Dancer Design Piezotactile Stimulator PTS-C2 – User Guide

IMPORTANT - Precautions

The amplifier generates high voltages to drive the piezoelectric wafers. Do not attempt to repair or disassemble any part of the system. If a probe or cable becomes damaged stop using it immediately.

The piezoelectric bender is brittle and ***will*** be destroyed by a force of more than about 500g applied to the probe. This is moderate finger pressure. Subjects and experimenters should be asked not to press on the probe.

Driving the piezo wafer at high amplitude with very low frequency (< 1Hz or DC) signals may cause the piezoelectric material to depole and decrease the efficiency of the device, so this should be avoided if possible. Note that logic signals (TTL) can have sustained low frequency components (static voltages), therefore logic signals are not recommended as a signal source.

It is recommended that the amplitude control be turned to zero when changing settings such as signal source or oscillator range, to prevent sudden changes in amplitude which may damage the wafer. Also, the amplitude should always be set to zero before switching the control unit on, and after using it.

The stimulator head is fragile and is sensitive to mechanical shocks. Great care should be taken to protect it especially when wrapping up the cable. The foam covers should be used when the stimulators are in storage.

The PTS-C2 is intended for research use only. It is not a medical device and is not intended for treatment or diagnosis.

DESCRIPTION

The PTS stimulator system consists of two piezoelectric stimulator heads incorporating piezo bender elements, a 2-channel amplifier with built-in oscillators and a power supply. A radio-frequency filter is available for use in MRI.

The stimulator head

The stimulator head consists of a piezoelectric bimorph element (bender) housed in a machined ceramic case. Attached to the bender is an adjustable 8mm probe which protrudes through a 10mm hole in the case, which acts as a fixed surround. Static indentation of the probe may be adjusted using a small tool provided. One turn of the probe changes the indentation by 1mm. The probe may be removed for cleaning. When adjusting or removing the probe take great care to apply only a minimum of inward force, and not to screw the probe fully in tightly.
Friction of the probe in its mounting block is maintained with kilopoise grease. If the probe becomes looser over time, remove the probe and apply a small amount of the kilopoise grease to the threads, then refit the probe. Note that the grease is very sticky so take care to get it on any exposed surfaces of the stimulator.

Also housed in the stimulator head is an optical displacement transducer which measures the position of the wafer.

The ceramic case has a soft PVC cover fitted. This may be removed if desired but note that the case is quite brittle and may break if dropped on a hard surface.

We recommend wrapping the cable onto the holder by rotating the holder to prevent twisting the cable.

The amplifier unit

The amplifier contains two completely independent identical channels. If a channel is not in use it should be switched off. Each channel contains a high voltage drive amplifier to drive the piezoelectric element, a wide-range sine-wave oscillator to provide a signal source, and the detector electronics for the displacement transducer.

The amplifier converts low-voltage signals into the high-voltage signals to drive the piezo element. Its only control is the amplitude control on the front panel.

The oscillator generates a stable sine-wave of between 0.45 and 600 Hz, in 3 switched ranges. The oscillator is connected to the amplifier when the Source switch is set to "On" or "Gated". In the On mode the oscillator runs continuously. In the Gated mode the oscillator is controlled by a logic-level (0 - 5V) signal connected to the Gate input on the rear panel. A logic 0 on the Gate input stops the oscillator, a logic 1 starts the oscillator. The oscillator always starts and ends at the zero-crossing point of the waveform. This means that if the oscillator is gated on by a positive-going pulse there will always be a whole number of cycles in the resulting sine-wave burst. This in turn means that the sine wave burst may continue after the gate signal has gone to logic 0 for a period equal to 1/f, where f is the frequency of the oscillator.

A square wave of frequency equal to the oscillator frequency is available at the Freq output on the rear panel. This is intended for connecting to a frequency meter in order to set the frequency to a precise value.

The amplifier may be driven by a signal from an external device such as a waveform generator or PC card with analog output. This signal should be connected to the Signal In connector on the rear panel. The Source switch should be set to "Ext". In this mode of operation the amplitude control will still work but the gate input will not.

Recommended amplitude of the external signal for full output swing of the amplifier is +/- 1V.

