OPERATING INSTRUCTIONS

MERCEM300Z

Mercury Analyzer

Installation, Operation, Maintenance

SICK
Sensor Intelligence.

Document Information

Document Identification
Title: Operating Instructions MERCEM300Z
Part No.: 8013255
Version: 2.0
Release: 2014-09

Described Product
Product names: MERCEM300Z
MERCEM300Z Indoor

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Original documents
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Legal information
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Glossary

CAN-Bus: Control Area Network. A field bus.

Ethernet: Computer networking technology. Basis for network protocols, such as TCP/IP.

Firewall: Safety concept of software and hardware components to restrict access to computer networks.

Modbus®: Field bus communication protocol

PROFIBUS®: Field bus communication protocol

OLE: Object Linking and Embedding. Standardized data interface (Microsoft Corporation)

OPC: Openness, Productivity, Collaboration. Standardized data interface (OPC Foundation™).

Span gas: Test gas with a concentration of approx. 75% of the upper measurement range limit

SOPAS (SICK Open Portal for Applications and Systems): SICK Parameter Setting and Data Calculation Software.

SOPAS ET: SOPAS PC Engineering Tool. Configuration protocol.

TCP/IP: Network protocol.

Warning Symbols


Hazard (general)


Hazard by voltage


Hazard by explosive substances/mixtures


Hazard by corrosive substances


Hazard by unhealthy substances


Hazard by laser radiation

Warning Levels/Signal Words

DANGER
Risk or hazardous situation which *will* result in severe personal injury or death.

WARNING
Risk or hazardous situation which *could* result in severe personal injury or death.

CAUTION
Hazard which *could* result in less severe or minor injuries.

NOTICE
Hazard which could result in property damage.

Information Symbols


Important technical information for this device


Important information on electric or electronic functions


Supplementary information


Link to information at another place


Nice to know

MERCEM300Z

1 Important Information

Main instructions for operation

Intended use

Own responsibility

1.1 Important Information

NOTICE: **During measurement: Keep cabinet door closed**

An open cabinet door results in measurement errors.

► Keep the cabinet door closed during operation.

Potentially dangerous gas in device

WARNING: Risk to health through contact with toxic gases

The modules and devices contain enclosed potentially dangerous gases that can escape due to a defect or leak. Refer to the Table below for these gases. If a leak occurs, the concentrations inside the enclosed device can increase up to a certain concentration. These concentrations are also shown in the Table.

► Regularly check the state of the device/module seals.

► Only open the device when well ventilated, especially when a leak of a device component is suspected.

Device / Module	Gas	Max. total volume (ml)	Max. concentration inside the device with a leak (defect)
MERCEM300Z MERCEM300Z Indoor	Hg	150 µg	80 ppb
	Hydrocarbons	6.5 ml	
Calibration gas generator	$HgCL_2$ solution	10 l	30 ppb

1.2 Intended use

1.2.1 Purpose of the device

MERCEM300Z and MERCEM300Z Indoor (referred to as "device" in the following) are extractive gas analysis systems and serve continuous measurement of mercury and mercury compounds in the exhaust gases of industrial combustion plants (emission measuring system).

The sample gas is taken at a sampling point and fed through the gas analysis system (extractive measurement).

1.3 Product identification

Product names:	MERCEM300Z Indoor MERCEM300Z
Manufacturer:	SICK AG Erwin-Sick-Str. 1 · D-79183 Waldkirch · Germany

Type plates

Number of type plates: 2

Position: Top right, inside and outside.

It is possible that the device has a different configuration to that described in this Manual.

► Refer to the System Documentation delivered with your device for the individual configuration of your system.

1.3.1 Installation location

MERCEM300Z Indoor

Installation location: In air-conditioned rooms (IP43).

MERCEM300Z

Installation location: Indoors or outdoors (IP55).

1.4 Responsibility of user

1.4.1 Target group

This Manual is intended for persons installing, operating and maintaining the MERCEM300Z and MERCEM300Z Indoor.

> ***NOTICE:*** **Responsibility for system safety**
> The person setting up the system in which the device is to be integrated is responsible for the safety of the system.

Operation

The device may only be operated by qualified persons who, based on their device-specific training and knowledge as well as knowledge of the relevant regulations, can assess the tasks given and recognize the hazards involved.

Installation and maintenance

Skilled persons may be required at certain times during installation and maintenance.

Please observe the information at the beginning of the respective Sections.

1.4.2 Correct use

- Use the device only as described in these Operating Instructions.
  The manufacturer bears no responsibility for any other use.
- Perform the specified maintenance work.
- Do not remove, add or modify any components to or on the device unless described and specified in the official manufacturer information. Otherwise:
  - The device could become dangerous.
  - Any warranty by the manufacturer becomes void.

1.4.3 Special local conditions

- In addition to these Operating Instructions, follow all local laws, technical rules and company-internal operating directives applicable at the respective installation location of the device.

1.4.4 Retention of documents

These Operating Instructions and the System Documentation:

- Must be available for reference.
- Must be passed on to new owners.

1.5 Additional documentation/information

The following documents are applicable in addition to these Operating Instructions:

Instructions delivered with the System Documentation

- Operating Instructions SCU
- Operating Instructions Cooling Unit
- Operating Instructions Gas Sampling System
- Operating Instructions Heated Sample Gas Line
- Operating Instructions Instrument Air Conditioning (Option)
- Operating Instructions Modular I/O System
- Documentation on individual settings
- Installation Plan

MERCEM300Z

2 Product Description

Device characteristics
Functional principle
Device description

2.1 Device characteristics

Fig. 1 MERCEM300Z front side view

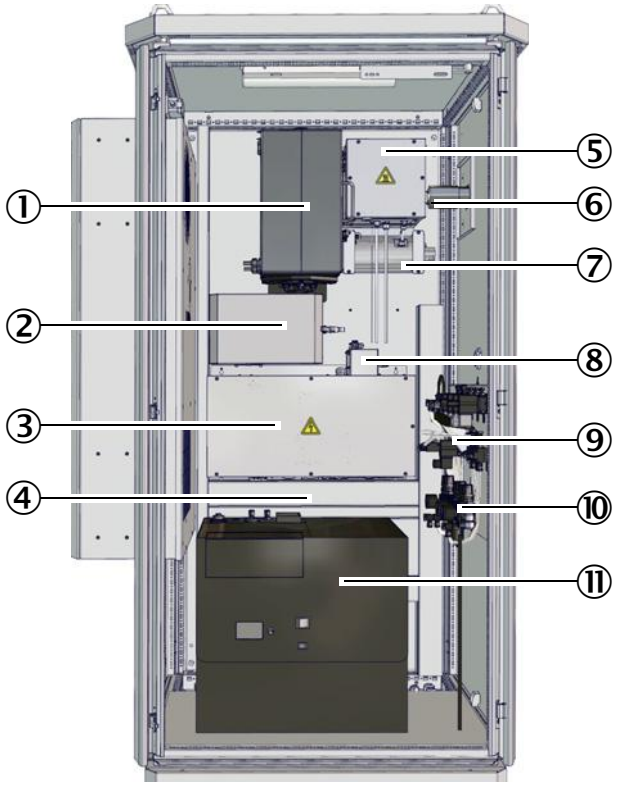
1 Operator panel (→ p. 39, § 5.2)
2 Air conditioner

Fig. 2 MERCEM300Z Indoor front side view

1 Operator panel (→ p. 39, § 5.2)

The internal layout of the MERCEM300Z and MERCEM300Z Indoor is identical.

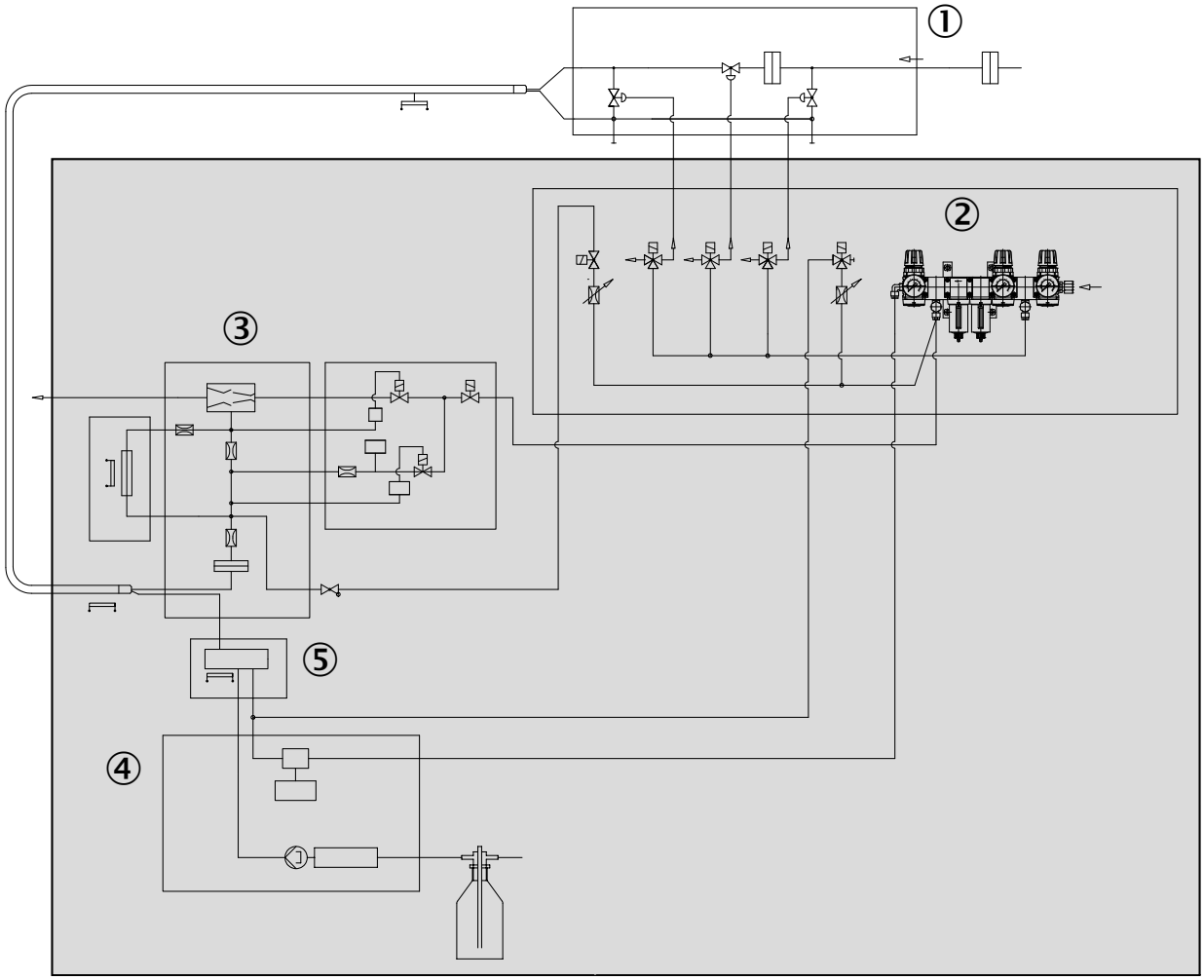
Fig. 3 Inside view (MERCEM300Z example)



1 Thermal converter and cell
2 Optical unit
3 Electronics with data interfaces and heater control
4 Power supply
Fuses (→ p. 69, § 8.6)
5 Ejector
6 Sample gas line (inlet)
(Gas outlet at device base)
7 Vaporizer for test gas generator CALSIC300 (option)
8 Pressure control module
9 Valve block
10 Instrument air conditioning
11 Test gas generator CALSIC300 with storage container (option)

2.2 Gas flow plan

Fig. 4 Gas flow plan



1 Gas sampling system
2 Instrument air conditioning
3 Thermal converter and cell
4 Test gas generator CALSIC300 (option)
5 Vaporizer (of test gas generator CALSIC300)

2.2.1 Method of operation

The device operates independently.

The operating states are signaled by status signals and entered in a logbook (SOPAS ET → p. 19, § 2.6).

- Feeding of the sample gas to the analyzer in a heated sample gas line.
- Conversion of mercury compounds into elementary mercury in a thermal converter.
- Measuring principle: Photometric with Zeeman effect.
- Standardized (pressure, temperature) output of measured values.
- Output, relative to humid flue gas.
- Test gas feed (adjustment)

Menu item	Test gas feed ...	Reference
Test	... manually with internal test gas generator CALSIC300 (option)	→ p. 41, § 5.4.1
manual	... manually with external test gas feed on gas sampling system	→ p. 26, § 3.5.3 and → p. 42, § 5.4.2
automatic	... cyclically with internal test gas generator CALSIC300 (option)	→ p. 44, § 5.4.3

- Integrated adjustment cell for automatic adjustment without test gases (→ p. 44, § 5.4.3).
- Operation with external UPS (uninterruptible power supply) (→ p. 69, § 8.5) possible.

2.2.2 Test gas generator CALSIC300 (option)

Option: Integrated test gas generator CALSIC300 (position → p. 15, Fig. 3).

- The initial solution, an $HgCl_2$ solution, is in a storage container (position → p. 15, Fig. 3).
- Using a vaporizer, the test gas generator generates test gas from the $HgCl_2$ solution.
- The test gas is transported to the cell via the gas sampling system (“test gas feeding on gas sampling system”) (→ p. 16, Fig. 4 and → p. 26, § 3.5.3).
- The test gas concentrations of the test gas generator are set using a menu.
- Test gas feeding is started cyclically or manually (→ p. 41, § 5.4).

2.2.3 Instrument air conditioning (option)

Option: Integrated instrument air conditioning.

For more information on instrument air conditioning → Operating Instructions for instrument air conditioning.

