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Sniff-0
Portable Scent Controller Olfactometer

Operating and Maintenance Manual

Applies to the following product models:
0F000001x / 0F000020x / 0F000031x / 0F000037x / 0F000038x / 0F000039x / 0F000081x / 0F000082x / 0F000083x

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1 Introduction

1.1 General Information

The contents of this document are the intellectual property of CyNexo srl. Any reproduction of this document, in whole or in part, is prohibited, unless otherwise specifically authorized in writing by CyNexo srl.

1.2 Purpose of the manual

This manual has been drawn up in order to provide all the indications and instructions required for transportation, handling and maintenance of the Sniff-0 olfactometer manufactured by CyNexo, Via Roma 6, 33050 Trivignano Udinese (UD), Italy.
It contains all the general information for the correct use of the olfactometer. This document has been drawn up in compliance with UNI10893:2000 standard (*Technical Documentation of product – Instructions for Use – Structure and exposition of contents*) and UNI10653:2003 standard (*Technical documentation – Quality of product technical documentation*).

1.3 Objectives and limitations of the manual

This manual is intended for all users of the Sniff-0 olfactometer and should be always kept at hand. The purpose of this manual is to provide information regarding:

- the technical characteristics and description of the system
- environmental requirements of the installation site and power sources
- accident prevention
- intended use of the system
- maintenance
- availability of spare parts

1.4 Storage of the manual

This manual forms an integral part of the Sniff-0 olfactometer and should be kept for future reference together with the system until final dismantling or disposal of the system.
The manual must always be available for consultation and must be stored in a safe place away from dust and moisture. In case of loss or damage that affects your ability to consult any part of it, the user must request a new copy from CyNexo.

1.5 Update of the manual

This manual has been drawn up simultaneously with the relevant system and shall not be considered inadequate only because it has been subsequently updated (even for similar systems) based on new knowledge. CyNexo srl reserves the right to modify their production together with the relevant manuals, without any obligation to update any previously delivered product or documents. Should any integration to the manual be required, this will be delivered to the user on record, who must keep them together with the original manual.

2 Quick start guide

Please read this section carefully BEFORE you start any operations with your new equipment. If at any time you identify damage to or an abnormal condition of the product, please STOP, safely disconnect the equipment from ALL power sources and contact us immediately through the channels provided in "Contact Details" section of this operating manual. Similarly, if at any stage you are unsure how to procced, please read the whole manual and if necessary, contact us before proceeding.

This unit weighs between 22 and 28kg (48-62 lbs) depending on the specific configuration. Please handle with care, and in order to avoid injuries, ensure it is always lifted by two suitable people.

Please read ALL labels and warnings prior to using this product. If in doubt, please do not proceed and contact us for clarifications.

2.1 Connections

The function of each connector is described in Table 1 and shown in below:

Connector #	Function	Description
1	PWR IN	+12V power supply IN
2	USB	USB2.0 interface to the control PC
3	Digital IN	Digital INPUT 0-5V (TTL compliant)
4	Digital OUT	Digital OUTPUT 0-5V (TTL compliant)
5	Air IN	Main air input connector
6	Air IN	Calibration air input
7	Air OUT	Calibration exhaust air output
8	Air OUT	Odours output

Table 1: I/O connections

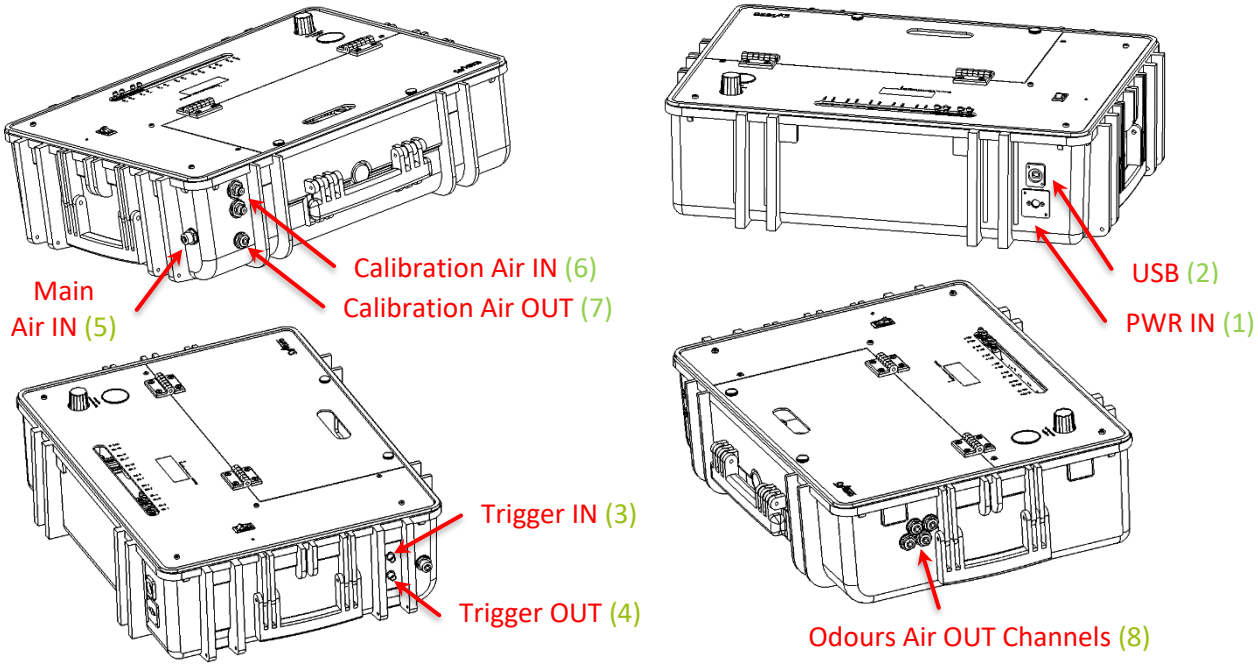

Figure 1: Sniff-O system layout

On the front side of the olfactometer you will find two calibration air input connectors as well as a larger single calibration air exhaust port. On the rear side of the olfactometer you will find access to power supply and USB communications connectors which allow you to connect the system to a PC and interface with other external devices. On the right-hand side you will find the constant flow and odour output channel connectors, while on the left-hand side you will find the main air input connector and the two BNC digital trigger IN and OUT connectors.

From a horizontal position, opening the upper suitcase cover by unlatching the 4 plastic latches around the perimeter of the lid allows the access to the internal part of the system.

2.2 FIRST STEP: connect the air input and fill the odour containers

Maximum air inlet pressure to this unit is 6 Bar (approx. 90 Psi). CAUTION: You should NEVER EXCEED this air inlet pressure. Doing so may void the warranty and may result in damage to the unit and a hazard to the user. For safety, we recommend using a separate inlet pressure regulator upstream of the unit to limit the maximum pressure.

Before you connect the air supply to the unit, always ensure the built-in relieving pressure regulator valve (top right-hand corner of the unit) is closed (fully relieving) and that all connections are secure.

For best results, we recommend only using clean, dry, odourless air at an inlet pressure of between 2.2 and 3 Bar, with a subsequent operating pressure (downstream of the relieving valve) between 2 and 2.8 bar. CAUTION: You should NEVER EXCEED an operating pressure of 3 Bar.

Separately, fill each of the provided glass scent jars with the chosen odours, tightly fasten the lids over each jar and connect the corresponding tubes to each, taking care to avoid any cross contamination and ensuring all connections are secure.

2.3 SECOND STEP: connect the power adapter

This product operates at 12V (max 60W), supplied by the included CE/FCC compliant power adapter. You should NEVER EXCEED this voltage. The power adapter is a universal/multi-region 110-220V 50-60Hz medical grade power supply. Please only use the original power adapter and certified power cords with this adapter, and only plug it into suitable and undamaged receptacles.

Connect the system to the power source using the included power adapter and taking care to align the connector pins, then flip the power switch in the top left-hand corner of the unit next to the LCD screen into the ON position. The system will power up and the display will welcome you with this message:

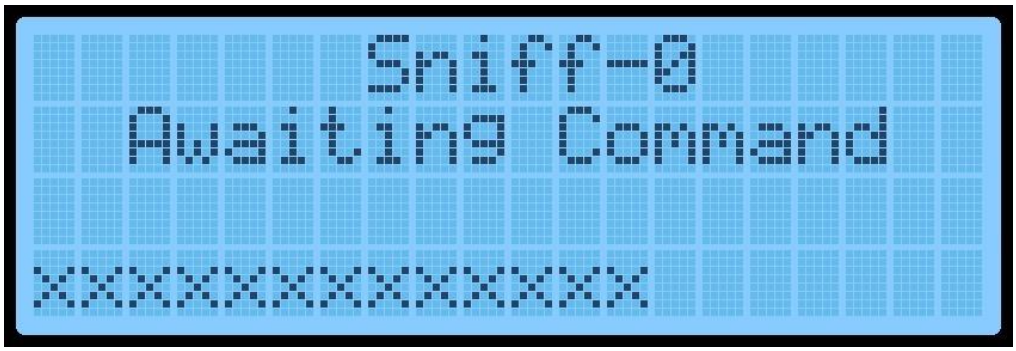

Figure 2: Sniff-0 digital display

2.4 THIRD STEP: set the desired air input pressure

After connecting the air supply tube to the unit and switching the power on, make sure the downstream odour channel tubes and manifold are not plugged or otherwise blocked and then gently open the supply air pressure at the relieving valve until you reach the desired operating pressure. We normally recommend using an operating pressure between 2 and 3 Bar and an air inlet pressure between 0.2 and 0.5 Bar (approx. 3-7 psi) greater than the operating pressure desired at the unit. Reducing the difference between supply and operating pressure will minimize noise due to pressure relieving.

CAUTION: The operating pressure downstream of the pressure relieving valve should NEVER EXCEED an operating pressure of 3 Bar.

2.5 FOURTH STEP: connect the USB control cable

You can now connect the provided USB 2.0 cable to your Sniff-0 device and then to the control PC, after which you should see a new serial connection appear in your I/O port list.

You are now ready to setup the communication with Sniff-0 and then run any of the commands as indicated in the “Communication and User Interface” section of this manual.

3 Definitions and terminology adopted in this manual

3.1 Definition of CAUTION and NOTE

CAUTION

This term refers to a procedure, a condition for which the non-compliance of the rules indicated may result in damage to the system or its components, or cause injury to the user.

NOTE

This term draws the reader's attention to particular aspects of the procedure described herein.

3.2 General definitions related to safety

USER

User means the person authorized to perform the activities within his/her competence in running the system, including the task of recognizing any possible hazards to oneself and/or to exposed persons, as well as to avoid any risks involved. Generally, authorization to run one or more systems is given following the operator's ability to demonstrate such competence, resulting from his/her previous capabilities, experience and training.

TECHNICIAN

See specialized personnel.

MAINTENANCE OPERATOR

See specialized personnel.

SPECIALIZED PERSONNEL

Specialized personnel means the person or persons having specific expertise in one or more specific fields, capable of carrying out any maintenance operation other than routine service operations. The specialized personnel may be the manufacturer's employee or an employee of an external company who is specifically authorized by the manufacturer.

EXPOSED PERSON

An exposed person is any person who, for whatever reason, happens to be completely or partially in a hazardous area.

HAZARDOUS AREA

A hazardous area is the whole area within which the presence of an exposed person may create possible risks to his/her health and safety.

HAZARD

A hazard is a situation or a reason for which one or more elements that can cause death of or serious injury to the user or exposed persons are present.

RISK

Risk means the possibility of a hazard and, consequently, the possibility that the user or exposed person may suffer an injury.

3.3 Technical definitions related to the olfactometer

The following technical terms are used in this manual:

EXPOSURE TIME

The total amount of time during which a specific odour is delivered.

3.4 Short forms / Abbreviations

The following is a list of terms that will be abbreviated when used within this manual.

Human Machine Interface	HMI
Electromagnetic compatibility	EMC
Standard litres per minute	SLPM
Litres per minute	LPM
Electroencephalography	EEG
Functional Magnetic Resonance Imaging	fMRI
Transistor–transistor logic	TTL
Return Merchandise Authorisation	RMA

4 Description and intended use of the olfactometer

This Sniff-0 device is intended for laboratory and production environments as an automatic, portable controlled scent dispenser, that allows the user to trigger and manage experimental or standard activities using a versatile and efficient HMI interface to program the device. It is possible to setup an operation using a control PC connected to the main unit via a USB cable, and via an appropriate control software (e.g. MATLAB, Python, E-Prime or your own customized solution).

Its main features are:

- USB interface for PC control
- Configurable control software
- Compatible with Python/MATLAB®/C/C++/E-Prime®/LabView®
- Dryer filter on incoming air (optional)
- Isolation class VI valves (max. leakage 0.00002 LPM @9.6 bar)
- Automated ON-OFF valves with 4ms activation time
- Manual flow regulation with 7 turns valve (automated flow regulation valves optional)
- Odour flow up to 4 SLPM (combined)
- Flow-meter reading accuracy 0.05 SLPM
- EEG e fMRI compatible (optional – applies to subject manifold only)
- Sterilizable hermetic glass jars as odour containers
- Triggering interface for "Real time" applications
- Digital I/O ports (1+1) for triggering (BNC ports compatible with TTL or Open Collector)
- Incorporated into portable rugged roller case
- 12V operating voltage with universal 110-220V 50-60Hz power supply (CE/FCC compliant)

The olfactometer can be integrated in existing installations in compliance with the mechanical and electrical regulations set forth in the following paragraphs of this manual.

Electrical connections available from Sniff-0 are reported in the following table:

Connector #	Function	Description
1	PWR IN	+12V power supply IN
2	USB	USB2.0 interface to the control PC
3	Digital IN	Digital INPUT 0-5V (TTL compliant)
4	Digital OUT	Digital OUTPUT 0-5V (TTL compliant)

Table 2: Sniff-0 electrical connectors

In order to avoid electromagnetic interferences, please take care to separate power paths, such as DC line input from USB or I/O paths.

