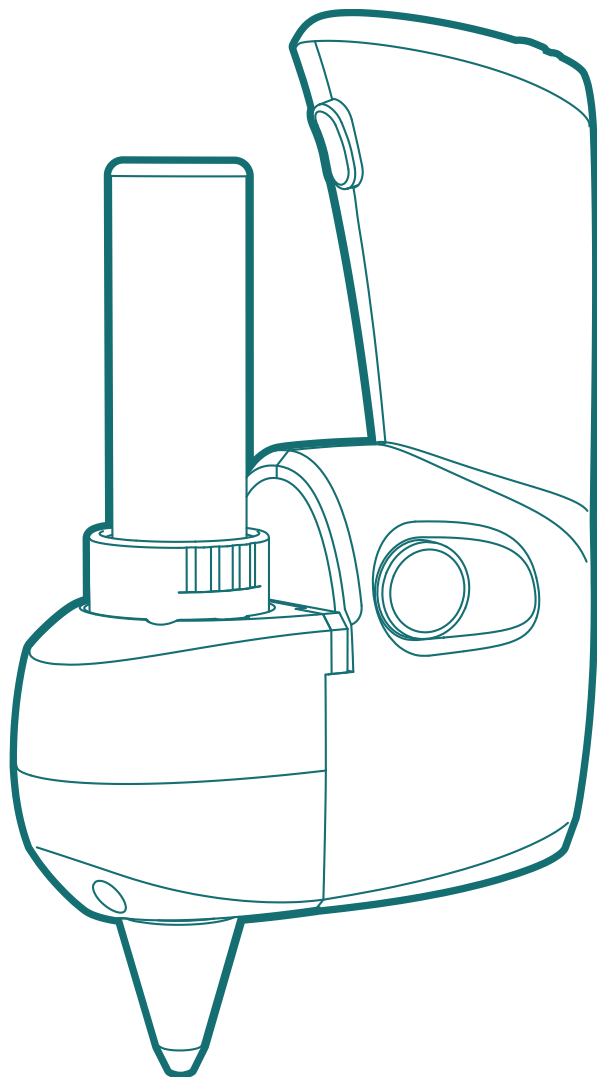


Solids Dispenser

SDH-1

MANUAL



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1. Volumetric Dispensing

1.1 Principle

The SDH-1 dispenser is based on the principle of volumetric dispensing. It is the automated and highly precise equivalent of a measuring spoon, portioning the volume, not the mass of the material.

Since powder doses are typically specified in mass, these specifications need to be converted to volume via the bulk density, which takes the voids around the particles into account and depends on granule size. Bulk density is different from solid density of a material, which is often listed in data sheets. The bulk density is generally much lower. It can be established by weighting a specific volume of powder, e.g. in a beaker or syringe barrel, without tapping or compressing the material.

1.2 Dosing

The dispensing disks in our equipment are permanently calibrated to a specific volume according to the target dose and material (bulk density). To change the single dose value of the dispensing head, the disk needs to be replaced with one of a different calibration. Disks are calibrated according to customer specifications to a dose target in a specific material; either nominally with bulk density value or based on testing with material samples.

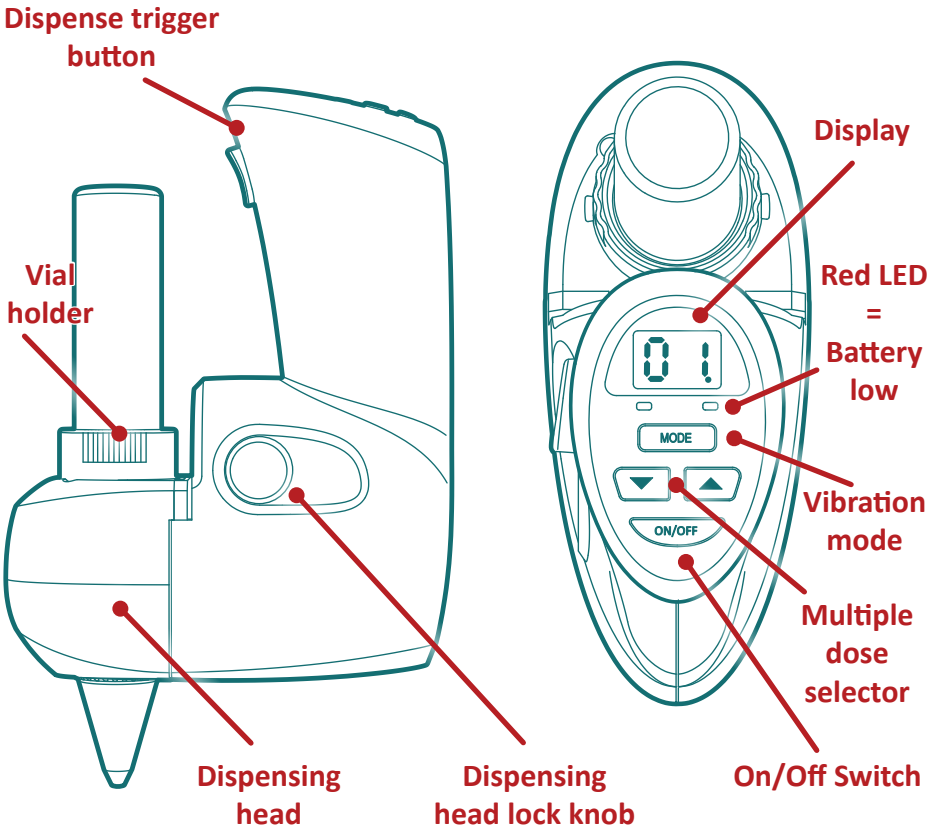
1.3 Dosing Error

Volumetric dosing has a natural variation in dose mass depending on material properties and dose size (larger doses dispense relatively more stable). The expected precision of the dosing for a given material and dose size needs to be established in tests.

