

Build guide

A cross-section of the distribution unit to be assembled is given in Figure 1. The technical drawing provides an overview of the used parts, for which also individual drawings are available.

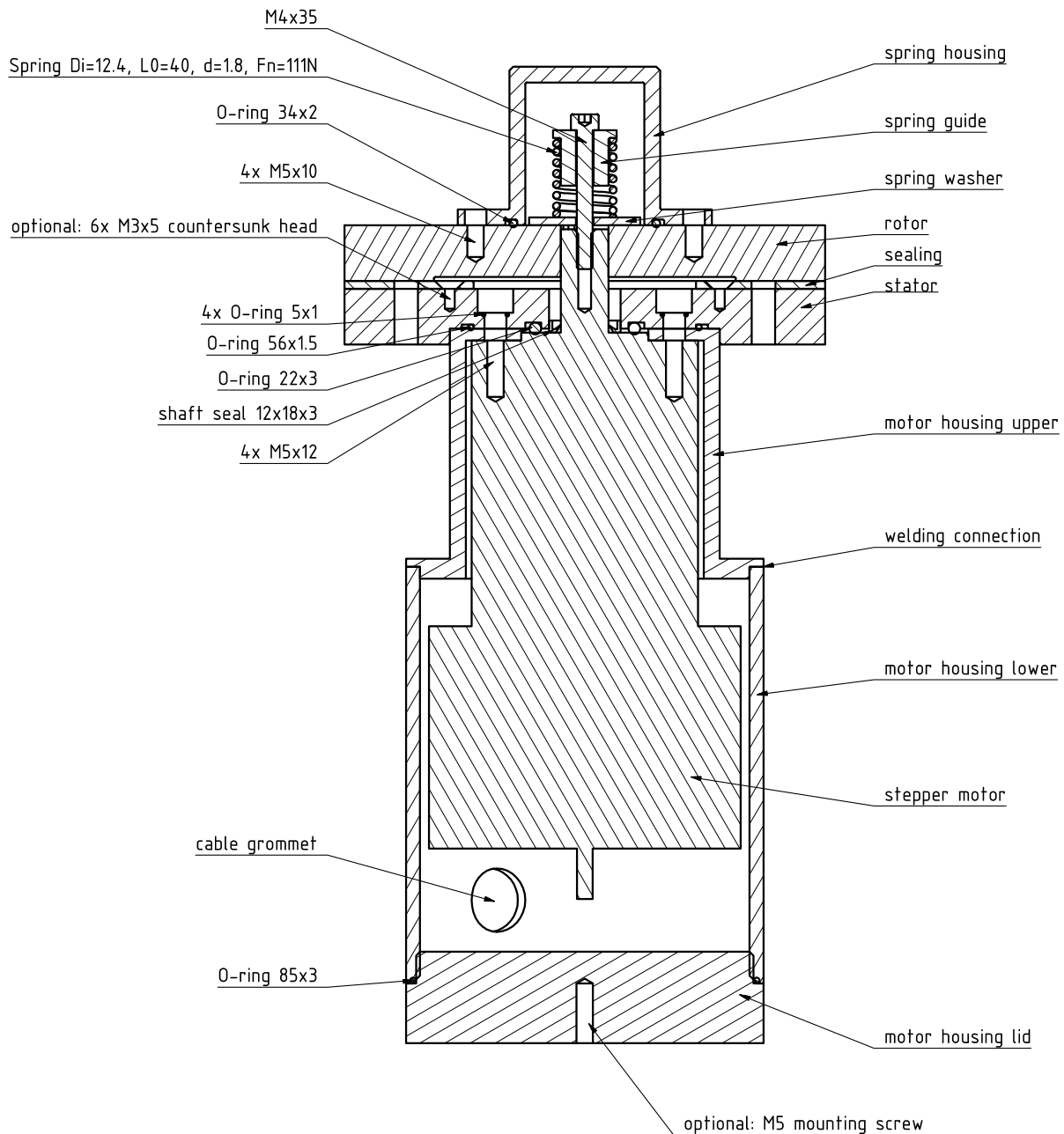


Figure 1 Schematic cross-section giving an overview of the main parts of the distribution unit

1. Prepare the rotor (PTFE) and the stator (PVC-U) discs according to the corresponding technical drawings, e.g. with a lathe, and drill the required bores, e.g. with a drilling press. Cut the required threads into the material with a tap.
2. Screw the push-in ports into the two discs (2 into the rotor and 36 into the stator). Do so carefully – the threads in plastic, especially those in the rotor (PTFE), are rather sensitive.

