Dräger

Dräger X-pid® 8500/9000/9500

HMG 000*/001*/001*

Technical manual

Dräger. Technology for Life®

Contents

1 Safety-related information

1.1 Information on safety notes and warnings

Safety notes and warnings warn of dangers and provide instructions for the safe use of the product. Failure to observe these safety notes and warnings may result in personal injury or damage to property.

1.1.1 Safety notes

This document contains sections with safety notes which warn of dangers. The type of danger and the consequences following failure to observe the safety note are included in every safety note.

1.1.2 Warnings

Warnings refer to steps of a task and warn of dangers which may result while the steps are executed. Warnings appear before the steps.

1.2 Basic safety information

– Before using this product, carefully read the associated instructions for use. This document does not replace the instructions for use.

Use in areas subject to explosion hazards

Devices or components for use in explosion-hazard areas which have been tested and approved according to national, European or international explosion protection regulations may only be used under the conditions specified in the approval and with consideration of the relevant legal regulations. The devices or components may not be modified in any manner. The use of faulty or incomplete parts is forbidden. The appropriate regulations must be observed at all times when carrying out repairs on these devices or components.

2 Conventions in this document

2.1 Meaning of the warning notes

The following alert messages are used in this document to provide and highlight areas of the associated text that require a greater awareness by the user. A definition of the meaning of each alert message is as follows:

Alert icon	Signal word	Consequences in case of non-observance
⚠	WARNING	Indicates a potentially hazardous situation. If not avoided, it could result in death or serious injury.
⚠	CAUTION	Indicates a potentially hazardous situation. If not avoided, it could result in physical injury. It may also be used to alert against unsafe practices.
	NOTICE	Indicates a potentially hazardous situation. If not avoided, it could result in damage to the product or environment.

2.2 Typographical conventions

Text	Text in bold identifies labels on the device, and screen texts.
►	This triangular symbol in warning notices identifies the options for avoiding the hazard.
ℹ	This symbol identifies information that makes the product easier to use.

2.3 Trade marks

Trade mark	Trade mark holder
X-pid®	bentekk GmbH | A Dräger Company
Bluetooth®	Bluetooth SIG, Inc.
Smart-Ex®	ECOM Instruments GmbH

The trade marks cited are only registered in certain countries and not necessarily in the country where this material has been published.

2.4 Glossary

Technical term	Explanation
Blue bar	Navigation element on the bottom edge of the user interface, which contains the majority of the available activities.

Technical term	Explanation
CAS number	The CAS number is a unique identifier for a chemical substance, which is used for assignment. As chemical substances often have several names, the use of the CAS number prevents misunderstandings. CAS stands for Chemical Abstracts Service.
Menu items	Menu structure with the following views: Measure, Calibrate, Archive, Settings and User level.
Measurement	Measuring in Seeker measuring mode. Measuring in Analysis measuring mode.
Analysis measurement mode	Monitoring the concentration of individual hazardous substances.
Seeker measurement mode	Continuous monitoring of the total concentration of volatile organic compounds. This mode is only available on the Dräger X-pid 9x00.
Peaks	Signal rises in the chromatogram which are assigned to substances.
Response	Substance-specific response behaviour on a PID. Substances in the same concentration can create signals of different heights. Response factors are standardised in relation to the substance isobutylene and balance this response behaviour.
Response time	Average time from injection to the discharge of a substance from the gas chromatograph.
Tabs	Sub-menu, for example, in the Archive view, with the following tabs: Measurements, Functional tests, Calibrations and Fresh air calibrations.

2.5 Abbreviations

Abbreviation	Explanation
Analysis PID	PID for the Analysis measurement mode
CSE	Confined space entry, clearance measurement (before entering confined spaces)
GC	Gas chromatography
IMEI	International Mobile Equipment Identity, unique 15-digit serial number of the control unit
PID	Photoionization detector
Seeker PID	PID for the Seeker measurement mode (Dräger X-pid 9x00 only)
UV	Ultraviolet
VOC	Volatile Organic Compounds

3 Description

3.1 Product overview

3.1.1 Gas detector

The Dräger X-pid xx00 is a portable gas detector for clearance measurements for hazardous substances in explosion-hazard areas at the workplace. Occupational exposure limits for benzene and other toxic and carcinogenic volatile organic compounds (VOCs) can be monitored using the gas detector.

The Dräger X-pid xx00 gas detector consists of three components:

– Dräger X-pid xx00 sensor unit (referred to below as "sensor unit")
– Dräger X-pid xx00 mobile app (referred to below as "mobile app")
– Explosion-proof smartphone (referred to below as the "control unit")

The metrology and sensors are located in the sensor unit, from which measurement data is transmitted to the control unit via Bluetooth and evaluated and displayed in the mobile app.

There are three Dräger X-pid xx00 product variants that combine different sensor unit models and mobile app versions as shown in the product matrix below.

		Mobile app version	
		x000	x500
Sensor unit Model	8x00	-	Dräger X-pid 8500
	9x00	Dräger X-pid 9000	Dräger X-pid 9500

The following table contains further details on the product variants:

Product variant	Explanation
X-pid 8500	Product variant for which more than 18 target substances are qualified and quantified for analysis and which allows users to independently expand this substance database. The Analysis measurement mode is available. The product variant is exclusively offered in the USA.
X-pid 9000	Product variant for which the target substances for analysis are restricted to benzene and butadiene. The Seeker and Analysis measurement modes are available.
X-pid 9500	Product variant for which more than 18 target substances are qualified and quantified for analysis and which allows users to independently expand this substance database. The Seeker and Analysis measurement modes are available.

Depending on the product variant, the gas detector offers the Analysis measurement mode or, additionally, the Seeker measurement mode. The measurement modes are explained below:

Measurement mode	Explanation
Seeker	Broadband measurement for the preliminary check and localisation of measurement points. The "Seeker" enables a continuous, directly displayed measurement of the total concentration of all existing VOCs without considering the substance-specific response. Selective measurement is not possible. The measurement mode is comparable to individual PID measuring devices.
Analysis	Selective measurement of previously selected individual substances, known as target substances, in a matter of seconds (discontinuous). For example, the "Analysis" enables the concentrations of benzene and butadiene to be individually displayed after 30 s with a high level of accuracy. The measurement mode is comparable to GC analyses in the laboratory.

For further information, see the following chapter: "Monitoring", page 28.

3.1.2 Sensor unit

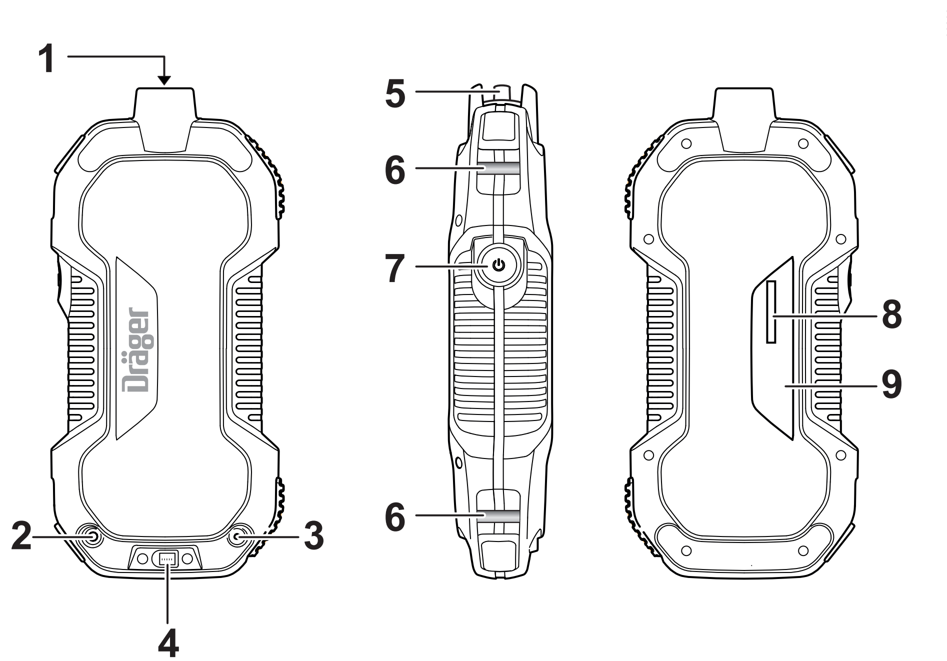
The sensor unit is equipped with the Dräger X-pid xx00 measurement technology and transmits measurement data via Bluetooth® 4.0 (Bluetooth® Low Energy).

The sample to be measured is sucked in with a volume flow rate of approx. 200 mL/min at the gas inlet at the front of the sensor unit via an internal pump. It is discharged via the corresponding gas outlet (M5 thread). The gas chromatography technology requires the use of a carrier gas that is sucked in at the gas inlet (M3 thread) and treated within the device using an activated carbon filter to generate fresh air free of volatile organic compounds. The gas inlets and outlets must be protected against water and dust.

The sensor unit can be turned on and off using the on/off button and is then controlled and operated via the control unit.

There are two different sensor unit models that are explained in the following table.

Model	Explanation
8x00	The sensor unit offers the Analysis measurement mode. The Dräger X-pid 8x00 sensor unit is exclusively offered in the USA.
9x00	The sensor unit offers both the Seeker measurement mode and the Analysis measurement mode.



1	Gas inlet with Luer connection (sample)	6	Mount for carrying strap
2	Gas outlet (M5 thread)	7	On/off button and status LED
3	Gas inlet (M3 thread)	8	Serial number
4	Charger plug (magnetic)	9	Name plate
5	Water and dust filter		

3.1.3 Control unit

The control unit is an explosion-proof Android smartphone, model Smart-EX® 01 by the company ecom. Other models and manufacturers are not approved for communication with the sensor unit and the installation of the mobile app.

The control unit connects to the sensor unit via Bluetooth 4.0 (Bluetooth Low Energy). The mobile app installed on the control unit enables the control of the measuring device and the evaluation of the received measurement data.

A software configuration ("Launcher") which hides several functions, other mobile apps and settings is implemented on the control unit. This hides the Android settings that can impair the gas detector’s functionality (e.g. turning off Bluetooth communication, deleting the mobile app and minimising the screen brightness). However, the Launcher can still be uninstalled, if necessary, and individual mobile apps can be visualised.

For further information, see the following chapter: "Adjusting the Launcher settings", page 56.

The Dräger App Store as well as the corresponding Dräger X-pid xx00 mobile app are preinstalled on the control unit upon delivery. The gas detector is therefore ready for operation without additional software installation or configuration. Please check for possible software updates via the Dräger App Store.

For further information, see the following chapter: "Updating the mobile app", page 53.

⚠ **WARNING**

Risk of explosion!

For use in explosion-hazard areas, the sensor unit and control unit generally need to be taken with you.

► The supplied ecom Smart-Ex® 01 control unit is approved for use in explosion-hazard areas.

► Pay attention to the approval and safety information for the ecom Smart-Ex® 01. The approvals for the control unit and the sensor unit differ.

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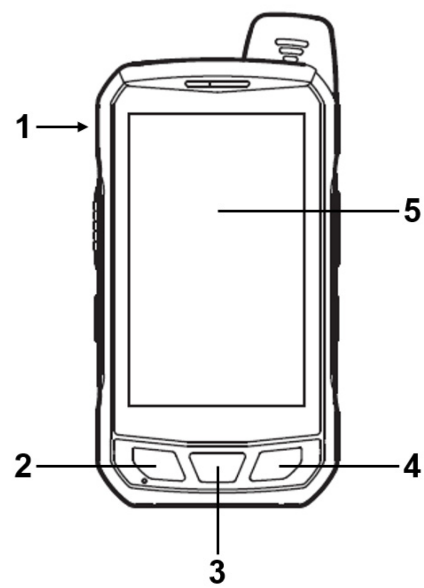


1	Power button	4	Selection button
2	Back button	5	Touch display
3	Home button		

3.1.4 Mobile app

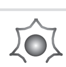
The mobile app is a native software application for Android and pre-installed on the control unit contained in the scope of supply of the Dräger X-pid xx00. The mobile app is developed and tested for the ecom Smart-Ex® 01 and is only approved for this model. Installation on other terminals is not possible.

