Embracing Challenge

Portable Sampling System for Adsorption Tubes (Sorbent Traps)

Instruction Manual

Version 1.00.00

Software Version: 1.00

Embracing Challenge

Get help

For more information about using your M&C product, please contact M&C TechGroup. We will answer your questions about commissioning, handling and technical service. With our experience and know-how, we will get your M&C product running in no time - and with no charge.

Please contact our service center in Ratingen, Germany,

for US Service Ventura, California

For faster service, please have this information ready when you contact us:

- Product model
- Product serial number
- M&C order or invoice number

- Germany service center:
  +49 2102 935 - 888
  service-DE@mc-techgroup.com
- US service:
  +1 805-654-6970
  info-usa@mc-techgroup.com

For online service and support information go to:

- www.mc-techgroup.com

Table of Contents

1 About this Instruction Manual

Welcome to the M&C product manual. The goal of this document is to give a broad overview of the main functions of the STS and to help you to get started.

If you have any questions about this instruction manual, please contact M&C or one of our official distributors.

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	40885 Ratingen, Deutschland

This instruction manual does not claim to be complete and it may be subject to technical modifications. We appreciate any feedback you may have to this document .

With the release of this version all older manual versions will no longer be valid.

The original instruction manual is in German.

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2 Safety Information

Read this important safety information carefully before installing the STS. Follow these safety precautions during commissioning, start-up and regular operation.

2.1 Intended Use

The portable sample system STS (sorbent trap sampler) is intended for use in general purpose areas (non-hazardous environments). It may only be operated in compliance with the information on page 14 chapter 'Technical Data' . You must meet the requirements of the ambient temperature and characteristics in particular.

Do not use this product for any other purpose. Improper use and handling can create hazards and cause damage. For more information, please refer to the safety information in this instruction manual.

2.2 Personal Safety

Read this instruction manual carefully before commissioning and operating the device. If you have any questions regarding the product or the application, please don't hesitate to contact M&C or an M&C authorized distributor.

Follow all instructions and warnings closely.

The product described in this instruction manual has been built and tested in our production facility. All analyzers are packed to be shipped safely. To ensure the safe operation and to maintain the safe condition, all instructions and regulations stated in this manual need to be followed.

This instruction manual includes all information regarding proper transportation, storage, installation, operation and maintenance of this product by qualified personnel.

2.3 Warning Signs and Definitions

DANGER DANGER indicates a hazardous situation which, if not avoided, will result in death or serious injury.

WARNING WARNING indicates a hazardous situation which, if not avoided, could result in death or serious injury.

 **CAUTION**	CAUTION indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.
NOTICE	NOTICE is used to address practices not related to physical injury.
 **High Voltage!**	Caution, risk of electric shock!
 **High Pressure!**	Caution, system might be under pressure.
 **Hot Surface!**	Caution, hot surface! Do not touch!
 **Hazardous Gas!**	Caution, hazardous and toxic gas! Do not inhale!
 **Qualified Personnel**	'Qualified personnel' are experts who are familiar with the installation, mounting, commissioning and operation of these types of products.
 **Safety Gloves!**	Put on safety gloves for your protection.
 **Pull Main Plug!**	Unplug power supply before opening!

Wear protective equipment	Working with chemicals, sharp objects or extremly high temperatures requires wearing protective equipment.

Wear safety glasses	Protect your eyes while working with chemicals or sharp objects. Wear safety glasses to prevent anything from getting into your eyes.

Note	'Note' indicates important information relating to the product or highlights parts of the documentation for special attention.

Do you need help?	Please contact M&C!

2.4 Safety regarding M&C components

Qualified personnel	Installation, commissioning, maintenance, inspections and any repairs of all M&C products and components must be carried out by qualified personnel in compliance with the current regulations.

M&C components may only be used in the areas specified by M&C. Protect the device from direct sunlight, rain and moisture.

Operate the device only in the permitted temperature and pressure ranges. For details, please refer to the technical data on page 14 chapter 'Technical Data' .

Don't repair or maintain this product without M&C's specific maintenance- and service instructions.

When replacing parts, use only original M&C spare parts.

Pull Main Plug!	If there is any indication that safe operation of the STS is no longer possible, turn off the power and disconnect the device from the power supply immediately.

Then protect the defective device against accidental switch-on and mark it clearly as defective.

2.5 Working on Electrical and Electronic Devices

Only qualified and authorized personnel are permitted to work on equipment which operates on 115 or 230 V AC supply voltage. Ensure that the generally accepted engineering standards and all of your national and local regulations are observed.

Note	Before connecting the device, please make sure that the supply voltage matches the specified voltage on the type plate.

High Voltage!	Protect yourself and others against damages which might be caused by high voltages. Disconnect the power supply before opening the device for access. Make sure that all external power supplies are disconnected.

Please make sure to take appropriate precautions even by working on unplugged or low-voltage devices. Unplugged devices need to be properly grounded to prevent damage to internal electronics from electrostatic discharges (ESD).

2.6 Not certified in Hazardous Areas

This device is NOT certified to be installed or operated in hazardous areas.

WARNING	Explosion hazard! For general purpose areas ONLY. Don't use the device in hazardous areas.

3 Introduction

Congratulations on your purchase of the portable sampling system for adsorption tubes (STS). We know from experience that you will surely enjoy this reliable and durable M&C product.

M&C is one of the premium and performance-driven companies in the business. With this in mind, our customers benefit from a number of significant advantages. We offer proven, durable and advanced products and solutions. We have listened to our customers needs, when designing our products, allowing M&C to provide premium products at a comparatively lower cost over the entire life cycle.

Our products and special systems are designed and tested in our own facilities by our highly skilled staff that are always quality-oriented. We carefully package our goods and send them to our customers worldwide.

With our 30 years of experience in customer-specific solutions for almost 30 different industries and applications, it is our goal to provide you with an excellent product. Our products offer fast commissioning, safe and reliable day-to-day operation and low maintenance.

We expect that our products fully meet your expectations. If you have any questions regarding the product or the application, please don't hesitate to contact M&C or your M&C authorized distributor. Our service does not end with the delivery of the products.

Thanks again for your purchase.

We appreciate your business.

4 Product Overview

The mobile sampling system STS (Sorbent Trap Sampler) meets the requirements of DIN CEN/TS 17286:2019-07 (mercury measurement with sorbent traps). The operating principle is a volume flow system with which a defined volume flow is passed through adsorption tubes. Quality assurance is ensured by using two independent volume flows. In addition, the adsorption tubes contain up to six sections. The criteria that these sections must meet are defined in the relevant regulations. The actual analysis of the adsorption tubes is then carried out in the laboratory.

Typical applications are sampling in flue gases of combustion plants. Furthermore, this device is a very efficient tool for separation tests of mercury from flue gases.

The M&C Sorbent Trap Sampler (STS) is a reliable, precise sampling system for determining total mercury in flue gases. The realistic detection limit is in the single-digit nanogram range, with a reproducibility of approx. 5 to 10 ng. The adsorption tubes are inserted into the heated probe and removed after a defined and programmed collection cycle. If required, the probe can be equipped with new adsorption tubes for further collection cycles. The adsorption tubes in the probe are tested for gas tightness before and after each collection cycle. The device is controlled by a front-panel PC and an internal programmable logic controller (PLC). All relevant data are recorded and documented in an individual report.

A cooler for condensate separation is connected downstream of the probe. For volume control of the flue gas, pumps and mass flow controllers (MFCs) are controlled by the PLC.

The main components of the system are as follows:

- Sample probe designed to hold the sorbent traps
- Heated gas sample line
- Cooler with peristaltic pumps for condensate removal
- Vacuum sensors
- Sample gas pump
- Filters
- MFCs
- Electronics
- Oxygen sensor (optional)

Calibration routines and system integrity checks are performed semi-automatically or manually with the user-friendly software

4.1 Receiving the Analyzer

The STS sampling system is usually delivered in 6 packaging units. The following parts are in the packaging units:

- Sample probe designed to take up the Sorbent Traps (Sorbent Traps are not included in the scope of delivery) with control and power cable

- Heated sample line with two inner liners
- Cooler unit with power cable and Ethernet cable (double-sided IP42 connection)
- Measuring unit with power cable and Ethernet cable (double-sided IP42 connection)
- Condensate removal vessel TK13/LA5 with filling level alarm
- Optional: Audit MFC with power supply cable and Ethernet cable (double-sided IP68 connection)
- Instruction manual

Note Please note that there are no materials or tools included in the package you might need for assembly or installation.

4.2 Type Plate and Serial Number

The type plates with the serial numbers are placed on the individual system components:

- Sample probe

The type plate is on the electric terminal box.

- Heated sample line

The type plate is on one of the gas connections.

- Cooler unit

The type plate is placed on the inlet recess on the side of the case.

- Measuring unit

The type plate is placed on the lateral surface of the case.

- Condensate removal vessel

The type plate is placed laterally on the vessel.

- Optional: Audit MFC

The type plate is on the case lid.

Note Please always quote the serial number when making enquiries or ordering spare parts.

5 Operating Principle

The operating principle is a volume flow system with which a defined volume flow is routed through adsorption tubes. Quality assurance is guaranteed by using two independent volume flows. In addition, the adsorption tubes contain up to six sections. The criteria that these sections must meet are defined in the relevant regulations.

5.1 Flow Chart

The following gas flow diagram shows an STS with a maximum of two possible sorbent traps.

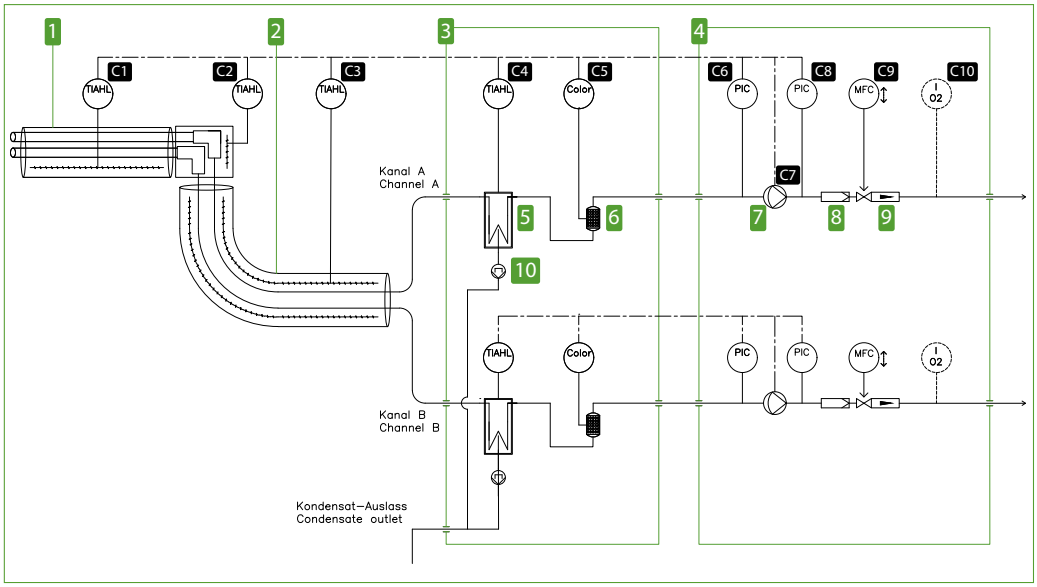


Fig. 1: Flow chart

1 *Sample probe*
2 *Heated gas sample line*
3 *Cooler unit*
4 *Measuring unit*
5 *Cooler unit: heat exchanger*
6 *Cooler unit: safety equipment*
7 *Measuring unit: sample gas pump*
8 *Measuring unit: filter*
9 *Measuring unit: control valve*
10 *Cooler unit: peristaltic pump*
C1 *Sample probe with temperature alarm high/low*
C2 *Elbow screw connections with temperature alarm high/low*
C3 *Heated gas sample line with temperature alarm high/low*
C4 *Cooler unit with temperature alarm high/low*
C5 *Cooler unit: condition monitoring of safety equipment*
C6 *Measuring unit: pressure measurement before sample gas pump*
C7 *Measuring unit: sample gas pump control*
C8 *Measuring unit: pressure measurement after sample gas pump*
C9 *Measuring unit: mass flow control*
C10 *Option for measuring unit: measurement of the O_2 content*

6 Technical Data

Sample Probe	
Part No.	**07A2340 with 1 m [≈ 3.3 ft] immersion depth**
Part No.	**07A2350 with 1.5 m [≈ 4.9 ft] immersion depth**
Part No.	**07A2360 with 2 m [≈ 6.6 ft] immersion depth**
Weather protection cover	Yes
Protection class terminal box	IP42 EN 60529
Material	Stainless Steel 904L
Material probe flange gasket	
Sampling temperature	Up to 200 °C [392 ° F]
Ambient temperature	5 to 40 °C [41 to 104 °F]
Temperature sensor	PT100
Temperature controller	PLC
Ready for operation	After 2 hours
Connection gas outlet	Tube connection DN 4/6 stainless steel
Heating capacity	1200 W
Power supply	230 V AC
Electrical connection	1 x Schuko® plug, 16 A
Electrical equipment standard	
Mounting flange	DN 65 PN 6, form B with mounting bolts on both sides M 12 x 40 mm
Weight	18 kg [≈ 39.7 lbs]

Cooler Unit	
Part No.	**07A2200 for 230 V AC**
Part No.	**07A2200a for 115 V AC**
Gas outlet dew point	Setting range: +2 to +15 °C [35.6 to 59 °F], factory setting: +5 °C [41 °F]
Gas outlet dew point stability	Under constant conditions < ± 0.1 °C [< ± 0.18 °F]
Gas inlet temperature	*Max. 80 °C [176 °F], optional: *max. 180 °C [356 °F] with stainless steel bulkhead fitting
Gas inlet water vapor saturation	*Max. +80 °C [176 °F]
Gas flow heat exchanger	*Max. 150 Nl/h
Ambient temperature	*+5 to +40 °C [41 to 104 °F]
Storage temperature	-25 to +65 °C [-13 to 149 °F]
Medium connections	Tube connection DN 4/6
Material of wetted parts	Stainless Steel 316 Ti, glass, PVDF, PTFE, Novopren®
Ready for operation	Approx. 3 min.
Power supply	115 or 230 V AC ±10 %, 50/60 Hz
Power consumption	Max. 240 VA; with temperature controller and heated line 230 V: max. 1620 VA, 115 V: max. 920 VA
Device fuse	4 A, time-delay, 5 x 20 mm, with option temperatur controller: 10 A, time-delay
Electrical connection	2 m cable [≈ 6.6 ft]

Cooler Unit	
Part No.	**07A2200 for 230 V AC**
Part No.	**07A2200a for 115 V AC**
Protection class	IP42 EN 60529
Housing version	Portable impact-resistant plastic case with integrated trolley and pull-out handle
Housing color	Black
Dimensions (W x H x D)	451 x 654 x 279 mm [≈ 17.8" x 25.8" x 11.0"] with casters and handle
Electrical equipment standard	EN 61010
Weight	Approx. 16 kg [≈ 35.3 lbs]

** Technical data with max. specifications are to be evaluated under consideration of the total cooling capacity at 25 °C [77 °F] and an outlet dew point of 5 °C [41 °F].*

Please note: Nl/h and Nl/min refer to the German standard DIN 1343 and are based on these standard conditions: 0 °C [32 °F], 1013 mbar.