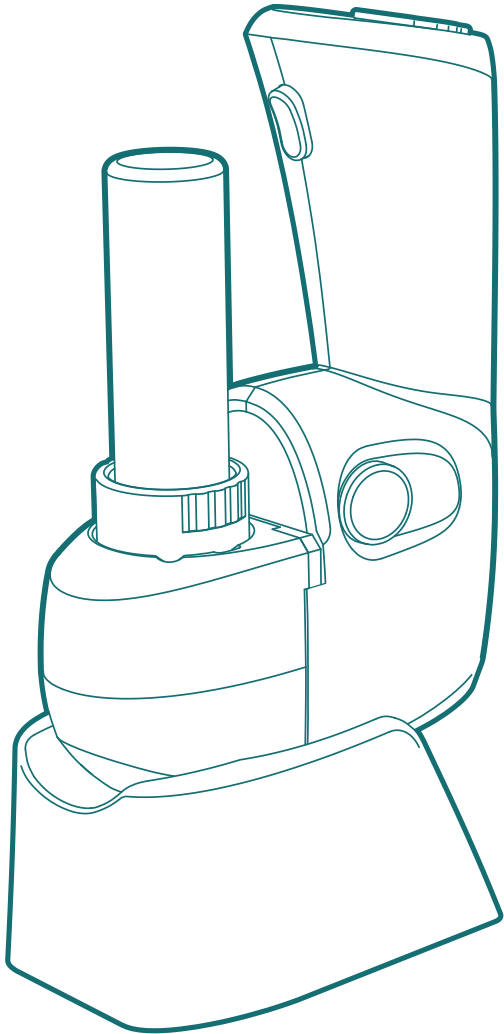
Static charge can affect dosing consistency as well. In many cases it leads to a 'coating' of the surfaces in the powder path with material. Due to this effect the first 5 doses of a series can be under dispensed. It is recommended to eliminate these first shots from a batch. The severeness of static depends on ambient humidity; it is most pronounced in very dry conditions. Dispensing disks and funnels in antistatic material are available to improve performance for such sensitive materials and environments.

A volumetric dose can be affected in its mass by humidity. While the mass may vary with moisture content, the volume will be largely constant. The dose volume is in these cases often the more relevant measure, since it ignores the humidity weighted in addition. While weighting doses (gravimetric dosing) might seem in such cases very precise, it could actually mask this error (with higher moisture content less material will be dosed for the same mass in gravimetric dosing). The volumetric dispensing will still provide quite a stable dose of the actual material in such cases.

2. Overview



When the dispenser is not in use, it can be placed on the cradle supplied.

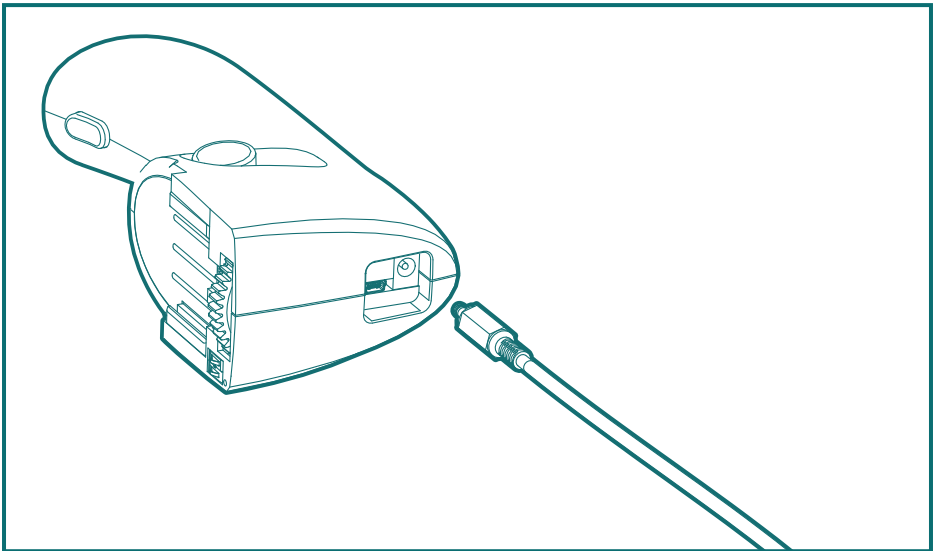


3. Operating Instructions

3.1 Charging the Dispenser

Please charge the dispenser for several hours up to a full load before usage. Attach the power adaptor to a wall outlet and insert the plug into the connector on the underside of the device.

With the full charge the dispenser can be used for many hours of continuous work.

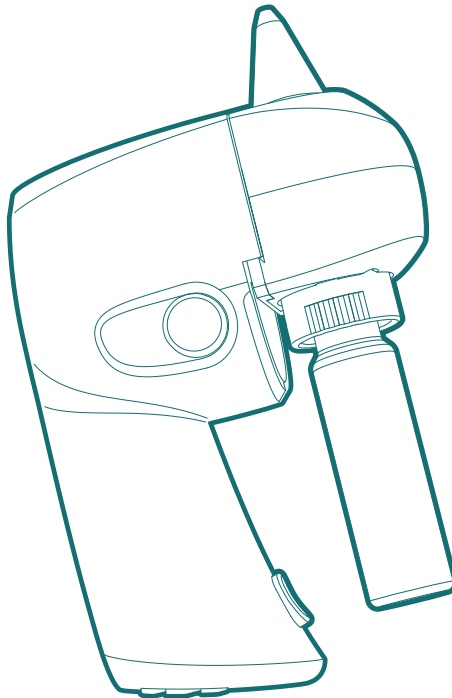


The power supply is switching type; therefore it will work for 110V grids as well as for 220V. The USB port next to the DC connector cannot be used for charging.

Please charge the equipment only with power adaptor provided, not general adaptors. Using such adaptors may destroy the internal battery.