The mobile app can be updated via the Dräger App Store. For further information, see the following chapter: "Establishing an Internet connection", page 53. Regular updates are recommended in order to benefit from new features and to rectify any errors. An upgrade from mobile app x000 version to x500 can be requested from Dräger Sales. To do so, you will need to provide the IMEI (15-digit serial number) of the control unit as part of the order, which can be found at the bottom of the name plate. The following table provides information on the different versions.

Version	Explanation
x000	Permits the selection of the target substances benzene and butadiene for the Analysis measurement mode. Other qualified and quantified substances cannot be assigned to the Analysis programs.
x500	Permits the selection of several target substances from a list of previously qualified and quantified substances for the Analysis measurement mode. For further information, see the following chapter: "Target substances", page 60. This list is expanded and can be provided via updates. Users can also qualify substances themselves and expand the mobile app database. For further information, see the following chapter: "Adjusting substances", page 40.

3.1.5 Status LED

The status LED displays various signals depending on the device and connection status of the sensor unit and mobile app.

Status LED		Description
Off		**Turned off** Sensor unit is turned off.
Pulsing		**Charge** Sensor unit is turned off and is being charged.
Alternating: Pulsing and double blinking		**Charged** Sensor unit is turned off and fully charged. Charging cable is connected.
On (continuous light)		**Connected** Sensor unit is turned on and connected to the mobile app.
Blinking		**Not connected** Sensor unit is turned on, but not connected to the mobile app.
Flashing		**Standby mode** Sensor unit is turned on, connected to the mobile app and in standby mode.
Sequence: lit, rapid blinking for 2 s and blinking		**Connection failed** Sensor unit is turned on, but the connection to the mobile app has failed. Sequence only for a short time following a failed connection attempt.
Rapid triple blinking for 6 s		**Sensor unit identified** Sensor unit is connected and the Blinking button in the Dashboard mobile app has been pressed to identify the connected sensor unit.

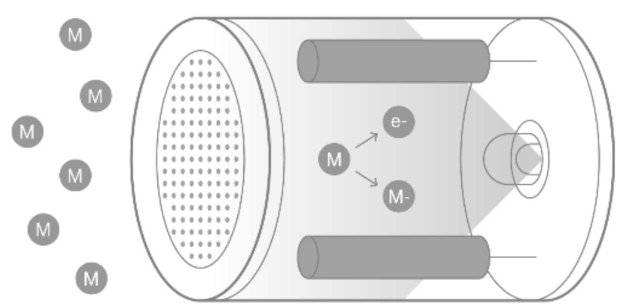
Status LED		Description
Rapid blinking		**Charging faulty** Sensor unit is turned off and is showing a charging error. The battery cannot be charged, e.g. due to the ambient temperature during charging or a fault, see "Chapter 5.5 Charging the sensor unit" for further information.
Fast flashing		**Updating firmware** The sensor unit is in boot loader mode. To switch the sensor unit to boot loader mode, hold down the on/off button for 5 s. The boot loader mode is required to update the firmware on the sensor unit. For further information, see the following chapter: "Updating the sensor unit firmware", page 53.

3.2 Feature description

The Dräger X-pid xx00 uses a miniaturised gas chromatograph (GC) in combination with a photoionization detector (PID) for the selective measurement of target substances and gas mixtures. The following section takes a short look at the underlying technology in order to provide a more in-depth understanding of the Dräger X-pid xx00 and to facilitate the interpretation of the measurement results.

3.2.1 Photoionisation detector (PID)

A photoionisation detector (PID) is a non-selective sensor for easily ionised gases and vapours. The following figure shows a schematic diagram of a PID.



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Molecules (M) of the sample to be examined are ionised in the sensor by the ultraviolet (UV) radiation, i.e. high-energy photons, of a gas discharge lamp. The ionisation releases electrons (e) from the molecules, which are trapped in the detector by the electrodes. This creates an electric current, whose progress is measured and recorded by the Dräger X-pid. The PIDs used in the Dräger X-pid are able to ionise and detect gases and vapours whose ionisation energy amounts to a maximum of 10.6 eV. This particularly includes volatile organic compounds (VOCs). Substances with an ionisation energy above 10.6 eV cannot be detected by the Dräger X-pid.

Among other things, the sensitivity of PIDs depends on the substance to be measured, i.e. different substances of the same concentration generally create different detector signals. To determine the absolute concentration of the different target substances, Dräger X-pid comes equipped with a database as standard, which contains the PID sensitivities for all specified target substances (response factors). Conversion automatically takes place in the background for the users.

As PIDs are not selective, i.e. no distinction can be made between different substances, the detector signal is the superimposition of all substance concentrations at the detector at the considered time, without taking account of the relevant substance-specific sensitivities.

PIDs have proven themselves to be particularly durable and sensitive in portable gas detectors. Calibrating the PID with test gas converts its output signal to a volume concentration (ppm or $mg \cdot m^{-3}$).

3.2.2 Gas chromatography (GC)

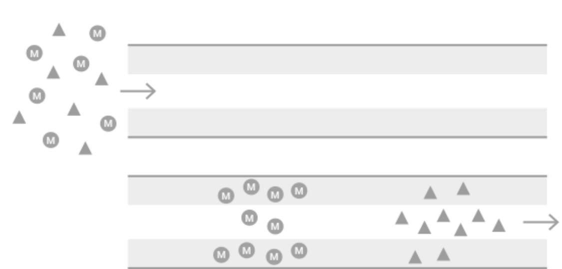
Gas chromatography (GC) is a separation process which separates different molecules in gas or vapour mixtures. The sample is injected into a capillary, the column, with the help of a carrier gas (mobile phase). The physical interaction between the gas molecules and the specially coated inner walls (stationary phase) of the column means that different molecules take different amounts of time to pass through the column.

The average time from the injection to the discharge of a substance from the column is characteristic of the relevant substance and is called the retention time. The retention time is used to assign substances, for which a retention time delta is provided as a tolerance.

So as not to distort the result of the analysis, it is important that the carrier gas is free of contamination wherever possible, i.e. from substances which can be ionised by the PID. To ensure that this is the case, the Dräger X-pid generates the carrier gas from the ambient air using an installed activated carbon filter.

The Dräger X-pid injection time lasts for one second and begins with the start of an analysis program on the user interface. After the completion of the injection up to the end of the analysis duration, a change in the gas concentration at the gas inlet of the Dräger X-pid does not affect the result of the analysis.

The following figure shows a schematic diagram of the separation of a gas mixture, consisting of two molecules, along a column.



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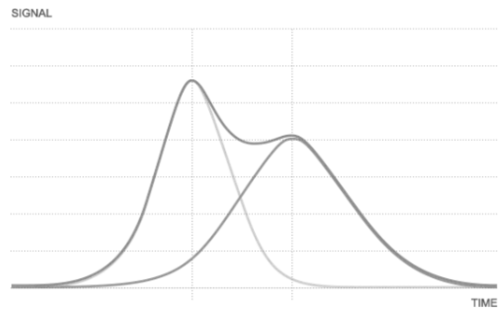
The chronological progression of the PID signal after the start of an injection is called a chromatogram. It shows two signal maxima ("peaks"), which are each caused by at least one of the substances contained in the investigated sample.

Although the peaks overlap, they can be mathematically separated from one another and evaluated by the Dräger X-pid data analysis. This improves the selectivity of the gas detector.



The observed retention time does not just depend on the investigated substance, but also on the properties of the GC separation column (e.g. length, diameter, material), the flow velocity and the ambient conditions, especially the temperature.

To obtain reproducible retention times for a substance, it is therefore important to keep the temperature of the separation column constant. To do so, the Dräger X-pid contains a regulated heating system which keeps the separation column at a constant temperature of 40 °C. The flow velocity is regulated by the set negative pressure behind the GC. The differential pressure sensor used here also compensates various ambient pressures.

The retention times of substances correlate positively with the boiling point or the volatility of a substance in non-polar (electrically neutral stationary phase) GC separation columns, as installed in the Dräger X-pid. This means that substances with lower boiling points (<50 °C) typically have extremely short retention times (<10 seconds) and substances with higher boiling points (>130 °C) have longer retention times (>80 seconds). Substances with boiling points >150 °C do not provide any meaningful measurement results because peaks become too wide and a distinction from the base signal noise is no longer possible. Benzene, with a boiling point of 80 °C, has a retention time of approx. 20 seconds.

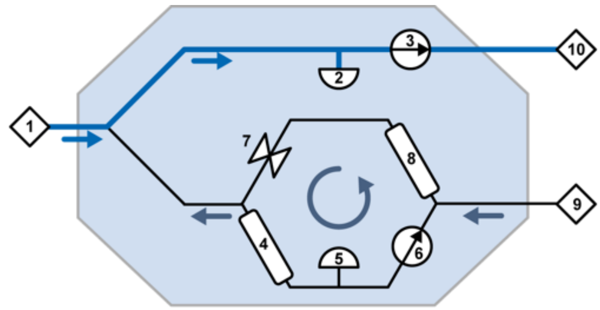
The retention times of the target substances of the Dräger X-pid are stored in a substance database in the mobile app. Retention times can fluctuate between devices due to the manufacturing tolerances of the GC separation columns, but are adjusted via the calibration.

3.2.3 Measurement

The Dräger X-pid 9x00 distinguishes between two measurement modes: First, the continuous, non-selective Seeker measurement mode and, second, the discontinuous, selective Analysis measurement mode. The Dräger X-pid 8x00 offers the Analysis measurement mode only.

After triggering an analysis, the gas sample is injected into the gas chromatograph for one second. The sensor unit then automatically switches back to the gas flow of the stationary operation. The analysis of the sample after injection into the gas chromatograph can vary between a few seconds and several minutes depending on the target substance. The gas flow of the stationary operation is active during this time. Changes to the gas atmosphere at the gas inlet do not have any impact on the result of an ongoing analysis.

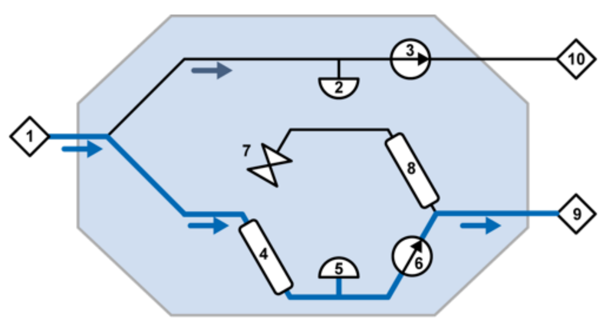
Stationary operation



The figure shows the gas flow through the Dräger X-pid xx00 during stationary operation, i.e. before and after an injection in the Analysis measurement mode. On the Dräger X-pid 9x00, this is the gas flow for continuous measurement in the Seeker measurement mode at the Seeker PID (2), whereas the Dräger X-pid 8x00 is not equipped with a Seeker PID.

The gas sample (1) is continuously sucked in by a pump (3) and detected at the Seeker PID (2) of the Dräger X-pid 9x00 before it is discharged via the gas outlet (10) as it is with the Dräger X-pid 8x00. At the gas inlet (9), the carrier gas is generated by an internal activated carbon filter (8) and permanently flushes the GC (4). This means that only filtered air reaches the Analysis PID (5) in stationary operation. The carrier gas is circulated by a second, controlled pump (6) and is therefore used multiple times in order to increase the service life of the activated carbon filter.

Injection of the sample for the Analysis measurement mode



The figure shows the gas flow through the Dräger X-pid xx00 during short-term injection of the sample for the Analysis measurement mode. The valve (7) is switched over for one second, the gas sample is carried through the GC and detected at the Analysis PID with a delay. The characteristic chromatogram is recorded in the meantime.

