Mercury TRACKER-3000 XS

Operating Manual

English
Version 2.6

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General information for safe operation

While operating the TRACKER-3000 XS, parts of its interior are under high voltage and UV-beams are produced inside. If safety regulations are ignored physical and/or material damages could occur. Only qualified personnel should be allowed to operate the TRACKER-3000 XS. Following conditions for correct function of the TRACKER-3000 XS are to be held: careful and correct storage, proficient operation and maintenance.

- Do not operate instrument if it is damaged.
- When connecting the TRACKER-3000 XS to an external power source please note the related safety regulations.
- Use only original Eneloop battery packs when operating the TRACKER-3000 XS on internal power supply.
- Make sure all plugs, cables and power cords used are not damaged.
- Regulations for prevention of accidents are to be followed.
- Before opening the TRACKER-3000 XS disconnect it from the external power supply and remove the battery pack.
- Repairs and maintenance on the opened and powered instrument must only be carried out by trained personnel.
- For stationary operation place the TRACKER-3000 XS on a stable and dry surface. The interior of the TRACKER-3000 XS should never get moist or wet. In case it happens, consult an expert.
- When using the TRACKER-3000 XS in mobile mode, make sure the shoulder strap is properly fixed to the instrument or its bag.
- The TRACKER-3000 XS is dedicated for the measurement of mercury concentration in gases. Do regard the related dangers especially while operating with toxic gases. Make sure that these parts of the instrument guiding the gas are not damaged and that the gas is guided back to the source or into an absorber. If explosive gases are measured or if measurements are made at places where explosion is possible, please follow the specific safety instructions.

Warning!
This is a class A, group 1 device. This device may cause radio interference in living quarters. In that case the operator may be obliged to take appropriate measures.

Contents

1. General description

1.1 Fields of application

The TRACKER-3000 XS serves for continuous measurement of the mercury concentration in non-flammable gases like air, nitrogen and others.

Following applications are examples for the versatility of the TRACKER-3000 XS:

- Tracing of mercury spillage in rooms.
- Survey of mercury in contaminated areas like abandoned plants which used mercury in production processes.
- Control of sanitation/decontamination work
- Measurement of mercury in laboratory room air of high schools and universities. Mercury was used very often in the past for thermometers and barometers. Therefore such rooms where practical exercises have been performed by students often show increased mercury concentrations.
- Measurement of mercury at working places where mercury is (or was) used. Such working places may be dentist laboratories, thermometer manufacturers, fluorescence lamp manufacturers, chlor-alkali production plants, battery manufacturers.
- Measurement of mercury in recycling plants for material containing mercury like lamps, batteries, filters and other components from natural gas industry.
- Monitoring of laboratories using mercury in porosimeters or diffusion pumps (to name just a few).
- Measurement of mercury in gases for quality control (hydrogen, nitrogen, calibration gases)
- As a highly sensitive mercury detector for research work
- Geochemical applications

Fig. 1:
The TRACKER-3000 XS at a derelict mining area

Fig. 2:
Tracing mercury spillage with the TRACKER-3000 XS.

Fig. 3:
Manifold fields of applications for the TRACKER-3000 XS.

1.2 Measuring principle

Basis for determination of the mercury concentration is the resonance absorption of the Hg-atoms at a wavelength of 253.7 nm. The sample gas is drawn through a 1 micron PTFE filter into the optical cell by a membrane pump. The optical cell is entirely made of synthetic quartz glass. Radiation of a mercury lamp passes through the cell and is measured by a solid state detector. The attenuation of the UV light reaching the detector depends on the number of mercury atoms in the optical cell. The internal computer performs the quantitative evaluation of the mercury concentration in the sample in real-time. In order to get an extremely stable baseline, the UV-light source is controlled by a reference beam and reference detector device.

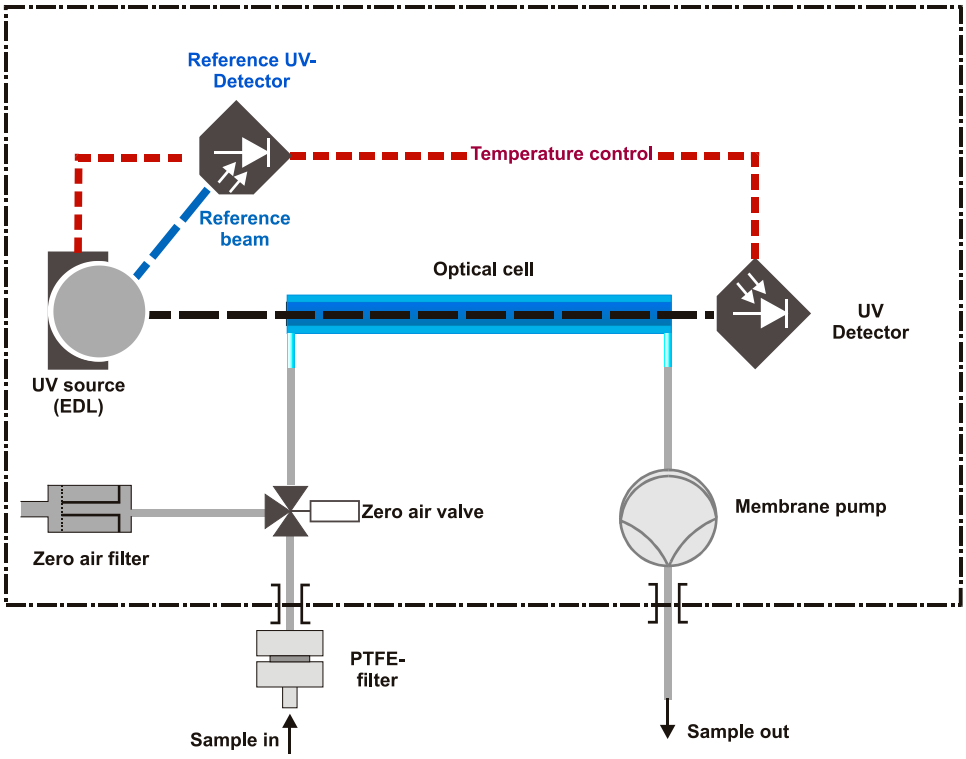


Fig. 4: Schematic diagram of the TRACKER-3000 XS

2. Preparing for operation

The TRACKER-3000 XS is unpacked and placed on a flat surface (e.g. table). Attach the enclosed shoulder strap to both sides of the TRACKER.
We recommend to leave the Tracker inside its protective carrying bag when measuring in mobile mode.

2.1 Telescopic sampling probe

The fitting of the sample probe is pushed into the Quickfit connector labelled “SAMPLE IN” until it is locked in place.

The sampling probe with its particle filter can be extended to the desired lenght.

Fig. 5: Tracker with sampling probe and shoulder strap

2.2 Electrical power supply

The TRACKER-3000 XS can be powered by internal batteries or an external 12 V DC source.

2.2.1 External power supply

The TRACKER-3000 XS can be operated on mains using the included power supply (Mascott, Type 9920). The separately packed mains cable for the power supply has to be connected first to the 3-pin socket on one side of the power supply. After that, the power supply can be connected to a mains outlet with the mains plug (which may be different depending on the system used in your country). The round plug which is on one end of a cable that is firmly installed on the power supply is connected to the socket on the front panel of the TRACKER-3000 XS marked „12 V DC".

Fig. 6:
Do not try to remove the Ferrit interference filter !

(Any other 12 V DC power source can also be used for powering the TRACKER-3000 XS. Please note that the power source has to deliver a minimum of 3 Amps. The voltage must not exceed 13.5 V)

2.2.2 Internal power supply

The TRACKER-3000 XS runs on built-in Eneloop* batteries. Use only original battery packs when changing batteries!

Fig. 7-1:
Front panel TRACKER-3000 XS with USB port and 12V connector for the battery charger/external 12 V DC power supply.

**) Eneloop batteries were developed by Sanyo / Panasonic. They are characterized by very low self-discharge.*

2.3 Battery charger

The TRACKER-3000 XS must not be operated while charging batteries.

The charger ACS 110 is designed to quick charge the battery pack.
Charging time of empty battery packs is approx. 7.5 - 8 h.

Note that new battery packs or packs that have not been used over a longer period of time, will reach their full capacity only after repeated charging / discharging.

2.3.1 Charging operation

- Switch off the TRACKER-3000 XS.
- Disconnect the TRACKER-3000 XS from mains power supply.
- Put primary plug of battery charger into wall socket. The red LED "Power" will light up.
- Connect the round 3-pin plug of charger cable into the 12 V DC socket of the TRACKER.
- Charging of the power pack will start automatically with the LED flashing green.

When the batter pack is fully charged the device will automatically switch to impulse-trickle-charge. The LED permanently lights up green.

If the LED is flashing red after connecting the charger to the Tracker-3000 XS, the battery pack must be replaced.

Disconnect charger cable first before switching on the TRACKER-3000 XS!

Fig. 7-2:
TRACKER-3000 XS, charger ACS 110 and 12 V plug to be connected to 12V socket.

2.3.2 Features of the battery charger

- micro-controller controlled charging.
- short circuit detection.
- battery charging state at the start of the charging cycle is of no importance.
- automatic switching over to trickle charge as soon as batteries are fully charged.
- button for discharging automatically followed by charging.

To avoid memory effect (loss of capacity due to frequent partial discharge), you have to discharge the battery pack after 40 - 50 charging cycles. Press the “Discharge” button. After discharging (or after a power interruption) the charger will automatically start (resume) charging.

2.3.3 Status LED

LED flashing green:	Charging.
LED permantly glowing green:	Battery fully charged, trickle charge.
LED flashing red:	Battery pack damaged

2.3.4 Safety and environment

Use only original Eneloop battery packs.

Do not open the charger. Repairs may only be done by the manufacturer.

For indoor use only.

Batteries are chemical waste. Throw away broken or used up batteries in designated containers or hand them in at a recycling centre.

2.3.5 Technical specifications

Prim:	100 -240 V AC, 50-60 Hz.
Sec:	1,45 - 14,5 V DC, max 800 mA 9,6 VA
Charging current:	800 mA
Discharging current:	150mA - 200mA

2.4 Fuse

The main fuse is located on the TRACKER-3000 XS interface board inside the instrument.
Fuse type: 20x5, 5 A medium slow.

Turn off the instrument, disconnect any power cable and remove the battery pack before opening the TRACKER-3000 XS!

The activated carbon cartridge has to be removed before you can change the fuse.

Clamps holding the carbon cartridge

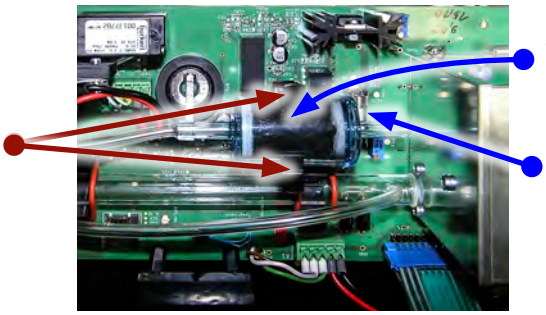


Fig. 8:
1) remove carbon cartridge

2) Main fuse on the interface board.

2.5 Operation and display components

The TRACKER-3000 XS features a waterproof IP 64 keypad and a graphic LCD with background illumination for comfortable communication with the operator.

2.6 Digital Signal output (USB / Bluetooth)

The TRACKER-3000 XS features Bluetooth capability and an USB port (see fig. 7-1, p. 10). A suitable USB cable for data transfer to a PC or Laptop is included on delivery.

USB **or** Bluetooth can be used for:

- transfer of data from the data logger (see chapter 3.2.2.2, p. 20)
- transfer of current parameter settings (see chapter 3.3.2.3, p. 30)

For a continuous transfer of measurements (see chapter 3.3.2.1, p. 28) only USB is available.

2.7 GPS

The TRACKER-3000 XS is able to receive GPS signals. Measurements can be stored together with the geographical position (see chapter 3.2.3, p. 21).

The GPS receives US-GPS, Galileo and GLONASS.

2.8 Sample gas connection

The sample inlet (quickfit) is located at the front panel of the TRACKER-3000 XS labelled “SAMPLE IN”.

Fig. 9-1: Sample inlet fitting

When operating the TRACKER-3000 XS make sure that a filter is installed at the gas inlet. If the sample probe is not connected, use the separate filter with prepaired quickfit-connection (included on delivery).

Fig. 9-2: Filter with quickfit connector for protection of the instrument when not used with the sampling probe

The sample gas can also be drawn from a distance to the TRACKER-3000 XS through a tube which has to be connected to the sample inlet.