Measuring Unit	
Part No.	**07A2100**
Ambient temperature	*+5 to +40 °C [41 to 104 °F]
Storage temperature	-25 to +65 °C [-13 to 149 °F]
Pressure	0.7 to 1.4 bar abs.
Number of gas inlets	2
Number of gas outlets	2
Medium connections	Tube connection DN 4/6
Material of wetted parts	SS 316 Ti, glass, PVDF, PTFE, Novopren®
Ready for operation	Approx. 30 min.
Mains connection	115 oder 230 V AC ±10 %, 50/60 Hz
Device fuse	4 A, slow
Electrical connection	2 m cable
Protection class	IP42 EN 60529
Housing version	Portable impact-resistant plastic case with integrated trolley and pull-out handle
Housing color	Black
Dimensions (W x H x D)	451 x 654 x 279 mm [≈ 17.8" x 25.8" x 11.0"] with casters and handle
Electrical equipment standard	EN 61010
Weight	Approx. 16 kg [≈ 35.3 lbs.]

** Technical data with max. specifications are to be evaluated under consideration of the total cooling capacity at 25 °C [77 °F] and an outlet dew point of 5 °C [41 °F].*

Gas Sample Line with two inner liners	
Part No.	
Operating temperature max.	+100 °C [212 °F]
Power consumption with DN 4/6	85 W/m
Power consumption with DN 6/8	100 W/m
Permissible ambient temperature	-20 to + 60 °C [- 4 to 140 °F]
Sample lines end caps	
Electrical connection	1.5 m [≈ 4.9 ft] connecting cable with plug 5-pole for max. 20 A, depending on required performance, for mains and PT100 sensor connection
Auxiliary power	230 V AC standard, fed via temperature controller
PT100 sensor positioning	0.25 m [≈ 9.8“] from feed-in connection - standard
Weight	First meter = 2 kg [≈ 4.4 lbs] ; every additional meter: 0.9 kg [≈ 2.0 lbs] - standard version
Length of sample line	Max. 30 m [≈ 98.4 ft] in one length
5-pole plug 20 A at connection fittings A-E from/to length	23.1 m to 30 m [≈ 75.8 ft to 98.4 ft]
Inner liner	PTFE, DN 4/6
Heating	200 °C [392 °F]
Thermal insulation	High-temperature polyester fleece
Outer jacket	Corrugated polyamide tube, black
Application areas/smallest bending radius	Mobile and stationary, indoor and outdoor installation/320 mm [≈ 12.6“]

Condensate Removal TK13/LA5	
Part No.	**09K4320**
Content approx.	10 l [≈ 2.2 gal]
Operating pressure at 20 °C	Atmospheric
Medium temperature	0 bis 50 °C [32 to 122 °F]
Ambient temperature	0 bis 55 °C [32 to 122 °F]
Storage temperature	-15 to + 65 °C [5 to 149 °F]
Connection condensate IN	2 x DN 4/6
Connection condensate OUT	Plug valve opening ø 11.5 mm [≈ 0.5“]
Dimensions (W x H x D)	230 (vessel diameter) x 308 x 310 mm (including plug valve opening) [≈ 9.1“ x 12.1“ x 12.2“]
Weight	1 kg [≈ 2.2 lbs]
Wetted parts	PE, rubber, PVDF
With filling level alarm	Yes
Switching capacity	48 V 0.5 A 10 W

Optional: Audit MFC	
Part No.	**07A2400**
Measuring principle	Mass
Dimensions	285 x 292 x 120 mm [≈ 11.2" x 11.5" x 4.7"]
Measuring range	34 to 1460 SCCM
Accuracy	< 1 %
Sample gas	
Min. gas flow	34 SCCM (at 2 bar abs.)
Max. gas flow	1460 SCCM
Gas pressure	Min. 2 bar abs. to max. 8 bar abs.
Accuracy	< 1 %
Reproducibility	< 1 %
Protection class	IP42
Electrical connection	115 V/230 V AC
Weight	3 kg [≈ 6.6 lbs]

6.1 Dimensions

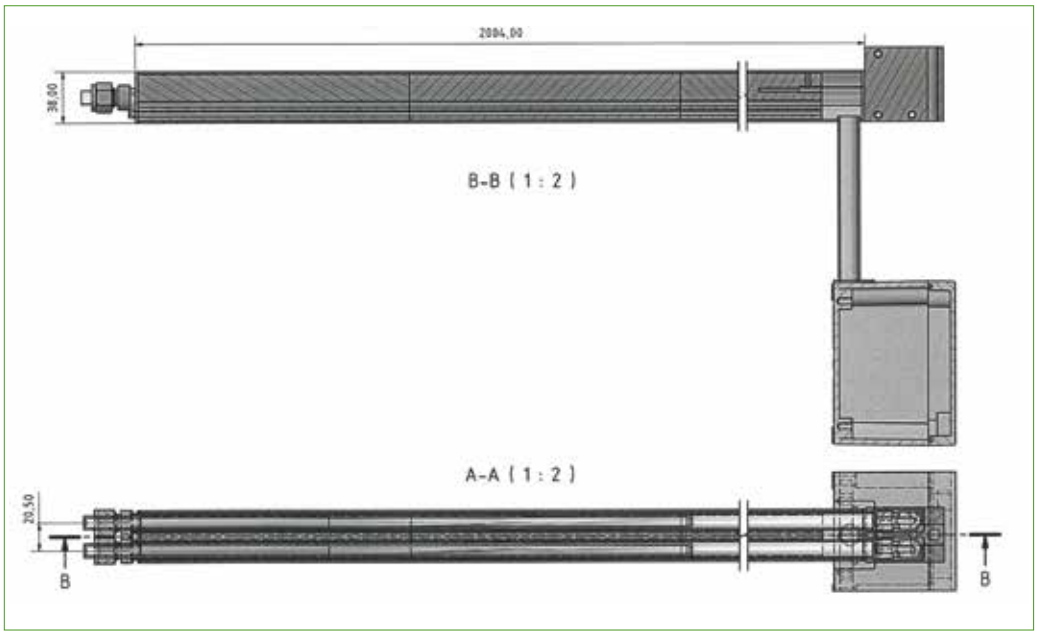


Fig. 2: View sample probe

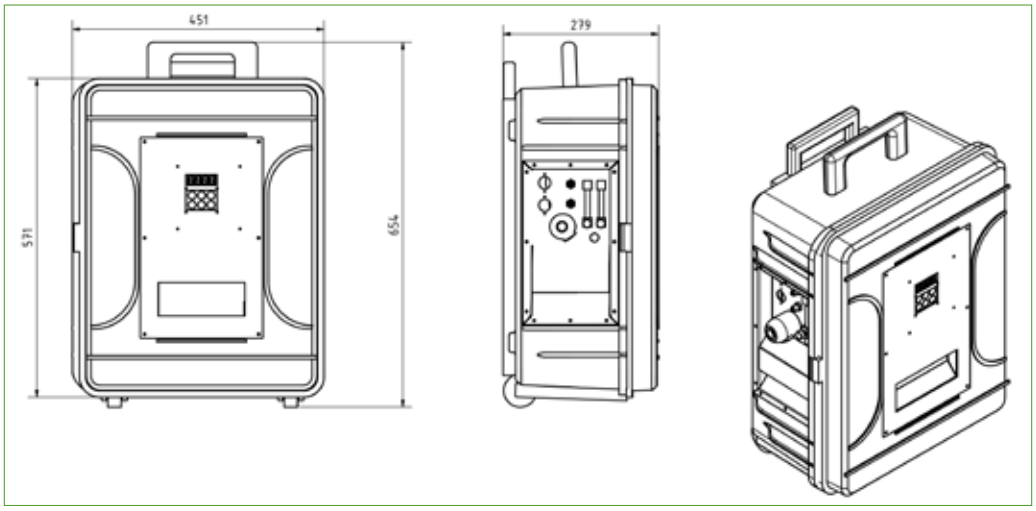


Fig. 3: Case dimensions for cooler and measuring unit

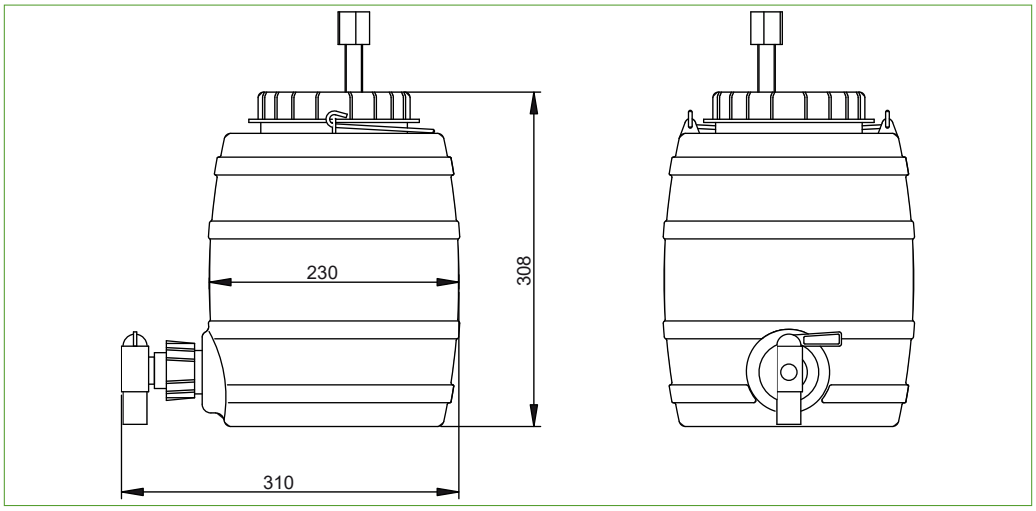


Fig. 4: Dimensions TK13/LA5

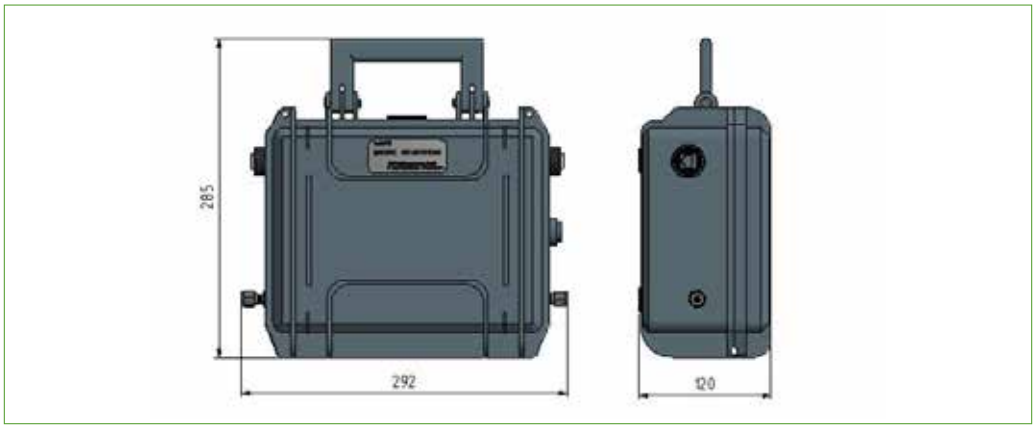


Fig. 5: Case dimensions for Audit MFC

6.2 Sampling Probe Connections

The connections of the probe are placed laterally on the electric terminal box.

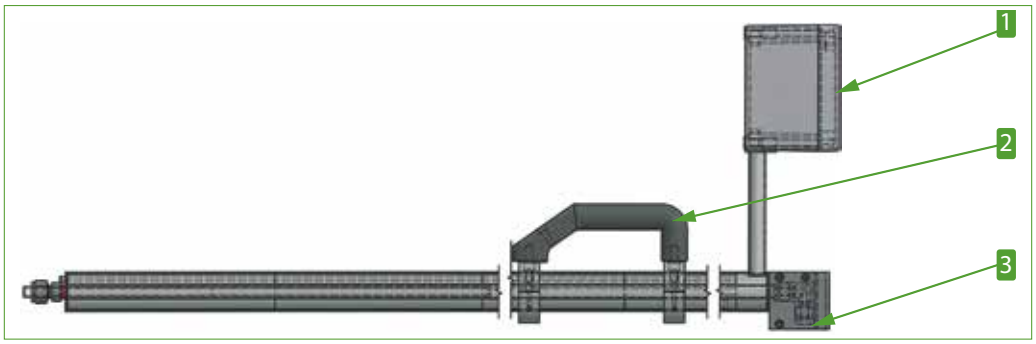


Fig. 6: Connections of the sampling probe

1 *Electric terminal box*
2 *Carrying handle*
3 *Sample gas IN and OUT*

6.3 Cooler Unit Connections

The connections of the cooler unit are placed on the side of the cooler unit.

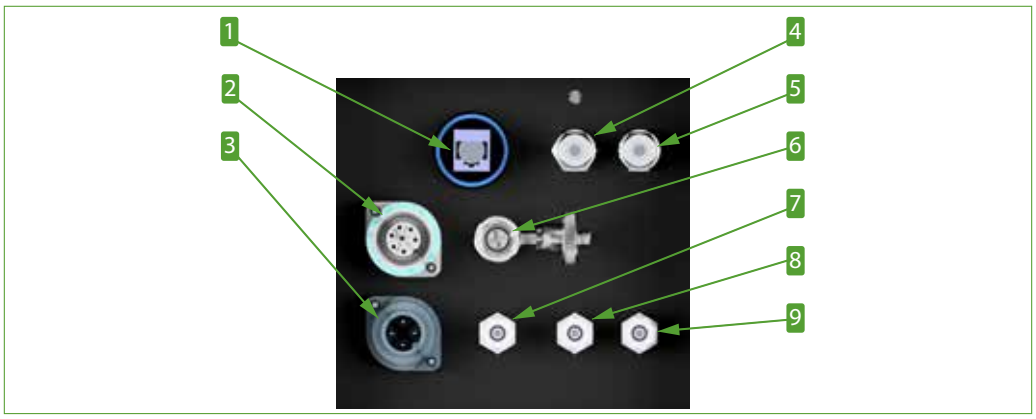


Fig. 7: Connections of the cooler unit

1 *Ethernet port*
2 *Connection of the heated sample line*
3 *Mains connection*
4 *Sample gas IN A*
5 *Sample gas IN B*
6 *LA 5 connection*
7 *Condensate outlet*
8 *Sample gas OUT A*
9 *Sample gas OUT B*

6.4 Connections of the Measuring Unit

Electrical and pneumatic connections are located at the rear of the measuring unit.

When the lid is open, Ethernet and USB ports are still available on the front panel. The connections on the front panel are protected with caps.

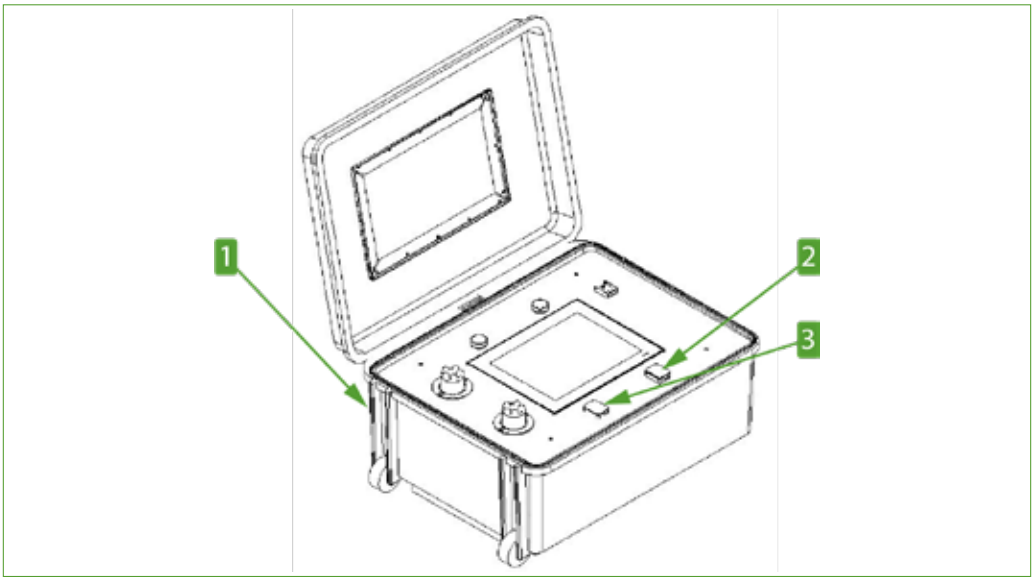


Fig. 8: Connections of the measuring unit

1 *Connections at the rear*
2 *USB port with protective cap*
3 *Ethernet port with protective cap*

Note You can connect a USB stick or an external keyboard to the USB port.

