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SKT100C – SKIN TEMPERATURE AMPLIFIER MODULE

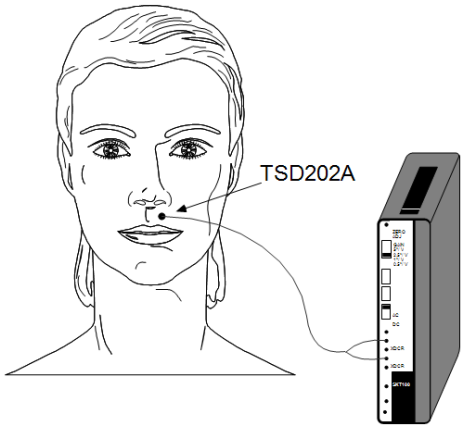
The SKT100C skin temperature amplifier module is a single channel, differential amplifier designed especially for skin and core temperature and respiration flow (rate) monitoring. The SKT100C is designed for use in the following applications:

General temperature measurement	Respiration rate determination
Psychophysiological investigations	Sleep studies

The SKT100C employs any of the BIOPAC TSD202 series thermistor transducers to measure temperature. The SKT100C includes a lower frequency response selection switch that permits either absolute (DC) or relative (via a 0.05 Hz or 0.5 Hz high pass filter) temperature measurements.

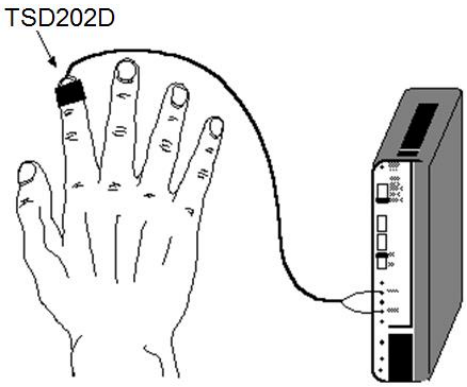
Connections and placement for **measuring respiration flow** using the SKT100C and the TSD202A fast-response surface temperature thermistor.

The SKT100C can also be used with the CBL203 and YSI Series 400 biomedical temperature probes. Connect CBL203 to SKT100C Vin+ and Vinï ports (either socket to either port); thermistors do not make electrical contact so GND is not required for safety.



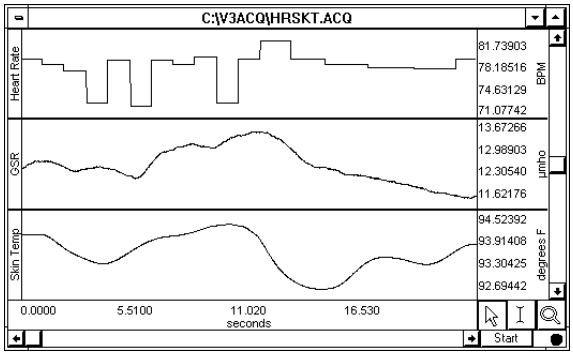
Respiration flow measurement using SKT100C and TSD202B

Connections and placement for **measuring index fingertip temperature** using the SKT100C and the TSD202D digit surface temperature probe. The probe is secured to the finger using the Velcro® strap on the transducer.



Index finger temperature measurement with TSD202D

This graph shows the relationship between fingertip skin temperature, skin conductance and heart rate. This configuration of physiological measurements can be useful for psychological testing and evaluation.



SKT versus EDA versus Heart Rate Waveforms

FREQUENCY RESPONSE CHARACTERISTICS

The 0.05 Hz high pass lower frequency response setting is a single pole roll-off filter.

See also: Sample frequency response plots: 1 Hz LP and 10 Hz LP

SKT100C CALIBRATION

Temperature Measurements

To measure **absolute** temperature, set the lower frequency response to DC.

To measure **relative** temperature changes, set the lower frequency response to 0.05 Hz or 0.5 Hz.

To set up Acq*Knowledge* to record temperature directly, perform the following:

A. Lower frequency response at **DC**:
In the scaling window, set the input voltages so they map to the respective temperature ranges indicated by the sensitivity setting. In this case, 0 V will always map to 90° F.

B. Lower frequency response at **0.05 Hz** or **0.5 Hz**:
In the scaling window, set the input voltages so they map to the respective temperature ranges indicated by the sensitivity setting. In this case, 0 V will map to the mean (average) temperature during the recording. Use this setting when temperature delta measurement is important, as when monitoring airflow (respiration rate).

