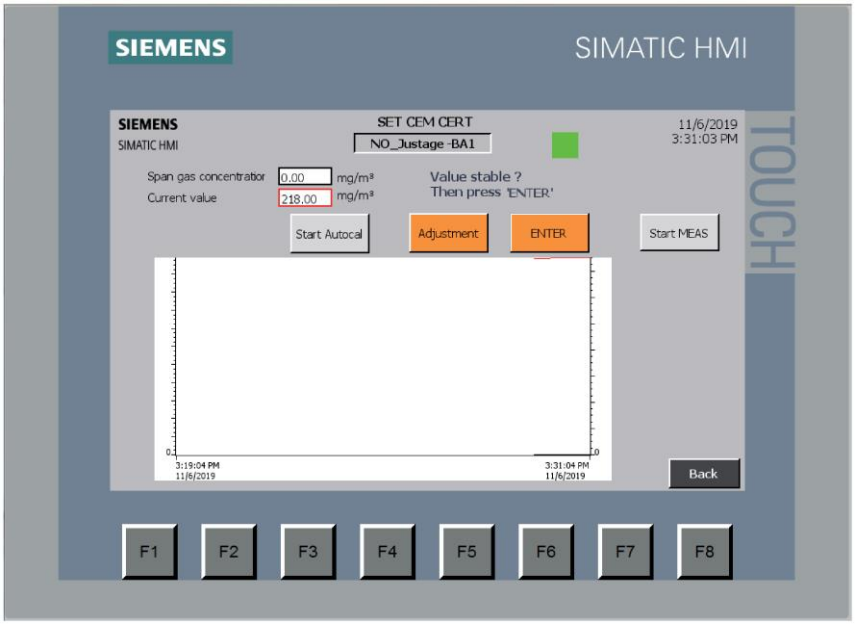


A complete AUTOCAL will now be performed. While this is taking place, the status traffic light at the top right is orange. As soon as this disappears again, the AUTOCAL is finished.

9.1.2.2 ULTRAMAT 23 – Full-scale value calibration of the individual components

Proceed as follows for the full-scale value calibration of ULTRAMAT 23:

1. Set the 3/2-way ball valve -RB1 (see Gas flow diagram (Page 71)) to the "Calibrate" position. This interrupts the sample gas flow and introduces the calibration gas into the analyzer. Before the calibration, make sure that sufficient calibration gas is available in the calibration gas cylinder and the flow is constant.
2. Press the following buttons: *"Menu"* → *"Calibration U23"* → "Calibrate component", e.g. *"Calibrate NO".*
3. For "Calibration gas concentration", input the concentration of the component in your calibration gas cylinder to be calibrated. This does not serve as a reference value, but adjusts the Y-scale in the diagram according to your input. The calibration gas concentration should already have been set directly in the menu of the analyzer beforehand.
   This action is described in the equipment manual of the analyzer.
4. Now press the "Calibrate" button.
   The analyzer switches to calibration mode.
   The following display appears:



5. Observe the course of the diagram on the display. As soon as the displayed measured value is stable and no longer rises, press the "ENTER" button.
   The calibration values are stored in the device.
6. Press the "Start MEAS" button.
7. Set the 3/2-way ball valve -RB1 to the "Measure" position in order to resume the measurement.

The analyzer then ends the function check set at the beginning; the measured value is valid again.

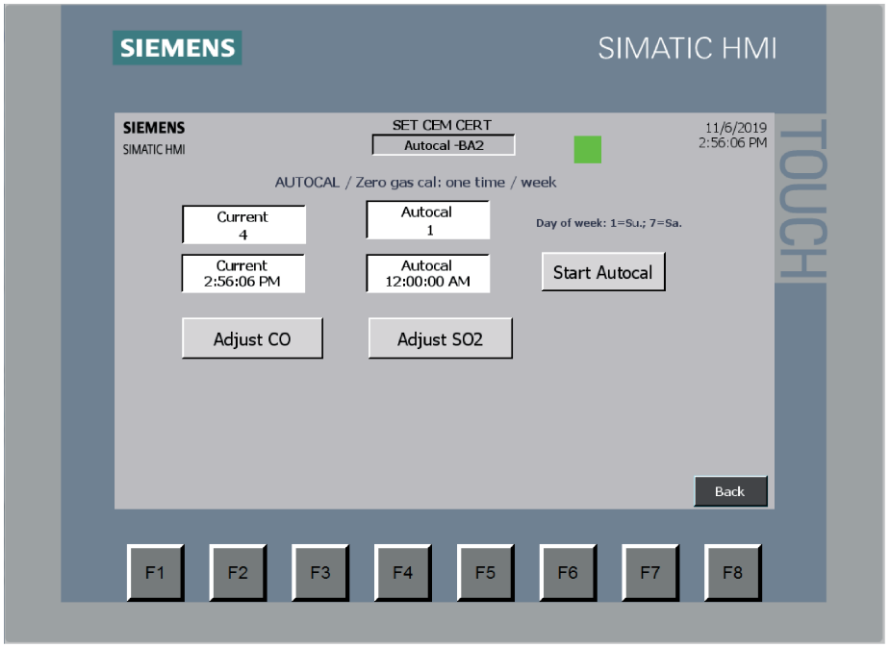
9.1.3 Calibration of ULTRAMAT 6/OXYMAT 6

The Set CEM CERT system is configured so that the ULTRAMAT 6 analyzer automatically performs an AUTOCAL (**here: zero and full-scale value calibration**) with the permanently connected zero and calibration gases once per week. The timing for this can be set.

The OXYMAT 6 can be operated in the same way as the ULTRAMAT 6 described here.