Fig. 9: Connections at the rear of the measuring unit

1 *Mains connection*
2 *Ethernet port 1*
3 *Ethernet port 2*
4 *Signal connection*
5 *Sample gas IN A*
6 *Sample gas IN B*
7 *Sample gas OUT A*
8 *Sample gas OUT B*

7 Using the Analyzer

7.1 Graphical User Interface (GUI)

The sampling system is controlled by a front-panel PC and an internal programmable logic controller (PLC). The user interface, also called HMI (Human-Machine-Interface), provides the interface between the sampling system and the user.

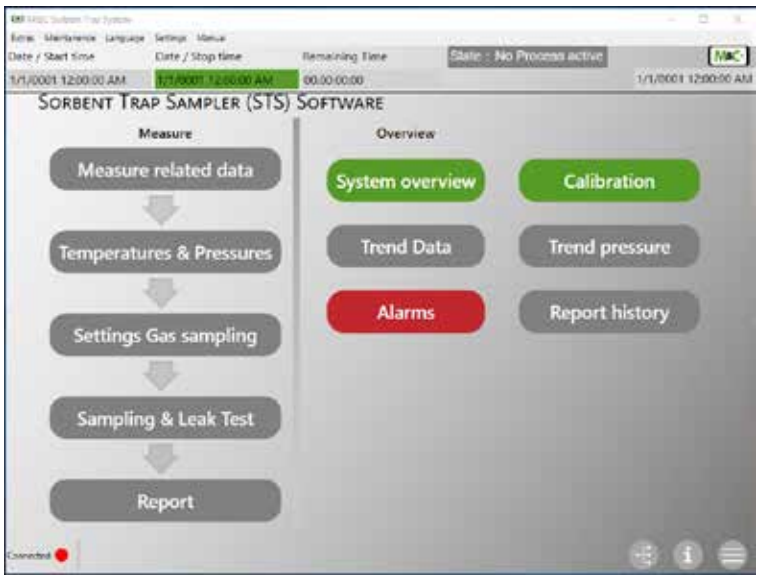


Fig. 10: Main menu of the sampling system

The following chapters provide explanations regarding the setup of the main menu and the structure of the menu. The illustrations in this instruction manual may differ slightly depending on the operating mode. Reading this description does not replace familiarizing yourself with navigating through the menus directly on the unit.

Note Familiarize yourself with navigating through the menus directly on the device.

7.2 Input via the Key Board

When entering data, use the keys on the front panel PC or connect an external keyboard to the USB connection at the measuring unit. The keyboard on the front-panel PC is accessible to you via the keypad button on the right of the display at the bottom.

Fig. 11: Keyboard button on the front-panel PC

For entries, proceed as follows:

	Keyboad ,Entries
1	Click into to the input field.
2	Enter the requested details via the keyboard on the front-panel PC or via an external keypad.
	Note The blue frame around the input field shows that the entered value has not yet been accepted.
3	Press the enter key on the keyboard in order to confirm the new value. Only when the blue frame is no longer displayed, has the system accepted the value.

8 Page Layout

The pages consist of four parts: menu bar, status bar, central display field and information line. On every page, the menu bar, the status bar and the information line remain visible. The central display field changes according to the opened page.

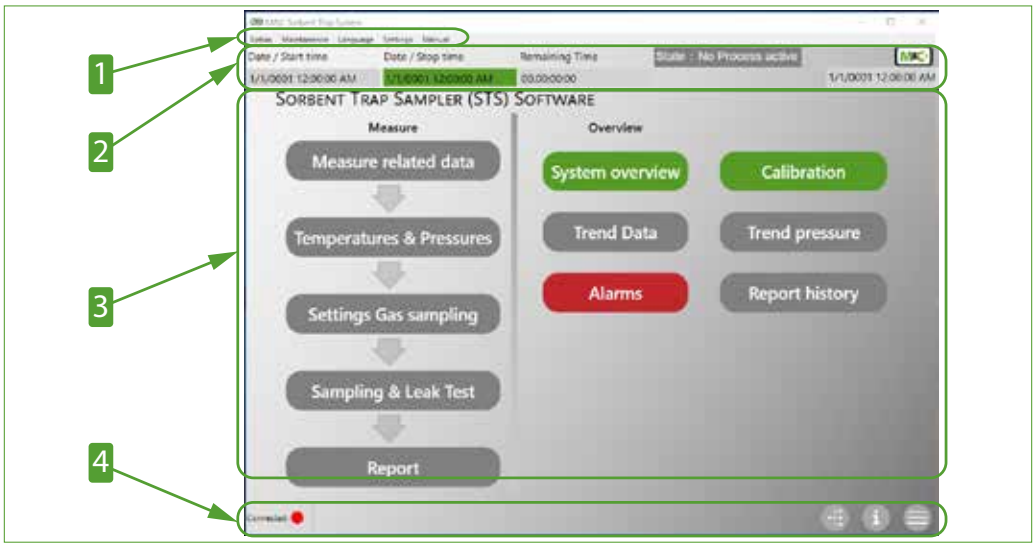


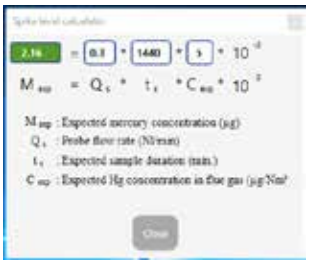
Fig. 12: Main Menu

1 *Menu bar*
2 *Status bar*
3 *Central display field*
4 *Information line*

8.1 Menu Bar

The menu bar at the top of the screen always remains visible when changes are made in the central display field. The following menu items are displayed in the menu bar:

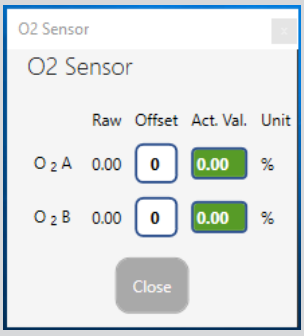
- Extras
- Maintenance
- Language
- Settings
- Manual

Menu Items Extras	Description
Extras -> Spike level calculator 	Here, the expected mercury concentration can be calculated in µg. After the calculation, close the spike level calculator by clicking on the cross in the header line or on the "Close" button. Example Calculation: An expected flue gas concentration of 5 µg/Nm^3 Hg, a flow rate of 0.3 L/min and a measuring period of 5 days result in the following: M_{exp} = 0.3 L/min * 1440 min/day * 5 days * 10-3 Nm^3 * 5 µg/Nm^3= 10.8 µg (This calculation runs in the background of the calculator) A spike level of 10. 8 µg ± 50 % is appropriate.

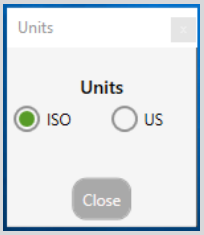
Menu Item	Description
Maintenance -> Mass Flow Controller (MFC) 	This page shows details regarding the mass flow controllers (MFCs): mass flow controller A, mass flow controller B and mass flow controller audit (optional). Here, the certificate data of the individual MFCs are provided. After each mandatory calibration of the MFCs by the manufacturer or a qualified body, the new data is entered here. You close the page by clicking on the cross in the header line or on the "Close" button.

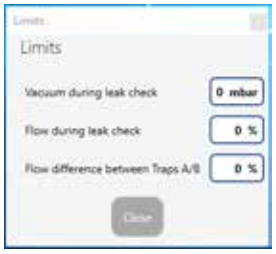
Note	Should the MFCs be exchanged, the new certificate data are entered here: certificate number and date, serial number and installation date.

Maintenance -> Temperature Sensor 	Here, the raw value measured by the temperature sensor is displayed in °C oder °F. To recalibrate the temperature sensor, the raw value can be changed by entering an offset. The actual value shows the changed temperature value in °C or °F. Six temperature sensors are available: in the process, in the measuring unit, in the heated sample line, in the sampling probe, in the probe tube and in the cooler unit. You close the page by clicking on the cross in the header line or on the "Close" button.

Menu Item	Description
Maintenance -> Pressure gauge 	Here, the raw value measured by the pressure gauge is displayed in bar. To recalibrate the pressure gauge, the raw value can be changed by entering an offset. The actual value shows the changed pressure in mbar. Four pressure gauges are available: Trap A, Trap B, MFC A and MFC B. You close the page by clicking on the cross in the header line or on the "Close" button.
Maintenance -> O2 Sensor 	Here, the raw value measured by the chemical oxygen sensor is displayed in vol%. The raw value can be changed by entering an offset. The actual value shows the changed oxygen value in vol%. Two chemical oxygen sensors are used: O_2 A und O_2 B. You close the page by clicking on the cross in the header line or on the "Close" button.

Menu Item Language	Description
Language -> German, English	Select the language of the STS software here. German and English are available.

Menu Item Settings	Description
Settings -> Signal Input	
Settings -> Unit 	Select the units in which the values are indicated. ISO or US units are available.

Menu Item Settings	Description
Settings -> Limit values 	Please enter the following limit values here: Minimum vacuum during the leakage test in mbar. Permissible percentage gas flow during the leakage test. Permissible difference in percent between Trap A und Trap B.
Settings -> IP Address of the PLC 	This page shows the IP address used. Enter a new IP address. Then confirm the new address by clicking on the "Accept" button.
Settings -> PLC Date & Time 	Here you transfer the system time to the PLC.

Menu Item Manual	Description
Manual -> Quick Start	Shows a short description of the most important buttons and menu items. Read the manual carefully before commissioning the device.
Manual -> Operating Manual	Shows the instruction manual for this device. Read the manual carefully before commissioning the device.
Manual -> Troubleshooting	Shows a table with Alarm messages and their impacts. This table is an extract from the manual. Read the manual carefully before commissioning the device.

8.2 Status Bar

In the status bar, date and time information that is important for the measurement is displayed. The status bar always remains visible even if the central display field is changed.

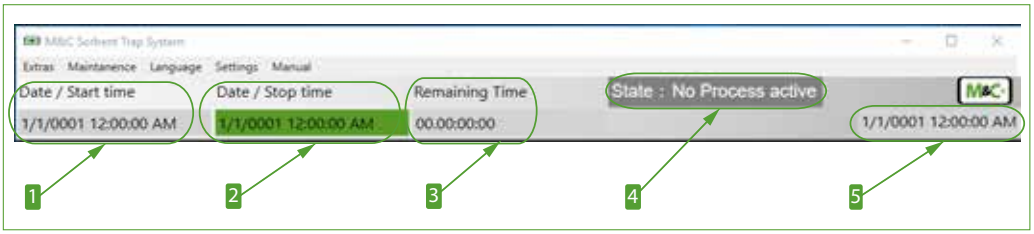


Fig. 13: Status bar

1 *Details regarding the start*
2 *Details regarding the end of the measuring*
3 *Remaining period of the measuring*
4 *Status of the sampling system*
5 *Status*
6 *Current date and current time*

8.3 Main Display Field

The central display field shows the selected page. Fig. 14 shows the display field of the main menu.

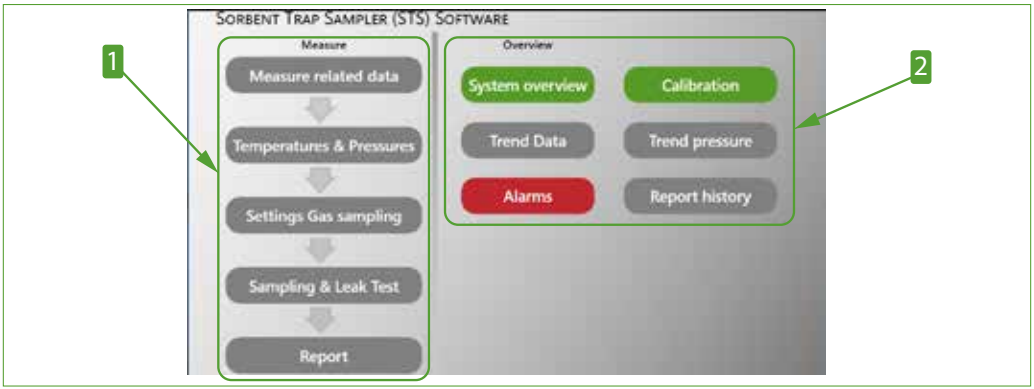


Fig. 14: Central display field of the main menu

1 *Steps to carry out the measurement*
2 *Overview*

8.4 Information Line

The information line is located at the bottom of the pages. It offers three buttons on the right side. These buttons take you back to the main menu, the system overview or open information about the central display field. The status bar always remains visible when you make changes in the central display field.

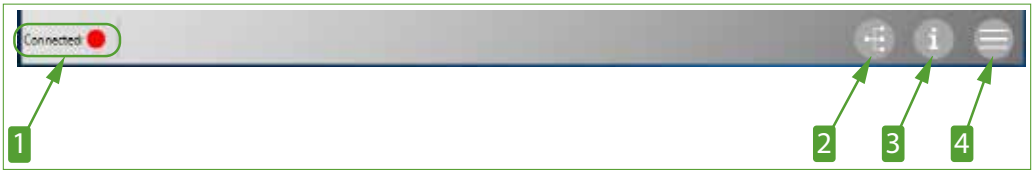


Fig. 15: Information line

1 Indicates if the front-panel PC is connected to the PLC (green dot) or not (red dot)

2 Button opens the system overview

3 Button opens information on the contents of the central display field

4 Button opens the main menu

9 Menu Structure

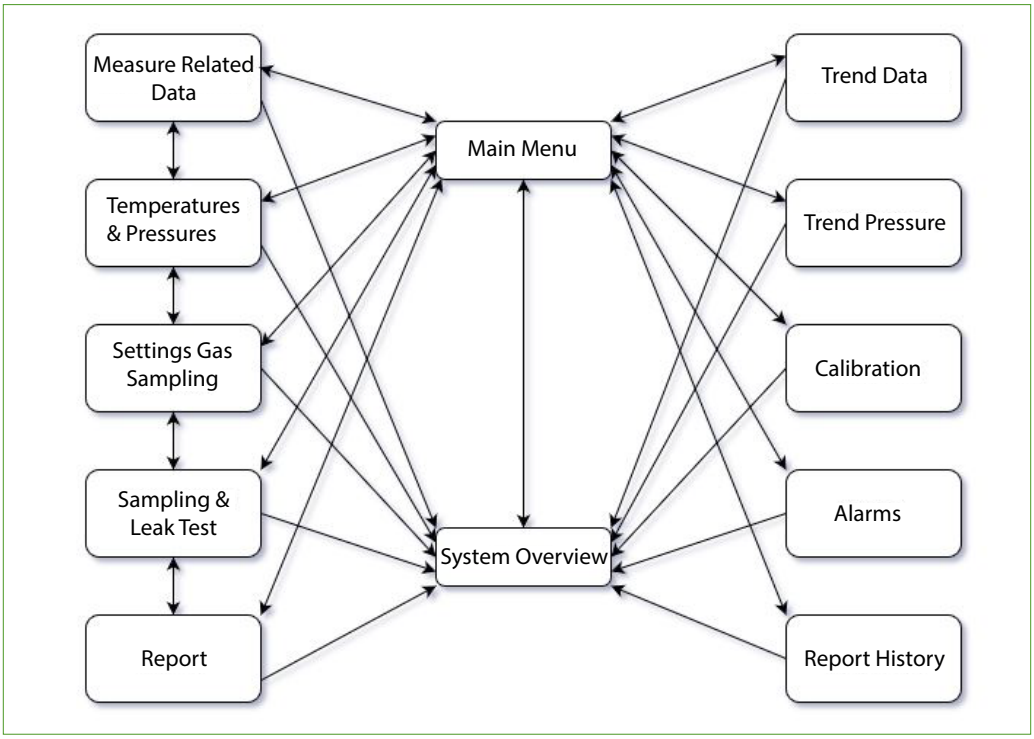


Fig. 16: Menu Structure

9.1 Main Menu

The buttons in the main menu are divided into Measurement and Overview. To perform a measurement, various settings are required. The buttons on the left side of the display field will guide you through the required input fields. The overviews on the right side of the display field are used for monitoring and control

The overview buttons on the right side will open the following pages:

- System Overview
- Trend Data (temperature)
- Alarms
- Calibration (non-mandatory calibration)
- Trend Pressures
- Report History

Note	All pages of the user interface can be accessed from the main menu.

