

ETT Gustatometer quick start



Table of Contents

Safety Information	3
Contact to ETT	3
Un-boxing / Installation	3
Working with the ETT Gustatometer	5
Create your first experiment.....	5
Typical tastants	5
Useful information	6
Resources	6
Tutorial 1 – The ETT Gustatometer paradigm wizard	6
Tutorial 2 – Cleaning procedures	8
Tutorial 3 – Filling the device	10
Tutorial 4 – Using external triggers.....	12
Tutorial 5 – Data management	12
Tutorial 6 – Assembly.....	12
Tutorial 6 – Applicator/mouthpiece setup	16

Safety Information

- This unit is designed to run on 110/220VAC only. Adjust power settings to local specifics
- The users must unplug the power to the unit before removing the cover of the unit.
- Electrical isolation is ensured by having only Teflon tubing in proximity with the subject.

Contact to ETT

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Un-boxing / Installation

Congratulations to your new ETT Gustatometer! We strongly recommend participating in our free training at our site that comes with every new ETT Gustatometer or consult our representative for on-site training. The next few simple steps will guide you through your very first setup of the boxed device:

- 1 Carefully open the box, in which you should find:
 - o The ETT Gustatometer



- o One plastic bag containing
 - 1 Stimulant/tastant –bag holder rack
 - 1 set of food safe bags for the stimulants
 - 1 food safe tubing set (0.5m, 8 channel) between reservoir bags and peristaltic pumps (incl. all necessary connectors)
 - 2 sets of replacement tubing for each peristaltic pump

- Customized mouthpiece/applicator



- 1 PTFE tubing set (8 m, 8 channel) between applicator and device (Incl. all necessary connectors)



- 1 Swallow sensor belt with digital input (optional)



- 1 Subject feedback pad with digital input (optional)
- 1 Power cord



- 1 coax cable with connectors



- 1 MRI RF Trigger converter



- 2 Set the plastic bag aside and take the device out of the box to set it up on a sturdy surface. We recommend a flat top lab cart with two levels each with dimensions of at least 0.5 m x 1 m. Set the device on the top level.
- 3 Connect the applicator/mouthpiece to the long 8 channel tubing / it is advised to follow the numbering scheme that you find in form of little flags next each connector, so the channels are assigned consistently. Therefore the rinse channel will automatically be placed in the center.
- 4 Follow the same principle to connect the other end-connectors to the device output channels
- 5 Prefill the bags with distilled water and connect the drip chamber while flow inside the tube is locked; then connect the other end as labeled to the device input channels and unlock the tube
- 6 Squish the drip chamber to prefill it for each channel
- 7 Connect the power cord and turn the device on. After the device started up you are asked to tap the touch-screen. This will bring you directly to the main window.
- 8 Tap the “manual mode” in the top right corner of the touch-screen of the device and check manual mode
- 9 Activate each channel for at least two minutes until you see the distilled water drip out of the end of the mouthpiece and the tubing is free of air (make sure to catch the water at the end in a cup or sink)
- 10 Run test paradigm (see Tutorial 1 “The ETT Gustatometer paradigm wizard” on how to build the paradigm)
- 11 After the experiment is done, follow the instructions of Tutorial 2 “Cleaning procedures”

Working with the ETT Gustatometer

Create your first experiment

Before the first experiment can be designed a few thoughts on your options with the ETT Gustatometer. You will be delivering drops of liquid through a system of Teflon tubing through an applicator into the subjects’ mouth. These drops of substances that will stimulate the gustatory sensation (tastants) are a chemical of choice dissolved in distilled water (dH₂O) or your specific neutral rinse, which usually mainly consists of distilled water. If the particle size is small enough even emulsions with high liquid portion are deliverable.

The ETT Gustatometer offers the option to deliver with 7 independent taste channels and one additional rinse channel. The experiment will be split into cycles that repeat themselves. During these cycles one will have a determined amount of tastant from one of the taste channels and one or more rinse cycles with a defined bolus.

Typical tastants

Typically people will deliver particles that are easily dissolved in water and where the formulation is reproducible exactly the same for every experiment. Generally know there are five categories of taste receptors that can detect:

- Sweetness
- Saltiness

- Bitterness
- Sourness
- Umami

To get a start, different concentrations of salt (NaCl), sugar/sucrose (C₁₂H₂₂O₁₁), caffeine (C₈H₁₀N₄O₂) and citric acid (C₆H₈O₇) are easy to create with distilled water.