9.1.3.1 ULTRAMAT 6 – AUTOCAL calibration of the zero point and full-scale value

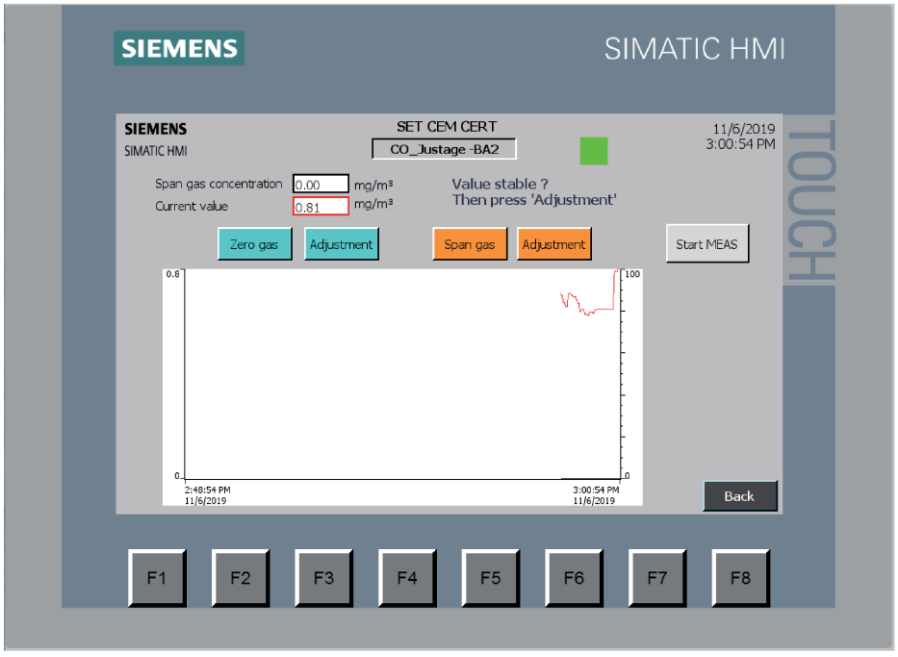
If the ULTRAMAT 6 has two measurement channels, these are calibrated at the same time with **one** calibration gas during an AUTOCAL. In the case of two calibration gases, the calibration must be adapted appropriately so that the measurement channels are calibrated one after the other in the AUTOCAL sequence.



A complete AUTOCAL is performed with the operating sequence "Menu" → "Calibration U6" → "Start AutoCal". The status traffic light is orange while the calibration takes place.

9.1.3.2 ULTRAMAT 6 – Single calibration of components

You can access the single calibration in the calibration menu using the *"Calibrate* component" button, e.g. "*Calibrate CO"*.



Press "*Zero gas"* or "*Calibration gas"* for a zero point calibration or full-scale value calibration, respectively. As soon as the value is stable, press "Calibrate *"*. To restart the measurement after the calibration, press "Start MEAS *"*.

Service and maintenance 10

10.1 Safety information

⚠ WARNING

Impermissible repair, service or maintenance

Repair and maintenance work may only be performed by personnel authorized by Siemens.

⚠ WARNING

Humid environment

Danger of electric shock.

- Avoid working on the system or the individual analyzers when these are under voltage.
- If working under voltage is required, ensure a dry environment.
- When performing cleaning and maintenance work, make sure that no moisture gets inside.

⚠ WARNING

Leaks in the sample gas path

Danger of poisoning.
When measuring toxic process media, these may be released or may accumulate inside the system or the individual analyzers if there are leaks in the sample gas path.

- Purge the system or affected analyzer with inert gas (e.g. nitrogen).
- Ensure proper disposal of the purged toxic process media by using an environmentally-compatible purging process.

⚠ WARNING

Improper connection after maintenance

Possible analyzer damage.

- Correctly connect the analyzer involved after maintenance.
- Close the analyzer and the system after maintenance.

CAUTION

Hot parts in the analyzer

After the system is switched off, temperatures capable of causing burns to unprotected skin may be present for some time.

- Wait at least 60 minutes before starting maintenance work.

CAUTION

Penetration of moisture inside the system

Damage to analyzer(s) or the system.

- When performing cleaning and maintenance work, make sure that no moisture gets inside the system or the analyzers involved.

10.2 Maintenance intervals

The measuring system must undergo maintenance at certain intervals in order to guarantee proper functioning. The recommended maintenance work is presented in the table below. The maintenance intervals specified there are based on the extensive experience of Siemens AG. The maintenance intervals can be further optimized if local conditions and empirical values suggest this. It is up to the system owner to decide whether to shorten or extend the maintenance interval on a system-related basis. However, extending the maintenance intervals requires official approval. Depending on the composition of the sample gas, it may be necessary to shorten the maintenance intervals.

All maintenance work that is marked with '**S**' in the following table may only be carried out by adequately trained personnel authorized by Siemens. Siemens offers six-monthly maintenance services as an optional service.

All maintenance work marked with '**C**' can be performed by trained or appropriately instructed personnel of the customer.