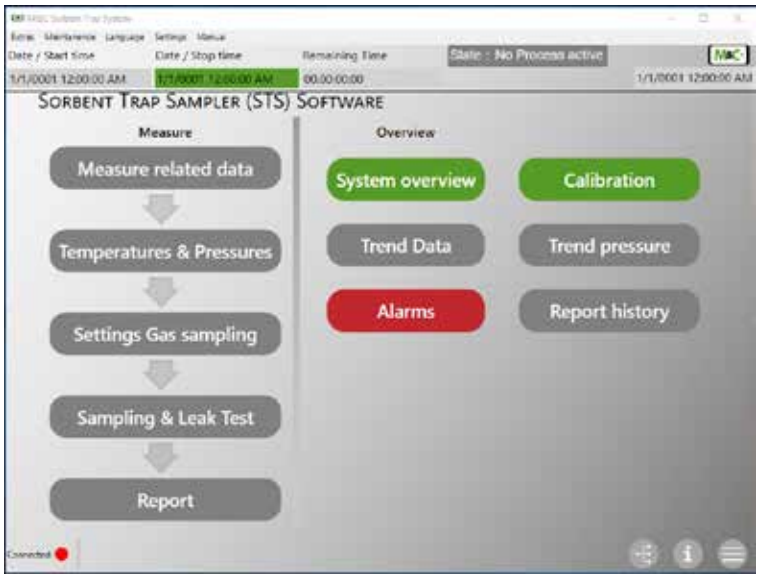


Fig. 17: Main menu with buttons

The buttons on the left side are connected with consecutive arrows. You open the following pages with these buttons:

- Measure Related Data
- Temperatures & Pressures
- Settings Gas Sampling
- Sampling & Leak Test
- Report

The arrows mean that you are directed through the data and inputs for the measurement.

If one of these pages is open, forward and back arrows for navigation will appear in the information line. The pages can be opened with the buttons from the main menu or with forward and backward arrows in the information line.

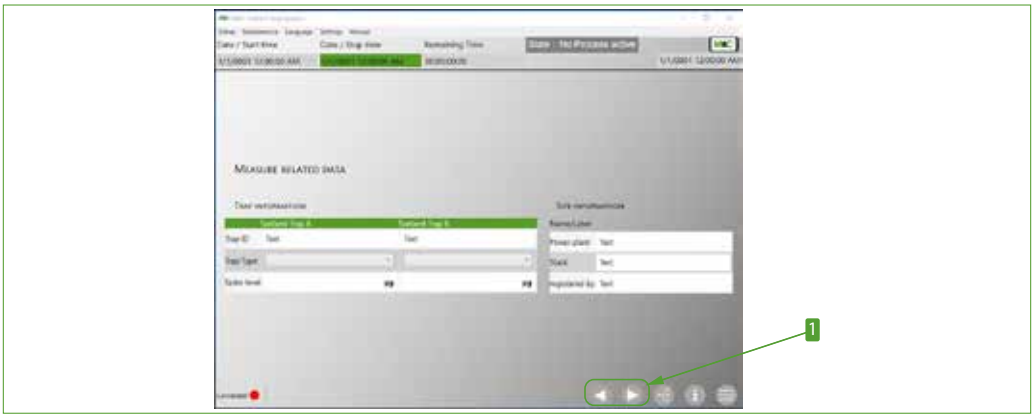


Fig. 18: Page "Measure Related Data" with arrow buttons in the information line

1 *Arrow buttons in the information line*

9.2 System Overview Page

In the system overview, all components that are used in the measurement are graphically displayed. Each of the green areas can change its color to red. If you click on one of these areas, the page on which this value was entered opens. For example, a red temperature value opens the „Temperatures & Pressures" page.

The following figure shows the system overview with the individual components.

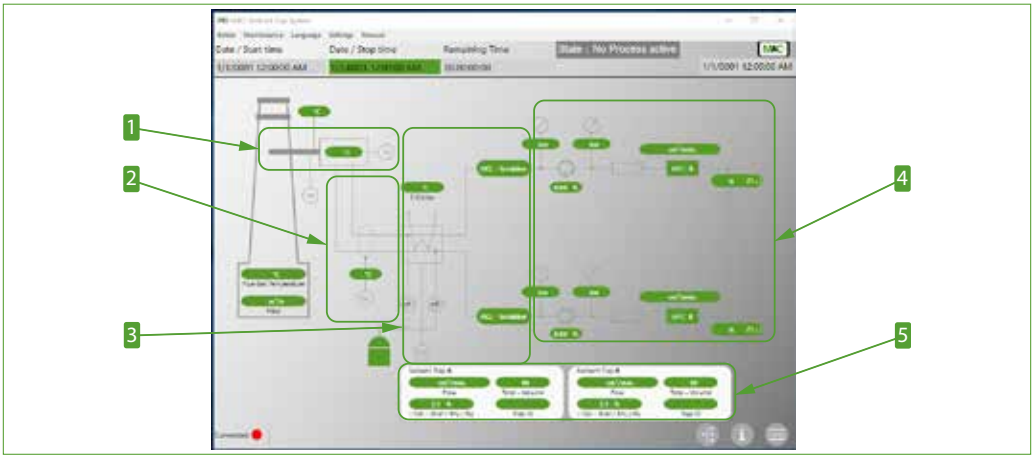


Fig. 19: System Overview with classification of the components

1 *Probe with probe tube*
2 *Gas sample line with 2 inner liners*
3 *Cooler unit*
4 *Measuring unit*
5 *Information about the MFCs in the measuring unit*

Note

With the "System Overview" button in the information line, you can access the system overview from any page.

9.3 Mandatory Calibration of MFCs

Note The mandatory calibration of mass flow controllers (MFCs) must be carried out by the manufacturer or a qualified body.

The precision of flow controllers must be proved annually as part of quality assurance. A calibration report must be prepared for each device using officially certified and computer-aided calibration equipment.

This calibration must be carried out by the manufacturer of the MFCs or a qualified body.

Note Enter each new certificate number and certificate date in the fields under the menu item "Maintenance -> Mass flow controller".

9.4 Non-Mandatory Calibration of MFCs

The mass flow controllers can be calibrated internally with the PLC between the required official calibrations. A calibration report is also generated for this calibration.

On this page, a calibration of the individual MFCs can be performed and the results can be displayed in report form and exported as PDF.

Fig. 20: Calibration of the MFCs

1 *Starting and stopping the calibration*
2 *Values of the previous calibration*
3 *Values of the current calibration*
4 *Information about the MFC Audit (optional)*
5 *Button to generate a calibration report*
6 *Arrow button*

Further pages are available for calibration. Click on the arrow button and the MFC calibration report header opens. Click again on the arrow button and the report list opens. The report header with the report list is printed together as a calibration report.

Note The calibration report consists of the report header and report list.

9.5 Trend Data (Temperature)

The diagram shows the values of the temperature sensors over a period of time.

In Table 2 in Fig. 21, it is possible to check only those temperature sensors whose curve is to be shown on the diagram.

However, if you move the cursor over the diagram, all values of the temperature sensors are displayed.

Note The cursor shows the values of all temperature sensors. The diagram only shows the temperature sensors selected from table 2.

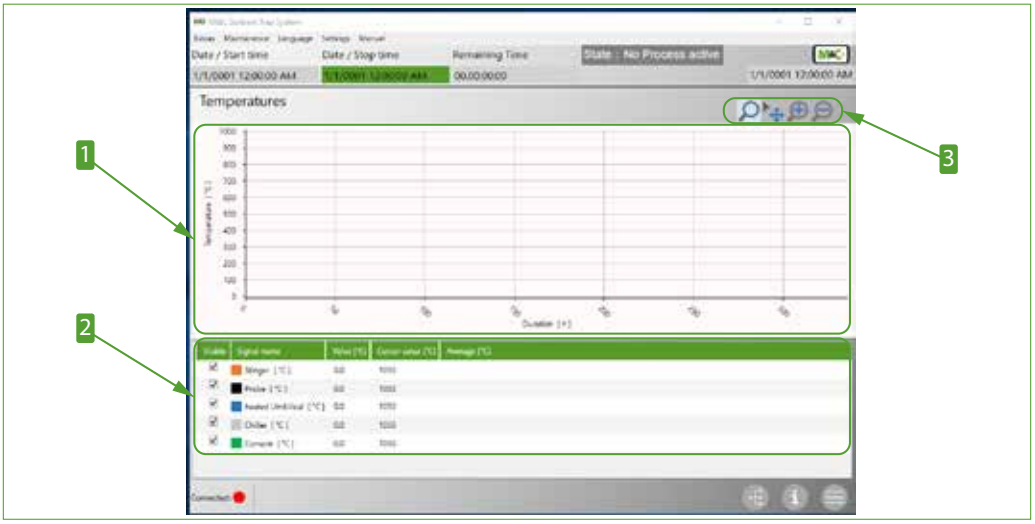


Fig. 21: Trend development of the temperatures over the measuring period

1 *Display area: temperature over time*
2 *Table of the existing temperature sensors*
3 *Zoom functions*

9.6 Trend Pressure

The diagram shows the values of the pressure sensors over a period of time.

In table 2 in Fig. Fig. 22, it is possible to check only the pressure sensors whose curve is to be presented in the diagram.

However, if you move the cursor over the diagram, all values of the pressure sensors are displayed.

Note The cursor shows the values of all pressure sensors. The diagram only shows the pressure sensors selected from table 2.

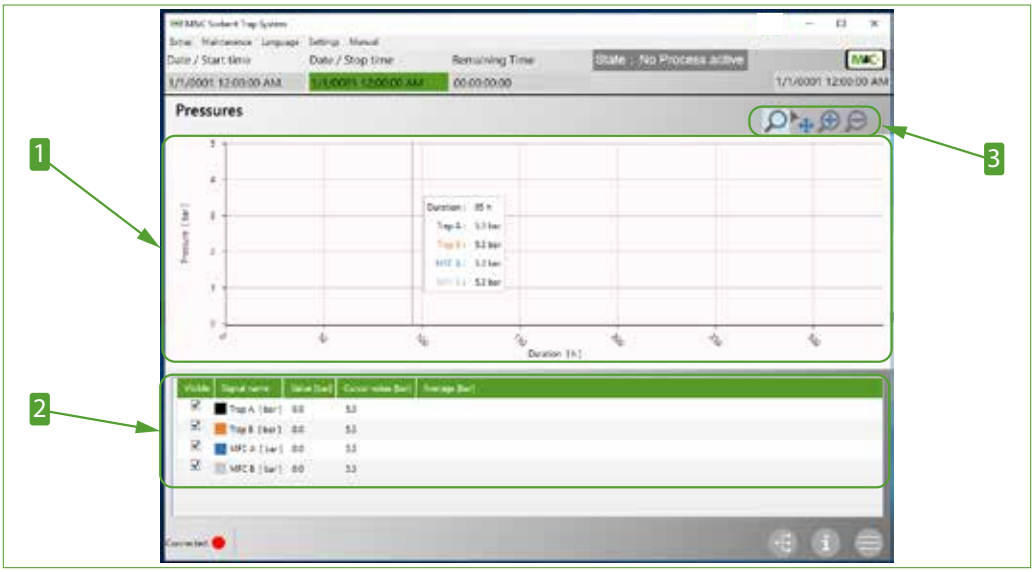


Fig. 22: Trend of the pressures over the measuring period

1 *Display area: Pressure over time*
2 *Table with the values of the pressure sensors*
3 *Zoom functions*

9.7 Alarm Page

The page "Alarms" lists all possible points in the system where an alarm can be triggered. If the color of the buttons switches from green to red, then an alarm has occurred at this point. If you click on the red button, you will be redirected to the page concerned.

Fig. 23: List of possible alarm messages

9.8 Report History

If you click on the "Report History" button, a page with a list opens. On this page, the existing reports of the individual measurements are listed. The list shows the file name, date, time and status of the measurement.

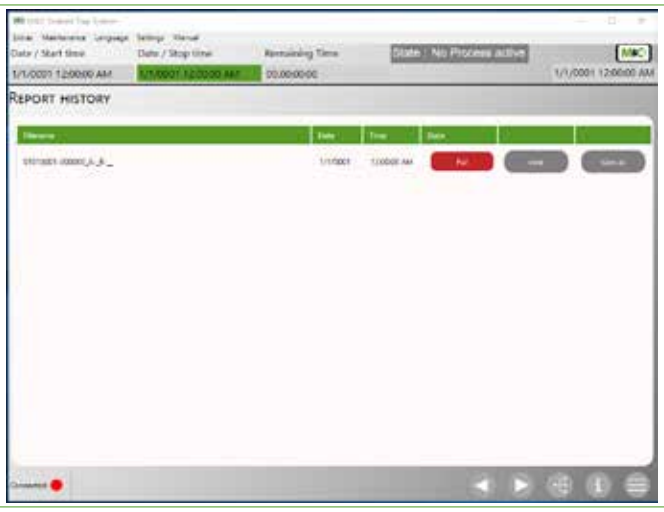


Fig. 24: Report History

9.9 Measure Related Data

On this page, the information about the traps is entered. The Trap IDs are stated on the traps.

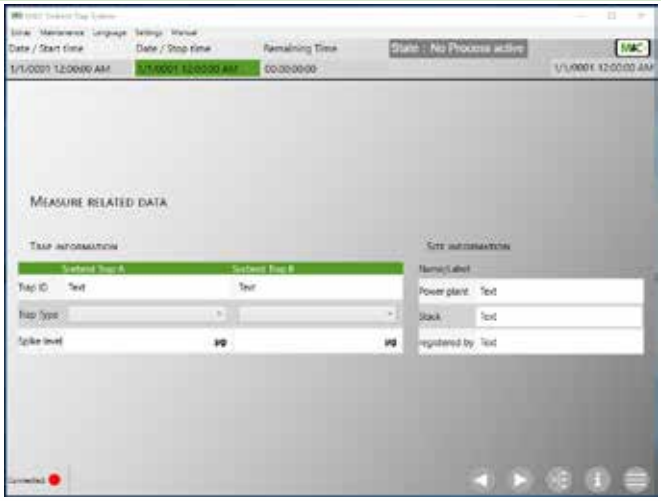


Fig. 25: Measure Related Data

9.10 Temperatures & Pressures

The target temperatures for the individual parts of the STS System are entered here. Alarms for exceeding or falling below the setpoint temperatures are also defined. Additionally, the duration of the exceeding or underrun can be defined before the alarm is triggered.

