

This quick guide obtains just brief information. In case you need detailed instructions, read **VERSALAB manuals from the manufacturer**. It is recommended to read the **Safety Instructions and Troubleshooting** guide before your work.

VERSALAB

Before starting measurement session:

Check the status bar: No sequence is running, the temperature is ≈ 300 K, the field is ≈ 0 Oe. The chamber is purged (see pressure window in the status bar) with the baffle set or with the VSM setup on. Flange clamp is fastened.

Before leaving:

Leave deactivated measurement option (utilities -> activate option) and disconnected electronic cables. Leave the chamber at 300 K, the field at 0 Oe, with baffle set or VSM setup loaded **and purge/sealed** (Baffle set ≈ 5 -20 Torr, VSM ≈ 122 Torr). Make sure the **flange clamp is fastened** (only after the purge in case of baffle set) and **make an entry in the logbook**.

In case you are not able to achieve these values, please contact the guarantor.

Status bar:

Sequence	Temperature	Field	Pressure	Compressor
Sequence Idle	300.00 K, Stable	0.01 Oe, Holding	27.3 Torr	Cooling: 0.479 W
Seq: <none>	Set: 300.00 K	Set: 0.00 Oe	Purged	Controlling
<none>	2.00 K/min, Fast Settle	100.00 Oe/sec, Linear		

Vibrating sample magnetometer (VSM)

- **Intro:** Sample temperatures 400 K - 50 K (with oven option up to 1.000 K), field up to 3T (30.000 Oe). Possibility of standard pick-up coil set (bore 6mm) or large pick-up coil set (bore 12mm) and corresponding guidance tube and sample rods. The maximal sample size should be 2mm lower than the coil set bore.
- **Sample preparation:** Use straws (in-plane/out of plane) or quartz holder with varnish glue/Kapton tape or brass holders with capsules/cylinders – according to the type of sample. In all cases, sample position 32mm from the lower end is advised (check on the mounting station available in the sample preparation box, align the end of the holder with the position 0 mm on the mounting station). For more info, see manual *04_VSM - section 3.3*.
- **HW setting up for VSM:** Pick-up coil set (standard/large) -> guidance tube (standard/large) -> motor -> **flange clamp** -> connections for electronics (VSM module, motor module).
- **SW setting up for VSM:** Utilities -> activate option -> VSM (wait). **Check the code of the used coil set**. Proceed to install/remove sample: Click “Open chamber” in the “VSM install/remove sample wizard” window (wait) and click “Seal” in the pressure window from the status bar. Insert sample on appropriate sample rod + put the black cap on the motor and proceed in the VSM wizard window -> standard operating mode -> next -> select path and file name -> apply field in status bar field window (e.g. 1.000 Oe) and scan for offset -> confirm value if it is reasonable -> close chamber (wait).
- **Measurement and sequences:** File -> open -> sequence – open an existing sequence or create a new one. It is advised to put the chamber in standby mode after the measurements at the end of the sequence. Save sequence and run it to measure. For more info, see manual *04_VSM - section 6*.
- **Removing the sample:** Set field to 0 Oe. Follow the procedure in install/remove sample – open chamber (wait) and click “Seal” in the pressure window from the status bar, take the sample out. A new sample can be inserted at this point (in that case, proceed in the “VSM install/remove sample wizard”). When the measurements are

finished either disassembly the VSM setup or at least purge/seal the VSM setup (pressure window in the status bar) if the next user is using the same setup (VSM with the same type of coils).

- Disassembly the VSM: First remove the sample (see the previous point). Close the “VSM install/remove sample wizard” window, deactivate VSM option in utilities -> activate option (deactivate). After this pull out the electronic cable connections (VSM module, motor module) and disassembly the flange clamp, motor, guidance tube, pick-up coil set. **Leave the chamber in “Before leaving” state (see top).**

Electrical transport option (ETO):