It is important to assure a proper drop formation at the mouth piece. So if the number of drops is set too low for a tastant with a high viscosity, the drop may just grow bigger and bigger and not actually fall onto the tongue in time. This aspect should be tested thoroughly.

Useful information

Storage: Before you store the ETT Gustatometer you have to run the cleaning procedure mentioned in Tutorial 2. If you intend NOT to use the device for more than one week, we recommend to detach all tubing from the ETT Gustatometer. Furthermore the bags, drip-chambers, tubing and supply-lines have to be disconnected from another. All parts have to be dry and free of any experimental residuals. The disinfected and dried mouthpiece should be stored in a separate bag. A dust free environment is ideal.

Resources

Tutorial 1 - The ETT Gustatometer paradigm wizard

No. 1	Channel Setting						
	1	2	3	4	5	6	7
Volume X*0.04ml	3	5	5	5	5	5	5
Responce	2S	2S	2S	2S	2S	2S	2S
Rest	2S	2S	2S	2S	2S	2S	2S
Wash	Volume X*0.04ml 2	Duration 2S		Repeat 9		Initial Wash 1	
Next Page	Paradigm Delay 3S		Paradigm Exe 2		EDIT		
Return							

Paradigm Setting

1	2	3	4	5	6	7	8	9	10	11	12
1	2	3	4	5	6	7	1	2	3	4	5
13	14	15	16	17	18	19	20	21	22	23	24
6	7	1	2	3	4	5	6	1	2	3	4
25	26	27	28	29	30	31	32	33	34	35	36
5	6	7	1	2	3	4	5	6	7	1	2
37	38	39	40	41	42	43	44	45	46	47	48
3	4	5	6	7	1	2	3	4	5	6	7

