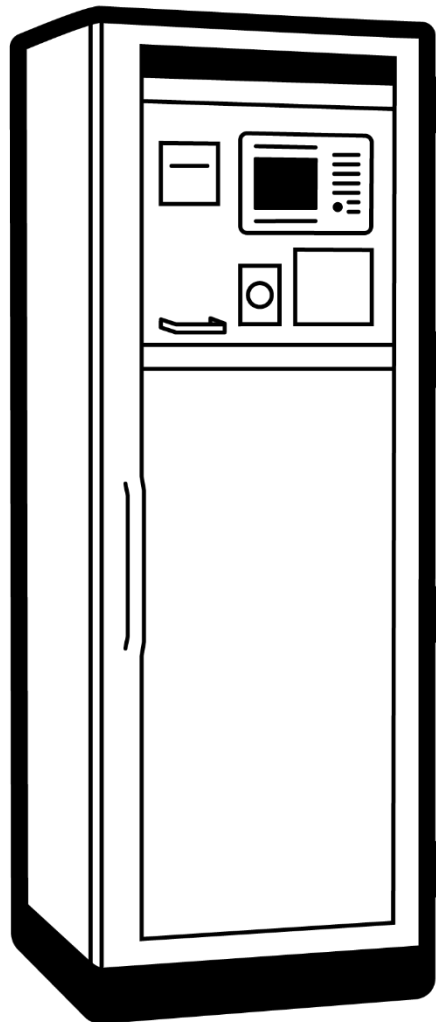




GT90 Dioxin+

Standard version



Operation Manual

V.E.2.02

Warranty Statement

This warranty applies to the Gasmet brand name products sold with this warranty statement. This warranty is applicable in all countries and may be enforced in any country where Gasmet Technologies Oy or its subsidiaries or its authorized service providers offer warranty service subject to the terms and conditions set forth in this warranty statement. The warranty period varies by product, check the warranty period, if necessary.

Gasmet Technologies Oy and its subsidiaries guarantee that all products manufactured and sold by it are free of defects in materials and workmanship under normal use during the warranty period.

The products of Gasmet Technologies Oy and its subsidiaries are manufactured using new materials or new and used materials equivalent to new in performance and reliability. Spare parts may be new or equivalent to new.

Gasmet Technologies Oy and its subsidiaries agree to either replace or repair free of charge (Ex Works Vantaa, Incoterms 2020) any such defective product or part that is returned to its repair facility within one (1) year of the delivery date. All parts or products removed under this warranty become the property of Gasmet Technologies Oy or its subsidiaries. The replacement product or part takes on the warranty status of the removed product or part.

The warranty does not extend to any product from which the serial number has been removed or that has been damaged or rendered defective (a) as a result of accident, misuse, abuse, normal wear of components or other external causes; (b) by operation outside the usage parameters stated in the user documentation that is provided with the product; (c) by the use of parts not manufactured by Gasmet Technologies Oy and its subsidiaries; or (d) by modification or service by anyone other than Gasmet Technologies Oy and its subsidiaries.

Gasmet Technologies Oy and its subsidiaries are not liable for any damages caused by the product or the failure of the product to perform, including any loss of profits or savings, incidental damages, or consequential damages.

Recycling Information

At the end of the product's life cycle, we encourage you to recycle the product in accordance with best local recycling practices. Contact your local authorities for more information on recycling of your old product. You can also contact Gasmet Technologies Oy for advice (contact@gasmet.fi).

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1. Safety regulations

All GT90 Dioxin+ manuals have to be read carefully and understood before the device is installed, operated, or maintained.

All GT90 Dioxin+ devices shall be installed, operated, and maintained by specific trained personnel only.

The information included in the manuals is essential for a proper device use and all procedures have to be strictly confirmed in accordance with these manuals. Changes in procedures, device use or the device construction of any GT90 Dioxin+ device have to be defined by the manufacturer only and have to be done in written form. Any responsibility beyond these facts is strictly denied.

This manual covers only the information to operate standard devices which are properly installed, prepared, and maintained. Please refer to the other manuals in case of direct device use: Site preparation manual and Maintenance manual.

Warranty and liability are strictly limited to the proper operation and use of the original device by trained personnel within the range of application of the manuals.

However, the device shall never be operated in case of any irregular circumstances or conditions, as described in the following, but not limited to these:

- > any physical damages of any part of the device or the connection lines
- > plant or environmental operation parameters outside the device operation limit or specification
- > influence of unspecified amount of water, other liquids, dust, gases, or other substances

In case of any irregular condition, the device shall be disconnected from electrical supply as well as from compressed air supply and has to be protected against use and operation.

1.1. Installation location

The location of the installation of GT90 Dioxin+ devices is regularly industrial areas which causes several hazards. Usually, additional safety regulations apply to these areas, which are on the responsibility of the operator or owner of the installation area.

If there are additional safety regulations valid for the installation area, they have to be taken into consideration.

1.2. Electricity

The main power switch of the device is - depending on the specific location of installation - connected to 220 to 380 VAC. The construction of the device meets all requirements for electrical devices, including:

Directives

EMC directives 2004/108/EC

Low voltage directive 2006/95/EC

Standards

Low voltage directive EN60439-1:1999

Sampling of dioxins TS 1948-5

All parts of the device have to be grounded properly. The grounding shall be tested after the installation by electrical authorized personnel.

Any electrical work as well as work inside the device and at the sampling probe unit, shall be done by specific trained and authorised personnel only.

It shall be considered, that when the main switch of the control cabinet is set to OFF (0) position, the cables between the main supply of electricity at the connectors X1 and the main switch, remain under voltage.

The procedures which are permitted without switching off/unplugging precautions are:

- > use of the terminal display and printer inside the control cabinet, but only if the cabinet's upper door is closed and the cabinet's lower front plate cover is mounted.
- > change of the filter cartridge of the sampling probe unit in case the device is in the "sampling stops" mode.
- > change of the backup filter in case the main power switch is in OFF (0) position.

1.3. Hot components

Flue gas and its ducts are regularly hot. For this reason, each contact to areas at these locations, where gas is leaving the flue gas channel as well as its inhalation, is seriously dangerous and should be avoided. Specific precautions for personal protection have to be done regularly according to the safety regulations of the installation location.

However, specific heated parts of the sampling probe unit of the device are the probes, which are usually inside the gas channel. In case of an installed device, it cannot be touched without opening the flue gas channel. Also, the gas conveying lines and the valves at the heat exchanger are possibly hot.

Generally, never touch hot or possible hot areas without a suitable protection.

Depending on the environment at the installation site, the heat exchanger of the sampling probe unit may be hot as well. It is recommended to use clean thermal protection gloves when changing the filter unit.

1.4. Water, liquids, dust

The device layout meets IP54. Any foreign substances or any liquids inside the control cabinet, outdoor box or junction box can cause serious damages to the device and, thus, are dangerous.

In case of these occurrences, the device has to be switched off and disconnected from electrical power supply as well as from the compressed air supply.

For a safe operation, especially outdoors or at industrial areas where the presence of water, liquids and dust can occur, the door of the outdoor box has to be closed properly. Proper locking of the door shall be checked each time when closing the door.

1.5. Compressed air

The device has to be supplied with compressed air. This supply has to meet the specifications for pressure (6 – 8 bar), maximum water content (dew point < 5 °C) and quality (oil free). Any use of other compressed gases or compressed air outside the specifications of the device is dangerous and can cause damage and therefore is strictly prohibited.

The gas specifications shall be checked to meet the specifications of the device before use.

1.6. Device stability

The device contains connection lines between sampling probe unit and control cabinet as well as lines to the control cabinet. Moving a device part attached to these lines, stepping on them or mechanical loading them has to be avoided in order to avoid any damage. The device parts need to be secured against unauthorised and accidental moving.

Screws that are used to mount the control cabinet to the floor can be tightened according to the scheme shown below (All dimensions in mm):

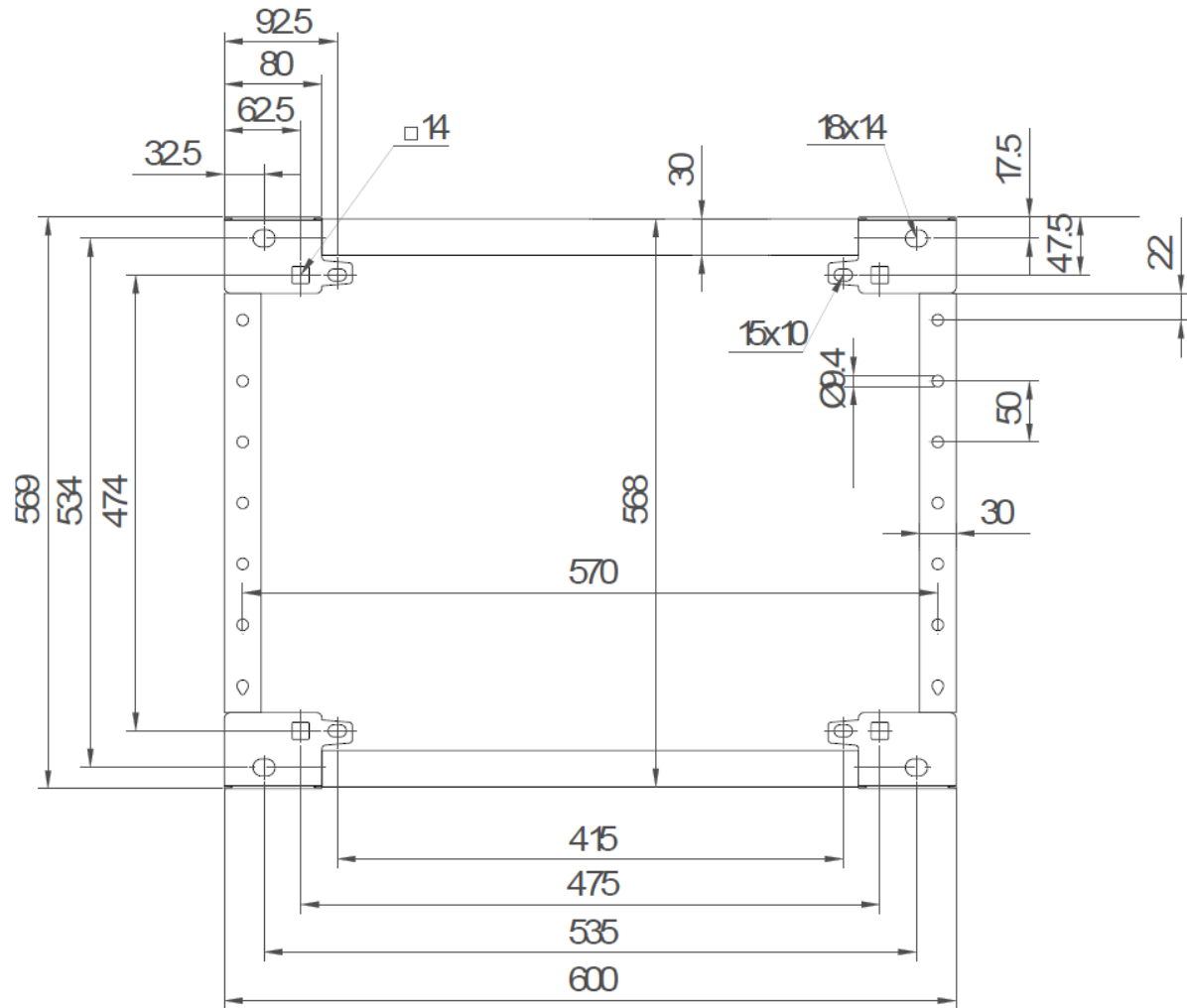


Figure 1. Socket frame dimensions

1.7. Toxicity

Dioxins are generally known to be toxic. The main part of these compounds and of other toxic organic compounds is adsorbed to dust. Dioxins are collected and concentrated inside the filter cartridge causing higher toxicity. Also unloaded filter cartridges which are prepared for sampling contain "sampling standard" dioxins spiked to the filters, in harmony with EN 1948 standard, and used as a reference for later recovery. The absolute amount of dioxins will be generally in the range below 100 ng I-TEQ per cartridge. However, for a secure handling

- > avoid any contact with and inhalation of the dust from the gas channel and inside the loaded filter cartridge.
- > avoid touching the outer or inner surface of the mixing chamber.
- > attach the closing cap to the mixing chamber for transportation.
- > do not open the quick fastener clamp between filter chamber and mixing chamber outside the designated laboratory area.

2. Basic concept

The GT90 Dioxin+ device is a permanently installed, long-term sampling device for measuring the concentrations of dioxins and other POPs in gas streams. The sampling method strictly follows the respective standard EN 1948-1 and TS 1948-5. The device is designed for long-term sampling up to 6 weeks, enabling short term sampling as well.

The use of an optional ParTrace® emission cartridge enables sampling of fine dust fractions (PM10, PM2.5, PM1) at the same time.

Several criteria have to be met for an accurate sampling and for the storage of these emission compounds as well as for the preparation work of the filter cartridges and the laboratory analyses. Thus, please cooperate with an experienced and preferably accredited laboratory for preparation and analysis of the cartridges. Using the same laboratory for preparing and analysing the cartridges is strongly recommended.

The results of the laboratory emission measurements are the volume concentration of sampled dioxins (and/or other analysed POP constituents) during the sampling period. By multiplying the concentration with the total gas volume and dividing it by the sampling period, the dioxin mass flow can be calculated.

The GT90 Dioxin+ devices follow the concept of doing most of the sampling unattended after a respective configuration. This device configuration is partially done specifically to the sampling location on installation, partially by the sampling institution or laboratory preparing and analysing the cartridges, and partially by the operator. The configuration of the part in responsibility of the operator is described in chapter 4 "System configuration and setup".

2.1. Sampling method

2.1.1. Dioxins

The sampling method used in the device is in full accordance with the respective European standards for the measurement of dioxins: EN 1948-1 and TS 1948-5.

The selected method is the dilution method, which is the only applicable method to be used for long-term sampling in complete accordance and conformity to EN 1948-1 standard.

The gas is sampled isokinetically from the gas stream, by using of one of two titanium probes alternately. The collected gas is transferred to a titanium mixing chamber, where it is diluted with dried and cooled air. Thus, the sampled gas is cooled by keeping the dew point below the gas mixture temperature which prevents any condensation. The gas mixture encounters three successive filtration stages, which are designed to trap dust, dioxins and dioxin-like PCB's while still allowing other flue gas stream components to pass through.

Some criteria of the European standard EN 1948-1 should be noted as follows:

- > The European standard for sampling dioxins EN 1948-1 is extended for doing long-term sampling with the 2006 release.
- > Short-term measurements (up to e.g., 8 hours) can be done as well with the GT90 Dioxin+ devices, however, the device is not limited to this period. The device is expected to collect 4 to 10 m³ in 8 hours, which is within the limit of quantification according the EN 1948-1 minimum requirements for sampling. In case of long-term sampling, the limit of quantification is accordingly better due to the much higher sampling volume.
- > The sampling is carried out using two sampling locations along a single sampling line (standard device version) or using one single probe (compact device version, which is more suitable for small stack diameters.

2.1.2. PCBs

The sampling method for dioxin-like PCBs is the same as for dioxins, EN 1948-1:2006. For the sampling of low -volatile substances e.g., dioxin-like PCBs, a maximum sampling temperature of 40 °C is recommended. This temperature can be configured by the operator accordingly.

The analytical method for the dioxin-like PCBs and marker PCBs is described in the EN 1948-4 standard.

Using this method, HCB (Hexachlorobenzene) can be analysed from the same sampling as well.

2.1.3. Fine dust (PM10, PM2.5)

Details about the sampling of fine dust are described in the ParTrace® Operation Manual.