3.2.4 Data analysis

The signals in the Analysis measurement mode are automatically evaluated by an analysis algorithm in order to provide the concentration of the relevant target substance. The position of peaks in the chromatogram, i.e. the associated retention times (average time from injection to the discharge of a substance from the GC), is initially determined. The measured retention times can be assigned to target substances with the help of the substance database in the mobile app. The concentration of the relevant target substance is then determined from the area covered by the associated peak (green area in the chromatogram in the mobile app's user interface).

In case of gas mixtures, it is possible that multiple peaks overlap in some cases. The Dräger X-pid xx00 uses advanced mathematical algorithms and models in order to reliably calculate the concentration of the individual substances.

This increases the selectivity and reduces the cross-sensitivity. The concentrations of the associated substances are calculated from the measured peak areas with the help of substance-specific sensitivities stored in the substance database.

3.2.5 Cross-sensitivities

Cross-sensitivities refer to false positive results for target substances, which can arise in the Dräger X-pid xx00 due to substances with very similar or the same retention times. In the event of a cross-sensitivity, the result shows an incorrect concentration for a substance which was not present in the injected sample, but which could not be separated or distinguished from the relevant target substance.

Cross-sensitivities with other substances cannot be ruled out due to the complexity and number of VOCs and applications of the Dräger X-pid xx00. The assessment therefore requires specialist application-specific knowledge. Substances with low boiling points <50 °C can often not be separated from one another, while substances with higher boiling points display a good selectivity.

Examples: 1,3-butadiene cannot be separated from isobutylene, which has a very similar volatility and retention time. This is, of course, not important if 1,3-butadiene and isobutylene do not simultaneously occur in the application. Benzene cannot be separated from cyclohexane. Benzene and 1,3-butadiene can be separated from toluene, ethylbenzene, n-hexane and xylene isomers with a good selectivity.

3.3 Intended use

Dräger X-pid 8500 is a portable gas detector for discontinuous measurement of the concentration of individual hazardous substances in Analysis measuring mode in ambient workplace air and in explosion-hazard areas.

Dräger X-pid 9000/9500 is a portable gas detector for continuous measurement of the total concentration of multiple volatile organic compounds in Seeker measuring mode and discontinuous measurement of the concentration of individual hazardous substances in Analysis measuring mode in ambient workplace air and in explosion-hazard areas.

3.4 Approvals

The approvals are given on the name plate. Pictures of the name plate and the declaration of conformity are provided in the supplementary documentation (order no. 9033879) contained in the scope of supply of the sensor unit.

ℹ The name plate on the sensor unit must not be concealed.

The approvals only apply to the sensor unit; the approvals for the control unit must be observed separately.

⚠ **WARNING**

Loss of explosion protection!

Surfaces/labels may compromise the explosion protection.

► Surfaces/labels larger than 16 cm^2 must fulfil special explosion protection conditions (e.g. electrical conductivity).

4 Operation

4.1 Operating concept

The gas detector is controlled by the mobile app. Operation primarily takes place via the touch display and the control elements on the mobile app user interface. The physical buttons on the control unit can also be used. The mobile app contains five menu items, which can be used to navigate through different views:

- **Measure** view: Display the Seeker measurement mode (Dräger X-pid 9x00 only) and select the Analysis measurement mode's analysis programs.
- **Calibrate** view: Functional test program, program for calibration and fresh air calibration (zero-point for the Seeker measurement mode of the Dräger X-pid 9x00).
- **Archive** view: Display saved messages, functional tests, calibrations and fresh air calibrations as well as options for adjusting this data.
- **Settings** view: Adjustment and configuration options for substances, analysis programs, languages and concentration units, among others.
- **User level** view: Change the user level to release selected features.

The automatic notes and instructions in the mobile app guide the user through, e.g., calibrations step by step.

4.2 Symbol explanations

The following explains the symbols used in the Dräger X-pid xx00 mobile app. The operating system symbols on the control unit's display must also be noted.

4.2.1 feature buttons

Symbol	Explanation
+	Add
✓	Confirm
×	Cancel/Discard
	Save
	Delete
>	Next
<	Back
|	Move element
^	Expand
∨	Collapse
≡	Open menu

Symbol	Explanation
	Sort
	Compare
	Import
	Export
	Reset
	Search
	Reduce user level
	Select all

4.2.2 Displays

Symbol	Explanation
	Measurement/functional test/calibration/fresh air calibration
	Project folder
	Concentration unit (ppm or mg/m^3)
	Substance
	Analysis programs
	Calibration programs
	Language
	Location
	Dashboard
	Date
	Colour scheme
	Help

4.2.3 Device status

Symbol	Explanation
	Rechargeable battery charge status
	Rechargeable battery charging

Symbol	Explanation
	Process running
	Error
	Warning

4.3 Switch the gas detector on or off

4.3.1 Initial start-up

The following set-up steps should be noted and performed, where necessary, when turning on the gas detector for the first time:

– If necessary, select the language. For further information, see the following chapter: "Changing the language", page 45.
– If necessary, perform a software update. For further information, see the following chapter: "Updating the mobile app", page 53.
– Change the password for user level 1. For further information, see the following chapter: "Changing the password", page 45.

4.3.2 Turning the sensor unit on

1. Hold down the on/off button for 3 s.
   ⇒ The status LED flashes as long as the sensor unit is not connected to the control unit or mobile app (flashing of the status LED).
   ⇒ After turning on, the sensor unit is automatically in the start-up and heat-up phase, even if it is not yet connected to the mobile app.

4.3.3 Turning the sensor unit off

1. Hold down the on/off button for 3 s until the status LED goes out.

● Alternatively, the sensor unit can be turned off in the mobile app, assuming they are still connected.

NOTICE
Deep discharge
The charge status of the sensor unit must be checked at least every two months in order to prevent a deep discharge. The sensor unit cannot be turned on if the rechargeable battery is completely discharged.
► Charge the sensor unit.

4.3.4 Turning on the control unit

1. Hold down the power button for 3 s.
   ⇒ The display is activated and several logos appear in succession.
   ⇒ The display with the time appears.

2. Swipe up with your finger and unlock the display.
   ⇒ The home screen appears.
   ⇒ The mobile apps (Dräger App Store and Dräger X-pid xx00 mobile app) are displayed.

4.3.5 Turning off the control unit

1. Hold down the power button for 3 s.
   ⇒ A pop-up with the turn off button appears.
2. Select **Turn off**.
   ⇒ An acoustic signal sounds.
   ⇒ The ecom logo appears.
   ⇒ The screen turns black.

NOTICE
Deep discharge
The charge status of the control unit must be checked at least every nine months in order to prevent a deep discharge. The control unit cannot be turned on if the rechargeable battery is completely discharged and the display does not show any charging process.

► Connect the control unit to the battery charger. The display turns on after a few minutes of charging time.
► Turn on the control unit.
► Pay attention to this and additional safety information for the control unit.

4.3.6 Starting or opening the mobile app

Starting (for the first time or if the mobile app has been exited):

1. Select the mobile app icon with the **Dräger X-pid xx00** subscript on the home screen.
   ⇒ The Dräger logo appears.
   ⇒ The **Measure** view is automatically displayed.

Opening (if the mobile app has been closed or minimised):

1. Select the mobile app icon with the **Dräger X-pid xx00** subscript on the home screen.
   ⇒ The **Measure** view is automatically displayed.

4.3.7 Closing or exiting the mobile app

Closing or minimising:

1. Press the home button on the control unit.
   ⇒ The home screen appears.
   ⇒ The mobile app has been minimised and remains active in the background.

Exiting:

1. Press the selection button on the control unit.
   ⇒ Windows of the various active mobile apps are shown.

2. Swipe the mobile app window to the right.
   ⇒ This exits the mobile app.

NOTICE
The mobile app does not have to be closed or exited after operating the gas detector. In case of an error, exiting and restarting the mobile app may be helpful. If the mobile app icon has accidentally been deleted on the home screen, this can be restored.

► Swipe up on the home screen until a white background with the installed mobile apps appears. Press and hold the icon to replace it on the home screen. If the mobile app has been uninstalled, it can be reinstalled via the Dräger App Store.

4.3.8 Connecting the sensor unit and control unit

Requirements:

– Sensor unit is turned on.
– Control unit is turned on.
– Mobile app is open.

Connecting the units:

1. Select **Connect** () in the centre of the **Measure** view or **Calibrate** view.
   ⇒ The dialogue with the connection set-up appears.
   ⇒ Connecting of the units is completed in just a few seconds.
   ⇒ Once the sensor unit is connected, the status LED is permanently illuminated and the **Measure** view is displayed.

Connection to another sensor unit
The connection process starts with an attempt to connect the control unit to the most recently connected sensor unit. If the intention is to connect to a different sensor unit, click on **Other** in the connection set-up dialogue. Activated sensor units which have not been connected are displayed with their serial numbers. Select the sensor unit to be connected in order to start a new connection process.

Repeated connection attempts
In some cases, it may take a while to establish a stable connection between the control unit and the sensor unit. If the connection speed is too slow, the connection is disconnected and a new connection attempt starts automatically. A stable connection is generally established within between a few seconds and one minute. If this is not the case, the pairing should be deleted on both units (For further information, see the following chapter: "Deleting the pairing", page 53.) and re-established. A corresponding notice appears on the user interface. If this process does not result in any improvement, contact Dräger Service.

4.4 User level

The mobile app has two user levels. User level 0 means that the user is not logged in and can only access the standard features. User level 1 is available after entering a password and enables access to the **Calibrate** and **Settings** menu items for the gas detector. The settings should only be changed by trained persons with a detailed understanding of the gas detector.

The following passwords are issued by default:

User level	Password	Typical users
0	-	e.g. safety officers, OHS employees and company fire department employees
1	1234	e.g. device manager, gas protection manager, analytical laboratory employees and head of operations

NOTICE

Changing the password

Dräger recommends changing the preset password after initial start-up. For further information, see the following chapter: "Changing the password", page 45.

The following user authorisations are assigned for the main features. An adjustment of the user authorisations per user level is not possible.

Features	User level 0	User level 1
Seeker measurement mode (Dräger X-pid 9x00 only)	✓	✓
Analysis measurement mode	✓	✓
Functional test	✓	✓
Calibration	-	✓
Fresh air calibration (Dräger X-pid 9x00 only)	✓	✓
View archive entries	✓	✓
Delete archive entries	-	✓
Substance data	-	✓
Programs	-	✓
Other settings	-	✓
Update software	-	✓

In the **User level** view, the user level can be increased by entering the password. This view also appears if the user wishes to perform an action that is not permitted in their user level (for example, when opening the **Calibrate** view with user level 0). An authorisation can then be granted more quickly. In the **User level** view, a lower user level can be actively selected by selecting 🔒 . In addition, the user level is automatically reduced from 1 to 0 after one hour.

The control unit does not have the screen lock activated by default. But this can be configured:

1. Press and hold the home screen.
2. Select **System settings**.
3. Navigate to the **Security area**.
4. Navigate to the **Screen lock** area.

4.5 Preparations for operation

⚠ **WARNING**
Risk of explosion!
When using a control unit, carrying strap or accessory that is not suitable, there is a risk that flammable or explosive atmospheres could be ignited.

► The control unit on which the mobile app is installed must be suitable and approved for use in explosion-hazard areas.
► Only use a control unit that is specified in the technical manual. For further information see: "Control unit", page 10.
► Only use the carrying strap supplied (order no. 6851846) made from anti-static material.
► Only use accessories that are suitable for use in explosion-hazard areas.

Before first use, make sure that the sensor unit and control unit with installed mobile app are available.

The functional integrity must be checked daily after the operational readiness ("every day of use") and before first use with a known concentration of the gas to be measured close to the application-specific target concentration, or preferably by way of a functional test with surrogate gas (For further information, see the following chapter: "Running a functional test", page 34.).