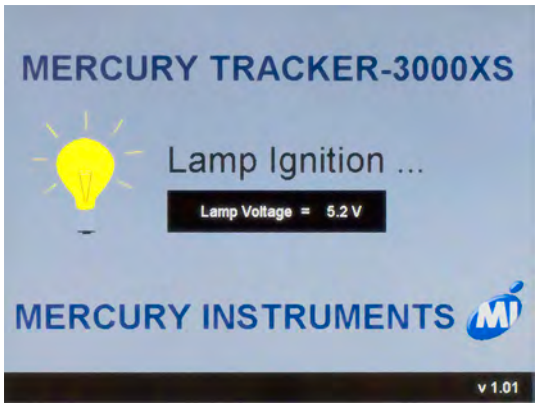
3. Operating instructions

3.1 Turning on the instrument

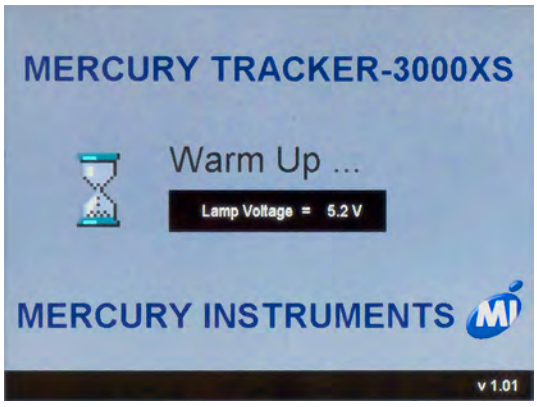
STOP

Disconnect battery charger cable before switching on the TRACKER!

After turning on the TRACKER-3000 XS the mercury lamp is ignited and brought to operating temperature. This is indicated be the following displays:

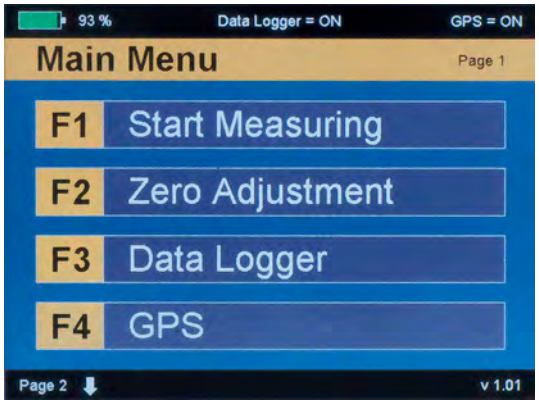


Display No. 1: Lamp Ignition

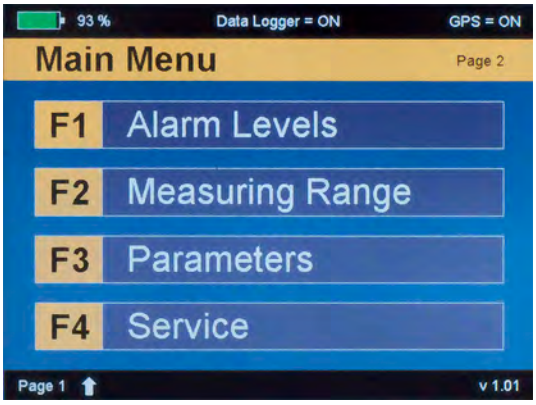


Display No. 2: Lamp Warm Up

After the lamp has ignited and the instrument has stabilized, which typically takes 3-15 minutes (depending on the ambient temperature), the main menu is displayed.
Switch between the two pages of the main menu by using the the arrow keys ▲ ▼.



Display No. 3-1: Main Menu, page 1



Display No. 3-2: Main Menu, page 2

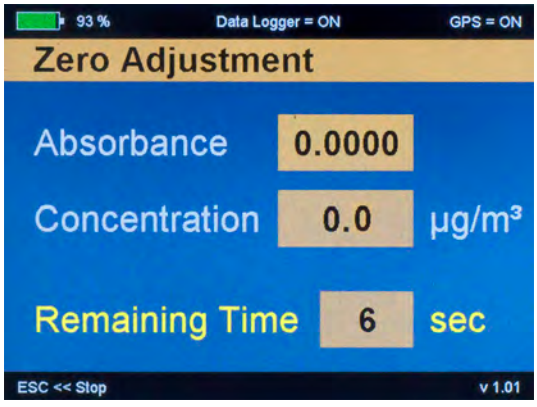
When using the Tracker for the first time you must first set up all parameters: see chapter 3.2, p. 18 *ff* and chapter 3.4, p. 34 *ff*.

3.1.1 Start up measuring

Press ***F1*** on <***page 1***> of the main menu to start measuring.

Before the measurement starts a zero adjustment will always be automatically performed. After zeroing measurement starts automatically.
During zero point adjustment an internal pinch valve cuts off the sample flow, air is drawn through an activated carbon cartridge and through the optical cell.

You can interrupt the zero adjustment by pressing ***ESC***. The last measured value will be taken as new zero value

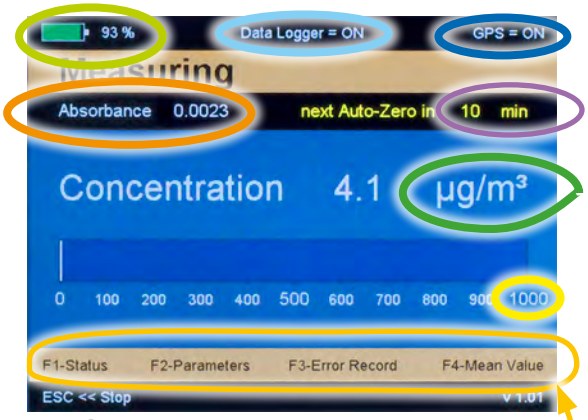


Display No. 4: Zero Adjustment

3.1.2 Displays while measuring

While measuring the display will show:

- Mercury concentration (µg/m³ or ppb, depending on the setting) numerically and as a bar graph
- current absorbance.
- time left until the next zero point adjustment, (only if Auto Zero is activated, see chapter 3.2.6.1, p. 23), otherwise the reading will be: ”No Auto Zero !“
- selected measuring range
- a graphic display visualising charging status of the battery. If the battery is nearly empty there will be an acoustic alarm of 0.5 sec on / 4 sec off
- Logger mode (ON / OFF)
- GPS mode(ON / OFF)



Display No. 5: Measuring

Battery state, logger and GPS mode are also displayed during zeroing.

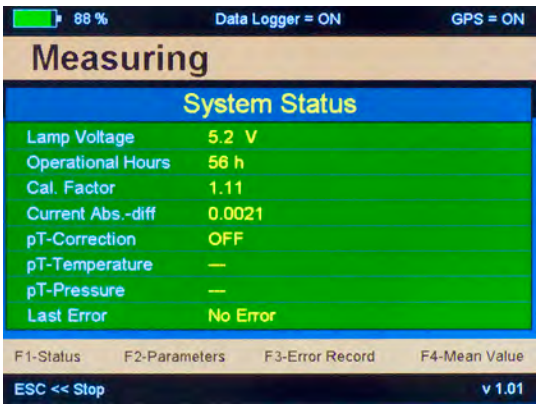
The measuring mode will stay active until it is interrupted by pressing the ESC key.

3.1.3 Further display options while measuring

By pressing ***F1***, ***F2***, ***F3*** or ***F4*** you have acces to informations about system status, current parameter settings, error record and currently used mean values.

3.1.3.1 Display of System Status

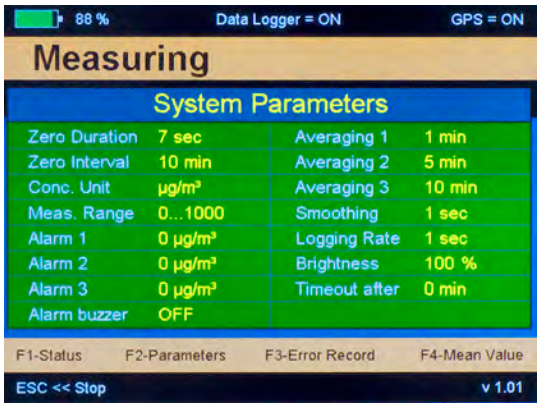
While measuring, the system status can be displayed by pressing ***F1***.



Display No. 5-1: System Status

3.1.3.2 Display of current parameter settings

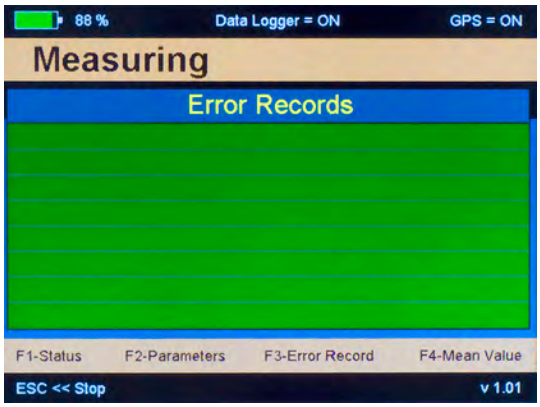
While measuring, the current system parameter settings can be displayed by pressing ***F2***.



Display No. 5-2: System Parameters

3.1.3.3 Display of error records

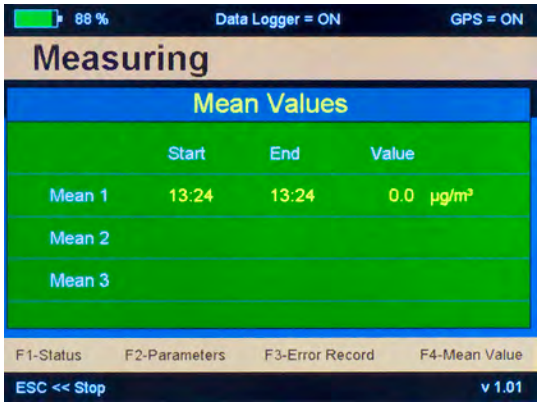
While measuring, the error record can be displayed by pressing ***F3***.



Display No. 5-3: Error Records

3.1.3.4 Display of mean values

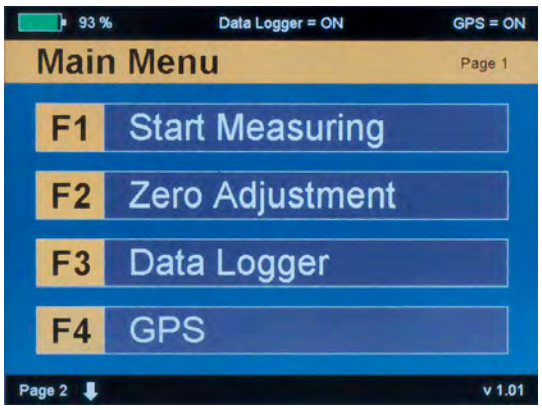
While measuring, the current mean values can be displayed by pressing ***F4***.



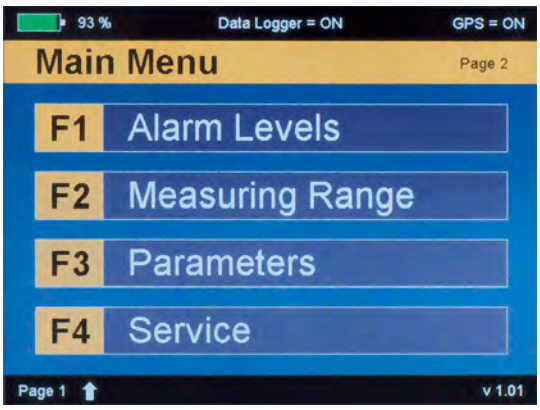
Display No. 5-4: Mean values

3.2 Main Menu

If the ESC key is pressed during measurement, the main menu will be displayed. Pressing the arrow keys ▼▲ lets you switch between the two pages of the main menu.



Display No. 3-1: Main Menu, page 1



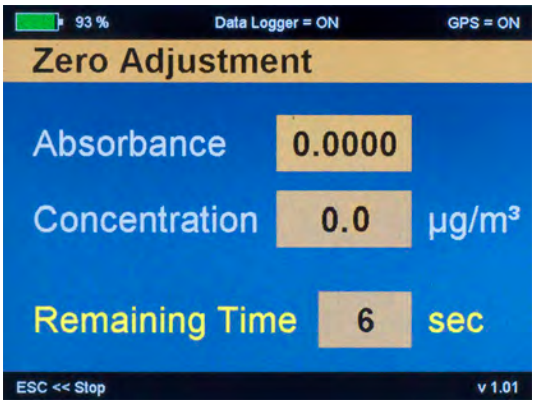
Display No. 3-2: Main Menu, page 2

The first page offers the options ***"Start Measuring"*** and ***"Zero Adjustment"***.
You can also activate/deactivate the ***"Data Logger"*** , edit its settings and turn the GPS on or off (see also chapter 3.2.3, p. 21).

Page 2 of the main menu lets you edit parameters that are not often changed. It also gives access to the ***"Service"*** - menu (see chapter 3.4, p. 34).

3.2.1 Manual zero adjustment

If ***F2*** is pressed on <***page 1***> of the ***"main menu"*** the zero point adjustment is started. During zero point adjustment an internal pinch valve cuts off the sample flow and filtered mercury free air is drawn through the optical cell.



Display No. 4: Zero Adjustment

When performing zero adjustment, the values of measurements during the last second will be set as new baseline. If the zero adjustment procedure is interrupted (by pressing the ESC key) while there is still sample gas in the optical cell (recognizable by drift in the absorbance reading), the zero adjustment may be incorrect.

3.2.2 Data logger

The TRACKER-3000 XS features a Data logger.
Measurements - along with geographical position if GPS is active (see also chapter 3.2.3, p. 21) - are saved in ASCII format to an internal 4GB SD card.