2.2. Measured parameters

Several further parameters are measured by the device and used for device control processes or sampling quality recording. These parameters are displayed and partially recorded in the terminal.

The most important parameters for the operator are the following:

- > gas temperature at sampling location
measured with a resistance thermometer
- > gas velocity at sampling location estimated from the difference of static and dynamic pressure of the gas. This value is indicated for the operator, but not used for the isokinetic controller.

$$v = k \times \sqrt{100 \times \Delta p}$$

v = velocity [m/s]

k = factor of flue gas density

Δp = differential pressure [mbar]

Wind tunnel calibrated nozzles are used in case the velocity signal is provided from the device (4 – 20 mA output. This is a device option).

- > gas humidity at sampling location calculated from the measured moisture concentration in the gas mixture and the dilution factor.

3. Device components

3.1. Sampling probe unit

The sampling probe unit is the part connected to the gas channel, where the gas has to be sampled. It is divided into two main sections, the inner sampling probe unit and the outer sampling probe unit.

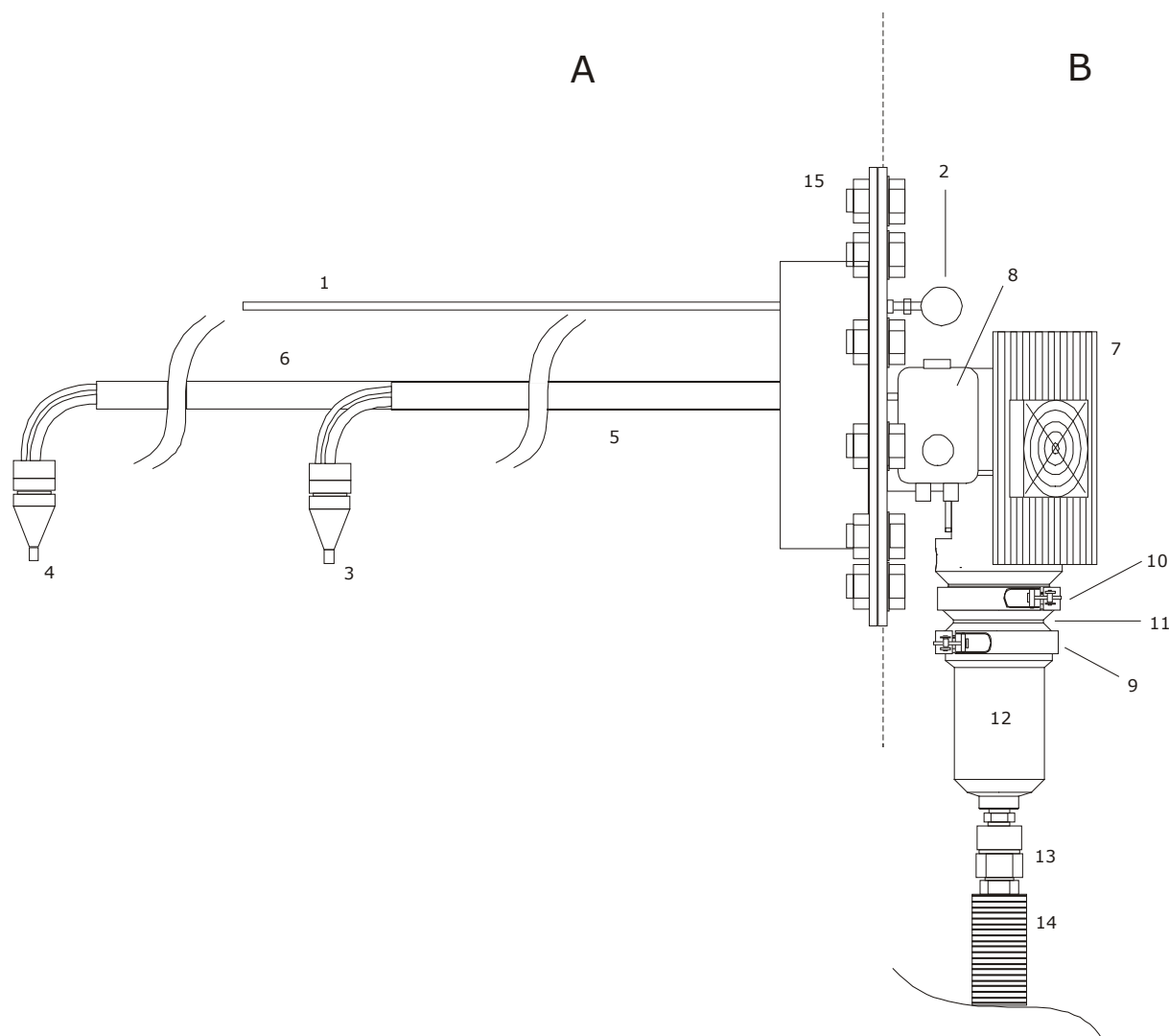


Figure 2. Sampling probe unit

A inner sampling probe unit	6 probe 2	10 upper quick fastener clamp
B outer sampling probe unit	7 heat exchanger with thermostatic device	11 mixing chamber
1 thermometer's thermowell	8 probe valves	12 filter chamber
2 thermometer	9 lower quick fastener clamp (only to be opened by the laboratory)	13 tube rapid connector
3 nozzle 1		14 heated sample line
4 nozzle 2		15 connection flange with screws
5 probe 1		

3.1.1. Inner sampling probe unit

The inner sampling probe unit is the part of the sampling probe unit, that cannot be accessed directly when being installed, due to its location inside the flue gas channel. The inner sampling probe unit is accessed during maintenance work, service work and installation only.

This section includes the titanium probes and nozzles and the temperature sensor, for the measurement of the flue gas temperature.

The usual probe arrangement for a standard device, where 2 probes are used, is shown in the following table:

flow direction	bottom to top	top to bottom	left to right	right to left
probe 1 (left)*	long	short	short	long
probe 2 (right)*	short	long	long	short

* view to the stack

For the operation, it is only important to know, that there are two probes used which are heated according to the device configuration.

3.1.2. Outer sampling probe unit

The outer sampling probe unit is the part where the sampling process takes place and is controlled. The collected compounds do not leave the outer sampling probe unit until the sampling cartridge is dismantled.

The main operational work to be done at the sampling probe unit is the filter cartridge replacement which is described in section 5.5 "Filter cartridge installation".

The main parts, and their functionalities are described in the following subsections. However, access to these parts is not necessary for normal device operation.

3.1.2.1. Probe valves

The valves enable the selection of one of the two probes for the sampling process. While sampling, usually one probe valve is open. If the probes are purged, also one of those valves or both are opened, but the gas flow direction is changed, so that gas flows from the outer to the inner sampling probe unit.

Both valves can be opened simultaneously using a respective maintenance function.

In other cases, both valves are closed.

3.1.2.2. Heat exchanger with thermostatic device

Attention: this part, depending on the configuration, is possibly hot. Do not touch it without using proper protection equipment.

This part is designed to control the temperature profile at the location of the sampling process, especially of the mixing chamber and the filter chamber. The main temperature to be controlled, is the filter temperature while sampling. During the sampling period, the temperature is higher compared to the non-sampling period. The temperature control takes place automatically according to the device configuration, where the filter target temperature for the sampling and the temperature for the non-sampling time can be set. These parameters are adjusted in case the device shall be used for other sampled components.

The filter cartridges are connected directly from the bottom to the heat exchanger block.

3.1.2.3. Filter cartridge (filter unit)

Attention: in case of using the ParTrace® option, this part, depending on the configuration, is possibly hot. Do not touch it without using proper protection equipment.

The filter cartridge has to be prepared for sampling by the analysing laboratory. The preparation by a different laboratory than the analysing laboratory is definitely not recommended due to possible differences in the spiking standard procedures.

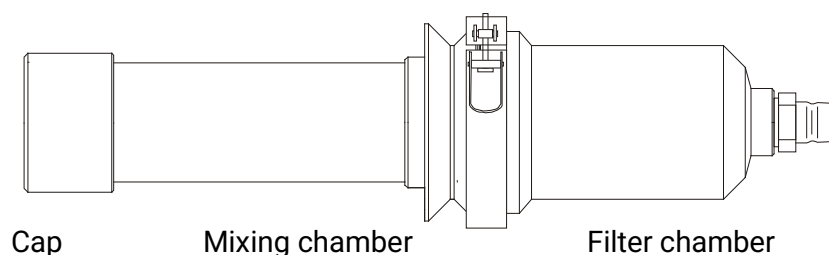


Figure 3. filter cartridge

The complete cartridge is delivered assembled to the plant operator, including the titanium filter chamber with a quick fastener clamp, an installed filter set consisting of 3 parts, a titanium mixing chamber which is connected to the filter chamber using an O-ring sealing and a quick fastener clamp, and two covering caps at the top and bottom, as well as another O-ring sealing. For installation, the caps have to be removed.

The filter cartridge must not be disassembled outside a designated area of a laboratory. Thus, the lower quick fastener clamp, connecting the filter chamber to the mixing chamber, is not allowed to be opened.

The installation procedure is described in section 5.5.

3.1.2.4. PartTrace® cartridge

Details about the ParTrace® cartridge are described in the ParTrace® Manual.

3.1.2.5. Junction box

The electrical connections between the main connection lines (coming from the control cabinet) and the local devices at the sampling probe unit are located in the junction box. There are no parts which need to be accessed by the device operator.

Attention: due to dangerous voltage inside this box (230 VAC), this part is allowed to be opened by trained and authorised personnel only.

3.1.2.6. Heated sample line

This part is one of the connection lines, but due to its ending at the location of the sampling probe unit and the use of this ending part when mounting and dismounting the filter cartridge, it shall be mentioned here. The mixed gas is passing through this heated sample line to the control cabinet.

The heated sample line is connected to the filter cartridge using a rapid connector. The line is well insulated and moderately heated inside. In normal operating conditions, it can be touched, but the outside temperature of the tube should be checked carefully before.

3.2. Control cabinet

The control cabinet is the main part of the device, which does all the control and measurements of the sampling process as well as the conditioning of the dilution air. It allows the configuration and control of the device and stores the sampling data.

3.2.1. Control cabinet enclosure

The control cabinet enclosure is usually key locked in order to ensure that the door is closed during unattended operation. The front door is made from glass, which enables the view to the main control devices easily and avoids unauthorised access.

The ventilation openings of the control cabinet are situated at the right side. These openings are not allowed to be covered or placed closer than 15 cm to any other objects. The air temperature at that area has to be kept strictly inside the operating temperature range.

The cabinet can be opened, using the device key to unlock the door. This causes the handle to be released. The handle is also used to open the door lock bars.

When closing the door, the handle has to be folded again. The door can be closed and locked without using the device key. Make sure to keep the key outside the device.

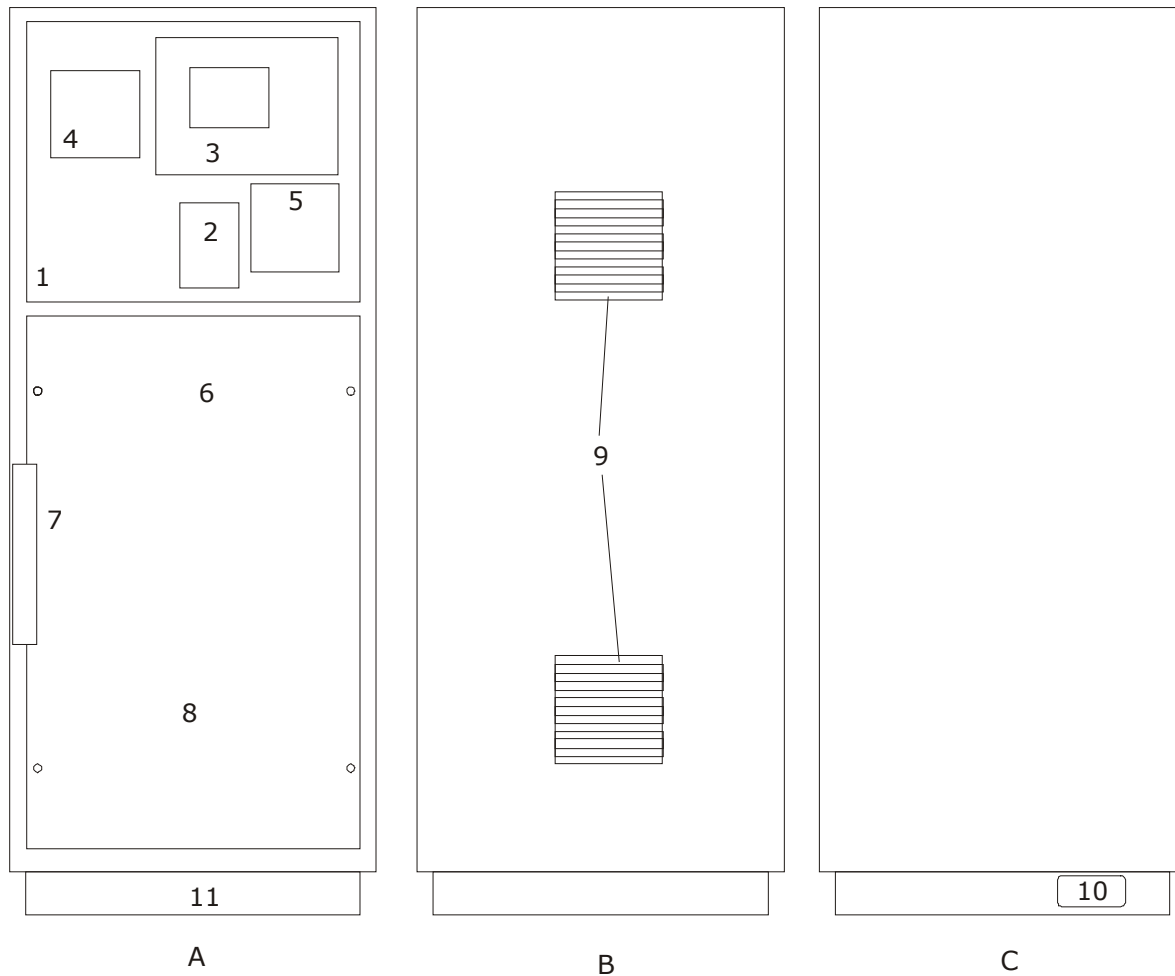


Figure 4. Control cabinet

- | | | |
|----------------------|--|----------------------------------|
| A front view | 4 printer | 8 main door (secure glass front) |
| B right side view | 5 device info plate | 9 ventilation openings |
| C rear view | 6 Control unit lower front plate cover | 10 hole for connection lines |
| 1 upper cabinet door | 7 main door handle/lock | 11 socket |
| 2 main power switch | | |
| 3 terminal | | |

3.2.2. Main power switch

The main switch is used to turn the device on or off. The electrical supply is switched off completely when the switch is in "0" position. However, the main voltage remains at the supply cables to the control cabinet and to the main switch. To disconnect the device completely from the electrical supply, the device has to be unplugged from the power supply mains socket.

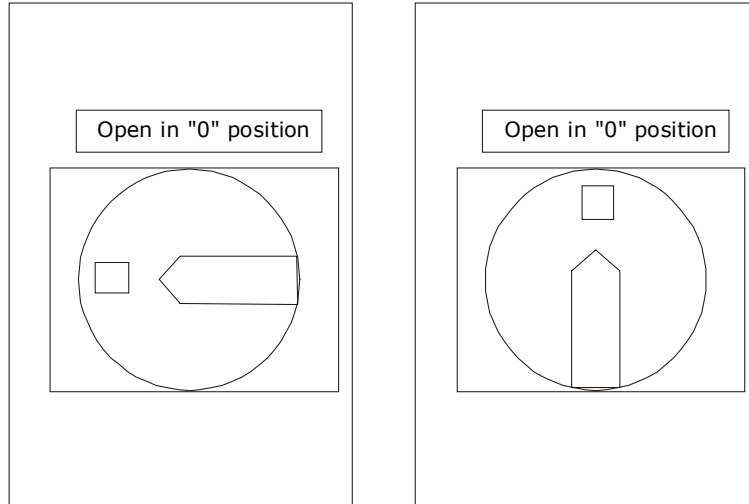


Figure 5. Main power switch in off (left) and on (right) position

3.2.3. Terminal

The terminal is the main part of the user interface, enabling device configuration and providing data storage. The information is displayed in several coloured pages organized in a logical structure.