⚠ **WARNING**
Serious damage to health!
Incorrect calibration can lead to incorrect measurement results, which may result in serious damage to health.

► Before performing safety-related measurements, check the calibration with a functional test and adjust as necessary. If national regulations exist, the functional test must be performed in accordance with these regulations.

Five steps must be completed to ensure operational readiness (typically 10 minutes):

1. Turn on the gas detector.
2. Follow the instructions in the mobile app.
3. Wait for the start-up phase, heat-up phase and temperature stabilisation to complete (For further information, see the following section: "Device statuses", page 26..).
4. Ensure that neither of the gas inlet openings or the gas outlet opening on the sensor unit are covered or contaminated.
5. Ensure that the water and dust filter is fitted and not covered or contaminated.

Then carry out the functional test.

4.6 Device statuses

The gas detector is ready for operation in consideration of chapter 4.5. If one of the following device statuses (apart from "ready for operation") is active, the key functions cannot be accessed in the Measurement and Calibration views. The user interface indicates the corresponding device statuses in these views. The features in the **Archive** and **Settings** views can continue to be used without restriction.

Device statuses	Explanation
Ready for operation	Once the preparations for operation (For further information, see the following chapter: "Preparations for operation", page 25.) have been made and none of the following phases are active.
Start-up phase	10 min After turning on the sensor unit so that the sensors achieve max. sensitivity and stability (incl. flushing phase).
Flushing phase	45 – 80 s After analyses and at the end of the start-up phase so that all substances are discharged from the GC separation column.
Heat-up phase	3 – 4 min. After turning on the sensor unit so that the GC separation column reaches the operating temperature of +40 °C
Temperature stabilisation	2 – 3 min. After the heat-up phase in order to precisely set the temperature and a warning if the GC separation column exceeds +40 °C.
Waiting phase	Manually configurable time between the individual analyses in a series analysis.
Standby mode	Can be activated manually (via the dashboard ○) in order to switch the sensor unit to a status to protect the pumps and the activated carbon filter.

4.6.1 Start-up phase

The start-up phase is used to stabilise the sensors and includes a flushing phase at the end. After ten minutes, the start-up phase, incl. flushing phase, is complete. The start-up phase runs automatically after turning on the sensor unit. The sensor unit does not have to be connected to the control unit to start and execute the start-up phase. The start-up phase is also necessary after briefly turning the sensor unit off and back on again in order to ensure that the PIDs achieve maximum sensitivity and stability.

4.6.2 Flushing phase

The flushing phase is used to flush the GC at the end of the start-up phase, after analyses, after cancelling an analysis or calibration and after exiting standby mode. The duration of the flushing phase falls as the duration of the analysis increases and typically amounts to 45 to 80 s. The process ensures that even substances with a low volatility are discharged from the GC separation column before a new analysis can be started.

With regard to the duration of the flushing phase, it is assumed that even the least volatile substance has been discharged from the GC after 150 s. Substances with even higher discharge times may be present in the application, but create a signal that is so low that the next measurement is not affected.

During the flushing phase, the gas flow through the GC is roughly doubled in order to reduce the duration of the process. Example: In an analysis program with an analysis lasting 30 s, the flushing phase lasts 60 s ([150 s – 30 s] / 2 = 60 s).

NOTICE

GC overload

If the GC is exposed to an excessive concentration (substance-dependent) in the Analysis measurement mode, the necessary flushing phase can be longer than the duration automatically defined by the device. A sharply declining baseline of the analysis signal points to this kind of overload.

► Make sure to avoid injection of excessive concentrations.

► After an overload, wait several minutes and do not turn the device off or to standby mode.

► If the Seeker of the Dräger Y-pid 9x00 exceeds a critical concentration, the user is warned before injection and must provide separate confirmation.

► The device indicates when the concentration of a target substance is above the measuring range.

4.6.3 Heat-up phase

The heat-up phase is used to bring the GC to the operating temperature and runs automatically after the sensor unit is turned on, at the same time as the start-up phase. The temperature of the GC is regulated, as it has an influence on the substance assignment. The duration of the heat-up phase depends on the initial temperature and typically takes 3 to 4 min. The heat-up phase is followed by a temperature stabilisation.

4.6.4 Temperature stabilisation

The temperature stabilisation serves to stabilise the GC operating temperature if this was previously too low (e.g. after the heat-up phase) or too high. The temperature stabilisation typically takes 2 to 3 min.

NOTICE

Temperature transgression

If the external temperature exceeds +40 °C and, as a result, the GC exceeds an operating temperature of +40 °C, the temperature stabilisation is also shown in the user interface. The X-pid xx00 gas detector is not ready for operation under these conditions and the key features are therefore blocked.

► Move the sensor unit to a cooler atmosphere so that the temperature stabilisation can be completed. The sensor unit is only operational up to +35 °C.

4.6.5 Waiting phase

In the case of series analyses, it is possible to define a waiting period between measurements. The waiting period extends from the completion of a flushing phase after an analysis to the start of another analysis. During this time, the gas detector is in a waiting phase with restricted functionality. The waiting phase is appropriate for mapping measurement strategies for which, for example, benzene measurements are to be performed at 30 min. intervals over a period of four hours.

4.6.6 Standby mode

The sensor unit can be placed in standby mode in the mobile app via the dashboard (O) to shorten the time until operational readiness following a break between measurements. Pumps are turned off in standby mode, whereas the PIDs remain turned on, the operating temperature is maintained and the sensor unit remains connected to the mobile app. Standby mode must be exited in the mobile app to restart the sensor unit. No measurements can be carried out in standby mode. The status LED flashes at regular intervals ( ). After standby mode, the device is ready for operation once again in just 85 s after completing a flushing phase. By contrast, turning off and turning on the sensor unit normally would require 10 min until the device is ready for operation.

NOTICE
Component wear
Due to component wear and tear, in particular of the PIDs, during extended breaks between measurements it is better to turn off the sensor unit instead of putting it into standby mode. For this reason, standby mode should only be used when a reduced time to operational readiness is required.

4.7 Monitoring

4.7.1 Seeker measurement mode (Dräger X-pid 9x00 only)

The "Seeker" mode is a broadband measurement for pre-testing and localising measurement points. This mode allows a continuous and direct-reading measurement of the total concentration of all volatile organic compounds (VOCs) present with an ionisation energy of less than 10.6 eV (photoionisation detector, abbreviated PID, with 10.6 eV UV radiation) without taking into account individual response factors. In this mode, the total concentration of the detected substances is determined with a simplified assumption of the response of the substance isobutylene (CAS number 115-11-7) and displayed in ppm. No individual substances are measured once multiple ionising volatile organic compounds are present.

If a measured value >0 ppm is displayed in a VOC-free atmosphere, a fresh air calibration should be performed to re-determine the zero-point. For further information, see the following chapter: "Carrying out a fresh air calibration", page 39.

If a significant deviation from the expected concentration is measured during a functional test, i.e. a measurement on a known gas standard (For further information, see the following chapter: "Functional test with surrogate gas

(standard)", page 35), a calibration to re-determine the Seeker sensitivity, among others, should take place. For further information, see the following chapter: "Carrying out a calibration", page 37.

NOTICE
Different response of substances
Different substances of the same concentration generate different signal levels on the Seeker, which is the reason why the total concentration does not correspond to the sum of the individual concentrations. By contrast, in the Analysis measurement mode, a substance’s individual response is taken into account, which enables greater accuracy.

NOTICE
Do not rely solely on the Seeker measurement mode for safety-related measurements. A target substance analysis, e.g. for benzene, is recommended, even if 0.00 ppm is displayed on the Seeker.

The following list provides an overview of the different possible interpretations of a display of, e.g., 32.1 ppm in Seeker measurement mode:

– ~32.1 ppm isobutylene[1)]
– ~14.8 ppm benzene
– ~11.0 ppm isobutylene and ~11.0 ppm toluene
– ~32.1 ppm isobutylene and ~10.0 ppm trichloroethane[2)]
– ~0.0 ppm isobutylene and diesel fumes with 10 different VOCs

Due to the different possible interpretations of the measured value, a restricted range of application is recommended for the Seeker measurement mode:

– Preliminary check of whether VOCs are even present in the ambient air.
– Localisation of measurement points for the Analysis measurement mode.
– Orienting measurements.

The described limitation also applies for single PID measuring devices due to the technology in use. For further information, see the following chapter: "Feature description", page 13.

4.7.2 Analysis measurement mode

The "Analysis" mode allows a selective measurement of previously selected individual substances, known as target substances, in a matter of seconds. A timed separation is performed on an injected gas sample using gas chromatography. Substance assignment and individual substance detection are possible as a result. For each target substance, the individual response factors are automatically taken into account and a concentration is output for each individual substance as the measurement result. The photoionisation detector used for the Analysis measurement mode ionises substances with an ionisation energy of less than 10.6 eV (10.6 eV UV radiation). Substances that can be ionised, but have a boiling temperature >150 °C, cannot be measured. Due to the low volatility, they have a retention time in which the discharge of the molecules is extended over a long period (side effect of the separation of other substances) so that their concentration is below the detection limit of the PID.

1) Response factors for isobutylene: 1.00; benzene: 0.46; toluene: 0.52
2) Ionisation energy of trichloroethane: 11.00 eV

Measurement with the Analysis measurement mode is possible by starting an analysis program once the gas detector is ready for operation. The analysis programs are contained in the **Measure** view as list elements. Detailed information can be shown by clicking on the arrow on the top right of every element. Clicking on the arrow once again hides the details. Clicking on the list element starts the relevant analysis program, i.e. a gas sample is injected and an analysis is run.

NOTICE

Start the analysis program at the right moment

When the analysis program is started, the gas sample available at the sensor unit is injected. The injection time amounts to 1 s.

► Do not start the analysis program before the gas sample is available at the device. When using accessories, such as hoses, wait until the gas sample is available at the device. With the Dräger X-pid 9x00 this can be read off in Seeker measurement mode if a measurable gas concentration is present.

Analysis programs are defined by the following parameters:

Parameter	Value range
Name	Freely selectable text to identify an analysis program.
Target substances	Selection from the quantity of qualified substances in order to assign these during an analysis and determine their concentration.
Analysis duration	Duration of the recording of the GC PID signal after injection. The duration of the analysis has a lower limit determined by the target substance with the highest retention time and is automatically calculated. The maximum configurable analysis duration is 10 min.
Flushing duration	Duration of the flushing phase, which decreases as the analysis duration increases. The flushing duration is calculated automatically to ensure that all substances have been discharged from the GC. The maximum flushing duration amounts to 73 s for an analysis duration of 5 s.
Repetitions	1 – single analysis, 2-10 series analysis. A number >10 cannot be selected as the processing power of the control unit is limited.
Waiting period	Only for series analyses: Freely selectable duration between the end of the flushing duration up to the start of the following analysis (if no flushing duration exists, up to the end of the analysis duration).

Three analysis programs are created as standard:

Name	Target substances	Analysis duration	Flushing duration	Repetitions
Analysis program 1	Benzene	30 s	60 s	1
Analysis program 2	Butadiene	10 s	70 s	1
Analysis program 3	Benzene, butadiene	30 s	60 s	1

The standard analysis programs cannot be edited or deleted. For further information, see the following chapter: "Adjusting the analysis programs", page 44.

Single analyses

Single analysis program

1. Start by clicking on the analysis program (list element).
   - Injection of the gas sample, visible as a grey area in the system of coordinates in the bottom area of the screen.
   - Separation of the gas sample and detection, visible as a graph (PID signal over the time after injection), a chromatogram.
   - Substance assignment and concentration calculation automatically take place in the background during the analysis program.
   - Result view in the table above the chromatogram and by additional data in the chromatogram (at the tops of peaks).
   - Flushing phase, only visible when changing to another view or after selecting **Save** (🖫) or **Discard** (✕) of the measurement.