2.3 Operation

- The unit is operated via an operator panel in the front door of the device.
- The device signals an *uncertain operating state* with status indicators (→ p. 33, § 4.3). The device remains in Measuring mode.
- Should a *malfunction* occur, the device switches automatically to “Stand-By” (→ p. 68, § 8.4).
  - The sample gas line and the sample gas path in the device are automatically purged with instrument air in this mode.
    If a test gas generator CALSIC300 is used: Test gas generator and vaporizer are also purged.
  - The analog outputs remain at the last valid measured value.

2.3.1 Operation via SOPAS ET (option)

Operator menus and measured value displays are also available on an external PC via the Ethernet connection (with the SOPAS ET engineering tool → p. 19, § 2.6).

2.4 Interfaces

- 2 x analog outputs
- 4 x digital inputs
- 4 x digital outputs
- 1 x Ethernet interface

More interfaces depending on configuration (refer to “Documentation of individual settings”).

2.5 Remote control

2.5.1 Ethernet

Standard: Ethernet (Modbus TCP/IP).

2.5.2 Modbus

Modbus® is a communication standard for digital controls to connect a »Master« device with several »Slave« devices. The Modbus protocol defines the communication commands only but not their electronic transfer; therefore it can be used with different digital interfaces (Ethernet).

2.5.3 OPC (option)

OPC is a standardized software interface that allows to exchange data between the applications of different manufacturers.

The SICK OPC server is required.

System bus: Ethernet.

2.6 SOPAS ET (PC program)

SOPAS ET can also be used to set the device parameters and provides access to the logbook.

SOPAS ET runs on an external PC connected to the device via the Ethernet interface (→ p. 29, § 3.7).

More information on SOPAS ET:
→ SOPAS ET Help menu

2.6.1 Language

Language setting exclusively in SOPAS ET:

Menu: *Diagnosis/System info* (User level: Authorized operator).

Then change once to any menu on the operator panel.

MERCEM300Z

3 Preparations for Initial Start-up

Installation
Assembly

3.1 Overview of work to be performed

Work to be performed	Authorized personnel	Reference
Preparation of installation location	Operator	→ p. 23, § 3.3
Setting up	Operator	→ p. 24, § 3.4
Laying the gas lines	Operator	→ p. 24, § 3.5
Laying the signal lines to the device	Operator	---
Laying the voltage supply to the device	Operator	---
Installation	SICK Customer Service	---
Initial start-up	SICK Customer Service	---

3.2 Scope of delivery

Please see the delivery documents for the scope of delivery.

3.3 Preparing the installation location

> ► The connection to the gas supply may only be performed by skilled persons who, based on their technical training and knowledge as well as knowledge of the relevant regulations, can assess the tasks given and recognize the hazards involved.

The persons performing the installation are responsible for the preparation of the installation location.

- Observe ambient conditions (see "Technical Data").
- Enclosure dimensions → p. 75, §9.3
- Clearance for air conditioner (only MERCEM300Z)
  The air outlet is on the left side of the enclosure.
  ► Maintain at least 200 mm (8 in.) distance. Do not block the air outlet.
  The air conditioner swivels to the side and the rear for opening (for service purposes):
  ► Maintain at least 650 mm (25 in.) distance sideways.
  ► Maintain 130 mm (5 in.) distance at the rear (recommendation)
  Otherwise, the air conditioner will not swivel open fully.
- Clearance for sample gas line on the right side of the enclosure.
  ► Maintain at least 200 mm (8 in.) distance.
- Clearance for cable ducts MERCEM300Z.
  The cables can be fed on the base only from the front or the rear.
  ► Maintain 150 mm (6 in.) distance.
- Clearance for cable ducts MERCEM300Z Indoor.
  ► Feed the cables through the right side panel.
- Ensure that the load carrying capacity of the floor is adequate (minimum 500 kg/m^2).
- Set up the device (in a low-vibration environment whenever possible).
- Set up the device as close as possible to the sampling point.
  Short sample gas lines result in short lag times.
  Recommendation: Do not exceed 5 m (200 in.).
  Max. line length:
  – Certified: 35 m (1400 in.)
  – Otherwise: 50 m (2000 in.)
- Provide (individual) attachments for the system cabinet.
  For installation on gratings: When working on the device, parts could drop or liquids drip and cause injuries.
  ► Provide a suitable base plate.

3.4 Transport and installation

The device may only be transported and installed by skilled persons who, based on their training and knowledge as well as knowledge of the relevant regulations, can assess the tasks given and recognize the dangers involved.

- Only transport the device upright.
- ► Install the device with suitable hoisting equipment (for example a crane) (device weight approx. 260 kg).
  - ► Use the lugs on the top cover.
- ► Immediately screw the device to the floor to secure it against falling over.

3.5 Laying the gas lines

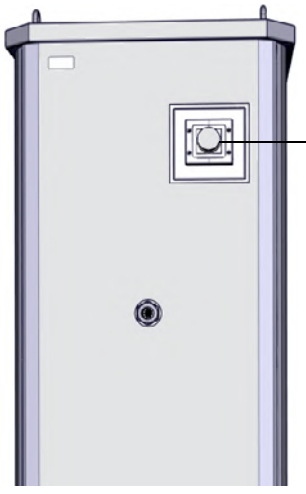
WARNING: Hazards through leaky gas path

- Health risk when noxious sample gas leaks out.
- Risk of damage to the device and adjacent equipment if the sample gas is corrosive or could create corrosive liquids in combination with water (e.g. humidity).
- The measured values could possibly be wrong if the gas path is leaky.
- Protect gas lines against frost.
- ► The gas lines to the device may only be laid by skilled persons who, based on their training and knowledge as well as knowledge of the relevant regulations, can assess the tasks given and recognize the dangers involved.
- ► Connection of the gas lines to the device may only be performed by SICK Customer Service.

WARNING: Risk of explosions when explosive sample gas is used

- ► Do not use the device for measuring combustible or explosive gases.

Fig. 5 Gas connections on the right cabinet side (example MERCEM300Z)



Heated sample gas line inlet, drilled hole 50 mm
MERCEM300Z:
Instrument air feed on device base:
M screw connection M16*1.5 D5-10

MERCEM300Z Indoor:
Instrument air feed on right side panel:
M screw connection M16*1.5 D5-10

Test gas feed into the device via the gas sampling system

3.5.1 Laying the sample gas lines

CAUTION: Risk of overheating

- ► Pay attention to the instructions for laying the heated sample gas line (→ Operating Instructions “Heated Sample Gas Line”)

CAUTION: Damage to device caused by condensation

- ► First apply sample gas to the sample gas line when putting the device into operation.
  Otherwise there is a risk of sample gas condensation in the sample gas path.

- ► Lay the sample gas line from the gas sampling system to the device.
  - – The electric connections of the sample gas line must be on the analyzer.
  - – When laying the line: Start at the device, leave the excess line on the gas sampling system.

3.5.2 Connecting the gas outlet

CAUTION: Noxious and aggressive exhaust gases.

Exhaust gases can contain components harmful to health or irritating.

- ► Lead the measuring system gas outlets outdoors or into a suitable flue.
- ► Do not connect the exhaust gas line with the exhaust gas line of sensitive subassemblies (e.g. cooler). Aggressive gases could damage these subassemblies as a result of diffusions.
- ► Observe information from the plant operator.

Lay the exhaust gas line in a suitable manner.

- ► The gas outlet must be open to the ambient pressure; in waste disposal lines it can be laid with a light partial vacuum.
- ► Do not bend or crimp exhaust gas lines.
- ► Use a suitable hose line (PTFE) to run the exhaust gas line into an open condensate container or a waste disposal line.
- ► Lay the line so that it always runs downwards.
- ► Keep the line opening free from any blockages or liquids.
- ► Protect the line from frost.

- ► Gas outlet:
  - – MERCEM300Z: The gas outlet is routed through the base at the rear.
  - – MERCEM300Z Indoor: The gas outlet is routed through the right side panel.

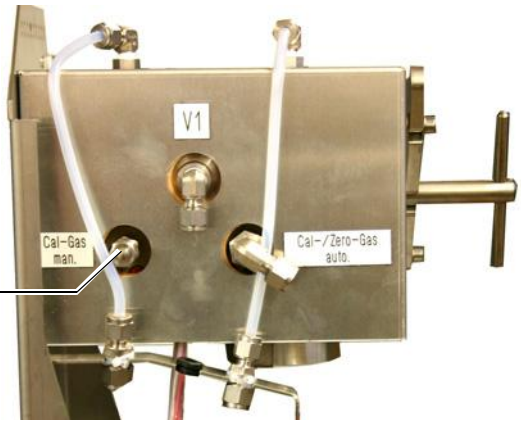
3.5.3 Test gas feeding on gas sampling system

For information on the gas sampling system SFU → “Operating Instructions SFU”

- Test gas temperature: 200 °C (test gas feeding via heated sample gas line).
- Test gas specification → Technical Data.

► Connection of test gas line for manual test gas feeding on the gas sampling system:

Fig. 6 Test gas connection



► Throughflow during test gas feed: Approx. 500 l/h.
  – The device builds up only slight counterpressure.
  – Regulate the flow via the pressure.
  – Max. pressure: 0.5 bar (50 kPa) overpressure.

► After unscrewing the test gas line: Screw the dummy cap back on.

3.6 Electrical installation

WARNING: Endangerment of electrical safety through not switching the power supply off during installation and maintenance work

An electrical accident can occur during installation and maintenance work when the power supply to the device or lines is not switched off using a power isolating switch/circuit breaker.

- ► Before starting the work, ensure the power supply can be switched off using a power isolating switch/circuit breaker in accordance with DIN EN 61010.
- ► Make sure the power isolating switch is easily accessible..
- ► An additional separation device is mandatory when the power isolating switch cannot be accessed or only with difficulty after installation of the device connection.
- ► The power supply may only be switched on again after work completion or for test purposes by persons carrying out the work under consideration of the valid safety regulations

WARNING: Endangerment of electrical safety through incorrect measurement of the mains line

Electrical accidents can occur when the specifications of a replacement for a removable mains line have not been adequately observed.

- ► When replacing a removable mains line, always observe the exact specifications in the Operating Instructions (Section Technical Data).

CAUTION: Device damage through incorrect or non-existing grounding

It must be ensured during installation and maintenance work, that the protective grounding of the devices or lines involved is established in accordance with EN 61010-1.

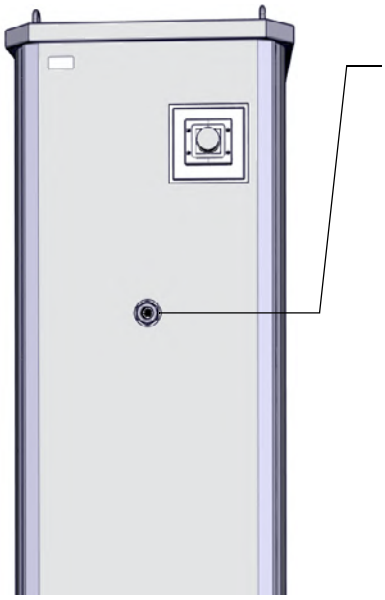
WARNING: Health risk by voltage

- ► Preparation of the electrical connections may only be performed by skilled electricians who, based on their technical training and knowledge as well as knowledge of the relevant regulations, can assess the tasks given and recognize the hazards involved.

Do not connect the device to the voltage supply.

- ► Let SICK Customer Service connect the electrical connection of the device.

Fig. 7 Electrical connections (example MERCEM300Z)



Duct for the tube bundle cable, 32 mm:
M screw connection M40*1.5 D22-32

Connection of power supply at device base:
M screw connection M32*8.5 D13-20
UPS: M20*1.5 D10-14
(→ p. 76, Fig. 16)

MERCEM 300Z:
Connection of signal lines at device base:
M screw connection M16*D5-10
(→ p. 76, Fig. 16)

MERCEM300Z Indoor:
Connection of signal lines on right side panel:
M screw connection M32*8.5 D13-20
UPS: M20*1.5 D10-14
Signal lines: Right side panel M16 D5-10

3.6.1 Laying the tube bundle cable of the gas sampling system

- ► The direction (connection on analyzer or on gas sampling system) of the tube bundle cable is optional.
- ► When laying the tube bundle cable, start at the device and leave excess lines at the gas sampling system.
- ► Let SICK Customer Service connect the tube bundle cable.

3.6.2 Connecting the potential equalization

- ► Let SICK Customer Service connect the potential equalization.

3.6.3 Connecting the signal lines

- ● The signal connections are on the electronic boards in the electronics unit.
- ● MERCEM300Z: The signal lines are routed through the device base.
- ● MERCEM300Z Indoor: The signal lines are routed through the right side panel.
- ► Let SICK Customer Service connect the signal lines on the device.

3.6.4 Preparation of mains supply

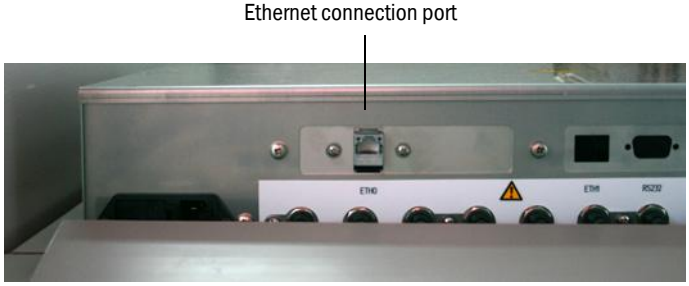
- ► The wiring system to the mains supply voltage of the system must be installed and fused according to the relevant regulations.
- ► Provide for suitable mains disconnection unit with fuse.
- ● Power input → Technical Data.
- ● Electric lines are routed through the device base.
- ► Let SICK Customer Service connect the electric lines on the device.

3.7 Ethernet interface

When the device is operated on the Ethernet, there is the risk of undesired access to the device via the Ethernet (“hacking”).
► Only operate the device with firewall protection.