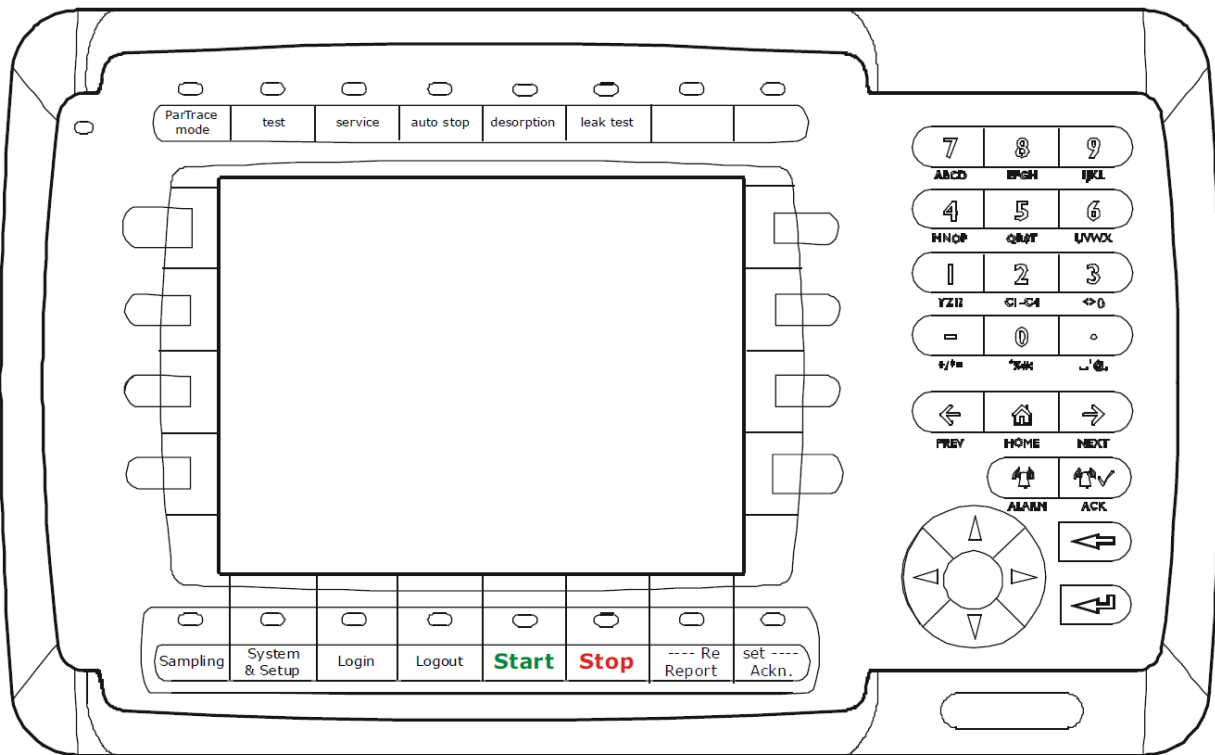


Figure 6. Terminal

Understanding of the terminal functionality is the basis for learning the device operations.

Avoid bringing dust or liquids to the terminal's surfaces. The front surface can be cleaned by using a soft cloth and mild soap.

3.2.3.1. Screensaver function

After several minutes of pressing no key, the terminal activates the screensaver automatically. The display will appear to be black when the screensaver is active. The screensaver can be deactivated by pressing any terminal key.

3.2.3.2. General terminal keys



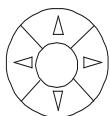
HOME key

Allows jumping to the main screen, independently from the actual position, shown page or layer.



PREV key

Jumps to the page displayed previously.



ARROW keys

Allows moving the cursor inside a page. In case of editing a parameter, the cursor moves inside the actual field, otherwise the cursor moves to the logical next field.



NUMBER and

CHAR keys

Allows entering information to the device. The numbers have higher priority than the characters. In case characters are required to be entered in a field; this character is generated by pressing the same key more often within short time. This process is similar to the use of the keys of a cellular phone.



ENTER key

Is used to begin and end inputs at the field, where the cursor is located when pressing this key. When an input is finished by pressing this key, the value is stored in the device. An undo-function is not available. If an input contains information which is not allowed to be set, e.g. a value outside the device range, the input is denied and the terminal answers with a short "beep". In this case, the allowed range is displayed for a few seconds.



BACKSPACE key

When adding inputs, pressing this key will cause the character or number left of the actual cursor position to be deleted.



ALARM key

Jumps to the alarm list page. This page shows the main information of the device status history. The alarm list includes a track of key names pressed by the user, as well as device faults and sampling steps like leak tests, etc.



ACK key

Is used to acknowledge events reported in the alarm list. This event information usually has to be used further, for initiating parameter adjustments, service or maintenance procedures or similar. The

information, which has been acknowledged, has to be reported to the laboratory or sampling institution. It can usually be found on the printed report as well.

3.2.3.3. Special terminal keys

SAMPLING key	Allows changing from the currently displayed page to the sampling page. This page includes the main information about the actual sampling procedure and provides further information when accessing its sub-menu pages. The configuration of the actual sampling process is also done in one of these sub-menu pages, being described as "sampling configuration".
SETUP key	Allows configuring the device. The parameters for the device operation and the adaptation to the specific plant are done using this page.
LOGIN key	Allows to login to a specific user level. Most pages are only accessible by using a permitted user level. The respective passwords are configured during the installation and are provided to the operator during training. When being logged in to a user level, ensure to logout when leaving the device. However, the logout is done automatically after a few minutes, if none of the terminal keys is pressed.
LOGOUT key	Sets the user level to 0 (zero) where only the main pages can be accessed. Manual device operation changes are blocked when being logged out.
START key	Starts or continues a measurement when it is stopped or paused but does not influence a stand-by period. Further, in case of "manual stop" mode, the probe desorption process is finished, and the regular sampling can be continued by pressing this key.
STOP key	Changes the actual status to stop or prepares to stop the device. During normal sampling operation, the device starts the desorption cycle in case of being configured to do that and will stop automatically when it is finished. In this case, the device can be stopped immediately by pressing the key again. In other cases, the device stops immediately. In case of resetting sampling values, the reset action can be interrupted within the delay period, by pressing the STOP key.
RESET key	is used to reset the sampling data when the device is stopped. This key is formed by two keys, the REPORT key and the ACKN. key, which should be pressed at the same time.

This key is usually used only after uninstalling a loaded cartridge and it causes the printer to generate a complete sampling protocol. The reset is delayed a few seconds, the delay is indicated by the respective LED-lights (see subsection 3.2.4)

REPORT key is used to print a sampling report including the actual sampling data, independent of whether the sampling is finished or not.

ACKN. key is used to confirm an error. An error is indicated by a flashing red lamp at the STOP key and can be caused by several reasons. Refer to section 6.2 for details. Further, the key is used together with the reset key to reset the actual sampling. Refer to the RESET key for details.

3.2.4. Terminal LED lights

The terminal LED light indicates main sampling and status information, which are most important for the operator.

LED light	Colour	permanent	slow flashing	fast flashing	Message
START	green	X			device is sampling
	green		X		sampling in startup procedure
	green			X	device stand-by
	red	X			while pressing
STOP	red	X			device is stopped
	red		X		device error, stopped
	green	X			while pressing
RESET and (REPORT+ ACKN.)	red		X		sampling values are being reset, delay time running, the reset can be interrupted by pressing the STOP key within this time
AUTO STOP	green	X			auto stop is activated
	red	X			auto stop is activated, and the sampling time is elapsed, the device can not start until setting it to manual mode, resetting the sampling or extending the sampling time
	no light	X			manual stop mode
DESORPTION	green		X		probe desorption active

LEAK TEST	green		X		leak test preparing or in progress
	green	X			leak test successful
	red	X			leak test failed
SERVICE	green	X			at least one service function is activated
TEST	green			X	(factory) device test mode is active
ParTrace mode	green	X			The mode for fine dust sampling is activated

Table 1. Terminal LED lights

3.2.5. Printer

The device's printer is used to print key information about the sampling process as well as information about the user's major actions and operation of the device. It is mainly secure against manipulation and ensures that no information can be lost.

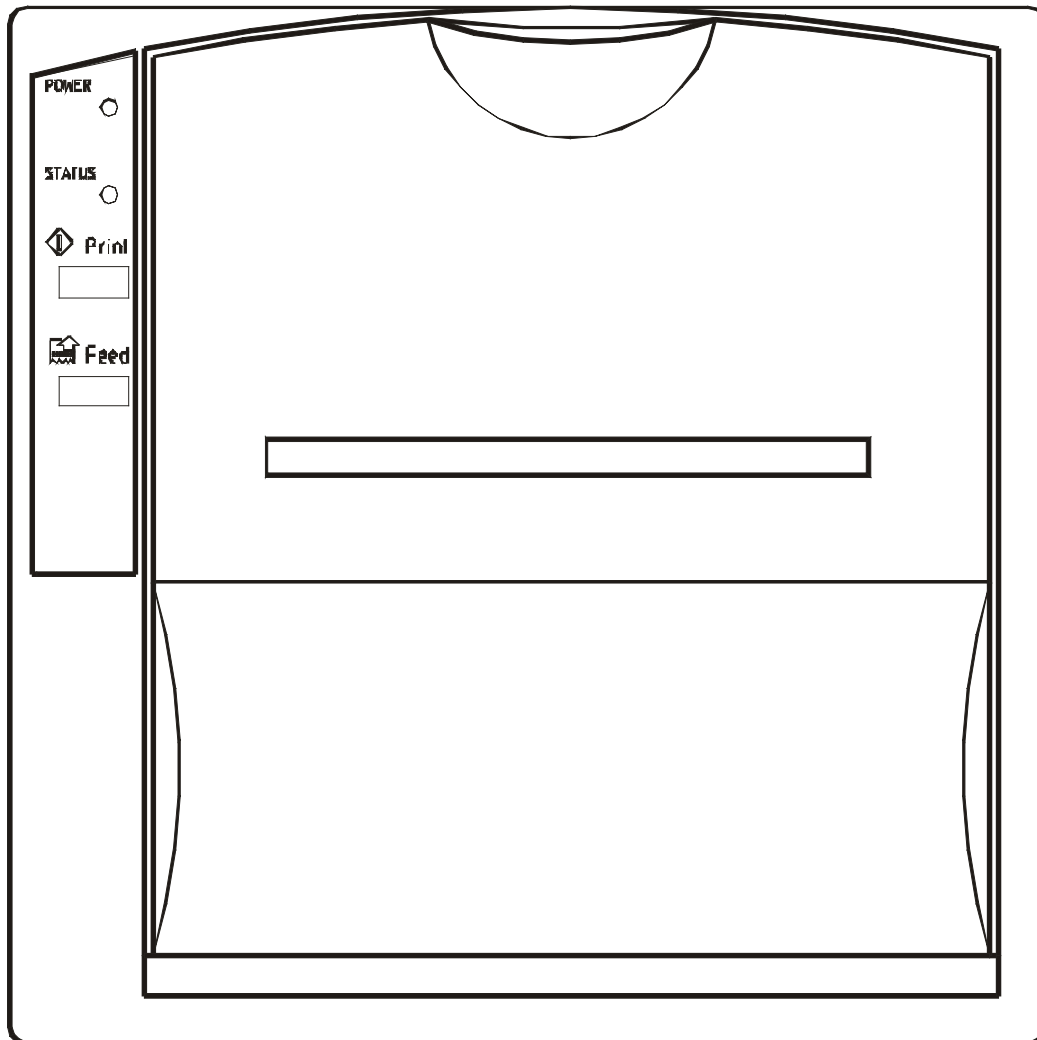


Figure 7. Printer

The printouts are usually sent in a protecting cover together with the associated filter unit to the laboratory to keep the sampling information and the respective sample together.

The POWER LED indicates that the printer is receiving power.

The STATUS LED indicates that the printer motor is on.

The PRINT key sends a carriage return <CR> code to the printer to finish a line, which was started. This key is usually not used.

The FEED key forwards the paper. In case time and date are printed, there are internal data which has to be ignored.

If the paper is runs out, which is indicated by a coloured line at the paper side, replace a new paper roll as described in the printer's inside sticker.

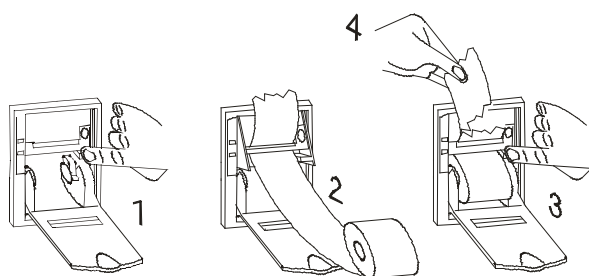


Figure 8. Printer paper refill procedure

The printer can be opened easily from the front side.

In case the printed text is bright, replace the printer cartridge.

Only original equipment is allowed to be used for replacement. For more information, refer to the maintenance manual.

3.2.6. Backup filter

The backup filter is the last filter used in the dilution air preparation. This filter ensures the dilution air is completely free from dioxins. According to the European standard EN 1948-1, the filter shall be analysed in case of emission values above the given limits. This is done to ensure that the dilution air is not the reason for the elevated emission results. Nonetheless, during normal operation, the expected amount of dioxins in the dilution air is zero and therefore, the backup filter will stay installed for a long time.

However, for operation in exact accordance with the European standard, this filter is removed after every sampling, stored for verification analysis, and replaced by new one for the next sampling.

The procedure for replacing the filter is quite easy, but shall only be done by trained personnel as follows:

- > ensure that the device is stopped correctly
- > switch off the compressed air supply
- > unlock and open the control cabinets' front glass door
- > [switch off the main power]
- > unlock and open the control cabinet's upper door
- > if needed, turn on the light
- > dismount the backup filter casing from its housing metal block by pulling the blue lock on the casing downwards while simultaneously twisting the casing 45° counterclockwise: steps (1) & (2) in Figure 9
- > put on clean room gloves before touching the filter
- > screw out the filter and its underneath holder by turning them about 2½ full turns counterclockwise (3)
- > pull off the filter from the holder and place it in a clean storage bag (4)
- > insert a new filter in the holder until it reaches the end of the holder (5) & (6)
- > mount the filter casing by pushing it back into its housing block and turn it 45° clockwise (7) & (8)
- > check the correct and tight installation again by slightly trying to pull out the casing off the block
- > close and lock the upper door
- > [switch on the main power]
- > switch on the compressed air supply

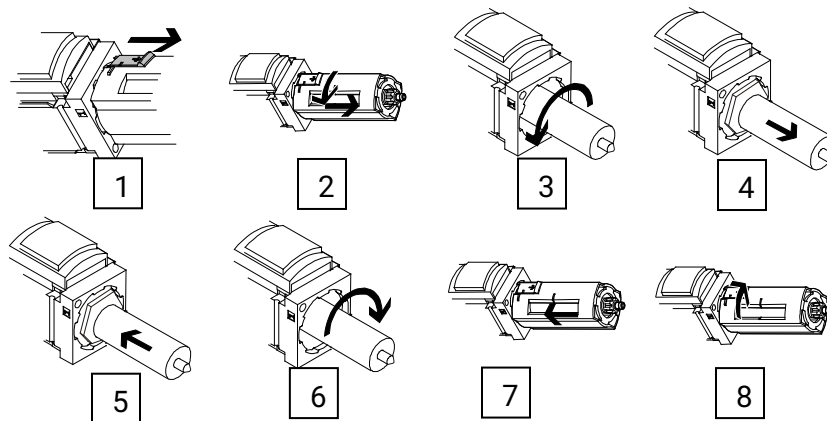


Figure 9. Backup filter changing procedure

The device is ready to continue operation after this procedure. The backup filter is usually stored and sent to the laboratory in case analysis of it has to be done.