Go Back

SET

Manual/Auto Control

1

2

3

4

5

6

7

8

on

on

on

on

on

on

on

on

START

3s

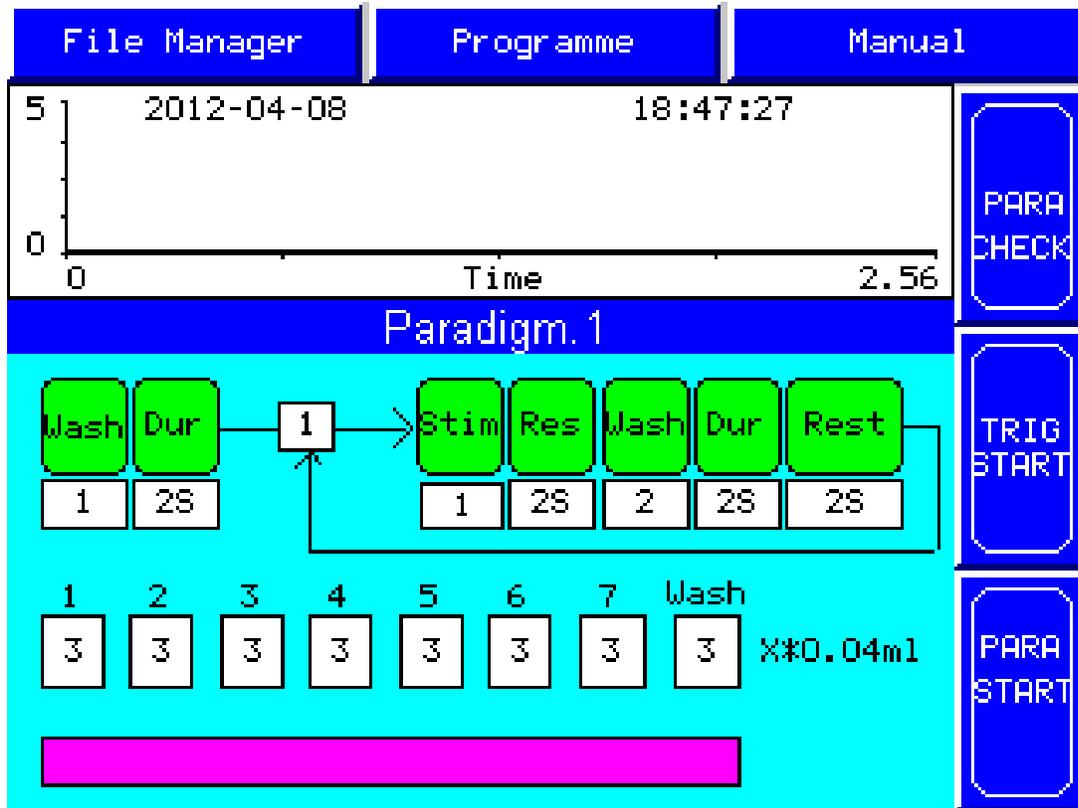
8#OFF

1s

Manual

Auto

Return



Tutorial 2 – Cleaning procedures

To guarantee optimal subject safety and a long lifespan of your ETT Gustatometer and the supplied equipment, we advise you to follow our cleaning procedures. It applies *before and after each use cycle*:

Cleaning the tubing

1. Stop all pumps
2. Flush all channels consecutively with **distilled water (dH2O)** as follows:
 - a. Detach reservoir bag from drip-chamber
 - b. Drain reservoir bag
 - c. Flush and fill reservoir-bag with 60-100 ml dH2O
 - d. Re-attach reservoir bag to drip-chamber
 - e. Switch the operating system to manual mode and activate the channel you just charged with dH2O

Be aware that you have to collect the liquid in a container of your choice coming out of the mouthpiece end.

- f. While you observe the Gustatometer pumping the full volume of the reservoir-bag through the tubing and mouth piece, you can start preparing continue to prepare channels the other channels by repeating steps 2.a. – 2.d until the current channel has

pumped all the liquid through. Then you can proceed with steps 2.e. and 2.f. until you went through all channels.

3. Flush all channels consecutively with **70% Ethanol** as follows:
 - a. Detach reservoir bag from drip-chamber
 - b. Drain reservoir bag
 - c. Flush and fill reservoir-bag with 40-60 ml 70% Ethanol
 - d. Re-attach reservoir bag to drip-chamber
 - e. Switch the operating system to manual mode and activate the channel you just charged with 70% Ethanol
 - f. While you observe the Gustatometer pumping the full volume of the reservoir-bag through the tubing and mouth piece, you can start preparing continue to prepare channels the other channels by repeating steps 2.a. – 2.d until the current channel has pumped all the liquid through. Then you can proceed with steps 2.e. and 2.f. until you went through all channels.
4. Repeat step 2 with 40-60 ml dH₂O and then continue with step 5
5. If you are planning the use device for an experiment, you are done already. If you are planning to store the Gustatometer for more than a few hours it is essential to dry all the tubing and connectors:
 - a. Detach the reservoir-bags
 - b. Blow pressurized medical air into them for about 2 minutes if you plan to re-use them
 - c. Set the dried bags aside
 - d. Disconnect the white Luer-lock connector from the output ports of the Gustatometer
 - e. Connect the 1 to 4 extender piece to white Luer connectors you just disconnected of the first 4 channels of your tubing
 - f. Connect to 1-4 extender to your bottle of pressurized medical grade air (alternatively you may use a wall outlet, put you will have to be able to throttle the pressure precisely)
 - g. Open the main valve and apply low pressure to the first for channels – within a few seconds the residual liquid inside the tubing should start bursting out of the mouth piece end of the tubing
 - h. Close the main valve after 5-20 minutes. Depending on the flow rate, everything should be dry by then.
 - i. Repeat steps 5.e.-5.h. with channels 5-8

Cleaning the mouth piece (applicator)

Since the mouth piece is in direct contact with the subject, strict hygiene is very important. The mouthpiece is designed with materials that allow disinfection with alcohol or even autoclaving it. You may also consider using a new mouthpiece for every subject, if your institution requests that.

If you intend to re-use the mouthpiece the following steps outside of sterilization are essential and if followed properly should provide sufficient hygiene.

1. Rinse the mouthpiece in a sink under running water directly after the experiment for at least two minutes, while rubbing all major particles (saliva, mucus, ..) off the applicator. Turn the mouthpiece upside down to also get sufficient flow through the parts inside the mouthpiece.
2. After the rinsing process the mouthpiece should be kept inside a container of freshly filled 70% Ethanol
3. After the cleaning process of the tubing is completed, repeating steps 1 and 2 while disconnected from the actual main lines is requested. You may want to use a 10 ml syringe to spray 70% ethanol into the interior parts of the applicator
4. After the mouthpiece is essentially clean it should be rinsed in a fresh container of dH₂O for several minutes while manually working it
5. Finally the mouthpiece should be dried from outside and inside with compressed medical air. If the tubing is not dry from inside yet, the 1-4 extender piece should be connected to the white Luer-Lock connectors and air should stream through each channel for at least 2 minutes
6. After the mouthpiece is perfectly dry it can either be autoclaved or stored in a sealable plastic bag until it is being used again.