3.2 Dispensing

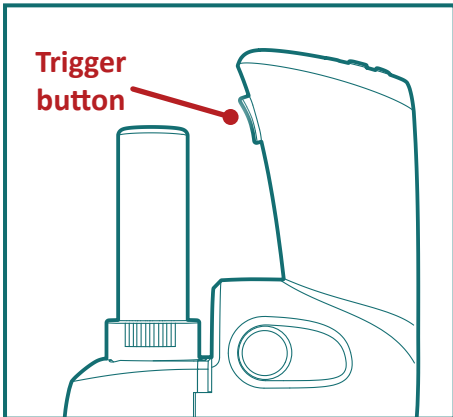
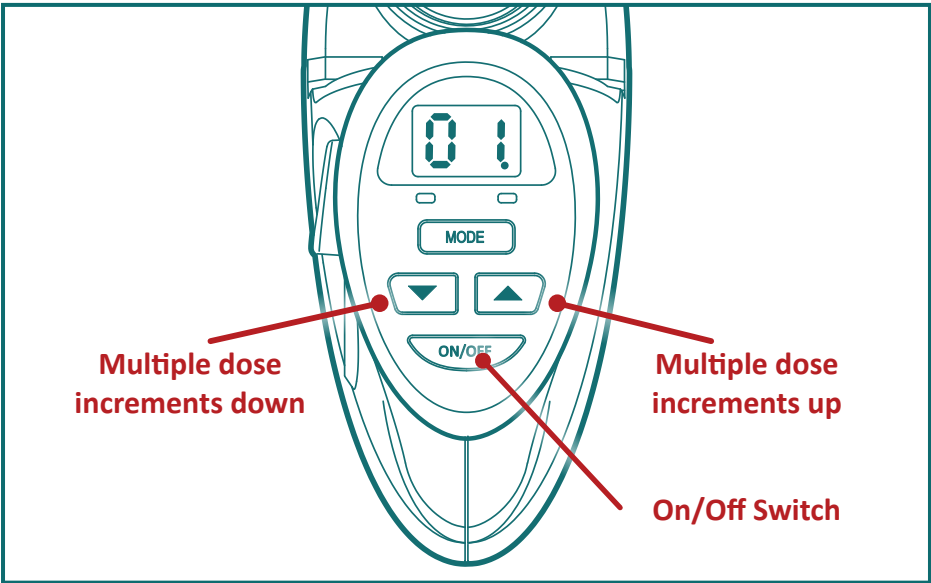
1) Attach the vial containing the material for dispensing to the vial receptacle by screwing it into the reservoir holder in the dispensing head by holding the dispenser upside down.



2) Switch the dispenser on. The dispensing disk will rotate and stop at the first home position (out of 4 positions in one full round).

The single dose size is determined by the volumetric calibration of the dispensing disk inside the dispensing head. Higher dispensing amounts can be achieved with multiple doses (pre-selectable).

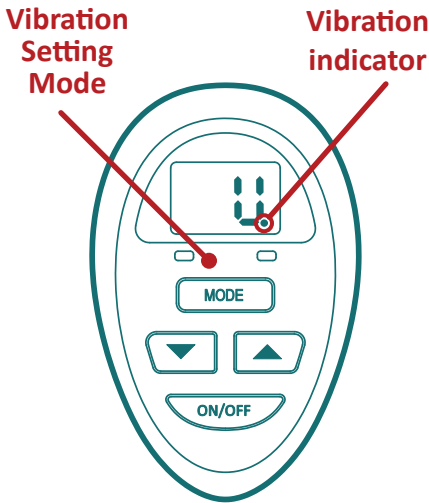
3) The dispenser can perform pre-selected multiple dose dispensing. Selection of the number of dose cycles is done at the multiple dose selector. For example, if 1 step dispenses 10mg of powder, 20 steps will dispense 200mg of powder and so on.



4) You can start dispensing the desired amount of powder by pressing the dispense trigger button. For best results, keep the dispenser upright, as vertical as possible. Tilt can affect the dispensing accuracy.

3.2 Controlling the Vibration Function

Powders which do not flow naturally require vibration to dispense consistently. The need for vibration can be established by trial. If there is no advantage in consistency, it is preferable to leave the vibration mode off since there will be less noise, wear and tear and the dispensing cycle will be faster. Some powders will actually dispense better without vibration (e.g. due to static charge). For best results, keep the vibration mode setting constant for specific materials and dose sizes.



An increased vibration level can have a tendency to increase the dose amount.

To switch the Vibration on and off, as well as control the vibration level, please proceed as follows:

- 1 Press and hold the Mode button to scroll one step through the vibration setting (no vibration, V1, V2,V3, V4,- no vibration...)
- 2 Press the Mode button briefly to display the current setting

Vibration Indicator:

Dot does not show on display:
Vibration deactivated

Dot shows on display:
Vibration activated

V1 Vibration level1 (lowest)

V2 Vibration level2 (medium)

V3 Vibration level3 (high)

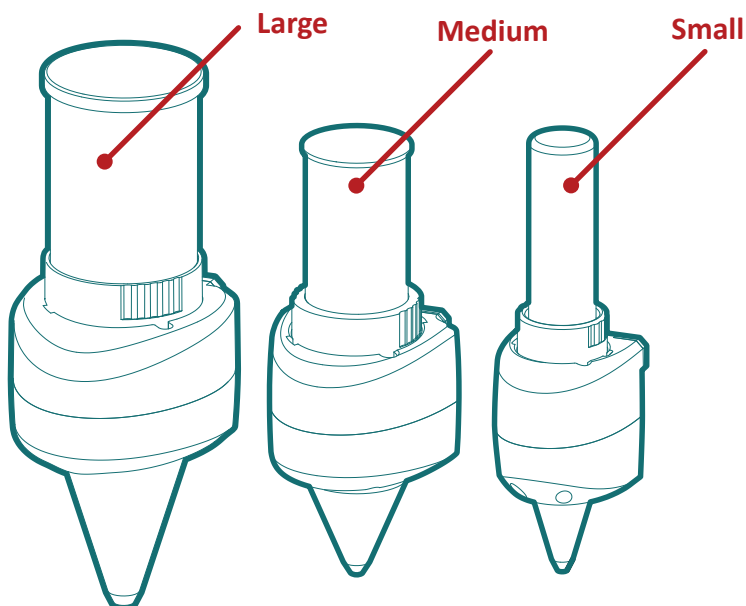
V4 Vibration level4 (maximum)

When Mode is pushed again on V3 the vibration setting will go back to Vibration Off.