Skin Temperature Measurements

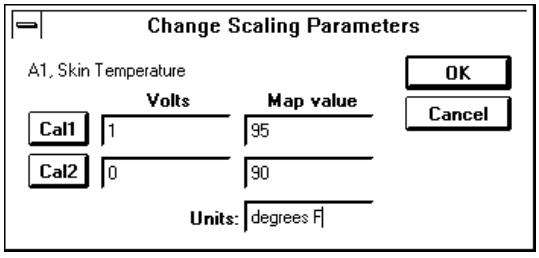
To measure **absolute** skin temperature, place the lower frequency response to DC.

To measure **relative** skin temperature changes or **respiration** rate (**airflow**), place the lower frequency response to 0.05 Hz or 0.5 Hz.

To set up Acq*Knowledge* to record temperature directly, perform the following:

A. Lower frequency response to **DC**:
In the scaling window, set the input voltages so they map to the ñDC onò temperature ranges indicated by the sensitivity setting. In this case, 0 V will always map to 90° F.

B. Lower frequency response to **0.05 Hz** or **0.5 Hz.**:
In the scaling window, set the input voltages so they map to the respective temperature ranges indicated by the sensitivity setting. In this case, 0 V will map to the mean (average) temperature measured during the recording and 1 V will map to one-half the ñdelta rangeò values, which corresponds to the chosen Gain setting.



Scaling setup window set to correspond to 5°/V setting on SKT100C

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SKT100C SPECIFICATIONS

Gain:	5, 2, 1, 0.5 °F/Vð can also calibrate in °C (see Input Signal Range below)
Output Range:	±10 V (analog)
Low Pass Filter:	1 Hz, 10 Hz
High Pass Filter:	DC, 0.05 Hz, 0.5 Hz
Sensitivity:	180 micro °F (100 micro °C)ð with MP System
Signal Source:	TSD202 Series Temperature Probe or CBL203 to YSI® Series 400 Biomedical Temperature Probes
Weight:	350 g
Dimensions:	4 cm (wide) x 11 cm (deep) x 19 cm (high)
Input Connectors:	Three 1.5 mm male Touchproof sockets (VIN+, Ground, VIN-)

Input Signal Range:

Gain	Range (°F)	Range (°C)	Delta Range (°F)	Delta Range (°C)
5	40-140	4.44-60	100	55.56
2	70-110	21.11-43.33	50	27.78
1	80-100	26.67-37.78	20	11.11
0.5	85-95	29.44-35	10	5.56

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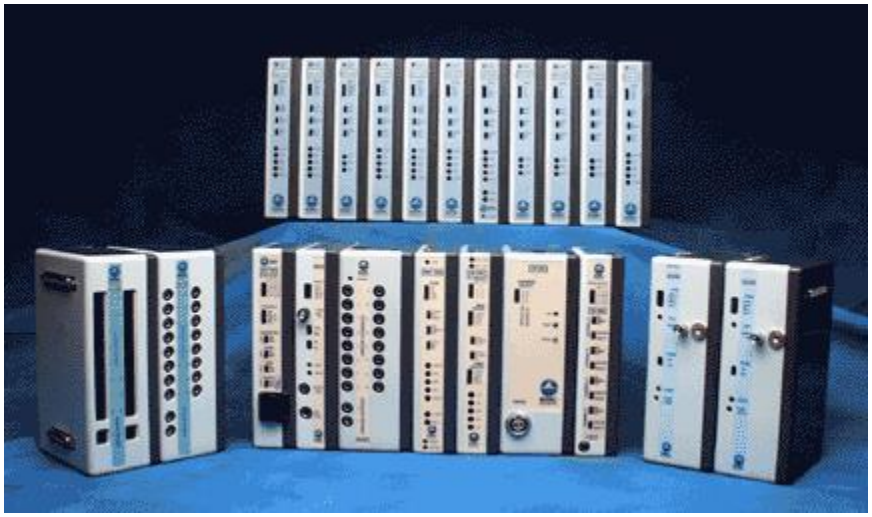
AMPLIFIER MODULES



100C series modules

The 100C series biopotential/transducer amplifier modules are single channel, differential input, linear amplifiers with adjustable offset and gain. These modules are used to amplify smaller voltage signals coming from raw electrodes and transducers (typically less than ±0.01 volt). In addition to amplifying signals, most of the 100C series modules include selectable signal conditioning ability so that data may be filtered or transformed as it is being collected.

- **Biopotential modules**: ECG100C, EEG100C, EGG100C, EMG100C, EOG100C, ERS100C
- **Transducer modules**: EDA100C; PPG100C; RSP100C; SKT100C
- **MRI Smart modules**ð advanced signal processing circuitry removes spurious MRI artifact from the source physiological data: ECG100C-MRI; EDA100C-MRI; EEG100C-MRI; EMG100C-MRI; PPG100C-MRI.