At this point a thorough visual inspection is also advised to catch possible defects before you start your next experiment!

Tutorial 3 – Filling the device

To actually pursue an experiment you will have to charge the Gustatometer with liquid tastants. Before you continue you should follow all steps from Tutorial 2 (Cleaning procedures). As soon as the device is clean, dry and ready, you can assemble it like described in Tutorial 6 (Assembly):

1. If you have the empty reservoir bags already attached, unplug the septum needles of the drip chambers one by one.
2. Take a 60 ml syringe with a luer lock tip, charge it with your tastant for the current channel.
3. Connect the stop cock to the syringe tip.
4. Penetrate the septum of the reservoir bag with the stop cock.



5. Unlock the stop cock and slowly transfer the tastant into the bag.
6. Lock the stop cock.
7. Clock-wise unscrew the syringe tip from the luer-lock of the stop cock.
8. Repeat steps 2,3 5,6,7 until the required amount of liquid is transferred into the bag.
9. Hold the exit of the reservoir bag above the body of the bag.
10. Carefully remove the stop cock. It may be easier to do this by first opening the stop cock.
11. Slowly insert the septum needle of the related drip chamber into the port of the reservoir.
12. Tightly squeeze the drip chamber several times to fill it with about 50% of its volume.

Be aware that already small quantities of air, may prevent your paradigm from performing properly. The amounts delivered per run may have a smaller volume than a potential air bubble!

13. Open the roller clamps and turn on the Gustatometer.
14. Switch to the manual mode of the operating system and start pumping the liquid until all the air is removed from the tube. Keep in mind to put a container under the applicator to prevent spills.
15. Repeat until all channels are charged. It is recommended to parallelize due to the long pumping periods.

Trouble shooting:

In case the pump doesn't pump the liquid through the device right away, disconnect a port right before the next part of the tubing filled already. Wait until the air is slowly pushed out. If that doesn't help check for leaks or closed valves.

If the liquid flow at the mouth piece seems to be inconsistent, pump longer to remove all the air from the tubing. Check that no air is entering the system at any point (Is the drip chamber filled?). If the flow is still inconsistent check if the tubing on the mouth piece is

Tutorial 4 - Using external triggers

The ETT Gustatometer can easily be triggered with a TTL pulse from another device via trigger in BNC port. The sent pulse should be at least 300 ms long. To initialize the trigger handler you will have to load a paradigm, attach the trigger cable to 'trigger in' knob and then tap 'trigger start'. As soon as the trigger is visible to the device the paradigm starts.