The need of doing an analysis is decided by the institution writing the measurement reports.

3.2.7. Pressure regulator

The pressure regulator is located directly above the backup filter. When changing the backup filter, the regulator has to stay in unchanged position. The exact position of the regulator is set when the device is installed. This position is locked, but the lock can be opened easily by manual access.

In case the pressure regulator position has changed accidentally, the device must not be set to operation unless the regulator is reset to its original position. The position is mentioned in the device installation report and will usually be 2.2 bar.

3.2.8. Dilution air treatment

This part consists of several filters, which condition the dilution air correctly, so that it can be used for the sampling process. The filters have to be replaced periodically. The period of use depends on the compressed air quality. Preventive maintenance will include an annual change at least. The filters are located at the bottom on left side of the control cabinet behind the lower inside cover.

3.2.9. Gas meter protection filter

This part consists of a module that includes a filter and an absorber.

Renewal of the filling material every 6 months is recommended for preventive maintenance. However, depending on the exact flue gas conditions, the need for renewal might be even more frequent (part DMA-GFR-001).

3.2.10. Vacuum pump

This part can be heard when the device is running and especially when the control cabinet's main door is opened. It is placed at the very low right part of the control cabinet behind the lower inside cover. Preventive maintenance will include an annual check for this part.

3.3. Connection lines

These lines consist of several lines for gas, signals and electricity. They are static device parts, and the operator has to ensure that there is no mechanical load to any of these lines at any time and that no damage occurs. In case of a damage of any of these lines, the device shall be switched off completely, unplugged from compressed air as well as from electrical supply and inspected by the supplier.

3.3.1. Electrical lines

Control cabinet and sampling probe unit are interconnected together by three cables of different voltages, being 230 V, 24 V and signals.

3.3.2. Compressed air

The compressed air supply has to meet the device specifications at any time (6 – 8 bar, dew point < 5 °C and oil free quality).

In case of supply outside the specifications, the device has to be switched off and the compressed air supply has to be closed.

A restart is only allowed in case the compressed air supply is back in the device specification range and the device has been checked to be free from damages.

3.3.3. Gas recycling line

The gas recycling line brings the sampling gas back to the chimney or to another position where it is allowed to be exhausted. This gas is possibly hot. The position of the gas recycling line has to be secured against moving, as well as against human access due to the danger of heat and toxicity. However, this gas will not contain dangerous amounts of dioxins.

3.3.4. Heated sample line

In the heated sample line, the gas mixture of sampled gas and dilution air are transported from the sampling probe unit to the control cabinet. The inner Teflon tube of the heated sample line is heated by two independent heater lines. The inner part is insulated and protected from the outside with a flexible protection conduit. Usually, the heated sample line temperature is within the range of 45 to 55 °C.

4. System configuration and setup

The main part of the device configuration is done during the first device start-up and remains unchanged. This chapter of the manual is limited to the configuration which has to be done or checked by the operator. Some of the functions are restricted to be only used by the maintenance intervention personnel and blocked by the need of high access level to the terminal.

The main page for the non-operational functions of the device, namely configuration and maintenance, is activated by pressing the System & Setup key on the terminal.

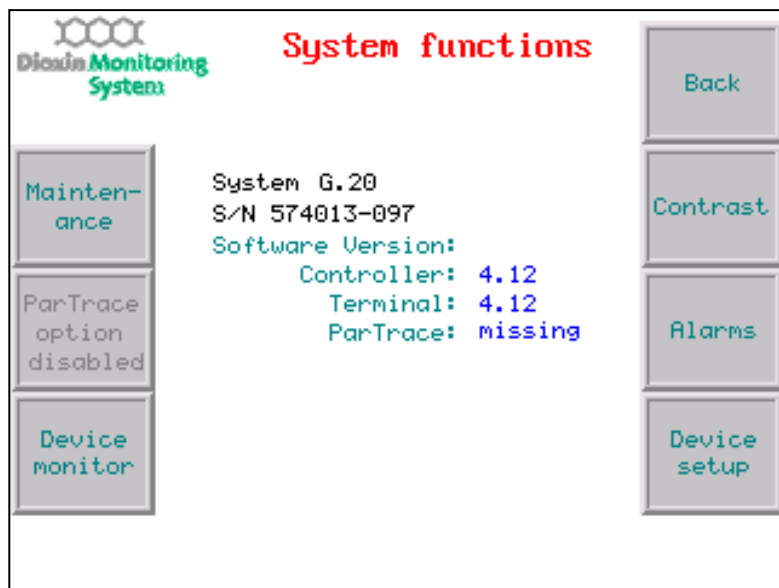


Figure 10. System functions page

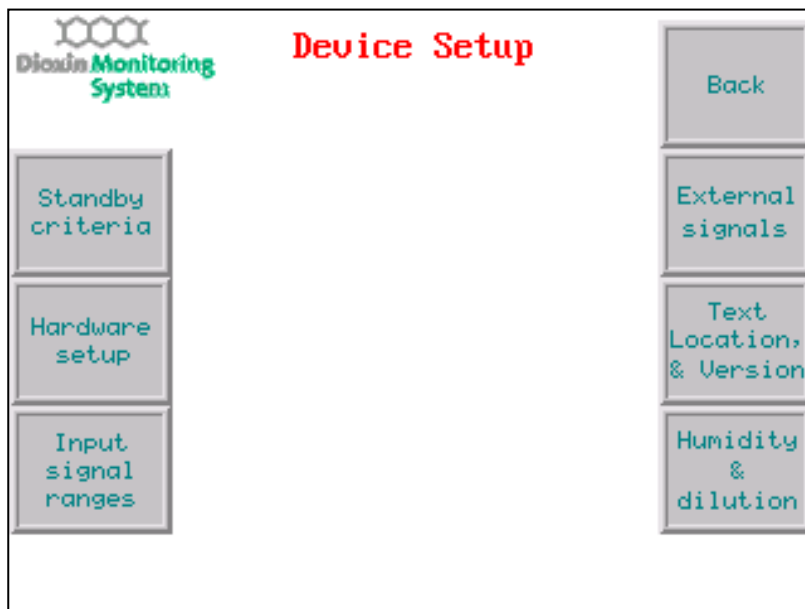


Figure 11. Device Setup page

4.1. Terminal contrast

The contrast of the terminal display can be changed by accessing the System & Setup page using the respective key on the lower left corner of the terminal and following the option "contrast". The contrast is changed with the option keys "+" to brighter and "-" to darker. The status is kept when leaving the page.

4.2. Sampling configuration

This page enables a user defined setup of the device for the operation of the current or the next sampling.

The main steps for the start-up of a measurement as well as for finalising it, are configured in this page and the detailed knowledge of the procedure is needed for a proper operation.

The Sampling Setup page is accessed by pressing the Sampling key on the terminal to open the Sampling page, and then selecting the option "Sampling Setup".

Figure 12. Sampling Setup page

4.2.1. Automatic or manual stop selection

The device can be configured to stop the sampling automatically or manually. The selection of an automatic stop is indicated by the "auto stop" LED light at the top part of the terminal. The option key "Stop auto/manual" on the Sampling Setup page toggles between the two modes.

4.2.1.1. Automatic stop selection

In case of selecting an automatic stop, the sampling will stop automatically after the sampling has run the period configured in the parameter "Runtime". This time represents the total time, including any stand-by periods.

The measurement cannot be started if the sampling time of the actual sampling has already elapsed, which is indicated by a red "auto stop" LED light.

4.2.1.2. Manual stop selection

In case of manual stop selection, sampling runs continuously until the sampling is stopped by pressing the STOP key. If probe desorption has been activated, pressing the STOP key once will stop the sampling and start the desorption operation. The device will stop automatically when the configured desorption time has elapsed. In case of a configured desorption process, the device can be stopped, and the desorption is cancelled immediately by pressing the STOP key a second time.

When manual stop is selected, the "Runtime" parameter is not used.

4.2.2. Desorption mode

Desorption is a thermal cleaning procedure for the inner tube of the probes which ensures to include also possible deposits of dioxins to the sample. A desorption time of 2 hours is recommended at the end of each sampling procedure.

Desorption can be activated so that it will automatically start at the end of the sampling procedure. If activated, desorption is done after pressing the STOP key once in manual sampling mode when the sampling is running. In automatic mode, desorption is started before the sampling period is expired and finished exactly at the end of the sampling time.

This mode is toggled by pressing the DESORPTION CONTROL key. The duration can be configured by entering the hours and minutes in the respective fields.

4.2.3. Purge mode selection

At the beginning of a sampling, the probes are purged with compressed air to ensure that the dust, which may have settled inside the probes during shutdowns, won't be mixed with the sample.

The probe purging can be initiated also in the events of system restart after a manual shutdown, after a stand-by period, or after a system error. This mode is selected by pressing the PURGE CONTROL key.

4.2.4. Report mode

Events are generally reported on the printed protocol ticket. Additionally, a brief status report can be added to the protocol at regular intervals. This interval is configured by entering the value in hours or days in the corresponding field. This mode can be selected by pressing the REPORT CONTROL key.

Note: it is recommended to use the event report only

4.2.5. Leak test mode

At the beginning of the sampling as well as when restarting and stopping of the device, the tightness of the sampling train is checked by a leak test. The leak test ensures the proper installation of the filter unit as well as the pneumatic function of the complete sampling train.

To increase the safety of the sampling procedure, it is possible to perform additional leak tests at regular intervals.

This time interval is configured by entering the value in hours in the corresponding field and selecting the mode by pressing the LEAK TEST MODE key.

If the "start, stop & interval" mode is activated, it is recommended to set the interval to an odd number, e.g., 7 or 15, so that the leak test takes place at different times every day.

4.2.6. ParTrace® mode

The ParTrace® mode is used for fine dust sampling using corresponding customized cartridge extensions, including impactor stages. The operation of the ParTrace® mode is only possible if this option has been included and activated in the device. Please refer to the ParTrace® Manual for details.

4.3. Stand-by criteria

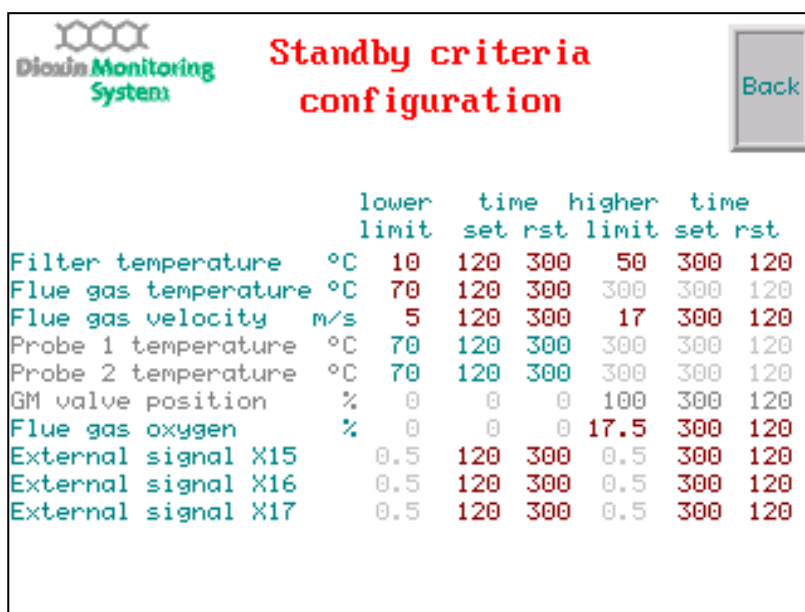
The stand-by criteria are configured on the first start-up for the particular site. Some of these parameters can be adjusted by the operators according to their requirements.

There are two types of stand-by criteria:

- > stand-by criteria to detect a shutdown of the plant (flue gas temperature and velocity, oxygen, external signals)
- > stand-by criteria to protect the measurement and the device (filter temperature, probe temperature, gas mixture (GM) valve position)

In case any of the selected parameters is outside their defined lower and higher limits for a certain period of time, the system will go into stand-by mode and continue to monitor these parameters until they are all back in their defined limits. Sampling will pause during the time when the device is in stand-by mode.

The configuration of these criteria is done on the related page, which can be accessed by pressing SYSTEM&SETUP key → "Device setup" → "Stand-by criteria".



		lower limit	time set	time rst	higher limit	time set	time rst
Filter temperature	°C	10	120	300	50	300	120
Flue gas temperature	°C	70	120	300	300	300	120
Flue gas velocity	m/s	5	120	300	17	300	120
Probe 1 temperature	°C	70	120	300	300	300	120
Probe 2 temperature	°C	70	120	300	300	300	120
GM valve position	%	0	0	0	100	300	120
Flue gas oxygen	%	0	0	0	17.5	300	120
External signal X15		0.5	120	300	0.5	300	120
External signal X16		0.5	120	300	0.5	300	120
External signal X17		0.5	120	300	0.5	300	120

Figure 13. Stand-by criteria configuration page

In general, a parameter is activated only if the "rst time" (reset time) of this parameter is not equal to 0 (zero). The "set time" and "reset time" values are given in seconds. To activate the stand-by mode, the parameter must stay constantly outside the defined limits for the duration of the "set time". To return to normal operation, a parameter must again stay constantly inside the defined limits for the duration of the "reset time" (rst).

4.3.1. Plant shut-down detection

4.3.1.1. Flue gas temperature

This enables to recognise a plant shutdown due to low flue gas temperature in the chimney.

4.3.1.2. Flue gas velocity

This enables to recognise a plant shutdown due to low flue gas velocity in the chimney and to prevent the device from malfunctioning in the event of an overload causing too high flue gas velocity.

4.3.1.3. Flue gas oxygen

An increase in the oxygen content of the flue gas also indicates a plant shutdown.

4.3.2. Protection of the sample and device

4.3.2.1. Filter temperature

This parameter enables to limit the temperature for precipitation and conservation of the dioxin fraction (filter).

4.3.2.2. Probe temperatures

This parameter is important especially for the device start-up after installation or after maintenance operation where the probes are cold. The system's sampling method uses heated probes, which is ensured by setting the values of these temperature parameters.

4.3.2.3. GM valve position

This value also helps in protecting the device from overload by high velocity and high dust amounts in the sampling filters.

4.3.3. External signals

Up to three additional external binary signals can be used to put the device to stand-by mode. The use of external signals is recommended for the detection of plant shutdown in advance to the shutdown detection by the above-mentioned measured parameters.

4.4. Sampling functionality of the device

4.4.1. Short term sampling of dioxins

The device can be used for short term measurements (e.g. 6 to 8 hours) following the EN 1948-1 requirements.

The recommended minimum sampling volume of 4 m³ shall be taken into consideration.

Especially for small sampling volumes, it is necessary to clean the probes and nozzles with high efficiency. For this purpose, the probes shall be purged for 1 hour to remove precipitated and possibly contaminated dust. Further, the use of the desorption function is recommended to clean the probes, nozzles, and ball valves. A minimum desorption time of 4 hours is recommended prior to short term measurements.

If the device is out of operation for a long period of time, the recommended desorption time should be increased to at least 12 hours.