Let SICK Customer Service lay the Ethernet cable in the system cabinet and connect the Ethernet cable.

Fig. 8 Ethernet connection port at the bottom of the electronics unit



- Ethernet connection port: At the bottom of the electronics unit, ETH0 port
- Transmission parameter: 10 Mbit/s half-duplex
- Addresses (The IP address must be unique):
  - IP addresses and addresses of the subnet masks:
    See SOPAS ET (→ p. 19, §2.6).

  To change the addresses (as from SOPAS 3.0):
  (*Note*: The device and PC must be in the same network segment)

  a) Doubleclick the device in the Device catalog.
  b) The device is shown in its own field.
  c) Click on the pen symbol on the right next to the IP address.
  d) Window "TCP/IP settings" opens.
  e) Change the IP address.

MERCEM300Z

4 Operation

Access
Operation
Status messages

4.1 Putting the device into operation

1 The device starts automatically when the power supply is switched on.
2 Close the cabinet door.
3 The *green* "*POWER*" LED on the display (→ p. 33, Fig. 9) of the device signals that supply voltage is present.
4 *"SICK"* is displayed on the screen.
5 The Measuring screen is then displayed (→ p. 35, § 4.5)
6 As long as the measuring system has not yet reached its "*Measuring*" operating state (e.g.: the operating temperature has not yet been reached):
   – Only the green "*POWER*" status LED lights.
   – Display: *"Heating"*
   – Classification "*Uncertain*".
7 Reaching of measuring operation state:
   – Only the green "*POWER*" status LED lights.
   – Display: *"Measuring"* (→ p. 33, Fig. 9).
   – No measured value blinks.

4.2 Operation

***NOTICE:* Keep the cabinet door closed**

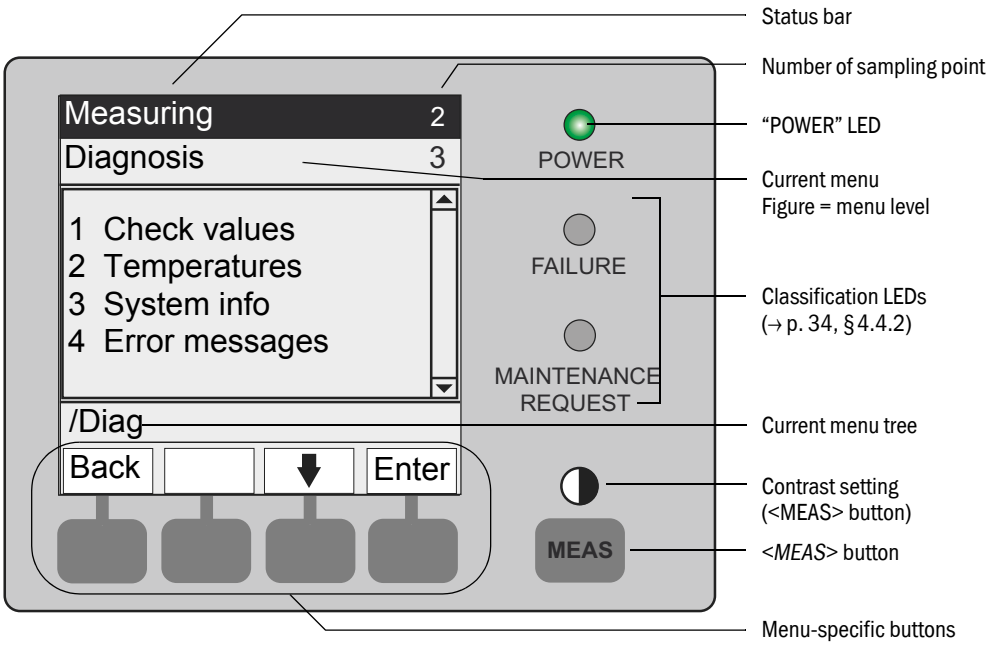
An open cabinet door results in measurement errors.

The device requires up to 1 h after closing the cabinet door to attain stable operation - depending on the external temperature.

► Keep the cabinet door closed during operation and secure against unauthorized opening.

4.3 Controls and indicators/displays

Fig. 9 Controls



4.3.1 Assignment of buttons

Button	Significance
<MEAS> button	
<MEAS>	Back to the Measuring screen from any menu. – All inputs not terminated with <*Save*> are discarded. – If the device is set to "*Maintenance*" (→ p. 34, § 4.4.2): Pressing the <MEAS> button does not affect the "*Maintenance*" state.
	In the Measuring screen: Toggle between list, bar and line representation (→ p. 35, § 4.5).
	◐ If the MEAS button is pressed for more than 2 seconds: A menu for contrast setting is shown.
Menu-specific buttons	
<Menu>	Leads to the main menu (→ p. 39, § 5.2). If the <Menu> button is not shown: Press <MEAS> first.
<Back>	Leads to the higher level menu. All inputs not terminated with <*Save*> are discarded.
<Enter>	Opens the selected menu.
<Save>	Saves changed parameters.
<Start>	Starts the displayed action.
<Set>	Saves the value.
⇩	Moves/scrolls downward.
⇧	Moves/scrolls upward. When digits are entered: Next higher digit.
⇨	Move to the right in the line.
<Diag>	*Diag* is shown only when there is a message. When this button is pressed, the current message is shown. More information on diagnosis → p. 51, § 5.5.4 List of error messages → p. 70, § 8.7

4.4 Status and classification

4.4.1 Status (operating state)

The respective operating state (e.g.: Measuring, heating, etc.) is shown in the top line of the operator panel.

4.4.2 Classification, LEDs

The classification (error status) is indicated by LEDs on the operator panel and recorded in the logbook.

Classification	LED	Significance	Measuring screen	Analog outputs[1]	Status signal[2,3]
Maintenance Wartung		The device is switched to "*Maintenance*" via the menu or program. The status bar shows: "*Maintenance*"	Current	Held[4]	According to setting
Uncertain Unsicher		The *uncertain* measured value (e.g. outside calibration range) *blinks*. To view the cause: Press the <*Diag*> button.	Current	Current	According to setting
Maintenance request Wartungsbedarf	*Yellow*	Irregularities (e.g. deviation from check cycle too high) that require a review of the cause. To view the cause: Press the <*Diag*> button.	Current	Current	According to setting
Failure Ausfall	*Red*	Device failure (e.g. lamp failed) To view the cause: Press the <*Diag*> button. The device is in "Stand-by" state (→ p. 68, § 8.4)	Held[4]	Held[4]	According to setting

1 Typical default (→ System Documentation).

2 Option (→ System Documentation).

3 See SOPAS ET in the "Digital outputs" menu.

4 The last valid measured value is held.

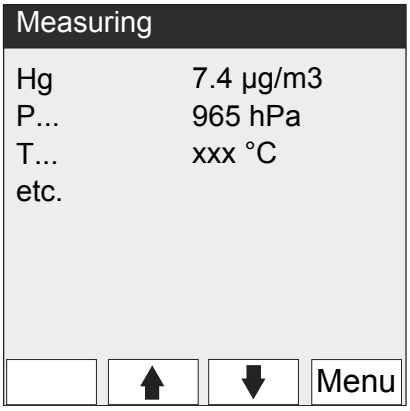
4.5 Measuring screens

The following values are shown on the Measuring screen:

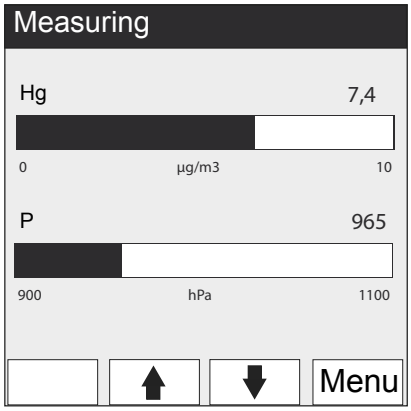
- Measured value
- Temperatures
- Pressures
- Flow

Measuring screens:

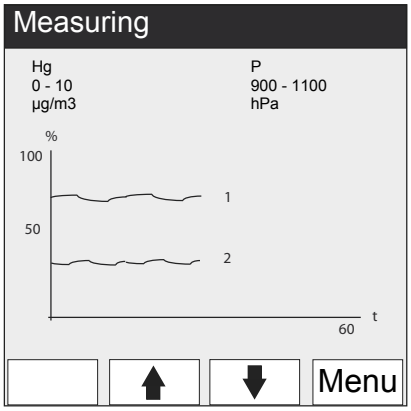
"List" (default)



"Bar graph"



"Line graph"



► To toggle between the Measuring screens: <*MEAS*> button

4.5.1 "List" Measuring screen

Display of measured values in tabular form.

The "List" Measuring screen is displayed:

- Automatically after the start of the system
- When the <*MEAS*> button is pressed

Update interval: 1 second (default)

4.5.2 "Bar graph" Measuring screen

Display of 2 measured values each time in bar format.

Update interval: 1 second

► Parameter settings of display areas → p. 53, §5.6.1.2

4.5.3 “Line graph” Measuring screen

Display of 2 measured values each time in the time diagram.
The y-axis is always scaled to 0 - 100% of the indicating range.
(The respective indicating range can be found below the component)
Line 1 = left component.
Line 2 = right component.
Update interval:

Time axis [min]	Update interval [sec]
6	4
15	10
30	20
60	40

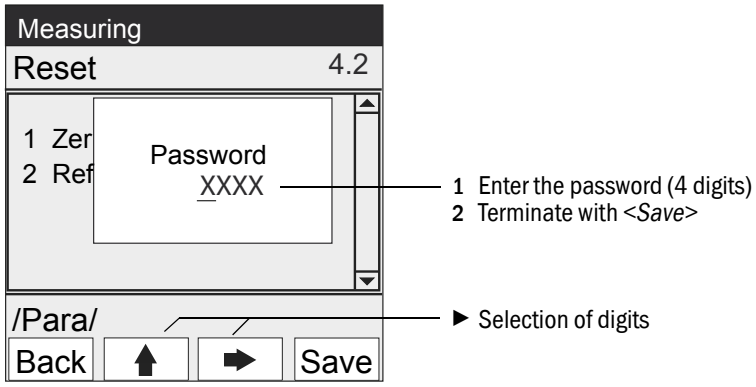
► Parameter settings of display areas → p. 53, §5.6.1.2

4.6 Password

Menus which enable changes of the measuring range are protected with a password.
The password is prompted automatically when such a menu is called up.

A description of the password-protected menus can be found in the “Technical Information” of the MERCEM300Z.

Fig. 10 Password input (Example: Reset menu)



- The password consists of 4 digits.
- The password is: “*1234*” (default)
- The password level remains valid for 30 minutes (default).

The password and duration of validity can be changed in SOPAS ET (→ p. 19, §2.6).

MERCEM300Z

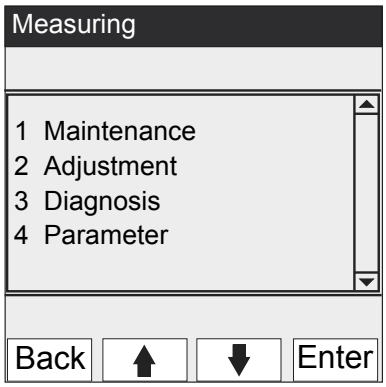
5 Menus

Menu tree
Menus

5.1 Menu tree

Menu No.	Menu tree	Explanation
1	**Maintenance**	→ p. 39, § 5.3
1.1	**Maintenance signal**	→ p. 39, § 5.3.1
1.1.1	On	
1.1.2	Off	
1.2	**Operating states**	→ p. 40, § 5.3.2
1.2.1	System stop	
1.2.2	Measuring	
1.2.2	Adjustm. manual	
1.2.3	H2O-Purging	
1.2.4	Leakage test	
1.2.5	Initialize	
2	**Adjustment**	→ p. 41, § 5.4
2.1	**Test**	→ p. 41, § 5.4.1
2.1.1	Activate / de-	
2.1.2	Start/Stop sequence	
2.1.3	Parameter	
2.2	**Manual**	→ p. 42, § 5.4.2
2.2.1	Span points	
2.2.2	Accept	
2.2.3	Activate / de-	
2.3	**automatic**	→ p. 44, § 5.4.3
2.3.1	Optical Adjustm.	
2.3.2	Zero: Analyzer	
2.3.3	Zero: System	
2.3.4	Adjust. Analyzer	
2.2.5	Adjust. System	
2.3.6	Drift Check	
2.3.7	Drift Correction	
2.3.8	Cancel	
2.4	**Parameter**	→ p. 45, § 5.4.4
2.4.1	Span pt_manual	
2.4.2	Correction factor	
2.4.3	Test gas generator	
2.4.4	Start time 1-8	
2.4.5	Start time 9-16	
3	**Diagnosis**	→ p. 49, § 5.5
3.1	**Check values**	→ p. 49, § 5.5.1
3.1.1	Zero drift	
3.1.2	Span pt drift	
3.1.3	Reference energy	
3.1.4	Intensity lamp	
3.2	**Temperatures**	→ p. 51, § 5.5.2
3.3	**System info**	→ p. 51, § 5.5.3
3.4	**Error messages**	→ p. 51, § 5.5.4
4	**Parameter**	→ p. 52, § 5.6
4.1	**Display**	→ p. 52, § 5.6.1
4.1.1	Scale 1-8	
4.1.2	Scale 9-16	
4.1.3	Timeline	
4.2	**Reset**	→ p. 54, § 5.6.2
4.2.1	Zero drift	
4.2.2	Span pt drift	
4.2.3	Reference energy	
4.2.4	Lamp energy	
4.2.5	Status	

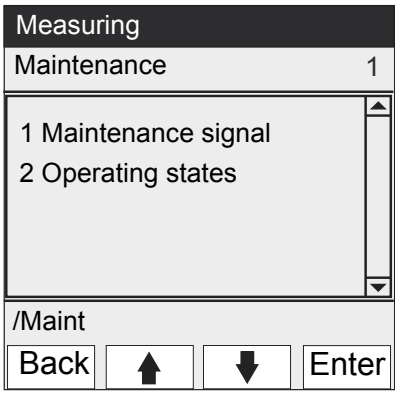
5.2 Main menu



→ p. 39, § 5.3
→ p. 41, § 5.4
→ p. 49, § 5.5
→ p. 52, § 5.6

5.3 Maintenance

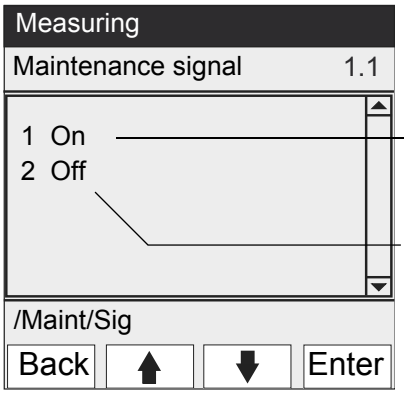
Menu 1: Maintenance



→ p. 39, § 5.3.1
→ p. 40, § 5.3.2

5.3.1 Maintenance/maintenance signal

Menu 1.1: Maintenance/Maintenance signal

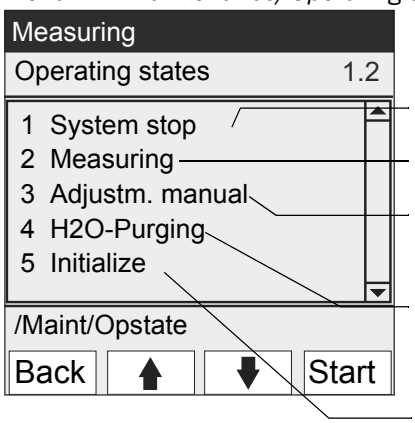


The maintenance signal is set in this menu.