Tutorial 5 - Data management

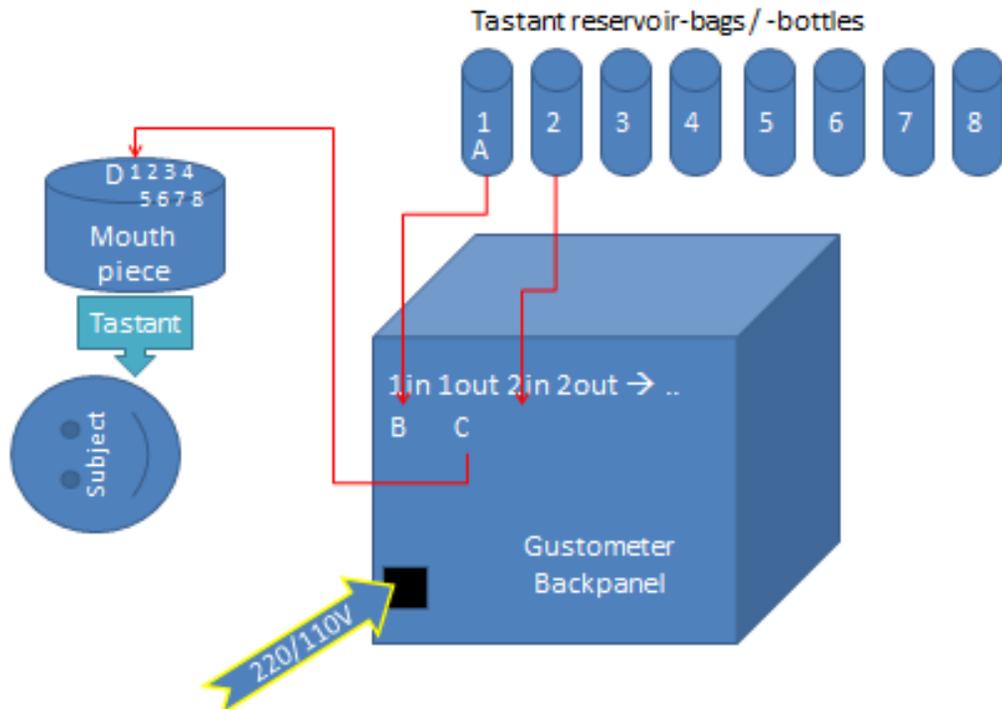
Creating data files

Prior any experiment you should create a new data file, for the data to be stored in a separate file. Therefore you have to tap on 'file' in the main window and then create new and assign a name and hit 'confirm' to finalize.

Tutorial 6 - Assembly

We tried to make assembling the Gustatometer external equipment as easy and straight-forward as possible. Nevertheless you should still follow this tutorial at least once to assure correct assembly to prevent flawed results from your experiments. If the device is not clean, you should consult Tutorial 2 before you continue.

At first it is important to get a general concept of the flow of tastants:

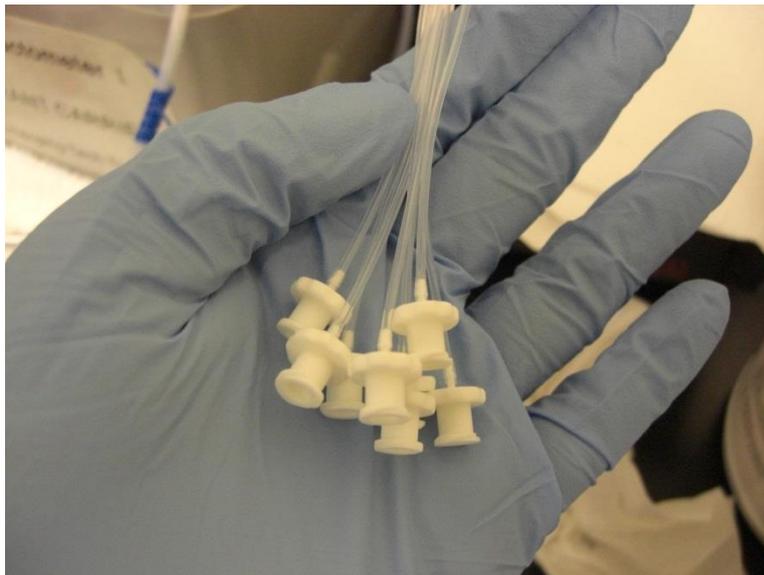


Connection scheme:

Reservoir A → Gustometer inlet B → Gustometer outlet C → Mouthpiece inlet D

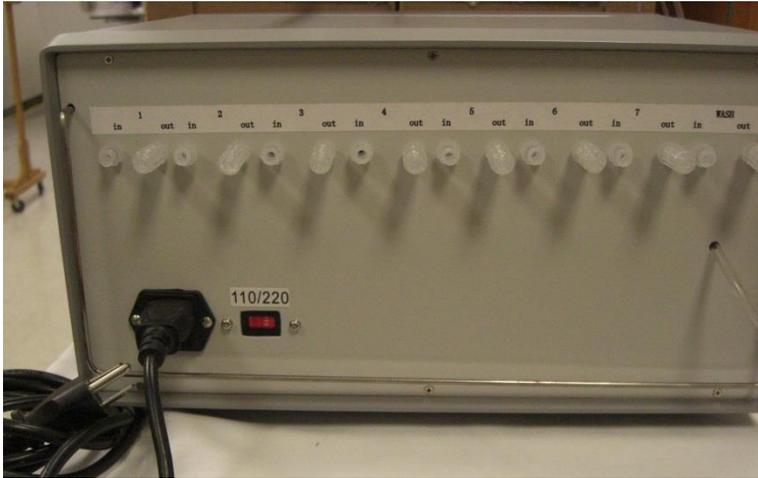
Now we can start the assembly:

1. Take the spooled PTFE tubing and identify the end which attached to the mouth piece – the channel markers should be labeled as D1-C8.