Maintenance work	Device label	Option	Maintenance interval in months					
			0.5	1	3	6	12	24
Sampling probe and sample gas line								
Inspect, clean and, if necessary, change filter	-WS1			**C**				
Check temperature of the sampling probe	-WS1				**C**			
Clean sample gas line	-EH1					**S**		
Check temperature of the sample gas line	-EH1				**C**			
Measuring system								
Inspect, clean and, if necessary, change filter	-VFx			**C**				
Check lines downstream of cooler for condensate					**C**			
Check solenoid valves for proper functioning and leaks	-QVx					**S**		
Check the condensate tank for the presence of condensate and empty if necessary	-CT	x	**C**					
Check BERO limit monitor for proper functioning	-BS4	x		**C**				
Replace feed hose of the condensate pumps	-EC1					**C**		
Replace valves and diaphragm of the sample gas pump	-GP1						**S**	
Check temperature of the sample gas cooler	-EC1			**C**				
Check cabinet air conditioning unit / cabinet fan / cabinet heater	-EC2 -GV1 -EH10	x					**S**	
Check measuring system for leaks				**C**				
Replace filter of the condensate trap	-VF1/2						**C**	
NO_x converter	-BC1	x		**C**				
Check temperature				**C**				
Check converter cartridge and replace if necessary							**C**	
Gas supply (calibration gas and zero gas)		x						
Check cylinder pressure				**C**				
Check pressure setting				**C**				
Analyzers (ULTRAMAT, OXYMAT, SIPROCESS UV600)	-BAx	x						
Calibrate full-scale value			**S***	**S***	**S***	**S***	**S***	**S***
Check for leaks						**S**		
Check connections						**S**		
Check display						**S**		

* This maintenance work is subject to legal requirements (see certificate of the measuring system)

10.3 Eliminating the moisture alarm

If there is moisture in the gas path downstream from the gas cooler, the built-in humidity sensor responds, the sample gas pump switches off and a fault message is output. This error can be corrected as follows:

1. Switch off the fuse of the sample gas pump.
2. Remove the gas lines downstream from the sample gas cooler.
3. Clean the removed gas lines or replace them with new lines.
4. Replace the filters in the section between the gas cooler and the analyzers.
5. Clean the components (e.g. flowmeter, humidity sensor, regulating valves) in this section.
6. Reinstall the clean parts.
7. Check the new or cleaned system for leaks.
8. Acknowledge the fault message on the control panel display.
9. Switch on the fuse of the sample gas pump again.

10.4 Harmful substances in the condensate

⚠WARNING

Harmful substances in the condensate

The condensate at the sample gas cooler or condensation trap can be corrosive, depending on the composition of the sample gas (e.g.: through SO_2, NO, H_2S, HCl, etc.). When you dip litmus paper into the condensate it will turn red.

- Wear protective clothing, protective goggles and protective gloves when handling the condensate!
- Prior to its disposal, dilute the condensate with tap water until it turns neutral and the litmus paper does not change color. Alternatively, you can also neutralize the condensate with a weak sodium carbonate solution (Na_2CO_3).

10.5 Emptying the condensate tank

The condensate level in the condensate tank must be regularly checked. If the level is too high, a maintenance request is displayed via the sensor. The condensate tank must be emptied when this maintenance request appears, at the latest.

While the condensate tank is being emptied, the measuring system operates without condensate disposal. The condensate tank must be emptied and reconnected as quickly as possible, because condensate may otherwise accumulate in the cooling paths of the cooler and impair measurements.

After reconnection of the condensate tank and the capacitive sensor, the condensate disposal is fully functional again.

The distance between the capacitive sensor and the condensate tank determines the sensitivity of the display.

To empty the condensate tank, proceed as follows:

1. Loosen the hose couplings on condensate tank (couplings close automatically when loosened).
2. Detach the capacitive sensor together with the mounting bracket (level monitoring).
3. Carefully remove the tank.
4. Dispose of the condensate from the tank properly via the yellow cap.
5. Reconnect the tank using the coupling and attach the capacitive sensor together with the mounting bracket between the tank and tank handle.

10.6 Spare parts/accessories

For spare parts, please refer to the SIOS Process Analytics (https://support.industry.siemens.com/cs/products?dtp=Manual&mfn=ps&pnid=13613&lc=en-WW).

Alarm, fault and system messages

11

11.1 Error messages

A group fault message is output on the operator display if one or more of the following conditions is not met:

- All fuses are OK
- All gas preparation elements are OK
- The maximum permissible cabinet temperature has not been reached or exceeded
- The minimum temperature of the sampling probe has been reached
- The minimum temperature of the sample gas line has been reached
- All air conditioning units (options) are OK
- Analyzer 1 is OK
- Analyzer 2 (option) is OK
- Analyzer 3 (option) is OK
- Flow rate is in the permissible range (72 ... 120 l/h) for each analyzer

The group fault message remains active until all individual fault messages are eliminated. The fault messages must be acknowledged on the SIMATIC HMI display after correction of the fault.

The group fault message is also output when the system is switched on. It is normally reset automatically after the warm-up period ends.

The following errors are reported:

Message	**Meaning**
Fault -EC1 sample gas cooler T > max	Fault sample gas cooler (see corresponding manual)
Fault -EC2 air conditioning unit	Fault air conditioning unit (see corresponding manual)
Fault -BC1 converter	Fault NOx converter (see corresponding manual)
Fault -BS3 control cabinet temperature T > max	Temperature in control cabinet too high
Fault -EH1 heated sample gas line T < min	Temperature of sample gas line too low
Fault probe -WS1 temperature T < min	Temperature of probe too low
Fault -F... miniature circuit breaker tripped	One or more fuses tripped
Analyzer -BAx: Fault	Fault on analyzer x
Analyzer -BAx: CHy fault	Fault in measurement channel y on analyzer x
Analyzer -BAx: Function check	Calibration process active or operator control of analyzer BAx
Analyzer -BAx: CHy function check	Calibration process active or operator control of measurement channel y of analyzer x
Analyzer -BAx: Maintenance request	Maintenance request from analyzer x (e.g. empty calibration gas cylinder)
Analyzer -BAx CHy: Maintenance request	Maintenance request from measurement channel y of analyzer x
Analyzer -BAx: Calibration gas	Analyzer x requests calibration gas
Analyzer -BAx: Zero gas	Analyzer x requests zero gas
Maintenance on system	Maintenance mode activated
Measurement invalid	Invalid measurement
Maintenance request from system	Maintenance request from system, e.g. filter change, full condensate tank
-BS4 condensate tank level L > max: Maintenance request	Condensate tank is full