Please refer to the Electrical system functional block diagram section of this manual for a complete schematic description.

4.1 System components identification

On the inside of the unit, usually under the access panel to the odour vases you will find a plastic label that reports model and serial numbers. This label displays the CyNexo logo and looks similar to that shown in Figure 3.

Figure 3: Label on the suitcase

Please do not cover or remove these labels. It may be necessary to provide CyNexo with information contained on these labels during the provision of assistance.

5 General information and safety regulations

5.1 Reference standards

The regulations considered during the design phase of the olfactometer are the following:

- Air Quality:
  - EN 13725:2003 Determination of odour concentration by dynamic olfactometry
- Low Voltage Directive
  - *Directive 2006/95/EC* on the approximation of the laws of Member States relating to electrical equipment designed for use within certain voltage limits.
- Medical Safety:
  - EC60601-1 3rd and 3.1st edition CB reportIEC60601-1 edition 3.1st (2012)
  - EN60601-1 (2006) + A11 + A1 + A12
  - CAN/CSA-C22.2 NO. 60601-1:14
  - ANSI/AAMI ES60601-1:2005/(R)2012

- ITE Safety:
  - IEC60950-1 (Ed.2,2005)
  - GB4943.1-2011
  - GB9254-2008
  - GB17625.1-2003

- General Safety:
  - SELV device
  - IEC 60364-4-41:2005

- CE:
  - MDD Directive 93/42/EEC

- Materials and Parts:
  - RoHS Directive 2011/65/EU Compliant

- EMC:
  - 2014/30/EU

Specific EMC testing references:

- *EN 60601-1-2* Electromagnetic compatibility (EMC) - Medical electrical equipment - Part 1-2: General requirements for basic safety and essential performance - Collateral Standard: Electromagnetic disturbances - Requirements and tests

- *EN 55011 / CISPR 11* Electromagnetic compatibility (EMC) - Industrial, scientific and medical (ISM) radio-frequency equipment – Electromagnetic disturbance characteristics – Limits and methods of measurement.

5.2 Operating environmental conditions

5.2.1 Temperature and humidity

The Sniff-0 olfactometer is equipped with electronic and mechanical components that are designed to operate within standard humidity range and the temperature range indicated in the table.

Minimum operating temperature (°C)	Maximum operating temperature (°C)
0	40

Table 3: Temperature limits

The olfactometer has an IP44 degree of protection, if the suitcase remains closed. The use the olfactometer in environments where dust or water splashes exceeding the limits envisaged by this protection degree is not allowed and may cause damage to the device.

Once opened the suitcase allows access to the pneumatic portions and other components which may be sensitive to dust and/or splashes: please take care to operate in a clean and splash free environment.

Protection degree	Protection against dust	Protection against water splashes
IP	4	4

Table 4: IP degree of protection degree

5.2.2 Operating environment

The Sniff-0 olfactometer should be used in environments featuring the environmental conditions described in this manual. Use is not allowed in environments where the described conditions have not been checked beforehand.

5.2.3 Lighting

In order to avoid an increase in temperature during the experimental activity, please do not leave the olfactometer directly exposed to sunlight during operation or for any prolonged period.

5.2.4 Vibrations

The Sniff-0 system can be safely transported over most surfaces and in most modes of transport, avoiding excessive vibrations, bumps, and direct impact. Any strong vibration may seriously damage the unit.

5.2.5 Residues and environmental contamination

The external case is rugged and made of glass fibre reinforced polypropylene (PP): the Environmental Working Group classifies PP as of low to moderate hazard. However, any product that may interact with this material (acids, reactive materials, etc.) or any sharp instruments which may scratch it must be handled with care in the proximity of the system. As PP is flammable, do not expose the suitcase to naked flames or other sources of ignition.

5.3 General safety regulations

5.3.1 Intended, non-intended and incorrect use

The manufacturer declines any responsibility whatsoever in case of:

- Incorrect installation, non-compliance or incorrect compliance with the instructions supplied in this manual
- Defects of the electrical power supply system
- Defects of the pneumatic compressed air supply system
- Modifications to and/or tampering with the system
- Operations carried out by untrained or unsuitable personnel

The correct operation of the system also depends on a scrupulous observance of this manual, which is required before carrying out the installation, start-up and maintenance of the system. Only the configurations envisaged in this document are accepted.

CAUTION: For MRI compatible products please note that only the subject manifold and tubes are ferrous material free. ALL the other components, including main unit, power supply, compressors must be kept outside the MRI safe zone.

Therefore, any inappropriate use that is not in agreement with the indications supplied herein is strictly forbidden.

5.3.2 Direct risk assessment

An analysis of the risks that may arise from the use and installation of the system has been carried out by CyNexo srl. The olfactometer is powered via a 110-230 VAC mains adapter but works mostly at 12 VDC (some components run at a lower voltage) and has no moving parts that can generate any risk to the user.

5.3.3 Risks related to the installation environment

The Sniff-0 olfactometer should be used in environments featuring the environmental conditions described in the manual. If the conditions are met, the system does not generate any risk due to the installation environment.

5.3.4 Risks related to the characteristics of the machine

The olfactometer unit is powered at 12 VDC and has no moving parts that can generate any risk to the user. The characteristics of the olfactometer do not generate any risk when used in the manner and in an environment complying with the conditions described in this manual.

5.3.5 Residual risks

The risks analysis has highlighted the following residual risks:

- Electric risks: it must be remembered that all system parts are powered at 12V or less, only the main power supply adapter is powered at 110-230VAC, and all electrical issues have been considered. The system has been designed and built to eliminate reasonably predictable risks and it is provided with suitable electric protections using a double insulated medical grade power supply. Indications for use and maintenance are included in the following paragraphs.

6 System layout

Below is a brief description of the system, divided by panels.

6.1 System top panel

This panel contains the main air flow regulators, power switch, status LED, and system displays.

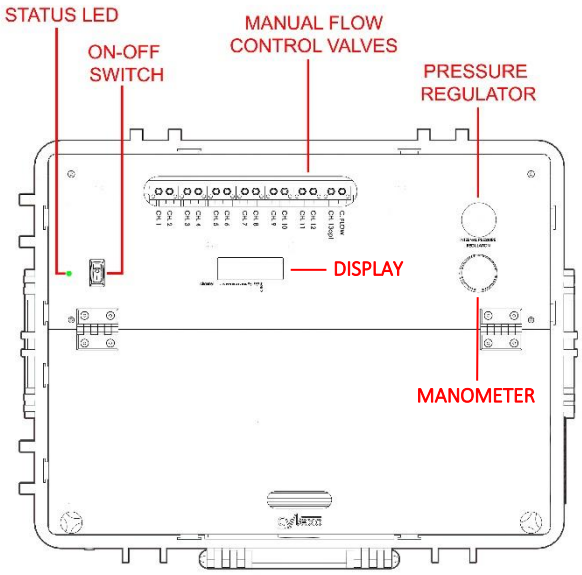

Figure 4: Top panel

6.1.1 Status LED

This LED changes its colour to reflect different system status: it is fully configurable by the control firmware and is switched off by default.

6.1.2 ON-OFF switch

The power supply switch is a two-position rocker switch: turn it on to power up the system.

6.1.3 Manual flow control valves

These knobs allow the manual regulation of air flow upstream of the optional stepper motor automatic flow control valves. If you have this option, please keep these manual valves open to the maximum flow to allow the stepper motors full-range regulation. Alternatively with the automatic control turned on, these valves can be partially closed to set the maximum allowed flow for each channel.

6.1.4 Display

The 20x4 character LCD module provides information on system status, flow regulation and alerts the operator to general system changes.

6.1.5 Pressure regulator

This pressure regulation valve allows for a fine tuning of operating air pressure and thus flow and must remain at or below 3 Bar (approx. 90 Psi). In order to avoid changes in air flow rates after the channels have been calibrated, ensure this regulator is not touched during any experiments. Pushing the knob down until it clicks will lock it. Similarly you will need to pull it up gently until it

clicks to be able to adjust the operating pressure. We recommend you always leave it in the locked position to avoid accidental changes in pressure once you have finished adjusting the operating pressure.

6.2 System right panel

This panel contains all the pneumatic connections to the subject manifold: please plug the tubes in following the colour code of each channel.

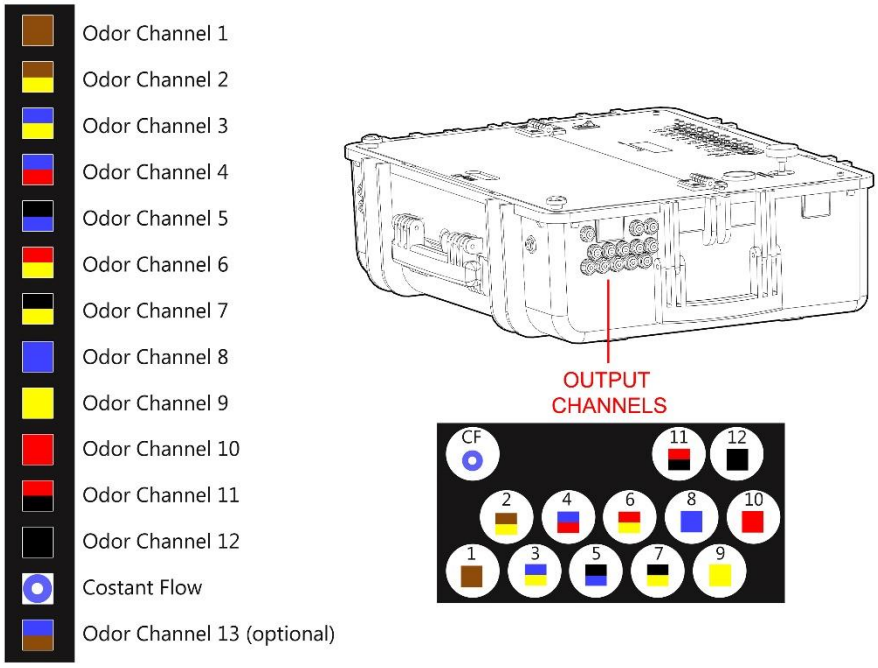

Figure 5: Right panel

It is important that these channels are not plugged when the device is in use. Only plug these connectors for storage and transport.

6.3 System rear panel

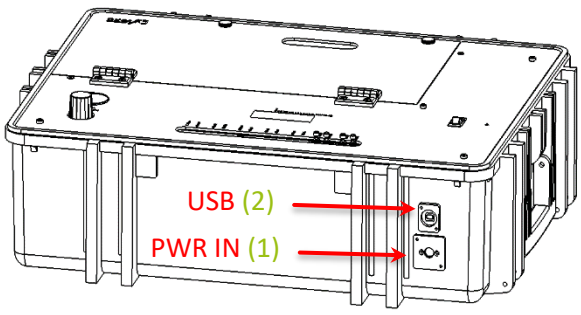

Figure 6: Rear panel

6.3.1 Power IN

This is the main power supply connector. Please plug the provided 12V power adapter cable here ensuring it is correctly aligned, fully inserted and locked. To disconnect, please pull back on the connector sheath prior to disconnecting the connector.

6.3.2 USB input (type B)

This is a USB type B connector and provides the communication between the device and host PC for controlling the olfactometer. Please use the shielded USB-A to USB-B cable provided with your device.

6.4 System left panel

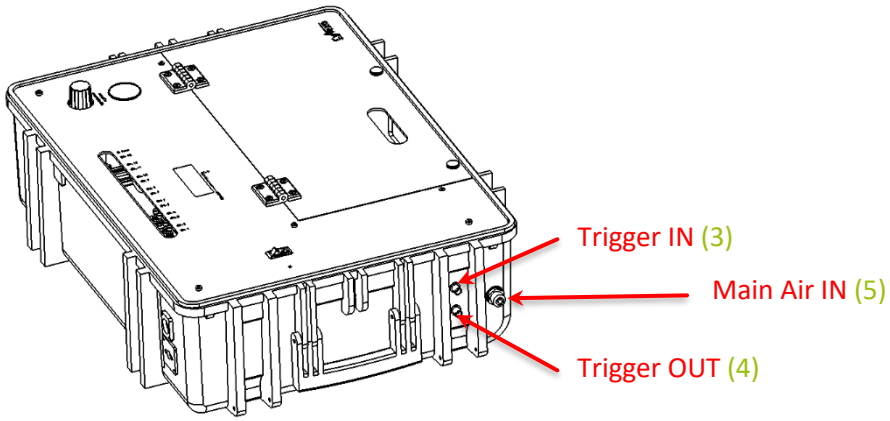

Figure 7: Rear panel

6.4.1 Main Air IN

This is a 6mm OD push-to-connect connector to supply the system with clean, dry and odourless air at a maximum of 6 Bar. We recommend a supply air pressure of between 2 and 3 Bar. When not in use please close with the provided cap to avoid any foreign bodies from entering the port.

6.4.2 Trigger IN

This standard BNC connector is the digital input port for "real time" triggering applications. It is compatible with TTL or Open Collector standards (0-5V, 10V tolerant) at up to 200Hz with pulses as short as 1ms.

6.4.3 Trigger OUT

This standard BNC connector is the digital output port for "real time" triggering applications. It is compatible with TTL or Open Collector standards (0-5V, 10V tolerant) at up to 200Hz with pulses as short as 1ms.