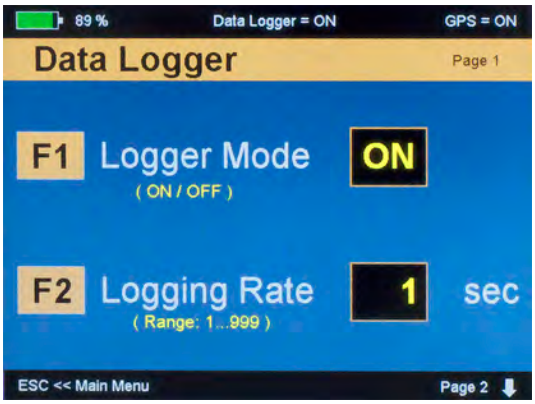
Press ***F3*** on <***page 1***> of the main menu to access the data logger menu. By pressing the arrow keys ▼▲ you can switch between the two pages of the data logger menu.

3.2.2.1 Data logger settings

Select <***page 1***> of the data logger menu.

Pressing ***F1*** turns the data logger on or off.

Press ***F2*** to edit the logging rate.



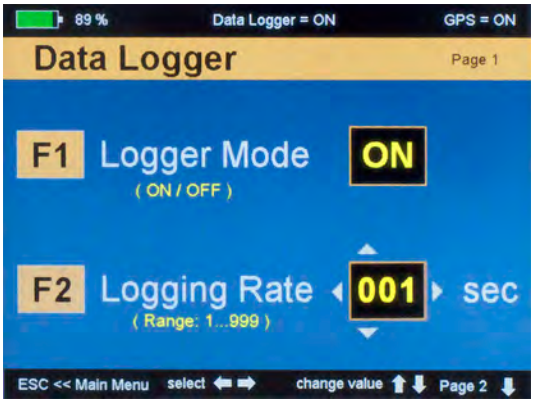
Display No. 6-1: Data Logger page 1

The arrow keys ◄► select the digit, the arrow keys ▼▲ change the value of the selected digit.

Confirm by pressing [***Enter***].

(This procedures applies to all multi-digit numerical inputs.)

The logger mode (ON/OFF) and the logging rate are saved when the Tracker is turned off.



Display No. 6-1: Data Logger page 1, Changing the Logging Rate

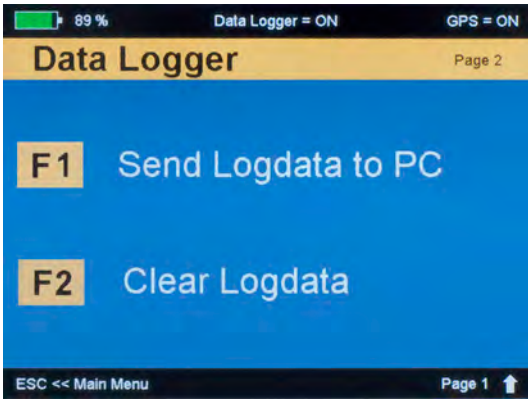
3.2.2.2 Data transfer

"Hg-Transfer" software (included on delivery) has to be properly installed on your computer to process the data. For installation and operation of Hg Transfer see chapter 3.3, p. 25 *ff*.

Before transferring any data Hg-Transfer has to be opened and made ready for recording data (see chapter 3.3.2.2, p. 29).

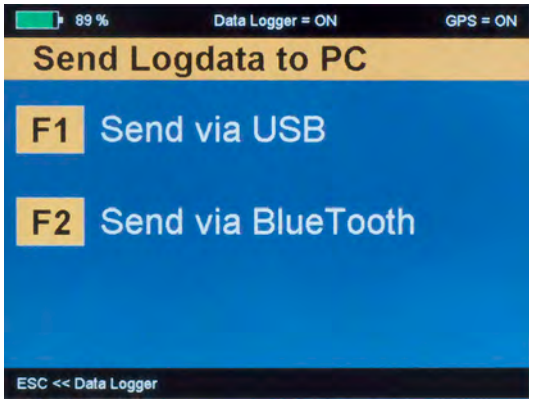
Select <***page 2***> of the data logger menu.

Press ***F1*** "***Send logdata to PC***" on <***page 2***> of the data logger menu to send the logged data to a PC or Laptop.



Display No. 6-2: Data Logger, page 2

Choose Bluetooth or USB.

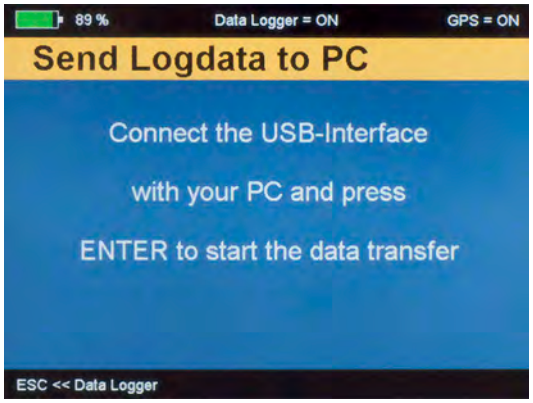


Display No. 6-3: Send Logdata to PC

3.2.2.2.1 Transfer via USB

Connect the USB port (fig. 7-1, p. 10) to a PC.
Press [***ENTER***] to start data transfer.

Pressing [***ESC***] will stop the data transfer.



Display No. 6-4 a: Send Logdata to PC: Connect USB

3.2.2.2.2 Transfer via Bluetooth

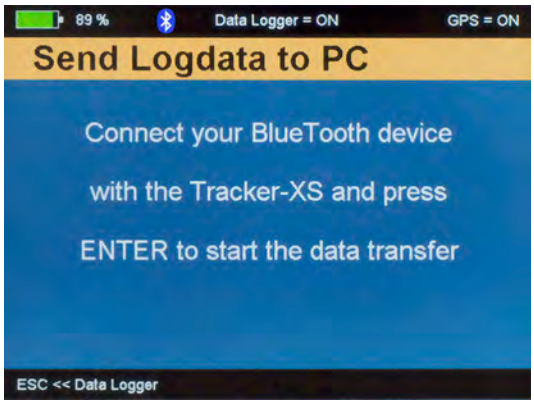
Max. range of Bluetooth is approx. 1 meter.

Activate Bluetooth on your Laptop and select TrackerXS-xxxx (it will be found automatically).

TrackerXS-xxxx = Bluetooth-name (xxxx = ID of your Tracker).

When the Tracker is recognized, a new COM-port is created at the end of the serial port list (port with the highest number, see chapter 3.3.1.2, p. 26).

Press [***ENTER***] to start data transfer.

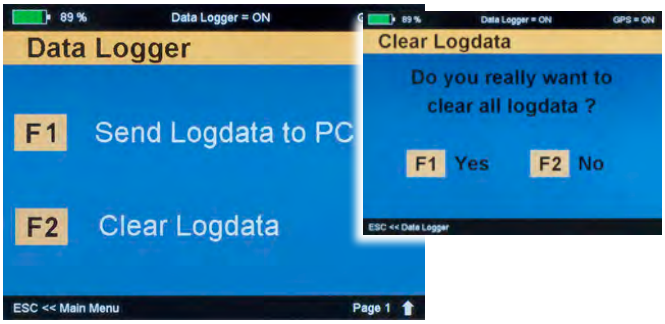


Display No. 6-4 b: Send Logdata to PC: Connect BLUETOOTH

3.2.2.3 Delete logged data

Press ***F2 "Clear logdata"*** on ***<page 2>*** of the data logger menu to delete all logged data.

You will be asked to confirm this step.



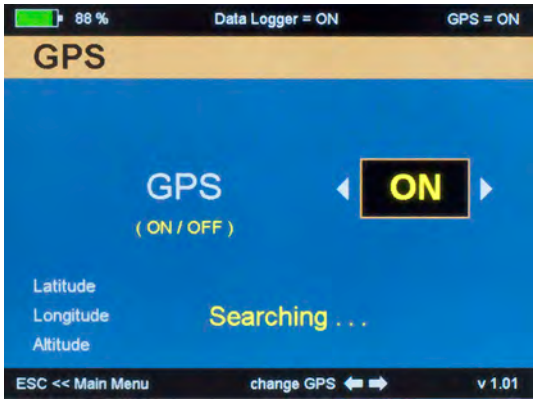
Display No. 6-2: Data Logger, page 2

3.2.3 GPS

Press ***F4*** on ***<page 1>*** of the main menu to access the GPS menu. Press the arrow keys ◄► to activate / deactivate the GPS.

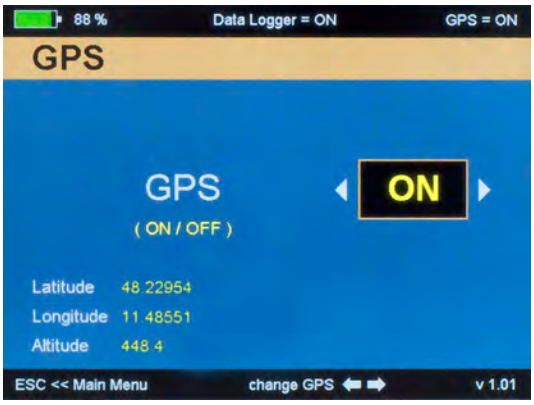
When activating the GPS after the Tracker was turned off for more than two hours, "cold boot" will take a few minutes until the Tracker has located a sufficient number of satellites.

The GPS has to be activated in the open (line of sight with the satellites) !



Display No. 8-1: searching for contact

If the Tracker is turned off for only a short period of time the saved orbital data of the satellites will enable the instrument to locate a sufficient number of satellites more quickly and the GPS can “warm boot” when turned on.



Display No. 8-2:
Display of the coordinates

Please note that the GPS is working inaccurately or not at all when used indoors. The GPS should stay turned off during continuous indoor operation.

3.2.4 Setting of alarm thresholds

Press ***F1 “Alarm“*** on <***page 2***> of the main menu.

By pressing ***F1/ F2/ F3*** up to three alarm thresholds can be set.

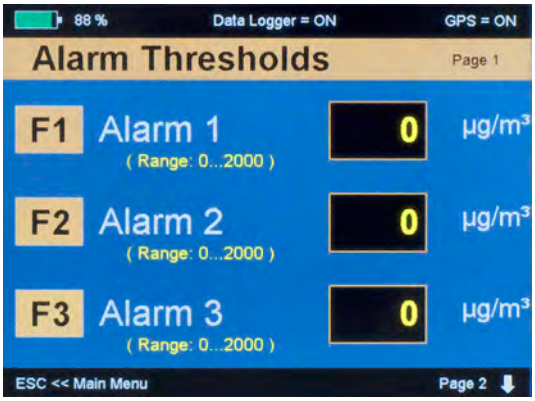
By pressing the arrow keys ◄► you select the digit, with the arrow keys ▼▲ the value of the selected digit is changed.

Confirm by pressing [***Enter***].

In case those thresholds are exceeded, there will be a blinking alarm message “Alarm 1 (2 /3)” on the screen while measuring, an alarm status signal going out and a buzzing sound:

Alarm 1: blinking, no buzz
Alarm 2: short buzzes
Alarm 3: continous buzzing

Pressing the arrow key ▼ brings you to <***page 2***>of the ***“Alarm”*** menu, where the alarm can be turned ON or OFF using the arrow keys ◄►.



Display No. 12-1:
setting of the alarm thresholds

Display No. 12-2:
turning the alarm ON or OFF

3.2.5 Selection of measuring range

Press ***F2 "Measuring Range"*** on ***<page 2>*** of the main menu.

Pressing the arrow keys ▼▲ lets you choose one of three measuring ranges:

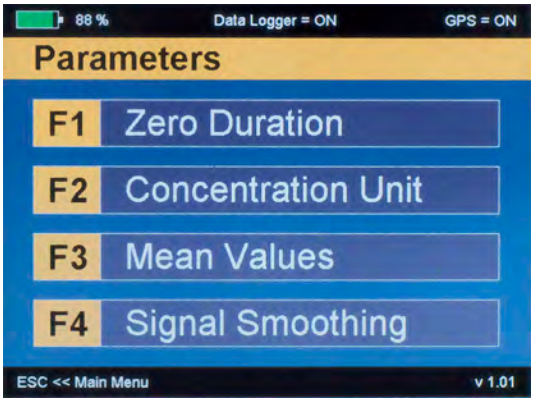
0.1 - 100 µg/m³
0 - 1000 µg/m³
0 - 2000 µg/m³

Display No. 14

3.2.6 More parameters

Pressing ***F3 "Parameters"*** on ***<page 2>*** of the main menu lets you select and edit:

- Zero duration
- Selection of concentration unit
- Time period for computing mean values
- Time period for signal smoothing



Display No. 16

3.2.6.1 Duration and repeat intervall of auto zero adjustment

Press ***F1 "Zero duration"*** in the ***"Parameters" menu***.

Pressing ***F1*** lets you edit the duration of the zero adjustment.

Pressing ***F2*** lets you edit the time interval between two zero adjustments.

(By pressing the arrow keys ◄► you select the digit, with the arrow keys ▼▲ the value of the selected digit is changed.)