- Intro: Sample temperatures 400 K - 50 K, field up to 3T (30.000 Oe). Enables measurements on two separate channels. The current source has a minimum precision of 1 nA and max. current 100 mA. It is capable of supplying both DC and AC with frequencies from 0.1 Hz to 200 Hz. The noise floor is 10 nΩ and allowed resistance measurements are up to 5 GΩ.
- Sample preparation: Prepare your sample on the puck using double-sided Kapton or copper tape, make the bonds **using the wire bonder** in the electro lab (see the mounting configurations in manual *06_ETO - section 5.2*).
- HW setting up for ETO: Insert the puck in the chamber using the transfer rod. Put on the baffle set to close the chamber. Do the purge/seal procedure and **after that fasten the flange clamp**. Connect the electronics (ETO module).
- SW setting up for ETO and immediate measurements:
 - Utilities -> activate option -> ETO (wait). In “ETO console” select the type of measurement (resistance, IV curves, differential resistance curves – for more information, see manual *06_ETO – sections 1.3 and 5.4*). Subsequently, choose the 2 or 4 wire method and the measured channels according to the bonding made on the sample. Select also the other parameters (e.g. amplitude in mA, voltage range, frequency, etc.). Select “measure”, and in the “ETO console” window in the “Status” tab the immediate measurement is seen (datafile path of the measurement can be seen and changed in the datafile tab).
 - It is advised to perform the resistance measurement first to check the bonding connections are not damaged and to know the optimal measurement range. Type in the current and by measuring through the lowest to the highest range find the optimal range.
- Measurement and sequences: File -> open -> sequence – open an existing sequence or create a new one. It is advised to put the chamber in standby mode after the measurements at the end of the sequence. Save the sequence and run it to measure. For resistance measurements, it is recommended to use a linear scan of field (not a sweep) as the principle of ETO measurement is step-by-step.
- Removing the sample: Disable the ETO option in utilities -> activate option (deactivate), then pull out the cable connection. Make sure the chamber is at room temperature and zero field, only then remove the flange clamp. Vent/seal the chamber and take out the sample. **Leave the chamber in “Before leaving” state (see top).**
- Addition - Break out Box: Break outbox (located on the shelf) enables the user to define specific connections and to use channel 3 for measurement. For using this box the ETO module is connected to it from one side and the cable from the other side of the box is connected to the chamber (where the ETO module would be connected).

If you experience any problems with the instrument (solved or unsolved) please contact the guarantor.

VERSALAB - Oven option for VSM

- Intro: VSM measurements in range 300 K - 1.000 K, needs high vacuum pressure ($\approx 10^{-6}$ Torr). Recommended sample dimension 3x5 mm (in reality max. 5x10 mm will fit too). Carefully **clean the setup parts** with cleanroom cloth + IPA (for better achieving of high vacuum). **Use gloves for the whole assembly** to reduce any dirt/oils in chamber parts. **Different sample holder + rod + oven top used.**
- Sample preparation: Use the heating sample holder and fix your sample on it using the cement. Let the cement dry ideally overnight and wrap in copper foil. **Use only plastic tweezers when working with the heating sample holder.** Video instructions are available on youtube 'QuantumDesignUSA' channel - playlist.
- HW setting up for oven VSM: Similar to classic VSM, only put the oven on top of the motor instead of the black cap (should be **fitted tightly** without any gap). Attach the additional electronics, i.e. the VSM oven cable to the oven. Both coil sets can be used, decide depending on the final heater + sample + foil dimensions (standard max. 5 mm total, otherwise coils can get scratched!)
- SW setting up for oven VSM: Do not forget to **check the code of the used coil set.** SW setup is similar to classic VSM with two differences:
 - a) Use the special sample rod (with top connection to oven) and plug the connection to the oven from inside.
 - b) Instead of "standard operation mode" choose "oven mode". It is also advised to tick the **extended purge** procedure before closing the chamber.
- Measurements and sequences:
 - Achieve the low pressure in the last point of the "VSM install/remove sample wizard" window when closing the chamber. It is advised to start a log file (in utilities -> log data, click all checkboxes in the other tabs and select a compressor q-map, set repetition every 5 s) to see the progress of pumping to low. You can plot the "chamber pressure" and "chamber status: parameters in time for better overview.
 - It is normal to obtain several "Hi vac errors" during pumping. In those cases, click on "Hi vac" in the chamber pressure status bar. This can happen repeatedly, insisting on the high vacuum will eventually bring the chamber to the low pressure.
 - When prepared to measure the "At HiVac" will appear in status bar. Achieving low pressure can take up to approx. 5 h. **Do not click on "vent cont." in any case** as this would open the seal to diaphragm pump and therefore could damage the turbopump at pressures lower than 2 Torr.
 - Making a sequence is identical to classic VSM. When measurement finishes, the temperature in the status bar refers to the chamber temperature (i.e. around 285 K, only the sample is being heated). Do not put the system in standby if you want to continue with more measurements of the same sample as this could slightly vent the chamber. When changing the sample, the chamber has to be vented and get HiVac again.
- Removing the sample: Identical as for classic VSM, the "open chamber" will adjust the pressure to atmospheric and bring the chamber to room temperature (from 285 K). Take the sample on rod out and break the cement off the holder and sample using IPA and a wooden stick.
- Disassembly the VSM: Similar to classic VSM: after SW deactivation, pull out also the cable for the oven and start the disassembly with the oven first.

Please always when using the oven option come to unload and clean the sample and disassembly the oven top + cable connection + rod with holder yourselves, as not everyone is familiar with this option. Leave the setup in the "Before leaving" state ready for next user.



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