6.5 System front panel

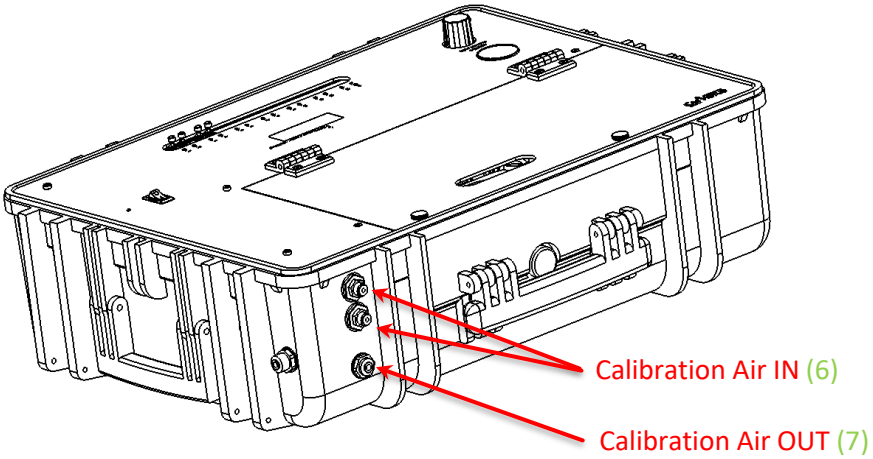

Figure 8: Front panel

6.5.1 Calibration Air IN

These two push-to-connect ports are used to feed in the two 4mm nasal tubes exiting the manifold (after carefully removing the nasal adapters) in order to conduct both flowrate calibration and timing delay calculation. When not in use please close with the provided caps to avoid any foreign bodies from entering the ports.

6.5.2 Calibration Air OUT

This is a simple venting port to allow a free flow of air through the flowmeter. Please ensure this port is unplugged during all flowrate calibration and timing delay calculation activities. When not in use please close with the provided cap to avoid any foreign bodies from entering the port.

6.6 Manifold

The main unit needs to be connected to the manifold through the provided PTFE tubes, one for each single odour and constant flow channel.
The manifold can be fixed on a static support or mounted on the subject's chest using the provided chest mounting harness as seen in the image below.

e

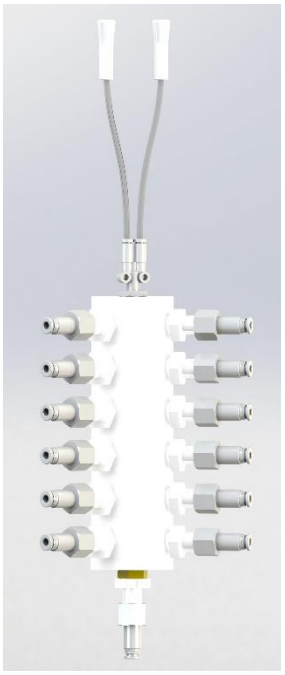

Figure 9 : 12+1 manifold

Figure 10 : 3+1 manifold with chest harness

Based on individual needs, we are able to provide many different formats and dimension of manifolds upon request. Please refer to the “Spare parts and accessories” section in this document for a list of common accessories and spare parts.

7 Communication and User Interface

Sniff-0 employs a communication scheme based on the Arduino DUE open hardware that allow a cross compatible support for Windows, GNU/Linux and Mac OS platforms. Moreover, a wide range of programming languages and frameworks are supported, thanks to the broad diffusion and use of the platform in scientific and general-purpose open platforms.
A brief step-by-step guide to on how to achieve a fully functional connection between the host computer and the olfactometer can be found below.

7.1 Arduino DUE Driver Installation

The first step to communicate with Sniff-0 is the installation of the Arduino DUE drivers on the host machine. This process may differ from platform to platform.
Please use the following guide, which is regularly updated:

https://www.arduino.cc/en/Guide/ArduinoDue#Toc2

Do NOT modify the system firmware during the driver installation phase: any change can produce severe damages to the olfactometer. Please contact CyNexo technical support if you have any issues or require a firmware update.

7.2 Serial communication

The following is a list of common serial programs that can be used to interact with the system by IDEs or via command line. Any mid to low level serial library can be used in the most common programming languages (C, C++, Python, MATLAB…) to achieve the same result.

7.2.1 Using the Arduino IDE

- You should have already completed this step while installing the driver. If not, then install the Arduino IDE following the instructions found at the following link and selecting the download most appropriate for your operating system:

https://www.arduino.cc/en/Main/Software

Figure 11: Arduino software download page

- Start the Arduino IDE
- Check that the drivers for the Arduino DUE have been installed by going to Tools > Boards and making sure Arduino Due (Programming Port) appears in the list (see below):

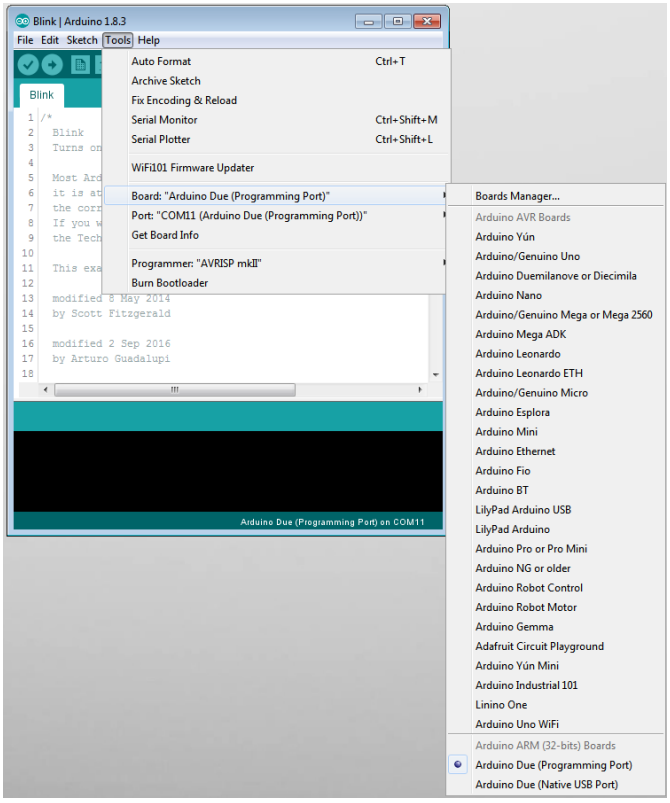

Figure 12: Check Arduino DUE drivers correctly installed

i. If not already selected, select the Arduino Due (Programming Port)

ii. Select the correct port by going to Tools > Port

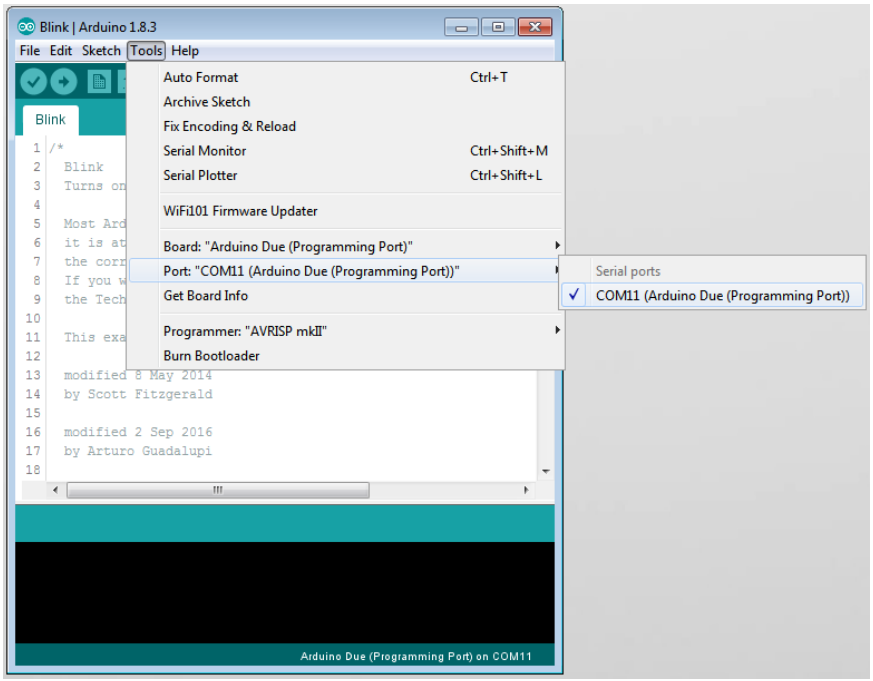

Figure 13: Check Arduino DUE comm port

iii. Open the serial communication by going to Tools > Serial Monitor

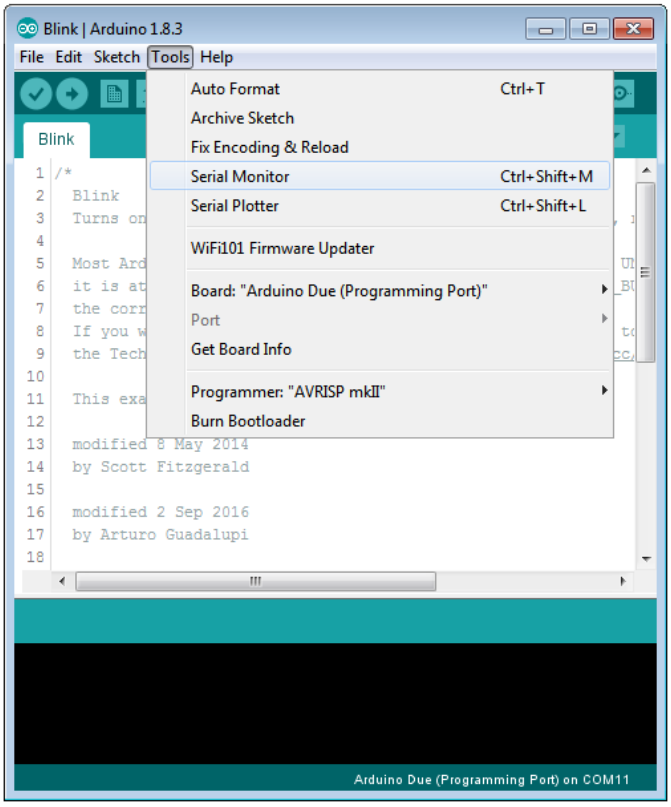

Figure 14: Open Arduino DUE serial monitor

iv. Set the correct communication parameters for the Sniff-0: “Carriage Return” and “9600 baud” (see red square below)

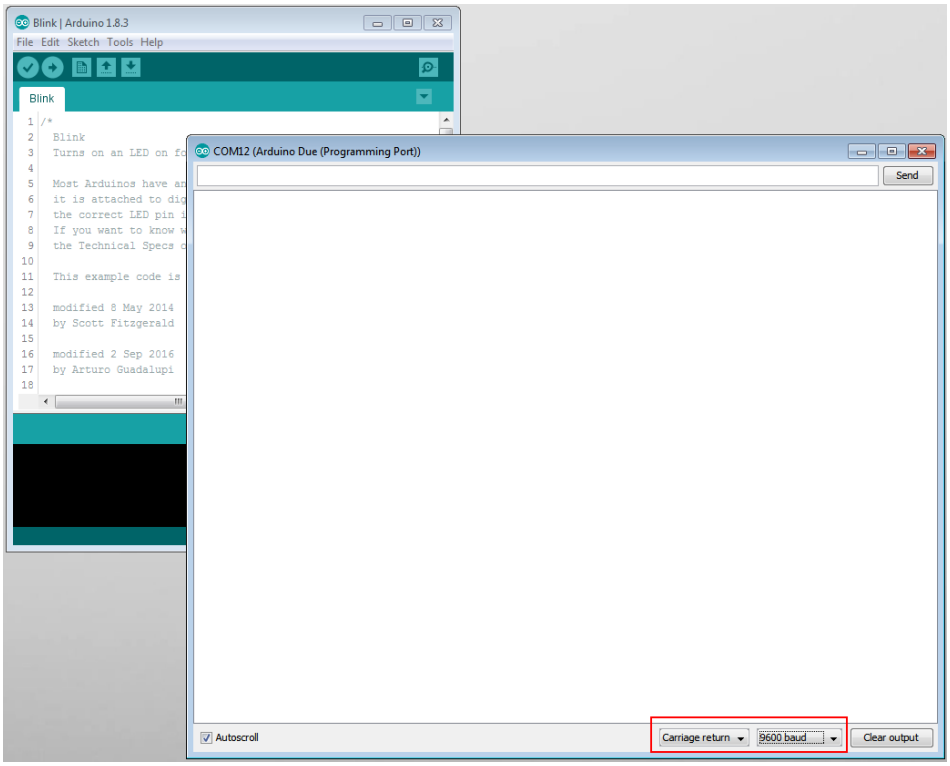

Figure 15: Set Arduino DUE carriage return and comm port speed

v. You are now ready to send commands to your Sniff-0

7.2.2 Using PuTTY

i. Download and install the software from this link: https://www.chiark.greenend.org.uk/~sgtatham/putty/latest.html

ii. Open PuTTY and set the echo on the terminal: Category > Terminal (if this option is not active you will not be able to see what you type on your screen, though this will have no impact from a functional point of view):

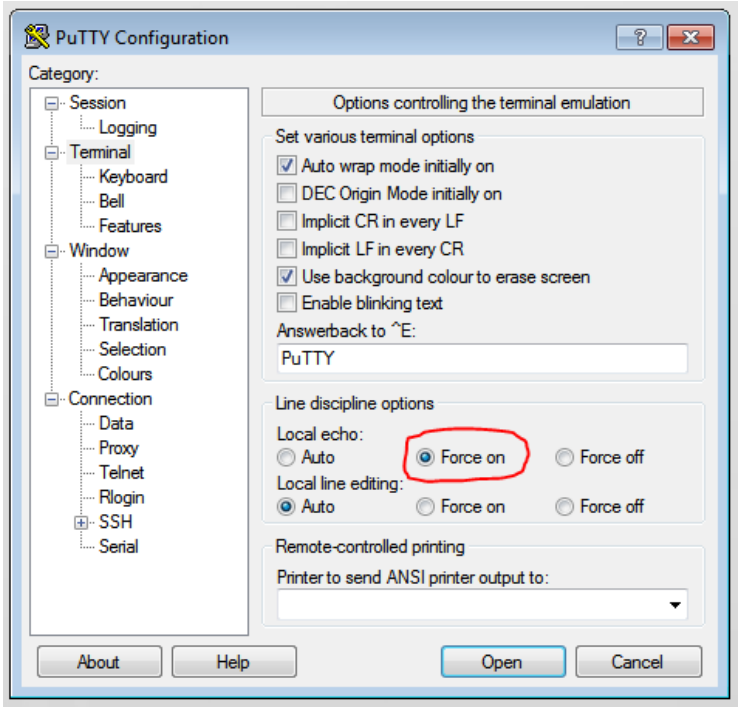

Figure 16: PuTTY set Arduino DUE local echo

iii. Set the serial communication parameters: Category > Connection > Serial (COM12 below is just an example: please enter the COM number applicable to your PC) ; N.B. Speed (baud) must be 9600.