4. Dispensing Heads

There are 3 sizes of dispensing heads available for the SDH-1: Small, Medium and Large. The small and medium head fits best to the configuration as as a handheld device.

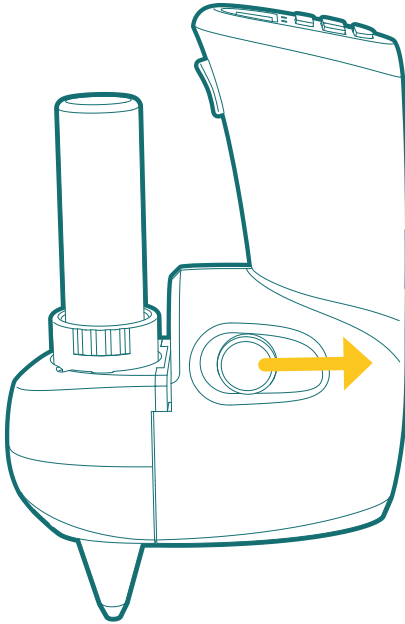
A Small head can be calibrated to dispense typically a single dose size of 5-250mg, a Medium head 5-800mg and a large one 5mg – 3g, depending on bulk density of the material. Higher dispensing amounts can be achieved with multiple doses (pre-selectable). The single dose is determined by the volumetric calibration of the dispensing disk inside the dispensing head.



Calibration volume range Small dispensing disk:	2.3mm³ -300mm³
Calibration volume range Mid size dispensing disk:	5.0mm³ -715mm³
Calibration volume range Large dispensing disk:	2.3mm³ -8000mm³

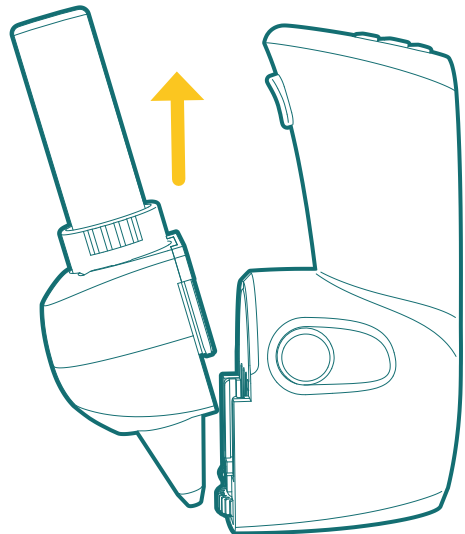
5. Cleaning of Dispensing Head

5.1 Detaching dispensing head to motor unit:

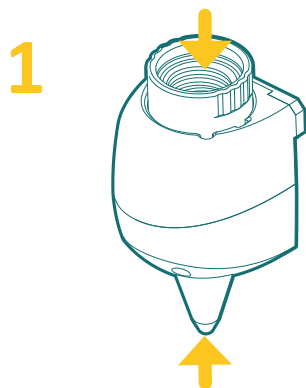


1) Push back the lock knob at the side of the dispenser.

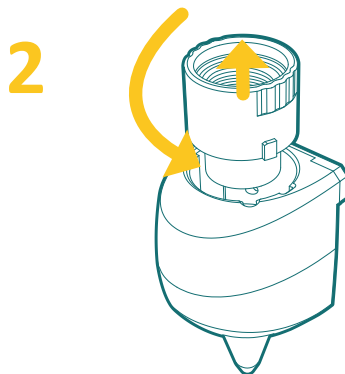
2) Slide the dispensing head upwards to detach it from the dispenser body.



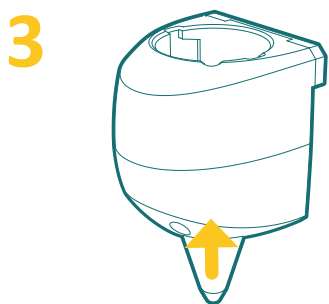
7.1 Cleaning of Small Dispensing Head



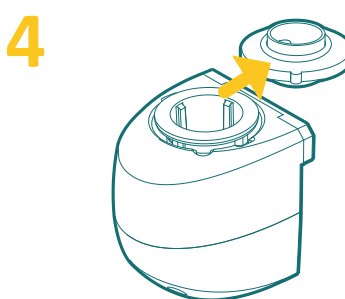
Detach the vial from dispensing head, blow compressed air (if available) into vial holder and funnel to remove particles. Turn funnel through the 4 dispensing positions to clear material in disk (chamber exposed in dispensing disk when aligned with aperture on top).



For more thorough cleaning, dismantle the dispensing head:
Rotate the vial holder anti-clockwise and pull it out vertically.



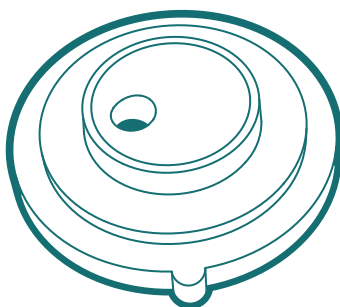
Push out funnel assembly from bottom.



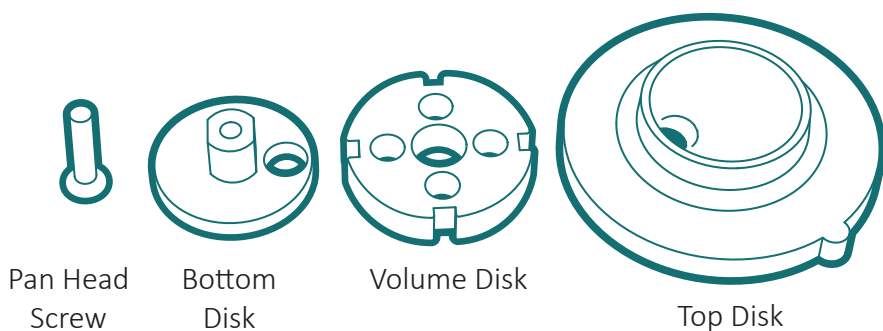
Pull out dispensing disk from funnel.