Alarm limits are defined here for the pressures of the traps and MFCs.

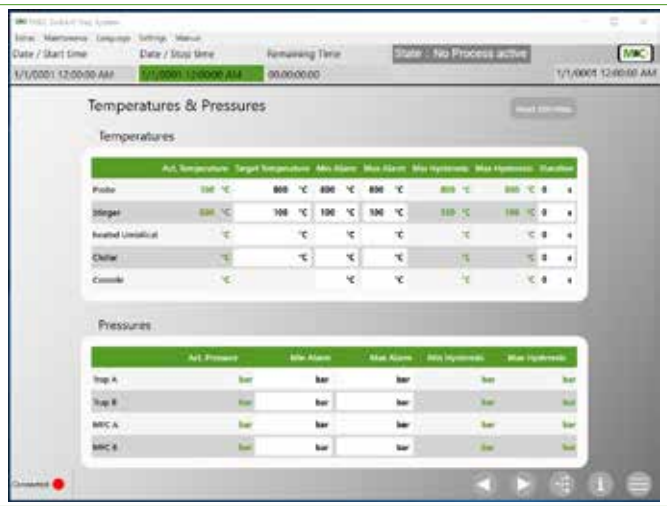


Fig. 26: Settings temperatures and pressures

9.11 Settings Gas Sampling

On the "Settings Gas Sampling" page, the information relating to the gas sampling, the measuring period and the measured data is entered.

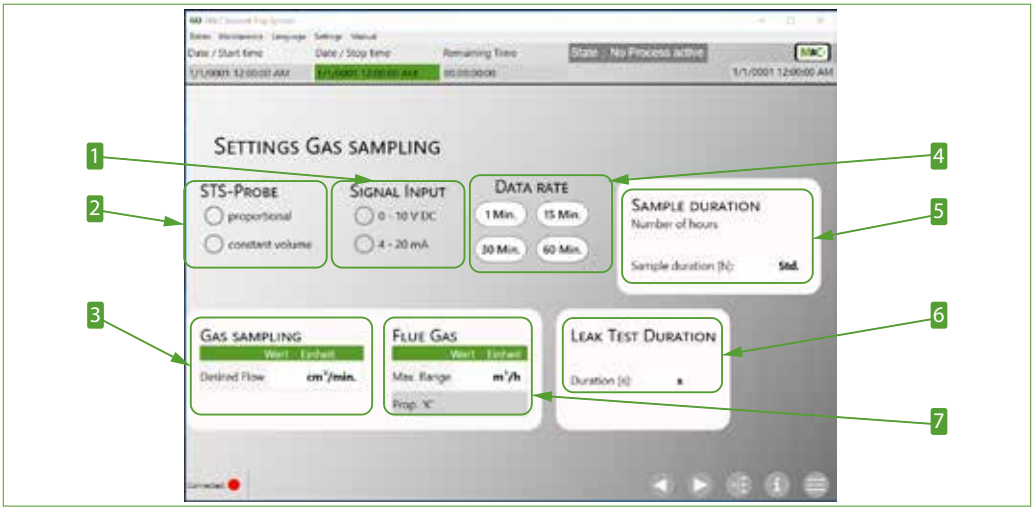


Fig. 27: Settings gas sampling

1 *Sample gas: proportional or constant volume*
2 *Signal input*
3 *Flow rate details*
4 *Data interval*
5 *Measuring period*
6 *Duration of leak test*
7 *Flue gas details*

9.12 Sampling & Leak Test

All entries are summarized on the page "Sampling & Leak Test".

Fig. 28: Settings of sampling & leak test

9.13 Report

The report lists the measurements performed. The report head and the report results table are printed out together as a report.

The report header includes the information relating to the traps and the pre- and post-STS leak tests.

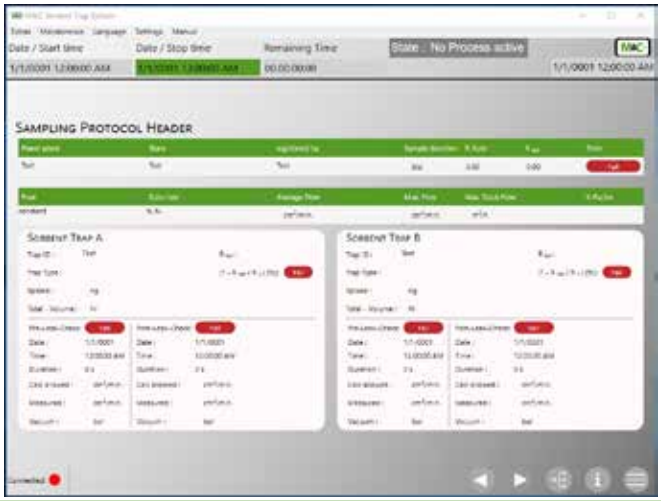


Fig. 29: Report header

The report results table lists the measured values. The number of values measured per collecting period is defined on the page "Settings Gas Sampling". The data interval can be set to 1, 15, 30 or 60 minutes.

Note

If no data interval is selected on the page "Settings Gas Sampling", then 1 minute will automatically be defined as interval.

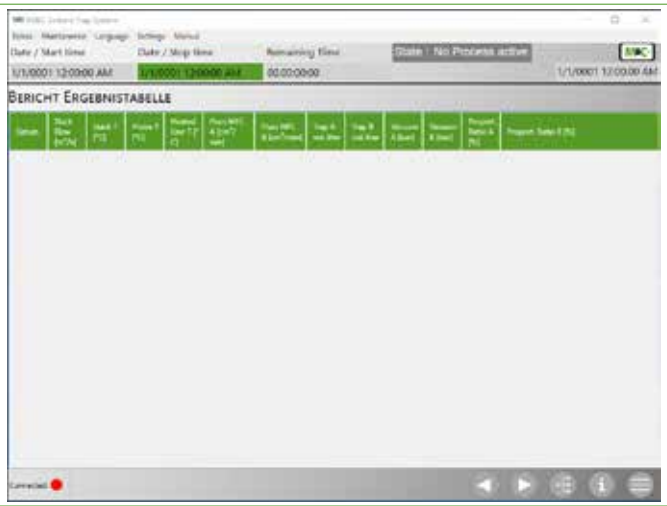


Fig. 30: Report results table

10 Operating Principle of the Sampling System (STS)

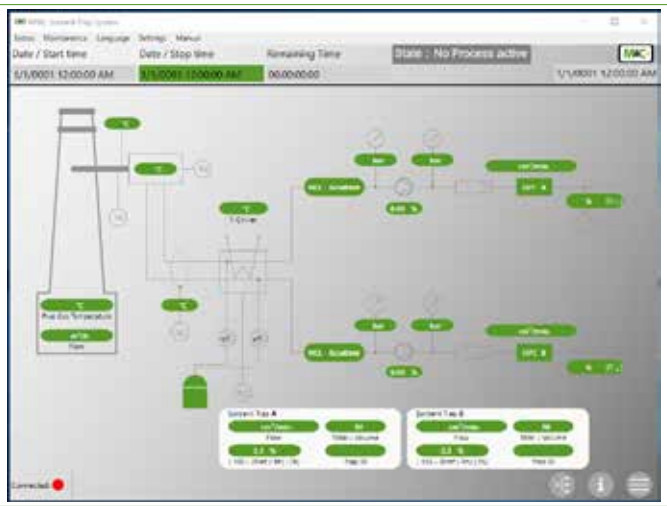


Fig. 31: System overview

The system overview shows how the Sorbent Trap System works. On the far left is a symbolic representation of the stack in which the probe with the strings A and B is mounted. To check the tightness of the two strings, the probe must be pulled out and the gas inlet closed. The tightness criterion is met if

- the flow rate measured amounts to less than 5 % of the selected flow rate,
- an absolute pressure of below 500 mbar abs. is reached,
- both conditions are fulfilled for 20 seconds.

Strings A and B are designed redundantly and are equipped with a cooling stage downstream of the probe to separate the condensate from the flue gas. Behind this cooling stage, an acid scrubber/silica gel cartridge is mounted and monitored by a colorimeter. Before the gas flow passes through the MFC, the gas flows through a 0.1 µm fine filter. Behind the MFC, a chemical oxygen measuring cell can be placed optionally.

When the collection time has elapsed, the tightness of the system must be checked analog to the start of the measurement. If this measuring sequence is not observed, the entire run is invalid.

11 Installation

WARNING

Explosion hazard!

Do not use the sampling system (STS) in explosive areas or for measuring explosive gases.

WARNING for heavy loads. The entire mobile sampling system is heavier than 40 kg [≈ 88.2 lbs]. The individual units do not weigh more than 20 kg [≈ 44.1 lbs].

Transport the units of the sampling system one at a time.

Electrical Voltage!

Attention electric shock!

When installing high-voltage systems with nominal voltages up to 1000 V, the requirements of VDE 0100 and your relevant standards and regulations must be observed!

This also applies to any connected alarm and control circuits. Before opening the modules, they must always be disconnected from the power supply.

Hot Surface!

Caution on hot surfaces!

The sampling probe and the gas sampling line are heated up to 200 °C [392 °F]. Both have mechanical devices that shield the hot surface.

During general electrical and mechanical work on the assembly, wear personal protective equipment (PPE) in accordance with the risk assessment.

The sampling system STS consists of 5 units:

- Sample probe designed to take up the sorbent traps (delivery without sorbent traps) with controller and power cable.
- Heated sample line with two inner liners.
- Cooler unit with power cable and Ethernet cable (IP68 connection on both sides).
- Measuring unit with power cable and Ethernet cable (IP68 connection on both sides).
- Condensate removal container TK13/LA5 with filling level alarm.

11.1 On-Site Requirements for Installing the Sample Probe

Observe the following check list, in order to determine the optimum **sampling point**:

- Select the optimum sampling point in compliance with the generally applicable guidelines or in consultation with the responsible bodies.
- Position the sampling point in such a way that there is sufficient space to install and remove the sample probe. Also take into account the insertion length of the probe tube (approx. 2 m [≈ 6.6 ft]).
- Ensure good accessibility to the sample probe. To change the sorbent traps, the sample probe must be completely detached from the sample socket and removed from the process.
- The mounting flange connection of the socket must have the size DN 65 PN 6.
- Provide a heat-resistant support tray for the sample probe, e.g. a rack. The sample probe is placed there while the sorbent traps are replaced.
- If the ambient temperature in the socket area is > 80 °C [176 °F] due to radiant heat, a heat radiation reflection plate must be installed on site to protect the probe.
- The entire system requires approx. 30 A distributed over three power plugs for measuring. Make sure that two electric circuits are available.

11.2 Installation of the Sample Probe

The operating position of the sample probe is with the connections of the heated gas sample line downwards.

The sample probe is attached to the on-site socket with four screws.

11.3 Preparing the Installation of the Electrical Gas Sample Line

- A minimum bending radius of 300 mm [≈ 11.8“] must be taken into account during installation.
- Check that your power supply voltage corresponds to the specification on the type plate.
- Check whether the materials in contact with the medium are resistant.
- Be careful when installing on machine parts with increased temperature.

- Please note: The ambient temperature at the sensor position determines the internal temperature in the entire sample line. Therefore, the sensor should be placed in the range of the highest ambient temperature to avoid overheating.
- Install the sample line protected from the wind, since wind causes considerable heat loss at the outer jacket.
- Different ambient temperatures in the area where the tube is laid cause different internal temperatures. In areas of lower ambient temperature, the internal temperature of the tube is lower, at higher ambient temperature it is accordingly higher than the controlled temperature value.
- Do not pull the sample line at the fitting. Every fitting is resistant to pressure, but susceptible to tension.

The heating tubes are normally delivered in a rolled-up condition. Please make sure that the heating hoses are not pulled off, as this would result in the smallest bending radius being undercut. The heating tubes must be unrolled.

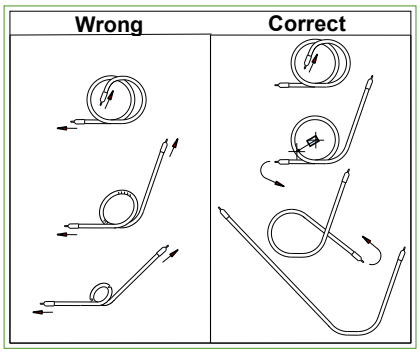


Fig. 32: Observe minimum bending radius

The tube axes should be parallel so that the direction of movement is on the same level.

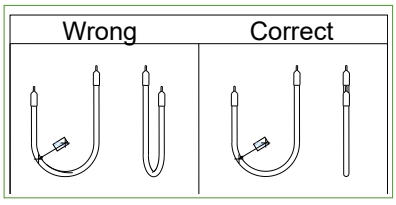


Fig. 33: Parallel tube axes

To avoid bending of hand-held tools, anti-kink protection must be provided according to the working position.

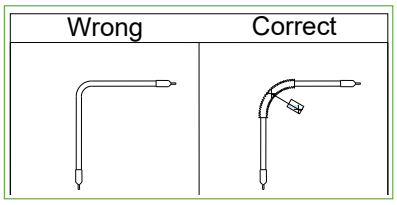


Fig. 34: Anti-kink protection

At the connection points, a straight piece, which is approx. 5 times the tube diameter in length, must be included in the planning.

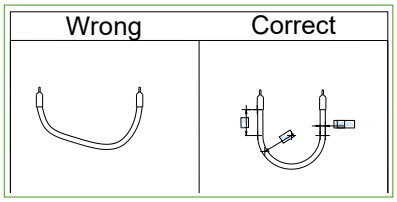


Fig. 35: Straight connection points

11.4 Installation Instructions Cooler Unit

- To ensure that the case of the cooler unit stands securely and stable, it should be placed on an even, horizontal surface.
- The operating position is exclusively vertical. Only then is the proper separation and discharge of the condensate in the heat exchanger of the cooler guaranteed.
- The case should be placed at a distance from heat sources and be freely ventilated so that no disturbing heat accumulation occurs.
- If the unit is installed in outdoor areas, adequate protection against direct sunlight and moisture must be provided. In winter, the installation site must be frost-free; observe the protection class of the case.
- The unit should only be operated in an upright position with the door closed. Any unused connectors must be closed with the appropriate covers. IP42 means protection against ingress of foreign particles ≥ 1 mm [≈ 0.04“] and dripping water up to an angle of ≤ 15°.
- To ensure the operational safety of the portable cooler unit and the downstream measuring unit and to avoid false alarms, the cooler unit must not be used outside the specified temperature range.
- The downstream measuring unit must always be operated at temperatures well above the set gas outlet dew point. This prevents subsequent condensation of the gas in the connecting lines to the measuring unit.