3. Place the adhesive side of the neoprene rubber seal onto the stator. Make sure that the bores in the two parts are aligned.
4. Prepare the two parts of the motor housing (e.g. turn the components from stainless steel on a lathe) according to the corresponding technical drawing and mount them together (e.g. by welding). Drill a 16 mm bore into the lower part of the motor housing.
5. Prepare the motor housing lid (PVC-U) according to the corresponding technical drawing, e.g. on a lathe.
6. Prepare the spring housing (PVC-U), the spring guide (steel), and the spring washer (steel) according to the technical drawings, e.g. on a lathe.

The prepared parts should look similar to those shown below (Figure 2).



Figure 2 Overview of the main parts of the distribution unit (Photo by André Künzelmann, UFZ)

7. Assemble the parts according to the technical drawing of the entire distribution unit (Figure 1). First mount the stator, the motor housing, and the stepper motor together (four M5x12 screws). Do not forget the O-rings.
8. Add the rotor and fix it with the spring array consisting of the spring washer, the spring, the spring guide, and the corresponding screw (M4x35). With the spring, the sealing pressure can be adjusted. It has an initial length of 40 mm and a rate of 4.94 N/mm.



Figure 3 Spring for sealing pressure adjustment

Setting the spring to a length of 25 mm (see Figure 3) creates the required sealing force of $(40 \text{ mm} - 25 \text{ mm}) \cdot 4.94 \text{ N/mm} = 74.1 \text{ N}$.

The sealing area is roughly 5945 mm^2 . Hence, the sealing pressure is $74.9 \text{ N} / 5945 \text{ mm}^2 = 0.0125 \text{ N/mm}^2$ or 1.275 m of water column. As a rule of thumb, the pressure that is applied to the sealing is equal to the water pressure that it will withstand without leakage. Note: Actually, there should be no water pressure applied to the sealing at all – as long as the system works as intended, all water flows directly into the sampling bottles. Finally, mount the spring housing onto the rotor with four M5x10 screws.

9. Mount the cable grommet into the 16 mm bore of the motor housing and push the cable through the grommet. Connect the cable strands to the strands of the stepper motor with butt connectors (see Figure 4). Connect the round connector to the other end of the cable.

10. Close the motor housing with the lid. The O-ring of the lid tends to squeeze out of its place when too much force is applied. Take care to keep it in place or squeeze it back.



Figure 4 Distribution unit, view from below

At this point, the distribution unit should look like shown in Figure 5.



Figure 5 Assembled distribution unit (Photo by André Künzelmann, UFZ)

11. Prepare the parts of the control unit according to Figure 6. Mount the coupler into the enclosure and the pin headers, the incremental encoder, and the rocker switch onto the prototyping circuit board.