7.2 Cleaning and Disassembly of Small dispensing disk

The dispensing disk can be cleaned externally by blowing compressed air through it, or by brushing, wiping with agents, such as Isopropyl alcohol or detergent. Rotate the volume disk to access all 4 apertures.

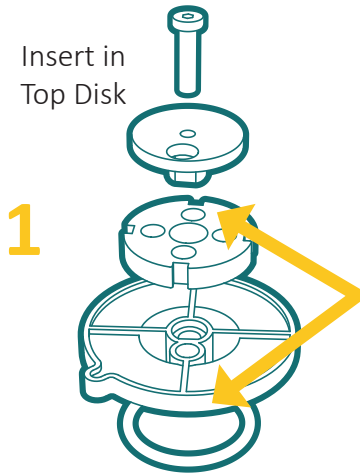


For more thorough cleaning of the dispensing disk it can be dismantled:

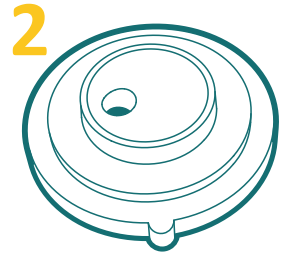


Remove the pan head screw on the underside of the dispensing disk to separate three parts and clean all parts by using compressed air, brushing or wiping.

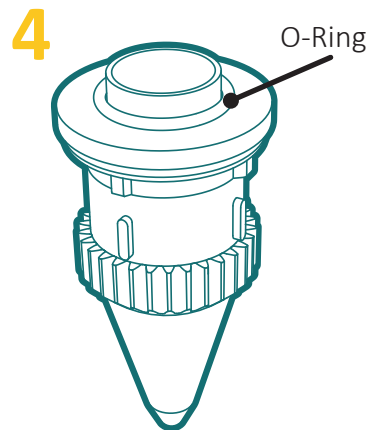
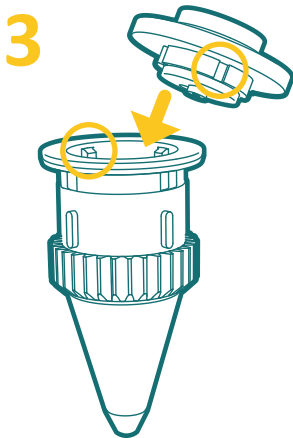
7.3 Re-assembly of Small Dispensing Disk and Head



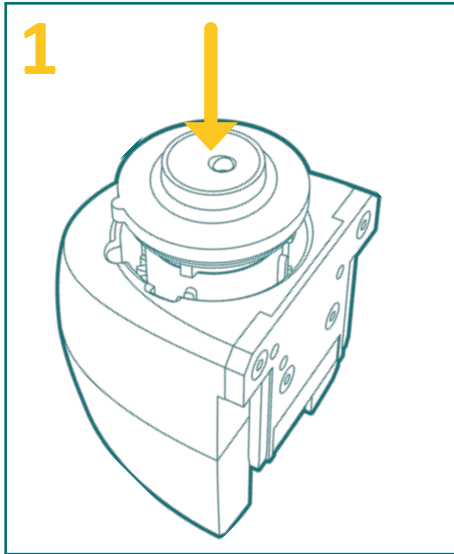
Slide bottom disk part into volume disk. Then insert into top disk while aligning the D-indexing feature. Insert screw. If the dispensing disk has pockets between the 4 apertures, these must be facing downwards.



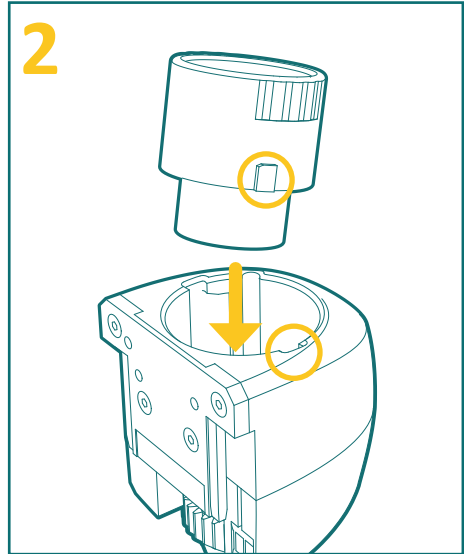
Tighten the screw in a manner that the disk can rotate smoothly with some slight friction. **Light tightening is sufficient, don't overtighten.**



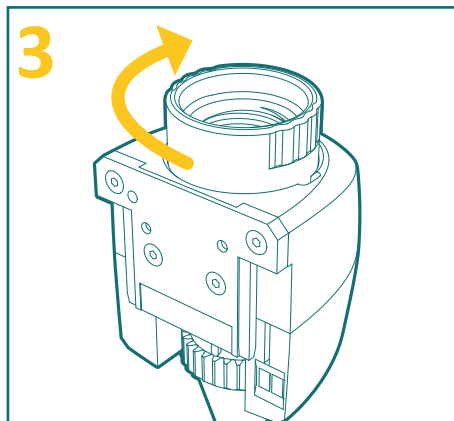
Funnel assembly- Insert the disk assembly with O-ring into funnel by aligning ribs and slot. Push in the disk.



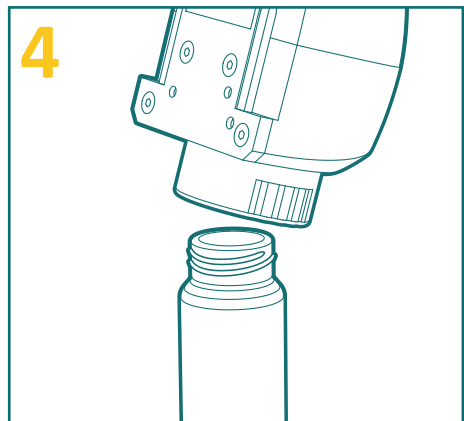
1
Insert disk and funnel into dispensing head casing.