Display No. 18-1

If "Zero Interval" is set to "0" , automatic zero adjustment is turned OFF.

3.2.6.2 Selection of concentration unit (µg/m³ / ppb)

Press ***F2 "Concentration Unit"*** in the***"Parameters"*** menu.

Pressing the arrow keys ▼▲ lets you choose between µg/m³ and ppb.

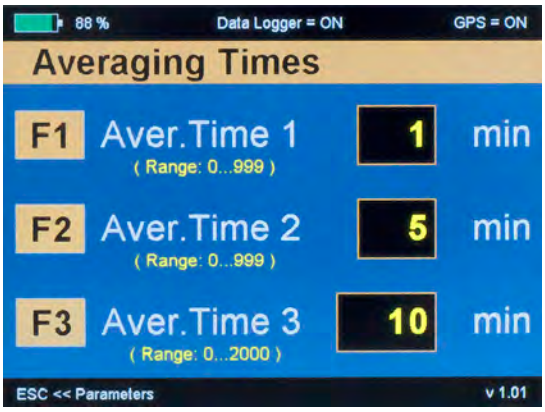
If µg/m³ is chosen as unit of concentration, and the pT-correction is "ON", the concentration unit while measuring will change to µg/Nm³ (µg/Norm cubic meter) (see chapter 3.4.9, p. 39).

Display No. 18-2

3.2.6.3 Setting of averaging times for mean values calculation

Press ***F3 "Mean Values"*** in the ***"Parameters" menu***.
While measuring the TRACKER-3000 XS files the mean values for the pre-set time intervals.

Pressing ***F1/F2/F3*** lets you enter up to three time intervals for computing mean values.



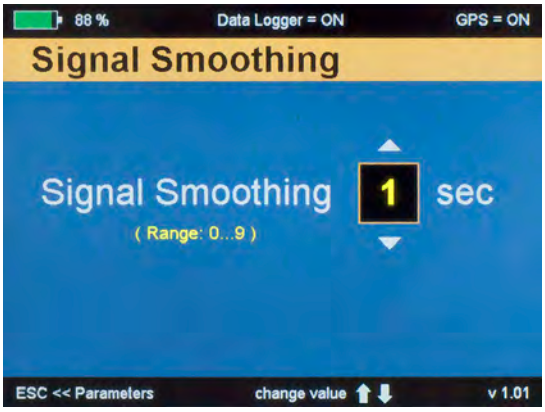
Display No. 18-3

Same procedure as usual: the arrow keys ◄►let you select the digit, the arrow keys ▼▲ change the value of the selected digit.

3.2.6.4 Signal smoothing

Press ***F4 "Signal smoothing"*** in the ***"Parameters"*** menu.

By pressing the arrow keys ▼▲ a time interval between 0 and 9 seconds can be entered.
The smoothed signal is the mean value of the measurements for the elapsed time period.



Display No. 18-4

3.3 Terminal software Hg-Transfer

The special software “Hg-Transfer” is included on delivery. It allows to transmit all data stored in the TRACKER-3000 XS to a PC or Laptop (Windows XP or higher) at any time. (File format: ASCII.txt or EXCEL®file.

3.3.1 Setup and configuration

All data stored in the TRACKER-3000 XS (calibration, absorbance, concentration, time, date, position . . .) are transmitted as ASCII characters.

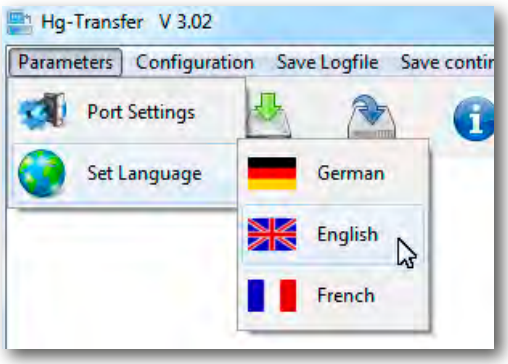
To connect the TRACKER-3000 XS to a PC either use Bluetooth (Bluetooth-name is: TrackerXS-xxxx; xxxx = ID of Bluetooth modul) or an USB cable (included on delivery).

If the USB connection is used you first have to install an USB driver (**CDM Driver, included on the Hg-Transfer CD**) on your PC.

Screenshot No. 1-1: Main window of Hg-Transfer

3.3.1.1 Set language

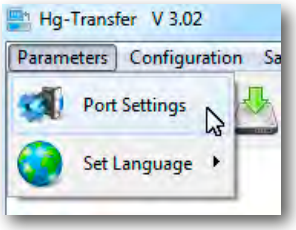
Select ***“Parameters“*** and ***“Set Language“*** for choosing the desired language.



Screenshot No. 1-2: Set language

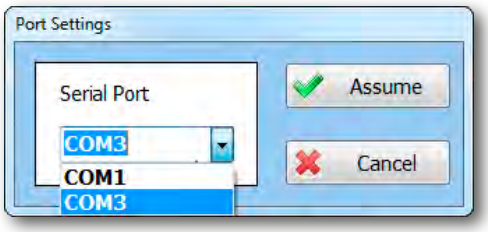
3.3.1.2 Select port (USB / Bluetooth)

Clicking ***"Parameters"*** and ***"Port Settings"*** lets you select the port of your computer to be used for communication with the TRACKER-3000 XS and data transfer.



Screenshots No. 2-1 and 2-2:

Port settings

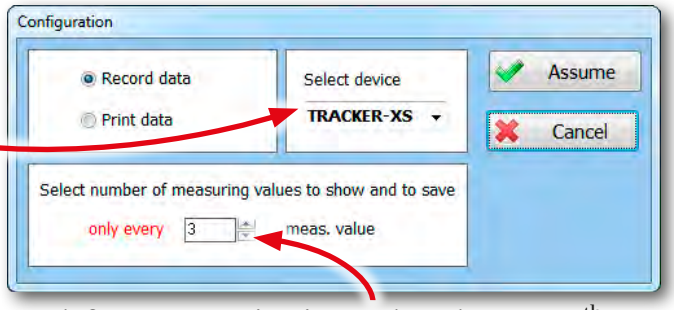


USB:
normally the port is selected automatically.

Bluetooth:
When the Tracker is recognized as a new Bluetooth-device, a new COM-port is created at the end of the serial port list (port with the highest number, see chapter 3.2.2.2.2, p. 21).

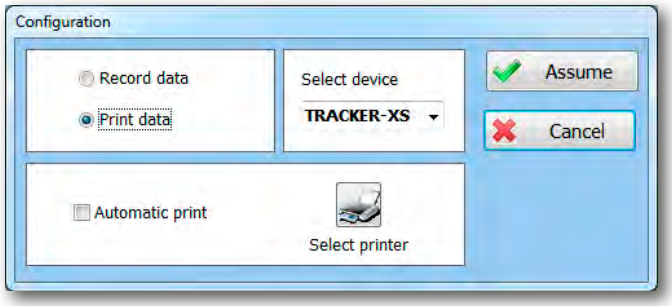
3.3.1.3 Configuration

By choosing ***"Configuration"*** you can select the type of analyzer:



Also you can choose between:
"Record data" or
"Print data".

If ***"Record data"*** is selected, you can define a measuring interval. Only every xth measurement will be saved. Measurements that lie in between will be ignored by Hg-Transfer.

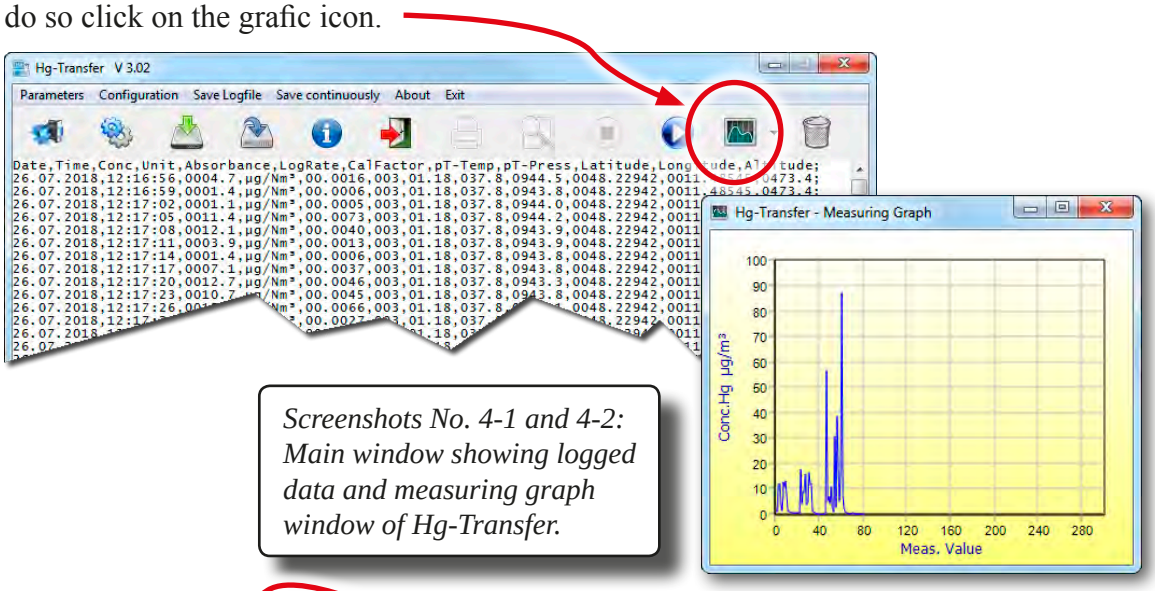


If ***"Print data"*** is selected, you can print parameters and settings of the TRACKER-30000 XS sent to Hg-Transfer. Also use this window to select your printer.
Do **NOT** activate "Automatic print" !

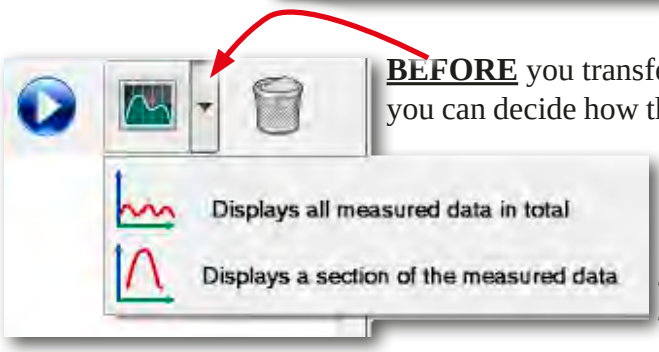
3.3.2. Transfer and display of data

Hg-Transfer offers two ways to visualize the measurements:
- Values of each measurement in the main screen (always)
- All (or parts of) measurements as a graph (additional option)

If you want the measurements displayed as a graph you have to open the Measuring Graph window **BEFORE** transferring data from the TRACKER-3000 XS to the PC. To do so click on the grafic icon.



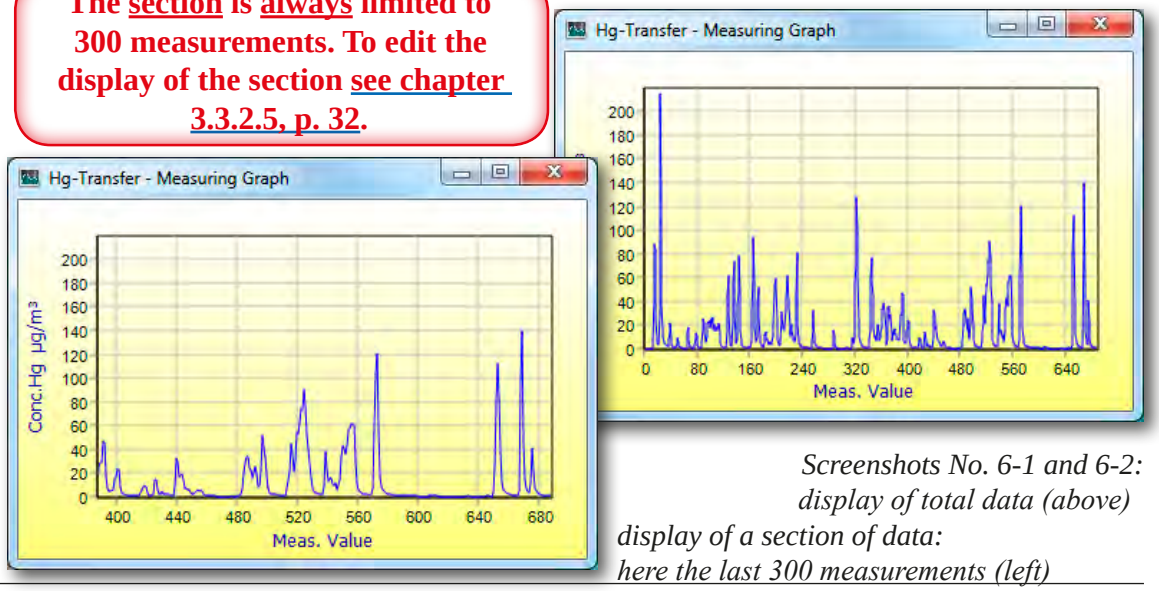
Screenshots No. 4-1 and 4-2: Main window showing logged data and measuring graph window of Hg-Transfer.



