Four or eight channel modular tissue bath system for smooth and striated muscle investigations
The modular setup features are:

- Easy upgrade to 2, 4, 8 channels
- Replaceable tissue baths (5, 10, 20 ml calibrated volume)
- Special vertical tissue baths with small volume (1, 2 ml calibrated volume)
- Tissue holders with built in electrodes for point or field stimulation and with gas bubbler
- Holders for vessel ring with suitable size (from Ø 0.8mm) for built in stimulating electrodes
- Gas chamber and gas flow controller
- One-plane self-adjusting manipulator with sensor clamp (300µm)
- Buffer reservoir with volume of 0.4 l. and 1.5 l. according to choice per channel
- Vibration-free stand
- External thermostatation (20l, 15liter/min circulation speed, 0.1°C accuracy
- Force/displacement sensors (SEN-03-34 from 10g to 500g)
- Four channel bridge amplifier (EXP-SG-4).

Theoretical setup:

In order to keep the basic physiological parameters in the system a coordinated operation is necessary. The flow chart shows the operation of the system. To keep the tissue sample alive, the optimal amount, flow and temperature is necessary which is achieved by:

1. Buffer flow to the chambers
2. Gas bubbling (Carbogen).
3. Keeping the temperature stable
**The system setup:**

**Main components:**

A  Organ chamber  
B  Buffer reservoir  
C  Circulating water bath  
D  Carbogen cylinder

The „A“ tissue bath is filled with buffer from the „B“ unit operated by a two-way tap. The tissue bath has two outlets. The upper outlet is an overflow to keep the calibrated volume. The lower outlet is for emptying the tissue chamber during operation or during cleaning. Calibration of the tissue chamber is based on fluid displacement in the tissue chamber by the tissue holder with 1% accuracy. (eg. in case of 10ml organ chamber: inner diameter of the organ chamber = Ø 18mm, tissue holder diameter = Ø 17,5mm).

The „C“ unit maintains the continuous and stable temperature. The unit keeps the flow of the water in a closed circuit providing stable temperature in the water jacket of the tissue chamber and the buffer reservoir as well.

The „D“ unit supplies the system with Carbogen gas filling a gas chamber. The fluid filled reservoirs and tissue chambers are supplied with gas from this gas chamber through an adjuster and a fine-pore bubbler.

**Buffer reservoir, Tissue bath, Sensor holder, Gas supplier with adjuster:**

Buffer reservoir, tissue bath, sensor holder and gas supplier with adjuster are the main components of one complete unit. These are assembled on the stand as one unit, then the tubing connections is done. This structure makes the replacement of any parts easy in case of damage. Moreover, malfunction of any part in the unit does not influence the operation of other units in the system, which is a further advantage.
**Parts of the holder:**

The reservoires and the tissue baths are supplied with gas through a gas chamber. Each reservoire and tissue bath is equipped with gas adjuster and bubbler. Bubblers are immersed into the buffer and maintain the dissolved gas concentration. For the proper function of the tissue sample a suitable gas content in the buffer is absolutely necessary. To make a large bubble surface for effective gas exchange a gas bubbler with adjuster was developed. Gas, coming from the cylinder through a reductor, is collected in a gas regulator then is driven into the bubbler head and to the buffer through a tube with suitable wall thickness.

**The tissue holder and tissue bath volume:**

The tissue bath unit comprises of two holders on the vertical bar:
- The upper one which cannot be moved
- The lower one which holds the tissue bath and the two-way tap for filling and can be moved

The tissue holders has four functions:
- Setting of tissue bath volume by volume displacement with 0.1% accuracy
- Providing gas into the buffer by a built in gas bubbler
- Providing electrical stimulation of the tissue sample by built in stimulating electrodes
- Providing a centralized suspension of the tissue sample
- Vessel ring holders (from Ø0,8mm) designed for built-in stimulating electrodes

The bottom shape of the tissue holders enable effective buffer change/wash out and prevents sticking the bubbles on the surface.
**Tissue application, pre-tension:**

During the development of the tissue bath system our goal was to get the tissue sample onto the tissue holder with a possible less stress and immerse as fast as possible into the oxygenated buffer. The handy solutions serve for the harmonized functionality.

**Step 1**
The tissue holder has to be „pulled out“ by lowering the tissue bath holder after loosening its fixing bolt in the rear. Then the holder is fixed again with the bolt. One end of the tissue strip is fixed onto transducer arm, the other end is fixed onto the hook on the tissue holder.

**Step 2**
The holder with tissue bath is slid upwards after loosening the fixing bolt until the tissue holder with the sample on it fully immersed into the carbogenized buffer.

**Step 3**
The excess of buffer drained through the overflow providing the previously set calibrated volume in the chamber. Then the bolt on the rear is fixed again.
**Small volume tissue baths (SD1-v0, SD2-v0):**

A complementary SD tissue bath with 1ml or 2ml volume is available. These baths are also equipped with bubbler, tissue holder, etc. like standard baths.

**Step 1**
Lower the tissue bath holder after loosening its fixing bolt in the rear. Remove the tissue holder and replace it with the SD bath then fix it with a screw.

**Step 2**
Pull out the tissue holder of SD bath. Place the tissue sample on it.

**Step 3**
Lift the tissue bath holder until the SD bath immersed into the buffer. The SD bath will be filled with the buffer. Following this lower the tissue bath again until the SD just above the buffer level in the tissue bath. Fix the organ bath holder with the bolt on the rear.
**Recommended software/hardware for recording:**

For recording and analysis of measured parameters we offer the following software/hardware systems:

- EASY Isosys - MDE Heidelberg
- LabChart - ADInstruments Power Lab.
- AcqKnowledge - BIOPAC

**Accessories required for operation:**

- EXP-ST-01, 02,-04
- CWB-02
- EXP-SG-1, 2, 4
- EXP-ST-01, 02,-04
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