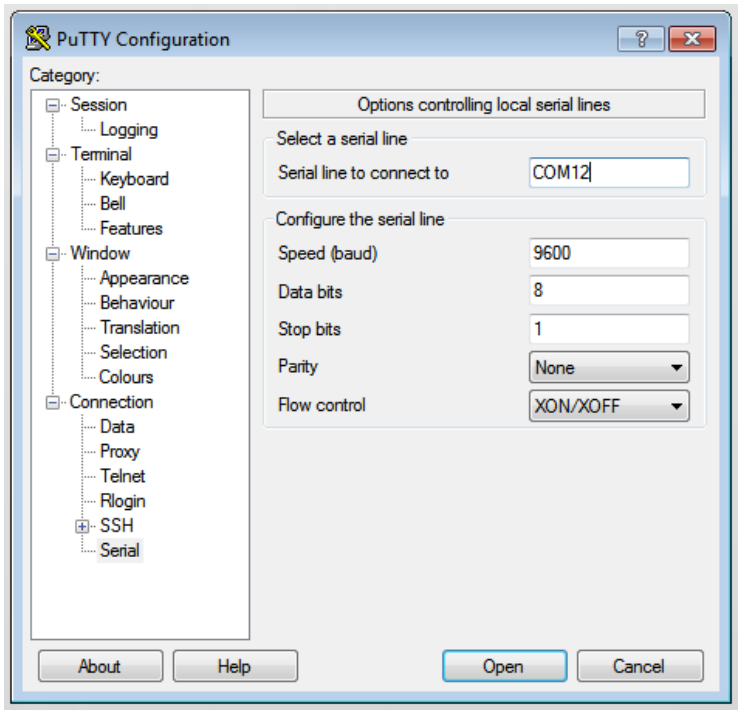

Figure 17: : PuTTY set Arduino DUE comm port and speed

iv. Open the connection

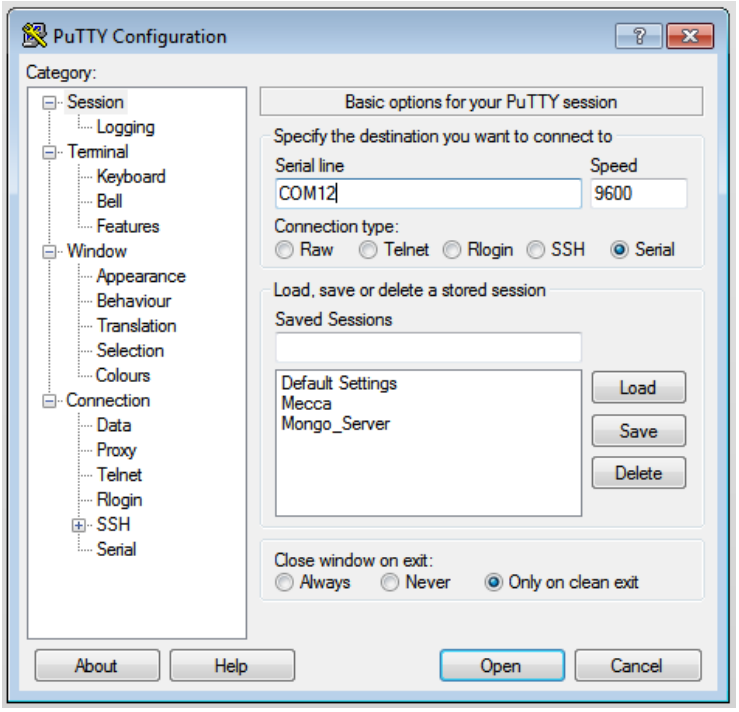

Figure 18: PuTTY set Arduino DUE open serial communication

v. You are now ready to send commands to your Sniff-0

7.3 Serial communication instruction set

Below you will find a list of the principal serial commands for your Sniff-0 device as well as a brief description and syntax example for each. Although commands may be show here in upper, lower or mixed case, the actual commands are not case sensitive.

7.3.1 SetVerbose

The **setVerbose** command is used to enable (1) or disable (0) the echo on the serial port for commands received by Sniff-0.
The use of echo is very useful during calibration phase.
During experiments it is generally better to disable the verbose mode as the experiment control software is not normally supposed to read the echo on the serial port and leaving it on may only cause delays in instruction execution.
Command use:

```
setVerbose 1
```

enable verbose mode

Verbose = 1 means serial port echo is enabled
Verbose = 0 means serial port echo is disabled

7.3.2 SetChannel

Set the active channel you wish to operate on.
Command use:

```
setChannel 1
```

Set Sniff-0 to operate on channel 1.

7.3.3 SetValve

Set the state of the valve (applies to currently active channel only, as defined by **setChannel**).
Command use:

```
setValve 1
```

Valve = 1 means Open the valve
Valve = 0 means Close the valve

The status of the valve for each channel is indicated in the lower row of the Sniff-0 display, where:
x = closed
o = open

7.3.4 TestDelay

Measures the delay between opening of the fast-acting solenoid valve and detection of the pressure front after the subject manifold (requires nasal adapters to be plugged into calibration ports of the device).
Command use:

```
testDelay 1
```

The delay will be measure on channel 1.

The delay will be calculated from a series of repeated measurements to ensure reliable results. Variation between measurements is generally less than 2ms.

7.3.5 SetToutValve

Sets the state of the valve for the active channel and sends a Trigger OUT signal.
Trigger OUT timing can be set using the **setTriggerOutDelay** and **setTriggerOutDuration** commands.
Command use:

```
setToutValve 1
```

Valve = 1 means Open the valve

Valve = 0 means Close the valve

The status of the valve for each channel is indicated in the lower row of the Sniff-0 display, where
x = closed
o = open

7.3.6 SetTriggerOutDelay

Set the delay in milliseconds between the valve event and the subsequent generation of the trigger OUT.
Command use:

```
setTriggerOutDelay 10
```

where “10” is the delay in millisecond

Values less than 0 are not admitted.
Default value for the delay is 0 milliseconds.

7.3.7 SetTriggerOutDuration

Set the duration of the trigger OUT signal
Command use:

```
setTriggerOutDuration 1
```

where “1” is the duration of the trigger signal in milliseconds

Values less than 1 are not admitted.
Default value for the delay is 1 milliseconds.

7.3.8 SetPrecision

Set the maximum tolerance accepted during the flow calibration in SLPM.
Command use:

```
setPrecision 0.1
```

0.1 is the tolerance that Sniff-0 will use during flow calibration.
Values less than 0.1 are not admitted.
Default value for precision is 0.1 SLPM.
We recommend not changing this value without previously contacting CyNexo tech support.

7.3.9 ReadFlow

Read the value of the air flow rate for the currently active channel.
Command use:

```
readFlow
```

❗ If the flow is 0.0 please check the tube connections for leaks or crossed-over channel

7.3.10 SetDirection

Set the direction of the stepper valve.
Command use:

```
setDirection 1
```

Direction = 1 means increase the flow
Direction = 0 means decrease the flow

7.3.11 SetStepDelay

Set the delay between one step and the next one in the movement of the stepper motor controlling the valve.
The delay between the steps is inversely proportional to the speed with which the valve changes the flow rate.

❗ Do NOT modify the default value unless you are certain of what are you doing. Please contact CyNexo technical support if you are unsure.
Command use:

```
setStepDelay 500
```

500 is the delay between steps in microseconds

Default value for the step delay is 500 microseconds.
Values of less than 250 microseconds are NOT recommended and may lead to the valve not operating correctly.

7.3.12 Steps

The steps command moves the valve stepper motor by the indicated number of steps.
If you are not sure of the position of the valve stepper motor (the start or end of stroke positions are particularly delicate) it is a MUST to move only a few steps (maximum 15) at a time: moving by too many steps (for example 100) beyond the start or end of stroke positions may permanently block the stepper motor. Please contact CyNexo technical support if you are unsure whether this might have occurred.

The steps command is closely related to the **setDirection** command which sets the direction of movement (Direction = 0 closes the valve while Direction = 1 opens the valve).
Before using the steps command, check the position of the manual flow control needle valve: if the manual valve is completely closed, the stepper valve will be unable to control the air flow in any way.
Command use:

steps 10

Moves the stepper valve by 10 steps in the direction previously set by the **setDirection** command.

7.3.13 DisableAllValves

Disable (close) all valves (applies only to fast acting solenoid valves and not to proportional stepper motor controlled valves).
Command use:

disableAllValves

The status of the valve for each channel is indicated in the lower row of the Sniff-0 display, where
x = closed
o = open

7.3.14 EnableAllValves

Enable (open) all valves (applies only to fast acting solenoid valves and not to proportional stepper motor controlled valves).
Command use:

enableAllValves

The status of the valve for each channel is indicated in the lower row of the Sniff-0 display, where
x = closed
o = open

7.3.15 SetFlow

The **setFlow** command allows you to automatically calibrate the flow of the various channels of the olfactometer.

! Before starting the automatic calibration, check the position of the manual needle valves (they must be open and allow at least the flow that you are requesting to be reached).
In case of doubt, it is preferable to leave the manual valves locked in the fully open position.

Command use:

setFlow 1:1.5;2:2;3:1;

The above syntax tells Sniff-0 to calibrate channel 1 to a flowrate of 1.5 SLPM, channel 2 at a flow rate of 2 SLPM and channel 3 at a flow rate of 1 SLPM. Please make sure you use a decimal point and not comma for the flow.

Flowrate values will be rounded to the closest 0.1 SLPM.
You may choose to **setFlow** for one, many or all channels.

7.3.16 ManualFlow

The **manualFlow** command allows you to manually calibrate the flow of the selected olfactometer channel. It is basically a continuous loop of the **readFlow** command.
When the desired value has been reached, the calibration phase can be ended by sending the **stopCalibration** command.
Command use:

```
manualFlow 1
```

Sets Sniff-0 for manual calibration of channel 1.
After receiving the command, Sniff-0 reads and visualizes the indicated channel flow on the display so that you can adjust the flow to the desired flowrate by adjusting the manual needle valve.
When the desired value has been reached, the calibration phase can be ended by sending the **stopCalibration** command.

7.3.17 StopCalibration

Interrupts the calibration process. Applies to both manual (**manualFlow**) and automatic (**setFlow**) calibrations processes.
Command use:

```
stopCalibration
```

7.3.18 OutTrigger

The **outTrigger** command allows you to check that the Sniff-0 trigger OUT port is functioning correctly. This command is linked to the **setTriggerOutDelay** and **setTriggerOutDuration** commands which set the delay and duration of the trigger OUT signal.

The output signal is a standard 5V TTL signal and will be sent as soon as the command is executed.
Command use:

```
outTrigger
```

7.3.19 InTrigger

The **inTrigger** command allows you to check that the Sniff-0 trigger in port is functioning correctly by waiting for a trigger IN signal for 10 seconds from when the command is executed. Should it not receive this signal with 10 seconds Sniff-0 will display a time out message.

The input signal must be a standard 5V TTL signal with a duration of at least 1ms.
Command use:

```
inTrigger
```

7.3.20 LoopTrigger

The **loopTrigger** command allows you to test for the correct functioning of the Sniff-0 trigger OUT and trigger IN by sending a trigger signal out one port and reading it back in through the other port.
During the execution of the command, the Sniff-0 status LED will light up green to indicate the correct reception of the trigger signal.
Command use:

```
loopTrigger
```

❗ For the correct execution of the command, please connect the trigger IN connector with the trigger OUT connector via a standard BNC male to male cable.

7.3.21 SetExperiment

The **setExperiment** command is used to disable (1) or enable (0) the echo on the LCD display for commands received by Sniff-0.
During the course of an experiment Sniff-0 receives many commands quickly and displaying them on screen becomes too quick to read. It is therefore preferable to set Sniff-0 to “experiment mode” so as to have fewer and clearer indications on the display.
The status of the valves will continue to be indicated in the lower part of the display.

When Sniff-0 is in experiment mode the verbose mode is automatically deactivated.
Command use:

```
setExperiment 1
```

enables “experiment mode”

Experiment = 1 means “experiment mode” enabled and thus LCD display echo is disabled
Experiment = 0 means “experiment mode” disabled and thus LCD display echo is enabled

7.3.22 OpenValveTimed

The **openValveTimed** opens the valve of the active channel for a precise amount of time.

The duration is given in milliseconds.
Command use:

openValveTimed 20

This opens the valve of the active channel for 20 milliseconds; Timing is controlled by the microcontroller and is thus very precise (<1ms).

7.3.23 OpenTValveTimed

The **openTValveTimed** prepares Sniff-0 to open the valve of the active channel for a precise amount of time as soon as it receives a trigger IN signal. The duration is given in milliseconds.
Command use:

openTValveTimed 20

This opens the valve of the active channel for 20 milliseconds as soon as Sniff-0 receives a trigger IN signal; Timing is controlled by the microcontroller so is very precise (<1ms).

7.3.24 SetCAChannel

The **setCAChannel** command will define the channel to be used as the Clean Air channel based on your own needs.
Command use:

setCAChannel 1

Sets Sniff-0 to operate on channel 1 when any command refers to the Clean Air channel.

7.3.25 CfOffOpenValveTimed

The **CfOffOpenValveTimed** opens the valve of the active channel for a precise amount of time and at the same time disables the constant flow channel. As soon as the delivery of the odour ends the constant flow channel is reactivated. The duration is given in milliseconds.
Command use:

CfOffOpenValveTimed 20

This opens the valve of the active channel for 20 millisecond and simultaneously closes the constant flow channel for this duration; Timing is controlled by the microcontroller so is very precise (<1ms).