2
Insert vial holder aligning ribs into groves.

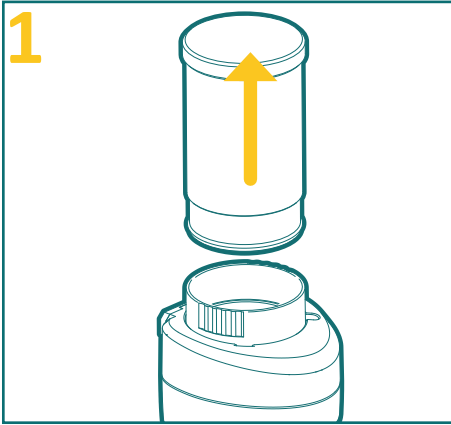


3
Rotate vial holder clockwise slightly until locked.

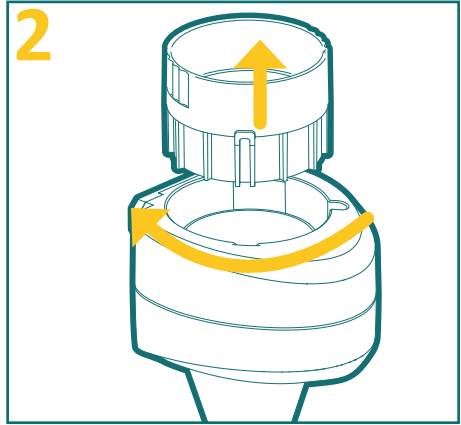


4
You can now reattach a vial by screwing into the vial holder.

7.4 Medium and Large Dispensing Heads



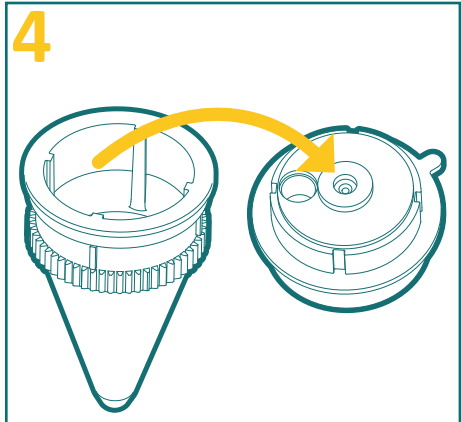
Pull out reservoir from dispensing head and clean out material. If available, blow compressed air into the dispensing head from top and trough funnel to remove particles.



For more thorough cleaning, dismantle the dispensing head: Rotate the reservoir holder anti-clockwise and pull it out.



Push the funnel with disk upwards.

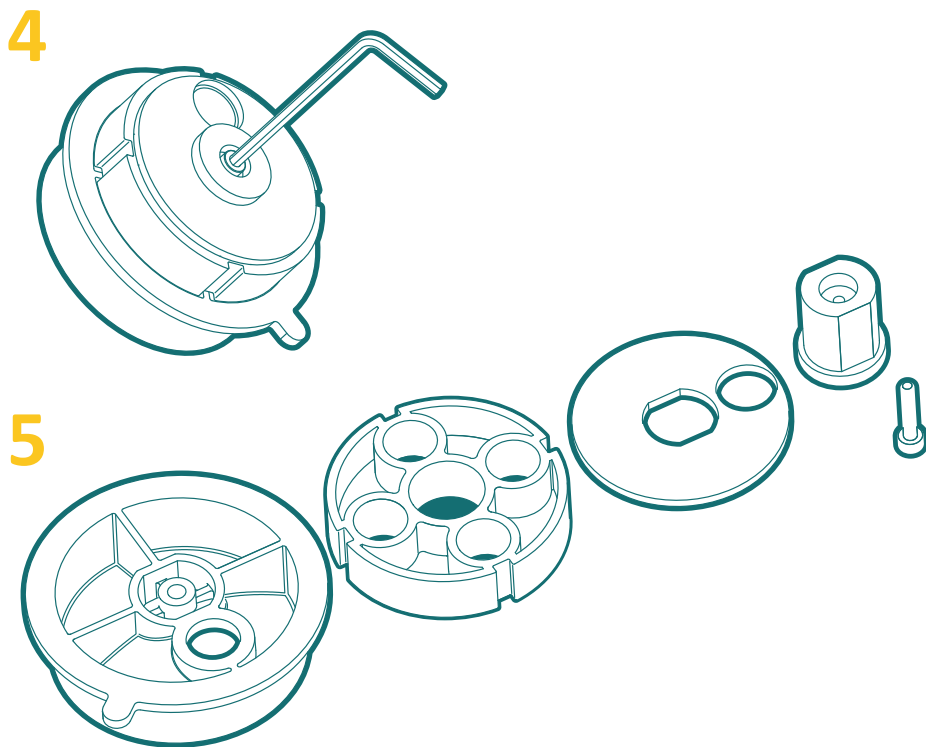


Pull the dispensing disk from funnel.

7.5 Large and Medium Dispensing Disks

The dispensing disk can be cleaned externally by blowing compressed air, brushing, or wiping with agents such as Isopropyl alcohol or detergent. Rotate the volume disk to access all 4 apertures.

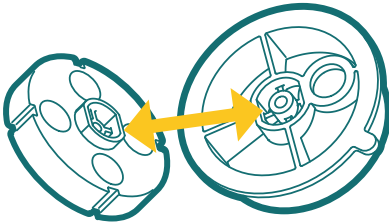
For more thorough cleaning the dispensing disk can be dismantled:



Remove the pan head screw on the underside of the dispensing disk to separate three parts and clean all parts by using compress air, brushing or wiping.

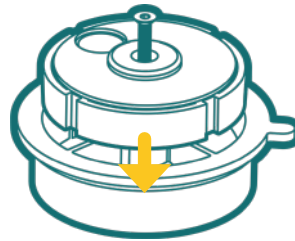
7.6 Reassembly of Large Dispensing Disk and Head

1



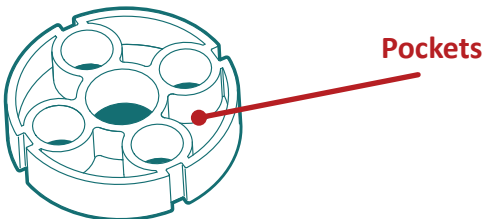
Insert the counter piece with screw through the bottom and volume disk. Engage by aligning flattened indexing details of counter piece and top disk.