The displacement transducer

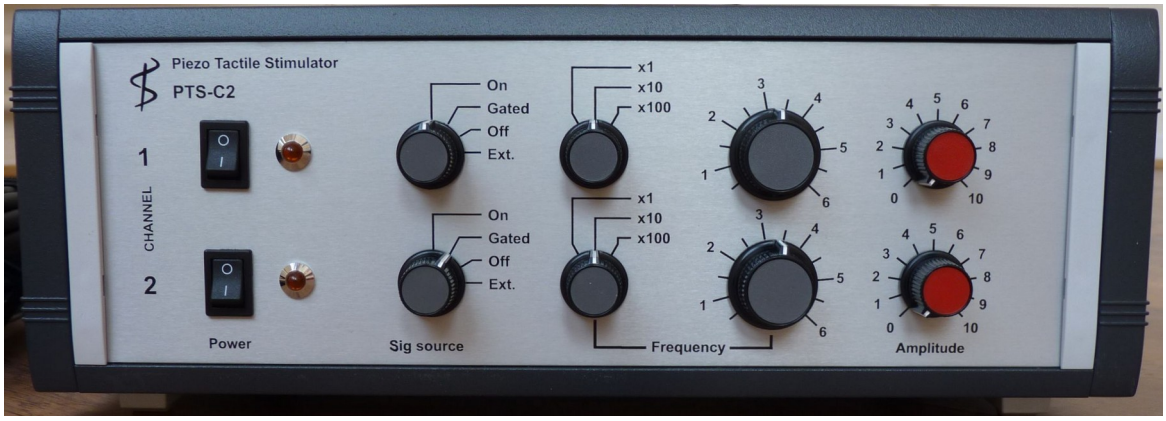
The displacement transducer produces a voltage output at the DT Out connector on the rear panel. The voltage varies linearly with the instantaneous displacement of the probe, with a ratio 10mV = 1 micron or 1V = 0.1mm. The transducer is intended for use when measuring vibrotactile thresholds using the PTS, or when it is desired to deliver a stimulus of known amplitude.
The transducer will work in a MRI scanner but when the scanner is running there will be a great deal of interference on the transducer signal. Therefore if it is desired to set a stimulus intensity in the scanner this should be done before the scan is started.

The output of the displacement transducer is auto-zeroing, which means that if the probe is stationary the output will tend to return to zero volts. Effectively there is a high-pass filter on the output with a cut-off frequency of 0.07Hz.

The power supply

The power supply is a 24V 1.25A supply with medical device approval to IEC 60601. It will run from 100 – 240V AC at 50/60 Hz. Other power supplies should not be used.

FRONT PANEL CONTROLS



Signal Source Switch

Selects the source of the vibratory signal:

- On: Internal oscillator, continuously on.
- Gated: Internal oscillator, gated on by a logic-level signal on the Gate input.
- Off: No signal.
- Ext: External Input connector. In this setting the oscillator controls and Gate input have no effect.

Frequency range and dial

Set the frequency of the internal oscillator.

Ranges are:
x1: 0.45 – 6Hz

x10: 4.5 – 60Hz
x100: 45 – 600Hz

Amplitude

Controls the amplitude of the stimulus. Numbers on the dial are arbitrary and do not correspond to any given displacement or force being delivered by the probe.

REAR PANEL CONNECTORS

Signal In: Input for external signal such as a signal generator or DAQ card.

Gate In: Input for logic level (TTL) gate pulse.

Freq Monitor: Outputs a square wave signal at the same frequency as the internal oscillator. May be connected to a frequency counter to set the oscillator frequency to an exact value.

DT Out: Output for displacement transducer signal

24V Power: Power input from power supply.

Ground: Electrically connected to the control unit chassis and the screens of the stimulator cables. This is usually not needed but is provided as a possible solution to noise or artifact seen in MRI scans or EEG signals. Connect this terminal to scanner room ground or EEG amplifier ground. A standard 4mm banana plug will fit the hole in the terminal.

MRI COMPATIBILITY

Stimulator boxes: Safe anywhere in the scanner but performance near or inside the RF coils may cause problems due to the displacement transducer circuit causing interference, the metallic components causing field distortion, or the bender vibrating due to gradient switching.
The connector has some small ferrous components so it should be kept away from the scanner.

Amplifier: May be used in the scanner room but should be kept clear of the scanner as there are some ferrous components inside. The amplifier should ideally be kept in the control room.

Filter: May be used in the scanner room but should be kept clear of the scanner as there are some ferrous components inside. Ideally the filter should be fitted into the penetration panel of the MRI room.

Power supply: Must be kept out of the scanner room as it contains magnetic components. Its performance may be degraded by the magnetic field and it emits RF signals which may interfere with the scanner.

SUPPORT

For advice on use of the PTS, technical support or servicing information contact Dancer Design.

Dancer Design
Room 66, The i Centre
Back Gate
Ingleton
LA6 3BT
UK

+44 7743 089056

www.dancerdesign.co.uk
chris@dancerdesign.co.uk