BEFORE you transfer data from the TRACKER-3000 XS you can decide how the measuring graph will be displayed: All data or (directly after transmission the last) 300 measurements.

Screenshot No. 5: Selecting the type of display

The section is always limited to 300 measurements. To edit the display of the section see chapter 3.3.2.5, p. 32.



Screenshots No. 6-1 and 6-2: display of total data (above) display of a section of data: here the last 300 measurements (left)

3.3.2.1 Data transfer while measuring

The TRACKER-3000 XS has to be in measuring mode.

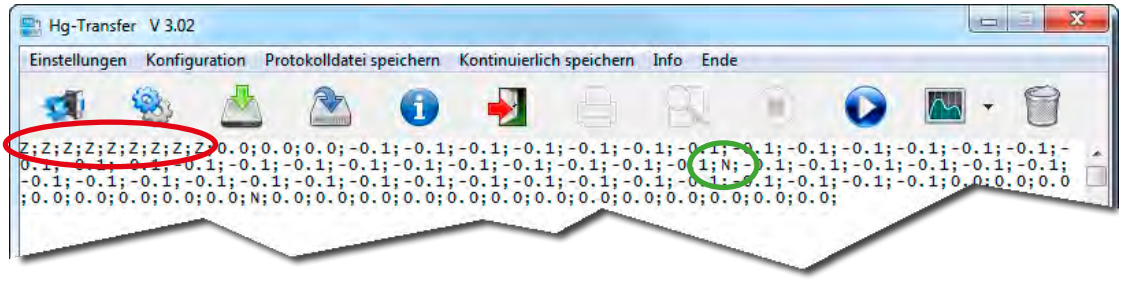
Data transfer while measuring is only possible via USB !

Data recording by Hg-Transfer is started by clicking on the start icon.

Stop recording of data.

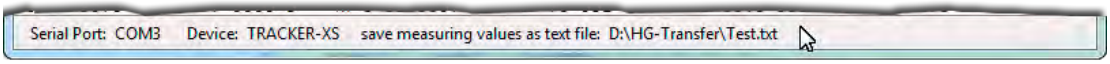
While measuring there is a continuous output of readings from the TRACKER-3000 XS every second. (The logging rate - see chapter 3.2.2.1, p. 19 - affects only the data **stored in the memory** (= data logger) of the **TRACKER-3000 XS**.)

The measuring interval set in the configuration menu (see chapter 3.3.1.3, p. 26) determines which nth value (every 2nd, 3rd, 4th etc.) will be **taken over by Hg-Transfer**.
The following data are shown in the main window of Hg-Transfer:
Measured Value; measured value..... and every 30 sec there is a signal indicating the status: Z = zero adjustment, N = normal operation, (M = Malfunction, A = Alarm)



Screenshot No. 7-1:
Main window of Hg-Transfer while measuring (M = Malfunction and A = Alarm not shown)

By clicking on **Save continuously** incoming data are saved to a previously selected file (*applies also when transferring logged data*). Format options are *.txt (ASCII) or *.xlsx (EXCEL®). If the recording of data is interrupted you have to define a new file before you continue recording measurements (or overwrite the old one).



Screenshot No. 7-2: Bottom bar of Hg-Transfer while saving continuously

When using Save continuously:
Note that FIRST you should click on the Save continuously icon and THEN start data transmission to prevent loss of data.

By clicking on **Save as** the content of the main window can be saved to a file. Format options are *.txt (ASCII) or *.xlsx (EXCEL®).

3.3.2.2 Transfer of logged data

When there are already logged data stored in the TRACKER-3000 XS, the whole log-file can be sent to a PC using the Hg-Transfer-Software.
Proceed as follows and mind the correct order:

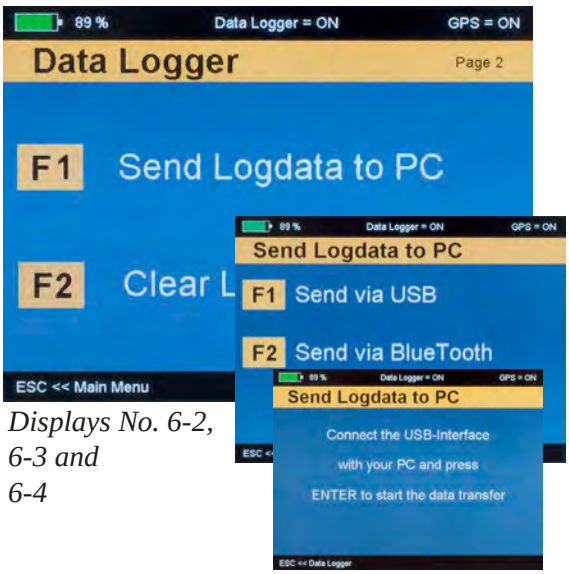
❶ **FIRST** click on the ***start recording*** symbolin Hg-Transfer.

❷ **THEN** press ***F1 "Send Logdata to PC"*** on <***page 2***> in the Data Logger menu of the TRACKER-3000 XS

- Choose USB or Bluetooth for transfer and
- confirm by pressing [***Enter***]

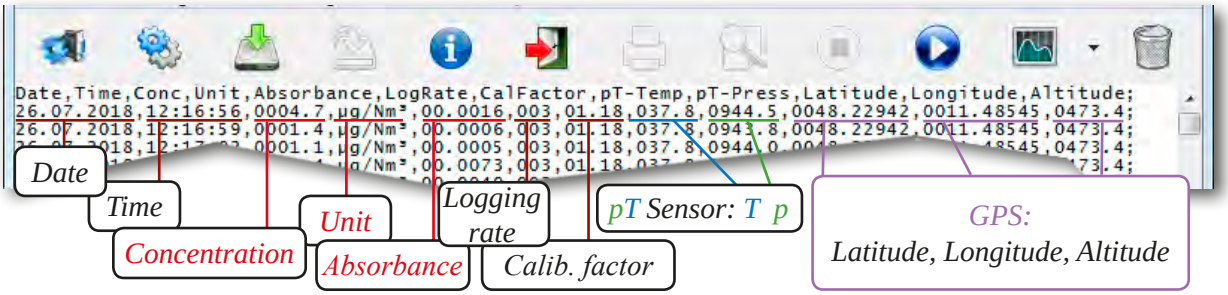
All data are transferred (depending on the number of data sets this may take a while).

See also chapter 3.2.2.2, p. 20.



Displays No. 6-2, 6-3 and 6-4

The following data are transferred and shown in the main window of Hg-Transfer: Date, Time, Concentration, Unit, Absorbance,Logging rate, Calibration factor, pT-Senor: Temperature, Pressure, GPS: Latitude, Longitude, Altitude



Screenshot No. 7-3: Main window of Hg-Transfer after transfer of logged data

Stop recording of data, transmission of data continues however ! (to transfer the complete log file you have to start all over again !)

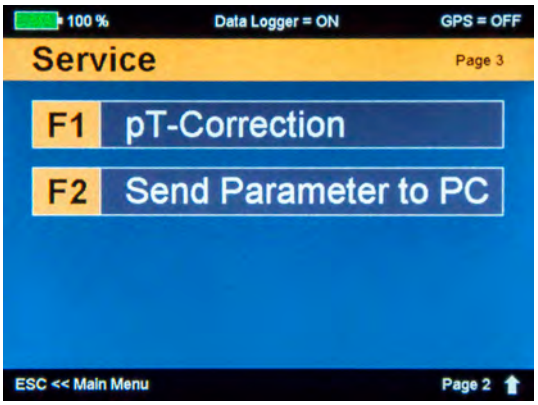
Saving procedures are identical to those described in the previous chapter.

3.3.2.3 Transfer of current parameters

Select ***"Record data"*** in ***"Configuration"*** (see chapter 3.3.1.3, p. 26):

❶ Data transfer from the TRACKER-3000 XS to the PC is started by clicking on the start icon.

❷ Press ***F2 "Send Parameter to PC"*** on <***page 3***> in the Service Menu of the TRACKER (see chapter 3.4, p. 34).

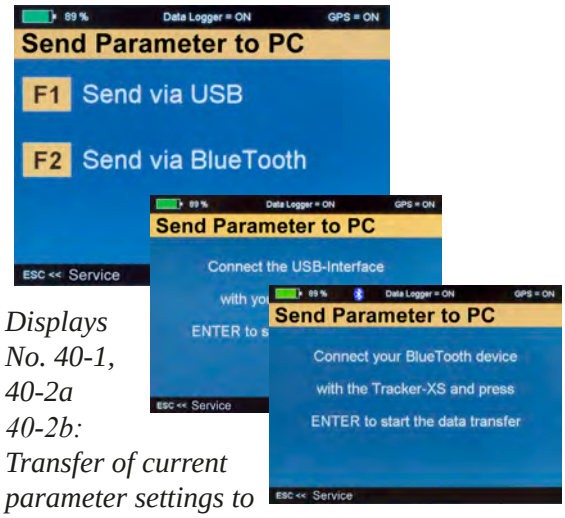


Display No. 20-3: Page 3 of the Service Menu

- Choose USB or Bluetooth for transfer and
- confirm by pressing [***Enter***]

The following data are transferred and shown (unformatted) in the main window of Hg-Transfer:

System Parameter
Zero Duration
Zero Interval
Concentration Unit
Measuring Range
Alarm 1 - 3
Alarmbuzzer ON/OFF
Averaging time 1 - 3
Signal Smoothing
Datalogger ON/OFF
Logging Rate
GPS ON/OFF
Language
Display Brightness
Display Timeout after
pT-Correction ON/OFF
System Status
Software-Version
Calibration Factor
Current Abs. - difference
Lamp Voltage
Operational hours
pT-Temperature
pT-Pressure
Last Error



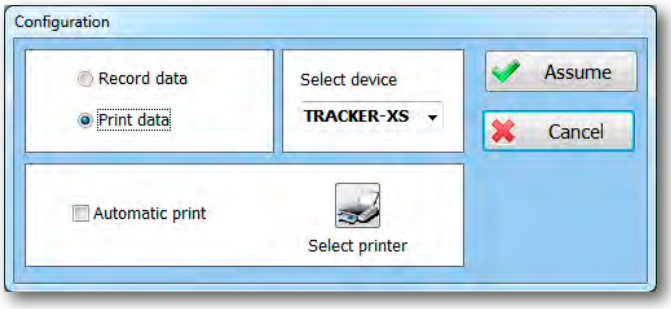
Displays No. 40-1, 40-2a 40-2b: Transfer of current parameter settings to a PC using either USB or Bluetooth

Before saving the parameters click the stop icon.

Save the (unformatted) parameter settings as *.txt-file!

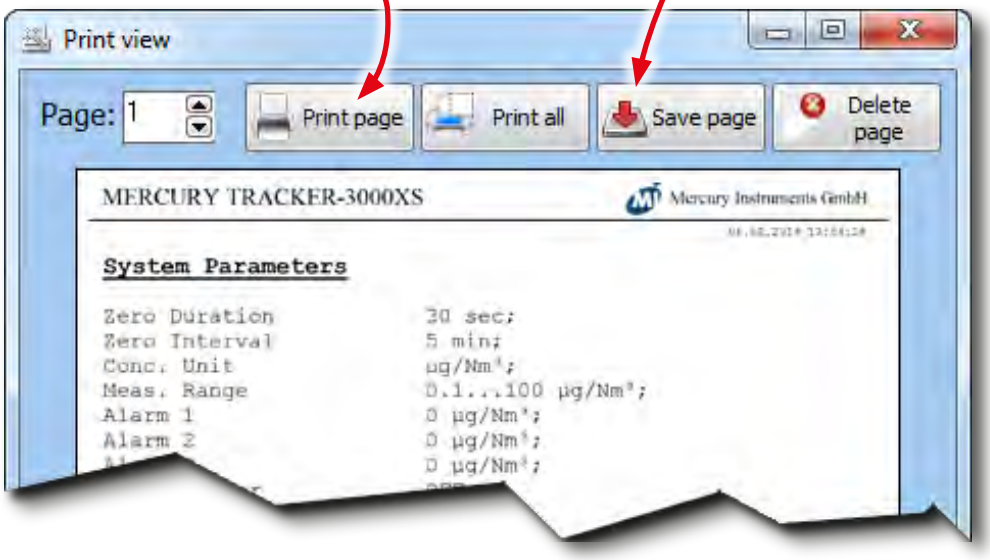
3.3.2.4 Transfer and easy printout of current parameters

There is a quick and convenient way to print the current settings of the TRACKER-3000 XS:



- Select ***"Print data"*** in the configuration menu (Do **NOT** select ***"automatic print"***). The printer icon will start blinking. 
- Click the start icon 
- **P**ress ***F2 "Send Parameter to PC"*** on <***page 3***> in the Service Menu of the TRACKER-3000 XS (see the chapter above)
- The print preview will open automatically.
- Click on ***"Print page"***

"Save page" lets you save the parameter settings as a *.jpg file

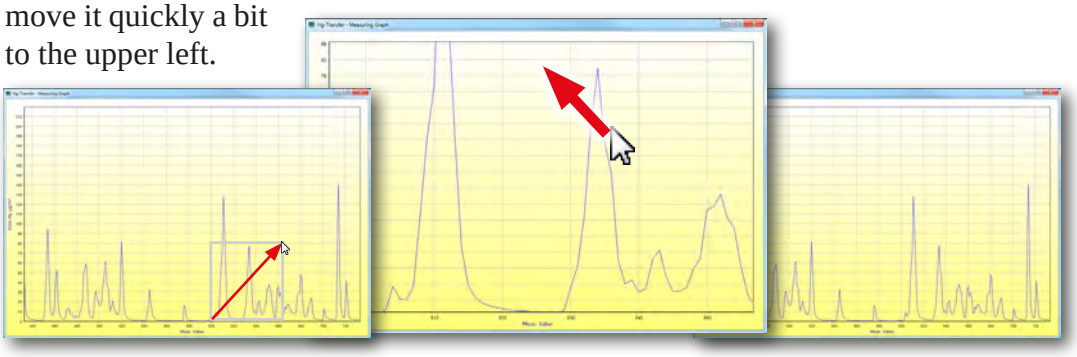


3.3.2.5 Visualizing measurements in the Measuring Graph Window

The measuring graph displays the measured concentrations. The y-axis is automatically scaled depending on the maximum concentration measured.