The result view of a single analysis displays the following information:

Information	Explanation
Target substances	Concentrations of detected target substances. If a substance is not assigned, 0.00 ppm is displayed. In actual fact, the concentration is below the detection limit of the relevant substance. If the analysis cannot be completed (e.g. in the event of a manual cancellation), N/A is shown instead of the concentration value.
Other substances	Retention time and concentration assuming the sensitivity of isobutylene for substances or their peaks which could not be assigned to any target substance. If no other substances are found, 0.00 ppm is displayed. In actual fact, the concentration is below the substance-specific detection limit.
Chromatogram	PID signal in mV depending on the time in s after the start of injection. Peaks represent substances. Blue windows show the expected retention times, incl. a tolerance interval for the target substances. Green areas show the calculated area of a peak, which flows into the concentration calculation.
Seeker (Dräger X-pid 9x00 only)	Concentration of the Seeker measurement mode at the time of starting the injection for a measurement with the Analysis measurement mode.
Comment	Visible for saved measurements. Free text with a note on the analysis.
General	Visible for saved measurements. Date, time, location, analysis program and sensor unit serial number of the analysis.

The substance assignment for target substances takes place based on known, substance-specific discharge times from the GC column, so-called retention times. These retention times are shown as blue windows for the target substances in an analysis program during the analysis in the chromatogram. A tolerance interval is permitted for the expected retention time (typically 7.5 % of the retention time or a maximum of 3.33 seconds). If the retention time of a peak (position of the highest value) lies within a window, this peak is identified as the target substance. The peak area does not have to lie completely in the target substance window. If several peaks lie within a target substance window, the peak with the larger area is assigned to the target substance and the peaks with smaller areas are displayed as different substances. A calibration balances minor changes in the retention times and shifts the target substance windows accordingly.

The concentration is calculated for target substances and other (unknown) substances. The calculated peak areas, calibration values and, for target substances, the substance-specific sensitivity are used for this purpose. The response of isobutylene (CAS number 115-11-7) is assumed for other substances. A calibration balances any minor changes. Major deviations are detected as part of the calibration and issued as an error message.

Series analyses

Series analyses are started by analysis programs which were created with a number of repetitions >2. Series analyses are not set up by default. They can be created. (For further information, see the following section: "Adjusting the analysis programs", page 44..)

Series analysis program sequence

– Program sequence like for a single analysis. Afterwards:
– Waiting period, visible by the progress bar on the top edge of the screen.
– Repetition of the single analysis from the injection of the gas sample step until the defined number of repetitions has been performed (no waiting period after the last repetition).

The result view of a series analysis displays the following information:

Information	Explanation
Target substances	Arithmetic mean of the detected concentrations of every target substance. Single values can be displayed by expanding the map element.
Other substances	Arithmetic mean of the detected concentrations for other (unknown) substances for all analyses. Single values can be displayed by expanding the map element.
Chromatograms	Single chromatograms of all analyses in the series are shown underneath one another.
Chromatogram superimposition	Superimposition of the chromatograms of all analyses in the series. The display is reduced to the signal, i.e. the calculated peak areas are not shown.
Seeker (Dräger X-pid 9x00 only)	Arithmetic mean of the concentrations detected with the Seeker measurement mode at the start of the injection in all analyses.
Comment	Visible for saved measurements. Free text with a note on the series analysis.
General	Visible for saved measurements. Date, time, location, analysis program and sensor unit.

4.7.3 Saving and deleting measurements

After the analysis, an analysis can be discarded or saved by clicking on the corresponding buttons on the user interface. A discarded analysis is not saved and cannot be restored. An analysis must be assigned to a project before saving. This can either be newly created or an existing project can be selected. It is also possible to add a comment when saving. The date and time as well as the location at the start of the analysis are automatically assigned.

ℹ The location of an analysis is determined by a GPS receiver in the control unit and a place name is added if an Internet connection exists (e.g. "Hamburg, Germany"). If you do not wish to save the location, the feature can be disabled in the mobile app settings.

Successful calibrations and, with the Dräger X-pid 9x00, fresh air calibrations are automatically saved.

4.7.4 Exporting and importing measurements

It is possible to export saved measurements, functional tests and calibrations as well as to import previously exported measurements, functional tests and calibrations. With the Dräger X-pid 9x00 it is not possible to export fresh air calibrations and it is consequently also not possible to import fresh air calibrations.

An Excel file with the key information as well as one or two DRAEGERXPID2 files with all data is saved in the control unit’s internal memory for every exported measurement, every functional test and every calibration. These files are located in the "Dräger X-pid" folder and can be transmitted via the USB cable of the control unit. Analyses, functional tests and calibrations can be imported using the DRAEGERXPID2 files.

Exporting measurements/functional tests/calibrations:

1. Open the **Archive** view.
2. Switch to the **Measurements/Functional tests/Calibrations** tab.
3. Select the project folder/sensor unit.
4. In the Blue Bar, select **Export** ( ).
5. Choose a selection of measurements/functional tests/calibrations.
6. Confirm the export.
7. Connect the control unit via USB cable.
8. Open the internal memory, Dräger X-pid folder, project folder.

Importing measurements/functional tests/calibrations:

1. Connect the control unit via USB cable.
2. Open the internal memory.
3. Open the **Dräger X-pid** folder.
4. Open the **Import** folder.
5. Copy the DRAEGERXPID2 files to the relevant folder.
6. Open the **Archive** mobile app view.
7. In the Blue Bar, select **Import** ( ).

4.8 Use of accessories (hoses)

⚠ **WARNING**
Risk of explosion!
When using unsuitable accessories, there is a risk that flammable or explosive atmospheres could be ignited.
► Only use accessories that are suitable for use in explosion-hazard areas.

Not every accessory is suitable for use with the Dräger X-pid xx00. Only chemically resistant materials may be used to prevent the spread or absorption of samples.

⚠ **CAUTION**
Health hazard!
If accessories absorb target substances, this may lead to false negative results, i.e. a reduced target substance concentration is indicated. If accessories made from absorbent material are used, samples may contain the target substance and present a danger to health although the indicated concentration is low or 0.00 ppm.

Long flushing phases may be necessary to prevent false positive measurement results, i.e. the measurement of substances that are the result of deposits in the hose rather than the measurement point.

Short hoses made of fluoroelastomer (FKM) are only suitable to a limited extent; their suitability depends e.g. on the volatility and concentration of the target substance. PTFE hoses or hoses with an internal PTFE hose are more suitable and are preferred. Do not exceed the maximum hose length of 10 m.

The degree of absorption and the necessary flushing duration for a hose used before can be checked by performing a measurement in a VOC-free atmosphere in which no residual concentration is expected to be measured.

4.9 Running a functional test

The functional test can be carried out with test gas which contains the target substance(s) or has been qualified as a surrogate gas by Dräger. Surrogate gas should be given preference due to the health risk posed by target substances.

NOTICE
Validity of the functional test
The functional test is valid for the period of operation of the activated device or max. 24 h. It should be performed on every day of use and before performing safety-related measurements. Calibration invalidates the last functional test and it must be repeated.

NOTICE
Never apply test gas with overpressure, instead use a T-piece with fluoroelastomer hose or the gassing adapter (order no. 6851850) between the test gas cylinder and the sensor unit. Only use a standard control valve (order no. 6810397) with 0.5 mL min^{-1}.

If the functional test is not successful or the deviation of the result from the test gas concentration is greater than the internal accuracy requirements:

– Carry out a calibration.
– Repeat the functional test.

4.9.1 Functional test with surrogate gas (standard)

The functional test with surrogate gas is only valid for Dräger X-pid xx00 target substances qualified and quantified ex-factory. If additional target substances are manually qualified for the X-pid x500, the suitability of a surrogate gas for the functional test and the accuracy of the concentration calculation must be verified.

Requirements for the functional test with surrogate gas (standard):

– Suitable test gas cylinder with standard 0.5 mL/min^{-1} control valve and gassing adapter available.
– The sensor unit is ready for operation.

1. Connect the test gas cylinder to the sensor unit using the gassing adapter. The water and dust filter must be fitted.
2. Start the functional test in the Calibrate view.
3. Follow the instructions in the mobile app. Only open and close the valve on the test gas cylinder when prompted to do so.
4. The functional test is automatically evaluated and the functional test status is displayed. With the Dräger X-pid 9x00, the functional test applies the Analysis measurement mode as well as Seeker.
5. Discard or save the functional test.

A saved functional test can be viewed in the archive.

The status of the most recently performed and saved functional test is also transmitted to the sensor unit and received when a new connection is established. A sensor unit can display the following functional test statuses. The current functional test status is displayed in the top section of the **Calibrate** view via colour coding on the right edge.

Functional test status	Colour coding
Unknown	red
Passed (valid for 24 h)	green
Passed (expired after 24 h)	yellow
Passed (expired after calibration)	yellow
Failed	red

A new functional test should be carried out for all functional test statuses apart from "Passed (valid for 24 h)". The functional test status is also attached to every message in order to ensure a better traceability of the correct function of the measuring device at the time of measurement.

The functional test is passed if the measurement results deviate from the test gas concentration by no more than 20 %:

Measurement mode	Display	Result, incl. tolerance
Analysis	Isobutylene	10.0 ppm ± 20 %
	Toluene	10.0 ppm ± 20 % (8.0 to 12.0 ppm)

Measurement mode	Display	Result, incl. tolerance
Seeker (Dräger X-pid 9x00 only)	when starting analysis	29.2 ppm ± 20 % (23.4 to 35.1 ppm)

⚠ **WARNING**

Serious damage to health!

Not every surrogate gas is suitable for the functional test, e.g. a gas mixture of isobutylene and air or nitrogen is not suitable.

► Only use surrogate gas that is indicated in this chapter.

► Please contact Dräger Service if you have any questions.

Use the following gas mixture for a functional test with surrogate gas:

Designation and description	Order no.
Isobutylene and toluene calibration gas	6814046
58 L gas, 10.0 ppm isobutylene, 10.0 ppm toluene in N_2	

4.9.2 Functional test with target substance (not surrogate gas)

Alternatively to surrogate gas, the functional test can be performed with a gas mixture containing the target substance or target substances.

Requirements for a functional test with target substance (not surrogate gas):

– Suitable test gas cylinder with standard 0.5 mL/min^{-1} control valve and gassing adapter available.

– Analysis program created for the functional test. For the Dräger X-pid x000, the analysis programs for 1,3-butadiene and benzene can be used. For the Dräger X-pid x500, further analysis programs can be created to be used as a functional test. For further information, see the following chapter: "Adjusting the analysis programs", page 44.

– The sensor unit is ready for operation.

1. Connect the test gas cylinder to the sensor unit using the gassing adapter. The water and dust filter must be fitted.
2. Open the valve of the test gas cylinder.
3. Start the functional test stored as analysis program as soon as it can be assumed that the gas concentration at the gas inlet of the sensor unit is stable. With the Dräger X-pid 9x00, the Seeker can be used to evaluate the concentration.
4. Close and remove the test gas cylinder about 3 s after starting. Wait for the result.
5. The result must be manually evaluated and assessed. No functional test status display exists in the Calibrate view or in the **Archive** view for the single measurement.

The functional test is successful if the measurement results deviate from the test gas concentration by no more than 20 %:

Measurement mode	Display	Result, incl. tolerance
Analysis (e.g. for benzene with 5.0 ppm in air)	Target substance (benzene)	Test gas conc. ± 20 % (5.0 ppm ± 20 %, corresponds to 4.0 to 6.0 ppm)

Measurement mode	Display	Result, incl. tolerance
Seeker (e.g. for benzene with 5.0 ppm in air) (Dräger X-pid 9x00 only)	when starting analysis	Test gas conc. * substance-specific response factor ± 20 % (10.9 ppm ± 20 %, corresponds to 8.7 to 13.0 ppm)

ℹ Substance-specific response factors can be viewed in the settings in the substance database.