2



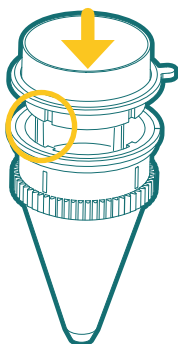
Push counter piece, bottom and volume disk vertically together; insert screw. Tighten screw in a manner that the disk can rotate smoothly with some slight friction.

Light tightening is sufficient, don't overtighten.



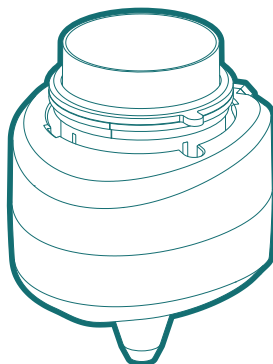
If the disks you are using has pockets between the chambers, these must be oriented **facing downwards**.

3



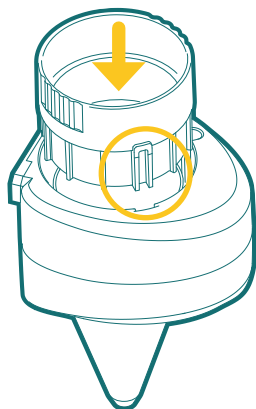
Insert disk into funnel aligning indexing details of disk and head.

4



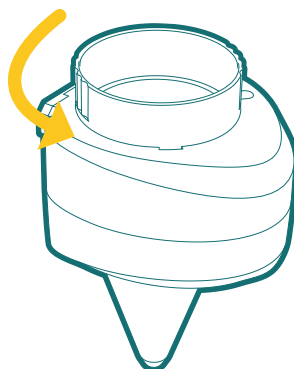
Insert funnel with disk into dispensing head casing while aligning the disk tongue in casing cutout.

5



Insert reservoir holder on top, aligning the lock details.

6



Lock reservoir holder by turning clockwise. You can insert now the reservoir again.

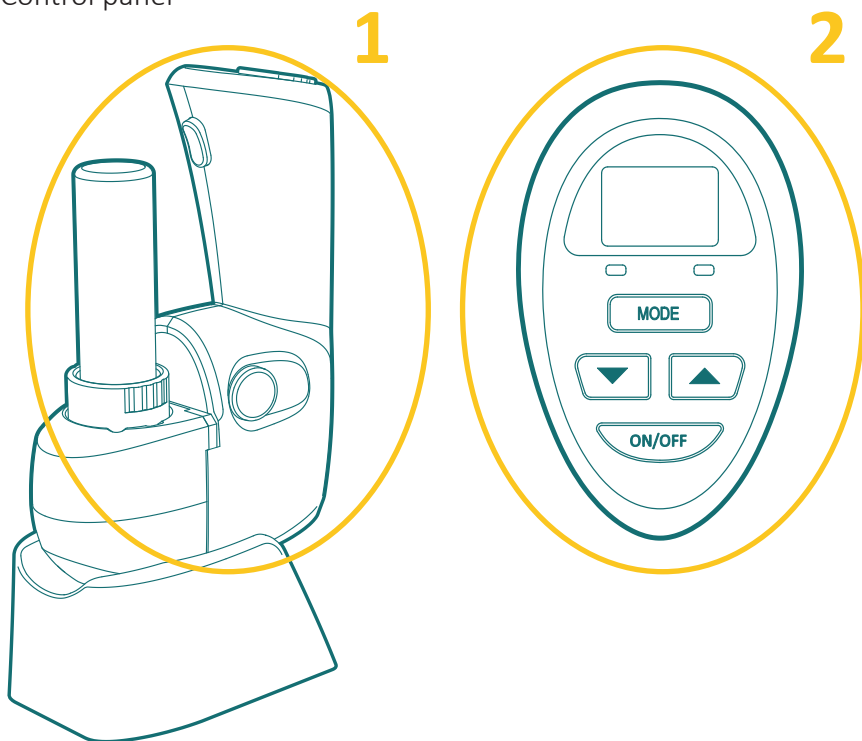
6. Cleaning of Main Unit

The dispensing head and its parts can be cleaned and disinfected normally.

Painted surfaces should not be cleaned with bleach, alcohol, IPA or any harsh chemicals. Mild disinfectant soap can be used on these painted surfaces.

Painted surfaces are found on the:

- 1 Main dispenser unit
- 2 Control panel



7. Calibration

7.1 Initial Calibration

In calibration the dispensing disks are machined for a specific, definite dose volume of the dosing chambers.

Depending on what is most practicable, the chamber size can be defined in several approaches:

7.1.1. Based on specification of a dose volume

The dispensing disk will be prepared with the chamber size according to the volume specification within the calibration volume range of the specific disk size.

Volume range:	for small disk:	2.3mm ³ -300mm ³
	for mid size disk:	2.3mm ³ -715mm ³
	for large disk:	2.3mm ³ -8100mm ³

7.1.2. Based on specification of dose mass with samples

The dispensing disk will be adjusted in testing until the mean of a test dosing string is very close to the target.

7.1.3. Based on specification of dose mass with bulk density

The dispensing disk will be prepared nominally to a volume that corresponds to the dose mass based on the bulk density of the material. The bulk density value is either obtained from the powder material manufacturer or established by weighting a specific volume of the material (say 50ml e.g. in a syringe barrel).

7.2 Volume Calculation

The calibrated volume corresponding to a dose target in mass can be calculated as follows:

$$\text{Dose target (g) / Bulk density (g/ml)} = \text{Dose volume (ml)}$$

The disk can be calibrated with this volume value.

If the nominal bulk density is not available it can be empirically established by weighting a fixed volume of the sample (e.g. 50ml in tube, beaker or syringe barrel). The bulk density results then as follows:

$$\text{Weight sample (g) / Volume weighted (ml)} = \text{Bulk density g/ml}$$

7.3 Calibration Verification and Recalibration

The dispensing disks should be verified periodically by testing in a string of doses in comparison to the test results when the disk was new (mean of actual doses and standard deviation). The original test results were provided as part of the outgoing inspection of new dispensers or dispensing disks. These tests are typically repeated onsite to check for any deviation as part of the IQ/OQ process.