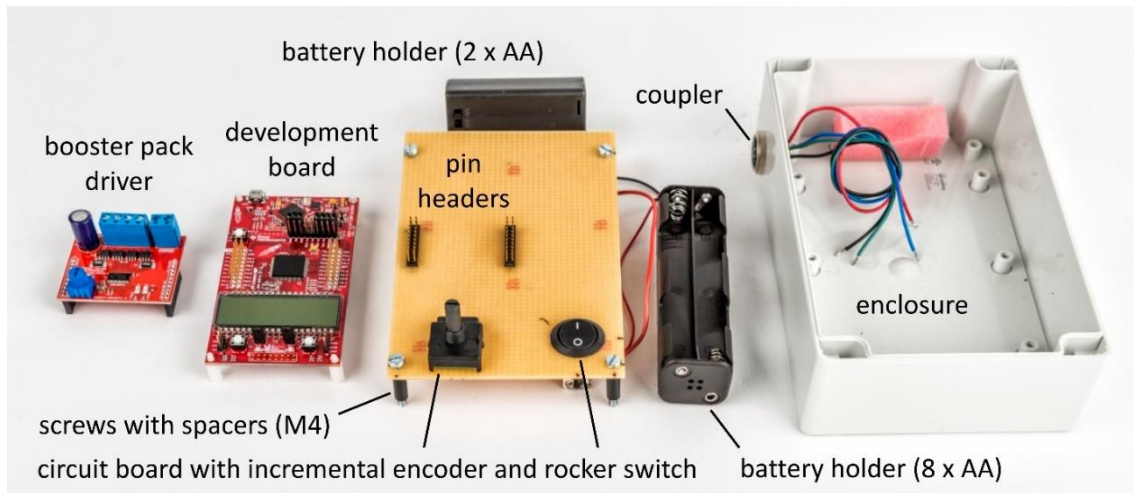


Figure 6 Overview of the main parts of the control unit (Photo by André Künzelmann, UFZ)

12. Assemble the parts according to the provided circuit diagram and follow the manual for software upload.

The assembled control unit should look like shown in Figure 7. When closing the enclosure, small pieces of foam can be used to keep the battery holders in place (see also Figure 1 in the main text). Moreover, it is often advisable to place a small desiccant pack into the control unit.

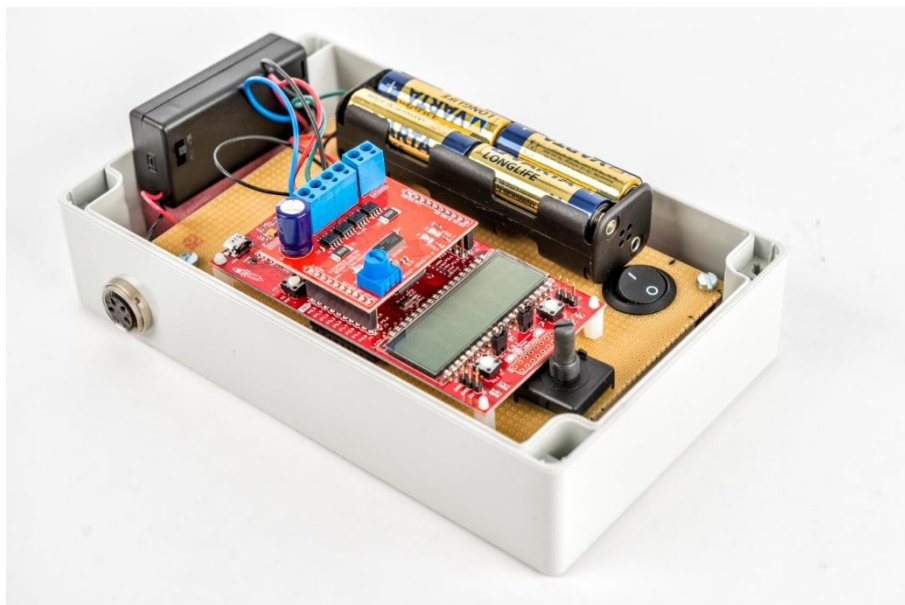


Figure 7 Assembled control unit (Photo by André Künzelmann, UFZ)

13. Connect the distribution unit and the control unit with the cable.

Now, the sampling bottles have to be prepared and connected.

14. Drill two 16 mm bores into each bottle cap and mount the cable grommets.

15. Connect the HDPE bottles to the distribution unit with short pieces of LDPE tubing. Water tubes lead from the push-in ports of the outer circle in the stator to the bottom of the sampling bottles. Thus, they have to be longer than the air tubes. The latter are pushed into the ports of the inner circle and extend just below the bottle caps. To remove a tube from a push-in port, the blue ring of the port has to be pushed.

16. Connect the pressure equilibration tube (LDPE; 15 m) to the inner port in the rotor.

17. Connect a rain inlet tube to the outer port in the rotor. The other end of the tube is connected to the rain funnel. To this end, we usually shortened the outlet of our plastic funnels until we could screw in an additional push-in port (R 1/2" thread). The latter can also be secured with electrical tape.

Now, the device can be operated (see separate manual).