⚠ **WARNING**
Serious damage to health!
The functional test with target substance is only valid for the target substance or target substances in the gas mixture in use, not for target substances that are not contained in the gas mixture.

Use the following gas mixture for a functional test for benzene:

Designation and description	Order no.
Benzene calibration gas	6814050
58 L gas, 5.0 ppm benzene in N_2	

4.10 Carrying out a calibration

A calibration balances fluctuations in the concentration calculation and substance assignment within defined limits. Measuring device errors may mean that calibration is not possible.

On the Dräger X-pid 8x00, the Analysis measurement mode is adjusted during a calibration. On the Dräger X-pid 9x00, the Seeker and Analysis measurement modes are adjusted simultaneously during calibration starting with a fresh air calibration.

⚠ **WARNING**
Daily calibration may be necessary depending on the conditions of use. To determine the calibration status by applying test gas, see functional test. If no deviations in the calibration status are observed in consecutive tests, the calibration interval can be gradually extended to up to 60 days. Further information is available from your Dräger representative. If necessary, calibrate the sensor unit.

NOTICE
Only perform a calibration with isobutylene and toluene calibration gas (order no. 6814046).

NOTICE
Never apply test gas with overpressure, instead use a T-piece with fluoroelastomer hose or the gassing adapter (order no. 6851850) between the test gas cylinder and the sensor unit. Only use a standard control valve (order no. 6810397) with 0.5 mL/min^{-1}

Requirements:

– Suitable test gas cylinder with standard 0.5 mL/min^{-1} control valve and gassing adapter available.
– The sensor unit is turned on, connected to the mobile app and the start-up phase, heat-up phase and temperature stabilisation have been completed.

1. Connect the gas cylinder to the sensor unit using the gassing adapter. The water and dust filter must be fitted.
2. Start the calibration in the mobile app and follow the instructions. The user is automatically guided through the calibration process and notified when the test gas needs to be applied.

If the calibration is not successful:

– The mobile app will display the calibration as failed.
– Repeat the calibration, and have the sensor unit tested by maintenance personnel as appropriate.
– Check the test gas.
– Follow the instructions in the mobile app.

Calibrations are automatically saved and can be viewed in the archive. The following information is provided:

Displayed information	Explanation
Sensitivity	
Seeker factor (Dräger X-pid 9x00 only)	Factor for the concentration calculation in Seeker measurement mode which calibrates the sensitivity of the Seeker PID.
Seeker (Dräger X-pid 9x00 only)	Determined sensitivity of the Seeker PID in percent; must be between 25 and 300 % for the calibration to be successful.
Analysis factor	Factor for the concentration calculation in Analysis measurement mode which calibrates the sensitivity of the Analysis PID.
Analysis	Determined sensitivity of the Analysis PID in percent; must be between 50 and 300 % for the calibration to be successful.
GC factor gradient	Gradient for the concentration calculation in Analysis measurement mode which calibrates the relative sensitivity between target substances based on their retention time and must be between 0 and 0.1 for calibration to be successful.
Selectivity	
Column efficiency	A parameter that describes the separating performance of the GC. The parameter corresponds to the square of the ratio between the retention time of toluene and the standard deviation of the peak of toluene from the calibration. A typical value is between 2,000 and 4,000.

Displayed information	Explanation
GC pressure	Negative pressure downstream of the GC used to control the flow rate through the GC. During calibration, the GC pressure is determined such that the retention time of toluene corresponds to the retention time specified in the database. This ensures that the target substances have the same retention times on all devices.
GC pressure factor	Factor by which the GC had to be adjusted during the last calibration. Calibration must be repeated as long as the value deviates by more than 0.05 from 1.00 in order to correct the factor to match the optimum value of 1.00.
General	
Date	Date of the first calibration measurement
Time	Time of the first calibration measurement
Location	Location of the first measurements (For further information, see the following chapter: "Saving the location", page 45 and displayed "Measurements" information)
Program	"Calibration" or "N/A"
Serial number	Serial number of the calibrated sensor unit
Measurements	
Measurement 1 *Measurement 2*	Measurements and their location are only displayed if the calibration was performed with the current control unit. If the sensor unit was not calibrated with the current control unit, only the above information minus the measurements and location is displayed; in addition, "N/A" is displayed for the program.

All of the data determined during the calibration and necessary for the concentration calculation is saved on the sensor unit so that a calibration is available when connecting to any control unit. The two calibration measurements are not transmitted and can therefore only be displayed if they were performed with the current control unit.

4.11 Carrying out a fresh air calibration

ℹ Fresh air calibration is only available on the Dräger X-pid 9x00.

Observe the following information for the fresh air calibration:

– The zero-point of the Seeker measurement mode can also be calibrated in the field in contaminated atmospheres by generating internal fresh air.
– Fresh air calibration is not a substitute for calibration, where the sensitivity of the Seeker is calibrated in addition to the zero-point. For further information, see the following chapter: "Carrying out a calibration", page 37.
– A fresh air calibration has no effect on the Analysis measurement mode.

1. Start the fresh air calibration in the Calibrate view of the mobile app and follow the instructions. During the fresh air calibration, you need to hold your finger in front of the water and dust filter in order to reverse the internal gas flows and conduct filtered air to the Seeker PID.

Fresh air calibrations are automatically saved and can be viewed in the archive. The zero-point is displayed in mV.

4.12 Archive

ℹ Fresh air calibration is only available on the Dräger X-pid 9x00.

Saved measurements, functional tests, calibrations and fresh air calibrations can be recalled in the **Archive** view. You can switch between the **Measure**, **Functional tests**, **Calibrations** and **Fresh air calibrations** tabs. Measurements are grouped by projects or date. **Sort** ( ) lets you change the sorting by project or date. Functional tests, calibrations and fresh air calibrations are grouped by the serial numbers of the sensor units. The detailed view for saved measurements corresponds to the result view directly after the measurement.

In the **Archive** view, measurements, functional tests, calibrations and fresh air calibrations can be selected for **Deletion** in the Blue Bar ( ). This process needs to be confirmed.

ℹ Deleted measurements, functional tests, calibrations and fresh air calibrations cannot be restored after they are deleted. The regular exporting of measurements and backup on another storage media is therefore recommended.

In the **Archive** view, measurements can be selected for **Comparison** in the Blue Bar ( ). In this case, average values and superimposed chromatograms are displayed, similar to the results view of a series analysis. For further information, see the following chapter: "Analysis measurement mode", page 29.

4.13 Adjusting substances

The following information can be checked in the **Settings** view for every substance and can be configured in some cases:

Information	Explanation	Configurable
Substance name	Common name of a substance	Yes
CAS number	Used to clearly identify substances	No
Molecular formula	Common notation indicating the type and number of atoms in a substance.	No
Boiling point, melting point, molar mass, density, vapour pressure and ionisation energy	Physical and chemical substance properties	No
PID response factor	Compensation of the substance-specific sensitivity of PID signals	No

Information	Explanation	Configu-rable
GC response factor	Additional compensation of the sub-stance-specific sensitivity of GC PID signals (standard value = 1)	Yes
Detection limit	Concentration from which a substance can be detected	No
Determination limit	Concentration from which a substance can be measured	No
Upper limit	Experimentally and/or theoretically determined concentration up to which a substance can be measured	No
Response time	Expected discharge time from the GC column	Yes
Retention time delta	Interval for the expected discharge time from the GC column (typically 7.5 % of the retention time or a maximum of 3.33 seconds)	Yes
Limit value	Concentration threshold from which an alarm is triggered	Yes

A distinction is made between **Qualified substances** and **All substances**. Only qualified substances can be added to analysis programs for use as target substances in an analysis. For further information, see the following chapter: "Qualifying substances and correcting the substance assignment", page 42. Substances are qualified by entering the values for the retention time and retention time delta.

Qualified substances are distinguished into qualified and qualified and quantified target substances.

Target sub-stances	Explanation	Colour coding
Qualified sub-stances	The concentration calculation is done based on simplified assumptions with modest demands on accuracy.	yellow
Qualified and quantified sub-stances	The concentration calculation is done based on substance-specific parame-ters determined in a laboratory by Dräger to meet high demands on accu-racy.	green

A concentration calculation for qualified substances takes place using simplified assumptions as standard. A quantification allows this concentration calculation to be improved for qualified substances. For further information, see the following chapter: "Quantifying substances and correcting the concentration calculation", page 43. The target substances of the Dräger X-pid xx00 are already qualified, but their concentration calculation can also be corrected, e.g. in the event of higher accuracy requirements close to a customer-specific target substance concentration.

NOTICE

Calibrate before adjustment

The correction of the concentration calculation and the substance assignment (shift in the retention time) for isobutylene and toluene determined by means of a calibration is transferred to all qualified substances. The retention time and the GC response factor (For further information, see the following chapter: "Quantifying substances and correcting the concentration calculation", page 43) may therefore only be adjusted based on analysis results that were determined directly after a calibration. This also applies for the qualification of a new substance. Otherwise, an inaccurate substance assignment may occur during the next calibration after an adjustment.

NOTICE

No adjustment of isobutylene and toluene

An adjustment of the values for isobutylene and toluene is not possible, as a precise re-determination of the concentration calculation (via sensitivity) and substance assignment (via retention time) takes place for both substances as part of the calibration.

4.13.1 Qualifying substances and correcting the substance assignment

Substances can only be qualified with the Dräger X-pid x500.

Requirements:

– The retention time of the substance to be qualified is known.

Determining the retention time

The retention time can be experimentally determined by test measurements on a known sample with the substance to be qualified. Carry out at least three analyses and use an average value as the expected retention time. A standard value of 7.5 % of the retention time or a maximum of 3.33 seconds can be entered as the retention time delta.

Qualifying substances:

1. Carry out a calibration.
2. Open the **Settings** view.
3. Enter the password.
4. Scroll to the **Substances** area and select it.
5. Switch to the **All** tab.
6. Select the substance to be qualified (it is possible to search by name and CAS number).
7. Enter the **Retention time** and **Retention time delta**.

Dräger recommends always using the CAS number to clearly identify a substance, as different substances have similar names and there is a risk of confusion.

If the substance assignment after a calibration is not sufficiently accurate, a substance-specific, manual correction via the retention time is possible; the procedure is the same as for the qualification of a substance.

Example - manual correction of the styrene substance assignment:

If, after calibrating and analysing with the target substance styrene on a known sample, the measured retention time of the substance deviates from the expected retention time, the expected retention time for the substance can be overwritten with the measured retention time. This is possible using the Retention time input field in the substance data view for styrene.

4.13.2 Quantifying substances and correcting the concentration calculation

Quantification ensures precise concentration calculations through substance-specific parameters. Dräger determines the parameters in a laboratory by performing at least three measurements per concentration point at a minimum of ten concentration points distributed over the whole measuring range of a target substance. For requests regarding quantification please contact the Dräger service.

Quantification cannot be performed by the user. If the concentration calculation after a calibration is not accurate enough, a substance-specific, manual correction via the GC response factor is possible.

Requirements:

– The GC response factor of the substance to be corrected is known.

Determining the GC response factor

The GC response factor can be experimentally determined by test measurements on a sample with a known concentration of the substance in question. Carry out at least three analyses and use an average value as the GC response factor.

Quantifying substances:

1. Carry out a calibration.
2. Open the **Settings** view.
3. Enter the password.
4. Scroll to the **Substances** area and select it.
5. Select the substance to be corrected (it is possible to search by name and CAS number).
6. Enter the **GC response factor**.

Validity of the GC response factor

The GC response factor is determined for a specific substance at a specific concentration and, consequently, offers accuracy for this concentration only. The accuracy may be different at other concentrations.