The most recommended method for desorption is to configure the device to perform desorption at the end of the sampling. Set the desired desorption time, start the device in manual sampling mode and finally, stop the device. Desorption will be carried out for the selected duration and will stop automatically when desorption ends.

4.4.2. Long term sampling of dioxins

Long term sampling is the normal operation mode of the device, enabling very low detection limits. A sampling volume of 100 m³ decreases the detection limit by a factor of 10, compared to 10 m³ sampling volume during a 6-hour sampling period.

4.4.3. Sampling of dioxin-like PCBs

The GT90 Dioxin+ device is also validated to sample dioxin-like PCBs as well as marker PCBs. Due to the typically high blank values for this type of measurement, a minimum sampling volume of 30 m³ is recommended, in order to achieve sufficient detection limits.

4.4.4. Fine particulate matter measurement (PM2.5, PM10)

Please refer to the ParTrace® manual for details about the device use for fine particulate matter (dust) sampling.

5. Device operation

Use of the device must be done by trained personnel only. A login is necessary to access the various pages of the terminal.

5.1. Operation login

The authorization system of the device is structured into different levels. Each level has a specific password and permits access to the pages and fields of that level and all lower levels.

Access to a level is done by pressing the LOGIN key and entering the password using the keypad. The entered characters appear on the screen as asterisks (*) only. The login is then validated by pressing the ENTER key.

If the password is accepted, the login level is displayed on the screen for a few seconds.

If the password is invalid, a short "beep" and a message informs that the password was denied. Repeat the login procedure using a valid password.

When finishing the terminal use, ensure to sign off using the LOGOUT key. The logout is also done automatically after a few minutes if no terminal key is pressed.

5.2. Device monitoring

5.2.1. Checking the terminal LED lights

The device condition can be inspected easily by checking the terminal LED lights, where the status can be recognised immediately. The exact message that is given by the device terminal lights is described in subsection 4.2.4 "Terminal LED lights".

5.2.2. Checking the main screen

The main page provides information about the actual status of the system. This page is accessed by pressing the HOME key and can be viewed without a login or a specific user level restriction. The following examples show different states of the device.

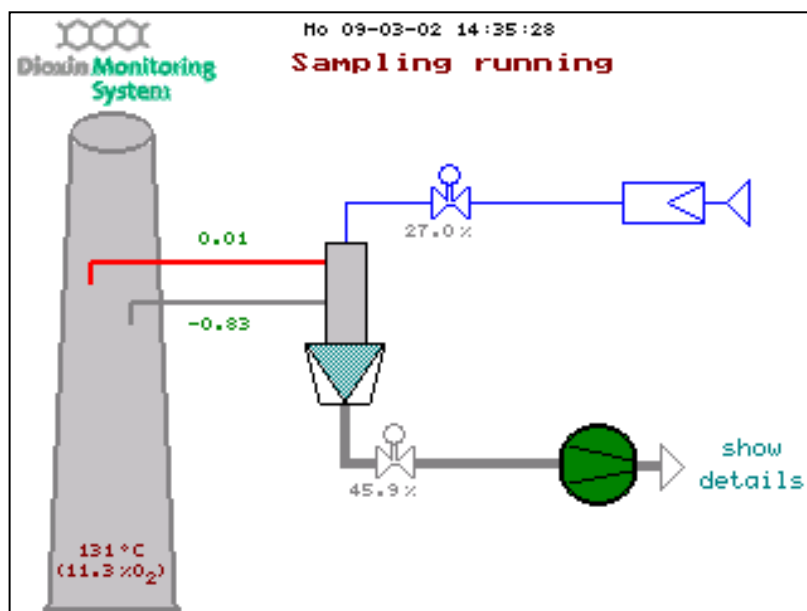


Figure 14. Device is in normal operation (basic main screen view)

In Figure 14, the device is in normal operation and sampling is running. Probe 1 is in use for sampling and sampling is at isokinetic conditions. Probe 2 is closed indicated by a pressure of -0.83 mbar. The dilution air valve position is at 27.0 %, the gas mixture valve position is at 45.9 %.

5.2.3. Checking the detailed main screen

It is possible to view more details on the main page. This includes most of the parameters measured by the device and some additional calculated values. Press the "show details" and "hide details" key to toggle between detailed and basic views.

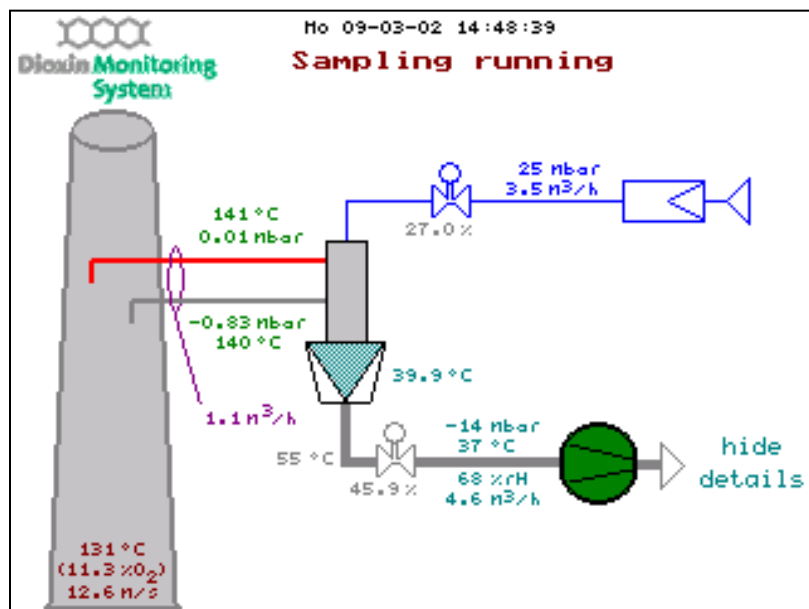


Figure 15. Device is in normal operation (detailed main screen view)

In Figure 15, the sampling volume flow rate is 1.1 m³/h and the calculated flue gas velocity is 12.6 m/s. The pressure drop along the sampling train is 39 mbar (25 mbar minus -14 mbar), which indicates quite free flow. This value should not exceed 120 mbar. The humidity of the gas mixture is 68 % (recommended <85 %).

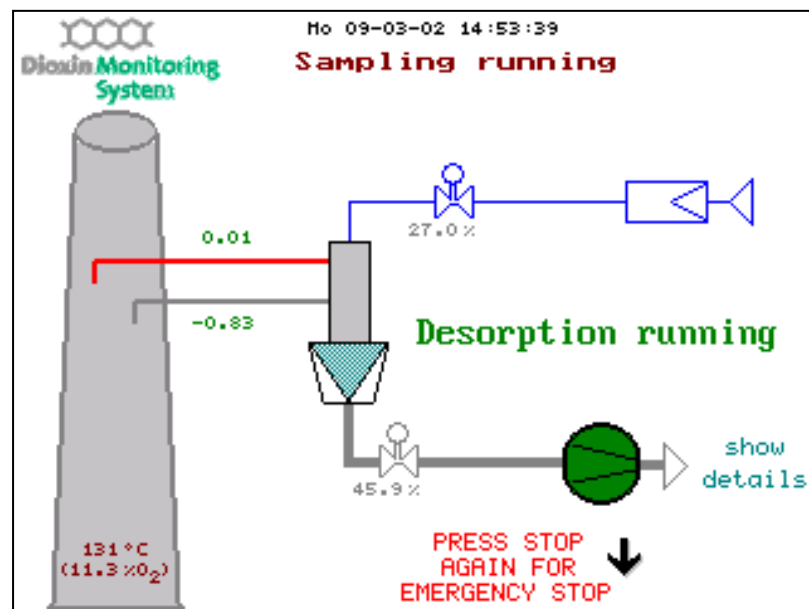


Figure 16. Device is in normal operation with desorption in progress

In Figure 16, desorption process is in progress. The device will automatically stop when the desorption is finished, but it can also be stopped manually by pressing the STOP key.

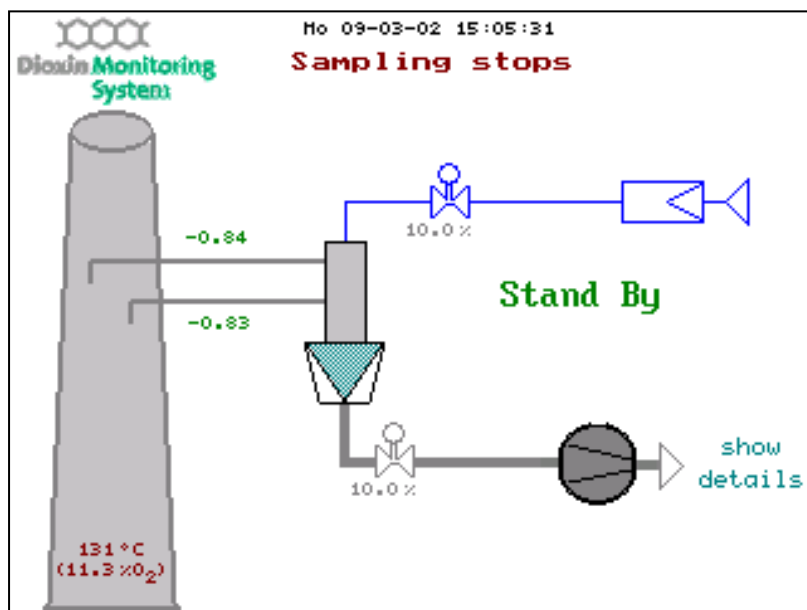


Figure 17. Device is in stand-by mode

In Figure 17, at least one of the stand-by parameters is outside its operating range. The device will resume sampling when all parameters are within their limits. Details about the reasons which triggered the stand-by can be found in the device monitor page, which is described in subsection 6.2.1.3.

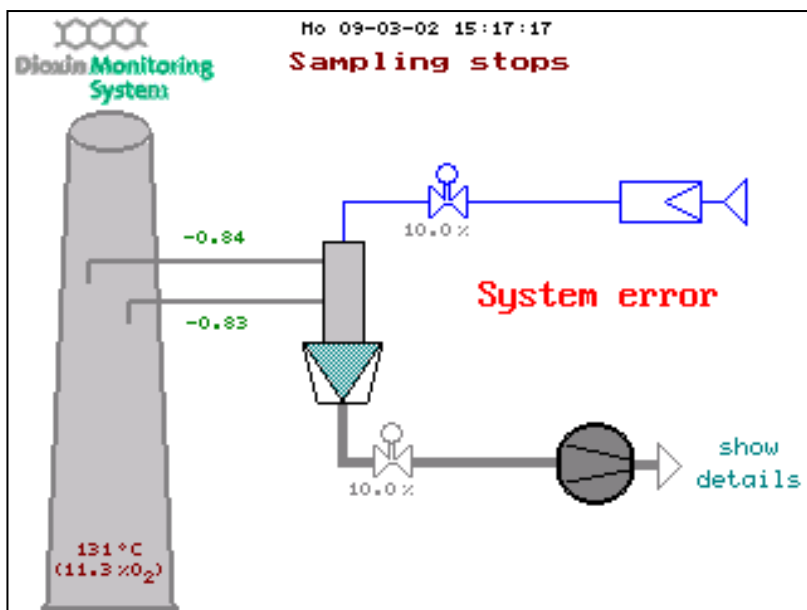


Figure 18. Device is out of use due to a system error

In *Figure 18*, an error causes the system to stop sampling. Check the printed protocol ticket, the alarm list, or the device monitor to find the exact reason causing the error as described in subsections 6.2.1.2 and 6.2.1.3.

The start-up procedure described in section 5.6 gives more details about the different modes and functions of the device.

5.3. Resetting Sampling Data

When a new sampling process starts or when it is stopped, the sampling log data needs to be reset. This is done in the sampling page by pressing the RESET combination key (press REPORT key and the ACKN. key at the same time). The LEDs on these buttons flash red for a few seconds, indicating a timeout. A sampling protocol ticket which includes the last sampling data is printed and the message "Resetting values..." is displayed on the sampling page.

The data reset can be cancelled by pressing the STOP key as long as the timer LEDs are still indicating the reset timeout.

It is possible to check that the reset has been successful by pressing the SAMPLING key on the terminal to view the Sampling page. If the data reset was performed correctly, all of the values shown on this page should be 0 (zero).

The screenshot shows the 'Sampling' page of the Gasmet device. At the top, it says 'Dioxin Monitoring System' and 'Installation: Municipal waste incinerator'. Below that, 'Cartridge ID: XY 300 cycle 21' is displayed. The main data area is divided into sections: 'Status' (Sampling stops), 'actual sampling time' (167.28 h), 'Volumes' (Flue gas, Dilution air (UL), Gas mixture (ML)), and 'Averaged values' (Filter temperature, Oxygen (O₂), Humidity (H₂O) GM). On the right side, there are four buttons: 'Back', 'Erase data log', 'Details', and 'Sampling setup'.

Sampling		
Dioxin Monitoring System		
Installation: Municipal waste incinerator		
Cartridge ID: XY 300 cycle 21		
Status	Sampling stops	
actual sampling time	167.28 h	
Volumes		
Flue gas	178.08	m ³ (nc,wet)
	143.84	m ³ (nc,dry)
Dilution air (UL)	791.12	m ³ (nc,dry)
Gas mixture (ML)	969.14	m ³ (nc,wet)
	934.96	m ³ (nc,dry)
Averaged values		
Filter temperature	40.1	°C
Oxygen (O ₂)	10.7	Vol%
Humidity (H ₂ O) GM	23.8	% rH

Figure 19. Sampling page before resetting values

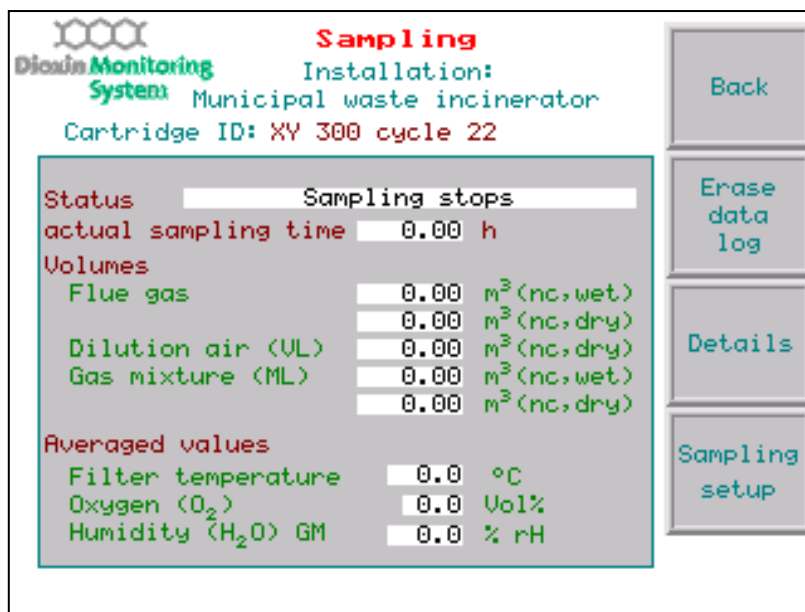


Figure 20. Sampling page after resetting values

5.4. Sample ID

The identification of a sample or cartridge can be configured at the Sampling page. This information is included in the printed report.