Technical specifications

12

System design	
Color	RAL 7035
Weight	Approx. 160 kg (353 lbs.)
Sheet-steel cabinet/frame Dimensions (with base) [1]	Indoor installation 2100 x 800 x 800 mm; 83" x 31 1/2" x 31 1/2" (H x W x D)
GRP cabinet Dimensions (with base) [1]	Outdoor installation 2060 x 900 x 800 mm; 81" x 35 1/2" x 31 1/2" (H x W x D)
Explosion protection classification	Installation outside the Ex zone
Degree of protection	IP 54 (avoid direct sunlight when installed outdoors)
Operating position	Vertical
Sample gas cooler	2-stage
Calibration • ULTRAMAT 23 • ULTRAMAT 6, OXYMAT 6	 Semi-automatic; AUTOCAL freely adjustable up to max. 24-hour interval Fully automatic
Analyzers	ULTRAMAT 23, ULTRAMAT 6, OXYMAT 6 and SIPROCESS UV600 For further technical details of the analyzers, refer to the corresponding operating instructions. This information is included in section 4 of the overall documentation with your delivery.

[1] A space of 500 mm (20") must be provided on the right or left side for the cable inlet and the connection of the heated sample gas line.

Climatic conditions	
Permissible ambient temperature • During operation • With heating in sheet-steel cabinet • With heating in GRP cabinet • With air conditioning	 +5 ° C ... +40 ° C, standard; conforms to EN 15267-3 -5 ° C ... +45 ° C -15 ° C ... +40 ° C Max. +52 ° C
Permissible ambient humidity	75% RH (relative humidity) annual average, non-condensing
The conditions of EN 15267-3 must be observed.	

Sample gas conditions[1]	
Max. sample gas pressure at inlet to sample preparation system	500 hPa (mbar)
Max. moisture content in sample gas[2, 3]	
• Cooler type: CSS, with PVDF heat exchanger	17 vol. %
• Cooler type: EGK 2-19, with glass heat exchanger	25 vol. %
Sample gas temperature	Max. 200 ° C at cabinet entry
Sample gas flow	Max. 60 l/h per analyzer module
Sample gas line, electrically heated	≤ 50 m, longer lengths on request

1) Sample gas must not be flammable or explosive

2) With NO and SO_2 concentrations < 500 mg/m^3, the glass heat exchanger must be used

3) When the SIPROCESS UV600 analyzer is used, the cooler type EGK 2-19 must be used due to its greater cooling capacity

Sampling probe (standard)[1]	
Dust load	< 2 g/m^3
Mounting flange	DN 65, PN 6, form B
Temperature controller	Pt100
Sampling tube	Stainless steel, inner, length 1 m (can be shortened)
Probe temperature	180 ° C
Filter stability	≤ 600 ° C

1) Sampling probes for higher temperatures and in other materials on request

Electrical characteristics	
Power supply	
• Supply 1	230 V AC, +10%/-15%, 50 ... 60 Hz
• Supply 2	400 V AC, +10%/-15%, 50 ... 60 Hz
Power consumption	Max. 5000 VA without heated sample gas line
Electrical inputs and outputs	
Output signals	4 ⋯ 20 mA (corresponding to the analyzer information) Additional digital inputs and outputs via PLC
Fusing of electronic loads	1-pin or 2-pin (selectable)

Physical setting data	
Gas cooler	Setpoint +4 ° C, set at factory
Monitoring of heated sample gas line -EH1 • K2 - Monitoring • K1 - Control	Setting on -KT1 T_{min} +140 ° C T_{set} +180 °C [1]
Temperature setting on probe	T_{set} +180 °C [1]
Cabinet temperature monitoring -KT2	Tmax +35 ° C
Cabinet air conditioning (manufacturer's setting on air conditioning unit)	15 ° C ... 35 ° C
Thermostat for frost protection heater -EH10	8 ° C

[1] The setpoint temperature of the heated sample gas line and the probe may differ depending on the acid dew point of the gas. The maximum setpoint temperature depends on the type of probe and the type of sample gas line. Observe the information provided by the respective manufacturer.

Time intervals	
Calibration • ULTRAMAT 23 • ULTRAMAT 6	24 h must be set for the automatic zero point calibration (Thermo AUTOCAL function activated). A weekly interval must be provided for the automatic zero and reference point calibration.
Maintenance	See current certificate