Please note that with constant flow air flow greater than about 1 SLPM the changeover from an odour channel to the constant flow channel will be characterised by a sharp and recognisable pressure wave. To avoid this effect, we recommend the use of a clean air channel (i.e. a standard

odour channel used without adding any odour) in addition to rather than purely instead of the constant flow channel.

7.3.26 TCfOffOpenValveTimed

The **TCfOffOpenValveTimed** prepares Sniff-0 to open the valve of the active channel for a precise amount of time as soon as it receives the trigger IN signal. For the duration of the channel activation the constant flow channel is deactivated. The duration is given in milliseconds.
Command use:

TCfOffOpenValveTimed 20

This opens the valve of the active channel for 20 milliseconds as soon as Sniff-0 receives a trigger IN signal; During these same 20 milliseconds the constant flow channel is deactivated. Timing is controlled by the microcontroller so is very precise (<1ms).

Please note that with constant flow air flow greater than about 1 SLPM the changeover from an odour channel to the constant flow channel will be characterised by a sharp and recognisable pressure wave. To avoid this effect, we recommend the use of a clean air channel (i.e. a standard odour channel used without adding any odour) in addition to rather than purely instead of the constant flow channel.

7.3.27 CaOffOpenValveTimed

The **CaOffOpenValveTimed** opens the valve of the active odour channel for a precise amount of time and at the same time disables the clean air channel. As soon as the delivery of the odour ends the clean air channel is reactivated. The duration is given in milliseconds.
Command use:

CaOffOpenValveTimed 20

This opens the valve of the active channel for 20 millisecond and simultaneously closes the clean air channel for this duration; Timing is controlled by the microcontroller so is very precise (<1ms).

7.3.28 TCaOffOpenValveTimed

The **TCaOffOpenValveTimed** prepares Sniff-0 to open the valve of the active channel for a precise amount of time as soon as it receives the trigger IN signal. For the duration of the channel activation the clean air channel is deactivated. The duration is given in milliseconds.
Command use:

TCaOffOpenValveTimed 20

This opens the valve of the active channel for 20 milliseconds as soon as Sniff-0 receives a trigger IN signal; During these same 20 milliseconds the clean air channel is deactivated. Timing is controlled by the microcontroller so is very precise (<1ms).

7.3.29 Tb_valveSound

The **Tb_valveSound** command opens the valve of the selected channel for the selected amount of time and generates a trigger OUT for the Spir-0 audio module to generate the sound based on selected delay.
The command is designed to synchronize the functionality of Sniff-0 with the audio portion of Spir-0.
Command use:

```
Tb_valveSound 1 200 400
```

This command opens the valve for channel 1 for 200 milliseconds and after 400 milliseconds (starting from the opening of the valve) sends a trigger OUT signal to Spir-0 so that the audio module can generate the predefined sound.

For the correct generation of the sound by Spir-0 please ensure you have previously sent Spir-0 the command necessary to prepare it to receive the trigger. The Spir-0 command needed is:

```
192.168.11.1/audio.py?sound=soundName.wav&task=vs
```

For more information, please consult your Spir-0 manual.

Through the trigger OUT port Sniff-0 generates the signals necessary for synchronization with Spir-0 and for markers used for later data analysis.
With this command a trigger will be generated when the valve is opened and a second trigger for audio generation (read the note below regarding the operation of the audio trigger).

Important: The Spir-0 sound module has a FIXED delay of 200 ms between the moment it receives the trigger IN and the moment the sound is generated.
This command already compensates for the above delay and so in our example (`Tb_valveSound 1 200 400`) the sound will be generated after exactly 400 ms from the opening of the valve. This means that if we indicate that we want the sound after 400 ms the trigger OUT signal to Spir-0 will be generated after 200 ms to compensate for the internal delay within Spir-0.

N.B.: All commands with the wording “tb_ta_” generate a second trigger indicating the actual start of the sound. Referring to the example above, the first trigger will be after 200 ms with a second trigger after 400 ms indicating the exact moment the sound is presented.

7.3.30 Tb_ta_valveSound

The **Tb_ta_valveSound** command opens the valve of the selected channel for the selected amount of time and generates a trigger OUT for the Spir-0 audio module to generate the sound based on the selected delay, followed by a second trigger OUT signal to indicate the exact moment

the sound is emitted. In all, three tigger OUT signals will be generated representing (1) valve opening, (2) trigger to Spir-0 for audio, (3) point in time actual sound is emitted.

The command is designed to synchronize the functionality of Sniff-0 with the audio module of Spir-0.
Command use:

Tb_ta_valveSound 1 200 400

This command opens the valve of channel 1 for 200 milliseconds and sends a trigger to Spir-0 so that after 400 milliseconds (counted from the opening of the valve) it generates the sound via Spir-0's audio module.

For the correct generation of the sound by Spir-0 please ensure you have previously sent Spir-0 the command necessary to prepare it to receive the trigger. The Spir-0 command needed is:

192.168.11.1/audio.py?sound=soundName.wav&task=vs

For more information, please consult your Spir-0 manual.

Through the trigger OUT port Sniff-0 generates the signals necessary for synchronization with Spir-0 and for markers used for later data analysis.
With this command a trigger is generated when the valve is opened, a second trigger is generated for Spir-0 to generate the sound and a third trigger is generated to indicate the actual moment the sound is emitted (see the note below regarding the operation of the audio trigger).

Important: The Spir-0 sound module has a FIXED delay of 200 ms between the moment it receives the trigger IN and the moment the sound is generated.
This command already compensates for the above delay and so in our example (Tb_ta_valveSound 1 200 400) the sound will be generated after exactly 400 ms from the opening of the valve. This means that if we indicate that we want the sound after 400 ms the trigger OUT signal to Spir-0 will be generated after 200 ms to compensate for the internal delay within Spir-0.

N.B.: All commands with the wording "tb_ta_" generate a second trigger indicating the actual start of the sound. Referring to the example above, the first trigger will be after 200 ms with a second trigger after 400 ms indicating the exact moment the sound is presented.

7.3.31 Tb_soundValve

The **Tb_soundValve** command generates a trigger OUT for the Spir-0 audio module to generate the sound and after the selected delay opens the valve of the selected channel for the selected amount of time.
The command is designed to synchronize the functionality of Sniff-0 with the audio module of Spir-0.
Command use:

Tb_soundValve 1 200 400

This command immediately sends a trigger OUT signal to Spir-0 so that the audio module can generate the predefined sound and after the selected delay of 400 ms (starting from the moment the sound is actually generate – see important note below on fixed audio delay) opens the valve for channel 1 for 200 milliseconds.

For the correct generation of the sound by Spir-0 please ensure you have previously sent Spir-0 the command necessary to prepare it to receive the trigger. The Spir-0 command needed is:

192.168.11.1/audio.py?sound=soundName.wav&task=sv

For more information, please consult your Spir-0 manual.

Through the trigger OUT port Sniff-0 generates the signals necessary for synchronization with Spir-0 and for markers used for later data analysis.
With this command a trigger OUT signal will immediately be generated for the audio generation (read the note below regarding the operation of the audio trigger) and another when the valve is opened.

Important: The Spir-0 sound module has a FIXED delay of 200 ms between the moment it receives the trigger IN and the moment the sound is generated.
This command already compensates for the above delay and so in our example (Tb_soundValve 1 200 400) the valve will be opened after exactly 400 ms from the start of the presentation of the sound. This means that if we indicate that we want the valve to be opened 400 ms after the start of the sound, the trigger for the sound will actually be generated 600 ms before so as to also compensate for the internal sound delay within Spir-0.

N.B.: All commands with the wording “tb_ta_” generate a second trigger indicating the actual start of the sound. Referring to the example above, a second trigger will be generated 200 ms after the first so as to indicate the exact moment the sound is presented.

7.3.32 Tb_ta_soundValve

The **Tb_ta_soundValve** command generates a trigger OUT for the Spir-0 audio module to generate the sound and then opens the valve of the selected channel for the selected amount of time.
The command is designed to synchronize the functionality of Sniff-0 with the audio module of Spir-0.
Command use:

Tb_ta_soundValve 1 200 400

This command generate a sound using the audio module of Spir-0 and after 400 milliseconds opens the valve of channel 1 for 200 milliseconds.

For the correct generation of the sound by Spir-0 please ensure you have previously sent Spir-0 the command necessary to prepare it to receive the trigger. The Spir-0 command needed is:

192.168.11.1/audio.py?sound=soundName.wav&task=sv

For more information, please consult your Spir-0 manual.

Through the trigger OUT port Sniff-0 generates the signals necessary for synchronization with Spir-0 and for markers used for later data analysis.
With this command a trigger OUT signal will immediately be generated for the audio (read the note below regarding the operation of the audio trigger), as second when the audio is actually emitted, and a third when the valve is opened.

Important: The Spir-0 sound module has a FIXED delay of 200 ms between the moment it receives the trigger IN and the moment the sound is generated.
This command already compensates for the above delay and so in our example (Tb_ta_soundValve 1 200 400) the valve will be opened after exactly 400 ms from start of the presentation of the sound. This means that if we indicate that we want the valve to be opened 400 ms after the start of the sound, the trigger for the sound will actually be generated 600 ms before so as to also compensate for the internal sound delay within Spir-0.

N.B.: All commands with the wording “tb_ta_” generate a second trigger indicating the actual start of the sound. Referring to the example above, a second trigger will be generated 200 ms after the first so as to indicate the exact moment the sound is presented.

7.3.33 Tb_in_breathSound

The **Tb_in_breathSound** command waits for the trigger IN from Spir-0, indicating that the subject has started inhaling, opens the valve of the selected channel for the selected amount of time, and generates the trigger necessary for the Spir-0 audio module to generate the sound after the selected delay.
The command is designed to synchronize the functionality of Sniff-0 with the audio module of Spir-0.
Command use:

Tb_in_breathSound 1 200 400

This command opens the valve of channel 1 for 200 milliseconds as soon as the trigger indicating that the subject started inhaling is received and after 400 milliseconds (counted from the opening of the valve) generates a sound using the audio module of Spir-0.

For the correct generation of the sound by Spir-0 please ensure you have previously sent Spir-0 the command necessary to prepare it to receive the trigger. The Spir-0 command needed is:

192.168.11.1/audio.py?sound=soundName.wav&task=vs

For more information, please consult your Spir-0 manual.

Through the trigger OUT port Sniff-0 generates the signals necessary for synchronization with Spir-0 and for markers used for later data analysis.
With this command a trigger is generated when the valve is opened and one for audio generation (read the note below regarding the operation of the audio trigger).

Important: The Spir-0 sound module has a FIXED delay of 200 ms between the moment it receives the trigger IN and the moment the sound is generated.
This command already compensates for the above delay and so in our example (Tb_in_breathSound 1 200 400) the sound will be generated after exactly 400 ms from the opening of the valve. This means that if we indicate that we want the sound to be emitted 400 ms after opening the valve, the trigger for the sound will be generated 200 ms after opening the valve in order to compensate for the internal sound delay within Spir-0.

N.B.: All commands with the wording “tb_ta_” generate a second trigger indicating the actual start of the sound. Referring to the example above, a second trigger will be generated 200 ms after the first audio generation trigger so as to indicate the exact moment the sound is presented.

7.3.34 Tb_ta_in_breathSound

The **Tb_ta_in_breathSound** command waits for the trigger IN from Spir-0, indicating that the subject has started inhaling, opens the valve of the selected channel for the selected amount of time, and generates the trigger necessary for the Spir-0 audio module to generate the sound after the selected delay.
The command is designed to synchronize the functionality of Sniff-0 with the audio module of Spir-0.
Command use:

Tb_ta_in_breathSound 1 200 400

This command opens the valve for channel 1 for 200 milliseconds as soon as the trigger indicating that the subject started inhaling is received and generates a sound via the audio module of Spir-0 after 400 milliseconds (counted from the opening of the valve).

For the correct generation of the sound by Spir-0 please ensure you have previously sent Spir-0 the command necessary to prepare it to receive the trigger. The Spir-0 command needed is:

192.168.11.1/audio.py?sound=soundName.wav&task=vs

For more information, please consult your Spir-0 manual.

Through the trigger OUT port Sniff-0 generates the signals necessary for synchronization with Spir-0 and for markers used for later data analysis.

With this command a trigger is generated when the valve is opened, a second trigger is generated for Spir-0 to generate the sound and a third trigger is generated to indicate the actual moment the sound is emitted (see the note below regarding the operation of the audio trigger).

Important: The Spir-0 sound module has a FIXED delay of 200 ms between the moment it receives the trigger IN and the moment the sound is generated.
This command already compensates for the above delay and so in our example (Tb_ta_in_ breathSound 1 200 400) the sound will be generated after exactly 400 ms from the opening of the valve. This means that if we indicate that we want the sound after 400 ms the trigger OUT signal to Spir-0 will be generated after 200 ms to compensate for the internal delay within Spir-0.

N.B.: All commands with the wording "tb_ta_" generate a second trigger indicating the actual start of the sound. Referring to the example above, the first trigger will be after 200 ms with a second trigger after 400 ms indicating the exact moment the sound is presented.

7.3.35 Tb_out_breathSound

The **Tb_out_breathSound** command waits for the trigger IN from Spir-0, indicating that the subject has started exhaling, opens the valve of the selected channel for the selected amount of time, and generates the trigger necessary for the Spir-0 audio module to generate the sound after the selected delay.
The command is designed to synchronize the functionality of Sniff-0 with the audio module of Spir-0.
Command use:

```
Tb_out_breathSound 1 200 400
```

This command opens the valve of channel 1 for 200 milliseconds as soon as the trigger indicating that the subject started exhaling is received and after 400 milliseconds (counted from the opening of the valve) generates a sound using the audio module of Spir-0.

For the correct generation of the sound by Spir-0 please ensure you have previously sent Spir-0 the command necessary to prepare it to receive the trigger. The Spir-0 command needed is:

```
192.168.11.1/audio.py?sound=soundName.wav&task=vs
```

For more information, please consult your Spir-0 manual.