5.5. Filter cartridge installation

5.5.1. Standard filter cartridge installation

The installation of the filter unit is the main task to be done by the operator. In order to avoid possible errors, installation work must be done very carefully according to the following instructions:

- > Avoid touching the surfaces of the heat exchanger assemblies, which are possibly hot. For safety, check them before touching using heat resistant gloves.
- > The filter cartridges are made from pure titanium, which is a very soft metal. Avoid contacting the cartridge with hard materials or exposing it to any kind of dust or dirt in order to keep the cartridge intact and free from contamination.
- > Avoid turning a loaded filter cartridge upside down when the cap is not properly attached on the mixing chamber.
- > Always hold the cartridge in a position where the mixing chamber is at the top.
- > Use clean room gloves to handle the filter cartridge and avoid touching the mixing chamber external surface.
- > All inside areas of the cartridge are included in the laboratory analysis, but not the outside areas. Avoid contaminating the inside of the cartridge with additional dust.
- > To avoid contamination and loss of the sample as well as contamination/loss of the analysing lab spiking standards, do not open the lower quick fastener clamp of the cartridge.

The installation of the cartridge must be carried out according to the following procedure:

- > ensure that the sampling has been stopped correctly
- > open the cartridge's transportation box and ensure that a prepared clean cartridge is available for replacement
- > check the heat exchanger temperature and – if needed – use protective gloves
- > disconnect the heated sample line rapid connector by pulling the outer ring (No. 1 in Figure 21) down and releasing the connector from its fixed stem.
- > Close the heated sample line end with a paper towel or a silicon plug to avoid foreign objects from entering into the tube then move it away from the cartridge's bottom (2)
- > disconnect the filter temperature sensor unit's rapid connector by pulling the outer ring (3) down and releasing the connector from its fixed stem. Move the unit away from the cartridge's bottom (4)
- > holding up the filter chamber (A), open the upper quick fastener clamp (E) of the cartridge then release and remove it (5)
- > still holding with the filter chamber (A), carefully pull down the cartridge out of the heat exchanger taking care not to turn the cartridge during this process (6)

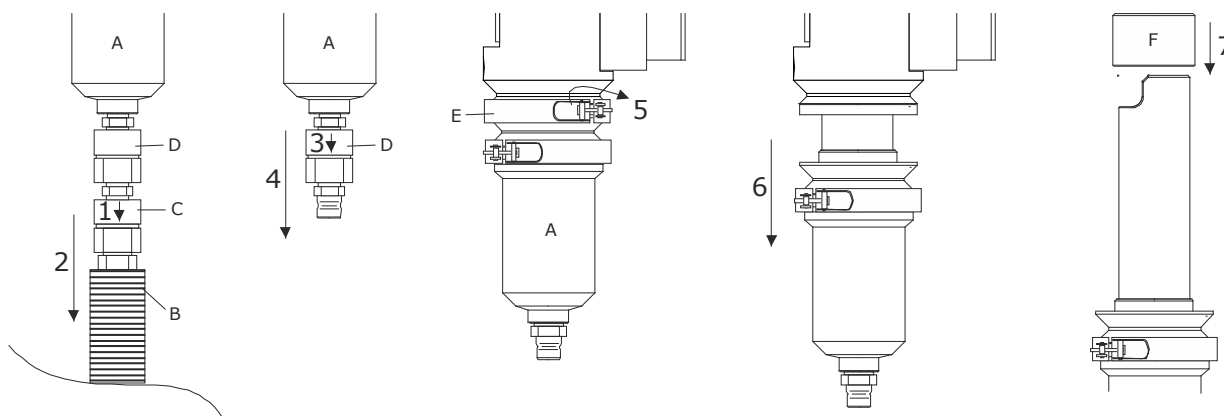


Figure 21. Uninstalling the filter cartridge

- | | |
|---|---|
| A filter chamber | D filter temperature sensor unit with rapid connector |
| B heated sample line with rapid connector | E upper quick fastener clamp |
| C ring | F cap |

- > remove the rubber sealing ring which is placed around the mixing chamber

- > close the upper cartridge part by attaching the cap (7) to the mixing chamber (in case there is no separate cap available, the cap of the new prepared cartridge may be used)
- > optionally, wrap the loaded cartridge with aluminium foil
- > ensure that the lower part of the heat exchanger surface is free from dust and clean it if necessary
- > swap the loaded cartridge with new prepared cartridge in the transportation box
- > gently clean the new rubber sealing ring and place it in the new prepared cartridge at the same position where it was taken from the loaded one, namely the mixing chamber
- > insert the unloaded cartridge up into the heat exchanger and ensure that the opening at the upper part of the mixing chamber (marked with ! in Figure 22) is facing towards the probes. If the mixing chamber cannot be completely inserted into the heat exchanger, check the opening position by slightly turning the cartridge (2)
- > attach the upper quick fastener clamp to its place and close it (3) making sure it is securely and firmly tightened
- > reconnect filter temperature sensor unit and the heated sample line rapid connectors to their stems (4, 5 & 6)

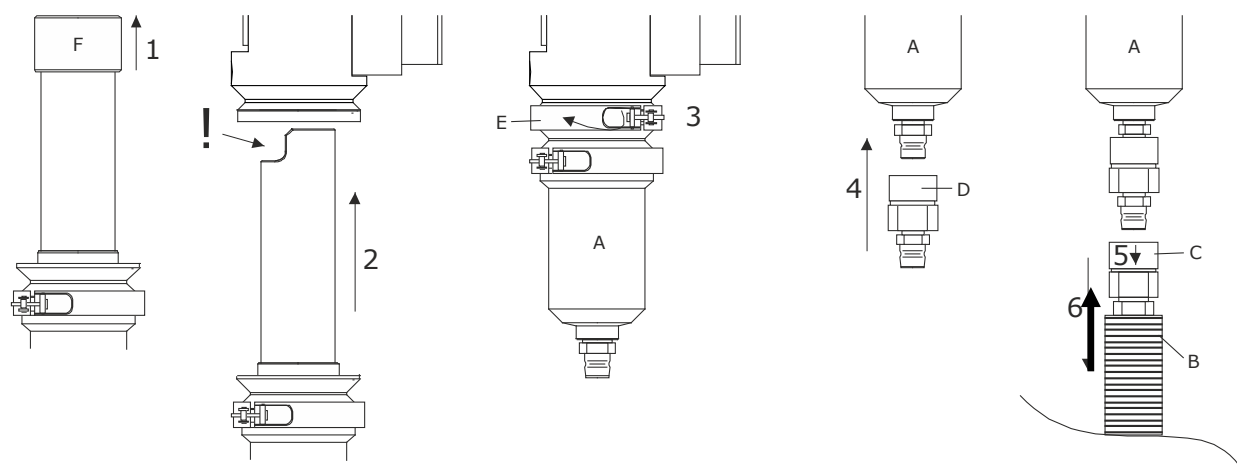


Figure 22. Filter cartridge installation

- | | |
|---|--|
| A filter chamber | D filter temperature unit with rapid connector |
| B heated sample line with rapid connector | E upper rapid connector |
| C ring | F cap |

5.5.2. ParTrace® cartridge installation

Refer to the ParTrace® manual for details about changing or installing a ParTrace® cartridge. ParTrace® cartridges are used for sampling fine particulate matter in addition to dioxins.

5.6. Start-up

After installing a cartridge, the device can be started by pressing the START key. Starting is not

possible in the event of a device error, which has to be handled first as described in section 6.2 "Errors and error handling".

During start-up, several system preparation and verification procedures are performed to ensure high sampling performance levels. These procedures can be interrupted at any time by pressing the STOP key, and, thus, the device will not start the sampling. Depending on the exact system configuration, the following functions will be executed and displayed on the main page.

5.6.1. Purging

The probes are cleaned with compressed air to remove any dust deposits. Typically, a duration of 90 seconds is set for purging each probe.

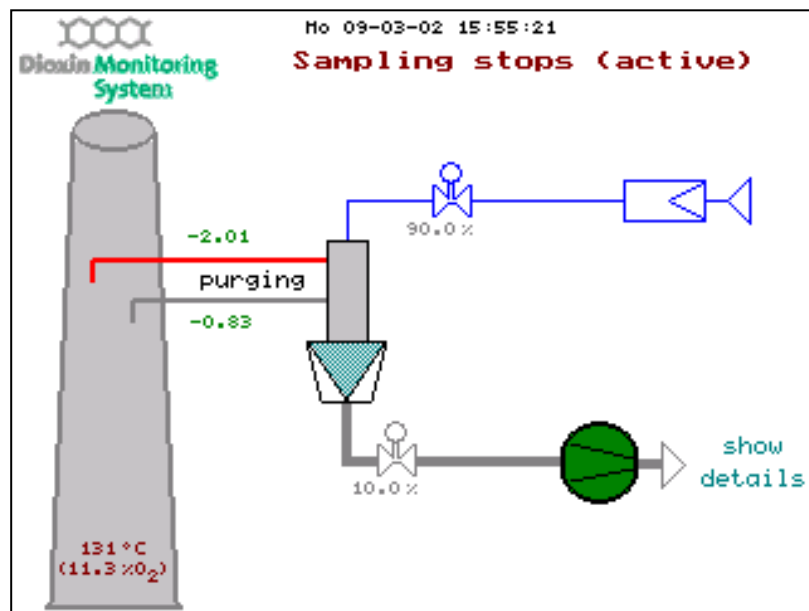


Figure 23. Probes purging in progress

5.6.2. Leak test

The leak test ensures the proper installation of the filter unit and the integrity of the sampling train. It is performed at every device start-up, at the device stop and, depending on the configuration, possibly at regular intervals.

During the leak test, two different pages are displayed on the terminal:

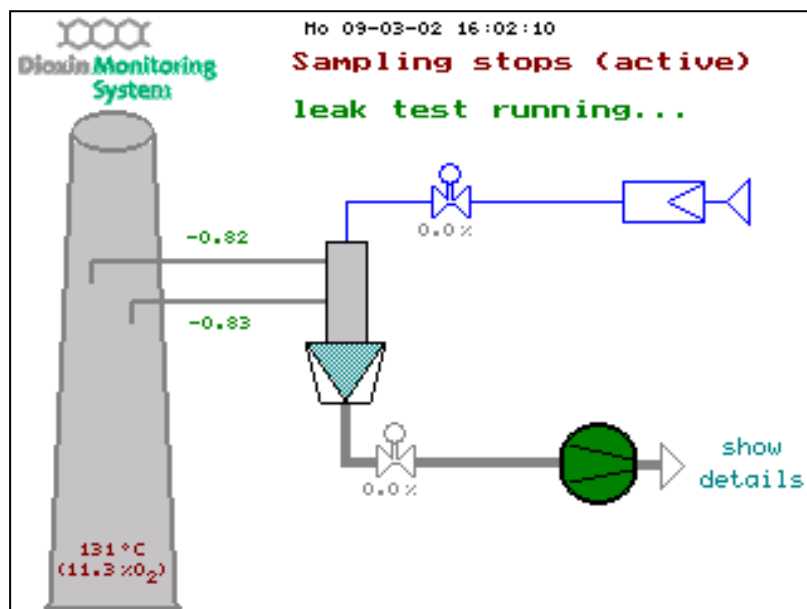
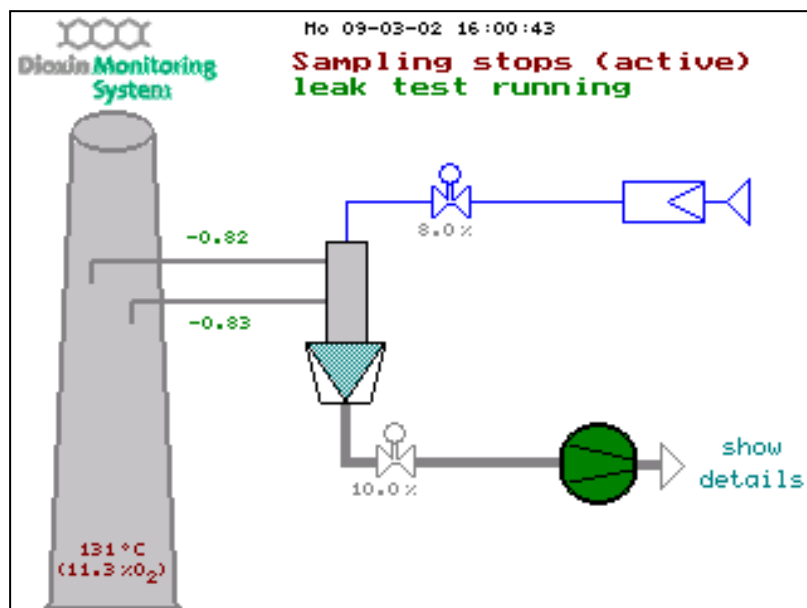


Figure 24 and 25: Device main page during a leak test

The detailed result of the leak test can be viewed on the “Device Maintenance” page, which is accessed by pressing the SYSTEM & SETUP button and selecting the option "Maintenance".

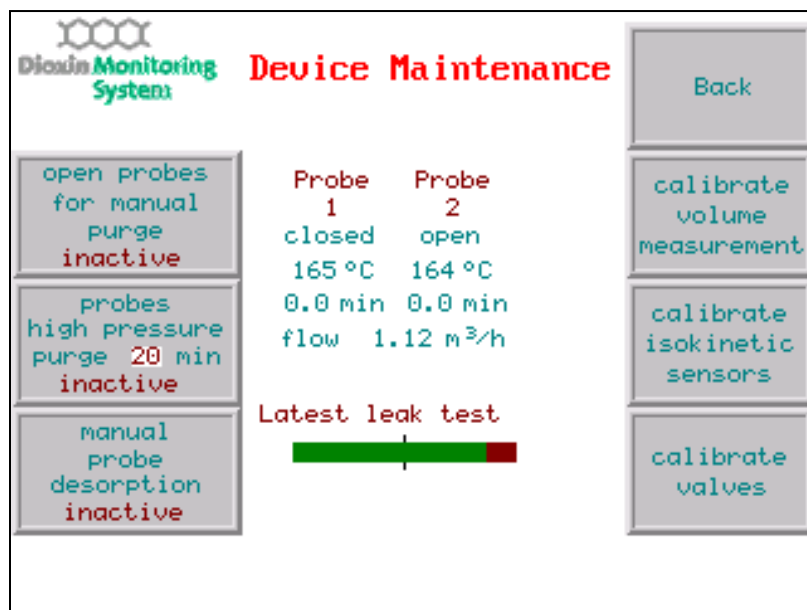


Figure 26. Device Maintenance page with leak test results

If the leak test fails, the following page is displayed.

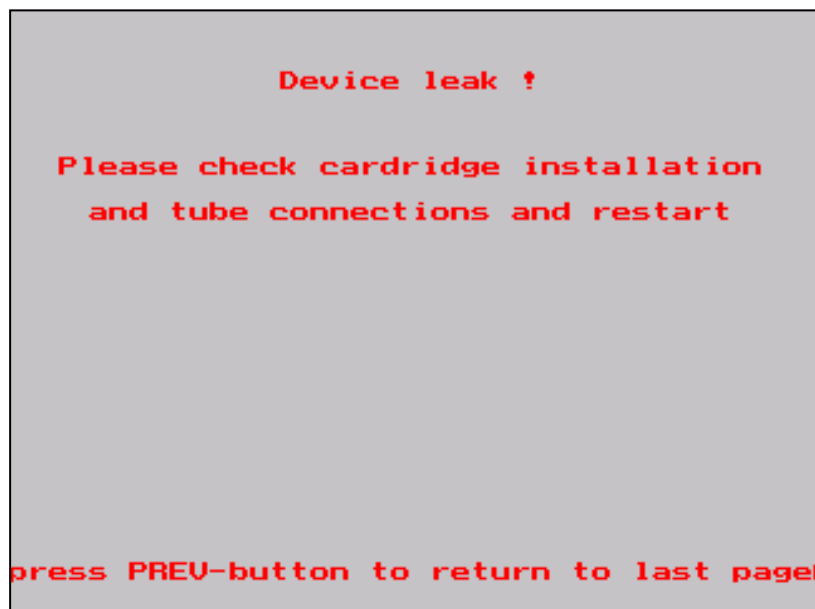


Figure 27. Page showing that the leak test has failed

Check if the filter cartridge is properly installed, especially the sealing must be checked for correct placement and if it is free from dust. The displayed page can be simply cleared by pressing the PREV key or any other navigation key of the terminal.

