Kuster FTS User Guide

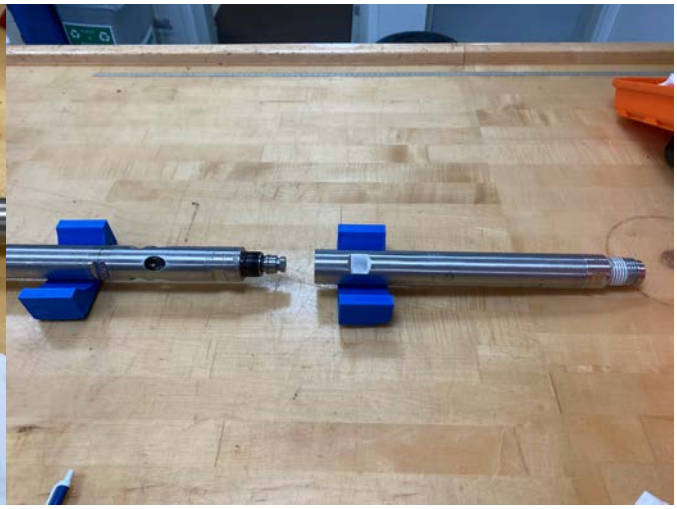
The operation procedure of this tool can be broken down into four parts: Preparing for sampling, Downhole operation, Extracting the sample, and cleaning and maintenance.

Preparing for Sampling

1. **Remove the following components**

Bull nose

Clock housing



2. Open the valves

First by depressing the lower spring(Fig. 3) followed by pressing a small tool into the small hole at the top end of the tool to overcome the top spring (fig. 4). You will hear a small click when the valves are locked open. After the valves are locked open the springs will be almost fully depressed(fig. 5, 6). Remember the lower valve must be opened first!

fig. 3

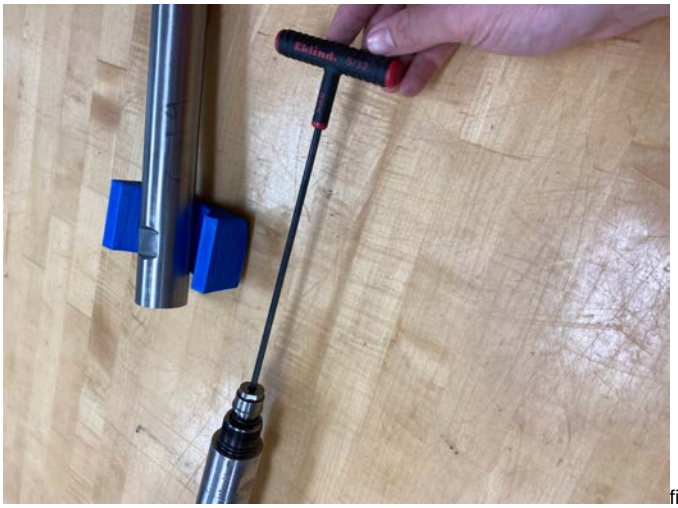


fig. 4


fig. 5


fig. 6

3. Program the clock

Be very careful when handling the clock as it is the most delicate piece of this tool and will need to be sent away for re-calibration if broken. Press the top of the timer down towards its body and rotate it so that the desired time is aligned with the mark on the frame(fig. 8). Be careful not to go too far as it cannot be turned back. You will have to wait.

Unscrew the top cap from the clock housing(fig. 7). Now you may place the clock into the clock housing with the time drum toward the bottom(fig. 9).