3.3.2.5.1 Zoom

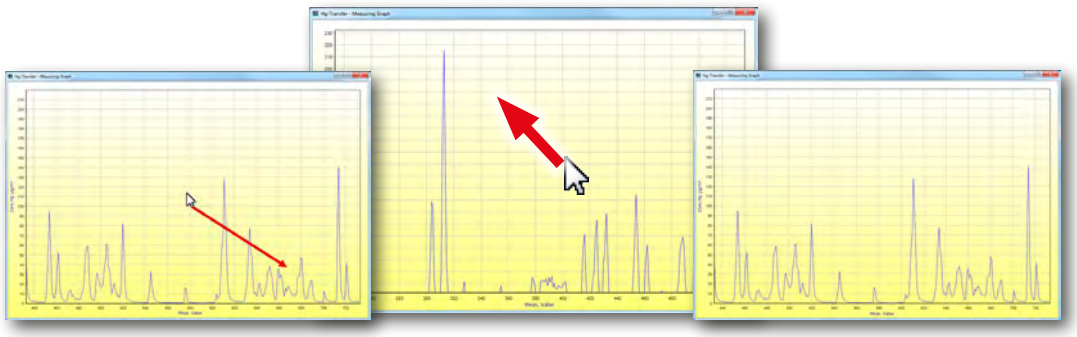
Hold down the right mouse button and open a rectangle to zoom in on part of the measured data. To return to the original view hold down the right mouse button and move it quickly a bit to the upper left.



Screenshots No. 8-1, 8-2 and 8-3:
Zoom in on a part of the data with the right mouse button pressed.
Restore the original view.

3.3.2.5.2 Select data

Pressing the left mouse button and moving the mouse lets you select different sections of the logfile.To return to the original view hold down the right mouse button and move it quickly a bit to the upper left.



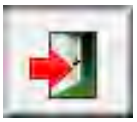
Screenshots No. 9-1, 9-2 and 9-3:
Select another view by moving the mouse with the left button pressed
and restoring the view.

If ”section” was chosen before data transfer, you can scroll to ”earlier” measurements. Nonetheless there will never be more than 300 measurements displayed.

3.3.2.6 Clear window, info and termination of program

Clicking this button will erase all data from the main window and the measuring graph of Hg-Tansfer.
Data stored in the RAM of the TRACKER-3000 XS will not be affected.

By clicking on **"About"** (i) you can check which version of Hg-Transfer -Software you are using.



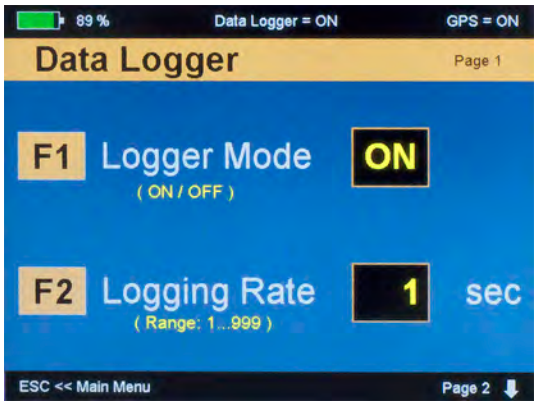
Choosing Exit closes the Hg-Transfer software.

3.3.3 Delete logged data

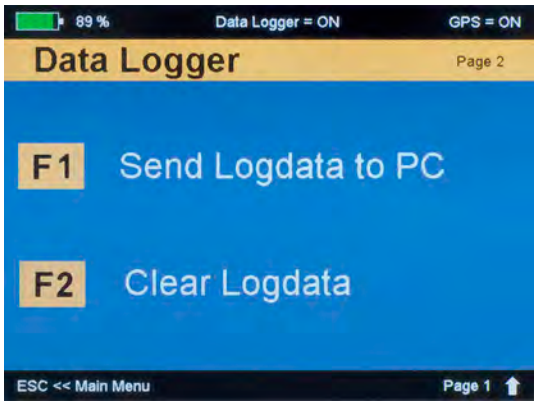
Press ***F3 "Data Logger"*** on <***page 1***> of the main menu, see chapter 3.2, p. 18.

Press the arrow key ▼ to select <***page 2***> of the logger menu.

Press ***F2 "Clear logdata"*** (see chapter 3.2.2.3, p. 21).
(You will be prompted to confirm this step)

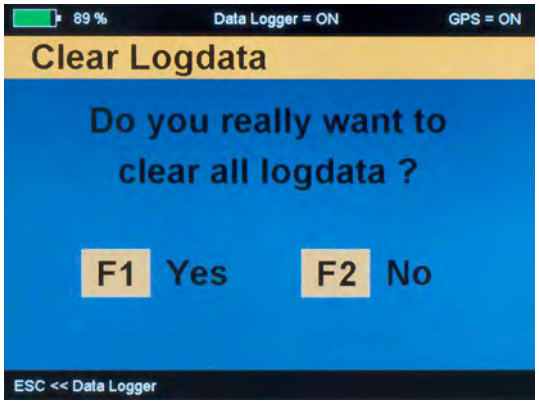


Display No. 6-1:
Page 1 of the Logger menu



Display No. 6-2:
Page 2 of the Logger menu

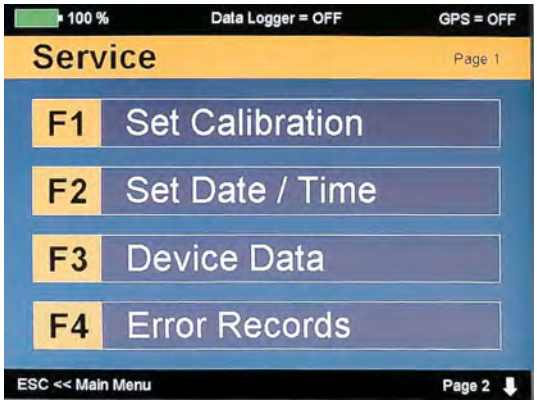
ALL measurement data stored in the *RAM of the TRACKER-3000 XS* will be deleted. Data in the *RAM of the computer (Hg-Transfer)* are NOT affected.)



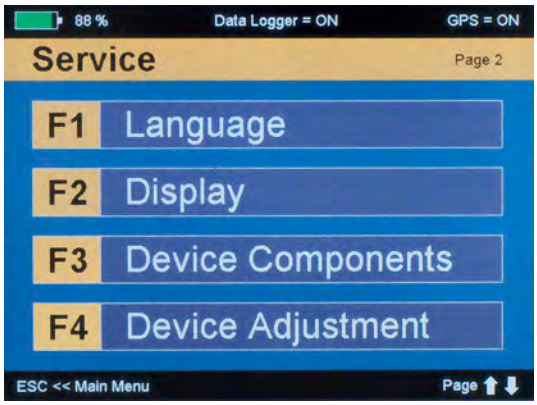
Display No. 6-del: clear Logdata

3.4 Service menu

Press ***F4 "Service"*** on <***page 2***> of the main menu (see chapter 3.2, p. 18) to access the service menu (three pages).

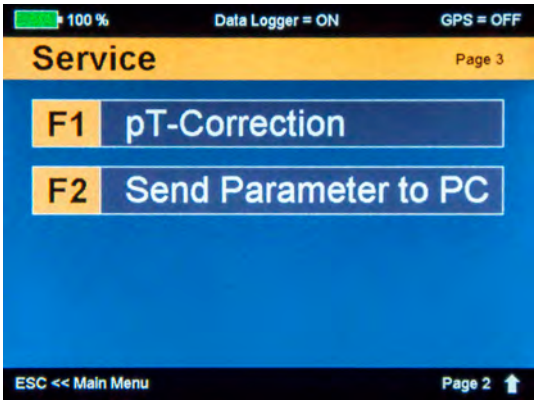


Display No. 20-1:
Page 1 of the Service Menu



Display No. 20-2:
Page 2 of the Service Menu

Use the arrow keys ▲▼ to switch between the different pages of the service menu.

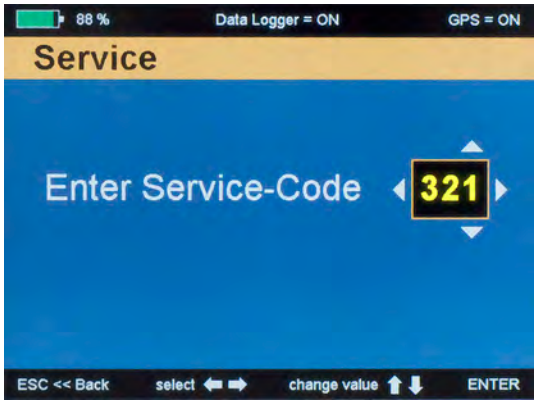


Display No. 20-3:
Page 3 of the Service Menu

3.4.1 Calibration

The menu ***"Calibration"*** allows to view all stored calibration factors, you can also enter a new calibration factor or delete all stored calibration factors.

Press ***F1 "Set Calibration"*** on <***page 1***> of the service menu. You will be prompted to enter a service code: ***321.***
Press [***ENTER***]) to confirm.



Display No. 22-00:
Enter service code - Calibration

3.4.1.1 Display of calibration factor list

With the service code entered, all stored calibration factors are listed on the dipsplay.

The current calibration factor is shown on the bottom right of the display.

Display No. 22-1

3.4.1.2 Delete all calibrations

Pressing of ***F4*** will delete all calibrations. (You will be prompted to confirm this step.)

3.4.1.3 Entering a new calibration factor

Press ***F1*** in display No. 21 to enter a new calibration factor. Use the arrow keys ◄► to select the desired digit.
Change the value of this digit with the arrow keys ▼▲.

Display No. 22-2

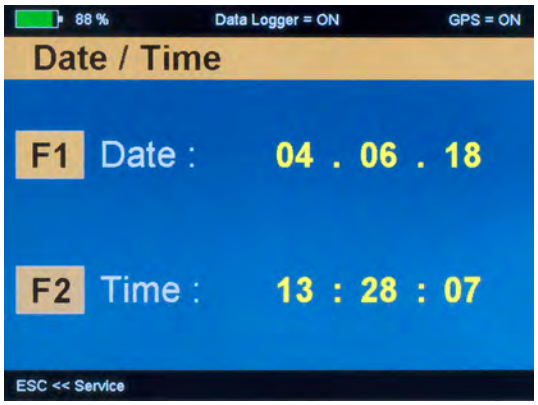
Every alteration of the calibration factor influences the measurements.Therefore the calibration factor should only be changed after previous determination with a suitable calibration gas source (e.g. Mercury Calibrator MC-3000 by ENVEA GmbH).

3.4.2 Setting of date and time

Press *F2* "***Set Date / Time***" on <***page 1***> of the service menu.

Press ***F1*** to set the date.

Press ***F2*** to set the time.

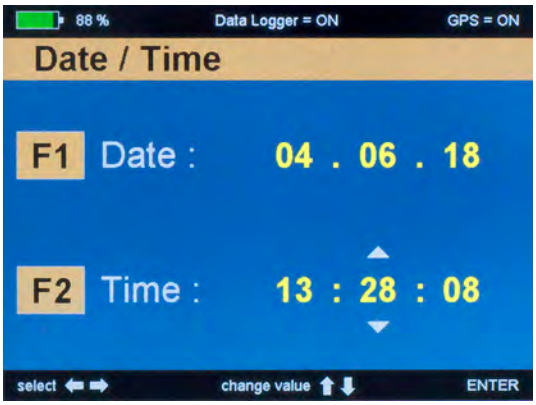


Display No. 24-1:
Display of date and time

Pressing the arrow keys ◄► lets you select the value to be changed.

Changing the value is done by pressing the arrow keys ▼▲.