In case the leak problem cannot be solved, check the control valves inside the control cabinet (check: glass tube fuse, red power supply LED, mechanical operation during start-up and calibration). Refer to the Maintenance Manual for more details or consult the local distributor or the manufacturer for assistance.

5.6.3. Stabilising mode

After a successful device test and preparation procedure, the device enters a mode to stabilise the sampling conditions.

Depending on the device configuration, this mode is activated for a few minutes.

This mode is also activated after a stand-by mode before continuing the sampling and after a device restart.

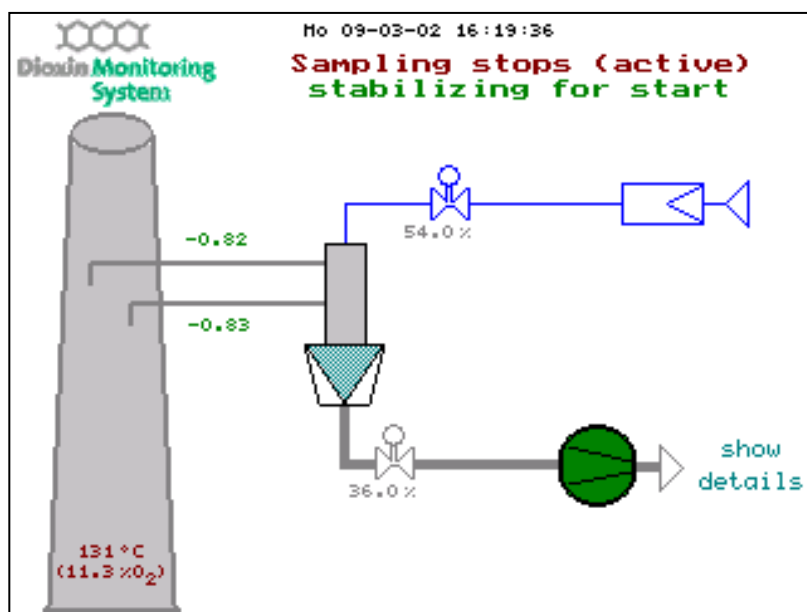


Figure 28. Device in stabilising mode

After stabilising, the device starts the sampling.

5.7. Measurement

The sampling is performed automatically according to the device configuration. Several pages provide additional information about the device status as well as about the conditions of the sampled gas.

5.7.1. Sampling page

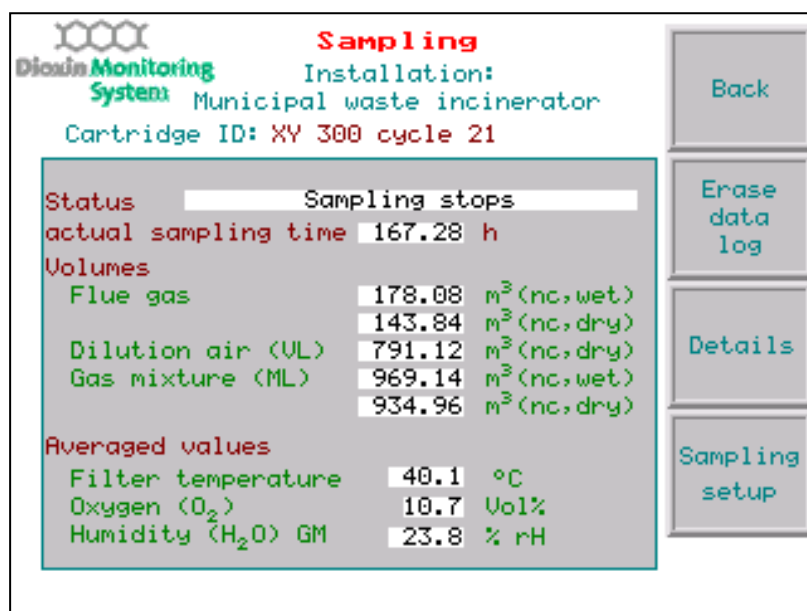


Figure 29. Sampling page

The sampling page shows the data of the actual sampling, which are important for the subsequent laboratory analysis. This data is the most important part of the sampling process. The page is accessed by pressing the SAMPLING key.

5.7.2. Detailed main screen

On the main screen, more details can be shown by pressing the "show details" option key. This includes most of the parameters measured by the device as well as some additionally calculated values. Select the "hide details" option to return to the default view.

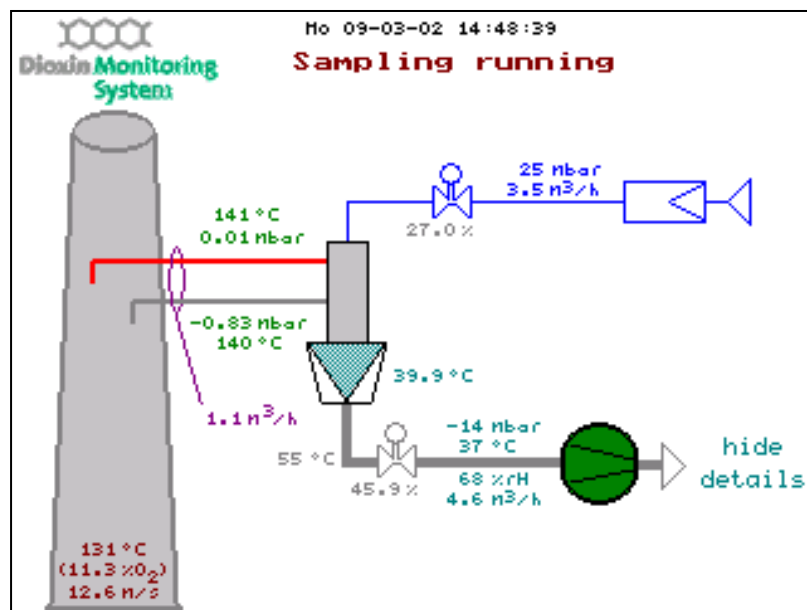


Figure 30. Detailed main page

5.8. Sampling stop

The sampling stops depending on the device configuration. The last step in the sampling process is a leak test. Avoid interrupting the final leak test since it is an important part of the sampling quality assurance. However, in case of emergency, pressing the STOP key will interrupt the leak test.

When "automatic stop" of the sampling protocol is selected, the sampling will stop automatically at the end of the configured sampling time. If probe desorption is activated, it will be finalised during this set sampling time.

In case of "manual stop" mode is selected, the device will end the sampling measurements if the STOP key is pressed once. If probe desorption is configured, it will start immediately and proceed as configured. The last step of the measurement is a leak test to ensure the system's functional integrity is valid up until the end of the sampling process. In emergency cases, the device can be completely stopped by pressing the STOP key a second time.

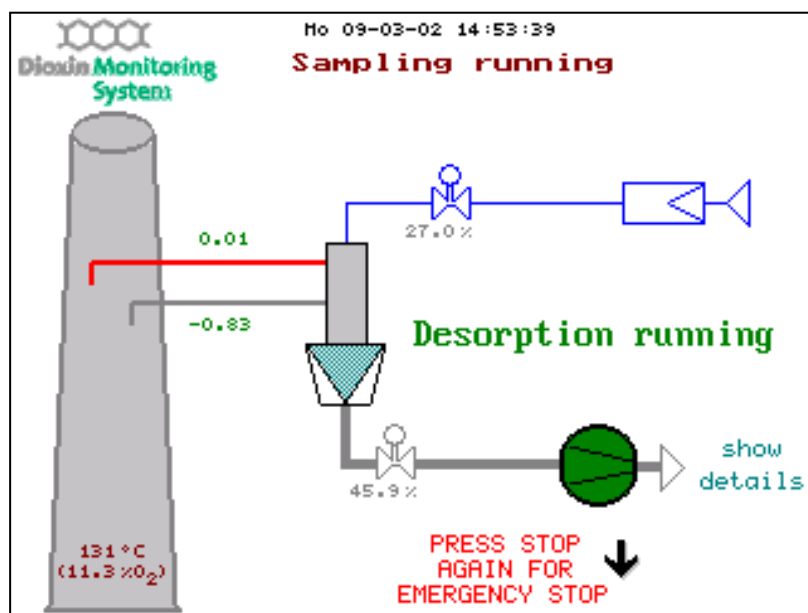


Figure 31. Probe desorption active

To generate a printed report, press the REPORT key, which also allows printing an interim report. The data can be reset only if the ACKN. and REPORT keys are pressed at the same time, otherwise the present data is kept.

The data must be reset before a new measurement is started.

The filter cartridge can be uninstalled after stopping the device as described in section 5.5.

6. Appendix

6.1. Technical data

The technical data depends on several cross-linked parameters. If one these parameters is changed, several others will be influenced. The data listed below describe the standard device configuration. Values in parentheses represent the recommended limits, but in some cases, they do not represent the technical limits. The device configuration is specifically adjusted to each installation and may vary.

6.1.1. General data

Sampling method	dilution method according to EN 1948-1:2006, TS 1948-5
Sampling interval ¹	2 hours to 6 weeks
Filter system	3 stage dry solid filters, separating dust and gas fraction
Device design	for industrial use
Probes	2 heated titanium, zero-pressure probes ²
Measurement range ³	0.0001 to 10 ng I-TEQ/m ³ (6 weeks)
Isokinetic control	direct at the actual sampling position
Remote control	Internet-TCP/IP
Product compliance	CE, UKCA

6.1.2. Physical dimensions

control cabinet	w d h	62 cm 62 cm 171 cm
outer sampling probe unit	w d h	52 cm 28 cm 60 cm ⁴
inner sampling probe unit	depending on length of probes	
heated line	length 3 m (2 – 70 m)	

¹ extendable for the application and needs

² single probe version is also available for very small gas channels

³ depending on laboratory parameters

⁴ including space for connecting/disconnecting the heated sample line

6.1.3. Operating environment

	Control cabinet	Sampling probe unit
temperature ⁵	−0 ... +45 °C	−10 ... +55 °C
humidity relative, none condensing	10 ... 90 %	10 ... 95 %

6.1.4. Flue gas parameters

velocity	2 to 20 m/s (up to 35 m/s ⁶)
temperature	up to 250 °C (up to 450 °C ⁶)
humidity	up to 350 g/m ³ (up to 500 g/m ³ ⁶)
dust content	up to 100 mg/m ³ ⁶
corrosive gases	limited according to design

6.1.5. External supply

main power	400 V 16 A, 3 phases + neutral + ground (230 V/16 A, 1 phase is optional with connection line limit of 10 m)
optional additional UPS	230 V / 150 W
Compressed air	max. 15 m ³ /h, 6 bar, dry ⁷ , oil free

6.1.6. External signals (optional, extendable)

to device	oxygen concentration in sampled gas ⁸ oxygen concentration status signal 3 external stand-by signals
from device	sampling status device error stand-by active

⁵ depending on wind speed

⁶ available with respective option only

⁷ dew point below 5 °C

⁸ used for averaging calculations and stand-by detection, not for process control

6.2. Errors and error handling

6.2.1. Information sources

In case of an error there are 3 sources for information, which usually indicate the same status.

6.2.1.1. Printed protocol

The printer generates a protocol ticket including all information about operator access, steps in the sampling procedure and system errors. Press the FEED key on the printer to read to the last printed lines, if they are not shown.

6.2.1.2. Alarm list

The alarm list also includes all the information about operator access, sampling procedures and system errors. The alarm list is accessed by pressing the "Alarm" button on the terminal.

The alarms are grouped together, with each group separated from the other by colours depending on their nature. The alarm groups indicate if the alarm is an operator access, a sampling procedure step or a device error.

Some errors have to be acknowledged by using the ACK key at the right side of the terminal. However, unacknowledged alarms do not block the device operation.

Before acknowledging an error, ensure to take the information in evidence, to report it to the sampling institution, the local distributor or manufacturer.

The alarm text can be zoomed in or out by pressing the "+" and the "-" magnifier keys on the terminal. The alarm date and time can be displayed or hidden by pressing the "watch" key on the terminal.

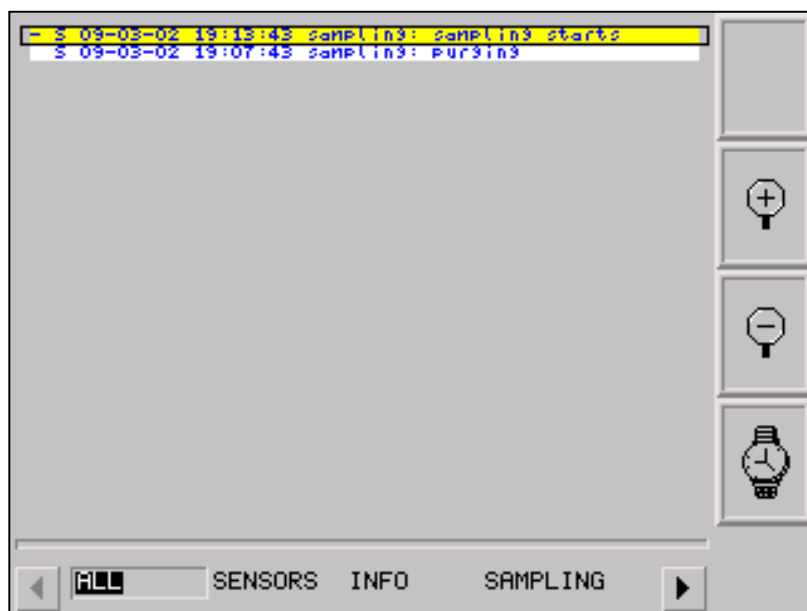


Figure 32. Alarm list

6.2.1.3. Device monitor

The device monitor is an overview page, that indicates the actual current status of each component and parameter of the device and sampling process, that is possibly causing an error or device stand-by. A green dot indicates that the component is operational, and that the parameter is within the defined limits. A red dot indicates that this component has triggered the stand-by mode, a system error or an alarm.

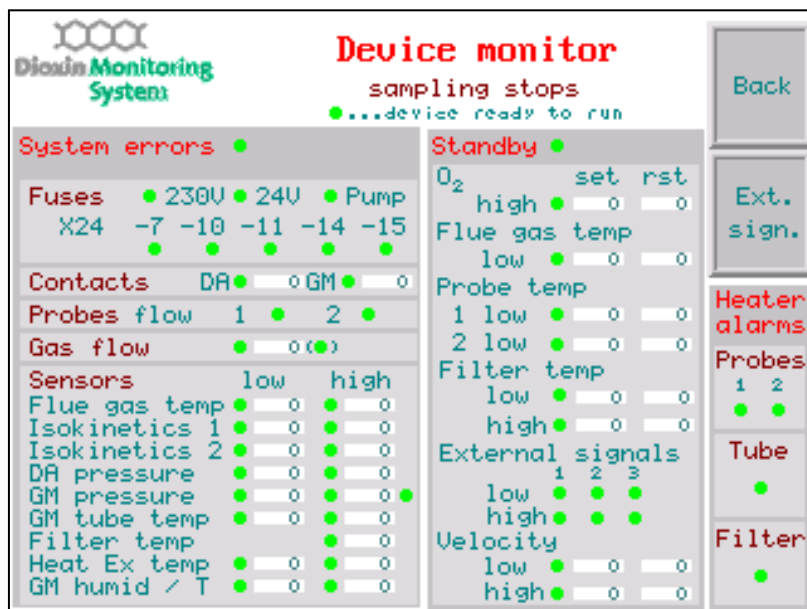


Figure 33. Device monitor

The device monitor page is accessed by pressing the SYSTEM & SETUP key followed by the "device monitor" option key.