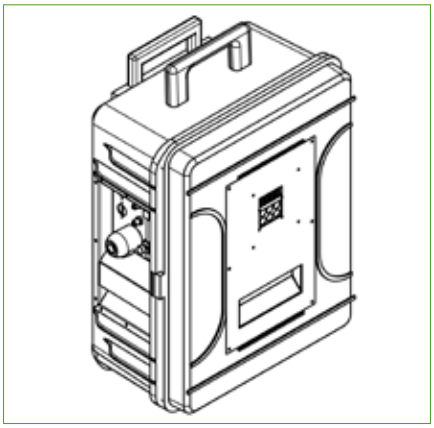


Fig. 36: Vertical operating position of the cooler unit

11.5 Installation Instructions Measuring Unit

- The case of the measuring unit should be placed on an even, horizontal surface to ensure that it stands securely and stable.
- The operating position is exclusively horizontal. Only then can the correct and precise operation of the mass flow controllers be guaranteed.
- The case should be placed away from heat sources and freely ventilated so that no disturbing heat accumulation occurs.
- If the unit is installed in outdoor areas, adequate protection against direct sunlight and moisture must be provided. In winter, the installation site must be frost-free; observe the protection class of the case.
- The device may only be operated in a horizontal position. Any plugs that are not used must be closed with the appropriate caps. When the cover is closed, the device complies with protection class IP42. IP42 means protection against foreign particles ≥ 1 mm [≈ 0.04“] and dripping water up to an angle of ≤ 15°.

Note

IP42 only with closed cover.

The cover of the device may be opened for operation. When the cover is open, the device does not meet protection class IP42.

- To ensure the operational safety and accuracy of the portable measuring unit and to avoid false alarms, the measuring unit must be used in the specified operating position and temperature range.

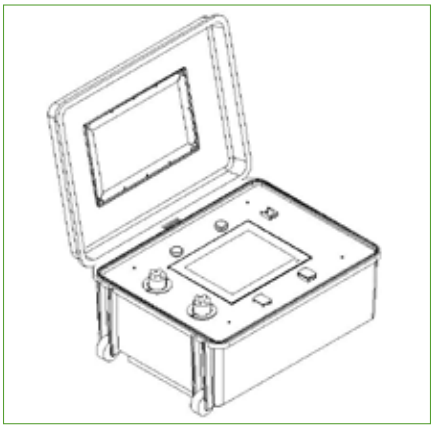


Fig. 37: Horizontal operating position of the measuring unit

11.6 Installation Instructions Condensate Container TK13/LA5

- To ensure that the condensate container stands securely and stable, it should be placed on an even, horizontal surface.
- The operating position is only vertical. Only then is the proper functioning of the integrated float switch guaranteed.
- The condensate container is supplied with the integrated float switch LA5 with 1 m [≈ 3.3 ft] connection cable LIYY 2 x 0.14 mm^2 for filling level monitoring.

Fig. 38: Vertical operating position of the condensate container

12 Supply Connections of the Sampling System (STS)

12.1 Electrical Connections Sample Probe

The sample probe has a connection for the heating.

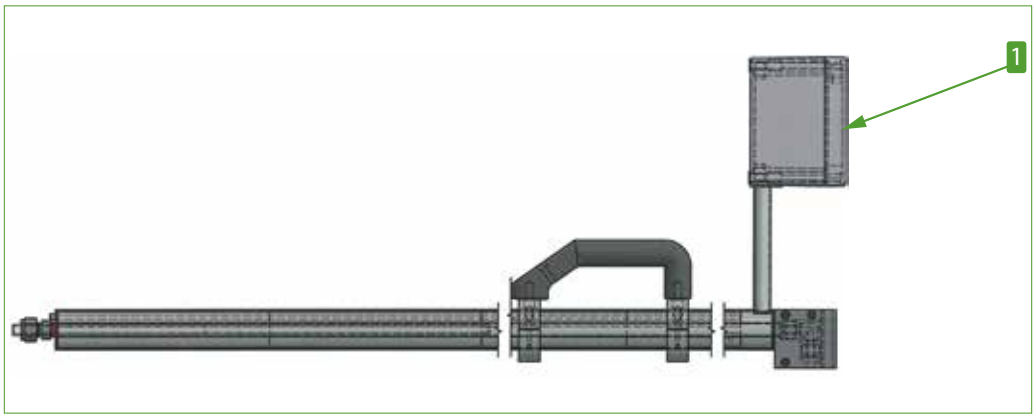


Fig. 39: Electrical connections at the sample probe

1 *Electrical terminal box*

12.2 Electrical Connections Cooler Unit

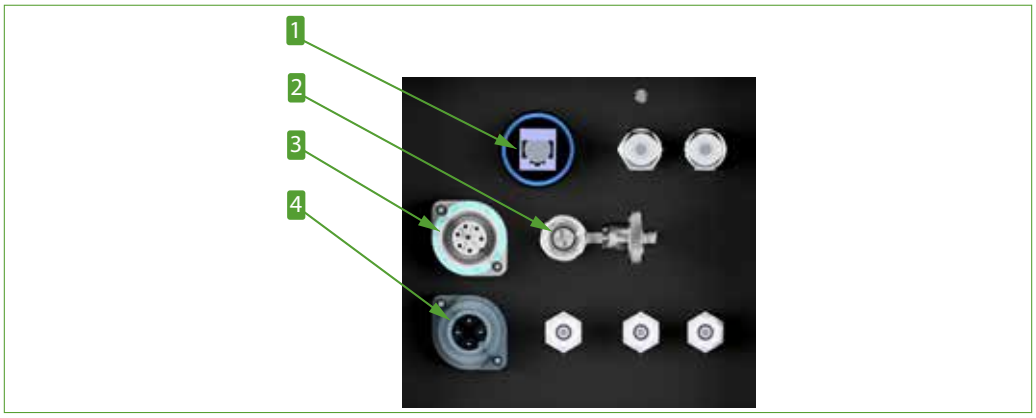


Fig. 40: Electrical connections at the cooler unit

1 *Ethernet connection*
2 *LA 5 connection*
3 *Connection to the heated sample line*
4 *Mains connection*

12.3 Electrical Connections Measuring Unit

The power supply connections of the measuring unit are located at the rear of the device. If you open the cover of the measuring unit, there is another Ethernet and a USB port on the front panel below the front-panel PC. These two connectors are protected by caps.

Fig. 41: Electrical connections at the rear of the measuring unit

1 *Mains connection*
2 *Ethernet port 1*
3 *Ethernet port 2*
4 *Signal connection*

12.4 Electrical Connections Audit MFC (Optional)

The audit MFC has an electrical connection and two Ethernet ports.

Fig. 42: Electrical connections on the sides of the audit MFC

1 *Ethernet port*
2 *Mains connection*
3 *Ethernet port*

12.5 Gas Connection Sample Probe

The sample probe has a connection for the electrically heated sample line.

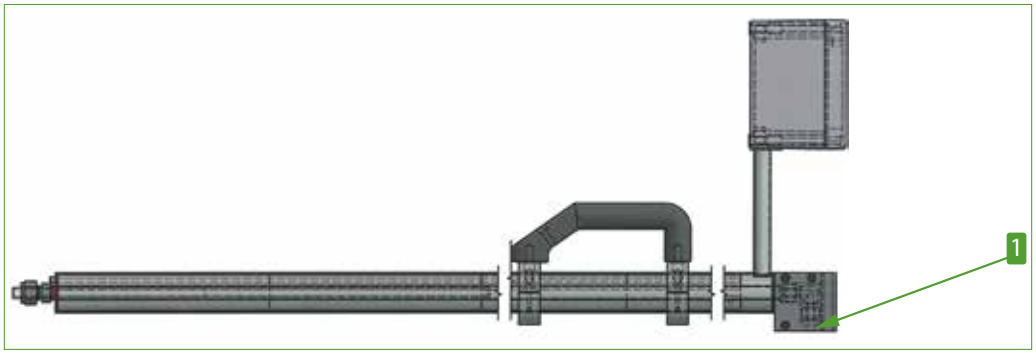


Fig. 43: Gas connections at the sample probe

1 *Gas connections at the probe*

12.6 Gas Connections Cooler Unit

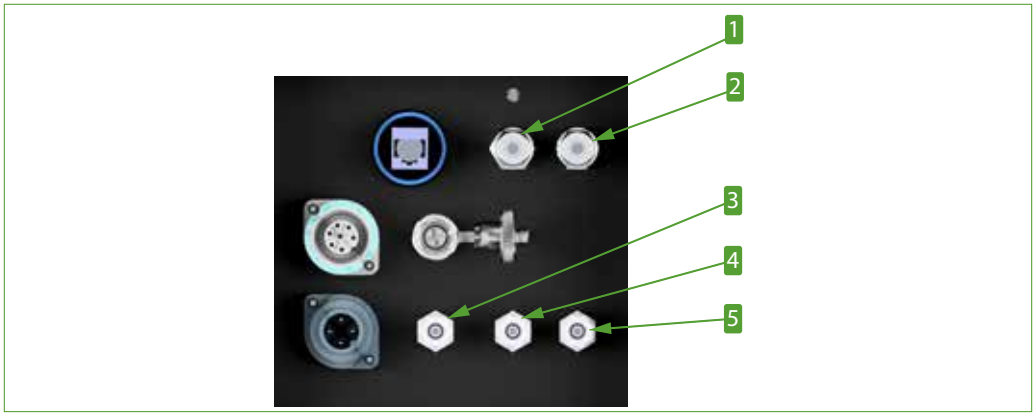


Fig. 44: Gas connections at the cooler unit

1 *Sample gas IN A*
2 *Sample gas IN B*
3 *Condensate connection*
4 *Sample gas OUT A*
5 *Sample gas OUT B*

12.7 Gas Connections Measuring Unit

Fig. 45: Gas connections at the measuring unit

1 *Sample gas IN A*
2 *Sample gas IN B*
3 *Sample gas OUT A*
4 *Sample gas OUT B*

12.8 Gas Connections Audit MFC (Optional)

The audit MFC has a sample gas IN and a sample gas OUT connection.

Fig. 46: Gas connections on the sides of the audit MFC

1 *Gas connection*
2 *Gas connection*

13 Start-Up

13.1 Preparation for Start-Up

Prior to initial commissioning, all system and process-specific security measures must be complied with.

When switching on, please ensure that the correct mains voltage according to the specifications on the type plate of the individual components is used.

ATTENTION	Device destruction due to incorrect mains voltage! Observe the correct mains voltage according to the type plate specifications!

Note	For measuring, the entire system requires approx. 30 A distributed over three power sockets. Make sure that two circuits are available.

13.2 Entering Data

You start the preparation for measuring by clicking on the button "Measure Related Data" in the main menu. The pages "Measure Related Data", "Temperatures & Pressures" and "Settings Gas Sampling" must be filled in prior to measuring.

On the page "Sampling & Leak Test", all entries are summarized. You start the pre-leak-test, the measurement and the post-leak-test on the page "Sampling & Leak Test".

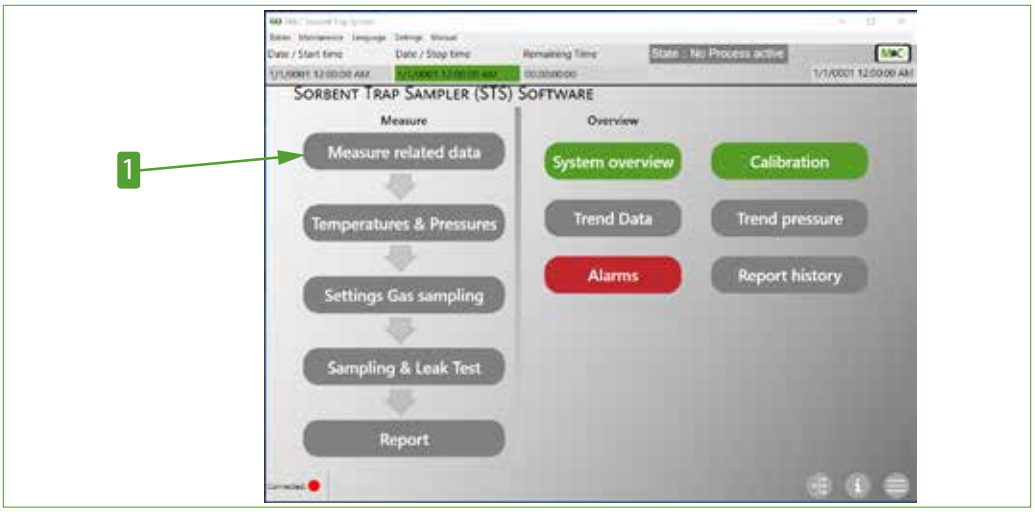


Fig. 47: Entering measuring data

1 *Button* "Measure Related Data"

13.2.1 General Data

On the page "Measure Related Data", details regarding the traps are entered. The trap IDs can be found on the traps.

Note

Use the keyboard of the front-panel PC or connect an external keyboard for input.

Click in the input field.

The blue frame around the input field indicates that the entered value has not yet been accepted.

Press the Enter key on the keyboard to confirm the new value. The system has only accepted the value when the blue frame is no longer displayed.

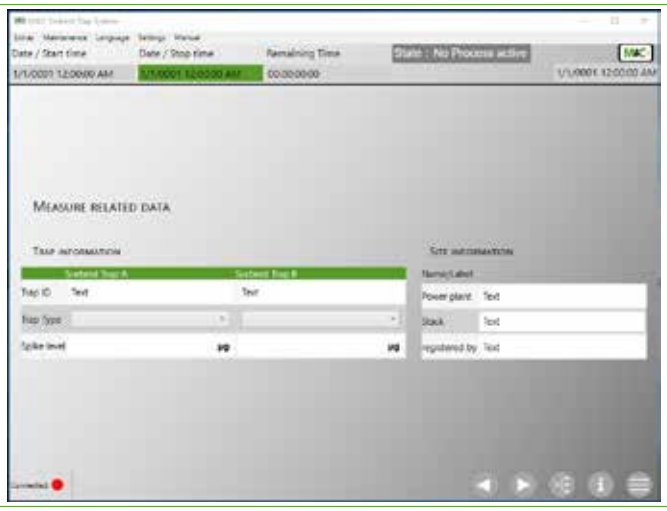


Fig. 48: Measure Related Data

- Enter Trap ID

Here, enter the trap IDs of the two sorbent traps Trap A and Trap B. The trap IDs can be found on the traps.

- Trap Type

12 different types of traps can be used. Here, you can select from a list the corresponding trap type that belongs to the trap ID.

- Spike Level

For official measurements, a defined quantity of mercury is doped in the last section of the sorbent trap. The spike level is indicated on the tubes. Enter the spike level of the individual traps here.

- Site Information

Enter the information on the power plant, stack and the person entering the required data here.

Note	Each input field has a maximum of 26 characters. Special characters that are not recognized by the system are replaced by spaces.

Note	Use the arrow keys in the information line to navigate through the pages that must be filled in for the measurement.

13.2.2 Temperatures and Pressures

On the "Temperatures & Pressures" page, enter the target temperatures for the individual control circuits of the STS system. Define the alarm limits for underrunning and exceeding the setpoint temperatures and the maximum time allowed for exceeding and underrunning.

Set the alarm limits of the pressures for the traps and the MFCs.

Fig. 49: Settings for temperatures and pressures

Note	The values entered here are also used for the subsequent measurements. Enter the new values here in case of changes.

- Temperatures

This list contains the temperatures of the probe, the probe tube (in the process), the heated tube, the cooler and the measuring unit. The target temperatures can be entered as default values.

The minimum and maximum alarm values indicate the temperature at which the alarm is triggered if the temperature falls below or exceeds the setpoint. If the alarm lasts for a certain period of time, the actual temperatures turn red.

The hysteresis values indicate how far the alarm value has been exceeded or fallen below. The duration on the right side of the table shows the allowed duration of this under- or overrun. If the setpoint temperature has been underrun or exceeded for longer than the specified period, the actual temperature is shown in red.