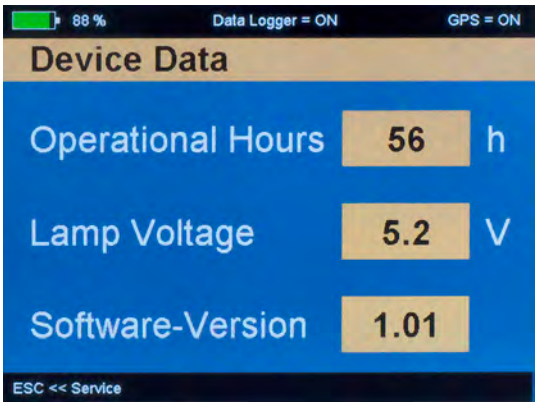
Confirm by pressing [***ENTER***].



Display No. 24-2:
Setting of date and time

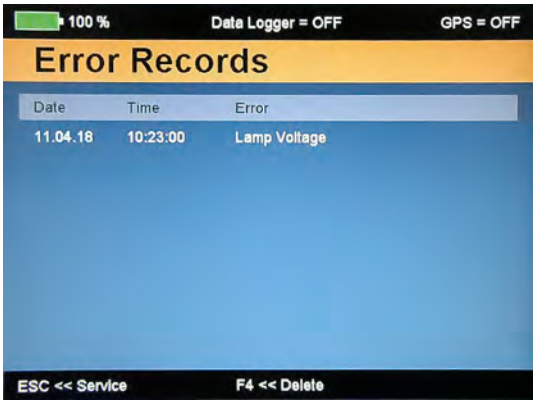
3.4.3 Device data

Press ***F3 "Device Data"*** on <***page 1***> in the service menu to get information about operational hours, current lamp voltageand softare version. Standard lamp voltage ranges from 3.0 to 9.0 V.

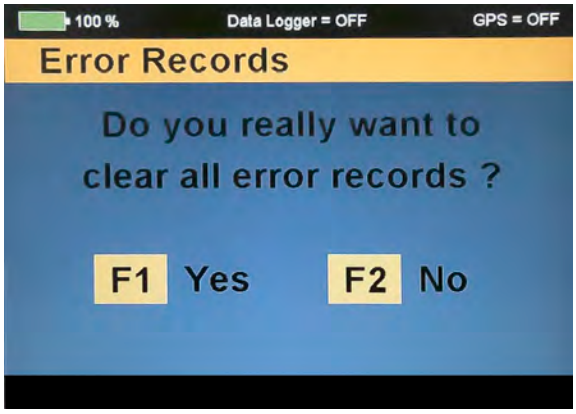


Display No. 26

3.4.4 Error records



Display No. 28-1



Display No. 28-del

Press ***F4 "Error Records"*** on <***page 1***> of the service menu to view a record of errors.

Pressing of ***F4*** lets you delete the error records.
(You will be prompted to confirm this step.)

3.4.5 Select language

English or German language can be selected in the service menu.

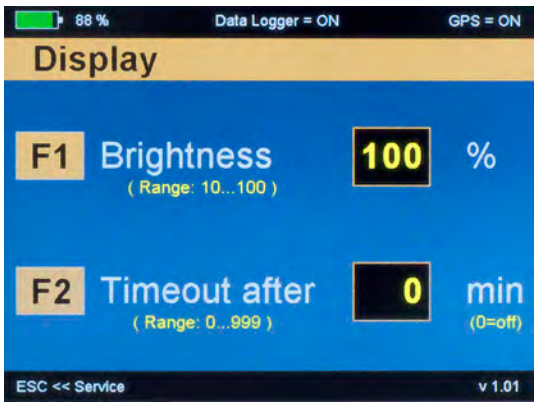
Press ***F1 "Language"*** on <***page 2***> of the service menu.

Select the desired language by pressing the arrow keys ▼▲.

Display No. 30

3.4.6 Adjust display

You can adjust the brightness of the display as well as a period of time after which the the brightness of the display is automatically reduced to about 20% if no key is pressed.



Display No. 32

Press ***F2 "Display"*** on <***page 2***> of the service menu (see chapter 3.4, p. 34).

Press ***F1*** or. ***F2*** to select either ***"Brightness"*** or ***"Timeout after"***.

To adjust ***"Brightness"*** hold one of the ▼▲ arrow keys depressed until the desired value is reached.

To adjust ***"Timeout after"*** the ◄► arrow keys let you select the digit to be edited, changing the value of the digit is done by pressing the arrow keys ▼▲.

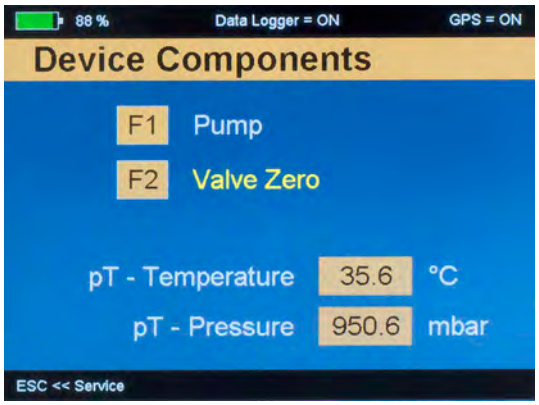
Press [***ENTER***] to confirm.

3.4.7 Manual test of the pump and the zero air valve

The operation of the pump and the zero air valve can be checked manually.

To do so press ***F3 "Device Components"*** on <***page 2***> of the service menu (see chapter 3.4, p. 34).

You can hear that pressing ***F1*** will turn the pump on (and off).
If you press ***F2*** there is a sligthtly audible click as the zero air valve is actuated.



Display No. 34

In addition temperature and pressure of the pT-sensor are shown (for turning the pT-correction on or off see chapter 3.4.9, p. 39).

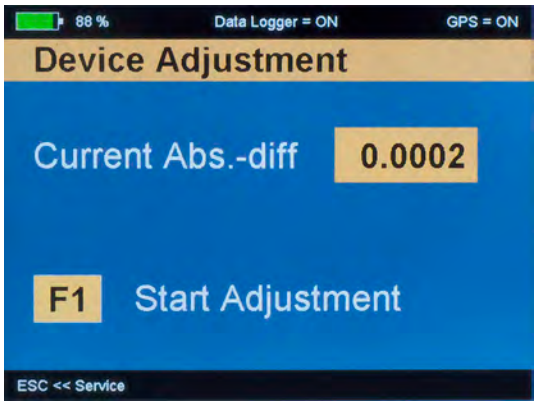
3.4.8 Device Adjustment (adjust zero offset)

Zero offset adjustment of the TRACKER-3000 XS should only be carried out after consulting ENVEA GmbH or one of its affiliates.

In some cases it may be observed that the reading of zero air is not zero even after a zero adjustment has been performed*). In this case the zero offset may be re-adjusted.

Select ***F4 "Device Adjustment"*** on ***<page 2>*** of the service menu, Enter the service code ***321*** and confirm by pressing [***ENTER***].

Press ***F1*** to start the adjustment.



Display No. 36-1

The zero offset adjustment MUST be carried out in surroundings that are completely free of mercury (e. g. in the open in an uncontaminated area).

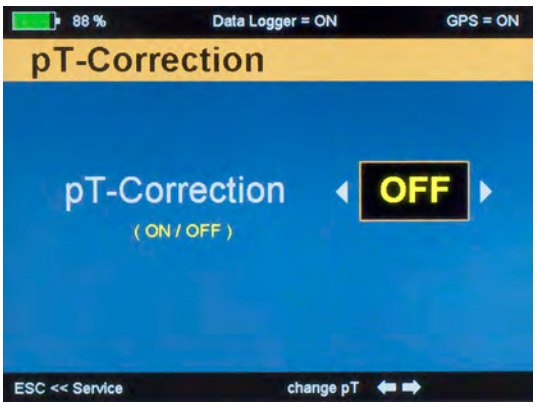
**) This can be the effect of minimal pressure differences between the activcated carbon filter and the sample inlet filter.*

3.4.9 pT-correction

Press ***F1 "pT-Correction"*** on ***<page 3>*** of the service menu.

Press the arrow keys ◄► to turn the pT-Correction on or off.

If µg/m³ is chosen as unit of concentration (see chapter 3.2.6.2, p. 24), the concentration unit while measuring will change to µg/Nm³ (µg/Norm cubic meter).



Display No. 38

3.4.10 Send parameters to PC

Please refer to chapter 3.3.2.3, p. 30.

4. Care and Maintenance

The TRACKER-3000 XS should be maintained regularly once a year. The following service work has to be done:

- Check of the optical cell and of the internal tubing for visible deposits. Replace if required.
- If the TRACKER-3000 XS is in permanent operation the membrane pump should be replaced every two years.
- Replace the carbon filter for zero air (see next page).
- Check the functionality of the zero air valve (see chapter 3.4.7, p. 38).

4.1 Calibration check

Depending on quality requirements the calibration of the TRACKER-3000 XS should be checked with a reference instrument. Due to the high stability of the photometer an annual check is normally sufficient. For the performance of the calibration check please contact ENVEA GmbH or one of its affilliates.

Each TRACKER-3000 XS has been calibrated before delivery. Every two years a professional calibration check is recommended. According to regulations applied on a special application more frequent re-calibration may be necessary.

If parts of the TRACKER-3000 XS in contact with sample gas are contaminated with active substances like sulphur, an immediate calibration check is recommended.

4.2 Particle filter

Under normal operation conditions, the sample gas particle filter (part No. 350-02) has to be inspected regularly. If a deposit of particulate matter is visible, the inline-filter has to be replaced. Expected time interval for a filter replacement is 1 ... 6 months if normal room air is measured.

Fig. 10-1: Particle filter with quickfit for easy connection to the sample inlet

Fig. 10-2: Particle filter on the sampling probe

4.3 Replacement of the carbon cartridge for zero air

The internal carbon cartridge of the TRACKER-3000 XS (part-No. 201-04) should be replaced annually.

Observe the following procedure:
This work should be carried out by trained personal or by ENVEA GmbH service partners only !

- Turn off the instrument (if applicable disconnect an external power source).
- Open the battery case and remove the battery pack (see chapter 4.4.1, p. 42).
- Place the Instrumenton a flat surface remove the six screws (Fig. 11-1) on the front panel of the TRACKER-3000 XS using the enclosed special screwdriver.
- Carefully lift the front plate by holding it on the connectors.
- Lift the front plate up completely (CAREFUL: the cable connecting to the battery pack may be caught in the opening to the battery compartment !) Place the front plate on a cushioned surface.
- Carefully remove the carbon cartridge from its clamps. (Fig. 12).
- Remove the tubings from the old cartridge.
- Connect the the new cartridge to the tubings and secure it in the clamps.
- Put the front plate back on the instrument (don‘t forget the battery cable !), insert and tighten the screws.

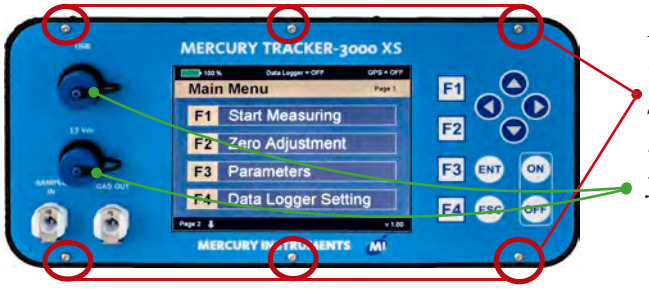


Fig. 11:
Opening the Tracker: Remove the six screws and pull the front plate up a bit by holding it on the connectors until you can get a firm grip on the plate.

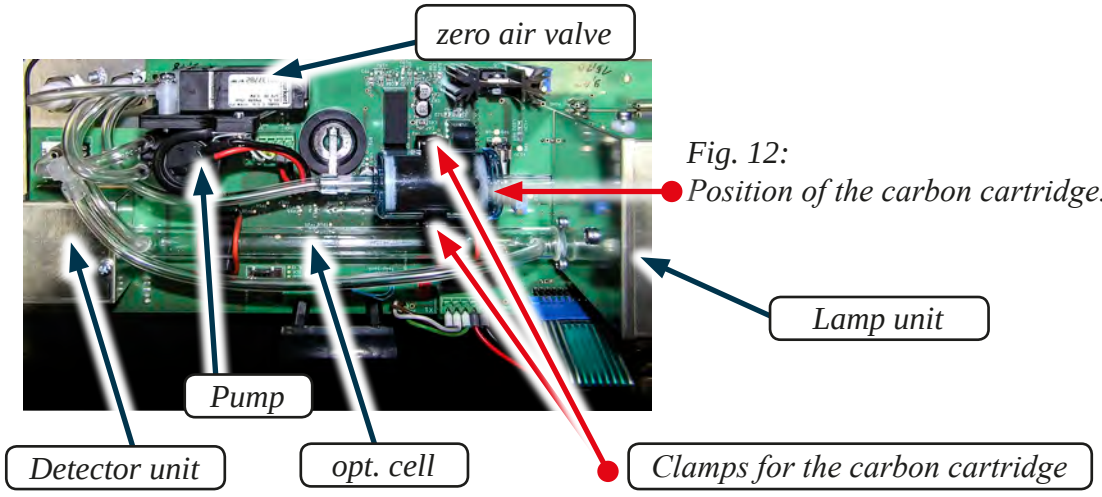


Fig. 12:
Position of the carbon cartridge.