6.2.2. Heater alarms

Heater alarms are active if one of the heater devices is not able to maintain the temperature within the defined range for a certain time. These alarms are automatically reset if the temperature is back in the range. Heater alarms are indicated by yellow in the device monitor page, the corresponding heater element has a marker in the HOME page (different colour or blinking).

6.2.2.1. Probe heater alarms

```
*****
20-10-31 14:25:01 probe 1
heater failure

the heater of probe 1
is either defect
or insufficient
```

Check the heater of the probe mentioned in the alarm by comparing the set value with the measured value. The alarm appears when the heater controller reaches the maximum heating configured time.

6.2.2.2. Gas mixture heated sample line heater alarm

```
*****
20-10-31 14:25:01 gas mixture tube
heater failure

the heater
of the gas mixture tube
is either defect
or insufficient
```

Check the heater of the gas mixture heated sampling line by comparing the set value to the measured value. The alarm is triggered if there a variation of $\pm 5^{\circ}\text{C}$.

6.2.2.3. Heat exchanger heater alarm

```
*****
20-10-31 14:25:01 heat exchanger
heater/cooler failure

the heater/cooler element
of the heat exchanger
is either defect
or insufficient
```

Check the heater of the heat exchanger by comparing the set value to the measured value when the device is stopped. The alarm is triggered when the heater controller reaches the maximum heating or cooling configured time.

6.2.3. Stand-by mode

The stand-by mode is a status of the device and does not represent an error. It indicates that at least one parameter is outside the configured operating range for a certain time and has not returned back inside this range given a long enough time. The device will continue sampling automatically if the parameter is back inside the range for the given long enough time.

The following message is printed out when the stand-by mode is activated:

```
20-10-31 14:23:53 Stand By -----
```

Details can be found in the device monitor page, described above.

6.2.4. Error messages

System errors are printed out on paper with the following message:

```
-----  
20-10-31 14:23:54 System error
```

6.2.4.1. Sensor error messages

```
20-10-31 14:23:55 mixed gas humidity  
sensor signal invalid
```

```
20-10-31 14:23:55 mixed gas temp  
sensor signal invalid
```

The above messages indicate that the humidity sensor needs to be checked or replaced.

```
20-10-31 14:23:56 device name  
sensor min
```

```
20-10-31 14:23:56 device name  
sensor max
```

These messages indicate that one of the sensors has reached its measurement range limit. The following sensors are reported:

Sensor	Location	Further checks
Mixed gas pressure	Control cabinet	Sensor pipes Solenoid valve GM flow control valve GM gas meter
Dilution air pressure	Control cabinet	Sensor pipes Solenoid valve DA flow control valve DA gas meter Compressed air supply
Probe x pressure	Sampling probe unit	Isokinetic sensor pressure pipes Probe valve Flow control valves Compressed air supply
Flue gas temp	Sampling probe unit	Sensor temp >0°C
Heat exchanger temp	Sampling probe unit	Sensor temp >0°C
Mixed gas tube temp	Gas mixture's (GM) heated sample line	Sensor temp >0°C
Filter temp	Sampling probe unit /rapid connector at GM heated sample line's mouthpiece	Sensor temp >0°C

6.2.4.2. Component error messages

```
20-10-31 14:26:00 mixed gas counter
time out

suggested checks:
O front gasmeter counter
rotation
O right flow control valve
O pump inlet tube
```

This message is caused by a broken mixed gas counter. Check the front gas meter volume display for correct operation (rotation of the number dials).

```
20-10-31 14:28:12 dilution air counter
time out

suggested checks:
O compressed air supply
O rear gasmeter counter
rotation
O DA flow control valve
```

This message is caused by a broken dilution air counter. Check the rear gas meter volume display for correct operation (rotation of the number dials).

```
20-10-31 14:30:41 GM valve at 100 %
(velocity: 13.2)
```

This message indicates that the gas mixture valve is operated at 100 % (fully open) and therefore isokinetic control is not possible.

6.2.4.3. Power supply messages

```
20-10-31 14:33:51 400 V main power
supply failure
```

This message indicates that at least one phase of the power supply is missing or that the phase rotation direction is incorrect.

```
20-10-31 14:34:08 fuse 24 V failure
```

This message indicates that at least one 24 V circuit breaker is down.

```
20-10-31 14:35:13 fuse 230 V failure
```

This message indicates that at least one 230 V circuit breaker is down.

```
20-10-31 14:35:58 pump failure
(fuse down)
```

This message indicates that the circuit breaker of the pump (Q03) is down. The pump must be checked for proper operation in this case.

6.2.4.4. Glass tube fuse messages

These messages appear when a glass tube fuse is broken.

```
20-10-31 14:36:14 glasstube fuse broken
GM valve (X24-10)

suggested checks:
O replace fuse
```

Depending on the fuse number, check the corresponding part of the device and replace the blown fuse with a fuse of the same type. More details about the components and their glass tube fuses can be found in the Maintenance Manual.

6.2.4.5. Probe purging error messages

```
20-10-31 14:37:24 probe 1
purging not successful

suggested checks:
O compressed air supply
O flow control valves
O probe valve
O free probe flow
```

This message indicates that the respective probe could not be purged correctly. The pressure did not achieve the expected level. The possible causes of this error are as follows:

- > the compressed air supply is not sufficient
- > the pressure controller inside the device is at a low level (default value is 2.5 bar)
- > the probe is blocked
- > the probe valve does not work correctly
- > the flow control valves are not working correctly
- > the nozzle is blocked
- > the isokinetic controller tubes contain water or are connected incorrectly (not tight or swapped)

6.2.5. Error handling

In general, the institution making the sample analysis and measurements, the local distributor or the manufacturer must help in handling errors. Refer to the Maintenance Manual for more details.

Before restarting, the device errors have to be acknowledged by using the ACKN. key. The acknowledgement is not possible if the error continues. Check the device monitor page before acknowledging an error.

In case the device is leaking, check the proper installation of the filter cartridge as described in section 5.56.5 "Filter cartridge installation".

6.3. Device operation messages

6.3.1. Examples of report message

6.3.1.1. Interim report example

```
20-10-31 14:40:31 statusreport -----
sampled flue gas: 178.08 m3(nc,wet)
143.84 m3(nc,dry)
oxygen average 10.7 Vol%
mixing chamber avg. 40.1 °C
status: stop: no standby: no
```

6.3.1.2. Sampling report example

```
20-10-31 14:42:18 sampling protocol
GT90 Dioxin+ Version G.21.1
S/N #790574-151 Software V1.03
Location: Municipal waste incinerator
Line: 1
fluegaschannel diameter: 1600 mm
-----
constants for calculation:
reference pressure: 1013 mbar
reference oxygen: 20.9 vol%
-----
Average values from sampling time:
filter temp: 40 °C
humidity GM: 45.1 %rH
oxygen: 10.7 Vol%
-----
SAMPLING PROTOCOL:
Cartridge: XY 300 cycle 21
Volumes:
mixed gas: 969.14 (m3 nc,wet)
          934.96 (m3 nc,dry)
dilution air 791.12 (m3 nc)
sampled flue gas: 178.08 (m3 nc,wet)
          143.84 (m3 nc,dry)
Periods:
stoping time: 0.0 (h)
stand By time: 14.3 (h)
sampling time: 167.3 (h)
-----
```

6.3.2. Sampling and information messages

This section includes only messages about the sampling process and the operator access. Error messages are described in section 6.2.

Messages triggered by operator access:

```
20-10-31 14:43:33 System start
Plant: Wood waste incinerator
Line: 1
```

```
20-10-31 14:44:10 sampling stop -----
```

Messages indicating activation and deactivation of simulation:

```
20-10-31 14:44:58 simulation O2 off
```

```
20-10-31 14:44:59 simulation O2 on ----
SimValue O2 11.2 %Vol
```

The following message appears if the external supplied signal is out of the specified range (4 – 20 mA). In this case, the simulation is automatically activated but will be automatically deactivated when a valid signal is received.

```
20-10-31 14:45:29 ext. oxygen signal
out of range
AutoSim: 11.2 Vol%
```

6.4. Internet remote control

The operator can remotely access all terminal pages that are allowed by the authorization system (see section 5.1) by installing the optional remote access box.

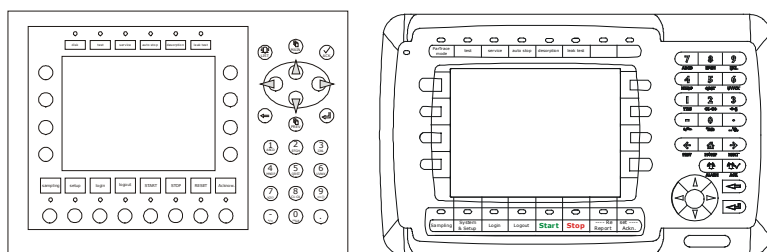


Figure 34. Terminal versions before 2007 (left) and 2007 and later (right)

6.4.1. Remote control parameters

The terminal has a network interface included. The network must be configured on the terminal and on the computer respectively to allow network communication. The standard configuration of a GT90 Dioxin+ terminal is:

Fixed IP address:	192.168.1.11
Subnet mask:	255.255.255.0
Gateway and DNS:	192.168.1.1

To directly access to terminal from a computer using an ethernet cable, the computer's network interface must be configured with the same network mask and an IP address 192.168.1.xxx, e.g., 192.168.1.50. The network socket of the terminal is found on its backside.

The device is protected by at least two password levels which have to be passed to allow access.

6.4.2. Remote control for 2007 and later devices

6.4.2.1. Network configuration

The IP configuration can be modified by the user. However, if necessary, consult the manufacturer or its local distributor for details.

For a direct connection from the terminal to a computer, a crossover ethernet cable can be used. For a connection to a router, a straight-through ethernet cable is needed in case the router does not support auto-negotiation, otherwise both cable types – straight-through or crossover– can be used.

The terminal is configured according to the following procedure:

- > open the control cabinet glass door and upper door to access the terminal from its backside
- > remove the power supply plug (24 V, green connector) from the terminal
- > remove the small grey plastic cover from the terminal
- > set DIP switch 1 to ON
- > connect power supply plug to the terminal
- > configure the terminal as needed
- > remove power supply plug (24 V, green connector) from the terminal
- > set DIP switch 1 to OFF
- > reinstall the small grey plastic cover to the terminal
- > connect power supply plug (24 V, green connector) to the terminal

Important: In case the connection is open to the Internet, it is strongly recommended to use a secure protocol (e.g., a VPN connection) and a firewall to protect the device against unauthorised access.

6.4.2.2. Software configuration

For the remote access to the terminal, it is necessary to install the E1000 *Remote Access Viewer* software on the computer used for remote access. This software is provided from the manufacturer or local distributor. For details, please refer to the respective manual which is provided with the software.

6.4.2.3. Remote access

To establish remote control connection, start the E1000 *Remote Access Viewer* program and enter the IP address of the device.

If the connection to the device is functions correctly, a window appears asking for the session password. Input the password and confirm.

Successful authentication results in displaying a separate window, showing the terminal and its actual display content. Now the device can be accessed and operated exactly in the same way as using the terminal directly at the control cabinet. Hence, a further login to the terminal is needed for accessing operator functions.

6.5. Checklists

6.5.1. Changing filter cartridge checklist

	ensure that the sampling has been stopped correctly
	ensure that a prepared clean cartridge is available for replacement
	open the cartridge's transportation box
	check the heat exchanger temperature and – if needed – use protective gloves
	disconnect the heated sample line rapid connector by pulling the outer ring down and releasing the connector from its fixed stem
	close the heated sample line end with a paper towel or a silicon plug to avoid foreign objects from entering into the tube then move it away from the cartridge's bottom
	disconnect the filter temperature sensor unit's rapid connector by pulling the outer ring down and releasing the connector from its fixed stem. Move the unit away from the cartridge's bottom
	holding up the filter chamber, open the upper quick fastener clamp of the cartridge then release and remove it
	still holding with the filter chamber, carefully pull down the cartridge out of the heat exchanger taking care not to turn the cartridge during this process
	remove the upper sealing ring which is placed around the mixing chamber
	close the upper cartridge part by attaching the cap to the mixing chamber (in case there is no separate cap available, the cap of the new prepared cartridge may be used)
	optionally, wrap the loaded cartridge with aluminium foil
	ensure that the lower part of the heat exchanger surface is free from dust and clean it if necessary
	swap the loaded cartridge with new prepared cartridge in the transportation box
	gently clean the new rubber sealing ring and place it in the new prepared cartridge at the same position where it was taken from the loaded one, namely the mixing chamber
	insert the unloaded cartridge up into the heat exchanger and ensure that the opening at the upper part of the mixing chamber is facing towards the probes. If the mixing chamber cannot be completely inserted into the heat exchanger, check the opening position by slightly turning the cartridge
	attach the upper quick fastener clamp to its place and close it making sure it is securely and firmly tightened
	reconnect filter temperature sensor unit's rapid connector to its stems
	reconnect the heated sample line's rapid connector to its stem

6.5.2. Changing backup filter checklist

	ensure that the device is stopped correctly
	switch off the compressed air supply
	unlock and open the control cabinets' front glass door
	[switch off the main power supply]
	unlock and open the control cabinet's upper door
	if needed, turn on the light
	dismount the backup filter casing from its housing metal block by pulling the blue lock on the casing downwards while simultaneously twisting the casing 45° counterclockwise
	put on clean room gloves for touching the filter
	screw out the filter and its underneath holder by turning them about 2½ full turns counterclockwise
	pull off the filter from the holder and place it in a clean storage bag
	insert a new filter in the holder until it reaches the end of the holder
	mount the filter casing by pushing it back into its housing block and turn it 45° clockwise
	check the correct and tight installation again by slightly trying to pull out the casing off the block
	close and lock the control cabinet's upper door
	[switch on the main power]
	switch on the compressed air supply

6.5.3. Starting a new sampling checklist

	device is correctly stopped and ready in a working condition	STOP LED light turns permanent red
	plant is in proper operation conditions	check velocity and temperature of flue gas
	for short-term sampling (sample volume smaller than 10 m ³): remove residues from probes	clean the probes of any residues by activating manual purging and desorption for 2 hours
	If the device has been shut down for an extended period (>2 days): remove dust from probes	clean the probes using compressed air or using a metal cleaning snake/brush
	new prepared filter cartridge is correctly installed	check that the filters are inside the cartridge
	sampling mode and configuration are correctly enabled	check the Sampling page
	device sampling data is reset	check that the values are zero in the Sampling page
	paper roll and ink ribbon in the printer	check the printer
	starting the device	press the START button
	purging successful	watch volume flow (2 m ³ /h or more, negative flow!) and pressure (decrease to -1.00 mbar or below)
	leak test successful	check leak test bar in the Maintenance page
	self-test successful	check for error messages or stand-by mode
	monitor constant plant conditions for the first 5 minutes of sampling	check volume flow rate (0.5 to 1.5 m ³ /h) and pressure at the probe currently in use (around 0.00 mbar)

6.5.4. Stopping a running sampling checklist

	check that manual mode is activated
	press STOP button to activate sampling finalisation mode
	press STOP button again in case of emergency
	if desorption is activated, wait for desorption to finish
	wait for leak test to be finalised
	check printed protocol ticket for successful leak test
	press RESET key to generate a protocol ticket
	uninstall the filter cartridge
	put the used loaded filter cartridge in the transportation box
	take the complete printed sampling protocol ticket out of the printer, make a copy and archive this copy
	enclose the original printed protocol ticket in the loaded cartridge transportation box
	send the transportation box to the laboratory

Appendix: Gasm

met Sales and Support Offices


Distributors: Please see our webpage at [Gasm

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