- ▶ Set the maintenance signal. Then:
  - Classification: "*Maintenance*" (→ p. 34, § 4.4.2)
  - Status bar: "*Maintenance*".
- ▶ Reset the maintenance signal.

5.3.2 Maintenance/operating states

Menu 1.2: Maintenance/Operating states

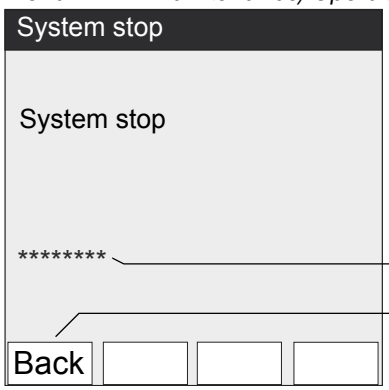


The operating states are switched on in this menu.

- ▶ System stop (→ § 5.3.2.1)
- ▶ Switch to Measuring operation.
- ▶ Switch Adjustm. manual on.
  (Switches the valves on the gas sampling system for manual gas feeding)
- ▶ For test gas generator option: Start purging of hoses and vaporizers (→ p. 56, § 6.1).
- ▶ Restart

5.3.2.1 System stop

Menu 1.2.1: Maintenance/Operating states/System stop



Switch off the measuring function and the gas sampling peripherals (valves, pumps).

The equipment function is maintained (e.g.: Operation of the heaters is continued).

Operating state: "*Maintenance*".

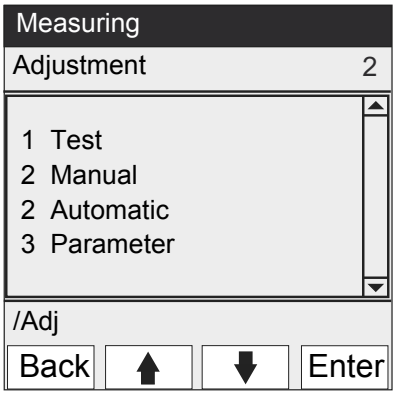
Purging with instrument air

- ● Display: Row of blinking asterisks.
- ▶ To exit the Menu: Press the "*Back*" button.
- ▶ To switch the measuring operation on again:
  - Press "*Measuring*".
  - Switch the maintenance signal off (→ p. 39, § 5.3.1).

5.4 Adjustment

Overview of the various adjustment sequences (→ p. 17, § 2.2.1)

Menu 2: Adjustment



→ p. 41, § 5.4.1
→ p. 42, § 5.4.2
→ p. 44, § 5.4.3
→ p. 45, § 5.4.4

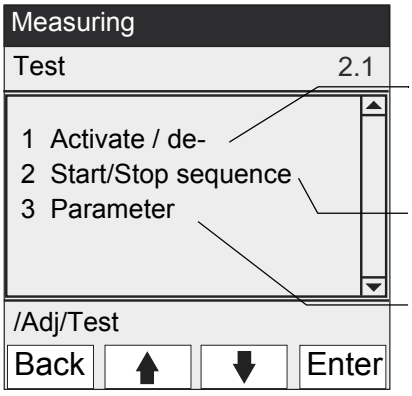
5.4.1 Adjustment/Test

Menu 2.1: Adjustment/Test

Test gases are configured and fed via the internal test gas generator CALSIC300 in this menu.

Up to three different test gas concentrations can be set and automatically fed.

The parameters for automatic test gas feed are not changed.
No correction factors are calculated.



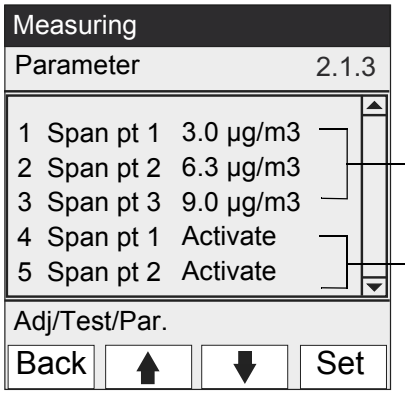
Activate test state and test gas feed option:
- Maintenance signal (switching logic see SOPAS ET)
- Valves are activated
- Analog outputs (switching logic see SOPAS ET)

▶ Starts the test gas feed sequence (according to configuration).

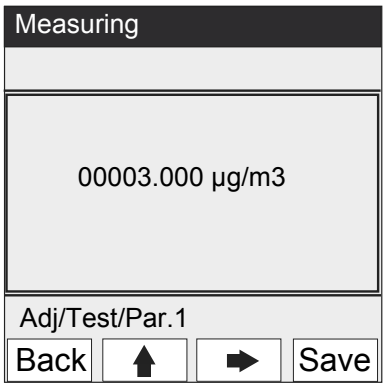
▶ Enter parameters → p. 42, § 5.4.1.1

5.4.1.1 **Adjustment/Test/Parameter**

Menu 2.1.3: Adjustment/Test/Parameter



- Enter the concentrations of the respective span point. Max. 3 concentrations.
- Activation/deactivation of the span point for the automatic sequence



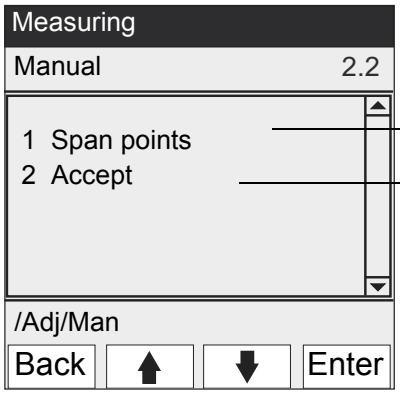
To change a value:
1 Select the desired span point.
2 "*Enter*".
3 Change the value. To do so:
Enter the numeric value.
Minus sign: As first digit: Press ⇧ several times.
4 To save: "*Save*".
5 The password is queried (→ p. 36, §4.6)

5.4.2 **Adjustment/manual**

Menu 2.2: Adjustment/Manual

Adjustment with gas feeding on the gas sampling system (external test gas) can be started in this menu.

Test gas connection → p. 26, §3.5.3

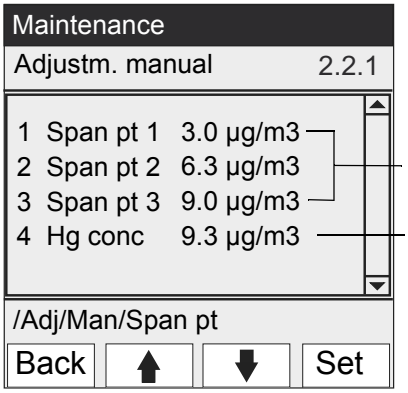


- ▶ Check and set span points → p. 43, §5.4.2.1
- ▶ If a new span point was set in submenu 2.1.1: Start adjustment here with new span points.→ p. 43, §5.4.2.2

5.4.2.1 **Span points**

Menu 2.2.1: Adjustment/manual/Span points

The span point adjustment (recalculate the correction factor) of the selected span point is manually performed in this menu item.



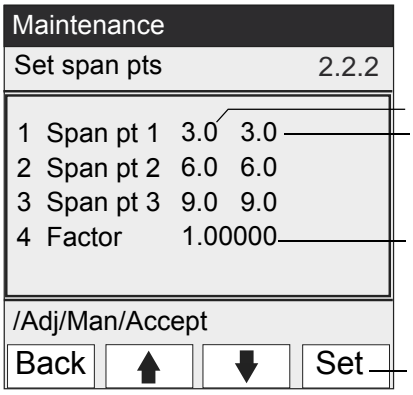
- Configured software (→ p. 45, § 5.4.4.1)
- Current measured Hg concentration (measured value)

1 Set the maintenance signal (→ p. 39, § 5.3.1).
2 Activate the “Adjustm. manual” operating state (→ p. 40, § 5.3.2).
3 Feed test gas to the gas sampling system (→ p. 26, § 3.5.3).
4 Wait for the end of the fill time (if necessary, exit the menu with “*Back*” to review the fill behavior in the line graph → p. 36, § 4.5.3).
5 Select the desired “Span pt”.
6 Press "*Set*": The measured value is set to the nominal concentration (correction factor is set).
If the deviation is too large (parameter settings → SOPAS ET), the device switches to “*Maintenance request*” (→ p. 34, § 4.4).
7 Press “*Back*” to exit the menu.
8 Go to the “Accept” menu (→ p. 42, § 5.4.2) and accept the new values.
9 Reset the maintenance signal (→ p. 39, § 5.3.1).

5.4.2.2 **Accept**

Menu 2.2.2: Adjustment/Manual/Span points

The determined new span points are set in this menu item.



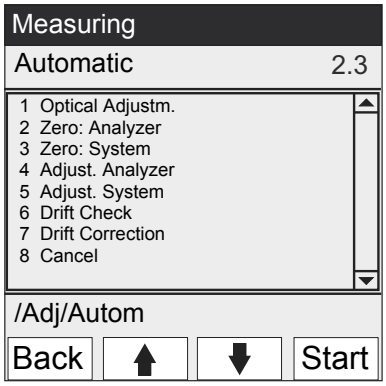
- Nominal value
- Measured value
- Factor: Calculated correction factor

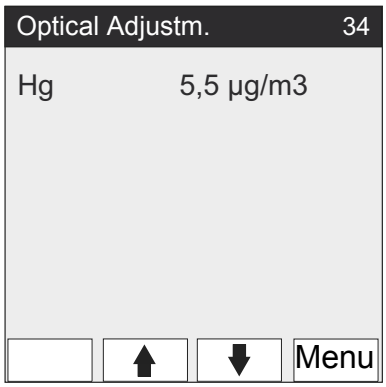
► Set measured value and correction factor.

5.4.3 Adjustment/Automatic

Menu 2.3: Adjustment/Automatic

Automatic adjustments are started in this menu item (parameter settings → SOPAS ET).





1 To start the check: Select the program and press "*Start*".
2 The password (→ p. 36, § 4.6) is queried.
3 Operating state: "*Maintenance*".
4 The Measuring screen is displayed during the check (with a down counter to the end of the check).
5 After the end of the adjustment, the device switches again to operating state "Measuring" (if "*Maintenance*" was previously manually set: Again to "*Maintenance*").

- If the deviation exceeds a limit (parameter settings in SOPAS ET), the device switches to the "*Maintenance request*" classification (→ p. 34, § 4.4).

- Measuring screen with down counter to the end of the program [s].

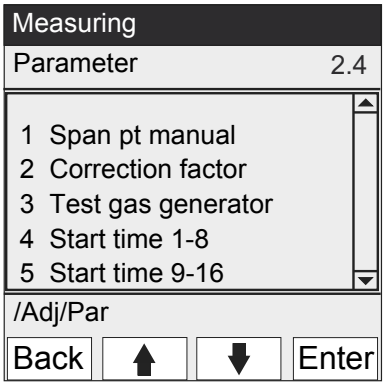
Description of programs

No.	Name	Function
1	Optical Adjustm.	Adjustment of zero point (with zero gas) and span point (with internal adjustment cell)
2	Zero: Analyzer	Check of zero point with internal zero point reflector.
3	Zero: System	Check of zero point by zero gas feeding with/without gas sampling system (as configured in SOPAS ET).
4	Adjust. Analyzer	Check of span point with internal adjustment cell.
5	Adjust. System	Check of span point by feeding test gas.
6	Drift Check	Drift check without acceptance of values (with internal adjustment cell or test gas generator (preset)).
7	Drift Correction	Drift check with automatic acceptance of correction (with internal adjustment cell or test gas generator (preset)).
8	Cancel	Cancel test or adjustment.

5.4.4 Adjustment/Parameter

Menu 2.4: Adjustment/Parameter

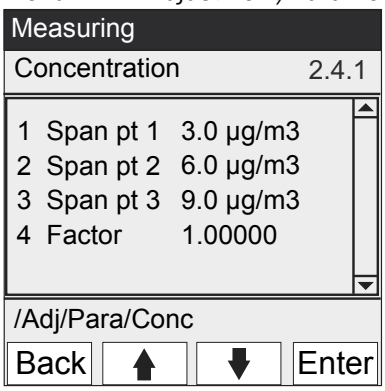
Parameters for the checks are entered in these menus.