Dimension drawings

13

13.1 Dimension drawings

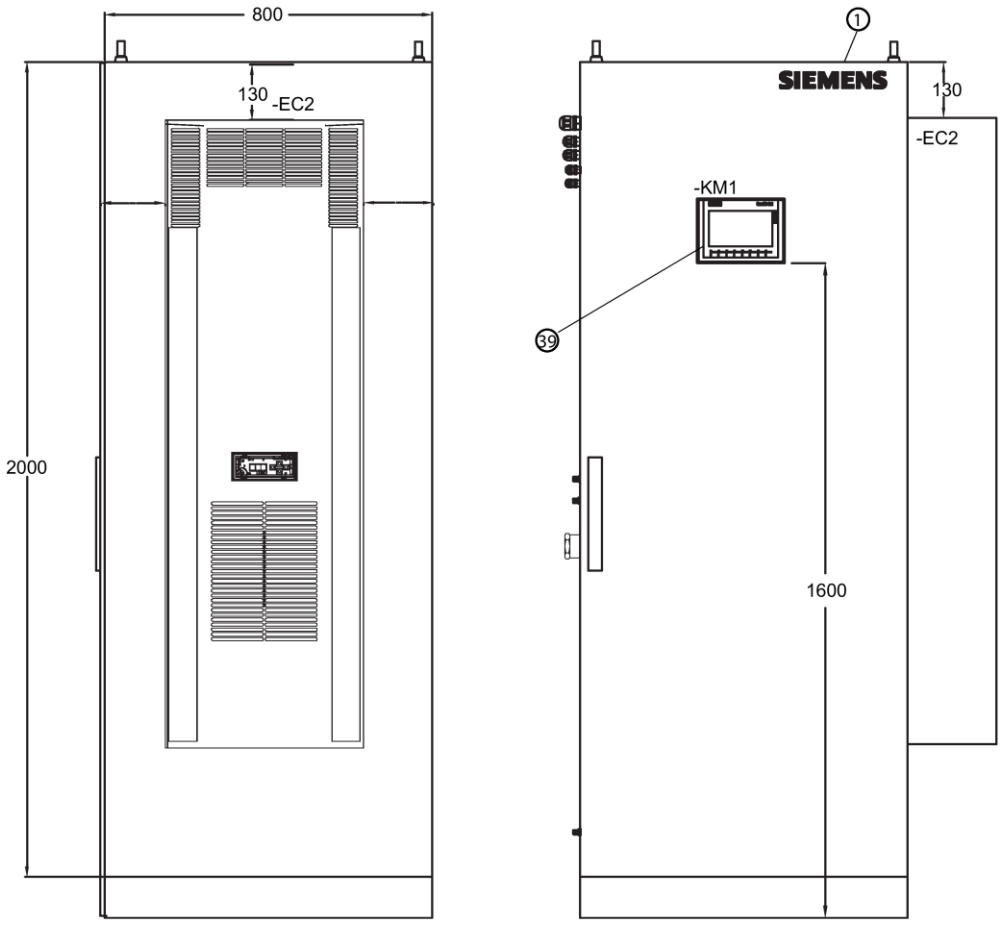


Figure 13-1 Set CEM CERT, right side view and front view with cabinet closed

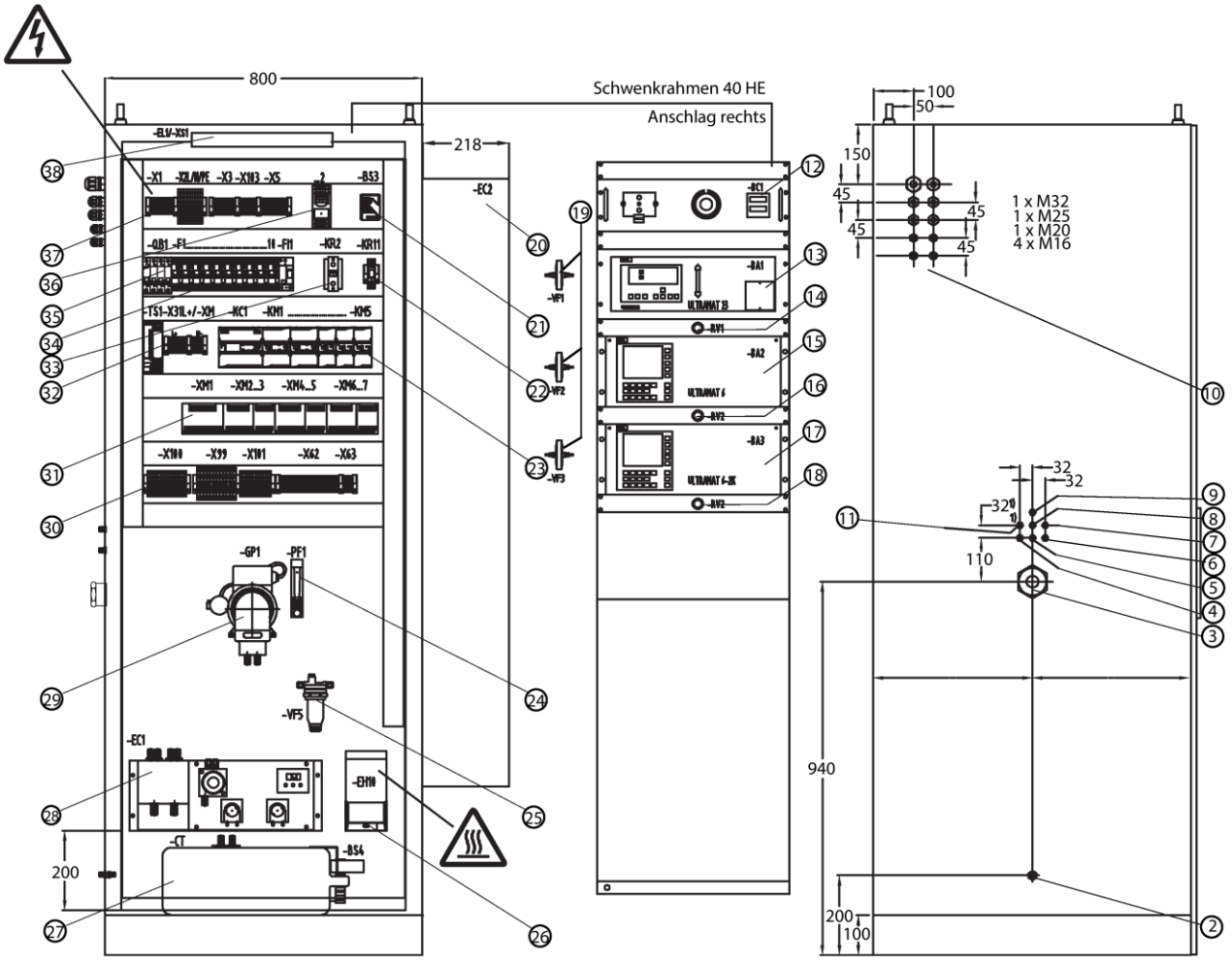


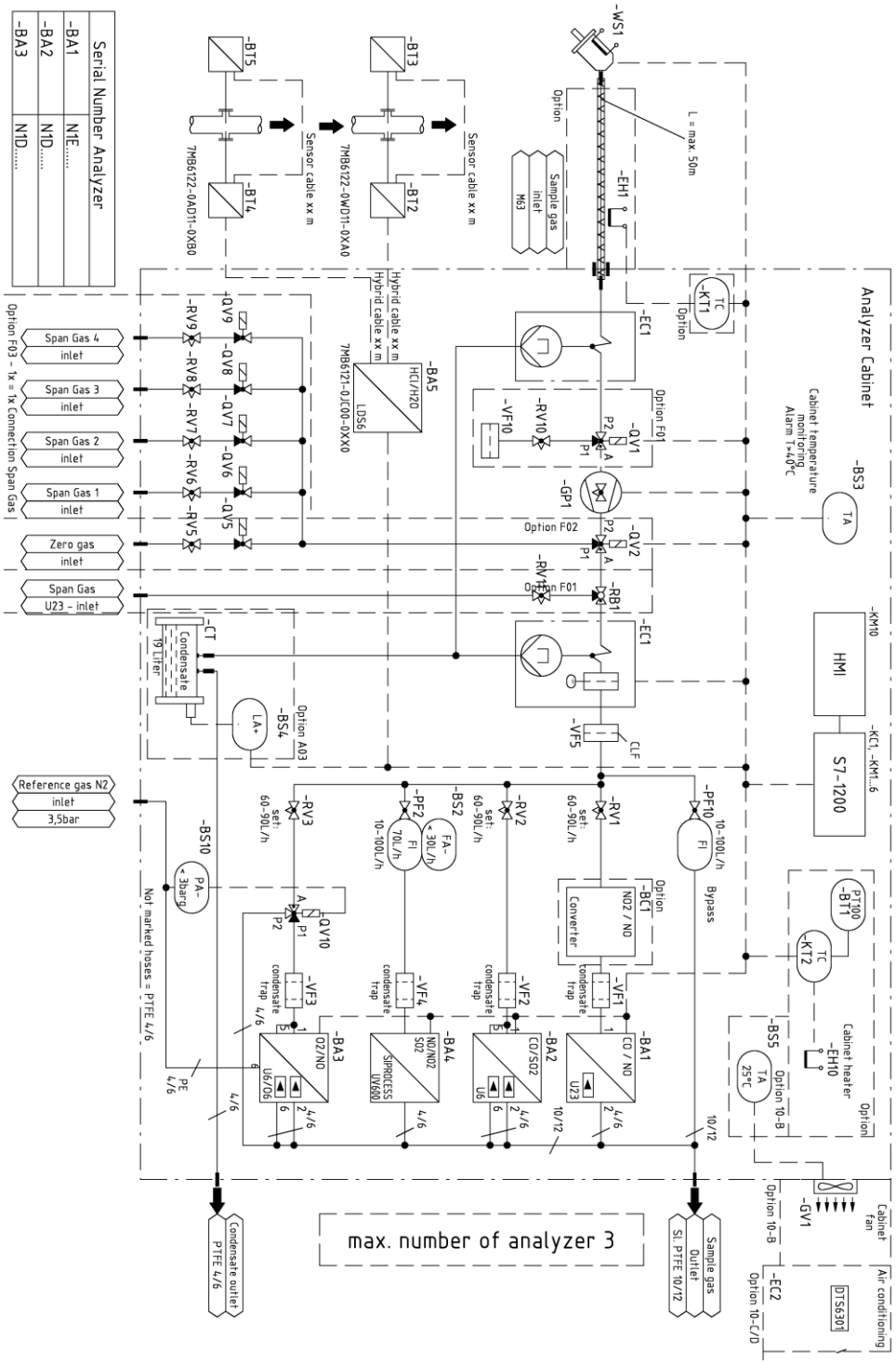
Figure 13-2 Set CEM CERT, front view with cabinet open, folded out hinged frame and left side view

Legend for cabinet drawings			
Connections		Components	
1	Sample gas outlet	12	NOx converter
2	Condensate vent	13	ULTRAMAT 23 gas analyzer
3	Sample gas inlet	14	Sample gas inlet regulating valve RV1
4	Calibration gas inlet 1	15	ULTRAMAT 6 gas analyzer
5	Calibration gas inlet 2	16	Sample gas inlet regulating valve RV2
6	Calibration gas inlet 3	17	ULTRAMAT 6 2-channel gas analyzer
7	Reference gas inlet	18	Sample gas inlet regulating valve RV3
8	Calibration gas U23	19	Filter VF 1 ... 3
9	Bypass outlet	20	Air conditioning unit (optional)
10	Electrical inputs and outputs	21	Control cabinet temperature monitoring BS3
11	Zero gas inlet	22	KRM
		23	KM1 ... KM5, KC1
		24	Flow meter PF1
		25	CLF filter VF5
		26	Thermostat for frost protection heater EH10
		27	Condensate tank
		28	Sample gas cooler
		29	Sample gas pump
		30	Terminal strips for signals
		31	XM1 ... XM7
		32	TS1/X31L
		33	KR2
		34	Miniature circuit breakers F1 ... F11, FM
		35	QB1
		36	Temperature controller for heated sample gas line
		37	Terminal strip for external connections
		38	EL1/XS1
		39	Operating window