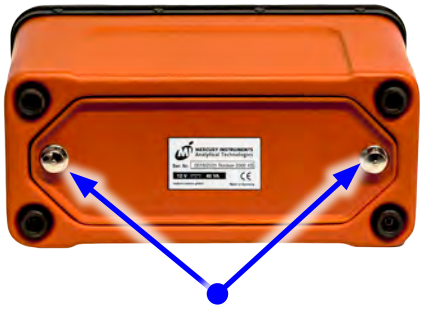
4.4 Battery compartment

4.4.1 Replacing the battery pack

Turn off the instrument (if applicable disconnect an external power source).

The battery compartment can opened by simply pulling on the snap closings.

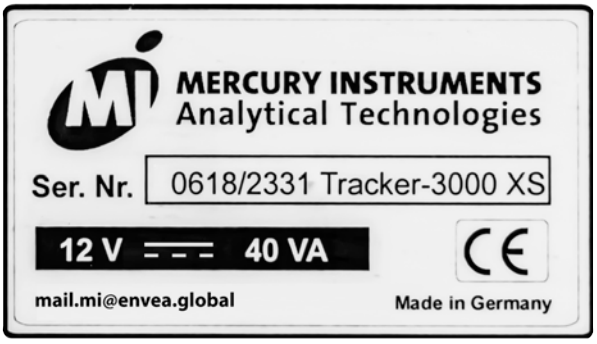
Fig. 13-1/2: Changing batteries and postion of serial number



Disconnect the battery from the cable connecting it to the instrument. Connect the new battery pack and insert it into the battery compartment. Push the bottom plate in place.

4.4.2 Type label and serial number

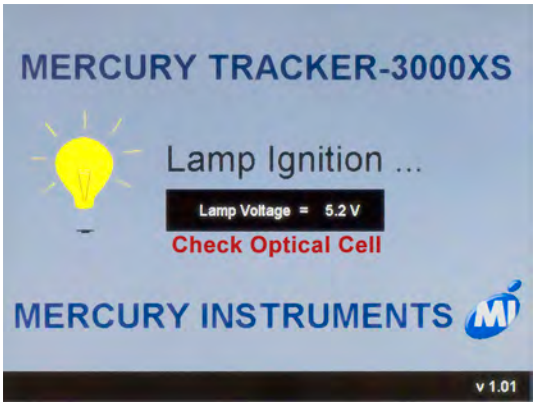
Plates with the serial number are located on the bottom plate and inside the battery compartment.



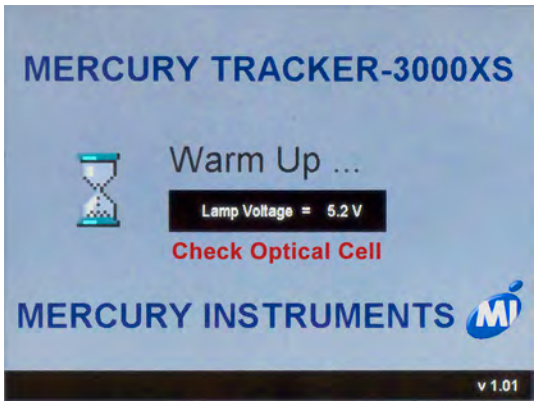
4.5 Warnings and error messages

4.5.1 Error messages during start-up

If the optical cell is polluted, error messages will appear during start-up.
Turn off the instrument and clean the optical cell (see chapter 4.6, p. 44).



Display No. 1 (during lamp ignition)

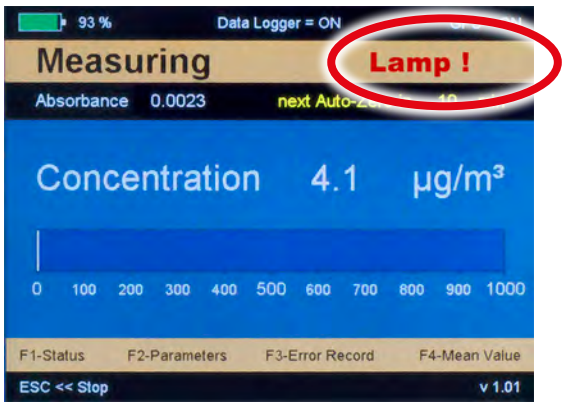


Display No. 2 (during lamp stabilization)

4.5.2 Error messages during operation

Error messages during measurement will appear blinking on the measuring display.

Measurement will continue however, there will be an entry in the error record (example: Lamp !).



Display No. 5:
Error message, e. g.: Lamp !

4.5.2.1 Lamp !

The installed electrodeless mercury lamp is monitored permanently. If its performance drops under a certain limit (lamp voltage >8.5 V) the warning “Lamp !” appears on the display. Contact the service.

4.5.2.2 Cl. cell.

This message is displayed in case the optical cell is badly polluted.
Clean or replace the optical cell (see chapter 4.6, p. 44).

4.6 Cleaning the optical cell

When the error messages “Check Optical Cell“ (see chapter 4.5.1, p. 43) or “Cl. cell “ (see chapter 4.5.2.2, p. 43) appear on the display, it may be necessary to clean the optical cell.

In case corrosive or toxic reagents have to be used to clean the optical cell, this work may only be carried out by trained personell wearing protective work clothing (lab coat, protective goggles, gloves).

- Turn off the instrument (if applicable disconnect an external power source).
- Remove the batteries (see chapter 4.4.1, p. 42)
- Open the instrument and remove the front plate (fig. 11, p. 41).
- Do not touch the glass with bare fingers! Always wear gloves !!
- Carefully remove the in- and outlet tubings from the optical cell. Remove the red rubber rings and carefully lift the cell out of its mounts, holding it by the nozzles.
- The optical cell should be rinsed with distilled water first and then dried. Drying can be done in a laboratory oven at mild temperatures (max. 85 °C) or/and by purging with clean air, nitrogen or argon.
- Depending on the composition of the soiling of the optical cell, cleaning with water may be not sufficient. In this case the cleaning has to be repeated with diluted hydrochloric acid (ca. 10 – 15 %). If the precipitation still remains, higher acid concentrations or concentrated hydroxide solutions (NaOH) may be used.
- If the optical cell is soiled with organic substances cleaning may be performed with pure ethanol or acetone.

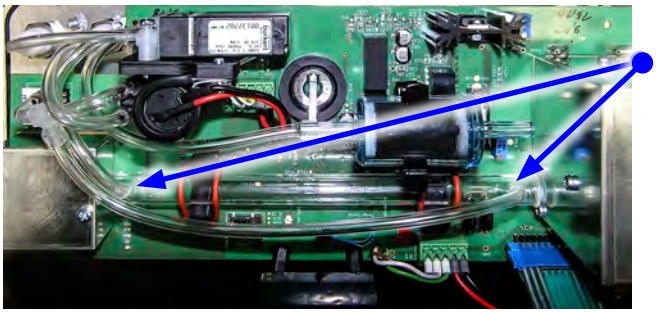


Fig. 14-1:
Remove tubings

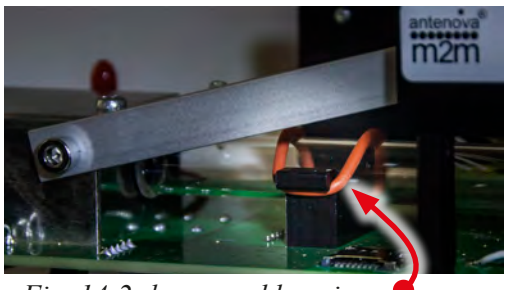


Fig. 14-2: loosen rubber rings

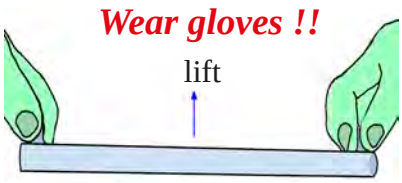


Fig. 14-3:
holding the optical cell

4.7 Cleaning the instrument

The front plate may be wiped clean with a soft moistened cloth. Do **NOT** use any solvents.

5. Technical information

5.1 Technical specifications

Instrument type	MERCURY TRACKER-3000 XS
Manufacturer	ENVEA GmbH (envea Group)
Measuring component	Mercury vapor Hg°
Measurement principle	Atom absorption
Wavelength	253,7 nm
UV-source	electrodeless mercury discharge lamp
Method of stabilising	optically with reference beam; thermally
Optical cell	entirely of fused silica Suprasil, l = 170 mm
Cell temperature	ca. 45 °C
Measuring ranges	0.1 - 100 [µg/m³] 0 - 10 ppb 0 - 1000 [µg/m³] 0 - 100 ppb 0 - 2000 [µg/m³] 0 - 200 ppb
Sensitivity	ca. 0.1 [µg/m³]
Sample gas flow	ca. 70 - 90 l/h
Digital outputs	USB, Bluetooth
Data storage	built-in Data logger, internal 4 GB SD-card automatic time and date stamp, GPS stamp if activated
Internal power supply (battery pack)	Eneloop Ni-MH 12 V / 5100 mAh
External power supply (mains adapter)	110 - 230 VAC / 50 - 60 Hz
Electrical power consumption	During start-up: max. approx. 40 VA (peak) continuous operation: 8.5 - 9 VA
Operating time (when running on batteries)	approx. 7 h
Dimensions	28 x 17 x 14 cm (WxHxD) photometer unit
Battery charger	Manufacturer: Ansmann AG Type: ACS 110 Protection class III IP protection class: IP 64
Weight	ca. 2,6 kg, incl. batteries

5.2 Operating conditions

Operating temperature	0 °C ... 40 °C
Sample temperature max.	65 °C
Operating humidity	ca. 90 % max. R.H.
Sample gas humidity, max.	no condensing conditions
CE approval	according to 2014/35/EU, 2014/30/EU, 2011/65/EU

5.3 Spare parts and accessories

ID	Item Description
201-03m	**Tygon tubing**, 4/7'' sample tubing
380-03m	**Tygon tubing**, 1/8 x 3/16'' internal tubing
201-04	**Activated Carbon Filter** filled with sulphurized activated carbon
202-10	**Gold Filter Cartridge** for testing of nonspecific readings
203-02	**Optical cell** l= 170 mm, completely made of synthetic fused silica (Suprasil)
203-61	**UV Lamp**, electrodeless spare lamp bulb
301-02	**Sample tubing (alternatively)** FEP 4 x 6 mm, low memory effect, recommended for lengths > 10 m
380-10	**Buffer battery for the RAM of the mikroprocessor** CR 20-16
304-01	**Membrane pump** complete pump
330-01	**Quick-Fit connector**, for connection of sample tubing or wand to sample gas inlet of the TRACKER-3000 XS
330-02	**Sample in/out Quick-Fit connector**, to be mounted on front panel of TRACKER-3000 XS
380-01	**Rechargeable Eneloop battery pack**, 12 V, for ca. 7 h operation
380-13	**Adapter cable** for cigarette lighter
380-15	**Charging cable**, external
350-02	**Sample filter,** set of 10 pcs.
380-05	**Sample probe** for field testing, extendable, with filter and tubing
380-06	**Battery charger** ACS 110, with connector cable
350-09	**electromagnetic valve** complete unit
380-13	**Adapter cable** for cigarttte lighter
380-20	**USB cable** (A --- mini B)
380-12	**LC Display**
380-96	**Fuse** 20 x 5, 5A medium slow
380-16	**Teflon connections** set with 2 corner connections, 1 T-connection
380-40	**pT sensor**

5.4 Cessation of use

If the instrument will not be in use for a longer period of time, the batteries should be fully charged.

When putting the instrument back to use conduct care and maintenance work as described in chapters 4.1 - 4.6 (p. 40 - 44).

Also check the function of the zero air valve and the membrane pump (see chapter 3.4.7, p. 38).

5.5 Disposal of the instrument

To correctly dispose if the instrument observe the following points:

- Remove the batteries and dispose of them according to applicable law
- Remove the carbon cartridge and dispose of it as hazardous waste according to applicable law
- The instrument is to be disposed of as electronic waste.

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APPENDIX: EC-Declaration of Conformity

CE

EC-Declaration of Conformity

The Company: **ENVEA GmbH**
Liebigstrasse 5
D-85757 Karlsfeld
Germany
Declares that the product: **MERCURY TRACKER-3000 XS**
Intended purpose: **Automatic measurement of mercury at trace concentration levels in air and other gases**
conforms with the basic requirements of the relevant EC directives:

2014/35/EU (low voltage directives)
2014/30/EU (EMC directive)
2011/65/EU (RoHS)

A conformity assessment method as provided in the directives has been executed.

For verification in accordance with the directives 89/336/EEC, 73/23/EEC and the other relevant provisions the following harmonized standards were applied:

EN 61326-1: 2012 Electrical equipment for measurement, control aloboratory use - EMC requirements
Part 1: General requirements
The tests included:
Radio frequency disturbance class A according to EN 55011
Electromagnetic immunity EN61326-1 Tab. 2 (industrial environment)

The tests regarding above standards have been conducted by:
dresden ingenieurtechnik gmbh, Dresden/Germany (Test Report Nr. 201 805 18).

This declaration is submitted by:

Karlsfeld, 25th July, 2018

Dr. Alfred Sauerer
General Manager

Dr. Brigitte Inderst
General Manager