→ p. 45, § 5.4.4.1
→ p. 47, § 5.4.4.3
→ p. 46, § 5.4.4.2
→ p. 48, § 5.4.4.4
→ p. 48, § 5.4.4.4

5.4.4.1 Span pt_manual

Menu 2.4.1: Adjustment/Parameter/Span pt manual



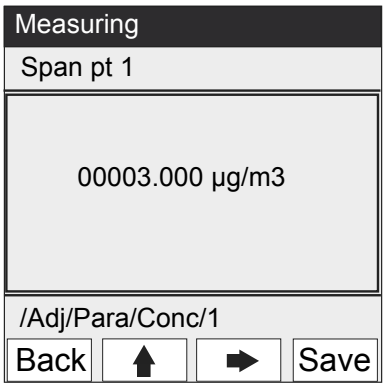
The nominal values for 3 test gas concentrations of the external test medium for manual test gas feed are entered in this menu.

Recommendation: 20%, 50%, 90% of full scale.

Factor: Calculated correction factor

To change a value:

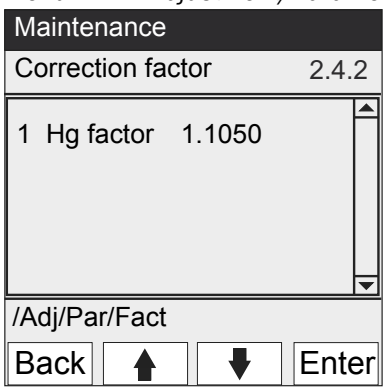
1 Select the desired span point.
2 "*Enter*".



3 Change the value. To do so:
Enter the numeric value.
Minus sign: As first digit: Press ⇧ several times.
4 To save: "*Save*".
5 The password is queried (→ p. 36, § 4.6)

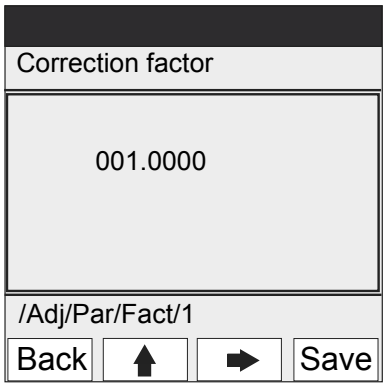
5.4.4.2 **Correction factor**

Menu 2.4.2: Adjustment/Parameter/Correction factor



The correction factor can be changed in this Menu item.

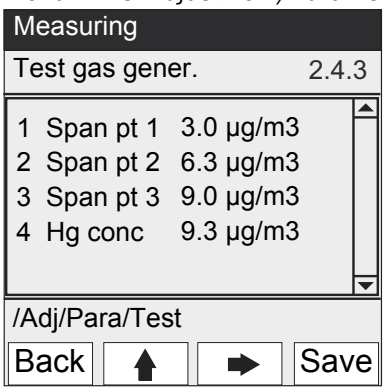
To change the correction factor:
1 Select the correction factor.
2 "*Enter*".



3 Enter the numeric value.
Minus sign: As first digit: Press ⇧ several times.
4 To save: "*Save*".
5 The password is queried (→ p. 36, § 4.6)

5.4.4.3 **Test gas generator**

Menu 2.4.3: Adjustment/Parameter/Test gas gener.

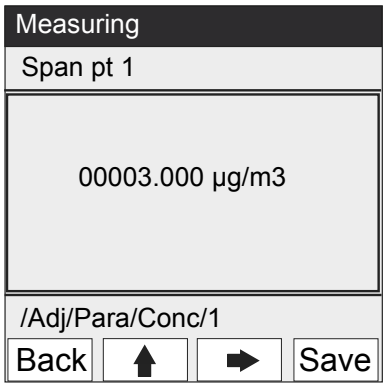


The nominal values for 3 test gas concentrations of the internal test gas generator CALSIC300 for automatic test gas feed are entered in this menu.

Recommendation: 20%, 50%, 90% of full scale.

To change a value:

1 Select the desired span point.
2 "*Enter*".

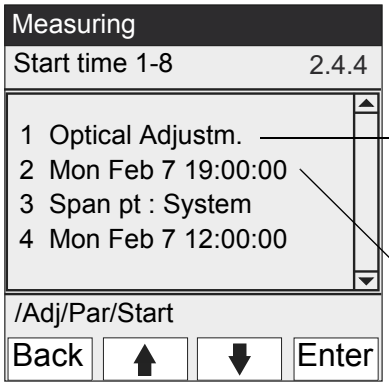


3 Change the value. To do so:
Enter the numeric value.
Minus sign: As first digit: Press ⇧ several times.
4 To save: "*Save*".
5 The password is queried (→ p. 36, § 4.6)

5.4.4.4 **Start times**

Menu 2.4.4: Adjustment/Parameter/Start time 1-8

Menu 2.4.5: Adjustment/Parameter/Start time 9-16



Preset sequence control programs are managed in this menu item.

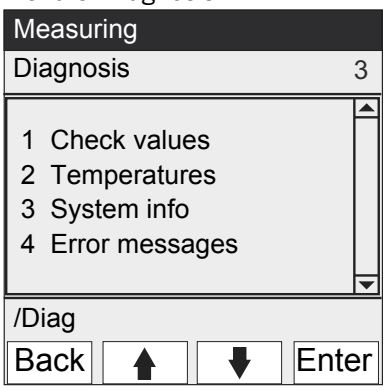
(Change of settings → SOPAS ET)

Sequence control program
Activation/deactivation of sequence control program:
1 Select the sequence control program
2 "*Enter*".

Start time
Activation/deactivation of start:
1 Select the start time
2 "*Enter*".

5.5 Diagnosis

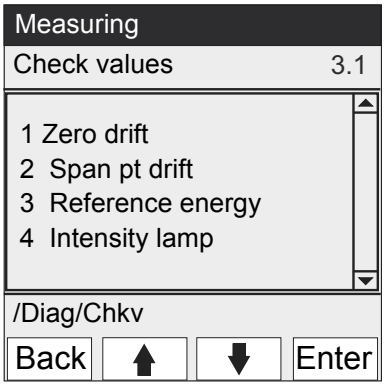
Menu 3: Diagnosis



→ p. 49, § 5.5.1
→ p. 51, § 5.5.2
→ p. 51, § 5.5.3
→ p. 51, § 5.5.4

5.5.1 Diagnosis/check values

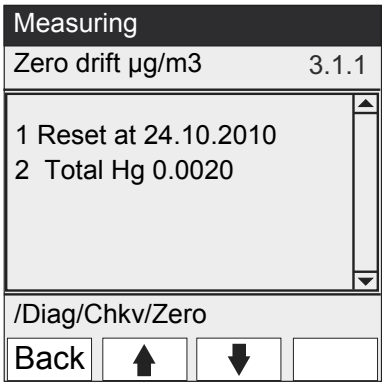
Menu 3.1: Diagnosis/Check values



→ p. 49, § 5.5.1.1
→ p. 50, § 5.5.1.3
→ p. 50, § 5.5.1.3
→ p. 50, § 5.5.1.4

5.5.1.1 Zero drift

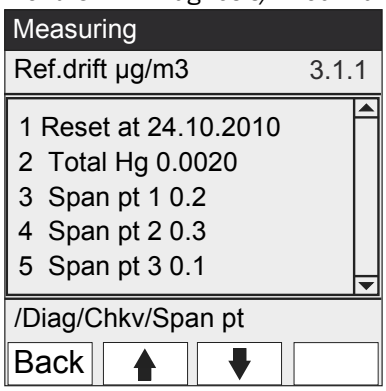
Menu 3.1.1: Diagnosis/Check values/ Zero drift



The zero drift since the last “Reset” of the zero drift (e.g. during maintenance, → p. 54, § 5.6.2) is shown in this menu. The zero drift is recalculated during each zero adjustment. This value can be used for system diagnosis.

5.5.1.2 **Span pt drift**

Menu 3.1.2: Diagnosis/Check values/Span pt drift

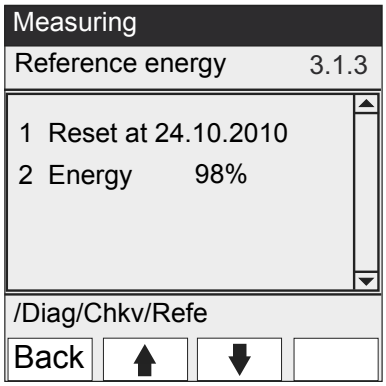


The span point drifts since the last “Reset” (e.g. during maintenance, → p. 54, § 5.6.2) are shown in this menu. The span drift is recalculated during each span point adjustment.

This value can be used for system diagnosis.

5.5.1.3 **Reference energy**

Menu 3.1.3: Diagnosis/Check values/Reference energy



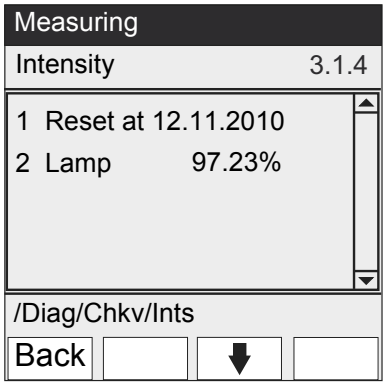
The current reference energy (in percent) is shown in this menu.

This value is monitored automatically. If the value is below a limit value (default: 60%), the device switches to the “Maintenance request” classification. Possible causes: Contamination of the cell windows.

A “Reset”(→ p. 54, § 5.6.2, e.g. during maintenance) sets the reference energy to 100%.

5.5.1.4 **Intensity**

Menu 3.1.4: Diagnosis/Check values/Intensity Lamp



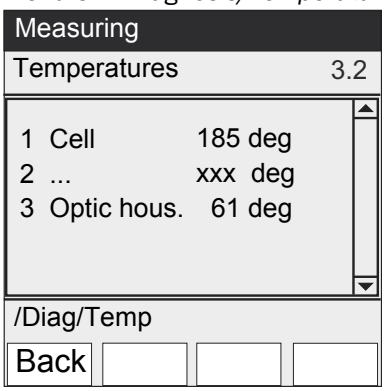
The current reference energy (in percent) is shown in this menu.

This value is monitored automatically. If the value is below a limit value (parameters can be set in SOPAS ET), the device switches to the “Maintenance request” classification.

A “Reset”(→ p. 54, § 5.6.2, e.g. during maintenance) sets the reference energy to 100%.

5.5.2 Diagnosis/temperatures

Menu 3.2: Diagnosis/Temperatures

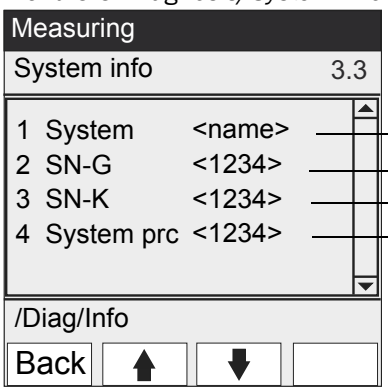


The current temperatures are shown in this menu.

deg = °C

5.5.3 Diagnosis/System info

Menu 3.3: Diagnosis/System info

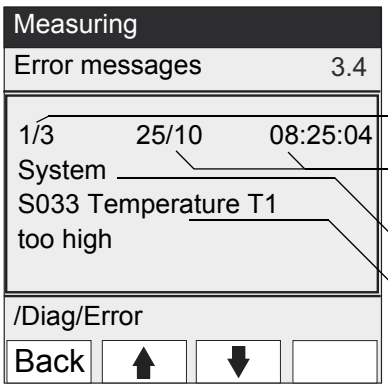


Device numbers and software versions are shown in this menu.

- Name of the system
- Serial number of device
- Serial number of cell
- System software version
- etc.

5.5.4 Diagnosis/error messages and Diag button

Menu 3.4: Diagnosis/Error messages and <*Diag*> button>

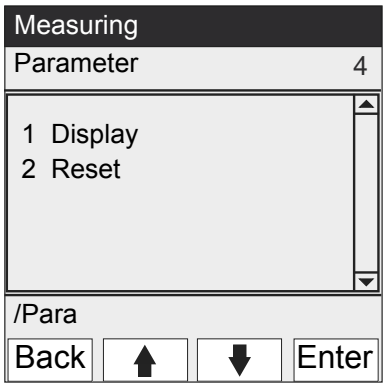


The *currently* existing messages are shown in this menu (Logbook → SOPAS ET).

- Current message / number of existing messages
- Date of occurrence (dd/mm)
  Time of occurrence (hh:mm:ss)
- Source (e.g.: System, measured component, receiver, etc.)
- Error cause (error number and clear text)
  (list of messages → p. 70, §8.7)

5.6 Parameter setting

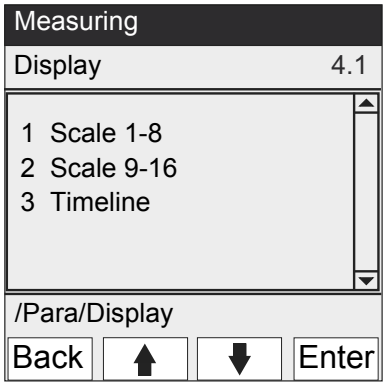
Menu 4: Parameter



→ p. 52, § 5.6.1
→ p. 54, § 5.6.2

5.6.1 Parameter settings/display

Menu 4.1: Parameter/Display

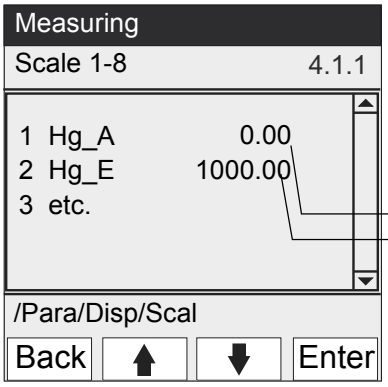


→ p. 53, § 5.6.1.1
→ p. 53, § 5.6.1.1
→ p. 53, § 5.6.1.2

5.6.1.1 **Scale**

Menu 4.1.1: Parameter/Display/Scale 1-8

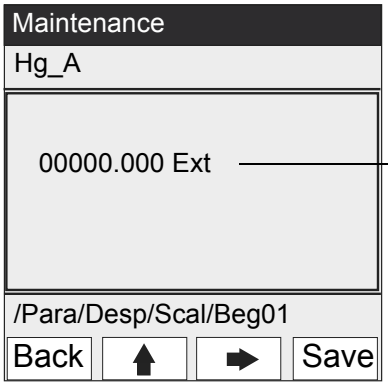
Menu 4.1.2: Parameter/Display/Scale 9-16



Bar graphs and line graphs are scaled in this menu. The normalization shown is valid for both types of graph.

