BioStim

Universal Floating End-stage

User's Manual

SUPERTECH

Important notes

There is a very important aspect to keep in mind always. **The Power ON switch of the BioStim Controller, or the BioStim Computer Interface should be turned on before connecting the output wires to the biological object! It is also necessary to disconnect the output of the End-stage from the biological object before turning the Power switch off!** The reason, why it is important is the following: this equipment is not a simple stimulus isolator unit, but an isolated **End-stage**. It means, that the floating electronic sections (the Constant Current, and the Constant Voltage Generators) are isolated from the other circuits via 4 kV isolation security, and very small isolation capacity optocouplers, but the isolated, floating sections are quite difficult electronic circuits. These circuits are powered from 120 V supply voltage. During the switching on period (in a few milliseconds of time window) these circuits are “standing up”. Similarly, in the switching off period the voltages of these circuits are “demolished”. These circuits are designed to work perfectly in normal operating conditions, but the switching on, and switching off transients are not normal working periods. In these short time intervals huge voltage transients (approximately 100 V in amplitude) voltage spikes are appeared at the output connectors. These spikes make catastrophic electrical shocks for the biological object.

The parts of the BioStim universal biological stimulator system

The **BioStim** system is divided into two functional parts. The time parameters are generated by the fully digital **BioStim Controller**, and the analogue voltage and current sources are implemented in the **End-stage**s. The parts of the system are manufactured as independent equipments. On one hand it results a more flexible and variable system, because the similar parts (e.g. the **End-stage**s) are compatible, and they can be changed easily. On the other hand the divided system meets the special experimental requirements much better, because the analogue **End-stage**s can be located close to the biological objects in the shielded environment, but the digital **BioStim Controller**, can be placed anywhere else. **BioStim Computer Interface** is an alternate of the **BioStim Controller** in special cases. You can find detailed descriptions about each elements of the **BioStim** system in the appropriate manuals.

Universal Floating End-stage

It can be used in human body surface, and microelectrode experiments as well. There is a Constant Current Generator, and a Constant Voltage Generator built into this **End-stage**. The output of the **End-stage** can be switched between Constant Current, and Constant Voltage modes on-the-fly, during the experiment. It is a very useful feature, because the first stimulating trials can be carried out in the secure Constant Voltage mode. If the experiment is qualitatively working, the **End-stage** can be switched into Constant Current mode, where the electric charge can be defined exactly. The only limitation is, that the alternation from the Constant Current Generator to the Constant Voltage Generator, or vice versa, must not be done during an active output pulse, only in the pauses between the pulses. If you would do this action even so, than an unwanted voltage, or current transient would be appeared at the output connectors (because the momentary voltage, and current levels of the two generators are different in the duration of the pulses, and they would be equalized through the biological object connected to the output connectors). The Constant Voltage mode has got two ranges: 10 V, and 100 V of full scale. The Constant Current mode has got two ranges: 100 μA, and 10 mA of full scale. The output amplitude in the selected range can be set using a 10-turn calibrated helical potmeter on the front panel. The nonlinearity (total amplitude error) of the **End-stage** is less than 5%. The floating output circuit of this **End-stage** is supplied by an internal high frequency power source. The isolation capacitance between the mains plug and the floating output is less than 10 pF. It is good enough for all of the microelectrode experiments, including patch clamp applications. The output leakage current is internally trimmed to absolute zero. A special feature of this **End-stage** is, that it does not generate any detectable electric noise. According to this feature it can be placed close to the experimental object even in a shielded environment.

Front panel controls

The middle switch at the top section is the selector of the working mode of the **End-stage**. It can be used to switch between the Constant Current, and Constant Voltage modes. This switch can be alternated anytime during the experiment.

Left to the working mode switch there is the range selector of the Constant Current Generator. The Constant Current mode has got two ranges: 100 μA, and 10 mA of full scale. This switch is ignored, if the Constant Voltage mode is selected by the working mode (middle) switch.