fig. 7

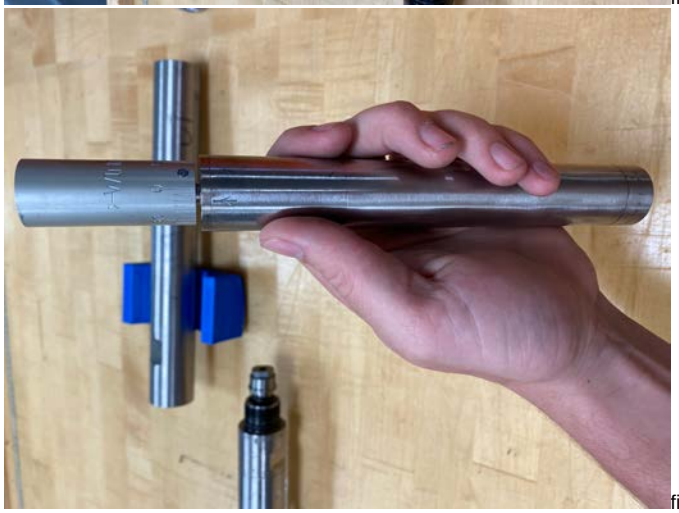


fig. 8


fig. 9

4. Assembly

Install the top cap, the bull nose, and clock housing complete the tool installation. A bump when installing the clock housing may cause the valve release to be triggered and they will need to be re-opened. The clock will then also need to be re-set unless you have enough wiggle room in the timing. Now slide on two centralizers spaced out along the tool with shaft collars on both sides of each to lock them in place(fig. 10).

 fig. 10

All connections should be firmly hand tightened. The tool is now ready to be connected to the core line and sent down hole.

Downhole Operation

1. Discuss with Ops and Core Techs

Make a plan as to what hardware will be run with the tool(whether it is out of a APC/XCB, RCB, or logging bit). Make sure the core techs have all hardware needed to assemble the tool into its protective pieces and attach it to the drill string. The drill pipe will be positioned with the bit ~10 meters above the target sample depth. The tool is normally run down at ~70m/min(this can be decided with the Ops Manager). After the tool is landed in the BHA wait until 15 minutes before the sample chamber will close. At this time the mud pumps should be turned off and the drill string (tool) and pipe will be lowered together the final 10 meters to the target sample depth. This will allow the sample to be collected at the final lowered depth as the entire water column is displaced. Wait until 5-10 minutes after tool should be closed to ensure sample is secured before bringing it up.

2. Come up with a sample target depth

This involves the staff scientist and scientists who are requesting the sample to come up with a target depth at which the sample is to be taken. Once this depth is given the correct timing calculations can be made.

3. Calculate Timing Needed

This is one of the most important steps of the operation procedure. In order to collect a good sample at the correct depth without wasting operational time the tool must close at the right moment. Add up the following estimates to come up with the correct clock setting. Note that these are rough estimates and operation procedure may change depending on hole conditions and sample requests.

- ~10 min from timer set to handing off to rig floor.
- ~10 min to attach to drill string.
- Time to be lowered(min) = (Target Depth-10)(m)/Lowering Speed(m/min)
- ~15 min so that pumps can be shut down and pipe and drill string can be lowered together the last 10m to capture sample at target depth.

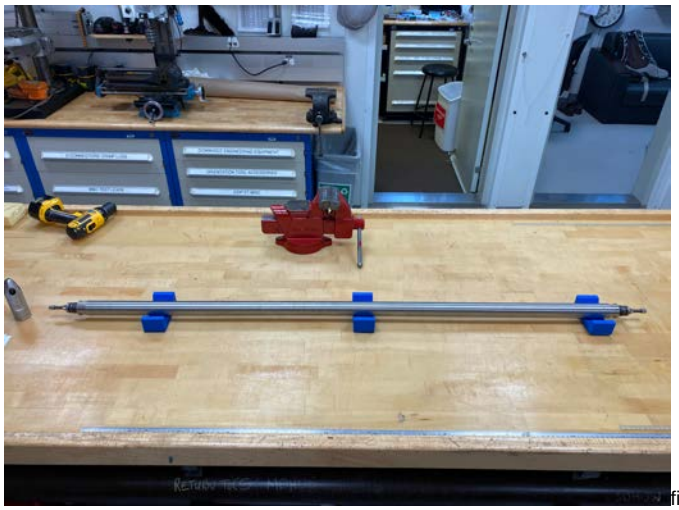
4. Make sure everybody is ready and begin

Once the plan is set and the time has been calculated set the timer and begin procedure. You are on the clock! Be ready for sample collection when the tool is on deck.