Graph update interval: 1 second.

- _A: Normalization start value
- _E: Normalization end value

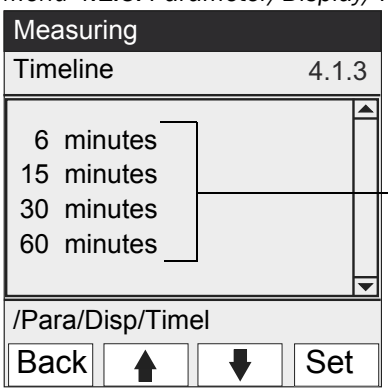


► Enter the numeric value.
Minus sign: As first digit: Press ⇧ several times.

Invalid entries (start value > end value) are not accepted.

5.6.1.2 **Timeline**

Menu 4.1.3: Parameter/Display/Timeline



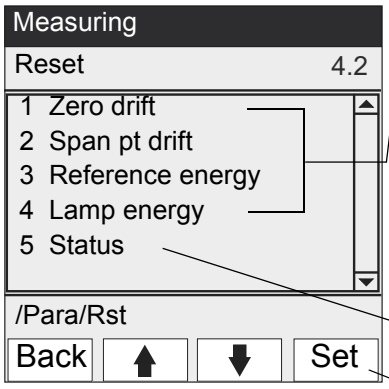
The parameters of the line graph timeline are set in this menu.

Graph update interval: Depending on scale (→ p. 36, § 4.5.3)

► Timeline end value (specified times)

5.6.2 Parameter/reset

Menu 4.2: Parameter/Reset



The drifts/reference energies for all components are set to:
- "0" (for zero or span point drift)
- "100%" (for reference energy)

The complete drift history is lost.
▶ Perform the reset only when you are sure that you want to reset the values.

▶ Reset of all existing messages.

▶ Execute selected menu item.

MERCEM300Z

6 Shutdown

Switch off
Shutting down
Transport
Disposal

6.1 Switching off (for a period up to approx. 2 weeks)

1 When the internal test gas generator CALSIC300 is fitted:
   a) Leave the device in ready-for-measurement status.
   b) Start the “H2O-Purging” purge program (menu: *Maintenance/Operating states*).
   c) Rinse vaporizer and hoses for approx. 1 hour with approx. 1 l of bidistilled water (to be provided by the operating company).
   d) Dry for approx. 10 min. by taking the feed hose out of the water and suctioning in ambient air.
   e) Set the device to “System stop” (menu: Maintenance/Operating states).
   f) Disconnect solution container and feed hose from the analyzer cabinet (bidistilled water and Hg chloride solution).
2 Switch the heaters off, if necessary.
   Information for cooling the thermal converter:
   The cooling of the thermal converter takes approx. 6 hours.
   The air conditioner must remain switched on during the cooling phase.
3 If necessary, switch off the instrument air after 7 hours.
4 If necessary, disconnect the analyzer cabinet from the mains.

Thermostatic control of the gas sampling system is then also switched off.
► Make sure the gas sampling system cannot be contaminated (e.g. by pulling the gas sampling system with probe tube).

6.2 Transport

The device contains subassemblies requiring transport safety devices.

- Preparation for transport may be performed by trained personnel only.
- Only transport the device upright.

6.3 Storage

Storage conditions:

- Indoors.
- Ambient temperature: -20 ... +40 °C (without Hg chloride solution)
- Relative humidity max. 80%, without condensation.
  Recommendation: Store the device in dry conditions whenever possible.

6.4 Disposal

► The device can easily be disassembled into its components which can be sent to the respective raw material recycling facilities.

Observe the relevant local conditions for the disposal of industrial waste.

The following subassemblies contain substances that may have to be disposed of separately:

- *Lamp*: Contains mercury.
- *Electronics*: Capacitors, rechargeable batteries, batteries.
- *Display*: Liquid of LC display.
- *Sample gas filters*: Sample gas filters could be contaminated by pollutants.
- *With test gas generator*: The contained liquid is acidic and contains substances that are toxic or harmful to the environment.

MERCEM300Z

7 Scheduled Maintenance

Maintenance plan
Spare parts

7.1 Maintenance intervals

7.1.1 Maintenance by operator

Maintenance work	Reference	w[1]	q[1]	h[1]
Visual inspection				
Check measured values for plausibility, if applicable, also in the control room.	———	x	x	x
Check whether status signals are pending or messages are or were active.	Menu 3 "*Diagnosis*"	x	x	x
Check lines, hoses and connections and whether exhaust gas line is free of bends.	———	x	x	x
Air dryer				
Check status LEDs of air dryer (option)	Observe information → p. 62, § 7.3.1.		x	x
Gas sampling system				
Visual check	→ p. 62, § 7.3.2		x	x
System cabinet				
Visual check of system cabinet.	→ p. 62, § 7.3.2		x	x
MERCEM300Z: Clean air conditioner (blow out outer fins)	———		x	x
Replace test gas generator solution (option)	→ p. 63, § 7.3.3			x
Analyzer				
Check sample gas flow (150 - 400 l/h)	Menu *"Measuring Screen"* (→ p. 35, § 4.5)		x	x
Check drift of zero and span point	Menu 3.1*: Diagnosis/ Check values*		x	x

[1] w = weekly, q = quarterly, h = every half year

7.1.2 Maintenance by Customer Service

Maintenance by SICK Customer Service: Every 5 years at the latest.

7.2 Expendable and wearing parts

Analyzer	Number[1]	1/2y[2]	1y	2y	5y	Part No.
Lamp spare parts set	1		x			2060110
Lamp subassembly spare parts set	1				x	2060244
O-ring optic housing 240 * 3	1				x	5324455
Thermal element spare parts set	1		x			2062703
Ejector block spare parts set, every year	1		x			2060701
Ejector block spare parts set, every 5 years	1				x	2060733
Gas sampling system						
Gas sampling filter 2µ spare parts set	1		x			2039002
“Glass fiber” gas sampling filter spare parts set	1		x			2043616
Bellow-seal valve spare parts set for SFU	1				x	2060250
Heating cartridge 115 V, 200 W 10x130 mm	1			x		6023104
Measuring resistor Pt100	1			x		6024087
Instrument air conditioning						
Filter element MXP-96-222	1		x			5315577
Filter element FRP-96-729	1		x			5315578
Test gas generator CALSIC300						
Spare parts set. Contains: Hose filter, hoses	1		x			5327020
Hg chloride solution, 5 L: – 50 µg – 100 µg – 450 µg – 1000 µg – 6000 µg	2	x				 5603853 5603854 5603855 5603856 5603857
Air dryer						
Maintenance set Carepac OFP 0005	1			x		5319343

[1] Quantity per maintenance interval

[2] 1/2y=1/2-yearly, 1y=yearly, 2y=2-yearly, 5y=5-yearly

> ***CAUTION:*** **Consumables only from SICK**
>
> The $HgCl_2$ solution to be replaced during maintenance may only be obtained from SICK.

7.3 Maintenance work

CAUTION: Malfunction hazard
► Use original SICK spare parts only.

7.3.1 Before commencing maintenance work:

***NOTICE:* An open cabinet door results in measurement errors.**
► Open the cabinet door for a short time only.
The device requires up to 1 h after closing the cabinet door to attain stable operation - depending on the external temperature.

Before beginning maintenance work, consider the following as applicable:

► Set the maintenance signal (menu 1.1 *Maintenance/Maintenance signal*).

► Disable “Cyclic programs” by adjusting the clock (menu 2.3.4 *Adjustment/Parameter/ Start time*).

7.3.2 Visual inspection

Device

- Only the “*green*” LED on the operator panel may light and *no* measured value may blink.
  Otherwise: Press the <*Diag*> button for more information.
- Perform a visual inspection of the device enclosures:
  - Dryness
  - Corrosion
  - Unusual odor
  - Unusual noises
- Perform a visual inspection of the test gas generator CALSIC300 (option):
  - Dryness
  - Unusual odor
  - Reaction solution fill level

Peripherals

- Sampling and draining of sample gas, tubes: Condition.
- Test gas supply: Condition, availability (use-by date), pressures.
- If fitted: Purge gas supply: Condition, availability, pressures.

7.3.3 Replacing the test solution

***CAUTION:* Consumables only from SICK**

The $HgCl_2$ solution to be replaced during maintenance may only be obtained from SICK.

If the interval (half a year) for replacement of the test solution is exceeded, the device is internally contaminated.

► Please contact SICK Customer Service.
Do not simply replace the solution.

CAUTION: Acidic solution

The test solution is harmful to health when inhaled, swallowed and when it comes in contact with the skin or the eyes.

► Take suitable protection measures when working on the container with the test solution (e.g. by wearing protective goggles or a safety mask, protective gloves and acid-proof protective clothes).

► Provide an acid resistant underlay (bowl).

► In case of contact with the eyes, rinse immediately with water and consult a doctor.
Wash skin with water.

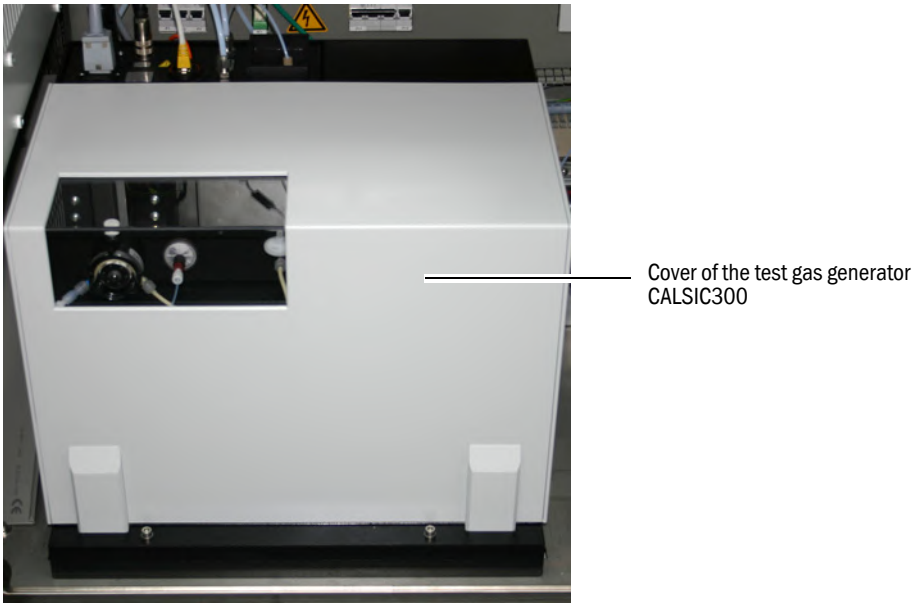
- Work quickly, place the canister with the fresh solution immediately into the device and make sure the device operates correctly again.

Procedure

1 If an adjustment cycle is running: Wait for the cycle to complete.

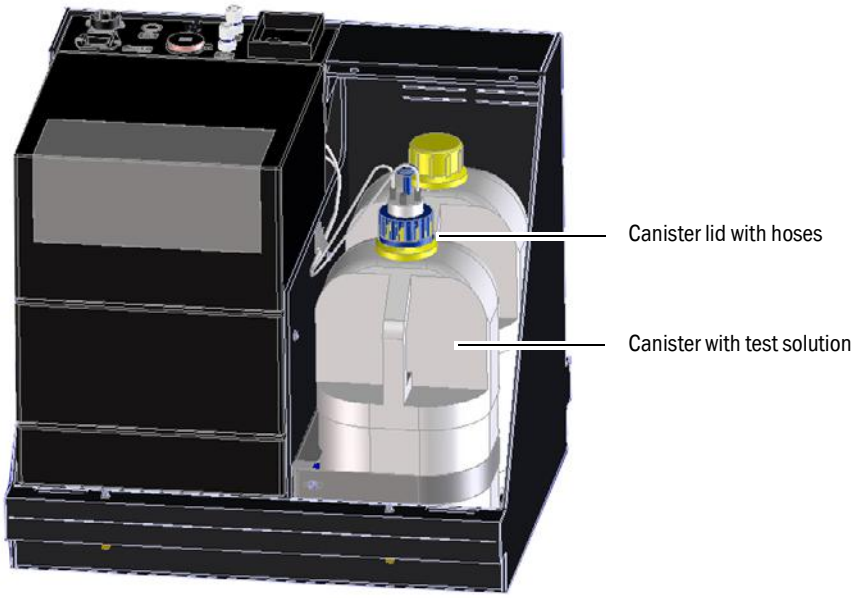
2 Check that the device will not switch to an adjustment cycle during the next 30 minutes (→ menus 2.3.4 and 2.3.5 “*Start time*”).
OR
Switch the device to *System stop* (→ menu 1.2.1 “*System stop*”).
– In both cases, the following is valid: If an adjustment cycle is due to start in this period: The cycle does not run.