If during the periodic verification testing the values have drifted and variation has increased, the disk should be replaced with a new component of the same specifications (chamber diameter and height). The wear of disks will depend besides intensity of use on the abrasive character of the dispensed material.

The dispensing disks can be ordered to specifications from XQ Instruments and will come with a new test report.

7.4 Workflow

The principle of these dispensers is volumetric, and the dispensing disks (the dosing element) are calibrated for a specific dose size as specified by the customer. With the calibrated dispensing disk this dose or selectable multiples of it (up to 99x) can be dispensed. One shot takes 3.5 seconds.

Selecting multiple doses allows to dispense different dose sizes from the same dispensing disk/head, as long as they have a common denominator. However dispensing time will increase and there can be a stack up error.

To change the single dose values, or switch to a material with different bulk density, the dispensing disk needs to be swapped with one to a new value. This takes only a few seconds. For different dose sizes and/or materials several dispensing disks can be kept at hand and switched quickly. Additional disks to new specifications can also be ordered from XQ Instruments at any time; e.g. when requirements change.

For switching instantly between materials and dose sizes it can be advantageous to have several dispensing heads at disposal. This way the entire dispensing head can be swapped instantly without the need of clearing out the material and no risk of cross-contamination. The dispensing heads can be temporarily stored with material inside (ideally in a dry chamber). Such additional heads with calibrated disks are available as accessories.

8. Quality Management

8.1 Calibration certificate

For calibrated dispensers, dispensing heads and dispensing disks calibration certificates are provided for verification of performance and filing as quality records. The results on the calibration report are the basis of comparison for IQ/OQ tests and subsequent periodic calibration tests.

8.2 IQ/OQ

Typical practise is to repeat the outgoing functional and calibration test when the equipment received by the customer as part of their IQ/OQ. Templates can provided for recording the results.

8.3 Periodic calibration test

The functional dispensing test should be repeated periodically. The frequency depends on the abrasiveness of the dispensed material. The test consists of a series of doses with the actual material. If the mean and variation of the doses has not changed beyond limits, the dispensing disks can continue to be used and the test results can be filed as quality records. If there is a significant drift or inconsistencies, the dispensing disk should be replaced and a new one to the exact same specifications as the initial one should be ordered. The new disk will come with a calibration certificate from XQ Instruments.

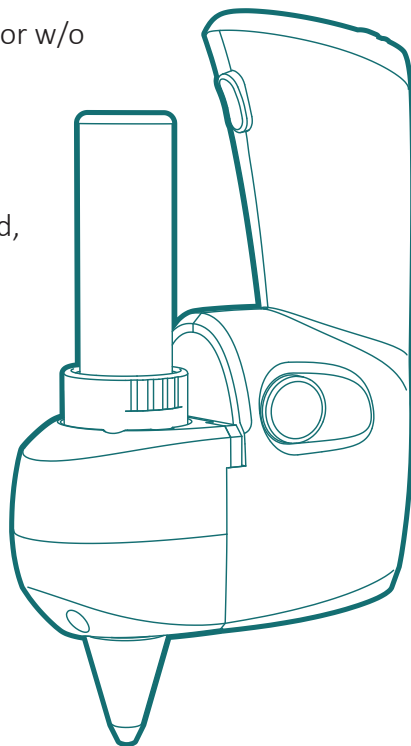
9. Troubleshooting

1. When the powder clogs and jams the dispensing head, the dispenser might stop (*Should display error code E1, see table below*).
2. Switch off and detach dispensing head from the device body. (*Refer to '6.4 Removal of dispensing head from dispenser body'*).
3. Follow usual cleaning procedures to dislodge any clogs. (*Refer to '7. Cleaning of Dispensing Head'*).
4. In case of clogging or excessive dose variation, check whether vibration is activated and has normal strenght.
5. If there is double dispensing or the head keeps rotating, the sensor can't read the black markers on the funnel correctly. Check whether there is powder or dust deposit on the markers or sensor and clean accordingly. (*Should display error code E1, see table below*).
6. Error Codes:

CODE	TYPE	CAUSES	ACTIONS
E1	Error	Dispensing head or funnel not in dispenser head.	<ul style="list-style-type: none">• Attach dispensing head or insert funnel `with disk and reservoir holder• Restart system or reposition funnel to clear the E1 error code.
E2	Error	Black marker not detected by IR sensor within 3 sec.	<ul style="list-style-type: none">• Check that black markers on the funnel are clean from powder deposit• Check whether dispensing head is jammed; disassemble and clean if required• Restart system or reposition funnel to clear the E2 error code.

10. Specifications

- Typical single dose size: 5 to 300 milligrams
- Automatic priming function
- Accuracy: +/- 3%, depending on substances
- Dosing cycle time: 2.5- 3.5 sec. (w. or w/o vibration)
- Sample vials (for small head):
Diameter 28 mm glass screw thread,
available in 40 or 60mls, 24-400
thread neck size or container (for
medium size head) PC tube 42mm
diameter
- Size: 225mm x 152mm x 54mm
- Weight: 500g
- Power Supply switching: 115V /
230V
- Power rating: 5W max
- Operating conditions 10 °C – 30 °C, humidity
- Storage conditions -5°C – 40 °C humidity 0-90%



11. EG-Declaration of Conformity

We,

XentiQ Partners Pte Ltd
35 Joo Koon Circle Vicplas Building
Singapore 629110

declare on our own responsibility that the laboratory device:

SDH-1 Solid dispenser

complies with all applicable provisions of the following directives:

- Low Voltage Directive 2014/35/EU
- EMC Directive 2014/30/EU
- Machinery Directive 2006/42/EC

Said Product complies with Directive 2011/65/EU (RoHS2)
Restriction on Hazardous Substances.



Singapore, 14.05.2020
Eugene TAN
Managing Director



INSTRUMENTS

User Manual DP1802-281G