Extracting the Sample

1. Disassembly

Once the tool is brought in by the core techs remove the centralizers and rinse them with water. Then break the connections and remove so that both the the bottom and top springs and valve assemblies are exposed(Fig. 11).

 fig. 11

2. Prepare for sampling

Attach the transfer head assemblies in the orientation of which you wish to take your sample from. Meaning one will have pressure attached to it to force out the water sample(fig. 12). While the other will have a sample manifold(fig. 13) that will drain into a sample container.


fig. 12


fig. 13

3. Open the sample chamber

The sample chamber is under the pressure equal to where the water was captured and most likely contains a gas headspace. Because of this pressure only the sampling end of the assembly will need to be opened at first and added pressure from the other end will not be needed until later. If the gas is wanted to be sampled make sure to have the tool slanted so that the gas will accumulate near the sampling assembly. First making sure all valves are closed on the sampling manifold begin to screw the black handle on the sampling assembly. Once you reach the set end of the screw the chamber is open. You most likely will not feel it open, do not try to turn past this point. Now by carefully opening the sampling manifold begin collecting gas/water.

4. Adding pressure to complete sampling

Once the water is no longer freely flowing out of the sample chamber it is time to open the pressurized transfer head assembly and force the water out. In the past an 'empty' nitrogen bottle was used at 20psi for this purpose as to not contaminate the sample with oxygen. As the sample chamber get close to empty lift the pressurized end up to ensure the most water come out before the nitrogen begins to come out. Once this happens the sampling is complete and hopefully there was close to 600mL of water obtained.

Cleaning/Maintenance

1. Rinse with DI water

Keep tool set up just as it was being sampled from with both transfer head assemblies attached. the goal is to rinse anything that would come in contact with the sample water as it is being extracted. Place the tool in a secure vertical position. Fill up a carboy with at least 1.8L of DI water and run a line from the carboy into the lower transfer head assembly. From the upper assembly and sample manifold run a hose into a (chamber*) that is then connected to a vacuum pump. If set up correctly(fig. 14a, b) once the pump is turned on it will suck the water through the tool effectively rinsing it three times. Remember not to have the openings of the (chamber*) directly opposite each other as the water will spray and some may get into the pump.


fig. 14a

fig. 14b

2. Wipe and dry out

After the tool is rinsed the transfer head assemblies can be removed and the upper and lower valve assemblies can be removed along with the push rod that connects them. Wipe down the push rod. Be sure to completely dry the sample chamber and tool components before reassembly.

3. Replace O-rings and lubricant where necessary

The Kuster tool should require little maintenance other than disassembly to clean and check the O-rings and reapplication of lubricant to the threads. At a minimum replace the inside sealing O-ring on both the upper and lower valve assembly(Fig. 15).


fig. 15

Replace the O-rings using the yellow and black tool that was designed and 3D printed for this purpose, found in the Kuster accessories box. Use the tool as follows:

A. Remove the top bracket of the tool and place the valve assembly in with the spring up(fig. 16)


fig. 16

B. Place top bracket on so that the spring fits into the center hole and screw it down until the lower limit nuts are reached. The spring is now fully depressed. Now remove the two split rings that become exposed(Fig. 17).

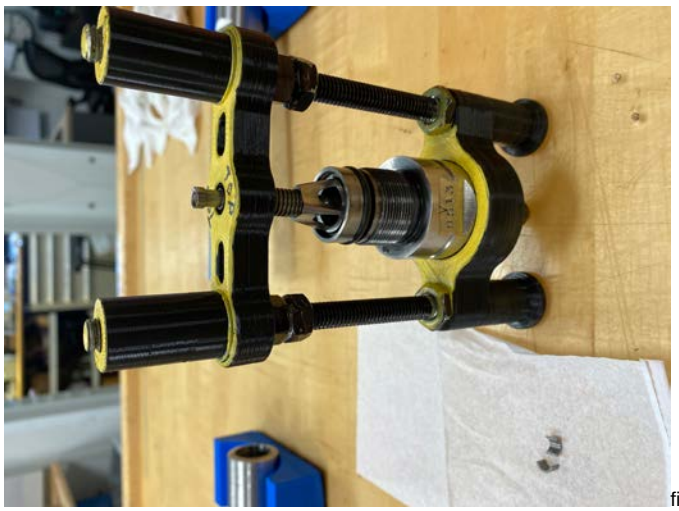


fig. 17

C. Unscrew and remove the top bracket completely and now you may remove the spring cap, spring, and valve from the body of the assembly (fig. 18).

D. Remove and replace the O-ring.

E. Repeat steps A-C in reverse to put together the valve assembly.

REMEMBER: After all maintenance and cleaning is complete make sure tool is completely dry before reassembly to prevent corrosion and build-up.