Through the trigger OUT port Sniff-0 generates the signals necessary for synchronization with Spir-0 and for markers used for later data analysis.

With this command a trigger is generated when the valve is opened and one for audio generation (read the note below regarding the operation of the audio trigger).

Important: The Spir-0 sound module has a FIXED delay of 200 ms between the moment it receives the trigger IN and the moment the sound is generated.
This command already compensates for the above delay and so in our example (Tb_out_breathSound 1 200 400) the sound will be generated after exactly 400 ms from the opening of the valve. This means that if we indicate that we want the sound to be emitted 400 ms after opening the valve, the trigger for the sound will be generated 200 ms after opening the valve in order to compensate for the internal sound delay within Spir-0.

N.B.: All commands with the wording "tb_ta_" generate a second trigger indicating the actual start of the sound. Referring to the example above, a second trigger will be generated 200 ms after the first audio generation trigger so as to indicate the exact moment the sound is presented.

7.3.36 Tb_ta_out_breathSound

The **Tb_ta_out_breathSound** command waits for the trigger IN from Spir-0, indicating that the subject has started exhaling, opens the valve of the selected channel for the selected amount of time, and generates the trigger necessary for the Spir-0 audio module to generate the sound after the selected delay.
The command is designed to synchronize the functionality of Sniff-0 with the audio module of Spir-0.
Command use:

```
Tb_ta_out_breathSound 1 200 400
```

This command opens the valve for channel 1 for 200 milliseconds as soon as the trigger indicating that the subject started exhaling is received and generates a sound via the audio module of Spir-0 after 400 milliseconds (counted from the opening of the valve).

For the correct generation of the sound by Spir-0 please ensure you have previously sent Spir-0 the command necessary to prepare it to receive the trigger. The Spir-0 command needed is:

```
192.168.11.1/audio.py?sound=soundName.wav&task=vs
```

For more information, please consult your Spir-0 manual.

Through the trigger OUT port Sniff-0 generates the signals necessary for synchronization with Spir-0 and for markers used for later data analysis.

With this command a trigger is generated when the valve is opened, a second trigger is generated for Spir-0 to generate the sound and a third trigger is generated to indicate the actual moment the sound is emitted (see the note below regarding the operation of the audio trigger).

Important: The Spir-0 sound module has a FIXED delay of 200 ms between the moment it receives the trigger IN and the moment the sound is generated.
This command already compensates for the above delay and so in our example (Tb_ta_out_ breathSound 1 200 400) the sound will be generated after exactly 400 ms from the opening of the valve. This means that if we indicate that we want the sound after 400 ms the trigger OUT signal to Spir-0 will be generated after 200 ms to compensate for the internal delay within Spir-0.

N.B.: All commands with the wording “tb_ta_” generate a second trigger indicating the actual start of the sound. Referring to the example above, the first trigger will be after 200 ms with a second trigger after 400 ms indicating the exact moment the sound is presented.

7.4 Examples of Typical Operations

7.4.1 Manual Calibration

a. **ManualFlow** #channel

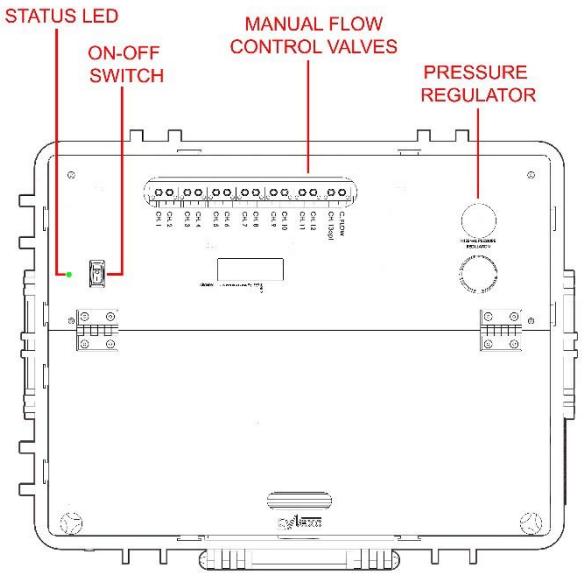

Figure 19: Upper panel

b. Manually adjust the flowrate by rotating the knobs on the manual flow control needle valves while verifying the actual flowrate on the display.

c. On completing the manual calibration procedure, send the "**stopCalibration**" (or **StopCalibration**) command.

7.4.2 Automatic channels calibration

a. Check that the manual valves do not limit flow below the desired level
b. Send the autocalibration command:
   setFlow #Channel:Flow;#Channel:Flow;#Channel:Flow;...
   Ex: setFlow 1:1.3;2:1.1 (sets the channel 1 to 1.3 SLPM and channel 2 to 1.1 SLPM)
c. Await the completion of the calibration process (if necessary it can be interrupted using the "**stopCalibration**" command)

7.5 MATLAB Example

This is an example of how to automate your script with MATLAB ®.

The typical steps for carrying out an experiment are divided into:

- Calibrations
- Execution of the experimental protocol

Calibration can be done as described previously.

The execution of the experiment protocol is normally delegated to a script language (MATLAB, Python, E-Prime®, LabView®, etc.).

This is an example of a basic experiment managed in MATLAB ®:

```
% Open Sniff-0 communication using serial port (remeber to check
% the correct name for the usb; you can use the arduino IDE to check it)

% Create the serial communication object;
% You have to change COM8 with the name of your communication port
sniffo = serial('COM8');

%Configure the serial communication

%Set the communication speed
set(sniffo,'BaudRate',9600);

%Set the command terminator
sniffo.Terminator = 'CR';
```

```
%Open the communication
fopen(sniffo);
pause(1);

%Write command
fprintf(sniffo,'setChannel 0');
pause(1);
fprintf(sniffo,'setValve 1');
pause(2);
fprintf(sniffo,'setChannel 1');
pause(2);
% repeat sequence of commands

% Be carefull, in this example the waiting time is the time between one
% odour generation and the next one; this mean that we have 2
% seconds of odour delivery and 3 second of pause before the
% next odour delivery
```

```
for i = 1:10
    fprintf(sniffo,'cfoffopenvalvetimed 2000');
    pause(5);
end

fprintf(sniffo,'setChannel 0');
pause(1);
fprintf(sniffo,'setValve 0');
pause(2);
%Close the communication
fclose(sniffo);
```

8 Electrical system functional block diagram

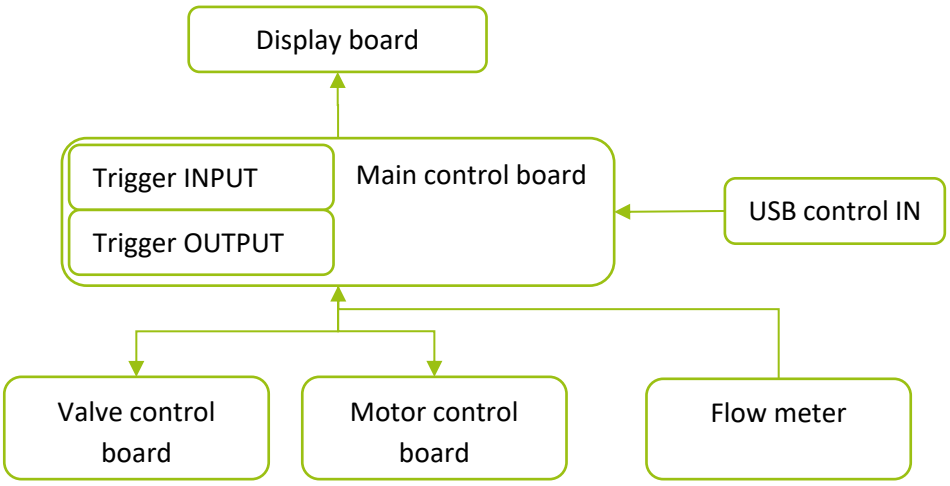

Figure 20: Olfactometer block chart

The system uses an Arduino DUE based main board to control a series of custom-made boards for specific machine functions, in particular:

- a multifunctional display board (20x4 characters) to track the status of the system
- interfaces with a high precision flow meter to manage the auto calibration function
- a motor and valve board to control each single channel in terms of on/off solenoid valves and flow regulation via the stepper motor valves

This is all done under a standard USB serial interface that allows all function to be controlled from a broad range of software platforms.

8.1 Trigger INPUT and OUTPUT

From the BNCs connectors on the outer left-hand side of the case and marked with the writing OUT and IN, you have access to a digital 5V TTL compliant signal in order to interface to any compatible device. An insulated 5V power supply provides a safe and standardized method to interface with external equipment to allow a flexible and easily programmable solution for creating triggered sequences.

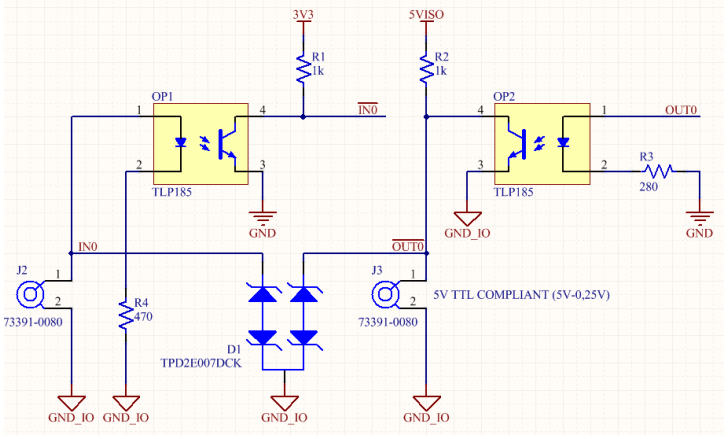

Figure 21: I/O reference schematic diagram

9 Pneumatic system functional block diagram

From the main air input (Caution: max inlet pressure allowed is 6 Bar) the air is fed into a high precision pressure regulator valve that stabilises the pressure to the desired value; any flowrate compensation systems upstream the system MUST BE AVOIDED (should you require an even more stable air flow or pressure, please contact us to discuss your needs). From the pressure regulator (Caution: max operating pressure allowed downstream of the pressure regulator is 3 Bar) the air flows through an active carbon filter (optional) to absorb any odours the air may have become contaminated with while inside the compressed air network and then through a blue silica dryer to remove residual moisture from the air. From here the clear dry air then flows through a distribution manifold that splits the flow to each independent channel. Each channel is then fitted with an inline manual control flow valve, followed by an automated servo-motor controlled variable flow control valve (optional), then a fast acting ON-OFF solenoid valve and finally an odour or scent jar (the exception being for the constant flow channel that doesn't require an odour/scent jar). From here the constant flow, whose function is to guarantee a constant amount of odourless air to the subject, and the odour laden air from the scent jars travel via independent tubes through the case wall and up to the subject manifold.

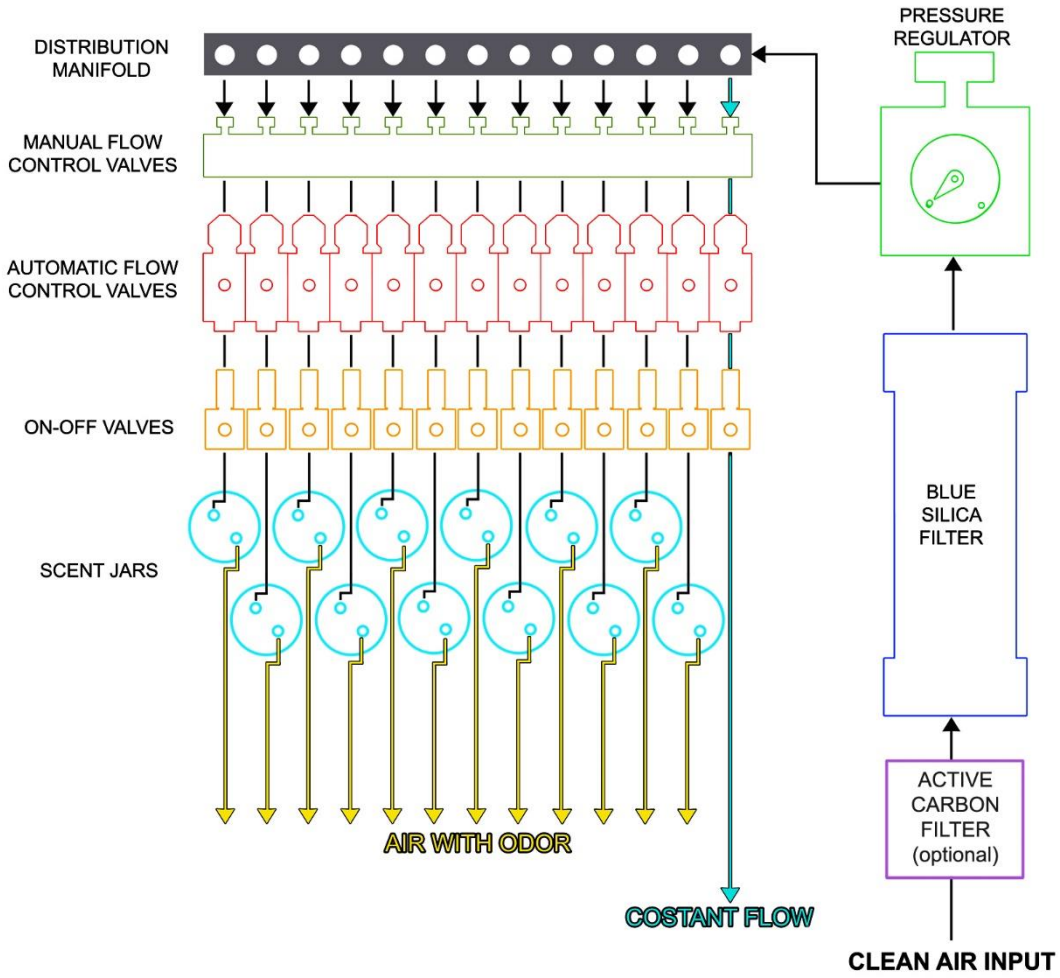

Figure 22: Pneumatic layout

Should you need a clean air channel, i.e. one with exactly the same characteristics as a normal scent channel but with no scent or odour, simply use one of the standard scent channels taking care to ensure both tubes and scent jars are clean and odour free.