Wiring diagrams

14

14.1 Gas flow diagram



14.2 Legend for gas flow diagram

Designation	Description of component
-BA1, -BA2, -BA3, -BA4	Gas analyzers
-BS2	
-BS3	Control cabinet temperature monitoring alarm when T > 40 ° C
-BS4	Condensate level monitoring (option)
-BS5	Control cabinet temperature monitoring fan ON when T > 25 ° C (option)
-BS10	Reference gas monitoring for OXYMAT 6 (option)
-BT1	Temperature sensor Pt100 cabinet heater temperature (option)
-CT	Condensate tank
-EC1	Sample gas cooler, dew point at 4 ° C
-EC2	Air conditioning (option)
-EH1	Sample gas line heater
-EH10	Thermostat for frost protection heater
-GP1	Sample gas pump
-GV1	Control cabinet fan (option)
-KT1	Sample gas heater monitoring
-KT2	Cabinet temperature monitoring
-PF2	Flow meter and flow monitoring for SIPROCESS UV600 (option)
-PF10	Bypass flow meter (option)
-QV1, -QV2	Solenoid valves for sample gas, zero gas and calibration gases
-QV5, -QV6, -QV7, -QV8, -QV9	Solenoid valves for zero gas and calibration gases
-RB1	Calibration gas cross-over cock U23 (option)
-RV1, -RV2, -RV3	Regulating valves for sample gas inlets
-RV5, -RV6, -RV7, -RV8, -RV9	Regulating valve for zero gas and calibration gases
-RV10	Regulating valve for AUTOCAL flow rate ULTRAMAT 23
-VF1, -VF2, -VF3, -VF4, -VF5, -VF10	Condensate trap
-WS1	Gas sampling probe
HMI	Human Machine Interface
S7-1200	Control unit

Appendix

A

A.1 Service and support

Technical support is available on the Internet at: Services & Support (https://support.industry.siemens.com/cs/gb/en/sc)

Your regional Siemens representative can be found here: Contact partner (https://w3.siemens.com/aspa_app/)

A.2 Returns

A.2.1 Returns

Note

Return delivery of contaminated device components

Device components which have come into contact with radioactive gases or substances, or have been exposed to radioactive or high-energy radiation, may no longer be returned.

The owner of the device must ensure in such cases that the contaminated device components are disposed of correctly in accordance with the local directives at the location of use.

The gas analyzer or replacement parts should be returned in their original packaging. If the original packaging is no longer available, we recommend that you wrap the device in plastic foil and pack it with shock-absorbing material (wood shavings, cellular rubber, or similar material) in a sufficiently large box. If you use wood shavings, the stuffed layer on each side should be at least 15 cm thick.

For overseas shipping, shrink-wrap the devices in an additional PE foil which is at least 0.2 mm thick, with a desiccant (e.g. silica gel) enclosed. For this type of shipping, you must also line the inside of the transport container with a double layer of tar paper.

If you return your device for repair, enclose the filled-in decontamination declaration as well as the filled-in fault description. In the case of guarantee claim, please enclose your guarantee card.

Decontamination declaration

With this declaration you confirm "that the device/spare part has been thoroughly cleaned, is free of residues, and that the device/spare part represents no danger for mankind and environment."

If the returned device/spare part has come into contact with poisonous, corrosive, flammable or polluting substances, you must thoroughly rinse, clean and neutralize the device/spare part before returning it, in order to ensure that all hollow areas are free of hazardous substances. Check the item after it has been cleaned.

SIEMENS will return devices or spare parts to you at your expense if a decontamination declaration is not included.

SIEMENS will only service returned products or spare parts if this decontamination declaration is enclosed which confirms that the products or spare parts have been correctly decontaminated and are therefore safe to handle. The decontamination declaration must be visibly attached to the outside of the packaging in a firmly secured transparent document bag.

A form for the Declaration of Decontamination is available from Services & Support Services & Support (https://support.industry.siemens.com/cs/gb/en/sc).

A.2.2 Return address

For quick identification and elimination of causes of error, we ask you to return the devices. The return address responsible for your location can be found here:
Return address (https://www.automation.siemens.com/mcms/aspa-db/en/automation-technology/Pages/default.aspx)

A.2.3 Error Description

Customer name	
Administrator	
Delivery address	
Phone/ Fax/ E-mail:	
Return delivery address (if not the same address as above)	
Device name	
MLFB No.	
Serial number	
Description of returned part	
Fault indication	
Process data at measuring point	
Operating temperature	
Operating pressure	
Composition of sample gas	
Operating duration/ operating date	
Confirmation	It is confirmed that the returned part has **not** come into contact with highly toxic or radioactive gases or substances, or been exposed to radioactive or high-energy radiation.
Company, department	
Last name, first name	
Location:	
Date:	Signature:

Software update ( ) yes ( ) no

ESD guidelines

B

Definition of ESD

All electronic modules are equipped with large-scale integrated ICs or components. Due to their design, these electronic elements are highly sensitive to overvoltage, and thus to any electrostatic discharge.

The electrostatic sensitive components/modules are commonly referred to as ESD devices. This is also the international abbreviation for such devices.

ESD modules are identified by the following symbol:

NOTICE
ESD devices can be destroyed by voltages well below the threshold of human perception. These static voltages develop when you touch a component or electrical connection of a device without having drained the static charges present on your body. The electrostatic discharge current may lead to latent failure of a module, that is, this damage may not be significant immediately, but in operation may cause malfunction.