ETT Gustatometer: Getting started guide | 2013a

2. Connect the mouthpiece luer-lock connectors to the end-pieces of the tubing (D1-D1; D2-D2;...). The transparent end pieces may not yet be connected to the white luer ends of the tubing.
3. Connect the white luer connectors on the other end of the tubing with each related output channel on the Gustatometer. These connections should be labeled as C1-C8 and need to be joined accordingly.



4. At this point you will need to find the reservoir bags/containers. With each container comes a connection line that connects the bag with the Gustatometer input port. Again connect luer to luer port (B1-B8).
5. Make sure the roll clamps on the tubing are open (up) and penetrate the septum with the drip chamber. If the bag contains a liquid already, it is recommended to hold the bag upside down, so the connector end is above the body of the bag.



6. After you penetrated the septum with all drip chambers, carefully squeeze the drip chamber to fill it to about 50% of its total volume. The drip chamber prevents air to enter your system.

Be aware that already small quantities of air, may prevent your paradigm from performing properly. The amounts delivered per run may have a smaller volume than a potential air bubble!



7. Open the roll clamp, set a container under the mouth piece the prevent spills and turn on the device. With the manual mode inside the Gustatometer operating system, charge the tubing with the tastants and guarantee an air free system as described in Tutorial 3.

Use data

As soon as the device is running in paradigm mode, it will record all system conditions during the run until the experiment stopped. Every 100ms the pump status among with trigger information and a time stamp is being stored inside a comma separated values (csv) document inside the SD-card that comes with the system. When the experiment ends the device will tell you to wait until all data is being stored. After the data is saved you can simply detach the SD-card and load it to your computer.

The data in the files ('dat.CSV') on the card will have the following format:

A - N

Where:

- A – two digit hour of recording (system time)

- B – two digit minute of recording (system time)
- C – two digit second of recording (system time)
- D – four digit voltage of the analog input for monitoring subject's swallow status
- E to K – digital stimulus channel logs (1 means stimulation ON, 0 means stimulation OFF)
- L – digital wash channel logs
- M – digital response log
- N – digital external trigger log (usually to start paradigm)

Tutorial 6 – Applicator/mouthpiece setup

The mouth piece setup is probably the most challenging part during the experimental setup. To assure good data quality during your experiments, you should repeat the following instructions several times until you are confident to be able to run an experiment. If the standard mouthpiece that comes with the Gustatometer does not suit your needs, you can contact your ETT support for a custom design.

Fitting the tubing

Proper routing of the PTFE tubing is important, to allow drop formation even for small delivery amounts. You can always acquire new mouthpieces from ETT. If you plan to reuse mouthpieces you should check correct fitting after every cleaning cycle and before every experiment that the tubing:

- Extends the panel inside the mouthpiece by about 1 mm,
- Has no bends or kinks,
- Is free of leaks, and
- Is straight and the ends are cut at a straight angle.

If any of these points is not met, you should contact ETT for service or replacement.

Coil mounting (fMRI package)

The ETT Gustatometer comes with a standard mounting system for a Siemens Tim 12 channel head coil. For alternate systems at your site we are able to create a custom fit solution on request.

The general principle is that the clamp attaches to the upper side of one or two head coil beams. Only friction between the coil and the clamp hold the piece in place. Therefore it slides easily along the direction of the main magnetic field, to fit each head. It allows also to be adjusted with an angle of up to 5 degrees to fit unusual face geometries.



The actual mouthpiece is connected to the clamp through a two rack track, which allows for height adjustments relative to the patient's mouth. A retaining pin holds the two at a fixed elevation during the experiment.

In case of an emergency the clamp allows to easily slide the whole setup upwards, with just the force of the subject's tongue.

Fitting a subject

When you actually setup the subject it is advised to fit the clamp to the upper part of the head coil first. While the subject gets situated in the coil, slide the mouthpiece into the clamp into the most upward position without securing it yet with the pin. Now slowly join the coil with the subject's mouth. Confirm with the subjects that they get all tastants during the standard test run through all channels.