Example - manual correction of the benzene concentration calculation:

If, after calibrating and analysing with the target substance benzene on a known sample, the measured concentration of the substance deviates from the expected concentration, this deviation can be corrected by adjusting the GC response factor for benzene. Assuming that a test gas should contain 1.0 ppm benzene and the average value of three benzene measurements on this test gas amounts to 1.2 ppm benzene, the existing benzene GC response factor must be corrected by 1.0/1.2. Assuming that the benzene GC response factor was previously 0.95, it must be corrected to a rounded value of 0.79 (=0.95 x 1.0/1.2). See the following equation for clarification:

$$\text{New GC response factor} = \text{Old GC response factor} * \frac{\text{Expected concentration}}{\text{Displayed concentration}}$$

Accuracy of test gases
Test gases have different accuracies, which are either listed on the test gas cylinder or the associated analysis certificate. Typical deviations between the target and actual concentration of 10 % can be assumed. The quantification at Dräger places especially high demands on the accuracy of test gases <10 %.

4.14 Adjusting the analysis programs

Three analysis programs are created as standard (For further information, see the following chapter: "Analysis measurement mode", page 29).

Creating/changing an analysis program:

1. Open the **Settings** view.
2. Enter the password.
3. Scroll to the **Programs** area.
4. Select **Measurement programs**.
5. Select **+** in the top navigation in order to create a new analysis program or select an element in the list of existing analysis programs to change it.
6. Enter the **Name**.
7. Select **Target substances**.
8. Determine the **Repetitions** (for series analysis, also determine the **Waiting period**).
9. Determine the **Analysis duration** (the **Flushing duration** is automatically calculated).
10. Select **Create/Save**.
11. The new/changed analysis program is visible in the **Measure** view.

Deleting an analysis program:

1. Open the **Settings** view.
2. Enter the password.
3. Scroll to the **Programs** area.
4. Select **Measurement programs**.
5. Select the analysis program to be deleted.
6. Select **Delete** and confirm.

The standard analysis programs cannot be changed or deleted. The Blue Bar contains further icons that can be used to rearrange analysis programs or to hide them in the **Measure** view.

4.15 Adjusting calibration programs

The target concentrations of test gases may deviate as can be seen in the supplied certificates or by performing test measurements e.g. with laboratory analysis tools. A test gas cylinder may e.g. contain 10.2 ppm isobutylene and 9.80 ppm toluene. In order to avoid that calibration is wrongly done based on target concentrations of 10.0 ppm each, the expected concentrations can be adjusted for calibrations and functional tests (within a range of 8.00 ppm to 12.0 ppm).

Adjusting expected concentrations:

1. Open the **Settings** view.
2. Enter the password.
3. Scroll to the **Programs** area.
4. Select **Calibration programs**.
5. Select **Calibration/Functional test**.
6. Enter the concentrations.

The adjustment is automatically transferred to the respective other program.

4.16 Additional configurations

4.16.1 Changing the language

1. Open the **Settings** view.
2. Enter the password.
3. Scroll to the **Language** area.
4. Select the language.
5. The mobile app restarts in the selected language. All settings and saved data are retained.

4.16.2 Changing the password

1. Open the **Settings** view.
2. Enter the password.
3. Scroll to the **Password** area.
4. Assign a new password.

ℹ If you have forgotten the password, contact Dräger Service to have it restored.

4.16.3 Saving the location

1. Open the **Settings** view.
2. Enter the password.
3. Scroll to the **Location** area.
4. Enable or disable the Location option.

ℹ The location of an analysis is determined by a GPS receiver in the control unit and a place name is added if an Internet connection exists (e.g. "Hamburg, Germany"). If you do not wish to save the location, the feature can be completely disabled.

4.16.4 Configuring the concentration units

Measurement mode	Concentration unit
Seeker (Dräger X-pid 9x00 only)	ppm Not configurable
Analysis	ppm or mg/m^3 Configurable

Configuring the concentration units for the Analysis measurement mode:

1. Open the **Settings** view.
2. Enter the password.
3. Scroll to the **Concentration unit** area.
4. Select the **ppm** or **mg/m^3** option.

All concentrations are initially determined in ppm and converted to mg/m3 when this concentration unit is selected. The constants used for this purpose are:

– Reference temperature: 293.15 K (20 °C)
– Reference pressure: 1013 mbar
– Gas constants: 8.314472 J mol^{-1} K^{-1}
– Molar mass: Individual molar mass of the target substances and molar mass of isobutylene for other substances.

With the Dräger X-pid 9x00, the concentration units must be adjusted for the Seeker measurement mode analogous to the Analysis measurement mode.

Recommendation on the concentration unit
As additional assumptions have to be made to calculate concentrations in the mg/m^3 units, we recommend performing measurements in the ppm concentration unit. The gas detector is specified for the use of the ppm concentration unit.

5 Troubleshooting

If the following remedial measures are unsuccessful, contact Dräger Service.

As troubleshooting and error analysis are often time-consuming, first rule out any possible user error. For further information, see the following chapter: "Frequent operating errors", page 49

5.1 Error

Error	Cause	Remedy
Sensor unit cannot be turned on.	Rechargeable battery not sufficiently charged.	Charge the rechargeable battery.
Control unit cannot be turned on.	Control unit has crashed or suffered a deep discharge.	Hold down the power button for a very long time (approx. 20 s). Charge the rechargeable battery for a long time (approx. 1 h).
Sensor unit turns off immediately after turning on.	Rechargeable battery not sufficiently charged. The energy consumption is high during the heat-up phase after the device is turned on.	Charge the rechargeable battery.
Sensor unit cannot be charged.	Battery charger or connector defective or has bad contact.	Check the battery charger and connector.
	Ambient temperature not complied with during charging.	For further information, see the following chapter: "Charging the sensor unit", page 51.
Mobile app is frozen or has a faulty display.	Software is in an unexpected status.	Exit and restart the mobile app.
A stable connection cannot be established between the control unit and the sensor unit.	To ensure a desired data transmission speed between the control unit and the sensor unit, their connection may be actively disconnected multiple times in the start-up phase until a stable connection is established.	If a stable connection is not established even after several minutes, delete the control and sensor unit pairing. For further information, see the following chapter: "Deleting the pairing", page 53.

Additional errors are displayed in a dialogue window in the mobile app's user interface when they occur and are superimposed on the current view. The dialogue window describes the error and a solution. To close the dialogue window, confirm the error with OK. If errors remain, they are displayed to the user via a red dashboard icon (**O**). The description of the error can be accessed via the dashboard (**O**). In addition, existing errors are displayed in the dialogue window whenever a new connection is established between the sensor unit and the control unit.

The defects associated with the error messages are critical for the correct function of the gas detector. The key features of the Dräger X-pid xx00 are therefore blocked.

Code	Error message
[X000 0000]	**Analysis PID defective.** Please turn the sensor unit off and back on again.
[0X00 0000] (Dräger X-pid 9x00 only)	**Seeker PID defective.** Please turn the sensor unit off and back on again.
[0080 0000]	**GC pressure not reached.** Check the inlets and outlets for contamination and whether the water and dust filter is installed. Please turn the sensor unit off and back on again.
[0040 0000]	**The sensor unit overheated.** Please move to a cooler atmosphere.
	Functional test failed Please check whether the functional test was performed as per the instructions and repeat the functional test. For further information, see the following chapter: "Running a functional test", page 34.
	Calibration failed Please check whether the calibration was performed as per the instructions and repeat the calibration. For further information, see the following chapter: "Carrying out a calibration", page 37.
(Dräger X-pid 9x00 only)	**Fresh air calibration failed** Please check whether the fresh air calibration was performed as per the instructions and repeat the fresh air calibration. For further information, see the following chapter: "Carrying out a fresh air calibration", page 39.

5.2 Warnings

Warnings are displayed in a dialogue window on the mobile app's user interface when they occur and are superimposed on the current view. The dialogue window describes the warning and a solution. To close the dialogue window, confirm the warning with the OK button. If warnings remain, they are displayed to the user via a yellow dashboard icon (**O**). The description of the warning can be accessed via the dashboard (O). In addition, existing warnings are displayed in the dialogue window whenever a new connection is established between the sensor unit and the control unit.

The causes associated with the warning messages generally only occur for a short time before the gas detector is once again ready for operation. The key features of the Dräger X-pid xx00 are therefore not blocked if warnings exist. If warnings occur regularly or permanently, contact Dräger Service.

Code	Error message
[0000 1000]	**Gas inlet is blocked.** Please check for possible blockages. The sensor unit has detected a pressure drop at the gas inlet. This may be caused by the kinking of an attached hose, a blocked water and dust filter or other things.
[0000 2000]	**Internal gas flows faulty.** Various causes may lead to the warning that the internally measured pressure difference is outside the valid range. Please check whether the water and dust filter is attached. Tightly fit the Luer connection. Check whether the gas inlet (M3 thread) and/or gas outlet (M5 thread) is blocked and remove any blockage.
	Bluetooth connection interrupted. Please move the devices close together. The control unit could not receive any data from the sensor unit. An attempt will first be made to re-establish the connection in the background. If this is not possible, the disconnection of the Bluetooth connection is displayed. Avoid sources of interference between the devices.
	Bluetooth data transmission is delayed. Please move the devices close together. The sensor unit has detected an increased number of data packages to be transferred. Data may be lost if this queue becomes too long. Avoid sources of interference between the devices and reconnect the sensor unit to the control unit if the warning appears repeatedly.
(Dräger X-pid 9x00 only)	**Seeker concentration is too high.** The sensor unit will automatically be switched to standby mode in a few seconds, as a critical concentration has been exceeded on the Seeker. The total VOC concentration amounts to >60.0 ppm. To protect the measuring device, the pumps are turned off to avoid stressing the internal activated carbon filter. This automatic switch to standby mode can be prevented by pressing the **Ignore** button. Specific reference is made to the high concentration when starting an analysis program.

5.3 Frequent operating errors

Operating error	Description
Incorrect valve	The test gas cylinder may only be used with a control valve with a constant flow of 0.5 L/min. Supply pressure regulators or trigger valves lead to incorrect functional tests and calibrations.

Operating error	Description
No gassing adapter	The control valve must not be connected to the sensor unit's inlet directly by hose. Only use the supplied gassing adapter (fluoroelastomer hose with T-piece) so that the test gas does not enter the sensor unit with overpressure.
Incorrect accessory material	Material such as silicone absorbs substances. Do not use accessories, such as hoses, which are made from this material. Use PTFE or fluoroelastomer hoses instead.
No water and dust filter	The water and dust filter protects the sensor unit from contaminants, such as large particles and water. It must always be attached, even during functional tests and calibration. Tightly fit the Luer connection.
Test gas empty	On the control valve, check whether adequate pressure and test gas is available (below approx. 5 bar, the test gas may be empty). Otherwise, the functional test and calibration are faulty and warnings are issued in the user interface.
Test gas left open	During a functional test and calibration, the test gas must only be opened if this is indicated on the user interface. The test gas can be closed during the analysis, as the injection already takes place in the first second.
Test gas applied too early	During functional test and calibration, test gas must only be applied once the mobile app displays a corresponding prompt. Otherwise, the functional test may fail due to a too high measured concentration at the Seeker.
Incorrectly injected	Only start analysis programs when the sample has actually reached the sensor unit. When using hoses or accessories, it may take longer until a sample has reached the sensor unit.
Luer connection leaking	When connecting the water and dust filter and accessories, make sure that the Luer connection is tight.

6 Maintenance

⚠ WARNING
Danger to health!
Test gas may damage health if inhaled.

► Do not inhale the test gas. Observe the hazard warnings of the relevant Safety Data Sheets and the instructions for use of the gas detector! Observe the national regulations when defining calibration intervals.

6.1 Maintenance intervals

Test	Interval
Inspection and maintenance by experts.	Every 12 months

Experts are specifically trained employees that have knowledge of and experience in inspecting and maintaining the relevant devices.

National and international regulations for inspection and maintenance must be observed.