- Pressures

This list shows the pressures of Trap A and Trap B and the two MFCs: MFC A and MFC B. The minimum and maximum pressure can be entered as default values.

The minimum and maximum alarm value show the pressure at which the alarm is triggered if the pressure falls below or exceeds the alarm value. In case of an alarm, the actual pressure turns red.

The hysteresis values indicate how far the alarm value has been exceeded or underrun.

13.2.3 Data for Gas Sampling

On the page `Settings Gas Sampling", information relating to gas sampling, the measuring period and data for measuring are entered.

Fig. 50: Entering settings for gas sampling

1 Arrow buttons in the information line

- STS-Probe

The STS-Probe is the sample gas taken from the stack. Here, it is indicated whether the sample gas has a constant volume flow or whether the flow of the sample gas changes proportionally. If the sample gas flow is proportional, a signal corresponding to the proportional flow is sent to the PLC of the system. This signal is taken into account by the PLC during the measurement. The signal can be in the range 0 to 10 V DC or 4 to 20 mA.

- Signal Input

The selection ranges of the signal input only appear if the ˝proportional˝ field under ˝STS-Probe˝ has been clicked. With a proportional sample gas flow, a signal corresponding to the proportional flow is transmitted to the PLC of the system. This signal is taken into account by the PLC during the measurement. The signal can be in the range 0 to 10 V DC or 4 to 20 mA.

- Data Rate

The volume of data recorded by the PLC is very high. Here, you have the possibility to set the time interval between the measurements that are listed in the report. With a shorter collection period of 30 minutes, a maximum of 30 measurement data can be collected. The selected data rates are highlighted in orange.

Note	If no data rate is selected, then 1 minute is automatically set as the rate.

- Sample Duration

The sorbent traps remain in the probe for the duration of the measurement. This time is called collection period. The maximum collection period is 2 weeks or 336 hours. The collection period depends on the traps and the specifications for the measurement.

Note	The collection duration is specified in hours. 45 minutes correspond to 0.75 hours.

Click into the input field behind ˝Sample Duration [h]:˝. The input field changes its color. Use the keyboard to enter the collection period. A blue frame around the input marks the newly entered value. Now press the Enter key to confirm the new value. The blue frame disappears and the value has been accepted.

Note	The blue frame around the input field indicates that the entered value has not yet been accepted. Only when the blue frame is no longer displayed, has the system accepted the value.

- Gas Sampling

Enter the required flow rate here. You can enter values between 34 and 1460 cm^3/min. The desired flow rate depends on the measurement specifications.

If you have selected `constant volume" for the STS-Probe, then no further information is required under `Gas Sampling" and `Flue Gas".

If you have selected `proportional" for `STS-Probe", then you must enter further values under `Flue Gas".

With a proportional flow, the maximum flow rate is calculated from the maximum range divided by the proportional factor K:`

Max. range / K = Max. flow rate

Note	The maximum flow rate is calculated. The value of the maximum flow rate must be between 34 and 1460 cm^3/min. Specification only required for proportional sample gas volume.

- Flue Gas (only for proportional volume)

For proportional sample gas volume, it must be defined which range of the flow rate corresponds to the range of the signal input. Enter the value of the flow range here.

Example: A signal input range from 0 to 10 V DC corresponds, for example, to a flow range of 10 000 m^3/min.

The proportional factor `K" indicates how often the maximum flow rate fits into the maximum range. The value of the maximum flow rate must be between 34 and 1460 cm^3/min.

- Leak Test Duration

For official measurements, the duration of the tightness measurement is specified. The period is entered here in seconds. The value corresponds to the maximum time it may take until the leak test is completed. Please note that the gas lines must be pumped empty for the leak test, i.e. the pumping out can vary in length depending on the line length and the cross-section of the lines.

13.2.4 Summary of Entries

All settings are summarized on the `Sampling & Leak Test" page. The entries cannot be changed on this page. If you want to change entries, use the arrow keys to go back to the corresponding input page.

Fig. 51: Page "Sampling & Leak Test"

13.3 Start Measuring

A complete measurement includes the pre-STS leak test, the actual measurement and the post-STS leak test. The results of these measurements are recorded in the report. The report results table is filled in during the measurement.

13.3.1 Start Pre-STS Leak Test

Check the settings on the "Tightness and Sampling" page. If the data for measuring are correct, click on the button "Start Pre-STS Leak Test" and start the test.

Note	When you start the pre-STS leak test, then the previous entries can no longer be changed.

In the status line, the message: "Status: pre-leak test in progress" appears.

The two buttons "Pause" and "Stop" next to the "Start Pre-STS Leak Test" button become active. The "Pause" and "Stop" buttons suspend or cancel the pre-STS leak test.

Hinweis	The "Pause" button stops the timer. In case of leakage problems, it is not necessary to wait until the end of the leakage test, but immediate action can be taken to rectify the fault.

If the pre-leak test has been successfully completed, the status line indicates: "Status: pre-leak test successful".

The button "Start STS-Probe" becomes active.

13.3.2 Measurement

Click on `Start STS-Probe“ and start the measurement. The message `Status: sampling process in progress“ appears in the status bar.

The date of the start time and stop time are displayed in the status bar. The remaining time shows the remaining period of the measurement in hours, minutes and seconds.

Note	Open page `System Overview“ during the measurement. The system overview shows the actual values of the entire system. All information you may need during the measurement is summarized on this page.

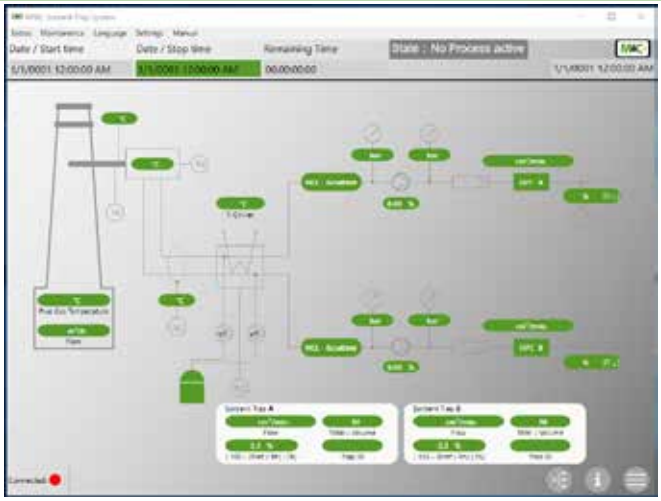


Fig. 52: Page `System Overview“ during the measurement

13.3.3 Start Post-STS Leak Test

To complete the measurement, the final leak test is carried out. Click on the button `Start Post-STS Leak Test“.

Note	Pausing the post-STS leak test is not possible. It can only be discontinued with the `Stop“ button. Interrupted Post-STS leak tests are failed tests.

After the post-STS leak test, the message in the status bar changes to status: `Ready“.

The entire measurement is completed.

14 Calibration

14.1 General

In order to carry out a calibration, you require special test gas.

Do not inhale!	WARNING OF HAZARDOUS GASES! Do not inhale!

14.2 Calibration of the Mass Flow Controllers A and B

- Test gas

The test gas consists of the following gases:

- 81.00 % N_2
- 12.00 % CO_2
- 7 % O_2

Note	During a measurement, the mass flow controllers (MFCs) cannot be calibrated. The calibration of the MFCs can be repeated prior to or after a measurement.

15 Service and Maintenance

Before starting any service or maintenance work, please make sure that any work carried out on the device is in compliance with all relevant regulations and standards.

Qualified Personnel	The service and maintenance work should be carried out exclusively by qualified personnel, preferably by M&C or your authorized M&C distributor.

High Voltage!	Disconnect power supply before opening the device for access. Make sure that all external power supplies are disconnected.

Please make sure that you also follow the appropriate precautions by working on unplugged or low-voltage devices. Unplugged devices need to be properly grounded to prevent damage to internal electronics from electrostatic discharges (ESD).

- Make sure that the upstream sample gas conditioning system is working properly in case of a faulty reading.
- Make sure that there are no leaks in the sample gas lines. Check that all gas fittings are connected correctly.
- Use only original M&C spare parts and consumables.

15.1 Mandatory Maintenance Work

It is mandatory to carry out maintenance work once a year. This maintenance consists of the following:

- A 3-point-calibration of the MFCs by a laboratory or the manufacturer (Bronkhorst)
- Inspection of the temperature sensor with a certified reference sensor
- Inspection of the pressure sensors with a certified reference sensor.

16 Consumables and Spare Parts List

The demand for wear and spare parts depends on the specific operating conditions.

When contacting us for spare parts, please have the device type designations and the serial number ready. Both can be found on the type plates of the units.

Sample Probe

Part No.	Description	Comments
	Ferrules	

Cooler Unit

Part No.	Description	Comments
97K0101	ECM-2/ECP(1/2)000C G/GL14 WT, jet-stream-heat exchanger, material: Duran® glass, connections: sample gas GL 18-6/6 mm und GL 14, condensate GL 25-12 mm	
90F5110	Adsorption material silica gel, dry pearls with humidity indicator, quantity 1 kg [≈ 2.2 lbs]	Recommendation: A filling of 150 g [≈ 0.3 lb] per trap is sufficient for approx. 2 weeks measuring
01P1307	Peristaltic pump SR25.2-W, 0.3 Nl/h, 115 / 230 V AC with PVDF tube screw connection DN 4/6	Spare part
90P1020	SR25.2: caster carriers, complete	Recommended spare part
90P1050	SR25.2: conveying belt	Recommended spare part
90P1007	SR25 pump tube with PVDF tube screw connection DN 4/6	Wear part

Measuring Unit

Part No.	Description	Comments
08A2600	G2.2 Add-on sample gas pump N3-R, 1-head-version, 24 V DC brush-free, rotational speed adjustable, delivery rate 3.5 Nl/min, parts in contact with medium: head PPS, diaphragm PTFE-coated, valves: Kalrez®	
98A1540	Electrochemical O2 sensor for industrial use, 3-pin-Molex-plug, MB 0-25 vol% O_2, resistant against acid gases and CO_2, unleaded	

Measuring Unit		
Part No.	**Description**	**Comments**
04F1000	Universal filter type FPF-0,1GF, for front-panel installation, with ultra-fine optical fiber filter element, filter porosity: 0.1 µm, connection: G 1/8“ i, material: PTFE, Viton®, glass,PVDF	
97A2000	HI-TEC digital mass flow controller MFC, range: 29,2-1460 sccm, gaskets: Viton® 51415, plunger: Kalrez® 6375, connections: 6 mm ferrule, output signal : PROFINET input signal : PROFINET, power supply: +15-24 V DC	

17 Appendix

17.1 Trouble Shooting

If the sampling system malfunctions, please also refer to the instruction manual stored directly in the front-panel PC or the list of possible alarm messages. You will find "Quick Start", "Operating Instructions" and "Troubleshooting" in the menu bar under the menu item "Manual".

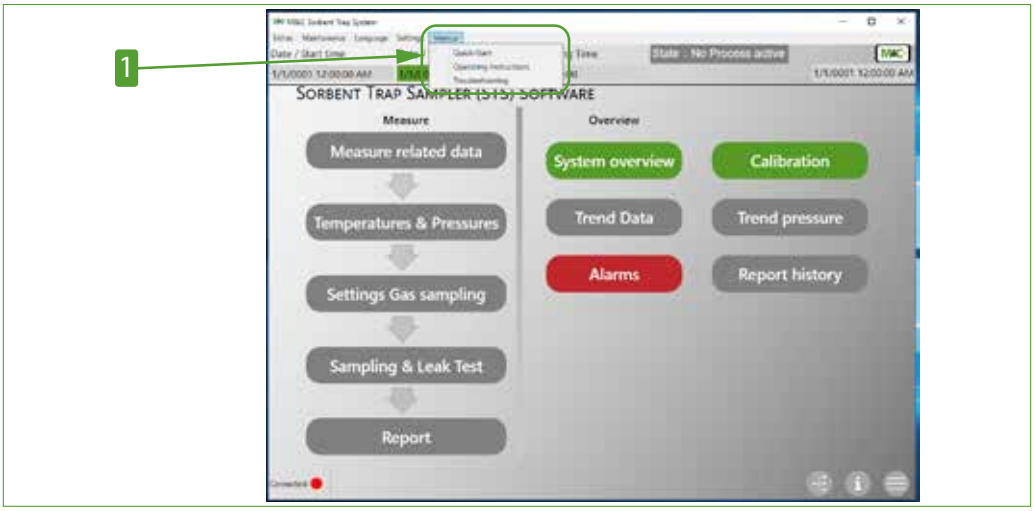


Fig. 53: Menu item "Manual"

1 Menu bar with menu item "Manual"

17.1.1 List of Alarm Messages

The Alarms menu lists all possible points in the system where an alarm can be triggered. If the color of the buttons changes from green to red, an alarm has occurred at this point. If you click on the red button, the values that have triggered the alarm will be displayed.

The following table lists the alarm messages.

Display	Description	Impact
Temperatur Sonde	Is triggered if the set limit values have been exceeded for longer than the waiting time indicated.	
Temperatur Messgasleitung	Is triggered if the set limit values have been exceeded for longer than the waiting time indicated.	

Display	Description	Impact
Temperatur Konsole	Is triggered if the set limit values have been exceeded for longer than the waiting time indicated.	Switches the measurement off after the waiting time, if 45 °C [113 °F] is exceeded because the MFC can no longer measure correctly.
Kühler Temperatur	Is triggered if the set limit values have been exceeded for longer than the waiting time specified.	Switches the measurement off.
Thermoelement defekt	Triggers in the event of cable break.	
Temperatur Sonden - Rohr	Is triggered if the set limit values have been exceeded for longer than the waiting time specified.	
Entfeuchter Strang A erneuern	Is triggered if the colorimeter from drying tower A reports a breakdown.	Stops pump A.
Entfeuchter Strang B erneuern	Is triggered if the colorimeter from drying tower B reports a breakdown.	Stops pump B.
A - MFC Kommunikationsfehler	Is triggered if no more data is received by MFC A.	Switches pump A off.
A - Sorbent Trap Einschränkung	Is triggered when the flow rate differs more than 20 % from the desired flow rate set.	
A - Sorbent Trap Durchfluss ≥ 15 %	Is triggered when the flow rate differs more than 15 % from the desired flow rate set.	
A - Sorbent Trap Durchfluss ≥ 25 %	Is triggered when the flow rate differs more than 25 % from the desired flow rate set.	

Display	Description	Impact
B - MFC Kommunikationsfehler	Is triggered if no more data is received by MFC B B.	Switches pump B off.
B - Sorbent Trap Einschränkung	Is triggered when the flow rate differs more than 20 % from the desired flow rate set.	
B - Sorbent Trap Durchfluss ≥ 15 %	Is triggered when the flow rate differs more than 15 % from the desired flow rate set.	
B - Sorbent Trap Durchfluss ≥ 25 %	Is triggered when the flow rate differs more than 25 % from the desired flow rate set.	
Kondensatbehälter leeren	Is triggered if the condensate container reports `full".	Stops the measurement.

Do you need help? Please contact M&C, if you need help with troubleshooting!