The scent jars contain the odours used to enrich the air with custom scents; The jar lids are fitted with highly sensitive check valves to avoid any contamination of the clean air upstream of the scent jars and as well as with a connector that brings the odour out.

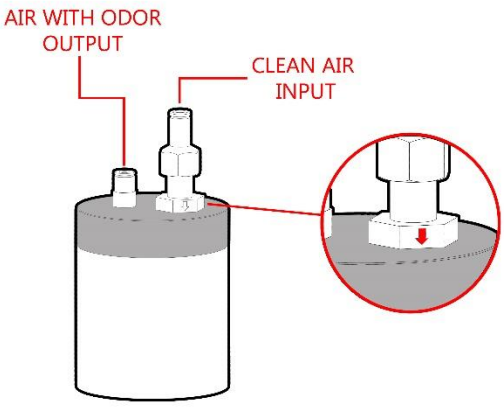

Figure 23: Scent jar assembly

In order to achieve a good level of sealing, the jar lids are fitted with sealing o-rings. Additionally or alternatively the lids can be sealed with Teflon tape, that must be wrapped on the glass jar thread up to 12 times.

Figure 24: Scent jar Teflon tape application

In case of suspected air or scent leakage from the jars, please hand tighten all the connections and if necessary, add Teflon tape to the treads. Each scent jar assembly has been tested in our labs up to 1 Bar.

Similarly in order to ensure a good seal, we recommend the odour and constant flow tubes between the Sniff-0 main unit and the subject manifold be sealed with Teflon tape at the compression fittings on the subject manifold. We recommend about 4 turns of tape prior to inserting the tubes into the manifold connectors as in the picture below. The connectors should then be firmly hand tightened.

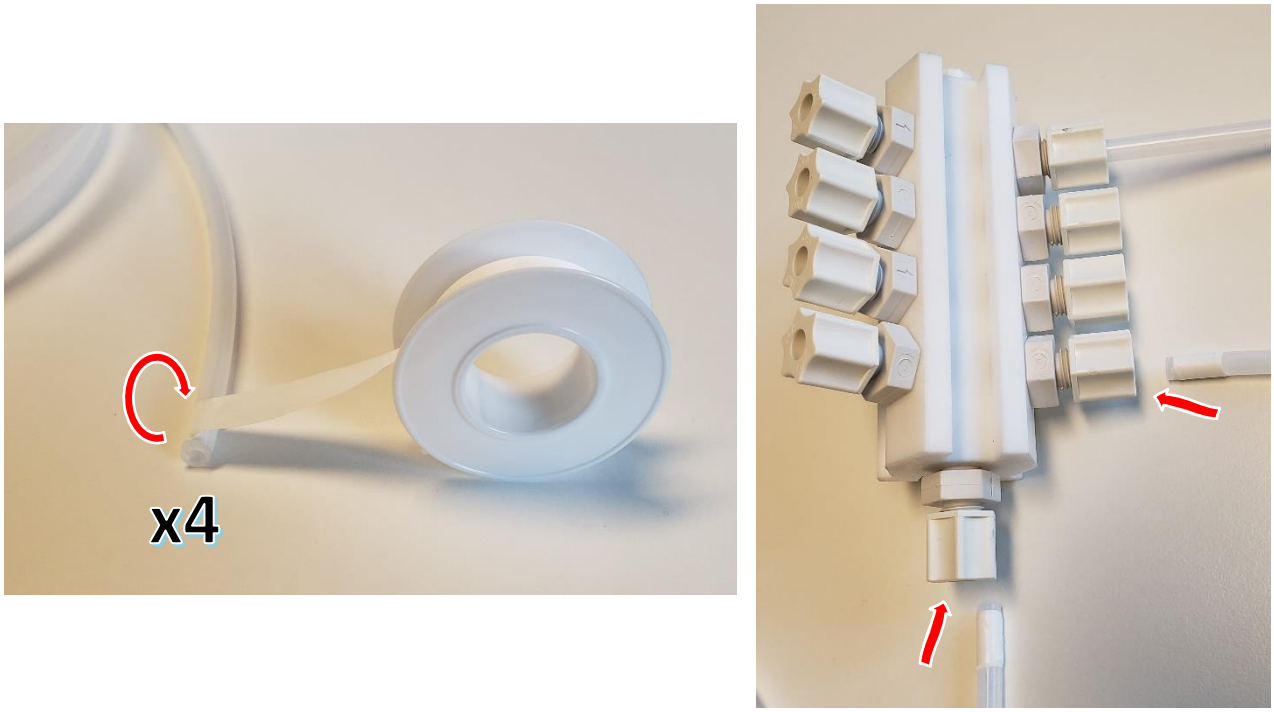

Figure 25: Teflon tape application to tubes for manifold compression fittings (fMRI version)

10 ElectroMagnetic Compatibility (EMC)

The development of Sniff-0 components has conducted with the aim of minimizing the interference with any other medical equipment, by respecting current legal limits (EN 55011/2016 class B) and further lowering the emissions where possible. The system was tested in an accredited lab, with the summary report included below.

10.1 Radiated emissions report

Anechoic chamber radiated emission, two sessions (lower band 30-300MHz, higher band 300-1GHz) with bi-cubic and log antenna.

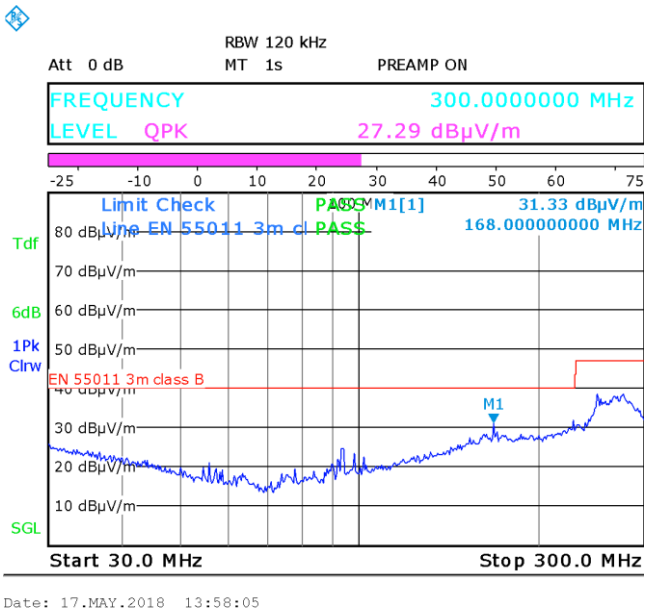

Figure 26: Radiated emissions chart 300 MHz

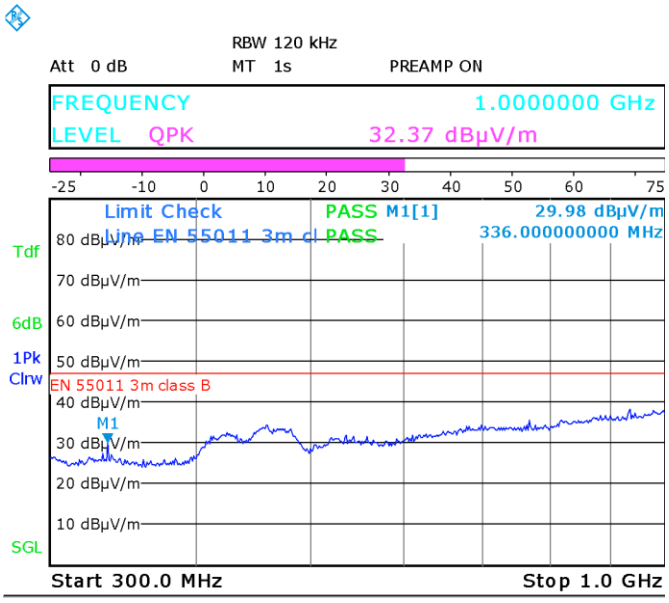

Figure 27: Radiated emissions chart 1 GHz

10.2 Conducted emissions report

The following is a report of the power supply emissions over the electrical system.

10.3 Phase emissions

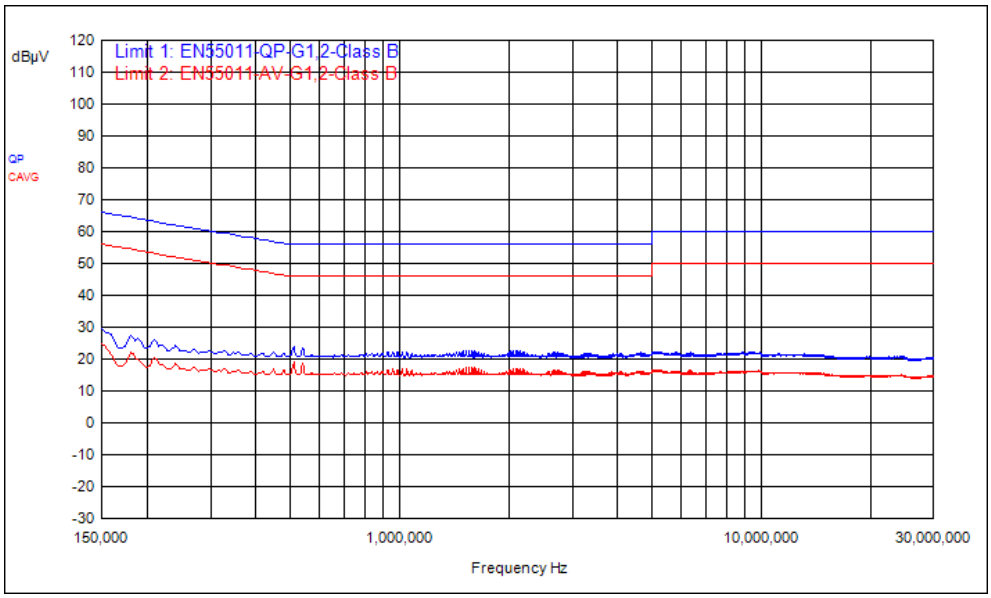

Figure 28: Phase emissions chart

10.4 Neutral emissions

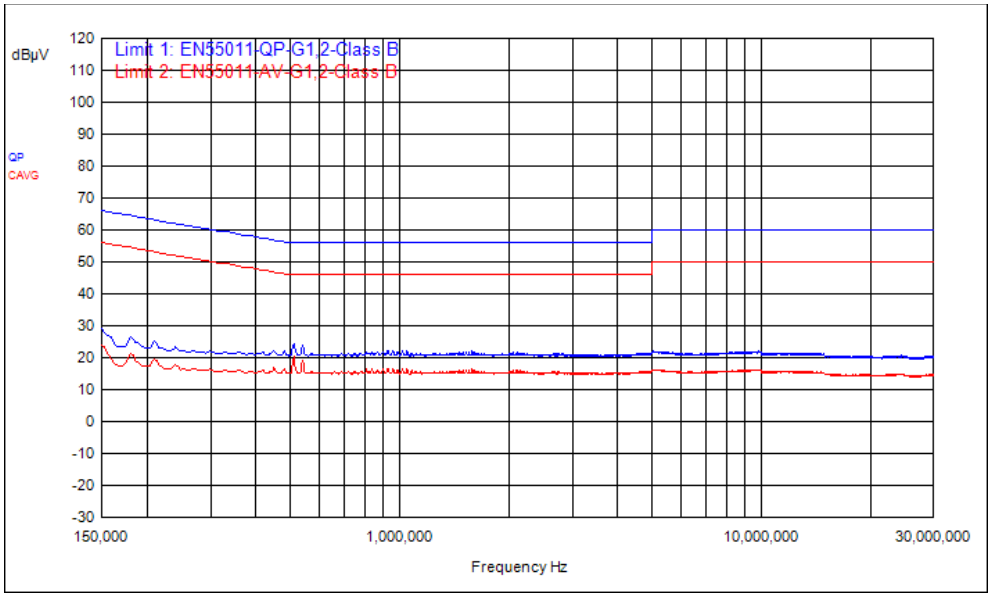

Figure 29: Neutral emissions chart

11 System mechanical dimensions

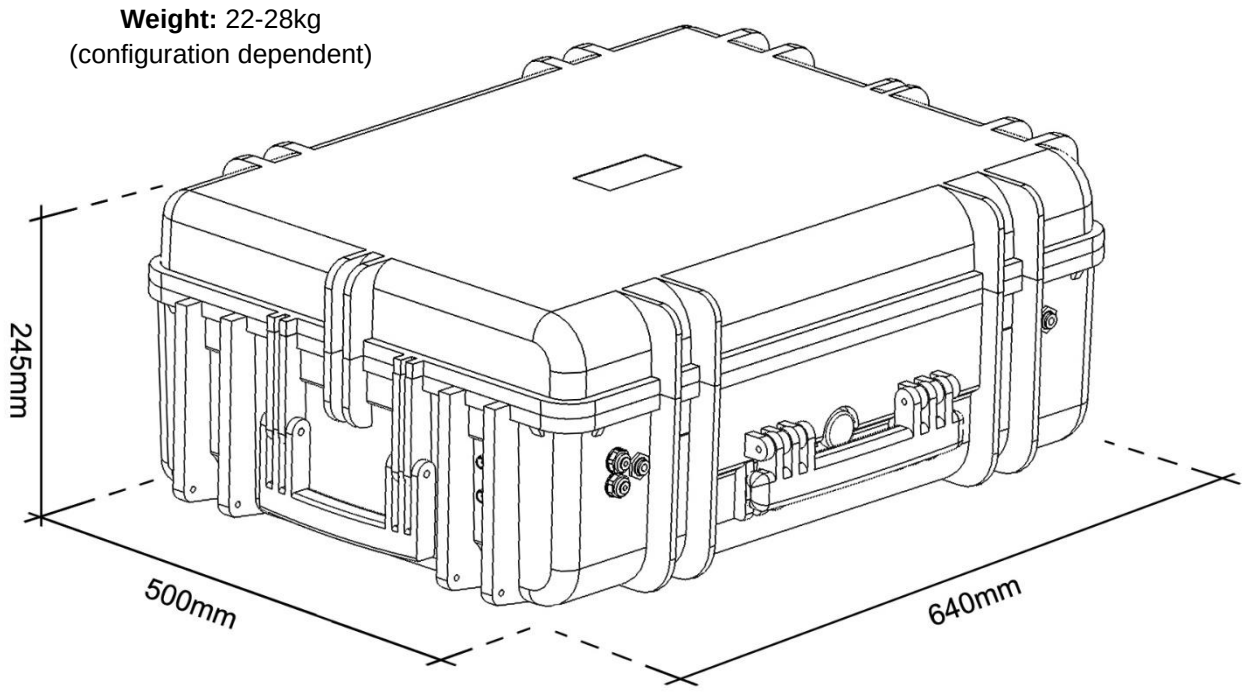

Figure 30: Olfactometer mechanical dimensions

12 Spare parts and accessories

CyNexo Code	Description
2P000014A	Nasal adapter PTFE for Sniff-0 set of 2
2P000015A	Nasal adapter PTFE for Spir-0 set of 2
2P000006A	Manifold Sniff-0 12+1 channel, PTFE
2P000011A	Manifold Sniff-0 12+1 channel, PTFE fMRI
1M000011A	Chest mount harness for manifold
1P000001A	Desiccant filter including desiccant refill
1P000068A	Tube 4x2mm PTFE natural (length to be specified)
1P000069A	Tube 6x4mm PTFE natural (length to be specified)
2P000012A	Scent jar 120ml + white PP caps assembled
2P000013A	Scent jar 120ml + black phenolic caps assembled
1E000624A	Power supply 12V 7.5A medical grade

Table 3: List of most common spare parts

For any of the above items as well as other spare parts or custom solutions, please contact CyNexo directly. You will find our contact details in the “Contact Details” section of this document.