6.2 Charging the sensor unit

⚠ WARNING
Risk of explosion!
The chargers are not constructed in accordance with regulations for wet weather conditions and explosion protection.

► Do not charge in explosion-hazard areas!

► Use the battery charger supplied (type FW8001/12, order no. 6851844 or type GTM96180-1217.9-5.9, order no. 6850018) with magnetic connector to charge the sensor unit.

► Ambient temperature during the charging process: +5 to +35 °C.

⚠ WARNING
Health hazard!
Magnets can affect the function of pacemakers and implantable cardioverter defibrillators (e.g. actuating the reed switch).

► Observe a minimum distance of 20 cm between the magnet connection and the implanted devices to avoid malfunctions and health hazards.

ℹ The rechargeable battery cannot be changed. If the rechargeable battery is faulty, it can be replaced during maintenance.

– The sensor unit can be charged whether turned on or off.
– When turned on and connected, the charging status of the sensor unit can be displayed in the mobile app.
– When turned off, the status LED pulses during the charging process (). When the sensor unit is fully charged, the status LED also blinks twice between the pulses ().

The typical charging time is 5 hours from complete discharge to full charge. Never store the device for extended periods (max. 2 months) without a power supply to avoid a complete discharge of the battery.

6.3 Replacing the water and dust filter

– Replace the water and dust filter if contaminated or blocked.
– Only use the water and dust filter listed as a spare part.

Designation and description	Order no.
Water and dust filter (without Luer adapter)	8319359
Water and dust filter set (incl. Luer adapter for OD ~5 mm and 3 mm)	8319364

6.4 Replacing the carrying strap

The carrying strap (order no. 6851846) is optional and can be fitted or removed as necessary. Note the corresponding supplementary sheet (order no. 9033883) for the sensor unit for this purpose (included in the sensor unit's scope of supply).

⚠ WARNING
Risk of explosion!
When using an unsuitable carrying strap, there is a risk that flammable or explosive atmospheres could be ignited.
► Only use the carrying strap supplied (order no. 6851846), which is made from anti-static material.

6.5 Cleaning

The sensor unit does not require any special care.

- In the case of heavy contamination, the sensor unit can be carefully cleaned with cold water. A sponge can be used for wiping if necessary.

⚠ CAUTION
Damage to the sensor unit
The sensor unit may be damaged by the ingress of liquid.
► Make sure that no liquid penetrates into the gas inlet openings and the gas outlet opening on the sensor unit.
► Clean carefully as required. Do not use detergents or solvents.

⚠ CAUTION
Damage to the activated carbon filter
Detergents and solvents can stress and potentially overstress the internal activated carbon filter.
► Do not use detergents or solvents near an operating sensor unit.

- Dry the sensor unit with a cloth.

6.6 Establishing an Internet connection

1. Open the Android drop-down menu by pulling it down from the top edge of the screen.
2. Select **WLAN**.
3. Select the network and enter the password as necessary.

✓ The Internet connection is established.

Alternatively, a SIM card can be inserted in the control unit and an Internet connection can be established via the mobile phone network. A description is provided in the ecom Smart-Ex 01 instructions for use.

6.7 Updating the mobile app

1. Establish an Internet connection. For further information, see the following chapter: "Establishing an Internet connection", page 53.
2. Open the **Dräger App Store** mobile app on the home screen.
   ⇒ The version is visible.
3. Select **Update**.
4. Follow the instructions on the user interface.

✓ The mobile app has been updated.
Saved messages, settings, etc., are not lost when an update occurs.

6.8 Updating the sensor unit firmware

1. Turn the sensor unit off.
2. Hold down the sensor unit’s on/off button for more than 5 s until the status LED flashes rapidly.
3. Connect the control unit to the sensor unit via the mobile app.
4. Open the settings and select **Update firmware**.
5. Select the firmware version with the highest number.
6. Select **Send**.
   ⇒ Wait for the update process to complete.
7. Confirm **Update successful** with **OK**.
   ⇒ The sensor unit is automatically turned off.
8. Turn the sensor unit on normally and connect.

6.9 Deleting the pairing

Deleting the pairing on the control unit:

1. Press and hold down on the home screen.
2. Select **System settings**.
3. Select **Bluetooth**.
4. Click on the cogwheel next to the serial number for which the pairing is to be deleted.
5. Select **Remove**.

Deleting the pairing on the sensor unit:

1. Turn on the sensor unit.
2. Immediately after turning it on, continue to quickly press the on/off button until the status LED briefly flashes.

7 Device settings

7.1 Device and sensor settings

The settings relating to the gas chromatography and photoionisation detectors cannot be configured.

7.2 Substance settings

The substance database consists of configurable and non-configurable values for every substance. For further information, see the following chapter: "Adjusting substances", page 40.

Select **Reset to factory settings** to restore the standard values for a substance.

Contact Dräger if ambiguities arise for non-configurable values.

All manually configured values are lost when resetting them to the factory settings for a substance.

7.3 Alarm settings

The Dräger X-pid xx00 is not a personal warning device, see intended use. It is, however, possible to define alarms in case of transgressions of threshold values for measurement results in the Analysis measurement mode. Visual alarms are displayed in the mobile app’s user interface and acoustic alarms as well as vibration alarms are issued by the control unit. These alarms are issued when substance-specific threshold values are exceeded. The alarms are disabled as standard. An alarm can be individually enabled or disabled and an individual threshold value can be defined for every substance.

NOTICE
Observe the national provisions
Standard threshold values are stored for some substances, which are frequently used as limit values. The user must check and observe the associated national provisions.

Configuring alarms

1. Open the Settings view.
2. Enter the password.
3. Select .
4. Select the substance.
5. Scroll to the **Warning** area.
6. Select the **Alarm** switch.
7. Adjust the limit value.

All manually configured values are lost when resetting them to the factory settings for a substance.

7.4 Adjusting the Android settings

1. Press the home button on the control unit.
   ⇒ The home screen is displayed.
2. Press and hold down on the black background.
   ⇒ A dialogue appears.
3. Select **System settings**.
   ⇒ All Android settings are visible and configurations, for WLAN for example, are available.

7.5 Adjusting the Launcher settings

1. Press the home button on the control unit.
   ⇒ The home screen is displayed.
2. Press and hold down on the black background.
   ⇒ A dialogue appears.
3. Select **APEX settings**.
   ⇒ All Launcher settings are visible.

7.5.1 Removing the Launcher

1. Open the Launcher settings.
2. Select **Advanced settings**.
3. Determine the **Standard launcher**.
4. Select **Google Now Launcher**.
5. Confirm the **Use Google Now Launcher as start app?** dialogue with **Always**.

✓ The original factory settings for the control unit are established.

7.5.2 Displaying other mobile apps

1. Open the Launcher settings.
2. Select **Drawer**.
3. Select **Hidden apps**.
4. Remove the check mark for mobile apps to be displayed.

✓ The mobile app is visible on the home screen.

ℹ In some cases, the mobile app icon is not visible directly on the home screen.

– On the home screen, swipe up on the black background with your finger. All displayed mobile apps appear on a white background.
– Holding down an icon allows a shortcut to be created; this shortcut can be dragged to the home screen.

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8 Transport

The sensor unit contains lithium batteries. During transport of the sensor unit, and particularly during air transport, observe the relevant safety regulations for lithium batteries.

Do not transport the sensor unit at below -20 °C or above +50 °C as it could become damaged.

NOTICE
Observe the safety instructions of the control unit!
The safety instructions of the control unit contain separate information on storage and must be observed.

9 Storage

- Store in a dry environment free of pollutants.
- Dräger recommends charging the sensor unit and the control unit during storage.
- Dräger recommends checking the charge status of the energy supply at least every 3 weeks if the sensor unit or the control unit is not left on charge.
- Do not store the sensor unit at below -20 °C or above +50 °C as it could become damaged.

NOTICE
Observe the safety instructions of the control unit!
The safety instructions of the control unit contain separate information on storage and must be observed.

⚠ **WARNING**
Risk of explosion!
Discharging isolated capacitances can create ignitable sparks.

► When storing the device, make sure that it is grounded and thus no isolated capacitance can be electrostatically charged.

ℹ To keep power consumption low in the heat-up phase, and to keep the heat-up phase as short as possible, store the sensor unit at room temperature.

10 Disposal

This product must not be disposed of as household waste. This is indicated by the adjacent symbol.
You can return this product to Dräger free of charge. For information please contact the national marketing organizations or Dräger.

11 Technical data

11.1 Sensor unit overview

Ambient conditions:	
During operation	-10 to +35 °C 700 to 1300 hPa 10 to 90% (up to 95% short-term) rel. hum.
Orientation	any
Degree of protection	IP 54 The gas inlet openings and gas outlet opening must be protected against liquids and contamination. The water and dust filter must always be fitted during operation.
Operating time	Typically 3 to 6 hours under normal conditions. The operating time reduces at low temperatures.
Dimensions	approx. 132 x 281 x 56 mm (W x H x D)
Weight	approx. 880 g

11.2 Target substances

The Dräger X-pid x000 is limited to the target substances of benzene and 1,3-butadiene, while the target substances in the following table are qualified and quantified in the Dräger X-pid x500.

Target substance	CAS number	LOD[1)], ppm	LOQ[2)], ppm	Upper limit[3)], ppm
Acrolein	107-02-8	0.33	1.00	100
Benzene	71-43-2	0.02	0.05	25.0
Butadiene, 1,3-	106-99-0	0.07	0.20	25.0
Dichloroethene (cis)	156-59-2	0.07	0.20	50.0
Dichloroethene (trans)	156-60-5	0.07	0.20	50.0
Dichloroethene, 1,1-	75-35-4	0.07	0.20	50.0
Ethylbenzene	100-41-4	1.00	3.00	300
Ethylene oxide	75-21-8	0.33	1.00	100
Hexane, n-	110-54-3	0.33	1.00	100
Isobutylene	115-11-7	0.07	0.20	100
Styrene	100-42-5	1.00	3.00	300
Tetrachloroethene (PER)	127-18-4	0.67	2.00	150
Toluene	108-88-3	0.33	1.00	100
Tricholoroethene	79-01-6	0.33	1.00	100
Vinyl chloride	75-01-4	0.33	1.00	100
Xylene, m-	108-38-3	1.00	3.00	300

Target substance	CAS number	LOD[1), ppm	LOQ[2), ppm	Upper limit[3), ppm
Xylene, o-	95-47-6	1.00	3.00	300
Xylene, p-	106-42-3	1.00	3.00	300

For the Dräger X-pid x500, further target substances are qualified but not quantified.				
Butane, 2-	78-93-3	1.00	3.00	300
Ethyl acetate	141-78-6	1.00	3.00	300

1) Concentration from which a substance can be detected, i.e. from which the sensor (PID) issues a signal. The limit of detection (LOD) depends on the sensitivity of the sensor. The LOD applies to 100 % sensitivity of the respective PID, a parameter that is determined during calibration and is displayed in the corresponding archive in the user interface of the control unit.
2) Concentration from which a substance can be measured, i.e. from which the sensor (PID) issues a signal that is within the specification of the measurement device, in particular, with regard to precision. The limit of quantification (LOQ) depends on the sensitivity of the sensor. The LOQ applies to 100 % sensitivity of the analysis PID, a parameter that is determined during calibration and is displayed in the corresponding archive in the user interface of the control unit. The LOQ is three times the LOD. Below these limits, signal rises (“peaks”) in the chromatogram do not sufficiently stand out from the sensor noise.
3) Concentration up to which a substance can be measured, i.e. from which the sensor (PID) issues a signal that is within the specification of the measurement device.

Qualified target substances can be added to analysis programs and assigned in analyses based on their retention times. The concentration calculation is done based on simplified assumptions with modest demands on accuracy. The measuring limits tabulated above and stored in the mobile app (LOD, LOQ and upper limit) are estimated values without guarantee of trueness.

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Subject to alteration

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