Right to the working mode switch there is the range selector of the Constant Voltage Generator. The Constant Voltage mode has got two ranges: 10 V, and 100 V of full scale. This switch is ignored, if the Constant Current mode is selected by the working mode (middle) switch.

Most left at the bottom section there are the output connectors. These two connectors are the floating output connectors of the **End-stage**. They are compatible with the 4 mm banana jacks. Furthermore they have got isolated plastic screws to fix simple wires up to 1 mm in diameter. **Be careful!** The output connectors are high voltage connectors! They are especially **dangerous** to touch in the Constant Current mode, because the compliance voltage (120 V) can be present here!

Next to the output connectors there is the output Polarity selector switch. The output connectors are identical except their polarity. There are many experimental arrangements, where the polarity of the stimuli has no importance. But if the polarity is important, it can be changed easily with this switch. This switch can be alternated anytime during the experiment.

In the middle at the bottom section there is the Control indicator LED. This is a dim, red LED. It is used to indicate visually the presence of the digital pulses at the input of the **End-stage**.

Next to the Control LED there is the Pulse Amplitude potmeter. The amplitude of the output pulses (always in the selected range) can be set using this 10-turn calibrated helical potmeter. If the scale of this potmeter shows 10.00 than the full scale value of the actually selected range is passed to the output connectors. If the scale of this potmeter shows 0.00 than zero value is passed to the output connectors.

Most right at the bottom section there is the Power ON indicator LED. If this green LED lights, it means, that the internal floating power supply unit is working, and the **End-stage** is active. The low voltage supply energy of the **End-stage** is coming from the **BioStim Controller**, or from the **BioStim Computer Interface**. The internal high voltage supply of the **Universal Floating End-stage** is generated by an internal high frequency power source. If the Power ON indicator lights, it means, that this internal power source is working. The Power switch of the **BioStim Controller**, or the **BioStim Computer Interface** should be turned on before connecting the output wires to the biological object. It is also necessary to disconnect the output of the **End-stage** from

the biological object before turning the Power switch off (see the Important notes section, too).

The connectors at the back side

In the middle there is the Internal Floating Shield connector. It is compatible with the 4 mm banana jacks. Furthermore it has got an isolated plastic screw to fix a simple wire up to 1 mm in diameter. Since the **Universal Floating End-stage** is designed to work in a seriously shielded environment, it is essential to shield the internal high frequency power source rigorously. The Internal Floating Shield connector is used for this purpose. You should connect it to the common Ground point of the Faraday-cage. The best point where it should be connected exactly can be found during the pilot experiments, when the lab is set up at first time.

At the right side there is the Isolated Control connector. It is used to connect the **End-stage** to the **BioStim Controller**, or to the **BioStim Computer Interface**. You should always use the special cable provided by Supertech. Avoid to use other power source to supply the **End-stage**, it should be powered only from the **BioStim Controller**, or from the **BioStim Computer Interface.** The power sources of these two equipments have got specially designed voltage rise-up characteristics, and special current limiting features optimized to provide the necessary low voltage supply for the internal high frequency power source of the **Universal Floating End-stage.** Any external pattern generator equipment, or any output port bit of a data acquisition card of a PC should be connected through the **BioStim Controller**, or through the **BioStim Computer Interface,** on standard TTL levels, at their appropriate connectors.

Further development

Until now we have developed many different features for the **Universal Floating End-stage**, as it is listed above. In spite of this, if you can not find the appropriate function for your special task in our actual choice, and this function seems to be interesting for other our customers, we will develop this function especially for you. It is our method, how we improve the features of our equipment. We collect all the notices and feedbacks of our customers, and we implement their (may be your) knowledge into the features of **BioStim**.

Warranty

We give you full warranty service, including rest parts for the period of 3 years by default. Longer warranty periods can also be defined and agreed (the actual conditions should be discussed before placing the order).

The warranty is valid only in that case, if the **End-stage** is powered from the **BioStim Controller**, or from the **BioStim Computer Interface**.

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