13 System maintenance

13.1 Cleaning and maintenance

❗ Don't use sharp objects on olfactometer that can scratch or damage surface or tubes.

☑ Any standard glass cleaner can be used to clean the surface, but avoid using products containing ammonia, acetone, alcohol, or other solvents on any Plexiglass components.

☑ Depending on dust environmental conditions, we recommend cleaning exposed surfaces at least once a month using a damp cloth.

Exposure to heat sources, thinners, corrosive or other chemical substances as well as strong electromagnetic or other forms of irradiation should be avoided both while cleaning the device and its components and in general, unless expressly indicated otherwise in this manual.

13.2 Regeneration of Dryer Desiccant

Your product has been supplied with a high-quality air-drying element. This unit contains circa 570g of moisture absorbing desiccant named “Regular DRIERITE” (a form of calcium sulphate) which can absorb up to 50g of water when operating at the maximum efficiency flow rate of 200 litres per hour, 3 SLPM or 0.1 SCFM. As the desiccant absorbs moisture from the input air as it flows through the unit it will progressively saturate, starting from the inlet (front side of device) and working its way up to the outlet connector (closest to relieving valve).

We have added a reusable moisture sensitive indicating strip close to the outlet connector of the dryer unit so that you can easily recognise when it is time to regenerate the desiccant. We recommend regenerating the desiccant as soon as it reaches a humidity level of 40%, but this will depend on your specific use and needs. We recommend checking the status of the desiccant at the start and end of every use, and no less than every 10 hours of operation. The time to saturation/exhaustion of the desiccant will depend on relative air humidity, air flow rates, frequency of use and age of the desiccant.

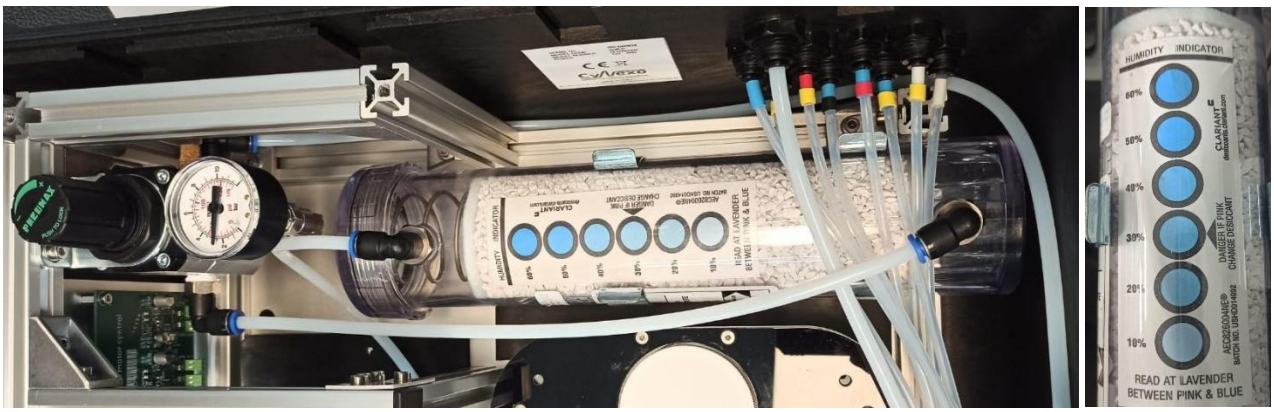

Figure 31: Dryer unit with humidity indicator strip

For the regeneration of Regular DRIERITE, the granules may be spread in layers one granule deep and heated for 1 hour at 210° C or 425° F. Please note that no colour change of the granules of “Regular Drierite” will be perceptible during the regeneration process. The regenerated material should then be placed in the original glass or metal container and sealed while still warn, avoiding leaving it in an environment where it can absorb environmental moisture again before being sealed. Please avoid pouring any powder or dust particles from the desiccant into the dryer unit, and carefully clean all dryer inner surfaces of dust before closing.

The temperature at which DRIERITE desiccants are regenerated is crucial in restoring DRIERITE to its original condition. Absorbed moisture is water of hydration and is chemically bound to the calcium sulphate of DRIERITE. Temperatures in the range of 400° – 450° F (205° – 230° C) are required to break these bonds and release absorbed moisture. Lower temperatures, regardless of heating time, will not regenerate DRIERITE unless applied under vacuum (26" Hg, 325° F or 28" Hg, 275° F). Care should be taken not to overheat DRIERITE desiccants. High temperatures can alter the crystal structure and render the desiccants permanently inactive.

See additional details here:

https://secure.drierite.com/catalog3/page19b.cfm

NOTE: “Regular Drierite” is not toxic but may cause irritation in some people if inhaled so please minimise the breathing of its dust, fumes, gas, mist, or vapours. After regeneration, and once the granules have been allowed to cool back down to room temperature, we recommend flushing the unit with abundant clean air prior to its first use. You can achieve this by either running clean air through the drier unit for several minutes prior to reinstalling it in your Sniff-0 device, or once installed by opening the constant flow (CF) channel and letting air flow through it for several minutes. Please remember to close/check all tube connections when finished to avoid unnecessary moisture absorption from the environment by the desiccant.

NOTE: We do not recommend the use of “Indicating Drierite” as this contains small quantities of cobalt chloride which acts as the humidity based colour changing agent. This compound may however be toxic if inhaled, so one should avoid breathing its dust, fumes, gas, mist, or vapours. As there is a risk that the Indicating Drierite may degrade to a fine powered over time, small quantities of cobalt chloride could accidentally be inhaled by an EXPOSED PERSON, thus creating a HAZARD situation leading to allergies, asthma symptoms, breathing difficulties, and even cancer and other illnesses in the case of prolonged exposure. In order to minimize this risk, if your device contains “Indicating Drierite” we recommend replacing it with “Regular Drierite” or a similar product as soon as possible.

14 System installation, handling and dismantling

14.1 General Information

Before installation, make sure that the area on which the system will be installed is completely clear from any type of sharp, abrasive or hot surfaces.

Always ensure the device is lifted safely. In the case of heavier items, please ensure two or more people execute the lift. In case of doubt contact your health and safety officer or contact us for advice.

14.2 Set up for system installation

14.2.1 Unpacking

Before installing the system, we recommend checking its general condition by following these instructions:

- Make sure that the external enclosure has not been damaged due to transportation or storage
- Remove any stains and marks from the plastic surfaces using a soft, non-abrasive lint free cloth dampened with glass cleaner. To avoid scratches or deposits, do not use any other materials.
- Check external and internal surfaces searching for any scratches or damage

The packing materials should be stored for possible return shipment of the system to CyNexo srl (such as for repairs, maintenance, upgrades, etc.)

14.2.2 Mechanical installation

Check that the surfaces where you are going to place the system can abundantly sustain the weight of this device, are stable and safe for this device.

14.2.3 Power cabling

This device is delivered with a standard power adapter and power cable. Should any cabling for power supply to the intended are of use be necessary, this must be carried out by a qualified installer. Please pay attention to:

- The supply voltage must be in the range of 110 to 230 VAC (50-60Hz)
- When laying any cable, make sure the external insulation is not damaged
- Avoid crushing or any other mechanical stress to the cable

14.2.4 USB communication cables

The installation of any fixed communication cabling must be carried out by a suitably qualified installer. We recommend the use of shielded cables for USB 2.0 or better. Please pay attention to:

- The supply voltage must be in the range of 110 to 230 VAC (50-60Hz)
- When laying any cable, make sure the external insulation is not damaged
- Avoid crushing or any other mechanical stress to the cable

14.2.5 Installation and connection

Once the above conditions have been checked, proceed with the installation by:

- Checking the connection between the power supply and the main unit using the supplied cable
- Check the correct installation of the USB cable

14.2.6 Dismantling or disassembly

The steps to be followed for disconnecting and dismantling your device are listed below:

- Turn off the power switch of the device
- Disconnect all USB, I/O, power supply and any other cables and connectors from the device
- Pack the device into it's original container or an alternative suitable container ensuring the device and all accessories snugly held in place and cannot move excessively

14.3 Disposal

Please dispose of all parts and materials responsibly.

14.3.1 Packaging materials

Packaging materials should be placed in appropriate collection points as per your local material disposal regulations.

14.3.2 Device disposal

To dismantle the system, separate the parts according to the type of material, place the various parts in the appropriate collection points following the disposal regulations of the location at which the equipment is installed. Please dispose of this device responsibly.

For any questions, please contact us as indicated in the Contact Details section.

15 Warranty

15.1 General terms

We guarantee that products and materials supplied are new and not damaged and guarantee this product for a period of twelve (12) months from the date of delivery. Should the shipping of this product not have been our responsibility, the warranty period will start no later than one (1) month from the date of notification that the goods are ready for delivery.

During the warranty period, we will be responsible to correct any defects or malfunctions related to its components, construction and assembly which impact the intended functionality of the product.

We additionally provide remote assistance for a period of 30 days after product delivery, via telephone and email, during normal Continental European business hours (9am to 5pm CET). Please note that in order to provide remote assistance, the product must be connected either directly to the internet (where applicable) or to a PC, itself connected to both the unit and the internet, and able to accept remote access sessions as requested by our support technicians. The lack of such an unhindered connection will significantly reduce our ability to provide you with the level of support foreseen.

This warranty does not however cover components subject to wear, or any problems due to the misuse or incorrect use of the equipment provided, lack of proper care or failed maintenance by you as the customer or anyone acting on your behalf. For consumable or replacement components, repairs and support outside of the warranty period, please refer to the System Maintenance section in this operating manual.

Under the terms of this warranty, we do not accept any responsibility for injury, damage or losses incurred by you or any third parties (including, without limitation, injury or material damages caused by an interruption to normal activities, lost funding or profits, loss of information or other losses) caused during or related to the use of the product provided. In such cases, we shall be liable only for the product provided and to a maximum of the net purchase value of the product supplied.

As the buyer you assume all responsibilities for damage caused due to the incorrect use of the product, abnormal variations in the product's working environment or to services connected directly or indirectly too it (such as abnormalities in the electrical, air or water supply, electromagnetic or thermal shock, network issues or malignant computer software) or any other act attributed to or permitted by your personnel or by anyone acting on your behalf.

All information provided related to this product shall be considered Confidential. You shall not disseminate, copy, decompile, modify, reverse engineer, or create derivative works out of any product or information provided without our explicit written consent.

Should a dispute arise, which cannot be amicably resolved, legal jurisdiction will fall under the courts of Udine, Italy.

In the case of a malfunction please contact us for assistance from one of our service technicians. Should the device need to be returned to CyNexo, we will issue you with an RMA. Please do not send equipment to us without an RMA as it may be refused, delayed or cause additional charges.

In case of an RMA, the customer will be responsible for suitably packaging, where possible in the original packaging materials and containers, and shipment of the device to CyNexo via insured courier service. CyNexo cannot accept any liability for damages occurred during shipment. Upon receipt CyNexo will perform

the necessary checks and contact you to discuss the results of these checks and next steps. CyNexo will be responsible for packaging and shipping of the device back to the customer.

15.2 Voiding of warranty

The warranty becomes void if a malfunction or failure is caused by:

- Tampering with the equipment
- Removal of identification labels or seals
- Installation, incorrect or improper use of software and/or hardware
- Any intervention or attempt to modify or repair the equipment by the customer, without the prior written authorization of CyNexo srl
- Damage, accidents and breakdowns caused by transport performed by the customer or transport company, even if previously authorized by CyNexo srl
- Incorrect use, misuse or use not intended by CyNexo srl
- Maintenance or repairs carried out by unauthorized personnel and/or use of non-original spare parts
- Any actions resulting from not correctly following the instruction set out in this operating manual

15.3 Warranty exclusions

The warranty is not applicable to the products and to the parts subject to wear if the failure is due to normal wear and tear thereof and not to a manufacturing defect (e.g.: tubes, gaskets, jar caps, electrical or fibre optical cables, etc.).
The warranty does not apply if our technical service and, subsequently, that of our suppliers are unable to find or reproduce the alleged defect.

16 Contact Details

Please feel free to contact us with any requests, specific needs or concerns at:

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