Modules can be cascaded by snapping the modules together. Up to sixteen 100C series modules can be connected to the MP System at any one time.

IMPORTANT

When cascading modules, it is important to remember that **no two amplifiers may be set to the same channel**. If two connected amplifier modules are left on the same channel, then contention will result and both amplifier outputs will give erroneous readings.

Amplifier offset Set by the zero adjust control trim potentiometer near the top of the module. The offset control can be used to adjust the zero point or ñbaselineò of a signal.

Gain Switch The four-position slide Gain switch controls sensitivity. Lower gain settings will amplify the signal to a lesser extent than higher gain settings. If the signal plotted on the screen appears to be very small for a given channel, increase the Gain for that particular channel. Conversely, if the signal seems to be ñcroppedò at +10 Volts or –10 Volts, decrease the Gain.

Connections Transducers and electrodes connect to the amplifiers using 1.5 mm female Touchproof connectors.

Electrodes

The biopotential amplifier modules use a three-electrode arrangement (VIN+, GND, VIN–). Although certain applications may require different arrangements of electrodes and/or transducers, some generalizations about electrode and transducer connections can be made. Electrodes measure the electrical activity at the surface of the skin, and since electricity flows from ï to +, measuring the flow of a signal requires that there be (at least) one ñ-ò electrode and (at least) one ñ+ò electrode. An additional electrode, a ñgroundò (or earth) electrode is used to control for the general level of electrical activity in the body.

Leads

Typically, electrode leads are used to connect individual electrodes to the *xxx*100C amplifier. Most electrode leads are shielded, which means they introduce less noise than an unshielded lead. A shielded electrode lead has an extra jack on one end that plugs into the SHIELD input on the amplifier modules. A standard electrode lead configuration consists of two LEAD110S electrode leads (one connected to the VIN + input and one to the VIN ï input on the amplifier) and a single LEAD110 (connected to the GND input on a biopotential amplifier).

Transducers

Transducers, on the other hand, are not designed to measure electrical activity directly and usually involve simpler connections. The transducers discussed in this manual translate physical changes (in temperature, for instance) into electrical signals. Connections for individual transducers are discussed in each section.

Channel

The active channel is selected using the channel select switch on the top of the module. The channel select switch can direct the amplifier output to one of sixteen possible MP System input channels. *Remember to make sure that each amplifier module is set to a unique channel.*

Zero Adjust

On input signals, a limited range in baseline level (DC offset) can be ñzeroed outò using the zero adjust potentiometer. Typically, the zero adjust will not have to be used (as it is preset at the factory). However, some of the 100C series modules can measure DC signals and, in certain circumstances, signal ñzeroingò may be required.

Setup

All 100C Series biopotential or transducer amplifiers incorporate specific gain, coupling and filtering options that are appropriate for the biopotential type or transducer signal that requires measurement. Generally, when an electrode or transducer is inserted into the corresponding 100C series module, the amplifier will immediately produce a useful output, with no user adjustments necessary.

Certain functionality is added to each module to optimize its performance with its intended signal measurement. For example, all 100C series biopotential amplifiers incorporate a selectable interference filter. When the interference filter is on, 50/60 Hz interfering signals are suppressed.

Filters

All 100C series amplifiers are constructed with filters that have a high degree of phase linearity. This means the 100C series modules will filter signals with as little distortion as possible. These modules also incorporate protection circuitry to limit input current in the event of input signal overload. Notch and bandstop filters have the potential to cause distortion, especially in the form of "ringing" in the data stream; biopotential hardware notch filters are implemented in conjunction with LP or HP functions to minimize distortion.

Line Freq

Line Frequency is set using the recessed switch boxes on the back of the amplifier module (50 Hz = all switches down, 60 Hz = all switches up). It is important to select the correct line frequency for your geographical region. Typically, U.S. line frequency is 60 Hz; Europe and China 50 Hz. Contact BIOPAC for additional line frequency information. All MP biopotential amplifier modules which contain a 50/60 Hz notch filter only engage the filter when the pass filter is also ON:

- ECG100C, EEG100C, EOG100C amplifiers: the 50/60 Hz notch is only engaged when the 35 Hz LPN low pass notch filter switch is set to ON.
- EMG100C, ERS100C amplifiers: the 50/60 HZ notch is only engaged when the 100 Hz HPN high pass notch filter switch is set to ON.

See individual module sections for details.