17.2 Quick Start: Prepare and Perform a Follow-up Measurement

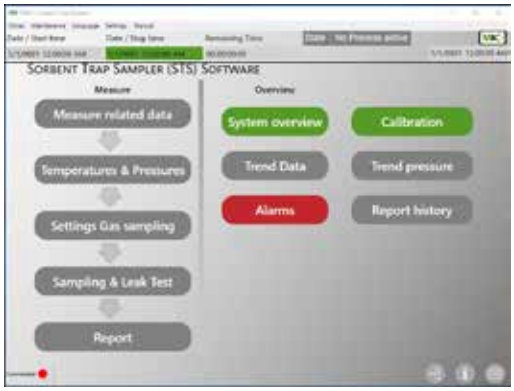

Warning	Read the operating instructions. Follow the safety instructions. This quick start is for qualified and experienced personnel only. You need a sound knowledge of the mobile sampling system and of the dangers associated with commissioning and operating to follow the instructions.

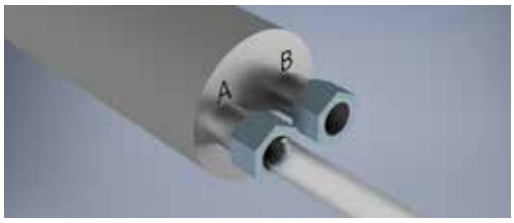


Hot Surface	Caution hot surfaces! The sample probe and the gas sample line are heated up to 200 °C [392 °F]. During general electrical and mechanical work on the assembly, wear personal protective equipment (PPE) in accordance with the risk assessment.

Please note: The measurement described here is a follow-up measuring. The measurement is performed after the initial measuring. Information on the first measurement at a new measuring point can be found in the instruction manual on page 40 chapter 11 Installation, page 46 chapter 12 Supply Connections of the Sampling System (STS) and page 50 chapter 13 Start-Up.

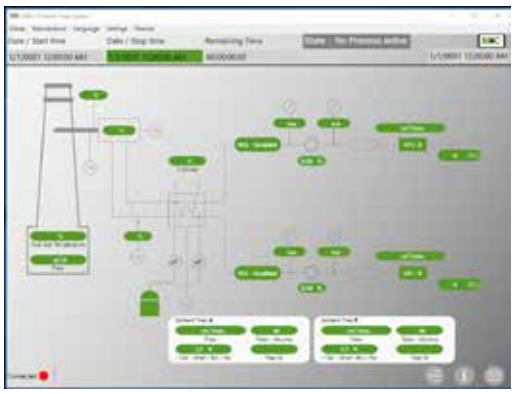
Steps	Quick Start: Prepare and Perform a Follow-up Measurement	
1	Take a bag with two traps. The traps are in closed transport tubes. The transport tubes are closed with a plug.	
2	Take a trap with instruction leaflet out of the bag. Trap ID is indicated on the transport tube and on the trap Instruction leaflet: Trap ID, trap type and spike level.	

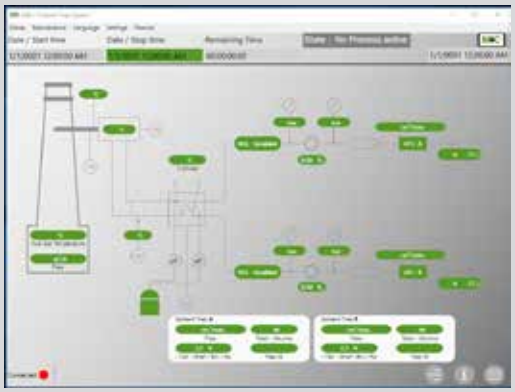
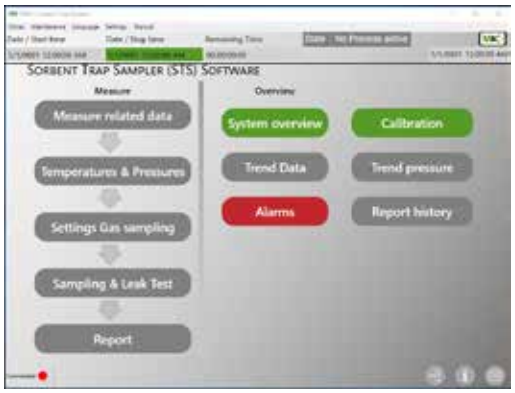
Steps	Quick Start: Prepare and Perform a Follow-up Measurement	
3	Start in the main menu. Click on button "Measure Related Data".	
4	Open keyboard. Alternatively: connect external keyboard to the USB port.	
5	Enter: Trap A: trap ID, trap type, indicate spike level. Check: details regarding power station, stack and person who has entered the data. In case of changes, enter new text.	
6	Note on the instruction leaflet: Trap A Current date and current time	
7	Put the instruction leaflet back into the bag. Open the transport tube. Take trap A out of the transport tube. Keep the transport tube with plug. Remove the cap on the side with the carbon and keep the cap. The glass tube of the trap is conical on this side.	

Steps	Quick Start: Prepare and Perform a Follow-up Measurement	
8	**Caution! Hot sample probe. Wear personal protective equipment.** Slide the trap with the conical side into the sample probe. The side with the carbon must be pushed deep enough into the fitting so that the carbon is completely within the heated area. The carbon is not visible from the outside.	
9	**Caution! Hot sample probe. Wear personal protective equipment.** Tighten the screw connection only hand-tight. A soft Teflon® seal holds the trap in the screw connection.	
10	Take the second trap with the instruction leaflet out of the bag. Keep the bag. The trap ID is indicated on the transport and on the trap. Instruction leaflet: trap ID, trap type und spike level	
11	Note on the instruction leaflet: Trap B Current date and current time	
12	Enter: trap B: trap ID, trap type, spike level. Click right arrow button.	

Steps	Quick Start: Prepare and Perform a Follow-up Measurement	
13	Put the instruction leaflet back into the bag. Open the transport tube. Take trap B out of the transport tube. Keep the transport tube and the plug. Remove the cap on the side with the carbon and keep the cap. The glass tube of the trap is conical on this side.	
14	**Caution! Hot sample probe! Wear personal protective equipment.** Push Trap B with the conical side into the sample probe. The side with the carbon must be pushed deep enough into the screw connection so that the carbon is completely within the heated area. The carbon is not visible from the outside.	
15	**Caution! Hot sample! Wear personal protective equipment.** Tighten the screw connection only hand-tight. A soft Teflon® seal holds the trap in the screw connection.	

Steps	Quick Start: Prepare and Perform a Follow-up Measurement	
16	Select: Specify data interval. If no data interval is selected, 1 minute is automatically selected. Check: constant or proportional flow rate. Select new flow rate type if changes are made. Check: signal input only with proportional flow. Check: duration of the measurement in hours. Check: desired flow rate. Check: Max. flow rate is calcuated with proportional flow rate. Indicate max. range and proportionality factor "K" only with proportional flow rate. Check: Duration of the leak tests. Also applies to the pre- and post-leak-test. Click on the right arrow button.	
17	Check: All values on this page must be green prior to the start of the pre-STS leak test. Start pre-STS leak test.	
18	**Caution! Hot sample probe! Wear personal protective equipment.** After successful pre-STS leak test, remove caps of trap A and trap B.	
19	**Caution! Hot sample probe! Wear personal protective equipment.** Check: Is the probe flange seal on the probe flange?	
20	Check: Is the flange at the stack closed with blind plate? **Warning! Hazardous gases! Do not inhale! Hot blind plate. Wear personal protective equipment.** Remove the blind plate.	

Steps	Quick Start: Prepare and Perform a Follow-up Measurement	
21	**Warning! Hazardous gases! Do not inhalte! Hot sample probe. Wear personal protective equipment.** Insert the sample probe into the flange at the stack and fasten it.	
22	Check: All values on this page must be green prior to the start of sampling. Start STS sampling. Note date/stop time. Click on "System overview" button.	
23	The system overview shows the actual values during the measurement. Values shown in red are alarms.	
24	Check: Measurement completed? Status: Sampling successful	
25	**Warning! Hazardous gases! Do not inhale! Hot sample probe. Wear personal protective equipment.** Loosen the fixture of the sample probe on the stack flange. Remove the sample probe from the stack and place it on a suitable surface.	
26	If available, close the flange on the stack with blind plate. **Warning! Hazardous gases! Do not inhale! Hot blind plat. Wear personal protective equipment.** Fasten the blind plate at the stack flange.	
27	**Caution! Hot sample probe. Wear personal protective equipment.** Place caps on trap A and trap B for post-STS leak test.	

Steps	Quick Start: Prepare and Perform a Follow-up Measurement	
28	Click on "Main Menu" button.	
29	Click on button "Sampling & Leak Test".	
30	Check: All values on this page must be green prior to starting the post-STS leak test. Start post-STS leak test. Post-STS leak test completed? Status: Ready	
31	**Caution! Hot sample probe! Wear personal protective equipment.** Remove trap A from the sample probe. Attention negative pressure!	

ATTENTION Beware of broken glass! Due to the negative pressure, trap A is drawn into the probe. Hold trap A firmly.

Steps	Quick Start: Prepare and Perform a Follow-up Measurement	
32	**Caution! Hot trap A. Wear personal protective equipment. Let trap A cool down.** Place the cap back on. After cooling down, slide trap A into the transport tube and close the transport tube with the plug. Put the transport tube into the bag with the instruction leaflet.	
33	**Caution! Hot sample probe! Wear personal protective equipment.** Remove trap B from the sample probe. Attention negative pressure!	
	ATTENTION Beware of broken glass! Due to the negative pressure, trap B is drawn into the probe. Hold trap B firmly.	
34	**Caution! Hot trap B. Wear personal protective equipment. Let trap B cool down.** Place the cap back on. After cooling down, slide trap B into the transport tube and close the transport tube with the plug. Put the transport tube into the bag with the instruction leaflet.	
35	Check: trap A and trap B are in one bag together with the instruction leaflets.	
36	Click on the "Print Report" button at the bottom on the left.	

Steps	Quick Start: Prepare and Perform a Follow-up Measurement
37	Save report on storage medium (e.g. USB stick). Alternatively: Save report on front-panel PC.
38	Send the report on a storage medium (e.g. USB stick) and the bag with Trap A and Trap B including instruction leaflets to the laboratory for analysis.

17.3 Additional Information

More information about the analyzer can be found on our website:

www.mc-techgroup.com

17.4 Declaration of Conformity

CE Certification

The STS complies with the following EU directives:

EMC directives

The STS complies with the EC directive 2014/30/EU 'Electromagnetic compatibility'.

Low Voltage Directive

The STS meets the requirements of the Low Voltage Directive 2014/35/EU.

To ensure the compliance with this EC directive, the STS conforms to the DIN EN 61010 standard.

Declaration of Conformity

The EU Declaration of conformity can be downloaded from the M&C website or directly requested from M&C.

17.5 Certificates

Calibration certificates are attached.

17.6 Warranty

In case of a device failure, please contact M&C immediately or your authorized M&C distributor.

We have a warranty period of 12 months from the delivery date. The warranty covers only appropriately used products and does not cover the consumable parts. Please find the complete warranty conditions in our terms and conditions.

The warranty includes a free-of-charge repair at a M&C facility or the free replacement of the device. If you return a device to M&C, please be sure that it is properly packaged and shipped with protective packaging. The repaired or replaced device will be shipped free of delivery charges to the point of use.

For more information about shipping and handling of returned devices, please see page 75 chapter 17.9 Shipping and Handling.

17.7 Liability and Disclaimer

This instruction manual is an original M&C document. It does not claim to be complete and it may be subject to technical modifications. We are not responsible for any printing errors or errors in the content of the manual. Please be assured that precautions have been taken to prevent errors in our product documentation to provide you with the best possible and accurate information.

Liabilities for indirect and direct damages that are related to the delivery or the usage of this instruction manual are excluded.

We are not liable for the content of translations from sources which are not authorized by M&C.

With the release of this version, all older instruction manual versions will no longer be valid.

17.8 Storage

If you plan to store your M&C product before installing and operating, please follow these storage recommendations. Make sure that the device is stored in a protected, dry and well ventilated area. Please cover the device with an appropriate cover to protect it from dirt and liquids.

If you have any questions about the proper storage of your M&C products, please feel free to contact us.

17.9 Shipping and Handling

If you need to ship your M&C product to another department inside your company or back to M&C, please follow these shipping and handling recommendations.

Please ship the device in its original packaging. This is the best way to protect the device. If the original packaging is not available any more, please use a sturdy cardboard box with enough packaging material to protect the device from damages during shipping.

If you send your M&C product in for maintenance work at our M&C facility, please send the properly packaged device to the M&C TechGroup address in the USA or Germany as needed.

17.10 Proper Disposal of the Device

At the end of the life cycle of our products, it is important to take care of the appropriate disposal of obsolete electrical and non-electrical devices. To help protect our environment, please follow the rules and regulations of your country regarding recycling and waste management.

18 About Us

18.1 M&C's Group of Companies

The M&C group of companies with its German head office and worldwide market activities emjoys the reputation as one of the well-known and strongest partners in the market.

Our company, our products, special systems and overall performance are well-established in the market. We continuously belong to the best of the best of our industry. This makes us very proud. Our core competences are to find qualified solutions for even the most complex and demanding measuring tasks. We are developing answers to solve the technical demands of the future. With our focus on premium services, we are reliable, innovative and an overall cost-effective market partner worldwide.

To learn more about M&C, please visit our website:

www.mc-techgroup.com

For even quicker access, please use our QR code:

18.2 The Quality-Oriented M&C Catalog

M&C offers national and international services, project planning and construction of special systems with a wide range of products. Our catalog covers a large variety of high-quality products with in-depth knowledge of various customer applications. Our product excellence and innovative solutions make M&C a world class company.

You can find the following product groups in our catalog. The combination of products from these groups offers a complete solution for most industrial needs. We develop, manufacture and test our products in accordance with a wide range of national and international standards.

Probes

Comprehensive range of probes with a large spectrum of available options for an almost unlimited range of applications.
Different materials available (Hastelloy®, Titan, PTFE, etc.)

Coolers

Optimised gas and condensate separation, low maintenance and self-monitoring.
Compact design for wall mounting or 19" rack.

Filters

Suitable for all processes, due to the modular and user-specific configuration possibilities of the filter components.
Filter enclosures available in glass, stainless steel, PVDF, PTFE or in different metal combinations.

Portable components

Developed for high-quality gas analysis at different locations.

Compact systems

Compact standard systems designed for a 19" enclosure or a plate structure.

Oxygen analyzer

A broad variety of products with high measuring accuracy.
Direct measuring is based on paramagnetic measuring principle (dumbbell-type).

18.3 Technical Consulting Services

M&C has earned a reputation as one of the most capable and experienced companies in the world, especially when it comes to difficult or complex measurement projects. We are proud that our customers have confidence in our products and continue to experience repeat business.

We also offer technical consulting for our components, devices and complete systems. We support our customers in finding individual solutions for their specific measuring tasks.

These individual solutions lead to new concepts of designing and building custom-made devices or complete systems. The dedication and commitment to finding solutions to the most complex and challenging tasks for our customers sets us apart from our competitors.

We have custom-made application experiences in many different fields worldwide. With this experience, we are able to support our customers by seeking and finding errors, trouble shooting during day-to-day operation or identifying hard to find interferences.

18.3.1 Ideas, Suggestions and Feedback

All our activities are designed to meet and exceed the demands of the market and the specific interests of our customers. That's why M&C is very interested in developing products, processes and services which are in demand and up-to-date.

This means that your feedback, ideas and suggestions are very important to us.

Please let us know what kind of new improvements and innovations you would like to see at M&C. Tell us what you like about M&C and what needs improvement.

Please send us an e-mail or feel free to just call us ...

We appreciate your comments.

Table of Illustrations

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Your M&C contacts world-wide

http://www.mc-techgroup.com/en/Locations-and-regions/