TSE Technical & Scientific Equipment GmbH



# **TSE Hemodynamic Systems**



Multi-purpose versatile systems for studying cardiovascular functions in small and large animals



## Modules for the Digital Hemodynamic Research System

#### Ultrasound Pulse Transmitter

Software controlled features:

- 5, 10, 20 MHz frequency of operation
- 1 to 100 kHz pulse repetition rate
- 1 through 16 transmit pulses
- Transmitter power control: 0 to 100 V
- Doppler signal gain control (60 dB range)
- M-mode signal time gain control (60 dB range)

#### Doppler/M-Mode Demodulator

- 16 bit resolution in-phase and quadrature sampling
- Automatic phase compensated demodulation
- Variable M-mode sampling rate
- Logarithmic demodulation of M-mode for a wide dynamic range

#### Analog Input and Output Module

- 6 analog inputs and 2 analog outputs with 16 bit digitization and sampling rate up to 100 KHz
- Software controlled gain setting for each channel
- Bipolar input ranges: 2.5, 1.25, 0.625, 0.3125, 0.15625 V
- Anti-alias filters on all channels

### Digital Hemodynamic Research System

This sophisticated system is the best solution in small animal hemodynamic research. Ideal suited for noninvasive measurements of blood flow velocities, accelerations, ejection times and isovolumic contraction/relaxation times it interfaces to PC/Laptop via the Universal Serial Bus (USB). Each module comes complete with software.

- 20 MHz and 10 MHz ultrasound bloodflow (Doppler) and cardiac dimension (Mmode) measurements
- Interfaces to Millar Tip-Catheters for blood pressure measurements
- Accepts analog signals from ECG amplifiers (such as used with the ECG Pad No. 690600)
- High sampling rates (up to 100 Ksamples/s)
- A built-in speaker allows listening to a selected Doppler channel

#### Blood Pressure Module

- Dual channels with direct interface for Millar catheters
- Automatic calibration to compensate temperature drift
- Sampling rates up to 100 KHz with 16 bit digitization

685000-D-UPT	Ultrasound Pulse Transmitter
685000-D-DMMD	Doppler/M-Mode Demodulator
685000-D-AIOM	Analog Input & Output Module
685000-D-BPM	Blood Pressure Module

# *Non-Invasive Flow Probe for the Digital System*

- Tubing or Steel mounted if a rigid probe is required
- Length: 10 cm, Diameter: 2, 3, 4, 5, or 6 mm
- Optional epoxy lenses to focus the sound beam



685000-MP Mounted Probe

Further probes see page 5



#### Doppler Signal Processing Workstation

This system is designed for cardiovascular research in small animals down to mice. It is a perfect real time analyzer including a report generation tool that accepts signals from any analog ultrasonic Doppler system generating in-phase and quadrature demodulated signals. It can also be used in conjunction with the Digital Hemodynamic Research System.

• High sampling rate (up to 125 kHz) and temporal resolution (up to 0.1 ms)

- Displays a grayscale spectrogram
- General parameters are heart rate and pulse wave velocity
- Systolic indices: Peak/mean aortic velocity, aortic acceleration, rise time, ejection time, stroke distance
- Diastolic indices: peak early (E) velocity, peak atrial (A) velocity, duration of E and A, E/A ratio
- Systolic diastolic relationships: Isovolumic relaxation time, Isovolumic contraction time

685000-DSPW Doppler Signal Processing Workstation



### Temperature and Heart Rate Monitoring System for Rats & Mice

- Electronic control of the heating element
- Simultaneous monitoring of temperature (rectal or skin) and ECG
- Analog ECG signal available for chart recorder
- Digital ECG trigger signal available
- Audio alert when ECG activity is present/absent
- Table top design without circulating water

685000-ECGPP	ECG Pad, complete with rectal
	probe
685000-ECGPPC	ECG Pad, complete with rectal
	probe and controller



### Multi-Channel Pulsed Doppler Analog Mainframe

- Available as 3, 6 or 12 channel mainframe
- Can be connected to a high frequency oscilloscope
- Recorder outputs are in a +/- 10 volt range
- A built-in speaker allows listening to a selected Doppler channel
- Accepts any of the modules listed below