Electrostatic charging

Anyone who is not connected to the electrical potential of their surroundings can be electrostatically charged.

The figure below shows the maximum electrostatic voltage which may build up on a person coming into contact with the materials indicated. These values correspond to IEC 801-2 specifications.

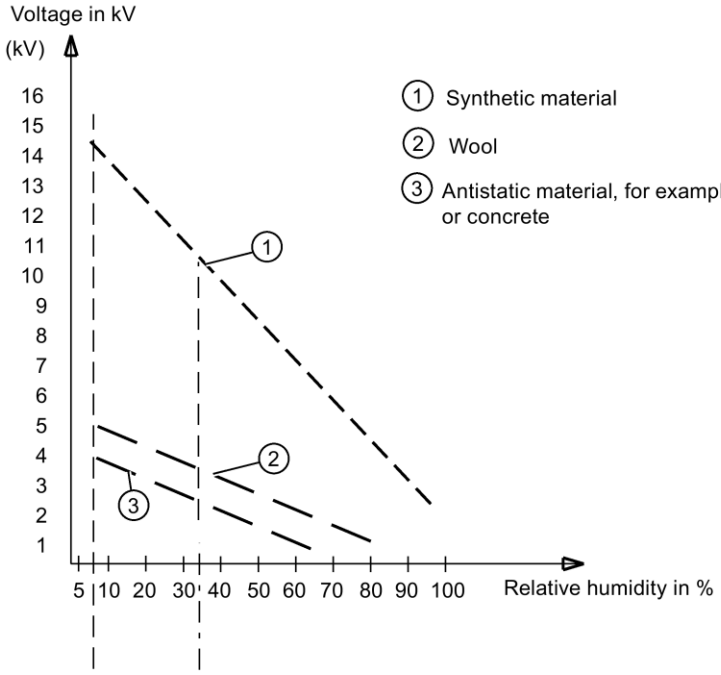


Figure B-1 Electrostatic voltages on an operator

Basic protective measures against electrostatic discharge

- Ensure good equipotential bonding:
  When handling electrostatic sensitive devices, ensure that your body, the workplace and packaging are grounded. This prevents electrostatic charge.
- Avoid direct contact:
  As a general rule, only touch electrostatic sensitive devices when this is unavoidable (e.g. during maintenance work). Handle the modules without touching any chip pins or PCB traces. In this way, the discharged energy can not affect the sensitive devices.

  Discharge your body before you start taking any measurements on a module. Do so by touching grounded metallic parts. Always use grounded measuring instruments.

List of abbreviations

C

C.1 List of abbreviations

Abbreviation/ Character	Meaning
"	Inch; unit of length 1" ≙ 25.4 mm
%	Percent; 100th part of whole
° C	Degree Celsius; unit of temperature
AMS	**A**utomated **M**easuring **S**ystem
AST	**A**nnual **S**urveillance **T**est
AUTOCAL	Automatic Calibration function
BImSchV	**B**undes**im**missions**sch**utz**v**erordnung (German Federal Emission Control Ordinance), one of 42 regulations of the Federal Republic of Germany (as of July 2017) for protection against harmful environmental impacts
CEM(S)	**C**ontinuous **E**mission **M**onitoring (**S**ystem)
CERT	**Cert**ified; this system is certified in accordance with EN 15267
DIN	**D**eutsches **I**nstitut für **N**ormung (German Institute for Standardization)
EC	**E**uropean **C**ommunity
EN	**E**uropean **N**orm (European Standard)
EU	**E**uropean **U**nion
GRP	**G**lass fiber **r**einforced **p**lastic
HMI	**H**uman **M**achine **I**nterface
hPa	**H**ecto**pa**scal, unit of pressure
Hz	**H**ert**z**, unit of frequency
IED	**I**ndustrial **E**missions **D**irective
IP	**I**nternal **P**rotection; degree of protection
IR	**I**nfra**r**ed
ISO	**I**nternational **S**tandardization **O**rganization
kg	Unit of mass; 1 kg ≙ 2,205 lbs.
lb	Pound (from Latin **l**i**b**ra), unit of mass; 1 lb. ≙ 0.4536 kg
mA	**M**illi**a**mpere, unit of electric current
MR	**M**easuring **r**ange
MCERTS	**M**onitoring **Cert**ification **S**cheme, monitoring and certification authority for England and Wales
mm	**M**illi**m**eter, unit of length
NDIR	**N**on-**d**ispersive **i**nfra**r**ed
NO_x	Generic designation for different nitrogen oxides
PVDF	**P**oly**v**inyli**d**ene **f**luoride, a plastic
PTFE	**P**oly**t**etra**f**luoro**e**thylene, a plastic; Teflon™ is one of its trade names
QAL	**Q**uality **A**ssurance **L**evel

Abbreviation/ Character	**Meaning**
RAL	RAL - Deutsches Institut für Gütesicherung und Kennzeichnung (German Institute for Quality Assurance and Certification)
RH	**R**elative **h**umidity
PLC	**P**rogrammable **l**ogic **c**ontroller
TA Luft	Technical Instructions on Air Quality Control (Germany)
TÜV	**T**echnischer **Ü**berwachungs**v**erein, monitoring and certification authority in Germany
UPS	**U**ninterruptible **p**ower supply
V	**V**olt, unit of voltage
VA	**V**olt-**a**mpere, unit of apparent power *S*
VDE	**V**erband **d**er **E**lektrotechnik, Elektronik und Informationstechnik (German Association for Electrical, Electronic and Information Technologies)
Vol.	**Vol**ume

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