Fig. 11 Test gas generator CALSIC300



3 Remove cover from test gas generator upwards.

Fig. 12 Canister with test solution



4 Provide an acid resistant underlay.

5 Remove the canister with used solution from the device.

6 Also remove the canister with fresh solution from the device.

> The test solution has a limited service life (approx. 1/2 year).
> ► Always use both canisters in the device first.
> ► Then use the new canister.
> ► Do not top up the test solution, it must be replaced.

7 Unscrew the lid from the canister with fresh solution.

> **CAUTION: Risk of chemical burns by acid**
> Acid can drip out of the connected hoses when the canister lid is removed.
> ► Remove the container lid over an acid resistant underlay.

8 Unscrew the lid from the canister with used solution and carefully pull the lid with the connected hoses out of the canister.
- Avoid dripping.
- Do not place the hoses on the ground

9 Place the lid with hoses immediately on the new canister and screw the lid tight.

10 Place the canister with fresh solution into the device.

11 Refit the cover.

12 Set the device to “Measuring” again.

● Close the canister with used solution with the lid and dispose of it ($HgCl_2$) in an environmentally compatible manner.

> The liquid contained in the dismounted storage container is acidic and contains inorganic or organic substances that are toxic or harmful to the environment. This waste must be disposed off according to legal regulations and as hazardous waste when necessary.

7.3.3.1 Function check after replacing the HgCl2 solution

WARNING: Health risk through escaping gases

A check of the safe function is necessary every time the HgCl2 solution is replaced.

- ► Carry out a one-point calibration.
- ► Make a visual check of hose connections for leaks.

MERCEM300Z

8 Clearing Malfunctions

Fuses
Status messages
Implausible measuring results

8.1 If the device does not function at all ...

Possible cause	Notes
Power supply has failed.	► Check the power supply (e.g. external switch, external fuses).
Internal fuse defective.	► Check fuses (→ p. 69, §8.6).
Software not working correctly.	► Switch the device off with the external mains switch and switch it on again after a few seconds.

8.2 When measured values are obviously incorrect ...

Possible cause	Notes
The device does not measure the sample gas.	► Check the measured medium path and all valves (e.g. switching from the test medium to the measured medium).
Sample gas path not gas-tight.	► Check the installations.
The device is not adjusted correctly.	► Perform an adjustment (→ p. 41, §5.4); check the test media first (setpoint value, service life, throughflow, setting in menu 2.3.1).

8.3 Malfunction messages

A malfunction has occurred when:

- The measured values blink.
- The "*yellow*" LED lights.
- The "*red*" LED lights.

► Press the <*Diag*> button for more information.

More information concerning the causes:

► Controls and indicators/displays → p. 33, §4.3
► Classifications (device state) → p. 34, §4.4.2
► List of error messages and possible causes → p. 70, §8.7

8.4 Stand-by

When a malfunction occurs, the device switches to "Stand-by":

- The sample gas path (including gas sampling system) is purged with instrument air.

► Press the <*Diag*> button for more information.

More information concerning the causes:

► Classifications (device state) → p. 34, §4.4.2
► List of error messages and possible causes → p. 70, §8.7

8.5 External UPS (option)

If the device is connected to an external UPS (uninterruptible power supply):

- Power take-off from the UPS: Max. 2510 VA

The following subassemblies are supplied power by the UPS:

- Air conditioner (MERCEM300Z)
- Test gas generator CALSIC300
- Electronics

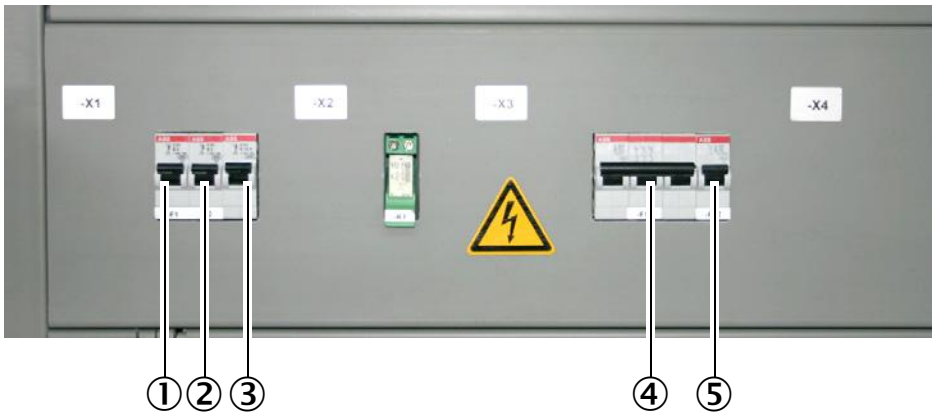
The following subassemblies are *not* supplied with power:

- Heaters

8.6 Fuses

Location of fuses: → p. 15, Fig. 3.

Fig. 13 System cabinet fuses



1	F1	6 A	Analyzer
2	F2	6 A	Test gas generator CALSIC300
3	F3	10 A	Air conditioner (MERCEM300Z)
4	F4	32 A	Heating, complete
5	F5	10 A	Cabinet light 10 A port

It is possible that the fuses of your device have a different assignment.

► Refer to the delivered System Documentation (→ p. 11, § 1.5) for fuse assignment.

8.7 Error messages and possible causes

Notes on the error messages:

- This Table also contains recommended solutions that can only be performed by specially trained personnel.
- If fault persists: Contact SICK Customer Service.

Initiator	Code	Error text	Classification	Description	Possible clearance
System	S001	Communication error	Failure	Communication fault between system and subassembly.	Check cable connections in system cabinet. Restart the device.
	S002	Configuration error		Configuration error, found module does not correspond to that of the nominal configuration	Please contact SICK Customer Service
	S003	Temperature		Temperature outside limit value.	Check temperature parameters in menu 3.2 *Diagnosis/ Temperatures*. Check heating circuits.
	S004	EEPROM		Internal fault.	Please contact SICK Customer Service
	S005	Analog input too high		Current at analog input above 22 mA	Check parameter settings of connected analog output and adapt, if required.
	S006	Voltage range		The input range of an analog input was exceeded.	
	S007	Check sum error			
	S008	Cell flow		Flow through cell is outside tolerance range (150 - 400 l/h).	Check induction air. Check pressure parameter P1/ P2 in SOPAS ET menu *Diagnosis/Sensor values/Pressures*. Check sample gas outlet for blockages.
	S009	Cell pressure		Cell pressure is outside tolerance range.	
	S010	Ambient pressure		Ambient pressure is outside tolerance range.	Check pressure sensor.
	S011	Ambient temperature		Temperature in cabinet is outside tolerance range.	Check air conditioner.
	S012	Vaporizer temperature		Vaporizer temperature is outside tolerance range.	Check vaporizer temperature in SOPAS ET menu *Diagnosis/ Sensor values/Temperatures*. Check communication between the test gas generator and the device by means of logbook error message ETH1. If this error occurs, there is no communication between the test gas generator and the device. Check cables.
	S013	Lamp energy		Lamp energy is outside tolerance range.	Check lamp energy in SOPAS ET menu *Diagnosis/Sensor values/Lamp*.
	S014	Lamp ignition		Lamp ignition failure.	Reinitialize device in menu 1.2.4 *Maintenance/Change operational state*.

Initiator	Code	Error text	Classification	Description	Possible clearance
	S015	Measured value		Error in calculation of measured value.	Please contact SICK Customer Service
	S016	PEM frequency		PEM frequency outside defined limit values during determination.	
	S017	PEM amplitude		PEM amplitude outside defined limit values during determination.	
	S018	Dark Aperture Value		Dark aperture measured value outside tolerance range.	
	S019	Value PEM adjustment cell		PEM adjustment cell measured value outside tolerance range.	
	S020	Zero:Co-,Sine		Internal fault.	
	S021	Zero:Stability			
	S022	Zero:Tolerance			
	S023	Span:Co-,Sine			
	S024	Span: Stability			
	S025	Span:Tolerance			
	S026	QAL3			
	S027	Motor			
	S028	FAIL xx			

Initiator	Code	Error text	Classification	Description	Possible clearance
System	S033	Communication error	Maintenance	Communication error with an I/O module	→ Operating Instructions “Modular I/O System”
	S034	Configuration I/O module		Configuration error, found module does not correspond to that of the nominal configuration	Please contact SICK Customer Service
	S035	Temperature		Temperature outside limit value.	Check temperature parameters in menu 3.2 *Diagnosis/ Temperatures*. Check heating circuits.
	S037	Span canceled		Sequence is aborted.	Start sequence again.
	S039	WARN07		Internal warning.	Please contact SICK Customer Service
	S040	Cell flow		Flow through cell is outside tolerance range.	Check induction air. Check pressure parameter P1/ P2 in SOPAS ET menu *Diagnosis/Sensor values/Pressures*. Check sample gas outlet for blockages.
	S041	Cell pressure		Cell pressure is outside tolerance range.	
	S042	Ambient pressure		Ambient pressure is outside tolerance range.	Check pressure sensor.
	S043	Ambient temperature		Temperature in cabinet is outside tolerance range.	Check air conditioner.
	S044	Vaporizer temperature		Vaporizer temperature is outside tolerance range.	Check vaporizer temperature in SOPAS ET menu *Diagnosis/ Sensor values/Temperatures*. Check communication between the test gas generator and the device by means of logbook error message ETH1. If this error occurs, there is no communication between the test gas generator and the device. Check cables.

Initiator	Code	Error text	Classification	Description	Possible clearance
	S045	Lamp energy		Lamp energy is outside tolerance range.	Check lamp energy in SOPAS ET menu *Diagnosis/Sensor values/Lamp*.
	S047	High/low voltage		5 V or 24 V voltage outside tolerance range.	Please contact SICK Customer Service
	S048	Output no current		Output was switched to a currentless condition because of time-out.	
	S049	Channel 1 error		The input range of the first analog input was exceeded or the desired current at the first analog input was not reached.	
	S050	Channel 2 error		The input range of the second analog input was exceeded or the desired current at the second analog input was not reached.	
	S051	Check sum error		The transmission process performed beforehand from the master to the slave (controller) has an incorrect check sum and the slave has not accepted the data.	
	S052	Busy		The microcontroller of the module still performs previous command.	
	S053	WARNxx		Internal warning.	

Initiator	Code	Error text	Classification	Description	Possible clearance
System	S057	Communication problem	Uncertain	Communication fault between system and subassembly.	Check cable connections in system cabinet. Restart the device.
	S058	Configuration problem		Configuration error, found module does not correspond to that of the nominal configuration	Please contact SICK Customer Service
	S059	Temperature		Temperature outside limit value.	Check temperature parameters in menu 3.2 *Diagnosis/Temperatures*. Check heating circuits.
	S060	Watchdog OFF		Watchdog is disabled	Restart the device.
	S061	FlashCard not detected		No flashcard	Please contact SICK Customer Service
	S062	Logbook problem		Logbook problem	Please contact SICK Customer Service

Initiator	Code	Error text	Classification	Description	Possible clearance
System	S065	Operational check	Operational check	Operational check	---

Initiator	Code	Error text	Classification	Description	Possible clearance
System	S085	Module not found	Extended	I/O (EXIST)	Please contact SICK Customer Service
	S091	Communication problem		Communication problem	
	S094	System start		System start	---

MERCEM300Z

9 Technical Documentation

Dimensions
Technical Data

9.1 Compliances and approvals

The technical design of this device complies with the following EU directives and EN standards:

- EC Directive: LVD (Low Voltage Directive)
- EC Directive: EMC (Electromagnetic Compatibility)

Applied EN standards:

- EN 61010-1: Safety requirements for electrical equipment for measurement, control and laboratory use
- EN 61326: Electrical equipment for measurement technology, control technology and laboratory use - EMC requirements
- EN 82079-1: Preparation of instructions for use - Structuring, content and presentation - Part 1: General principles and detailed requirements
- EN 14181: Calibration of continuously operating emission measuring instruments
- EN 15267-3: Certification of automated measuring systems - Part 3
- US EPA conform

9.1.1 Electrical protection

- Insulation: Protection class 1 according to EN 61010-1.
- Contamination: The control unit operates safely in an environment up to contamination level 2 according to EN 61010-1 (usual, non-conductive contamination and temporary conductivity by occasional moisture condensation).

9.2 Licenses

Exclusion of liability

The firmware of this device was developed using open source software. The user is exclusively responsible for any modifications made to open source components. All warranty claims shall be invalidated in this case.

The following exclusion of liability applies to the GPL components in relation to the rights holders: This program is distributed in the hope that it will be of use, but with no guarantee of this; neither is there any implied guarantee of marketability or suitability for a particular purpose. For details, see the GNU General Public License.

With regard to the other open source components, we refer you to the exclusions of liability of the rights holders contained in the license texts on the provided CD.

Software licenses

In this product, SICK uses unmodified open source software and, insofar as required and where permitted under the relevant license conditions, modified open source software.

The firmware of this device is, therefore, subject to the copyrights listed on the provided CD. A complete list of the open source programs used and the associated license conditions can be found on the provided CD.