#### Pulsed Doppler Module

- Suitable for most acute and chronic velocity measurements
- Advancing or receding flow is taken into account
- Outputs: mean and phasic velocity and a voltage proportional to the range gate delay
- Doppler shifts up to 31.25 kHz are detected with a 62.5 kHz PRF (pulse repetition frequency)
- Manages small/larger vessels (20/10 MHz)
- Can be used with mounted probes to measure blood flow **non-invasively**

#### High Velocity Doppler Module

- Most useful on hepatic, renal and mesenteric arteries
- Doppler shifts up to 62.5 kHz are detected with a 62.5 kHz PRF

#### Transit-Time Dimension Gauge Module

- For measuring myocardial segment length, wall thickness and vessel diameter
- Used with paired ultrasonic crystals from 5-20 MHz

685000-M03	3-channel Mainframe
685000-M06	6-channel Mainframe
685000-M12	12-channel Mainframe

Several function modules are available for measuring a variety of physiological data.

• Dimensions from 2-50 mm can be measured from up to 4 sets of crystals without interference (requiring 4 modules)

#### Single Crystal Displacement Module

- Useful to study regional ventricular function
- Works with a single epicardial transducer
- Measures thickening at fixed depth as selected by range gate delay
- Resolution: 0.01 mm (max. thickening 2.5 mm, max. depth 1.2 cm at 20 MHz)

#### Dual Pressure Amplifier Module

- For standard pressure transducers
- Contains two standard bridge amplifiers
- Each amplifier equipped with individual balance and gain control and a phasic/zero/mean output switch

#### Pressure Differentiator Module

- Contains a single pressure amplifier, a derivative amplifier and a calibrator for dP/dt measurements
- Simultaneous outputs for phasic pressure, mean pressure and dP/dt.

#### ECG/Rate Module

- Contains a differential ECG amplifier with lead switching, a R-wave trigger and a rate counter
- Outputs: ECG, heart rate, R-wave pulse
- Lead set: 4 limb leads, 2 V-leads and ground
- Optional: Cable for the ECG pad
- Optional: 3-lead clip-cable and manual lead switch

#### 685000-A-PDM Pulsed Doppler Module 685000-A-HVDM High Velocity Doppler Module 685000-A-TTDGM Transit-Time Dimension Gauge Module 685000-A-DPM **Dual Pressure Module** 685000-A-PDIM Pressure Differentiator Module 685000-A-ECGRM ECG/Rate Module 685000-A-SCDM Single Crystal Displacement Module

#### Single Channel Pulsed Doppler

- Compact system with analog velocity output and alternative output, which can be used with the DSPW
- PRF range from 20 to 125 kHz (Standard: 62.5 kHz)
- 10, 20 MHz or other frequencies

685000-A-SCPD Single Channel Pulsed Doppler

#### Multigate Pulsed Doppler

- For evaluating velocity profiles sensing at 8 places along the sound
- Detailed hemodynamics in real time
- Separate velocity and quadrature audio outputs for each channel and output for an X-Y display
- 10, 20 MHz

685000-A-MPD	Multigate Pulsed I	Doppler
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#### Hemodynamic probes

#### Flow Probes



#### Epoxy Doppler Cuffs

- For vessels of 2-8 mm diameter
- Fixed with suture ties or tape glued around the probe
- ID: 2.0, 2.5, 3.0, 3.5, 4.0, 4.5, 5, 6, 7 or 8 mm

685000-EDC Ep

Epoxy Doppler Cuffs

Mounted Probes See page 2

#### Catheter Stub Probes

- For exposed vessels down to 0.5 mm diameter
- Size: 5, 6, or 7 French





#### Silastic Cuffs – pliable

- For vessels from 0.5 to 2.0 mm
- Imbedded sutures for ties are provided
- Form a full ring if closed

685000-SCP Silastic Cuffs - pliable

#### **Dimension Probes**



#### Epicardial Thickening Patches

- For ventricular wall thickening measurements
- Can be paired with segment length crystals for thickness measurements via sonomicrometry
- Cloth patch or wire frame; diameter: 1 or 2 mm

685000-ETP Epicardial Thickening Patches



#### Segment Length Crystals

- For wall thickness used in pairs with epicardial patch
- Expoxy lense to spread the sound
- Used with Transit Time Dimension Gauge Module
- 1, 1.5 or 2 mm Ø; teflon sleeving for easier insertion
- 5, 10 or 20 MHz

685000-SLC Segment Length Crystals

685000-TCC Transducer Connecting Cable

All probes are available with 10 or 20 MHz frequency.

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