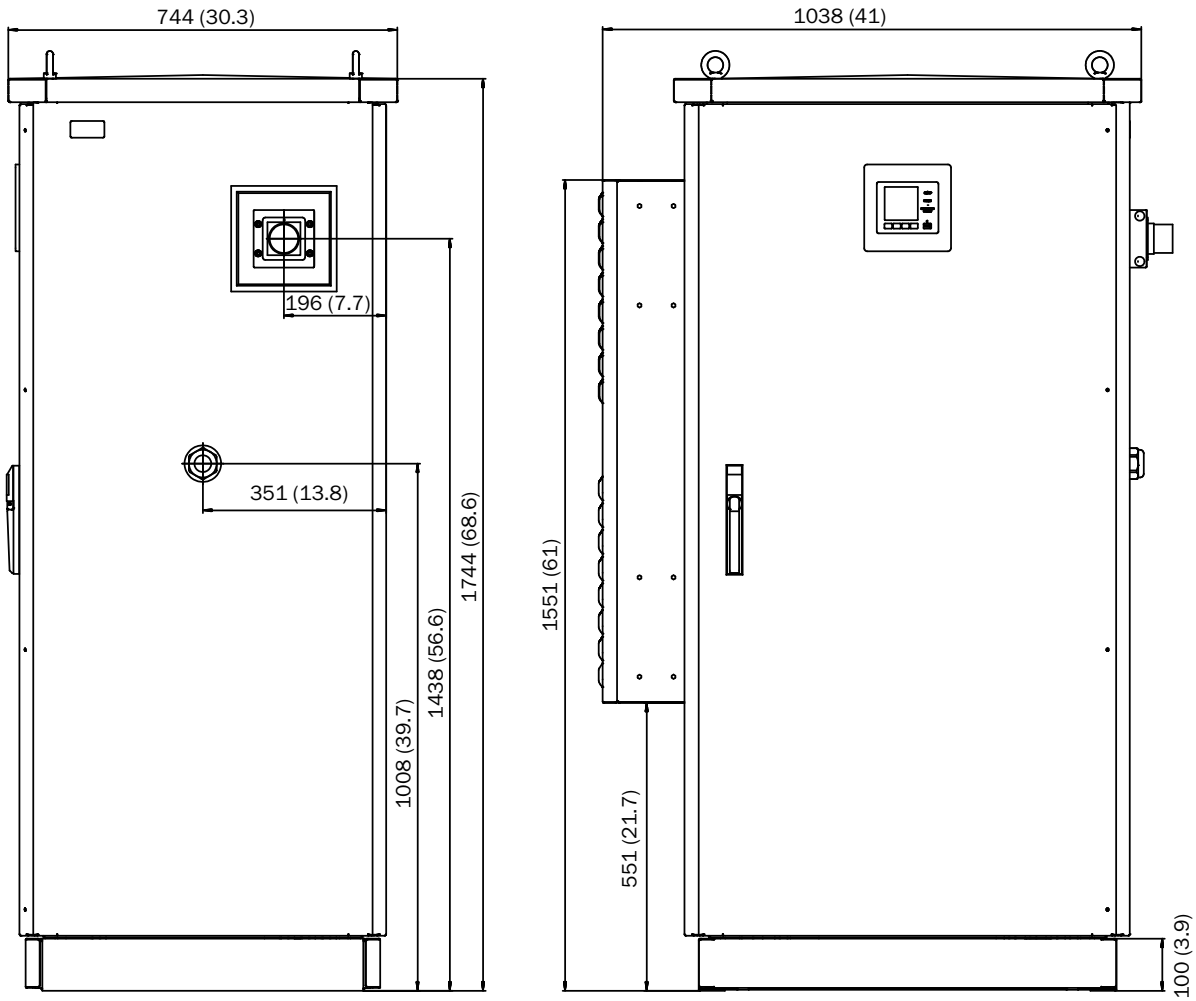
Source codes

The source codes of the open source programs used on this device can be ordered under the following e-mail address: info.pa@sick.de. Please state “Open Source Software” when ordering the source code.

9.3 Dimensions

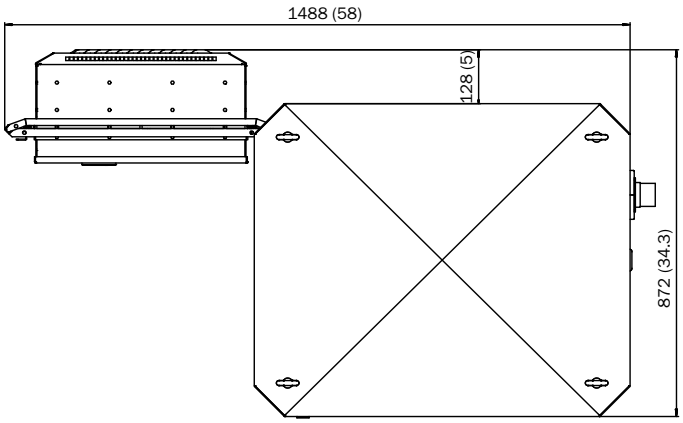
9.3.1 MERCEM300Z

Fig. 14 Dimensions



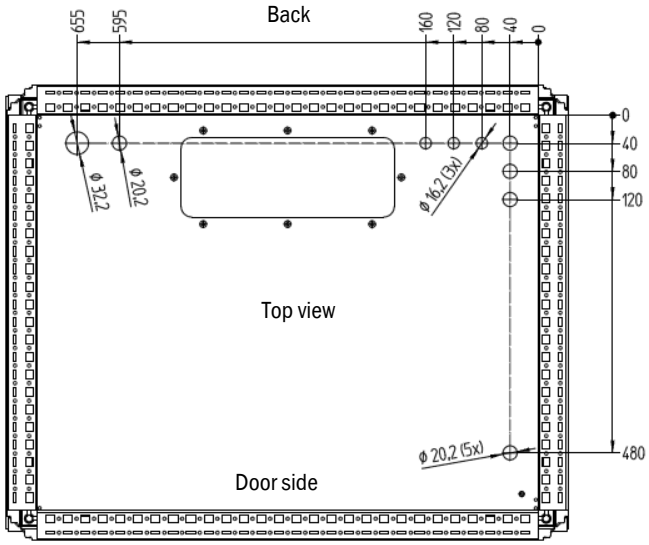
► Pay attention to side clearances → p. 23, §3.3

Fig. 15 Dimensions (view with air-conditioner opened)



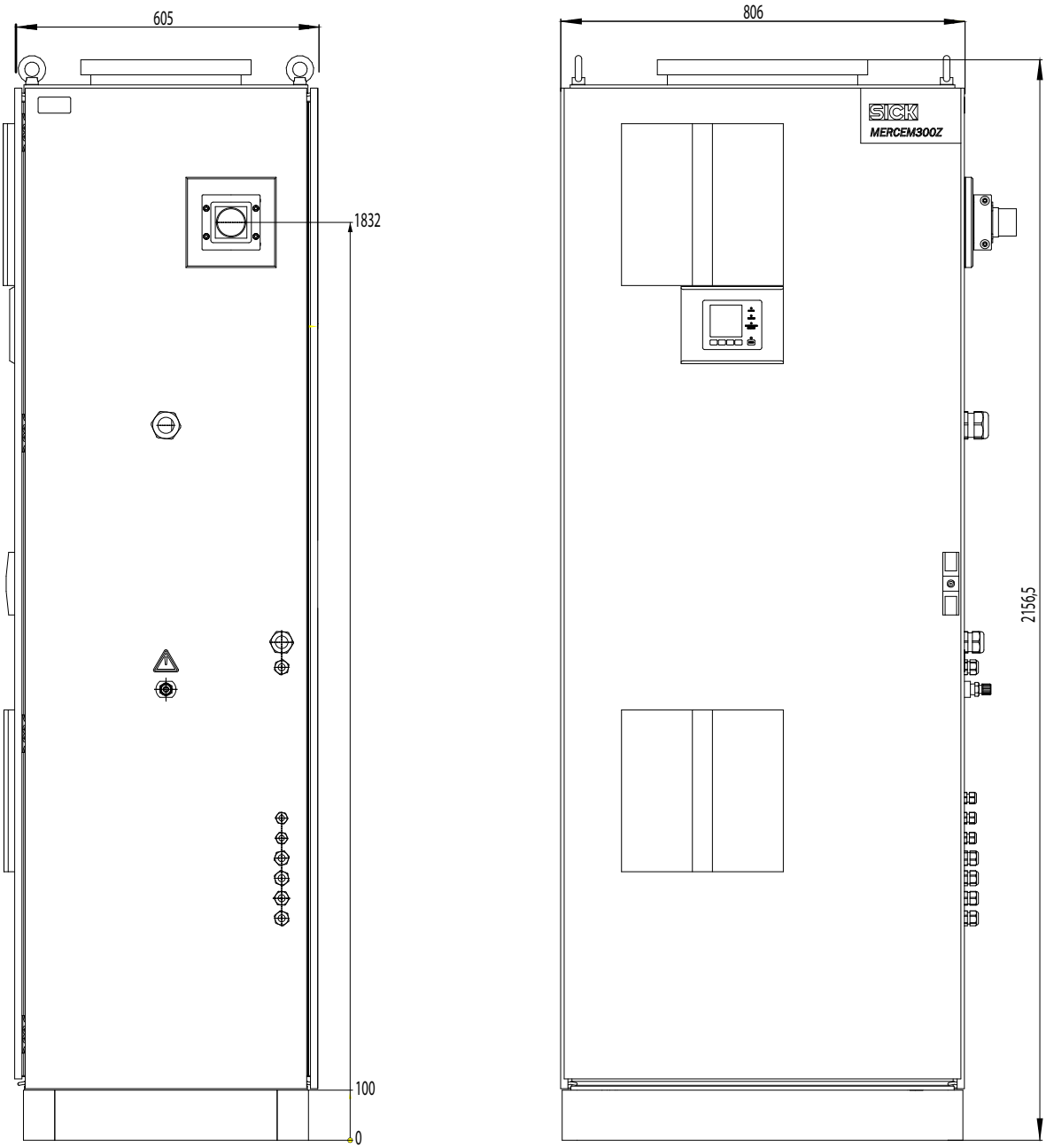
► Pay attention to side clearances → p. 23, § 3.3

Fig. 16 Bottom plate



9.3.2 MERCEM300Z Indoor

Fig. 17 Dimensions



► Pay attention to side clearances → p. 23, §3.3

9.4 Technical Data

Measuring range	
Smallest measurement range Hg	10 µg/m3

The measuring ranges can have individual settings → delivered system documentation.

Measured value recording	
Detection limit	< 2% of measuring range
Zero drift	< 3% of full scale reading per maintenance interval
Sensitivity drift	< 3% of full scale reading per maintenance interval
Temperature effect	< 2% of respective measuring range / 10 K
Setting time t_{90}	< 200 s

Device features	
Enclosure dimensions:	
– MERCEM300Z	1744x1038x744 mm (x41x30.3 in.) (HxWxD) including air conditioner, without connection socket
– MERCEM300Z Indoor	806x2165x605 mm (31.7x85.2x23.8 in.) (HxWxD)
Weight:	
– MERCEM300Z	250 kg
– MERCEM300Z Indoor	220 kg
Material:	
– MERCEM300Z	Aluminium, double-walled
– MERCEM300Z Indoor	Steel
Enclosure color	Grey
Heating temperature:	
– Gas sampling system	Max. 200°C (390°F)
– Sample gas line	Max. 200°C (390°F)
– Cell	Approx. 1000 °C (1800 °F)
Sample gas:	
– Flow (from sampling point)	150 - 400 l/h
– Temperature of cell	Approx. 1000 °C (1800 °F)
– Sample gas temperature at sampling point	Max. 1300°C (2400°F)
– Input pressure	90 ... 110 kPa (0.9 ... 1.1 bar)

Ambient conditions	
Ambient temperature:	
– MERCEM300Z	–20 ... +50 °C (-4 ... +120 °F)
– MERCEM300Z Indoor	+5 ... +35 °C (+41 ... +95 °F)
Storage temperature	–20 ... +40 °C (-4 ... +104 °F) (without Hg chloride solution)
Relative humidity	Max. 80% (without condensation)
Ambient air pressure	850 ... 1100 hPa (mbar)
Degree of protection	IP 55 (outdoor operation)

Power input[1]	
System cabinet:	
– MERCEM300Z	Max. 3100 VA (including air conditioner)
– MERCEM300Z Indoor	Max. 2200 VA
Test gas generator	1000 VA
Heated sample gas line	95 VA/m
Gas sampling system	450 VA

Power input[1]	
Heated probe tube	450 VA
UPS	Max. 2510 VA

1 The feed depends on the application. Refer to System Documentation.

Gas supply			
Gas	Quality	Input pressure	Flow
Instrument air	Particle size max. 1 µm, oil content max. 0.1 mg/m^3, pressure dew point max. –30 °C (-22 °F).	500 ... 700 kPa (5.0 ... 7.0 bar)	Approx. 2500 l/h
External test gas	Precision: ± 2% Water content: 5 ... 30%	max. 50 kPa (0.5 bar)	Approx. 500 l/h

Piping	
Sample gas inlet	6 mm Swagelok
Test gas inlet (in cabinet)	6 mm Swagelok
Gas inlet instrument air	10 mm Swagelok
Gas outlet	10 mm Swagelok

Operation and interfaces	
Digital outputs[1]	4 outputs: electrically insulated, relay changeover contact, 50 V, max. 4 A
Digital inputs[1]	4 inputs, electrically insulated, 24 V, 0.3 A
Analog outputs[1]	2 outputs, 0/4 - 20 mA, electrically insulated, max. load 500 Ohm
Data interfaces	CAN-Bus (system bus to optional remote I/O interfaces)
Remote control	Ethernet (Modbus TCP/IP): - Plug: RJ 45 - Type: TCP/IP peer-to-peer. - Method: 10 MBit half-duplex
PC operation	SOPAS ET via Ethernet

1 Optionally extendable, system-dependent configuration → delivered system documentation. Description → Operating Instructions “Modular I/O System”

Sample gas line	
Length	Recommended: Max 5 m (200 in.); Certified: Max. 35 m (1400 in.) Otherwise: Max. 50 m (2000 in.)
Temperature	Max. 200°C (390°F)
Power input	95 VA/m (2.43 VA/in.)

Internal test gas generator CALSIC300 (option)	
Generated test gas	$HgCl_2$
Test gas concentration.	Depending on measuring range
Contained test liquid	$HgCl_2$, approx. 10 l

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